AutomationDirect

1/16 DIN Series

Operator's Manual

PM24

Microprocessor-Based Process/Temperature Limit Controller

PM24 Operator's Manual
Manual Rev. 2.2
Firmware Version 1.50
March 2003

Made In USA

Technical Support

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General Safety Information

Electrical Hazards and Warnings

Prior to connecting the controller, read the user's manual for proper connection and operating information.

Follow National Electrical Code (NEC) safety requirements when wiring and connecting a power source and sensors or other devices to the controller. Failure to do so could result in injury, death or damage to equipment and property.

Make sure the proper input voltage is applied to the controller. Improper voltage will result in damage to the unit.

Use caution when removing the controller from its case, there may be live voltage present at the terminals. This should only be done by a qualified technician.

All terminal screws must be tightened securely. Terminal screws not properly secured can cause an electrical short that may damage property, equipment or cause injury or death. Terminal screws improperly secured may fall into equipment causing possible damage to property or equipment.

This instrument is not intended for use in life safety applications.

Important: For applications where physical injury or equipment damage might occur in the event our product fails, we recommend the installation of independent safety equipment with its own independent sensor that will shut down the process.

Important: Firmware version of controller must match the version indicated on the bottom front cover of this manual.

PM 24 Limit Controller

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PM24
1/16 DIN Microprocessor-Based Temperature/Process Limit Controller

1. MAIN FEATURES

- Process/Temperature multi-sensor input, without hardware change.
- Accepts 7 thermocouples, RTD-Pt100, DC mA, mV and Volts. All inputs are factory calibrated.
- Programmable Scaling: -1999 to 9999 with selectable decimal point for: mA, mV and Volts input.
- Selectable ºF/ºC temperature.
- RTD-Pt100 with 1º temperature resolution: -326 to 986ºF (-199 to 530ºC), and 0.1º temperature resolution: -199.9 to 986.0ºF (-199.9 to 530.0ºC).
- Input sample rate: 10 reading per second (100 ms).
- Output Alarms: Dual stationary SPST Alarm Relays, with individual hysteresis adjustment.
- Sensor break protection in any condition.
- Easy-to-set programming menu.
- Firmware version displayed during power up.
- High impact ABS enclosure.
- Dimensions: 48x48x106mm.
- Power: 90 to 260Vac.

2. SPECIFICATIONS

- Dimensions: 48 x 48 x 106mm (1/16 DIN) Approximate weight: 200g max.
- Panel cut-out: 45.5 x 45.5mm (± 0.3mm)
- Terminal connection: screws, accepting 16 – 24 AWG or 6.3 mm fork lugs.
- Power: 90 to 260Vac, 50/60Hz, Consumption: 7VA max.
- Operating environment: 0 to 50°C (32 to 122°F, humidity: 10 to 90% RH, non-condensing.
- Flame-Retardant ABS Plastic Case.
- Warm-up time: 15 minutes max.

INPUT

- Keypad selection of input type (refer to table 1)
- Display resolution : 0.1ºF/C or 1ºF/C (RTD-Pt100),
  -1999 to 9999 fully scalable for mA, mV and Volts input
- Input sample rate: 10 per second (100 ms)
- Accuracy : Thermocouples J, K, T, E, N: 0.2% of span, ±1ºC, ±1 digit
  Thermocouples R, S: 0.25% of span, ±3ºC, ±1 digit
  Pt100, mA, mV and Volts: 0.2% of span, ±1 digit
- Input impedance: 0-50mV and thermocouples: >10MΩ
  0-10 Volts DC: >1MΩ
  4-20 mADC: 100 Ω
- Pt100 measurement: DIN 43760 standard (α=0.00385).
  3-wire circuit, cable resistance compensation.
  Excitation current: 170μA.

