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User's Manual

SINGLE LOOP PID CONTROLLER with AUTO TUNE

5040
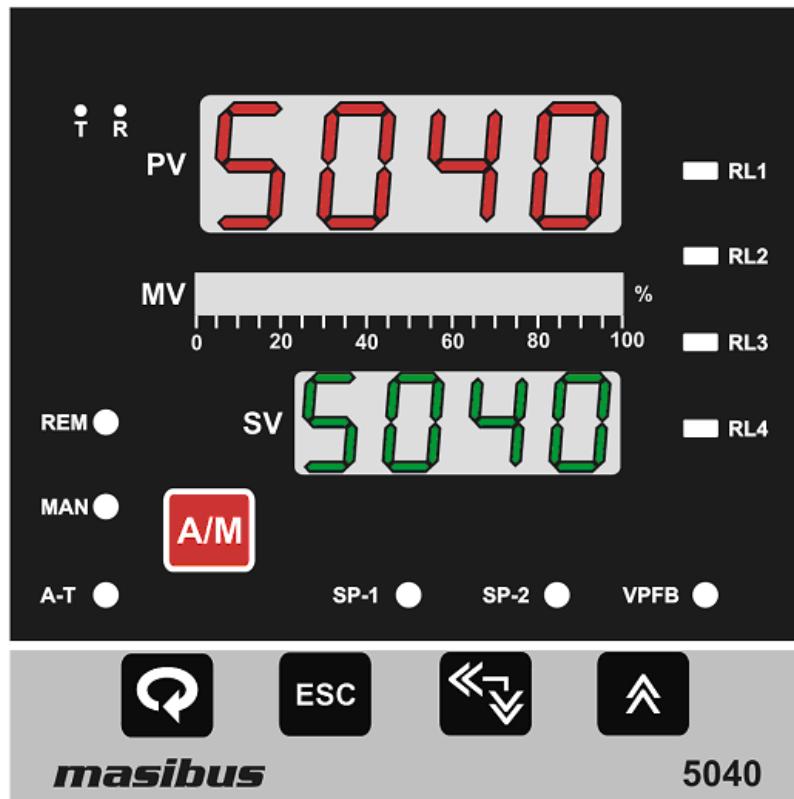
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Contents

1. INTRODUCTION

Foreword

Thank you for purchasing 5040 series PID controller. This manual describes the basic functions and operation methods of 5040.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 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.

Product Ordering Code

Ordering Code							
Model	Input		Power Supply		Control O/P		Rx O/P	
5040	1	E	U1	85-265VAC/ 100-300VDC	1	Relay	1	4-20mA
	2	J	U2	18-36VDC	2	Pulse	2	0-20mA
	3	K			3	Linear	3	1-5V
	4	T			4	MOV	4	0-5V
	5	B					5	0-10V
	6	R						
	7	S						
	8	N						
	9	Pt-100						
	A	-10 to 20mV						
	B	0 to 75mV						
	C	0 to 100mV						
	D	0.4 to 2V						
	E	0 to 2V						
	F	0 to 5V						
	G	1 to 5V						
	H	0 to 10 V						

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.

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	*This indicates a danger that may result in death or serious injury if not avoided.*

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

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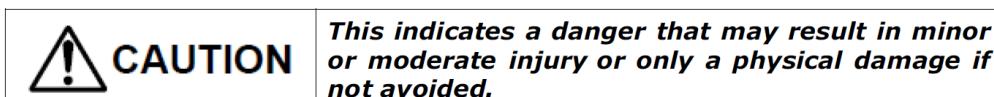
2. INSTALLATION DETAILS

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

Panel Cutout
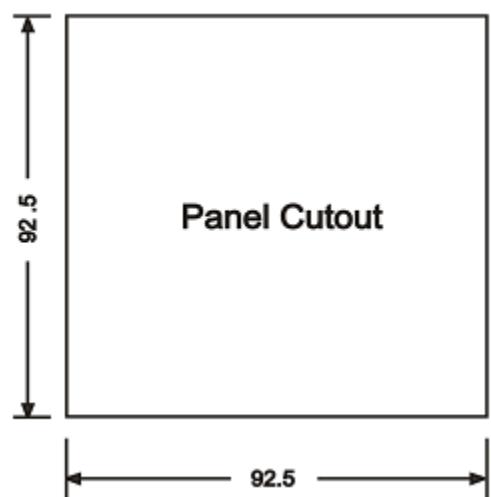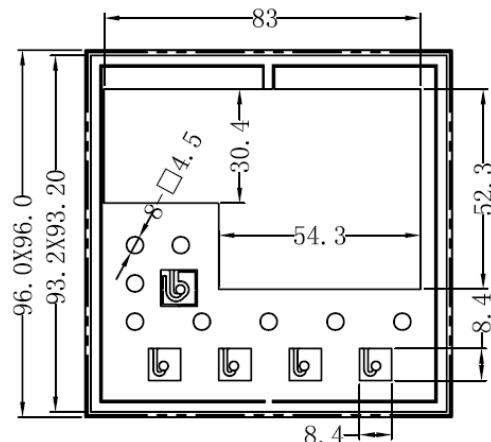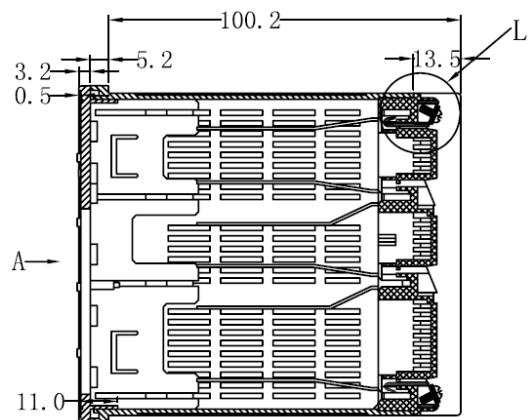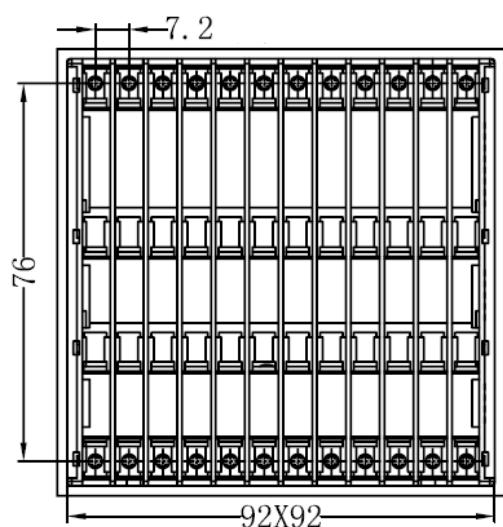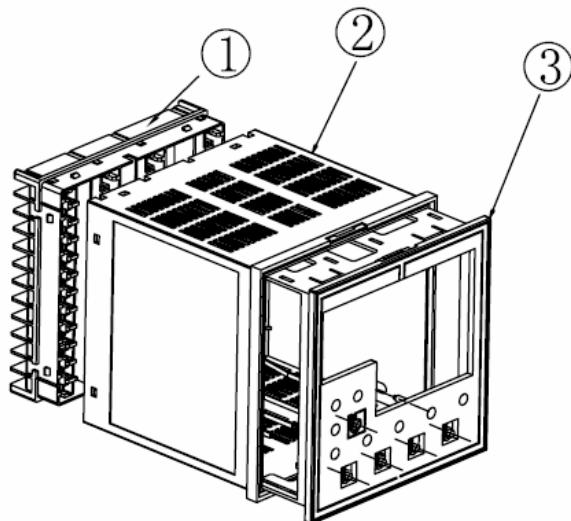
2.3 How to connect wires

⚠ 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 shouldnot be used as jumper points asthey 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 tric 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), RTD (Pt100), Current, Voltage
Display Range	Table-3.1
Accuracy	TC, RTD: ± 0.1% of F.S ± 1 degC
	Current, Voltage: ± 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 (Conductor resistance 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%

Table-3.1: Input Display Range		
Input Type		**Range**
Thermocouple	E	-200 to 1000°C
	J	-200 to 1200°C
	K	-200 to 1370°C
	T	-200 to 400°C
	B	450 to 1800°C
	R	0 to 1750°C
	S	0 to 1750°C
	N	-200 to 1300°C
RTD	Pt-100	-199.9 to 850.0°C
Voltage	-10 to 20mV	-1999 to 9999
	0 to 75mV	
	0 to 100mV	
	0 to 5V	
	1 to 5V	
	0 to 10 V	
	0.4 to 2V	
	0 to 2V	
Current	4 to 20mA (Ext. 100Ω)	
	0 to 20mA (Ext. 100Ω)	

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Digital Input	
No of DI	4
Input Type	Non-Voltage Contact or Pulse Input(24VDC,@5mA)
Rating	24VDC@5mA Max
Purpose	Target Set point selection, Auto/Manual selection, Remote /Local mode switching, Run/Stop mode selection
Minimum status detection Holds Time	About 1 Second

Remote Input Signal	
Input Type	Settable in a range from 0-5 V or 1-5 V DC. The input type can be selected with the front keypad. For 0 – 20mamp (0-5v) and 4 – 20mamp (1-5v) 250ohms (0.1%, low ppm) resistor should be connected externally. Input sampling time for remote input is 3 times the PV input.
Input Range	-1999 to 9999 counts
Resolution	17-bit
Input Resistance	> 1Mohm
Input Accuracy	±0.1% instrument range, ±1 Count

Feedback Resistance Input	
Slide resistance value	100 ohms to 1K ohms of overall resistance (burnout detection for all the three wires provided)
Measuring resolution:	0.1% of overall resistance (After User's adjustment).

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''
Bar Display	20 Orange LEDs for %POWER, Valve position indication
Status Indication	Red LEDs for RELAY and Alarm status, Manual mode status, Remote status. Green LEDs for Communication, Red LEDs for Set Point selection 1 and 2, Auto-tune status, Valve Position Feedback status
Keys	5 keys for configuration, calibration and operation

3.3 Output

Output Types
RELAY OUTPUT(PID and ON/OFF control)
SSR OUTPUT
LINEAR OUTPUT (4-20mAmp)
VALVE POSITION WITH FEEDBACK CONTROL (VPFB)
VALVE POSITION WITHOUT FEEDBACK CONTROL (VPFN)

Control Output (Field Programmable)	
Relays	1 (Relay-1) for Relay and ON-OFF Output Type 2 (Relay-1 & Relay-2) for VPFB & VPFN Output Type
Type	Single Change over (C, NO, NC)
Rating	2A @ 230VAC / 30VDC

Pulse Output (SSR)	
Output signal	Pulse output
Load resistance	500 ohms Max. Or less
Output signal On-condition	16mAmp DC or more
Off-condition	3mAmp DC or less
Resolution	10 ms

Linear Output	
Output Signal	4-20mA@500Ω Max, Accuracy: 0.25% of FS

Retransmission Output	
Number of output	1
Output According to	Process Value, Set point, Control output or Valve Position
Output Signal	4-20mA/ 0-20mA/1-5VDC/ 0-10V DC
Load resistance For Current o/p For Voltage o/p	 500Ω Max. 3KΩ Min.
Output accuracy	±0.25% of span

Alarm Output	
Number of Outputs	4 if Output Type is Linear or Pulse (Relay-1 to Relay-4), 3 if Output Type is Relay or ON-OFF (Relay-2 to Relay-4) 2 if Output Type is VPFB or VPFN (Relay-3 & Relay-4) 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)

Contact Digital Outputs	
Number of outputs	4
Output type	Open collector
Output Contact rating	24V DC, 50 mA, with inbuilt current limit protection
Purpose	Various Alarm outputs such as PV High / Low etc. Also, fault diagnosticoutputs such as PV Input OPEN, RSP Input OPEN, and VPFB Input OPEN areavailable

Loop Power Supply	
Supply Voltage	24VDC (±1V) @30mAwith 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
Optional	18-36VDC
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 and Communication O/P.
Insulation resistance: 20MΩ 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	< 1 Kg.
Case color	Black
Enclosure Material	ABS
Terminal Cable Size	2.5mm^2
Accessories	Two mounting clamps

