

User's Manual

DIGITAL TEMPERATURE CONTROLLER

5002U-P



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1.INTRODUCTION

Foreword

Thank you for purchasing 5002U-P Temperature controller. This manual describes the basic functions and operation methods of 5002U-P. 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 continues 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 our 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.

Trademarks

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Adobe, Acrobat, and Postscript are either registered trademarks or trademarks of Adobe Systems Incorporated. All other product names mentioned in this user's manual are trademarks or registered trademarks of their respective companies.

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.

Product Ordering Code

Ordering Code								
Model	Input		Power Supply		Retransmission o/p		Communication o/p	
5002U-P	X		X		X		X	
	1	E	U1	85-265VAC /100-300 VDC	N	None	N	None
	2	J	U2	18-36VDC	1	4-20 mA	Y	RS 485
	3	K			2	0-20 mA		
	4	T			3	1-5V		
	5	B			4	0-5V		
	6	R			5	0-10V		
	7	S						
	8	N						
	P	C						
	Q	G						
	9	Pt-100						
	A	-10 to 20 mV						
	B	0 to 75mV						
	C	0 to 100 mV						
	D	0.4 to 2V						
	E	0 to 2V						
	F	0 to 5V						
	G	1 to 5V						
	H	0 to 10 V						
	S	Special+						

+: Consult Factory

The 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.

List of Accessories

The product is provided with the following accessories according to the model and suffix codes (see the table below). Check that none of them are missing or damaged.

No	Item name	Part number	Qty	Remarks
1	Mounting Clamps	-	2	

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	<i>This indicates a danger that may result in death or serious injury if not avoided.</i>
 CAUTION	<i>This indicates a danger that may result in minor or moderate injury or only a physical damage if not avoided.</i>

2. INSTALLATION DETAILS

2.1 How to Install

Mounting method: Panel mounting

To install the controller select a location where:

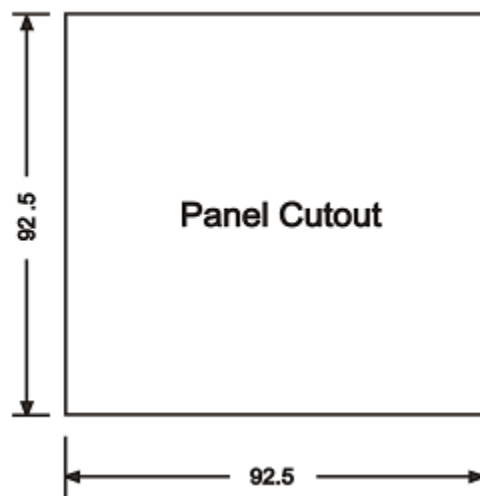
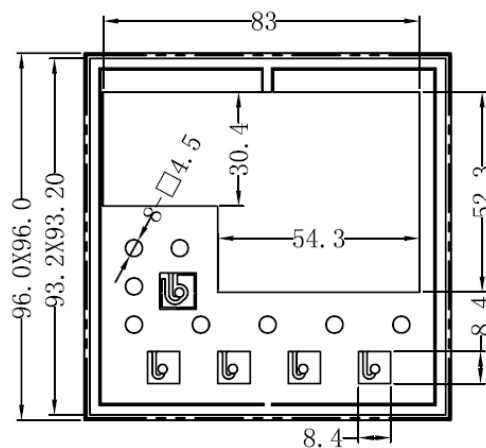
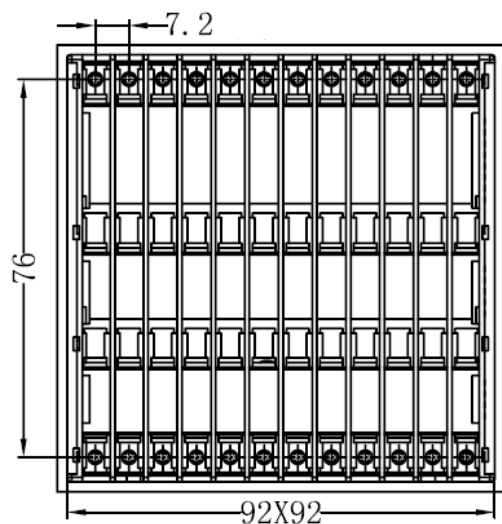
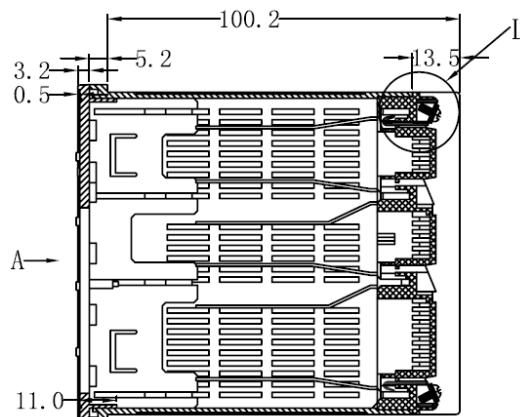
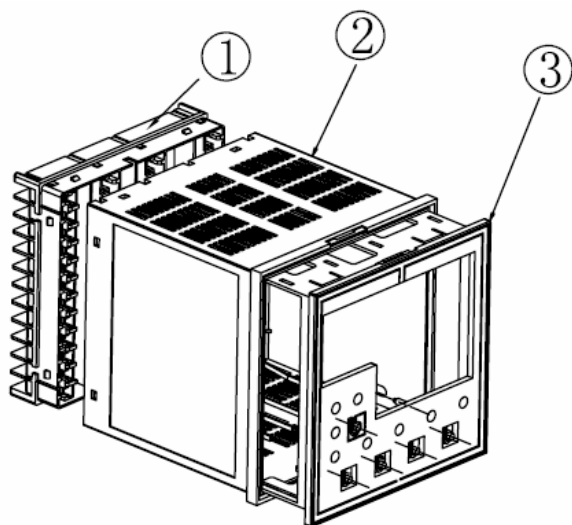
- ✓ no one may accidentally touch the terminals
- ✓ mechanical vibrations are minimal
- ✓ corrosive gas is minimal
- ✓ temperature can be maintained at about 25°C to 35°C and the fluctuation is minimal
- ✓ no direct radiant heat is present
- ✓ no magnetic disturbances are caused
- ✓ no wind blows against the terminal board
- ✓ no water splashed
- ✓ no flammable materials are around



Turn off the power to the controller before installing it on the panel because there is a possibility of electric shock

2.2 External Dimensions and Panel Cutout Dimensions

Unit: mm



2.3 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.
- 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 – 23** 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.



CAUTION:

High voltage transients may occur when switching inductive loads such as some contactors or solenoid valves. Through the internal contacts, these transients may introduce disturbances which could affect the performance of the instrument.

For this type of load it is highly recommended that a “snubber” is connected across the normally open contact of the relay switching through load. The snubber recommended consists of a series connected resistor/capacitor (typically 15nF/100Ohms). A snubber will also prolong the life of the relay contacts. A snubber should also be connected across the output of a triac output to prevent false triggering under line transient conditions.

3. HARDWARE SPECIFICATION DETAILS

3.1 Inputs

Analog Input	
Input Type	Thermocouple (E, J, K, T, B, R, S, N,C, G), RTD (Pt100), Current, Voltage
Display Range	Refer Table 6.1 - Page No. 22
Accuracy	TC(E,J,K,T,C,J,N,C,G), RTD: $\pm 0.1\%$ of F.S ± 1 degC TC(B,R,S): $\pm 0.2\%$ of F.S ± 1 degC Current, Voltage: $\pm 0.1\%$ of F.S ± 1 Count
ADC Resolution	17 bits
Display Resolution	0.1°C / 1 Count*
Sampling Rate	4 Samples/Sec
CJC Error	± 2.0 °C Max
Sensor Burnout current	0.25uA
RTD excitation current	1mA Max
Allowable wiring resistance for RTD	Maximum 15 ohms/wire (Conductorresistance between three wires should be equal)
NMRR	> 40 dB
CMRR	> 120 dB
Temp-co	< 100ppm/°C
Input Impedance	> 1MΩ
Max Voltage	20VDC
Protection	Wire beak detection of any wire
Resolution	0.1 degC

* For G, C TC: 1.0 °C / 1 Count

3.2 Display & Keys

Front Panel Details	
PV Display	4-digits, 7-segment, Red LEDs, character height of 0.56"
SV Display	4-digits, 7-segment, Green LEDs, character height of 0.4"
Status Indication	Red LEDs for RELAY and Alarm status Green LEDs for Communication, Red LEDs for Set Point selection 1, 2 and 3.
Keys	5 keys (Menu, Escape, Shift, Increment and ACK)

3.3 Output

Control Output (Field Programmable)	
Output Type	ON/OFF or Proportional
Proportional Band	0.1 to 999.9
Cycle time	1 to 250 Sec
MR (Manual Reset)	-50% to 50%
Hysteresis	1 to 250 (on/off mode)

Retransmission	
Number of output	1
Output Signal	4-20mA / 0-20mA / 1-5VDC / 0-10V DC
Load resistance	
For Current o/p	<500Ω
For Voltage o/p	>3KΩ
Output accuracy	$\pm 0.25\%$ of span

Relay / Alarm Output	
Relays	4(Configurable for control/Alarm)
Type	Single Change over (C, NO, NC)
Rating	5A @ 230VAC / 30VDC
Mode	Proportional* or ON/OFF control (field selectable)

Note: * proportional control settable for relay No.1 only.

Loop Power Supply	
Supply Voltage	24VDC ($\pm 1V$) @30mA with Inbuilt Short Circuit Protection
Minimum load resistance	800 ohms

3.4 Communication Details

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

3.5 Power Supply

Standard	85-265VAC/ 100-300VDC
Power consumption	<12 VA

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, Retransmission and Communication O/P.

Insulation resistance: 50M Ω or more at 500 V DC between power terminals and grounding terminal.