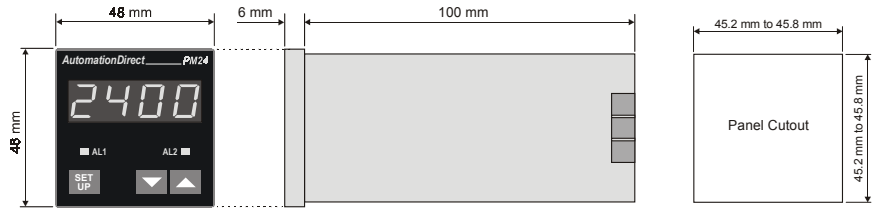
SENSOR WIRE INPUT:

- **Thermocouples** are connected to terminals 2(+) and 3(-), with positive on terminal 2.
- **Voltage signals up to 50 mV** should be connected to terminals 2(+) and 3(-).
- **Pt100 sensors** are connected to terminals 1, 2 and 3, as indicated in this manual. For full compensation of cable resistance only cables with equal wire electrical resistance should be used.
- **Voltage signals up to 10 Vdc** should be connected to terminals 5(+) and 3(-)
- **Current 4 to 20mA** signals should be connected to terminals 4 (+) and 3 (-).

OUTPUT:

- Two SPST Relays (without contact suppression):
  Resistive: 3A @ 250VAC / 3A @ 125VAC / 3A @ 30VDC
  Inductive: 2A @ 250VAC / 2A @ 30VDC
  Dielectric Strenght: 750Vrms between open contacts (at sea level for 1 min.)

2.1 MAIN DIMENSIONS AND CUTOUT:

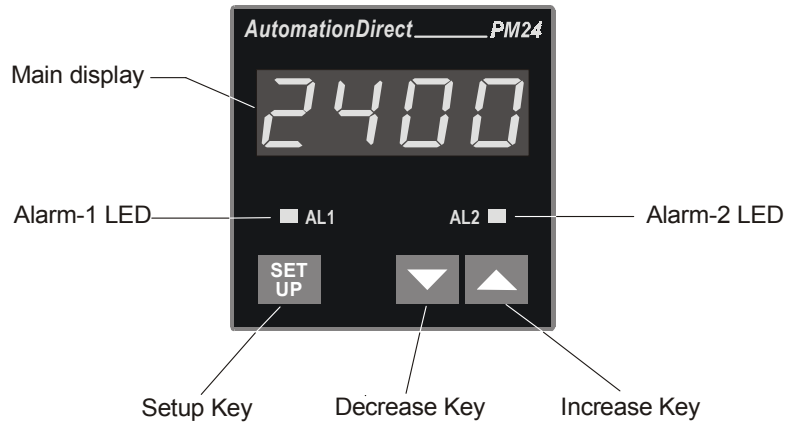


(not to scale)

(Figure 1)

3. OPERATION

Operator Interface



(Figure 2)

Main display - PV: Displays the PV (**P**rocess **V**ariable) value, and used when configuring the parameters of the controller.

Alarm 1 - AL1 LED: status of the alarms, (LED On = alarm active).

Alarm 2 - AL2 LED: status of the alarms, (LED On = alarm active).

SETUP key: used to set up the menu cycles.

DECREASE key: used to change parameter values.

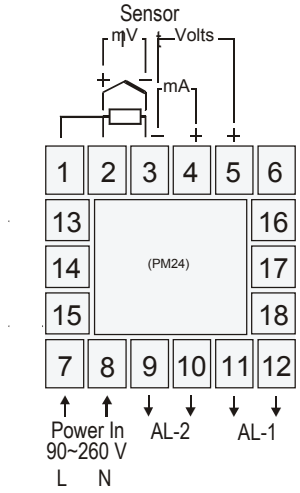
INCREASE key: used to change parameter values.

IMPORTANT:

When the controller is turned on, the firmware version is displayed for approximately 4 seconds, after which the controller starts normal operation. The value of PV is displayed and the outputs are enabled after 6 seconds.

Prior to first operation, the controller should be fully configured. The user must set basic parameters such as input type ("tYPE"), alarm set points ("A1SP" and "A2SP"), etc.

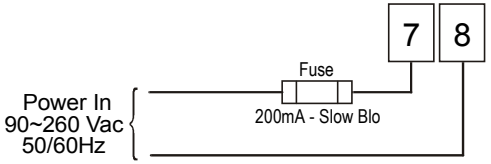
3.1 ELECTRICAL CONNECTIONS:



(Figure 3)

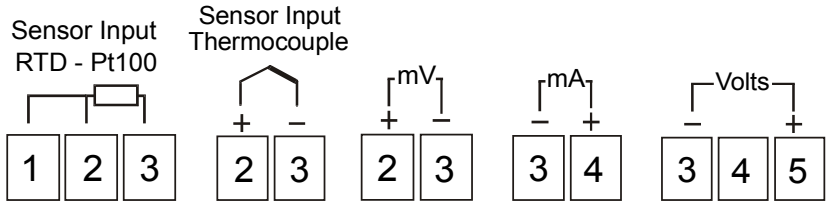
3.2 POWER WIRING:

AC Voltage Power Wiring



Note: The installation of fuse is optional, depending on level of protection required.

