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User's Manual

FLAMEPROOF CONTROLLER   LC5296-XP
LC5296-XP-I
LC5296-XP-AT

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Contents

1. INTRODUCTION

Foreword

Thank you for purchasing FLP(Flameproof) series

**LC5296-XP-AT (PID with Auto Tuning + ON-OFF Controller) /
LC5296-XP (ON-OFF Controller) /LC5296-XP-I (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.

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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.*

LC5296-XP-AT can be configured as PID or ON-OFF Controller.

To change configuration of LC5296-XP-AT, following steps are required to follow.

From menu parameter settings if user enter 5296 Password in Pass menu in configuration menu then it will displays

Parameter (PV display)		Setting Name & Description	Default Value	Show if Only
Symbol	**Name**			
COP (*CoP*)	Control Output Type	Select Controlling Type for Output *Pid* / *onoF* 0 : PID 1 : onof	*Pid*	Enter Password 5296 from configuration menu parameter settings

1. In *conF* menu, *PASS* sub menu, if user enter '5296', sub menu will come *COP*: it has two options *Pid* or *ONOF*.
2. Selected *COP* in above menu will be displayed on power on condition. Like PV: *5296* SV: *tC-E* then PV: *COP* SV: *ONOF*. If *COP*: *Pid* is selected then PV: *COP* SV: PID.
3. For *COP* = PID, then in *conF*. mode, after *Ot* menu, *COP* menu will come. With three option, *P*, *PI* or *Pid*.

On selection of PID / ON-OFF, only relevant parameters will be displayed in menu.

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2. SPECIFICATIONS

2.1 Inputs

Analog Input	
Input Type	Thermocouple, RTD (Pt100), Current, Voltage
Display Range	Refer Table-2.1
Accuracy	$\pm$ (0.25% of FS+ 1 degree) for T/C and 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	4 Samples/Sec
CJC Error	±3.0 °C Max
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 type	**Range**
PT100 (0.1°C)	-199.9 to 850.0°C
PT100 (1°C)	-200 to850°C
E	-200 to 1000°C
J	-200 to1200°C
K	-200 to1372°C
T	-200 to400°C
B	450 to1800°C
R	0 to1768°C
S	0 to1768°C
*4-20mA /1-5VDC, *0-20mA /0-5VDC 0-10V	-1999 to 9999 (Field Scalable)

*Use external 250ohms, 0.1% for current Input

2.2 Display & Keys

Model	Display	Specification
LC5296-XP-AT	PV Display	4-Digit, 7-Segment, Red, Character height of 0.56"
	SV / Parameter Display	4-Digit, 7-Segment, Green, Character height of 0.40"
	Status Indication	Individual RED Led for Relay, SSR Output, Manual Status, communication(Rx &Tx) Status
LC5296-XP	PV Display	4-Digit, 7-Segment, Red, Character height of 0.56"
	SV / Parameter Display	4-Digit, 7-Segment, Green, Character height of 0.40"
	Status Indication	Individual RED Led for Relay Status& communication(Rx &Tx) Status
LC5296-XP-I	PV Display	4-Digit, 7-Segment, Red, Character height of 0.56" or 0.8"
	Status Indication	Individual RED Led for Relay Status& communication(Rx &Tx) Status (Available based on Ordering Code)

2.3 Output Types

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

Model	Output Type	Description
LC5296-XP-AT	**Relay Output**	2 Relays Relay-1 • For PID or ON-OFF Controlling. • Used as Alarm-1 Output if Output Type is Linear Relay-2 • Alarm-2 Output
	SSR Output *	Voltage Pulse Output Available at Terminals of Relay-1
	Linear Output	Available at Terminals of Retransmission-1. Linear Output Type as per selection in Retransmission-1 Output Type.
LC5296-XP	**Relay Output**	2 Relays for ON-OFF Controlling
LC5296-XP-I	**Relay Output**	2 Relays for ON-OFF Controlling (Optional)

• 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)

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Relay Output	
Relays	1 (For LC5296-XP-AT) 2 (For LC5296-XP) Optional For LC5296-XP-I
Type	Single Change over Three Terminals (C, NO, NC)
Rating	2A @ 230VAC / 30VDC

Pulse Output (SSR)(For LC5296-XP-AT Only)	
Output signal	Voltage Pulse Output
Output signal On-condition	11VDC or more
Off-condition	2VDC or less
Resolution	10 ms
Linear Output (For LC5296-XP-AT Only)	
Output Signal	Voltage (0-5VDC, 1-5VDC, 0-10VDC) @3kΩ Min Current (4-20mADC, 0-20mADC) @500Ω Max

Retransmission Output	
Number of output	1 (@Retransmission-2)(For Linear Output Type) or 2 (@Retransmisswion-1&2)(For Relay 0r SSR Output Type)
Output According to	Process Value
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

Alarm Output (For LC5296-XP-AT Only)	
Number of Outputs	2 if Output Type is Linear(@Relay-1&2), 1 if Output Type is Relay or SSR(@Relay-2) Control relays are available as alarm outputs
Output signal	Three terminals (NC, NO, and C)
Purpose	Alarm output and others. (See Alarm and Digital outputs function)
Relay contact rating	250 V AC or 30 V DC, 2A (resistive load)

Loop Power Supply	
Supply Voltage	24VDC (±1V) @26mA with Inbuilt Short Circuit Protection
Minimum load resistance	800 ohms

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)

> **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 and Control output < 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. Input Scalability for Linear Input type(only for LC5296-XP and LC5296-XP-I model)
2. Ramp Soak Function (only for LC5296-XP-AT)

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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
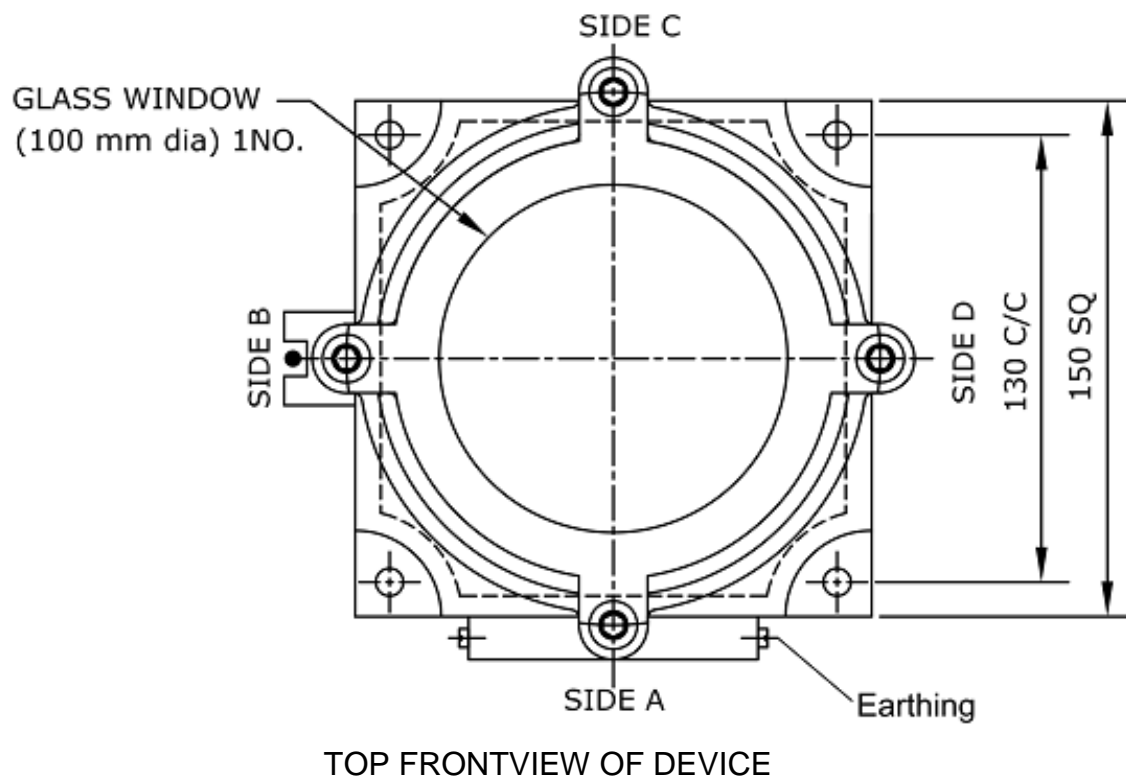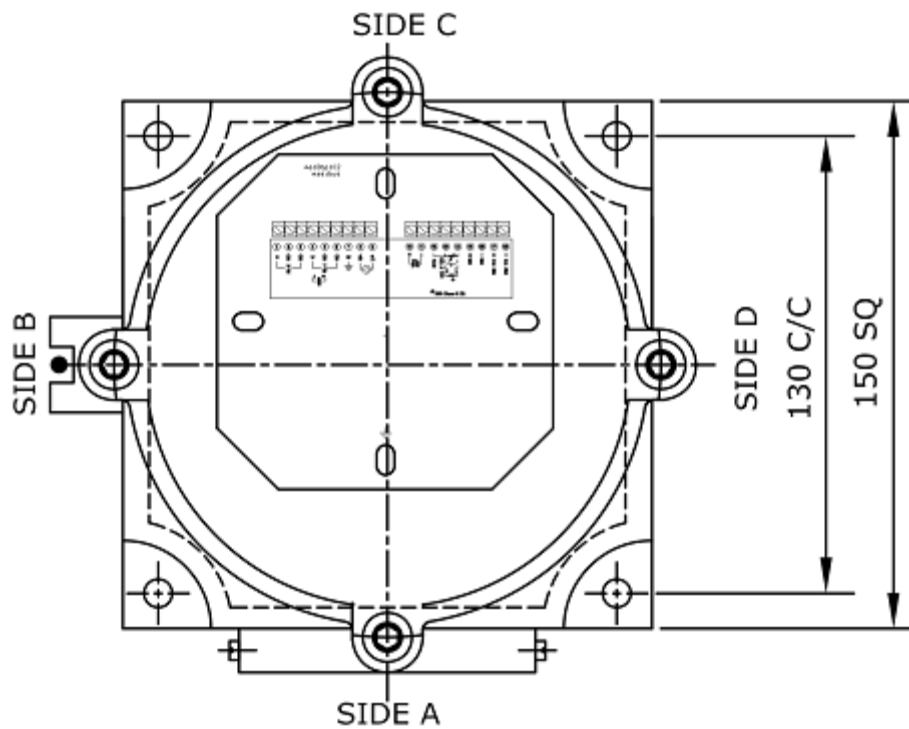Hardware: High tensile zinc passivated / stainless steel (ss-304)
Mountings: Wall mountings with the help of 4 NOS bolts of size M8
Cable entry size/no: ¾" ET – 5 NOS
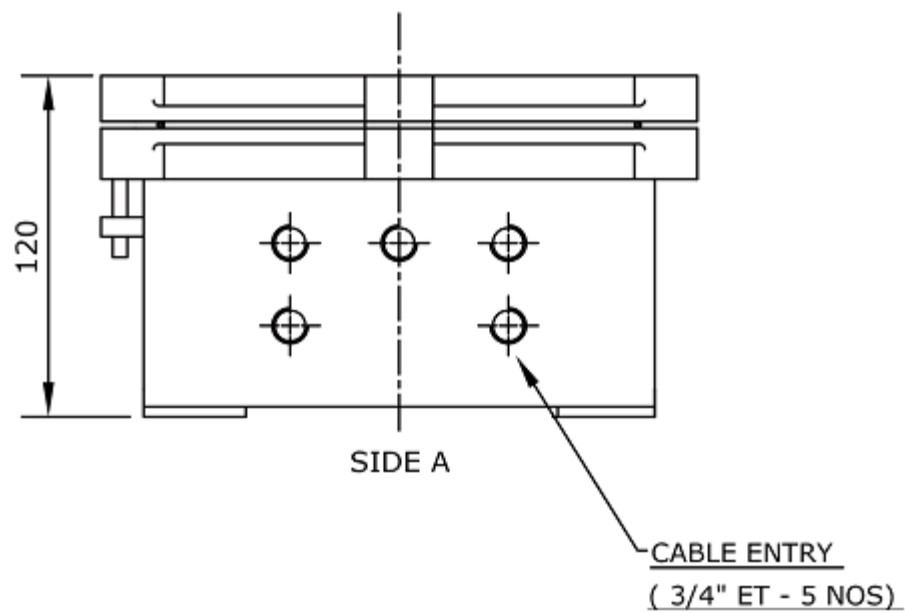Plug Details: 3 Blind Plug & 2 Cable gland ¾"ET