3.7 Environmental

Operating temperature	0-55 °C
Storage temperature	0-80 °C
Humidity	30-95 %RH non-condensing
Tempco	FOR PV (Main input), RSP (Remote input) and Position Feedback Input < 100ppm. FOR Retransmission(Current and Voltage) and Control Output < 150ppm
Instrument Warm-up Time	15 minutes or more after power on

4. WIRING DIAGRAM

4.1 BACK PLATE WIRING DETAIL

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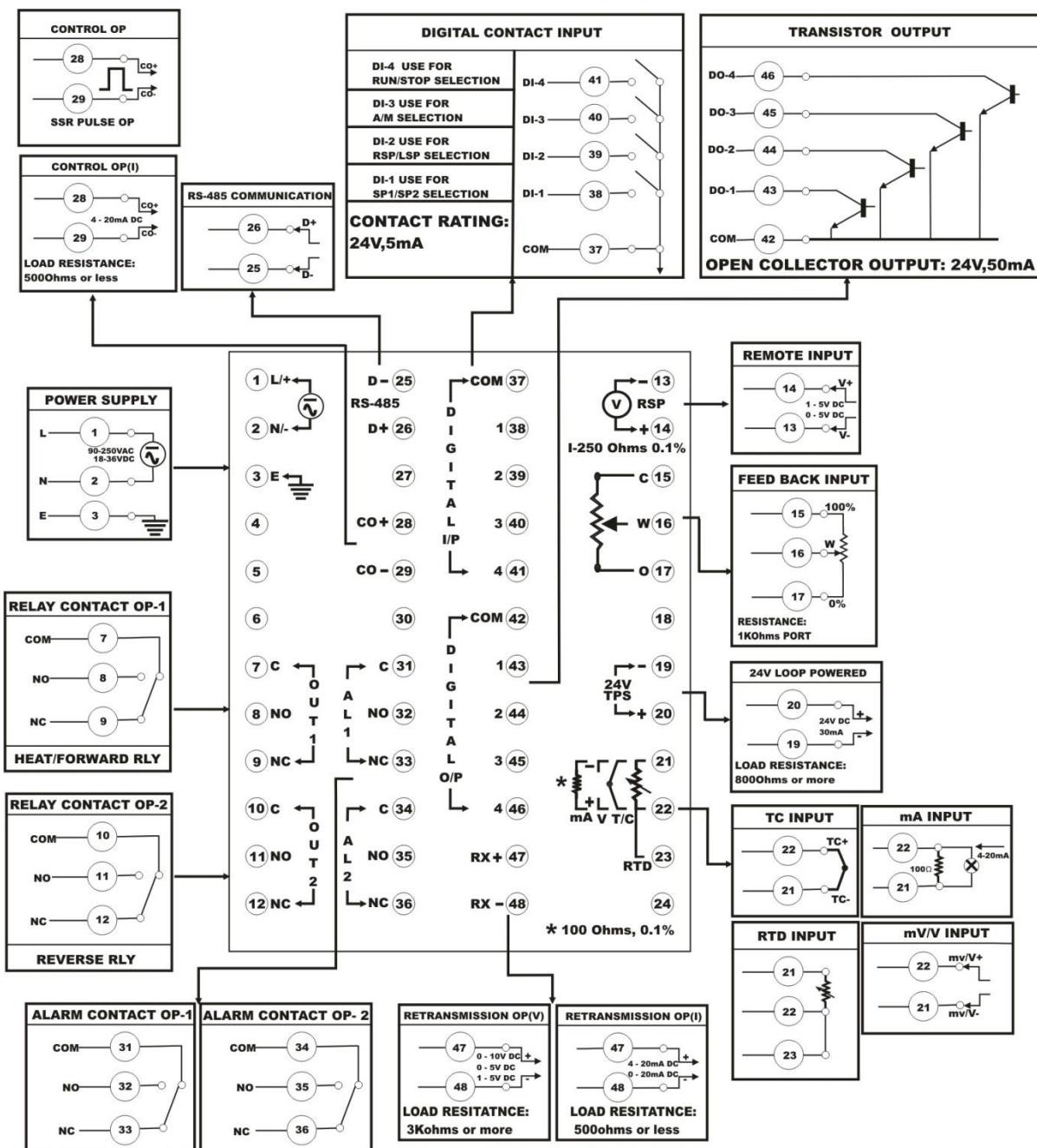
4.2 TRASMITTED POWER SUPPLY WIRING DIAGRAM
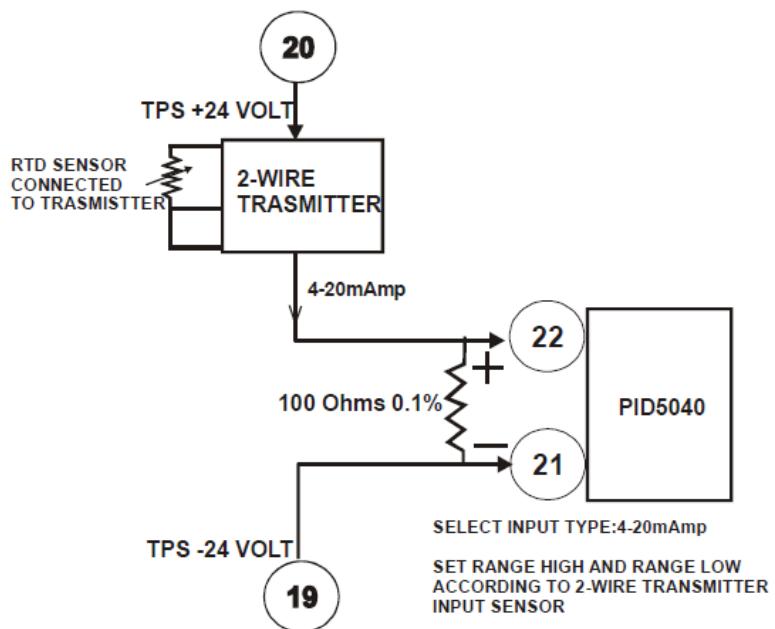
4.3 VALVE POSITION FEEDBACK WIRING
(FOR INTERLOCK FORWARD AND REVERSE RELAY)
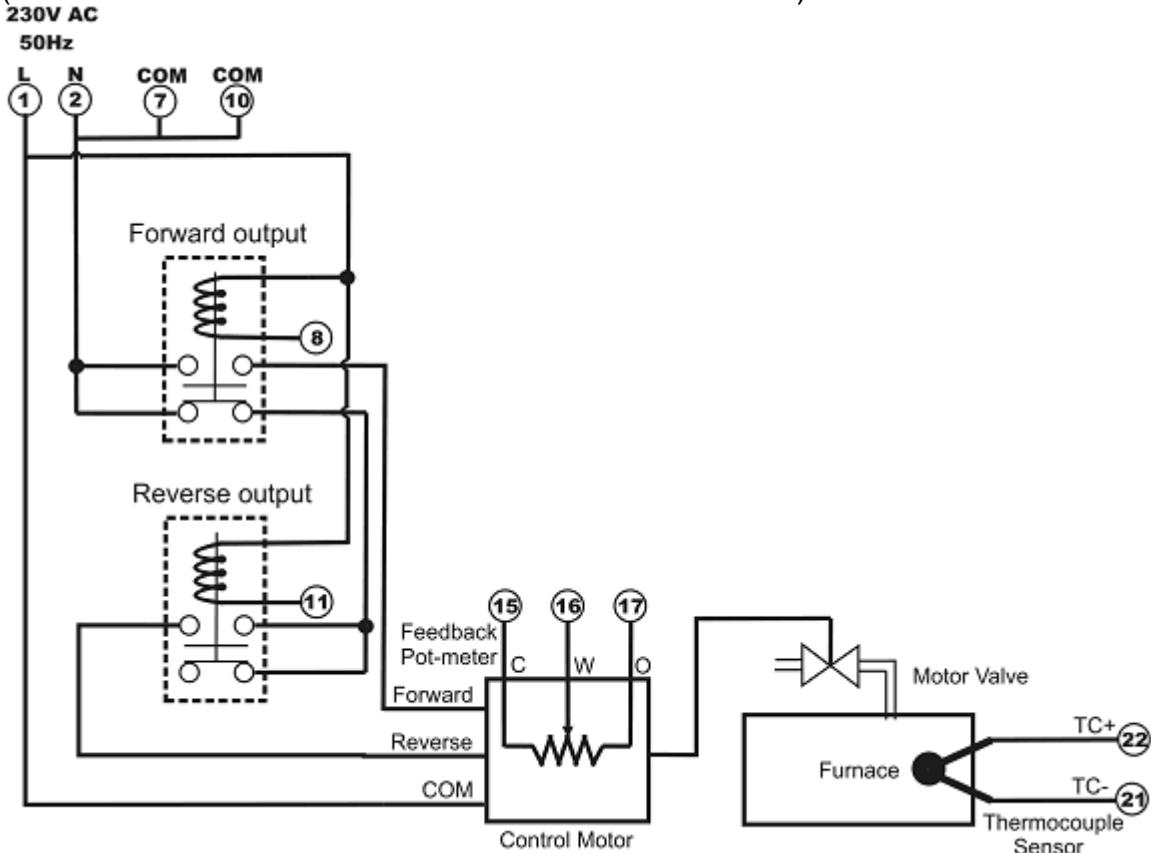
5. FRONT PANEL DETAILS

Name of Part	Function
Process Value Display**(PV)**	Display process value. Display parameter name when userset 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. Display control output value when in manual mode.
Control Output Value Bar Display**(MV)**	Display control output value in form of Bar scaled in 20 segments.
Output Indicator Lamps(**RL1 & RL2**)	In Heat action, RL1 lamp will Indicate the on status of the heat output. In Valve Position Feedback action & Without Valve Position Feedback action; RL1 lamp will indicate the status of the Heat Or Forward Output And RL2 lamp will indicate the status of Cool Or Reverse Output. In Control applications with Linear Control Output, RL1 and RL2 will work as Normal Alarms (Alarm 1 & 2). When Alarm 1 & 2 Occurs, Respective Alarm lamp willlight (In Red).
Alarm Indicator Lamps**(RL3 & RL4)**	When Alarm 3&4 occurs, respective Alarm lamp (RL3 & RL4) will light (In Red).
Remote/Local Set point Indicator Lamp**(REM)**	It indicates whether Remote Set Point is selected or not. It will light when Remote Set Point is selected.
Manual Mode Lamp(**MAN**)	Indicator lamp will light when Manual Mode is selected
Communication Indicator Lamps**(T,R)**	Indicator lamps will blink when the communication is on.
Auto-Tune Indicator Lamp**(A-T)**	Indicator lamp will blink when Auto tune Process is on.

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Name of Part	Function
Set Point – 1 **(SP-1)**	Indicator lamp will on when Set Point 1 is selected. All controller action with respect to SP-1
Set Point – 2**(SP-2)**	Indicator lamp will on when Set Point 2 is selected. All controller action with respect to SP-2
Valve Position Feedback**(VPFB)**	Indicator Lamp will on when output type is VPFB 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. Also, in manual mode control output (%power) can be decreased using Shift/Decrement key.

AUTO/MANUAL KEY:

It is used to switch between auto to manual mode and manual to auto mode. During manual mode Increment key is used to increase to power and Shift/Decrement key is used to decrease the power.

Example:

How to change SET POINT:-

SP.1 and SP.2 will be shown in operator mode if they are selected in one of the SELECT Display Parameter from LEVEL-5 Menu.
Here SELECT display 1(D.S.1) is set for *SP-1* and SELECT display 2(D.S.2) is set for *SP-2* and D.T.1 & D.T.2 is R+W. So they can be editable.

PV/SV Display Run Mode — Press Menu Key to change the set point value

SP.1 ← Process Value Window
1234 ← Set Value Window

PV SP.1
SV 123_ — Press INC Key Last Digit started to blink and press INC key to change the digit

PV SP.1
SV 12_5 — Press shift Key to Shift the digit Press INC key to change the digit

PV SP.1
SV 12_5 — Press Menu Key to store the change value in nonvolatile memory & to select next display.