3.6 Physical

Size	96(W) x 96(H) x 110(D)mm
Front Bezel	96 x 96 mm
Panel Cutout	92.5 + 0.8(W) x 92.5 + 0.8(H) mm
Depth behind Panel	110 mm
Installation	Panel-mounting type. With Top and Bottom mounting hardware (1 each)
Weight	500 gms. (Approx)
Case color	Black
Enclosure Material	Molded ABS
Terminal Cable Size	2.5mm ²
Accessories	Two mounting clamps, 100 ohms Ext. Resistor

3.7 Environmental

Operating temperature	0-55 °C
Storage temperature	0-80 °C

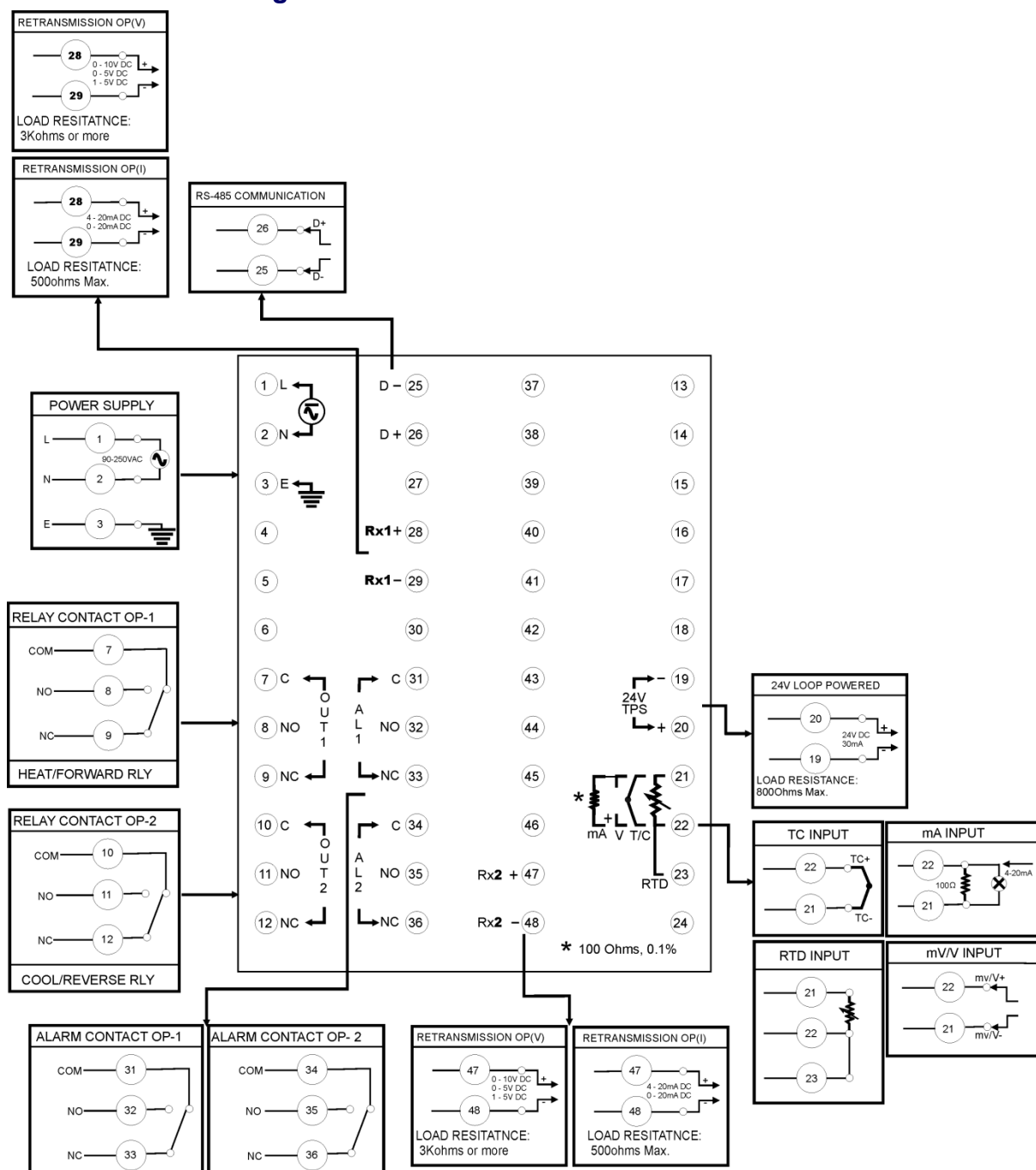
Humidity	20-95 %RH non-condensing
Tempco	FOR PV < 100ppm. FOR Retransmission(Current and Voltage) < 150ppm
Instrument Warm-up Time	15 minutes after power on

3.8 Special Feature

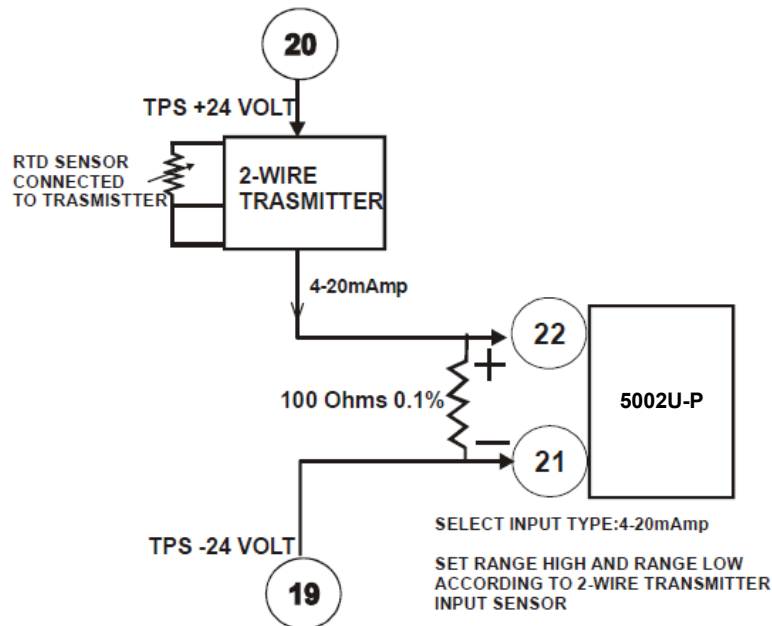
- Square Root Extraction
- Input Scalability (For Linear Input type)

4. WIRING DIAGRAM

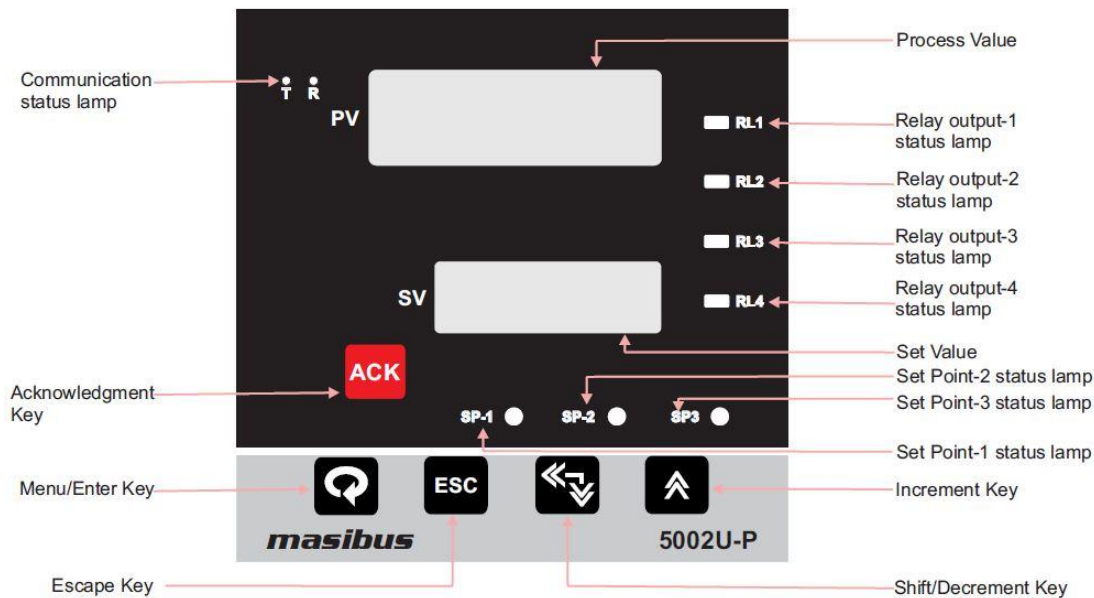
4.1 Back Plate Wiring Detail



4.2 Transmitted Power Supply Wiring Diagram



5. FRONT PANEL DETAILS



Name of Part	Function
Process Value Display(PV)	Display process value. Display parameter name when user set parameter. Display error message when an error occurs.
Set Value Display (SV)	Display set value. Display parameter value of parameter in process value field when user set parameter.
Output Indicator	In Heat action, RL1 lamp will Indicate the on status of

Lamps(RL1 & RL2)	the heat output. When Alarm 1 & 2 Occurs, Respective Alarm lamp will light (In Red).
Alarm Indicator Lamps(RL3 & RL4)	When Alarm 3 & 4 occurs, respective Alarm lamp (RL3 & RL4) will light (In Red).
Communication Indicator Lamps(T,R)	Indicator lamps will blink when the communication is on.

Name of Part	Function
Set Point – 1 (SP-1)	Indicator lamp will on when Set Point for Alarm 1 is selected. All controller action with respect to SP-1
Set Point – 2 (SP-2)	Indicator lamp will on when Set Point of Alarm 2 is selected.
Set Point – 3(SP-3)	Indicator lamp will on when Set Point of Alarm 3 is selected.

5.1 Key Function Description

MENU/ENTER KEY:



It is used to enter in the sub menu (various levels) and save the parameters to nonvolatile memory, when user setting a proper data by Increment and shift key for parameter configuration.

ESCAPE KEY:



It is used to come out from any sub menu (various levels) to the run mode.

