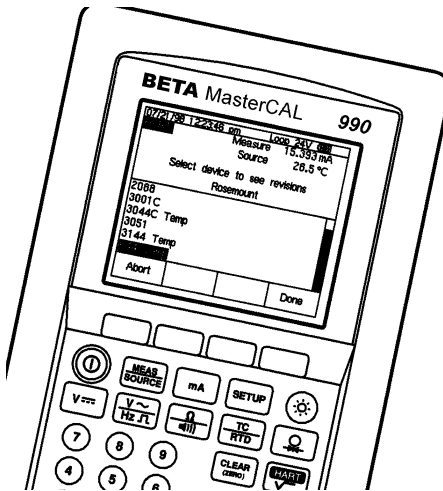


BETA MasterCAL[®] 990



One instrument does it all and does it very well.

- HART™ Smart Transmitter communications protocol built-in
- Temperature – RTDs and Thermocouples
- DC Voltage and Current
- Pressure – with high performance BETA pressure modules
- Frequency
- Ad-hoc calibration documentation support
- Calibration automation and documentation with many popular 3rd party software packages

Important Features

- Simultaneous input and output displays
- Menu-driven operation with “soft” function keys
- Bright White backlit display
- Hand-held, lightweight with rechargeable battery power to get the job done
- Rugged over-molded urethane case stands up to “hard knocks” use
- Multi-lingual interface in English, French, German, Italian and Spanish
- Automated procedures – user programmable – do it your way!
- Auto stepping and ramping of output signals
- Custom engineering units
- Switch testing for voltage, current, temperature and pressure signals
- Transmitter mode
- Bar code entry
- And, did we say, HART™ protocol communications interface

With an incredible list of capabilities and ease of use features, it's the only calibrator you need.

Ordering Information – BETA MasterCAL 990 includes:

- MasterCAL 990 Multi-function Documenting Calibrator
- Test lead set (4 leads, test clips, test probes)
- Nickel Cadmium battery pack
- Battery pack charger
- Deluxe carrying case
- BPPA100 Pressure Module Adapter
- Serial port cable
- HART communications cable
- NIST traceable calibration certificate w/ data
- Multi-lingual instruction manual on CD
- Warranty registration card

HART (Highway Addressable Remote Transducer) Protocol Features

- Universal commands
- Common practice commands
- Device specific commands for many popular devices
- Point-to-point operation
- Multi-drop operation
- Burst mode compatibility (disables burst mode during calibration)
- Read HART PV (primary variable) in digital mode
- Read and write HART configuration functions
- Change sensor configuration
- Re-tag smart transmitters
- Read and clone transmitter configuration
- Automated HART sensor trim and output trim
- Eliminates the need for an expensive “configurator/communicator” for routine calibration jobs

Documenting Software Support

- Applied Systems Technologies Cornerstone Cal Station and Base Station
- Emerson Process Management AMS
- Prime Technologies ProCAL
- Honeywell DocuMint
- Others supporting the ISA Field Calibrator Interface standard

HART™ Protocol Support Specifications

The **MasterCAL 990** supports HART protocol instructions from version 5.7 of the protocol. Our instruction set includes:

- **Universal commands** – provides functions for all field instruments to read manufacturer and device type, read PV (primary variable/input signal), 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 to perform configuration functions that are device specific for a wide variety of popular field instruments (see table).

MasterCAL 990 supports all HART protocol operating modes including:

- **Point-to-point operation** where a single HART instrument is connected in a loop. Normally the calibrator will be connected directly at the instrument's local signal terminals.
- **Multi-drop configuration** where up to 16 HART instruments may be connected on a single 20 milliAmp loop. The calibrator will poll the loop and address the user's choice of instruments on the bus.
- When a HART instrument is in **burst mode**, it transmits data without waiting to be polled. The 990 will temporarily disable burst mode during calibration and then later restore the instrument to burst mode operation.

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

Table 1

¹Sensor Trim not supported

Do I still need a HART communicator?

It's likely that you do.

Although the **BETA MasterCAL 990** supports many HART instructions, it does not support DD libraries because it does not have a DD interpreter. Its functions are comparable to a HART 275 communicator with that one exception. BUT, it does eliminate the need for taking a HART communicator to the field in order to perform most instrument maintenance.

