User's Manual

409-4IN Temperature Indicator

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Contents

1. Introduction

Product Overview/Description

409-4IN is a powerful micro-controller based large display process indicator, designed to accept multiple input types and two programmable set points with individual relays. Model-409-4IN accepts 21 different types of inputs (all industry standard input) which are field configurable, facilitates plant operator to use in any application. 409-4IN is easy to operate and configuration is user friendly.

Model and Suffix code

Check the model and suffix codes to confirm that the product received is one which was ordered.

MODEL	INPUT		COMMUNICATION		RELAY		RETRANSMISSION O/P		MOUNTING PROTECTION	
409-4IN	1	E	N	NONE	N	None	N	None	P0	19" Rack (IP20)
	2	J	Y	RS485	Y	2 Relays	C	4-20mA	W0	Wall (IP20)
	3	K					D	0-20mA	W1	Wall (IP65)
	4	T					E	1-5V		
	5	B					F	0-5V		
	6	R					G	0-10V		
	7	S								
	9	PT-100								
	C	4-20 mA								
	D	0-20mA								
	E	1-5V								
	F	0-5V								
	G	0-10V								
	H	0-2 V								
	I	0.4 – 2V								
	R	±75mV								
	U	0-75mV								
	V	0-400Ω								
	W	0-6000Ω								
	M	Serial RS 485								
	S	Special								

Table 1.

Accessory

The product is provided with the following accessory. (See the table2below).

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

Table 2.

2. Safety/Warning Precaution

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.

3. Front Panel Description

Keyboard and Operation

There are four keys for operation of the instruments. For understanding the operation first of all understand the functionality of keys as shown in Fig.1.

Fig 1. Front Panel for Wall Mount

Fig 2. Front Panel for Panel Mount

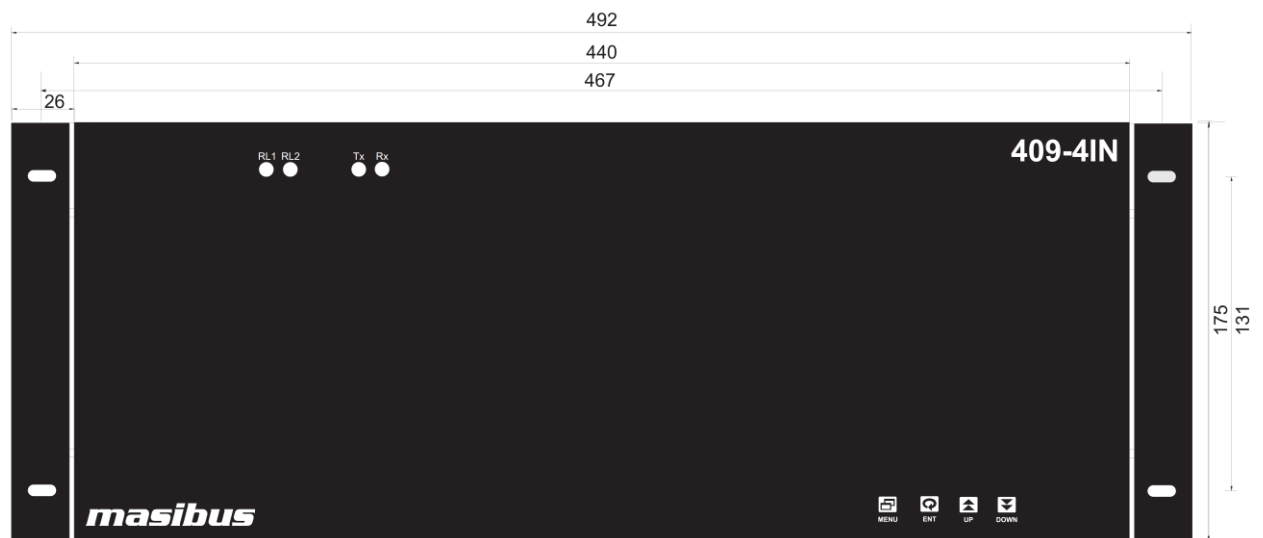| Name of Part	Symbol	Function
UP key	⬆	• Increment the Value of any Parameter • User presses during RUN mode to invoke segment testing mode*.
DOWN key	⬇	• Decrement the Value of any Parameter. • Shows ambient value for T/C Input in RUN mode.
MENU key	⎘	• Shows different SET Points, if pressed in RUN mode. • In Sub Menu it can be used to get to the next Parameter.
ENTER key	↻	• Use as an acknowledgement for Alarm Status. • It is also used to save the parameters to nonvolatile memory, when user setting a proper data by Increment and decrement key for parameter configuration.
PV (Present Value) Display	PV	• 4 digital 4 inch RED Display • Display process value. • Display parameter name when user set parameter. • Display Parameter Value when in Edit mode. • Display error message when an error occurs.
Relay-1 Indication	RL1	• ON when Relay-1 is energized & OFF otherwise.
Relay-2 Indication	RL2	• ON when Relay-2 is energized & OFF otherwise.
TX Indication	Tx	• ON when device is transmitting some Data (RS-485).
RX Indication	Rx	• ON when device is receiving some Data (RS-485).

*All digits segments display one after another. example. 1111, 2222, 3333 to 9.9.9.9.
After that unit will be in run mode.

4. Terminal Arrangement Diagram
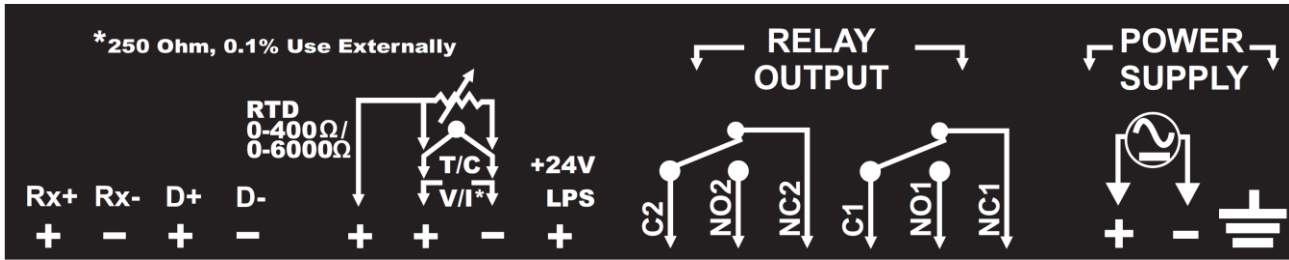
Fig 3. Terminal Arrangement for Panel Mount
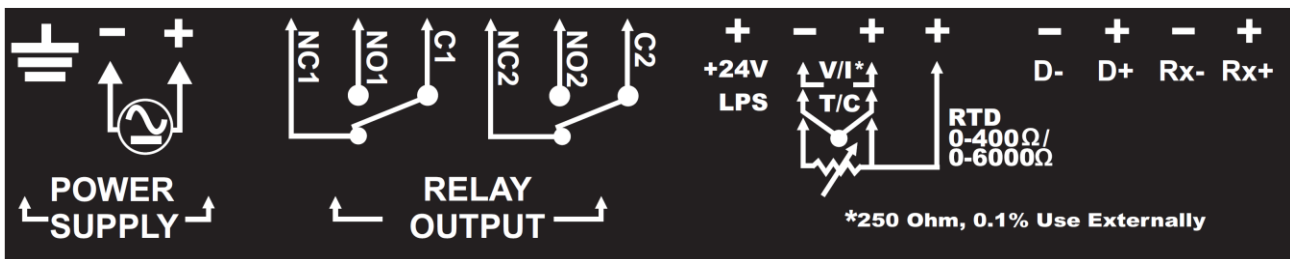
Fig 4. Terminal Arrangement for Wall mount