PV SP.2
SV 1235 — Press ESC KEY to return to the run mode

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

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6. MENU LAYOUT

6.1 RUN TIME INDICATION/FUNCTION

Following parameters can view or change during run time.

- Press Shift/Dec key to show percentage power (0.0 to 100.0%)
- For Thermocouple input type, Press Inc key to show ambient temperature.
- During manual mode, Inc key and Shift key/Decrement Key will use to modify the percentage power.
- During manual mode, If VPFB/VPNA output type is selected, Inc key and Shift key will use to OPEN or CLOSE the Valve.
- Press Escape key to show percentage Valve Position(0.0 to 100.0%) in SV display (available only if Valve position feedback is selected)

6.2 Set Point Setting

Pressing MENU key PV Display shows 5P.1(SP.1) message (if d.5.1 is selected for 5P.1). 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	Reg.No
Symbol	Name			
5P.1 (SP.1)	Target Set point-1	Depending on PV sensor type selected	200	1
5P.2 (SP.2)	Target Set point-2	Depending on PV sensor type selected	300	2

6.3 LEVEL - 1

Pressing MENU key for 3 seconds (approx.) PV Display shows ñodE (mode) message. SV display shows LuL1 (LvL1) Use Inc key to move to other menu levels. Or Press MENU key again to scroll through the menu items of Level - 1.

This level allows user to auto tune a process or manually set the PID values and some other parameters as shown below.

LEVEL 1: Control Parameters Configuration					
Parameter (PV display)		Setting name and Description SV Display	Default value	Shows only if	Reg.No
Symbol	Name				
Pūd (Pwd)	Password	0 to 9999(Password Protection for Level-1)	-	LOCK-1 set on in Level-4	-
AtUn (A.tUn)	Auto tune	YES/no 1:(YES) 0:(no)	no	Output Type is RLY, SSR, CUR	-
Pb (Pb)	Proportional Band	0.1 to 999.9	50.0	Not available for Output type OnOF	3

ႭႨ (ti)	Integral Time	0 to 1000 seconds	120	Not available for Output type OnOF	4
Ⴀძ (td)	Derivative Time	0 to 250 seconds	30	Not available for Output type OnOF	5
ძ.FⴂႠ (d.FCt)	Derivative Factor	0.01 to 1.00	0.01	Not available for Output type OnOF	6
ⴂႠ (Ct)	Cycle Time	1 to 250 seconds	10	Not available for Output type OnOF	7
ძⴂ (DC)	Duty Cycle	10% to 100%	20%	Not available for Output type OnOF	8
ძხ (db)	Position Proportional Dead Band	0.1 to 50.0	1.0	Not available for Output type OnOF	9
Pხ.SH (Pb.SH)	P band shift (Overshoot suppression)	-50 to 50 %	0%	Not available for Output type OnOF	10
Ⴀ ıL (TI.L)	Integral Inihibit Low	1 to 100	100	Not available for Output type OnOF	11
ᴍr (MR)	Manual Reset	-50 to 50 %	0%	Not available for Output type OnOF	11
HY (HY)	hysteresis (For On/Off control)	1 to 250	2	Control type is on/off	12
rАᴍP (Ramp)	Ramp Rate type	nonE/ᴍ ın .r/hr .r 0:none 1:min.r 2:hr.r	None	Not available for Output type OnOF	13
rᴍP.r (rmp.r)	Ramp rate value	0.1 to 999.9 Degree per minutes or hour	0.1	Not available for Output type OnOF	14

6.4 LEVEL - 2

Pressing MENU key for 3 seconds (approx.) PV Display shows ᴍodE (mode) message. SV display shows LʋL2 (LvL2) Use Inc key to move to other menu levels. Please refer Alarm / Digital output section for better understanding and selection of alarm types.

LEVEL 2: Alarm AND Digital Output Settings					
Parameter (PV display)		Setting name and description SV Display	Default value	Shows only if	Reg.No.
Symbol	Name				
Pᴍd (Pwd)	Password	0 to 9999(Password Protection for	-	LOCK-2 set on in Level-4	-

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		Level-2)			
A1SP (A1.SP)	Alarm 1 Set point	PV range selected[1]	0		15
A1tP (A1.tP)	Alarm 1 Type	0 to 18. Refer alarm type Table-8.1	0 (none)		16
A1HY (A1.HY)	Alarm 1 Hysteresis	1 to 250	2		17
A1LC (A1.LC)	Alarm 1 Logic (normal or fail safe selection)	norm/FLSF 0:(norm) 1: (FLSF)	Normal		18
A1dY (A1.Dy)	Alarm 1 Delay	1 to 99 seconds	10		19
A2SP (A2.SP)	Alarm 2 Set point	PV range selected[1]	0		20
A2tP (A2tP)	Alarm 2 Type	0 to 18. Refer alarm type Table-8.1	0(none)		21
A2HY (A2.HY)	Alarm 2 Hysteresis	1 to 250	2		22
A2LC (A2.LC)	Alarm 2 Logic (normal or fail safe selection)	norm/FLSF 0:(norm) 1: (FLSF)	Normal		23
A2dY (A2.Dy)	Alarm 2 Delay	1 to 99 seconds	10		24
A3SP (A3.SP)	Alarm 3 Set point	PV range selected[1]	0		25
A3tP (A3.tP)	Alarm 3 Type	0 to 18. Refer alarm type Table-8.1	0(none)		26
A3HY (A3.HY)	Alarm 3 Hysteresis	1 to 250	2		27
A3LC (A3.LC)	Alarm 3 Logic	norm/FLSF 0:(norm) 1: (FLSF)	Normal		28
A3dY (A3.Dy)	Alarm 3 Delay	1 to 99 seconds	10		29
A4SP (A4.SP)	Alarm 4 Set point	PV range selected[1]	0		30
A4tP (A4.tP)	Alarm 4 type	0 to 18. Refer alarm type Table-8.1	0(none)		31
A4HY (A4.HY)	Alarm 4 Hysteresis	1 to 250	2		32
A4LC (A4.LC)	Alarm 4 Logic	norm/FLSF 0:(norm) 1: (FLSF)	Normal		33
A4dY (A4.Dy)	Alarm 4 Delay	1 to 99 seconds	10		34
d1SP	Digital Output 1 Set	PV range selected[1]	0		35

(d1.SP)	point				
ᴅ ꟸᴛᴘ (d1.tP)	Digital Output 1 Type	0 to 18. Refer alarm type Table-8.1	0(none)		36
ᴅ ꟸHY (d1.HY)	Digital Output 1 Hystresis	1 to 250	2		37
ᴅ ꟸLC (d1.LC)	Digital Output 1 Logic	norm/FLSF 0:(norm) 1: (FLSF)	Normal		38
ᴅ ꟸdY (d1.Dy)	Digital Output 1 Delay	1 to 99 seconds	10		39
d2SP (d2.SP)	Digital Output 2 Set point	PV range selected[1]	0		40
d2tP (d2.tP)	Digital Output 2 Type	0 to 18. Refer alarm type Table-8.1	0(none)		41
d2HY (d2.HY)	Digital Output 2 Hysteresis	1 to 250	2		42
d2LC (d2.LC)	Digital Output 2 Logic	norm/FLSF 0:(norm) 1: (FLSF)	Normal		43
d2dY (d2.Dy)	Digital Output 2 Delay	1 to 99 seconds	10		44
d3SP (d3.SP)	Digital Output 3 Set point	PV range selected[1]	0		45
d3tP (d3.tP)	Digital Output 3 Type	0 to 18. Refer alarm type Table-8.1	0(none)		46
d3HY (d3.HY)	Digital Output 3 Hysteresis	1 to 250	2		47
d3LC (d3.LC)	Digital Output 3 Logic	norm/FLSF 0:(norm) 1: (FLSF)	Normal		48
d3dY (d3.Dy)	Digital Output 3 Delay	1 to 99 seconds	10		49
d4SP (d4.SP)	Digital Output 4 Set point	PV range selected[1]	0		50
d4tP (d4.tP)	Digital Output 4 type	0 to 18. Refer alarm type Table-8.1	0(none)		51
d4HY (d4.HY)	Digital Output 4 Hysteresis	1 to 250	2		52
d4LC (d4.LC)	Digital Output 4 Logic	norm/FLSF 0:(norm) 1: (FLSF)	Normal		53
d4dY (d4.Dy)	Digital Output 4 Delay	1 to 99 seconds	10		54

[1] If the value falls outside the range, output is unpredictable

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6.5 LEVEL - 3

Pressing MENU key PV for 3 seconds (approx.) Display shows ﬨodE (mode) message. SV display shows LuL3 (LvL3) 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 3: Functional Parameters Configuration Part-1					
Parameter (PV display)		Setting name and description (SV display)	Default value	Shows only if	Reg. No.
Symbol	Name				
Pﬨd (Pwd)	Password	0 to 9999(Password Protection for Level-3)	-	LOCK-3 set on in Level-4	-
inP.t (inP.t)	PV Input Type (E, J, K, T etc.)	Follow Table-3.1	K-TC		55
ACJC (A.CJC)	Auto Cold junction Compensation	Yes/no 1:(YES) 0: (no)	YES	Input sensor is T/c. type	56
F.CJC (F.CJC)	Fix cold junction Compensation	0 to 60.0 Degree	0.0	Input sensor is T/c. type	57
PuH i (Pv.Hi)	Process value range high setting (span > zero)	Range of the sensor(Table 3.1) / -1999 to 9999 (for linear input types)	1370		58
PuLo (Pv.Lo)	Process value range lower setting		-200		59
dP (dP)	Decimal Point Setting	0 to 3	0	Input is linear type	60
ot (oT)	Output Type	rELY/ SSr/cUr/ onoF/ uPFb/uPFn 0:(rLY) – Relay 1:(SSR) – Pulse Output 2:(Cur) – Current 3:(OnOF) – on-off control 4:(vpfb)-position with feedback 5:(vpfn)-position without feedback	0(Relay)		61
CoH i (Co.Hi)	Control Output high limit(high limit >low limit)	0.0 to 100.0 %	100.0		62
CoLo (Co.Lo)	Control Output low limit	0.0 to 100.0 %	0		63
PuSC. (PV.SC.)	Process value scale	doﬨn/ UP/ nonE 0:(down) 1:(up) 2:(none)	down		64
SP.ﬨd. (SP.Md.)	Remote/Local SP selection	LoCL/rﬨot 0:(LoCL) – Local 1:(rMot) - Remote	Local		65

od ir (o.dir)	Output (Cool / Heat) Direction (Dir / Rev)	dir/rEu 1:(dir) 0:(rev)	Rev		66
nt im (m.tim)	Motor Travel Time (position proportional without feedback)	10 to 500 sec	60	Pid type selected is valve position with/without feedback	67
AFūb (A.FWB)	Auto feedback	YES/no 1:(YES) 0:(no)	No	Pid type selected is valve position with/without feedback	68
Sqrt (Sqrt)	Square Root for Linear Inputs Type	YES/no 1:(YES) 0:(no)	No	Input type selected is linear	69
SP.no (SP.no)	Set point selection(Target set point to control the process)	1/2 1:(sp.1) 2:(sp.2)	1 (Set Point–1)		70
FLtr (FLtr)	Filter for Process value (1st order low-pass IIR filter)	0 to 60 seconds	5		71
Po (Po)	Preset Control output during stop mode	0.0 to 100.0% power	0.0%		72
di-1 (di -1)	Digital input-1	YES/no 1:(YES) 0: (no)	No		73
di-2 (di-2)	Digital input-2	YES/no 1:(YES) 0: (no)	No		74
di-3 (di-3)	Digital input-3	YES/no 1:(YES) 0: (no)	No		75
di-4 (di-4)	Digital input-4	YES/no 1:(YES) 0: (no)	No		76
P.2.Ad (P.Z.Ad)	Zero position adjustment	0% TO 80%	0%	o/p VPFB selected	-
P.S.Ad (P.S.Ad)	Span position adjustment	20% TO 100%	100%	o/p VPFB selected	-

6.6 LEVEL - 4

Pressing MENU key for 3 seconds (approx.) PV Display shows Mode (mode) message. SV display shows LuL4 (LvL4) Use Inc key to move to other menu levels. Press set key again to scroll through the menu items of particular level.

