PPI Omni 48 Economic Self-Tune PID Temperature Controller User Manual

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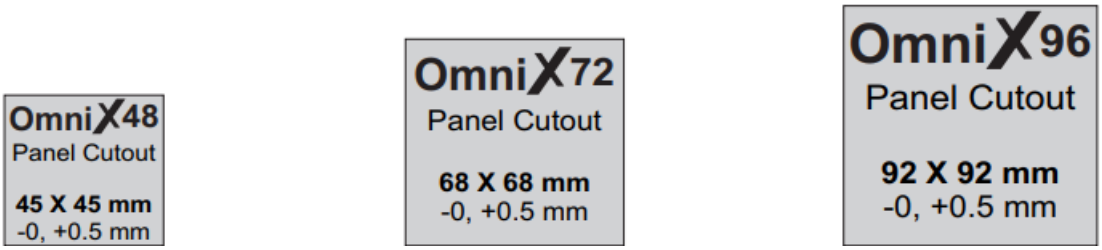
PPI Omni 48 Economic Self-Tune PID Temperature Controller

PANEL MOUNTING AND ELECTRICAL CONNECTIONS

WARNING
MISHANDLING / NEGLIGENCE CAN R E S U LT I N P E R S O N A L D E AT H O R SERIOUS INJURY.

PANEL CUTOUTS

Figure 1.1



PANEL MOUNTING

Follow the steps below for mounting the controller on panel:

1. Prepare a square cutout to the size shown in Figure 1.1 depending on the model (OmniX48, OmniX72, OmniX96).
2. Remove the Panel Mounting Clamp 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.
5. Slide the mounting clamp forward until it is firmly in contact with the rear face of the mounting panel and the tongues of the clamp engage in the ratchets on the controller enclosure. Ensure that the clamp springs push firmly against the rear face of the mounting panel for secured mounting.

ELECTRICAL CONNECTIONS
Observe the followings while making electrical connections.

1. Run power supply cables separated from Thermocouple / RTD cables.
2. Use appropriate fuses and switches, wherever necessary, for driving the high voltage loads.
3. Do not over-tighten the terminal screws while making connections.
4. Switch-off the controller supply while making / removing any connections .

The Electrical Connection Diagram is shown on the Right Side of the controller enclosure. The diagram shows the terminals viewed from the REAR SIDE with the controller label upright. The terminal numbers are also embossed on the rear side of the controller. Refer Figure 1.2 (a) for model OmniX48, Figure 1.2 (b) for model OmniX72 and Figure 1.2 (c) for model OmniX96.

Figure 1.2(a)

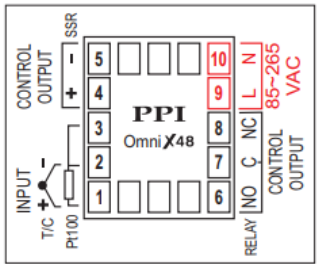


Figure 1.2(b)

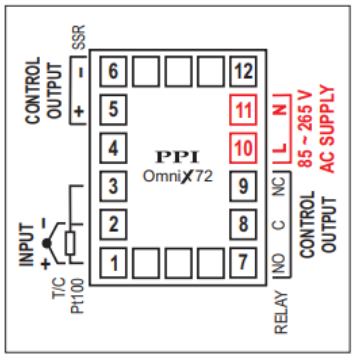
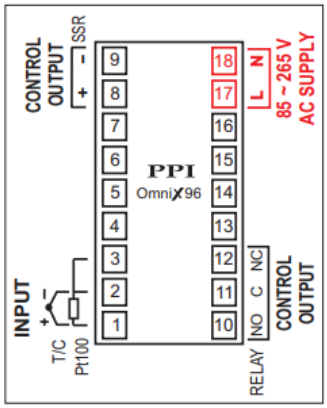


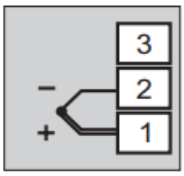
Figure 1.2(c)



INPUT (Terminals 1, 2 and 3)
The controller accepts Thermocouples (J & K Type) and RTD Pt100. Connect Thermocouple or RTD Pt100 as described below.

