PID CONTROLLER

MODEL: PX-72

DESCRIPTION

A PID controller is an instrument used in industrial control applications to regulate temperature, flow, pressure, speed and other process variables. PID (Proportional Integral Derivative) controllers use a control loop feedback mechanism to control process variables and are the most accurate and stable controller.

The ASHE PX-72 is a fully configurable micro-controller based universal Digital Process Indicator with PID control or ON/OFF control action. It's offered in a highly compact, rugged and reliable execution. The instrument has three keys on the front panel, with which the operator can set the parameters and configure the instrument. A four-digit red LED digital display is provided to indicate the process value and set value. The display can indicate any scale range between –999 to +9999 units. The analog PID controller output indicates on bargraph display.

The Indicators accept all industrial standard input signals, like 4 to 20 mA DC, DC Voltage, and Temperature sensors like RTD Pt-100, Thermocouples (type J,K,R,S). The instrument also provides RS 485 communication signal on Modbus RTU with four baud rate selection options.

The PX-72 can provide PID control action for Relay1, while Relay2 has ON/OFF control action and the PX-72 provides two control relay set points, which may be configured for either Heating & Cooling setting with independent Hysteresis value through the Keypad on the front panel. The instrument operates on 90 to 270 VAC universal AC power supply and is offered in Panel-mount execution.

The ASHE Universal PX-72 PID Controller offers a high degree of reliability owing to its inherent accuracy in process measurement and control, besides other characteristics like total immunity to shocks, dust, ambient temperatures, humidity and corrosive atmospheres. Further, the instruments are manufactured using selected high-grade components which guarantee their functional reliability and long operational life.

INSTALLATION

The instrument should be mounted in the panel using the mounting clamps provided. All inter-connections to the instrument should be made with strong multi-strand wire of the order of 2.5 sq.mm. The ends of the wires should be properly ferruled and suitably terminated.

The cables carrying the Input Signal should be properly isolated from the Power Line cables to prevent any electromagnetic interference or noise-related malfunctions from the Mains Power Line. Use of shielded twisted pair cable is recommended for the input signal. It is essential that the instrument be earthed to a proper grounding point before connecting the power supply.

After connecting the input signal to a suitable source or Sensor, the power may be switched ON. The instrument must first be configured and then calibrated (see sections below).

OPERATION & SETTINGS

The front panel of the PX-72 Digital Indicator is as shown below:

The Indicator has one display window on the front panel for indication of Process value and the menu options. Two LED indications show the status of the two control Relays.

CONTROL KEYS

The instrument has three keys on the front panel, as described below:

PROG	The PROGRAM key is the central co-ordinating key for accessing the settings of the instrument. Pressing this Key, one can sequentially view, change and save the parameters such as Input selection, Zero & Span settings, Decimal Points, Relay set-point, Hysteresis, Control Logic, etc.
⇧	The INC or Incrementing key allows the operator to select the numeral in the digit being set. The digit will sequentially display 0, 1, 2….9 on each pressing of the INC key. This may be used to set the Zero/Span calibration range on the display.
⇩	The DEC or Decrementing key allows the operator to select the numeral in the digit being set. The digit will sequentially display 9, 8, 7….0 on each pressing of the DEC key. This may be used to set the Zero/Span calibration range on the display.

Control Parameters

Cycle Time:

The Cycle time for output is the time where the output is on for percentage of that time and off for a percentage of that time, creating a portioning effect. The cycle time is only used where PI, PD or PID control action is used. The shorter the cycle time, the higher the proportionate resolution is, and better is the control.
For Relay output: Set to 10 to 30 seconds or more
For Linear output (4-20mamp output): Cycle time is not required.

Proportional Band:

Proportional action is the action which the control output varies in proportion to the deviation between the setting value and the processing temperature. If the proportional band is narrowed, even if the output changes by a slight variation of the processing temperature, better control results can be obtained as the offset decreases. However, if when the proportional band is narrowed too much, even slight disturbances may cause variation in the processing temperature, and control action changes to ON/OFF action and the so called hunting phenomenon occurs. Therefore, when the processing temperature comes to a balanced position near the setting value and a constant temperature is maintained, the most suitable value is selected by gradually narrowing the proportional band while observing the control results.

