

## MANUAL



**Sub-Zero Dry Block**  
**TEMPERATURE CALIBRATOR**  
**METCAL 40**

## BRIEF PROFILE



An ISO 9001-2015 certified Instrumentation company (since 1972) serving Industries in India & Worldwide thro' the Manufacture & Supply of World-Class Calibration Instruments & Systems like Temperature, Pressure & Signal Calibrators, Black Body Calibration Sources, Pneumatic & Hydraulic Hand Pumps, Dead Weight & Comparison Testers, Calibration Test Benches, etc.

*Dear User,*

*Thank you for selecting Nagman's Sub-Zero Temperature Calibrator (Dry Block) and becoming a proud owner of this Calibration Instrument.*

*We have strived hard to ensure the accuracy of the contents of this manual. We would appreciate any suggestions/feedback to correct any errors noticed and to improve the quality of contents of this Manual*

*Specifications are subject to change owing to continuous development and we reserve rights to effect Changes / Modifications to this Manual.*

*Read the Instructions before starting to use the Product.*

*Wishing you for a long association with us.*

*For any service related issues, please contact [service@nagman.com](mailto:service@nagman.com)*

### **VERSION CONTROL**

<b>Version No.</b>	<b>Updated on</b>	<b>Updated by</b>
V 1.1	11-11-2022	Nagman

## CONTENTS

---

<b>S.No.</b>	<b>Description</b>	<b>Page No.</b>
1.	Introduction .....	5
2.	Specification.....	6
3.	Standard Delivery & Optional Accessories .....	9
4.	Parts Identification with Picture.....	10
5.	Connection Diagram .....	17
6.	Safety Instructions .....	18
7.	Operating Instruction .....	24
8.	Troubleshooting / Maintenance.....	28

---

## 1. INTRODUCTION

Precision Dry block Sub-Zero Master Temperature Calibrator (METCAL 40) is used for calibrating RTD's, Thermocouples, Temperature Switches, Temperature Indicators etc.

The front panel continuously shows the current Thermo well block temperature. Desired temperature is set by using keypad which gives the corresponding set value in the display.

Proper use of the instrument will provide accurate calibration of temperature sensors.

### **Heater Block**

The "Block" is made up of Aluminium and provides a relatively constant and accurate temperature environment. Peltiers are placed inside the Cooling tower assembly to provide heating & cooling to the sensor.

A high precision platinum RTD is embedded at the base of the block assembly to sense and control the temperature of the block.

The entire assembly is suspended in an air cooled chamber thermally isolated from the chassis and electronics.

## 2. SPECIFICATION

Range	-10°C to 120°C
Resolution	0.01°C
Accuracy	±0.2°C
Stability	±0.02°C
Stabilization time	7 minutes approx.
Temperature Readout	°C/°F Switchable.
Axial Uniformity (40 mm)	±0.2°C
Radial Uniformity	±0.02°C
Heating Time (Amb. to 120°C)	10 minutes approx.
Cooling time (Amb. to -10°C)	15 minutes approx..
Cooling time (120 to -10°C)	25 minutes approx..
Switch Test facility	Provided
Interchangeable Thermowell	Multihole to suit 2 x ¼" & 1 x ½" Probes. Other Sizes available as optional
Power Supply	Standard - 230V AC, 50 Hz Optional - 110V AC, 60 Hz
Switch contact	Open/Close
Immersion Depth	150 mm
Well diameter	30 mm
Weight	9 kg (approx.)
Dimensions (L x D x H)	160 X 365 X 450 mm

## MEASUREMENT CAPABILITY

### Input Measurement

Type	Resolution	Range	Accuracy
mVL	0.001	0 to 100	$\pm(0.025\% + 2\mu\text{V})$
mVH	0.01	0 to 1000	$\pm(0.025\% + 10\mu\text{V})$
Volts	0.0001	0 to 10	$\pm(0.025\% + 0.08\text{mV})$
mA	0.0001	0 to 25	$\pm(0.025\% + 0.4\mu\text{V})$
Ohms	0.001	0 to 500	$\pm(0.025\% + 12\text{m}\Omega)$
KOhms	0.00001	0 to 3.5k	$\pm(0.025\% + 120\text{m}\Omega)$

