



*Precision multi-function documenting calibrator and HART™ configurator/communicator in one hand-held instrument*



# Precision multi-function documenting calibrator

## General Features

- Precision multi-function calibrator and HART™ configurator/communicator in one hand-held instrument
- Measure/read thermocouple, RTD, Ohms, DC and AC Voltage, DC current, pressure, and frequency
- Source/simulate thermocouple, RTD, Ohms, DC Voltage and current, pressure, and frequency
- Simultaneous input and output split-screen displays
- Loop power function
- Switch testing functions
- Transmitter mode
- Automated and user-programmable procedures
- Engineering units, percent of scale, square-law inputs, or custom units
- Multi-lingual interface – English, French, German, Italian, and Spanish
- 200x240 pixel, bright white, backlit LCD display
- Rugged over-molded urethane case for field use
- Calibration automation and documentation with many popular third-party software packages
- Complies with CAN/CSA C22.2 No 1010.1-92, ANSI/ISA S82.01-1994, UL3111, and EN610-1:1993

## HART Protocol Features

- Universal, common practice and device-specific commands
- Point-to-point and multi-drop operation
- Burst mode compatibility
- Read HART PV in digital mode
- Read and write HART configuration functions
- Read and clone transmitter configuration
- Re-tag smart transmitters
- Automated HART sensor and output trim

## The MasterCAL 990 - A Precision Multi-Function Documenting Calibrator

First and foremost, the MasterCAL 990 is a precision, multi-function documenting calibrator that will calibrate virtually any process instrument you have – thermocouples, RTDs, Ohms, Voltage, current, pressure, and frequency. A host of convenience features, including source ramp functions, loop power, variable density data logging with a week's worth of calibration results storage, compatibility with many third-party calibration documentation software programs, and a built-in HART configuration/communicator, make the MasterCAL 990 an indispensable tool.

A large, white backlit LCD provides simultaneous display of input and output. Menu-driven, "soft" function keys provide rapid setup and measurement. The multi-lingual interface ensures the MasterCAL 990 is useful in as broad a range of applications and locations as possible. A high capacity rechargeable battery pack provides extended usage. An optional battery eliminator is available for extended monitoring applications. The MasterCAL 990 is housed in an over-molded urethane case that provides a solid grip and protection against "hard knocks".

## Source/Simulation

The MasterCAL 990 will source/simulate thermocouple, RTD, Ohms, DC Voltage and current, and frequency. Auto-step and ramp functions are provided on all outputs and ranges.

### Measurement/Read

The MasterCAL 990 will measure/read thermocouple, RTD, Ohms, DC and AC Voltage, DC current, pressure, and frequency. Measuring pressure requires the use of the Beta Pressure Module Adapter (Model BPPA100) with any of Beta's Pressure Modules (please refer to the separate Pressure Module data sheet for ranges and accuracies).

### Switch Test Mode

Process limit switches can be tested for both upper and lower trip limits and deadband. Using a split-screen measure/source mode, the MasterCAL 990 accepts a normal process variable measurement associated with the limit switch, and the switch contacts. The 990 will automatically monitor and record the measurement as the switch is activated and then deactivated. A graphical plot of deadband is displayed, making switch test quick and accurate.

### Simultaneous Measure/Source

Using a split-screen display mode, the MasterCAL 990 will simultaneously measure and source various process variables. These variables depend on whether loop power is enabled or disabled. Please refer to Table 1.

### Transmitter Mode

The MasterCAL 990 can be inserted in a 4-20 mA process loop to simulate a 2-wire transmitter. The MasterCAL 990 provides the loop excitation and modulates the loop current, simulating the 2-wire transmitter.

### Built-In Calculator Functions

The MasterCAL 990 features a built-in calculator with square-root function, with accessible registers containing measure and source values.

### Barcode Entry Option

The MasterCAL 990 will accept input from an optional barcode wand for rapid entry of instrument serial numbers.