1. Mechanical Details for IIA & IIB Enclosure

TOP FRONTVIEW OF DEVICE

INTERNAL VIEW WITH TERMINAL CONNECTION DETAILS

CABLE ENTRY
(3/4" ET - 5 NOS)

BOTTOM VIEW FOR CABLE ENTRY

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78.87

78.87

4xM3x5mm
male/female
spacer/stud
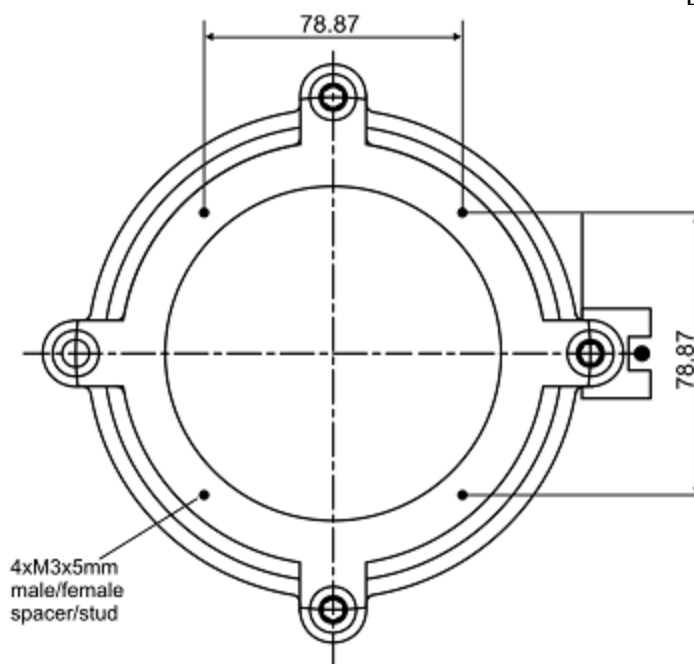
TOP VIEW FOR DISPLAY CARD ASSEMBLY

2. Mechanical Details for IIA, IIB & IIC Enclosure

165

Glass Window
100mm Dia

180

MOUNTING HOLE
10 MM

120

TOP VIEW

FRONT VIEW OF DEVICE

INTERNAL VIEW WITH TERMINAL CONNECTION DETAILS

165

180

120

TOP VIEW

MOUNTING HOLE
10 MM

140

HINGE
ARRANGMET

(3/4)" 5 Nos.
ET CABLE ENTRY

EARTHING SCREW

BOTTOM VIEW FOR CABLE ENTRY

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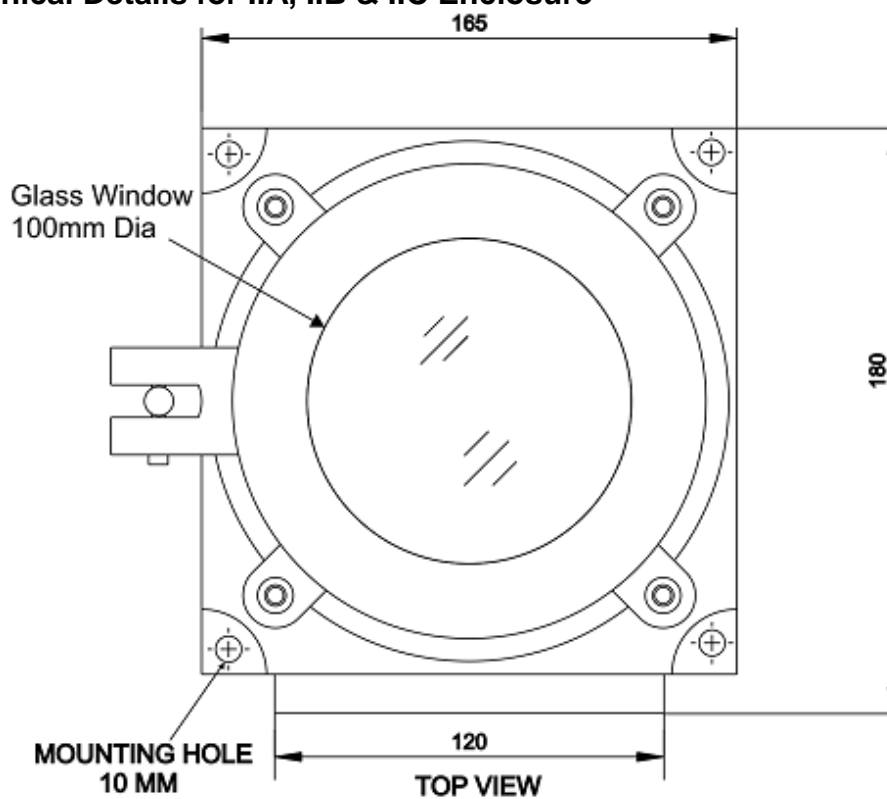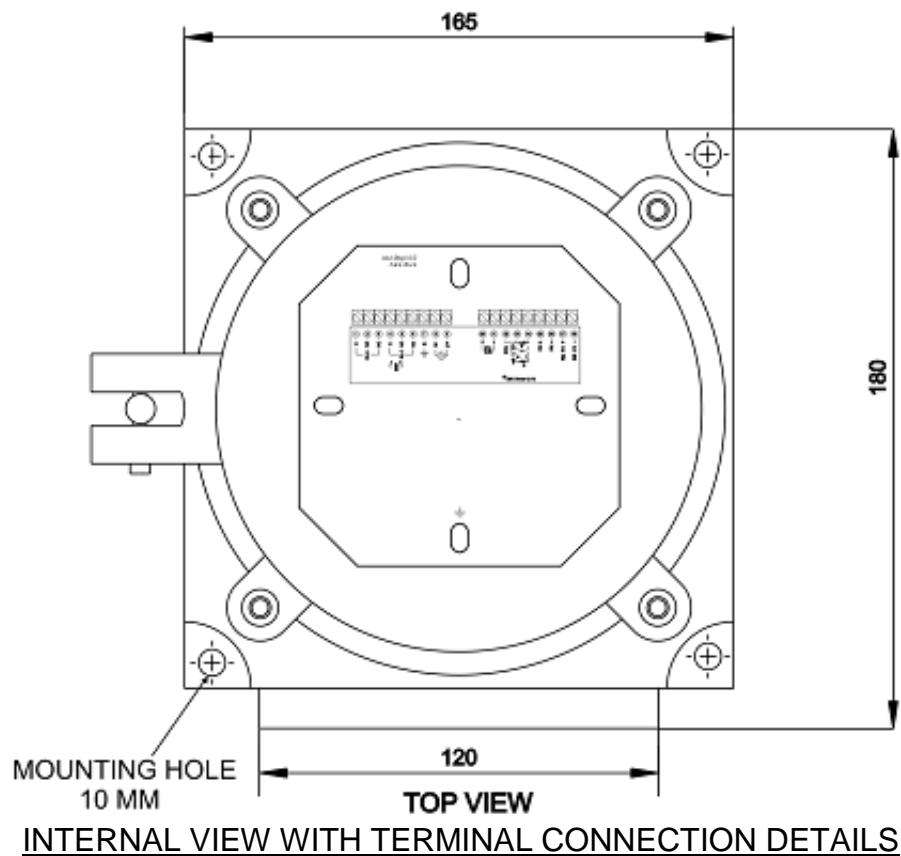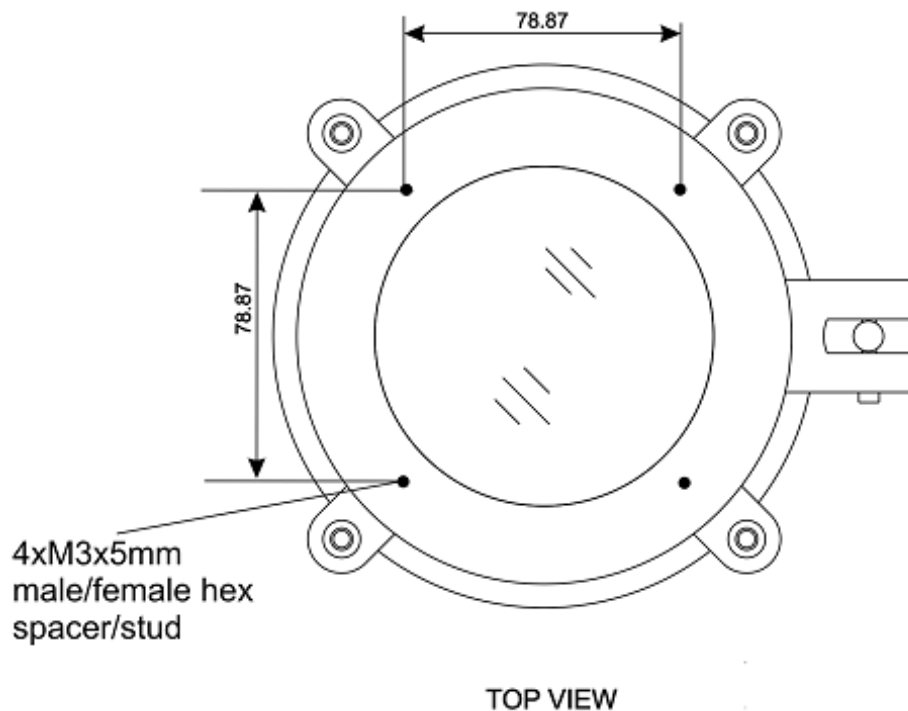
TOP VIEW

TOP VIEW FOR DISPLAY CARD ASSEMBLY

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
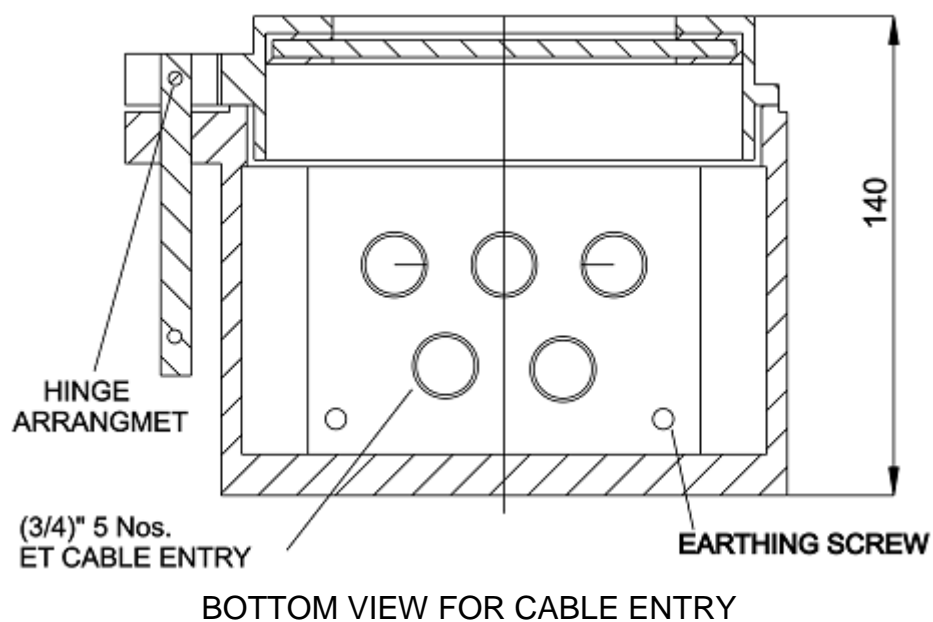Components: Glass window dia. 100 mm. 6mm Thickness -1 no.
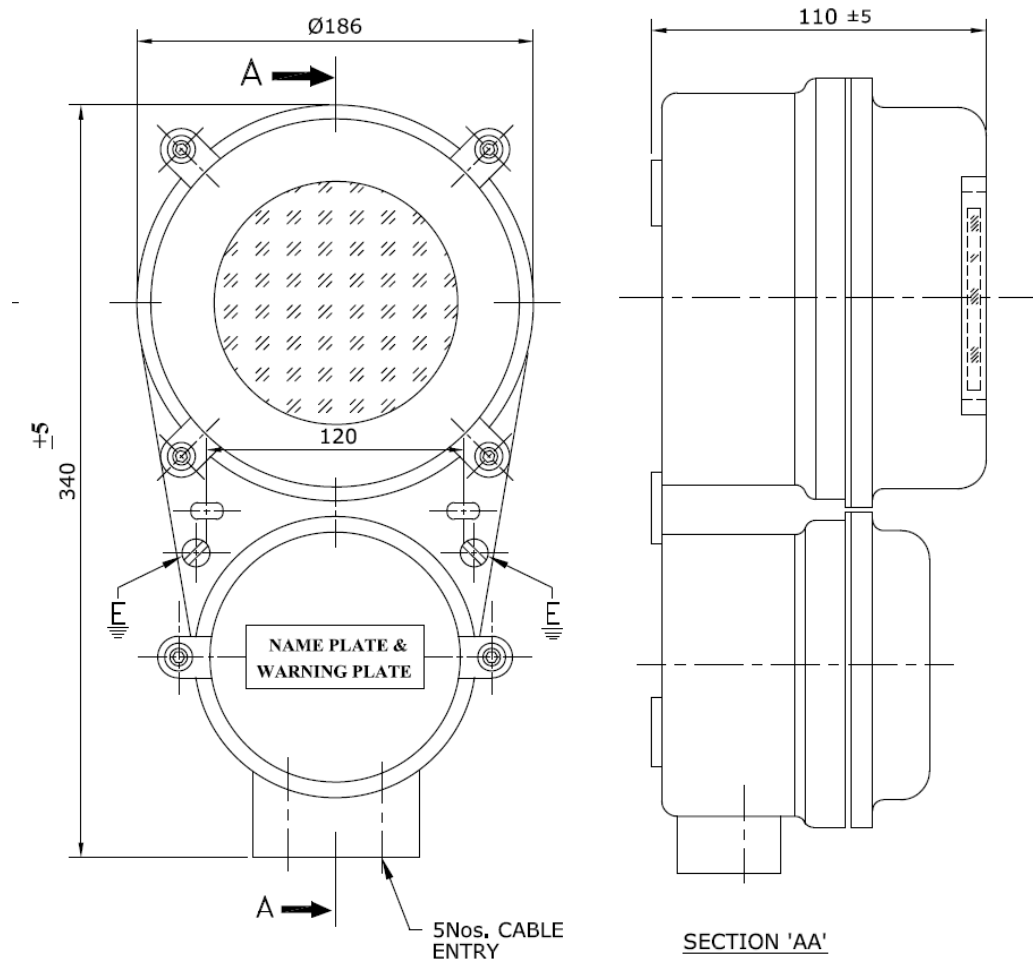
FLP Dual compartment Enclosure Front View and Section view