4.1 Terminal Description

Terminal	Description	SYMBOL
L/+	Mains Supply 90-270VAC	
N/-		
E		
NC1 Normally close-1	Relay 1	
NO1 Normally open-1		
C1 Common-1		
NC2 Normally close-2	Relay 2	
NO2 Normally open-2		
C2 Common-2		
24V LPS+	Transmitted power supply	
TC- / V- / mV-/LPS-	For Thermocouple, RTD ,Linear, and mV Input	
TC+/ V+/mV+		
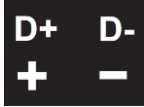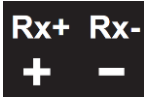
RTD common	For RTD Input Only (Three wire Compensation).	
D+	Rs-485 Communication (Serial Input)	**D+ D-** **+ −**
D-		
Rx+	Retransmission Output	**Rx+ Rx-** **+ −**
Rx-		

Table 3.

5. Menu Layout

Menu Layout

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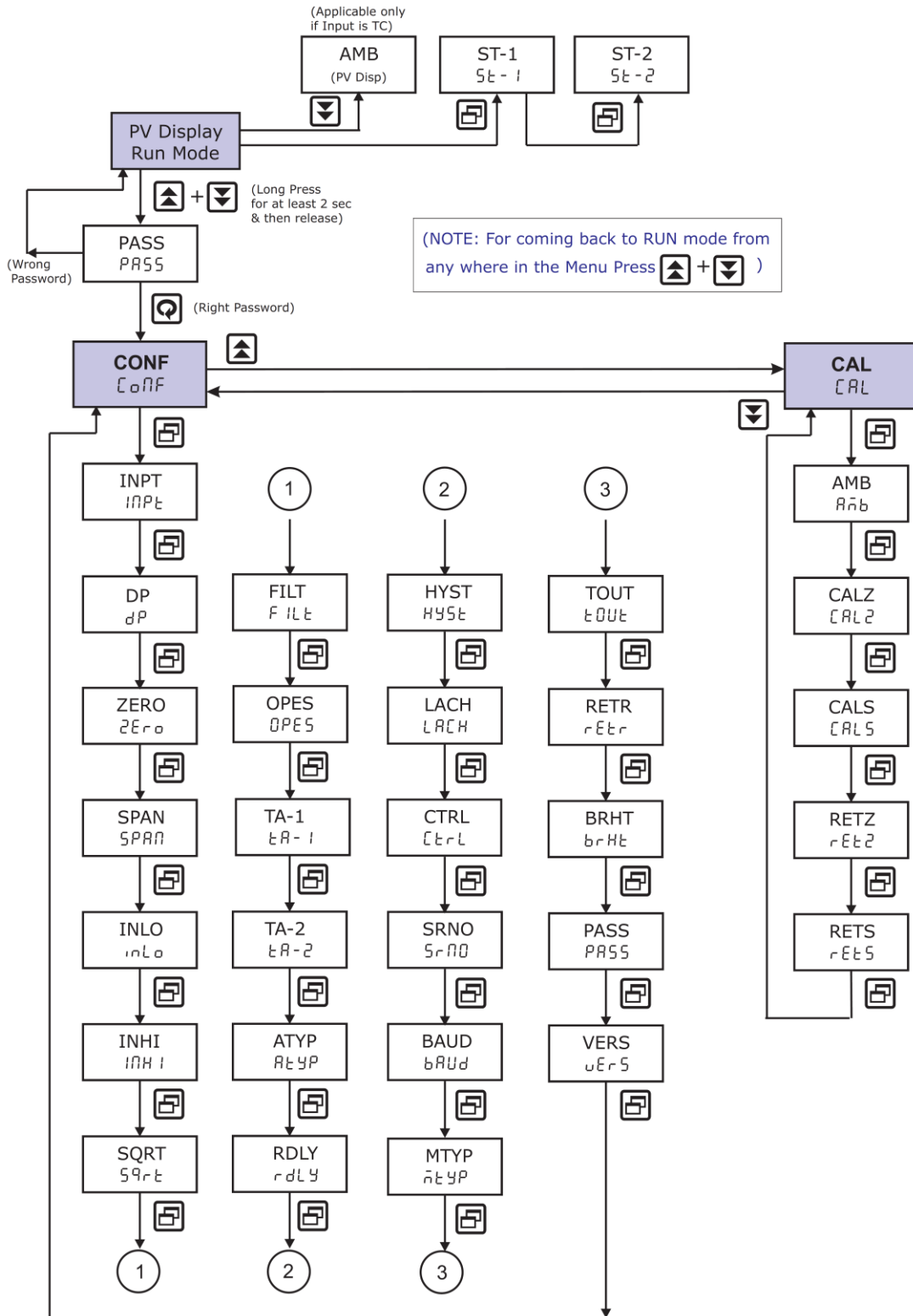
RUN Time Indication/Function

Following parameters can view or change during run time.

- For Thermocouple input type, Press Decrement key to show ambient temperature.
- For Alarm Acknowledgment, Press Enter Key.

Set Point Setting

Parameter (PV display)		Setting name and description	Default value	Shows only if
Symbol	Name			
ST-1 (5ᵗ - ꞁ)	Set Point 1	Range Depending on PV sensor type selected	100	-
ST-2 (5ᵗ-2)	Set Point 2	Range Depending on PV sensor type selected	100	-

Configuration Mode

CONFIGURATION PARAMETERS

Parameter (PV display)		Setting Name & Description	Default Value	Show if Only
Symbol	Name			
INPT (ınPᵗ)	INPUT Type	Set PV Input Type ᵗC E/ᵗC J /ᵗC ꝑ /ᵗC ᵗ /ᵗC ᵬ /ᵗC ᵣ /ᵗC S /ᵣᵗd .ꞁ /0- .4ꝑ/0-6ꝑ / ꞁ- ꞁ0/0- ꞁ0/0-5ᵤ / ꞁ-5ᵤ /0-2ᵤ/ .4-2/ ꞁ020/ ꞁ-ᵗ5/0-ᵗ5/5ErL/4-20/0-20	1-5V	