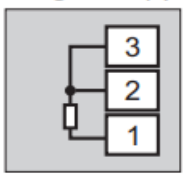
Thermocouple
Connect Thermocouple Positive (+) to terminal 1 and Negative (-) to terminal 2 as shown in Figure 1.3 (a). Use correct type of extension lead wires or compensating cable. Avoid joints in the cable.

Figure 1.3(a)



RTD Pt100, 3-wire
Connect single leaded end of RTD bulb to terminal 1 and the double leaded ends to terminal 2 and 3 (interchangeable) as shown in Figure 1.3 (b). Use copper conductor leads of very low resistance for RTD connections. Ensure that all 3 leads are of the same gauge and length. Avoid joints in the cable.

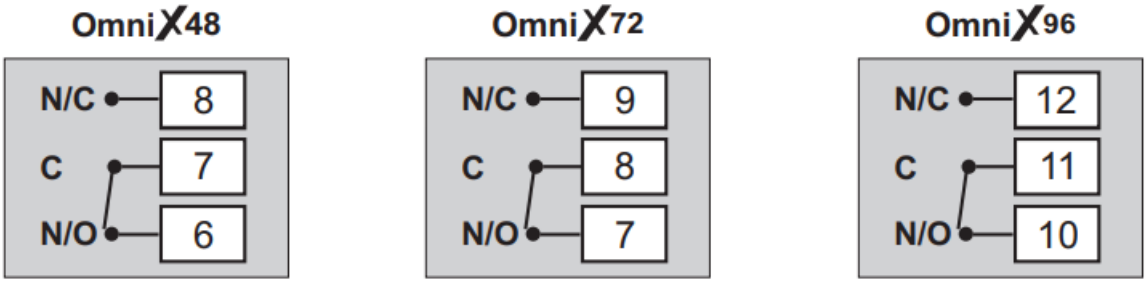
Figure 1.3(b)



OUTPUT
The Controller is supplied with both Relay contacts and SSR Drive Voltage outputs on separate terminals. Use output type in accordance with the value set for the parameter ‘Control Output Type’ on Page-12.
The Terminals for Relay and SSR output (for all 3 models) are shown in the Figures 1.4 (a) & 1.4 (b), respectively.

Relay

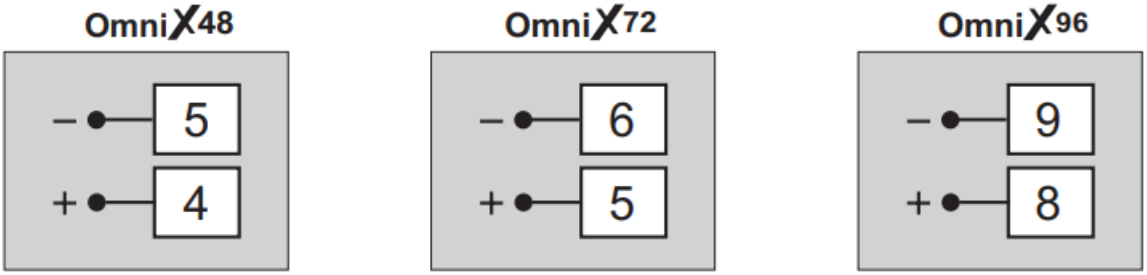
Figure 1.4(a)



N/O (Normally Open), C (Common), N/C (Normally Closed) contacts are potential-free and are rated 10A/240 VAC (resistive load).

