User's Manual

409 Temperature Indicator with Alarm

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1. Introduction

1.1 Product Overview/Description

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

1.2 Model and Suffix code

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

MODEL	INPUT		Digital Input*		Power Supply		COMMUNICATION		RETRANSMISSION O/P	
409	1	E	N	None	U1	85-265VAC/ 100-300VDC	N	NONE	N	None
	2	J	Y	Yes	U2	18-36VDC	Y	RS485	C	4-20mA
	3	K							D	0-20mA
	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.

1.3 Accessory

The product is provided with the following accessory. (Seethe 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

3.1 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 409

MENU key: It is used to come out from the main or sub menu.

ENTER key: It is used to select the desired parameter in various operating Mode. After setting the data to proper value, by increment or decrement key, it is used to enter the value of the selected parameter in memory.

UP key: It is used to increment the parameter for selection. Value of Parameter can be incremented by pressing this key. If the key is pressed continuously for more than 10 counts change, the rate of increment will be made faster. This facility is to allow faster data change for higher values.

DOWN key: It is used to decrement the parameter for selection. Value of parameter can be decremented by pressing this key. If the key is pressed continuously for more

than 10 counts change, the rate of decrement will be made faster. This facility is to allow faster data change for higher values. User presses during RUN mode for Thermocouple input it shows ambient value.

Communication Status lamps: Lamps will blink when communication is on.

Alarm status lamps: When alarm occurs respective alarm lamp will on.

