



## IMP | PIM | SAM

Zone Temperature  
Controller  
for Runnerless Molding  
Applications



*Manual*



# **ATHENA... TEMPERATURE/PROCESS AND POWER CONTROLS YOU CAN DEPEND ON.**



Since 1965, Athena Controls, Inc. has been at the forefront of control technology, and was one of the first companies to offer a fully microprocessor-based, 1/4 DIN digital temperature controller. Our product line has expanded to include a complete range of panel, rack-mounted, and open-card process controllers, highly efficient SCR power controllers and solid-state motor contactors, and specialized temperature control products and systems for the plastics industry.

Athena's products are sold and serviced worldwide through a network of authorized sales representatives and distributors.



- General Purpose Microprocessor and Analog Controllers
- SPI-Compatible 1/32, 1/16, 1/8, and 1/4 DIN Auto-Tune Process Controllers
- Ramp-Soak and Multi-Input Process Controllers
- Low-Cost, Non-Indicating Temperature Controllers



- Phase Angle and Zero Switched SCR Power Controls
- Phase Angle and Zero Switched Solid-State Contactors
- Staging Controllers for Large KW Loads



- Single and Multi-Zone Hot Runner Control Modules
- Portable Controller and Mainframe Systems
- Cables, Mounting Boxes, and Accessories

# OPERATING INSTRUCTIONS

## ALARM/MODE DISPLAY

DISPLAY	ALARM SYMBOLS
	OVER TEMPERATURE
	UNDER TEMPERATURE
	THERMOCOUPLE OPEN
	NO HEAT
	THERMOCOUPLE REVERSED

## DOT INDICATORS

- POWER BEING DELIVERED TO LOAD
- MANUAL MODE ON  
(DISPLAY INDICATES PERCENTAGE OF POWER)
- REMOTE AND STANDBY OPERATION

DIGITAL SETPOINT SWITCH  
ACCURATELY SETS A  
SETPOINT TEMPERATURE

TEMPERATURE AND PERCENTAGE  
POWER DISPLAY

STANDBY (WARM) REGION

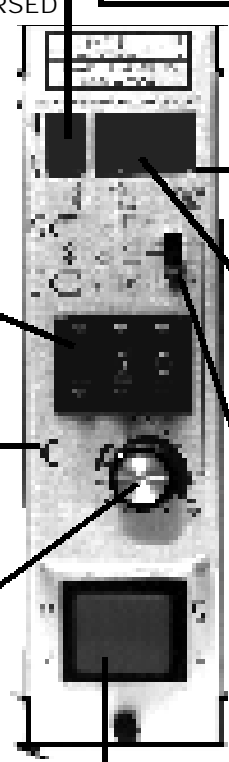
PERCENTAGE POWER ADJUSTMENT KNOB  
CONTROLS PERCENTAGE OF POWER  
SUPPLIED TO LOAD IN MANUAL

