Model 5040
User's Manual Digital Indicating Controller

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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 continuing 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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Revision

1st Edition: March 2010.

Checking the Contents of the Package

Unpack the box and check the contents before using the product. If the product is different from that 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:

The Single Loop Controller unit has a nameplate affixed to the top of the terminals. Check the model and suffix codes inscribed on the nameplate to confirm that the product received is that which was ordered.

Model	Suffix code	Optional code	Remarks

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

2. Installation:

How to Install:

Mounting method: Panel mounting

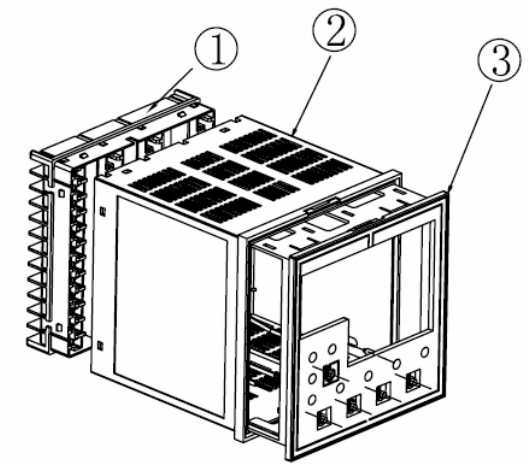
To install the controller select a location where:

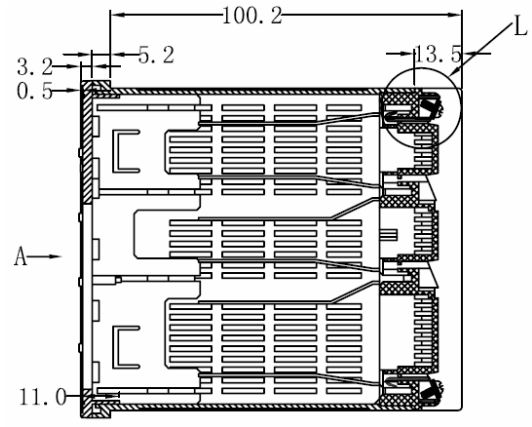
- no one may accidentally touch the terminals
- mechanical vibrations are minimal
- corrosive gas is minimal
- temperature can be maintained at about 25˚C to 35˚C and the fluctuation is minimal
- no direct radiant heat is present
- no magnetic disturbances are caused
- no wind blows against the terminal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

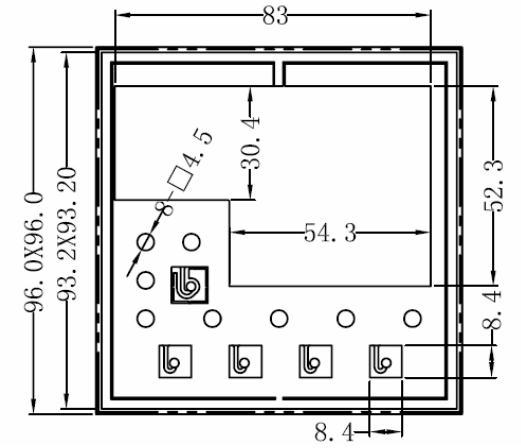
 Turn off the power to the controller before installing it on the panel because there is a possibility of electric shock

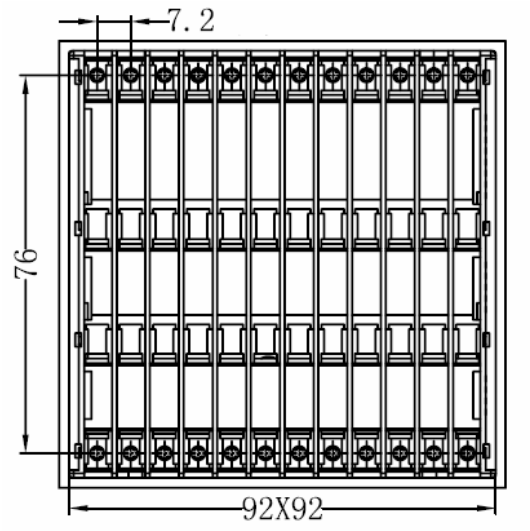
External Dimensions and Panel Cutout Dimensions:

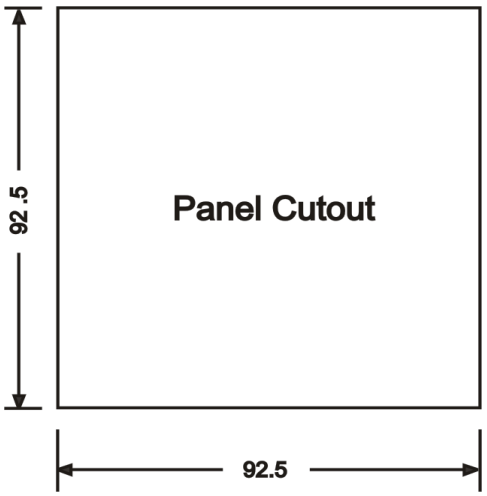
Unit: mm











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 with a tester or the like 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 "sunbber" is connected across the normally open contact of the relay switching through load. The sunbber recommended consists of a series connected resistor/capacitor (typically 15nF/100Ohms). A sunbber will also prolong the life of the relay contacts. A sunbber should also be connected across the output of a tric output to prevent false triggering under line transient conditions.

3. Hardware Specification Detail:

Input type: Universal input type
Thermocouple, RTD, Millivolt, Voltage, Current INPUT types are software selectable.
Applicable Standards: DIN (ITS-90) for Thermocouple and RTD

Type	Range	Accuracy	Resolution
E	-200 to 1000°C	±0.1% of instrument range ± 1 digit for temperature equal to or higher than 0º C ± 0.25% of instrument range ± 1 digit for temperature below 0º C ±0.25% of instrument range ± 1 digit(B,R,S TYPE TC)	0.1°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	-199.9 to 850.0°C	± 0.1% of instrument range ± 1 digit	
0 to 75mV	-1999 to 9999	± 0.1% of instrument range ± 1 digit	1 Count
0 to 100mv			
0.4 to 2V			
0 to 2V			
0-20 mA*			
4-20 mA*			
0 to 5V			
1 to 5V			
0 to 10V			
-10 to 20mV			

*For DC current input, 100 Ohms (0.1%, 25 ppm) shunt resistor must be connected externally. For DC current and Voltage input, Scaling is possible and decimal point is selectable.
Sampling Period: 250mSeconds.

Resolution: 17-bit

Burnout detection: Functions for TC, RTD, linear input signal. (It detects whether sensor is connected or not) Control output or Alarm output can be selected for sensor error condition.

Measurement current (RTD): About 1milli Ampere

Input Impedance: >1 Mohm for thermocouple/ mV/RTD/Volts inputs

Noise Rejection Ratio:
NMRR (Normal mode rejection ratio) > 40 dB (50/60 Hz) or more
CMRR (Common mode rejection ratio) > 120 dB (50/60 Hz) or more

Allowable wiring resistance for RTD: Maximum 15 ohms/wire (Conductor resistance between three wires should be equal).

Reference Junction Compensation Error: ±2°C

Remote Input Signals:
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 maximum
Resolution: 17-bit
Input resistance: > 1Mohm.
Input accuracy: ±0.1% instrument range, ±1 Count

Feedback Resistance Input:
Slide resistance value: 1kohms to 2Kohms of overall resistance (burnout detection for all the three wires provided)
Measuring resolution: 0.1% of overall resistance (After User's adjustment).

Loop Power Supply:
Supply Voltage: 24 ± 1 VDC, 30 mAmp with Inbuilt Short Circuit Protection. When using 24V DC loop power supply, keep the operating ambient temperature between 0 to 40°C
Minimum load resistance: 800 ohms

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

- RELAY OUTPUT(PID and ON/OFF control)
- SSR OUTPUT (Voltage Pulse)
- LINEAR OUTPUT (4-20mAmp)
- VALVE POSITION FEEDBACK CONTROL
- VALVE POSITION WITHOUT FEEDBACK CONTROL

Also, Output Direction (Direct/Reverse) for Heating and Cooling are selectable from software.

Retransmission Output:
Number of outputs: 1
Process Value, Set point, or Control output can be selected as a Retransmission output.
Output signal: 0-20 mA, 4-20 mA, 0-5 V, 1-5 V or 0-10 V DC.
Voltage or current output can be selected through software and internal jumper settings.
Load resistance: 500 ohms Max. Or less for current output. 3k or higher for voltage output

Output accuracy: ±0.25% of span.

Control Output:
Current Output:
Output signal: 4-20 mA
Load resistance: 500 ohms Max. Or less for current output.
Accuracy: ±0.25% of span.

Voltage pulse output:
Output signal: Voltage Pulse
Load resistance: 500 ohms Max. Or more.
Output signal On-voltage: 11 V DC or more.
Off-voltage: 2 V DC or less.
Resolution: 10 ms
Voltage Pulse or current output can be selected through software.

Relay Contact Outputs:
Number of outputs: 1 or 2 (two for forward/reverse motor control type) Heating/Forward-side output Cooling/Reverse-side output
Output signal: Three terminals (NC, NO, and C)
Relay Contact rating: 250 V AC or 30 V DC, 2A (resistive load)
Resolution: 10 ms

Alarm Outputs:
Number of Outputs: 2 if control output (Linear or Voltage Pulse) used for controlling, the two 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
Purpose: Various Alarm outputs such as PV High / Low, PV Input OPEN, RSP Input OPEN, VPFB Input OPEN and other Fail safe conditions are available.
Output type: Open collector.
Output Contact rating: 24V DC, 50 mA, with inbuilt current limit protection.