SSR Drive Voltage

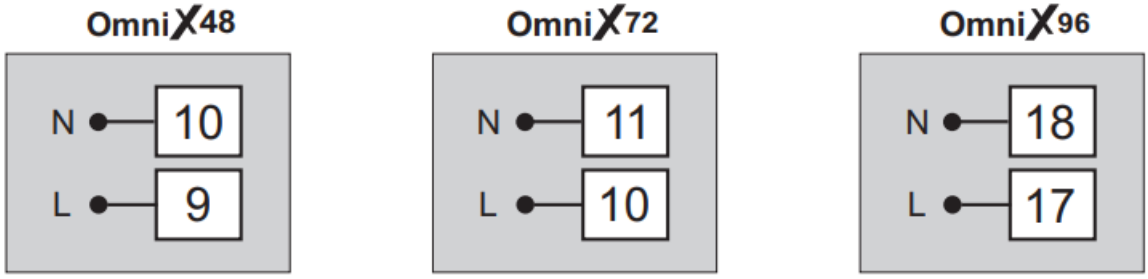
Figure 1.4(b)



Connect Terminal marked (+) to positive SSR Terminal and Terminal marked (-) to negative SSR Terminal.

POWER SUPPLY

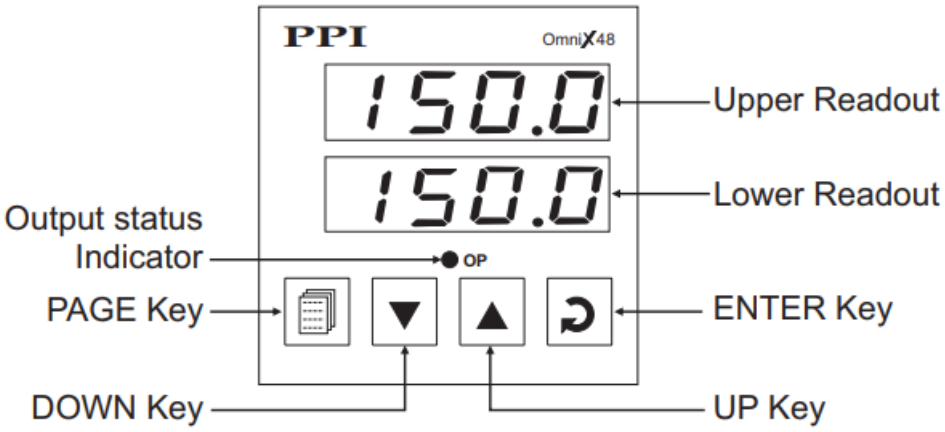
Figure 1.5



The controller accepts single phase, 50/60 Hz Line Voltage ranging from 85 to 264 VAC. Use well-insulated copper conductor wire of the size not smaller than 0.5 mm2. Connect Line Voltage as shown in Figure 1.5.

FRONT PANEL : LAYOUT AND OPERATION

Figure 2.1



READOUTS

The Upper Readout is a 4 digit, 7-segment bright red LED display and usually displays the Measured Temperature. 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 SP (Control Setpoint) or % Output Power. In Set-up Mode, the Lower Readout displays prompts for the parameters.

INDICATOR

The Front panel Indicator 'OP' shows the ON/OFF status of the control output (Relay/SSR).

KEYS

There are four tactile keys provided on the front panel for configuring the controller and setting-up the parameter values. The Table 2.1 lists each key (identified by the front panel symbol) and the associated function.

Table 2.1

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

POWER UP

Upon switching on the power to the controller, all displays and indicators are lit on for approximately 3 seconds.

This is followed by the indication of the model name  on the Lower Readout and  on Upper Readout.

MAIN DISPLAY

After the Power-up display sequence, the Controller enters MAIN Display Mode. The Upper Readout shows the measured PV (Process Value) and the Lower Readout displays the SP (Control Setpoint). The MAIN Display Mode is the one that shall be used most often.