INCREMENT KEY:



It is used to increment the parameter for selection. Value of parameter can be incremented by pressing this key. When first time increment key pressed, DP (decimal point) in SV display blink, so user can modify the value with increment key. It is used to increment the value in particular digit. Value can be incremented from 0- 9 and from '9' again it rollovers to '0'.

SHIFT KEY/DECREMENT KEY:



It is used to Shift the digit to set the parameter as describe in increment key when DP (decimal point) started to blink. Menu key is used to go forward to show next parameter and Shift key is used to go backward to show previous parameter.

ACKNOWLEDGEMENT KEY:

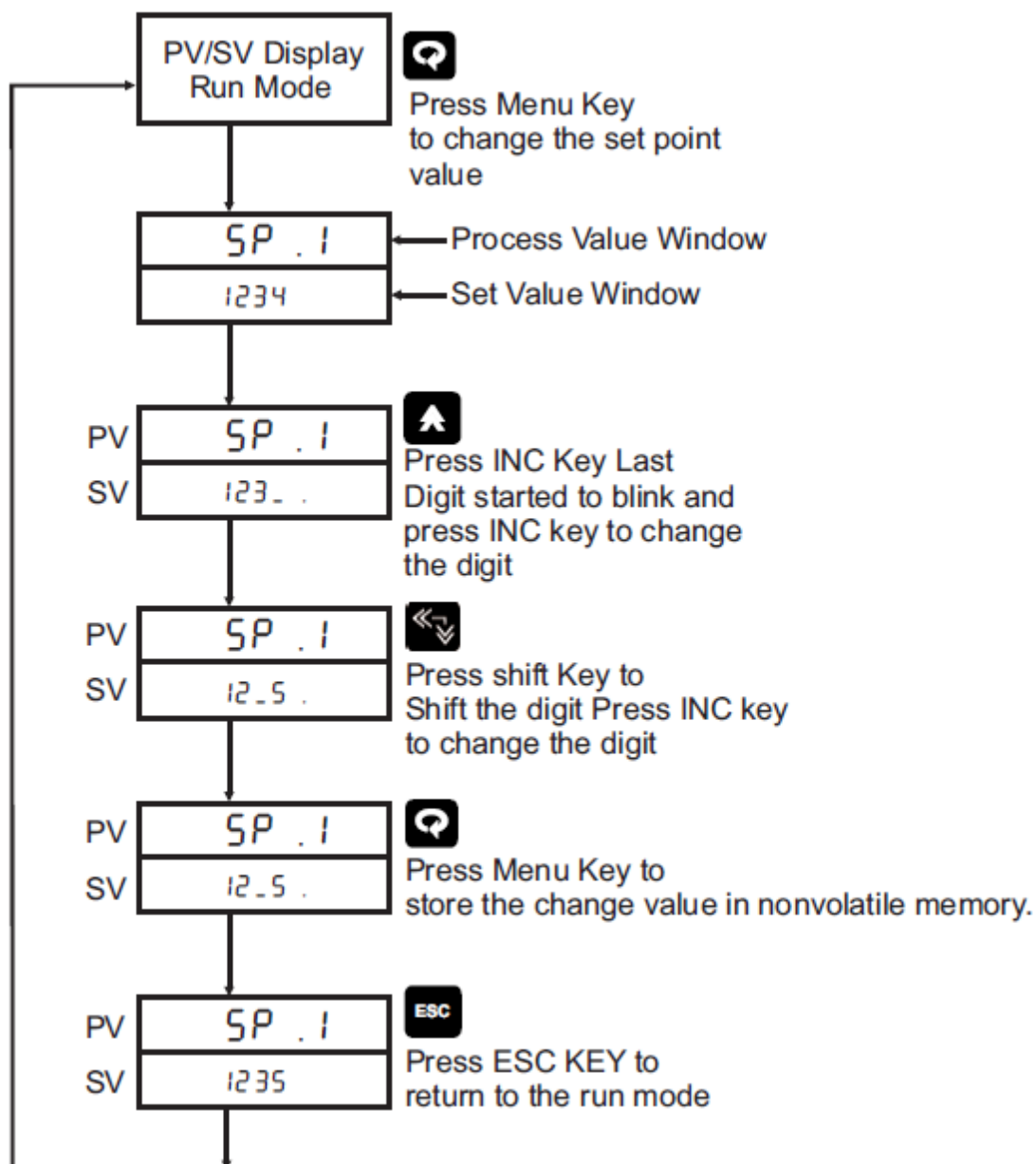


It is used as Acknowledgement key for Alarm type relay.

Example:

How to change SET POINT:-

SP.1 will be shown in operator mode and they can be editable.



NOTE: ALL other parameters can EDIT according to the above steps.

6. MENU LAYOUT

6.1 Run Time Indication/Function

Following parameters can view or change during run time.

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

6.2 Set Point Setting

Pressing MENU key PV Display shows **SP . I**(SP.1) message . SV display shows **Set Point Value** Use Inc and shift key to modify value. OR press MENU key again to set value for next parameter.

Set Point Setting:				
Parameter (PV display)		Setting name and description (SV display)	Default value	Shows only if
Symbol	Name			
SP . I (SP.1)	Target point-1 Set	Depending on PV sensor type selected	200	Control type is on/off or P
Pb (Pb)	Proportional Band	0.1 to 999.9	50.0	Control type is P
HY (HY)	hysteresis (For On/Off control)	1 to 250	2	Control type is on/off
A1SP (A1.SP)	Alarm 1 Set point	PV range selected ¹	0	Output Type is none
A1HY (A1.HY)	Alarm 1 Hysteresis	1 to 250	2	Output Type is none
A2SP (A2.SP)	Alarm 2 Set point	PV range selected ¹	0	
A2HY (A2.HY)	Alarm 2 Hysteresis	1 to 250	2	
A3SP (A3.SP)	Alarm 3 Set point	PV range selected ¹	0	
A3HY (A3.HY)	Alarm 3 Hysteresis	1 to 250	2	
A4SP (A4.SP)	Alarm 4 Set point	PV range selected ¹	0	
A4HY (A4.HY)	Alarm 4 Hysteresis	1 to 250	2	

6.3 LEVEL – 1

Pressing MENU key for 3 seconds (approx.) PV Display shows **mode** (mode) message. SV display shows **LvL 1** (LvL1) Use Inc key to move to other menu levels.

LEVEL 1: Alarm Settings				
Parameter(PV display)		Setting name and description SV Display	Default value	Shows only if
Symbol	Name			
Pwd (Pwd)	Password	0 to 9999>Password	-	LOCK-1 set on in Level-3

		Protection for Level-1)		
A1tP (A1.tP)	Alarm 1 Type	0 to 22. Refer alarm type Table-8.1	0 (none)	Output Type is none
A1LC (A1.LC)	Alarm 1 Logic (normal or fail safe selection)	norm/FLSF 0:(norm) 1: (FLSF)	Normal	Output Type is none
A1Dy (A1.Dy)	Alarm 1 Delay	1 to 99 seconds	10	Output Type is none
A1Lt (A1.LT)	Alarm 1 Latch	YES/no 1:(YES) 0:(no)	0	Output Type is none
A2tP (A2tP)	Alarm 2 Type	0 to 22. Refer alarm type Table-8.1	0(none)	
A2LC (A2.LC)	Alarm 2 Logic (normal or fail safe selection)	norm/FLSF 0:(norm) 1: (FLSF)	Normal	
A2Dy (A2.Dy)	Alarm 2 Delay	1 to 99 seconds	10	
A2Lt (A1.LT)	Alarm 2Latch	YES/no 1:(YES) 0:(no)	0	
A3tP (A3.tP)	Alarm 3 Type	0 to 22. Refer alarm type Table-8.1	0(none)	
A3LC (A3.LC)	Alarm 3 Logic	norm/FLSF 0:(norm) 1: (FLSF)	Normal	
A3Dy (A3.Dy)	Alarm 3 Delay	1 to 99 seconds	10	
A3Lt (A1.LT)	Alarm 3Latch	YES/no 1:(YES) 0:(no)	0	
A4tP (A4.tP)	Alarm 4 type	0 to 22. Refer alarm type Table-8.1	0(none)	
A4LC (A4.LC)	Alarm 4 Logic	norm/FLSF 0:(norm) 1: (FLSF)	Normal	
A4Dy (A4.Dy)	Alarm 4 Delay	1 to 99 seconds	10	
A4Lt (A1.LT)	Alarm 4Latch	Yes/no 1:(YES) 0:(no)	0	

¹ If the value falls outside the range, output is unpredictable.

6.4 LEVEL - 2

Pressing MENU key PV for 3 seconds (approx.) Display shows **mode** (mode) message. SV display shows **LvL2** (LvL2) Use Inc key to move to other menu

levels. This level allows user to select input type and some other parameters as shown below.