**Table 1 – Simultaneous Measure/Source**

| Measure Function          | Source Function |    |      |          |     |     |
|---------------------------|-----------------|----|------|----------|-----|-----|
|                           | DC V            | mA | Freq | $\Omega$ | TC  | RTD |
| DC V                      | D E             | D  | D E  | D E      | D E | D E |
| mA                        | D E             |    | D E  | D E      | D E | D E |
| AC V                      | D E             | D  | D E  | D E      | D E | D E |
| Frequency ( $\geq 20$ Hz) | D E             | D  | D E  | D E      | D E | D E |
| Frequency ( $< 20$ Hz)    |                 |    |      |          |     |     |
| $\Omega$                  | D               |    | D    | D        | D   | D   |
| Continuity                | D               |    | D    | D        | D   | D   |
| TC                        | D E             | D  | D E  | D E      |     | D E |
| RTD                       | D               |    | D    | D        | D   | D   |
| 3W RTD                    | D               |    | D    | D        | D   | D   |
| 4W RTD                    | D               |    | D    | D        | D   | D   |
| Pressure                  | D E             | D  | D E  | D E      | D E | D E |

Simultaneous measure/source works with:  
D= Loop power disabled; E= Loop power enabled

### The MasterCAL 990 - A HART Configurator/Communicator

#### HART Implementation

The MasterCAL 990 supports HART Version 5.7 protocol instructions. Its functions are comparable to a HART 275 Communicator; because the MasterCAL 990 does not have a DD interpreter, it does not support DD libraries. Most instrument maintenance functions can be accomplished using just the MasterCAL 990 without the need for a separate HART communicator. Hookup is simple with the supplied HART interface cable. The calibrator menus automatically branch to appropriate adjustment choices. Automatic completion of test templates and automatic fetching and sending of analog readings during trim operations make HART calibration a highly efficient operation.

#### Protocol Instructions

The MasterCAL 990 instruction set includes three levels of commands:

**Universal Commands** – provides functions for all field instruments to read manufacturer and device type, primary variable/input signal (PV), read output, tag ID, etc.

**Common Practice Commands** – provides functions that are common to most field instruments, such as reading multiple variables, setting damping features, etc.

**Device-Specific Commands** – allows the MasterCAL 990 to perform device-specific configuration functions for a wide variety of popular field instruments. Please refer to Table 2.

#### Operating Modes

The MasterCAL 990 supports HART Point-to-Point Operation, where a single HART instrument is connected in a loop; the calibrator is normally connected directly at the instrument's local signal terminals. The MasterCAL 990 is also compatible with multi-drop and burst mode HART installations.

#### Documenting Calibration

The MasterCAL 990 is compatible with many third-party calibration documentation software programs including:

- Applied Systems Technologies Cal Station and Base Station
- Emerson Process Management AMS
- Prime Technologies ProCal
- Fluke DPC Track
- Honeywell DocuMint
- Others supporting the ISA Field Calibrator Interface standard



**Table 2 – Device Specific Configuration Functions**

| Manufacturer         | Pressure Instruments                    | Temperature Instruments   |
|----------------------|---|---|
| ABB/Kent-Taylor      | 600T                                    | 658T <sup>1</sup>   |
| ABB/Hartmann & Braun | Contrans P <sup>1</sup> , AS 800 Series |   |
| Endress & Hauser     | CERABAR S,<br>CERABAR M,<br>DELTABAR S  | TMT 122 <sup>1</sup> , TMT 182 <sup>1</sup> ,<br>TMT 162 <sup>1</sup> |
| Foxboro Eckardt      |   | T1/RTT20 <sup>1</sup>   |
| Foxboro/Invensys     | I/A Pressure                            |   |
| Honeywell            | ST3000                                  | STT25T <sup>1</sup> , STT25H <sup>1</sup>                             |
| Moore Products       | 344 <sup>1</sup>                        |   |
| Rosemount            | 1151<br>2088<br>3001C<br>3051, 3051S    | 3044C<br>644<br>3144<br>3244, 3144P                                   |
| Siemens              | SITRANS P DS<br>SITRANS P ES            |   |
| SMAR                 | LD301                                   | TT301 <sup>1</sup>  |
| Viatran              | I/A Pressure                            |   |
| Wika                 | UNITRANS                                | T32H <sup>1</sup>   |
| Yokogawa             | EJA                                     | YTA 110, 310, and 320   |

