![masibus logo]

User's Manual

FLAMEPROOF CONTROLLER

LC5296-XP-DC

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Contents

1. INTRODUCTION

Foreword

Thank you for purchasing FLP (Flameproof) series

LC5296-XP-DC (ON-OFF Controller)

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.*

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2. SPECIFICATIONS

2.1 Inputs

Analog Input	
Input 1 Type	RTD (Pt100), Current, Voltage, Serial
Input 2 Type	RTD (Pt100), Current, Voltage,Serial
Display Range	Refer Table-2.1
Accuracy	$\pm$ (0.25% of FS+ 1 degree) for RTD input. $\pm$ (0.1% of FS+ 1 count) for Linear input.
ADC Resolution	16 bits
Display Resolution	0.1°C / 1 Count
Sampling Rate	2 Samples/Sec
Sensor Burnout current	0.25uA
RTD excitation current	0.166mA (Approx)
Allowable wiring resistance for RTD	Maximum 15 ohms/wire (Conductor resistance between three wires should be equal)
NMRR	> 40 dB
CMRR	> 120 dB
Temp-co	< 150ppm/°C
Input Impedance	> 1MΩ (Voltage Input) 250Ω (Current Input)
Max Voltage	20VDC

Table-2.1 Input Display Range		
Input-1 type	**Input- 2 Type**	**Range**
PT100 (0.1°C)	**PT100 (0.1°C)**	-199.9 to 850.0°C
PT100 (1°C)	**PT100 (1°C)**	-200 to850°C
*4-20mA /1-5VDC, *0-20mA /0-5VDC 0-10VDC Serial	***4-20mA /1-5VDC, *0-20mA /0-5VDC Serial**	-1999 to 9999 (Field Scalable)

*Use external 250ohms, 0.1% for current Input

2.2 Display & Keys

Model	Display	Specification
LC-5296-XP-DC	PV -1 Display	4-Digit, 7-Segment, Red, Character height of 0.56".
	PV -2 Display / Parameter Display	4-Digit, 7-Segment, Red, Character height of 0.56"
	Status Indication	Individual RED Led for Relay Status& communication(Rx &Tx) Status

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2.3 Output Types

Output types are software selectable from the Key board or Modbus.

Output Type	Description
Relay Output	2 Relays for ON-OFF Controlling

- Also, Output Direction [Direct (Cooling) /Reverse (Heating)] is selectable from software.
- At a time unit can support Relay or SSR Output. (Factory settable)(Specify in Order Code)

Relay Output	
Relays	2 (For LC5296-XP-DC)
Type	Single Change over Three Terminals (C, NO, NC)
Rating	2A @ 230VAC / 30VDC

Retransmission Output	
Number of output	2
Retransmission mapping	With respect to Input no.
Output Signal	4-20mA / 0-20mA /1-5VDC / 0-5VDC / 0-10V DC
Load resistance • For Current o/p • For Voltage o/p	< 500Ω > 3KΩ
Output accuracy	±0.25% of span

Loop Power Supply	
Supply Voltage	24VDC (±10%) @60mA

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	<10 VA
Data backup	Non-volatile memory (can be written up to 100000 times)

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> ➢ **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:** 20MΩ or more at 500 V DC between power terminals and grounding terminal.

2.6 Environmental Conditions

TEMPCO	For Input to PV Display < 100ppm.
	For Display to Retransmission < 100ppm
Humidity	30% to 95% RH (Non-Condensing)
Instrument Warm-up Time	Approx. 15 minutes
Ambient temperature	0 to 55°C
Storage Temperature	0 to 80°C

2.7 Special Feature:

1 Relay mapping with respect to input no.
2 Retransmission output mapping with respect to input no.

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3. PHYSICAL SPECIFICATIONS & MOUNTING DETAILS

3.1 External Dimensions

Unit: mm

Mounting method: Wall Mounting

Unit: mm
Weight: Approx. 3 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: ¾" ET – 5 NOS
Plug Details: 3 Blind Plug & 2 Cable gland ¾"ET

