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User's Manual

FLAMEPROOF pH indicator
PHI-22-XP

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Contents

1. INTRODUCTION

Foreword

Thank you for purchasing FLP (Flameproof) series.

Flameproof pH Indicator
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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Checking the Contents of the Package

Unpack the box and check the contents before using the product. If the product is different from which you have ordered, if any parts or accessories are missing, or if the product appears to be damaged, contact your sales representative.
The Single Loop Controller unit has a nameplate affixed to the one side of the enclosure. Check the model and suffix codes inscribed on the nameplate to confirm that the product received is that which was ordered.

Safety Precautions

The product and the instruction manual describe important information to prevent possible harm to users and damage to the property and to use the product safely. Understand the following description (signs and symbols), read the text and observe Descriptions.

DESCRIPTION OF SIGNS:

⚠ WARNING	***This indicates a danger that may result in death or serious injury if not avoided.***
⚠ CAUTION	***This indicates a danger that may result in minor or moderate injury or only a physical damage if not avoided.***

2. SPECIFICATIONS

2.1 Inputs

Input	
Input pH	pH : 0.00 to 14.00
Input Temp	RTD (Pt 100 -3 wire) -50 to 150 ^{0} C/ -58 to ^{0} 302 F
Accuracy	pH: ±0.05 Temp: ±0.25% of FS ±1 degree
ADC Resolution	16 bits
Display Resolution	pH : 0.00 , Temp: 0.1 °C / ^{0}F
Sampling Rate	2 Samples/Sec
Temp. Compensation	Auto/Manual
Burnout current	0.25uA
RTD excitation current	0.166mA (Approx.)
NMRR	> 40 dB
CMRR	> 120 dB
Temp-co	< 100ppm for Input to Display < 150ppm for Input to retransmission output
Input Impedance	$10^{12}\Omega$

2.2 Display & Keys

Display	**Specification**
Process Value pH	0.8", 7 segment, Red LED, 4 digits
Process Value Temp	0.56", 7 segment, Red LED, 4 digits
Status LEDs	Relay, Communication, ATC, mV and ^{0}F
Keys	ENT/SET, ESC, Increase, Decrease

2.3 Output Types

Relay Output	
Relays	2 Nos.
Type	Single Change over (C, NO, NC) Rating
Rating	5A @ 230VAC / 30VDC

Retransmission Output (Optional)	
Current	0/4-20mA @500Ω Max.
Voltage	0/1-5V, 0-10V @2KΩ Min.
Accuracy	0.25% of FS

2.4 Communication Details

Communication	
Interface	RS485 (2 Wire)
Protocol	Modbus-RTU
Baud rate	9600, 19200, 38400 bps

2.5 Power Supply

Standard	85-265VAC/ 100-300VDC
Optional	18-36VDC
Power Consumption	<10VA

- **Isolation (Withstanding voltage)**
  - Between primary terminals* and secondary terminals**:
    At least 1500 V AC for 1 minute
  - Between primary terminals* and grounding terminal:
    At least 1500 V AC for 1 minute
  - Between grounding terminal and secondary terminals**:
    At least 1500 V AC for 1 minute
  - Between secondary terminals**:
    At least 500 V AC for 1 minute
    * Primary terminals indicate power terminals and relay output terminals.
    ** Secondary terminals indicate analog I/O signal and Communication O/P.

- **Insulation resistance:** 50MΩ or more at 500 V DC between power terminals and grounding terminal.

2.6 Environmental Conditions

Operating temperature	0-55 °C
Storage temperature	0-80 °C
Humidity	20-95 %RH non-condensing

2.7 Special Feature

1. User selectable Automatic or Manual Temperature Compensation
2. For gas group I, IIA and IIB as per IS: 2148/04 and IP65 as per 13346:04 (Optional: IIC group)
3. Touch Sensitive Keys for Operation
4. Large and Bright Red seven segment LED Display
5. Inbuilt Diagnostics to indemnify the problems.
6. Re-transmission output (optional) RS485 serial communication (optional)
7. Fail-safe Design protecting the process in case of system malfunctioning
8. Relay/ retransmission output mapping with respect to pH / Temp.
9. Password protected configuration to avoid unauthorized tampering
10. RS-485 serial communication (Optional)
11. Electrode Performance indicator
12. User selectable lower display: SP1/SP2/mV/temp
13. 5 point calibration
14. Slope / offset adjustment

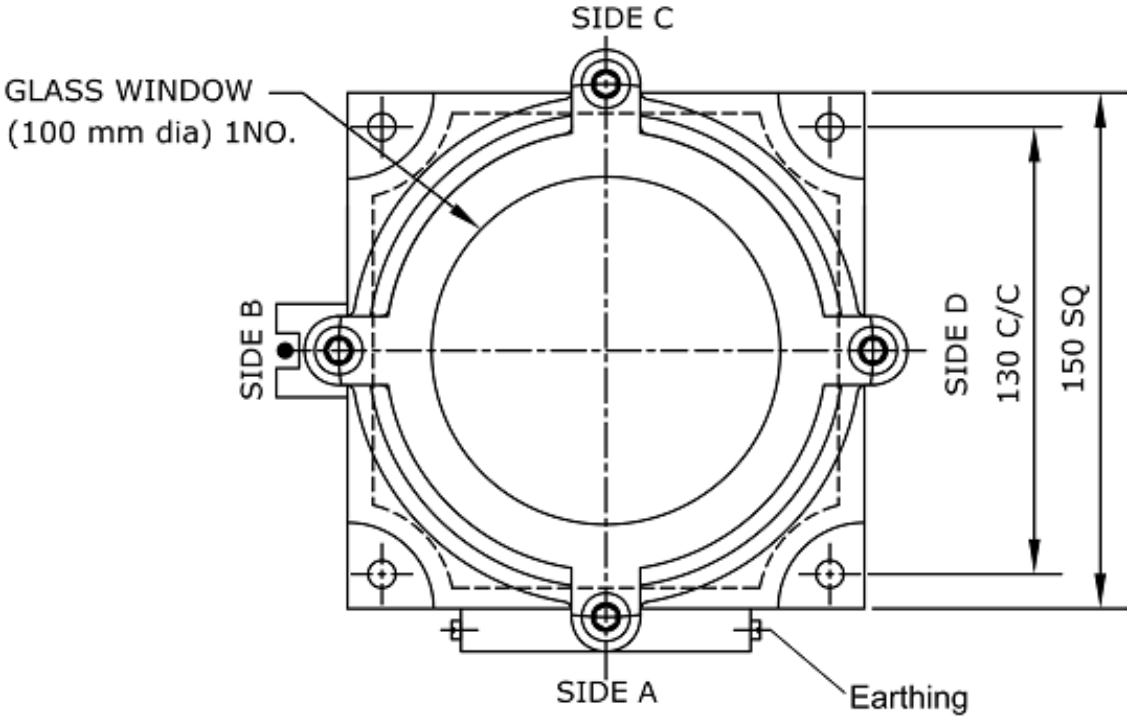
3. PHYSICAL SPECIFICATIONS & MOUNTING DETAILS

3.1 External Dimensions

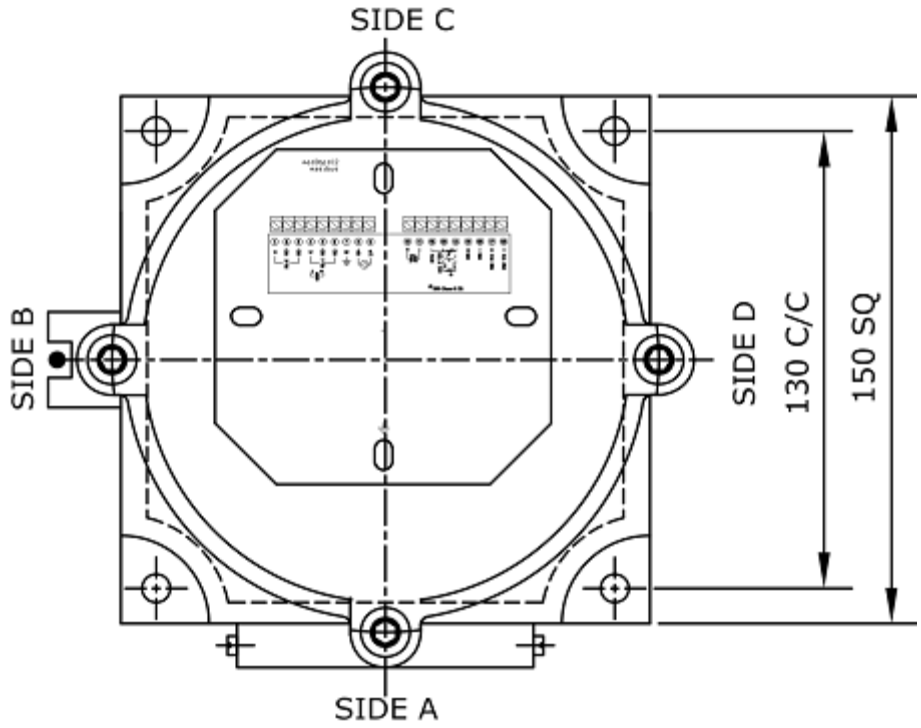
Unit: mm

Mounting method: Wall Mounting
Weight: For IIA, IIB& IIC Enclosure: Approx. 3 Kg.
For IIA & IIB Enclosure: Approx. 2.6 Kg.
Type of Protections: Flameproof (Explosion Proof) EX-d
Area Classification: Hazardous Location of Zone 1 & 2
Gas Groups: IIA, IIB&IIC
IP Protection: IP 66
Apparatus Standard: IS 2148-2004 & IS-13346-2004
Material: Aluminum Alloy LM-6.
Finish: Anti corrosive epoxy light grey shade- 631 of IS:5
Hardware: High tensile zinc passivated / stainless steel (ss-304)
Mountings: Wall mountings with the help of 4 NOS bolts of size M8
Cable entry size/no: M20 – 6 NOS
Plug Details: 4 Blind Plug & 2 Cable gland M20