4. Panel Cutout Dimension

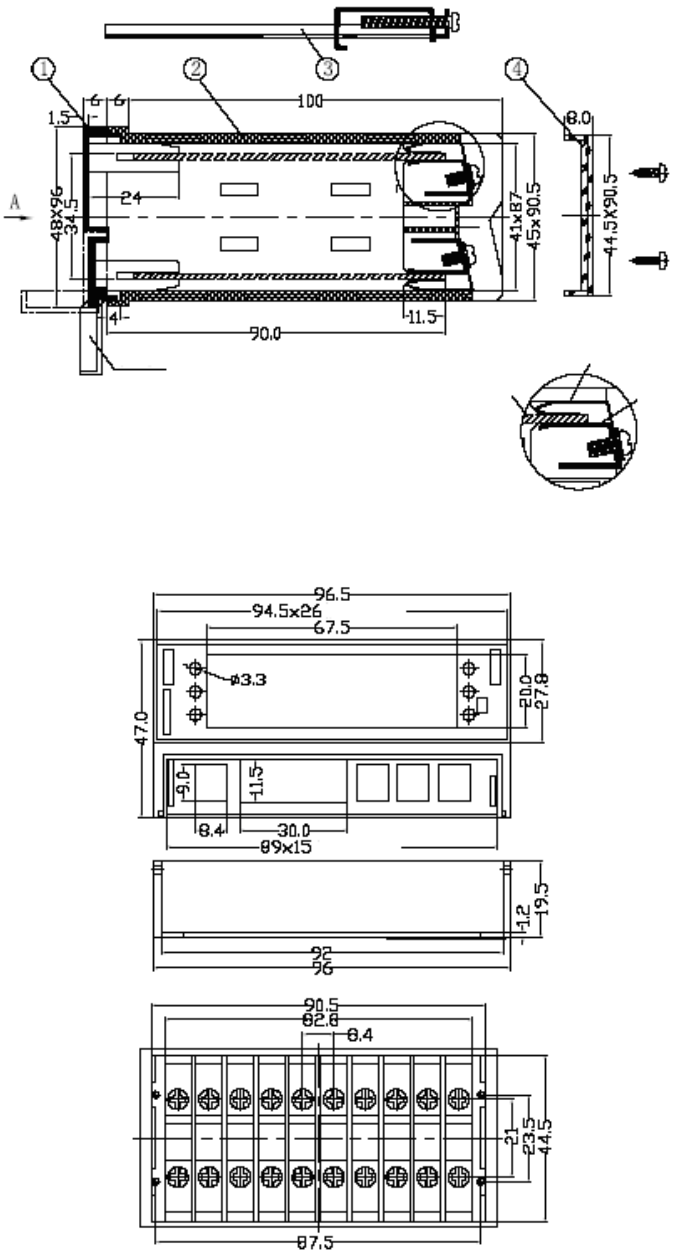


Fig 2.Panel cut out for 409

5. Terminal Arrangement Diagram

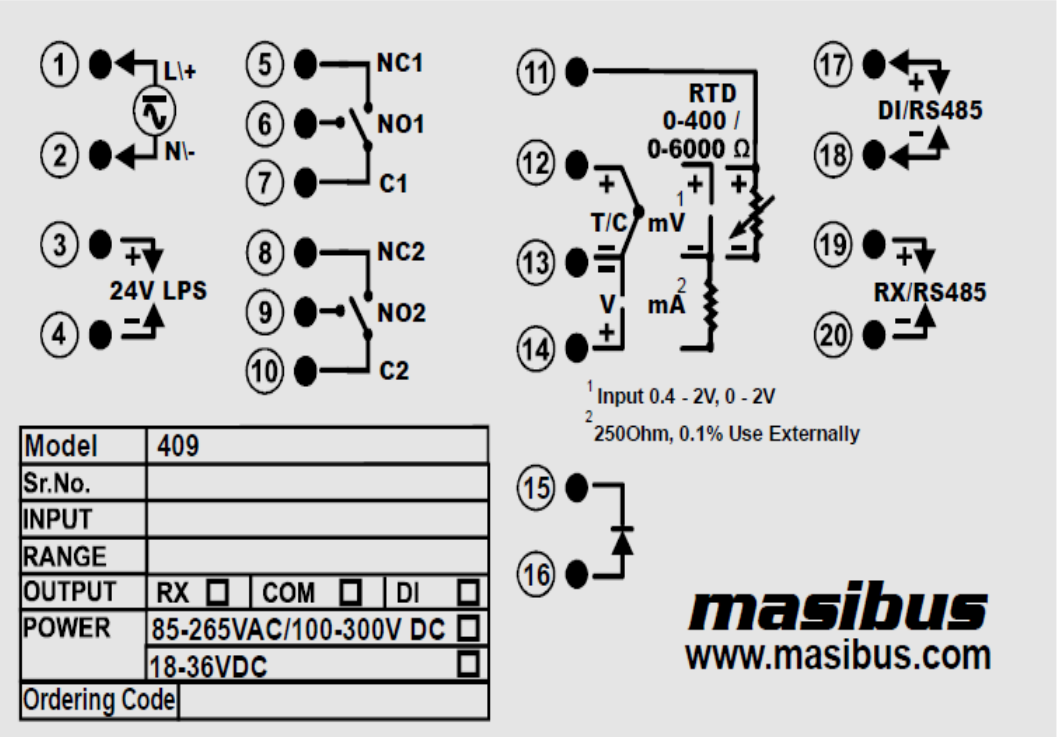


Fig 3. Terminal arrangement for 409

6. Configuration Guidelines

6.1 Menu Parameter List

Parameter	Name	Setting and Display range
PASS	Pass word	0001 – 9999
oP	Message indicates password entered correctly	
FAIL	Message indicates password entered is wrong.	
INPUt	Input type selection	
tc-E	Thermocouple ‘E’ type	
tc-J	Thermocouple ‘J’ type	
tc-P	Thermocouple ‘K’ type	
tc-t	Thermocouple ‘T’ type	
tc-b	Thermocouple ‘B’ type	

tc-r	Thermocouple ‘R’ type	
tc-S	Thermocouple ‘S’ type	
Pt 100	RTD pt100 type	
0 .-4P	0-400Ω potentiometer	
0-6P	0-6000Ω potentiometer	
1-10u	± 10 volt DC	
0-10u	0-10 volt DC	
0-5u	0-5 volt DC	
1-5u	1-5 volt DC	
0-2u	0-2 volt DC	
.4-2u	0.4-2 volt DC	
-10-20	-10-20 mV DC	
1-75	± 75 mV DC	
0-75	0-75 mV DC	
SErL	Serial input	
4-20	4-20 mA DC	
0-20	0-20 mA DC	
dP	Decimal point	
0	No decimal point.	
.0	Decimal point at unit position	
.00	Decimal point at 10th position	
.000	Decimal point at 100th position	
.0000	Decimal point at 1000th position	
2Ero	Zero enter	
SPAN	Span enter	
INLO	Input low value(Input Scalability)	
INHI	Input high value(Input Scalability)	
CAL 16	Calibration	
CALS	Span calibration	
CAL2	Zero calibration	
CALA	Ambient calibration	

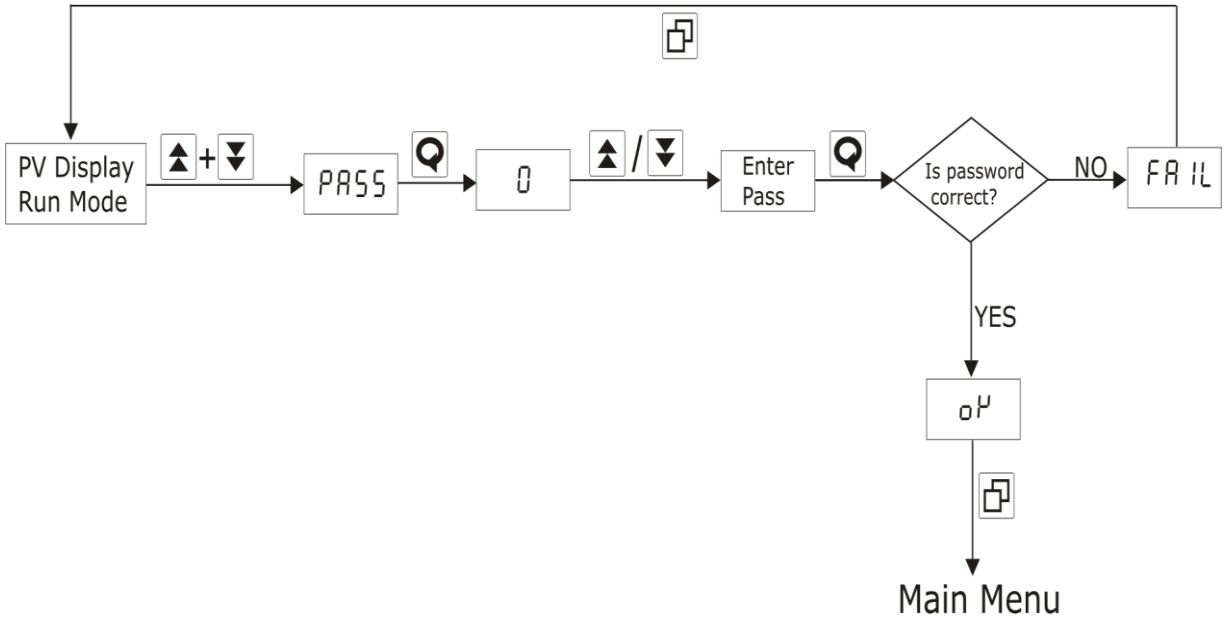
ALArn	Alarm Logic	
AtYPE	Alarm type	
hh	High-High logic	
hL	High-Low logic	
LL	Low-Low logic	
SELCt	Selection for Alarm 1 & 2.	
AL 1	Alarm 1	
AL2	Alarm 2	
ALArn	Alarm selection	
tr IP	Trip selection	
LAtch	Latch status	
YES	Latch Yes	
No	Latch No	
hYSt	Hysteresis	0-255
SEnSr	Sensor logic selection	
UP	Up scale logic	
doun	Down scale logic	
SEtP 1	Set point 1 for Alarm 1	
SEtP2	Set point 2 for Alarm 2	
rLdLY	Relay delay	0-9999
ctrLY	Control relay logic	
on	On control relay	
OFF	OFF control relay	
Conun	485-Communication	
Sr-No	Serial number for Modbus.	1-247
bAUd	Baud rate selection	
4800	4800	
9600	9600	
19200	19200	
38400	38400	
rEtrn	Retransmission	