### RTD

Type	Resolution	Range	Accuracy
Pt100	0.01	-100 to 800	$\pm(0.025\% + 0.1^\circ\text{C})$
Pt200	0.1	-100 to 600	$\pm(0.025\% + 0.15^\circ\text{C})$
Pt500	0.1	-100 to 530	$\pm(0.025\% + 0.1^\circ\text{C})$
Pt1000	0.01	-100 to 650	$\pm(0.025\% + 0.1^\circ\text{C})$

### Thermocouples

Type	Resolution	Range	Accuracy
J	0.1	-100 to 1200	$\pm(0.025\% + 0.1^\circ\text{C})$
K	0.1	-60 to 1260	$\pm(0.025\% + 0.1^\circ\text{C})$
R	0.1	150 to 1700	$\pm(0.025\% + 0.2^\circ\text{C})$
S	0.1	170 to 1700	$\pm(0.025\% + 0.2^\circ\text{C})$
N	0.1	0 to 1300	$\pm(0.025\% + 0.1^\circ\text{C})$
B	0.1	920 to 1820	$\pm(0.025\% + 0.2^\circ\text{C})$
T	0.1	0 to 400	$\pm(0.025\% + 0.1^\circ\text{C})$

## **ENVIRONMENTAL CONDITIONS**

This instrument should not be operated in an excessively dusty & dirty environment and explosive zones.

The instrument operates safely under the following conditions :

- Operating temperature :  $23 \pm 2^{\circ}\text{C}$
- Storage Temperature :  $-20^{\circ}\text{C}$  to  $40^{\circ}\text{C}$ .
- Ambient relative humidity : 15 – 50%

Mains voltage within  $\pm 5\%$  of nominal

Minimum vibrations in the calibration environment.



### 3. STANDARD DELIVERY & OPTIONAL ACCESSORIES

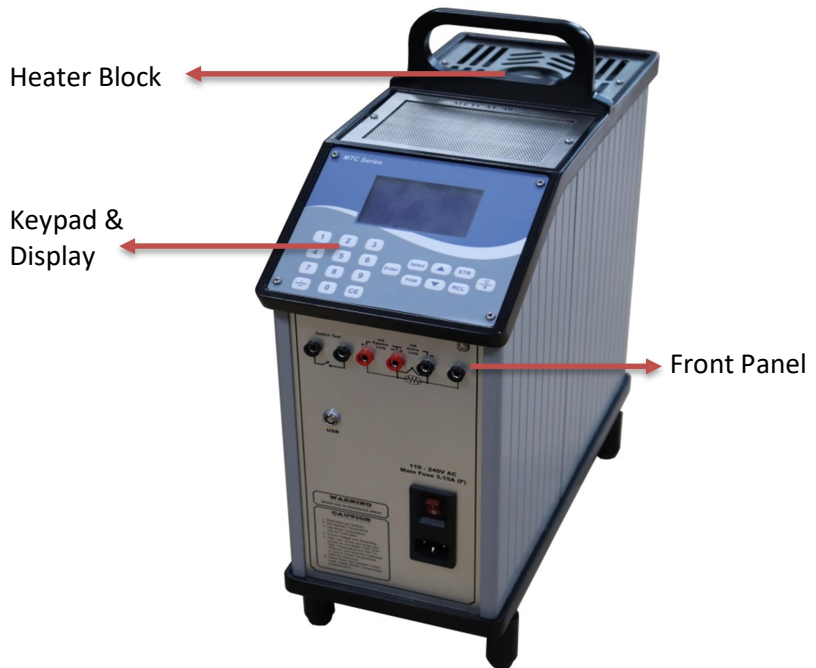
#### Standard Delivery

- Basic Instrument
- Test Leads, Mains Cable & Spare Fuses
- Multihole Insertion Tubes (to suit 2 x ¼" & 1 x ½" probe)
- Tool for Insertion Tubes
- Computer Interface & "Metcal" Calibration Software
- Calibration Certificates are issued in Accordance with our Scope as granted by NABL per ISO/IEC 17025:2017 Standards
- Carrying Case
- Instruction Manual