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4. TERMINAL CONNECTIONS

4.1 Single compartment enclosure
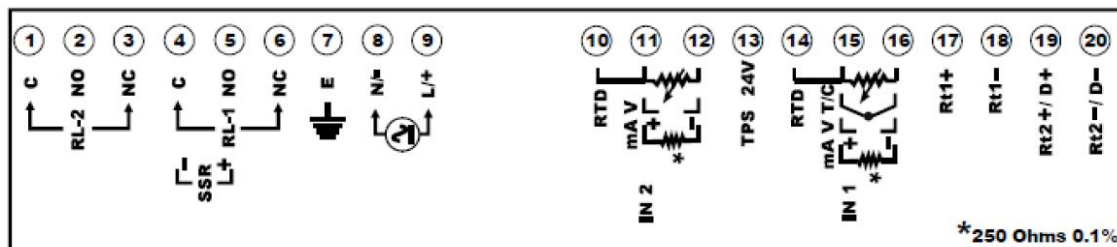
4.2 Dual compartment enclosure

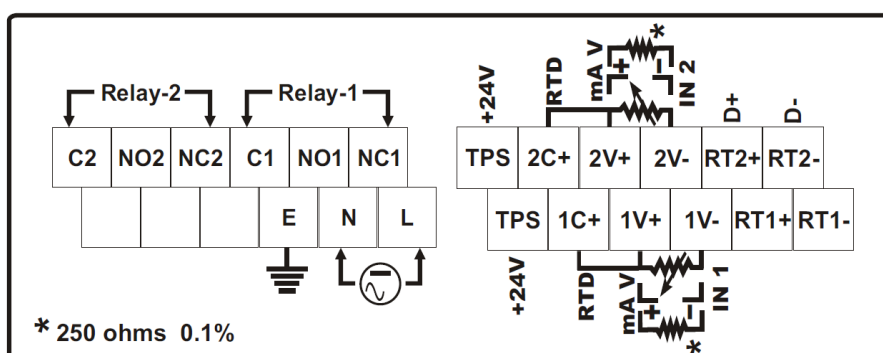| Terminal No.	Description	
1 (C2) 2 (NO2) 3 (NC2)	• For Relay-2 potential free Contacts (Use 230V -2A load)	
	• Alarm-2 o/p.	LC5296-XP-AT
	• ON-OFF control	LC5296-XP
4 (C1) 5 (NO1) 6 (NC1)	• For Relay-1 potential free Contacts (Use 230V -2A load)	
	• PID / On-Off Control o/p. • Alarm-1 o/p, if output type is Linear. • Terminal 4,5:- SSR Pulse o/p.	LC5296-XP-AT
	• ON-OFF control	LC5296-XP
7 (Earth)	Earth Connection	
8 (N/-) 9 (L/+)	Power Supply Input	
10 (C+)	For RTD Input Only (Input-2 - Not available)(Three wire Compensation)	
11 (V+) 12 (V-)	For Thermocouple, RTD & Linear Input(Input-2 - Not available)	
13 (TPS+)	24VDC Loop power supply	
14 (C+)	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	

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 astheymight 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.
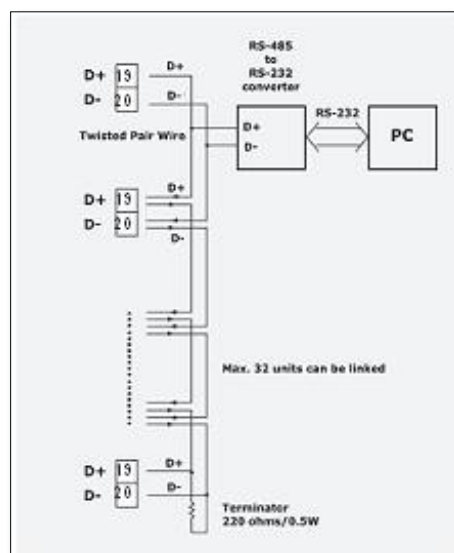
Fig 4.2: RS485 Connection Details

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5. FRONT PANEL DETAILS
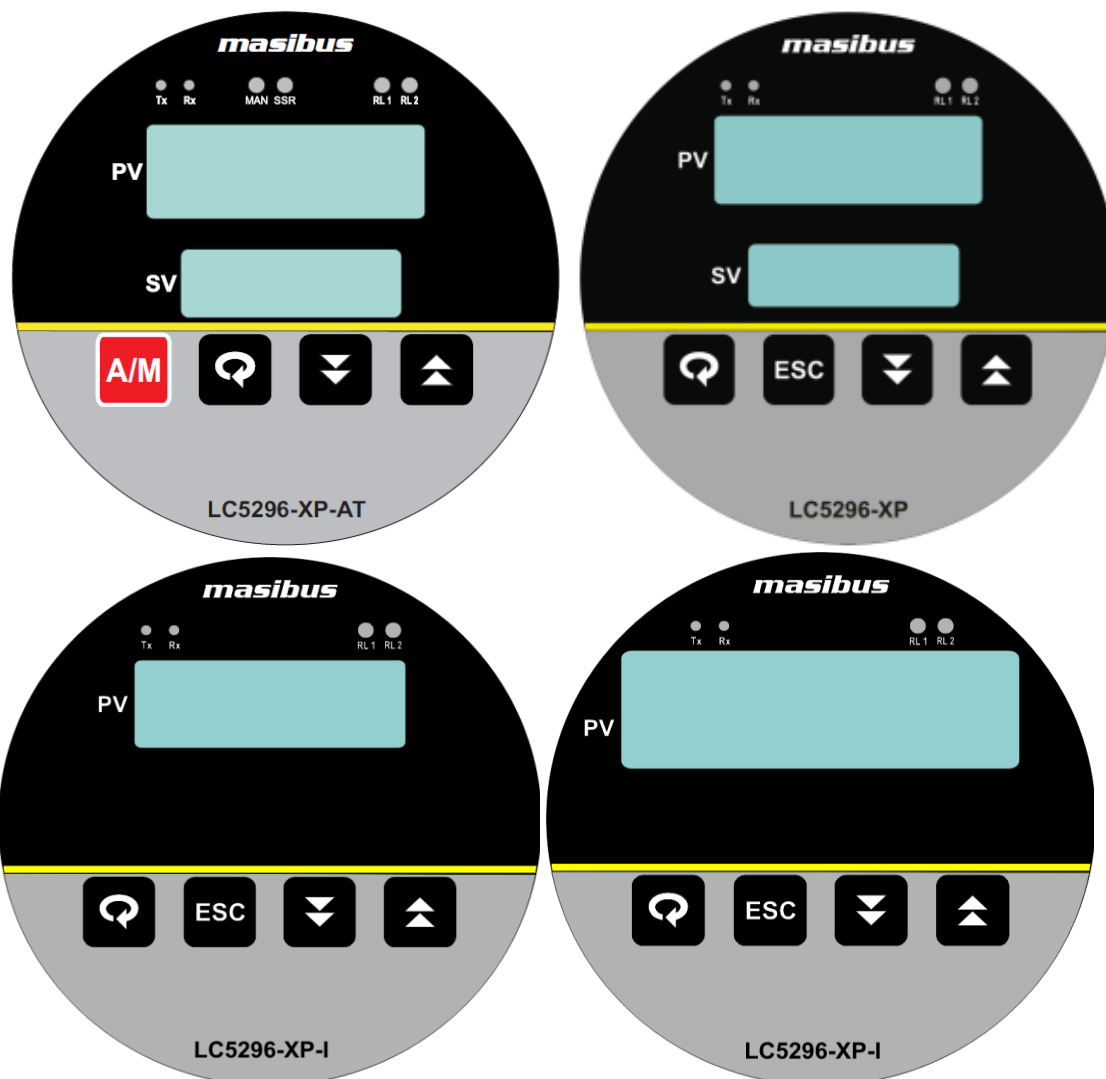
5.1 Front Panel Description

Name of Part	Symbol	Function	LC5296-XP-AT	LC5296-XP	LC5296-XP-I
Increment Key	⏫	• Enter into Edit Mode. • Increment the Value of any Parameter in edit mode. • Shows ambient value for T/C Input in RUN mode. • In Manual Mode this key is used to Increment the %Power. (for LC5296-XP-AT Only)	✓	✓	✓
Decrement Key	⏬	• Enter into Edit Mode. • Decrement the Value of any Parameter in edit mode.	✓	✓	✓

		• Shows %Power value if Device is in Auto Mode during RUN mode. (for LC5296-XP-AT Only) • In Manual Mode this key is used to Decrement the %Power. (for LC5296-XP-AT Only)			
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.	✗	✓	✓
Auto/Manual Key	A/M	• It is used to switch between Auto to Manual mode and Manual to Auto mode if pressed for at least 2 sec in case of F .PEY in CONF menu is selected A-ṁorrAṁP is nonE. • If Ramp is not none and F .PEY in CONF menu is selected SoP .ṫ then it will display remaining time	✓	✗	✗
PV (Process Value) Display	PV	• 4 digital 0.56 inch RED Display • Display process value. • Display parameter name when user set parameter. • Display error message when an error occurs.	✓	✓	✗
SV (Set Value) Display	SV	• 4 digital 0.4 inch GREEN • Display set value. • Display parameter value of parameter in process value field when user set parameter. • Display control output value when in manual mode.	✓	✓	✓
Relay-1 Indication	RL1	• ON when Relay-1 is energized & OFF otherwise.	✓	✓	✓
Relay-2 Indication	RL2	• ON when Relay-2 is energized & OFF otherwise.	✓	✓	✓
SSR Indication	SSR	• SSR ON status.	✓	✗	✗
MANUAL Indication	MAN	• ON when unit is in Manual mode. • OFF when unit in Auto Mode.	✓	✗	✗
TX	Tx	• ON when device is transmitting some Data	✓	✓	✓

| Indication | | (RS-485). | | | |
| RX Indication | Rx | • ON when device is receiving some Data (RS-485). | ✓ | ✓ | ✓ |

NOTE:

✓: Available for this Model.