Contact Digital Inputs*:*
Number of inputs: 4
Purpose: Target set point selection, Auto/ Manual selection, Remote/ Local mode switching and Run/Stop mode selection.
Input type: Non-voltage contact or transistor open collector input
Input contact rating: 24 V DC, 5 mA or more
Minimum status detection Holds time: About 1 Second

Communication:
Communication Type: Half duplex/Asynchronous (RS-485)
Communication Protocol: MODBUS RTU
Baud rate, Parity and Stop bit are selectable form the key board.
All parameters are Configurable through MODBUS.

Connectable number of unit: 32
Communication error Detection: CRC Check

Display Specifications:

PV display: 4-digits, 7-segment, Red LEDs, character height of 0.56''
Set point display: 4-digits, 7-segment, Green LEDs, character height of 0.4''
Bar Display: 20 Orange LEDs for %POWER, Valve position indication
Status indicating lamps: Red LEDs for RELAY AND Alarm status, Manual mode status, Remote status. Green LEDs for Communication,Green Leds for Set Point selection 1 and 2,Auto-tune status Green Led,Valve Position Feedback status Green Led.

Power Supply Specifications:

Power supply: Rated voltage of 85 to 260V AC (±10%), 50/60 Hz
Rated voltage of 18 to 36V DC (Optional),
Power consumption: Max. 15 VA
Data backup: Non-volatile memory (can be written up to 100000 times)
Withstanding Voltage:

- Between primary terminals* and secondary terminals** at least 1500VAC for 1 minute
- Between secondary terminals at least 600V AC for 1 minute

Insulation resistance: 20Mohms or more at 500V DC
*Primary terminals indicate power terminals and relay output terminals
**Secondary terminals indicate analog I/O signals, voltage pulse output, Contact input terminals, Remote input.

Signal Isolations Specifications:

PV input terminals: Not isolated from Feedback slide resistance input terminals and from the internal circuit. But isolated from other input/output terminals.
Remote input terminals: Isolated from other input/output terminals and the internal circuit.
24 VDC loop power supply terminals: Not isolated from internal circuit.
Analog output terminals (Voltage/current control output): Not isolated from current outputs and voltage pulse output. Isolated from other input/output terminals and internal circuit.
Retransmission output terminals (voltage/current): Not isolated from current or voltage outputs Isolated from other input/output terminals and internal circuit.
Relay contact control output terminals: Isolated between contact output terminals and from other Input/output terminals and internal circuit.
Contact input terminals: Isolated from other input/output terminals and internal circuit.
RS-485 Communication terminals: Isolated from other input/output terminals and internal circuit
Relay contact output terminals: Isolated between relay contact outputs. Isolated from other input/output terminals and internal circuit.
Transistors contact output terminals: Non-isolated between transistor contact outputs, but isolated from other input/output terminals and other terminals
Feedback slide resistance input terminals: Not isolated from PV input terminals but isolated from other input/output terminals and from internal circuit.
Power terminals: Isolated from other input/output terminals and internal circuit.

Construction, Installation, and Wiring:

Construction: Only the front panel is dust-proof
Material: ABS resin and Polycarbonate
Case color: Black
Weight: About 1 kg or less

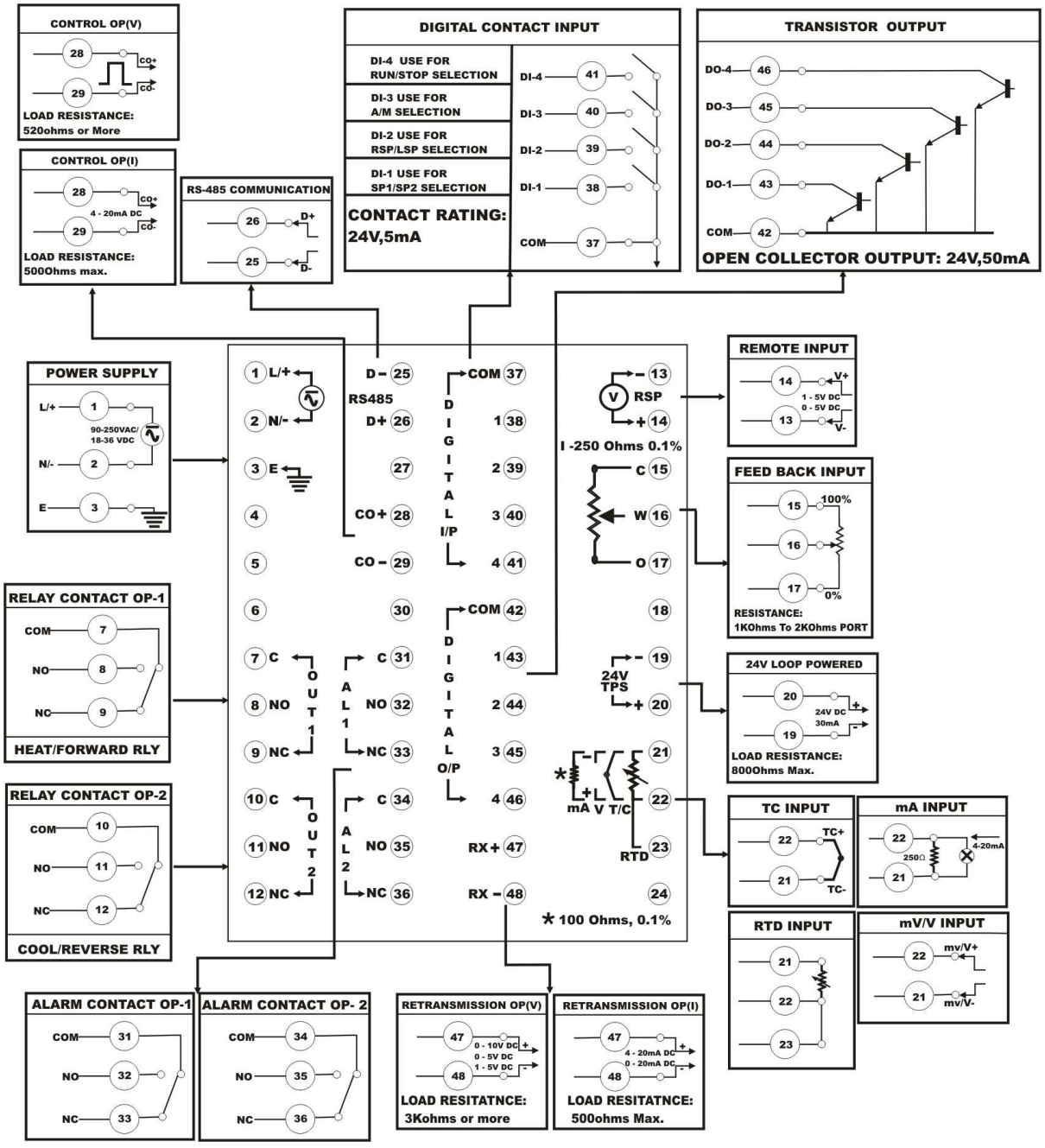
Dimensions: 96 (W) x 96 (H) x 110 (depth from panel face) mm.
Installation: Panel-mounting type. With Top and Bottom mounting hardware (1 each)
Panel cutout dimensions: 92.5 + 0.8(W) x 92.5 + 0.8(H) mm

Environmental Conditions:

TEMPCO: FOR PV (Main input) and RSP (Remote input) less than 100ppm. FOR Retransmission and Control output less than 150ppm.
Humidity: 30% to 95% RH (Non-Condensing)
Instrument Warm-up Time: 30 minutes or more after power on
Ambient temperature: 0 to 55°C

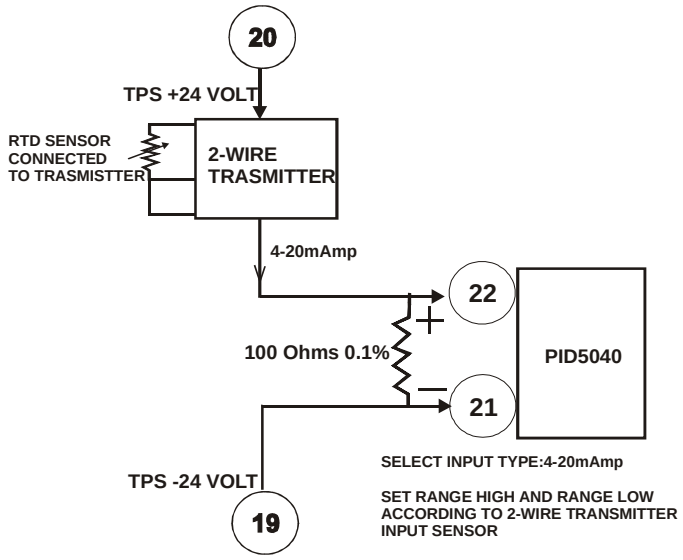
4. WIRING DIAGRAM:

BACK PLATE WIRING DETAIL:

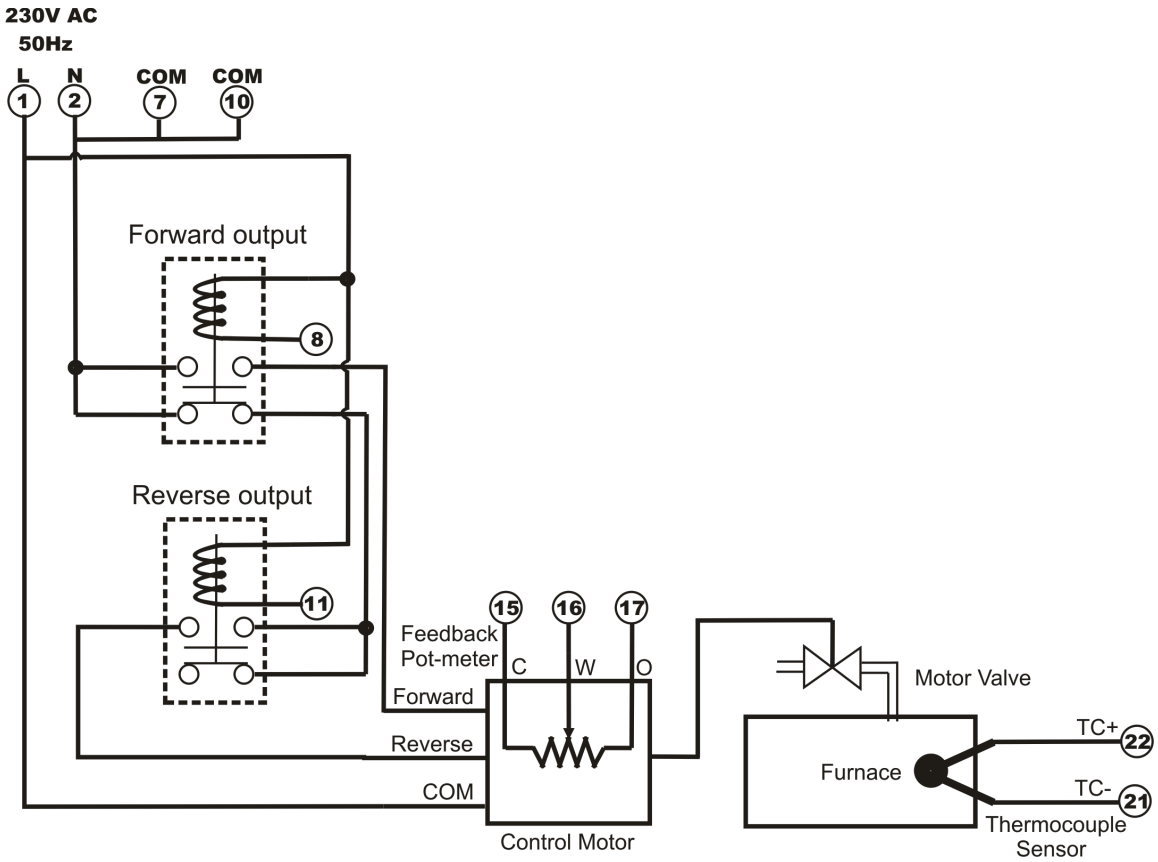


TRASMITTED POWER SUPPLY WIRING DIAGRAM:

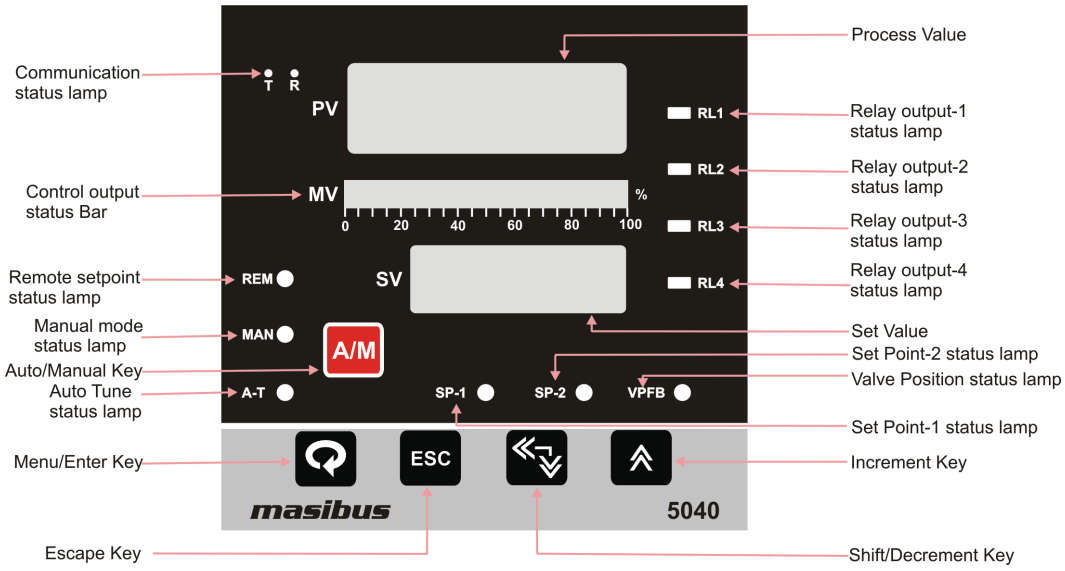
Transmitted Power Supply Wiring Diagram:



VALVE POSITION FEEDBACK WIRING FOR INTERLOCK FORWARD AND REVERSE RELAY:



5. FRONT PANEL:



Name of Part	Function
Process Value Display**(PV)**	Displays Process Value. Display Parameter Name When You Set Parameter. Displays Error Message When An Error Occurs.
Set Value Display **(SV)**	Displays Set Value. Displays Parameter Value Of Parameter In Process Value Field When You Set Parameter. Displays Control Output Value When in Manual Mode. Display blink SP value and Tune message when auto tune start
Control Output Value Bar Display**(MV)**	Displays Control Output Value in Form of Bar Scaled in 20 Segments.
Output Indicator Lamps(**RL1 & RL2**)	In Heat Action, OP1 Lamp will Indicate The On Status Of The Heat output. In Valve Position Feedback Action & Without Valve Position Feedback Action; OP1 Lamp Will Indicate The Status Of The Heat Or Forward Output And OP2 Lamp Will Indicate The Status Of Cool Or Reverse Output. In Control Applications With Linear Control Output They Will Work As Normal Alarms (Alarm 1 & 2). When Alarm 1 & 2 Occurs, Respective Alarm Lamp Is Lit (In Red).
Alarm Indicator Lamps**(RL3 & RL4)**	When Alarm 1 & 2 Occurs, Respective Alarm Lamp (RL3 & RL4) Is Lit (In Red).
Remote/Local Set point Indicator Lamp**(REM)**	It Indicates Whether Remote Set Point Is Selected Or Not. It Is Lit 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 light When The Communication Is On.
Auto-Tune Indicator Lamps**(A-T)**	Indicator Lamps Will blink When Auto tune Process is on.

Name of Part	Function
Set Point – 1 **(SP-1)**	Indicator Lamps Will On When Set Point 1 is selected.
Set Point – 1 **(SP-2)**	Indicator Lamps Will On When Set Point 1 is selected.
Valve Position Feedback**(VPFB)**	Indicator Lamps Will On When output type is VPFB selected.

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: 

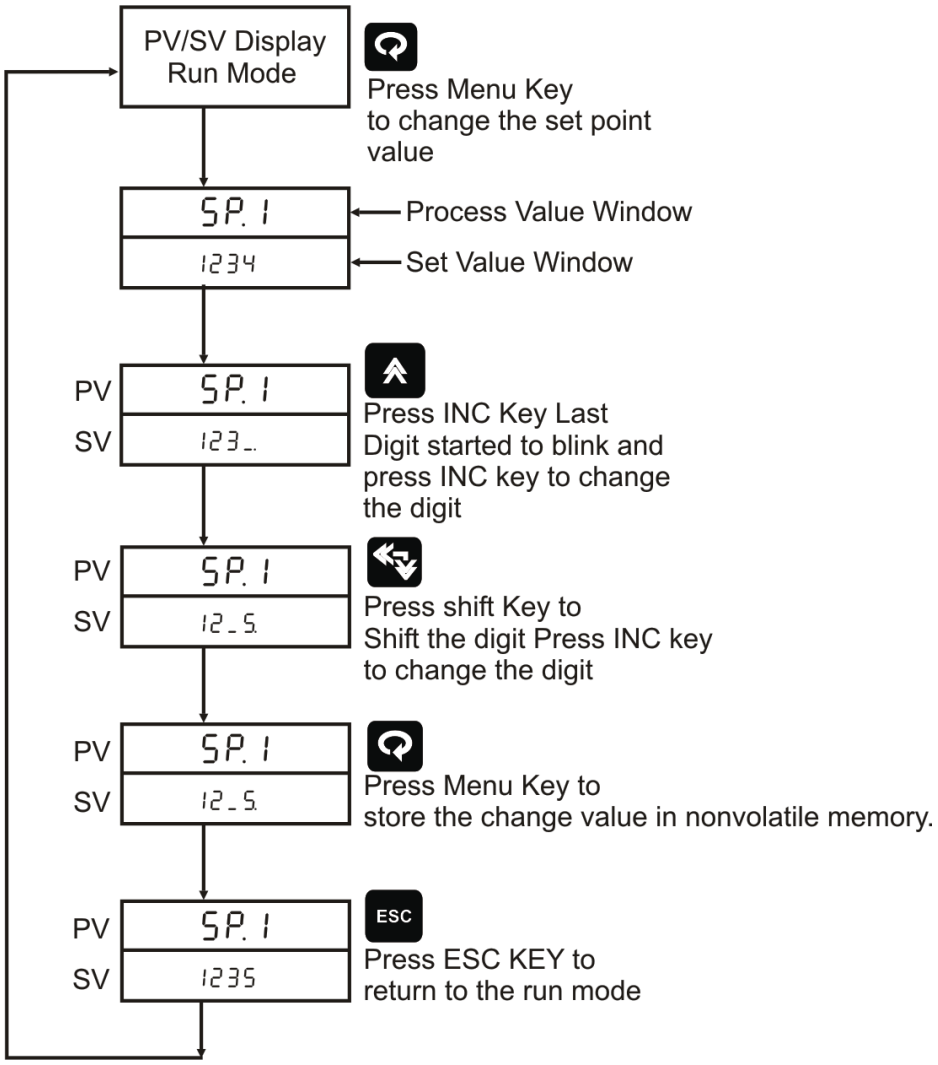
It is used to Shift the digit to set the parameter as describe in increment key when DP (decimal point) started to blink. Menu key is used to go forward to show next parameter and Shift key is used to go backward to show previous parameter. Also, in manual mode control output (%power) can be decrement using Shift 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:-



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

6. Menu Layout:

RUN TIME INDICATION:

Following parameters can view or change during run time.

