BrainChild

E62 Economy PID Temperature Controller

User Manual



RoHS

UMEE621B

Mar 2025

EN version B v2.2

Warning Symbol

This document contains notices that you should observe to ensure your safety, as well as to protect the product and connected equipment. These notices are highlighted in the manual by a warning triangle and are marked as follows.

⚠ The danger symbol indicates that death or severe personal injury may result if proper precautions are not taken. Do not proceed beyond a Warning symbol until the indicated conditions are fully understood and met.

Preface

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NOTE

It is strongly recommended that a process should incorporate a Limit Control like a Brainchild L91 which will shut down the equipment at a preset process condition to avoid possible damage to products or systems.

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No products return can be accepted without a completed Return Material Authorization (RMA) form.

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1 Overview

1.1 Introduction

The new generation economy PID microprocessor-based Fuzzy logic controllers incorporate two bright easy to read LCD Displays which indicate Process Value (PV) and SetPoint (SP). The Fuzzy Logic technology incorporated on the E62 controller enables a process to reach a predetermined set point in the shortest time with a minimum of overshoot during startup (Power ON) or external load disturbances (example: an oven door being opened).

Below are the controller model and details

Model No	Mounting Type	DIN Size	Dimensions L x W x D (mm)	Depth Behind Panel (mm)
E62	Panel Mount	1/16 DIN	48 x 48 x 75	65

Controller Models

These controllers are powered by 100-240VAC supply, incorporating a 2 Amp control relay output as a standard. The output can be selected as a 12VDC output, linear current or linear voltage to drive an external device. There are 6 types of alarms that can be configured for the alarm output. The controllers are fully programmable for **PT100 and thermocouple (Type J, K, T, R, and S)**. The input signal is digitized by using an 18-bit A to D converter. Its fast-sampling rate allows the controller to control fast processes.

1.2 Features

The new generation of low-cost PID controllers has a lot of unique features.
The unique features are listed below.

- LCD Display Screen
- High Accuracy 18 Bit A-D Conversion and 15 Bit D-A Conversion
- Input Signal: TC (Type J, K, T, R, S), RTD (PT100)
- Fastest Sampling Rate of 200 msec
- Fuzzy Logic + PID Technology
- RS-485 Interface
- Auto-Tuning
- Parameter Lockout Protection
- Bidirectional Menu Navigation by User Keys
- Easy to Use and High Performance with Low Cost
- SEL function allows to rearrange user menu
- CE/ RoHS/ REACH/ WEEE Certification
- IP50 Rating and Optional IP65 for Front Panel

LCD Display

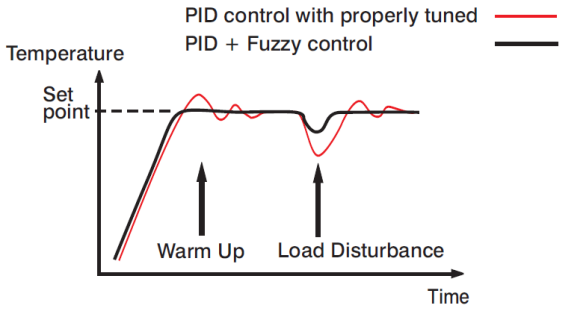
The controllers will be equipped with high brightness LCD Display.

Digital Communication

RS-485 Digital communication is available as an additional option. These options allow the units to be integrated with supervisory control systems and software. By using twisted pair wires, up to 32 units can be connected via an RS-485 interface to a host computer.

Fuzzy PID Technology

By using proprietary Fuzzy modified PID technology, the control loop will minimize overshoot and undershoot in the shortest allowable time. The following diagram is a comparison of results with and without Fuzzy Logic technology.



Fuzzy PID Control

High Accuracy

The E62 controllers are manufactured using an innovative technology which contains an 18-bit A to D converter for high-resolution measurement (true 0.1°F resolution for thermocouple and PT100 sensors) and a 15-bit D to A converter for a linear current or voltage control output. The innovative technology provides improved operating performance, enhanced reliability and higher density with low cost.

Fast Sampling Rate

The sampling rate of the input A to D converter reaches 200 msec. This fast sampling rate allows the controllers to control fast processes.

Fuzzy Control

The function of Fuzzy control is to adjust PID parameters from time to time to make manipulation of the output more flexible and adaptive to various processes. The result is to enable a process to reach a predetermined set point in the shortest time, with a minimum of overshoot and undershoot during power-up or external load disturbances.

Auto-Tuning

The auto-tuning function allows the user to simplify the initial setup for a new system. A clever algorithm is provided to obtain an optimal set of control parameters for the process. It can be applied either as the process is warming up (cold start) or when the process is in a steady-state (warm start).

Parameter Lockout Protection

According to user security requirements, one of four lockout levels can be selected to prevent the unit from being changed abnormally.

Digital Filter

A first-order low-pass filter with a programmable time constant is used to improve the stability of the process value (PV). This is particularly useful in certain applications where the process value is too unstable to be read.

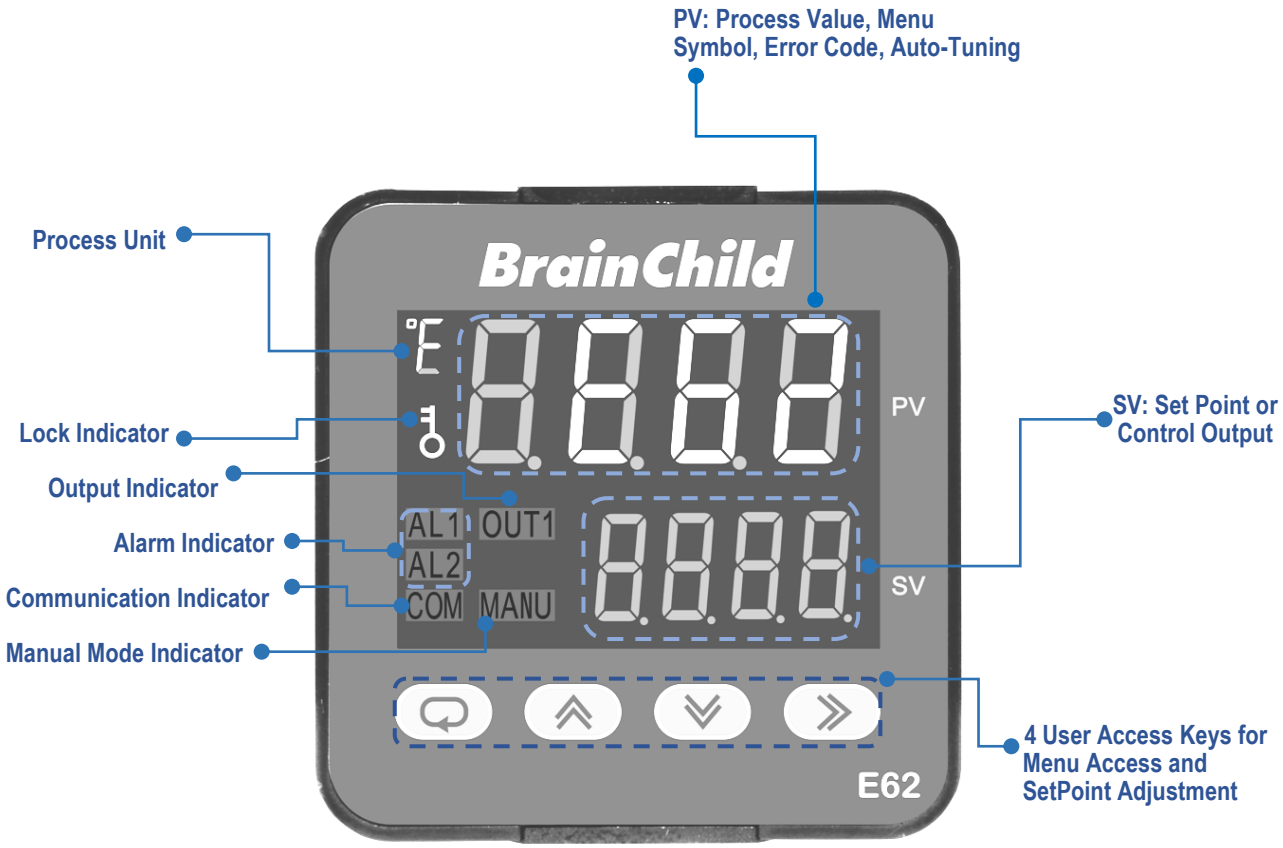
SEL Function

These controllers have the flexibility for the user to select those parameters which are most significant to them and put these parameters into the “USER” menu for quick access. There are up to 8 parameters that can be selected to allow the user to build their display sequence in the USER menu.

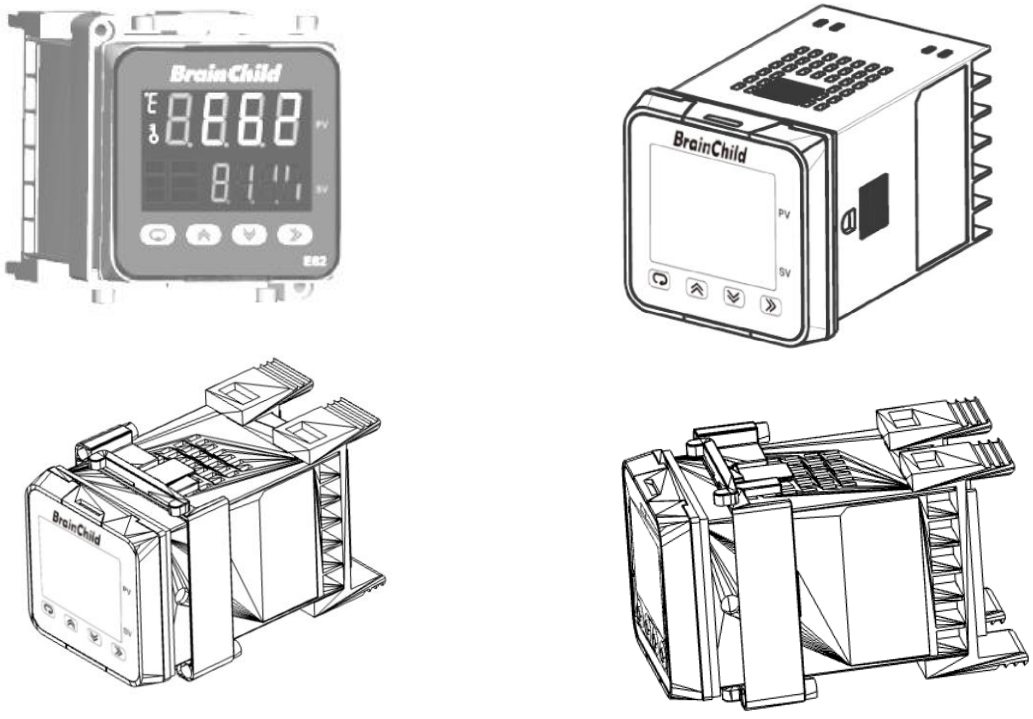
Bidirectional Menu Navigation

The controllers have bidirectional menu navigation. This will allow the user to access previous menu settings easily by using ▲ keys.

1.3 Overview & Appearance



Front Panel and Function



E62 Appearance

1.4 Specifications

Power Specification				
Power Supply	100-240VAC, 47-63Hz			
Power Consumption	8VA, 4W Maximum			
Over Voltage Category	II			
Signal Input				
Type	TC (Type J, K, T, R, S), RTD (PT100 DIN) (PT100 JIS)			
Resolution	18 Bits			
Sampling Rate	5 Times / Second (200msec)			
Maximum Rating	-2VDC minimum, 12VDC maximum			
Input Characteristics	**Type**	**Range**	**Accuracy @ 25°C**	**Input Impedance**
	J	-120°C to 1000°C (-184°F to 1832°F)	±2°C	2.2 MΩ
	K	-200°C to 1370°C (-328°F to 2498°F)	±2°C	2.2 MΩ
	T	-250°C to 400°C (-418°F to 752°F)	±2°C	2.2 MΩ
	R	0°C to 1767.8°C (32°F to 3214°F)	±2°C	2.2 MΩ
	S	0°C to 1767.8°C (32°F to 3214°F)	±2°C	2.2 MΩ
	PT100(DIN)	-210°C to 700°C (-346°F to 1292°F)	±0.4°C	1.3 KΩ
	PT100(JIS)	-200°C to 600°C (-328°F to 1112°F)	±0.4°C	1.3 KΩ
Temperature Effect	1.5µV /°C for all inputs			
Sensor Lead Resistance Effect	**Thermocouple:** 0.2 µV /Ω; **3-wire RTD:** 2.6°C /Ω of Difference of Resistance of two leads **2-wire RTD:** 2.6°C /Ω of Sum of Resistance of two leads			
Burn-Out Current	200nA			
CMRR	Common Mode Rejection Ratio: 120 dB			
NMRR	Normal Mode Rejection Ratio: 55dB			
Sensor Break	Sensor Break Detection: Sensor open for Thermocouple, RTD, Sensor short for RTD input			
	Sensor Break Response Time: Within 4 seconds for Thermocouple, and RTD			

Control Output	
Type	Relay, Pulsed Voltage (SSRD), Linear Voltage (mA), Linear Current (VDC)
Relay Rating	2A, 240VAC, 200000 Life Cycles for Resistive Load
SSRD	12V/ 30mA
Linear Output Ranges	0-22.2mA (0-20mA/ 4-20mA), 0-11.1VDC (0 - 10VDC)
Linear Output	Linear Output Resolution:15 Bits
	Linear Output Regulation: 0.02% for full load change
	Linear Output Setting Time: 0.1 Sec (Stable to 99.9%)
Isolation Breakdown Voltage	1000 VAC
Temperature Effect	±0.01% of Span/ °C
Load Capacity of Linear Output	Linear Current: 500Ω max., Linear Voltage: 10KΩ min
Alarm	
Relay Type	Form A
Maximum Rating	2A, 240VAC, 200000 Life Cycles for Resistive Load
Alarm Functions	Deviation High, Deviation Low, Deviation Out-of-Band, Deviation In-Band, Process High, Process Low, None
Alarm Mode	Normal, Latching, Hold, Latching/Hold
Data Communication	
Interface	RS-485
Protocol	Modbus RTU (Slave Mode)
Address	1 to 247
Baud Rate	2.4 KBPS to 115.2 KBPS
Parity Bit	None, Even or Odd
Stop Bit	1 Bit
Data Length	7 or 8 Bits
Communication Buffer	150 Bytes
User Interface	
Keypad	4 Keys
Display Type	4 Digit LCD Display
No of Display	2
Upper Display Size	0.58”
Lower Display Size	0.3”

Control Mode	
Output	Reverse (Heating) or Direct (Cooling) Action
ON-OFF	0.1~50.0°C (0.1~90.0°F) hysteresis control (P band = 0)
P or PD	0 - 100.0 % offset adjustment
PID Control	Fuzzy logic modified Proportional band 0.1 ~ 500.0°C (0.1~900.0°F), Integral time: 0 – 3600 Secs, Derivative Time: 0 - 360.0 Secs
Cycle Time	0.1 to 90.0 Seconds
Manual Control	Heat (MV1)
Auto-Tuning	Cold Start and Warm Start
Failure Mode	Auto transfer to manual mode while sensor break or A-D Converter damage
Digital Filter	
Function	First Order
Time Constant	0,0.2, 0.5, 1, 2, 5, 10, 20, 30, 60 Seconds, Programmable
Environmental and Physical Specifications	
Temperature	Operating Temperature : -10°C ~ 50°C; Storage Temperature: -40°C ~ 60°C
Humidity	0 ~ 90 % RH (Non-Condensing)
Altitude	2000 Meters Maximum
Pollution	Degree II
Insulation Resistance	20MΩ Minimum (@500V DC)
Dielectric Strength	2000VAC, 50/60 Hz for 1 Minute
Vibration Resistance	10 to 55 Hz, 10m/s^2 for 2 Hours
Shock Resistance	200 m/s^2 (20g)
Housing	Flame Retardant Polycarbonate
Mounting	Panel
DIN Size	1/16 DIN
Dimensions	48*48*75 mm (W-H-D)
Depth Behind Panel	65mm
Cut Out Dimensions	45*45 mm
Weight	98 g
Safety & Certificate	
Protective Class	IP50 Rated Front Panel, IP20 Housing, Optional IP65 Front Panel/ Terminal Cover
Certificate	CE, RoHS, REACH, WEEE
EMC	EN61326-1

1.5 Ordering Code

1.5.1 E62 Ordering Code



① **Power Input**
4: 100 ~ 240 VAC, 47-63Hz

② **OP1 Main Output**
1: Form A Relay (2A/ 240VAC)
2: 12VDC/ 30mA SSRD
3: Isolated 4-20mA/ 0-20mA Linear Control
5: Isolated 0-10VDC Linear Control

③ **Alarm Output**
1: Form A Relay (2A/ 240VAC)

④ **Option 1**
0: None
1: Form A Relay (2A/ 240VAC) Alarm 2
2: RS-485 Interface

⑤ **Option 2**
0: IP50 Panel
1: IP65 Panel
2: IP50 Panel + Terminal Cover
3: IP65 Panel + Terminal Cover

1.5.2 Accessory

CM9A-3 = Isolated 4-20mA/0-20mA Retransmission Module
CM9A-5 = Isolated 0-10VDC Retransmission Module

1.6 Keys and Displays

KEYPAD OPERATION

SCROLL KEY:

This key is used to select a parameter to be viewed or adjusted.

UP/Increase KEY:

This key is used to increase the value of the selected parameter.

DOWN/Decrease KEY:

This key is used to decrease the value of the selected parameter.

SHIFT KEY:

This key is used to:

- Move to the digit of the selected parameter and change the value by using up or down key to increase or decrease the value.

**Scroll Up: + **

Two keys pressed synchronously is used to:

- Go to the previous parameter

RESET: +

Two keys pressed synchronously are used to:

- Revert the display to the home screen.
- Reset a latching alarm once the alarm condition is removed.
- Stop manual control mode, Auto-Tuning mode or calibration mode.
- Clear an Auto-Tuning or communication error message.
- Enter the manual control menu if a failure mode occurs.