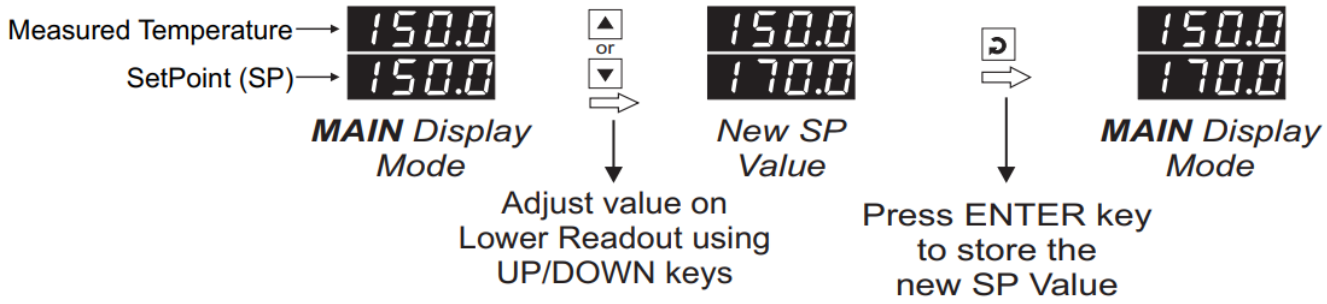
If the controller is configured to operate in PID Control Mode; the Lower Readout can be toggled to indicate either SP or % Output Power using the ENTER Key. The default Lower Readout upon Power-up is SP. While indicating % Power, the left most digit indicates P and remaining digits indicate power value.

ADJUSTING SP

The SP value can be directly adjusted on the Lower Readout while the controller is in the MAIN Display Mode and the Lower readout is showing SP value. Step through the following sequence to adjust the SP value:

1. Press and release UP/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 set value is registered and stored in the controller's non-volatile memory.

Figure 2.2



TEMPERATURE ERROR INDICATION

In case the Temperature falls below the Minimum Range or rises above the Maximum Range specified for the selected 'Input Type' or in case the input sensor is open / broken; the Upper Readout flashes the error messages listed in Table 2.2 below. The Figure 2.3 illustrates an open sensor condition.

Figure 2.3

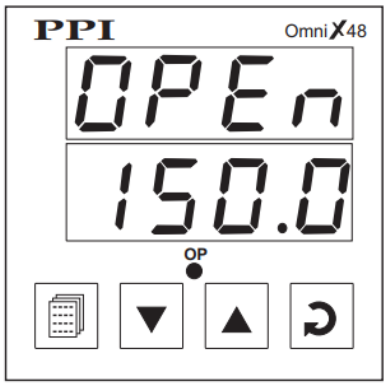


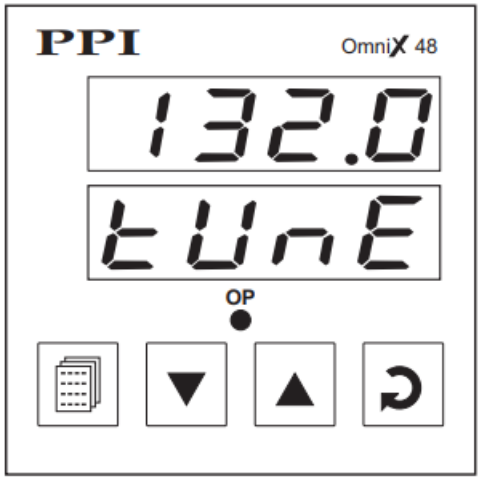
Table 2.2

Message	PV Error Type
Or	Over-range (Temperature above Max. Range)
Ur	Under-range (Temperature below Min. Range)
OPEn	Open (Sensor open / broken)

TUNE INDICATION (Applicable for PID Control Only)

Upon issuing 'Self Tune Command', the controller starts tuning itself to the process under control. While the controller is busy in Tuning itself to the process, the Lower Readout flashes the message "Tune", as shown in figure 2.4 below. The user is advised not to disturb the process or alter any parameter values while the "Tune" message is being flashed. The "Tune" message automatically disappears upon completion of Tuning procedure and the controller reverts to MAIN Display Mode.

