¼ DIN Size Universal
Single Loop Process Controller

neuro 202L Plus

Single Loop Uni-Directional/Bi-Directional Control
Built-in 16 Segment Ramp/Soak Profile
Optional Remote/Auxiliary Setpoint Input
Alarms, Retransmission & RS485 Serial Outputs

User Manual

CONTENTS

¼ DIN Size Universal Single Loop Process Controller

Section 1
FRONT PANEL LAYOUT

The controller front panel comprises of Digital Readouts, LED Indicators and Push Button Keys as shown in Figure 1.1 below.

Figure 1.1
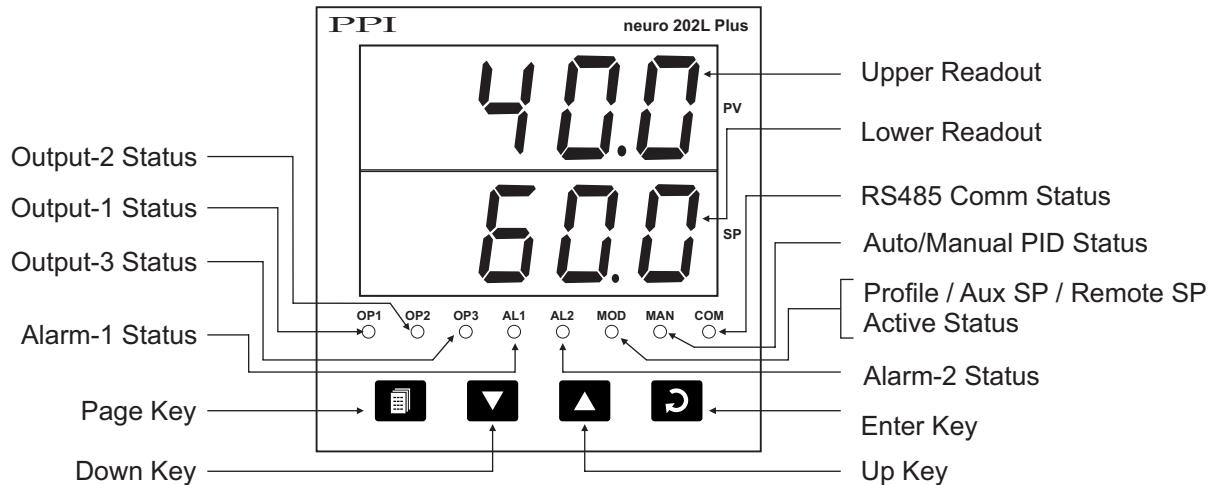
READOUTS

The Upper Readout is a 4 digit, 7-segment Luminous Green LED display and usually displays the PV (Process Value). In Set-up Mode, the Upper Readout displays parameter values/options.

The Lower Readout is a 4 digit, 7-segment Luminous Green LED display and usually displays Setpoint Value or % Output Power. In Set-up Mode, the Lower Readout displays parameter names (prompts) .

INDICATORS

The front panel indicators are LED's that show various statuses as listed in Table 1.1 below.

Table 1.1

Indicator	Status
OP1, OP2, OP3	Indicate Output-1, Output-2 & Output-3 Relay/SSR ON/OFF status. Remains OFF if the selected output is DC Linear (mA / V).
AL1, AL2	Alarm-1 & Alarm-2 Status. Flashes while the alarm is active.
MOD	Glows while Profile, Auxiliary SP or Remote SP is active.
MAN	• Glows while the controller is in Manual power output mode. • Remains OFF if Automatic (PID). Standby or Profile mode is active.
COM	RS485 Communication Status. Flashes when data is being exchanged with Master Device.

KEYS

There are four tactile keys provided on the front panel for configuring the controller, setting-up the parameter values and selecting Operation Modes. Refer Table 1.2 for detailed key operations.

Table 1.2

Symbol	Key	Function
	PAGE	Press to enter or exit set-up mode.
▼	DOWN	Press to decrease the parameter value. Pressing once decreases the value by one count; keeping pressed speeds up the change.
▲	UP	Press to increase the parameter value. Pressing once increases the value by one count; keeping pressed speeds up the change.
↺	ENTER	Press to store the set parameter value and to scroll to the next parameter on the PAGE.

Section 2
BASIC OPERATION

POWER-UP

Upon power-up, all displays and indicators are lit on for approximately 3 seconds. This is followed by the indication of the controller model name $\boxed{n.202}$ on the Upper Readout and the firmware version (e.g. $\boxed{01.10}$) on the Lower Readout, for approximately 1 second.

MAIN DISPLAY MODE

After the Power-up display sequence, the Upper Readout starts showing the measured PV (Process Value) and the Lower Readout displays the Setpoint Value. This is the MAIN Display Mode that shall be used most often.

% Output Power Indication

In PID control mode, the Lower Readout can be toggled using ENTER key to indicate either % output power or setpoint value (SP). The output power is indicated with the left most digit showing 'P', 'H' or 'C' depending upon uni-directional (Heat or Cool) or bi-directional (Heat and Cool) control mode. Refer Figure 2.1 below.

Figure 2.1

$\boxed{P \quad 32}$ $\boxed{H \quad 25}$ $\boxed{C \quad 12}$

Heat or Cool **P**ower   **H**eat Power   **C**ool Power

Uni-directional Control   **Bi-directional Control**

Adjusting SP (Control Setpoint)

If permitted at Supervisory Level, the SP value can be directly adjusted on the Lower Readout in the MAIN Display Mode. While the Lower Readout shows the control setpoint, step through the following sequence for adjusting the SP value :

1. Press and release UP or DOWN key once. The Lower Readout starts flashing.

2. Use UP/ DOWN keys to adjust the SP value.

3. Press and release ENTER key. The Lower Readout stops flashing and the new set value is registered and stored.

Tune Mode Indication (PID Control)

The Lower Readout flashes $\boxed{tUnE}$ while the controller is Tuning. Do not disturb the process or alter any parameter values while Tuning is in progress. The "Tune" message automatically disappears upon completion of Tuning procedure.

Profile Mode Indications

(Applicable for Ramp / Soak Profile version)

While a Profile Cycle is in progress, the front panel indicator 'MOD' flashes or glows steady. The steady glowing indicates that though the profile is active, it is currently in HOLD state. Also, the Lower Readout shows the Profile Setpoint instead of the control setpoint (SP). In PID control mode, the % Output Power can be viewed by toggling the Lower Readout using ENTER key.

The Lower Readout also facilitates viewing the information about the current profile segment viz.; the Segment Number, Segment Type (ramp / soak) and the Target Set-point (if current segment is ramp) or the Balance Time (if current segment is soak).

Upon keeping the UP key pressed, the Lower Readout shows the Segment Type and the Segment Number as shown in Figure 2.2 (a) & 2.2 (b).

Figure 2.2 (a)

Segment Type **Ramp**   Segment Number **2**

Figure 2.2 (b)

Segment Type **Soak**   Segment Number **3**

Upon keeping the DOWN key pressed, the Lower Readout shows the Target Set-point (if current segment is ramp) or the Balance Time (if current segment is soak) as shown in Figure 2.3 (a) & 2.3 (b).

Figure 2.3 (a)

Target Ramp Set-point

Figure 2.3 (b)

Balance Soak Time

Note :

If Profile Cycle is in progress; the controller is always in Auto Mode. That is, Manual Mode selection is suppressed.

Auxiliary Set-point Mode Indication

(Applicable for Auxiliary Set-point version)

The controller is supplied with 2 rear panel terminals for connecting remote switch (potential-free contacts) to toggle between Main Control Set-point (SP) & Auxiliary Control Set-point.

The "Open" & "Close" switch positions activate Main Control Set-point (SP) & Auxiliary Control Set-point, respectively.

The front panel indicator 'MOD' glows steady if Auxiliary Control Set-point is active.

Remote Set-point Mode Indication

(Applicable for Remote Set-point version)

The controller accepts DC Current (0/4-20 mA) or DC Voltage (0-5/10 V) as Remote Set-point Input. The parameter 'Remote Set-point' $\boxed{rnSP}$ on PAGE-17 must be set to 'Enable' for activating Remote Set-point feature. If this parameter is set to 'Disable' then the controller always treats Main Control Set-point (SP) as active.

The Controller also provides 2 rear panel terminals for connecting remote switch (potential-free contacts) to toggle between Main Control Set-point (SP) & Remote Control Set-point, if 'Enabled' on PAGE-17.
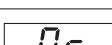
The "Open" & "Close" switch positions activate Remote Control Set-point & Main Control Set-point (SP), respectively.

The front panel indicator 'MOD' glows steady if Remote Control Set-point is active.

PV Error Indications

The PV Error Type is flashed on the Upper Readout. For different Error Types and the Causes, refer Table 2.1 below.

Table 2.1

Message	Error Type	Cause
Or	Over-range	PV above Max. Range
Ur	Under-range	PV below Min. Range
$OPEn$	Sensor Open	Thermocouple / RTD broken

CONTROL / ALARM STATUS UNDER PV ERROR CONDITIONS

a) The tuning, if in progress, is aborted.

b) The Profile Cycle, if in progress, enters in HOLD state.

c) Under *Over-range* or *Under-range* error condition, all the control outputs are switched off. However, under *Sensor Open* error, the PID control output power is maintained at the value set for the parameter "Sensor Break Output Power" on PAGE-12.

d) For Alarm activation, the under-range condition is treated as minimum PV, whereas the over-range and open conditions are treated as maximum PV. Thus, Process High, Positive Deviation Band and Window Band alarms activate under *Over-range/Open error*. Similarly, Process Low, Negative Deviation Band and Window Band alarms activate under *Under-range error*.

MANUAL MODE OPERATION

This operation mode is available only if the control action is PID and if the manual mode operation is permitted at supervisory level. In this mode, the controller operates in Open Loop mode wherein the % Output Power is manually adjusted by the operator. This mode is often used during process start-up to make sure that the process equilibrium is achieved before the control is transferred for subsequent automatic (Close Loop) control. The controller ensures a *bumpless* Auto / Manual transfer.

The manual mode can be activated or de-activated using ENTER key. While in manual mode, the Upper Readout shows PV and the Lower Readout shows % Power that can be adjusted using UP / DOWN keys.

Follow the steps below to enter (Activate) into Manual Mode and to revert to (De-activate) Automatic Mode.

1. Hold ENTER key pressed for approximately 2 seconds until front panel indicator MOD glows steady.

2. Release Enter key. The controller is now placed in Manual mode. The Upper Readout displays the PV and the Lower Readout displays the %Output Power.

3. Adjust the Output Power using the UP / DOWN keys. The Output Power is adjustable between the set Power Low and Power High limits.

To de-activate the Manual mode; hold the ENTER key pressed for approximately 2 seconds until the front panel indicator MOD turns off. The controller now enters into Auto control mode with the first power same as that was adjusted last while in Manual mode.

Notes:

1. The controller can not be placed in Manual mode while a Profile Cycle is in progress. If the controller is in manual mode and if profile start command is issued, the controller reverts to Auto Mode and initiates profile.

2. The Manual mode Activation / De-activation is suppressed while the Tuning is in progress. However, the Tuning procedure can be activated regardless of whether the controller is in Auto or Manual control mode.

3. While the controller is in Manual Mode, Standby Mode (explained later in this section) can not be entered and vice-a-versa.

4. If the power fails while the Manual Control Mode is active; upon resumption of power the controller continues to remain in Manual control mode with the last user set power.

STANDBY MODE

This mode allows the operator to put the controller in '*indication-only*' mode wherein all the output control signals as well as Alarm Relays are forced OFF. This may be desired prior to the start of a new process batch.

If enabled at supervisory level, the standby mode can be activated or de-activated by setting the parameter 'Standby' to *Yes* or *No*, respectively. The standby parameter is available on Operator PAGE-0.

Notes:

1. *The Standby mode and Tuning operation are mutually exclusive. If Standby mode is activated while the controller is tuning, the controller aborts tuning operation and enters Standby mode.*

2. *If the Power Supply to the controller is switched-off or a Power-failure occurs while the controller is operating in Standby mode; upon resumption of power, the controller continues to operate in Standby mode.*

OPERATOR PAGE AND PARAMETERS

The controller provides a separate page that contains parameters that require frequent settings by the operator. The page is called *Operator Page* and the parameters are called *Operator Parameters*. The availability of operator parameters is controlled at supervisory level and the parameter settings is not locked by the Master Lock.

Accessing Operator Page & Adjusting Parameters

Step through the following sequence to open the operator page and to adjust the operator parameter values.

1. Press and release PAGE key. The Lower Readout shows $\boxed{PAGE}$ (PAGE) and Upper Readout shows $\boxed{0}$ (0).

2. Press ENTER key. The Lower Readout shows prompt for the first available operator parameter and the Upper Readout shows value for the parameter.

3. Use UP / DOWN keys to adjust the value and then press ENTER key to store the set value and scroll to next parameter.

The controller automatically reverts to MAIN Display Mode upon scrolling through the last operator parameter. Alternatively, use PAGE key to return to MAIN Display Mode.