**Scroll Down: + **

Two keys pressed synchronously directly go to the Manual control mode

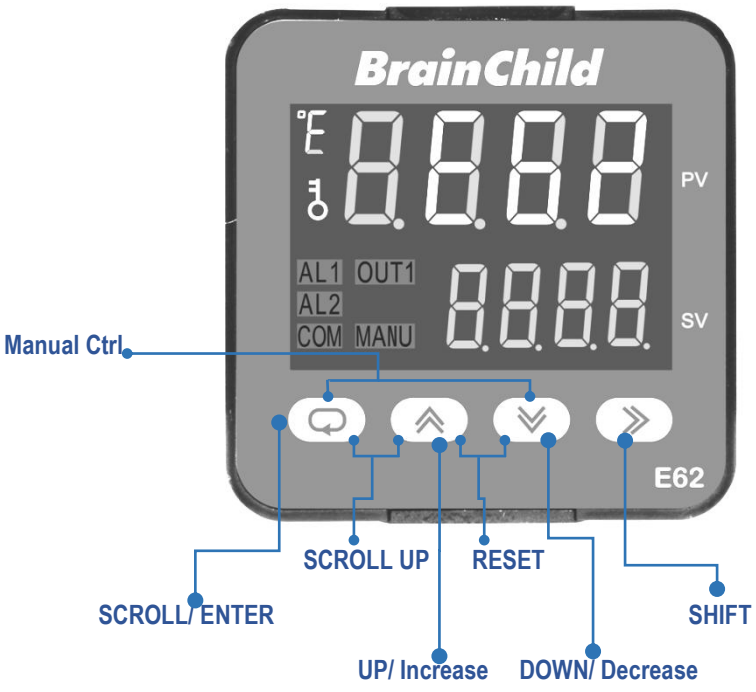
ENTER KEY:

Press and hold for 5 seconds or longer to:

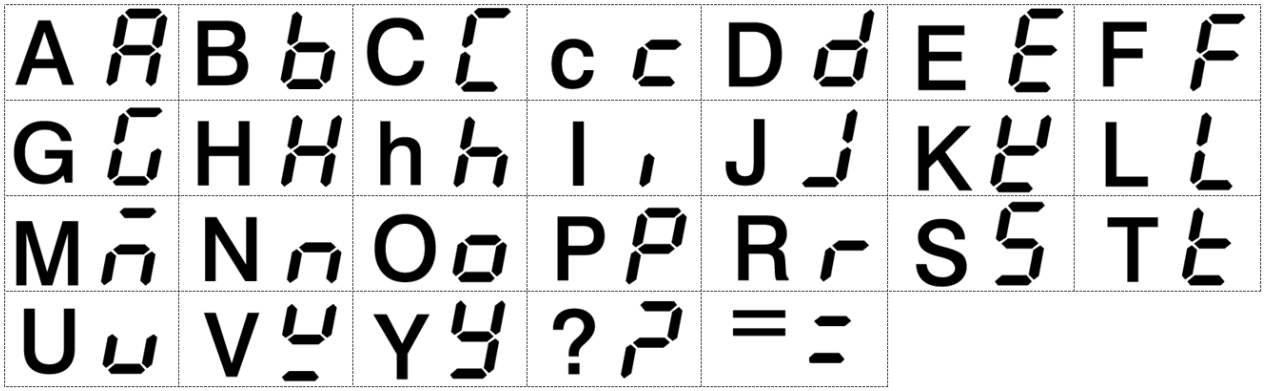
- Enter the Auto-Tuning mode. A-t The display will show.
- Enter the manual control mode. HAnd The display will show.
- Enter the setup menu mode. SEt The display will show.
- CAL Perform calibration of a selected parameter during the calibration procedure. The display will show

Press and hold for 3.1 seconds, then let go to select auto tuning mode.
Press and hold for 4.2 seconds, then let go, to select manual control mode.
Press and hold for 5.3 seconds, then let go to select setup mode.
Press and hold for 6.4 seconds, then let go to select calibration mode.

During power-up, the upper display will show PROG and the lower display will show the Firmware version for 6 seconds.



Front Panel Keys

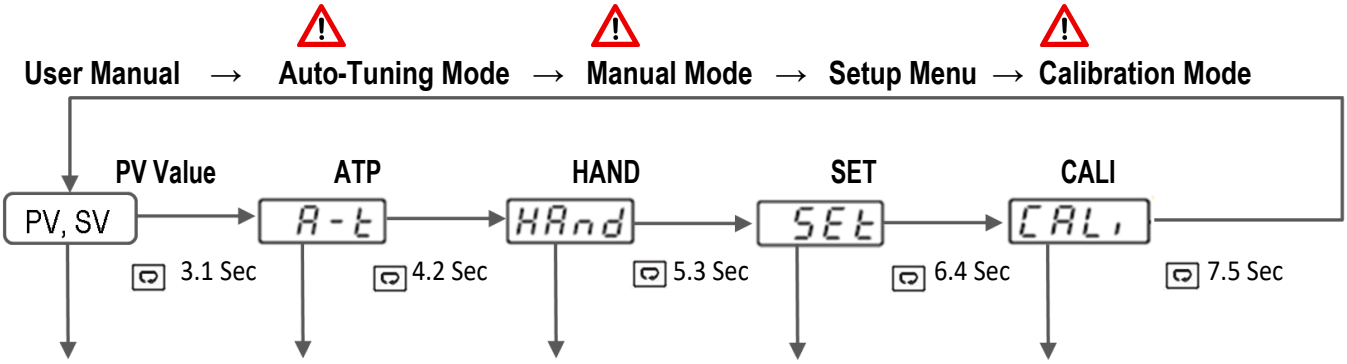


Characters Displayed on the LCD screen

1.7 Menu Flowchart

The Menu has been divided into 5 groups. They are as follows:

1. User Menu
2. Auto-Tuning Mode Menu
3. Manual Mode Menu
4. Setup Menu
5. Calibration Mode Menu



To access parameter In the User Menu, Refer to Section 1.7.1

To start Auto-Tuning Mode, Refer to Section 1.7.2

To start Manual Control Mode, Refer to Section 1.7.3

To access parameter in the Setup Menu, Refer to Section 1.7.4

To access Calibration Mode, Refer to Section 1.7.5

Press ⊡ for the next parameter

Press ⊡ and ▲ key to return to the previous parameter.

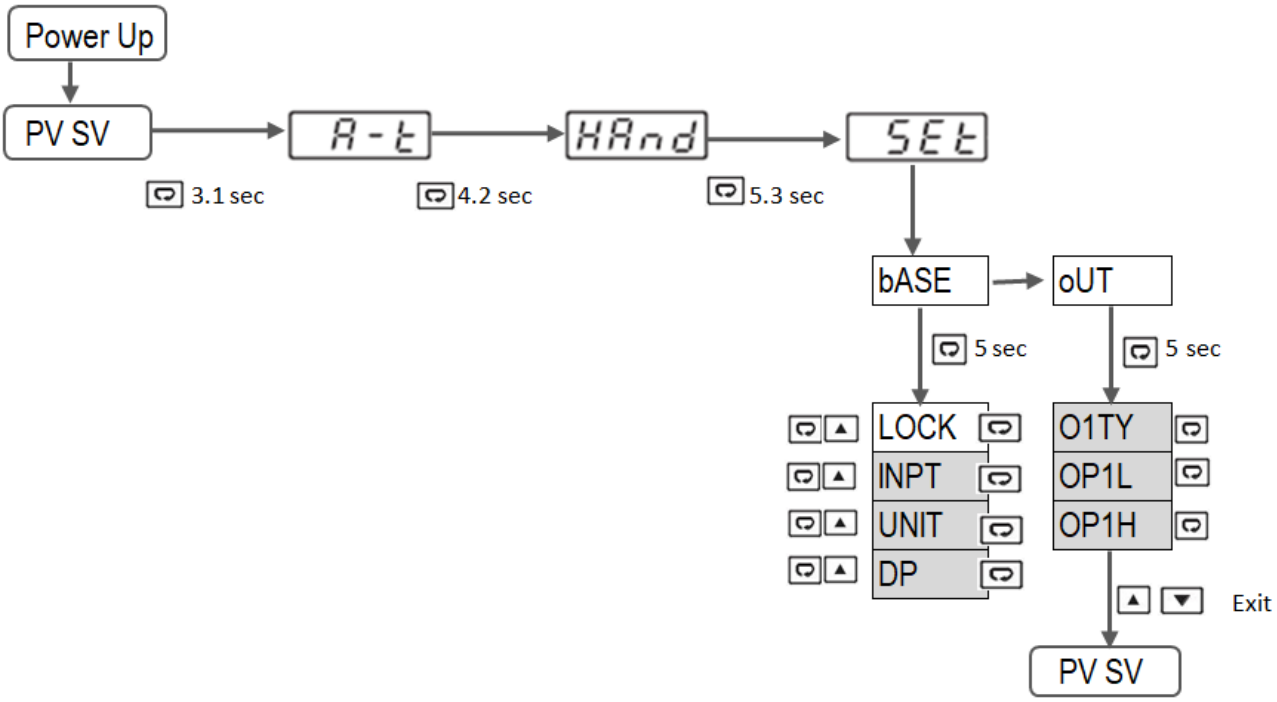
Quick Start Up Setting

Before You Start, Setup Input/Output

After power-up, press and hold for 5.3 seconds, then let go to enter Setup Menu.

Complete Parameter setting, INPT, UNIT, DP, O1TY, O1L and O1H.

- Enter the Setup Menu. Press for 5 seconds to enter Basic Menu (bASE). Finish setting for INPT, UNIT and DP. Exit the level.
- Return to the Setup Menu. Press for 5 seconds to enter Output Menu (oUT). Finish setting for O1TY, O1L and O1H. Press and hold and return to homepage.



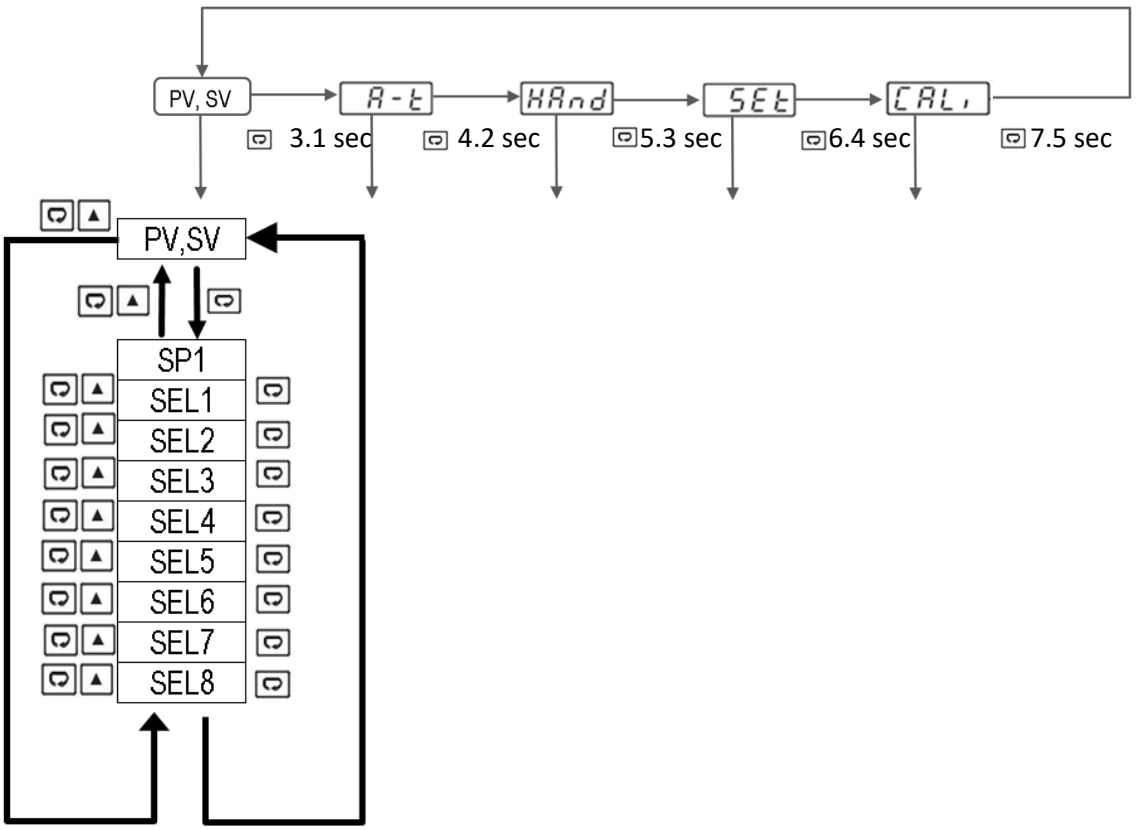
1.7.1 User Menu

The below user menu parameters are available depends on the user selection.

Use ▣ key to enter basic menu parameters, and press ▣ again to select SP1, SEL1~SEL8.

Press ▣▲ to return to the previous.

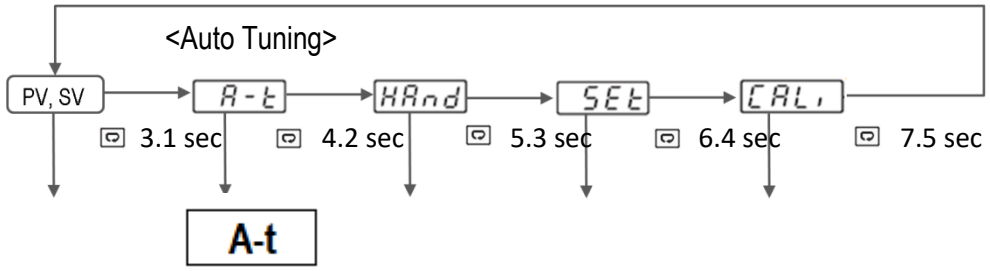
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User Menu Parameter

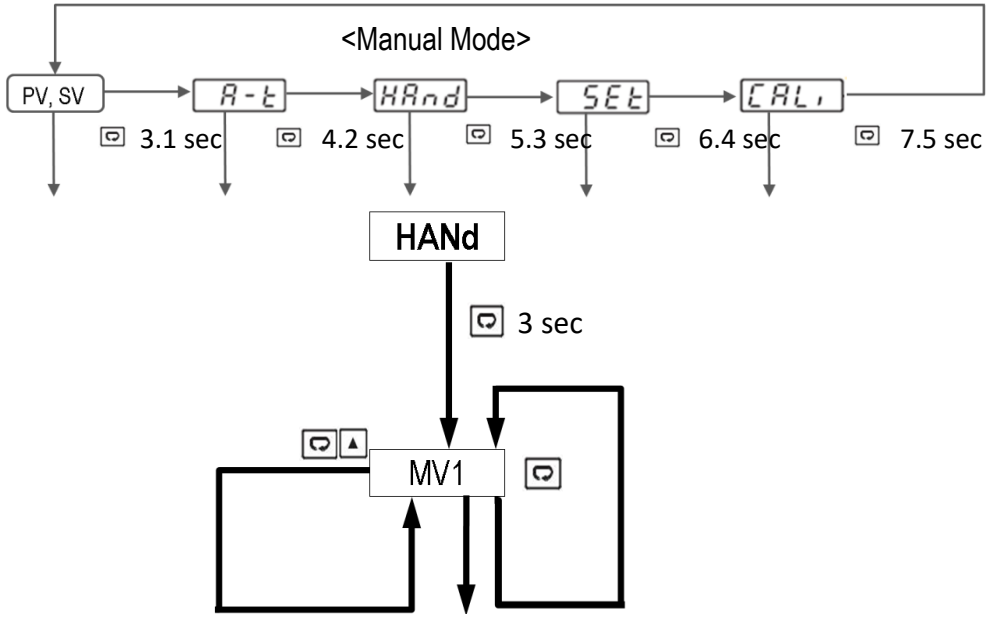
Modbus	Parameter	Description
0	SP1	Set Point 1
64	PV	Process value
65	SV	Current set point value
44	SEL1	Select 1st parameter for user menu
45	SEL2	Select 2nd parameter for user menu
46	SEL3	Select 3rd parameter for user menu
47	SEL4	Select 4th parameter for user menu
48	SEL5	Select 5th parameter for user menu
49	SEL6	Select 6th parameter for user menu
50	SEL7	Select 7th parameter for user menu
51	SEL8	Select 8th parameter for user menu

1.7.2 Auto-Tuning Mode



Press key 5 seconds to activate Auto-Tuning Mode

1.7.3 Manual Mode Menu



Press key 3 seconds to execute the selected default program

Enter Manual Control Mode via PC

Please refer to Function code 6.1.1/6.1.2/6.1.3 & communication 6.8.2/6.8.3/6.8.4

Query

	06	00	H'48	H'68	H'27	HI	LO
Slave Address	Function Code	Register Address		Data Hi /Lo		CRC16	

Manual Mode Parameter

Modbus	Parameter	Description
66	MV1	Output 1 %Value

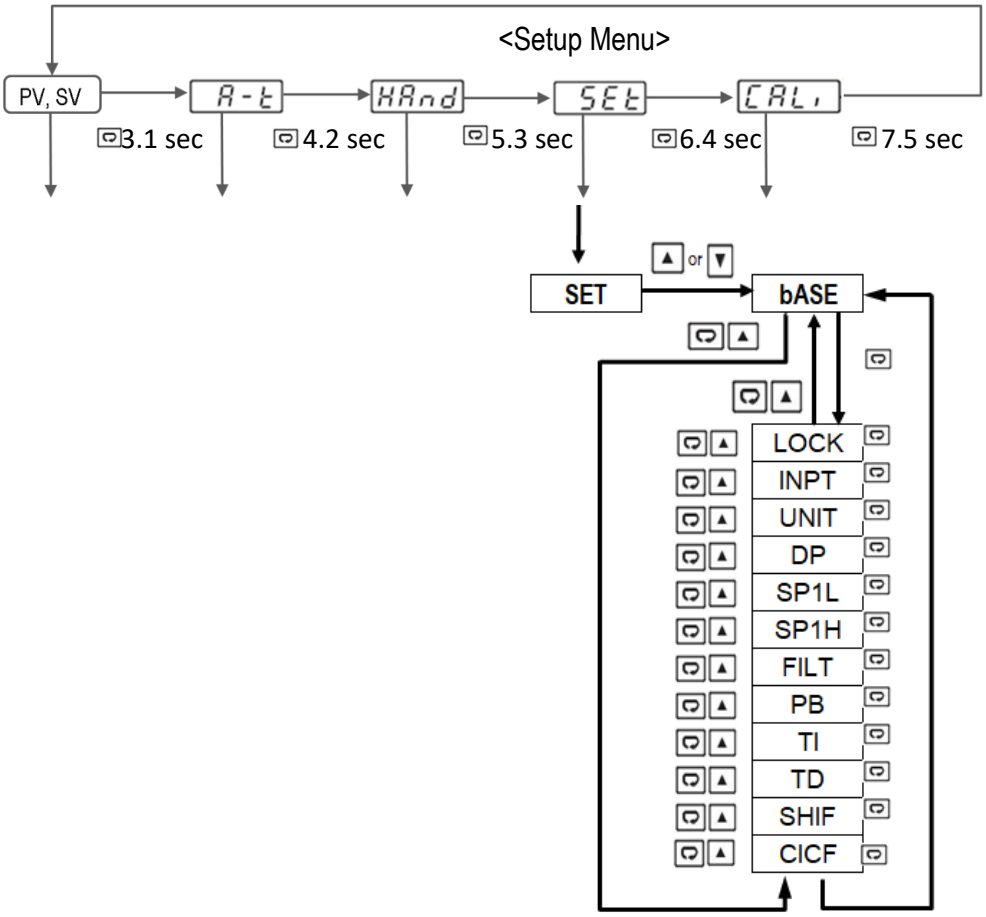
1.7.4 Setup Menu

The setup menu has been categorized into eight categories. They are listed as below.