Value	Input Type	Range
0	TC E	-200 to 1000 °C
1	TC J	-200 to 1200 °C
2	TC K	-200 to 1372 °C
3	TC T	-200 to 400 °C
4	TC B	450 to 1800 °C
5	TC R	0 to 1768 °C
6	TC S	0 to 1768 °C
7	RTD.1	-199.9 to 850.0 °C
8	0-.4K	
9	0-6K	
10	±10V	
11	0-10 V0	-1999 to 9999
12	0-5 V	
13	1-5 V	

			14	0-2V				

		14	0-2V		
		15	.4-2V		
		16	-10-20 mV		
		17	1-75 mV		
		18	0-75 mV		
		22	SERL		
		23	4-20 mA*		
		24	0-20 mA*		

Use external 250ohms,0.1% for current input

Parameter	Name	Description	Default	Condition
DP (dP)	Decimal Point	Set position of Decimal Point on Display. 1 /0 .1 /0 .01 /0 .001 0 : 1 1 : 0.1 2 : 0.01 3 : 0.001	1 (0.1)	Input Type is Linear
ZERO (ZEro)	Zero	Automatically change to the Input Lower Range with changing of Input Type (Refer Above Table) Can be set to any value within the Input Range & less the SPAN Value.	-199.9 (If 1-5V)	
SPAN (SPAn)	Span	Automatically change to the Input Higher Range with changing of Input Type (Refer Above Table) Can be set to any value within the Input Range & greater the ZERO Value.	999.9 (If 1-5V)	
INLO (inLo)	In Low Range	Automatically change to the Input Lower Range with changing of Input Type (Refer Above Table) Can be set to any value within the Input Range & less the SPAN Value.	1.000 (if 1-5V)	Only in Linear input
INHI (inhi)	In High Range	Automatically change to the Input Higher Range with changing of Input Type (Refer Above Table) Can be set to any value within the Input Range & greater the ZERO Value.	5.000 (if 1-5V)	Only in Linear input
SQRT (SQrt)	Square Root	Enable or Disable Square Root YES /no 0 : YES 1 : NO	0 (NO)	Only in Linear input
FLTR (FLtr)	Filter	Filter is time (in sec), that PV will wait before getting to its value after filter set. 0-60 sec	0	
OPES (oPES)	OPEN Sensor Status	Set Control O/P & Retransmission state when Input OPEN condition. UP/down 0 : UP 1 : DOWN	0 (UP)	
TA-1 (tA-1)	Type of Alarm	Set which Set Point to shown in SV display in RUN mode while device is in Auto Mode ALrm /triP 0 : ALRM 1 : TRIP	0 (ALRM)	
TA-2 (tA-2)	Type of Alarm	Set which Set Point to shown in SV display in RUN mode while device is in Auto Mode	0 (ALRM)	

		ALrn /trip 0 : ALRM 1 : TRIP		
ATYP (AtYP)	Alarm Type	Set which Set Point to shown in SV display in RUN mode while device is in Auto Mode HH/HL/LL 0 : HH 1 : HL 2 : LL	0 (HH)	
RDLY (rdLY)	Relay Delay (For Relay)	Relay Delay is amount of time (in sec), that Relay will wait before getting ON after the ON condition occurs. 1 to 9999 sec	0 sec	
HYST (HYSt)	Hysteresis (For Relay)	Hysteresis Value (in °C) for Relay <table><tr><td>1 to 255</td><td>TC & RTD Input</td></tr><tr><td>0.1 to 25.5</td><td>RTD.1 Input</td></tr><tr><td>1 to 255</td><td>Linear Input with DP=0</td></tr><tr><td>0.1 to 25.5</td><td>Linear Input with DP=1</td></tr><tr><td>0.01 to 2.55</td><td>Linear Input with DP=2</td></tr><tr><td>0.001 to 0.255</td><td>Linear Input with DP=3</td></tr></table>	0.1	
LACH (LACH)	Latch	Enable or Disable Latch YES /no 0 : YES 1 : NO	1 (NO)	
CTRI (CtrL)	Control Relay	Select Control Relay Status on /oFF 0 : ON 1 : OFF	0 (OFF)	
SRNO (Srno)	Serial No.	Unit ID for Modbus-RS485 Communication 1 to 247	1	
BAUD (bAUd)	Baud Rate	Set Modbus RS485 Communication Baud Rate 4800 / 9600 /19 .2P /38 .4P 0 : 4800 (4800 bps) 1 : 9600 (9600 bps) 2 : 19.2K (19200 bps) 3 : 38.4K (38400 bps)	1 (9600)	
MTYP (ntYP)	Modbus Type	Enable or Disable Latch A / b 0 : A 1 : B	0 (A)	
TOUT (tOUt)	Time Out	Time Out is time (in sec), For Display PV 1-32 sec	1	Only in SERL input
RETR (rEtr)	Retransmission	Retransmission Output Type This output is according to PV input. Zero & Span acts as Min & Max value of retransmission o/p scale respectively. 0-5u / 1-5u /0- 10u /4-20 /0-20 0 : 0-5V 1 : 1-5V 2 : 0-10V 3 : 4-20mA 4 : 0-20mA Voltage or Current is Jumper Selectable from the Hardware.	3 (4-20mA)	

BRHT (brHt)	Brightness	Adjust Brightness of the 7-segment Display. 10 to 100	100	
PASS (PASS)	Password	Set Device Password 0 to 99	1	
VERS (uErS)	Version	Shows the Version of the Current Firmware	-	

Calibration Mode

Parameter (PV display)		Setting Name & Description	Default Value	Show if Only
Symbol	**Name**			
AMB (Amb)	Ambient	Ambient Adjustment	-	Input is TC
CALZ (CALZ)	Calibration Zero	Calibration Zero for PV Input (PV Display : Current PV)	-	
CALS (CALS)	Calibration Span	Calibration Span for PV Input (PV Display : Current PV)	-	
RETZ (rEtZ)	Retransmission-ZERO	Calibration Zero for Retransmission Output PV Display : For Current & Voltage: 0 If voltage:-0.000 & If Current:-4.000	-	
RETS (rEtS)	Retransmission-SPAN	Calibration Span for Retransmission Output PV Display : For Current & Voltage: 0 If voltage:-8.000 & If Current:-20.00	-	

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Example:

1. How to change Input Type

2. How to change Control Set Point-1
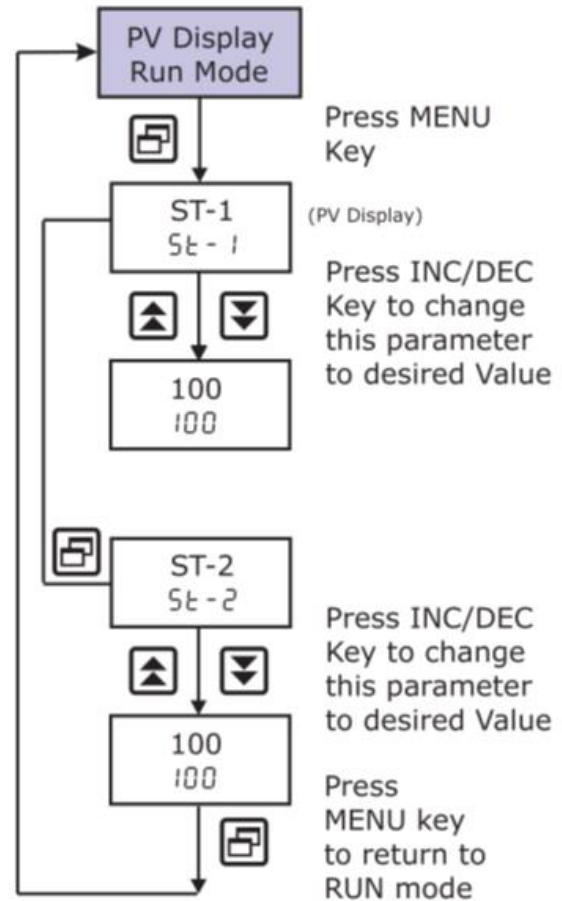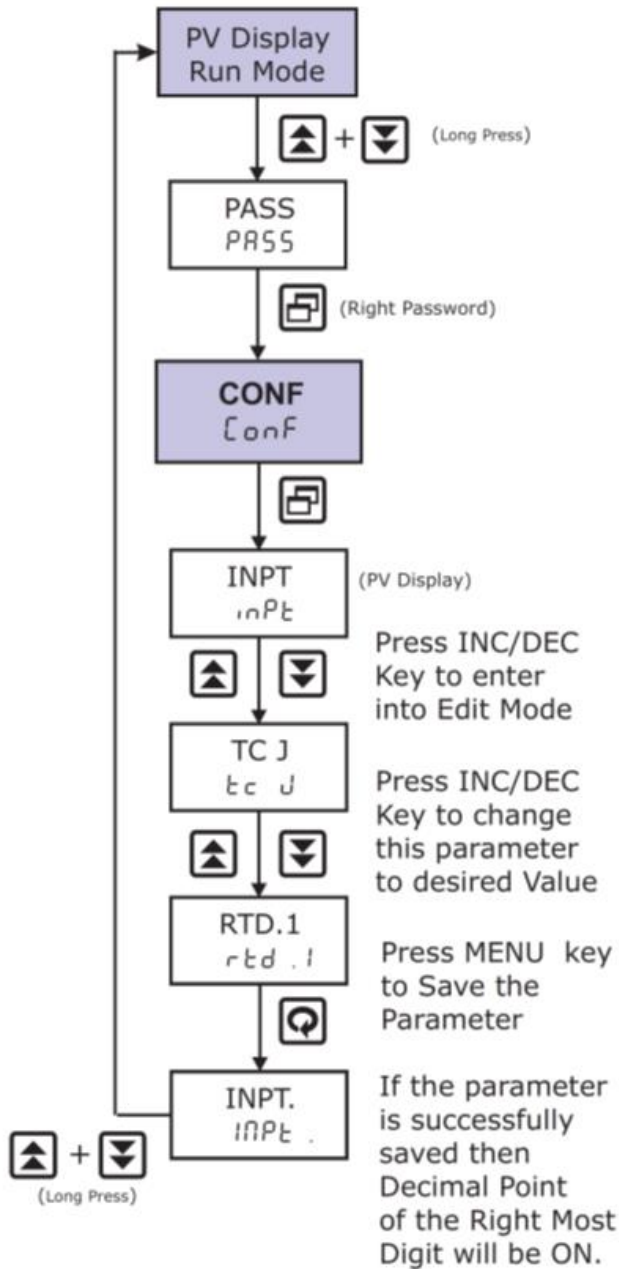
6. CONTROL FUNCTION

6.1 ON/OFF Control

ON/OFF Controller is the simplest form of temperature control device. The output from the device is either on or off, with no middle state. An on-off controller will switch the output only when the temperature crosses the set point. For heating control, the output is on when the temperature is below the set point, and off above set point.

Since the temperature crosses the set point to change the output stage, the process temperature will be cycling continually, going from below set point to above, and back below. In cases where this cycling occurs rapidly, and to prevent contactors and valves from getting damaged, an on-off differential, or "hysteresis," is added to the controller operations. On-Off hysteresis prevents the output from "chattering" or making fast, continual switches if the cycling above and below the set point occurs very rapidly.
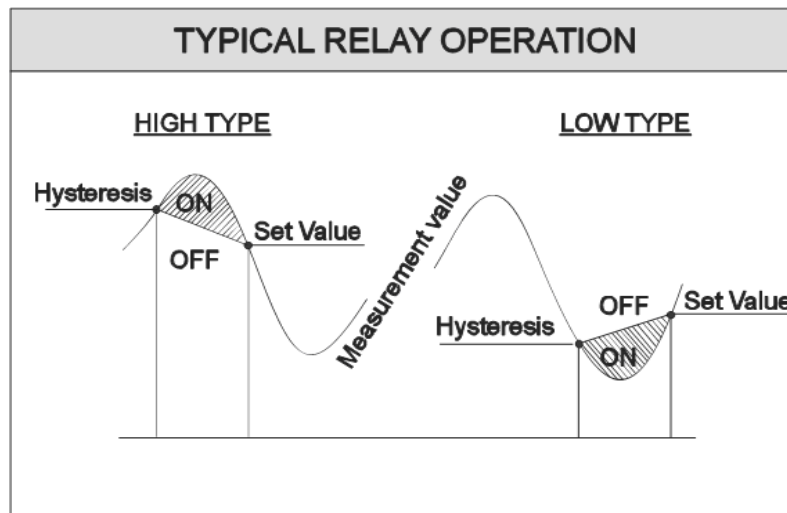
Figure 8.1: Typical Relay operation

High type (H-ON):

For High type of set value, once process value reaches up to set point + Hysteresis value, relay will be ON after few seconds (as per relay delay) and it will be ON until process value goes down to Set point.

Low type (L-ON):

For Low type of set value, once process value reaches down to set point – Hysteresis value relay will be ON after nearly few seconds (as per relay delay) and it will be ON until process value goes up toward Set point.

6.2 Messages during OPEN SENSOR condition

Input type	Message
TC-E	OPEN
TC-J	OPEN
TC-K	OPEN
TC-T	OPEN
TC-B	OPEN
TC-R	OPEN
TC-S	OPEN
PT 100	OPEN
0-400Ω	OPEN
0-6000Ω	OPEN
±10V	RANDOM VALUE
0-10V	-1999
0 to 5V DC	UNDR
1 to 5V DC	OPEN
0 to 2V DC	OPEN
0.4 to 2V DC	OPEN
-10 to 20mV DC	OPEN
±75mV	OPEN
0-75mV	OPEN
Serial	-----
4-20mA	OPEN
0-20mA	UNDR

Table 4.

Note: If set zero/span for input type is less then maximum value of zero and span for then process value will display readings above 5% of display range, then after it will show OVER/UNDER message until value crosses maximum value of Sensor range.

Process value greater then maximum value of zero/span then display will show 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 message instead it will show either OVER/UNDER.