rEt u	Retransmission voltage	
0-10u	Output 0-10V	
0-5u	Output 0-5V	
1-5u	Output 1-5V	
rEt mA	Retransmission current	
0-20	Output 0-20mA	
4-20	Output 4-20mA	
r cAL	Retransmission calibration	
rtn S	Retransmission span	
rtn 2	Retransmission zero	
dI IP	Digital input	
FiLt	Digital Filter	0-60
Pu hi	Maximum Process valuewhich instrument has measured*	
Pu Lo	Minimum process value which instrument has measured*	
toUt	Time out	1-32
Sqrt	Square Root	
YES	Square Root Yes	
No	Square Root No	
brIht	Brightness	1-100
chANG	Change of password	0001 – 9999
oP	Message indicates password change correctly	
doPEN	Sensor Diode is OPEN	

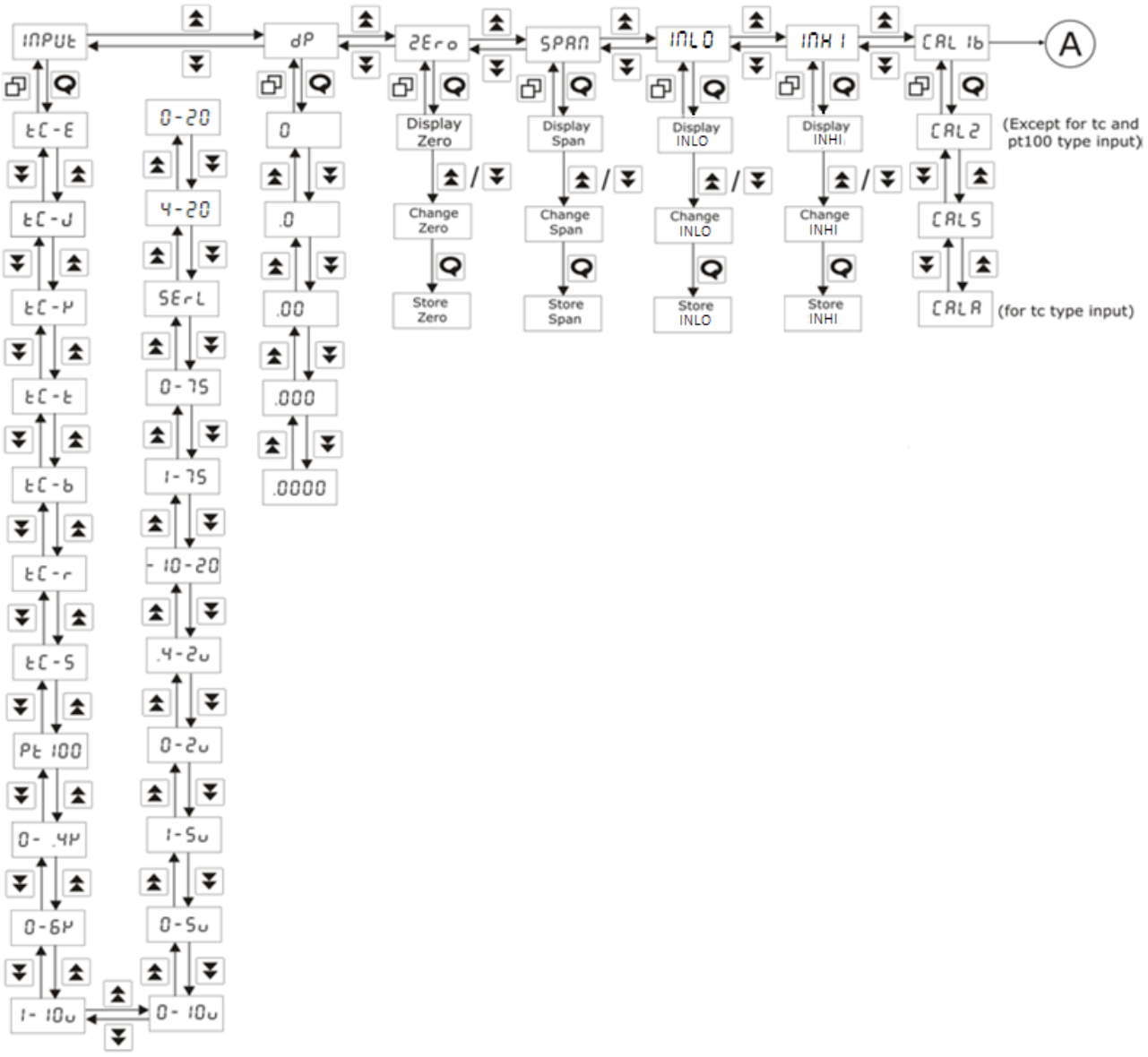
Table 3.