3.3 INPUT SIGNAL WIRING:

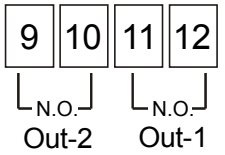


(Figure 4)

NOTE: Use copper conductors rated for at least 75 ºC. For Thermocouple sensors use appropriate compensated thermocouple wires.

3.4 OUTPUT ALARM WIRING:

Dual SPST Relay
Output Alarms



(Figure 5)

3.5 PANEL ASSEMBLY:

First remove the mounting clamp and insert the controller into the panel cut out. Place the unit into the panel cutout and slide the mounting clamp from the rear to a firm grip at the panel.

The internal circuitry can be fully removed from the housing without disconnecting any wiring. By using the thumb, just press the tab in the lower part of the front panel, grab the front panel firmly and pull the front face and circuitry from the housing.

Warning: Use caution when removing the controller from its case, there may be live voltage present at the terminals. This should only be done by a qualified technician. It is recommended that power to the controller be disconnected prior to removing the controller from the case.

3.6 ERROR MESSAGES:

The connection and configuration errors for most of the problems encountered when using the controller are shown below.

Error messages are displayed to help the user to identify possible problems.

: Process temperature is below the selected sensor range.

: Process temperature is above the selected sensor range

: Controller or sensor error.

Example: - Broken (open) thermocouple, mA, mV or Volts open loop.
- Pt100 badly connected, short-circuited, open, or high cable resistance.

4. MENU SYSTEM:

The Parameter Menu System is organized into four basic cycles. This is shown in the chart below.

Cycle
1 – Indication
2 – Alarms
3 – Configuration
4 – Calibration

4.1 INITIAL STARTUP

When the controller is initially energized the Firmware version is displayed for approximately 4 seconds after which the controller reverts to the normal operation mode in the **Indication** cycle. The value of the process variable (**PV**) is displayed and the outputs are enabled after 6 seconds.

Important: The Firmware version of the controller must match the version indicated on the bottom front cover of this manual.

4.2 SETUP CYCLE PARAMETER ACCESS:

The Indication cycle is the default cycle for the controller and only shows the PV. All other cycles have parameters that can be accessed and changed to configure the controller as needed.

The cycles need only to be accessed when a change of parameters is necessary. To reach the other parameters the user must keep the **SETUP key** pressed for approximately 4 seconds. After this time the controller will display the first parameter of the next cycle. By keeping the **SETUP key** pressed for another 3 seconds the next cycle will be accessed.

Release the **SETUP key** when the desired cycle is reached. Press the **SETUP key** once to access the next parameter in the same cycle or quickly press the **SETUP** key to move through the parameters in the cycle. After the last parameter in a cycle is reached, pressing the SETUP key one last time will bring the controller back to the **Indication** cycle (**Cycle-1**). The display will also revert to the **Indication** cycle after 20 seconds if the parameters in a cycle are not changed.

Once in a desired parameter the display will alternate the name and value. The value can then be changed by pressing the ▼ or ▲ key.

The following page shows the Cycle Parameter Menu.

Cycle Parameter Menu

Cycle-1	Cycle-2	Cycle-3	Cycle-4
INDICATION	ALARMS	CONFIGURATION	CALIBRATION
PV Indication	A1SP Alarm 1	tYPE Input Type	InLC Input Low Calibration
	A2SP Alarm 2	dPPo Decimal Point Position	InHC Input High Calibration
	ALrE Differential	un It Unit	CJL Cold Junction Low Calibration
		InLL Input Low Limit	
		InHL Input High Limit	
		OFFS Offset Signal Input	
		A1Fu Alarm 1 Funtion	
		A2Fu Alarm 2 Funtion	
		A1HY Alarm 1 Hysteresis	
		A2HY Alarm 2 Hysteresis	
		Prot Security Protection	

NOTE: Any changed parameter is saved into non-volatile memory when scrolling to the next parameter or 20 seconds after the new parameter is changed.