(1) Basic Menu (bASE)
(2) Output Menu (oUT)
(3) Communication Menu (CoMM)
(4) User Select Menu (SEL)

1.7.4.1 Basic Menu (bASE)

Use ▲ or ▼ key to get bASE in the lower display then use ⟲ key to enter to basic menu parameters.

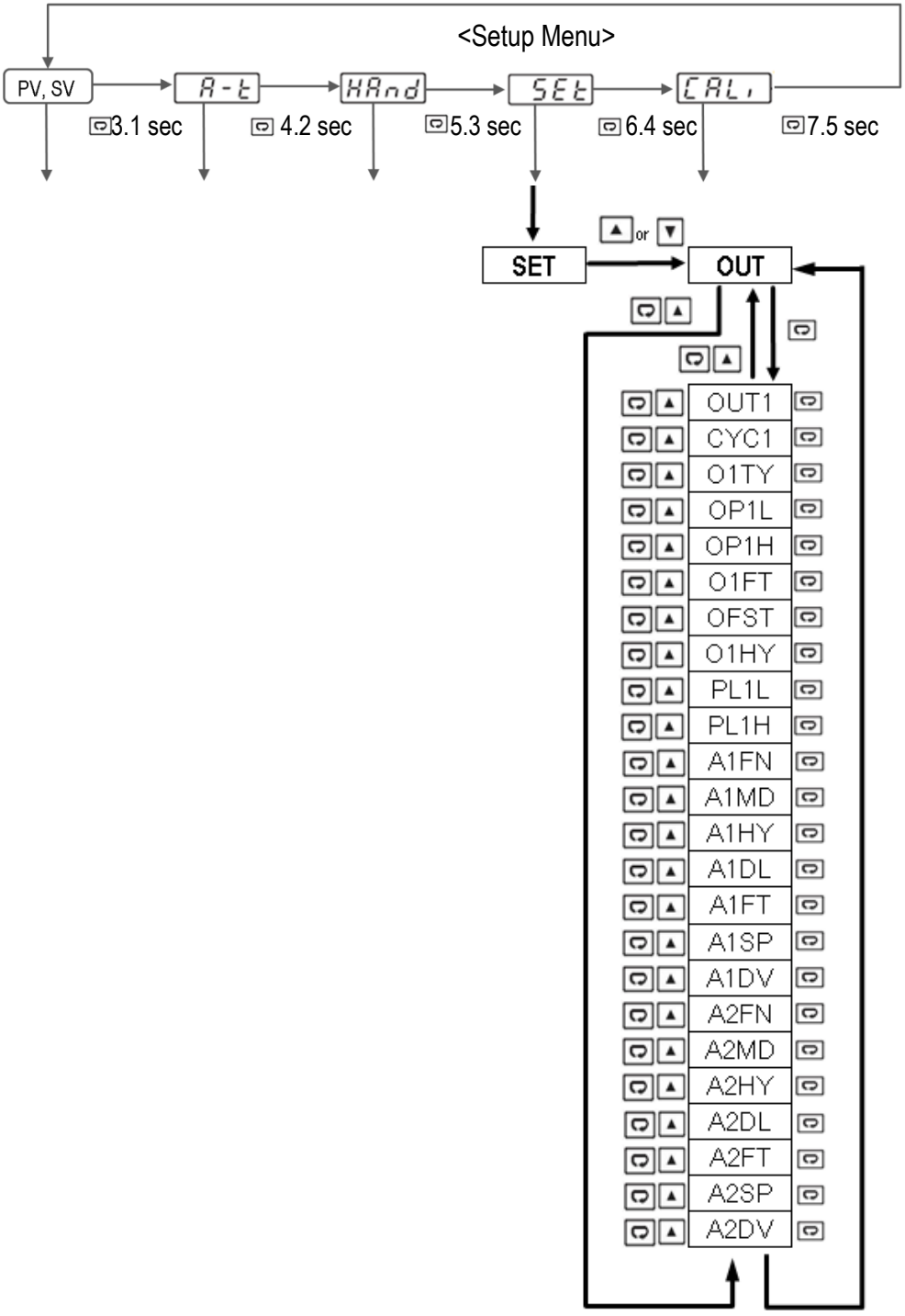


Basic(bASE) Parameter

Modbus	Parameter	Description
3	LOCK	Select parameters to be locked
4	INPT	Input sensor selection
5	UNIT	Input unit selection
6	DP	Decimal point selection
9	SP1L	Low limit of set point value
10	SP1H	High limit of set point value
12	FILT	Filter damping time constant of PV
14	PB	Proportional band value
15	TI	Integral time value
16	TD	Derivative time value
11	SHIF	PV shift (offset) value
68	CICF	CICF filter switch

1.7.4.2 Output Menu (oUT)

Use ▲ or ▼ key to get oUT in the lower display then use ↵ key to enter to output menu parameters.



Output (oUT) Parameter

Modbus	Parameter	Description
17	OUT1	Output 1 function
21	CYC1	Output 1 cycle time
18	O1TY	Output 1 signal type
7	OP1L	OP1 linear output low limit value
8	OP1H	OP1 linear output high limit value
19	O1FT	Output 1 failure transfer mode
22	OFST	Offset value for P control
20	O1HY	Output 1 ON-OFF control hysteresis
23	PL1L	MV1 power value limit low
24	PL1H	MV2 power value limit high
25	A1FN	Alarm 1 function for alarm 1 output
26	A1MD	Alarm 1 operation mode
29	A1HY	Alarm 1 Hysteresis control
34	A1DL	Alarm 1 delay
28	A1FT	Alarm 1 failure transfer mode
1	1	A1SP
13	A1DV	Alarm 1 deviation value
33	A2FN	Alarm 2 function for alarm 2 output
35	A2MD	Alarm 2 operation mode
36	A2HY	Hysteresis control of alarm 2
38	A2DL	Alarm 2 delay
37	A2FT	Alarm 2 failure forced transfer mode
2	A2SP	Alarm 2 set point
43	A2DV	Alarm 2 deviation value

OP1L/ OP1H Table

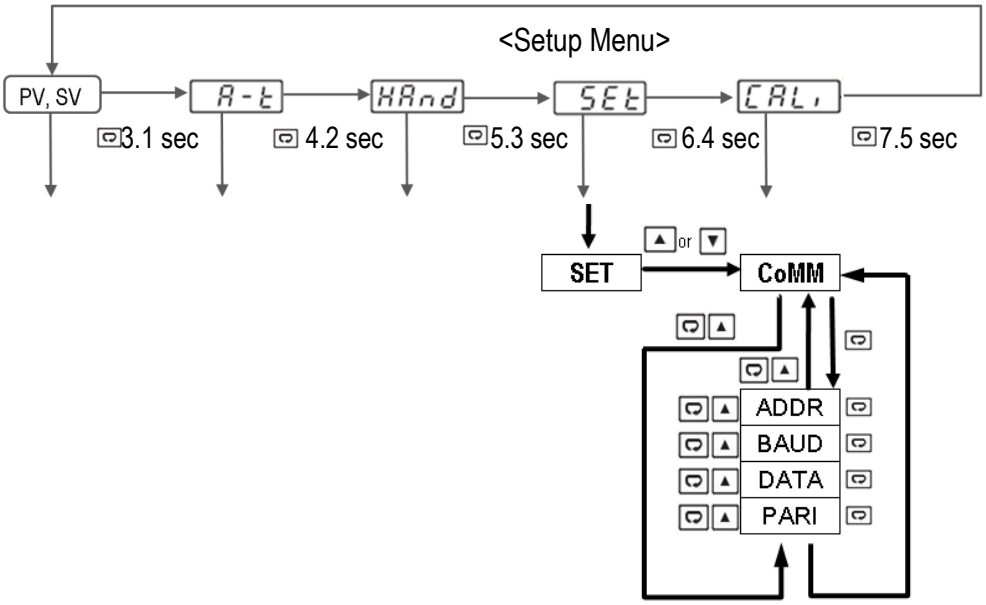
	Range	OP1L	OP1H
OM9A-3	4-20	20.0	100.0
OM9A-3	0-20	0.0	100.0
OM9A-5	0-5V	0.0	50.0
OM9A-5	1-5V	10.0	50.0
OM9A-5	0-10	0.0	100.0

*When O1TY as DC.MA or DC.Vo, set the value based on usage requirement

1.7.4.3 Communication Menu (CoMM)

Use ▲ or ▼ key to get CoMM in the lower display then use ↵ key to enter into communication menu parameters.

* Please note that confirm A2FN set to CoMM when using communication.

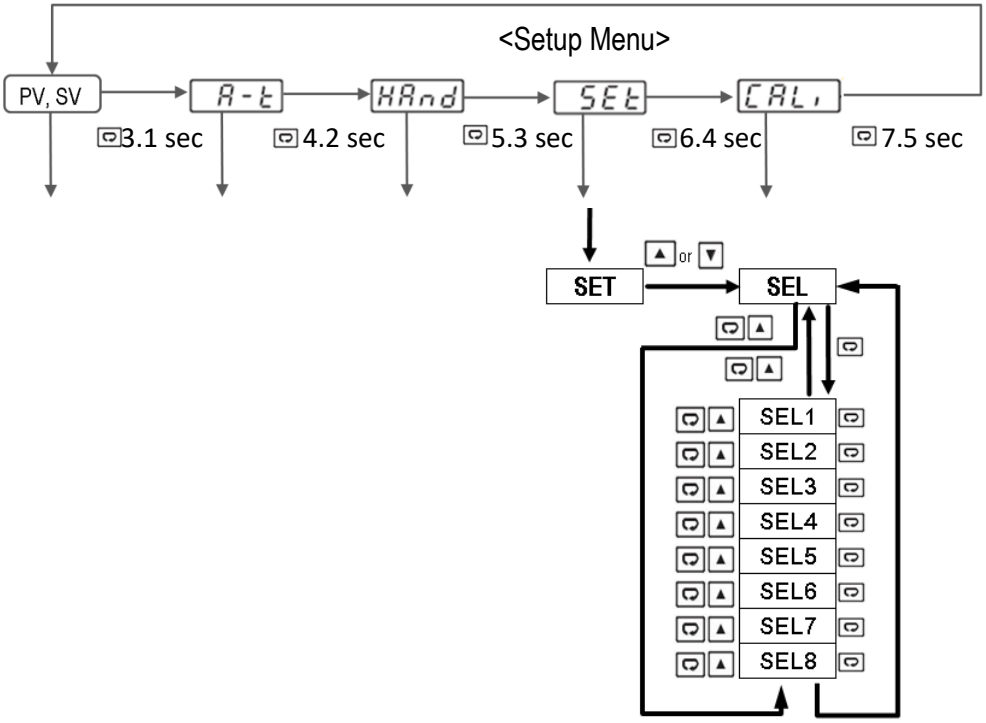


Communication Parameter

Modbus	Parameter	Description
39	ADDR	Address assignment of digital communication
40	BAUD	Baud rate of digital communication
41	DATA	Data bit count of digital communication
42	PARI	The parity bit of digital communication

1.7.4.4 User Select Menu (SEL)

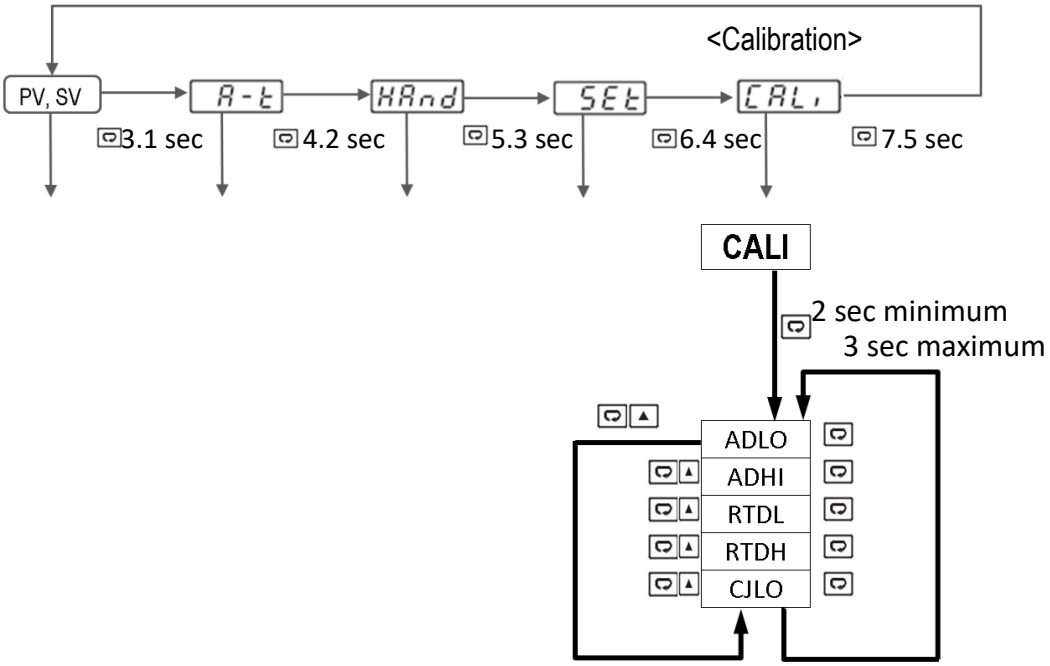
Use ▲ or ▼ key to get SEL in the lower display then use ↵ key to enter to select the user menu parameters.



User Select Parameter

Modbus	Parameter	Description
44	SEL1	Select 1st parameter for user menu
45	SEL2	Select 2nd parameter for user menu
46	SEL3	Select 3rd parameter for user menu
47	SEL4	Select 4th parameter for user menu
48	SEL5	Select 5th parameter for user menu
49	SEL6	Select 6th parameter for user menu
50	SEL7	Select 7th parameter for user menu
51	SEL8	Select 8th parameter for user menu

1.7.5 Calibration Mode



Press key for 2 seconds or longer (not more than 3 seconds) then release it to enter calibration Mode.
Press Key for 5 seconds to perform calibration.
* Please note that it is required to use specialized equipment to apply calibration, attempting to change will affect device accuracy

Note:

- Using Manual, Auto-Tuning, Calibration modes will break the control loop and change some of the previous setting data. Make sure that the system is allowable to apply these modes.
- The flow chart shows a complete list of all parameters. For actual application, the number of available parameters will vary depending on the setup and model of the controller and will be less than that shown in the flow chart.
- The user can select up to 8 parameters to put in the user select menu by using the SEL1~SEL8 parameters in the setup menu

Calibration Mode Parameter

Modbus	Parameter	Description
52	ADLO	mV calibration low coefficient
53	ADHI	mV calibration high coefficient
54	RTDL	RTD calibration low coefficient
55	RTDH	RTD calibration high coefficient
56	CJLO	Cold junction calibration low coefficient

1.8 Parameter Availability Table

Register Address	Parameter Notation	Existence Conditions
0	SP1	Exists unconditionally
1	A1SP	Exists if A1FN=PVHI,PVLO
2	A2SP	Exists if A2FN=PVHI,PVLO
3	LOCK	Exists unconditionally
4	INPT	Exists unconditionally
5	UNIT	Exists unconditionally
6	DP	Exists unconditionally
7	OP1L	Exists if O1TY=DCMA,DCVO
8	OP1H	Exists if O1TY=DCMA,DCVO
9	SP1L	Exists unconditionally
10	SP1H	Exists unconditionally
11	SHIF	Exists unconditionally
12	FILT	Exists unconditionally
13	A1DV	Exists if A1FN=DEHI,DELO,DBHI,DBLO
14	PB	Exists unconditionally
15	TI	Exists if PB>0
16	TD	Exists if PB>0
17	OUT1	Exists unconditionally
18	O1TY	Exists unconditionally
19	O1FT	Exists unconditionally
20	O1HY	Exists if PB=0
21	CYC1	Exists if PB>0
22	OFST	Exists if PB>0 and TI=0
23	PL1L	Exists if PB>0
24	PL1H	Exists if PB>0
25	A1FN	Exists unconditionally
26	A1MD	Exists if A1FN≠NONE
28	A1FT	Exists if A1FN≠NONE
29	A1HY	Exists if A1FN≠NONE
33	A2FN	Exists unconditionally
34	A1DL	Exists if A1FN≠NONE
35	A2MD	Exists if A2FN=DEHI,DELO,DBHI,DBLO,PVHI,PVLO
36	A2HY	Exists if A2FN=DEHI,DELO,DBHI,DBLO,PVHI,PVLO
37	A2FT	Exists if A2FN=DEHI,DELO,DBHI,DBLO,PVHI,PVLO
38	A2DL	Exists if A2FN=DEHI,DELO,DBHI,DBLO,PVHI,PVLO