TOP VIEW
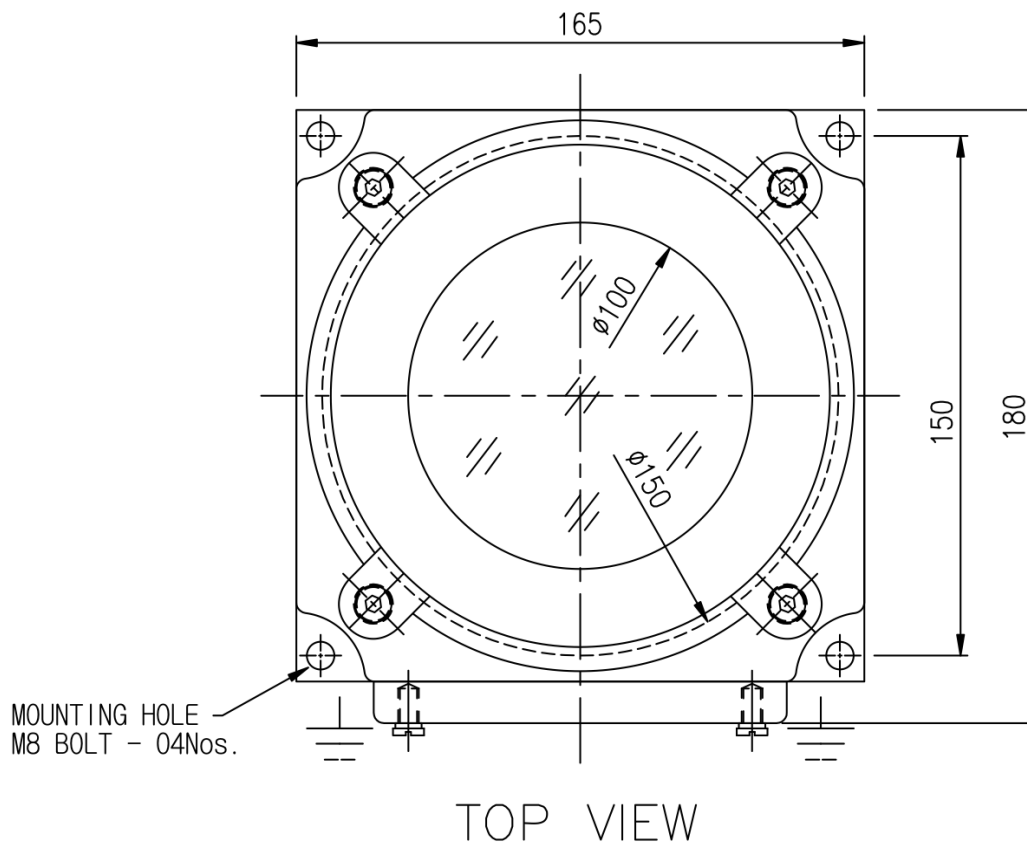
FRONT VIEW OF LC5296-XP-DC

TOP VIEW

INTERNAL VIEW WITH TERMINAL CONNECTION DETAILS
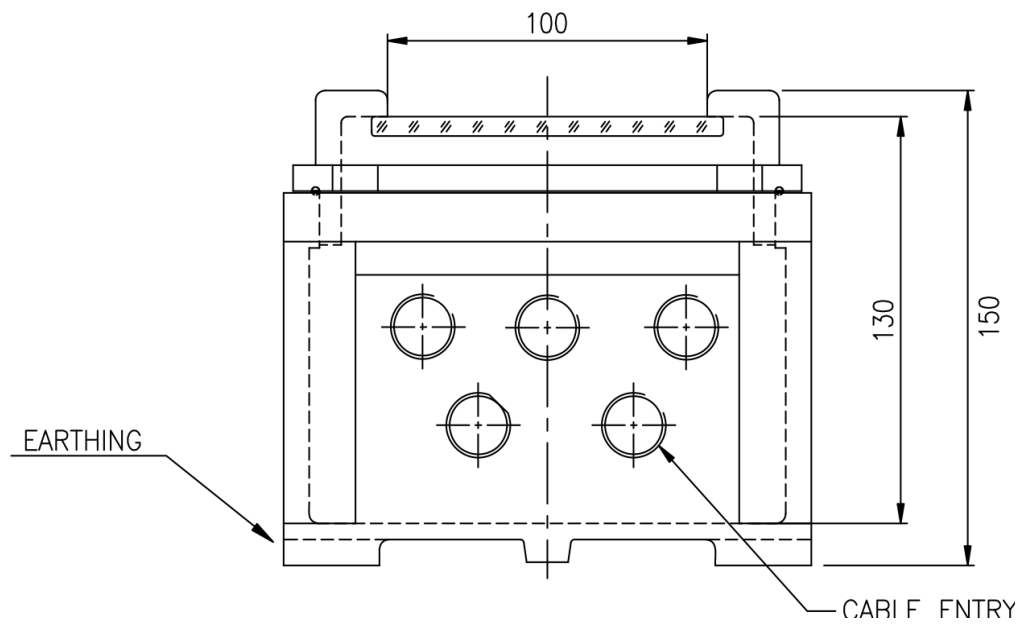
SIDE VIEW FOR CABLE ENTRY

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3.2 External Dimensions & for dual compartment enclosure
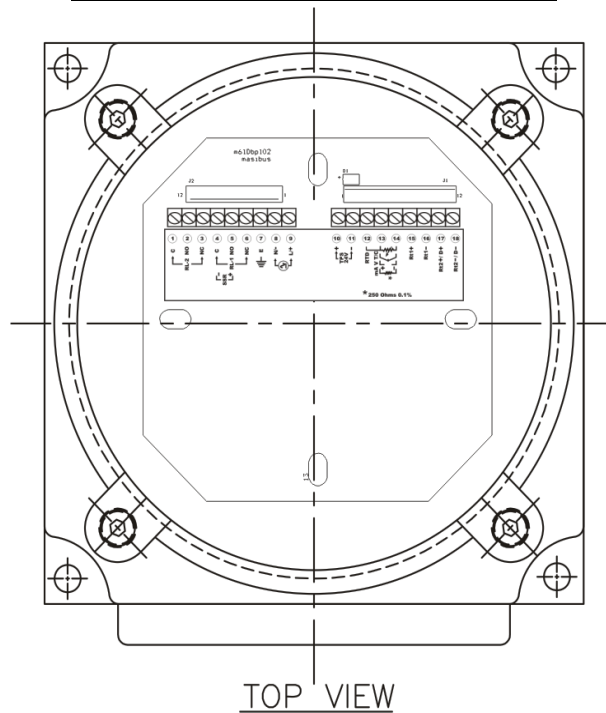
Unit: mm

Mounting method: Wall Mounting
Weight: Approx. 6Kg.
Type of Protections: Flameproof (Explosion Proof) EX-d
Area Classification: Hazardous Location of Zone 1 & 2
Gas Groups: IIA, IIB
IP Protection: IP 65 As per IS / IEC 60529-2001
Apparatus Standard: IS/IEC 60079-1:2007
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: ¾" ET – 5 NOS
Plug Details: 3 Blind Plug & 2 Cable gland ¾"ET
Components: Glass window dia. 100 mm. 6mm Thickness -1 no.
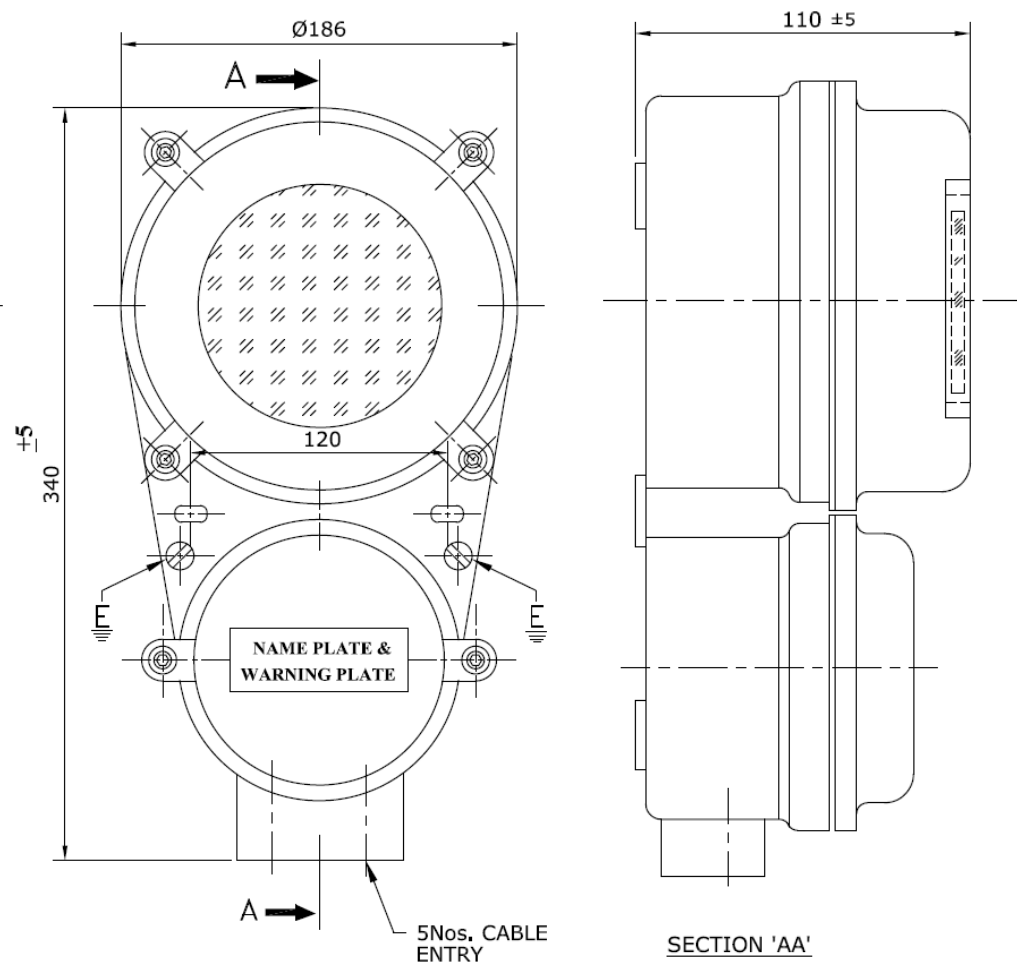
FLP Dual compartment Enclosure Front View and Section view