The operator parameters are described in Table 2.2. Note that the parameters presented on operator page depend upon the functions selected/enabled and supervisory level permissions.

Table 2.2

Parameter Description	Settings (Default Value)
ACTIVATE / DE-ACTIVATE STANDBY MODE $\boxed{Stby}$ This parameter is available and applicable only if Standby mode is enabled at supervisory level. Set the parameter value to 'Yes' or 'No' for entering and exiting the Standby mode, respectively.	$\boxed{no}$ No $\boxed{YES}$ Yes (Default : No)
CONTROL SETPOINT $\boxed{SP}$ This is the Main Setpoint value that the controller respects for the control purpose. This value is not applicable if running a profile or if the controller is tuning or in standby mode.	Setpoint Low Limit to Setpoint High Limit (Default : -199)
ALARM-1 SETPOINT $\boxed{A1.SP}$ The High or Low limit for Alarm-1 if the selected alarm type is Process High or Process Low.	Min. to Max. Range specified for the selected Input Type (Default : Min or Max Range)

Parameter Description	Settings (Default Value)
ALARM-1 DEVIATION BAND `A 1.dE` The deviation band value for Alarm-1 if the selected type is Deviation Band.	**For DC mA/mV/V** : -1999 to 9999 counts **For Thermocouples/RTD** : -999 to 999 or -199.9 to 999.9 (Default : 0)
ALARM-1 WINDOW BAND `A 1.bA` The window band value for Alarm-1 if the selected type is Window Band.	**For DC mA/mV/V** : 3 to 9999 counts **For Thermocouples/RTD** : 3 to 999 or 0.3 to 999.9 (Default : 0)
ALARM-2 SETPOINT `A2.SP` **ALARM-2 DEVIATION BAND** `A2.dE` **ALARM-2 WINDOW BAND** `A2.bA` Same as that described for Alarm-1 above but applied to Alarm-2.	Same as that for Alarm-1 above but applied to Alarm-2.
AUXILIARY CONTROL SETPOINT `AU.SP` *(Available for Auxiliary Set-point version)* The auxiliary setpoint value.	Setpoint Low Limit to Setpoint High Limit (Default : -1999)

Section 3
SET-UP MODE : ACCESS AND OPERATION

The various parameters are arranged in different groups, called PAGES, depending upon the functions they represent. Each group is assigned a unique numeric value, called PAGE NUMBER, for its access.

The parameters are always presented in a fixed format: The Lower Readout displays the parameter prompt (Identification Name) and the Upper Readout displays the set value. The parameters appear in the same sequence as listed in their respective sections.

SET-UP MODE

The Set-up Mode allows the user to view and modify the parameter values. Follow the steps below for setting the parameter values:

1. Press and release PAGE key. The Lower Readout shows PAGE and the Upper Readout shows page number 0. Refer Figure 3.1.

2. Use UP / DOWN keys to set the desired PAGE NUMBER.

3. Press and release ENTER key. The Lower Readout shows the prompt for the first parameter listed in the set PAGE NUMBER and the Upper Readout shows its current value. If the entered PAGE NUMBER is invalid (contains no parameter list or any associated function), the controller reverts to the MAIN Display Mode.

4. Press and release the ENTER key until the prompt for the required parameter appears on the Lower Readout. (The last parameter in the list rolls back to the first parameter).

5. Use UP / DOWN keys to adjust the parameter value. (The display flashes if UP key is pressed after reaching the maximum value or DOWN key is pressed after reaching the minimum value).

6. Press and release the ENTER key. The new value gets stored in the controller's non-volatile memory and the next parameter in the list is displayed.

The Figure 3.1 illustrates the example of altering the value for the parameter 'Control Action' from On-Off to PID.

Figure 3.1

Main *Display Mode*	*Default Page*	*Page Number*	*First Parameter on Page-12*	*New Parameter value*	*Next Parameter on Page-12*
Press PAGE key to enter Set-up Mode	Use UP/DOWN key to set the Page Number	Press ENTER key to open the Page	Use UP/DOWN keys to change the value	Press ENTER key to store the value & move to next parameter	
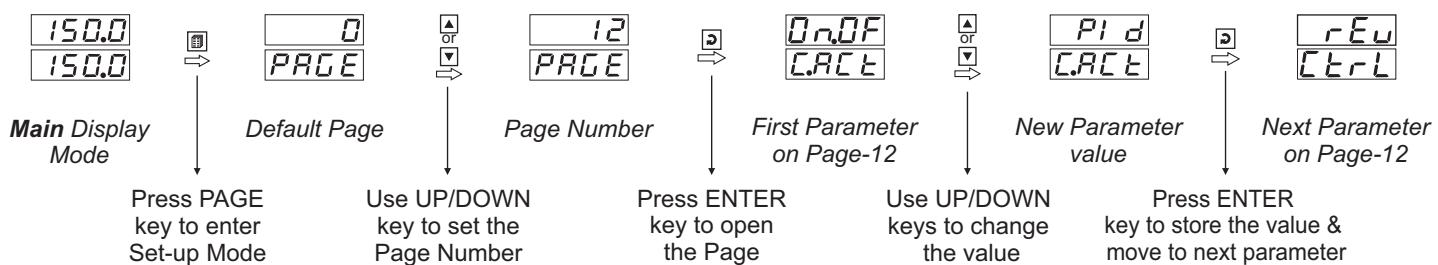
Notes

1. *Each page contains a fixed list of parameters that are presented in a pre-determined sequence. Note, however, that availability of a few parameters, called Conditional Parameters, depend upon the settings for some other parameters. For example, the parameter 'Control Hysteresis' for Output-1 is available only if, the set value for the parameter 'Control Action' is 'On-Off'.*

2. *To exit the set-up mode and return to the MAIN Display Mode, press and release PAGE key.*

3. *If no key is pressed for approximately 30 seconds, the set-up mode times out and reverts to the MAIN Display Mode.*

MASTER LOCKING

The controller facilitates locking all the PAGES (except Operator PAGE) by applying Master Lock Code. Under Locking, the parameters are available for *view only* and cannot be adjusted. The Master Lock, however, does not lock the operator parameters. This feature allows protecting the rather less frequently used parameters against any inadvertent changes while making the frequently used operator parameters still available for editing.

For enabling / disabling the Lock, step through the following sequence:

Locking

1. Press and release PAGE key while the controller is in the MAIN Display Mode. The Lower Readout shows PAGE and the Upper Readout shows 0.

2. Use UP / DOWN keys to set the Page Number to 123 on the Upper Readout.

3. Press and release ENTER key. The controller returns to the MAIN Display Mode with the Lock enabled.

The Figure 3.2 below illustrates the Locking procedure.

Figure 3.2

150.0		0		123		150.0
150.0		PAGE		PAGE		150.0
MAIN Display Mode		*Default Page*		*Locking Code*		*MAIN* Display Mode
	Press PAGE key to enter Set-up Mode		Use UP/DOWN key to set the 'Locking Code'		Press ENTER key to Lock & Return to Main Mode	
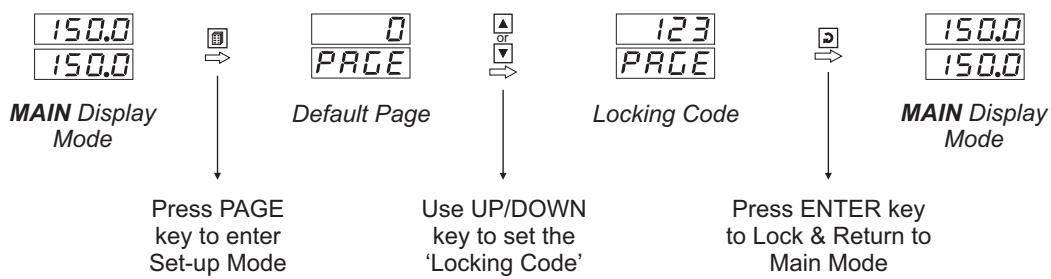
UnLocking

Repeat the Locking procedure twice for unlocking.

Section 4
PAGE-10 : CONTROL PARAMETERS

Refer Table 4.1 for the parameter descriptions and settings.

Table 4.1

Parameter Description	Settings (Default Value)
PROPORTIONAL BAND $\boxed{Pb}$ *(Available for PID Control only)* Sets proportional gain (% power per unit error). Defined in same units and resolution as that for PV.	1 to 9999 counts (Default : 500)
INTEGRAL TIME $\boxed{It}$ *(Available for PID Control only)* Sets integral time constant in seconds. Setting the value to 0, cuts-off integral action.	0 to 3600 Seconds (Default : 100 sec.)
DERIVATIVE TIME $\boxed{dt}$ *(Available for PID Control only)* Sets derivative time constant in seconds. Setting the value to 0, cuts-off derivative action.	0 to 600 Seconds (Default : 16 sec.)
CYCLE TIME $\boxed{Ct}$ *(Available for PID Control only)* Sets the total 'On + Off' time in seconds for time modulating power output through Output-1 Relay / SSR.	0.5 to 100.0 Seconds (in steps of 0.5 secs.) (Default : 10.0 sec.)
RELATIVE COOL GAIN $\boxed{rEL.C}$ *(Available for PID Control with bi-directional, that is, Heat-Cool mode)* Sets the ratio of cooling power to the heating power.	0.1 to 10.0 (Default : 1.0)
COOL CYCLE TIME $\boxed{C.Ct}$ *(Available for PID Control with bi-directional, that is, Heat-Cool mode)* Sets the On + Off cycle time in seconds for time modulating power output through Output-2 Relay / SSR.	0.5 to 100.0 Seconds (in steps of 0.5 secs.) (Default : 10.0 sec.)
HYSTERESIS $\boxed{HYSt}$ *(Available for On-Off or Pulsed On-Off Control only)* Sets differential (dead) band between On-Off switching for Output-1. Defined in same units and resolution as that for PV.	1 to 9999 counts (Default : 2)
PULSE TIME $\boxed{PL.t}$ *(Available for Pulsed On-Off Control only)* Sets the total 'On + Off' pulse time in seconds for Output-1 Relay / SSR output.	Pulse ON Time to 120.0 Seconds (Default : 2.0 sec.)

Parameter Description	Settings (Default Value)
PULSE-ON TIME `On.t` *(Available for Pulsed On-Off Control only)* Sets the ON pulse time in seconds for Output-1 Relay / SSR output.	0.1 to Value set for Pulse Time (Default : 1.0)
COOL HYSTERESIS `C.HYS` *(Available for On-Off or Pulsed On-Off Control with bi-directional mode)* Sets differential (dead) band between On-Off switching for Output-2. Defined in same units and resolution as that for PV.	1 to 9999 counts (Default : 2)
COOL PULSE TIME `C.PL.t` *(Available for Pulsed On-Off Control with bi-directional mode)* Sets the total 'On + Off' pulse time in seconds for Output-2 Relay / SSR output.	Cool ON Time to 120.0 Seconds (Default : 2.0)
COOL PULSE-ON TIME `C.On.t` *(Available for Pulsed On-Off Control with bi-directional mode)* Sets the ON pulse time in seconds for Output-2 Relay / SSR output.	0.1 to Value set for Cool Pulse Time (Default : 1.0)
HEAT POWER LOW `PL` *(Available for PID Control only)* Sets the minimum % output power limit for Output-1.	0 to Heat Power High (Default : 0)
HEAT POWER HIGH `PH` *(Available for PID Control only)* Sets the maximum % output power limit for Output-1 .	Heat Power Low to 100 (Default : 100)
COOL POWER LOW `C.PL` *(Available for PID Control with bi-directional, that is, Heat-Cool mode)* Sets the minimum % output power limit for Output-2.	0 to Cool Power High (Default : 0)
COOL POWER HIGH `C.PH` *(Available for PID Control with bi-directional, that is, Heat-Cool mode)* Sets the maximum % output power limit for Output-2.	Cool Power Low to 100 (Default : 100)

Section 5
PAGE 11 : ALARM AND RETRANSMISSION (RECORDER) PARAMETERS

Refer Table 5.1 for parameter description & settings.