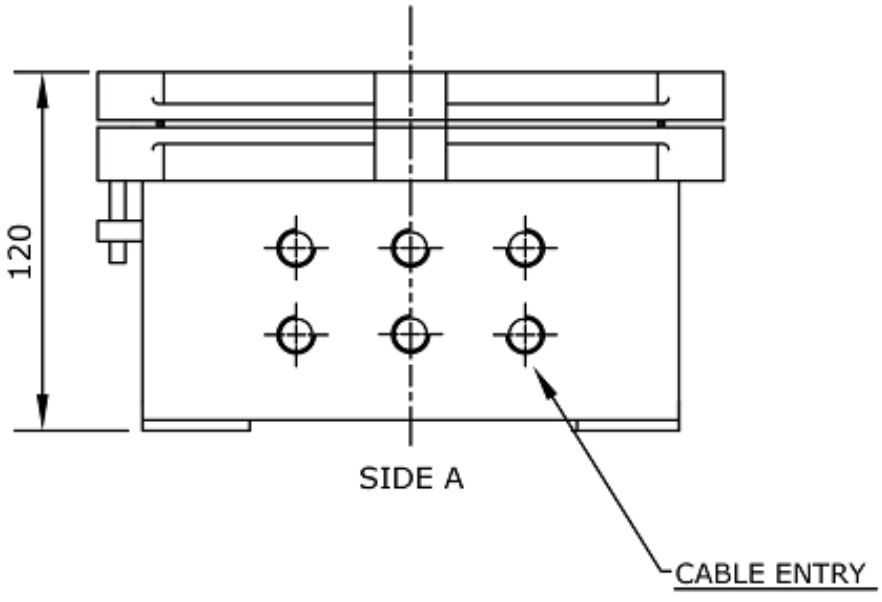
1. Mechanical Details for IIA & IIB Enclosure