- Press Shift 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.

Set Point setting:-

Pressing MENU key PV Display shows SEt .1 (Set.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 Set point 2.

Set Point Setting:				
Parameter (PV display)		Setting name and description (SV display)	Default value	Shows only if
Symbol	Name			
SP.1 (SP.1)	Target Set point-1	Depending on PV sensor type selected	200	-
SP.2 (SP.2)	Target Set point-2	Depending on PV sensor type selected	300	-

Level – 1:-

Pressing MENU key for 3 seconds (approx.) PV Display shows mode (mode) message. SV display shows LvL1 (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
Symbol	Name			
AtUn (A.tUn)	Auto tune	YES/no 1:(YES) 0:(no)	no	Control type selected is PID type
Pb (Pb)	Proportional Band	0.1 to 999.9	50.0	Control type is PID.
ti (ti)	Integral Time	0 to 1000 seconds	120	
td (td)	Derivative Time	0 to 250 seconds	0	
Ct (Ct)	Cycle Time	1 to 250 seconds	10	Control type is heat or cool, position f/b, without f/b PID.
db (db)	Position Proportional Dead Band	0.1 to 50.0	1.0	Control type is PID.
PbSH (Pb.SH)	P band shift (Overshoot suppression)	-50.0 to 50.0 %	0%	Control type is PID.
Arw (ARW)	Anti Reset Windup	0 to 100%	0%	Control type is PID.
HY (HY)	hysteresis (On/Off control)	1 to 250	2	Control type is on/off
rAmP (Ramp)	Ramp Rate type	none/ min.r /hr.r 0:none 1:min.r 2:hr.r	None	Control type is PID
rmP.r (rmp.r)	Ramp rate value	0.1 to 999.9 Degree per minutes or hour	0.1	Control type is PID

LEVEL 2:-

Pressing MENU key for 3 seconds (approx.) PV Display shows nodE (mode) message. SV display shows LvL2 (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
Symbol	Name			
A1SP (A1.SP)	Alarm 1 Set point	PV range selected[1]	0	
A1tP (A1.tP)	Alarm 1 Type	0 to 18. Refer alarm type table.	0 (none)	
A1HY (A1.HY)	Alarm 1 Hysteresis	1 to 250	2	
A1LC (A1.LC)	Alarm 1 Logic (normal or fail safe selection)	norn / FLSF 0:(norm) 1: (FLSF)	Normal	
A1dY (A1.Dy)	Alarm 1 Delay	1 to 99 seconds	1	
A2SP (A2.SP)	Alarm 2 Set point	PV range selected[1]	0	
A2tP (A2tP)	Alarm 2 Type	0 to 18. Refer alarm type table.	0(none)	
A2HY (A2.HY)	Alarm 2 Hysteresis	1 to 250	2	
A2LC (A2.LC)	Alarm 2 Logic (normal or fail safe selection)	norn / FLSF 0:(norm) 1: (FLSF)	Normal	
A2dY (A2.Dy)	Alarm 2 Delay	1 to 99 seconds	1	
A3SP (A3.SP)	Alarm 3 Set point	PV range selected[1]	0	
A3tP (A3.tP)	Alarm 3 Type	0 to 18. Refer alarm type table.	0(none)	
A3HY (A3.HY)	Alarm 3 Hysteresis	1 to 250	2	

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

A3LC (A3.LC)	Alarm 3 Logic	norn / FLSF 0:(norm) 1:(FLSF)	Normal	
A3dY (A3.Dy)	Alarm 3 Delay	1 to 99 seconds	1	
A4SP (A4.SP)	Alarm 4 Set point	PV range selected[1]	0	
A4tP (A4.tP)	Alarm 4 type	0 to 18. Refer alarm type table.	0(none)	
A4HY (A4.HY)	Alarm 4 Hysteresis	1 to 250	2	
A4LC (A4.LC)	Alarm 4 Logic	norn / FLSF 0:(norm) 1:(FLSF)	Normal	
A4dY (A4.Dy)	Alarm 4 Delay	1 to 99 seconds	1	
d1SP (d1.SP)	Digital Output 1 Set point	PV range selected[1]	0	
d1tP (d1.tP)	Digital Output 1 Type	0 to 18. Refer alarm type table.	0(none)	
d1HY (d1.HY)	Digital Output 1 Hysteresis	1 to 250	2	
d1LC (d1.LC)	Digital Output 1 Logic	norn / FLSF 0:(norm) 1:(FLSF)	Normal	
d1dY (d1.Dy)	Digital Output 1 Delay	1 to 99 seconds	1	
d2SP (d2.SP)	Digital Output 2 Set point	PV range selected[1]	0	
d2tP (d2.tP)	Digital Output 2 Type	0 to 18. Refer alarm type table.	0(none)	
d2HY (d2.HY)	Digital Output 2 Hysteresis	1 to 250	2	
d2LC (d2.LC)	Digital Output 2 Logic	norn / FLSF 0:(norm) 1:(FLSF)	Normal	
d2dY (d2.Dy)	Digital Output 2 Delay	1 to 99 seconds	1	
d3SP (d3.SP)	Digital Output 3 Set point	PV range selected[1]	0	
d3tP (d3.tP)	Digital Output 3 Type	0 to 18. Refer alarm type table.	0(none)	

d3HY (d3.HY)	Digital Output 3 Hysteresis	1 to 250	2	
d3LC (d3.LC)	Digital Output 3 Logic	norn / FLSF 0:(norm) 1:(FLSF)	Normal	
d3dY (d3.Dy)	Digital Output 3 Delay	1 to 99 seconds	1	
d4SP (d4.SP)	Digital Output 4 Set point	PV range selected[1]	0	
d4tP (d4.tP)	Digital Output 4 type	0 to 18. Refer alarm type table.	0(none)	
d4HY (d4.HY)	Digital Output 4 Hysteresis	1 to 250	2	
d4LC (d4.LC)	Digital Output 4 Logic	norn / FLSF 0:(norm) 1:(FLSF)	Normal	
d4dY (d4.Dy)	Digital Output 4 Delay	1 to 99 seconds	1	

LEVEL: - 3

Pressing MENU key PV for 3 seconds (approx.) Display shows ᵐodE (mode) message. SV display shows LvL3 (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
Symbol	Name			
inP.t (inP.t)	PV Input Type (E, J, K, T etc.)	Follow Table 1	K-TC	
A.CJC (A.CJC)	Auto Cold junction Compensation	YES/no 1:(YES) 0: (no)	YES	Input sensor is T/c. type
F.CJC (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 / -1999 to 9999 (for linear input types)	1370	
Pv.Lo (Pv.Lo)	Process value range lower setting		-200	
dP (dP)	Decimal Point Setting	0 to 3	0	Input is linear type
oT (oT)	Output Type	rELY / SSr/ cUr/ onoF/ uPFb/uPFn 0:(rLY) – Relay 1:(SSR) – Voltage pulse 2:(Cur) – Current 3:(OnOF) – onof control 4:(vpfb)-position with feedback 5:(vpfn)-position without feedback	0(Relay)	
Co.Hi (Co.Hi)	Control Output high limit (hi > lo)	0.0 to 100.0 %	100.0	
Co.Lo (Co.Lo)	Control Output low limit	0.0 to 100.0 %	0	
PV.SC. (PV.SC.)	Process value scale	UP / doun / nonE 0:(up) 1:(down) 2:(none)	down	

SP.md (SP.Md.)	Remote/Local SP selection	LoCL / rmot 0:(LoCL) – Local 1:(rMot) - Remote	Local	
odir (o.dir)	Output (Cool / Heat) Direction (Dir / Rev)	dir / rEv 1:(dir) 0:(rev)	Rev	
mtim (m.tim)	Motor Travel Time (position proportional without feedback)	10 to 500 sec	60	Pid type selected is valve position with/without feedback
AFdb (A.FWB)	Auto feedback	YES/no 1:(YES) 0:(no)	No	Pid type selected is valve position with/without feedback
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(Target set point to control the process)	1/2 1:(sp.1) 2:(sp.2)	1(Set Point – 1)	
FLtr (FLtr)	Filter for Process value (1st order low-pass IIR filter)	0 to 60 seconds	2	
Po (Po)	Preset Control output during stop mode	0.0 to 100.0% power	0.0%	
di-1 (di -1)	Digital input-1	YES/no 1:(YES) 0: (no)	No	
di-2 (di-2)	Digital input-2	YES/no 1:(YES) 0: (no)	No	
di-3 (di-3)	Digital input-3	YES/no 1:(YES) 0: (no)	No	
di-4 (di-4)	Digital input-4	YES/no 1:(YES) 0: (no)	No	