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4. TERMINAL CONNECTIONS

4.1 Single compartment enclosure
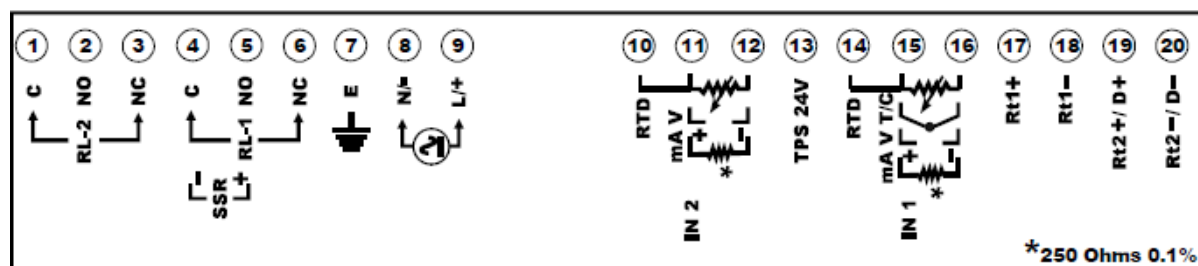
4.2 Dual compartment enclosure
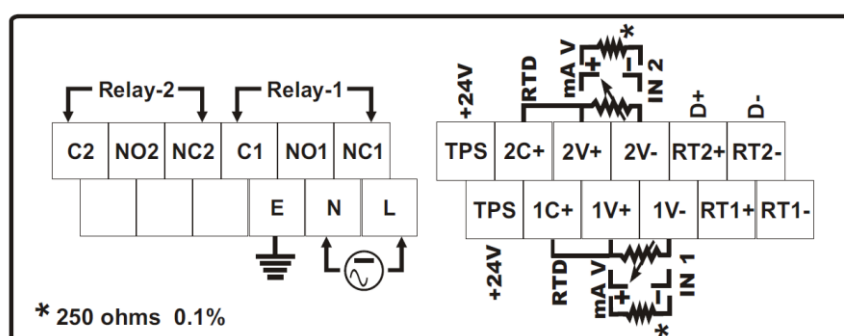
Terminal No.	Description	
1 (C2)	• For Relay-2 potential free Contacts (Use 230V -2A load)	
2 (NO2) **3 (NC2)**	• ON-OFF control	LC5296-XP-DC
4 (C1)	• For Relay-1 potential free Contacts (Use 230V -2A load)	
5 (NO1) **6 (NC1)**	• ON-OFF control	LC5296-XP-DC
7 (Earth)	Earth Connection	
8 (N/-) **9 (L/+)**	Power Supply Input	
10	For RTD Input Only (INPUT-2) (Three wire Compensation).	
11 (TC+/ V+) **12 (TC- / V-)**	For Thermocouple, RTD & Linear Input (INPUT-2)	
13 (TPS+)	24VDC Loop power supply	
14	For RTD Input Only (INPUT-1) (Three wire Compensation).	
15 (TC+/ V+) **16 (TC- / V-)**	For Thermocouple, RTD & Linear Input (INPUT-1)	
17 (Linear Output+/RTR1+) **18 (Linear Output-/RTR1-)**	• For Retransmission-1 output • Linear type Control Output	
19 (D+/ RTR2+) **20 (D- / RTR2-)**	• For Retransmission-2 output • Modbus-RTU Communication Output	

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4.1 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.
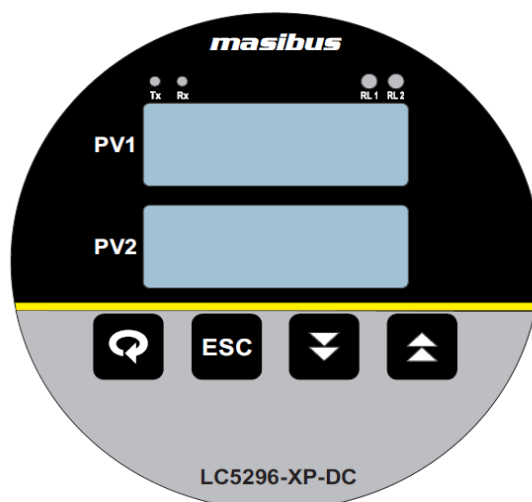- ✓ Terminal Details: <= 2.5mm^2 conductor
- ✓ Provide power from a single-phase instrument power supply. If there is a lot of noise in the power line, insert an insulating transformer into the primary side of the line and use a line filter on the secondary side. Do not place the primary and secondary power cables close to each other.
- ✓ For thermocouple input, use shielded compensating lead wires for wiring. For RTD input, use shielded wires that have low conductor resistance and cause no significant differences in resistance between the three wires. Do not connect Terminal – 12 when thermocouple or Linear input is selected.
- ✓ 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.
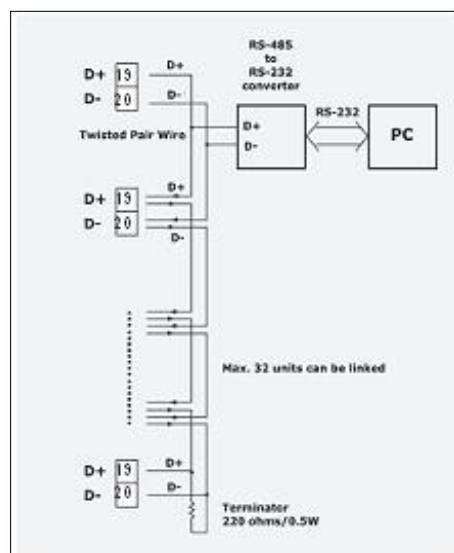
**Fig 4.2: RS485 Connection Details**

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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.
Decrement Key	⏬	• Enter into Edit Mode. • Decrement the Value of any Parameter in edit 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 (TUNE, CONF, CAL) • 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	ESC	• Get to the Previous Menu level.
PV 1 (Process Value) Display	PV1	• 4 digital 0.56 inch RED Display • Display process value for Input 1 • Display parameter name when user set parameter. • Display error message when an error occurs.
PV 2 (Process Value) Display	PV2	• 4 digital 0.56 inch RED Display • Display process value for Input 2 • Display parameter value of parameter in process value field when user set parameter.
Relay-1 Indication	RL1	• ON when Relay-1 is energized & OFF otherwise.
Relay-2 Indication	RL2	• ON when Relay-2 is energized & 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 LC5296-XP-DC