LEVEL 4: Functional Parameters Configuration Part-2					
Parameter (PV display)		Setting name and description (SV display)	Default value	Shows only if	Reg. No.
Symbol	Name				
Pᴗd (Pwd)	Password	0 to 9999(Password Protection for Level-3)	-	LOCK-4 set on in Level-4	-
rSP.t (rSP.t)	Remote SP Input type	0-5ᴗ / 1-5ᴗ 0:(0-5v) – 0-5 V 1:(1-5v) – 1-5 V	0 – 5v	Set point is remote type	77
rSP.H (rsP.H)	Remote SP range High setting	can be set within -1999 to 9999 but not outside PV-High and PV-LOW limit	1370		78
rSP.L (rsp.L)	Remote SP range Low Setting	Can be set within -1999 to 9999 but not outside PV-High and PV-LOW limit	-200		79
rSP.o (rSP.o)	Remote SP Offset	-100.0 to 100.0	0.0		80
rSP.F (rSP.F)	Remote SP factor	00.01 to 10.00	01.00		81
Sr.no (Sr.no)	Unit ID	1 to 247	1	-	82
bAUd (bAUd)	Communication Baud rate	9600/ 19.2P 0:(9600) – 9600 bps 1:(19.2K) –19.2 Kbps	19.2k bps		83
Pr.St. (Pr.St)	Parity/Stop bit selection	P.nS.1 /P.nS.2/P.oS.1/ P.ES.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 odd -stop bit-1 3:(P.E.S.1)-parity even - stop bit-1	No parity /Stop bit - 2		84
rtr.t (rtr.t)	Retransmission Output Type	0-20/4-20 / 0-5ᴗ/ 1-5ᴗ 0-10v 0:(0-20) – 0-20mA 1:(4-20) – 4-20mA	4-20 mA		85

		2:(0 - 5) – 0 – 5volt 3:(1 - 5) – 1 – 5volt 4:(0 – 10) - 0 -10volt			
rtr.u (rtr.v)	Retransmission variable	5P/Pu/Co/Zu 0:(SP) – Set point 1:(Pv) –Process value 2:(CO) – Control output 3:(Zv) – Feedback value	PV		86
r.d ir (r.dir)	Retransmission direction	d ir/ rEu 1:(dir) 0: (rev)	Dir		87
rtr.H (rtr.H)	Retransmission upper limit	-5.0% to 105.0%	105.0%		88
rtr.L (rtr.L)	Retransmission lower limit	-5.0% to 105.0%	-5.0%		89
At.HY (At.HY)	AT hysteresis	0 to 25.0	5.0		90
t.oUt (t.out)	Timeout of display back to PV/SV	10 to 100 Seconds	60		91
Püd (Pwd)	Password to Enter into lock mode	0 to 9999	-		-
LoCH (LOCK)	Lock LEVEL-1	L lon/L loF 1:L1on 0:L1oF	L1 OF		-
LoCH (LOCK)	Lock LEVEL-2	L2on/L2oF 1:L2on 0:L2oF	L2 OF		-
LoCH (LOCK)	Lock LEVEL-3	L3on/L3oF 1:L3on 0:L3oF	L3 OF		-
LoCH (LOCK)	Lock LEVEL-4	L4on/L4oF 1:L4on 0:L4oF	L4 OF		-
LoCH (LOCK)	Lock LEVEL-5 Calibration	L5on/L5oF 1:L5on 0:L5oF	L5 ON		-
S.Püd (S.Pwd)	Password Set password to lock selected level	0 to 9999	0	if lock is on user can set password for all level	-

![masibus logo]

6.7 LEVEL –5

Pressing MENU key for 3 seconds (approx.) PV Display shows Mode (mode) message. SV display shows ᴸᵘᴸ5(LvL5) Use Inc key to move to other menu levels. Press set key again to scroll through the menu items of particular level.

Select the 'SELECT display' parameter, and thenenter register number (Reg. No.) to accompanying thatParameter.The registered parameter can be accessed in operator mode by pressing **MENU** key. Select the 'Display Parameter Type' as**R** to make selected parameter as read only and**R+W** toread + write**.**

Note: The registered no of all parameters can be found from the Last column of Menu Description of all LEVEL.

For example, By registering "64" for hysteresis (ᴴᵞ) to D.S.1, **HY** parameter can be appear first in operator mode.And if **D.S.1** is **R+W** this parameter can be editable. And if **D.S.1** is **R** then this parameter shows the current value of HY and the value can't be editable.

LEVEL 5: SELECT Display settings:				
Parameter (PV display)		Setting name and description (SV display)	Default value	Shows only if
Symbol	Name			
Pᴜᵈ (Pwd)	Password	0 to 9999(Password Protection for Level-3)	-	LOCK is set on in Level-5
d.S.1 (D.S.1)	SELECT display 1	0 to 91 (0 = None) Can be set within 0 to 91.	1	
d.1t (D.1.T)	Display1 Parameter Type	ᴿ / ᴿ⁻ᵂ 0: ᴿ⁻ᵂ: Read+write 1:ᴿ: Read only	0	
d.S.2 (D.S.2)	SELECT display 2	0 to 91	2	
d.2t (D.2.T)	Display 2 Parameter Type	ᴿ / ᴿ⁻ᵂ 0: ᴿ⁻ᵂ: Read+write 1:ᴿ: Read only	0	
d.S.3 (D.S.3)	SELECT display 3	0 to 91	0	
d.3t (D.3.T)	Display 3 Parameter Type	ᴿ / ᴿ⁻ᵂ 0: ᴿ⁻ᵂ: Read+write 1:ᴿ: Read only	0	
d.S.4 (D.S.4)	SELECT display 4	0 to 91	0	
d.4t (D.4.T)	Display 4 Parameter Type	ᴿ / ᴿ⁻ᵂ 0: ᴿ⁻ᵂ: Read+write 1:ᴿ: Read only	0	
d.S.5 (D.S.5)	SELECT display 5	0 to 91	0	

d.5.t (D.5.T)	Display 5 Parameter Type	r / r-ū 0: r-ū: Read+write 1:r: Read only	0	
d.5.6 (D.S.6)	SELECT display 6	0 to 91	0	
d.6.t (D.6.T)	Display 6 Parameter Type	r / r-ū 0: r-ū: Read+write 1:r: Read only	0	
d.5.7 (D.S.7)	SELECT display 7	0 to 91	0	
d.7t (D.7.T)	Display 7 Parameter Type	r / r-ū 0: r-ū: Read+write 1:r: Read only	0	
d.5.8 (D.S.8)	SELECT display 8	0 to 91	0	
d.8.t (D.8.T)	Display 8 Parameter Type	r / r-ū 0: r-ū: Read+write 1:r: Read only	0	
d.5.9 (D.S.9)	SELECT display 9	0 to 91	0	
d.9.t (D.9.T)	Display 9 Parameter Type	r / r-ū 0: r-ū: Read+write 1:r: Read only	0	
d.5.10 (D.S.10)	SELECT display 10	0 to 91	0	
d.10t (D.10.T)	Display 10 Parameter Type	r / r-ū 0: r-ū: Read+write 1:r: Read only	0	
LocP (LOCK)	Password Set password to lock selected level	L.oFF/L.on 0: L.OFF:Level-5 Menu Lock OFF 1: L.ON:Level-5 Menu Lock ON	0	

6.8 Calibration

Pressing MENU key PV Display shows n̄odE (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			
Pūd (Pwd)	Password	0 to 9999(Password Protection for Level-5)	-	LOCK-5 set On in Level-4
Ān̄b (Amb)	Ambient	Ambient Adjustment	-	PV Sensor type is T/c.
tc.L.5	Thermocouple and	Depending on PV	-	Pv sensor type

(tc.L.S)	Linear Span Calibtriaon	sensor type selected		is T/c or Linear
rtd.2 (rtd.Z)	Calibration Zero FOR RTD Input		-	PV Sensor type is RTD
rtd.5 (rtd.S)	Calibration Span FOR RTD Input		-	PV Sensor type is RTD
rSP.2 (rSP.Z)	Remote SP Zero calibration		-	Remote set point is selected
rSP.5 (rSP.S)	Remote SP Span calibration		-	Remote set point is selected
PFb2 (pFb.Z)	Position Feedback Zero calibration		-	Output type is Position proportional type with feedback
PFb.5 (pFb.S)	Position Feedback Span calibration		-	Output type is Position proportional type with feedback
rtr.2 (rtr.Z)	Retransmission Zero calibration		-	
rtr.5 (rtr.S)	Retransmission Span calibration		-	
CoP.2 (CoP.Z)	Control Output Zero calibration		-	Output type is Current Output
CoP.5 (CoP.S)	Control Output Span calibration		-	Output type is Current Output

6.9 Factory Reset Parameters

Pressing MENU key PV Display shows ᴝodE (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			
Pᴝd (Pwd)	Password	0 to 9999	-	-

ᴸdᴱF (L.dEF)	LOAD Default	CAL\PArA (CAL)\(PARA) CAL- Only calibration set to default value PARA- 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-4. Also, PASSWORD can be set using S.Pwd (S.PWD)**

INPUT TYPE SELECTION TABLE:

Type	I/PN O	Type Display	Range	Resolution
E	1	E tc	-200 to 1000°C	0.1°C
J	2	J tc	-200 to 1200°C	
K	3	H tc	-200 to 1370°C	
T	4	t tc	-200 to 400°C	
B	5	b tc	450 to 1800°C	
R	6	r tc	0 to 1750°C	
S	7	S tc	0 to 1750°C	
N	8	n tc	-200 to 1300°C	
RTD	9	rtd	-199.9 to 850.0°C	
-10 to 20mV	10	-10.20	-1999 to 9999 Counts	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	0.4-2		
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		

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7. PARAMETER FLOW CHART

LVL3	LVL4	LVL5
LuL3	LuL4	LuL5

PWD	PWD	PWD
Pūd	Pūd	Pūd

INP.T	M.TIM	RSP.T	T.OUT	D.S.1	D.S.7
InP.t	ñt.iñ	rSP.t	t.OUt	d5.1	d5.7

A.CJC	A.WFB	RSP.H	PWD	D.1.T	D.7.T
ACJC	AūFb	rSP.H	Pūd	d.1t	d.7t

F.CJC	SQRT	RSP.L	LOCK-1	D.S.2	D.S.8
F.CJC	59rt	rSP.L	LOCP-1	d5.2	d5.8

PV.HI	SP.NO	RSP.O	LOCK-2	D.2.T	D.8.T
PuH.i	SP.no	rSP.O	LOCP-2	d2t	d.8t

PV.LO	FLTR	RSP.F	LOCK-3	D.S.3	D.S.9
PuLO	FLtr	rSP.F	LOCP-3	d5.3	d5.9

DP	P.O.	SR.NO	LOCK-4	D.3.T	D.9.T
dP	P.O.	Sr.ñO	LOCP-4	d3t	d.9t

OT	DI-1	BAUD	LOCK-5	D.S.4	D.S.10
Ot	di-1	bAUd	LOCP-5	d5.4	d5.10

CO.Hi	DI-2	PR.ST	LOCK-6	D.4.T	D.10.T
COH.i	di-2	Pr.5t	LocP-6	d.4t	d.10t

CO.LO	DI-3	RTR.T	PWD	D.S.5	LOCK
COLO	di-3	rtr.t	Pūd	d5.5	LocP

PV.SC	DI-4	RTR.V		D.5.T	
PuSC	di-4	rtr.u		d5t	

SP.ñd	P.Z.AD	R.DIR		D.S.6	
	P.2.Ad	r.dir		d5.6	

O.DIR	P.S.AD	AT.HY		D.6.T	
Od.ir	P.5Ad	At.HY		d.6t	

(4)   (5)   (6)

