



Alarm Event Recording

Distributed Monitoring

Machine Monitoring

Power Quality

Calibrators

Recorders

Transducers

Signal Conditioning

Distribution Monitoring

# Product Catalog 102



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**AMETEK**

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# PRODUCT CATALOG 102



Since 1961, Rochester Instrument Systems, a division of Ametek Power Instruments, has provided innovative instrumentation from our design and production facilities in Rochester, New York. Joining with Scientific Columbus in 1996, Rochester has emerged as a leading supplier with its unique one-stop shopping advantage for customers. Our ISO 9001 certification is proof of our dedication to high standards of quality in our business and our products. Rochester has the resources and commitment needed to be a reliable partner for your worldwide instrumentation requirements.

# ROCHESTER is ISO-9001 Certified



## *Certificate of Approval*

*Awarded to*  
**ROCHESTER INSTRUMENT SYSTEMS**  
255 NORTH UNION STREET  
ROCHESTER, NEW YORK, U.S.A.

*Bureau Veritas Quality International (NA) Inc. certifies that the Management System of the above supplier has been audited and found to be in accordance with the requirements of the standards and scope of supply detailed below.*

STANDARDS \_\_\_\_\_  
ISO 9001  
ANSI/ISO/ASQ Q9001

SCOPE OF SUPPLY \_\_\_\_\_

**MANUFACTURE AND DESIGN OF POWER QUALITY PRODUCTS, POWER METERING PRODUCTS AND DIGITAL TRANSIENT RECORDERS, LOAD LOGGERS, ANNUNCIATORS, SEQUENTIAL EVENTS RECORDERS, AC MEASUREMENT TRANSDUCERS, CALIBRATORS, MACHINE MONITORING, SIGNAL CONDITIONING/ALARMS.**

*Original Approval Date:* 4 MARCH 1993

*Subject to the continued satisfactory operation of the supplier's Management System, this Certificate is valid for a period of three years from:*

23 APRIL 1999

For Bureau Veritas Quality International (N.A.) Inc.  
Jamestown, New York U.S.A.

Date 30 APRIL 1999



A handwritten signature in black ink, appearing to read 'Paul [unclear]', is written over a horizontal line.

# AMETEK

## Services

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**Ametek Power Instruments is a company dedicated to providing the highest quality products and exceptional customer service. Our ISO-9001 Certification reflects our commitment to excellence.**

- About Ametek – An Introduction
- Worldwide Sales Offices
- Product Information  
Customer Service
- Training and Field Service
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- Repairs, Spare Parts, and Calibration Services

## About Ametek – An Introduction

*A record of innovation and experience you can depend on.*

Rochester Instrument Systems, a division of Ametek, was founded by instrumentation professionals in 1961. For over 30 years we've designed and manufactured innovative products, provided superior technical training, and offered the highest level of services anywhere. We consistently deliver innovative technology to protect your people, your equipment and the environment during process plant operations as well as maximizing utility power performance. For the future you can expect continued support through our innovation and experience.

## Alarm Monitoring

Visual and audible indications of alarms are the key benefits of our microprocessor - based annunciator systems. These proven, reliable annunciators give you maximum flexibility and dependable operations so you can respond quickly and appropriately. Select the model that best fits your application: compact remote units, compact window based products, or large scale event logging systems. All of which provide the highest level of dependability.

Our DMS-2000 system provides annunciation along with event recording, alarm management, and graphical analysis. This system gives you complete and accurate records of alarms providing you with confidence in operation and increased levels of safety.

For specific event recording needs, our Integrated System Monitor provides unmatched design specification criteria with mean time between failure measured in years. Modularity and speed of response are only a few of the benefits of these systems.

## Power Recording

We pioneered the digital transient recorder in the mid-1980's and have advanced the technology to today's level: You get the most sophisticated fault recording and analysis systems in the world. Reliable, high speed recording with unsurpassed accuracy is available from our 8 channel stand alone unit to our 64 channel system. Each

system is complemented by our exclusive software that provides reliable communication, on-screen analysis and automatic printout of data for process cogeneration applications to utility generation and transmission networks.

## Power Measurement

When you compare specifications and price, it's clear we're your choice for power transducers. Whether you're measuring inferential power in a process application or telemetering in a substation we offer the widest range and highest operational specification in the industry. We offer % of reading accuracies as well as an almost limitless range of application capabilities. Combine this with the most competitive pricing structure available there is no other choice.

## Process Monitoring

Keep your machinery in peak operating condition with the best monitoring systems and signal conditioning products in the industry. They not only help protect your expensive equipment they help reduce overall system cost and calibration efforts. The panel mount models provide the highest density available in smart technology. The temperature monitoring systems provide the highest level of operational diagnostics and accuracy.

Test the accuracy of most process variables safely and easily with our lightweight, hand-held calibrators. Representing the best in test and calibration innovation, our calibrators provide benchtop performance in portable units.

All of these products along with the highest level support, engineering, and service mean a winning combination for you. We are committed to excellence and completely certified to ISO 9001.

Buying from Ametek Power Instruments means only one thing – a great value with the highest level of quality. Quality not only in the products we ship but also the highest level quality in our support, engineering, and service.

# AMETEK Services

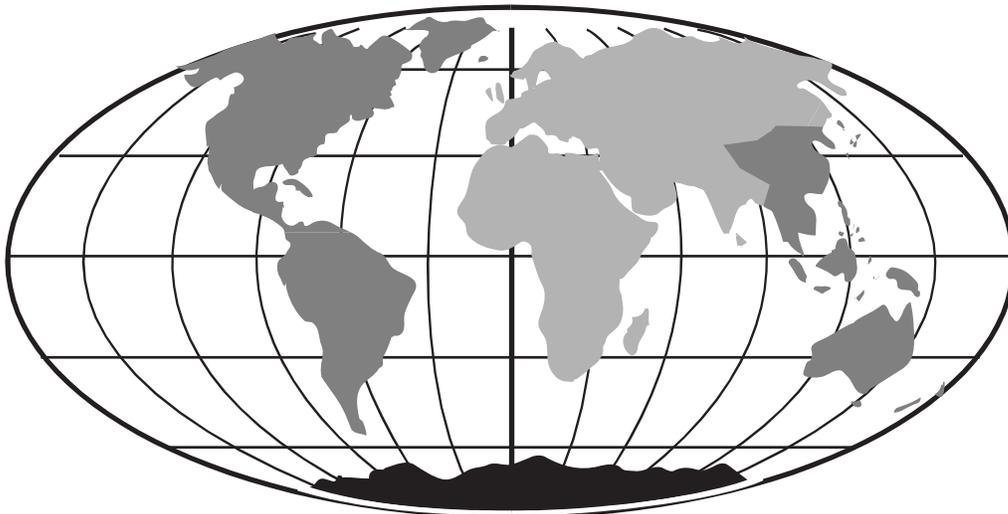
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## Worldwide Sales Offices

Ametek Power Instruments has two units, one in Rochester, NY USA, and one in Crayford, England and Hillend, Scotland, UK. This catalog applies to the products sold through our offices in Rochester, NY. If you are located in the areas shaded in the figure below, please contact Ametek UK, or their local representative, for assistance and information.

ROCHESTER NY USA  
TERRITORY:  
WESTERN HEMISPHERE

BELFAST OFFICE TERRITORY:  
UK, EUROPE, MIDDLE EAST,  
AFRICA



[www.rochester.com](http://www.rochester.com)

## Contacting Ametek Representatives

Ametek Power Instruments has representatives throughout the USA and the world. Our representatives are authorized to provide you literature and information about Ametek products and services, and to handle your need for pricing quotations, delivery times, and product ordering. If you do not know your local representative, please contact the factory in Rochester, NY USA for assistance.

SINGAPORE OFFICE TERRITORY:  
FAR EAST, INDIA, PAKISTAN

## Product Information, Technical Support, and Customer Service

Your local Ametek sales representative is your full-service contact for application assistance, pricing, delivery, status, and customer service. Your local representative knows your needs, and can respond directly to you. Your representative also can provide demonstrations, evaluation products, and can arrange for other Ametek services.

To support your local representative, the Ametek plant is organized for direct contact with the people who are

responsible for making and delivering our products. Each manufacturing cell is able to provide application assistance, pricing, delivery, status, and customer service for the particular product lines made in the cell.

Ametek encourages you to contact your authorized representative first. If this is not possible, please use the following numbers to contact our plant for assistance. The 1-800 numbers are effective for U.S.A. and Canada only.

Requirement	Contact	Phone	Fax
Emergency Ordering or Assistance	Service Hotline	800-881-4156	
General Information All Ametek Departments	Switchboard	716-263-7700	716-262-4777
Technical Support or Field Service/Training	Tech Support Line	800-374-4835	716-238-4985
<b>Product Support:</b>			
1. Annunciators, DMS-2000, RiSCue	Cell Manager	716-238-4987	716-238-4029
2. Transducers	Cell Manager	716-238-4955	716-238-4945
3. Signal Conditioners	Cell Manager	716-238-4944	716-238-4097
4. Temp/Vibration Monitors, Special, and Out-of-Catalog Products	Cell Manager	716-238-4984	716-238-4905
5. Transient Recorders SERs, ISM-1, Systems	Cell Manager	716-238-4987	716-238-4985
6. Calibrator/DPG	Cell Manager	716-238-4944	716-238-4097
7. Load/ LineFacts, LoadLoggers, Trips	Cell Manager	716-238-4987	716-238-4985
8. Power Quality	Cell Manager	716-238-4700	716-238-4927
<b>Product Literature Only</b>	Market Pulse, Inc.	216-460-0809	216-460-0810
<b>Ametek Web Site</b>	<a href="http://www.rochester.com">www.rochester.com</a>	<b>Ametek Email</b>	<a href="mailto:info@rochester.com">info@rochester.com</a>

# AMETEK

## Services

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### Training and Field Service

#### RiS Product Training Workshops

##### Learn How To Operate and Maintain Your Ametek Products

Ametek Power Instruments is committed to providing cost effective training for our customers. Ametek offers intensive, hands-on workshops where you can gain valuable experience and training on your Ametek System(s). Learn how to get the most from your products with a thorough understanding of operating characteristics and how to efficiently correct any misoperation.

##### Factory Training Workshops

Ametek recommends factory training for individuals or groups of less than five students. Annual Factory Training Workshops are offered for Transient Recorder products on an established schedule. Workshops may also be arranged at the factory for other Ametek products as needed.

##### On-site Workshops

Ametek recommends on-site training for groups of six to ten students. On-site training offers significant savings in student travel and lodging costs. An additional benefit is realized as your people are trained as a team. Group dynamics contribute to a thorough understanding of the subject and overcoming reluctance to ask the instructor questions.

##### Transient Recorders

Ametek offers Transient Recorder Operation & Maintenance Workshops. Each workshop offers a careful balance between lecture and hands-on training. Students will gain the practical knowledge and experience of dealing with real-world conditions. With the practical knowledge gained in a Ametek Workshop, students can focus on the issue of understanding power disturbances, line faults, relay response and other critical factors using timely information provided by a Ametek Transient Recorder in optimal working condition.

##### Sequential Events Recorders

Ametek offers Sequential Events

Recorder Operation & Maintenance Workshops. Workshops are offered singly or in combinations. Choose one workshop to fill a specific need, or a combination workshop to meet several needs with one session.

Each workshop offers a careful balance between lecture and hands-on-training. Students will gain the practical knowledge and experience of dealing with real-world conditions. With the practical knowledge gained in a Ametek Workshop, students can focus on the real cause of power/process disturbances using the "first-out" information provided by a Ametek Sequential Events Recorder in optimal working condition.

##### Annunciators

Ametek offers Annunciator Operation & Maintenance Workshops. Choose a workshop to fill your specific needs and goals.

Each workshop offers a careful balance between lecture and hands-on training. Students will gain the practical knowledge and experience of dealing with real-world conditions. With the practical knowledge gained in a Ametek Workshop, students can focus on plant operations using the information provided by an Annunciator in optimal working condition.

##### Combined Systems

- Transient Recorder & Sequence of Events Recorder systems
- Sequence of Events Recorder & Annunciator systems

Ametek can provide combinations of workshops for customers with combined systems. Combined systems include multiple equipment types like the ones listed above. A Total System approach to combined systems optimizes student time in class and reinforces technical skills. Complex system wiring, safety considerations, system grounding, input wiring and other common topics are covered once for both systems to reduce overall class time. Significant additional savings are realized by making only one trip to the site.

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## Field Service

Field Service is available for all Ametek Products and Systems at published rates plus parts and expenses. Field Service may be arranged by contacting the Cell Manager (see table). Please be prepared to explain the nature of the service desired, and identify the product by specific model number and serial number, or system by specific serial number or Ametek Sales Order (S.O.) number and location.

Rates are set at 3 levels: normal hours (8 hours/day), overtime hours, and holiday hours. Travel time to/from our Rochester, NY office will also be charged at the normal hourly rate.

Arrangements for Field Service should be made as far in advance as practical.

Parts required for Field Service will be provided at the current list price. If the Ametek equipment being serviced is under warranty, parts will be repaired by Ametek at no charge.

Ametek Field Service is warranted against workmanship defects for 60 days from the date of completion of service, and the work will be documented by a report provided to the customer upon completion.

### International Field Service Arrangements

Due to the need for work entry permits, Visas, and customs clearance for materials, all Field Service for non-US/Canada areas must allow adequate notice of four (4) weeks prior to departure. Emergency arrangements will be made when possible, but Ametek does not have control of the issuing of Government documentation.

Nominal preparation time is charged for preparation of travel papers, Visas, documents for shipment of material, etc., when field service is to be performed outside the continental USA or Canada. International service will be invoiced in US dollars. Currency conversion to US dollars will be made at published rates.

## Field Service for the Asia/Pacific Region

Ametek provides Singapore-based field services to our customers located in the Pacific rim countries. Prompt dispatch of a Field Service engineer can be made by contacting the Ametek Cell Manager (see table). Full details of the required service, including Ametek equipment type and model, should be provided at the time of inquiry.

## Repairs, Spare Parts, and Calibration Services

Ametek provides factory repair for all of its products. Rapid turnaround service is available. Most repairs are quoted at a fixed price, so you know the cost up front. You or your authorized Ametek representative can contact Ametek concerning Repair Service (see table).

A Customer Service person is available for cost inquiries, quotations, scheduling, and to provide return material authorization (RMA) during regular business hours (see table). All items returned to Ametek must have an RMA number, including warranty repairs.

Three levels of Repair Service are available for most products. Complex products that require diagnosis and testing will be repaired at standard rates and times. Please request the service level when contacting Ametek:

1. Super Service – 48-hour turnaround from time of receipt at our Rochester NY facility – guaranteed when you specify Super Service and provide adequate information to perform the repair. If Ametek does not meet the promised turnaround, the repair price will be reduced by 25%.

2. Rush Service – 5 working day turnaround from time of receipt at our Ametek facility is guaranteed, with rates 10% less than Super Service. If Ametek does not meet the turnaround, repair price will be further reduced by 15%.

3. Standard Service – turnaround for standard service averages two weeks after receipt. Standard service is priced at 25% less than Super Service, and is available for all Ametek products.

## Repair policies

1. Repairs, including products under warranty, must have an RMA from Ametek. An appropriate Purchase Order number for non-warranty repair is needed before work can begin. Items received without an RMA will be returned.

2. Warranty on Repairs Performed by Ametek: Ametek Power Instruments, Inc. (Ametek) warrants that repairs on Ametek products performed by Ametek will be free from defects of workmanship or material for 60 days from delivery of the material to the ordering customer, or the remainder of the original Ametek product warranty, whichever is longer. Additional terms of the warranty are as stated in the standard Ametek product warranty.

3. All items repaired by Ametek, including warranty repairs, will be returned by the same mode of shipment as received at Ametek, such as overnight, second day, ground express, or truck. Ametek will charge when a more costly shipping mode is requested for returns.

## Calibration Service

Ametek also provides NIST-Traceable calibration service for our instruments. Calibration service and turnaround is arranged by contacting the appropriate Cell (see table). Re-calibration under warranty will be performed at the normal calibration rates.

An RMA number must also be obtained prior to sending in any item for calibration. A certificate of calibration will be provided when the item is returned to you. If calibration cannot be done on the item once received by Ametek, you will be contacted with further information.

## Spare Parts

Spare Parts for Ametek equipment can be ordered directly by contacting the appropriate Cell (see table).

# AMETEK

## Services

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### Payment

Ametek provides standard payment terms of Net 30 days to our domestic customers with approved credit. All sales FOB Factory.

VISA and Mastercard are also accepted.



Consult your Ametek representative for full details.

### Warranty

Ametek provides a one year warranty on our products, with factory repair or replacement of defective material at our option. Please consult your Ametek representative for a complete statement of warranty terms.

### Service Contracts

#### Custom System Service

On-site service contracts are available for support of Ametek products. This offers the advantage of predictable costs for maintenance. An agreement can be tailored to each customer's specific needs. Please contact the Cell Manager (see table) for more details.

### Out-of-Catalog Items

Ametek has discontinued regular production of several products and removed them from this catalog. We will accept new orders for these products only upon confirmation from the factory. Ametek maintains a fully staffed Special Products Group to handle these out-of-production products. We will continue to provide service and support for these products through spares or replacement for as long as we can obtain components.

### Out of Catalog Products as of this catalog:

SC-7500 Signal Conditioner

SC-4301 Panel Meter

CL-2000 Calibrator

PM-9900 Pressure Modules

VT-1215 Vibration Switch

CL-4006 RTD Calibrator

CL-4202 Current/Voltage Calibrator

CL-4205 Temperature Calibrator

MM-9800 Multimeters

ET-8200 Rack Mounted Trip/Alarms

SC-8300 Rack Mounted Transmitters

### Previously Obsolete Products

TR-1620, TR-1630, TR-1640, TR-1650, TR-1626, TR-1645 Transient Recorders

TR-1625 Master Station

SSM-9400 Smart System Monitor

CL-4500 SuperCal II

RA-800, RA-1800, RA-2800, RA-3800

TR-1622, TR-1630P, RCU, TR-1700

AN-100, AN-1100, AN-2100, AN-4100, AN-5100, AN-3190

DPG-600, CL-6000

FM-100 Fault Monitor

TR-1650 Transient Recorder

LP-260 Load Profiler (Replaced by

LF-1 Power Quality Logger)

PR-2050 Tap Position Transmitter

SC-5400 P/I converters

CT-1200 Calibrated Trip Alarms

SC-6500 Smart 2-Wire Transmitter

TD-2000 Rack Mounted Transducers

CL-2241 Frequency Calibrator

CL-4001 Current Loop Calibrator

CL-4003 Voltage Calibrator

CL-4004 Loop Powered Indicator

CL-4005 Thermocouple Calibrator

## Agency Approved Products

Ametek offers a variety of products which have agency approvals. Please consult your Ametek representative for availability of specific models and features which have received approval, and the class of approval. Ask for drawing #1072-469.

<b>PRODUCT LINE</b>	<b>FM ORDINARY LOCATION</b>	<b>FM HAZARDOUS LOCATION</b>	<b>CSA ORDINARY LOCATION</b>	<b>CSA HAZARDOUS LOCATION</b>	<b>BASEEFA HAZARDOUS LOCATION</b>	<b>CENELEC</b>
AN-3100C AN-3196B	✓ ✓	✓ ✓	✓ ✓			
AN-5131 AN-6150			✓ ✓			
TM-2480 VT-2490 VT-3360	✓	✓ ✓	✓ ✓ ✓	✓		
ET-1200 SC-1300 SC-2300 SC-4300 SC-4400 SC-7400	✓ ✓ ✓ ✓ Pending ✓	✓ ✓ ✓ ✓ Pending ✓	✓ ✓ ✓ ✓ Pending ✓	✓   Pending ✓	✓   ✓ ✓	✓
DPG-700	✓	✓	✓	✓		

# AMETEK

## Services

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# AMETEK

## Alarm and Event Recording

**The AMETEK series of alarm annunciators is a family of products including microprocessor based integral annunciators, annunciator display units and remote logic annunciators.**

The following categories describe our product offerings:

**Integral Annunciators** – These annunciators are self-contained units with front window display and all alarm electronics included to support all annunciator functions (alarm sequences, horn and relay outputs, pushbuttons). Input and power connections are made directly at the rear terminals. This is best suited for applications where the field contact wiring can be located near the display.

**Display Unit Only** – These are lamp boxes configured in a variety of sizes and shapes. These are driven from remote annunciator electronics, PLC, etc.

**Remote Annunciators** – This annunciator is provided with all alarm electronics for connection to remote displays. The alarm inputs connect directly to this unit and the display is connected via a cable of pre-determined length. This is best suited for applications where their alarm displays are remote from the input wiring.



Description	Integral Annunciators	Display Unit Only	Remote Annunciator Electronics
4 point per cell Back Lit Window Annunciator	AN-3100C	AN-5131C	AN-6100R
8 point per cell Back Lit Window Annunciator	—	AN6150	AN-6100R
12 point LED Annunciator	AN-3196	—	—
12 point Relay Annunciator	SM-100	—	—

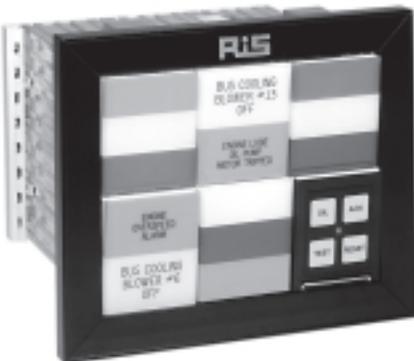
# AMETEK

## Alarm and Event Recording

### AN-3100C Annunciator

- Field Programmable
- Internal Expandability
- Modbus Output
- Compact Unit
- Programmable Common Relay Outputs
- OPC Server
- Rugged Construction

The AN-3100C annunciator provides a modular design allowing the most flexible physical configuration available. This window annunciator is cell-based with up to 4 windows, or inputs, per cell. You can put virtually any number of cells in any configuration into one system.



Each cell has built in expansion capability with no increase in physical size or electronics and can have 1, 2, 3, or 4 windows. Multiple window colors are available along with complete window engraving in various sizes.

This system comes with everything required for complete operation: all power supplies, control push buttons and options. Simply specify a cell configuration, window colors, power,



*Sequence Control Module*



*Auxiliary Relay Module — Attached via ribbon cable to the Sequence Control Module*

sequence and options.

#### Sequence Control Module

The Sequence Control Module detects changes in field contacts and lights on alarm. Each module contains a microprocessor that makes it switch programmable and internally expandable to adapt to changing requirements.

DIP switches allow you to change any point from Normally Open to Normally Closed and select between two common relay outputs. On a per module basis, you can select opera-

tional sequences and auxiliary relay operation.

Each Sequence Control Module is internally expandable from 1 to 4 points, depending on the system specified.

#### Adjustable Input Response Time

The standard response time is 50 milliseconds. Each module can have optional potentiometers added to vary the input response time in a 1 to 30 second range to eliminate nuisance alarms (SCI Option).

#### Transistor And Logic Level Inputs From PLCs

Transistor and logic level outputs from programmable logic controllers (PLCs), personal computers and other devices can provide inputs to the AN-3100C. (STO Option)

#### High Speed Event Capture

This optional feature captures changes in normally open or normally closed field contacts down to 1 millisecond in duration for transient alarm monitoring. (SCJ Option)

#### Optional Auxiliary Relays

You can add repeat relay output modules to any or all Sequence Control Modules. The relay output modules connect to the Sequence Control Module with a flexible ribbon cable, as shown in the adjacent photo. The relays are specified (on a per point basis) as being open or closed, coil energized or de-energized, and are set to follow alarm memory, the field contact, or to mimic the visual display.

#### Auxiliary Relay Action

**Follows Field Contact** — The auxiliary relay changes state with the field contact and is not affected by the sequence or any commands issued.

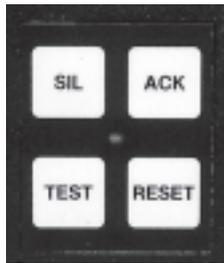
**Follows Alarm Memory** — The auxiliary relay changes state on alarm and stays in alarm until the annunciator visual indication returns to normal.

**Mimics Visual Display** — The auxiliary relay changes state in relation to the visual indication and can drive a lamp

box. For example, if the annunciator window is flashing, the auxiliary relay will change state at the same rate.

### Common Service Module

The Common Service Module controls



*Common Service Module — with membrane switch pad and power on LED*

the annunciator and provides common relays, power supply and TEST, ACKNOWLEDGE, SILENCE and RESET pushbuttons.

The Common Service Module mounts either integrally to the AN-3100C, usually occupying the lower right hand cell, or externally. It is available in several configurations for remote wall and panel mounting. The integral version has four push buttons: TEST, ACKNOWLEDGE, SILENCE, and RESET; an optional FIRST-OUT RESET is available. The externally mounted CSM provides input for customer mounted TEST, ACKNOWLEDGE, SILENCE and RESET pushbuttons.

### Full System Test

The TEST push button initiates a full system test that simulates inputs and exercises the logic of each cell. Events that occur during the test are stored in memory and displayed at the end of the test. The TEST function can also be switch programmed to actuate auxiliary relays.

### Common Service Module

The Common Service Module normally has three common output relays, with up to five optionally available. The relays can be selected for up to eight different output options to control audibles, reflash to other annunciators, and detect power or data bus malfunctions.

### Relay Output Options

- (A, B and C standard)
- A. Critical audible
- B. Non-critical audible
- C. Ringback audible
- D. Power failure
- E. Common contact follower
- F. Critical reflash
- G. Non-critical reflash
- H. Data bus malfunction

### Power On Indicator

A red colored LED indicates power on in the integral common service module. It is located in the center of the push buttons.

### Fail-Soft Design

If a failure occurs in the Common Service Module the individual input modules still capture alarms and light the windows.



*Rack Mounted AN-3100C with 4 point LED display modules*

### Serial Modbus

The AN-3135 Serial Modbus module occupies one cell, and is configured for bi-directional communications, as a master or slave device. It can transmit or receive information using the industry standard Modbus protocol. Each serial Modbus module connects up to 64 alarm points, and provides instant connectivity to PLC, DCS, and PL based systems.

### OPC Server

The AN-3135 Modbus module is required to activate the OPC (OLE for process control) server which provides connectivity to many OPC client applications.

### RiSCue Alarm Management Software

The AN-3100C Annunciator can now be connected to RiSCue Alarm Management Software, enhancing your alarm reporting and notification. See Section 4 for additional details on RiSCue.

### Other Programmable Options

A DIP switch programs flash rates, audible pulsing, reset status and other system options.

### LED Displays

Optional LED displays can reduce the system power requirements by 60 mA per point. LED displays require only 10 mA to operate versus 70 mA for conventional bulbs and don't require replacement. The LED displays are normally configured for 4 points per module. Engraved lamacoid tags provide legends.

# AMETEK

## Alarm and Event Recording

### AN-3100C Windows & Engraving

Windows are available in five different solid colors to easily differentiate groups of points by nature of the alarm. Operators quickly distinguish solid color windows.

The windows slide onto the front of the input card and can be quickly removed and exchanged when you need to internally expand the number of inputs or change your legend.

Each module has up to 8 bulbs to provide lighting redundancy in any configuration or density. Double intensity lighting is optional with eight bulbs per point on single input and four bulbs per point on dual input modules.

#### Window Colors Available

- White
- Red
- Amber
- Green
- Blue

#### Engraving

Fifteen different letter sizes are available. The chart to the right describes the maximum number of lines and maximum number of characters per line for each letter size. The standard lettering is in condensed gothic. Many other types of lettering and symbols are available.

#### Engraving Guidelines

Character Size	Inches	Maximum Number of Lines Per Window				Approximate Total Number of Characters Available on any Line
		Extra Large Window	Large Window	Medium Window	Standard Window	
02	1/16	33	15	10	5	37
03	3/32	22	10	7	4	28
04	1/8	16	7	5	3	21
05	5/32	13	6	4	3	17
06	3/16	10	5	3	2	13
07	7/32	9	4	3	2	11
08	1/4	8	4	2	2	10
09	9/36	7	3	2	1	9
10	5/16	6	3	2	1	8
11	11/32	5	2	1	1	7
12	3/8	5	2	1	1	7
13	13/32	5	2	1	1	6
14	7/16	4	2	1	1	6
15	15/32	4	2	1	1	5
16	1/2	4	2	1	1	5



2.85"  
(72.39mm)

Single-point window (extra large)

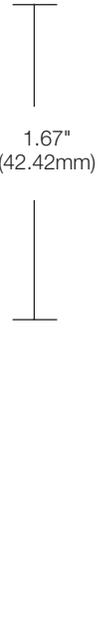


3.34"  
(84.48mm)

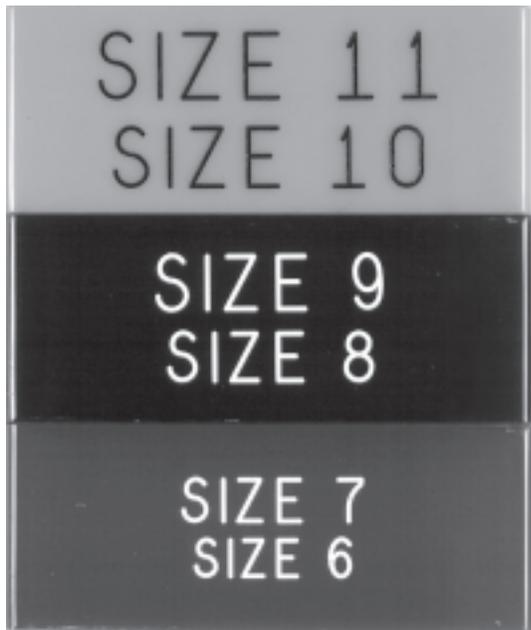


2.85"  
(72.39mm)

Two-point windows (large)



1.67"  
(42.42mm)



2.85"  
(72.39mm)

Three-point windows (medium)



1.11"  
(28.3mm)



2.85"  
(72.39mm)

Four-point windows (standard)



.83"  
(21.25mm)

# AMETEK

## Alarm and Event Recording

### AN-3100C Dimensions & Connections

#### 19" Rack Mounting

The standard configuration is 6 cells wide. It is recommended that systems less than 6 cells wide be ordered with a bezel. (STD/2 Option)

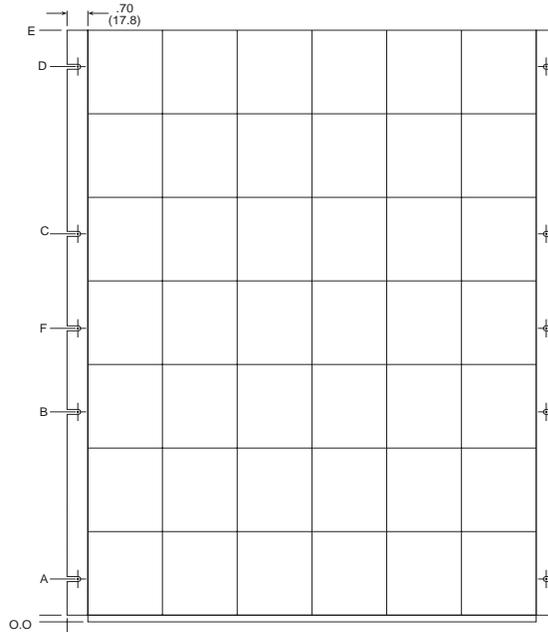
Mounting Depth: 9" (228.6 mm)

#### Mounting Information

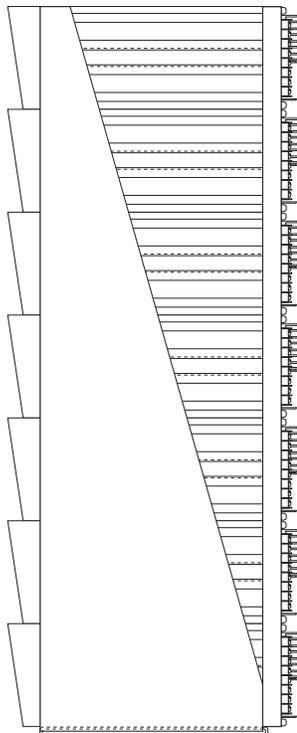
	A	B	C	D	E	F	
Number of Cells High	1H	.859 (21.8)	2.609 (66.2)	—	—	3.469 (88.0)	
	2H	1.484 (37.7)	5.434 (139.3)	—	—	6.969 (177.0)	
	3H	1.484 (37.7)	3.734 (94.8)	6.734 (171.0)	8.984 (228.2)	10.469 (265.9)	
	4H	1.484 (37.7)	5.484 (139.3)	8.484 (215.5)	12.484 (317.1)	13.969 (354.8)	
	5H	1.484 (37.69)	5.484 (149.3)	11.984 (304.4)	15.984 (406.0)	17.469 (443.7)	
	6H	1.484 (37.69)	5.484 (139.29)	15.484 (393.29)	19.484 (494.9)	20.969 (532.61)	10.484 (266.29)
	7H	1.484 (37.69)	5.484 (139.29)	18.984 (482.19)	22.984 (583.79)	24.469 (621.51)	12.484 (317.09)

The mounting information shown above provides support locations depending on the number of cells the system is high. (distance from 0.0 reference.)

Typical Rack Mounting Front View

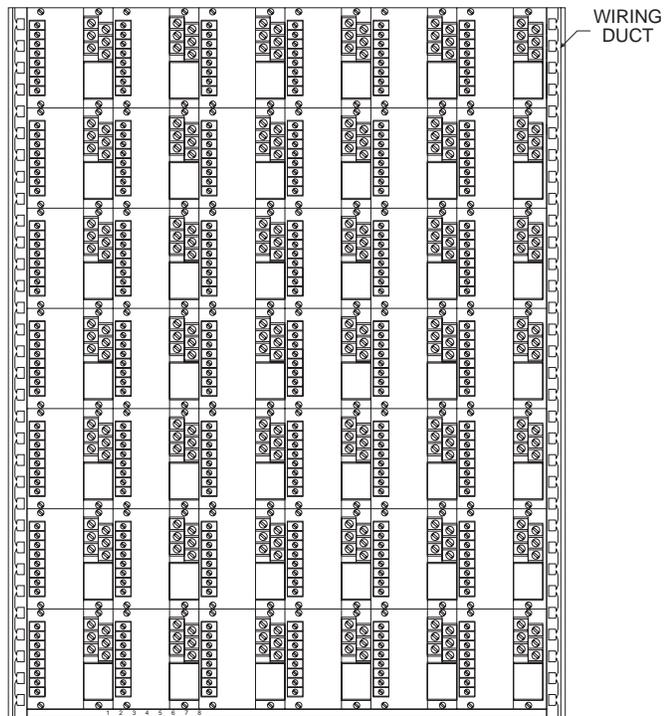


#### Side View



Note: Wiring Duct supplied on both sides for 3 cell high → systems and larger. ←

#### Rear View



**Panel Mounting**

All mounting dimensions are based on the number of cells, not windows. Each cell can be divided into up to 4 windows.

**Panel Mounting**

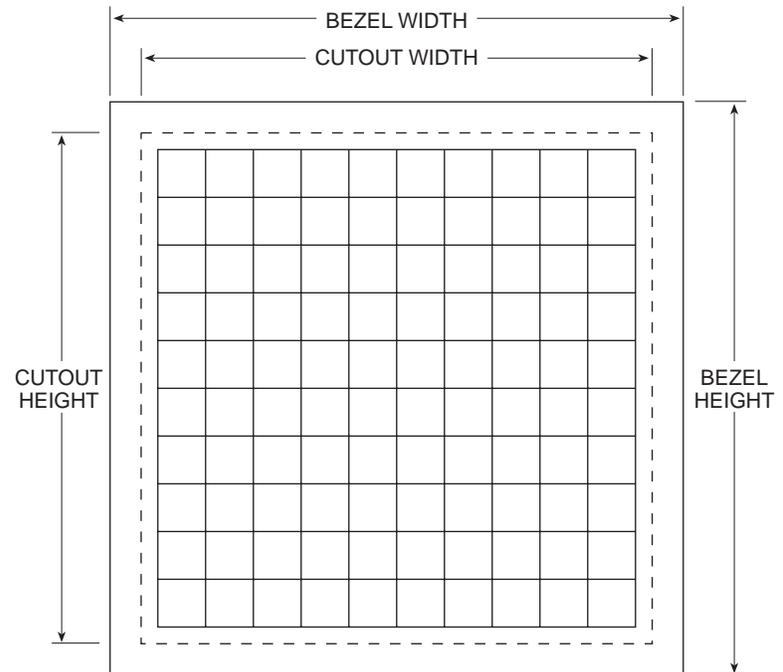
**Depth Behind Panel:**  
9.5" (241.3 mm) maximum.

Dimensions are in inches with millimeters in parentheses ( ).

	NUMBER OF CELLS WIDE														
	1W	2W	3W	4W	5W	6W	7W	8W	9W	10W	11W	12W	13W	14W	15W
Bezel Width	5.26 (133.6)	8.17 (207.5)	11.08 (281.6)	13.99 (355.3)	16.90 (429.3)	19.83 (503.7)	22.74 (577.6)	25.65 (651.5)	28.56 (725.4)	31.47 (799.3)	34.38 (873.2)	37.29 (947.1)	40.20 (1021.1)	43.11 (1094.9)	46.02 (1168.9)
Cutout Width	4.01 (101.9)	6.92 (175.8)	9.83 (249.7)	12.74 (323.6)	15.65 (397.5)	18.56 (471.4)	21.47 (545.3)	24.38 (619.3)	27.29 (693.2)	30.20 (767.1)	33.11 (840.9)	36.02 (914.9)	38.93 (988.8)	41.84 (1062.7)	44.75 (1136.6)

	NUMBER OF CELLS HIGH														
	1H	2H	3H	4H	5H	6H	7H	8H	9H	10H	11H	12H	13H	14H	15H
Bezel Height	5.75 (146.0)	9.15 (233.0)	12.56 (319.0)	15.97 (405.6)	19.37 (492.0)	22.77 (578.3)	26.17 (664.7)	29.58 (751.3)	32.99 (837.9)	36.4 (924.5)	39.80 (1011.2)	43.20 (1097.8)	46.50 (1184.4)	50.00 (1271.0)	53.40 (1357.6)
Cutout Height	4.50 (114.3)	7.90 (200.7)	11.30 (287.0)	14.70 (373.4)	18.10 (459.7)	21.50 (546.1)	24.90 (632.5)	28.30 (718.8)	31.70 (805.2)	35.10 (891.5)	38.50 (978.2)	41.90 (1064.8)	45.30 (1151.4)	48.70 (1238.0)	52.10 (1324.6)

**Note:** Consult factory for displays beyond 15 high x 15 wide.

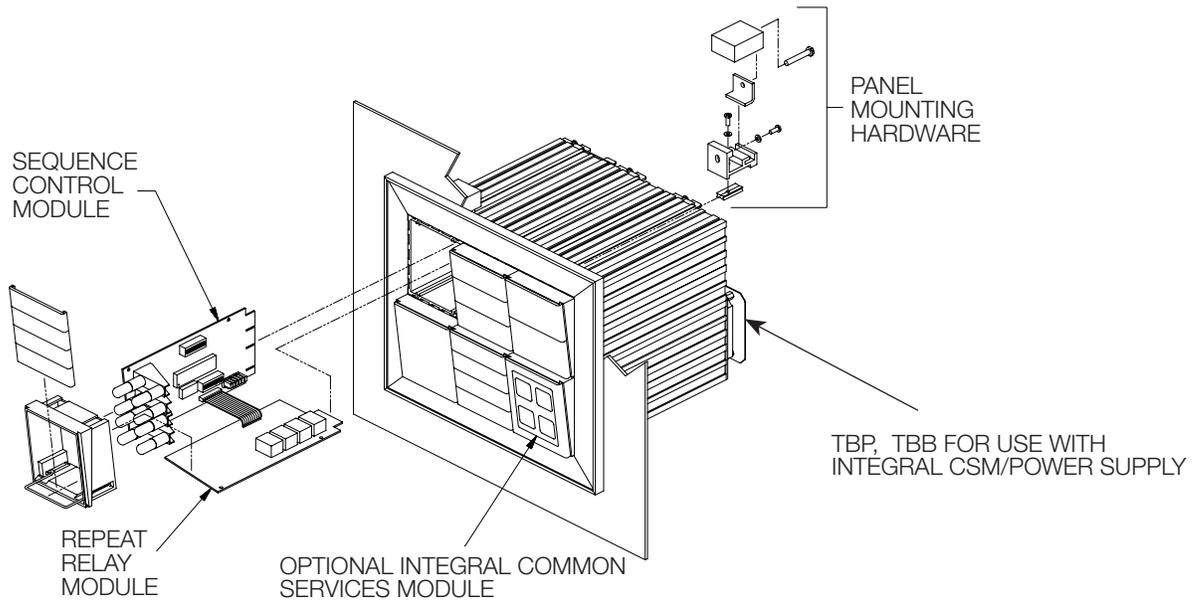


# AMETEK

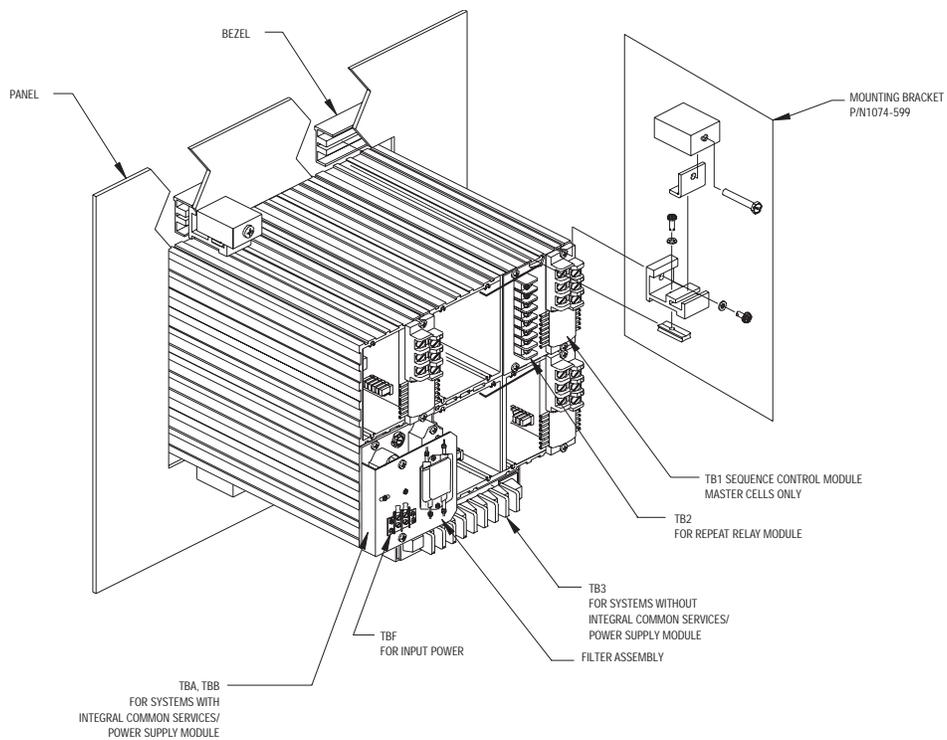
## Alarm and Event Recording

### AN-3100C Dimensions & Connections

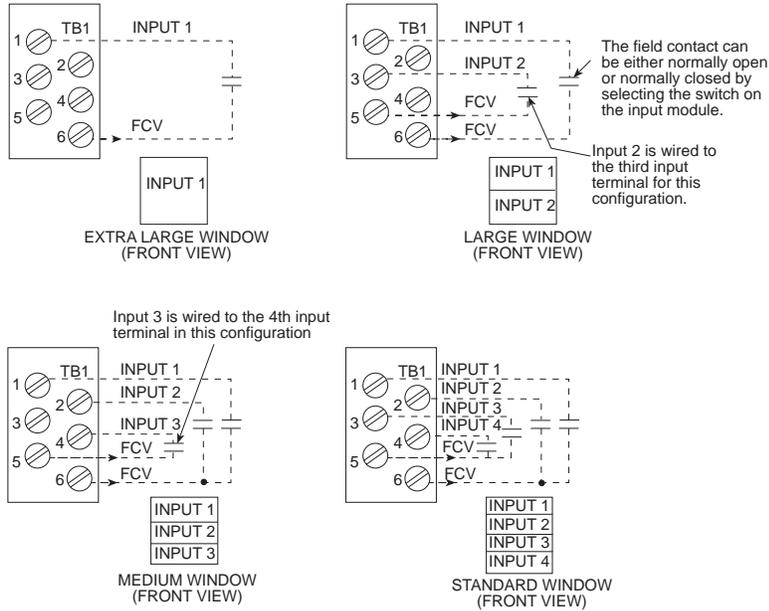
General Outline — Front View



General Outline — Rear View

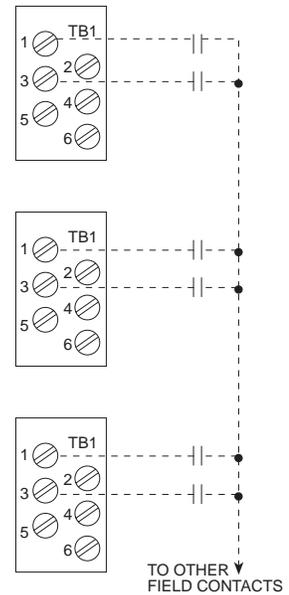


### Input Field Contact Wiring (Ametek supplied Field Contact Voltage)

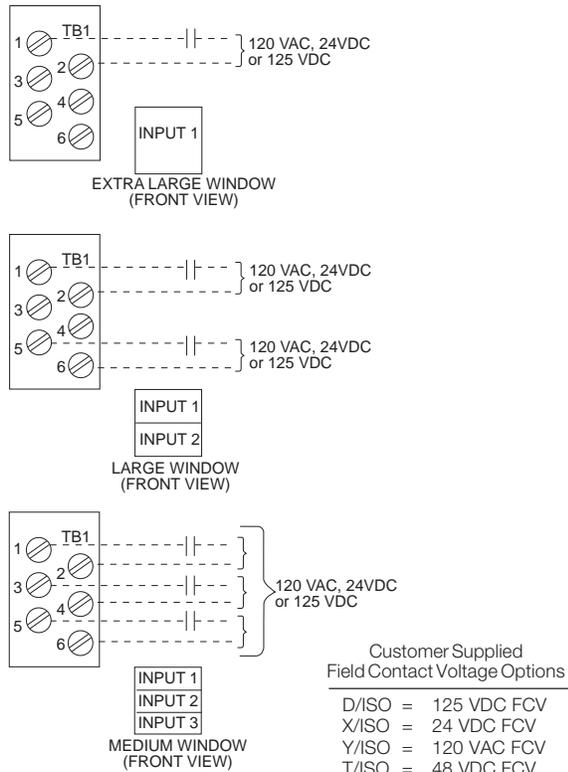


Note: Terminals 5 and 6 are connected internally. FCV is replaced where utilizing logic inputs in lieu of contact closures.

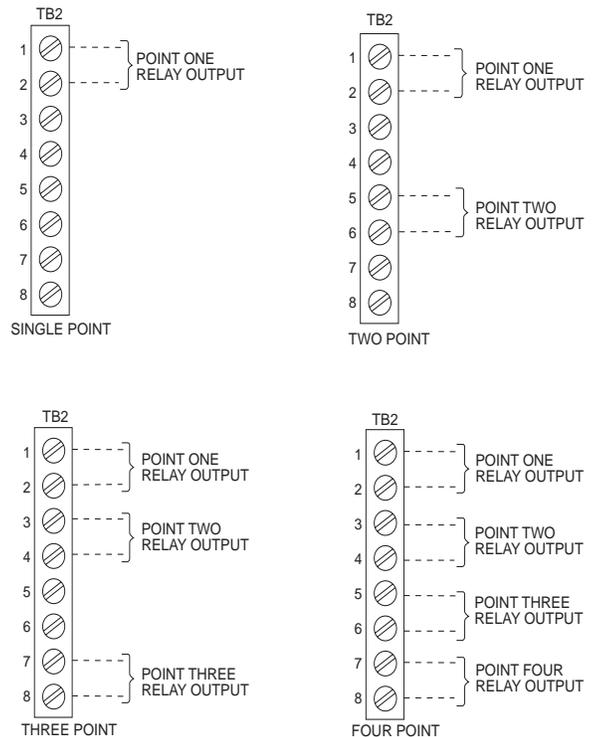
### Typical Field Contact Wiring 3 Input Modules Shown Wired With 1 FCV Connection



### Isolated Field Contact Wiring (Customer Supplied Field Contact Voltage) (AN-3143-9 isolated input module) Maximum 3 pts. per cell.



### Repeat Relay Wiring



# AMETEK

## Alarm and Event Recording

### AN-3100C NEMA Panel Covers

For applications where panel mounted annunciation in hostile environments is required, NEMA 4/12 panel covers are recommended. Many standard sizes are available. To help choose the panel cover that best meets your needs, please consult the adjacent chart.

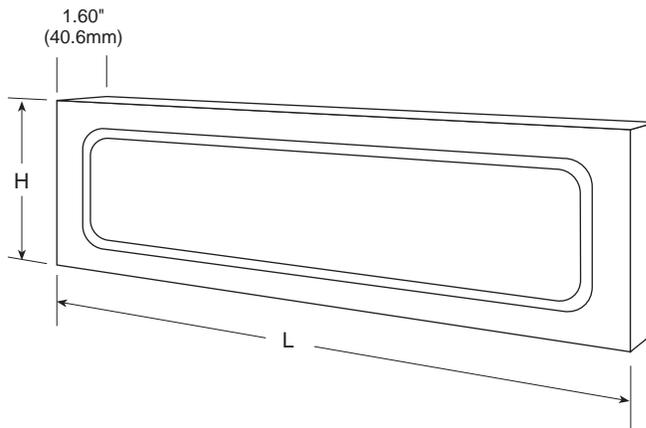
NEMA Front Cover (NFC) Options			
Approximate Dimensions			
Cell Format	H		L
1 high x 3 wide	8.94"	(227.0 mm)	14.89" (378.2 mm)
	x 4 wide	8.94" (227.0 mm)	17.80" (452.1 mm)
	x 5 wide	8.94" (227.0 mm)	20.71" (526.0 mm)
	x 6 wide	8.94" (227.0 mm)	23.62" (599.9 mm)
	x 7 wide	8.94" (227.0 mm)	26.53" (673.8 mm)
	x 8 wide	8.94" (227.0 mm)	29.44" (747.8 mm)
2 high x 2 wide	12.34"	(313.4 mm)	11.98" (304.3 mm)
	x 3 wide	12.34" (313.4 mm)	14.89" (378.2 mm)
	x 4 wide	12.34" (313.4 mm)	17.80" (452.1 mm)
	x 5 wide	12.34" (313.4 mm)	20.71" (526.0 mm)
	x 6 wide	12.34" (313.4 mm)	23.62" (599.9 mm)
	x 7 wide	12.34" (313.4 mm)	26.53" (673.8 mm)
	x 8 wide	12.34" (313.4 mm)	29.44" (747.8 mm)
	x 9 wide	12.34" (313.4 mm)	32.35" (821.7 mm)
	x 12 wide	12.34" (313.4 mm)	41.08" (1043.4 mm)
3 high x 3 wide	15.74"	(399.8 mm)	14.89" (378.2 mm)
	x 4 wide	15.74" (399.8 mm)	17.80" (452.1 mm)
	x 5 wide	15.74" (399.8 mm)	20.71" (526.0 mm)
	x 6 wide	15.74" (399.8 mm)	23.62" (599.9 mm)
	x 7 wide	15.74" (399.8 mm)	26.53" (673.8 mm)
	x 8 wide	15.74" (399.8 mm)	29.44" (747.8 mm)
	x 12 wide	15.74" (399.8 mm)	41.08" (1043.4 mm)
	4 high x 2 wide	19.14"	(486.1 mm)
x 3 wide		19.14" (486.1 mm)	14.89" (378.2 mm)
x 4 wide		19.14" (486.1 mm)	17.80" (452.1 mm)
x 6 wide		19.14" (486.1 mm)	23.62" (599.9 mm)
x 8 wide		19.14" (486.1 mm)	29.44" (747.8 mm)
x 9 wide		19.14" (486.1 mm)	32.35" (821.7 mm)
x 12 wide		19.14" (486.1 mm)	41.08" (1043.4 mm)
5 high x 3 wide	22.54"	(572.5 mm)	14.89" (378.2 mm)
	x 4 wide	22.54" (572.5 mm)	17.80" (452.1 mm)

Standard width is 1.60" (40.6 mm)

NOTE: Please consult factory for certified drawings and for other available sizes.

### Hinged NEMA 4/12 Panel Mount Covers

The panel cover is constructed of 16 gauge, cold-rolled steel with a textured black finish. The corners are sealed by a neoprene sponge gasket and the window is 1/8" thick plexiglass. Adjustable grip latches secure the hinged cover to the mounting plate.



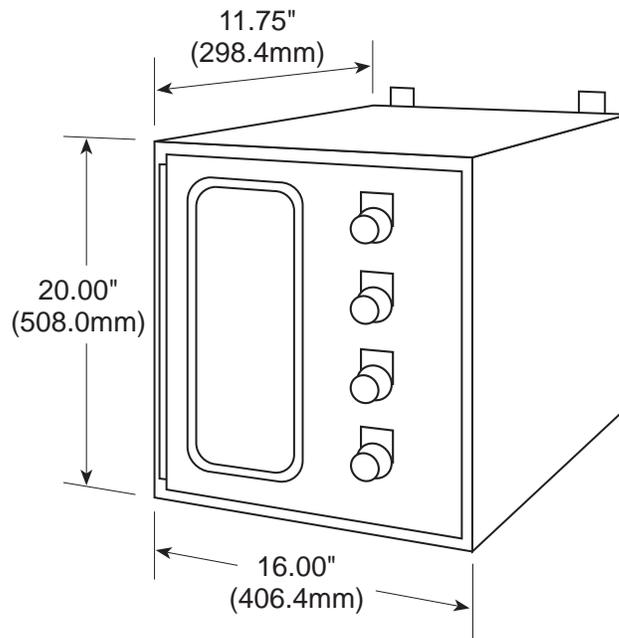
## AN-3100C For Hazardous Locations

### NEMA Enclosures

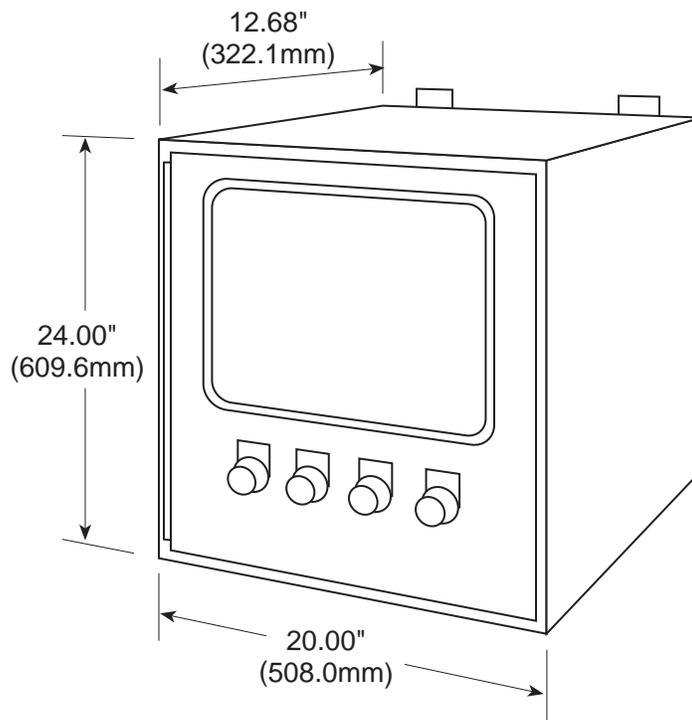
Three standard NEMA 4/12 type surface mount enclosures are available: a 12 cell model (3H x 4W), an 8 cell model (4H x 2W), and a 4 cell model (4H x 1W). All housings are oil-tight, water-tight, weather resistant and can be equipped for purge applications. Standard features include door-mounted pushbuttons. Available options include repeat relays, external audibles and pushbuttons, and a common-alarm rotating dome light. The rotating dome light is designed to alert operators of alarms in conditions where noise may drown out audibles. It can be specified in red, blue, amber, or green for either integral or remote mounting.

### Approvals

FM and CSA approved for ordinary locations. Some models approved by FM for hazardous locations (DIV 2). Consult factory for details.



Surface Mount NEMA 4/12  
Enclosure - 4H x 1W and 4H x 2W



Surface Mount NEMA 4/12  
Enclosure - 3H x 4W

# AMETEK

## Alarm and Event Recording

### AN-3100C Specifications

#### Input Signals (Alarm Signals):

- A. Relay contacts, normally closed or normally open. Isolated 24, 48 or 125 VDC normally supplied for use on field contacts; 12, 24, 48, 125, or 250 VDC may also be supplied by customer.
- B. Optically isolated inputs
  1. AC wetted contact (8 VAC through 128.7 VAC customer supplied) can be used. Maximum number of points per cell is three. AC wetted contacts up to 12 in series may also be monitored at 120 VAC  $\pm 20\%$ . (SCM Option)
  2. DC series contact (10 VDC through 140 VDC customer supplied) can be used. Maximum number of points per cell is three. DC wetted contacts (up to nine) may also be monitored at 125 VDC  $\pm 15\%$ . (SCM Option)
- C. Computer or other instrument-type logic solid-state input voltages.

#### Output Signals:

- A. Lights (steady, fast flash, slow flash, or intermittent fast flash).
- B. Auxiliary relays (retransmitting).
- C. Alarm, critical alarm, and ringback audible relays.
- D. Reflash and critical reflash retransmit output relays.
- E. Power Monitor output relay.
- F. Common Contact Follower relay.
- G. Data Bus Malfunction relay.

**Response Time:** 50 milliseconds standard; 1 millisecond to 30 seconds available optionally.

#### Surge Withstand Capability (SWC):

Test conforms to ANSI/IEEE C37.90.1-1989 (oscillatory) and IEC 801-4 Level 2.

#### Power Requirements:

- A. 120 VAC, +16%, -25% (50 or 60 Hz).
- B. 240 VAC, +16%, -25% (50 or 60 Hz)
- C. 24VDC, +25%, -16%
- D. 125 or 250 VDC, +25%, -20%
- E. 48VDC, +25%, -10%
- F. 4.5 watts per point on alarm; approximately 1 watt per point on

standby.

#### Retransmitting Relay Ratings:

Contacts rated at 5 amperes at 24 VDC or 120 VAC and 0.1 ampere at 125 VDC resistive.

#### Audible Relay Ratings:

2 amperes at 24VDC  
0.6 amperes at 120VAC  
0.1 amperes at 125 VDC resistive

#### Controls (Integral or Remote):

- A. Acknowledge pushbutton.
- B. Silence pushbutton.
- C. Test pushbutton.
- D. Reset pushbutton.

#### Circuit Design:

Microprocessor per module.

#### Packaging:

Extruded aluminum cell with interchangeable plug-in modules.

#### Ambient Temperature Range:

32°F to 140°F, 0°C to 60°C.

**Humidity:** 0-95% non-condensing.

#### Window Sizes:

- A. 0.83" x 2.85" (21.25 x 72.39mm), standard.
- B. 1.11" x 2.85" (28.3 x 72.39mm), medium.
- C. 1.67" x 2.85" (42.42 x 72.39mm), large.
- D. 3.34" x 2.85" (84.84 x 72.39mm), extra large.

**Weight:** 1.68 lbs (0.76 kg) per cell.

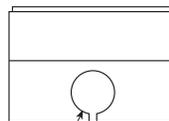
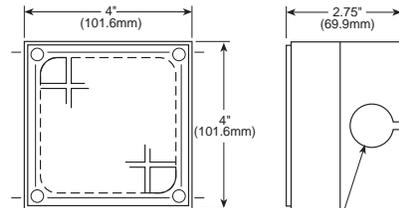
#### Approvals:

FM and CSA approved for ordinary locations. Some models FM approved for hazardous locations (DIV 2). Consult factory for details.

### AN-3100C Peripherals

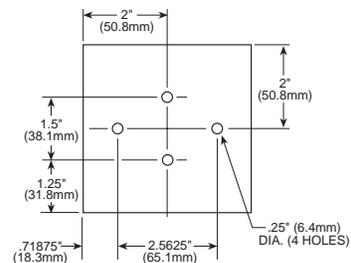
#### Horn

24 VDC P/N 1011 - 349  
120 VAC P/N 4200 - 004  
125 VDC P/N 1049 - 145



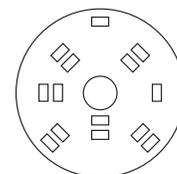
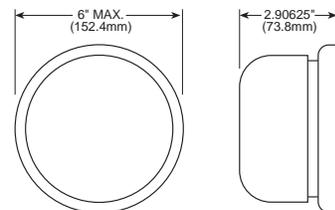
KNOCKOUT FOR 5" (12.7mm) DIA. CONDUIT TOP & BOTTOM

KNOCKOUT FOR .75" (19.08mm) DIA. CONDUIT-2 SIDES



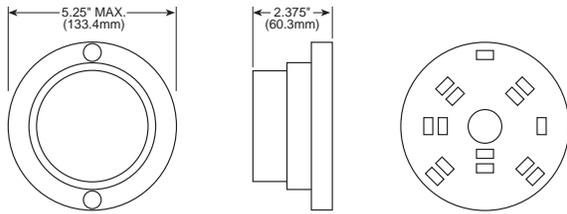
Sound level: 97 dB at 10'.  
Weight: 2 lbs. 4 oz (1.0 kg)

#### Bell — Vibrating Edwards No. 435-6" 24 VDC P/N 1023-298



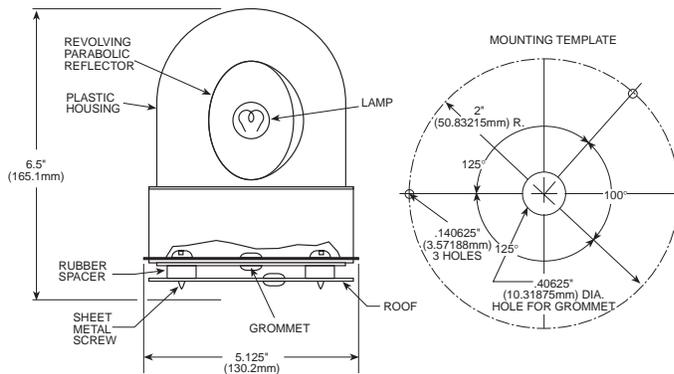
Universal adaptaplate mounts directly on surface of any single gang opening: 3 1/4", 3 1/2", 4" octagon; 4" SQ. box or equivalent surface fitting. Sound level: 92 dB at 10'.  
Weight: 2 lbs. 11 oz. (1.2 kg)

**Buzzer — Vibrating Edwards No. 343-A 24 VDC  
P/N 1005-563**



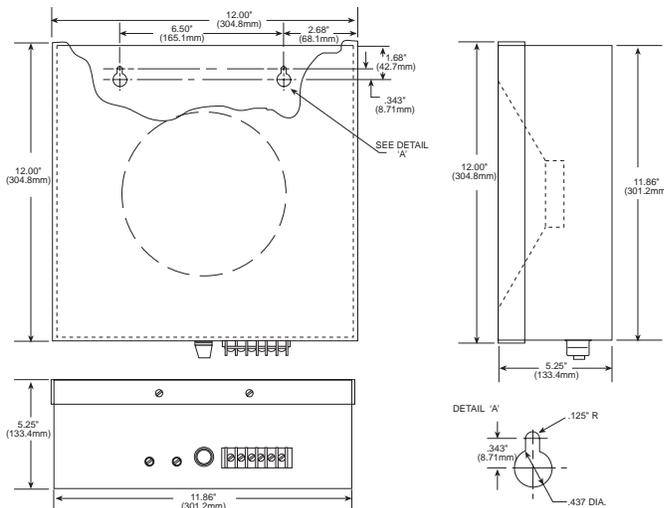
Universal adaptaplate mounts directly on surface of any single gang opening: 3 1/4", 3 1/2", 4" octagon; 4" SQ. box or equivalent surface fitting. Sound level: 70 dB at 10'. Weight: 2 lbs. 5 oz. (1.1 kg)

**Beacon — Federal Model 121A Vitalite  
P/N 1055-365**



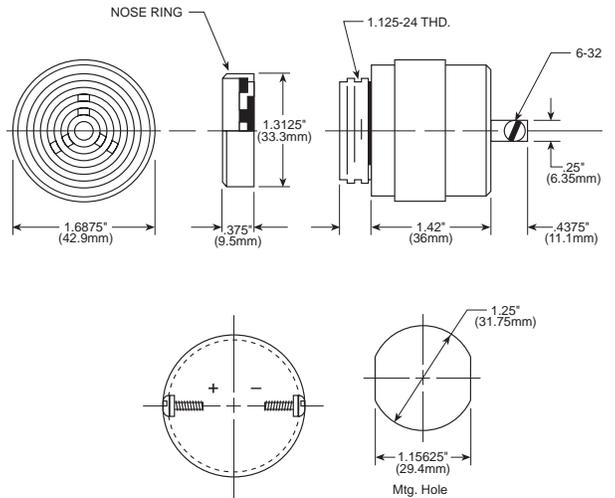
Voltages: 12, 24 or 32/36 VDC  
Weight: 1 lb. 3 oz. (.5 kg)

**Electronic Horn  
Model AN-1150A**



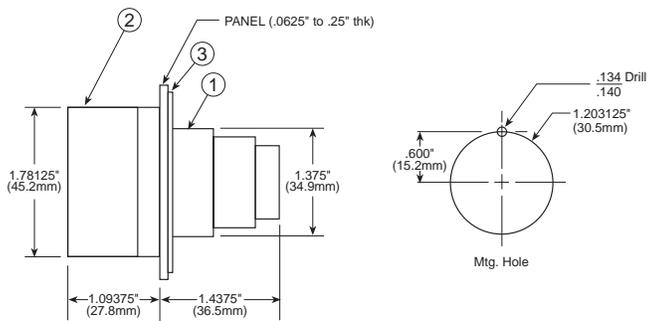
24 VDC, 48 VDC, 125 VDC, 120 VAC, 240 VAC  
Sound level: 96 dB at 10'. Weight: 11 lbs. 14 oz. (5.4 kg)  
Two adjustable tones, adjustable volume

**Remote Mounted Sonalert  
Steady P/N 1011-350  
Pulsing P/N 1021-949**



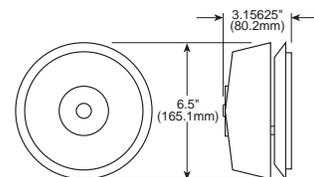
Sound level: 60-80 dB. Weight: 3 oz. (.1 kg)

**Remote Mounted Pushbuttons**



NOTE: Contact Rating: Continuous, 10 A Normal Load  
Break: 120 VAC, 6 A or 125 VDC 2.2 A.  
Weight: 6 oz. (.2 kg)

**Chime — Edwards 339-G1 24 VDC  
P/N 1070-078**



Sound level: 81 dB at 10'. Weight: 2 lbs. 7 oz. (1.2 kg)

# AMETEK

## Alarm and Event Recording

### AN-3100C Power Supplies & Accessories

Ametek offers two configurations of power supplies: integral or remote wall mounted. Input voltages are 120 VAC, 240 VAC, 250 VDC, 125 VDC or 48 VDC. (24 VDC requires no power supply.)

#### Integral Power Supply

The integral power supply takes up one cell and is contained within the same cell as the Common Service Module for maximum space savings. The integral supply is provided any time that the integral Common Service Module is specified, providing that the supply has the drive capacity to power the number of windows. See Table 1.

#### Remote Mounted Power Supply

The remote mounted power supply is only provided when a remote mounted Common Service Module is specified or when the integral supply cannot be used. Also, the remote supply contains the common module. The remote supply is extremely compact and provides a higher drive capability than the integral supply. Multiple remote supplies are provided when the window capacity becomes too large for a single remote supply. See Table 2.

Tables 1 and 2 are for quick reference. Both tables present the maximum number of cells a single power supply can drive.

**Table 1 — Integral Power Supply — Maximum Number of Display Cells\***

	Cell Configuration			
	4 pts/ cell	3 pts/ cell	2 pts/ cell	1 pt/ cell
No relay no audible	10	14	21	21
With relay no audible	8	11	17	19
With relay and Sonalert	8	11	17	18
With relay and horn	8	10	15	17

**Table 2 — External Power Supply — Maximum Number of Display Cells (Ratings per single power supply)\***

	Cell Configuration			
	4 pts/ cell	3 pts/ cell	2 pts/ cell	1 pt/ cell
No relay no audible	24	32	47	48
With relay no audible	19	25	38	42
With relay and Sonalert	19	25	38	42
With relay and horn	19	25	37	41

\*Nominal 100% lamp duty cycle @ 30°C, derate to 50% lamp duty cycle @ 60°C.

### Power Monitor AN-039



For monitoring prime or backup power.

**Output Signal:** Form C relay output contacts rated at 10 amps, 24 VDC or 120 VAC resistive.

**Dimension:**  
8.5" (216.0mm) h  
2.75" (70mm) w  
5.2" (132.1mm) d

**Weight:** 2 lbs. 8 oz. (1.1 kg)

### Ground Detector PR-2000



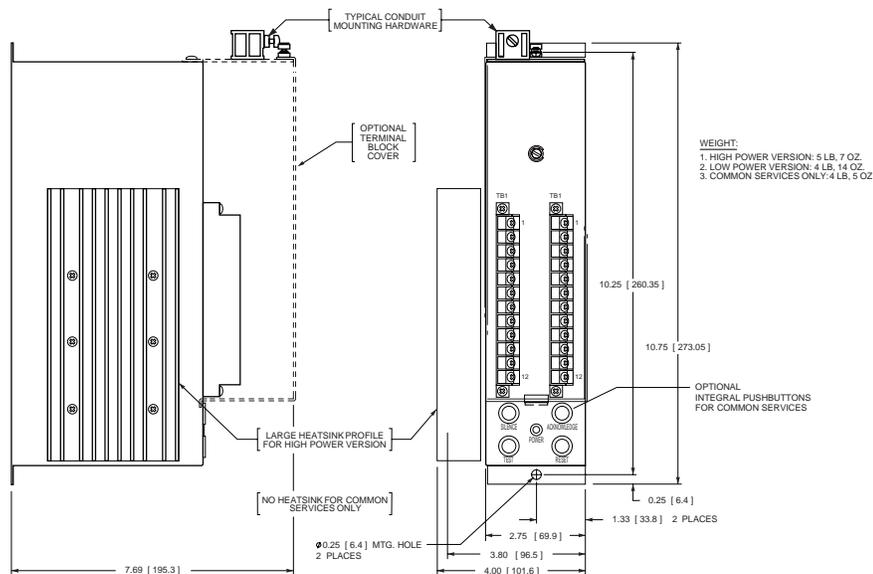
For detecting grounds in field wiring.

**Output Signal:** SPDT contacts rated 10 amps, 28 VDC or 120 VAC resistive.

**Trip Adjustment:** 1K-150 Kohm, continuously adjustable

Consult factory for details on this product.

### AN-3100C Remote Power Supply Dimensions



## AN-3100C Programmable Sequences

Fourteen sequences are switch selectable on an individual input module basis. A brief description of each of the nine basic sequences and a list of available options is given below.

**A — Automatic Reset.** Acknowledged alarm indications are automatically reset when process conditions return to normal.

**M — Manual Reset.** Acknowledged alarm indications must be manually reset when process conditions return to normal.

**R — Ringback.** Provides visual and audible indications to alert operators both under alarm conditions and when alarms return to normal.

**F1A — First-Out.** Initial alarm is highlighted by flashing and audible indications. Subsequent alarms go into the acknowledged state and are not locked in if momentary.

**F2M-1 — First-Out.** Similar to F1A except that the Silence pushbutton can silence the audible and retain the First-Out flashing. Momentary alarms are locked in and manual reset is required.

**FFAM2 — First-Out.** Similar to F2M-1 except that the First-Out alarm can only be reset after the process condition has returned to normal.

**F3A — First-Out.** Similar to F1A except that two visual flash rates are provided, one for First-Out and one for subsequent alarms. A First-Out Reset pushbutton is required.

**F3C — First-Out.** Dual color red/white sequence, red on first-out, white on subsequent.

**R-12C — Ringback.** Dual color sequence, white on alarm, green on visual ringback.

**Multiple First-Out Groups.** Optional up to four separate first-out groups per annunciator.

Option	Function	Description
1	Silence Pushbutton	A separate pushbutton to allow silencing the audible device without affecting visual displays.
2	Interlock Pushbutton	An interlock requiring operation of the pushbuttons in sequence of SILENCE, ACKNOWLEDGE, RESET.
4	No Lock-In	The lock-in feature is deleted. Momentary alarms return to the normal sequence state without operation of the ACKNOWLEDGE pushbutton.
6	No Audible	The audible device is deleted.
7	Automatic Silence	A time delay device to silence the alarm audible device after a set time of 30 seconds, without affecting the visual displays.
8	Common Ringback	A common audible device to call attention to both the alarm and ringback sequence states.
10	No Ringback Audible	The ringback audible device is deleted.
11	Common Ringback Visual	The same type flashing indication is used to indicate both the alarm and ringback sequence states.
12	Automatic Momentary Ringback	Ringback sequence momentary alarms go to the ringback state without operation of the ACKNOWLEDGE pushbutton.

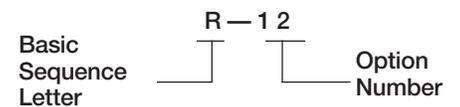
### Basic Sequence

#### Letter

A  
M  
R

#### Key Words

Automatic Reset  
Manual Reset  
Ringback

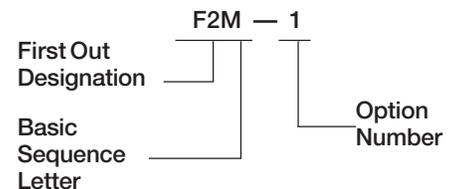


### First Out Designation

F1  
F2  
F3

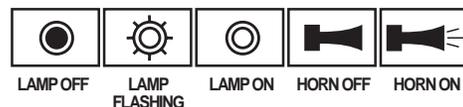
#### Key Words

No Subsequent Alarm State  
No Subsequent Alarm Flashing  
First Out Flashing and Reset Pushbutton



P Process  
S Sequence  
V Visual  
A Audible

### LEGEND



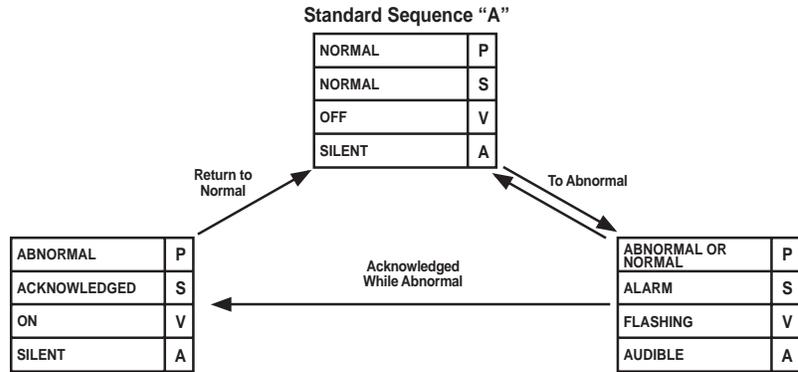
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## Alarm and Event Recording

### AN-3100C Operational Sequences

#### Sequence "A" Features:

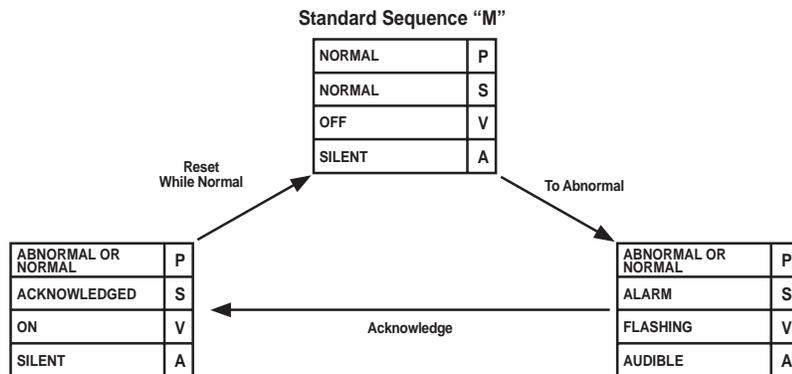
- Acknowledge and Test push buttons
- Alarm audible device
- Lock-in of momentary alarms until acknowledged
- The audible device is silenced and flashing stops when acknowledged
- Automatic reset of acknowledged alarm indications when process conditions return to normal
- Operations test



ISA REFERENCE	ALARM DEVICE	NORMAL	ALERT	ACKNOWLEDGE	RETURN TO NORMAL	RETURN TO NORMAL BEFORE ACK.	ACKNOWLEDGE	RESET
ISA-A	VISUAL							
	AUDIBLE							

#### Sequence "M" Features:

- Acknowledge and Test push buttons
- Alarm audible device
- Lock-in momentary alarms until acknowledged
- The audible device is silenced and flashing stops when acknowledged
- Manual reset of acknowledged alarm indications when process conditions return to normal
- Operational test

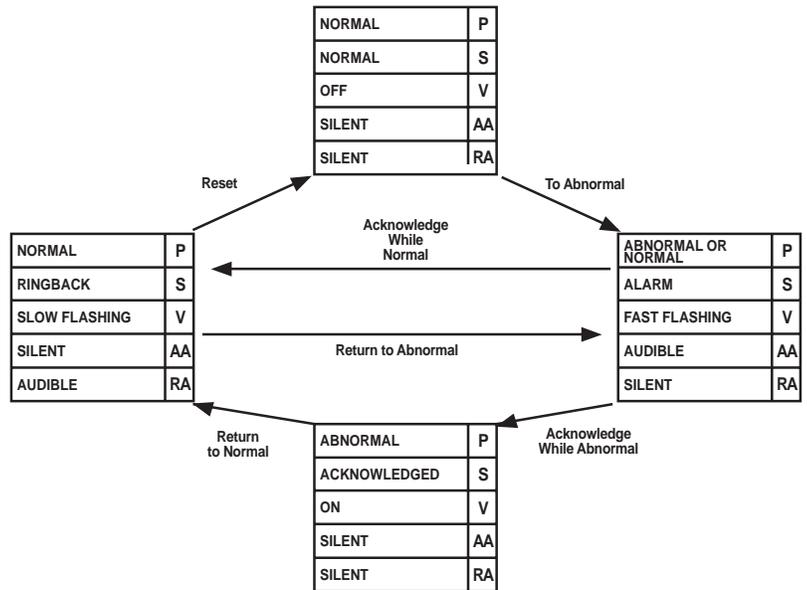


ISA REFERENCE	ALARM DEVICE	NORMAL	ALERT	ACKNOWLEDGE	RETURN TO NORMAL	RETURN TO NORMAL BEFORE ACK.	ACKNOWLEDGE	RESET
ISA-M	VISUAL							
	AUDIBLE							

### Sequence “R-12” Features:

- Acknowledge, Reset and Test push buttons
- Alarm and ringback audible devices
- The audible device is silenced and fast flashing stops when acknowledged
- Ringback visual and audible indications when process conditions return to normal
- Manual reset of ringback indications
- Operational test

### Standard Sequence “R-12”



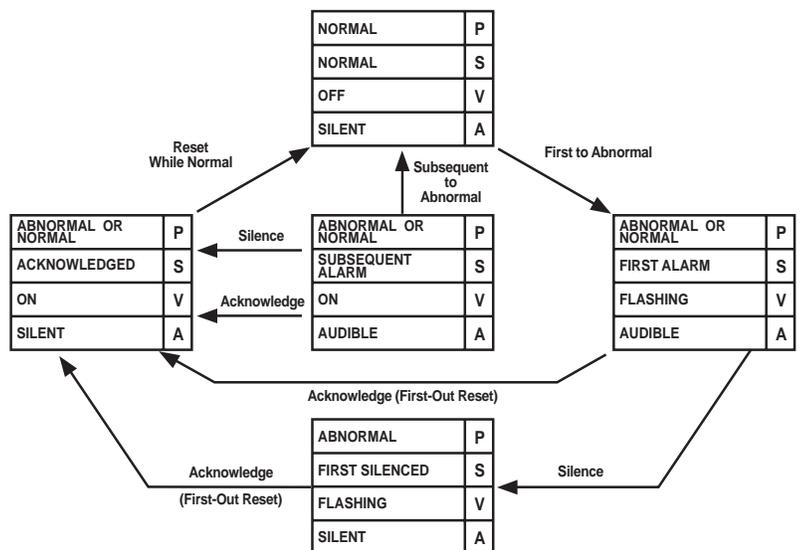
ISA REFERENCE	ALARM DEVICE	NORMAL	ALERT	ACKNOWLEDGE	RETURN TO NORMAL	RETURN TO NORMAL BEFORE ACK.	ACKNOWLEDGE	RESET
R-12	VISUAL							
	AUDIBLE							

\*A distinctly different ringback audible can be provided in most cases

### Sequence “F2M-1” Features:

- Silence, Acknowledge, Reset and Test push buttons
- Alarm audible device
- Lock-in of momentary alarms until acknowledged
- Option 1: Silence push button to silence the audible device while retaining First-Out flashing indication
- Flashing indication for first alarm only. New subsequent alarms have the same visual indication as acknowledged alarms
- First-Out indication is reset when acknowledged
- Manual reset of acknowledged alarm indications after process conditions return to normal
- Operation test

### First-Out Sequence “F2M-1”



ISA REFERENCE	ALARM DEVICE	NORMAL	ALERT		ACKNOWLEDGE		RETURN TO NORMAL		RETURN TO NORMAL BEFORE ACK.		ACKNOWLEDGE		FIRST-OUT RESET
			INITIAL	NEXT	INITIAL	NEXT	INITIAL	NEXT	INITIAL	NEXT	INITIAL	NEXT	
F2M-1 †	VISUAL												
	AUDIBLE												

† Silence function not shown. See line diagram above.

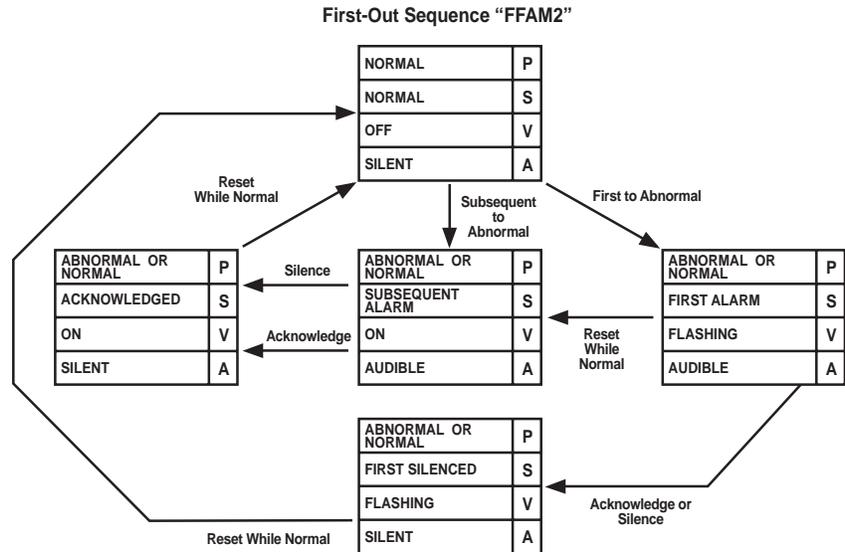
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## Alarm and Event Recording

### AN-3100C Operational Sequences

#### Sequence "FFAM2" Features:

- Silence, Acknowledge Reset and Test push buttons
- Alarm audible device
- Lock-in of momentary alarms until acknowledged
- Option 1: Silence push button to silence the audible device while retaining First-Out flashing indication
- Flashing indication for first alarm only. New subsequent alarms have the same visual indication as acknowledged alarms
- First-Out point can only be reset after it has returned to normal
- Manual reset of acknowledged alarm indications after process conditions return to normal
- Operational test



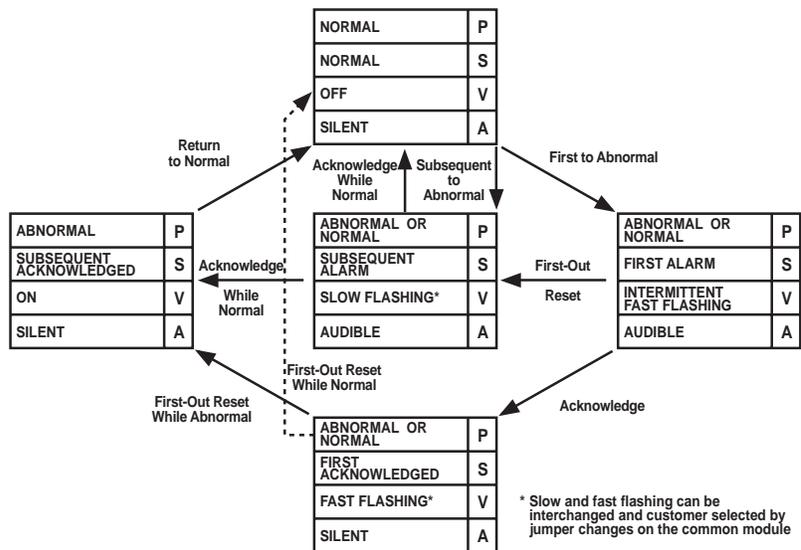
SEQUENCE CODE	ALARM DEVICE	NORMAL	ALERT		ACKNOWLEDGE		RETURN TO NORMAL		RETURN TO NORMAL BEFORE ACK.		ACKNOWLEDGE		FIRST-OUT RESET
			INITIAL	NEXT	INITIAL	NEXT	INITIAL	NEXT	INITIAL	NEXT	INITIAL	NEXT	
FFAM2	VISUAL												
	AUDIBLE												

Note: Silence function not shown. See line diagram above. Depressing Reset button will cause light to go Steady On.

#### Sequence "F3A"

#### Sequence "F3A" Features:

- Acknowledge, First-Out Reset and Test push buttons
- Alarm audible device
- Lock-in of momentary alarms until acknowledged
- First-Out flashing is different from subsequent flashing
- First-Out reset push button to change the First-Out visual indication to be the same as subsequent visual indications
- Automatic reset of acknowledged alarm indications after process conditions return to normal
- Operational test

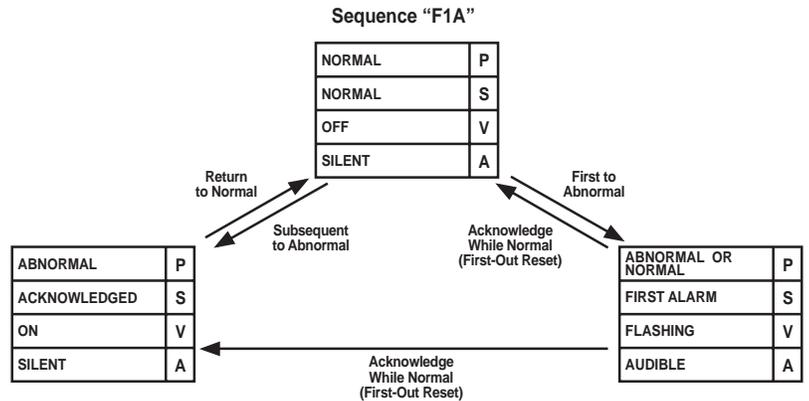


\* Slow and fast flashing can be interchanged and customer selected by jumper changes on the common module

ISA REFERENCE	ALARM DEVICE	NORMAL	ALERT		ACKNOWLEDGE		RETURN TO NORMAL		RETURN TO NORMAL BEFORE ACK.		ACKNOWLEDGE		FIRST-OUT RESET
			INITIAL	NEXT	INITIAL	NEXT	INITIAL	NEXT	INITIAL	NEXT	INITIAL	NEXT	
F3A	VISUAL												
	AUDIBLE												

### Sequence "F1A" Features:

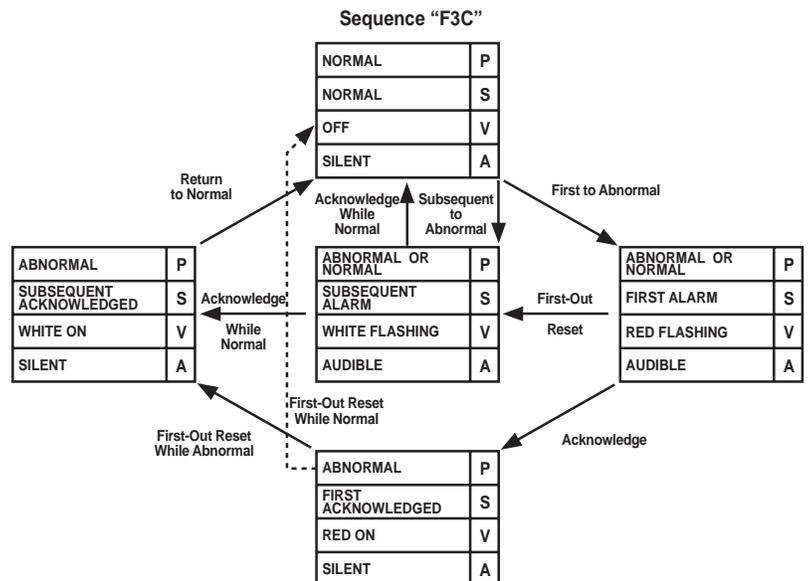
- Acknowledge and Test push buttons
- Alarm audible device
- Lock-in of momentary first alarm until acknowledged. No lock-in of momentary alarms
- Flashing and audible indications for first alarm only. New subsequent alarms go to the acknowledged state
- First-Out indication is reset and the audible is silenced when acknowledged
- Automatic reset of acknowledged alarm indications after process conditions return to normal
- Operational test



ISA REFERENCE	ALARM DEVICE	NORMAL	ALERT		ACKNOWLEDGE		RETURN TO NORMAL		RETURN TO NORMAL BEFORE ACK		ACKNOWLEDGE	
			INITIAL	NEXT	INITIAL	NEXT	INITIAL	NEXT	INITIAL	NEXT	INITIAL	NEXT
F1A	VISUAL											
	AUDIBLE											

### Sequence "F3C" Features:

- Acknowledge, First-Out Reset and Test Pushbuttons
- Alarm audible device
- Lock-in of momentary alarms until acknowledge
- First-Out color is different from subsequent color
- First-Out Reset pushbutton to change the First-Out color to be the same as subsequent visual indications
- Automatic reset of acknowledged alarm indications when process conditions return to normal
- Operational test using sequence: Test; First-Out Reset; Acknowledge



P Process  
 S Sequence  
 V Visual  
 A Audible

ISA REFERENCE	ALARM DEVICE	NORMAL	ALERT		ACKNOWLEDGE		RETURN TO NORMAL		RETURN TO NORMAL BEFORE ACK		ACKNOWLEDGE		FIRST-OUT RESET
			INITIAL	NEXT	INITIAL	NEXT	INITIAL	NEXT	INITIAL	NEXT	INITIAL	NEXT	
F3A	VISUAL												
	AUDIBLE												

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## Alarm and Event Recording

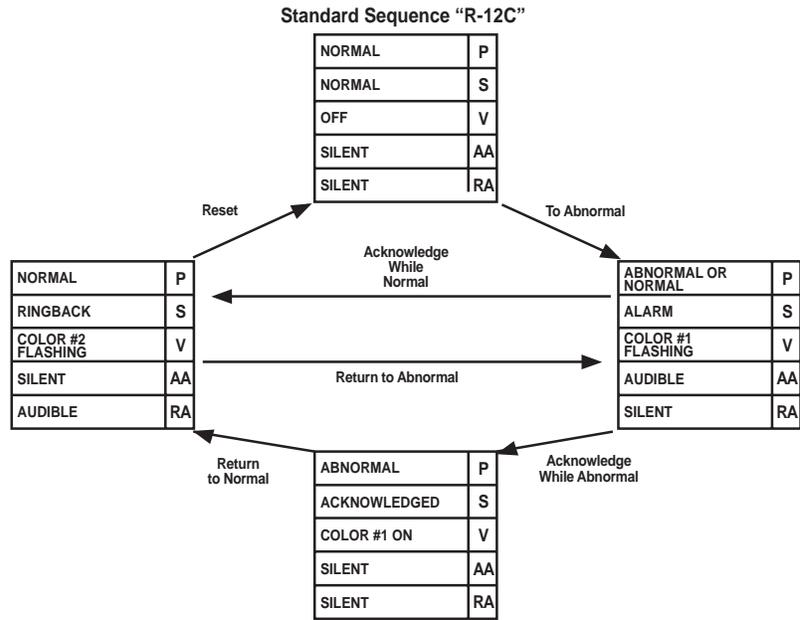
### AN-3100C Operational Sequences

#### Sequence "R-12C" Features

- Acknowledge, Reset and Test Pushbuttons
- Alarm and ringback audible devices
- The audible device is silenced and flashing stops when acknowledged
- Ringback visual and audible indications when process conditions return to normal
- Manual reset of ringback indications
- Operational test

Annunciator sequences are from ISA Standard S18.1.© Instrument Society of America, 1979, reprinted with permission.

P Process                      A Audible  
 S Sequence                    AA Alarm Audible  
 V Visual                        RA Ringback Audible



ISA REFERENCE	ALARM DEVICE	NORMAL	ALERT	ACKNOWLEDGE	RETURN TO NORMAL	RETURN TO NORMAL BEFORE ACK.	ACKNOWLEDGE	RESET
R-12	VISUAL							
	AUDIBLE							

\*A distinctly different ringback audible can be provided in most cases

### AN-3100C Ordering

The model number of the AN-3100C consists of twelve (12) items derived from the order codes listed below. When ordering a system that includes any "intermix" options (e.g. more than one window color), an intermix order form should be completed to fully define the annunciator. If you have any questions, contact your nearest Ametek representative for assistance.

AN-3100C -	1	-	2	-	3	-	4	-	5	-	6	-	7	-	8	-	9	-	10	-	11	-	12
	Number of Cells High		Number of Cells Wide		Common Module		Window Size		Active Points		Window Color		Operational Sequence		Field Contact Voltage		Prime Power		Relay Per Point		Standard Options		Engraving

#### ORDER CODE FOR EACH ENTRY ITEM

Each item has a unique order code which must be entered in its specific location in the model number sequence. The following is a tabulation of the order codes that must be used for each and every item of the standard model number.

**Item 1**  
 The order code defines the number of cells high, not to exceed 12.

**Item 2**  
 The order code defines the number of cells wide, not to exceed 12.

Item 3 Order Code	Common Module
INTB	Integral with pushbuttons (mounted in lower right cell)
INTO	Integral without pushbuttons (mounted in lower right cell — requires external pushbuttons)
RPB	Remote, panel mount with pushbuttons
RWO	Remote, wall mount without pushbuttons (requires external pushbuttons)

Item 4 Order Code	Window Size
4	Standard, 4 per cell
3E	Medium, 3 per cell, field expandable
2E	Large, 2 per cell, field expandable
1E	Extra large, 1 per cell, field expandable
LED	LED display, 4 per cell
FC	Future cell, provided with an extra large size, matching window (logic module and lamps not included)
IMW	Intermix window size
1N	Extra large, 1 per cell, non-expandable
2N	Large, 2 per cell non-expandable

**Item 5**

**Active Point** — define total number of equipped or active points.

**Item 6**

**Order**

**Code Window Color**

W	White
R	Red
A	Amber
G	Green
B	Blue
LED	LED
IMC	Intermix window color

Refer to Intermix Matrix Order Form on page 2.23 for location.

**Item 7**

- A. Define the operational sequence by letter designation from the sequences shown on page 2.15 and enter that designation in the model number format.
- B. For an intermix sequence, enter order code IMO in the model number format. Note that all points in the same cell must have the same sequence.

**Item 8**

**Order**

**Code Field Contact Voltage**

D	125 VDC
X	24 VDC
T	48 VDC
D/ISO	125 VDC, isolated, three points per cell maximum
Y/ISO	120 VAC, isolated, three points per cell maximum
X/ISO	24VDC, isolated, three points per cell maximum
T/ISO	48 VDC, isolated, three points per cell, maximum

**Item 9**

**Order**

**Code Prime Power/Power Supplies**

F	24 VDC, non-isolated supply
E	48 VDC, isolated supply
C	125 VDC, isolated supply
H	250 VDC, isolated supply
B	120 VAC, 50/60 Hz, isolated supply
A	240 VAC, 50/60 Hz, isolated supply

**Item 10**

**Order**

**Code Relay Action**

NR	No relays required	
FOE	Follows field contact	Contacts open/coil energized
FOD	Follows field contact	Contacts open/coil de-energized
FCE	Follows field contact	Contacts closed/coil energized
FCD	Follows field contact	Contacts closed/coil de-energized
MOE	Follows alarm memory	Contacts open/coil energized
MOD	Follows alarm memory	Contacts open/coil de-energized
MCE	Follows alarm memory	Contacts closed/coil energized
MCD	Follows alarm memory	Contacts closed/coil de-energized
IMR	Intermix relays	

Refer to Intermix Matrix Order Form on page 2.23 for location.

STK	Additional Relay	Per Point
-----	------------------	-----------

**Item 11**

**Order**

**Code Description**

SCA	Auxiliary relay test
RMD	Auxiliary relays mimic visual display
SCC	Common contact follower relay output (takes the place of the ringback audible relay)
SCD	Power failure relay output
SCE	Loss of data buss relay output
SCF	Common non-critical reflash relay output
SCG	Common critical reflash relay output
SCH	No audible on test
SCI	Adjustable time delay, in specific ranges:
SCI/1	2 to 30 seconds
SCI/2	1 to 14 seconds
SCI/3	0.4 to 6 seconds
SCI/4	.07 to 1 second
SCJ	Decreased response time. With normally open field contacts. Captures alarms down to 1 millisecond in duration.
SCM	Series contacts inputs
SCN	Blocking diodes. Allows sharing of field contacts with other devices for DC FCV only.
SCO/2	Two first-out groups

**Relay State When Field Input Is In Its Normal Condition**

SCO/3	Three first-out groups
SCO/4	Four first-out groups
STA	Pulsing the alarm audible at the slow flash rate, not available with first out sequences.
STB	Pulsing the ringback audible at the slow flash rate.
STC/1	Automatic alarm and ringback silence after 30 seconds
STC/2	Audible delay of automatic alarm and ringback silence adjustable up to 10 hours (remote time delay relay)
STD/1	19 inch rack mounting
STD/2	19 inch bezel rack mounting
STE	Rear terminal cover
STG/1**	Steady Sonalert mounted in a cell (requires one extra cell)
STG/2**	Pulsing Sonalert mounted in a cell (requires one extra cell)
STI	Critical/non-critical relays activated at the same time
STL	Double intensity, available only with extra large (one per cell) and large (two per cell) windows. Doubles power supply requirements.
STM	Moisture/fungus proof coating
STN	Status point indication in place of alarm point indication
STO	Transistor and logic level inputs, specify exact type
STZ	Increased input response in place of (Fixed) standard 50 ms. Specify one of the following with order: 70 ms, 120 ms, 200 ms, 500 ms, 700 ms, 1 sec, 2 sec (See SCI)
PORT/1	AN-3135 1-24 Inputs Serial Modbus
PORT/2	AN-3135 25-48 Inputs Serial Modbus
PORT/3	AN-3135 49-64 nputs Serial Modbus

\*\*Location must be defined by completing the intermix matrix form.

NOTE: Any model number containing IMW, IMC, IMO, or IMR designations requires an intermix matrix order form.

**Item 12**

**Order**

<b>Code Engraving</b>	
Y	Engraving provided by Ametek
NR	Engraving not required

# AMETEK

## Alarm and Event Recording

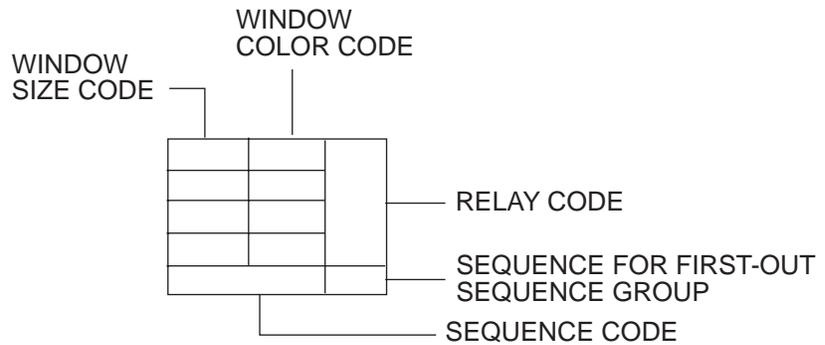
### AN-3100C Intermix Matrix

The basic model number does not provide the necessary information to configure special intermix options (window size/color, sequence, relays). When intermixed codes are used, this form must accompany the order to allow us to properly configure the system to the customer's requirements.

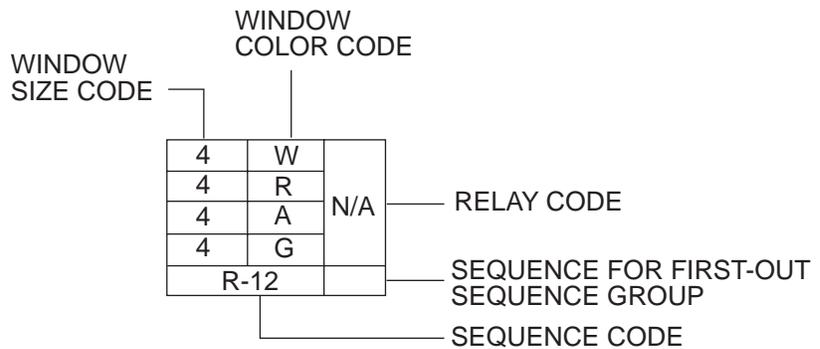
**Step 1:** If utilizing internal CSM, allow one cell position.

**Step 2:** Define each cell's requirements as shown:  
(MARK FUTURE CELLS -"FC").

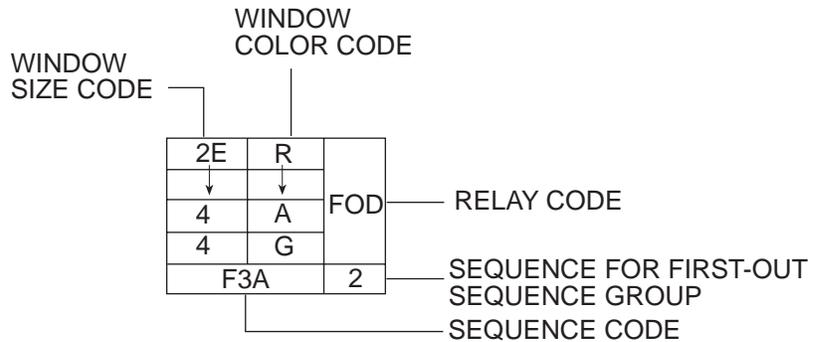
**Step 3:** Make any appropriate notes at the bottom of the form. (See next page for reproducible form).



#### Example 1



#### Example 2



# Intermix Matrix Order Form

(Reproduce as necessary)

		COLUMNS										
		10	9	8	7	6	5	4	3	2	1	
ROWS	J											
	I											
	H											
	G											
	F											
	E											
	D											
	C											
	B											
	A											COMMON MODULE

Additional Information \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

# AMETEK

## Alarm and Event Recording

### AN-5131 Annunciator Display Unit

The Ametek AN-5131 Annunciator Display is available in an unlimited variety of configurations. This modular window annunciator is structured around extruded aluminum cells. Each cell can be divided to provide one, two, three, or four windows and lamp displays. This feature can also be used in the field to easily expand capacity by changing per-cell displays to correspondingly smaller sizes. Windows are available in an assortment of sizes and colors that can be mixed or matched in any combination. Bezels and mounting hardware are provided for panel mounting. AN-5131 input options include terminals or connectors.



### Pushbutton Control Module

A Pushbutton Control Module is available which controls the remote annunciator electronics by providing pushbuttons for TEST, ACKNOWLEDGE, SILENCE and RESET functions.



Pushbutton Control Module — with switch pad and power on LED

The Pushbutton Control Module mounts integrally to the AN-5131 Annunciator Display Unit, usually occupying the lower right hand cell.

### AN-5131 Windows & Engraving

Windows are available in five different solid colors to easily differentiate groups of points by nature of the alarm. Operators quickly distinguish solid color windows.

The windows slide onto the front of the input card and can be quickly removed and exchanged when you need to internally expand the number of inputs or change your legend.

Each module has up to 8 bulbs to provide lighting redundancy in any configuration or density. Double intensity lighting is optional with eight bulbs per point on single input and four bulbs per point on dual input modules.

#### Engraving Guidelines

Character Size	Inches	Maximum Number of Lines Per Window				Approximate Total Number of Characters Available on any Line
		Extra Large Window	Large Window	Medium Window	Standard Window	
02	1/16	33	15	10	5	37
03	3/32	22	10	7	4	28
04	1/8	16	7	5	3	21
05	5/32	13	6	4	3	17
06	3/16	10	5	3	2	13
07	7/32	9	4	3	2	11
08	1/4	8	4	2	2	10
09	9/36	7	3	2	1	9
10	5/16	6	3	2	1	8
11	11/32	5	2	1	1	7
12	3/8	5	2	1	1	7
13	13/32	5	2	1	1	6
14	7/16	4	2	1	1	6
15	15/32	4	2	1	1	5
16	1/2	4	2	1	1	5

#### Window Colors Available

- White
- Red
- Amber
- Green
- Blue

#### Engraving

Fifteen different letter sizes are available. The chart below describes the maximum number of lines and maximum number of characters per line for each letter size. The standard lettering is in condensed gothic. Many other types of lettering and symbols are available.

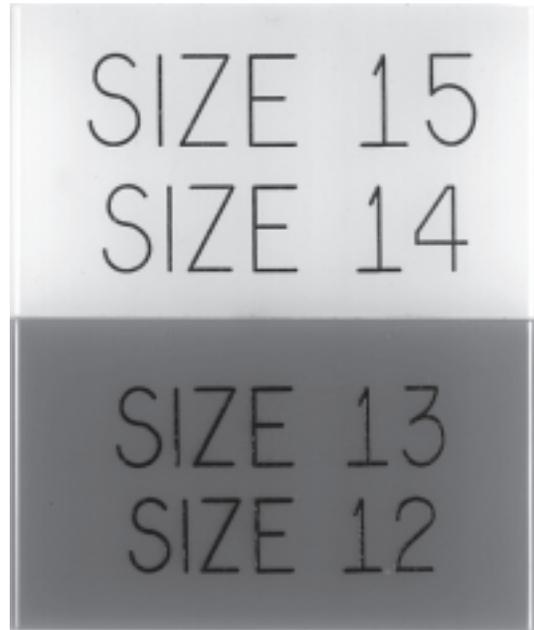


2.85"  
(72.39mm)

Single-point window (extra large)

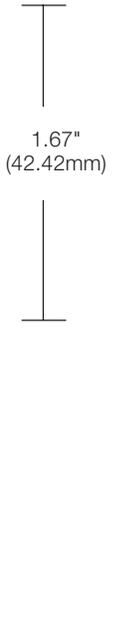


3.34"  
(84.48mm)

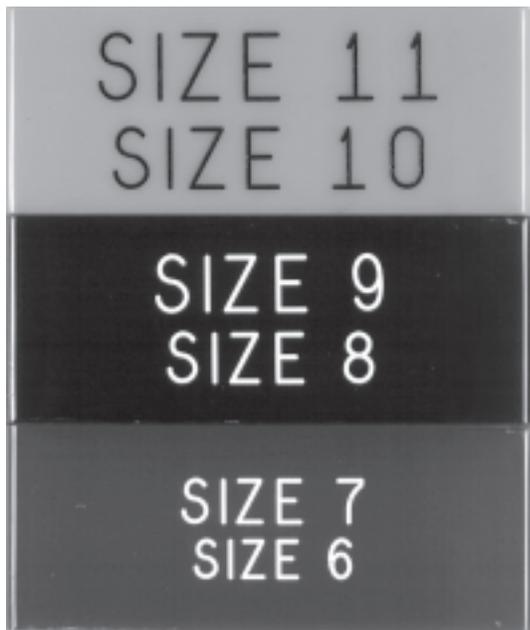


2.85"  
(72.39mm)

Two-point windows (large)



1.67"  
(42.42mm)



2.85"  
(72.39mm)

Three-point windows (medium)



1.11"  
(28.3mm)



2.85"  
(72.39mm)

Four-point windows (standard)



.83"  
(21.25mm)

# AMETEK

## Alarm and Event Recording

### AN-5131 Dimensions & Connections

#### 19" Rack Mounting

The standard configuration is 6 cells wide. It is recommended that systems less than 6 cells wide be ordered with a bezel. (STD/2 Option)

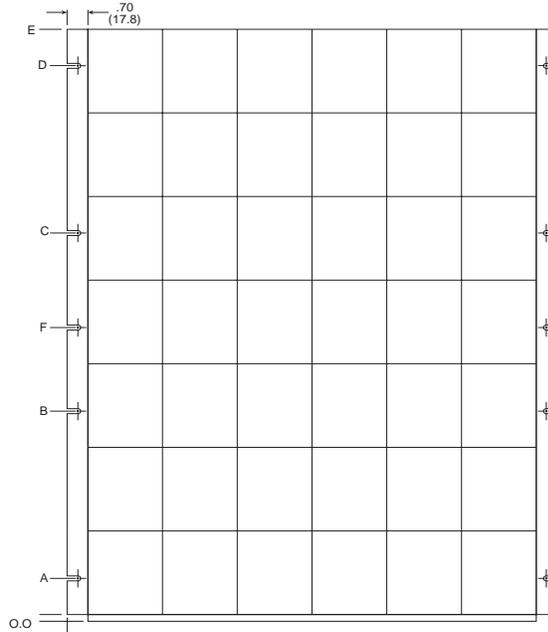
Mounting Depth: 4.5" (114.3 mm)

#### Mounting Information

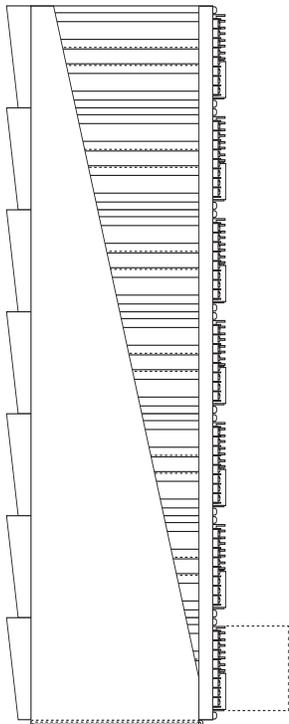
	A	B	C	D	E	F	
Number of Cells High	1H	.859 (21.8)	2.609 (66.2)	—	—	3.469 (88.0)	
	2H	1.484 (37.7)	5.434 (139.3)	—	—	6.969 (177.0)	
	3H	1.484 (37.7)	3.734 (94.8)	6.734 (171.0)	8.984 (228.2)	10.469 (265.9)	
	4H	1.484 (37.7)	5.484 (139.3)	8.484 (215.5)	12.484 (317.1)	13.969 (354.8)	
	5H	1.484 (37.69)	5.484 (149.3)	11.984 (304.4)	15.984 (406.0)	17.469 (443.7)	
	6H	1.484 (37.69)	5.484 (139.29)	15.484 (393.29)	19.484 (494.9)	20.969 (532.61)	10.484 (266.29)
	7H	1.484 (37.69)	5.484 (139.29)	18.984 (482.19)	22.984 (583.79)	24.469 (621.51)	12.484 (317.09)

The mounting information shown above provides support locations depending on the number of cells the system is high. (distance from 0.0 reference.)

Typical Rack Mounting Front View

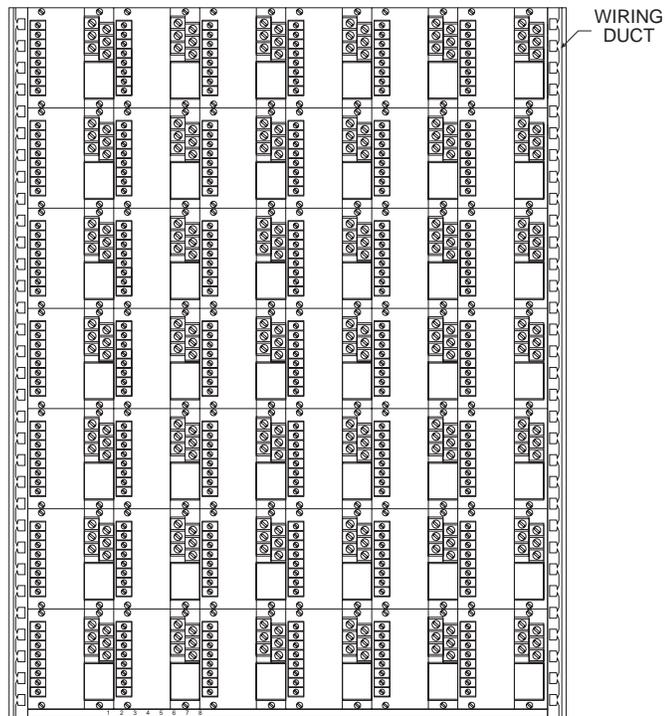


#### Side View



Note: Wiring Duct supplied on both sides for 3 cell high → systems and larger.

#### Rear View



**Panel Mounting**

All mounting dimensions are based on the number of cells, not windows. Each cell can be divided into up to 4 windows.

**Panel Mounting**

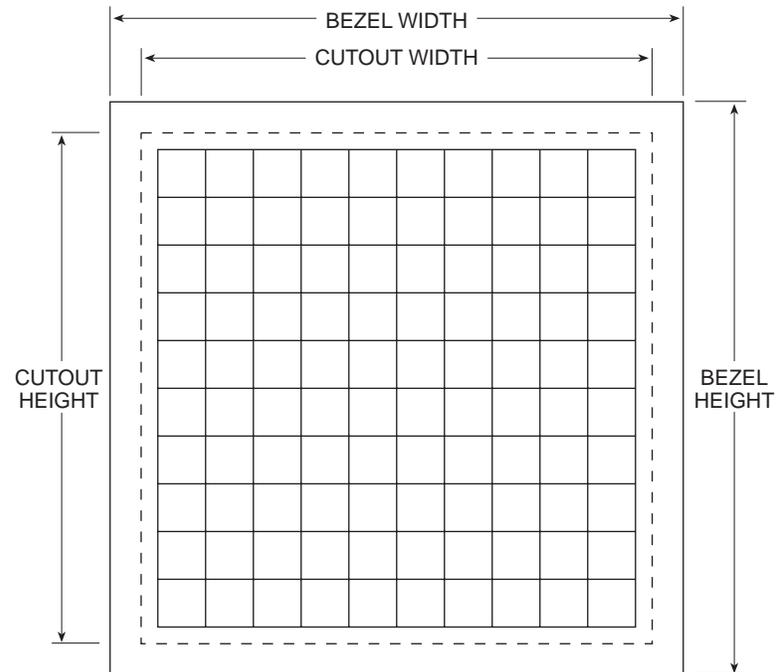
**Depth Behind Panel:**  
4.5" (114.3 mm) maximum.

Dimensions are in inches with millimeters in parentheses ( ).

	NUMBER OF CELLS WIDE														
	1W	2W	3W	4W	5W	6W	7W	8W	9W	10W	11W	12W	13W	14W	15W
Bezel Width	5.26 (133.6)	8.17 (207.5)	11.08 (281.6)	13.99 (355.3)	16.90 (429.3)	19.83 (503.7)	22.74 (577.6)	25.65 (651.5)	28.56 (725.4)	31.47 (799.3)	34.38 (873.2)	37.29 (947.1)	40.20 (1021.1)	43.11 (1094.9)	46.02 (1168.9)
Cutout Width	4.01 (101.9)	6.92 (175.8)	9.83 (249.7)	12.74 (323.6)	15.65 (397.5)	18.56 (471.4)	21.47 (545.3)	24.38 (619.3)	27.29 (693.2)	30.20 (767.1)	33.11 (840.9)	36.02 (914.9)	38.93 (988.8)	41.84 (1062.7)	44.75 (1136.6)

	NUMBER OF CELLS HIGH														
	1H	2H	3H	4H	5H	6H	7H	8H	9H	10H	11H	12H	13H	14H	15H
Bezel Height	5.75 (146.0)	9.15 (233.0)	12.56 (319.0)	15.97 (405.6)	19.37 (492.0)	22.77 (578.3)	26.17 (664.7)	29.58 (751.3)	32.99 (837.9)	36.4 (924.5)	39.80 (1011.2)	43.20 (1097.8)	46.50 (1184.4)	50.00 (1271.0)	53.40 (1357.6)
Cutout Height	4.50 (114.3)	7.90 (200.7)	11.30 (287.0)	14.70 (373.4)	18.10 (459.7)	21.50 (546.1)	24.90 (632.5)	28.30 (718.8)	31.70 (805.2)	35.10 (891.5)	38.50 (978.2)	41.90 (1064.8)	45.30 (1151.4)	48.70 (1238.0)	52.10 (1324.6)

**Note:** Consult factory for displays beyond 15 high x 15 wide.

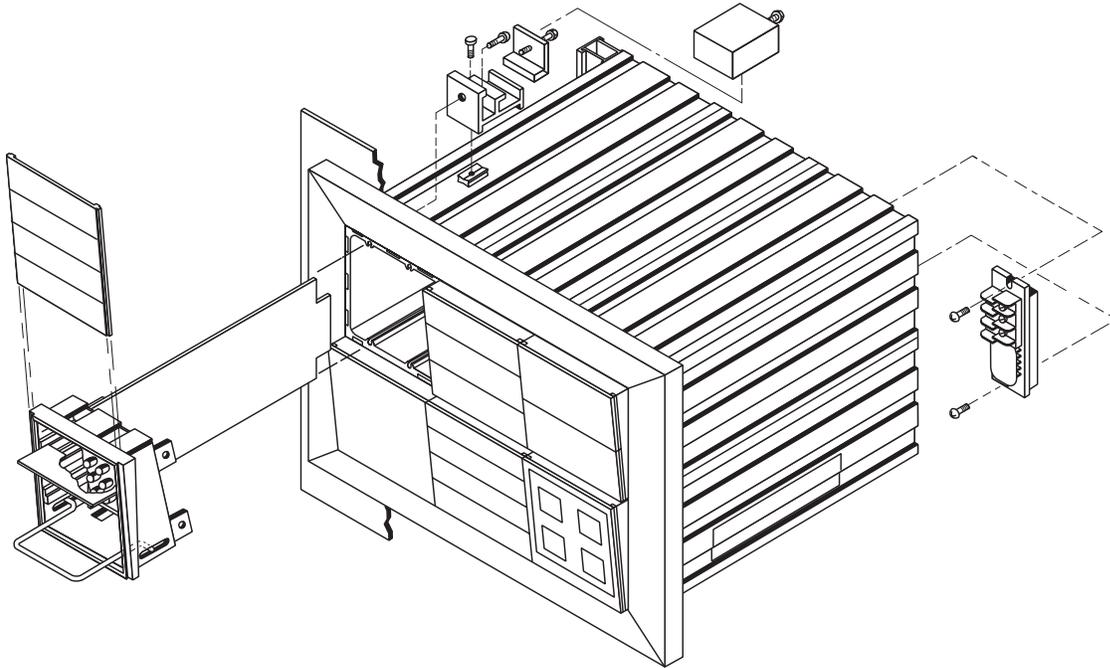


# AMETEK

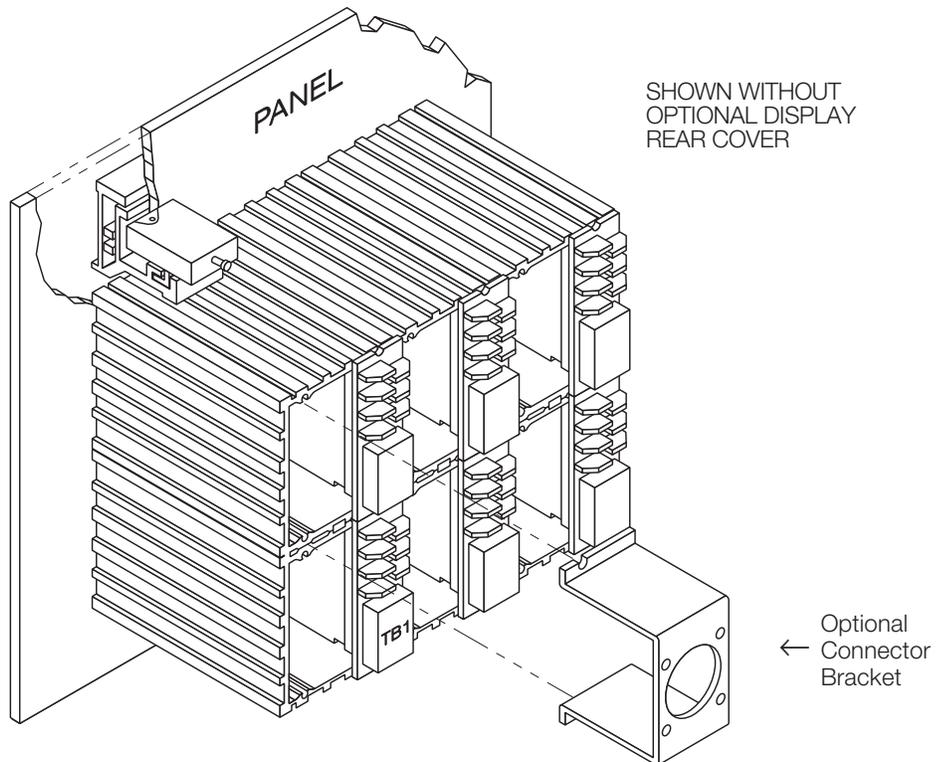
## Alarm and Event Recording

### AN-5131 Dimensions & Connections

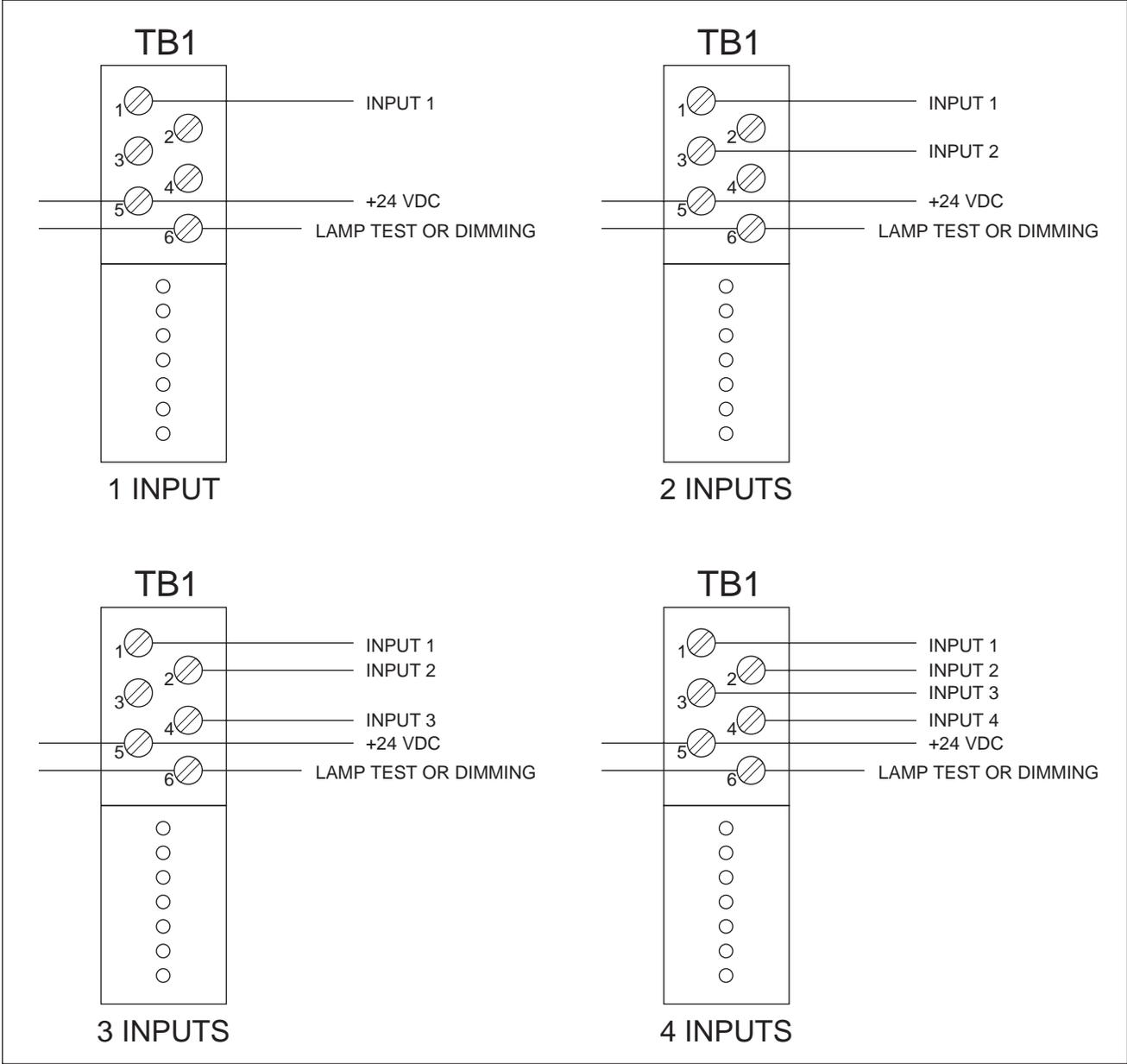
General Outline — Front View



General Outline — Rear View



# Display Cell Input Wiring Connections



# AMETEK

## Alarm and Event Recording

### AN-5131 NEMA Panel Covers

For applications where panel mounted annunciation in hostile environments is required, NEMA 4/12 panel covers are recommended. Many standard sizes are available. To help choose the panel cover that best meets your needs, please consult the adjacent chart.

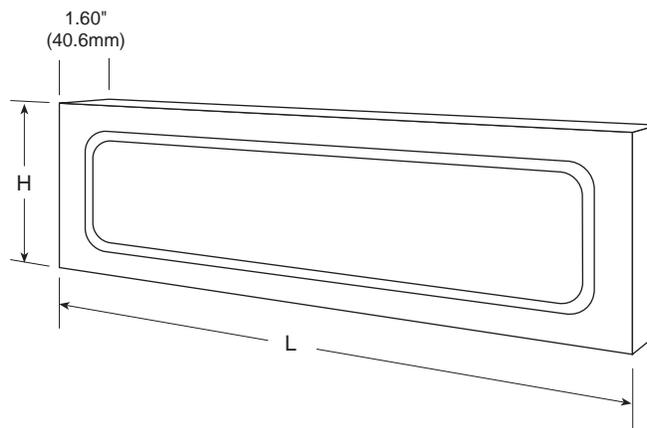
NEMA Front Cover (NFC) Options		
Approximate Dimensions		
Cell Format	H	L
1 high x 3 wide	8.94" (227.0 mm)	14.89" (378.2 mm)
x 4 wide	8.94" (227.0 mm)	17.80" (452.1 mm)
x 5 wide	8.94" (227.0 mm)	20.71" (526.0 mm)
x 6 wide	8.94" (227.0 mm)	23.62" (599.9 mm)
x 7 wide	8.94" (227.0 mm)	26.53" (673.8 mm)
x 8 wide	8.94" (227.0 mm)	29.44" (747.8 mm)
2 high x 2 wide	12.34" (313.4 mm)	11.98" (304.3 mm)
x 3 wide	12.34" (313.4 mm)	14.89" (378.2 mm)
x 4 wide	12.34" (313.4 mm)	17.80" (452.1 mm)
x 5 wide	12.34" (313.4 mm)	20.71" (526.0 mm)
x 6 wide	12.34" (313.4 mm)	23.62" (599.9 mm)
x 7 wide	12.34" (313.4 mm)	26.53" (673.8 mm)
x 8 wide	12.34" (313.4 mm)	29.44" (747.8 mm)
x 9 wide	12.34" (313.4 mm)	32.35" (821.7 mm)
3 high x 3 wide	15.74" (399.8 mm)	14.89" (378.2 mm)
x 4 wide	15.74" (399.8 mm)	17.80" (452.1 mm)
x 5 wide	15.74" (399.8 mm)	20.71" (526.0 mm)
x 6 wide	15.74" (399.8 mm)	23.62" (599.9 mm)
x 7 wide	15.74" (399.8 mm)	26.53" (673.8 mm)
x 8 wide	15.74" (399.8 mm)	29.44" (747.8 mm)
x 12 wide	15.74" (399.8 mm)	41.08" (1043.4 mm)
4 high x 2 wide	19.14" (486.1 mm)	11.98" (304.3 mm)
x 3 wide	19.14" (486.1 mm)	14.89" (378.2 mm)
x 4 wide	19.14" (486.1 mm)	17.80" (452.1 mm)
x 6 wide	19.14" (486.1 mm)	23.62" (599.9 mm)
x 8 wide	19.14" (486.1 mm)	29.44" (747.8 mm)
x 9 wide	19.14" (486.1 mm)	32.35" (821.7 mm)
x 12 wide	19.14" (486.1 mm)	41.08" (1043.4 mm)
5 high x 3 wide	22.54" (572.5 mm)	14.89" (378.2 mm)
x 4 wide	22.54" (572.5 mm)	17.80" (452.1 mm)

Standard depth is 1.60" (40.6 mm)

NOTE: Please consult factory for certified drawings and for other available sizes.

### Hinged NEMA 4/12 Panel Mount Covers

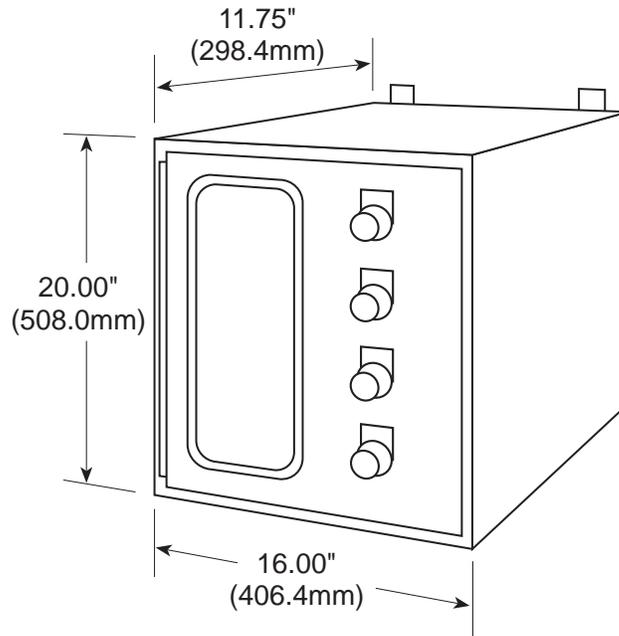
The panel cover is constructed of 16 gauge, cold-rolled steel with a textured black finish. The corners are sealed by a neoprene sponge gasket and the window is 1/8" thick plexiglass. Adjustable grip latches secure the hinged cover to the mounting plate.



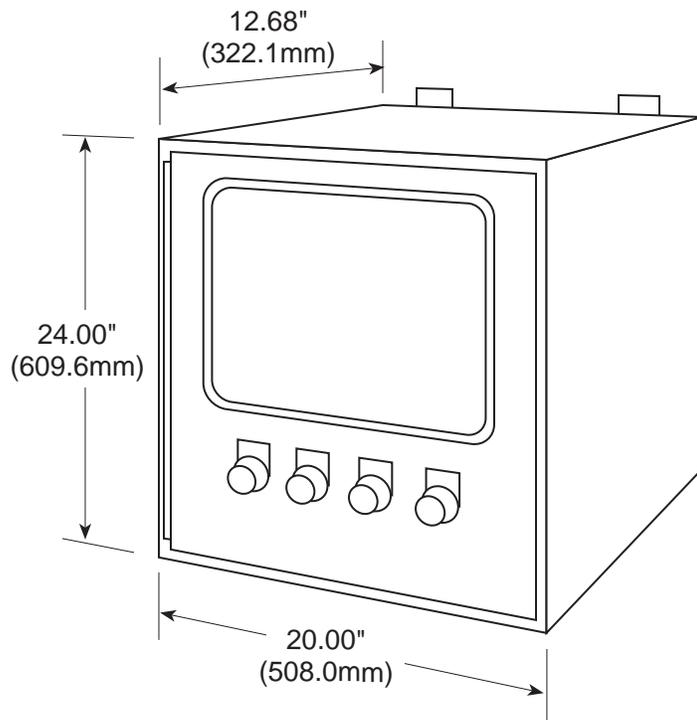
## AN-5131 For Harsh Environment

### NEMA Enclosures

Three standard NEMA 4/12 type surface mount enclosures are available: a 12 cell model (3H x 4W), an 8 cell model (4H x 2W) and a 4 cell model (4H x 1W). All housings are oil-tight, water-tight, weather resistant and can be equipped for purge applications. Standard features include door-mounted pushbuttons. Available options include external audibles and pushbuttons, and a common-alarm rotating dome light. The rotating dome light is designed to alert operators of alarms in conditions where noise may drown out audibles. It can be specified in red, blue, amber, or green for either integral or remote mounting.



Surface Mount NEMA 4/12  
Enclosure - 4H x 1W and 4H x 2W



Surface Mount NEMA 4/12  
Enclosure - 3H x 4W

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## Alarm and Event Recording

### AN-5131 Specifications

#### Input Signals (Alarm Signals):

Lamp inputs provided by remote annunciator electronics assembly, such as Ametek AN-6100R remote annunciator system.

#### Power Requirements:

24 volt lamps, powered by remote annunciator electronics system.

#### Controls (Integral or Remote):

- A. Acknowledge pushbutton.
- B. Silence pushbutton.
- C. Test pushbutton.
- D. Reset pushbutton.

#### Packaging:

Extruded aluminum cell with interchangeable plug-in modules.

#### Ambient Temperature Range:

32°F to 140°F, 0°C to 60°C.

**Humidity:** 0-95% non-condensing.

#### Window Sizes:

- A. 0.83" x 2.85" (21.25 x 72.39mm), standard.
- B. 1.11" x 2.85" (28.3 x 72.39mm), medium.
- C. 1.67" x 2.85" (42.42 x 72.39mm), large.
- D. 3.34" x 2.85" (84.84 x 72.39mm), extra large.

**Weight:** 1.68 lbs (0.76 kg) per cell.

### AN-5131 Ordering

The model number of the AN-5131 consists of seven (7) items derived from the order codes listed below. When ordering a system that includes any "intermix" options (e.g. more than one window color), an intermix order form should be completed to fully define the annunciator display. If you have any questions, contact your nearest Ametek sales office for assistance.

Each item has a unique order code which must be entered in its specific location in the model number sequence. The following is a tabulation of the order codes that must be used for each and every item of the standard model number.

AN-5131 -	<u>1</u>	x	<u>2</u>	-	<u>3</u>	-	<u>4</u>	-	<u>5</u>	-	<u>6</u>	-	<u>7</u>
	Number of Cells High		Number of Cells Wide		Window Size		Active Points		Window Color		Standard Options		Engraving

ORDER CODE FOR EACH ENTRY ITEM

#### Item 1

The order code defines the number of cells high.

#### Item 2

The order code defines the number of cells wide.

#### Item 3

##### Order

##### Code Window Size

- 4 Standard, 4 per cell
- 3E Medium, 3 per cell, field expandable
- 2E Large, 2 per cell, field expandable
- 1E Extra large, 1 per cell, field expandable
- LED LED display, 4 per cell
- FC Future cell, provided with an extra large size, matching window (module and lamps not included)
- IMW Intermix window size

#### Item 4

**Active Point** — define total number of equipped or active points.

#### Item 5

##### Order

##### Code Window Color

- W White
- R Red
- A Amber
- G Green
- B Blue
- LED LED
- IMC Intermix window color

Refer to Intermix Matrix Order Form on page 2.23 for location.

#### Item 6

##### Order

##### Code Standard Options

- NR None required
- STD/1 19" rack mounting, 1 - 12H x 6W only
- STD/2 19 inch bezel rack mounting
- STE Cover for rear terminals
- STG-1\* Sonalert (steady) mounted in a cell
- STG-2\* Sonalert (pulsing) mounted in a cell
- STH\* Silence/acknowledge/rest/test pushbuttons mounted in a cell
- NFC Reference page 2.53 for dimensions
- STY Integral plug connector - up to 32 points per plug
- DMR Dim resistors - applied per cell only
- TSD Test diodes - applied per cell only

\* Location must be defined by completing the intermix matrix form.

NOTE: Any model number containing IMW or IMC designations requires an intermix matrix order form.

#### Item 7

##### Order

##### Code Engraving

- Y Engraving provided by Ametek
- NR Engraving not required

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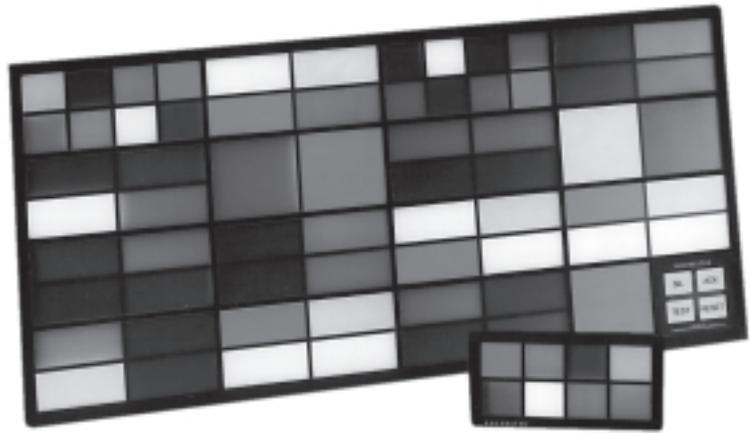
## AN-6150 Modular Annunciator Display Unit

- Low Cost Visual Display
- Configurable in 4 Standard Window Sizes
- Laser Printed Legends
- Easy Installation and Maintenance.

The Model AN-6150 is a compact, cellular display unit which allows a wide variety of customer configurations. Any combination of four standard window sizes can be accommodated in each cell. These cells can be configured in any matrix up to 4 high and 4 wide. The single module is designed to DIN 2.84" x 5.67" standard.

The AN-6150 Modular Display Unit is suitable for panel mounting. Six window colors are available which can be back lighted by incandescent lamps. Alternatively, LED cluster lamps are available to meet long life requirements. Legends are laser printed on clear transparencies to allow changes to be done by the customer. Pushbutton membrane switches can also be added for Silence, Test, Acknowledge and Reset functions.

These units come standard with flush panel mounting brackets and terminal block connections. Please refer to ordering information for additional options.



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### AN-6150 Specifications

#### Construction

Modular interlocking matrix configuration, multiples of standard DIN size 72mm x 144mm (2.83 in. x 5.67 in.) cells up to 4 cells high by 4 cells wide.

#### Mounting

Flush panel mount or standard 19 inch rack panel mount for 3 cell wide display only.

#### Window Sizes

Four standard sizes.  
Small 0.98" x 1.14" (25mm x 29mm)  
Medium 0.98" x 2.40" (25mm x 61mm)  
Large 2.13" x 2.40" (54mm x 61mm)  
Ex Large 2.13" x 4.96" (54mm x 126mm)

#### Window Colors

Red, Amber, Yellow, Green, Blue, White illuminated by incandescent lamps.

Red, Amber, Green illuminated by LED clusters.

#### Legends

Laser printed on clear film or engraved filters. Secret window until lit and secret legends optional.

#### Illumination

#656 wedge type bulb, long life, 28 volt, 0.06 Amp filament lamp or equivalent. Dual lamps in all window sizes. Dual lamps are optional in small window size.

Optional illumination by LED cluster each 24 volt, 0.025 Amp with limited colors (see Window Colors).

#### Connections

Ribbon cable or Terminal Block accepting maximum wire size 16 AWG.

#### Ambient Working Temperature

14°F to 122°F (-10°C to 50°C)

#### Recommended Working Voltage

24 volts ±10% for increased lamp life with 28 volt lamp.

#### Power Requirements

Each cell has a total of 8 plug-in filament lamps or LED clusters.

Power required per cell: 28 volt lamp working at 24 volts – 0.5 Amp, 12 watts

24 Volt LED cluster working at 24 volts – 0.2 Amp, 4.8 watts

#### Control Module

SILENCE, TEST, ACKNOWLEDGE and RESET membrane pushbuttons within a large size window (54mm x 61mm – 1/2 cell size) (2.13 in x 2.40 in) including internal audible device and visual power-on indicator.

#### Weight

0.48 lbs (0.22 Kg) per cell.

#### Maintenance

Access to all window elements is available from the panel front using only a small screwdriver.

#### Agency Approvals

CSA approved for ordinary locations. FM approval for ordinary locations pending.