MENU LAYOUT for LC5296-XP-DC

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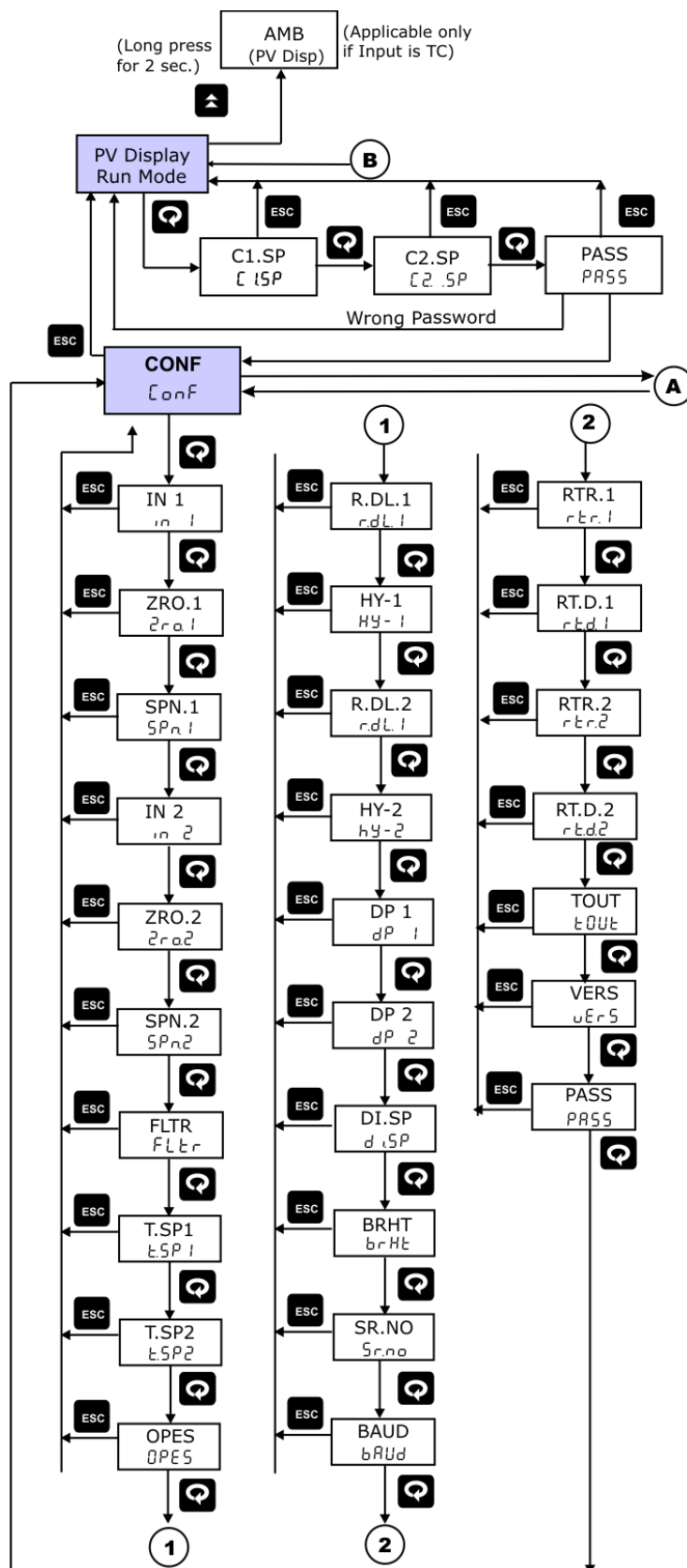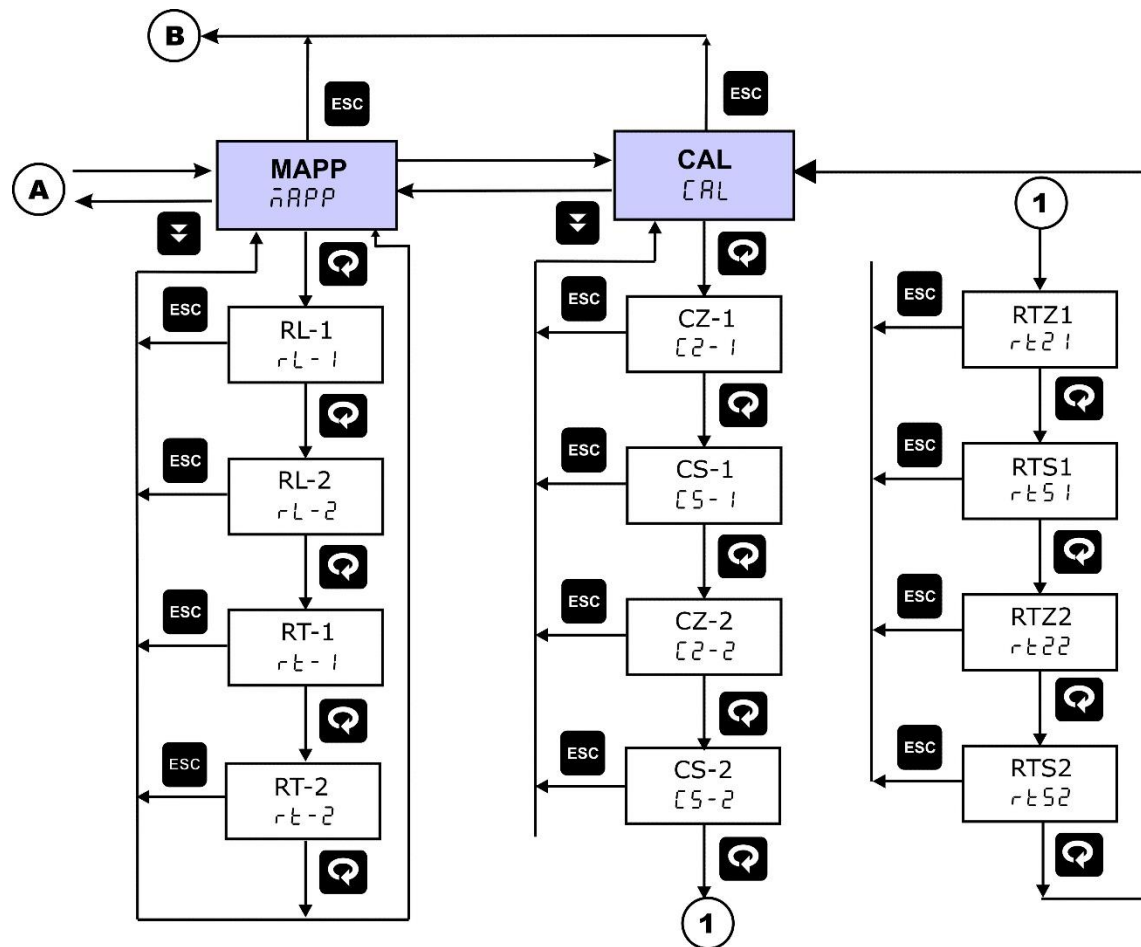
6.1 RUN Time Indication/Function

Following parameters can view or change during run time.
- In upper display, it shows Process value for input-1.
- In lower display, it shows Process value for input-2.