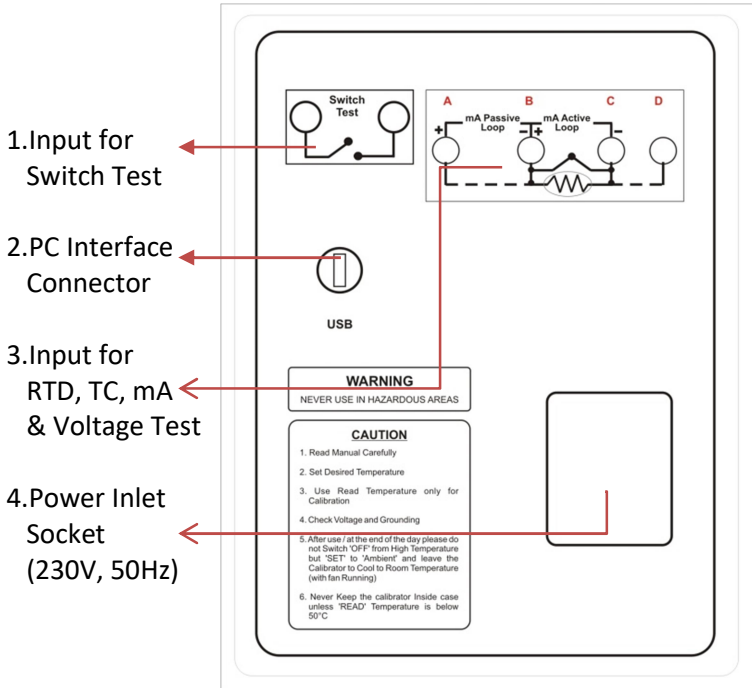
#### Optional Accessories

- Additional Thermowells / Insertion Tubes & Multihole – Consult us.

#### 4. PARTS IDENTIFICATION (Typical Photo)

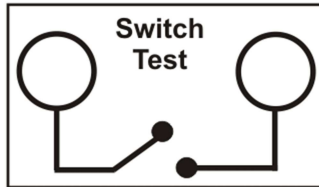



## FRONT PANEL




## 1.Input for Switch Test :

Switch Test Connection details are shown below :



Select menu option in keypad, press  upward key, the display shows in

	Switch Test
READ	50
OPEN	:
CLOSE	: 50

1. Switch test

2. Edit date/time.

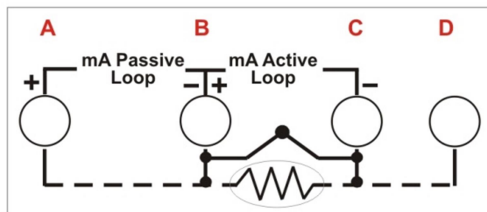
Enter Numeric key 1.

## 2. Computer Interface :

To interface with Computer USB

### 3.Input for RTD, TC, mA and Voltage Test

**RTD** : The RTD Input Connection details are shown below :

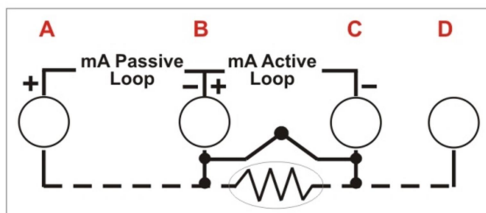


2 Wire Use terminals BC for 2 wire with A, B and C, D to be short

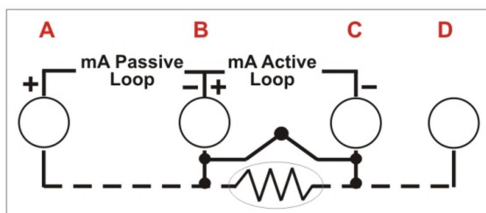
3 Wire Use terminals A, B, C for 3 wire with C, D to be short