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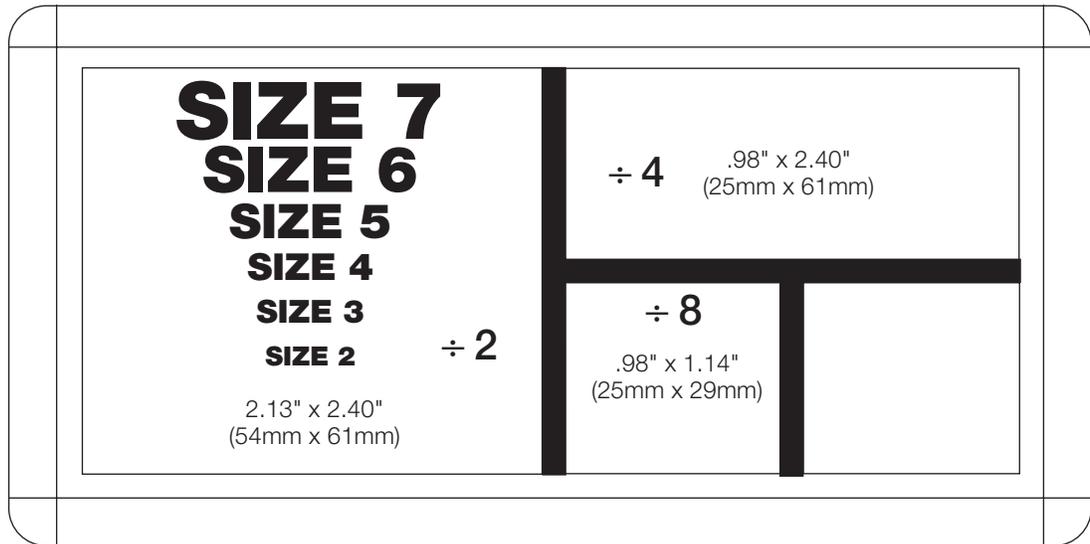
## Alarm and Event Recording

### AN-6150 Dimensions

#### Legend Lettering Sizes

		Window Size			
		25 x 29mm ÷ 8	25 x 61mm ÷ 4	54 x 61mm ÷ 2	54 x 126mm ÷ 1
Size 2	no. of lines	6	6	14	14
	chars per line	14	30	30	62
Size 3	no. of lines	4	4	9	9
	chars per line	10	20	20	22
Size 4	no. of lines	3	3	7	7
	chars per line	7	15	15	31
Size 5	no. of lines	2	2	5	5
	chars per line	6	12	12	24
Size 6	no. of lines	2	2	5	5
	chars per line	5	10	10	21
Size 7	no. of lines	2	2	4	4
	chars per line	4	9	9	19

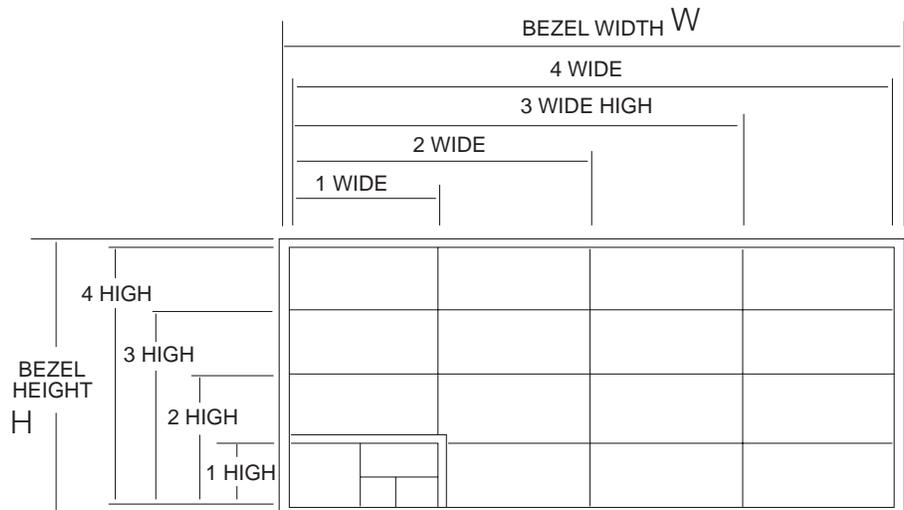
#### Single Unit and Window (Actual Sizes)



2.84" x 5.67"  
(72mm x 144mm)  
DIN Unit

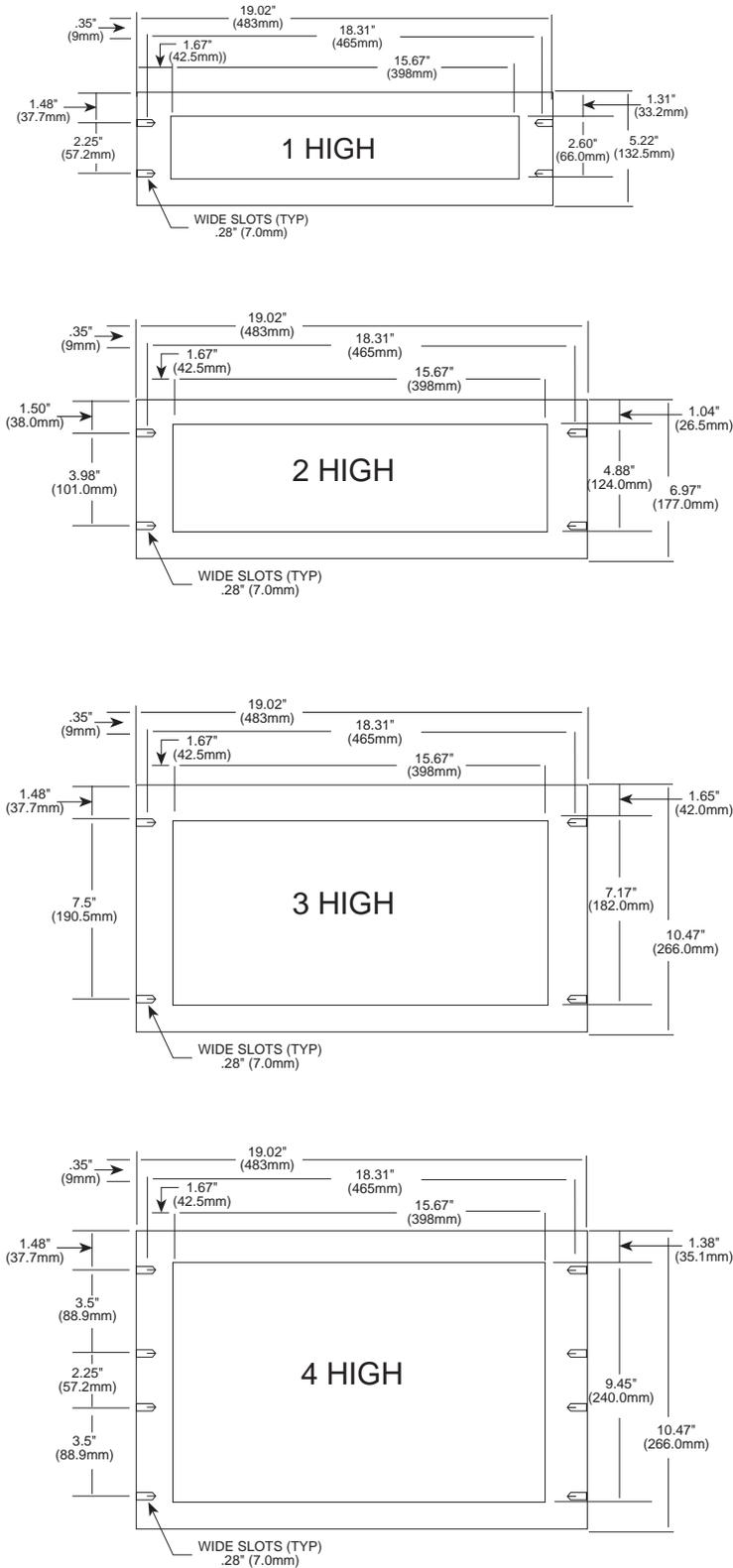
Number of Cells Wide "W"				
	1	2	3	4
Bezel Width	5.67 (144)	10.79 (274)	5.91 (404)	21.02 (534)
Cutout Width	5.43 (138)	10.55 (268)	15.67 (398)	20.79 (528)

Number of Cells High "H"				
	1	2	3	4
Bezel Height	2.83 (72)	5.12 (130)	7.40 (188)	9.68 (246)
Cutout Height	2.60 (66)	4.88 (124)	7.17 (182)	9.45 (240)



## AN-6150 Dimensions (standard rack mounting adapters)

Overall Depth: 2.24" (57mm)



xx = +.010  
-.000

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## Alarm and Event Recording

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### AN-6150 Ordering Information

AN-6150 1— 2 — 3 — 4 — 5 — 6 — 7

#### Item 1

Defines number of cells high. Not to exceed 4.

#### Item 2

Defines number of cells wide. Not to exceed 4.

#### Item 3

Defines the window size. Enter one of the following:

S	Small	0.98" x 1.14" (25mm x 29mm)
M	Medium	0.98" x 2.40" (25mm x 61mm)
L	Large	2.13" x 2.40" (54mm x 61mm)
EL	X Large	2.13" x 4.96" (54mm x 125mm)
IMW		Intermixed window formats*

#### Item 4

Indicates type of lens assembly

VW	Visible Window laser printed
SW	Secret Window laser printed (Not available with LED illumination)
VL	Visible Legend engraved*
SL	Secret Legend engraved*

#### Item 5

Indicates type of illumination.

24C	Incandescent lamps (24V)
24R	LED array red (24V)
24A	LED array amber (24V)
24G	LED array green (24V)

#### Item 6

Indicates window color.

R	Red
Y	Yellow
G	Green
A	Amber
W	White
B	Blue (Not available with LED)
IMC	Intermix colors*

\*Specify

#### Item 7

Standard Options. Indicates requirements of any additional options. Please specify from list below.

NR	None Required
STD	19" rack mount panel (3 cell wide only) 1 cell high 2 cells high 3 cells high 4 cells high
STH	Integral pushbuttons for SILENCE, TEST, ACKNOWLEDGE, and RESET, located in bottom right hand cell.
RCA	Ribbon cable assembly, 6 ft. long (medium window size only)

#### Notes:

1. LED option not available with secret window option.
2. Integral pushbutton assembly not available with Extra Large (full cell) window.
3. Ribbon cable assembly not available with 1 cell wide array with or without pushbuttons or 1 x 2 cell array with pushbuttons.

## AN-3196B LED Annunciator

- 12 Point, Fully Self-Contained Annunciator
- CSA Approved, Ordinary Locations
- FM Approved, Ordinary and Division 2 Locations (AC horn only)
- Expands Existing Annunciators Through Two Reflash Outputs
- Isolated Inputs
- Fully Field Switch Programmable
- AC/DC Field Contact Voltage
- Available in Panel Mount, Surface Mount or NEMA Enclosure
- MODBUS Communications Option

The AN-3196B is a self contained, compact LED annunciator with reflash capability. It can be used as a stand-alone annunciator or to enhance or expand other annunciators.

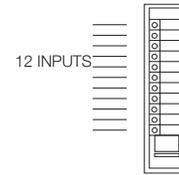
This model offers dependable indication of alarms via red LEDs with adjacent descriptive legend plates. Each unit comes complete with 12 inputs, integral control push buttons, power supplies, output relays for reflash to another annunciator, and audible alarming capabilities.



### Stand Alone Annunciator

The AN-3196B is a self-contained 12-point annunciator that can alert personnel locally through both flashing LED's and external audible devices. This annunciator is a low cost method of providing annunciator benefits to remote locations.

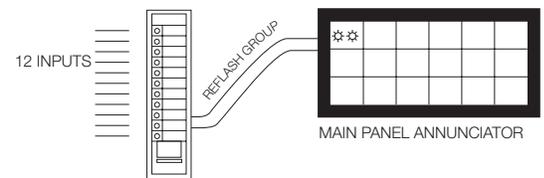
### Panel Mount



### Annunciator Expansion

The reflash output relays on the AN-3196B can be used to combine up to 12 new inputs to alarm a single full-size window of an existing annunciator. Reflash can be used to add additional points to non-expandable annunciators and when it is undesirable to reduce the window size on an internally expandable annunciator.

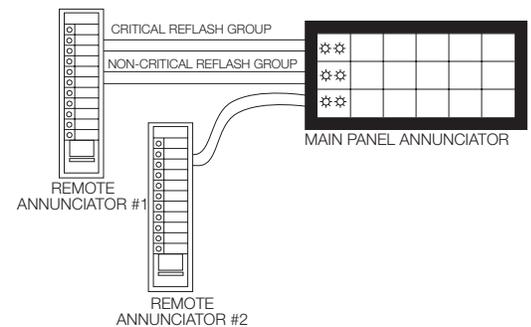
### Additional Points For Existing Annunciator Systems



### Remote Monitoring with Reflash

The AN-3196B can provide detailed alarm data to local personnel and reflash the alarms to a control room annunciator. The reflash data often provides sufficient general information about alarms occurring at remote locations for operators to react properly, and detailed alarm data is available on the AN-3196B LED display if required. Cost savings are realized through the reduction in wiring and control room annunciator size.

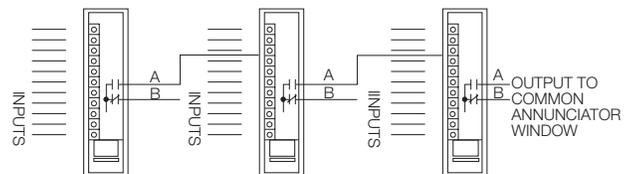
### Multiple Remote Units With Output To Main Panel Annunciator



### Multiple Remotes to One Common Window

Multiple AN-3196Bs can be linked together by using a reflash output from one unit as an input to another. The last AN-3196B can reflash the alarm data from all of the units to a single window in a control room annunciator.

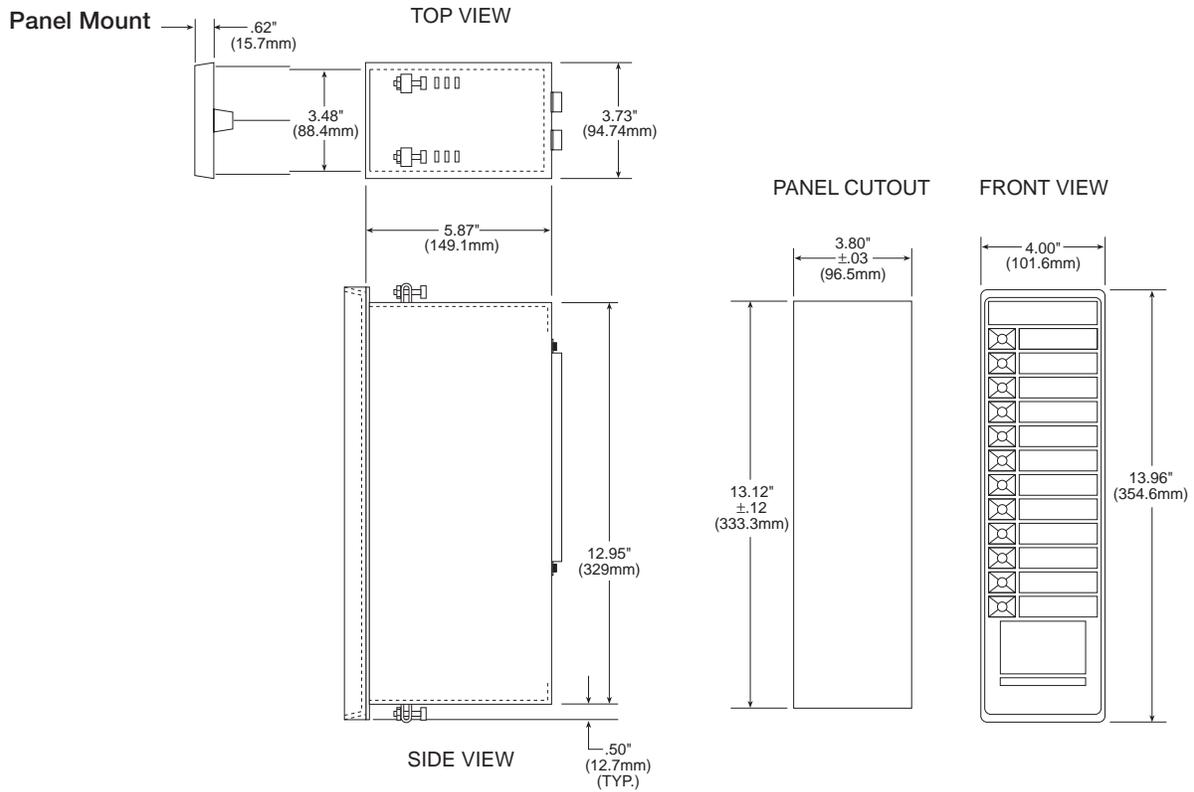
### Multiple Remotes With Outputs To One Common Annunciator Window



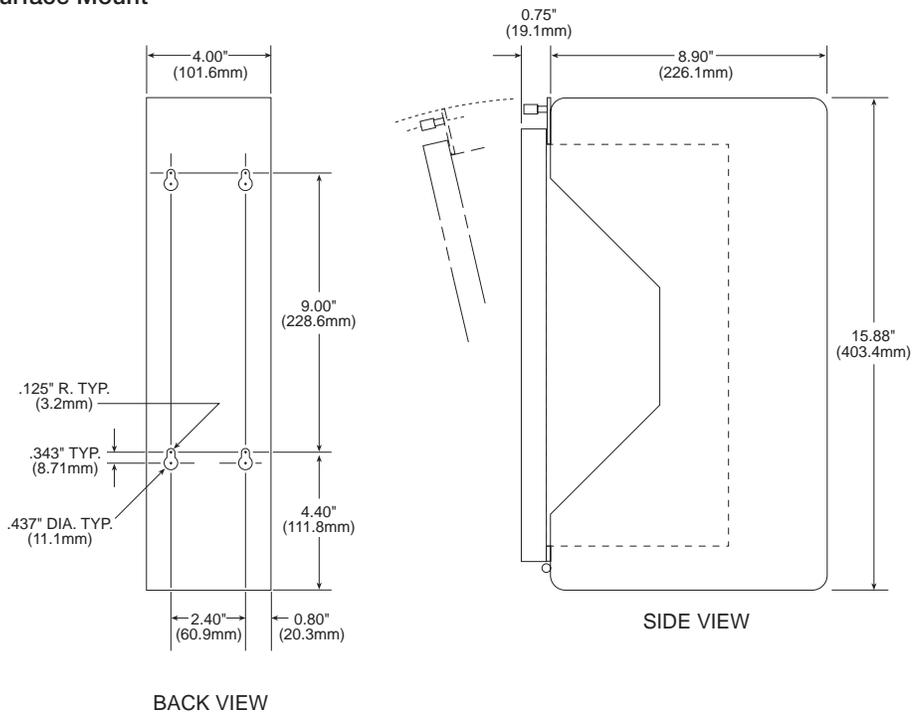
# AMETEK

## Alarm and Event Recording

### AN-3196B Dimensions & Connections

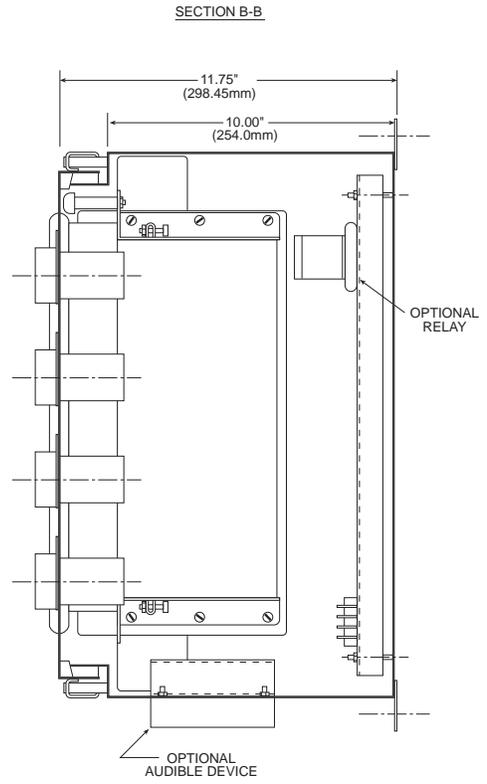
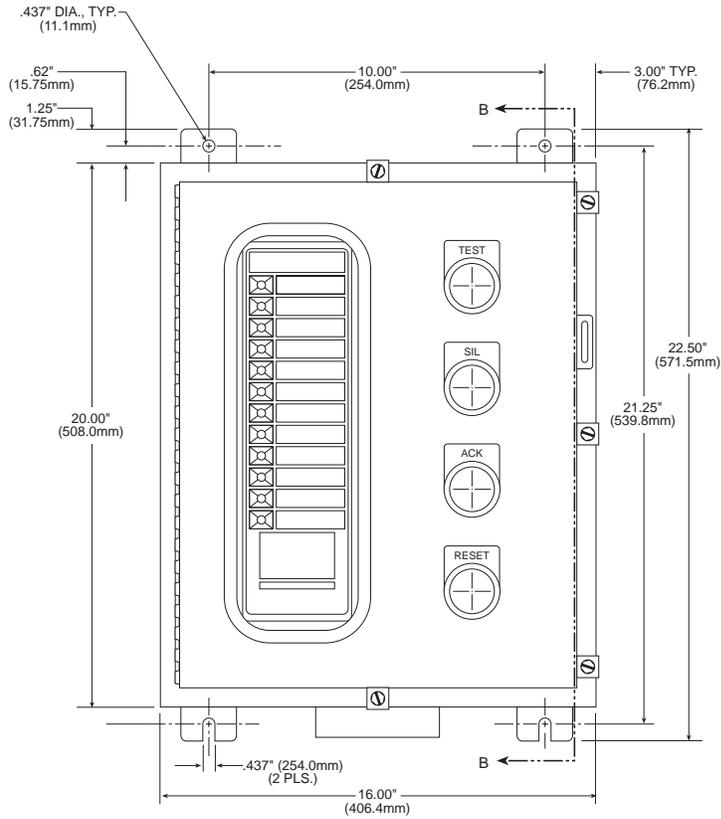


### Surface Mount



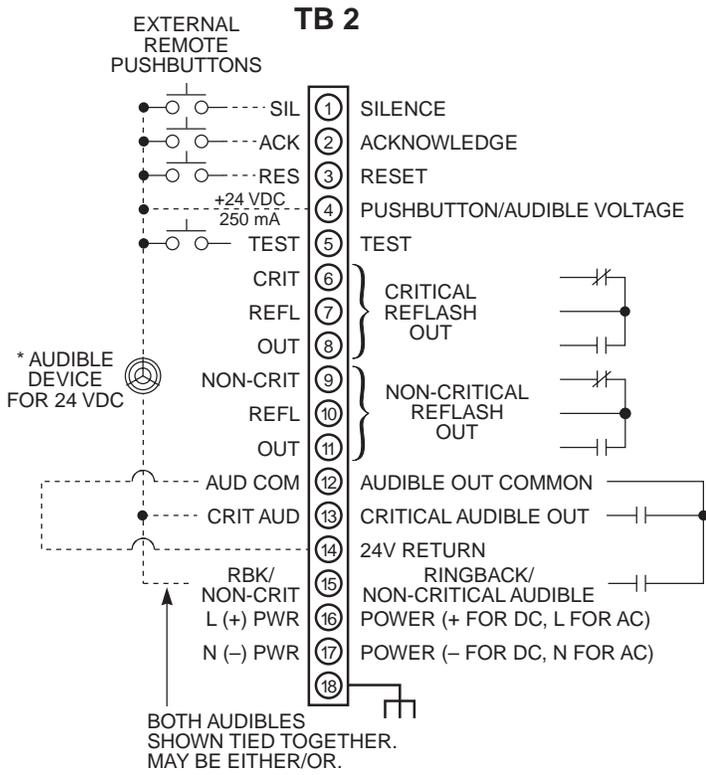
# AN-3196B Dimensions & Connections

## NEMA 4/12 Enclosure



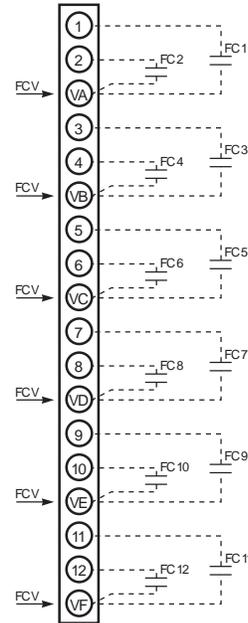
# AMETEK

## Alarm and Event Recording

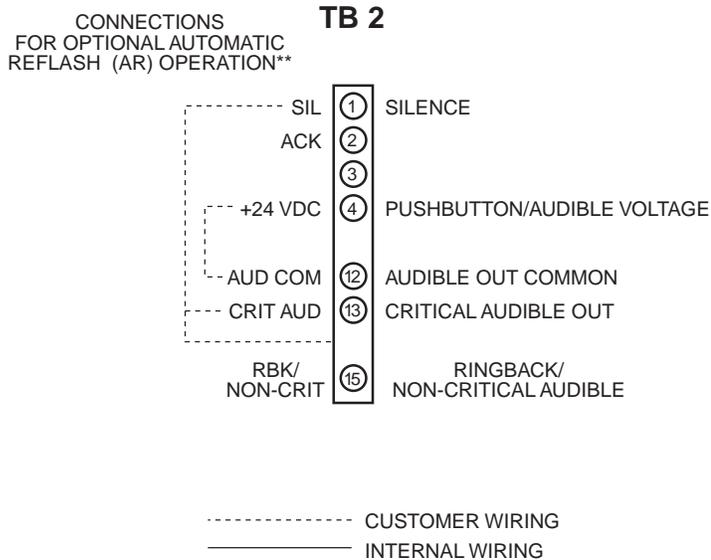


\* FOR OTHER AUDIBLE DEVICES  
REF DWG 1072-030

**TB 1**  
FIELD CONTACT CONNECTIONS  
INTERNALLY SUPPLIED FCV

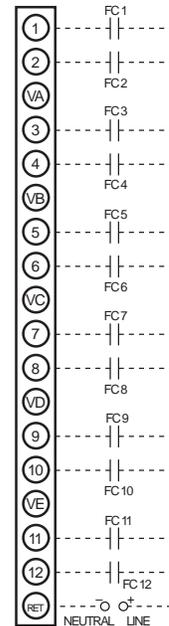


**NOTE:** FIELD CONTACTS MAY BE ANY COMBINATION OF NO OR NC.



\*\* Recommended configuration for remote AN-3196B reflash output to main annunciator, where audible function in remote location is not required. This hook-up is not compatible with audible device hook-up shown in above diagram.

**TB 1**  
FIELD CONTACT CONNECTIONS  
EXTERNALLY SUPPLIED FCV



**NOTE:** OTHER CONFIGURATIONS AVAILABLE. CONTACT FACTORY OR LOCAL REP FOR MORE INFORMATION.

## AN-3196B Specifications

### Input Signals:

NO or NC contacts, switch selectable

### Output:

- A. LED indicator per point
- B. Audible and Reflash Output Relay  
Contacts rated at:  
5 amperes at 24 VDC or  
120 VAC resistive  
3 amperes at 120 VAC resistive
- C. Optional remote mounted audible devices
- D. 24 VDC @ .25 A available for driving audible device

### Ambient Temperature Range:

32°F to 140°F (0°C to 60°C)

### Relative Humidity:

0% to 95% (non-condensing)

### Power Source and Requirements:

- A. 120 VAC: 120 VAC ± 10%, 50-60Hz at 100 mA maximum
- B. 240 VAC: 240 VAC ± 10%, 50-60Hz at 50 mA maximum
- C. 125 VDC: 105 VDC to 140 VDC at 100 mA maximum
- D. 24 VDC: 20 VDC to 28 VDC at 400 mA maximum
- E. 48 VDC: 44 VDC to 52 VDC at 250 mA maximum

### Terminals:

Screw Barrier type  
12 AWG wire maximum

### Controls:

Integral Test, Acknowledge, Silence and Reset pushbuttons

### Field Contact Voltage:

- A. Isolated, internally supplied 125 VDC or 24 VDC for 48 VDC, 125 VDC, 120/240 VAC Prime Power
- B. Non-isolated, internally supplied 24 VDC for 24 VDC prime power or 48 VDC for 48 VDC prime power
- C. Isolated externally supplied 125 VDC, 48 VDC, 24 VDC, 120 VAC

### Enclosures:

General purpose standard panel or surface mount enclosures.

### Labeling:

Black lamacoid legend plates with white lettering for each point, plus one for unit identification (see engraving information)

**Isolation:** 1700 VDC

### Surge Withstand Capability (SWC):

Test conforms to ANSI /IEEE C37.90.1-1989 (oscillatory) and IEC 801-4 Level 2

**Weight:** 9 lbs. (4.09 kg) Panel Mount  
53 lbs. (24 kg) in NEMA Enclosure

### Sequence Selection:

Chose from 9 available sequences by DIP switch selection. Only one sequence can be selected at any given time for all 12 alarm points. The 9 available sequences are listed under Ordering, Item 1 and are defined on Page 2.15.

Legend Plate Engraving Sizes		
Letter Size	Maximum # of lines	Maximum # of characters per Line
1/8" (3.2mm)	3	22
5/32" (4mm)	3	18
3/16" (4.8mm)	2	14
1/4" (6.4mm)	1	11
Other sizes available upon request.		

## AN-3196B Ordering

The AN-3196B is supplied in the following versions, stocked and immediately available from the factory. Individual model numbers are defined by the following fill-in items:

AN-3196B- 1 - 2 - 3 - 4 - 5 - 6 - 7  
 Sequence Prime Field Contact Audible Reflash Enclosure Communications  
 Power Voltage Options

### Item 1 Sequence

Chose from these available sequences:

A FFAM2  
 F2M-1 A-4  
 M R12  
 F1A F2A  
 F3A A4  
 R

### Item 2 Prime Power

F 24 VDC  
 E 48 VDC  
 C 125 VDC  
 B 120 VAC  
 A 240 VAC

### Item 3 Field Contact Voltage

#### Internally Supplied

D 125 VDC  
 X 24 VDC  
 T 48 VDC

#### Customer Supplied

D/C 125 VDC Isolated  
 X/C 24 VDC Isolated  
 T/C 48 VDC Isolated  
 Y/C 120 VAC Isolated

### Item 4 Audible Options

\*SNS Sonalert Steady Tone  
 Remote Mount  
 \*SNP Sonalert Pulsing  
 Remote Mount  
 HAC 120 VAC Remote Horn  
 HDC 24 VDC Remote Horn  
 HDH 125 VDC Remote Horn  
 NR Not Required  
 \*Audible device not integrally mounted in NEMA 4/12 enclosure.

### Item 5 Reflash Option

AR Automatic Reflash  
 MR Manual Reflash (Standard)

### Item 6 Enclosure

PM Panel Mount  
 SM Surface Mount  
 4WM Wall mount, NEMA 4  
 SCM Series Contact Monitor Inputs

### Item 7 Communications

Port 1 Serial Modbus

# AMETEK

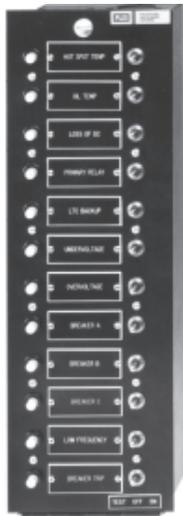
## Alarm and Event Recording

### SM-100U Substation Monitor

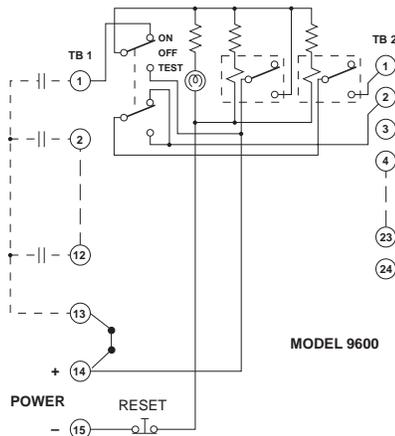
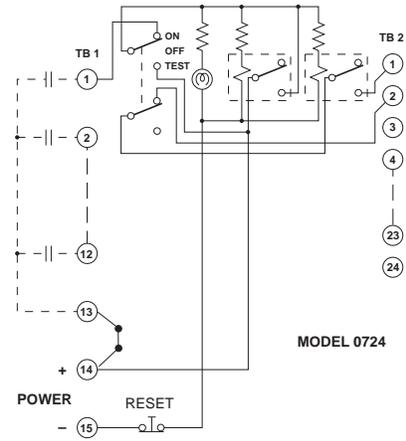
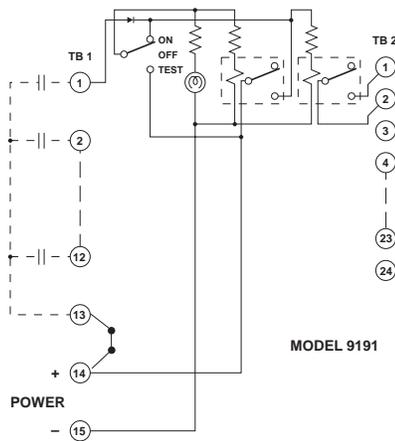
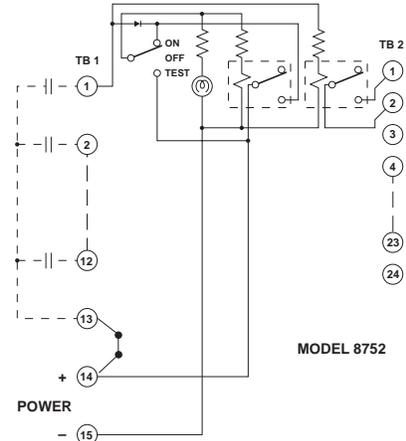
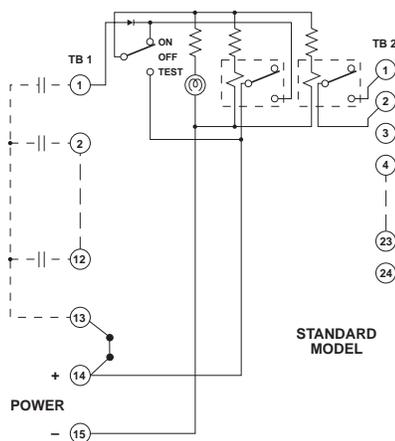
- 12 Point Annunciator
- High Reliability in Severe Temperature Conditions
- Simple Operation
- Individual Reset Per Point
- 125 VDC or 48 VDC

The SM-100U is a compact, self-contained substation annunciator providing 12 points of alarms. This model is supplied with all lamps and name plates, operation control switches, and an output for communicating to a SCADA system.

Automatic locking of alarm conditions along with complete redundant output relays provide the optimum in remote substation annunciator applications.



### SM-100U Connections

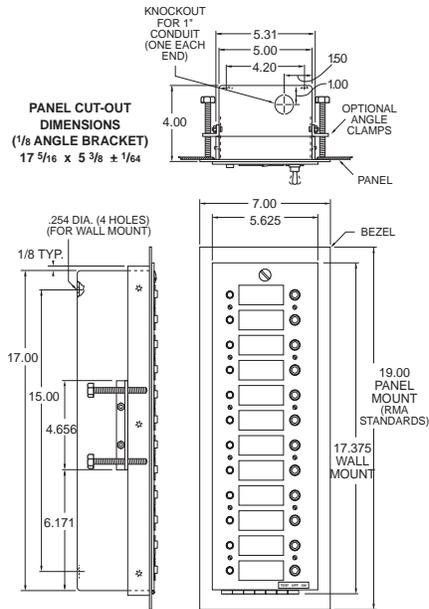


TB1=12 Normally Open Alarm Contacts

Relay Contacts Are Shown In De-Energized (Normal) State

TB2=12 Normally Open Auxiliary Contacts For Use With Supervisory, Audible, Or Visual Indicator

## SM-100U Dimensions



## SM-100U Specifications

### Input Signals:

Normally open alarm contacts supplied with voltage from the positive side of the station battery.

### Output Signals:

Lighted lamps upon alarm status until manually reset. Individual auxiliary relay contacts.

**Operating Voltage:** 125 VDC or 48 VDC

### Power Dissipation:

6 Watts @ 125 VDC per point  
2.2 Watts @ 48 VDC per point  
0 Watts during standby

### Lamps:

Telephone type 24 ESB, operated at reduced voltage for 50,000 hour life.

### Relays:

Contact rating is 5A at 24 VDC, 0.1A at 125 VDC

### Sequence of Operation

Condition	Field Alarm Contacts	Switch	Lamp	Auxiliary Contacts
Normal	Open	On	Off	Open
Alarm	Closed	On	On	Closed
Return to Normal	Open	On	On	Closed
Reset	Open	Off	Off	Open

**Ambient Temperature Range:**  
-30°F to 140°F (-34°C to 60°C)

**Humidity:** 0 to 95% non-condensing

**Isolation :** 600 VAC or 1000 VDC  
Input to case, output to case, input to output.

**Surge Withstand Capability (SWC):**  
Conforms to ANSI/IEEE C37.90.1-1989

### Field Connections:

Terminal block with #6 screws.  
12 AWG wire maximum.

### Dimensions:

5.625"W x 17.00"H x 4.00"D  
(14.29 cm x 43.18 cm x 10.16 cm)

**Weight:** 9 lbs. 13 oz. ( 4.45 kilos)

### Mounting:

Wall mount or panel mount is available

### Labeling:

Black lamacoid legend plates with white engraved lettering. Each plate is 1" x 2.5" overall. Up to 5 lines with 24 characters per line is possible using 1/8" engraving. Please consult factory for other various options on engraving sizes.

## SM-100U Ordering

Specify each item:

### Item 1 – Model Number

SM100U for 125 VDC power  
SM100UA for 48 VDC power

### Item 2 – Legends

Specify legends engraved or blank, and options as desired.

### Item 3

#### Optional Operation Sequences

- STD Auxiliary contacts latched until reset
- 8752 Auxiliary contacts follow field contacts
- 9191 Auxiliary contacts latched until reset and alarm clears
- 9600 Common reset, auxiliary contacts latched until reset, auxiliary contacts activated on test
- 0724 Common reset, auxiliary contacts latched until reset,

# AMETEK

## Alarm and Event Recording

### AN-6100R Remote Annunciator



- Remote electronics
- User configurable
- Field expandable
- Full ISA sequences
- Analog and contact inputs
- Full grouping capabilities
- MODBUS Serial Output
- OPC Server

This annunciator provides the maximum in system flexibility and user controlled configuration packaged in rack or panel mount chassis. All functional electronics are enclosed in these chassis supporting true remote applications where the electronics must be separate from the annunciator window displays. The electronics is so versatile that it can also be mounted directly at the display location supporting almost any annunciator application.

The AN-6100R electronics can be used in conjunction with existing displays, or a full line of Ametek annunciator displays can be provided.

#### System Operation

The AN-6100R utilizes remote electronics packaged in a compact rack mount or panel mount chassis. Each chassis includes a CPU which controls all of the functionality per chassis. There are two chassis available; single unit which accepts up to 10 I/O modules and a dual chassis which accepts up to 23 I/O modules.

System configuration can be customized at the factory and can be easily edited in the field using a DOS based PC through a standard RS232 port. Almost any configuration can be accomplished including single point windows, multiple window displays, first out groupings and reflash groupings plus more.

Inputs can be either contact or 4-20ma analog with 128 contact inputs per chassis, or 32 analog inputs per chassis, or a combination of both. One analog replaces 4 contact inputs.

Outputs can be wired to the Ametek display units, AN-5131 or AN-6150 (see separate display section for the benefits of each of these) or can be wired directly to any existing annunciator display. The electronics can be located up to 100 meters from the display.

#### Configuration

The AN-6100R can consist of almost any point definition and window display requirement. Simply choose the proper number of modules to perform all of the input, grouping, audibles, repeat relays, first out groupings, and window display drivers to fulfill the application.

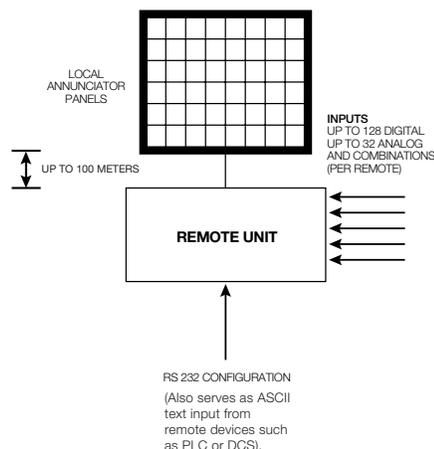
Almost any combination of modules can be used to perform the following on a per chassis basis:

- 128 contact inputs or 32 analog inputs
- combinations of contact and digital (1 analog = 4 contact)
- 128 individual lamp driver outputs
- 112 individual repeat relay outputs
- 16 individual audible outputs
- 16 separate first out groupings
- 16 separate reflash grouping outputs
- 16 separate voting/logic grouping outputs

Larger systems are accomplished by simply combining multiple chassis together.

Configuration is accomplished via a DOS or Windows™ based PC through a standard RS232 port. The onboard program allows updating the configuration directly in the field.

#### Typical System



#### Modules Available

- 8 point I/O module – 8 contact inputs and 8 lamp driver outputs.
- 16 point input module – 16 contact inputs.
- 8 point AC input module – 8 AC contact inputs.
- 8 point line monitor – 8 contact inputs and verifies condition of input wiring.
- 8 point analog module – 8 each 4-20 ma inputs.
- 16 point output module – 16 open collector outputs (NPN sink).
- 16 point output modules – 16 open collector outputs (PNP source).
- 16 point output module – 16 reed relay contacts NO or NC.
- 8 point output module – 8 reed relay contacts NC or NO.
- 5 point output module – 5 power relay outputs.

#### Remote Unit Specifications

##### Electrical Characteristics

##### Power Requirements:

24 VDC, 48 VDC, 125 VDC ± 12%  
115/230 VAC ± 10% 50/60 Hz

##### Input Current:

approximately 2 mA per input

##### Environmental

##### Operating Temperature:

32° to 140°F (0° to 60°C)

##### Storage Temperature:

-13° to 185°F (-25 to 85°C)

**Humidity:** 0-95% non-condensing

**Contact Inputs:** NO or NC, field selectable by DIP switch on a per point basis.

##### Field Contact Voltage:

24, 48, 125 VDC, isolated and non-isolated, 120 VAC isolated

**Analog Inputs:** 4-20 mA

**Input Capacity:** 128 digital inputs per RU or 32 analog inputs per RU or combinations of both.

**Response Time:** 40 millisecond.

##### Outputs

**Lamp Drive:** 200 mA @24 VDC, 5 watts

**Reed Relay:** 100 VDC @ 0.25 A max. SPST, volts free NO/NC

##### Power Relay:

24 VDC @ 2.0A  
240 VAC @ 1.0 A

**Alarm Sequence – Annunciator Functions**

All ISA Sequences. Two sequences per CPU available. Either sequence can be assigned to any input point.

**Mechanical Characteristics**

Single Chassis:  
5.5”H x 7.25”D x 19”W

**Double Chassis:**  
11.5”H x 7.25”D x 19”W

**Chassis Mounting:** surface or rack mount capability

**Terminals:** all input/output modules have gold plated terminals.

**Programmable Features**

**Input Time Delay:** 0.04 sec to 40 min (approx.) in 40 millisecond increments

**Flash Rates:** on/off time adjustable

**Push-button Controls:** a total of 64 programmable as a combination of:  
Acknowledge  
First Out Acknowledge  
Lamp Test  
Group Lamp Test  
Full Functional Test  
Reset  
Audible Silence

**Output Capacity:** up to 224 digital outputs

**Output Assignment:**  
All inputs can be assigned to any output, open collector, reed relay or power relay, or multiples of the same by use of the configurator program.

**Auto Delete from Scan:**

Any input can be removed from service manually or automatically after a predetermined number of alarms in a set period of time occurs, preventing nuisance alarms.

**Audibles:**

16 Alarm Audibles  
1 Alarm Return to Normal

**Groups:**

16 Control Groups  
16 Audible Groups  
16 Group Lamps  
16 Group Relays  
16 Group Inhibits  
16 First Out Groups  
16 Voting Groups  
16 Logic Groups

**Individual Point Inhibit:**

Software inhibit available for any alarm point.

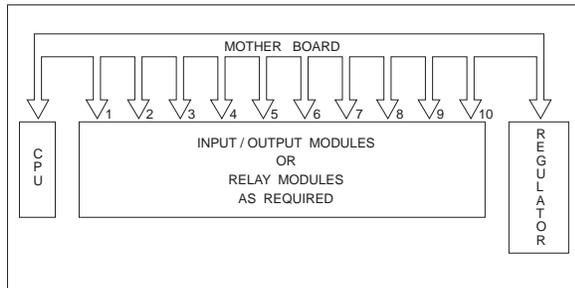
**Boolean Logic:**

Groups of inputs can activate an alarm after certain and/or conditions are met. Alarms can activate lamps or relay outputs.

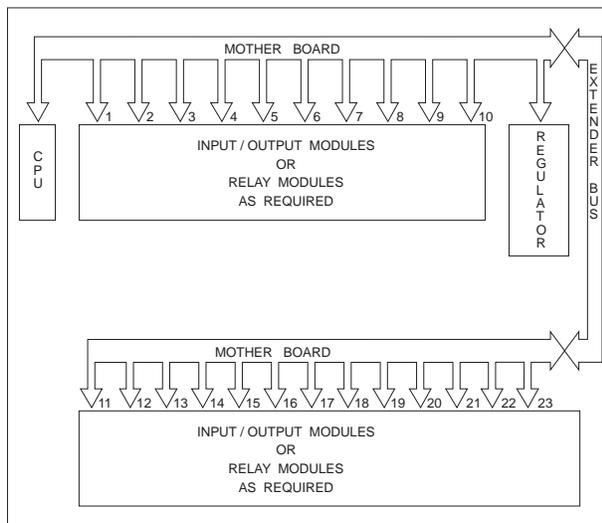
**Voting Logic:**

Groups of inputs can activate an alarm after voting conditions (2 out of 3, 4 out of 6, etc.) are met. Alarms can activate lamps or relay outputs.

**Single Chassis Block Diagram**



**Double Chassis Block Diagram**

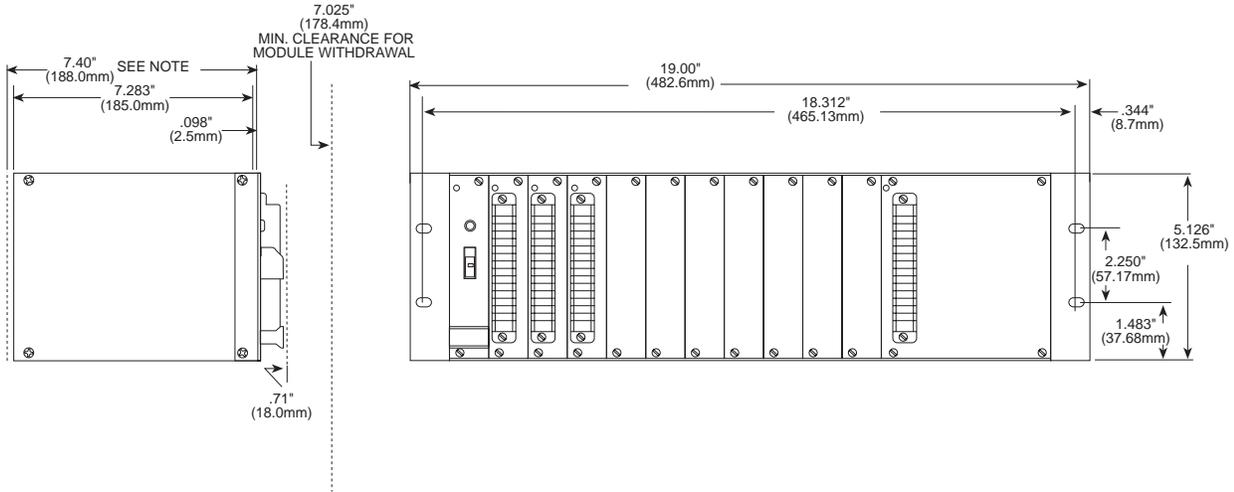


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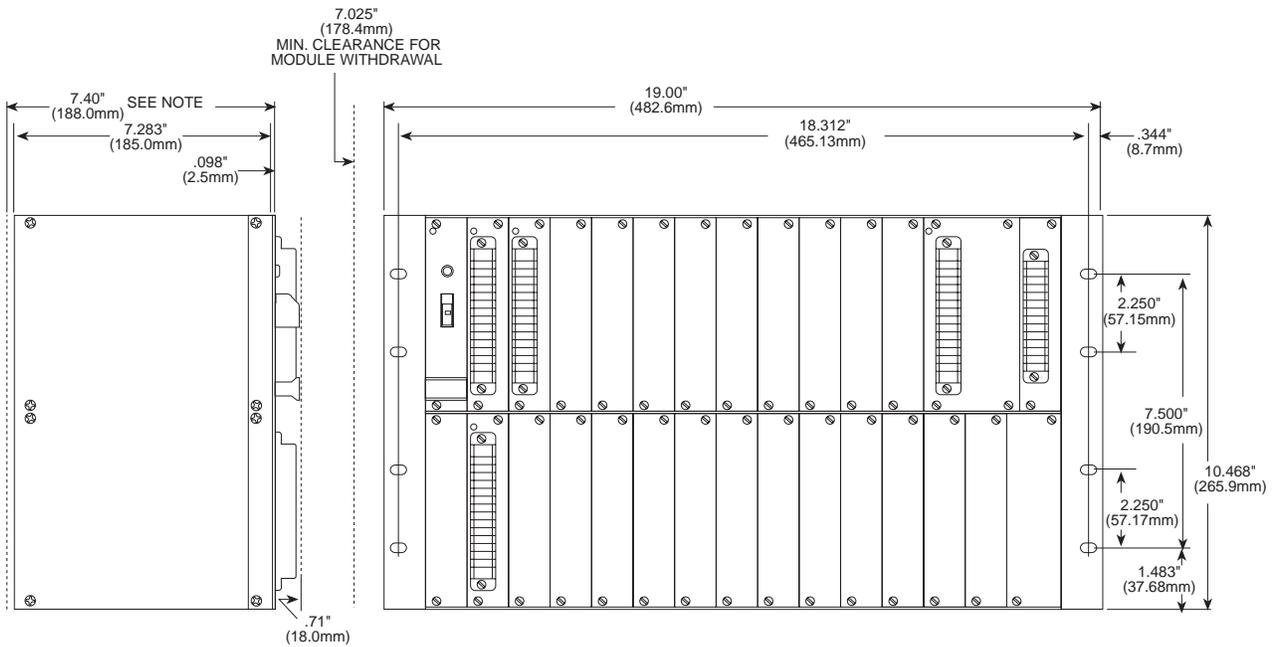
## Alarm and Event Recording

### Mounting & Dimension

#### Single Chassis



#### Double Chassis



## AN-6100R Ordering

Codes:

AN-6100R - 1 - 2 - 3 - 4(I/O) - 5 - 6 - 7 - 8 - 9

**Item 1** Remote Units = # of chassis required and size of each.

Remote unit - includes CPU & power regulator			
	available		
description	slots	order code	qty req.
single chassis rack mount	10	SR	
single chassis panel mount	10	SP	
dual chassis rack mount	23	DR	
dual chassis panel mount	23	DP	

**Item 2**

(Defined by the # of outputs) Prime power = level and quantity of supplies required.			
		order code	qty req.
125 vdc		C	
115 vac		B	
24 vdc		F	
48 vdc		E	
100 watts = 30 outputs & 180 watts = 60 outputs 125 vdc and 115 vac provided in separate assembly.			

**Item 3**

Field contact voltage (FCV) =# of supplies required if Ametek supplied and level for input modules.			
description		order code	qty req.
customer supplied 24 vdc		CS24	
customer supplied 48 vdc		CS48	
customer supplied 125 vdc		CS125	
customer supplied 115 vac		CS115	
AMETEK supplied 24 vdc		X	
AMETEK supplied 48 vdc		T	
AMETEK supplied 125 vdc		D	

**Item 4** Modules = listing of all types of modules required

Input /output modules required			
description		order code	qty req.
8 point I/O (DC only)		A	
8 point input (AC or DC)		B	
8 point input and line monitor (24 vdc)		C	
16 point input		D	
8 point analog input		E	
16 output - screw term, NPN sink		F	
16 output - ribbon, NPN sink		G	
16 output - screw term, PNP source		H	
8 output reed relay, NO, screw term		I	
8 output reed relay, NC, screw term		J	
16 output reed relay, NO, ribbon		K	
16 output reed relay, NC, ribbon		L	
5 output power relay		M	
Note: total output points must equal system outputs including special relays and audibles. Total number of inputs must equal system inputs plus four (test, ack, reset, silence) for control pushbutton module required and one for power monitor. (Note: model # must show # of input/outputs where I/O is shown.)			

# AMETEK

## Alarm and Event Recording

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### Item 5 Sequences

Chose any two ISA Sequences: A, A4, M, R, F1A, F2M-1, F3A, R12.

### Item 6 Cable = # of cables, termination, and length of cables (remote to display)

Cables required - remote unit to display			
cable type	order code	qty	feet
point - to - point with connector	STY		
point - to - point pig tail	PT		
Specify if more than one cable is required. List all cable distances.			

### Item 7 Control pushbutton module = determines if test, ack, reset, silence pushbuttons are provided by Ametek.

Control Pushbutton Module Requirement			
description		order code	qty
remote Ametek supplied		STH	
customer supplied		CS	
cable			
Specify N/A if STH option is specified with individual displays provided by Ametek.			
The same length cable will be supplied as specified above.			

### Item 8 Display = determines if a display is required. If yes then display model # must be provided. Display (from AN6150 or AN5131 catalog section) use separate sheet if necessary, giving description number.

### Item 9 Miscellaneous

Example: Requirement calls for 28 contact inputs with individual windows in existing display. Prime is 125vdc as is Ametek provided FCV. Push button panel should also be provided. No displays are to be provided. Also requires one first out grouping and 4 separate group outputs plus 1 audible.

Appropriate model # AN6100R - 1SR - 1C - 1D - 5A (33/33) - F1A - NA - STH - N - N/A

1SR = 1 each single chassis

1C = 1 each 125vdc prime power supply

1D = 125 vdc Ametek supplied FCV

5A = 5 each 8 I/O modules (this includes the 4 inputs needed for test, ack, reset, silence and 1 input for power monitor).

33 inputs = 28 contact inputs + 4 for CSM and 1 for power monitor

33 outputs = 28 lamp drivers and reed relay outputs for groups and 1 audible

F1A = first out sequence, factory programmed

NA = no cables required

STH = Ametek provided common service module

N = no displays needed

N/A = no special notations

## ISM-1 Integrated System Monitor

Ametek Power Instruments, Inc. — the pioneer in sequential events recorders — proudly presents the standard of excellence and reliability: the advanced Integrated System Monitor (ISM-1).

ISM-1. So advanced it's simple! Based on extensive interviews with professionals in the electric power industry RIS has utilized advanced technology to design this state-of-the-art system to meet the four most important needs in event recording systems: reliability, ease of service, data integrity, and compact design. The ISM-1, minimizes the number of components and uses low-power circuitry, redundant logic power supplies, fiber optic interfaces, and redundant connections. This achieves not only unprecedented levels of reliability, accuracy and efficiency but also simplifies installation and maintenance to save considerable time and costs.

Significant retrofit savings in time, material and manpower! Retrofit savings are significant with the ISM-1, which consists of: an Event Capture Unit (ECU), Communications Interface Unit (CIU), Field Contact Voltage power supply (FVC), and Input Modules in a variety of mounting configurations.



### Features and Benefits:

- fewer components to maximize reliability, save space, simplify service, and reduce retrofitting costs.
  - integral, redundant logic power supplies are interchangeable between ECU and CIU and easily accessible (as are all circuit boards) for quick replacement to save time and costs.
  - hardware/software filters minimize false signals from noise and bounce, eliminate false printouts, and improve accuracy.
  - fiber optic links between ECU and CIU eliminate ground loops, remove electromagnetic interference, improving data integrity, saving wiring time and costs.
  - CIU time sync capability accepts IRIG-B, pulse per time unit, or 50/60 Hz signals.
  - CIU has optional status contacts, communication ports, fiber optic links.
  - ECU and CIU have complete self-diagnostics with system status visible on front panel LEDs.
  - variety of Input Termination Configurations, from 32 up to 128 inputs or rack mounting for higher density applications, include optical isolators, initial input conditioning, and input check circuitry.
  - modbus interface selectable as RS-232 or RS-485
- Cost-saving design meets the industry's four most important needs in event recording systems.**
- **Unprecedented reliability**  
ECU Mean Time Between Failures: 115 years  
CIU MTBF: 67 years  
Input Board MTBF: 127 years
  - **Simplified Design for Easy Service** fewer components, easy access to plug-in modules
  - **Precise Data Integrity** "noise" filters and fiber optic communications
  - **Compact Versatility** microprocessor-based recorder only 1.75" x 19"

# AMETEK

## Alarm and Event Recording

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### ISM Specifications

<b>Input Signals</b>	Normally open (NO) or normally closed (NC) contacts can be set on a per point or group basis via remote printer/keyboard or computer.
<b>Clock Accuracy</b>	100 milliseconds per day typical with software correction, 100 milliseconds per day with TCXO option over entire temperature range; $\pm 1$ millisecond with IRIG-B.
<b>Time Synchronization</b>	(CIU only) IRIG-B, AC-line, pulse per unit time standard.
<b>Isolation</b>	Via optical couplers to provide isolation from input to output and power. An optional isolated module provides isolation from input-to-input and accepts AC inputs.
<b>RFI</b>	Tested per SAMA standards to PMC 33.1C-1978 class 2, band A, B, & C.
<b>Di-electric Strength</b>	Conforms to IEEE/ANSI 313-1971/C37.90, 1500V DC input to ground.
<b>Operating Temperature Range</b>	0° to 60° Centigrade.
<b>Field Contact Voltage (FCV)</b>	24,48, 125, 250 volts DC, RiS or customer supplied — or 120, 240 volts AC customer supplied; negative fcv also available.
<b>Logic Power</b>	20-60 or 95-300 VDC and 120/240 VAC 50/60 Hz. 10 watts maximum per ECU or CIU.
<b>Surge Withstand Capacity (SWC)</b>	Conforms to IEEE/ANSI 472-1974/C37.90a.
<b>Humidity</b>	0 to 95% non-condensing.
<b>Input/Output</b>	<p><b>ECU:</b> Dual RS-232 ports, independently configured for baud rate, parity, X-ON/X-OFF, and other parameters to support a wide variety of standard serial printers and keyboards. The same data is sent to both ports.</p> <p><b>CIU:</b> Selection of up to 14 of the following:</p> <ul style="list-style-type: none"><li>• SCM-P fiber optic module for interfacing with an ECU (up to 1000M).</li><li>• Relay Driver Module (RDM) provides four software-driven relay drivers (1 per system max).</li><li>• Dual RS-232 provides redundant and/or primary and backup output ports.</li><li>• IBM Interface provides a fixed-protocol interface for remote or local communication to an IBM or compatible PC for in-depth data analysis using RiS software.</li><li>• CRT Annunciator provides interface and control for CRT annunciator in control room applications.</li><li>• Distributed Control Systems provide fixed-protocol interface for a variety of distributed control systems.</li><li>• Modbus interface to output to PLCs, <b>AN-3100</b>, <b>RiSCue</b>, or other devices.</li></ul>

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## Input Module

**Compact, simple and advanced, the Input Module saves installation/retrofit costs.**

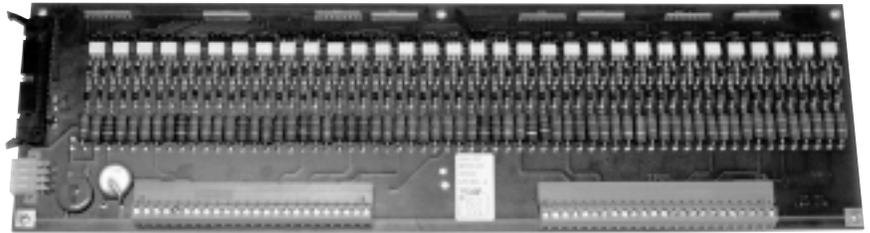
These compact Input modules offer the widest alternatives, and simplify installation to save time and costs. The Input Termination Panel (ITP) consists of an input module and a choice of terminal blocks. Panels (21"H x 19"W) accommodate 32 or 64 inputs.

The standard input module includes optical isolators, initial input conditioning, and input check circuitry. The input check function is a detailed system test that verifies both the on and off operation of the optical coupler and correct signal flow through the entire system.

Two other input modules are available. One is an AC input module — which also accepts DC inputs — that provides isolation from input to input utilizing two terminals per point and independent optical isolators. The second is a negative Field Contact Voltage (common positive) board to compliment the standard common negative input board.

A typical application using a standard input panel allows 384 inputs in a single cabinet, or 768 inputs using the high-density panels. For retrofit applications, there is a rack mount card cage for the input module to handle up to 512 inputs.

Simple installation. For retrofit applications, the input boards can be connected to existing field terminal blocks via ribbon cable connector at one end, and discrete wires at the other end. Other options are available so existing field wiring and terminal blocks can be used, thus reducing installation time and manpower requirements.



## Logic Power Supply

Redundant power, detailed visual indicators, quick and easy module replacement. Here again is unsurpassed reliability. The Logic Power Supply includes redundant power supplies with automatic bumpless transfer. It also provides fast, accurate diagnostic information shown on the front panel LEDs. Dual sources, AC and DC, increase reliability.

### Simplicity

If either power supply fails, replacement is fast and simple. The power supply module is accessible from the front panel and can be removed simply by loosening two thumb screws. Just slide out the failed module and slide in a new one.

### Reliability

The power supply operates in a variety of configurations, including AC/DC and DC/AC. Just select the operating range, from 20-60V or 95-300V DC, along with 120/240V AC, 50/60Hz. Each of the two power inputs is distributed to both of the power supplies for added reliability. Since the power supplies generate a maximum of only 10

watts, there is very little heat dissipation and heat stress on the electronics, so reliability is improved. And since no special cooling fans or vents are required, problems associated with dust and debris are minimized.

### Visual control

Front panel indicators include four LEDs that monitor input from each power supply — giving you a quick indication of where any problem may be. The front panel also holds four quick-change fuses that independently protects both power supplies from each power source.

### Interchangeable

The same supply module is used in both ECU and CIU, reducing spare parts stocking requirements.

# AMETEK

## Alarm and Event Recording

### ECU Event Capture Unit

**Unprecedented speed,  
accuracy, reliability and  
compact versatility.**

The Event Capture Unit can be a stand-alone sequence of events recorder, or the front end of larger systems. Since it is microprocessor based and utilizes advanced technology, it requires only 1.75" of standard 19" rack space and consumes less than 5 watts of power.

The ECU supplies the required logic for either 128 or 256 inputs. All inputs are simultaneously sampled every millisecond and can be configured for normally open or normally closed. All data is stored with one-millisecond resolution regardless of how the system or per-point parameters are configured.

The ECU samples the inputs and controls the digital filtering. This eliminates excessive recording caused by contact bounce, false recording caused by noise, and other problems. In addition to a system "first hit" filter, a per-point filter that can be set for 1 to 255 milliseconds is added to the system-wide filter. To further eliminate nuisance or oscillating alarms, the operator can program, on a per-point basis, to automatically delete points from scan, and automatically re-insert them at a later time.

Fiber optic links are used to communicate from the ECU to the Communications Interface Unit (CIU). These links are serial data communications to reduce physical connections, which means major savings over copper-wired systems. Only a single pair of fibers are



needed for each ECU. Fiber optics also eliminate problems with ground loops, electromagnetic interference, and other "noise." Links can be up to 1000 meters, allowing remote mounting of ECUs and Terminal Panels. This can save thousands of dollars in material and labor costs involved with laying copper wire for each input, and using available equipment space in various locations.

#### Non-volatile memory

After an input change-of-state is recorded to 1 millisecond resolution, it is stored in a non-volatile, 1000-level (per ECU) historical circular memory. This provides a buffer for the printer and allows detailed analysis at a later date. In addition to the historical memory, there is sufficient memory for 119 characters per point description, that can be split into any combination of alarm and return-to-normal legends. The legends can easily be typed into

a personal computer, stored on disk as an ASCII file, and downloaded to the ECU/CIU if desired — or they can be entered from a keyboard.

#### Dual Ports

The ECU includes a dual RS-232 port for both the input and output of data. Both ports can be configured for their own baud rate, parity, and other parameters to support a variety of standard printers and other output devices. These ports, used with a keyboard/printer or terminal, can be used to enter legends and access the historical memory. To prevent unauthorized access, the user can program a password to the configuration commands to limit access to critical parameters.

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## CIU Communications Unit

**Simple, compact,  
efficient — with  
advanced capabilities.**

The CIU performs three major functions: 1) communicates with and time-sorts data from multiple ECUs in systems with more than 256 inputs; 2) acts as a “smart” interface to a variety of peripheral devices; and 3) accepts external time-synchronization signals.

The CIU uses only 3.5 inches of rack space and uses an identical power supply as the ECU — thus reducing spare parts requirements. To reduce downtime, its power supply is easily accessible. Power consumption is less than 10 watts, so there is little heat dissipation for improved reliability. Also, all the connectors are either gold plated or gas tight to minimize contact failure.

To output data to peripheral devices, a variety of modules are available, including: RS-232 modules for printing, CRT or Lightbox Annunciators, **Modbus**, IBM computers, and various distributed control systems; dual RS-232 modules for redundant applications and cost-saving; and a relay driver module to expand the number of relay driven outputs. This relay module allows the operator to program up to four relays to trip when user-defined conditions occur.

The CIU accepts any combination of these modules with no modification to its internal program. This makes expansion and changes as easy as adding modules and configuring new interfaces.



### Versatility

The CIU has 14 card slots controlled by the Master Communications Processors. Additionally, there is a time keeper processor to provide precise time synchronization. The slots can be used for any combination and type of modules offered. These include a Systems Communications Module (SCM) for communicating to ECUs up to 1000 meters away.

### Multiple diagnostics

The CIU has both on-line automatic and operator-initiated diagnostics, and is constantly running a diagnostic routine to locate possible failures. Detailed diagnostics can be manually initiated or programmed to occur on a selected time basis. Whatever routine is used, failures are output to the printer in plain language descriptions; there are no error codes to look up.

### LED visual indicators

For a quick visual indication of system operations, the CIU has six front panel LEDs. The indicators are for proper operation of the internal clock, data transmitted and data received, presence of external time synchronization, and status indicators for Alert conditions and Fault conditions. The Alert LED indicates low-level malfunctions, and the Fault LED indicates a problem that may affect system operation or data integrity.

# AMETEK

## Alarm and Event Recording

### FCV Field Contact Voltage

The Field Contact Voltage (FCV) power supply provides wetting voltage for dry contact inputs and performs input check and ground detection. To support the wide range of possible combinations, this FCV power supply can be configured for your powered contacts, thereby supplying only input check and ground detection. It can be configured to supply 24, 48, 125 or 250V DC wetting voltage for either 256 or 512 points, or 256 points with redundant power supplies.

The input check function, available only with the DC input module, is a detailed diagnostic routine that turns the optical coupler on and off to verify the proper operation of all logic circuits and optical couplers. The ground detector provides an LED and relay driver for indication of ground faults. Plug-in connection reduces the time needed to locate ground faults.



#### Modbus Interfacing

With the Modbus interface module, the ISM-1 can interface with plant computers or PLCs to provide contact status information, millisecond time tag data and system date and time. This reduces the need to wire the same contact into multiple systems reducing the overall cost. Additionally, the system can be interfaced to an RiS AN-3100 system equipped with a Modbus interface to provide light box annunciation with programmable sequences, reflash capability and all the other features of the AN-3100. As with PLCs or plant computers, this provides overall savings in reduced wiring.

Included with the RiSCue software is the ability to take data from the ISM-1 Modbus module and convert it to standard OPC format. This simplifies the process of getting the data from the ISM-1 to your plant computer or other OPC compliant systems.

#### Reliable, Versatile, High MTBF

Reliability is the number one criteria in the design of Ametek Power Instruments' events recorder. Every component, every connector, and every piece of hardware was selected with the goal of achieving reliability orders of magnitude higher than any other events recorder. Virtually all operating parameters are programmable in the ISM-1, to tailor the alarming and reporting to the needs of different applications. Interfaces to printers, DCS systems, CRT annunciator, and PC computers provide the necessary data for prompt response or analysis. A variety of input filtering options reduces false reports from sensitive or noise-generating equipment.

# DMS-2000 Distributed Monitoring System

The DMS-2000 is a distributed Alarm Monitoring System with all of the features of a Visual Annunciator System combined with the time tagging of events to 1 msec. One wired input connection is all that you need to gain both visual display and sequence of events recording, eliminating costly wiring and system maintenance. The DMS-2000 presents your alarm information into open interfaces, such as Serial Modbus and OPC. This provides instant connectivity into many different applications, including PLC's, DCS and HMI Software packages.

## Features

- Field Contact Inputs (normally open or closed)
- Analog Inputs (4 adjustable trip points)
- Pushbutton Controls (test, acknowledge, silence, reset)
- Lamp Outputs for Annunciator Displays
- Repeat Relay Outputs
- Audible Alarm Relays
- All ISA Alarm sequences available, including First-Out

- Group Inputs and Outputs (any group of inputs can activate any output lamp, relay, audible, etc)
- Boolean Logic Outputs AND Voting Logic Outputs
- Selectable Input Filter Delay
- Automatic delete from scan
- IRIG-B Time Synchronization
- 1000 Event Storage per Remote Unit
- All input, output and group configurations are factory configured and easily changed through our Windows based configuration tool.

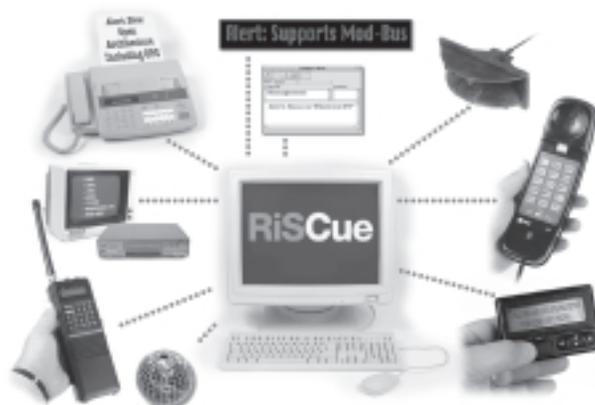
## Get the Best of Both Worlds



**Visual Annunciation**



**1msec Sequence of Events Recording**



**Instant Alarm Notification**

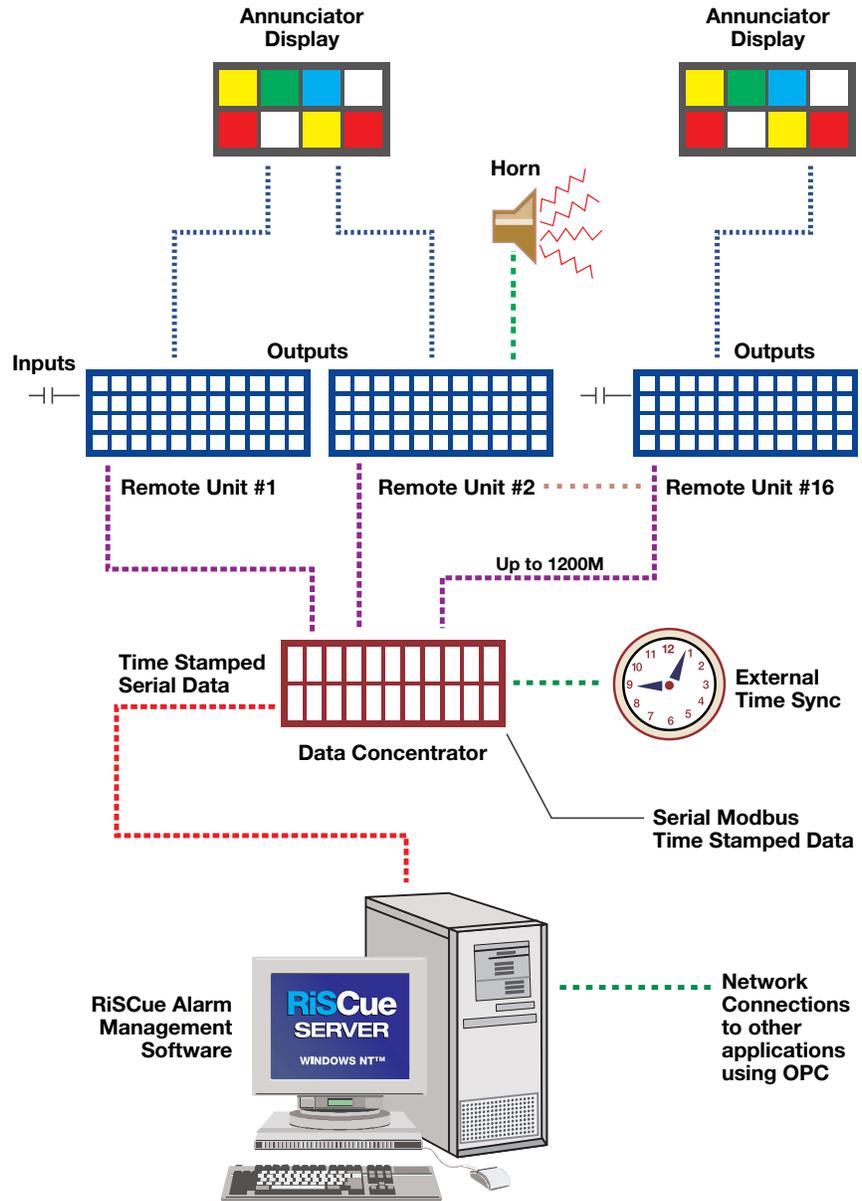
# AMETEK

## Alarm and Event Recording

### System Architecture

The DMS-2000 offers a flexible building block design that can be distributed throughout your plant. The system consists of multiple Remote Units that provide input terminations and logic for all analog and digital inputs as well as lamp and relay outputs. Each Remote Unit can be installed wherever convenient; close to the input wiring or close to the visual displays. We offer a full selection of visual displays making it easy for you to pick one that fits your application.

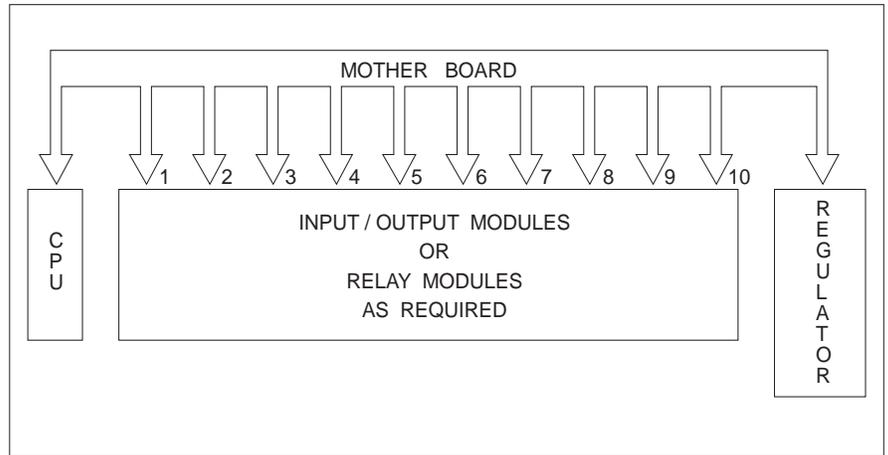
The Data Concentrator collects all of the alarm information from up to 16 Remote Units providing one common data source to your own application or our Alarm Management Software, RiSCue. The Data Concentrator provides a common clock synchronization to all Remote Units and can be located up to 1200 meters away from any Remote Unit.



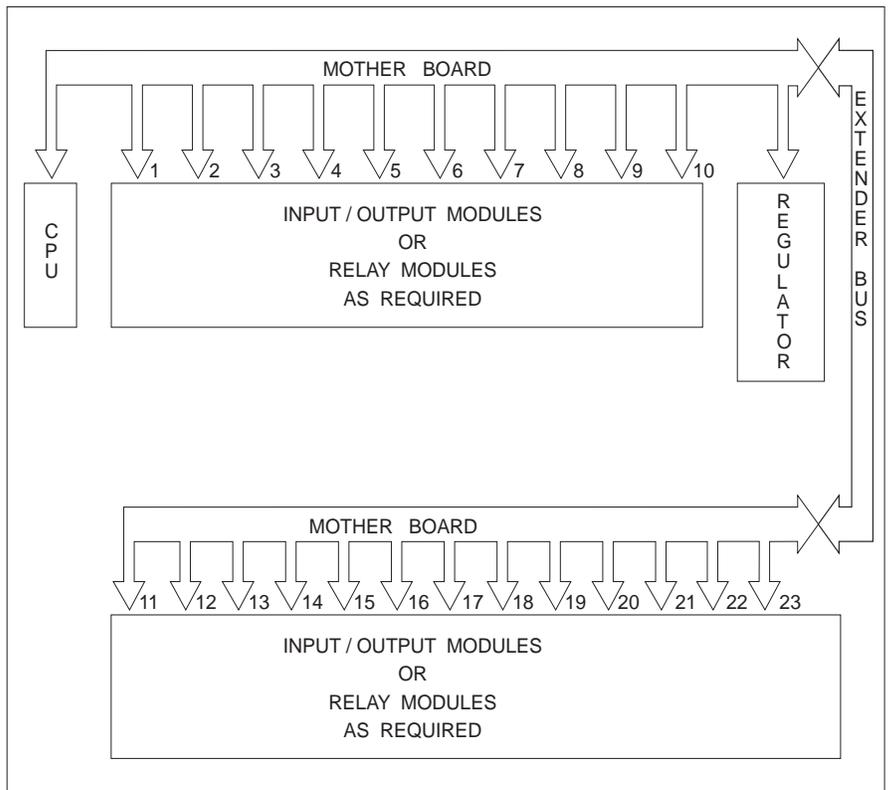
## DMS-2000 Remote Unit Chassis Dimensions & Connections

The chassis are standard depth single or double 19" wide card racks. The boxes contain the CPU, the I/O, the relay cards and the power supply. The size of the chassis is dependent on the system size, the number of alarms to be monitored, the number of control switches and the number of lamp outputs etc. The chassis motherboards have predetermined positions for the CPU and regulator, while the I/O and relay cards can be located in any other slot. The chassis can be ordered front or rear mounted — the angle brackets are simply reversed from back to front as necessary.

Single Chassis Block Diagram



Double Chassis Block Diagram

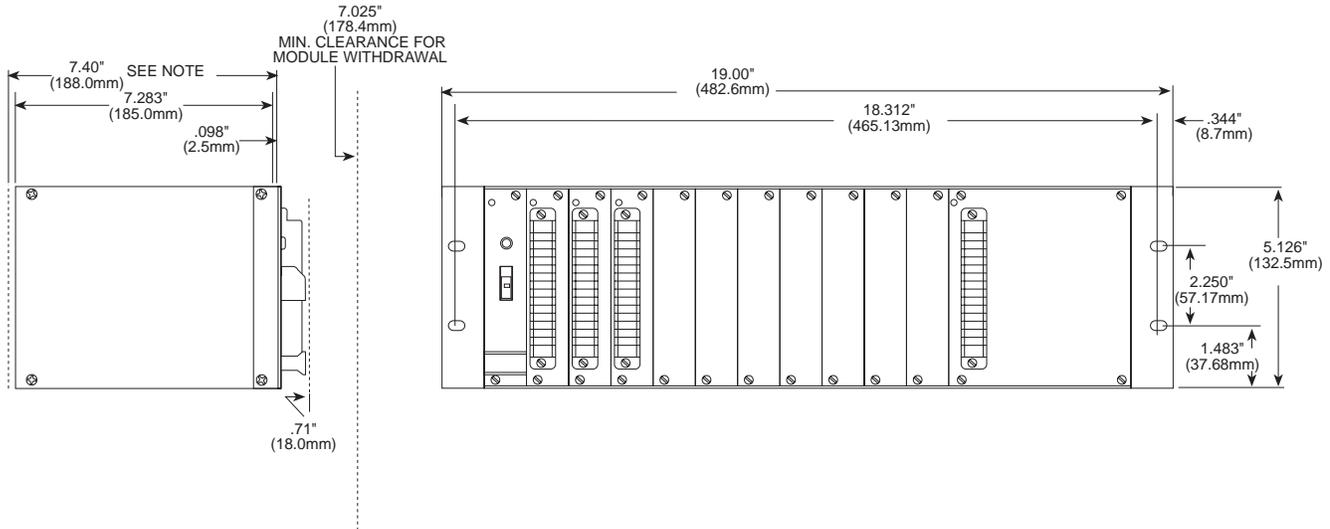


# AMETEK

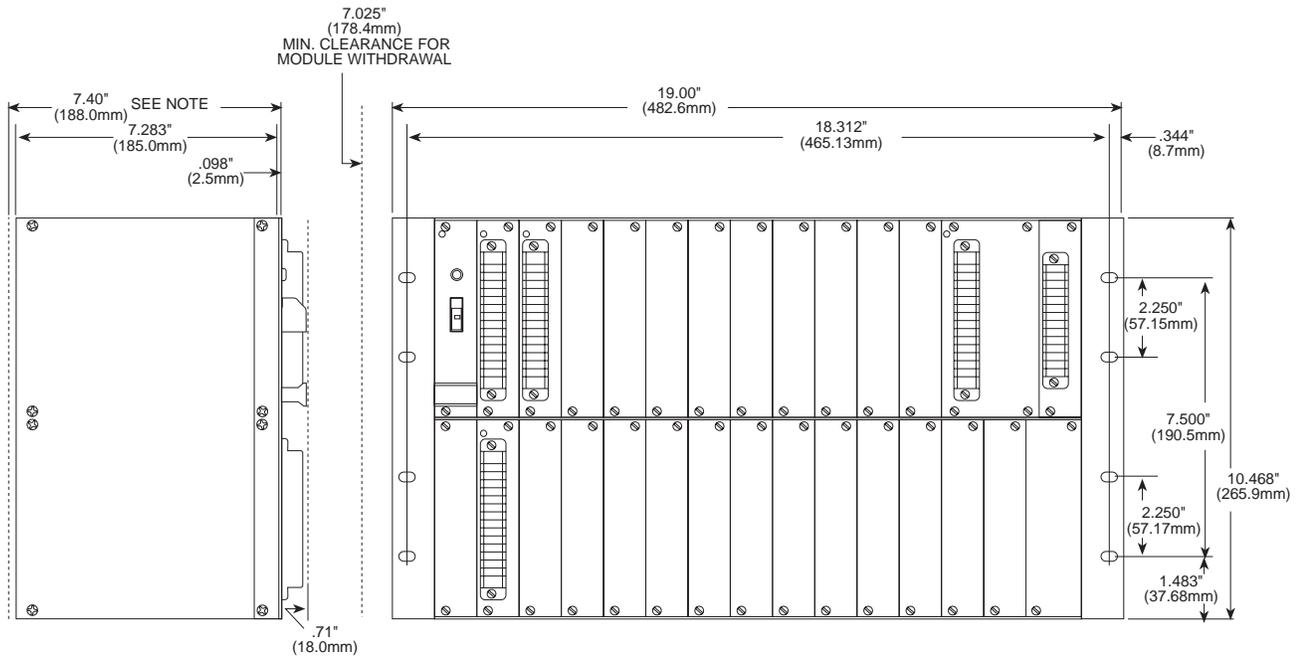
## Alarm and Event Recording

### Dimensions

#### Single Chassis

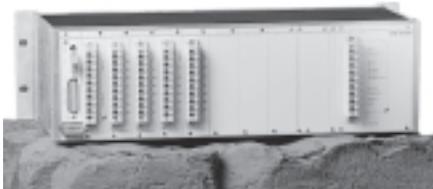


#### Double Chassis



## DMS-2000 Remote Units

The Remote Unit is a microprocessor based input/output device that collects both analog and digital inputs. It time and date stamps the alarms, activates lamps, relays or audible devices and accepts control inputs from your pushbuttons.(test, acknowledge, reset, etc.) Each Remote Unit supports up to 128 inputs and outputs, all time tagged to the millisecond. The Remote Unit communicates to the Data Concentrator using a high speed RS-422 serial communication link, that can be as long as 1200 meters. (longer distances available through fiber optics)



## Annunciator Displays

The DMS-2000 Remote Units provide lamp driver outputs for connection into any variety of Lamp Displays. Ametek's AN-6160 and AN-5131 are compact displays that take less than 5 inches of depth behind the panel. The AN-6150 is a modular display that can be configured into any size from 4 cells high by 4 cells wide. Each 'window cell' can display 1, 2, 4 or 8 separate alarms depending on your size availability. Window legends are laser printed on standard transparencies by the user, providing a quick and economical solution especially for changes or additions. The AN-5131 is a modular display that can be configured into any size from 15 cells high by 15 cells wide. Each 'window cell' can display 1, 2, 3 or 4 separate alarms depending on your size availability. All lamps are front accessible, and a variety of window colors are available to highlight your most critical alarms.

## Data Concentrator

The Data Concentrator is the central collection unit for up to 16 Remote Units. Multiple Data Concentrators can be used for un-limited size systems. The Data Concentrator also provides connections for external clock synchronization and sends the same time reference to all remote units, so the entire system maintains a 1msec time stamp regardless of how many inputs there are. The Data Concentrator comes with a standard Serial Output for connection into the RiSCue Alarm Management Software. The DMS-2000 also comes with our OPC Server, (version 1 & 2 compliant), for connection into any OPC Client Application.

## RiSCue Alarm Management Software

The RiSCue Alarm Management Software provides the alarm display, intelligent reports and instant notification of alarms using phone, fax, pager, email, marquee or PA System.

## DMS-2000 System Features

## DMS-2000 System Benefits

Annunciation and Events Recording combined

Reduces wiring costs, and system maintenance

Up to 2048 Inputs per each Data Concentrator

Large system capacity, meets most requirements

Serial Communications, Modbus & OPC

Share alarm information with many applications, at minimal cost

1 Millisecond Resolution

Needed for accurate process fault diagnosis

System fault diagnostics

Always know the status of your system

First-out indication of alarms

Aids in failure diagnosis, identify what the initial cause is

Analog and Digital Inputs

Accepts full complement of alarm input types

Modular system architecture

Low cost expansion, easily changed and adapted to the application

Windows Configuration utility

Easy to setup, configure and make changes

Environmental noise immunity

Operates in all environments

# AMETEK

## Alarm and Event Recording

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### DMS-2000 Specifications

#### Electrical Characteristics Power Requirements:

24 VDC, 48 VDC, 125 VDC  $\pm$  12%  
120/240 VAC  $\pm$  10% 50/60 Hz

#### Alarm Input Current:

approximately 2 mA per input

#### Contact Inputs:

NO or NC, field selectable by DIP switch  
on a per point basis

#### Field Contact Voltage:

24, 48, 125 VDC, isolated and non-isolated,  
120 VAC isolated

#### Analog Inputs: 4-20 mA and 1-5 VDC

#### Capacity:

128 digital inputs per RU or  
32 analog inputs per RU or combinations of both.  
2048 inputs per data concentrator.

#### Analog Input Response Time: 40 millisecond.

#### Digital Input Response Time: 20 millisecond.

#### Resolution: 1 millisecond.

#### Outputs

**Lamp Drive:** 200 mA @24 VDC, 5 watts  
**Reed Relay:** 100 VDC @ 0.25 A max., SPST,  
volts free NO/NC  
**Power Relay:** 24 VDC @ 2.0 A, 240 VAC @ 1.0 A

#### Capacity: up to 224 digital outputs per RU

#### Data Transmission

##### Data Concentrator To Computer –

##### Remote To Data Concentrator – up to 9600 baud

Type	Distance
RS-232C	50ft/15m
RS-422	4000ft/1200m

#### Alarm Sequence — Annunciator Functions

All ISA Sequences. Two sequences per CPU  
available. Either ISA sequence can be  
assigned to any input point.

#### Mechanical Characteristics

**Single Chassis:** 5.5"H x 7.25"D x 19"W

**Double Chassis:** 11.5"H x 7.25"D x 19"W

#### Chassis Mounting: surface or rack mount capability

#### Terminals:

all input/output modules have gold plated  
terminals.

#### Input Time Delay:

0.04 sec to 40 min  
in 40 millisecond increments

#### Flash Rates: on/off time adjustable.

#### Push-button Controls:

Acknowledge  
First Out Acknowledge  
Lamp Test  
Group Lamp Test  
Full Functional Test  
Reset  
Audible Silence

#### Output Assignment:

All inputs can be programmed to any output:  
lamp, reed relay or power relay, or multiples of  
the same by use of the configurator program.

#### Audibles:

16 Alarm Audible Groups  
1 Alarm Return to Normal Group

#### Groups:

16 Control Groups  
16 Audible Groups  
16 Group Lamps  
16 Group Relays  
16 Group Inhibits  
16 First Out Groups

#### Individual Point Inhibit:

Software inhibit available for any alarm point.

#### Environmental

**Operating Temperature:** 32° to 140°F (0° to 60°C)

**Storage Temperature:** -13° to 185°F (-25 to 85°C)

**Humidity:** 0-95% non-condensing

## RiSCue Innovative Alarm Management Through Intelligent Messaging

Effectively Monitor Your Entire Plant or Process with the Dynamic Functions of RiSCue. This versatile open solution provides seamless integration into any control or information environment!

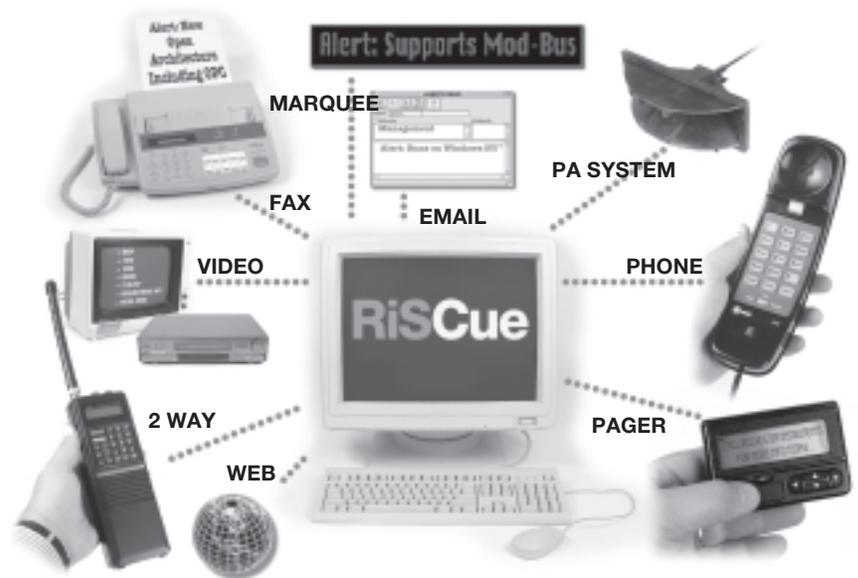
RiSCue™ is an innovative PC-based alarm management system with an unprecedented capability to accurately detect, present, notify and respond to abnormal conditions. RiSCue™'s open technology provides direct connectivity to plant floor data, using non-proprietary protocols like DDE and OPC. The advanced alarm detection methods provide 16 limit tests on each input, adding unparalleled preciseness. Auto-configuration of alarm inputs eliminates difficult startups by importing the tag information instantaneously.

Your plant response time is improved with the instant notification of alarms by phone, pager, two-way radio, fax, email and local announce, reaching you anywhere at anytime. Powerful, yet secure; RiSCue™'s fully distributed client-server architecture provides key personnel with on-line information of plant conditions. Productivity is enhanced while maintaining safety and regulatory compliance.

Accurate and efficient alarm management with distributed notification become a reality with the advanced features of RiSCue™. Using RiSCue™ for total plant solutions will improve consistency in the methods used to process alarms, and open gateways for information sharing.

### Open Connectivity

- Provides Alarm Management Systems with direct access to plant floor data
- Replaces labor-intensive interfaces currently used to exchange data



RiSCue™ serves as the front-end for all of Ametek's alarm monitoring products, providing a turn-key solution for all your monitoring needs. RiSCue™'s OPC Server also provides direct connectivity to OPC compliant devices, and DDE information exchange opens up many other possibilities to centralize your alarm management. Whether you're measuring temperature, pressure, flow, or discrete contacts, putting RiSCue™ in charge of all of your alarms will save you time and money. RiSCue™ Alarm Management will reduce the labor required to process alarms, provide greater consistency in the methods used to handle alarms and provide a quick response to the problem at hand.

### Powerful and Secure

- 32 Bit Native NT, multi-threaded design
- Intelligent distribution of information to anyone, anywhere

RiSCue™ takes advantage of Windows NT™'s enhanced performance, security, and server-client architecture. Multiple clients can be allowed partial or full access to the alarm information and configuration features. LAN, WAN compatibility provides local or remote distribution

of alarm information, even internet compatible through a web browser.

### RiSCue™ Providing the New Standard In Messaging

Activate every emergency response from one system!

### Plant Alarm Notification

- Announce alarm through existing plant communication systems
- Distribute information everywhere it is needed
- Alert operators at connected computers
- Live video feed of process conditions

Any plant alarm can initiate the notification system. You could notify a supervisor of an event by cell phone during evening hours, then print a report on his fax machine or send an email for review the following morning. Plant personnel could be reached by pager, detailing the exact nature and location of the problem. You receive the information instantaneously and you are guaranteed your best people will always be notified of and respond to critical alarms, regardless of date and time.

# AMETEK

## Alarm and Event Recording

These agents can be activated alone or in any combination.

**PHONE:** RiSCue™ will dial, connect and transmit a voice message of the alarm, time and date of occurrence, process values and any custom message. Remote acknowledgement ensures the call was received correctly. RiSCue™'s text-to-speech technology provides the quickest set-up, eliminating the need to record custom voice messages.

**PAGER:** Worldwide numeric and alphanumeric pages are supported. Numeric will display a phone number, while alphanumeric can display the same text message sent by voice, fax or e-mail.

**E-MAIL:** RiSCue™ can send and receive e-mail messages. Alarm information is integrated into the message headers to allow recipient to see information quickly. When RiSCue™ receives an e-mail, it will initiate any desired sequence of additional actions.

**VIDEO:** RiSCue™ supports both fixed and remote control cameras. At any time, the cameras can pan and zoom to any preset area, providing the detail you need. The live video feed can be stored and replayed whenever needed.

**FAX:** RiSCue™ will send a fax and confirm receipt. Fax banner, to and from fields and message are automatically created.

**2-WAY RADIO/ PLANT PAGING & ANNOUNCEMENT SYSTEMS:** Analog audio signal is generated through a sound card for 2-way radio, paging and announcement systems. Audio consists of an introductory tone followed by any text-to-speech message.

**MARQUEE:** Standard ASCII messaging output is provided for overhead marquees. Flashing and scrolling are supported.



*Configure all actions, including video, by simply selecting the action and recipient from the pull-down options.*

### Sound the Alarm for Advanced Monitoring

Dramatically increase productivity and regulatory compliance!

### Ease of Use

- **Easy to configure, you can be up and running in less than an hour**
- **Simple day to day operations, with a natural and intuitive software configuration**
- **Locates data sources automatically and imports the tag information seamlessly**

For an alarm management system to be truly effective, it has to be easy to configure and easy to use for day-to-day operations and RiSCue™ is just that. RiSCue™ offers an Auto-Configuration feature which locates data sources automatically and imports the tag information almost instantaneously. Special programming of drivers, adding large databases, and bringing in alarms from a variety of equipment is done effortlessly by searching the network for data sources like Annunciators, Events Recorders, DCS & PLC Systems, or HMI Systems.

### Advanced Alarm Detection

- **16 limit tests per process input**
- **Boolean, rate of change, and deviation alarm tests**
- **Reads raw analog or digital values**
- **Time and date stamp added to all alarms**

RiSCue™ uses a highly accurate, sophisticated means of setting alarm set-points and limits through boolean equations, rate of change and deviation tests. RiSCue™ provides the capability to perform 16 separate limit tests for each analog input, allowing the closest examination of your most critical alarms. RiSCue™ can also use preselected alarm set-points from existing applications, bringing in the information automatically. Real time alarm information can be transferred from the external application

(Annunciator, Sequence of Events Recorder, etc.) or can be time and date stamped directly at the RiSCue™ PC.

### Intelligent Notification Options

- **Selectable alarm and action delays**
- **Delay on acknowledge**
- **Built-in notification schedule**

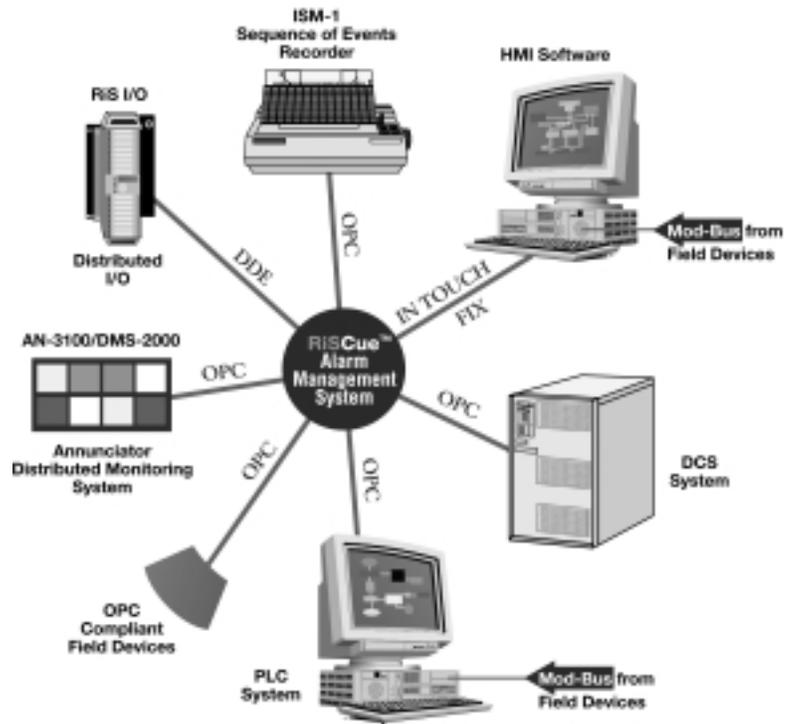
Alarm and instant notifications can be delayed to give plant personnel time to react, or to prevent nuisance alarms. Delays on acknowledgement provide plant personnel a reasonable time to act on the alarm before activating the notification system. RiSCue™'s Contact Editor stores phone numbers, pager numbers, email addresses, etc. and the Schedule Editor indicates when these numbers can be reached. Contacting anyone at any location at anytime is possible.

## Intelligent Alarm & Action Display

- Alarm and Action Summary, Alarm and Action History
- Built-in Active X controls for Annunciator Graphics
- Configurable Alarm Zones and Priorities
- Advanced sorting and querying
- Auto-Archival of alarms

RiSCue™ displays alarm and actions using separate windows for current events and historical storage. Automatic archiving of alarms for permanent storage unclutters your history Reports for easy viewing.

RiSCue™'s built-in Active X controls provide Annunciator Graphic Displays with selectable grid sizes to mimic alarm panels. Window colors and alarm set-up is easily configurable. To further simplify your alarm viewing, all alarms can be configured with their own alarm zone and priority. RiSCue™ user access can be limited to specific Alarm Zones, enhancing security and usability.



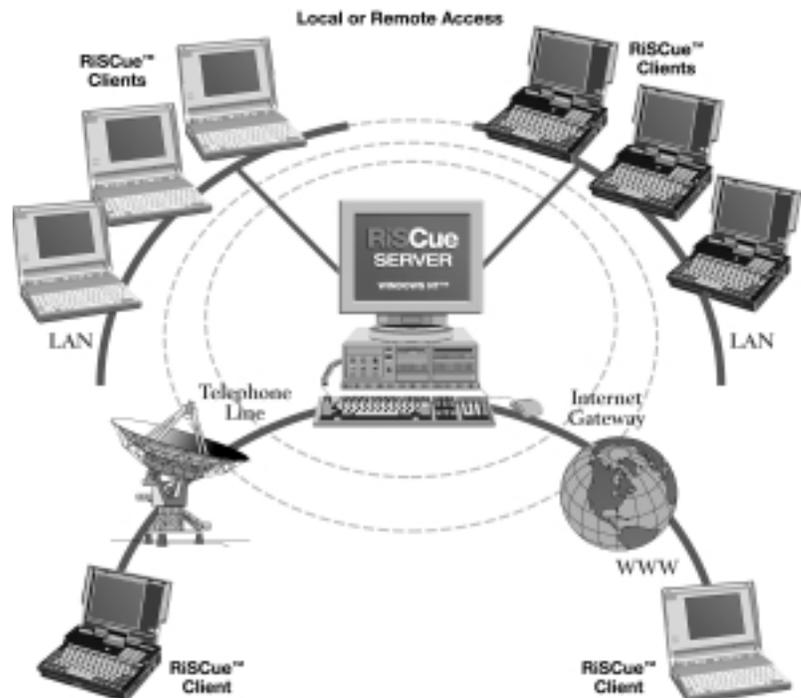
## Unlimited Flexibility

RiSCue™'s open connectivity to OPC (version 2.0 compliant,) DDE and ODBC information exchange opens up many other possibilities to centralize your alarm management.

## Distributing Plant Alarm Information

- Alarm information at your fingertips
- Share information across your company's existing open network

RiSCue™'s alarm and event information can be made available to multiple users and plant management through a company's existing open network. RiSCue™ requires only a network card and cable for connection to your open network.



# AMETEK

## Alarm and Event Recording

### RiSCue™ Features

#### Open Connectivity and Data Sharing

- Direct connectivity to Ametek's Alarm Annunciator and Sequence of Events Recorder products
- OPC compliant, DDE, InTouch, and FIX data connectivity
- Fully functional OPC Server (version 2.0)

#### Instant Alarm Notification

- Phone, fax, pager, two-way radio, email, local PA announce, display marquee
- Live real-time video feed and remote control capability
- Simultaneous and back-up notifications
- Text-to-speech engine for natural voice annunciation

#### Fully Distributed Design

- 32 bit native NT, multi-threaded design
- Fully distributed server-client architecture
- Alarm information shared with anyone, anywhere, using existing LAN/WAN
- Advanced security restricts unauthorized access

#### Advanced Alarm and Event Processing

- Comprehensive alarm configuration, up to 16 limit tests per input
- Boolean, rate of change and deviation test
- Reads raw analog or digital values
- Time and date stamp added to all alarms

#### Ease of Use

- Auto-configuration allows direct import of alarm tags
- Configurable alarm zones and priorities
- Advanced sorting and querying
- Auto-archival of alarms
- Import/export alarm database

#### Intelligent Display

- Alarm and action summary, alarm and action history
- Built-in Active X controls for annunciator graphics

### RiSCue™ System Requirements

#### Server:

Windows NT™ 4.0 or later version  
66 MHz 486 processor (100 MHz Pentium™ recommended)  
16 MB RAM (32 recommended)  
30 MB free disk space  
VGA monitor, mouse, CD ROM drive

#### Clients:

(can also run on same processor as Server)

Windows 95™/Windows NT™ 4.0 or later version  
66 MHz 486 processor  
16 MB RAM  
10 MB free disk space  
VGA monitor, mouse, CD ROM drive

### Instant Notification System (Action Agents)

Action Agent	Hardware Requirement
Local announce through PC speaker or plant paging system, two-way radio	PC Sound Card
Phone and numeric paging	NT modem with Unimodem V driver supports, or Dialogic telephone board
Alphanumeric paging	Standard modem
Fax	Standard modem with fax capability (a single modem will support numeric paging and alphanumeric paging and fax)
Email	Connection to POP server using SMTP (Simple Mail Transfer Protocol)
Display marquee	Serial Com Port
Video	NT compatible video capture board and B/W camera having standard 1V peak-peak output. A CD recorder, or other tape drive is recommended for long term video storage.

# AMETEK

## Machine Monitoring

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**Machine monitoring equipment is essential in today's industrial market place. It offers customers added safety for their machines, plants, and personnel. When used properly, machine monitoring can be the first warning of an impending "un-safe" condition, so breakdowns can be averted. The system can also be used to monitor a machine's condition, so preventative maintenance can be scheduled.**

- Monitor Process and Key Machine Parameters
  - Temperature
  - Thrust
  - Seismic
  - Displacement
  - Tachometer
  - Eccentricity

- Continuous Monitoring

- Dual and Triple Channels

- Complete Accessories

- **FM/CSA Approval for Div 2 areas**  
Ametek offers a complete line of Machine Monitoring equipment, from single channel Vibration switches to multi-channel Systems. The VT-3360 Vibration Transmitter are recommended for single channel vibration monitoring of non-critical applications. The VT-2490 Machine Monitoring System is recommended for critical applications that require multiple channels of temperature, process, and vibration variables. The TM-2480 Temperature Monitoring System is recommended for all applications that require multiple channels of temperature and process variables only. The monitoring systems are configurable to the application using plug-in modules for Temperature, Thrust, Seismic, Displacement, Tachometer, and Eccentricity measurements. Ametek also offers a complete line of probes and sensors

used on the front end of our monitoring systems.

The following sections detail the different types of Machine Monitoring equipment and related products. Each section includes complete specifications and ordering. Dimensional drawings are included for all products and accessories.

**\*\* Obsolete \*\***



# AMETEK

## Machine Monitoring

### Two Wire Vibration Transmitter VT-3360



The Ametek Model VT-3360 Vibration Transmitter is a totally solid-state device providing vibration monitoring for non-critical rotating machinery. It combines a vibration sensor and electronics that provide for input power, 4-20 mA analog vibration output signal, and 0-1.0 mA vibration wave form output signal—all on just two wires. Various adjustments, sensing ranges and other features make the VT-3360 suitable for many vibration monitoring applications.

Power for the VT-3360 is from a user supplied unregulated DC power-supply with a maximum voltage of 50 volts. The proper voltage of the power-supply is calculated from the equation.

### VT-3360 Specifications

**Operating Temperature Range:**  
-22° to +185°F (-30° to +85°C)

**Enclosure:** NEMA 4, weatherproof

**Agency Approvals:** FM & CSA  
(Explosion proof):  
FM Class I: Div. 1 (Groups C & D)  
FM Class II: Div. 1 (Groups E, F, G)  
FM Class III: Div. 1  
Div. 2 Class I (Groups A, B, C, D)  
I.S. Class I, Div. 1, Groups A, B, C, D with Barriers

**Weight:** 3 lbs. (1.4 Kg.)

**RFI/EMI Immunity:** Tested to SAMA Standard PM33.1C.1978. Class 2-ABC-3% Max, lid on and metal conduit shielding wires, 20MHz to 1GHz @ 10V/Meter

**Repeatability:** +2% of reading

**Outputs:**

- a. 4-20 mA DC proportional to vibration level.
- b. User-selectable instantaneous vibration wave form signal from 0-1.0 mA peak A.C.

**Power (V/S):** 12 to 50 VDC, unregulated  
 $V_s = R_L \times I_{FS} + 12$   
 $R_L = \text{ohms}; I_{FS} = \text{amps}$

**Transverse Sensitivity:** Less than 10% of sensitive axis.

**Isolation:** 1000V rms to housing.

**Wire Size:** AWG #12 maximum.  
**Mounting:** 1/2-14 NPT stud, any axis (sensitive axis parallel to stud center line).

**Case Material:** Cast aluminum, low copper content.

**Overrange Capability:**  
150% of range,  $I_{max} = 1.5 I_{FS}$  (DC only)  
140% of range,  $I_{max} = 1.4 I_{FS}$  (DC and AC signals combined)  
Where IFS is full scale output current.

**Note:** That to maintain linearity under overrange conditions RL must be less than or equal to:  
 $\frac{(V_s - 12)}{0.03}$  Volts  
0.03 Amps

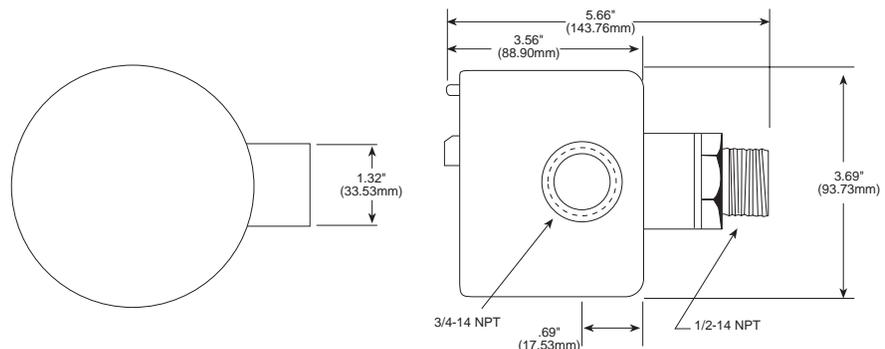
### VT-3360 Ordering

Model	Description
VT-3360-05	0-0.5 ips/4-20 mA (05) (0-12.5mm/sec) (4-750Hz, 240-45000RPM)

Model	Description
VT-3360-10	0-1.0 ips/4-20 mA (10) (0-25mm/sec) (4-750Hz, 240-45000RPM)

Model	Description
VT-3360-20	0-2.0 ips/4-20 mA (20) (0-50mm/sec) (4-400Hz, 240-24000RPM)

### VT-3360 Outline & Dimensions



## TM-2480 Temperature/Process Monitors

**Ametek Series TM-2480 Temperature Monitors** are complete integral systems designed for the continuous monitoring of temperature points whose primary sensors are resistance temperature detectors (RTD) and/or thermocouples, and they provide both alarm and shutdown functions when preset levels are exceeded. Three standard models are available, all of which utilize high-density, two or three channel, plug-in modules.



Each model in the series has five different outputs associated with its monitoring capability. Each temperature variable, with its associated alarm and shutdown trip levels, can be selected and digitally displayed. Point status indication is provided by light emitting diodes (LED) mounted on the front panel of each module. Integral facilities for reflashing group alarms into the control room annunciator are furnished. Finally, an analog output signal is available on each point for driving external indicators and/or recorders.

All TM-2480 models include one common trip and one common alarm relay in a meter/common service module. Should any of the individual alarm or trip set points be exceeded, one or both of these common relays will operate. Additionally, individual per-point relays can be provided.

On triple input modules, the per-point relay can be jumper selected to operate either the alarm or trip set point. As an alternative, these per-point relays on triple input modules can be linked to provide a group alarm and group trip per module. Sectionalized grouping of three-point modules within one system is, therefore, easily accommodated by wiring module group alarm or trip relay contracts in parallel or series. This dramatically reduces customer relay logic wiring and installation costs.

On dual input modules, two relays per input are provided – one for the alarm set point and one for the trip set point. Output relays are environmentally sealed (nitrogen filled) to ensure reliable operation in dusty or corrosive environments.

### Three High-Density Models

The Series TM-2480 is available in three different models/capacities, using dual or triple input modules. The TM-2481 model includes a meter/common service module and the capability for up to two modules. The TM-2482 includes a meter/common service module and capability for up to 4 modules. The TM-2485 is available to monitor up to 10 modules of either the dual or triple input variety, providing up to 30 channels per system. This unit has an expandable capacity beyond the 10 modules through the use of one or more chassis of an additional 10 modules each, including auxiliary power supply. The only limitation to system size is the visual readout distance between detector modules on the furthest slave chassis and the common digital display on the master chassis.

All three TM-2480 modules are supplied with integral detector modules, meter/common service module, operator display panel, power supply, and field wiring termination. All modules, in turn, are standardized, front removable, plug-in type with two or three-channel circuits. Field wiring connections are made via high-density, clamp-style terminals. System power is 115 or 230 volts AC, 50/60 Hz, as standard. DC powered systems for 24, 48, and 125 volts fully isolated supplies are available as an option on all systems.

# AMETEK

## Machine Monitoring

### Available Models

Series TM-2480 Temperature Monitors are available in the following standard configurations:

- a. **TM-2481**— two module system comprised of two dual or triple input detector modules, plus meter/common service module. Suitable for panel mounting.
- b. **TM-2482** — four module system comprised of four dual or triple input detector modules, plus meter/common service module. Suitable for panel mounting.
- c. **TM-2485** — a 10 module system comprised of ten dual or triple input detector modules, plus meter/common service module. Suitable for 19-inch rack mounting; optional bezel for panel mounting available.

For systems greater than 10 modules, additional 10 module chassis can be provided complete with 10 dual or triple input detector modules and integral auxiliary power supply. Connections between 10 module chassis are made by a plug-in cable slave harness. Standard length is 39 inches (1 meter).

### Special Enclosure Options

Series TM-2480 Temperature Monitors are available with the following special enclosure options:

- a. Weatherproof enclosures for surface mounting with protection to NEMA 4 or IP55 requirements.
- b. Weatherproof with viewing window for panel mounting.
- c. Terminals are available at the rear of the chassis for customer wiring to remote read push-buttons when the TM-2480 is mounted in a sealed enclosure.

### TM-2480 Common Service Module

Each TM-2480 system is equipped with one meter/common service module (CSM) which supplies power to the detector modules and provides digital readout of channel temperatures

and set points. Selection of these readouts is made by means of solid-state, interlocked, push-button circuits with LEDs, to acknowledge parameter selection.

Push-button and circuits for selecting in-service meter calibration checks are also located here.

Additionally, a common group reflash indicator and reset push-button are located on the meter/common service module. This push-button will be illuminated if one or more points within the system are in an alarm or trip condition. Pressing this push-button will clear alarm and trip circuits on all channels that are jumpered for manual reset, providing the channel input conditions have returned to normal. Details of the indicator annunciator sequence are defined in "General Specifications."

The meter/common service module includes a common alarm relay and a common trip (shutdown) relay. Alarm outputs from each individual temperature channel are bused to the common alarm reflash relay. (As an option, the reflash relay can be jumpered to serve as an audible warning relay without reflash.) Similarly, all trip outputs from each channel are bused to the common trip relay.

### TM-2480 Specifications

#### Operating Temperature Range:

-4° to 140°F (-20°C to +60°C) maximum operating temperature [storage -22° to 167°F (-30°C to +75°C)]

#### Ambient Temperature Effects:

- a. Span-less than 0.02%/°C
- b. Zero-less than 0.05%/°C

**Relative Humidity:** 10% to 60% for basic accuracy; 10% to 90% with reduced accuracy of ± 0.4% for set points and readout.

**Environmental Protection:** optional conformal circuit board coating; all relays are sealed, nitrogen filled, and have gold plated contacts

#### System Power:

- a. Standard 117/240 VAC, 50/60 Hz, +10% to -20% limits
- b. Optional 24, 48, or 125 VDC, isolated, +20% to -20% limits

**Power Supply Effects:** less than ±0.1% of span for a ±10% variation from nominal voltage

### Burden:

- a. TM-2481-less than 23 VA, fully equipped
- b. TM-2482-less than 32 VA, fully equipped
- c. TM-2485-less than 60 VA, per 10 module chassis

**Power Interruption:** up to 150 rms without spurious alarms/trips

**RFI Immunity:** Test classification-SAMA Standard: PMC 33.1C.1978, Class 2—ABC—2.5% max with sensor leads shielded and twisted core input wiring utilized: max error of 1.0% at 27 MHz, 150 MHz, and 470 MHz at a field strength of 10 volts per meter

**Customer Terminals:** clamp-style terminals with wire protection on 0.2" (5 mm) centers; maximum conductor size 10 AWG (2.5 mm<sup>2</sup>)

### Dimensions and Weights

- a. TM-2481: 12.5 lbs (5.8 kg)
- b. TM-2482: 14.5 lbs (6.6 kg)
- c. TM-2485: 30.0 lbs (13.6 kg)

### Approvals

CSA and FM approved for Division 2 locations

### TM-2480 Ordering

To order a TM-2480 System  
 —Specify the chasis/CSM model number, as shown below  
 —Specify the detector module model number(s), as shown on pages 4.12 and 4.13.

### TM-2480 Chassis/CSM Ordering

TM248 1- 2- 3- 4- 5- 6- 7- 8- 9

#### Item 1 System Size

Code	Description
1	2 Input modules
2	4 Input modules
5	10 Input modules

#### Item 2 Range Number 1 Linear RTD

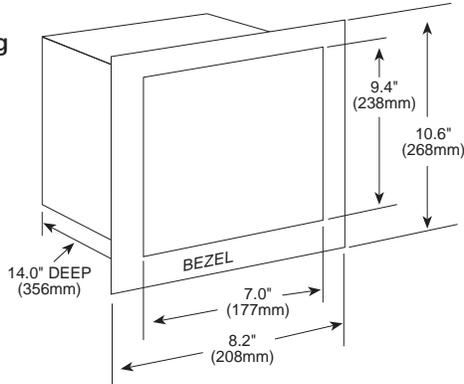
Code	Description
P	100Ω Pt RTD
C	10Ω Cu RTD
V	DC Voltage*
I	DC Current*
O	Not fitted

\*Consult Factory for ranging in engineering units. Insert value per instructions in next section (SCALING).

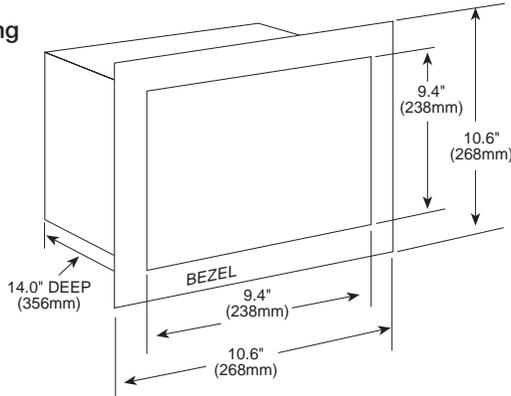
(Continued on page 3.5)

## TM-2480 Dimensions

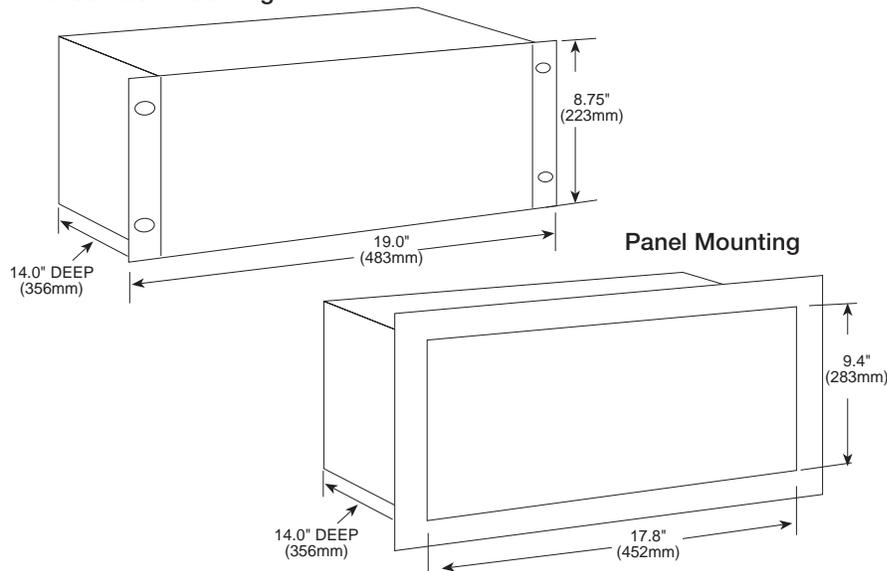
### TM-2481 Panel Mounting



### TM-2482 Panel Mounting



### TM-2485 Rack Mounting



BEZEL OPTION PANEL CUTOUT

### Item 3 Range Number 1 Scaling

Insert range code 01 to 29. See Input module specifications on page 4.13. For analog inputs, insert desired readout.

Example: 123 (0-600 PSI)  
4-20 mA=0-600 PSI  
0-100% Readout

### Item 4 Range Number 2 T/C or Ni RTD

Code	Description
N	120Ω Ni RTD
K	Type K T/C
T	Type T T/C
J	Type J T/C
E	Type E T/C
O	Not Included

### Item 5 Range Number 2 Scaling

Insert range code 01 to 29, See Input module specifications on page 4.13.

### Item 6 System Power

Code	Description
P1	220 V/240 VAC
P2	110 V/120 VAC
P4	24 VDC Isolated
P5	48 VDC Isolated
P6	125 VDC Isolated

### Item 7 System Common Relays

Common trip relay provided as standard.

Code	Description
A	Audible warning relay
R	Reflash relay

### Item 8 Relay Status

Code	Description
E	Energized for normal (Both relays)
D	De-energized for normal (Both relays)
A	Alarm energized/trip de-energized
R	Alarm de-energized trip energized

### Item 9 Special Options

Code	Description
BO	Panel-Mounting Bezel, TM-2485
SS	Sealed surface-mounting Enclosure
HW	Hinged panel mount window
EX	Expanded System Above 10 Input Modules
CC	Conformal Coating
00	No Special Options
D2	Div 2, CSA, FM Cert.
19R	19" Rackmount adapter 2481/82 only

# AMETEK

## Machine Monitoring

### VT-2490 Machine Monitoring System

- Vibration, Temperature, and Process Monitoring in a Single Integrated System
- High-Density, Plug-In Chassis in Three Standard Capacities
- Easy-To-Read Display in Engineering Units
- Local and Remote Display of Key Data
- Unique Common System Relays
- Field Selectable Operation of Key Features
- RFI Immunity
- A Choice of AC and DC Power Supplies
- Easy System Expansion in the Field
- FM/CSA Approval for Division 2 Locations

Ametek VT-2490 high-density systems monitor all key machine parameters: vibration, position, temperature, speed and process variables such as flows, pressure and levels.

In component terms, a complete VT-2490 system consists of a base unit chassis with rear panel I/O terminals, detector modules, and a common control/display/power supply module. The VT-2490 system will accept most standard field sensors such as proximity probes, accelerometers, velocity pickups, thermocouples, RTDs and process transmitters.

Three different size systems are available, all of which have a common service module and which accept any combination of plug-in detector modules.

The VT-2491 system, designed for panel mounting, provides for up to two detector modules. The VT-2492 system, also designed for panel mounting, includes up to four monitoring modules. The VT-2495 system accepts up to 10 detector modules and is designed for 19-inch rack mounting, with an optional bezel for panel mounting. This unit is expandable beyond 10 modules through one or more slave chassis of 10 modules each. For intermediate size systems, blank cover panels are available.

VT-2490 machine monitors provide unique system relay capability for maximum safety and flexibility. The VT-2491 and VT-2492 have up to three separate, sealed relays for annunciation

or other emergency action: GROUP ALARM, GROUP TRIP, and Probe OK relays. The VT-2495 offers even more—the capability to distinguish between vibration and temperature/process problems in a large system. Thus, critical temperature and/or process ALARMS (and similarly TRIPS) can be given special attention. The VT-2495 has up to five separate relays: GROUP ALARM and GROUP TRIP relays for selected temperature and process alarms; GROUP ALARM and GROUP TRIP relays for vibration channels; and Probe OK to warn of any vibration sensor faults. Each channel can be individually interfaced with these system relays using field-selectable jumper links. On all three systems, the GROUP ALARM(s) also serve as GROUP REFLASH(es) to flash both the lighted reset push-button and a remote annunciator. The reset button permits reset of all relay circuits that are jumpered for manual reset, provided conditions have returned to normal. It also permits acknowledgment of abnormal circuits. It can be activated remotely, and serves as a unique built-in annunciator. It lights and flashes (and the relay changes state) whenever one channel (or other subsequent selected ones) goes to ALARM or TRIP. REFLASH permits the grouping of many channels into one remote annunciator point without loss of pre-channel warning and acknowledgment capability.



All models feature a choice of AC (standard) or DC (optional) power. Field wiring connections are made on the chassis exterior system backplane via high-density DIN clamp-style terminals.

A number of valuable system options are available, including RFI/EMI immunity, conformal coating of all circuit boards, an extender module for calibration/troubleshooting, various weatherproof and waterproof enclosures for surface (wall) mounting, and flush panel mounting and hinged window assemblies for waterproofing on the face of the monitor in a panel. All enclosures contain viewing windows eliminating the constant need to open the enclosure. A remote selection option is also offered to allow any system to be mounted in a purged or weatherproof enclosure and viewed through a window. Readout selection is achieved by using customer supplied remote push-buttons wired to terminals at the rear of the chassis.

For hookup of portable vibration analysis equipment, one output jack for shaft phase reference is provided on the front of the VT-2490-CSM module. Two timing mark output jacks for different shaft speeds are provided on the VT-2495-CSM module.

## **VT-2490 Specifications**

**Operating Temperature Range:**  
-20°C to +60°C (-4°F to +140°F)

**Storage Temperature Range:**  
-30°C to +75°C (-22°F to +167°F)

### **System Power:**

- a. Standard 117/240 VAC 50/60 Hz, 10% to -20% variation
- b. Optional 24/48, 125 ±20% VDC isolated

### **Power Supply Effects:**

< ±0.1% of span (FS) for 10% variation

### **Burden:**

- a. VT-2491: less than 28 VA fully equipped
- b. VT-2492: less than 38 VA fully equipped
- c. VT-2495: less than 70 VA fully equipped

### **RFI/EMI Immunity:**

- a. Temperature process modules: SAMA Standard PMC33.1C.1978, Class 2 — ABC — 2.5% maximum with sensor leads shielded and twisted covers; maximum error 1.0% at 27 MHz, 150 MHz and 470 MHz at field strength 10 V/Meter. Standard on all models.
- b. Vibration modules: dependent on type of sensor and sensitivity (consult factory). Typical maximum 5%.

**Customer Terminals:** Clamp style terminals with wire protection on 0.2" (5 mm) centers; maximum conductor size 10 AWG (2.5 mm<sup>2</sup>).

### **Mounting:**

- a. VT-2491 & VT-2492: panel mounting with integral bezel.
- b. VT-2495: standard 19-inch rack mounting; optional panel mounting with bezel.

### **Weights (dependent on system):**

- a. VT-2491: 13 lbs (6 kg) fully equipped.
- b. VT-2492: 15 lbs (7 kg) fully equipped.
- c. VT-2495: 31 lbs (14 kg) fully equipped.

For additional data, see Ordering Section.

# AMETEK

## Machine Monitoring

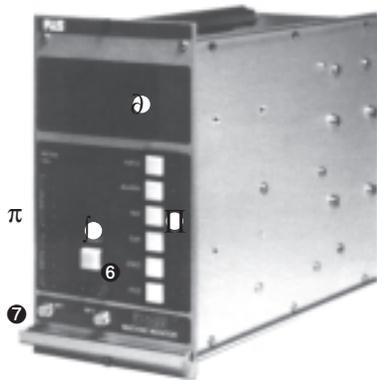
### VT-2490 Common Service Module

The Common Service Module (CSM) supplies power to the detector modules and sensors for increased reliability. The CSM's digital display provides precise readout on-demand of all channels in easy-to-understand, customer-selected engineering units, such as mils, in/sec, °F, °C, %, psig, mm/sec and others. All channel parameters are individually selectable: input, ALARM and TRIP set points, GAP/BIAS, zero point and full scale deflection (span). Proximity probe gap clearance and seismic transducer bias are accurately displayed in volts on the common service module for calibration purposes, as well as for in-service checks.

Due to the precise nature of the digital readout, the critical accuracy of the ALARM and TRIP set points is  $\pm 0.1\%$  FS or 1 digit. The machine's monitored condition is also displayed on the common service module with high resolution. Display selection is made by lighted, interlocked, common push-buttons and per-channel, momentary-contact push-button on each detector module. Optional outputs can duplicate the call-up and display of all selectable functions on a remote separate meter or CRT.

Ametek offers two different common service modules. The VT-2490-CSM is used in both the VT-2491 and the VT-2492 systems and accepts up to three different input range and parameter combinations, with an option of three more. The VT-2495-CSM, which is designed for the VT-2495 system, accepts up to six input range and parameter combinations.

The CSM incorporates front panel set points for fine-calibrating the readout of the span and zero points for all ranges. In-service verification of the five volt reference calibration source is also available on the front panel. Start-up inhibit and x2 or x3 start-up multiplication of all selected ALARM and TRIP circuits are offered to facilitate normal run-ups and protect during abnormal ones. Individual channels may be included (or not) by a field-selectable jumper link. This permits special system control. The relay "over-ride" is made known by a front panel LED, so that monitoring protection is not inadvertently by-passed.



#### Common Service Module Features

1. Digital LED Display: provides readout of all channel parameters and set points in customer selected engineering units, with fully floating decimal point.
2. Digital Display Readouts: common service modules provide display of customer-selected engineering units.
3. Common System Push-button: lighted, interlocked buttons, each with an adjacent LED, allow operator selection for display of: input (machine's monitored condition); ALARM set point; TRIP set point; gap (for sensor voltage gap or bias level); zero; and FSD (full scale deflection).
4. Zero and Span Potentiometer: calibrate readout of individual input ranges.
5. Reset Push-button (with reflash indicator): for manual reset of ALARM and TRIP circuits once channel conditions return to normal.
6. Front Panel Test Jacks: for in-service check of internal calibration source using digital volt meter.
7. Timing Mark Output Jack: for hookup of portable vibration analysis equipment; provides shaft phase reference output (two different outputs available on VT-2495-CSM).

### VT-2490 Common Service Module Specifications

#### System Input Range and Parameter Combinations:

VT-2490-CSM (VT-2491, 92 systems):  
3 standard; 6 optional.

VT-2495-CSM (VT-2495 system):  
6 standard.

#### Notes:

1. One non-linear input (T/C or 120 Ohm Ni RTD) per system is standard. Several ranges (up to system maximum) can be specified for one type of sensor.
2. Minimum span for T/C inputs: 8 mV; minimum span for RTD inputs: 25mV

#### Digital Meter Readout:

Maximum Scale : 1000 to +1999 with full floating decimal point and resolution of  $\pm 1$  digit to display the following in engineering units:

- a. Channel input
- b. Channel ALARM set point
- c. Channel TRIP set point
- d. Gap Bias Voltage: for vibration inputs
- e. Meter range calibration check: zero and FSD

#### Engineering Units Display:

- a. 3 standard or 5 optional parameters (in addition to "gap" volts) for VT-2491 and VT-2492 systems.
- b. 6 standard parameters (one of which is volts) for VT-2495 system.

#### Relay Contact Outputs:

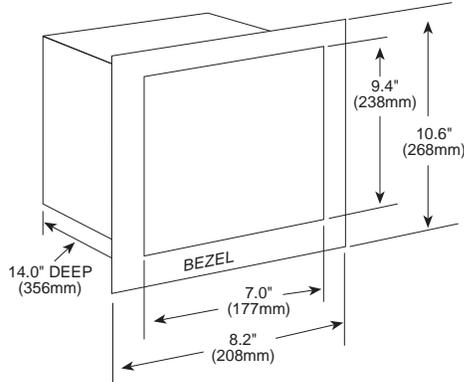
Common service module relays environmentally-sealed (nitrogen-filled) to avoid contamination:

- a. AC—240 VAC maximum, 3 A maximum, or 300 VA maximum.
- b. DC—up to 30 VDC maximum at 3 A maximum or 90 watts maximum, resistive load; 30 VDC to 220 VDC maximum, 50 watts switching maximum (resistive load only).
- c. VT-2491-CSM and VT-2492-CSM: up to three system relays—GROUP ALARM (Reflash), GROUP TRIP, Probe OK (optional).
- d. VT-2495-CSM:
  1. Standard: same as above.
  2. Optional: five system relays:
    - (a) Temperature/process: GROUP ALARM (Reflash), GROUP TRIP.
    - (b) Vibration: GROUP ALARM (Reflash), GROUP TRIP, Probe OK.

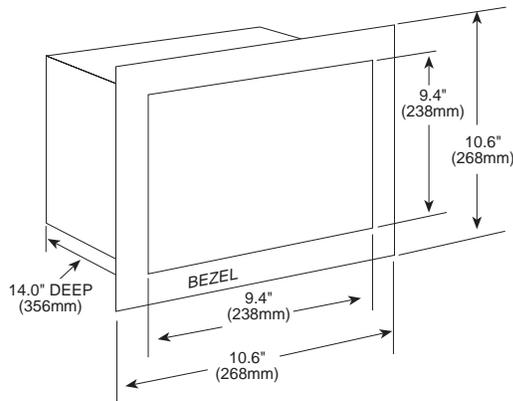
**Calibration Accuracy:** Digital readout  $\pm 0.25\%$  FSD or 1 digit (if greater).

## VT-2490 Dimensions

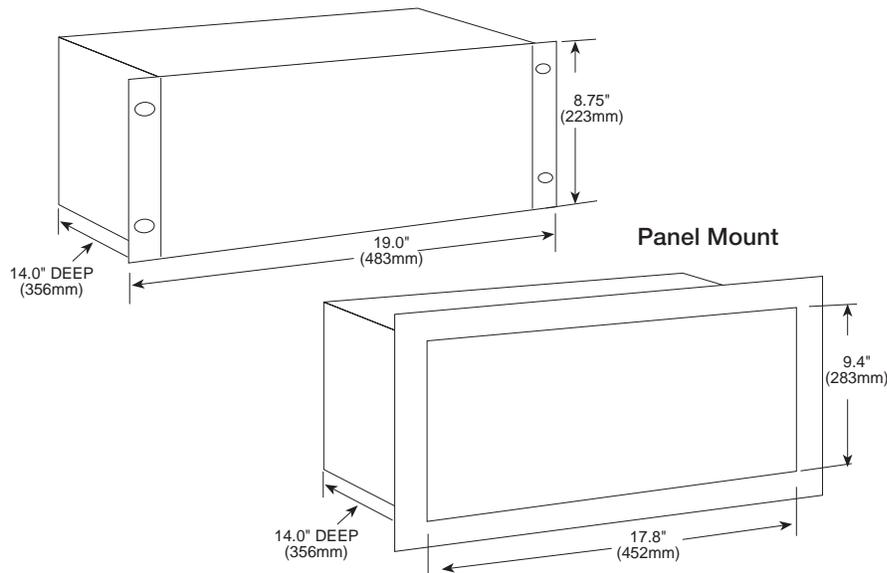
### VT-2491 Panel Mount



### VT-2492 Panel Mount



### VT-2495 Rack Mount



BEZEL OPTION PANEL CUTOUT

## VT-2490 Ordering

To order a VT-2490 system

- Specify the chassis/CSM model number, as shown below.
- Specify the detector module model number(s) as shown on pages 4.12 through 4.24

### VT-2490 Chassis/CSM Ordering

VT-249 1-2-3-4-5-6

Must use one option from each group.

#### Item 1 Rack Size

Code	Description
1	2 module rack
2	4 module rack
5	10 module rack

#### Item 2 System Power

Code	Description
1	220/240 VAC
2	110/120 VAC
4	24 VDC isolated
5	48 VDC isolated
6	125 VDC isolated

#### Item 3 CSM Relays

Code	Description
A	Audible warning relay (group alarm)
R	Refresh relay

Note: Group Trip is standard.

#### Item 4 Optional CSM Relays

Code	Description
K	Probe OK (VT-2491, VT-2492)
R	Probe OK, group alarm and trip (VT-2495)
X	No extra relays (VT-2491, VT-2492, VT-2495)

#### Item 5 CSM Relay Status

Code	Description
E	Normally energized
D	Normally de-energized

#### Item 6 Options

Code	Description
BO	VT-2495 panel mount bezel
SS	Surface mount weather-proof cabinet
HW	Hinged window cover, water-proof
EX	10 module expansion chassis, aux. p.s. per 10 extra modules
D2	Division 2 approval, CSA, FM
CC	Conformal coating, CSM and motherboard
00	No options
19R	19" Rackmount adapter, 2491/92 only

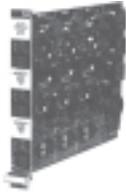
# AMETEK

## Machine Monitoring

### Detector Modules for TM-2480 and VT-2490 Systems

#### TM-2471/2/3 Triple Channel Temperature & Process Modules

(For use with TM-2480 and VT-2490 systems)



Typical TM/VT Detector Module

TM-2471/2/3 high-density, triple channel modules provide continuous monitoring of RTDs, thermocouples, and process variables. These modules provide both alarm and shutdown functions per channel when pre-set limits are exceeded and digital readout on demand, via the display on the system's Common Service Module.

One range and sensor type can be specified per module, with the maximum number of ranges and sensors determined by the monitor system. The triple channel thermocouple module (TM-2471) accepts types K, T, J, and E grounded and ungrounded thermocouples. The triple channel process module (TM-2472) accepts process analog signals proportional to a wide range of variables (pressure, flow, level, etc.) in any of seven standard instrument ranges (six current and two voltage ranges). The triple channel RTD module (TM-2473) accepts platinum, copper, or nickel RTD sensors.

Each channel of a triple channel module has adjustable ALARM and TRIP set points which activate LED indicators and relays when pre-set limits are exceeded. The thermocouple and analog modules have input circuits that are fully floating with 500 VDC channel-to-channel isolation to ensure high rejection of common mode ripple and noise and to allow sensors to be grounded. The RTD module incorporates a constant-current, three-wire compensated bridge circuit connected to the remote three-wire RTD sensor. All modules have automatic built-in sensor failure detection.

This feature will cause an alarm (but will inhibit shutdown) for sensor failure (see specifications, Note 4). Up to five different outputs per module are available

from the system chassis' rear terminal, including a per-channel, filtered analog signal for data processing or strip chart recording.

#### Field Selectable Relay Modes

Each channel on any of these modules features a DPDT sealed relay. By means of jumpers on the module, these relays can be assigned to an ALARM function per point, TRIP function per point, or group alarm and group trip per module. This latter feature allows flexible grouping of module relay alarm and trip contact outputs with a minimum of external wiring, thus reducing system installation costs. Jumpers are also provided on all circuits to allow in-service change of trip mode (high or low), sequence (manual or automatic reset), and relay state (normally energized or de-energized). In addition, each channel may be jumpered to the system's group alarm/reflash and group trip relays.

#### TM-2474/5/7 Dual Channel Temperature & Process Modules

(For use with TM-2480 and VT-2490 systems)



TM-2474/5/7 high-density, dual channel modules provide continuous and process variables. These modules provide both alarm and shutdown functions per channel when pre-set limits are exceeded and digital readout on demand, via the display on the system's Common Service Module.

One range and sensor type can be specified per module, with the maximum number of ranges and sensors determined by the monitor system.

The dual channel thermocouple module (TM-2474) accepts types K, T, J, and E grounded and ungrounded thermocouples. The dual channel process module (TM-2475) accepts process analog signals proportional to a wide range of variables (pressure, flow, level, etc.) in any of eight standard instrument ranges (six current and two voltage ranges). The dual channel RTD module (TM-2477) accepts platinum, copper, or nickel RTD sensors or selected thermistor sensors.

Each channel of a dual channel module has adjustable ALARM and TRIP set points, which activate LED indicators and relays when pre-set limits are exceeded. The thermocouple and analog modules have input circuits that are fully floating with 500 VDC channel-to-channel isolation, to ensure high rejection of common mode ripple and noise and to allow sensors to be grounded. The RTD module incorporates a constant-current, three-wire compensated bridge circuit connected to the remote three-wire RTD sensor. All modules have automatic built-in sensor failure detection. This feature will cause an alarm (but will inhibit shutdown) for sensor failure (see Specifications, Note 4). Up to five different outputs per module are available from the system chassis' rear terminal, including a per-channel, filtered current or voltage analog signal for data processing or strip chart recording.

#### Field Selectable Relay Modes

Each of the two channels per module feature an alarm relay with SPDT contacts and a trip relay with DPDT contacts. Jumpers are provided to allow in-service per-channel change of trip mode (high or low), sequence (manual or automatic reset) and relay state (normally energized or de-energized.)

#### Standard Analog Input Ranges:

Code	Input Range	Input Impedance
22	1 to 5 mA	200Ω
23	4 to 20 mA	50Ω
24	10 to 50 mA	20Ω
25	0 to 1 mA	1K
26	0 to 10 mA	100Ω
27	0 to 20 mA	50Ω
28	0 to 1 V	5 M
29	1 to 5 V	5 M

Note: Consult factory for other input ranges, non-linear analog inputs, or for meter display scaled in engineering units.

**Input Impedance:** greater than 5 megohms for thermocouple inputs

#### Outputs:

- a. Meter Range: (readout on Common Service Module)
  1. Temperature: linearized in °C or °F, maximum scale -150° to +1999° with resolution of ±1 degree
  2. Process: consult factory for specific variables and ranges.
- b. Calibration Accuracy: ±0.25% FS or 1 digit if greater

- c. Relays: environmentally-sealed (nitrogen-filled): 240 VAC, 3 A, or 300 VA maximum AC rating; 30 VDC at 3 A or 90 W, or 30-to-220 VDC at 50 W switching maximum resistive load.
- d. Analog Outputs (rear terminal): voltage or current ranges available; accuracy  $\pm 0.25\%$  FSD (proportional to sensor response characteristics.)