*When 24V Signal applied momentarily at the DI terminal (or Power OFF) then it will clear both values and same value will be stored in PV HI and in PV LO. Input is OPEN then message OVER will be in PV HI and UNDER will be in PV LO. Note that during power on wait until all functionality initialized otherwise PV HI/LO values will be wrong.

6.2 Menu Layout for 409



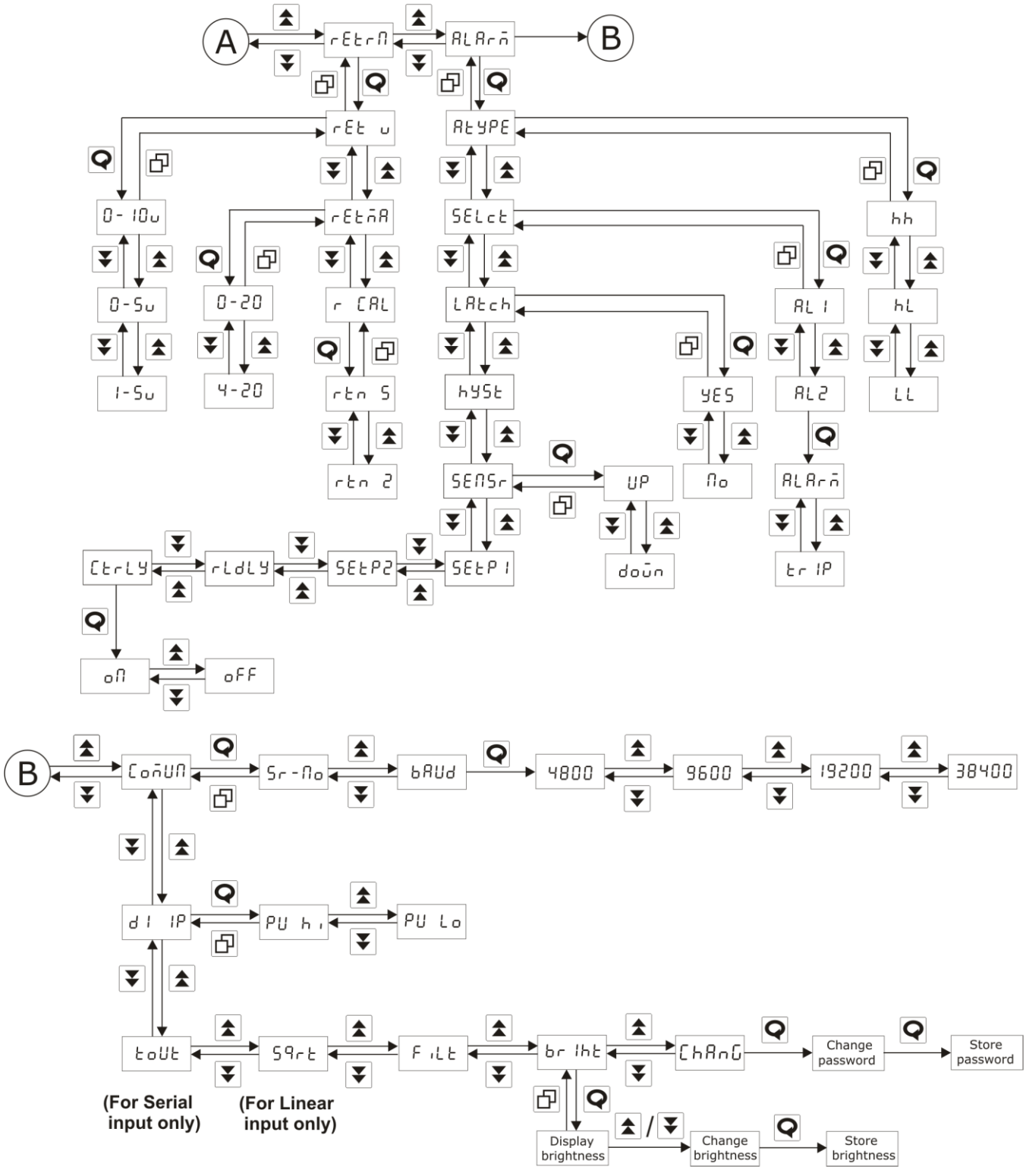
6.3 Main Menu for 409



Temperature Indicator: 409

REF NO: m59A/om/101

Issue NO: 16



7. Alarm Operation

7.1 Alarm type

HH-high, very high. AL1-high, AL2-very high

HL-high, low AL1-low, AL2-high.

LL-low, low AL1-very low, AL2-low.

This setting is common for all groups.

7.2 Status of ALARM/TRIP

It will toggle between ALARM and TRIP depending up on selection in menu. ALARM mode is further subdivided into Alarm with Latch and Alarm without Latch.

TRIP is useful when the relay is used for tripping the plant or device and it is not to be started once again. Open condition is treated as normal condition in TRIP type.

7.3 Latching of ALARM

This is used for latching of discrete LEDs and relay status when alarm limit is crossed. This option will keep discrete LEDs/Relay latched even after channel has come to normal status until ENTER (ACK) key is pressed. This option can be changed to YES or NO for enabling or disabling respectively. When configurations of Alarms are of TRIP type, these parameters will be skipped from display. Different conditions for the ALARM/TRIP have been mentioned in the following table 6 ,7, 8, 9.