## MODE SELECT TOGGLE SWITCH

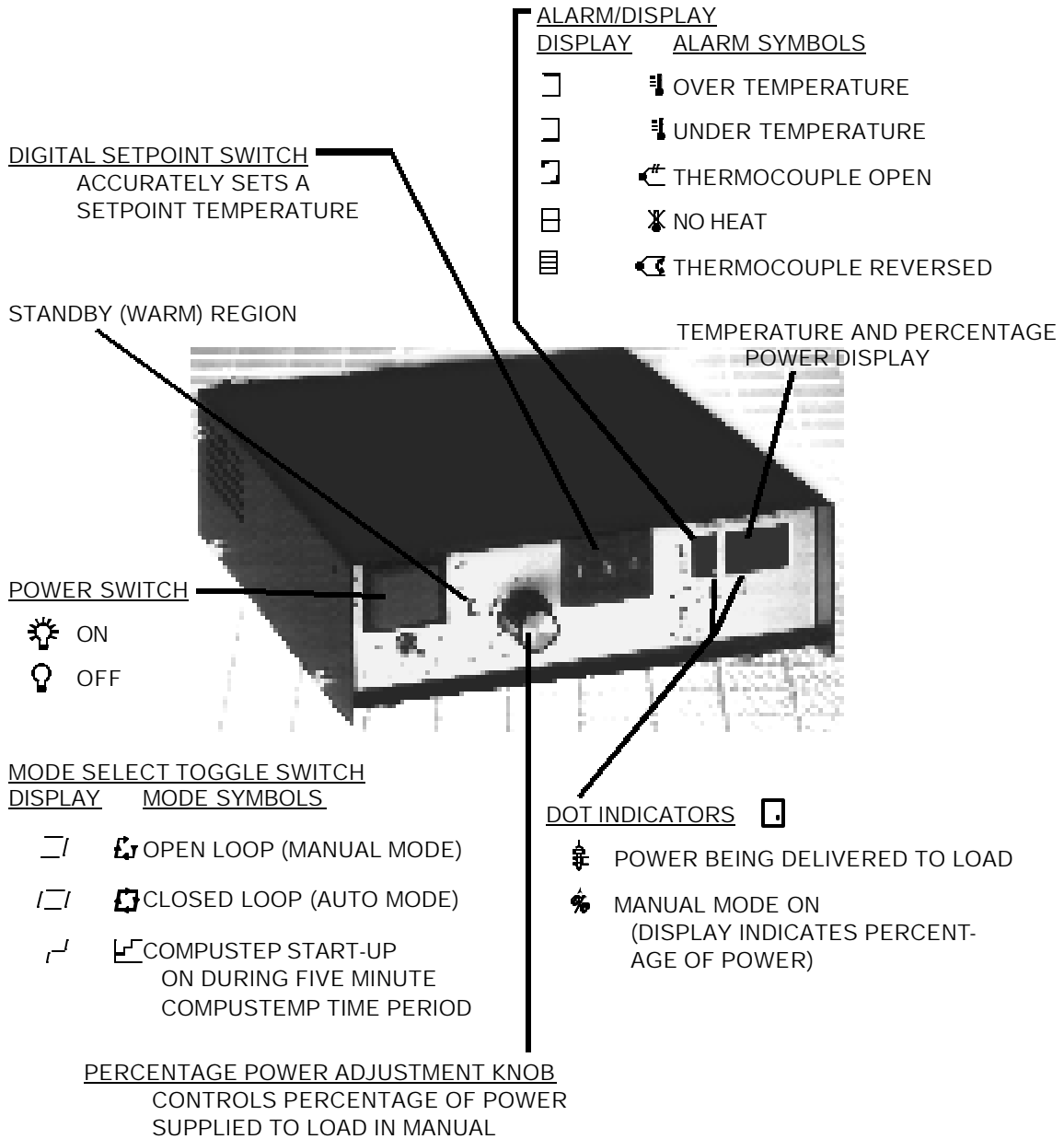
- | DISPLAY | MODE SYMBOLS   |
|---------|--|
|         | OPEN LOOP (MANUAL MODE)  |
|         | CLOSED LOOP (AUTO MODE)  |
|         | COMPUSTEP START-UP<br>ON DURING FIVE MINUTE<br>COMPUSTEP TIME PERIOD |

## POWER SWITCH

- ON
- OFF



# PIM SERIES PORTABLE SINGLE ZONE HORIZONTAL CONTROLLER



## **OPERATING INSTRUCTIONS**

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### **IMP Series 15 and 30 Amp Temperature Controllers PIM Series 10 and 15 Amp Temperature Controllers**

#### **Section I. General Description**

The IMP and PIM Series are microprocessor based PID controllers specifically designed to perform most operator functions automatically. The IMP Series are plug-in units, while the PIM Series are portable, stand-alone instruments. Both are self-adjusting and capable of maintaining a very high degree of temperature accuracy over a wide range of operating conditions. A digital display eliminates parallax error caused by conventional analog methods of display. This enhances the accuracy of the controller while making information easier to see.

Simplified controls and the use of status symbols allow the operator to make adjustments easily. The status display also provides visual indication of normal or abnormal operating conditions in both controller and load.

All that is required of the operator is to set the temperature desired. From that point on, the controller will automatically perform all the operations required to achieve and maintain the selected temperature.

Included in the design is a built-in safety feature which when operating in closed-loop mode will automatically cut off the controller output power when any TC fault is detected. In open-loop operation, the display shows percentage of power as set by the power control potentiometer (0-100%).

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The IMP plug-in controller is capable of receiving a standby command from the SAM auxiliary module. When a standby or low heat command is acknowledged from the SAM during closed-loop operation, the controller will operate with a fixed setpoint. When receiving a standby command during open-loop operation, the output power of the controller will be reduced to 1/4 of the front panel power control setting.

The IMP controller also sends alarm status conditions to the SAM auxiliary module for annunciation and remote control functions.

## **Section II. Installation (IMP Series Only)**

All IMP Series controllers are ready to use as shipped from the factory. Prior to installation into a mainframe, make sure the voltage, Hz and degree options are as ordered and correspond to the Product ID label.