**Output Table**

Code	Analog Outputs Range	Output Load ( $\Omega$ )
01	0 to 1 mA	12 K max
02	0 to 5 mA	24 K max
03	0 to 10 mA	1.2 K max
04	0 to 20 mA	600 max
05	1 to 5 mA	2.4 K max
06	4 to 20 mA	600 $\Omega$ max
07	0 to 5 VDC	25 K min
08	0 to 10 VDC	25 K min
09	1 to 5 VDC	25 K min

**General Performance:**

- a. Set points: two per channel, 0-100% minimum adjustment;  $\pm 0.5^\circ\text{C}$  over the range by blind-set multi-turn potentiometers.
- b. Deadband: 0.5% standard (other values optional)
- c. Channel Isolation:
  - 1. Thermocouple and analog input circuits fully floating, 500 VDC channel-to-channel isolation.
  - 2. RTD sensor inputs common to internal system 0 volts; grounded RTDs are not recommended for use with the VT-2490 system.
  - 3. Meter outputs common to internal system 0 volts
- d. Temperature Effect: span,  $<0.02\%$  of reading/ $^\circ\text{C}$ ; zero,  $<0.05\%$  degree/ $^\circ\text{C}$
- e. RFI Immunity: 27, 150, 470 MHz max. error, 1% at 10 volts per meter.

**TM-2471/2/3/4/5/7 Ordering**

TM-247 1-2-3-4-5-6-7-8-9-10-11

**Item 1 Module Type**

Code	Description
1	Triple T/C
2	Triple Analog
3	Triple RTD
4	Dual T/C
5	Dual Analog
7	Dual RTD
8	Blank

**Item 2 Sensor Type**

Code	Description
P	100 $\Omega$ Pt RTD
N	120 $\Omega$ Ni RTD
C	10 $\Omega$ Cu RTD

**TM-2471/2/3/4/5/7 Input Modules Specifications**

**Standard Temperature Input Ranges & Sensors:**

Code	Input/Display Range		RTD Sensors			Thermo-Couples				
	$^\circ\text{C}$	Code	$^\circ\text{F}$	100 $\Omega$ Pt	10 $\Omega$ Cu	120 $\Omega$ Ni	K	T	J	E
01	0 to 100	—	—	X		X		X	X	
02	0 to 150	12	0 to 300	X	X	X	X	X	X	X
03	0 to 200	13	0 to 400	X	X	X	X	X	X	X
04	0 to 300	—	—				X	X	X	
05	0 to 400	14	0 to 750	X			X	X	X	X
—	—	15	0 to 1000	X				X		X
06	0 to 600	16	0 to 1100				X		X	X
07	0 to 1000	17	0 to 1800				X		X	X
08	-100 to 200	18	-150 to 400	X			X	X	X	X
09	-100 to 400	19	-150 to 750	X			X	X	X	X
10	-100 to 1000	20	-150 to 1800						X	X
11	-100 to 1100	21	-150 to 2000				X			

- Note:
1. All 100 $\Omega$  Platinum RTDs calibrated using DIN standard values R212/R32F and R100/ROC = 1.2850. All other standards must be requested.
  2. Maximum number of ranges per systems: See VT-2490 CSM and VT-2490 product descriptions.
  3. For greater resolution of analog output, input range may be reduced. Accuracy will be  $\pm 0.25\% \pm 1^\circ\text{C}$  ( $^\circ\text{F}$ ) of range.
  4. Sensor failure detection: high, high/high mode initiates alarm (not shutdown) for RTD open or short and T/C open circuit, and live zero analog inputs.

K	Type K T/C
T	Type T T/C
J	Type J T/C
E	Type E T/C
V	DC Voltage
I	DC Current

**Item 3 Input Range**

Insert range code 01 to 29, See input Tables, Insert 'SS' for Special; Two Ranges Maximum Per System; For analog inputs, write in desired readout\*\*

**Item 4 Alarm Sequence Status**

Code	Description
M	Latching manual reset
A	Auto reset when return to normal
H	High for alarm
L	Low for alarm

**Item 5 Trip Sequence Status**

Code	Description
M	Latching, manual reset
A	Auto reset when return to normal
H	High for trip
L	Low for trip

**Item 6 Alarm Trip Delay**

Code	Description
DA	1 Sec. delay on alarm
DT	1 Sec. delay on trip
DB	1 Sec. delay on both alarm and trip relay
00	Standard time delay (see specifications)

**Item 7 Relay Designation**

For triple modules only

Code	Description
A	Alarm relay per point
T	Trip relay per point
G	Group alarm and trip per module

For dual modules only

R	Alarm and trip relay per module
---	---------------------------------

**Item 8 Relay Status**

Code	Description
E	Energized for normal
D	De-energized for normal
A	Alarm energized/trip de-energized
R	Alarm de-energized/trip energized

**Item 9 Output Signal**

Code	Description
V	Voltage, dual & triple modules
I	Current, dual modules only

**Item 10 Output Range**

Insert Range Code 01 to 09, See Output Table, General Specifications

**Item 11 Options**

Code	Description
00	None
CC	Conformal coating

\*\*Example: I23 (0-600 PSI)  
4-20 mA=0-600 PSI  
0-100% Readout

# AMETEK

## Machine Monitoring

### Thrust Modules

#### VT-2461-T & VT-2462-TT

(For use with VT-2490 systems)

The single-channel VT-2461-T thrust module monitors the axial position of a rotating shaft or thrust bearing. A dual channel module (VT-2462-TT) is also available for sophisticated monitoring of turbomachinery and for petrochemical and refinery applications involving API-670 specifications.

#### Common Features

Many features are common to both thrust modules — for instance, two fully-adjustable ALARM and TRIP set points, one for normal (active) and another for counter (inactive) thrust. They activate LEDs and sealed relays when pre-set limits are exceeded. The set points are arranged for easy operator understanding with color-coded LEDs, ID tag, and push-to-read push-button. Digital readout of thrust in engineering units (mils or  $\mu\text{M}$ ) is supplied on demand, via the display on the system's common service module (CSM). A jumper allows field selectable inversion of the sense of the probe (to provide positive readout for either normal or counter thrust).

Each module also includes a module ID tag plus Probe OK status LED to warn of circuit fault. A sensor failure is indicated by activating the channel's ALARM relay and LED and the CIRCUIT-FAULT relay in the CSM, turning off the channel OK LED, and disabling the TRIP circuit (to prevent false shutdowns). The operator can interrogate the channel through the common service module to determine the nature of the fault. A wide selection of per channel outputs are available from the system chassis' rear terminal, including the "raw" signal and a standard analog signal for data processing or strip chart recording. Also an AC output of the "raw" sensor signal is provided by a front panel jack with buffered short-circuit protection.

#### VT-2461-T Single Thrust Module

The single thrust module (VT-2461-T) features one channel, which accepts the output signal from one proximity probe and driver. It provides four set points — two (ALARM and TRIP) for active axial position and two for inactive position. An ALARM in either direction

(increasing positive or negative displacement between the probe and the target) activates the GROUP ALARM relay. Similarly, a TRIP in either direction activates the GROUP TRIP relay. Factory-set relay time delays are available for the ALARM and TRIP circuits on each channel to minimize false shutdowns.

All relays on the module are field-selectable for normally energized or de-energized, manual or auto-reset, and system relay interfacing. Each channel can be designated to interface with the CSM's GROUP ALARM and GROUP TRIP relays. For example, any channel's ALARM can also actuate the CSM GROUP ALARM relay if desired. More critical channels can, therefore, be grouped for special annunciation and attention.

#### VT-2462-TT Dual Thrust Module

A dual thrust module (VT-2462-TT) featuring two proximity probe channels for dual thrust monitoring. There are four set points common to both channels — two (GROUP ALARM and GROUP TRIP) for active axial position and two for inactive position. Consequently, Channel A's and Channel B's ALARM set points for positive displacement (active thrust) are always the same. Channel A's and B's TRIP set points are also shared in this manner. Two group relays are offered: a GROUP ALARM relay for an ALARM in either direction on either Channel A or Channel B; and a GROUP TRIP relay for a TRIP in either direction on Channel A AND/OR Channel B. The GROUP TRIP relay thus provides field-selectable AND/OR voting logic between the two channels.

As an option, the VT-2462-TT can be used as two single thrust channels with the probes installed in two different thrust bearings. In such cases, the set points and relays are still shared as described above.

Unique, field-selectable First-Out annunciation is also available on the VT-2462-TT to assist in post-fault diagnosis.

The relay time delays on the VT-2462-TT are fully field-selectable. In addition, this module has a unique circuit fault protection. A "delayed return-to-normal"

check of the input prevents intermittent sensor failures from falsely shutting down machinery. The associated Probe OK LED flashes and TRIP is inhibited for 10 seconds following correction of a circuit fault condition. Proper operation is thus ensured. To maintain protection if AND voting is selected, the VT-2462-TT automatically reverts back to OR voting given a sensor failure.

Field-selectable "Dual Fault Shutdown Protection" is also available to safeguard machinery during rapid thrust bearing failure. If both channels experience circuit fault within 10 seconds of each other (indicative of a sudden thrust collar failure), TRIP will be automatically initiated. No TRIP will occur if the time interval is greater than 10 seconds between the two faults. As an alternative, the module may be jumpered to inhibit TRIP if both channels experience circuit fault.

### VT-2461-T & VT-2462-TT Specifications

For the complete specifications of each model, refer to both "General Specifications" and the corresponding section of "Individual Module Specifications."

#### Specifications

##### Inputs:

- Sensitivity: 200 mV/mil (8mV/ $\mu\text{M}$ ) or 100 mV/mil (4 mV/ $\mu\text{M}$ ).
- Impedance: 20K ohm (single-ended, one side to system common).

##### Outputs:

- Meter Output to CSM Display: (see Ordering section for ranges).
- Calibration Accuracy:  $\pm 0.25\%$  FS or 1 digit if greater.
- Sensor Signal (front panel): buffered, 2K ohms.
- Relays: gold-plated, environmentally-sealed (nitrogen-filled); one DPDT for ALARM and TRIP; 240 VAC, 3 A or 300 VA maximum AC rating; 20 VDC at 3 A or 90 W, or 20-to-220 VDC at 50 W switching maximum resistive load.
- Relay Response Time: standard 1 second for ALARM and 3 for TRIP.
- Analog Outputs (rear terminal): voltage or current ranges available (see Ordering Section); accuracy  $\pm 0.25\%$  of span.

**General Performance:**

- a. Set Points: two for normal and two for counter thrust; 0-100% minimum adjustment; ±0.1% resolution; ±1 digit readout accuracy
- b. Deadband: 0.5% standard (other values optional).
- c. Frequency Response: DC to 1 Hz
- d. Channel Separation: 40 dB minimum crosstalk DC to 1 Hz; sensor power supplies are buffered and limited to 50 mA
- e. Temperature Effect: span, ≤ 0.03% of reading/°C; zero, ≤ 0.03% of span/°C

**Individual Module Specifications VT-2461-T**

- a. Relays: one DPDT for ALARM, one for TRIP
- b. Relay Time Delays: optional factory-set, 1-10 seconds for ALARM and TRIP
- c. Set Points: four
  - 1. Two (ALARM and TRIP) for active axial thrust
  - 2. Two for inactive thrust

**VT-2462-TT**

- a. Relays: one DPDT per channel; a GROUP ALARM for an ALARM in either direction on either Channel A or Channel B; and GROUP TRIP for a TRIP in either direction on Channel A AND/OR Channel B.
- b. Relay Time Delays: field selectable ALARM, 0.5-8.0 seconds in 0.5 second intervals; field-selectable TRIP, 1-16 seconds in 1 second intervals.
- c. Set Points: four common to both channels.
- d. First-Out (field-selectable): the LED of the first channel to ALARM (or to TRIP) flashes.
- e. Voting Logic (TRIP circuit): field-selectable AND/OR voting.
- f. Circuit Fault Protection: a "delayed return-to-normal" check of the input prevents intermittent sensor failures from falsely shutting down machinery.
- g. Dual fault shutdown protection (field selectable):
  - 1. If both channels experience circuit fault within 10 seconds of each other, TRIP will be automatically initiated. No TRIP will occur if time interval is greater than 10 seconds.

- 2. Module may be jumpered to inhibit TRIP if both channels experience circuit fault.
- h. Analog Meter Panel: Either one or both channels can be continuously displayed on the analog meter panel.

**VT-2461-T & VT-2462-TT Thrust Modules Ordering**

VT-246 1-2-3-4-5-6-7-8-9-10-11-12-13-14

Must use one option from each group.

Item 1 Code	Module Type Description
1-T	Single Thrust
2-TT	Dual Thrust, API-670 Conformance

Item 2 Code	Module Range Description
33	15-0-15 mils
34	25-0-25 mils
35	30-0-30 mils
36	40-0-40 micrometers
37	400-0-400 micrometers
38	600-0-600 micrometers
39	750-0-750 micrometers
40	1000-0-1000 micrometers
41	Unlisted ranges Consult Factory

Item 3 Code	Analog Output Description
01	Current analog 0-1 mA
02	Current analog 0-5 mA
03	Current analog 0-10 mA
04	Current analog 0-20 mA
05	Current analog 1-5 mA
06	Current analog 4-20 mA
07	Voltage analog 0-5 VDC
08	Voltage analog 0-10 VDC
09	Voltage analog 1-5 VDC

Item 4 Code	Relay Designation Description
G	Group alarm & group trip per module

Item 5 Code	Relay Sequence Description
M	Latching, manual reset
A	Auto reset when return to normal

Item 6 Code	Dual Fault Shutdown Description
X	VT-2461-T, not available
I	Dual Fault inhibits trip, VT 2462-TT
P	Dual Fault provides trip, VT-2462-TT

I and P options are field selectable.

Item 7 Code	AND/OR Voting Trip CKT Description
X	VT-2461-T, not available
A	"AND", VT-2462-TT only
O	"OR", VT-2462-TT only

A and O options are field selectable.

Item 8 Code	CSM Group Relay Service Description
A	All relay outputs interface to CSM relays VT-2461-T
Y	"Yes", VT-2462-TT alarm to CSM alarm
N	"No", VT-2462-TT alarm to CSM alarm

Item 9 Code	Relay Status Description
E	Normally energized
D	Normally de-energized
A	Alarm energized/trip de-energized VT-2462-TT only
R	Alarm de-energized/trip energized VT-2462-TT only

Item 10 Code	Relay Time Delay VT-2461 Only Description
01-10	Alarm time delay in seconds (ex: 01) VT-2461-T (01 sec. std.)
01-10	Trip time delay in seconds (ex: 03) VT-2461-T (03 sec. std.)

Delay is factory set only.

Item 11 Code	Relay Time Delay VT-2462 Only Description
0.5-8.0	Alarm in 0.5 second intervals
01-16	Trip in 1.0 second intervals

Delay is field alterable for VT-2462-TT.

Item 12 Code	Input Sensitivity Description
1	100 mV/mil
2	200 mV/mil

Item 13 Code	Probe Drive Voltage Description
1	-24 VDC at 40 mA
2	-18 VDC at 40 mA

Item 14 Code	Options Description
00	None
CC	Conformal coating

# AMETEK

## Machine Monitoring

### Seismic Modules VT-2463-SS & VT-2464-SS (For use with VT-2490 systems)

#### Common Features

Many features are common to both seismic modules. There are two separate monitoring channels, each with two fully-adjustable set points, ALARM and TRIP, grouped for easy operator understanding with color-coded LEDs, ID tag, and push-to-read engineering units (g, M/S<sup>2</sup>, in/sec, or mm/sec) on the digital display of the system common service module (CSM).

Each module also includes a module ID tag plus Probe OK status LEDs to indicate circuit fault. A sensor failure is indicated by the OK LED off and the ALARM LED on. The defective channel's TRIP relay (if any) is disarmed to prevent false shutdowns while the ALARM relay and/or CIRCUIT FAULT relay in the common service module activates to warn of the fault. The channel can then be interrogated via the CSM to verify sensor failure and assist in troubleshooting. Two front panel jacks with buffered sensor signal outputs are offered for interfacing with portable analyzers. In addition, each channel has a wide selection of voltage and current analog outputs available on the rear of the system chassis.

A number of different transducers can be used with SS modules, including integrated accelerometers (for temperatures less than 250°F/120°C), charge accelerometers with charge amplifiers or line-drivers (for temperatures higher than 250°F/120°C) and any type of velocity pickup. Power for each sensor is provided on its one input/output cable.

Each channel also offers a choice of vibration detection and display options: for rub and imbalance problems, peak detection and display of the vibration are standard; for anti-friction bearings and where noise or turbulence is present, true RMS detection and display (or average detection and peak display) are standard. Sharp, precision filtering (low, high and bandpass) is available to focus the monitoring protection on specific problems occurring at particular frequencies.

Both modules are capable of either single or dual-path monitoring. In dual path monitoring, a single sensor provides inputs to both channels with different ranges and/or parameters. An accelerometer is usually

employed with the measured acceleration monitored in "g's" (or M/S<sup>2</sup>) on one channel and velocity in "in/sec" (or mm/sec) on the other, using integration.

All relays on both modules are field-selectable for normally energized or de-energized, manual or auto-reset, system relay interfacing, and system Start-up Control interfacing. These last two features provide special system flexibility. Each channel can be designated to interface with the CSM's GROUP ALARM and GROUP TRIP relays. For example, a channel's ALARM can also actuate the GROUP ALARM relay. More critical channels can, therefore, be grouped for special annunciation and attention. Similarly, each channel's relays can be linked to the system Start-up Control (x2, x3, or Inhibit) to ensure maximum protection during run-ups without false shutdowns.

#### VT-2463-SS Module

On the VT-2463-SS, one sealed relay is supplied per channel, assignable to channel ALARM or TRIP or GROUP ALARM and GROUP TRIP. Factory-set relay time delays are available for the ALARM and TRIP circuits on each channel to minimize false shutdowns.

#### VT-2464-SS Module

The seismic module (VT-2464-SS) features two sealed relays per channel (one for ALARM and one for TRIP). First-Out annunciation is provided to make post-fault diagnosis easier — the LED of the first channel to go into ALARM (and similarly into TRIP) flashes, while subsequent alarms will have continuously lit LEDs.

The relay time delays on the per-channel ALARM and TRIP circuits are fully field-selectable. In addition, VT-2464 modules have a unique form of circuit fault protection. A "delayed return-to-normal" check of the input prevents intermittent sensor failures from falsely shutting down machinery. The associated Probe OK LED flashes and TRIP is inhibited for 10 seconds following correction of a circuit fault condition, which indicates proper operation.

### Seismic Module Specifications

For the complete specifications of each model, refer to both "General Specifications" and the corresponding section of "Individual Module Specifications."

#### General Specifications

##### Inputs:

- Sensitivity: accelerometer (or charge amplifier): 100 mV/g (10mV/M/S<sup>2</sup>) or 10 mV/g (1 mV/M/S<sup>2</sup>). Velocity pickup: 100 mV/in/sec (3.94 mV/mm/sec) or 195 mV/in/sec (7.68 mV/mm/sec).
- Impedance: 20 K ohm nominal (single-ended, one side to system common).

##### Outputs:

- Meter Output to CSM Display: (see Ordering section for ranges).
- Calibration Accuracy:  $\pm 0.25\%$  FS or 1 digit (if greater).
- Sensor Signal (front panel): buffered, 2K ohms.
- Relays: gold-plated, environmentally-sealed (nitrogen filled), 240 VAC, 3 A or 300 VA maximum AC rating; 30 VDC at 2 A or 90 W or 30 to 220 VDC at 50 W switching maximum resistive load.
- Start-up Control: voltage free operator contact on rear of CSM for x2, x3, or Inhibit of ALARM and TRIP.
- Relay Response Time: 1 second for ALARM and 3 for TRIP, standard.
- Analog Outputs (rear terminal): voltage or current ranges available (see Ordering Section); accuracy  $\pm 0.25\%$  of span.
- Transducers Power Supply: +24 VDC compliance at 2 or 4 mA constant current for 2- or 3-wire input; also +24, -24, and -18 VDC at 50 mA maximum.

##### Transfer Performance:

- Set Points: two per channel, 0-100% minimum adjustment;  $\pm 0.1\%$  resolution;  $\pm 1$  digit readout accuracy.
- Deadband: 0.5% standard (other values optional).
- Frequency vs. Amplitude Response:  $\pm 2\%$  7.5 Hz to 6 kHz; sensor power supplies are buffered and limited to 50 mA.
- Parameter Selection: peak, true RMS, or average detection and display of g, in/sec, M/S<sup>2</sup>, mm/sec; peak detection with peak-to-peak display of mils and  $\mu\text{M}$ .
- Integration: acceleration to velocity, velocity to displacement.
- Filter: 24 dB/octave roll-off, low, high and band-pass.
- Temperature Effect: span,  $\leq 0.03\%$  of reading/ $^{\circ}\text{C}$ ; zero,  $\leq 0.03\%$  of span/ $^{\circ}\text{C}$ .

## Individual Module Specifications

### VT-2463-SS

- Relays: one DPDT per channel
- Relay Time Delays: optional factory-set, 1-10 seconds for ALARM and TRIP.

### VT-2464-SS

- Relays: one SPDT and one DPDT per channel. ALARM is field selectable to be either the SPDT or the DPDT relay (with TRIP being the other). Other relay voting available. Please consult the factory.
- Relay Time Delays: field selectable ALARM, 0.5-8.0 seconds in 0.5 second intervals; field selectable TRIP, 1-16 seconds in 1 second intervals.
- First-Out: the LED of the first channel to go into ALARM (and similarly into TRIP) flashes.
- Circuit Fault Protection: a "delayed return-to-normal" check.
- Analog Meter Panel: either or both channels can be continuously displayed on the analog meter panel.

## VT-2463-SS and VT-2464-SS Seismic Modules Ordering

VT-246 1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19

Must use one option from each group.

Item 1 Code	Module Type Description
3	1 relay per channel, factory set relay time delays
4	2 relays per channel, API-670 conformance

### Item 2 Channel A Range Description

55	Range*
56	0 to 3g
57	0 to 5g
58	0 to 10g
59	0 to 15g
60**	0 to 20g
61**	0 to 30g
62**	0 to 50g
63**	0 to 75g
64	0 to 250g
65	0 to 30 M/S <sup>2</sup>
66	0 to 50 M/S <sup>2</sup>
67	0 to 100 M/S <sup>2</sup>
68	0 to 150 M/S <sup>2</sup>
69	0 to 200 M/S <sup>2</sup>
70	0 to 300 M/S <sup>2</sup>
71	0 to 500 M/S <sup>2</sup>
72	0 to 750 M/S <sup>2</sup>

72	0 to 2000 M/S <sup>2</sup>
73	0 to 0.3 in/sec
74	0 to 0.5 in/sec
75	0 to 1.0 in/sec
76	0 to 3.0 in/sec
77	0 to 8 mm/sec
78	0 to 12.5 mm/sec
79	0 to 25 mm/sec
80	0 to 50 mm/sec
81	Unlisted ranges (C/F)

\*For peak-to-peak displacement, see Displacement Module PDB, Codes 42-54

\*\*Available only with 10 mV/g or special sensor.

Item 3 Code	Channel B Range Description
42-80	See listing in Item 2
81	Unlisted ranges (C/F)

### Item 4 Analog Output Description

01	0-1 mA
02	0-5 mA
03	0-10 mA
04	0-20 mA
05	1-5 mA
06	4-20 mA
07	0-5 VDC
08	0-10 VDC
09	1-5 VDC

### Item 5 Relay Designation Description

A	Alarm relay per channel
T	Trip relay per channel
G	Group Alarm/Trip per module
	<b>VT-2464 only</b>
1	SPDT alarm, DPDT trip per channel
2	DPDT alarm, SPDT trip per channel

### Item 6 Relay Sequence Description

M	Latching, manual reset
A	Auto reset when return to normal

### Item 7 Relay Time Delay Description

	<b>VT-2463 Only</b>
01-10	Alarm, factory set (01 sec. std.)
01-10	Trip, factory set (03 sec. std.)

### Item 8 Relay Time Delay Description

	<b>VT-2464 Only</b>
0.5-8.0	Alarm 0.5 second intervals, field alterable
01-16	Trip 1.0 second intervals, field alterable

### Item 9 Relay Status Description

E	Normally energized
D	Normally de-energized
A	Alarm energized/trip de-energized
R	Alarm de-energized/trip energized

### Item 10 Integration Channel A Description

X	None
V	Acceleration to velocity
D	Velocity to displacement

### Item 11 Integration Channel B Description

X	None
V	Acceleration to velocity
D	Velocity to displacement

### Item 12 Sensor Sensitivity Channel A Description

1	100 mV/g
2	50 mV/g
3	10 mV/g
4	100 mV/in/sec
5	195 mV/in/sec
6	Other inputs (consult factory)

### Item 13 Sensor Sensitivity Channel B Description

1	100 mV/g
2	50 mV/g
3	10 mV/g
4	100 mV/in/sec
5	195 mV/in/sec
6	Other inputs (consult factory)
D	Dual path, one sensor input to both channels A and B

### Item 14 Sensors Power Supply Description

0	Velocity pick-up
1	-24 VDC at 40 mA
2	-18 VDC at 40 mA
3	4 mA compliance at +18 VDC
4	Non-Ametek sensors

### Item 15 Detection/Display Mode Description

1	Peak detection and display
2	True RMS detection and display
3	Average detection and display
4	Special

### Item 16 Filter

	(-3dB Frequencies in Hz Listed-consult factory for additional frequencies)
Low Pass	50, 75, 100, 250, 500, 1000, 2500, 20,000, x (none)
High Pass	3, 5, 10, 25, 50, 100, 250, 2500, x (none)
Band-Pass	(List both above, 1:10 ratio of Low/high recommended)

### Item 17 Start Up Control Selection Description

1	Inhibit alarm and trip relay
3	x3 increase in set point levels
4	None

### Item 18 CSM Group Relay Interface Description

A	All relay drive outputs interface to CSM relays
	VT-2463-SS only
Y	Alarm to CSM alarm
N	No alarm to CSM alarm
Y	Trip to CSM trip
N	No trip to CSM trip

### Item 19 Options Description

00	None
CC	Conformal coating

# AMETEK

## Machine Monitoring

### Displacement Modules VT-2463-XY & VT-2464-XY; VT-2463-PP & VT-2464-PP

(For use with VT-2490 systems)

Ametek has several different modules that monitor vibration displacement. The VT-2463 modules are available in either XY or PP versions. The XY modules are for X-Y proximity monitoring, using two proximity probes 90° apart. AND/OR channel voting logic is supplied on the TRIP circuits for minimizing false shutdowns. The PP versions are for two channels of single-axis proximity monitoring. They are identical to the XY modules, except that they utilize normal OR voting logic (not AND/OR) on the TRIP circuits. Ametek also offers another module series (VT-2464) in XY and PP versions with two sealed relays per unit.

#### Common Features

There are two separate monitoring channels per module and each channel can accept one sensor input with power for the sensor supplied from the system chassis. The peak-to-peak vibration level is shown on demand in easy-to-read engineering units (mils or  $\mu\text{M}$ ) on the digital display of the system common service module (CSM). Also provided on a per-channel basis are two fully-adjustable set points, ALARM and TRIP, arranged for easy operator understanding with color-coded LEDs, ID tag, and push-to-read push-button.

Each module also includes a module ID tag plus Probe OK status LEDs to indicate circuit fault. A sensor failure is indicated by the OK LED going out and the ALARM LED coming on. The defective channel's TRIP relay (if any) is disarmed to prevent false shutdowns while the ALARM relay and/or CIRCUIT FAULT relay in the common service module activates to warn of the fault. The channel can then be interrogated via the CSM to verify sensor failure and assist in troubleshooting. XY versions set for AND voting of the TRIP circuits automatically revert back to the OR mode in the event of a sensor failure. Two front panel jacks with buffered sensor signal outputs are offered for interfacing with portable analyzers. In addition, each channel has a wide selection of current or voltage analog outputs available on the rear of the system's chassis.

All relays on Ametek displacement modules are field-selectable for normally energized or de-energized, manual or auto-resent, system relay interfacing and system start-up control interfacing. Each channel can be designated to interface with the CSM's GROUP ALARM and GROUP TRIP relays. For example, any channel's ALARM can also actuate the GROUP ALARM relay. More critical channels can, therefore, be grouped for special annunciation and attention. Similarly, each channel's relays can be linked to the system start-up control (x2, x3, or Inhibit) to ensure maximum protection during run-ups without false shutdowns.

#### VT-2463-XY and -PP Modules

On the VT-2463s, one sealed relay is supplied per channel, assignable to channel ALARM or TRIP or module GROUP ALARM and GROUP TRIP. Relay time delays are available for the ALARM and TRIP circuits on each channel to minimize false shutdowns. The delay time is factory-set.

#### VT-2464-XY and -PP Modules

The VT-2464-XY and -PP feature two sealed relays per channel (one for ALARM and one for TRIP). First-Out annunciation is provided to make post-fault diagnosis easier — the LED of the first channel to go into ALARM (and similarly into TRIP) flashes, while subsequent alarms will have continuously lit LEDs.

The relay time delays on the VT-2464's ALARM and TRIP circuits are fully field-selectable. In addition, these modules have a unique form of circuit fault protection. A "delayed return-to-normal" check of the input prevents intermittent sensor failures from falsely shutting down machinery. The associated Probe OK LED flashes and TRIP is inhibited for 10 seconds following correction of a circuit fault condition, which indicates proper operation.

### Displacement Modules Specifications

For the complete specifications of each model, refer to both "General Specifications" and the corresponding section of "Individual Module Specifications."

#### General Specifications

##### Inputs:

- Sensitivity: 200 mV/mil (8 mV/ $\mu\text{M}$ ) or 100 mV/mil (4 mV/ $\mu\text{M}$ ).
- Impedance: 20 K ohm (single-ended, one side to system 0 V).

##### Outputs:

- Meter Output to CSM Display: (see Ordering section for ranges).
- Calibration Accuracy:  $\pm 0.25\%$  FS or 1 digit (if greater).
- Sensor Signal (front panel): buffered.
- Relays: gold-plated, environmentally-sealed (nitrogen filled), 240 VAC, 3 A or 300 VA maximum AC rating; 30 VDC at 3 A or 90 W or 30-to-220 VDC at 50 W switching maximum resistive load.
- Start-up Control: voltage free operator contact on rear of CSM for x2, x3, or Inhibit of relays.
- Relay Time Delays: standard 1 second for ALARM and 3 for TRIP.
- Analog Outputs (rear terminals): voltage or current ranges available (see Ordering Section); accuracy  $\pm 0.25\%$  of span.

##### Transfer Performance:

- Set Points: two per channel, 0-100% minimum adjustment;  $\pm 0.1\%$  resolution;  $\pm 1$  digit readout accuracy.
- Deadband: 0.5% standard (other values optional).
- Frequency vs. Amplitude Response:  $\pm 2\%$  7.5 Hz to 5 kHz;  $\pm 10\%$  3.5 Hz to 10 kHz; -3 dB 16 kHz.
- Channel Separation: 40 dB minimum crosstalk DC to 20 kHz; sensor power supplies are buffered and limited to 50 mA.
- Temperature Effect: span,  $\leq 0.03\%$  of reading/ $^{\circ}\text{C}$ ; zero,  $\leq 0.03\%$  of span/ $^{\circ}\text{C}$ .

#### Individual Module Specifications

##### VT-2463-PP

- Relays: one DPDT per channel
- Relay Time Delays: optional factory-set, 1-10 seconds for ALARM and for TRIP.

##### VT-2463-XY

- Relays: one DPDT per channel.
- Relay Time Delays: optional factory-set, 1-10 seconds for ALARM and for TRIP.
- Voting Logic: TRIP circuits are factory-set to either OR or AND voting logic.

##### VT-2464-PP

- Relays: one SPDT and one DPDT per channel. ALARM is field-selectable to be either the SPDT or the DPDT relay (with TRIP being the other).
- Relay Time Delays: field-selectable ALARM, 0.5-8.0 seconds in 0.5

second intervals; field-selectable TRIP, 1-16 seconds in 1 second intervals.

- c. First-Out: the LED of the first channel to go into ALARM (and similarly into TRIP) flashes.
- d. Probe OK: the associated Probe OK LED flashes and TRIP is inhibited for 10 seconds following correction of a circuit fault condition.
- e. Analog Meter Panel: either or both channels can be continuously displayed on the analog meter panel.

**VT-2464-XY**

- a. Relays: one SPDT and one DPDT per channel. ALARM is field-selectable to be either the SPDT or the DPDT relay (with TRIP being the other).
- b. Relay Time Delays: field selectable ALARM, 0.5-8.0 seconds in 0.5 second intervals; field-selectable TRIP, 1-16 seconds in 1 second intervals
- c. First-Out: the LED of the first channel to go into ALARM (and similarly into TRIP) flashes.
- d. Probe OK: the associated Probe OK LED flashes and TRIP is inhibited for 10 seconds following correction of a circuit fault condition.
- e. Analog Meter Panel: either or both channels can be continuously displayed on the analog meter panel.
- f. Voting Logic: the TRIP circuits have field-selectable AND/OR voting logic.

**Displacement Modules  
VT-2463-XY, VT-2464-XY,  
VT-2463-PP, VT-2464-PP  
Ordering**

VT-246 1-2-3-4-5-6-7-8-9-10-11-12-13-14-15

Must use option from each group.

<b>Item 1 Code</b>	<b>Module Type Description</b>
3	One relay per channel, factory set relay time delays
4	2 relays per channel, 1st out indication, field selectable delay, API-670 conformance

<b>Item 2 Code</b>	<b>Proximity Monitoring Description</b>
XY	X-Y proximity modules
PP	2 channels of single axis proximity monitoring

<b>Item 3 Code</b>	<b>Module Range Description</b>
42	Range Peak-to-Peak 0 to 3 mils
43	0 to 5 mils
44	0 to 10 mils
45	0 to 15 mils
46	0 to 20 mils
47	0 to 30 mils
48	0 to 80 μM
49	0 to 125 μM
50	0 to 400 μM
52	0 to 600 μM
53	0 to 750 μM
54	Special ranges (C/F)

<b>Item 4 Code</b>	<b>Analog Output (Rear Terminal) Description</b>
01	0-1 mA
02	0-5 mA
03	0-10 mA
04	0-20 mA
05	1-5 mA
06	4-20 mA
07	0-5 VDC
08	0-10 VDC
09	1-5 VDC

<b>Item 5 Code</b>	<b>Relay Designation Description</b>
	<b>VT-2463 Only</b>
A	Alarm relay per channel, VT-2463-PP only
T	Trip relay per channel, VT-2463-PP only
R	Alarms "OR" voting/trips "OR" voting
N	Alarms "OR" voting/trips "AND" voting
	<b>VT2464 only</b>
B	Alarm and trip relay per channel
R	Alarms "OR" voting/trips "OR" voting
N	Alarms "OR" voting/trips "AND" voting

<b>Item 6 Code</b>	<b>Relay Selection VT-2464 Only Description</b>
1	SPDT alarm, DPDT trip
2	DPDT alarm, SPDT trip
X	Not available for VT-2463

<b>Item 7 Code</b>	<b>Relay Sequence Description</b>
M	Latching, manual reset
A	Auto reset when return to normal

<b>Item 8 Code</b>	<b>Relay Status Description</b>
E	Normally energized
D	Normally de-energized
A	Alarm energized/trip de-energized
R	Alarm de-energized/trip energized

<b>Item 9 Code</b>	<b>Relay Time Delay VT-2463 Only Description</b>
01-10	Alarm, factory set in seconds, VT-2463 only (01sec. std.)
01-10	Trip, factory set in seconds, VT-2463 only (03 sec. std.)

<b>Item 10 Code</b>	<b>Relay Time Delay VT-2464 Only Description</b>
0.5-8.0	Alarm, field alterable, .5 second interval, VT-2462 only
01-16	Trip, field alterable 1 second interval, VT-2464 only

<b>Item 11 Code</b>	<b>Input Sensitivity Description</b>
1	100 mV/mil
2	200 mV/mil

<b>Item 12 Code</b>	<b>Probe Driver Voltage Description</b>
1	-24 VDC at 40 mA
2	-18 VDC at 40 mA

<b>Item 13 Code</b>	<b>Start Up Control Selection Description</b>
1	Inhibit alarm and trip relay
2	x3 increase in set point levels
4	None

<b>Item 14 Code</b>	<b>CSM Group Relay Interface Description</b>
A	All relay drive outputs interface to CSM relays, VT-2463-SS only
Y	Alarm to CSM alarm, VT-2464 only
N	No alarm to CSM alarm, VT-2464 only
Y	Trip to CSM trip, VT-2464 only
N	No trip to CSM trip, VT-2464 only

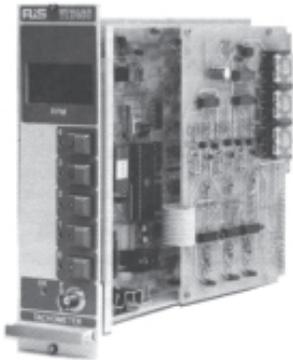
<b>Item 15 Code</b>	<b>Options Description</b>
00	None
CC	Conformal coating

# AMETEK

## Machine Monitoring

### Tachometer Module VT-2466-TK

(For use with VT-2490 systems)



VT-2466-TK tachometer modules provide continuous monitoring of shaft speed (RPM) when used in Ametek Series VT-2490 machine monitoring systems. Each features its own independent, continuous digital display of shaft speed from 0.1 to 19,999 RPM in large easy-to-read digits. A Ametek tachometer module accepts an input from a proximity probe, magnetic pick-up or a fiber optic light source and provides power to the sensor as needed.

The VT-2466-TK plugs into any two adjacent VT-2490 chassis spaces. Four independent set points and relays are available for ALARM or TRIP of under or over speed conditions. A fifth set point with relay is dedicated to Zero-Speed detection.

### Tachometer Module Specifications

#### Inputs:

- Rate: pulse rate, 0.2 to 10,000 per second; pulses per revolution, 1 to 255.
- Sensitivity: 0.5 V to 24 V; sensitivity is automatically adjusted as a function of the amplitude of the input signal.
- Shape: sine, square, triangle, or 1% duty cycle pulse. (10 microseconds minimum pulse width.)
- Offset: from +15 to -24 VDC.
- Impedance: greater than 10,000 ohms.
- Probe drive: +15, -18, -24 V.

#### Outputs:

- Integral Displays
  - Displays revolutions per minute. Displays set points when set point select button is pushed.
  - Red LED digits 0.4" (10 mm) high.
  - Fullscale is 19,999 RPM (rev/min.).
  - Accuracy is  $\pm 0.1\%$  of fullscale  $\pm 1$  digit. Note: Fullscale for analog outputs and set points is adjustable, but fullscale of display is always 19,999 with a 5% overrange capability.
- Alarm Trip Output Contacts
  - Four set points available.
  - Individual settings for abnormal state to be above or below the set point.
  - Two form C contacts per set point.
  - Output relays can be individually selected to be normally energized or normally de-energized.
  - An LED per point is provided to indicate that output is in the abnormal state. Two yellow and two red LEDs are standard.
  - Each set point can be individually selected to drive the Reflash bus and the GROUP TRIP or the GROUP ALARM bus.
  - Each set point can be latched in the abnormal state, requiring manual reset or it can automatically reset when input returns to normal.
  - Set point accuracy is the same as display accuracy.
  - Resolution of set point is 0.5% of fullscale selected for analog output.
  - The set point is the input value where output changes state when input is going from low to high. When input goes from high to low, output will change state at a point 0.5% below set point.
- Zero-Speed: A fifth set point is provided and is dedicated to the Zero-Speed function. It has all of the features of the other set points except for the set point range. The Zero-Speed can be set from 0.1 to 25.5 RPM in 0.1 RPM steps. The set point is the input value at which the Zero-Speed output changes state when the input is going from high to low. When going from low to high, the Zero-Speed will change state at 5 times the set point. Note: The Zero-

Speed set point must be above the minimum pulses per second input rate (0.2 pps). The Zero-Speed LED (yellow) will be ON when the input is below the set point.

- Analog Outputs
  - Non-isolated.
  - Fullscale RPM can be selected at 1,000, 2,000, 3,000, 4,000, 6,000, 10,000, 15,000, 20,000.
  - Accuracy —  $\pm 0.1\%$  of fullscale.
  - Outputs — 4-20 mA; 1-5 V (500 ohm impedance); etc.
  - Overrange — analog output can exceed fullscale value by 5%.
- Other Outputs
  - A conditioned input signal (12 V through 1 K ohm) is available on front panel jack.
  - For certain types of inputs, a Probe OK signal is generated. This controls a green front panel LED. When not OK, ALARM #1 is forced to abnormal state and all other set point outputs are inhibited. Probe Not OK can be connected to the Not OK bus.
  - When probe Not OK is detected, the last reading will be held on display until Probe OK is restored.

#### Temperature Range

- Storage: -20 to +65°C (-4° to 149°F)
- Operating: -20 to +60°C (-4° to 140°F)
- Accuracy Effects:
  - Display: 0.005%/°C
  - Analog Output: 0.15%/°C
  - Set Points: -0.01%/°C

#### Pulse Input Range

- The selected fullscale, the pulses per revolution, and the zero speed per point must be selected to be within the 0.2 to 10,000 pulse per second operating range. The following equations are useful for checking these values:

$$\begin{aligned} \text{max. no. of pulses per rev.} &= \\ &= 600,000 \text{ Fullscale RPM min.} \\ \text{RPM} &= 12 \text{ pulses per revolution} \end{aligned}$$

- Display will show actual RPM regardless of fullscale setting as long as input rate is within the allowable range (0.2 to 10,000 pulses per second) and display capacity has not been exceeded (1 to 21,000 RPM).



# AMETEK

## Machine Monitoring

### VT-2479 Dual 2-Wire Transmitter Detector Modules (For use with VT-2490 systems)

#### Module VT-2479

VT-2479 is a general purpose 2-wire transmitter dual channel detector module. It provides stabilized, current-limited 24 volt DC supplies suitable for powering 4-20 mA electrical loops.

Each channel has adjustable ALARM and TRIP set points, which activate LED indicators and relays when the pre-set limits are exceeded. Built-in loop failure detection inhibits trip action if the loop current falls below 1.4 mA. (Loop failure is indicated by operation of the alarm indicator and relay.) All relays are field selectable for normally energized or de-energized, manual or auto-reset and system relay interfacing. The latter feature enables individual channels to be designated to be interfaced with the CSM's GROUP ALARM and GROUP TRIP relays, thus allowing critical channels to be grouped for special annunciation and action.

- Inputs from standard 2-wire transmitters
- 24V loop supply and self-check
- Two set points LEDs and relays (ALARM and TRIP) per channel
- Choice of analog outputs
- System readout in engineering units

### VT-2469 Dual 2-Wire Transmitter Detector Modules (For use with VT-2490 systems)

#### Module VT-2469

VT-2469 is a variant of the VT-2479 specially intended for use with the Ametek VT-3360 Vibration Transmitter. In addition to the features of the VT-2479, the VT-2469 separates the AC current analog of the vibration (if selected on the VT-3360), conditions and amplifies it to a standardized sensitivity of 1 V/inch per second (80 mV/mm per second) and presents it as a buffered output to the miniature BNC jacks on the front panel, for signal analysis purposes.

Individual green "OK" LEDs are used to indicate a healthy loop circuit and these are extinguished if a fault is detected. In this case the TRIP relay is inhibited, while the group "OK" relay in the CSM is activated. This sequence of operation is designed to conform with that of other Ametek vibration detector modules which might be installed in the system.

- All VT-2479 features, plus inputs from VT-3360 2-wire vibration transmitter
- "OK" LED (loop healthy)
- Readout in velocity units (in/s or mm/s)
- Buffered normalized vibration signal on front panel
- Choice of analog outputs

### VT-2479 & VT-2469 Specifications

**Number of Channels:** Two  
Supply to 2-Wire Transmitter  
+25 VDC  $\pm 1$  V Current limited at 40 mA  
 $\pm 4$  mA Ripple and noise 50 mV PK to PK

#### Inputs from 2-Wire Transmitter

VT-2479: 4-20 mA DC terminated into 100 ohm input monitoring resistor with scaled readout in engineering units on CSM.

VT-2469: 4-20 mA DC terminated into 100 ohm input monitoring resistor.  
(Optional — 0-800  $\mu$ A AC vibration analog signal (if selected from VT-3360))

**Corresponding to range:** 0.5, 0-1.0, or 2.0 in/sec (0-12, 0-25 or 0-50 mm(sec))

**Output sensitivity:** 1.0V = 1.0 in/sec = 25 mm/sec

#### Outputs

- a. Meter Output to CSM Display: (calibration accuracy 0.25% FS or  $\pm 1$  digit)
- b. ALARM (SPDT) and TRIP (DPDT) Relays: optional DPDT contact for ALARM if remote select feature not used.
- c. Relay Contact Rating: gold plated environmentally sealed (nitrogen filled) 240 VAC 3A or 300 VA max AC rating: 30 VDC 3A or 90W or 30 to 220 VDC 50W switching max DC rating (resistive load) contact configuration.
- d. Relay Response Time: 100 mS for ALARM 250 mS for trip (for other delays contact factory)
- e. Sensor Signal (VT-2469): buffered 1 V/inch per sec (80 mV/mm per second)
- f. Analog Outputs: rear terminals (see OUTPUT TABLE) accuracy  $\pm 0.25\%$  of span.

#### General Performance

- a. Set Points: two per channel 0-100% minimum adjustment,  $\pm 0.1\%$  resolution,  $\pm 1$  digit readout accuracy.
- b. Deadband: 0.5% standard (others optional)
- c. Frequency response: (VT-2469) 3 Hz to 20 kHz
- d. Temperature effect: span 0.01% reading/ $^{\circ}$ C, zero 0.01% of span/ $^{\circ}$ C

## VT-2479 & VT-2469 Ordering

### VT-2479 Ordering

VT-2479 1—1—2—3—4—5—6  
—7—8—9—10—11—12—13

**Item 1 Input Range (4-20mA)**  
**Code Description**  
23 Insert range

**Item 2 Alarm Sequence**  
**Code Description**  
M Latching, manual reset  
A Auto reset when return to normal

**Item 3 Alarm Level Status**  
**Code Description**  
H High for alarm  
L Low for alarm

**Item 4 Trip Sequence**  
**Code Description**  
M Latching, manual reset  
A Auto reset when return to normal

**Item 5 Trip Level Status**  
**Code Description**  
H High for trip  
L Low for trip

**Item 6 Relay Time Delay (seconds)**  
**Code Description**  
00 Standard (see specifications)  
DA 1 Sec Alarm  
DT 1 Sec Trip  
DB 1 Sec Alarm & Trip

**Item 7 Relay Designation**  
**Code Description**  
R Alarm and trip relay per point

**Item 8 Relay Status**  
**Code Description**  
E Energized for normal  
D De-energized for normal  
A Alarm energized/trip de-energized  
R Alarm de-energized/trip energized

**Item 9**  
**Code Description**  
Y/N Trip to CSM trip relay

**Item 10**  
**Code Description**  
Y/N Alarm CSM alarm relay

**Item 11 Output Range**  
See  
Table Insert range code 01 to 09

**Item 12**  
**Code Description**  
CC Conformal Coating

**Item 13 Engineering Unit Readout Range**  
(max. full scale  $\pm$  1999.)  
Note: For engineering unit readout, state overall range and units of measure (i.e. 0-2000 PSIG, 0-200 GPM etc.)

### VT-2469 Ordering

VT-2469 TW-VT-2479—1—1—2—3—4—5—6—7—8—9

**Item 1 Input Range**  
**Code Description**  
74 0-0.5 in/sec  
75 0-1. in/sec  
76 2.0 in/sec  
78 0-12.5 mm/sec  
79 0-25.0 mm/sec  
80 0-50.0 mm/sec

**Item 2 Relay Sequence**  
**Code Description**  
M Latching, manual reset  
A Auto reset when return to normal

**Item 3 Relay Time Delay (seconds)**  
**Code Description**  
00 Standard  
DA 1 Sec Alarm  
DT 1 Sec Trip  
DB 1 Sec Alarm & Trip

**Item 4 Relay Designation**  
**Code Description**  
R Alarm and trip relay per point

**Item 5 Relay Status**  
**Code Description**  
E Energized for normal  
D De-energized for normal  
A Alarm energized/trip de-energized  
R Alarm de-energized/trip energized

**Item 6**  
**Code Description**  
Y/N Trip to CSM trip relay

**Item 7**  
**Code Description**  
Y/N Alarm to CSM alarm relay

**Item 8 Output Range**  
**Code Description**  
See  
Table Insert range code 01 to 09

**Item 9**  
**Code Description**  
CC Conformal coating

Output Table

Code	Analog Outputs Range	Output Load ( $\Omega$ )
01	0 to 1 mA	12 K max
02	0 to 5 mA	2.4 K max
03	0 to 10 mA	1.2 K max
04	0 to 20 mA	600 max
05	1 to 5 mA	2.4 K max
06	4 to 20 mA	600 $\Omega$ max
07	0 to 5 VDC	25 K min
08	0 to 10 VDC	25 K min
09	1 to 5 VDC	25 K min

# AMETEK

## Machine Monitoring

### VT-2467-EC Eccentricity Module

(For use with VT-2490 systems)

The Single Channel Module provides true peak-to-peak eccentricity monitoring of rotor/shaft bow at slow roll conditions. It measures bent or bowed shafts rotating at speeds as low as 1/2 RPM. It is designed so that only one proximity probe is required for its use.

### VT-2467-EC Specifications

**Inputs:** one per module.

- Sensitivity: 200 mV/mil (8 mV/μM) or 100 mV/mil (4 mV/μM)
- Impedance: 100K ohm (single-ended, one-side to 0V)
- Time Constant Input Filter: 2.5 seconds

**Outputs:**

- Meter Output to CSM Display: (calibration accuracy 0.25% fullscale or ±1 digit).
- Sensor Signal: (front panel/rear terminals), buffered, 2K ohms
- Relays: one DPDT for ALARM, one DPDT for TRIP
- Relay Time Delay: Factory set, 1 second ALARM 3 seconds TRIP
- Analog Outputs (rear terminals): Voltage or current ranges (see Ordering section)—accuracy ± 0.25% of span

**Set Points:**

- Two: Alert (Yellow LED) Danger (Red LED)
- Adjustment: 0-100% of span 20-turn front accessible potentiometer
- Resolution: ±0.1%, ±1 digit readout accuracy

**Transfer Performance**

- Frequency Response: 45 - 4500 RPM, ±0.2% 0.5 - 450 RPM, ±0.5%
- Deadband: 0.5% standard (other values optional)
- Isolation/Channel Specification: 40 dB minimum Crosstalk, 0.5 - 4500RPM; sensor power supplies are buffered and limited to 50 mA
- Response Time: 2 cycle update
- Temperature Effect: Span, 0.03% of reading/°C Zero, 0.03% of span/°C
- Low Pass Filter: 4-Pole, choice of 600 or 500 RPM cutoff

**Circuit Fault/Probe OK**

- Probe OK LED (Green) will go off upon detection of input circuit fault. Associated OK relay will actuate in the CSM. Probe OK relay in CSM can be disabled for this module by removal of jumper.

**Optional Analog Meter Panel**

The output of the module can be displayed on a continuous analog meter (optional)

**Probe Driver Power Supply:** -24 VDC or -18 VDC source, current limited

**Start-Up Control**

No alarm action until 1.5 revolutions have been completed. Group inhibit may be bypassed by jumper.

**Time out clear:** 2.25 minutes.

### VT-2467 Eccentricity Module Ordering

VT-2467—1—2—3,4,5—6—7—8—

9—10—11—12—13—14—15

**Item 1 Module Range Peak to Peak**

**Code Description**

- |    |             |
|----|-------------|
| 43 | 0 - 5 mils  |
| 44 | 0 - 10 mils |
| 45 | 0 - 25 mils |

**Item 2 Analog Output (rear terminals)**

**Code Description**

- |    |            |            |
|----|------------|------------|
| 01 | 0 - 1 mA   | 12 K max.  |
| 02 | 0 - 5 mA   | 2.4K max.  |
| 03 | 0 - 10 mA  | 1.2 K max. |
| 04 | 0 - 20 mA  | 600 max.   |
| 05 | 1 - 5 mA   | 2.4K max.  |
| 06 | 4 - 20 mA  | 600 max.   |
| 07 | 0 - 5 VDC  | 25 K min.  |
| 08 | 0 - 10 VDC | 25 K min.  |
| 09 | 1 - 5 VDC  | 25 K min.  |

**Item 3 Relay Designation**

**Code Description**

- |   |                          |
|---|--------------------------|
| R | Alarm and Trip per point |
|---|--------------------------|

**Item 4 Relay Sequence**

**Code Description**

- |   |                       |
|---|-----------------------|
| M | Latching manual reset |
| A | Auto reset on normal  |

**Item 5 Relay Status**

**Code Description**

- |   |                                   |
|---|-----------------------------------|
| E | Normally energized                |
| D | Normally de-energized             |
| A | Alarm energized/trip energized    |
| R | Alarm re-energized/trip energized |

**Item 6 Relay Time Delay (Factory set in seconds)**

**Code Description**

- |         |                 |
|---------|-----------------|
| 01 - 03 | (std. 01) Alarm |
| 01 - 03 | (std. 03) Trip  |

**Item 7 Input Sensitivity**

**Code Description**

- |   |            |
|---|------------|
| 1 | 100 mV/mil |
| 2 | 200 mV/mil |

**Item 8 Probe Driver Voltage**

**Code Description**

- |   |                 |
|---|-----------------|
| 1 | -24VDC @ 40 mA  |
| 2 | -18 VDC @ 40 mA |

**Item 9 L. P. Filter**

**Code Description**

- |   |                 |
|---|-----------------|
| 1 | 600 rpm cutoff  |
| 2 | 5000 rpm cutoff |

**Item 10 Start-up Inhibit**

**Code Description**

- |   |     |
|---|-----|
| Y | Yes |
| N | No  |

**Item 11 Group Trip to CSM**

**Code Description**

- |   |     |
|---|-----|
| Y | Yes |
| N | No  |

**Item 12 Group Alarm to CSM**

**Code Description**

- |   |     |
|---|-----|
| Y | Yes |
| N | No  |

**Item 13 Reflash to CSM**

**Code Description**

- |   |     |
|---|-----|
| Y | Yes |
| N | No  |

**Item 14 Probe OK**

**Code Description**

- |   |          |
|---|----------|
| Y | Active   |
| N | Disabled |

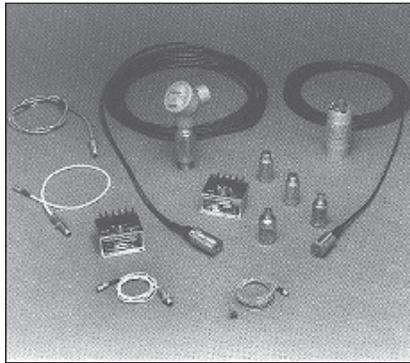
**Item 15 Conformal Coating**

**Code Description**

- |    |              |
|----|--------------|
| CC | Required     |
| 00 | Not Required |

## SENSORS FOR ALL CRITICAL VIBRATION PARAMETERS

- Proximity Probes
- Velocity Pickups
- Accelerometers
- Complete with Hardware, Cabling & Signal Conditioners



### Proximity (Eddy Current) Probes

Ametek proximity probes are non-contacting displacement transducers powered by a matching driver (Model 1148) and interconnect cable of specific length. They measure the distance between the probe tip and the machine part being monitored, usually the shaft. The unique epoxy tip design of the Ametek probe minimizes the possibility of probe damage, as well as protection against corrosive liquids. Extension cables (for the distance from the probe driver to the probe) are available to 20 feet (or more) with optional armor shielding. The measurable frequency range is from DC to over 600,000 cpm.

### Probe Model 1113/1114/1115 Specifications

#### Input:

- Probe type: Inductive proximity 1113/1114/1115
- Probe Tip Dia.: 0.25 in /6.35mm
- Supply Voltage: -24VDC nominal
- Supply Current: 10mA maximum at -24VDC

#### Output:

- Scale Factor: 200mV/mil (DA) Standard (1 mil=0.001 in/25.4µm)
- Impedance: 50 ohms

#### Performance:

(Figures in brackets for I.S. application with zener safety barrier)

- Gap Range: 3 to 100 mils (3 to 90 mils).
- Linear Range: 5 to 95 mils (5 to 90 mils).
- Linerarity: ±1 mil from best straight line from 5 to 100 mils (5 to 90 mils).
- Static Accuracy: ± 1 mil
- Dynamic Accuracy: ±5% of 200 mV/mil
- Frequency Range: DC to 10 kHz
- Probe Cable Electrical Length: 10 meters maximum.
- Sensitivity to Interchangeability: ±2 mils static or ± of 200 mV/mil dynamic
- Calibration: Slope, offset and bias field adjustable
- Calibration Target: 4140 Steel-Standard material

#### Mechanical:

- Input Connection: SMA Coaxial socket, stainless steel (1/4-36)
- Output and Supply Connections: 6-32 screw terminal barrier
- Construction: Potted in heavy aluminum base
- Weight: 230 grams/8.11 ounces
- Operating Temperature Range: -20°C to +70°C.
- Calibration for Cable Length: The probe driver is ranged and calibrated for total electrical cable length, i.e.:  
Total Electrical Cable Length =  
Electrical Length of Proximity Probe Cable +  
Electrical Length of Extension cable

For the 1113/1114/1115 proximity probe "pigtail" cable and the extension cable, the electrical and physical cable lengths are equal.

Standard Probe Bodies	
Length (in inches)	Part Number
1	1040-134
1.5	1040-135
2	1040-136
2.5	1040-137
3	1040-138
4	1040-139
6	1040-140
8	1040-141
10	1040-142

# AMETEK

## Machine Monitoring

### Proximity Probe Driver Model 1148 Specifications

#### Electrical:

- a. Input:
  1. Probe type: inductive proximity  
1113/1114/1115.
  2. Probe tip diameter: 0.25 in. / 6.35 mm.
  3. Supply Voltage: -24V DC Nominal
  4. Supply Current: 10mA Maximum at -24V DC.
- b. Output:
  1. Scale factor: 200 mV/mil (DA)  
Standard (1 mil = 0.001 in/25,4µm).
  2. Impedance: 50 ohms
- c. Performance:
  1. Gap Range: 3 to 100 mils
  2. Linear Range: 5 to 95 mils
  3. Linearity: ±1 mil from best straight line from 5 to 100 mils.
  4. Static Accuracy: ± 1 mil.
  5. Dynamic Accuracy ± 5% of 200m V/mil.
  6. Frequency Range: DC to 10 kHz
  7. Probe Cable Electrical Length: 10 meters maximum.
  8. Sensitivity to Interchangeability: ± 2 mils Static or ± 2% of 200mV/mil Dynamic.
  9. Calibration: Slope and offset and bias field adjustable
  10. Calibration Target: 4140 steel – standard material.

#### Mechanical:

- a. Outline dimensions and mounting: as shown
- b. Input Connections: SMA coaxial socket, stainless steel (1/4 - 36).
- c. Output and Supply Connections: 6 – 32 screw terminal barrier.
- d. Construction: Potted in heavy aluminum base.
- e. Weight: 230 grams/8.11 ounces.

#### Environmental:

- a. Operating Temperature Range: -20°C to +70°C

**Calibration For Cable Lengths:** The probe driver is ranged and calibrated for total electrical cable length, i.e.: –

Total Electrical Cable Length = Electrical Length of Proximity Probe Cable + Electrical Length of Extension Cable.

(For the 1113/1114/1115 Proximity Probe “Pigtail” Cable and the Extension Cable, the Electrical and Physical Cable Lengths are equal).

#### Probe Driver Order/Identification

Code: Example: 1148 – 5 – 250 – 200

1148 = Model

5 = Total Electrical Cable Length (meters)

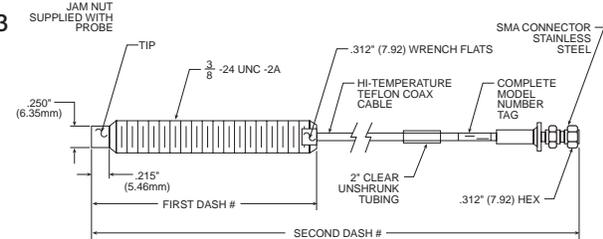
250 = 0.25 inch Diameter Probe Tip

200 = 200mV/mil Output Scaling Factor

### Proximity Probes Dimensions

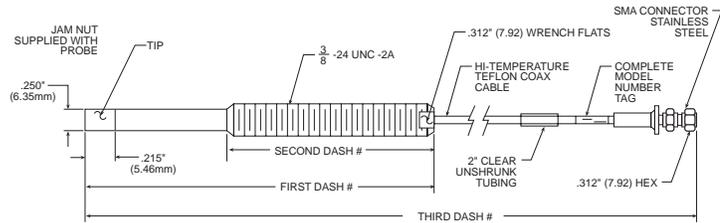
#### Proximity Model 1113

##### Full Thread



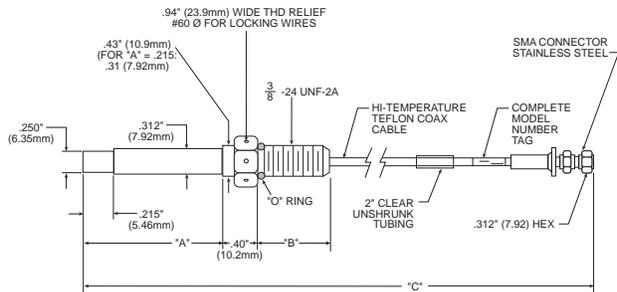
#### Proximity Model 1114

##### With Relief



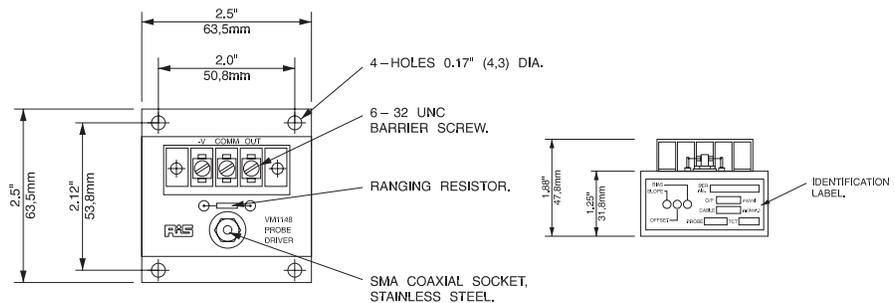
#### Proximity Model 1115

##### Reverse Mount



#### Probe Driver

##### Model 1148



## Proximity Probe Model 1113/1114/1115 Ordering

### Proximity Probe Model 1113 Ordering

Model 1113 —1—2—3—4

#### Item 1

##### Probe Length (in inches)

Standard: 1, 1.5, 2, 2.5, 3, 4, 6, 8, 10

#### Item 2

##### Overall Length (in meters)

Standard: 0.5, 1.0

#### Item 3

##### Cable Type

L=95 ohms 0.15 (3.8) Dia.

#### Item 4

##### Cable

C=Cable

A=Armor over cable

AT=Teflon shrink tubing over armor (consult factory)

AP=Polyolefin shrink tubing over armor (consult factory)

#### Notes:

1. Body Lengths other than shown can be supplied (consult factory).
2. Overall lengths other than shown are available (consult factory).
3. Cable length is adjusted for electrical characteristics.

### Proximity Probe Model 1114 Ordering

Model 1114 —1—2—3—4—5

#### Item 1 Probe Length (in inches)

Standard: 1.5, 2, 2.5, 3, 4, 6, 8, 10

#### Item 2 Threaded Length (in inches)

Standard: 1.0–8.5 in 0.5 increments

#### Item 3 Overall Length (in meters)

Standard: 0.5, 1.0

#### Item 4 Cable Type

L=95 ohms 0.15 (3.8) dia.

#### Item 5 Cable

C=Cable

A=Armor over cable

AT=Teflon shrink tubing over armor (consult factory)

AP=Polyolefin shrink tubing over armor (consult factory)

#### Notes:

1. Body lengths other than shown can be supplied (consult factory).
2. Overall lengths other than shown are available (consult factory).
3. Cable length is adjusted for electrical characteristics.
4. Proximity probes use stainless steel SMA connectors to conform to API-670.
5. Shrink tubing available-polyolefin or teflon — (consult factory)

### Proximity Probe Model 1115

Model 1115 —1—2—3—4—5

#### Item 1 “A” (in inches)

Standard = 0.215, 0.5, 1.125, 1.625, 2.0

#### Item 2 “B” (in inches)

Standard = 1.0

#### Item 3 “C” (in meters)

Standard = 0.5, 1.0

#### Item 4 Cable Type

L = 95 ohms 0.15 (3.8) dia.

#### Item 5 Cable

C=Cable

A=Armor over cable

AT=Teflon shrink tubing over armor (consult factory)

AP=Polyolefin shrink tubing over armor (consult factory)

#### Note:

1. SMA connector shipped loose for installation purposes.
2. Body lengths other than shown can be supplied (consult factory).
3. Overall lengths other than shown are available (consult factory).
4. Cable length is adjusted for electrical characteristics.

## Extension Cable Model 1331 Ordering

Model 1331 —1—2

**Description:** SMA-SMA (M-F) for proximity probes

#### Item 1

Cable Length (meters)

4.0, 4.5, 8.0, 8.5 (specify one)

#### Item 2

Cable: C=Cable

A=Armor over cable

(Specify one)

#### Note:

1. Cable length adjusted for electrical characteristics.

Example : 1331-4.5-C

# AMETEK

## Machine Monitoring

### Velocity Pickups

Ametek velocity pickups are self-generating devices that measure "seismic" motion, usually at the bearing housing. They are rugged units with high noise immunity and long signal transmission capability. Their low impedance AC output signal is proportional to vibration velocity, making them ideal for many applications. Both low and high temperature, as well as low frequency axis sensitive models are available.

### Velocity Pickups Specifications

#### Velocity Pickup Model 1716/1718

**Frequency:** 900 to 60000 RPM (-3db)

**Output:**

7.7mV/mm/sec±5% at 6000 RPM  
195mV/in/sec±5% at 6000 RPM

**Impedance:** 88Ω

**Displacement:** ≥2.5 mm/0.1 in.

**Weight:** 397 gms/ 140 oz.

**Temperature:** 130°C/266°F (1716)  
204°C/400°F (1716T)

**Orientation:** All Axis

**Material:** Aluminum

#### Velocity Pickup Model 1719H/1720/1721H/1722V

**Frequency:** 270 to 60000 RPM (-3db)

**Output:**

7.7mV/mm/sec±5% at 6000 RPM  
195mV/in/sec±5% at 6000 RPM

**Impedance:** 88Ω

**Displacement:** ≥2.5mm/.1 in.

**Weight:** 397 gms/14 oz.

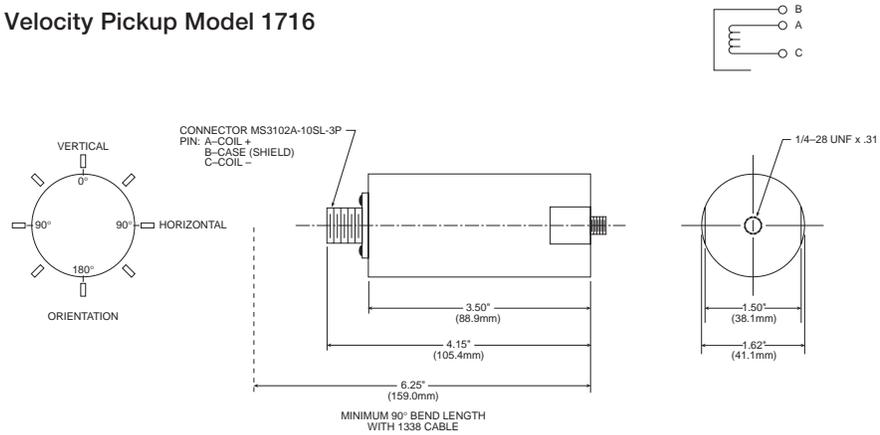
**Temperature:** 130°C/266°F

**Orientation:** All axis

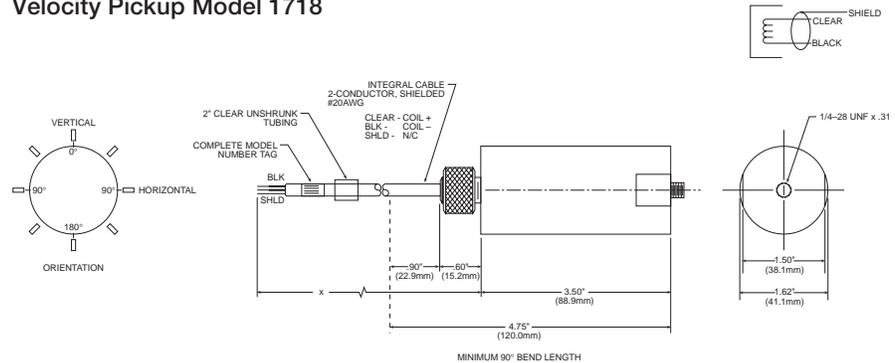
**Material:** Aluminum

### Velocity Pickups Dimensions

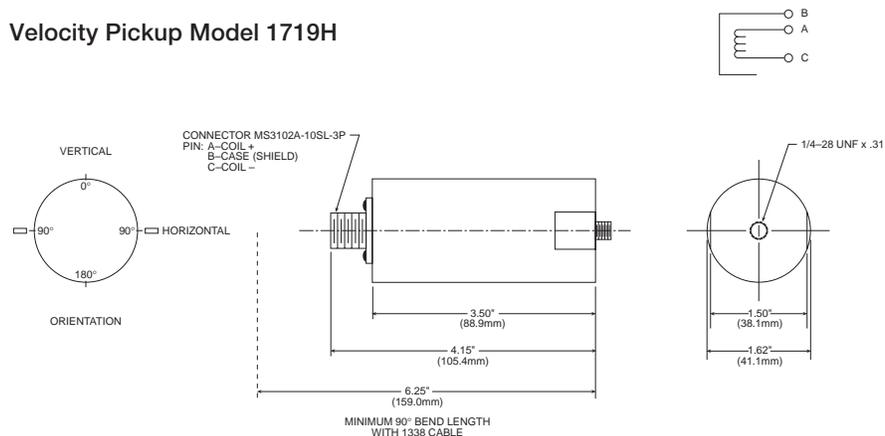
#### Velocity Pickup Model 1716



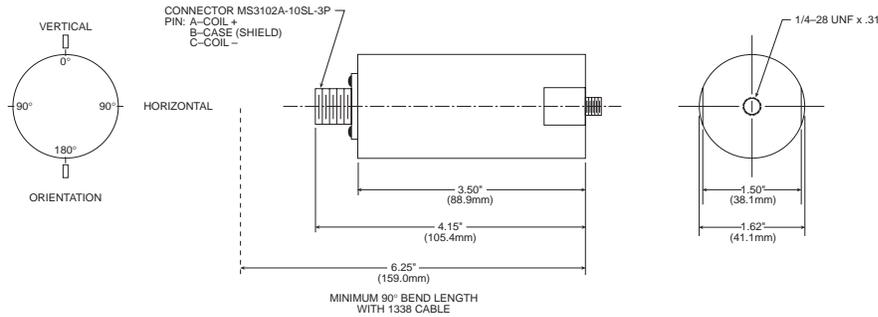
#### Velocity Pickup Model 1718



#### Velocity Pickup Model 1719H



### Velocity Pickup Model 1720V



### Velocity Pickups Ordering

**Velocity Pickup Model 1716**  
Model 1716 – (T)  
Temperature Range

### Velocity Pickup Model 1718

Model 1718 —1—2

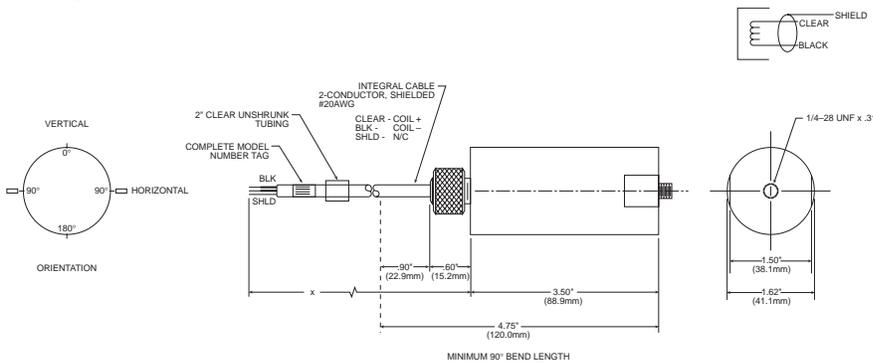
#### Item 1 Cable Length

3M=3 meters  
10F=10 feet  
Other Lengths optional

#### Item 2 Cable

C=Cable  
A=Armor cable  
(limit 25 ft./7.5 meters)

### Velocity Pickup Model 1721H



### Velocity Pickup Model 1719H

Model 1719H

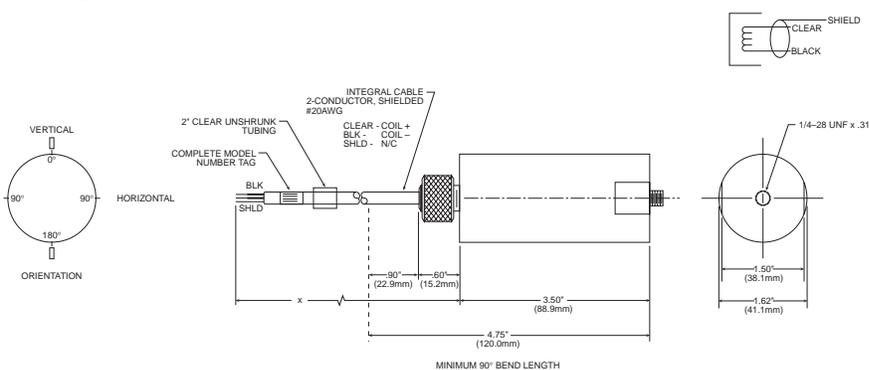
### Velocity Pickup Model 1720V

Model 1720V

Note: 1. Mates with 1388 cable.

Unit	Axis	Description
1716	Horz/Vert	Top Connector, 195 mV/in/sec, 15-1000 Hz, 260°F (130°C) limit
1718	Horz/Vert	Same as 1716 except with integral cable, no connector
1719H	Horz	Top Connector, 195 mV/in/sec, 5-1000 Hz, 260°F (130°C) limit
1720V	Vert	Top Connector, 195mV/in/sec, 5-1000 Hz, 260°F (130°C) limit
1721H	Horz	Same as 1719H except with integral cable, no connector
1722V	Vert	Same as 1720V except with integral cable, no connector

### Velocity Pickup Model 1722V



### Velocity Pickup Cables Ordering

Unit Description  
1338 Use with 1716, 1719H, 1720V  
Specify length in feet.  
Example: 1338-50F

# AMETEK

## Machine Monitoring

### Accelerometers

Accelerometers are seismic motion sensors with an output proportional to acceleration. Ametek offers low, medium, and high frequency models to meet most industry requirements and standards. All are rugged and transmit a high output, noise-free signal over long distances.

Two types of accelerometers exist: "charge" units for operation above 250°F, using a charge amplifier or impedance cable; "low impedance" units with integrated electronics for operation below 250°F, free from any cable length considerations.

### Accelerometer Specifications

#### Accelerometer Model 2073

##### Electrical:

- Sensitivity: 100mV/g  $\pm 5\%$
- Frequency Response: 3 Hz to 10 kHz  $\pm 5\%$
- Equivalent Noise: 0.0005g
- Power: Constant current - 4mA  
Compliance voltage - 24V
- Output Impedance:  $< 100 \Omega$
- Transverse Sensitivity:  $< 5\%$
- Temperature: -40°C to 121°C  
-40°F to 250°F
- Case: Signal isolated

##### Mechanical:

- Mounting Stud: 1/4-28 UNF-2A
- Weight: 80 gms/2.8 oz.
- Material: Stainless Steel Type 303
- Case: Hermetically sealed

#### Accelerometer Model 2075

##### Electrical:

- Sensitivity: 100 mV/g  $\pm 5\%$
- Frequency Response: 3 Hz to 10 kHz  $\pm 5\%$
- Equivalent Noise: 0.0005g
- Power: Constant Current 4mA (Bias  $12 \pm 2$ VDC), Compliance Voltage 24V
- Output Impedance:  $< 100 \Omega$
- Transverse Sensitivity:  $< 5\%$
- Temperature: -40°C to 121°C  
-40°F to 250°F
- Case: Signal isolated

##### Mechanical:

- Mounting Stud: 1/4-28 UNF-2A
- Weight: 80gms/2.8 oz.  
(without cable)
- Material: Stainless Steel Type 303
- Cable: Type Belden 8402. Environmentally-sealed for splash resistance. Length (7.6 meters) 25 feet Conductors 20 AWG.

#### Accelerometer Model 2076

##### Electrical:

- Sensitivity: 100 mv/g  $\pm 5\%$
- Frequency Response: 5 Hz to 10 kHz  $\pm 5\%$
- Equivalent Noise: 001g
- Power: Constant current 4mA  
Compliance voltage 24V
- Output: Impedance  $< 100 \Omega$
- Transverse Sens:  $< 5\%$
- Temperature: -40°C to 121°C  
-40°F to 250°F
- Case: Isolated

##### Mechanical:

- Mounting Stud: 1/4-28 UNF-2A
- Weight: 85 gms/3.0 oz.
- Material: Stainless Steel Type 304
- Case: Hermetically Sealed

#### Accelerometer Model 2077

##### Electrical:

- Sensitivity: 100mV/g  $\pm 5\%$  at 100 Hz
- Frequency Response: 5 Hz to 1000 Hz  $\pm 5\%$
- Equivalent Noise: 0.001g
- Power: Constant Current 4mA  
(Bias 11 +4/-6VDC)  
Compliance Voltage 24V
- Output Impedance:  $< 100 \Omega$
- Transverse Sens:  $< 7\%$
- Temperature: -58°C to 121°C  
-50°F to 250°F
- Case: Signal Isolated

##### Mechanical:

- Mounting Stud: 1/2 NPT
- Weight: 420 gms/15 oz.
- Material: Stainless Steel Type 303
- Case: Hermetically sealed
- Terminals: Epoxy Sealed
- Type: Compression
- Max Wire: 14 AWG.

#### Accelerometer Model 2079

##### Electrical:

- Charge Sens: 25pc/g
- Frequency Response: 5Hz-5kHz  $\pm 5\%$
- Temperature: -50°C to 260°C  
-58°F to 436°F
- Transverse Sens:  $< 5\%$
- Case: Isolated

##### Mechanical:

- Mounting Stud: 1/4-28 UNF
- Weight: 85gms/3 oz.
- Material: Stainless Steel Type 304
- Case: Hermetically Sealed

#### Velocity Sensor Model 2083

##### Electrical:

- Sensitivity: 100mV/in./sec  $\pm 5\%$   
Max Velocity: 50 in/sec
- Frequency Response: 4.0 Hz to 2.0 kHz  $\pm 5\%$
- Equivalent Noise: 0.005 in./sec
- Power: Constant Current 4mA  
Compliance Voltage 24V
- Output Impedance:  $< 100 \Omega$
- Transverse Sen:  $< 5\%$
- Temperature: -50°C to 121°C  
-58°F to 250°F
- Sens Change: -10% to +10%
- Case: Isolated

##### Mechanical:

- Mounting Stud: 1/4-28 UNF-2A
- Weight: 133 gms/4.7 oz.

#### Velocity Sensor Model 2085

##### Electrical:

- Sensitivity: 100mv/in./sec  $\pm 5\%$   
Max velocity 50 in./SEC
- Frequency Response: 4.0 Hz to 2.0 KHz  $\pm 5\%$
- Equivalent Noise: 0.0005 in./SEC
- Power: Constant Current 4mA  
(Bias  $12 \pm 2$ VDC) Compliance Voltage 24V
- Output Impedance:  $< 100 \Omega$
- Transverse Sens:  $< 5\%$
- Temperature: -50°C to 121°C  
-58°F to 250°F
- Sens Change: -10% to  $\pm 10\%$
- Case Signal: Isolated

##### Mechanical:

- Mounting Stud: 1/4-28 UNF-2A
- Weight: 133gms/4.7 oz without cable
- Material: Stainless Steel 303  
(consult factory-316 stainless steel)
- Cable: Type Belden 8402. Environmentally sealed for splash resistance. Length (7.6 meters) 25 feet, Conductors 20AWG.

## Charge Amplifier Model 2144 Specifications

### Electrical:

- Input: Signal source accelerometer piezoelectric
- Charge Sensitivity: 25pc/g standard  
16 to 1600 pc/g available
- Supply Voltage: up to -32 Volts DC
- Supply Current: 15 mA (typical)  
at -24VDC

### Output:

- Scale Factor: 100 mv/g (50,10 mV/g available)
- Impedance: 50 ohms
- Voltage Swing: Maximum peak-to-peak range in 2 Volts less than supply voltage
- Bias: -12V±VDC

### Performance:

- Frequency Response: 2% Down at 6Hz, upper frequency set by accelerometer
- Noise: 25 UV RMS RT1 (Typical)
- Calibration: Field adjustable

### Mechanical:

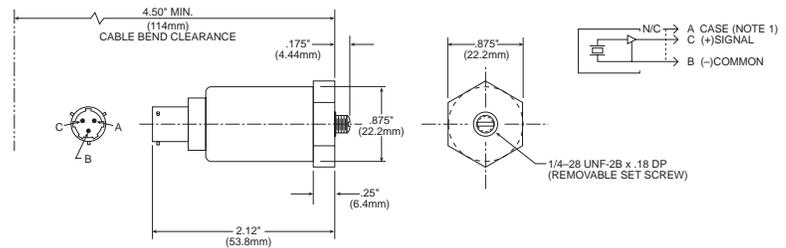
- Input Connection: coaxial 1/4-36, stainless steel
- Output and Supply Connections: Barrier, 3 screw terminals 6-32
- Construction: Potted in heavy aluminum case, stainless steel case available
- Environmental Operation Temperature Range: -34°C to + 85°C
- Storage Temperature Range: -55° C 60 +125°C

## Charge Amplifier Model 2144 Ordering

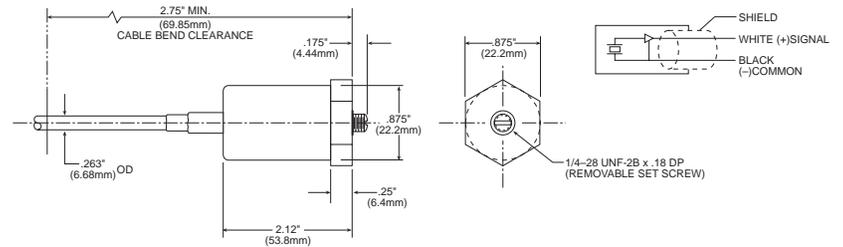
Model	Description
2144-25-100	Charge amplifier: API-678 format, for use with charge accelerometer (eg. Model 2079)

## Accelerometers Dimensions

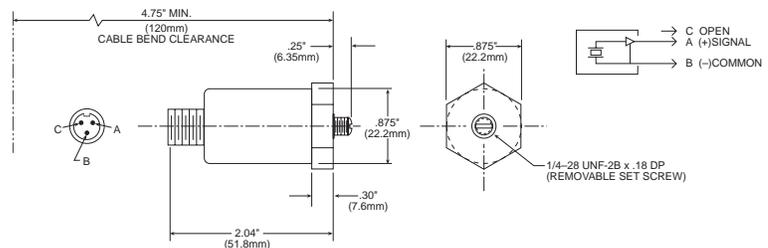
### Accelerometer Model 2073



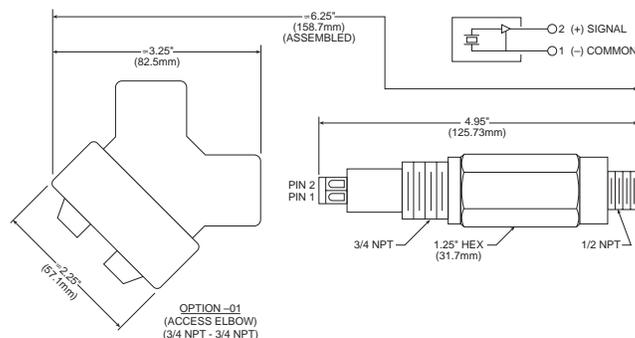
### Accelerometer Model 2075



### Accelerometer Model 2076



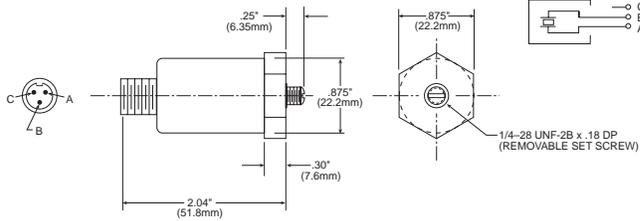
### Accelerometer Model 2077



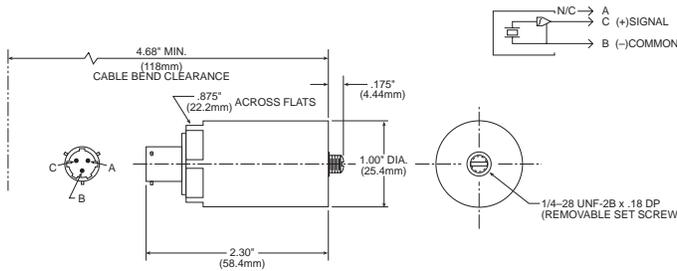
# AMETEK

## Machine Monitoring

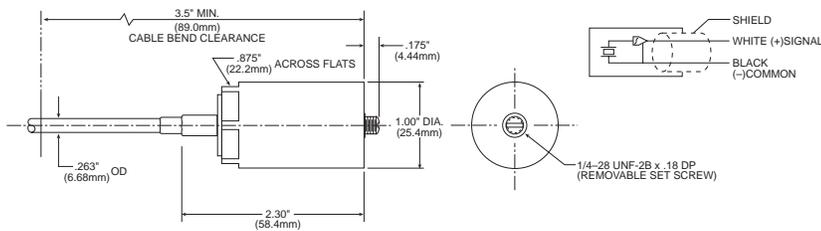
### Accelerometer Model 2079



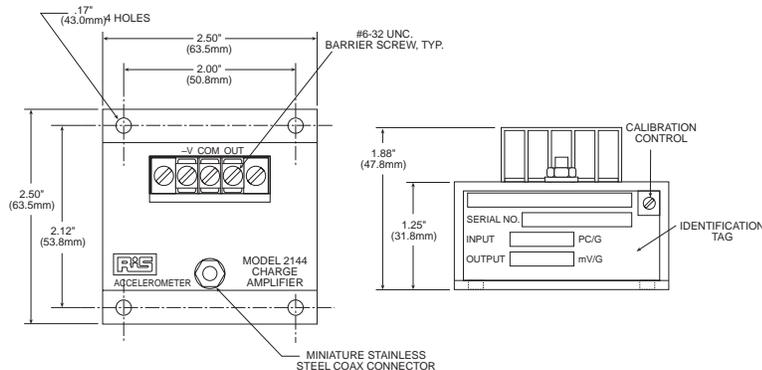
### Velocity Sensor Model 2083



### Velocity Sensor Model 2085



### Charge Amplifier Model 2144



## Accelerometers Ordering

### Model

2073

Note: 1. Serial numbers prior to 308 have pin A connected to case.

### Model

2075

2076

2077

2079

2083

2085

## Accelerometer Cables

### Model Description

1332 Use w/2073, 2083

1333 Use w/2076

1334 Use w/2079 LoTemp

1336 Use w/2079 HiTemp

Specify cable length in feet with model number.

Example: 1332-50F  
50 ft. cable for 2073/2083

## Mounting Hardware

A wide range of accessories exist for mounting Ametek probes. Depending on whether the probe is a contacting or non-contacting type, it can be mounted directly on the equipment by means of an angle bracket. Ametek mounting hardware makes probe installation easy and in-place probe adjustments possible. Contact the Ametek factory for assistance in choosing the suitable hardware for your application.

# AMETEK Recorders

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**Ametek provides event and waveform recording for power generation, transmission and distribution system analysis. These recorders are widely used in power utilities, from large investor-owned business to small co-generators, rural electric cooperatives, and industrial electrical systems.**

Bulk consumers of electric power, manufacturing plants, power substations, and process equipment users also can monitor critical operations for rapid diagnosis and restoration of service.

Ametek's recorders also provide logging and recording of steady-state values to aid in understanding of load conditions, with fault detection and long term monitoring capability.

All Ametek Transient Recorder products provide for data transmission to PC computers, which allows complete analysis using Ametek's Windows™-based packages.

- **Sequential Events Recorders**

The ISM-1 is fully user-configurable to record contact sequences for 1 to 6656 points with 1 millisecond resolution. A wide variety of input termination and output options allow easy application to most processes and electric utility plants and substations.



- **Digital Transient Recorders**

The TR-100, TR-2000 and new P&QR Series are the most cost effective products of their kind.

- **Portable Units**

Available as a DL-8000 (TR-100), DL-9000 (TR-2000) and P&QR-P.



# AMETEK

## Event Recorders

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**The Ametek Integrated System Monitor, ISM-1, is a modular contact sequence of events recorder system offering the flexibility and reliability to tackle any application from several to several thousand points with confidence.**

- Reliable
- Versatile
- High MTBF
- Optional Modbus Interface
- Optional RiSCue Alarm Management Software

Reliability was the number one criteria in the design of the ISM-1. Every component, every connector, and every piece of hardware was selected with the goal of achieving reliability orders of magnitude higher than any other events recorder.

Virtually all operating parameters are programmable in the ISM-1, to tailor the alarming and reporting to the needs of different applications. Interfaces to printers, DCS systems, CRT annunciator, and PC computers provide the necessary data for prompt response or analysis. A variety of input filtering options reduces false reports from sensitive or noise-generating equipment.

The ISM-1 is the only sequence of events recorder designed to last as long as the facility in which it is installed — with minimal service or maintenance!



## Event Capture Unit

The Event Capture Unit or ECU is the heart of the ISM-1 System. Each ECU supplies the logic required to monitor either 128 or 256 inputs and can function as a stand alone events recorder. Each input is sampled every millisecond and can be configured for normally open or normally closed contacts.

The design of the ECU virtually eliminates the nuisance of false alarms. Digital filters are available on a system wide and per input channel basis. The ECU can be configured to automatically delete noisy points from scan and reinsert them at a later time.



## ECU Specifications

**Inputs:** 32-256 contacts per ECU  
N.O./N.C. per input

**Power:** Redundant 20-60 or 90-260 VDC and/or 120/240 VAC 50/60Hz

**Outputs:** (2) RS-232 ports for local terminal I/O and printer, (1) Fiber Optic port for interface to CIU. Specify distances up to 1000 meters between ECU and CIU.

**MTBF:** 115 years

**Legends:** 119 characters per input; divisible in any combination of alarm and return-to-normal descriptor

**Event Memory:** Minimum of 1000 events per ECU in system.

## ISM-SX

By addition of Input Isolation Modules, FCV power supply, and user input/output devices, a complete recording system is created for up to 256 points. This is available as the ISM-SX.

## Communications Interface Unit

The Communications Interface Unit (CIU) interfaces with single or multiple ECUs as well as CIUs to provide a more advanced recording system. Each CIU constantly runs a self diagnostic routine and provides error messages with clear visual indication of system status.



Each CIU performs the following general functions:

- Communicates with, and time sorts data from, multiple ECUs in the system
- Acts as a smart interface to a variety of Inputs/Outputs.
  - 4 User programmable function contact inputs
  - 2 User programmable relay outputs
- Selection of up to 14 of the following:
  - SCM fiber optic module for interfacing with remote ECU up to 500 meters away (up to 1000 meters optional)
  - RDM relay driver module provides four additional software driven relay outputs
  - Dual RS-232 module provides redundant and/or primary and backup output ports for terminals, printers, and other RS-232 compatible devices including Modbus and other DCS protocols
  - Parallel Output Port provides interface for high speed parallel printers
  - Fiber Optic Port provides a high speed data output for interfacing with other CIUs in very large systems
  - IBM Interface provides an error corrected binary interface for high speed, reliable remote or local communication to an IBM or compatible PC
- Power: Same as ECU

## Field Contact Voltage Power Supply

The Field Contact Voltage (FCV) power supply provides wetting voltage for dry contact inputs and performs input check and ground detection functions.

## FCV Specifications

**Inputs:** 256 or 512 contact inputs per supply

**Wetting Voltage:** 24, 48, 125, or 250 VDC.



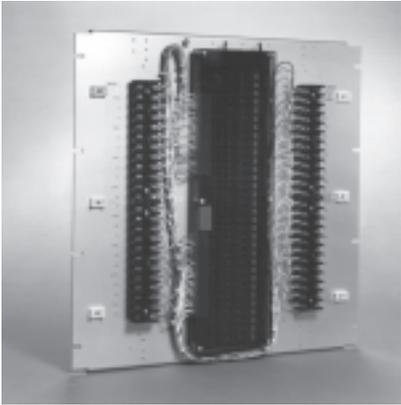
## Configurations Available:

- (1) Single 256 point supply
- (2) Dual 512 point supply
- (3) Redundant 256 point supply
- (4) Two different FCV voltages, 256 points each

# AMETEK Event Recorders

## Input Options

Compact, simple and advanced to save installation/retrofit costs. These simple termination options offer the widest alternatives and simplify installation to save time and costs. The standard input module, used in all of these options, includes optical isolators, initial input conditioning and input check circuitry.

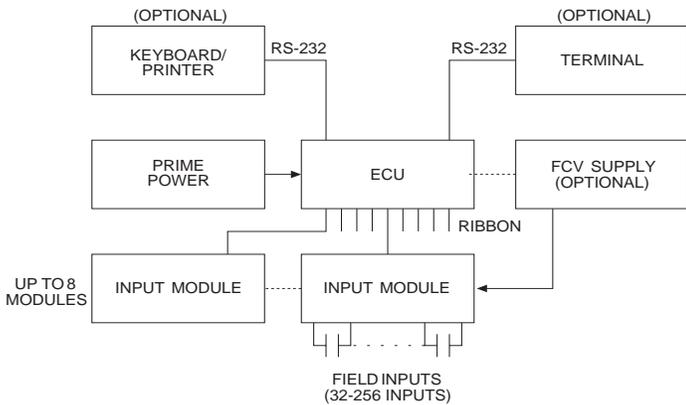


## A wide selection of Input Assemblies to meet any application

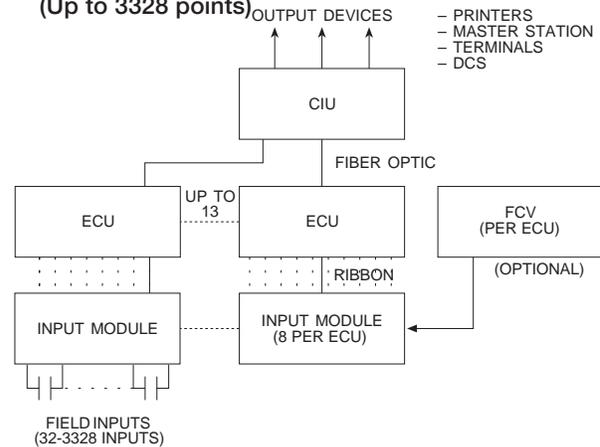
	Height	Width	Depth Behind Panel (Not Including Wiring)	Maximum Number Of Inputs	Terminations
Input Terminal Shelf (ITS)	7.0"	19.0"	22.0"	128	compression terminal blocks
High Density Input Card Rack	27.75"	19.0"	8.4"	512	compression terminal blocks or interface to existing RiS AN-4100/RA-3800 Input Panels (AN-4190)
DC Input Terminal Panel (ITP-C)	19.25"	19.0"	0.0"	64	compression terminal blocks
DC Input Terminal Panel (ITP-TB)	19.25"	19.0"	0.0"	32	uses GE or States terminal blocks
Fully Isolated ITP AC/DC	24.46"	19"	0.0"	32	2 terminals per input, uses GE or States blocks

## Applications

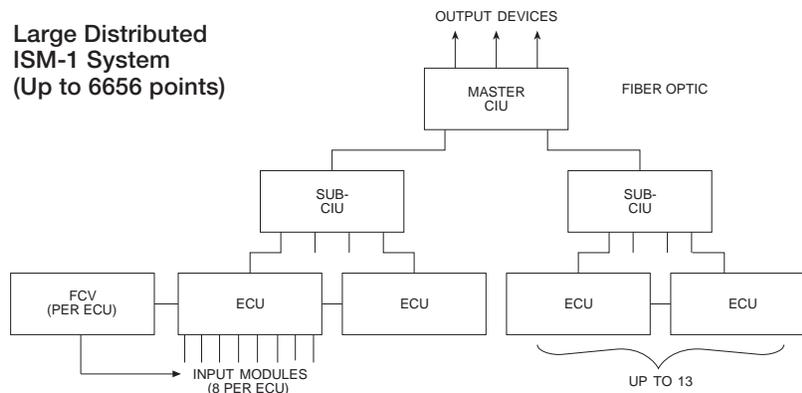
### ISM-SX Block Diagram (Up to 256 points)



### Standard Systems (Up to 3328 points)



### Large Distributed ISM-1 System (Up to 6656 points)



## ISMCOMM Software

- Automatic Retrieval of Data
- “Multi-Site Analyzer”

The ISMCOMM software is a program used to automatically or manually retrieve data recorded by the ISM-1 to a computer via an RS-232 link and selected modems.

Once the data is stored at the computer, files can be merged, a time window can be extracted, selected points can be extracted and any information can be printed out in true sequential order. Even data from different recorders!

**Requirements:** IBM-PC/XT or compatible with 640K RAM, DOS 3.1 or later, monitor, hard disk drive, printer and serial port.

## ISM System Specifications

**Inputs:** 1 — 6656 inputs

**Input Resolution:** 1 millisecond system wide, regardless of number of inputs

**Isolation:** Via optical couplers to provide isolation from input to output and power. An optional isolated module provides isolation from input-to-input and accepts AC inputs.

**Input Normal State:** Normally open (NO) or normally closed (NC) can be set on a per point or group basis via printer/keyboard or remote computer.

**Field Contact Voltage (FCV):** Wet or dry contacts 24, 48, 125, 250 VDC, Ametek or customer supplied, or 24, 48, 120, 240 VAC customer supplied. Negative FVC is also available.

**CIU Time Synchronization:** IRIG-B, AC-line, pulse per unit time selectable by the user, with crystal clock backup.

**Clock Accuracy:** 100 milliseconds per day typical with software correction, 100 milliseconds per day with TCXO option over entire temperature range; ± 1 millisecond with IRIG-B (CIU only).

**Logic Power:** 20-60 or 90-260 VDC and 120/240 VAC 50/60 HZ 10 watts maximum per ECU or CIU.

**Operating Temperature Range:** 32° to 140°F (0 to 60°C)

**Humidity:** 0 to 95% non-condensing

**Surge Withstand Capacity (SWC):** Conforms to IEEE/ANSI C37.90.1-1989

**RFI:** Tested per SAMA standards to PMC 33.1c-1978 class 2, band A, B and C

**Dielectric Strength:** Conforms to IEEE C37.90-1978, 1500 VDC input to ground

**Output Format:** ASCII serial text in the following order: point status, point number, date and time, legend

### CRT Annunciator:

A CRT color annunciator option provides control room operators with dynamic alarm displays as they happen. The display can be programmed for alarm grouping, color coding, and several types of sequences. A custom control keyboard provides direct access to current alarms and recent status changes.

### Modbus:

Using a dual serial port, the ISM can output all recorded data on request to a Modbus master. This is also used to interface the ISM-1 to our RiSCue Alarm Management Software.

### Typical Computer Screen for ISMCOMM

Event File: C:\RIS\ISM-1\DATA.EVT						Total Events = 27
Event	Type	Point	Time	Date	Station	
18	A -	00005	at 16:34:04.348	on 07/31/91	from Northside Station	Loss of Station Service
19	A -	00001	at 16:34:05.771	on 07/31/91	from Northside Station	Loss of DC/Breaker Control
20	A -	00002	at 16:34:05.794	on 07/31/91	from Northside Station	Hot Oil
21	A -	00004	at 16:34:07.662	on 07/31/91	from Northside Station	Hot Spot
22	A -	00003	at 16:34:07.890	on 07/31/91	from Northside Station	LTC Backup Alarm
23	N -	00002	at 16:34:08.312	on 07/31/91	from Northside Station	Oil Temp. OK
24	N -	00001	at 16:34:08.337	on 07/31/91	from Northside Station	DC on Line
25	N -	00005	at 16:34:09.607	on 07/31/91	from Northside Station	Service OK
26	N -	00004	at 16:34:09.926	on 07/31/91	from Northside Station	Hot Spot OK
27	N -	00003	at 16:34:10.921	on 07/31/91	from Northside Station	LTC Normal

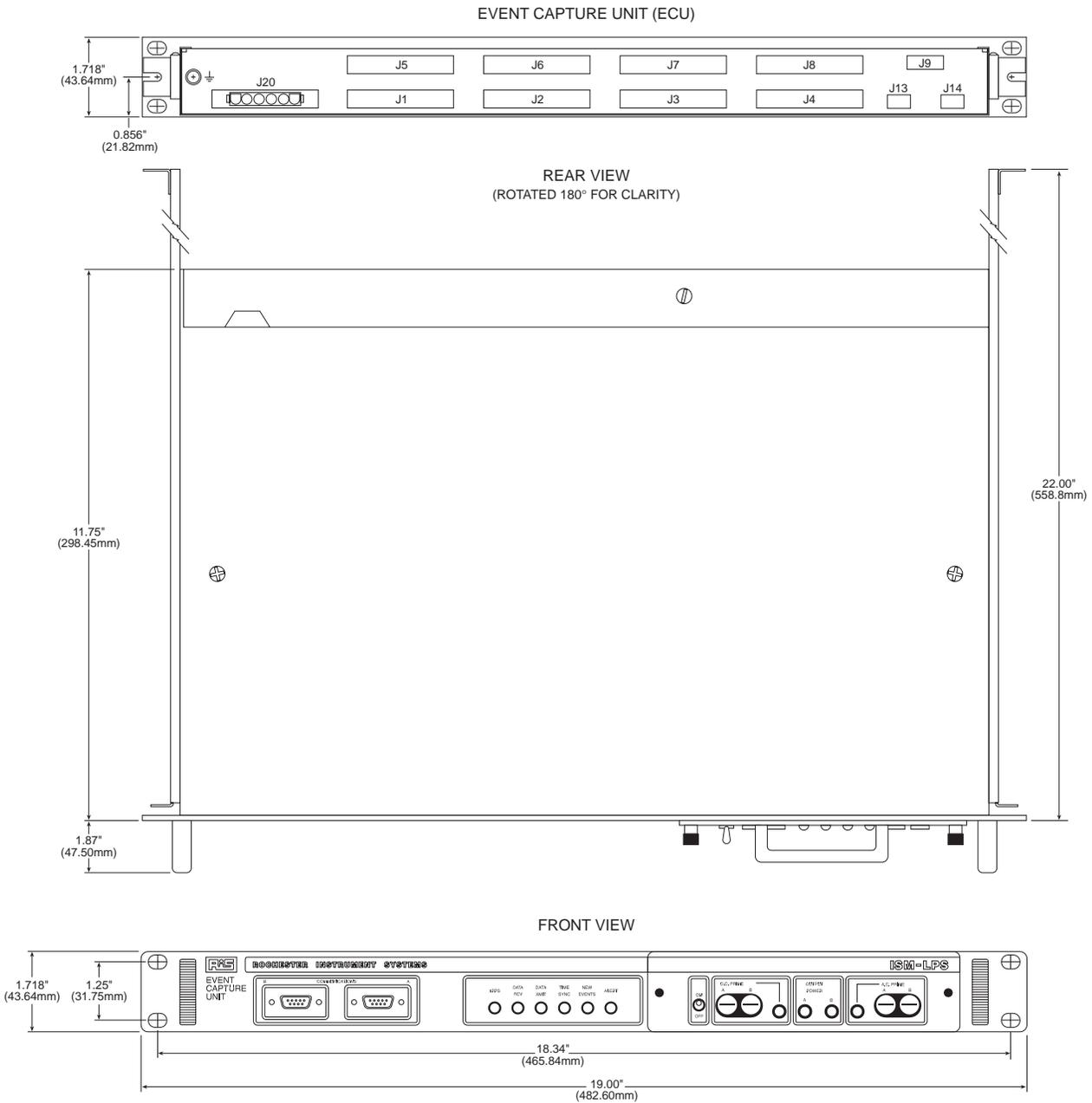
F1 - Display Help Screen                      ESC - Quit                      Legend Offset = 0

# AMETEK

## Event Recorders

### ECU Dimension & Connections

#### Event Capture Unit (ECU)

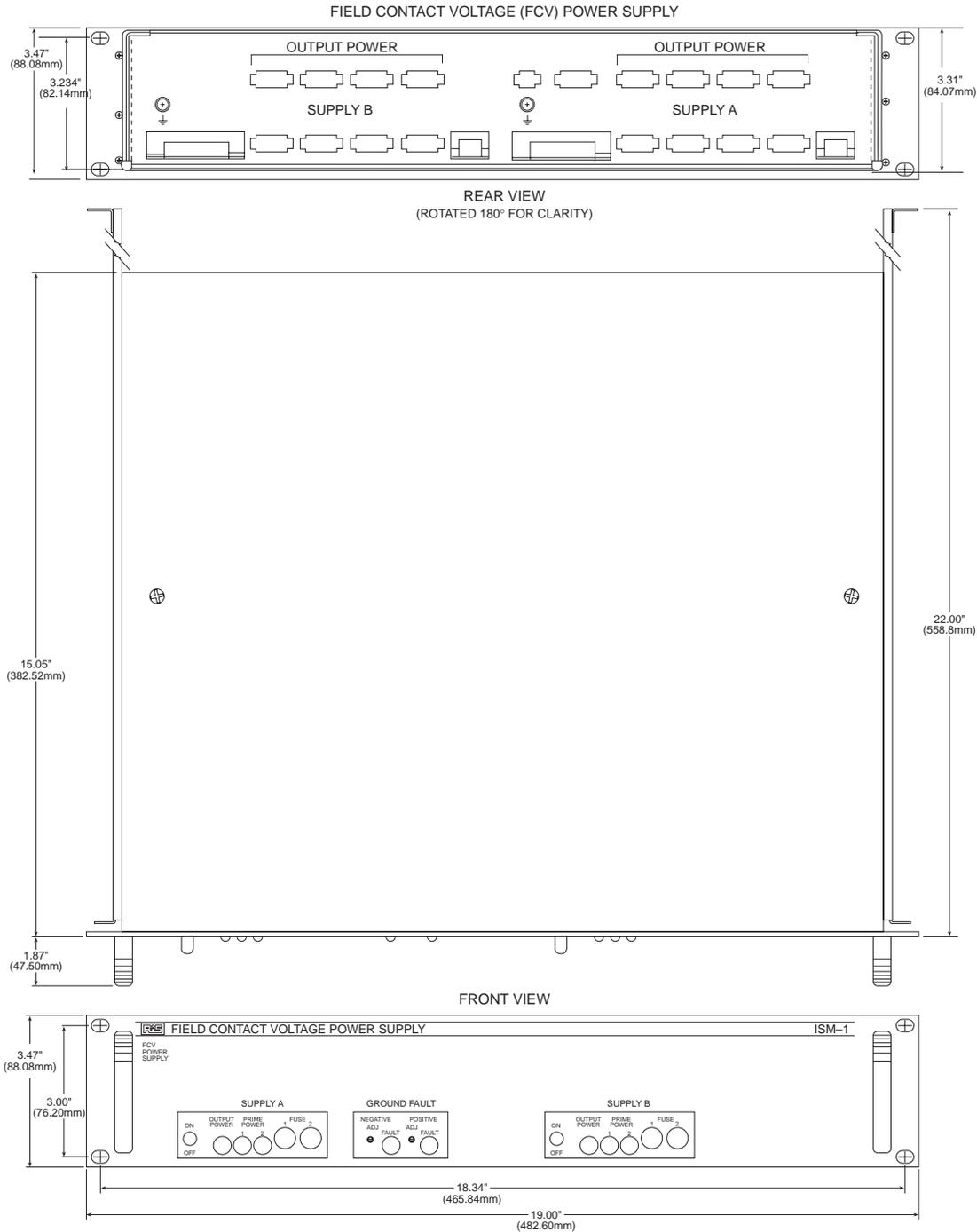




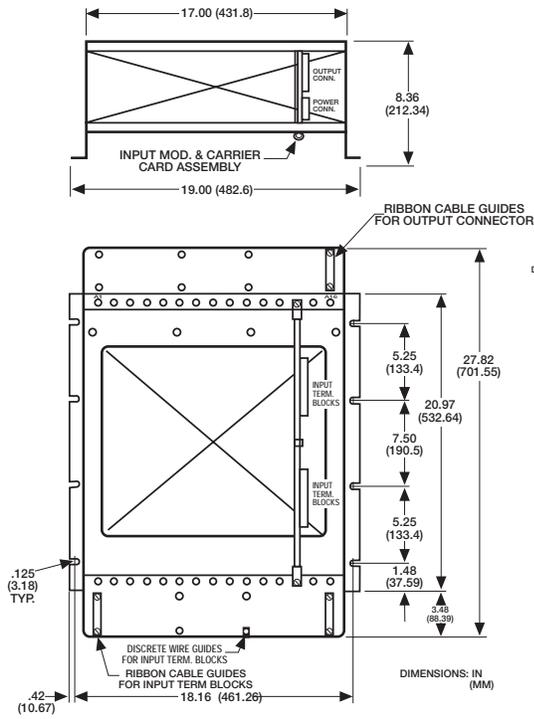
# AMETEK Event Recorders

## FCV Dimensions & Connections

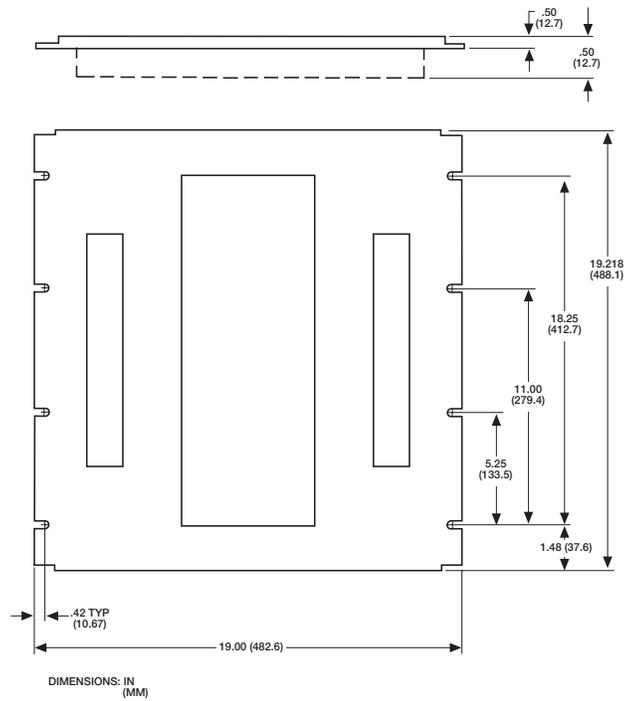
### Field Contact Voltage (FCV) Power Supply



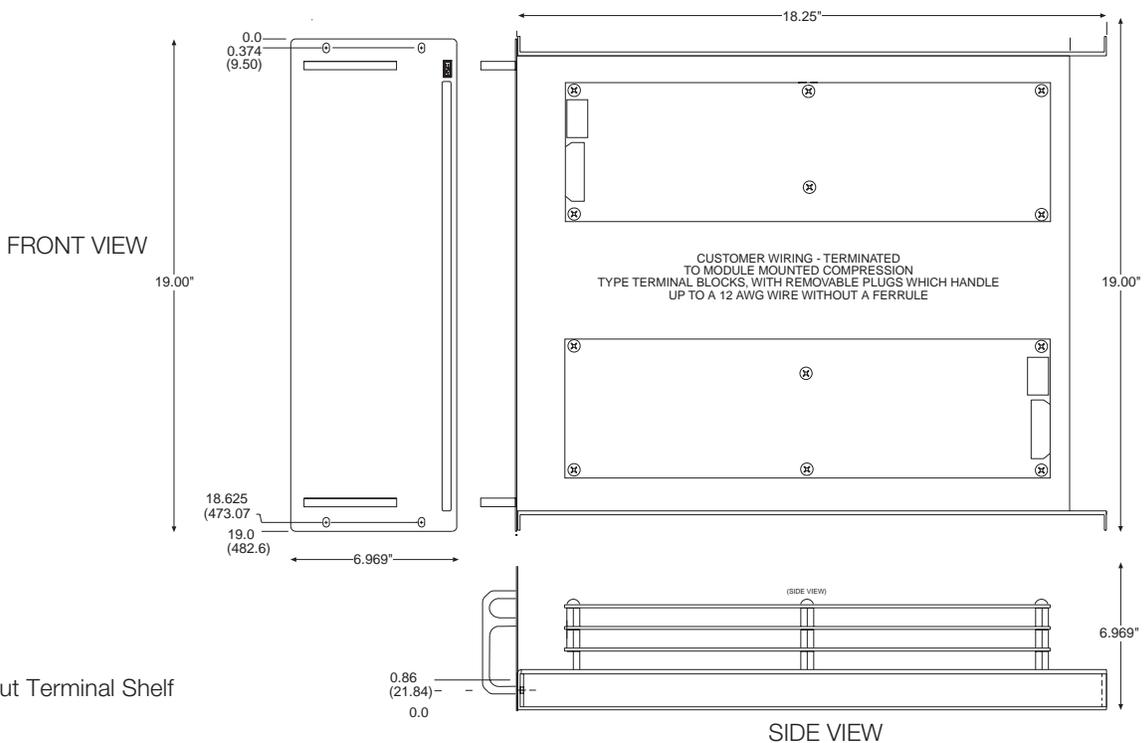
# Input Module Dimensions



High Density Input Module Chassis



Typical Input Termination Panel



Input Terminal Shelf

SIDE VIEW

# AMETEK

## Event Recorders

### ISM-1 Integrated System Monitor Ordering

ISM -1 1 — 2 — 3 — 4 — 5 — 6 — 7 — 8 — 9 — 10

#### Item 1. System Wired Capacity —

Total # of wired points (1-6656)

#### Item 2. System Active Capacity —

Number of active points, in multiples of 32.

#### Item 3. Prime Input Power source

- A 125 VDC
- B 48 VDC
- C 120/240 VAC
- D 250 VDC
- E 24 VDC

#### Item 4. Communication Interface

**Unit (CIU)** — required for Smart Interface or if multiple ECUs are utilized.

- 0 Not required
- 1 One required

#### Item 5. Event Capture Unit (ECU) —

128 point unit. Divide the # of active points by 128 to determine the # of ECUs required. Replace the X in the model number with the quantity required.

- XS Short range  
(20 meters maximum)
- XL Long range  
(500 meters maximum)
- 0 None required  
(Use 256 Point)

#### Item 6. Event Capture Unit (ECU) —

256 point unit. Divide the # of active points by 256 to determine the # of ECUs required. Replace the X in the model number with the quantity required.

- 0 None required (use 128 point)
- XS Short range  
(20 meters maximum)
- XL Long range  
(500 meters maximum)

#### Item 7. Field Contact Voltage (FCV)

— The # of FCV units typically equals the number of ECU's. Replace the X in the model number with the quantity required. Specify positive or negative.

- XA Customer supplied  
(requires Input Check Module — Specify Voltage)
- XB Redundant 125 VDC
- XC Redundant 48 VDC
- XD Redundant 24 VDC
- XE Non-redundant 125 VDC
- XF Non-redundant 48 VDC

XG Non-redundant 24 VDC

**Item 8. Input Terminations** — Divide the number of wired points by 32 or 64, depending on the type of terminations required. Replace the X in the model number with the quantity required. All Input Modules provide optical isolation with a common return. Isolated Input Modules provide an isolated return per point. Input Terminal Shelves (ITS) are provided with chassis slides and are designed for 19" rack mounting.

#### Input Termination Panel (ITP)

- XA Lo density States Sliding Links (32)
- XB Lo density EB-25 (32)
- XC Lo density CR-151 (32)
- XD High density Phoenix compression (64)
- XN High density compression (32)
- XE Lo density isolated States Sliding Link (32)
- XF Lo density isolated EB-25 (32)
- XG Lo density isolated CR151 (32)
- XH High density isolated Phoenix compression (64)

#### Input Termination Shelf (ITS)

- XI High density Phoenix compression (32)
- XJ High density Phoenix compression (64)
- XK High density Phoenix compression (96)
- XL High density Phoenix compression (128)

#### Input Rack

- XR Input Card Rack — Capacity of 8 modules not included (256 points)
- XRD Input Modules — 32 points
- XRA Isolated Input Modules — 32 points

#### Item 9. Printer type

- A None required
- B 40 column Red/Black printer mounted on a 19" shelf suitable for rack mounting.
- C 40 column Red/Black printer and keyboard mounted on a 19" shelf suitable for rack mounting.

D Other

#### Item 10. Options

- L Cabinet Mounting — 27"W x 31"D x 90"H NEMA 1 Cabinet
- J Portable keyboard
- \*T TCXO 1 ppm high accuracy clock
- \*DH Dual RS232 Port
- \*PO Parallel Port
- \*FO Fiber Optic Output Port
- \*RD Relay Driver Module for CIU
- \*CI/XXX Computer Interface—Specify IBM-PC, Bailey, Fox 1A, Fox 300, Modbus
- +M IBM-PC compatible Master Station Software (ISMCOMM)
- \*K1 Color CRT Annunciator with Control keyboard

\*Requires a CIU  
+One time fee per customer

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## ISM-SX Stand Alone ECU System Ordering

ISM -SX 1 — 2 — 3 — 4 — 5 — 6

### Item 1. System Wired Capacity

- 128 128 Point Event Capture Unit
- 256 256 Point Event Capture Unit

### Item 2. System Active Capacity

Specify the number of active points in multiples of 32.

### Item 3. Input Power

- A 125 VDC
- B 48 VDC
- C 120/240 VAC
- D 250 VDC
- E 24 VDC

### Item 4. Field Contact Voltage

(Specify positive or negative.)

- A Customer Supplied — Specify voltage
- B Redundant 125 VDC
- C Redundant 48 VDC
- D Redundant 24 VDC
- E 125 VDC Non-redundant
- F 48 VDC Non-redundant
- G 24 VDC Non-redundant

### Item 5. Input Terminations

The terminal blocks and input module are mounted on an Input Termination Panel (ITP). Replace the X in the model # with the quantity required. Input Terminal Shelves (ITS) are provided with chassis slides and are designed for 19" rack mounting. A standard 10 ft. ribbon cable is provided to connect the input termination panel(s) to the ECU.

- XA States sliding links ITP (32 inputs)
  - XB EB-25 ITP (32 inputs)
  - XC CR-151 ITP (32 inputs)
  - XD Compression ITP (64 inputs)
  - XN Compression ITP (32 inputs)
  - XE Isolated States ITP (32 inputs)
  - XF Isolated EB-25 ITP (32 inputs)
  - XG Isolated CR-151 ITP (32 inputs)
  - XH Isolated Compression ITP (64 inputs)
  - XI Compression ITS (32 inputs) non-isolated
  - XJ Compression ITS (64 inputs) non-isolated
  - XK Compression ITS (96 inputs) non-isolated
  - XL Compression ITS (128 inputs) non-isolated
  - XR 256 pt. Input Card Rack (Rack only)
  - XRD Input Cards (32 inputs — for Card Rack)
  - XRA Isolated Input Card (32 inputs)
- Others available Consult Factory

**Note:** All inputs are optically isolated from input-to-output. The isolated input options also provide input-to-input isolation.

### Item 6. Options

- B Shelf Mounted Printer (with shelf)
- C Printer/Keyboard and Shelf
- J Portable Keyboard Extra Manual

# AMETEK Transient Recorders

## TR2000 Series Multi-Function Recorders

Be prepared in today's increasingly competitive and dynamic industry. The Multi-Function Recorder (TR2000) series was designed to be at the leading edge of technology. These recorders represent the next generation of utility analysis monitoring. A farsighted product, which uses the most advanced technology available, yet remains fully compatible with the successful TR-100 and DL-8000 series recorders.

Today's customers expect superior solutions for their needs. Concerned with obtaining optimal power flow via the network, while still retaining control and reliability, they are demanding not only increased, but integrated functionality to be provided in a cost effective product. Such a product aids asset management and planning, while remaining fully flexible and compatible with existing systems and producing real time answers. The total package is not complete without the superior, reliable support and after sales service, which one can expect from Ametek.

Such solutions can only be met by listening to the customer and utilizing advanced technology in a variety of unique and important applications. The bottom-line is that our customers wish to obtain a greater degree of useful information to gain a competitive advantage, retain their customers and lower operational costs.

**The TR2000 performs Transient Recording, Phasor Measurement, Disturbance Recording, Sequence of Events Recording, Power Quality Monitoring, and Data Logging, simultaneously.**

The TR2000 has many functions aimed at obtaining not just standard data, but more useful information and presenting it in such a way as to aid engineering personnel making rapid decisions. For a relatively small capital outlay the recorder can have a big impact on the effectiveness of the power system, via protection, monitoring, minimal maintenance and asset management. The TR2000 family has a range of



models, allowing the customer to choose that which best meets technical requirements and budgetary constraints.

The TR2000 is a dynamic monitoring system, producing information in an accessible format to enable direct action to be taken, sometimes even before a potential problem becomes a reality. Communication with the recorder can be both local and remote allowing for flexibility of response and the ability to obtain real time information.

A major benefit of the TR2000 is that it aids real time monitoring of a power system. This could enable the increased loading of transmission lines, so a greater amount of control could be obtained over the transmission networks producing substantial resultant savings. In a deregulated environment the TR2000 provides the necessary data to increase revenues.

### Software Overview

The TR2000 is enhanced with a wide range of application software, utilizing Windows95™, Windows98™ and WindowsNT™ and includes functions for communicating, configuring, downloading, displaying and analyzing the TR2000 itself and its records. Special applications are used to report on a range of parameters that define power quality. Automated processes include an Expert System to minimize the amount of engineering time needed to process the data records. A flexible reporting scheme enables the right information to be sent to the right person at the right time and enables the selling of data to Energy Service Providers.

### Applications for use

The TR2000 has a wide variety of functions; and is particularly suitable for use in all of the following applications:

- Generation
- Transmission
- Distribution
- Laboratories
- Thyristor stack monitoring
- Flexible ac transmission system (FACTS) monitoring
- Static VAR compensators monitoring
- Geomagnetically induced currents (GIC)
- DC links
- Lightning studies
- General power system research

### Key Functions

- Very high speed recording sampling at up to 195 kHz (optional)
- Transient fault recorder up to 384 samples per cycle
- Disturbance recorder (2 samples per cycle)
- Disturbance logger (1 sample per 2 cycles, optional)
- Trend recording
- Power quality monitor
- Stability monitor (optional — Synchrophasor measurement)
- Fault locator
- Real time monitor
- Sequence of events recorder
- On line switchgear and battery monitor
- Energy meter with peak demand
- Plant commissioning and diagnostic tool
- Electronic chart recorder

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## Very high speed Transient Recorder

The high speed option allows for all analog inputs to be sampled synchronously up to 195,000 times per second. Digital inputs can also be sampled at this rate although in most cases they would be recorded at an integer submultiple.

The high speed recorder is ideally suited to special applications such as lightning studies, monitoring high speed switching in Static VAR compensators (SVCs) and Flexible AC Transmission Systems (FACTS).

## Transient Fault Recorder

Analog inputs are sampled at up to 384 samples per cycle with a maximum record length of 30 seconds. The VT & CT waveforms and auxiliary protection contacts are recorded before, during and after a fault clearance. Expert System software is used to analyze this data and report on any abnormalities. Other information can be extracted for fault impedance calculations, power quality and system maintenance.

The transient fault recorder is used for post fault analysis in verifying protection and circuit breaker operations and also fault clearance times. Information about fault type, fault levels and duration are an aid to fault location and clearance. Transient and incipient faults are also quantified, to allow improvements in supply security to be made.

## Disturbance Recorder

Analog inputs are stored at 2 samples per cycle with a maximum recording length of 30 minutes. The disturbance recorder provides information which enables improved understanding of the power network.

Longer term events are monitored by the Disturbance Recorder. RMS and phasor information are stored per channel, along with frequency from 2 channels. These are used to compute a wide variety of power system quantities. This function is particularly useful in recording reclose sequences and power and frequency stability events. Additionally, it can be used to extend the pre and post fault times of a transient record.

Triggers for the Disturbance Recorder include low frequency oscillation on the power & frequency signals.

## Disturbance Logger

As an **option** all of the RMS and phasor quantities can be recorded continuously in a 2 week circular buffer. Very subtle events, which do not trigger the Disturbance Recorder, can be recovered and analyzed from the Disturbance Logger.

## Trend Recording

The input and computed quantities are logged as maximum, minimum and average quantities every minute. One years worth of data is saved by the system. This enables historical data at a reduced sampling rate, to be retrieved for trend and power quality analysis. The data can be used to replace circular chart recorders to verify voltage regulation and balancing.

## Power Quality Monitor

Power quality can be determined by a set of parameters. Those recorded by the TR2000 series include:

- Voltage and frequency profiles
- Voltage dips and surges
- Loss of supply
- Harmonic content
- Flicker
- Imbalance (voltage)
- Watts

Voltage dips are stored in a database and are classified by severity and duration. A 3-D plot identifies any problem equipment or sites. Comparisons of different sites or improvements in performance are possible following system reinforcement or changes in protection settings.

Flexible display options allow this information to be shown in a wide range of styles: text or graphics, histograms, scatter plots, etc. Measurements can be compared with standard values, such as IEEE519.

# AMETEK Transient Recorders

## Stability Monitor

A very powerful feature of the TR2000 series is the ability to trigger on and record differential phasor measurements. Because the inputs are sampled at very regular intervals, the absolute angle of the positive sequence voltage vector can be computed very accurately. This value is compared with the angle from a remote location, normally the far end of a transmission line. Since the two TR2000s are effectively time locked together via an internal GPS receiver or external PPS and serial time code the difference in phase angle is used as a measure of system stability.

## Fault Locator

Based on the information in a transient record of a line fault and a model of the transmission line impedance the distance to fault can be calculated. Source and remote end impedances, remote end infeed and mutual coupling are used to compute a more accurate distance.

The source, remote and line impedances may be entered in sequence component, per phase or per unit form. The fault distance is computed several times during the period of the fault and the results averaged. The fault impedance is also returned. This can be used with a complex impedance model to locate the source of a fault in a distribution network.

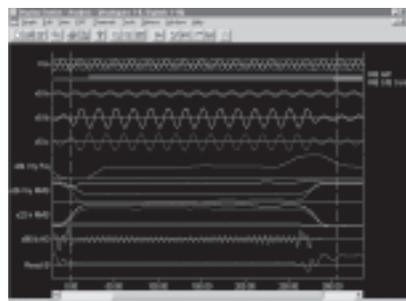
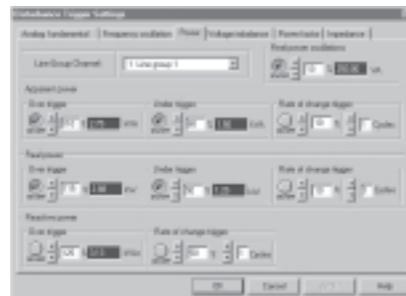
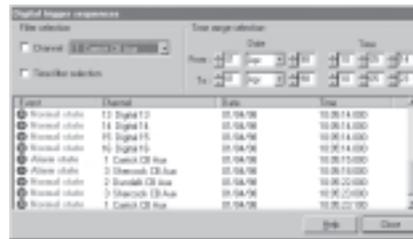
## Real Time Monitor

As well as triggering and logging the TR2000 series includes the ability to view analog and digital inputs and computed values in near real time. Measured values and waveforms can be seen remotely. These can replace or act as backup systems for:

- Waveform oscilloscope
- Panel meters
- Annunciator panel
- Vector display

## Sequence of Events Recorder

All transitions on the digital inputs of the TR2000 are recorded and can be displayed independently or with a disturbance or logger record. The time resolution is 1 ms. Input point and time filtering are available to limit the number of events displayed.



## On-line Switch Gear and Battery Condition Monitoring

Circuit breaker operations are recorded and then analyzed by the Expert System. The measurements from each operation are stored in a database and can be used in a number of programmable contact wear formulas.

The accumulated number of operations, arcing current and arcing time all contribute to wear of the main contacts. An added feature of the TR2000 is that by selecting one of the three standard formulas the optimum service time for each of switchgear can be determined.

The TR2000 series can also monitor the breaker coil currents and battery voltage. Trip coil profiling is a diagnostic tool used to highlight any degradation in the operation of circuit breakers.

## Energy Meter

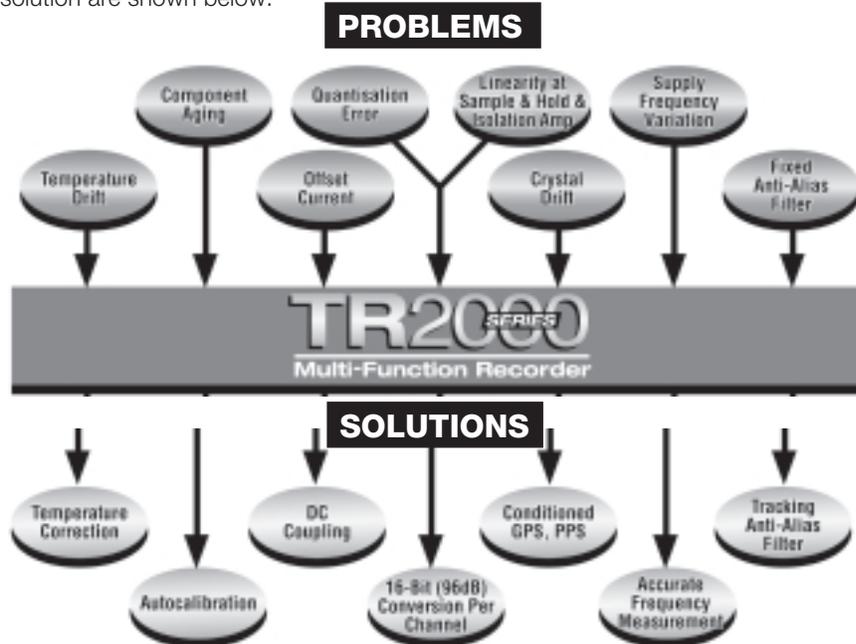
The power values from the logger are used to compute energy demand over a variable interval. Peak demand and power factor can be tracked to help minimize energy cost for large consumers.

## Plant Commissioning and Diagnostic Tool

The extensive set of functions within Display Station Analysis (DSA) allow it to be used in the installation and commissioning of power equipment. Test records can be taken either manually or automatically and analyzed with DSA to check for correct operation of switchgear, transformers, etc. These records can be archived and used for comparison during future diagnostic checks.

## Effective Solutions

Effective solutions to potential sources of measurement error are incorporated in the design of the TR2000 series. Possible errors and their related solution are shown below:



## Purchasing Information

### User Programmable Sampling up to 384 samp/cyc

MODEL	DESCRIPTION
TR-2108	8 Analog / 16 Digital Inputs
TR-2116	16 Analog / 32 Digital Inputs
TR-2124	24 Analog / 48 Digital Inputs
TR-2132	32 Analog / 64 Digital Inputs

### User Programmable Sampling up to 195 kHz

MODEL	DESCRIPTION
TR-2208	8 Analog / 16 Digital Inputs
TR-2216	16 Analog / 32 Digital Inputs
TR-2224	24 Analog / 48 Digital Inputs
TR-2232	32 Analog / 64 Digital Inputs

# AMETEK

## Transient Recorders

### TR2000 Series Specifications

#### INPUTS

no. of channels	8, 16, 24 or 32 Analog 16, 32, 48 or 64 Digital larger systems available
voltage inputs	63 - 120V RMS typical
current inputs	1A or 5A RMS nominal typical
over range	212 Vrms (voltage) Selectable for current (x1 -x20)
frequency response	DC – 1/2 sampling rate
accuracy	Better than 0.1% of full scale @25°C. Inputs can be temperature compensated and are software calibrated (no pots required)
digital inputs	24 / 48 / 125 / 250 V dc, normally open or closed, wetted contact
digital debounce	0 – 10ms in 1ms increments (for trigger validation only)

#### RECORDING (TRANSIENT)

recording resolution	16 bits. 65536 levels (15 plus sign)
sample rate	TR2100 – up to 384 samples per cycle COMTRADE rates supported TR2200 – up to 195 kHz Analog and digital can have different rates
pre-fault time	2 – 500 cycles
post-fault time	Fault length will extend as long as a trigger condition exists. Minimum is 8 – 100 cycles
safety window	Recording time after active trigger: 4–16 cycles
maximum length	Maximum record size: 1 – 30 sec. This prevents memory filling with a continuous trigger
synchronization	All analog channels sampled together and time tagged to better than +/- 100 ns.

#### RECORDING (DISTURBANCE)

sample rate	2 x supply frequency (100/120 Hz)
pre-fault	10 sec. to 10 min.
post-fault time	Fault length will extend as long as a trigger point condition exists Minimum value is 30 sec. – 5 min.
maximum record	Absolute maximum size 1 – 30 min. length.
computed values at PC	Voltage & current, real power, reactive power, apparent power, power factor, total harmonic distortion and frequency (x2) Positive, negative & zero sequence components

#### RECORDING (DISTURBANCE LOGGING) – OPTIONAL

sample rate	1/2 x supply frequency (25/30 Hz)
recording time	2 weeks (circulating buffer)
computed values	As above
<b>Recording (trend)</b> sampling interval	1 minute – data can be retrieved at up to a 60 minute interval
record length	52 weeks (circulating buffer)
stored parameters	Maximum, minimum & average voltage, current, frequency (2), power, flicker, harmonics & imbalance. Digital data in SER format at user defined time resolution.

#### TRIGGERING (TRANSIENT)

analog channels	Over/under RMS level (or DC), Rate-of-Change and THD per analog input. 2 positive, zero and negative sequence triggers per 8 analog inputs. 2 over, under and R-o-C frequency triggers per chassis. 1 differential frequency trigger per chassis
accuracy	0.5%
digital channels	Normal to alarm state and return to normal state. Edge or level sensitive
programmability	Triggering on any number of analog or digital channels
cross trigger	Allows unlimited number of recorder channels with precise time sync From disturbance triggers

#### TRIGGERING (DISTURBANCE)

analog channels	Under/over level of fundamental and R-o-C Power & frequency oscillation Imbalance & impedance Cross trigger from transient recorder
-----------------	--

#### SYSTEM TIMING

time source	Internal GPS receiver (antenna included)
accuracy	Normally better than +/- 60 ns
back up clocks	Dual, 32,768 Hz. crystal oscillators
range	Time and date. Year 2000 compliant. (including leap year and day of year)
synchronization	1 pulse per second on optical port. Any number of systems can be linked together
serial time code	Time code input or output for synchronization of linked systems

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**COMMUNICATIONS**

serial ports	Up to 4 x RS232 type
default setting	57.6K baud, 8 bits, 1 stop, no parity
modem	Hayes compatible type internal or external, fax compatible
phone line sharing	External unit to share a single phone line with a station phone or other IEDs
network connection	10Base2 (50 $\Omega$ coax & BNC) or 10BaseT
network protocol	TCP/IP

**DATA STORAGE**

buffer storage	32 MB RAM
program storage	4 MB flash ROM
permanent storage	3.5" hard disk – 13 Gbytes

**Front Panel Display**

LED indicators	Power OK (Green) Battery OK (Green) System on line (Green) Data available (Amber) Communication in progress (Amber) Communication failure (Red) Loss of time sync (Red) Disk fault (Red) Temperature fault (Red) Attention (Red)
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**STATUS RELAYS**

max. number of outputs	32 (1 per analog in)
contact rating	10 W max. 0.5 A max. 300 V dc / 240 V ac max. N/O contacts available

**Power Supply**

input voltage options	100-300Vdc/120/240Vac or 88-164DC
power requirement	60VA (16 channel) 70VA (32 channel)

**VOLTAGE WITHSTAND**

isolation	Channel to channel Channel to ground (as per IEC 255-5, IEEE C37.90)
impulse voltage withstand	5 kV 1.2/50 ms. 0.5 Joule (as per IEC 255-5, IEEE C37.90)
surge withstand	2.5 kV, 1 MHz damped sine wave (as per IEC 255-22-1, IEEE C37.90)
RFI	as per IEC 801-3, IEC 801-6 and IEEE C37.90 (10V/M)
ESD	as per IEC 801-2

**ENCLOSURE**

cabinet	Steel 19" rack mounting cabinet 8 & 16 channel – 6U 24 & 32 channel – 8U Wall mount and portable options
weight	15 kg

**ENVIRONMENT**

operating temperature	-10 to 55°C 14 to 131°F
relative humidity	0 – 97% non condensing

**OPTIONS****internal**

Modem card  
Network card  
Synchrophasor software (Differential Phasor Measurements)  
Disturbance Logger software

**external**

Range of wall mounting enclosures  
Interface equipment for current channels  
(wedding ring CTs, clamp CTs, shunt resistors)  
Telephone line sharing unit  
Hall effect CTs for DC battery supply  
modem

**software**

Display Station (required)  
Expert System  
Voltage Dip database  
Switchgear Maintenance database  
Distance to Fault

# AMETEK

## Transient Recorders

### TR100 Series Transient Recorders



The Transient Recorder is an essential monitoring requirement for transmission, distribution, generation or any major user of power.

Ametek's years of application knowledge and experience, together with our versatile product range, can meet the requirements of markets demanding anything from a small low cost TR up to the needs of a large distributed network of TR's.

The TR-100 Series introduces to the market a Transient Fault Recording System with unparalleled levels of flexibility, while providing the user with the worlds most user friendly TR available today.

Two 19" rack mounting units are available with up to 32 analog/64 digital input channels on the TR-132 and up to 16 analog/32 digital input channels on the TR-116. The TR will operate as a stand-alone system or link to a PC-based Master Station. In terms of performance, the system has a sample rate of up to 192 samples per cycle, with a vast selection of standard triggers simultaneously available on each channel or on a system basis, including over and under limit violation with adjustable hysteresis, rate of change, zero and negative sequence, sub-cycle drop out (sinewave quality) and frequency.

The high speed, high resolution recording and flexible triggering modes make the Ametek TR ideal for capturing all forms of line transients from conductor clashes and lightning strikes to spikes and sub-cycle distortion. It can be used for verifying protection/breaker operation as well as monitoring power quality.

- 8 to 32 Analog Channels
- 16 to 64 Digital Channels
- Simple-to-Service Plug-in Circuit Card Design
- Substation Environment Qualified
- Extensive, Flexible Remote-Controlled Triggering
- Full 12-Bit A/D With Simultaneous Sampling
- DC Coupling Standard
- Standard ISA Bus Architecture For Easy Upgrades
- Simple Point-And-Click Windows Interface
- Full Context-Sensitive Help
- Waveforms Displayed At Highest Resolution Possible On Your Monitor
- Fault, Trend, Flicker and Harmonic Recording Simultaneously
- Traditional Fault Recording
- Optimize Switchgear Maintenance
- Long-Term Load Data For Planning
- Harmonic Recording
- Voltage Quality Monitoring
- Windows™ Based Graphical User Interface (GUI) For Ease Of Use

The TR's unique dynamic post fault length optimizes data memory usage by terminating the recording of a record once a steady state has returned for a predefined period. Short faults generate short records while a longer fault will cause the fault recording period to be extended.

Local parameter setting and record transfer is performed simply by plugging in a portable computer running Ametek's Windows™ based software into the port on the front panel of the TR-100. One computer can be used for many TR-100's, thereby reducing costs and making the parameter and fault record data more secure.