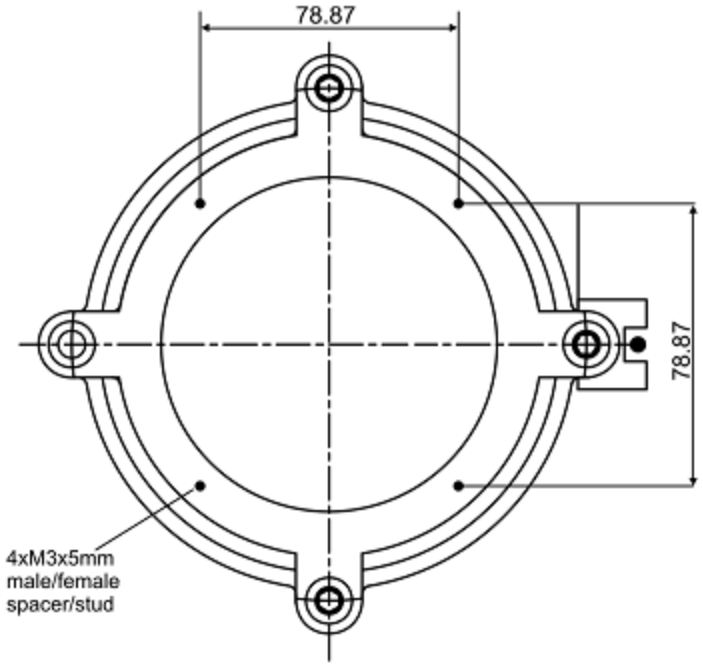
TOP FRONTVIEW OF DEVICE



INTERNAL VIEW WITH TERMINAL CONNECTION DETAILS

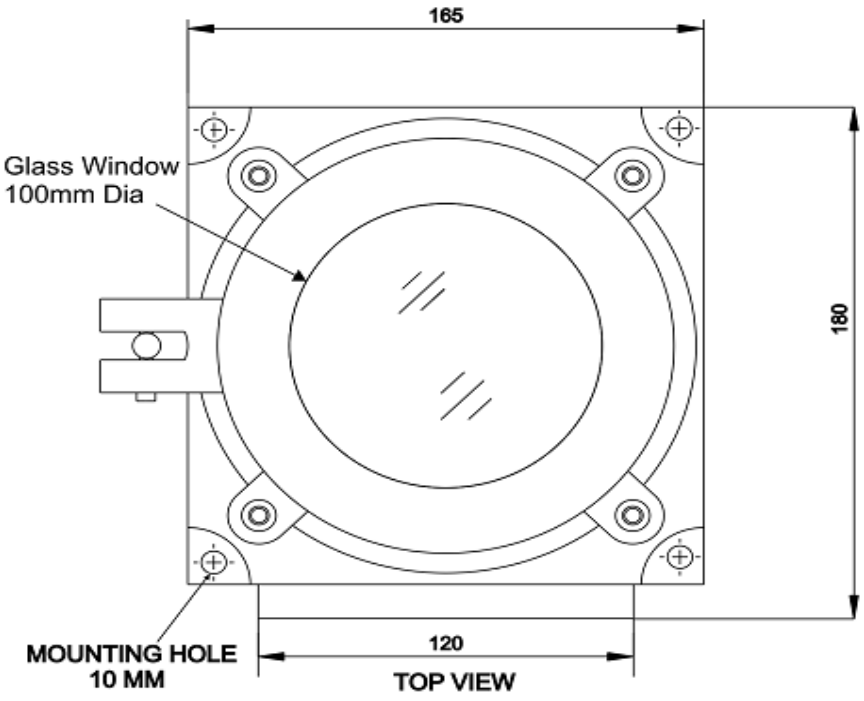


BOTTOM VIEW FOR CABLE ENTRY

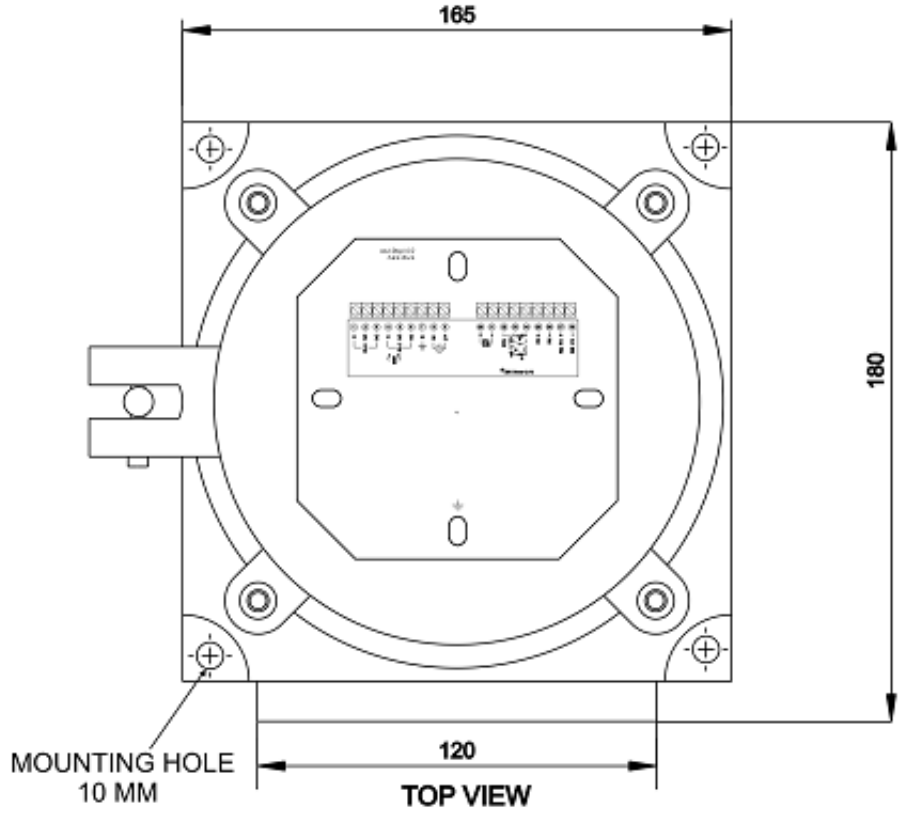


TOP VIEW FOR DISPLAY CARD ASSEMBLY

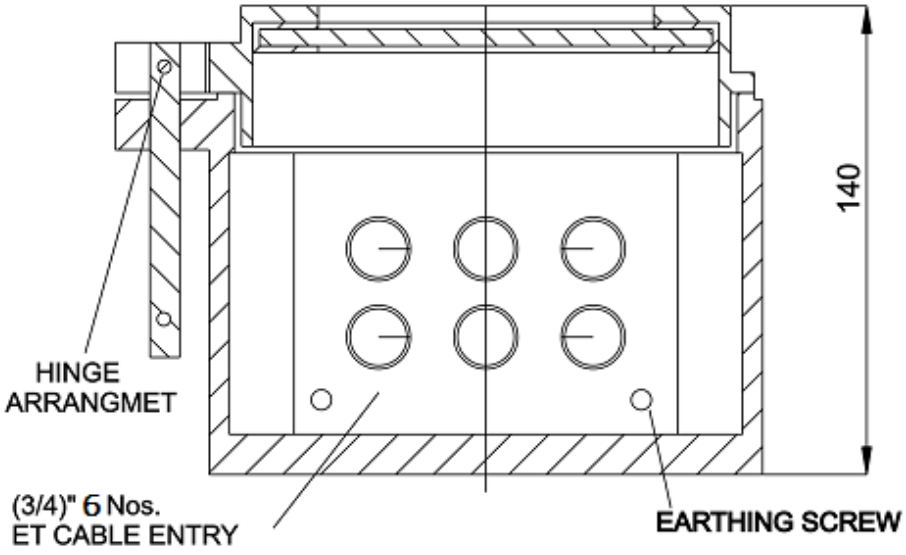
2. Mechanical Details for IIA, IIB & IIC Enclosure



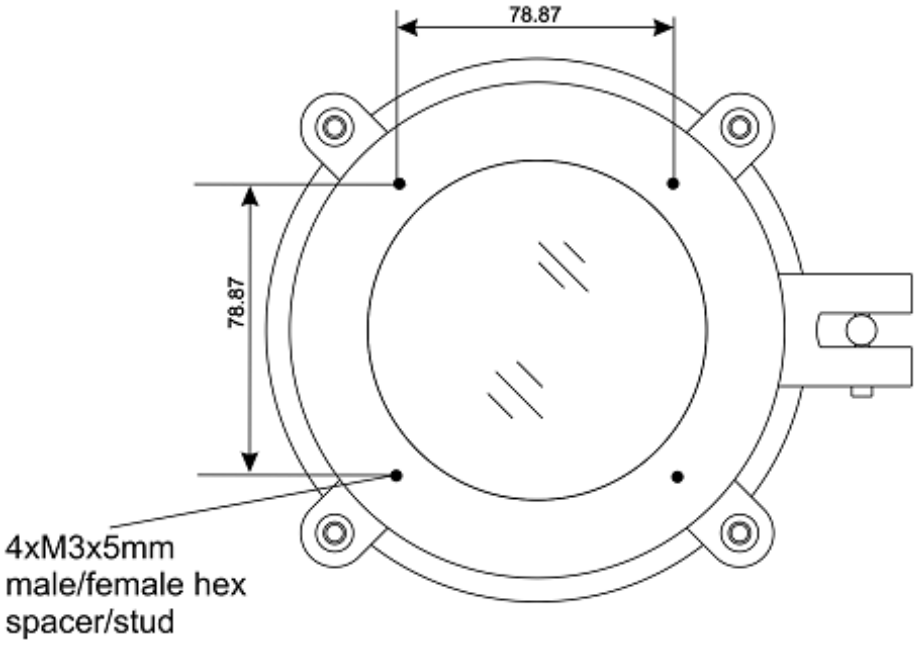
FRONT VIEW OF DEVICE



INTERNAL VIEW WITH TERMINAL CONNECTION DETAILS



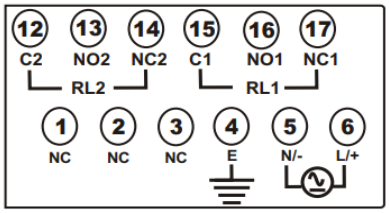
BOTTOM VIEW FOR CABLE ENTRY

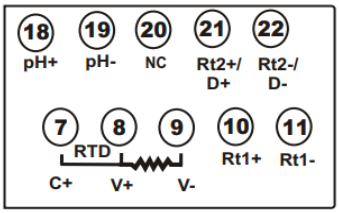


TOP VIEW FOR DISPLAY CARD ASSEMBLY

4. TERMINAL CONNECTIONS

4.1 Single compartment enclosure





Terminal No.	Description
1 (NC)	Not connected
2 (NC)	Not connected
3 (NC)	Not connected
4 (Earth)	Earth Connection
5 (N/-) **6 (L/+)**	Power Supply Input
7 (C+) **8 (V+)** **9 (V-)**	For RTD Input Only (Three wire Compensation)
10 RTR1+ **11 RTR1-**	• For Retransmission-1 output
12 (C2) **13 (NO2)** **14 (NC2)**	• For Relay-2 potential free Contacts (Use 230V -5A load) Alarm-2 o/p.
15 (C1) **16 (NO1)** **17 (NC1)**	• For Relay-1 potential free Contacts (Use 230V -5A load) Alarm-1 o/p.
18 (pH+) **19 (pH-)**	• pH Positive terminal • pH Negative terminal
20 (NC)	• Not connected
21 (D+/ RTR2+) **22 (D- / RTR2-)**	• For Retransmission-2 output • Modbus-RTU Communication Output

4.2 How to connect wires

Before carrying out wiring, turn off the power to the controller and check that the cables to be connected are not alive because there is a possibility of electric shock.

NOTE:

- ✓ All wiring must confirm to appropriate standards of good practice and local codes and regulations. Wiring must be suitable for Voltage, Current and temperature rating of the system.
- ✓ Terminal Details: <= 2.5mm^2 conductor.

- ✓ Provide power from a single-phase instrument power supply. If there is a lot of noise in the power line, insert an insulating transformer into the primary side of the line and use a line filter on the secondary side. Do not place the primary and secondary power cables close to each other.
- ✓ Use repeater after each set of 32 instruments connected in RS-485 Communication.
- ✓ Unused terminals should not be used as jumper points as they may be internally connected, which may cause damage to the unit.
- ✓ Unused control terminals should not be used as jumper points as they might be internally connected, which may cause damage to the unit.
- ✓ Use >250V-1Amp Cable for Power Supply.
- ✓ Supply voltage must be below maximum voltage rating specified on the label.
- ✓ If cable has two parallel wires inside then isolation between them must be 2.5 KV.

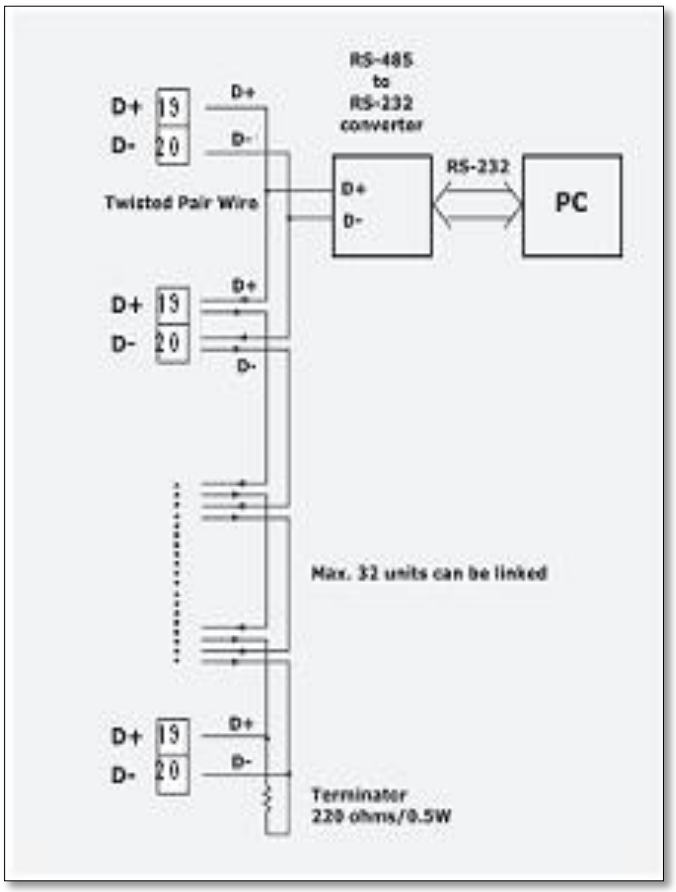
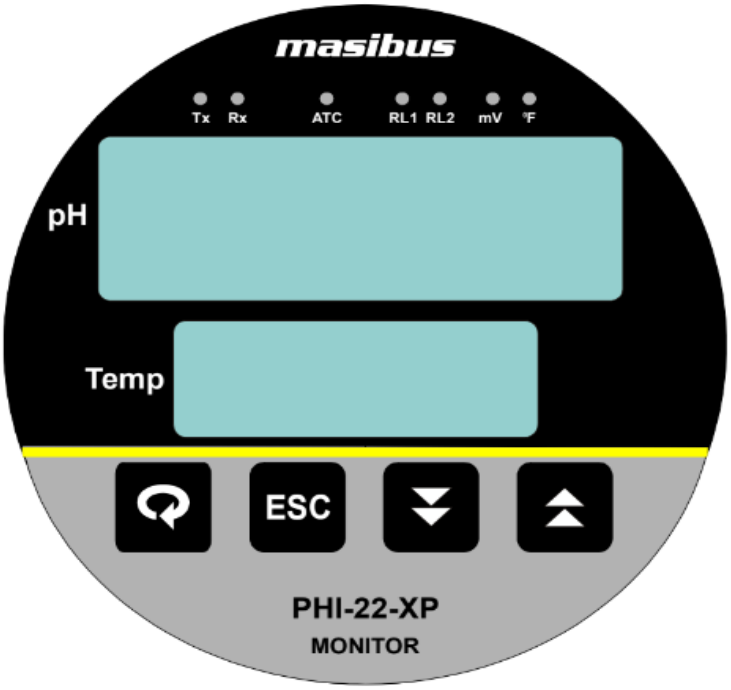