Integral Time:

Integral action is used to eliminate offset. When the integral time is shortened, the returning speed to the setting point is quickened. However, the cycle of oscillation is also quickened and the control becomes unstable.

Derivative Time:

Derivative action is used to restore the change in the processing temperature according to the rate of change. It reduces the amplitude of overshoot and undershoots width. If the derivative time is shortened, restoring value becomes small, and if the derivative time is made longer, an excessive returning phenomenon may occur and the control system may be oscillated.

TERMINAL DIAGRAM

UPPER TERMINAL BLOCK

Input	1	2	3	4	5	6	7	8	9	10	11	12	13
4 to 20 mA			+	-	+	-		A	B	G		+	-
0-10 VDC			+	-	24 VDC Out		NC	RS-485 Modbus			NC	4-20mA DC OUTPUT	
RTD Pt-100	-	-	+										
TC	+	-											

LOWER TERMINAL BLOCK

14	15	16
L	N	E
90-270 VAC, 50/60Hz Power Supply		

17	18	19	20	21	22
NO1	C1	NC1	NO2	C2	NC2
RELAY-1			RELAY-2		

TECHNICAL SPECIFICATIONS

Model	ASHE PX-72
Type	Universal PID Controller
Input Signals	4 to 20 mA DC, DC Voltage, RTD Pt-100, Thermocouples-Types J,K,R,S (Universal Input)
Output Signal	4 to 20 mA DC
Load Driving Capacity	600 ohms
Displays	4 digit 0.5" and 0.39" seven segment displays and Bargraph display
Scale Range	-999 to +9999
Linearity	± 0.1%
Calibration	Configurable from front Keypad
Control Output	Two Relay change over contacts
Contact Rating	10 Ampere @ 230 VAC (resistive loads).
Control Logic	PID control action with Auto tune or Manual tune optionand ON-OFF control Action with Heating and Cooling option(Selectable)
Accuracy	±0.1 % of FSD
Communication	RS-485 on Modbus RTU Protocol
Auxillary Output	24 V DC at 100mA for Aux Transmitter Power (Optional)
Power Supply	90 to 270 VAC, 50 Hz
Dimensions	96x96x110 mm [HxWxD]
Enclosure	Industrial Grade ABS
Execution	Panel Mounting
Weight	Approximately 0.5 Kg.
Operating Temperature	0 to 55° C

KEY PRESSED	UPPER DISPLAY	LOWER DISPLAY	Default Settings	FUNCTION
(POWER ON)	**ASHE**	**rtd.1**	Cur	Selected sensor
	OPEn	**250**		If Input Signal is not connected.
	IPLO	**500**		Selected sensor
	Atun	**Yes**	no	Yes/No selection
User Settings:				
PROG	**Con1**	**HEt**	COL	Type of Control output for Relay1. Options are: - HEt Heating Control Logic COL Cooling Control Logic PId PID Control OFF No control action. Instrument works as a simple indicator.
PROG	**SEt1**	**20. 00**	20. 00	Adjust the desired Set-Point for Relay-1 using INC and DEC keys. *[Range is –999 to 9999].*
PROG	**HyS1**	**0 2**	0 0	Process Value Hysterisis : Adjust the desired Hysterisis for Relay-1 using INC and DEC keys *[e.g. 0010 for a hysterisis of 10 degrees].*
PROG	**dLY1**	**0 5**	0 0 0 0	*between 0001 to 0254*
PROG	**Con2**	**HEt**	COL	Type of Control output for Relay2. Options are: - HEt Heating Control Logic COL Cooling Control Logic OFF No control action. Instrument works as a simple indicator.
PROG	**SEt2**	**60. 00**	60. 00	Adjust the desired Set-Point for Relay-2 using INC and DEC keys. *[Range is –999 to 9999].*
PROG	**HyS2**	**0.0 2**	0.0 0	Process Value Hysterisis : Adjust the desired Hysterisis for Relay-2 using INC and DEC keys *[e.g. 0010 for a hysterisis of 10 degrees].*
PROG	**dLy2**	**0 5**	0 0 0 0	*betn 0001 to 0254*