Table 5.1

Parameter Description	Settings (Default Value)
ALARM-1 TYPE $\boxed{AL\_1}$ Selects the Alarm-1 activation type. Selecting 'None' disables the alarm and suppresses all the related parameters for Alarm-1.	$\boxed{nonE}$ None $\boxed{P\_Lo}$ Process Low $\boxed{P\_hi}$ Process High $\boxed{dE}$ Deviation Band $\boxed{bAnd}$ Window Band (Default : None)
ALARM-1 SETPOINT $\boxed{A1.SP}$ *(Available for Process High or Process Low Alarm-1 Type)* Sets Alarm limit independent of control setpoint for Alarm-1 activation. Defined in same units and resolution as that for PV.	Min. to Max. Range specified for the selected Input Type (Default : Min or Max Range)
ALARM-1 DEVIATION BAND $\boxed{A1.dE}$ *(Available for Deviation Band Alarm-1 Type)* Sets positive or negative deviation (offset) limit from control setpoint for High or Low Alarm-1 activation, respectively. Defined in same units and resolution as that for PV.	**For DC mA/mV/V** : -1999 to 9999 counts **For Thermocouples/RTD** : -999 to 999 or -1.999 to 999.9 (Default : 5)
ALARM-1 WINDOW BAND $\boxed{A1.bA}$ *(Available for Window Band Alarm-1 Type)* Sets symmetrical positive and negative deviation (offset) limits around control setpoint for both High and Low Alarm-1 activation. Defined in same units and resolution as that for PV.	**For DC mA/mV/V** : 3 to 9999 counts **For Thermocouples/RTD** : 3 to 999 or 0.3 to 999.9 (Default : 5)
ALARM-1 HYSTERESIS $\boxed{A1.HY}$ Sets differential (dead) band between Alarm-1 ON and OFF switching states. Units and resolution are same as that for PV.	**For DC mA/mV/V** : 1 to 9999 counts **For Thermocouples/RTD** : 1 to 999 or 0.1 to 999.9 (Default : 2)
ALARM-1 INHIBIT $\boxed{A1.h}$ Setting to 'Yes' suppresses Alarm-1 activation upon power-up or process start-up.	$\boxed{no}$ No $\boxed{YES}$ Yes (Default : No)

Parameter Description		Settings (Default Value)
ALARM-2 TYPE	AL_2	
ALARM-2 SETPOINT	$A2.SP$	
ALARM-2 DEVIATION BAND	$A2.dE$	
ALARM-2 WINDOW BAND	$A2.bA$	Same as that for Alarm-1 above but applied to Alarm-2.
ALARM-2 HYSTERESIS	$A2.HY$	
ALARM-2 INHIBIT	$A2.ih$	
Same as that described for Alarm-1 above but applied to Alarm-2.		
PV/SP SELECTION FOR RETRANSMISSION $trnS$ *(Available if Output-3 function is recorder)* Selects either Process Value (PV) or Control Setpoint (SP) for retransmission (recording).		Pu Process Value SP Setpoint (Default : Process Value)
RECORDER (RETRANSMISSION) LOW $rEC.L$ *(Available if Output-3 function is recorder)* Sets the minimum value (PV or SP) that shall correspond to the minimum recorder output signal level (0 mA or 4 mA or 0 V).		Min. to Max. Range Specified for the Selected Input Type (Default : -199)
RECORDER (RETRANSMISSION) HIGH $rEC.H$ *(Available if Output-3 function is recorder)* Sets the maximum value (PV or SP) that shall correspond to the maximum recorder output signal level (20 mA or 5 V or 10 V).		Min. to Max. Range Specified for the Selected Input Type (Default : 1376)

Section 6
PAGE 12 : INPUT/OUTPUT CONFIGURATION PARAMETERS

Refer Table 6.1 for parameter description & settings.

Table 6.1

Parameter Description	Settings (Default Value)
CONTROL ACTION `C.Act` Select appropriate Control Algorithm suited for process requirement.	`On.OF` On-Off `PULS` Pulsed On-Off `PId` PID (Default : PID)
CONTROL LOGIC `CtrL` Select Reverse (*heat* logic) or Direct (*cool* logic).	`rEu` Reverse `dir` Direct (Default : Reverse)
SETPOINT LOW LIMIT `SP.Lo` Set minimum permissible value for control setpoint.	Min. Range to Setpoint High for the selected Input Type (Default : -199)
SETPOINT HIGH LIMIT `SP.hi` Set maximum permissible value for control setpoint.	Setpoint Low to Max. Range for the selected Input Type (Default : 1376)
SENSOR BREAK OUTPUT POWER `Sb.OP` *(Available for PID control only)* In case of Thermocouple / RTD broken or disconnected, the controller outputs this power value under open loop condition.	0 to 100 % (Default : 0 %)
INPUT TYPE `inPt` Select Input type in accordance with the type of Thermocouple or RTD or Sensor / Transducer Output (mA/mV/V) connected for process value measurement.	Refer Table 6.2 (Default : Type K)
PV UNITS `Unit` *(Available for Thermocouple / RTD Inputs)* Selects temperature measurement units in °C or °F.	`°C` °C `°F` °F (Default : °C)
SIGNAL LOW `S.Lo` *(Available for DC linear mV/V/mA Inputs only)* The transmitter output signal value corresponding to PV RANGE LOW parameter value. Refer *Appendix-B : DC Linear Signal Interface* for details.	(see table below)

Input Type	Settings	Default
0 to 20 mA	0.00 to Signal High	0.00
4 to 20 mA	4.00 to Signal High	4.00
0 to 80 mV	0.00 to Signal High	0.00
Reserved	0.0 to Signal High	0.0
0 to 1.25 V	0.000 to Signal High	0.000
0 to 5 V	0.000 to Signal High	0.000
0 to 10 V	0.00 to Signal High	0.00
1 to 5 V	1.000 to Signal High	1.000

Parameter Description	Settings (Default Value)		
SIGNAL HIGH `5.Hi` *(Available for DC linear mV/V/mA Inputs only)* The transmitter output signal value corresponding to PV RANGE HIGH parameter value. Refer *Appendix-B : DC Linear Signal Interface* for details.	**Input Type** / **Settings** / **Default** table below:		

Input Type	Settings	Default
0 to 20 mA	Signal Low to 20.00	20.00
4 to 20 mA	Signal Low to 20.00	20.00
0 to 80 mV	Signal Low to 80.00	80.00
Reserved	Signal Low to 80.00	80.00
0 to 1.25 V	Signal Low to 1.250	1.250
0 to 5 V	Signal Low to 5.000	5.000
0 to 10 V	Signal Low to 10.00	10.00
1 to 5 V	Signal Low to 5.000	5.000

Parameter Description	Settings (Default Value)
PV RESOLUTION `rSLn` *(Available for DC linear mV/V/mA & RTD Inputs only)* Set the process value indication resolution (decimal point). All the resolution based parameters (Control Setpoint, Hysteresis, Alarm Setpoints etc.) then follow this resolution setting.	`1` → 1 `0.1` → 0.1 `0.01` → 0.01 `0.001` → 0.001 **Note** : 0.01 & 0.001 not available for RTD inputs (Default : 1)
PV RANGE LOW `r.Lo` *(Available for DC Linear Inputs)* Set process value corresponding to SIGNAL LOW parameter value. Refer *Appendix-B : DC Linear Signal Interface* for details.	-1999 to 9999 (Default : 0)
PV RANGE HIGH `r.hi` *(Available for DC Linear Inputs)* Set process value corresponding to SIGNAL HIGH parameter value. Refer *Appendix-B : DC Linear Signal Interface* for details.	-1999 to 9999 (Default : 1000)
OFFSET FOR PV `OFSt` This value is algebraically added to the measured PV to derive the final PV that is displayed and compared for alarm / control. Final PV = Measured PV + Offset	**For DC mA/mV/V** : 1 to 9999 counts **For Thermocouples/RTD** : 1 to 999 or 0.1 to 999.9 (Default : 0)
DIGITAL FILTER TIME CONSTANT `FiLt` Set the time constant, in seconds, for the low-pass digital filter applied to the measured PV. The filter helps smoothing/averaging the signal input and removing the undesired noise.	0.5 to 60.0 Seconds (in steps of 0.5 Seconds) (Default : 2.0 sec.)

Table 6.2

Option	What it means	Range (Min. to Max.)
tC_J	Type J Thermocouple	0 to +960°C / +32 to +1760°F
tC_K	Type K Thermocouple	-200 to +1376°C / -328 to +2508°F
tC_t	Type T Thermocouple	-200 to +385°C / -328 to +725°F
tC_r	Type R Thermocouple	0 to +1770°C / +32 to +3218°F
tC_S	Type S Thermocouple	0 to +1765°C / +32 to +3209°F
tC_b	Type B Thermocouple	0 to +1825°C / +32 to +3317°F
tC_n	Type N Thermocouple	0 to +1300°C / +32 to +2372°F
tC_E	Type E Thermocouple	-200 to +1000°C / -328 to +1832°F
rtd	3-wire, RTD Pt100	-199 to +600°C / -328 to +1112°F **or** -199.9 to +600°C / -199.9 to +999.9°F
0-20	0 to 20mA DC current	-1999 to +9999 units
4-20	4 to 20mA DC current	
0.080	0 to 80mV DC voltage	
rESu	Reserved	
1.25	0 to 1.25V DC voltage	
5.0	0 to 5.0V DC voltage	
10.0	0 to 10.0V DC voltage	
1-5	1 to 5.0V DC voltage	

Section 7
PAGE 13 : SUPERVISORY PARAMETERS

Refer Table 7.1 for parameter description & settings.

Table 7.1

Parameter Description	Settings (Default Value)
SELF-TUNE COMMAND `tUnE` *(Available for PID control only)* Set to 'Yes' to initiate a new tuning cycle or set to 'No' to abort a tuning operation in progress.	`no` No `YES` Yes (Default : No)
OVERSHOOT INHIBIT `oS.h` *(Available for PID control only)* Enabling this feature controls the rate of PV rise or fall upon process start-up in order to reach the control setpoint with minimum overshoot/undershoot possible.	`dSbL` Disable `EnbL` Enable (Default : Disable)
OVERSHOOT INHIBIT FACTOR `Oi h.F` *(Available for PID control with Overshoot Inhibit enabled)* This parameter adjusts the effectiveness of the Overshoot Inhibit feature. Increase the value if the overshoot is curbed but the PV takes longer to reach the SP. Decreases the value if the overshoot persists.	1.0 to 2.0 (Default : 1.0)
SP ADJUSTMENT ON LOWER READOUT `SP.Lr` Supervisory permission for control setpoint editing on Lower Readout. Set to 'Enable' for permission.	`dSbL` Disable `EnbL` Enable (Default : Enable)
SP ADJUSTMENT ON OPERATOR PAGE `SP.OP` Supervisory permission for control setpoint editing on Operator Page. Set to 'Enable' for permission.	`dSbL` Disable `EnbL` Enable (Default : Enable)
MANUAL MODE `HAnd` Supervisory permission for Auto/Manual mode selection. Set to 'Enable' for permission.	`dSbL` Disable `EnbL` Enable (Default : Disable)
ALARM SP ADJUSTMENT ON OPERATOR PAGE `AL.SP` Supervisory permission for Alarm setpoint adjustments on Operator Page. Set to 'Enable' for permission.	`dSbL` Disable `EnbL` Enable (Default : Disable)
STANDBY MODE `StbY` Supervisory control over availability of Standby (entry / exit) command on Operator Page. 'Enable' for availability.	`dSbL` Disable `EnbL` Enable (Default : Disable)

Parameter Description	Settings (Default Value)
PROFILE ABORT COMMAND ON PAGE-1 `Abrt` Supervisory control over availability of Profile Abort command on Page-1. 'Enable' for availability.	`dSbL` Disable `EnbL` Enable (Default : Disable)
CONTROLLER ID NUMBER `Id` Unique numeric code assigned to the controller for identification by the host. Set the value as required by the host.	1 to 127 (Default : 1)
BAUD RATE `bAUd` Communication speed in 'Bits per Second'. Set the value to match with the host baud rate.	`4.8` 4800 `9.6` 9600 `19.2` 19200 (Default : 9.6)
COMMUNICATION PARITY `PAri` One of the communication error trapping features. Select the data packet parity as implemented by the host protocol.	`nonE` None `EuEn` Even `Odd` Odd (Default : Even)
COMMUNICATION WRITE ENABLE `Com.E` Setting to 'No' disallows the host to set or modify any parameter value. The host, however, can read the values.	`no` No `YES` Yes (Default : No)

Section 8

PAGE-16, PAGE-14, PAGE-1 : PROFILE PARAMETERS

Note : This Section is applicable only if the Controller is supplied with "Setpoint Profile" option.

The profile utility requires profile configuration and profile settings. Also, the controller facilitates on-line alterations of the parameters pertaining to the running segment. To simplify profile operation, the rather large list of parameters has been split in multiple pages as under.

Profile Configuration : PAGE-16

Use this list of parameters to configure the profile for number of segments, number of cycles (repeats), output(s) status upon profile completion and power fail recovery method. Refer Table 8.1 below.