LEVEL – 4:
Pressing MENU key for 3 seconds (approx.) PV Display shows Mode (mode) message. SV display shows LvL4 (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
Symbol	Name			
rSP.t (rSP.t)	Remote SP Input type	0-5u / 1-5u 0:(0-5v) – 0-5 V 1:(1-5v) – 1-5 V	0 – 5v	Set point is remote type
rSP.H (RsP.H)	Remote SP range High setting	Can be set within -1999 to 9999 but not outside	1370	
rSP.L (Rsp.L)	Remote SP range Low Setting	Can be set within -1999 to 9999 but not outside	-200	
rSP.o (rSP.o)	Remote SP Offset	-100.0 to 100.0	0.0	
rSP.F (rSP.F)	Remote SP factor	00.01 to 10.00	01.00	
Srno (Srno)	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	PnS1 / PnS2 / PoS1 / PES1 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	
rtr.t (rtr.t)	Retransmission Output Type	0-20 / 4-20 / 0-5u / 1-5u 0-10u 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	

rtr.u (rtr.v)	Retransmission variable	SP / Pu / Co 0:(SP) – Set point 1:(Pv) –Process value 2:(CO) – Control output	PV	
r.dir (r.dir)	Retransmission direction	dir / rEu 1:(dir) 0: (rev)	Dir	
rtr.H (rtr.H)	Retransmission upper limit	-5.0% to 105.0%	105.0%	
rtr.L (rtr.L)	Retransmission lower limit	-5.0% to 105.0%	-5.0%	
AtHY (At.HY)	AT hysteresis	0 to 20.0	5.0	
toUt (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	-	
LoCP (LOCK)	Lock LEVEL-1	L1on / L1oF 1:L1on 0:L1oF	L1OF	
LoCP (LOCK)	Lock LEVEL-2	L2on / L2oF 1:L2on 0:L2oF	L2OF	
LoCP (LOCK)	Lock LEVEL-3	L3on / L3oF 1:L3on 0:L3oF	L3OF	
LoCP (LOCK)	Lock LEVEL-4	L4on / L4oF 1:L4on 0:L4oF	L4OF	
LoCP (LOCK)	Lock LEVEL-5 Calibtriaon	L5on / L5oF 1:L5on 0:L5oF	L5ON	
SPwd (S.Pwd)	Password Set password to lock selected level	0 to 9999	0	if lock is on user can set password for all level

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			
ᴬᵐᵇ (Amb)	Ambient	Ambient Adjustment	-	PV Sensor type is T/c.
ᵗᶜ.ᴸ.ˢ (tc.L.S)	Thermocouple and Linear Span Calibtriaon	Depending on PV sensor type selected	-	Pv sensor type is T/c or Linear
ʳᵗᵈ.² (rtd.Z)	Calibration Zero FOR RTD Input		-	PV Sensor type is RTD
ʳᵗᵈ.ˢ (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.ˢ (rSP.S)	Remote SP Span calibration		-	Remote set point is selected
ᴾᶠᵇ.² (pFb.Z)	Position Feedback Zero calibration		-	Output type is Position proportional type with feedback
ᴾᶠᵇ.ˢ (pFb.S)	Position Feedback Span calibration		-	Output type is Position proportional type with feedback
ʳᵗʳ.² (rtr.Z)	Retransmission Zero calibration		-	
ʳᵗʳ.ˢ (rtr.S)	Retransmission Span calibration		-	
ᶜᵒᴾ.² (CoP.Z)	Control Output Zero calibration		-	Output type is Current Output
ᶜᵒᴾ.ˢ (CoP.S)	Control Output Span calibration		-	Output type is Current Output

Factory Reset Parameters:

Pressing MENU key PV Display shows mode (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			
Pwd (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		-

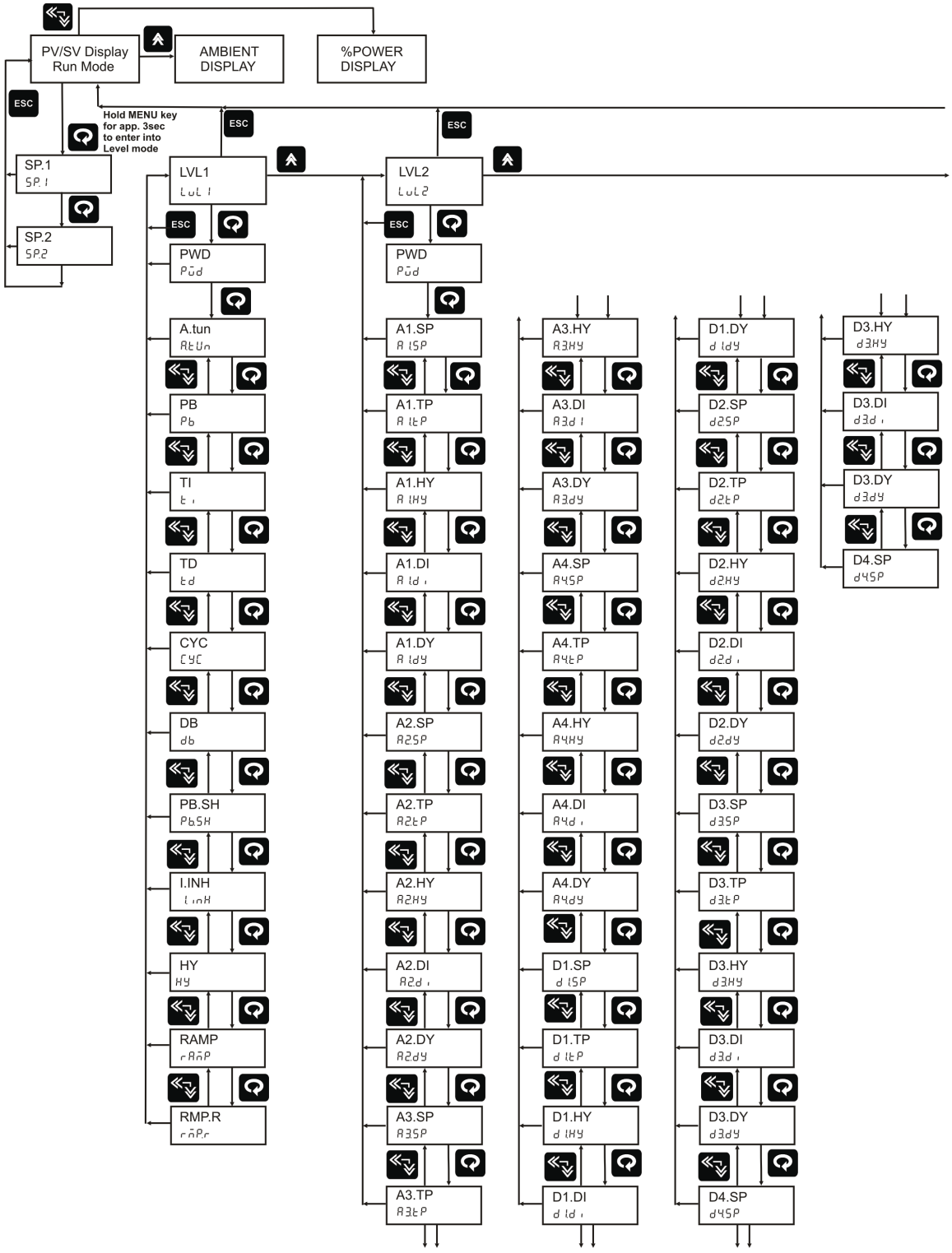
Note: - Factory reset will load default parameters, as mention in MENU LAYOT (Default value). Once this function applies, user has to switch off the instrument and again switch on the instrument to work according to Default value.

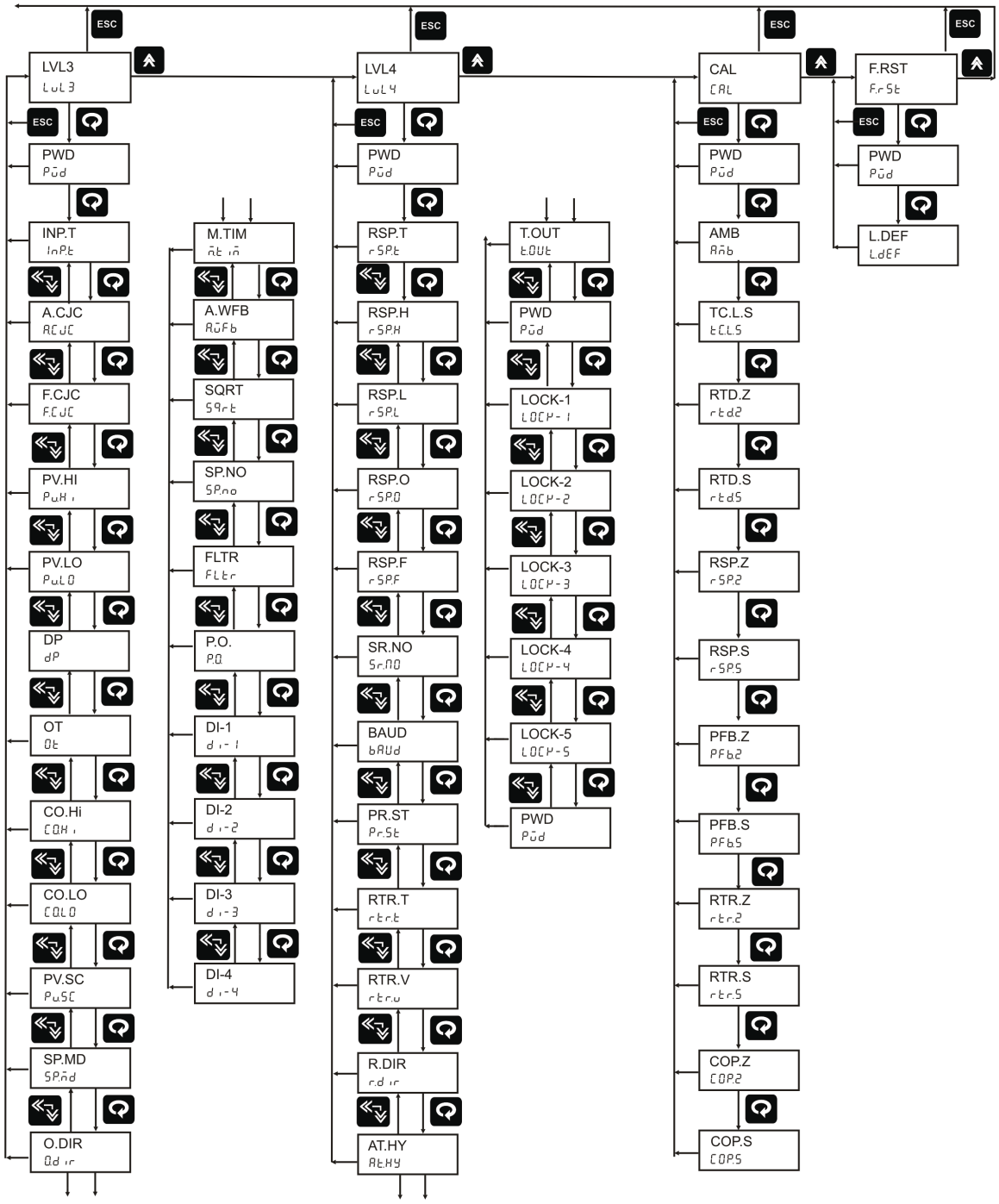
INPUT TYPE SELECTION TABLE:

Type	I/P NO	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	K 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		
0.4 to 2V	13	0.4-2		
0 to 2V	14	0-2v		
4 to 20mamp	15	4-20		
0 to 20mamp	16	0-20		
0 to 5V	17	0-5v		
1 to 5V	18	1-5v		
0 to 10V	19	0-10v		

7. Parameter FLOW CHART:

PID-5040 has a number of software parameters which may or may not be required depending on your particular applications.