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```
                    ESC                    ESC
   ┌──────────────────────────┐         ┌──────────┐
   │         ┌────────┐  ▲    │ ┌────────┐     ▲   │
   │ ┌───────│ CAL    │       │ │ F.RST  │          │
   │ │       │ CAL    │       └─│ F.r5t  │          │
   │ │       └────────┘         └────────┘
   │ │        ESC   Q            ESC   Q
   │ │       ┌────────┐         ┌────────┐
   │ │       │ PWD    │         │ PWD    │
   │ │       │ Pud    │         │ Pud    │
   │ │       └────────┘         └────────┘
   │ │             Q                  Q
   │ │       ┌────────┐         ┌────────┐
   │ │       │ AMB    │         │ L.DEF  │
   │ │       │ Anb    │         │ LdEF   │
   │ │       └────────┘         └────────┘
   │ │             Q
   │ │       ┌────────┐
   │ │       │ TC.L.S │
   │ │       │ tCL5   │
   │ │       └────────┘
   │ │             Q
   │ │       ┌────────┐
   │ │       │ RTD.Z  │
   │ │       │ rtd2   │
   │ │       └────────┘
   │ │             Q
   │ │       ┌────────┐
   │ │       │ RTD.S  │
   │ │       │ rtd5   │
   │ │       └────────┘
   │ │             Q
   │ │       ┌────────┐
   │ │       │ RSP.Z  │
   │ │       │ r5P.2  │
   │ │       └────────┘
   │ │             Q
   │ │       ┌────────┐
   │ │       │ RSP.S  │
   │ │       │ r5P.5  │
   │ │       └────────┘
   │ │             Q
   │ │       ┌────────┐
   │ │       │ PFB.Z  │
   │ │       │ PFb2   │
   │ │       └────────┘
   │ │             Q
   │ │       ┌────────┐
   │ │       │ PFB.S  │
   │ │       │ PFb5   │
   │ │       └────────┘
   │ │             Q
   │ │       ┌────────┐
   │ │       │ RTR.Z  │
   │ │       │ rtr.2  │
   │ │       └────────┘
   │ │             Q
   │ │       ┌────────┐
   │ │       │ RTR.S  │
   │ │       │ rtr.5  │
   │ │       └────────┘
   │ │             Q
   │ │       ┌────────┐
   │ │       │ COP.Z  │
   │ │       │ COP2   │
   │ │       └────────┘
   │ │             Q
   │ │       ┌────────┐
   │ └───────│ COP.S  │
   │         │ COP5   │
   │         └────────┘
```

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 & DIGITAL OUTPUTS

For all Alarm and Digital outputs (open collector) there are five settings. (AS shown in LEVEL – 2 Menu)

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

SET VALUE: Alarm set point / Digital output 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	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.A.H	Absolute value High alarm	Ref figure 1
6	Pu.A.L	Absolute value Low alarm	Ref figure 2
7	SP.A.H	Absolute value set point high alarm	Ref figure 7
8	SP.A.L	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 Band alarm with standby	Same as figure 6
13	P.S.A.H	Absolute value High alarm with standby	Same as figure 7
14	P.S.A.L	Absolute value Low alarm with standby	Same as figure 8
15	Pu-E.	PV error(OPEN/OVER/UNDER)	Note 1
16	rSP.E	RSP error	Note 1
17	uP-E	VPFB error	Note 1
18	P.r.u.E	Any type of error	Note 1

NOTE-1: The fault diagnosis output turns on in case of input burnout (PV, Remote set point, Feedback slide wire) failure.

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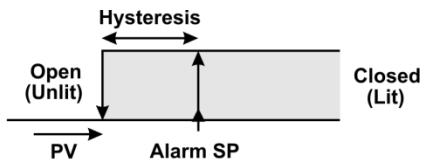
Absolute Value High Alarm
Figure: 1
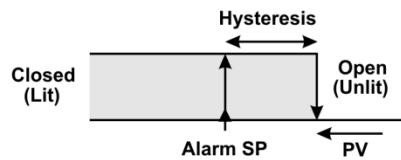
Absolute Value Low Alarm
Figure: 2
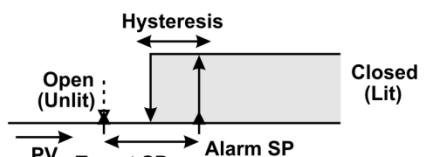
Deviation High Alarm
Figure: 3
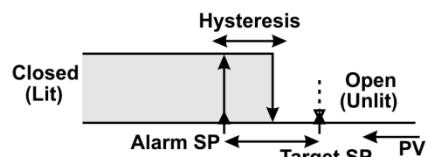
Deviation Low Alarm
Figure: 4
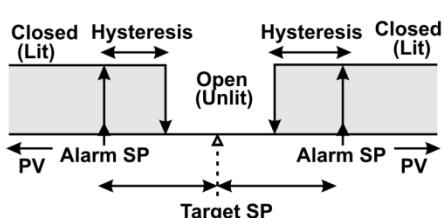
Deviation High/Low Range Alarm
Figure: 5
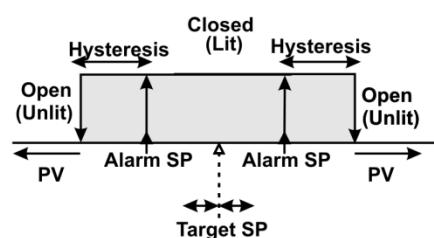
Deviation High/Low Band Alarm
Figure: 6
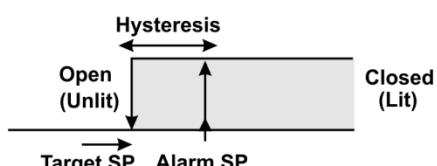
Absolute Value
Set Point High Alarm
Figure: 7
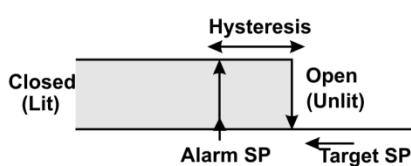
Absolute Value
Set Point Low Alarm
Figure: 8

<u>**Hystresis :**</u> Hystresis 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.
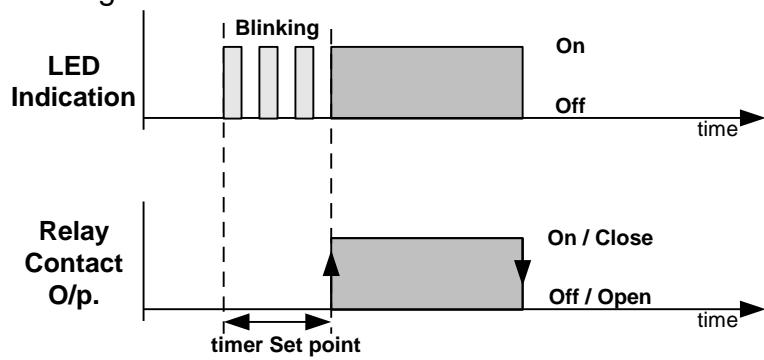
Standby operation:
For alarm types, 9 to 14, the relay action happens only after the PV has crossed the SP after power on.

Example:

Stand-by Action

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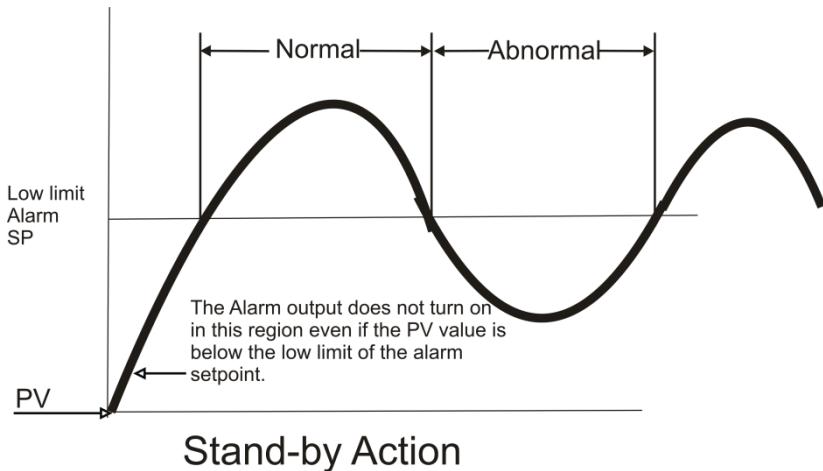
9.DIGITAL INPUTS

There are four digital inputs for various purposes.

To achieve these functions through field contact, user has to select ЧЕ5 for particular digital input in **Level – 3**mode.

Digital Input – 1: SET POINT-1 / SET POINT-2 SELECTIONS

If target set point number has been switched using contact input, when the Di-1 Set to YES, that function cannot be selected by keystroke.

Digital Input – 2: AUTO / MANUAL MODE SELECTIONS

If AUTO and MAN have been switched using contact input, when the Di-2 is set to YES, switching between AUTO and MAN cannot be achieved by keystroke.

Digital Input – 3: LOCAL / REMOTE SET POINT SELECTIONS

Switching between REM and LCL is possible for only controllers with remote input feature. If remote status is achieved by external contact input (Di-3 set to YES), switching between REM and LCL cannot be achieved by keystroke.

Digital Input – 4: RUN / STOP CONTROL SELECTIONS

Selection between the RUN and STOP state can be made with contact input only. This function will stop to calculate MV (Manipulated Variable). SV display shows 5toP**(Stop)**message. Run/Stop function is used during Emergency or to shut down the plant. This function cannot be achieved by keystroke.

If PV Scale (Burn out sensor) selected asnonE **(none),** during Stop condition, Control Output will be Preset Output. i.e. %MV = Preset Output.

Status	DI 1		DI 2		DI 3		DI 4	
NO	No Function		No Function		No Function		No Function	
YES	ON	Set Point-2 Selected	ON	Manual Mode	ON	Remote Set Point	ON	STOP state
	OFF	Set Point -1 Selected	OFF	Auto Mode	OFF	Local Set Point	OFF	RUN State

Note: Excitation voltage rating is 24V dc.That can be provided internally or externally depends upon the requirement (Factory selectable).

10. CONTROL FUNCTION DETAILS

Direct/ReverseControl (Output Direction):