Table 8.1

Parameter Description	Settings (Default Value)
PROFILE MODE ENABLE $\boxed{Pr\text{-}OF}$ Enable or Disable the setpoint profile feature. If disabled, all the profile related parameters and commands are suppressed.	$\boxed{dSbL}$ Disable $\boxed{EnbL}$ Enable (Default : Disable)
NUMBER OF SEGMENTS $\boxed{n.SEG}$ Set the number of segments to constitute the setpoint profile.	1 to 16 (Default : 16)
NUMBER OF REPEATS $\boxed{n.rPt}$ Set the number of times the profile is to be repeated (cycled) before end of profile. After completion of the last segment of the running profile cycle, the profile restarts from the first segment.	1 to 9999 (Default : 1)
COMMON HOLDBACK $\boxed{Co.Hb}$ The profile allows either *Common* or *Independent* 'Holdback Type' and 'Holdback Value' for all profile segments. Set this parameter to 'Yes' if common settings are desired for the Holdback feature.	$\boxed{no}$ No $\boxed{YES}$ Yes (Default : Yes)
OUTPUT OFF $\boxed{OP.OF}$ Set to 'Yes' if after the end of profile, all the control outputs are to be *forced Off* till the issuance of next profile Start command.	$\boxed{no}$ No $\boxed{YES}$ Yes (Default : No)
POWER FAIL STRATEGY $\boxed{Pr.FL}$ Selecting *Abort* terminates a running profile in case of power failure. Selecting *Continue* resumes : (a) The ramp segment execution with the profile setpoint prevailing at the time of power failure. (b) The soak segment execution for the balance time.	$\boxed{Abrt}$ Abort $\boxed{Cont}$ Continue (Default : Continue)

Profile Settings : PAGE-14

Note : The parameters on this page are available only if the profile feature is enabled on Page-16.

Use this list of parameters to set individual profile segment for the target setpoint, time interval, holdback type and value. Refer Table 8.2 below.

Table 8.2

Parameter Description	Settings (Default Value)
SEGMENT NUMBER $\boxed{5E\mathcal{L}.n}$ Select profile segment number for editing the following parameters.	1 to 16 (Default : 1)
TARGET SETPOINT $\boxed{t\_5P}$ Set the Target (End) value for the selected profile segment number.	Min. to Max. Range specified for the selected Input Type (Default : -199)
TIME INTERVAL $\boxed{t\,inE}$ Set the time duration of ramping or soaking for the selected profile segment number.	0 to 9999 Minutes (Default : 0)
HOLDBACK TYPE $\boxed{Hb.tY}$ **Note : If the parameter 'Common Holdback' is set to 'Yes' on Page-16, then this parameter appears only for segment number 1 and is applied to all other segments.** Disable the Holdback Band (Set None) or set the scope (up, down or both) for the profile holdback feature.	$\boxed{nonE}$ None $\boxed{UP}$ Up $\boxed{dn}$ Down $\boxed{both}$ Both (Default : None)
HOLDBACK VALUE $\boxed{Hb.uL}$ **Note : If the parameter 'Common Holdback' is set to 'Yes' on Page-16, then this parameter appears only for segment number 1 and is applied to all other segments.** Set the band (deviation from profile setpoint) value for the profile holdback feature.	**For DC mA/mV/V** : 1 to 9999 counts **For Thermocouples/RTD** : 1 to 999 or 0.1 to 999.9 (Default : 1)

On-line Alterations : PAGE-1

Note : The parameters on this page are available only if the profile feature is enabled on Page-16.

The profile facilitates altering the running segment of the profile for the current execution without affecting the profile settings on PAGE-14. That is, the changes made to the parameter values become applicable for the current execution of the segment only. This allows adjusting the profile, if required, in accordance to some unexpected process behavior. Refer Table 8.3.

Table 8.3

Parameter Description	Settings (Default Value)
END OF PROFILE ACKNOWLEDGE `EOP.A` This parameter is available if Output-2 and / or Output-3 Relay / SSR is programmed to turn ON as an 'End Of Profile' signal. Set this parameter to 'Yes' (after end of profile is reached) to acknowledge the alarm and to turn OFF the output.	`no` No `YES` Yes (Default : No)
PROFILE START COMMAND `Strt` **PROFILE ABORT COMMAND** `Abrt` These parameters are mutually exclusive. Use *Start* command to commence a new profile cycle and *Abort* command to abort / terminate a running profile cycle. Set the value to 'Yes' to issue the command.	`no` No `YES` Yes (Default : No)
PROFILE PAUSE COMMAND `PAUS` This parameter is available while a profile cycle is in progress and can be used to Pause (halt) the profile as long as desired. Set the command to 'Yes' for Pausing and 'No' to continue. Under Pause state, the ramp segment stops ramping while the soak segment stops counting down the timer.	`no` No `YES` Yes (Default : No)
SEGMENT SKIP COMMAND `SYIP` Use this command to terminate a running profile segment and to move to the next segment. Skipping the last segment will result in completion of the current profile cycle.	`no` No `YES` Yes (Default : No)
The following parameters allow altering the running segment values (Time Interval, Holdback Band Type & Holdback Band Value) and Number of Repeats. The alterations made on the running segment are applicable only for the current execution of the profile cycle.	
SEGMENT TIME INTERVAL `tinE` The time interval for a *Ramp* segment actually determines the RATE at which the setpoint steps towards the target setpoint. Thus, altering the time interval shall immediately affect the 'Ramp Rate' for the current segment. If the time interval is modified for the *Soak* segment then the time elapsed so far is ignored and the soak timer starts counting down to 0 from the altered time interval value.	0 to 9999 Minutes
SEGMENT HOLDBACK TYPE `Hb.ty` The modified Holdback Band Type is applied immediately on the current segment.	`nonE` None `UP` Up `dn` Down `both` Both

Parameter Description	Settings (Default Value)
SEGMENT BAND VALUE `Hb.uL` The modified Holdback Band Value is applied immediately on the current segment.	**For DC mA/mV/V** : 1 to 9999 counts **For Thermocouples/RTD** : 1 to 999 or 0.1 to 999.9
PROFILE REPEAT COUNTER `b.rPt` This parameter shows the remaining profile cycles. If the value is altered, the repeat counter starts counting down from the new set value.	1 to 9999
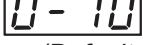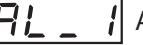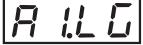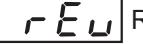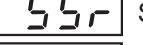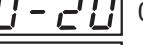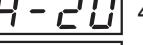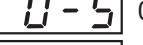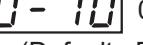
Section 9
PAGE-15 : OP1, OP2 & OP3 FUNCTION PARAMETERS

Refer Table 9.1 for parameter description & settings.

Table 9.1

Parameter Description	Settings (Default Value)
OUTPUT-1 TYPE `OP 1.t` Select the type in accordance with the hardware configuration for Output-1 (OP1).	`rLY` Relay `SSr` SSR `0-20` 0 - 20mA `4-20` 4 - 20mA `0-5` 0 - 5V `0-10` 0 - 10V (Default : Relay)
OUTPUT-2 FUNCTION SELECTION `OP2.F` *(Applicable for Output-2 hardware module, if fitted)* Select the function that will utilize Output-2 module as output. *(The EOP option is available for Ramp/soak Profile version only. Refer Appendix-C for End-of-Profile Event Output.)	`nonE` None `AL_1` Alarm-1 `EOP` *End-of-Profile `C.Con` Cool Control (Default : None)
ALARM-1 LOGIC `A 1.LG` *(Available if Output-2 function is Alarm-1 Output)* Select 'Normal' if Alarm-1 is to activate an Audio / Visual alarm. Select 'Reverse' if Alarm-1 is to Trip the system.	`norm` Normal `rEu` Reverse (Default : Normal)
OUTPUT-2 TYPE `OP2.t` *(Available if Output-2 function is Cool Control)* Select the type in accordance with the hardware configuration for Output-2 (OP2).	`rLY` Relay `SSr` SSR `0-20` 0 - 20mA `4-20` 4 - 20mA `0-5` 0 - 5V `0-10` 0 - 10V (Default : Relay)
OUTPUT-2 EOP STATUS `O2.E.S.` *(Available if Output2 function is End-of-Profile)* Selecting 'ON' keeps the Output-2 OFF while profile is in progress and turns ON at the end of profile. Selecting 'OFF' keeps the Output-2 ON while profile is in progress and turns OFF at the end of profile.	`On` ON `OFF` OFF (Default : ON)

Parameter Description	Settings (Default Value)
OUTPUT-2 EOP TIME UNITS `O2.Ut` *(Available if Output-2 function is End-of-Profile & EOP Status is set to 'ON')* Select time units for the parameter 'Output-2 EOP Time Interval'.	`SEC` Seconds `min` Minutes `HoUr` Hours (Default : Seconds)
OUTPUT-2 EOP TIME INTERVAL `O2.E.t.` *(Available if Output-2 function is End-of-Profile & EOP Status is set to 'ON')* Set the time (in selected units) for which the Output-2 status after the End-of-Profile is to be maintained. (For indefinite time interval, set the value to 0).	0 to 9999 (Default : 0)
OUTPUT-3 FUNCTION SELECTION `OP3.F` *(Applicable for Output-3 hardware module, if fitted)* Select the function that will utilize Output-3 module as output. *(The EOP option is available for Ramp/soak Profile version only. Refer Appendix-C for End-of-Profile Event Output.)	`nonE` None `AL_2` Alarm-2 `EOP` *End Of Profile `rEC` Recorder (Default : Alarm)
ALARM-2 LOGIC `A2.LG` *(Available if Output-3 function is Alarm-2 Output)* Select 'Normal' if Alarm-2 is to activate an Audio / Visual alarm. Select 'Reverse' if Alarm-2 is to Trip the system.	`norm` Normal `rEu` Reverse (Default : Normal)
OUTPUT-3 EOP STATUS `O3.E.S.` *(Available if Output-3 function is End-of-Profile)* Definition same as Output-2 EOP Status .	`On` ON `OFF` OFF (Default : ON)
OUTPUT-3 EOP TIME UNITS `O3.Ut` *(Available if Output-3 function is End-of-Profile & Event Status is set to 'ON')* Definition same as Output-2 EOP Time Units.	`SEC` Seconds `min` Minutes `HoUr` Hours (Default : Seconds)
OUTPUT-3 EOP TIME INTERVAL `O3.E.t.` *(Available if Output-3 function is End-of-Profile & Event Status is set to 'ON')* Definition same as Output-2 EOP Time.	0 to 9999 (Default : 0)
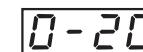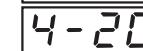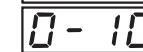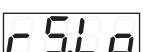
Parameter Description		Settings (Default Value)
RECORDER OUTPUT TYPE *(Available if Output-3 function is Recorder)* Select type for Output-3 in accordance with the hardware module fitted.	`r EC.o`	`0 - 20` 0 to 20mA `4 - 20` 4 to 20mA `0 - 5` 0 to 5V `0 - 10` 0 to 10V (Default : 0 to 20mA)

Section 10
PAGE-17 : REMOTE SETPOINT PARAMETERS

Refer Table 10.1 for parameter description & settings.

Table 10.1

Parameter Description	Settings (Default Value)
REMOTE SETPOINT FEATURE ENABLE `r 5.En` Enable or Disable the Remote Setpoint Feature. *Disabling the feature will suppress all other related parameters.* *Note : If this feature is enabled, the rear panel Digital Input terminals can be used to switch between Main and Remote Setpoint. Refer section on Back Panel Connections.*	`no` No (disable) `YES` Yes (enable) (Default : No)
REMOTE SETPOINT INPUT SIGNAL TYPE `r 5.5G` Select the DC Input Signal connected to the rear panel terminals that shall correspond to the Setpoint Value.	`0 - 20` 0 to 20mA `4 - 20` 4 to 20mA `0 - 5` 0 to 5V `0 - 10` 0 to 10V (Default : 0 to 20mA)
REMOTE SETPOINT RANGE LOW `r 5.Lo` Sets the Setpoint Value corresponding to minimum input signal value (0/4mA or 0V). The resolution and units are same as that for Process Value.	Min. Range for the selected Input Type to Remote Setpoint Range High (Default : -199)
REMOTE SETPOINT RANGE HIGH `r 5.Hi` Sets the Setpoint Value corresponding to maximum input signal value (20mA or 5/10V). The resolution and units are same as that for Process Value.	Remote Setpoint Range Low to Max. Range for the selected Input Type (Default : 1376)

Section 11
MECHANICAL INSTALLATION

The following precautions should be strictly observed while installing the controller:

1. The place of installation should be free of corrosive/combustible gases and electrically conductive pollution.

2. Ensure that the place of installation is not subject to rapid ambient changes that can cause condensation. Also the Ambient Temperature and Relative Humidity surrounding the controller should not exceed the maximum specified for the proper operation of the controller.

3. The place of installation should be adequately protected against excessive electrostatic or electromagnetic interference.

4. The controller should not be subject to direct vibration or shock.

5. The controller should not be exposed to dust, salt air, direct sunlight or radiant heat.

OUTER DIMENSIONS

The Figure 11.1 shows the outer dimensions of the controller.

