User's Manual

RTD CALIBRATOR

RC-12

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Contents

1. Introduction

Foreword

Thank you for purchasing ***RTD Calibrator RC-12***.
The RC-12 calibrator is compact hand-held calibrator with an easy to use graphical user interface.

This manual describes the basic functions and operation methods. Please read through this user's manual carefully before using the product

Notice

The contents of this manual are subject to change without notice as a result of continuous improvements to the instrument's performance and functions.

Every effort has been made to ensure accuracy in the preparation of this manual. Should any errors or omissions come to your attention, however, please inform MASIBUS Sales office or sales representative. Under no circumstances may the contents of this manual, in part or in whole, be transcribed or copied without our permission.

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Safety

Before you use the instrument, make sure that you read and understand all the related data. This includes: the applicable local safety procedures, this publication, and the instructions for the accessories/options/equipment you are using it with

General warnings

WARNING

It is dangerous to ignore the specified limits for the instrument or its related accessories.
Do not use the instrument or accessory if it is not in its normal condition.
Use the applicable protection and obey all safety precautions.
Do not use the instrument in locations with explosive gas, vapor or dust. There is a risk of an explosion.

Electrical warnings

To prevent electrical shocks or damage to the instrument, do not connect more than 30V between the terminals, or between the terminals and the ground.

This instrument uses a Lithium-Ion battery pack. To prevent an explosion or fire, do not short circuit, do not disassemble, and keep it safe from damage. For operating conditions, see section 6.1 on Page-47

To prevent battery leakage or heat generation, only use the battery charger in the temperature range 0 to 45°C (32 to 113°F). For operating conditions, see section 6.1 on Page-49.

To make sure the display shows the correct data, disconnect the test leads before you set the power to on or change to another measure or source function.

Cautions

To prevent damage to the display, do not use sharp objects on the screen.
Before you start an operation or procedure in this publication, make sure that you have the necessary skills (if necessary, with qualifications from an

approved training establishment). Follow good engineering practice at all times.

Summary of functions

This table gives a summary of the available functions with the RC-12 calibrator.

Function
Easy to read liquid crystal display (LCD) in color
Rechargeable lithium Ion battery with enhanced power control for prolonged battery life.
* Measure RTD(Pt10, Pt50, Pt100, Pt200, Pt400, Pt1000, Pt100(3926),Ni100(672), Ni100(618), Ni120(672), Cu10(427), Cu50(427), Cu100(427)), Resistance (0 to 4000 ohms), mA, mA(24V), V
* Simulate RTD(Pt10, Pt50, Pt100, Pt200, Pt400, Pt1000, Pt100(3926),Ni100(672), Ni100(618), Ni120(672), Cu10(427), Cu50(427), Cu100(427)), Resistance (0 to 4000 ohms)
Step/Ramp functions: Automatic/Manual
Universal Serial Bus (USB) communications ports: For computer Communications, Battery Charging& Firmware Upgrade
Data Logging.
Other functions: Maximum / Minimum / Average, filter, tare, adjustable backlight, alarm indication (on the display and buzzer), automatic Display off.

** Refer to the Specification Sheet on Page: 49*

2. RC-12 Hardware Parts & Accessories

2.1 Unpacking & Inspection

At the factory each new RC12 passes a careful inspection. It should be free of scrapes and scratches and in proper operation order upon receipt. The receiver should, however, inspect the unit for any damage that may have occurred during transit. If there are signs of obvious mechanical damage, package contents are incomplete, or the instrument does not operate according to specifications, contact the purchasing sales office as soon as possible.

Sr. No	Description	Qty
1.	Calibration Certificate	1
2.	RC12 user guide	1
3.	2mm to 2mm banana cable Red , 100cm	3
4.	2mm to 2mm banana cable Black , 100cm	3
5.	Crocodile clip Red	3
6.	Crocodile clip Black	3
7.	Connecting plug 4mm to 2mm, Red	3
8.	Connecting plug 4mm to 2mm, Black	3
9.	USB A to mini USB B type cable for PC communication and charging	1
10.	5V 1A charging adaptor	1
11.	Leather cover of RC12	1
12.	RC12 configuration & Logging software CD-mCAL.	1

The standard accessories are as follows:

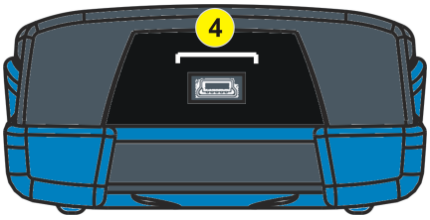
If you have to return the instrument to the factory for any reason, use the original packing whenever possible. Include a detailed description of the reason for the return.

2.2 Operational Sections and Connections

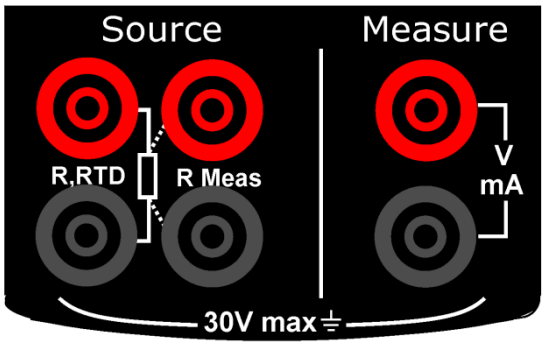
All sections and connections are presented in detail on the next pages.

Note: Keep in mind that the next picture (as well as all pictures of RC-12 in this manual) has an example configuration of modules. The configuration of your RC-12 may vary significantly from the one in the picture.

1	Terminal Connection For RTD Measure & Source and EM Measure
2	Keypad Section
3	Color Display
4	USB Connection Slot for PC Communication & Charging



2.2.1 The Terminal Connections



➢ **EM Measure Terminals**

Input Terminal for measuring voltage, current and supplying loop power.

EM Measure Terminals	
mA	Range: 0.000 – 24.000 mA Resolution: 0.001 mA
mA(24V)	Range: 0.000 – 24.000 mA Resolution: 0.001 mA
V	Range: 0.000 – 30.000 V Resolution: 0.001 V

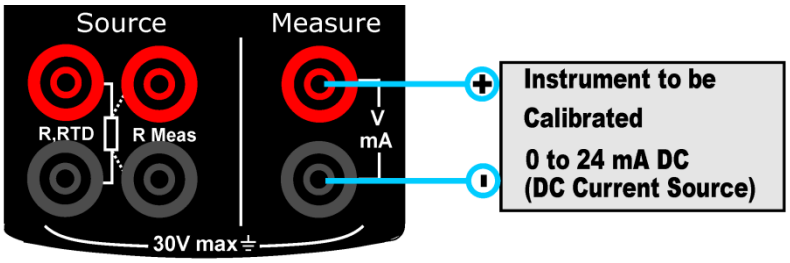
- **Current Measurement**

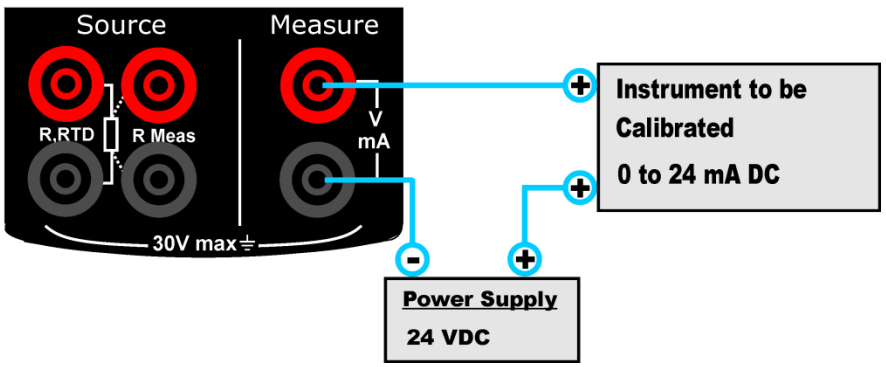
  RC-12 supports current measurement using either RC-12 as the loop power supply while at the same time measuring the current or simply measuring the current while an external power supply is used.

  The following picture displays the connection for Current Measurement for different mode. And also different ways of providing the supply power to the loop.

  - mA Current Measurement

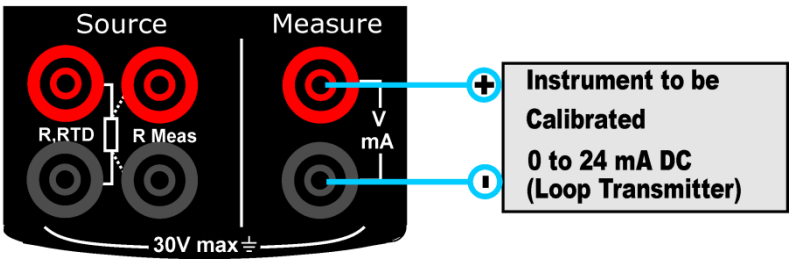
    In this mode RC-12 not providing any supply voltage. For proper measurement the external device should capable of providing the voltage supply. If the external device should not capable, an external Power Supply should be connected in series.





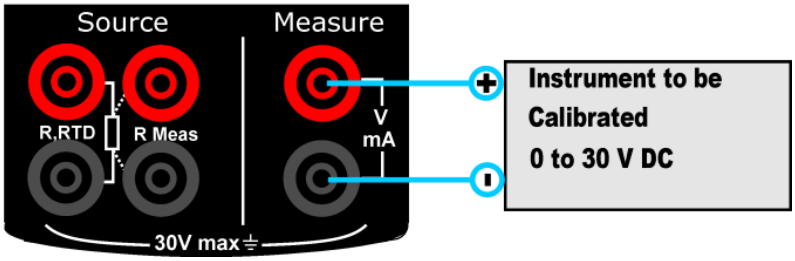
➢ mA Read Power Current Measurement

In this mode RC-12 works as Loop Power Supply while at the same time measuring the current.



Voltage Measurement

RC-12is capable of voltage Measurement with two voltage measurement ranges.
The following picture displays the connection for Voltage Measurement for different mode.

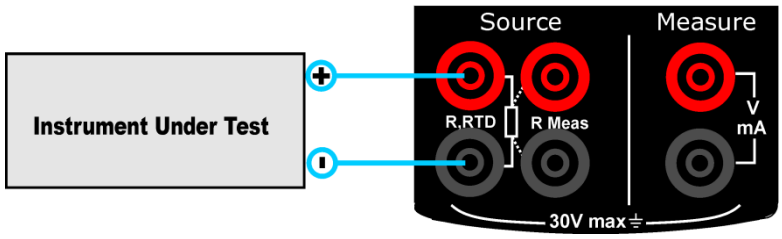


➢ **RTD Terminals**

Terminals for measuring & simulating RTD. For RTD/Ω types refer specification sheet on page 50.

- **RTD/Resistance simulation**

RC-12 is capable of RTD/Resistance generation. The following picture displays the connection for RTD and Resistance simulation. In RTD simulation RC-12 mimics an RTD. The instrument under test generates the current for the RTD measurement.
RC-12 controls the voltage across its terminals so that the resistance (voltage to
Current ratio) corresponds to the simulated temperature. Use of 2-, 3-or 4-wire connection is up to the receiver instrument. Use only the two leftmost terminals with every wiring option. Connect the possible third and fourth wire according to the
Requirements of the connected instrument but use only the two left most terminals.

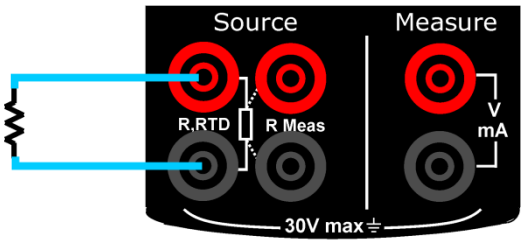


- **RTD/Resistance measurement**

  RC-12 is capable of RTD/Resistance measurement. The following picture displays the connection for RTD and Resistance measurement.

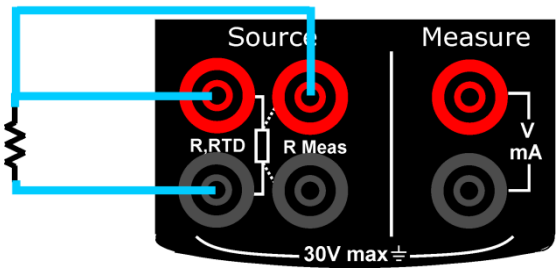
  - 2-Wire RTD Measurement

    Two leftmost terminals are used in 2-wire systems. RC-12 displays the selected wiring system in run page. RC-12 sources current through the resistor and measure the voltage drop across same terminals. The result is acceptable, if the resistance of the connection wires is significantly smaller than actual measured resistance.



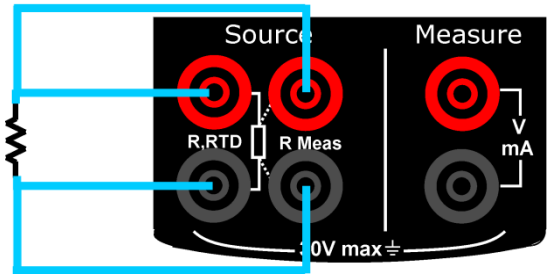
  - 3-Wire RTD Measurement

    RC-12 sources current through the resistor and measure the voltage drop across the entire current loop and across the upper side connection wire as shown in figure. If both left side connection wires are identical, RC-12 can compensate for the resistance of the connection wires.