Register Address	Parameter Notation	Existence Conditions
39	ADDR	Exists if A2FN=COMM
40	BAUD	Exists if A2FN=COMM
41	DATA	Exists if A2FN=COMM
42	PARI	Exists if A2FN=COMM
43	A2DV	Exists if A2FN=DEHI,DELO,DBHI,DBLO
44	SEL1	Exists unconditionally
45	SEL2	Exists unconditionally
46	SEL3	Exists unconditionally
47	SEL4	Exists unconditionally
48	SEL5	Exists unconditionally
49	SEL6	Exists unconditionally
50	SEL7	Exists unconditionally
51	SEL8	Exists unconditionally
52	ADLO	Exists unconditionally
53	ADHI	Exists unconditionally
54	RTDL	Exists unconditionally
55	RTDH	Exists unconditionally
56	CJLO	Exists unconditionally
57	CJCT	Exists unconditionally
58	DATE	Exists unconditionally
59	SRNO	Exists unconditionally
63	CJCL	Exists unconditionally
64	PV	Exists unconditionally
65	SV	Exists unconditionally
66	MV1	Exists unconditionally
68	CICF	Exists unconditionally
69	EROR	Exists unconditionally
71	PROG	Exists unconditionally
72	CMND	Exists unconditionally
73	JOB1	Exists unconditionally

Parameter Availability

1.9 Parameters Description

Modbus Register Address	Parameter Notation	Parameter Description	Range	Default Value	Data Access Type	Scale Unsigned 16 bit Data	
						Low	High
0	SP1	Set Point 1	Low: SP1L High: SP1H	25.0 °C (77.0 °F)	R/W	-19999	45536
1	A1SP	Alarm 1 set point	A1FN=PVHI/PVLO Low: SP1L High: SP1H	100.0 °C (212.0 °F)	R/W	-19999	45536
2	A2SP	Alarm 2 set point	A2FN=PVHI/PVLO Low: SP1L High: SP1H	100.0 °C (212.0 °F)	R/W	-19999	45536
3	LOCK	Select parameters to be locked	0 ***None:*** No parameter is locked 1 ***SEt:*** Setup data are locked 2 ***uSEr:*** Setup data and user data are locked. SetPoint are unlocked. 3 ***ALL:*** All data are locked	0	R/W	0	65535
4	INPT	Input sensor selection	0 ***J_tC***: J type Thermocouple 1 ***K_tC***: K type Thermocouple 2 ***t_tC***: T type Thermocouple 3 ***R_tC***: R type Thermocouple 4 ***S_tC***: S type Thermocouple 5 ***Pt. dN***: PT 100 DIN 6 ***Pt.JS***: PT 100 JIS	1	R/W	0	65535
5	UNIT	Input unit selection	0 ***oC***: °C unit 1 ***oF***: °F unit	0	R/W	0	65535
6	DP	Decimal point selection	0 ***No.dP:*** no decimal point 1 ***1-dP:*** 1 decimal point	1	R/W	0	65535
7	OP1L	OP1 linear output low limit value	Low: 0.0 High: OP1H	0.0	R/W	0	65535
8	OP1H	OP1 linear output high limit value	Low: OP1L High: 110.0 %	100.0	R/W	0	65535
9	SP1L	Low limit of set point value	Low: J_TC: -120.0°C (-184.0°F) K_TC: -200.0°C (-328.0°F) T_TC: -250.0°C (-418.0°F) R_TC: 0.0°C (32.0°F) S_TC: 0.0°C (32.0°F) PTDN: -200.0°C (-328.0°F) PTJS: -200.0°C (-328.0°F) High: SP1H	-17.8 °C (0.0 °F)	R/W	-19999	45536
10	SP1H	High limit of set point value	Low: SP1L High: J_TC: 1000.0°C (1828.0°F) K_TC: 1370.0°C (2498.0°F) T_TC: 400.0°C (752.0°F) R_TC: 1767.7°C (3214.0°F) S_TC: 1767.7°C (3214.0°F) PTDN: 850.0°C (1562.0°F) PTJS: 600.0°C (1112.0°F)	537.8 °C (1000.0 °F)	R/W	-19999	45536
11	SHIF	PV shift (offset) value	Low: -200.0°C (-360.0°F) High: 200.0°C (360.0°F)	0.0 °C (0.0 °F)	R/W	-19999	45536

Modbus Register Address	Parameter Notation	Parameter Description	Range	Default Value	Data Access Type	Scale Unsigned 16 bit Data	
						Low	High
12	FILT	Filter damping time constant of PV	0 ***0***: 0 sec time constant 1 ***0.2***: 0.2 sec time constant 2 ***0.5***: 0.5 sec time constant 3 ***1***: 1 sec time constant 4 ***2***: 2 sec time constant 5 ***15:*** 5 sec time constant 6 ***10***: 10 sec time constant 7 ***20***: 20 sec time constant 8 ***30***: 30 sec time constant 9 ***60***: 60 sec time constant	2	R/W	0	65535
13	A1DV	Alarm 1 deviation value	A1FN=DEHI/DELO/DBHI/DBLO Low: 0.0 High: 500.0°C (900.0°F)	10.0 °C (18.0 °F)	R/W	0	65535
14	PB	Proportional band value	Low: 0.0 High: 500.0°C (900.0°F)	10.0 °C (18.0 °F)	R/W	0	65535
15	TI	Integral time value	Low: 0 High: 3600 sec	60	R/W	0	65535
16	TD	Derivative time value	Low: 0 High: 360.0 sec	3.0	R/W	0	65535
17	OUT1	Output 1 function	0 ***REVR:*** Reverse (heating) control action 1 ***dIRt:*** Direct (cooling) control action	0	R/W	0	65535
18	O1TY	Output 1 signal type	0 ***RELY:*** Relay output 1 ***SSrd:*** Solid state relay drive output 2 ***DC.MA:*** DC current 3 ***DC.Vo:*** DC voltage	0	R/W	0	65535
19	O1FT	Output 1 failure transfer mode	0~1000: 0.0 ~ 100.0 % to continue output 1 control function if the sensor fails, or select OFF (0) or ON (1) for ON-OFF control	0.0	R/W	-19999	45536
20	O1HY	Output 1 ON-OFF control hysteresis	Low: 0.1 High: 50.0 °C (90.0°F)	0.5°C (0.9 °F)	R/W	0	65535
21	CYC1	Output 1 cycle time	Low: 0.1 High: 90.0 sec.	18.0	R/W	0	65535
22	OFST	Offset value for P control	Low: 0 High: 100.0 %	25.0	R/W	0	65535
23	PL1L	MV1 power value limit low	Low: 0 High: 50 % or PL1H	0	R/W	0	65535
24	PL1H	MV1 power value limit high	Low: PL1L High: 100 %	100	R/W	0	65535
25	A1FN	Alarm 1 function for alarm 1 output	0 ***NoNE:*** No alarm function 1 ***dE.HI:*** Deviation high alarm 2 ***dE.Lo***: Deviation low alarm 3 ***db.HI:*** Deviation band out of band alarm 4 ***db.Lo:*** Deviation band in band alarm 5 ***PV.HI:*** Process value high alarm 6 ***PV.Lo:*** Process value low alarm	1	R/W	0	65535

Modbus Register Address	Parameter Notation	Parameter Description	Range	Default Value	Data Access Type	Scale Unsigned 16 bit Data	
						Low	High
26	A1MD	Alarm 1 operation mode	0 ***NoRM***: Normal alarm action 1 ***LtCH:*** Latching alarm action 2 ***HoLd:*** Hold alarm action 3 ***Lt.Ho:*** Latching & Hold action	0	R/W	0	65535
28	A1FT	Alarm 1 failure transfer mode	0 ***oFF:*** OFF if sensor fails 1 ***oN:*** ON if sensor fails	1	R/W	0	65535
29	A1HY	Alarm 1 Hysteresis control	Low: 0.1 High: 50.0°C (90.0°F)	0.1 °C (0.2 °F)	R/W	0	65535
33	A2FN	Alarm 2 function for alarm 2 output	0 ***NoNE:*** No alarm function 1 ***dE.HI:*** Deviation high alarm 2 ***dE.Lo***: Deviation low alarm 3 ***db.HI:*** Deviation band out of band alarm 4 ***db.Lo:*** Deviation band in band alarm 5 ***PV.HI:*** Process value high alarm 6 ***PV.Lo:*** Process value low alarm 7 COMM: RS485	2	R/W	0	65535
34	A1DL	Alarm 1 delay	Low: 0 High: 5999 sec	0	R/W	0	65535
35	A2MD	Alarm 2 operation mode	0 ***NoRM***: Normal alarm action 1 ***LtCH:*** Latching alarm action 2 ***HoLd:*** Hold alarm action 3 ***Lt.Ho:*** Latching & Hold action	0	R/W	0	65535
36	A2HY	Hysteresis control of alarm 2	Low: 0.1°C High: 50.0°C (90.0°F)	0.1 °C (0.2 °F)	R/W	0	65535
37	A2FT	Alarm 2 failure forced transfer mode	**0** ***oFF:*** Alarm output OFF if sensor fails **1** ***oN:*** Alarm output ON if sensor fails	1	R/W	0	65535
38	A2DL	Alarm 2 delay	Low: 0 High: 5999 sec	0	R/W	0	65535
39	ADDR	Address assignment of digital communication	Low: 1 High: 255	1	R/W	0	65535
40	BAUD	Baud rate of digital communication	0 ***2.4:*** 2.4 Kbits/s baud rate 1 ***4.8:*** 4.8 Kbits/s baud rate 2 ***9.6:*** 9.6 Kbits/s baud rate 3 ***14.4:*** 14.4 Kbits/s baud rate 4 ***19.2:*** 19.2 Kbits/s baud rate 5 ***28.8:*** 28.8 Kbits/s baud rate 6 ***38.4:*** 38.4 Kbits/s baud rate 7 ***57.6:*** 57.6 Kbits/s baud rate 8 **115.2:** 115.2 Kbits/s baud rate	2	R/W	0	65535
41	DATA	Data bit count of digital communication	0 **7bIt:** 7 bit 1 ***8bIt:*** 8 bit	1	R/W	0	65535

Modbus Register Address	Parameter Notation	Parameter Description	Range	Default Value	Data Access Type	Scale Unsigned 16 bit Data	
						Low	High
42	PARI	The parity bit of digital communication	0 ***EVEN:*** Even parity 1 ***odd:*** Odd parity 2 ***NoNE:*** No parity bit	0	R/W	0	65535
43	A2DV	Alarm 2 deviation value	A2FN=DEHI/DELO/DBHI/DBLO Low: 0.0 High: 500.0°C (900.0°F)	10.0°C (18.0 °F)	R/W	0	65535
44	SEL1	Select 1st parameter for user menu	0 ***NONE*** 1 ***A1SP*** 2 ***A2SP*** 3 ***LOCK*** 4 ***INPT*** 5 ***PB*** 6 ***TI*** 7 ***TD*** 8 ***SHIF*** 9 ***OFST*** 10 ***O1HY*** 11 ***A1HY*** 12 ***A2HY*** 13 ***ADDR***	0	R/W	0	65535
45	SEL2	Select 2nd parameter for user menu	Same as the SEL1	0	R/W	0	65535
46	SEL3	Select 3rd parameter for user menu	Same as the SEL1	0	R/W	0	65535
47	SEL4	Select 4th parameter for user menu	Same as the SEL1	0	R/W	0	65535
48	SEL5	Select 5th parameter for user menu	Same as the SEL1	0	R/W	0	65535
49	SEL6	Select 6th parameter for user menu	Same as the SEL1	0	R/W	0	65535
50	SEL7	Select 7th parameter for user menu	Same as the SEL1	0	R/W	0	65535
51	SEL8	Select 8th parameter for user menu	Same as the SEL1	0	R/W	0	65535
52	ADLO	mV calibration low coefficient	Low: -1999 High: 1999	------	R/W	-19999	45536
53	ADHI	mV calibration high coefficient	Low: -1999 High: 1999	------	R/W	-19999	45536
54	RTDL	RTD calibration low coefficient	Low: -1999 High: 1999	------	R/W	-19999	45536
55	RTDH	RTD calibration high coefficient	Low: -1999 High: 1999	------	R/W	-19999	45536
56	CJLO	Cold junction calibration low coefficient	Low: -5.00 High: 40.00	------	R/W	-19999	45536
57	CJCT	Cold Junction Temperature	Low: -4000 High: 9000	------	R	-19999	45536
58	DATE	Date	Low: 0; High: 65535	------	R	0	65535

Modbus Register Address	Parameter Notation	Parameter Description	Range	Default Value	Data Access Type	Scale Unsigned 16 bit Data	
						Low	High
59	SRNO	Serial Number	Low: 0; High: 65535	------	R	0	65535
63	CJCL	Cold junction low calibration voltage	Low: 0 High: 7552	------	R	0	65535
64	PV	Process value	Low: -19999 High: 45536	------	R	-19999	45536
65	SV	Current set point value	Low: SP1L High: SP1H	------	R	-19999	45536
66	MV1	Output 1 %Value	Low: 0.00 High: 100.00 %	------	R (R/W, Manual)	0	65535
68	CICF	CIC filter switch	0 ***OFF*** 1 ***ON***	0	R/W	0	65535
69	EROR	Error code	Low: 0 High: 65535	------	R	0	65535
70	MODE	Operation mode & alarm status	Low: 0 High: 65535	------	R	0	65535
71	PROG	Device version, firmware version	67.XX	------	R	0	65535
72	CMND	Command code	Low: 0; High: 65535	------	R/W	0	65535
73	JOB1	Job code	Low: 0; High: 65535	------	R/W	0	65535

2 Installation and Wiring

Sometimes dangerous voltages capable of causing death are present in this instrument. Before doing the installation or any troubleshooting procedures, the power to the equipment must be switched off and isolated. Units suspected of being faulty must be disconnected and removed to a properly equipped workshop for testing and repair. Component replacement and internal adjustments must be made by a qualified maintenance person only.

To minimize the possibility of fire or shock hazards, do not expose this instrument to rain or excessive moisture.

Do not use this instrument in areas under hazardous conditions such as excessive shock, vibration, dirt, moisture, corrosive gases or oil. The ambient temperature of the area should not exceed the maximum rating specified in the specification

Remove stains from this equipment using a soft, dry cloth. Do not use harsh chemicals, volatile solvents such as thinner or strong detergents to clean the equipment to avoid deformation.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

2.1 Unpacking

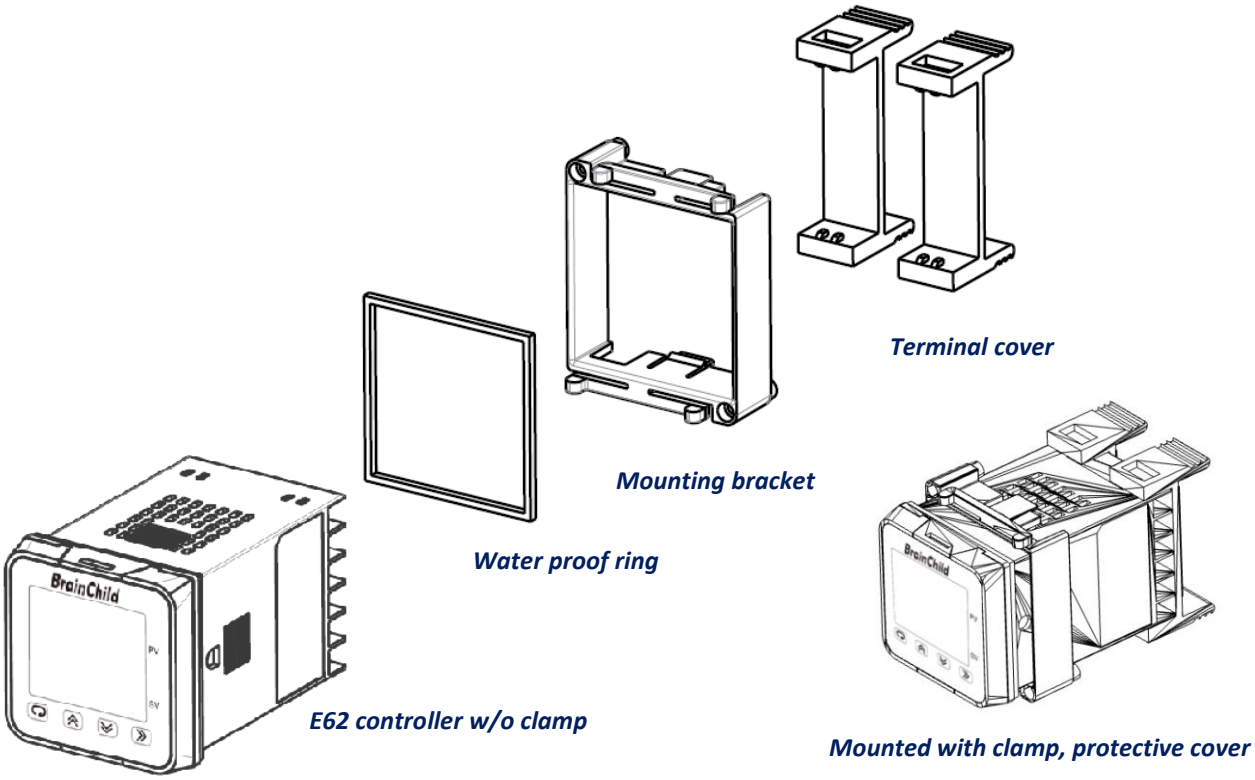
Upon receipt of the shipment, remove the controller from the carton and inspect the unit for shipping damage. If any damage is found, contact your local representative immediately. Note the model number and serial number for future reference when corresponding with our service center. The serial number (S/N) is labeled on the box and the housing of the controller. The controller is designed for indoor use only and is not intended for use in any hazardous area. It should be kept away from shock, vibration, and electromagnetic fields (such as variable frequency drives), motors and transformers. It is intended to operate under the following environmental conditions.