✗: Not Available for this Model.

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6. MENU LAYOUT for LC5296-XP-AT

Long Press 🔁 to Return to **RUN Mode** from anywhere in the Menu.

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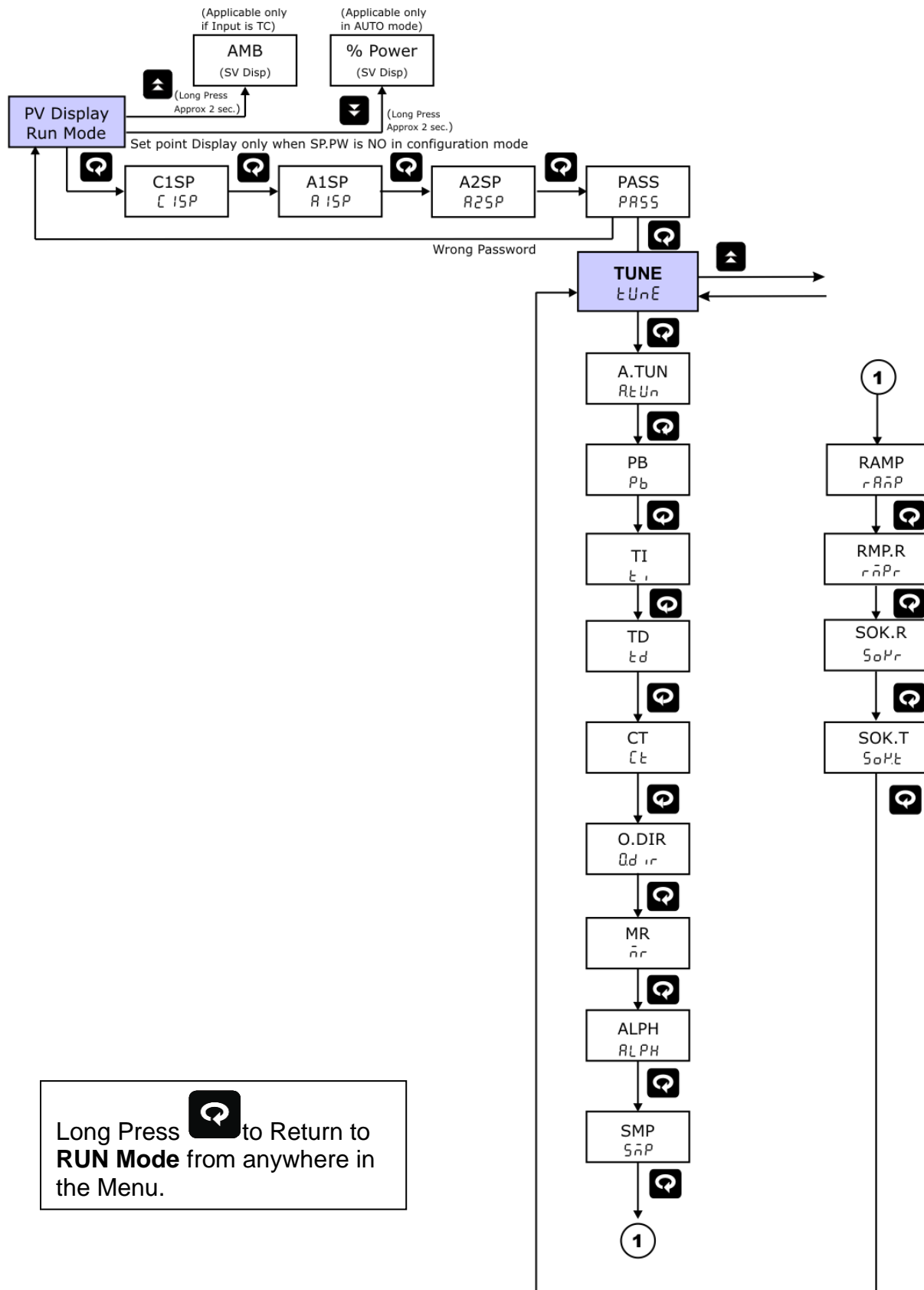
MENU LAYOUT for LC5296-XP-AT
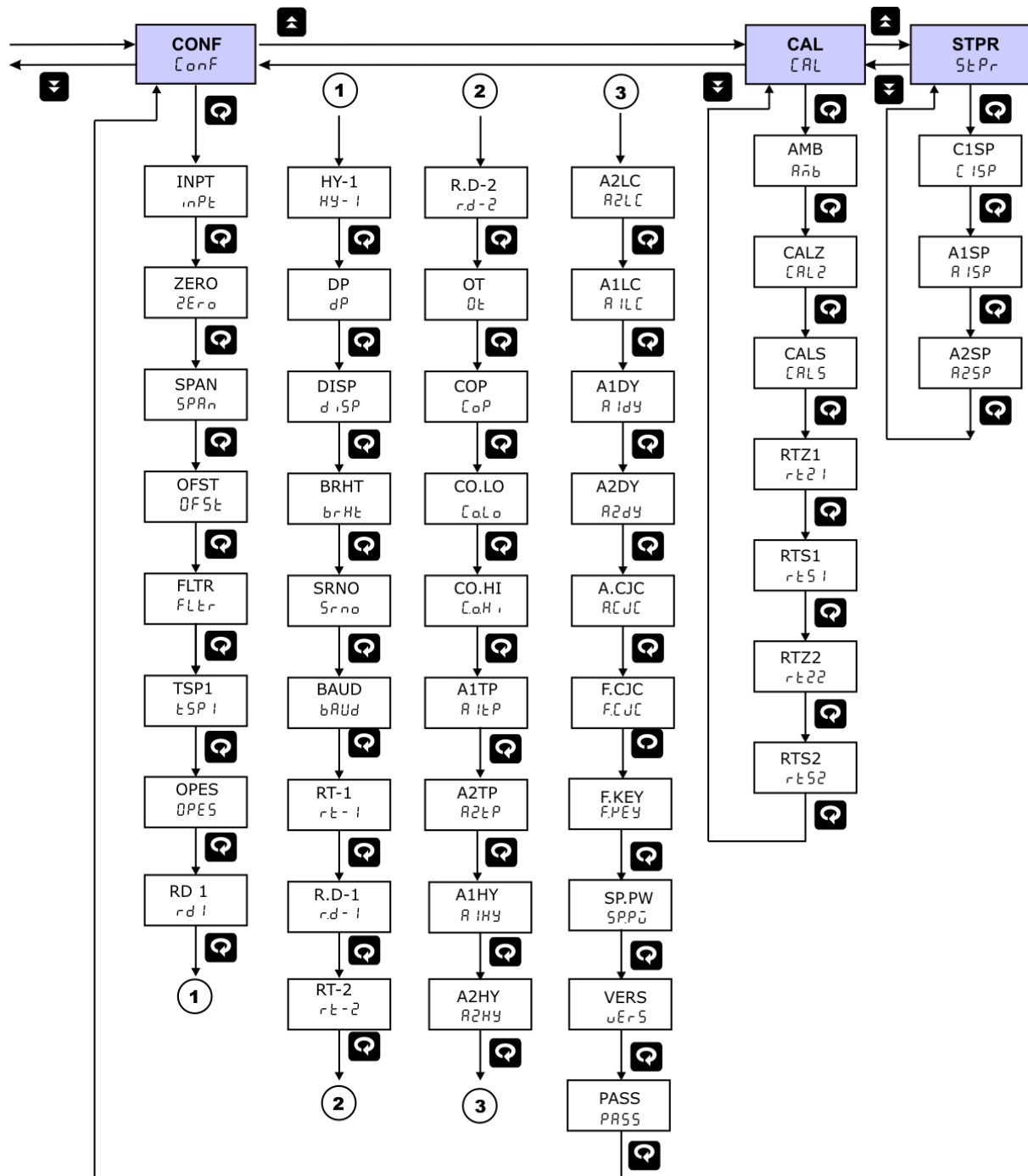
6.1   RUN Time Indication/Function

Following parameters can view or change during run time.

- Press Decrement key to show percentage power Auto Mode (0.0 to100.0%)

- For Thermocouple input type, Press Increment key to show ambient temperature.

- During manual mode, Increment key and Shift Decrement Key will use to modify the percentage power.

- Press **A/M** to toggle between AUTO & MANUAL mode or display time.

6.2 *SET POINT SETTING

Set Point Setting:

Parameter (PV display)		Setting name and description	Default value	Shows only if
Symbol	Name			
C1SP (C 1SP)	Control Set Point 1	Range Depending on PV sensor type selected	100	-
A1SP (A 1SP)	Alarm Set Point 1	Range Depending on PV sensor type selected	100	Output Type is LIN(Linear)
A2SP (A2SP)	Alarm Set Point 2	Range Depending on PV sensor type selected	100	-

*only shows if SP.PW is No in configuration mode

6.3 AUTO TUNE MODE

AUTOTUNE PARAMETERS

Parameter (PV display)		Setting Name & Description	Default Value	Show if Only
Symbol	Name			
A.TUN (A .tUn)	Auto Tune	Start / Stop Auto Tuning Process YES / no 0 : NO (Stop Auto Tuning) 1 : YES (Start Auto Tuning)	no	Control Type is PI or PID
PB (Pb)	Proportional Band	Adjust Proportional Band 0 to 9999 or 0.0 to 999.9	10 .0	Control Type is P or PI or PID
TI (t i)	Integral Time	Adjust Integral Time 0 to 1000	60	Control Type is PI or PID
TD (td)	Derivative Time	Adjust Derivative Time 0 to 180	0	Control Type is PID
CT (Ct)	Cycle Time	Adjust Cycle Time For, SSR o/p: (1 – 60 sec) Relay o/p: (10 – 300 sec)	1 (or) 10	
O.DIR (o .d ir)	Output Direction	Set Output Direction d ir/rEu 0 : REV (REVERSE)	rEu	Control Type is P or PI or PID

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Parameter Symbol	Name	Setting Name & Description	Default Value	Show if Only
		1 : DIR (Direct)		
MR (m̄r)	Manual Reset	Adjust Manual Reset Value It is used to shift P Band for critical Controlling situations. (Applicable only if Control O/P is "P") -(PB/2) to +(PB/2) EX. If PB = 50, SP = 100, O.DIR = REV MR = 0 MR = 25	0	Control Type is P

PV	% POWER		PV	%POW
<= 75	100 %		<= 100	100 %
100	50 %		125	50 %
>= 125	0 %		>= 150	0 %

Parameter Symbol	Name	Setting Name & Description	Default Value	Show if Only
ALPH (ALPH)	Sampling Rate	Adjust Sampling Rate Its acts like Derivative Factor. It is used to decrease effect of D term in PID output for some critical operating condition 0.01 to 1.00	1.00	Control Type is PID
SMP (Sm̄P)	Sampling Period	Set Sampling Period for Derivative Term 200 / 500 / 1 0 : 200 ms 1 : 500 ms 2 : 1 sec	200	Control Type is PID
RAMP (rAm̄P)	Ramp Rate type	nonE/m̄in .r/hr .r 0:none 1:min.r 2:hr.r	nonE	Not available for Output type OnOFF
Rmp.R (rm̄P .r)	Ramp rate value	0.1 to 999.9 Degree per minutes or hour	0 .1	Not available for Output type OnOFF
SOK.R (SoP .r)	Soak rate	1 to 9999 minutes	100	Not available for Output type OnOFF
SOK.T (SoP .t)	Soak type	S .hod/S .rSt 0:s.hod 1:s.rst	S .rSt	Not available for Output type OnOFF

6.4 CONFIGURATION MODE

CONFIGURATION PARAMETERS

Parameter (PV display)		Setting Name & Description	Default Value	Show if Only
Symbol	**Name**			
INPT (inPt)	INPUT Type	Set PV Input Type tC E /tC J /tC P /tC t /tC b / tC r /tC S /rtd .1 /rtd/0-5u / 1- 5u/0- 10	tC E	

Value	Input Type	Range	
0	TC E	-200 to 1000 °C	
1	TC J	-200 to 1200 °C	
2	TC K	-200 to 1372 °C	
3	TC T	-100 to 400 °C	
4	TC B	450 to 1800 °C	
5	TC R	0 to 1768 °C	
6	TC S	0 to 1768 °C	
7	RTD.1	-199.9 to 850.0 °C	
8	RTD	-200 to 850 °C	
9	0-5 V / 0-20 mA*	-1999 to 1999	
10	1-5 V / 4-20 mA*		
11	0-10V		