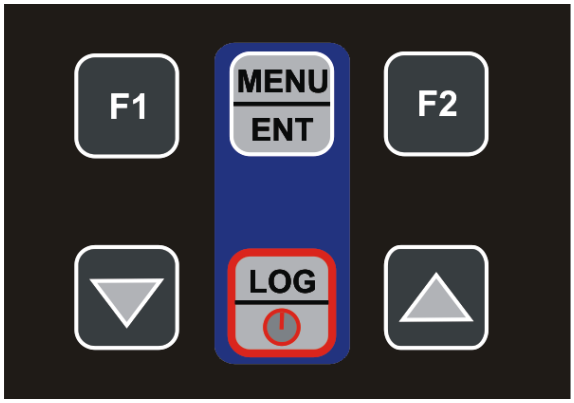


➢ 4-Wire RTD Measurement

RC-12 sources current through the resistor from two left side terminals and measure the voltage drop across the resistor from the two right side terminals. The 4-wire method gives the resistance between the terminals of the resistor; it is insensitive to the resistance of the connection wires.



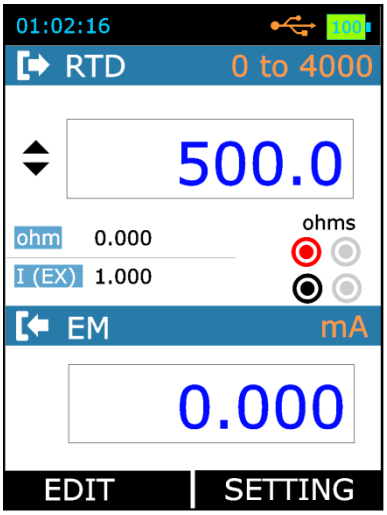
2.2.2 The KeyPad



RC-12 has six different keys. The key description is given below.

F1	This key has different functionalities in different menu. And that is shown on Bottom Left Part of Display.
F2	This key has different functionalities in different menu. And that is shown on Bottom Right Part of Display.
▽	This key is use to scroll down to the next parameter. And also for decrementing the value of digit in Editbox.
△	This key is use to scroll up to the previous parameter. And also for incrementing the value of digit in Editbox.
MENU ENT	This Key is use for Entering into the MENU Page from Run Page. And Also for Saving Edited Parameter to the memory.
LOG	This key is use to log current reading in memory if device is on Run Page& Log Mode is Manual. (In other Page than Run Mode, this key is use to come directly to Run Page. Long presses (Approx. 2 Sec) on this key will ON-OFF the Unit.

2.2.3 The Display



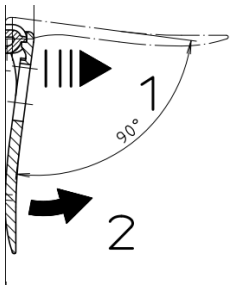
- This is a LCD with a 2.4” color display.
- The display has resolution of 240x320 pixels supporting 262K Colors.
- Refer Section 3.2.3 on Page-17for more details on Different Display Mode and Icon Details.

2.2.4 The USB Connection

- The USB Connection Connector is given at Top of the RC-12. It’s a USB mini B-Type Female Connector.
- It is common for PC Communication & Charging the device.
- The USB cable given with the device is USB A-type Male to USB B-type male. It’s common for connecting Charger & PC.

2.2.5 Stand for Table Top Use

- This Stand would offer the best support for table top use which gives good viewing angle when UC12 is placed table top
- Procedure to Open Stand
  -  is being engraved on the top of the stand. You should pull a bit first.
  -  is being engraved on the bottom of the stand. Now during first pull of above you can release this lower part easily so that you can maneuver the stand as you like.



2.3 Power Options

There are three power options:

- **Lithium-Ion battery:** All the instrument functions are available with a charged battery.
- **5 V DC Charging Adaptor:** It supplies power to the instrument and charges the battery at the same time. It charges the battery when the instrument is on or off.
- **USB mini Type B connection:** This charges the battery when the instrument is off and increases the battery life when the instrument is on instrument cannot be charged with USB when it is ON.

2.4 Battery

The Device uses 2300mAh Lithium-Ion Battery.

WARNING

- **To prevent an explosion or fire, do not short circuit, do not disassemble, and keep it safe from damage.** For operating conditions, **see section 6.1 on Page-49.**
- **To prevent an explosion or fire, use only the Masibus specified battery, battery charger & USB Cable.**
- **To prevent battery leakage or heat generation, only use the battery charger in the temperature range 0 to 45°C (32 to 113°F).** For operating conditions, **see section 6.1 on Page-49.**

When you set the power on, the battery symbol at the top of the display shows the charge Status. To get more information on Battery go to Battery Info Page in Setting Menu.

2.4.1 Charge time

Charge Method	Charge Time (to Full Capacity)
External Charging Adaptor	≈ 5 hours

Note:

USB mini Type B connector charges the battery when the instrument is off and increases the battery life when the instrument is on.

2.4.2 Operating Time

Operation	Battery Duration
Continuous operation (measure)	> 18 hours
Continuous operation (measure and source(@12mA))	> 8 hours

These are typical operating times for a new, fully charged Li-Ion battery pack with these settings:

- *Backlight Intensity* set to 5% (Default: 100%)
- *Backlight Timeout* set to 0 (0=Infinite) (Default: 0)

Power save options: To get the best battery duration, set a low value for the *Backlight Intensity* (40%) and a short *Timeout*.

The maximum operating time without recharging varies depending on the usage and brightness setting of the display light. Also the generated output current and the usage of the 24V transmitter supply affect the maximum operating time.

Notes:

- *LC-12's memory and the internal clock/calendar use a small amount of power although the calibrator is switched off. Remember to check the capacity of the batteries from time to time although LC-12 is not in use.*
- *Do not leave LC-12 without a Battery Pack or an Empty Battery for a long time. LC-12 may lose its settings if it is left without a support voltage for an extended period.*

3. Start Up & Basic Operations

3.1 Power ON or OFF

To set the instrument power ON, press and release 

button until the display comes on. During the power on sequence, the instrument shows a Startup Message and then shows the applicable data.

To set the instrument power off, press and hold (≈ 2 seconds) 

button again. When the power is off, the last set of configuration options stays in memory.

3.2 The User Interface

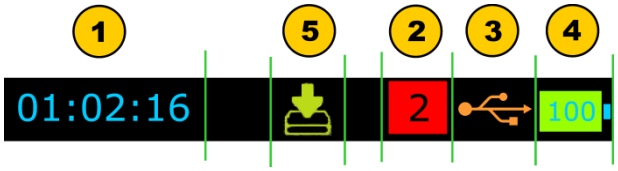
Every time RC-12 is switched on, the startup message ends in RUN Page.

There are3 Display Mode available in RUN Page.

1. RTD Measure/Source Mode
2. EM Measure Mode
3. RTD Measure/Source + EM Measure Mode

This Display Mode can be selected from MENU→DISPLAY Page.
In case of Dual Mode Display Screen is divided into two parts. Due to that only few additional info will appear on RUN Page. But Which Information to be shows can be selectable in Display Mode Menu. Refer Section 3.2.3 on Page-17for more info.

3.2.1 The Status Bar



The Status Bar at the top of the display is visible only in RUN Page. It is divided into four main sections.

1	Time in HH:MM:SS Format Available in Two Format 1. 24 Hour (default) 2. 12 Hour *This setting is available in Date/Time in Settings Menu*
2	Error Code Indicator This Icon is visible if any On-Board Peripherals like RTC, ADC, DAC, etc. not working Properly. Refer Section 5.1 on Page 48 for Troubleshooting these Errors. The List of Error Code available in this device is given below.

Error Code	Description
0	Memory Corrupted or Device Unable to Read/Write it.
1	RTC Not working Properly
2	Device unable to Read battery Information.
3	Measure Mode Not Working
5	Data Log Memory Corrupt
6	Source Mode Not Working
9	More than one Errors from above list is occurring.

3	USB Connection Status Icon Icon is visible if USB Charger Adaptor or USB Data Cable is connected to the Device. Icon is different for both indication & this stated below.

	USB Data Cable is connected & Communication with PC is available.
	USB Charger Adaptor is connected. Battery starts Charging.

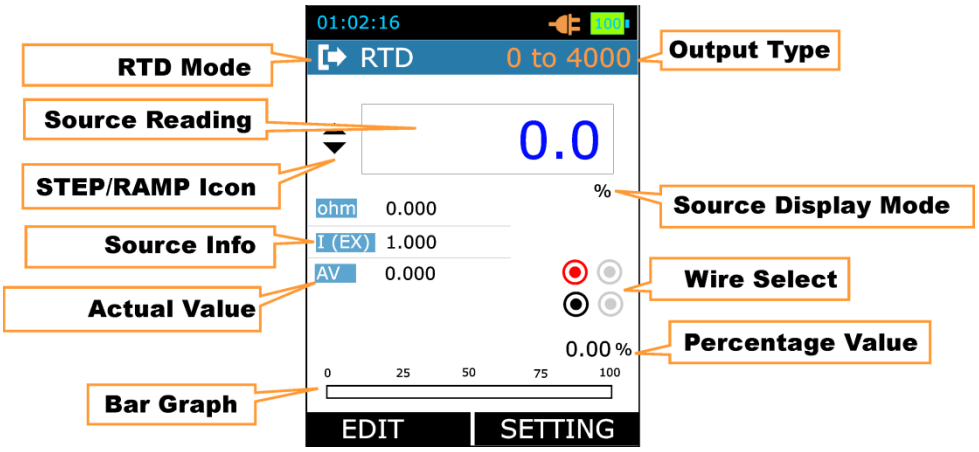
4	Battery Charge Percentage Indicator. Always visible in Run page. Battery % is shown in the center of the icon. And the icon background is filled with Green, Yellow & Red color if Battery % is >= 50%, >= 20 &<20 respectively.
5	Data Logging Enable Status Indicator. Icon is visible if Data Logging is enabled and also it will blink when a Datalog is stored to memory.

3.2.2 The Function key Bar

The Function Key Bar at the bottom of the display is visible all the time. There are 2 Function Key Available. The meaning of the Function Keys varies depending on the situation. A Blank Function key text means that the function is disabled at the moment.

3.2.3 Display Mode

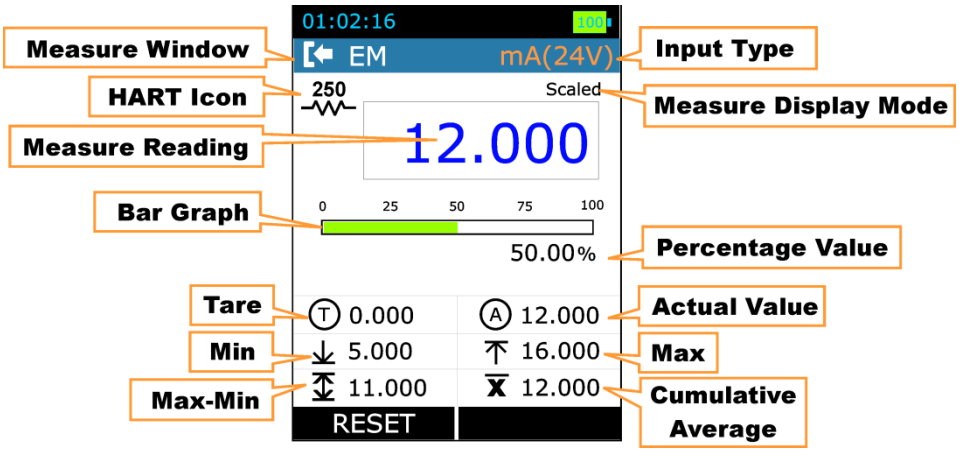
i. RTD Mode



RTD Display Mode	
RTD Mode	Shows the Current RTD Mode RTD Measure Mode RTD Source Mode
Output Type	Shows the current RTD Type.
Source Reading	Shows the RTD Source reading according to RTD Type.
STEP/RAMP Icon	Shows the Icon indicating STEP/RAMP mode. Only applicable if RTD mode is *SOURCE*. Manual Step Step UP Step DOWN Rising Ramp Falling Ramp Ramp Hold @ 0%

		Ramp Hold @ 100%
Additional Info.	Shows the Addition Information according to TC Mode & Additional Info selected in *MENU →DISPLAY→TC terminal.*	
Bar Graph	Horizontal Bar graph according to RTD Percentage Value (0.00% - 100.00%). The value scales according to RTD reading and Input 0% & 100% value as set in *MENU →DISPLAY→RTD terminal* Menu.	
Percentage Value	The Percentage Value in according to RTD Reading.	
Wire Select	Shows which RTD configuration is used. (2-wire, 3-wire, 4-wire)	
Source Display Mode	Shows which display mode is selected either percentage or actual.	
Actual Value	When display mode percentage Actual value bar display the actual source value.	
Source Info	When RTD is in source mode it shows the excitation current which comes from the measure device.	

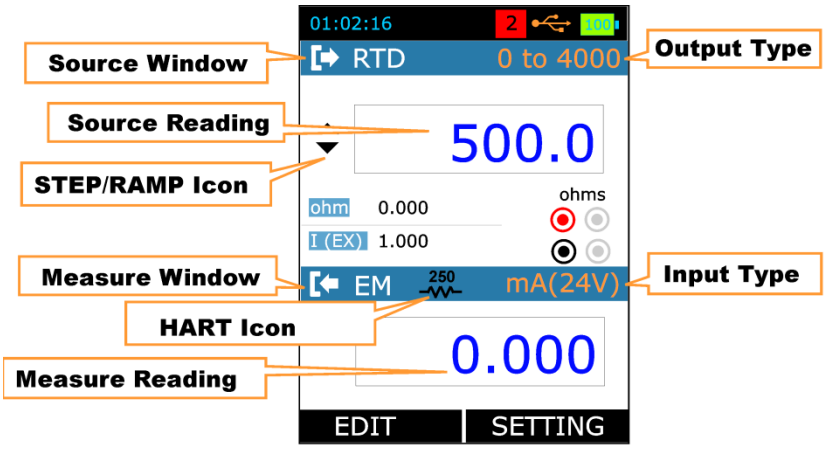
ii. EM Measure Mode



Measure Window		
Input Type	The Input Type.	
	mA	mA Current Input
	mA(24V)	mA Current (Read Power-24V) Input
	V	V Voltage Input
Measure Display Mode	The Measure Reading Display Mode.	
	Actual	Displays the Raw Input Value without any scaling
	Percentage	Displays the Percentage Value.
	Scaled	Displays the Scaled Value
Measure Reading	The Reading as per the Measure Display Mode	
HART Icon	HART Enable Status Icon. This icon will appear if HART is enabled from *MENU →SETTING →HART* page. (This icon is visible for mA(24V) Input Type only. For other Input Types this will invisible regardless of HART settings)	
Bar Graph	Horizontal Bar graph according to Input Percentage Value (0.00% - 100.00%).	

