1/16 DIN Size Universal Single Loop Process Controller

neuro 202

Universal Input with 24VDC @ 30mA Excitation Voltage
Single Loop Uni-Directional/Bi-Directional Control
Universal Control Output as Relay / SSR / mA or V
Alarms, Retransmission & RS485 Serial Outputs
16 Segment Ramp/Soak Profile or Auxiliary Setpoint Input

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User Manual

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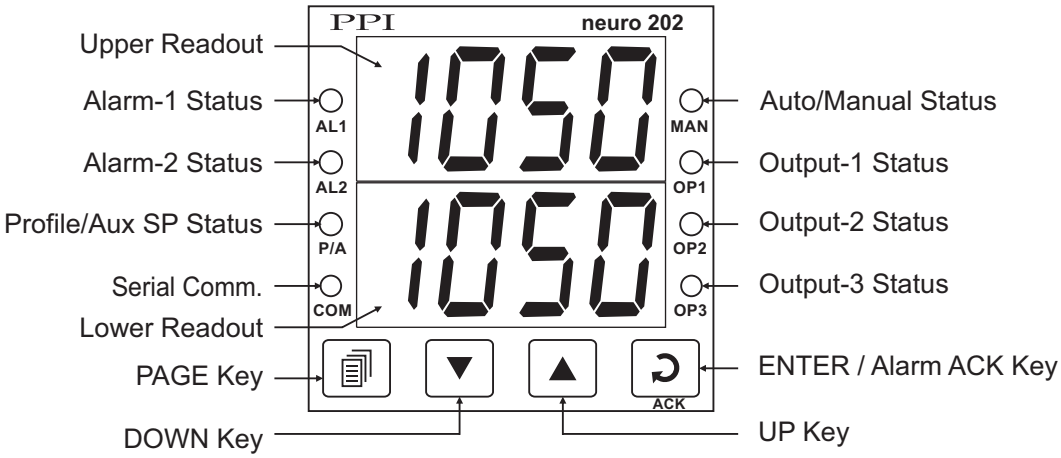
Section 1

FRONT PANEL LAYOUT

The controller front panel comprises of digital readouts, LED indicators and membrane keys as shown in Figure 1.1 below.

Figure 1.1



READOUTS

The Upper Readout is a 4 digit, 7-segment bright 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 bright 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 red LED's that show the status related to control, alarm and operation mode. Refer Table 1.1 below for details.

Table 1.1

Indicator	Status
AL1	Flashes while Alarm-1 is active.
AL2	Flashes while Alarm-2 is active.
P/A	**Profile Mode** • Flashes while the controller is executing ramp/soak profile cycle. • Glows continuously if the profile cycle is in HOLD state. • Remains OFF, if not executing a profile Cycle. **Auxiliary Setpoint Mode** • Remains OFF, if main SP is the control SP. • Glows continuously if auxiliary SP is the control SP.

Indicator	Status
COM	Serial Communication Status. Flashes when data is being exchanged with Master Device.
MAN	• Glows if the Manual (PID) mode is active. • Remains OFF if Automatic (PID). Standby or Profile mode is active.
OP1 OP2 OP3	• Indicate Output-1, Output-2 & Output-3 ON/OFF status, respectively, if the Output type is Relay or SSR. • Remain OFF if the Output type is DC Linear.

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 / ACK	Set up Mode : Press to store the set parameter value and to scroll to the next parameter on the PAGE. Run Mode : Press to acknowledge any pending Alarm(s). This also turns off the Alarm relay.

Section 2

BASIC OPERATION

POWER-UP

Upon power-up the controller executes the following sequence of operations.

- Checks for Sensor Fault. If the connected sensor type is RTD Pt100 and the selected sensor type is any of thermocouples or vice-a-versa; the controller displays sensor fault massage (S.FLt) on upper readout. The user is advised to take necessary corrective action and press Enter key to acknowledge the fault.
- All displays and indicators are lit on for approximately 3 seconds to check any display segment failure.
- Displays controller model name on the Upper Readout and the firmware version on the Lower Readout, for approximately 1 second. This helps user to verify features and refer to the correct documents versions.

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

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 (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 if controller is supplied with Ramp / Soak Profile option)

While a Profile Cycle is in progress, the front panel indicator 'MODE' flashes or glows steady with Green color. 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). The % Output Power (if PID Control) can be viewed by toggling the Lower Readout using ENTER key.

The Lower Readout also shows 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 Segment Number as shown in Figure 2.2 (a) & 2.2 (b).

Figure 2.2 (a)

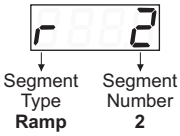
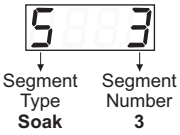


Figure 2.2 (b)



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)

Figure 2.3 (b)

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 if controller is supplied with Auxiliary Set-point option)

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 'MODE' glows steady with Green color if Auxiliary 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

Upper Readout	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) While in *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 *Sensor Open* conditions are treated as maximum PV. Thus, Process High, positive Deviation Band and Window Band alarms activate under *Over-range/Sensor Open* error. Similarly, Process Low, negative Deviation Band and Window Band alarms activate during *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 for process start-up to make sure that the process equilibrium is achieved before the control is transferred for subsequent automatic (closed 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 5 seconds until front panel indicator MAN 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 and 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 5 seconds until the front panel indicator MAN 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

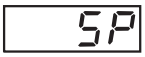
Step through the following sequence to open the operator page and to adjust the operator parameter values.

1. Press and release PAGE key. The Lower Readout shows (PAGE) and Upper Readout shows (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

The parameters in Operator Page are editable only if permission is enabled in Supervisory Page (PAGE-13)	
Parameter Description	**Settings**
ACTIVATE / DE-ACTIVATE STANDBY MODE Set the parameter value to 'Yes' or 'No' for entering and exiting the Standby mode, respectively.	No Yes (Default : No)
CONTROL SETPOINT  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 : -1999)
ALARM-1 SETPOINT The Process High or Process Low limit for Alarm-1.	Min. to Max. Range specified for the selected Input Type (Default : Min or Max Range)
ALARM-1 DEVIATION BAND The Alarm setpoint for Alarm-1 if the Alarm Type is the Deviation Band value for Alarm-1.	**For DC mA/mV/V** : -1999 to 9999 counts **For Thermocouples/RTD** : -999 to 999 or -1.999 to 999.9 (Default : 0)
ALARM-1 WINDOW BAND The Alarm setpoint for Alarm-1 if the Alarm Type is the Window Band value for Alarm-1.	**For DC mA/mV/V** : 3 to 9999 counts **For Thermocouples/RTD** : 3 to 999 or 0.3 to 999.9 (Default : 0)

Parameter Description	Settings
ALARM-2 SETPOINT **ALARM-2 DEVIATION BAND** **ALARM-2 WINDOW BAND** 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 *(Available only if the Controller is supplied with Auxiliary Set-point option)* The alternate control set-point that the controller respects for control purpose when selected through remote input terminals.	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.