Figure 2.4



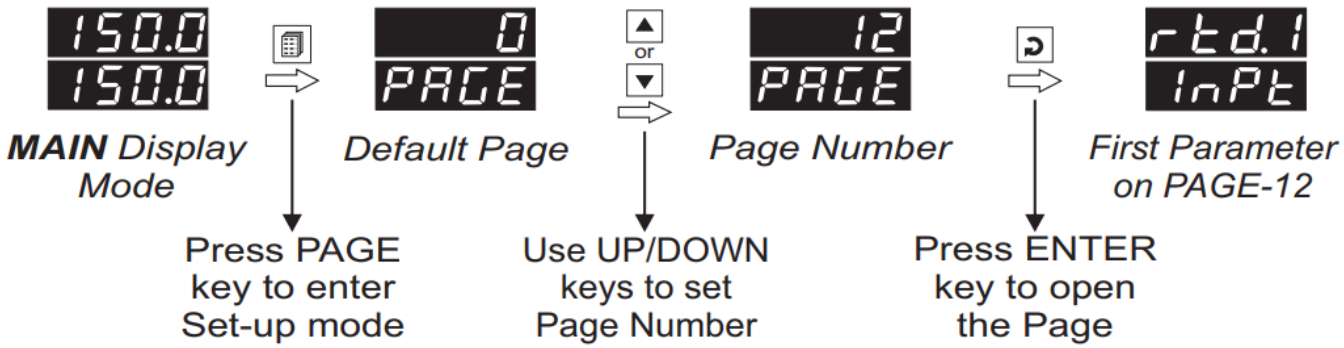
SET-UP MODE : ACCESS AND OPERATION

The controller requires various user settings that determine how the controller will function or operate. These settings are called Parameters.
For the convenience and ease of operation, the various parameters have been grouped separately depending upon the functions they define. Each such group is called a PAGE. Each PAGE is assigned a unique number, called PAGE NUMBER, for its access. The parameters contained in a PAGE are presented in a fixed sequence to the user for setting. The user can access a desired PAGE by entering its PAGE NUMBER and can select and set the desired parameter values.

PARAMETER PROMPTS
Each parameter has an identifying tag, called the Parameter Prompt. While setting parameter values in a PAGE, the parameter prompt is always displayed on the Lower Readout and its current value is displayed on the Upper Readout.

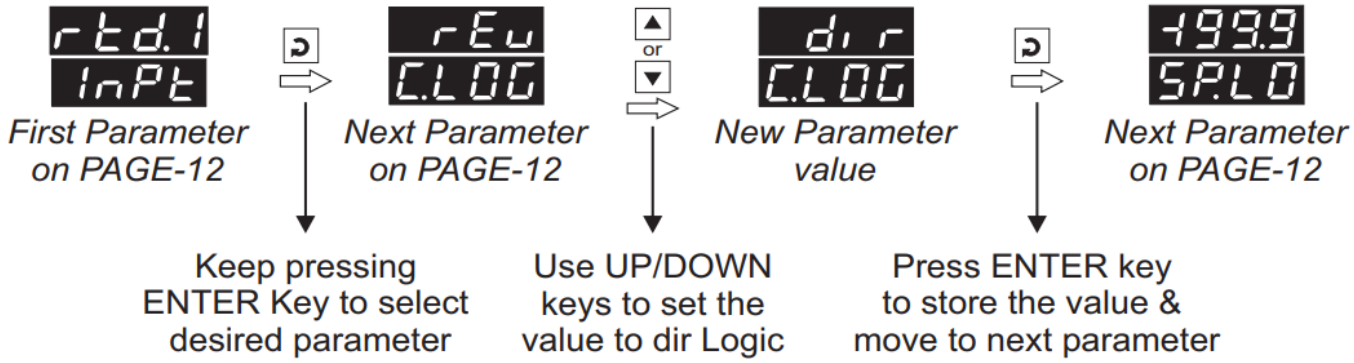
ACCESSING A PAGE
Each PAGE is accessible only from the MAIN Display Mode. That is, from the current PAGE, the user must return to the MAIN Display Mode before the other PAGE can be accessed.
Figure 3.1 illustrates access to the desired PAGE from MAIN Display Mode.