Percentage Value	The Percentage Value in Percentage according to Input Value.
Tare	The Tare Value Set from *MENU→DISPLAY→EM Terminal-Tare* page
Actual Value	The Raw Input Value without any scaling This will appear only if **Main Display** in *MENU→DISPLAY→EM Terminal is* set to **PERCENTAGE/SCALED.**
Min	Displays the minimum value found after a measurement was started or minimum was reset.
Max	Displays the maximum value found after a measurement was started or maximum was reset.
Max-Min	Displays the Maximum-Minimum value found after a measurement was started or Maximum-Minimum was reset.
Cumulative Average	Displays the Cumulative Average value found after a measurement was started or Cumulative Average was reset.

iii. RTD + EM Mode



RTD + EM Mode	
Output Type **Source Reading** **STEP/RAMP Icon** **Source window**	Refer RTD Display Mode on Page 17.
Input Type **Measure Reading** **HART Icon**	Refer EM Display Mode on Page 18

3.2.4 Display Operations

There are mainly four types of widgets available in the Device Menu Style.

i. ListBox
ii. EditBox

iii. CheckBox
iv. RadioButtonBox

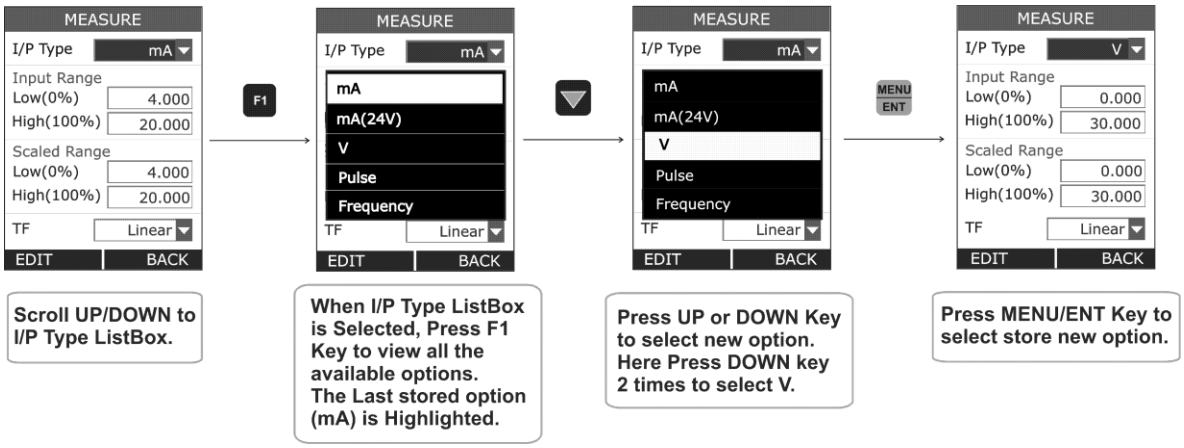
The below section will show how to change the value of different widgets.

- **ListBox**

  ListBox are used when there is a limited amount of preset values. You have to select one of the available options. The list of available options is displayed in the Centre part.

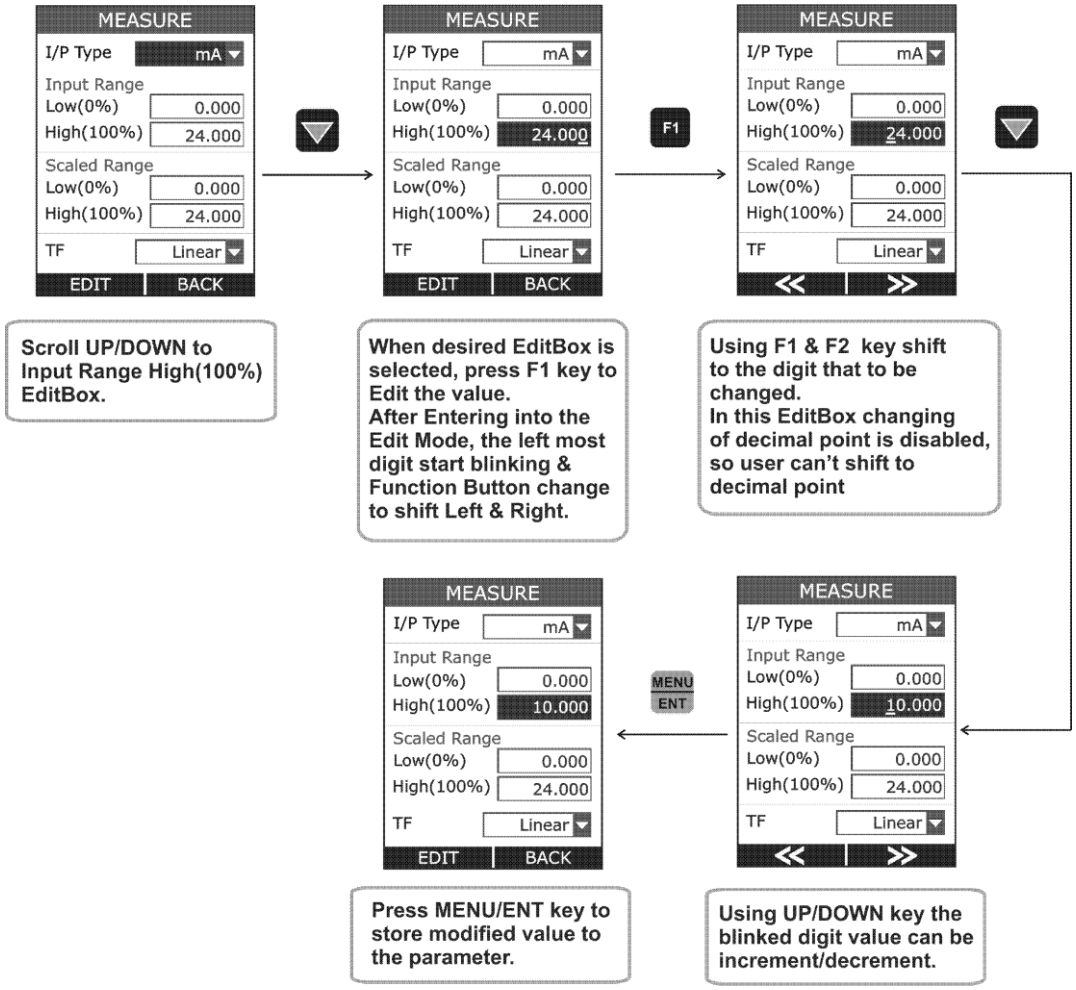
  A ListBoxList opens when you press the **F1**key. Use **UP/DOWN** key to scroll through the available options. Select one of the options with the **ENTER** key.

  Example: How to change of Input Type (I/P Type) from mA to V.
  This Option is available in *MENU→EM SETUP* Page.



- **EditBox**

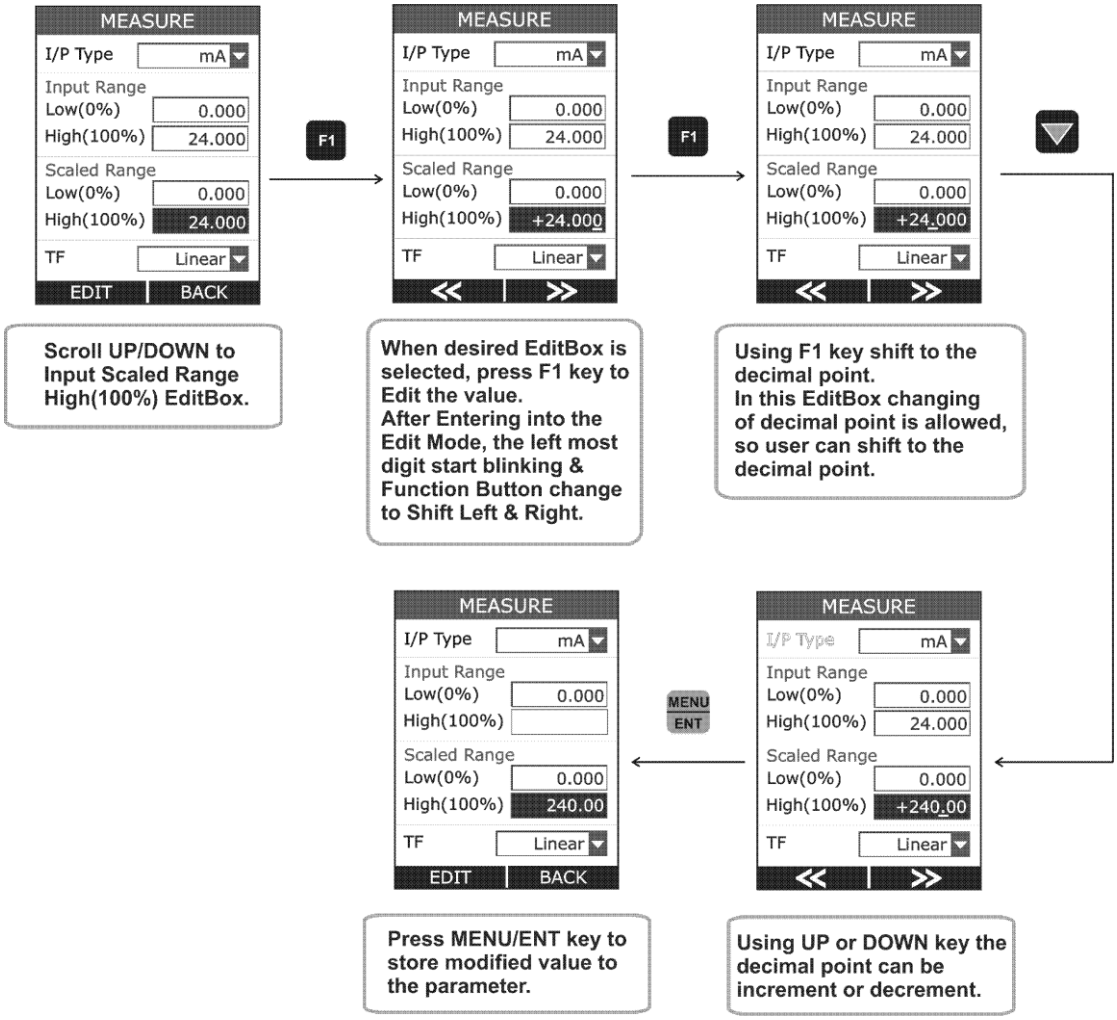
  EditBox is used where a large range of value can be possible for a parameter.
  To edit the value of an EditBox press **F1** key. After that EditBox enters into the Edit mode where **F1**&**F2** keys are works as shifter. User can shift to desired digit and using **UP** or **DOWN** key digit value can be incremented or decremented. The modified value can be saved using **MENU/ENT** key.



The above figure shows the example how to change Input High (100%) Range from 24.000 to 10.000 mA.

There are mainly 2 types of EditBox in this device. In most of the EditBox changing of decimal point & changing of sign is not allowed. But there are few EditBox, where these are allowed. Examples Scaled Low (0%) &High (100%) etc.

The below figure shown the example how to change decimal point of the Input Scaled High (100%) Range.

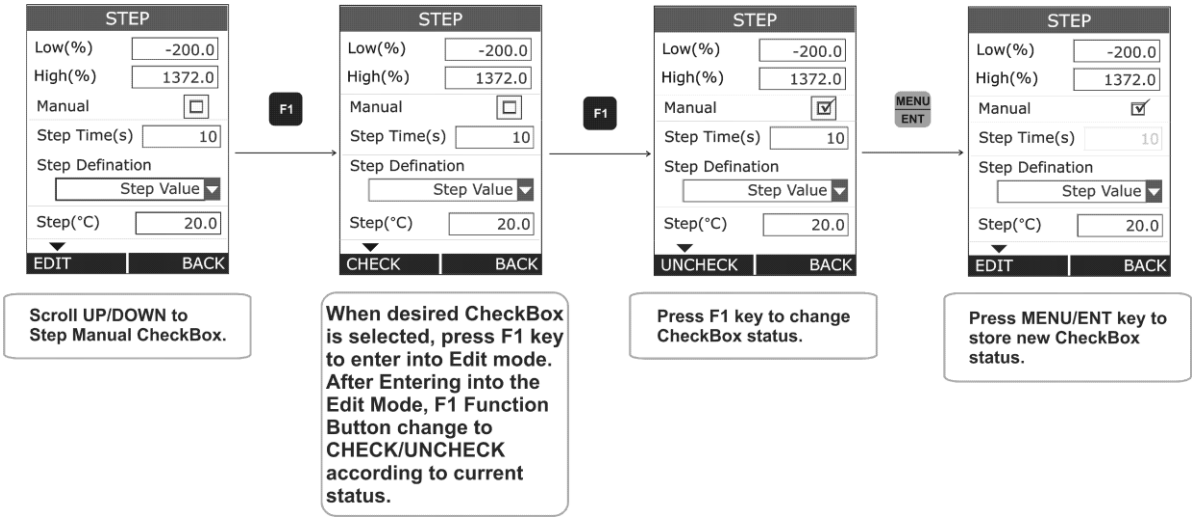


To change the sign of the value, shift to the sign digit and pressing UP or DOWN key will toggle the sign.