6.2 Set Point Setting

Pressing SET key PV Display shows $C1.SP$ (C1.SP) message. SV display shows **Control Set Point-1 Value**. Use Inc and Dec key to modify value. OR press MENU

Set Point Setting:				
Parameter (PV display)		**Setting name and description**	**Default value**	**Shows only if**
Symbol	Name			
C1.SP ($C1.SP$)	Control Set Point 1	Range Depending on PV sensor type selected	100	-
C2.SP ($C2.SP$)	Control Set Point 2	Range Depending on PV sensor type selected	100	-

key again to set value for **Control Set Point-2 Value.**

6.3 CONFIGURATION MODE

CONFIGURATION PARAMETERS				
Parameter (PV display)		**Setting Name & Description**	**Default Value**	**Show if Only**
Symbol	**Name**			
IN 1 ($In\ 1$)	Input-1 Type	Set PV Input -1 Type $rtd.1 / rtd / 0-5u / 1-5u / 0-10u / SErL$ Value / Input Type / Range: 7 / RTD.1 / -199.9 to 850.0 °C 8 / RTD / -200 to 850 °C 9 / 0-5 V / 0-20 mA* 10 / 1-5 V / 4-20 mA* 11 / 0-10 V 12 / Serial (9-12 range -1999 to 1999) *Use external 250ohms,0.1% for current input	$rtd.1$	
Zro.1 ($Zro.1$)	Zero-1	Automatically change to the Input Lower Range with changing of Input Type (Refer Above Table) Can be set to any value within the Input Range & less the SPAN Value.	-199.9 (If RTD.1)	

SPN.1 (5Pn .1)	Span-1	Automatically change to the Input Higher Range with changing of Input Type (Refer Above Table) Can be set to any value within the Input Range & greater the ZERO Value.	850 .0 (If RTD.1)	
IN 2 (In 2)	Input-2 Type	Set PV Input -2 Type rtd .1 / rtd / 0-5u / 1-5u / 5ErL <table><tr><td>Value</td><td>Input Type</td><td>Range</td></tr><tr><td>7</td><td>RTD.1</td><td>-199.9 to 850.0 °C</td></tr><tr><td>8</td><td>RTD</td><td>-200 to 850 °C</td></tr><tr><td>9</td><td>0-5 V / 0-20 mA*</td><td rowspan="2">-1999 to 1999</td></tr><tr><td>10</td><td>1-5 V / 4-20 mA*</td></tr><tr><td>11</td><td>Serial</td><td></td></tr></table> ***Use external 250ohms,0.1% for current input**	rtd .1	
Zro.2 (2ro .2)	Zero-2	Automatically change to the Input Lower Range with changing of Input Type (Refer Above Table) Can be set to any value within the Input Range & less the SPAN Value.	- 199 .9 (If RTD.1)	
SPN.2 (5Pn .2)	Span-2	Automatically change to the Input Higher Range with changing of Input Type (Refer Above Table) Can be set to any value within the Input Range & greater the ZERO Value.	850 .0 (If RTD.1)	
FLTR (FLtr)	Filter	Filter for PV Input no / YES 0 : NO 1 : YES	YES	
T.SP1 (t .5P 1)	Type of Set Point (Control Set Point-1) (Relay-1)	Set Type of Set Point 1 L-on / H-on 0 : L-ON (Lower ON) 1 : H-ON (Higher ON) Refer ON-OFF Control on Page:22	L - On	
T.SP2 (t .5P2)	Type of Set Point (Control Set Point-2) (Relay-2)	Set Type of Set Point 2 L-on / H-on 0 : L-ON (Lower ON) 1 : H-ON (Higher ON) Refer ON-OFF Control on Page:22	L - On	

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OPES (*oPES*)	OPEN Sensor Status	Set Control O/P & Retransmission state when Input OPEN condition. *doun* / *UP* 0 : DOWN 1 : UP	*UP*	
R.DL.1 (*r .dL .1*)	Relay Delay (For Relay-1)	Relay Delay is amount of time (in sec), that Relay 1 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 (in °C) for Relay-1 {table} 	1 to 100	RTD Input
0.1 to 100.0	RTD.1 Input
1 to 100	Linear Input with DP=0
0.1 to 100.0	Linear Input with DP=1
0.01 to 10.00	Linear Input with DP=2
0.001 to 1.000	Linear Input with DP=3		*0 .1*	
R.DL.2 (*r .dL .2*)	Relay Delay (For Relay-2)	Relay Delay is amount of time (in sec), that Relay 2 will wait before getting ON after the ON condition occurs. 1 to 99 sec	*1*	
HY-2 (*HY-2*)	Hysteresis – 2 (For Relay-2)	Hysteresis Value (in °C) for Relay-2 {table} 	1 to 100	RTD Input
0.1 to 100.0	RTD.1 Input
1 to 100	Linear Input with DP=0
0.1 to 100.0	Linear Input with DP=1
0.01 to 10.00	Linear Input with DP=2
0.001 to 1.000	Linear Input with DP=3		*0 .1*	
DP 1 (*dP 1*)	Decimal Point-Input- 1	Set position of Decimal Point on Display for PV1. *0* / *0 .0* / *0 .00* / *0 .000* 0 : 0 1 : 0.0 2 : 0.00 3 : 0.000	*0*	Input Type is Linear and Serial
DP 2 (*dP 2*)	Decimal Point-Input- 2	Set position of Decimal Point on Display for PV2. *0* / *0 .0* / *0 .00* / *0 .000* 0 : 0 1 : 0.0 2 : 0.00 3 : 0.000	*0*	Input Type is Linear and Serial
DI.SP (*d i .SP*)	Display Set Point	Set which Set Point to shown in SV display in RUN mode while device is in Auto Mode	*0*	

		$C1.SP / C2.SP$ 0 : C1.SP (Control Set Point 1) 1 : C2.SP (Control Set Point 2)		
BRHT (brHt)	Brightness	Adjust Brightness of the 7-segment Display. 10 to 100	100	
SR.NO (Sr.no)	Serial No.	Unit ID for Modbus-RS485 Communication 1 to 247	1	Device supports RS485 Communication.
BAUD (bAUd)	Baud Rate	Set Modbus RS485 Communication Baud Rate $9600 / 19.2K / 38.4K$ 0 : 9600 (9600 bps) 1 : 19.2K (19200 bps) 2 : 38.4K (38400 bps)	9600	Device supports RS485 Communication.
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	Device Supports Retransmission Output.