4.3 DIGITAL SERIAL NUMBER ACCESS:

To read the controller's serial number (8 digits), hold down the ▲ key for a few seconds and the first four digits will appear on the display. To read the second four digits, hold down the ▼ key for a few seconds and the second four digits will appear on the display, completing the 8 digits serial number.

The serial number is recorded in the factory and cannot be changed.

5. CONTROLLER CONFIGURATION

The Configuration section gives information on parameter settings in each Cycle which will help to configure the controller for the desired operation. **However, the first parameter that needs to be programmed is the Input Type (tYPE) in the Configuration cycle, Cycle-3 (see section 5.3 page 11, and Table 1 page 12).** This will determine the scale for all other parameter values, i.e.: a J thermocouple has different temperature range than a K thermocouple and will have a different setpoint range.

5.1 CYCLE 1 – OPERATION:

PV INDICATION	After power up the display indicates the measured value proportional to the input signal.

5.2 CYCLE 2 – ALARM SETPOINTS:

Low and high alarms are used to signal minimum and maximum temperature values as programmed in the "A1SP" and "A2SP" prompts

A1SP Alarm 1	**SETPOINT for Alarm 1**: Tripping point for alarm 1 (see Table 2, page 13).
A2SP Alarm 2	**SETPOINT for Alarm 2**: Tripping point for alarm 2 (see Table 2, page 13).
ALrE **Al**arm **Re**ference (Diferential)	**REFERENCE VALUE FOR DIFFERENTIAL ALARM**: a value in respect to which the differential, differential low, and differential high alarms will be set. **Valid for alarms type 2, 3, 4, 8, 9, and 10 (see Table 2, page 13).**

5.3 CYCLE 3 – INPUT TYPE, AND ALARMS CONFIGURATION:

tYPE **Type**	**INPUT TYPE:** Selects the input sensor type to be connected to the indicator. **Default: 1 (T/C Type K)** ***"This is the first parameter to be set"*** (Refer to Table 1, page 12).
dPPo **D**ecimal **P**oint	**DECIMAL POINT POSITION:** Available only for input types 18, 19 or 20. Defines the number of digits to be shown after the decimal point. Programmable from 0 to 3. **Default: 0**
un It **unit**	**TEMPERATURE UNIT:** Selects display indication for degrees Celsius or Fahrenheit. **Default: 0** 0 - degrees Celsius (°C) 1 - degrees Fahrenheit (°F)
InLL **In**put **L**ow **L**imit	**INPUT LOW LIMIT:** Available for input types from 9 to 20. Defines the lowest value to be displayed when the input signal is at its lower value. For input types from 0 to 8 it defines the lowest alarm set point value. **Default: -150**
InHL **In**put **H**igh **L**imit	**INPUT HIGH LIMIT:** Available for input types from 9 to 20. Defines the highest value to be displayed when the input signal is at its upper value. For input types from 0 to 8 it defines the highest alarm set point value. **Default: 1370**
OFFS **Offs**et Input	**OFFSET SIGNAL INPUT:** Offset value to be added to the PV to compensate sensor error. **Default: 0**
A1Fu **A**larm **1** **Fu**nction	**FUNCTION OF ALARM 1:** Refer to Table 2, page 13, for function description and respective codes to set at this prompt. **Default: 0**
A2Fu **A**larm **2** **Fu**nction	**FUNCTION OF ALARM 2:** Refer to Table 2, page 13, for function description and respective codes to set at this prompt. **Default: 0**
A1HY **A**larm **1** **Hy**steresys	**ALARM 1 HYSTERESIS:** Defines the differential range between the PV value at which the alarm is turned on and the value at which it is turned off (in engineering units). **Default: 1**
A2HY **A**larm **2** **Hy**steresys	**ALARM 2 HYSTERESIS:** Defines the differential range between the PV value at which the alarm is turned on and the value at which it is turned off (in engineering units). **Default: 1.**
Prot **Prot**ection	**FUNCTION PROTECTION:** See description and Figure 8 on page 15, and Figure 9 on page 16. **Default: 1** 0 = No protection, all cycles can be accessed. 1 = No access to cycle 4 2 = No access to cycle 3, and cycle 4. 3 = No access to cycle 2, cycle 3, and cycle 4.