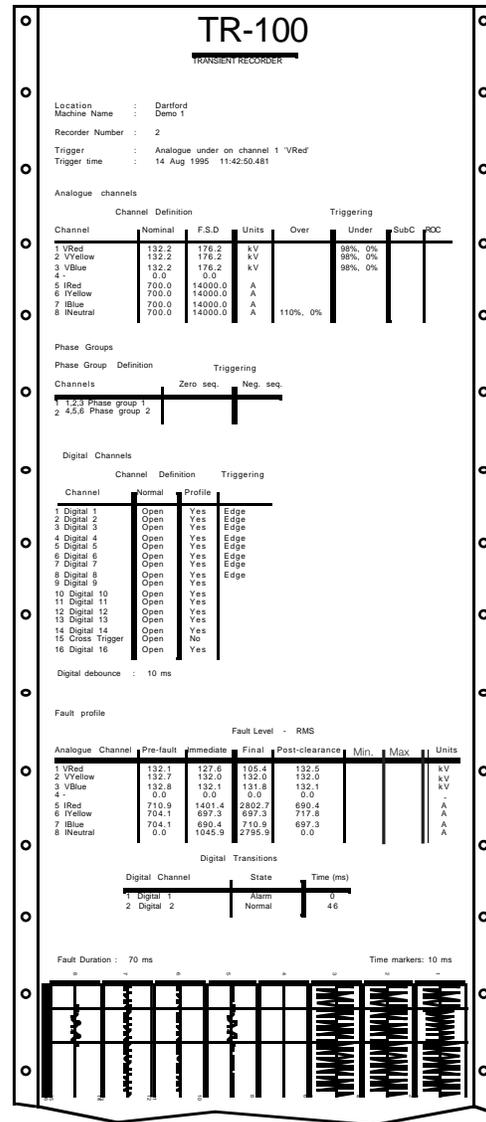
The TR-100 is typically part of an integrated monitoring network with multiple TR's located within substations over a region, and a Windows™ based Master Station normally located in the engineering department or in a control center running Ametek's Communication, Configuration and Analysis software. Communications between the Master Station and the TR's is normally by plug-in data modems using the local telephone exchange, but other networks can be supported.

Any number of TR-100 recorders can be cross-triggered together to extend the number of analog and digital channels forming a single system.

## Features

- 486 industrial grade CPU
- Downloadable firmware
- 16 Mbytes of RAM memory (optional internal hard disk drive)
- Up to 192 samples per cycle sample rate
- Real time graphical display and numeric measurement for easy and accurate trigger level setting
- Software triggers available simultaneously
  - Under limit violation with adjustable hysteresis per input (real time display/ measurement available)
  - Over limit violation with adjustable hysteresis per input (real time display/ measurement available)
  - Rate of change trigger per input
  - Sub-cycle drop out (sinewave distortion) trigger per input
  - Negative sequence component (real time display/ measurement available)
  - Zero sequence component (real time display/ measurement available)
  - Over, Under and Rate-of-Change of Frequency (1 per chassis)
  - Digital Inputs; level, or edge with selectable return-to-normal triggering
- DC pulse or optional IRIG-B (time code) time synchronization

## Printing of Fault Records



### HEADER

Fault records may be printed locally by the TR-100 or TR-2000 as shown in the sample on the left, or remotely at the Master Station using Ametek Analysis software. Every record has the location of the recorder, the time and date of the record and the source of the trigger.

### CONFIGURATION

The names, scales and trigger levels of each analog and digital channel are shown next.

### PHASE GROUP CONFIGURATION

Two phase groups are available per every 8 inputs.

### RECORD PROFILE

The configuration is followed by a profile of the record with actual signal levels, durations and digital transition times measured from the data.

### GRAPHICAL PLOT

The analog and digital inputs are then displayed in graphical form with horizontal lines indicating the start and end of the trigger condition.

# AMETEK Recorders

## Mechanical Specifications

### INPUTS

- Voltage Inputs:** 69-120V rms nominal, 212V rms full scale
- Current Inputs:** Typically 1 or 5A rms selected by external shunt or CICT.
- Input Coupling:** DC (0) to 3,000Hz, (+0dB, -3dB)
- Accuracy:** Better than 0.5% F.S.
- Digital Input FCV:** 24, 48, 125 or 250V dc wetted contact NO/NC.
- Digital Input Debounce:** 0 to 10mSec selectable in 1mS steps (for triggering only)
- Capacity:**
- TR-116 Max.:** 16 analog (V or I selectable), 32 digital.
  - TR-132 Max.:** 32 analog (V or I selectable), 64 digital.
- Input Expansion:** In increments of 8 analog and 16 digital. Systems to 128 analog inputs or more are available.

### RECORDING

- Resolution:** 12 bit A/D (1:4096).
- Media:** 16 Mbytes RAM, optional internal hard disk drive.
- Sampling Rate:** User selected (24-192 samples/cycle)
- Total Recording Time**
- RAM:** 16 Mbytes (approx. 37 seconds at 96 samples/cycle with 32 channels)
  - Hard Drive:** Up to a maximum of 1024 records. 2 to 100 cycles.
- Pre-fault Time:** 8 cycles to 10 Sec. Fault length can optionally extend for as long as a trigger condition exists to a max. limit.
- Maximum Record Length:** 15 sec.
- Synchronization:** All channels sampled simultaneously.
- Multi-Recorder Synchronization:** Channels between cross triggered recorders are timed to within 1 sample.

### TRIGGERING

- Analog:** Over limit violation with hysteresis  
Under limit violation with hysteresis  
Rate of Change  
Zero sequence  
Negative sequence  
Sub-cycle drop out (Sinewave Quality)  
Frequency
- Accuracy:** Better than 2%.
- Digital:** Alarm and return to normal, edge or level sensitive.

### SERIAL COMMUNICATIONS

- Port Types:** 2 x RS-232, one local, one remote.
- Programming:** Recorder identification. (Location/Name)  
Channel parameters and labels.  
Trigger levels and enables.  
Sample rate and fault capture times.  
Memory operation (Stop/Overwrite).  
Time and Date  
Printer setup  
Modem setup
- Modem:** Hayes compatible, internal or external type.

### PRINTING (Local to Recorder)

- Printer Port:** Standard Centronics type.
- Printer Selection:** Consult factory for latest list of laser, inkjet and dot matrix printers.
- Output Reports:** System configuration.  
Fault record header.  
Fault record profile comprised of measured values for ...  
Fault duration and faulted channel.  
Pre, during and post fault values per analog channel.  
Digital channel timing.  
Plot of fault record  
Diagnostics and error log.

### TIME BASE

- Resolution:** 0.1mSec.
- Internal Clock Accuracy:** Better than 1 Sec. per day.
- Synchronization:**
- DC (std.):** 1 pulse per second, minute or hour on digital input 16.
  - IRIG-B (opt.):** From station clock.

### FRONT PANEL STATUS DISPLAY

- LED Indicators:** Power on (green).  
Armed/ready (green).  
New events (amber).  
Communications (amber).  
Attention (red).
- Push Button:** Test, disarm and rearm recorder.  
Hard drive
- Options:** Trend recording  
Harmonic recording  
DNP 3.0  
Fax output  
Flicker Recording  
Ethernet

### STATUS RELAYS

- Operating Voltage:** 24, 48, 125 or 250V DC external coil supply  
125V DC/380V AC, 5A max.
- Contact Rating:** Power OK.  
Armed/ready.  
Attention.  
System triggered (minimum on time 500mS).

### OPERATING VOLTAGES

- Prime Power:** 88 to 300V DC, 85 to 264V AC standard. 24 or 48V DC optional.
- Burden:** <20 VA load (8 channels)
- Backup Battery:** Internal battery for real-time clock and parameter memory.

### ENVIRONMENTAL

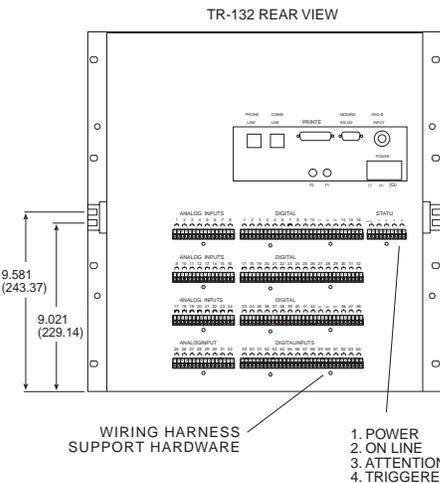
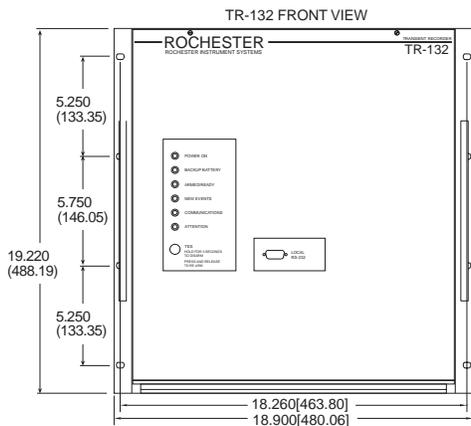
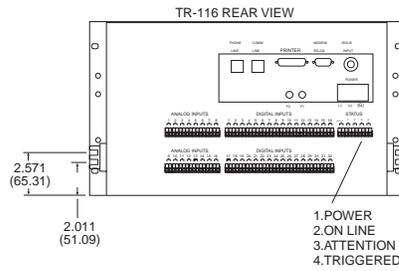
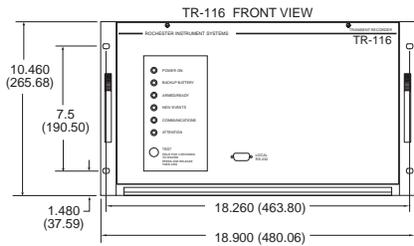
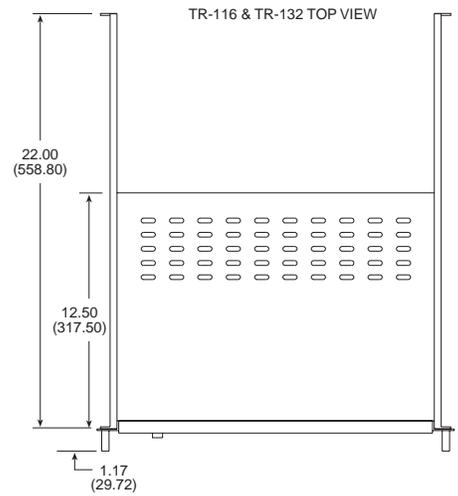
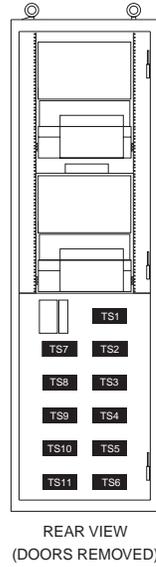
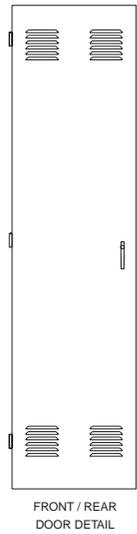
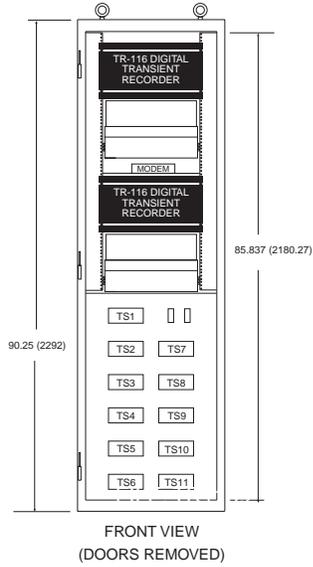
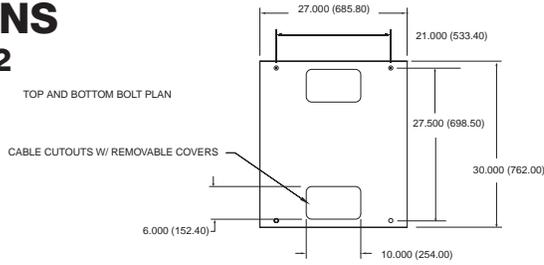
- Operating Temperature:** -10°C to 55°C.
- Humidity:** 0 to 95% RH non condensing.
- Isolation:** 2kV rms for 1 minute (channel to channel and channel to ground).  
1.5kV rms on power supply
- Impulse Withstand:** 5kV, 1.2/50µSec, 0.5 joule.
- Surge Withstand:** 2.5kV, 1MHz damped sine wave per standards ...  
IEEE/ANSI C37.90.1-1989.  
IEC 255-4.  
IEC 255-5.
- RFI Protection:** Per IEEE/ANSI C37.90.2-1987.

### MECHANICAL DETAILS

- TR-116 Rack:** 19" wide rack, 30lbs (13.7 Kg)  
7U high (12.23").
- TR-132 Rack:** 19" wide rack, 60lbs (27.4 Kg)  
11U high (19.23").
- Mounted:** 19" rack mounted.
- Terminals:** Rear access screw compression type - up to 14ga.
- DL8000 Size:** 21 1/8"W x 11 3/4"H x 21 3/4"D  
541.7mm x 301.3mm x 557.7mm
- Weight:** 50 lbs (22.7Kg)

# SPECIFICATIONS

## TR-116 and TR-132



# AMETEK Transient Recorders

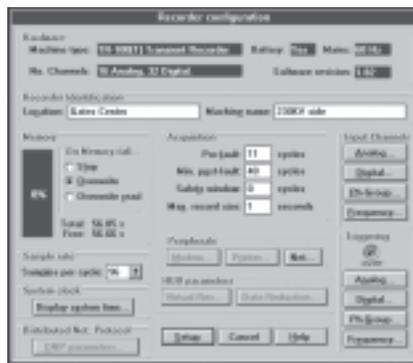
## Master Station Analysis Software

After retrieving the necessary fault records using the communications software, the analysis package allows the Master Station to display fault records, analyze them and print to any Windows™ supported printer.

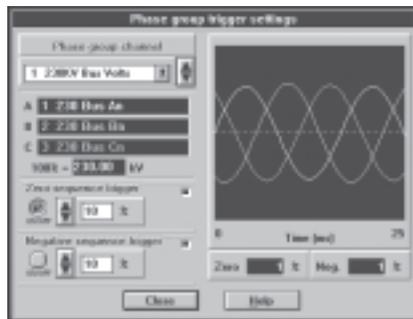
This analysis software provides a complete set of functions for complete power system fault analysis with built in tools to simplify the setup of displays and printer functions. The user interface follows the recommended Windows conventions and gives several options to manipulate waveforms through keyboard and/or mouse operation.



Analog Trigger Settings Window, where the Real Time Values for each Voltage and Current Input can be read.



Main Operating Parameters are set up from this window.



Zero and Negative Sequence Component Trigger Settings Window, where three channels make up a Phase Group. The Real Time Sequence Components are displayed. Color coding allows user to verify proper channel selection and wiring.

## File Features:

- Full support of the Comtrade file format

## Display Features:

- Add, remove or rearrange waveforms on screen
- Place waveform cursors to read time and amplitude
- Select channels and time range for display, printing or modification of display parameters
- Dynamic scaling of waveforms

## Analysis Features:

- Reports channel that triggered each fault record
- Instant graphic measurements of time and amplitude differences between two points on waveform

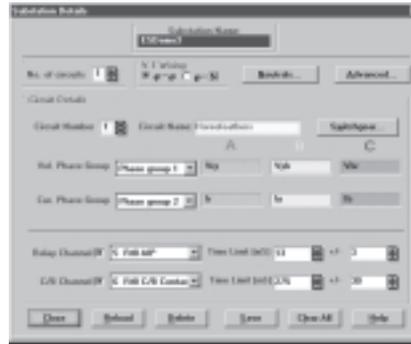
## Printing Features:

- Works with nearly all Windows™ supported printers
- High-resolution printing
- Color printing

## Expert System Software

The suite of Expert System Software consists of three separate packages that are linked together by a shared database created by the user in the Automated Analysis portion of the software.

The three packages are the Expert System (Automated Analysis), Voltage Dip Analysis, and Breaker Performance Monitor.



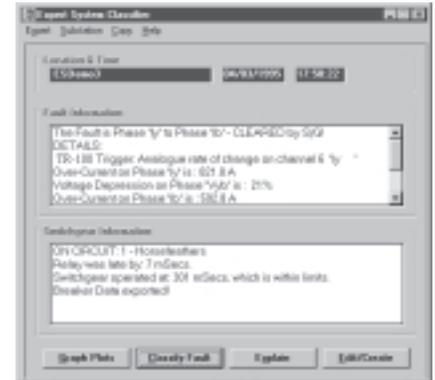
### Basic Substation Configuration

This screen is used to configure each circuit being monitored and the “filters” used to create reports. Thereby increasing the efficient utilization of data while reducing workload.



### Automated Analysis Results

Above is a sample of the automated analysis results obtained automatically during Auto-poll or Auto-call. This text can be viewed without having to open and view the waveform data. The full waveform/fault data is still available for analysis if needed.



### Manual Analysis Output

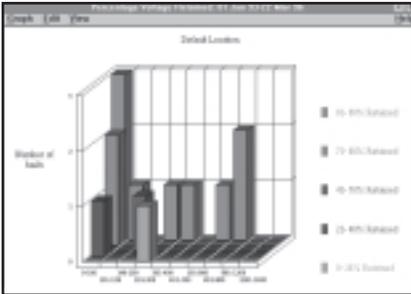
Above are the results from manually calling up the automated analysis. Below is an Explanation Window that can be accessed for a summary of why the program reached the conclusion it did.



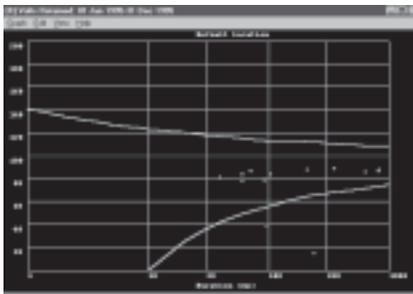
# AMETEK Recorders

## Voltage Dip Analysis

Below is a sample plot from the Voltage Dip Analysis software package. This shows the ability to take a series of faults from a specific location and plot the voltage retained against the duration of the faults, showing the quantity of faults for each interval/retention. This is useful for comparing voltage quality at different locations or at the same location after changes to the power system have been made. This can also be used to show variations in the voltage retained as faults propagate through the various voltage levels. Plots can be customized for time interval, magnitude and voltage drop. This allows users to customize the plots shown to management or users of electrical power.



Using the Voltage Dip Analysis software, the same series of faults can be plotted against standard limit curves such as CEBEMA or other user created curves as shown below.

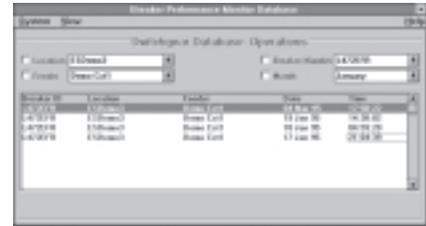
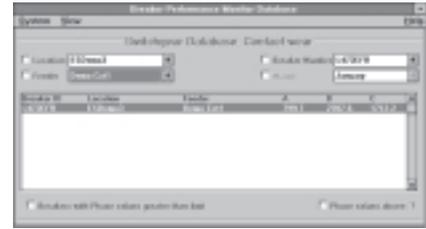


## Breaker Performance Monitor

After each fault has been analyzed by the Expert System, the results can be passed to the Breaker Performance Monitor software (BPM). At the bottom is the BPM setup screen.

The BPM software uses the data for each breaker operation to track breaker wear 3 different ways: the cumulative current interrupted (shown at top right), the duty interrupted by the breaker based in  $i^n t$  (where  $n$  is user defined) or the number of operations for a breaker (shown at bottom right).

Since the information is kept in a database, it is easy to switch between the 3 methods eliminating the need for stand-alone devices.



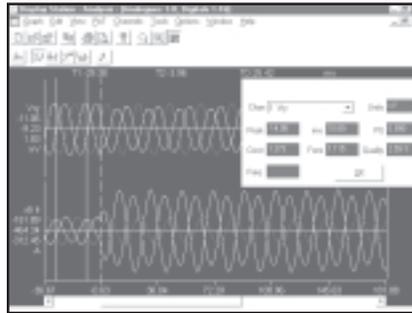
## Power Analysis Tools

Ametek' Power Analysis Tools (PAT) is a set of mathematical calculations which can be applied to waveforms displayed using Display Station software. PAT contains 3-phase calculations for lines or circuits, yielding peak, RMS, per unit values, power quantities (MVA, MW, MVAR, X/R), frequency, distortion and sequence components.

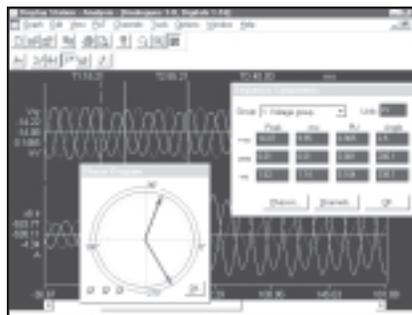
It also provides phasor display and harmonic analysis. PAT is used by calling the set of tool ICONs to the screen, then selecting a waveform and tool to be used. PAT will then display the resulting graphical and tabular data.

The use of color and graphics enhances the understanding of the power system situation.

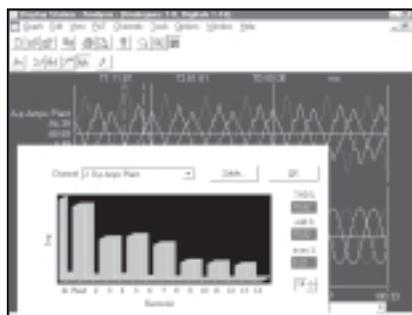
For added enhancement to analyzing data, there are now a variety of calculations that can be done to create virtual channels.



*Event Waveform Display Window, with the Power Analysis Toolkit active. Single Channel Calculations made on any channel over a selected time frame.*



*Event Waveform Display Window, with the Power Analysis Toolkit active. Sequence Components calculated on a Phase Group basis. A Phasor Diagram is also displayed with the angle based on the start of the selected region.*

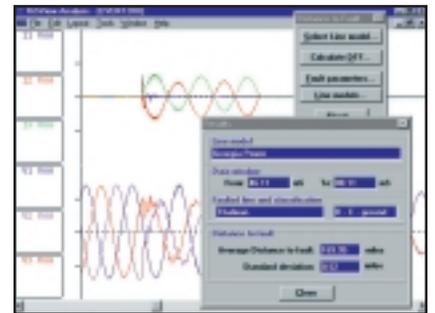


*Event Waveform Display Window, with the Power Analysis Toolkit active. Harmonic Analysis on any channel over a selected time frame.*

## Distance-To-Fault

The Distance-To-Fault (DTF) program uses user-entered line parameters to analyze fault data and calculate distance to the fault from the recorder which saw the fault. DTF is accurate to 2% when untapped 2-terminal transmission lines are analyzed. It cannot be used on tapped or multi-terminal lines. The user must have some knowledge of line characteristics as computed by EMTP or similar computer simulations to use DTF.

Even if DTF isn't used for new-real time fault location and crew dispatch, it is a useful tool for verifying power system models used for relay settings.



*Event Waveform Display Window, with fault location results identified.*

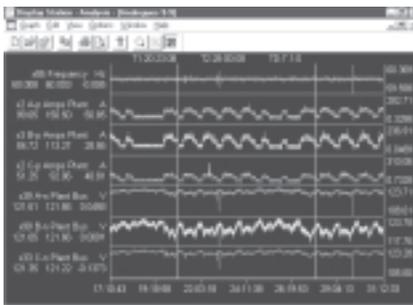
# AMETEK Recorders

## Recording Simultaneous Faults, Trend Data, Harmonic Profiles, Flicker, and other power parameters

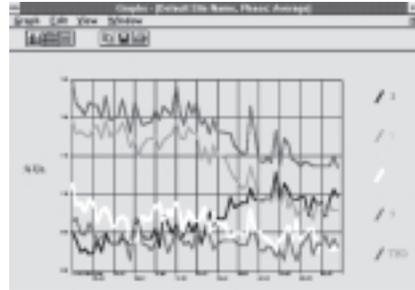
The Ametek recorders have the ability to record faults, trend data and harmonic profiles simultaneously eliminating the need for circular chart recorders or other IED's.

The trend duration varies by recorder and the storage interval varies by parameter.

This Trend Data can be used for load balancing, voltage regulation verification, equipment sizing and many other applications.

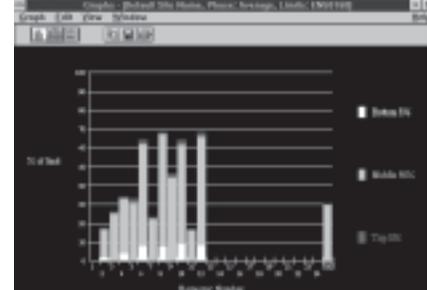


## Harmonix



## Recording Harmonic Spectrum

The TR-100, TR-2000 and PQR all have the ability to periodically record a harmonic spectrum from channels in the recorder. A variety of plotting methods are available to the user. Above is a sample file showing a 12-hour interval at a 10 minute sample rate. The magnitude is plotted as a % of the fundamental frequency (50/60Hz) input magnitude. It can also be plotted as an absolute magnitude. This shows all of the odd harmonics plus THD as an average of all phases of the circuit. Additional plot options include comparing the minimum, maximum and average magnitudes of various harmonics recorded for the time window selected.



## Custom Limits

This plot shows the same data plotted against a standard limit such as IEEE519 or EN50160 (EN is shown above). Custom limits can be created by the user. The green portion of the plot show the % samples (over the time window plotted) that were between 0-5% of the maximum recorded value for that harmonic. The blue portion is the relative number of samples that were between 5-95% of the maximum recorded value and the red is the relative number of samples in the 95-100% range. Additionally, single sample intervals for the harmonics for all 3 phases can be displayed.

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## Optional Hardware

### Resistive Current Shunt

The Resistive Current Shunt is designed for permanent applications as an interface from the CT secondary wiring to the Ametek family of recorders.

The shunt's compact design make it ideal for mounting within fault recorder panels.

Being resistive rather than inductive, greater levels of accuracy in terms of phase angle and magnitude are possible. Thus, Ametek recommends the use of this type of shunt, particularly in applications where Distance to Fault calculations are to be made or knowing DC off-sets during the fault is critical.

### Current Isolator CT

The clip-on Current Isolator CT (CICT) is ideal for monitoring current channels when it is not possible to interrupt the CT circuit to install a resistive shunt. You can also use the CICT's for temporary/portable installations.



All CICT's connect safely and easily to existing CT secondary wiring without alteration, shunts or test switches. So you'll save on expensive installation time and hardware.

They can be mounted up to 2,000 feet from the recorder, using standard shielded cables.

### DNP 3.0 Protocol

The Ametek recorders have the ability to communicate to the SCADA/EMS system using the DNP 3.0 protocol. Data available includes magnitudes from any channel, frequency, or profile from the most recent event and diagnostic data.

*Ranges: 1.0A up to 12.5A nominal. Full scale is 20 times nominal*

# AMETEK Recorders

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## Ametek Customer Support

### Factory Acceptance Testing



Ametek encourages customers to visit the factory at any time. As part of the system purchase, you can send personnel in to witness our standard testing of the recorders. An added benefit is the exposure your personnel will get to the basic operation of the recorder and associated software. This considerably reduces the learning curve in most situations for those that have not used the software or recorders previously.

### Training



Ametek offers a full compliment of Training Courses for both the recorders and software. Most effective after the systems have been installed and in use for a period of time, the classes range from Familiarization Training to Recorder Operation, Software Operation and System Troubleshooting. These courses can be held either at your site or at the factory – whatever is most convenient for your personnel.

### Installation and Start-up Services



To assist in starting up the systems, Ametek can supply a qualified Field Service Technician to verify system configuration, settings and field wiring. At the same time, your technicians get additional exposure to both the hardware and software making future operation easier for them. Additional services may be contracted to do complete installation including laying field wiring for the inputs. Ametek also provides a toll-free number (for the US and Canada) for technical support any time you have questions.

## DL-8000 and DL-9000 Portable Recorders

**The DL-8000 and DL-9000 are advanced power monitoring systems in a rugged portable package.**

The DL-8000 and DL-9000 portable systems are equipped to support a range of measurement transducers and connection options providing an attractive and flexible monitoring system for both the power utility and industrial user.

An extensive suite of Windows™ based software is available with the portable system for local (lap-top PC) or remote setup, data retrieval, analysis and reporting via modem or network communications.

- Motor Starts
- Relay, Fuse and recloser coordination and optimization
- Load Balancing
- Harmonic magnitudes
- Co-gen plant monitoring
- Motor control center monitoring
- Sags and Swells
- Steady-State Voltage Compliance
- Surges and transient changes
- Equipment Sizing
- Data for K-Factor calculations needs
- Flicker



The DL-8000 and DL-9000 portables have been designed to be easily installed on-site, vastly reducing any commissioning time. The system includes optional push-fit (shrouded) protective rear panel connections to analog and digital measurement points using fused jaw-clips, pigtail leads and non-invasive CT clamps.

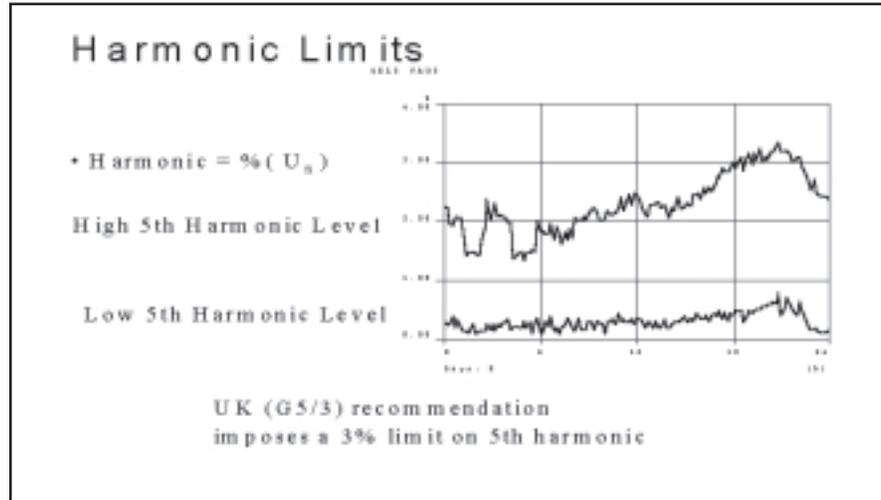
The DL8000 and DL-9000 portables have identical technical specifications to the TR-100 and TR-2000 recorders with some additional features and accessories to enhance portability and simplify equipment installation.



# AMETEK Recorders

## Features:

- Rugged Enclosure with Carry Handle
- Fault Recording using a Wide Range of Programmable Triggers
- Power Quality Event Capture and Analysis
- Provides 8 Analog/16 Digital Input Channels or optional 16 Analog/32 Digital Input Channels
- Uses a Range of CT Clamps for Non-Invasive Connection
- Supports  $\Delta$ -Y (3 or 4 wire) VT Connections
- Extensive Windows™ based Applications Software
- Universal AC/DC Supply
- Logged Recording of Voltage, Current, Harmonics, Flicker and Frequency using Integral Hard Disk



Harmonics Logging Comparing Same Location at 2 Different Times

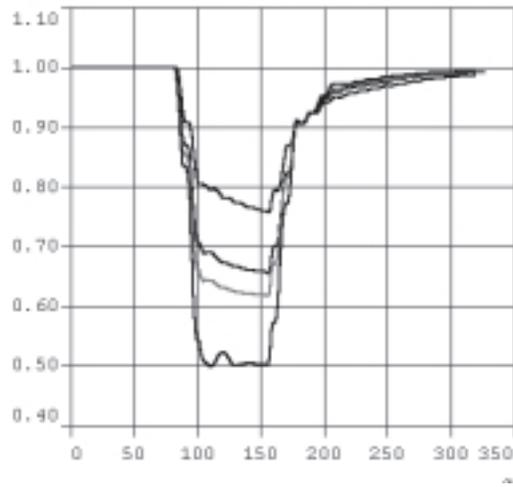
## Options:

- Cellular Modem for Remote Communications
- Ethernet Card for Network Support
- Push-fit Rear Panel Connectors and Test Leads for Simple Installation
- Voltage Divider for 600, 480 and 277V Systems
- CT Interface Unit supporting a Wide Range of CT Ratios and scaling



Waveform Capture (simultaneous on up to 16 analog and 32 digital inputs)

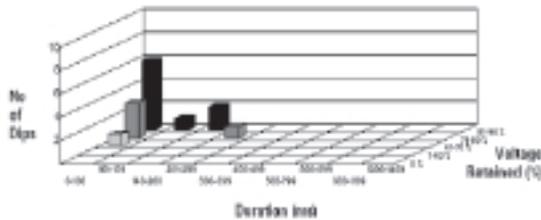
275 ---> 11KV  
 fault propagation  
 shows how severe  
 faults at transmission  
 levels affect all other  
 voltage levels



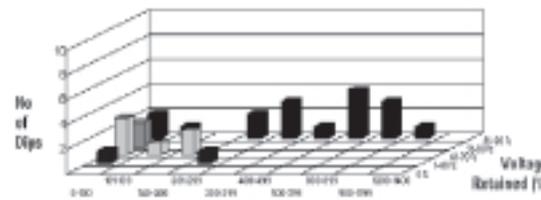
Voltage Fault Propagation Comparing Voltage Dip Severity at Different Power System Voltage Levels

## Voltage Dips Profiles (May - Sept. 1995)

Site A.



Site B.



Voltage Dip Profiles for Power Quality Assessment Comparing 2 Sites Over Same Time Interval

# AMETEK

## Power and Fault Recorders

### **P&QR128 and P&QR256** Comprehensive Power and Fault Recorders with Advanced Features

Identify power and fault data with the affordable P&QR series power and fault recorders.

Whether you are a utility identifying power and fault problems on the power grid, or a facilities manager monitoring power quality concerns in your plant... the P&QR Series offers the perfect, affordable solution you've been looking for.

#### **For Utilities**

Deregulation means increased competition for utilities. Providing affordable power quality affirmation to your key customers is critical to keep customers from migrating away, and to win new customers. The P&QR128 and P&QR256 are useful for troubleshooting relay misoperation. The P&QR Series offers utilities incredible flexibility, ease of use, durability, and perhaps most importantly, dramatic cost savings!

#### **For Customers**

For even modest sized power customers, doing business in this newly deregulated environment, a power quality monitor is one of the best investments your company can make! Your power and fault monitor will help you take surveys of sufficient length and provide the information you need to decide exactly how to best buy your power: spot, flat rate, time of use, seasonal. Your P&QR128 or P&QR256 can easily pay for itself in a short period of time. Providing answers about your power consumption is only the beginning, many additional benefits are yours with a P&QR128 or P&QR256 from Ametek Power Equipment.



#### **Economic Incentives!**

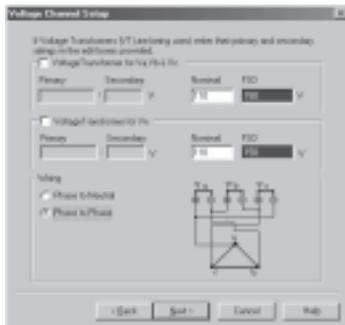
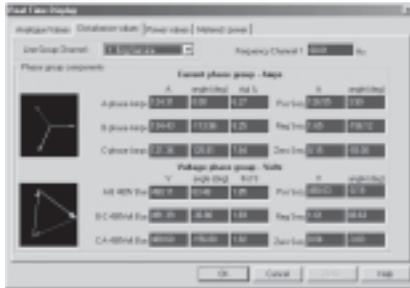
One of the biggest reasons to buy your new P&QR128 or P&QR256 is purely economic! We've packed many high end fault recording functions into a well built unit that is offered at a very low cost. The P&QR Series has many of the functions that you would expect in a fault and power quality recorder. However, we would like to point out many features that are rare for a unit at this price, and even some features that are not available on other units at any price!

- **First, these Power Quality Recorders have enormous data storage capacity. They come with a standard 6 gigs of storage. This gives you plenty of flexibility for long measurement surveys, or short highly concentrated data collection.**
- **The units are phase locked looped to offer you extraordinary sampling accuracy even if the frequency you are monitoring shifts. Most competitive products don't have this capability.**
- **Ametek Power Equipment P&QR Series has excellent RFI rejection, minimizing the unwanted effects of cell phones, computers, broadcast, or hand-held radios.**
- **You can identify and isolate**

**problems using the fault recording and waveform capture capabilities.**

- **The low cost P&QR128 and P&QR256 offer great flexibility to the Power Quality professional. For instance, you can take advantage of its multiple-voltage ranges and selectable CT scaling to obtain improved accuracy by optimizing your A to D measurement.**
- **Best of all, these units have optional ethernet or modem connectivity so you can get the data you need without having to leave your chair.**
- **The dynamic P&Qs software will quickly and easily help you get the most out of your P&QR. A more complete explanation of P&Qs follows.**
- **Check out the technical specifications chart to see all the terrific features offered by the P&QR128 and P&QR256.**

Whether it's avoiding a costly plant shut down, finding power quality problems or just making sure that you are paying the lowest possible price for your electricity usage... the Ametek Instrument System P&QR is the right solution for you!



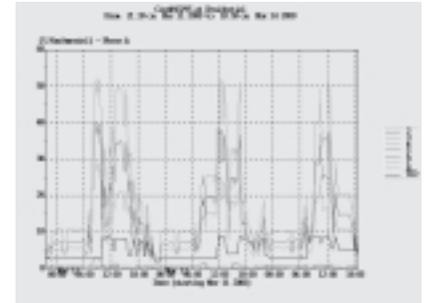
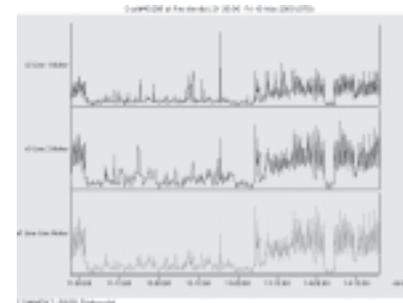
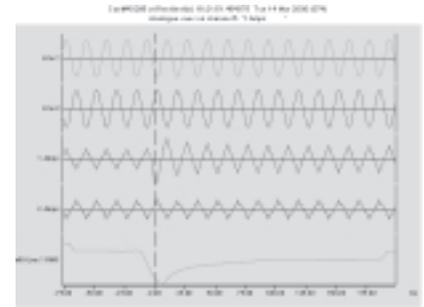
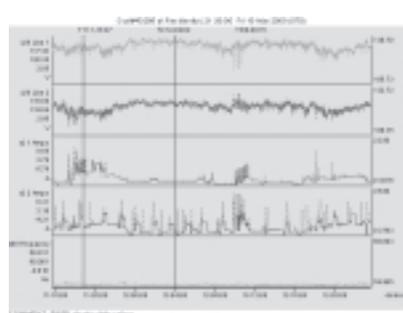
- Determine the lowest possible price for power
- Pays for itself in savings
- Large memory capacity allows for long surveys or short concentrated data collection
- Extraordinary sampling accuracy
- RFI rejection minimizes the effects of outside interference
- Isolates problems with waveform recording
- Optimizes A to D measurements
- Optional internet transports data to you
- Enclosed unit can be used outdoors

## Features

- 8 channel input:  
4 voltage, 4 current
- 14 bit recording
- 8 Mbytes internal memory
- 6.4 Gbytes hard disk
- Sample rate 128/cycle (optional 256/cycle)
- Relay input
- Real time clock
- Measures waveform faults
- Measures voltage dips and surges
- Measures harmonics
- Measures flicker and imbalance
- Records voltage and current, frequency and real power
- Computes demand, phase angle, power factor, and sequence components at PC
- Event triggering accuracy is better than 2%
- RS232 serial port
- Internal modem option available
- Ethernet network option available
- Free phone support
- Powerful P&Qs software for communications and analysis

## Benefits

- Affordable fault recording
- Provides power quality affirmation
- Simple to use



## P&Qs

This basic communications and configuration software provides autopoll and autocal support with auto-event retrieval for the P&Qs. As part of the polling process, the recorder clock can be updated and events can be retrieved. P&Qs is an abbreviated version of Display Station and Display Station Analysis.

## Autopoll/call

- Operates in a totally automatic mode if configured; operating both in parallel provides added reliability in detecting problems in communication and minimizing communication expenses.

## Auto-event retrieval

- The recorder sends data automatically to the PC where it is most useful. Retrieval of profile, cameo and/or fault data minimizes time to retrieve data in critical situations.

## Configuration control

- Recorder configurations for up to 10 P&Qs are stored at the PC. P&Qs flags the user if there are differences for better control.

## 32-bit Windows software

- Operates on the most common operating systems in use.

# AMETEK

## Power and Fault Recorders

### RiS P&QR TECHNICAL SPECIFICATIONS

#### INPUTS

No. of channels	8 (4 voltage, 4 current) consult factory for other configurations
Voltage inputs (options)	150 V RMS maximum 300 V RMS maximum 600 V RMS maximum Star (wye) or delta connections
Current inputs (options)	1/5A RMS nominal 100/200/500/1000 A RMS nominal (1.4V fsd. Int. or ext. burden) Designed to record to 40% overrange
Frequency response P&QR128	40Hz – 3kHz. (+0dB, -3dB for voltages) DC – 3kHz (+0dB for currents)
Frequency response P&QR256	40Hz – 6kHz. (+0dB, -3dB for voltages) DC – 6kHz (+0dB, -3dB for currents)
Accuracy	Better than 0.2% of full scale

#### RECORDING

Recording resolution	14 bits.
Recording accuracy	+/- 1 lsb.
Sample rate	128 samples per cycle 6.4/7.68k samples per second option for 256 samples per cycle 2 samples per cycle for high-speed RMS envelope capture

#### DATA STORAGE

Internal memory	8 Mbytes
Hard disk	6.4 Gbytes (minimum)

#### RECORDED DATA

Waveform Capture	4 cycles pre, 12 cycles post Option for up to 2 seconds Up to 1 minute of RMS data
Trending – (16 weeks)	Voltages: 1 minute min/max/avg Currents: 1 minute min/max/avg Frequency: 1 minute min/max/avg Watts: 1 minute min/max/avg Harmonics: 10 minute min/max/avg/angle to the 50th harmonic Imbalance: 10 minute min/max/avg Flicker: 10 minute Pst
Metered values	kVAh ±kWh ±kVAh
Computed (at PC)	Phase angle, power factor, demand (sliding or fixed window) and sequence components

#### EVENT TRIGGERING

Trigger parameters	Over/under level with hysteresis. ROC & THD
Accuracy	Better than 2%
Pre-fault time	4 cycles (128 or 256 samp/cyc); 1-10 sec. (2 samp/cyc)
Post-fault time	12 cycles (128 or 256 samp/cyc); 1-59 sec. (2 samp/cyc)
External trigger	Relay contact (24-120Vdc nominal)

#### POWER SUPPLY

Input voltage range	88–300V dc, 85–264V ac, 50/60Hz 24 or 48Vdc optional
Power requirement	20 VA
Battery	Optional 12V for recorder operation

#### REAL TIME CLOCK

Clock source	32,768 Hz. crystal oscillator
Resolution	1 ms.
Range	Time and date (including leap year and day of the year).
Synchronization	50/60 Hz from voltage input

#### COMMUNICATIONS

Serial port	RS232 type.
Speed	up to 57 kBaud
Modem (optional)	Hayes compatible type internal. (up to 57.6 kBaud)
Network (option)	TCP/IP 10Base2 or 10BaseT

#### VOLTAGE WITHSTAND

Isolation	Channel to channel (voltage) Channel to ground. 2 kV RMS for 1 minute (as per IEEE C37.90-1987/IEC 255-5)
Impulse voltage withstand	Channel to channel (voltage) Channel to ground 5 kV, 1.2/50 ms. 0.5 Joule (as per IEEE C37.90-1987/IEC 255-5)
Electrical fast transient (EFT)	4 kV, 5/50 ns. 15 ms burst length non-maloperate (as per IEEE C37.90-1987/IEC 255-22-1)
Surge withstand (SWC)	2.5 kV, 1 MHz HF burst disturbance non-maloperate (as per IEEE C37.90-1987/IEC 255-22-1)
RFI immunity	10 V/m 20 MHz – 1 GHz (80% AM @ 1 kHz). Non – maloperate (as per IEEE C37.90-1987/BS EN 50082)
RFI emission — radiated	40 dB mV/m (27 – 130 MHz) 47 dB mV/m (130 MHz – 1 GHz) EN 55022B (class 'B' limits) (as per BS EN 50081-1)
— conducted	(150 kHz – 30 Mhz) EN 55022B (class 'B' limits)
— harmonics	(100 Hz – 30 MHz) (as per IEC 555 class 'A' limits)
Electrostatic discharge (ESD)	8 kV contact, 15 kV radiated discharge. Non-maloperate (as per IEC 801-2)

#### ENCLOSURE

Mounting	Wall
Size	200 x 300 x 120 mm (7.87 x 11.8 x 4.7 in.) Optional 300 x 400 x 210 mm (11.75 x 16 x 8.25)
Weight	6 Kg. (13.2lbs.) Optional 8kg (17.6 lbs)

#### ENVIRONMENT

Operating temperature	-10 to 50 °C 14 to 122 °F
Storage temperature	-40 to 70 °C -40 to 158 °F
Humidity	5 – 95% RH (non condensing)

# Communications, Analysis and System Configuration

## Software

A single communication and analysis package is used for the TR-100, TR-2000 and P&QR series recorders. Additionally, when RVComms is used, the powerful analysis software can be used for the older TR-1600 series recorders.

Ametek's software programs provide advanced fault analysis, communication and configuration functions in a 486 based PC-compatible (minimum) computer. The programs have a very flexible graphical user interface which uses Windows 95™, 98™, NT or Windows 2000™. Many fault analysis features are provided and there are optional programs for additional

mathematical functions. There are two major modules of Ametek software available.

## Communications

This provides communication to, and configuration of, the TR-100, TR-2000 and P&QR series either (1) remotely via a modem link to a Master Station normally located in central engineering or at a control center, (2) locally via a direct connection on site or (3) via an Ethernet link.

The communications software has a unique feature that allows the user to set over and/or under trigger levels with hysteresis on the analog channels with the actual signal displayed in near real time. This waveform is overlaid with the equivalent trigger levels which improves the ease and accuracy of trigger settings (see next page).

Sub cycle drop out or THD triggers measure the quality of a voltage or current waveform. Small perturbations which would not be detected by

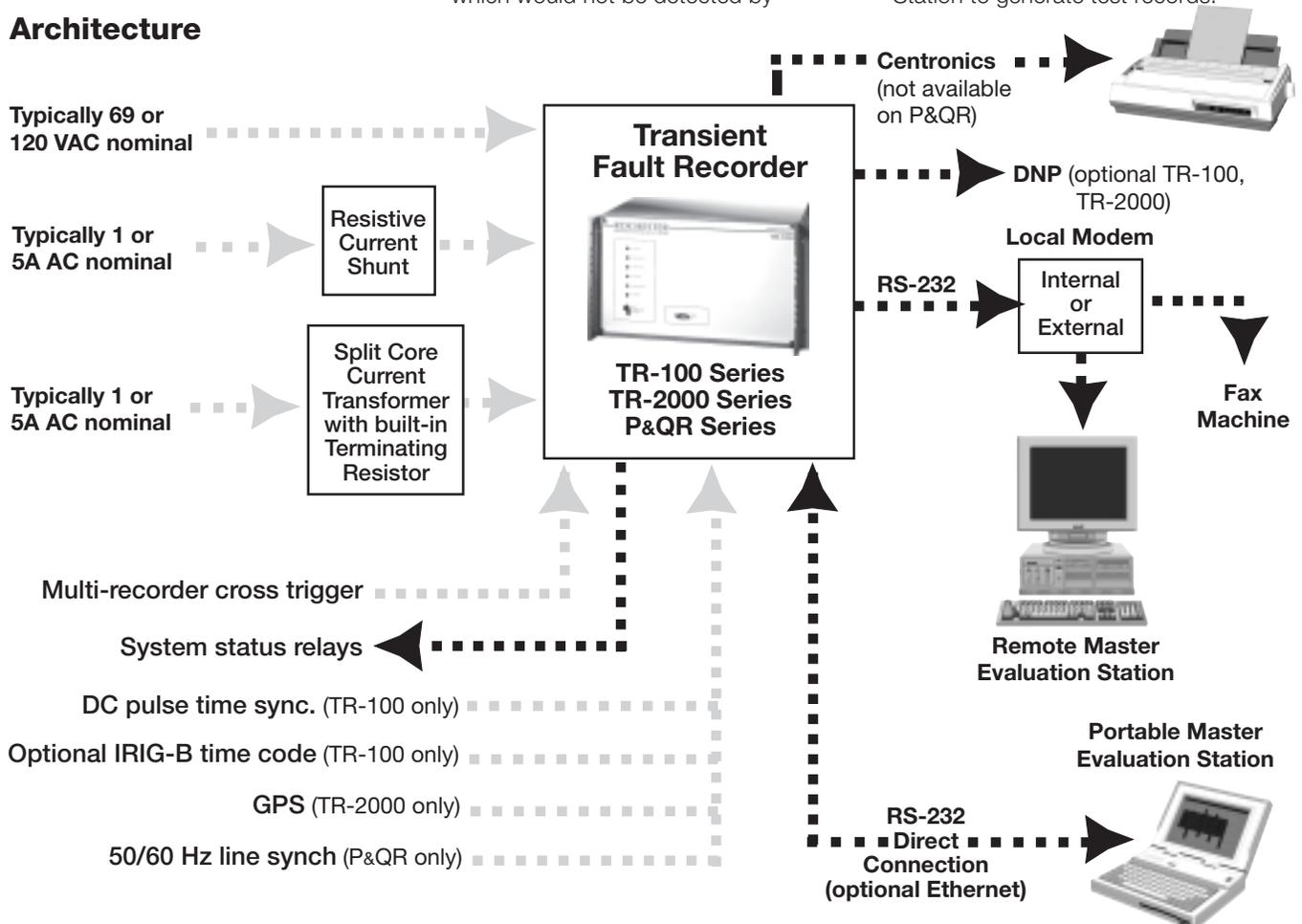
standard level or rate of change triggering can be recorded by the TR-100, TR-2000 or P&QR.

Sets of three analog channels can be defined as phase groups. For each group, zero and negative sequence component trigger levels can be set. Again, the display of near real time data ensures correct values are used and inputs are wired in properly (see next page). Two phase groups are available per 8 inputs.

The recorders can be set to dial up the Master Station when a fault is recorded (Auto Call) and the Master Station can be programmed to contact each recorder in a region at regular intervals to check for new records (Auto Poll). A communications log records any problems incurred during auto polling.

Unauthorized parameter updates and record downloading can be protected by passwords. A recorder may be remotely triggered from the Master Station to generate test records.

## Architecture





# AMETEK Power Quality

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**Deregulation means increased competition. For even modest sized power customers, an investment in power quality monitoring is one of the best a company can make. Ametek Power Instruments offers an array of accurate, flexible and easy to use power quality equipment and software.**

## **PQRx**

Innovative, comprehensive and affordable, the PQRx is a permanently mounted recorder that provides the information you need to decide exactly how to buy your power and looks at key power quality parameters.

## **AmetekPQSystem**

A complete, fully automated system which uses the power of the internet for everything from data collection to comprehensive report generation.

## **AmetekPQService**

Provides continuous monitoring and analysis and data collection, generates reports and supplies answers.

## **DL-8000/DL-9000**

Advanced power monitoring systems based on our fault recorder technology in portable packages.

## **Display Station Software**

Ametek's software packages provide complete control of power quality monitors and recorders, extensive sets of data viewing tools and a variety of communications options for the PQRx, DL-8000 and DL-9000.

## **AmetekAiPower**

Data monitoring and analysis software that expertly reads your power quality recorder data, analyzes it and recommends solutions.

## **Ametek ACE 4000**

Fully integrates an industrial grade Pentium™ PC with a high speed DSP based power quality analyzer in a portable package.

## **Ametek ACE 2000**

This permanent or portable unit measures all aspects of power consumption and performs the tasks of over 100 instruments.

## **Ametek ACE Quatro**

High resolution cycle-by-cycle power analysis from a smart portable featuring advanced single & three-phase power quality monitor/recorder and simultaneous sampling of 4 voltages, 4 currents.

*Ametek Power Instruments: providing answers about your power consumption is only the beginning.*



# AMETEK

## Power Quality

### PQRx Power Quality Recorders

#### Comprehensive Power Quality Recorders with Advanced Features

“Check up” on power quality data with the affordable PQRx Power Quality Recorder.

Whether you are a utility diagnosing a power quality problem on the power grid, or a facilities manager performing a scheduled check up on power quality concerns in your plant... the PQRx is the perfect, affordable remedy you've been looking for.

#### For Utilities

Deregulation means increased competition for utilities. Providing affordable power quality affirmation to your key customers is critical to keep customers from migrating away, and to win new customers. The PQRx offers utilities incredible flexibility, ease of use, durability, and perhaps most importantly, dramatic cost savings!

#### For Customers

For even modest sized power customers, doing business in this newly deregulated environment, a power quality monitor is one of the best investments your company can make! Why just spot check? The PQRx is an affordable monitor which allows continuous monitoring, reducing and even eliminating the odds of missing a PQ event. Further, you collect important trend information, which indicates if problems are getting worse, better, or are just a one-time anomaly. Your power quality monitor will help you take a survey of sufficient length to provide the information you need to decide exactly how to best buy your power: spot, flat rate, time of use, seasonal. Your PQRx can easily pay for itself in a short period of time. Providing answers about your power consumption is only the beginning, many additional benefits are yours with an PQRx from Ametek Power Instruments.



#### Economic Incentives!

One of the biggest reasons to buy your new PQRx is purely economic! We've packed many high end recording functions into a well built unit that is offered at a very low cost. The PQRx has many of the functions that you would expect in a power quality recorder. However, we would like to point out many features that are rare for a unit at this price, and even some features that are not available on other units at any price!

- **First, this Power Quality Recorder has enormous data storage capacity. It comes with a standard 6 gigs of storage. This gives you plenty of flexibility for long measurement surveys, or short highly concentrated data collection.**
- **The units are phase locked looped to offer you extraordinary sampling accuracy even if the frequency you are monitoring shifts. Most competitive products don't have this capability.**

- **Ametek Power Instruments PQRx has excellent RFI rejection, minimizing the unwanted effects of cell phones, computers, broadcast, or hand-held radios.**
- **You can identify and isolate problems using the fault recording and waveform capture capabilities.**

- **The low cost PQRx offers great flexibility to the Power Quality professional. For instance, you can take advantage of its multiple-voltage ranges and selectable CT scaling to obtain improved accuracy by optimizing your A to D measurement.**
- **Best of all, these units have optional internet connectivity so you can get the data you need without having to leave your chair.**
- **The dynamic Ametek PQSystem software will quickly and easily help you get the most out of your PQRx. A more complete explanation of PQSystem LE software follows.**
- **Check out the Technical Specifications chart to see all the terrific features offered by the PQRx.**

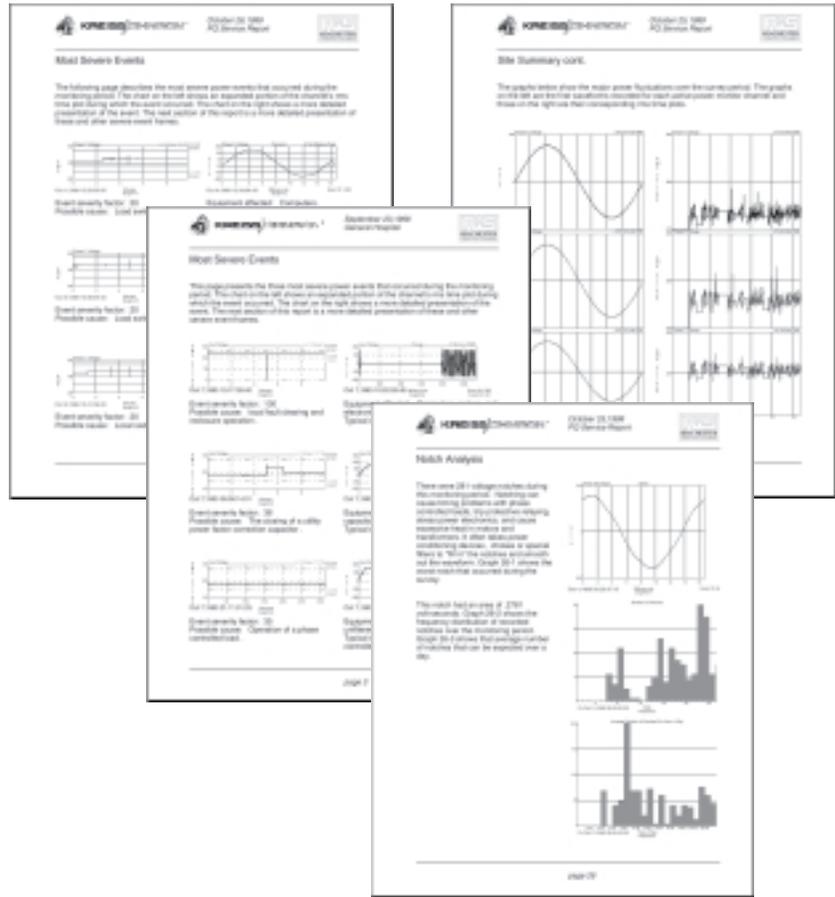
Whether it's avoiding a costly plant shut down, finding power quality problems or just making sure that you are paying the lowest possible price for your electricity usage... the Ametek Power Instruments PQRx is the right prescription for you!

## PQRx Features

- 8 channel input:  
4 voltage, 4 current
- 14 bit recording
- 8 Mbytes internal memory
- 6.4 Gbytes hard disk
- Sample rate 128/cycle
- Relay input
- Real time clock
- Measures waveform faults
- Measures voltage dips and surges
- Measures harmonics
- Measures flicker and imbalance
- Records voltage and current, frequency, and real power
- Computes demand, phase angle, power factor, and sequence components at PC
- Event triggering accuracy is better than 1%
- RS232 serial port
- Internal modem option available
- Ethernet network option available
- Free phone support
- Ametek PQ System software

## PQRx Benefits

- Provides complete range of power quality events
- Simple to use
- Determine the lowest possible price for power
- Pays for itself in savings
- Large memory capacity allows for long surveys or short concentrated data collection
- Permits longer survey periods than traditional power quality studies
- Extraordinary sampling accuracy
- RFI rejection minimizes the effects of outside interference
- Isolates problems with waveform recording
- Optimizes A to D measurements
- Optional internet transports data to you
- Enclosed unit can be used outdoors
- Low maintenance
- Artificial intelligence in software provides answers and solutions, not just data



## PQSystem Software

Automated data gathering and comprehensive report generation for the PQRx are provided by the PQSystem software. This software uses the power of the internet to provide instant analysis and solutions to reduce downtime, prevent equipment damage and monitor energy costs.

### Answers, not just data

- Instant, automated analysis and solutions
- Continuous review and interpretation of data
- Reduces downtime from PQ problems
- Manages energy costs

### The power of the web

- Easy access to analysis reports
- Download reports to your word processor

### Automation

- Automated data collection and analysis
- Automatically generated reports

### Warning System

- Avoid power quality problems with continuous analysis and trend information
- Identify problems before damage occurs

### Open Architecture

- No compatibility limitations
- Interfaces with most monitors
- Stores data in ODBC compliant database

### Auto-call and paging

- Unique to PQSystem and PQRx, the recorder auto-transfers data to a PC and the PC pages appropriate personnel for near instantaneous notification of problems

# AMETEK

## Power Quality

### RiS PQRx TECHNICAL SPECIFICATIONS

#### INPUTS

No. of channels	8 (4 voltage, 4 current) consult factory for other configurations
Voltage inputs (options)	150 V RMS maximum 300 V RMS maximum 600 V RMS maximum Star (wye) or delta connections
Current inputs (options)	1/5A RMS nominal 100/200/500/1000 A RMS nominal (1.4V fsd. Int. or ext. burden) Designed to record to 40% overrange
Frequency response	40Hz – 3kHz. (+0dB, -3dB for voltages) DC – 3kHz (+0dB for currents)
Accuracy	Better than 0.2% of full scale

#### RECORDING

Recording resolution	14 bits.
Recording accuracy	+/- 1 lsb.
Sample rate	128 samples per cycle 6.4/7.68k samples per second 2 samples per cycle for high-speed RMS envelope capture

#### DATA STORAGE

Internal memory	8 Mbytes
Hard disk	6.4 Gbytes (minimum)

#### RECORDED DATA

Waveform Capture	4 cycles pre, 12 cycles post Option for up to 2 seconds Up to 1 minute of RMS data
Trending – 16 weeks	Voltages: 1 minute min/max/avg Currents: 1 minute min/max/avg Frequency: 1 minute min/max/avg Watts: 1 minute min/max/avg Harmonics: 10 minute min/max/avg/angle to the 50th harmonic Imbalance: 10 minute min/max/avg Flicker: 10 minute Pst
Metered values	kVAh ±kWh ±kVArh

#### EVENT TRIGGERING

Trigger parameters	Over/under level with hysteresis. ROC & THD
Accuracy	Better than 1%
Pre-fault time	4 cycles (128 or 256 samp/cyc); 1-10 sec. (2 samp/cyc)
Post-fault time	12 cycles (128 or 256 samp/cyc); 1-59 sec. (2 samp/cyc)
External trigger	Relay contact

#### POWER SUPPLY

Input voltage range	88–300V dc, 85–264V ac, 50/60Hz 24 or 48Vdc optional
Power requirement	20 VA
Battery	Optional 12V for recorder operation

#### REAL TIME CLOCK

Clock source	32,768 Hz. crystal oscillator
Resolution	1 ms.
Range	Time and date (including leap year and day of the year).
Synchronization	50/60 Hz from voltage input

#### COMMUNICATIONS

Serial port	RS232 type.
Speed	up to 57 kBaud
Modem (standard)	Hayes compatible type internal. (up to 57.6 kBaud)
Network (option)	TCP/IP 10Base2 or 10BaseT

#### VOLTAGE WITHSTAND

Isolation	Channel to channel (voltage) Channel to ground. 2 kV RMS for 1 minute (as per IEEE C37.90-1987 IEC 255-5)
Impulse voltage withstand	Channel to channel (voltage) Channel to ground 5 kV, 1.2/50 ms. 0.5 Joule (as per IEEE C37.90-1987 IEC 255-5)
Electrical fast transient (EFT)	4 kV, 5/50 ns. 15 ms burst length non-maloperate (as per IEEE C37.90-1987 IEC 255-22-1)
Surge withstand (SWC)	2.5 kV, 1 MHz HF burst disturbance non-maloperate (as per IEEE C37.90-1987 IEC 255-22-1)
RFI immunity	10 V/m 20 MHz – 1 GHz (80% AM @ 1 kHz). Non – maloperate (as per IEEE C37.90-1987 BS EN 50082)
RFI emission	— radiated 40 dB mV/m (27 – 130 MHz) 47 dB mV/m (130 MHz – 1 GHz) EN 55022B (class 'B' limits) (as per BS EN 50081-1) — conducted (150 kHz – 30 Mhz) EN 55022B (class 'B' limits) — harmonics (100 Hz – 30 MHz) (as per IEC 555 class 'A' limits)
Electrostatic discharge (ESD)	8 kV contact, 15 kV radiated discharge. Non-maloperate (as per IEC 801-2)

#### ENCLOSURE

Mounting	Wall
Size	300 x 400 x 210 mm (11.75 x 16 x 8.25)
Weight	8 Kg. (13.2lbs.)

#### ENVIRONMENT

Operating temperature	-10 to 50 °C 14 to 122 °F
Storage temperature	-40 to 70 °C -40 to 158 °F
Humidity	5 – 95% RH (non condensing)

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## **AmetekPQSystem Total Monitoring/ Analysis Solution**

### **Automated Data Gathering and Report Delivery using the power of the internet**

Given the greater range of energy choices and the complexity of diagnosing power quality problems, a utility-operated power monitoring and analysis service is essential.

AmetekPQSystem allows energy providers to supply their customers with analysis services at a fraction of the cost of a conventional power monitoring and analysis system. For commercial or industrial customers, a smaller scale, fully automated monitoring and analysis system is available.



### **Own your own complete custom Power Quality System sized to your needs and gain an edge in today's deregulated market**

Utilities, multi-facility, single-point facility and large customers can own a complete system and capitalize on today's deregulated market. This complete system is fully automated — from data collection to comprehensive reports. AmetekPQSystem uses the power of the internet to deliver information where it is needed most. AmetekPQSystem is a complete turnkey package which includes installation and training by Ametek engineers.

AmetekPQSystem is a complete web-based system which includes:

- Power quality monitors
- A communications system for collecting data from customer/remote sites
- A power family of fully integrated software applications. Your Ametek Sitemaster includes Ametek Alarm, Ametek Pager, Ametek Report Generator, Ametek Ai Browser, Communications and Drivers
- Database, data graphing and charting tools
- Analysis and reporting software
- Paging and warning functions
- Web-based reporting
- Can include installation and training by Ametek technicians

### **Total Solution for Utilities**

- Provides a total solution for utilities to serve customers
- Competitive advantage in today's deregulated market
- Proof of performance for quality delivered

### **Total Solution for Large Users**

- Establish a reasonable cost of power quality
- Monitor quality of incoming power
- Identify sources of power quality problems
- Provide solutions

### **Benefits**

- Provides answers, not just data with instant, automated analysis and solutions based on sophisticated artificial intelligence technologies
- Continuously reviews data and employs expert embedded reasoning to interpret information and generate executive analysis reports
- Determines the severity of a problem and its origin, along with a generally accepted solution to the problem
- Reports are output in word processing format for ease of editing

- Analyzes and uploads trend analysis to the web
- Reduces downtime and equipment damage from power quality problems and manages energy costs

### **The power of the web**

- Easy access to the analysis reports on the Internet
- Personal password-protected web pages for customer
- Customers can view their most recent power quality report, download the report to their word processor, view their energy and demand trends (as well as other measurement parameters including harmonics)

### **The power of automation**

- Create a list of the jobs you want done, and the timing, then AmetekPQSystem does the rest. From trending harmonics to producing a complete power quality analysis report, AmetekPQSystem makes your life simple
- Automated data collection and automated data analysis
- Automatically generates reports and makes them available to you and/or your customers

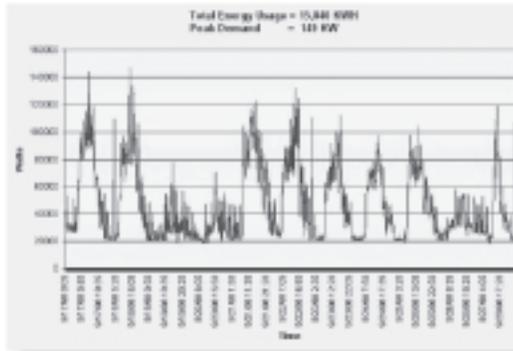
### **Power warning system**

- Optional activation of a pager when a harmful power quality event is detected
- Complete analysis of problem is available on the customer's password-protected web page
- Avoid power quality problems with the continuous analysis and trend information
- Identify problems before downtime or equipment damage occurs

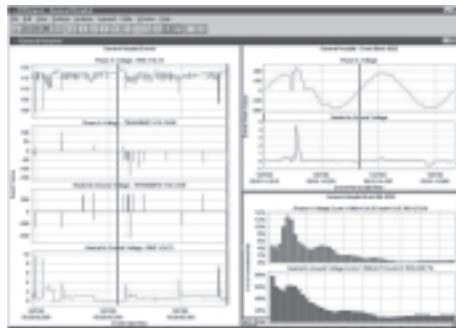
# AMETEK Power Quality

## The power of open architecture

- A true open architecture system without compatibility limitations
- Interfaces with many different power monitors
- Ametek is committed to developing communications drivers for new monitors as they are introduced into the market
- Choose the monitoring hardware that best suits your needs
- Stores data in an ODBC compliant database with a published schema
- Use widely available commercial applications like EXCEL, or AmetekPQSystem's easy-to-learn universal data viewing and graphing software, AmetekAi•Browser™
- AmetekAi•Browser™ includes all of the charts you want, including CBEMA, as well as time plots, phasors, and harmonic distribution, plot data from different monitoring equipment all in the same chart



Customers can view energy and demand on their web site.



View and download measurement data in an ODBC compliant database.

## Why AmetekPQSystem?

Issue	In-house	PQSystem
Power Quality Monitoring for Customers	Capital & Labor Intensive	Affordable
Use of Customer's Existing PQ Monitors	Seldom	Yes, many models supported
On-Staff Engineer Trained in Power Quality Analysis	Highly Advised	Optional
Outside Consultants to advise beyond basic PQ matters	Often Required	Never Required
Round the Clock Customer PQ Monitoring	Capital & Labor Intensive	Automated & Affordable
Data Collection	Manual	Automated
PQ Problem Analysis	After the fact	Instantly
PQ Problem Identification from Data	Time intensive	Automatic Expert System
Notification of Problem	Often panic shut down	Instantly
Off-premises Notification of PQ Problem	Not likely	Internet, optional pager
Reports	Time Consuming	Automated & Simple
Multiple Site Monitoring	Difficult & Expensive	Simple common database
Keep Customer's monthly costs low	Seldom	Always
Information available 24 hours a day	Unlikely	Yes, on customer web page

## **AmetekPQService Affordable Power Quality Service Over The Net**

### **Automated power quality service is now available for one low monthly fee... with no capital investment**

Getting the answers that you need with AmetekPQService is simple. You do not need to select, purchase, operate and maintain power monitoring hardware and software. Everything is included. One monthly fee covers it all. Continuous monitoring and analysis means that AmetekPQService is there whenever you need it, collecting data, generating reports and supplying answers.

### **Just buy the answers and reduce your cost of power quality!**

AmetekPQService is a comprehensive service which provides commercial and industrial facilities with continuous monitoring and analysis of their power systems. Reports are generated around the clock and automatically posted on your personal web page in an easy-to-read format, making information available for review at any time. AmetekPQService is there whenever you need it.

AmetekPQService is simple. You do not need to select, purchase, operate and maintain power monitoring hardware and software. One monthly fee covers it all. Ametek offers an optional service which activates a pager when the system detects a harmful power quality event. Other service options are available, and Ametek Power Instruments can provide custom support as needed.



### **Here's How It Works...**

1. You get power power quality monitors installed and tested
2. You get data monitored at frequent intervals
3. You get written reports with clear answers
4. You get instant internet reports, answers anywhere, anytime
5. You get cost saving demand and energy reports
6. You get prompt problem and alarm notification
7. You Get Measurement Data: View and download raw measurement data in an ODBC compliant database

### **Simple Power Management**

- web-based automated remote analysis
- includes a power quality monitor, installation, monthly executive report and a password protected web page

### **Around The Clock Analysis**

- continuous monitoring of power system
- generates easy-to-read professional reports
- supplies answers, not just data
- reduces need for outside consultants

### **PQ Warning System**

- optional service activates a pager when a harmful power quality event is detected
- generates a new PQ report for analysis and answers
- continuous analysis and trend information identifies problems before your company experiences a loss

### **Put the Power of the Web to Work for You**

- easy access to and viewing of reports via the Internet
- personal web pages are password protected and can be viewed with a standard browser
- reports and raw data measurements can be downloaded to your PC

### **Cash in on Deregulation**

- AmetekPQService provides energy consumption profiles that help match your facility with the best Energy Service Provider
- AmetekPQService monitoring ensures that your facility receives acceptable levels of power quality at all times
- if power quality is compromised AmetekPQService determines if the problem is in-house or with your ESP
- disputes with your ESP can be quickly resolved

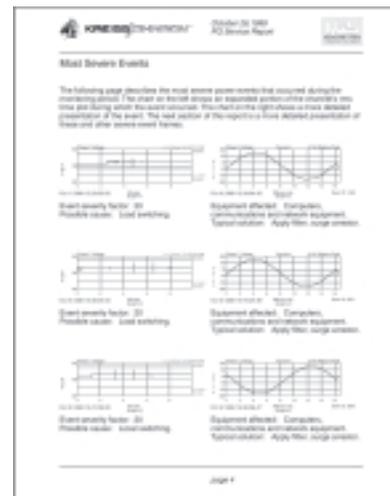
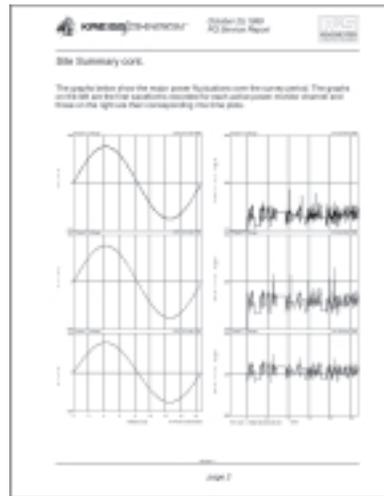
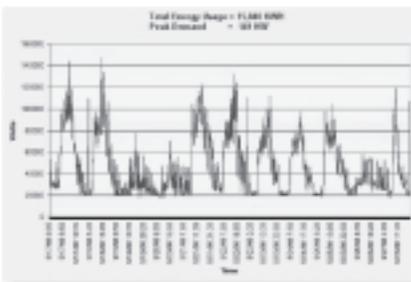
### **Professional Reports**

- complete reports with color charts and graphs make identifying problems easy
- record power disturbances, severity, and cause
- record origination (whether within your facility or from the distribution grid), equipment affected and possible solutions
- separate reports are generated for each monitoring device
- energy reports chart usage, demand, and peak billing parameters
- track and analyze harmonics, peak loading and other parameters
- verify IEC, ANSI and IEEE compliance

# AMETEK Power Quality

## AmetekPQService is a complete system which includes:

- power monitors
- a communications system for collecting data from customer/remote sites
- database, data graphing and charting tools
- analysis and reporting software
- paging and warning functions
- web-based reporting



## Why Is AmetekPQService Better?

Issue	In-house	PQService
Purchase Of Expensive PQ Data Collection Device(s)	Yes	No
Use Your Existing Monitors	Yes	Yes (most units supported)
On-Staff Engineer Trained In Power Quality Analysis	Highly Advised	Optional
Outside Consultants To Advise Basic PQ Matters	Often Required	Not Required
Round The Clock Monitoring	Seldom	Always
Data Collection	Usually manual	Automated
Prompt PQ Problem Analysis	After The Fact	Instantly
PQ Problem Identification from Data	Time Intensive	Automatic Expert System
Notification of Problem	Often Shut Down	Often Averts Shut Down
Off-premises Notification of PQ Problem	Not Likely	Internet and Optional Page
Reports	Time Consuming	Automated & Simple
Multiple Site Monitoring	Difficult, Expensive	Simple Common Database
Low monthly costs	Seldom	Always
Money Saving Power Usage & Demand Information	Unavailable	Yes. Often Pays For Itself

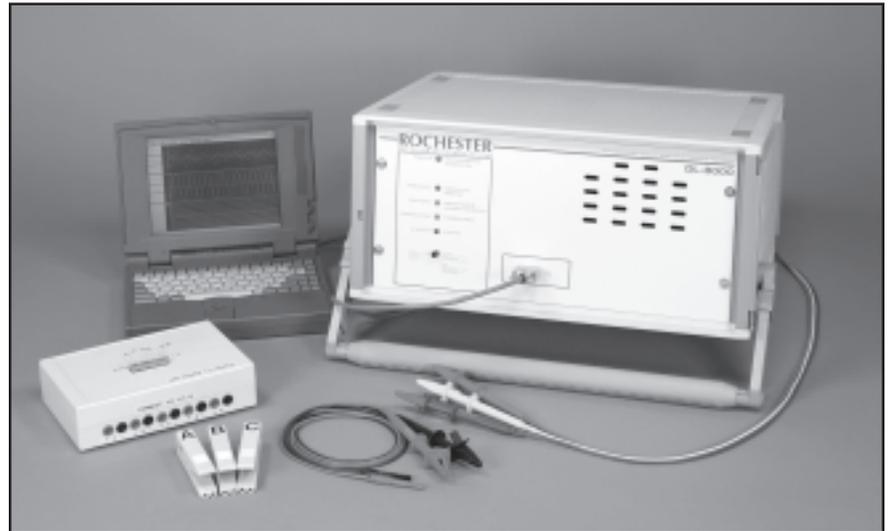
# AMETEK Power Quality

## DL-8000 and DL-9000 Portable Power Quality Monitors

**The DL-8000 and DL-9000 Power Quality Monitors are advanced power monitoring systems in a rugged portable package.**

The DL-8000 and DL-9000 portable systems are equipped to support a range of measurement transducers and connection options providing an attractive and flexible monitoring system for the power utility, commercial and industrial user.

An extensive suite of Windows™ based software is available with the portable system for local (laptop PC) or remote setup, data retrieval, analysis and reporting via modem or network communications.



The DL-8000 portable has been designed to be easily installed on-site, vastly reducing any commissioning time. The system includes optional push-fit (shrouded) protective rear panel connections to analog and digital measurement points using fused jaw-clips and non-invasive CT clamps.

### Data For:

- Motor Starts
- Relay, Fuse and recloser coordination and misoperation studies
- Load Balancing
- Harmonic magnitudes
- Co-gen plant monitoring
- Motor control center monitoring
- Sags and Swells
- Steady-State Voltage Compliance
- Surges and transient changes
- Equipment Sizing
- Data needed for K-Factor calculations
- Automatic Transfer Switch testing/monitoring

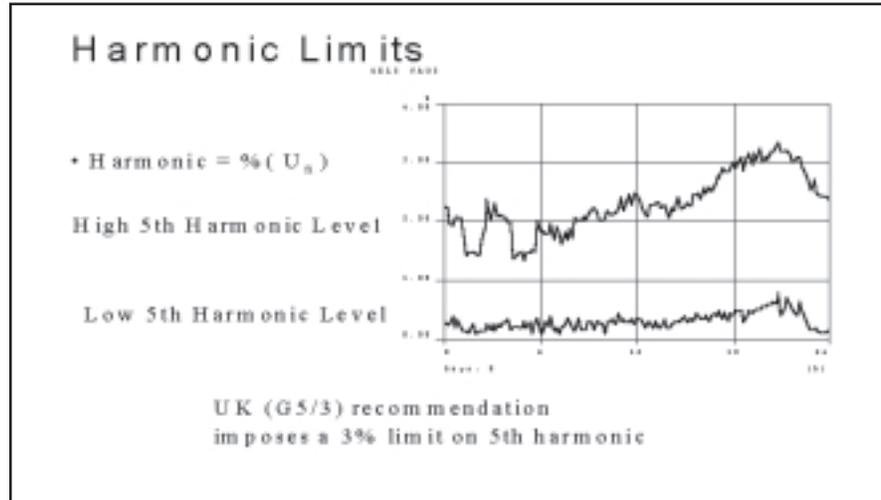
# AMETEK Power Quality

## Features:

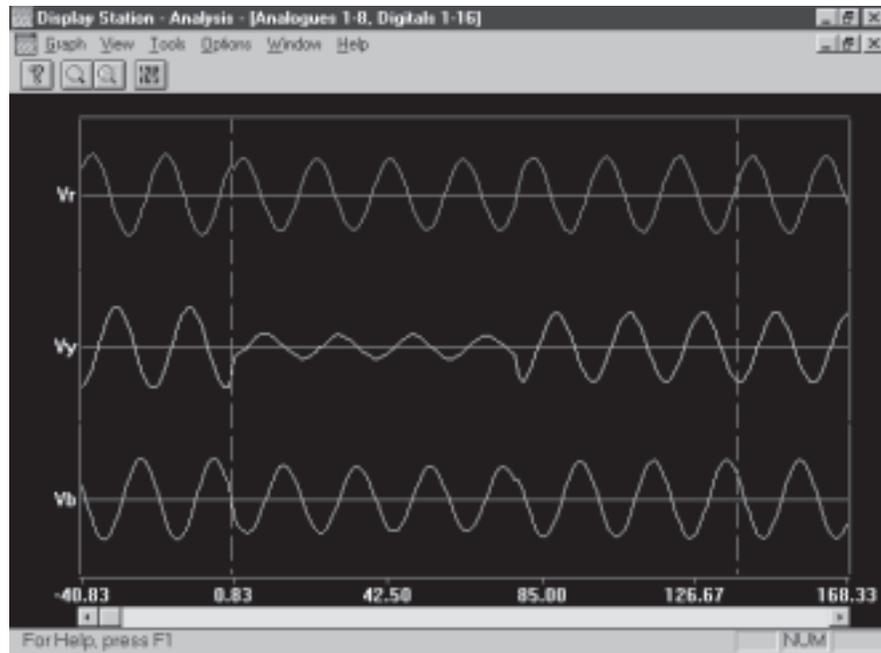
- Rugged Enclosure with Carry Handle
- Fault Recording using a Wide Range of Programmable Triggers
- Power Quality Event Capture and Analysis
- Provides 8 Analog/16 Digital Input Channels or optional 16 Analog/32 Digital Input Channels
- Uses a Range of CT Clamps for Non-Invasive Connection
- Supports  $\Delta$ -Y (3 or 4 wire) VT Connections
- Extensive Windows™ based Applications Software
- Universal AC/DC Supply
- Logged Recording of Voltage, Current, Harmonics and Frequency using Integral Hard Disk

## Options:

- Cellular Modem for Remote Communications
- Ethernet Card for Network Support
- Push-fit Rear Panel Connectors and Test Leads for Simple Installation
- Voltage Divider box for 600, 480 and 277V Systems
- CT Interface Unit supporting a Wide Range of CT Ratios

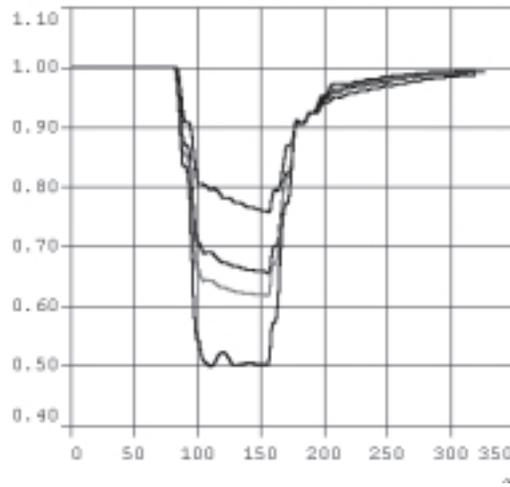


Harmonics Logging Comparing Same Location at 2 Different Days



Waveform Capture (simultaneous on up to 16 analog and 32 digital inputs)

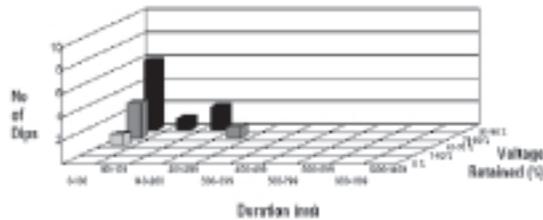
275 ---> 11KV  
 fault propagation  
 shows how severe  
 faults at transmission  
 levels affect all other  
 voltage levels



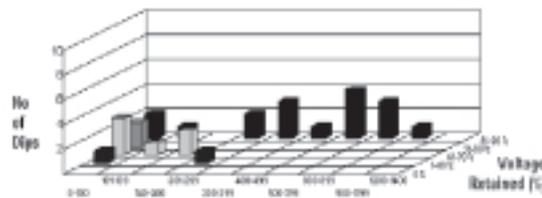
Voltage Fault Propagation Comparing Voltage Dip Severity at Different Power System Voltage Levels

## Voltage Dips Profiles (May - Sept. 1995)

Site A.



Site B.



Voltage Dip Profiles for Power Quality Assessment Comparing 2 Sites Over Same Time Interval

# AMETEK

## Power Quality

### DL8000 Portable Power Quality Monitor (CONTINUED)

The DL-8000 Series brings to the market a Power Quality Recording System with unparalleled levels of flexibility, while providing the user with the worlds most user friendly software available today.

Two portable units are available with up to 16 analog/32 digital input channels on the DL-8000. The DL-8000 will operate as a stand-alone system or link to a PC-based Master Station. In terms of performance, the system has a sample rate of up to 192 samples per cycle, with a vast selection of standard triggers simultaneously available on each channel or on a system basis to initiate waveform capture. These include over and under limit violation with adjustable hysteresis, rate of change, zero and negative sequence, sub-cycle drop out (sinewave quality) and frequency.

The high speed, high resolution recording and flexible triggering modes make the Ametek DL-8000 ideal for capturing all forms of power quality from sags, swells and lightning strikes to spikes and sub-cycle distortion. It can be used for verifying protection/breaker operation as well as many types of power quality monitoring.

The DL-8000's unique dynamic post fault length optimizes data memory usage by terminating the recording of a problem once a steady state has returned for a predefined period. Short faults generate short records while a longer fault will cause the fault recording period to be extended

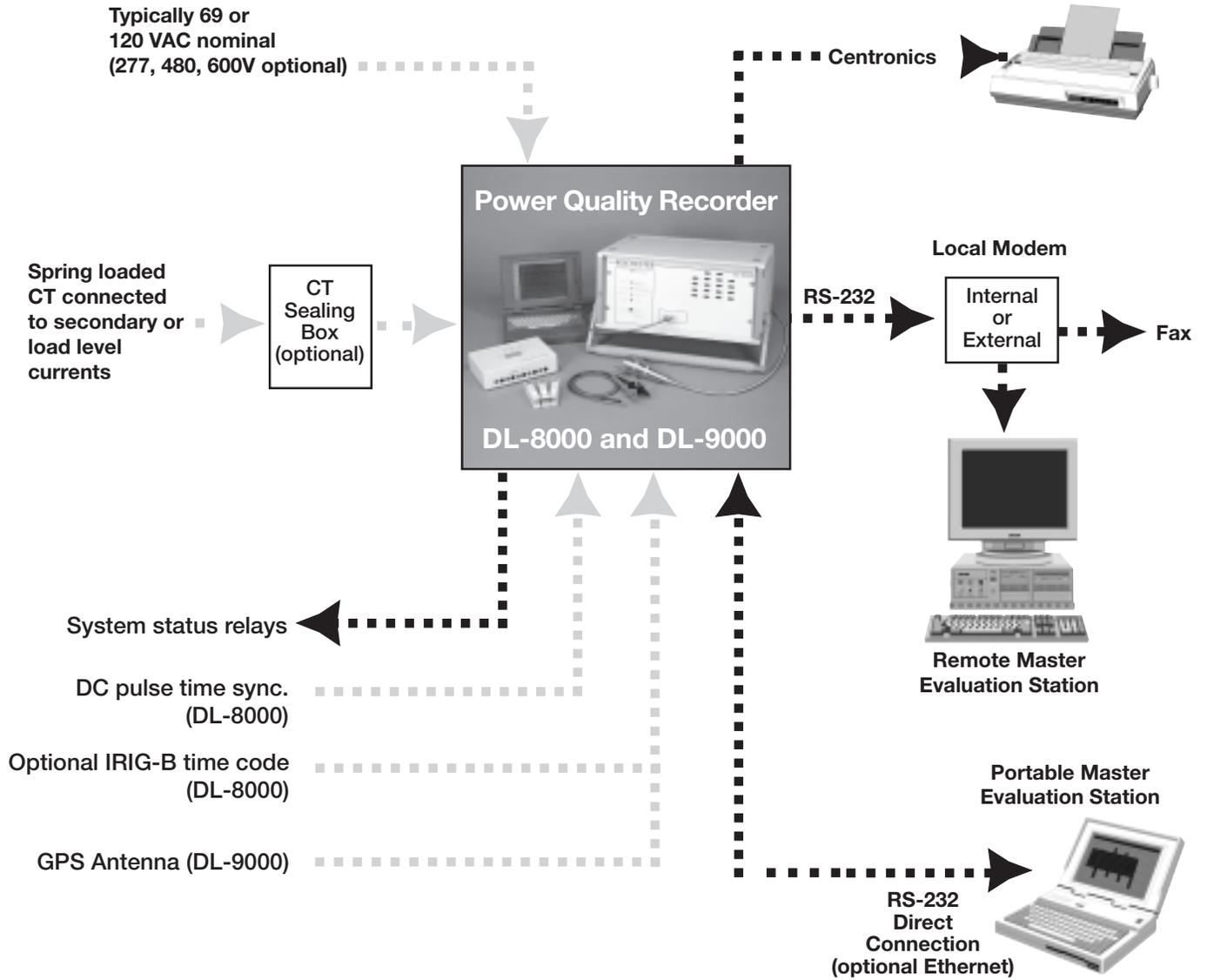
Local parameter setting and record transfer is performed simply by plugging in a portable computer running Ametek's Windows™ based software into the port on the front panel of the DL-8000. One computer can be used for many DL-8000's, thereby reducing costs and making the parameter and fault record data more secure.

- 8 or 16 Analog Channels
- 16 or 32 Digital Channels
- Simple-to-Service Plug-in Circuit Card Design
- Substation Environment Qualified
- Extensive, Flexible Remote-Controlled Triggering
- Full 12-Bit A/D With Simultaneous Sampling
- DC Coupling Standard
- Standard ISA Bus Architecture For Easy Upgrades
- Simple Point-And-Click Windows Interface
- Full Context-Sensitive Help
- Waveforms Displayed At Highest Resolution Possible On Your Monitor
- Fault, Trend, Harmonic, and Flicker Recording Simultaneously
- Optimize Switchgear Maintenance
- Long-Term Load Data For Planning
- Harmonic Recording
- Voltage Quality Monitoring
- Windows™ Based Graphical User Interface (GUI) For Ease Of Use

### Features

- 486 industrial grade CPU
- Downloadable firmware
- Internal hard disk drive
- Up to 192 samples per cycle sample rate
- Real time graphical display and numeric measurement for easy and accurate trigger level setting
- Software triggers available simultaneously
  - *Under limit violation with adjustable hysteresis per input (real time display/ measurement available)*
  - *Over limit violation with adjustable hysteresis per input (real time display/ measurement available)*
  - *Rate of change trigger per input*
  - *Sub-cycle drop out (sinewave distortion) trigger per input*
  - *Negative sequence component (real time display/ measurement available)*
  - *Zero sequence component (real time display/ measurement available)*
  - *Over, Under and Rate-of-Change of Frequency (1 per chassis)*
  - *Digital Inputs; level, or edge with selectable return-to-normal triggering*
- DC pulse or optional IRIG-B (time code) time synchronization

## Architecture



# AMETEK Power Quality

## DL-8000 Power Quality Monitor

## Communications, Analysis and System Configuration

### Software

Ametek's software programs provide advanced data analysis, communication and configuration functions in a 486 PC-compatible (minimum) computer. The programs have a very flexible graphical user interface which uses Windows 95™, Windows 98™, NT™, or 2000™. Many fault analysis features are provided and there are optional programs for additional mathematical functions. There are two major modules of Ametek software available.

### Communications

This provides communication to, and configuration of, the DL-8000 series either (1) remotely via a modem link to a Master Station normally located in central engineering or at a control center, (2) locally via a direct connection on site or (3) via an Ethernet link.

The communications software has a unique feature that allows the user to set over and/or under trigger levels with hysteresis on the analog channels with the actual signal displayed in near real time. This waveform is overlaid with the equivalent trigger levels which improves the ease and accuracy to trigger settings (see next page).

Sub cycle drop out triggering measures the quality of a voltage or current waveform. Small perturbations which would not be detected by standard level or rate of change triggering can be recorded by the DL-8000.

Sets of three analog channels can be defined as phase groups. For each group, zero and negative sequence component trigger levels can be set. Again, the display of near real time data ensures correct values are used and

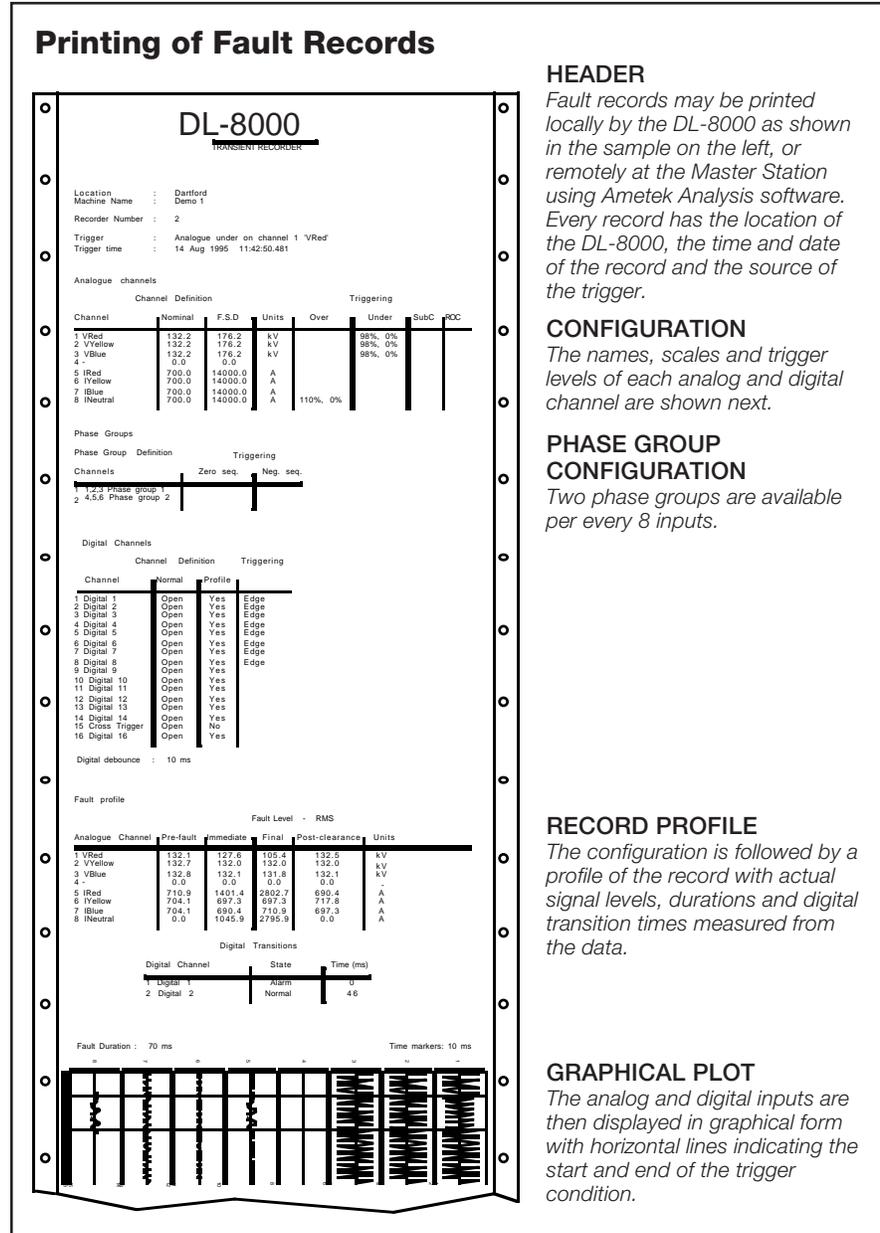
inputs are wired in properly (see next page). Two phase groups are available per 8 inputs.

The DL-8000 can be set to dial up the Master Station when a fault is recorded (Auto Call) and the Master Station can be programmed to contact each recorder in a region at regular intervals

to check for new records (Auto Poll). A communications log records any problems incurred during auto polling.

Unauthorized parameter updates and record downloading can be protected by passwords. A DL-8000 may be remotely triggered from the Master Station to generate test records.

### Printing of Fault Records



### HEADER

Fault records may be printed locally by the DL-8000 as shown in the sample on the left, or remotely at the Master Station using Ametek Analysis software. Every record has the location of the DL-8000, the time and date of the record and the source of the trigger.

### CONFIGURATION

The names, scales and trigger levels of each analog and digital channel are shown next.

### PHASE GROUP

### CONFIGURATION

Two phase groups are available per every 8 inputs.

### RECORD PROFILE

The configuration is followed by a profile of the record with actual signal levels, durations and digital transition times measured from the data.

### GRAPHICAL PLOT

The analog and digital inputs are then displayed in graphical form with horizontal lines indicating the start and end of the trigger condition.

## Master Station Software

After retrieving the necessary fault records using the communications software, the analysis package allows the Master Station to display fault records, analyze them and print to any Windows™ supported printer.

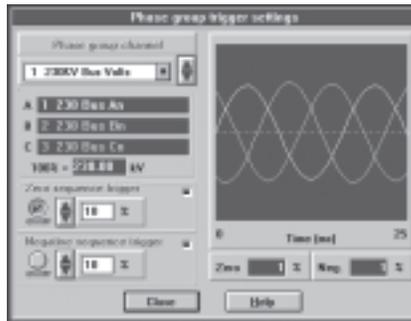
This analysis software provides a complete set of functions for complete power system fault analysis with built in tools to simplify the setup of displays and printer functions. The user interface follows the recommended Windows conventions and gives several options to manipulate waveforms through keyboard and/or mouse operation.



Analog Trigger Settings Window, where the Real Time Values for each Voltage and Current Input can be read.



Main Operating Parameters are set up from this window.



Zero and Negative Sequence Component Trigger Settings Window, where three channels make up a Phase Group. The Real Time Sequence Components are displayed. Color coding allows user to verify proper channel selection and wiring.

## File Features:

- Full support of the Comtrade file format

## Display Features:

- Add, remove or rearrange waveforms on screen
- Place waveform cursor to read time and amplitude
- Select channels and time range for display, printing or modification of display parameters
- Dynamic scaling of waveforms

## Analysis Features:

- Reports channel that triggered each fault record
- Instant graphic measurements of time and amplitude differences between two points on screen

## Printing Features:

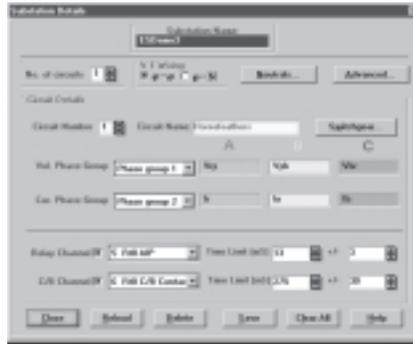
- Works with nearly all Windows™ supported printers
- High-resolution color printing

# AMETEK Power Quality

## Expert System Software

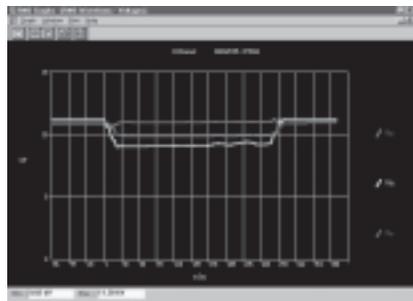
The suite of Expert System Software consists of three separate packages that are linked together by a shared database created by the user in the Automated Analysis portion of the software.

The three packages are the Automated Analysis, Voltage Dip Analysis, and Breaker Performance Monitor. To create a variety of plots from the harmonic trend data recorded by a DL-8000, the Harmonix software program is used.



### Basic Substation Configuration

This screen is used to configure each circuit being monitored and the "filters" used to create reports. Thereby increasing the efficient utilization of data while reducing workload.



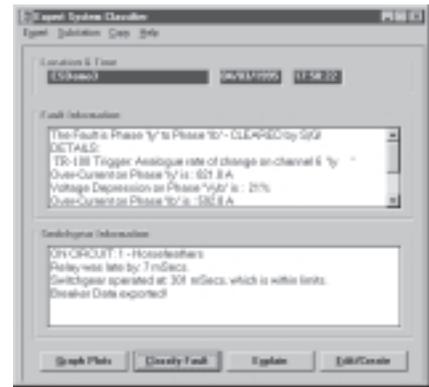
### RMS Envelope

The Automated Analysis software provides the ability to plot the recorded data as an RMS envelope for the entire file. Above is a plot of the voltages for an 11Kv (p-p) circuit. Note the min/max values given in the lower left of the plot.



### Automated Analysis Results

Above is a sample of the automated analysis results obtained automatically during Auto-poll or Auto-call. This text can be viewed without having to open and view the waveform data. The full waveform/fault data is still available for analysis if needed.



### Manual Analysis Output

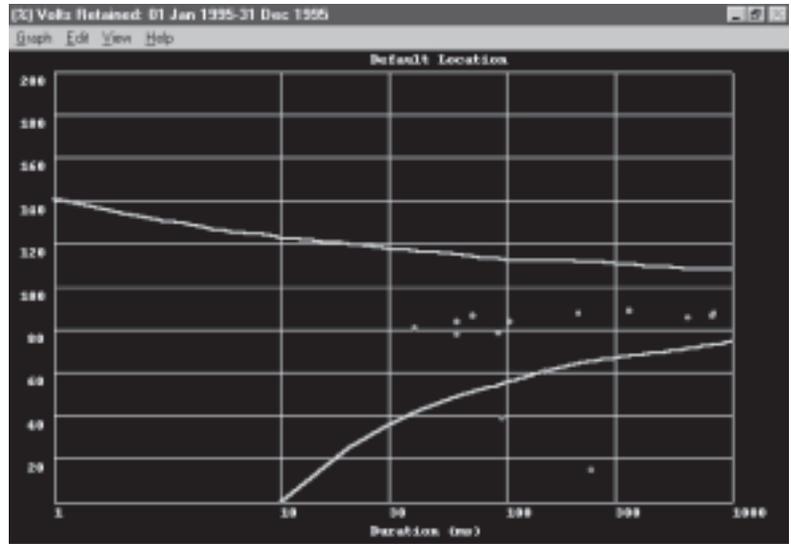
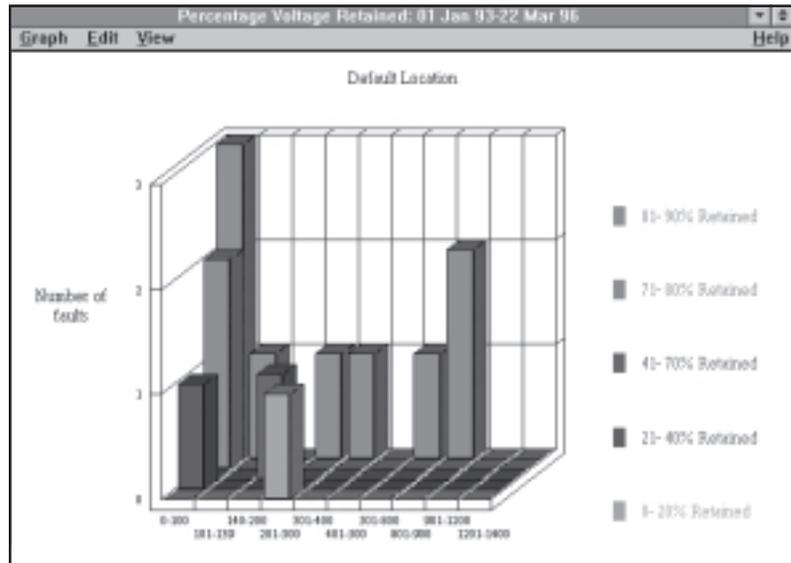
Above are the results from manually calling up the automated analysis. Below is an Explanation Window that can be accessed for a summary of why the program reached the conclusion it did.



## Voltage Dip Analysis

To the right is a sample plot from the Voltage Dip Analysis software package. This shows the ability to take a series of faults from a specific location and plot the voltage retained against the duration of the faults, showing the quantity of faults for each interval/% retention. This is useful for comparing voltage quality at different locations or at the same location after changes to the power system have been made. Plots can be customized for time interval, magnitude and voltage drop. This allows users to customize the plots shown to management or users of electrical power.

Using the Voltage Dip Analysis software, the same series of faults can be plotted against standard limit curves such as CEBEMA or other user created curves as shown to the right.



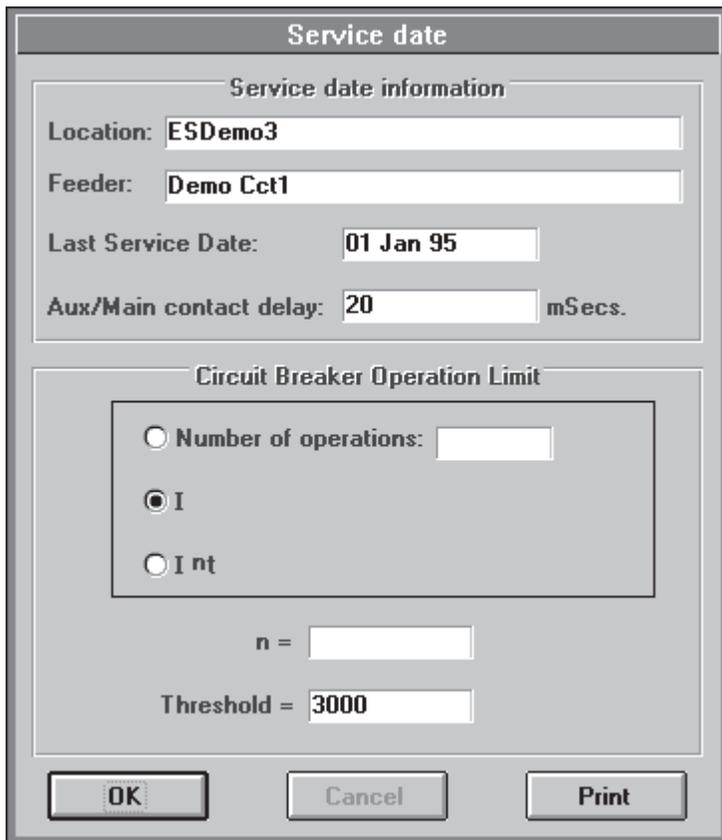
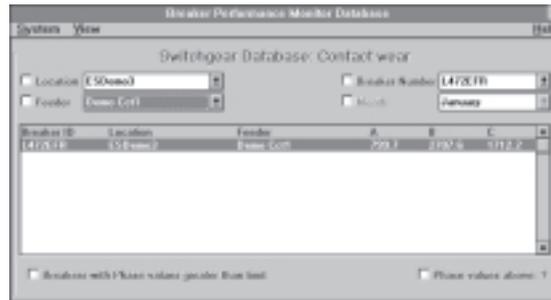
# AMETEK Power Quality

## Breaker Performance Monitor

After each fault has been analyzed by the Expert System, the results can be passed to the Breaker Performance Monitor software (BPM). At the bottom is the BPM setup screen.

The BPM software uses the data for each breaker operation to track breaker wear 3 different ways: the cumulative current interrupted (shown at top right), the duty interrupted by the breaker based in  $I^n t$  (where  $n$  is user defined) or the number of operations for a breaker (shown at bottom right).

Since the information is kept in a database, it is easy to switch between the 3 methods eliminating the need for stand-alone devices.

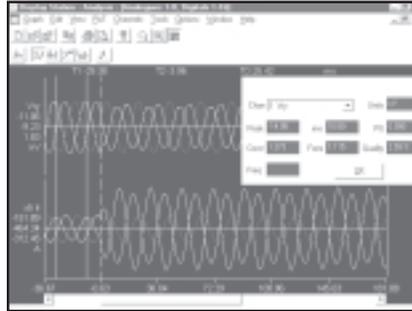


## Power Analysis Tools

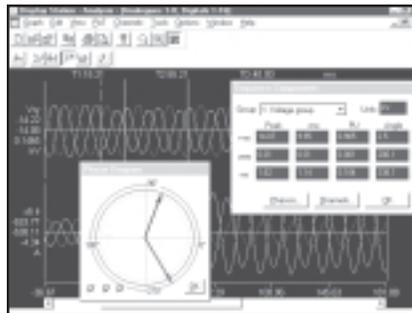
Ametek' Power Analysis Tools (PAT) is a set of mathematical calculations which can be applied to waveforms displayed using DL-8000 series software. PAT contains 3-phase calculations for lines or circuits, yielding peak, RMS, per unit values, power quantities (MVA, MW, MVAR, X/R), frequency, distortion and sequence components.

It also provides phasor display and harmonic analysis. PAT is used by calling the set of tool ICONS to the screen, then selecting a waveform and tool to be used. PAT will then display the resulting graphical and tabular data.

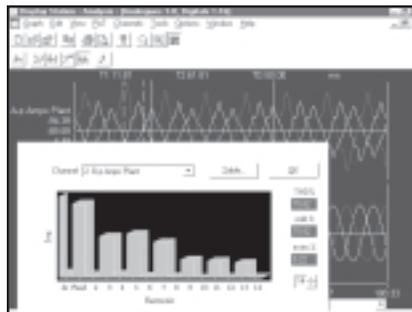
The use of color and graphics enhances the understanding of the power system situation.



*Event Waveform Display Window, with the Power Analysis Toolkit active. Single Channel Calculations made on any channel over a selected time frame.*



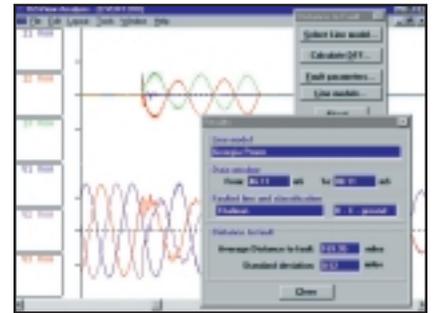
*Event Waveform Display Window, with the Power Analysis Toolkit active. Sequence Components calculated on a Phase Group basis. A Phasor Diagram is also displayed with the angle based on the start of the selected region.*



*Event Waveform Display Window, with the Power Analysis Toolkit active. Harmonic Analysis on any channel over a selected time frame.*

## Distance-To-Fault

The Distance-To-Fault (DTF) program uses user-entered line parameters to analyze fault data and calculate distance to the fault from the recorder which saw the fault. DTF is accurate to 2% when untapped 2-terminal transmission lines are analyzed. It cannot be used on tapped or multi-terminal lines. The user must have some knowledge of line characteristics as computed by EMTP or similar computer simulations to use DTF.



*Event Waveform Display Window, with fault location results identified.*

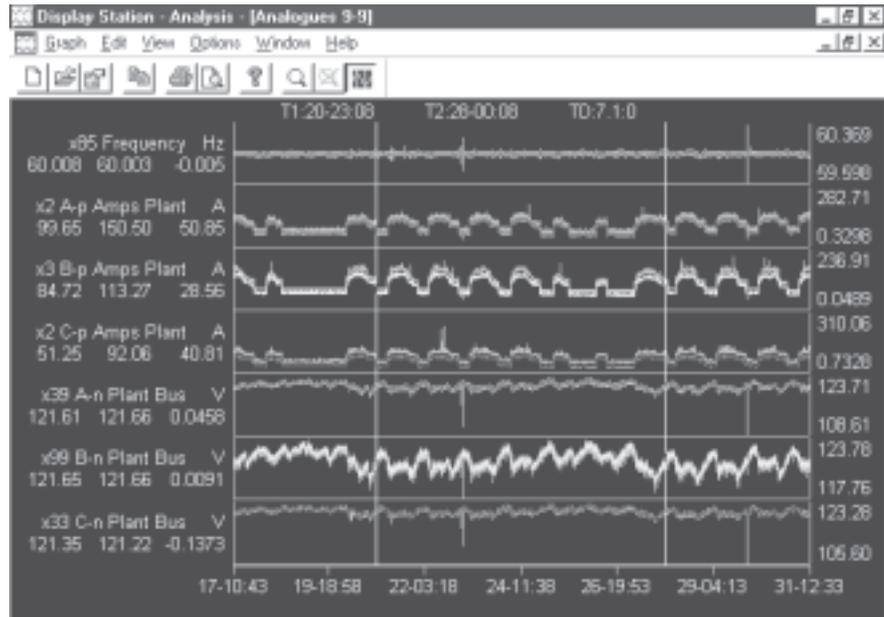
# AMETEK Power Quality

## Recording Simultaneous Faults, Trend Data and Harmonic Profiles

The DL-8000 has the ability to record faults, trend data and harmonic profiles simultaneously eliminating the need for circular chart recorders or other IED's.

The trend is 26 weeks of data stored as 1 minute min/max/average for every channel and 1 frequency channel as shown on the right.

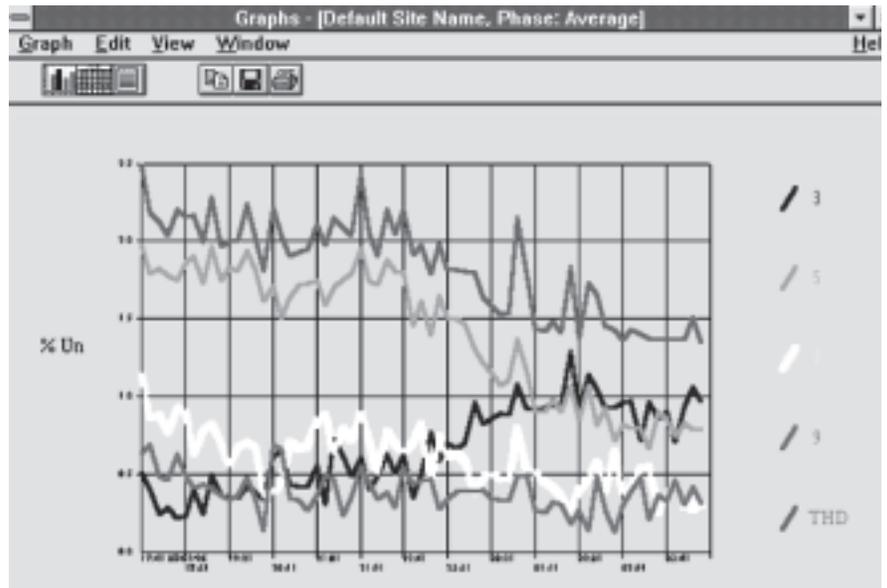
This Trend Data can be used for load balancing, voltage regulation verification, equipment sizing and many other applications.



## Harmonix

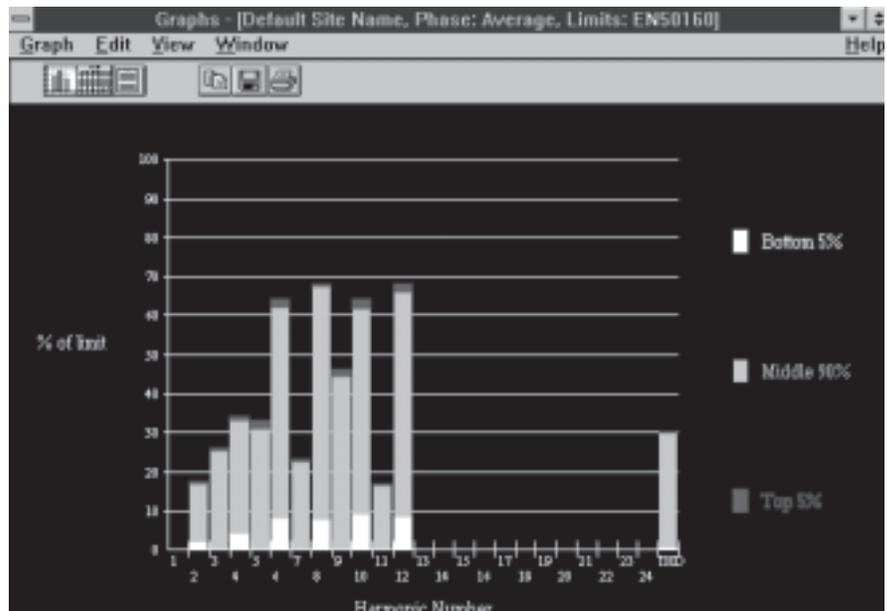
### Recording Harmonic Spectrum

The DL-8000 has the ability to periodically record a harmonic spectrum from 3 channels in the recorder. A variety of plotting methods are available to the user. To the right is a sample file showing a 12-hour interval at a 10 minute sample rate. The magnitude is plotted as a % of the fundamental frequency (50/60Hz) input magnitude. It can also be plotted as an absolute magnitude. This shows all of the odd harmonics plus THD as an average of all phases of the circuit. Additional plot options include comparing the minimum, maximum and average magnitudes of various harmonics recorded for the time window selected.



### Custom Limits

This plot shows the same data plotted against a standard limit such as IEEE519 or EN50160 (EN is shown). Custom limits can be created by the user. The green portion of the plot show the % samples (over the time window plotted) that were between 0-5% of the maximum recorded value for that harmonic. The blue portion is the relative number of samples that were between 5-95% of the maximum recorded value and the red is the relative number of samples in the 95-100% range. Additionally, single sample intervals for the harmonics for all 3 phases can be displayed.



# AMETEK

## Power Quality

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### **AmetekAiPower Data Monitoring and Analysis Software**

#### **Simply and Automatically Read, Analyze and Report Power Quality Data... and Have Room To Grow**

Not only is AmetekAiPower Software a stand-alone product, it is part of a complete system. For instance, you can obtain around-the-clock Power Quality monitoring and analysis for one or multiple sites using the Internet. AmetekPQService is our new web based, PQ monitoring and analysis service. Your "answers" to Power Quality problems are just a mouse click away with any standard browser. There are also many advanced notification services, such as paging, that let you know when there is a PQ concern at your facility. For more information, request our AmetekPQService brochure.

Our AmetekAiPower software can even expand to meet the needs of utilities and large end-users. Our PQSystem offers a state-of-the-art power monitoring and analysis system for utility and ESP customer service programs. Request our PQSystem brochure to see how your firm can be more competitive in this deregulated era where "customer service" counts most.

#### **A Simple Answer for Expert Analysis**

For many companies, the promised benefits of Power Quality technology have gone unrealized. Despite investing in expensive monitoring equipment and manpower, the answers to their power quality problems remains locked within their data. Until today! Ametek Power Instruments new AmetekAiPower software unlocks the answers hidden within your Power Quality data!

#### **As easy as 1, 2, 3.**

1. Reads your power quality recorder's measurement data
2. Uses Artificial Intelligence to analyze this data
3. Produces complete and professional reports, giving you the answers you need.

#### **Our Experts Join Your Team**

AmetekAiPower Software is like having a team of power quality experts on staff. Today's multi-function data recorders can capture data about significant power quality problems. But companies may not have the available manpower or expertise to sift through all the data collected. AmetekAiPower quickly extracts and organizes the answers you need.

#### **Compatible!**

There are many Power Quality measurement devices on the market today. AmetekAiPower will work with many major data recorders! AmetekAiPower Software knows your recorder's data format. So if you already own a power quality monitoring device, you'll now be able to realize the all the benefits you originally bargained for. If you're in need of power quality recorders, Ametek Power Instruments offers the most advanced, yet affordable units on the market today. Either way... AmetekAiPower software integrates with your both your past and future!

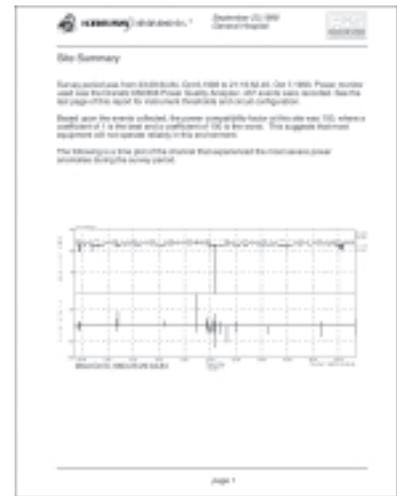
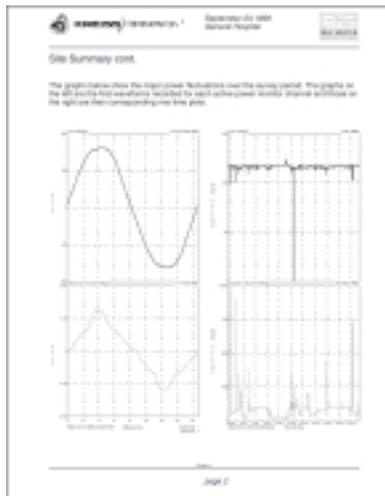
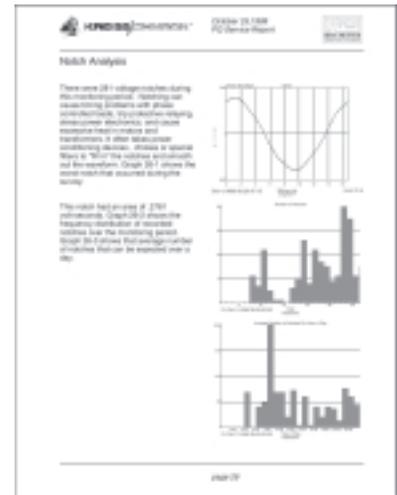
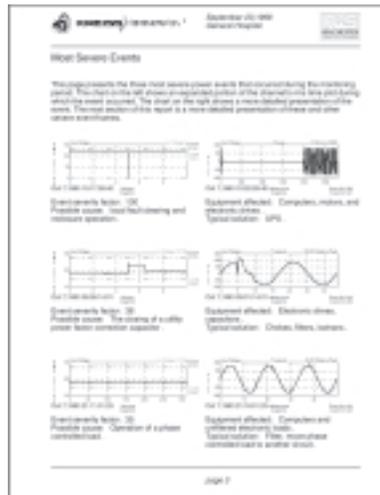
#### **How AmetekAiPower Works**

AmetekAiPower is a Windows™ program that uses Artificial Intelligence tools, such as Fuzzy Logic, Neural Networks, and Expert Systems, to look deep into your power quality measurement data. The program applies this knowledge to your data and automatically generates a complete professional report. Not only are hours saved in analysis and report creation, the AmetekAiPower Software user has the embedded knowledge of a staff of experts behind him.

Examples of the embedded knowledge or "rules" are voltage waveform patterns of motor starts and capacitor switching. Such a rule might be, "if a major current increase is recorded during a voltage sag, then the origin of the sag is downstream from the monitoring location." With hundreds of embedded waveform patterns and rules, the ANSWERS you are looking for, the ones that could affect the continuous operation of your facility are quickly in your hands.

Here are just a few examples of the reports AUTOMATICALLY generated by AmetekAiPower. (For additional full size reports visit [www.rochester.com/pdf/pqreports.pdf](http://www.rochester.com/pdf/pqreports.pdf))

- Site Summary
- Most Severe Event
- Statistical Analysis
- Disturbance Analysis
- Power and Harmonic Analysis
- Run Summary
- Plus many more



## Why AmetekAiPower?

Issue	Before AiPower	After AiPower
Interpreting Data for PQ Monitor	Required Extensive Review	Automatic
On-Staff Engineer Trained in Power Quality Analysis	Highly Advised	Optional
Outside Consultants to advise beyond basic PQ matters	Often Required	Never Required
Use of multiple PQ Monitors from different manufacturers	Various Software Needed	Simple, Single Analysis Software
Prompt PQ Problem Analysis	After the fact	Instantly
PQ Problem Identification from Data	Time intensive	Automatic Expert System
Notification of Problem	Often shut down	Often averts shut down
Off-premises Notification of PQ Problem	Not likely	Internet and optional page
Reports	Time Consuming	Automated & Simple
Multiple Site Monitoring	Difficult & Expensive	Simple common database

# AMETEK

## Power Quality

### Ametek ACE 4000 Power Quality Analyzer

Specifically designed for power quality monitoring applications demanding high measurement accuracy and flexible electronic data distribution, the Ametek ACE 4000 represents a two-generation leap in the design of Power Quality Analyzers. Our smartest analyzer ever, the Ametek ACE 4000's ability to diagnose virtually any power problem quickly, simply, and accurately makes it the best tool available for electric power quality analysis. This PQA will give you full cycle-by-cycle measurements on 8 channels (4 voltage and 4 current); and one survey set-up captures it all: power, harmonic, waveform, flicker, and transient, simultaneously.

#### Instant "On-The-Spot" Analysis and Reports

The world's first truly portable Pentium-based power recorder and analyzer. Replaces more than five separate instruments by incorporating Power Quality, Power, Harmonics, High Speed Recorder, Wattmeter, Logger and Flicker measurement.

The Ametek ACE 4000 packs all the power and flexibility you will need for acquiring and processing data with absolutely no gaps in measurement, sampling, or recording.

The lightweight Ametek ACE 4000 is a precise high-speed DSP based analyzer combined with an industrial grade Pentium PC laptop computer. It is built to acquire and process all data simultaneously and cycle-by-cycle, making more than 10,000 measurements each cycle. Absolutely no gap in measurement, sampling, or recording ever occurs in the performance of independent functions. Everything you need is built right into a compact, weather resistant IP65 NEMA3R, scientifically designed casing.

Fully integrated software combines all the power and features of Windows™ with new Ametek Power ACE software. The Ametek ACE 4000 comes with Smart Touch Opti View™ touch screen technology for fast operation, and an enormous memory for storing data.



The Ametek ACE 4000 can be operated as a portable stand-alone unit or used remotely with built-in Ethernet, Internet via 56K modem, serial, or parallel ports. It can exchange data with other ACE instruments, like the Quatro using PowerACE software. In fact, it can operate with just about any network.

All measurements including transients, harmonics to the 63rd order, sags and swells, as well as every power flow parameter and flicker measurement are simultaneously recorded onto the instrument's high capacity hard drive with true cycle-by-cycle measurement. With a minimum sampling rate of 256 samples per cycle on every channel and an operating frequency range of dc, 45-65 Hz and 400 Hz, all recorded data, samples, phasors, waveforms, harmonic spectra, and measurement text can be displayed in real-time with readout of cursor-selected waveform amplitude/time values.

Once a measurement survey is complete, the ACE 4000's Automatic Report Wizard will allow you to create a power quality report for rapid review and analysis. There is no need to download data do do an analysis or generate a report. Simple, elegant, and powerful, the Ametek ACE4000 is the state-of-the-art in power monitoring today.

#### Features

- Makes over 10,000 measurements each and every cycle synchronously on 8 input channels (4 voltage & 4 current) with absolutely no sampling or measurement gaps
- Simultaneously measures power, harmonics, waveform, flicker and transients ... along with other data
- Records, analyzes, reports and displays graphs with unequalled accuracy in monitor comparison
- Communicates through Internet, ethernet, serial, parallel, modem, RF or GPS
- Lightweight and built into a weather resistant, rugged casing
- 1 MHz peak detector, 4 MHz high speed transient analyzer (optional)
- 6.2 Gbytes data storage capacity

#### Benefits

- Has a color LCD including Smart Touch Opti View™ for ease of use
- Impressive number crunching capability provided by Pentium™ processor
- Huge data storage capacity
- Requires no external computer thanks to fully integrated Ametek PowerAce for Windows™ analysis software
- Fully compatible with Ametek ACE Quatro
- Free lifetime software upgrade
- Generates reports
- Communicates on LAN or by modem, Ethernet, Internet, parallel, serial and modem communications are standard equipment
- Unparalleled measurement accuracy
- Multi-tasking, multi-user

#### Applications

- On location analysis
- Load profiling
- Customer satisfaction
- Proof of performance
- Harmonics analysis
- Power quality survey
- Power factor surveys
- Demand studies
- Flicker surveys
- Transient detection
- Waveform capture and analysis

## Ametek ACE 4000 Power Quality Analyzer Specifications

GENERAL		USER INTERFACE	
VOLTAGE INPUTS:	PHASE A, B, C, NEUTRAL, AND GROUND	ACTIVE TFT DISPLAY :	10.4" DIAGONAL COLOR SCREEN
CURRENT INPUTS:	PHASE A, B, C, AND NEUTRAL		640 X 480 DPI WITH TOUCH
POWER TYPES:	3-PHASE DELTA AND WYE, 3-4 WIRE, SPLIT-PHASE, 3 SINGLE PHASE	MINI KEYBOARD :	SCREEN FEATURE
		PC SOFTWARE :	QWERTY POWERACE FOR WINDOWS™
OPERATING POWER		MEMORY	
AC VOLTAGE :	80-230 VAC	HARD DRIVE :	6.2 GBYTE IDE
DC VOLTAGE :	125 VDC - 250 VDC	FLOPPY DRIVE :	1.44 MBYTE 3.5"
FREQUENCY :	DC, 45-65, 400 Hz		
MEASUREMENT RANGE AND CAPABILITY		MEASUREMENT ACCURACY	
CHANNELS :	4 VOLTAGE/4 CURRENT	VOLTAGE :	+/-0.05% FULL SCALE
VOLTAGE:	5-750 VAC, 0-800 VDC, 1200 VDC T < 1 SEC. 0.01 TO 20000 PT RATIO	CURRENT :	+/-0.05% FULL SCALE
INPUT TYPE:	INDIVIDUALLY ISOLATED	FAST TRANSIENT :	1 μSEC, 1% FULL SCALE
IMPEDANCE:	2 MEGOHM	RESOLUTION :	14 BIT
CURRENT:	0 TO 3 VAC/DC OR 5A AC/DC (OPTIONAL) 0.01 TO 10000 CT RATIO	<b>ENVIRONMENTAL</b>	
SAMPLE RATE 60 Hz:	256 SAMPLES/CYCLES (15.5 KHz)	ENCLOSURE :	RAIN, DUST, ICE, CORROSION AND FLAME RESISTANT V-0, IP65
SAMPLE RATE 50 Hz:	256 SAMPLES/CYCLES (12.8 KHz)	OPERATING TEMPERATURE:	-30 TO 55 DEGREES C (-22 TO 131 DEGREES F)
SAMPLE RATE 400 Hz:	128 SAMPLES/CYCLES (51.2 KHz) (avbl. 2000)	OPERATING HUMIDITY:	0 TO 98% NON-CONDENSING
SAMPLE RATE PEAK DETECTOR:	1 MHz (4MHz avbl. 2000)	<b>PHYSICAL</b>	
SAMPLE RATE 4 MHz:	OPTIONAL	DIMENSIONS:	470 MM X 470 MM X 241 MM (9.5"X18.5"X18.5") (HEIGHT X WIDTH X DEPTH)
SYNCHRONIZATION:	CH1 VOLT, CH1 CURRENT OR PLL - OR AC LINE DC	WEIGHT:	9 KG (20 LBS)
MAX. ALLOWABLE:	6 KVPK +/-0.2% FULL SCALE		
VOLTAGE & CURRENT:		POWERACE FOR WINDOWS™	
	RMS; MIN, MAX, AVG ON ALL MEASUREMENTS (CONFIGURABLE), WAVEFORMS	COMPATIBILITY:	WINDOWS™ 95, 98, NT
POWER QUALITY:	WAVESHape FAULTS, SNAPSHOTS, RMS SUMMARIES AND VARIATIONS, FREQUENCY, DEMAND	QUICK SETUP:	FULLY AUTOMATIC OR SELECTION OF PREDEFINED SETUPS
POWER FLOW:	WATTS, ACTIVE, APPARENT, REACTIVE, POWER FACTOR	ADVANCED SETUP:	FULL SETUP CUSTOMIZATION
ENERGY/DEMAND:	ACTIVE, APPARENT, REACTIVE, THERMAL DEMAND	REAL TIME:	ALL MEASUREMENTS INCLUDING TEXT, WAVEFORMS, SPECTRA, PHASORS
UNBALANCE:	VOLTAGE	SURVEY ANALYSIS:	TIME PLOTS, SUMMARIES, TEXT, WAVEFORMS, SPECTRA, PHASORS, FLICKER CPF
HARMONICS:	DC, THD UP TO 63RD ORDER, VOLTAGE, CURRENT, POWER	CBEMA PLOT:	YES
TRANSIENT CAPTURE:	1MHz PEAK DETECTOR (*4MHz PEAK DETECTOR avbl. 2000)	DATA DOWNLOAD:	FULL OR BY EVENT.
FLICKER:	ACCORDING TO IEC 868, IEC 61000- 4-15	AUTOMATIC SURVEY REPORT:	REPORT GENERATION INTO MS WORD 7.0, DATA EXPORT IN ASCII-CSV FORMAT. SUMMARY AND TEXT REPORTS
COMMUNICATIONS		RECORDER	
ETHERNET:	TCP/IP 10 BASE T, BNC, RJ45 (TWISTED PAIR AND COAX)	ACTIVATION:	CONTINUOUS, OR BY EXCEPTION, EXTERNAL AND INTERNAL, CLOCK TIME
MODEM:	56 KBPS	RATE:	1 CYCLE - 1 WEEK OR 1-10,000 CYCLES, MULTIPLE RATES FOR CONTINUOUS AND ON-TRIGGER RECORDING, CONFIGURABLE SYNCHRONIZATION.
SERIAL:	RS232	TRIGGERS:	VOLTAGE AND CURRENT, INTERNAL, EXTERNAL, MANUAL, UP TO 32 ON ANY MEASUREMENT, PRE-TRIGGER 1 SEC., POST-TRIGGER UNLIMITED.
PARALLEL:	CENTRONICS		
INTERNET/INTRANET:	THROUGH ISP		
INFRARED (FOR ACE QUATRO):	SHORT DISTANCE (1 M/9600 BAUD) (3'/9600 BAUD), LONG DISTANCE (10 M/1200 BAUD) (30'/1200 BAUD)		

# AMETEK

## Power Quality

### Ametek ACE 2000 Power Quality Analyzer

The Ametek ACE 2000, a high-performance, high-capacity tool performs the tasks of five separate portable instruments. Its DSP computing power allows for simultaneous recording of voltage and current channels in four modes. These modes — a fully integrated wattmeter, harmonic analyzer, transient analyzer and flicker analyzer — can be configured for each application, thus ensuring maximum versatility and flexibility. Analysis is then provided by ACE for Windows software, complete with automatic report generation.

With eight fully-isolated analog input channels, its dual-processor architecture means high measurement accuracy, even with extremely distorted waveforms. The Ametek ACE 2000 measures, displays, and records all aspects of power.

#### The Professional Choice

The Ametek ACE 2000 is a true stand-alone electric power quality analyzer, performing the tasks of five instruments, and providing easy analysis and display of spectra, waveforms, phase, vectors and more.

The Ametek ACE 2000 comes in three different package styles, each an easily transportable, all-in-one solution for your power quality analysis needs.

One of the Ametek ACE 2000's main advantages is that future upgrades can be made simply by diskette, and those software upgrades are available for free. The Ametek ACE 2000 has lots of space for data storage — over 3.1 GB — so data and measurements captured can be stored (depending on user preference) in normal mode, at alarm thresholds, or by external trigger. No limits are placed on your power measuring survey. For maximum flexibility, the recording rate can be set anywhere between 20 milliseconds and one hour. In harmonic mode, wattmeter measurements may be carried out simultaneously.

In addition to being an easily transportable, all-in-one solution, the Ametek ACE2000 offers a functional keyboard, high-contrast graphics display, and a fully menu-driven environment. The Real-Time



Display and clear visual presentation provide a comprehensive view of spectra, waveforms, transient events, phase vectors, and more for easy analysis. Thanks to its user-friendly interface and advanced Ametek ACE for Windows analysis software, data can be printed, analyzed, and exported in numerous file formats including Excel™, Windows Metafile, Lotus 1-2-3™, Bitmap, and more. The Ametek ACE 2000 package is also offered with automatic report generator.

#### Features

- **AC/DC WATTMETER**  
The main measurement capabilities of the wattmeter include RMS voltage and RMS current; effective, apparent and reactive power; true power factor; frequency; active and reactive energy; and minimum, maximum and average values for meter readings.
- **HARMONIC ANALYSIS**  
In harmonic analysis mode, the ACE2000 provides the user with simultaneous THD, spectrum (0-50th harmonic), module and angle (360°), and direction reports. The phasor diagram also ensures that each phase is correctly connected.
- **TRANSIENT ANALYSIS**  
The ACE2000's transient analyzer captures all waveform disturbances and displays them in graphic mode. The system can handle up to 16 configurable triggers and combine these into various logical expressions according to application, for maximum flexibility.
- **THE NEW FLICKERMETER**  
The new IEC 868 normalized flickermeter mode is designed to measure any quantity of flicker sensation through statistical analysis procedures to obtain short-term and

long term severity flicker indicators such as (CPF, P50%S, P10%S, P3%S, P0,1%S, PMAX, PST, PLT) with any voltage input frequency from 50-60 Hz.

- Eight fully-isolated analog input channels for simultaneous recording of voltage and current channels in four modes
- Storage power of over 3.1 GB sets no limits to power measuring surveys
- Recording rates anywhere from 20 milliseconds to one hour
- Comes with advanced PowerAce analysis software so data can be printed, analyzed and exported in numerous file formats
- A real stand-alone instrument, comes in three different package styles

#### Benefits

- A Real-Time Display and clear visual presentation provide a comprehensive overview of spectra, waveforms, transient events, phase vectors, and more for easy analysis.
- A functional keyboard, high-contrast graphic display, and fully menu driven environment make the Ametek ACE2000 a pleasure to program.
- Data can be printed, or transferred to computer for further analysis.
- Provides extraordinary protection against shock, vibration, and temperature extremes
- Free lifetime software upgrade
- Versatile, flexible and affordable

#### Applications

- Power quality survey
- Harmonic study
- Energy and demand survey
- Flicker survey
- Load profiling
- Transient detection
- Waveform capture and analysis

# Ametek ACE 2000 Power Quality Analyzer Specifications

WATTMETER		RECORDER	
SINGLE-PHASE AND 3-PHASE:	RMS V INST./MIN./AVG./MAX. RMS A INST./MIN./AVG./MAX./NEUTRAL W INST./AVG./MAX, VAR INST./AVG./MAX, DELTA VAR AVG., VA INST./AVG. PF. INST./AVG., DISP PF. INST./AVG. KWH, KVARH, KVAH DEMAND W, VA, PF INST./MAX.	RECORDING MEASURES:	WATTMETER: 24 MAX. AMONG ALL MEASURES HARMONIC: FROM 1ST TO 50TH ORDER AND/OR WAVEFORM
3-PHASE:	VOLTAGE UNBALANCE KWHI (PERIOD I=1 TO 4) KVARHI (PERIOD I=1 TO 4)	RECORDING RATE:	WATTMETER: 20 MSEC. TO 1 HOUR HARMONICS : 1 SEC. TO 1 HOUR
L1 PHASE:	FREQUENCY (Hz)	STORAGE:	HARD DISK UNIT > 3.1 GBYTES (MODEL DEPENDING)
		FLOPPY DISK UNIT:	3"1/2, 1.44 MBYTES MS-DOS® COMPATIBLE
HARMONIC ANALYZER		DIGITAL OUTPUTS	
	ALL VOLTAGE AND CURRENT CHANNELS: THD, 0 TO 50TH HARMONIC (MOD., ANGLE, AND DIRECTION) PHASORS	NUMBER OF CHANNELS:	2
		TYPE :	RELAY CONTACT: 24 VDC MAX. 250 MA MAX.
TRANSIENT ANALYZER		ALARMS	
SAMPLING FREQUENCY:	ALL VOLTAGE AND CURRENT CHANNELS: 12.5 KHz	NUMBER:	16 MAX. ON INST./AVG. MEASURES OR HARMONIC AND THD MEASURES
RECORDING TIME PER EVENT:	40 MSEC. TO 1.8 SEC. (PROGRAMMABLE)	TIME RESOLUTION:	10 MSEC. FOR VOLTAGE RMS
TRIGGER TYPES:	RMS THRESHOLDS, PEAK, DISTURBANCE, EXTERNAL		
FLICKER ANALYZER		DIGITAL INPUTS	
VOLTAGE INPUT:	ALL VOLTAGE CHANNELS CPF, P50%, P10%, P3%, P1%, P0.1%, PMAX, PST, PLT (FREQUENCY 50-60 Hz)	NUMBER OF CHANNELS:	2
		TYPE :	PASSIVE OPTOCOUPLED : 24 VDC MAX.
COMMUNICATION PORT		OPERATING POWER	
TYPE:	RS232 (UP TO 115 KBAUD), PARALLEL, INTERNAL MODEM	AC VOLTAGE :	80-230 VAC
		DC VOLTAGE :	125 VDC - 250 VDC
		FREQUENCY:	DC, 45-65 Hz
RANGES		ACE FOR WINDOWS™	
VOLTAGE:	6 TO 750 VRMS, 800 VDC	COMPATIBILITY:	WINDOWS™ 3.x, 95, 98
MAX. ALLOWABLE:	1200 VDC T < 1 SEC. 0.01 TO 20000 PT RATIO	QUICK SETUP:	FULLY AUTOMATIC OR SELECTION OF PREDEFINED SETUPS
CURRENT:	3 VAC (5 A AC OPTIONAL)	ADVANCED SETUP:	FULL SETUP CUSTOMIZATION
FREQUENCY:	DC OR 45 TO 65 Hz	REAL TIME:	ALL MEASUREMENTS INCLUDING TEXT, WAVEFORMS, SPECTRA, PHASORS
MINIMUM INPUT SENSITIVITY:	30 V OR 250 MA	SURVEY ANALYSIS:	TIME PLOTS, SUMMARIES, TEXT, WAVEFORMS, SPECTRA, PHASORS, FLICKER CPF
SCALING VOLTAGE MULTIPLIER:	0.01 TO 20000 (WITH EXTERNAL PT)	DATA DOWNLOAD:	FULL OR BY EVENT.
SCALING CURRENT MULTIPLIER:	0.01 TO 10000 (WITH EXTERNAL CT)	AUTOMATIC SURVEY REPORT:	REPORT GENERATION INTO MS WORD 6.0/7.0, DATA EXPORT IN ASCII-CSV FORMAT. SUMMARY AND TEXT REPORTS
ACCURACY VOLTAGE:	0.1% F.S.		
CURRENT:	0.1% F.S. (PLUS CT ERROR)		
FREQUENCY:	FROM 45 TO 65 Hz 0.1% OF RDG		
HARMONIC:	0.1% F.S. FOR THD > 0.1%		
ANALOG INPUTS			
NUMBER OF CHANNELS:	8 (4 VOLTAGE AND 4 CURRENT OR 8 VOLTAGE)		
TYPE:	FULLY ISOLATED		
OPTIONAL INPUT MODULE:	4-20 MA		
PRINTER PORT		ARCHITECTURE	
TYPE:	CENTRONICS	PHYSICAL (BENCH-TOP):	185 MM X 327 MM X 350 MM (7"X13"X14") (HEIGHT X WIDTH X DEPTH)
		WEIGHT:	10.9 KG (24 LBS)
		DISPLAY:	LCD 160 X 128 DOTS (96 MM X 78 MM) CCT TYPE BACKLIGHT WITH AUTO SHUT-OFF
		KEYBOARD:	20 KEYS WITH ROTARY KNOB (JOG)

# AMETEK

## Power Quality

### Ametek ACE Quatro Power Recorder

The Ametek ACE Quatro is an advanced low-cost single- and three-phase power quality monitor and recorder, featuring simultaneous wattmeter, harmonic, transient, and flicker analysis capabilities. For cycle-by-cycle power analysis, it offers high-resolution 8 KHz sampling of 8 channels, 4 voltages, and 4 currents, with a fast 16-bit digital processor. A truly versatile tool, the Ametek ACE Quatro is accurate and extremely reliable. Best of all, the Ametek ACE Quatro is extremely compact and very lightweight.