Retransmission output during OPEN sensor/Diode Open condition

I/P	0-20 mA O/P		4-20 mA O/P	
	UP Scale O/P	DW Scale O/P	UP Scale O/P	DW Scale O/P
*TC	21.00	0.0	20.8	3.2
Pt-100	21.00	0.0	20.8	3.2
0~5V	21.00	0.0	3.2	3.2
1~5V	21.00	0.0	20.8	3.2
±75mV	21.00	0.0	20.8	3.2
0~75mV	21.00	0.0	20.8	3.2
0~10V	Random	Random	Random	Random
*±10V	Random	Random	Random	Random
0~2V	21.00	0.0	20.8	3.2
0.4~2V	21.00	0.0	20.8	3.2
-10~20mV	21.00	0.0	20.8	3.2
0~6000Ω	21.00	0.0	20.8	3.2
0~400Ω	21.00	0.0	20.8	3.2
Serial	21.00	0.0	20.8	3.2
4-20mA	21.00	0.0	20.8	3.2
0-20mA	21.00	0.0	3.2	3.2

Table 5A

I/P	0-10 V O/P		0-5 V O/P		1-5 V O/P	
	UP Scale O/P	DW Scale O/P	UP Scale O/P	DW Scale O/P	UP Scale O/P	DW Scale O/P
*TC	10.50	0.0	5.25	0.0	5.20	0.80
Pt-100	10.50	0.0	5.25	0.0	5.20	0.80
0~5V	10.50	0.0	5.25	0.0	5.20	0.80
1~5V	10.50	0.0	5.25	0.0	5.20	0.80
±75mV	10.50	0.0	5.25	0.0	5.20	0.80
0~75mV	10.50	0.0	5.25	0.0	5.20	0.80
0~10V	Random	Random	Random	Random	Random	Random
*±10V	Random	Random	Random	Random	Random	Random
0~2V	10.50	0.0	5.25	0.0	5.20	0.80
0.4~2V	10.50	0.0	5.25	0.0	5.20	0.80
-10~20mV	10.50	0.0	5.25	0.0	5.20	0.80
0~6000Ω	10.50	0.0	5.25	0.0	5.20	0.80
0~400Ω	10.50	0.0	5.25	0.0	5.20	0.80
Serial	10.50	0.0	5.25	0.0	5.20	0.80
4-20mA	10.50	0.0	5.25	0.0	5.20	0.80
0-20mA	10.50	0.0	5.25	0.0	5.20	0.80

Table 5B.

*TC – E,J,K,T,B,R,S.

*±10V – OPEN is not displayed in this input type.

Above mention value in the table 5A, 5B will come only after calibration for specific o/p type i.e. Voltage/Current.

6.3 Relay Delay

Relay delay is the parameter used to set the delay (second) in the operation of relays (both 1&2).Minimum value of delay is 0(second) and maximum value 9999 (second) can be configured using keyboard.

6.4 Control Relay

Control relay "OFF" then relay will function according to the condition mention in the following tables. Control relay "ON" then functioning of relay will be just opposite to the condition mention in the table. Lamp functioning will be as mention in the table i.e. no change in the LED status.

Alarm AL1 (Momentary Alarm): when in abnormal condition ACK not pressed.

Condition			Normal	Abnormal	UP	DOWN	ACK**	Normal*	ACK***
High	Alarm Latch(Yes)	LAMP	OFF	FLASH	FLASH	OFF		FLASH	OFF
		RELAY	OFF	ON	ON	OFF		OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	FLASH	OFF		OFF	OFF
		RELAY	OFF	ON	ON	OFF		OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF		FLASH	OFF
		RELAY	OFF	ON	OFF	OFF		ON	OFF
Low	Alarm Latch(Yes)	LAMP	OFF	FLASH	OFF	FLASH		FLASH	OFF
		RELAY	OFF	ON	OFF	ON		OFF	OFF
	Alarm Ltch(No)	LAMP	OFF	FLASH	OFF	FLASH		OFF	OFF
		RELAY	OFF	ON	OFF	ON		OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF		FLASH	OFF
		RELAY	OFF	ON	OFF	OFF		ON	OFF
VLow	Alarm Latch(Yes)	LAMP	OFF	FLASH	OFF	FLASH		FLASH	OFF
		RELAY	OFF	ON	OFF	ON		OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	OFF	FLASH		OFF	OFF
		RELAY	OFF	ON	OFF	ON		OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF		FLASH	OFF
		RELAY	OFF	ON	OFF	OFF		ON	OFF

Table 6.

Alarm AL2 (Momentary Alarm): when in abnormal condition ACK not pressed.

Condition			Normal	Abnormal	UP	DOWN	ACK**		Normal*	ACK***
VHigh	Alarm Latch(Yes)	LAMP	OFF	FLASH	FLASH	OFF			FLASH	OFF
		RELAY	OFF	ON	ON	OFF			OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	FLASH	OFF			OFF	OFF
		RELAY	OFF	ON	ON	OFF			OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF			FLASH	OFF
		RELAY	OFF	ON	OFF	OFF			ON	OFF
High	Alarm Latch(Yes)	LAMP	OFF	FLASH	FLASH	OFF			FLASH	OFF
		RELAY	OFF	ON	ON	OFF			OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	FLASH	OFF			OFF	OFF
		RELAY	OFF	ON	ON	OFF			OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF			FLASH	OFF
		RELAY	OFF	ON	OFF	OFF			ON	OFF
LOW	Alarm Latch(Yes)	LAMP	OFF	FLASH	OFF	FLASH			FLASH	OFF
		RELAY	OFF	ON	OFF	ON			OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	OFF	FLASH			OFF	OFF
		RELAY	OFF	ON	OFF	ON			OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF			FLASH	OFF
		RELAY	OFF	ON	OFF	OFF			ON	OFF

Table 7.

Alarm AL1 (Maintained Alarm): when in abnormal condition ACK is pressed.

Condition			Normal	Abnormal	UP	DOWN	ACK**	Normal*	ACK***
High	Alarm Latch(Yes)	LAMP	OFF	FLASH	FLASH	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	ON	OFF	ON	OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	FLASH	OFF	STEADY	OFF	OFF
		RELAY	OFF	ON	ON	OFF	OFF	OFF	OFF

	Trip	LAMP	OFF	FLASH	OFF	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	OFF	ON	ON	OFF
Low	Alarm Latch(Yes)	LAMP	OFF	FLASH	OFF	FLASH	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	ON	ON	OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	OFF	FLASH	STEADY	OFF	OFF
		RELAY	OFF	ON	OFF	ON	OFF	OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	OFF	ON	ON	OFF
VLOW	Alarm Latch(Yes)	LAMP	OFF	FLASH	OFF	FLASH	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	ON	ON	OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	OFF	FLASH	STEADY	OFF	OFF
		RELAY	OFF	ON	OFF	ON	OFF	OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	OFF	ON	ON	OFF

Table 8

Alarm AL2 (Maintained Alarm): when in abnormal condition ACK is pressed.