<sup>1</sup> Sensor Trim not supported



# Specifications

## Specifications (18 °C to 28 °C unless otherwise noted)

### DC Voltage Read and Source

| Measurement Range/Accuracy<br>(% of reading + % of full scale; 1 year; 2 year) |  |
|--|--|
| 0.000 to 110.000 mV  | ±0.025% rdg.<br>+0.015%FS  |
| 0.000 to 1.10000 V   | ±0.05% rdg. +0.015%FS<br>±0.025% rdg.<br>+0.005%FS                         |
| 0.000 to 11.0000 V   | ±0.05% rdg. +0.005%FS<br>±0.025% rdg.<br>+0.005%FS                         |
| 0.000 to 110.000 V   | ±0.05% rdg. +0.005%FS<br>±0.025% rdg.<br>+0.005%FS                         |
| 0.000 to 300.00 V  | ±0.1% rdg. +0.005%FS<br>±0.05% rdg. +0.005%FS<br>±0.1% rdg. +0.005%FS      |
| Read Input Impedance   | 5 MOhms  |
| Read Common Mode Error   | ±0.008% FS/V <sub>COMMON-MODE</sub>  |
| Read Input Voltage   | 300 V rms maximum  |
| Temperature Coefficient  | (±0.001% rdg +<br>0.0015% FS)/°C;<br>-10 °C to 18 °C, and 28°C<br>to 50 °C |

| Source Range/Accuracy<br>(% of reading + % of full scale; 1 year; 2 year) |   |
|---|---|
| 0.000 to 110.000 mV   | ±0.01% rdg. +0.005%FS<br>±0.015% rdg.<br>+0.005%FS                      |
| 0.000 to 1.10000 V  | ±0.01% rdg. +0.005%FS<br>±0.015% rdg.<br>+0.005%FS                      |
| 0.000 to 15.0000 V  | ±0.01% rdg. +0.005%FS<br>±0.015% rdg.<br>+0.005%FS                      |
| Source Output Loading   | (±0.001% FS + 1 μV)/mA  |
| Source Common Mode Error  | 0.008% FS/V <sub>COMMON-MODE</sub>                                      |
| Source Output Current   | 10 mA maximum   |
| Source Output Voltage   | 30 VDC maximum  |
| Temperature Coefficient   | (±0.001% rdg + 0.001%<br>FS)/°C; -10 °C to 18 °C,<br>and 28 °C to 50 °C |

### AC Voltage Read (10% to 100% of range)

| Measurement Range/Accuracy<br>(% of reading + counts; 1 year; 2 year) |   |
|---|---|
| 20 to 40 Hz   | ±2% rdg. +10<br>±2% rdg. +10                              |
| 40 to 500 Hz  | ±0.5% rdg. +5<br>±0.5% rdg. +5                            |
| 500 Hz to 1 kHz   | ±2% rdg. +10<br>±2% rdg. +10                              |
| 1 to 5 kHz  | ±10% rdg. +20<br>±10% rdg. +20                            |
| Read Input Voltage  |   |
| Minimum   | 0.5 V above 1 kHz   |
| Ranges  | 1.1000 V, 11.000 V,<br>110.00 V, 300.0 V                  |
| Maximum   | 300 V rms   |
| Read Input Impedance  | 5 MOhms and <100 pF                                       |
| Read Input Coupling   | AC only   |
| Read Common Mode Error  | ±0.008% FS/V <sub>COMMON-MODE</sub>                       |
| Temperature Coefficient   | ±10% of spec/°C;<br>-10 °C to 18 °C, and 28°C<br>to 50 °C |

### DC Current Read and Source

| Measurement Range/Accuracy<br>(% of output + % of full scale; 1 year; 2 year) |   |
|---|---|
| 0.000 to 30.000 mA  | ±0.01% +0.015%FS<br>±0.02% +0.015%FS                                      |
| 0.000 to 110.000 mA   | ±0.01% +0.015%FS<br>±0.02% +0.015%FS                                      |
| Read Common Mode Error  | ±0.01% FS/V <sub>COMMON-MODE</sub>  |
| Read Input Voltage  | 30 VDC maximum  |
| Temperature Coefficient   | (±0.001% rdg + 0.002%<br>FS)/°C;<br>-10 °C to 18 °C, and 28°C<br>to 50 °C |

| Source Range/Accuracy<br>(% of output + % of full scale; 1 year; 2 year) |  |
|--|--|
| 0.000 to 22.000 mA   | ±0.01% +0.015%FS<br>±0.02% +0.015%FS   |
| Transmitter simulate<br>(current sink)                                   | ±0.02% rdg. +0.005%FS<br>±0.015% rdg. +0.005%FS                              |
| Source Burden Voltage  | 24 V maximum   |
| Source Common Mode Error   | 0.008% FS/V <sub>COMMON-MODE</sub>   |
| Source Input Voltage   | 30 VDC maximum   |
| Temperature Coefficient  | (±0.003% output +<br>0.003% FS)/°C;<br>-10 °C to 18 °C, and 28°C<br>to 50 °C |