4 Wire Directly insert to A, B, C, D.

**Thermocouple** : For all TC, B for Positive (+) and C for Negative (-)



**mA**





### Passive Loop for 2 Wire :

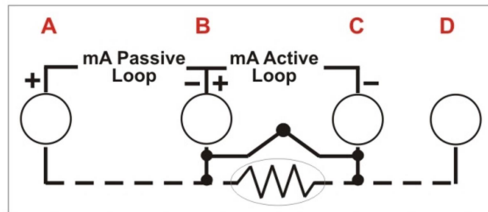
Transmitter with Internal Power Supply (A for Positive (+) and B for Negative (-))



### Active Loop :

Transmitter with External Power Supply (B for Positive (+) and C for Negative (-))

### Voltage



B for Positive (+) and C for Negative (-)

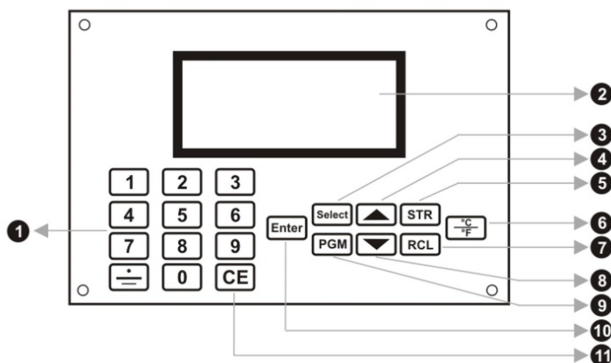
*\* Note that this connection is for potential free contact.*

### 4. Power Inlet Socket :

Input Supply (230V AC, 50 Hz)

## Keypad & Display :

### Keypad



S.No.	Description
1	NUMERIC KEYS used to enter values
2	LCD.(128 x 64) Graphic display
3	SELECT KEY used to select the parameter i.e. mV <sub>L</sub> , mV <sub>H</sub> , Volts, mA, Ohms, kOhms, T/C, and RTD
4 & 8	Upwards / Downward KEYS
5	STR KEY (Store key) used to store the input values(Max 10 values)
6	°C/°F KEY used to select the units
7	RCL KEY (Recall key) used to recall the stored input values using increment and decrement.
9	PGM KEY used to manually add - Thermocouple C <sub>j</sub> external temperature
10	ENTER KEY used to accept selected options or entered values.
11	CE KEY (escape key) used to cancel a selection/edit or return to previous menu.

## Display

The Display is divided into four separate segments.

- 1<sup>st</sup> line indicates the set Temperature
- 2<sup>nd</sup> line indicates the Read Temperature
- 3<sup>rd</sup> line indicates the Input value  
(eg.: mVL, mVH, Volts. etc.)
- 4<sup>th</sup> line indicates input parameters unit identification.



## 5. CONNECTION DIAGRAM (Typical photo)







Temperature Sensor (UUT)



Dry Block Calibrator  
Metcal 40

## 6. SAFETY INSTRUCTIONS

### Symbols Used

S. No.	Symbol	Description
1.		Read the user manual before operating the instrument.
2.		Warning- conditions that may pose hazards to the user.
3.		Caution-conditions that may damage the instrument.
4.		Special Information
5.		Hot surface- areas which are at high temperature
6.		Electric shock- condition that may pose shock to the user.

### **Warning- conditions that may pose hazards to the user.**

- Inspect the instrument for damage before each use. Do not use the instrument if it appears damaged or operates abnormally
- Do not place the instrument under a cabinet or other structure. Leave enough clearance to allow for safe and easy insertion and removal of probes
- Do not operate this instrument in an excessively wet, oily, dusty or dirty environment and explosive zones.
- Do not operate near flammable materials.
- Do not slam the probe sheath into the thermo well. It may cause a shock to the sensor and affect the calibration.