Condition			Normal	Abnormal	UP	DOWN	ACK**	Normal*	ACK***
VHigh	Alarm Latch(Yes)	LAMP	OFF	FLASH	FLASH	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	ON	OFF	ON	OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	FLASH	OFF	STEADY	OFF	OFF
		RELAY	OFF	ON	ON	OFF	OFF	OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	OFF	ON	ON	OFF
High	Alarm Latch(Yes)	LAMP	OFF	FLASH	FLASH	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	ON	OFF	ON	OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	FLASH	OFF	STEADY	OFF	OFF
		RELAY	OFF	ON	ON	OFF	OFF	OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	OFF	ON	ON	OFF
LOW	Alarm Latch(Yes)	LAMP	OFF	FLASH	OFF	FLASH	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	ON	ON	OFF	OFF
	Alarm Latch(No)	LAMP	OFF	FLASH	OFF	FLASH	STEADY	OFF	OFF
		RELAY	OFF	ON	OFF	ON	OFF	OFF	OFF
	Trip	LAMP	OFF	FLASH	OFF	OFF	STEADY	STEADY	OFF
		RELAY	OFF	ON	OFF	OFF	ON	ON	OFF

Table 9.

Notes: *means normal condition after abnormal has occurred.

**means ACK pressed in abnormal condition.

***means ACK pressed in normal condition after abnormal has occurred.

7. Calibration Procedure

Calibration for Input

The calibration in the instrument is using front panel keys only. Instrument can be calibrated even during installed condition.

Calibration is carried out using following steps.

1) First of all enter in to calibration mode using front panel keys. Display indicates "CAL" in 4-segment display.
2) Press 'MENU' key to enter in to calibration for "zero", "span" or "ambient"
3) Display indicates "CAL2" for zero calibration;"CAL5" for span calibration and "Amb" for ambient calibration. User can enter in to zero/span/ambient calibration using UP, DOWN keys.
4) Input type other then thermocouple display will be either "CAL2" or "CAL5" because for other inputs (except thermocouple) ambient calibration is not required.
5) To perform zero calibration, press DOWN key when display shows "CAL2". Feed input corresponding to zero and adjust the value of display using UP, DOWN keys .Once value is adjusted using UP, DOWN keys press ENTER to store that value in memory .Display will start flashing when user presses ENTER key. Same procedure is required to perform calibration for span or ambient type.
6) Sometimes user may require iteration for zero and span calibration for better linearity/accuracy.
7) Depending upon input type selected value in the display is calibrated within limited range.

Input type	Calibration for input
E,J,K,T,B,R,S	Either of any input
Pt-100, 0-400Ω	Either of any input
0-10V,0-5V,1-5V,0-2V,0.4-2V,4-20mA,0-20mA	Either of any input
±10V	Specific input
±75mV,75mV,-10 – 20mV	Either of any input
0-6000Ω	Specific input

Table 10.

Calibration for Retransmission

The calibration in the instrument is using front panel keys only. Instrument can be calibrated even during installed condition.

Calibration is carried out using following steps.

1) Enter in to calibration mode using front panel keys. Display indicates "CAI" in 4-segment display.
2) Press 'MENU' key to enter in to calibration for "RETZ" and "RETS"
3) Display indicates "RETZ "for zero calibration; "RETS" for span calibration User can enter in to zero/span calibration using UP, DOWN keys (applicable for both voltage/current output).
4) To perform zero calibration press DOWN key when display shows "RETZ". Retransmission output will be nearly equal to 0 V/0mA depending up on type of selection. If output differs from 0V/0mA vary counts to get desire output.
5) Irrespective of value of count try to obtain 0V/0mA at the output and press ENTER key to store calibrated value in memory.

Repeat the above same steps for span calibration here, desired voltage output is 10V and current output is 20mA.

Note: calibration for voltage output is required to do in 0-10V range and for current output its 0-20mA range, which incorporates other ranges also. In case of current output specially to calibrate for zero side vary count in display such that output is greater than zero mA and then bring it down by varying counts it to zero mA.

8. Communication Parameter

Introduction

The unit can be connected in RS-485 communication data link either in multi drop or repeat mode. Each unit must have unique Serial Number. Entire range of addresses (1 to 247) may be used. Before starting any communication, choose a baud rate compatible to the host computer. The serial protocol used is MODBUS RTU.

Function Code for Modbus

CODE	NAME	Function
01	Read coil status	Use to read Relay
03	Read Holding registers	Use to read PV
04	Read input registers	Use to read programmable registers
05	Force single coil	Use to ON /OFF single coil.
16	Preset Multiple register	Use to write programmable register

Table 11.

The error checking field contains a 16-bit value implemented as two eight-bit bytes. The error check value is the result of a Cyclical Redundancy Check (CRC) calculation performed on the message contents.

8.1.1 Parameter Address Details For codYP : A

Sr.No	Parameter	Absolute address	Type	Minimum value	Maximum Value	Access Type
1.	*Relay status1	1	Bit	0	1	R/W
2.	*Relay status2	2	Bit	0	1	R
3.	*Alarm status1	10001	Bit	0	1	R
4.	*Alarm status2	10002	Bit	0	1	R
5.	*Alarm 1 Blinking	10004	Bit	0	1	R
6.	*Alarm 2 Blinking	10005	Bit	0	1	R
7.	Process value	30001	Integer			R
8.	Ambient	30002	Integer			R
9.	Zero display	40001	Integer			R/W

10.	Span display	40002	Integer			R/W
11.	Set point 1	40003	Integer			R/W
12.	Set point 2	40004	Integer			R/W
13.	Relay delay	40005	Unsigned Integer	0	9999	R/W
14.	Brightness	40006	Unsigned char	1	100	R/W
15.	*Input type selected	40007	Unsigned Integer	0	18	R/W
16.	*Decimal point	40008	Unsigned char	0	4	R/W
17.	Hysteresis	40009	Integer	0	255	R/W
18.	Serial number	40010	Unsigned Char	1	247	R/W
19.	*Baud rate	40011	Unsigned char	0	3	R/W
20.	*Alarm logic type	40012	Unsigned Integer	0	2	R/W
21.	*Alarm 1	40013	Unsigned Integer	0	1	R/W
22.	*Alarm 2	40014	Unsigned Integer	0	1	R/W
23.	*Alarm Latch	40015	Unsigned Integer	0	1	R/W
24.	* Alarm sensor	40016	Unsigned char	0	1	R/W
25.	*Relay control	40017	Unsigned Integer	0	1	R/W
26.	Password	40018	Unsigned integer	1	9999	R/W
27.	Serial Input PV	40031	Integer	-1999	9999	R/W
28.	Time out	40032	Unsigned Integer	1	32	R/W
29.	*Sqrt	40033	Unsigned char	0	1	R/W
30.	*Filter	40034	Unsigned integer	0	60	R/W
31.	*Retransmission o/p	40035	Unsigned char	0	4	R/W
32.	Inlo	40036	Integer	0	15	R/W
33.	Inhi	40037	Integer	0	15	R/W

Table 12.