HART Calibration Applications

The **MasterCAL 990** makes HART calibration an efficient operation. Hookup is easy with the included HART interface cable; providing quick access to all the most important HART data. The calibrator menus automatically branch to appropriate adjustment choices. There's automatic completion of test templates and automatic fetching and sending of analog readings during trim operations.

GENERAL SPECIFICATIONS AND FUNCTIONS

Documenting calibration

The BETA MasterCAL 990 is a multi-function documenting calibrator. It 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

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Data log function

Measure functions: Voltage, current, resistance, frequency, temperature, pressure

Reading rate: 1, 2, 5, 10, 20, 30, or 60 readings per minute

Maximum record length: 8000 readings (7980 for 30 or 60 readings per minute)

Ramp function

Source functions: Voltage, current, resistance, frequency, temperature

Rate: 4 steps/second

Trip detect: Continuity or voltage *Continuity detection not available when sourcing current*

Loop power function

Voltage: Selectable, 24 V or 28 V

Accuracy: 5%

Maximum current: 22 mA, short-circuit protected

Maximum input voltage: 30 V dc

Note: 250W series resistance is automatically supplied whenever loop power is enabled.

HART modem interface: Maximum input voltage: 30 V dc

Environmental specifications

All calibrator specifications apply from +18 °C to +28 °C unless stated otherwise.

Operating temperature: -10 °C to 50 °C, (-20 °C typical except for frequency and ac voltage measurement)

Storage temperature: -20 °C to 60 °C

Operating altitude: 2800 m above mean sea level (9186 ft)

90-day specifications: The standard specification intervals for the MasterCAL 990 are 1 and 2 years.

Typical 90-day measurement and source accuracy can be estimated by dividing the one year “% of reading” or “% of output” specifications by 2. Floor specifications, expressed as “% of f.s.” or “counts” or “ohms” remain constant.

Power: Internal battery pack NiCd, 7.2 V, 1700 mAh; NiMH (744 only) 7.2 V, 3500 mAh

Battery Life: Typical usage, >8 hours

Dimensions: 130 x 236 x 61 mm (5.1 x 9.3 x 2.4 in.)

Weight: 1.4 kg (3 lbs. 1 oz.)

Side Port Connections:

- Pressure module connector
- RS-232 connector to interface to your PC
- Connection for optional battery eliminator

Safety: Complies with CAN/CSA C22.2 No 1010.1-92, ANSI/ISA S82.01-1994, UL3111, and EN610-1:1993.

Data Storage Capacity: 1 week of calibration results

MEASUREMENT FUNCTION SPECIFICATIONS

DC voltage measurement

Accuracy (% of reading + % of full scale)

Range (full scale)	1 year	2 years
110.000 mV	0.025% + 0.015%	0.05% + 0.015%
1.10000 V	0.025% + 0.005%	0.05% + 0.005%
11.0000 V	0.025% + 0.005%	0.05% + 0.005%
110.000 V	0.05% + 0.005%	0.1% + 0.005%
300.00 V	0.05% + 0.005%	0.1% + 0.005%

Temperature coefficient: (0.001% reading + 0.0015% f.s.)/°C from -10 °C to 18 °C and 28 °C to 50 °C

Input impedance: 5 MΩ

Common mode error: 0.008% f.s./(Common Mode Volt)

Maximum input voltage: 300 V rms

AC voltage measurement

Accuracy (% of reading + counts)

Frequency range	1 year	2 years
20 to 40 Hz	2% + 10	2% + 10
40 to 500 Hz	0.5% + 5	0.5% + 5
500 Hz to 1 kHz	2% + 10	2% + 10
1 to 5 kHz	10% + 20	10% + 20

Ranges: 1.1000, 11.000, 110.00, 300.0 V Specifications apply for 10% to 100% of range

Input impedance: 5 MΩ and <100 pF

Input coupling: AC only

Temperature coefficient: 10% of spec/°C from -10 °C to 18 °C and 28 °C to 50 °C

Maximum input voltage: 300 V rms

Minimum input voltage: 0.5 V above 1 kHz

DC current measurement

Accuracy (% of reading + % of full scale)

Range (full scale)	1 year	2 years
30.000 mA	0.01% + 0.015%	0.02% + 0.015%
110.00 mA	0.01% + 0.015%	0.02% + 0.015%

