

INTRODUCTORY NOTE

*This manual includes all the information you need to install, operate and maintain the **MULTI-Cal Multifunction Calibrator** and its accessories.*

***Meriam** has used the best care and efforts in preparing this book and believes the information in this publication to be accurate. **Meriam** products are subjected to continuous improvement; these improvements could require changes to the information of this manual. **Meriam** reserves the right to change such information without notice.*

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***MULTI-Cal Multifunction Calibrator** uses sophisticated analog and digital technologies. Any maintenance operation must be carried out by qualified personnel ONLY. **Meriam** supplies instructions and operative procedures for any operation on the instrument. We recommend contacting our technicians for any support requirements.*

***MULTI-Cal** is fully tested in conformity with the Directive No.89/336/CEE Electromagnetic Compatibility. **Meriam** shall not be liable in any event, including technical and publishing errors or omissions, for any incidental and consequential damages, in connection with, or arising out of the use of this book.*



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1 GENERAL PERFORMANCE

MULTI-Cal is a complete system to test, measure and calibrate a variety of field device with a single handheld instrument. This indicator-simulator is a multifunction instrument, with 2 isolated and independent channels, designed to meet the needs of instrumentation engineers on the test bench and in the field. Accurate, compact, rugged, and easy to use MULTI-Cal is the ideal solution to measure and simulate millivolts, volts (up to 10V) and mA on active and passive loop. The two channels allow simultaneous measurement and simulation for voltage (up to 30V) and current on active and passive loop.

Channel 1 (In-Out)

- millivolt
- volt
- milliampere
- ohm
- temperatures with thermocouples
- temperatures with resistance thermometers

Channel 2 (In)

- volt
- milliampere

The MULTI-Cal has been developed using the most advanced microprocessor technology to provide high accuracy on extended ranges and powerful operating flexibility.

The modular firmware includes the algorithms of thermocouples and resistance thermometers in accordance with IEC, DIN standards. IPTS68 and ITS90 linearization are memory stored and can be selected through the keyboard.

The simulation-measurement of resistance and temperature with resistance thermometer uses a special proprietary active circuit (Patent no. 206327).

A unique internal automatic Reference junction (R_j) compensation system allows the MULTI-Cal to provide accurate input and output readings over wide operating conditions, with a temperature range from -5°C to +50°C. External compensation is also available with temperature adjustable from -50°C to +100°C.

The selection of operating functions is made on a polycarbonate thermoformed membrane keyboard which assures up to one million operations per key.

Two thick film membrane "slidewires" (Patent Pending) are used to set the simulated signal value.

Measured and simulated values are indicated on a high quality LCD dot matrix display which provides good contrast even in poor light conditions.

A menu-driven procedure allows for the generation of up to 60 memory stored values, or for continuous or step ramp simulation values.

The instrument executes mathematical functions for averaging unstable input signals and, when used in combination with the scale factor, for square root calculations.

The shock-resistant ABS case is ergonomically designed for easy and practical use.

The instrument is powered by a rechargeable Ni-MH rechargeable battery pack. An external battery charger is supplied as a standard accessory.

1.1 MULTI-Cal model code

Cat. 3922 - A - B

Each instrument is supplied with rechargeable battery pack, AC charger / power adapter, soft case, NIST traceable certificate + data and User's Manual.

Table A	<u>Battery type</u>
1	Ni-MH rechargeable battery pack with external charger / AC power supply Plug Types (specify plug type with order): Ni-MH/120VAC 50/60 Hz – USA plug Ni-MH/230VAC 50/60 Hz – Schuko plug Ni-MH/230VAC 50/60 Hz – UK plug Ni-MH/230VAC 50/60 Hz – European plug Ni-MH/100VAC 50/60 Hz – USA/Japan plug