For Heat (Reverse Action) and Cool (Direct Action) type PID control logic, user has to program the proportional band, integral time and derivative time for proper control. They can either be set by auto tuning or can be changed manually as explained in control parameters.

Ramp Function:
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.
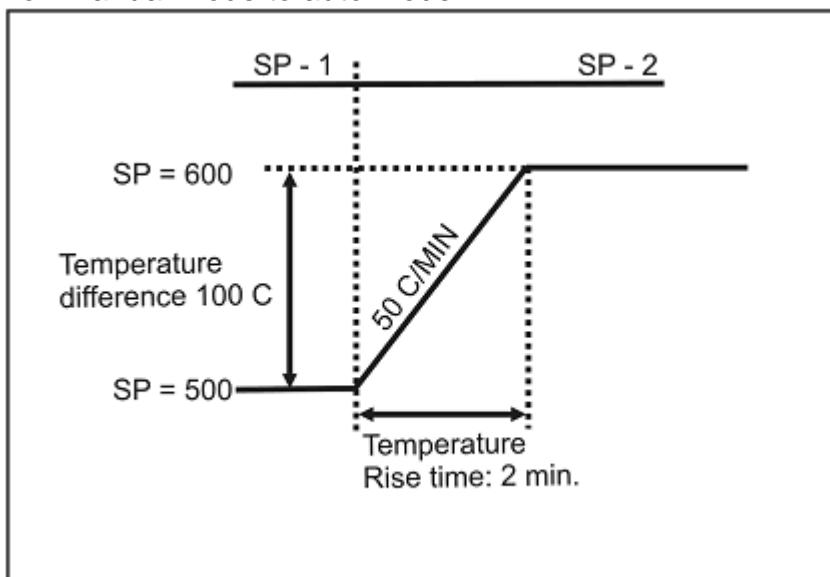
The ramp function will be performed when ramp unit parameter is selected as n̄ lnr (minute rate) or Hrr (hour rate). The ramp rate can be programmed by setting the parameter RR. When ramp is on, decimal point in SV display will blink. The ramping function will be cancelled in following conditions.

- A change is made from Auto mode to manual mode.
- Sensor Failure occurs.
- Auto tuning function is activated.

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 set point properly, select the parameter A .tun (A.TUN) in program menu (Level-1) and set it to YES.

During Auto Tuning process **A-T** Led will blink. After auto tuning procedures are completed, 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.

Note:
If Ramp function is used,it will be disabled once the auto tuning starts. The auto tuning is cancelled as soon as either failure mode or manual control mode occurs.

AUTO TUNE FUNCTION:
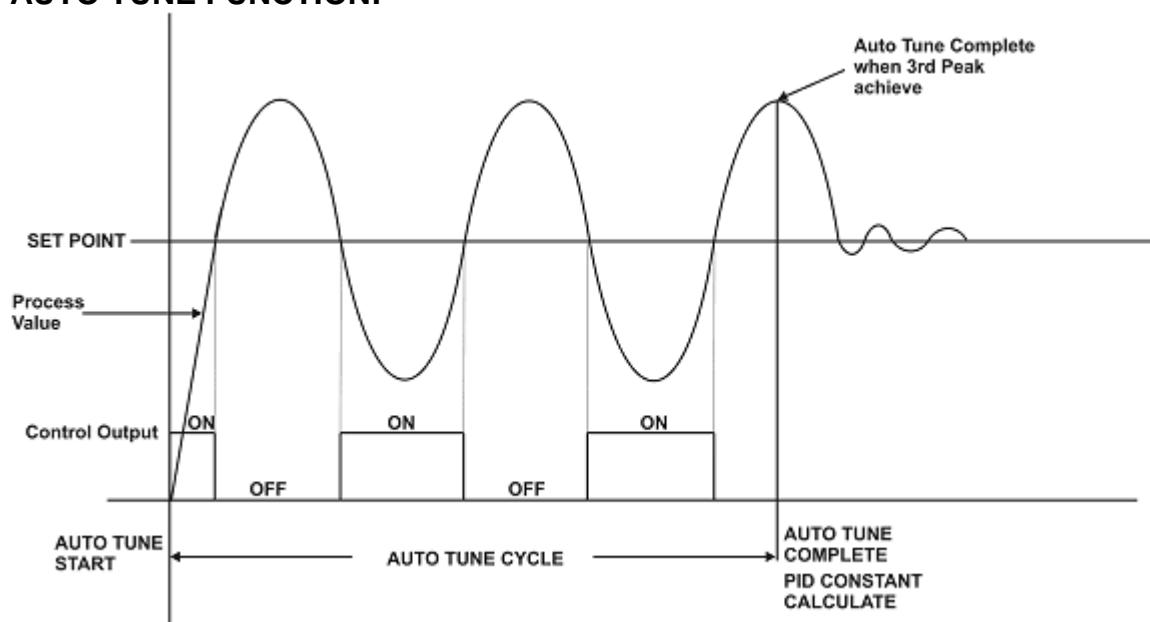
Auto Tuning is a function with which the controller automatically measures the process characteristics to automatically set the optimum PID constants. Limit Cycle method is used to calculate the PID values.

Auto tune function is not available for Valve Position Feedback and Valve Position without Feedback PID control type.

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 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 atset 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

For SSR driver output: Set to 1 second or more

FOR Linear output (4-20mamp output): Cycle time is not required
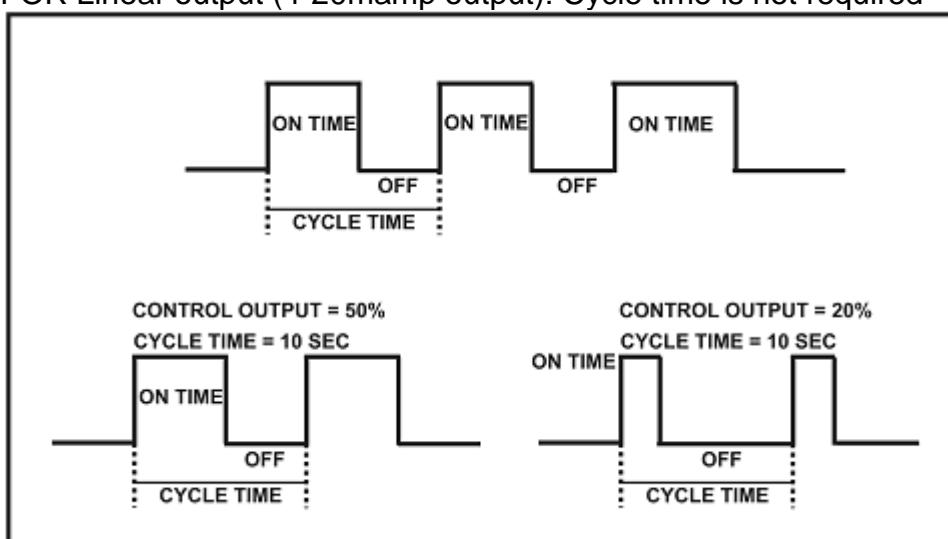
BASIC PID TUNING PROCEDURE:

ADJUSTMENT SEQUENCE	SYMPTOM	SOLUTION
Proportional Band	Slow Response	Decrease PB
	Overshoot or Oscillation	Increase PB
Integral Time	Slow Response	Decrease TI
	Instability or Oscillation	Increase TI
Derivative Time	Slow Response or Oscillation	Decrease TD
	High Overshoot or Instability	Increase TD

Basic PID ADJUSTMENT GUIDE

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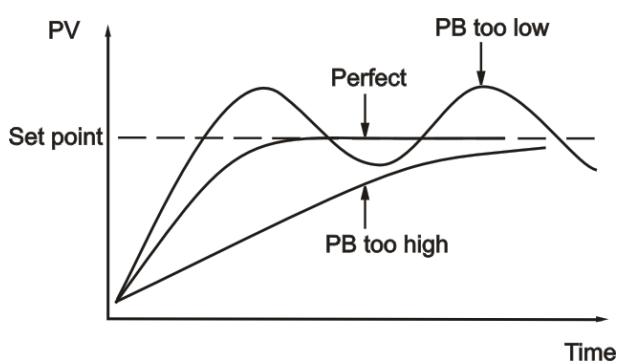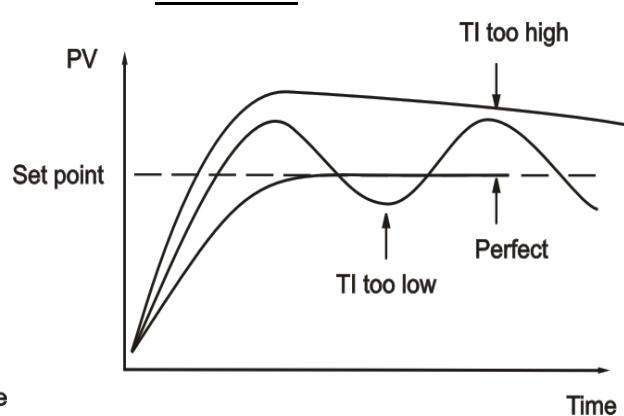
P ACTION: -

I ACTION:-

D ACTION:-
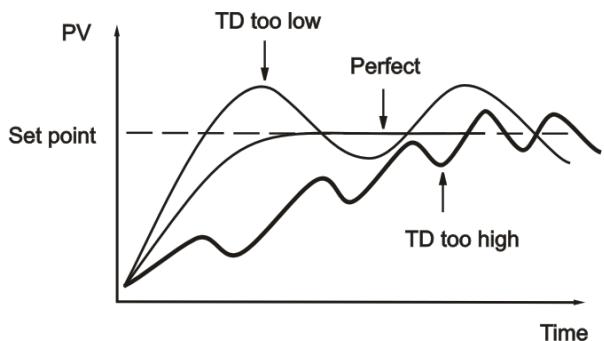
Digital Filter (FLTR):-

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:

Input (PV)   Filtering for 2 second   Filtering for 10 second
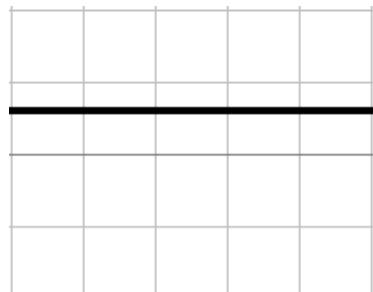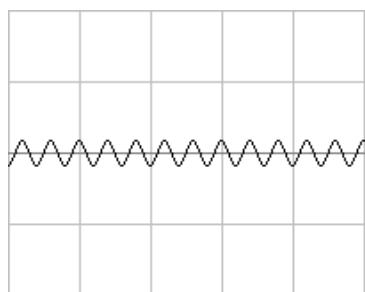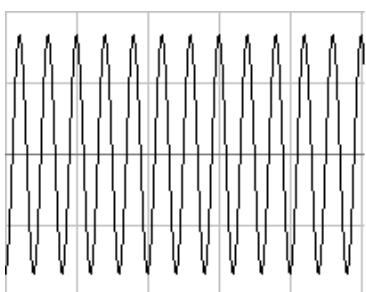
Position Proportional Control:

Position proportional control can be of either feedback type or estimating type.
In feedback type position proportional control, the controller obtains a valve position signal from a feedback slide wire resistor attached to a valve.

In estimating type position proportional control, user has to set the operating time required for a valve to change from the fully closed position to the fully open position. With the preset operating time, the controller controls the valve by estimating the position. In the case of estimating type position proportional control, there is no need for feedback input wiring.

Feedback-type position proportional control is superior to the estimating type in terms of control performance. When in manual operation you can directly manipulate the controller's output terminals. Pressing Increment key sends the valve into opening motion while pressing the Shift key sends it to closing motion.
The figure below shows a schematic representation of a loop configured for position proportional control.

Also, Valve's Zero and Span positions canbe adjusted in level – 3(Position Zero Adjustment and Position Span Adjustment). Using Increment and Shift key user can set the position of valve
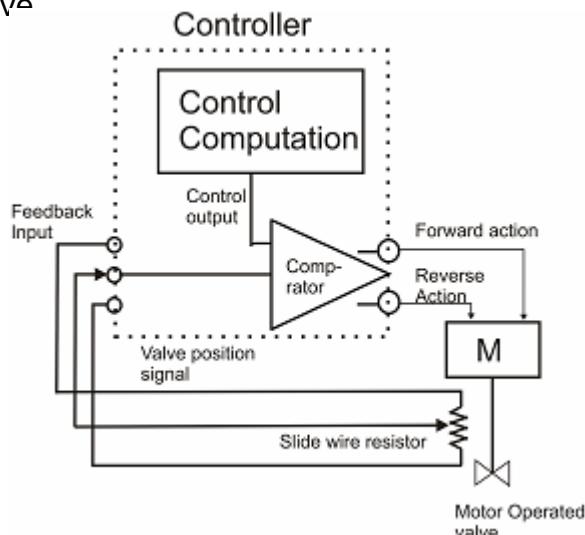
Control Output Selection:

OUTPUT TYPE	RELAY CAN CONFIGUR AS			
	RELAY1	RELAY2	RELAY3	RELAY4
RELAY	USE FORCONTROLHEAT/COOL ACTION	ALARM2	ALARM3	ALRAM4
SSR(Pulse output)	ALARM1	ALARM2	ALARM3	ALARM4
CURRENT(Analog current output)	ALARM1	ALARM2	ALARM3	ALARM4
ON-OFF ACTION	USE FOR CONTROL ACTION	ALARM2	ALARM3	ALARM4
Position feedback Action	USE TO CONTROL FORWARD RELAY	USE TO CONTROL REVERSE RELAY	ALARM3	ALARM4

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Without feedback Action	USE TO CONTROL FORWARD RELAY	USE TO CONTROL REVERSE RELAY	ALARM3	ALARM4

11. CALIBRATION PROCEDURE

Calibration is provided for ambient temperature, PV sensor input, Remote set point, Control output, Retransmission output and Position feedback potentiometer.

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
- Remote set point input
- Position feedback input
- Retransmission output (calibration for voltage or current)
- Control output (calibration for current)

11.1 Ambient temperature adjustment

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

PV display shows � Ānb .Ā (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.

11.2 PV input sensor calibration

When user enters in calibration menu, PV display shows message tc .L .S (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 ūA ıt (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 .Z (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 ūA ιŁ (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 rŁd .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 ūA ιŁ (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.

11.3 Remote set point calibration

This menu will come up only if; the Remote set point selected. (AS per Cal menu)

When user enters in calibration menu, PV display shows message rSP .Z (RSP.Z) for remote input zero calibration. Feed remote signal input using a calibrator, such that input value is close to input's lower range value.

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

Use Inc/Shift key to correct the displayed reading to the desired set point value and press ENT key. The controller will store zero calibration value. Press MENU key for span calibration.