LEVEL 2: Functional Parameters Configuration Part-1				
Parameter (PV display)		Setting name and description (SV display)	Default value	Shows only if
Symbol	Name			
Pwd (Pwd)	Password	0 to 9999 (Password Protection for Level-2)	-	LOCK-2 set on in Level-3
inP.t (inP.t)	PV Input Type (E, J, K, T etc.)	Follow Table-6.1	K-TC	
ACJC (A.CJC)	Auto Cold junction Compensation	Yes/no 1: (YES) 0: (no)	YES	Input sensor is T/c. type
FCJC (F.CJC)	Fix cold junction Compensation	0 to 60.0 Degree	0.0	Input sensor is T/c. type
Pv.Hi (Pv.Hi)	Process value range high setting (span > zero)	Range of the sensor (Table 6.1) / -1999 to 9999 (for linear input types)	1370	
Pv.Lo (Pv.Lo)	Process value range lower setting		-200	
IN.HI (IN.HI)	Input value range higher setting	Input high value (For Linear type only)	0	Input is linear type
IN.LO (IN.LO)	Input value range lower setting	Input low value (For Linear type only)	0	Input is linear type
dP (dP)	Decimal Point Setting	0 to 3	0	
ot (Ot)	Output Type	onoff / P / none 0: (onoff) – on-off 1: (P) – Proportional Control 2: (none) – None	0 (On-off)	
Pb (Pb)	Proportional Band	0.1 to 999.9	50.0	Control type is P
Ct (Ct)	Cycle Time	1 to 250 seconds	10	Control type is P
MR (MR)	Manual Reset	-50 to 50 %	0%	Control type is P
HY (HY)	hysteresis (For On/Off control)	1 to 250	2	Control type is on/off
PV.SC. (PV.SC.)	Process value scale	down / up 0: (down) 1: (up)	down	
o.dir (o.dir)	Output (Cool / Heat) Direction (Dir / Rev)	dir / rev 1: (dir) 0: (rev)	Rev	

rdly (rdly)	Relay Delay	0 to 99	0							
Sqrt (Sqrt)	Square Root for Linear Inputs Type	YES/no 1:(YES) 0:(no)	No	Input type selected is linear						
SP.no (SP.no)	Set point selection to display set point in RUN mode	1/2/3/4 1:(sp.1) 2:(sp.2) 3:(sp.3) 4:(sp.4)	1 (Set Point-1)							
FLtr (FLtr)	Filter for Process value (1 st order low-pass IIR filter)	0 to 60 seconds	5							
oFSt (oFSt)	Offset for Process Value	<table border="1"><tr><th>Input</th><th>Range</th></tr><tr><td>TC, RTD</td><td>-100.0 to 100.0</td></tr><tr><td>Linear</td><td>-1000 to 1000</td></tr></table>	Input	Range	TC, RTD	-100.0 to 100.0	Linear	-1000 to 1000	0	
Input	Range									
TC, RTD	-100.0 to 100.0									
Linear	-1000 to 1000									
SP (SP)	Set Point and hysteresis Display Option	UnLP/LP 0:(Unlock) 1:(Lock)	UnLP (Unlock)							

6.5 LEVEL - 3

Pressing MENU key for 3 seconds (approx.) PV Display shows Mode (mode) message. SV display shows **LvL3**(LvL3) Use Inc key to move to other menu levels. Press set key again to scroll through the menu items of particular level.

LEVEL 3: Functional Parameters Configuration Part-2				
Parameter (PV display)		Setting name and description (SV display)	Default value	Shows only if
Symbol	Name			
Pwd (Pwd)	Password	0 to 9999(Password Protection for Level-3)	-	LOCK-3 set on in Level-3
Sr.no (Sr.no)	Unit ID	1 to 247	1	-
bAUd (bAUd)	Communication Baud rate	9600/19.2K 0:(9600) – 9600 bps 1:(19.2K) – 19.2 Kbps	19.2k bps	
Pr.St (Pr.St)	Parity/Stop bit selection	P.N.S.1 /P.N.S.2/P.O.S.1 /P.E.S.1 0:(P.N.S.1)-parity none-stop bit-1 1:(P.N.S.2)-parity none - stop bit-2 2:(P.O.S.1)-parity	No parity /Stop bit - 2	

		odd -stop bit-1 3:(P.E.S.1)-parity even - stop bit-1		
r t lt (rtr.t)	Retransmission 1 Output Type	0-20/4-20 / 0-5v/ 1-5v 0- 10v 0:(0-20) – 0-20mA 1:(4-20) – 4-20mA 2:(0 - 5) – 0 – 5volt 3:(1 - 5) – 1 – 5volt 4:(0 – 10) - 0 -10volt	4-20 mA	
r ldr (r.dir)	Retransmission 1 direction	d ir/ rEv 1:(dir) 0: (rev)	Dir	
r t lH (rtr.H)	Retransmission 1 upper limit	-5.0% to 105.0%	105.0%	
r t lL (rtr.L)	Retransmission 1 lower limit	-5.0% to 105.0%	-5.0%	
r t lS (rtr.S)	Retransmission 1 Span	Higher Range of Output as per Range of the sensor	1370	
r t lZ (rtr.Z)	Retransmission 1 Zero	Lower Range of Output as per Range of the sensor	-200	
r t2t (rtr.t)	Retransmission 2 Output Type	0-20/4-20 / 0-5v/ 1-5v 0-10v 0:(0-20) – 0-20mA 1:(4-20) – 4-20mA 2:(0 - 5) – 0 – 5volt 3:(1 - 5) – 1 – 5volt 4:(0 – 10) - 0 -10volt	4-20 mA	
r2dr (r.dir)	Retransmission 2 direction	d ir/ rEv 1:(dir) 0: (rev)	Dir	
r t2h (rtr.H)	Retransmission 2 upper limit	-5.0% to 105.0%	105.0%	
r t2L (rtr.L)	Retransmission 2 lower limit	-5.0% to 105.0%	-5.0%	
r t2S (rtr.S)	Retransmission 2 Span	Higher Range of Output as per Range of the sensor	1370	
r t2Z (rtr.Z)	Retransmission 2 Zero	Lower Range of Output as per Range of the sensor	-200	
t.out (t.out)	Timeout of display back to PV/SV	10 to 100 Seconds	60	
Pwd (Pwd)	Password to Enter into lock mode	0 to 9999	-	
L o F	Lock LEVEL-1	L lo n/L lo F	L1 OF	

(LOCK)		1:L1on 0:L1oF		
L _o C _P (LOCK)	Lock LEVEL-2	L ₂ on/L ₂ oF 1:L2on 0:L2oF	L2 OF	
L _o C _P (LOCK)	Lock LEVEL-3	L ₃ on/L ₃ oF 1:L3on 0:L3oF	L3 OF	
L _o C _P (LOCK)	Lock LEVEL-4 Calibration	L ₄ on/L ₄ oF 1:L4on 0:L4oF	L4 ON	
S _P Wd (S.Pwd)	Password Set password to lock selected level	0 to 9999	0	if lock is on user can set password for all level

6.6 Calibration

Pressing MENU key PV Display shows *mode* (mode) message. SV display shows *Cal* (Cal) Use Inc key to move to other menu levels. Press MENU key again to scroll through the menu items of particular level. For more detail refer Calibration procedure.

Calibration:				
Parameter (PV display)		Setting name and description (SV display)	Default value	Shows only if
Symbol	Name			
P _W d (Pwd)	Password	0 to 9999(Password Protection for Level-4)	-	LOCK-4 set On in Level-3
A _{mb} (Amb)	Ambient	Ambient Adjustment	-	PV Sensor type is T/c.
t _c .L.S (tc.L.S)	Thermocouple and Linear Span Calibration	Depending on PV sensor type selected	-	Pv sensor type is T/c or Linear
r _t d.Z (rtd.Z)	Calibration Zero FOR RTD Input		-	PV Sensor type is RTD
r _t d.S (rtd.S)	Calibration Span FOR RTD Input		-	PV Sensor type is RTD
r _t 1Z (rtr.Z)	Retransmission1 Zero calibration		-	
r _t 1S (rtr.S)	Retransmission1Span calibration		-	
r _t 2Z (rtr.Z)	Retransmission2 Zero calibration		-	
r _t 2S (rtr.S)	Retransmission2 Span calibration		-	

6.7 Factory Reset Parameters

Pressing MENU key PV Display shows $\bar{n}odE$ (mode) message. SV display shows $F.rSt$ (F.rST) Use Inc key to move to other menu levels. Press MENU key again to scroll through the menu items of particular level.

Factory Reset Mode:				
Parameter (PV display)		Setting name and description (SV display)	Default value	Shows only if
Symbol	Name			
$P\bar{u}d$ (Pwd)	Password	0 to 9999	-	-
$L.dEF$ (L.dEF)	LOAD Default	$CL\backslash PAR$ (CAL)/(PAR) CAL - Only calibration set to default value PAR- All parameters excluding calibration will set to default value	-	-

Note: - Factory reset will load default parameters, as mention in MENU LAYOUT (Default value). Once this function applies, user has to switch off the instrument and again switch on the instrument to work according to Default values.

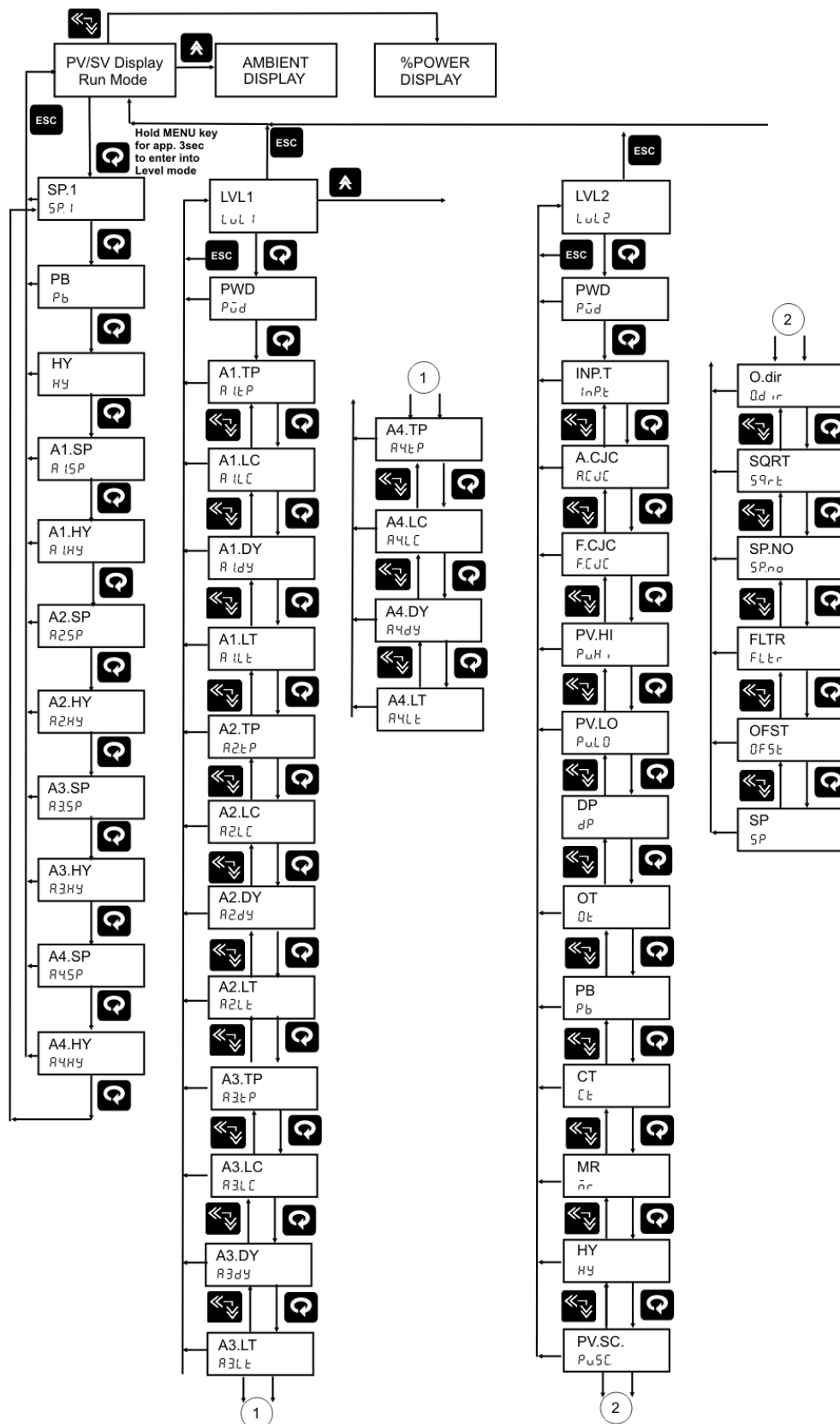
Note: -In menu layout, for each level **PASSWORD** will be enable using **LOCK ON/OFF** selection in Level-3. Also, **PASSWORD** can be set using $5.P\bar{u}d$ (S.PWD)