- **<u>CheckBox</u>**

  CheckBox is used where Binary Value (1/0, True/False) is available for any parameter.

  To change the CheckBox status press **F1** key. This will enter into the edit mode. In this mode status can be toggled by pressing **F1** key. Press **MENU/ENT** key to store new status.

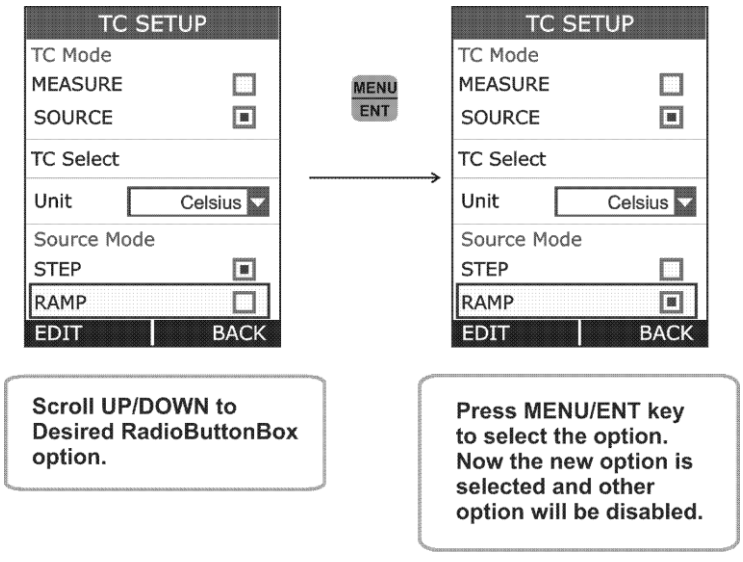


- **<u>RadioButtonBox</u>**

  RadioButtonBox is used where very few values can be possible and all the available values need to be visible.

  In this device, two types of RadioButtonBoxare available. One with 1 value can be selectable & the other where 1 or 2 values can be selectable at a time.
  In RadioButtonBox the other option can be selected by pressing MENU/ENT key on that option. When pressing this key the new option will be selected and the other option will be disabled.

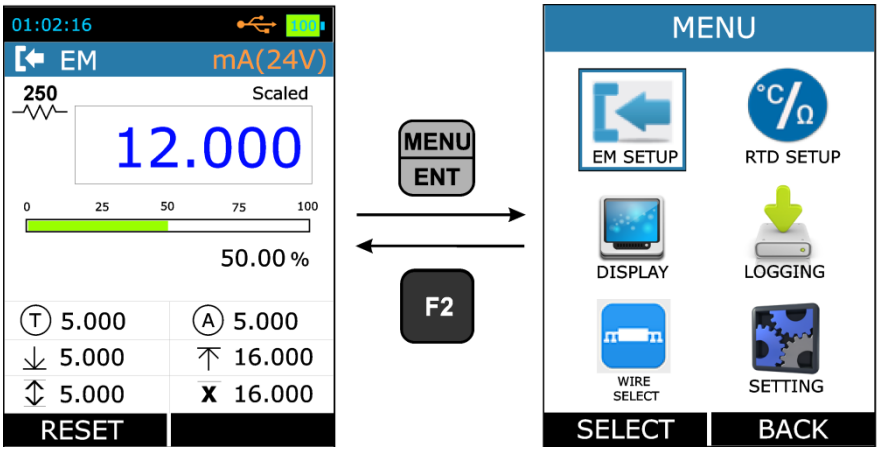
  Below an example is given, How to change RTDSourceMode from STEP to RAMP.



4. Menu Layout

4.1 MENU page

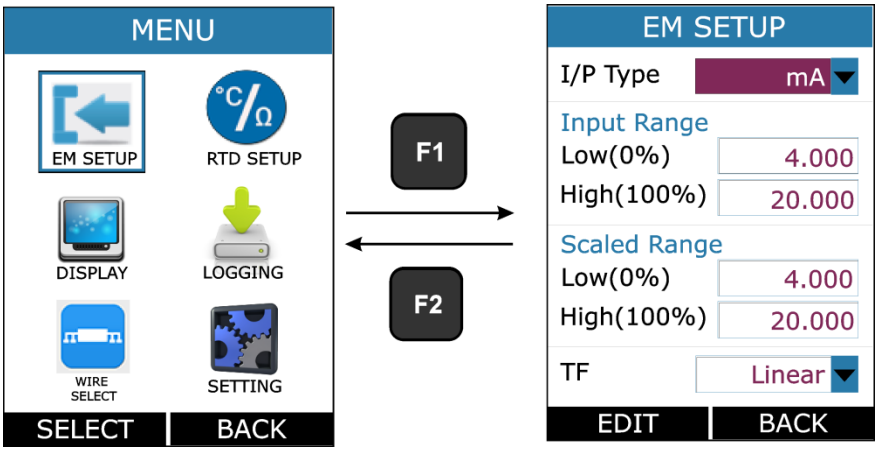
There are mainly six Menus in this device.
To enter into the MENU page press **MENU/ENT** key & press **F2** key to come out from Menu page.



EM SETUP	Contains Parameters related to EM Measure Mode like Input Type, Range etc.
RTD SETUP	Contains Parameters related to RTDlikeRTD Mode, RTD Type etc.
DISPLAY	Contains Parameters related to different display mode for RUN page
LOGGING	Contains Parameters related to Data Logging.
Wire Select	Contains Parameters related to wire selection mode
SETTINGS	Contains Parameters related to General Settings of the device like display, Date/Time, Calibration, Reset, etc.

4.2 MEASURE Page

This Page is appears in *RUN →MENU →EM SETUP.*

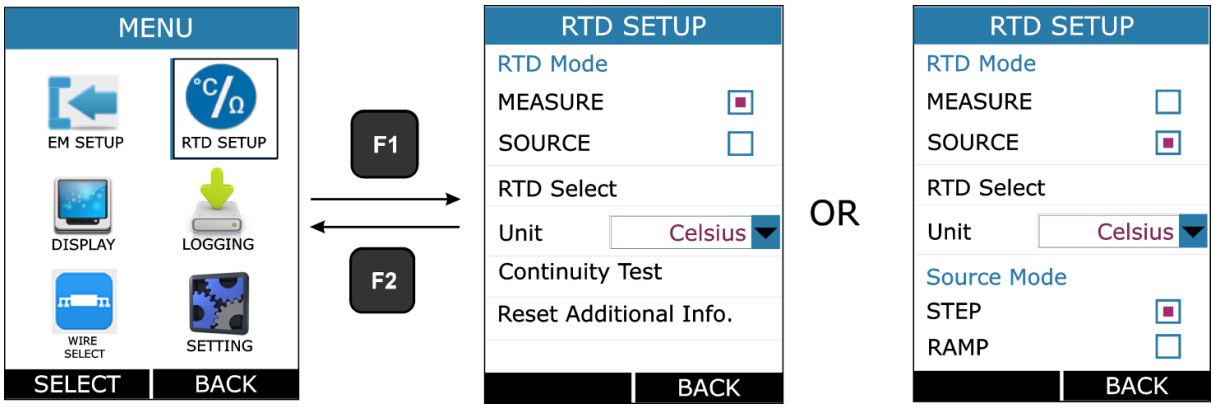


This page contains parameters related to EM Measure like Input Type, Input Range, Scaling and Transfer Function. The Description of the Parameters appear on this page is given below.

Parameter Name	Description / Options
I/P Type (Input Type)	Measure Input Type Available Options: mA : 0.000 to 24.000 mA DC mA(24V) : 0.000 to 24.000 mA DC V : 0.000 to 30.000 V DC
Input Range **Low (0%)**	Low Range for Measure Input. Range: Default Input Low to **Input Range High (100%)** This parameter is enabled, if **Main Display** in *MENU →DISPLAY →EM SETUP* is set to **Percentage**or **Scaled.**
Input Range **High (100%)**	High Range for Measure Input. Range: **Input Range Low(0%)**to Default Input High This parameter is enabled, if **Main Display** in *MENU →DISPLAY →EM SETUP* is set to **Percentage**or **Scaled.**
Scaled Input Range **Low (0%)**	Scaling Low Range for Measure Input. Range: -99999 to **Scaled Input Range High (100%)** Decimal Point for this EditBox can be changeable. This parameter is enabled, if **Main Display** in *MENU →DISPLAY →EM SETUP* is set to **Scaled.**
Scaled Input Range **High (100%)**	Scaling High Range for Measure Input. Range: **Scaled Input Range Low(0%)**to 99999 Decimal Point for this EditBox can be changeable. This parameter is enabled, if **Main Display** in *MENU →DISPLAY →EM SETUP* is set to **Scaled.**
TF (Transfer Function)	Transfer Function for Scaling Available Options: Linear x^2 (x^2) x^(1/2) (√x) This parameter is enabled, if **Main Display** in *MENU →DISPLAY →EM SETUP* is set to **Scaled.**

4.2 SOURCE Page

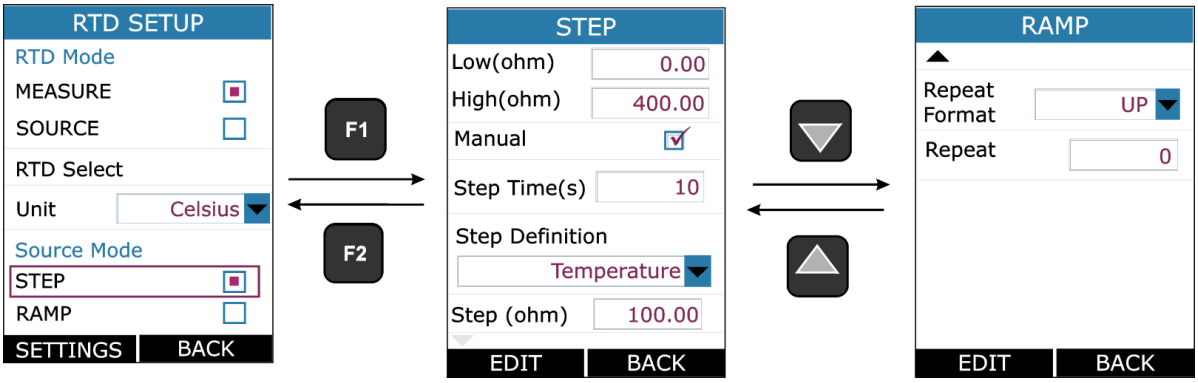
This Page is appears in *RUN →MENU →RTD SETUP.*



This page contains parameters related to RTD like RTD ModeType,RTD select, Unit, RTD Source Mode etc. The Description of the Parameters appear on this page is given below.

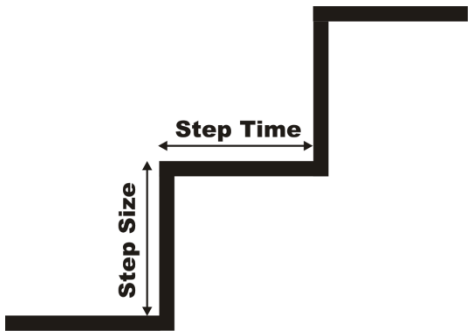
Parameter Name	Description / Options
RTD Mode	RTD Mode Available Options: MEASURE SOURCE
RTD Select	Select the RTD Type for Measurement / Simulation Refer section 6 on page 48 for more details on RTD type and its available range.
RTD Unit **Unit**	Measure/Source Reading Unit Available Options: Celsius Fahrenheit Kelvin
Continuity Test	To test continuity. This Option appear only if RTD Mode is MEASURE.
Reset Additional Info.	Reset the Additional Info. Like Min, Max of Measure RTD. This option appear only if RTD Mode is MEASURE.
Source Mode	RTD Source Output Format This option appear only if RTD Mode is *SOURCE*. Available Options: STEP RAMP At a time one can be selectable. Press F1 key on the one of the option for more settings.

4.2.1 STEP Page



Parameter Name	Description / Options
Low	Starting Value of Step. Enter value according to RTD Display Mode. If display mode is actual enter value in ohms and if display mode is % enter value in %.
High	Ending Value of Step. Enter value according to RTD Display Mode. If display mode is actual enter value in ohms and if display mode is % enter value in %.
Manual (Output Type)	Step Manual Mode Selection CheckBox. Ticking this checkbox will enable Step Manual Mode. And Un-ticking will enable Auto Step Mode.
Step Time (s)	Enter the time for a single step in seconds, Range: 1 to 9999 This parameter is enabled only for Auto Step Mode (Manual CheckBox is Un-Checked)
Step Definition	Step Definition for the Step function. Available Options: Temperature (Appear only if RTD Display mode is Actual) Percentage (Appear only if RTD Display mode is Percentage) User Defined
Step	Step Value in Temperature/mV/% according to RTD Display Mode and RTD unit. Only appear if Step Definition is Temperature or Percentage.
Define Steps	User Defined Step value for Manual and Auto Step Mode. This option appear only if Step Definition is User Defined. Maximum 10 step value can be configured. First enter the no of step and then define step value in serial order.
Repeat Format	How the stepping should be done. Available Options: UP DOWN UP/DOWN

	DOWN/UP This parameter is enabled only for Auto Step Mode (Manual CheckBox is Un-Checked)
Repeat Repeat Counts	Defines how many times the steps are repeated Range: 1 to 9999 This parameter is enabled only for Auto Step Mode (Manual CheckBox is Un-Checked)



- **Manual Stepping**

  To Enable Manual Stepping, select Source Type as STEP & Check the Manual CheckBox.

  If this mode is enabled, ▲▼ icon will appear in Source Display Window in RUN Page.

  Pressing UP or DOWN key in RUN Page will Increment or Decrement Source Value by Step specified in STEP Page.