*Use external 250ohms,0.1% for current input

ZERO (2Ero)	Zero	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.	-200 (If TC E)	
SPAN (5PAn)	Span	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.	1000 (If TC E)	
OFST (oF5t)	offset	Offset Value 	Input type	range
---	---
RTD/ Thermocouple	-100.0 to +100.0
Linear	-1000 to +1000		0.0	
FLTR (FLtr)	Filter	Filter for PV Input no / YES 0 : NO 1 : YES	YES	
TSP1 (t5P1)	Type of Set Point	Set Type of Set Point L-on / H-on 0 : L-ON (Lower ON) 1 : H-ON (Higher ON) Refer ON-OFF Control on Page:40	L-on	Control Type is ON-OFF. (Not available for Linear O/P)
OPES (oPES)	OPEN Sensor Status	Set Control O/P & Retransmission state when Input OPEN condition. doun / UP 0 : DOWN 1 : UP	UP	
RD 1 (rd 1)	Relay Delay (For Relay-1)	Relay Delay is amount of time (in sec), that Relay will wait before getting ON after the ON condition occurs.	1	Control Type is ON-OFF

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		1 to 99 sec		
HY-1 (HY-1)	Hysteresis – 1 (For Relay-1)	Hysteresis Value (in °C) for Relay-1 during ON-OFF type Control. 	1 to 100	TC & 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		1	Control Type is ON-OFF
DP (dP)	Decimal Point	Set position of Decimal Point on Display. 0 / 0.0 / 0.00 / 0.000 *0 : 0 *1 : 0.0 2 : 0.00 3 : 0.000	1	Input Type is Linear, *if input type is RTD or TC.
DISP (d iSP)	Display Set Point	Set which Set Point to shown in SV display in RUN mode while device is in Auto Mode C1.SP / A2.SP / A1.SP 0 : C1.SP (Control Set Point 1) 1 : A2.SP (Alarm Set Point 2) 2 : A1.SP (Alarm Set Point 1)	C1.SP	Output Type is Relay or SSR then A1.SP will not appear.
BRHT (brHt)	Brightness	Adjust Brightness of the 7-segment Display. 10 to 100	100	
SRNO (Srno)	Serial No.	Unt ID for Modbus-RS485 Communication 1 to 247	1	Device supports RS485 Communication.
BAUD (bAUd)	Baud Rate	Set Modbus RS485 Communication Baud Rate 9600 / 19.2P / 38.4P 0 : 9600 (9600 bps) 1 : 19.2K (19200 bps) 2 : 38.4K (38400 bps)	9600	Device supports RS485 Communication.
RT-1 (rt-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.

R.D-1
(r .d- 1)
	Retransmission-1 Direction	Set Direction for the Retransmission Output-1
		rEu / d ir
		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
		Refer Retransmission o/p table on Page 54 for more info.
			d ir	Device Supports Retransmission Output& OP.T (Output Type) is not LINEAR.

RT-2 (rt-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.
R.D-2 (r .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.
OT (ot)	Output Type	Output Type rELY / SSr/ L in 0 : RELY (Relay) 1 : SSR (Voltage Pulse Output) 2 : LIN (Linear) Device can support RELAY or SSR output once at a time. (Factory Settable) ** Device can support Control output type P Id or onoF .(Factory Settable)	rELY	**LIN and SSR option will not appear if COP(Control Type) is ON-OFF
COP (CoP)	Control Output Type	Select Controlling Type for Output P / P i / P id 0 : P (Proportional Control) 1 : PI 2 : PID	P	Control output type is PID
CO.LO (Co .Lo)	Control Output Low Limit in %	Control Output Low Limit in %. 0.0 to 100.0 % (It will be always less then CO.HI)	0 .0	Control output type is PID

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CO.HI (Co.Hi)	Control Output High Limit in %	Control Output High Limit in %. 0.0 to 100.0 % (It will be always greater then CO.LO)	100.0	Control output type is PID
A1TP (A1tP)	Alarm Type - 1	Refer ALARM Type Table on Page.45 0 to 15	Pu.AL	Output Type is LIN(Linear)
A2TP (A2tP)	Alarm Type - 2	Refer ALARM Type Table on Page.45 0 to 15	Pu.AL	
A1HY (A1HY)	Alarm 1 Hysteresis	Set Hysteresis(in °C) for Alarm-1 1 to 100 — TC & 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	1	Output Type is LIN(Linear)
A2HY (A2HY)	Alarm 2 Hysteresis	Set Hysteresis(in °C) for Alarm-2 1 to 100 — TC & 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	1	
A1LC (A1LC)	Alarm 1 Logic	Set Logic for Alarm-1 norm / FLSF 0 : NORM (Normal) 1 : FLSF (Fail-Safe) Page. 46 shows operation diagram of different alarm Type for Alarm Logic NORM (Normal). For Fail-Safe Logic Alarm will work completely opposite to Normal behavior. (i.e. for any particular condition when Relay is ON for Normal logic, for that condition relay will OFF for Fail-Safe Logic & vice-versa)	norm	Output Type is LIN(Linear)
A2LC (A2LC)	Alarm 2 Logic	Set Logic for Alarm-2 norm / FLSF 0 : NORM (Normal) 1 : FLSF (Fail-Safe)	norm	
A1DY (A1dY)	Alarm 1 Delay	Alarm Delay is amount of time (in sec), that Relay-1 will wait before getting ON after the alarm condition occurs. 1 to 99 sec	1	Output Type is LIN(Linear)
A2DY (A2dY)	Alarm 2 Delay	Alarm Delay is amount of time (in sec), that Relay-2 will wait before getting ON after the alarm condition occurs. 1 to 99 sec	1	

Parameter	Name	Setting Name & Description	Default	Show if Only
A.CJC (*A .CJC*)	Auto Cold Junction Compensation	Select Auto Cold Junction Compensation required or not for TC input Type. *no* / *YES* 0 : NO 1 : YES	*YES*	Input Type is TC
F.CJC (*F .CJC*)	Fix cold junction Compensation	Set Fix cold junction Compensation value. 0 to 60.0 °C	*0 .0*	Input Type is TC & A.CJC is NO
F.KEY (*F .KEY*)	Function Key	Select A/M or Soak time *A-m/SOK .t* 0 : A-M 1 : SOK.T	*SOK .t*	Control output type is PID
SP.PW (*SP .Pw*)	SetPointLock setting	Select No / Yes *NO/YES* 0 : NO 1 : YES	*NO*	
VERS (*vErS*)	Version	Shows the Version of the Current Firmware	-	
PASS (*PASS*)	Password	Set Device Password 0 to 9999	*1*	

6.5 CALIBRATION MODE

CALIBRATION PARAMETERS				
Parameter (PV display)		**Setting Name & Description**	**Default Value**	**Show if Only**
Symbol	**Name**			
AMB (*Amb*)	Ambient	Ambient Adjustment	-	Input is TC
CALZ (*CALZ*)	ZERO	Calibration Zero for PV Input (SV Display : PV)	-	
CALS (*CALS*)	SPAN	Calibration Span for PV Input (SV Display : PV)	-	
RTZ1 (*rtZ1*)	Retransmission-1 ZERO	Calibration Zero for Retransmission Output-1 (SV Display : If voltage: 0.000 If Current: 4.000)	-	Device Supports Retransmission Output
RTS1 (*rtS1*)	Retransmission-1 SPAN	Calibration Span for Retransmission Output-1 (SV Display : If voltage: 8.000 If Current: 20.00)	-	Device Supports Retransmission Output
RTZ2 (*rtZ2*)	Retransmission-2 ZERO	Calibration Zero for Retransmission Output 2 (SV Display : If voltage: 0.000 If Current: 4.000)	-	Device Supports Dual Retransmission Output

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

6.6 *SETPARAMODE

*only shows if SP.PW is Yes in configuration mode

Set Point Setting:				
Parameter (PV display)		Setting name and description	Default value	Shows only if
Symbol	Name			
C1SP (C 15P)	Control Set Point 1	Range Depending on PV sensor type selected	100	-
A1SP (A 15P)	Alarm Set Point 1	Range Depending on PV sensor type selected	100	Output Type is LIN(Linear)
A2SP (A25P)	Alarm Set Point 2	Range Depending on PV sensor type selected	100	-

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.
➤ **The Linear type control output will depend on the type of Retransmission-1 output selection**. If Retransmission-1 type output is 4-20mA, then the linear output will function respectively.
➤ 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?

PV Display
Run Mode

C1SP
C 1SP

A1SP
A 1SP

A2SP
A2SP

PASS
PASS

Wrong Password

CONF
ConF

INPT
inPt
Y tC

Press INC/DEC
Key to enter
into Edit Mode

INPT
inPt
Y tC

Press INC/DEC
Key to change
this parameter
to desired Value

INPT
inPt
rtd.1

Press Set key
to Save the
Parameter

INPT.
inPt
rtd.1

If the parameter
is successfully
saved then
Decimal Point
of the Right Most
Digit will be ON.

Press & Hold Set Key
for few Seconds at any time
to exit from Menu Mode &
Come to Run Mode

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7. MENU LAYOUT for LC5296-XP

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MENU LAYOUT for LC5296-XP

```
        ESC

      CAL
      CAL

      AMB
      Amb

      ZERO
      ZEro

      SPAN
      SPAn

      RT.1.Z
      rt.1Z

      RT.1.S
      rt.1S

      RT.2.Z
      rt.2Z

      RT.2.S
      rt.2S
```

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7.1 RUN Time Indication/Function

Following parameters can view or change during run time.

- For Thermocouple input type, Press Increment key to show ambient temperature.

7.2 Set Point Setting

Pressing SET key PV Display shows C1.SP (C1.SP) message. SV display shows **ControlSet 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 **ControlSet Point-2 Value.**

7.3 CONFIGURATION MODE

CONFIGURATION PARAMETERS				
Parameter (PV display)		Setting Name & Description	Default Value	Show if Only
Symbol	Name			
INPT (inPt)	INPUT Type	Set PV Input Type tC E /tC J /tC k /tC t /tC b / tC r /tC S / rtd .1 / rtd/ 0-5u / 1-5u/0-10 <table><tr><td>Value</td><td>Input Type</td><td>Range</td></tr><tr><td>0</td><td>TC E</td><td>-200 to 1000 °C</td></tr><tr><td>1</td><td>TC J</td><td>-200 to 1200 °C</td></tr><tr><td>2</td><td>TC K</td><td>-200 to 1372 °C</td></tr><tr><td>3</td><td>TC T</td><td>-100 to 400 °C</td></tr><tr><td>4</td><td>TC B</td><td>450 to 1800 °C</td></tr><tr><td>5</td><td>TC R</td><td>0 to 1768 °C</td></tr><tr><td>6</td><td>TC S</td><td>0 to 1768 °C</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="3">-1999 to 1999</td></tr><tr><td>10</td><td>1-5 V / 4-20 mA*</td></tr><tr><td>11</td><td>0-10V</td></tr></table>**Use external 250ohms,0.1% for**	tC k	

		current input		
ZERO (2Ero)	Zero	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.	-200 (If TC K)	
SPAN (5PAn)	Span	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.	1372 (If TC K)	
FLTR (FLtr)	Filter	Filter for PV Input no / YES 0 : NO 1 : YES	YES	
INLO (inLo)	Input low	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.	0 (if 0-10V)	Only in Linear input
INHI (inhi)	Input high	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.	10 (if 0-10V)	Only in Linear input
OFST (oFSt)	offset	Offset Value <table><tr><td>Input type</td><td>range</td></tr><tr><td>RTD/ Thermocouple</td><td>-100.0 to +100.0</td></tr><tr><td>Linear</td><td>-1000 to +1000</td></tr></table>	0.0	
T.SP1 (t.5P1)	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:40	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:40	L-ON	

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OPES (oPES)	OPEN Sensor Status	Set Control O/P & Retransmission state when Input OPEN condition. doʊn / 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 	1 to 100	TC & 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		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 	1 to 100	TC & 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		1	
DP (dP)	Decimal Point	Set position of Decimal Point on Display. 0 / 0.0 / 0.00 / 0.000 0 : 0 1 : 0.0 2 : 0.00 3 : 0.000	1	Input Type is Linear
DI.SP (di.SP)	Display Set Point	Set which Set Point to shown in SV display in RUN mode while device is in Auto Mode C1.SP / C2.SP 0 : C1.SP (Control Set Point 1) 1 : C2.SP (Control Set Point 2)	0	
BRHT (brHt)	Brightness	Adjust Brightness of the 7-segment Display. 10 to 100	100	

SR.NO (5r .no)	Serial No.	Unit ID for Modbus-RS485 Communication 1 to 247	¦	Device supports RS485 Communication.
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	Device supports RS485 Communication.
RTR.1 (rtr . l)	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 . l)	Retransmission -1 Direction	Set Direction for the Retransmission Output-1 rEu / d ir 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 Refer Retransmission o/p table on Page 54 for more info.	d ir	Device Supports Retransmission Output.