7.4 HH Logic

HH-high, very high. AL1-high, AL2-very high

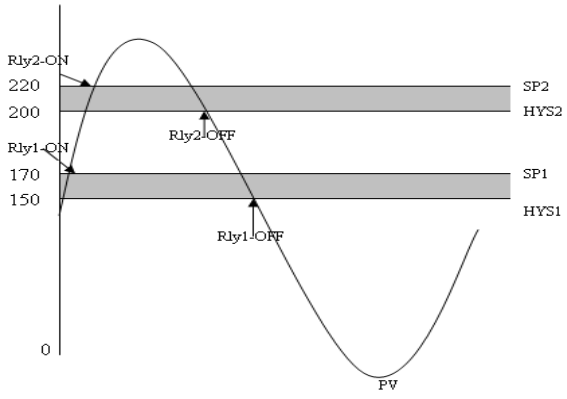


Fig 4.

AL1-High, AL2-Very High

SP2>SP1

If PV>SP1 but, less then SP2 => Relay 1- ON, Relay 2-OFF.

If PV<SP1-Hyst1 => Relay 1-OFF, Relay 2-OFF.

PV>SP2 => Relay1 and Relay2 both are ON.

If PV<SP2-Hyst2 but, >SP1 => Relay 1-ON, Relay 2-OFF.

Depending up on condition set i.e. Latch Yes/No, Acknowledge Yes/No or Trip refer table6 ,7, 8, 9.

7.5 HL Logic

HL-high, low AL1-low, AL2- high.

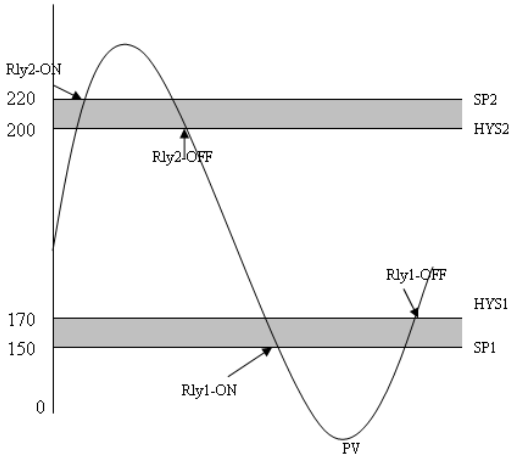


Fig 5.

AL1-low, AL2- High

SP2>SP1

If PV>SP2 then Relay 2-ON.

If PV<SP2-Hyst2 => Relay 2-OFF.

PV<SP1 => Relay1 ON.

If PV>SP1+Hyst1 then. Relay 1-OFF.

Depending up on condition set i.e. Latch Yes/No, Acknowledge Yes/No or Trip refer table 6 ,7, 8, 9.

7.6 LL Logic

LL-low, low AL1-very low, AL2-low.

AL1-Low, AL2-Very Low

SP2>SP1

If PV<SP1 then => Relay 1-ON, Relay 2-ON

Relay 1-ON till PV>SP1+HYS1 after that Relay 1-OFF.

Relay 2-ON till PV>SP2+HYS2 after that Relay 2- OFF.

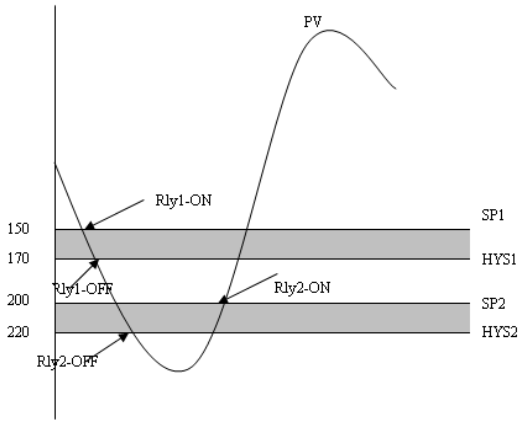


Fig 6.

Depending upon condition set i.e. Latch Yes/No, Acknowledge Yes/No or Trip refer table 6 ,7, 8, 9.

7.7 Open sensor UP scale/DOWN scale

This is used to define the state of the alarms in OPEN sensor condition. It can be configured as UP Scale or DOWN Scale by keys.This condition works if and only if OPEN sensor condition occurs. Suppose ,UP scale has been selected and “HH” logic is there then during OPEN sensor condition Relay 1 & 2 will be ON and Lamp will be FLASH as shown in table6 ,7, 8, 9.if DOWN logic is selected then relays and Lamp will be OFF.

7.8 HH Logic

HH-high, very high. AL1-high, AL2-very high.

In this logic if “UP Scale” condition has been selected than in OPEN sensor condition ALARM 1 and ALARM 2 will be in the ABNORMAL condition and will work according to the following tables 6 ,7, 8, 9.If “DOWN Scale” Condition has been selected for this logic than in OPEN sensor condition ALARM 1 and ALARM 2 will be in the NORMAL State of operation.

7.9 HL Logic

HL-high, low AL1-low, AL2-high.

In this logic if “UP Scale” condition has been selected than in OPEN sensor condition ALARM 2 will be in the ABNORMAL condition and ALARM 1 will be in the NORMAL condition will work according to the following tables6 ,7, 8, 9.If “DOWN Scale” Condition has been selected for this logic than in OPEN sensor condition ALARM 1 will be in the ABNORMAL condition and ALARM 2 will be in the NORMAL condition and will work according to the following tables.

7.10 LL Logic

LL-low, low AL1-very low, AL2-low.

In this logic if “UP Scale” condition has been selected than in OPEN sensor condition ALARM 1 and ALARM 2 will be in the NORMAL condition and will work according to the following tables 6 ,7, 8, 9.If “DOWN Scale” Condition has been selected for this logic than in OPEN sensor condition ALARM 1 and ALARM 2 will be in the ABNORMAL State of operation.