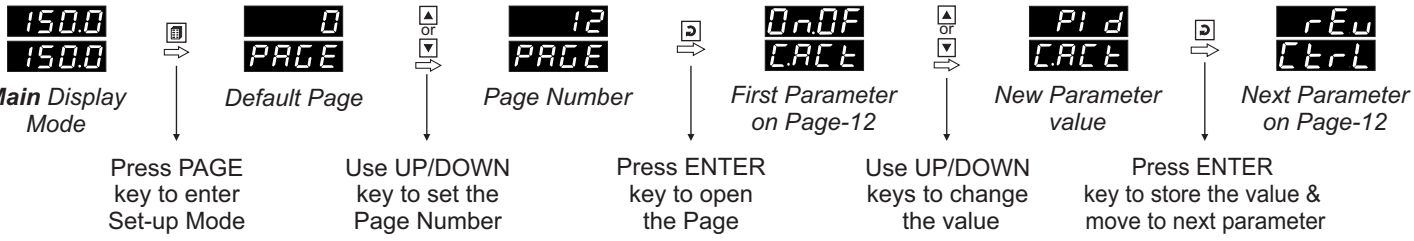
SET-UP MODE

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



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.

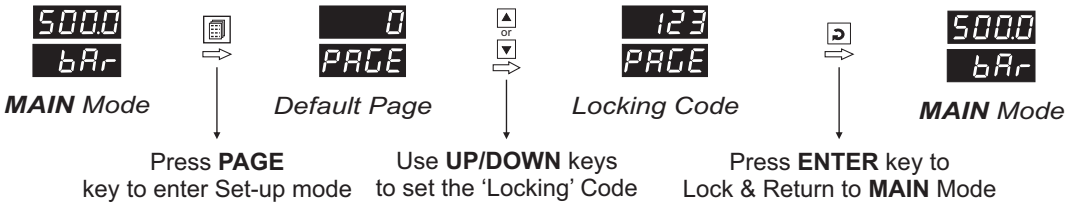
For enabling / disabling the Lock, step through the following sequence:

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



Un-Locking

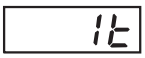
Repeat the Locking procedure twice for unlocking.

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 ***(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  ***(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 ***(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 ***(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 ***(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 ***(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 ***(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 ***(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 ***(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 ***(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 ***(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 ***(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 ***(Available for PID Control only)*** Sets the minimum % output power limit for Output-1.	0 to Heat Power High (Default : 0)
HEAT POWER HIGH ***(Available for PID Control only)*** Sets the maximum % output power limit for Output-1 .	Heat Power Low to 100 (Default : 100)
COOL POWER LOW ***(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 ***(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 AL_1 Selects the Alarm-1 activation type. Selecting 'None' disables the alarm and suppresses all the related parameters for Alarm-1.	nonE None P_Lo Process Low P_hi Process High dE Deviation Band bAnd Window Band (Default : None)
ALARM-1 SETPOINT 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 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 -99.9 to 999.9 (Default : 5)
ALARM-1 WINDOW BAND 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 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 A1.Ih Setting to 'Yes' suppresses Alarm-1 activation upon power-up or process start-up.	no No 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 **ALARM-2 HYSTERESIS** A2.HY **ALARM-2 INHIBIT** A2. Ih 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.
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).	Pv 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

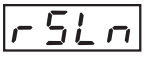
PAGE-12 : INPUT/OUTPUT CONFIGURATION PARAMETERS

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 Pulse P Id PID (Default : PID)
CONTROL LOGIC CtrL Select Reverse (*heat* logic) or Direct (*cool* logic).	rEu Reverse di r 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 SG.Lo ***(Available for DC linear mV/V/mA Inputs only)*** The transmitter output signal value corresponding to PV RANGE LOW parameter value. Refer *Appendix-A : 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
Reserved	0.0 to Signal High	0.0
0 to 80 mV	0.00 to Signal High	0.00
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

<table>
<tr><th>Parameter Description</th><th>Settings
(Default Value)</th></tr>
<tr><td>SIGNAL HIGH
(Available for DC linear mV/V/mA Inputs only)
The transmitter output signal value corresponding to PV RANGE HIGH parameter value. Refer Appendix-A : DC Linear Signal Interface for details.</td><td><table>
<tr><th>Input Type</th><th>Settings</th><th>Default</th></tr>
<tr><td>0 to 20 mA</td><td>Signal Low to 20.00</td><td>20.00</td></tr>
<tr><td>4 to 20 mA</td><td>Signal Low to 20.00</td><td>20.00</td></tr>
<tr><td>Reserved</td><td>Signal Low to 80.00</td><td>80.00</td></tr>
<tr><td>0 to 80 mV</td><td>Signal Low to 80.00</td><td>80.00</td></tr>
<tr><td>0 to 1.25 V</td><td>Signal Low to 1.250</td><td>1.250</td></tr>
<tr><td>0 to 5 V</td><td>Signal Low to 5.000</td><td>5.000</td></tr>
<tr><td>0 to 10 V</td><td>Signal Low to 10.00</td><td>10.00</td></tr>
<tr><td>1 to 5 V</td><td>Signal Low to 5.000</td><td>5.000</td></tr>
</table></td></tr>
<tr><td>PV RESOLUTION 
(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.</td><td>Refer Table 6.2
(Default : 1)</td></tr>
<tr><td>PV RANGE LOW
(Available for DC Linear Inputs)
Set process value corresponding to SIGNAL LOW parameter value. Refer Appendix-A : DC Linear Signal Interface for details.</td><td>-1999 to 9999
(Default : 0)</td></tr>
<tr><td>PV RANGE HIGH
(Available for DC Linear Inputs)
Set process value corresponding to SIGNAL HIGH parameter value. Refer Appendix-A : DC Linear Signal Interface for details.</td><td>-1999 to 9999
(Default : 1000)</td></tr>
<tr><td>OFFSET FOR PV
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</td><td>For DC mA/mV/V :
1 to 9999 counts
For Thermocouples/RTD :
1 to 999 or 0.1 to 999.9
(Default : 0)</td></tr>
<tr><td>DIGITAL FILTER TIME CONSTANT
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.</td><td>0.5 to 60.0 Seconds
(in steps of 0.5 Seconds)
(Default : 2.0 sec.)</td></tr>
</table>

Table 6.2

Option	What it means	Range (Min. to Max.)	Resolution
tC_J	Type J Thermocouple	0 to +960°C / +32 to +1760°F	Fixed 1°C / 1°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	
rESu	Reserved for customer specific Thermocouple type not listed above. The type shall be specified in accordance with the ordered (optional on request) Thermocouple type.		
rtd	3-wire, RTD Pt100	-199 to +600°C / -328 to +1112°F **or** -199.9 to 600.0°C / -199.9 to 999.9°F	User settable 1°C / 1°F **or** 0.1°C / 0.1°F
0-20	0 to 20mA DC current	-1999 to +9999 units	User settable 1 / 0.1 / 0.01/ 0.001 units
4-20	4 to 20mA DC current		
rESu	Reserved		
0.080	0 to 80mV DC voltage		
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. Ih ***(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. hF ***(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 (CoñtE) 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 : Yes)

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 PrOF Enable or Disable the setpoint profile feature. If disabled, all the profile related parameters and commands are suppressed.	dSbL Disable EnbL Enable (Default : Disable)
NUMBER OF SEGMENTS n.SEG Set the number of segments to constitute the setpoint profile.	1 to 16 (Default : 16)
NUMBER OF REPEATS 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 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.	no No YES Yes (Default : Yes)
OUTPUT OFF 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.	no No YES Yes (Default : No)
POWER FAIL STRATEGY 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.	Abrt Abort 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 SEG.n Select profile segment number for editing the following parameters.	1 to 16 (Default : 1)
TARGET SETPOINT t_SP 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 ti nE Set the time duration of ramping or soaking for the selected profile segment number.	0 to 9999 Minutes (Default : 0)
HOLDBACK TYPE 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.	nonE None UP Up dn Down both Both (Default : None)
HOLDBACK VALUE 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 changes. 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 SkiP 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 tiME 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