Figure 11.1

Front View

Side View
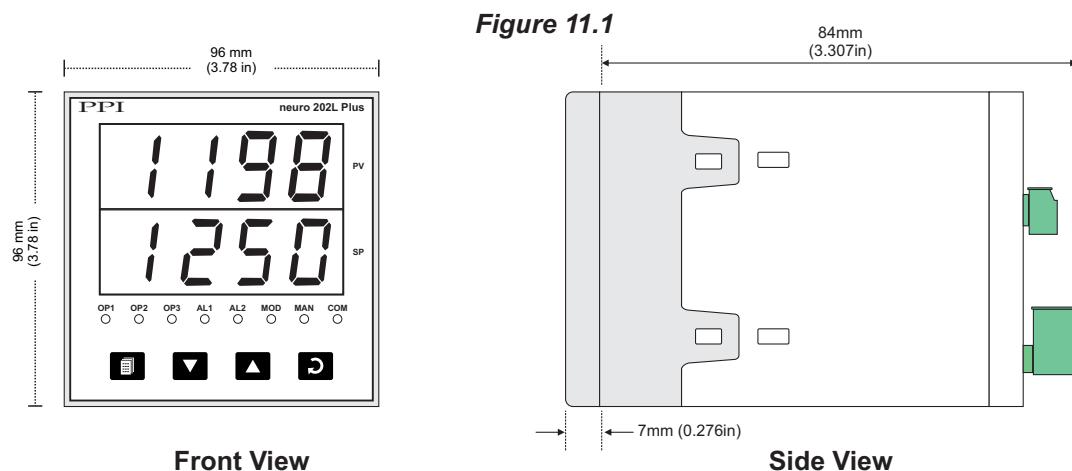
PANEL CUTOUT AND RECOMMENDED MINIMUM SPACING

The Figure 11.2 shows the panel cutout requirements for a single controller and also the minimum spacing recommended if several controllers are required to be mounted on a single panel.

Figure 11.2

Panel Cutout

92 X 92 mm
-0, +0.5 mm

(3.622 X 3.622 in)
(-0, +0.02 in)

10mm (0.39in)

38mm (1.5in)
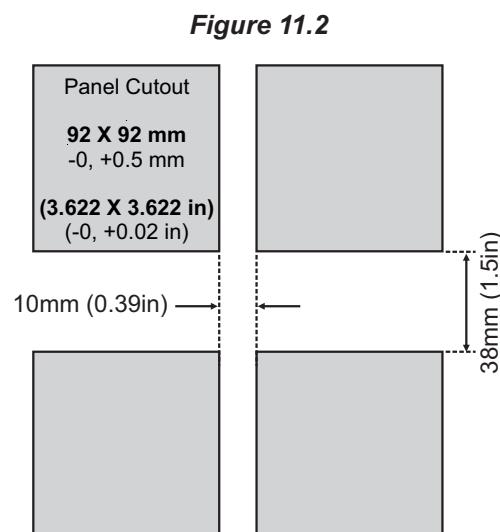
PANEL MOUNTING

Follow the steps below for mounting the controller on panel:

1. Prepare a square cutout to the size shown in Figure 11.2.

2. Remove the Mounting Clamps from the controller Enclosure.

3. Insert the rear of the controller housing through the panel cutout from the front of the mounting panel.

4. Hold the controller gently against the mounting panel such that it positions squarely against the panel wall, see Figure 11.3. Apply pressure only on the bezel and not on the front label.

5. Fix the Mounting Clamps (one after the other) such that the metallic projection fits in the square hole provided on the top and bottom sides of the enclosure. Tighten the clamp screw until the clamps firmly secures against the panel wall.

Figure11.3

Bezel

Controller

Clamps

Mounting Panel with
Square Cutout
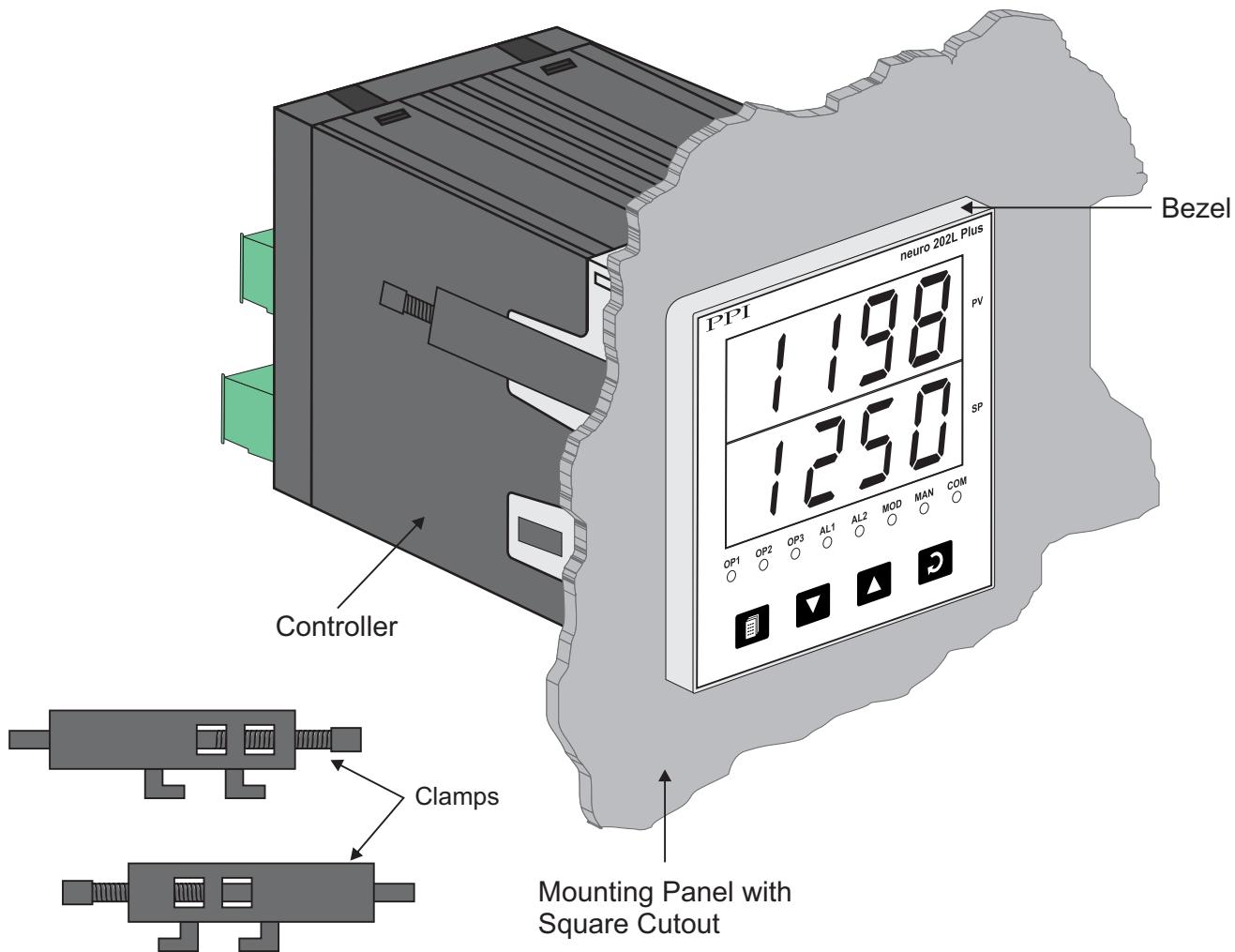
Section 12
ELECTRICAL CONNECTIONS
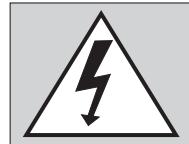
WARNING
MISHANDLING / NEGLIGENCE CAN RESULT IN PERSONAL DEATH OR SERIOUS INJURY.

1. The user must rigidly observe the Local Electrical Regulations.

2. Do not make any connections to the unused terminals for making a tie-point for other wires (or for any other reasons) as they may have some internal connections. Failing to observe this may result in permanent damage to the controller.

3. Run power supply cables separated from the low-level signal cables (like Thermocouple, RTD, DC Linear Current/Voltage, etc.). If the cables are run through conduits, use separate conduits for power supply cable and low-level signal cables.

4. Use appropriate fuses and switches, wherever necessary, for driving the high voltage loads to protect the controller from any possible damage due to high voltage surges of extended duration or short-circuits on loads.

5. Take care not to over-tighten the terminal screws while making connections.

6. Make sure that the controller supply is switched-off while making/removing any connections or removing the controller from its enclosure.

CONNECTION DIAGRAM

The Electrical Connection Diagram is shown on the Rear side of the controller enclosure. Refer the label provided on the Rear Side for terminal numbers. The Connection Diagram is a generic one; the connections shown for optional modules are applicable only if the modules are fitted.

The rear panel electrical wiring connection diagrams are shown in Figure12.1 below.

Figure 12.1
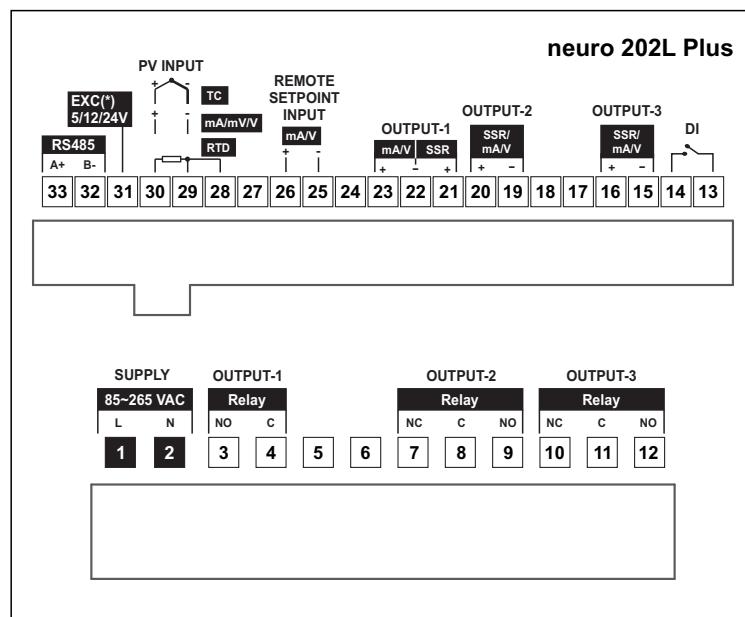
DESCRIPTIONS

The back panel connections are described as under:

PV INPUT (Terminals : 30, 29, 28)

The controller accepts Thermocouples (J, K, T, R, S, B, N, E), 3-wire RTD Pt100 and DC Linear Current / Voltage (mA/mV/V) as input.

Figure 12.2 (a)
*Thermocouple Input*
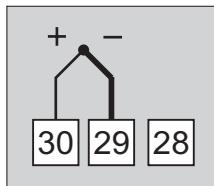
Figure 12.2 (b)
RTD Input
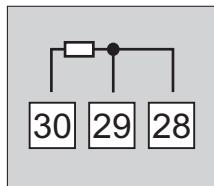
Figure 12.2 (c)
mA / mV / V Input
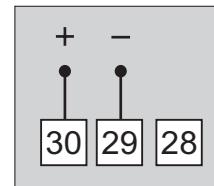
* Refer "EXC 5/12/24VDC : Excitation Voltage for Transmitters (Terminal : 31)"

Thermocouple

Connect Thermocouple Positive (+) to terminal 30 and Negative (-) to terminal 29 as shown in Figure 12.2 (a). Use the correct type of Thermocouple extension lead wires or compensating cable for the entire distance ensuring the correct polarity throughout. Avoid joints in the cable.

RTD Pt100, 3-wire

Connect single leaded end of RTD bulb to terminal 30 and the double leaded ends to terminal 29 and 28 (interchangeable) as shown in Figure 12.2 (b). Use copper conductor leads of very low resistance ensuring that all 3 leads are of the same gauge and length. Avoid joints in the cable.

DC Linear Voltage (mA / mV / V)

Connect Signal (+) to terminal 30 & Return (-) to terminal 29, as shown in Figure 12.2 (c). Use a shielded twisted pair with the shield grounded at the signal source for connecting mV / V source.

REMOTE SETPOINT INPUT (Terminals : 27, 26, 25, 24)

The controller accepts DC Voltage (0~5/10 V) or DC Current (0/4~20 mA) as signal input for Remote Setpoint. Refer Figure 12.3 below for connections. The details are same as that described for PV Input above.