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Parameter (PV display) Symbol / Name		Setting Name & Description	Default Value	Show if Only
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 / dir 0 : REV (REVERSE) 1 : DIR (DIRECT)	dir	Device Supports Dual Retransmission Output.
A.CJC (A.CJC)	Auto ColdJunction Compensation	Select Auto Cold Junction Compensation required or not for TC input Type. no / yES 0 : NO 1 : YES	yES	Input Type is TC
F.CJC (F.CJC)	Fix cold junction Compensation	Set Fix cold junction Compensation value. 0 to 60.0 °C	0.0	Input Type is TC & A.CJC is NO
VER (uEr)	Version	Shows the Version of the Current Firmware	-	
PASS (PASS)	Password	Set Device Password 0 to 9999	1	

7.4 CALIBRATION MODE

CALIBRATION PARAMETERS				
Parameter (PV display)		**Setting Name & Description**	**Default Value**	**Show if Only**
Symbol	**Name**			
AMB (Amb)	Ambient	Ambient Adjustment	-	Input is TC
ZERO (ZEro)	ZERO	Calibration Zero for PV Input (SV Display : PV)	-	
SPAN (SPAn)	SPAN	Calibration Span for PV Input (SV Display : PV)	-	

RT.1.Z (rt .1 .2)	Retransmission-1 ZERO	Calibration Zero for Retransmission Output-1 (SV Display : If voltage: 0.000 If Current: 4.000)	-	Device Supports Retransmission Output
RT.1.S (rt .1 .5)	Retransmission-1 SPAN	Calibration Span for Retransmission Output-1 (SV Display : If voltage: 8.000 If Current: 20.00)	-	Device Supports Retransmission Output
RT.2.Z (rt .2 .2)	Retransmission-2 ZERO	Calibration Zero for Retransmission Output 2 (SV Display : If voltage: 0.000 If Current: 4.000)	-	Device Supports Dual Retransmission Output
RT.2.S (rt .2 .5)	Retransmission-2 SPAN	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.

➤ 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?
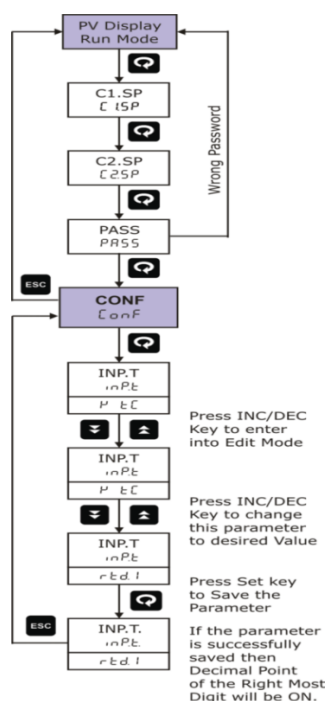
8. CONTROL FUNCTION

- Model LC5296-XP-AT is a microcontroller based PID controller& ON-OFF Controller.
- Model LC5296-XPismicrocontroller based ON-OFF Controller without PID controlling.

8.1 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 setpoint. 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.
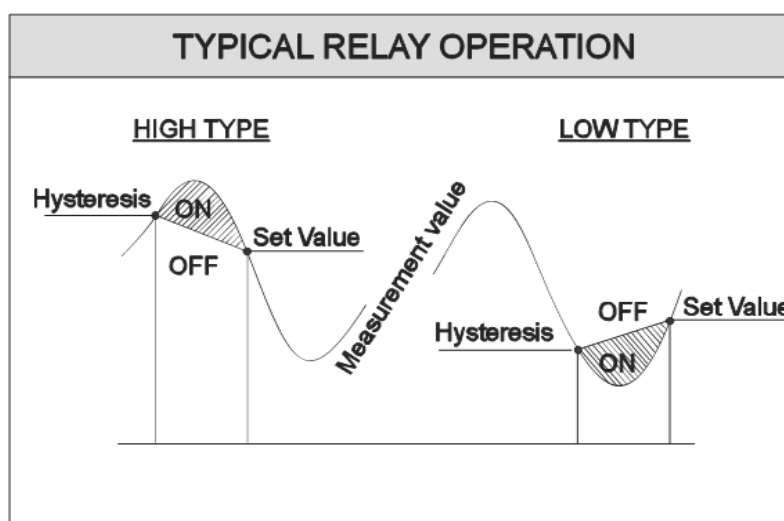
Figure 8.1: Typical Relay operation

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.

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NOTE:-

- ➤ **LC5296-XP is having only ON-OFF controlling so no need to do any additional setting.**
- ➤ **Whereas LC5296-XP-AT has both ON-OFF & PID Controlling. If ON-OFF controlling is required, C.OP.T (Control Type) must be selected as ON-OFF.**
- ➤ **For LC5296-XP-AT, ON-OFF control type is available for Relay & SSR output type only.**
- ➤ **In LC5296-XP-AT, when PB,TI,TD term is '0' and auto tune is set 'no', and unit is not in manual mode, then control output will work as on-off controller else it will work as PID controller**

8.2 PID Control

(LC5296-XP-AT Only)

AUTO TUNE FUNCTION:
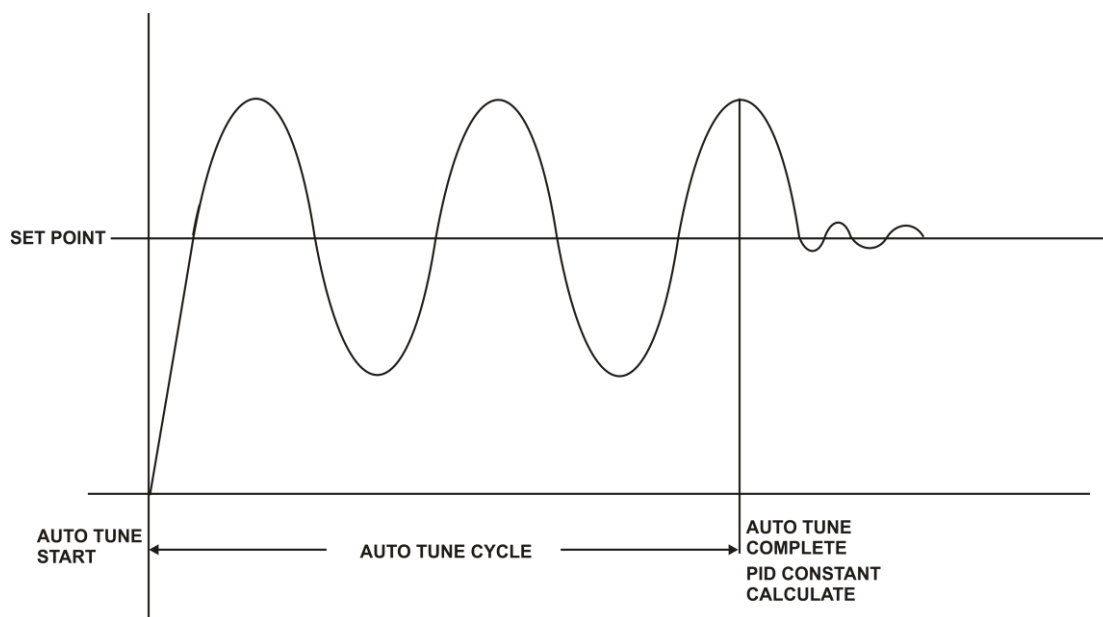
Auto Tuning:

The Auto tuning process is performed at set point. Temperature will oscillate around the set point during tuning process. Set a set point to a lower value if overshooting around the normal process value is likely to cause damage. To start the auto tuning process, set the desired set point, select the parameter AT in TUNE menu and set it to YES.

During Auto tuning lower display will flash AT (AUTO) message. After auto tune procedure is completed, the AT message will be removed and controller will revert back to the PID control by using the new calculated PID values. The PID values obtained are stored in the nonvolatile memory.

Control Parameter:-

Proportional BAND:

Proportional action is the action which the control output varies in proportion to the deviation between the setting value and the processing temperature. If the proportional band is narrowed, even if the output changes by a slight variation of the processing temperature, better control results can be obtained as the offset decreases. However, if when the proportional band is narrowed too much, even slight disturbances may cause variation in the processing temperature, and control action changes to ON/OFF action and the so called hunting phenomenon occurs. Therefore, when the processing temperature comes to a balanced position near the setting value and a constant temperature is maintained, the most suitable value is selected by gradually narrowing the proportional band while observing the control results.

Integral Time:

Integral action is used to eliminate offset. When the integral time is shortened, the returning speed to the setting point is quickened. However, the cycle of oscillation is also quickened and the control becomes unstable.

Derivative Time:

Derivative action is used to restore the change in the processing temperature according to the rate of change. It reduces the amplitude of overshoot and undershoots width. If the derivative time is shortened, restoring value becomes small, and if the derivative time is made longer, an excessive returning phenomenon may occur and the control system may be oscillated.

Manual Reset:

Virtually no process requires precisely 50% output on single output controls or 0% output on two output controls. Because of this many older control designs incorporated an adjustment called manual reset (also called offset on some controls). This adjustment allows the user to redefine the output requirement at the set point. A proportioning control without manual reset or Integral time (defined above) will settle out somewhere within the proportioning band but likely not on the set point.
Some controls use manual reset (as a digital user programmable value), this allows the user to preprogram the approximate output requirement at the set point to allow for quicker settling at set point when Automatic reset (Integral time) set to zero. Range for the manual reset is -50.0% to +50.0% of proportional band.

Cycle Time:

The Cycle time for output is the time where the output is on for percentage of that time and off for a percentage of that time, creating a portioning effect. The cycle time is only used where PI, PD or PID control action is used. The shorter the cycle time, the higher the proportionate resolution is, and better is the control.
For Relay output: Set to 10 to 300 seconds or more
For SSR output: Set to 1 to 60 seconds or more

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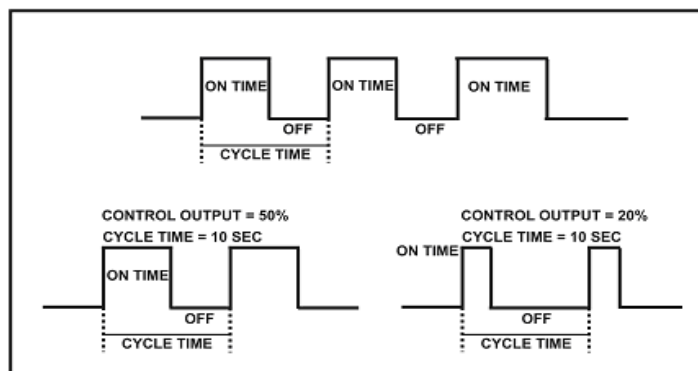
BASIC PID TUNING PROCEDURE:

ADJUSTMENT SEQUENCE	SYMPTOM	SOLUTION
Proportional Band	Slow Response	Decrease PB
	Overshoot or Oscillation	Increase PB
Integral Time	Slow Response	Decrease TI
	Instability orOscillation	Increase TI
Derivative Time	Slow Response or Oscillation	Decrease TD
	High Overshoot orInstability	Increase TD
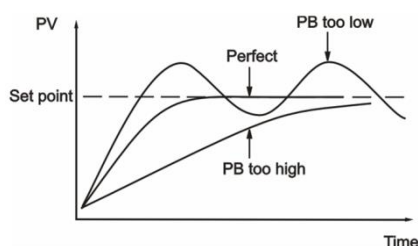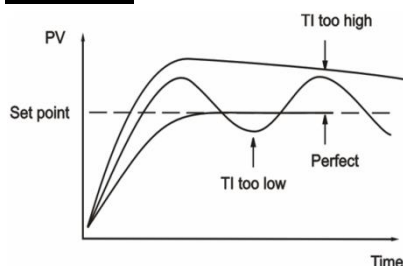
P ACTION: -   **I Action: -**   **D Action: -**
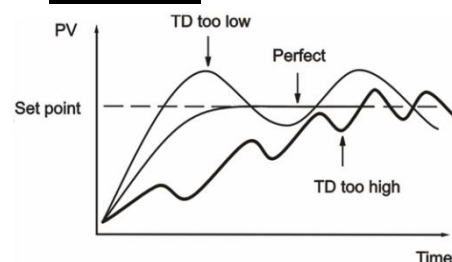
Control output Selection:

"C.OP.T"	"OP.T"	Terminal 4,5,6	Terminal 1,2,3	Terminal 15, 16	Terminal 17, 18
P/PI/PID	Relay	USE FOR CONTROL ACTION	ALARM2	AO output	AO Output/ Communication
	SSR	USE FOR CONTROL ACTION	ALARM2	AO output	AO Output/ Communication
	Linear	ALARM1	ALARM2	USE FOR CONTROL ACTION	AO Output/ Communication
ON-OFF Action	Relay	USE FOR CONTROL ON-OFF ACTION	ALARM2	AO output	AO Output/ Communication

NOTE:-At a time either Relay or SSR is provided(factory set For Terminal 17, 18 only one is available (AO Output or Communication

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8.3 Ramp and Soak Function:

(LC5296-XP-AT Only)

This function is used to stop the sudden change of set point. The ramp function is performed in following conditions. The target set point is changed. Target set point number is changed. (**For example:** Switching from SP-1 to SP-2). The power is turned ON or the controller is recovered from power failure. A change is made frommanual mode to auto mode.