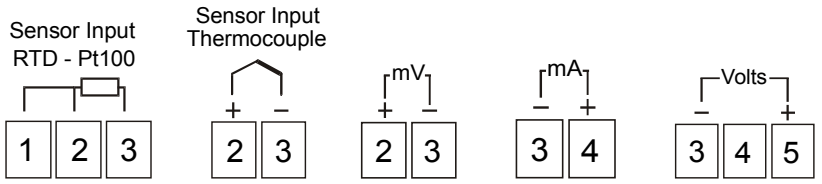
Input Type:

Table 1 – Input Type:

INPUT TYPE	CODE	RANGE
Thermocouple **J**	0	-166 to 1400°F (-110 to 760°C)
Thermocouple **K**	1	-238 to 2498°F (-150 to 1370°C)
Thermocouple **T**	2	-256 to 752°F (-160 to 400 °C)
Thermocouple **E**	3	-130 to 1328°F (-90 to 720°C)
Thermocouple **N**	4	-238 to 2372°F (-150 to 1300°C)
Thermocouple **R**	5	32 to 3200°F (0 to 1760°C)
Thermocouple **S**	6	32 to 3200°F (0 to 1760°C)
Pt100 (Resolution 0.1°)	7	-199.9 to 986.0°F (-199.9 to 530.0°C)
Pt100 (Resolution 1°)	8	-326 to 986°F (-199 to 530°C)
4 to 20mA	9	Linearized J: -166 to 1400°F (-110 to 760°C)
4 to 20mA	10	Linearized K: -238 to 2498°F (-150 to 1370°C)
4 to 20mA	11	Linearized T: -256 to 752°F (-160 to 400 °C)
4 to 20mA	12	Linearized E: -130 to 1328°F (-90 to 720°C)
4 to 20mA	13	Linearized N: -238 to 2372°F (-150 to 1300°C)
4 to 20mA	14	Linearized R: 32 to 3200°F (0 to 1760°C)
4 to 20mA	15	Linearized S: 32 to 3200°F (0 to 1760°C)
4 to 20mA	16	Linearized Pt100: -199.9 to 986.0°F (-199.9 to 530.0°C)
4 to 20mA	17	Linearized Pt100: -326 to 986°F (-199 to 530°C)
0 to 50mV	18	Linear. Programmable range from -1999 to 9999
4 to 20mA	19	Linear. Programmable range from -1999 to 9999
0 to 10V	20	Linear. Programmable range from -1999 to 9999

NOTE: In case of sensor break or failure an error "**Erro**" message is displayed.

Wires Sensor Input



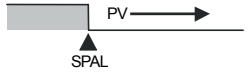
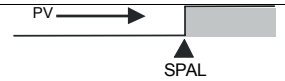
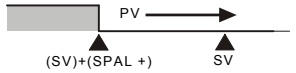
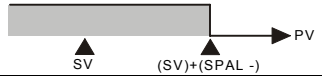
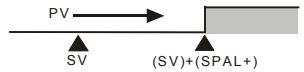
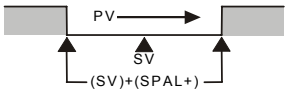
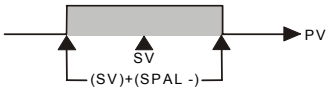
(Figure 6)

Notes: 1) For Thermocouple Sensors use appropriate compensated thermocouple wires.

2) Use copper conductors rated for at least 75 ºC (except on T/C).

Alarm Type:

Table 2 – Alarm Type

TYPE	CODE	ACTION
Low Alarm (Low Process Alarm)	0	**Low SPAL** 
High Alarm (High Process Alarm)	1	**High SPAL** 
Differential Low (Deviation Low)	2	**Dif-Low SPAL+**  **Dif-Low SPAL-** 
Differential High (Deviation High)	3	**Dif-High SPAL+**  **Dif-High SPAL-** 
Differential (Band Alarm)	4	**Dif-SPAL+**  **Dif-SPAL-** 
Input Sensor Error	5	**Alarm is ON whenever:** • Process is below selected range. • Process is above selected range. • Thermocouple or Pt100 is broken (open). • Pt100 is shorted, badly connected or wire impedance is too high.
(Alarm Functions) Alarm with inhibition at power-up	6	**Low alarm** disabled at power-up
	7	**High alarm** disabled at power-up
	8	**Differential low** limit alarm disabled at power-up
	9	**Differential high** limit alarm disabled at power-up
	10	**Differential** alarm disabled at power-up

(where SPAn means: **A 1SP** and **A2SP**)

Alarm Functions:

Low Alarm: Activates at present value, independent of main setpoint. Low process-alarm activates at and below alarm setting.