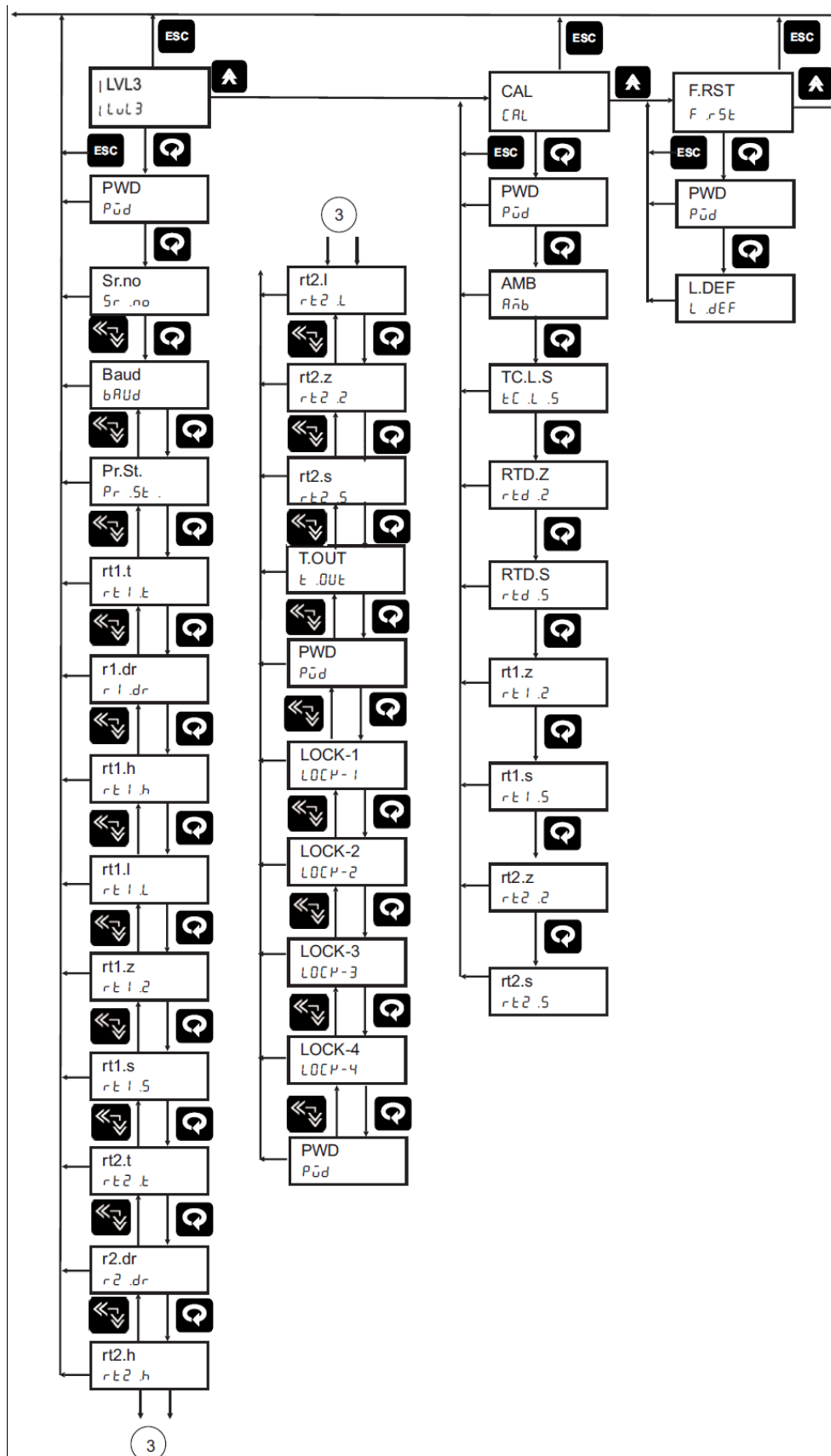
INPUT TYPE SELECTION TABLE:

Type	I/P NO	Type Display	Range	Accuracy	Resolution
E	1	$E\ t_c$	-200 to 1000°C	$\pm 0.1\%$ of instrument range ± 1 digit for temperature Equal to or higher than 0° c $\pm 0.2\%$ of instrument range ± 1 digit for temperature Below 0° c $\pm 0.2\%$ of instrument range ± 1 digit (B,R,S type TC)	0.1°C
J	2	$J\ t_c$	-200 to 1200°C		
K	3	$K\ t_c$	-200 to 1370°C		
T	4	$t\ t_c$	-200 to 400°C		
B	5	$b\ t_c$	450 to 1800°C		
R	6	$r\ t_c$	0 to 1750°C		
S	7	$s\ t_c$	0 to 1750°C		
N	8	$n\ t_c$	-200 to 1300°C		
C	20	$C\ t_c$	0 to 2310°C	$\pm 0.1\%$ of instrument range ± 1 digit	1°C
G	21	$G\ t_c$	0 to 2310°C		
RTD	9	rtd	-199.9 to 850.0°C	$\pm 0.1\%$ of instrument range ± 1 digit	0.1°C
-10 to 20mV	10	-1020	-1999 to 9999 Counts	$\pm 0.1\%$ of instrument range ± 1 digit	1 Count
0 to 75mv	11	$0-75$			
0 to 100mV	12	$0-100$			
0 to 2V	13	$0-2u$			
0.4 to 2V	14	$04-2$			
4 to 20mAmp	15	$4-20$			
0 to 20mAmp	16	$0-20$			
0 to 5V	17	$0-5u$			
1 to 5V	18	$1-5u$			
0 to 10V	19	$0-10u$			

Table 6.1

7. PARAMETER FLOW CHART





NOTE: It is important that the controller be set up in proper manner. Failure to do so could result in incorrect operation, as changing some parameters will change other related functions.

8. ALARMS

For all Alarm there are five settings. (As shown in LEVEL – 1 Menu)