Figure 12.3
mA / V Input
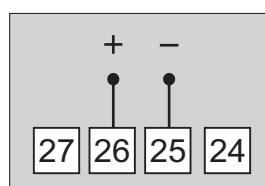
**EXC 5/12/24VDC :** Excitation Voltage for Transmitters (Terminal : 31)

The Controller is supplied with either 5 or 12 or 24VDC @ 30 mA power source. This is primarily meant for exciting 2-wire or 4-wire Current / Voltage output transmitters. Please note that only the Source terminal (positive) is provided on the back panel termination. The Sensor negative terminal is used as Return terminal (ground) for excitation output.
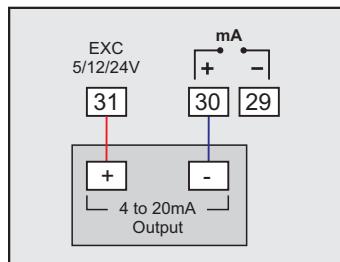
2-wire Current Transmitter
(5/12/24VDC Supply)
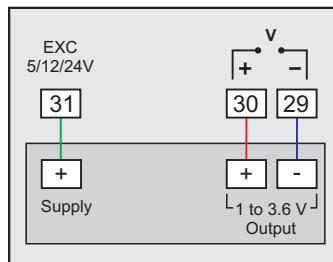
3-wire Voltage Transmitter
(5/12/24VDC Supply)
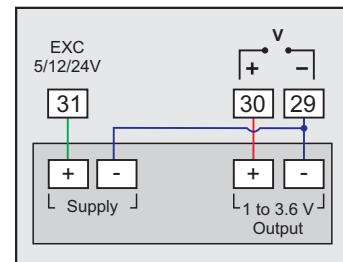
4-wire Voltage Transmitter
(5/12/24VDC Supply)

DI (Digital Input) (Terminals : 13, 14)

The Controller is fitted with potential-free contact closure as Digital Input. The function of this digital input is dependent on the controller version as shown in the figures below.
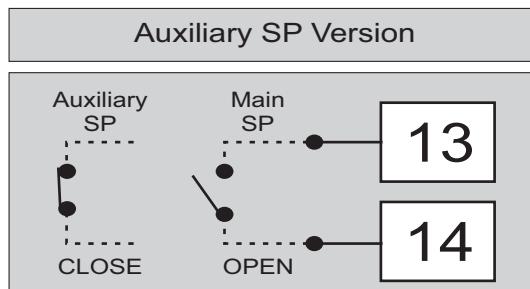
Figure 12.4 (a)
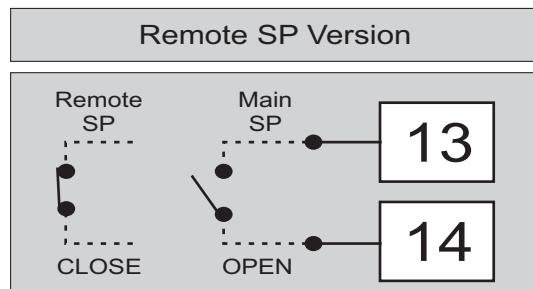
Figure 12.4 (b)
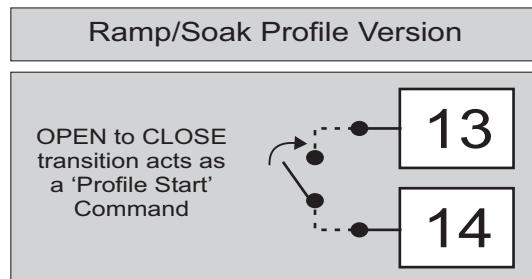
Figure 12.4 (c)

OUTPUT-1 Relay (Terminals : 3, 4)
OUTPUT-1 SSR (Terminals : 22, 21)
OUTPUT-1 mA/V (Terminals : 23, 22)

The Output-1 is supplied as universal output selectable as Relay, SSR or DC Linear Current (or Voltage). Use terminals in accordance with the selected type.
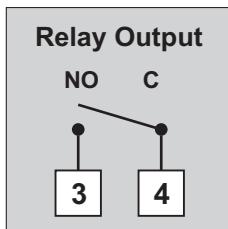
Figure 12.5 (a)   *Figure 12.5 (b)*   *Figure 12.5 (c)*

Relay Output	SSR Output	mA/V Output
NO C	− +	+ −
[3] [4]	[23] [22] [21]	[23] [22] [21]
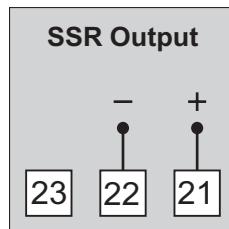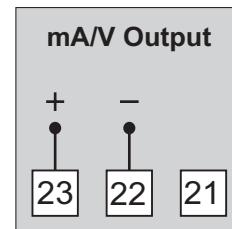
Relay

Potential-free changeover contacts NO (Normally Open) and C (Common) rated 2A/240 VAC (resistive load) are provided as Relay output. Use external auxiliary device like contactor with appropriate contact rating for driving the actual load.

SSR

DC Voltage level is generated for switching the external SSR (Solid State Relay). Connect (+) and (-) terminals of SSR to controller terminals 21 and 22, respectively. Use Zero-Crossover, 3 to 30 VDC operated SSR, rated approximately 1.5 times the actual load rating. Use appropriate Heat Sink for load rating exceeding 10A.

DC Linear Current / Voltage Output

If the Output-1 is configured for DC Linear (mA/V), connect the power module (like Thyristor, SCR, I/P Converter, etc.) as shown in figure 12.5 (c).

OUTPUT-2 Relay (Terminals : 7, 8, 9)   &   **OUTPUT-3 Relay** (Terminals : 10, 11, 12)
OUTPUT-2 SSR (Terminals : 20, 19)   &   **OUTPUT-3 SSR** (Terminals : 16, 15)
OUTPUT-2 mA/V (Terminals : 20, 19)   &   **OUTPUT-3 mA/V** (Terminals : 16, 15)

The Output-2 and Output-3 are supplied as options and the type (Relay, SSR, mA, V) must be specified at the time of ordering. Thus output-2 & output-3 are factory configured for either Relay / SSR or DC Linear Voltage or DC Linear Current. The connection descriptions are the same as those described for Output-1. Refer Figure 12.6(a), 12.6(b) & 12.6(c)

*Figure 12.6(a)*   *Figure 12.6(b)*   *Figure 12.6(c)*
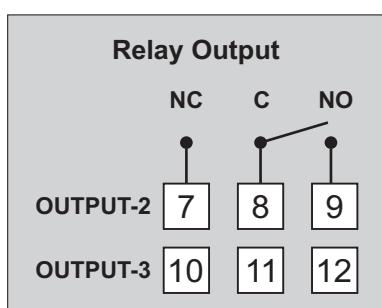
Relay Output	SSR Output	mA/V Output
NC C NO	+ −	+ −
OUTPUT-2 [7] [8] [9]	OUTPUT-2 [20] [19]	OUTPUT-2 [20] [19]
OUTPUT-3 [10] [11] [12]	OUTPUT-3 [16] [15]	OUTPUT-3 [16] [15]
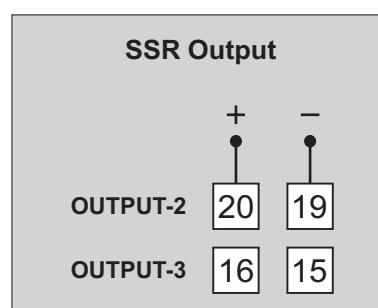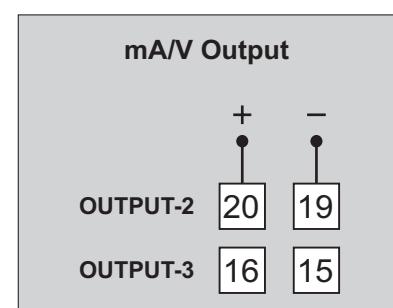
RS485 COMMUNICATION PORT (Terminals : 33 , 32)

Connect terminals 33 and 32 of the controller to (A+) and (B-) terminals of the Master device as shown in figure 12.7 below. For reliable noise free communication, use a pair of twisted wires inside screened cable as shown in Figure 12.7. The wire should have less than 100 ohms / km nominal DC resistance (Typically 24 AWG or thicker). Connect the terminating resistor (Typically 100 to 150 ohm) at one end to improve noise immunity.

Figure 12.7
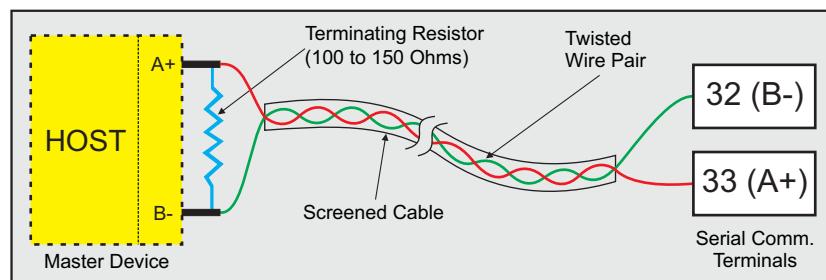
85~264 VAC : Power Supply (Terminals 1, 2)

The controller is supplied with power connections suited for 85 to 264 VAC line supply. Use well-insulated copper conductor wire of the size not smaller than $0.5mm^2$ for power supply connections. Connect Line (Phase) supply line to terminal 1 and the Neutral (Return) supply line to terminal 2 as shown in Figure 12.8 below. The controller is not provided with fuse and power switch. If necessary, mount them separately. Use a time lag fuse rated 1A @ 240 VAC.

Figure 12.8
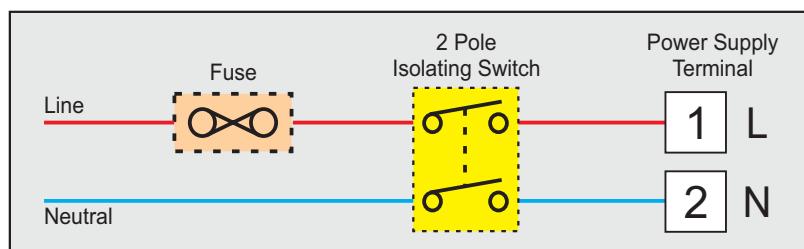
Section 13
MODBUS MAPPING

Table 1 : Read Only Parameters

Parameter	Data Type	Address	Remark
Parameter Modified through Front Panel Keys	16 bit signed integer	1	<table><tr><th>Value</th><th>Meaning</th></tr><tr><td>1</td><td>One or more parameters are modified using front panel keys since last read.</td></tr><tr><td>0</td><td>No parameter is modified since last read.</td></tr></table>
Process Value (PV)	16 bit signed integer	2	*Resolution Based Parameter : Refer Appendix-A* The following constant counts indicate PV Errors. <table><tr><th>Value</th><th>PV Error Type</th></tr><tr><td>-32768</td><td>Under Range</td></tr><tr><td>+32752</td><td>Over Range</td></tr><tr><td>+32767</td><td>Sensor Open</td></tr></table>
Alarm 1 Status	16 bit signed integer	3	<table><tr><th>Value</th><th>Status</th></tr><tr><td>0</td><td>Alarm OFF</td></tr><tr><td>1</td><td>Alarm ON</td></tr></table>
Alarm 2 Status	16 bit signed integer	4	
Ambient Temperature	16 bit signed integer	5	*Resolution Based Parameter : Refer Appendix-A* The measured Ambient Temperature used for thermocouple cold junction compensation. The value is always in °C with 0.1 resolution.
Working Control Setpoint	16 bit signed integer	6	*Resolution Based Parameter : Refer Appendix-A* The current Control Setpoint value. (User-set / Profile / Remote / Auxiliary).
Control Output 1 Relay / SSR Status	16 bit signed integer	7	<table><tr><th>Value</th><th>Status</th></tr><tr><td>0</td><td>Relay/SSR OFF</td></tr><tr><td>1</td><td>Relay/SSR ON</td></tr></table>
Control Output 2 Relay / SSR Status	16 bit signed integer	8	
Output 3 as End-of-Profile Relay / SSR Status	16 bit signed integer	10	**Note** : If output type is DC mA/V, the status is always 0.
Control Output Power	16 bit signed integer	9	Range : -100% to 100%. -100% to 0% : Cool Power 0% to 100% : Heat Power

Ramp / Soak Profile Parameters			
Parameter	**Data Type**	**Address**	**Remark**
Current Profile Segment Number	16 bit signed integer	600	The profile segment number, 1 to 16, in progress.
Current Profile Segment Type	16 bit signed integer	601	The profile segment type, Ramp / Soak, in progress. Value / Segment Type: 0 = Soak, 1 = Ramp
Current Profile Segment Target Setpoint	16 bit signed integer	602	*Resolution Based Parameter : Refer Appendix-A* The current profile segment target (end) setpoint.
Current Profile Setpoint	16 bit signed integer	603	*Resolution Based Parameter : Refer Appendix-A* The current profile (ramp / soak) setpoint.
Balance Soak Time	16 bit signed integer	604	The balance soak time (in Minutes) of a running soak segment.
Segment Hold Status	16 bit signed integer	605	Value / Status: 0 = Running, 1 = Hold

Segment Type table (Address 601):

Value	Segment Type
0	Soak
1	Ramp

Status table (Address 605):

Value	Status
0	Running
1	Hold

Remote Setpoint Parameters			
Parameter	**Data Type**	**Address**	**Remark**
Remote Setpoint Value	16 bit signed integer	800	*Resolution Based Parameter : Refer Appendix-A* The computed Remote Setpoint value based on the mA/V signal input applied at the rear panel terminals.