## Ohms Read and Source

| Measurement Range/Accuracy<br>(% of reading + Ohms; 1 year; 2 year) |   |
|---|---|
| 0.000 to 11.000 Ohms  | $\pm 0.05\% + 50 \text{ m}\Omega$   |
|   | $\pm 0.075\% + 50 \text{ m}\Omega$  |
| 0.000 to 110.00 Ohms  | $\pm 0.05\% + 50 \text{ m}\Omega$   |
|   | $\pm 0.075\% + 50 \text{ m}\Omega$  |
| 0.000 to 1.1000 kOhms   | $\pm 0.05\% + 0.5 \Omega$   |
|   | $\pm 0.075\% + 0.5 \Omega$  |
| 0.000 to 11.000 kOhms   | $\pm 0.1\% + 10 \Omega$   |
|   | $\pm 0.1\% + 10 \Omega$   |
| Read Common Mode Error  | $\pm 0.005\% \text{ FS}/V_{\text{COMMON-MODE}}$   |
| Read Input Voltage  | 30 VDC maximum  |
| Continuity  | continuous tone $<< 25 \Omega$ ;<br>no tone $> 400 \Omega$  |
| Temperature Coefficient   | $(\pm 0.01\% \text{ FS} + 2 \text{ m}\Omega)/^\circ\text{C}$ ;<br>$-10^\circ\text{C}$ to $18^\circ\text{C}$ , and $28^\circ\text{C}$<br>to $50^\circ\text{C}$ |

## Source Range/Accuracy (% of output + Ohms; 1 year; 2 year)

|                                   |   |
|-----------------------------------|---|
| 0.000 to 11.000 Ohms              | $\pm 0.01\% + 20 \text{ m}\Omega$   |
|                                   | $\pm 0.02\% + 20 \text{ m}\Omega$   |
| 0.000 to 110.00 Ohms              | $\pm 0.01\% + 40 \text{ m}\Omega$   |
|                                   | $\pm 0.02\% + 40 \text{ m}\Omega$   |
| 0.000 to 1.1000 kOhms             | $\pm 0.02\% + 0.5 \Omega$   |
|                                   | $\pm 0.03\% + 0.5 \Omega$   |
| 0.000 to 11.000 kOhms             | $\pm 0.03\% + 5 \Omega$   |
|                                   | $\pm 0.04\% + 5 \Omega$   |
| Read Common Mode Error            | $\pm 0.008\% \text{ FS}/V_{\text{COMMON-MODE}}$   |
| Source Input Voltage              | 30 VDC maximum  |
| Current Through Source Resistance |   |
| 11.000 Ohms range                 | 3 mA DC max.; 0.1 mA DC min.  |
| 11.000 Ohms range                 | 3 mA DC max.; 0.1 mA DC min.  |
| 11.000 Ohms range                 | 3 mA DC max.; 0.01 mA DC min.   |
| 11.000 Ohms range                 | 1 mA DC max.; 0.01 mA DC min.   |
| Temperature Coefficient           | $\pm 0.01\% \text{ FS}/^\circ\text{C}$ ;<br>$-10^\circ\text{C}$ to $18^\circ\text{C}$ , and $28^\circ\text{C}$<br>to $50^\circ\text{C}$ |

## Frequency Read and Source

(For frequencies  $< 109.99 \text{ Hz}$ , specification applies for signals with slew rates  $> 5 \text{ V/ms}$ )

| Measurement Range/Accuracy (1 year; 2 year) |                        |
|---|------------------------|
| 1.00 to 109.99 Hz                           | $\pm 0.05 \text{ Hz}$  |
|   | $\pm 0.05 \text{ Hz}$  |
| 110.0 to 1099.9 Hz                          | $\pm 0.5 \text{ Hz}$   |
|   | $\pm 0.5 \text{ Hz}$   |
| 1.100 to 10.999 kHz                         | $\pm 0.005 \text{ Hz}$ |
|   | $\pm 0.005 \text{ Hz}$ |
| 11.00 to 50.00 kHz                          | $\pm 0.05 \text{ kHz}$ |
|   | $\pm 0.05 \text{ kHz}$ |
| Minimum Input Amplitudes                    |                        |
| 1 Hz to 1 kHz squarewave                    | 300 mVP-P              |
| 1 kHz to 30 kHz squarewave                  | 1.4 VP-P               |
| $> 30 \text{ kHz}$                          | 2.8 VP-P               |
| Maximum Input Amplitudes                    |                        |
| 1 Hz to 1 kHz                               | 300 V rms              |
| $> 1 \text{ kHz}$                           | 30 V rms               |
| Input Impedance                             | 5 MOhms                |