PV shows the message rSP .5 (remote set point span calibration). SV display shows value corresponding to signal input value and old calibration data. Feed signal input using a calibrator, such that process value is close to signal's upper range value. Use Inc/Shift key to arrive at the desired set point value and press ENT key. The controller will display message ūA ιŁ (wait) in the SV display to indicate that it is doing the necessary calculations.

Depending on the situation, this process may take few seconds.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 Remote set point is over.

11.4 Position Feedback Calibration

This menu will come up only if; valve position feedback is selected. Press MENU key repeatedly, till PV display shows message PFb .Z (position feedback zero calibration).

SV display shows feedback value corresponding to feedback signal value and old calibration data. Take the feedback signal to close position. Use Inc/Shift key to correct the displayed reading to the desired value (usually its value is zero).Press ENT

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key. The controller will store zero calibration value. Press MENU key for span calibration.

PV shows the message `PFb .5` (position feedback span calibration). SV display shows value corresponding to signal input value and old calibration data. Feed signal input using a calibrator, such that process value is close to signal's upper range value. Use Inc/Shift key to arrive at the desired set point value. Press ENT key.

When the calculations are over, the new calibration values are stored automatically. Calibration for position feedback signal is over.

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

11.5 Retransmission output calibration (Voltage/current output)

Press MENU key repeatedly, till PV display shows message `rtr .2` (retransmission 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 `rtr .5` (retransmission 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.

11.6 Control output calibration (current output)

Press MENU key repeatedly, till PV display shows message `CoP .2` (control output zero calibration).SV display shows the value being outputted on control output terminals. Measure the value using a highly accurate digital multi meter. Use Inc/Dec key to correct the displayed reading to the measured value. Press ENT key. The controller will store zero calibration value. Press set key to calibrate retransmission output span calibration menu.

PV shows the message `CoP .5` (control 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 control 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,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,4-20mamp,0-20mamp	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 than calibration is not required for other input types from Group-1.

12. 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.

12.1 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

12.2 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.

12.3 Modbus parameters

(Absolute Address 30001 to 30007)

Sr. No	Parameter	Absolute address	Data Type	Minimum value	Maximum value	Access Type
1	PV	30001	Integer	-1999	9999	R
2	Remote set Point	30002	Integer	-1999	9999	R
3	Valve position	30003	Integer	0.0	100.0	R
4	%Power	30004	Integer	0.0	100.0	R
5	Ambient	30005	Integer	0.0	60.0	R
6	AUTO Tune status	30006	Integer	0	1	R
7	RELAY and DO status	30007	Integer	0	255	R

Note: Relay and DO statuscan be read in **Binary Format.**

Modbus parameters :(Absolute Address 40001 to 40100)

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	Set Point – 2	40002	Integer	Input type range low	Input type range high	R/W
3	Proportional band	40003	Integer	1	9999	R/W
4	Integral time	40004	Integer	0	1000	R/W
5	Derivative time	40005	Integer	0	250	R/W
6	Derivative Factor	40006	Char	1	100	R/W
7	Cycle time	40007	Integer	1	250	R/W
8	Duty Cycle	40008	Char	10	100	R/W
9	Dead Band	40009	Integer	0.1	50.0	R/W
10	Pb shift	40010	Integer	-50	50	R/W
11	Manual Reset	40011	Integer	-50	50	R/W
12	Hystresis	40012	Integer	1	250	R/W
13	Ramp	40013	Char	0	2	R/W
14	Ramp Rate	40014	Integer	1	9999	R/W
15	A/M mode	40015	Char	0	1	R/W
16	%Power	40016	Integer	0	1000	R/W
17	AL1 SP	40017	Integer	-1999	9999	R/W
18	AL1 TP	40018	Char	0	16	R/W
19	AL1 HYS	40019	Integer	1	250	R/W
20	AL1 DIR	40020	Char	0	1	R/W
21	AL1 DLY	40021	Char	1	99	R/W
22	AL2 SP	40022	Integer	-1999	9999	R/W
23	AL2 TP	40023	Char	0	16	R/W
24	AL2 HYS	40024	Integer	1	250	R/W
25	AL2 DIR	40025	Char	0	1	R/W
26	AL2 DLY	40026	Char	1	99	R/W
27	AL3 SP	40027	Integer	-1999	9999	R/W
28	AL3 TP	40028	Char	0	18	R/W
29	AL3 HYS	40029	Integer	1	250	R/W
30	AL3 DIR	40030	Char	0	1	R/W
31	AL3 DLY	40031	Char	1	99	R/W
32	AL4 SP	40032	Integer	-1999	9999	R/W
33	AL4 TP	40033	Char	0	18	R/W
34	AL4 HYS	40034	Integer	1	250	R/W
35	AL4 DIR	40035	Char	0	1	R/W
36	AL4 DLY	40036	Char	1	99	R/W
37	DO1 SP	40037	Integer	-1999	9999	R/W
38	DO1 TP	40038	char	0	18	R/W
39	DO1 HYS	40039	Integer	1	250	R/W
40	DO1 DIR	40040	Char	0	1	R/W
41	DO1 DLY	40041	Char	1	99	R/W
42	DO2 SP	40042	Integer	-1999	9999	R/W
43	DO2 TP	40043	char	0	18	R/W
44	DO2 HYS	40044	Integer	1	250	R/W
45	DO2 DIR	40045	Char	0	1	R/W

46	DO2 DLY	40046	Char	1	99	R/W
47	DO3 SP	40047	Integer	-1999	9999	R/W
48	DO3 TP	40048	Char	0	18	R/W
49	DO3 HYS	40049	Integer	1	250	R/W
50	DO3 DIR	40050	Char	0	1	R/W
51	DO3 DLY	40051	Char	1	99	R/W
52	DO4 SP	40052	Integer	-1999	9999	R/W
53	DO4 TP	40053	Char	0	18	R/W
54	DO4 HYS	40054	Integer	1	250	R/W
55	DO4 DIR	40055	Char	0	1	R/W
56	DO4 DLY	40056	Char	1	99	R/W
57	Input type	40057	Char	1	19	R/W
58	Auto CJC	40058	Char	0	1	R/W
59	Fix CJC	40059	Integer	0	600	R/W
60	Range high	40060	Integer	-1999	9999	R/W
61	Range low	40061	Integer	-1999	9999	R/W
62	Decimal Point	40062	Char	0	3	R/W
63	Control Output type	40063	Char	0	5	R/W
64	Co Range High	40064	Integer	0.0%	100.0%	R/W
65	Co Range Low	40065	Integer	0.0%	100.0%	R/W
66	PV Scale	40066	Char	0	2	R/W
67	Set point mode	40067	Char	0	1	R/W
68	Output Direction	40068	Char	0	1	R/W
69	Motor Travel time	40069	Integer	10	500	R/W