Table 2 : Read / Write Parameters

Parameter	Data Type	Address	Remark
Input Type	16 bit signed integer	100	<table><tr><th>Value</th><th>Type</th></tr><tr><td>0</td><td>Type J Thermocouple</td></tr><tr><td>1</td><td>Type K Thermocouple</td></tr><tr><td>2</td><td>Type T Thermocouple</td></tr><tr><td>3</td><td>Type R Thermocouple</td></tr><tr><td>4</td><td>Type S Thermocouple</td></tr><tr><td>5</td><td>Type B Thermocouple</td></tr><tr><td>6</td><td>Type N Thermocouple</td></tr><tr><td>7</td><td>Reserved TC (Default: Type J)</td></tr><tr><td>8</td><td>RTD Pt100, 3-wire</td></tr><tr><td>9</td><td>0 to 20 mA</td></tr><tr><td>10</td><td>4 to 20 mA</td></tr><tr><td>11</td><td>0 to 80 mV</td></tr><tr><td>12</td><td>Reserved (Default: 0 to 80 mV)</td></tr><tr><td>13</td><td>0 to 1.25 V</td></tr><tr><td>14</td><td>0 to 5 V</td></tr><tr><td>15</td><td>0 to 10 V</td></tr><tr><td>16</td><td>1 to 5 V</td></tr></table>
PV Units	16 bit signed integer	101	<table><tr><th>Value</th><th>Unit</th></tr><tr><td>0</td><td>°C</td></tr><tr><td>1</td><td>°F</td></tr></table> **Note** : Applicable for Input type TC & RTD only.
PV Resolution	16 bit signed integer	102	**For RTD Pt100 Input**<table><tr><th>Value</th><th>Resolution</th></tr><tr><td>0</td><td>1</td></tr><tr><td>1</td><td>0.1</td></tr></table>**For mV/V/mA Input**<table><tr><th>Value</th><th>Resolution</th></tr><tr><td>0</td><td>1</td></tr><tr><td>1</td><td>0.1</td></tr><tr><td>2</td><td>0.01</td></tr><tr><td>3</td><td>0.001</td></tr></table>

Parameter	Data Type	Address	Remark
Signal Low	16 bit signed integer	103	*Resolution Based Parameter : Refer Appendix-A*
Signal High	16 bit signed integer	104	
PV Range Low	16 bit signed integer	105	
PV Range High	16 bit signed integer	106	
Offset for PV	16 bit signed integer	107	
Digital Filter Time Constant	16 bit signed integer	108	*Resolution Based Parameter : Refer Appendix-A* Settable in multiples of 0.5 Seconds. Non-multiples of 0.5 are automatically converted to the nearest multiple of 5.
Alarm-1 Type	16 bit signed integer	200	<table><tr><th>Value</th><th>Type</th></tr><tr><td>0</td><td>None</td></tr><tr><td>1</td><td>Process Low</td></tr><tr><td>2</td><td>Process High</td></tr><tr><td>3</td><td>Deviation Band</td></tr><tr><td>4</td><td>Window Band</td></tr></table>
Alarm-2 Type	16 bit signed integer	205	
Alarm-1 SP	16 bit signed integer	201	*Resolution Based Parameter : Refer Appendix-A*
Alarm-1 Hysteresis	16 bit signed integer	202	
Alarm-2 SP	16 bit signed integer	206	
Alarm-2 Hysteresis	16 bit signed integer	207	
Alarm-1 Inhibit	16 bit signed integer	203	<table><tr><th>Value</th><th>Inhibit</th></tr><tr><td>0</td><td>Disable</td></tr><tr><td>1</td><td>Enable</td></tr></table>
Alarm-2 Inhibit	16 bit signed integer	208	
Alarm-1 Logic	16 bit signed integer	204	<table><tr><th>Value</th><th>Logic</th></tr><tr><td>0</td><td>Normal</td></tr><tr><td>1</td><td>Reverse</td></tr></table>
Alarm-2 Logic	16 bit signed integer	209	
Control Action	16 bit signed integer	300	<table><tr><th>Value</th><th>Action</th></tr><tr><td>0</td><td>On-Off</td></tr><tr><td>1</td><td>Pulsed On-Off</td></tr><tr><td>2</td><td>PID</td></tr></table>

Parameter	Data Type	Address	Remark
Control Mode	16 bit signed integer	301	<table><tr><td>Value</td><td>Logic</td></tr><tr><td>0</td><td>Reverse</td></tr><tr><td>1</td><td>Direct</td></tr></table>
Setpoint Low Limit	16 bit signed integer	302	*Resolution Based Parameter : Refer Appendix-A*
Setpoint High Limit	16 bit signed integer	303	
Control Setpoint	16 bit signed integer	304	
Hysteresis	16 bit signed integer	320	
Cool Hysteresis	16 bit signed integer	321	
Pulse time	16 bit signed integer	330	
Pulse-on time	16 bit signed integer	331	
Cool Pulse Time	16 bit signed integer	332	
Cool Pulse-on time	16 bit signed integer	333	
Tune Command & Status	16 bit signed integer	350	**Write Operation** Value / Action 129 / Start Tuning 128 / Abort Tuning **Read Operation** Value / Tuning Status 0 / Not Tuning 1 / Tuning in Progress
Proportional Band	16 bit signed integer	351	*Resolution Based Parameter : Refer Appendix-A*
Integral Time	16 bit signed integer	352	—
Derivative Time	16 bit signed integer	353	—
Relative Cool Gain	16 bit signed integer	354	*Resolution Based Parameter : Refer Appendix-A*
Heat Power Low	16 bit signed integer	355	—

Parameter	Data Type	Address	Remark
Heat Power High	16 bit signed integer	356	—
Cool Power Low	16 bit signed integer	357	—
Cool Power High	16 bit signed integer	358	—
Cycle Time	16 bit signed integer	359	*Resolution Based Parameter : Refer Appendix-A*
Cool Cycle Time	16 bit signed integer	360	
Sensor Break Output Power	16 bit signed integer	361	—
Overshoot Inhibit	16 bit signed integer	362	Value / Overshoot Inhibit table: 0 = Disable, 1 = Enable
Overshoot Inhibit Factor	16 bit signed integer	363	—
Auto / Manual PID	16 bit signed integer	364	Value / PID Mode table: 0 = Auto, 1 = Manual
PID Manual Power	16 bit signed integer	365	Range : -100% to 100%. -100% to 0% : Cool Power. 0% to 100% : Heat Power
Standby Mode	16 bit signed integer	366	Value / Standby table: 0 = Disable, 1 = Enable
Output-1 Type (Heat Control)	16 bit signed integer	400	Value / Output Type table: 0 = Relay, 1 = SSR, 2 = 0 to 20 mA, 3 = 4 to 20 mA, 4 = 0 to 5 V, 5 = 0 to 10 V
Output-2 Type (Cool Control)	16 bit signed integer	402	
Output-2 Function	16 bit signed integer	401	Value / Function table: 0 = None, 1 = Alarm, 2 = End-of-Profile, 3 = Cool Control

Overshoot Inhibit (362)

Value	Overshoot Inhibit
0	Disable
1	Enable

Auto / Manual PID (364)

Value	PID Mode
0	Auto
1	Manual

Standby Mode (366)

Value	Standby
0	Disable
1	Enable

Output-1 Type / Output-2 Type (400 / 402)

Value	Output Type
0	Relay
1	SSR
2	0 to 20 mA
3	4 to 20 mA
4	0 to 5 V
5	0 to 10 V

Output-2 Function (401)

Value	Function
0	None
1	Alarm
2	End-of-Profile
3	Cool Control

Parameter	Data Type	Address	Remark
Output-3 Function	16 bit signed integer	403	<table><tr><td>**Value**</td><td>**Function**</td></tr><tr><td>0</td><td>None</td></tr><tr><td>1</td><td>Alarm</td></tr><tr><td>2</td><td>End-of-Profile</td></tr><tr><td>3</td><td>Retransmission</td></tr></table>
PV/SP Selection for Retransmission	16 bit signed integer	500	<table><tr><td>**Value**</td><td>**PV/SP**</td></tr><tr><td>0</td><td>PV</td></tr><tr><td>1</td><td>SP</td></tr></table>
Output-3 Type Retransmission	16 bit signed integer	501	<table><tr><td>**Value**</td><td>**Output-3 Type**</td></tr><tr><td>0</td><td>0 to 20 mA</td></tr><tr><td>1</td><td>4 to 20 mA</td></tr><tr><td>2</td><td>0 to 5 V</td></tr><tr><td>3</td><td>0 to 10 V</td></tr></table>
Recorder (Retransmission) Low	16 bit signed integer	502	*Resolution Based Parameter : Refer Appendix-A*
Recorder (Retransmission) High	16 bit signed integer	503	

Ramp / Soak Profile Parameters

Parameter	Data Type	Address	Remark
Profile Start / Abort Command & Status	16 bit signed integer	610	**Write Operation**<table><tr><td>**Value**</td><td>**Action**</td></tr><tr><td>129</td><td>Start Profile</td></tr><tr><td>128</td><td>Abort Profile</td></tr></table>**Read Operation**<table><tr><td>**Value**</td><td>**Profile Status**</td></tr><tr><td>0</td><td>Not Started</td></tr><tr><td>1</td><td>Running</td></tr></table>
Profile Pause Command & Status	16 bit signed integer	611	**Write Operation**<table><tr><td>**Value**</td><td>**Command**</td></tr><tr><td>1</td><td>Apply Pause</td></tr><tr><td>0</td><td>Remove Pause</td></tr></table>**Read Operation**<table><tr><td>**Value**</td><td>**Profile Status**</td></tr><tr><td>0</td><td>Running</td></tr><tr><td>1</td><td>Paused</td></tr></table>

Parameter	Data Type	Address	Remark
Skip 'Current Profile Segment' Command	16 bit signed integer	612	<table><tr><th>Value</th><th>Command</th></tr><tr><td>0</td><td>—</td></tr><tr><td>1</td><td>Skip</td></tr></table>
Profile End Acknowledge	16 bit signed integer	613	<table><tr><th>Value</th><th>Command</th></tr><tr><td>0</td><td>—</td></tr><tr><td>1</td><td>Acknowledge</td></tr></table>
Interval Time for Running Profile Segment	16 bit signed integer	614	Modify the set Interval Time for the profile segment in progress.
Band Type for Running Profile Segment	16 bit signed integer	615	Modify the set Hold Band Type for the profile segment in progress. <table><tr><th>Value</th><th>Band Type</th></tr><tr><td>0</td><td>None</td></tr><tr><td>1</td><td>Up</td></tr><tr><td>2</td><td>Down</td></tr><tr><td>3</td><td>Both (Up & Down)</td></tr></table>
Band Value for the Running Profile Segment	16 bit signed integer	616	*Resolution Based Parameter : Refer Appendix-A* Modify the Hold Band value for the profile segment in progress.
Running Profile Repeat Counter	16 bit signed integer	617	Read or Modify the current Profile Repeat Counter.
Profile Enable / Disable Command	16 bit signed integer	630	<table><tr><th>Value</th><th>Command</th></tr><tr><td>0</td><td>Disable</td></tr><tr><td>1</td><td>Enable</td></tr></table>
Number of Profile Segments	16 bit signed integer	631	—
Profile Repeat Counts	16 bit signed integer	632	—
Control Output Off	16 bit signed integer	633	<table><tr><th>Value</th><th>Control Output</th></tr><tr><td>0</td><td>—</td></tr><tr><td>1</td><td>Forced Off</td></tr></table>
Power-Fail Strategy	16 bit signed integer	634	<table><tr><th>Value</th><th>Strategy</th></tr><tr><td>0</td><td>Abort Profile</td></tr><tr><td>1</td><td>Continue Profile</td></tr></table>

Parameter	Data Type	Address	Remark
Common Holdback	16 bit signed integer	635	<table><tr><td>**Value**</td><td>**Holdback**</td></tr><tr><td>0</td><td>Independent</td></tr><tr><td>1</td><td>Common</td></tr></table>
Target Setpoint for Segments	16 bit signed integer	(Segment 1 to 16) 636, 640, 644, 648, 652, 656, 660, 664, 668, 672, 676, 680, 684, 688, 692, 696	*Resolution Based Parameter : Refer Appendix-A* MODBUS Address = 636 + [(n-1) X 4]; n : 1 to 16 segment number Example : Target Setpoint for Segment 2 Address = 636 + [(2-1) X 4] = 640
Time Interval for Segments	16 bit signed integer	(Segment 1 to 16) 637, 641, 645, 649, 653, 657, 661, 665, 669, 673, 677, 681, 685, 689, 693, 697	MODBUS Address = 637 + [(n-1) X 4]; n : 1 to 16 segment number Example : Time Interval for Segment 2 Address = 637 + [(2-1) X 4] = 641
Band Type for Segments	16 bit signed integer	(Segment 1 to 16) 638, 642, 646, 650, 654, 658, 662, 666, 670, 674, 678, 682, 686, 690, 694, 698	MODBUS Address = 638 + [(n-1) X 4]; n : 1 to 16 segment number Example : Band Type for Segment 2 Address = 638 + [(2-1) X 4] = 642 <table><tr><td>**Value**</td><td>**Band Type**</td></tr><tr><td>0</td><td>None</td></tr><tr><td>1</td><td>Up</td></tr><tr><td>2</td><td>Down</td></tr><tr><td>3</td><td>Both (Up & Down)</td></tr></table>
Band Value for Segments	16 bit signed integer	(Segment 1 to 16) 639, 643, 647, 651, 655, 659, 663, 667, 671, 675, 679, 683, 687, 691, 695, 699	*Resolution Based Parameter : Refer Appendix-A* MODBUS Address = 639 + [(n-1) X 4]; n : 1 to 16 segment number Example : Band Value for Segment 2 Address = 639 + [(2-1) X 4] = 643