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. Alarm and Digital Outputs:

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

- Set Value
- Type
- Hystresis(Dead band)
- 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 1
2	Pud.L	Deviation Low alarm	Ref figure 2
3	Pud.r	Deviation High & Low limit alarm	Ref figure 3
4	Pud.b	Deviation High & Low range alarm	Ref figure 4
5	PuAH	Absolute value High alarm	Ref figure 5
6	PuAL	Absolute value Low alarm	Ref figure 6
7	SP.AH	Absolute value set point high alarm	Same as type 5
8	SP.AL	Absolute value set point low alarm	Same as type 6
9	P.Sd.H	Deviation High alarm with standby	Ref figure 7
10	P.Sd.L	Deviation Low alarm with standby	Ref figure 8
11	P.Sd.r	Deviation High & Low limit alarm with standby	Ref figure 9
12	P.Sd.b	Deviation High & Low range alarm with standby	Ref figure 10
13	P.SAH	Absolute value High alarm with standby	Ref figure 11
14	P.SAL	Absolute value Low alarm with standby	Ref figure 12
15	Pu-E.	PV error(OPEN/OVER/UNDER)	
16	rSP.E	RSP error	
17	uP-E	VPFB error	
18	P.r.uE	Any type of error	

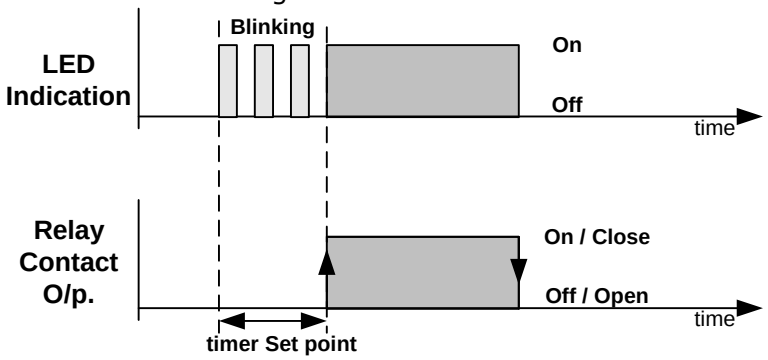
Hystresis (Dead band): Hystresis (Dead band) application is shown in the figure.

Direction:

All the figures here are shown considering the setting is direct (Normal). If the settings are reversing (Fail Safe), the relays will behave exactly the opposite. However, it's worth mentioning that the relays will be in off (de-energized state on

Power on / reset condition). They will energize only after approximate 5 seconds. When alarm type none is selected, ALRAM relay status depends on Direction.

Delay: A time delay can be provided for the actual output. 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. This is denoted by the cross lines for relay operation in figure illustrating for various types selected.