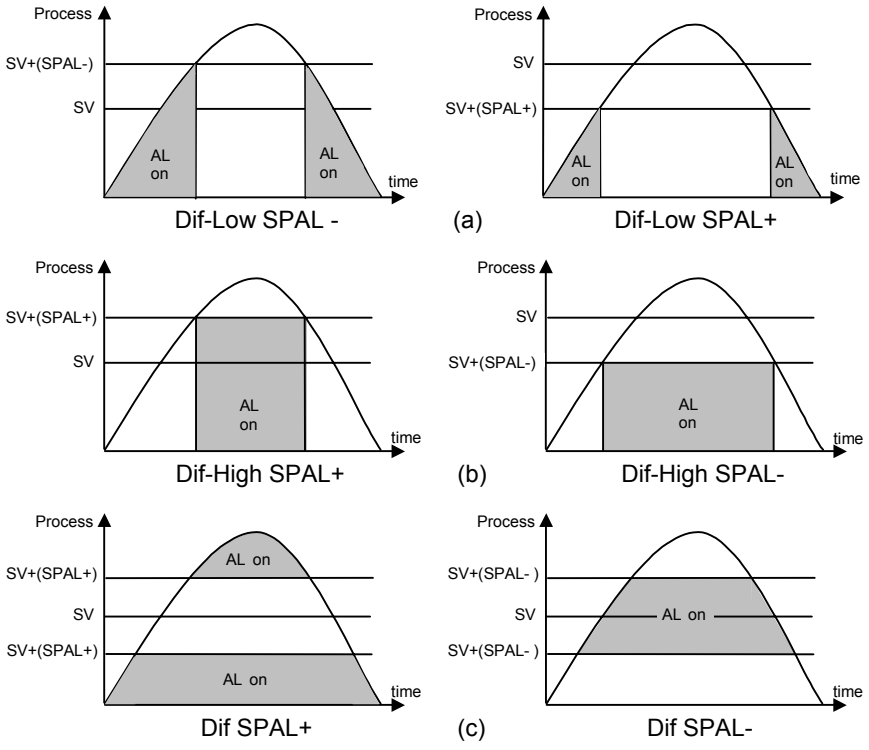
High Alarm: Activates at present value, independent of main setpoint. High process-alarm activates at and above alarm setting.

Differential Low: Activates at present deviation (negative or positive) value from Alarm Reference (**ALrE**). Low deviation-alarm activates below alarm setting. Figure 7(a) gives a graphical description of this.

Differential High: Activates at present deviation (negative or positive) value from Alarm Reference (**ALrE**). High deviation-alarm activates above alarm setting. This is represented in figure 7(b).

Differential: Activates when the process exceeds a specified band-alarm centered around the Alarm Reference (**ALrE**). See Figure 7(c).

Inhibition at power-up: Alarm blocking at power-up inhibits the relay alarm from activating when the unit is first energized. The alarm will only trip after the process variable reaches a new alarm situation.



(Figure 7)

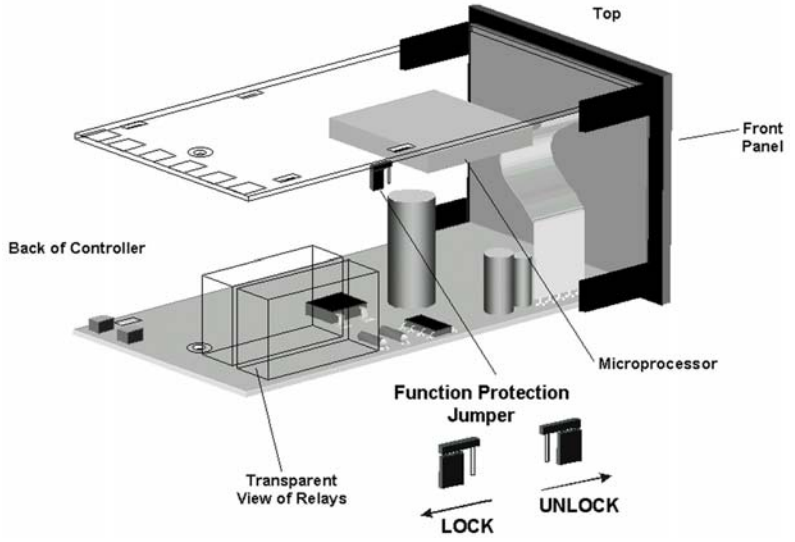
*Function Protection (**Prot**):*

The controller is shipped with full accessibility. If you want to use the "Function Protection" to disable access to cycles 2, 3 and 4, follow the steps below:

- After programming the controller for the desired operation select the level of cycle access desired in Cycle-3 at the **prot** parameter using the ▼ or ▲ keys.
- Remove the controller circuitry from the housing by using the thumb to press the tab in the lower front face of the controller, then, while firmly grabbing the front face at the top and bottom pull it and the circuitry from the case.

Warning: Use caution when removing the controller from its case, there may be live voltage present at the terminals. This should only be done by a qualified technician. It is recommended that power to the controller be disconnected prior to removing the controller from the case.

- View the controller in the position shown in Figure 8 and note the Protection Jumper on the top main board.
- **Enable Function Protection** (locks the **Prot** parameter) by placing the jumper over both jumper prongs as shown in figure below.
  Needle nose pliers are recommended for changing jumper position.
- **Disable Function Protection** (unlocks the **Prot** parameter) by placing the jumper over both jumper prongs as shown in figure below.
- Once the desired protection is obtained slide the controller back in the case making sure that the main board and power supply board stay in the circuit board channels at the top and bottom side walls of the case. Use the palm of the hand to press the front panel flush into the controller housing.



(Figure 8)

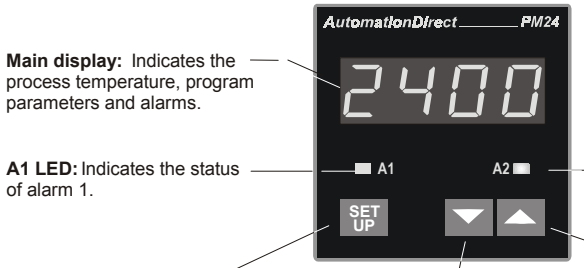
CYCLE 4 - CALIBRATION LEVEL:

NOTE: *All input and output types are factory calibrated. This cycle should only be accessed by experienced personnel. If in doubt do not press the ▼ or ▲ keys in this cycle.*

InLC **In**put **L**ow **C**alibration	**SENSOR OFFSET CALIBRATION**. Sets the temperature sensor low calibration (offset). The display shows only the corrected temperature and not the offset added. A signal simulator should be used to inject a low value signal to properly adjust the offset.
InHC **In**put **H**igh **C**alibration	**INPUT HIGH CALIBRATION**. Sets the sensor input circuit gain or high calibration. A signal simulator should be used to inject a high value signal to properly adjust the offset.
CJ L **C**old **J**unction **L**ow **C**alibration	**COLD JUNCTION OFFSET CALIBRATION**: Sets the cold junction °C offset calibration. A good thermometer or a temperature simulator should be used to properly adjust this parameter.

PM24 Quick Setup Reference

Key and Display Functions



Main display: Indicates the process temperature, program parameters and alarms.

A1 LED: Indicates the status of alarm 1.

A2 LED: Indicates the status of alarm 2.

SET UP: Used to move forward throught a menu Cycle. Used to advance to the next Cycle when pressed and held for 4 seconds.

▲: Used to increase the value of the displayed parameter.

▼: Used to decrease the value of the displayed parameter.

Set Up Cycle Parameters

Cycle-1	Cycle-2	Cycle-3	Cycle-4
INDICATION	ALARMS	CONFIGURATION	CALIBRATION
PV Indication	A 1SP Alarm 1	tYPE Input Type	InLC Input Low Calibration
	A2SP Alarm 2	dPPo Decimal Point Position	InHC Input High Calibration
	ALrE Differential	un It Unit	CJL Cold Junction Low Calibration
		InLL Input Low Limit	
		InHL Input High Limit	
		OFFS Offset Signal Input	
		A 1Fu Alarm 1 Funtion	
		A2Fu Alarm 2 Funtion	
		A 1HY Alarm 1 Hysteresis	
		A2HY Alarm 2 Hysteresis	
		Prot Security Protection	

Quick Set Up

This quick reference setup is intended to be used by experienced users that are familiar with the PM24 set up menu or those that need only basic limit alarm operation. This guide will show how to configure the input and basic alarm functions. For detailed programming information refer to the Table of Contents to find the required instructions for a particular function. Follow these steps:

1. **Indication**: Connect Power and Input wiring to the proper terminal connections (page 6). After power-up the controller is in the **Indication** Cycle and shows the PV in the display.