Environmental Parameter	Specification
Operating Temperature	-10°C to 50 °C
Humidity	0% to 90% RH(Non-condensing)
Altitude	2000 M Maximum

Environmental Specification

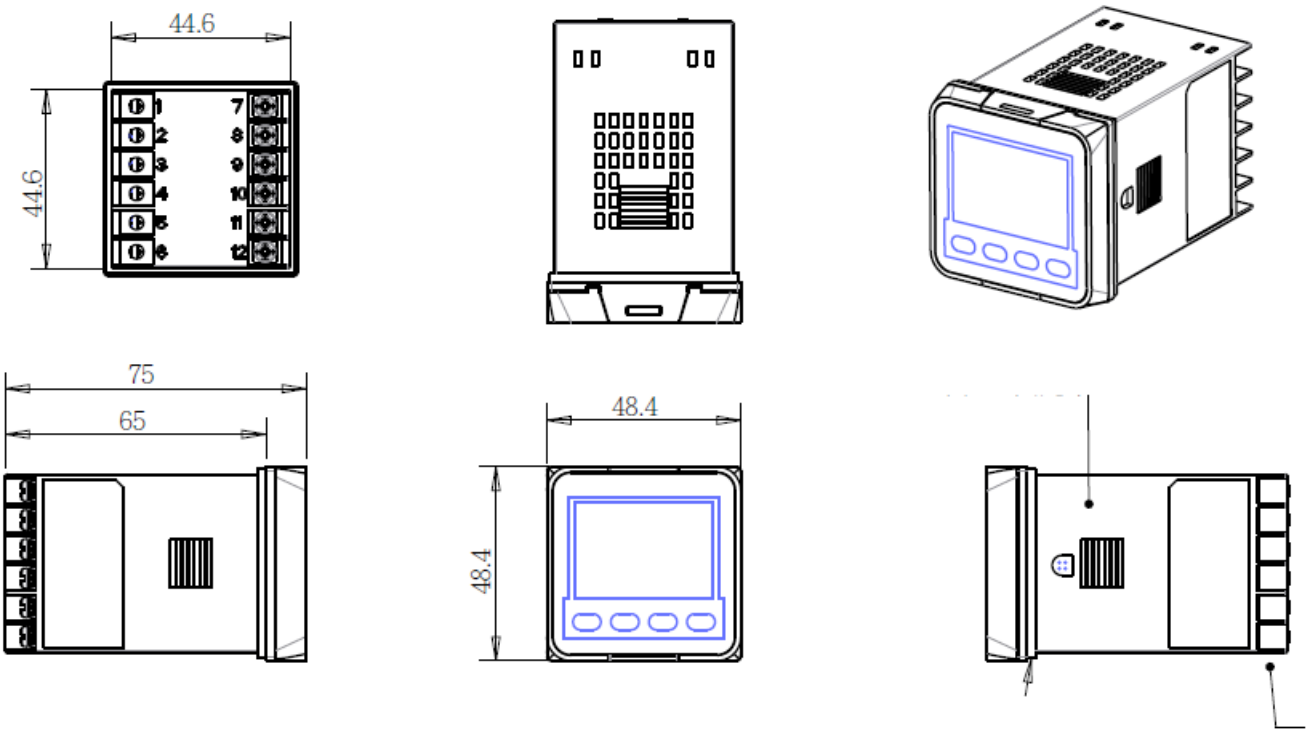
2.2 Mounting

Make the panel cut out as per the dimensions required by the controller. The dimensions of the different sizes of the controllers are given in the following section. Remove the mounting clamps from the controller and insert the controller into the panel cut out. After inserting the controller into the panel cut out, re-install the mounting clamps. Gently tighten the clamp screws until the controller is properly secured into the cutout.

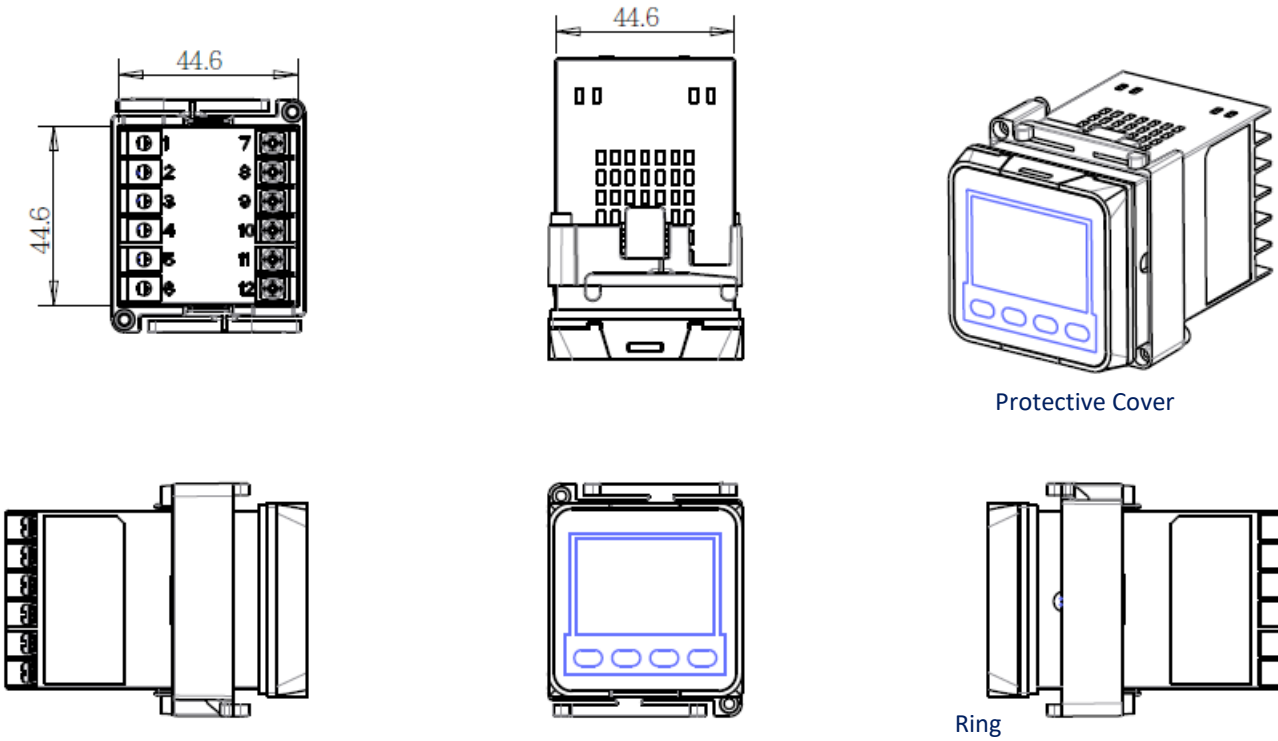


E62 Mounting

2.2.1 E62 Dimension

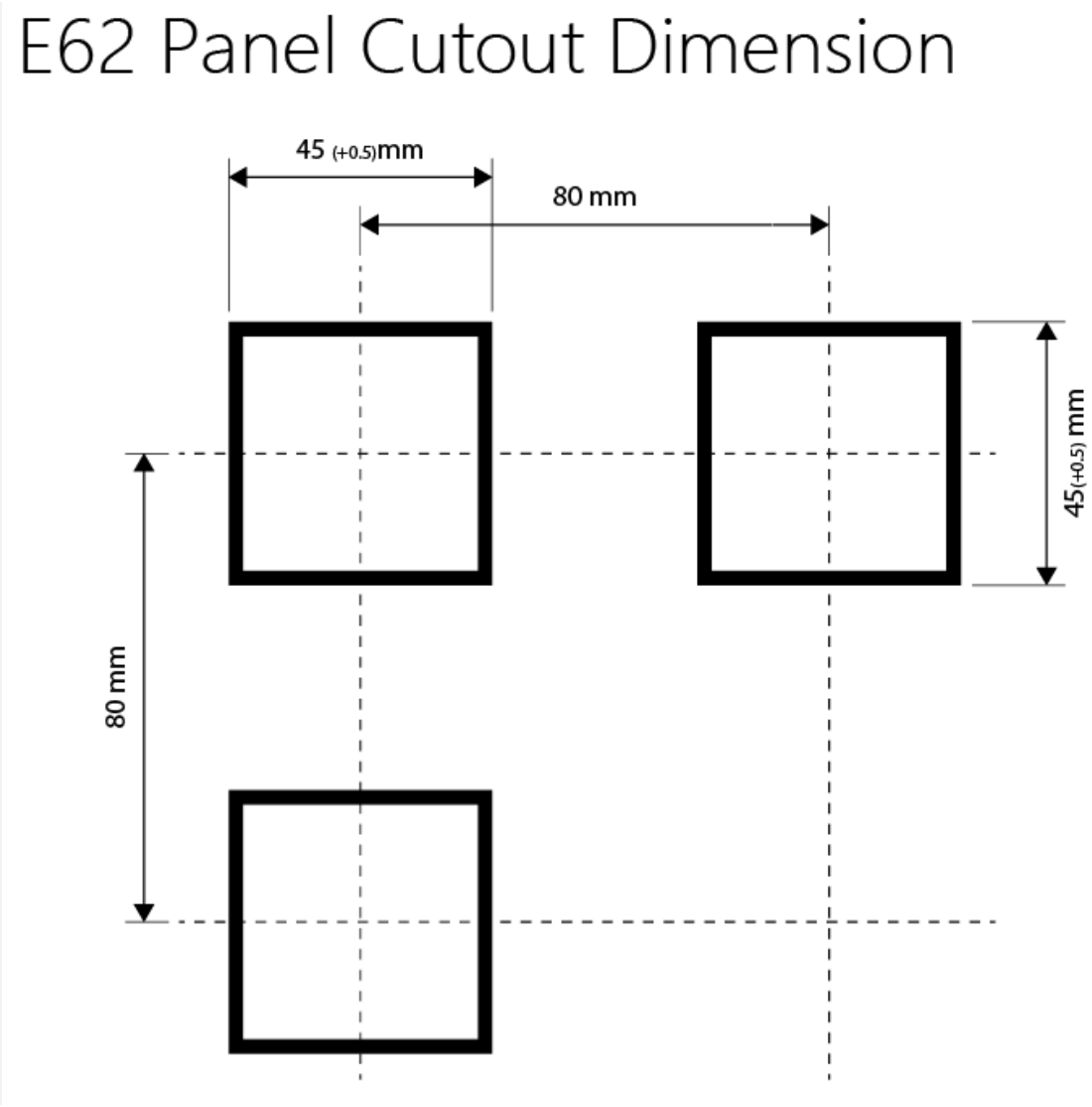


E62 Dimension without Clamp



E62 Dimension with Clamp

2.2.2 Panel Cutout



E62 Panel cutout

2.3 Wiring

⚠ Sometimes dangerous voltages capable of causing death are present in this instrument. Before doing the installation or any troubleshooting procedures, the power to the equipment must be switched off and isolated. Units suspected of being faulty must be disconnected and removed to a properly equipped workshop for testing and repair. Component replacement and internal adjustments must be made by a qualified maintenance person only.

The utmost care must be taken to ensure that the maximum voltage rating specified on the label is not exceeded.

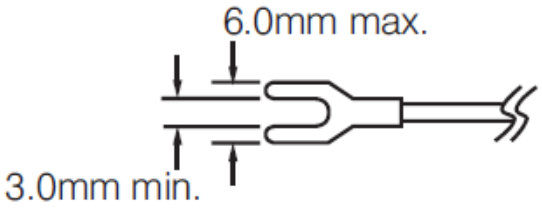
It is recommended that the supply power of these units be protected by fuses or circuit breakers rated at the lowest value possible

All units should be installed inside a suitably grounded metal enclosure to prevent live parts being accessible to human hands and metal tools.

All wiring must conform to appropriate standards of good practice and local codes and regulations. Wiring must be suitable for the voltage, current, wire size (18AWG) and temperature rating of the system.

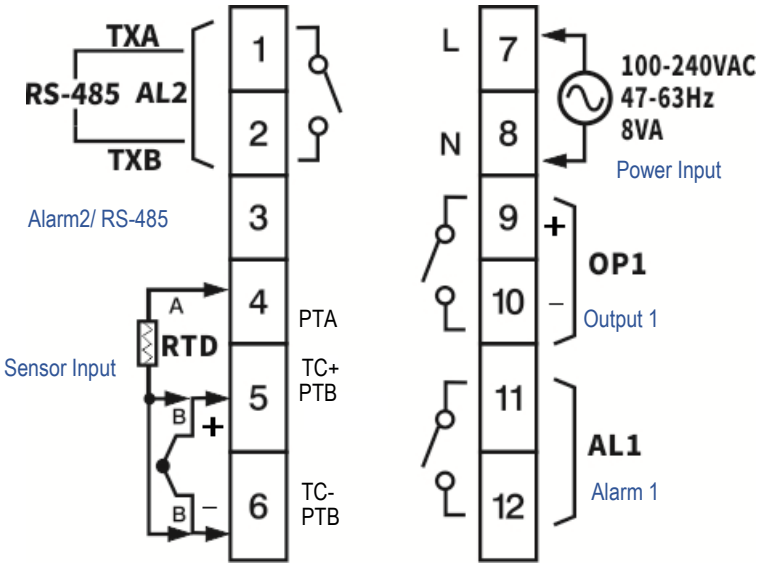
The tightening torque on the Screw terminals; for E62 should not exceed 1 N-m (2 KgF-cm).temperature Min.60°C, use copper conductors only.

Except Thermocouple Wiring, all other wires used are to be standard copper conductors with the maximum Gauge not exceeding 18AWG. Before powering on the controller, the equipment ground must be connected with a minimum of 1.6mm diameter conductor for protective grounding.



Lead Terminal for all models

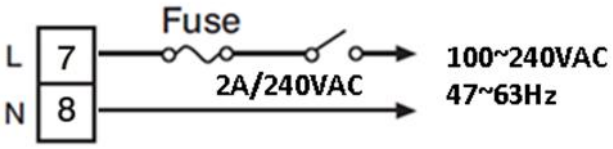
2.3.1 E62 Terminal Connection



E62 Rear Terminal Connection

2.4 Power Wiring

The controller is designed to operate at 100-240VAC depending on power input option ordered. Check that the installation voltage corresponds with the power rating indicated on the product label before connecting power to the controller. Near the controller, a fuse and a switch rated at 2A/240VAC should be equipped as shown below.



Power Wiring

⚠ This equipment is designed for installation in an enclosure which provides adequate protection against electric shock. The enclosure must be connected to earth ground.

⚠ Local requirements regarding electrical installation should be rigidly observed. Consideration should be given to prevent unauthorized persons from accessing the power terminals.

2.5 Sensor Installation

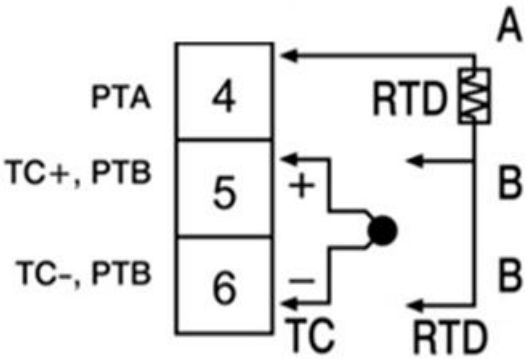
Proper sensor installation can eliminate many problems in a control system. The probe should be placed so that it can detect any temperature change with minimal thermal lag. In a process that requires fairly constant heat output, the probe should be placed close to the heater. In a process where the heat demand is variable, the probe should be closed to the work area. Some experiments with probe location are often required to find this optimum position.

In a liquid process, the addition of a stirrer or agitator can help to eliminate thermal lag. Since the thermocouple is a point measuring device, placing more than one thermocouple in parallel can provide average temperature readout and produce better results in most air heated processes.

The proper sensor type is also a very important factor to obtain precise measurements. The sensor must have the correct temperature range to meet the process requirements. In special processes, the sensor might need to have different requirements such as being leak-proof, ant vibration, antiseptic, etc.

Standard sensor limits of error are ±4°F (± 2°C) or 0.75% of sensed temperature (half that for special) plus drift caused by improper protection or an over-temperature occurrence. This error is far greater than controller error and cannot be corrected on the sensor except by proper selection and replacement.

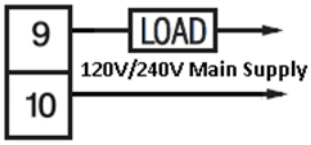
2.6 Sensor Input Wiring



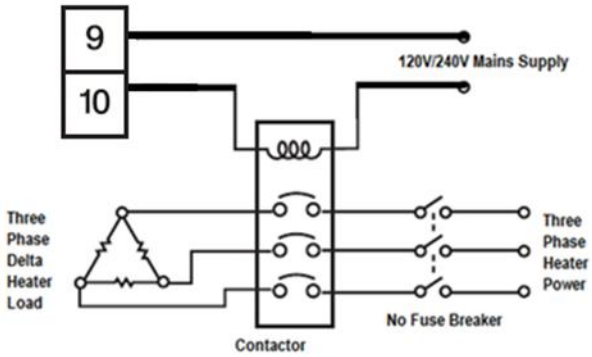
Sensor Input Wiring

2.7 Control Output Wiring

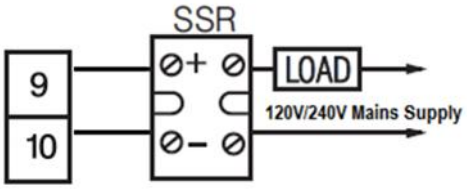
2.7.1 Output 1

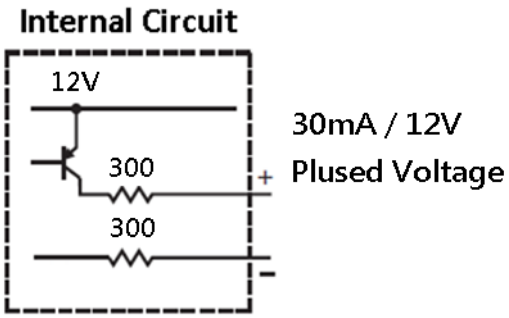


Output 1 Relay to Drive Load



Output 1 Relay to Drive Contactor

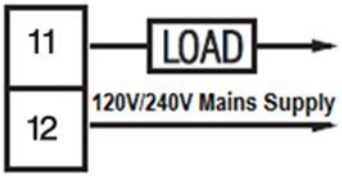




Output 1 Pulsed Voltage to Drive SSR

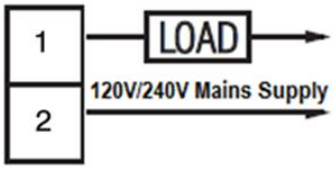
2.8 Alarm Wiring

2.8.1 Alarm 1



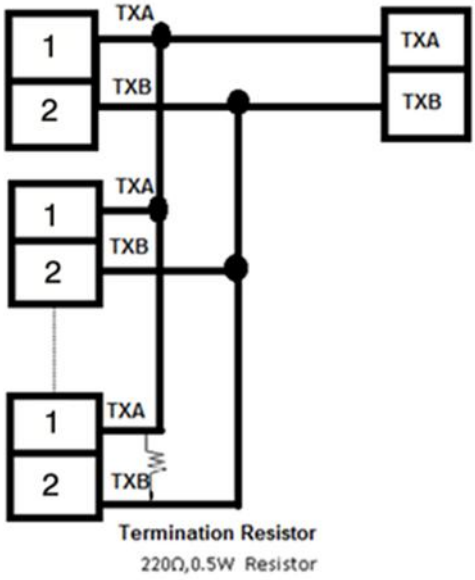
Alarm 1 Output to Drive Load

2.8.2 Alarm 2



Alarm 2 Output to Drive Load

2.9 RS-485 Data Communication



RS-485 Wiring

3 Programming

Press ⊡ for 5.3 seconds and release to enter the setup menu. Press ⊡ and release to select the desired parameter. The upper display indicates the parameter symbol, and the lower display indicates the value of the selected parameter.