## Source Range/Accuracy (1 year; 2 year)

|                     |  |
|---------------------|--|
| 0.00 to 10.99 Hz    | $\pm 0.01 \text{ Hz}$                      |
|                     | $\pm 0.01 \text{ Hz}$                      |
| 11.00 to 109.99 Hz  | $\pm 0.1 \text{ Hz}$                       |
|                     | $\pm 0.1 \text{ Hz}$                       |
| 110.0 to 1099.9 Hz  | $\pm 0.1 \text{ Hz}$                       |
|                     | $\pm 0.1 \text{ Hz}$                       |
| 1.100 to 21.999 kHz | $\pm 0.002 \text{ kHz}$                    |
|                     | $\pm 0.002 \text{ kHz}$                    |
| 22.00 to 50.00 kHz  | $\pm 0.005 \text{ kHz}$                    |
|                     | $\pm 0.005 \text{ kHz}$                    |
| Waveforms           | squarewave with 50%<br>duty cycle sinewave |
| Amplitude           | 0.1 to 10 VP-P;<br>user-adjustable         |
| Amplitude Accuracy  |  |
| 1 to 1099 Hz        | $\pm 3\%$ of output + 0.5% FS              |
| 1.1 to 10.9 kHz     | $\pm 10\%$ of output + 0.5% FS             |
| 11 to 50 kHz        | $\pm 30\%$ of output + 0.5% FS             |
| Input Voltage       | 30 VDC maximum                             |

## Thermocouple Read and Source

(Accuracies with external cold junction; add 0.2 °C for internal junction; sensor inaccuracies not included)

|                         |   |
|-------------------------|---|
| Resolution              | 0.1 °C  |
| Temperature Scale       | ITS-90 or IPTS-68, selectable   |
| Compensation            | IPTS-90 per Monograph 175 for E/N/J/K/T/B/R/S thermocouples<br><br>IPTS-68 per IEC 584-1 for E/J/K/T/B/R/S thermocouples<br><br>IPTS-68 per DIN 43710 for L and U thermocouples |
| Input Voltage           | 30 VDC maximum  |
| Common Mode Error       | 0.01 °C/V <sub>COMMON-MODE</sub>  |
| Temperature Coefficient | 0.05 °C/°C;<br>-10 °C to 18 °C, and 28 °C to 50 °C  |

Read Type/Range/Accuracy (1 year; 2 year)

|                   |                  |
|-------------------|------------------|
| J Thermocouple    |                  |
| -210 to -100 °C   | ±0.6 °C; ±0.9 °C |
| -100 to +800 °C   | ±0.3 °C; ±0.4 °C |
| +800 to +1200 °C  | ±0.5 °C; ±0.8 °C |
| K Thermocouple    |                  |
| -210 to -100 °C   | ±0.7 °C; ±1.0 °C |
| -100 to +400 °C   | ±0.3 °C; ±0.4 °C |
| +400 to +1200 °C  | ±0.5 °C; ±0.8 °C |
| +1200 to +1372 °C | ±0.7 °C; ±1.0 °C |
| T Thermocouple    |                  |
| -250 to -200 °C   | ±1.7 °C; ±2.5 °C |
| -200 to 0 °C      | ±0.6 °C; ±0.9 °C |
| 0 to +400 °C      | ±0.3 °C; ±0.4 °C |
| E Thermocouple    |                  |
| -250 to -200 °C   | ±1.3 °C; ±2.0 °C |
| -200 to -100 °C   | ±0.5 °C; ±0.8 °C |
| -100 to +600 °C   | ±0.3 °C; ±0.4 °C |
| +600 to +1000 °C  | ±0.4 °C; ±0.6 °C |
| R Thermocouple    |                  |
| -20 to 0 °C       | ±2.3 °C; ±2.8 °C |
| 0 to +100 °C      | ±1.5 °C; ±2.2 °C |
| +100 to +1767 °C  | ±1.0 °C; ±1.5 °C |
| S Thermocouple    |                  |
| -20 to 0 °C       | ±2.3 °C; ±2.8 °C |
| 0 to +200 °C      | ±1.5 °C; ±2.1 °C |
| +200 to +1400 °C  | ±0.9 °C; ±1.4 °C |
| +1400 to +1767 °C | ±1.1 °C; ±1.7 °C |
| B Thermocouple    |                  |
| +600 to +800 °C   | ±1.3 °C; ±2.0 °C |
| +800 to +1000 °C  | ±1.0 °C; ±1.5 °C |
| +1000 to +1820 °C | ±0.9 °C; ±1.3 °C |