7.11 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	RANDOM VALUE
0 to 5V DC	UNDER
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	-19999

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.

If diode is OPEN in that case message on display will be “dOPEN” .Switch OFF the instrument connects the diode properly and switch ON to have proper display. During diode OPEN condition modbus gives fixed value.

7.12 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.

7.13 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.

7.14 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(N o)	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.

8. Calibration Procedure

8.1 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 16" in 5-segment display.
2) Press 'ENTER' key to enter in to calibration for "zero", "span" or "ambient" (for Thermocouple type input zero calibration is not require).
3) Display indicates "CAL2" for zero calibration;"CALS" for span calibration and "CALA" for ambient calibration. User can enter in to zero/span/ambient calibration using UP, DOWN keys.
4) If input type selected is Thermocouple then there is no zero calibration hence, display will be either "CALS" or "CALA".
5) Input type other then thermocouple display will be either "CALz" or "CALs" because for other inputs (except thermocouple) ambient calibration is not require.
6) To perform zero calibration, press ENTER key when display shows "Calz". 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.
7) Sometimes user may require iteration for zero and span calibration for better linearity/accuracy.
8) 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	Specific input
0-5V,1-5V,4-20mA,0-20mA	Either of any input
±10V,0-10V	Either of any input
0-2V,0.4-2V	Either of any input
±75mV,75mV	Either of any input
-10 – 20mV	Specific input
0-400Ω	Specific input
0-6000Ω	Specific input

Table 10.

8.2 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 “RETRN” in 5-segment display.
2) Select type of output i.e. voltage or current output RET V or RET I then and then it will allow you to enter for calibration of zero and span.
3) After selecting type of output Press UP, DOWN key to get a prompt “RCAL” and press ENTER key to enter in to calibration.
4) 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).
5) To perform zero calibration press ENTER key when display shows “RETZ”. When user presses ENTER key display will be previously stored counts for voltage output/current output. 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.
6) 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.

9. Communication Parameter

9.1 Introduction

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

Function Code 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
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.

9.2 Parameter Address Details

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	*Digital Input	10003	Bit	0	1	R
6	*Alarm 1 Blinking	10004	Bit	0	1	R
7	*Alarm 2 Blinking	10005	Bit	0	1	R
8	Process value	30001	Integer			R
9	Ambient	30002	Integer			R
10	Maximum PV	30003	Integer			R
11	Minimum PV	30004	Integer			R
12	Process value	30051	Swapped Long	-19999	99999	R
13	Maximum PV	30053	Swapped Long	-19999	99999	R
14	Minimum PV	30055	Swapped Long	-19999	99999	R

15	Zero display	40001	Integer			R/W
16	Span display	40002	Integer			R/W
17	Set point 1	40003	Integer			R/W
18	Set point 2	40004	Integer			R/W
19	Relay delay	40005	Integer	0	9999	R/W
20	Brightness	40006	Unsigned Integer	1	100	R/W
21	*Input type selected	40007	Unsigned char	0	18	R/W
22	*Decimal point	40008	Unsigned char	0	4	R/W
23	Hysteresis	40009	Unsigned char	0	255	R/W
24	Serial number	40010	Unsigned Char	1	247	R/W
25	*Baud rate	40011	Unsigned char	0	3	R/W
26	*Alarm logic type	40012	Unsigned char	0	2	R/W
27	*Alarm 1	40013	Unsigned char	0	1	R/W
28	*Alarm 2	40014	Unsigned char	0	1	R/W
29	*Alarm Latch	40015	Unsigned char	0	1	R/W
30	* Alarm sensor	40016	Unsigned char	0	1	R/W
31	*Relay control	40017	Unsigned char	0	1	R/W
32	Password	40018	Unsigned integer	1	9999	R/W
33	Serial Input PV	40031	Integer	-19999	19999	R/W
34	Time out	40032	Unsigned char	1	32	R/W
35	*Sqrt	40033	Unsigned char	0	1	R/W
36	Filter	40034	Unsigned integer	0	60	R/W
37	Process value	40051	Swapped Long	-19999	99999	R
38	Zero display	40053	Swapped Long	-19999	99999	R/W
39	Span display	40055	Swapped Long	-19999	99999	R/W
40	Set point 1	40057	Swapped Long	-19999	99999	R/W

41	Set point 2	40059	Swapped Long	-19999	99999	R/W

Table 12.

- *Relay status1, *Relay status2: it gives status of LED. Relay status1 can be used to
- *Digital Input : 1 = OFF, 0= ON.
- 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 1003- 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.
- If Span Display value is greater than 32759 ,PV Values when OPEN: 100001, UNDER: 100002, OVER: 100003, doPEN: 100004.
- If Span Display value is less than 32760 ,PV Values when OPEN: 32767, UNDER: 32765, OVER: 32766, doPEN: 32762
- *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.

9.3 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 13.

10. Technical Specifications

10.1 Input Specification

INPUT TYPES Table:			
INPUT	**Type**	**Range**	**Accuracy**
TC	E	-200.0 to 1000.0 ºC	0.1 % of Full span ± 1 digit
	J	-200.0 to 1200.0 ºC	
	K	-200.0 to 1350.0 ºC	
	T	-200.0 to 400.0 ºC	
	B	450.0 to 1800.0 ºC	
	R	0.0 to 1750.0 ºC	
	S	0.0 to 1750.0 ºC	
RTD	Pt 100	-200.0 to 850.0 ºC	
DC Current	4-20 mA	-19999 to 99999, -1999.9 to 9999.9, -199.99 to 999.99, -19.999 to 99.999 -1.9999 to 9.9999	
	0-20 mA		
DC Voltage	0-5 V		
	1-5 V		
	0-2 V		
	0.4 – 2V		
	± 10V		
	0-10 V		
	-10-20mV		
	± 75 mV		
	0-75 mV		
Resistance Input	0-400Ω		
	0-6000Ω		
Serial	PV Write Facility	-19999 to 19999	

Table 14.