- *Relay status1, *Relay status2 it gives status of LED. Relay status1 can be used to acknowledge
- Alarm 1 Blinking, Alarm 2 Blinking : 1= Blinking On, 0 = Blinking Off
- Acknowledge using function code-5
- Address 3-16 for future use only

- *Alarm status1, *Alarm status2 gives status of abnormal condition only. Address 1006- 1016 for future use only
- *Input type: 0 = Etc, 1 = Jtc, 2 = Ktc, 3 = Ttc,4 =Btc,5 =Rtc, 6 = Stc, 7= pt-100,8 = 0-400Ω, 9 =0-6000Ω, 10 = ±10V, 11 = 0-10V, 12 = 0-5V, 13 = 1-5V,14 = 0-2V,15 = 0.4-2V, 16 = -10-20mV, 17 = ±75mV, 18 = 0-75mV,22=Serial, 23=4-20mA,24=0-20mA
- *Baud rate: 0 = 4800, 1 = 9600, 2 = 19200, 3 = 38400
- *Alarm Latch: 0 = YES, 1 = NO
- Alarm sensor: 0 =UP, 1=DOWN
- *Relay control: 0 = ON, 1=OFF
- *Alarm logic type: 0 = HH, 1 = HL, 2 = LL.
- *Alarm 1: 0 = Alarm, 1 = Trip
- *Alarm 2: 0 = Alarm, 1 = Trip.
- Values when OPEN: – 32767, UNDER: – 32765, OVER: – 32766.
- *Decimal point: 0=0, 1= .0, 2=.00, 3=.000, 4=.0000
- *Sqrt: 0 = YES, 1 = NO
- *Filt: 0 = No Filter, 1-60 = Filter used.
- * Retransmission o/p: 0 = 0-5V, 1 = 1-5V , 2 = 0-10V , 3 = 4-20mA , 4 = 0-20mA

8.1.2 Parameter Address Details For ᚾᚴᎩᏢ : ᑊ (405-4IN)

Sr. No.	Analog Parameters	Absolute Address	Type of Access	Type	Value Applicable
1*	Process Value	40001	R/*W	Int	As Perspc. Table Of I/P Type Range
2	Set Value-1	40002	R/W	Int	Conf. Zero To Conf. Span
3	Setvalue-2	40003	R/W	Int	
4	Set Value-1 Hysteresis	40004	R/W	Int	0 – 255 Count
5	Set Value-2 Hysteresis	40005	R/W	Int	
6	Engineering Zero	40006	R/W	Int	Max Value As Perspc. Table Of I/P Type Range
7	Engineering Span	40007	R/W	Int	
8	Decimal Position	40008	R/W	Unsigned char	0 To 3

Table 13

* Absolute Address 40001 is Read/Write only if Serl prompt is made 'YES'(Only serial input). If Serl prompt is made 'NO' then absolute address 40001 is Read only.

Exceptional Response

CODE	MEANING
01	Function code Invalid. It must be 01, 03, 04,05 or 16.The function code received in the query is not allowable action for the slave.
02	Illegal address value. The data address received in the query is not an allowable address for the salve.
03	Illegal data value. A value contained in the query data field is not an allowable value for the salve.
06	When Master device write some parameters to Slave device, If slave device busy then it will send 06 code to indicate slave device is busy.

Table 14.

9. Technical Specifications

Display:

PV: Red LED 4-digit, character size 4.00".

LED for status indication (Alarm and Tx/Rx).

Operation keys: Menu, Enter, Increment, Decrement.

Input:

Input	Type	Range	Accuracy
TC	E	-200 to 1000 ºC	±0.1 % Of Full Span ±1Digit (B,R,S,0-6KΩ: ±0.15% Of Full Span ± 2 Digit)
	J	-200 to 1200 ºC	
	K	-200 to 1350 ºC	
	T	-200 to 400 ºC	
	B	450 to 1800 ºC	
	R	0 to 1750 ºC	
	S	0 to 1750 ºC	
RTD	Pt 100	-200 to 850 ºC	
DC Current	4-20 mA	-1999 to 9999,	
	0-20 mA		
	0-5 V	-1999 to 9999,	
	1-5 V		
	0-2 V	-1999 to 9999,	

DC Voltage	0.4 – 2V	-1999 to 9999	
	± 10V		
	0-10 V	-1999 to 9999	
	-10-20mV		
	± 75 mV		
	0-75 mV		
Resistance Input	0-400Ω		
	0-6000Ω		
Serial	PV Write Facility	-1999 to 9999	

* For DC Current input, 250Ω shunt resistor (sold separately) must be externally installed.

For DC current and voltage input, scaling is possible and decimal point can be changed.

Burn out current   : 0.25 uA

Reference Junction compensation error: ±2 ºC

Noise Rejection Ratio   Common mode: >120 dB (50Hz)

                    Normal mode :   >40 dB   (50Hz)

RTD   : Allowable lead wire resistance 15 Ω or less.

Input Impedance: >1MΩ (Voltage Input)

              250 Ω for (Current Input)

TEMPCO   :< 100 ppm for input to display

            :<150 ppm for retransmission output.

Input Sampling period:

        5 Sample/Sec

Alarm:

        Alarm AL1 - Momentary Alarm

                Condition – high/low/vlow

                Lamp – on/flash/latch

                Relay – on/off

Alarm AL2 - Momentary Alarm

Condition – vhigh/high/low

Lamp – on/flash/latch

Relay – on/off

Transmission output

DC Current: 0 to 20 mA DC, 4 to 20 mA DC

DC Voltage: 0 to 10V DC, 0 to 5V DC, 1 to 5V DC. (One at a time factory settable).

Accuracy: ±0.25% of full Span

Load Resistance for current O/P: 500 Ω or less

Load Resistance for Voltage O/P: 3 KΩ or more

Supply voltage:

Standard: 85-265VAC/ 100-300VDC

Optional: 18-36VDC

Power consumption: <10 VA

Data backup: Non-volatile memory (can be written up to 100000 times)

Power Consumption:

Max. 10 VA

Insulation resistance:

Between Power supply terminal and ground terminal, 500V DC 50MΩ.

Environment:

Ambient: 0 to 55 ºC.

Humidity: 20 to 95% RH (Non-condensing).

Case:

Material: MS Powder Coated

Color: **IP 20 :** Black

IP 65 : Light Gray

Protection: IP 20 : Panel / Wall / 19" Rack Mount

IP 65 : Wall Mount

Mounting method:

Panel / Wall / 19" Rack Mounting

Dimension:

IP 20 : 440mm (W) x 175mm (H) x 70mm (D)

IP 65 : 500mm (W) x 300mm (H) x 120mm (D)

Panel Cutout:

444mm(+0.8) x 175mm(+0.8)

Weight:

IP 20 : 3 kg (Approx.)

IP 65 : 8.3 kg (Approx.)