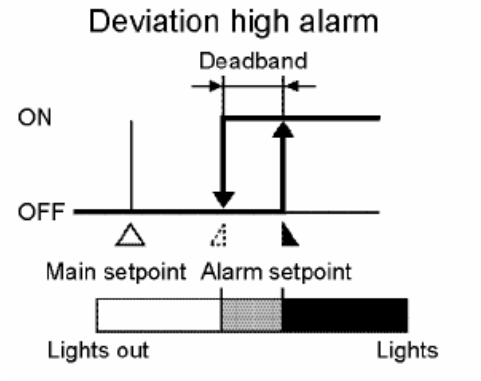


FIGURE 1

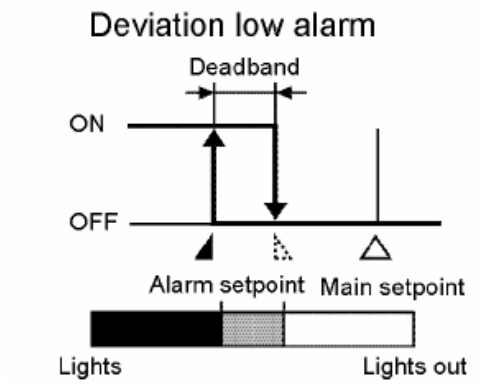


FIGURE 2

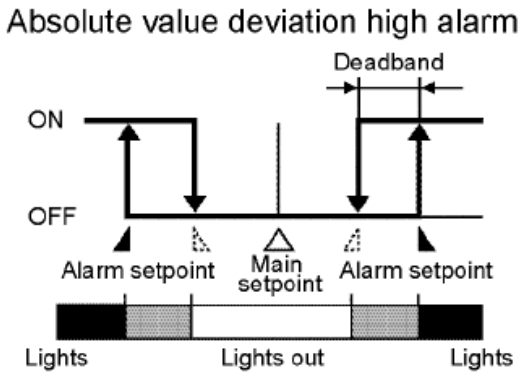


FIGURE 3

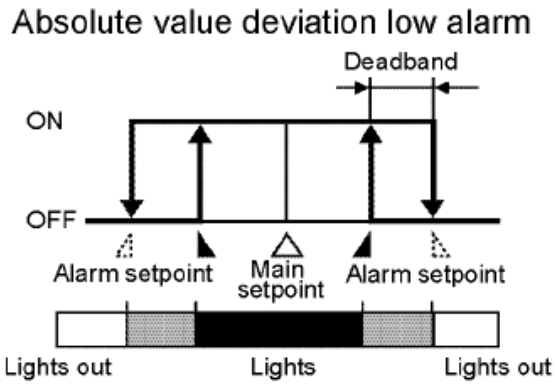


FIGURE 4

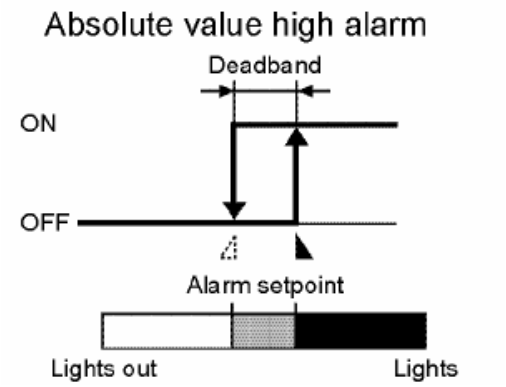


FIGURE 5

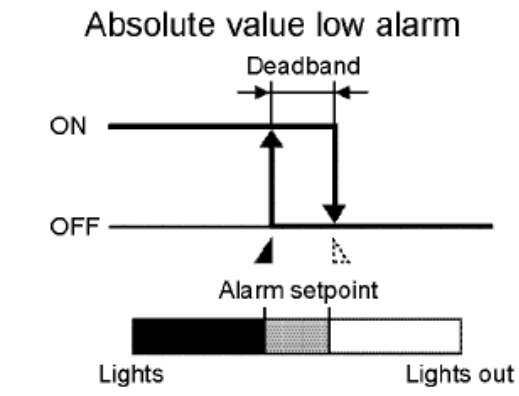


FIGURE 6

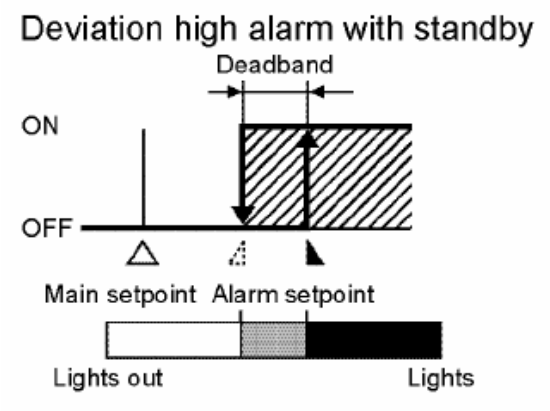


FIGURE 8

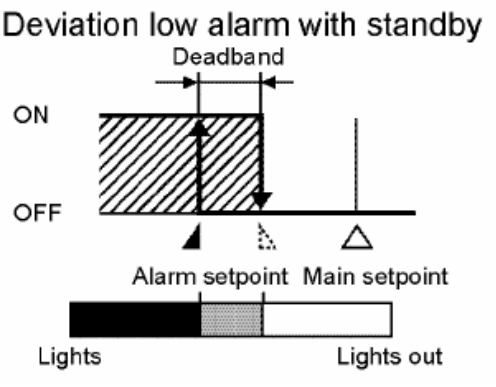


FIGURE 7

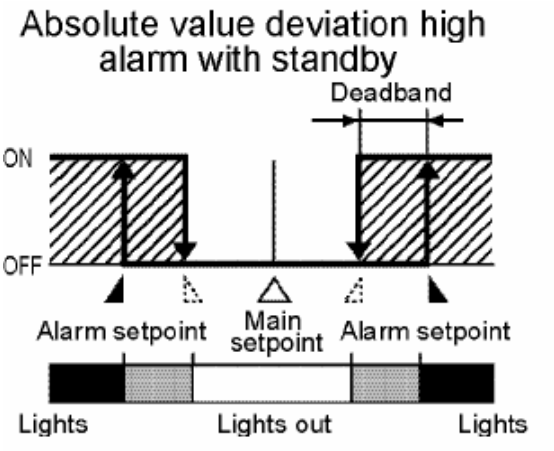


FIGURE 9

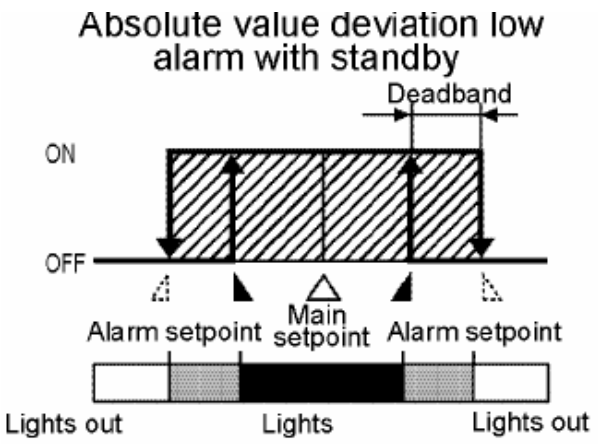


FIGURE 10

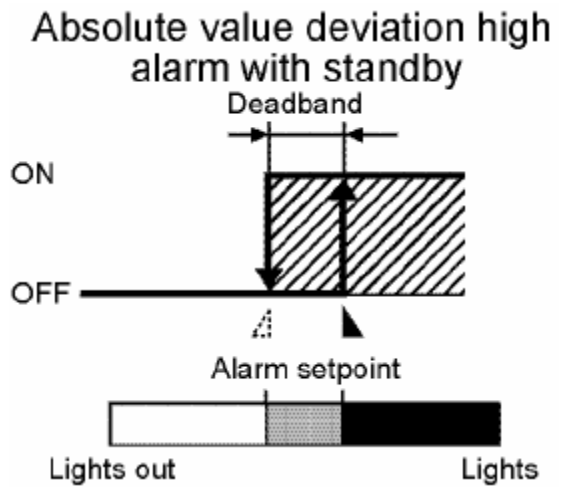


FIGURE 11

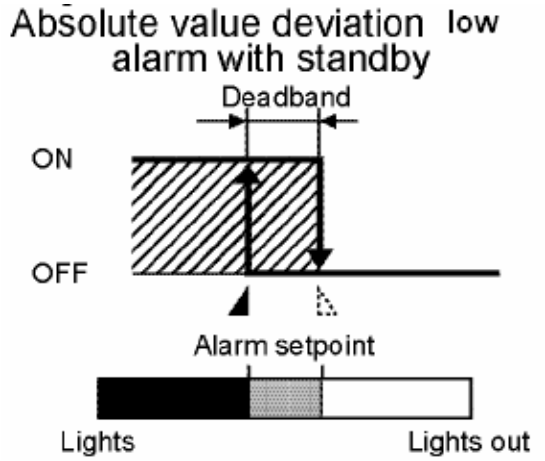


FIGURE 12

9. Digital Inputs:

There are four digital inputs for various purposes.
To achieve these functions through field contact, user has to select **YES** 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

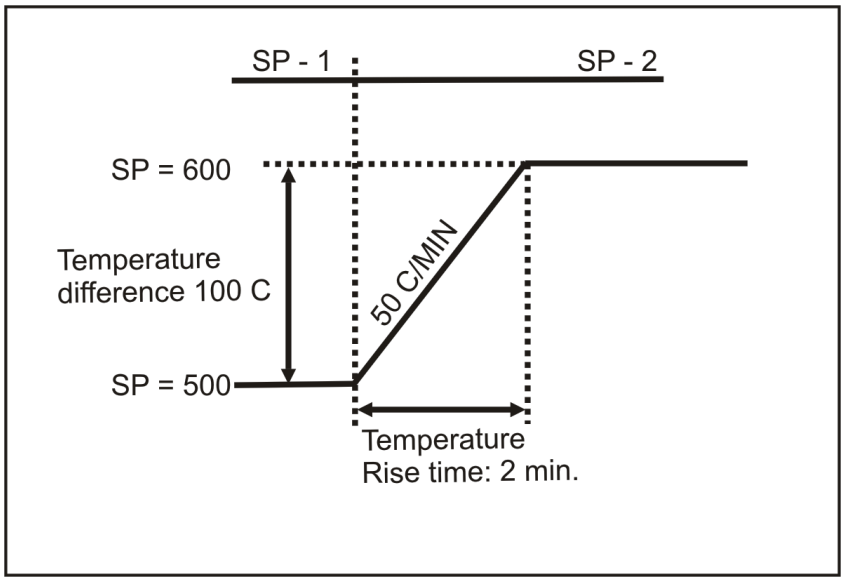
Selection between the RUN and STOP state can be made with contact input only. This function will stop to calculate MV (Manipulated Variable). SV display shows StoP **(Stop)** message. Run/Stop function is used during Emergency or to shut down the plant. This function cannot be achieved by keystroke.

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

10. Control Function:

Heating/Cooling Control:
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 Heat Action. 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 from manual mode to auto mode.



The ramp function will be performed when ramp unit parameter is selected as $\bar{n}$ $\bar{l}\bar{n}\bar{r}$ (minute rate) or $H\bar{r}\bar{r}$ (hour rate). The ramp rate can be programmed by setting the parameter RR. The ramping function will be cancelled in following conditions.

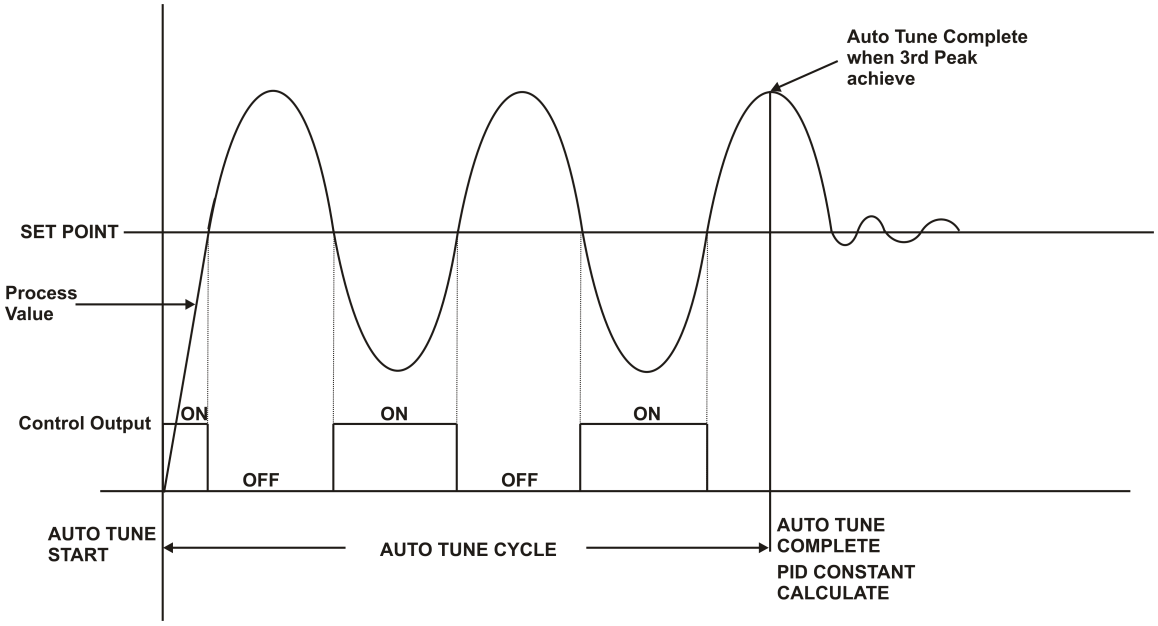
- A change is made from Auto mode to manual mode.
- Power Failure occurs.
- Sensor Failure occurs.
- Auto tuning function is activated.

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 $A\ .\bar{t}\bar{u}\bar{n}$ (A.TUN) in program menu (Level-1) and set it to YES.

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

Note:
If Ramp function is used, then 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.

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:

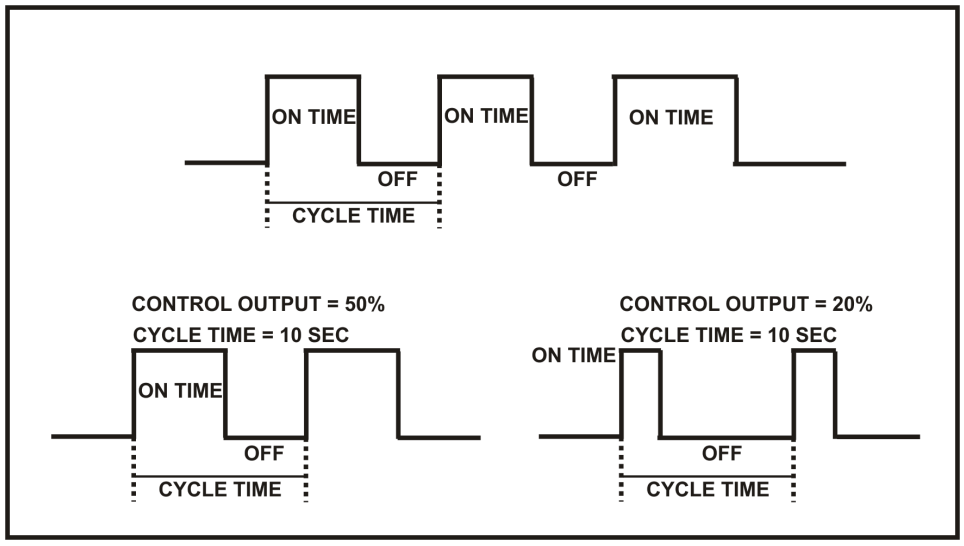
Integral action is used to eliminate offset. When the integral time is shortened, the returning speed to the setting point is quickened. However, the cycle of oscillation is also quickened and the control becomes unstable.