Parameter	Data Type	Address	Remark
Output-2 EOP Status	16 bit signed integer	700	*Refer Appendix-C for End-of-Profile Event Output.*
Output-3 EOP Status	16 bit signed integer	703	

Value	OP2 Status
0	On
1	Off

Parameter	Data Type	Address	Remark
Output-2 EOP Time Units	16 bit signed integer	702	
Output-3 EOP Time Units	16 bit signed integer	705	

Value	Time Units
0	Seconds
1	Minutes
2	Hours

Parameter	Data Type	Address	Remark
Output-2 EOP Time Interval	16 bit signed integer	701	—
Output-3 EOP Time Interval	16 bit signed integer	704	—

Remote Setpoint Parameters

Parameter	Data Type	Address	Remark
Remote SP Enable	16 bit signed integer	801	

Value	Remote SP
0	Disable
1	Enable

Parameter	Data Type	Address	Remark
Remote SP Input Signal Type	16 bit signed integer	802	

Value	Input Signal Type
0	0 to 20 mA
1	4 to 20 mA
2	0 to 5 V
3	0 to 10 V

Parameter	Data Type	Address	Remark
Remote SP DC Low Range	16 bit signed integer	803	*Resolution Based Parameter : Refer Appendix-A*
Remote SP DC High Range	16 bit signed integer	804	

Auxiliary Setpoint Parameters

Parameter	Data Type	Address	Remark
Auxiliary Setpoint Value	16 bit signed integer	900	*Resolution Based Parameter : Refer Appendix-A*

HANDLING DECIMAL VALUES IN MODBUS REGISTERS

Overview

MODBUS protocol utilizes 16-bit signed integer registers (Input and Holding Registers) to store data. These registers accommodate values within the range -32,767 to 32,768. However, many process parameters require values with decimal precision. Since MODBUS registers inherently do not support floating-point values, decimal handling is achieved through scaling techniques.

This section describes how **Fixed** and **Programmable** decimal point parameters are stored and retrieved using MODBUS registers.

Handling Fixed Decimal Point Values

For parameters with a fixed decimal resolution, the integer values written to the MODBUS register are automatically converted by the device. However, when reading values, users must convert the retrieved integer values back to their corresponding decimal representations by dividing them by the appropriate power of 10.

Example: Fixed Decimal Resolution of 0.01
- Parameter Range: -12.34 to 20.00
- Scaling Factor: 100 (since $0.01 = 10^{-2}$)
- Writing a Value: To set a parameter to 34.82, write 34.82 × 100 = 3482 into the register.
- Reading a Value: If the register contains 3482, the actual value is 3482 ÷ 100 = 34.82.

This method ensures consistency in handling values with fixed decimal precision across MODBUS communication.

Handling Programmable Decimal Point Values

For parameters with a programmable decimal resolution, the number of decimal places is stored in a separate parameter named Resolution (or PV Resolution). The resolution value determines the scaling factor applied when storing and retrieving values in MODBUS registers.

Resolution Parameter Definition

The resolution parameter is stored as an integer value corresponding to the decimal precision:

Resolution Value	Decimal Precision	Scaling Factor
0	1 (No Decimals)	$10^0=1$
1	0.1	$10^1=10$
2	0.01	$10^2=100$
3	0.001	$10^3=1000$

Example: Programmable Decimal Resolution

- Resolution Parameter Value: 3 (corresponding to 0.001 resolution)
- Writing a Value: To set the parameter to 27.651, use Scaling Factor 1000 (corresponding to Resolution value 3) to convert the decimal value to integer value : 27.651 × 1000 = 27651 and write to the MODBUS register.
- Reading a Value: If the register contains 27651, divide by 1000 (10^3) to get 27.651.

Using this method, MODBUS allows flexible handling of parameters where decimal precision may need to be adjusted dynamically.

APPENDIX - B

DC LINEAR SIGNAL INTERFACE

Overview

Various transmitters generate different signal types, such as mV, V, or mA, with distinct signal ranges. To ensure compatibility with a wide range of transmitters, PPI products offer configurable Signal Type and Range settings.

Common industry-standard signal ranges include:
- 0 to 80 mV, 0 to 160 mV
- 0 to 5 V, 1 to 5 V, 0 to 10 V
- 0 to 20 mA, 4 to 20 mA

Additionally, since transmitters output different signal ranges corresponding to specific process values (e.g., a 1 to 4.5 V signal may represent 5% to 95% RH), PPI products allow users to configure the process value range and resolution.

Required Parameters for Linear Transmitter Interface

For interfacing linear transmitters, the following six parameters must be configured:

Parameter	Definition	Example
Input Type	Defines the standard DC signal type in which the transmitter signal range falls.	4 to 20 mA
Signal Low	The minimum signal value corresponding to the lowest process value.	4.00 mA
Signal High	The maximum signal value corresponding to the highest process value.	20.00 mA
PV Resolution	Defines the smallest measurable unit for the process value.	0.01 psi
Range Low	The process value corresponding to Signal Low.	0.00 psi
Range High	The process value corresponding to Signal High.	5.00 psi

Mathematical Representation

The relationship between transmitter signal values and the corresponding process values follows a straight-line equation:

$$Y = mX + C$$

Where;

X : Signal Value from Transmitter

Y : Process Value Corresponding to X

C : Process Value Corresponding to X = 0 (Y-intercept)

m : Slope (Change in Process Value per unit Change in Signal Value)
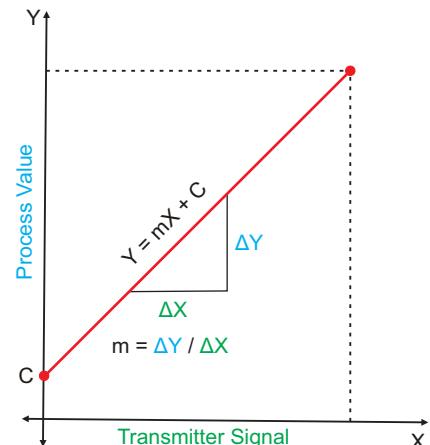
Examples of Transmitter Configurations

Example 1:

Pressure Transmitter (**4 to 20 mA** corresponding to **0 to 5 psi**)

Input Type	:	4-20 mA
Signal Low	:	4.00 mA
Signal High	:	20.00 mA
PV Resolution	:	0.01
Range Low	:	0.00
Range High	:	5.00
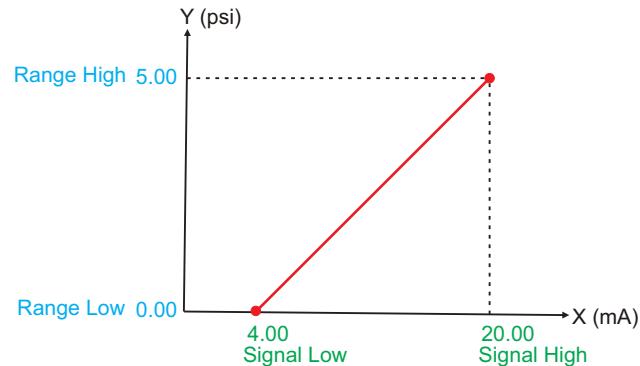
Example 2

Humidity Transmitter (**1 to 4.5 V** corresponding to **5 to 95 %RH**)

Input Type	:	0-5 V
Signal Low	:	1.000 V
Signal High	:	4.500 V
PV Resolution	:	0.1
Range Low	:	5.0
Range High	:	95.0
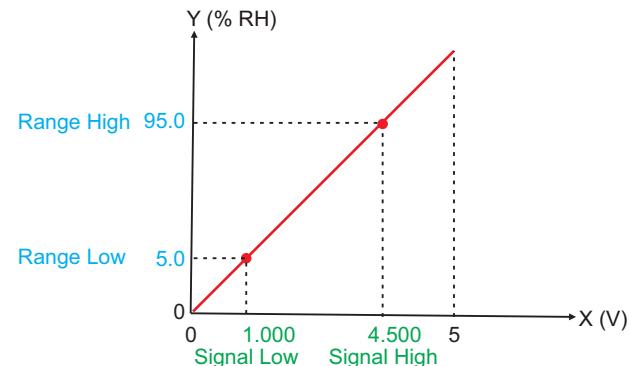
Example 3

Temperature Transmitter (**0 to 20 mA** corresponding to **-50 to 250 °C**)

Input Type	:	0-20 mA
Signal Low	:	0.00 mA
Signal High	:	20.00 mA
PV Resolution	:	0.1
Range Low	:	-50.0
Range High	:	250.0
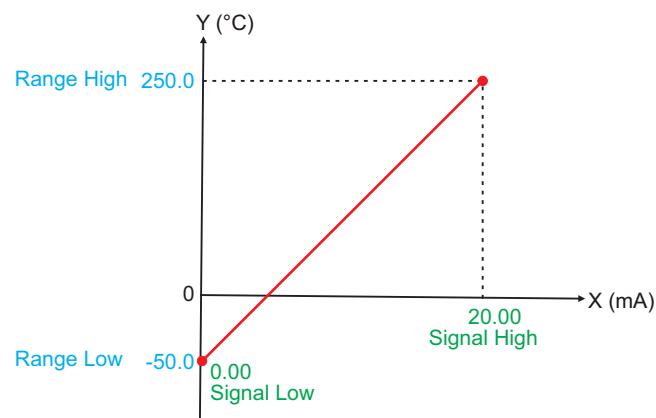
APPENDIX - C

END-OF-PROFILE EVENT IN RAMP / SOAK PROFILE EXECUTION

Overview

The End-of-Profile Event function allows Output-2 (OP2) or Output-3 (OP3) to be programmed in association with ramp/soak profile execution. The output behaviour can be customized based on specific process requirements, such as triggering an alarm upon profile completion or controlling a device during profile execution.

This appendix provides a detailed explanation of the End-of-Profile Event, its configuration parameters, and practical use cases.

Functionality

The End-of-Profile Event controls the state of an output based on the execution of a programmed ramp/soak profile. Two modes of operation are available:

1. ON Mode
In this mode the output remains OFF during profile execution and turns ON at the end. This mode is typically used for triggering an alarm or indicator upon profile completion.

2. OFF Mode
In this mode the output remains ON during profile execution and turns OFF at the end. This mode is used for running an external device (e.g., a blower or a process actuator) that is required throughout the profile execution.

Configuration Parameters

The End-of-Profile Event is configured using the following parameters:

1. Output Selection
The user can assign either Output-2 (OP2) or Output-3 (OP3) as the end-of-profile event output. Set the parameter OP2 Function or OP3 Function as **EOP**.

2. Output Status Type
This parameter determines whether the output turns ON or OFF at the end of the profile:

- ON Mode: The selected output remains OFF throughout profile execution and turns ON at the end.
- OFF Mode: The selected output remains ON during profile execution and turns OFF at the end.

3. Time Settings (For ON Mode Only)
If the output is set to turn ON at the end of the profile, the following additional parameters must be configured:

- Time Unit: Defines the unit of time for the output duration: Seconds, Minutes, or Hours.
- Time Interval: Specifies the duration (0 to 9999 units) for which the output remains active.

Practical Use Cases

The End-of-Profile Event is useful in various industrial applications. Below are some practical examples demonstrating its implementation.

Example 1: Alarm Activation on Profile Completion

Scenario: A temperature controller executes a ramp/soak profile to heat a material to a specific temperature over a defined period. Once the profile is complete, an alarm must be triggered to notify the operator.
Configuration:

- Assign Output: OP2 Function → End-of-Profile Event
- Set Output Status: ON (Remains OFF during execution and turns ON at the end)
- Set Time Parameters:
  ➢ Time Unit: Minutes
  ➢ Time Interval: 10 (Alarm remains ON for 10 minutes)

Operation:
- During profile execution, the alarm output remains OFF.
- At the end of the profile, Output-2 (OP2) activates and stays ON for 10 minutes.

Example 2: Blower Operation During Profile Execution

Scenario: A curing process requires continuous airflow from a blower during a temperature ramp-up and soak period. Once the profile is complete, the blower must be turned OFF.
Configuration:

- Assign Output: OP3 Function → End-of-Profile Event
- Set Output Status: OFF (Remains ON during execution and turns OFF at the end)
- Time Parameters: Not applicable (Output turns OFF immediately at profile completion)

Operation:
- During profile execution, Output-3 (OP3) remains ON, running the blower.
- At the end of the profile, OP3 deactivates, stopping the blower.

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