Figure 3.1



ADJUSTING PARAMETER VALUES
For accessing and adjusting the parameter, one must first open the PAGE containing the parameter.
Figure 3.2 illustrates how to access the desired parameter(s) and adjust the corresponding value(s). The example shows accessing the parameter ‘Control Logic’ and changing its value from ‘Reverse’ to ‘Direct’. Press PAGE key to revert to MAIN Mode.

Figure 3.2



PARAMETER LOCKING

For protecting the parameter values from unauthorized / accidental alterations, the parameter adjustments can be Locked. The Operator Page is not affected by locking.

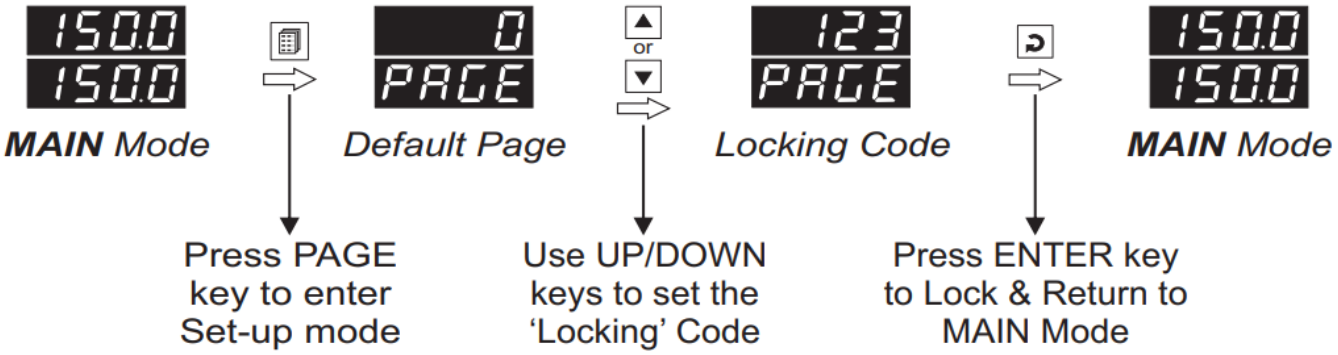
Locking

Follow the steps below to apply Locking when the controller is unlocked.

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 3.3 illustrates the steps for Locking.

Figure 3.3



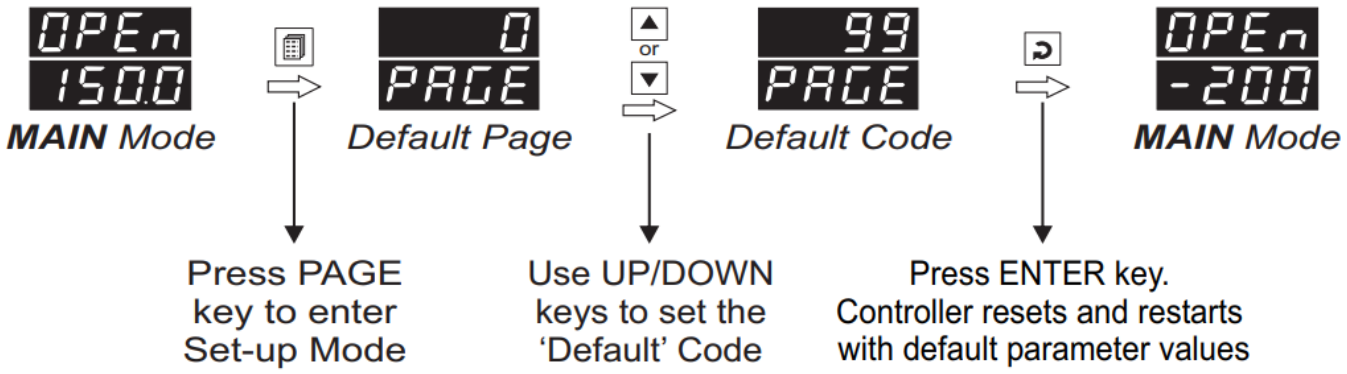
Un-Locking

For Un-Locking, repeat the sequence of steps shown in figure 3.3 twice.