- Do not leave the inserts in the instrument for prolonged periods. It may cause damage due to high operating temperature of the instrument.
- This instrument and the thermometer probes are sensitive instrument that can be damaged. Always handle those devices with care.
- Calibration Equipment should only be used by Trained Personnel.

### Caution-conditions that may damage the instrument.

- Do not use this instrument for any application other than the calibration work. Any other use of the instrument may cause unknown hazards to the user. Also Completely unattended operation is not recommended
- Do not use the instrument if the Cooling fan located at the bottom of the Instrument is out of order
- Always operate this instrument at room temperature at  $23\pm 2^{\circ}\text{C}$ . Allow sufficient air circulation for the instrument by leaving at least 6 inches (15cm) of clearance around the instrument
- Do not turn off the instrument at temperatures higher than  $100^{\circ}\text{C}$ . This would create a hazardous situation. Select a set-point less than  $100^{\circ}\text{C}$  (preferably close to the ambient temperature) and allow the Instrument to cool before it turning OFF.
- Calibrator life time can be shortened by continuous high temperature operation.



## Hot surface- areas which are at high temperature



- Do not touch the Thermo well or the Insert while the calibrator is heating up, they may be very hot.
- Do not touch the tip of the sensor when it is removed from the Insert / thermo well, it may be very hot.
- Do not touch the well access surface of the instrument.
- Do not touch the handle of the calibrator during use – it may be hot.

## **Electric shock- condition that may pose shock to the user.**



- This instrument must be plugged into a 230 V AC, 50Hz, electric outlet only.
- The power cord of the instrument is equipped with a three-pin grounding plug for protection against electrical shock hazards. It must be plugged directly into a properly grounded three-pin socket. The receptacle must be installed in accordance with local codes and ordinances. Do not use an extension cord or adapter plug.
- Always replace the power cord with an approved cord of correct rating and type.
- If supplied with user accessible fuses, always replace the fuse with one of the same rating voltage and type
- If a main power supply fluctuation occurs, immediately turn off the instrument. Power bumps from brown-outs could damage the instrument. Wait until the power has stabilized.

## **Storing and transporting the Calibrator**

- The following guidelines should always be observed when storing and transporting the calibrator. This will ensure that the calibrator remain in good working condition.

### **Storing**

- Switch OFF the calibrator using the power control switch.
- If you intend to store the calibrator in the Packing Box after use, you must ensure that the instrument has cooled to a temperature, at least close to 10°C / 50°F ambient temperature before placing it in the Packing Box

### **Transporting**

- The Inserts must be removed to avoid damage to the instrument if the calibrator is to be transported to long distances

## 7. OPERATING INSTRUCTION

### Precheck

- Switch ON the instrument.
- Wait until the self-diagnostic routines are finished.
- Set value (default) should be zero.
- Read value should show the ambient temperature.
- Set any temperature in the display.
- If the up arrow shows the display, then we can make sure that the instrument is in working Condition.

### Preparation of the Calibrator for Calibration

- Insertion tube diameter is selected according to the diameter of the sensor to be calibrated.
- The fan should begin quietly blowing air through the instrument after the illumination of controller display.
- Sensor is inserted in the insertion tube
- Display shows SET as 0°C and READ as Room Temperature.
- Select the required parameters by pressing SELECT option in the keypad.
- It shows the parameters such as T/C, RTD, mA, mV, mvH, volts, mA, ohms, kohms, T/C and RTD. Select the sensor and its type which is to be calibrated.
- Choose the read-out scale (°C/°F) you require by activating the key



- Set the required temperature using the numeric keys and press ENTER.
- The cooling tower will heat to SET temperature.
- Wait until the required SET temperature is equal to the READ temperature.
- When the SET and the READ temperature have been equal for about 07 minutes, a beep signal will heard and a tick mark will appear in the display. This indicates that you have achieved the stable thermowell temperature. Now you can take the readings.
- Connect the RTD probes to the corresponding terminals in the front plate of the instrument.
- Display shows the bath temperature as the INPUT parameter which corresponds to the READ temperature.