  In RUN Page, Source Value can directly change by Pressing **F1** key (EDIT) and modifying value like in EditBox. And STEP Setting can be accessed directly by **F2** key (SETTING).

- **Auto Stepping**

  To Enable Auto Stepping, select Source Type as STEP & Un-Check the Manual CheckBox.
  If this mode is enabled, ⮥ (Step UP) or ⮦ (Step Down) icon will appear in Source Display Window in RUN Page and F1 & F2 Button change to **START**&**SETTING** respectively.

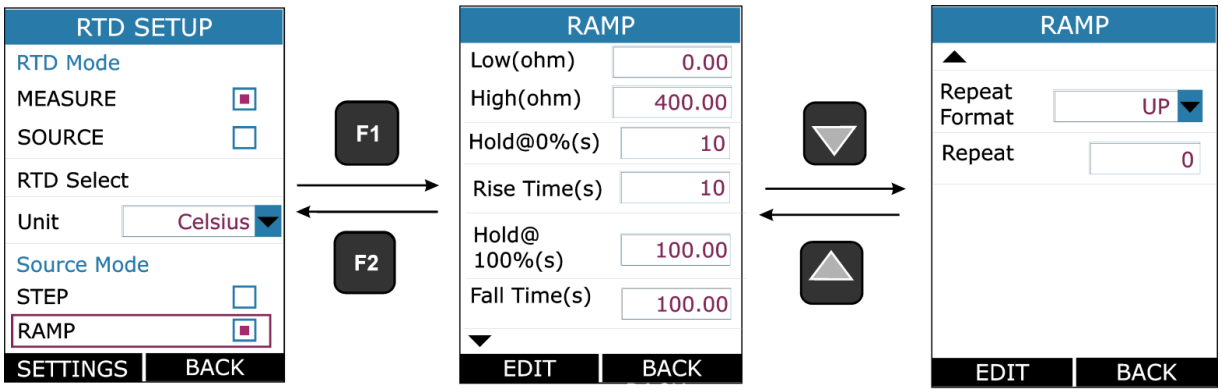
  Automated Step can be started by Pressing **F1** key (START). After that F1 & F2 key will change to **PAUSE**&**STOP**respectively. So by

pressing F1 & F2 key running STEP can be PAUSE or STOP at any time in RUN Page.

STEP Setting can be accessed directly by **F2** key (SETTING).

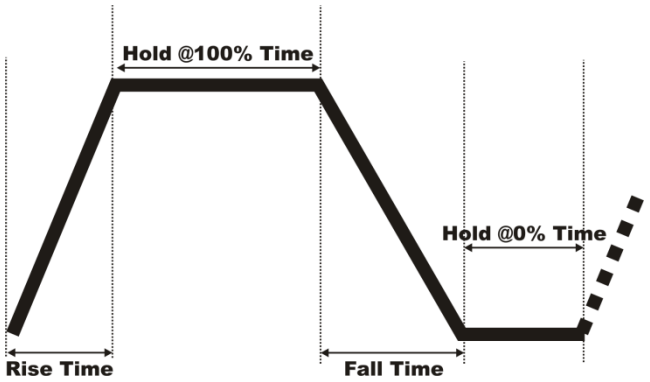
NOTE: While STEP is running STEP settings can't be accessible and Source Page Parameter settings can't be change.Stop STEP before changing any settings.

4.2.2 RAMP Page



Parameter Name	Description / Options
Low	Starting Value of Ramp. Enter value according to RTD Display Mode. If display mode is actual enter value in ohms and if display mode is % enter value in %.
High	Ending Value of Ramp. Enter value according to RTD Display Mode. If display mode is actual enter value in ohms and if display mode is % enter value in %.
Hold@0%(s)	Time to wait at Low (0%) level in second. This parameter is use for **Repeat Format UP/DOWN** or **DOWN/UP**. Range: 0 to 9999
Rise Time (s)	Time to Increase from Low to High Level. Range: 1 to 9999
Hold@100%(s)	Time to wait at High (100%) level in second. This parameter is use for **Repeat Format UP/DOWN** or **DOWN/UP**. Range: 0 to 9999

Fall Time (s)	Time to decrease from High to Low Level. <u>Range:</u> 1 to 9999
Repeat Format	How the Ramp should be done. <u>Available Options:</u> UP DOWN UP/DOWN DOWN/UP
Repeat Repeat Counts	Defines how many times the steps are repeated <u>Range:</u> 1 to 9999



- **<u>Starting the RAMP</u>**

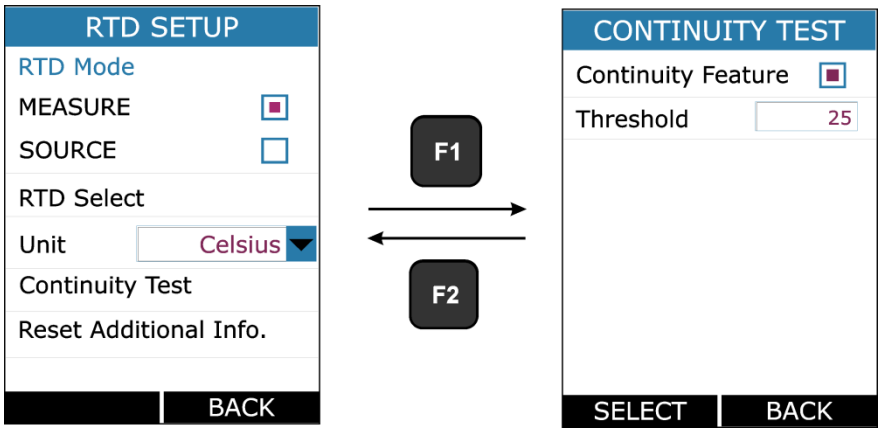
  To Enable Ramp, select Source Type as RAMP.

  If this mode is enabled, ⎍ (Rising Ramp) or ⎎ (Falling Ramp) or ⎍⎎ (Ramp Hold @ 100%) or ⎎⎍ (Ramp Hold @ 0%) icon will appear in Source Display Window according to current RAMP mode in RUN Page and F1 & F2 Button change to **START**&**SETTING** respectively.

  RAMP can be started by Pressing **F1** key (START). After that F1 & F2 key will change to **PAUSE**&**STOP**respectively. So by pressing F1 & F2 key running RAMP can be PAUSE or STOP at any time in RUN Page.

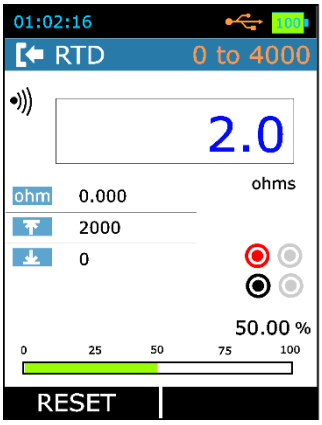
  <u>NOTE:</u> While RAMP is running RAMP settings can't be accessible and Source Page Parameter settings can't be change. Stop RAMP before changing any settings.

4.2.3Continuity Test



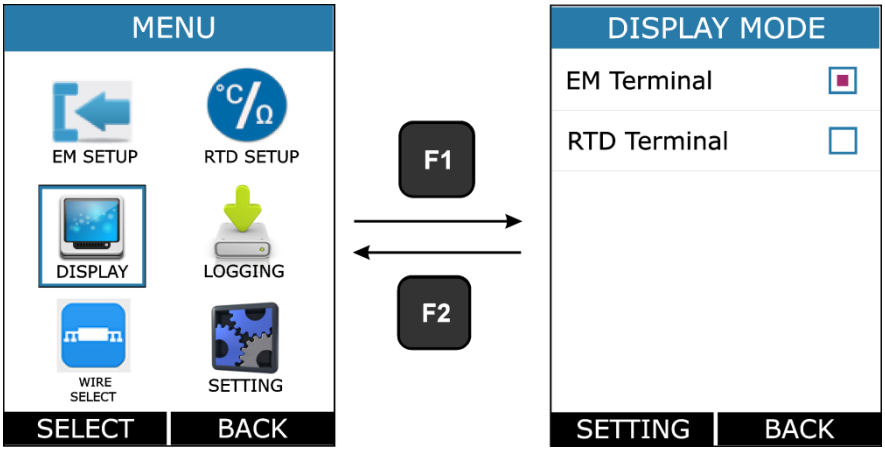
Parameter Name	Description / Options
Continuity Feature	Continuity Feature Selection Radiobuttonbox. Selecting radiobuttonbox will enable continuity feature for RTD Measure Mode.
Threshold	Enter the threshold value of resistance up to which continuity test is applied. Range: 0 to 100

When Testing Continuity Beep sounds and continuity symbol appear on run page as shown in below figure.When resistance between the Ω Measure terminal is less than 25Ω (or defined in threshold parameter). To test the continuity remove power from the circuit to be tested.



4.3 DISPLAY Page

This Page is appears in *RUN →MENU →DISPLAY.*



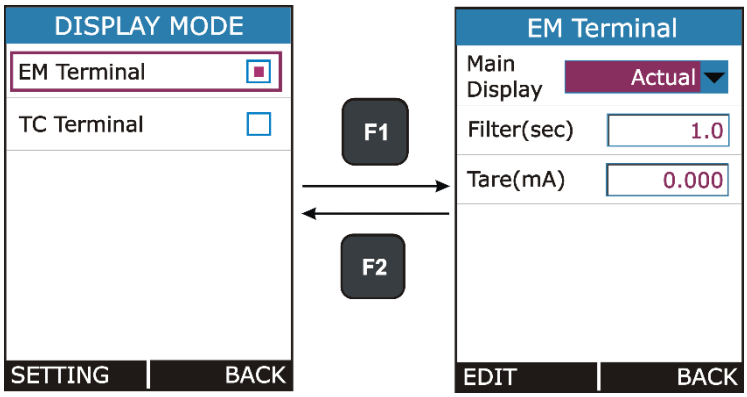
There is mainly three RUN Display Mode possible in this device. And this mode can be selected from the above Page. What information to be shown in each RUN Display Mode can be defined by this page.

In this page there is one RadioButtonBox. At a time one or two option can be selected. The possible combinations are given below.

1	EM(Electrical Measurement) Only
2	RTD(Measure/Source) Only
3	EM + RTD

4.3.1 EM Display Settings

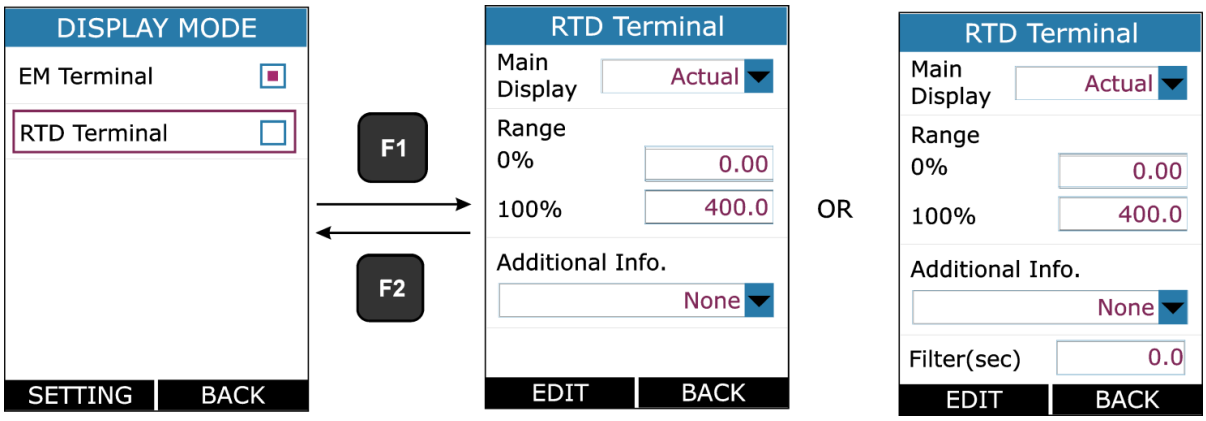
This Page is appears in *RUN →MENU →DISPLAY →EM Terminal.*



<table>
<tr><th>Parameter Name</th><th>Description / Options</th></tr>
<tr><td>Main Display</td><td>Select which Reading to be display as a Main Reading (Reading Displays in Box in RUN Page).
<u>Available Options:</u>
<table>
<tr><td>Actual</td><td>Display the Actual Input Value</td></tr>
<tr><td>Percentage</td><td>Display the Percentage Value of the Input.
The Value depends on Input Range. These settings are available from MENU →EM SETUP.</td></tr>
<tr><td>Scaled</td><td>Display the Scaled Value of the Input.
The Scale Value depends on Input Range, Input Scaled Range & Transfer Function. These settings are available from MENU →EM SETUP.</td></tr>
</table></td></tr>
<tr><td>Filter(sec)</td><td>1st Order IIR Low Pass Filter for Input Reading.
Filter is useful when a measurement signal contains unwanted noise.
<u>Range:</u>
0.0 to 60.0 sec</td></tr>
<tr><td>Tare(unit)</td><td>The Tare value is subtracted from the reading of the measured value.
Here unit is changed according to current Input Type and Measure Display Mode.
<u>Range:</u>
In accordance with Input Range & Measure Display Mode.
Note: Beware of the problems that may result in not seeing the true measurement value.</td></tr>
</table>