Table B	<u>Options</u>
0	No NIST certificate
1	NIST certificate + data

1.2 Specifications

International Temperature Scale:	both IPTS 68 and ITS 90
Reference Junction Compensation (Rj):	internal automatic from -5°C to +50°C (+23°F to +122°F) External programmable from -50°C to +100°C (-58°F to +212°F)
Reference Junction accuracy:	± 0.15°C/°C for temperatures below or exceeding the +18°C to +28°C (64°F to 82°F) band
Common Mode Rejection:	>130 dB at 50/60 Hz ±1 Hz
Normal Mode Rejection:	>65 dB at 50/60 Hz ±1 Hz
Temperature stability:	for temperatures below or exceeding the +18°C to +28°C (64°F to 82°F) band Span: ±0.003% of rdg/°C (Channel 1 only) ±0.015% of rdg/°C (Channel 2 only) Zero: ±0.2 μV/°C (Channel 1 only) ±0.5 mV/°C or ±0.4 μA/°C (Channel 2 only)
Rtd and Ω measurement excitation current:	0.25 mA
Rtd and Ω simulation excitation current:	from 0.2 to 3 mA
Rtd cable compensation error:	±0.005°C/Ω of total cable resistance
Rtd cable compensation limit:	100 Ω each wire
Shunt resistance (mA range):	38 Ω (Channel 1 only) 105 Ω (Channel 2 only)
mA measurement and generation	Active and Passive loop
Input impedance:	10 MΩ 1 MΩ (10 V range and Channel 2 only)
Output Impedance (mV and Tc):	<0.5 Ω with a maximum current of 0.5 mA
Maximum resistance load:	1000 Ω at 20 mA
Maximum input overvoltage:	50 V 5 V (Rtd ranges only)
Maximum input overcurrent:	100 mA 6 mA (Rtd ranges only)
Source resistance effect:	1 μV/1000 Ω
Engineering unit indication:	4 characters directly on the display
Power supply:	n. 4 rechargeable Ni-MH battery Mains operation and battery charge 100, 115, 230 V 50/60 Hz
Recharging time:	max 12 h at 90%
Battery life:	12 h on measuring mode - 4 h on 20 mA passive loop
Display:	high contrast alphanumeric LCD with backlight device
Operative ambient temperature:	from -10°C to 50°C (15°F to 122°F)
Storage temperature:	from -30°C to 60°C (-22°F to 140°F)
Case:	ABS 120x60x230 mm
Weight:	net 1 kg gross 1.5 kg

1.4.1 Table of ranges and accuracy MULTI-Cal

Sensor or parameter	Total range	Accuracy Range	Resolution	Accuracy (%of rdg)
Tc type J °C	-210 to +1200	-170 to 1200	0.1	±0.03% (2)
°F	-346 to +2192	-274 to 2192	0.1	±0.03% (2)
Tc type K °C	-270 to +1370	-120 to 1300	0.1	±0.03% (1)
°F	-454 to +2498	-184 to 2372	0.1	±0.03% (1)
Tc type T °C	-270 to +400	-120 to +400	0.1	±0.03% (1)
°F	-454 to +752	-184 to 752	0.1	±0.03% (1)
Tc type R °C	0 to +1760	+500 to +1700	0.1	±0.03% (3)
°F	+32 to +3200	+932 to +3092	0.1	±0.03% (3)
Tc type S °C	0 to +1760	+800 to +1760	0.1	±0.03% (3)
°F	+32 to +3200	+1472 to +3200	0.1	±0.03% (3)
Tc type B °C	+200 to +1820	+1000 to +1820	0.1	±0.03% (3)
°F	+392 to +3308	+1832 to +3308	0.1	±0.03% (3)
Tc type C °C	0 to +2300	0 to +2300	0.1	±0.03% (3)
°F	+32 to +4172	+32 to +4172	0.1	±0.03% (3)
Tc type G °C	0 to +2300	200 to +2300	0.1	±0.03% (3)
°F	+32 to +4172	+392 to +4172	0.1	±0.03% (3)
Tc type D °C	0 to +2300	0 to +2200	0.1	±0.03% (3)
°F	+32 to +4172	+32 to +3992	0.1	±0.03% (3)
Tc type U °C	-200 to +400	-120 to +400	0.1	±0.03% (1)
°F	-328 to +752	-184 to +752	0.1	±0.03% (1)
Tc type L °C	-200 to +760	-180 to +760	0.1	±0.03% (1)
°F	-328 to +1400	-292 to +1400	0.1	±0.03% (1)
Tc type N °C	0 to +1300	0 to +1300	0.1	±0.03% (1)
°F	+32 to +2372	+32 to +2372	0.1	±0.03% (1)
Tc type E °C	-270 to +1000	-150 to +1000	0.1	±0.03% (1)
°F	-454 to +1832	-238 to +1832	0.1	±0.03% (1)
Tc type F °C	0 to +1400	0 to +1400	0.1	±0.03% (1)
°F	+32 to +2552	+32 to +2552	0.1	±0.03% (1)
Pt 100 °C	-200 to +850	-200 to +600	0.1	±0.03% (2)
IEC °F	-328 to +1562	-328 to +1112	0.1	±0.03% (2)
Pt 100 °C	-200 to +850	-200 to +600	0.1	±0.03% (2)
JIS °F	-328 to +1562	-328 to +1112	0.1	±0.03% (2)
Pt 100 °C	-200 to +850	-200 to +600	0.1	±0.03% (2)
US °F	-328 to +1562	-328 to +1112	0.1	±0.03% (2)
Ni100 °C	-60 to +180	-60 to +180	0.1	±0.03% (1)
°F	-76 to +356	-76 to +356	0.1	±0.03% (1)
Ni120 °C	0 to +150	0 to +150	0.1	±0.03% (1)
°F	+32 to +302	+32 to +302	0.1	±0.03% (1)
mV	-18 to +21	-18 to +21	1µV	±(0.02%+3µV)
mV	0 to +100	0 to 21	1µV	±(0.02%+3µV)
		21 to 53	10µV	±(0.02%+3µV)
		53 to 100	10µV	±(0.02%+6µV)
mV	0 to 1000	0 to 1000	100µV	±(0.02%+60µV)
V	0 to 10	0 to 10	1mV	±(0.02%+0.4mV)
mA	0 to 21	0 to 21	1µA	±(0.02%+0.5µA)
Ω (IN)	0 to 400	0 to 400	10mΩ	±(0.02%+38mΩ)
Ω (OUT)	0 to 400	0 to 400	10mΩ	±(0.03%+78mΩ)
MULTI-Cal (CH2)				
mA (IN)	0 to +22	0 to +22	1µA	±(0.03%+1µA)
V (IN)	0 to 30	0 to 30	1mV	±(0.03%+1.2mV)
Note:				
– The relative accuracies shown are stated for 360 days and operative conditions from +18°C to +28°C (+64 °F to +84°F).				
– Typical 90 days relative accuracy can be estimated by dividing the "% of rdg" specifications by 1.8.				
– Typical 2 year relative accuracy can be estimated by multiplying the "% of rdg" specifications by 1.5.				
– All input ranges: additional error ±1 digit.				
– Meriam traceability chart and uncertainty can be supplied on request				
(1) zero error ±0.1°C				
(2) zero error ±0.15°C				
(3) zero error ±0.5°C				