Communication

Communication Interface	Based on EIA RS-485.
Communication method	Half-duplex communication start stop synchronous.
Communication Speed	4800/9600/19200/38400bps selectable by key.
Parity	None.
Communication Protocol	Modbus RTU.
Connectable number of unit	Max.32 unit per host computer.
Communication error detection	CRC check.

Transmitter Output:

24V DC@50mA (±10 % accuracy)

Isolation specification:

- 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.

Special Feature:

Square Root Extraction

Digital Filter   0-60 Sec.
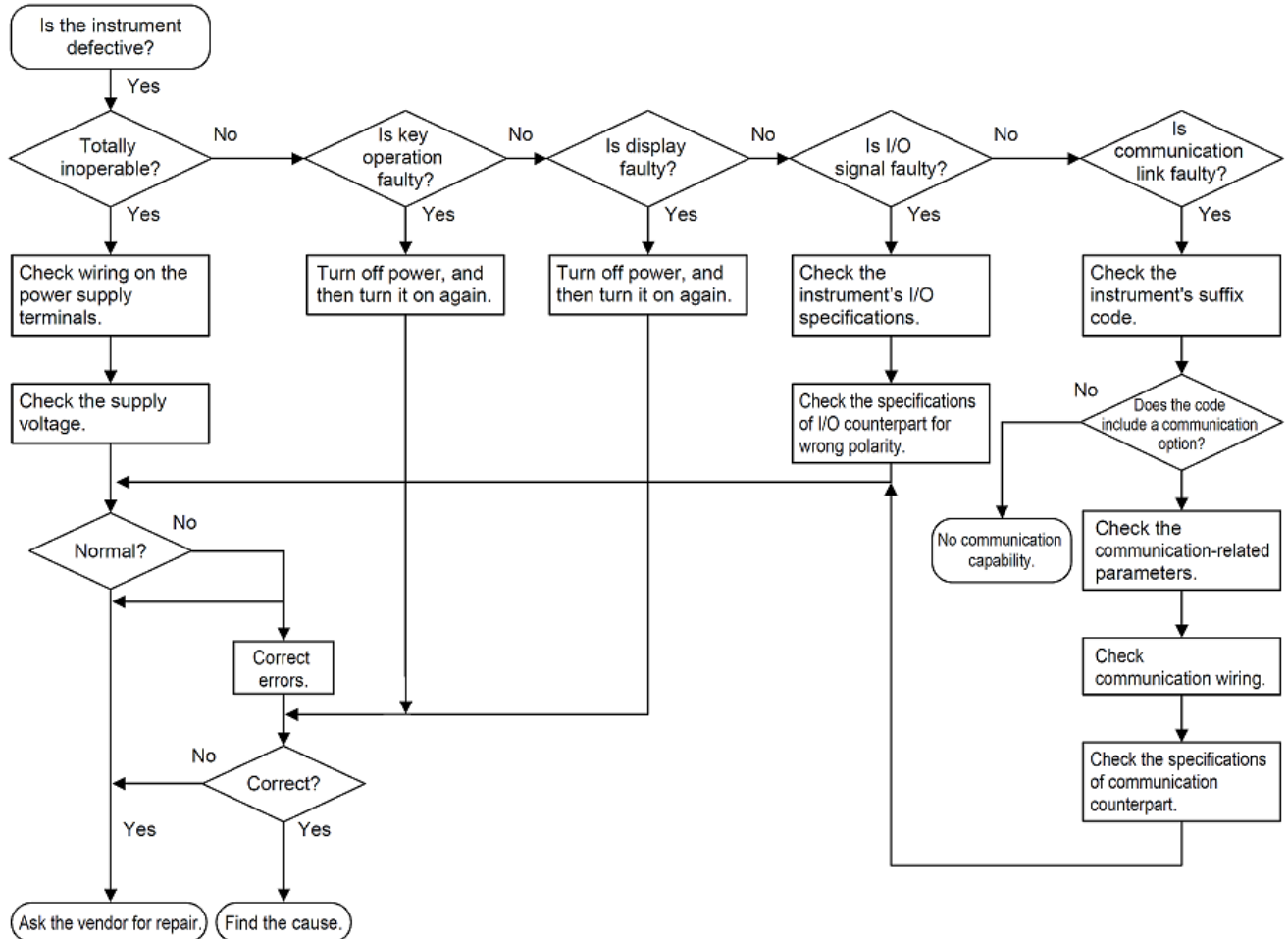
Input Scalability   For Linear Input type

10. Appendix

Troubleshooting

Jumper Location for Retransmission Output

Jumper Setting for Retransmission card: m61Cao102
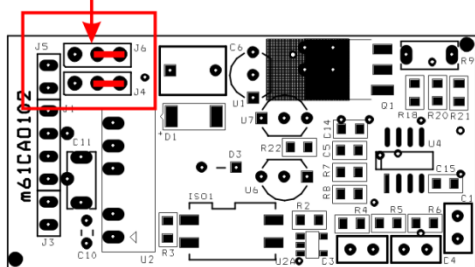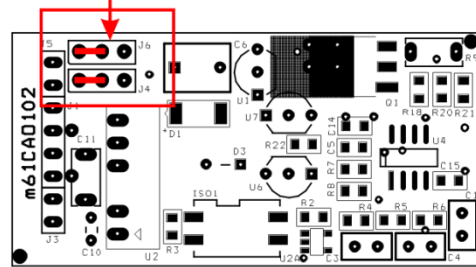
Square Root Linearization

The formula for square root is:

$$PV = Zero + [(Span - Zero)\sqrt{Vinput - Vlow/(Vhigh - Vlow)}\,]$$

Where: Span is the high end of process variable

Zero is the low end of process variable

Vinput is actual voltage or current value of input

Vhigh is the high end of input signal range (5V or 20mA)

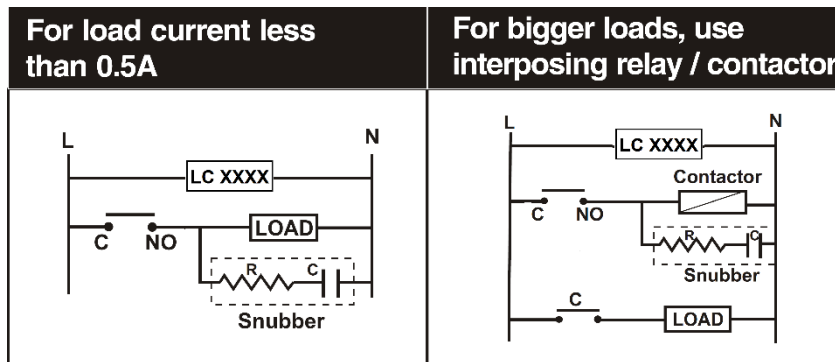Vlow is the high end of input signal range (1V or 4mA)

Example:PV is 0-1000

Input signal range is 1-5V

Input signal is 3V

PV will be,

$$PV = 0 + [(1000\text{-}0)\sqrt{(3-1)/(5-1)}\,] = 707$$

Load connection

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

Electrical precautions during use

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