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.

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 (Voltage pulse): Set to 1 second or more
FOR Linear output (4-20mamp output): Cycle time is not required

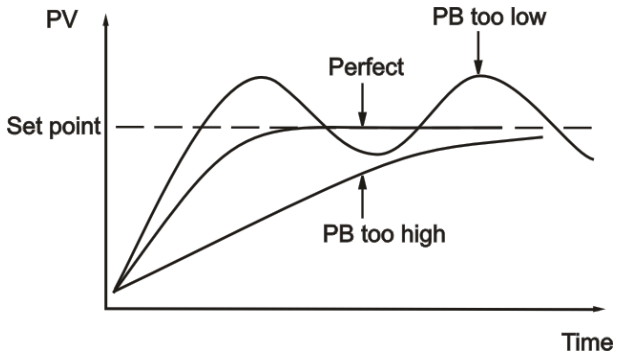


BASIC PID TUNING PROCEDURE:

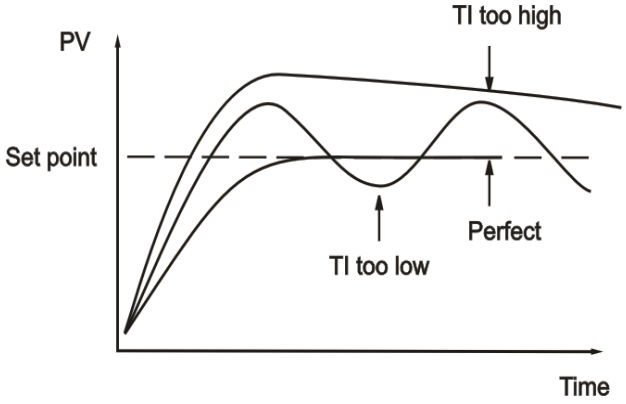
ADJUSTMENT SEQUENCE	SYMPTOM	SOLUTION
Proportional Band	Slow Response	Decrease PB
	Overshoot or Oscillation	Increase PB
Integral Time	Slow Response	Decrease TI
	Instability or Oscillation	Increase TI
Derivative Time	Slow Response or Oscillation	Decrease TD
	High Overshoot or Instability	Increase TD

Basic PID ADJUSTMENT GUIDE

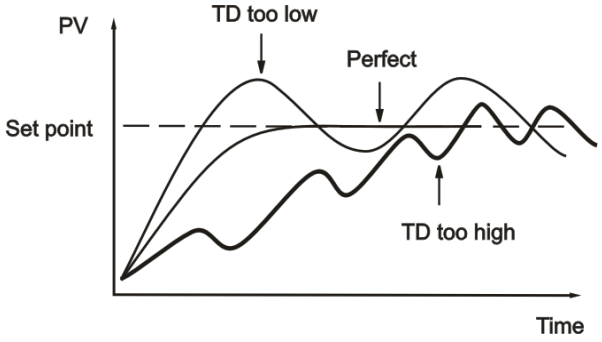
P ACTION: -



I ACTION:-



D ACTION:-

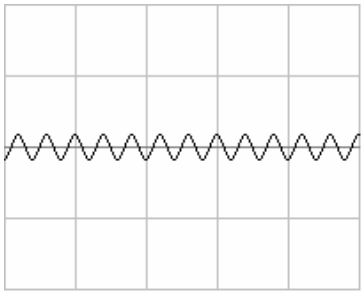


Digital Filter (FLTR):-

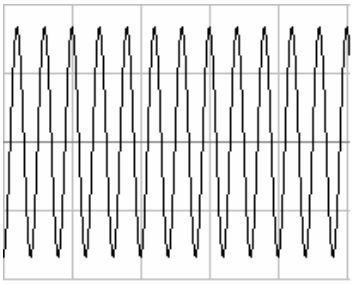
In certain application the process value is too unstable to be read. To improve this, a programmable low pass filter incorporated in the controller can be used. This is a first order IIR filter with time constant specified by FLtr **(FLTR)** parameter of **LEVEL-3**. The input filter will reduce the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

Filter Effects:

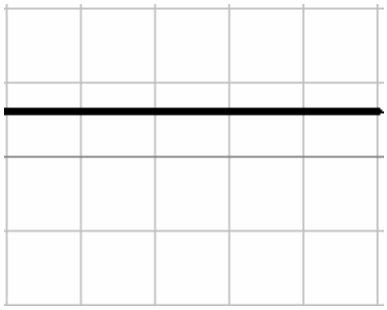
Filtering for 2 second



Input (PV)



Filtering for 10 second



Position Proportional Control:

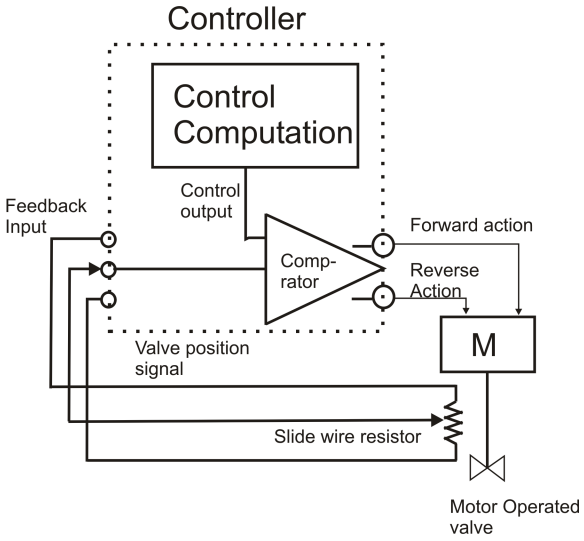
Position proportional control can be of either feedback type or estimating type.

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.



Control output Selection:

OUTPUT TYPE	RELAY CAN CONFIGUR AS			
	RELAY1	RELAY2	RELAY3	RELAY4
RELAY	USE FOR CONTROL HEAT/COOL ACTION	ALARM2	ALARM3	ALRAM4
SSR(Voltage Pulse)	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
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
- Position feedback
- Retransmission output (calibration for voltage or current)
- Control output (calibration for current)

Ambient temperature adjustment:-
This menu will come up only if; the input sensor selected is Thermocouple type.
PV display shows AMb .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.

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 WAIt (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 rtd2 (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 WAIT (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 rtdS (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 WAIT (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.

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 rEn.2 (REM.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.S (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 WAIT (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.

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

PV shows the message PFb.S (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.

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.

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:

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.

Function code 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

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.

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 status can 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	Cycle time	40006	integer	1	1000	R/W
7	Dead Band	40007	integer	1	500	R/W
8	Pb shift	40008	integer	0	100	R/W
9	Anti Reset Windup	40009	integer	0	100	R/W
10	Hystresis	40010	integer	1	250	R/W
11	Ramp	40011	char	0	2	R/W
12	Ramp Rate	40012	integer	1	9999	R/W
13	A/M mode	40013	char	0	1	R/W
14	Reserved	40014	-	-	-	-
15	Reserved	40015	-	-	-	-
16	Reserved	40016	-	-	-	-
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	Pre. 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	-100	100	R/W
84	RSP factor	40084	char	1.00	10.00	R/W

85	SR.NO	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 Type	40088	char	0	4	R/W
89	Retransmission Variable	40089	char	0	2	R/W
90	Retransmission Direction	40090	char	0	1	R/W
91	Retransmission Range high	40091	Integer	-5.0%	100.0%	R/W
92	Retransmission Range low	40092	Integer	-5.0%	100.0%	R/W
93	Auto tune Hys	40093	char	1	250	R/W
94	Time out	40094	char	10	100	R/W
95	Lock - 1	40095	char	0	1	R/W
96	Lock - 2	40096	Integer	0	1	R/W
97	Lock - 3	40097	Integer	0	1	R/W
98	Lock – 4	40098	char	0	1	R/W
99	Lock – 5	40099	char	0	1	R/W
100	Password	40100	integer	0	9999	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 MENU LAYOUT.

12. MISCELLENIOUS

PV INPUT STATUS DISPLAY DURING BURNOUT CONDITION:

Input type	Display Message
TC-E	OPEN(oPEn)
TC-J	OPEN
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	PV LOW
0 to 20mAmp	PV LOW
4 to 20mAmp	OPEN
-10 to 20mV DC	OPEN
0-100mV DC	OPEN
0-75mV DC	OPEN

Table 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 ouEr/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 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 ouEr/Undr (OVER/UNDER).

RSP (REMOTE SET POINT) BURNOUT CONDITION:

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

VALVE POSITION FEEDBACK OPEN CONDITION:

Position Feedback input	Display Message
1KΩ-POT	PFb .E **(PFB.E)**
2KΩ-POT	PFb .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 PFb .E **(PFB.E)** (Position Feedback Error).

RETRAMISSION OUTPUT TABLE FOR OPEN /OVER /UNDER CONDITION:

RETRASMISSION	VARIABLE	SCALE	ACTION	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/RSP	-	-	-	-	-	3.2
4-20mamp	CO	UP	DIR	20.0	20.0	4.0	-
	CO	DOWN	REV	20.0	4.0	20.0	-
	CO	UP	REV	4.0	4.0	20.0	-
	CO	DOWN	DIR	4.0	20.0	4.0	-

Table 2

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

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

CONTROL OUTPUT TABLE OPEN/OVER/ UNDER CONDITION:

CONTROL OP	SCALE	ACTION	DISPLAY INDICATION		
			OPEN	OVER	UNDER
4-20mamp	UP	DIR	20.0	20.0	4.0
CURRENT					
	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	UP	DIR	ON	ON	OFF
Voltage pulse					
	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 (OPEN SENSOR) selected as nonE **(none), during Open sensor i.e. Burnout condition, Control Output will be Preset Output.**