Note: If you select mvL or mvH while using T/C, add the voltage corresponding to the ambient temperature with the INPUT voltage which is shown in the display.

### **mA measurement:**

Connection of passive 2-wire mA transmitter:

- Press Select key and select mA parameter using the numeric keys (1-9).
- Place the 2 wire transmitter into a correct sized insert in the heating thermowell and set the desired calibration temperature.
- Connect 2 wire transmitters to be calibrated to the passive terminals placed on the front panel of the calibrator.
- The display will show the transmitter's output signal in mA.
- Compare the SET temperature and the output signal of the transmitter.

Connection of active 2 wire mA transmitter with external power supply:

- Press Select key and select mA parameter using the numeric keys (1-9).
- Place the 2 wire transmitter into a correct sized insert in the heating thermowell and set the desired calibration temperature.
- Connect the 2wire transmitter and the external power supply to the passive terminals placed on the front panel of the calibrator.
- The display will show the transmitter's output signal in mA.

- Comparing the SET temperature and the output signal of the transmitter.

#### Test of Thermostat Switch:

- Place the thermostat switch into a correct sized insert in the heating thermo well.
- Connect the terminals placed on the front panel of the calibrator to the thermostat switch to be powered and calibrated.
  
- Switch calibrator ON.
- Ensure that thermostat is not connected to any other voltage supply.
- Select required temperature.
- When SET point of the thermostat is obtained, the display will show open / close condition.

## 8. TROUBLESHOOTING / MAINTENANCE

- The calibration instrument has been designed with ease of operation and simplicity of maintenance.
- Proper care of the instrument requires very little maintenance.
- If the outside of the instrument becomes soiled, it may be wiped clean with a damp cloth and mild detergent. Do not use harsh chemicals on the surface which may damage the paint.
- It is important to keep the thermowell of the calibrator clean and clear of any foreign matter. Do not use fluid to clean out the thermowell.
- If a hazardous / flammable or any material particle spilt on or inside the equipment, the user is responsible for taking the suitable steps to clean the equipment.
- Do not use fluids to clean out the thermowell. It may leak into the instrument and cause damage.

### **Socket Fuse:**

- Locate the main fuse in the fuse box in the socket.
- Open the lid of the fuse box using a screw driver.
- Replace the fuse with the same rating.

S. No.	Problem	Possible Cause	Solution
1.	No light in display	Power not available to the Unit.	Check the power supply to the Unit.
		Power switch not ON	Ensure the power switch ON.
			Ensure 5V to the display.
Fuse Open.	Check the fuse, if defective, replace the fuse of same rating.		
2.	Read value shows "OVLD"	Over load	Check (-15V DC) in power board
		Sensor Open.	Contact Customer Service.
3.	Fan not working	No Supply to Fan	Check the fan power supply voltage.
		Fan defect	Replace the fan
4.	Equipment not cooling enough	Peltier defect	Contact Customer Service.
5.	Display shows "EEPROM error"	IC Problem	Contact Customer Service.

## **Adjusting and calibrating the instrument**

You are advised to return the calibrator to Nagman, Chennai - INDIA or to an accredited laboratory at least once a year for calibration.

## **Returning the calibrator for Service**

When returning the calibrator to the manufacturer for service, please provide complete information about the problems faced for clear analysis of the problem. The calibrator should be returned in the original packing.

## **Nagman's liability ceases if :**

- Parts are replaced / repaired using spare parts which are not identical to those recommended by the manufacturer.

Nagman's liability is restricted to errors that originated from the factory.

---

*For more details, write to :*

## **NAGMAN INSTRUMENTS AND ELECTRONICS PRIVATE LIMITED**

170/1a2, Chennai Bangalore Highway Road,  
Sembarambakkam, Chennai - 600 123. INDIA.

Phone: +91-44-66777000, 011, 022, 033

Email: [support@nagman.com](mailto:support@nagman.com).

Website : [www.nagman.com](http://www.nagman.com)