PROG		**A S H E**	(process value)	If select “LO”, relay will energize below set point (if Input Signal is connected)
PROG	**SEn**	**Cur**	Cur	Selection of Input Sensor, options are: Cur (This is for 4 to 20 mA DC Input) VoLt (0 to 10 VDC Input) rtd 1 (RTD (Pt-100 Input) rtd.1 (RTD (Pt-100 Input) J (J-Type Thermocouple) ├ (K-Type Thermocouple) r (r-Type Thermocouple) S (S-Type Thermocouple)
PROG	**dP**	**100. 0**	100. 0	Set the Decimal Position. *[Applicable for Current & Voltage Input only]*..
PROG	**IPC**	**00. 0**	00. 0	* -10. 0 to +10. 0 range
PROG	**rnGL**	**00 00**	00 00	The desired Zero (lower) range setting for the process being measured may be set using INC and DEC keys. The minimum Zero level possible is –999.
PROG	**rnGH**	**9999**	1000	The desired Span (upper) range setting for the process being measured / controlled may be set using INC and DEC keys. The maximum Span level possible is +9999.
PROG	**S – Id**	**0 001**	00 01	Slave Identity number (range is from 0001 to 0255)
PROG	**bAud**	**9600**	9600	Selectable 19200, 9600,4800,38400
PROG	**C-OP**	**Cont / tEmP**	tEmP	PID output or Indicator output selection
		Process Value		
Press and hold the Increment (ê) key for 4 seconds		**Abt**	28	Instrument goes into “User” mode. [Indicates the preset Ambient Temperature – can be changed as required]
Calibration Settings :				
Press the Increment ↑ and Decrement	**PASS**	**00 02**		Set the password 2 for proceed.

↓ keys for 3 second				
PROG	**ModE**	**Cont**		Can select for indicator mode or controller mode (Cont / Indt)
Connect mA source at back terminals, ensure connection.				
PROG	**I-LO**	**1360**		Feed 4mA to the instrument and press decrement key to save zero calibration point. Short JP1 and JP2.
PROG	**I-HI**	**6811**		Feed 20mA to the instrument and press decrement key to save span calibration point. Short JP1 and JP2.
Connect V source at back terminals, ensure connection.				
PROG	**V-LO**	**1**		Feed 0V to the instrument and press decrement key to save zero calibration point. Remove Short JP1 and JP2.
PROG	**V-HI**	**7265**		Feed 10V to the instrument and press decrement key to save span calibration point. Remove Short JP1 and JP2.
Connect RTD source at back terminals, ensure connection.				
PROG	**rtdL**	**1805**		Feed resistance corresponding to -100◦C to the instrument and press dec key to save Zero calibration point of RTD input.
PROG	**rtdH**	**6988**		Feed resistance corresponding to 400◦C to the instrument and press dec key to save Span calibration point of RTD input.
Connect mV source at back terminals, ensure connection.				

PROG	├ **– LO**	**198**		Feed 0 mV to the instrument and press dec key to save Zero calibration point of k type
PROG	├ **- HI**	**5100**		Feed 48.8 mV to the instrument and press dec key to save Span calibration point
PROG	**r – 402**	**ADC Count**		Feed 0 mV to the instrument and press dec key to save Zero calibration point of R type
PROG	**r - 3861**	**ADC Count**		Feed 20 mV to the instrument and press dec key to save Span calibration point of R & S
PROG	**Abt**	**24.5**		Selectable
PROG	├ **FACt**	**00 01**		
PROG	**ZEro**	**160**		Use increment & decrement keys to get 4mA on the multi-meter and press next key.
PROG	**SPAn**	**516**		Use increment & decrement keys to get 20mA on the multi-meter and press next key.
PROG	**Process Value**	**Set Value**		(process value)