When the process value crosses the set point value for the first instant, a "soak period" begins.
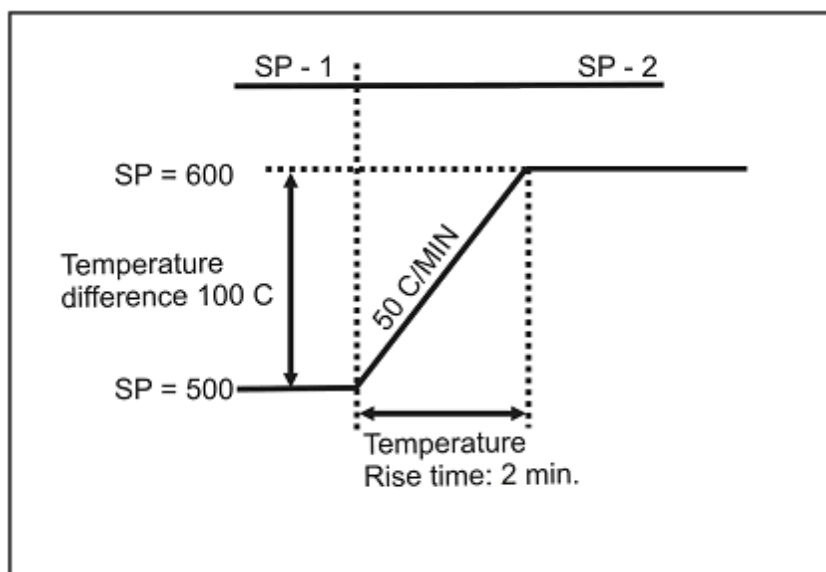
The ramp function will be performed when ramp unit parameter is selected as ñ¹ɴʀ (minute rate) or Hʀʀ (hour rate). The ramp rate can be programmed by setting the parameter rmp.r.

The Soak rate is programmed by setting 5oP.r. Soak time will be performed according to 5.hod and 5.r5t. When the soak type is 5.hod it will not reset the soak rate when the power is down and when the Soak type is 5.r5t it will reset the soak rate when the power is down.

The ramp and Soak function will be cancelled in following conditions.
• A change is made from Auto mode to manual mode.
• Sensor Failure occurs.
• Auto tuning function is activated.

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9. ALARM OUTPUT

Available Only for LC5296-XP-AT

For all Alarm outputs there are five settings. (As shown in configuration mode Menu)

- Set Value (in run mode)
- Type
- Hysteresis(Dead band)
- Direction (Normal/Fail safe)
- Delay

<u>**SET VALUE:**</u> Alarm set point

9.1 ALARM TYPES

Various alarm operations are shown in the reference figure.

ALARM TYPE NO	Display message	ALARM TYPE	Note
0	nonE	None	NO operation available
1	Pud.H	Deviation High alarm	Ref figure 3
2	Pud.L	Deviation Low alarm	Ref figure 4
3	Pud.r	Deviation High & Low range alarm	Ref figure 5
4	Pud.b	Deviation High & Low Band alarm	Ref figure 6
5	Pu.AH	Absolute value High alarm	Ref figure 1
6	Pu.AL	Absolute value Low alarm	Ref figure 2
7	SP.AH	Absolute value set point high alarm	Ref figure 7
8	SP.AL	Absolute value set point low alarm	Ref figure 8
9	P.Sd.H	Deviation High alarm with standby	Same as figure 3
10	P.Sd.L	Deviation Low alarm with standby	Same as figure 4
11	P.Sd.r	Deviation High & Low range alarm with standby	Same as figure 5
12	P.Sd.b	Deviation High & Low limit alarm with standby	Same as figure 6
13	P.S.AH	Absolute value High alarm with standby	Same as figure 1
14	P.S.AL	Absolute value Low alarm with standby	Same as figure 2
15	Pu-E.	PV error(OPEN/OVER/UNDER)	Note 1

<u>**NOTE-1:**</u>
The fault diagnosis output turns on in case of input burnout (PV) failure.

Absolute Value High Alarm
Figure: 1

Absolute Value Low Alarm
Figure: 2

Deviation High Alarm
Figure: 3

Deviation Low Alarm
Figure: 4

Deviation High/Low Range Alarm
Figure: 5

Deviation High/Low Band Alarm
Figure: 6

Absolute Value
Set Point High Alarm
Figure: 7

Absolute Value
Set Point Low Alarm
Figure: 8
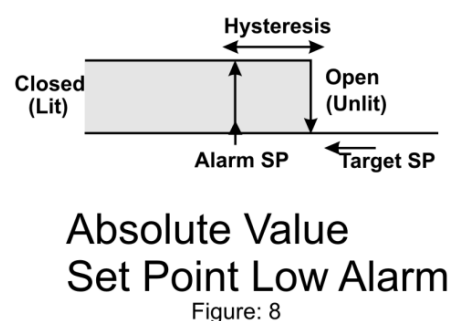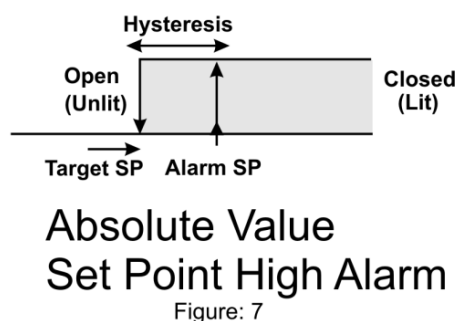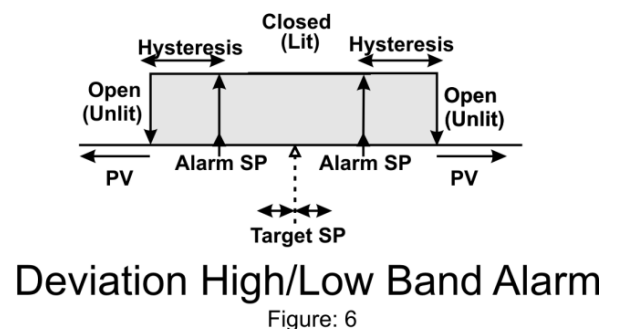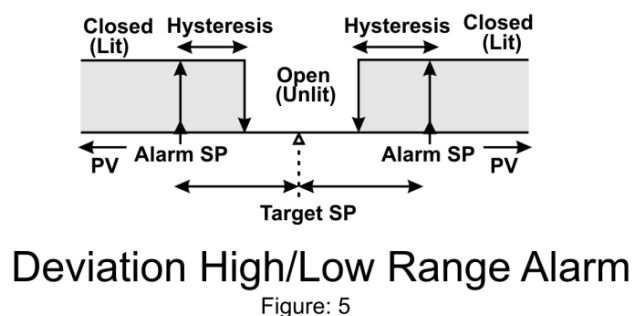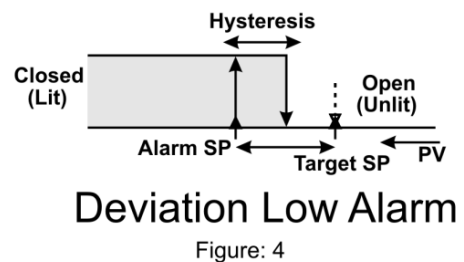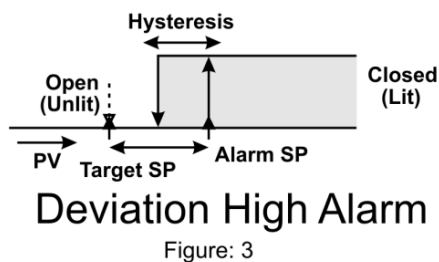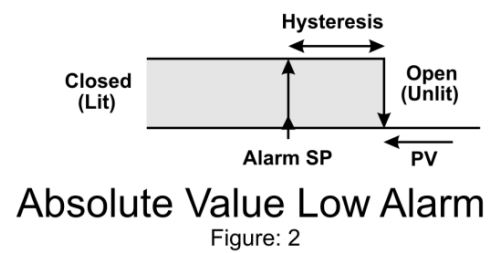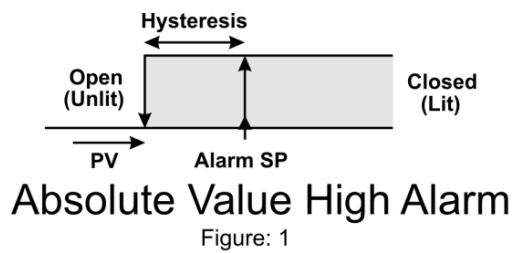
NOTE:-
➤ LIT = LED on, UNLIT = LED off
➤ Up arrow indicate Alarm will ON from this value.
➤ Down arrow indicate Alarm will OFF from this value.

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Hysteresis (Dead band): Hysteresis (Dead band) application is shown in the figure.

Direction:
All the figures here are shown considering the setting is direct (Normal). If the settings are reversing (Fail Safe), the relays will behave exactly the opposite. However, it's worth mentioning that the relays will be in off (de-energized state on Power on / reset condition). They will energize only after approximate 5 seconds. When alarm type none is selected, ALRAM relay status depends on Direction.

Delay:
A time delay can be provided for the actual output. The relay will operate after the set delay time.

Standby operation:
For alarm types, 9 to 14, the relay action happens only after the PV has crossed the SP after power on.

Example:-

Stand-by Action

FIGURE 9.1. ALARM OUTPUT DIAGRAM

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10. CALIBRATION PROCEDURE

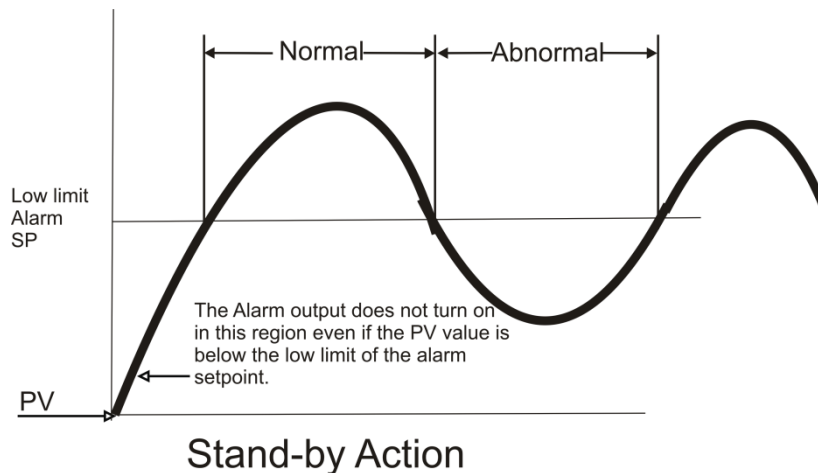### 10.1 Procedure for CAL-zero and CAL-span

- 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.