3.1 User Security

There are 4 selections under lock function which will control data security function. Use ⊡ or ⊡ key to get bASE in the lower display then use ⊡ key to select and enter the LOCK parameters.

Modbus Address	Lock Selection	Access Rights
3	***None***	No parameter is locked
	SEt	Setup data are locked
	uSEr	Setup data and User data except Set Point are locked
	ALL	All data are locked

3.2 Signal Input

INPT: Select the sensor type or signal type for signal input

- **Range:** (Thermocouple) J_tC, K_tC, T_tC, R_tC, S_tC; (RTD) PT100

UNIT: Select the processing unit

- **Range:** °C, °F. The unit is either °C or °F, no other selection.

DP: Select the resolution of the process value.

- **Range:** For Thermocouple and RTD Signal NO. DP, 1-DP

3.3 Control Output

There are 4 kinds of control modes can be configured as shown below.

Control Mode	OUT 1	O1HY
Heat Only	REVR	Δ
Cool Only	DIRT	Δ
Heat PID, Cool ON-OFF	REVR	X
Heat PID, Cool PID	REVR	X

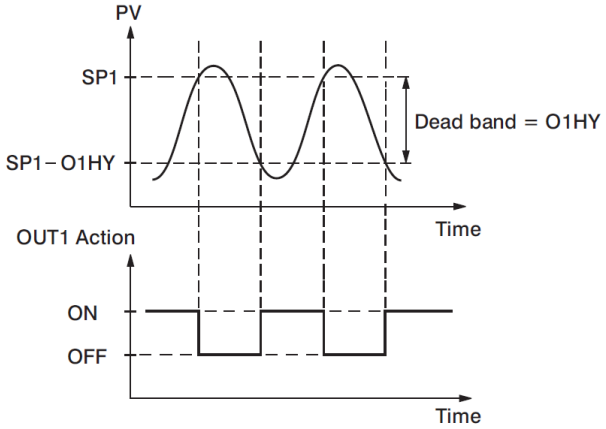
Control Mode

X: Not applicable

Δ: Required if ON-OFF Control is configured

3.3.1 Heat Only ON-OFF Control

Select REVR for OUT1, Set PB to 0. O1HY is used to adjust the dead band for ON-OFF control. The output 1 hysteresis (O1HY) setting becomes available when PB = 0. The heat only ON-OFF control function is shown below.



Heat Only ON-OFF Control

ON-OFF control may cause excessive process oscillations even if the hysteresis is set to the smallest value. If ON-OFF control is set (i.e. PB = 0), TI, TD, CYC1, OFST will no longer be applicable and will be hidden. Auto-Tuning mode will also be unavailable.

3.3.2 Heat only P or PD Control

Select REVR for OUT1 set TI = 0, OFST is used to adjust the controlled offset (manual reset). If PB ≠0 then O1HY will be hidden.

OFST Function: OFST is measured in % with a range of 0 - 100.0 %. When the process is stable, let's say the process value is lower than the setpoint by 5°C. Let's also say that 20 is used for the PB setting. In this example, 5°C is 25% of the proportional band (PB).

By increasing the OFST value by 25%, the control output will adjust itself, and the process value will eventually coincide with the set point.

When using Proportional (P) control (TI = 0), Auto-Tuning will be unavailable. Refer to "manual tuning " section for the adjustment of PB and TD. Manual reset (OFST) is usually not practical because the load may change from time to time; meaning the OFST setting would need to be constantly adjusted. PID control can avoid this problem.

3.3.3 Heat only PID Control

Select REVR for OUT1. PB and TI should not be zero. Perform Auto-Tuning for initial startup, or set PB, TI and TD using historical values. If the control result is not satisfactory, use manual or Auto-Tuning to improve the control performance. The unit contains a very clever PID and Fuzzy algorithm to achieve the set point with a very small overshoot and very quick response to the process if it is properly tuned.

3.3.4 Cool only Control

ON-OFF control, P (PD) control and PID control can be used for cooling control. Set OUT1 to DIRT (direct action). The other functions for cooling only are ON-OFF control, cool only P (PD) control and cool only PID control are same as for heating, except that the output variable (and action) is reversed.

NOTE: ON-OFF control may result in excessive overshoot and undershoot problems in the process. P (or PD) control will result in a deviation of the process value from the setpoint. It is recommended to use PID control for Heat-Cool control to produce a stable and zero offset process value.

3.3.5 Other Setup Required

O1TY & CYC1 are set per the type of outputs installed (OUT1) installed. CYC1 are set according to the output 1 type (O1TY). Generally, if SSRD or SSR is used for O1TY, CYC1 is set to a value of 0.5 - 2 seconds. If a Relay is used for O1TY, CYC1 is set to a value of 10 - 20 seconds. If a linear output is used, CYC1 is not applicable.

The user can use Auto-Tuning program for initial start-up, or they can directly set the appropriate values for PB, TI & TD using the historical records for repeat systems. If the control behaviors are still inadequate, then manual tuning may be required to improve control.

3.4 Alarm

The controller has up to 2 alarm outputs, alarm 1 or alarm 2. There are 6 types of alarm functions that can be selected. There are 2 kinds of alarm modes (A1MD or A2MD) available for each alarm function (A1FN or A2FN). In addition to the alarm output, the RS485 output can also be configured as a second alarm, which has provided 6 different alarm functions available.

3.4.1 Alarm Types

There are different types of alarms as listed below that the user can assign to different alarm outputs.

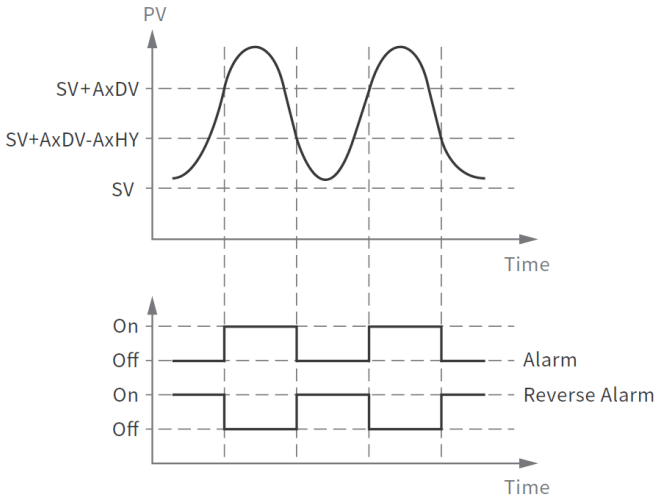
0. **NoNE:** No Alarm function
1. **dE. HI:** Deviation high alarm
2. **dE. Lo:** Deviation low alarm
3. **dB. Hi:** Deviation band out of band alarm
4. **dB. Lo:** Deviation band in band alarm
5. **PV. HI:** Process value high alarm
6. **PV. Lo:** Process value low alarm

3.4.1.1 Deviation Hi/Lo Alarm

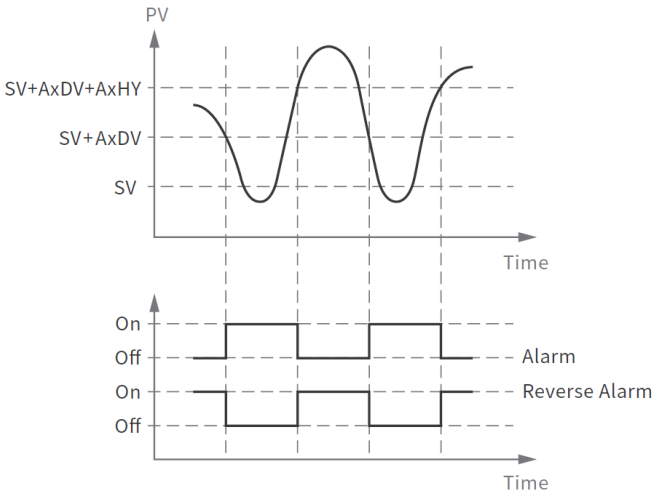
dE.HI: When the process value is higher than SV+AxDV, a **deviation high alarm (dE. HI)** occurs. The alarm is off when the process value is lower than SV+AxDV-AxHY.
dE.Lo: When the process value is lower than SV+AxDV, a **deviation low alarm (dE. Lo)** occurs. The alarm is off when the process value is higher than SV+AxDV+AxHY.

A deviation alarm alerts the user when the process value deviates too far from the set point. The trigger level of a deviation alarm moves with the setpoint.

- When the process value is higher than SV+A1DV or SV+A2DV, a deviation high alarm occurs. The alarm is off when the process value is lower than SV+A1DV-A1HY or SV+A2DV-A2HY.
- When the process value is lower than SV+A1DV or SV+A2DV, a deviation low alarm occurs. The alarm is off when the process value is higher than SV+A1DV+A1HY or SV+A2DV+A2HY.



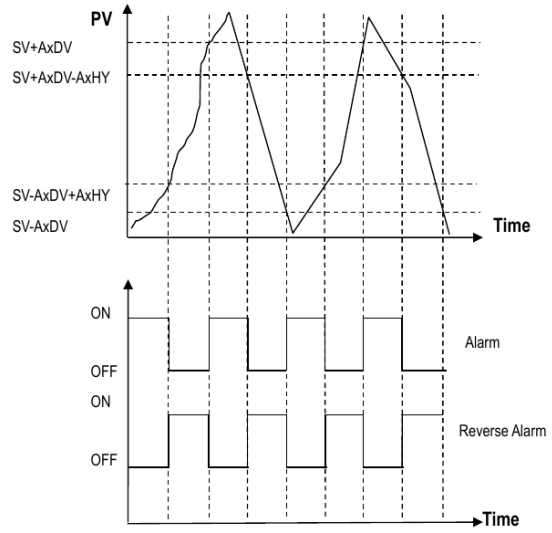
Deviation High Alarm (dE.HI)



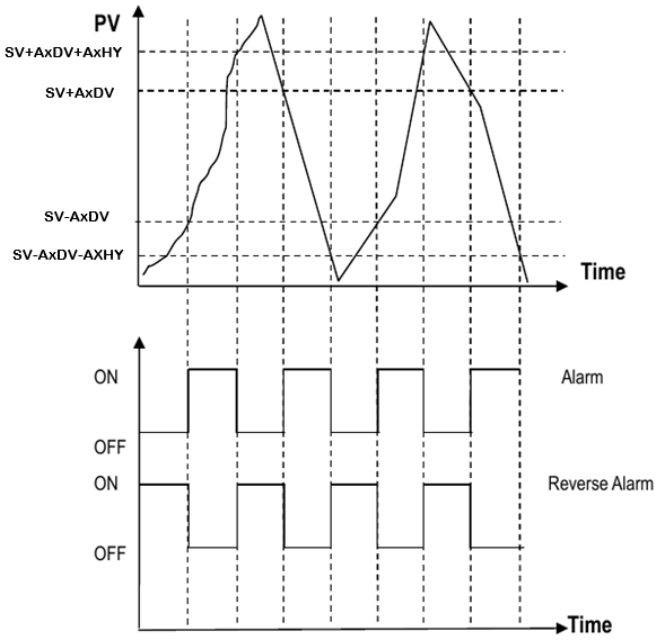
Deviation Low Alarm (dE.Lo)

3.4.1.2 Deviation-Band Out-of-Band/In-Band Alarm

A deviation band alarm presets two trigger levels centred on the set point. The two trigger levels are SV+AxDV and SV–AxDV. When the process value is higher than (SV+AxDV) or lower than (SV – AxDV), a **deviation band out of band alarm (dB. HI)** occurs. When the process value is within the trigger levels, a **deviation band in band alarm (dB. Lo)** occurs. In the above descriptions, SV denotes the current setpoint value for the control. This is different from SP1 when the ramp function is used.



Deviation out of Band Alarm (db.HI)

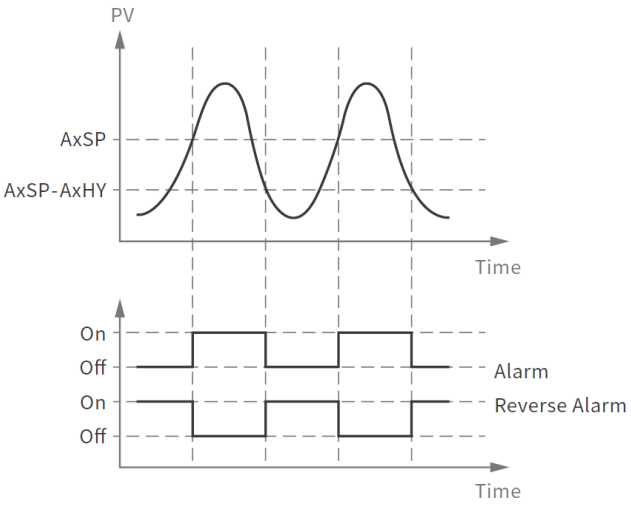


Deviation In-Band Alarm (db.Lo)

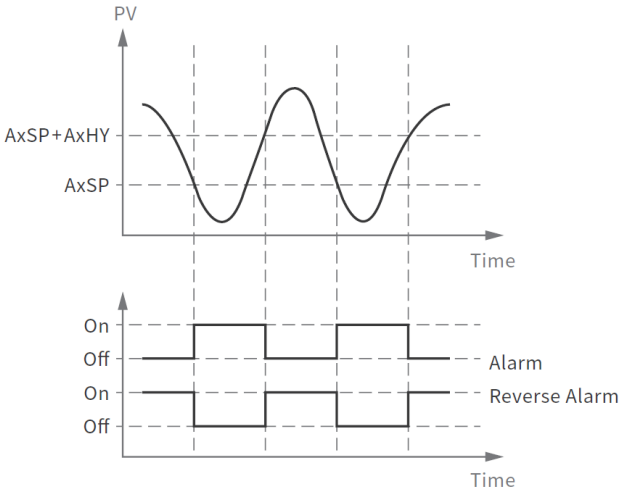
3.4.1.3 Process Value Hi/Lo Alarm

A process alarm can set two absolute trigger levels. When the process value is higher than AxSP, a **process high alarm (PV. HI)** occurs. The alarm is off when the process value is lower than AxSP-AxHY.

When the process value is lower than AxSP, a **process low alarm (PV. Lo)** occurs. The alarm is off when the process is higher than AxSP+AxHY. A process alarm is independent of the set point.



Process Value High (PV.HI)



Process Value Low (PV.Lo)

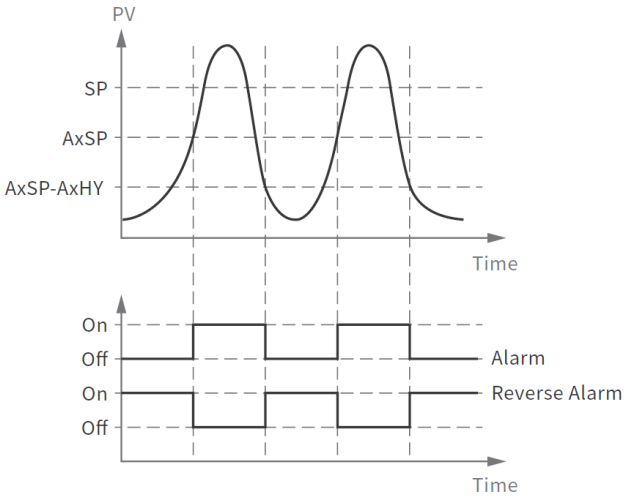
3.4.2 Alarm Modes

There are 4 types of alarm modes available for each alarm function.

1. Normal alarm
2. Latching alarm
3. Holding alarm
4. Latching/ Holding alarm

3.4.2.1 Normal Alarm: ALMD = NORM

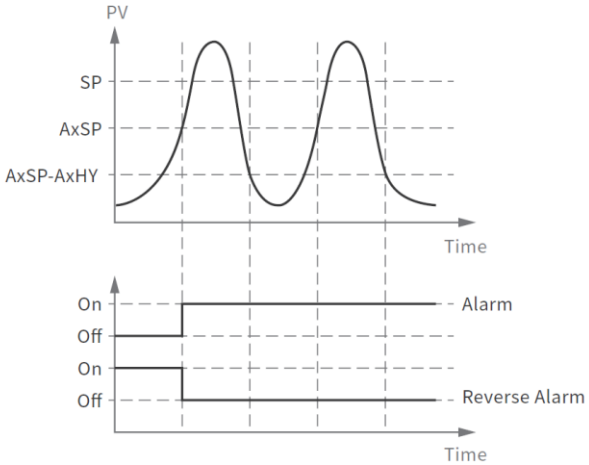
When a normal alarm is selected, the alarm output is de-energized in the non-alarm condition and energized in an alarm condition.