70	Auto Feedback	40070	Char	0	1	R/W
71	Square root	40071	Char	0	1	R/W
72	Set point 1 or 2	40072	Char	1	2	R/W
73	PV Filter	40073	Char	0	60	R/W
74	Preset output	40074	Integer	0.0%	100.0%	R/W
75	RUN/STOP PID	40075	Char	0	1	R/W
76	DI – 1	40076	Char	0	1	R/W
77	DI – 2	40077	Char	0	1	R/W
78	DI – 3	40078	Char	0	1	R/W
79	DI - 4	40079	Char	0	1	R/W
80	RSP type	40080	Char	0	1	R/W
81	RSP Range High	40081	Integer	-1999	9999	R/W
82	RSP Range Low	40082	Integer	-1999	9999	R/W
83	RSP offset	40083	Integer	-1000	1000	R/W
84	RSP factor	40084	Char	0.01	10.00	R/W
85	Slave Device id	40085	Char	1	247	R/W
86	Baud Rate	40086	Char	0	1	R/W
87	Parity/Stop Bit	40087	Char	0	3	R/W
88	Retransmission	40088	Char	0	4	R/W

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|						
	Type					
89	Retransmission Variable	40089	Char	0	3	R/W
90	Retransmission Direction	40090	Char	0	1	R/W
91	Retransmission Range high	40091	Integer	-5.0%	105.0%	R/W
92	Retransmission Range low	40092	Integer	-5.0%	105.0%	R/W
93	Auto tune Hys	40093	Char	1	250	R/W
94	Time out	40094	Char	10	100	R/W
95	Lock – 1 (Level-1)	40095	Char	0	1	R/W
96	Lock – 2 (Level-2)	40096	Integer	0	1	R/W
97	Lock – 3 (Level-3)	40097	Integer	0	1	R/W
98	Lock – 4 (Level-4)	40098	Char	0	1	R/W
99	Lock – CAL	40099	Char	0	1	R/W
100	Password	40100	integer	0	9999	R/W
101	SELECT display 1	40101	Char	0	91	R/W
102	Display1 Type	40102	Char	0	1	R/W
103	SELECT display 2	40103	Char	0	91	R/W
104	Display 2 Type	40104	Char	0	1	R/W
105	SELECT display 3	40105	Char	0	91	R/W
106	Display 3 Type	40106	Char	0	1	R/W
107	SELECT display 4	40107	Char	0	91	R/W
108	Display 4 Type	40108	Char	0	1	R/W
109	SELECT display 5	40109	Char	0	91	R/W
110	Display 5 Type	40110	Char	0	1	R/W
111	SELECT display 6	40111	Char	0	91	R/W
112	Display 6 Type	40112	Char	0	1	R/W
113	SELECT display 7	40113	Char	0	91	R/W
114	Display7 Type	40114	Char	0	1	R/W
115	SELECT display 8	40115	Char	0	91	R/W
116	Display 8 Type	40116	Char	0	1	R/W
117	SELECT display 9	40117	Char	0	91	R/W
118	Display 9 Type	40118	Char	0	1	R/W
119	SELECT display 10	40119	Char	0	91	R/W
120	Display10 Type	40120	Char	0	1	R/W
121	Lock – 5 (Level-5)	40121	Char	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.

13. Appendix

13.1 Troubleshooting

If the operating display does not appear after turning on the controller's power, follow the measures in the procedure below.
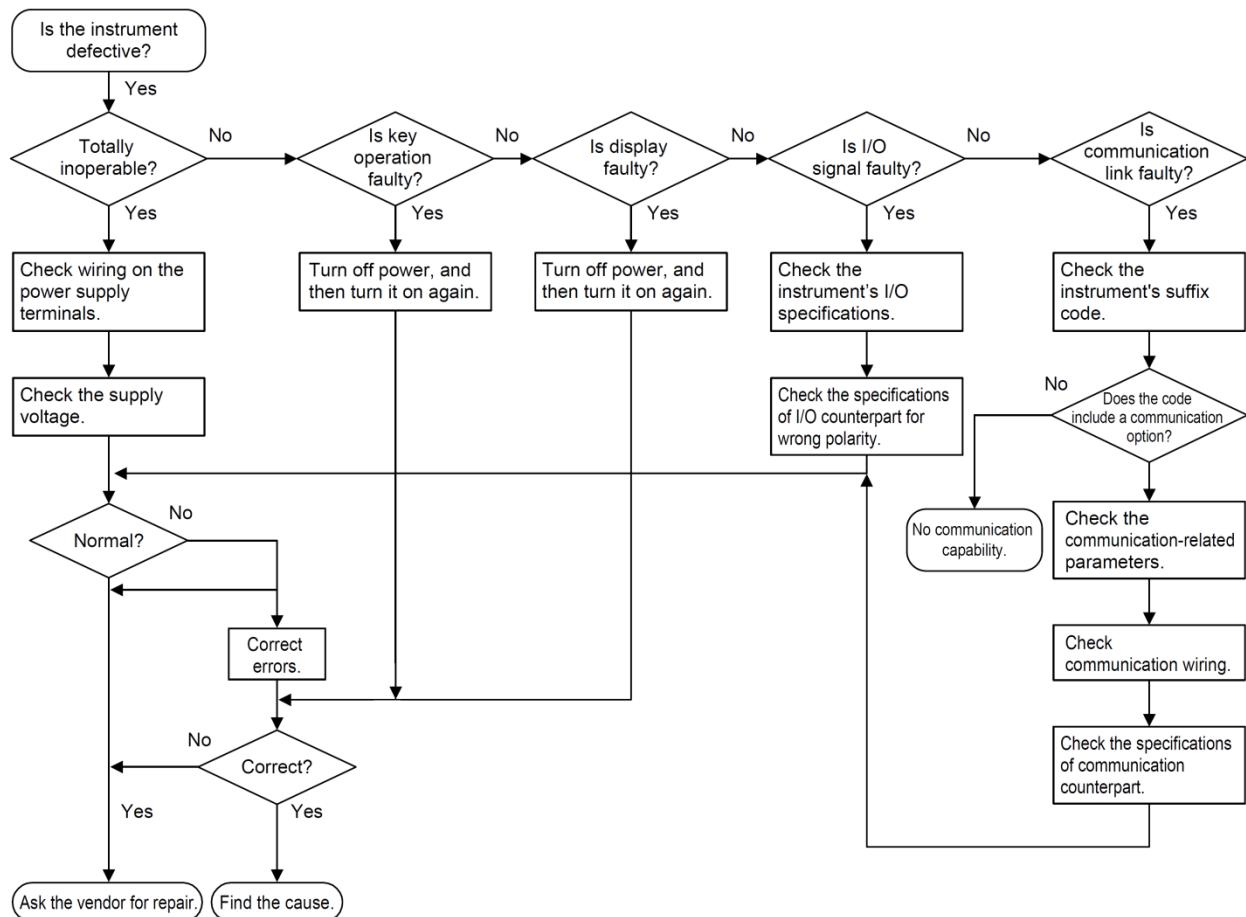
If a problem appears complicated, contact our sales representative.

IMPORTANT

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

13.2 PV INPUT STATUS DISPLAY DURING BURNOUT CONDITION

Input type	Display Message
TC-E	OPEN(oPEn)
TC-J	OPEN

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TC-K	OPEN
TC-T	OPEN
TC-N	OPEN
TC-B	OPEN
TC-R	OPEN
TC-S	OPEN
PT 100(RTD)	OPEN
0-10V DC	OPEN
0 to 5V DC	OPEN
1 to 5V DC	OPEN
0 to 2V DC	OPEN
0.4 to 2V DC	OPEN
0 to 20mAmp	OPEN
4 to 20mAmp	OPEN
-10 to 20mV DC	OPEN
0-100mV DC	OPEN
0-75mV DC	OPEN

Table-13.1

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 ouƐr/Undr (OVER/UNDER) message until value crosses maximum value of Sensor range. Process value greater then maximum value of zero/span then display will show oPƐn (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 oPƐn (OPEN) message instead it will show either ouƐr/Undr (OVER/UNDER).

13.3 RSP (REMOTE SET POINT) BURNOUT CONDITION

Input type for Remote set point	Display Message
0-5V DC	rSP .Ɛ(RSP.E)
1-5V DC	rSP .Ɛ(RSP.E)

13.4 VALVE POSITION FEEDBACK OPEN CONDITION

Position Feedback input	Display Message

100Ω-POT to 1KΩ-POT	ⁿᶠᵇ.ᴱ (PFB.E)

NOTE:
20-segment LED BAR will start to blink to indicate that Position Feedback input is not connected properly in Run mode. In calibration mode, SV display shows ⁿᶠᵇ.ᴱ **(PFB.E)** (Position Feedback Error).

13.5 RETRAMISSION OUTPUT TABLE FOR OPEN /OVER /UNDER CONDITION

RETRASMISSION	VARIABLE	PROCESS SCALE	RETRASMISSION 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	-
4-20mamp	SP/LOCAL	-	-	-	-	-	-
	SP/REMOTE	-	DIR	-	-	-	20.8
	SP/REMOTE	-	REV	-	-	-	3.2
4-20mamp	VPFB(Position Feedback)	-	DIR	-	-	-	3.2
		-	REV	-	-	-	20.8
4-20mamp* (Note-3)	CO(Control Output)/DIR	UP	DIR	20.8	20.8	3.2	-
	CO/REV	UP	DIR	3.2	3.2	20.8	-
	CO/REV	UP	REV	20.8	20.8	3.2	-
	CO/DIR	UP	REV	3.2	3.2	20.8	-
	CO/DIR	DOWN	DIR	3.2	20.8	3.2	-
	CO/REV	DOWN	DIR	20.8	3.2	20.8	-
	CO/REV	DOWN	REV	3.2	20.8	3.2	-
	CO/DIR	DOWN	REV	20.8	3.2	20.8	-

Table 2

NOTE: -

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1) For Retransmission output type 0-20mamp, 0-10v, 1-5v and 0-5v also applicable according to above table.

2) For 0-20mamp, 0-10v and 0-5v minimum output value will be 0mamp and 0v respectively.

*3) Duringburnout condition, retransmission output w.r.t. CO and Process Scale selected none; retransmission output will follow preset output as set in Level - 3.

13.6 CONTROL OUTPUT TABLE OPEN/OVER/ UNDER CONDITION

CONTROL OP	Process Scale	Output Direction	DISPLAY INDICATION		
			OPEN	OVER	UNDER
4-20mamp Current	UP	DIR	20.0	20.0	4.0
	DOWN	REV	20.0	4.0	20.0
	UP	REV	4.0	4.0	20.0
	DOWN	DIR	4.0	20.0	4.0
SSR Pulse Output	UP	DIR	ON	ON	OFF
	DOWN	REV	ON	OFF	ON
	UP	REV	OFF	OFF	ON
	DOWN	DIR	OFF	ON	OFF
RELAY	UP	DIR	ON	ON	OFF
	DOWN	REV	ON	OFF	ON
	UP	REV	OFF	OFF	ON
	DOWN	DIR	OFF	ON	OFF
VPFB/VPNA	UP	DIR	FWD ON	FWD ON	REV ON
	DOWN	REV	FWD ON	REV ON	FWD ON
	UP	REV	REV ON	REV ON	FWD ON
	DOWN	DIR	REV ON	FWD ON	REV ON

Table 3

NOTE:- 1) If PV Scale (Burn out sensor) selected as ⁿoⁿᴱ (none), during Open sensor i.e. Burnout condition, Control Output will be Preset Output.

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13.7 Digital Input & Retransmission Output Type Selection Settings

In this Model Digital Input & Retransmission Output come with the two different types

Digital Input as	**Retransmission Output as**
- Non-Voltage Contact Switch	- Current Output
- Voltage Pulse (24VDC@5mA) Input	- Voltage Output

Refer below figures for Jumper Setting to change Digital Input & Retransmission Output type.
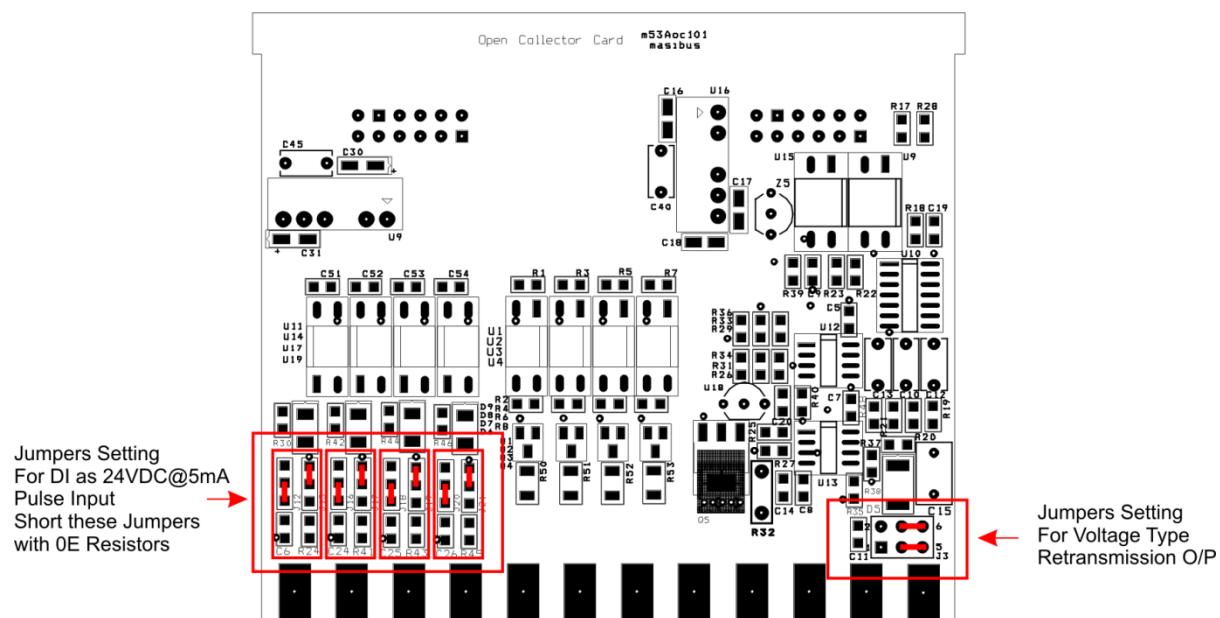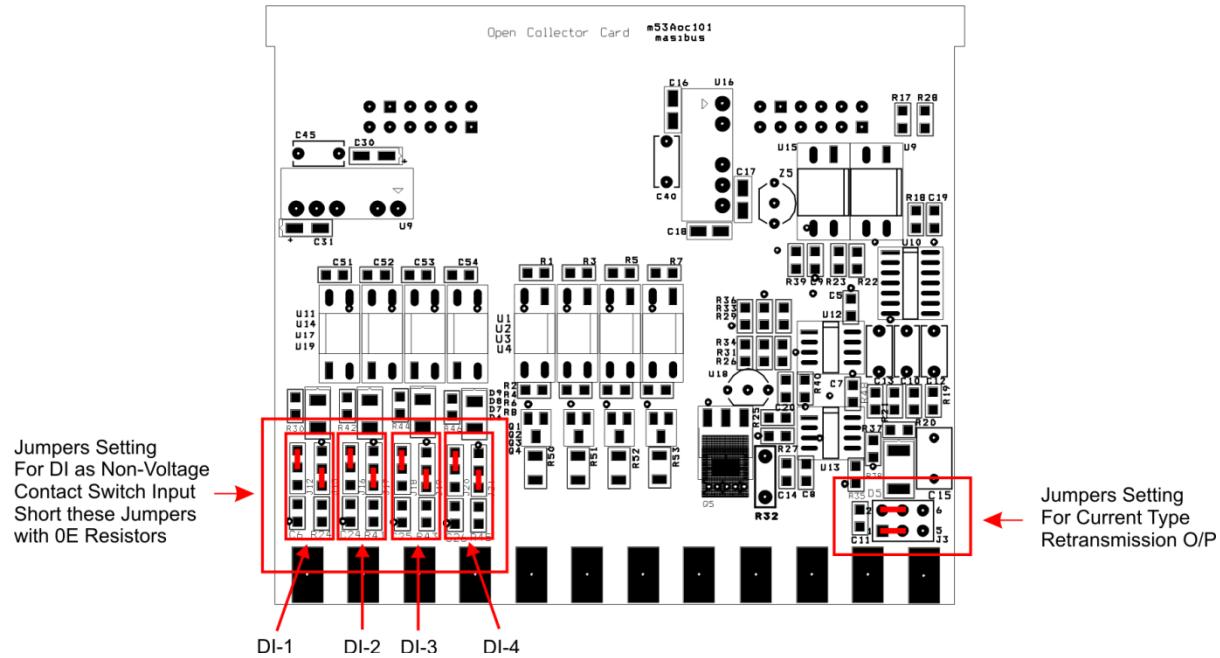
Note: All four Digital Inputs can be configured differently between available two types at the same time.