4.3.2 RTD Display Settings

This Page is appears in *RUN →MENU →DISPLAY →RTD Terminal.*

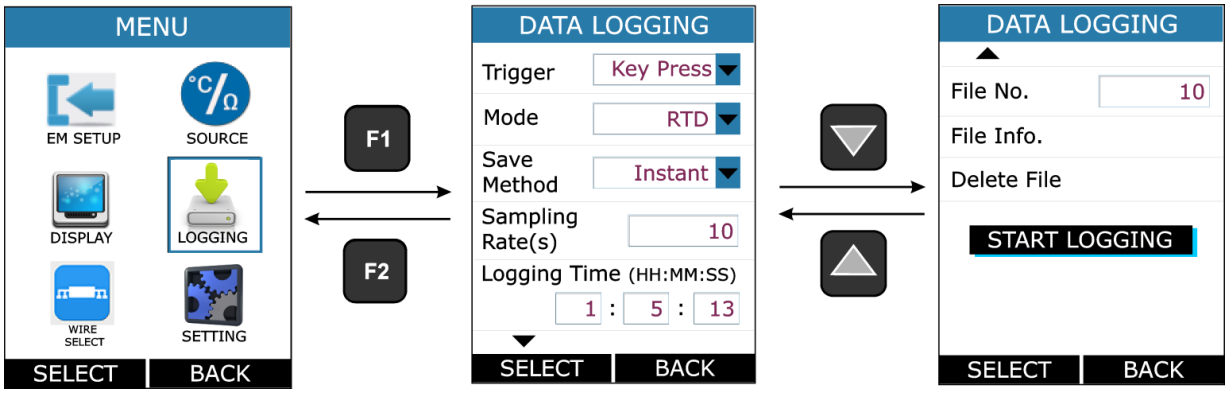


<table>
<tr><th>Parameter Name</th><th>Description / Options</th></tr>
<tr><td>Main Display</td><td>Select which Reading to be display as a Main Reading (Reading Displays in Box in RUN Page).
<u>Available Options:</u>
<table>
<tr><td>Actual</td><td>Display the Actual RTD/Resistance Value</td></tr>
<tr><td>Percentage</td><td>Display the Percentage Value of RTD/Resistance according to value set in 0% & 100%.</td></tr>
</table></td></tr>
<tr><td>0%</td><td>Low Value in Temperature/ohms for (0-100%) scaling.</td></tr>
<tr><td>100%</td><td>High Value in Temperature/ohms for (0-100%) scaling.</td></tr>
<tr><td>Additional Info.1</td><td>Choose which information to be shown as RTD Mode Additional Information on RUN Page.
<u>Available Options for RTD Measure Mode:</u>
<table>
<tr><th>Options</th><th>Icon</th><th>Description</th></tr>
<tr><td>None</td><td>-</td><td>No info is visible.</td></tr>
<tr><td>Actual Value</td><td>AV</td><td>Shows the Actual RTD Temperature/ohms value without any scaling.
This option is available only if RTD Display Mode is Percentage.</td></tr>
<tr><td>Maximum</td><td>⤒</td><td>Shows the Maximum measured reading from the time when info last reset.</td></tr>
<tr><td>Minimum</td><td>⤓</td><td>Shows the Minimum measured reading from the time when info last reset.</td></tr>
<tr><td>Min & Max</td><td>-</td><td>Shows the Minimum and Maximum value both together. This option available only for RTD Display mode.</td></tr>
</table>
<u>Available Options for RTD Source Mode:</u>
<table>
<tr><th>Options</th><th>Icon</th><th>Description</th></tr>
<tr><td>None</td><td>-</td><td>No info is visible.</td></tr>
<tr><td>Actual Value</td><td>AV</td><td>Shows the Actual RTD Temperature/ohms value without any scaling.
This option is available only if RTD Display Mode is Percentage.</td></tr>
<tr><td>Excitation Current</td><td>I (EX)</td><td>Shows the current which is sourced by instrument under test.</td></tr>
</table></td></tr>
<tr><td>Filter(sec)</td><td>1st Order IIR Low Pass Filter for RTD Measure Reading.
This option is available only for RTD mode is Measure.
Filter is useful when a measurement signal contains unwanted noise.
<u>Range:</u>
0.0 to 60.0 sec</td></tr>
</table>

4.4 DATA LOGGING Page

This section gives examples of how to log Readings with time and date over a set time period or on a key press. Logged data is stored in a user defined file in internal memory.

This Page is appears in *RUN →MENU →LOGGING.*



Parameter Name	Description / Options
Trigger	Data Logging Trigger ModeSelection. Available Options: Key Press: Log Data on pressing LOG from RUN key Page. Periodic: Log Data periodically at every Sampling Rate for total time specified by Logging Time.
Mode	Data Mode Selection for Logging Available Options: EM: Log only EM Measure Readings. RTD: Log only RTD Terminal Readings. EM+RTD: Log EM MeasureandRTD Terminal both Readings. This parameter is enabled only for Periodic Trigger.
Save Method	Reading Type selection for Logging Available Options: Instant Min Max Average All This parameter is enabled only for Periodic Trigger.
Sampling Rate(s)	Sampling Rate for Periodic Data Logging in seconds. Range: 1 to 9999 This parameter is enabled only for Periodic Trigger.
Logging Time	Total Logging Time in HH:MM:SS Format for Periodic Logging.

(HH:MM:SS)	This parameter is enabled only for Periodic Trigger.
File No.	File Number. Range: 1 to 25 This parameter is enabled only for Periodic Trigger.
File Info.	Shows the information of stored files. This information contains Logging Start Time & Date and No of Samples stored in the file.
File Delete	Delete stored file.
START LOGGING	Press F1 key while selecting this button to start the Logging.

NOTES:

- Maximum No of Reading that can be stored in,

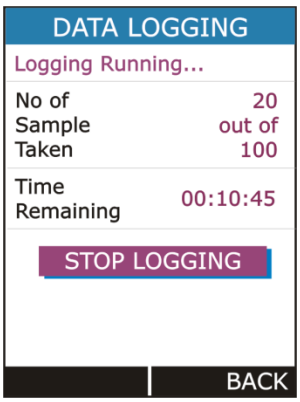
Logging Mode	Max. Reading
Periodic	150000
Key Press	528

- In Periodic mode, changing of any Measure or Source parameter is not allowed. So While Periodic Logging is Running, User can't enter into *MEASURE*, *SOURCE* and *DISPLAY* menu. But in Key Press Logging mode, there is no restriction.

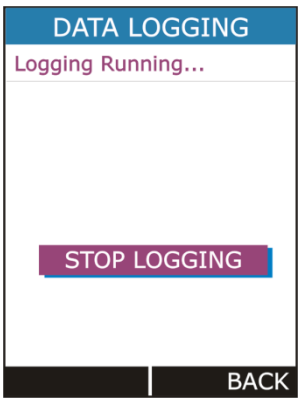
- In Periodic Mode, if error message like "*Not Sufficient Memory*" comes while starting the Logging. Try to Reduce Logging Time or Increase Sampling Period or try deleting some existing files.

- In Key Press Mode, If No of Samples reach its maximum limit that is 484, the next sample will start from the first overwriting the memory.
- While Logging is running, entering into the *LOGGING* menu shows below page.

for Periodic Mode



for Key Press Mode



For Periodic Mode, this page contains information of Number of Samples Taken and

Time Remaining for Logging in HH:MM: SS.

- Both Periodic and Key Press logging can be stop manually by pressing F1 key on STOP LOGGING Button. For Periodic Mode, Logging will automatically stopped when defined log time ends and a message "*LOGGING DONE*" pop ups.

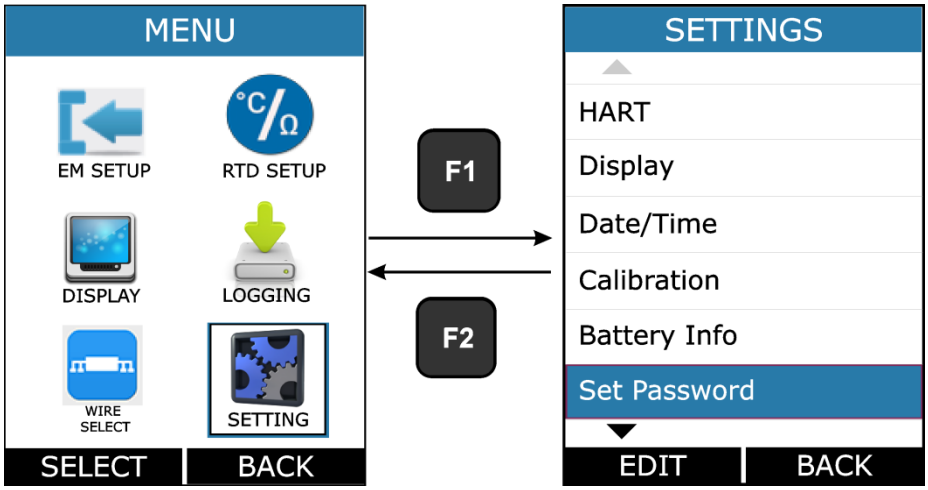
Transferring the Results to a Personal Computer:

A 32-bit Windows® software called **mCAL+.exe**is shipped together with RC-12 if you bought the Data Logging option. Start thissoftware just as any other Windows® software.

All communication between the PC and RC-12 is initiated from**mCAL+.exe**.
More information of the software in mL12lm401_00.pdf document available in software CD.

4.6 SETTING Page

This Page is appears in *RUN →MENU →SETTING.*

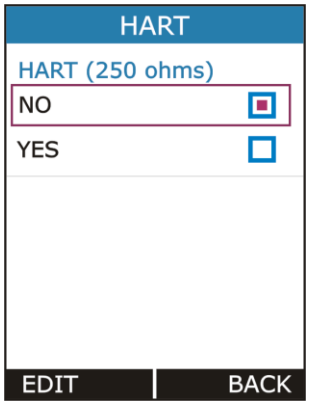


All the available Settings Options are given below.

i. HART
ii. Display
iii. Date/Time
iv. Calibration
v. Battery Info.

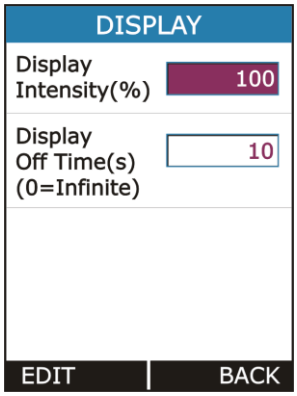
vi. Set Password
vii. Factory Reset
viii. About Us

Press F1 key to Enter into the settings of any option.
Description of all settings given below.



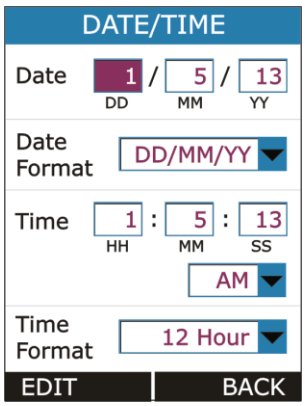
4.6.1 HART Settings

Select YES to add a Series resistor (250Ω) into the mA circuit.
You can then use this instrument together with a HART® communicator to set up and calibrate HART® devices.
This option is applicable for mA (24V) Read Power Input Type Only.



4.6.2 Display Settings

Display Intensity	Display Brightness Settings. Range: 5 to 100
Display Off Time	Standby Time in second after which display will turn Off. To turn the display off press any key. Range: 0 to 9999 sec Setting 0 will disable this feature. That means display will never turn off automatically.



4.6.3 Date/Time Settings

To set the Time + Date of the device.

There are 2 Date Format supported in this device **DD/MM/YY**&**MM/DD/YY**. This is useful only in Data Logging, to decide in which format Date to be stored.

There are 2 Time format supported in this device **24**

Hour&**12 Hour**. This is to select in which format the time should be displayed on Run page & time to be stored in Data Logging.

AM/PM selection is enabled only for 12 Hour Time Format.

4.6.4 Calibration

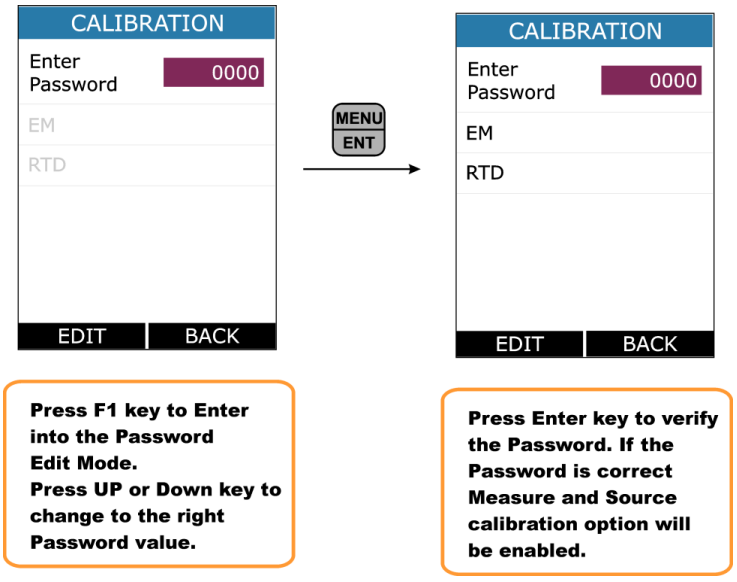
The instrument is factory calibrated for the specified range, but due to long term drift of components, re-calibration may be necessary in some cases. For calibrating the instrument a reliable source & reliable measurement device is required. This source should be at least ten times accurate compared to the range of the instrument.

Note: Masibus can provide a calibration service that is traceable to international standards.

We recommend that you return the instrument to the manufacturer or an approved service agent forcalibration. If you use an alternative calibration facility, make sure thatit uses these standards.

The unit can be calibrated without opening it and without trim pots. To enter in calibration mode follow the steps below.