- Set Value
- Type
- Hysteresis
- Direction (Normal/Fail safe)
- Delay
- Latch

SET VALUE: Alarm set point

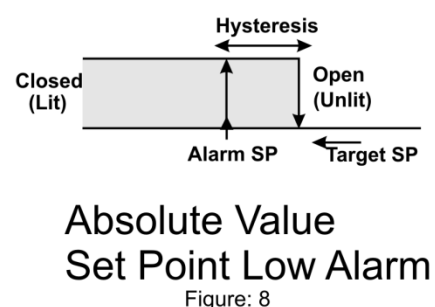
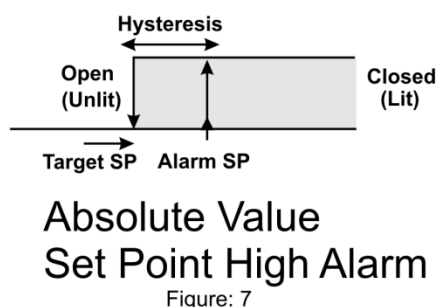
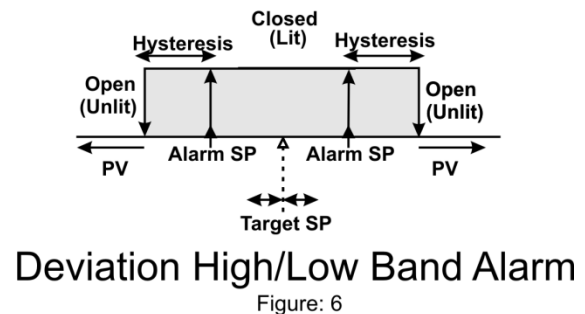
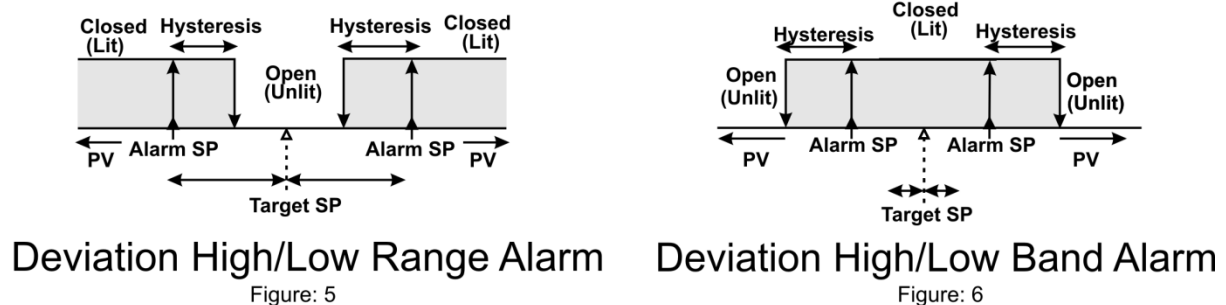
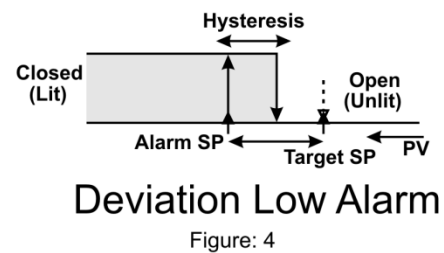
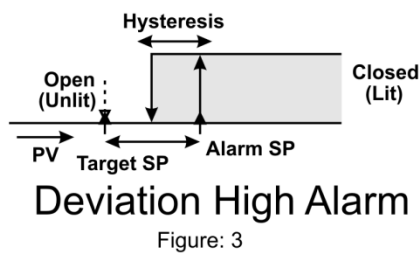
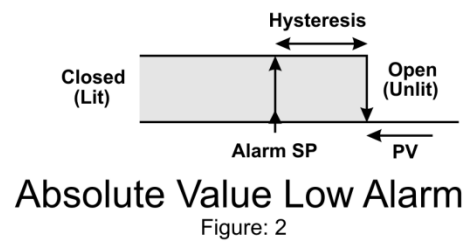
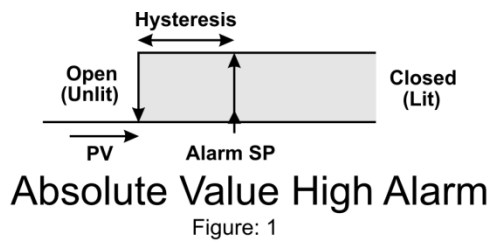
ALARM TYPES: Various alarm operations are shown in the reference figure.

ALARM TYPE NO	Display message	ALARM TYPE	Note
0	nonE	None	NO operation available
1	PdHC	Deviation High control	Ref figure 3
2	PdHA	Deviation High alarm	Ref figure 3
3	PdLC	Deviation Low control	Ref figure 4
4	PdLA	Deviation Low alarm	Ref figure 4
5	PdrC	Deviation High & Low Range control	Ref figure 5
6	PdrA	Deviation High & Low Range alarm	Ref figure 5
7	PdbC	Deviation High & Low Band control	Ref figure 6
8	PdbA	Deviation High & Low Band alarm	Ref figure 6
9	PAHC	Absolute value High control	Ref figure 1
10	PAHA	Absolute value High alarm	Ref figure 1
11	PALC	Absolute value Low control	Ref figure 2
12	PALA	Absolute value Low alarm	Ref figure 2
13	SPRH	Absolute value set point high alarm	Ref figure 7
14	SPRL	Absolute value set point low alarm	Ref figure 8
15	P5dH	Deviation High alarm with standby	Same as figure 3
16	P5dL	Deviation Low alarm with standby	Same as figure 4
17	P5dr	Deviation High & Low Range alarm with standby	Same as figure 5
18	P5db	Deviation High & Low Band alarm with standby	Same as figure 6
19	P5RH	Absolute value High alarm with standby	Same as figure 7
20	P5RL	Absolute value Low alarm with standby	Same as figure 8
21	Pu-E	PV error(OPEN/OVER/UNDER)	Note 1
22	Pr uE	Any type of error	Note 1

Note: In case of alarm, relay can be resetted with application of acknowledge key

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

Table 8.1

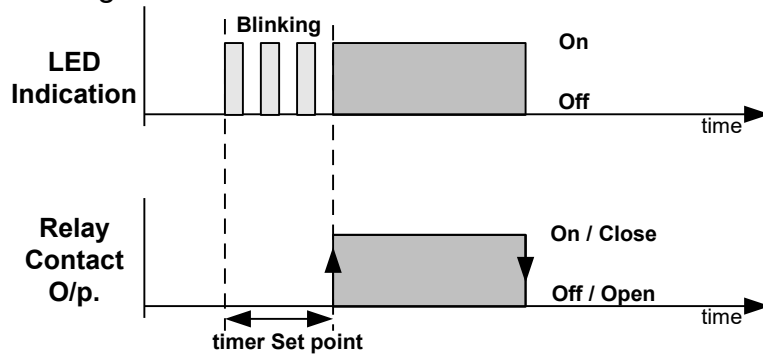


Hysteresis : Hysteresis application is shown in the figure.

Direction: All the figures here are shown considering the setting is Normal. If the settings are Fail Safe, the relays will behave exactly the opposite way. 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, relay status depends on Direction.

Delay:

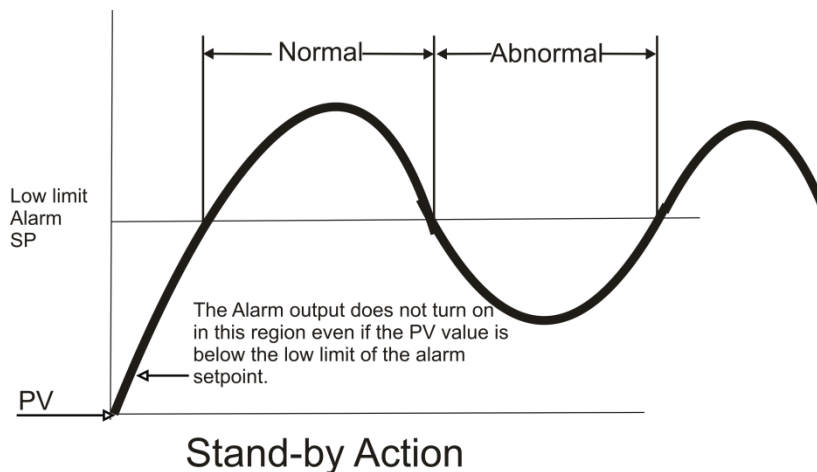
A time delay can be provided for the actual output. Effects of delay are illustrated in the diagram below.



Standby operation:

For alarm types, 15 to 20, the relay action happens only after the PV has crossed the SP after power on.

Example:



9. CONTROL FUNCTION DETAILS

Direct/Reverse Control (Output Direction):

For Heat (Reverse Action) and Cool (Direct Action) type Proportional control logic, user has to program the proportional band for proper control. They can be changed manually as explained in control parameters.

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.

Manual Reset:

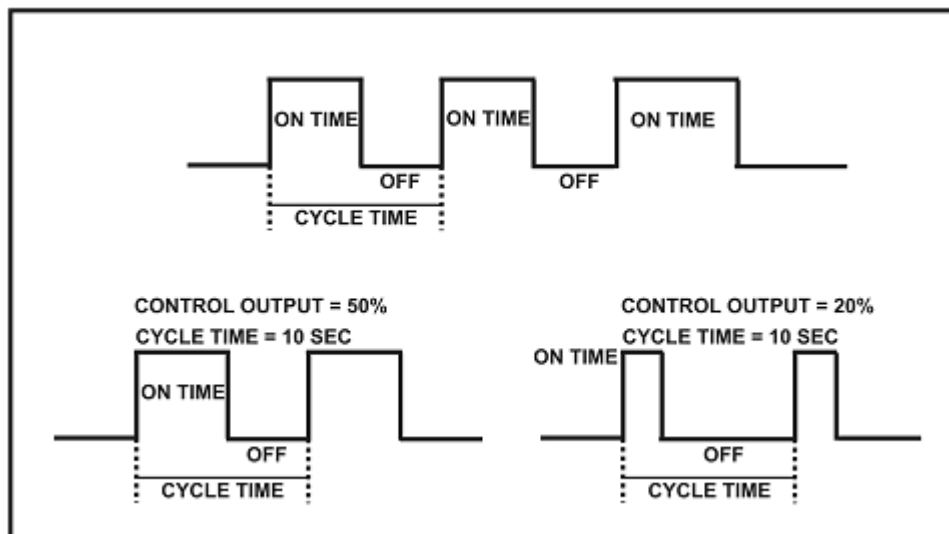
Virtually no process requires precisely 50% output on single output controls or 0% output on two output controls. Because of this many older control designs incorporated an adjustment called manual reset (also called offset on some controls). This adjustment allows the user to redefine the output requirement 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 setpoint.

Some controls use manual reset (as a digital user programmable value), this allows the user to preprogram the approximate output requirement at the setpoint to allow for quicker settling at set point when Automatic reset (Integral time) set to zero. Range for the manual reset is -50% to +50% 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.

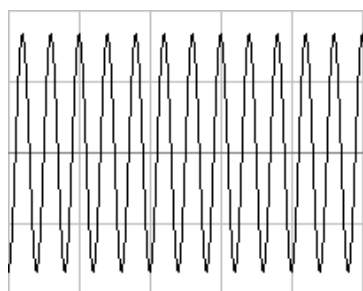
For Relay output: Set to 10 to 30 seconds or more



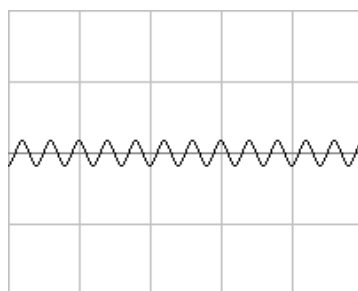
Digital Filter (FLTR):-

In certain application the process value is too unstable to be read. To improve this, a programmable low pass filter incorporated in the controller can be used. This is a first order IIR filter with time constant specified by *FLTR* (FLTR) parameter of **LEVEL-3**. The input filter will reduce the oscillation or fluctuation of the process value. Excessive filter can be dangerous, may produce an unstable process.