Process Value High- Normal Alarm

3.4.2.2 Latching Alarm: ALMD = LTCH

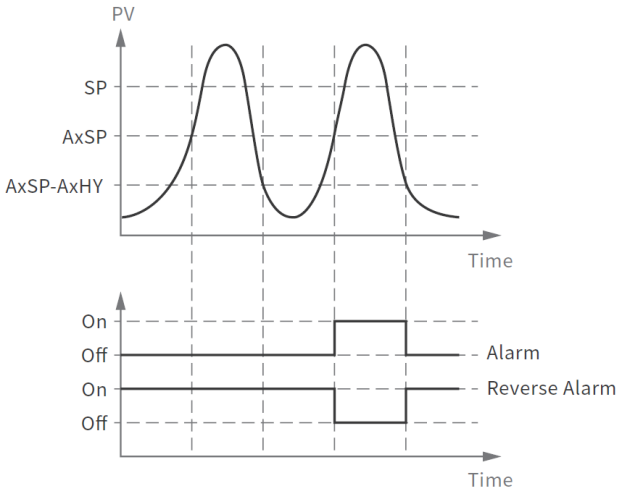
If a latching alarm is selected, once the alarm output is energized, it will remain unchanged even if the alarm condition is cleared. The latching alarm can be reset by pressing the RESET key once the alarm condition is removed.



Process Value High- Latching Alarm

3.4.2.3 Holding Alarm: ALMD = HOLD

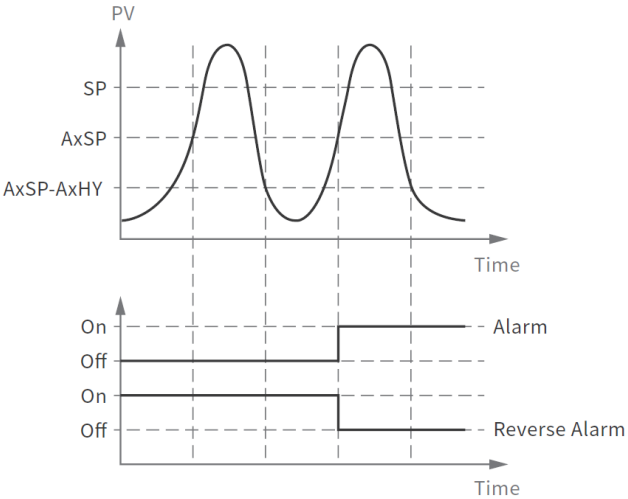
A holding alarm prevents an alarm condition during power-up. Only if the PV meets the Alarm condition as soon as the controller is powered on, setting the holding Alarm will ignore the alarm condition for the first time after powering on. Afterward, the alarm performs the same function as a normal alarm. If the condition is not as described above, the holding alarm will work as the regular alarm.



Process Value High- Holding Alarm

3.4.2.4 Latching / Holding Alarm: ALMD = LT. HO

A latching/holding alarm performs both holding and latching functions. The latching alarm is reset when the RESET key is pressed after the alarm condition is removed.



Process Value High- Latching & Holding Alarm

3.4.3 Alarm Delay

In certain applications during startup, nuisance alarms will be generated before the process value reaches the set point. To avoid these kinds of nuisance alarms, a time delay for alarms is available. To enable the time delay for alarms, set the delay time using the A1DL & A2DL parameters. These parameters will avoid the nuisance alarm during the process value reaches the setpoint.

For example, the process setpoint set to 100. When approaching near 100, the process setpoint will go to 103 and 97. During this time the Hi Alarm will be activated and deactivated continuously. To avoid these kinds of nuisance alarms the alarm delay function can be used. It will generate the alarm after the PV is in alarm condition continuously at least for the period configured in alarm delay parameters. The alarm delay can be configured in seconds.

3.4.4 Alarm Failure Transfer

Alarm Failure transfer is activated as the unit enters failure mode. The respective Alarm will go on if ON is set for A1FT & A2FT and will go off if OFF is set for A1FT & A2FT. The unit will enter failure mode if a sensor break occurs or if the A-D converter fails.

3.5 User Select Menu Configuration

Conventional controllers are designed with parameters in a fixed order.

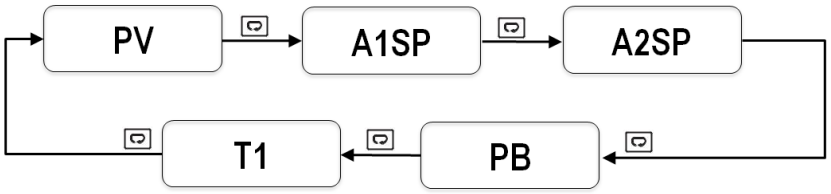
If the user needs a friendlier menu operation to suit their application, most conventional controllers do not offer a solution. The controllers have the flexibility for the user to select those parameters which are most significant and put these parameters in an easy access USER menu.

There are eight user-friendly parameters from the below list that can be set for user select menu configuration using the SEL1-SEL8 parameters.

0. NONE
1. A1SP
2. A2SP
3. LOCK
4. INPT
5. PB
6. TI
7. TD
8. SHIF
9. OFST
10. O1HY
11. A1HY
12. A2HY
13. ADDR

When using the up-down key to select parameters, all of the above parameters may not be available. The number of visible parameters is dependent on the setup configuration.

Example:
OUT1 is set to DE. LO, PB = 100.0, SEL1 is set to A1SP, SEL2 is set to A2SP, SEL3 is set to PB, SEL4 is set to TI, SEL5~SEL8 is set to NONE. Now, the USER menu display appears as below.

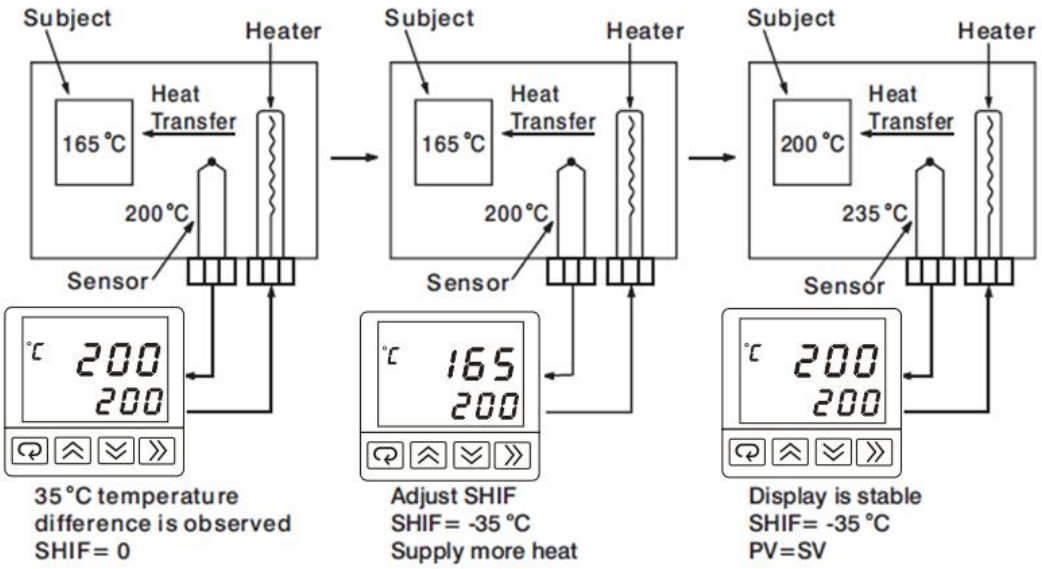


Configurable User Menu

3.6 User Calibration

Factory Calibration
Each unit is calibrated in the factory before shipment. The user can still modify the calibration in the field.
The basic calibration of the controller is highly stable and set for life.

User Stable Calibration Application Using PV-Shift
User calibration allows the user to offset the permanent factory calibration.
In certain calibration applications it is desirable to shift the controller display value from its actual value. This can be easily accomplished by using the PV shift function as calibration.
A process is equipped with a heater, a sensor and a subject to be warmed up. Due to the design and position of the components in the system, the sensor could not be placed any closer to the part. Thermal gradient (different temperature) is common and necessary to an extent in any thermal system for heat to be transferred from one point to another. If the difference between the sensor and the subject is 35°C, and the desired temperature at the subject to be heated is 200°C, the controlling value or the temperature at the sensor should be 235°C. You should input -35°C as to subtract 35°C from the actual process display. This in turn will cause the controller to energize the load and bring the process display up to the set point value.



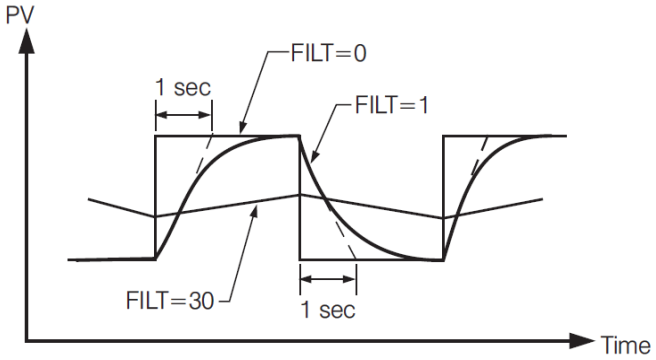
Calibration Application

3.7 Digital Filter

In certain applications, 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 filter with a time constant specified by the FILT parameter. A value of 0.5 seconds is used as a factory default. Adjust FILT to change the time constant from 0 to 60 seconds. 0 seconds represents no filter applied to the input signal. The filter is characterized by the following diagram.

Note

The Filter is available only for the process value (PV) and is performed for the displayed value only. The controller is designed to use an unfiltered signal for control even when a filter is applied. If a lagged (filtered) signal is used for control; it may produce an unstable process.



Filter Characteristics

3.8 Failure Transfer

The controller will enter failure mode if one of the following conditions occurs.

1. An SBER error occurs due to an input sensor break.
2. An ADER error occurs due to the A-D converter of the controller fails.

Output 1 will perform the failure transfer (O1. ft) function as the controller enters failure mode.

3.8.1 Output 1 Failure Transfer

If Output 1 Failure Transfer is activated, it will perform as follows:

1. If output 1 is configured as proportional control (PB≠0), and a value of 0 to 100.0 % is set for O1FT, then output 1 will perform failure transfer. After that, the value of O1FT will be used for controlling output 1.
2. If output 1 is configured as ON-OFF control (PB=0), then output 1 will transfer to an off state if OFF is set for O1FT, and transfer to on state if ON is set for O1FT.

3.8.2 Alarm Failure Transfer

An alarm failure transfer is activated as the controller enters failure mode. After that, the alarm output will transfer to the ON or OFF state which is determined by the set value of A1FT and A2FT.

3.9 Auto-Tuning



The Auto-Tuning process will be performed at the SetPoint (SP1). The process will oscillate around the setpoint during the tuning process. Set a set point to a lower value if overshooting beyond the normal process value will cause damage. It is usually best to perform Auto-Tuning at the SetPoint the machine is expected to be operated at, with the process running normally (i.e. material in the oven, etc.)

Auto-Tuning is generally applied in the following cases:

- Initial setup for a new process
- The setpoint is changed substantially from the previous Setpoint when Auto-Tuning was performed.
- The control result is unsatisfactory

3.9.1 Auto-Tuning Operation Steps

1. The system has been installed normally.
2. Do not use a zero value for PB or TI; otherwise, the Auto-Tuning program will be disabled.
3. The LOCK parameter should be set to NONE.
4. Set the setpoint to a normal operating value or a lower value if overshooting beyond the normal process value will cause damage.
5. Press and hold the ⏎ key until A-t appear on the upper display, then let go.

NOTE:
If the ramping function is used, it will be disabled once Auto-Tuning is started. The Auto-Tuning mode is disabled if either a failure mode or manual control mode occurs.

Procedures:
Auto-Tuning can be applied either as the process is warming up (Cold Start) or as the process has been in a steady-state (Warm Start). After the Auto-Tuning process is completed, the PV will stop flashing and the unit will revert to PID control by using its new PID values. The PID values obtained are stored in non-volatile memory.

3.9.2 Auto-Tuning Error

If Auto-Tuning fails, an ATER AtEr message will appear on the upper display in any of the following cases.

- ❖ If set zero for PB and TI
- ❖ If Auto-Tuning process exceeds 3600-sec time-out limit
- ❖ If the setpoint/SP1 is changed during the Auto-Tuning process

3.9.3 Solution for Auto-Tuning Error

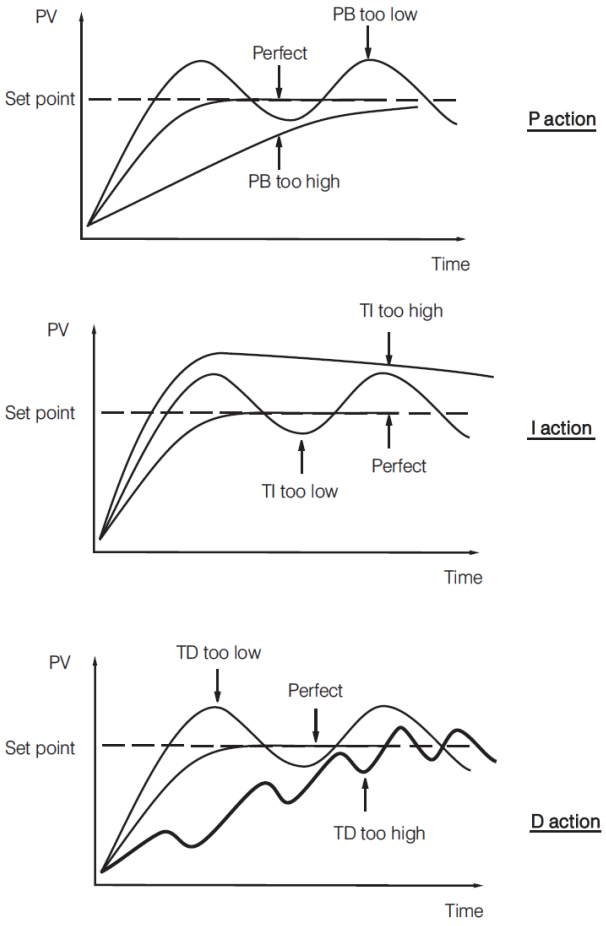
1. Try Auto-Tuning once again.
2. Do not change the setpoint value during the Auto-Tuning process.
3. Do not set zero value for PB and TI.
4. Set PID values manually
5. Touch RESET ▲ + ▼ key to reset the AtEr message.

3.10 Manual Tuning

In certain applications (very few), using Auto-Tuning to tune a process may be inadequate for the control requirement. In this case, the user can try manual tuning.
If the control performance by using Auto-Tuning is still unsatisfactory, the following guidelines can be applied for further adjustment of PID values.

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

PID Parameter Adjustment Guide



Effects of PID Adjustment

3.11 Manual Control

To enable manual control, ensure the LOCK parameter is set to NONE. Press and hold ⟲ for 4.2 seconds or until HAnd ---- (Hand Control) appear on the display. Press and hold ⟲ for 5 seconds or until the MANU indicator begin to flash. The lower display will show H---. The controller has now entered manual control mode. H--- Indicates the output control variable for output 1. The user can use the up-down keys to adjust the percentage values for the heating or cooling output.
The controller performs open-loop control as long as it stays in manual control mode. The manual mode menu can be reached by pressing ▼⟲ keys also

3.11.1 Exit Manual Control

Pressing the ▲ + ▼ key will revert the controller to its normal display mode.

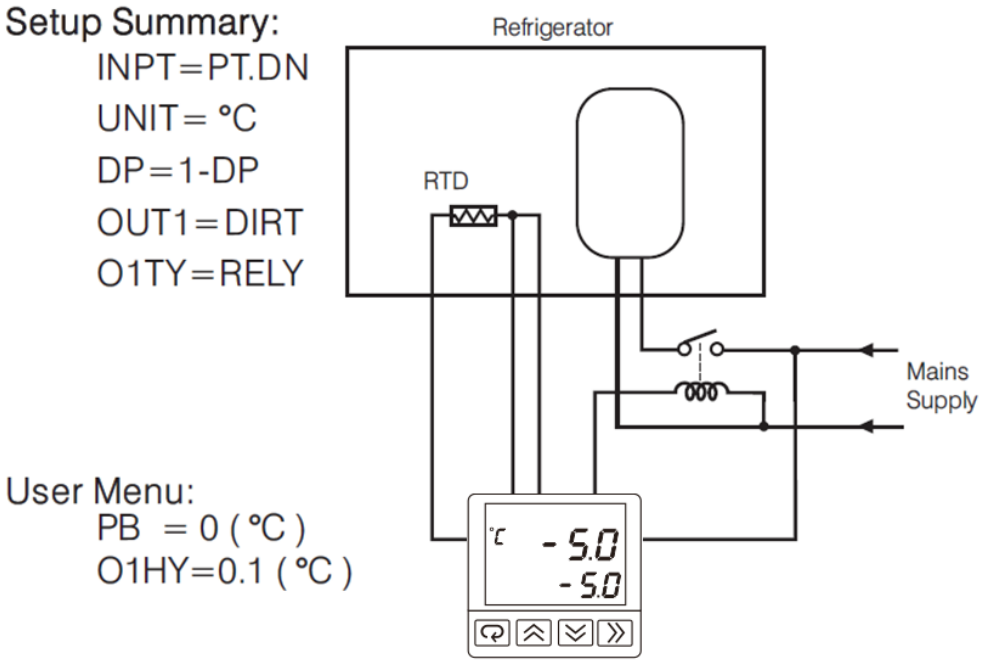
3.12 Data Communication

The controllers support RS-485 Modbus RTU protocol for data communication. Using a PC for data communication is the most economical way. The signal is transmitted and received through the PC communication Port. Since a standard PC can't support an RS-485 port, a network adaptor such as an RS232 to RS485 Converter or USB to Serial Converter must be used to convert RS-485 to RS-232 or USB for a PC.