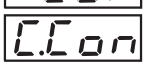
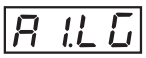
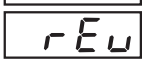
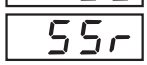
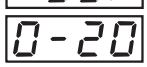
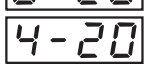
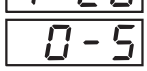
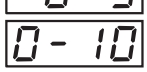
Parameter Description	Settings
SEGMENT BAND VALUE The modified Holdback Band Value is applied immediately on the current segment.	**For DC mA/mV/V** : 1 to 9999 counts **For Thermocouples/RTD** : 1 to 999 or 0.1 to 999.9
PROFILE REPEAT COUNTER This parameter shows the remaining profile cycles. If the 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 Select the type in accordance with the hardware configuration for Output-1 (OP1).	Relay SSR 0 - 20mA 4 - 20mA 0 - 5V 0 - 10V (Default : Relay)
OUTPUT-2 FUNCTION SELECTION *(Applicable for Output-2 hardware module, if fitted)* Select the function / feature that will utilize Output-2 module as output.	None Alarm-1 End Of Profile  Cool Control (Default : None)
ALARM-1 LOGIC  *(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.	Normal  Reverse (Default : Normal)
OUTPUT-2 TYPE *(Available if Output-2 function is Cool Control)* Select the type in accordance with the hardware configuration for Output-2 (OP2).	Relay  SSR  0 - 20mA  4 - 20mA  0 - 5V  0 - 10V (Default : Relay)
OP2 EVENT STATUS *(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 OFF (Default : ON)

Parameter Description	Settings (Default Value)
OP2 EVENT TIME UNITS 02.Ut *(Available if Output-2 function is End of Profile & Event Status is set to 'ON')* Select time units for the parameter 'Output-2 Event Time'.	SEC Seconds Min Minutes HoUr Hours (Default : Seconds)
OP2 EVENT TIME 02.Et *(Available if Output-2 function is End of Profile & Event 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 OP3F *(Applicable for Output-3 hardware module, if fitted)* Select the function / feature that will utilize Output-3 module as output.	nonE None AL_2 Alarm-2 EOP End Of Profile rEC Recorder (Default : Alarm)
ALARM-2 LOGIC A2LG *(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.	norn Normal rEu Reverse (Default : Normal)
OUTPUT-3 EVENT STATUS 03.ES *(Available if Output-3 function is End-of-Profile)* Definition same as Output-2 Event Status.	On ON OFF OFF (Default : ON)
OUTPUT-3 EVENT TIME UNITS 03.Ut *(Available if Output-3 function is End of Profile & Event Status is set to 'ON')* Definition same as Output-2 Event Time Units.	SEC Seconds Min Minutes HoUr Hours (Default : Seconds)
OUTPUT-3 EVENT TIME 03.Et *(Available if Output-3 function is End of Profile & Event Status is set to 'ON')* Definition same as Output-2 Event Time.	0 to 9999 (Default : 0)

Parameter Description	Settings (Default Value)
RECORDER OUTPUT TYPE rEC.O *(Available if Output-3 function is Recorder)* Select type for Output-3 in accordance with the hardware module fitted.	0-20 0 to 20mA 4-20 4 to 20mA 0-5 0 to 5V 0-10 0 to 10V (Default : 0 to 20mA)

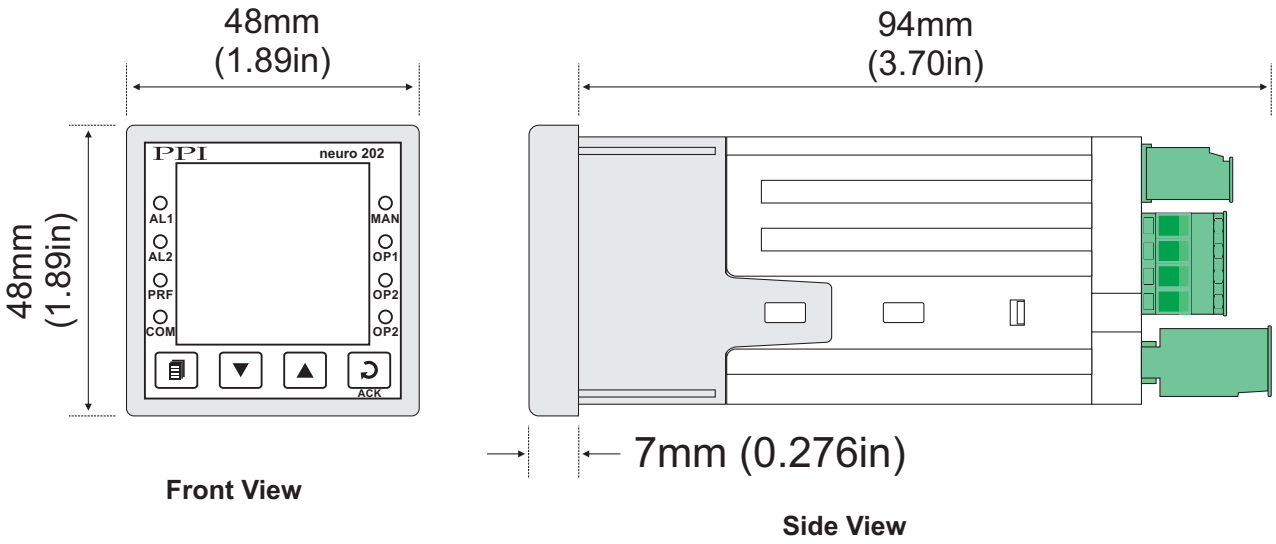
Section 10

MECHANICAL INSTALLATION

OUTER DIMENSIONS AND PANEL CUTOUT

The Figure 10.1 shows the controller outer dimensions.

Figure 10.1



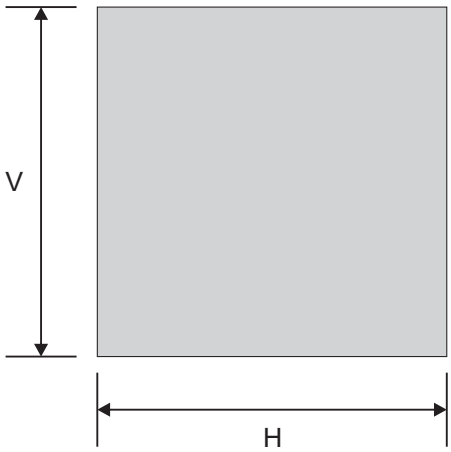
Front View

Side View

PANEL CUTOUT

The Figure 10.2 shows the panel cutout requirements for a single controller.