Filter Effects:



ut (PV)



Filtering for 2 second



Inp

Filtering for 10 second

Control Output Selection:

OUTPUT TYPE	RELAY CAN CONFIGUR AS			
	RELAY1	RELAY2	RELAY3	RELAY4
ON-OFF ACTION	USE FOR CONTROL ACTION	ALARM2	ALARM3	ALARM4
P Action	USE FOR CONTROL HEAT/COOL ACTION	ALARM2	ALARM3	ALARM4
None	ALARM1	ALARM2	ALARM3	ALARM4

10. CALIBRATION PROCEDURE

Calibration is provided for ambient temperature, PV sensor, input Retransmission output1 and output2.

First select the calibration function as described below and then follow the procedure depending on the parameter to be calibrated. The sequences of parameters that will be available for calibration are listed below:

- Ambient temperature adjustment
- PV sensor input
- Retransmission1 output (calibration for voltage or current)
- Retransmission2 output (calibration for voltage or current)

10.1 Ambient temperature adjustment

This menu will come up only if; the input sensor selected is Thermocouple type.

PV display shows $\overline{A} \overline{A} \overline{b} . \overline{A}$ (Ambient temperature adjusts). SV display shows ambient temperature measured by the controller and by applying old calibration data.

DP of last digit will blink to indicate that the value can be changed. Use Inc/Shift key to adjust it to desired value. Once the desired value set and press ENT key, the blinking DP will go off to indicate that the value has been registered. The controller will automatically save all the new calculations. Ambient temperature adjustment is over.

Press MENU key to calibrate other parameters or press Escape key to come out to normal operation.

10.2 PV input sensor calibration

When user enters in calibration menu, PV display shows message $t_c .L .5$ (Thermocouple/Linear Span) for sensor input span calibration for Thermocouple and Linear input type. Feed sensor input using a calibrator, such that process value is close to upper range value.

Note: The controller allows the user to calibrate sensor's input anywhere in the range, but it is recommended that it should be calibrate the input at points close to lower and upper range values.

DP of last digit will blink to indicate that the value can be changed. Use Inc/Shift key to correct the displayed reading to the desired process value and press ENT key. The controller will display message $\bar{u}A .t$ (wait) in the SV display to indicate that it is doing the necessary calculations.

When the calculations are over, the new calibration values are stored automatically. For TC and Linear input type user has to calibrate SPAN only.

FOR RTD input user has to calibrate ZERO and SPAN.

PV shows the message $rtd .2$ (calibration Zero). SV display shows process value corresponding to input sensor value and old calibration data. Feed sensor input using a calibrator, such that process value is close to sensor's lower range value. Use Inc/Shift key to arrive at the desired process value. Press ENT key to register the changes.

The controller will display message $\bar{u}A .t$ (wait) in the SV display to indicate that it is doing the necessary calculations. Depending on the situation, this process may take few seconds to calibrate.

Once zero is calibrated, press MENU key for RTD span calibration.

PV shows the message $rtd .5$ (rtd.S) (calibration Span). SV display shows process value corresponding to input sensor value and old calibration data. Feed sensor input using a calibrator, such that process value is close to sensor's upper range value. Use Inc/Shift key to arrive at the desired process value. Press ENT key to register the changes.

The controller will display message $\bar{u}A .t$ (wait) in the SV display to indicate that it is doing the necessary calculations. When the calculations are over, the new calibration values are stored automatically. In case, the controller cannot complete the calibration due to any reason, it will hold previous calibration parameters. Calibration for input sensor is over.

10.3 Retransmission1 and Retransmission2 output calibration (Voltage/current output)

Press MENU key repeatedly, till PV display shows message $rt 1 .2$ (Retransmission1 output zero calibration).

SV display shows the value being outputted on Retransmission output terminals. Measure the value using a highly accurate digital multi meter. Use Inc/Shift key to correct the displayed reading to the measured value. Press ENT key. The controller will store zero calibration value. Press MENU key to calibrate retransmission output span calibration menu.

PV shows the message $rt 1 .5$ (Retransmission1 output span calibration). SV display shows the value being outputted on retransmission output terminals. Measure the value. Use Inc/Shift key to correct the displayed reading to the measured value. Press ENT key. When the calculations are over, the new calibration values are stored

automatically. Calibration for Retransmission output is over. Press MENU key to calibrate other parameters or press Escape key to come out to normal operation.

Group Calibration Detail:-

Group NO	Input type	Calibration for input
1	E,J,K,T,N,C,G,0-75mv,0-100mv	Either of any input
2	Pt-100(RTD)	Specific input
3	B,R,S,-10 to 20mv	Either of any input
4	0-2V,0.4-2V,4-20mA,0-20Amp	Either of any input
5	0-10V,0-5v,1-5V	Either of any input

NOTE:

If you calibrate any input from any group i.e. I/P E-TC from Group – 1 then calibration is not required for other input types from Group-1.

11. COMMUNICATION DETAILS

The MODBUS Communications protocol as RS-485 interface module is installed. Only RTU mode is supported. Data is transmitted as 8-bit binary bytes with 1 start bit, 1/2 stop bit and optional parity checking (None, Even, Odd). Baud rate may be set to 9600 and 19200.

11.1 Function codes use 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

11.2 Exception responses for Modbus

Code	Name	Meaning
01	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the slave. If a Poll Program Complete command was issued, this code indicates that no program function preceded it.
02	ILLEGAL DATA ADDRESS	The data address received in the query is not an allowable address for the slave
03	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for the slave
06	SLAVE DEVICE BUSY	When Master device write some parameters to Slave device If slave device busy it will send 06 code to indicate slave device is busy.

11.3 Modbus parameters

Sr. No	Parameter	Absolute address	Data Type	Minimum value	Maximum value	Access Type
1	RELAY 1	1	bit	0	1	R
2	RELAY 2	2	bit	0	1	R
3	RELAY 3	3	bit	0	1	R
4	RELAY 4	4	bit	0	1	R

(Absolute Address 30001 to 30002)

Sr. No	Parameter	Absolute address	Data Type	Minimum value	Maximum value	Access Type
1	PV	30001	Integer	-1999	9999	R
2	Ambient	30002	Integer	0	60	R

Modbus parameters :(Absolute Address 40001 to 40063)

Sr. No	Parameter	Absolute address	Data Type	Minimum value	Maximum value	Access Type
1	Set Point – 1	40001	Integer	Input type range low	Input type range high	R/W
2	AL1 SP	40002	Integer	-1999	9999	R/W
3	AL1 TP	40003	Char	0	22	R/W
4	AL1 HYS	40004	Integer	1	250	R/W
5	AL1 LC	40005	Char	0	1	R/W
6	AL1 DLY	40006	Char	1	99	R/W
7	AL1.LT	40007	Char	0	1	R/W
8	AL2 SP	40008	Integer	-1999	9999	R/W
9	AL2 TP	40009	Char	0	22	R/W
10	AL2 HYS	40010	Integer	1	250	R/W
11	AL2 LC	40011	Char	0	1	R/W
12	AL2 DLY	40012	Char	1	99	R/W
13	AL2.LT	40013	Char	0	1	R/W
14	AL3 SP	40014	Integer	-1999	9999	R/W
15	AL3 TP	40015	Char	0	22	R/W
16	AL3 HYS	40016	Integer	1	250	R/W
17	AL3 LC	40017	Char	0	1	R/W
18	AL3 DLY	40018	Char	1	99	R/W
19	AL3.LT	40019	Char	0	1	R/W
20	AL4 SP	40020	Integer	-1999	9999	R/W
21	AL4 TP	40021	Char	0	22	R/W
22	AL4 HYS	40022	Integer	1	250	R/W
23	AL4 LC	40023	Char	0	1	R/W
24	AL4 DLY	40024	Char	1	99	R/W
25	AL4.LT	40025	Char	0	1	R/W
26	Input type	40026	Char	1	21	R/W
27	Auto CJC	40027	Char	0	1	R/W
28	Fix CJC	40028	Integer	0	600	R/W
29	Range high	40029	Integer	-1999	9999	R/W
30	Range low	40030	Integer	-1999	9999	R/W
31	Decimal Point	40031	Char	0	3	R/W
32	Output type	40032	Char	0	2	R/W
33	Proportional band	40033	Integer	1	9999	R/W
34	Cycle time	40034	Integer	1	250	R/W
35	Manual Reset	40035	Integer	-50	50	R/W
36	Hystresis	40036	Integer	1	250	R/W

37	PV Scale	40037	Char	0	1	R/W
38	Output Direction	40038	Char	0	1	R/W
39	Relay Delay	40039	char	0	99	R/W
40	Square root	40040	Char	0	1	R/W
41	Set point Display	40041	Char	1	4	R/W
42	PV Filter	40042	Char	0	60	R/W
43	Slave Device id	40043	Char	1	247	R/W
44	Baud Rate	40044	Char	0	1	R/W
45	Parity/Stop Bit	40045	Char	0	3	R/W
46	Retransmission 1 Type	40046	Char	0	4	R/W
47	Retransmission 1 Direction	40047	Char	0	1	R/W
48	Retransmission 1 Range high	40048	Integer	-5.00%	105.00%	R/W
49	Retransmission 1 Range low	40049	Integer	-5.00%	105.00%	R/W
50	Retransmission 1 Range span	40050	Integer	-1999	9999	R/W
51	Retransmission 1 Range zero	40051	Integer	-1999	9999	R/W
52	Retransmission 2 Type	40052	Char	0	4	R/W
53	Retransmission 2 Direction	40053	Char	0	1	R/W
54	Retransmission 2 Range high	40054	Integer	-5.00%	105.00%	R/W
55	Retransmission 2 Range low	40055	Integer	-5.00%	105.00%	R/W
56	Retransmission 2 Range span	40056	Integer	-1999	9999	R/W
57	Retransmission 2 Range zero	40057	Integer	-1999	9999	R/W
58	Time out	40058	Char	10	100	R/W
59	Lock – 1 (Level-1)	40059	Char	0	1	R/W
60	Lock – 2 (Level-2)	40060	Integer	0	1	R/W
61	Lock – 3 (Level-3)	40061	Integer	0	1	R/W
62	Lock – CAL	40062	Char	0	1	R/W
63	Password	40063	Integer	0	9999	R/W
64	Inhi	40064	Integer	>Inlo value	Maximum Input Value	R/W
65	Inlo	40065	Integer	Minimum Input Value	<Inhi value	R/W
66	Offset	40066	Integer	-1000	1000	R/W
67	SP Lock/Unlock	40067	Integer	0	1	R/W

NOTE:-

1. Modbus function code 06 is used to preset single register but it is user responsibility to preset appropriate register because through keyboard few parameters are disabling according to the configuration set by user but Modbus

will display all these parameters when user read through Modbus function code 04.