Fig 4.2: RS485 Connection Details

5. FRONT PANEL DETAILS



5.1 Front Panel Description

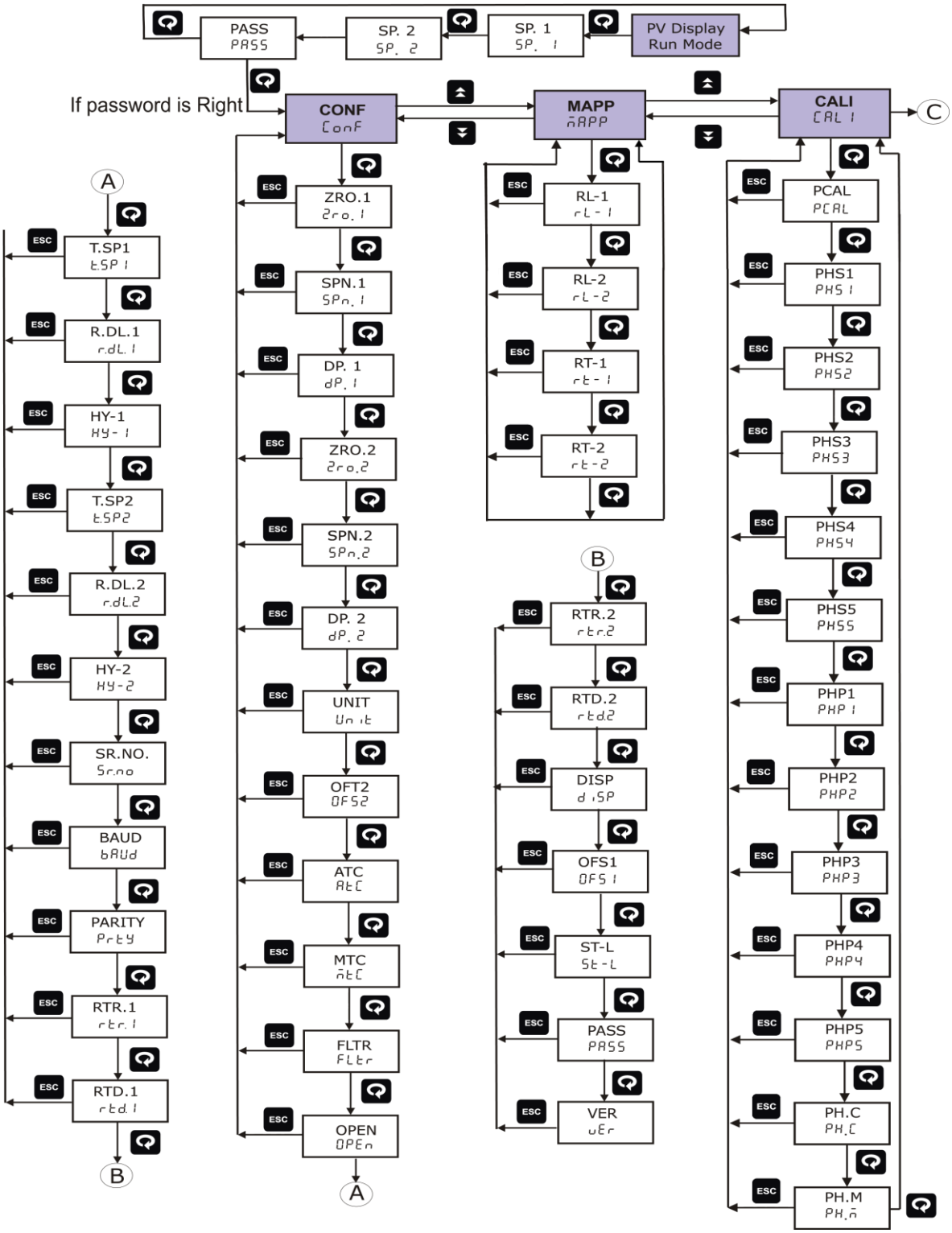
Name of Part	Symbol	Function
Increment Key		• Enter into Edit Mode. • Increment the Value of any Parameter in edit mode. • Shows mV value of attached pH sensor in RUN mode.
Decrement Key		• Enter into Edit Mode. • Decrement the Value of any Parameter in edit mode. • Indicates Performance of attached pH Sensor based on value of slope and offset in RUN mode.
SET Key (Menu / Enter Key)		• Shows Different Set Point, if this pressed in RUN mode. • It is used to enter in the sub menu (CONF,MAPP, CALI) • In Sub Menu it can be used to get to the next Parameter. • It is also used to save the parameters to nonvolatile memory, when user setting a proper data by Increment and decrement key for parameter configuration.
Escape Key		• Get to the Previous Menu level.
pH PV (Process Value) Display	pH PV	• 4 digital 0.8 inch RED Display • Display process value for pH • Display parameter name when user set parameter. • Display error message when an error occurs.