Figure 10.2



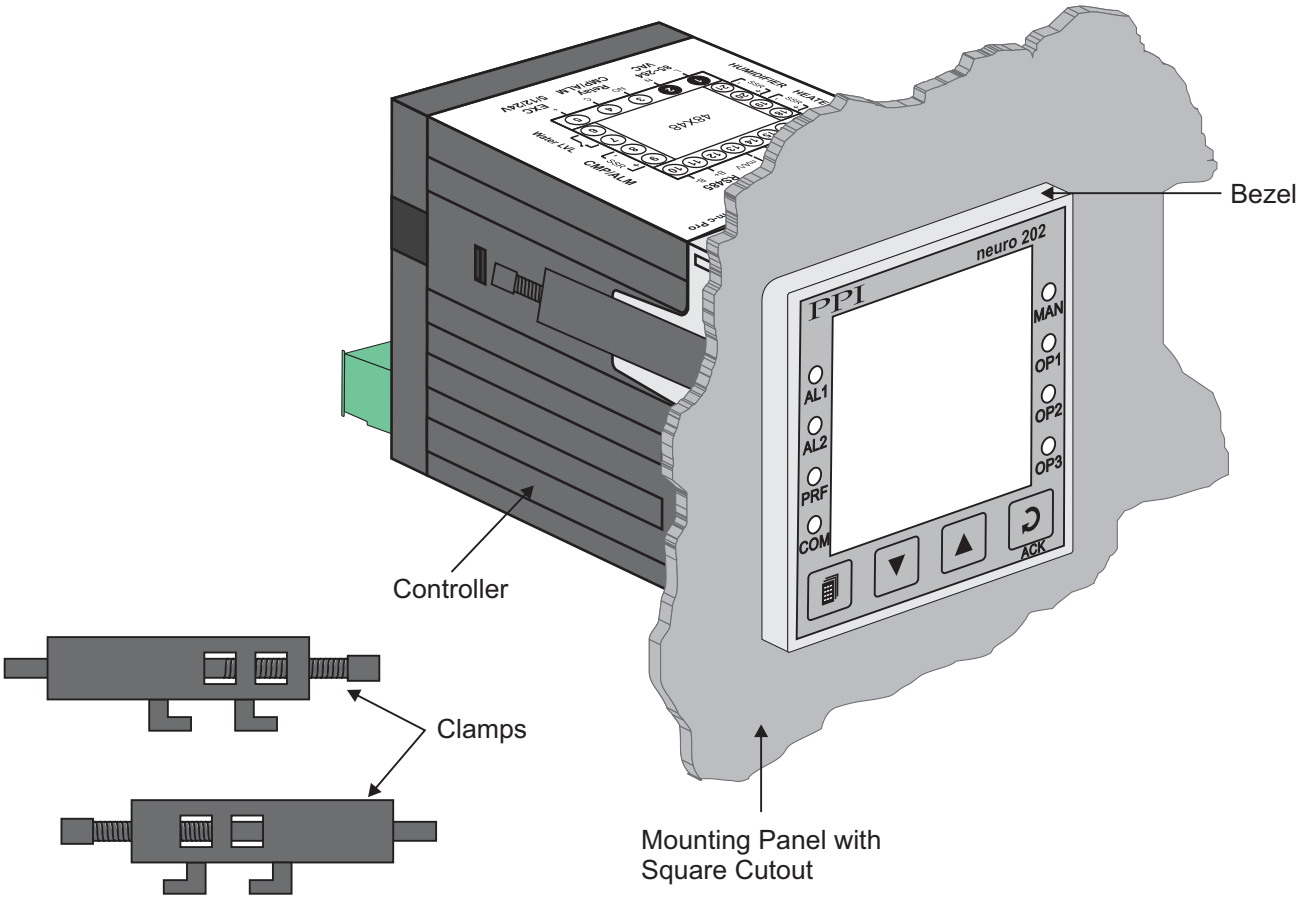
Parameter	Dimensions	
	mm	inches
H	45 (-0, +0.5)	1.77 (-0, +0.02)
V	45 (-0, +0.5)	1.77 (-0, +0.02)

PANEL MOUNTING

Follow the steps below for mounting the controller on panel:

1. Prepare a square cutout to the size shown in Figure 10.2.
2. Remove the Panel Mounting Clamp from the controller Enclosure and insert the rear of the controller housing through the panel cutout from the front of the mounting panel.
3. Hold the controller gently against the mounting panel such that it positions squarely against the panel wall, see Figure 10.3. Apply pressure only on the bezel and not on the front label.
4. Insert the mounting clamps on either side of the controller in the slots provided for the purpose. Rotate the screws clockwise so that they move forward until they push firmly against the rear face of the mounting panel for secured mounting.

Figure 10.3



Section 11

ELECTRICAL CONNECTIONS

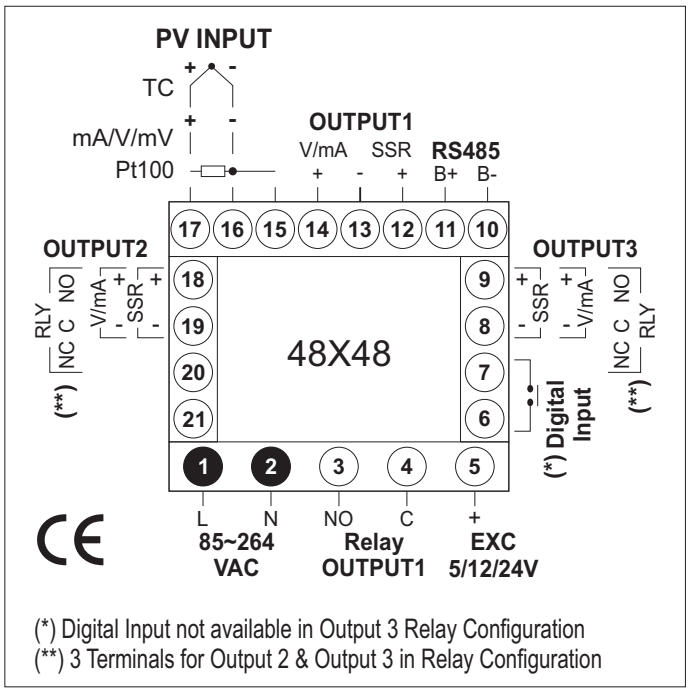
WARNING
MISHANDLING / NEGLIGENCE CAN RESULT IN PERSONAL DEATH OR SERIOUS INJURY.

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 indicator.
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 indicator 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 Indicator supply is switched-off while making/removing any connections or removing the Indicator from its enclosure.

CONNECTION DIAGRAM

The Electrical Connection Diagram is shown on the top side of the enclosure. The diagram shows the terminals viewed from the REAR SIDE with the controller label upright. The connecters provided for wiring are pluggable male-female type. The female parts are soldered on the controller PCBs while the male parts are with screws and removable. The rear panel electrical wiring connection diagram is shown in Figure 11.1.

Figure 11.1



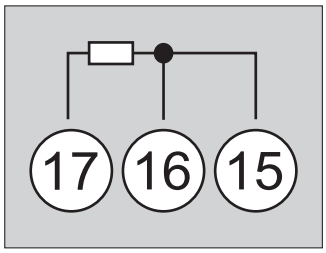
(*) Digital Input not available in Output 3 Relay Configuration
(**) 3 Terminals for Output 2 & Output 3 in Relay Configuration

DESCRIPTIONS

The back panel connections are described as under:

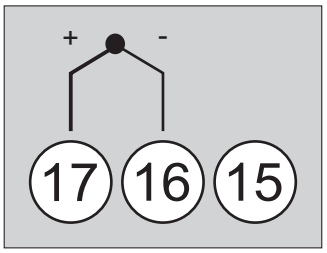
PV INPUT : RTD Pt100, 3-wire / Thermocouple / mA / mV / V (Terminals : 17, 16, 15)

Figure 11.2 (a)



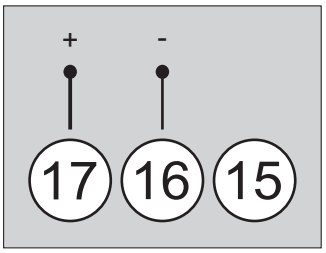
RTD Pt100, 3-wire

Figure 11.2 (b)



Thermocouple

Figure 11.2 (c)



mA / mV / V

RTD Pt100, 3-wire

Connect single leaded end of RTD bulb to terminal 17 and the double leaded ends to terminal 16 and 15 (interchangeable) as shown in Figure 11.2 (a). Use low resistance copper conductor leads of the same gauge and length. Avoid joints in the cable.