SETTING DEFAULT VALUES

The controller is shipped from the factory with all the parameters set to their default values. Refer Figure 3.4 above for regaining the factory default values.

Figure 3.4



INPUT / OUTPUT CONFIGURATION PARAMETERS

Refer Table 4.1 for the parameter descriptions and settings.

Parameter Description	Settings (Default Value)
INPUT TYPE InPt Select Input type in accordance with the type of sensor (Thermocouple or RTD) connected for temperature measurement.	Refer Table 4.2 for various available 'Input Types' along with their respective Ranges and Resolutions. (Default : Type K)
CONTROL LOGIC C.LOG *Reverse* Heating Control (Output Power *decreases* with increase in Temperature). *Direct* Cooling Control (Output Power *increases* with increase in Temperature).	rEu Reverse dir Direct (Default : Reverse)
SETPOINT LOW SP.LO Sets minimum permissible control setpoint value.	Min. Range to Setpoint High for the selected Input type (Default : Min. Range for the Selected Input Type)
SETPOINT HIGH SP.H1 Sets maximum permissible control setpoint value.	Setpoint Low to Max. Range for the selected Input type (Default : Max. Range for the Selected Input Type)
OFFSET FOR MEASURED TEMPERATURE OFSt This value is algebraically added to the measured Temperature to derive the final temperature that is displayed and compared for alarm / control. Final Temperature = Measured Temperature + Offset	-1999 to 9999 **or** -199.9 to 999.9 (Default : 0)

DIGITAL FILTER F, LE This value determines the averaging rate of measured temperature and thus helps removing undesired fast changes in the measured temperature. The higher the value the better the averaging but the slower the response to actual changes. The default value, 1.0 Second, is appropriate in most cases.	0.5 to 25.0 Seconds (in steps of 0.5 Seconds) (Default : 1.0)
CONTROL OUTPUT TYPE C_OP Select the output type in accordance with the control output used.	rLY Relay SSr SSR (Default : Relay)

Table 4.2

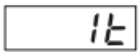
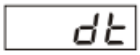
Option	What it means	Range (Min to Max)	Resolution
tc_J	Type J Thermocouple	0 to +960°C	1°C
tc_K	Type K Thermocouple	-200 to +1375°C	1°C
rtd	3-wire, RTD Pt100	-199 to +600°C	1°C
rtd.1	3-wire, RTD Pt100	-199.9 to +600.0°C	0.1°C

CONTROL PARAMETERS

Refer Table 5.1 for the parameter descriptions and settings.

Table 5.1

Parameter Description	Settings (Default Value)
CONTROL MODE CtrL Select appropriate Control Algorithm suited for process requirement. *On-Off* The control algorithm tends to maintain the **Temperature** at **SP** by either switching the output fully OFF or fully ON. The On and Off switching is differentiated by the user settable 'Hysteresis'. *PID* The control algorithm uses a 2nd order equation to compute the '% Output Power' required to maintain the **Temperature** at **SP**. The constants P, I, D are automatically set by the controller by issuing Self-Tune command.	On.OF On-Off PId PID (Default : PID)
HYSTERESIS (*For On-Off Control only*) HYSt Sets differential (dead) band between On-Off switching of the control output (Relay/SSR).	1 to 999 or 0.1 to 99.9 (Default : 2 or 0.2)
COMPRESSOR TIME DELAY (*For On-Off Control only*) dLY This parameter is mainly used for Compressor Load. For compressor switching it is desired that once the compressor is switched OFF, there must be some time delay before it is switched ON again. The switching ON of the compressor should therefore take place only if both the conditions, that is; the time delay is elapsed and PV is above the Setpoint, are satisfied. Set this parameter value to zero if no time delay is required.	0 to 600 Sec. (in steps of 0.5 Sec.) (Default : 0)
CYCLE TIME (*For PID Control only*) Ct For time-proportionating PID control, the output power is implemented by adjusting the ratio of ON : OFF time of a fixed time interval, called 'Cycle Time'. Larger Cycle Time ensures longer Relay/SSR life but may result in poor control accuracy and vice-a-versa. *The recommended Cycle Time values are; 20 sec. for Relay and 1 sec. for SSR*.	0.5 to 120.0 Seconds (in steps of 0.5 Seconds) (Default : 20.0 Sec)