RT.D.1
(rt.d.1)
	Retransmission-1 Direction	Set Direction for the Retransmission Output-1
		
		rEu / dir
		
		0 : REV (REVERSE)
		1 : DIR (DIRECT)
		
		EX. If i/p is RTD.1, ZERO=0, SPAN=600, RTR.1=4-20mA &
		
		  RT.D.1=DIR
		  when PV = 0, RTR o/p = 4mA
		      PV = 300, RTR o/p = 12mA
		      PV = 600, RTR o/p = 20mA
		
		  RT.D.1=REV
		  when PV = 0, RTR o/p = 20mA
		PV = 300, RTR o/p = 12mA
		 PV = 600, RTR o/p = 4mA
			dir	Device Supports Retransmission Output.

		Refer Retransmission o/p table on Page 29 for more info.		
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	Device Supports Dual Retransmission Output.
RT.D.2 (rt .d .2)	Retransmission-2 Direction	Set Direction for the Retransmission Output-2 rEu / d ir 0 : REV (REVERSE) 1 : DIR (DIRECT)	d ir	Device Supports Dual Retransmission Output.
*TOUT (tOUt)	Time Out	Time Out is time (in sec), For Display PV 1-32 sec	ı	Only if SERL input
VERS (uErS)	Version	Shows the Version of the Current Firmware	-	
PASS (PASS)	Password	Set Device Password 0 to 9999	ı	

*After Time out period,
PV Display: "----" message
Modbus Holding register 40046, 40047: Last value of Serial input

6.4 MAP MODE

MAP PARAMETERS				
Parameter (PV display)		**Setting Name & Description**	**Default Value**	**Show if Only**
Symbol	**Name**			
RL-1 (rL - 1)	Map Relay-1	For mapping relay-1 0 : IN 1 1: IN 2	iN 1	
RL-2 (rL -2)	Map Relay-2	For mapping relay-2 0 : IN 1 1: IN 2	iN 1	

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RT-1 (rt-1)	Map retransmission-1	For mapping retransmission-1 0:IN 1 1: IN 2	IN 1	Device Supports Retransmission Output.
RT-2 (rt-2)	Map retransmission-2	For mapping retransmission-2 0:IN 1 1: IN 2	IN 1	Device Supports Dual Retransmission Output.

NOTE:-

➤ Please refer Table no.10.5 mapping options for Relay and Retransmission.

6.5 CALIBRATION MODE

CALIBRATION PARAMETERS				
Parameter (PV display)		**Setting Name & Description**	**Default Value**	**Show if Only**
Symbol	**Name**			
CZ-1 (C2-1)	Calibration Zero-1	Calibration Zero for PV Input-1 (PV Display : Current PV)	-	
CS-1 (C5-1)	Calibration Span-1	Calibration Span for PV Input-1 (PV Display : Current PV)	-	
CZ-2 (C2-1)	Calibration Zero-2	Calibration Zero for PV Input-2 (PV Display : Current PV)	-	
CS-2 (C5-2)	Calibration Span-2	Calibration Span for PV Input-2 (PV Display : Current PV)	-	
RTZ1 (rt21)	Retransmission Zero-1	Calibration Zero for Retransmission Output-1 (SV Display : If voltage: 0.000 If Current: 4.000)	-	Device Supports Retransmission Output
RTS1 (rt51)	Retransmission Span-1	Calibration Span for Retransmission Output-1 (SV Display : If voltage: 8.000 If Current: 20.00)	-	Device Supports Retransmission Output
RTZ2 (rt22)	Retransmission Zero-2	Calibration Zero for Retransmission Output 2 (SV Display : If voltage: 0.000 If Current: 4.000)	-	Device Supports Dual Retransmission Output
RTS2 (rt52)	Retransmission Span-2	Calibration Span for Retransmission Output-2 (SV Display : If voltage: 8.000 If Current: 20.00)	-	Device supports Dual Retransmission Output

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.

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➤ No need to feed input while calibrating Rx. o/p. just make the value in calibration mode equal to the displayed value.

Example: How to change Input Type?
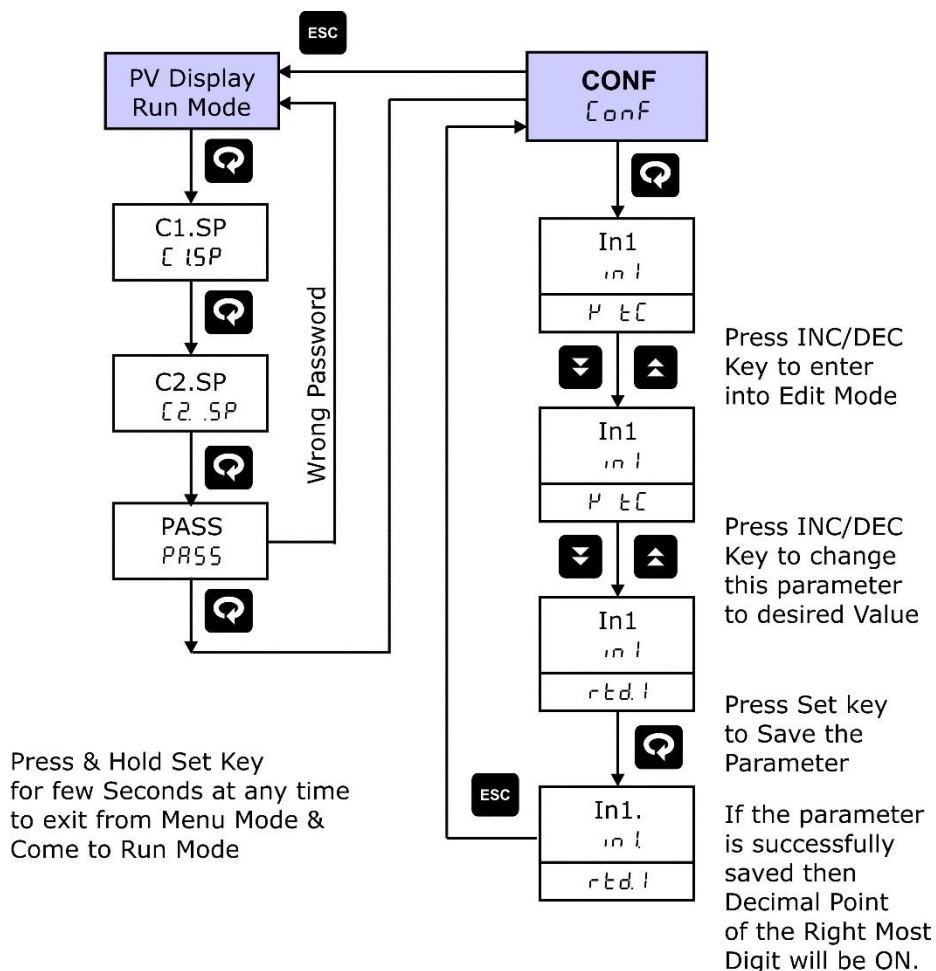
7. CONTROL FUNCTION