Thermocouple

Connect Thermocouple Positive (+) to terminal 17 and Negative (-) to terminal 16 as shown in Figure 11.2 (b). Use correct type of extension lead wires or compensating cable. Avoid joints in the cable.

mA / mV / V

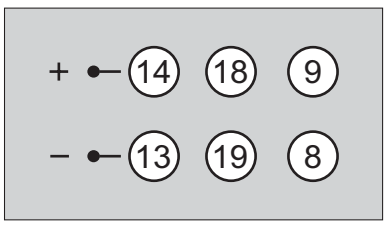
Use a shielded twisted pair with the shield grounded at the signal source for connecting mV / V source. Connect common (-) to terminal 2 and the signal (+) to terminal 1, as shown in Figure 11.2 (c).

OUTPUT1 : Control - V/mA (Terminals : 13, 14)
Control - SSR (Terminals : 12, 13)
Control - Relay (Terminals : 3, 4)

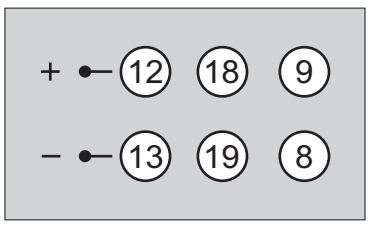
OUTPUT2 : Control - V/mA (Terminals : 18, 19)
Control / Alarm - SSR (Terminals : 18, 19)
Control / Alarm - Relay (Terminals : 18, 19, 20)

OUTPUT3 : Retrans - V/mA (Terminals : 8, 9)
Alarm - SSR (Terminals : 8, 9)
Alarm - Relay (Terminals : 7, 8, 9)

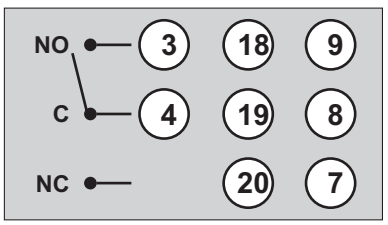
Figure 11.3



Ouput1 / Output2 / Output3 V/mA



Output1 / Output2 / Output3 SSR



Output1 / Output2 / Output3 Relay

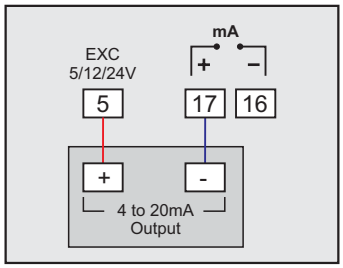
mA / V Output
The Positive (+) of mA / V is available at Terminal 14 & the Negative (-) at Terminal 13.

Relay Output
Potential-free Relay changeover contacts NO (Normally Open) and C (Common) rated 10A/240 VAC (resistive load).

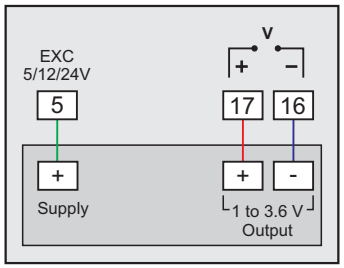
SSR Output
Connect (+) and (-) terminals of SSR to (+) and (-) terminals of controller, respectively. Use Zero-Crossover, 3 to 30 VDC operated SSR.

EXC 5/12/24VDC : Excitation Voltage for Transmitters (Terminal : 5)

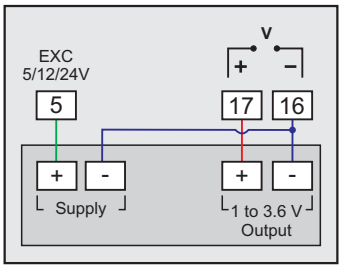
The Controller is supplied with either 5 or 12 or 24VDC @ 30 mA power source. This is primarily meant for exciting 2-wire or 4-wire Current / Voltage output transmitters. Please note that only the Source terminal (positive) is provided on the back panel termination. The Sensor negative terminal is used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



2-wire Current Transmitter
(5/12/24VDC Supply)



3-wire Voltage Transmitter
(5/12/24VDC Supply)

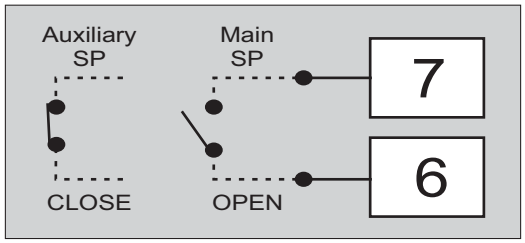


4-wire Voltage Transmitter
(5/12/24VDC Supply)

DIGITAL INPUT FOR AUXILIARY SP SELECTION (Terminals : 6, 7)

If the Controller is ordered with Auxiliary Setpoint feature, the digital input (potential-free contact closure) for Main & Auxiliary Setpoint selection is provided on terminals 6 & 7. The Setpoint selection is as shown in figure 11.4.

Figure 11.4

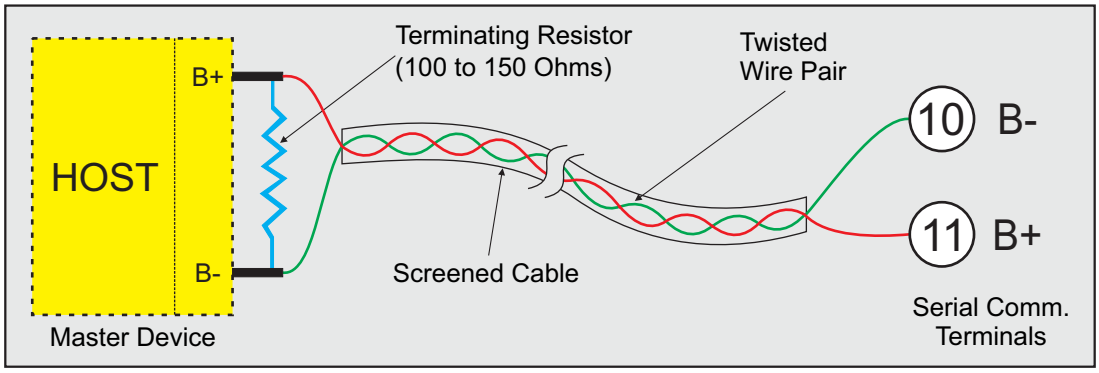


RS485 : Serial Communication Port (Terminals 10, 11)

Connect terminal 11 and 10 of the controller to (+) and (-) RS485 terminals of the Master device.

To ensure reliable operation of the Serial Communication Link (without data corruption due to line noise or reflections), use a pair of twisted wires inside screened cable with the terminating resistor (100 to 150 Ohms) at one end, as shown in Figure 11.5 below.