Parameter Description	Settings (Default Value)
PROPORTIONAL BAND (*For PID Control only*)  The Proportional Band is defined in terms of process value deviation from the setpoint (also known as process error). Within the band the output power is varied from maximum (100%) at maximum deviation to minimum (0%) at minimum deviation. The process value thus tends to stabilize at a point within the band where the power input equals losses. Larger Band results in better stability but larger deviation. The Proportional Band value is automatically calculated by controller's Self-Tune feature and seldom requires any manual adjustments.	0.1 to 999.9 (Default : 10.0)
INTEGRAL TIME (*For PID Control only*)  The application of proportional band alone results in process value stability within the band but away from the setpoint. This is called steady state Offset Error. The integral action is incorporated for automatic removal of offset error with minimum oscillations. The Integral Time value is automatically calculated by controller's Self-Tune feature and seldom requires any manual adjustments. Setting the value 0 cuts-off Integral action.	0 to 1000 Seconds (Default : 100 Sec)
DERIVATIVE TIME (*For PID Control only*)  It is desired that the controller should respond to any dynamic changes in the process conditions (like variations in load, power supply fluctuations, etc.) fast enough so as to retain the process value near the setpoint. The Derivative Time determines how strong the output power will change in response to the rate of change of measured PV. The Derivative Time value is automatically calculated by controller's Self-Tune feature and seldom requires any manual adjustments. Setting the value 0 cuts-off Derivative action.	0 to 250 Seconds (Default : 25 Sec)

SUPERVISORY PARAMETERS

Refer Table 6.1 for the parameter descriptions and settings.

Table 6.1

Parameter Description	Settings (Default Value)
SELF-TUNE COMMAND tUnE Set this parameter to YES to activate 'Tuning' operation. Select as NO if, for any reason, the 'Tuning' operation in progress is to be aborted.	no No YES Yes (Default : No)
OVERSHOOT INHIBIT ENABLE / DISABLE oS.i h Set this parameter to 'Enable' if the process exhibits unacceptable overshoot upon start-up or a step change in SP. If Enabled, the controller monitors and controls the rate of change of Temperature in order to minimize or eliminate overshoot.	dSbL Disable EnbL Enable (Default : Disable)
OVERSHOOT INHIBIT FACTOR Oi h.F This parameter is available only if 'Overshoot Inhibit' is enabled. Adjust this parameter value to improve the effectiveness of the controller's Overshoot Inhibit feature. Increase the value if the overshoot is curbed but the Temperature takes too long to reach the SP. Decrease the value if the overshoot persists.	1.0 to 2.0 (Default : 1.2)

OPERATOR PARAMETER

Table 7.1

Parameter Description	Settings (Default Value)
SETPOINT LOCKING S.LOC This parameter allows locking the adjustment of the SP on Lower Readout in Main Display Mode. For Locking, set the parameter value to 'Yes'. This allows the operator to protect the SP from any unauthorized changes.	no No YES Yes (Default : No)

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Documents / Resources

PPI Omni 48 Economic Self-Tune PID Temperature Controller [pdf] User Manual
Omni 48 Economic Self-Tune PID Temperature Controller, Omni 48, Economic Self-Tune PID Temperature Controller, Tune PID Temperature Controller, Temperature Controller, Controller