Temperature coefficient: (0.001% reading + 0.002% f.s.)/°C from -10 °C to 18 °C and 28 °C to 50 °C

Common mode error: 0.01% f.s./(Common Mode Volt)

Maximum input voltage: 30 V dc

Resistance measurement

Accuracy (% of reading + ohms)

Range (full scale)	1 year	2 years
11.000 W	0.05% + 50 mΩ	0.075% + 50 mΩ
110.00 W	0.05% + 50 mΩ	0.075% + 50 mΩ
1.1000 kW	0.05% + 0.5 Ω	0.075% + 0.5 Ω
11.000 kW	0.1% + 10 Ω	0.1% + 10 Ω

Temperature coefficient: (0.01% f.s. + 2 mΩ)/°C from -10 °C to 18 °C and 28 °C to 50 °C

Common mode error: 0.005% f.s./(Common Mode Volt)

Maximum input voltage: 30 V dc

Continuity: Continuous tone <25 Ω, No tone >400 Ω

BETA MasterCAL 990 Multi-function Documenting Calibrator
Preliminary Specifications – subject to change without notice

Frequency measurement

Accuracy

Range	1 year	2 years
1.00 to 109.99 Hz	0.05 Hz	0.05 Hz
110.0 to 1099.9 Hz	0.5 Hz	0.5 Hz
1.100 to 10.999 kHz	0.005 kHz	0.005 kHz
11.00 to 50.00 kHz	0.05 kHz	0.05 kHz

For frequencies <109.99 Hz, specification applies for signals with slew rates >5 V/ms
Minimum amplitude for Hz measurement: (Squarewaves) 1 Hz to 1 kHz, 300 mV p-p; 1 kHz to 30 kHz, 1.4 V p-p; >30 kHz, 2.8 V p-p
Maximum input: 1 Hz to 1 kHz, 300 V rms; >1 kHz, 30 V rms
Input impedance: 5 M Ω

SOURCING (SIMULATION) FUNCTION SPECIFICATIONS

DC voltage output

Accuracy (% of output + % of full scale)

Range (full scale)	1 year	2 years
110.000 mV	0.01% + 0.005%	0.015% + 0.005%
1.10000 V	0.01% + 0.005%	0.015% + 0.005%
15.0000 V	0.01% + 0.005%	0.015% + 0.005%

Temperature coefficient: (0.001% output + 0.001% f.s.)/ $^{\circ}$ C from -10 $^{\circ}$ C to 18 $^{\circ}$ C and 28 $^{\circ}$ C to 50 $^{\circ}$ C
Maximum output current: 10 mA
Loading: (0.001% f.s. + 1 μ V)/mA
Common mode error: 0.008% f.s./(Common Mode Volt)
Maximum input voltage: 30 V dc

DC current output

Accuracy (% of output + % of full scale)

Range (full scale)	1 year	2 years
22.000 mA	0.01% + 0.015%	0.02% + 0.015%
Current sink (simulate transmitter)	0.02% + 0.03%	0.02% + 0.03%

Specification applies from 2 to 22 mA; below 2 mA typical accuracy is 0.15% of full scale
Maximum burden voltage: 24 V
Temperature coefficient: (0.003% output + 0.003% f.s.)/ $^{\circ}$ C from -10 $^{\circ}$ C to 18 $^{\circ}$ C and 28 $^{\circ}$ C to 50 $^{\circ}$ C
Common mode error: 0.008% f.s./(Common Mode Volt)
Maximum input voltage: 30 V dc

Resistance sourcing

Accuracy (% of output + ohms)

Range (full scale)	1 year	2 years
11.000 W	0.01% + 20 m Ω	0.02% + 20 m Ω
110.00 W	0.01% + 40 m Ω	0.02% + 40 m Ω
1.1000 k?	0.02% + 0.5 Ω	0.03% + 0.5 Ω
11.000 k?	0.03% + 5 Ω	0.04% + 5 Ω

Temperature coefficient: 0.01% f.s./ $^{\circ}$ C from -10 $^{\circ}$ C to 18 $^{\circ}$ C and 28 $^{\circ}$ C to 50 $^{\circ}$ C
Maximum and minimum current through source resistance:

	Maximum	Minimum
11 Ω range:	3 mA dc	0.1 mA dc
110 Ω range:	3 mA dc	0.1 mA dc
1.1 k Ω range:	3 mA dc	0.01 mA dc
11 k Ω range:	1 mA dc	0.01 mA dc

Common mode error: 0.008% f.s./(Common Mode Volt)
Maximum input voltage: 30 V dc

BETA MasterCAL 990 Multi-function Documenting Calibrator
 Preliminary Specifications – subject to change without notice

Frequency sourcing

Accuracy

Range	1 year	2 years
0.00 to 10.99 Hz	0.01 Hz	0.01 Hz
11.00 to 109.99 Hz	0.1 Hz	0.1 Hz
110.0 to 1099.9 Hz	0.1 Hz	0.1 Hz
1.100 to 21.999 kHz	0.002 kHz	0.002 kHz
22.000 to 50.000 kHz	0.005 kHz	0.005 kHz

Waveforms: Squarewave w/50% duty cycle, sinewave

Amplitude: 0.1 to 10 V p-p (user adjustable)

Amplitude accuracy: 3% of output + 0.5% of f.s., 1 to 1099 Hz; 10% of output + 0.5% of f.s., 1.1 to 10.9 kHz; 30% of output + 0.5% f.s., 11 to 50 kHz

Maximum input voltage: 30 V dc

PRESSURE MEASUREMENT AND SIMULATION SPECIFICATIONS

Requires use of included BPPA100 Pressure Module Adapter.

See BetaPort–P Pressure Module Data Sheet 030606R0 for ranges and accuracies.

TEMPERATURE MEASUREMENT AND SIMULATION SPECIFICATIONS

Temperature, RTDs

Accuracy

Type and range	Measure		Source	
	1 year	2 years	1 year	2 years
10 W Cu (427)				
-100 to 0 °C	2 °C	2 °C	1 °C	1 °C
0 to 260 °C	2 °C	2 °C	1 °C	1 °C
100 W Pt (3916)				
-200 to -190 °C	0.3 °C	0.4 °C	0.3 °C	0.4 °C
-190 to 0 °C	0.3 °C	0.4 °C	0.1 °C	0.2 °C
0 to 630 °C	0.5 °C	0.8 °C	0.2 °C	0.4 °C
100 W Pt (3926)				
-200 to 0 °C	0.3 °C	0.4 °C	0.1 °C	0.2 °C
0 to 630 °C	0.5 °C	0.8 °C	0.2 °C	0.4 °C
100 W Pt (385)				
-200 to 0 °C	0.3 °C	0.5 °C	0.1 °C	0.2 °C
0 to 400 °C	0.5 °C	0.8 °C	0.2 °C	0.4 °C
400 to 800 °C	0.8 °C	1.0 °C	0.4 °C	0.5 °C
200 W Pt (385)				
-200 to 0 °C	0.3 °C	0.5 °C	0.1 °C	0.2 °C
0 to 400 °C	0.5 °C	0.8 °C	0.2 °C	0.4 °C
400 to 630 °C	0.8 °C	1.0 °C	0.4 °C	0.5 °C
500 W Pt (385)				
-200 to 0 °C	0.3 °C	0.5 °C	0.1 °C	0.2 °C
0 to 400 °C	0.5 °C	0.8 °C	0.2 °C	0.4 °C
400 to 630 °C	0.8 °C	1.0 °C	0.4 °C	0.5 °C
1000 W Pt (385)				
-200 to 0 °C	0.3 °C	0.5 °C	0.1 °C	0.2 °C
0 to 400 °C	0.5 °C	0.8 °C	0.2 °C	0.4 °C
400 to 630 °C	0.8 °C	1.0 °C	0.4 °C	0.5 °C
120 W Ni (672)				
-80 to 260 °C	0.3 °C	0.4 °C	0.1 °C	0.2 °C

For 2-wire and 3-wire measurements add 0.4 °C

Sensor inaccuracies not included

Resolution: 0.1 °C, except 1 °C for 10 Ω Cu

Temperature coefficient: 0.02 °C/°C from -10 °C to 18 °C and 28 °C to 50 °C

Maximum input voltage: 30 V dc

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

BETA MasterCAL 990 Multi-function Documenting Calibrator
Preliminary Specifications – subject to change without notice