C Thermocouple

|                   |                  |
|-------------------|------------------|
| 0 to +800 °C      | ±0.6 °C; ±0.9 °C |
| +800 to +1200 °C  | ±0.8 °C; ±1.2 °C |
| +1200 to +1800 °C | ±1.1 °C; ±1.6 °C |
| +1800 to +2316 °C | ±2.0 °C; ±3.0 °C |
| L Thermocouple    |                  |
| -200 to -100 °C   | ±0.6 °C; ±0.9 °C |
| -100 to +800 °C   | ±0.3 °C; ±0.4 °C |
| +800 to +900 °C   | ±0.5 °C; ±0.8 °C |
| U Thermocouple    |                  |
| -200 to 0 °C      | ±0.6 °C; ±0.9 °C |
| 0 to +600 °C      | ±0.3 °C; ±0.4 °C |
| N Thermocouple    |                  |
| -200 to -100 °C   | ±1.0 °C; ±1.5 °C |
| -100 to +900 °C   | ±0.5 °C; ±0.8 °C |
| +900 to +1300 °C  | ±0.6 °C; ±0.9 °C |

Source Type/Range/Accuracy (1 year; 2 year)

|                   |                  |
|-------------------|------------------|
| J Thermocouple    |                  |
| -210 to -100 °C   | ±0.3 °C; ±0.4 °C |
| -100 to +800 °C   | ±0.2 °C; ±0.3 °C |
| +800 to +1200 °C  | ±0.2 °C; ±0.3 °C |
| K Thermocouple    |                  |
| -210 to -100 °C   | ±0.4 °C; ±0.6 °C |
| -100 to +400 °C   | ±0.3 °C; ±0.4 °C |
| +400 to +1200 °C  | ±0.3 °C; ±0.4 °C |
| +1200 to +1372 °C | ±0.3 °C; ±0.4 °C |
| T Thermocouple    |                  |
| -250 to -200 °C   | ±0.9 °C; ±1.4 °C |
| -200 to 0 °C      | ±0.4 °C; ±0.9 °C |
| 0 to +400 °C      | ±0.3 °C; ±0.4 °C |
| E Thermocouple    |                  |
| -250 to -200 °C   | ±0.6 °C; ±0.9 °C |
| -200 to -100 °C   | ±0.3 °C; ±0.4 °C |
| -100 to +600 °C   | ±0.3 °C; ±0.4 °C |
| +600 to +1000 °C  | ±0.2 °C; ±0.3 °C |
| R Thermocouple    |                  |
| -20 to 0 °C       | ±1.2 °C; ±1.8 °C |
| 0 to +100 °C      | ±1.1 °C; ±1.7 °C |
| +100 to +1767 °C  | ±0.9 °C; ±1.4 °C |
| S Thermocouple    |                  |
| -20 to 0 °C       | ±1.2 °C; ±1.8 °C |
| 0 to +200 °C      | ±1.1 °C; ±1.7 °C |
| +200 to +1400 °C  | ±0.9 °C; ±1.4 °C |
| +1400 to +1767 °C | ±1.0 °C; ±1.5 °C |