#### The Easy-To-Use, Go Anywhere PQ Solution

A powerful power monitor and truly versatile tool for today's power quality technician. The Ametek ACE Quatro is the smallest and lowest cost power quality recorder to include flicker and harmonics.

Ametek ACE Quatro can be installed anywhere, indoors or out, comes with an infrared serial communications port and most importantly, is easy to use.

The Ametek ACE Quatro is the smallest, lowest-cost, most light-weight solution in PQA data recording. It's also the easiest to use. It can be installed anywhere, indoors or out. It comes with an infrared serial communications port, which can communicate results to the Ametek ACE 4000, or any PC, with Ametek PowerACE software. The powerful infrared interface allows you to download recordings wirelessly to your PC.

A power survey containing up to six months' data stored in flash memory can be transferred to a PC via a RS-232 infrared link or external modem for report generation and data analysis. Ametek PowerACE software for Windows™ supports communication and analysis of the recorded data. Create complete reports including summaries, charts, and graphs to



display and print a comprehensive profile of an individual load or site.

Compact and designed to mount anywhere indoors or out, multiple Ametek ACE Quatros can be installed within a facility or at several substations to monitor critical points comparing data gathered on the same time base. The Ametek ACE Quatro can be line-powered, or powered by an external supply for low voltage monitoring and it is equipped with LEDs to provide visual confirmation of 'power on' and proper phase connections. The Quatro is shipped complete with mounting straps to attach the ACE Quatro to any pole, transformer, or panel.

#### Features

- Small, low cost and lightweight
- Highly accurate and extremely reliable
- Provides advanced single- and three-phase power quality monitoring and recording
- Simultaneous power, harmonic, transient and flicker analysis capabilities ... and much more
- High-resolution sampling on 8 channels: 4 voltage and 4 current (V, A, W, Var, power factor, THD, energy, and more)
- Equipped with an infrared serial communication port
- Ships with Ametek PowerACE software
- NEMA 4x enclosure

#### Benefits

- Advanced PowerAce software provides full compatibility with the Ametek ACE 4000, or any PC
- Free lifetime software upgrades from web page
- Can be easily mounted anywhere, indoors or out
- Infrared serial communication port allows you to download data from as far as 30 feet away
- Wireless transfer saves time and money
- Firmware upgradeable in field
- Low-cost method to monitor multiple points simultaneously

#### Applications

- Power quality
- Load studies
- Flicker
- THD

## Ametek ACE Quatro Power Recorder Specifications

GENERAL		MEMORY	
VOLTAGE INPUTS:	PHASE A, B, C, NEUTRAL, AND GROUND	INTERNAL:	1 MBYTE FLASH MEMORY, UP TO 6 MONTHS OF DATA
CURRENT INPUTS:	PHASE A, B, C, AND NEUTRAL	REAL TIME CLOCK:	10 YEARS BATTERY LIFE DATE/TIME/YEAR YEAR 2000 COMPLIANT
POWER TYPES:	3-PHASE DELTA AND WYE, 3-4 WIRE, SPLIT-PHASE, SINGLE PHASE		
OPERATING POWER		COMMUNICATIONS	
AC VOLTAGE :	180-480 VAC 230-600 VAC (CANADA OR ON REQUEST)	SERIAL RS232:	INFRARED SHORT DISTANCE (1 M/9600 BAUD) (3'/9600 BAUD), LONG DISTANCE (10 M/1200 BAUD) (30'/1200 BAUD)
POWER ADAPTER:	80-230 VAC	MODEM:	EXTERNAL OPTIONAL
FREQUENCY:	45-65		
MEASUREMENT ACCURACY		POWERACE FOR WINDOWS™	
VOLTAGE:	+/-0.2% FULL SCALE	COMPATIBILITY:	WINDOWS™ 95, 98, NT
CURRENT:	+/-0.2% FULL SCALE	QUICK SETUP:	FULLY AUTOMATIC OR SELECTION OF PREDEFINED SETUPS
IMPULSE:	125 μSEC, 0.2% FULL SCALE	REAL TIME:	ALL MEASUREMENTS INCLUDING VOLTS, POWER, ENERGY, HARMONICS
RESOLUTION:	16 BIT	SURVEY ANALYSIS:	TIME PLOTS, SUMMARIES, TEXT, HARMONICS, SPECTRA, FLICKER CPF
ENVIRONMENTAL		DATA DOWNLOAD:	FULL
ENCLOSURE:	RAIN, DUST, ICE, CORROSION AND FLAME RESISTANT V-0 NEMA 4X, IP 66	AUTOMATIC SURVEY REPORT:	REPORT GENERATION INTO MS WORD 7.0, DATA EXPORT IN ASCII-CVS FORMAT. SUMMARY AND TEXT REPORTS
OPERATING TEMPERATURE:	- 25 TO 60 DEGREES C (-13 TO 140 DEGREES F)		
OPERATING HUMIDITY:	0 TO 98% NON-CONDENSING		
PHYSICAL			
DIMENSIONS:	220 MM X 160 MM X 75 MM (8.5"X6"X3") (HEIGHT X WIDTH X DEPTH)		
WEIGHT:	1 KG (2.2 LBS)		
ENCLOSURE:	KYDEX 510		
MEASUREMENT RANGE AND CAPABILITY		MEASUREMENT CAPABILITY	
CHANNELS:	4 VOLTAGE/4 CURRENT	VOLTAGE & CURRENT:	RMS - AVG, MIN, MAX, ON ALL MEASUREMENTS, FREQUENCY
INPUT TYPE:	SINGLE ENDED	POWER:	VA, VAR, WATT, PF
IMPEDANCE:	5 MEGOHM	ENERGY:	WATT HOURS
VOLTAGE:	5-600 VAC, 0.01 TO 20000 PT RATIO	HARMONICS:	THD UP TO 50TH ORDER, ANGLE, VOLTAGES, CURRENT THD ONLY
CURRENT:	0 TO 3 VAC OR 0-5 A AC/DC 0.01 TO 10000 CT RATIO	FLICKER :	PST, PLT (ACCORDING TO IEC 868 & IEC 61000- 4-15)
SAMPLE RATE:	8 KHz VOLTAGE & CURRENT		
MAX. ALLOWABLE:	1.2 KVPK +/-0.2% FULL SCALE		
USER INTERFACE		RECORDER	
PC SOFTWARE:	POWERACE	ACTIVATION:	1,5,10,15, 30 MIN TO 1 HR. (CONFIGURABLE).
COMPATIBILITY:	WINDOWS™ 95, 98, NT		

# AMETEK Power Quality

## Ametek PowerACE Software

With Ametek PowerACE for Windows™ software, and the Ametek ACE family of power quality analyzers and recorders, you never need to guess. Every power and power quality measurement is made simultaneously, cycle-by-cycle so you need never sacrifice one measurement parameter for another.

If you are concerned with current measurements, why settle for less resolution on the load side than on the voltage? With PowerACE™ load profiling, full resolution of current and voltage measurements is available simultaneously with complete trigger capability included for current and voltage parameters.

### The Heart of our System

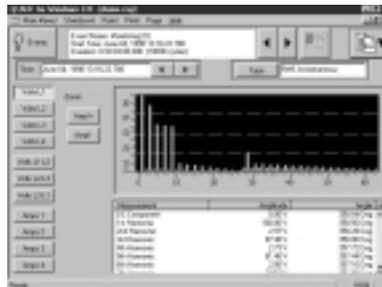
The fundamental reason to use any piece of test equipment is to verify the existence of a problem, identify its source, and report that information when and where you need it. PowerACE does all of that and more.

Ametek PowerACE software for Windows™ completes up to ten thousand measurements per cycle, so you will never miss an electrical power event again!

If the cost of power is an issue, Ametek PowerACE for Windows™ will show you how to achieve the lowest possible energy costs. Ametek PowerACE includes everything you need to measure power factor, determine Peak Demand and ultimately lower your costs. Why spend money and time on a dedicated submetering installation when you can find ways to reduce energy costs with the Ametek ACE family of analyzers and Ametek PowerACE?

Ametek PowerACE supports real time readings, reports, telephone, or Ethernet communications, and more. When used with the Ametek ACE 4000, the combination of powerful software and Pentium processor, allows you to communicate and generate reports while continuing to gather data.

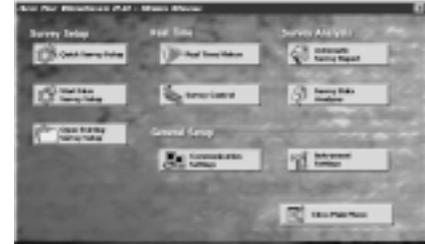
Ametek PowerACE provides an open file



architecture that allows access to all collected data for use in custom programs or data manipulation. But the real power of Ametek PowerACE comes when you want to customize measurements. Perhaps you need non-standard calculations, or want to process data with another piece of software. Ametek PowerACE for Windows™ is fully compatible with all Windows™ software, and downloading into FoxPro, Excel, Lotus or any other spreadsheet is just the beginning. Fully integrated within the Windows™ environment, Ametek PowerACE will allow you to access data, and transfer or transform it in just about any way you need, all at the touch of a shortcut key.

With Ametek PowerACE you won't need a dedicated predictive maintenance program. Ametek PowerACE for Windows™ software is able to predict all kinds of problems before they happen.

The automatic report generator creates reports and eliminates extraneous data with a few keystrokes. If your report requires all the data, simply let the report



generator summarize all events, and supply charts and graphs for every parameter measured simultaneously.

Ametek PowerACE provides a simplified universal platform to record, measure, report and display all electrical parameters.

### Ametek PowerACE for Windows™

- Provides complete control of Ametek ACE 4000 and Quatro
- Full instrument setup capability
- Supplies an expandable set of quick setups tailored to various PQ applications — for those who want to “plug and play”
- Provides an extensive set of data viewing tools such as time plot, text, CPF curve, CBEMA, phasor diagram, harmonic and spectrum, all of which you can customize according to your wants or needs
- Communicates through ethernet with any computer or with Ametek ACE 4000 hooked up to your network
- Access your data and control your instrument from virtually anywhere
- Exports data in CSV ASCII text, and a range of industry standard software formats such as Word, Excel, etc.
- Displays data in real time — even waveforms! — directly on the instrument as well as remotely from your PC
- Has an on-line user manual to guide you
- Free lifetime software upgrade
- Intuitive and easy to use
- Continuous simultaneous data acquisition
- Variable recording rate selection
- Harmonic spectra analysis
- Zooming and cursor tools
- Reporting tools
- Printer and peripheral support

## AmetekACEPortables

Capability	Ametek ACE 4000	Ametek ACE 2000	Ris ACE Quatro
Power Quality	•	•	•
Load Profile	•	•	•
Flicker (50 & 60 Hz)	•	•	•
Power	•	•	•
Power Factor	•	•	•
Frequency	•	•	•
Voltage Harmonics	63rd	50th	THD only
Current Harmonics	63rd	50th	
THD	•	•	•
Lifetime Software Update	•	•	•
Software	PowerAce	Ace for Windows	PowerAce
Free Phone Support	•	•	•
Portable	•	•	•
Sample Rate	256/cycle	128/cycle	8KHz (Non Sync)
Inputs	4V/4I	4V/4I	4V/4I
Isolated Inputs	•	•	
AC/DC Inputs	•	•	
Waveform Capture	•	•	
Relay Inputs	optional	•	
Transients	•	•	MAx/Min (>250µsec)
Demand	•	•	
Real Time Display	•	•	•
Display Type	Color Touchscreen	LCD	PC
Simultaneous Power, Flicker, and Harmonics	•		•
Computer Required for Set Up			•
Computer Required for Analysis		•	•
Modem	•	•	External
Infrared Data			•
Ethernet	•		
8 Channel Oscilloscope	•		
10,000 Measurements/cycle	•		
Built-In Pentium Processor	•		
On Board Analysis	•		



# Distribution Monitoring

**The Ametek LoadLoggers\*, Load Profilers\* and P&QR are non-invasive digital recording loggers for gathering data on distribution loads and power quality. Whether the data is from a load site or direct from the distribution system, the Ametek Load Management products are easy to install, operate and analyze.**

- **Distribution Line Loadloggers:**

LoadLogger is a primary side (100V – 69KV) current recorder providing load profiles for periods from 4.5 to 66 days.

- **Recording Ammeter:**

The Load Profiler uses the same technology as the LoadLogger to record current on secondary circuits (to 700V) or insulated conductors.

- **P&QR:**

The P&QR128 is a data logger and power quality recorder designed for load side monitoring.

**Data from the Ametek Distribution Monitoring products can be used for:**

- Fault Analysis
- Improving power quality
- Monitoring effectiveness of load tap changers/voltage regulators
- Monitoring of peak transformer loading
- Monitoring effect of (or need for) capacitors
- Load growth analysis
- Recording peak load values and times
- Analyzing time-of-day load fluctuations
- Load imbalance studies (EMF and losses)
- Accurate and complete data for distribution modelling programs
- Fuse sizing
- Theft-of-service studies
- Evaluating circuits for DA/DSM
- Replacing substation chart recorders



\*LoadLoggers and Load Profilers are not available in Canada through Ametek.

# AMETEK

## Distribution Monitoring

### LOADLOGGER LL-230A

The LOADLOGGER is a rugged digital recording ammeter for non-invasive recording of distribution line currents. Using a hot stick, the LOADLOGGER clamps onto overhead lines up to 69 kV and can record up to 1000 amps with 1 amp resolution.

Up to 66 days of load data can be stored by the LOADLOGGER and then downloaded to a personal computer where the data is analyzed using our LOADSMART® software.



### LL-230A Specifications

**Conductor Size:** 0.2 to 1.093 inches diameter (Max. 795 MCM). A rubber adapter is used for bare or insulated conductor diameter 0.2 to 0.4 inches.

**Maximum Conductor Voltage:** 69 kV

**Current Range:** 0-1000 amps

#### Battery Life:

Lithium batteries: 1 year minimum  
Can be supplemented by a standard 9 V alkaline battery.

#### Memory:

Recording memory is user selectable to stop when full or continuously record on a first-in, first-out basis.

Data storage capacity is determined by averaging interval selected.

Averaging Interval	Maximum Storage
15 min.	66 days
5 min.	22 days
1 min.	4.5 days

**Resolution:** 1 Amp

**Accuracy:** <5% of reading

**Internal Clock Accuracy:** One minute per 2 weeks over specified temperature range.

**Operating Temperature Range:** -40°C to +55°C

**Weight:** 5.0 lbs. (2.3 kg) nominal

#### Environment:

Lifetime warranty for water-resistance

### Computer Interface Adapter Specifications

**Computer Connector:** Standard 25 pin D-type female connector. Connects to com 1, 2, 3 or 4 on PC. 9 pin connector also available.

#### Power:

AC adapter or 9 V alkaline battery

**AC Adapter:** Standard AC adapter is alternative power source

**Battery Check:** Voltage level factory set to 6.95 V to verify life of lithium battery in LL

### LCD Module Specifications

**Display Type:** Liquid Crystal – Display 1" high digits

**Update Frequency:** Display is updated every 3 seconds.

**Mounting:** Attached to LOADLOGGER at the serial interface connector.

**Power Supply:** Operates directly from the LOADLOGGER's battery.

**Operating Temperature:** 0°C to +40°C

**Dimensions:** 5.84 x 2.5 x 1.3 inches (150mm x 64mm x 34mm) nominal

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## Load Profiler LP-260



The Load Profiler is a rugged, non-invasive digital recording ammeter for simple, cost effective collection of load data on your power circuits.

To monitor and record line currents, clip the split-core current transformer (CT) to any conductor up to 700 volts, or any insulated cable under 2" diameter—even underground distribution cables.

The Load Profiler can be used as a hand-held ammeter for instantaneous current readings, or can be left on-site to collect up to 66 days of data. Current readings from 0-1000 amps, are averaged and stored at a user selected time interval. The recorded data is then transferred to a computer to generate current vs. time load profiles for load management analysis.

## LP-260 Specifications

**Operating voltage:** 0-700 volts on non-insulated cables unlimited on insulated cables

**Current Range:** 0-1000 amps

**Resolution:** 1 amp

**Accuracy:**  $\pm 3\%$  of reading

**Temperature Range:**

-30°C to 55°C up to 800 amps

-30°C to 30°C up to 1000 amps

(Display operation is 0° to 40°C)

**Cable:** Up to 2" outside diameter

**Memory:**

Averaging Interval	Maximum Storage
15 min.	66 days
5 min.	22 days
1 min.	4.5 days

**Dimensions:**

Housing:	3" x 2" x 6"
CT:	4" outside diameter
Cord:	6 feet long
Weight:	1.7 lbs.

# AMETEK

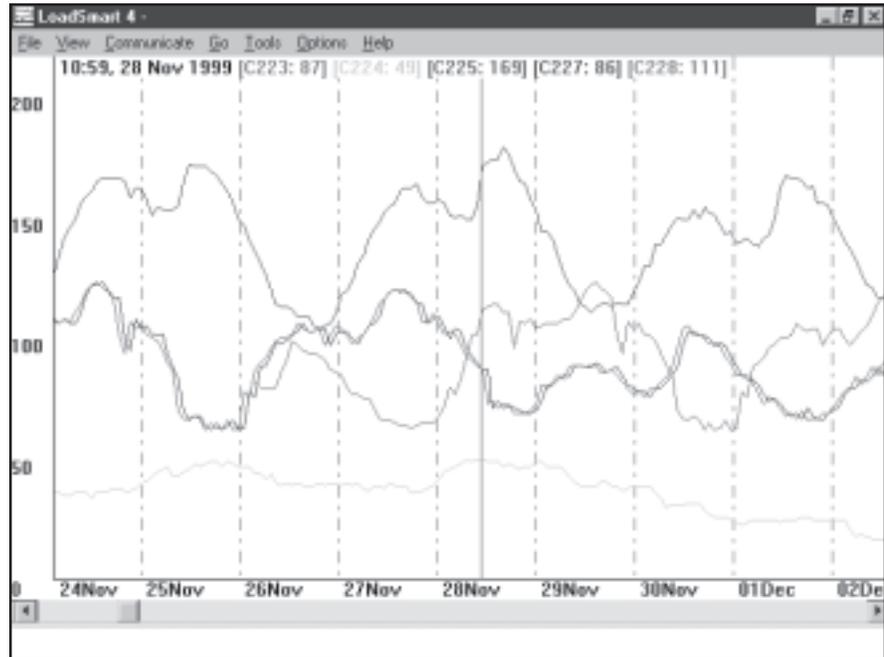
## Distribution Monitoring

### LOADSMART Software

LOADSMART Software is a powerful tool for analyzing load data. The software allows you to initialize each recorder and then load data is transferred to a computer and time stamped to real time using LOADSMART.

LOADSMART is used for both LOADLOGGERS and Load Profilers and performs the following functions:

- Initialize recorder
- Download recorded data to personal computer
- Time stamp data to real time
- Obtain minimum and maximum readings
- Add, subtract, or average time coincident files
- Convert data values to spreadsheet formats



*Time of day load fluctuations*

#### Hardware requirements:

- IBM compatible computer
- Windows® 3.1, '95, '98 or NT
- RS-232 serial port

### Ordering

Please specify the complete model number of the kit or single logger required.

#### LOADLOGGERS

Model	Description
LL-230	single phase LOADLOGGER module
LL-231	3 phase starter kit. Includes the following as standard: 3 LL-230 single phase modules LOADSMART software 1 Computer Interface Adapter 1 LCD display Instruction Manual Carrying case
LL-232	3 phase kit. Includes the following as standard: 3 LL-230 single phase modules Carrying case

#### Peripheral Items and Spares

Model	Description
LL-233	Computer interface adapter
LL-234	LCD display for use with LL-230
LL-235	Carry case for use with LL-231 or LL-232
	Spare lithium battery pack for use with LL-230

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## **P&QR128 and P&QR256**

### **Comprehensive Power and Fault Recorders with Advanced Features**

**“Sniff Out” power and fault data with the affordable P&QR series power and fault recorders.**

Whether you are a utility “sniffing out” power and fault problems on the power grid, or a facilities manager “sniffing out” power quality concerns in your plant... the P&QR Series offers the perfect, affordable solution you’ve been looking for.

#### **For Utilities**

Deregulation means increased competition for utilities. Providing affordable power quality affirmation to your key customers is critical to keep customers from migrating away, and to win new customers. The P&QR128 and P&QR256 are useful for troubleshooting relay misoperation. The P&QR Series offers utilities incredible flexibility, ease of use, durability, and perhaps most importantly, dramatic cost savings!

#### **For Customers**

For even modest sized power customers, doing business in this newly deregulated environment, a power quality monitor is one of the best investments your company can make! Your power and fault monitor will help you take surveys of sufficient length and provide the information you need to decide exactly how to best buy your power: spot, flat rate, time of use, seasonal. Your P&QR128 or P&QR256 can easily pay for itself in a short period of time. Providing answers about your power consumption is only the beginning, many additional benefits are yours with a P&QR128 or P&QR256 from Ametek Instrument Systems.



#### **Economic Incentives!**

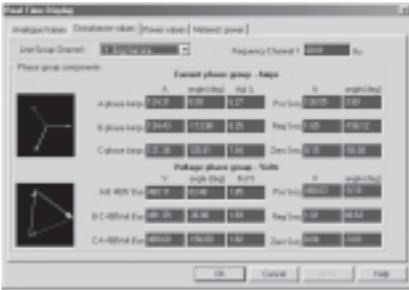
One of the biggest reasons to buy your new P&QR128 or P&QR256 is purely economic! We’ve packed many high end fault recording functions into a well built unit that is offered at a very low cost. The P&QR Series has many of the functions that you would expect in a fault and power quality recorder. However, we would like to point out many features that are rare for a unit at this price, and even some features that are not available on other units at any price!

- **First, these Power Quality Recorders have enormous data storage capacity. They come with a standard 6 gigs of storage. This gives you plenty of flexibility for long measurement surveys, or short highly concentrated data collection.**
- **The units are phase locked looped to offer you extraordinary sampling accuracy even if the frequency you are monitoring shifts. Most competitive products don’t have this capability.**
- **Ametek Instrument Systems P&QR Series has excellent RFI rejection, minimizing the unwanted effects of cell phones, computers, broadcast, or hand-held radios.**

- **You can identify and isolate problems using the fault recording and waveform capture capabilities.**
- **The low cost P&QR128 and P&QR256 offer great flexibility to the Power Quality professional. For instance, you can take advantage of its multiple-voltage ranges and selectable CT scaling to obtain improved accuracy by optimizing your A to D measurement.**
- **Best of all, these units have optional ethernet or modem connectivity so you can get the data you need without having to leave your chair.**
- **The dynamic P&Qs software will quickly and easily help you get the most out of your P&QR. A more complete explanation of P&Qs follows.**
- **Check out the technical specifications chart to see all the terrific features offered by the P&QR128 and P&QR256.**

Whether it’s avoiding a costly plant shut down, finding power quality problems or just making sure that you are paying the lowest possible price for your electricity usage... the Ametek Instrument System P&QR is the right solution for you!

# AMETEK Distribution Monitoring



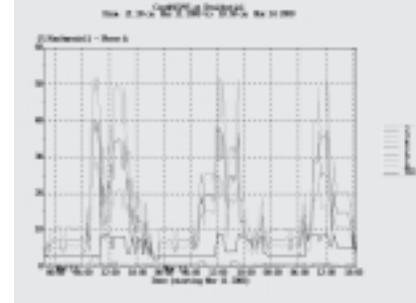
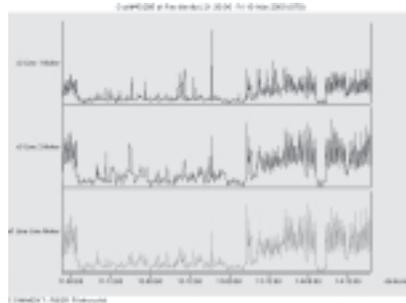
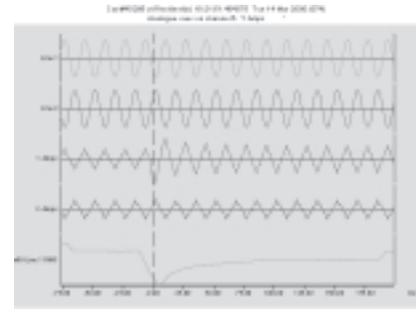
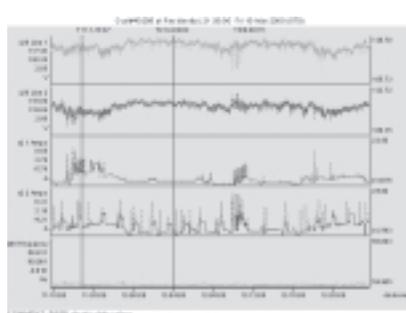
- Determine the lowest possible price for power
- Pays for itself in savings
- Large memory capacity allows for long surveys or short concentrated data collection
- Extraordinary sampling accuracy
- RFI rejection minimizes the effects of outside interference
- Isolates problems with waveform recording
- Optimizes A to D measurements
- Optional internet transports data to you
- Enclosed unit can be used outdoors

## Features

- 8 channel input:  
4 voltage, 4 current
- 14 bit recording
- 8 Mbytes internal memory
- 6.4 Gbytes hard disk
- Sample rate 128/cycle (optional 256/cycle)
- Relay input
- Real time clock
- Measures waveform faults
- Measures voltage dips and surges
- Measures harmonics
- Measures flicker and imbalance
- Records voltage and current, frequency and real power
- Computes demand, phase angle, power factor, and sequence components at PC
- Event triggering accuracy is better than 2%
- RS232 serial port
- Internal modem option available
- Ethernet network option available
- Free phone support
- Powerful P&Qs software for communications and analysis

## Benefits

- Affordable fault recording
- Provides power quality affirmation
- Simple to use



## P&Qs

This basic communications and configuration software provides autopoll and autocal support with auto-event retrieval for the P&Qs. As part of the polling process, the recorder clock can be updated and events can be retrieved. P&Qs is an abbreviated version of Display Station and Display Station Analysis.

## Autopoll/call

- Operates in a totally automatic mode if configured; operating both in parallel provides added reliability in detecting problems in communication and minimizing communication expenses.

## Auto-event retrieval

- The recorder sends data automatically to the PC where it is most useful. Retrieval of profile, cameo and/or fault data minimizes time to retrieve data in critical situations.

## Configuration control

- Recorder configurations for up to 10 P&Qs are stored at the PC. P&Qs flags the user if there are differences for better control.

## 32-bit Windows software

- Operates on the most common operating systems in use.

# RiS P&QR TECHNICAL SPECIFICATIONS

## INPUTS

No. of channels	8 (4 voltage, 4 current) consult factory for other configurations
Voltage inputs (options)	150 V RMS maximum 300 V RMS maximum 600 V RMS maximum Star (wye) or delta connections
Current inputs (options)	1/5A RMS nominal 100/200/500/1000 A RMS nominal (1.4V fsd. Int. or ext. burden) Designed to record to 40% overrange
Frequency response P&QR128	40Hz – 3kHz. (+0dB, -3dB for voltages) DC – 3kHz (+0dB for currents)
Frequency response P&QR256	40Hz – 6kHz. (+0dB, -3dB for voltages) DC – 6kHz (+0dB, -3dB for currents)
Accuracy	Better than 0.2% of full scale

## RECORDING

Recording resolution	14 bits.
Recording accuracy	+/- 1 lsb.
Sample rate	128 samples per cycle 6.4/7.68k samples per second option for 256 samples per cycle 2 samples per cycle for high-speed RMS envelope capture

## DATA STORAGE

Internal memory	8 Mbytes
Hard disk	6.4 Gbytes (minimum)

## RECORDED DATA

Waveform Capture	4 cycles pre, 12 cycles post Option for up to 2 seconds Up to 1 minute of RMS data
Trending – (16 weeks)	Voltages: 1 minute min/max/avg Currents: 1 minute min/max/avg Frequency: 1 minute min/max/avg Watts: 1 minute min/max/avg Harmonics: 10 minute min/max/avg/angle to the 50th harmonic Imbalance: 10 minute min/max/avg Flicker: 10 minute Pst
Metered values	kVAh ±kWh ±kVArh
Computed (at PC)	Phase angle, power factor, demand (sliding or fixed window) and sequence components

## EVENT TRIGGERING

Trigger parameters	Over/under level with hysteresis. ROC & THD
Accuracy	Better than 2%
Pre-fault time	4 cycles (128 or 256 samp/cyc); 1-10 sec. (2 samp/cyc)
Post-fault time	12 cycles (128 or 256 samp/cyc); 1-59 sec. (2 samp/cyc)
External trigger	Relay contact (24-120Vdc nominal)

## POWER SUPPLY

Input voltage range	88–300V dc, 85–264V ac, 50/60Hz 24 or 48Vdc optional
Power requirement	20 VA
Battery	Optional 12V for recorder operation

## REAL TIME CLOCK

Clock source	32,768 Hz. crystal oscillator
Resolution	1 ms.
Range	Time and date (including leap year and day of the year).
Synchronization	50/60 Hz from voltage input

## COMMUNICATIONS

Serial port	RS232 type.
Speed	up to 57 kBaud
Modem (optional)	Hayes compatible type internal. (up to 57.6 kBaud)
Network (option)	TCP/IP 10Base2 or 10BaseT

## VOLTAGE WITHSTAND

Isolation	Channel to channel (voltage) Channel to ground. 2 kV RMS for 1 minute (as per IEEE C37.90-1987/IEC 255-5)
Impulse voltage withstand	Channel to channel (voltage) Channel to ground 5 kV, 1.2/50 ms. 0.5 Joule (as per IEEE C37.90-1987/IEC 255-5)
Electrical fast transient (EFT)	4 kV, 5/50 ns. 15 ms burst length non-maloperate (as per IEEE C37.90-1987/IEC 255-22-1)
Surge withstand (SWC)	2.5 kV, 1 MHz HF burst disturbance non-maloperate (as per IEEE C37.90-1987/IEC 255-22-1)
RFI immunity	10 V/m 20 MHz – 1 GHz (80% AM @ 1 kHz). Non – maloperate (as per IEEE C37.90-1987/BS EN 50082)
RFI emission	— radiated 40 dB mV/m (27 – 130 MHz) 47 dB mV/m (130 MHz – 1 GHz) EN 55022B (class 'B' limits) (as per BS EN 50081-1)
	— conducted (150 kHz – 30 Mhz) EN 55022B (class 'B' limits)
	— harmonics (100 Hz – 30 MHz) (as per IEC 555 class 'A' limits)
Electrostatic discharge (ESD)	8 kV contact, 15 kV radiated discharge. Non-maloperate (as per IEC 801-2)

## ENCLOSURE

Mounting	Wall
Size	200 x 300 x 120 mm (7.87 x 11.8 x 4.7 in.) Optional 300 x 400 x 210 mm (11.75 x 16 x 8.25)
Weight	6 Kg. (13.2lbs.) Optional 8kg (17.6 lbs)

## ENVIRONMENT

Operating temperature	-10 to 50 °C 14 to 122 °F
Storage temperature	-40 to 70 °C -40 to 158 °F
Humidity	5 – 95% RH (non condensing)

# AMETEK

## Distribution Monitoring

### Communications, Analysis and System Configuration

#### Software

A single communication and analysis package is used for the TR-100, TR-2000 and P&QR series recorders. Additionally, when RVComms is used, the powerful analysis software can be used for the older TR-1600 series recorders.

Ametek's software programs provide advanced fault analysis, communication and configuration functions in a 486 based PC-compatible (minimum) computer. The programs have a very flexible graphical user interface which uses Windows 95™, 98™, NT or Windows 2000™. Many fault analysis features are provided and there are optional programs for additional

mathematical functions. There are two major modules of Ametek software available.

#### Communications

This provides communication to, and configuration of, the TR-100, TR-2000 and P&QR series either (1) remotely via a modem link to a Master Station normally located in central engineering or at a control center, (2) locally via a direct connection on site or (3) via an Ethernet link.

The communications software has a unique feature that allows the user to set over and/or under trigger levels with hysteresis on the analog channels with the actual signal displayed in near real time. This waveform is overlaid with the equivalent trigger levels which improves the ease and accuracy of trigger settings (see next page).

Sub cycle drop out or THD triggers measure the quality of a voltage or current waveform. Small perturbations which would not be detected by

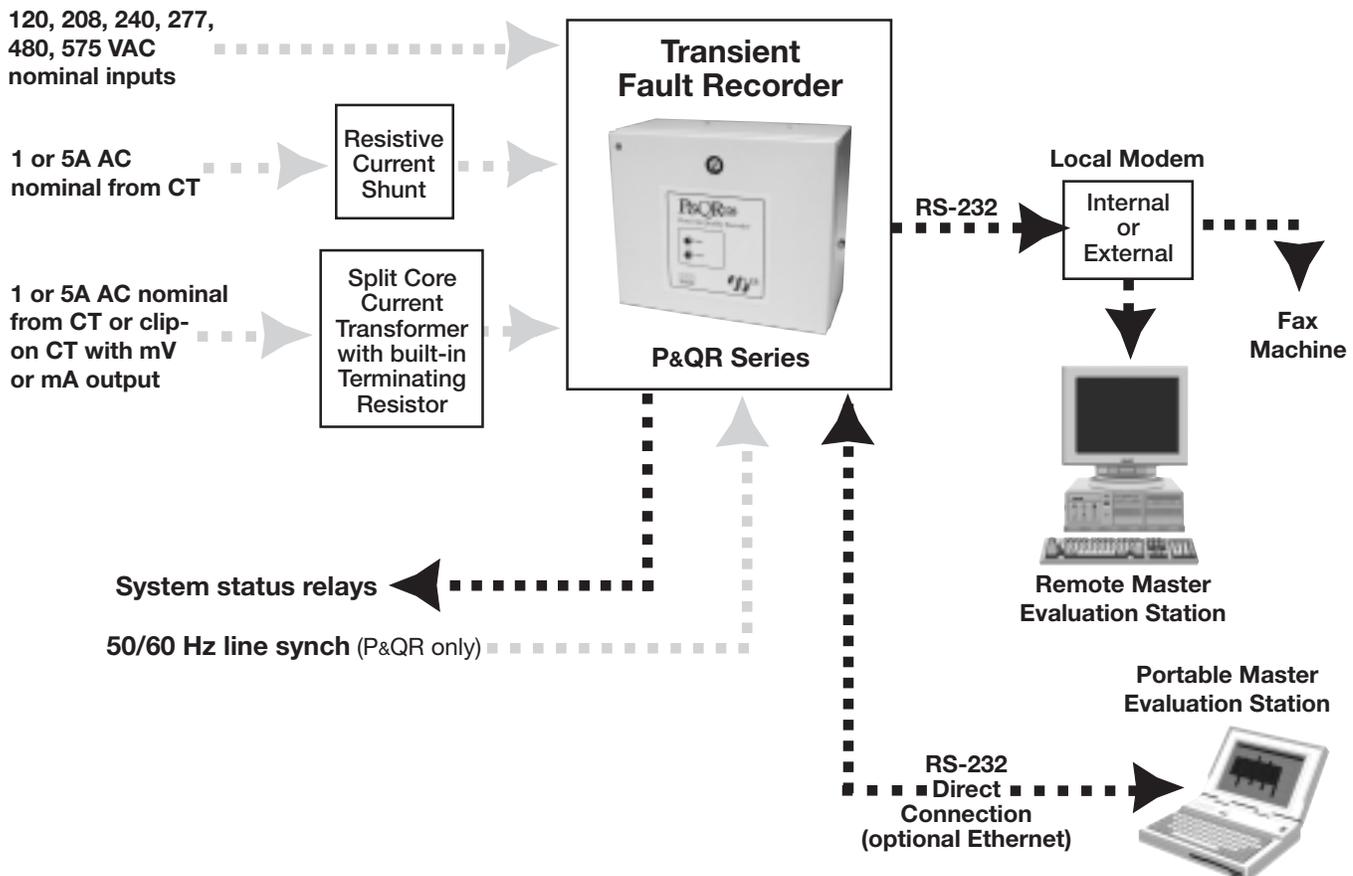
standard level or rate of change triggering can be recorded by the TR-100, TR-2000 or P&QR.

Sets of three analog channels can be defined as phase groups. For each group, zero and negative sequence component trigger levels can be set. Again, the display of near real time data ensures correct values are used and inputs are wired in properly (see next page). Two phase groups are available per 8 inputs.

The recorders can be set to dial up the Master Station when a fault is recorded (Auto Call) and the Master Station can be programmed to contact each recorder in a region at regular intervals to check for new records (Auto Poll). A communications log records any problems incurred during auto polling.

Unauthorized parameter updates and record downloading can be protected by passwords. A recorder may be remotely triggered from the Master Station to generate test records.

### Architecture



# AMETEK

## Signal Conditioning

### Signal Conditioning

**The extensive line of Ametek signal conditioners provide application flexibility in installation, configuration and operation. Choose from 2- or 4- wire; transmitter or trip; surface, rail, head or panel mount; analog or digital electronics; and a wide variety of inputs, outputs and power supply options.**

This section of the catalog is divided into several sub-sections. Each sub-section describes a line of products and includes all drawings, specifications and ordering information.

Sections describing configuration kits and accessories are also included.

Ametek signal conditioning products continue a tradition of quality, reliability, accuracy and repeatability.

### Signal Conditioning Family Guide

#### SC-7400 Family

Universal 4-wire transmitters and trips for mV, T/C, RTD, ohm, current, voltage and slidewire applications. Hand-held configurator, or PC configuration software.

- SC-7401
- SC-7402
- SC-7403
- SC-7404
- SC-7405
- HHC-7400
- PC-7400

#### SC-4400 Family

Universal 2-wire transmitters for mV, T/C, RTD, and resistance applications. Head or field mounted.

- SC-4400
- HHC-4400
- PC-4400

#### SC-4300 Family

2-wire switch selectable transmitters.

- SC-4300L/U
- SC-4300R
- SC-4326
- SC-4372

#### Loop powered isolators

- SC-2302

#### Loop-powered indicators and meters

- SC-4300M
- SC-4301M
- SC-4302M
- SC-4303M

#### ET-1200 Family

4-wire trips for RTD, T/C, mA, mV, DC voltage/current and AC voltage/current.

- ET-1200 L/U
- ET-1202 L/U
- ET-1205
- ET-1208
- ET-1214
- ET-1215
- ET-1218
- ET-1219
- ET-1228
- ET-1275
- ET-1278
- ET-Dimensions & Ordering

#### SC-1300 Family

4-wire transmitters, signal conditioners and computational devices.

- SC-1300
- SC-1300L
- SC-1300R
- SC-1300U
- SC-1302
- SC-1320
- SC-1324
- SC-1326
- SC-1326W
- SC-1330
- SC-1350
- SC-1352
- SC-1354
- SC-1356
- SC-1358
- SC-1362
- SC-1364
- SC-1372
- SC-1374
- SC-1380
- SC-1382
- SC-1390
- SC-1396
- SC-1398
- SC-Dimensions & Ordering

#### High Density Enclosures

- P-11
- A-12

# AMETEK

## Signal Conditioning

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### Signal Conditioners - Transmitters - Electronic Alarms

*Input/output Isolation Is Standard Unless Otherwise Stated*

#### Resistance Inputs (RTD's, Slidewire, Strain Gage)

##### 2-wire RTD Transmitters

Switch Selectable SC-4372  
Programmable SC-4400

##### 4-wire RTD Transmitters

Single/Differential Inputs SC-1372  
Single/Differential Inputs, Non-isolated SC-1374  
Universal Input, Single Analog Output SC-7401  
Universal Input, Dual Analog Output SC-7402  
Universal Input, Analog And Relay Output SC-7405  
High Density, Rack Mounted SC-8372\*  
High Density, Rack Mounted, Non-isolated SC-8374\*

##### 2-wire Slidewire/Potentiometer Transmitters

0-20,000 Ohms SC-4300R  
0-500 Ohms SC-4400

##### 4-wire Slidewire/Potentiometer Transmitters

0-10,000 Ohms SC-1300R  
0-5,000 Ohms, Analog Output SC-7401  
0-5,000 Ohms, Dual Analog Output SC-7402  
0-5,000 Ohms, Single Analog And Relay Output SC-7405  
0-20,000 Ohms, Rack Mounted SC-8300R\*

##### Strain Gage Transmitters

120 Ohm or 350 Ohm Inputs SC-1390  
Dual Input SC-8391\*

##### Alarms/Trips - RTD Input

Single Trip With Adjustable Deadband ET-1278  
Single Trip With Universal Input SC-7403  
Single Trip, Analog Output, Universal Input SC-7405  
Single Trip, High Density Rack Mount SC-8274\*  
Single Trip, High Density Rack Mount, No L.E.D. Option SC-8274A\*  
Dual Trip With Fixed Deadband ET-1275  
Dual Trip, Universal Input SC-7404  
Dual Trip, High Density Rack Mount SC-8275\*  
Dual Trip, High Density Rack Mount, No Led Option SC-8275A\*

\*Consult factory

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## Signal Conditioners - Transmitters - Electronic Alarms

*Input/output Isolation Is Standard Unless Otherwise Stated*

### Millivolt/Thermocouple Inputs

#### 2-wire Transmitters

mV, Thermocouple, Switch Selectable SC-4326  
Universal Input, Programmable SC-4400

#### 4-wire Transmitters

mV SC-1326  
mV Input, High Density, Rack Mount SC-8326\*  
Thermocouple SC-1326W  
Thermocouple, High Density, Rack Mount SC-8326W\*  
Thermocouple, Linearized Output, High Density, Rack Mtd SC-8327\*  
Universal Input, Single Analog Output SC-7401  
Universal Input, Dual Analog Output SC-7402  
Universal Input, Analog And Relay Output SC-7405

#### Alarms/Trips - mV, Thermocouple Inputs

Single Trip With Adjustable Deadband ET-1208  
Single Trip With Universal Input SC-7403  
Single Trip, Analog Output, Universal Input SC-7405  
Single Trip, mV Input, High Density, Rack Mount SC-8204\*  
Single Trip, mV Input, High Density, Rack Mount, No L.E.D. Option SC-8204A\*  
Single Trip, Thermocouple Input, High Density, Rack Mount SC-8204W\*  
Single Trip, Thermocouple Input, High Density, Rack Mount, No L.E.D. Option SC-8204WA\*  
Dual Trip With Fixed Deadband ET-1205  
Dual Trip, Universal Input SC-7404  
Dual Trip, mV Input, High Density, Rack Mount SC-8205\*  
Dual Trip, High Density, Rack Mount, No L.E.D. Option SC-8205A\*  
Dual Trip, Thermocouple Input, High Density, Rack Mount SC-8205W\*  
Dual Trip, Thermocouple Input, High Density, Rack Mount, No L.E.D. Option SC-8205WA\*

### Current/Voltage Inputs

#### 2-wire Transmitters

AC Current/Voltage, Switch Selectable SC-4300L/U

#### 4-wire Transmitters

DC Current/Voltage (Non Isolated) SC-1300  
Signal Isolator, mV, mA, V Input SC-1302  
Signal Inverter SC-1302S  
mA/Voltage Input, High Density, Rack Mount SC-8302\*  
mA/Voltage Input, High Density, Rack Mount, 2-wire Xmtr P.S. SC-8302E\*  
DC Voltage, Universal Input, Single Analog Output SC-7401  
DC Voltage, Universal Input, Dual Analog Output SC-7402  
DC Voltage, Universal Input, Single Analog Output and Relay Output SC-7405  
AC Current SC-1300L  
AC Voltage SC-1300U

#### Loop Powered Isolator

4-20 mA Input, 4-20 mA Output SC-2302-1  
10-50 mA Input, 4-20 mA Output SC-2302-2  
10-50 mA Input, 10-50 mA Output SC-2302-3  
10-50 mA Input, 10-50 mA Output, High Density SC-8502\*

\*Consult factory

# AMETEK

## Signal Conditioning

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### Signal Conditioners - Transmitters - Electronic Alarms

*Input/output Isolation Is Standard Unless Otherwise Stated*

#### Alarms/Trips

Single Trip, mV, mA, Voltage Input, Fixed Deadband	ET-1214
Single Trip, mV, mA, Voltage Input, Adjustable Deadband	ET-1218
Single Trip, DC Voltage, Bipolar Current Input	SC-7403
Single Trip Plus Analog Output, DC Voltage, Bipolar Current Input	SC-7405
Single Trip, mA/Voltage Input, High Density, Rack Mount	SC-8214*
Single Trip, mA/Voltage Input, High Density, Rack Mount, No Led Option	SC-8214A*
Dual Trip, mV, mA, Voltage Input, Fixed Deadband	ET-1215
Dual Trip, mV, mA, Voltage Input, Adjustable Deadband	ET-1219
Dual Trip, DC Voltage, Bipolar Current Input	SC-7404
Dual Trip, mA/Voltage Input, High Density, Rack Mount	SC-8215*
Dual Trip, mA/Voltage Input, High Density, Rack Mount, No Led Option	SC-8215A*
AC Current/Voltage Input, Single Trip, Fixed Deadband	ET-1200L/U
AC Current/Voltage Input, Dual Trip, Fixed Deadband	ET-1202L/U

#### Deviation Alarm

mV, mA, Voltage Input, Single Trip, Adjustable Deadband	ET-1228
mA/Voltage Input, High Density, Rack Mount, No L.E.D. Option	SC-8228A*

#### 4-Wire Signal Conditioners/Computational Devices/Special Application Transmitters

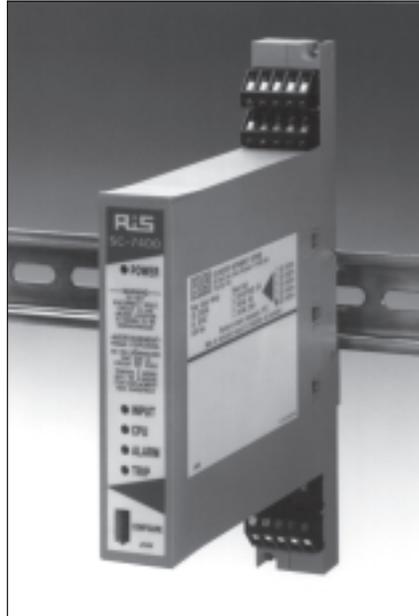
High-low Selector, 2,3,4 Inputs	SC-1320
Median Selector, 3 Inputs	SC-1324
Square Root Extractor	SC-1330
Square Root Extractor, High Density, Rack Mount	SC-8330*
Frequency Transmitter, 0-24 KHz	SC-1350
Frequency Transmitter, High Density, Rack Mount	SC-8350*
Multiplier/Divider, $D=A*B/C$	SC-1352
Multiplier/Divider, High Density, Rack Mount	SC-8352*
Adder/Subtractor, 2, 3, 4 Inputs, $Y=A\pm B\pm C\pm D$	SC-1354
Adder/Subtractor, 2, 3, 4 Inputs, High Density, Rack Mount	SC-8354*
Linear Integrator, mA, V Input; 0-64,000 Counts/hour Output	SC-1356
Square Root Integrator, mA, V Input; 0-64,000 Counts/hour Output	SC-1358
Signal Limiter, mA, V Input; mA, V, mV Output	SC-1362
Lead Or Lag Transmitter, mA, V Input; mA, V, mV Output	SC-1364
Pulse Duration Transmitter .6 - 2457.6 Seconds Output	SC-1380
Pulse Duration Receiver .2 - 409.65 Seconds Pulse Input	SC-1382
Rate-limited Transmitter, 3.6 - 3600 Seconds Output	SC-1396
Scale And Bias Transmitter, .1 - 10 Ratio 50% Bias	SC-1398

\*Consult factory

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## Universal 4-wire Transmitters and Trips SC - 7400

- Universal input
- 0.1% Accuracy
- Optional built-in intrinsic safety barriers.
- Quick and simple - No pots or switches to set.
- Continuous Self-calibration
- High density - DIN mount
- Modular design
- Password Protection



The SC-7400 is an intelligent, universal input signal conditioner/alarm trip that isolates and transmits the status of process signals on a single control loop basis. It handles a variety of temperature and process inputs and offers combinations of analog and relay contact outputs.

All parameters - such as input and output range, setpoints, deadband and burnout - are customer-selectable via software.

Operate it on a PC with easy-to-use Windows based software or with an optional hand-held configurator for easy, on-site configuring and re-configuring of modules. Alternatively, opt for the factory to perform a custom configuration to meet your needs.

The SC-7400 series incorporates state-of-the-art technology to provide:

- safe, reliable monitoring of plant and machinery
- peak operation for your equipment
- reduced overall system cost and calibration efforts
- the highest density available in smart technology
- the highest level of operational diagnostics and accuracy

With the SC-7400, one unit can be programmed to meet numerous applications ... and you may purchase it with optional intrinsic safety barriers that meet CSA and FM agency requirements. Functional benefits include detachable field wiring, password protection, integrity diagnostics, full software programmability, high packing density, low spare inventory, and EMC immunity.

Fully trained Ametek representatives are equipped with demonstration units for customer selection assistance.

**SC-7401 Single analog output**

**SC-7402 Dual analog output**

**SC-7403 Single alarm output**

**SC-7404 Dual alarm output**

**SC-7405 Single analog and alarm output**

# AMETEK

## Signal Conditioning

### Specifications

#### Indicators

Power	Green LED
Input sensor	Green LED (on = OK)
Module Operation	Green LED (on = OK)
Alarm 1	Red LED (on = alarm)
Alarm 2	Red LED (on = alarm)

#### Power Supply

Jumper selectable for 24V DC, 48V DC, 110V DC, 120V AC 50/60 Hz nominal.

#### Input Signals

##### DC Volt (Non IS Models only):

0 to 1V, 0 to 5V, 0 to 10V, 1 to 5V, 0 to XV (special factory configuration X=20 to 200V (30 V maximum for CSA))

##### DC Current (Non IS Models only):

0 to 1 mA, 0 to 5mA, 1 to 5mA, 0 to 10mA, 0 to 20 mA, 4 to 20 mA, 10 to 50 mA, 0 to 5 mA Bipolar, 0 to 10 mA Bipolar

##### DC mV (All models):

-15 to +85 mV absolute operating range. Zero and span may be set anywhere within range. 4 mV minimum span.

##### T/C (All models):

Software configurable for linearized or non-linearized output

##### Ohms - 3 or 4 wires (All models):

0 to 500  $\Omega$  absolute operating range. Zero and span may be set anywhere within range. 50  $\Omega$  minimum span

##### RTD (All models) - 2, 3 or 4 wire, 3 wire differential for Pt and Ni RTD, 2 wire only for Cu RTD:

100  $\Omega$  Pt  $\alpha=0.003850$ , -200 to +850°C, Min span 50°C

100  $\Omega$  Pt  $\alpha=0.003916$ , -200 to +850°C, Min span 50°C

100  $\Omega$  Pt  $\alpha=0.003923$ , -200 to +650°C, Min span 50°C

120  $\Omega$  Ni, -80 to +320°C, Min span 50°C

10  $\Omega$  Cu, -200 to +260°C, Min span 460°C

##### Slidewire (Non IS Models only):

May be configured for 500 to 5000  $\Omega$  span based at zero ohms

#### Input Accuracy:

mV:  $\pm 0.02\%$  of reading  $\pm 0.005$  mV, Linear with input

V:  $\pm 0.05\%$  of reading  $\pm 0.6$  mV, Linear with input

mA:  $\pm 0.05\%$  of reading  $\pm 3.0$   $\mu$ A, Linear with input

T/C: Accuracy listed in table plus cold junction error

T/C Type	Range °C	Accuracy	Min/Max Span $\pm$ °C
NIST - J	-180 to 760	$\pm 0.3^\circ$ C	110 to 940
NIST - K	-180 to 1300	$\pm 0.5^\circ$ C	140 to 1480
NIST - E	-150 to 1000	$\pm 0.3^\circ$ C	90 to 1150
NIST - R	0 to 500	$\pm 1.0^\circ$ C	450 to 1600
	500 to 1600	$\pm 0.7^\circ$ C	
NIST - S	0 to 500	$\pm 1.0^\circ$ C	480 to 1600
	500 to 1600	$\pm 0.7^\circ$ C	
NIST - T	-200 to 0	$\pm 0.4^\circ$ C	160 to 600
	0 to 400	$\pm 0.3^\circ$ C	
NIST - B	300 to 500	$\pm 2.0^\circ$ C	650 to 1500
	500 to 1800	$\pm 1.0^\circ$ C	
BS* - N	0 to 800	$\pm 0.3^\circ$ C	140 to 1300
	800 to 1300	$\pm 0.5^\circ$ C	
DIN - J	-200 to 900	$\pm 0.3^\circ$ C	110 to 1100
DIN - T	-200 to -100	$\pm 0.4^\circ$ C	160 to 800
	-100 to 600	$\pm 0.3^\circ$ C	

\* British Standard

**Cold Junction Error:**  $\pm 0.5^\circ$  C

#### Non-Linearized T/C:

$\pm 0.02\%$  of reading  $\pm 0.005$  mV plus cold junction accuracy

#### Analog output signals

Software configurable current outputs: Voltage outputs configurable through software and external terminal block wire jumper:

Range	Max load	Range	Impedance
0 - 1mA	1600 k $\Omega$	0 - 1V	1 k $\Omega$
0 - 5 mA	3200 k $\Omega$	0 - 5V	1 k $\Omega$
0 - 10 mA	1600 k $\Omega$	1 - 5V	1 k $\Omega$
0 - 20 mA	800 $\Omega$	0 - 10V	1 k $\Omega$
4 - 20 mA	800 $\Omega$		

#### Relay output

Contact Rating (trip outputs): 3A, 250V AC resistive or 3A, 30V DC, 30W max., SPDT

Trip Range: 0.5 to 100% of span in 0.15% increments

Deadband: 0 to 20% of span in 1% increments

#### Analog Output Accuracy:

0 to 5mA, 0 to 5V, 1 to 5V output ranges:  $\pm 0.1\%$  of span, all other analog output ranges:  $\pm 0.05\%$  of span

#### Tracking Accuracy (SC-7402 only):

4 to 20 mA  $\pm 0.5\%$  max - others  $\pm 1\%$  typical

#### Trip Output Accuracy:

$\pm 0.01\%$  of span

#### Functional Characteristics

##### Analog Output Step Response:

For a step of 0 to 100% of span the 10 to 90% response time is less than 0.5 second. The response time from input change to 90% output change is less than 1 second.

##### Trip Output Step Response:

For a step of 0 to 100% and the delay

set to zero the trip will occur within 0.5 second.

#### Input Impedance:

T/C, mV: Greater than 2 M $\Omega$

mA: 50  $\Omega$   $\pm 5\%$

V: 500 K  $\Omega$   $\pm 5\%$

#### RTD Excitation:

165  $\mu$ A  $\pm 10\%$

#### RTD Failure:

Open Lead: Upscale

Shorted RTD: Downscale

Sensor OK LED turned off with sensor failure. Failure defined as 5% over or under the selected input range or input channel out of range. Analog output configurable for either upscale or downscale burnout. Trip output configurable for alarm if sensor fails.

#### T/C Burnout Current:

Less than 0.1  $\mu$ A

#### T/C, mV, mA, V Failure:

Sensor OK LED turned off with sensor failure. Failure defined as  $\pm 5\%$  over or under the selected input range or input channel out of range. Analog output configurable for either upscale or

downscale burnout. Trip output configurable for alarm if sensor fails.

**Dielectric Strength:**

2.5kV AC 50/60 Hz from input to output/power/ground  
 1KV AC from power to output/ground  
 1KV AC between output and ground  
 1KV AC between analog and relay outputs if applicable

**Insulation Resistance:**

Less than 5 M  $\Omega$  at 500V DC after 1 minute

**Leakage Current:**

Less than 1 mA at 2500 VAC after 1 minute

**Long Term Stability:**

Less than 0.1% of span over 6 months

**Warm Up:**

Full accuracy within 5 minutes of power applied

**Power Consumption:**

DC: Nominal 2.5 W with one transmitter or trip output (transmitter output at 20 mA or relay on).  
 Nominal 3.0 W with two outputs (same conditions)

120V AC, 50/60Hz: Nominal 4 VA at a leading power factor

**Weight: 0.18 lbs (0.4 Kg)**

*Specifications subject to change without notice.*

**Operating Influences**

**Input Reference Conditions:**

mV: 0 to 10 mV  
 T/C: 0 to 200 °C "J" T/C  
 RTD: 0 to 200 °C 100  $\Omega$  Platinum  
 Ohm: 0 to 100  $\Omega$

**Analog Output Reference Condition:**

4 to 20 mA, 250  $\Omega$  load

**Ambient Temperature:**

Nominal: 23  $\pm$ 1°C  
 Operating Range: -20 to +70°C  
 Storage Range: -40 to +85°C  
 Effect on Accuracy:  $\pm$ 0.005%/°C max.  
 For Current Input  $\pm$ 0.0075%/°C max.  
 For Copper RTD Input  $\pm$ 0.01%/°C max.  
 Effect on Cold Jct:  $\pm$ 0.015°C/°C max.

**Relative Humidity:**

Range: 25 to 95% non-condensing  
 Effect on Accuracy:  $<$ 0.075% of span for a change in RH of 25 to 95% at 23 °C

**Vibration Effect:**

Range: A constant displacement of 1mm over the range of 5 to 15 Hz, and an acceleration of 5 m/s/s over the range of 15 to 150 Hz

Effect on Accuracy:  $<$ 0.05% of span  
 Drop and Topple:  $<$ 0.05% of span

**Common Mode Effect:**

$<$ 120 dB at 120V AC 50/60 Hz

**Normal Mode Effect:**

$<$ 40 dB with peak to peak signal within maximum input range

**Supply Voltage:**

Nominal: 24V DC, 48 VDC, 110 VDC, 120 VAC 50/60 Hz

Range:  $<$ 15%

Effect on Accuracy:  $<$ 0.05% of span over the range

**Magnetic Field Effect:**

$<$ 0.05% of span at 0.5 mT, 50/60 Hz

**Electromagnetic Susceptibility:**

$<$ 1% of span over the frequency range of 20 to 1000 MHz at a field strength of 10V/M

$<$ 2% of span over the frequency ranges of 50-55 MHz and 95-115 MHz

at a field strength of 1V/M

Tested to: IEC 801.3 Level 2

**SWC Protection:**

Conforms to IEC 801-4 level 2

**ESD (electric discharge):**

IEC801-2 level 3 (8kV), No permanent damage

**Agency Approvals**

Ordinary location:

FM: FM3810 ANSI/ISA S82.01, S82.02, S82.03

CSA: C22.2 NO.142

Surge withstand capability: per CEI/IEC 801-4 level 2

**Intrinsic safety**

Hazardous location:

FM: FM-3610

Class 1, Div. 1, Groups A, B, C & D

CSA: C22.2 NO. 157

Class 1, Div. 1, Groups A, B, C & D

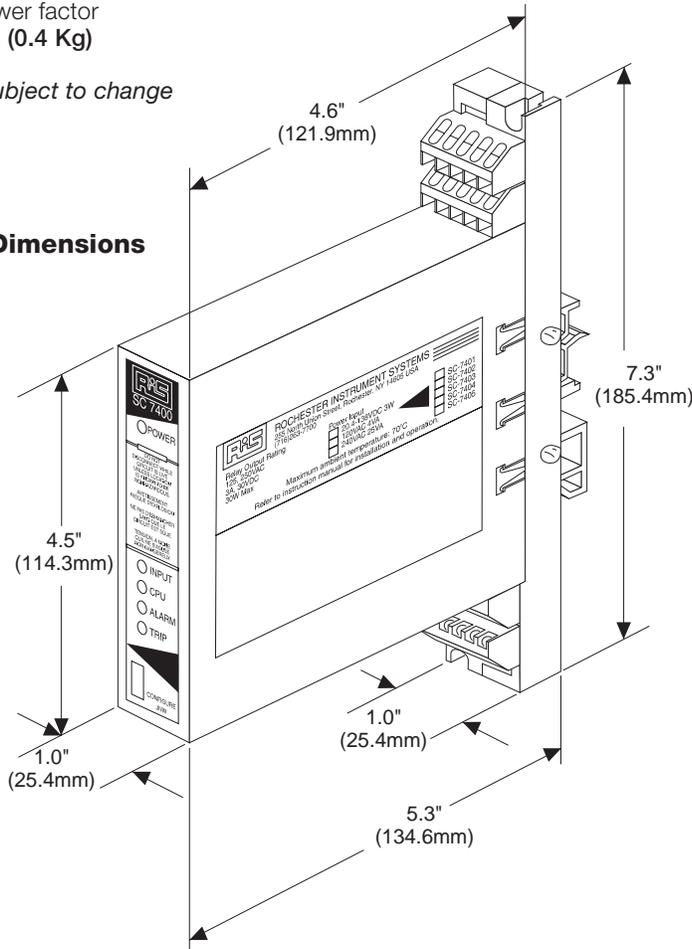
Division 2:

FM: FM-3611

Class 1, Div. 2, Groups A, B, C & D

CSA: C22.2 No. 213

**SC-7400 Dimensions**

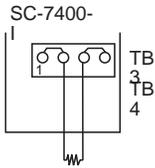
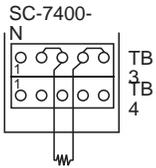


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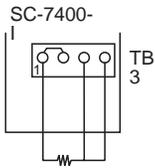
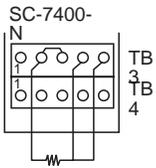
## Signal Conditioning

### Inputs

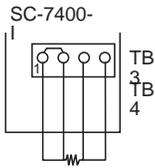
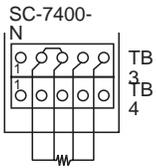
#### 2-Wire Ohm, RTD



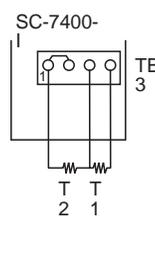
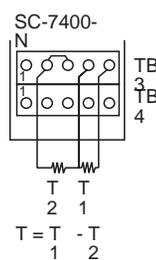
#### 3-Wire Ohm, RTD



#### 4-Wire Ohm, RTD



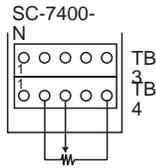
#### 3-Wire Differential, RTD



$$T = T - T$$

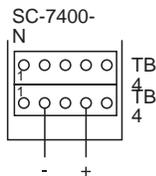
$$1 \quad 2$$

### Slidewire



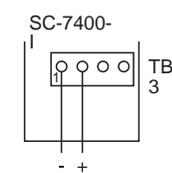
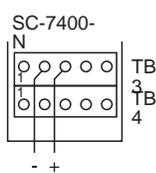
SC-7400-  
NOT AVAILABLE

### Current

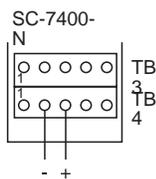


SC-7400-  
NOT AVAILABLE

### mV, T/C

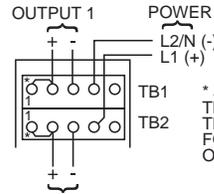


### Volts



SC-7400-  
NOT AVAILABLE

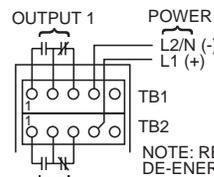
### SC-7401-N, SC-7402-N, SC-7401-I and SC-7402-I



\* JUMPER TB1-1 TO  
TB1-2 AND  
TB2-1 TO TB2-2  
FOR VOLTAGE  
OUTPUTS ONLY

OUTPUT 1  
OUTPUT 2  
(SC-7402-N, SC-7402-I ONLY)

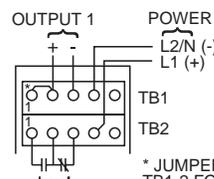
### SC-7403-N, SC-7404-N, SC-7403-I and SC-7404-I



NOTE: RELAYS SHOWN IN  
DE-ENERGIZED STATE

OUTPUT 1  
OUTPUT 2  
(SC-7404-N, SC-7404-I ONLY)

### SC-7405-N, SC-7405-I



\* JUMPER TB1-1 TO  
TB1-2 FOR VOLTAGE  
OUTPUTS ONLY

NOTE: RELAYS SHOWN IN  
DE-ENERGIZED STATE

### Ordering Information

Model	Description
SC-7401	Single Analog Output
SC-7402	Dual Analog Output
SC-7403	Single Alarm Output
SC-7404	Dual Alarm Output
SC-7405	Single Analog and Single Alarm Output
	<b>Code</b> <b>Intrinsic Safety Option</b>
	N Non-intrinsically safe unit and base plate
	I Intrinsically-safe unit and base plate
	<b>Code</b> <b>Base plate mounting</b>
	S Surface mount
	R DIN rail mount base plate
	<b>Code</b> <b>Configuration</b>
	NC Not configured
	FC Factory configured
SC-7401	I S NC Ordering Example

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## Hand Held Configurator HHC-4400/7400

- Compact, Lightweight Design
- 3 Levels of Security
- Easy To Read Screens
- Optional interface to PC for hard copy printout and disk storage
- Works with both SC-7400 and SC-4400 transmitters and trips



The Ametek Hand Held Configurator communicates with the SC-7400 and SC-4400 Signal Conditioners.

The unit configures transmitters, and performs inspection and maintenance functions. You select and initiate programs from menus to review and configure the transmitter.

An alphanumeric display provides an 80 character LCD screen in the form of 4 lines of 20 characters each. A variable contrast control is located on the right side of the communicator.

The security system provides three levels of access: Level A for only reviewing parameters; Level B to review and modify parameters; and Level C to establish passwords and to perform all other functions. If passwords are not established by the customer, all users will be at Level B.

An automatic battery saver shuts the unit off after five minutes of inactivity.

Power is provided by a 9V battery.

### Display:

- 5 x 7 dot matrix character based LCD
- 4 lines of 20 characters each with 232 character set

### Keyboard:

36 multi-function keys providing:

- 26 upper and lower case alphabet characters
- 10 numeric keys
- 16 operator and punctuation keys
- 4 cursor keys
- audio 'click' and tactile feedback
- auto-repeat after 1 sec depression.

### Internal Memory:

- 64K ROM for operating system, and standard programs
- 32K RAM

### Mass-storage Device: (Non-Volatile)

- DP-7400 - Program/Data Pak for SC-7400 configuration.
- DP-4400 - Program/Data Pak for SC-4400 configuration
- DP-1280 - 128K Data Pak for program storage

### Memory Retention:

Internal memory: supported by battery

## Specifications

### Power Supply:

9V battery

### Power Consumption:

100  $\mu$ A to 60 mA depending on application

### Peripheral Port:

16-pin slot behind sliding section on top of unit

### Temperature:

Operating: 0° to 50° C  
Storage: -20° to 60° C

### Weight:

.88 lb. (250g) approximately

### CNF61 Interface:

#### Connections:

Power and intelligence via 16 pin top-slot port

### Internal Memory:

EPROM firmware defines communication format and specifies menu options

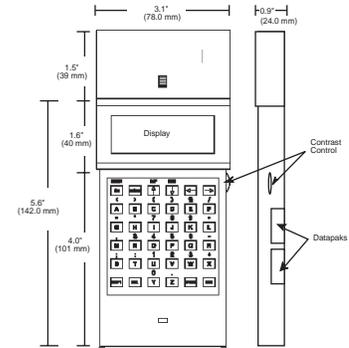
# AMETEK

## Signal Conditioning

### Ordering Information

Model	Description			
<b>HHC-</b>	Hand Held Configurator			
	<b>Code</b>	<b>Program/Datapak and Cable</b>		
	<b>4400</b>	Program/Datapak and cable for SC-4400 transmitters		
	<b>7400</b>	Program/Datapak and cable for SC-4400 transmitters and trips		
	<b>Code</b>	<b>File Storage</b>		
	<b>N</b>	No additional data storage		
	<b>D</b>	Additional 128K datapak for configuration storage		
	<b>Code</b>	<b>Personal Computer Interface Cable</b>		
	<b>N</b>	None		
	<b>C</b>	Cable and software to HHC to personal computer		
<b>HHC-</b>	<b>4400</b>	<b>D</b>	<b>C</b>	<b>Ordering Example</b>

### HHC-7400 Dimensions



#### Individual Items

**Program/datapaks**  
 DP-4400 Program/datapak for SC-4400  
 DP-7400 Program/datapak for SC-7400

**Additional datapak**  
 DP-1280 128K Datapak for configuration storage

**Extra cables**  
 SC-7411 Universal cable to connect HHC to SC-4400/SC-7400

SC-7412 Cable to connect HHC to personal computer\* cable

\*Cables which connect to a PC have a RS-232, 25 pin female connector.

### PC-7400 Configuration Kit

- Configures both SC-4400 and SC-7400 Transmitters and Trips
- Windows™-based software
- Configuration storage
- "As-built" documentation
- Interface with hand-held communicator

The Ametek PC configuration kit is used to set up all parameters of the SC-4400 and SC-7400 range of transmitters and trips. The program operates under an easy-to-learn, quick-to-use Windows environment. All parameters may be stored on disk and printed for later reference. The software requires an IBM-compatible running Windows version 3.0 or above.

The configuration kit may be used in tandem with a hand-held communicator

to increase the flexibility of operation in the field and in the instrument shop.

#### PC-7400

Personal computer configuration kit consisting of the following:

- Windows-based, IBM compatible PC software
- PC to transmitter cable
- Instruction manual

### Ordering Information

Model	Description			
<b>PC-</b>	Windows based personal computer configurator software and cable*			
	<b>Code</b>	<b>Transmitter configuration software</b>		
	<b>7400</b>	Software for SC-7400 and SC-4400 transmitters		
	<b>Code</b>	<b>Diskette size</b>		
	<b>3</b>	3.5" Diskette		
	<b>5</b>	5" Diskette		
	<b>Code</b>	<b>HHC to personal computer connection kit</b>		
	<b>N</b>	None		
	<b>C</b>	Cable and software to connect HHC to personal computer		
<b>PC-</b>	<b>7400</b>	<b>3</b>	<b>C</b>	<b>Ordering Example</b>

#### Individual Items

**Software**  
 PC-7400 PC software for SC-7400 and SC-4400 transmitters

**Cables**  
 SC-7412 Cable to connect HHC to personal computer cable.  
 SC-7415 Universal cable to connect PC to SC-4400/7400.\*

\*Cables which connect to a PC have a RS-232, 25 pin female connector

## Universal Field /Head Mounted Transmitter SC-4400

- Field/Head Mount
- Compact Size
- Universal Inputs
- No Field Adjustments
- Excellent Temperature Stability
- Input-output Isolation
- DIN Mount

The SC-4400 transmitter has been designed to minimize purchase and installation costs through its universal inputs and compact size. Accepting thermocouple, RTD, mV, voltage, and resistance inputs, the SC-4400 becomes a universal transmitter which reduces spare parts inventory and training/familiarization costs. Its compact design and light weight allows it to be installed in the sensor head thereby reducing installation costs, and simplifying engineering and documentation.

The unit is configured via Hand Held Configurator, or a PC. Both allow a permanent storage of the program for fast duplication/downloading, and through a connection to a printer, a hardcopy of the program configuration can be generated. The use of the configurators with built-in prompts eliminates the need for field adjustments or errors, and reduces configuration time.

The use of encapsulated circuitry and a patented cover plate ensures excellent temperature stability and RFI rejection plus a typical .1% accuracy. They also enable the units to be installed in hazardous locations without the need for explosion-proof housings.

Its unique design requires only 10 Volts for operation, thereby enabling it to drive into a 700 ohm load with a 24 Volt supply. Input-output isolation is standard.

### Technical Specifications

#### Output Signal

4 to 20mA = Output will be linear with temperature up to 21mA.

#### Output Load

Vs	10	20	24	30	36
R	0	500	700	1000	1300

Output load limit increases 50 Ω per 1V from Vs = 10V up to 36V DC.



#### Output Load Regulation:

Between minimum and maximum supply voltage the output will change by <0.005% per volt.

#### Output Ripple:

<0.05% of span rms

#### Response Time:

For a step change in input, the output signal will rise to within 1% of its final value in < 1.5 seconds.

#### Sensor Failure:

TC Sensors & mV inputs - Software selectable Upscale or Downscale for open circuit sensor.

RTD Sensor - Software selectable Upscale or Downscale for open circuit sensor, Downscale for short circuit sensor.

Under Upscale/Downscale conditions the output will rise to 22 mA ±5% or below 3.8mA respectively.

### Sensor Types and Ranges

Sensor	Configuration Range Limits				Accuracy referred to Input (°C)	Minimum Span	
	MIN (°F)	MIN (°C)	MAX (°F)	MAX (°C)		(°F)	(°C)
NIST-J	-292	-180	1400	760	±0.3	212	100
NIST-K	-292	-180	2372	1300	±0.3	212	100
NIST-E	-238	-150	1832	1000	±0.3	194	90
NIST-R	32	0	932	500	±1	842	450
	932	500	2912	1600	±0.7		
NIST-S	32	0	932	500	±1	896	480
	932	500	2912	1600	±0.7		
NIST-T	-328	-200	32	0	±0.4	212	100
	32	0	752	400	±0.3		
B.S.*	32	0	1472	800	±0.3	284	140
	1472	800	2372	1300	±0.5		
NIST-B	572	300	932	500	±2.0	1202	650
	932	500	2372	1800	±1		
RTD 100Ω Pt 2, 3 or 4-wire	-328	-200	1562	850	±1 of Reading ±0.1°C Linear w/Temperature	80	25
mV	-15mV		85mV		±0.02% of Reading ±5μV	4mV	
Ohms	0		500Ω		±0.1% of Span	50Ω	

Accuracy stated for thermocouples excludes cold junction compensation error. (See Operating Temperature Effects for details). (@20°C ± 1°C)

Transmitter range can be configured anywhere within the maximum and minimum limits stated providing selected range is more than or equal to the minimum span.

\*British Standard

# AMETEK

## Signal Conditioning

### Sensor Lead Resistance Effect:

TC/mV Inputs: <math>< 100\mu\text{V}/100\ \Omega</math>  
 RTD Sensors: <math>\pm 0.1\%</math> of span  
 for sensor leads 0 to 10  $\Omega$

### Isolation:

Input-output-case 500V.

### Power Supply

Maximum: 36V DC (30 VDC  
 for IS applications)

Minimum: 10VDC

Maximum output

Load @ 24VDC: 700  $\Omega$

Reverse polarity protection provided.

Output will be within 1% of steady state value less than 2 seconds after applying power.

### Operating Influences

#### Temperature:

Reference: 68°F (20°C)

Operating: -13 to +176°F (-25 to +80°C)

Storage: -40 to +185°F (-40 to +85°C)

#### Operating Temperature Effects

Span Drift: 0.0025% per °F max.  
 (0.005% per °C max.)

#### Zero Drift:

$\left\{ \begin{array}{l} 0.5 + \text{Input offset} \\ \text{Input span} \end{array} \right\} \times 0.005\% \text{ per } ^\circ\text{F max}$

Cold Junction Accuracy and Tracking:  
 $\pm 0.5^\circ\text{F} \pm 0.01^\circ\text{F}$  per °F change from reference.

#### Humidity

100% condensing when in weather-proof or explosion proof housing 95% non-condensing without housing.

### Long Term Drift

Less than 0.1% of span over 6 months - non accumulative.

### RFI/EnI Compliance

#### Reference Conditions:

RTD inputs: 32-392°F (0-200°C)

mV & TC Type K: 0-10mV

#### Electrostatic Discharge:

• Meets IEC 801.2 (8kV).

• Electromagnetic Fields/Radio Frequency Interference Protection.

• Meets IEC 801.3 level 3 and SAMA

PMC 33.1 1878, Class 2-ABC.

• Less than 1% deviation of span for field strength 10V/M 20 to 1000MHZ.

#### Transient high voltage bursts on I/O lines:

Meets IEC 801.4 level 3

#### Noise Rejection:

Common mode: -120dB at 50/60 Hz

Series mode: -46dB at 50/60 Hz

#### Intrinsic Safety

##### Approvals:

• Certificate No: EECS (BASEEFA) EX-94C-2042.

• FM (Pending).

• Intrinsically Safe (entity with barriers) - Installation in Class I, Div. 1, Groups A, B, C & D; Class II, Div. 1, Groups E, R & G; Class III, Div. 1 hazardous locations.

• C.S.A. (Pending).

• Intrinsically Safe (with certified barriers) Installation in Class I, Div. 1, Groups A, B, C & D; Class II, Div. 1, Groups E, F & G; Class III, Div. 2 hazardous locations.

• GENELEC EN50.014 & EN50.020. Classification Eex ia IIc T4 176°F (80°C) max. Suitable for mounting in Zone 0, 1 and 2 areas when powered through compatible approved safety barrier.

#### Transmitter Safety Limits:

Vmax: in + 30V Wmax: in = 1W

Imax: in = 200mA Ceq: = 0.06 $\mu\text{F}$

Equivalent capacitance Ceq must be deducted from the maximum cable capacitance specified for the selected safety barrier - see manufacturers data.

#### Compatible Barriers:

MTL788, MTL788R, MTL787SP.

Any equivalent barrier to above or isolated safety barrier/repeater that meets the stated safety limits providing the total end to end resistance of the barrier circuits, cable resistance plus loop resistance is less than 700  $\Omega$  when powered from +24V supply.

#### Safety Environmental Protection:

No additional safety protection required for hazardous area mounting.

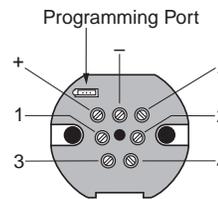
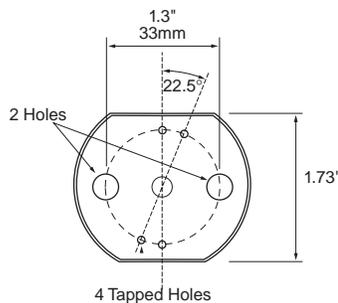
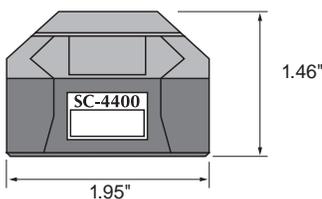
#### Environmental protection

IP21 IEC 529 1976

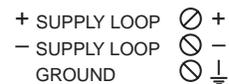
#### Weight:

0.1 kg, 0.22 lbs, 3.5 oz.

## Connections

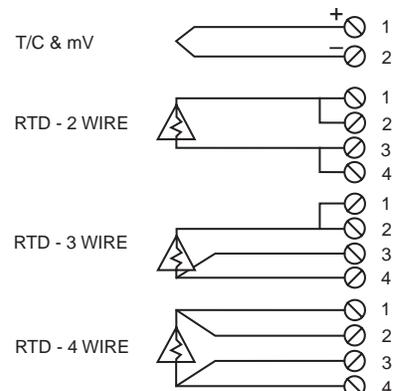


Transmitter viewed from topside with cover removed.



## Ordering Information

Model	Description								
SC-4400	2 wire Head or Fielding Mounting Transmitter								
	<table border="1"> <thead> <tr> <th>Code</th> <th>Configuration</th> </tr> </thead> <tbody> <tr> <td>DS</td> <td>Default Settings (100 <math>\Omega</math> RTD 0-100°C)</td> </tr> <tr> <td>SU</td> <td>Configured to Customer Requirement</td> </tr> </tbody> </table>	Code	Configuration	DS	Default Settings (100 $\Omega$ RTD 0-100°C)	SU	Configured to Customer Requirement		
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N	No Options								
SC-4400	DS N Ordering Example								



## 2 Wire AC Current/ Voltage Transmitter SC-4300 L/U

- Current or Voltage Input Selectable
- User/Field Rangeable
- 4-20 mA Loop-Powered
- Input/Output Isolation
- DIN Rail Mountable



The Ametek Power Instruments model SC-4300 L/U is a 2-wire input selectable AC voltage or current transmitter. Both the input type and range are field selectable using easily accessible switches. The isolated 4-20mA loop current output is proportional to the input current or voltage with zero and span adjustability.

The compact 4300 L/U is gasketed and sealed from moisture and dirt. It mounts on a surface or DIN rail without additional mounting plates or adapters. Weather-proof and explosion-proof enclosures are optional. All input selections and range adjustments are located on top of the SC-4300 L/U case under a gasketed cover.

The combination of field rangeability, compact design and loop-powered 4-20mA output gives the SC-4300 L/U the flexibility demanded by today's instrumentation users. The Ametek tradition of excellent quality, service and safety also makes the SC-4300 L/U the right choice for your application.

# AMETEK

## Signal Conditioning

### SC-4300L/U Specifications

**Input Range:** (Switch Selectable)

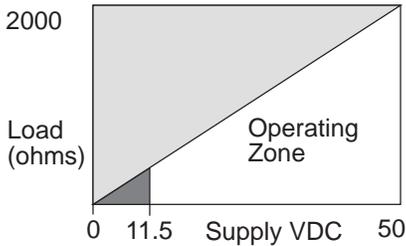
AC Voltage	AC Current
0-200 mV	0-200 mA
0-1 V	0-1 A
0-5 V	0-5 A
0-10 V	
0-25 V	
0-50 V	
0-125 V	
0-250 V	

**Output:** 4-20 mA DC

**Power Supply:** 11.5 - 50 VDC

**Power Supply Effect:** 0.005% of span per volt

**Load Limitations:**



**Input Span:** field adjustable, 20-100% of selected range

**Input Zero:** field adjustable, 0-50% of selected range

**Isolation:** 600 VDC or peak AC, input/output/case

**Input Impedance:**

200 mV and 10 V ranges: 250 K $\Omega$

All other voltage ranges: 1 M $\Omega$

5 A range: 0.04  $\Omega$  shunt

200 mA and 1 A ranges: 1  $\Omega$  shunt

**Accuracy:**

**Linearity:**  $\pm 0.15\%$  of span

**Repeatability:**  $\pm 0.05\%$  of span

**Hysteresis:**  $\pm 0.02\%$  of span

**Temperature Limits:**

**Operation:**  $-31^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

**Storage:**  $-40^{\circ}\text{C}$  to  $120^{\circ}\text{C}$

**Temperature Effects:**

Zero:  $\pm 0.025\%$  of span/ $^{\circ}\text{C}$

Span:  $\pm 0.025\%$  of span/ $^{\circ}\text{C}$

### Ordering Information

Specify Model 4300 L/U Transmitter and any desired options. Factory calibration is available – specify input type and range.

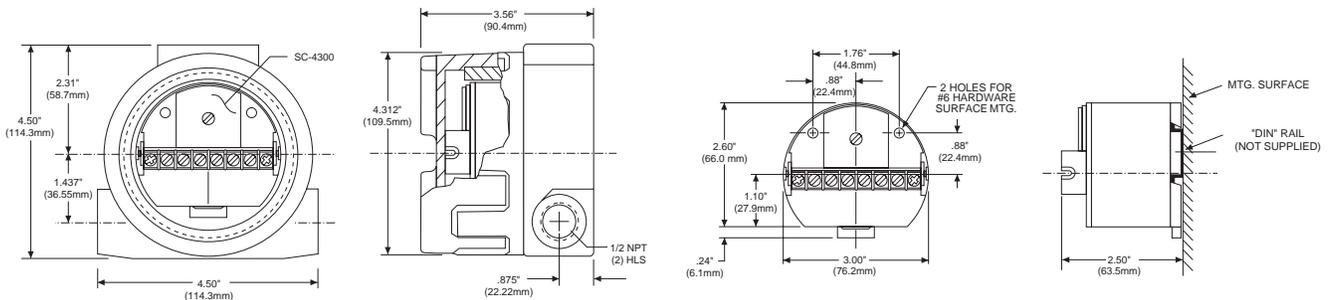
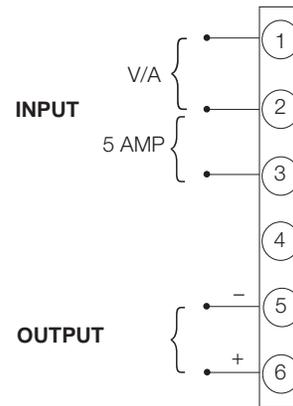
SC-4300L/U Isolated AC current/voltage transmitter

**Options:** Factory ranging of any SC-4300

SC-4300XP Explosion/weather-proof housing for SC-4300 transmitters

SC-4300XP2 2" pipe mount kit for SC-4300XP

### SC-4300 L/U Connections



**Explosion-proof Housing**

**Universal Enclosure**  
(for Surface or DIN Rail mounting)

## 2-Wire Slidewire Transmitter SC-4300R

- Switch Selectable Range
- Input/Output Isolation
- High Accuracy
- Mounting Options
- DIN Mount



The Ametek Power Instruments Model SC-4300R 2-wire Transmitter accepts a slidewire input, typically from a position measurement device, and provides an output loop current of 4-20 mA proportional to the input resistance. The input may be anywhere in the range of 50 to 20K ohms. Span and zero offset adjustments are made with 16 position switches for coarse settings, and 25 turn potentiometers for fine adjustments. There are no components or jumpers to change in selecting the range.

The transmitter circuitry includes low output ripple, excellent RFI/EMI immunity and complete input to output isolation, for avoiding ground-loop problems. Power is obtained from the current-loop, so wiring is simplified.

Since the SC-4300R will operate on as little as 10 volts, use with standard 24V power supplies and intrinsic safety barriers is possible without needing expensive signal repeaters or re-transmitters.

The compact SC-4300R case is gasketed and sealed for protection from moisture and dirt. It mounts on a surface or DIN rail without additional mounting plates or adapters. Also, weather-proof and explosion-proof enclosures are available as options. All input and range adjustments are located on top of the SC-4300R case, under a gasketed cover.

In addition, each SC-4300R is backed by the Ametek organization, with traditional excellent support, quality and service.

# AMETEK

## Signal Conditioning

### Specifications

**Input:** Slidewire/potentiometer, 3-wire (HI, LO, wiper)

**Input Slidewire Impedance:** 50 ohm minimum, 20 K ohm maximum

**Input Range:** 0-100% of slidewire impedance

**Span:** Adjustable, 20% of input range minimum, 100% of input range maximum

**Zero Offset:** Adjustable, 0 ohm minimum, 80% of input range maximum

**Common Mode Rejection:** 120 dB at 50/60 Hz

**Output:** 4-20 mA DC, linear with input

**Power Supply:** 10-50 VDC

**Output Ripple:** 0.04% of span rms, max.

### Accuracy:

Repeatability:  $\pm 0.05\%$  of span, max.

Hysteresis:  $\pm 0.02\%$  of span, max.

Linearity:  $\pm 0.05\%$  of span, max.

**Isolation:** 600 VDC or peak AC, input/output, input/case, output/case

**Response Time:** <75 ms, 10% to 90%

**RFI Immunity:**  $\pm 0.05\%$  of span maximum per SAMA PMC 33.1C, transmitter case must be properly grounded.

**Grounding:** Instrument must be properly grounded at the terminal strip for RFI immunity. Also, either the input or output, but not both, may be grounded.

### Temperature Limits:

Operation:  $-31^{\circ}\text{C}$  to  $85^{\circ}\text{C}$

Storage:  $-40^{\circ}\text{C}$  to  $120^{\circ}\text{C}$

### Temperature Effects:

Zero:  $\pm 0.025\%$  of span/ $^{\circ}\text{C}$

Span:  $\pm 0.01\%$  of span/ $^{\circ}\text{C}$

### Agency Approvals:

FM, CSA, BASEEFA approved for intrinsically safe operation

### Ordering Information

Specify Model SC-4300R Transmitter and any desired options. Factory ranging is available. Specify range, span and zero offset.

SC-4300R Isolated slidewire transmitter

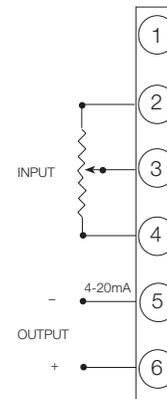
### Options:

Factory ranging of any SC-4300

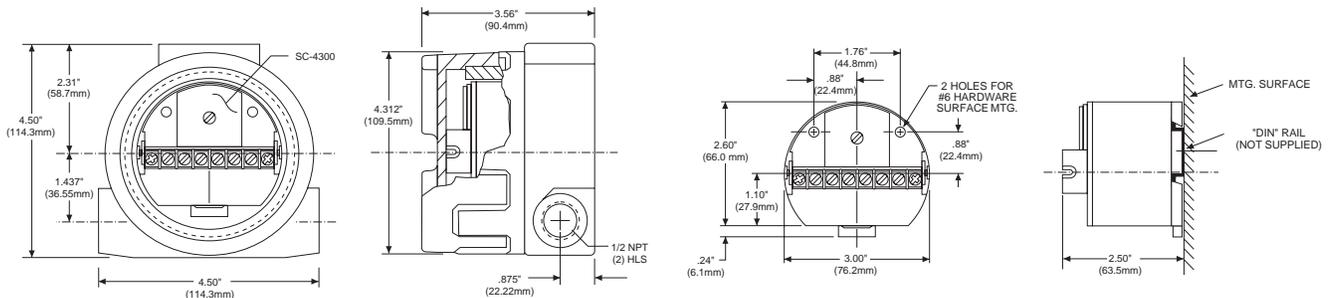
SC-4300XP Explosion /weather-proof housing for SC-4300 transmitters

SC-4300XP2 2" pipe mount kit for SC-4300XP

### SC-4300R Connections



### SC-4300R Dimensions



### Explosion-proof Housing

### Universal Enclosure

(for Surface or DIN Rail mounting)

## 2-Wire TC/mV Transmitter SC-4326

- User Selectable Input
- Switch Selectable Range
- Input/Output Isolation
- Mounting Options
- FM, CSA, BASEEFA Approvals For Intrinsically Safe Operation.
- DIN Mount



The Ametek Power Instruments Model SC-4326 2-wire Transmitter accepts a millivolt input from any specified thermocouple or millivolt source. The output is an analog 4-20mA current signal proportional to the millivolt input. The input type and range can be changed with switch settings on the transmitter, eliminating the need for jumpers or range resistors.

The transmitter circuitry includes: automatic thermocouple cold-junction temperature compensation, low output ripple, excellent RFI/EMI noise immunity and complete input to output isolation, for avoiding ground-loop problems. Power is obtained from the current-loop, so wiring is simplified.

The compact SC-4326 case is gasketed and sealed for protection from moisture and dirt. It mounts on a

surface or DIN rail without additional mounting plates or adapters. Also, weather-proof and explosion-proof enclosures are available as options. All input and range adjustments are located on the top of the SC-4326 case, under a gasketed cover.

In addition, each SC-4326 is backed by the Ametek organization, with traditional excellent support, quality and service.

# AMETEK

## Signal Conditioning

### Specifications

#### Inputs:

Switch selectable, DC millivolts or type J, K, T, E, R, S, B thermocouples

#### Input Impedance:

2 megohms minimum; 0.6μA excitation

#### Input Span:

3 to 100mV, 16 position rotary switch coarse adjustment, 20 turn potentiometer fine adjustment

#### Input Zero Offset:

-10 to +30mV, 16 position rotary switch coarse adjustment, 20 turn potentiometer fine adjustment

#### TC Burnout Protection:

Upscale or downscale, DIP switch selectable

#### Output:

4-20mA DC into 3365 ohms, max., at maximum power supply voltage

**Output Ripple:** 0.04% rms, max.

**Isolation:** 600VDC or peak AC

**Power Supply:** 10 to 50VDC

#### Power Supply Effect:

0.002% of span/volt change, max.

#### Accuracy:

TC conformity:  $\pm 0.075\%$  of span, max.

Repeatability:  $\pm 0.05\%$  of span, max.

Hysteresis:  $\pm 0.02\%$  of span, max.

Stability:  $\pm 0.02\%$  of span, max.

#### Temperature Limits:

Operation:  $-31^{\circ}$  to  $+85^{\circ}\text{C}$

Storage:  $-40^{\circ}$  to  $+120^{\circ}\text{C}$

#### Temperature Effects:

Zero:  $\pm 0.025\%$  of span/ $^{\circ}\text{C}$ , max.

Span:  $\pm 0.01\%$  of span/ $^{\circ}\text{C}$ , max.

#### Cold Junction Error:

$\pm 1^{\circ}\text{C}$ , max.,  $0^{\circ}$  to  $50^{\circ}\text{C}$ .

$\pm 3.5^{\circ}\text{C}$ , max.,  $-31^{\circ}$  to  $+85^{\circ}\text{C}$ , type J,

K, T, E inputs

$\pm 9^{\circ}\text{C}$ , max.,  $-31^{\circ}$  to  $+85^{\circ}\text{C}$ , type R,

S, B inputs

#### RFI Immunity:

$< 0.5\%$  of span, max., tested per SAMA PMC33.1C

#### Common Mode Rejection:

120 dB @ 50/60Hz.

#### Response Time:

$< 75\text{mS}$ , 10% to 90%

#### Agency Approvals:

FM, CSA, BASEEFA, approved for intrinsically safe operation, also FM and CSA Exp. rated

### Ordering Information

Specify Model SC-4326 Transmitter and any desired options. Factory calibration is available - specify input type and range.

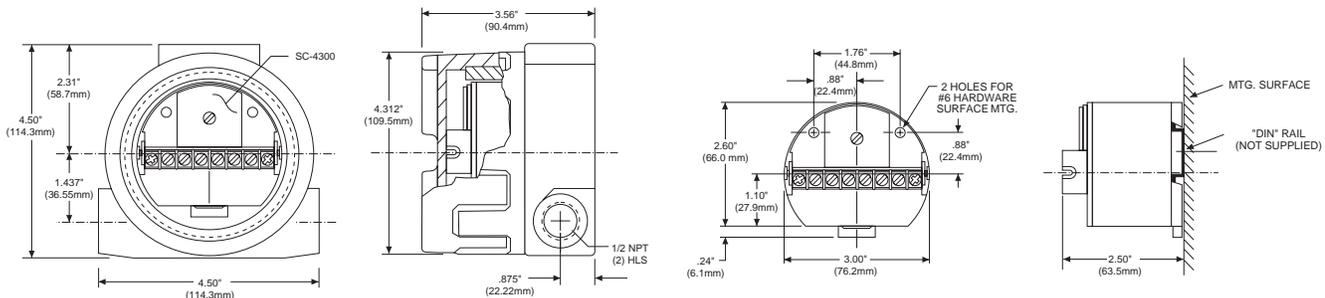
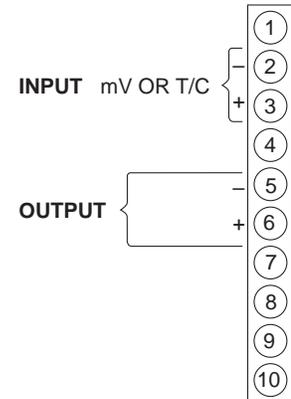
SC-4326 Isolated thermocouple/millivolt transmitter

#### Options

SC-4300XP Explosion/weather-proof housing for SC-4300 transmitters

SC-4300XP2 2" pipe mount kit for SC-4300XP

### SC-4326 Connections



### Explosion-proof Housing

### Universal Enclosure

(for Surface or DIN Rail mounting)

## 2-Wire RTD Transmitter SC-4372

- Ni and Pt input
- Output linearized to Input Temperature
- Switch Selectable Range
- Input/Output Isolation
- Mounting Options
- FM, CSA and BASEEFA Approved for Intrinsically Safe Operation
- DIN Mount



The Ametek Power Instruments Model SC-4372 2-Wire Transmitter accepts a Ni or Pt RTD input and generates a 4-20mA current output. The output is isolated and linearized to input temperature. The input type is single-jumper selected, and range is switch selected. One model of the SC-4372 covers both RTD types, 2 and 3 wire inputs, with full zero and span adjustability over the entire specified input range.

The transmitter circuitry includes automatic leadwire compensation, low output ripple, excellent RFI/EMI noise immunity and complete input to output isolation, for avoiding ground-loop problems. Power is obtained from the current-loop, so wiring is simplified.

The compact SC-4372 case is gasketed and sealed for protection from moisture and dirt. It mounts on a surface or DIN rail without additional

mounting plates or adapters. Also, weather-proof and explosion-proof enclosures are available as options. All input and range adjustments are located on the top of the SC-4372 case, under a gasketed cover.

In addition, each SC-4372 is backed by the Ametek organization, with traditional excellent support, quality and service.

# AMETEK

## Signal Conditioning

### SC-4372 Specifications

#### Inputs:

100 ohm Platinum RTD, .385 or .3902 coefficient, 2 or 3 wire.  
120 ohm Nickel RTD, 2 or 3 wire

Single jumper selectable, Ni or Pt

#### Excitation Current:

Pt RTD: 325 to 375  $\mu$ A  
Ni RTD: 225 to 350  $\mu$ A

#### Input Span:

Pt RTD: 50°C min., 700°C max.  
Ni RTD: 50°C min., 300°C max.  
(16 position switch coarse adjustment, 20 turn potentiometer fine adjustment)

#### Input Zero Offset:

Pt RTD: -31°C to 500°C  
Ni RTD: -31°C to 310°C  
(16 position switch coarse adjustment, 20 turn potentiometer fine adjustment)

#### Input Operating Range:

Pt RTD: -31°C to 850°C  
Ni RTD: -31°C to 310°C

#### Open Sensor Protection:

 Upscale

#### Leadwire Compensation:

 >40 ohm per lead, 3-wire RTDs

#### Output:

 4-20 mA DC, linear with input temperature

#### Output Ripple & Noise:

SC-4372: 0.05% p-p of span

#### Isolation:

 850 VDC, 600 VAC

#### Power Supply:

 10 to 50 VDC

#### Power Supply Effect:

 0.0015% of span per volt change, max.

#### Accuracy:

Repeatability:  $\pm 0.05\%$  of span, max.  
Hysteresis:  $\pm 0.02\%$  of span, max.  
Stability:  $\pm 0.02\%$  of span, max.

#### Linearization:

0.25% of input span, or 0.25°C max.

#### Temperature Limits:

Operation: -31°C to 85°C  
Storage: -40°C to 120°C

#### Temperature Effects:

Zero:  $\pm 0.025\%$  of span/°C  
Span:  $\pm 0.01\%$  of span/°C, max.

#### RFI Immunity:

<0.5% of span per SAMA PMC33.1C, transmitter case grounded

#### Common Mode Rejection:

120 dB, 50/60 Hz

#### Response Time:

 <75mS, 10% to 90%

#### Grounding:

 Case must be grounded for RFI immunity; input or output (but not both) may be grounded.

#### Agency Approvals:

FM, CSA, BASEEFA approved for intrinsically safe operation.

#### Ordering Information

Specify Model SC-4372 Transmitter and any desired options. Factory calibration is available – specify input type and range.

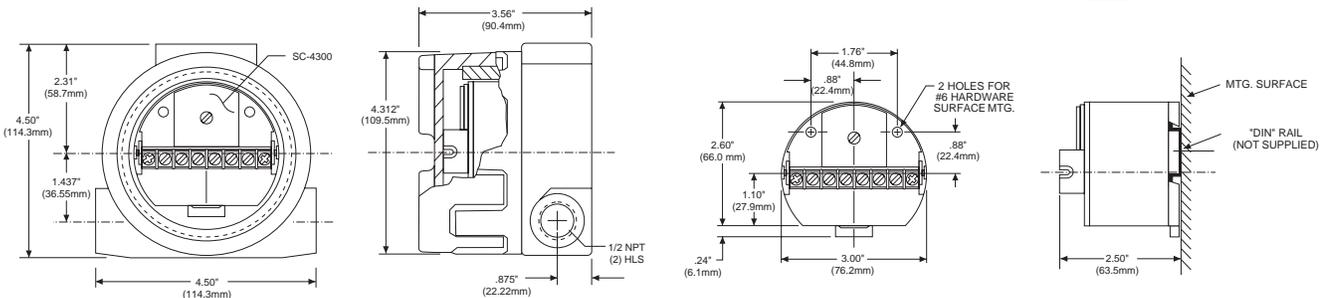
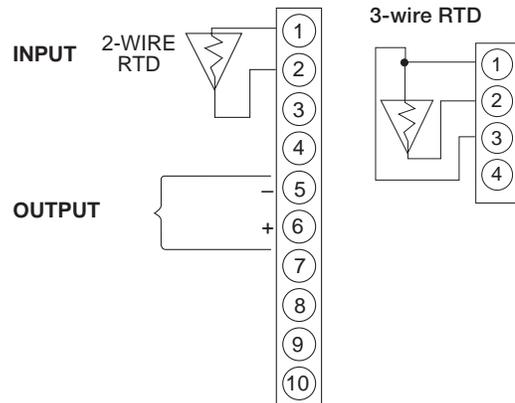
SC-4372 Isolated RTD transmitter

#### Options

SC-4300XP Explosion/weather-proof housing for SC-4300 transmitters

SC-4300XP2 2" pipe mount kit for SC-4300XP

### SC-4372 Connections



### Explosion-proof Housing

### Universal Enclosure

(for Surface or DIN Rail mounting)

## Loop Isolators SC-2302

- Low Cost
- Compact
- Loop Powered
- Signal Isolation



Ametek Loop Isolators are compact, low cost devices for isolating and converting common process current signals. They are loop powered from the input current, requiring no external power source.

### SC-2302 Specifications

	Input	Output
SC-2302-1	4-20 mA	4-20 mA
SC-2302-2	10-50 mA	4-20 mA
SC-2302-10	10-50 mA	10-50 mA

**Isolation:** 600 VAC/1000 VDC

**Linearity:**  $\pm 0.1\%$  of span @ 20°C

**Repeatability:**  $\pm 0.1\%$  of span

**Hysteresis:**  $\pm 0.1\%$  of span

**Input Voltage Drop:**  
<10V at rated output

**Output Loop Drive:**  
20 mA into 275 ohm maximum  
50 mA into 110 ohm maximum

**Output Load Effect:**  $<\pm 0.05\%$  of span

**Ambient Temperature Range:**  
-40° to 85°C

**Ambient Temperature Effect:**  
 $\pm 0.01\%/^{\circ}\text{C}$  Span error  
 $\pm 0.025\%/^{\circ}\text{C}$  Zero shift

**Common Mode Rejection:**  
>110 db at 50/60 Hz

**RFI Effect:**  
<1% of span per SAMA PMC33.1C

**Agency Approvals:**  
FM and CSA, Ordinary Location  
FM Class I, Division 2, Groups A, B, C, and D

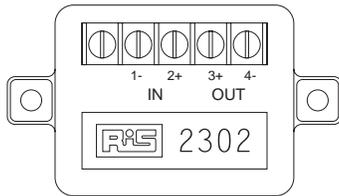
W/ Explosion Proof Housing Option –  
FM Class I, Division 2, Groups C and D  
FM Class II, Division 2, Groups E, F, and G

# AMETEK

## Signal Conditioning

### Loop Isolator Connections

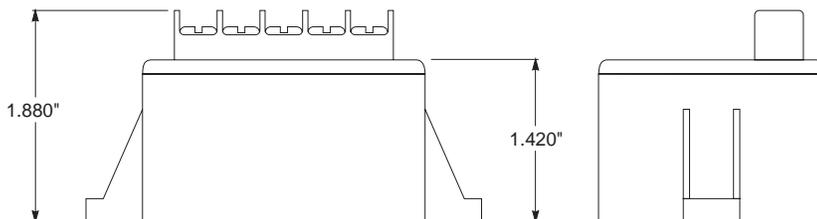
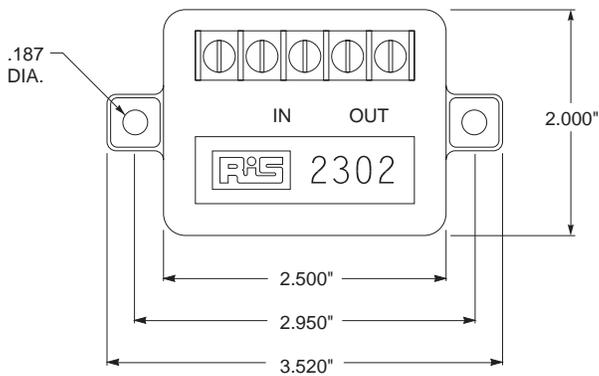
SC-2302



### Ordering Information

	Input	Output
SC-2302-1	4-20 mA	4-20 mA
SC-2302-2	10-50 mA	4-20 mA
SC-2302-10	10-50 mA	10-50 mA

### SC-2302 Loop Isolator Dimensions



## Scaleable Field Mounted Process Indicators SC-4300M

- 4-20mA current input
- Display scaleable in engineering units
- 3 Mounting styles
- Easy to range
- Low voltage drop

Series SC-4300M Process Indicators are compact loop-powered meters whose displays may be user scaled to read in the engineering units of the process. Each model mounts in series with any 4-20mA signal, and is powered by that current, with no external power needed.

Three models are available for field mounting. Model SC-4300M mounts on Ametek SC-4300 2-wire transmitters; Model SC-4302M is in a NEMA 4X housing for weather-proof applications; Model SC-4303M is for stand alone surface mounting, or for mounting in an explosion-proof case.





## AC Current/Voltage Alarms

### ET-1200L/U

### ET-1202L/U

- AC current/voltage input
- Single or dual trips
- Fixed deadband
- Conforms to IEEE SWC Test



These single and dual trip alarms accept AC current or voltage inputs (field alterable) and provide one DPDT 5 amp (ET-1200L/U or two SPDT 5 amp (ET-1202L/U) universal relay contact outputs. Basic input spans are 16 to 200 VAC or 0-1 to 0-7.5 amps.

All models come with fixed deadband less than 0.5% of span. Response time is less than 400 milliseconds. The frequency range of all models is 50-500 Hz. Series 1200 ac current/voltage alarms conform to the IEEE SWC test.

### Specifications

#### Inputs:

- Any AC current from 0-1 amp to 0-7.5 amps AC, burden less than 0.5 VA
- Any AC voltage from 0-16 to 0-200 VAC signal, burden less than 1.5 VA

**Input Frequency Range:** 50-500 Hz

#### Input Surge Capability:

AC Current: 20 amps continuous; 250 amps for 1 second per hour

AC voltage: 200% of input specified, continuous

**Deadband:** Fixed deadband; less than 0.5% of span

#### Outputs:

- single relay: one DPDT contact rated 5 A at 30 VDC; 5A at 250 VAC resistive
- dual relay: two SPDT contacts rated 5 A at 30 VDC; 5 A at 250 VAC resistive
- standard LED: alarm display to indicate trip condition

#### Optional Outputs:

- contacts rated at 10 A at 28 VDC or 115 VAC resistive (T10 option); not available on the P-11 enclosure; uses dual slot on the A-12 enclosure
- environmentally-sealed contacts rated 2 A at 30 VDC or 115 VAC resistive (D option)

**Repeatability:**  $\pm 0.1\%$  of span, maximum

**Response Time:** Less than 400 milliseconds

# AMETEK

## Signal Conditioning

### Controls:

ET-1200L/U: Multiturn trip-set potentiometers with clockwise rotation to increase setting

ET-1202L/U: Two multiturn trip-set potentiometers with clockwise rotation to increase setting

**Trip Set Adjustment:** 0-100% continuous, independent adjustment per trip-set point by infinite resolution potentiometer

### Trip Point Stability and Drift:

For 25° to 125°F (-4° to 52°C):  
±0.5% of span maximum for a 50°F (28°C) change in ambient temperature;  
±0.2% typical

### LED Visual Indication of Alarm Condition:

ET-1200L/U: One

ET-1202L/U: Two

**Relay Action:** Specify normally energized (failsafe) or de-energized (non-failsafe)

ET-1200L/U: Hi Trip or Lo Trip

ET-1202L/U: Hi/Lo Trip  
Lo/Hi Trip  
Hi/Hi Trip or  
Lo/Lo Trip

### Ambient Temperature Range:

0° to 140°F (-18° to 60°C)

### Operating Power Supplies:

- 115 VAC ±20%, 50/60 Hz 5 watts (standard)
- 24 VDC +20%-15%, 3.5 watts, H suffix (non-isolated)
- 230 VAC ±20%, 50/60 Hz, 5 watts (H2 suffix)
- 115 VAC ±10%, 60 Hz, 5 watts (H3 suffix; P-11 or A-12 option)
- 115 VAC ±10%, 50/60 Hz, 5 watts (H4 suffix; P-11 or A-12 option)
- 230 VAC ±10%, 50/60 Hz, 5 watts (H5 suffix; P-11 or A-12 option)
- 24 VDC ±20%, 4.5 watts (I suffix; isolated)
- 48 VDC ±20%, 5 watts (I1 suffix; isolated)
- Refer to Option section for a complete list of options for each model.

**Power Supply Effect:** ±0.15% for specified power variation

**Isolation:** 600 VAC or 1000 VDC input/output/power for the AC or isolated DC power version

**Net Weight:** 3.4 lbs (1.54 kg) approximate

### Enclosures:

- single unit surface mount (standard)
- A-12, high-density, 19" rack or surface mount with front access terminal blocks; units with AC input require 2 slots
- NEMA 4 and 12, from one to 24 units
- explosion-proof single unit; FM approved for Class 1, Division 1, Groups C and D
- Refer to Options section for a complete list of options for each model

### Agency Approvals:

FM approved for ordinary locations and hazardous locations Divisions 1 and 2, Class I, Groups C & D; Class II, Groups E, F & G. Ametek explosion-proof housing required for hazardous locations.

### Ordering Information:

refer to pages 7.38, 7.39

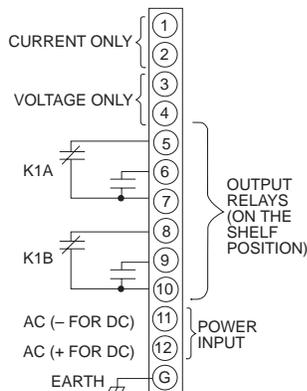
### Dimensions:

refer to page 7.40

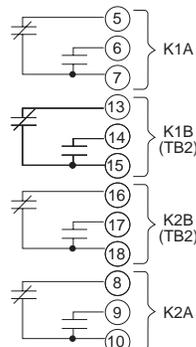
## ET-1200L/U and ET-1202L/U

### Connections

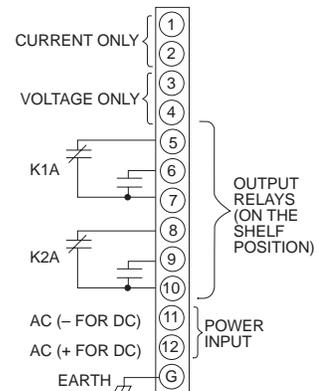
#### ET-1200L/U



#### T2 Option ET-1200 L/U only



#### ET-1202L/U



## T/C and mV Alarms

### ET-1205

- T/C or mV inputs
- Dual relay outputs
- 0-100% continuously adjustable set point
- Fixed deadband

### ET-1208

- T/C or mV inputs
- Single relay output
- 0-100% continuously adjustable set point
- Adjustable deadband



### ET-1205 and ET-1208

The ET-1205 accepts inputs from any standard thermocouple or millivolt source and provides a dual universal relay output with a 0-100% continuously adjustable set point. Cold junction compensation is standard on all thermocouple alarms.

The ET-1208 is similar to the ET-1205 but provides a single relay and an adjustable deadband.

### Specifications

#### Inputs:

- any thermocouple type (R, S, E, K, T, J, B) providing input spans between 10 and 100 mV, standard; calculated from input temperature range.
- input spans between 10 and 100 mV, standard
- zero offsets available from -5 to +70 mV, standard
- optional input spans:  
SS1: 3.00 to 4.99 mV  
SS2: 5.00 to 9.99 mV

**Input Impedance:** One megohm minimum input impedance without upscale protection

#### Outputs:

- single relay: one DPDT contact rated  
5 A at 30 VDC; 5 A at 250 VAC resistive
- dual relay: two SPDT contacts rated  
5 A at 30 VDC; 5 A at 250 VAC resistive
- standard LED: alarm display to indicate trip condition

#### Optional Outputs:

- contacts rated at 10 A at 28 VDC or 115 VAC resistive (T10 option); not available on the P-11 enclosure; uses dual slot on the A-12 enclosure
- environmentally-sealed contacts rated 2 A at 30 VDC or 115 VAC resistive (D option)
- analog output module with the following available outputs (O option):

Voltage Outputs	Current Outputs
2-10 VDC	10-50 mA
1-5 VDC	4-20 mA
0.2-1 VDC	2-10 mA
20-100 mV	1-5 mA
2-10 mV	0.2-1 mA

Note: Any analog output may also be zero based.

- Refer to Options section for options for each model.

# AMETEK

## Signal Conditioning

### Trip Point Stability and Drift:

$$\pm 0.02\%/^{\circ}\text{F} + \left( \frac{\text{offset}}{\text{span}} \times 0.01\%/^{\circ}\text{F} \right) \text{ maximum}$$

$$\left[ \pm 0.036\%/^{\circ}\text{C} + \left( \frac{\text{offset}}{\text{span}} \times 0.018\%/^{\circ}\text{C} \right) \text{ max.} \right]$$

For 25°F to 125°F (-4°C to 52°C)

Typical is 0.5 x maximum. For spans <10 mV, maximum temperature effect is:

$$\left( \frac{10\text{mV}}{\text{spanmV}} \right) \times 0.02\%/^{\circ}\text{F} + \left( \frac{\text{offset}}{\text{span}} \times 0.01\%/^{\circ}\text{F} \right)$$

### Deadband:

ET-1205: Fixed deadband; unless otherwise specified, fixed to 0.5% of span (typical); field alterable from 0.2 to 10%

ET-1208: Adjustable deadband; from less than 1 to 100% of span continuously adjustable (blind set)

### Controls:

ET-1205: Two multiturn trip-set potentiometers

ET-1208: One multiturn trip-set potentiometer.  
Manual override deadband cancel pushbutton

**Trip Adjustment:** 0-100% of span continuously adjustable

### LED Visual Indication of Alarm Condition:

ET-1205: Two

ET-1208: One

**Relay Action:** Must specify normally energized (failsafe) or de-energized (non-failsafe)

ET-1205: Hi/Lo Trip, Lo/Hi Trip, Hi/Hi Trip or Lo/Lo Trip

ET-1208: Hi Trip or Lo Trip

**Repeatability:** ±0.1% of span, maximum

**Response Time:** Less than 200 milliseconds

**Ambient Temperature Range:** 0° to 140°F (-18° to 60°C)

### Operating Power Supplies:

- 115 VAC ±20%, 50/60 Hz 5 watts (standard)
- 24 VDC +20%-15%, 3.5 watts, H suffix (non-isolated)
- 230 VAC ±20%, 50/60 Hz, 5 watts (H2 suffix)
- 115 VAC ±10%, 60 Hz, 5 watts (H3 suffix; P-11 or A-12 option)
- 115 VAC ±10%, 50/60 Hz, 5 watts (H4 suffix; P-11 or A-12 option)
- 230 VAC ±10%, 50/60 Hz, 5 watts (H5 suffix; P-11 or A-12 option)
- 24 VDC ±20%, 4.5 watts (I suffix; isolated)
- 48 VDC ±20%, 5 watts (I1 suffix; isolated)
- refer to Option section for a complete list of options for each model.

**Power Supply Effect:** ±0.15% for specified power variation

**Power Supply Isolation:** 600 VAC or 1000 VDC input/output/power for the AC or isolated DC power version

**Net Weight:** 3.4 lbs (1.54 kg) approximate

### Enclosures:

- single unit surface mount (standard)
- P-11, high-density, 19" rack mount with rear access terminal blocks
- A-12, high-density, 19" rack or surface mount with front access terminal blocks
- NEMA 4 and 12, from one to 24 units
- explosion-proof single unit, FM approved for Class 1, Division 1, Groups C and D
- refer to Options section for a complete list of options for each model

### Agency Approvals:

FM approved for ordinary locations and hazardous locations Divisions 1 and 2, Class I, Groups C & D; Class II, Groups E, F & G. Ametek explosion-proof housing required for hazardous locations.

CSA approved for ordinary locations, all unit types with either 117 VAC, 24 VDC isolated or 24 VDC non-isolated power versions. ET-1200 series contact rating at 117 VAC/24 VDC is 3 amps.

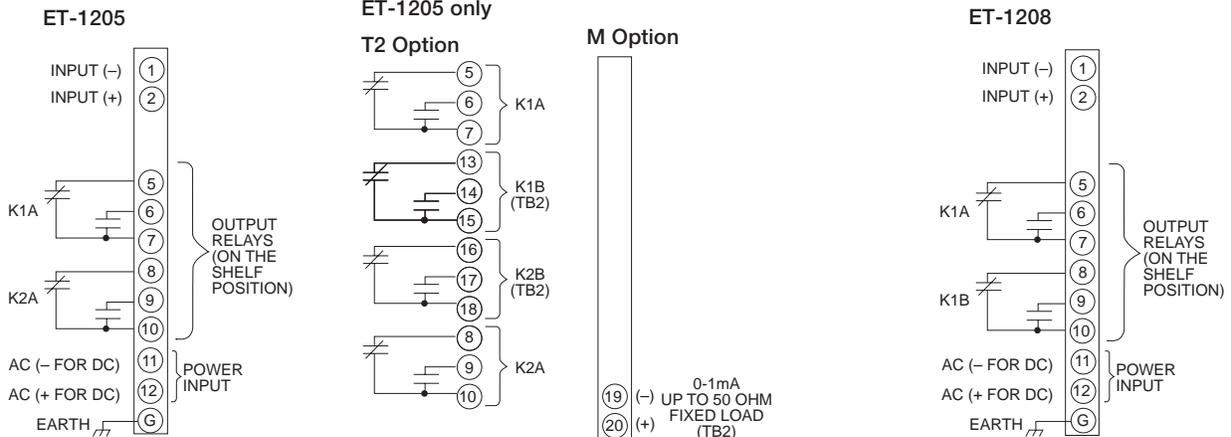
### Ordering Information:

see pages 7.38, 7.39

### Dimension Drawings:

see page 7.40

## ET-1205 & ET-1208 Connections



## Current & Voltage Alarms

### ET-1214, ET-1218

- Single trips
- DC current/voltage inputs
- Fixed/adjustable deadband
- Single or dual inputs

### ET-1215, ET-1219

- Dual trips
- DC current/voltage inputs
- Fixed/adjustable deadband
- Single or dual inputs



The ET-1214 and ET-1218 accept DC current or voltage inputs and provide a single universal relay output with a 0-100% continuously adjustable set point.

The ET-1218 differs from the ET-1214 by offering an adjustable deadband.

The ET-1215 and ET-1219 accept DC current or voltage inputs and provide a dual universal relay output with a 0-100% continuously adjustable set point.

The ET-1219 differs from the ET-1215 by offering an adjustable deadband.

The ET-1218 and ET-1219 include deadband cancel buttons for manual override.

### Specifications

The alarms described above have the following common specifications.

#### Outputs:

- single relay: one DPDT contact rated 5 A at 30 VDC; 5A at 250 VAC resistive
- dual relay: two SPDT contacts rated 5 A at 30 VDC; 5 A at 250 VAC resistive
- standard LED: alarm display to indicate trip condition

#### Optional Outputs:

- contacts rated at 10 A at 28 VDC or 115 VAC resistive (T10 option); not available on the P-11 enclosure; uses dual slot on the A-12 enclosure
- environmentally-sealed contacts rated 2 A at 30 VDC or 115 VAC resistive (D option)
- see Options, pages 7.38, 7.39.

**Repeatability:**  $\pm 0.1\%$  of span, maximum

**Response Time:** Less than 200 milliseconds.

**Inputs:** For ET-1215 and 1219, specify if dual input required.

Input	Input Impedance
0-200 mV	400 k $\Omega$
0-500	1 M $\Omega$
0-1 VDC	2 M $\Omega$
0.25-1.25 VDC	2 M $\Omega$
1-5 VDC	5 M $\Omega$
2-10 VDC	200 k $\Omega$

0-1 mA	5000 $\Omega$
1-5 mA	1000 $\Omega$
2-10 mA	500 $\Omega$
4-20 mA	250 $\Omega$
10-50 mA	100 $\Omega$

Note: Any of the above ranges can also be zero based.

**X-Option:** Voltage inputs — 20,000 ohms per volt input impedance; maximum voltage input, 200 VDC

#### Low Input Impedance: (LZ Option)

Input	Input Impedance
1-5 mA	40.2 $\Omega$
2-10 mA	20.0 $\Omega$
4-20 mA	10.0 $\Omega$
10-50 mA	4.5 $\Omega$

Note: Any of the above ranges can also be zero based.

# AMETEK

## Signal Conditioning

### Deadband:

ET-1214 & 1215: Fixed deadband; fixed to 0.5% (typical) of span; field alterable from 0.2% to 10%

ET-1218 & 1219: Adjustable deadband; from less than 1 to 100% of span

### Controls:

ET-1214: Multiturn trip-set potentiometer with clockwise rotation to increase setting

ET-1215: Two multiturn trip-set potentiometers with clockwise rotation to increase setting

ET-1218, Multiturn trip-set and ET-1219 deadband potentiometers with clockwise rotation to increase setting. Manual override deadband cancel pushbutton

### Trip Point Stability and Drive:

For 25° to 125°F (-4° to 52°C)  
±0.01%/°F (±0.018%/°C) maximum  
±0.004%/°F (±0.007%/°C) typical

### LED Visual Indication of Alarm Condition:

ET-1214 & 1218: One  
ET-1215 & 1219: Two

**Relay Action:** Specify normally energized (failsafe) or de-energized (non-failsafe)

ET-1214/1218: Hi Trip or Lo Trip  
ET-1215/1219: Hi/Lo Trip, Lo/Hi Trip, Hi/Hi Trip or Lo/Lo Trip

### Ambient Temperature Range:

0° to 140°F (-18° to 60°C)

### Operating Power Supplies:

- 115 VAC ±20%, 50/60 Hz 5 watts (standard)
- 24 VDC +20%-15%, 3.5 watts, H suffix (non-isolated)
- 230 VAC ±20%, 50/60 Hz, 5 watts (H2 suffix)
- 115 VAC ±10%, 60 Hz, 5 watts (H3 suffix; P-11 or A-12 option)
- 115 VAC ±10%, 50/60 Hz, 5 watts (H4 suffix; P-11 or A-12 option)
- 230 VAC ±10%, 50/60 Hz, 5 watts (H5 suffix; P-11 or A-12 option)
- 24 VDC ±20%, 4.5 watts (I suffix; isolated)
- 48 VDC ±20%, 5 watts (I1 suffix; isolated)
- Refer to Option section for a complete list of options for each model.

**Power Supply Effect:** ±0.15% for specified power variation

**Isolation:** 600 VAC or 1000 VDC input/output/power for the AC or isolated DC power version

**Net Weight:** 3.4 lbs (1.54 kg) approximate

### Ordering Information:

refer to page 7.38, 7.39

### Dimensions:

refer to page 7.40

### Enclosures:

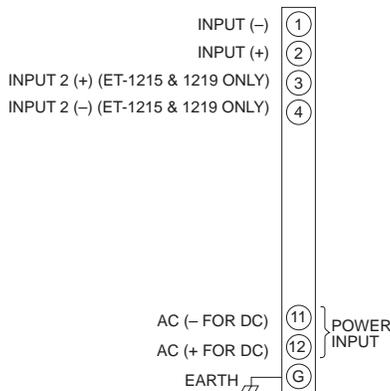
- single unit surface mount (standard)
- P-11, high-density, 19" rack mount with rear access terminal blocks, DC inputs only
- A-12, high-density, 19" rack or surface mount with front access terminal blocks; units with AC input require 2 slots
- NEMA 4 and 12, from one to 24 units
- explosion-proof single unit; FM approved for Class 1, Division 1, Groups C and D
- Refer to Options section for a complete list of options for each model

### Agency Approvals:

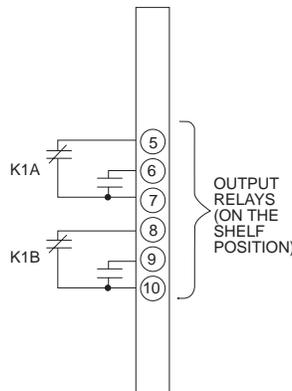
FM approved for ordinary locations and hazardous locations Divisions 1 and 2, Class I, Groups C & D; Class II, Groups E, F & G. Ametek explosion-proof housing required for hazardous locations.

CSA approved for ordinary locations, (except L/U) with either 117 VAC, 24 VDC isolated or 24 VDC non-isolated power versions. ET-1200 Series contact rating at 117 VAC/24 VDC is 5 amps.

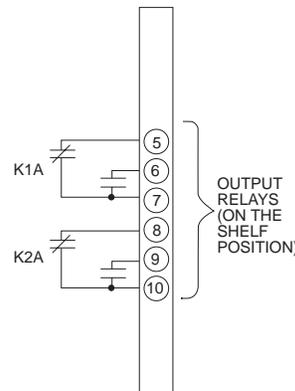
ET-1214/15/18/19



ET-1214 & ET-1218

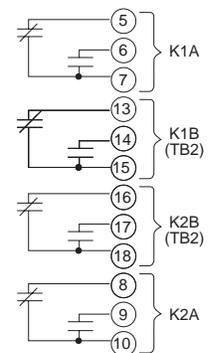


ET-1215 & ET-1219



T2 Option

ET-1215 & ET-1219 Only



## Deviation Alarm

### ET-1228

- DC current/voltage input
- Single or dual inputs
- Two independent trips
- Adjustable deadband



The ET-1228 accepts either two inputs or a single input with an internal reference and provides dual contact outputs based on the deviation from set point.

#### ET-1228 Specifications

##### Inputs:

Input	Input Impedance
0-100 mV	200 k $\Omega$
0-500 mV	1 M $\Omega$
0-1 VDC	2 M $\Omega$
0.25-1.25 VDC	2 M $\Omega$
1-5 VDC	5 M $\Omega$
0-1 mA	5000 $\Omega$
1-5 mA	1000 $\Omega$
2-10 mA	500 $\Omega$
4-20 mA	250 $\Omega$
10-50 mA	100 $\Omega$

Note: Any of the above ranges can also be zero based.

##### Low Input Impedance: (LZ Option)

Input	Input Impedance
0.2-1 mA	100 $\Omega$
1-5 mA	20 $\Omega$
2-10 mA	10 $\Omega$
4-20 mA	5 $\Omega$
10-50 mA	2 $\Omega$

Note: Any of the above ranges can also be zero based.

##### Outputs:

- single relay: one DPDT contact rated 5 A at 30 VDC; 5A at 250 VAC resistive
- dual relay: two SPDT contacts rated 5 A at 30 VDC; 5 A at 250 VAC resistive
- standard LED: alarm display to indicate trip condition

##### Optional Outputs:

- contacts rated at 10 A at 28 VDC or 115 VAC resistive (T10 option); not available on the P-11 enclosure; uses dual slot on the A-12 enclosure
- environmentally-sealed contacts rated 2 A at 30 VDC or 115 VAC resistive (D option)

# AMETEK

## Signal Conditioning

**Deadband:** Adjustable deadband; from less than 1 to 100% of deviation

**Controls:** Multiturn trip-set and deadband potentiometers with clockwise rotation to increase setting. Manual override deadband cancel pushbutton

**Trip Point Stability and Drive:**  
For 25° to 125°F (-4° to 52°C)  
±0.01%/°F (±0.018%/°C) maximum  
±0.004%/°F (±0.007%/°C) typical

**Deviation Set:** 0 to 20% of span, continuously adjustable with infinite resolution 20 turn potentiometer

**Input Reference Option:** Used to compare a single input to an adjustable reference point.

**LED Visual Indication of Alarm Condition:** Two

**Relay Action:** Specify normally energized (failsafe) or de-energized (non-failsafe)  
Hi Trip or Lo Trip referenced to input 2  
K1 trips on positive deviation of input 1  
K2 trips on negative deviation of input 1

**Ambient Temperature Range:**  
0° to 140°F (-18° to 60°C)

**Operating Power Supplies:**

- 115 VAC ±20%, 50/60 Hz 5 watts (standard)
- 24 VDC +20%-15%, 3.5 watts, H suffix (non-isolated)
- 230 VAC ±20%, 50/60 Hz, 5 watts (H2 suffix)
- 115 VAC ±10%, 60 Hz, 5 watts (H3 suffix; P-11 or A-12 option)
- 115 VAC ±10%, 50/60 Hz, 5 watts (H4 suffix; P-11 or A-12 option)
- 230 VAC ±10%, 50/60 Hz, 5 watts (H5 suffix; P-11 or A-12 option)
- 24 VDC ±20%, 4.5 watts (I suffix; isolated)
- 48 VDC ±20%, 5 watts (I1 suffix; isolated)
- Refer to Option section for a complete list of options for each model.

**Enclosures:**

- single unit surface mount (standard)
- P-11, high-density, 19" rack mount with rear access terminal blocks, DC inputs only
- A-12, high-density, 19" rack or surface mount with front access terminal blocks; units with AC input require 2 slots

- NEMA 4 and 12, from one to 24 units
- explosion-proof single unit; FM approved for Class 1, Division 1, Groups C and D
- Refer to Options section for a complete list of options for each model

**Agency Approvals:**

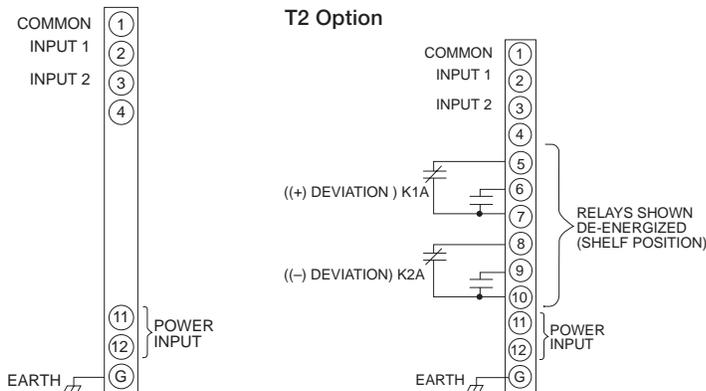
FM approved for ordinary locations and hazardous locations Divisions 1 and 2, Class I, Groups C & D; Class II, Groups E, F & G. Ametek explosion-proof housing required for hazardous locations.

CSA approved for ordinary locations, with either 117 VAC, 24 VDC isolated or 24 VDC non-isolated power versions. ET-1200 Series contact rating at 117 VAC/24 VDC is 5 amps.

**Ordering Information:**  
see page 7.38, 7.39

**Dimensions:**  
see page 7.40

### ET-1228 Connections



## RTD Alarms

### ET-1275

- RTD input
- Dual trips
- Fixed deadband
- Optional voltage/current output

### ET-1278

- RTD input
- Single trip
- Adjustable deadband
- Optional voltage/current output



### ET-1275 & ET-1278

The ET-1275 accepts inputs from any standard RTD and provides a dual universal relay output with a 0-100% continuously adjustable set point.

The ET-1278 is similar to the ET-1275 but provides a single relay output and an adjustable deadband.

### ET-1275 & ET-1278 Specifications

#### Inputs:

- Spans from 10 to 1260 ohm. Specify two or three-wire RTDs, RTD type, input temperature range and the minimum/maximum resistance.
- The span must be minimum of 5% of the minimum RTD resistance
- Optional input spans:  
SS3: 2.50 to 4.99 ohms  
SS4: 5.00 to 9.99 ohms

#### Outputs:

- single relay: one DPDT contact rated 5 A at 30 VDC; 5A at 250 VAC resistive
- dual relay: two SPDT contacts rated 5 A at 30 VDC; 5 A at 250 VAC resistive
- standard LED: alarm display to indicate trip condition

#### Optional Outputs:

- contacts rated at 10 A at 28 VDC or 115 VAC resistive (T10 option); not available on the P-11 enclosure; uses dual slot on the A-12 enclosure
- environmentally-sealed contacts rated 2 A at 30 VDC or 115 VAC resistive (D option)
- analog output module with the following available outputs (O option):

Voltage Outputs	Current Outputs
2-10 VDC	10-50 mA
1-5 VDC	4-20 mA
0.2-1 VDC	2-10 mA
20-100 mV	1-5 mA
2-10 mV	0.2-1 mA

Note: Any analog output may also be zero based.

# AMETEK

## Signal Conditioning

### Trip Point Stability and Drift:

For 25° to 125°F (-4° to 52°C):

$$\pm \left( \frac{\text{RTD min.}(\Omega)}{\text{span}\Omega} \times 0.002\% \right) + 0.008\%/^{\circ}\text{F max.}$$

$$\left[ \pm \left( \frac{\text{RTD min.}(\Omega)}{\text{span}\Omega} \times 0.0036\% \right) + 0.015\%/^{\circ}\text{F max.} \right]$$

Example:

For 25Ω span with 100Ω RTD minimum:

±0.016%/°F maximum (±0.0288%/°C maximum)

### Deadband:

ET-1275: Fixed deadband: unless otherwise specified, fixed to 0.5% (typical) of span; field alterable from 0.2 to 10%

ET-1278: Adjustable deadband: from less than 1 to 100% of span continuously adjustable

### Controls:

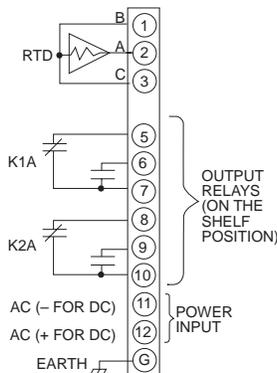
ET-1275: Two multiturn trip-set potentiometers

ET-1278: Multiturn trip-set and deadband potentiometers. Manual override deadband cancel pushbutton

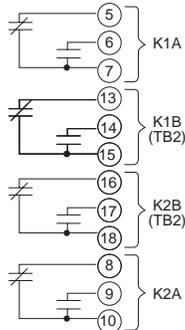
**Trip Set Adjustment:** 0-100% of span continuously adjustable

### ET-1275 & ET-1278 Connections

#### ET-1275



#### ET-1275 Only T2 Option



### LED Visual Indication of Alarm Condition:

ET-1275: Two

ET-1278: One

**Relay Action:** Specify normally energized (failsafe) or de-energized (non-failsafe)

ET-1275: Hi/Lo Trip

Lo/Hi Trip

Hi/Hi Trip

Lo/Lo Trip

ET-1278: Hi Trip or

Lo Trip

**Repeatability:** ±0.1% of span, maximum

**Response Time:** Less than 200 milliseconds

### Ambient Temperature Range:

0° to 140°F (-18° to 60°C)

### Operating Power Supplies:

- 115 VAC ±20%, 50/60 Hz 5 watts (standard)
- 24 VDC +20%-15%, 3.5 watts, H suffix (non-isolated)
- 230 VAC ±20%, 50/60 Hz, 5 watts (H2 suffix)
- 115 VAC ±10%, 60 Hz, 5 watts (H3 suffix; P-11 or A-12 option)
- 115 VAC ±10%, 50/60 Hz, 5 watts (H4 suffix; P-11 or A-12 option)
- 230 VAC ±10%, 50/60 Hz, 5 watts (H5 suffix; P-11 or A-12 option)
- 24 VDC ±20%, 4.5 watts (I suffix; isolated)
- 48 VDC ±20%, 5 watts (I1 suffix; isolated)
- Refer to Option section for a complete list of options for each model.

**Power Supply Effect:** ±0.15% for specified power variation

**Power Supply Isolation:** 600 VAC or 1000 VDC input/output/power for the AC or isolated DC power version

**Net Weight:** 3.4 lbs (1.54 kg) approximate

### Enclosures:

- single unit surface mount (standard)
- P-11, high-density, 19" rack mount with rear access terminal blocks
- A-12, high-density, 19" rack or surface mount with front access terminal blocks
- NEMA 4 and 12, from one to 24 units
- explosion-proof single unit; FM approved for Class 1, Division 1, Groups C and D
- Refer to Options section for a complete list of options for each model

### Agency Approvals:

FM approved for ordinary locations and hazardous locations Divisions 1 and 2, Class I, Groups C & D; Class II, Groups E, F & G. Ametek explosion-proof housing required for hazardous locations.

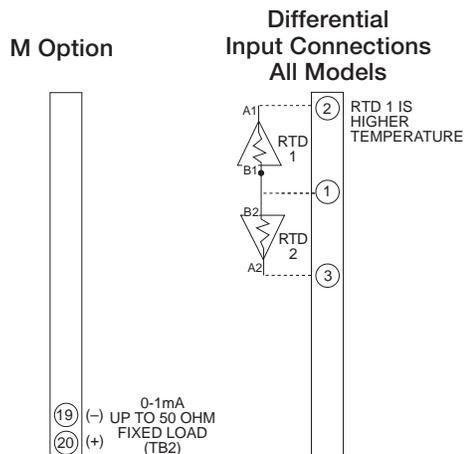
CSA approved for ordinary locations, all unit types with either 117 VAC, 24 VDC isolated or 24 VDC non-isolated power versions. ET-1200 Series contact rating at 117 VAC/24 VDC is 5 amps.