2. **Input Type**: Press and hold the **SETUP** key until tYPE is shown in the display, approximately 7 seconds. Select the Input Type from **Table 1** on page 12 by using the ▼ or ▲ keys. If Input Type is linear (codes 18,19 or 20) proceed to 3. If Input Type is temperature (codes 0 – 17) proceed to 4.

3. **Decimal Point Position: Used only if input is linear, Input Types 18,19 or 20.** After selecting the Input type in Cycle-3 press the **SETUP** key once until dPPo is shown in the display. Select the desired decimal point position using the ▼ or ▲ keys.

4. **Unit: Used only if Input Type is temperature, Input Types 0 – 17.** After selecting the Input Type in Cycle-3 press the **SETUP** key twice until Un It is shown in the display. Using the ▼ or ▲ keys select the unit, 0 = °C and 1 = °F.

5. **Alarm Functions:** While still in Cycle-3 press the **SETUP** key a few times until A1Fu is shown in the display. Select the Alarm Type from Table 2 on page 13 using the ▼ or ▲ keys. If another limit alarm is desired then press the **SETUP** key once until A2Fu is shown in the display then select the Alarm Type for alarm 2.

6. **Alarm Set Points:** After setting up the Alarm Functions press the SETUP key several times until the Indication Cycle is reached (PV display). From the Indication Cycle press and hold the **SETUP** key for approximately 4 seconds until A1SP is shown in the display, Cycle-2. Select the value of the set point for Alarm 1 using the ▼ or ▲ keys. If a second alarm limit was programmed, then press the SETUP key once until A2SP is shown in the display. Select the value of the set point for this alarm using the ▼ or ▲ keys as well. This will set up the controller for limit alarm operation.

All parameter settings are stored in non-volatile memory when scrolling to the next parameter or if the value has not been changed within a 20 second period.

NOTES:

PM24

Configuration Sheet

Name:_____ Date:_____

Part#: _____

Project:_____

Process Setpoint:			
Cycle 3 CONFIGURATION	Default	CODE/VALUE	CHARACTERISTICS / FUNCTION
tYPE	1		
dPPo	0		
Un It	0		
I n.LL	- 150		
I n.HL	1370		
A 1FU	0		
A2FU	0		
A 1HY	1		
A2HY	1		
Prot	1		
Cycle 2 ALARMS	Default	CODE/VALUE	CHARACTERISTICS / FUNCTION
A 1SP	6 10		
A2SP	6 10		
ALrE	- 150		

Error Codes Table for Temperature/Process Controllers

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The connection and configuration errors for most of the problems encountered in using the controller are shown below. A final revision of the connections and parameters will save time and further losses.

Error messages are displayed to help the user to identify possible problems.

Error Codes Table

Display Shows	Cause
_ _ _ _	Process or temperature is below the selected sensor range.
- - - -	Process or temperature is above the selected sensor range.
Erro	Sensor error. Example: 1. No connections on the sensor input terminals. 2. Broken thermocouple (open wire) or broken RTD-Pt100. 3. RTD-Pt100 badly connected, short-circuited or high cable resistance.
Err 1	RTD-Pt100 badly connected, short-circuited or high cable resistance.
Err 6	This kind of error is caused when, for instance, a 4-20mA signal goes through the mV or Thermocouples input and can introduce signals of up to 30VDC at the input point and force the Auto/Zero and Auto/Span to work outside the limits that guarantee the precision of the controller. This error goes away when the signal is removed from the input and the connection is fixed (normally, input signals of up to 30VDC do not damage the controller's hardware).
Err 2	Auto/Zero Problem: This error is caused by a wong connection and indicates that a voltage greater than 30VDC was input into the sensor and the Auto/Zero circuit was damaged. It is necessary to revise the controller.
Err 4	Auto/Span Problem: This error is caused by a wrong connection and indicates that a voltage greater than 30VDC was input into the sensor and the Auto/Span circuit was damaged. It is necessary to revise the controller.

NOTE: The controllers do not accept AC-Voltage or AC-Current in the sensor input. This type of signal can damage the controller.