10.2 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.

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11. COMMUNICATION PROTOCOL–MODBUS RTU

11.1 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.

<u>**Function Code for Modbus**</u>

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

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.

11.2 Modbus Parameter Address

Sr. No.	Parameters	Absolute Address	Type	Access Type	LC5296-XP-AT	LC5296-XP
1	PROCESS VALUE	30001	Int	Read Only	✓	✓
2	POWER IN PERCENTAGE	30002	Int	Read Only	✓	✗
3	AUTOTUNE STATUS	30003	Int	Read Only	✓	✗
4	AMBIENT	30004	Int	Read Only	✓	✓
5	SSR STATUS	30005	Int	Read Only	✓	✗
6	RELAY-1 STATUS	30006	Int	Read Only	✓	✓
7	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	LC5296-XP-AT	LC5296-XP
1	Input Type	40001	Int	R + W	✓	✓
2	Zero	40002	Int	R + W	✓	✓
3	Span	40003	Int	R + W	✓	✓
4	Filter	40004	Int	R + W	✓	✓
5	SET Type-1	40005	Int	R + W	✓	✓

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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	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	Control output type	40021	Int	R + W	✓	✗
22	Control type	40022	Int	R + W	✓	✗
23	Alarm-1 Type	40023	Int	R + W	✓	✗
24	Alarm- 2 Type	40024	Int	R + W	✓	✗
25	Alarm-1 hysteresis	40025	Int	R + W	✓	✗
26	Alarm-2 hysteresis	40026	Int	R + W	✓	✗
27	Alarm-1 logic	40027	Int	R + W	✓	✗
28	Alarm-2 logic	40028	Int	R + W	✓	✗
29	Alarm-1 delay	40029	Int	R + W	✓	✗
30	Alarm-2 delay	40030	Int	R + W	✓	✗
31	Auto CJC	40031	Int	R + W	✓	✓
32	Fixed CJC	40032	Int	R + W	✓	✓
33	Version	40033	Int	R	✓	✓
34	Password	40034	Int	R + W	✓	✓
35	Control set point-1	40035	Int	R + W	✓	✓
36	Alarm Set Point-1 Control Set Point-2 **(Refer Note-1)**	40036	Int	R + W	✓	✓
37	Set Value 2	40037	Int	R + W	✓	✗
38	Proportional band	40038	Int	R + W	✓	✗
39	Integral time	40039	Int	R + W	✓	✗
40	Derivative time	40040	Int	R + W	✓	✗

41	Cycle time	40041	Int	R + W	✓	✘
42	Output Direction	40042	Int	R + W	✓	✘
43	Manual reset	40043	Int	R + W	✓	✘
44	Sampling rate	40044	Int	R + W	✓	✘
45	Sampling period	40045	Int	R + W	✓	✘
46	%POWER	40046	Int	R + W	✓	✘
47	Auto/Manual	40047	Int	R + W	✓	✘
48	Control low	40048	Int	R + W	✓	✘
49	Control high	40049	Int	R + W	✓	✘
50	Ramp – type	40050	Int	R + W	✓	✘
51	Ramp – rate	40051	Int	R + W	✓	✘
52	Soak - rate	40052	Int	R + W	✓	✘
53	Soak type	40053	Int	R + W	✓	✘
54	offset	40054	Int	R + W	✓	✘
55	Function Key	40055	Int	R + W	✓	✘
56	INLO	40056	Int	R + W	✘	✓
57	INHI	40057	Int	R + W	✘	✓

11.3 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.

Note:

1. **For Model LC5296-XP-AT address 40035 refer to Alarm Set Point-1
   For Model LC5296-XP address 40035 refer to Control Set Point-2**

2. ✓ : Available for this Model.

   ✘ : Not Available for this Model.

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

4. **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.**

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(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.)

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

   EX: Input Type (Applicable Range: 0 to 11):

Input Type	Value
E-tc	0
J-tc	1
K-tc	2
T-tc	3
B-tc	4
R-tc	5
S-tc	6
RTD 0.1 degree	7
RTD 1 degree	8
0 – 5V	9
1 – 5V	10
0-10V	11

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12. Appendix

12.1 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.
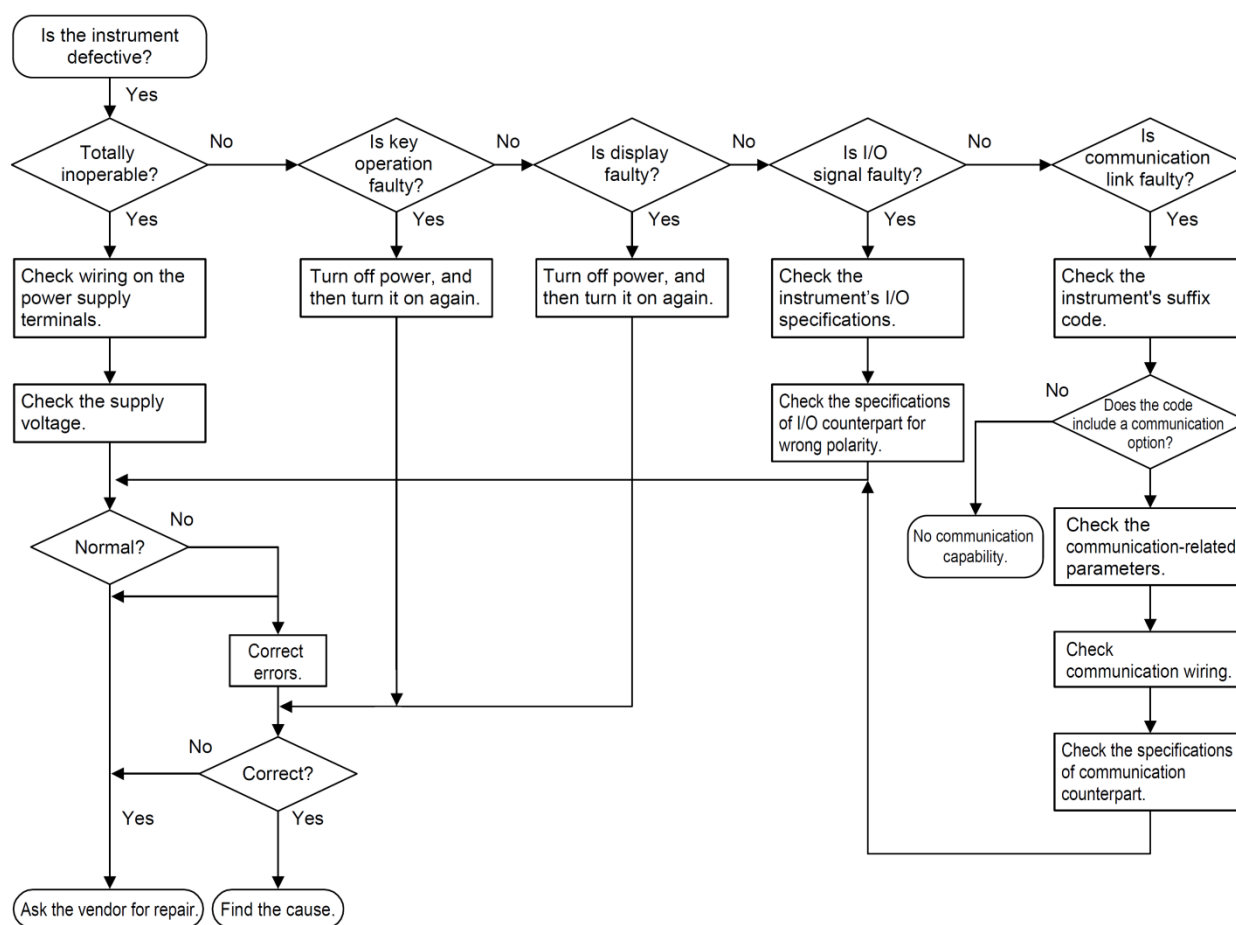
![IMPORTANT icon] **IMPORTANT**

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

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12.2 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

12.3 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.

## 12.4 Control Output Table for OPEN/OVER/ UNDER Condition

CONTROL OP	Process Scale	Output Direction (O.DIR)	DISPLAY INDICATION		
			OPEN	OVER	UNDER
4-20mamp Current	UP	DIR	20.0	20.0	4.0
	DOWN	REV	4.0	4.0	20.0
	UP	REV	20.0	4.0	20.0

	DOWN	DIR	4.0	20.0	4.0
SSR Pulse Output	UP	DIR	ON	ON	OFF
	DOWN	REV	OFF	OFF	ON
	UP	REV	ON	OFF	ON
	DOWN	DIR	OFF	ON	OFF
RELAY	UP	DIR	ON	ON	OFF
	DOWN	REV	OFF	OFF	ON
	UP	REV	ON	OFF	ON
	DOWN	DIR	OFF	ON	OFF

## 12.5 Jumper Settings for Addon Card Selection &RetransmissionOutput Type

- Thesedevicescome with different Variants differing by various Output option available.
- There are Two Addon 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:
  - o Voltage (0-10VDC, 0-5VDC, 1-5VDC)
  - o Current (4-20mADC, 0-20mADC)
- This can be Settable by changing the Position of Shorting Link Jumpers on Retransmission Addon Card shown in below figure.
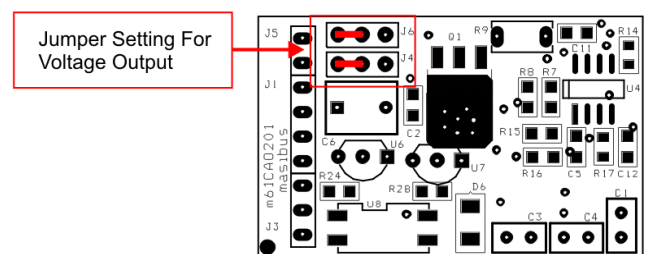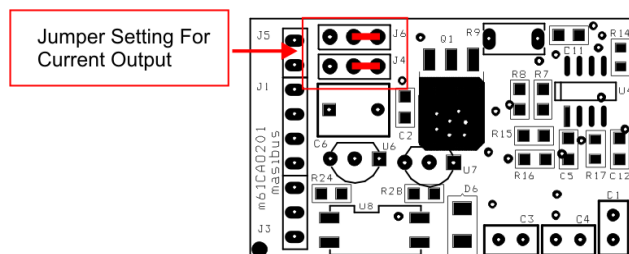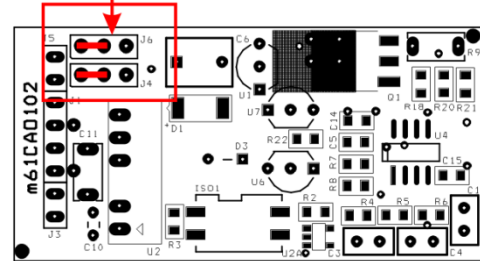

- **Jumper Setting for Retransmission card: m61Cao201**

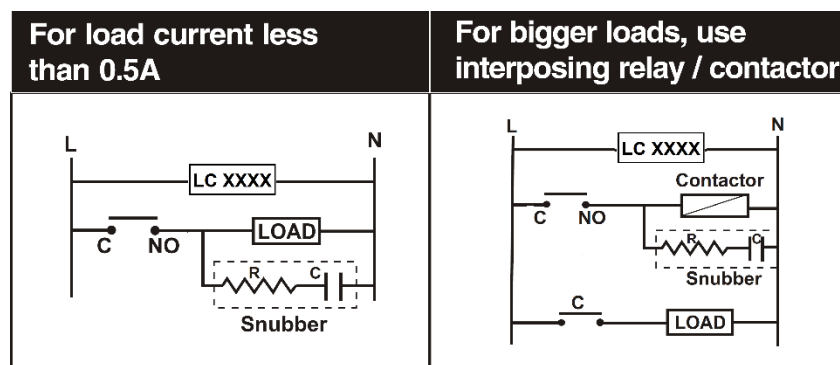- **Jumper Setting for Retransmission card: m61Cao102**
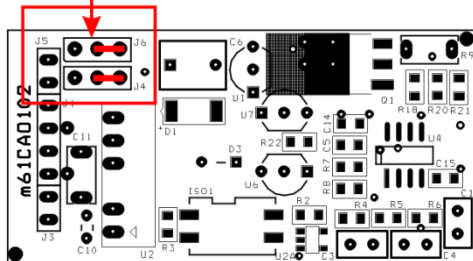
12.6 Load connection

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.