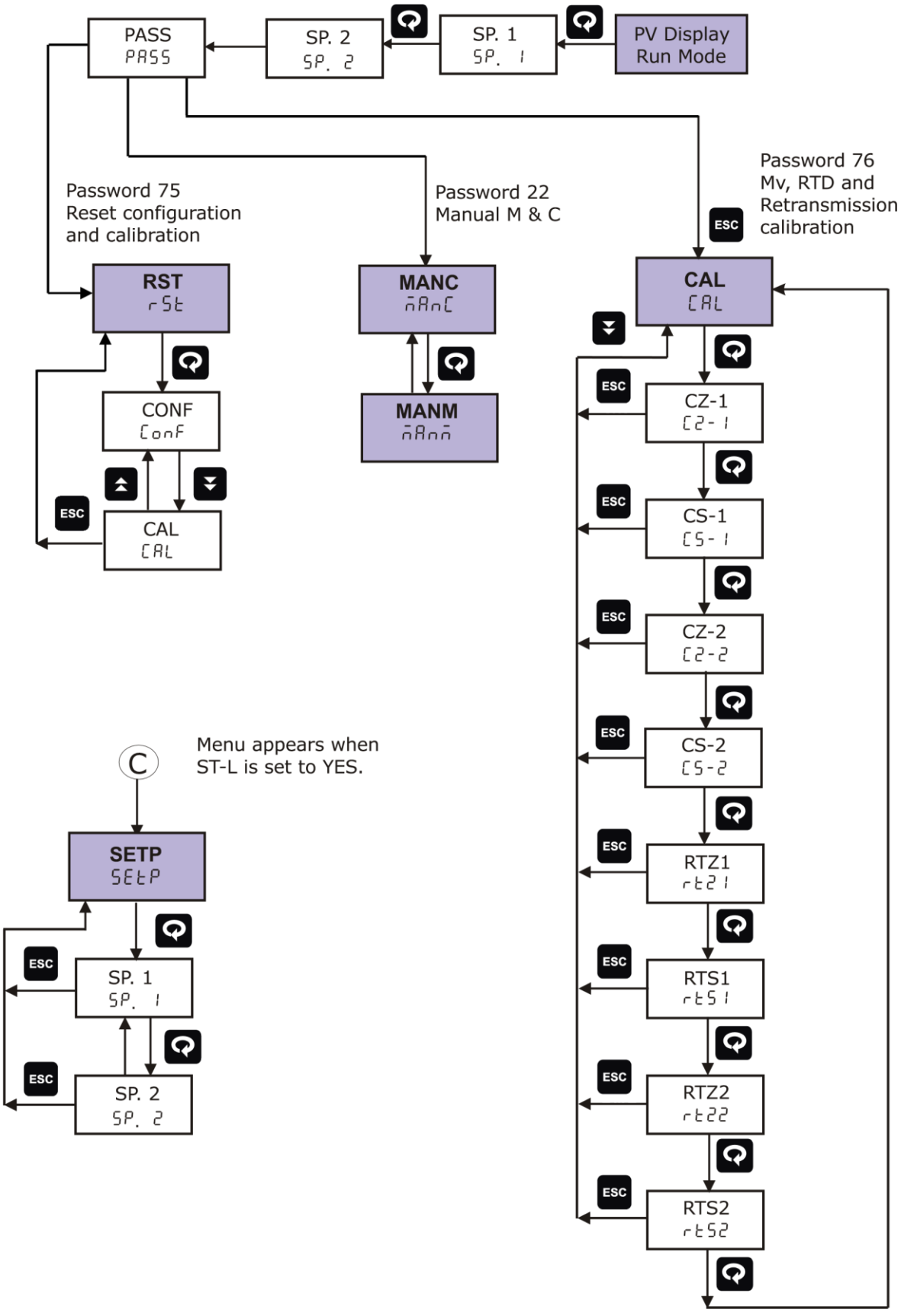
Temp PV (Process Value) Display	Temp PV	• 4 digital 0.56 inch RED Display • Display process value for Temperature. • Display parameter when user set parameter. • Display error message when an error occurs.
Relay-1 Indication	RL1	• ON when Relay-1 is energized & OFF otherwise.
Relay-2 Indication	RL2	• ON when Relay-2 is energized & OFF otherwise.
ATC Indication	Automatic Temperature compensation	• ON when user select YES in ATC menu
mV	mV	• ON when user press up key in run mode. • ON when mV is selected in DISP parameter of CONF menu. • OFF otherwise.
Fahrenheit	^{0}F	• ON when DegF unit is selected in UNIT parameter of CONF menu • OFF otherwise.
TX Indication	Tx	• ON when device is transmitting some Data (RS-485).
RX Indication	Rx	• ON when device is receiving some Data (RS-485).

6. MENU LAYOUT for PHI-XP-22

1. Press ESC at any time to exit from Menu Mode & Come to Run Mode.
2. Press INC/DEC Key to enter into Edit Mode.
3. Press INC/DEC Key to change this parameter to desired Value.
4. Press ENT key to Save the Parameter.

If password is wrong




PASS
PASS
SP. 2
SP. 2
SP. 1
SP. 1
PV Display
Run Mode
Password 75
Reset configuration
and calibration
Password 22
Manual M & C
Password 76
Mv, RTD and
Retransmission
calibration
RST
rSt
MANC
MANC
CAL
CAL
CONF
Conf
MANM
MANM
ESC
CAL
CAL
CZ-1
C2-1
CS-1
CS-1
CZ-2
C2-2
CS-2
CS-2
RTZ1
rt21
RTS1
rtS1
RTZ2
rt22
RTS2
rtS2
C
Menu appears when
ST-L is set to YES.
SETP
SEtP
SP. 1
SP. 1
SP. 2
SP. 2

6.1 RUN Time Indication/Function

Following parameters can view or change during run time.

- Press Decrement key to show pH Electrode condition.
- Press Increment key to show Millivolt.

6.2 SET POINT SETTING

Set Point Setting:				
Parameter (PV display)		Setting Name & Description	Default Value	Show if Only
Symbol	Name			
SP1 (SP 1)	Alarm Set Point 1	Range Depending on mapped PV sensor type selected	1.00	-
SP2 (SP2)	Alarm Set Point 2	Range Depending on mapped PV sensor type selected	1.00	-

NOTE: -

➢ only shows if ST-L is NO in configuration mode

6.3 CONFIGURATION MODE

CONFIGURATION PARAMETERS				
Parameter (PV display)		Setting Name & Description	Default Value	Show if Only
Symbol	Name			
ZERO1 (Zro 1)	Zero1	Automatically change to the Input Lower Range with changing of Input Type Can be set to any value within the Input Range & less the SPAN1 Value.	00.00	-
SPAN1 (SPn 1)	Span1	Automatically change to the Input Higher Range with changing of Input Type Can be set to any value within the Input Range & greater the ZERO1 Value.	14.00	-
DP1 (dP 1)	Decimal Point 1 (For pH)	Set position of Decimal Point on Display. 0 / 0.0 / 0.00 0 : 0 1 : 0.0 2 : 0.00	1	-

ZERO2 (Zro2)	Zero2	Automatically change to the Input Lower Range with changing of Input Type Can be set to any value within the Input Range & less the SPAN2 Value.	-50.0 If Unit is °C -58.0 If Unit is °F	-
SPAN2 (SPn2)	Span2	Automatically change to the Input Higher Range with changing of Input Type Can be set to any value within the Input Range & greater the ZERO2 Value.	150.0 If Unit is °C 302.0 If Unit is °F	-
DP2 (dP2)	Decimal Point 2 (For RTD)	Set position of Decimal Point on Display. 0 / 0.0 0 : 0 1 : 0.0	1	-
Unit (Unit)	Unit	Set unit for RTD 0: degC 1: degF	dEGC	-
OFS2 (oFS2)	Offset for PV2 RTD	Offset for RTD -10.0 To 10.0	0.0	-
ATC (Atc)	ATC(Automatic temperature compensation)	Automatic temperature compensation no / YES 0 : NO 1 : YES	YES	-
MTC (mtc)	MTC(Manual Temperature compensation)	Manual Temperature compensation	25.0	ATC is NO
FLTR (FLtr)	Filter	Filter for PV Input no / YES 0 : NO 1 : YES	YES	-
OPES (oPES)	OPEN Sensor Status	Set Relay O/P & Retransmission state when Input OPEN condition. doun / UP 0 : DOWN 1 : UP	UP	-
TSP1 (tSP1)	Type of Set Point	Set Type of Set Point for Relay-1 L-on / H-on 0 : L-ON (Lower ON) 1 : H-ON (Higher ON) Refer ON-OFF Logic	L-ON	-

RDL1 (r .dL .1)	Relay Delay (For Relay-1)	Relay Delay is amount of time (in sec), that Relay1 will wait before getting ON after the ON condition occurs. 1 to 99 sec.	1	-
HY-1 (HY- 1)	Hysteresis – 1 (For Relay-1)	Hysteresis Value for Relay-1 during ON-OFF Logic 00.00 To 25.50 — RLY-1 mapped IN-1 0.0 TO 255.0 — RLY-1 mapped IN-2	1	-
TSP2 (tSP2)	Type of Set Point	Set Type of Set Point for Relay-2 L-on / H-on 0 : L-ON (Lower ON) 1 : H-ON (Higher ON) Refer ON-OFF Logic	L-ON	-
RDL2 (r .dL .2)	Relay Delay (For Relay-2)	Relay Delay is amount of time (in sec), that Relay2 will wait before getting ON after the ON condition occurs. 1 to 99 sec.	1	-
HY-2 (HY- 1)	Hysteresis – 2 (For Relay-2)	Hysteresis Value for Relay-2 during ON-OFF Logic. 00.00 To 25.50 — RLY-2 mapped IN-1 0.0 TO 255.0 — RLY-2 mapped IN-2	1	-
SRNO (Srno)	Serial No.	Unit ID for Modbus-RS485 Communication 1 to 247	1	-
BAUD (bAUd)	Baud Rate	Set Modbus RS485 Communication Baud Rate 9600 / 19 .2P / 38 .4P 0 : 9600 (9600 bps) 1 : 19.2K (19200 bps) 2 : 38.4K (38400 bps)	9600	-
PARITY (PrtY)	PARITY	Set parity For Communication	PnS 1	-
RTR-1 (rtr .1)	Retransmission 1 Type	Retransmission-1 Output Type This output is according to PV input. Zero & Span acts as Min & Max value of retransmission o/p scale respectively. 0-5u / 1-5u / 0- 10u / 4-20 / 0-20 0 : 0-5V 1 : 1-5V 2 : 0-10V 3 : 4-20mA 4 : 0-20mA Voltage or Current is Jumper Selectable from the Hardware.	4-20	-