| B Thermocouple    |                  |
|-------------------|------------------|
| +600 to +800 °C   | ±1.0 °C; ±1.5 °C |
| +800 to +1000 °C  | ±0.8 °C; ±1.2 °C |
| +1000 to +1820 °C | ±0.8 °C; ±1.2 °C |
| C Thermocouple    |                  |
| 0 to +800 °C      | ±0.6 °C; ±0.9 °C |
| +800 to +1200 °C  | ±0.7 °C; ±1.0 °C |
| +1200 to +1800 °C | ±0.9 °C; ±1.4 °C |
| +1800 to +2316 °C | ±1.3 °C; ±2.0 °C |
| L Thermocouple    |                  |
| -200 to -100 °C   | ±0.3 °C; ±0.4 °C |
| -100 to +800 °C   | ±0.2 °C; ±0.3 °C |
| +800 to +900 °C   | ±0.2 °C; ±0.3 °C |

| U Thermocouple   |                  |
|------------------|------------------|
| -200 to 0 °C     | ±0.4 °C; ±0.6 °C |
| 0 to +600 °C     | ±0.3 °C; ±0.4 °C |
| N Thermocouple   |                  |
| -200 to -100 °C  | ±0.6 °C; ±0.9 °C |
| -100 to +900 °C  | ±0.5 °C; ±0.8 °C |
| +900 to +1300 °C | ±0.3 °C; ±0.4 °C |

*Note: When simulating temperature in As Found/As Left procedures, steps may be either linear by temperature or linear by mV potential.*



## RTD Read and Source

(For 2-wire or 3-wire measurements, add 0.4 °C; sensor inaccuracies not included)

|   |   |
|---|---|
| Resolution                                  | 0.1 °C, except 1 °C for 10 Ω Cu                                     |
| Input Voltage                               | 30 VDC maximum  |
| Input Current for RTD Source Function       |   |
| 10, 100, 120 Ω RTDs                         | 8 mA DC   |
| 200, 500, 1000 Ω RTDs                       | 1 mA DC   |
|   | addresses pulsed transmitters and PLCs with pulses as short as 1 ms |
| Temperature Coefficient                     | 0.02 °C/°C; -10 °C to 18 °C, and 28 °C to 50 °C                     |
| Read Type/Range/Accuracy (1 year; 2 year)   |   |
| Cu10  |   |
| -100 to 0 °C                                | ±2.0 °C; ±2.0 °C  |
| 0 to +260 °C                                | ±2.0 °C; ±2.0 °C  |
| Pt100 (3916)                                |   |
| -200 to -190 °C                             | ±0.3 °C; ±0.4 °C  |
| -190 to 0 °C                                | ±0.3 °C; ±0.4 °C  |
| 0 to +630 °C                                | ±0.5 °C; ±0.8 °C  |
| Pt100 (3926)                                |   |
| -200 to 0 °C                                | ±0.3 °C; ±0.4 °C  |
| 0 to +630 °C                                | ±0.5 °C; ±0.8 °C  |
| Pt100 (385)                                 |   |
| -200 to 0 °C                                | ±0.3 °C; ±0.5 °C  |
| 0 to +400 °C                                | ±0.5 °C; ±0.8 °C  |
| +400 to +800 °C                             | ±0.8 °C; ±1.0 °C  |
| Pt200 (385)                                 |   |
| -200 to 0 °C                                | ±0.3 °C; ±0.5 °C  |
| 0 to +400 °C                                | ±0.5 °C; ±0.8 °C  |
| +400 to +630 °C                             | ±0.8 °C; ±1.0 °C  |
| Pt500 (385)                                 |   |
| -200 to 0 °C                                | ±0.3 °C; ±0.5 °C  |
| 0 to +400 °C                                | ±0.5 °C; ±0.8 °C  |
| +400 to +630 °C                             | ±0.8 °C; ±1.0 °C  |
| Pt1000 (385)                                |   |
| -200 to 0 °C                                | ±0.3 °C; ±0.5 °C  |
| 0 to +400 °C                                | ±0.5 °C; ±0.8 °C  |
| +400 to +630 °C                             | ±0.8 °C; ±1.0 °C  |
| Ni120 (672)                                 |   |
| -80 to +260 °C                              | ±0.3 °C; ±0.4 °C  |
| Source Type/Range/Accuracy (1 year; 2 year) |   |
| Cu10  |   |
| -100 to 0 °C                                | ±1.0 °C; ±1.0 °C  |
| 0 to +260 °C                                | ±1.0 °C; ±1.0 °C  |

## Pt100 (3916)

|                 |                  |
|-----------------|------------------|
| -200 to -190 °C | ±0.3 °C; ±0.4 °C |
| -190 to 0 °C    | ±0.1 °C; ±0.2 °C |
| 0 to +630 °C    | ±0.2 °C; ±0.4 °C |