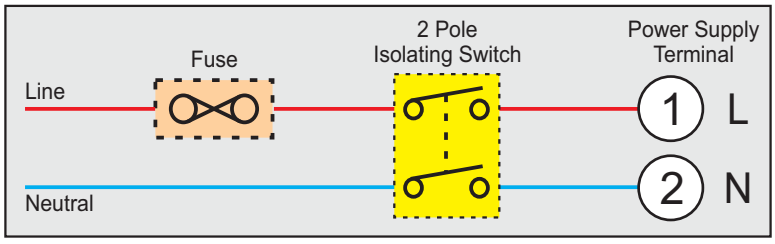
Figure 11.5



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 11.6 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 11.6



Section 12

MODBUS MAPPING

Table 1 : Read Only Parameters

<table>
<tr><th>Parameter</th><th>Data Type</th><th>Address</th><th>Remark</th></tr>
<tr><td>Parameter Modified through Front Panel Keys</td><td>16 bit signed integer</td><td>1</td><td>
<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 MODBUS read.</td></tr>
<tr><td>0</td><td>No parameter is modified since last MODBUS read.</td></tr>
</table>
</td></tr>
<tr><td>Process Value (PV)</td><td>16 bit signed integer</td><td>2</td><td>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>
</td></tr>
<tr><td>Alarm 1 Status</td><td>16 bit signed integer</td><td>3</td><td rowspan="2">
<table>
<tr><th>Value</th><th>Status</th></tr>
<tr><td>0</td><td>Alarm OFF (Inactive)</td></tr>
<tr><td>1</td><td>Alarm ON (Active)</td></tr>
</table>
</td></tr>
<tr><td>Alarm 2 Status</td><td>16 bit signed integer</td><td>4</td></tr>
<tr><td>Ambient Temperature</td><td>16 bit signed integer</td><td>5</td><td>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.</td></tr>
<tr><td>Working Control Setpoint</td><td>16 bit signed integer</td><td>16</td><td>Resolution Based Parameter : Refer Appendix-A

The current Setpoint value used for control. The value depends on the current mode of operation and thus may represent the Main Setpoint, Auxiliary Setpoint or Ramp/Soak Profile Setpoint.</td></tr>
<tr><td>Output-1 (As Control Output) Relay / SSR Status</td><td>16 bit signed integer</td><td>6</td><td rowspan="2">
<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>
Note :
If output type is DC mA/V, the status is always 0.
</td></tr>
<tr><td>Output-2 (As Control Output) Relay / SSR Status</td><td>16 bit signed integer</td><td>7</td></tr>
<tr><td>Control Output Power</td><td>16 bit signed integer</td><td>8</td><td>-100% to 0% : Cool Power
0% to 100% : Heat Power</td></tr>
</table>

<table>
<tr><th colspan="4">Ramp / Soak Profile Parameters</th></tr>
<tr><th>Parameter</th><th>Data Type</th><th>Address</th><th>Remark</th></tr>
<tr><td>Current Profile Segment Number</td><td>16 bit signed integer</td><td>9</td><td>The running profile segment number (1 to 16)</td></tr>
<tr><td>Current Profile Segment Type</td><td>16 bit signed integer</td><td>10</td><td>The running profile segment type.
<table><tr><th>Value</th><th>Segment Type</th></tr><tr><td>0</td><td>Soak</td></tr><tr><td>1</td><td>Ramp</td></tr></table></td></tr>
<tr><td>Current Profile Segment Target Setpoint</td><td>16 bit signed integer</td><td>11</td><td>Resolution Based Parameter : Refer Appendix-A

The target (end) setpoint for the running profile segment.</td></tr>
<tr><td>Balance Soak Time</td><td>16 bit signed integer</td><td>13</td><td>The balance soak time (in Minutes) of a running soak segment.</td></tr>
<tr><td>Segment Hold Status</td><td>16 bit signed integer</td><td>14</td><td>Indicates whether the current profile segment is in Hold Status.
<table><tr><th>Value</th><th>Status</th></tr><tr><td>0</td><td>Running</td></tr><tr><td>1</td><td>Hold</td></tr></table></td></tr>
<tr><td>Output-3 as End-of-Profile Relay / SSR Status</td><td>16 bit signed integer</td><td>17</td><td><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></td></tr>
<tr><th colspan="4">Auxiliary Setpoint Parameter</th></tr>
<tr><th>Parameter</th><th>Data Type</th><th>Address</th><th>Remark</th></tr>
<tr><td>Auxiliary Setpoint DI Status</td><td>16 bit signed integer</td><td>40</td><td><table><tr><th>Value</th><th>DI Status</th></tr><tr><td>0</td><td>Contact Open : Main SP Active</td></tr><tr><td>1</td><td>Contact Close : Aux SP Active</td></tr></table></td></tr>
</table>