RTD-1 (rtd .1)	Retransmission -1 Direction	Set Direction for the Retransmission Output-1 rEu / d ir 0 : REV (REVERSE) 1 : DIR (DIRECT)	d ir	-
RTR-2 (rtr .2)	Retransmission -2 Type	Retransmission-2 Output Type This output is according to PV input. Zero & Span acts as Min & Max value of retransmission o/p scale respectively. 0-5u / 1-5u / 0- 10u / 4-20 / 0-20 0 : 0-5V 1 : 1-5V 2 : 0-10V 3 : 4-20mA 4 : 0-20mA Voltage or Current is Jumper Selectable from the Hardware.	4-20	-
RTD-2 (rtd .2)	Retransmission -2 Direction	Set Direction for the Retransmission Output-2 rEu / d ir 0 : REV (REVERSE) 1 : DIR (DIRECT)	d ir	-
DISP (d iSP)	SV display Selection	Set which parameter to show in SV display in RUN mode. Pu2 / SP 1 / SP2 / nu 0 : PV2 (Temperature) 1 : SP1 (Set Point 1) 2 : SP2 (Set Point 2) 3 : mV (millivolt of attached pH sensor)	Pu2	-
OFS1 (oFS 1)	Offset for PV1 pH	Offset for pH - 10.00 To 10.00 — DP=2 - 10.0 To 10.0 — DP=1 - 10 To 10 — DP=0	00.00	-
ST-L (St-L)	Set point lock	To lock the set point no / YES 0: NO 1: YES	YES	
PASS (PASS)	Password	Set Device Password 0 to 9999	1	-
VER **(uEr)**	Version	Shows the Version of the Current Firmware	1.00	-

6.4 MAPP MODE

MAPP MODE PARAMETERS				
Parameter (PV display)		**Setting Name & Description**	**Default Value**	**Show if Only**
Symbol	**Name**			
RL-1 (rL-1)	Relay – 1 mapp	Relay-1 mapp In 1 / In 2 **0: Input -1 (pH)** **1: Input -2 (RTD)**	In 1	-
RL-2 (rL-2)	Relay – 2 mapp	Relay-2 mapp In 1 / In 2 **0: Input -1 (pH)** **1: Input -2 (RTD)**	In 1	-
RT-1 (rt-1)	Retransmission -1	Retransmission -1 Mapp In 1 / In 2 **0: Input -1 (pH)** **1: Input -2 (RTD)**	In 1	-
RT-2 (rt-2)	Retransmission-2	Retransmission -2 Mapp In 1 / In 2 **0: Input -1 (pH)** **1: Input -2 (RTD)**	In 1	-

6.5 CALI MODE

CALIBRATION-1 PARAMETERS [Input calibration]				
Parameter (PV display)		**Setting Name & Description**	**Default Value**	**Show if Only**
Symbol	**Name**			
PCAL (PCAL)	Calibration points	User selectable point for pH calibration	1	
PHS1 (PHS 1)	pH set-1	pH point-1 calibration		PCAL is 1.
PHS2 (PHS2)	pH set-2	pH point-2 calibration		PCAL is 2.
PHS3 (PHS3)	pH set-3	pH point-3 calibration		PCAL is 3.
PHS4 (PHS4)	pH set-4	pH point-4 calibration		PCAL is 4.
PHS5 (PHS5)	pH set 5	pH point-5 calibration		PCAL is 5.

PHP1 (PHP 1)	pH point-1	pH buffer point-1 (enter the value of buffer solution for PHS1)	4 .01	PCAL is 1.
PHP2 (PHP2)	pH point-2	pH buffer point-2 (enter the value of buffer solution PHS2)	7 .00	PCAL is 2.
PHP3 (PHP3)	pH point-3	pH buffer point-3 (enter the value of buffer solution PHS3)	9 .16	PCAL is 3.
PHP4 (PHP4)	pH point-4	pH buffer point-4 (enter the value of buffer solution PHS4)	10 .00	PCAL is 4.
PHP5 (PHP5)	pH point-5	pH buffer point-5 (enter the value of buffer solution PHS5)	12 .00	PCAL is 5.
PH.C (PH .C)	Intercept	After calibration display Intercept.		-
PH.M (PH .m)	Slope	After calibration display slope.		-

NOTE: - ELECTRODE PERFORMANCE.

Slope and mv are used to calculate the electrode's performance.

1. If slope is between 95-105% or offset is ±0-20mv.
   - Electrode is in good condition. Unit display Good.

2. If slope is between 90-94% or offset is ±20-35mv.
   - Electrode needs cleaning. Unit display Cln .

3. If slope is between 85-89% or offset is ≥35mv or ≤ -35mv.
   - Electrode is faulty. Unit display FALt.

6.6 SET POINT MODE

Set Point Setting:				
Parameter (PV display)		**Setting Name & Description**	**Default Value**	**Show if Only**
Symbol	**Name**			
SP1 (SP 1)	Alarm Set Point 1	Range Depending on mapped PV sensor type selected	1 .00	-
SP2 (SP2)	Alarm Set Point 2	Range Depending on mapped PV sensor type selected	1 .00	-

NOTE: -

- The only shows if ST-L is yes in configuration mode.

6.7 RESET MODE (Password – 75)

RESET PARAMETERS				
Parameter (PV display)		Setting Name & Description	Default Value	Show if Only
Symbol	Name			
RST (rSt)	Configuration	Configuration reset ConF / CAL **0.CONF** **1.CAL**	ConF	-

6.8 CAL MODE (Password – 76)

CALIBRATION PARAMETERS				
Parameter (PV display)		Setting Name & Description	Default Value	Show if Only
Symbol	Name			
CZ-1 (C2-1)	ZERO-1 (mV calibration)	Zero calibration for mV input	-	-
CS-1 (C5-1)	SPAN-1 (mV calibration)	Span calibration for mV input	-	-
CZ-2 (C2-1)	ZERO-2 (RTD calibration)	Zero calibration for RTD	-	-
CS-2 (C5-2)	SPAN-2 (RTD calibration)	Span calibration for RTD	-	-
RTZ1 (rtz1)	Retransmission-ZERO-1	Calibration Zero for Retransmission Output-1 (SV Display : If voltage: 0.000 If Current: 4.000)	-	-
RTS1 (rtS1)	Retransmission-SPAN-1	Calibration Span for Retransmission Output-1 (SV Display : If voltage: 8.000 If Current: 20.00)	-	-
RTZ2 (rtz2)	Retransmission-ZERO-2	Calibration Zero for Retransmission Output 2 (SV Display : If voltage: 0.000 If Current: 4.000)	-	-

RTS2 (rt52)	Retransmission-SPAN-2	Calibration Span for Retransmission Output-2 (SV Display : If voltage: 8.000 If Current: 20.00)	-	-

NOTE:-

- The retransmission output type is jumper selectable. Thus if current type or voltage type output, will be decided by the position of the jumper.
- No need to feed input while calibrating Rx. o/p. just make the value in calibration mode equal to the displayed value.

6.9 MANUAL C & M MODE (Password – 22)

MANUAL C & M PARAMETERS				
Parameter (PV display)		**Setting Name & Description**	**Default Value**	**Show if Only**
Symbol	**Name**			
MANC (mAnC)	Manual C	Intercept adjustment	00.00	-
MANM (mAnm)	Manual M	Slope adjustment	1000	-

7. CONTROL FUNCTION

7.1 ON/OFF Control

ON/OFF Controller is the simplest form of temperature control device. The output from the device is either on or off, with no middle state. An on-off controller will switch the output only when the temperature crosses the set point. For heating control, the output is on when the temperature is below the set point, and off above set point. Since the temperature crosses the set point to change the output stage, the process temperature will be cycling continually, going from below set point to above, and back below. In cases where this cycling occurs rapidly, and to prevent contactors and valves from getting damaged, an on-off differential, or "hysteresis," is added to the controller operations. On-Off hysteresis prevents the output from "chattering" or making fast, continual switches if the cycling above and below the set point occurs very rapidly.

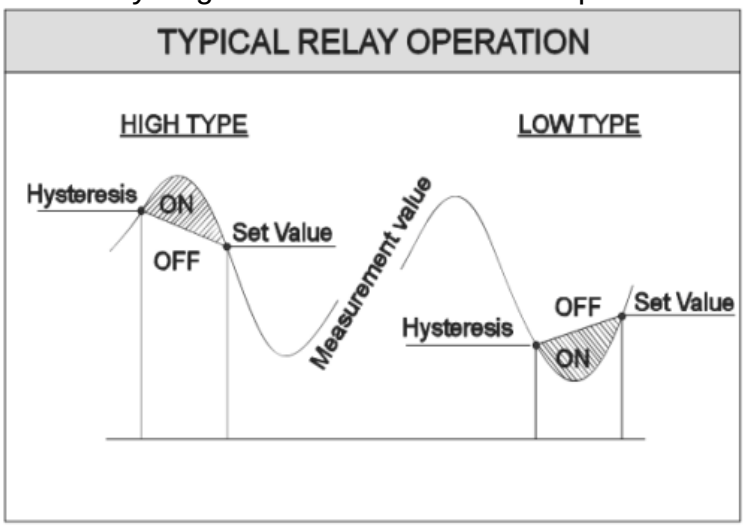


Figure 7.1: Typical Relay operation

High type (H-ON): For High type of set value, once process value reaches up to set point + Hysteresis value, relay will be ON after few seconds (as per relay delay) and it will be ON until process value goes down to Set point.