Temperature, Thermocouples

Accuracy

Measure Source

Type and range	Measure		Source	
	1 year	2 years	1 year	2 years
E				
-250 to -200 °C	1.3 °C	2.0 °C	0.6 °C	0.9 °C
-200 to -100 °C	0.5 °C	0.8 °C	0.3 °C	0.4 °C
-100 to 600 °C	0.3 °C	0.4 °C	0.3 °C	0.4 °C
600 to 1000 °C	0.4 °C	0.6 °C	0.2 °C	0.3 °C
N				
-200 to -100 °C	1.0 °C	1.5 °C	0.6 °C	0.9 °C
-100 to 900 °C	0.5 °C	0.8 °C	0.5 °C	0.8 °C
900 to 1300 °C	0.6 °C	0.9 °C	0.3 °C	0.4 °C
J				
-210 to -100 °C	0.6 °C	0.9 °C	0.3 °C	0.4 °C
-100 to 800 °C	0.3 °C	0.4 °C	0.2 °C	0.3 °C
800 to 1200 °C	0.5 °C	0.8 °C	0.2 °C	0.3 °C
L				
-200 to -100 °C	0.6 °C	0.9 °C	0.3 °C	0.4 °C
-100 to 800 °C	0.3 °C	0.4 °C	0.2 °C	0.3 °C
800 to 900 °C	0.5 °C	0.8 °C	0.2 °C	0.3 °C
K				
-200 to -100 °C	0.7 °C	1.0 °C	0.4 °C	0.6 °C
-100 to 400 °C	0.3 °C	0.4 °C	0.3 °C	0.4 °C
400 to 1200 °C	0.5 °C	0.8 °C	0.3 °C	0.4 °C
1200 to 1372 °C	0.7 °C	1.0 °C	0.3 °C	0.4 °C
T				
-250 to -200 °C	1.7 °C	2.5 °C	0.9 °C	1.4 °C
-200 to 0 °C	0.6 °C	0.9 °C	0.4 °C	0.6 °C
0 to 400 °C	0.3 °C	0.4 °C	0.3 °C	0.4 °C
U				
-200 to 0 °C	0.6 °C	0.9 °C	0.4 °C	0.6 °C
0 to 600 °C	0.3 °C	0.4 °C	0.3 °C	0.4 °C
B				
600 to 800 °C	1.3 °C	2.0 °C	1.0 °C	1.5 °C
800 to 1000 °C	1.0 °C	1.5 °C	0.8 °C	1.2 °C
1000 to 1820 °C	0.9 °C	1.3 °C	0.8 °C	1.2 °C
R				
-20 to 0 °C	2.3 °C	2.8 °C	1.2 °C	1.8 °C
0 to 100 °C	1.5 °C	2.2 °C	1.1 °C	1.7 °C
100 to 1767 °C	1.0 °C	1.5 °C	0.9 °C	1.4 °C
S				
-20 to 0 °C	2.3 °C	2.8 °C	1.2 °C	1.8 °C
0 to 200 °C	1.5 °C	2.1 °C	1.1 °C	1.7 °C
200 to 1400 °C	0.9 °C	1.4 °C	0.9 °C	1.4 °C
1400 to 1767 °C	1.1 °C	1.7 °C	1.0 °C	1.5 °C
C				
0 to 800 °C	0.6 °C	0.9 °C	0.6 °C	0.9 °C
800 to 1200 °C	0.8 °C	1.2 °C	0.7 °C	1.0 °C
1200 to 1800 °C	1.1 °C	1.6 °C	0.9 °C	1.4 °C
1800 to 2316 °C	2.0 °C	3.0 °C	1.3 °C	2.0 °C

Sensor inaccuracies not included

Accuracy with external cold junction; for internal junction add 0.2 °C

Resolution: 0.1 °C

Temperature scale: ITS-90 or IPTS-68, selectable

Compensation: ITS-90 per NIST Monograph 175 for E, N, J, K, T, B, R, S thermocouples; IPTS-68 per IEC 584-1 for E, J, K, T, B, R, S thermocouples; IPTS-68 per DIN 43710 for L, U thermocouples

Temperature coefficient: 0.05 °C/°C from -10 °C to 18 °C and 28 °C to 50 °C

Common mode error: 0.01 °C/(Common Mode Volt)

Maximum input voltage: 30 V dc

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

In CANADA contact: **techniCAL** for a distributor nearest you.

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