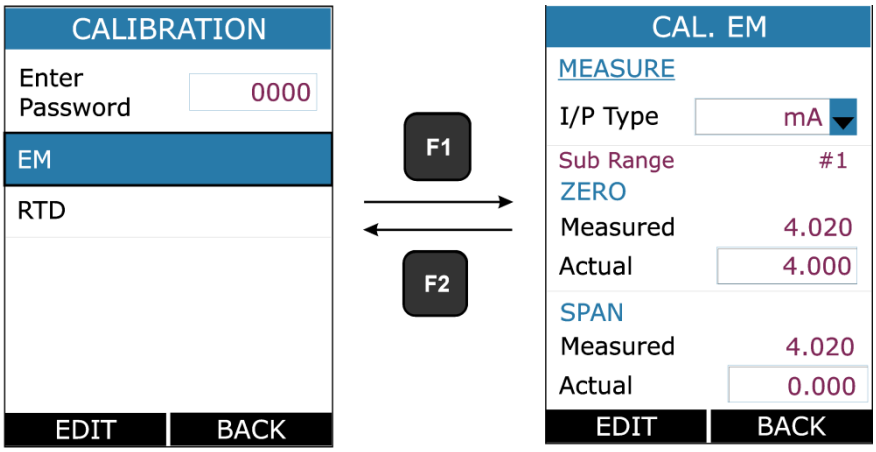
First press the MENU/ENT key in RUN mode to enter in Menu page. In Menu page select the Settings option and press F1 key to enter into the Setting mode. In setting mode select the Calibration option and press F1 key to enter into the calibration mode.



To calibrate the instrument first enter the correct password. If the entered password is correct Measure & Source Calibration option will be enabled.

- **Procedure for calibration of EM Measure Mode**

  First select the Input Type which to be calibrated.



  For Better Calibration Input Range is divided into two sub ranges. So For each input type, Calibration of both sub ranges need to done. The Sub Ranges of each input type is given in the below table.

Input Type	Sub Ranges	Recommended Calibration Points
mA (0.000 to 24.000 mA)	1. 0.000 to 12.000 mA	ZERO: 1.000 mA SPAN: 11.000 mA
	2. 12.000 to 24.000 mA	ZERO: 13.000 mA SPAN: 23.000 mA
mA(24V) (0.000 to 24.000 mA)	1. 0.000 to 12.000 mA	ZERO: 1.000 mA SPAN: 11.000 mA
	2. 12.000 to 24.000 mA	ZERO: 13.000 mA SPAN: 23.000 mA
V (0.000 to 30.000 V)	1. 0.000 to 15.000 V	ZERO: 1.000 V SPAN: 14.000 V
	2. 15.000 to 30.000 V	ZERO: 16.000V SPAN: 29.000V

  Note: It is not compulsory to calibrate at recommended points. User can calibrate at any points within specified Sub Range. The Sub Range is shown on the screen. But make sure to calibrate Zero & Span in the same sub range.

  Example: - Calibrating mA Input

  To calibrate **ZERO for Sub Range #1,**

- Apply mA Input value near to Recommended Zero Value for Sub Range 1 (for mA sub range 1 it is 1.000mA) from reliable source device.
- For example, If apply 1.000mA from the external source. **Measured** value shows the value that has been measured by the RC-12. If this value is 1.020 enter 1.000 value in **ZERO Actual Value** Edit Box & Press **MENU/ENT** key to calibrate the ZERO.

Similarly, for **SPAN for Sub Range #1** calibration,

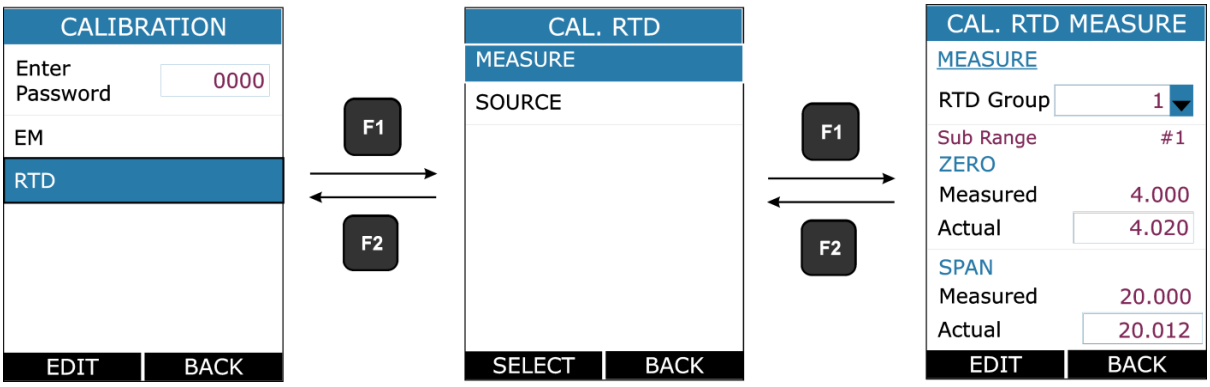
- Apply mA Input value near to Recommended Span Value for Sub Range 1 (for mA sub range 1 it is 11.000mA) from reliable source device.
- For example, If apply 11.000mA from the external source. If the **Measured** value shows 10.995 enter 11.000 value in **SPAN Actual Value** Edit Box & Press **MENU/ENT** key to calibrate the SPAN.

- Follow the same procedure to calibrate for the Sub Range 2.
- The same procedure is applicable for other Input Type.
- To calibrate input use other source in series or parallel to device according to the input type which is ten times accurate compared to the range of the instrument.

Note: Calibration of mA Input will also calibrate mA(24V) input. No need to separately
calibrate mA(24V) Input.

- **Procedure for calibration of RTD Measure**

  To enter into the RTD Measure Calibration, Select the **RTD** option in Calibration page and MEASURE option in CAL. RTD page.



All RTD input are divided into 4 groups.

For Better Calibration Accuracy groups are divided into two sub ranges. So for those groups, Calibration of both sub ranges need to done. The Sub Ranges of each input type is given in the below table.

RTDMEASURE Group		Sub Range	Recommended Zero	Recommended Span
1	0 to 400 Ohms	1	5.00 Ohms	190.00Ohms
		2	210.00 Ohms	390.00 Ohms
2	0 to 800 Ohms	1	380.00 Ohms	790.00 Ohms
3	0 to 1600 Ohms	1	780.00 Ohms	1590.00 Ohms
4	0 to 4000 Ohms	1	1100.00 Ohms	2400.0Ohms
		2	2600.0 Ohms	3900.0 Ohms

Note: It is not compulsory to calibrate at recommended points. User can calibrate at any points within specified Sub Range. The Sub Range is shown on the screen. But make sure to calibrate Zero & Span in the same sub range. Make sure unit is in 4-wire mode during RTD Measure Mode.

Example: - Calibrating Group-1

Select Group 1 in RTD Group ListBox.

To calibrate **ZERO for Sub Range #1,**

- Apply Resistance Input value near to Recommended Zero Value for Sub Range 1 (for Group 1 sub range 1 it is 5.00Ohms) from reliable source device.
- For example, If apply 5.00Ohms from the external source. **Measured** value shows the value that has been measured by the RC-12. If this value is 5.02 enter 5.00 value in **ZERO Actual Value** Edit Box & Press **MENU/ENT** key to calibrate the ZERO.

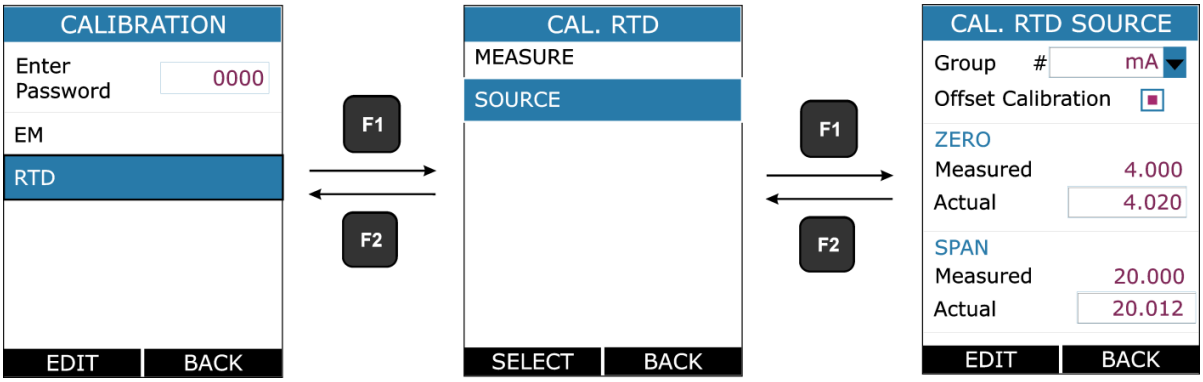
Similarly, for **SPAN for Sub Range #1** calibration,

- Apply Resistance Input value near to Recommended Span Value for Sub Range 1 (for Group 1 sub range 1 it is 190.00Ohms) from reliable source device.
- For example, If apply 190.00Ohms from the external source. If the **Measured** value shows 191.00 enter 190.00 value in **SPAN Actual Value** Edit Box & Press **MENU/ENT** key to calibrate the SPAN.

- Follow the same procedure to calibrate for the Sub Range 2.
- The same procedure is applicable for other RTD Measure Group.
- To calibrate input use other source according to the input type which is ten times accurate compared to the range of the instrument.

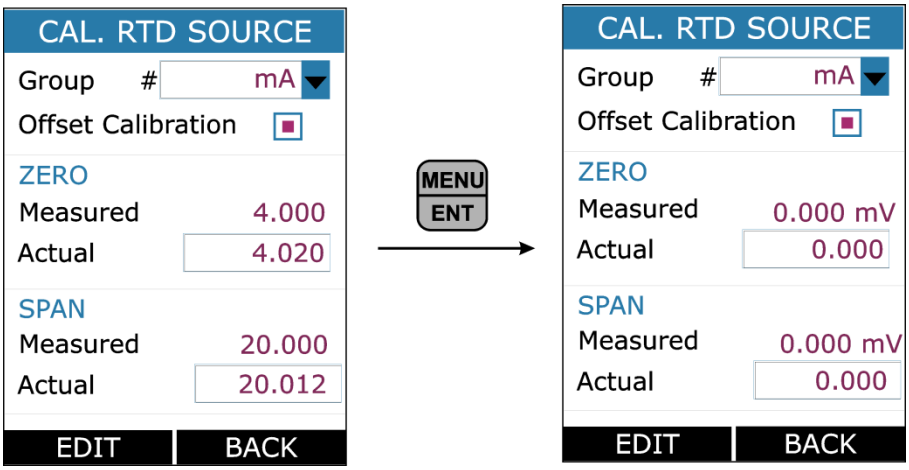
- **<u>Procedure for calibration of RTD Source</u>**

To enter into the RTD Source Calibration, Select the **RTD** option in Calibration page and SOURCE option in CAL. RTD page.



For RTD source calibration first calibrate Offset for all 4 groups.

- **<u>Procedure for calibration of Offset</u>**



- To enter into the Offset Calibration, Select the **Offset Calibration radiobuttonbox**in**CAL. RTD SOURCE** page.

Example: - Calibrating Offset

Offset measured value for zero and span is always 0.000mV

To calibrate **ZERO,**

- Select **ZERO Measured** Edit Box, when this Edit Box is selected RC-12 will source value that is seen in **ZERO Expected** Value (here RC-12 will source 0.000mV).
- For Example the external measure unit is measuring 0.080 mV offset. Then enter 0.080 value in **ZERO Actual** Edit Box & Press **MENU/ENT** key to calibrate the ZERO.

To calibrate **SPAN,**

- Select **SPAN Measured** Edit Box, when this Edit Box is selected RC-12 will source value that is seen in **SPAN Expected** Value (here RC-12 will source 0.000mV).
- For Example the external measure unit is measuring 0.082 mV offset. Then enter 0.082 value in **SPANActual** Edit Box & Press **MENU/ENT** key to calibrate the SPAN.

- **Procedure for calibration of Resistance**
  - All RTD Source are divided into 4 groups.

RTD SOURCE Group		Zero	Span
1	0 to 200 Ohm	1.00 Ohm	180.00 Ohm
2	200 to 400 Ohm	220.00 Ohm	380.00 Ohm

3	400 to 1000 Ohm	430.00 Ohm	980.00 Ohm
4	1000 to 4000 Ohm	1050.00 Ohm	3950.00 Ohm

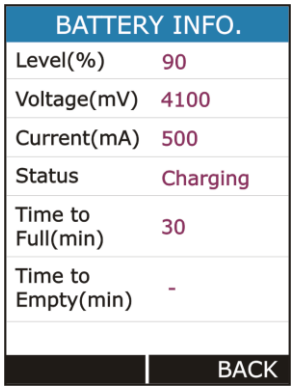
Example: - Calibrating Group-2

To calibrate **ZERO,**

- Select **ZERO Measured** Edit Box, when this Edit Box is selected RC-12 will source value that is seen in **ZERO Expected** Value (here RC-12 will source 220.00Ohm).
- Now Measure the source value in Reliable Measure Unit. For Example the external measure unit is measuring221.00Ohm. Then enter 221.00 value in **ZERO Measured** Edit Box & Press **MENU/ENT** key to calibrate the ZERO.

To calibrate **SPAN,**

- Select **SPAN Measured** Edit Box, when this Edit Box is selected RC-12 will source value that is seen in **SPAN Expected** Value (here RC-12 will source 380.00 Ohm).
- Now Measure the source value in Reliable Measure Unit. For Example the external measure unit is measuring382.00Ohm. Then enter 382.00 Ohmvalue in **SPAN Measured** Edit Box & Press **MENU/ENT** key to calibrate the SPAN.
  Follow the same procedure to calibrate the other RTD Source Group.



4.6.5 Battery Info.

This page shows the basic battery Information.

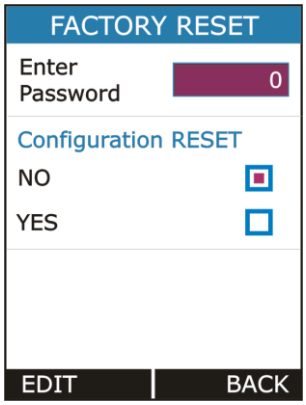
- Battery Level (Percentage)
- Battery Voltage (in mV)
- Current (in mA)
- Battery Status
- Time to Full (in min)
- Time to Empty (in min)

4.6.6Set Password

Change Device Password.