Low type (L-ON): For Low type of set value, once process value reaches down to set point – Hysteresis value relay will be ON after nearly few seconds (as per relay delay) and it will be ON until process value goes up toward Set point.

8. CALIBRATION PROCEDURE

8.1 Procedure for CAL-zero and CAL-span (password 76)

- 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 is required. This source should be at least ten times accurate compared to the range of the instrument.
- The unit can be calibrated without opening it and without trim pots. To enter in calibration mode press 'SET/ENT' key consecutively in Run mode until **PASS** message on the display. Now press 'INCREMENT KEY' to enter the correct password. After entering the correct password, **CAL** message is displayed, now press 'SET/ENTER KEY' to bring calibration mode. **CZ-1** message is displayed. Now press 'SET/ENTER KEY', this will bring the next calibration parameters on display as **CS-1, CZ-2, CS-2, RTZ 1, RTS 1, RTZ 2 and RTS 2**, in case of MV Input it will show **CZ-1** (Zero calibration) and **CS-1** (Span calibration) , in case of RTD Input it will show **CZ-2** (Zero calibration) and **CS-2** (Span calibration).
- After applying appropriate Input from the calibrator source, press 'INCREMENT' OR 'DECREMENT KEY' to bring the actual Input value on display and then press 'ENTER KEY' to save that value.

Example:-

At zero calibration reading expected on the display is 100 and it shows 107, adjust the process value to 100 by using 'DECREMENT KEY'. Now press 'ENT' to store the calibration parameter in non-volatile memory. Similarly one can calibrate SPAN and retransmission parameters.

For calibrating i/p, both zero and span are calibrated. Here **one-shot calibration** technique is used, i.e. the zero and span are calibrated once. Individual zero or span can also be calibrated; first calibrate zero and then span.

8.2 Procedure for RET-zero and RET-span

For calibrating the retransmission output, both retransmission zero and retransmission span has to be calibrated. At a time there can be either one or two retransmission output available. If only one retransmission is used, then calibrate **RTZ1** (retransmission 1 zero) and **RTS1** (retransmission 1 span) and if there are two retransmission outputs available, then calibrate **RTZ2** (retransmission 2 zero) and **RTS2** (retransmission 2 span) for second retransmission. No need to feed input while calibrating retransmission o/p. it is like calibrating using digital trim pot. Only look at the output, display value has no significance with output generated.

Example:-

At retransmission zero calibration, expected output is 0.00mA and it gives 0.153mA. Then adjust the output value to 0.153 by using 'INCREMENT KEY or

DECREMENT KEY'. Now press 'SET/ENT' to store the calibration parameter in non-volatile memory. Similarly one can calibrate retransmission span.

8.3 Procedure for pH Calibration (user's password)

PHI-22-XP pH indicator capable of 5 point custom calibration for high accuracy across the measurement range. This points are user selectable.
It is recommended at least 2 point calibration

NOTE:-
During the calibration process Rinse the probes with deionized water or rinse solution to avoid cross contamination, and then place it in the next pH buffer.

Example for 3 Point Calibration

1. Enter into CALI mode and select 3 using 'INCREMENT KEY or DECREMENT KEY' for 3 point calibration.

2. And then select pH buffer solution pH 4.01, pH 7.00 and pH 9.16 enter this values in PHP menu in CALI mode or user can change this value as required with respect to the buffer solution is available.

3. For calibration, dip pH probe in pH 4.01 buffer and in CALI mode PHS menu press UP key and then press SET/ENT key. Once calibration is done at pH 4.01.same procedure is applied for pH 7.00 and pH 9.16 or with the buffer solution available.

9. COMMUNICATION PROTOCOL–MODBUS RTU

9.1 INTRODUCTION

The unit can be connected in RS-485 communication data link either in multi drop or repeat mode. Each unit must have unique Serial Number. Entire range of addresses (1 to 247) may be used. Before starting any communication, choose a baud rate compatible to the host computer. The serial protocol used is MODBUS RTU.

Function Code for Modbus

CODE	NAME	Function
03	Read Holding registers	Use to read PV1, PV2, output, Millivolt etc.
04	Read input registers	Use to read programmable registers
06	Preset Single register	Use to write programmable register

The error checking field contains a 16-bit value implemented as two eight-bit bytes. The error check value is the result of a Cyclical Redundancy Check (CRC) calculation performed on the message contents.

9.2 Modbus Parameter Address

Sr. No.	Parameters	Absolute Address	Type	Access Type
1	PROCESS VALUE (PH)	30001	Int	Read Only
2	PROCESS VALUE (RTD)	30002	Int	Read Only
3	RELAY-1 STATUS	30003	Int	Read Only
4	RELAY-2 STATUS	30004	Int	Read Only
5.	Millivolt	30005	int	Read Only

NOTE: Process Value (PV) Error Conditions Value

OPEN : 32767
UNDER : 32765
OVER : 32766

Sr. No.	Parameters	Absolute Address	Type	Access Type
1	ALARM SET POINT 1	40001	Int	R + W
2	ALARM SET POINT 2	40002	Int	R + W
3	Reserved for future	40003	Int	R
4	ZERO 1	40004	Int	R + W
5	SPAN 1	40005	Int	R + W
6	DP 1	40006	Int	R + W
7	Reserved for future	40007	Int	R

8	Reserved for future	40008	Int	R
9	ZERO 2	40009	Int	R + W
10	SPAN 2	40010	Int	R + W
11	DP 2	40011	Int	R + W
12	UNIT	40012	Int	R + W
13	OFST	40013	Int	R + W
14	ATC	40014	Int	R + W
15	MTC	40015	Int	R + W
16	FLTER	40016	Int	R + W
17	OPEN SENSOR	40017	Int	R + W
18	HIGH LOW FLAG1	40018	Int	R + W
19	RD1	40019	Int	R + W
20	HY1	40020	Int	R + W
21	HIGH LOW FLAG2	40021	Int	R + W
22	RD2	40022	Int	R + W
23	HY2	40023	Int	R + W
24	SRNO	40024	Int	R + W
25	BAUD	40025	Int	R + W
26	PARITY	40026	Int	R
27	RTR1	40027	Int	R + W
28	RTR_DIR1	40028	Int	R + W
29	Reserved for future	40029	Int	R
30	Reserved for future	40030	Int	R
31	RTR2	40031	Int	R + W
32	RTR_DIR2	40032	Int	R + W
33	Reserved for future	40033	Int	R
34	Reserved for future	40034	Int	R
35	DISPLAY	40035	Int	R + W
36	pH Offset	40036	Int	R + W
37	Set point lock	40037	Int	R + W
36	PASSWORD	40038	Int	R + W
37	VERSION	40039	Int	R
38	CAL POINT SELECTION	40040	Int	R + W
39	CALIB POINT 1	40041	Int	R + W
40	CALIB POINT 2	40042	Int	R + W
41	CALIB POINT 3	40043	Int	R + W
42	CALIB POINT 4	40044	Int	R + W
43	CALIB POINT 5	40045	Int	R + W

44	RESET	40046	Int	R + W
45	RELAY MAP 1	40047	Int	R + W
46	RELAY MAP 2	40048	Int	R + W
47	RET MAP 1	40049	Int	R + W
48	RET MAP 2	40050	Int	R + W
49	ELECTRODE	40051	Int	R
50	MANUALC	40052	Int	R + W
51	MANUALM	40053	Int	R + W