Contact Input	1-Channel (Isolated) Non- voltage contact input, Maximum reverse voltage 6V,Maximum Forward voltage 50V, Capacity 24V DC, 10mA

SPECIFICATIONS:

Sampling Period	4 Sample/Sec
Burn out current	0.5 uA
Input Impedance	1M Ω (Approx.) for TC, RTD, 0-2V,0.4-2V,0-75mV, ±75mV,0-400 Ω 220 kΩ for 0-10V, ±10V 440 kΩ for 0-5V, 1-5V, 0-6000 Ω
Noise RejectionRatio	
Common Mode	>100 dB (50Hz)
Normal Mode	>40 dB (50Hz)
Reference-junction compensation error	±2 ºC
Response time	< 1000mS
Resolution	17-bit
RTD	Allowable lead wire resistance 15 Ω or less.
Repeatability	0.05% of FS

* 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.

10.2 Output Specifications

RETRANSMISSION OUTPUT

DC Current	0 to 20 mA DC, 4 to 20 mA
DC Voltage	0 to 10 V DC, 0 to 5V DC, 1 to 5V DC.Accuracy ±0.25% of full Span (one at a time factory settable).
Load Resistance for current O/P	<=600 Ω
Load Resistance for Voltage O/P	>=2 KΩ

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

10.3 General Specifications

DISPLAY	PV: Red LED 5-digit, character size 0.56”. LED for status indication (Alarm and Tx/Rx)
Operation keys	Escape, Enter, Increment, Decrement
Ambient	0 to 55 ºC.
Humidity	20 to 95% RH (Non-condensing).
Case Material	ABS Plastic
Case Color	Black
Mounting method	Panel mounting
Dimension	96mm(W)*48mm(H)*112mm(D)

Panel Cutout	92mm(W)*46mm(H)
Weight	260 grams (Approx.)
TEMPCO	< 100 ppm for input to display <150 ppm for retransmission output

10.4 Power Supply

Power Supply	85 to 265VAC @50HZ / 100-300VDC, 18 to 36VDC (One at a time factory settable)
Power Consumption	Max. 10VA
Transmitter Power Supply	24V DC ±10% @26mA (±10 % accuracy)

10.5 Isolation

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
Insulation resistance Between Power supply terminal and ground terminal	500V DC 50 MΩ

* Primary terminals indicate power terminals and relay output terminals.

** Secondary terminals indicate analog I/O signal and Communication O/P.

10.6 Communication Specifications

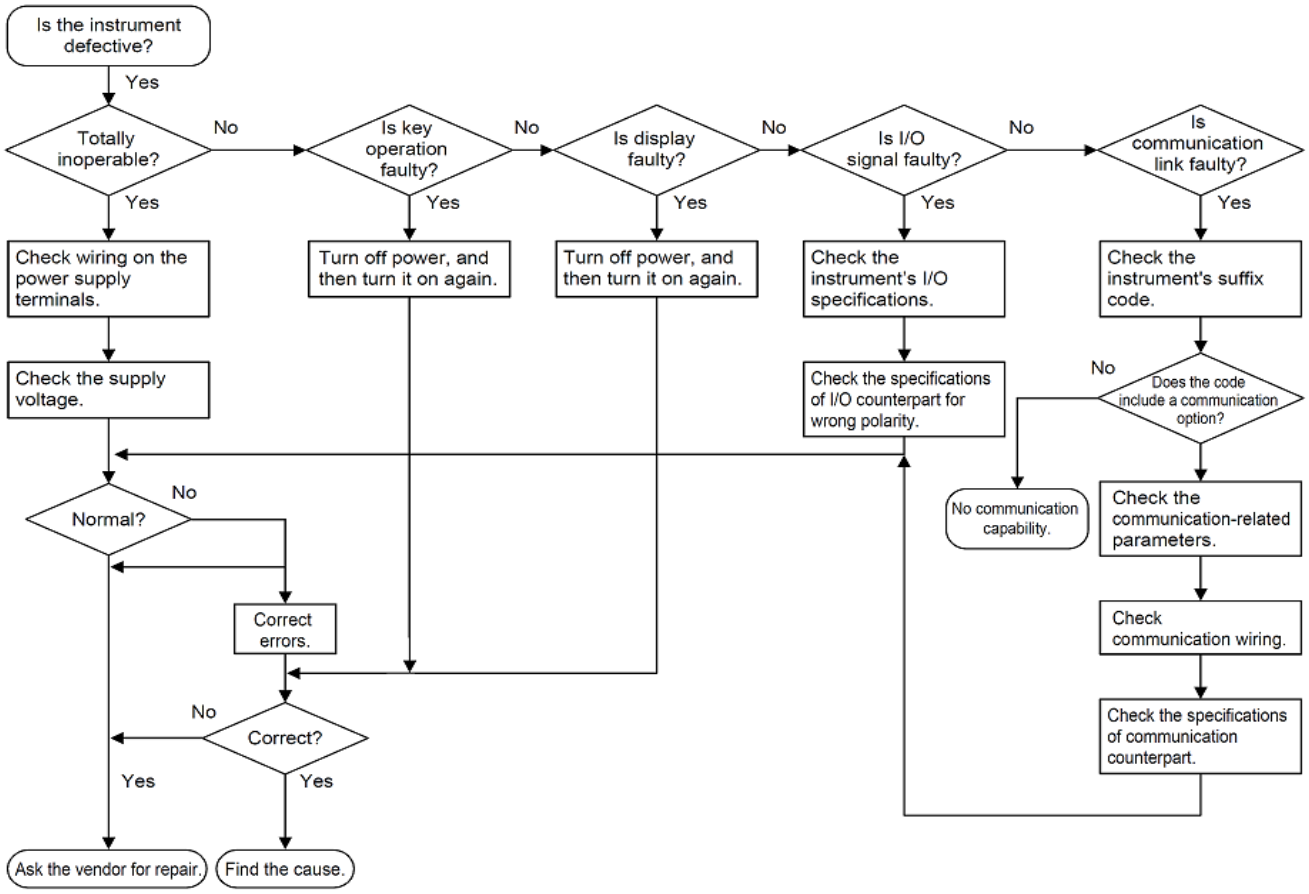
Communication Interface	Based on EIA RS-485
Communication method	Half-duplex communication start stop synchronous
Communication Speed	4800/9600/19200/38400bps selectable by key
Parity	None
Communication Protocol	Modbus RTU
Connectable number of unit	Max.32 unit per host computer
Communication error detection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