2 GENERAL FEATURES

2.1 Input and output flexibility

Advanced flexibility of performance has been achieved using microprocessor technology. Each instrument, through a menu-driven procedure, allows measurement or simulation of mV, V, mA, Ω , or any normalized IEC, DIN and JIS thermoelectric sensor J, K, T, R, S, B, C, U, L, N, E, F, G, D, Pt100, Ni100 and Ni120.

The microprocessor performs automatic polynomial linearization and cold junction compensation to assure high accuracy. °C or °F selection can be made through a reconfiguration set-up.

2.2 Self calibration

The hardware-firmware design allows an automatic calibration of the instrument. A precision source (from 0 to 10V), a 0°C reference system, a standard resistor of 400 Ω ($\pm 0.02\%$ accuracy) and an ohm meter are necessary. The calibration procedure is protected by a security code.

2.3 Keyboard

A thermoformed metal-click tactile polycarbonate membrane keyboard, with a working life of one million operations per key, seals the internal electronics from the surrounding environment.

Contact closure of membrane keys is acknowledged, as a coded signal, directly by the microprocessor. Two membrane slidewires (patent pending) allow operator setting of the simulation value.

2.4 Display

The high contrast alphanumeric LCD display with dot matrix (2 rows x 16 characters) allows easy reading, even in poor light conditions, and simultaneously indicates the active function (measured or simulated), engineering unit and type of sensor or signal.

2.5 Scale factor function

Menu-driven set-up to measure or simulate electrical signal values in terms of engineering units.

Four programmable alphanumeric characters are available on the display to show the symbol of the parameter (i.e. mbar, %RH, %CO, etc.). The display will indicate the scaled input/output value.

2.6 Square root function

Can be programmed during the set-up procedure (e.g. linear ranges only) to obtain direct readings of flow from a ΔP transmitter signal. The display limits are 0 and +2500.

2.7 Average measurements

For measurement of unstable input signals by a progressive averaging of a programmable number of conversions.

2.8 Simulation programs

Menu-driven set-up to generate:

- a continuous or step ramp output where the user enters total time, start point, end point and size of the step as prompted by the set-up procedure menu

- a manual repeat increment through keyboard
- an automatic sequence of up to 60 stored values (20 groups of 3 memories).

2.10 Case

The case is designed for easy hand held operation and transportation.

The body is injection moulded, shock-resistant ABS with internal metal coating.

A soft carrying case with shoulder strap is supplied with the instrument as a standard accessory.

3 PHYSICAL DESCRIPTION

The MULTI-Cal portable calibrator consists of a rugged and compact case, a mother board with all base functions, a daughter board for the auxiliary functions, a tactile membrane keyboard, an LCD display and a rechargeable NiMH battery pack.

The internal surface of the case is metal coated to improve the characteristics of electrical noise shielding and thermal equalization of all internal circuits.

The battery container is located on the lower part of the case, and it is accessible through a cover fastened by a metal screw.

The two halves of the case are joined together by four metal screws located on the back side.

The soft case, with shoulder strap, assures better protection of the instrument against mechanical knocks or scratches.