### Ordering Information:

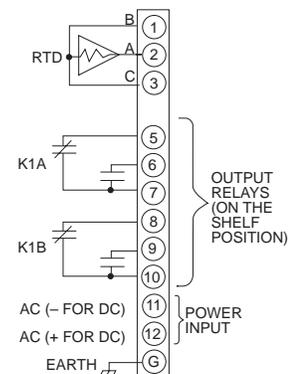
See pages 7.38, 7.39

### Dimensions:

See page 7.40

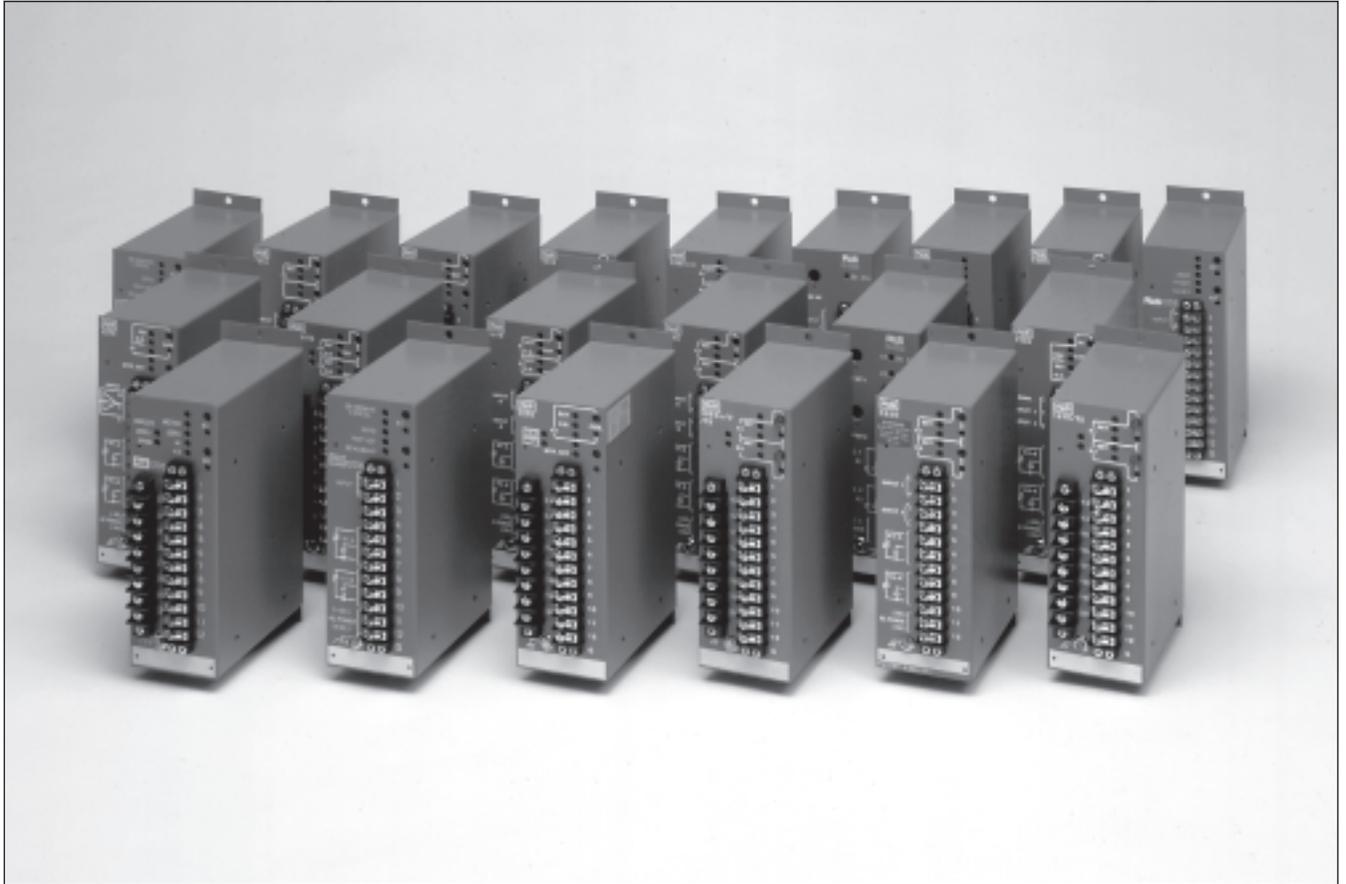


#### ET-1278



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## ET-1200 Alarms Ordering Guide



**ET-1200 L/U Single AC Current/Voltage Alarm**

**ET-1202 L/U Dual AC Current/Voltage Alarm**

**ET-1205 Dual TC/mV Alarm with Fixed Deadband**

**ET-1208 Single TC/mV Alarm with Adjustable Deadband**

**ET-1214 Single Current/Voltage Alarm w/Fixed Deadband**

**ET-1215 Dual Current/Voltage Alarm w/Fixed Deadband**

**ET-1218 Single Current/Voltage Alarm w/Adjustable Deadband**

**ET-1219 Dual Current/Voltage Alarm w/Adjustable Deadband**

**ET-1228 Single Deviation Alarm w/Adjustable Deadband**

**ET-1275 Dual RTD Alarm with Fixed Deadband**

**ET-1278 Single RTD Alarm with Adjustable Deadband**

# AMETEK

## Signal Conditioning

### Options

### ET-1200 Alarms Quick Reference Option Chart

#### 1. Input Options

Model No. and Description	Option Ordering Suffix	RFI*	SS1	SS2	SS3	SS4	X	LZ	IR
ET-1200 L/U Single AC Current/Voltage Alarm									
ET-1202 L/U Dual AC Current/Voltage Alarm									
ET-1205 Dual TC/mV Alarm with Fixed Deadband		SP	O	O					
ET-1208 Single TC/mV Alarm with Adjustable Deadband		SP	O	O					
ET-1214 Single Current/Voltage Alarm w/Fixed Deadband		SP					O	A	
ET-1215 Dual Current/Voltage Alarm w/Fixed Deadband		SP					O	A	
ET-1218 Single Current/Voltage Alarm w/Adjustable Deadband		SP					O	A	
ET-1219 Dual Current/Voltage Alarm w/Adjustable Deadband		SP					O	A	
ET-1228 Single Deviation Alarm w/Adjustable Deadband		SP					O	A	
ET-1275 Dual RTD Alarm with Fixed Deadband		SP			O	O			
ET-1278 Single RTD Alarm with Adjustable Deadband		SP			O	O			

#### 2. Power Supply

H*	H2*	H3	H4
A	A	O	O
A	A	O	O
A	A	O	O
A	A	O	O
A	A	O	O
A	A	O	O
A	A	O	O
A	A	O	O
A	A	O	O
A	A	O	O

### ET-1200 Alarms Options

#### Item 1. Input Options

Code	Description
SS1	3 to 4.99 millivolt spans (for mV and T/C units only)
SS2	5 to 9.99 millivolt spans (for mV and T/C units only)
SS3	2.50 to 4.99 ohm spans (RTD units only); minimum span $\geq \frac{\text{minimum input } (\Omega)}{20}$
SS4	5 to 9.99 $\Omega$ input spans
X	voltage inputs: 20,000 ohms per volt input impedance, maximum voltage input 200 VDC
LZ	Low impedance current inputs
IR	Input reference (deviation units only)
RFI	Radio frequency filter protection, not available on AC inputs

#### Item 2. Power Supply Options

Code	Description
H	24 VDC (+20%, -15%) non-isolated prime power
H2	230 VAC, $\pm 20\%$ , 50/60 Hz prime power, standard enclosure
H3	115 VAC, $\pm 10\%$ , 60 Hz only, for use with A-12 or P-11 enclosure mounted units
H4	115 VAC, $\pm 10\%$ , 50/60 Hz, for use with A-12 or P-11 enclosure mounted units

H5	230 VAC, $\pm 10\%$ , 50/60 Hz, for use with A-12 or P-11 enclosure mounted units
I	24 VDC $\pm 20\%$ , isolated prime power
I1	48 VDC, $\pm 20\%$ , isolated prime power
E	Power for external two-wire transmitter, 24 VDC at 20 mA, maximum, special order
FS	Individual slow blow power-line fuse

If no power supply ordering suffix is indicated on the order, 115 VAC,  $\pm 20\%$ , 50/60 Hz (standard) will be supplied.

#### Item 3. Output Options

Code	Description
O	Transmitting output for alarm, refer to unit specifications
M	0-1 mA DC meter output option, 0-50 $\Omega$ allowable analog meter loop
T2	DPDT relay output, for dual alarms only (except D1 option)
T10	10 amp contact rating for stand enclosure only
J	SPDT relay output environmentally sealed, 2 amp contact rating
D	DPDT relay output environmentally sealed, 2 amp contact rating (requires T2 for dual units)
LR	Latching relay, integral or remote reset, special order

#### Item 4. Relay Action

#### Item 5. Enclosure Options

Code	Description
P11*	11 unit, plug-in enclosure with rear wiring access
A12*	12 unit card enclosure with front and rear wiring access
NEMA 4	enclosures for one to 24 units, standard
NEMA 12	enclosures for one to 24 units, standard
XP	explosion-proof, single unit, FM approved for Class I, Class II, Division 1, Groups C and D
B	Conduit mounting plate to accommodate two, 1/2 inch conduit entries.
C	Conduit mounting plate and terminal cover, option B above, plus screwed-on metal front cover

\*ET-1200L/U and ET-1202L/U require dual slot on the A-12 enclosure and not available on the P-11 enclosure.

#### Item 6. Tagging Options

Code	Description
SST	Stainless steel strip tag
EST	Stainless steel engraved tag
ELT	Plastic lamacoid engraved tag (Specify lettering of tag)

**Options†**

H5	I	I1	E	FS
O	O	O	SP	O
O	O	O	SP	O
O	O	O	SP	O
O	O	O	SP	O

O	O	O	SP	O
O	O	O	SP	O
O	O	O	SP	O
O	O	O	SP	O
O	O	O	SP	O

O	O	O	SP	O
O	O	O	SP	O

**3. Output Options**

O	M	T2	T10	J	D	LR
			O		O	SP
		O	O	O	O	SP
O	O	O	O	O	O	SP
O	O		O		O	SP

			O		O	SP
		O	O	O	O	SP
			O		O	SP
		O	O	O	O	SP
		O	O	O	O	SP

O	O	O	O	O	O	SP
O	O		O		O	SP

**5. Enclosure Options**

P11	A12	N4	N12	XP	B	C
	O	O	O	O	O	O
	O	O	O	O	O	O
O	O	O	O	O	O	O
O	O	O	O	O	O	O

O	O	O	O	O	O	O
O	O	O	O	O	O	O
O	O	O	O	O	O	O
O	O	O	O	O	O	O
O	O	O	O	O	O	O

O	O	O	O	O	O	O
O	O	O	O	O	O	O

**6. Tagging Options**

SST	EST	ELT
O	O	O
O	O	O
O	O	O
O	O	O

O	O	O
O	O	O
O	O	O
O	O	O
O	O	O

O	O	O
O	O	O

**Matrix Legend**

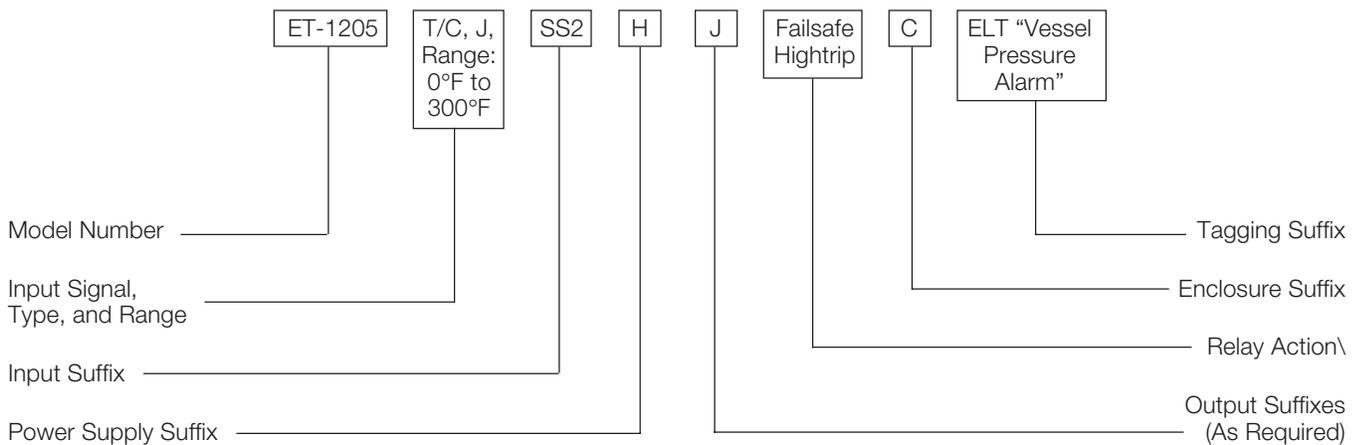
A	= available option at no additional cost
O	= option available at extra cost
	= not available
SP	= available on special order only

The option designations are similar for many alarms. For a complete description of how a particular option applies to a particular model, please consult the specific model description in this catalog.

**Caution:**

**Certain options are not compatible with others. Contact your local Ametek representative or the Ametek factory if you have any questions.**

**ET-1200 Alarm Ordering**



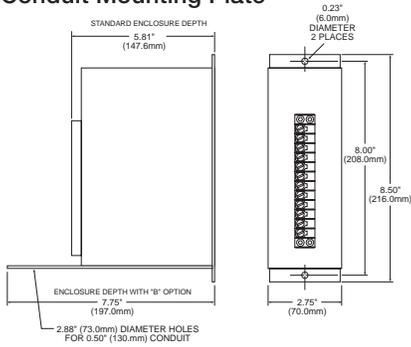
This order is for a Model ET-1205 thermocouple alarm which accepts a Type IJ thermocouple with a range of 0°F to 300°F. The input span is between 5 and 9.99 mV (SS2). The alarm features 24Vdc prime power (H), two SPDT hermetically

sealed relays (J), with failsafe / hightrip action. It is housed in a standard enclosure that includes a conduit mounting plate and terminal cover (C) and has a plastic lamacoid tag (ELT) engraved with "Vessel Pressure Alarm."

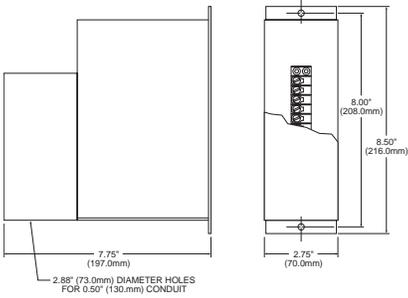
# AMETEK

## Signal Conditioning

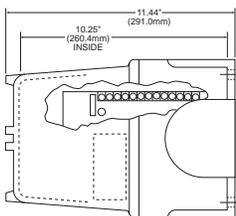
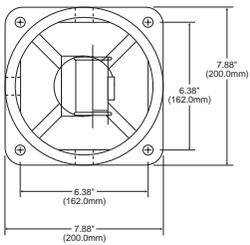
### Standard Enclosure with Suffix B Conduit Mounting Plate



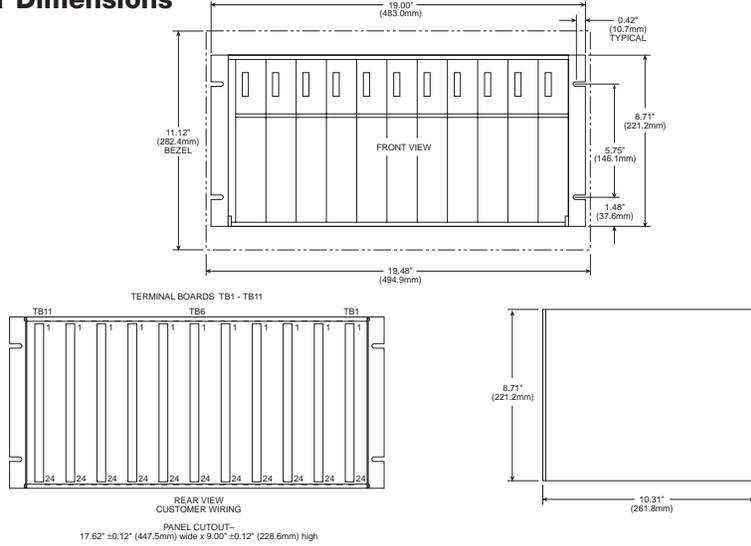
### Standard Enclosure with Suffix C Conduit Mounting Plate and Cover



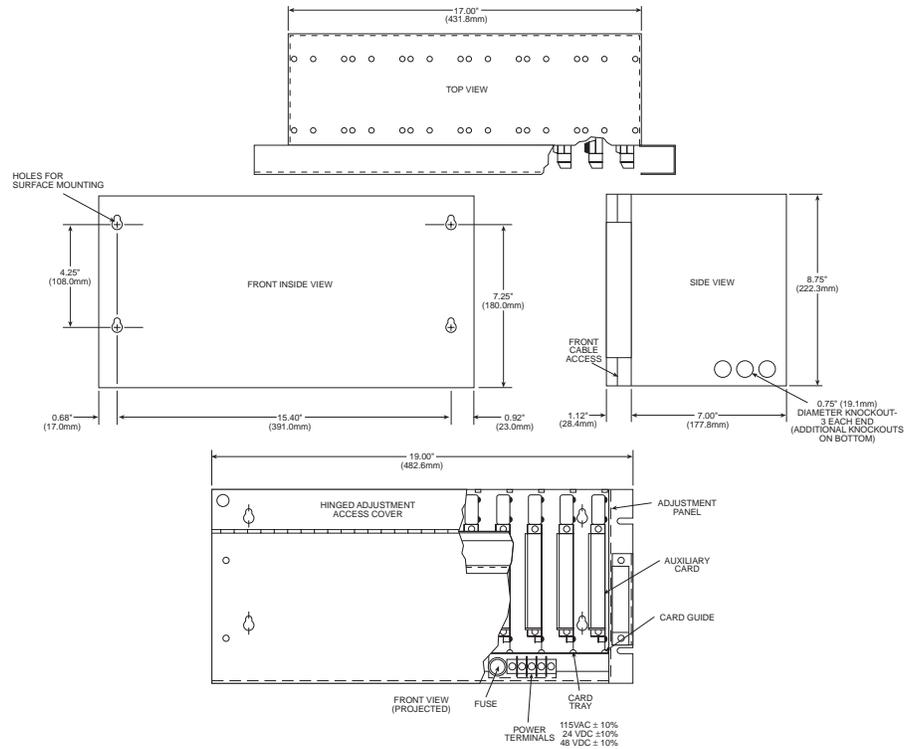
### Explosion-Proof Housing



### P-11 Dimensions



### A-12 Dimensions



## Voltage/Current Transmitters

### SC-1300 SC-1302

- mV, V, mA inputs
- Current/voltage outputs
- Input/output isolation (SC-1302)
- Optional pulse duration output
- Surface or rack mount
- High load output option



The SC-1300 and SC-1302 accept voltage or current inputs and provide a current or voltage output.

The SC-1302 provides isolation between the input, output and power for AC or isolated DC powered units.

#### SC-1300 Specifications

##### Inputs:

Input	Input Impedance
0-1 VDC	2 M $\Omega$
0.25-1.25 VDC	2 M $\Omega$
1-5 VDC	5 M $\Omega$
0-1 mA	5000 $\Omega$
1-5 mA	1000 $\Omega$
2-10 mA	500 $\Omega$
4-20 mA	250 $\Omega$
10-50 mA	100 $\Omega$

Note: Any of the above ranges can also be zero based.

##### Ambient Temperature Effect:

For 25°F to 125°F (-4°C to 52°C)  
 $\pm 0.01\%/^{\circ}\text{F}$  ( $\pm 0.018\%/^{\circ}\text{C}$ ) maximum  
 $\pm 0.004\%/^{\circ}\text{F}$  ( $\pm 0.007\%/^{\circ}\text{C}$ ) typical

##### Response Time:

Less than 50 milliseconds (10-90%)

##### Isolation:

600 VAC or 1000 VDC input/power isolation for AC or isolated DC powered units

#### SC-1302 Specifications

##### Inputs:

Voltage Inputs	Current Inputs	Current Input Impedance*
0-100 mVDC	0, 0.2-1 mA DC	5k $\Omega$
0-200 mVDC	0, 1-5 mA DC	1k $\Omega$
0-500 mVDC	0, 2-10 mA DC	500 $\Omega$
0-1 VDC	0, 4-20 mA DC	250 $\Omega$
0.25-1.25 VDC	0, 10-50 mA DC	100 $\Omega$
0, 1-5 VDC		
0, 2-10 VDC		

\*For low input impedance, use SC-1326 Linear inverter available for all ranges.

##### Voltage Input Impedance:

Greater than 5 M $\Omega$

##### Response Time:

Less than 400 mS (10-90%)

##### Ambient Temperature Effect:

(1-5 V input)  
 For 25°F to 125°F (-4°C to 52°C)  
 $\pm 0.02\%/^{\circ}\text{F}$  ( $\pm 0.036\%/^{\circ}\text{C}$ ) maximum  
 $\pm 0.01\%/^{\circ}\text{F}$  ( $\pm 0.018\%/^{\circ}\text{C}$ ) typical

##### Isolation:

Input/output/power is 600 VAC of 1000 VDC for AC or isolated DC powered units.

# AMETEK

## Signal Conditioning

### Output Signals:

mA	Output Drive Capability
10-50 mA	320Ω
4-20 mA	800Ω
2-10 mA	1600Ω
1-5 mA	3200Ω
0.2-1 mA	16,000Ω

VDC	Output Impedance
2-10 VDC	500Ω
1-5 VDC	250Ω
0.2-1 VDC	50Ω
0-100 mVDC	5Ω
0-10 mVDC	0.5Ω

Note: Any of the above ranges can also be zero based

**Linearity:** ±0.1% of span, maximum error; except SC-1300L and SC-1300U

**Repeatability:** ±0.1% of span, maximum error

**Ambient Temperature Range:** 0° to 140°F (-18° to 60°C)

**Power Supply Effect:** ±0.15% for a ±20% power variation maximum with 800 ohm load and 4-20 mA output (H3, H4, H5 options ±10%)

**Common Mode Rejection:** 130 dB at 60 Hz

### Power Supplies:

- 115 VAC ±20%, 50/60 Hz, 5 watts (standard)
- 24 VDC ±20%, 3.5 watts (H suffix; non-isolated)
- 230 VAC ±20%, 50/60 Hz, 5 watts (H2 suffix)
- 115 VAC ±10%, 60 Hz, 5 watts, (H3 suffix; P-11 or A-12 option)
- 115 VAC ±10%, 50/60 Hz, 5 watts (H4 suffix; P-11 or A-12 option)
- 230 VAC ±10%, 50/60 Hz, 5 watts (H5 suffix; P-1 or A-12 option)
- 24 VDC ±20%, 4.5 watts (I suffix; isolated)
- 48 VDC ±20%, 5 watts, (I1 suffix; isolated)

**Controls:** Multiturn zero and span potentiometers

**Net Weight (Approximate):** 3.4 lbs. (1.54 kg)

### Enclosures:

- single unit surface mount (standard)
- P-11, high density, 19" rack mount (with rear access terminal blocks)
- A-12, high density, 19" rack and surface mount (with front access terminal blocks)
- NEMA 4 and 12 (from one to 24 units)
- explosion-proof single unit, FM approved for Class 1, Division 1, Groups C and D

### High Load Drive Option (HO):

mA	Output Drive Capability
10-50 mA	600Ω
4-20 mA	1600Ω
2-10 mA	3200Ω
1-5 mA	6400Ω
0.2-1 mA	32,000Ω

Note: any analog output may also be zero based

### True Voltage Output Option (VO):

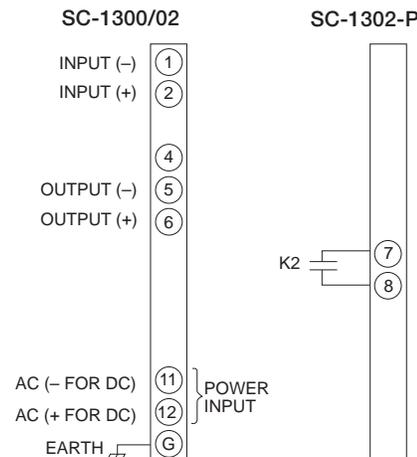
VDC	Minimum Drive Impedance
0-10 VDC	300Ω
0-5 VDC	150Ω

**Agency Approvals:** FM approved for ordinary locations and hazardous locations Divisions I and 2, Class 1, Groups C & D; Class II, Groups E, F & G. Explosion-proof housing required for hazardous locations.

CSA approved for ordinary locations for SC-1300 and SC-1302 with either 117 VAC, 24 VDC isolated or 24 VDC non-isolated power versions.

**Ordering Information:** see page 7.56, 7.57

**Dimensions:** see page 7.58



## AC Current/Voltage Transmitters

### SC-1300L SC-1300U

- 0-7.5 amps input
- 0-200V input
- Input/output/ground isolation
- Current/voltage output
- Surface or rack mounts



The SC-1300L accepts an AC current input and converts it to a current or DC voltage signal.

The SC-1300U accepts an AC voltage input and converts it to a current or DC voltage signal.

#### SC-1300L Specifications

**Inputs:**

From 0-1 to 0-7.5 amps AC, burden less than 0.5 VA

**Isolation Characteristics:**

1500 V rms, input to output, input to ground; 600 V rms output to ground

**Input Overdrive Capability:**

20 amps continuous, 250 amps for one second per hour

**Ambient Temperature Effect:**

For 25°F to 125°F (-4°C to 52°C):  
±0.01%/°F (±0.018%/°C) maximum  
±0.004%/°F (±0.007%/°C) typical

**Linearity:**

±0.3% maximum,  
±0.1% typical for 5-100% of span

#### SC-1300U Specifications

**Inputs:**

Any AC voltage from 0-16 to 0-200 V at 50-500 Hz, burden less than 1.5 VA

**Isolation Characteristics:**

2400 V peak, input to output, input to ground; 600 V peak output to ground

**Input Overdrive Capability:**

200% of input specified, continuous

**Linearity:**

±0.3% maximum,  
±0.1% typical for 5-100% of span

# AMETEK

## Signal Conditioning

### Specifications

#### SC-1300L, SC-1300U

**Repeatability:**  $\pm 0.1\%$  of span, maximum error

**Ambient Temperature Range:** 0° to 140°F (-18° to 60°C)

#### Output Signals:

mA	Output Drive Capability
10-50 mA	320 $\Omega$
4-20 mA	800 $\Omega$
2-10 mA	1600 $\Omega$
1-5 mA	3200 $\Omega$
0.2-1 mA	16,000 $\Omega$

VDC	Output Impedance
2-10 VDC	500 $\Omega$
1-5 VDC	250 $\Omega$
0.2-1 VDC	50 $\Omega$
0-100 mVDC	5 $\Omega$
0-10 mVDC	0.5 $\Omega$

Any of the above ranges can be zero based.

#### Lead Compensation Error:

Lead Resistance ( $\Omega$ ) x 1% maximum  
Span ( $\Omega$ )

This error may be nulled by zero adjustment.

**Controls:** multiturn zero and span potentiometers

#### Power Supply Effect:

$\pm 0.15\%$  for a  $\pm 20\%$  power variation maximum with 800 ohm load and 4-20 mA output (H3, H4, H5 options  $\pm 10\%$ )

#### Power Supplies:

- 115 VAC  $\pm 20\%$ , 50/60 Hz, 5 watts (standard)
- 24 VDC  $\pm 20\%$ , 3.5 watts (H suffix; non-isolated)
- 230 VAC  $\pm 20\%$ , 50/60 Hz, 5 watts (H2 suffix)
- 115 VAC  $\pm 10\%$ , 60 Hz, 5 watts, (H3 suffix; P-11 or A-12 option)
- 115 VAC  $\pm 10\%$ , 50/60 Hz, 5 watts (H4 suffix; P-11 or A-12 option)
- 230 VAC  $\pm 10\%$ , 50/60 Hz, 5 watts (H5 suffix; P-1 or A-12 option)
- 24 VDC  $\pm 20\%$ , 4.5 watts (I suffix; isolated)
- 48 VDC  $\pm 20\%$ , 5 watts, (I1 suffix; isolated)

#### Net Weight (Approximate):

3.4 lbs. (1.54 kg)

#### Enclosures:

- single unit surface mount (standard)
- P-11, high density, 19" rack mount (with rear access terminal blocks)
- A-12, high density, 19" rack and surface mount (with front access terminal blocks)
- NEMA 4 and 12 (from one to 24 units)
- explosion-proof single unit, FM approved for Class 1, Division 1, Groups C and D

#### High Load Drive Option (HO):

mA	Output Drive Capability
10-50 mA	600 $\Omega$
4-20 mA	1600 $\Omega$
2-10 mA	3200 $\Omega$
1-5 mA	6400 $\Omega$
0.2-1 mA	32,000 $\Omega$

Note: any analog output may also be zero based

#### True Voltage Output Option (VO):

VDC	Minimum Drive Impedance
0-10 VDC	300 $\Omega$
0-5 VDC	150 $\Omega$

**Agency Approvals:** FM approved for ordinary locations and hazardous locations Divisions 1 and 2, Class 1, Groups C & D; Class II, Groups E, F & G. Ametek explosion-proof housing required for hazardous locations.

CSA approved for ordinary locations, all unit types with either 117 VAC, 24 VDC isolated or 24 VDC non-isolated power versions.

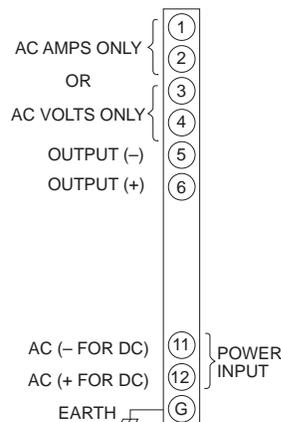
#### Ordering Information:

see page 7.56, 7.57

#### Dimensions:

see page 7.58

#### SC-1300L/U



## RTD and Slidewire Transmitters

### SC-1300R

- Slidewire inputs
- High output load option

### SC-1372, SC-1374

- RTD inputs
- Optional input/output isolation
- Differential RTD inputs
- High output load option



### SC-1300R, SC-1372, and SC-1374

The SC-1300R accepts a direct potentiometer input and converts it to a current or voltage signal.

The SC-1372 accepts an input from an RTD and converts it to a current or voltage signal. The SC-1372 accepts two or three-wire RTD's with lead wire compensation. Differential RTD measurement is available. This unit is isolated between the input, output and power for AC or isolated DC powered units.

The SC-1374 is similar to the SC-1372 but is not isolated between the input and power for AC powered units.

### SC-1372 and SC-1374 Specifications

**Inputs:** 100Ω platinum, 10Ω copper and 120Ω nickel, standard. Consult factory for other available ranges. 3Ω to 1260 Ω spans with differential measurement.

#### Ambient Temperature Effect:

For 25°F to 125°F (-4°C to 52°C):

Zero:

$RTD \min.(\Omega) \times 0.002\% + 0.008\%/^{\circ}F \max.$   
span (Ω)

Span: 0.008%/°F maximum

For 10Ω span with 100Ω RTD minimum:

0.028%/°F zero drift

0.008%/°F span drift maximum

#### Response Time:

SC-1372: less than 400 mS (10-90%)

SC-1374: less than 50 mS (10-90%)

#### Isolation:

SC-1372: 600 VAC or 1000 VDC input/output/power for AC or isolated DC powered units.

SC -1374: 600 VAC or 1000 VDC input/power for AC or isolated DC powered units.

### SC-1300R Specifications

#### Input:

from 10Ω to 20,000Ω spans. Total slidewire resistance must be specified when ordering.

#### Slidewire Power Dissipation:

less than 175 microwatts

#### Slidewire Constant Current Source:

Slidewire Range*		Slidewire Current
Min.	Max.	Maximum
0-10Ω	0-50Ω	10 mA
0-50Ω	0-100Ω	10 mA
0-100Ω	0-199Ω	10 mA
0-200Ω	0-399Ω	5 mA
0-400Ω	0-799Ω	2 mA
0-800Ω	0-1499Ω	1 mA
0-1500Ω	0-2999Ω	0.5 mA
0-3000Ω	0-5999Ω	0.25 mA
0-5999Ω	0-10,000Ω	0.15 mA

\*Total slidewire resistance must be specified when ordering.

#### Response Time:

less than 50 milliseconds (10-90%)

#### Isolation:

600 VAC or 1000 VDC input/power isolation for AC or isolated DC powered units

#### Ambient Temperature Effect:

for 25° to 125°F (-4° to 52°C):  
±0.01%/°F (±0.018%/°C) maximum,  
±0.004%/°F (±0.007%/°C) typical

# AMETEK

## Signal Conditioning

### SC-1300R, SC-1372, and SC-1374 Specifications

**Linearity:**  $\pm 0.1\%$  of span, maximum error;  $\pm 1^\circ\text{C}$  max. for Ni and Pt RTDs,  $0.3^\circ\text{C}$  typical

**Repeatability:**  $\pm 0.1\%$  of span, maximum error

**Ambient Temperature Range:**  $0^\circ$  to  $140^\circ\text{F}$  ( $-18^\circ$  to  $60^\circ\text{C}$ )

#### Output Signals:

mA	Output Drive Capability
10-50 mA	320 $\Omega$
4-20 mA	800 $\Omega$
2-10 mA	1600 $\Omega$
1-5 mA	3200 $\Omega$
0.2-1 mA	16,000 $\Omega$

VDC	Output Impedance
2-10 VDC	500 $\Omega$
1-5 VDC	250 $\Omega$
0.2-1 VDC	50 $\Omega$
0-100 mVDC	5 $\Omega$
0-10 mVDC	0.5 $\Omega$

Any of the above ranges can be zero based.

#### Lead Compensation Error:

Lead Resistance ( $\Omega$ ) x 1% maximum Span ( $\Omega$ )

This error may be nulled by zero adjustment.

**Controls:** multiturn zero and span potentiometers

**Common Mode Rejection (SC-1372):** 130 dB @ 60 Hz

**Power Supply Effect:**  $\pm 0.15\%$  for a  $\pm 20\%$  power variation maximum with 800 ohm load and 4-20 mA output (H3, H4, H5 options  $\pm 10\%$ )

#### Power Supplies:

- 115 VAC  $\pm 20\%$ , 50/60 Hz, 5 watts (standard)
- 24 VDC  $\pm 20\%$ , 3.5 watts (H suffix; non-isolated)
- 230 VAC  $\pm 20\%$ , 50/60 Hz, 5 watts (H2 suffix)
- 115 VAC  $\pm 10\%$ , 60 Hz, 5 watts, (H3 suffix; P-11 or A-12 option)
- 115 VAC  $\pm 10\%$ , 50/60 Hz, 5 watts (H4 suffix; P-11 or A-12 option)
- 230 VAC  $\pm 10\%$ , 50/60 Hz, 5 watts (H5 suffix; P-1 or A-12 option)
- 24 VDC  $\pm 20\%$ , 4.5 watts (I suffix; isolated)
- 48 VDC  $\pm 20\%$ , 5 watts, (I1 suffix; isolated)

#### Net Weight (Approximate):

3.4 lbs. (1.54 kg)

#### Enclosures:

- single unit surface mount (standard)
- P-11, high density, 19" rack mount (with rear access terminal blocks)
- A-12, high density, 19" rack and surface mount (with front access terminal blocks)

d. NEMA 4 and 12 (from one to 24 units)

e. explosion-proof single unit, FM approved for Class 1, Division 1, Groups C and D

#### High Load Drive Option (HO):

mA	Output Drive
<b>Capability</b>	
10-50 mA	600 $\Omega$
4-20 mA	1600 $\Omega$
2-10 mA	3200 $\Omega$
1-5 mA	6400 $\Omega$
0.2-1 mA	32,000 $\Omega$

Note: any analog output may also be zero based

#### True Voltage Output Option (VO):

VDC	Minimum Drive
<b>Impedance</b>	
0-10 VDC	300 $\Omega$
0-5 VDC	150 $\Omega$

**Agency Approvals:** FM approved for ordinary locations and hazardous locations Divisions 1 and 2, Class 1, Groups C & D; Class II, Groups E, F & G. Ametek explosion-proof housing required for hazardous locations.

CSA approved for ordinary locations, all unit types with either 117 VAC, 24 VDC isolated or 24 VDC non-isolated power versions.

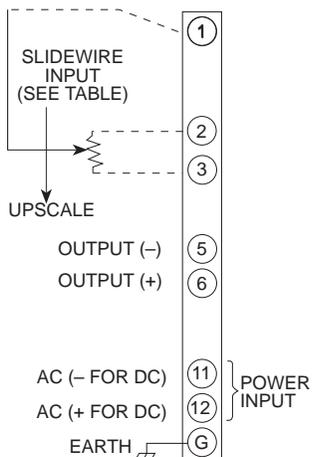
#### Ordering Information:

see page 7.56, 7.57

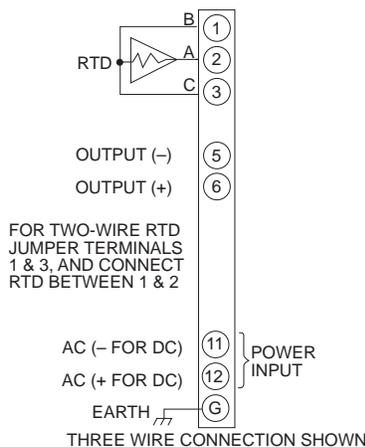
#### Dimensions:

see page 7.58

### SC-1300R Connections

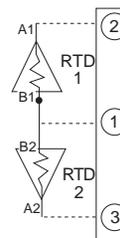


### SC-1372 and SC-1374 Connections

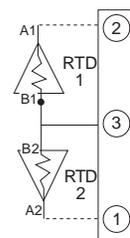


#### Differential Input Connections

##### SC-1372



##### SC-1374



## Millivolt and Thermocouple Transmitters

### SC-1326 SC-1326W

- Input/output isolation
- Spans from 3-80mV
- Burnout protection
- Class 1, Div 1 & 2 approvals
- Surface or rack mount



The SC-1326 accepts a millivolt signal and converts it to a current or voltage signal.

The SC-1326W accepts a thermocouple input and produces a current or voltage signal. It has built-in cold junction compensation and input/output isolation.

#### SC-1326 Specifications

##### Inputs:

- millivolt input spans between 10 and 100 mV with a live zero of -25 to 100 mV
- optional input spans:
  - SS1 3.00 to 4.99 mV
  - SS2 5.00 to 9.99 mV

##### Low Input Impedance (LZ Option):

Input	Input Impedance
0-5 mA	10 $\Omega$
1-5 mA	12.4 $\Omega$
0-10 mA	5.1 $\Omega$
2-10 mA	6.05 $\Omega$
0-20 mA	2.5 $\Omega$
4-20 mA	3.0 $\Omega$
0-50 mA	1.0 $\Omega$
10-50 mA	1.25 $\Omega$

#### SC-1326W Specifications

##### Inputs:

- any thermocouple type: J, K, T, E, R, S, B
- standard input spans (calculated from input temperature range) are between 10 and 80 mV
- optional input spans:
  - SS1 3 to 4.99 mV
  - SS2 5 to 9.99 mV

##### Cold Junction Error:

$\pm 1^\circ\text{C}$  for J, K, T, E, R, S, B inputs over a range of 25° to 125°F (-4° to 52°C)

# AMETEK

## Signal Conditioning

### SC-1326 and SC-1326W Specifications

**Linearity:**  $\pm 0.1\%$  of span, maximum error; linearity referred to mV signal for thermocouple inputs

**Repeatability:**  $\pm 0.1\%$  of span, maximum error

**Ambient Temperature Range:** 0° to 140°F (-18° to 60°C)

**Ambient Temperature Effect:**

- for 25° to 125°F (-4° to 52°C):  $\pm 0.02\%/^{\circ}\text{F}$  ( $\pm 0.036\%/^{\circ}\text{C}$ ) maximum,  $\pm 0.01\%/^{\circ}\text{F}$  ( $\pm 0.018\%/^{\circ}\text{C}$ ) typical
- for spans less than 10 mV, ambient temperature effect is:  

$$\frac{10 \text{ mV}}{\text{span mV}} \times 0.02\%/^{\circ}\text{F}$$

**Input Impedance:**

- without downscale: greater than 1 M $\Omega$
- with downscale: 40 mA T/C excitation current

**Output Signals:**

mA	Output Drive Capability
10-50 mA	320 $\Omega$
4-20 mA	800 $\Omega$
2-10 mA	1600 $\Omega$
1-5 mA	3200 $\Omega$
0.2-1 mA	16,000 $\Omega$

VDC	Output Impedance
2-10 VDC	500 $\Omega$
1-5 VDC	250 $\Omega$
0-2.1 VDC	50 $\Omega$
0-100 mVDC	5 $\Omega$
0-10 mVDC	0.5 $\Omega$

Note: Any of the above ranges can also be zero based.

**Ordering Information:**

see page 7.56, 7.57

**Dimensions:**

see page 7.58

**Response Time:**

less than 400 milliseconds (10-90%)

**Controls:** multiturn zero and span potentiometers

**Isolation:** 600 VAC or 1000 VDC input/output. Input/power isolation for AC or isolated DC powered units.

**Power Supply Effect:**  $\pm 0.15\%$  for a  $\pm 20\%$  power variation maximum with 800 ohm load and 4-20 mA output (H3, H4, H5 options  $\pm 10\%$ )

**Common Mode Rejection:**

130 dB @ 60 Hz

**Power Supplies:**

- 115 VAC  $\pm 20\%$ , 50/60 Hz, 5 watts (standard)
- 24 VDC  $\pm 20\%$ , 3.5 watts (H suffix; non-isolated)
- 230 VAC  $\pm 20\%$ , 50/60 Hz, 5 watts (H2 suffix)
- 115 VAC  $\pm 10\%$ , 60 Hz, 5 watts (H3 suffix; P-11 or A-12 option)
- 115 VAC  $\pm 10\%$ , 50/60 Hz, 5 watts (H4 suffix; P-11 or A-12 option)
- 230 VAC  $\pm 10\%$ , 50/60 Hz, 5 watts (H5 suffix; P-1 or A-12 option)
- 24 VDC  $\pm 20\%$ , 4.5 watts (I suffix; isolated)
- 48 VDC  $\pm 20\%$ , 5 watts, (I1 suffix; isolated)

**Net Weight (Approximate):**

3.4 lbs. (1.54 kg)

**Enclosures:**

- single unit surface mount (standard)
- P-11, high density, 19" rack mount (with rear access terminal blocks)
- A-12, high density, 19" rack and surface mount (with front access terminal blocks)
- NEMA 4 and 12 (from one to 24 units)
- explosion-proof single unit, FM approved for Class 1, Division 1, Groups C and D

**High Load Drive Option (HO):**

mA	Output Drive Capability
10-50 mA	600 $\Omega$
4-20 mA	1600 $\Omega$
2-10 mA	3200 $\Omega$
1-5 mA	6400 $\Omega$
0.2-1 mA	32,000 $\Omega$

Note: any analog output may also be zero based

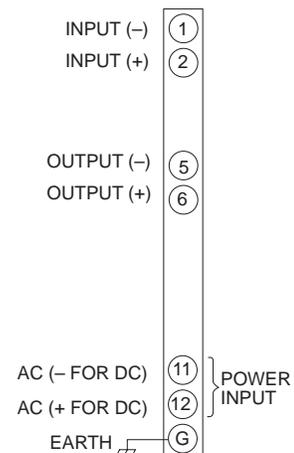
**True Voltage Output Option (VO):**

VDC	Minimum Drive Impedance
0-10 VDC	300 $\Omega$
0-5 VDC	150 $\Omega$

**Agency Approvals:** FM approved for ordinary locations and hazardous locations Divisions I and 2, Class 1, Groups C & D; Class II, Groups E, F & G. Ametek explosion-proof housing required for hazardous locations.

CSA approved for ordinary locations, all unit types with either 117 VAC, 24 VDC isolated or 24 VDC non-isolated power versions.

### SC-1326 and SC-1326W Connections



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## SC-1300 Specialty Transmitters and Computational Devices

The SC-1300 Family provides a series of specialty transmitters and computational devices for process control applications. They are panel mounted, field adjustable, and do not require any software of programming to set up or modify their functionality. The transmitter functions include:

- Frequency
- Lead/lag
- Pulse Duration (Transmitter and receiver)
- Strain Gage
- Rate-Limiter

The computational devices include:

- High-Low Signal Selector
- Median Selector
- Signal Limiter
- Square Root Transmitter
- Multiplier/Divider
- Adder/Subtractor
- Integrator (Linear)
- Integrator (Square Root)
- Ratio and Bias Transmitter

These units are available for both stand alone panel mount, or in high density multi-card racks or enclosures which offer space savings. They can also be intermixed with the ET-1200 Series alarms in the high density enclosures.

### Specialty Transmitters

#### SC-1350 Frequency Transmitter

A single channel device which accepts a frequency or pulse input and converts it to a voltage or current output. Inputs can range from 5 to 24,000 Hz with amplitudes up to 50 volts peak-to-peak.

This device is useful for interfacing with process measurements often found with tachometers, mass flow meters, magnetic flowmeters, turbine meters and metering pumps.

#### SC-1364 Lead/Lag Transmitter

Produces a phase lead or phase lag between .005 and 50 minutes in a process loop. The main purpose is to improve stability or control response due to use of feedforward control schemes or multiple process lags.

#### SC-1380 Pulse Duration Transmitter

Converts a standard instrument level signal input into an output pulse or relay closure. The output duration or "on time" is proportional to the input signal level with a repetition rate adjustable over preselected ranges. Typical applications include: use as an on-off proportioning device or simple controller, SCR control for heaters, and valve control in filling applications.

#### SC-1382 Pulse Duration Receiver

Accepts an input pulse and converts it to an analog output proportional to the duration or duty cycle of the input pulse.

#### SC-1390 Strain Gage Transmitter

Accepts a strain gage input and converts it to an analog output. Strain gage bridges of 120 or 350 ohms can be used. Excitation voltage levels with remote sensing at the primary transmitter junction are provided to eliminate lead length effects.

#### SC-1396 Rate-Limited Signal Transmitter

This device accepts an input signal and limits the speed of the output change. If the input changes at a rate which exceeds the predetermined value, the output rate of change is limited to a rate which can be set between 3.6 and 3600 seconds (1 hour). Independent rising and falling rates can be set via two multiturn potentiometers.

Applications include speed control for rotating equipment, and reduction of valve movement in flow control.

It can also be used to generate a ramp for setpoint control such as found in reactor temperature controls.

# AMETEK

## Signal Conditioning

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### SC-1300 Computational Devices

#### SC-1320 High-Low Signal Selector

Accepts 2, 3 or 4 inputs, and selects the signal which is the highest or lowest. High or low operation is easily changed via jumpers, and is useful in override control schemes for Temperature/Pressure control.

#### SC-1324 Median Selector

Accepts three inputs and provides an output which is proportional to the median or middle input. If one of the inputs should fail, the output will be proportional to the lower of the two remaining inputs.

#### SC-1330 Square Root Extractor

Provides an output signal proportional to the square root of the input signal. Typical uses include: linearizing the signal from a differential pressure flow transmitter, linearizing the signal in a gas flow calculation and squaring-type RMS voltage or current transducers.

#### SC-1352 Multiplier/Divider

Accepts up to 3 inputs and provides a wide range of equations which include:

$$D=A*B*C$$

$$D=A*B/C$$

$$D=A^2/C$$

$$D=A/C$$

$$D=A/B$$

These devices are used in applications such as: gas flow and BTU calculations, inferred levels and other indirect quantitative measurements where direct measurements are not possible.

#### SC-1354 Adder/Subtractor

Accepts 2, 3 or 4 inputs and provides the function  $Y = \pm A \pm B \pm C \pm D$ . It can be used to determine the total flow through several lines, or determine the differential between an inflow and outflow.

#### SC-1356 Linear Integrator

Converts an analog input to a variable pulse output proportional to the integral of the input. Outputs can be solid state and/or relay with a frequency of 0-64,000 counts per hour. The field alterable rate often represents the quantitative number of units such as liters, gallons, pounds or cubic feet.

#### SC-1358 Square Root Integrator

Converts an analog input to a variable pulse output proportional to the integral of the square root of the input. Outputs can be solid state and/or relay with a frequency of 0-64,000 counts per hour. This device is often used in conjunction with a differential pressure flow transmitter to generate a value representing the number of gallons or liters flowing through a line.

#### SC-1362 Signal Limiter

Limits the output to a predetermined level regardless of input signal. The unit contains independent adjustments for both high and low limits. Applications include limiting motor or pump speeds and valve openings.

#### SC-1398 Scale and Bias Transmitter

Accepts an input signal which can be biased up to  $\pm 100\%$ . Typical applications include: drum level control, and temperature and/or speed control where it is necessary to keep one variable higher than another process parameter.

## Common Specifications

### Output Signals:

All models except: SC-1356, 1358 and 1380.

mA	Output Drive Capability
10-50 mA	320Ω
4-20 mA	800Ω
2-10 mA	1600Ω
1-5 mA	3200Ω
0.2-1 mA	16,000Ω

VDC	Output Impedance
2-10 VDC	500Ω
1-5 VDC	250Ω
0.2-1 VDC	50Ω
0-100 mVDC	5Ω
0-10 mVDC	0.5Ω

Note: Any of the above ranges can also be zero based.

**Repeatability:** ±0.1% of span, maximum error

### Ambient Temperature Range:

0° to 140°F (-18° to 60°C)

### Ambient Temperature Effect:

For 25°F to 125°F (-4°C to 52°C):  
±0.01%/°F (±0.018%/°C) maximum  
±0.004%/°F (±0.007%/°C) typical

**Power Supply Effect:** ±0.15% for a ±20% power variation maximum with 800 ohm load and 4-20 mA output (H3, H4, H5 options ±10%)

### Common Mode Rejection:

130 db at 60 Hz on isolated units

**Isolation:** All models except SC-1390. 600 VAC or 1000 VDC input/power isolation for AC or isolated DC powered units.

### Power Supplies:

- 115 VAC ±20%, 50/60 Hz, 5 watts (standard)
- 24 VDC ±20%, 3.5 watts (H suffix; non-isolated)
- 230 VAC ±20%, 50/60 Hz, 5 watts (H2 suffix)
- 115 VAC ±10%, 60 Hz, 5 watts, (H3 suffix; P-11 or A-12 option)
- 115 VAC ±10%, 50/60 Hz, 5 watts (H4 suffix; P-11 or A-12 option)
- 230 VAC ±10%, 50/60 Hz, 5 watts (H5 suffix; P-1 or A-12 option)
- 24 VDC ±20%, 4.5 watts (I suffix; isolated)
- 48 VDC ±20%, 5 watts, (I1 suffix; isolated)

### Net Weight (Approximate):

3.4 lbs. (1.54 kg)

## SC-1320 Specifications

### Inputs:

Input	Input Impedance
1-5 VDC	5 MΩ
0-4 VDC	5 MΩ
0.25-1.25 VDC	2 MΩ
0.2-1 mA	5000Ω
1-5 mA	1000Ω
2-10 mA	500Ω
4-20 mA	250Ω
10-50 mA	100Ω

Note: Any of the above ranges can also be zero based.

**Response Time:** less than 50 ms (10-90%)

**Controls:** Multiturn zero and span potentiometers

## SC-1324 Specifications

### Inputs:

Input	Input Impedance
0-1 VDC	2 MΩ
0.25-1.25 VDC	2 MΩ
1-5 VDC	5 MΩ
0-1 mA	5000Ω
1-5 mA	1000Ω
2-10 mA	500Ω
4-20 mA	250Ω
10-50 mA	100Ω

Note: Any of the above ranges can also be zero based.

**Response Time:** less than 50 ms (10-90%)

**Controls:** Multiturn zero and span potentiometers

## SC-1330 Specifications

### Inputs:

Input	Input Impedance
0-1 VDC	2 MΩ
0.25-1.25 VDC	2 MΩ
1-5 VDC	5 MΩ
0-1 mA	5000Ω
1-5 mA	1000Ω
2-10 mA	500Ω
4-20 mA	250Ω
10-50 mA	100Ω

Note: Any of the above ranges can also be zero based.

**Linearity:** ±0.1% of span from 2.5 to 100% of input maximum; ±0.25% of span from 1 to 2.5% of input maximum

**Response Time:** less than 200 ms (10-90%)

**Controls:** Multiturn input zero, output zero, balance, span and dropout potentiometers

**Low Limit Cutoff:** from .25 to 10% of input span

### Basic Equation:

$$K\sqrt{A} = D$$

# AMETEK

## Signal Conditioning

### SC-1350 Specifications

#### Inputs:

Frequency input spans from 5.8 Hz to 24,000 Hz maximum (zero based)

**Impedance:** 1 MΩ

#### Frequency Range:

10 kHz  
10 kHz-20 kHz  
20 kHz-24 kHz

#### Signal Amplitude:

Minimum	Maximum
125 mV RMS	50 V P-P
225 mV RMS	50 V P-P
300 mV RMS	50 V P-P

**Response Time:** 100 ms from 60 Hz to 24,000 Hz; for less than 60 Hz response time is equal to seven input pulses

**Controls:** Multiturn zero and span potentiometers

### SC-1352 Specifications

#### Inputs:

Input	Input Impedance
1-5 VDC	5 MΩ
0-4 VDC	2 MΩ
0.25-1.25 VDC	2 MΩ
0-1 mA	5000Ω
1-5 mA	1000Ω
2-10 mA	500Ω
4-20 mA	250Ω
10-50 mA	100Ω

Note: Any of the above ranges can also be zero based.

**Linearity:** ±0.2% of span from 2.5% to 100% of input maximum; ±0.1% typical

#### Response Time:

Less than 50 ms (10-90%)

**Controls:** Multiturn zero, span, Ka, Kb, Kc, a<sub>o</sub>, b<sub>o</sub>, c<sub>o</sub> potentiometers

#### Basic Equation:

$D = \frac{AB}{C}$  which can be expanded to:

$$D = \frac{(K_a \times A + a_o)(K_b \times B + b_o)}{(K_c \times C + c_o)} \times K_s$$

$$K_A^2 = D, K_{AB} = D, \frac{K_A^2}{C} = D, K \frac{A}{C} = D,$$

$$K \frac{AB}{C} = D, \frac{K}{C} = D, K\sqrt{A} = D, \text{ and}$$

$$K\sqrt{\frac{A}{B}} = D$$

Where:

Ks = Gain adjustable from 0.5 to 2.5

Ka, Kb, Kc = input scale factor adjustable from 0 to 1.5

ao, bo = input rebias level adjustable from 0 to 1.5

co = input rebias level adjustable from 0 to 1.0

A, B, C = normalized inputs

### SC-1354 Specifications

#### Inputs:

Input	Input impedance
1-5 VDC	5 MΩ
0.25-1.25 VDC	2 MΩ
0-1 mA	5000Ω
1-5 mA	1000Ω
2-10 mA	500Ω
4-20 mA	250Ω
10-50 mA	100Ω

Note: Any of the above ranges can also be zero based

**Linearity:** ±0.15% of span maximum

#### Response Time:

Less than 50 ms (10-90%)

**Controls:** Multiturn potentiometers:

output zero, span scale factor for input A, B, C and D

#### Basic Equation:

$$V_o = K_s[\pm K_a(V_a - A_o) \pm K_b(V_b - B_o) \pm K_c(V_c - C_o) \pm K_d(V_d - D_o)] + K_o$$

Where:

Ks adjustable from 0.15 to 1.2

Ka, Kb, Kc, Kd adjustable from 0 to 1.75

Va, Vb, Vc, Vd = input level

Ko, Ao, Bo, Co, Do adjustable from 0-20% of nominal full scale output

### SC-1356/SC-1358 Specifications

#### Inputs:

Input	Input Impedance
1-5 VDC	5 MΩ
0-2 VDC	4 MΩ
0.25-1.25 VDC	2 MΩ
0-1 VDC	2 MΩ
0-500 mVDC	1 MΩ
0-200 mVDC	400 kΩ
0-100 mVDC	200 kΩ
0-50 mVDC	100 kΩ
0-1 mA	5000Ω
1-5 mA	1000Ω
2-10 mA	500Ω
4-20 mA	250Ω
10-50 mA	100Ω

Note: Any of the above ranges can also be zero based.

#### Outputs:

**Counts:** 0-60 to 0-64,000 counts per hour, full scale as specified (field alterable over the entire range)

**Output Pulse Rating:** 24 VDC into a minimum load of 100Ω, nominal 35 ms duration

**Relay Output Rating:** 15 VA (Suffix K1)

**Response Time:** Less than 50 ms (10-90%)

**Controls:** Multiturn zero, span and dropout potentiometers

#### SC-1356

**Zero Dropout:** 0.5 to 20% adjustable, factory set at 1% unless otherwise specified

#### SC-1358

**Zero Dropout:** Adjustable 0.5% to 4% typically, factory set at 1% unless otherwise specified.

**Square Root Operation:** May not be converted in the field to linear operation

### SC-1362 Specifications

#### Inputs:

Input	Input Impedance
0-1 VDC	2 MΩ
0.25-1.25 VDC	2 MΩ
1-5 VDC	5 MΩ
0-1 mA	5000Ω
1-5 mA	1000Ω
2-10 mA	500Ω
4-20 mA	250Ω
10-50 mA	100Ω

Note: Any of the above ranges can also be zero based.

#### Response Time:

Less than 50 ms (10-90%)

**Controls:** Multiturn zero and span, hi-limit and lo-limit potentiometers

### SC-1364 Specifications

#### Inputs:

Input	Input Impedance
0-1 VDC	2 MΩ
0.25-1.25 VDC	2 MΩ
1-5 VDC	5 MΩ
0-1 mA	5000Ω
1-5 mA	1000Ω
2-10 mA	500Ω
4-20 mA	250Ω
10-50 mA	100Ω

Note: Any of the above ranges can also be zero based.

#### Response Time:

Lag Time: 0.005 to 50 minutes (5 ranges)

Lead Time: 0.005 to 50 minutes (5 ranges)

**Controls:** Multiturn output zero, input zero, span, low time constant and time constant controls

**Zero Frequency Gain:** 0.800 to 1.200, adjustable

**Rate Gain:** lead mode only, 10

### SC-1380 Specifications

#### Inputs:

Input	Input Impedance
1-5 VDC	5 MΩ
0.2-1 VDC	2 MΩ
0.25-1.25 VDC	2 MΩ
0-1 mA	5000Ω
1-5 mA	1000Ω
2-10 mA	500Ω
4-20 mA	250Ω
10-50 mA	100Ω

Note: Any of the above ranges can also be zero based.

#### Outputs:

24 VDC ±20% at 100 mA maximum current draw with a range from 0.6 sec. to 2457.6 seconds. Optional relay contact output: one form A (single pole normally open) mercury film contact, 150 milliohms maximum contact resistance, non-position sensitive ("K2" suffix)

#### Response Time:

Less than 50 ms (10-90%)

**Controls:** Multiturn zero and span and period potentiometers

**Contact Rating:** 1 amp at 24 VDC (24 watts) or 200 mA at 115 VAC (22 VA), resistive load only (K2 code)

**Linearity:** ±0.25% of span maximum; ±0.15% typical

### SC-1382 Specifications

**Inputs:** Full scale pulse width from 200 milliseconds to 409.65 seconds; input form is dry contact or 10 to 35 VDC pulse

**Linearity:** ±0.25% of span maximum; ±0.15% typical

**Controls:** Multiturn zero and span potentiometers

### SC-1390 Specifications

#### Inputs:

One or two 120 ohm or 350 ohm strain gage bridge or transducers, with a minimum output of 1 mV/V and a maximum excitation of 10 volts. Must specify :

1. bridge type
2. excitation voltage
3. mV/V

**Response Time:** Less than 50 milliseconds (10-90%)

**Linearity:** ±0.25% maximum, ±0.1% typical

**Controls:** Multiturn zero and span and bridge power potentiometers

**Bridge Excitation:** 4 to 10 VDC, field adjustable

**Isolation:** 600 VAC/1000 VAC input to power, excitation to input, output to power

### SC-1396 Specifications

#### Inputs:

Input	Input Impedance
0-1 VDC	2 MΩ
0.25-1.25 VDC	2 MΩ
1-5 VDC	5 MΩ
0-1 mA	5000Ω
1-5 mA	1000Ω
2-10 mA	500Ω
4-20 mA	250Ω
10-50 mA	100Ω

Note: Any of the above ranges can also be zero based.

**Controls:** Multiturn zero and span and rise limiting and fall limiting potentiometers

**Rate Control:** Field adjustable from 3.6 seconds to 3600 seconds in three ranges

3.6-36  
36-360  
360-3600

**Relay Output Rating:** 15 VA, normally open contact (reed-relay type).

### SC-1398 Specifications

#### Inputs:

Input	Input Impedance
1-5 VDC	5 MΩ
0.2-1 mA	5000 Ω
1-5 mA	1000 Ω
2-10 mA	500 Ω
4-20 mA	250 Ω
10-50 mA	100 Ω

Note: Any of the above ranges can also be zero based.

**Input Bias Range:** 100% of full scale

**Response Time:** Less than 50 milliseconds (10-90%)

**Controls:** Switches for coarse setting and 20 turn potentiometers for fine setting of ratio, output bias and input bias

**Ratio (Gain) Range:** 0.1 to 10.0 (100:1)

**Output Bias Range:** 0-50% of full scale

#### Equation:

$$D=K(A-a)+d$$

Where:

A=input

a=input bias

D=output

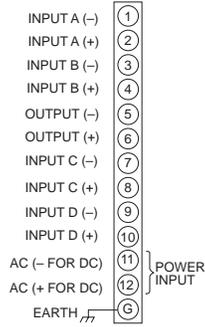
d=output bias

K=ratio

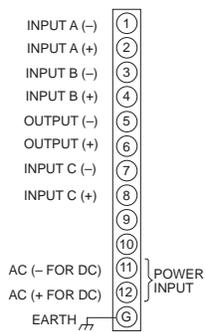
# AMETEK

## Signal Conditioning

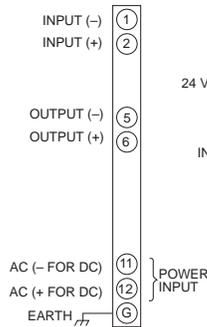
### SC-1320



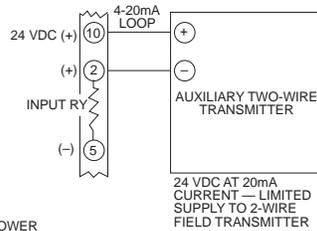
### SC-1324



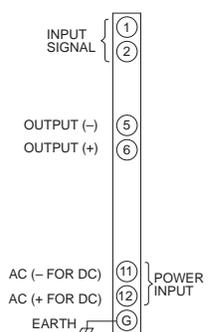
### SC-1330



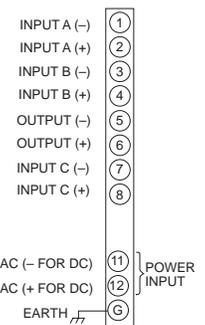
### 24 VDC 2-Wire Power



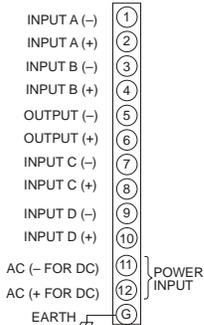
### SC-1350



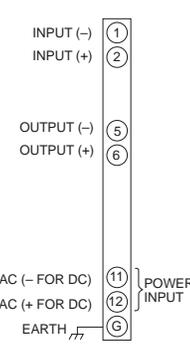
### SC-1352



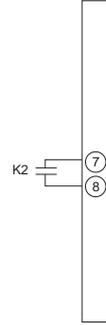
### SC-1354



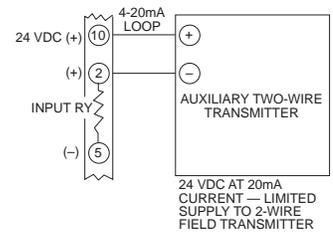
### SC-1356 and SC-1358



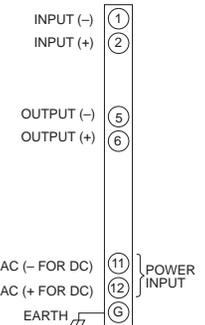
### K1 Option



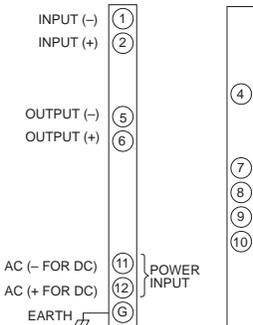
### 24 VDC Two Wire Power



### SC-1362

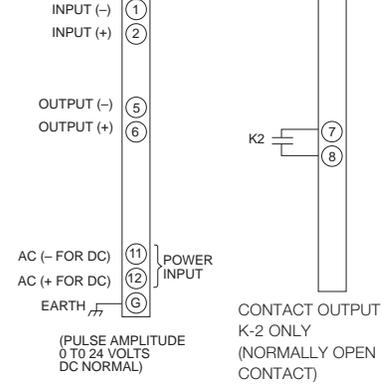


### SC-1364

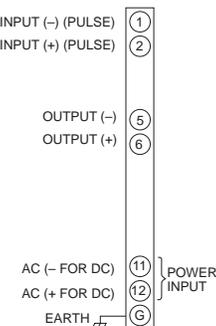


Range Selection	
Lag/Lead Time (Seconds)	Jumper External Terminals
1000-3000	—
300-1000	10 to 9
100-300	10 to 8
30-100	10 to 7

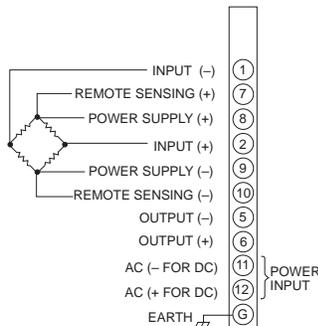
### SC-1380



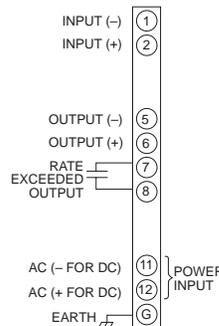
### SC-1382



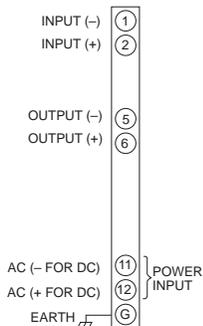
### SC-1390



### SC-1396



### SC-1398



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## SC-1300 Signal Transmitter Ordering Guide



**SC-1300 DC Current/Voltage Transmitter**  
**SC-1300L AC Current Transmitter**  
**SC-1300R Slidewire/Potentiometer Transmitter**  
**SC-1300U AC Voltage Transmitter**  
**SC-1302 Isolated Transmitter**

**SC-1320 High-Low Signal Selector**  
**SC-1324 Median Selector**  
**SC-1326 Isolated mV Transmitter**  
**SC-1326W Isolated T/C Transmitter**  
**SC-1330 Square Root Transmitter**

**SC-1350 Frequency Transmitter**  
**SC-1352 Multiplier/Divider Transmitter**  
**SC-1354 Adder/Subtractor Transmitter**  
**SC-1356 Linear Integrator**  
**SC-1358 Square Root Integrator**

**SC-1362 Signal Limiter Transmitter**  
**SC-1364 Lead/Lag Transmitter**  
**SC-1372 Isolated RTD Transmitter**

**SC-1374 RTD Transmitter**  
**SC-1380 Pulse Duration Transmitter**  
**SC-1382 Pulse Duration Receiver**  
**SC-1390 Strain Gauge Transmitter**  
**SC-1396 Rate-Limited Signal Transmitter**  
**SC-1398 Ratio and Bias Transmitter**

# AMETEK

## Signal Conditioning

### Options

### SC-1300 Signal Transmitter Quick Reference Option Chart

#### 1. Input Options

#### 2. Power Supply

Model No. and Description	Option Ordering Suffix	RFI <sup>2</sup>	SS1	SS2	SS3	SS4	X	LZ	SL
SC-1300 DC Current/Voltage Transmitter		0					0		
SC-1300L AC Current Transmitter <sup>1</sup>									
SC-1300R Slidewire/Potentiometer Transmitter		0							
SC-1300U AC Voltage Transmitter <sup>1</sup>									
SC-1302 Isolated Transmitter		0					0		

H	H2	H3	H4	H5
A	A	0	0	0
A	A	0	0	0
A	A	0	0	0
A	A	0	0	0
A	A	0	0	0

SC-1320 High-Low Signal Selector		0							
SC-1324 Median Selector		0							
SC-1326 Isolated mV Transmitter		0	0	0				A	
SC-1326W Isolated T/C Transmitter		0	0	0					SP
SC-1330 Square Root Transmitter		0					0		

A	A	0	0	0
A	A	0	0	0
A	A	0	0	0
A	A	0	0	0
A	A	0	0	0

SC-1350 Frequency Transmitter		0							
SC-1352 Multiplier/Divider Transmitter		0							
SC-1354 Adder/Subtractor Transmitter		0							
SC-1356 Linear Integrator		0					0		
SC-1358 Square Root Integrator		0					0		

A	A	0	0	0
A	A	0	0	0
A	A	0	0	0
A	A	0	0	0
A	A	0	0	0

SC-1362 Signal Limiter Transmitter		0					0		
SC-1364 Lead/Lag Transmitter		0					0		
SC-1372 Isolated RTD Transmitter		0			0	0			A

A	A	0	0	0
A	A	0	0	0
A	A	0	0	0

SC-1374 RTD Transmitter		0			0	0			A
SC-1380 Pulse Duration Transmitter <sup>1</sup>		0					0		
SC-1382 Pulse Duration Receiver		0							
SC-1390 Strain Gauge Transmitter		0			0	0			
SC-1396 Rate-Limited Signal Transmitter		0					0		
SC-1398 Ratio and Bias Transmitter		0					0		

A	A	0	0	0
A	A	0	0	0
A	A	0	0	0
A	A	0	0	0
A	A	0	0	0
A	A	0	0	0

<sup>1</sup>Requires dual slot on A12 enclosure.

<sup>2</sup>Available on stand alone units only.

### Options

#### SC-1300 Transmitter Options

Item 1. Code	Input Options Description
SS1	3 to 4.99 millivolt spans (for mV and T/C units only)
SS2	5 to 9.99 millivolt spans (for mV and T/C units only)
SS3	2.50 to 4.99 ohm spans (RTD units only)
SS4	5 to 9.99Ω input spans
X	voltage inputs: 20,000 ohms per volt input impedance, maximum voltage input 200 VDC

LZ	Low impedance current inputs	H4
3N, 3P	Signal linearization, applies to RTD units	
RFI	Radio frequency filter protection, not available on AC inputs	H5
<b>Item 2. Code</b>	<b>Power Supply Options Description</b>	
H	24 VDC (+20%,-15%) non-isolated prime power	I
H2	230 VAC, ±20%, 50/60 Hz prime power, standard enclosure	I1
H3	115 VAC, ±10%, 60 Hz only, for use with A-12 or P-11 enclosure mounted units	E
		FS

115 VAC, ±10%, 50/60 Hz, for use with A-12 or P-11 enclosure mounted units
230 VAC, ±10%, 50/60 Hz, for use with A-12 or P-11 enclosure mounted units
24 VDC ±20%, isolated prime power
48 VDC, ±20%, isolated prime power
Power for external two-wire transmitter, 24 VDC at 20 mA, maximum, special order
Individual slow blow power-line fuse



# AMETEK

## Signal Conditioning

Item 5. Code	Enclosure Options Description
P11*	11 unit, plug-in enclosure with rear wiring access
A12*	12 unit card enclosure with front and rear wiring access
NEMA 4	Enclosures for one to 24 units, standard
NEMA 12	Enclosures for one to 24 units, standard
XP	Explosion-proof, single unit, FM approved for Class 1, Division 1, Groups C and D
B	Conduit mounting plate to accommodate two, 1/2 inch conduit entries.

C Conduit mounting plate and terminal cover, option B above, plus screwed-on metal front cover

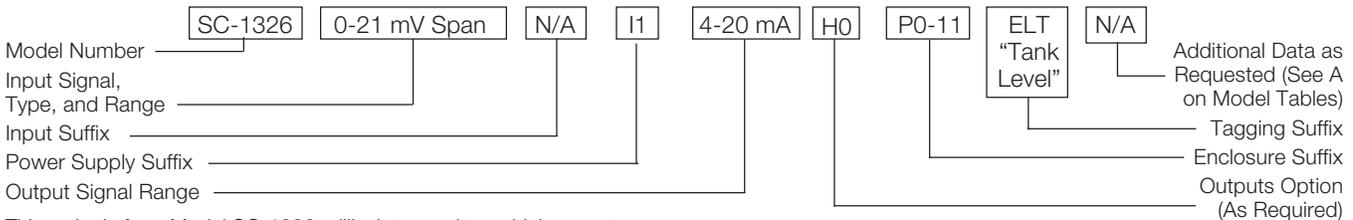
Item 6. Code	Tagging Options Description
SST	Stainless steel strip tag
EST	Stainless steel engraved tag
ELT	Plastic lamacoid engraved tag (Specify lettering of tag)

\*If no power supply order suffix is given, the unit will have standard 115 VAC ±20%, 50/60 Hz.

\*SC-1300L/U and SC-1380 require dual slot on the A-12 enclosure. Units with P, HO and VO options require dual slot on the A-12 and P-11 enclosures.

**Caution:**  
Certain options are not compatible with others. Contact your local Ametek representative or the Ametek factory if you have any questions.

### Series 1300 Signal Transmitters



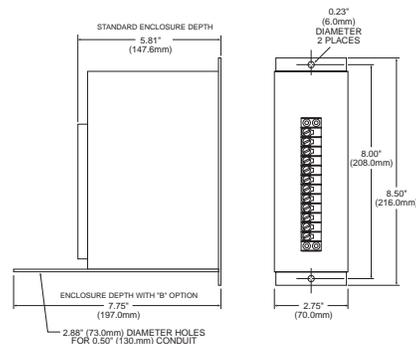
This order is for a Model SC-1326 millivolt transmitter which accepts a 20 mV span. It includes no special input options and operates on 48 Vdc (I1). The output range is 4-20 mA with high output drive (HO). It is

configured for plug-in use in a P-11 rack mount and has a lamacoid tag that reads "Tank Level." No additional variables need to be specified.

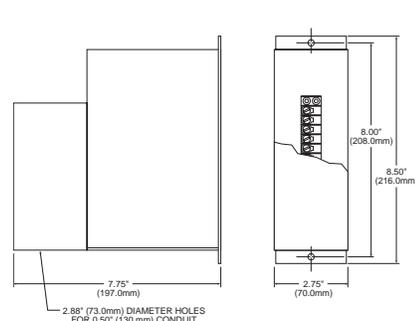
### Single Unit Enclosure Dimension Drawings

#### SC-1300 Transmitters

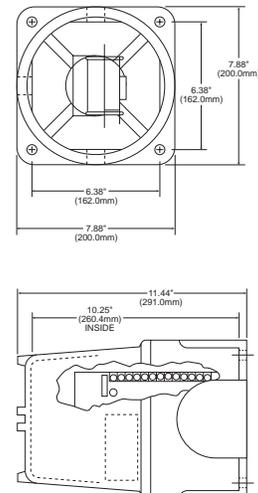
##### Standard Enclosure with Suffix B Conduit Mounting Plate



##### Standard Enclosure with Suffix C Conduit Mounting Plate and Cover



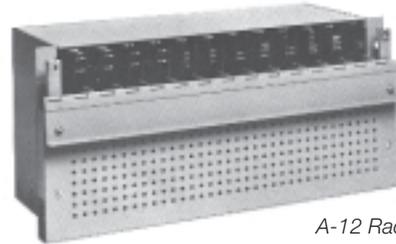
##### Explosion-Proof Housing



## High Density Instrument Enclosures

### A-12 Rear Access P-11 Front Access

- Multiple Card Enclosures
- Plug-In Enclosures
- Panel Mount
- Surface Mount
- And Combinations of the Above



*A-12 Rack*



*P-11 Rack*

### ET-1200 and SC-1300 High Density Enclosures

Ametek Power Instruments makes two high-density enclosures for packaging ET-1200 alarms and SC-1300 signal conditioners: the P-11, 19" rack mount (with rear access terminal blocks) and the A-12, 19" rack mount (with front access terminal blocks).

#### P-11 Rack Mounted Multiple

#### Instrument Enclosure

The P-11 enclosure provides efficient and high-density means packaging of 11 instruments in a space measuring only 19" x 8.75" x 10" (483mm x 222mm x 254mm).

Instrument modules may be arranged in any order providing that the arrangement does not take up more than 11 spaces. Most of the SC-1300 and ET-1200 units fit into a single plug-in slot. Some options require two slots.

#### Application Considerations

The P-11 is available with 24 VDC, 48 VDC or 115 VAC prime power. 24 VDC power may be ordered with common non-isolated or individual isolated DC-to-DC supplies.

#### A-12 Rack or Surface Mounted

#### Multiple Instrument Enclosure

The Ametek A-12 multi-unit enclosure is an efficient means of packaging up to 12 instruments in a space 17" x 8.75" x 7". This enclosure is suitable for mounting either in a standard 19" relay rack or for wall mounting. Most SC-1300 and ET-1200 instruments need only a single rack position.



# AMETEK

## Transducers

### Current & Voltage Transducers for Single Phase Measurements

**CCC-1B**  
**VCC-1B**  
**VCX-1B**

- Used and Approved Worldwide
- High Accuracy
- Outstanding Overload and Temperature Performance
- Excellent Long-Term Stability
- Meets ANSI C37.90.1-1974 (IEEE SWC) and BEAMA No. 219 Tests
- Wide Selection of Input/Output Ranges
- Process Outputs (4-20 mA)



#### Applications

- Closed loop process control element
- Motor overload protection
- Substation line and bus monitoring
- Distribution circuit monitoring
- Supervisory control and data acquisition
- Improved precision of dynamic network models

The Ametek Power Instruments CCC Current Transducer and VCC Voltage Transducer are compact instruments designed to accept an AC current or voltage input and provide a proportional DC output. The VCX Voltage Transducer is a suppressed zero unit that provides the same type of output signal. These transducers are designed to respond to the average value of the input signal, but all models are calibrated to indicate the RMS of a pure sinusoid. All models are constructed with an ultra-linear transformer input stage isolating the input from the solid-state output amplifier.

Like all Ametek Power Instruments transducers, these current and voltage units incorporate state-of-the art electrical and mechanical design. Only the highest quality components, latest production techniques and most advanced test equipment and procedures are used in their manufacture. All models are designed to meet the ANSI SWC (surge withstand capability) test and BEAMA Test No. 219, to assure reliable performance in the field.

CCC, VCC and VCX transducers are housed in rugged drawn-steel enclosures with welded-on mounting plates. The entire circuitry may be pulled by removing

two easily-accessible screws without dismounting the enclosure from the panel.

For more information on current and voltage transducers, application assistance on a special project, or simply to place an order, consult your nearest Ametek Sales Office.

# AMETEK

## Transducers

### CCC-1B Current Transducers VCC-1B Voltage Transducers VCX-1B Suppressed Zero Voltage Transducers

CURRENT TRANSDUCER OPTIONS & STANDARD CALIBRATION (TABLE NO. 1)

OPTIONS	CURRENT INPUT		OVERLOAD WITHSTAND			
	RANGE (O-F.S.) STANDARD CALIBRATION	OVER RANGE WITH FULL ACCURACY	CONTINUOUS @ 65° C		3 SEC./HOUR	1 SEC./HOUR
			X1, X5, XA, X	X10, X20		
C1	0-1 Amps	0-1.5 Amps	10 Amps	10 Amps	20 Amps	50 Amps
C2	0-2 Amps	0-3.0 Amps	10 Amps	10 Amps	40 Amps	100 Amps
C5	0-5 Amps	0-7.5 Amps	20 Amps	10 Amps	100 Amps	250 Amps
C10	0-10 Amps	0-15 Amps	20 Amps	10 Amps	250 Amps	400 Amps

VOLTAGE TRANSDUCER INPUT OPTIONS & STANDARD CALIBRATION (TABLE NO. 2)

OPTIONS	POTENTIAL INPUT		OVERLOAD WITHSTAND	
	RANGE (O-F.S.) STANDARD CALIBRATION	OVER RANGE WITH FULL ACCURACY	CONTINUOUS @ 65° C	1 SEC./HOUR
P1	0-150 Volts	0-200 Volts	1.5xF.S.	2xF.S.
P2	0-250 Volts	0-330 Volts	1.5xF.S.	2xF.S.
P3	0-550 Volts	0-600 Volts	1.5xF.S.	2xF.S.

POWER SUPPLY OPTIONS (TABLE NO. 3)

OPTIONS		EXTERNAL POWER SUPPLY	
		RANGE	BURDEN (MAXIMUM)
E0 Self-powered	Note: P2-X5, C10-X5, and any combinations including XA, X10 or X20 options, require an external power supply	—	—
E1		85-150 VAC	4 VA
E2		170-300 VAC	4 VA
E3		300-550 VAC	4 VA

OUTPUT OPTIONS, CURRENT & VOLTAGE TRANSDUCERS (TABLE NO. 4)

OPTIONS	OUTPUT			INPUT BURDEN (MAXIMUM @ 50-60 Hz)		
	RANGE	LOAD	CURRENT LIMITING	CURRENT TRANSDUCERS		VOLTAGE TRANSDUCERS
				Self-Powered	Externally-Powered	
X1	0-1 mADC	0-10K $\Omega$	—	0.5 VA	0.5 VA	2.0 VA
X5	0-5 mADC	0-3K $\Omega$	—	1.0 VA	0.5 VA	2.0 VA
X10	0-10 mADC	0-1.5K $\Omega$	15-20 mADC	1.5 VA	0.5 VA	2.5 VA
X20	0-20 mADC	0-750 $\Omega$	30-40 mADC	2.0 VA	0.5 VA	3.0 VA
XA	4-20 mADC	0-750 $\Omega$	30-40mADC	—	0.5 VA	3.0 VA
X( )*	0-DC Volts	Consult Factory	—	—	0.5 VA	—

\*Example: X (0-10 VDC)

**FREQUENCY OPTIONS (TABLE NO. 5)**

OPTIONS	CALIBRATION FREQUENCY
F50	50 Hz
F60	60 Hz

**CALIBRATION (TABLE NO. 6)**

OPTIONS	F.S. CALIBRATION
Z0 Z1	Defined by Tables 1&2 (Standard) Special factory calibration Specify F.S. output and F.S. input: any value between 1-10 Amps or 85-550 Volts. External power option required

**Specifications  
CCC-1B & VCC-1B**

**Accuracy:**  $\pm 0.25\%$  full scale at 25°C  $\pm 2^\circ\text{C}$  for combinations of C5 (X1, XA, or X) and P1 (X1, XA or X). All other combinations  $\pm 0.50\%$  full scale.

**Operating Temperature Range:** -20°C to +65°C

**Operating Humidity:** 0-95%, non-condensing

**Output Ripple, Peak:** 1% all models except with option X10, 0.5% all models with option X10

**Response Time:** <400 ms from 0 to 99% for all models except with option X10, 400 ms from 0 to 90% for all models with option X10

**Calibrate Adjustment:**  $\pm 10\%$  minimum

**Dielectric Test:** 2000 VAC rms, minimum

**Surge Withstand:** Meets ANSI C37.90.1-1974 (IEEE Std. 472 SWC) and BEAMA No. 219 Tests

**Influences Affecting Accuracy:**  
A. Temperature:  $\pm 0.5\%$ , max.  
B. Long-term Stability:  $\pm 0.25\%$  per year, max., non-cumulative  
C. Frequency:  $\pm 0.2\%/Hz$  from nominal to  $\pm 10Hz$

**Weight (nominal):**

	WITHOUT OPTION XA	WITH OPTION XA
Pounds	1.0	1.4
Kilograms	.5	.65

A case ground terminal is standard.

**Specifications, VCX-1B  
Suppressed Zero Voltage  
Transducers**

The VCX voltage transducer provides a 0 to 1 mADC analog output for a variety of customer selected input ranges. Narrowing the input range improves output resolution by a factor of four over a zero-based input range.

Refer to the following specifications when placing an order.

**Maximum F.S. Input:** 150 VAC

**Minimum Input:** 85 VAC

**Burden:** 3 VA

**Temperature Influence:**  $\pm 1\%$  full scale, max.

**F.S. Output:** 1 mADC into 0-10K $\Omega$  load

**Self-Powered**

**Accuracy:**  $\pm 0.5\%$  F.S. @ 25°C  $\pm 2^\circ\text{C}$

**Calibration Adjustment:** 10 to 35 volt span

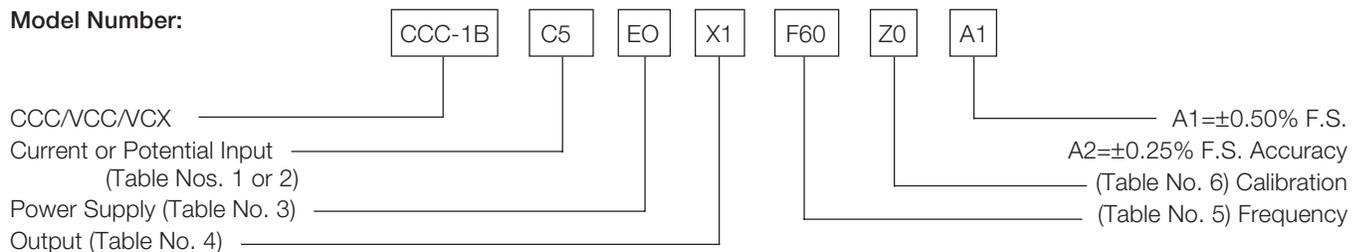
**Zero Adjustment:** 85-140 VAC in two ranges (85-115 VAC and 115-140 VAC)

All other specifications are the same as those for Series VCC.

**Ordering Information:**

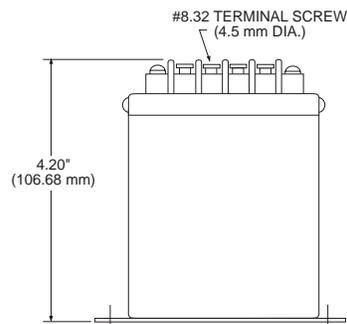
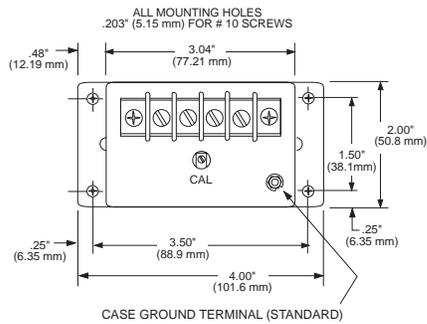
To avoid delays in delivery, always specify by model number and appropriate option suffixes in the order shown in the following example. No order is complete unless all suffixes are specified.

**Model Number:**



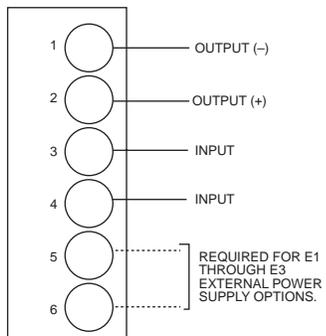
# AMETEK Transducers

## Dimensions:

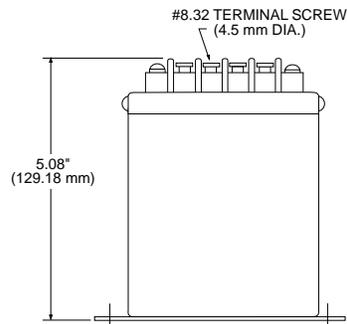


## Connections:

### Current & Voltage—Single Phase CCC-1B, VCC-1B



### EXTERNALLY POWERED DIMENSIONS



## Combined Watt/VAR Transducers

### For Three-Phase and Single-Phase Systems

WV-15

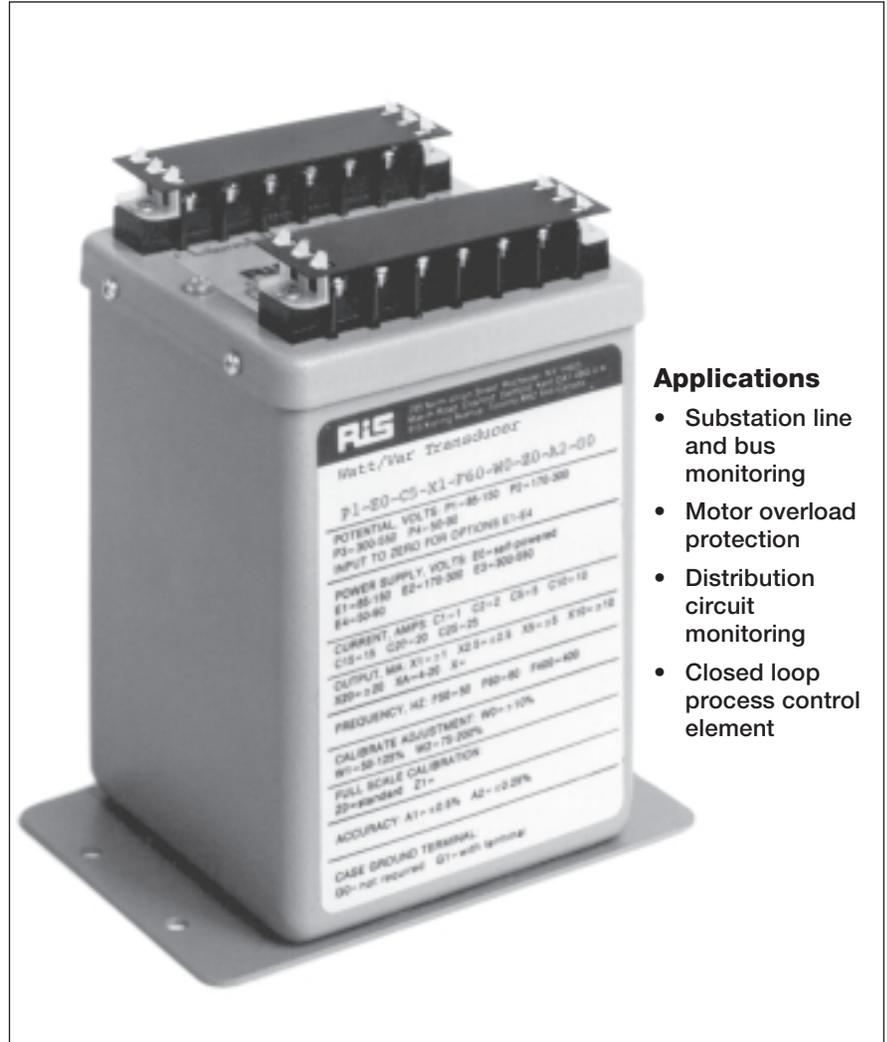
WV-20

WV-25

WV-30

- Two Transducers in One Enclosure
- Common Inputs for Separate Watt & VAR Outputs
- Occupies 50% Less Panel Space
- Requires 50% Fewer Connections
- Provides Greatest Economy in Watt & VAR Measurements
- Meets ANSI C37.90.a-1974 (IEEE SWC) & BEAMA No. 219 Tests
- Wide Selection of Current & Potential Input Ranges
- Choice of Voltage or Current Outputs

The Ametek Power Instruments combined Watt/VAR transducers are compact power transducers that provide two Direct Current (DC) outputs proportional to the real and reactive power input. The output accuracy is 0.25% including the effects of current, voltage, power factor, frequency, and output load. Housed in the same size enclosure as the PCE and VCE (discrete) Watt and VAR units,



the WV combined transducer occupies half the panel space required by two units. A single PT and a single CT connection per element means half of the connections. These factors provide a substantial space and cost savings with no sacrifice in performance.

The electronic circuits of the WV transducer make it possible to guarantee a temperature influence of less than 0.25% (for the X1 output) over a range of -20° to +65°C. Long term stability is  $\pm 0.25\%$  per year non-cumulative, permitting greatly extended calibration schedules and considerable cost savings.

The DC output signals, representing Watts and VARs, not only indicate the magnitude, but the direction of the measured quantities. The polarity is positive for unity power factor, or when

used at a power interchange point, positive for importing power, in the Watt output, and positive for lagging power factor in the VAR output. Any load resistance from short-circuit to maximum load can be applied and the output load may be changed in-service without affecting accuracy or calibration.

The WV transducer is mounted in a rugged drawn steel enclosure with a welded-on plate for easy installation.

For more information on the combined Watt/VAR transducer, application assistance on a special project, or to place an order, consult your nearest Ametek Sales Office.

# AMETEK

## Transducers

### General Specifications

#### Series WV Combined Watt / VAR Transducers

APPLICATION GUIDE (TABLE NO. 1)

MODEL NUMBER	CONNECTION	VOLTAGE	LOAD
WV-15*	1 phase	unrestricted	unrestricted
	3 phase 3 wire	balanced	balanced
WV-20	3 phase 3 wire	unrestricted	unrestricted
WV-25	3 phase 4 wire	balanced	unrestricted
WV-30	3 phase 4 wire	unrestricted	unrestricted

\*Specify single-phase or three-phase connection.

POTENTIAL OPTIONS (TABLE NO. 2)

OPTIONS	NOMINAL	POTENTIAL INPUT RANGE	
		SELF-POWERED MODEL	EXTERNALLY-POWERED MODEL
P1	120 VAC	90-150 VAC	0-150 VAC
P2	240 VAC	170-300 VAC	0-300 VAC
P3	480 VAC	300-550 VAC	0-550 VAC
Potential Burden, Maximum		6 VA	0.5 VA
Potential Overload Withstand		maximum rating, continuous	1.5 x nominal rating, continuous

POWER SUPPLY OPTIONS (TABLE NO. 3)

OPTIONS	EXTERNAL POWER SUPPLY	
	RANGE	BURDEN (MAXIMUM)
E0, self-powered	—	—
E1 } E2 } E3 } externally powered	90-150 VAC	5.5 VA
	170 - 300 VAC	5.5 VA
	300 - 550 VAC	5.5 VA

CURRENT OPTIONS (TABLE NO. 4)

OPTIONS	CURRENT INPUT			CURRENT OVERLOAD WITHSTAND		
	NOMINAL	OVER RANGE WITH FULL ACCURACY	BURDEN (MAXIMUM)	CONTINUOUS AT 65° C	3 SEC./ HOUR	1 SEC./ HOUR
C1	0-1 Amps	0-1.25 Amps	0.05 VA	10 Amps	40 Amps	50 Amps
C2	0-2 Amps	1-2.5 Amps	0.10 VA	10 Amps	40 Amps	100 Amps
C5	0-5 Amps	0-6.25 Amps	0.25 VA	20 Amps	100 Amps	250 Amps
C10	0-10 Amps	0-12.5 Amps	0.50 VA	20 Amps	250 Amps	400 Amps

**OUTPUT OPTIONS (TABLE NO. 5)**

OPTIONS	OUTPUT		
	RANGE (F.S.)	LOAD	COMPLIANCE
X1	0-±1 mADC	0-10 KΩ	± 11 Volts
X5	0-±5 mADC	0-2.4 KΩ	± 12 Volts
X10	0-±10 mADC	0-1.2 KΩ	± 12 Volts
XA	4-20 mADC (unipolar power)	0-600 Ω	± 12 Volts
XB	4-12-20 mADC (bipolar)	0-600 Ω	± 12 Volts
X (0-VDC)	DC voltage, ±10 V max.	—	—

**FREQUENCY OPTIONS (TABLE NO. 6)**

OPTIONS	FREQUENCY (NOMINAL)
F50	50 Hz
F60	60 Hz

**CALIBRATE ADJUSTMENT OPTIONS (TABLE NO. 7)**

Separate zero and calibrate controls are provided for watt and VAR sections.

OPTION	CALIBRATE GAIN ADJUSTMENT	ZERO ADJUSTMENT
W0 (standard)	±10%	±2%
W1 (extended)	50-125%	±2%
W2 (extended)	75-200%	±2%

**STANDARD CALIBRATION, WATTS OR VARS (TABLE NO. 8)**

Multiply the appropriate values shown in Table B by the factor shown in Table A to determine the full-scale calibration – watts or VARs – for the desired instrument. Specify Option Z0 for standard calibration as defined by these tables. Specify Option Z1 for special factory calibration and indicate the full scale value.

**TABLE A**

FOR MODEL NUMBER	MULTIPLY BY
WV-15 1 phase connection	1
WV-15 3 phase connection	2
WV-20	2
WV-25,30	3

**TABLE B**

POTENTIAL INPUT OPTION	CURRENT INPUT RANGE			
	C1 (0-1)	C2 (0-2)	C5 (0-5)	C10 (0-10)
P1 (85-150)	100	200	500	1000
P2 (170-300)	200	400	1000	2000
P3 (300-550)	400	800	2000	4000

**Accuracy:** .25% F.S. at 25° C ± 5° C

**Operating Temperature Range:** -20° to +65° C

**Operating Humidity:** 0-99%, non-condensing

**Output Ripple, Peak:** <1%

**Output Current Limiting:** 1.5 x maximum for option numbers X10, XA and XB

**Response Time (to 99%):** <400 m.s.

**Influences Affecting Accuracy:**

Temperature: ±0.25%, max for Option X1  
±0.5%, max. for all other output options

Long Term Stability: ±0.25%/yr., max., noncumulative

Frequency: 0.1%/Hz, max. from nominal frequency, ±10 Hz for watt transducer output.

Typical ±3% at nominal frequency plus 400 Hz for watt transducer output

**Power Factor Range:** Unity to lead or lag zero

**Self Powered:** Yes, unless one of options E1-E3 is specified

**Isolation:** 2000 V rms, minimum, Input/Output/Power/Case

**Surge Withstand:** ANSI C37.90.a-1974 (IEEE SWC)

BEAMA Test No. 219

**Size:** See outline dimensions, page 8.8

**Case ground terminal standard**

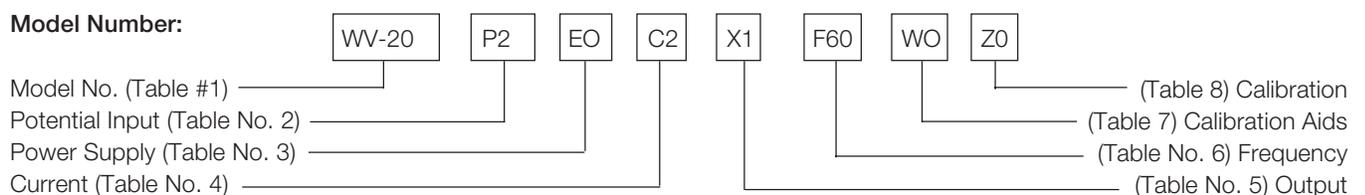
**Weight (nominal):**

	WV-15	WV-20	WV-25	WV-30
<b>Pounds</b>	3.4	4.0	4.0	4.5
<b>Kilograms</b>	1.5	1.8	1.8	2.0

**Ordering Information:**

To avoid delays in delivery, always specify by model number and appropriate option suffixes in the order shown in the following example. No order is complete unless all suffixes are specified.

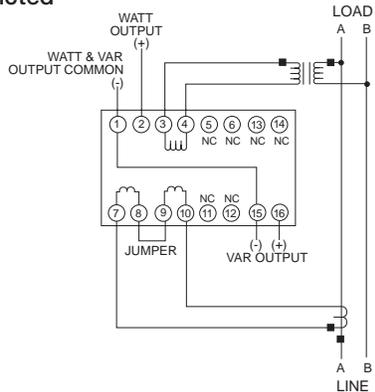
**Model Number:**



# AMETEK Transducers

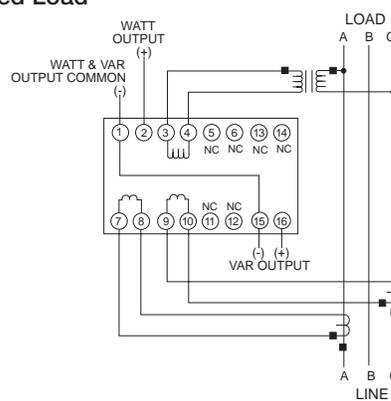
## Connection Diagrams & Outline Dimensions

### WV-15 Single-Phase Connection Unrestricted



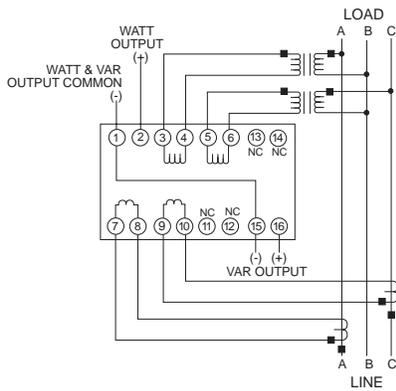
For options E1-E3, connect external power to terminals 13 and 14.

### WV-15 Three-Phase Connection Balanced Load



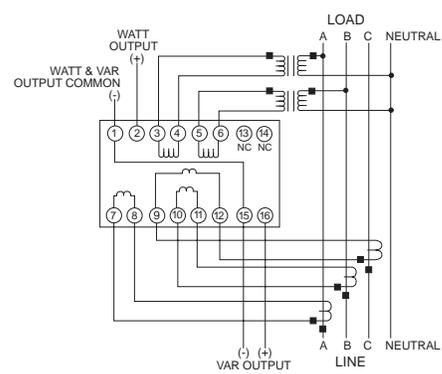
For options E1-E3, connect external power to terminals 13 and 14.

### WV-20 Unrestricted



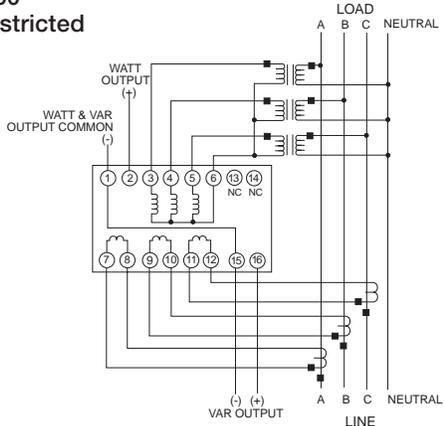
For options E1-E3, connect external power to terminals 13 and 14.

### WV-25 Balanced Load



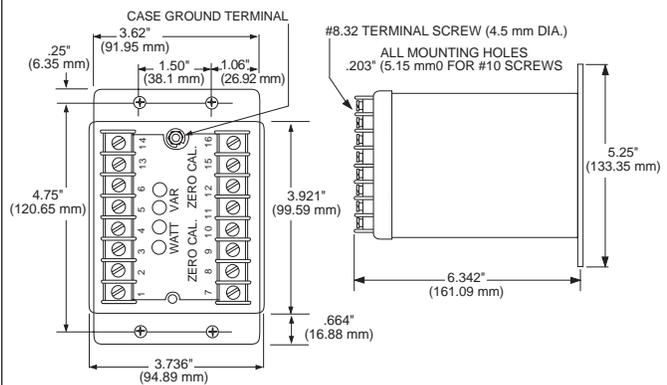
For options E1-E3, connect external power to terminals 13 and 14.

### WV-30 Unrestricted



For options E1-E3, connect external power to terminals 13 and 14.

### Outline Dimensions, All Models



Case Ground Terminal Standard

Above transducers are also available in rack-mounted configurations.

## Electronic Watt & VAR Transducers

**PCE  
VCE**

**For Three-Phase and Single-Phase Systems**

- 0.25% Accuracy
- Used and Approved Worldwide
- Excellent Long-Term Stability
- Meets ANSI C37.90.A-1974 (IEEE SWC) and BEAMA No. 219 Tests
- High Accuracy with Distorted Waveforms
- Wide Selection of Current and Potential Input Ranges
- Available with Choice of Voltage or Current Output Signals



### Applications

- Substation line and bus monitoring
- Motor overload protection
- Distribution circuit monitoring
- Closed loop process control element

The Ametek Power Instruments Watt and VAR transducers provide a Direct Current (DC) output proportional to the real or reactive power input. The output accuracy is 0.25% including the effects of current, voltage, power factor, frequency, and output load.

The electronic circuits of the PCE and VCE make it possible to guarantee a temperature influence of less than 0.25% (for the X1 output) over a range of -20° to +65°C. Long term stability is  $\pm 0.25\%$  per year non-cumulative, permitting greatly extended calibration

schedules and considerable cost savings.

The DC output signal, representing Watts or VARs, not only indicates the magnitude but the direction of the measured quantity. The polarity is positive for unity power factor in the PCE, and positive for lagging power factor in the VCE. Any load resistance from short-circuit to maximum load can be applied and the output load may be changed in-service without affecting accuracy or calibration.

The PCE and VCE are mounted in a rugged drawn steel enclosure with a welded-on mounting plate for easy mounting.

For more information on Watt or VAR transducers, application assistance on a special project, or to place an order, consult your nearest Ametek Sales Office.

# AMETEK

## Transducers

### General Specifications PCE & VCE Watt and VAR Transducers

APPLICATION GUIDE (TABLE NO. 1)

MODEL NUMBER		CONNECTION	VOLTAGE	LOAD
WATT	VAR			
PCE-15*	VCE-15*	1 phase	unrestricted	unrestricted
		3 phase 3 wire	balanced	balanced
PCE-20	VCE-20	3 phase 3 wire	unrestricted	unrestricted
PCE-25	VCE-25	3 phase 4 wire	balanced	unrestricted
PCE-30	VCE-30	3 phase 4 wire	unrestricted	unrestricted

\*Specify single-phase or three-phase connection when used with the Option "Z1".

POTENTIAL OPTIONS (TABLE NO. 2)

OPTIONS	POTENTIAL INPUT RANGE	
	SELF-POWERED MODEL	EXTERNALLY-POWERED MODEL
P1 (120 VAC nominal)	85-150 VAC	0-150 VAC
P2 (240 VAC nominal)	170-300 VAC	0-300 VAC
P3 (480 VAC nominal)	300-550 VAC	0-550 VAC
Potential Burden, Maximum	4 VA	0.1 VA
Potential Overload Withstand	maximum rating, continuous	1.5 x nominal rating, continuous

POWER SUPPLY OPTIONS (TABLE NO. 3)

OPTIONS	EXTERNAL POWER SUPPLY	
	RANGE	BURDEN (MAXIMUM)
E0, self-powered	—	—
E1 } externally powered	85-150 VAC	4 VA
E2 }	170 - 300 VAC	4 VA
E3 }	300 - 550 VAC	4 VA

CURRENT OPTIONS (TABLE NO. 4)

OPTIONS	CURRENT INPUT			CURRENT OVERLOAD WITHSTAND		
	NOMINAL	OVER RANGE WITH FULL ACCURACY	BURDEN (MAXIMUM)	CONTINUOUS AT 65° C	3 SEC./ HOUR	1 SEC./ HOUR
C1	0-1 Amps	0-1.5 Amps	0.25 VA	10 Amps	20 Amps	50 Amps
C2	0-2 Amps	1-3.0 Amps	0.25 VA	10 Amps	40 Amps	100 Amps
C5	0-5 Amps	0-7.5 Amps	0.25 VA	20 Amps	100 Amps	250 Amps
C10	0-10 Amps	0-15 Amps	0.50 VA	20 Amps	250 Amps	400 Amps

**OUTPUT OPTIONS (TABLE NO. 5)**

OPTIONS	OUTPUT		
	RANGE (F.S.)	LOAD	COMPLIANCE
X1	0-±1 mADC	0-10 KΩ	± 11 Volts
X5	0-±5 mADC	0-3 KΩ	± 15 Volts
X10	0-±10 mADC	0-1.4 KΩ	± 14 Volts
XA	4-20 mADC (unipolar power)	0-750 Ω	± 15 Volts
XB	4-12-20 mADC (bipolar)	0-750 Ω	± 15 Volts
X (0-VDC)	DC voltage, ±10 v max.	—	—

**FREQUENCY OPTIONS (TABLE NO. 6)**

OPTIONS	FREQUENCY (NOMINAL)
F50	50 Hz
F60	60 Hz
F400	400 Hz

**CALIBRATE ADJUSTMENT OPTIONS (TABLE NO. 7)**

OPTION	CALIBRATE GAIN ADJUSTMENT	ZERO ADJUSTMENT
W0 (standard)	±10%	±2%
W1 (extended)	50-125%	±2%
W2 (extended)	75-200%	±2%

**STANDARD CALIBRATION, WATTS OR VARS (TABLE NO. 8)**

Multiply the appropriate values shown in Table B by the factor shown in Table A to determine the full-scale calibration – watts or VARs – for the desired instrument. Specify Option Z0 for standard calibration as defined by these tables. Specify Option Z1 for special factory calibration and indicate the full scale value.

**TABLE A**

FOR MODEL NUMBER	MULTIPLY BY
PCE / VCE-15 1 phase connection	1
PCE / VCE-15 3 phase connection	2
PCE / VCE-20	2
PCE / VCE-25,30	3

**TABLE B**

POTENTIAL INPUT OPTION	CURRENT INPUT RANGE			
	C1 (0-1)	C2 (0-2)	C5 (0-5)	C10 (0-10)
P1 (85-150)	100	200	500	1000
P2 (170-300)	200	400	1000	2000
P3 (300-550)	400	800	2000	4000

**ACCURACY OPTIONS (TABLE NO. 9)**

OPTION	ACCURACY % F.S.	Accuracy includes the effects of:
A2	±0.1% typical ±0.25% worst case	<ul style="list-style-type: none"> <li>potential, within range</li> <li>current, within range</li> <li>power factor, within range</li> <li>frequency, nominal</li> <li>load, within range</li> <li>humidity, within range</li> <li>ambient temperature 25°C ±5°C</li> <li>external power supply, within range</li> </ul>

**Weight (nominal):**

	PCE/VCE-15	PCE/VCE-20	PCE/VCE-25	PCE/VCE-30
<b>Pounds</b>	3.0	3.4	3.5	3.8
<b>Kilograms</b>	1.4	1.5	1.6	1.7

**Operating Temperature Range:** -20° to +65° C

**Operating Humidity:** 0-99%, non-condensing

**Output Ripple, Peak:** <1%

**Output Current Limiting:** 1.5 x maximum for options X10, XA and XB

**Response Time (to 99%):** <400 m.s.

**Power Factor Range:** Unity to lead or lag zero

**Self Powered:** Yes, unless one of options E1-E3 is specified

**Isolation:** 2000 V rms, minimum, Input/Output/Power/Case

**Surge Withstand:** ANSI C37.90.a-1974 (IEEE SWC) BEAMA Test No. 219

**Influences Affecting Accuracy:**

Temperature: ±0.25%, max for Option X1

±0.5%, max. for all other output options

Long Term Stability: ±0.25%/yr., max., noncumulative

Frequency: 0.1%/Hz, max. from nominal frequency, ±10 Hz for all watt transducers.

Typical ±3% at nominal frequency plus 400 Hz.

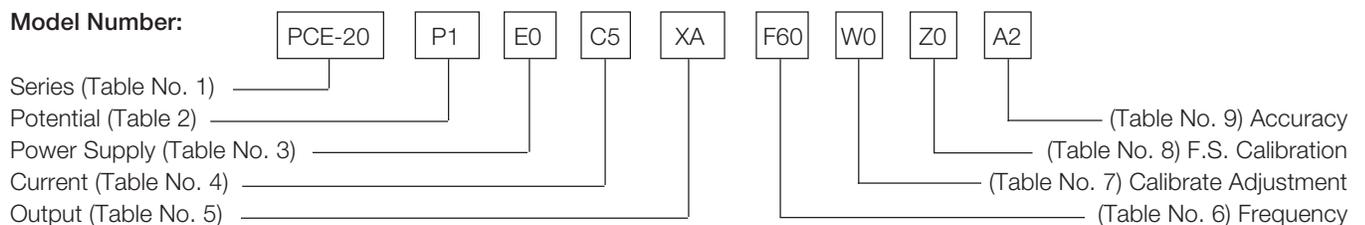
**Size:** See outline dimensions, page 8.12

**Case ground terminal standard**

**Ordering Information:**

To avoid delays in delivery, always specify by model number and appropriate option suffixes in the order shown in the following example. No order is complete unless all suffixes are specified.

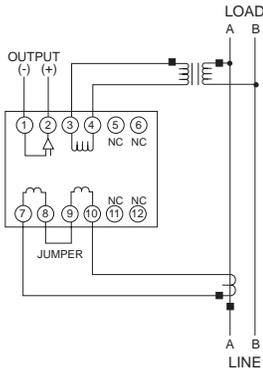
**Model Number:**



# AMETEK Transducers

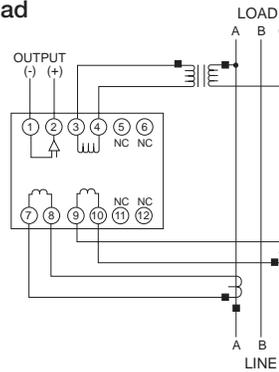
## Connection Diagrams & Outline Dimensions

### PCE-15 & VCE-15 Single-Phase Connection Unrestricted



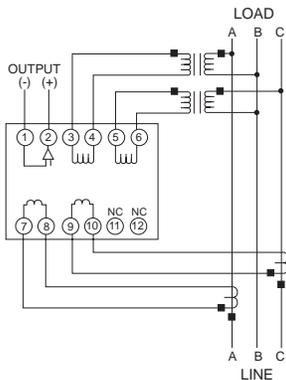
For options E1-E3, connect external power to terminals 11 and 12.

### PCE-15 & VCE-15 Three-Phase Connection Balanced Load



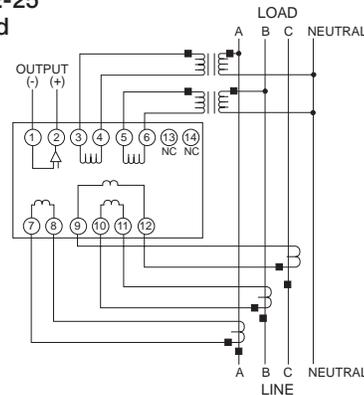
For options E1-E3, connect external power to terminals 11 and 12.

### PCE-20 & VCE-20 Unrestricted



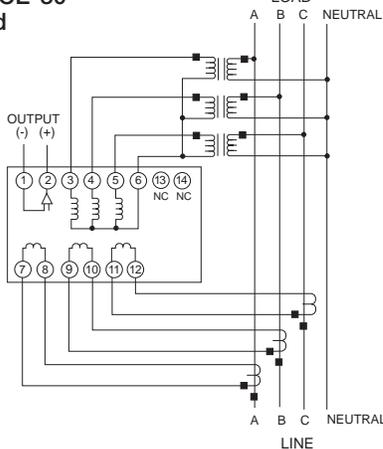
For options E1-E3, connect external power to terminals 11 and 12.

### PCE-25 & VCE-25 Balanced Load



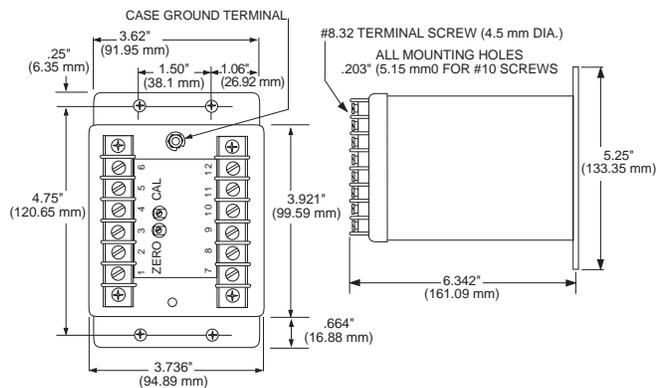
For options E1-E3, connect external power to terminals 13 and 14. An 8-point terminal block is furnished with this option.

### PCE-30 & VCE-30 Unrestricted



For options E1-E3, connect external power to terminals 13 and 14. An 8-point terminal block is furnished with this option.

### Outline Dimensions, All Models



Above transducers are also available in rack-mounted configurations.

## Triple Current and Voltage Transducers for Three Phase Measurements

### CCC-30B

### VCC-30B

- Three-In-One Packaging (three voltage or current transducers)
- $\pm 0.25\%$  Intrinsic Accuracy
- Outstanding Overload and Temperature Performance
- Excellent Long-Term Stability
- Meets IEEE SWC Test
- Current or Voltage Output
- Compact Size



### Applications

- Supervisory control and data acquisition systems
- Substation line and bus monitoring
- Motor overload protection distribution circuit monitoring
- Closed loop process control element

The Ametek Power Instruments CCC-30B Current Transducers and VCC-30B Voltage Transducers are compact and highly accurate instruments designed to accept three independent AC current or voltage inputs, and provide proportional DC outputs. Each transducer section is designed to respond to the average value of its input signal, but is calibrated to indicate the RMS of a pure sinusoid. The three elements are totally isolated input to output, input to input, output to output and everything to case.

Like all Ametek Power Instruments

transducers, these current and voltage units incorporate state-of-the-art electrical and mechanical design. Only the highest quality components, latest production techniques and most advanced test equipment and procedures are used in their manufacture. All models incorporate temperature compensated circuits and are designed to meet the IEEE SWC (surge withstand capability) test to assure reliable performance in the field.

CCC-30B and VCC-30B transducers are housed in rugged drawn-steel enclosures with welded-on mounting plates. The entire circuitry may be pulled by removing four easily acces-

sible screws without dismantling the enclosure from the panel.

For more information on current and voltage transducers, application assistance on a special project, or simply to place an order, consult your nearest Ametek sales office.

# AMETEK Transducers

## CCC-30B Current and VCC-30B Voltage Transducers

### CURRENT TRANSDUCER OPTIONS & STANDARD CALIBRATION (TABLE NO. 1)

OPTION	CURRENT INPUT		OVERLOAD WITHSTAND		
	RANGE (0-F.S.) STANDARD CALIBRATION	OVER RANGE WITH FULL ACCURACY	CONTINUOUS @ 65° C	3 SEC./HOUR	1 SEC./HOUR
C5	0-5 AMPS	0-7.5 AMPS	20 AMPS	100 AMPS	250 AMPS

### VOLTAGE TRANSDUCER INPUT OPTIONS & STANDARD CALIBRATION (TABLE NO. 2)

OPTION	POTENTIAL INPUT		OVERLOAD WITHSTAND	
	RANGE (0-F.S.) STANDARD CALIBRATION	OVER RANGE WITH FULL ACCURACY	CONTINUOUS @ 65° C	1 SEC./HOUR
P1	0-150 VOLTS	0-200 VOLTS	1.5 x F.S.	2 x F.S.

**POWER SUPPLY** All units are self-powered. Specify E0 when ordering.

### OUTPUT OPTIONS, CURRENT & VOLTAGE TRANSDUCERS (TABLE NO.3)

OPTIONS	OUTPUT			OVERLOAD WITHSTAND	
	RANGE	LOAD	CURRENT LIMITING	CURRENT TRANSDUCERS	VOLTAGE TRANSDUCERS
X1 X (0-VDC)	0-1 mADC 0 + DC Volts	0-10KΩ Consult Factory	— —	0.5 VA —	2.0 VA —

### FREQUENCY OPTIONS (TABLE NO. 4)

OPTIONS	CALIBRATION FREQUENCY
F50	50 Hz
F60	60 Hz

### CALIBRATION (TABLE NO. 5)

OPTIONS	F.S. CALIBRATION
Z0 Z1	Standard, defined by Tables 1 & 2 Special factory calibration (Specify F.S. output and F.S. input)

## Specifications

**Accuracy:** 0.25% Full Scale at 25° C ±2° C

### Influences Affecting Accuracy:

- A. Temperature: ±0.5%, max.
- B. Long-term Stability: ±0.25% per year, max., non-cumulative
- C. Frequency: ± 0.2%/Hz from nominal to ± 10 Hz

**Operating Temperature Range:** -20° C to +65° C

**Operating Humidity:** 0-95%, non-condensing

**Output Ripple, Peak:** <1%

**Response Time:** <400 ms from 0-99% of final value

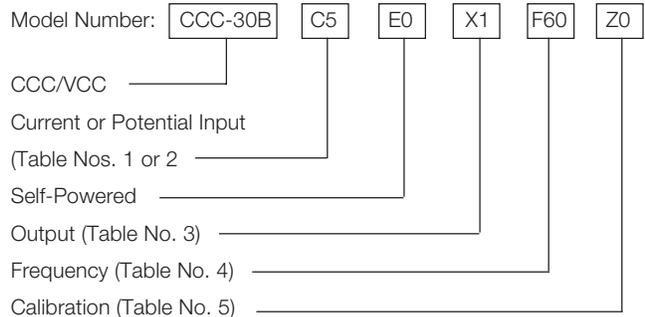
**Calibrate Adjustment:** ± 10%

**Isolation:** 200 VAC RMS, min., Input/Output/Power/Case

**Surge Withstand:** meet ANSI C37.90.1-1974 (IEEE SWC) and BEAMA No. 219 Tests

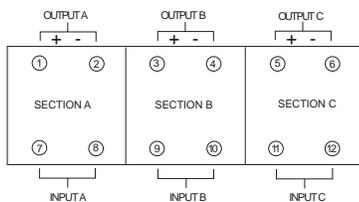
Case Ground Terminal Standard

## Ordering Information:

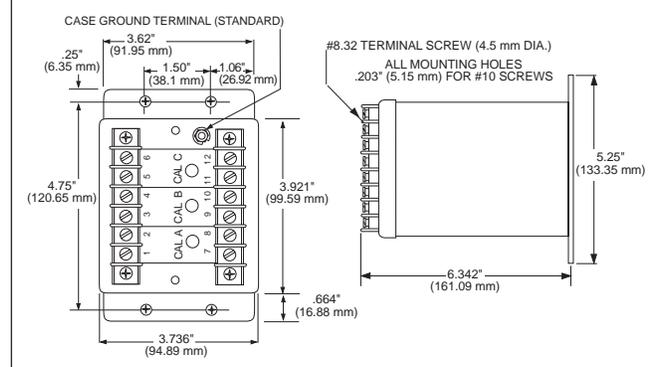


## Connection Diagram

**Current & Voltage—  
Three Phase**  
CCC-30B, VCC-30B



## Outline Dimensions



## Electronic Watt/Watthour & VAR/VARhour Transducers for Three-Phase & Single-Phase Systems

### WWH VVH

- Accuracy  $\pm 0.25\%$  F.S.
- Measures Forward/Reverse Power & Energy
- Calibration Traceable to N.I.S.T.
- Outstanding Temperature Performance
- Excellent Long-Term Stability
- Meets ANSI/IEEE STD. (IEEE SWC) and BEAMA No. 219 Tests
- Wide Selection of Input & Output Levels



The Ametek Power Instruments Watt/Watthour (WWH) and VAR/VARhour (VVH) Transducers are versatile, compact power transducers that provide simultaneous power (watts or VARs) and energy (watthours and VARhours) measurement. The watt or VAR output is an analog signal proportional to the real or reactive power input. The output accuracy is 0.25% including the effects of current, voltage, power factor, frequency and output load. The watthour or VARhour pulses are continuously transmitted as form "C", three wire, break before make K-Y-Z Relay contact transitions.

The K-Y-Z Relay Contacts are mercury wetted, and rated at 1 billion operations to provide years of bounce free KWH counts. Both the analog and digital signals are available in bi-directional form for co-generation, interchange transactions, or lead/lag reactive power measurement.

Conversion of power and time into watthour or VARhour measurement is accomplished with analog and digital circuitry providing a wide variety of output ranges without compromising measurement accuracy.

To complete the package Ametek Power Instruments offers a companion product, a self-contained, stand-alone register module (RM) with one or two rollover or counters for direct readout of KWH. The RM includes an internal power supply and rugged mechanical case that mounts easily on any horizontal or vertical surface.

For more information on watt/watthour, VAR/VARhour transducers, application assistance on a special project, or to place an order, consult your nearest Ametek Sales Office.

# AMETEK

## Transducers

### WWH & VVH Transducers

APPLICATION GUIDE (TABLE NO. 1)

MODEL NUMBER		CONNECTION	VOLTAGE	LOAD
WATT/WATTHOUR	VAR/VARHOUR			
WWH-15*	VVH-15*	1 phase	unrestricted	unrestricted
		3 phase / 3 wire	balanced	balanced
WWH-20	VVH-20	3 phase / 3 wire	unrestricted	unrestricted
WWH-25	VVH-25	3 phase / 4 wire	balanced	unrestricted
WWH-30	VVH-30	3 phase / 4 wire	unrestricted	unrestricted

\*Specify single-phase or three-phase calibration.

POTENTIAL OPTIONS (TABLE NO. 2)

OPTIONS	NOMINAL	A2 OPTION	
		SELF POWERED	EXTERNALLY POWERED
P1	120 VAC	85-150 VAC	0-150 VAC
P2	240 VAC	170-300 VAC	0-300 VAC
P3	480 VAC	300-550 VAC	0-500 VAC
Potential Burden Maximum (at normal input)		10VA	.05 VA
Potential Overload Withstand		1.5 x normal rating, continuous	

POWER SUPPLY OPTIONS (TABLE NO. 3)

OPTIONS	EXTERNAL POWER SUPPLY		
	NOMINAL	RANGE A2	BURDEN MAXIMUM (AT NOMINAL INPUT)
E0, self powered	none required for self-powered unit		N/A
E1 } E2 } E3 } externally powered	120 240 440	85-150 170-300 300-550	10 VA 10 VA 10 VA

CURRENT OPTIONS (TABLE NO. 4)

OPTIONS	CURRENT INPUT			CURRENT OVERLOAD WITHSTAND		
	NOMINAL	OVER RANGE WITH FULL ACCURACY	BURDEN (MAXIMUM)	CONTINUOUS AT 65° C	3 SEC./ HOUR	1 SEC./ HOUR
C1 A2 only	0-1 Amps	0-1.5 Amps	0.25 VA	10 Amps	20 Amps	50 Amps
C2 A2 only	0-2 Amps	1-3.0 Amps	0.25 VA	10 Amps	40 Amps	100 Amps
C5	0-5 Amps	0-7.5 Amps	0.25 VA	20 Amps	100 Amps	250 Amps
C10 A2 only	0-10 Amps	0-15 Amps	0.50 VA	20 Amps	250 Amps	400 Amps

ANALOG OUTPUT OPTIONS, WATT OR VAR (TABLE NO. 5)

OPTIONS	OUTPUT			
	RANGE (F.S.)	CURRENT LIMITING	LOAD	COMPLIANCE
X1 } X5 } X10 } X20 } A2 only	0± 1 mADC 0± 5 mADC 0± 10 mADC 0± 20 mADC	— — 15-20 mADC 30-40 mADC	0-10K 0-3K 0-1.5K 0-750	± 11 volts ± 15 volts ± 15 volts ± 15 volts
XA } XB } X (0-VDC)	4-20 mADC (unipolar power) 4-12-20 mADC (bipolar) DC voltage, ± 10 V max	30-40 mADC 30-40 mADC —	0-750 0-750 —	+ 15 volts + 15 volts —

DIGITAL OUTPUT OPTIONS WATTHOUR OR VARHOUR (TABLE NO. 6)

OPTIONS	OUTPUT - WATTHOUR OR VARHOUR	CONTACT RATING	CONTACT LIFE
Y1	Uni-directional — single 3-wire output	100 VA, 2 A, and 500V maximum, resistive load)	10 <sup>9</sup> operations
Y2	Bi-directional — dual 3-wire outputs		

**FREQUENCY OPTIONS (TABLE NO. 7)**

OPTIONS	CALIBRATION FREQUENCY
F50	50 Hz ± 2 Hz
F60	60 Hz ± 2 Hz

**MOUNTING ORIENTATION (TABLE NO. 8)**

OPTIONS	ORIENTATION (MOUNTING PLATE)
H0	horizontal mounting ±30°
H1	vertical mounting ±30°

**CALIBRATE ADJUSTMENT OPTIONS (TABLE NO. 9)**

OPTIONS	CALIBRATE ADJUSTMENT	ZERO ADJUSTMENT
	WITH ACCURACY OPTION A2	WITH ACCURACY OPTION A2
W0 (standard)	± 10%	± 2%
W1 (extended)	50-125%	± 2%
W2 (extended)	75-200%	± 2%

**CALIBRATION (TABLE NO. 10)**

**Standard Digital Option:** 1 count (contact transfer)/watthour or VARhour, specify option ZDO.

**Standard Analog Option:** Full scale calibration, watts or VARs, determined by multiplying value in Table 10A by factor shown in Table 10B. Specify option ZAO.

**Non-Standard Digital Option:** State desired counts per hour at the secondary of the PT and CTs and indicate the PT and CT ratios.

**Non-Standard Analog Option:** Indicate fullscale value in watts or VARs, or provide fullscale load, PT & CT ratios. Specify option ZA1.

**TABLE 10A**

FOR MODEL NUMBER	MULTIPLY BY
WWH/VVH-15 1 phase connection	1
WWH/VVH-15 3 phase connection	2
WWH/VVH-20	2
WWH/VVH-25, 30	3

**TABLE 10B**

POTENTIAL INPUT OPTIONS	CURRENT INPUT OPTION		
	C1 (0-1)	C2 (0-2)	C5 (0-5)
P1	100	200	500
P2	200	400	1000
P3	400	800	2000

**ACCURACY (TABLE NO. 11)**

OPTION	ACCURACY	Accuracy includes the effects of:
A2	±0.1% F.S. typical ±0.25% F.S. worst case	<ul style="list-style-type: none"> <li>• potential, within range</li> <li>• current, within range</li> <li>• power factor, within range</li> <li>• frequency, nominal</li> <li>• load, within range</li> <li>• humidity, within range</li> <li>• ambient temperature 25°C ±2°C</li> <li>• external power supply, within range</li> </ul>

**Operating Temperature Range:** -20° to +65°C

**Operating Humidity:** 0-99%, non-condensing

**Output Ripple, Peak:** 1% for option A2

**Response Time (to 99%):** 400 m.s.

**Power Factor Range:** Unity to lead or lag zero

**Self Powered:** Available with option E0 (A2 only)

**Isolation:** 2000 V rms, minimum, Input/Output/Power/Case

**Influences Affecting Accuracy:**

Temperature: ±0.25%, max. for option X1 from -20° to +65° C  
±0.5%, max. for all other output options from -20° to +65° C

Long Term Stability: ± 0.25%/year, max., noncumulative

Frequency: ± 0.1%/Hz max. from 50 or 60 Hz, ± 10 Hz, for all watt/watthour transducers ± 3% max. up to 450 Hz

**External Magnetic Field**

Less than 0.01% of rated output with a magnetic field of 100 ampere-turns produced by a straight conductor six-feet long carrying a current of the same frequency and phase as the applied voltage and positioned in any direction 10 inches from the center of the unit.

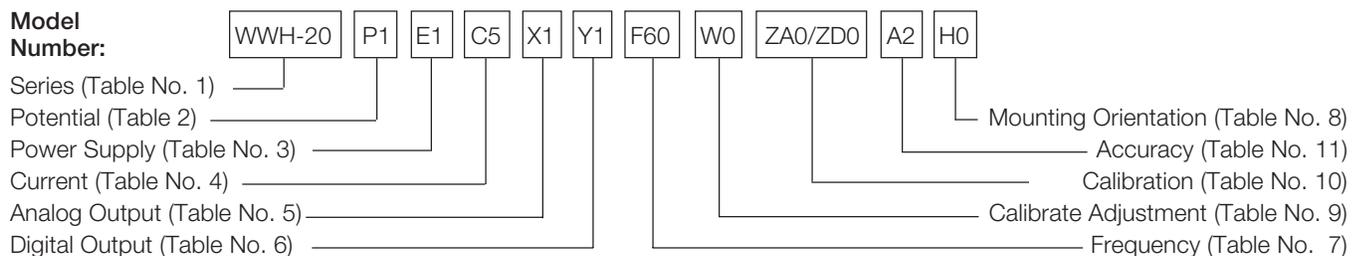
**Size:** See outline dimensions on page 8.20

**Orientation:** see table 8.

**Weight (nominal):** 6.5 pounds (2.95 kilos)

**Ordering Information:**

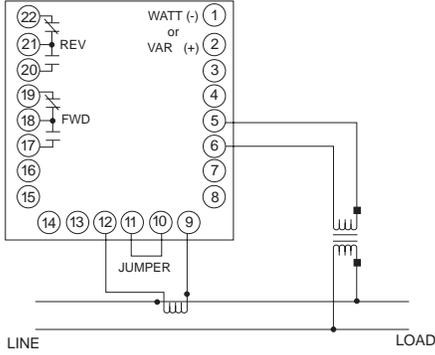
To avoid delays in delivery, always specify by model number and appropriate option suffixes in the order shown in the following example. No order is complete unless all suffixes are specified.



# AMETEK Transducers

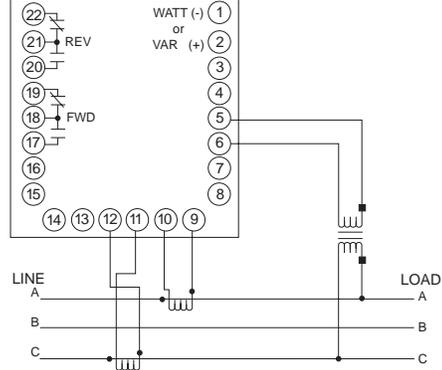
## Connection Diagrams & Outline Dimensions

### WWH-15 & VWH-15 Single-Phase Connection Unrestricted



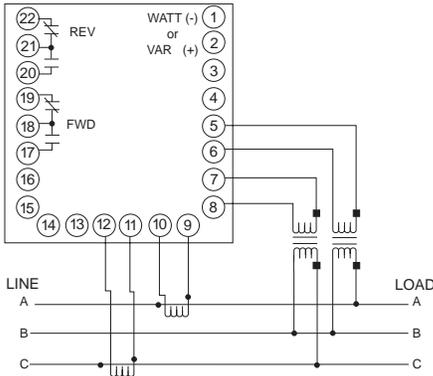
Connect external power to terminals 15 and 16.

### WWH-15 & VWH-15 Three-Phase Connection Balanced Load



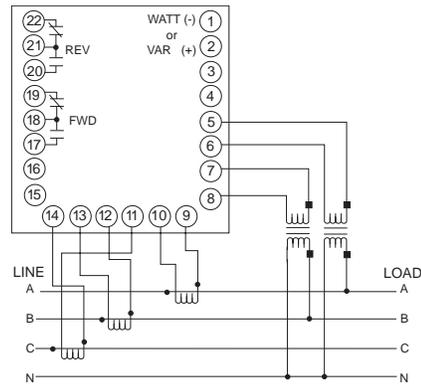
Connect external power to terminals 15 and 16.

### WWH-20 & VWH-20 Unrestricted



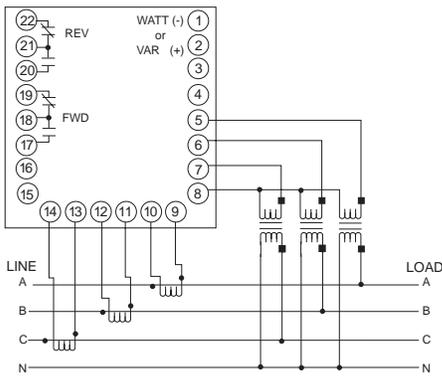
Connect external power to terminals 15 and 16.

### WWH-25 & VWH-25 Balanced Load



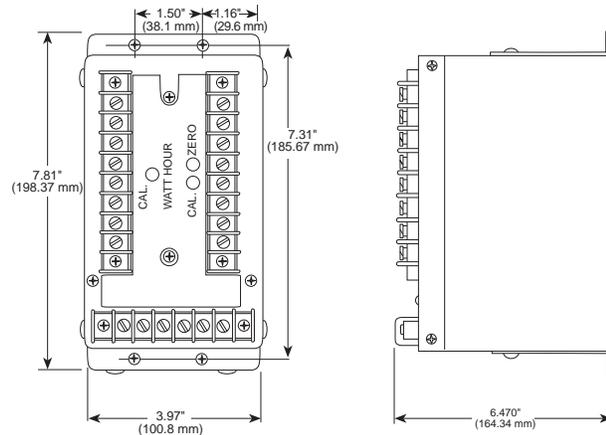
Connect external power to terminals 15 and 16.

### WWH-30 & VWH-30 Balanced Load



Connect external power to terminals 15 and 16.

### Outline Dimensions, All Models



Above transducers are also available in rack-mounted configurations.

## Display Register Module for WWH and VVH Transducers

### RM-10

### RM-20

- Single or Dual Displays
- Non-Volatile Display Register
- Self-Contained Power Supply
- Dual Displays for Forward and Reverse Energy Metering Applications
- Meets ANSI-C37.90.1-1974 IEEE SWC and BEAMA No. 219 Tests



The Ametek Power Instruments watt-hour and VAR-hour register modules are an optional companion product to the Ametek watt/watthour (WWH) and VAR/VARhour (VVH) transducers. The RM-10 single register module will accumulate and visually display the total watthour or VARhour pulses from the WWH or VVH electronic transducers.

The RM modules can be ordered with these options:

- Single display for uni-directional (co-generation) energy readings.
- Resettable or non-resettable displays
- Re-transmitting mercury-wetted relays for interfacing to remote displays or centralized data acquisition systems.
- A wide range of external power supply inputs

### General Specifications

#### Display Register Operation:

The non-volatile display will register one count for each transfer of the input (bi-stable Form C, 3-wire). RM display modules have a typical life of  $10^8$  counts.

**Operating Temperature Range:**  $-20^{\circ}$  to  $+70^{\circ}\text{C}$

#### RM-10 Single Display Register Input

**Characteristics:** Single Form C relay, 3-wire, SPDT dry contact. Maximum rate 15,500 counts per hour.

#### RM-20 Dual Display Register Input

**Characteristics:** Dual Form C relay, 3-wire, SPDT dry contact each input. Maximum rate 15,500 counts per hour.

#### Visual Output:

Digit height: 0.125" (3.18mm)  
6 digit display: resettable via push-button  
8 digit display: non-resettable

#### Re-Transmitting Relay Output Option:

Isolated mercury-wetted contact relay (single or dual), Form C, 3-wire SPDT. Contact rated for 2 Amps at 100 VA and 500 Volts resistive. The relay output is a bi-stable device with one normally open and one normally closed contact. Each time a count registers, both contacts change state.

**Weight:** Approximately 3.9 lbs. (1.7kg)

For more information on the Register Module, application assistance on a special project or to place an order, call your nearest Ametek sales office.

# AMETEK Transducers

## Specifications

Type and Quantity of Display Registers (Table 1)

OPTION	RM-10 (SINGLE DISPLAY REGISTER)
R1	One 6-digit register Resettable (Useable with Y1 option on the WWH-VVH Transducer)
R3	One 8-digit register No-resettable (Useable with Y1 option on the WWH/VVH Transducer).

OPTION	RM-20 (DUAL DISPLAY REGISTER)
R2	Two 6-digit registers Resettable (Useable with Y2 option on the WWH-VVH Transducer)
R4	Two 8-digit register No-resettable (Useable with Y2 option on the WWH/VVH Transducer).

External Power Option (Table 2)

OPTION	EXTERNAL POWER	SUPPLY (Nominal)	OPERATING RANGE	TYPICAL RANGE
E1	120 VAC	50/60 Hz	85-150	1.5 VA
E2	240 VAC	50/60 Hz	170-300	1.5 VA
E3	480 VAC	50/60 Hz	300-550	1.5 VA

Re-transmitting Relay Option (Table 3)

OPTION	RELAYS
B0	No Re-transmitting Relays
B1	One Re-transmitting Relay
B2	Two-Re-transmitting Relays

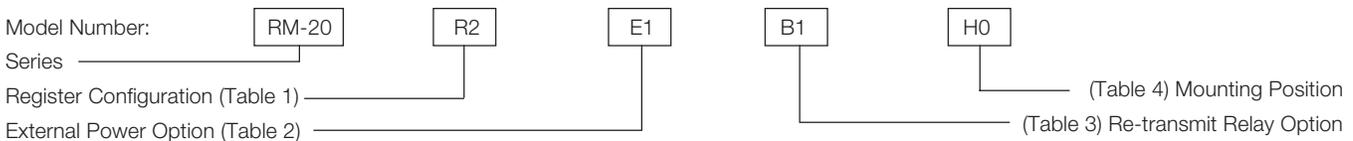
Mounting Orientation (Table 4)

OPTION	ORIENTATION (MOUNTING PLATE)
H0	Horizontal Mounting $\pm 30^\circ$
H1	Vertical Mounting $\pm 30^\circ$

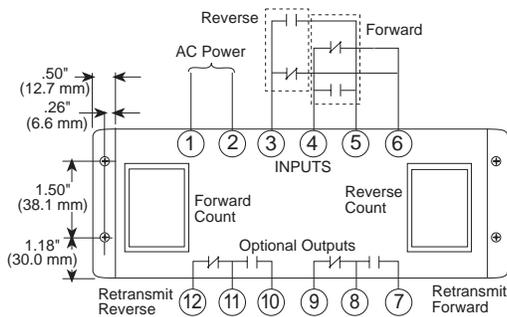
## Ordering Information

To avoid delays in delivery, always specify by model number and appropriate option suffixes.

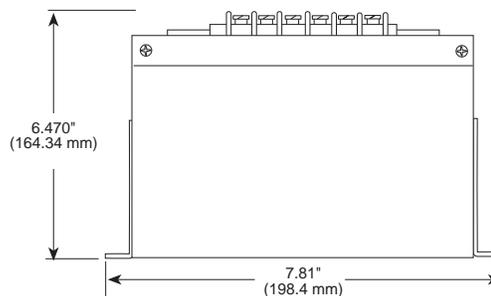
The order is complete with all suffixes are specified



## Connection Diagram



## Outline Dimensions



## Phase Angle and Power Factor Transducers

**PFA**  
**PFN**  
**PAN**

- 0.5% Accuracy
- Calibration Capability to  $\pm 170^\circ$  in Phase Angle Measurements
- Outstanding Overload and Temperature Performance
- Meets ANSI C37.90.1-1974 (IEEE SWC) and BEAMA No. 219 Tests
- Current or Voltage Output
- Compact size



Ametek Power Instruments Phase Angle/Power Factor Transducers (PFA) are designed to measure the angle between the voltage and current in a circuit or between the voltages of two isolated circuits.

The PFN model measures the voltage to current phase angle in a 3-phase 3-wire or 4-wire circuit. The PAN measures the phase angle between the voltage of two isolated circuits. A common application of a PAN is measurement of the voltage phase angle across an open circuit breaker. Bus tie breakers and generator unit breakers require voltage to voltage line synchronization that only a phase angle transducer can measure.

The Power Factor Transducers are ideal for monitoring power factor for correction in energy management applications. In addition, they do not require dedicated current or potential transformers, offering a significant cost savings to the end user.

For more information, application assistance on a special project or to place an order, consult your nearest Ametek sales office.

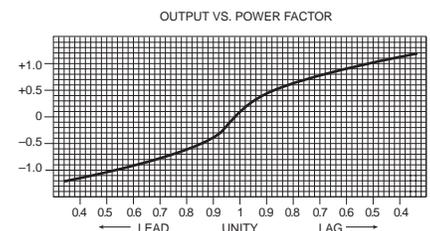
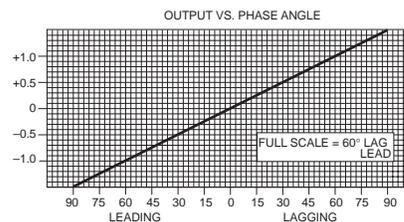
### Operation

Current and potential input signals are isolated through input transformers, which have been designed for low burden and zero phase error contribution. These signals are then applied, through filters, to integrated circuit zero crossing detectors.

The output of these detectors is applied to frequency division and phase comparison digital circuitry. A

precision reference power supply provides a zero drift bias to the phase comparison circuitry. A cycle to cycle comparison is made, and the output amplifier and its associated filters are updated every cycle. A high gain operational amplifier output stage receives the signal from the output integrator, and provides a proportional DC current or voltage output.

### Output Scaling:



# AMETEK

## Transducers

APPLICATION GUIDE (TABLE NO. 1)

MODEL NUMBERS					
SINGLE PHASE			THREE PHASE		VOLT/VOLT PHASE ANGLE
PFA-1B-60	PFA-1B-90	PFA-1B-180	PFN-1B-60	PFN-1B-90	PAN-1B-180
0 TO ± 60°	0 TO ± 90°	0 TO ± 180°	0 - ± 60° (0.5 PF)	0 - ± 90° (0.0 PF)	0 TO ± 180°

**NOTES:**

1. Model PAN-1B-180 measures the phase angle between two voltages.
2. For Model PAN-1B-180 the output is positive when  $V_{43}$  lags  $V_{21}$ .