9.3 Exceptional Response

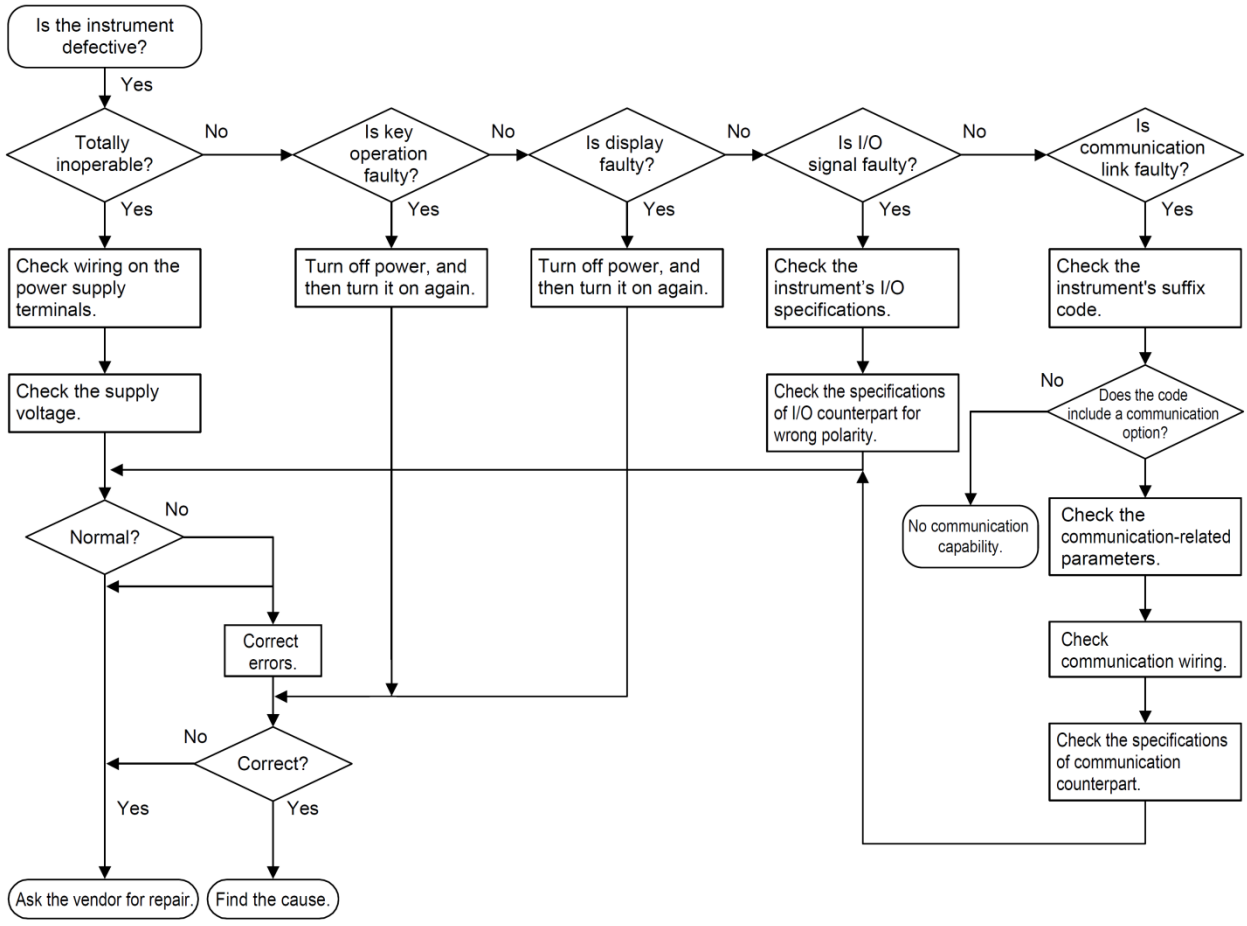
CODE	MEANING
01	Function code Invalid. It must be 01, 05, 03 or 06.The function code received in the query is not allowable action for the slave.
02	Illegal address value. The data address received in the query is not an allowable address for the salve.
03	Illegal data value. A value contained in the query data field is not an allowable value for the salve.
06	When Master device write some parameters to Slave device, If slave device busy then it will send 06 code to indicate slave device is busy.

10. Appendix

10.1 Troubleshooting

If the operating display does not appear after turning on the controller's power, follow the measures in the procedure below.

If a problem appears complicated, contact our sales representative.



IMPORTANT

Take note of the parameter settings when asking the vendor for repair.

10.2 ON-OFF LOGIC

Relay type	PV	Relay	LED
Hi-On	PV > SP	On	On
	PV < SP	Off	Off
Open sensor	Up scale	On	On
	Down scale	Off	Off
Low-On	PV > SP	Off	Off
	PV < SP	On	On
Open sensor	Up scale	Off	Off
	Down scale	On	On

10.3 Retransmission Output Table for OPEN /OVER /UNDER Condition

RETRASMISSION	VARIABLE	SCALE	ACTION	OPEN	OVER	UNDER
4-20mA						
	PV	UP	DIR	20.8	20.8	3.2
	PV	DOWN	REV	3.2	3.2	20.8
	PV	UP	REV	20.8	3.2	20.8
	PV	DOWN	DIR	3.2	20.8	3.2
1-5V	PV	UP	DIR	5.2V	5.2V	0.8V
	PV	DOWN	REV	0.8V	0.8V	5.2V
	PV	UP	REV	5.2V	0.8V	5.2V
	PV	DOWN	DIR	0.8V	5.2V	0.8V

NOTE: -

1. OPEN/UNDER/OVER condition is applicable to all input types except 0-5v / 0-20mA.

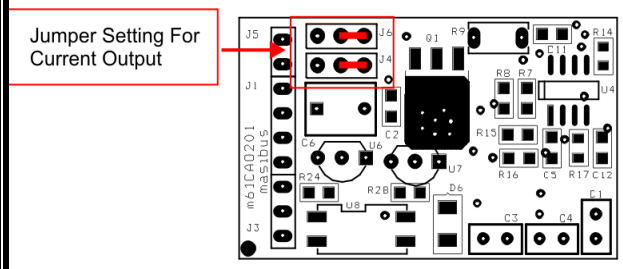
10.4 Jumper Settings for Add-on Card Selection &Retransmission Output Type

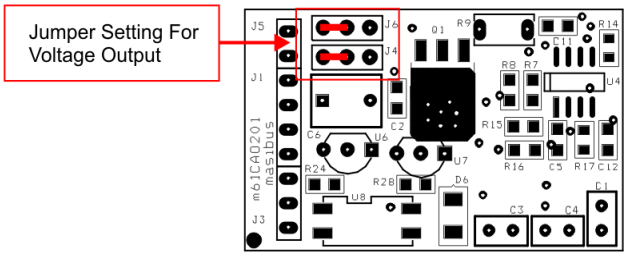
- These devices come with different Variants differing by various Output option available.
- There are Two Add-on Card Slots available on PCB of Signal Card. The Right Most Slot is fixed for Retransmission (Analog) Output. And the other Left Slot can be used for either Retransmission or RS-485 Communication Card by appropriate Jumper setting shown in below figure.
- 0E (SMD 0805) Resistor is used for shorting the Jumper.

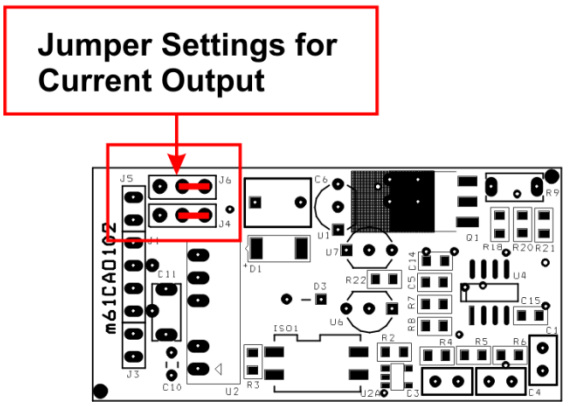
- There are mainly Two types of Retransmission Output is available:
  - Voltage (0-10VDC, 0-5VDC, 1-5VDC)
  - Current (4-20mADC, 0-20mADC)
- This can be Settable by changing the Position of Shorting Link Jumpers on Retransmission Add-on Card shown in below figure.

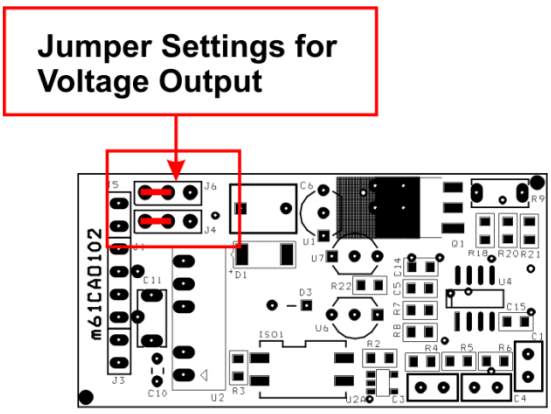
- **Jumper Setting for Retransmission card: m61Cao201**

- **Jumper Setting for Retransmission card: m61Cao102**

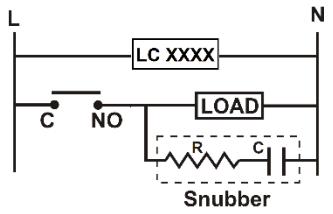
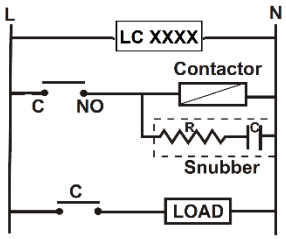








10.5 Load connection

For load current less than 0.5A	For bigger loads, use interposing relay / contactor
	

Electrical precautions during use

Electrical noise generated by switching of inductive loads can create momentary disruption, erratic display, and latch up, data loss or permanent damage to the instrument. Use of snubber circuits across loads as shown above, is recommended.