Table 2 : Read / Write Parameters

<table>
<tr><th>Parameter</th><th>Data Type</th><th>Address</th><th>Remark</th></tr>
<tr><td>Input Type</td><td>16 bit signed integer</td><td>44</td><td>
<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>
</td></tr>
<tr><td>PV Units</td><td>16 bit signed integer</td><td>45</td><td>
<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.
</td></tr>
<tr><td>PV Resolution</td><td>16 bit signed integer</td><td>46</td><td>
<table>
<tr><th colspan="2">For RTD Pt100 Input</th></tr>
<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><th colspan="2">For mV/V/mA Input</th></tr>
<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>
</td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Data Type</th><th>Address</th><th>Remark</th></tr>
<tr><td>Signal Low</td><td>16 bit signed integer</td><td>182</td><td rowspan="5">Resolution Based Parameter : Refer Appendix-A</td></tr>
<tr><td>Signal High</td><td>16 bit signed integer</td><td>183</td></tr>
<tr><td>PV Range Low</td><td>16 bit signed integer</td><td>47</td></tr>
<tr><td>PV Range High</td><td>16 bit signed integer</td><td>48</td></tr>
<tr><td>Offset for PV</td><td>16 bit signed integer</td><td>49</td></tr>
<tr><td>Digital Filter Time Constant</td><td>16 bit signed integer</td><td>50</td><td>Settable in multiples of 5. The values that are non-multiples of 5 are automatically converted to the nearest multiple of 5.</td></tr>
<tr><td>Alarm-1 Type</td><td>16 bit signed integer</td><td>51</td><td rowspan="2"><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></td></tr>
<tr><td>Alarm-2 Type</td><td>16 bit signed integer</td><td>55</td></tr>
<tr><td>Alarm-1 SP</td><td>16 bit signed integer</td><td>42</td><td rowspan="4">Resolution Based Parameter : Refer Appendix-A</td></tr>
<tr><td>Alarm-1 Hysteresis</td><td>16 bit signed integer</td><td>52</td></tr>
<tr><td>Alarm-2 SP</td><td>16 bit signed integer</td><td>43</td></tr>
<tr><td>Alarm-2 Hysteresis</td><td>16 bit signed integer</td><td>56</td></tr>
<tr><td>Alarm-1 Inhibit</td><td>16 bit signed integer</td><td>53</td><td rowspan="2"><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></td></tr>
<tr><td>Alarm-2 Inhibit</td><td>16 bit signed integer</td><td>57</td></tr>
<tr><td>Alarm-1 Logic</td><td>16 bit signed integer</td><td>54</td><td rowspan="2"><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></td></tr>
<tr><td>Alarm-2 Logic</td><td>16 bit signed integer</td><td>58</td></tr>
<tr><td>Control Action</td><td>16 bit signed integer</td><td>59</td><td><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></td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Data Type</th><th>Address</th><th>Remark</th></tr>
<tr><td>Control Mode</td><td>16 bit signed integer</td><td>60</td><td><table><tr><th>Value</th><th>Logic</th></tr><tr><td>0</td><td>Reverse (Heat)</td></tr><tr><td>1</td><td>Direct (Cool)</td></tr></table></td></tr>
<tr><td>Setpoint Low Limit</td><td>16 bit signed integer</td><td>63</td><td rowspan="9">Resolution Based Parameter : Refer Appendix-A</td></tr>
<tr><td>Setpoint High Limit</td><td>16 bit signed integer</td><td>64</td></tr>
<tr><td>Control Setpoint</td><td>16 bit signed integer</td><td>65</td></tr>
<tr><td>Hysteresis</td><td>16 bit signed integer</td><td>66</td></tr>
<tr><td>Cool Hysteresis</td><td>16 bit signed integer</td><td>67</td></tr>
<tr><td>Pulse time</td><td>16 bit signed integer</td><td>68</td></tr>
<tr><td>Pulse-on time</td><td>16 bit signed integer</td><td>69</td></tr>
<tr><td>Cool Pulse Time</td><td>16 bit signed integer</td><td>70</td></tr>
<tr><td>Cool Pulse-on time</td><td>16 bit signed integer</td><td>71</td></tr>
<tr><td>Tune Command & Status</td><td>16 bit signed integer</td><td>41</td><td><table><tr><th colspan="2">Write Operation</th></tr><tr><th>Value</th><th>Action</th></tr><tr><td>129</td><td>Start Tuning</td></tr><tr><td>128</td><td>Abort Tuning</td></tr><tr><th colspan="2">Read Operation</th></tr><tr><th>Value</th><th>Tuning Status</th></tr><tr><td>0</td><td>Not Tuning</td></tr><tr><td>1</td><td>Tuning in Progress</td></tr></table></td></tr>
<tr><td>Proportional Band</td><td>16 bit signed integer</td><td>72</td><td>Resolution Based Parameter : Refer Appendix-A</td></tr>
<tr><td>Integral Time</td><td>16 bit signed integer</td><td>73</td><td>—</td></tr>
<tr><td>Derivative Time</td><td>16 bit signed integer</td><td>74</td><td>—</td></tr>
<tr><td>Relative Cool Gain</td><td>16 bit signed integer</td><td>75</td><td>Resolution Based Parameter : Refer Appendix-A</td></tr>
<tr><td>Heat Power Low</td><td>16 bit signed integer</td><td>76</td><td>—</td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Data Type</th><th>Address</th><th>Remark</th></tr>
<tr><td>Heat Power High</td><td>16 bit signed integer</td><td>77</td><td>—</td></tr>
<tr><td>Cool Power Low</td><td>16 bit signed integer</td><td>78</td><td>—</td></tr>
<tr><td>Cool Power High</td><td>16 bit signed integer</td><td>79</td><td>—</td></tr>
<tr><td>Cycle Time</td><td>16 bit signed integer</td><td>80</td><td rowspan="2">Resolution Based Parameter : Refer Appendix-A</td></tr>
<tr><td>Cool Cycle Time</td><td>16 bit signed integer</td><td>81</td></tr>
<tr><td>Sensor Break Output Power</td><td>16 bit signed integer</td><td>82</td><td>—</td></tr>
<tr><td>Overshoot Inhibit</td><td>16 bit signed integer</td><td>83</td><td><table><tr><th>Value</th><th>Overshoot Inhibit</th></tr><tr><td>0</td><td>Disable</td></tr><tr><td>1</td><td>Enable</td></tr></table></td></tr>
<tr><td>Overshoot Inhibit Factor</td><td>16 bit signed integer</td><td>84</td><td>Resolution Based Parameter : Refer Appendix-A</td></tr>
<tr><td>Auto / Manual PID Mode</td><td>16 bit signed integer</td><td>184</td><td><table><tr><th>Value</th><th>PID Mode</th></tr><tr><td>0</td><td>Auto</td></tr><tr><td>1</td><td>Manual</td></tr></table></td></tr>
<tr><td>PID Manual Power</td><td>16 bit signed integer</td><td>185</td><td>Range : -100% to 100%.
-100% to 0% : Cool Power
0% to 100% : Heat Power</td></tr>
<tr><td>Standby Mode</td><td>16 bit signed integer</td><td>85</td><td><table><tr><th>Value</th><th>Standby</th></tr><tr><td>0</td><td>Disable</td></tr><tr><td>1</td><td>Enable</td></tr></table></td></tr>
<tr><td>Output-1 Type
(Heat Control)</td><td>16 bit signed integer</td><td>61</td><td rowspan="2"><table><tr><th>Value</th><th>Output Type</th></tr><tr><td>0</td><td>Relay</td></tr><tr><td>1</td><td>SSR</td></tr><tr><td>2</td><td>0 to 20 mA</td></tr><tr><td>3</td><td>4 to 20 mA</td></tr><tr><td>4</td><td>0 to 5 V</td></tr><tr><td>5</td><td>0 to 10 V</td></tr></table></td></tr>
<tr><td>Output-2 Type
(Cool Control)</td><td>16 bit signed integer</td><td>62</td></tr>
<tr><td>Output-2 Function</td><td>16 bit signed integer</td><td>160</td><td><table><tr><th>Value</th><th>Function</th></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>Cool Control</td></tr></table></td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Data Type</th><th>Address</th><th>Remark</th></tr>
<tr><td>Output-3 Function</td><td>16 bit signed integer</td><td>168</td><td><table><tr><th>Value</th><th>Function</th></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></td></tr>
<tr><td>PV/SP Selection for Retransmission</td><td>16 bit signed integer</td><td>172</td><td><table><tr><th>Value</th><th>PV/SP</th></tr><tr><td>0</td><td>PV</td></tr><tr><td>1</td><td>SP</td></tr></table></td></tr>
<tr><td>Output-3 Type Retransmission</td><td>16 bit signed integer</td><td>173</td><td><table><tr><th>Value</th><th>Output-3 Type</th></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></td></tr>
<tr><td>Recorder (Retransmission) Low</td><td>16 bit signed integer</td><td>174</td><td rowspan="2">Resolution Based Parameter : Refer Appendix-A</td></tr>
<tr><td>Recorder (Retransmission) High</td><td>16 bit signed integer</td><td>175</td></tr>
<tr><td colspan="4">Ramp / Soak Profile Parameters</td></tr>
<tr><th>Parameter</th><th>Data Type</th><th>Address</th><th>Remark</th></tr>
<tr><td>Profile Start / Abort Command & Status</td><td>16 bit signed integer</td><td>40</td><td><table><tr><th colspan="2">Write Operation</th></tr><tr><th>Value</th><th>Action</th></tr><tr><td>129</td><td>Start Profile</td></tr><tr><td>128</td><td>Abort Profile</td></tr><tr><th colspan="2">Read Operation</th></tr><tr><th>Value</th><th>Profile Status</th></tr><tr><td>0</td><td>Not Started</td></tr><tr><td>1</td><td>Running</td></tr></table></td></tr>
<tr><td>Profile Pause Command & Status</td><td>16 bit signed integer</td><td>93</td><td><table><tr><th colspan="2">Write Operation</th></tr><tr><th>Value</th><th>Command</th></tr><tr><td>1</td><td>Apply Pause</td></tr><tr><td>0</td><td>Remove Pause</td></tr><tr><th colspan="2">Read Operation</th></tr><tr><th>Value</th><th>Profile Status</th></tr><tr><td>0</td><td>Running</td></tr><tr><td>1</td><td>Paused</td></tr></table></td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Data Type</th><th>Address</th><th>Remark</th></tr>
<tr><td>Skip ‘Current Profile Segment’ Command</td><td>16 bit signed integer</td><td>94</td><td><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></td></tr>
<tr><td>Profile End Acknowledge</td><td>16 bit signed integer</td><td>95</td><td><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></td></tr>
<tr><td>Interval Time for Running Profile Segment</td><td>16 bit signed integer</td><td>25</td><td>Modify the set Interval Time for the profile segment in progress.</td></tr>
<tr><td>Band Type for Running Profile Segment</td><td>16 bit signed integer</td><td>26</td><td>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></td></tr>
<tr><td>Band Value for the Running Profile Segment</td><td>16 bit signed integer</td><td>27</td><td>Resolution Based Parameter : Refer Appendix-A