10.7Special Feature

Square Root	
Digital Filter	**0-60 Sec.**
Scalability	**Input Scalability for linear inputs**

11. Appendix

11.1 Troubleshooting



11.2 Jumper Location for Retransmission Output

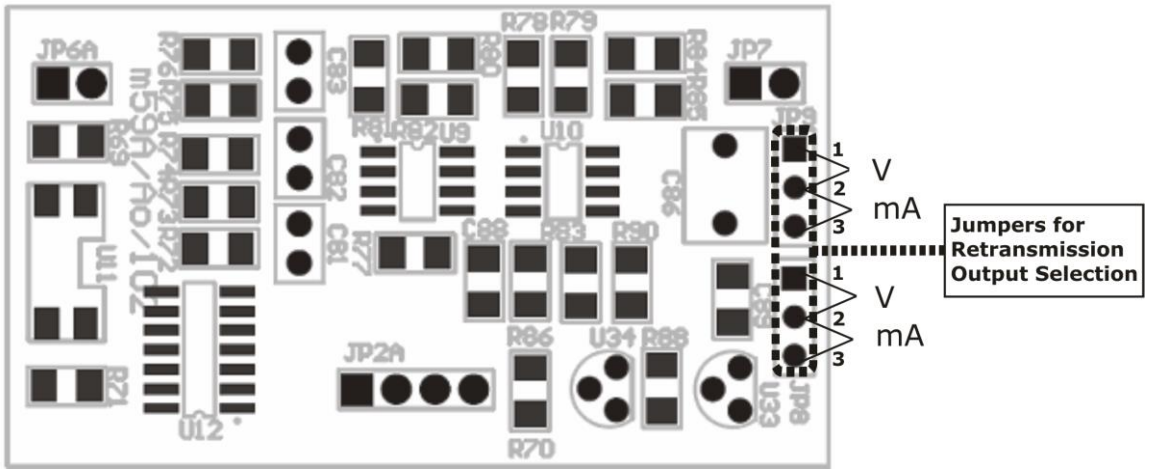


Fig 7. Jumper Location for Retransmission output

- For V retransmission output short the 1 and 2 pins of jumpers JP8 and JP9 of AO card as shown in figure 7.
- For mA retransmission output short the 2 and 3 pins of jumpers JP8 and JP9 of AO card as shown in figure 7.

11.3 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

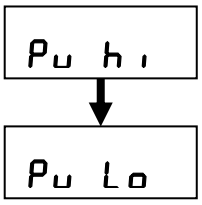
PV will be,

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

11.4 Digital Input

Press ENTER key to enter in to the submenu of digital input when display shows "dI IP".

The submenus of "dI IP" are as shown in following Fig.8.



Maximum value of Process

Minimum value of Process

Fig.8

When display shows "dI IP" and user presses ENTER key display message will be either "Pu hi" or "Pu Lo" depending up on previously selected.If display shows "Pu hi" then by pressing UP key display changes to "Pu LO" and even after user presses UP key last

display will be "Pu LO". Similarly, if display shows "Pu LO" then by pressing DOWN key display changes to "Pu HI" and even after user presses DOWN key last display will be "Pu HI". For selection of specific menu i.e. "Pu HI" or "Pu LO" press ENTER key, display will show corresponding value of process value. To come out from submenus i.e. "Pu HI" or "Pu LO" press MENU key display will be "diIP".

Maximum value of PV

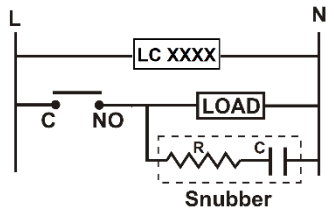
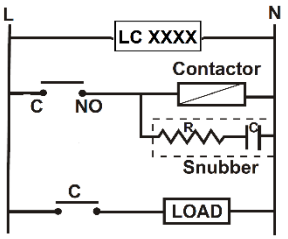
When display shows "Pu HI" press ENTER key to see the maximum process value which instrument has measured. To come out of this press MENU key display will be "Pu HI".

Minimum Value of PV

When display shows "Pu LO" press ENTER key to see the minimum process value which instrument has measured. To come out of this press MENU key display will be "Pu LO".

When 24V Signal applied momentarily at the DI terminal(or Power OFF) then it will clear both values and same value will be stored in PV HI and in PV LO.Input is OPEN then message OVER will be in PV HI and UNDER will be in PV LO.Note that during power on wait until all functionality initialized otherwise PV HI/LO values will be wrong.

11.5 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.