This password has to be entered before Calibrating & Resetting Configuration Parameters.

To change password Enter Current Password. If the entered password is correct then New Password EditBox will be enabled. Then enter the New Password and press **MENU/ENT** key to store it.



4.6.7Factory Reset

To Reset RC-12 Parameters to its Default Value.

To Reset Enter Current Password. If the entered password is correct then New Password EditBox will be enabled. Then enter the New Password and press **MENU/ENT** key to store it.

4.6.8 About Calibrator

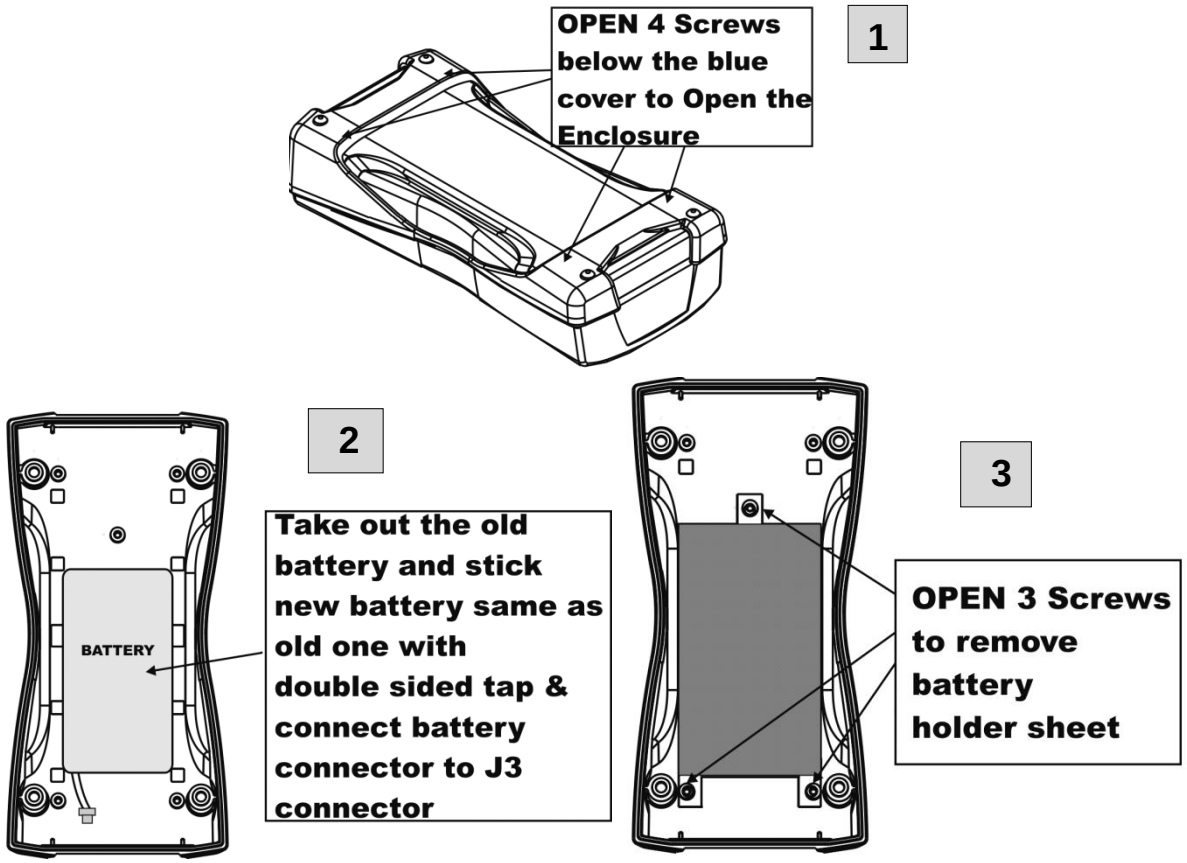
This Page illustrates the Connection diagrams for valid connections to this device.

5. Maintenance & Troubleshooting

5.1 Common Problems

Problem	Possible Causes
Device Not Starting Up	• Battery Discharged • Battery Connection Loose
Reading Fluctuation/ Reading OPEN	• Wrong / Loose Connections
Error Code on status bar	• One of the peripheral not working properly. (Solution: Restart the Device if still error code showing contact factory)
Calibration Out	• Distortion in due to external noise connection (Solution: Check connection. If still out contact factory or Recalibrate Device in authorized cal-lab.)
Battery Not Charging	• Battery Connection Loose • Battery Dead

5.2 Replacing the Battery



6. General Specifications

6.1 General Specifications

Display Mode	mA/V Measure + RTD/Ω(Source or measure), mA/V Measure Only, RTD/Ω(Source or measure) only
Supported units for RTD type	°C/°F/°K
RTD Measurement Current	300 uA
Maximum Resistance excitation current (simulation)	3 mA (0 … 650 Ω) Iexc × Rsim< 2.0 V (650 ... 4000 Ω)
Settling time (pulsed currents RTD Simulation)	>1 ms
Max. input voltage (EM Terminal)	30 VDC
Temperature Coefficient	≤30 ppm
Input Impedance Measure (EM Terminal)	V >1MΩ mA =10 Ω
Response time	Input <100ms Output <100ms
Display update rate	10 readings/ second
Isolation	500VDC between mA/V Measure and RTD/Ω(Source or measure)
Data logging	Logged data is stored in a user defined file in internal memory Periodic logging: 150000 readings max
Communication Interface	USB 2.0
Operating temperature	0^0 to 55^0 C
Operating temperature when charging batteries	0 to 45^0 C
Storage temperature	-20^0 to 60^0 C
Relative Humidity	30% to 90% non-condensing
Warm-up time	15 Minutes

6.2 Display & Keys

Display	2.4” TFT LCD, 262K Color, Graphical, 42.72 mm x 60.26 mm, 240x320 pixels, White LED Backlight
Keys	6 Membrane Keys

6.3 Special Features

Loop power output	24V DC, ±10% (24mA maximum)
HART mA Loop Resistor	250 Ω ± 20%
Special Function	Step/Ramp functions: Automatic/Manual. $\sqrt{x}$, x^2 : for mA/V measure

6.4 Power Supply

Battery Type	Rechargeable Li-ion battery pack, 2300mAh 3.7V
Charging Time	<5 hours
Charger supply	100-240 VAC, 50/60 Hz; Output 5V DC@1A
Battery Life on full charge	>15 hours for RTD/Ω measure/source with minimum backlight on, > 8 hours for 12mA(24V) measure mode with minimum backlight brightness
Battery Status Indication	Battery symbol displayed with % power remaining

6.5 Physical

Dimensions	161.7 mm (L) x 82.1 mm (W) x 39.5 mm (H)
Housing Material	ABS Plastic
Electrical Terminals	Two nos. , 2 mm safety sockets
RTD Terminals	Four nos. , 2 mm safety sockets
Weight	<300 grams
Protection	IP20

6.6 Electrical Measurement Parameters and Accuracy

Parameter	Range	Resolution	Accuracy
V	0-30.00 VDC	0.001 V	±0.02% of reading ± 2 count
mA	0-24.00 mA	0.001 mA	±0.02% of reading ± 2 count

6.7 Resistance Measurement 0 ... 4000 ohm

Range	Resolution	Accuracy
0….1600 Ω	10 mΩ	4 Wire Connection: 0.02% of reading ± 0.01 Ω 3 Wire Connection: 0.02% of reading ± 0.015 Ω
1600….4000 Ω	100 mΩ	4 Wire Connection: 0.02% of reading ± 0.1 Ω 3 Wire Connection: 0.02% of reading ± 0.15 Ω

6.8 Resistance Simulation 0 ... 4000 ohm

Range	Resolution	Accuracy*
0….400 Ω	10 mΩ	0.02% of reading ± 0.02 Ω
400….4000 Ω	100 mΩ	0.02% of reading ± 0.15 Ω

6.9 RTD Measurement and Simulation

1) Pt10 …… Pt1000, -200 …… 850 ºC

Range	Resolution	Accuracy
-200….200 °C	**Pt10…Pt400:** 0.01 °C **Pt500,Pt1000:** 0.1 °C	4 wire Measurement: 0.15°C Simulation*: 0.15 °C
200….600 °C		4 wire Measurement: 0.2 °C Simulation*: 0.25 °C
600….850 °C		4 wire Measurement: 0.3 °C Simulation*: 0.35 °C

2) Ni100, -60 …… 180 ºC

Range	Resolution	Accuracy
-60….180 °C	0.01 °C	4 wire Measurement: 0.1 °C Simulation*: 0.15 °C

3) Ni120, -80 …… 260 ºC

Range	Resolution	Accuracy
-80….260 °C	0.01 °C	4 wire Measurement: 0.1 °C Simulation*: 0.15 °C

4) Cu10, -200 …… 260 ºC

Range	Resolution	Accuracy
-200….260 °C	0.01 °C	4 wire Measurement: 0.2 °C Simulation*: 0.8 °C

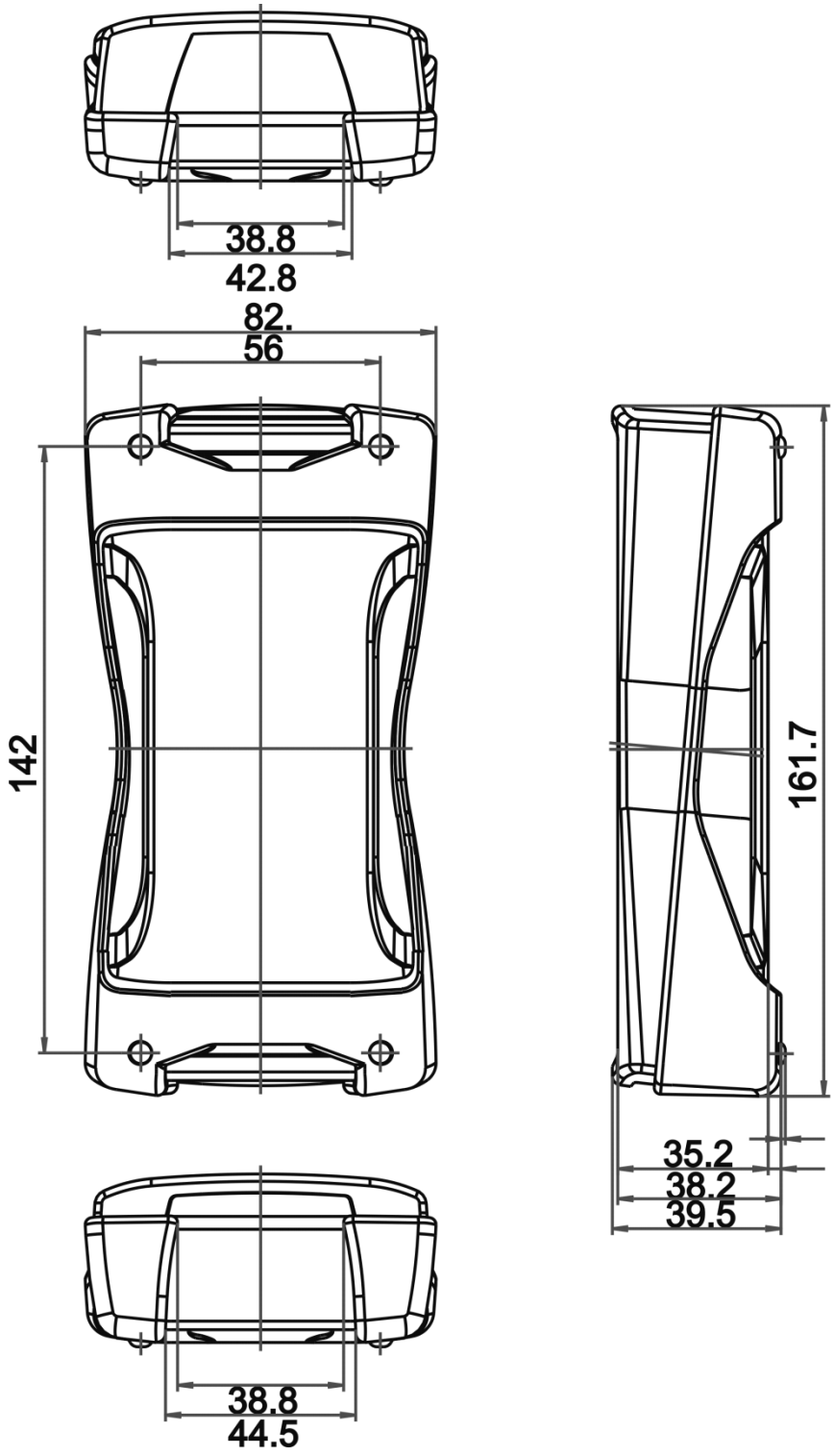
Note: * Specification valid with an excitation current >0.2 mA (0...400 ohm), >0.1 mA (400...4000 ohm)

** Read accuracy is based on 4-wire input. For 3-wire RTD measurements, assuming all three RTD leads are matched, add 1.0 °C (Pt10 and Cu10), 0.6 °C (Pt50 and Cu50), and 0.4 °C (Other RTD types) to the specifications.

6.10 Available RTD Types

1) Pt10 (385)
2) Pt50 (385)
3) Pt100 (385)
4) Pt200 (385)
5) Pt400 (385)
6) Pt500 (385)
7) Pt1000 (385)
8) Pt100 (3926)
9) Ni100 (672)
10) Ni100 (618)
11) Ni120 (672)
12) Cu10 (427)
13) Cu50 (427)
14) Cu100 (427)

6.11Enclosure Dimensions



6.12 Ordering Code

Ordering Code
RC 12