2. User can configure instrument through Modbus, to set appropriate parameters value refer in MENU LAYOUT.

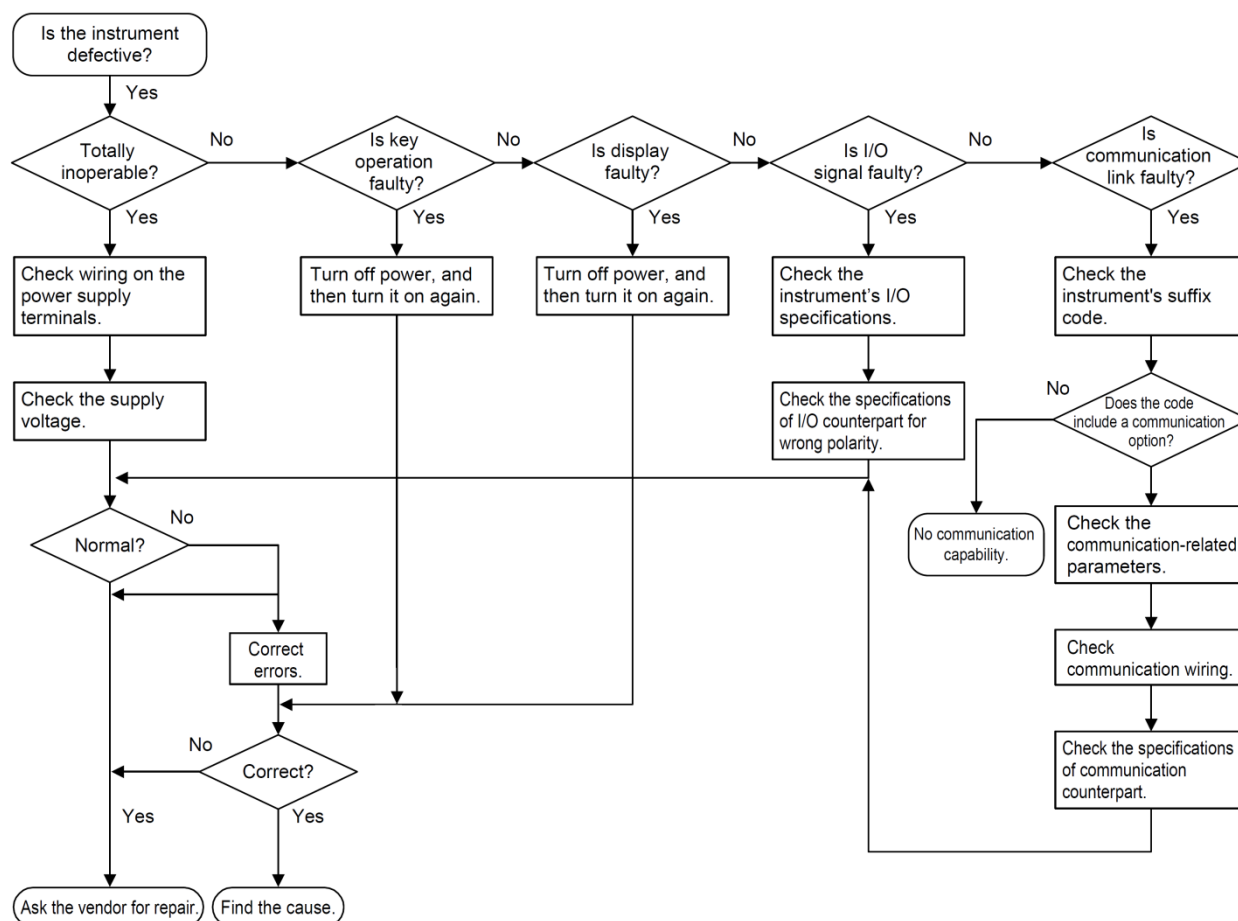
12. APPENDIX

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

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

12.2 PV Input Status Display During Burnout Condition

Input type	Display Message	Input type	Display Message
TC-E	OPEN(OPEN)	PT 100(RTD)	OPEN
TC-J	OPEN	0-10V DC	UNDR
TC-K	OPEN	0 to 5V DC	OPEN
TC-T	OPEN	1 to 5V DC	OPEN
TC-N	OPEN	0 to 2V DC	OPEN
TC-B	OPEN	0.4 to 2V DC	OPEN
TC-R	OPEN	0 to 20mAmp	OPEN
TC-S	OPEN	4 to 20mAmp	OPEN
TC-C	OPEN	-10 to 20mV DC	OPEN
TC-G	OPEN	0-100mV DC	OPEN
		0-75mV DC	OPEN

Table-12.2

Note:

If set PV_low/PV_high for input type is less then maximum value of zero and span for then process value will display readings above 5% of display range, then after it will show **OVER/UNDER** (OVER/UNDER) message until value crosses maximum value of Sensor range. Process value greater then maximum value of zero/span then display will show **OPEN** (OPEN) message. Retransmission o/p will follow 5% of display range and then it will give fixed o/p depending up on OPEN sensor selection. In case of linear inputs scaling is applied then during OPEN sensor condition it may not show **OPEN** (OPEN) message instead it will show either **OVER/UNDER** (OVER/UNDER).

12.3 Retransmission Output Table for OPEN /OVER /UNDER Condition

RETRANSMISSION	VARIABLE	PROCESS SCALE	RETRANSMISSION DIRECTION	OPEN	OVER	UNDER	ERROR
4-20mamp	PV	UP	DIR	20.8	20.8	3.2	-
	PV	DOWN	REV	20.8	3.2	20.8	-
	PV	UP	REV	3.2	3.2	20.8	-
	PV	DOWN	DIR	3.2	20.8	3.2	-

Table 12.3

NOTE: -

- 1) For Retransmission output type 0-20mamp, 0-10v, 1-5v and 0-5v also applicable according to above table 12.3.
- 2) For 0-20mamp, 0-10v and 0-5v minimum output value will be 0mamp and 0v respectively.



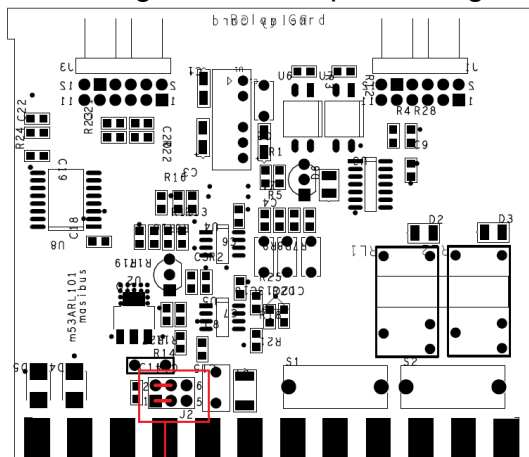
12.4 Retransmission Output1 Type Selection Settings

In this Model Retransmission Output come with the two different types

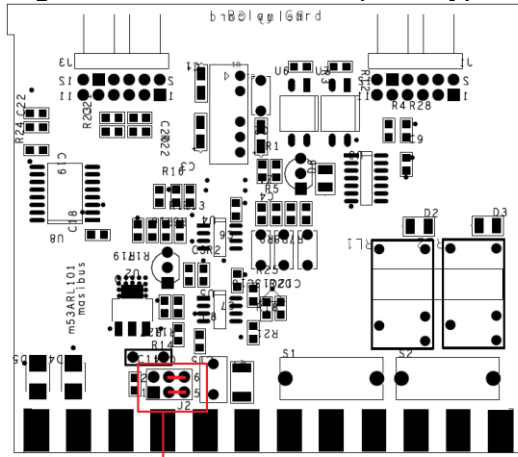
Retransmission Output as

- Current Output
- Voltage Output

Refer below figures for Jumper Setting to change Retransmission Output 1 type.



Jumper Setting For
Current Type
Retransmission Output



Jumper Setting For
Voltage type
Retransmission Output

12.5 Relay Logic

CONDITION	ALARM LATCH/ CONTROL	RELAY/LED	NORMAL	ABNORMAL	UP	DOWN	ACK IN ABNORMAL CONDITION	NORMAL	ACK IN NORMAL CONDITION
HIGH	ALARM LED LATCH YES	LED	OFF	FLASH	FLASH	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	ON	OFF	OFF	OFF	OFF
	ALARM LED LATCH NO	LED	OFF	FLASH	FLASH	OFF	STEADY	OFF	OFF
		RELAY	OFF	ON	ON	OFF	OFF	OFF	OFF
LOW	CONTROL	LED	OFF	STEADY	STEADY	OFF	-	OFF	-
		RELAY	OFF	ON	ON	OFF	-	OFF	-
	ALARM LED LATCH YES	LED	OFF	FLASH	OFF	FLASH	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	ON	OFF	OFF	OFF
LOW	ALARM LED LATCH NO	LED	OFF	FLASH	OFF	FLASH	STEADY	OFF	OFF
		RELAY	OFF	ON	OFF	ON	OFF	OFF	OFF
	CONTROL	LED	OFF	STEADY	OFF	STEADY	-	OFF	-
		RELAY	OFF	ON	OFF	ON	-	OFF	-