Modify the Hold Band value for the profile segment in progress.</td></tr>
<tr><td>Running Profile Repeat Counter</td><td>16 bit signed integer</td><td>28</td><td>Read or Modify the current Profile Repeat Counter.</td></tr>
<tr><td>Profile Enable / Disable Command</td><td>16 bit signed integer</td><td>86</td><td><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></td></tr>
<tr><td>Number of Profile Segments</td><td>16 bit signed integer</td><td>87</td><td>—</td></tr>
<tr><td>Profile Repeat Counts</td><td>16 bit signed integer</td><td>88</td><td>—</td></tr>
<tr><td>Control Output(s) Off (At the End-of-Profile)</td><td>16 bit signed integer</td><td>91</td><td><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></td></tr>
<tr><td>Power-Fail Strategy</td><td>16 bit signed integer</td><td>92</td><td><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></td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Data Type</th><th>Address</th><th>Remark</th></tr>
<tr><td>Output-2 Event Status
(if Selected as End-of-Profile)</td><td>16 bit signed integer</td><td>165</td><td rowspan="2"><table><tr><th>Value</th><th>OP2 Status</th></tr><tr><td>0</td><td>On during Profile, Off otherwise</td></tr><tr><td>1</td><td>Off during Profile, On otherwise</td></tr></table></td></tr>
<tr><td>Output-3 Event Status
(if Selected as End-of-Profile)</td><td>16 bit signed integer</td><td>169</td></tr>
<tr><td>Output-2 Event Time Units
(if Selected as End-of-Profile)</td><td>16 bit signed integer</td><td>167</td><td rowspan="2"><table><tr><th>Value</th><th>Time Units</th></tr><tr><td>0</td><td>Seconds</td></tr><tr><td>1</td><td>Minutes</td></tr><tr><td>2</td><td>Hours</td></tr></table></td></tr>
<tr><td>Output-3 Event Time Units
(if Selected as End-of-Profile)</td><td>16 bit signed integer</td><td>171</td></tr>
<tr><td>Output-2 Event Time Interval
(if Selected as End-of-Profile)</td><td>16 bit signed integer</td><td>166</td><td>—</td></tr>
<tr><td>Output-3 Event Time Interval
(if Selected as End-of-Profile)</td><td>16 bit signed integer</td><td>170</td><td>—</td></tr>
<tr><td colspan="4">Auxiliary Setpoint Parameters</td></tr>
<tr><th>Parameter</th><th>Data Type</th><th>Address</th><th>Remark</th></tr>
<tr><td>Auxiliary Setpoint Value</td><td>16 bit signed integer</td><td>186</td><td>Resolution Based Parameter : Refer Appendix-A</td></tr>
</table>

APPENDIX - A

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:

$$Y = mX + C$$

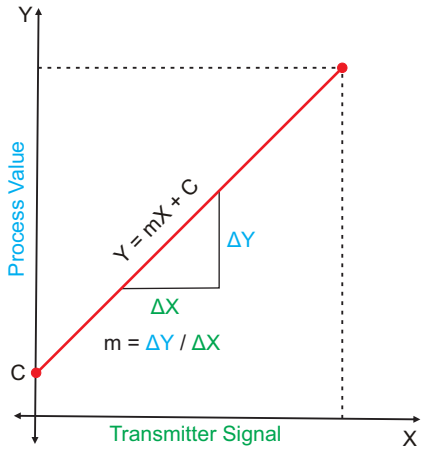
Where;

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)

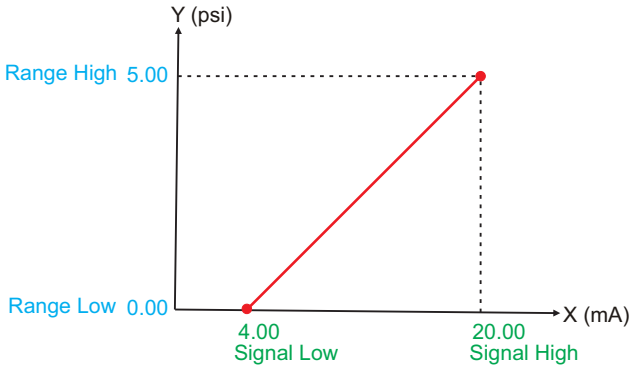


Examples of Transmitter Configurations

Example 1:

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

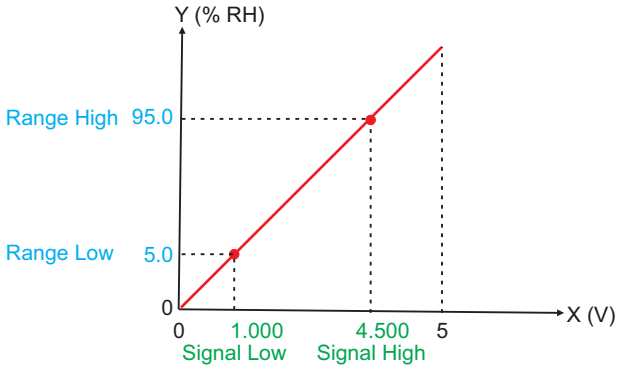
Input Type	:	4-20 mA
Signal Low	:	4.00 mA
Signal High	:	20.00 mA
PV Resolution	:	0.01
Range Low	:	0.00
Range High	:	5.00



Example 2

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

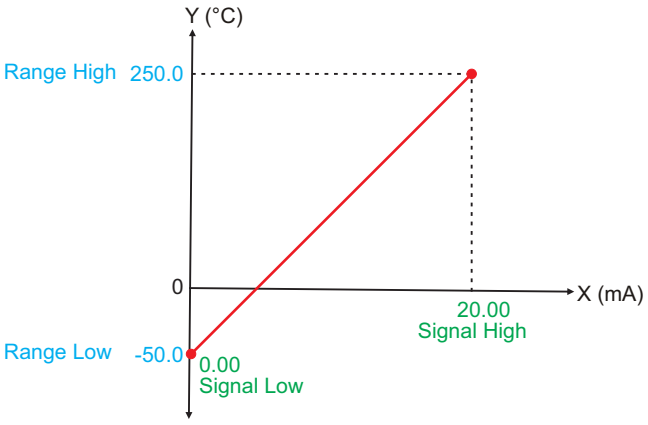
Input Type	:	0-5 V
Signal Low	:	1.000 V
Signal High	:	4.500 V
PV Resolution	:	0.1
Range Low	:	5.0
Range High	:	95.0



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



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