4 Applications

4.1 Cool Only Control

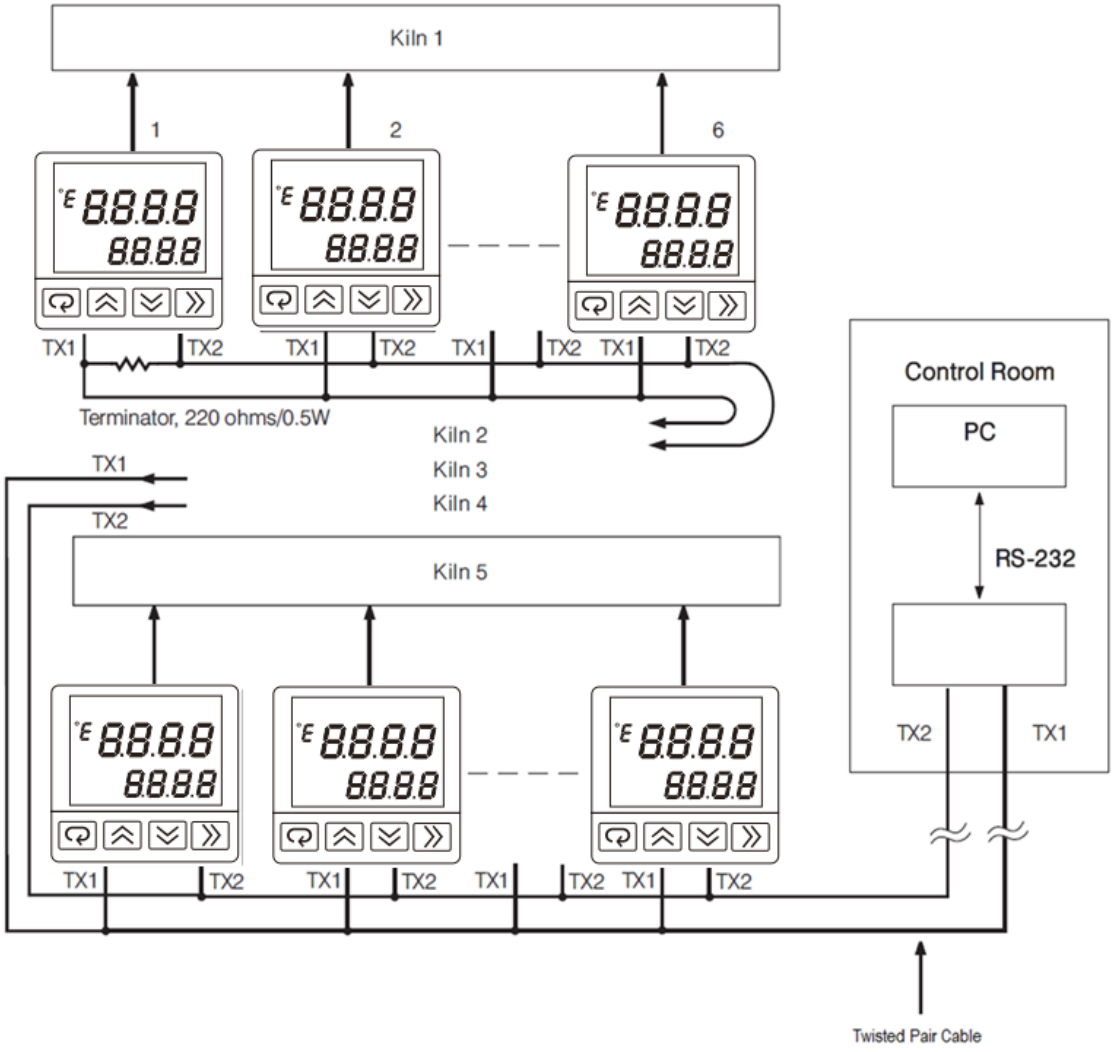
The E62 Controller is used to control a refrigerator at a temperature below 0°C. Since the required temperature is lower than the ambient temperature, a cooling action is required. Hence, select DIRT for OUT1. Since output 1 is used to drive a magnetic contactor, O1TY is set to RELY. A small temperature oscillation is tolerable; therefore, use ON-OFF control to reduce the overall wear and cost. To achieve ON-OFF control, PB is set to zero and O1HY is set to 0.1°C.



Cooling Control

4.2 RS 485 Communication in Controller

A Tile making plant has 5 production lines. Each production line is equipped with 6 Controllers to control the temperature for the Kiln. The foreman wants to be able to program the controllers and monitor the process in the control room to improve quality and productivity. A cost-effective solution for the above application is to use 30 controllers with RS-485 communication plus a converter and PC based software for this application.
The system is installed as shown in the following diagram.



RS-485 Application

5 Calibration

⚠ Do not proceed through this section unless there is a definite need to re-calibrate the controller. All previous calibration data will be lost. Do not attempt recalibration unless you have appropriate calibration equipment. If calibration data is lost, you will need to return the controller to your supplier who may charge you a service fee to re-calibrate the controller.

⚠ Entering the calibration mode will break the control loop. Make sure that the system is allowable to apply the calibration mode.

5.1 Equipment Required Before Calibration

1. A high accuracy calibrator (Fluke 5520A Calibrator recommended) with the following functions
   - ❖ 0 - 100 mV millivolt source with 0.005 % accuracy
   - ❖ 0 - 10 V voltage source with 0.005 % accuracy
   - ❖ 0 - 20 mA current source with 0.005 % accuracy
   - ❖ 0 - 300Ω resistant source with 0.005 % accuracy
2. A test chamber providing 25°C - 50°C temperature range
3. A switching network (SWU16K, optional for automatic calibration)
4. A calibration fixture equipped with programming units (optional for automatic calibration)
5. A PC installed with calibration software (optional for automatic calibration)

The calibration procedures described in the following section are step by step manual procedures. Since a controller needs 30 minutes to warm up before calibration, calibrating the units one by one is quite inefficient. An automatic calibration system for small quantity as well as for an unlimited quantity is available upon request.

5.1.1 Manual Calibration Procedure

Set the Lock parameter to the unlocked condition (LOCK= 0). Press and hold the scroll key until  appears on the display, then release the scroll key. Press the scroll key for 2-3 seconds then release, the display will show  and the unit will enter the calibration mode.

5.1.1.1 Calibrate Zero of A to D Converter

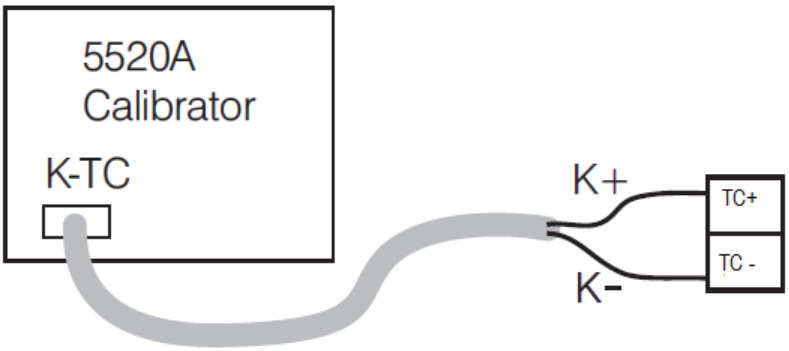
Short the thermocouple input terminals (TC+, TC-) and select the input type as K type Thermocouple in the INPT parameter in bASE menu configuration. Press and hold the scroll key until CAL, appears on the display, then release the scroll key. Press the scroll key for 2-3 seconds then release, the display will show AdLo and the unit will enter the calibration mode Then press scroll key for at least 5 seconds. The display will blink a moment and a new value is obtained. If the display didn't blink or the obtained value is equal to -199.9 or 199.9, then the calibration failed.

5.1.1.2 Calibrate Gain of A to D Converter

Select the input type as K type Thermocouple in the INPT parameter in bASE menu configuration. Press and hold the scroll key until CAL, appears on the display, then release the scroll key. Press the scroll key for 2-3 seconds then release, the display will show AdLo and the unit will enter the calibration mode. Press scroll key to navigate to AdHi. Send a 60-mV signal to the thermocouple input terminals with the correct polarity. Press scroll key for at least 5 seconds. The display will blink a moment and a new value is obtained. If the display didn't blink or the obtained value is equal to -199.9 or 199.9, then the calibration fails.

5.1.1.3 Calibrate Offset of Cold Junction Compensation

Setup the equipment according to the following diagram for calibrating the cold junction compensation. Note that a K type thermocouple must be used.



Cold Junction calibration Setup

Let controller sit at least 20 minutes in a room temperature of 25±3°C. The 5520A calibrator is to be configured as a K type thermocouple output with internal compensation. Send a 0.00°C signal to the controller.

Select the input type as K type Thermocouple in the INPT parameter in bASE menu configuration. Press and hold the scroll key until CAL, appears on the display, then release the scroll key. Press the scroll key for 2-3 seconds then release, the display will show AdLo and the unit will enter the calibration mode. Press scroll key to navigate to CJLo. Press up/down key to obtain 0.00. Press the scroll key for at least 5 seconds. The display will blink a moment and a new value is obtained. If the display didn't blink or the obtained value is equal to -5.00 or 40.00, then the calibration failed.

5.1.1.4 Calibrate RTD Input

Select the input type as PT100 RTD in the INPT parameter in bASE menu configuration. Press and hold the scroll key until CAL, appears on the display, then release the scroll key. Press the scroll key for 2-3 seconds then release, the display will show AdLo and the unit will enter the calibration mode. Press scroll key to navigate to rtdL. Send a 100 Ω signal to the RTD input terminals (PTA, PTB, PTB) according to the connection. Press the scroll key for at least 5 seconds. The display will blink a moment, otherwise, the calibration failed.

Press scroll key and the display will navigate to rtdH. Change the resistance value to 300Ω. Press scroll key for at least 5 seconds. The display will blink a moment and two values are obtained for RTDH and RTDL. If the display didn't blink or the obtained value is equal to -199.9 or 199.9, then the calibration failed.

6 Communication

This chapter explains the Modbus Communication protocol of the controller using RS-485 communication. This supports only RTU mode. Data is transmitted as 8-bit binary bytes with 1 start bit,1 stop bit and optional parity checking (None, Odd, Even). Baud rate may be set to 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600 and 115200 BPS.

6.1 Functions Supported

Only function code 03,06 and 16 are available for the controllers. The message formats for each function code are described as follows.

6.1.1 Function Code 03: Read Holding Registers

Query (From Master)	Slave Address (1~247)	Response (From Slave)	Slave Address (1~247)
	Function Code (03)		**Function Code (03)**
	Starting Address of Register Hi (00)		Byte Count
	Starting Address of Register Lo (00~73)		Data1 Hi
	No of Words Hi (00)		Data1 Lo
	No of Words Lo (1~74)		Data2 Hi
	CRC16 Hi		Data2 Lo
	CRC16 Lo		…
			Data ‘n’ Hi
			Data ‘n’ Lo
			CRC16 Hi
			CRC16 Lo

Function Code 03

6.1.2 Function Code 06: Pre-Set Single Register

Query (From Master)	Slave Address (1~247)	Response (From Slave)	Slave Address (1~247)
	Function Code (06)		**Function Code (06)**
	Starting Address of Register Hi (00)		Starting Address of Register Hi (00)
	Starting Address of Register Lo (00~73)		Starting Address of Register Lo (00~73)
	Data Hi		Data Hi
	Data Lo		Data Lo
	CRC16 Hi		CRC16 Hi
	CRC16 Lo		CRC16 Lo

Function Code 06

6.1.3 Function Code 16: Pre-Set Multiple Register

Query (From Master)	Slave Address (1~247)			Response (From Slave)	Slave Address (1~247)		
	Function Code (16)				**Function Code (16)**		
	Starting Address of Register Hi (00)				Starting Address of Register Hi (00)		
	Starting Address of Register Lo (00~73)				Starting Address of Register Lo (00~73)		
	No of Words Hi (00)				No of Words Hi (00)		
	No of words Lo (1~74)				No of words Lo (1~74)		
	Bytes Count (2~148)				Bytes Count (2~148)		
	Data1	Hi			Data1	Hi	
	Data1	Lo			Data1	Lo	
	Data2	Hi			Data2	Hi	
	Data2	Lo			Data2	Lo	
	…				…		
	Data	’n’	Hi		Data	’n’	Hi
	Data	’n’	Lo		Data	’n’	Lo
	CRC16	Hi			CRC16	Hi	
	CRC16	Lo			CRC16	Lo	

Function Code 16

6.2 Exception Responses

If the controller receives a message which contains a corrupted character (parity check error, framing error etc.), or if the CRC16 check fails, the controller ignores the message. However, if the controller receives a syntactically correct message which contains an illegal value, it will send an exception response, consisting of five bytes as follows:

Slave address + offset function code + exception code + CRC16 Hi +CRC16 Lo

Where the offset function code is obtained by adding the function code with 128 (i.e. function 3 becomes H'83), and the exception code is equal to the value contained in the following table.

Exception Code	Description	Reason
1	Bad Function Code	The function code is not supported by the controller
2	Illegal Data Addresses	Register address out of range
3	Illegal Data Value	Data value out of range or attempt to write a read-only or protected data

Exception Code

6.3 Parameter Mapping

The parameter mapping of Modbus address is available in section 1.9

6.4 Error Code

The description of the Error code is explained below

Error Code	Display Symbol	Description & Reason	Corrective Action
10	ER10	**Communication error:** bad function code	Correct the communication software to meet the protocol requirements.
11	ER11	**Communication error:** register address out of range	Do not issue an over-range address of the register to the slave
14	ER14	**Communication error:** attempt to write a read-only data	Do not write read-only data or protected data to the slave.
15	ER15	**Communication error:** write a value which is out of range to a register	Do not write an over-range data to the slave register
26	ATER	**Auto-Tuning Error:** Failed to perform Auto-Tuning function	- Auto-Tuning process exceeds 3600 secs. The PID values obtained after Auto-Tuning process are out of range. Retry Auto-Tuning. - Do not change the SetPoint value during Auto-Tuning process. - Use manual tuning instead of Auto-Tuning process. - Do not set the value as zero for TI & PB.
29	EEPR	EEPROM can't be written correctly	Return to the original manufacturer for repair.
30	CJER	Cold junction compensation for Thermocouple malfunction	Return to the original manufacturer for repair.
39	SBER	Input sensor break	Replace the input sensor.
40	ADER	A to D converter or related component(s) malfunction	Return to the original manufacturer for repair.

Error Code

6.5 Mode

The Value of the Mode Register is as below.

Mode Value	Mode
H'000X	Normal mode
H'010X	Calibration mode
H'020X	Auto-Tuning mode
H'030X	Manual control mode
H'040X	Failure mode
H'0X00	Alarm status 1 & 2 off
H'0X01	Alarm 1 status on
H'0X02	Alarm 2 status on

Operation Mode

6.6 Command Mode

The Value of the Command Mode and job registers are as below.

Command Mode Value		Mode	Description	Job1 Value			Function Code	
Dec	Hex				Dec	Hex	06	16
26680	6838	Write Date	Set Date Low:0 High:3719 Date =(Y*12+M) *31+D Year=0…9→Y=0…9 Month=1…12→M=0…11 Day=1…31→D=0…30	[DATE]	[DATE]	[DATE]		✓
26665	6829	Calibration Mode	Calibrate ADLO	ADLO	52	0034		✓
			Calibrate ADHI	ADHI	53	0035		✓
			Calibrate RTDL	RTDL	54	0036		✓
			Calibrate RTDH	RTDH	55	0037		✓
			Calibrate CJLO	CJLO	56	0038		✓
26664	6828	Auto-tuning Mode	Go to auto-tuning mode	…	…	…	✓	✓
26663	6827	Manual Mode	Go to manual mode	…	…	…	✓	✓
26661	6825	Reset	Do same action as Reset key by holding ▲ + ▼ keys sync	…	…	…	✓	✓

Command Mode

When the value of the Command Mode Register is 26663 then the MV1 registers can be read and write. Once the command mode register value is 26661 the MV1 registers becomes read only.

6.7 PROG Code

The Program Code is defined in the below table.

Program Code	Model No
67.XX	E62

Program Code

6.8 Communication Examples

6.8.1 Read PV, SV and MV1

Send the following command to the controller via the communication port

	03	00	H'40	H'00	H'03	HI	LO
Slave Address	Function Code	Starting Address		No of Words		CRC16	

6.8.2 Perform Reset Function

Query

	06	00	H'48	H'68	H'25	HI	LO
Slave Address	Function Code	Register Address		Data Hi /Lo		CRC16	

6.8.3 Enter Auto-Tuning Mode

Query

	06	00	H'48	H'68	H'28	HI	LO
Slave Address	Function Code	Register Address		Data Hi /Lo		CRC16	

6.8.4 Enter Manual Control Mode

Query

	06	00	H'48	H'68	H'27	HI	LO
Slave Address	Function Code	Register Address		Data Hi /Lo		CRC16	

6.8.5 Read All Parameters

Query

	03	00	00	H'00	H'4A	HI	LO
Slave Address	Function Code	Starting Address		No of Words		CRC16	

6.8.6 Calibrate ADLO

	H'10	00	H'48	00	02	04	H'68	H'29	00	H'34	HI	LO
Slave Address	Function Code	Register Address		No of Words		Bytes Count	Data Hi /Lo		Data Hi /Lo		CRC16	

-Please install 20A circuit breaker on the power supply end
-To remove the dust please use the dry cloth
-The installation that the safety of any system incorporating the equipment is the responsibility of the assembler of the system
-If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired
-Do not cover the cooling vents to maintain airflow
-Beware not to over-tighten the terminal screws. For E62 should not exceed 1 N-m (2 Kgf-cm), temperature Min.60°C, use copper conductors only.

-Veuillez installer un disjoncteur 20A à l'extrémité de l'alimentation
-Pour enlever la poussière, veuillez utiliser le chiffon sec
-L'installation que la sécurité de tout système incorporant l'équipement est la responsabilité de l'assembleur du système
-Si l'équipement est utilisé d'une manière non spécifiée par le fabricant, le la protection fournie par l'équipement peut être altérée
-Ne couvrez pas les évents de refroidissement pour maintenir le flux d'air
-Attention à ne pas trop serrer les vis des bornes. Pour E62 et R22 ne doivent pas dépasser 1 N-m (8,9 Lb-in ou 10,2 Kgf-cm), température Min.60°C, utiliser uniquement des conducteurs en cuivre.