- Model LC5296-XP-DC is microcontroller based ON-OFF Controller

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

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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.
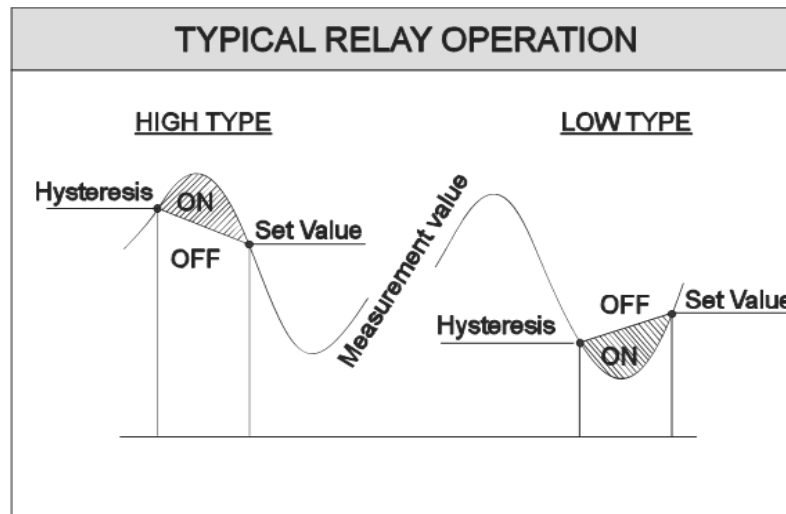
Figure 8.1: Typical Relay operation

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.

NOTE:-
➤ **LC5296-XP-DC is having only ON-OFF controlling so no need to do any additional setting.**

8. CALIBRATION PROCEDURE

8.1 Procedure for CAL-zero and CAL-span

- 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 trimpots. To enter in calibration mode press 'ENT' key consecutively in Run mode until **PASS** message on the display. Now press 'INCREMENT KEY' to enter the correct password (Enter user's password if selected or enter factory default password: 1), after entering the correct password, **TUNE/CONF** message is displayed, now press 'INCREMENT KEY' to bring calibration mode. Invoking of Increment key will show **CAL** message. Now press 'ENT', this will bring the first calibration parameter on display as **AMB.** (Ambient in case of T/C), in case of RTD or Linear Input it will show **CALZ.** (Zero calibration).

- After applying appropriate Input from the calibrator source, press 'INCREMENT' OR 'DECREMENT KEY' to bring the actual process value on display.

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 Ambient, 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. While calibrating thermocouple type input, first calibrate the ambient (if required) and then continue with the span calibration of the same.

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 'ENT' to store the calibration parameter in non-volatile memory. Similarly one can calibrate retransmission span.

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
01	Read coil status	Use to read Relay and Digital output status
03	Read Holding registers	Use to read PV, Control, RSP output etc
04	Read input registers	Use to read programmable registers
06	Preset Single register	Use to write programmable register

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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 VALUE1	30001	Int	Read Only
2	PROCESS VALUE2	30002	Int	Read Only
3	RELAY-1 STATUS	30006	Int	Read Only
4	RELAY-2 STATUS	30007	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	Input Type -1	40001	Int	R + W
2	Zero-1	40002	Int	R + W
3	Span-1	40003	Int	R + W
4	Filter	40004	Int	R + W
5	SET Type-1	40005	Int	R + W
6	SET Type-2	40006	Int	R + W
7	Open Sensor Status	40007	Int	R + W
8	Relay Delay -1	40008	Int	R + W
9	Hysteresis 1	40009	Int	R + W
10	Relay Delay -2	40010	Int	R + W
11	Hysteresis 2	40011	Int	R + W
12	Decimal Point-1	40012	Int	R + W
13	Display set point	40013	Int	R + W
14	Brightness	40014	Int	R + W
15	Serial Number	40015	Int	R + W
16	Baud Rate	40016	Int	R + W
17	Retransmission o/p Type -1	40017	Int	R + W
18	Retransmission o/p direction - 1	40018	Int	R + W
19	Retransmission o/p Type -2	40019	Int	R + W
20	Retransmission o/p direction - 2	40020	Int	R + W
21	Version	40033	Int	R

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22	Password	40034	Int	R + W
23	Control Set point-1	40035	Int	R + W
24	Control Set Point-2	40036	Int	R + W
25	Set Value 2	40037	Int	R + W
26	Input Type-2	40038	Int	R + W
27	Zero-2	40039	Int	R + W
29	Span-2	40040	Int	R + W
30	Decimal Point-2	40041	Int	R + W
31	Relay-1 Map	40042	Int	R + W
32	Relay-2 Map	40043	Int	R + W
33	Retransmission-1 Map	40044	Int	R + W
34	Retransmission-2 Map	40045	Int	R + W
35	Serial Input PV 1	40046	Int	R + W
36	Serial Input PV 2	40047	int	R + W
37	Time out	40048	Unsigned char	R + W
38	PV after Time out 0: holds Last PV, 1: PV shows "----"	40049	Unsigned char	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.

<u>**Note:**</u>

1. **Any Parameter which is not available for the Model, the value at its address will be "0". And it is Not Writable.**

2. **If some parameters are blocked in the Menu due to particular Configuration Settings, value at their respective address will be "0". And these are Not Writable.**

   (EX: If device's Input type is currently RTD.1, so DP (Decimal Point) parameter will not available in the Menu. So at its Address (40011) value will be "0" & it can't changeable.)

3. **Refer Menu Mode Description Table the value & Range of each Parameter.**

   **EX: Input Type (Applicable Range: 7 to 12):**

Input Type - 1	Input Type - 2	Value
RTD 0.1 degree	RTD 0.1 degree	7
RTD 1 degree	RTD 1 degree	8
0 – 5V	0 – 5V	9
1 – 5V	1 – 5V	10
0-10V	NA	11
Serial	Serial	12