POTENTIAL OPTIONS (TABLE NO. 2)

OPTIONS	NOMINAL VOLTAGE	POTENTIAL INPUT RANGE	
		SELF-POWERED MODEL	EXTERNALLY-POWERED MODEL
P1	120 VAC	85-150 VAC	10-150 VAC
P2	240 VAC	170-300 VAC	20-300 VAC
P3	480 VAC	300-550 VAC	30-550 VAC
Potential Burden, Maximum		4 VA, total including electronics supply circuit	1 VA, total
Potential Overload Withstand		1.5 x nominal rating, continuous	

POWER SUPPLY OPTIONS (TABLE NO. 3)

OPTIONS	EXTERNAL POWER SUPPLY	
	RANGE	BURDEN (MAXIMUM)
E0, self-powered	—	—
E1 } externally E2 } powered E3 }	85-150 VAC	4 VA
	170 - 300 VAC	4 VA
	300 - 550 VAC	4 VA

CURRENT OPTIONS (TABLE NO. 4)

OPTIONS	CURRENT INPUT			CURRENT OVERLOAD WITHSTAND		
	NOMINAL	OVER RANGE WITH FULL ACCURACY	BURDEN (MAXIMUM)	CONTINUOUS AT 65° C	3 SEC./ HOUR	1 SEC./ HOUR
C1	0.1-1 Amps	1.5 Amps	0.25 VA	10 Amps	20 Amps	50 Amps
C5	0.5-5 Amps	7.5 Amps	0.25 VA	20 Amps	100 Amps	250 Amps

**OUTPUT OPTIONS (TABLE NO. 5)**

OPTIONS	OUTPUT		
	RANGE (F.S.)	LOAD	COMPLIANCE
X1	0-±1 mADC	0-10 KΩ	± 11 Volts
X5	0-±5 mADC	0-3 KΩ	± 15 Volts
X10	0-±10 mADC	0-1.5 KΩ	± 15 Volts
X20	0-±20 mADC	0-750 Ω	± 15 Volts
XA	4-20 mADC (unipolar power)	0-750 Ω	± 15 Volts
XB	4-12-20 mADC (bipolar)	0-750 Ω	± 15 Volts
X (0-VDC)	DC voltage, ±10 v max.	—	—

**FREQUENCY OPTIONS (TABLE NO. 6)**

OPTIONS	FREQUENCY (NOMINAL)
F50	50 Hz
F60	60 Hz

**Specifications:**

**Accuracy:** ±0.2% full scale typical, ±0.5% full scale worst case at 25° C ±5° C

**Operating Temperature Range:** -20° to +65°C

**Operating Humidity:** 0-99%, non-condensing

**Output Ripple, Peak:** 1%

**Output Current Limiting:** 1.5 x maximum for option numbers X10, X20, XA, and XB

**Response Time (to 99%):** 400 mS

**Isolation:** 2000V rms, minimum, Input/Output/Power/Case

**Zero Adjustment:** ± 2%

**Calibration Adjustment:** ± 10%

**Weight (nominal):** 3.0 pounds / 1.4 Kilograms

**Surge Withstand:** ANSI C37.90.1-1974 (IEEE SWC) BEAMA Test No. 219

**Influences Affecting Accuracy:**

Temperature: ± 0.5%, Max.

Long Term Stability: ± 0.25%/Yr., max., noncumulative

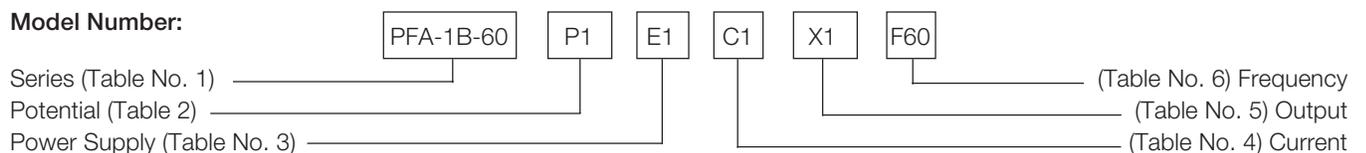
**Size:** see outline dimensions, page 8.24

**Case Ground Terminal Standard**

**Ordering Information:**

To avoid delays in delivery, always specify by model number and appropriate option suffixes in the order shown in the following example. No order is complete unless all suffixes are specified.

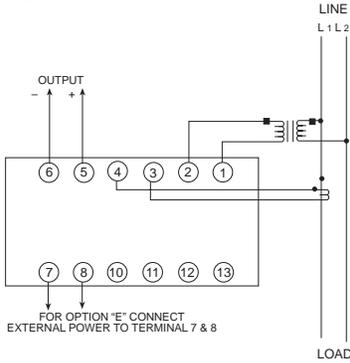
**Model Number:**



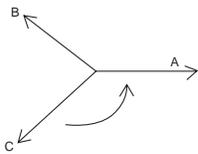
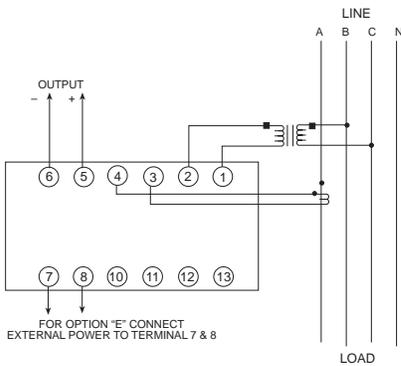
# AMETEK Transducers

## Connection Diagrams & Outline Dimensions

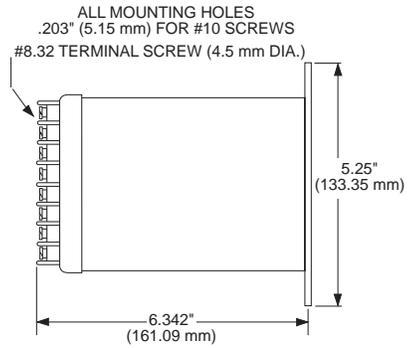
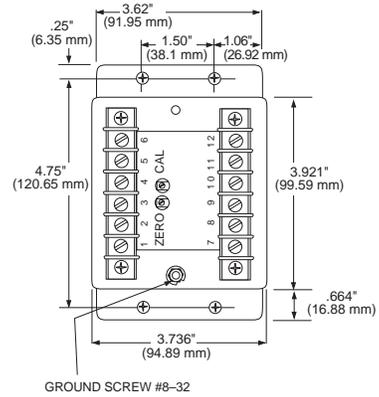
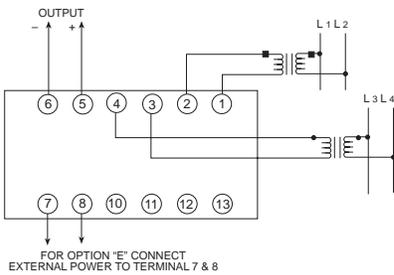
PFA Single Phase



PFN Three Phase/Three of Four Wire  
Balanced Load



PAN Volt/Volt Phase Angle



## Frequency Transducers

### FCX-1B FCN-1B

- .01% Accuracy
- .01% Linearity
- Crystal-Based Internal Reference
- Narrow Frequency Spans
- Wide Range of Input/Output Options
- Outstanding Temperature Performance
- Excellent Long-Term Stability



Ametek Power Instruments FCX and FCN Frequency Transducers are precision-engineered instruments designed to provide a constant current output into a variable impedance. The DC output from the device(s) very accurately represents the input frequency deviation from a selected center frequency of 50 or 60 Hz.

Each unit accepts an AC input signal that is transformer isolated and filtered to eliminate noise or harmonics-based errors. The signal is then compared to a precision frequency generated by a quartz crystal, and the difference is converted to an analog current output. Use of the integral crystal-based frequency standard, in combination with drift-free digital circuitry, delivers high accuracy and excellent temperature performance.

FCX and FCN Transducers are available in numerous input ranges, including a very narrow frequency deviation span for maximum resolution. For more information on the frequency transducer, application assistance on a special project, or to place an order, consult your nearest Ametek Sales Office.

# AMETEK Transducers

## Specifications

APPLICATION GUIDE (TABLE 1)

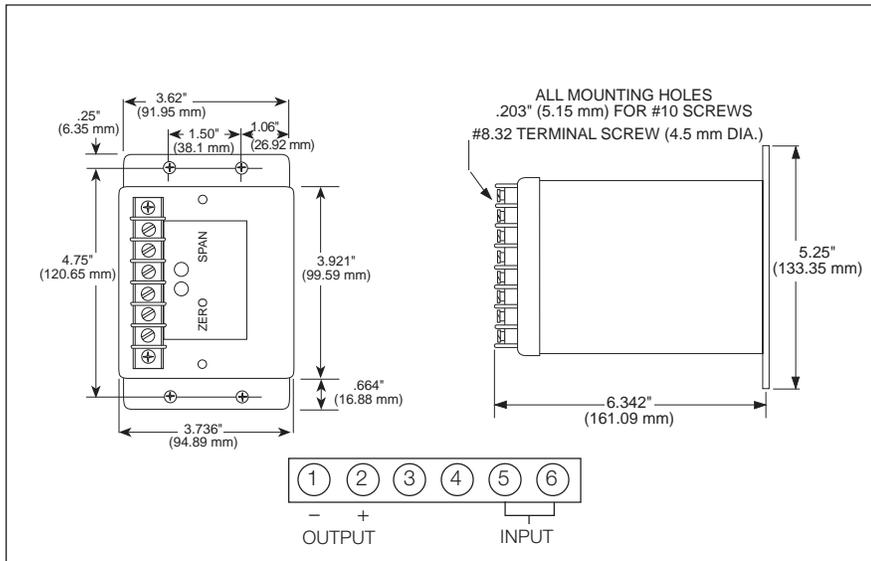
FREQUENCY SPAN			
MODEL	MINIMUM FREQUENCY	CENTER FREQUENCY	MAXIMUM FREQUENCY
FCN-1B	negative full scale DC output	zero DC output	positive full scale DC output
FCX-1B	zero DC output	one-half full scale DC output	full scale DC output

APPLICATION GUIDE (TABLE 3)\*

OPTION	FCN-1B MODELS	FCX-1B MODELS	LOAD	COMPLIANCE
X1	0-±1 mA	0-1 mA	0-10 KΩ	± 11 Volts
X2.5	0-±2.5 mA	0-2.5 mA	0-6 KΩ	± 15 Volts
X5	0-±5 mA	0-5 mA	0-3 KΩ	± 15 Volts
X10	0-±10 mA	0-10 mA	0-1.5 KΩ	± 15 Volts
XA	—	4-20 mA	0-750 Ω	± 15 Volts
XB	4-12-20 mA	—	0-750 Ω	± 15 Volts
X (0-VDC)	DC voltage, ±10 VDC max.	—	—	—

\* See general specifications below, for temperature influence.

## Dimensions



POTENTIAL OPTIONS (TABLE 2)

OPTIONS	POTENTIAL INPUT
P1	85-150 VAC
P2	170-300 VAC
P3	300-550 VAC

FREQUENCY OPTIONS (TABLE 4)

OPTIONS	CENTER FREQUENCY
F50	50 Hz
F60	60 Hz

DEVIATION OPTIONS (TABLE 5)

OPTION	DEVIATION SPAN
D1	± 1 Hz
D2	± 2 Hz
D3	± 3 Hz
D5	± 5 Hz

### Operating Temperature Range:

-20°C to +65°C

### Operating Humidity:

0-99%, non-condensing

### Output Ripple Peak:

<.25% of rated output

### Dielectric Test:

2000 V rms minimum

### Surge Withstand:

ANSI C37.90a 1974 (IEEE)

Beama Test No. 219

### Response Time:

(to 99%) <250 ms.

### Burden: <2 VA

### Zero Adjustment: ±2% span

### Calibrate Adjustment: ±4% span

### Accuracy:

±.01% of center frequency at 25°C

### Temperature Influence on Accuracy:

<20 ppm/°C

### Long-Term Stability:

<±.008%/year drift, non-cumulative

### Weight:

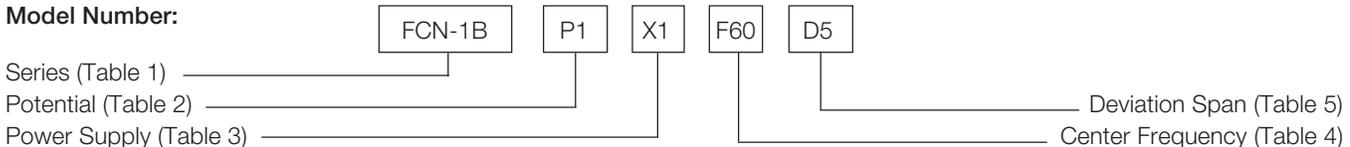
3.0 lb., (1.4 kilograms)

### Case Ground Terminal: standard

## Ordering Information:

To avoid delays in delivery, always specify by model number and appropriate option suffixes in the order shown in the following example. No order is complete unless all suffixes are specified.

### Model Number:



Specifications subject to change without notice.

## Power Monitors\* For Watt-hour Measurement Series PM-1000

- Low Cost, Direct Electrical Energy Monitoring
- Provides Pulse Output Proportional to Watthours
- Ideally Suited to Sub Metering, Load Shedding, and Energy Management Systems
- Single and Three Phase 120, 208, 240, 277, 480 and 575 Volts AC Models
- Complete Kits Include Current Transformer(s)
- Easily Installed and Maintenance Free
- Five Current Ranges Available from 0-50 to 0-1000 Amps
- Optional Non-Volatile Integral Electronic Display of Kilowatthours



\*U.S. Patent No. 4437,059

Ametek power monitors accurately measure the line voltage, current and power factor, then internally compute the consumed energy and deliver a pulse output proportional to the kwh used.

Ametek power monitors are directly compatible with most energy control equipment: computers, programmable controllers, electronic counters and microprocessor-based energy management systems. An optional, direct-reading digital display with non-volatile memory shows cumulative kwh.

Ametek power monitors are designed for use with line voltages ranging from 95 to 630 Vac, for single-phase (two wire or split leg) or three-phase (three-wire or four-wire) service. Current transformers are rated at 50A, 100A, 200A, 500A and 1000A to satisfy the widest range of uses. If your needs fall outside these ranges, Ametek can custom fit for virtually any service.

Ametek power monitors are furnished as complete kits with a sealed electronics package, clearly marked barrier-type terminals, a safety cover and the necessary current transformers. A six-digit, non-volatile\*, optional display is available for local readout in kwh.

The monitors install quickly and easily. Split-core current transformers, designed for use on insulated conductors only, reduce the power interruption duration during installation. The output of the transformer is a low level AC voltage, allowing installation on existing systems. Installation should be consistent with the most recent edition of the National Electric Code.

\* Operates from 2 "N" Type batteries. Alkaline cells are recommended. Average battery life is four years.

# AMETEK Transducers

## Model Selection Charts

Follow these simple steps to select the proper power monitor for your needs.

Code	Service	Step 1
10	Single Phase 2-wire (120 or 240 Vac)	
15	Three Phase 3-wire (balanced load only, 208 or 480 Vac)	
22	Single Phase 3-wire (120 or 240 Vac)	
20	Three Phase 3-wire (208, 480 or 575 Vac)	
30	Three Phase 4-wire (120 or 277 Vac)	

Code	Line Current	Step 2
01	50 Amp (Ring Core CT)	
02	100 Amp	
03	200 Amp	
04	500 Amp	
05	1000 Amp	
06	50 Amp (Split Core CT)	

Code	Line Voltage (Vac)	Step 3
120	95-150 Vac	
208	164-250 Vac	
240	195-285 Vac	
277	195-305 Vac	
480	340-530 Vac	
575	525-630 Vac	

Code	Output Pulse Rating per KWH	Step 4				
	Service	Amp rating of current transfores				
		0-50	0-100	0-200	0-500	0-1000
K0†	Single Phase 2-wire (10)	4000	2000	1000	400	200
K0†	Three Phase 3-wire (15) (balanced load)	1000	500	250	100	50
K1‡	All services	1.0	1.0	1.0	1.0	1.0
K2‡	All services	0.1	0.1	0.1	0.1	0.1

† standard ‡ optional

Code	Output Drive	Step 5
D	5 to 30 Vdc, 200 mA (Standard)	
T	to 140 Vac, 50 mA (TRIAC)	

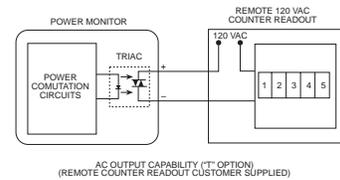
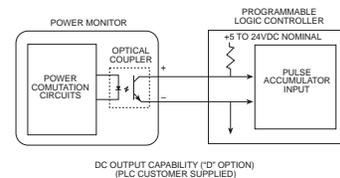
Code	Digital Display	Step 6
M	Non-resettable 6-digital display counter (requires K1 option)	
R	Resettable 6-digital display counter (requires K1 option)	
O	No display (Standard)	

EXAMPLE: **PM - 30 02 - 120 - K1 - D - O**

Step 1
Step 2
Step 3
Step 4
Step 5
Step 6

## Application Hints

- Current inputs should be selected for the lowest possible range to assure the highest possible accuracy, i.e., a circuit with a load that never exceeds the 50 am range under normal conditions should not be monitored with a higher range current transformer.
- The output mechanism is a solid-state switch that passes an electrical pulse, either AC or DC, with rates as specified in step 4. Output options as shown below provide interface with all common computing and controlling devices.



- A non-volatile, 6-digit LCD display is available as an option. This integral, tamper-resistant display shows cumulative kwh for local readout.

**Pulse Rate:** See step 4

**Pulse Width:** PM 1000: 30 to 70 msec  
PM 2000, 2200, 3000: 50 to 70 msec

### DC Output:

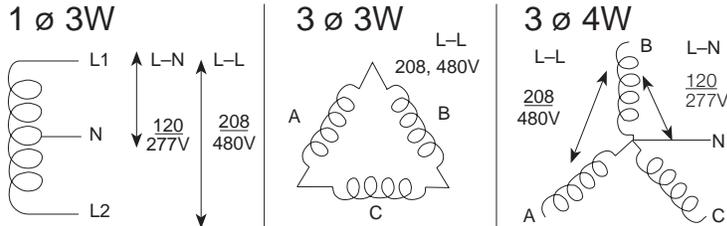
voltage: +5 to +30 Vdc (Customer specified)  
current: 200 mA maximum  
off-stage leakage current: <500 μ A @ 24 vdc

### AC Output:

voltage: 10 to 140 Vac (Customer supplied)  
current: 50 mA maximum

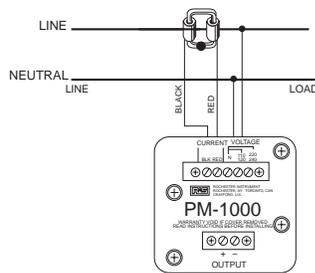
# Power Monitor Connections

## Power Distribution Configurations

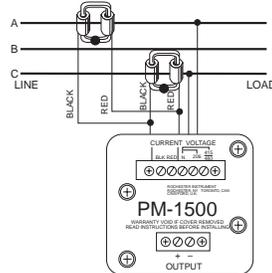


## Connections

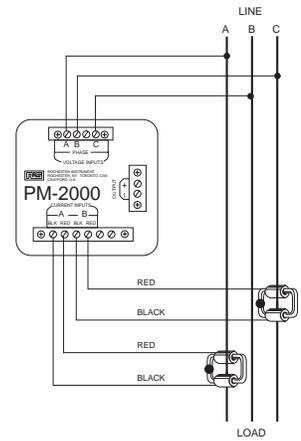
PM-10XX Single Phase Two-Wire



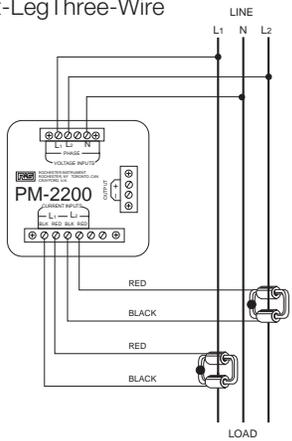
PM-15XX Three Phase Three-Wire



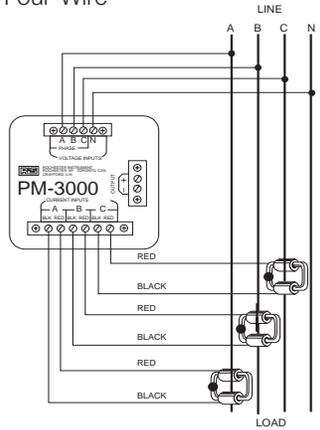
PM-20XX Three Phase Three-Wire



PM-22XX Single Phase Split-Leg Three-Wire



PM-30XX Three Phase Four-Wire



**Notes:**

- a. Polarity sensitive phasing dots must be aligned properly.
- b. All terminal block screws are #6.
- c. Do not ground secondary side of supplied CT's

# AMETEK Transducers

## Specifications

### Accuracy\*:

- a. 0.5% of range + 1.5% of reading  
maximum error
- b. 0.2% of range + 0.5% of reading  
typical error

\*Includes CT accuracy, temperature and humidity at reference condition, linearity, current inputs within specified range, power factor at unity with 120/240 VAC model on 240 volt range and 208/480 VAC model on 480 volt range. Operation on 120 VAC or 208 VAC may add 0.5% inaccuracy (maximum).

**Operating Temperature Range:** 0°F to 140°F, Display 32°F to 122°F

**Operating Humidity Range:** 0 to 95%, non-condensing

### Temperature Effect on Accuracy:

.04%/°F over the temperature range, maximum .02%/°F over the temperature range, typical

**Power Consumption:** 0.5 to 1.0 watt

### Power Factor Effects on Accuracy:

Power factor changes between unity and  $\pm 0.8$  less than  $\pm 1.0\%$

### Isolation: 1500 VAC/2500 VDC

between any input and the output (with CT(s) attached)

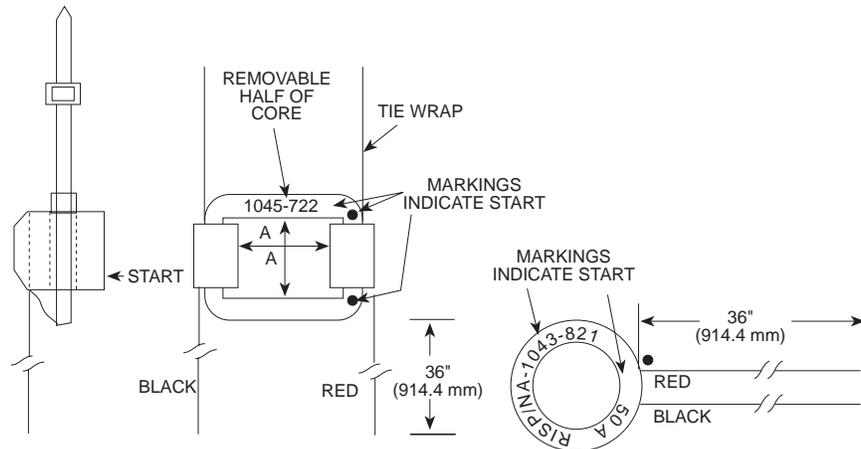
### Input Ranges (50 or 60 Hz):

AC Voltage (Nominal)	Operating Range
110/120 VAC	95-150 Volts
220/240 VAC	195-285 Volts
208 VAC	164-250 Volts
277 VAC	195-305 Volts
480 VAC	340-530 Volts
575 VAC	525-630 Volts
AC Current	Operating Range
0-50 Amps	0-60 Amps
0-200 Amps	0-240 Amps
0-500 Amps	0-600 Amps
0-1000 Amps	0-1200 Amps

### Case Dimensions:

4.6" wide x 4.8" deep x 4.6" high  
(116.8 mm x 121.9 mm x 116.8 mm)

## Dimensions:



INTERNAL DIMENSION 'A'	50 AMP	100 AMP	200AMP	500AMP	1000AMP
	0.8" (20.3 mm)	0.8" (20.3 mm)	1.1" (27.9 mm)	1.25" (31.8 mm)	2.25" (57.2 mm)

INTERNAL DIAMETER — 0.75" (19.1 mm) approx.  
OUTSIDE DIAMETER — 1.825" (46.4 mm) approx.

Larger Currents Available

Split Core Transformer      Ring Core Transformer  
(50 Amps)

\* Accuracy stated at reference temperature and humidity, current inputs within CT nominal range, power factor at one.

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## Utility Power Transducers



Ametek Power Instruments' utility power transducers meet the IEEE surge withstand and isolation levels to provide high level reliability in substation, switchgear and plant applications. The 0-1mA output models are ideal input for meters, RTU's, SCADA and other substation devices as well as satisfying switchgear requirements. The 4-20mA output models compliment this by offering inputs to switchgear and plant control panels.

Universal terminations are provided to support direct replacement using your existing wiring. Standard nominal inputs of 120 VAC and 5 Amps AC provide direct connection to existing PT's and CT's.

### **Current and Voltage/Transducers**

Each converts sinusoidal AC voltage or current inputs into a proportional DC output. These units respond to the average value, but are calibrated to have the output represent the RMS of a pure sine wave.

### **Watt & VAR Transducers**

The Watt Transducers convert real AC power to a proportional DC output. Similarly, the VAR Transducers convert reactive AC power (VARs) to a proportional DC output with an accuracy of .15% of reading. Both designs incorporate totally electronic computational circuits for the Watt and VAR calculations. The VAR Transducer includes an integral phase shifter, thus eliminating any need for expensive external phase shifting transformers.

### **Combined Watt/VAR Transducers**

The Watt/VAR Transducer combines both a Watt Transducer and a VAR Transducer in one enclosure. The outputs are two separate DC signals proportional to Watt and VAR inputs on one circuit with an accuracy of .15% of reading.

### **Watt/Watthour and VAR/VARhour Transducers**

These transducers offer a combined instantaneous output proportional to either Watts or VARs, combined with a

pulse output proportional to totalized power or VARs, with an accuracy of .15% of reading. The outputs are unidirectional for positive flow and housed in one enclosure. The output pulse rate is equal to one pulse per Watthour or VARhour. Register modules are offered providing a direct digital readout of the accumulated power of VARs.

### **Metering Accuracy Watt Transducers**

These units convert real AC power to a proportional DC output with an accuracy of .1% of reading.

### **Frequency Transducers**

The deviation to a center frequency of the line being monitored will be converted to a low level DC signal. The standard deviation is  $\pm 5$  Hertz from a center frequency with optional 1 and 2 Hertz deviation.

### **Power Factor and Phase Angle Transducers**

Two separate models are offered for conversion of a single phase power factor or line phase angle into a low level DC signal.

# AMETEK

## Transducers

### Specifications

DESCRIPTION	MODEL NUMBER	CURRENT INPUT RANGE	VOLTAGE INPUT RANGE	OUTPUT RANGE	FULL SCALE CALIBRATION	POWER	ACCURACY
<b>Current Models</b>							
1 phase current	UCX1F6	0-5A	N/A	0-1mA	5A	Self-powered	0.20% R.O.
3 phase current	UCX3F6	0-5A	N/A	0-1mA	5A	Self-powered	0.20% R.O.
1 phase current	UCXAF6	0-5A	N/A	4-20mA	5A	Separate 120VAC	0.20% R.O.
<b>Voltage Models</b>							
1 phase voltage	UVX1F6	N/A	0-150V	0-1mA	150V	Self-powered	0.20% R.O.
3 phase voltage	UVX3F6	N/A	0-150V	0-1mA	150V	Self-powered	0.20% R.O.
1 phase voltage	UVXAF6	N/A	0-150V	4-20mA	150V	Separate 120VAC	0.20% R.O.
1 phase voltage-compressed	UVXCF6	N/A	Note 2	0-1mA	150V	Self-powered	0.20% R.O.
<b>Watt Models</b>							
3 phase 3 wire balanced 1-1/2 element	WS33B	0-5A	85-150V	±1mA	±1000 Watts	Self-powered	.15% RDG
3 phase 3 wire balanced 1-1/2 element	WSA3B	0-5A	85-150V	4-20mA	1000 Watts	Self-powered	.15% RDG
3 phase 3 wire 2 element	WS33U	0-5A	85-150V	±1mA	±1000 Watts	Self-powered	.15% RDG
3 phase 3 wire 2 element	WSA3U	0-5A	85-150V	4-20mA	1000 Watts	Self-powered	.15% RDG
3 phase 4 wire balanced 2-1/2 element	WS34B	0-5A	85-150V	±1mA	±1500 Watts	Self-powered	.15% RDG
3 phase 4 wire balanced 2-1/2 element	WSA4B	0-5A	85-150V	4-20mA	1500 Watts	Self-powered	.15% RDG
3 phase 4 wire 3 element	WS34U	0-5A	85-150V	±1mA	±1500 Watts	Self-powered	.15% RDG
3 phase 4 wire 3 element	WSA4U	0-5A	85-150V	4-20mA	1500 Watts	Self-powered	.15% RDG
<b>VAR Models</b>							
3 phase 3 wire balanced 1-1/2 element	VS33B	0-5A	85-150V	±1mA	±1000 VARs	Self-powered	.15% RDG
3 phase 3 wire balanced 1-1/2 element	WSA3B	0-5A	85-150V	4-20mA	1000 VARs	Self-powered	.15% RDG
3 phase 3 wire 2 element	VS33U	0-5A	85-150V	±1mA	±1000 VARs	Self-powered	.15% RDG
3 phase 3 wire 2 element	VSA3U	0-5A	85-150V	4-20mA	1000 VARs	Self-powered	.15% RDG
3 phase 4 wire balanced 2-1/2 element	VS34B	0-5A	85-150V	±1mA	±1500 VARs	Self-powered	.15% RDG
3 phase 4 wire balanced 2-1/2 element	VSA4B	0-5A	85-150V	4-20mA	1500 VARs	Self-powered	.15% RDG
3 phase 4 wire 3 element	VS34U	0-5A	85-150V	±1mA	±1500 VARs	Self-powered	.15% RDG
3 phase 4 wire 3 element	VSA4U	0-5A	85-150V	4-20mA	1500 VARs	Self-powered	.15% RDG
<b>Watt/VAR Combined Models</b>							
3 phase 3 wire balanced 1-1/2 element	WVS33B	0-5A	90-150V	±1mA	±1000 Watt/VARs	Self-powered	.15% RDG
3 phase 3 wire balanced 1-1/2 element	WWSA3B	0-5A	90-150V	4-20mA	1000 Watt/VARs	Self-powered	.15% RDG
3 phase 3 wire 2 element	WVS33U	0-5A	90-150V	±1mA	±1000 Watt/VARs	Self-powered	.15% RDG
3 phase 3 wire 2 element	WWSA3U	0-5A	90-150V	4-20mA	1000 Watt/VARs	Self-powered	.15% RDG
3 phase 4 wire balanced 2-1/2 element	WVS34B	0-5A	90-150V	±1mA	±1500 Watt/VARs	Self-powered	.15% RDG
3 phase 4 wire balanced 2-1/2 element	WWSA4B	0-5A	90-150V	4-20mA	1500 Watt/VARs	Self-powered	.15% RDG
3 phase 4 wire 3 element	WVS34U	0-5A	90-150V	±1mA	±1500 Watt/VARs	Self-powered	.15% RDG
3 phase 4 wire 3 element	WWSA4U	0-5A	90-150V	4-20mA	1500 Watt/VARs	Self-powered	.15% RDG
<b>Watt/Watthour Models</b>							
3 phase 3 wire balanced 1-1/2 element	WHR33B	0-5A	85-150V	0-1mA/pulse	1000 Watt/WH	Self-powered	.15% RDG
3 phase 3 wire 2 element	WHR33U	0-5A	85-150V	0-1mA/pulse	1000 Watt/WH	Self-powered	.15% RDG
3 phase 4 wire balanced 2-1/2 element	WHR34B	0-5A	85-150V	0-1mA/pulse	1500 Watt/WH	Self-powered	.15% RDG
3 phase 4 wire 3 element	WHR34U	0-5A	85-150V	0-1mA/pulse	1500 Watt/WH	Self-powered	.15% RDG
<b>VAR/VARhour Models</b>							
3 phase 3 wire balanced 1-1/2 element	VHR33B	0-5A	85-150V	0-1mA/pulse	1000 VARs/VH	Self-powered	.15% RDG
3 phase 3 wire 2 element	VHR33U	0-5A	85-150V	0-1mA/pulse	1000 VARs/VH	Self-powered	.15% RDG
3 phase 4 wire balanced 2-1/2 element	VHR34B	0-5A	85-150V	0-1mA/pulse	1500 VARs/VH	Self-powered	.15% RDG
3 phase 4 wire 3 element	VHR34U	0-5A	85-150V	0-1mA/pulse	1500 VARs/VH	Self-powered	.15% RDG

Description	Model Number	Current Input Range	Voltage Input Range	Output Range	FullScale Calibration	Power	Accuracy
<b>Register Modules</b> <b>Used With Watthour &amp; VARhour Models</b> 6 digit resettable 8 digit non-resettable	RM10R1 RM10R3	N/A N/A	N/A N/A	— —	1 Count/WH or VH 1 Count/WH or VH	Separate 120VAC Separate 120VAC	— —
<b>Frequency Models</b> 1 phase bipolar 1 phase unipolar	F1BD5 F1UD5	N/A N/A	85-150V 85-150V	±1mA 0-1mA	60Hz ±5Hz 60Hz ±5Hz	Self-powered Self-powered	.01%CF .01%CF
<b>Phase Angle/ Power Factor Models</b> 1 phase 180 power factor Volt/volt phase angle 180	PF180 PA180	N/A N/A	85-150V 85-150V	±1mA ±1mA	±180° ±180°	Self-powered Self-powered	.2%FS .2%FS

## Common Specifications

**Accuracy:** as stated

**Drift:** .003% per C°

**Operating Temperature:** -20°C to +65°C

**Response Time:** <400mSec.

**Humidity:** 0-99% non-condensing

**Output Compliance:**

11 Volts for 1mA (10K ohms)  
15 Volts for 20mA (750 ohms)

**Current Input Burden:**

Current models: .5VA  
Power models: .25VA

**Current Input Overload (all models):**

Continuous: 20A  
1 sec/hr: 250A

**Current Overrange With Accuracy**

**(all models):** 7.5 Amps

**Voltage Input Burden:**

Voltage models: 2VA  
Power models: .1VA

**Standards:**

UCX1F6, UVX1F6: ANSI/IEE C37.90. 1-1987  
ANSI/IEEE 460-1988  
All other models:  
ANSI C37.90a-1974/IEEE 472 BEAMA 219

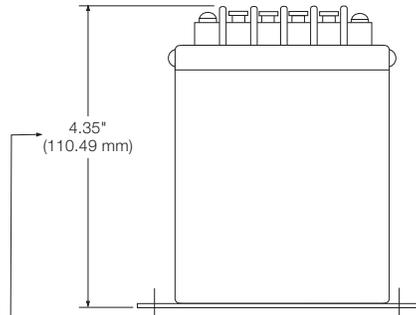
**Notes:**

- External power option available on all models except on the following: UCX1F6, UCX3F6, UVX1F6, UVX3F6.
- UVXCF6 has 2 calibration ranges, 85-115V and 115-140V with adjustable 10-50V span.
- 1 and 2 Hertz deviation available in frequency models.
- 60 and 90 degree models available on power factor models.
- All models calibrated for 60Hz. 50Hz is available as an optional calibration.
- Output for power factor models is linear to the cosine of the phase angle.
- Separate power 85-150VAC for metering accuracy. 90-150VAC for combined Watt/Var.
- Derate voltage input burden to 4VA for power input for externally powered models and for phase A input for self-powered models.
- Pulse rate for Watt/Watthour and VAR/VARhour models are 1 pulse per Watthour.
- Power units available in single phase.

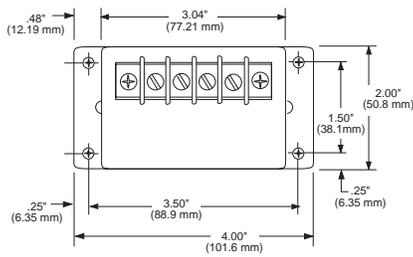
# AMETEK Transducers

## Dimensions:

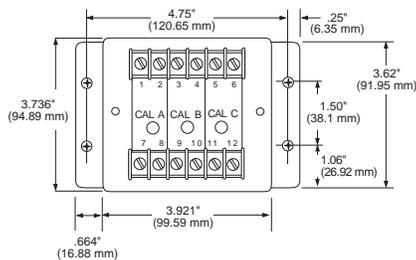
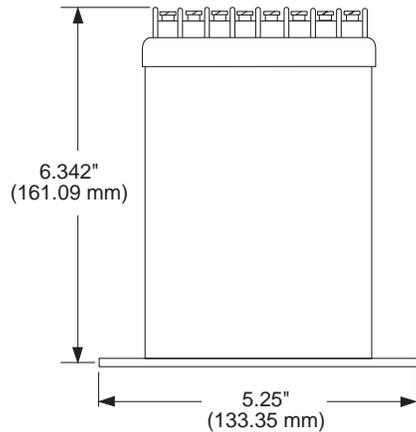
### Current & Voltage - Single Phase



UCXAF6  
UVXAF6 → 5.08" (129.18 mm)



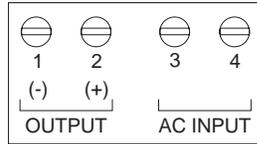
### Current & Voltage - Three Phase



## Connections

### Current & Voltage — Single Phase

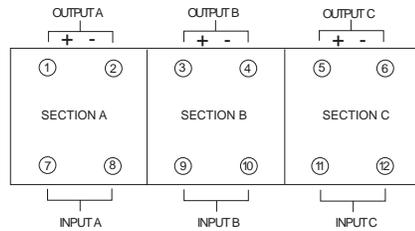
- UCX1F6 1 phase current (1mA)
- UCXAF6\* 1 phase current (20mA)
- UVX1F6 1 phase voltage (1mA)
- UVXAF6\* 1 phase voltage (20mA)



\*Utilizes 6 position terminal block.  
5 & 6 used for connection to external power.

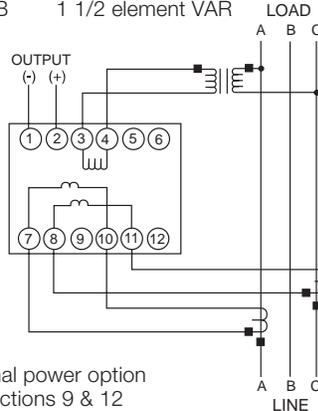
### Current & Voltage — Three Phase

- UCX3F6 3 phase current
- UVX3F6 3 phase voltage



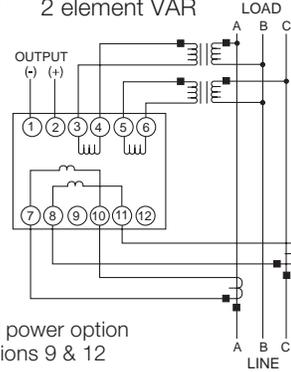
### Watt & Var

- WS33B 1 1/2 element Watt
- WSA3B 1 1/2 element Watt
- VS33B 1 1/2 element VAR
- VSA3B 1 1/2 element VAR



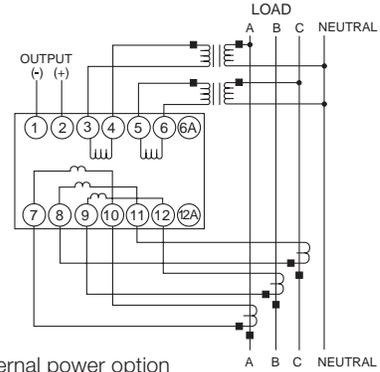
External power option  
connections 9 & 12  
(Also available in single  
phase)

- WS33U 2 element Watt
- WSA3U 2 element Watt
- VS33U 2 element VAR
- VSA3U 2 element VAR



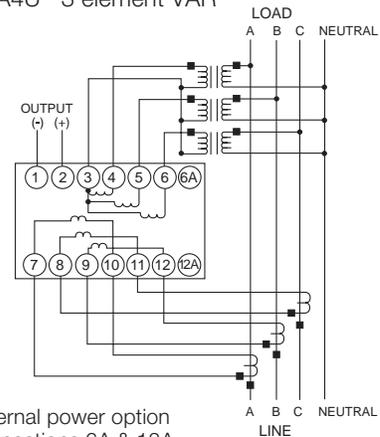
External power option  
connections 9 & 12

- WS34B 2 1/2 element Watt
- WSA4B 2 1/2 element Watt
- VS34B 2 1/2 element VAR
- VSA4B 2 1/2 element VAR



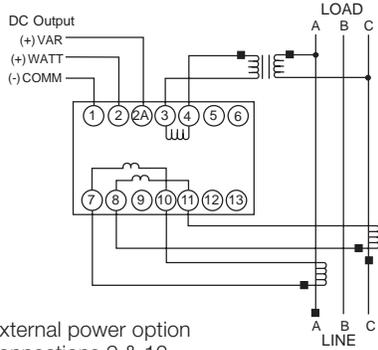
External power option  
connections 6A & 12A

- WS34U 3 element Watt
- WSA4U 3 element Watt
- VS34U 3 element VAR
- VSA4U 3 element VAR



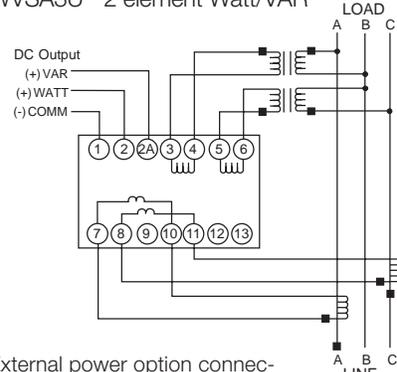
External power option  
connections 6A & 12A

WWS33B 1 1/2 element Watt/VAR  
 WWSA3B 1 1/2 element Watt/VAR



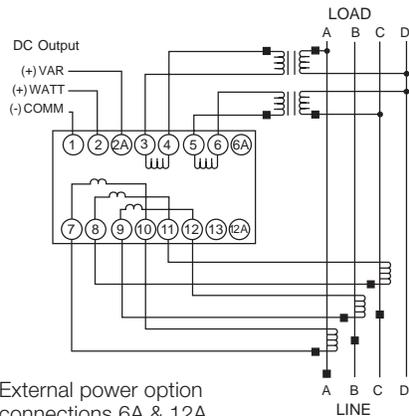
External power option connections 9 & 12  
 (Also available in single phase)

WWS33U 2 element Watt/VAR  
 WWSA3U 2 element Watt/VAR



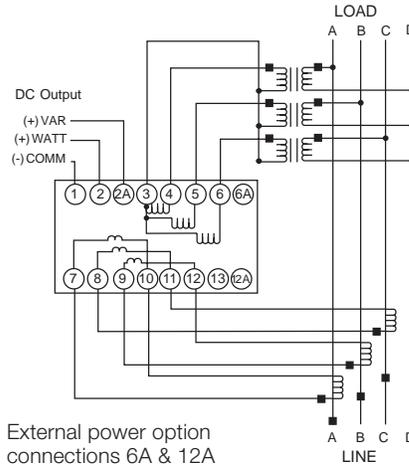
External power option connections 9 & 12

WWS34B 2 1/2 element Watt/VAR  
 WWSA4B 2 1/2 element Watt/VAR



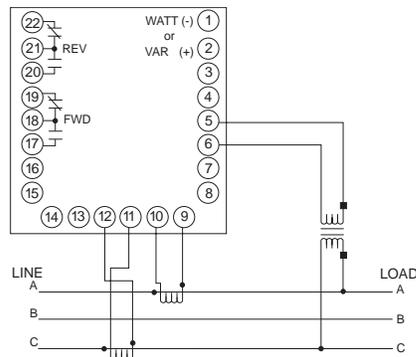
External power option connections 6A & 12A

WWS34U 3 element Watt/VAR  
 WWSA4U 3 element Watt/VAR



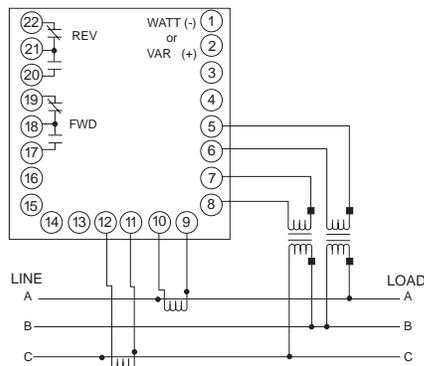
External power option connections 6A & 12A

WHR33B 1 1/2 element Watt/Watthour



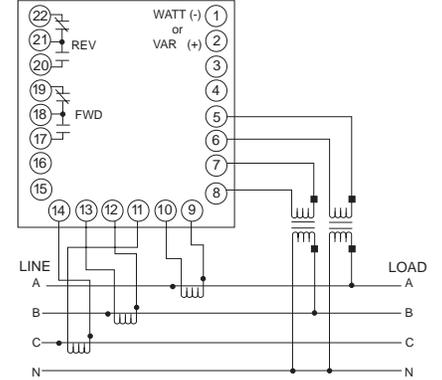
External power option connections 15 & 16

WHR33U 2 element Watt/Watthour



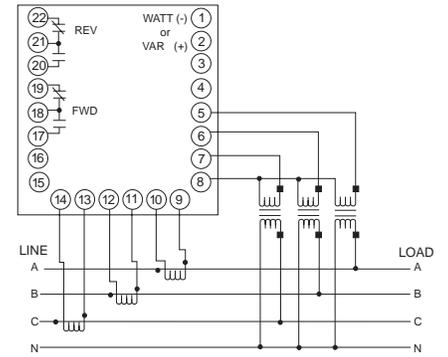
External power option connections 15 & 16

WHR34B 2 1/2 element Watt/Watthour



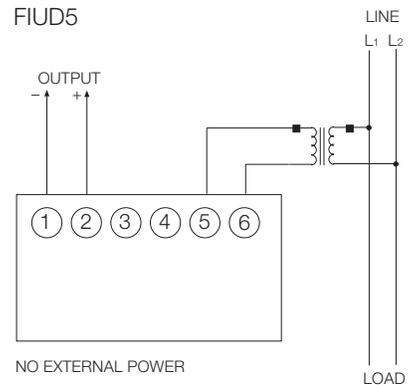
External power option connections 15 & 16

WHR34U 3 element Watt/Watthour



External power option connections 15 & 16

Frequency  
 FIBD5  
 FIUD5



# AMETEK

## Transducers

### Calibration Guide & Ordering Guide

This simple procedure will help you identify the calibration needed to support any Watt, VAR, Watt/VAR combined application.

**Step 1: Determine the proper model and circuit and the associated standard calibration (Watts or VARs):**

Circuit	# of Elements	Standard Calibration Full Scale	Calibration Range
1 phase	1	500	250-1000
3 phase/3 wire balanced	1-1/2	1000	500-2000
3 phase/3 wire unbalanced	2	1000	500-2000
3 phase/4 wire balanced	2-1/2	1500	750-3000
3 phase/4 wire unbalanced	3	1500	750-3000

The above standard calibration is the PT/CT secondary side calibration range or what is measured directly at the unit's terminals. When the unit senses the standard full scales Watts or VARs the resulting output will be full scale. The above extended range is the allowable extension to the standard range for special calibration.

If the calibration needs to be verified proceed to the next step.

**Step 2: Determine primary side calibration with following equation:**

Primary calibration = std calibration x PT ratio x CT ratio

Example: 3 phase 3 wire unbalanced Watt unit (2 element)

PT ratio primary:secondary = 1440:120 (or 12)

CT ratio primary:secondary = 200:5 (or 40)

Inserting these numbers into the equation:

Primary calibration = 1000 x 12 x 40

Primary calibration = 480,000 (480KW)

When the unit senses 480KW primary (1000 Watt secondary) the output will be at full scale.

If this equals the required primary calibration range, stop here and order the appropriate unit.

If the primary calibration range differs from the standard equation, proceed to the next step.

**Step 3: Determine if the actual primary calibration is**

**within the standard adjustment range.**

Standard adjustment = 10%

From the example above standard adjustment is 480KW ± 10% = 432KW to 528KW primary (or 900 to 1100 secondary)

If the calibration range is within this limit, the following 2 separate choices apply; if the calibration range is outside this limit, proceed directly to step 4.

1. Order the standard unit and fine tune the calibration at use site.
2. Order the base unit with the special calibration option code "Z" (please specify the exact calibration and PT & CT ratios). The unit will be calibrated to the exact calibration range specified.

**Step 4: Determine if the actual primary calibration is within the allowable extended range.**

There are extended ranges allowable per the table in step 1. If the exact calibration is within these extended limits, order the base unit with the special calibration option code "Z" (please specify the exact calibration and PT & CT ratios).

If the calibration is outside these limits, please consult the factory for more details and options.

### Ordering Guide

1. Choose proper base model for application.
2. Determine external or internal power.
3. Determine calibration range.
4. Verify 60Hz or 50Hz operation.

Example: Base model: (from list)

External power (if required): -E

Special calibration (if required): -Z

50 Hz operation (if required): -5

For a 3 phase 3 wire unbalanced Watt transducer with

- 5A Current Input
- 150 V Voltage Input
- 1000 Watt Calibration
- ±1mA Output
- External Power

Model number is WS33U-E

## Current Transducer with 4-20 mA<sub>dc</sub> Clamping Circuit

### UCXAF6CLP

- 1 Phase Current
- 21.1 mA<sub>dc</sub> Maximum Output
- 0.25% FS Accuracy
- ISO 9000



#### Applications

- Eliminate inrush current to your Distributed Control System (DCS)

Ametek introduces a new current limiting 4-20 mA<sub>dc</sub> Current Transducer that clamps the output to 21.1 mA<sub>dc</sub> with current overload. This current limiting feature is ideal for all Distributed Control System (DCS) applications where inrush current can cause the DCS to misinterpret the signal resulting in equipment failure or erroneous system operation.

Ametek power transducers meet the IEEE surge withstand and isolation levels to provide high level reliability in substation, switchgear and plant application.

Like all Ametek Power Instruments transducers, these clipping CT units incorporate state-of-the art electrical and mechanical design. Only the highest quality components, latest production techniques and most advanced test equipment and procedures are used in their manufacture. All models are designed to meet the ANSI SWC (surge withstand capability) test and BEAMA Test No. 219, to assure reliable performance in the field.

The Clipping CT transducer is housed in rugged drawn-steel enclosures with welded-on mounting plates. The entire circuitry may be pulled by removing

two easily-accessible screws without dismantling the enclosure from the panel.

For more information on current transducers, application assistance on a special project, or simply to place an order, consult your nearest Ametek Sales Office.

# AMETEK Transducers

## Specifications

**Current Input Range:** 0-5A

**Output Range:** 4-20 mAdc

**Maximum Output:** 21.1 mAdc

**Full Scale Calibration:** 5A

**Power:** Separate 120 VAC

**Accuracy:** 0.25% FS

**Operating Temperature:**

-20°C to 65°C

**Humidity:** 0-99% non-condensing

**Output Ripple:** <1% peak all models

**Response Time:** <400 msec, 0-99%

**Standard:** UCXAF6CLP – ANSI/IEEE  
C37.90.a-1989

**Warmup:** Full accuracy in 15 minutes

**Frequency:** 60Hz<sup>1</sup>

**Stability:** .25%/year, nonaccumulative

**Drift:** 0.003% per °C

**Accuracy:** <0.25% FULLSCALE

**Output Compliance:** 15 Volts for  
20mA (750Ω)

**Current Input Burden:** .5A

**Current Input Overload:**

Continuous – 20A

1 sec/hr – 250A

**Current Overrange with Accuracy:**

5.05A

<sup>1</sup> All models are calibrated for 60Hz.

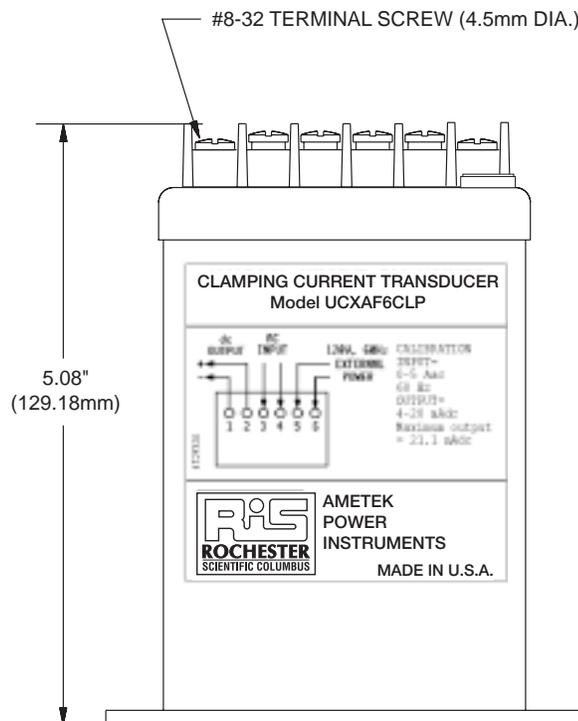
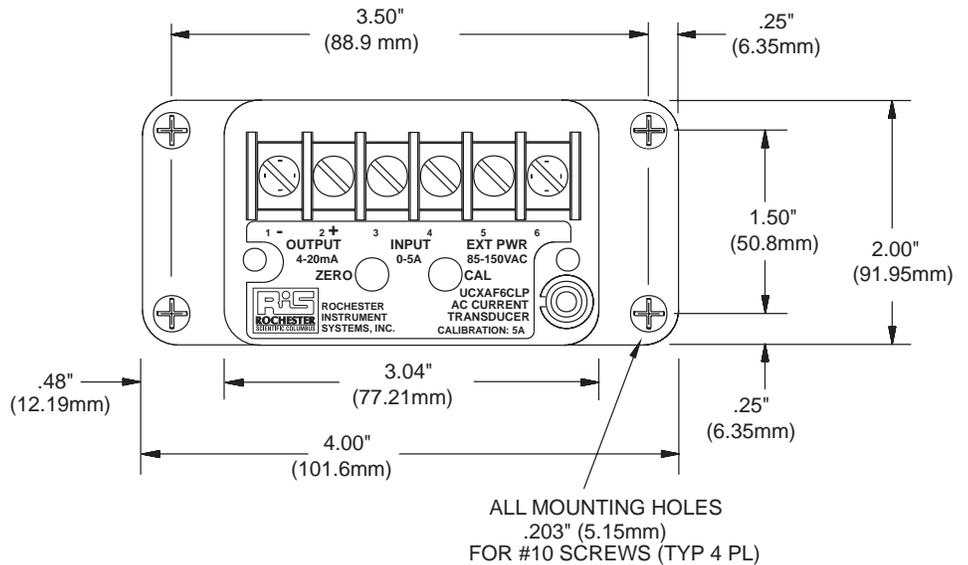
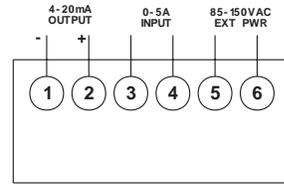
50Hz is available as an optional calibration (-z option).

## Ordering Information:

Specify model number UCXAF6CLP.

## Dimensions and Wiring

### UCXAF6CLP CURRENT TRANSDUCER EXTERNAL POWER



## UL Recognized Power Transducer

### *ULtra™ Series*

- Voltage, Current, Watt, and Var Transducers
- US and Canadian UL Recognized
- 0.2% of Reading Accuracy
- 4-20 mAdc or 0-1 mAdc Output Available
- Small Can Sizes
- 50 Hz or 60 Hz
- 2500 VRMS Isolation
- Easy Model Number System



UL Recognized  
USA and Canada  
   
E149133 E149133

The *ULtra™* Series of AC power transducer addresses all your process control and industrial requirements where AC measurements are required. The new series is available in Current, Voltage, Watt and VAR, in either 50 or 60 Hz. The current transducer is available in a standard 4-20 mAdc or 0-1 mAdc output configuration. They meet ANSI/IEEE C37.90.1 - 1989 surge withstand test. They are available at 5 Amp and 120 Volts; 10 Amp and 240 Volts options available on the Current and Voltage transducer respectively.

Like all Ametek Power Instruments transducers, the *ULtra* Series units incorporate state-of-the art electrical and mechanical design. Only the highest quality components, latest production techniques and most advanced test equipment and procedures are used in their manufacture. All models are designed to meet the ANSI SWC (surge withstand capability) test and BEAMA Test No. 219, to assure reliable performance in the field.

*ULtra* Series power transducers are housed in rugged drawn-steel enclosures with welded-on mounting plates.

The entire circuitry may be pulled by removing two easily-accessible screws without dismantling the enclosure from the panel.

For more information on Ametek transducers, assistance on special applications, or simply to place an order, consult your nearest Ametek Sales Office.

# AMETEK

## Transducers

### ULtra Series Specifications AC CURRENT/Voltage Transducer

#### Current Input:

Nominal	5A	10A
Calibrating Range	0-5A	0-10A
Range with Linearity	0-7.5A	0-15A
Overload Continuous	15A	20A
Overload 1 sec/hour	250A	250A
Burden per Element	0.25 VA at 5A	0.35 VA at 10A

#### Voltage Input:

Nominal	120V	240V
Calibrating Range	0-150V	0-300V
Overload Continuous	180V	300V
Burden per Element	1.2 VA at 120V	1.2 VA at 240V

#### External Power (4-20 mAdc Output):

Input Range	85-150 Vac
Frequency Range	50-500 Hz
Burden per Element	2.5 VA (max.)

#### Rated Output (RO):

##### 0-1 mAdc Output

1 mAdc for Standard Calibration

##### 4-20 mAdc Output

20 mAdc for Standard Calibration

**Accuracy:**  $\pm 0.2\%$  of RO

#### Temperature Effect on Accuracy:

$\pm 0.0075\%/^{\circ}\text{C}$  (typical) - Current  
 $\pm 0.015\%/^{\circ}\text{C}$  (typical) - Voltage

#### Operating Temperature Range:

0-1 mAdc Output	-20°C to +60°C
4-20 mAdc Output	-20°C to +50°C

#### Compliance Voltage:

0-1 mAdc Output	10 Vdc
4-20 mAdc Output	15 Vdc

#### Load:

##### 0-1 mAdc Output

Any load from 0-10,000 $\Omega$  at 1 mAdc

##### 4-20 mAdc Output

Any load from 0-750 $\Omega$  at 20 mAdc

**Output Ripple Peak:**  $< 0.05\%$  RO

#### Response Time:

0-1 mAdc	$< 400\text{ms}$ to 99%
4-20 mAdc	$< 500\text{ms}$ to 99%

#### Standard Calibration Adjustments:

##### 0-1 mAdc Output

Gain  $\pm 10\%$  of Reading (minimum)

##### 4-20 mAdc Output (Current/Voltage)

Gain  $\pm 20\%$  of Reading (minimum)

##### 4-20 mAdc Output

Zero  $\pm 5\%$  of Zero Point (minimum)

**Frequency:** 58Hz - 62Hz

#### Stability (per year):

$\pm 0.25\%$  RO Non-Accumulative

#### Operating Humidity:

0-95% Non-Condensing

#### Isolation:

Dielectric Withstand 2500 VRMS (60Hz)

##### 0-1 mAdc Output

Complete (Input/Output/Case)

##### 4-20 mAdc Output

Complete (Input/Output/Power/Case)

#### Surge Withstand:

ANSI/IEEE C37.90.1-1989

#### Maximum Net Weight:

One Element	1lb., 1oz. (0.48kg)
Three Element	2lbs., 9oz. (1.16kg)

#### Approximate Dimensions:

(excluding mounting plate)

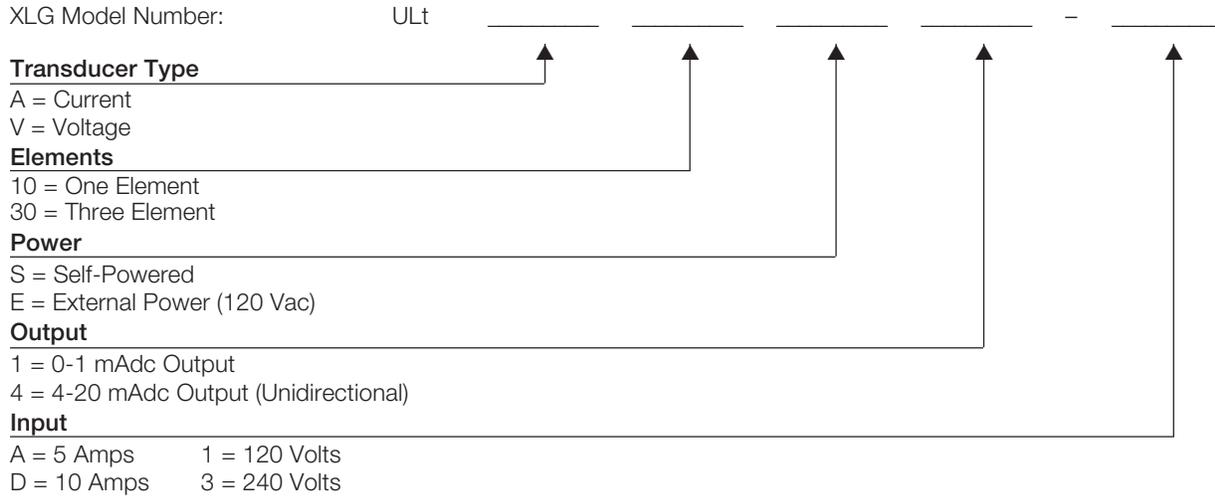
One Element

3.1"W x 2.0"D x 4.1"H  
(79mm x 51mm x 104mm)  
Style III Case

Three Element

4.4"W x 3.8"D x 4.7"H  
(112mm x 97mm x 119mm)  
Style II Case

## Ordering Information

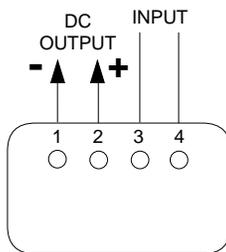


For additional ordering information, please consult the factory at 1-800-274-5368

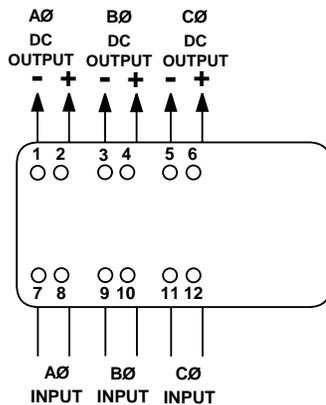
## Wiring Diagrams

### AC Voltage Transducer with 0-1 mAdc Outputs

#### One Element

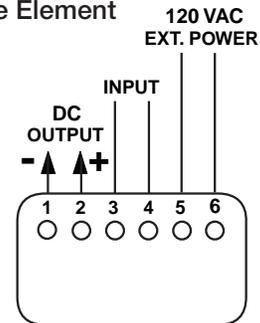


#### Three Element

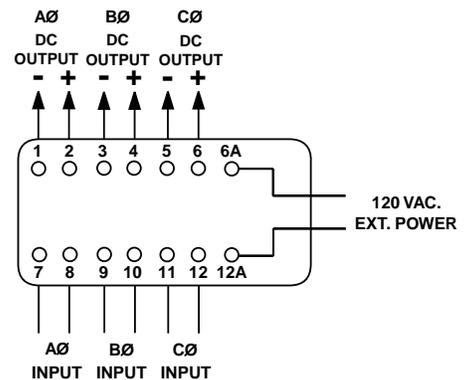


### AC Voltage Transducer with 4-20 mAdc Outputs

#### One Element



#### Three Element



E Models: Shown  
 S Models: External auxiliary power not required.  
 Bottom terminal strip (7-12) omitted on S-model 1-element units

# AMETEK

## Transducers

### Ultra Series Specifications AC Watt or VAR Transducer

#### Current Input:

Nominal	5A
Range*	0-10A
Overload Continuous	15A
Overload 1 sec/hour	250A
Burden per Element	0.3 VA (max.) at 5A

#### Voltage Input:

Nominal	120V
Range*	0-150V
Overload Continuous	180V
Burden per Element	0.035 VA (max.) at 120V

#### External Power:

Input Range	85-150 Vac
Frequency Range	50-500 Hz
Burden (watt)	4 VA (max.)
(var)	4.5 VA (max.) at 120V

#### Rated Output (RO) =

500 Watts per Element:

##### 0-1 mAdc Output

±1 mAdc for Standard Calibration

##### 4-20 mAdc Output

20 mAdc for Standard Calibration

#### Frequency:

Watt:	58Hz - 62Hz
Var:	60Hz (standard)

#### Stability (per year):

±0.25% RO Non-Accumulative

#### Accuracy:

##### 0-1 mAdc Output

Watt	±(0.1% Reading + 0.05% RO)
Var	±(0.1% Reading + 0.1% RO) at 0-200% RO

##### 4-20 mAdc Output

±0.2% of Output Range

#### Temperature Effect on Accuracy:

##### 0-1 mAdc Output

Watt	±0.005%/°C (typical)
Var	±0.0075%/°C (typical)

##### 4-20 mAdc Output

Watt	±0.0075%/°C (typical)
Var	±0.008%/°C (typical)

#### Operating Temperature Range:

Watt	0-1 mAdc Output	-20°C to +70°C
Var	0-1 mAdc Output	-20°C to 60°C
	4-20 mAdc Output	-20°C to +50°C

#### Compliance Voltage:

0-1 mAdc Output	10 Vdc
4-20 mAdc Output	15 Vdc

#### Load:

##### 0-1 mAdc Output

Any load from 0-10,000Ω at 1 mAdc

##### 4-20 mAdc Output

Any load from 0-750Ω at 20 mAdc

**Output Ripple Peak:** <0.05% RO

#### Response Time:

0-1 mAdc	<400ms to 99%
4-20 mAdc	<500ms to 99%

**Power Factor:** Any

#### Power Factor Effect on Accuracy:

±0.2% RO (maximum)

#### Standard Calibration Adjustments:

##### 0-1 mAdc Output

Gain	±2% of Reading (min.)
Zero	None Required

##### 4-20 mAdc Output

Gain	±20% of Reading (min.)
Zero	±5% of Zero Point (min.)

#### Operating Humidity:

0-95% Non-Condensing

#### Isolation:

Dielectric Withstand 2500 VRMS at 60Hz for 1 minute.  
Complete (Input/Output/Power/Case)

#### Surge Withstand:

ANSI/IEEE C37.90.1-1989

#### Maximum Net Weight:

One Element	1lb., 1oz. (0.48kg)
Three Element	2lbs., 9oz. (1.16kg)

#### Approximate Dimensions:

(excluding mounting plate)  
4.4"W x 3.9"D x 4.9"H  
(112mm x 97mm x 124mm)  
Style III Case

#### Overrange with Linearity:

##### 0-1 mAdc Output

500-1000 Watts/Vars per Element

##### 4-20 mAdc Output

500-600 Watts/Vars per Element

\* Total input not to exceed 200% of standard-calibration watts on units with 0-1 mAdc output. Total input not to exceed 120% of standard-calibration watts on units with 4-20 mAdc output.



# AMETEK

## Transducers

### Ultra Series Specifications AC Watt/Var Transducer

#### Current Input:

Nominal	5A
Range*	0-10A
Overload Continuous	15A
Overload 1 sec/hour	250A
Burden per Element	0.3 VA (max.) at 5A

#### Voltage Input:

Nominal	120V
Range*	0-150V
Overload Continuous	180V
Burden per Element	0.035 VA (max.) at 120V

#### External Power:

Input Range	85-150 Vac
Frequency Range	50-500 Hz
Burden	8 VA (max.) at 120V

#### Isolation between Watt and Var Options

±10 Vdc Dynamic Separation  
(±15 Vdc separation on all E1 & S1 models)

#### Rated Output (RO) =

500 Watts per Element:

##### 0-1 mAdc Output

±1 mAdc for Standard Calibration

##### 4-20 mAdc Output

20 mAdc for Standard Calibration

#### Accuracy:

##### 0-1 mAdc Output

Watt	±(0.1% Reading + 0.05% RO)
Var	±(0.1% Reading + 0.1% RO) at 0-200% RO

##### 4-20 mAdc Output

±0.2% of Output Range

#### Temperature Effect on Accuracy:

##### 0-1 mAdc Output

Watt	±0.005%/°C (typical)
Var	±0.0075%/°C (typical)

##### 4-20 mAdc Output

Watt	±0.0075%/°C (typical)
Var	±0.008%/°C (typical)

#### Operating Temperature Range:

0-1 mAdc Output	-20°C to +70°C
0-1 mAdc Output	-20°C to 60°C

#### Compliance Voltage:

0-1 mAdc Output	10 Vdc
4-20 mAdc Output	15 Vdc

#### Load:

##### 0-1 mAdc Output

Any load from 0-10,000Ω at 1 mAdc

##### 4-20 mAdc Output

Any load from 0-750Ω at 20 mAdc

Output Ripple Peak: <0.05% RO

#### Response Time:

0-1 mAdc	<400ms to 99%
4-20 mAdc	<500ms to 99%

Power Factor: Any

#### Power Factor Effect on Accuracy:

±0.2% RO (maximum)

#### Standard Calibration Adjustments:

##### 0-1 mAdc Output

Gain	±2% of Reading (min.)
Zero	None Required

##### 4-20 mAdc Output

Gain	±20% of Reading (min.)
Zero	±5% of Zero Point (min.)

Frequency: 60Hz (standard)

#### Stability (per year):

±0.25% RO Non-Accumulative

#### Operating Humidity:

0-95% Non-Condensing

#### Isolation:

Dielectric Withstand 2500 VRMS at 60Hz for 1 minute.  
Complete (Input/Output/Power/Case)

#### Surge Withstand:

ANSI/IEEE C37.90.1-1989

#### Maximum Net Weight:

3lbs., 5oz. (1.51kg)

#### Approximate Dimensions:

(excluding mounting plate)  
4.4"W x 3.8"D x 6.5"H  
(112mm x 97mm x 165mm)  
Style IV Case

#### Overrange with Linearity:

##### 0-1 mAdc Output

500-1000 Watts/Vars per Element

##### 4-20 mAdc Output

500-600 Watts/Vars per Element

No additional error within voltage compliance.  
Reduce load resistance as required.

\* Total input not to exceed 200% of standard-calibration watts and vars on units with 0-1 mAdc output. Total input not to exceed 120% of standard-calibration watts and vars on units with 4-20 mAdc output.

## Ordering Information

XLG Model Number: \_\_\_\_\_ ULt \_\_\_\_\_ - \_\_\_\_\_

### Transducer Type

C = Combination Watt/Var

### Elements

10 = 1 Element                      25 = 2 1/2 Element  
 20 = 2 Element                      30 = 3 Element

### Auxiliary Power

S = Self-Powered (internal auxiliary power)  
 E = External Auxiliary Power (120 Vac std.)

### Output

1 = 0 to ±1 mAdc  
 4 = 4-20 mAdc Output (Unidirectional)  
 12=4-12-20 mAdc Output (Bidirectional)  
 15=4-20 mAdc Unidirectional (watts)/4-12-20 mAdc Bidirectional (vars)

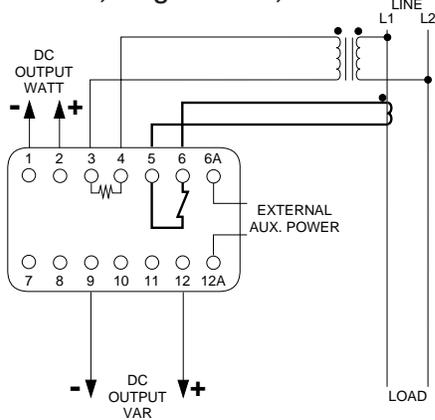
### Input

A = 5 Amps  
 1 = 120 V

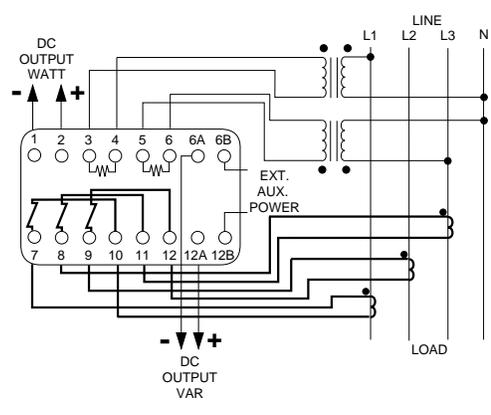
For additional ordering information, please consult the factory at 1-800-274-5368

## Wiring Diagrams

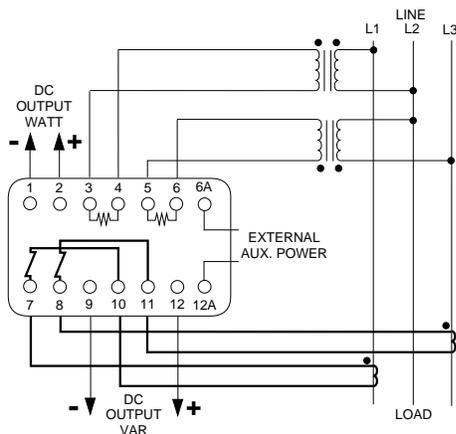
### 1 Element, Single Phase, 2 wire



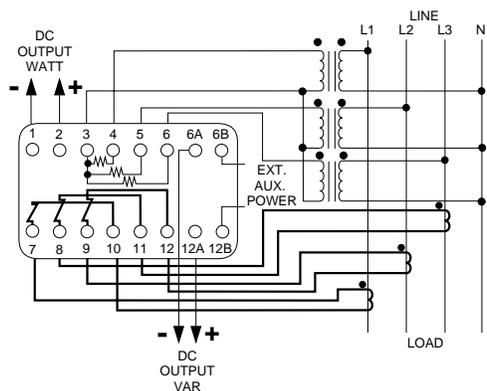
### 2 1/2 Element, 3 Phase, 4 Wire, Wye



### 2 Element, 3 Phase, 3 Wire, Delta



### 3 Element, 3 Phase, 4 Wire, Wye



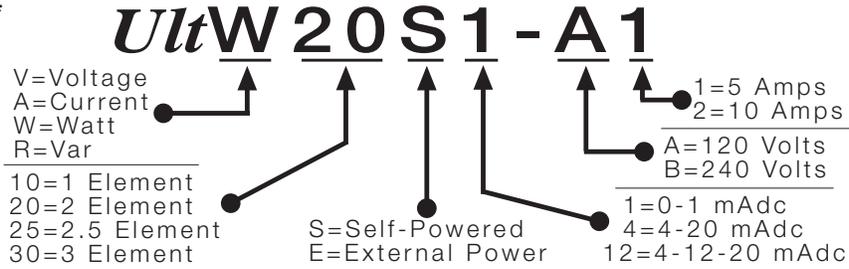
E Models: Shown

S Models: External auxiliary power not required.

Bottom terminal strip (7-12) omitted on S-model 1-element units

# AMETEK Transducers

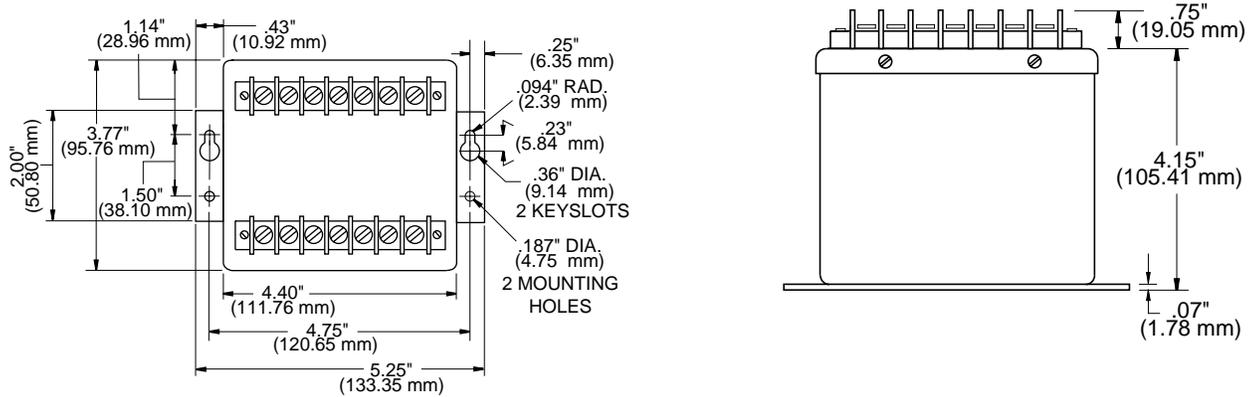
## Ordering Information\*



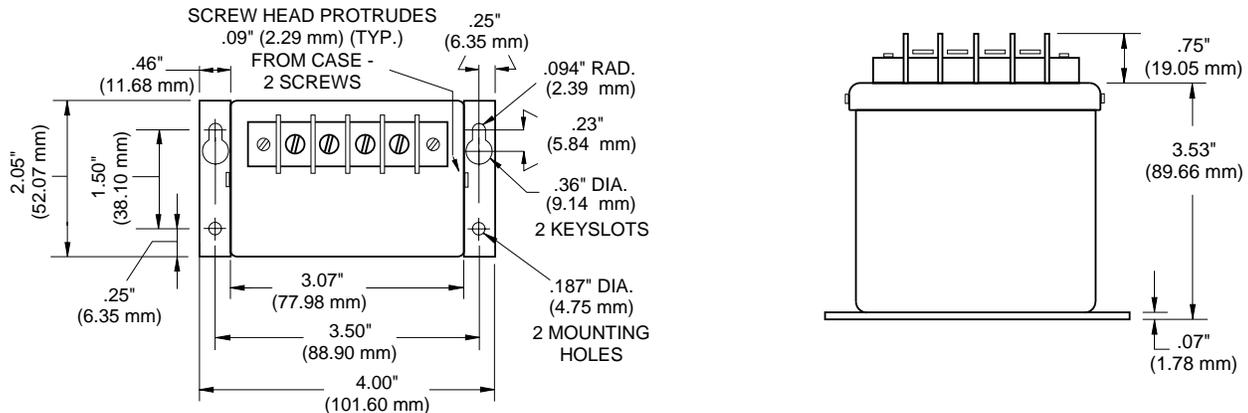
## Case Dimensions

### Ultra Series Transducers

#### Style II



#### Style III



**NOTE:**

Terminal strips shown for illustration purposes only. For exact terminal-strip configuration on specific units, see connection diagrams on preceding pages.

Drawings not to scale.

\* 60 Hz Standard, for 50 Hz just specify "50 Hz" in your description.

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## RLP Modular Plug-In Transducers

The RLP Series of transducers is a family of power instrumentation transducers in a compact, modular plug-in form. RLP transducers are ideal where large quantities of transducers are required, but space is limited.

RLP transducers feature three enclosure widths to accommodate two, four, or eight modules. Each module consists of two parts: a plug-in assembly and a back-panel assembly.

For current inputs, the current transformers are located on the back-panel assembly so the current inputs are not opened when the plug-in assembly is removed. New or additional plug-ins or back panels can be added in the field.



### Modules Available

- Current
- Voltage
- Combined Current/Voltage
- Expanded-Scale Voltage
- Watt
- Var
- Combined Watt/Var
- Phase Angle
- Voltage Angle
- Frequency

### Features

- Modular concept & compact design save transducer panel space
- Up to six transducers in one module
- Two, four, or eight modules in one enclosure
- Lower installation costs
- Easy to install
- Convenient front-panel access

### Applications

- Substations
- Generating stations
- SCADA

### Outputs

- 0 to  $\pm 1$  mAdc
- 1–5 or 1–3–5 mAdc
- 4–20 or 4–12–20 mAdc



# AMETEK

## Transducers

### Specifications

#### RLP AC Average-Sensing Current or Voltage Transducers

Specifications		0–1 mAdc Amps (Current Transducer)	P-Option* Amps (Current Transducer)	0–1 mAdc Volts (Voltage Transducer)	P-Option* Volts (Voltage Transducer)
<b>Current Input</b>	Nominal Calibrating Range Range with Linearity Overload Continuous Overload 1 Second/Hour Burden/Element	5 A 0–5 A 0–10 A 20 A 250 A 0.25 VA (maximum) at 5 A	5 A 0–5 A 0–6 A 20 A 250 A 0.25 VA (maximum) at 5 A	N/A	N/A
<b>Voltage Input</b>	Nominal Calibrating Range Range with Linearity Overload Continuous Burden/Element	N/A	N/A	120 V 0–150 V 0–150 V 180 V 2.2 VA (maximum) at 120 V	120 V 0–150 V 0–165 V 180 V 2.2 VA (maximum) at 120 V
<b>External Auxiliary Power</b>	Input Range Frequency Range Burden/Element	None Required	100–130 Vac 50–500 Hz 3 VA Nominal	None Required	100–130 Vac 50–500 Hz 3 VA Nominal
<b>Rated Output (RO) = 5 A or 150 V/Element</b>		1 mAdc for Standard Calibration	5 or 20 mAdc for Std. Calibration, depending on selected output range*	1 mAdc for Standard Calibration	5 or 20 mAdc for Std. Calibration, depending on selected output range*
<b>Accuracy</b>	Standard A4 Models	±0.25% RO ±0.1% RO	± 0.25% of Span	±0.25% RO ±0.1% RO	± 0.25% of Span
<b>Temperature Effect on Accuracy</b>		±0.01% / ° C	±0.015% / ° C	±0.01% / ° C	±0.015% / ° C
<b>Operating Temperature Range</b>		-20° C to +60° C	-20° C to +50° C	-20° C to +60° C	-20° C to +50° C
<b>Compliance Voltage</b>		10 Vdc	25 Vdc	10 Vdc	25 Vdc
<b>Load</b>		0–10,000 Ω	0–5,000 W for 1–5 mAdc units 0–1,250 W for 4–20 mAdc units	0–10,000 Ω	0–5,000 W for 1–5 mAdc units 0–1,250 W for 4–20 mAdc units
<b>Output Ripple Peak</b>		< 0.25% RO	< 0.25% of Span	< 0.25% RO	< 0.25% of Span
<b>Response Time</b>		< 400 ms to 99%			
<b>Standard Calibration Adjustments</b>	Gain Zero	±10% of Reading (minimum) None Required	±20% of Span (minimum) ±5% of Zero Point (minimum)	±10% of Reading (minimum) None Required	±20% of Span (minimum) ±5% of Zero Point (minimum)
<b>Frequency Range</b>		50–500 Hz (specify nominal)			
<b>Stability (per year)</b>		±0.1% RO, Noncumulative	±0.15% of Span, Noncumulative	±0.25% RO, Noncumulative	±0.3% of Span, Noncumulative
<b>Operating Humidity</b>		0–95% Noncondensing			
<b>Isolation</b>		Complete (Input/Output/Case)	Complete (Input/Output/Power/Case)	Complete (Input/Output/Case)	Complete (Input/Output/Power/Case)
<b>Dielectric Withstand</b>		1500 VRMS at 60 Hz			
<b>Surge Withstand</b>		ANSI/IEEE C37.90.1			
<b>Maximum Net Weight</b>		Weights vary by model; consult factory.			
<b>Approximate Dimensions</b>		See enclosure diagrams on page 85.			

\*P-Option includes 1–5 and 4–20 mAdc outputs. Not available on all models.

Specifications subject to change without notice.

## Specifications RLP AC Expanded-Scale Voltage Transducers

Specifications		0–1 mAdc Volts (Expanded-Scale Voltage Transducer)	P-Option* Volts (Expanded-Scale Voltage Transducer)
<b>Voltage Input</b>	Span/Range Overload Continuous Burden/Element	Any 20–60 V span between 90–150 V (customer specified)** 150 V 2 VA (maximum) at 120 V	
<b>External Auxiliary Power</b>	Input Range Frequency Range Burden	None Required	100–130 Vac 50–500 Hz 3 VA Nominal
<b>Rated Output (RO)</b>		0 mAdc at low end of range (customer specified) 1 mAdc at high end of range (customer specified)	1 or 4 mAdc at low end of range (customer specified) 5 or 20 mAdc at high end of range (customer specified)
<b>Accuracy</b>		±0.25% of Input Voltage for 60 Hz	
<b>Temperature Effect on Accuracy</b>		±0.007% / ° C	±0.01% / ° C
<b>Operating Temperature Range</b>		-20° C to +60° C	-20° C to +50° C
<b>Compliance Voltage</b>		10 Vdc	25 Vdc
<b>Load</b>		0–10,000 Ω	0–5,000 Ω for 1–5 mAdc units 0–1,250 Ω for 4–20 mAdc units
<b>Output Ripple Peak</b>		< 2.5% RO	< 2.5% of Span
<b>Response Time</b>		< 400 ms to 99%	
<b>Standard Calibration Adjustments</b>	Gain Zero	±5% of Span ±5% of Span	±20% of Span ±5% of Span
<b>Frequency Range</b>		55–65 Hz	
<b>Stability (per year)</b>		±0.25% of Input Voltage, Noncumulative	
<b>Operating Humidity</b>		0–95% Noncondensing	
<b>Isolation</b>		Complete (Input/Output/Case)	Complete (Input/Output/Power/Case)
<b>Dielectric Withstand</b>		1500 VRMS at 60 Hz	
<b>Surge Withstand</b>		ANSI/IEEE C37.90.1	
<b>Maximum Net Weight</b>		Weights vary by model; consult factory.	
<b>Approximate Dimensions</b>		See enclosure diagrams on page 85.	

\* P-Option includes 1–5 and 4–20 mAdc outputs.

\*\*Minimum span must be at least 18% of low-end voltage.

Specifications subject to change without notice.

# AMETEK

## Transducers

### Specifications RLP AC Watt or Var Transducers

Specifications		0 to ±1 mAdc Watts (Watt Transducer)	P-Option* Watts (Watt Transducer)	0 to ±1 mAdc Vars (Var Transducer)	P-Option* Vars (Var Transducer)
<b>Current Input</b>	Nominal Range** Overload Continuous Overload 1 Second/Hour Burden/Element	5 A 0–10 A 20 A 250 A 0.2 VA (maximum) at 5 A			
<b>Voltage Input</b>	Nominal Range** Overload Continuous Burden/Element	120 V 0–150 V 200 V 0.02 VA (maximum) at 120 V			
<b>External Auxiliary Power</b>	Input Range Frequency Range Burden	85–135 Vac 50–500 Hz 3 VA Nominal	100–130 Vac 50–500 Hz 5 VA Nominal	85–135 Vac 50–500 Hz 3 VA Nominal	100–130 Vac 50–500 Hz 5 VA Nominal
<b>Rated Output (RO) = 500 Watts or Vars/Element</b>		±1 mAdc for Standard Calibration	5 or 20 mAdc for Std. Calibration, depending on selected output range*	±1 mAdc for Standard Calibration	5 or 20 mAdc for Std. Calibration, depending on selected output range*
<b>Accuracy</b>		±(0.2% Reading + 0.01% RO) at 0–200% RO	±(0.2% Reading + 0.05% RO) at 0–120% RO	±(0.2% Reading + 0.02% RO) at 0–200% RO	±(0.3% Reading + 0.05% RO) at 0–120% RO
<b>Temperature Effect on Accuracy</b>		±0.005% / ° C	±0.0075% / ° C	±0.009% / ° C	±0.012% / ° C
<b>Operating Temperature Range</b>		-20° C to +70° C	-20° C to +50° C	-20° C to +60° C	-20° C to +50° C
<b>Compliance Voltage</b>		10 Vdc	25 Vdc	10 Vdc	25 Vdc
<b>Load</b>		0–10,000 Ω	0–5,000 Ω for 1–5/1–3–5 mAdc units 0–1,250 Ω for 4–20/4–12–20 mAdc units	0–10,000 Ω	0–5,000 Ω for 1–5/1–3–5 mAdc units 0–1,250 Ω for 4–20/4–12–20 mAdc units
<b>Output Ripple Peak</b>		< 0.5% RO			
<b>Response Time</b>		< 400 ms to 99%			
<b>Power Factor</b>		Any			
<b>PF Effect on Accuracy</b>		±0.1% VA (maximum)		±0.15% VA (maximum)	
<b>Standard Calibration Adjustments</b>	Gain Zero	±2% of Reading (minimum) None Required	±20% of Span (minimum) ±5% of Zero Point (minimum)	±2% of Reading (minimum) None Required	±20% of Span (minimum) ±5% of Zero Point (minimum)
<b>Frequency Range</b>		58–62 Hz		60 Hz	
<b>Stability (per year)</b>		±0.1% RO, Noncumulative	±0.15% of Span, Noncumulative	±0.2% RO, Noncumulative	±0.25% of Span, Noncumulative
<b>Operating Humidity</b>		0–95% Noncondensing			
<b>Isolation</b>		Complete (Input/Output/Power/Case)			
<b>Dielectric Withstand</b>		1500 VRMS at 60 Hz			
<b>Surge Withstand</b>		ANSI/IEEE C37.90.1			
<b>Maximum Net Weight</b>		Weights vary by model; consult factory.			
<b>Approximate Dimensions</b>		See enclosure diagrams on page 85.			
<b>Overrange with Linearity</b>		500–1000 Watts/Element	500–600 Watts/Element	500–1000 Vars/Element	500–600 Vars/Element
No additional error within voltage compliance. Reduce load resistance as required.					

## Specifications RLP Combined AC Watt/Var Transducers

Specifications		0 to ±1 mAdc Watts (Combined Watt/Var Transducer)	P-Option* Watts (Combined Watt/Var Transducer)	0 to ±1 mAdc Vars (Combined Watt/Var Transducer)	P-Option* Vars (Combined Watt/Var Transducer)
<b>Current Input</b>	Nominal Range** Overload Continuous Overload 1 Second/Hour Burden/Element	5 A 0–10 A 20 A 250 A 0.2 VA (maximum) at 5 A			
<b>Voltage Input</b>	Nominal Range** Overload Continuous Burden/Element	120 V 0–150 V 200 V 0.02 VA (maximum) at 120 V			
<b>External Auxiliary Power</b>	Input Range Frequency Range Burden	85–135 Vac 50–500 Hz 3 VA Nominal	100–130 Vac 50–500 Hz 7 VA Nominal	85–135 Vac 50–500 Hz 3 VA Nominal	100–130 Vac 50–500 Hz 7 VA Nominal
<b>Rated Output (RO) = 500 Watts or Vars/Element</b>		±1 mAdc for Standard Calibration	5 or 20 mAdc for Std. Calibration, depending on selected output range*	±1 mAdc for Standard Calibration	5 or 20 mAdc for Std. Calibration, depending on selected output range*
<b>Accuracy</b>		±(0.2% Reading + 0.01% RO) at 0–200% RO	±(0.2% Reading + 0.05% RO) at 0–120% RO	±(0.2% Reading + 0.02% RO) at 0–200% RO	±(0.3% Reading + 0.05% RO) at 0–120% RO
<b>Temperature Effect on Accuracy</b>		±0.005% / ° C	±0.0075% / ° C	±0.009% / ° C	±0.012% / ° C
<b>Operating Temperature Range</b>		-20° C to +60° C	-20° C to +50° C	-20° C to +60° C	-20° C to +50° C
<b>Compliance Voltage</b>		10 Vdc	25 Vdc	10 Vdc	25 Vdc
<b>Load</b>		0–10,000 Ω	0–5,000 Ω for 1–5/1–3–5 mAdc units 0–1,250 Ω for 4–20/4–12–20 mAdc units	0–10,000 Ω	0–5,000 Ω for 1–5/1–3–5 mAdc units 0–1,250 Ω for 4–20/4–12–20 mAdc units
<b>Output Ripple Peak</b>		< 0.5% RO			
<b>Response Time</b>		< 400 ms to 99%			
<b>Power Factor</b>		Any			
<b>PF Effect on Accuracy</b>		±0.1% VA (maximum)		±0.15% VA (maximum)	
<b>Standard Calibration Adjustments</b>	Gain Zero	±2% of Reading (minimum) None Required	±20% of Span (minimum) ±5% of Zero Point (minimum)	±2% of Reading (minimum) None Required	±20% of Span (minimum) ±5% of Zero Point (minimum)
<b>Frequency</b>		60 Hz			
<b>Stability (per year)</b>		±0.1% RO, Noncumulative	±0.15% of Span, Noncumulative	±0.2% RO, Noncumulative	±0.25% of Span, Noncumulative
<b>Operating Humidity</b>		0–95% Noncondensing			
<b>Isolation</b>		Complete (Input/Output/Power/Case)			
<b>Dielectric Withstand</b>		1500 VRMS at 60 Hz			
<b>Surge Withstand</b>		ANSI/IEEE C37.90.1			
<b>Maximum Net Weight</b>		Weights vary by model; consult factory.			
<b>Approximate Dimensions</b>		See enclosure diagrams on page 85.			
<b>Overrange with Linearity</b>		500–1000 Watts/Element	500–600 Watts/Element	500–1000 Vars/Element	500–600 Vars/Element
No additional error within voltage compliance. Reduce load resistance as required.					

# AMETEK

## Transducers

### Specifications

#### RLP AC Phase Angle or Voltage Angle Transducers

Specifications		0 to ±1 mAdc (Phase Angle Transducer)	P-Option* (Phase Angle Transducer)	0 to ±1 mAdc (Voltage Angle Transducer)	P-Option* (Voltage Angle Transducer)
<b>Current Input</b>	Nominal Range** Overload Continuous Burden/Element	5 A 0.5–5 A 10 A 250 A 0.2 VA (maximum) at 5 A		N/A	
<b>Voltage Input</b>	Nominal Range** Overload Continuous Burden/Element	120 V 95–135 V 150 V 4 VA (maximum) at 120 V			
<b>Second Voltage Input</b>	Nominal Range** Overload Continuous Burden/Element	N/A		120 V 50–135 V 150 V 2.2 VA (maximum) at 120 V	
<b>External Auxiliary Power</b>	Input Range Frequency Range Burden	None Required	100–130 Vac 50–500 Hz 2 VA Nominal	None Required	100–130 Vac 50–500 Hz 2 VA Nominal
<b>Rated Output (RO)</b>		±1 mAdc for Standard Calibration	5 or 20 mAdc for Std. Calibration, depending on selected output range*	±1 mAdc for Standard Calibration	5 or 20 mAdc for Std. Calibration, depending on selected output range*
<b>Accuracy</b>		±1° at 25° C			
<b>Phase Angle Range (without ambiguous readings)</b>		0 to ±45°, 0 to ±60°, 0 to ±75°, and 0 to ±180°			
<b>Temperature Effect on Accuracy</b>		±0.5°	±0.6°	±0.5°	±0.6°
<b>Operating Temperature Range</b>		-20° C to +60° C	-20° C to +50° C	-20° C to +60° C	-20° C to +50° C
<b>Compliance Voltage</b>		10 Vdc	25 Vdc	10 Vdc	25 Vdc
<b>Load</b>		0–10,000 Ω	0–5,000 Ω for 1–3–5 mAdc units 0–1,250 Ω for 4–12–20 mAdc units	0–10,000 Ω	0–5,000 Ω for 1–3–5 mAdc units 0–1,250 Ω for 4–12–20 mAdc units
<b>Output Ripple Peak</b>		< 1% RO			
<b>Response Time</b>		< 400 ms to 99%			
<b>Standard Calibration Adjustments</b>	Gain Zero	±3% of Reading (minimum) ±2% RO (minimum)	±20% of Span (minimum) ±5% of Zero Point (minimum)	±3% of Reading (minimum) ±2% RO (minimum)	±20% of Span (minimum) ±5% of Zero Point (minimum)
<b>Frequency</b>		Nominal ±3%			
<b>Stability (per year)</b>		±1% RO, Noncumulative	±1% of Span, Noncumulative	±1% RO, Noncumulative	±1% of Span, Noncumulative
<b>Operating Humidity</b>		0–95% Noncondensing			
<b>Isolation</b>		Complete (Input/Output/Case)	Complete (Input/Output/Power/Case)	Complete (Input/Output/Case)	Complete (Input/Output/Power/Case)
<b>Dielectric Withstand</b>		1500 VRMS at 60 Hz			
<b>Surge Withstand</b>		ANSI/IEEE C37.90.1			
<b>Maximum Net Weight</b>		Weights vary by model; consult factory.			
<b>Approximate Dimensions</b>		See enclosure diagrams on page 85.			

## Specifications RLP AC Frequency Transducers

Specifications		0–1 mAdc (Frequency Transducer)	P-Option* (Frequency Transducer)
<b>Voltage Input</b>	Nominal Range Overload Continuous Burden/Element	120 V 90–150 V 150 V 2 VA (maximum) at 120 V	
<b>External Auxiliary Power</b>	Input Range Frequency Range Burden	None Required	100–130 Vac 50–500 Hz 2 VA Nominal
<b>Rated Output (RO)</b>		1 mAdc at Maximum Rated Frequency	5 or 20 mAdc for Standard Calibration, depending on selected output range*
<b>Accuracy</b>		±0.02% of Center Frequency at 25° C	±0.005% of Center Frequency at 25° C
<b>Temperature Effect on Accuracy</b>		±0.0025% / ° C	±0.005% / ° C
<b>Operating Temperature Range</b>		-20° C to +60° C	-20° C to +50° C
<b>Compliance Voltage</b>		10 Vdc	25 Vdc
<b>Load</b>		0–10,000 Ω	0–5,000 Ω for 1–5 mAdc units 0–1,250 Ω for 4–20 mAdc units
<b>Output Ripple Peak</b>		< 1% RO	< 1% of Span
<b>Response Time</b>		< 400 ms to 99%	
<b>Standard Calibration Adjustments</b>	Gain Zero	±5% of Span (minimum) ±10% of Span (minimum)	±20% of Span (minimum) ±5% of Zero Point (minimum)
<b>Stability (per year)</b>		±0.02% of Center Frequency	±0.04% of Center Frequency
<b>Operating Humidity</b>		0–95% Noncondensing	
<b>Isolation</b>		Complete (Input/Output/Case)	Complete (Input/Output/Power/Case)
<b>Dielectric Withstand</b>		1500 VRMS at 60 Hz	
<b>Surge Withstand</b>		ANSI/IEEE C37.90.1	
<b>Maximum Net Weight</b>		Weights vary by model; consult factory.	
<b>Approximate Dimensions</b>		See enclosure diagrams on page 85.	

# AMETEK

## Transducers

### Specifications RLP Temperature Transducers

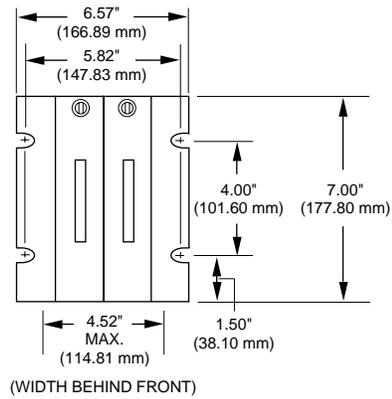
Specifications		0–1 mAdc (Temperature Transducer)	P-Option* (Temperature Transducer)
<b>External Auxiliary Power</b>	Input Range Frequency Range Burden	90–130 Vac 50–500 Hz 3.5 VA Nominal	100–130 Vac 50–500 Hz 5.5 VA Nominal
<b>Rated Output (RO)</b>		1 mAdc at Maximum Calibrated Temperature	5 or 20 mAdc for Standard Calibration, depending on selected output range*
<b>Accuracy</b>	Nickel-Iron Platinum Copper	0.8% of Span 0.5% of Span 0.8% of Span	
<b>Temperature Effect on Accuracy</b>		±0.015% / ° F	±0.017% / ° F
<b>Operating Temperature Range</b>		-20° C to +60° C (-4° F to +140° F)	-20° C to +50° C (-4° F to +122° F)
<b>Compliance Voltage</b>		10 Vdc	25 Vdc
<b>Open Circuit Voltage</b>		16 Vdc	30 Vdc
<b>Load</b>		0–10,000 Ω	0–5,000 Ω for 1–5 mAdc units 0–1,250 Ω for 4–20 mAdc units
<b>Output Ripple Peak</b>		< 1% RO	< 1% of Span
<b>Response Time</b>		< 50 ms to 99%	
<b>Standard Calibration Adjustments</b>	Gain Zero	±5% of Span (minimum) ±3% of Span (minimum)	±20% of Span (minimum) ±5% of Zero Point (minimum)
<b>Stability (per year)</b>		±0.4% RO, Noncumulative	±0.5% of Span, Noncumulative
<b>Operating Humidity</b>		0–95% Noncondensing	
<b>Isolation</b>		Input/Power/Case and Output/Power/Case	
<b>Dielectric Withstand</b>		1500 VRMS at 60 Hz	
<b>Surge Withstand</b>		ANSI/IEEE C37.90.1	
<b>Maximum Net Weight</b>		Weights vary by model; consult factory.	
<b>Approximate Dimensions</b>		See enclosure diagrams on page 85.	

# Enclosure Drawings

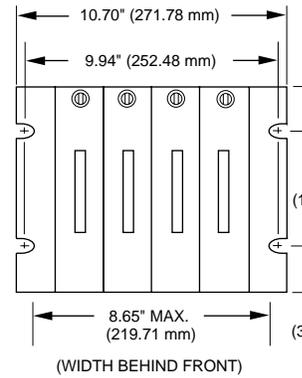
## RLP Modular Plug-In Transducers

### ENCLOSURE DRAWINGS

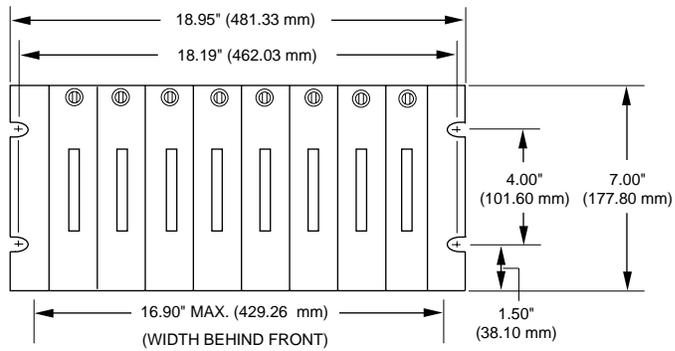
**2-Module Enclosure**



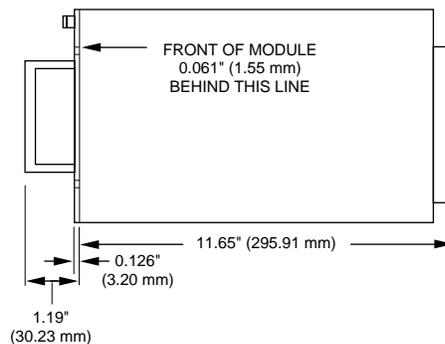
**4-Module Enclosure**



**8-Module Enclosure (front view)**



**Enclosure Module (side view)**

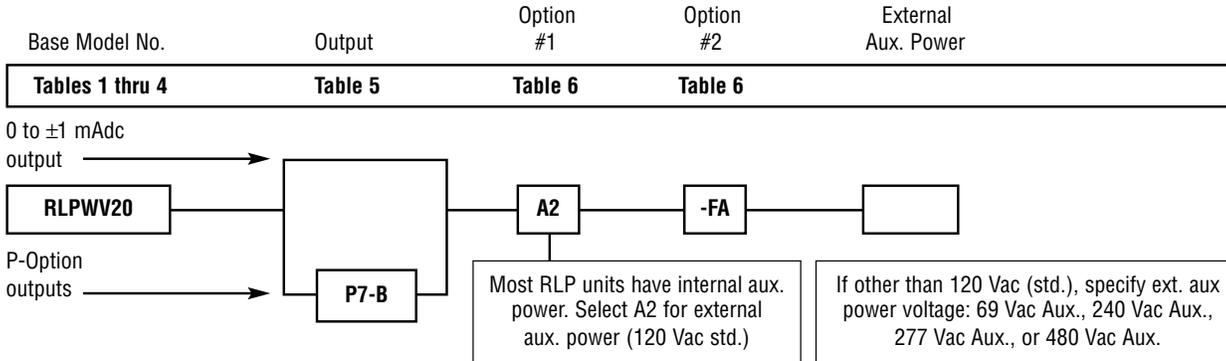


# AMETEK Transducers

## Ordering Procedure RLP Modular Plug-In Transducers

### ORDERING PROCEDURE

Specify by base model number and appropriate selection or option suffixes in the order shown in the following example.



EXAMPLES: RLPWV20A2-FA  
2-element, 0 to ±1 mAdc Watt/Var Plug-In Transducer; 120 Vac external auxiliary power; front access.

RLPWV20P7-BA2-FA  
2-element, 4-12-20 mAdc Watt/Var Plug-In Transducer; 120 Vac external auxiliary power; front access.

**You must specify a model number for each module position in the bin (l-r). Specify unused positions as either "blank" or "empty".**

Position 1	
Position 2	
Position 3	
Position 4	
Position 5	
Position 6	
Position 7	
Position 8	

**You must specify the size of enclosure and quantity of blank modules (if required). This information is not part of the model number, but must be provided to the factory when you place your order. Delete the "K" from the part numbers below if you do not want the factory to assemble your enclosure.**

8-Position Bin		10093-001K
4-Position Bin		10387-001K
2-Position Bin		10386-001K
Quantity of Blanks		10184-001

**Table 1 Current or Voltage Base Model Numbers**

**CURRENT OR VOLTAGE TRANSDUCERS IN ONE PLUG-IN MODULE**

Current Model No.	Description
RLPC	One Current Unit
RLPC2	Two Current Units
RLPC3	Three Current Units
Voltage Model No.	Description
RLPE	One Voltage Unit
RLPE2	Two Voltage Units
RLPE3	Three Voltage Units
RLPE4*	Four Voltage Units
Expanded-Scale Voltage Model No.	Description
RLPEX	One Voltage Unit (with 90-150 V expanded-scale option)
RLPEX2	Two Voltage Units (with 90-150 V expanded-scale option)
RLPEX3	Three Voltage Units (with 90-150 V expanded-scale option)

**COMBINED CURRENT/VOLTAGE TRANSDUCERS IN ONE PLUG-IN MODULE**

Combined Current/Voltage Model No.	Description
RLPCE	One Current Unit/One Voltage Unit
RLPC2E	Two Current Units/One Voltage Unit
RLPC3E*	Three Current Units/One Voltage Unit
RLPCE2	One Current Unit/Two Voltage Units
RLPCE3*	One Current Unit/Three Voltage Units
RLPCE4*	One Current Unit/Four Voltage Units
RLPC2E2*	Two Current Units/Two Voltage Units
RLPC2E3*	Two Current Units/Three Voltage Units
RLPC2E4*	Two Current Units/Four Voltage Units
RLPC3E2*	Three Current Units/Two Voltage Units
RLPC3E3*	Three Current Units/Three Voltage Units

**\*Not available with 1-5 or 4-20 mAdc outputs.**

## Ordering Procedures RLP Modular Plug-In Transducers

**Table 2 Watt or Var Base Model Numbers**

WATT OR VAR TRANSDUCERS IN ONE PLUG-IN MODULE				COMBINED WATT/VAR TRANSDUCERS IN ONE PLUG-IN MODULE	
Watt Model No.	Description	Var Model No.	Description	Combined Watt/ Var Model No.	Description
RLPW10	1-Element Watt	RLPV10	1-Element Var	RLPWW10	1-Element Watt/Var
RLPW15	1 1/2-Element Watt	RLPV15	1 1/2-Element Var	RLPWW15	1 1/2-Element Watt/Var
RLPW20	2-Element Watt	RLPV20	2-Element Var	RLPWW20	2-Element Watt/Var
RLPW25	2 1/2-Element Watt	RLPV25	2 1/2-Element Var	RLPWW25	2 1/2-Element Watt/Var
RLPW30	3-Element Watt	RLPV30	3-Element Var	RLPWW30	3-Element Watt/Var
				RLPWW10-30*	Three 1-Element Watt/Vars

\*Not available with 1-5 or 4-20 mAdc outputs.

**Table 3 Phase Angle or Voltage Angle Base Model Numbers**

ONE OR TWO PHASE ANGLE TRANSDUCERS IN ONE PLUG-IN MODULE		ONE OR TWO VOLTAGE ANGLE TRANSDUCERS IN ONE PLUG-IN MODULE	
Phase Angle Model No.	Description	Voltage Angle Model No.	Description
RLPF1-45	One 45° Phase Angle Unit	RLPA1-45	One 45° Voltage Angle Unit
RLPF1-60	One 60° Phase Angle Unit	RLPA1-60	One 60° Voltage Angle Unit
RLPF1-75	One 75° Phase Angle Unit	RLPA1-75	One 75° Voltage Angle Unit
RLPF1-180	One 180° Phase Angle Unit	RLPA1-180	One 180° Voltage Angle Unit
RLPF2-45	Two 45° Phase Angle Units	RLPA2-45	Two 45° Voltage Angle Units
RLPF2-60	Two 60° Phase Angle Units	RLPA2-60	Two 60° Voltage Angle Units
RLPF2-75	Two 75° Phase Angle Units	RLPA2-75	Two 75° Voltage Angle Units
RLPF2-180	Two 180° Phase Angle Units	RLPA2-180	Two 180° Voltage Angle Units

**Table 4 Frequency Base Model Numbers**

ONE OR TWO FREQUENCY TRANSDUCERS IN ONE PLUG-IN MODULE	
Frequency Model No.	Description
RLPZ150	One 50 Hz Frequency Unit
<b>RLPZ160</b>	<b>One 60 Hz Frequency Unit</b>
RLPZ1400	One 400 Hz Frequency Unit
RLPZ250	Two 50 Hz Frequency Units
<b>RLPZ260</b>	<b>Two 60 Hz Frequency Units</b>
RLPZ2400	Two 400 Hz Frequency Units

**Table 5 Output Selection**

	P-Option	Output Range	Compliance Voltage	Maximum Load	Max. Open Circuit Voltage
<b>0 to ±1 mAdc output is standard, and is specified by the Base Model Numbers. For outputs other than 0 to ±1 mAdc, indicate the appropriate P-Option in the "Output" position of the complete model number.</b>	P6**	1-5 mAdc	25 Vdc	5000 Ω	30 Vdc
	P7**	4-20 mAdc	25 Vdc	1250 Ω	30 Vdc
	P6-B***	1-3-5 mAdc	25 Vdc	5000 Ω	30 Vdc
	P7-B***	4-12-20 mAdc	25 Vdc	1250 Ω	30 Vdc

\*\*P6 and P7 options are available for all RLP types except Phase Angle and Voltage Angle.

\*\*\*P6-B and P7-B options are available for all RLP types except Current, Voltage, Frequency, and Temperature.

**Table 6 Options**

Option	Description
-1	240 V Input
-5	10 A Input
A2****	External Auxiliary Power (120 Vac std.)
-FA	Front Access

\*\*\*\*Most RLP transducers come standard with internal auxiliary power (A4 option). If you require external auxiliary power, the A2 option designator should come before any other options in the complete model number.

If you require additional options not shown here, please consult the factory.

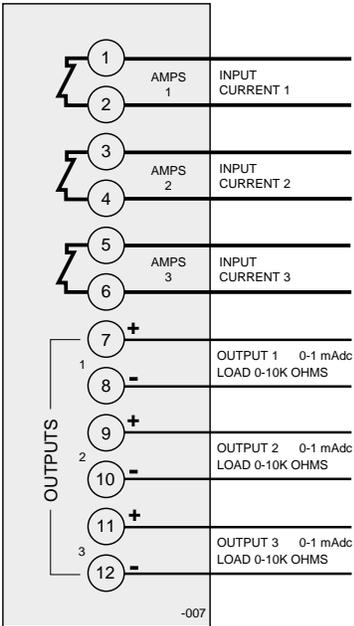
Combined Watt/Watthour or Var/Varhour and Combined Phase/Voltage Angle transducers are available in RLP format on special order. Please consult the factory for more information.

# AMETEK Transducers

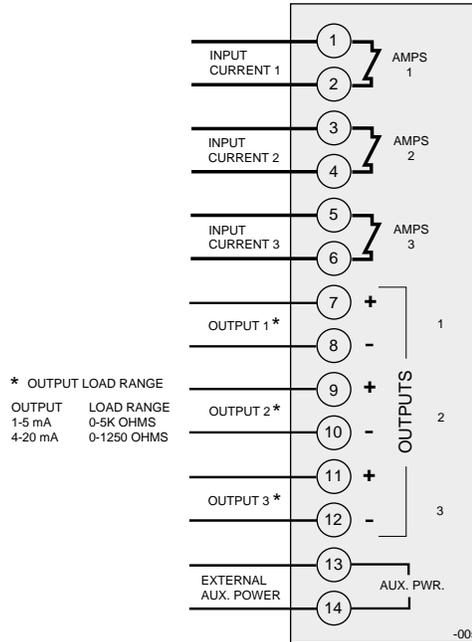
## Wiring Diagrams RLP Modular Plug-In Transducers

### WIRING DIAGRAMS

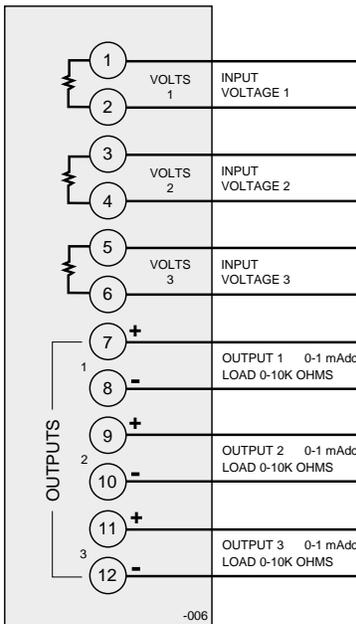
Models C, C2, C3 Current



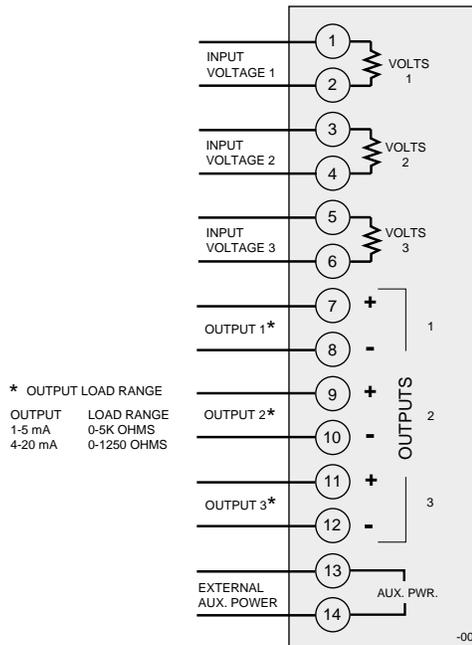
Models CP7A2, C2P7A2, C3P7A2 Current with External Aux. Power



Models E, E2, E3 Voltage  
Models EX, EX2, EX3 Expanded-Scale Voltage  
Models Z1, Z2 Frequency



Models EP7A2, E2P7A2, E3P7A2 Voltage with External Aux. Power  
Models Z1P7A2, Z2P7A2 Frequency with External Aux. Power  
(Consult factory for drawing of Expanded-Scale Voltage with External Aux. Power)

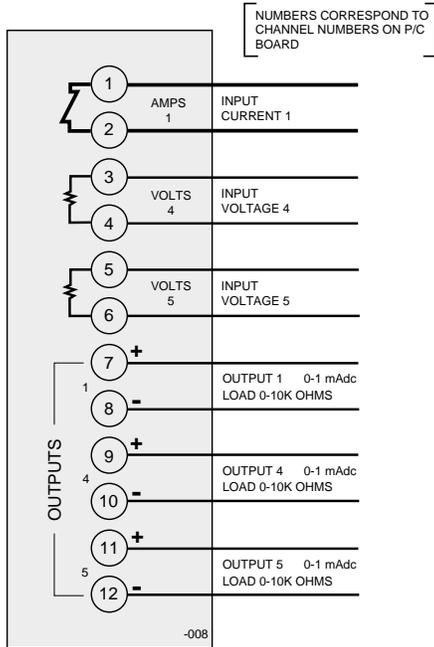


# Wiring Diagrams

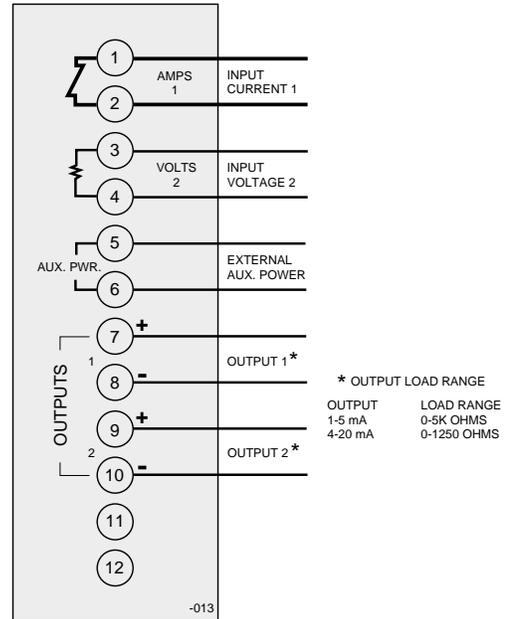
## RLP Modular Plug-In Transducers

### WIRING DIAGRAMS

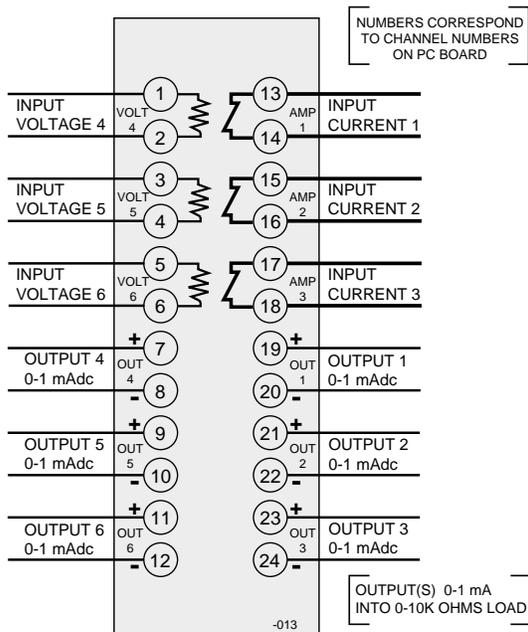
Models CE, CE2, Current/Voltage



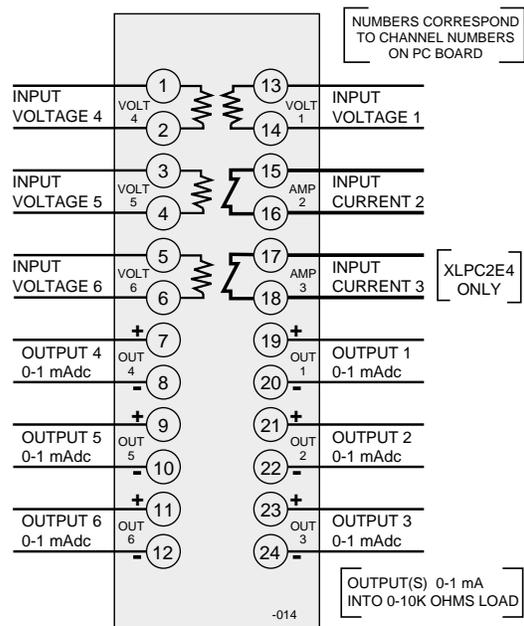
Model CEP7A2 Current/Voltage with External Aux. Power  
(Consult factor<sup>y</sup> for drawing of CE2P7A2)



Models CE3, C2E, C2E2, C2E3, C3E, C3E2, C3E3 Current/Voltage



Models CE4, C2E4, Current/Voltage  
Model E4 Voltage

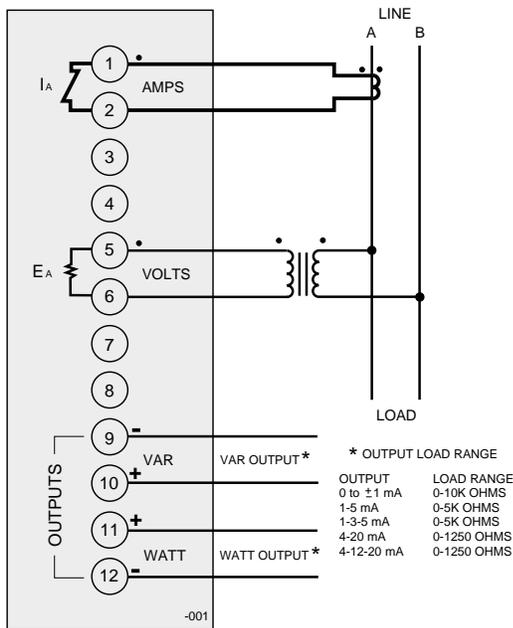


# AMETEK Transducers

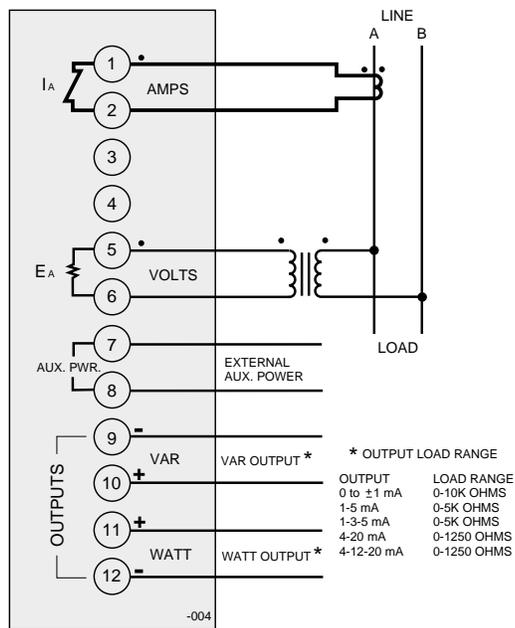
## Wiring Diagrams RLP Modular Plug-In Transducers

### WIRING DIAGRAMS

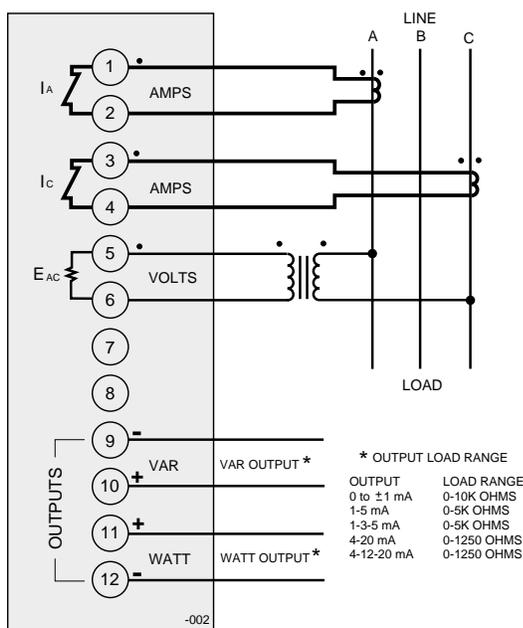
1-Element Watt, Var, Watt/Var



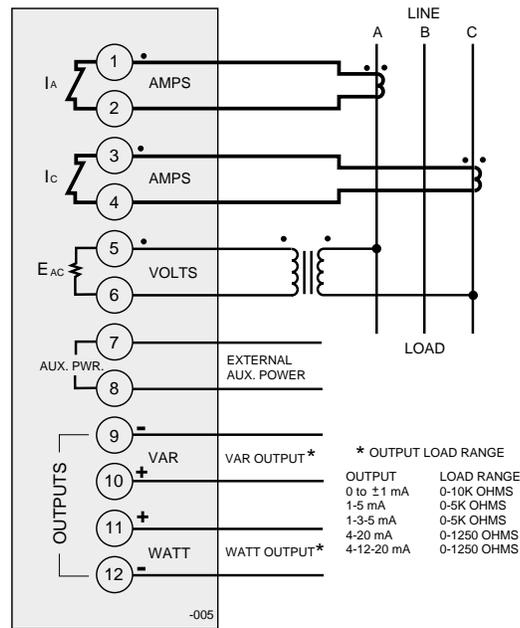
1-Element Watt, Var, Watt/Var with External Aux. Power



1 1/2-Element Watt, Var, Watt/Var



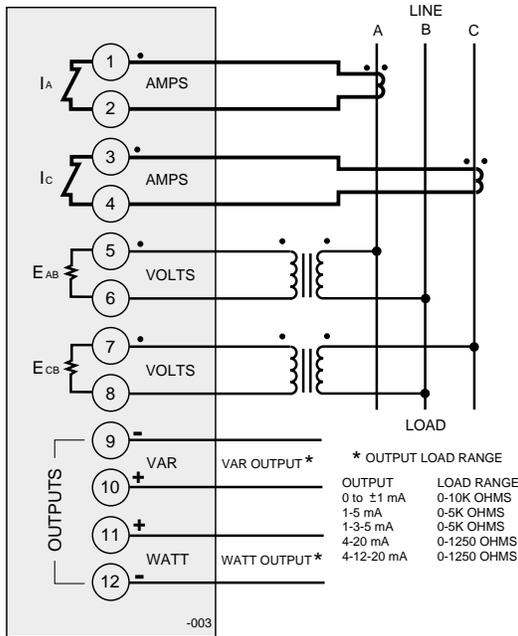
1 1/2-Element Watt, Var, Watt/Var with External Aux. Power



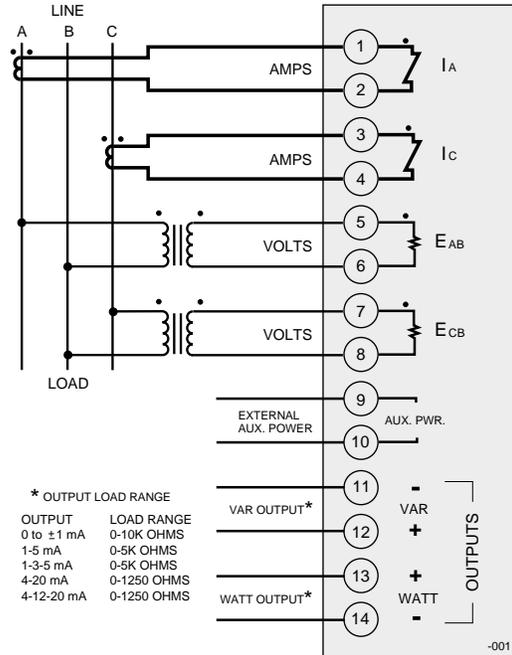
# Wiring Diagrams RLP Modular Plug-In Transducers

## WIRING DIAGRAMS

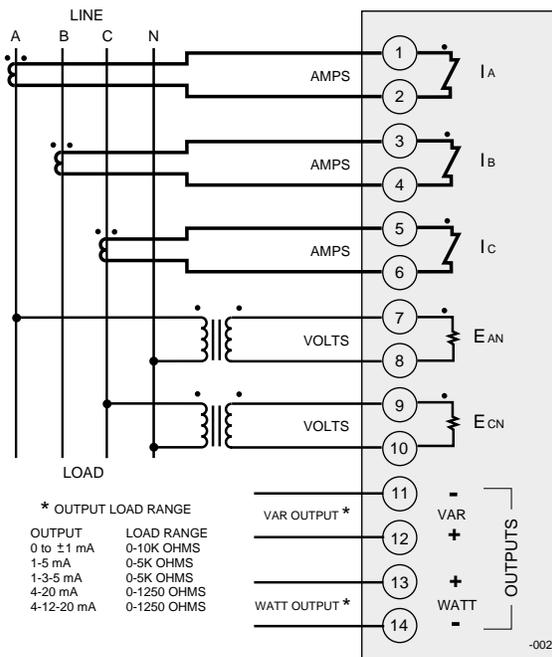
2-Element Watt, Var, Watt/Var



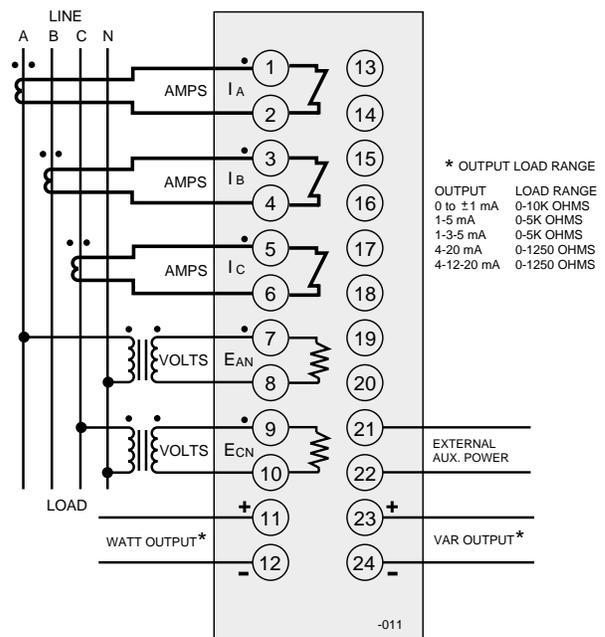
2-Element Watt, Var, Watt/Var with External Aux. Power



21/2-Element Watt, Var, Watt/Var



21/2-Element Watt, Var, Watt/Var with External Aux. Power

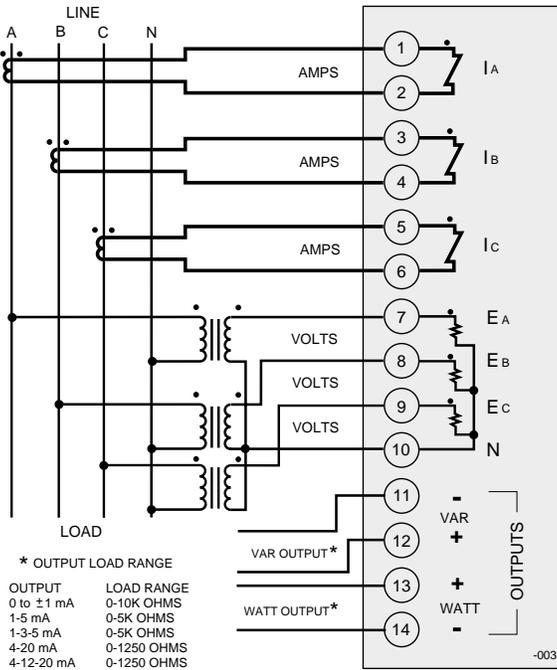


# AMETEK Transducers

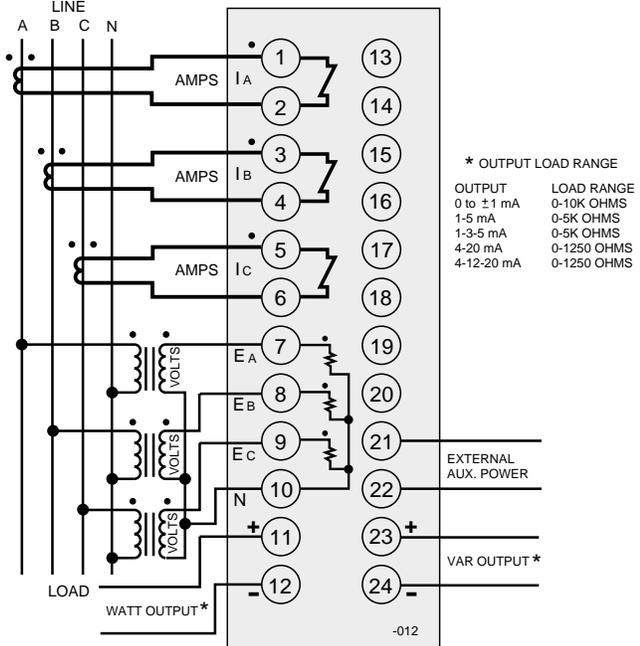
## Wiring Diagrams RLP Modular Plug-In Transducers

### WIRING DIAGRAMS

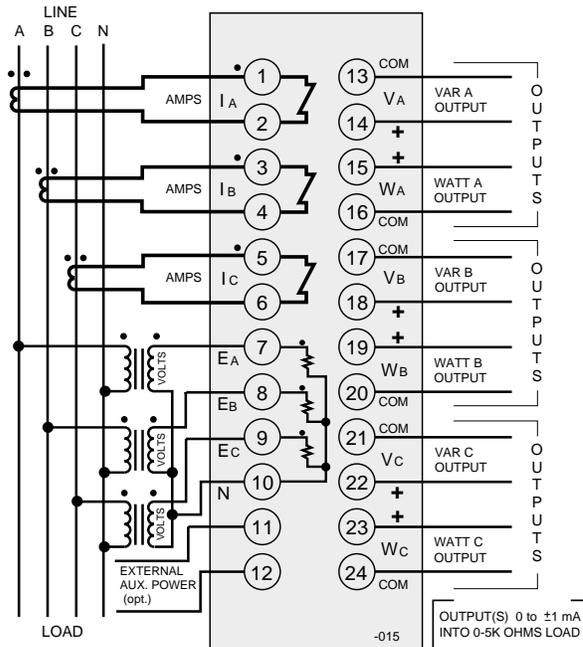
3-Element Watt, Var, Watt/Var



3-Element Watt, Var, Watt/Var with External Aux. Power



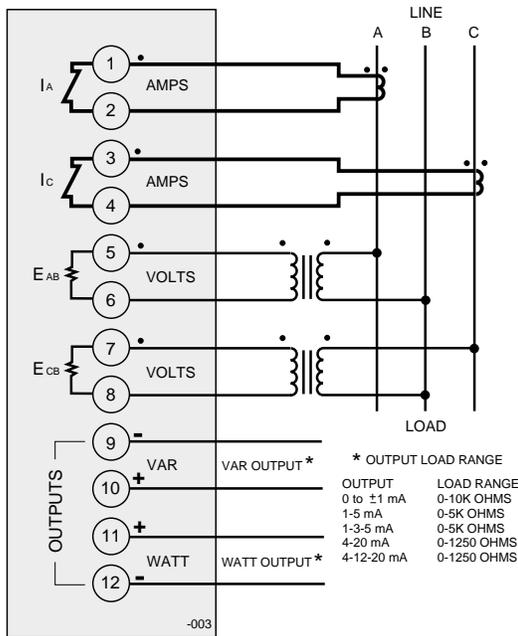
Three 1-Element Watt/Vars in One Module with or without External Aux. Power



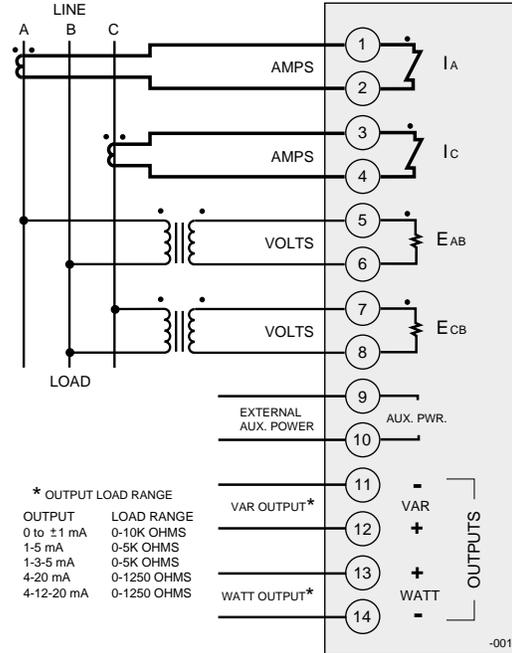
# Wiring Diagrams RLP Modular Plug-In Transducers

## WIRING DIAGRAMS

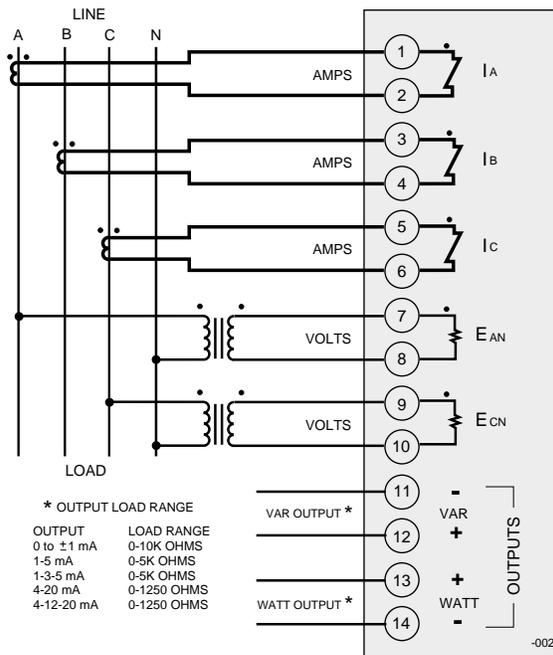
2-Element Watt, Var, Watt/Var



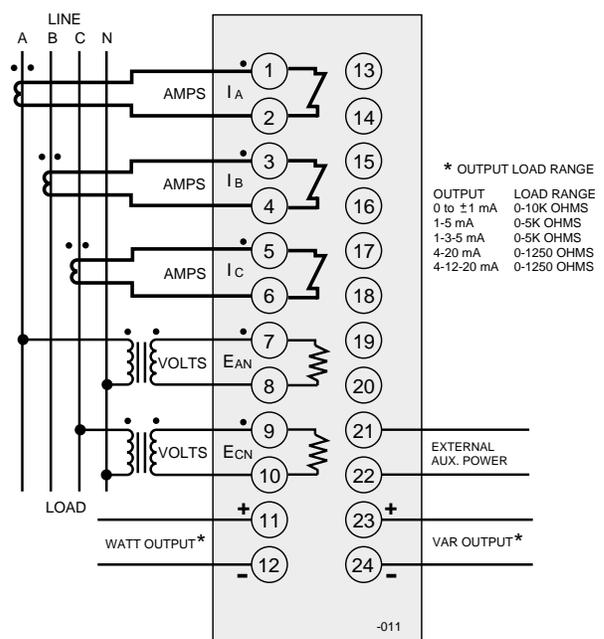
2-Element Watt, Var, Watt/Var with External Aux. Power



2 1/2-Element Watt, Var, Watt/Var



2 1/2-Element Watt, Var, Watt/Var with External Aux. Power



# AMETEK

## Transducers

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# Ametek DIN Series Transducers

## Ordering Information

The model number of each R-SERIES transducers includes coded information regarding the FUNCTION, INPUT SIGNAL and OUTPUT. Determine the desired FUNCTION and refer to the Table of Contents to locate the page on which the transducers that perform that function are listed. The model numbers are coded as explained below:

The first group of letters designate the FUNCTION, such as “RV”, “RMSV”, “RI”, “RW”, etc. Multifunction models include a combination of letters denoting specific functions, such as V, I, W. For three-channel transducers, the digit “3” appears after the FUNCTION code. The second group of digits indicates the full scale of the INPUT PARAMETER, i.e., VOLTAGE or current or BOTH.

For DC CURRENT and DC POWER transducers, the input current is specified as a voltage obtained from a DC current shunt, (e.g., “.05” indicates 50 Millivolt at full scale DC current).

Finally, the third group of digits indicates the output signal. One or two digits indicates a DC VOLTAGE output. When these are followed by “M”, the output is in mADC. If the part number ends with a “4/20”, the output is 4 to 20 Milliamperes DC. For explanation of the codes of FREQUENCY transducers, please refer to page 24. Several examples of transducers model numbers are shown below:



MODEL	DESCRIPTION
RMSV-150-1M	TRUE RMS voltage transducer with a 150 VAC input range and an output of 1 mADC.
RMSV3-150-4/20	Three-channel TRUE RMS voltage transducer with 150 VAC input for each channel and a 4/20 mADC output for each channel.
RW-300-5-10	AC WATT transducer with 300 VAC input voltage, 5 AAC input current and 10 VDC output.
RWDC-50-0.1-10	DC WATT transducer with 50VDC input voltage, 100 mADC input current and 10 VDC output.

# AMETEK Transducers

## Theory of Operation

### INTRODUCTION

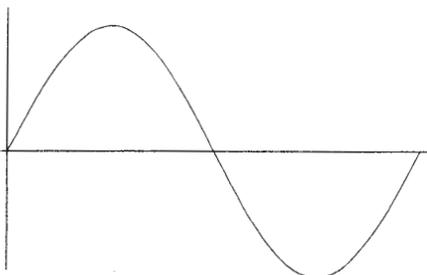
The R-Series Transducers are designed for accurately measuring electrical parameters of AC and DC electric networks. The transducers convert the incoming voltage and current signals to a DC analog signal that can be processed by external monitoring and logging circuits and provide a high voltage isolation between the input and the output. True RMS AC voltage and current transducers provide output signals that are TRUE RMS values of the input parameters independent of the signal waveshape. The averaging AC voltage and current transducers provide output signals which are proportional to the average value of the incoming signal and are calibrated as the RMS of a sine wave input signal. The AC WATT transducers provide output signals that represent REAL ACTIVE POWER for any network power factor. Other transducers are available for measuring KVAR, KVA and FREQUENCY.

The standard output options of the transducers are 0-10 VDC, 0-1 mADC, or 4-20 mADC.

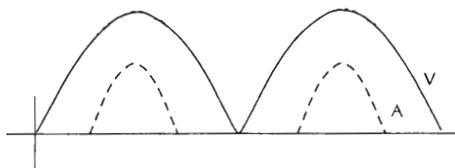
The current transformers are available with either a 1-Ampere or a 5-Ampere output at full scale.

### WHAT IS A TRUE RMS TRANSDUCER?

The voltages and currents in AC power lines, when not affected by a complex non-linear load, are basically sine waves which represent voltage produced by a rotating generator. The average value of a sine wave voltage is 70.7% of the peak value of the sine wave as shown in the following diagram.