## Pt100 (3926)

|              |                  |
|--------------|------------------|
| -200 to 0 °C | ±0.1 °C; ±0.2 °C |
| 0 to +630 °C | ±0.2 °C; ±0.4 °C |

## Pt100 (385)

|                 |                  |
|-----------------|------------------|
| -200 to 0 °C    | ±0.1 °C; ±0.2 °C |
| 0 to +400 °C    | ±0.2 °C; ±0.4 °C |
| +400 to +800 °C | ±0.4 °C; ±0.5 °C |

## Pt200 (385)

|                 |                  |
|-----------------|------------------|
| -200 to 0 °C    | ±0.1 °C; ±0.2 °C |
| 0 to +400 °C    | ±0.2 °C; ±0.4 °C |
| +400 to +630 °C | ±0.4 °C; ±0.5 °C |

## Pt500 (385)

|                 |                  |
|-----------------|------------------|
| -200 to 0 °C    | ±0.1 °C; ±0.2 °C |
| 0 to +400 °C    | ±0.2 °C; ±0.4 °C |
| +400 to +630 °C | ±0.4 °C; ±0.5 °C |

## Pt1000 (385)

|                 |                  |
|-----------------|------------------|
| -200 to 0 °C    | ±0.1 °C; ±0.2 °C |
| 0 to +400 °C    | ±0.2 °C; ±0.4 °C |
| +400 to +630 °C | ±0.4 °C; ±0.5 °C |

## Ni120 (672)

|                |                  |
|----------------|------------------|
| -80 to +260 °C | ±0.1 °C; ±0.2 °C |
|----------------|------------------|

## Pressure Read and Source

Please refer to the Beta Pressure Module Data Sheet, 030606R0 for ranges and accuracies. Requires use of included BPPA100 Pressure Module Adapter.



## General

### Loop Power

|                  |                                |
|------------------|--------------------------------|
| Voltage          | 24 V or 28 V, selectable       |
| Maximum Current: | 22 mA, short-circuit protected |
| Input Voltage    | 30 VDC maximum                 |
| Accuracy         | 5%                             |

*Note: A 250U series resistance is automatically supplied whenever loop power is enabled.*

### Ramp Functions

|                  |   |
|------------------|---|
| Source Functions | Voltage, current, Ohms, frequency, temperature                                  |
| Rate             | 4 steps/second  |
| Trip Detect      | continuity or voltage; continuity detection not available when sourcing current |

### Data Log Function

|                       |  |
|-----------------------|--|
| Measure Functions     | Voltage, current, Ohms, frequency, temperature, pressure |
| Reading Rate          | 1, 2, 5, 10, 20, 30, or 60 readings/minute               |
| Maximum Record Length | 8,000 readings 7,980 for 30 or 60 readings/minute        |

### Environmental

|                       |  |
|-----------------------|--|
| Operating Temperature | -20 °C to +50 °C<br>-10 °C to +50 °C for in spec frequency and AC read   |
| Storage Temperature   | -20 °C to +60 °C   |
| Altitude              | 9,186 ft (2800 m) above mean sea level   |
| Stability (90 day)    | Typical 90-day measurement/read and source/simulate accuracy can be estimated by dividing the one year “% of reading” or “% of output” specifications by 2. Floor specifications, expressed as “% of FS” or “counts” or “Ohms” remain constant |
| Power Requirements    | 7.2 VDC  |
| Battery               | NiMH rechargeable, 3500 mAH; included  |
| Battery Life          | >8 hours, typical usage  |

### Physical

|                      |  |
|----------------------|--|
| Dimensions           | 9.3"H x 5.1"W x 2.4"D<br>(236 x 130 x 61 mm)   |
| Weight               | 3 lbs, 1 oz. (1.4 kg)  |
| Connectors/Ports     | Pressure module connector<br>RS232 serial<br>External power in   |
| Included Accessories | Test lead set (4 leads, test clips, test probes)<br>NimMH battery pack<br>Battery pack charger<br>Deluxe carrying case<br>BPPA100 Pressure Module Adapter<br>Serial port cable<br>HART communications cable<br>NIST-traceable calibration certificate, with data<br>Multi-lingual instruction manual on CD<br>Warranty registration card |
| Optional Accessories | Barcode wand   |

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