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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.
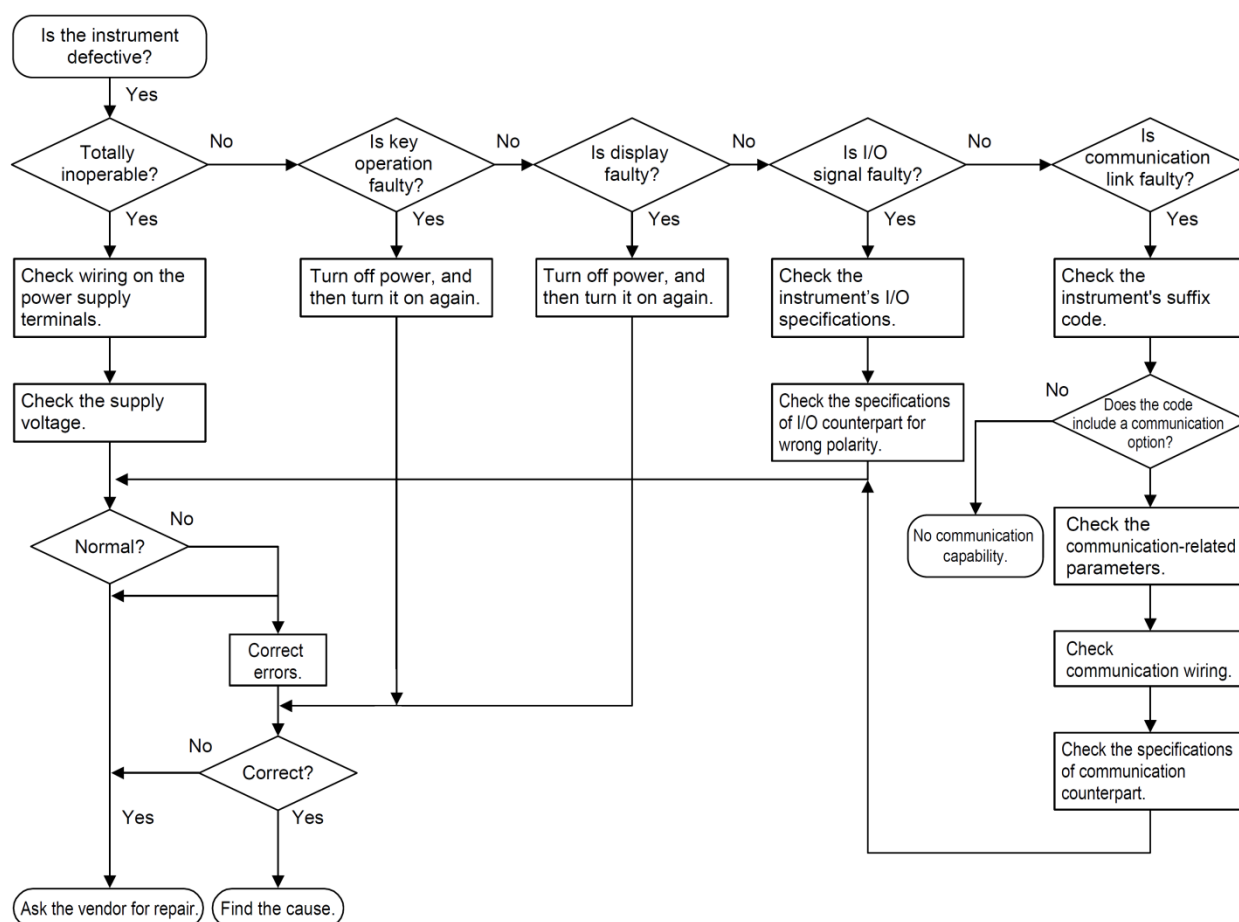
⚠ **IMPORTANT**

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

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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
	PV	UP	DIR	20.8	20.8	3.2
	PV	DOWN	REV	3.2	3.2	20.8
4-20mA						
	PV	UP	REV	20.8	3.2	20.8
	PV	DOWN	DIR	3.2	20.8	3.2
	PV	UP	DIR	5.2V	5.2V	0.8V
	PV	DOWN	REV	0.8V	0.8V	5.2V
1-5V						
	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.

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10.4 Control Output Table for OPEN/OVER/ UNDER Condition

CONTROL OP	Process Scale	Output Direction (O.DIR)	DISPLAY INDICATION		
			OPEN	OVER	UNDER
RELAY	UP	DIR	ON	ON	OFF
	DOWN	REV	OFF	OFF	ON
	UP	REV	ON	OFF	ON
	DOWN	DIR	OFF	ON	OFF

10.5 Mapping Table for Relay and Retransmission Conditions

Mapping for	Parameters	Mapping Options	Description
Relay	**RL-1**	0 (IN 1)	Relay - 1 for Process value 1
		1 (IN 2)	Relay - 1 for Process value 2
	RL-2	0 (IN 1)	Relay - 2 for Process value 1
		1 (IN 2)	Relay - 2 for Process value 2
Retransmission	**RT-1**	0 (IN 1)	Retransmission - 1 for Process value 1
		1 (IN 2)	Retransmission - 1 for Process value 2
	RT-2	0 (IN 1)	Retransmission - 2 for Process value 1
		1 (IN 2)	Retransmission - 2 for Process value 2

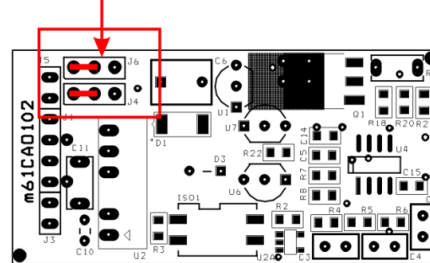## 10.6 Jumper Settings for Add-on Card Selection & Retransmission Output type

- 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.

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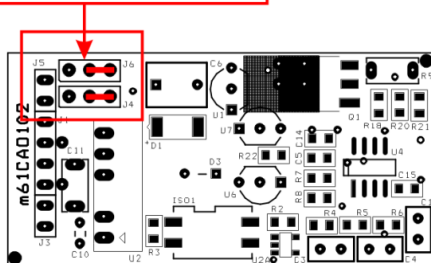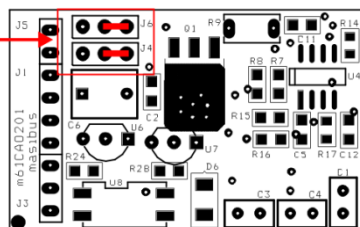

- **Jumper Setting for Retransmission card: m61Cao102**

10.7 Load connection

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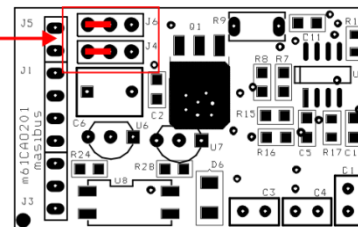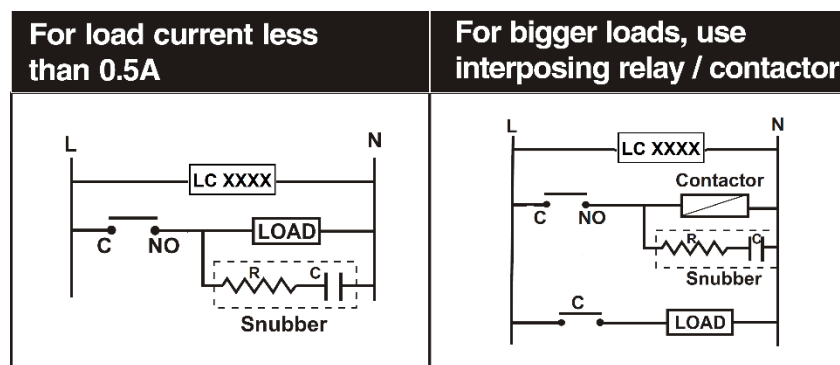
Electrical precautions during use

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