In a network that has non-linear loads, such as rectifiers, adjustable speed drives or switching power supplies that are used in many computers, the waveshapes of the voltage and the current are distorted. The waveshapes of a rectifier circuit are shown in the following diagram.



The true value of a distorted wave is not represented by an average reading instrument. The more accurate method is the TRUE ROOT MEAN SQUARE, or RMS, value as obtained by a TRUE RMS converter.

A TRUE RMS converter is a specialized electronic circuit that measures the incoming voltage or current signal, amplifies it, multiplies the value by itself, computes the mean value of this product, computes the square root value of the mean, and provides an output signal which is the true RMS value of the signal.

### TRANSDUCERS with ANALOG OUTPUTS

AC voltage and current transducers that provide an analog output are very common in the process industry and in electrical switchboard systems. Such transducers provide either a DC voltage or a DC current that can be read by monitoring meters, loggers, oscilloscope and recorders. A 4-20 Milliampere DC output signal is commonly used in control systems.

### ISOLATION

To protect the operator and the equipment connected to a transducer from the high voltages present in electric networks, electrical transducers incorporate means of isolating the output wires and the enclosure from the line voltage. Isolating the input from the output can be achieved either by means of transformers or by optical isolating circuits.

Electrical transducers can be connected directly to a power line or they can be connected to voltage reducing transformers and current reducing transformers. Voltage reducing transformers, known as Potential Transformers (PTs), reduce the high voltage of a power line to a level that is compatible with the input range of the transducer being used. Current transformers, sometimes referred to as "CTs", reduce the high current in a power line to a level that is compatible with the transducer range or the meter range. The output of many installed metering CTs is 5 Amperes at full scale.

## WHAT ARE POWER TRANSDUCERS?

Monitoring the power delivered to a load provides important information on the power line. When dealing with a purely linear resistive load, the power consumed by the load can be obtained by multiplying the voltage by the current. In actual practice, however, loads are rarely purely resistive. Practical loads contain capacitive or inductive components which cause a phase shift between the voltage and the current. The phase shift and the distortion are taken into consideration by the Ametek power transducers.

The **Real Power** consumed by a load is :

$$W = E \times I \times \text{COSINE } q \quad (1)$$

Where  $W$  = Real Power in Watts  
 $E$  = Voltage in Volts  
 $I$  = Current in Amperes  
 $q$  = Phase Angle

The **Apparent Power** is the product of the voltage and the current:

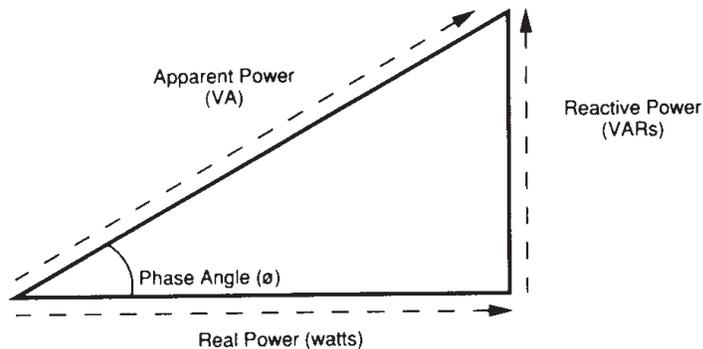
$$VA = E \times I \quad (2)$$

The **Reactive Power** is expressed as:

$$\text{VAR} = E \times I \times \text{SINE } q \quad (3)$$

### The Power Triangle

The relationship between the apparent power, the real power, the reactive power and the phase angle can be displayed as shown below:



## The Power Factor

The Cosine of the phase angle is referred to as the Power Factor. The **Real Power** can, therefore, be obtained by:

$$W = E \times I \times \text{PF} \quad (4)$$

Where PF is the Power Factor

## WHAT ARE CURRENT TRANSFORMERS?

The **CURRENT** ratio of a standard magnetic-core transformer, ignoring losses, is defined by the equation:

$$I_2 = (N_1/N_2) \times I_1$$

Where  $I_1$  = Input current,  $I_2$  = Output current  
 $N_1$  = Number of turns of primary coil  
 $N_2$  = Number of turns of secondary coil

An AC current transformer is a special kind of transformer which does not have a primary coil. The conductor whose current is to be measured acts as the primary coil when it is placed inside the magnetic path of the core.

The signal obtained from an AC current transformer has the same waveshape as the current being measured. However, current transformers introduce measurement errors of amplitude, phase and waveshape due to frequency range limitations.

A current transformer converts the primary current of the conductor to a current output whose value depends on  $N_2$ . Using equation (1), the output current can be computed if  $N_2$  is known. If  $N_2$  is 1000 turns, the output current is 1/1000 of the primary current, which can be expressed as 1 Milliampere per Ampere. Such a current transformer is referred to as having a ratio of 1000:1. The output of this CT can be read by any AC ammeter whose input impedance is compatible with the specifications of the current transformer.

# AMETEK

## Transducers

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### MEASURING POWER

The active power in Watts in a single-phase electric network with a linear load can be obtained by the following equation:

$$W = E \times I \times PF$$

For a resistive load, the Power Factor is 1.0. For reactive loads, such as motors and compressors, the voltage and the current are not in phase, and the power factor is always less than 1.0. The Ametek transducers and power line monitors perform this computation internally. They measure the voltage either directly or by the use of a step-down transformer. The current is measured either directly or by using a current transformer.

In a balanced three-phase **WYE** network, where all three loads are identical, only one current clamp or current transformer is needed, and the power is given by the following equation:

$$W = 3 \times V_a \times I_1 \times PF$$

Where  $V_a = V_b = V_c =$  Phase-to-Neutral voltage  
 $I_1 = I_2 = I_3 =$  Phase current

If the loads are unbalanced, three current transformers are required, and the following equation applies:

$$W = (V_a \times I_1 \times PF_1) + (V_b \times I_2 \times PF_2) + (V_c \times I_3 \times PF_3)$$

In a balanced DELTA network, again only one current transformer is needed, and the power is:

$$W = 3 \times V_{a-b} \times I_1 \times PF$$

Where  $V_{a-b} = V_{b-c} = V_{c-a} =$  Phase-to-Phase voltage  
 $I_1 = I_2 = I_3 =$  Phase current

If the load is unbalanced, either two or three CTs are required. The power of each phase must be computed and summed to obtain the total network power.

Non-linear loads, such as SCR control circuits and switching power supplies, cause distortion of the currents and the voltages, and they introduce harmonic frequencies to the power line. Under these conditions, PTs and CTs must have a wide frequency response so that the harmonics of the line frequency are not eliminated from the power computation. In addition, the power transducers must be capable of processing distorted waveforms caused by non-linear loads.

### GLOSSARY OF TERMS

**Ampere:** The unit of measuring alternating (AC) or direct (DC) electric current.

**Volt:** The unit of measuring alternating (AC) or direct (DC) electric potential force (voltage).

**RMS:** Root Mean Square is the square root of the sum of the squares of instantaneous amplitudes of a waveform. It is the effective value of an AC waveform that produces heat equivalent to a DC of the same value.

**Power:** Electrical energy expended per unit time.

**Apparent Power:** (in VA) is the product of the voltage and the current delivered to a load.

**Real Power:** (in Watts) is the component of the apparent power that represents true work.

**Reactive Power:** (in VAR) is the component of the apparent power which performs no real work.

**Frequency:** (in Hertz) the number of periods of a waveform that occurs in one second.

**Power Line Frequency:** The fundamental frequency of a power system (60 Hz in the US, 50 Hz in many other countries).

**Transformer:** A device that transfers a voltage (PT) or a current (CT) using a coupling of electromagnetic flux fields of its windings.

**Power Factor:** The ratio of Real Power to the Apparent Power ( $W/VA$ ).

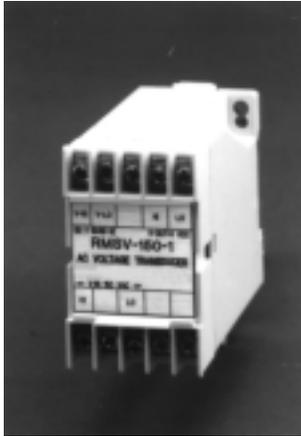
**Single-Phase:** Electric network in which only one phase of current is available in a two-conductor or a three-conductor circuit.

**Delta Connection:** Electric network using a 3-phase transformer where the windings form an electrical triangle whose corners are the connections to the 3-phase load.

**Wye ("Y") Connection:** Electric network using a 3-phase transformer with all phase windings connected to a common (Neutral) point.

**Accuracy Class:** The percent of the reading of an instrument plus a constant.

## EXAMPLES OF THE R-SERIES TRANSDUCERS



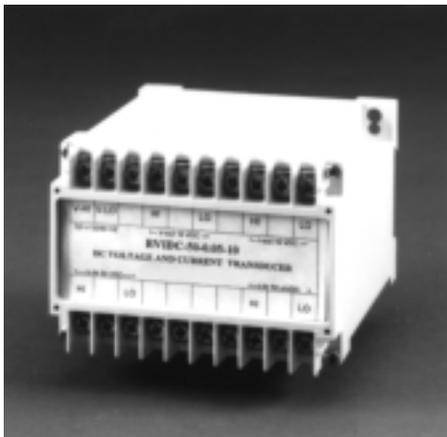
SIZE A  
TRANSDUCER



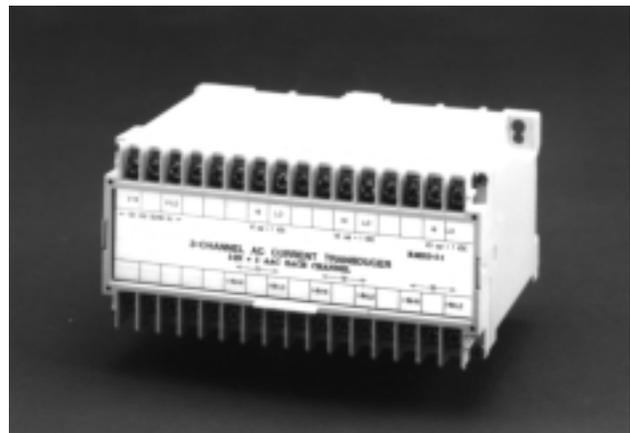
SIZE B  
TRANSDUCER



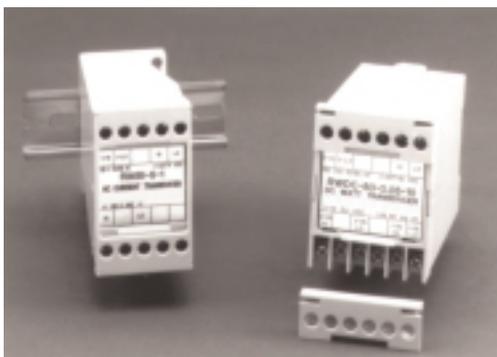
SIZE C  
TRANSDUCER



SIZE D  
TRANSDUCER



SIZE E  
TRANSDUCER



OPTIONAL TERMINAL COVERS

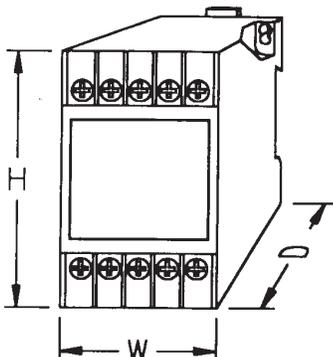
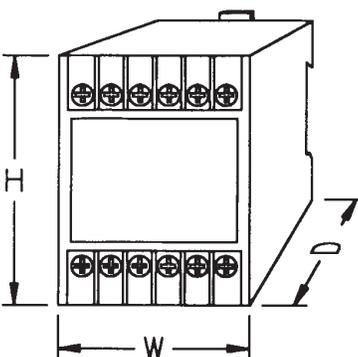
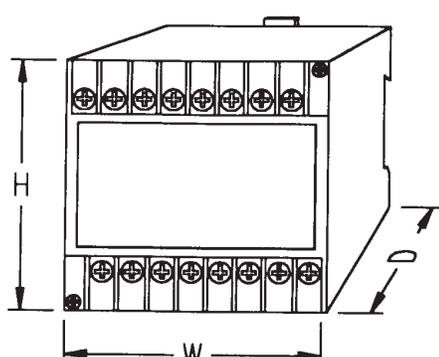
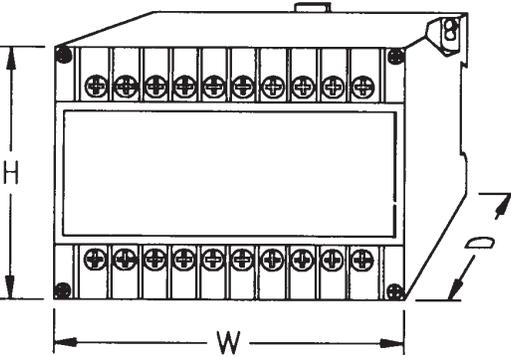
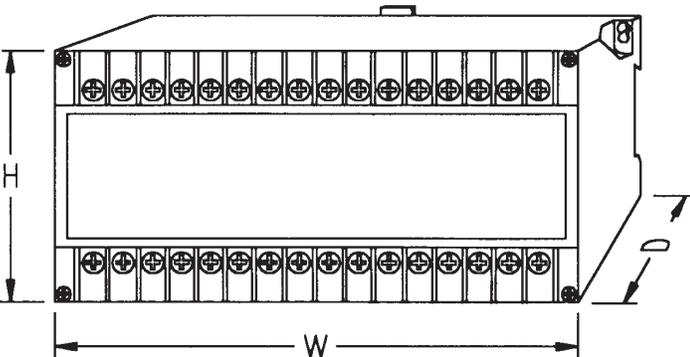
THE R-SERIES TRANSDUCERS ARE PACKAGED IN ENCLOSURES DESIGNED FOR DIN-RAIL MOUNTING. THE DIMENSIONS OF EACH MODEL ARE INCLUDED ON THE FOLLOWING PAGE.

THESE ENCLOSURES HAVE EXTERNAL AND INTERNAL BARRIERS BETWEEN TERMINALS TO PROVIDE ISOLATION AND TO PREVENT ACCIDENTAL TOUCHING OF LIVE VOLTAGES THAT MAY BE PRESENT ON THE TERMINALS.

OPTIONAL SNAP-ON TERMINAL COVERS ARE AVAILABLE TO PROVIDE ADDED PROTECTION AGAINST ELECTRICAL SHOCK AND SHORTING.

# AMETEK Transducers

## PHYSICAL SPECIFICATIONS OF THE R-SERIES TRANSDUCERS

SIZE A	SIZE B	SIZE C
		
<p>WIDTH: 1.77" (45.0 mm)            HEIGHT: 2.9" (75.0 mm)            DEPTH: 4.4" (112 mm)            No. of TERMINALS: 10</p>	<p>WIDTH: 2.17" (55.0 mm)            HEIGHT: 2.9" (75.0 mm)            DEPTH: 4.4" (112 mm)            No. of TERMINALS: 12</p>	<p>WIDTH: 2.95" (75.0 mm)            HEIGHT: 2.9" (75.0 mm)            DEPTH: 4.4" (112 mm)            No. of TERMINALS: 16</p>
SIZE D		SIZE E
		
<p>WIDTH: 3.94" (100.0 mm)            HEIGHT: 2.9" (75.0 mm)            DEPTH: 4.49" (114 mm)            No. of TERMINALS: 20</p>		<p>WIDTH: 5.9" (150.0 mm)            HEIGHT: 2.9" (75.0 mm)            DEPTH: 4.4" (112 mm)            No. of TERMINALS: 32</p>
GENERAL SPECIFICATIONS		
<p><b>ENCLOSURE TYPE:</b>            Standard 35mm DIN Rail            and/or panel mounting holes  <b>HOUSING:</b> ABS  <b>PANEL:</b> Polycarbonate, 10% Glass Filled  <b>COLOR:</b> Light Gray</p>		<p><b>TERMINALS:</b>  <b>TERMINAL PRESSURE PLATES:</b>            Zinc Plated, Chromated Steel  <b>TERMINAL SCREWS:</b>            For Flat-head or Phillips Screwdrivers            Phillips Zinc Plated, Chromated Steel  <b>CONNECTOR CONTACT:</b>            Tin Plated Bronze  <b>TERMINAL COVERS ARE OPTIONAL</b></p>

# AC VOLTAGE TRANSDUCERS

**RV**

**0.5% ACCURACY**

## SPECIFICATIONS

INPUT SIGNAL RANGE: FULL SCALE - CONTINUOUS  
50% OVERRANGE - 3 MINUTES  
(600 Volts Maximum)

OUTPUT SIGNAL: AVERAGE (Calibrated as RMS value  
of a sinewave)

OUTPUT OPTIONS: 0-10 VDC;  
0-1 or 4-20 mADC

LINE FREQUENCY: 50-400 Hz

ACCURACY AT 60 Hz: 0.5% of full Scale For Sine Wave

OUTPUT RIPPLE: 1% Peak-to-Peak Maximum

ISOLATION TEST: 1 kV - 1 MINUTE

TEMPERATURE RANGE: 0 to +50 Deg. C

STORAGE TEMPERATURE: -20 TO +80 Deg. C

POWER: 120 VAC 50/60 Hz

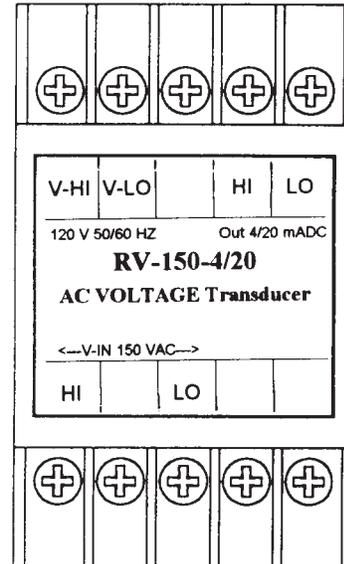
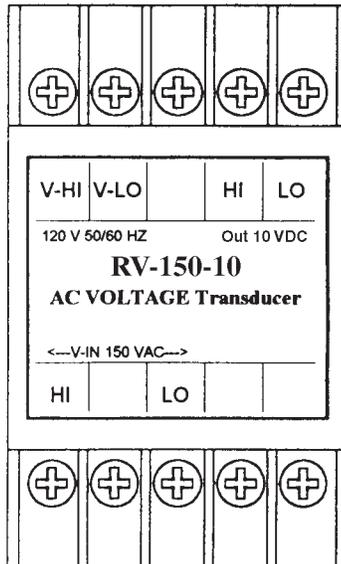
ENCLOSURE: DIN RAIL TYPE 46277

SIZE A: 1.77" x 2.9" x 4.4"

## Applications and Features

AVERAGE READING TRANSDUCERS.

FOR USE IN INEXPENSIVE VOLTAGE MONITORING.



## SELECTION CHART OF OUTPUT OPTIONS

INPUT	MODEL NUMBER RV-					
	10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
100 VAC	100-10	1083-000	100-1M	1083-004	100-4/20	1083-008
150 VAC	150-10	1083-001	150-1M	1083-005	150-4/20	1083-009
300 VAC	300-10	1083-002	300-1M	1083-006	300-4/20	1083-010
600 VAC	600-10	1083-003	600-1M	1083-007	600-4/20	1083-011

# AMETEK Transducers

## 3-CHANNEL AC VOLTAGE TRANSDUCERS

## RV3

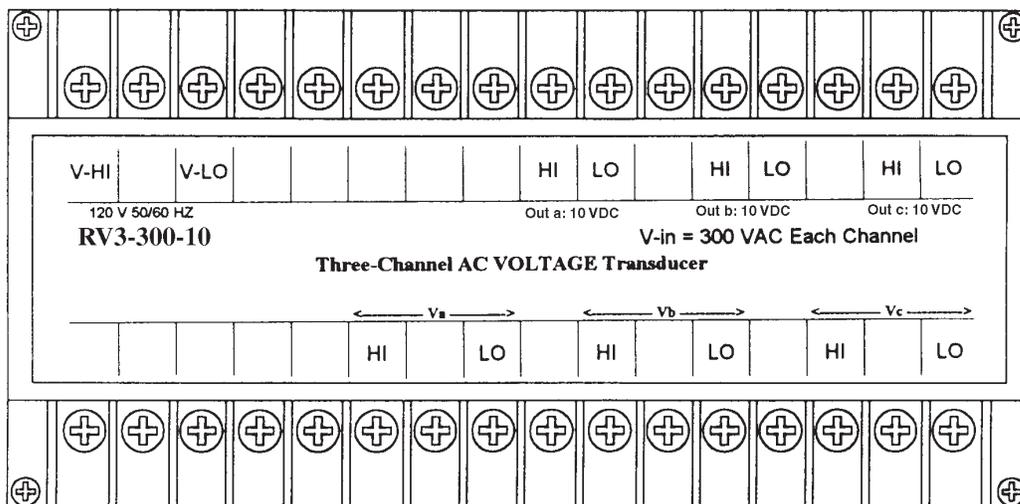
### 0.5% ACCURACY

### SPECIFICATIONS

INPUT SIGNAL RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 MINUTES (600 Volts Maximum)
OUTPUT SIGNALS:	AVERAGE (Calibrated as RMS value of a sinewave) One output for each channel
OUTPUT OPTIONS:	0-10 VDC 0-1 or 4-20 mADC
LINE FREQUENCY:	50-400 Hz
ACCURACY AT 60 Hz:	0.5% of full Scale For Sine Wave
OUTPUT RIPPLE:	1% Peak-to-Peak Maximum
ISOLATION TEST:	1 kV - 1 MINUTE
TEMPERATURE RANGE:	0 to +50 Deg. C
STORAGE TEMPERATURE:	-20 TO +80 Deg. C
POWER:	120 VAC 50/60 Hz
ENCLOSURE:	DIN RAIL TYPE 46277
SIZE E:	5.9" x 2.9" x 4.4"

### Applications and Features

AVERAGE READING TRANSDUCERS.  
FOR USE IN INEXPENSIVE VOLTAGE  
MONITORING.



### SELECTION CHART OF OUTPUT OPTIONS

MODEL NUMBER RV3-						
INPUT	10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
100 VAC	100-10	1083-012	100-1M	1083-016	100-4/20	1083-020
150 VAC	150-10	1083-013	150-1M	1083-017	150-4/20	1083-021
300 VAC	300-10	1083-014	300-1M	1083-018	300-4/20	1083-022
600 VAC	600-10	1083-015	600-1M	1083-019	600-4/20	1083-023

# TRUE RMS AC VOLTAGE TRANSDUCERS

## 0.5% ACCURACY

# RMSV

### SPECIFICATIONS

INPUT SIGNAL RANGE: FULL SCALE - CONTINUOUS  
50% OVERRANGE - 3 MINUTES  
(600 Volts Maximum)

OUTPUT SIGNAL: TRUE RMS

OUTPUT OPTIONS: 0-10 VDC;  
0-1 or 4-20 mADC

LINE FREQUENCY: 50-400 Hz

ACCURACY at 60 Hz: 0.5% of Full Scale

OUTPUT RIPPLE: 1% Peak-to-Peak Maximum

ISOLATION TEST: 1 kV - 1 MINUTE

TEMPERATURE RANGE: 0 to +50 Deg. C

STORAGE TEMPERATURE: -20 to +80 Deg. C

POWER: 120 VAC 50/60 Hz

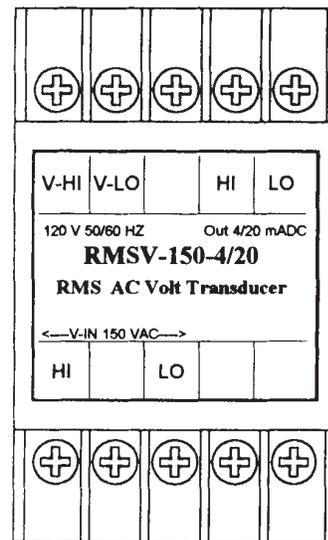
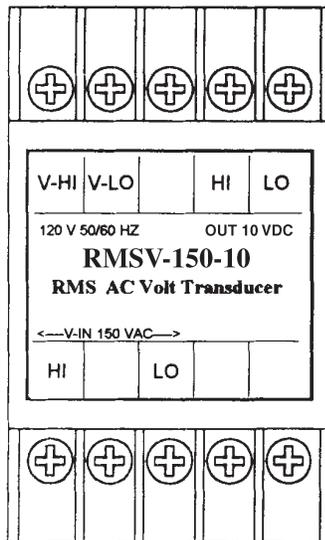
ENCLOSURE: DIN RAIL TYPE 46277

SIZE A: 1.77" x 2.9" x 4.4"

### Applications and Features

TRUE RMS TRANSDUCERS.

FOR NON-SINUSOIDAL VOLTAGE MONITORING.



### SELECTION CHART OF OUTPUT OPTIONS

MODEL NUMBER RMSV-						
INPUT	10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
100 VAC	100-10	1083-024	100-1M	1083-028	100-4/20	1083-032
150 VAC	150-10	1083-025	150-1M	1083-029	150-4/20	1083-033
300 VAC	300-10	1083-026	300-1M	1083-030	300-4/20	1083-034
600 VAC	600-10	1083-027	600-1M	1083-031	600-4/20	1083-035

# AMETEK Transducers

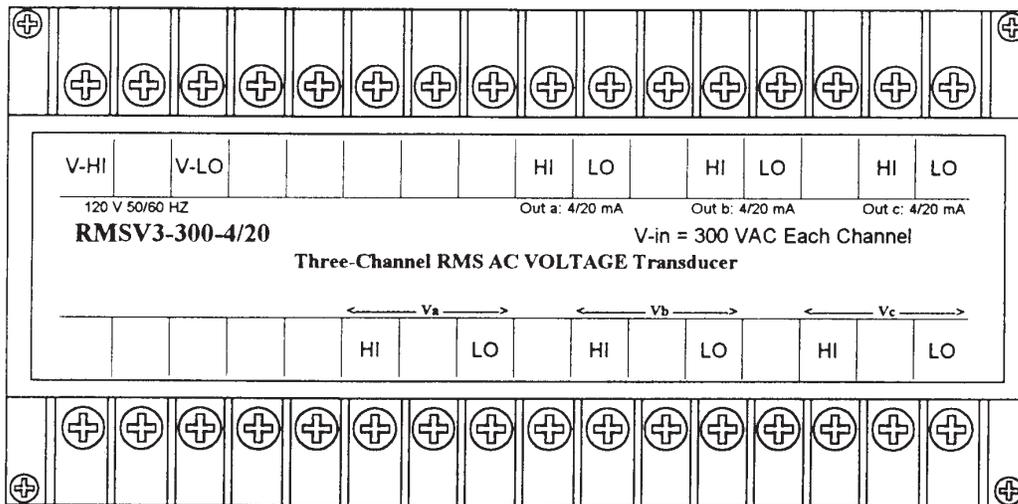
## 3-CHANNEL RMS AC VOLTAGE TRANSDUCERS **RMSV3** 0.5% Accuracy

### SPECIFICATIONS

INPUT SIGNAL RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 MINUTES (600 Volts Maximum)
THREE OUTPUT SIGNALS:	TRUE RMS
OUTPUT OPTIONS:	0-10 VDC 0-1 or 4-20 mADC
LINE FREQUENCY:	50-400 Hz
ACCURACY CLASS:	0.5% of Full Scale
OUTPUT RIPPLE:	1% Peak-to-Peak Maximum
ISOLATION TEST:	1 kV - 1 MINUTE
TEMPERATURE RANGE:	0 to +50 Deg. C
STORAGE TEMPERATURE:	-20 to +80 Deg. C
POWER:	120 VAC 50/60 Hz
ENCLOSURE:	DIN RAIL TYPE 46277
SIZE E:	5.9" x 2.9" x 4.4"

### Applications and Features

TRUE RMS TRANSDUCERS.  
FOR NON-SINUSOIDAL VOLTAGE MONITORING.



### SELECTION CHART OF OUTPUT OPTIONS

MODEL NUMBER RMSV3-						
INPUT	10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
100 VAC	100-10	1083-036	100-1M	1083-040	100-4/20	1083-044
150 VAC	150-10	1083-037	150-1M	1083-041	150-4/20	1083-045
300 VAC	300-10	1083-038	300-1M	1083-042	300-4/20	1083-046
600 VAC	600-10	1083-039	600-1M	1083-043	600-4/20	1083-047

# AC CURRENT TRANSDUCERS

RI

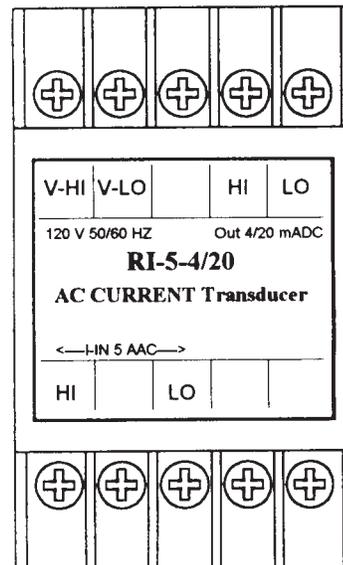
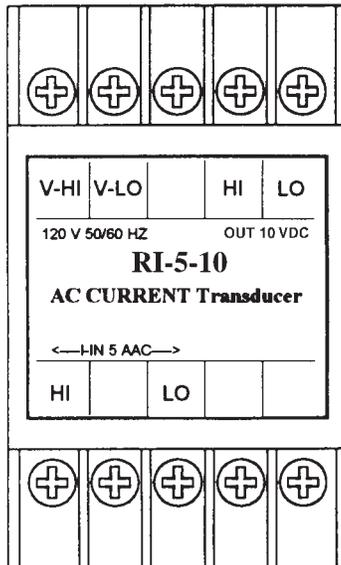
## 0.5% ACCURACY

### SPECIFICATIONS

INPUT SIGNAL RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 MINUTES
OUTPUT SIGNAL:	AVERAGE. CALIBRATED AS RMS VALUE OF A SINE WAVE
OUTPUT OPTIONS:	0-10 VDC; 0-1 or 4-20 mADC
LINE FREQUENCY:	50-400 Hz
ACCURACY at 60 Hz:	0.5% of Full Scale For Sine Wave
OUTPUT RIPPLE:	1% Peak-to-Peak Maximum
ISOLATION TEST:	1 kV - 1 MINUTE
TEMPERATURE RANGE:	0 to +50 Deg. C
STORAGE TEMPERATURE:	-20 to +80 Deg. C
POWER:	120 VAC 50/60 Hz
ENCLOSURE:	DIN RAIL TYPE 46277
SIZE A:	1.77" x 2.9" x 4.4"

### Applications and Features

AVERAGE READING TRANSDUCERS.  
FOR INEXPENSIVE CURRENT  
MONITORING.



### SELECTION CHART OF OUTPUT OPTIONS

MODEL NUMBER RI-						
INPUT	10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
1 AAC	1-10	1083-048	1-1M	1083-051	1-4/20	1083-054
5 AAC	5-10	1083-049	5-1M	1083-052	5-4/20	1083-055
10 AAC	10-10	1083-050	10-1M	1083-053	10-4/20	1083-056

# AMETEK Transducers

## 3-CHANNEL AC CURRENT TRANSDUCERS

**RI3**

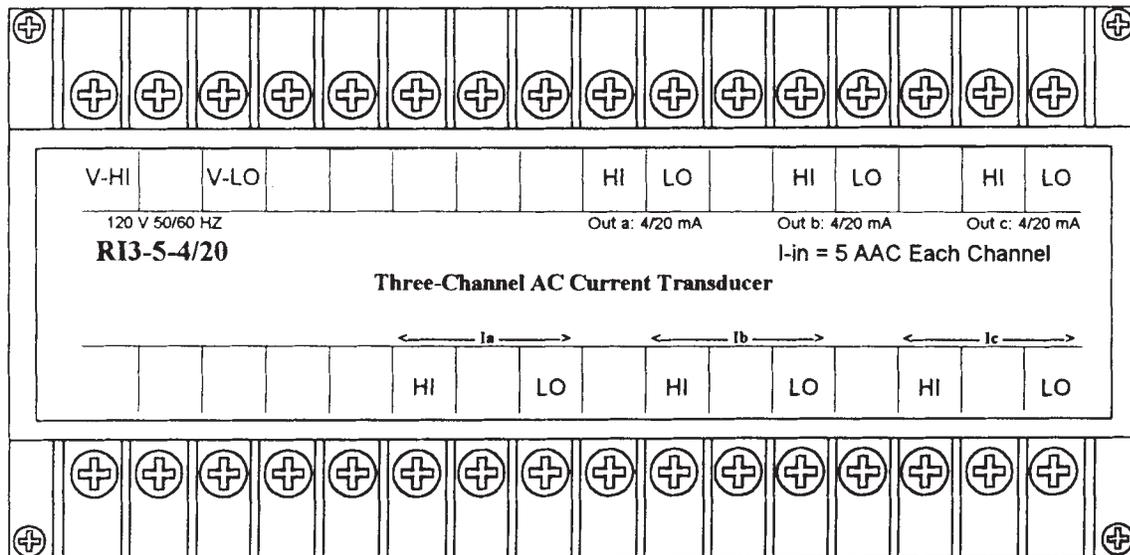
**0.5% ACCURACY**

### SPECIFICATIONS

INPUT SIGNAL RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 MINUTES
THREE OUTPUT SIGNALS:	AVERAGE. CALIBRATED AS RMS VALUE OF A SINE WAVE
OUTPUT OPTIONS:	0-10 VDC 0-1 or 4-20 mADC
LINE FREQUENCY:	50-400 Hz
ACCURACY CLASS:	0.5% of Full Scale For Sine Wave
OUTPUT RIPPLE:	1% Peak-to-Peak Maximum
ISOLATION TEST:	1 kV - 1 MINUTE
TEMPERATURE RANGE:	0 to +50 Deg. C
STORAGE TEMPERATURE:	-20 to +80 Deg. C
POWER:	120 VAC 50/60 Hz
ENCLOSURE:	DIN RAIL TYPE 46277
SIZE E:	5.9" x 2.9" x 4.4"

### Applications and Features

AVERAGE READING TRANSDUCERS.  
FOR INEXPENSIVE CURRENT MONITORING.



### SELECTION CHART OF OUTPUT OPTIONS

#### MODEL NUMBER RI3-

INPUT	10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
1 AAC	1-10	1083-057	1-1M	1083-060	1-4/20	1083-063
5 AAC	5-10	1083-058	5-1M	1083-061	5-4/20	1083-064
10 AAC	10-10	1083-059	10-1M	1083-062	10-4/20	1083-065

# TRUE RMS AC CURRENT TRANSDUCERS

## 0.5% ACCURACY

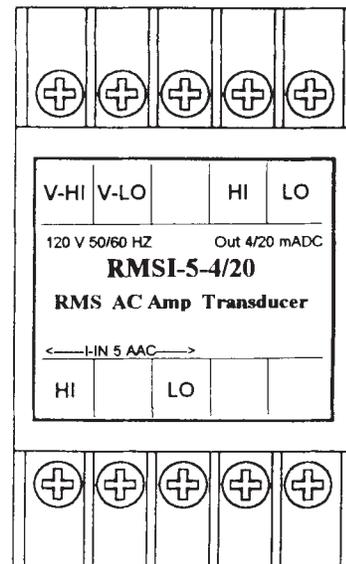
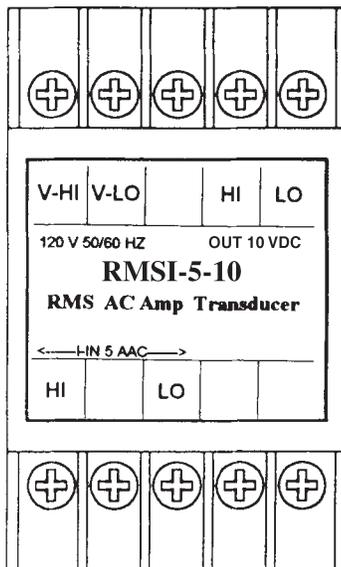
**RMSI**

### SPECIFICATIONS

INPUT SIGNAL RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 MINUTES
OUTPUT SIGNAL:	TRUE RMS
OUTPUT OPTIONS:	0-10 VDC; 0-1 or 4-20 mADC
LINE FREQUENCY:	50-400 Hz
ACCURACY at 60 Hz:	0.5% of Full Scale
OUTPUT RIPPLE:	1% Peak-to-Peak Maximum
ISOLATION TEST:	1 kV - 1 MINUTE
TEMPERATURE RANGE:	0 to +50 Deg. C
STORAGE TEMPERATURE:	-20 to +80 Deg. C
POWER:	120 VAC 50/60 Hz
ENCLOSURE:	DIN RAIL TYPE 46277
SIZE A:	1.77" x 2.9" x 4.4"

### Applications and Features

TRUE RMS TRANSDUCERS  
FOR NON-SINUSOIDAL CURRENT MONITORING.



SELECTION CHART OF OUTPUT OPTIONS						
	MODEL NUMBER RMSI-					
INPUT	10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
1 AAC	1-10	1083-066	1-1M	1083-069	1-4/20	1083-072
5 AAC	5-10	1083-067	5-1M	1083-070	5-4/20	1083-073
10 AAC	10-10	1083-068	10-1M	1083-071	10-4/20	1083-074

# AMETEK Transducers

## 3-CHANNEL RMS CURRENT TRANSDUCERS

## RMSI3

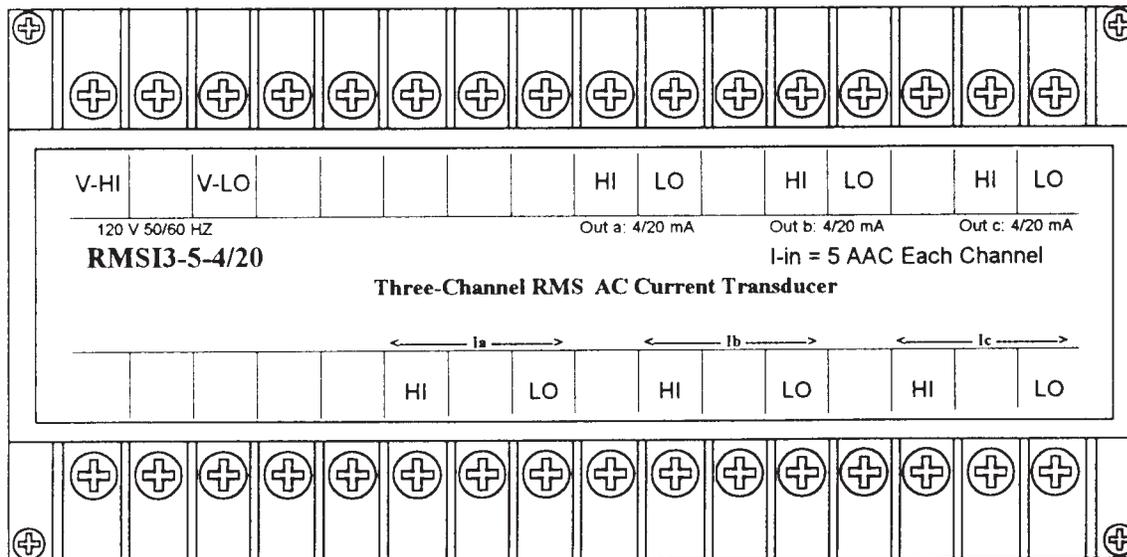
### 0.5% ACCURACY

### SPECIFICATIONS

INPUT SIGNAL RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 MINUTES
THREE OUTPUT SIGNALS:	TRUE RMS
OUTPUT OPTIONS:	0-10 VDC 0-1 or 4-20 mADC
LINE FREQUENCY:	50-400 Hz
ACCURACY CLASS:	0.5% of Full Scale
OUTPUT RIPPLE:	1% Peak-to-Peak Maximum
ISOLATION TEST:	1 kV - 1 MINUTE
TEMPERATURE RANGE:	0 to +50 Deg. C
STORAGE TEMPERATURE:	-20 TO +80 Deg. C
POWER:	120 VAC 50/60 Hz
ENCLOSURE:	DIN RAIL TYPE 46277
SIZE C:	5.9" x 2.9" x 4.4"

### Applications and Features

TRUE RMS TRANSDUCERS.  
FOR NON-SINUSOIDAL CURRENT MONITORING.



### SELECTION CHART OF OUTPUT OPTIONS

#### MODEL NUMBER RMSI3-

INPUT	10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
1 AAC	1-10	1083-075	1-1M	1083-078	1-4/20	1083-081
5 AAC	5-10	1083-076	5-1M	1083-079	5-4/20	1083-082
10 AAC	10-10	1083-077	10-1M	1083-080	10-4/20	1083-083

# AC WATT TRANSDUCERS

**RW**

## 0.5% ACCURACY

### SPECIFICATIONS

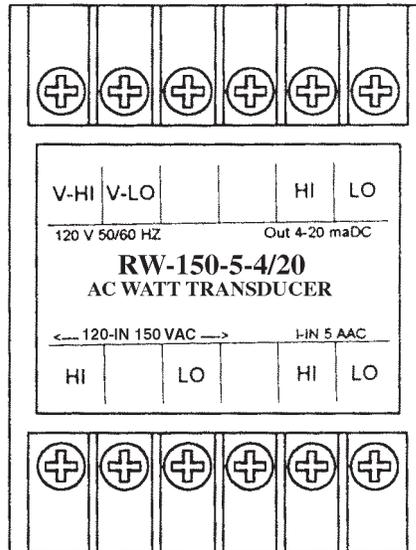
INPUT VOLTAGE RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 SECONDS (600 Volts Maximum)
INPUT CURRENT RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 SECONDS 50/60 Hz
LINE FREQUENCY:	TRUE ACTIVE POWER (WATTS)
OUTPUT SIGNAL:	0-10 VDC; 0-1 or 4-20 mADC
OUTPUT OPTIONS:	0.5% of Full Scale
ACCURACY CLASS:	1% Peak-to-Peak Maximum
OUTPUT RIPPLE:	1 kV - 1 MINUTE
ISOLATION TEST:	0 to +50 Deg. C
TEMPERATURE RANGE:	-20 to +80 Deg. C
STORAGE TEMPERATURE:	120 VAC 50/60 Hz
POWER:	DIN RAIL TYPE 46277
ENCLOSURE:	2.17" x 2.9" x 4.4"
SIZE B:	

### Applications and Features

FOR NON-SINUSOIDAL POWER MONITORING.

OUTPUT PROPORTIONAL TO ACTIVE POWER, WHERE:  
 $W = E \times I \times \text{POWER FACTOR}$

OUTPUT IS INDEPENDENT OF VOLTAGE OR CURRENT WAVEFORMS.



SELECTION CHART OF OUTPUT OPTIONS							
VOLTAGE INPUT	CURRENT INPUT	MODEL NUMBER RW-					
		10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
150 VAC	1 AAC	150-1-10	1083-084	150-1-1M	1083-090	150-1-4/20	1083-096
150 VAC	5 AAC	150-5-10	1083-085	150-5-1M	1083-091	150-5-4/20	1083-097
300 VAC	1 AAC	300-1-10	1083-086	300-1-1M	1083-092	300-1-4/20	1083-098
300 VAC	5 AAC	300-5-10	1083-087	300-5-1M	1083-093	300-5-4/20	1083-099
600 VAC	1 AAC	600-1-10	1083-088	600-1-1M	1083-094	600-1-4/20	1083-100
600 VAC	5 AAC	600-5-10	1083-089	600-5-1M	1083-095	600-5-4/20	1083-101

# AMETEK Transducers

## AC WATT TRANSDUCERS – 3-PHASE, DELTA

## RW32

### 0.5% ACCURACY

#### SPECIFICATIONS

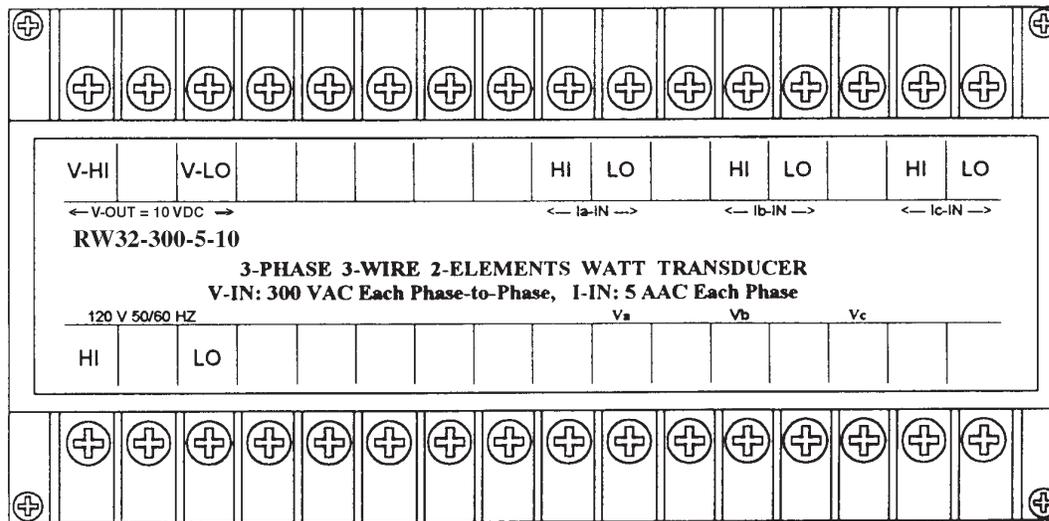
INPUT VOLTAGE RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 SECONDS (600 Volts Maximum)
INPUT CURRENT RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 SECONDS
LINE FREQUENCY:	50/60 Hz
OUTPUT SIGNAL:	TRUE ACTIVE 3-PHASE POWER
OUTPUT OPTIONS:	0-10 VDC; 0-1 or 4-20 mADC
ACCURACY CLASS:	0.5% of Full Scale
OUTPUT RIPPLE:	1% Peak-to-Peak Maximum
ISOLATION TEST:	1 kV - 1 MINUTE
TEMPERATURE RANGE:	0 to +50 Deg. C
STORAGE TEMPERATURE:	-20 to +80 Deg. C
POWER:	120 VAC 50/60 Hz
ENCLOSURE:	DIN RAIL TYPE 46277
SIZE E:	5.9" x 2.9" x 4.4"

#### Applications and Features

FOR NON-SINUSOIDAL POWER MONITORING IN 3-PHASE 3-WIRE INSTALLATIONS.

OUTPUT PROPORTIONAL TO ACTIVE POWER.

OUTPUT IS INDEPENDENT OF VOLTAGE OR CURRENT WAVEFORMS.



#### SELECTION CHART OF OUTPUT OPTIONS

VOLTAGE INPUT	CURRENT INPUT	MODEL NUMBER RW32-					
		10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
150 VAC	1 AAC	150-1-10	1083-120	150-1-1M	1083-126	150-1-4/20	1083-132
150 VAC	5 AAC	150-5-10	1083-121	150-5-1M	1083-127	150-5-4/20	1083-133
300 VAC	1 AAC	300-1-10	1083-122	300-1-1M	1083-128	300-1-4/20	1083-134
300 VAC	5 AAC	300-5-10	1083-123	300-5-1M	1083-129	300-5-4/20	1083-135
600 VAC	1 AAC	600-1-10	1083-124	600-1-1M	1083-130	600-1-4/20	1083-136
600 VAC	5 AAC	600-5-10	1083-125	600-5-1M	1083-131	600-5-4/20	1083-137

# AC WATT TRANSDUCERS – 3-PHASE, WYE

## 0.5% ACCURACY

**RW43**

### SPECIFICATIONS

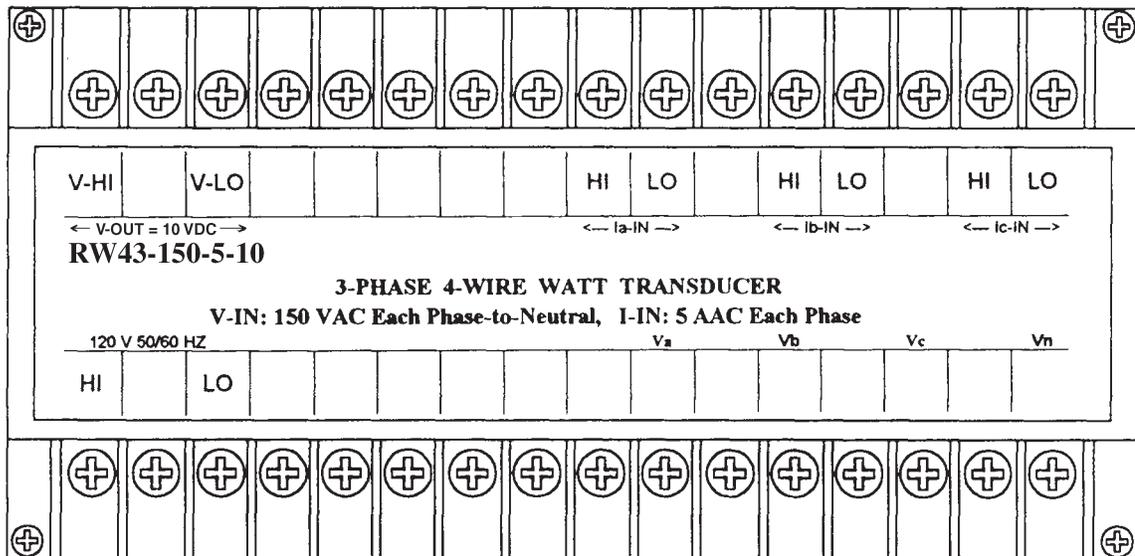
INPUT VOLTAGE RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 SECONDS (600 Volts Maximum)
INPUT CURRENT RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 SECONDS
LINE FREQUENCY:	50/60 Hz
OUTPUT SIGNAL:	TRUE ACTIVE POWER
OUTPUT OPTIONS:	0-10 VDC; 0-1 or 4-20 mADC
ACCURACY CLASS:	0.5% of Full Scale
OUTPUT RIPPLE:	1% Peak-to-Peak Maximum
ISOLATION TEST:	1 kV - 1 MINUTE
TEMPERATURE RANGE:	0 to +50 Deg. C
STORAGE TEMPERATURE:	-20 to +80 Deg. C
POWER:	120 VAC 50/60 Hz
ENCLOSURE:	DIN RAIL TYPE 46277
SIZE E:	5.9" x 2.9" x 4.4"

### Applications and Features

FOR NON-SINUSOIDAL POWER MONITORING IN 3-PHASE 4-WIRE INSTALLATIONS.

OUTPUT PROPORTIONAL TO ACTIVE POWER.

OUTPUT IS INDEPENDENT OF VOLTAGE OR CURRENT WAVEFORMS.



SELECTION CHART OF OUTPUT OPTIONS							
VOLTAGE INPUT	CURRENT INPUT	MODEL NUMBER RW43-					
		10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
150 VAC	1 AAC	150-1-10	1083-138	150-1-1M	1083-142	150-1-4/20	1083-146
150 VAC	5 AAC	150-5-10	1083-139	150-5-1M	1083-143	150-5-4/20	1083-147
300 VAC	1 AAC	300-1-10	1083-140	300-1-1M	1083-144	300-1-4/20	1083-148
300 VAC	5 AAC	300-5-10	1083-141	300-5-1M	1083-145	300-5-4/20	1083-149

# AMETEK Transducers

## AC VOLTAGE and CURRENT TRANSDUCERS

### RVI

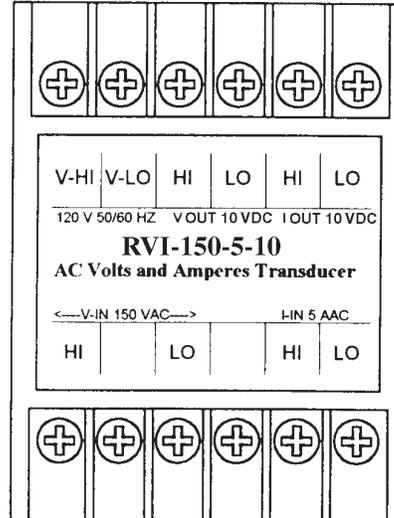
**0.5% ACCURACY TWO OUTPUTS: ONE for AC VOLTS and ONE FOR AC AMPERES**

### SPECIFICATIONS

INPUT VOLTAGE RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 SECONDS (600 Volts Maximum)
INPUT CURRENT RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 SECONDS
LINE FREQUENCY:	50 - 400 Hz
TWO OUTPUT SIGNALS:	AVERAGE. CALIBRATED AS RMS VALUE OF SINE WAVE
OUTPUT OPTIONS:	0-10 VDC; 0-1 or 4-20 mADC Both channels the same
ACCURACY CLASS:	0.5% of Full Scale
OUTPUT RIPPLE:	1% Peak-to-Peak Maximum
ISOLATION TEST:	1 kV - 1 MINUTE
TEMPERATURE RANGE:	0 to +50 Deg. C
STORAGE TEMPERATURE:	-20 to +80 Deg. C
POWER:	120 VAC 50/60 Hz
ENCLOSURE:	DIN RAIL TYPE 46277
SIZE B:	2.17" x 2.9" x 4.4"
SIZE C for 4-20 mADC:	2.95" x 2.9" x 4.4"

### Applications and Features

FOR MONITORING AC VOLTAGE and  
AC CURRENT SIMULTANEOUSLY.  
AVERAGE READING TRANSDUCERS.



### SELECTION CHART OF OUTPUT OPTIONS

VOLTAGE INPUT	CURRENT INPUT	MODEL NUMBER RVI-					
		10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
150 VAC	1 AAC	150-1-10	1083-150	150-1-1M	1083-156	150-1-4/20	1083-162
150 VAC	5 AAC	150-5-10	1083-151	150-5-1M	1083-157	150-5-4/20	1083-163
300 VAC	1 AAC	300-1-10	1083-152	300-1-1M	1083-158	300-1-4/20	1083-164
300 VAC	5 AAC	300-5-10	1083-153	300-5-1M	1083-159	300-5-4/20	1083-165
600 VAC	1 AAC	600-1-10	1083-154	600-1-1M	1083-160	600-1-4/20	1083-166
600 VAC	5 AAC	600-5-10	1083-155	600-5-1M	1083-161	600-5-4/20	1083-167

# RMS VOLTAGE and CURRENT TRANSDUCERS **RMSVI**

**0.5% ACCURACY TWO OUTPUTS: ONE for RMSVOLTS and ONE FOR RMS AMPERES**

## GENERAL SPECIFICATIONS

INPUT VOLTAGE RANGE: FULL SCALE - CONTINUOUS  
50% OVERRANGE - 3 SECONDS  
(600 Volts Maximum)

INPUT CURRENT RANGE: FULL SCALE - CONTINUOUS  
50% OVERRANGE - 3 SECONDS

LINE FREQUENCY: 50 - 400 Hz

TWO OUTPUT SIGNALS: TRUE RMS  
(Independent of input waveforms)

OUTPUT OPTIONS: 0-10 VDC; 0-1 or 4-20 mADC  
Both channels the same

LINE FREQUENCY: 50 - 400 Hz

ACCURACY at 60 Hz: 0.5% of Full Scale

OUTPUT RIPPLE: 1% Peak-to-Peak Maximum

ISOLATION TEST: 1 kV - 1 MINUTE

TEMPERATURE RANGE: 0 to +50 Deg. C

STORAGE TEMPERATURE: -20 to +80 Deg. C

POWER: 120 VAC 50/60 Hz

ENCLOSURE: DIN RAIL TYPE 46277

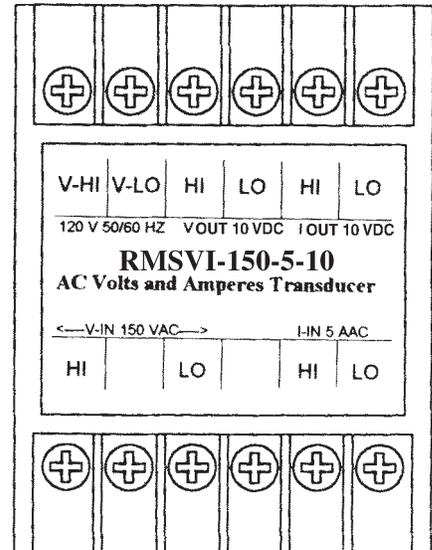
SIZE B: 2.17" x 2.9" x 4.4"

SIZE C for 20 or 4-20 mADC: 2.95" x 2.9" x 4.4"

## Applications and Features

FOR MONITORING NON-SINUSOIDAL AC VOLTAGE and AC CURRENT SIMULTANEOUSLY.

TRUE RMS TRANSDUCERS.



SELECTION CHART OF OUTPUT OPTIONS							
VOLTAGE INPUT	CURRENT INPUT	MODEL NUMBER RMSVI-					
		10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
150 VAC	1 AAC	150-1-10	1083-168	150-1-1M	1083-174	150-1-4/20	1083-180
150 VAC	5 AAC	150-5-10	1083-169	150-5-1M	1083-175	150-5-4/20	1083-181
300 VAC	1 AAC	300-1-10	1083-170	300-1-1M	1083-176	300-1-4/20	1083-182
300 VAC	5 AAC	300-5-10	1083-171	300-5-1M	1083-177	300-5-4/20	1083-183
600 VAC	1 AAC	600-1-10	1083-172	600-1-1M	1083-178	600-1-4/20	1083-184
600 VAC	5 AAC	600-5-10	1083-173	600-5-1M	1083-179	600-5-4/20	1083-185

# AMETEK Transducers

## AC KW, VOLTAGE AND CURRENT TRANSDUCERS RWVI

**0.5% ACCURACY THREE OUTPUTS: WATTS, RMS VOLTS and RMS AMPERES**

### SPECIFICATIONS

INPUT VOLTAGE RANGE: FULL SCALE - CONTINUOUS  
50% OVERRANGE - 3 SECONDS  
(600 Volts Maximum)

INPUT CURRENT RANGE: FULL SCALE - CONTINUOUS  
50% OVERRANGE - 3 SECONDS

LINE FREQUENCY: 50/60 Hz

THREE OUTPUT SIGNALS: W out: REAL ACTIVE POWER  
V out: TRUE RMS  
I out: TRUE RMS

OUTPUT OPTIONS: 0-10, VDC; 0-1 or 4-20 mADC  
All channels the same

ACCURACY CLASS: 0.5% of Full Scale

OUTPUT RIPPLE: 1% Peak-to-Peak Maximum

ISOLATION TEST: 1 kV - 1 MINUTE

TEMPERATURE RANGE: 0 to +50 Deg. C

STORAGE TEMPERATURE: -20 to +80 Deg. C

POWER: 120 VAC 50/60 Hz

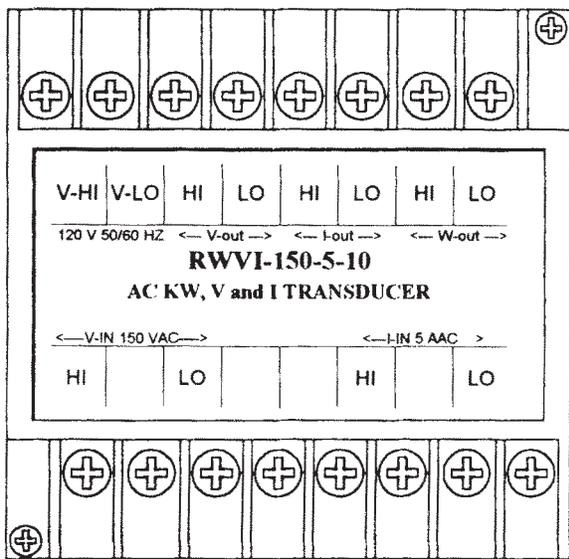
ENCLOSURE: DIN RAIL TYPE 46277

SIZE C: 2.95" x 2.9" x 4.4"

SIZE E for 4-20 mADC: 5.9" x 2.9" x 4.4"

**Applications and Features**

FOR MEASURING TRUE KW ACTIVE POWER, TRUE RMS VOLTAGE and TRUE RMS CURRENT SIMULTANEOUSLY.



SELECTION CHART OF OUTPUT OPTIONS							
VOLTAGE INPUT	CURRENT INPUT	MODEL NUMBER RWVI-					
		10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
150 VAC	1 AAC	150-1-10	1083-186	150-1-1M	1083-192	150-1-4/20	1083-198
150 VAC	5 AAC	150-5-10	1083-187	150-5-1M	1083-193	150-5-4/20	1083-199
300 VAC	1 AAC	300-1-10	1083-188	300-1-1M	1083-194	300-1-4/20	1083-200
300 VAC	5 AAC	300-5-10	1083-189	300-5-1M	1083-195	300-5-4/20	1083-201
600 VAC	1 AAC	600-1-10	1083-190	600-1-1M	1083-196	600-1-4/20	1083-202
600 VAC	5 AAC	600-5-10	1083-191	600-5-1M	1083-197	600-5-4/20	1083-203

# AC KVA, VOLTAGE AND CURRENT TRANSDUCERSR VA

## 0.5% ACCURACY THREE OUTPUTS: VA, RMS VOLTAGE and RMS CURRENT

### SPECIFICATIONS

INPUT VOLTAGE RANGE: FULL SCALE - CONTINUOUS  
50% OVERRANGE - 3 SECONDS  
(600 Volts Maximum)

INPUT CURRENT RANGE: FULL SCALE - CONTINUOUS  
50% OVERRANGE - 3 SECONDS

LINE FREQUENCY: 50 - 400 Hz

THREE OUTPUT SIGNALS: VA out: APPARENT POWER  
V out: TRUE RMS  
I out: TRUE RMS

OUTPUT OPTIONS: 0-10 VDC; 0-1 or 4-20 mADC  
All channels the same

ACCURACY CLASS: 0.5% of Full Scale

OUTPUT RIPPLE: 1% Peak-to-Peak Maximum

ISOLATION TEST: 1 kV - 1 MINUTE

TEMPERATURE RANGE: 0 to +50 Deg. C

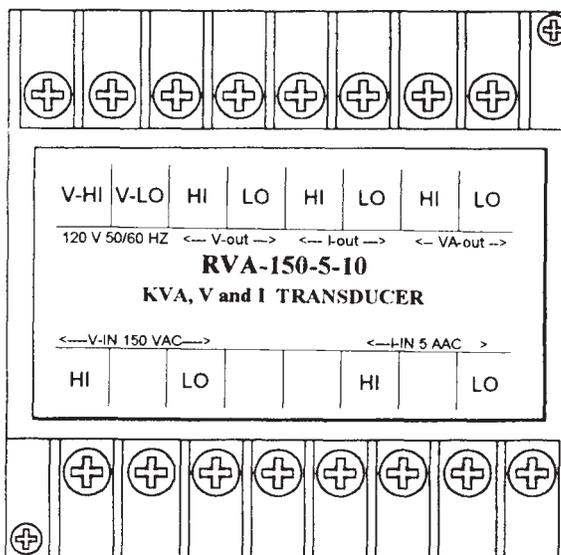
STORAGE TEMPERATURE: -20 to +80 Deg. C

POWER: 120 VAC 50/60 Hz

ENCLOSURE: DIN RAIL TYPE 46277  
SIZE C: 2.95" x 2.9" x 4.4"  
SIZE E for 20 OR 4-20 mADC: 5.9" x 2.9" x 4.4"

### Applications and Features

FOR MEASURING KVA APPARENT POWER, TRUE RMS VOLTAGE and TRUE RMS CURRENT SIMULTANEOUSLY.



SELECTION CHART OF OUTPUT OPTIONS							
VOLTAGE INPUT	CURRENT INPUT	MODEL NUMBER RVA-					
		10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
150 VAC	1 AAC	150-1-10	1083-204	150-1-1M	1083-210	150-1-4/20	1083-216
150 VAC	5 AAC	150-5-10	1083-205	150-5-1M	1083-211	150-5-4/20	1083-217
300 VAC	1 AAC	300-1-10	1083-206	300-1-1M	1083-212	300-1-4/20	1083-218
300 VAC	5 AAC	300-5-10	1083-207	300-5-1M	1083-213	300-5-4/20	1083-219
600 VAC	1 AAC	600-1-10	1083-208	600-1-1M	1083-214	600-1-4/20	1083-220
600 VAC	5 AAC	600-5-10	1083-209	600-5-1M	1083-215	600-5-4/20	1083-221

# AMETEK Transducers

## AC VAR, VOLTAGE & CURRENT TRANSDUCERS RVAR

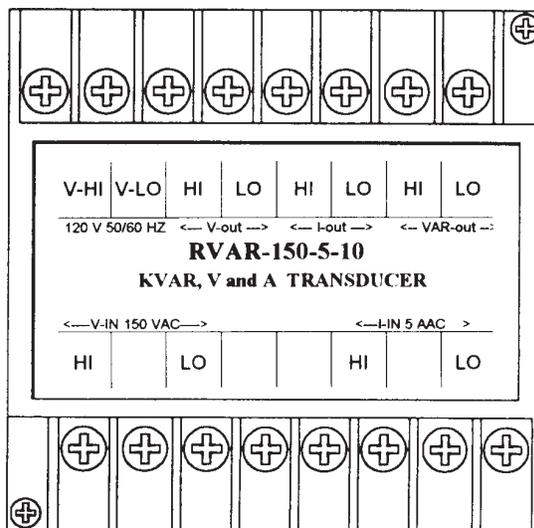
**0.5% ACCURACY THREE OUTPUTS: VAR, RMS VOLTAGE and RMS CURRENT**

### SPECIFICATIONS

INPUT VOLTAGE RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 SECONDS (600 Volts Maximum)
INPUT CURRENT RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 SECONDS
LINE FREQUENCY:	50/60 Hz
THREE OUTPUT SIGNALS:	VAR out: REACTIVE POWER V out: TRUE RMS I out: TRUE RMS
OUTPUT OPTIONS:	0-10 VDC; 0-1 or 4-20 mADC All channels the same
ACCURACY CLASS	0.5% of Full Scale
OUTPUT RIPPLE:	1% Peak-to-Peak Maximum
ISOLATION TEST:	1 kV - 1 MINUTE
TEMPERATURE RANGE:	0 to +50 Deg. C
STORAGE TEMPERATURE:	-20 to +80 Deg. C
POWER:	120 VAC 50/60 Hz
ENCLOSURE:	DIN RAIL TYPE 46277
SIZE C:	2.95" x 2.9" x 4.4"
SIZE E for 4-20 mADC:	5.9" x 2.9" x 4.4"

### Applications and Features

FOR MEASURING KVAR REACTIVE POWER, TRUE RMS VOLTAGE and TRUE RMS CURRENT SIMULTANEOUSLY.



### SELECTION CHART OF OUTPUT OPTIONS

VOLTAGE INPUT	CURRENT INPUT	MODEL NUMBER RVAR-					
		10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
150 VAC	1 AAC	150-1-10	1083-222	150-1-1M	1083-228	150-1-4/20	1083-234
150 VAC	5 AAC	150-5-10	1083-223	150-5-1M	1083-229	150-5-4/20	1083-235
300 VAC	1 AAC	300-1-10	1083-224	300-1-1M	1083-230	300-1-4/20	1083-236
300 VAC	5 AAC	300-5-10	1083-225	300-5-1M	1083-231	300-5-4/20	1083-237
600 VAC	1 AAC	600-1-10	1083-226	600-1-1M	1083-232	600-1-4/20	1083-238
600 VAC	5 AAC	600-5-10	1083-227	600-5-1M	1083-233	600-5-4/20	1083-239

# FREQUENCY TRANSDUCERS

**RF**

## 0.5% ACCURACY

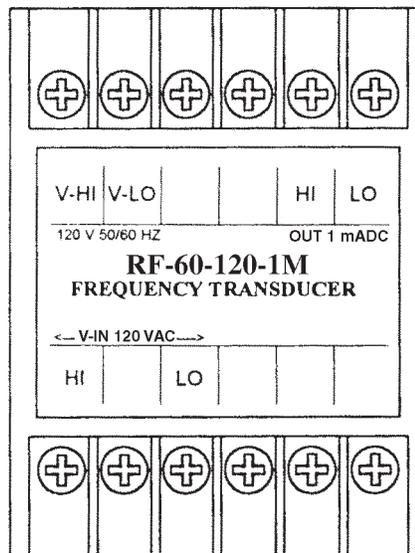
### SPECIFICATIONS

INPUT SIGNAL RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 MINUTES (600 Volts Maximum)
OUTPUT SIGNAL	PROPORTIONAL TO FREQUENCY
OUTPUT OPTIONS:	0-10 VDC; 0-1 or 4-20 mADC
ACCURACY CLASS:	0.5% of Full Scale
OUTPUT RIPPLE:	1% Peak-to-Peak Maximum
ISOLATION TEST:	1 kV - 1 MINUTE
TEMPERATURE RANGE:	0 to +50 Deg. C
STORAGE TEMPERATURE:	-20 to +80 Deg. C
POWER:	120 VAC 50/60 Hz
ENCLOSURE:	DIN RAIL TYPE 46277
SIZE B:	2.17" x 2.9" x 4.4"

### Applications and Features

FOR MEASURING POWER LINE  
FREQUENCY AND WIDE RANGE  
FREQUENCY.

OUTPUT IS PROPORTIONAL TO THE  
INPUT FREQUENCY.



Input Voltage Range  
80-150 V, 120 V  
Nominal

SELECTION CHART OF OUTPUT OPTIONS						
MODEL NUMBER RF-						
Frequency Range	10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
45 to 55 Hz	50-120-10	1083-240	50-120-1M	1083-249	50-120-4/20	1083-258
55 to 65 Hz	60-120-10	1083-241	60-120-1M	1083-250	60-120-4/20	1083-259

# AMETEK Transducers

## DC VOLTAGE TRANSDUCERS

## RVDC

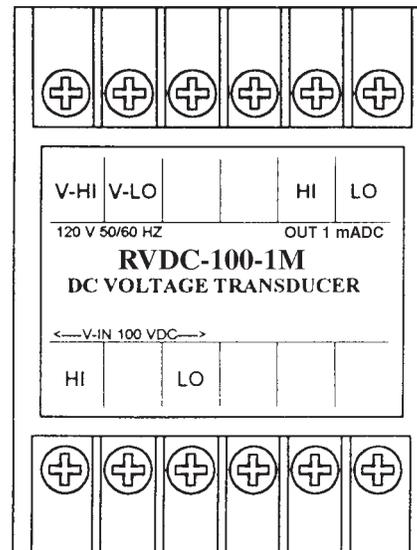
### 0.5% ACCURACY

### SPECIFICATIONS

INPUT SIGNAL RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 MINUTES (600 Volts Maximum)
OUTPUT SIGNAL:	PROPORTIONAL TO INPUT DC VOLTS
OUTPUT OPTIONS:	0-10 VDC; 0-1 or 4-20 mA DC
ACCURACY CLASS:	0.5% of Full Scale
OUTPUT RIPPLE:	1% Peak-to-Peak Maximum
ISOLATION TEST:	1 kV - 1 MINUTE
TEMPERATURE RANGE:	0 to +50 Deg. C
STORAGE TEMPERATURE:	-20 to +80 Deg. C
POWER:	120 VAC 50/60 Hz
ENCLOSURE:	DIN RAIL TYPE 46277
SIZE B:	2.17" x 2.9" x 4.4"

### Applications and Features

DC VOLTAGE MONITORING WHERE  
INPUT-OUTPUT ISOLATION IS  
IMPERATIVE.



### SELECTION CHART OF OUTPUT OPTIONS

INPUT	MODEL NUMBER RVDC-					
	10 VDC	P/N	1 mA DC	P/N	4-20 mA DC	P/N
1 VDC	1-10	1083-267	1-1M	1083-273	1-4/20	1083-279
10 VDC	10-10	1083-268	10-1M	1083-274	10-4/20	1083-280
60 VDC	60-10	1083-269	60-1M	1083-275	60-4/20	1083-281
100 VDC	100-10	1083-270	100-1M	1083-276	100-4/20	1083-282
150 VDC	150-10	1083-271	150-1M	1083-277	150-4/20	1083-283
300 VDC	300-10	1083-272	300-1M	1083-278	300-4/20	1083-284

# DC CURRENT TRANSDUCERS

**RIDC**

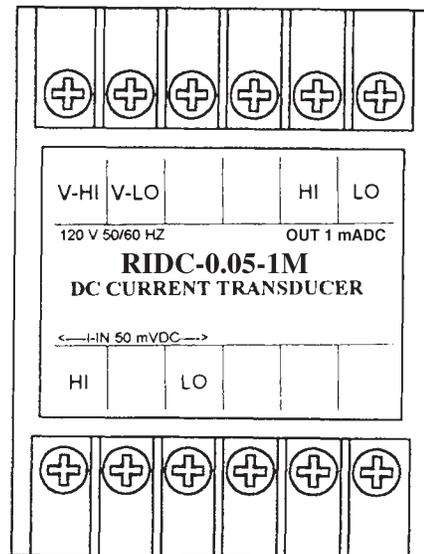
## 0.5% ACCURACY

### SPECIFICATIONS

INPUT SIGNAL RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 MINUTES
OUTPUT SIGNAL:	PROPORTIONAL TO DC INPUT SIGNAL
OUTPUT OPTIONS:	0-10 VDC; 0-1 or 4-20 mADC
ACCURACY CLASS:	0.5% of Full Scale
OUTPUT RIPPLE:	1% Peak-to-Peak Maximum
ISOLATION TEST:	1 kV - 1 MINUTE
TEMPERATURE RANGE:	0 to +50 Deg. C
STORAGE TEMPERATURE:	-20 to +80 Deg. C
POWER:	120 VAC 50/60 Hz
ENCLOSURE:	DIN RAIL TYPE 46277
SIZE B:	2.17" x 2.9" x 4.4"

### Applications and Features

FOR DC CURRENT SHUNT MONITORING WHERE INPUT-OUTPUT ISOLATION IS IMPERATIVE.



SELECTION CHART OF OUTPUT OPTIONS						
MODEL NUMBER RIDC-						
INPUT	10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
50 mVDC	0.05-10	1083-285	0.05-1M	1083-288	0.05-4/20	1083-291
100 mVDC	0.1-10	1083-286	0.1-1M	1083-289	0.1-4/20	1083-292

# AMETEK Transducers

## DC WATT TRANSDUCERS

## RWDC

### 0.5% ACCURACY

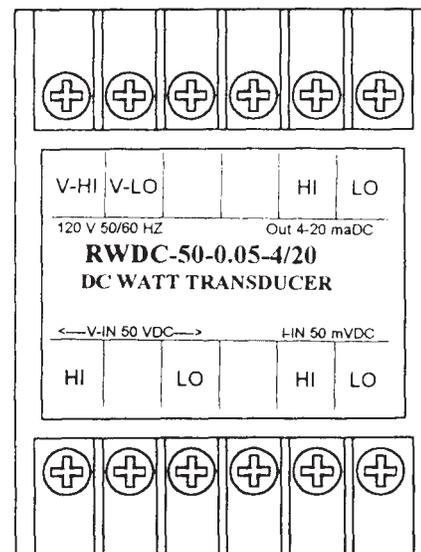
### SPECIFICATIONS

INPUT VOLTAGE RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 SECONDS
INPUT CURRENT RANGE:	FULL SCALE - CONTINUOUS 50% OVERRANGE - 3 SECONDS
FREQUENCY RANGE:	DC to 2,000 Hz
OUTPUT SIGNAL:	DC POWER (WATTS)
OUTPUT OPTIONS:	0-10 VDC; 0-1 or 4-20 mA DC
ACCURACY CLASS:	.5% of Full Scale
OUTPUT RIPPLE:	1% Peak-to-Peak Maximum
ISOLATION TEST:	1 kV - 1 MINUTE
TEMPERATURE RANGE:	0 to +50 Deg. C
STORAGE TEMPERATURE:	-20 to +80 Deg. C
POWER:	120 VAC 50/60 Hz
ENCLOSURE:	DIN RAIL TYPE 46277
SIZE B:	2.17" x 2.9" x 4.4"

### Applications and Features

FOR MEASURING DC POWER.

TRANSDUCER MULTIPLIES THE DC LINE VOLTAGE BY THE DC VOLTAGE OBTAINED FROM A CURRENT SHUNT



### SELECTION CHART OF OUTPUT OPTIONS

VOLTAGE INPUT	CURRENT INPUT	MODEL NUMBER RWDC-					
		10 VDC	P/N	1 mADC	P/N	4-20 mADC	P/N
10 VDC	50 mVDC	10-0.05-10	1083-294	10-0.05-1M	1083-306	10-0.05-4/20	1083-318
10 VDC	100 mVDC	10-0.1-10	1083-295	10-0.1-1M	1083-307	10-0.1-4/20	1083-319
50 VDC	50 mVDC	50-0.05-10	1083-297	50-0.05-1M	1083-309	50-0.05-4/20	1083-321
50 VDC	100 mVDC	50-0.1-10	1083-298	50-0.1-1M	1083-310	50-0.1-4/20	1083-322
150 VDC	50 mVDC	150-0.05-10	1083-300	150-0.05-1M	1083-312	150-0.05-4/20	1083-324
150 VDC	100 mVDC	150-0.1-10	1083-301	150-0.1-1M	1083-313	150-0.1-4/20	1083-325
300 VDC	50 mVDC	300-0.05-10	1083-303	300-0.05-1M	1083-315	300-0.05-4/20	1083-327
300 VDC	100 mVDC	300-0.1-10	1083-304	300-0.1-1M	1083-316	300-0.1-4/20	1083-328

# DPMS Digital Programmable Measurement System

With traditional transducers, one transducer is required for each measurement that you need. With the DPMS, one transducer can make multiple measurements. In fact, you can take up to 34 measurements simultaneously with just one DPMS unit! This means you can often specify one DPMS instead of multiple transducers. With direct communications capability, think of the savings that can be achieved in every aspect of a new project. Not only is it easier for Engineering, the DPMS will also save on wiring and valuable panel space.

The DPMS can be configured to the exact measurement you need. Configuration is done easily with the included PC configuration software, or you can request that your DPMS come pre-configured from the factory. With optional voltage ranges, there is virtually no transducer application that a DPMS can't fill.

The DPMS makes an excellent back up strategy. Rather than stocking numerous types and quantities of back-up transducers, you can now stock far fewer DPMS units, which can be quickly and easily configured to your replacement needs.

One of the most exciting innovations of the DPMS is its communication capabilities. With MODBUS and DNP as standard protocols, connections have never been simpler. The RS-485 port allows the transducer to communicate directly to your equipment through a multi-drop configuration, saving you valuable input ports and the need for multiplexors. All this and also a separate

port to use with the DPMS-D external display. It gets even better! The DPMS also supports TLC. In those applications where accuracy is important, but it may not be practical to install equipment at the point you wish to actually measure, use TLC to correct for inaccuracies brought on by transformer and line losses.

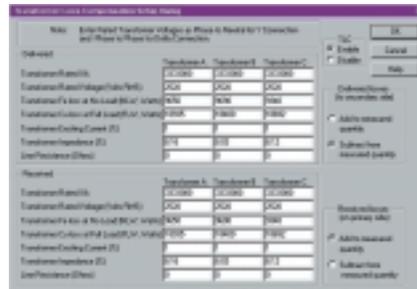
Check the specs! You will find the DPMS to be highly accurate, durable, flexible, and economical. The future of transducers has arrived, and it's the DPMS – Digital Programmable Measurement System from Ametek Power Instruments, the world leader in transducer technology!



*The advanced technology of the DPMS makes it easy to set up and configure.*

## Fully Programmable Digital & Analog Transducer with Built-in Communications

- Multi-Function Transducer is perfect solution for many varied applications
- Configured by User (or factory as needed)
- Programmable as 2, 2.5 or 3 elements
- Configurable Analog Outputs and Digital Contact & Alarm Outputs
- Excellent for replacement strategy: One unit replaces many makes and models
- Highly Accurate
- Excellent for back-up strategy: One unit on shelf backs up many varied units in the field.
- Programmable Communications of MODBUS and DNP 3.0
- True RMS
- Remote Display Option available
- Space Saving Size 3.75" x 5.375" x 6.5"
- Transformer Loss Compensation (TLC)



*The DPMS ships with configuration software to get you up and running quickly.*



*Easily change transducer settings and outputs with DPMSTalk configuration software.*

# AMETEK Transducers

## DPMS Order Configuration Sheet

A base DPMS is standard equipped with: a nominal potential of 120V, nominal current of 5 Amps, no analog outputs, no digital outputs, and communications kit for programming the DPMS. The communications kit is standard and includes DPMSTalk programming software and a RS-232/485 adapter with cable.

### Additional Options:

Nominal voltage input: **P2** = 277V  
**P3** = 480V  
**P4** = 69V.  
Analog output option: **A1** = 0-1mA  
**A2** = 4-20mA.  
Digital output option: **D1** = Contact outputs.  
Programming Kit: **R0** = Without Programming kit consisting of DPMSTalk Configuration Software and RS-232/485 adapter cable

Fill in the order codes as shown below to create model number:

### Example:

**DPMS-P3-A1-D1** is a DPMS at 480V with 1mA analog outputs, digital contact outputs, and with RS-232/485 adapter cable and DPMSTalk configuration software.

## Digital Power Measurement System Specifications

### Programmable Configuration

2 element for 3 phase 3 wire delta  
2 1/2 element for 3 phase 4 wire wye  
3 element for 3 phase 4 wire wye

### Measured and/or calculated quantities

Watts – per phase and total  
Vars – per phase and total  
Voltage – phase to neutral (4 wire), phase to phase (3 wire)  
Current – phase and neutral (calculated)  
Volt Amps – per phase and total  
Frequency  
Distortion – Total Harmonic Distortion of each voltage & current  
Watt hours – delivered and received  
Var hours – delivered and received  
Power Factor – per phase and system

### Inputs

Current Nominal – 5 amps  
Operating Range – 0 to 10 amps  
Burden per Element = 0.25 VA  
Voltage Nominal – 120 volts  
Operating Range – 85 to 150 volts  
Optional: 69 VAC Nominal, Range 50-85  
277 VAC Nominal, Range 180-320 VAC  
480 VAC Nominal, Range 310-550 VAC  
Burden per Element: 0.05 VA  
Frequency 45 to 65 Hertz  
Sample Rate 128 Samples/Cycle  
Power Supply 95 to 265 VAC @ 50/60 Hz or DC  
6 VA Maximum @ 120 V

### Measurement/Calculation Accuracy

Volts, Amps, Watts, Vars: 0.2%  
Watt hours, Var hours: 0.2%  
Neutral current: 0.75%  
Volt Amps: 0.5%  
Power Factor:  $\pm 0.008^*$  (rated VA/input VA)  
Analog output:  $\pm 0.1\%$

### Outputs

3 Channel Analog:  
All (3) channels are independently configured and scaled with DPMSTalk software  
Option A1: 0 to  $\pm 1$  ma, maximum 10 volt compliance  
Option A2: 4 to 20 ma, maximum 12 volt compliance  
Response Time  $\leq 200$  mS  
6 Channel Digital – Option D1:  
All (6) channels are independently configured and scaled with DPMSTalk software as KYZ contacts for energy measurements or as high/low threshold alarms. Solid state rated 50 ma @135 VAC/VDC with less than 5 volt drop  
54,000 CPH maximum

### Environment

Operating Temperature range:  $-20^{\circ}$  to  $+70^{\circ}$ C  
Storage Temperature:  $-40^{\circ}$  to  $+85^{\circ}$ C  
Humidity: 20 to 90% RH non condensing  
RFI:  $<1\%$  when subjected to 10 V/M @ 1 meter  
ESD: IEC 801-2 level 3 (8 kV) with no damage  
Surge Withstand: ANSI/IEEE C37.90, IEC 801-4 Class 4  
Isolation: 2500 VAC RMS from Input/Output/Power/Case  
500 VAC RMS between digital outputs  
Communication/Configuration ports share common with the analog outputs

### Influences Affecting Accuracy

Temperature: Conversion only: 75 ppm/ $^{\circ}$ C  
Including analog outputs: 125 ppm/ $^{\circ}$ C  
Long Term Stability: 0.1% of rated output/year, noncumulative  
Humidity: less than 0.05% of rated output over the operating range

### Mechanical

Size: 3.75" x 5.375" x 6.5"  
Weight: 2.6 lbs. (1.2 kg.)

### Communications

Hardware Protocol: RS-232 (full duplex)  
or RS-485 (half duplex)  
Programmable Software Protocol  
Modbus: RTU or ASCII Mode  
DNP 3.0

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## DPMS-D Optional Digital Display

### Display

- 4 line x 20 character vacuum fluorescent display allows Unit ID and 3 simultaneous measurements to be viewed
- Character height 0.19 inch
- Color-blue
- 3 key switches allow selection of data to be viewed
- 12 standard display screens and 4 custom display screens
- Displays in primary units (CT&PT ratios configured in DPMS)

### Quantities available for display

- Watts – per phase and total
- Vars – per phase and total
- Watthours – delivered and received
- Varhours – delivered and received
- Voltage – phase to neutral (4 wire), phase to phase (3 wire)
- Current – phase and neutral (calculated)
- Volt Amps – per phase and total
- Power Factor – per phase and system frequency
- Distortion – total harmonic distortion of each voltage and current
- Watthours – bidirectional
- Varhours – bidirectional
- Unit ID

### Communications

- Multi Addressing allows communication to up to 15 DPMS units per DPMS-D display module
- Half duplex RS-485
- Recommended maximum distance between DPMS and DPMS-D is 4000 feet



### Power Requirements

- 95 to 256 VAC @ 50/60 Hz or DC

### Mechanical

- Panel cutout 4.38 x 3.75 inches
- Weight 1.4 lbs. (0.64 kg.)

### Environmental

- Operating Temperature range: -20° to +70°C
- Storage Temperature: -40° to +85°C
- Humidity: 20 to 90% RH non condensing
- RFI: no effect when subjected to 10 V/M @ 1 meter
- ESD: IEC 801-2 level 3 (8 kV) with no damage
- Surge Withstand: ANSI/IEEE C37.90, IEC 801-4 Class 4
- Isolation: 2500 VAC RMS from power to Case or Communications port 1



# AMETEK

## AccuPro Calibrators

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**A full line of portable instrument calibrators to meet the needs of all process instrument users.**

Ametek/AccuPro™ calibrators can be used to calibrate most process instrumentation ranging from signal conditioners to temperature transmitters.

All Ametek calibrators are NIST traceable and can read and/or source signals including:

- Frequency
- Volts
- Millivolts
- Milliamps
- T/C
- RTD
- Ohms
- Pressure
- Vacuum

### Product

CL-4002  
CL-9000  
Total IQ  
DPG-700

### Description

Loop current calibrator  
Diamond™ universal, multifunction calibrator series  
Instrument management software  
Digital pressure gauge

# AMETEK

## AccuPro Calibrators

### CL-4002 Multifunction Process Current Calibrator



- Sources & Simulates 0 to 24 mA
- Reads 0 to  $\pm 50$  mA
- Displays in Milliamps or Percent
- Powers 2-wire Transmitters While Reading Loop Current

Ametek Model CL-4002 Current Calibrator is a rugged, compact battery powered tool for reading, sourcing and simulating common process control currents to calibration accuracy. It features a large LCD display and sealed membrane keypad for selecting the operating mode and output current. The high quality case has provision for input/output leads via standard banana jacks, and a plug for the optional AC power adaptor.

**SOURCE:** The output current may be set to any value from 0.00 to 24.0 mA DC. Use the up and down buttons to continuously set the output, or step to 0.00, 4.00, 12.00 or 20.0 mA instantly by pressing the labeled buttons. If desired, select the display in percent (of 4-20 mA range) rather than milliamps by pressing the '%' button. Pressing the "mA" button returns the display to milliamps.

**SIM:** Simulate mode sets the calibrator to simulate operation of a 2-wire transmitter in a loop with external power. Set the loop current in percent or milliamps in the same way as in SOURCE mode. The CL-4002 regulates the loop current to the set value over the range of 0.00 to 24.0 mA.

**READ:** Read DC milliamp currents from 0.00 to  $\pm 50.0$  mA. The display may be set to read in percent (of 4-20 mA range) by pressing the "%" button. The percent reading will track the current input to 199.9% (about 40 mA).

**RD/PWR:** Provides 24 VDC power for operating a 2-wire transmitter. Calibrator display reads the loop current in percent or milliamps over a range of 0.00 to 24.0 mA (-25.0 to 125.0%).

Other features of the CL-4002 are: low battery indicator on the LCD display, single sealed ON/OFF button on the keypad, bipolar autoranging display for milliamp readings (10 microamp resolution from 0.00 to 19.99 mA, 0.1 mA resolution from 20.00 to 50.0 mA), standard zippered case with belt loop and an easily replaced single 9 V battery for power.

### CL-4002 Specifications

**Accuracy:**

$\pm 0.05\%$  of full scale reading,  $\pm 1$  count

**Display:** Liquid crystal display, 3.5 digit, 0.6" (15.2mm) high

**Display Range:**

0.00 to  $\pm 19.99$  mA  
 $\pm 20.0$  to  $\pm 50.0$  mA  
0.0 to  $\pm 199.9\%$

**Temperature Ranges:**

Operating:  $-20^{\circ}$  to  $50^{\circ}$ C  
Storage:  $-40^{\circ}$  to  $60^{\circ}$ C

**Temperature Effect:**

50ppm/ $^{\circ}$ C, nominal, 100ppm/ $^{\circ}$ C, max.

**Relative Humidity:**

0 to 95%, non-condensing

**Output/2-wire Range:**

0.00 to 24.0 mADC (-25.0 to 125.0%), SOURCE, SIM and RD/PWR modes

**Instant Output Settings:**

0.00 mA (-25.0%), 4.00 mA (0.0%), 12.00 mA (50.0%), 20.0 mA (100.0%) SOURCE and SIM modes

**Output Drive:** 1000 ohms, max., SOURCE mode

**Input Impedance:** 20 ohms  $\pm 5\%$ , READ mode

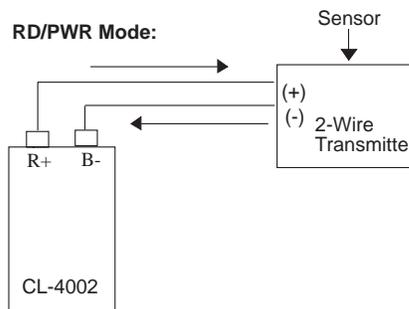
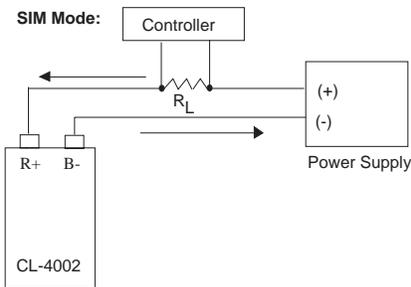
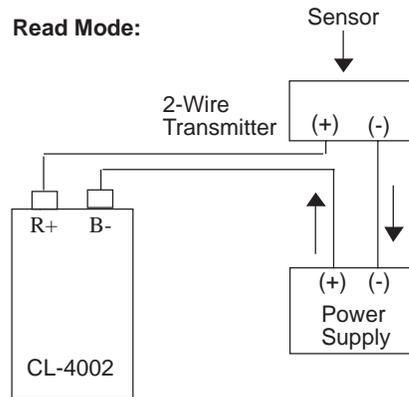
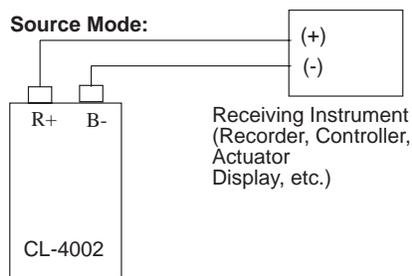
**Input Protection:** No damage to instrument or calibration from inputs to  $\pm 75$  V. Internal Field replaceable fuse for inputs greater than  $\pm 75$  V.

**Battery:** 1 each 9 V alkaline, included

**Battery Life:** 8 hours, typical, SOURCE and RD/PWR modes; 40 hours, typical READ and SIM modes

**AC Adaptor:** Optional, Model CL-4100 (-120 for 120V), 50/60 Hz; (-240 for 240 V), 50/60 Hz. Output 9 VDC

## CL-4002 Connections



**Low Voltage Indicator:** LO BAT indicator of LCD display when internal battery drops below 6.5 VDC

**Loop Voltage Limits:** 1 to 60 VDC external loop power, SIM mode; 24 VDC  $\pm$ 0.2 V internal supply, SOURCE and RD/PWR modes.

**Size:** 144.8 x 88.9 x 35.6mm  
(5.7 x 3.5 x 1.4 inches)

**Weight:** 12 oz. (0.34 Kg.)

### Ordering Information

Model	Description
CL-4002	Precision hand-held loop current calibrator
	<b>Code</b> <b>Carrying Case</b>
	<b>C</b> Carrying Case
	<b>NC</b> Not required
	<b>Code</b> <b>AC Power Adaptor</b>
	<b>120</b> 120V AC adaptor
<b>NA</b> Not required	
CL-4002	<b>C NA Ordering Example</b>

Precision hand-held CL-4002 loop current calibrator with carrying case. No power supply adaptor required.

# AMETEK

## AccuPro Calibrators

### CL-8026 Universal Temperature Calibrator



The CL-8026 is a universal temperature calibrator capable of sourcing and monitoring temperature signals including RTDs, thermocouples, mV and resistance. Utilizing the latest techniques in software filtering enables the CL-8026 to work with the major brands of smart temperature transmitters without the need to enter "trim" mode. It features a large, easy-to-read LCD display, and easily accessible terminals at the top of the unit. The calibrator's rugged housing and the sealed keyboard insure trouble free operation in the harshest environments.

#### SPECIFICATIONS

**Display:** 128 x 64 point LCD  
**Connections:** 6 posts accepting banana plugs and wires  
**Real Time Clock Accuracy:** < 1 minute per month @ 25°C  
**Power:** AC Adapter or six "C-cell" Alkaline or NiCd batteries  
**Battery Life (minimum):**  
 40 hours (measure)  
 8 hours (source)  
**Weight:** 2 lb. (0.9 kg)  
**Dimensions:**  
 9.75h x 5.25w x 2.5d inches  
 (24.8h x 13.3w x 6.4d cm)

#### STANDARD FEATURES:

- Input (monitor) and output (source) functions
- Monitors and simulates:
  - 13 Thermocouples - J,K,E,T,R,S,B,N,C,D,G,L,U
  - 5 RTDs -Platinum, Copper, Nickel
  - mV, resistance
- Intuitive soft-keys
- 10 User defined set points
- Automatic/Manual set point cycling
- Easy-to-read display
- Internal/external cold junction compensation
- Alkaline or rechargeable NiCd batteries
- AC Power option
- Carrying Case and Test Leads included
- NIST Certificate of Traceability included

#### Included with AccuPro Temperature Calibrator

Battery pack, 6 'C' alkaline batteries, multi-tip lead set, instruction manual, NIST certified traceable test data and carrying case.

#### Ordering Information

<b>CL-8026</b>	Ametek Temperature Calibrator	
	<b>Code</b>	<b>Optional Power Adapter</b>
	120	120V AC power adapter
	240	240V AC power adapter
	NR	Not required
<b>CL-8026</b>	120	<b>Ordering Example</b>

Ametek Temperature Calibrator with 120V AC power adapter

Signal Type	Range	Input (Accuracy)	Output
mV	0-200mV	0.025%	0.025%
Resistance	(0-500Ω)	0.035%	0.050%

#### RTDs

100Ω Pt (a = 0.385)	-200°C to 850°C	0.5°C	0.8°C
100Ω Pt (a = 0.3916)	-200°C to 850°C	0.5°C	0.8°C
100Ω Pt (a = 0.3923)	-200°C to 850°C	0.5°C	0.8°C
120Ω Ni (a = 0.385)	-80°C to 320°C	0.25°C	0.5°C
10Ω Cu (a = 0.385)	-100°C to 260°C	1.0°C	2.0°C

#### Thermocouples

J	-210°C to 1200°C	0.5°C	0.5°C
K	-200°C to 1370°C	0.5°C	0.5°C
T	-200°C to 400°C	0.5°C	0.5°C
E	-200°C to 1000°C	0.5°C	0.5°C
R	-50°C to 430°C	2.0°C	2.0°C
R	430°C to 1760°C	1.0°C	1.0°C
S	-50°C to 430°C	2.0°C	2.0°C
S	430°C to 1760°C	1.0°C	1.0°C
B	200°C to 1200°C	3.0°C	3.0°C
B	1200°C to 1820°C	1.0°C	1.0°C
N	-150°C to 1300°C	0.5°C	0.5°C
C	0°C to 2320°C	1.5°C	1.5°C
D	0°C to 2320°C	1.5°C	1.5°C
G	100°C to 2320°C	2.0°C	2.0°C
L	-200°C to 900°C	0.5°C	1.0°C
U	-200°C to 600°C	0.5°C	1.0°C

## DPG-700 Precision Digital Pressure Gauge



DPG-700 digital pressure gauges are hand-held calibrators that simultaneously display and measure pressure, vacuum and DC milliamp industrial process signals. They are battery powered and housed in rugged cases with membrane keypads to resist harsh industrial environments.

The DPG-700 has large, easy to read, 5 digit LCD displays for pressure and current measurements. The sealed membrane switches allow easy selection of multiple engineering units and process reference zero. The DPG-700 is powered by five C cell batteries which allow for more than 8 hours of continuous operation. Pressure connections are made via a 1/4" quick connect fitting on the bottom of the unit.

### Units Key:

The units key is used to select the desired engineering units for pressure and vacuum. The corresponding DC mA reading is displayed directly below the pressure value.

### Zero Key:

The Zero Key allows the selection of your reference pressure. If a suppressed or elevated zero reference is required, the pressure on the system should be brought to the required level, then the zero key depressed. This will reset the display to 0, and is the reference point for further measurements.

### Optional Pump Use:

The DPG-720A pump is capable of pressure or vacuum operation (both in one unit). It can be connected to the DPG via the pressure port. The pump can be supplied complete with tubing and fittings for calibration of most pressure instrumentation. See the following pages.

## DPG-700 Specifications

### Pressure Ranges and Accuracies

Model	Range	Accuracy	Resolution
<b>DPG-700-015</b> 15 PSIG max.	-10 to +15 PSIG -10 to 0 PSIG 0 to +15 PSIG	± 0.1% FS, ± 1 count ± 0.05% FS, ± 1 count	0.001 PSIG 0.001 PSIG
<b>DPG-700-030</b> 30 PSIG max.	-10 to +30 PSIG -10 to 0 PSIG 0 to +30 PSIG	± 0.1% FS, ± 1 count ± 0.05% FS, ± 1 count	0.002 PSIG 0.002 PSIG
<b>DPG-700-100</b> 100 PSIG max.	-10 to +100 PSIG -10 to 0 PSIG 0 to +100 PSIG	± 0.1% FS, ± 1 count ± 0.05% FS, ± 1 count	0.01 PSIG 0.01 PSIG

### Calibration:

The DPG can be calibrated using a precision pressure source and a special keypad sequence. No potentiometer adjustments are required.

### Pressure Medium:

Non-corrosive gas, dry or moist air

### LCD Display:

Simultaneous readout of pressure and current; pressure and current engineering units; low battery indicator; warm-up indicator; updated three times per second.

### Instrument Power:

Alkaline batteries (5 C cells); more than 8 hours of operation at room temperature on a set of batteries or AC line adapter for 117/230 VAC, ± 10% @ 50/60 Hz.

### Overrange Protection:

3X full range pressure without damage or need to recalibrate.

### Temperature Range:

Operation: 0° to +50° C  
Storage: -20° to +60° C

### Temperature Effect:

± 0.01%/°C span

### Pressure Port:

Quick connect style fitting for 1/4" i.d. tubing with mating adapter.

### Size:

63.5 x 144.8 x 208.3mm  
(2.5 x 5.7 x 8.2 inches)

**Weight:** 1 lb. 14 oz. (0.85 kg)

### Milli Ampmeter:

Range: -50.00 to +50.00 mADC  
Accuracy: ± 0.05% of full scale  
± 1 count  
Resolution: 0.005 mA  
Impedance: <100 ohms

### Agency Approvals:

DPG-700 is CSA and FM Division 2, Class I, II, and III, Groups A, B, C, and D approved.

### Pressure Display Units:

**DPG-700-015 and DPG-700-030:**  
PSI, in Hg, in H<sub>2</sub>O, ft H<sub>2</sub>O, Atm, Bar, mBar, mm H<sub>2</sub>O, cm H<sub>2</sub>O, m H<sub>2</sub>O, mm Hg, cm Hg, Torr, kPa, gm/cm<sup>2</sup>, kg/cm<sup>2</sup>, lb/ft<sup>2</sup>, tn/ft<sup>2</sup>

### DPG-700-100:

PSI, in Hg, in H<sub>2</sub>O, ft H<sub>2</sub>O, Atm, Bar, mBar, cm H<sub>2</sub>O, m H<sub>2</sub>O, mm Hg, cm Hg, Torr, kPa, gm/cm<sup>2</sup>, kg/cm<sup>2</sup>, lb/ft<sup>2</sup>, tn/ft<sup>2</sup>

## DPG-700 Ordering

### Standard items included are:

- Digital Pressure Gauge DPG-700
- Certificate of calibration and NIST traceability
- Carrying case (DPG-712)
- 1 set of test leads (DPG-713)
- Instruction manual
- 117 VAC Power Adapter

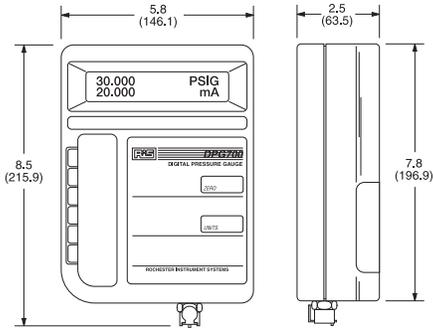
### Options:

DPG-711: 230 VAC adapter  
DPG-720A: Pressure/Vacuum Pump  
Precision hand pump with multiturn vernier adjustment for calibration.  
1074 - 746 Quick Connect Kit

# AMETEK

## AccuPro Calibrators

### DPG-700 Dimensions



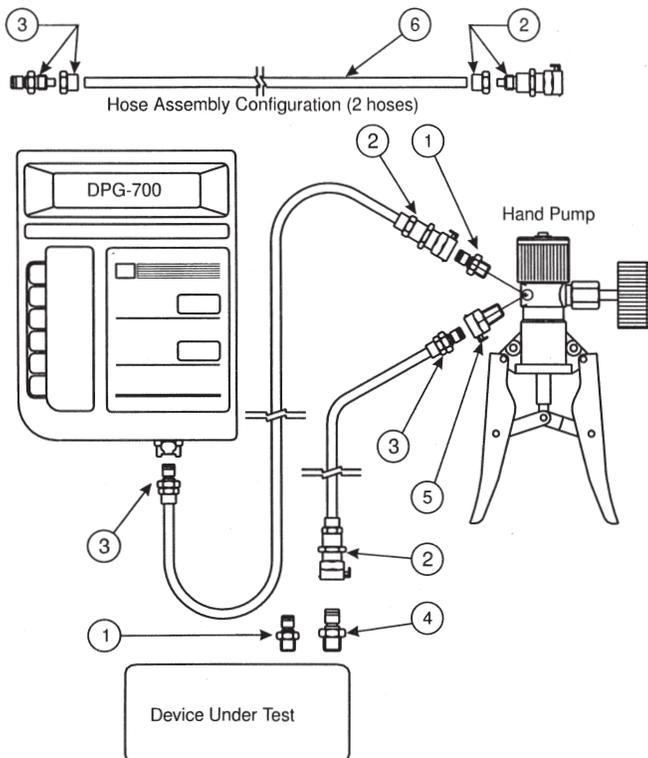
### Ordering Information

Model	Description
<b>DPG-700</b>	Precision Digital Pressure Gauge
<b>Code</b>	<b>Pressure Range</b>
<b>15</b>	-10 to +15 PSIG
<b>30</b>	-10 to +30 PSIG
<b>100</b>	-10 to +100 PSIG
<b>Code</b>	<b>AC Power Adaptor</b>
<b>117</b>	117 V AC adapter
<b>230</b>	230 V AC adapter
<b>NA</b>	Not required
<b>Code</b>	<b>Pressure Vacuum Pump</b>
<b>P</b>	Precision pressure / vacuum hand pump
<b>NP</b>	Not required
<b>Code</b>	<b>Quick Connect Kit</b>
<b>C</b>	Quick connect tubing and fittings kit
<b>NC</b>	Not required
<b>DPG-700</b>	<b>30 230 P NC Ordering Example</b>

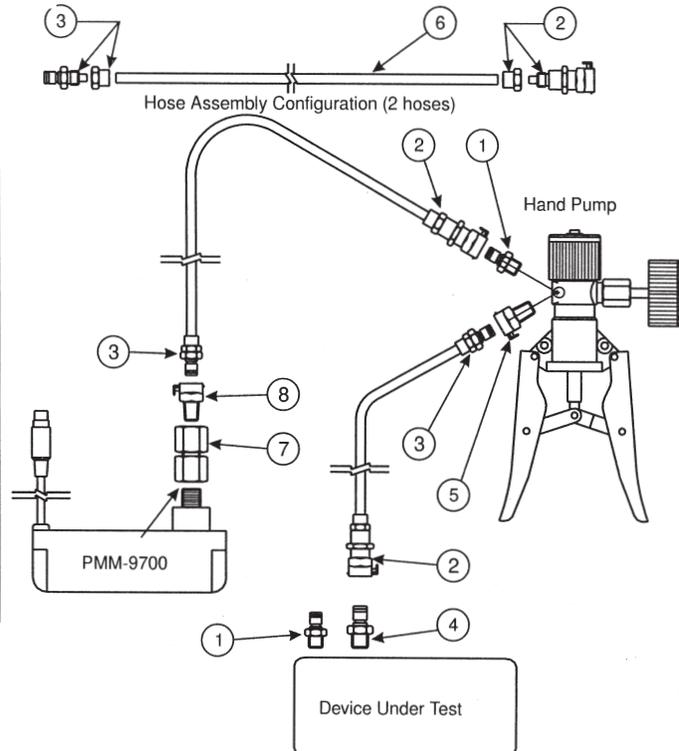
DPG-700 precision digital pressure gauge, measuring pressures in the range -10 to +30 PSIG, with 230 VAC power adapter and precision hand pump.

### Typical Connection Configuration

#### PMM-9700 Connection



#### DPG-700 Connection



### DPG-720A Precision Pressure Pump

The Ametek DPG-720A Precision Pressure Pump is a hand-operated mechanical pump. It is designed to generate precise pressures to 200 psi for use in pneumatic testing and calibration.

The DPG-720A combines simplicity of design with quality construction for long service life with virtually no maintenance. The compound-leverage, squeeze-action design and light weight permit easy, one-handed operation at any angle. Dual 1/8"-27 FNPT output ports located in the machined brass pump body permit the application of pressure to two devices simultaneously.

Precise output to 0.001 psig resolution is possible through the manipulation of the Coarse and Fine Pressure Adjustments. The DPG-720A can also generate negative pressures to -2 psi through the use of the Fine Pressure Adjustment.

### DPG-720A Specifications

**Output Range:** -2 to 200 psi

**Resolution:** 0.001 psig

**Compatible Media:** Non-conductive, non-corrosive instrument grade clean air or inert gas

**Pump Body Construction:** Machined brass casting

**Pressure Connections:** Dual 1/8"-27 FNPT output ports

**Weight:** 1.9 pounds (0.87 kg)

### DPG-700 Quick Connect Kit

The Ametek DPG-700 Quick-Connect Kit (P/N 1074-746) connects a DPG-720A Precision Pressure Pump to a DPG-700 Digital Pressure Gauge and a pneumatic transmitter. The kit consists of:

Item	Part No.	Qty.	Description
1.	6002-392	2	1/8" Coupling Insert, 1/8" MNPT
2.	6002-391	2	1/8" Coupling Body, .17" I.D. Tubing
3.	0630-372	2	1/8" Coupling Insert, .17" I.D. Tubing
4.	6002-457	1	1/8" Coupling Insert, 1/4" MNPT
5.	6002-004	1	1/8" Coupling Body w/Shut-off, 1/8" MNPT
6.	0630-514	2	.17" I.D. Tubing, 6 Feet long
7.	6002-458	1	1/4" Hex Fitting, 1/4" FNPT
8.	6002-456	1	1/8" Coupling Body, 1/4" MNPT

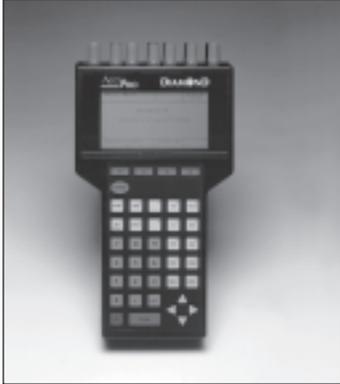
**An accessory Quick Connect Kit (P/N 1074-746), consisting of chrome-plated brass fittings and two 3-foot sections of polypropylene tubing rated to 250 psi, provides easy connection to most pneumatic transmitters.**



# AMETEK

## AccuPro Calibrators

### AccuPro Diamond CL-9000 Series



#### Universal Multi-Function Field Calibrators

- **Universal calibrator for all instrument types**  
Always have the right tool at hand
- **Ergonomic design and carrying case**  
Easy to carry into the field
- **Operates as part of computer-aided calibration system**  
Automate the documentation and management of instrument recalibrations
- **NIST Traceable**

#### The AccuPro™ Diamond™ Calibrator

The AccuPro Diamond Series-9000 calibrators are easy-to-use, universal, multi-function process instrumentation calibrators. Use them to calibrate the widest possible range of process instruments. Diamond Series calibrators are compatible with current, voltage, frequency, resistance and temperature signals, including thirteen thermocouples and five RTD types. Dedicated connectors allow any combination of input and output signals. With one device to service all your instrument calibration needs, you'll always have the right tool at hand.

Lightweight and housed in a sleek case that fits in one hand, the Diamond is the ideal tool to carry into the field. The calibrator combines an easy-to-read graphical display and color-coded alphanumeric keypad with an intuitive 'soft-key' system. All this makes operation quick and simple. Special

functions like ramping and stored setpoints are designed to assist you still further.

With the newest in low-voltage electronics, the AccuPro Diamond is a real energy saver. There is even a special battery save option. All so that you won't have to keep running back to the shop for new batteries.

When you need reliable signal measurement and simulation, you will want an AccuPro Diamond Series calibrator. To ensure maximum accuracy, the calibrator keeps constant track of output signals with a special feedback circuit. All thermocouple measurements are made using automatic internal cold-junction compensation, or with reference to an external probe. You can even enter reference temperatures manually.

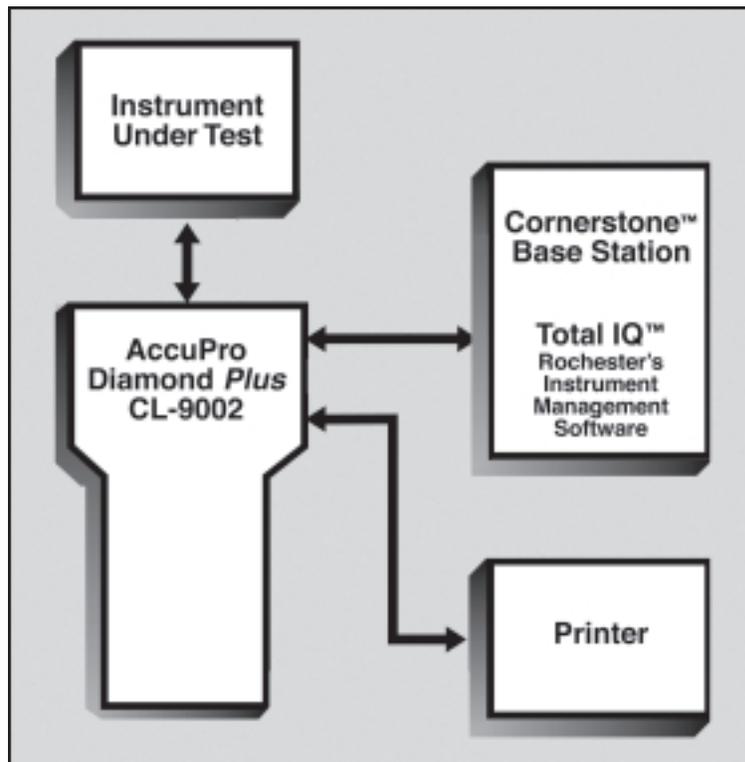
#### The AccuPro Diamond Plus

The AccuPro Diamond Plus CL-9002 or CL-9004 has all the features of the standard Diamond model, but can also be used as part of a sophisticated

computer-aided calibration system. If you need to calibrate a number of instruments in the field, you can carry all required calibration information in your Diamond Plus calibrator. Simply download pre-programmed procedures, instructions and calibration specifications from Total IQ™—Ametek's Windows™-based instrument management—or from the emerging standard for computer-aided calibration software, Cornerstone™ Base Station from Applied System Technologies.

Attach the Diamond Plus to the instrument under test and use it to perform these procedures automatically. The calibrator stores all test details, including the time, date and the operator. Return the information to your PC at your convenience.

The Diamond Plus can even be used to print calibration reports without a personal computer. Attach its serial port directly to a printer, and it will download calibration records as an ASCII text file.





#### STANDARD FEATURES

- Simultaneous Inputs and Outputs
  - 13 Thermocouples: B, C, D, E, G, J, K, L, N, R, S, T, U
  - 5 RTDs: 100Ω Pt, 120Ω Ni, 10Ω Cu
  - mA, mV, Voltage, Resistance, Frequency
- Trip Detection
- Pressure
- 24 Vdc Transmitter Power
- Transmitter Simulator
- mA Input/Output
- Automatic Data Collection
- Manual Data Entry
- 21 Point As Found/As Left Calibrations
- 21 Step Set Point
- Auto/Manual Set Point Cycling
- Output Ramping
- Full Alphanumeric Keypad
- Field Entry of Calibration Notes
- Serial Output (PC or Printer)
- Storage for 50 Calibrations
- Sealed Keypad Case
- NIST Certificate of Traceability
- 3 Year Warranty
- Alkaline and Rechargeable Batteries
- Test Leads and Carrying Case

CAPABILITY				
MODEL	ELECTRICAL*	PRESSURE	DOCUMENTATION	HART INTERFACE
CL9001	X	X		
CL9002	X	X	X	
CL9003	X			
CL9004	X		X	
CL9005	X	X	X	X

\* RTD, TC, mV, V, Ohms, mA, Frequency

#### GENERAL SPECIFICATIONS

- Display:** 240 x 128 pixel graphic LCD, 95 x 54 mm
- Power:** 6 'C' size alkaline (standard) or NiCd cells (optional)
- Battery life:**  
 Continuous sourcing > 8 hours  
 Continuous monitoring > 40 hours
- Dimensions:** 229 x 133 x 64 mm (9 x 5.2 x 2.5 inches)
- Weight:** 1.37 kg (3 lbs.)
- Operating Temperature Range:** 0°C to 50°C
- Storage Temperature Range:** -20°C to 60°C
- Operating Humidity Range:** 20 to 90% relative humidity, non-condensing. The effect on accuracy is <0.05°C for a change in relative humidity from 20 to 90% at 23°C.
- Radio-Frequency Interference (RFI):** Conforms to SAMA PMC 33.1 1978, mV input and output will not shift more than 1% of full-scale when tested at a field strength of 10 V/M at a distance of 1m from 20 MHz to 1 GHz.
- Warranty:** Three year parts and

# AMETEK

## AccuPro Calibrators

### TECHNICAL SPECIFICATIONS

SIGNAL	ACCURACY (% fs)		DISPLAY	
	INPUT	OUTPUT	RESOLUTION	
0mV to 200mV	0.025%	0.025%	0.01mV	Input Impedance (mV): >10 MΩ
0V to 20V	0.025%	0.001V		Input Impedance (V): >2 MΩ
0V to 50V	0.025%	0.001V		
0mA to 24mA	0.025%	0.001mA		Input Impedance: <25 Ω / Output Compliance: 19V minimum
0mA to 50mA	0.025%	0.001mA		Maximum Input Voltage: 24 VDC
1Hz to 1000Hz	0.1 count	0.1 count	0.1Hz	
100Hz to 10KHz	1.0 count	1.0 count	0.001KHz	Frequency Measurement: 0.1V to 100V peak-to-peak
1 CPM to 1000 CPM	1.0 count	1.0 count	0.1 CPM	Frequency Output: 0.1V to 10V peak-to-peak Input Impedance: 2 MΩ // 123.5 pF Zero-based squarewave
0.1 CPH to 100 CPH	0.05 count	0.05 count	0.01 CPH	Output Amplitude Accuracy: 5% of full Scale
5 to 500 Ohms	0.035%		0.05%	0.1 Ohm
<b>RTD (2, 3 or 4 wire)</b>				
100Ω Pt (∞ = .385)	0.5°C	0.8°C	0.1°C	100Ω Pt: -200 to +850°C
100Ω Pt (∞ = .3916)	0.5°C	0.8°C	0.1°C	
100Ω Pt (∞ = .3923)	0.5°C	0.8°C	0.1°C	
120Ω Ni	0.25°C	0.5°C	0.1°C	120Ω Ni: -80° to +320° C
10Ω Cu	1.0°C	2.0°C	0.1°C	10Ω Cu: -10° to +260° C
<b>Thermocouples (internal or external CJC)</b>				
B 1200 to 1820°C	1.0°C	1.0°C	0.1°C	
C 0 to 2320°C	1.5°C	1.5°C	0.1°C	
D 0 to 2320°C	1.5°C	1.5°C	0.1°C	
E -200 to 1000°C	0.5°C	0.5°C	0.1°C	
G 100 to 2320°C	2.0°C	2.0°C	0.1°C	
J -210 to 1200°C	0.5°C	0.5°C	0.1°C	
K -200 to 1370°C	0.5°C	0.5°C	0.1°C	
L -200 to 900°C	1.0°C	1.0°C	0.1°C	
N -150 to 1300°C	0.5°C	0.5°C	0.1°C	
R 430 to 1760°C	1.0°C	1.0°C	0.1°C	
S 430 to 1760°C	1.0°C	1.0°C	0.1°C	
T -200 to 400°C	0.5°C	0.5°C	0.1°C	
U -200 to 600°C	1.0°C	1.0°C	0.1°C	

### Ordering Information

**Included with AccuPro Diamond and AccuPro Diamond Plus**  
 Battery pack, 6 'C' alkaline batteries, multi-tip lead set, instruction manual, NIST certified traceable test data, carrying case.

Model	Description
CL-9001	AMETEK AccuPro Diamond
CL-9002	AMETEK AccuPro Diamond Plus
CL-9003	AMETEK AccuPro Diamond without pressure input
CL-9004	AMETEK AccuPro Diamond Plus without pressure input
	Code   Optional Power Adapter
	<b>120</b>   120V AC power adapter
	<b>240</b>   240V AC power adapter
	<b>NP</b>   Not required
	Code   Test Lead Sets
	<b>STL</b>   Standard Test Lead Set
	<b>DTL</b>   Deluxe Test Lead Set
	Code   Instrument Management Software
	<b>IQ<sup>1</sup></b>   Total IQ™—Ametek Windows-based instrument management software
	<b>CST<sup>2</sup></b>   Cornerstone™ Base Station—Windows-based instrument management software
	<b>NS</b>   Not required
<b>CL-9002</b>	<b>120 DTL IQ</b>   <b>Ordering Example</b>

Ametek AccuPro Diamond Plus with 120V AC adapter and with Total IQ instrument management software. <sup>1,2</sup>  
 Compatible with AccuPro Diamond Plus CL-9002/4/5.

## AccuPro Diamond CL-9005 HART® Calibrator



### Universal Multi-Function Documenting Calibrator for HART® and Conventional Instruments

#### STANDARD FEATURES

- Capacity for 40 or 75 HART Command Sets
- Non-Volatile Memory
- Field Upgradeable
- Automatic Battery Save Function
- Simultaneous Inputs and Outputs
- 13 Thermocouples: B, C, D, E, G, J, K, L, N, R, S, T, U
- 5 RTDs: 100Ω Pt, 120Ω Ni, 10Ω Cu Frequency
- Trip Detection
- Pressure
- 24 Vdc Transmitter Power
- Transmitter Simulator
- Simultaneous mA Input/Output
- Automatic Data Collection
- Manual Data Entry
- 21 Point As Found/As Left Calibrations
- 21 Step Set Point
- Auto/Manual Set Point Cycling
- Output Ramping
- Full Alphanumeric Keypad
- Field Entry of Calibration Notes
- Serial Output (PC or Printer)
- Storage for 50 Calibrations
- Sealed Keypad Case
- NIST Certificate of Traceability
- 3 Year Warranty
- Alkaline and Rechargeable Batteries
- Test Leads and Carrying Case

The CL-9005 HART® Calibrator eliminates the need to carry a hand-held communicator when performing calibrations on HART instruments. The CL-9005 combines the full capabilities of the Diamond Plus Multi-Function, Documenting Calibrator with the HART hand-held communicator functions of Output Trim, Sensor Trim, Re-ranging (Zero and Span), Tag, Description and Date changes. The closed loop feedback of the calibrator's output provides the high accuracy required for Smart transmitter calibrations.

The HART Interface Adapter (HIA) provides the communications interface between the calibrator and instrument under test. It automatically energizes, establishes communications, and downloads the proper command set when activated by the user. Held in its own carrying case, it is attached to the back of the calibrator and holds the command sets for the HART instruments. New HART devices or new revisions can be added through its serial port and a PC.

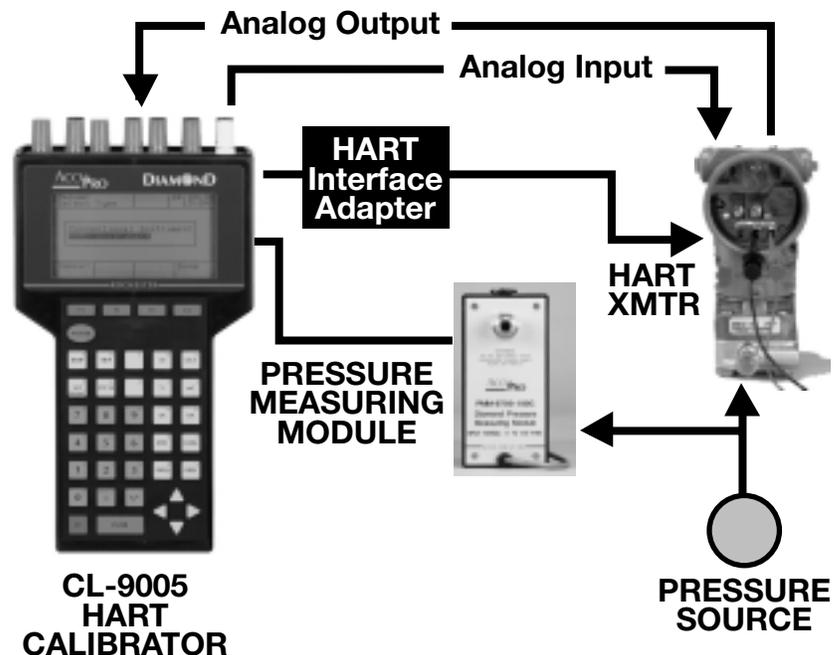
When viewing HART instruments, the user is able to view the analog and digital input and output variables.

Trimming the output or sensor require less than 5 keystrokes each. Up to 50 documented calibrations, each with 21 As Found and 21 As Left analog data values can be held by the CL-9005. Calibration data can be transferred to a PC, printer or calibration management program such as Total IQ™ or Cornerstone™.

Supported HART Instruments:

Manufacturer	Model	Rev	Part No	Rev
Rosemount	1151	1 - 6	3044C	1
	3144	1, 2	3051C	1, 2
Yokogawa	EJA			
Foxboro	RTT		IGP	
	IAP		IDP	
	IPS		IFL	

Deluxe Test Lead Set Option  
 1-48" Cable w/alligator clips  
 1 48" cable with mini grabbers  
 2 shorting double banana plugs  
 1 case



# AMETEK

## AccuPro Calibrators

### General Specifications

**Display:** 240 x 128 pixel graphic LCD, 95 x 54 mm

**Power:**  
Calibrator — six 'C' size alkaline (standard) or NiCd cells (optional)  
HART Interface Adapter — one 9V alkaline

**Battery life:**  
Calibrators:  
Continuous sourcing > 8 hours  
Continuous monitoring > 40 hours  
Hart Interface adapter: > 8 hours

**Dimensions:** 229 x 133 x 64 mm (9 x 5.2 x 2.5 inches)

**Weight:** 1.37 kg (3 lbs.)

**Operating Temperature Range:** 0 to 50°C

**Storage Temperature Range:** -20 to 60°C

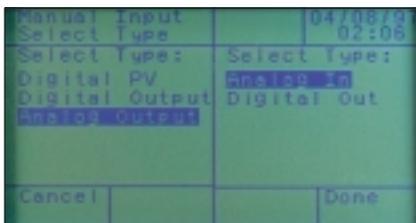
**Operating Humidity Range:** 20 to 90% relative humidity, non-condensing. The effect on accuracy is <0.05°C for a change in relative humidity from 20 to 90% at 23°C.

**Radio-Frequency Interference (RFI):** Conforms to SAMA PMC 33.1 1978, mV input and output will not shift more than 1% of full-scale when tested at a field strength of 10 V/M at a distance of 1m from 20 MHz to 1 GHz.

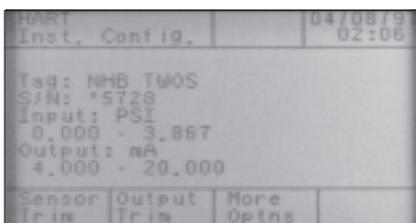
**Warranty:** Three year parts and labor

SIGNAL	ACCURACY (% fs)		DISPLAY
	INPUT	OUTPUT	RESOLUTION
0mV to 200mV	0.025%	0.025%	0.01mV
0V to 20V		0.025%	0.001V
0V to 50V	0.025%		0.001V
0mA to 24mA		0.025%	0.001mA
0mA to 50mA	0.025%		0.001mA
1Hz to 1000Hz	0.01%	0.01%	0.1Hz
100Hz to 10KHz	0.01%	0.01%	0.001KHz
1 CPM to 1000 CPM	0.01%	0.01%	0.1 CPM
0.1 CPH to 100 CPH	0.05%	0.05%	0.01 CPH
Frequency Measurement: 0.1V to 100V peak-to-peak			
Frequency Output: 0.1V to 10V peak-to-peak, Zero-based squarewave			
5 to 500 Ohms	0.035%	0.05%	0.1 Ohm
<b>RTD (2, 3 or 4 wire)</b>			
100Ω Pt (∞ = .385)	0.5°C	0.8°C	0.1°C 100Ω Pt: -200.2 to +850°C
100Ω Pt (∞ = .3916)	0.5°C	0.8°C	0.1°C
100Ω Pt (∞ = .3923)	0.5°C	0.8°C	0.1°C
120Ω Ni	0.25°C	0.5°C	0.1°C 120Ω Ni: -80° to +320° C
10Ω Cu	1.0°C	2.0°C	0.1°C 10Ω Cu: -10° to +260° C
<b>Thermocouples (internal or external CJC)</b>			
B 1200 to 1820°C	1.0°C	1.0°C	0.1°C
C 0 to 2320°C	1.5°C	1.5°C	0.1°C
D 0 to 2320°C	1.5°C	1.5°C	0.1°C
E -200 to 1000°C	0.5°C	0.5°C	0.1°C
G 100 to 2320°C	2.0°C	2.0°C	0.1°C
J -210 to 1200°C	0.5°C	0.5°C	0.1°C
K -200 to 1370°C	0.5°C	0.5°C	0.1°C
L -200 to 900°C	1.0°C	1.0°C	0.1°C
N -150 to 1300°C	0.5°C	0.5°C	0.1°C
R 430 to 1760°C	1.0°C	1.0°C	0.1°C
S 430 to 1760°C	1.0°C	1.0°C	0.1°C
T -200 to 400°C	0.5°C	0.5°C	0.1°C
U -200 to 600°C	1.0°C	1.0°C	0.1°C

### Ordering Information



Calibrator Displays: Input and Output viewing options (above) and HART Instrument configuration (below).



Model	Description	
CL-9005	Ametek Diamond Plus with Pressure Capability and HART® Interface	
	Internal Memory will hold up to 50 instrument calibrations	
	Code	HART Interface Module Memory
	SM	Standard Memory - up to 40 HART instruments
	EM	Extended Memory - up to 75 HART instruments
	Code	Optional Power Adaptor
	120	120 V AC adaptor
	240	240 V AC adaptor
	NR	Not required
	Code	Test Lead Sets
	STL	Standard Test Lead Set
	DTL	Deluxe Test Lead Set
	Code	Optional HART Command Tables
ABB	ABB Kent-Taylor 600T	
FPB	Fisher & Porter-Bailey 50DP, 50 PL	
MOR	Moore Products 341 XTC, 344 XTC	
SMR	SMAR LD301, TT301	
FOX	Foxboro, RTT2, IAP, IDP, IGP, IFL	
CL-9005	EM 120 DTL FOX	
<b>Ordering Example</b>		

Ametek CL-9005 Diamond Plus with Extended Memory Option, 120V AC adaptor, Deluxe Test Lead Set and Foxboro Instrument Command Tables.

## PMM-9700 Series Pressure Measuring Modules



- **3 Ranges:** 0-15 psig  
0-30 psig  
0-100 psig
- **High accuracy - 0.07%**  
Ensures accurate calibration of instruments
- **Stainless steel sensors**  
Accepts corrosive liquids and gases
- **Temperature compensated sensors**  
Ensures performance over a wide temperature range
- **Over range protection**  
Sensor protection to twice input range
- **Remote mounting from calibrator**  
Protects personnel and calibrator from steam, heat and other process hazards
- **NIST traceable**  
Accurate calibration of module and instruments
- **Three year warranty**  
Rugged design reduces life cycle costs

The PMM-9700 pressure measuring modules enable the measurement of gases and liquids with the Diamond calibrators. Each module has a 316 stainless steel sensor which allows an interface with pressure media that may contain corrosive materials.

Each module includes a serial interface cable that plugs into the side of the Diamond calibrator which enables the calibrator to be located a comfortable distance away from process connections such as steam, hot liquids and caustic materials. This feature minimizes the possibility of accidental personnel injury and/or equipment damage.

The pressure modules support a 0.07% accuracy thereby ensuring accurate calibration of instruments and pressure devices such as transmitters, gages and indicators.

Each module provides on-board temperature compensation and signal conversion. The digital signal transmission attenuates the effects of RFI and EMI, and also permits the modules to be interfaced with a personal computer or terminal.

Over range protection to twice the range of the module is standard. A 1/4" NPT male connector permits easy connection to process pressure.

The Diamond calibrator firmware permits zeroing of the module at non-zero pressures which is ideal for liquid level and other elevated pressure applications.

The calibrator firmware also supports 19 different engineering units including in H<sub>2</sub>O, psig, mm Hg, Atm, kPa and more.

### Output Resolution:

15 and 30 psig models  
0.007% maximum of full scale  
100 psig model  
0.010% maximum of full scale

### Over Range Protection:

2 times full scale pressure without damage

### Long Term Drift:

Less than ±0.05% of full scale accuracy shift per year

### Power Supply:

The module(s) are powered by the Diamond calibrator or can be operated from 24 Vdc +10%, -25%.

### Power Consumption:

Maximum: 20 mA @ 19 Vdc (380 mW)

Typical: 130-150mW

### Communications Format:

8 data, 1 stop bit, no parity, 9700 baud

### Temperature Range:

Operating: 0 to +50°C  
Storage: 0 to +60°C

### Maximum Process Temperature:

70°C without damage

### Temperature Effect:

The temperature effect on accuracy is 150 ppm/°C maximum over the operating temperature range.

### Relative Humidity:

Operating Range: 20% to 90% non-condensing

### Humidity Effect:

The humidity effect on accuracy is 0.05% of span for a change in RH from 20% to 90% at 23°C.

## Ordering Information

Model	Description
PMM-9700	Pressure Measuring Module
	<b>Code</b> <b>Input Pressure Range</b>
	-15G                          0 to ±15 psig
	-30G                          0 to ±30 psig
	-100G                        0 to ±100 psig
PMM-9700	-30G <b>Ordering Example</b>

Pressure Measuring Module with 0-30 psig Input Range

## PMM-9700 Specifications

**Available Engineering Units** (all models): Atm, psig, in Hg 0°C, in H<sub>2</sub>O 20°C, ft H<sub>2</sub>O 20°C, Bar, mBar, mm H<sub>2</sub>O 4°C, m H<sub>2</sub>O 0°C, cm Hg 0°C, Torr, kPa, g/cm<sup>2</sup>, kg/cm<sup>2</sup>, lb/ft<sup>2</sup>, in H<sub>2</sub>O 60°C, in H<sub>2</sub>O 4°C.

Model Number	Input range	Accuracy *
PMM-9700-15G	0 to +15 psig	±0.07% F.S., ±0.02 psig
PMM-9700-30G	0 to +30 psig	±0.07% F.S., ±0.03 psig
PMM-9700-100G	0 to +100 psig	±0.07% F.S., ±0.01 psig

\* Accuracy is dependent upon zeroing the unit prior to taking the measurement

# AMETEK

## AccuPro Calibrators

### PMM-9850 Multi-Range Pressure Pack



The Multi-Range Pressure Pack is available with 2 or 3 ranges for gas and liquid pressure measurement with the Diamond Calibrators. Each pack can contain any combination of PMM-9700 modules, each which has a 316 stainless steel sensor which allows an interface with pressure media which may contain corrosive materials. By combining multiple pressure ranges into a single, rugged and lightweight housing, the number of individual devices needed for pressure calibrations is reduced.

The 0.07% high accuracy ensures accurate calibration of instruments and pressure devices such as transmitters, gages and indicators.

Each module provides on-board temperature compensation and signal conversion. The digital signal transmission attenuates the effects of RFI and EMI and also permits the modules to be interfaced with a personal computer or terminal via the RS-232 serial port.

Over range protection to twice the range of the module is standard. A 1/4" NPT male connector permits easy connection to process pressure.

The serial interface cable which plugs into the side of the Diamond calibrator enables the calibrator to be located a comfortable distance away from process connections such as steam, hot liquids and caustic materials. This feature minimizes the possibility of accidental injury and/or equipment damage. It detaches to avoid bending stresses from accidental catching on poles and structural members.

The Diamond calibrator firmware permits zeroing of the module at non-zero pressures which is ideal for liquid level and other elevated pressure applications.

The calibrator firmware also supports 19 different engineering units including in H<sub>2</sub>O, psig, mm Hg, Atm, kPa and more.

- **3 Ranges:** 0-15 psig  
0-30 psig  
0-100 psig
- **High accuracy - 0.07%**  
Ensures accurate calibration of instruments
- **Stainless steel sensors**  
Accepts corrosive liquids and gases
- **Temperature compensated sensors**  
Ensures performance over a wide temperature range
- **Over range protection**  
Sensor protection to twice input range
- **Remote mounting from calibrator**  
Protects personnel and calibrator from steam, heat and other process hazards
- **NIST traceable**  
Accurate calibration of module and instruments
- **Three year warranty**  
Rugged design reduces life cycle costs

## PMM-9850 Specifications

**Available Engineering Units** (all models): Atm, psig, in Hg 0°C, in H<sub>2</sub>O 20°C, ft H<sub>2</sub>O 20°C, Bar, mBar, mm H<sub>2</sub>O 4°C, m H<sub>2</sub>O 0°C, cm Hg 0°C, Torr, kPa, g/cm<sup>2</sup>, kg/cm<sup>2</sup>, lb/ft<sup>2</sup>, in H<sub>2</sub>O 60°C, in H<sub>2</sub>O 4°C.

### Input Range Options:

0 to +15 psig, 0 to +30 psig, 0 to +100 psig

### Input Range Accuracy:

0 to +15 psig     ±0.07% F.S., ±0.002% psig  
 0 to +30 psig     ±0.07% F.S., ±0.003% psig  
 0 to +100 psig    ±0.07% F.S., ±0.01% psig

### Output Resolution:

15 and 30 psig models     0.007% maximum of full scale  
 100 psig model             0.010% maximum of full scale

### Over Range Protection:

2 times full scale pressure without damage

### Long Term Drift:

Less than ±0.05% of full scale accuracy shift per year

### Power Supply:

The module(s) are powered by the Diamond calibrator or can be operated from 24 Vdc +10%, -25%.

### Power Consumption:

Maximum: 20 mA @ 19 Vdc (380 mW)  
 Typical: 130-150mW

### Communications Format:

8 data, 1 stop bit, no parity, 9600 baud

### Temperature Range:

Operating: 0 to +50°C  
 Storage: 0 to +60°C

### Maximum Process Temperature:

70°C without damage

### Temperature Effect:

The temperature effect on accuracy is 150 ppm/°C maximum over the operating temperature range.

### Relative Humidity:

Operating Range: 20% to 90% non-condensing

### Humidity Effect:

The humidity effect on accuracy is 0.05% of span for a change in RH from 20% to 90% at 23°C.

### RFI:

When tested at field strength of 10 V/M at a distance of 1M, the pressure reading will not shift by more than 1% of full scale.

**Size:** 9.25 x 5.5 x 2.25 inches  
 (24.1 x 14.0 x 5.6 cm)

**Weight:** 2.8 pounds (1.25 kg)

## Ordering Information

Model	Description			
PMM-9850	Multi-Range Pressure Pack – Requires PMM-9850-C Cable			
		<b>Code</b>	<b>1st Pressure Module Input Pressure Range</b>	
		-15G	0 to ±15 psig	
		-30G	0 to ±30 psig	
		-100G	0 to ±100 psig	
		<b>Code</b>	<b>2nd Pressure Module</b>	
		-15G	0 to ±15 psig	
		-30G	0 to ±30 psig	
		-100G	0 to ±100 psig	
		<b>Code</b>	<b>3rd Pressure Module</b>	
		-15G	0 to ±15 psig	
		-30G	0 to ±30 psig	
	-100G	0 to ±100 psig		
PMM-9850	-15G	-30G	-100G	Ordering Example

Multi-Range Pressure Pack with -15G, -30G and -100G Modules

# AMETEK AccuPro Calibrators

## TOTAL IQ™ Calibration Management Software for Computer-Aided Calibration and Documentation



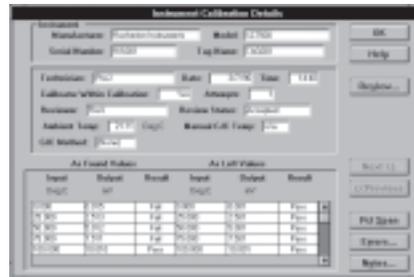
- Automates instrument calibration
- Downloads pre-programmed calibration procedures
- Built-in scheduling of instrument calibration routes
- Powerful database for instrument inventory
- Maintains calibration history
- Stores Instrument and calibration data
- Calibration graphs of instrument performance
- Printed reports
- Import/export to Microsoft® EXCEL™ and other Windows™ based programs
- Assists in compliance with ISO, EPA, OSHA, FDA and insurance audits
- Four levels of password protected security
- Allows automatic and manual data entry
- Comment fields, drawing references and special information fields
- Compatible with Ametek Power Instruments Diamond Plus Calibrators



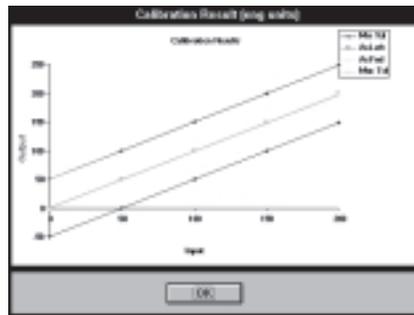
Total IQ is a software package for the automation of instrument calibration and documentation. Standard and special calibration procedures can be stored, downloaded and automatically executed by the Diamond Plus calibrators. The “As Found” and “As Left” data is time and date stamped and then uploaded to the serial port of the host PC and stored for analysis and future comparisons.

Built on Microsoft ACCESS™, its powerful database editor allows the creation of instrument inventory lists based on vendor, installed location, calibration dates, types and other criteria. The commentary fields and automatic data capture streamlines the calibration process, insures data integrity, and frees up manpower for other plant tasks.

### Instrument Calibration History



### Calibration Graphs



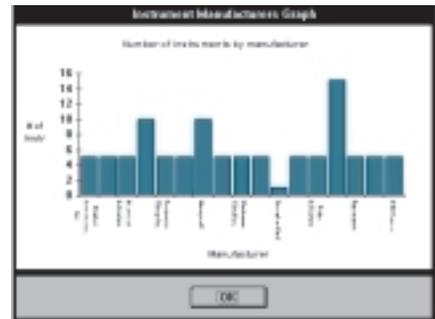
### PC REQUIREMENTS:

- PC 486-SX or higher processor running at 50 Mhz minimum
- 12 MB RAM
- 10 MB of hard disk space (empty database)
- Microsoft ® mouse or equivalent
- Microsoft Windows ® 3.1 or higher, running in 386 enhanced mode

### ORDERING INFORMATION

- Total IQ II... Calibration and Documentation Software
- 1080-757 ... PC to Calibrator Communications Cable

### Graphs of Instrument Inventory, Workload and Routes



### Calibration Schemes: Standard and User Defined