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### **CAUTION**

Never insert or remove a controller from a mainframe with the AC power on. Hazardous potentials exist on components inside the mainframe and controller. Always disconnect AC power to the mainframe when servicing.

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To install a plug-in controller into a mainframe, release the locking device on the lower edge of the unit by pulling the plunger gently away from the panel. Align the upper and lower edges of the printed circuit board on the controller with the mainframe card guide slot and slide in until the rear connector is completely engaged. Lock the controller into the frame by depressing the plunger on the locking device.

### **Section III. Operation**

*Note: Any flashing display indicates that a fault has been detected by the controller. Refer to section on **Faults**.*

#### **A. Automatic Closed-loop Operation**

- 1- Position Mode select switch to closed-loop ("o").
- 2- Set temperature on Setpoint switch.
- 3- Turn on AC power.
- 4- After a short reset delay, the measured temperature will be displayed. If the temperature is 30 degrees F (17°C) or more below setpoint, the undertemperature alarm display (lower segment of the leftmost digit) will flash. If the temperature is 30 degrees F (17°C) or more above setpoint, the overtemperature alarm display (upper segment of the leftmost digit) will flash. During alarm conditions, temperature display will also flash. If the temperature is within alarm limits, the display will stop flashing, and the leftmost digit will display closed-loop mode ("o").
- 5- Power to load indicator (the decimal point of the leftmost digit) will be on if any power is being applied to the load.

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- 6- When any of the thermocouple (TC) faults are detected, output power will be cut-off automatically and the temperature display will be blanked out. The leftmost digit will show “□” for (TC open), “☒” for (TC reverse) or “☐” for No Heat and flash twice per second.

**B. Automatic Operation with CompuStep® system**

When starting from cold, it is recommended that the CompuStep system be used, as this will serve to lengthen heater life considerably.

- 1- Position the mode select switch to CompuStep mode (“ $\text{r}^{\text{J}}$ ”).
- 2- Set the desired temperature on the setpoint switch.
- 3- Turn on the AC power.
- 4- After reset delay, the measured temperature will be displayed. If temperature is less than 200 degrees F (93°C) the controller will enter the CompuStep mode. This is indicated by the step symbol “ $\text{r}^{\text{J}}$ ” on the leftmost digit. During this mode, the controller gradually increases power to load in small steps and limits the load temperature to 256 degrees F (124°C). After 5 minutes, the controller will exit from CompuStep mode and automatically go to setpoint. Any thermocouple faults detected during the 5 minute interval will cause the CompuStep mode to end prematurely. A standby command from a SAM module will also terminate CompuStep mode. When CompuStep ends, the controller will operate as described in the Automatic Closed-Loop Operation section. If temperature is above 200 degrees F (93°C), controller will bypass CompuStep and go directly to setpoint.



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### **C. Manual Open-Loop Operation**

- 1- Position the mode select switch to open-loop (“ $\square I$ ”).
- 2- Turn the AC power on.
- 3- After reset delay, the controller will display the percentage of output power as adjusted by the power control knob. The percentage power indicator will be on. Thus 0.00 corresponds to 0% (no power) and 1.00 corresponds to 100% (full power). The leftmost digit will display open-loop mode (“ $\square I$ ”). 75% power is shown as 0.75.

### **D. Manual Control Pre-Set**

The following procedure can be used to pre-set the Manual power control knob position in the event of a thermocouple break in closed-loop operation.

A good thermocouple is required to start with, as this procedure compares the temperature attained using automatic (closed-loop) control with that obtained using manual (open-loop) control. When the temperature is the same using either automatic or manual control, then the position of the Manual power control knob is correct.

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### **Procedure for Manual Control Pre-Set**

- 1- Adjust controller for closed-loop operation and obtain good molded parts. This will adjust the controller to the proper temperature.
- 2- Position the module select switch to open-loop and set the manual control knob to roughly 25%. Wait for 10 seconds, than momentarily switch to closed-loop mode to examine the temperature. If it is above the setpoint, the manual power is too high to maintain proper temperature. If it is below setpoint, the manual power is too low. Adjust the power control knob accordingly, wait for 10 seconds, then re-examine the temperature by switching momentarily to closed-loop mode. Repeat this procedure until the temperature is the same in either automatic or manual control.

### **E. Standby Heat (SAM module only)**

Standby heat is a low heat level used to keep heaters and associated equipment warm. Its purpose is to prevent moisture build-up in heaters and equipment during idle periods and to provide fast start-up when returning to normal operations.

When using a Standby Alarm Module (SAM), activate the standby switch. The SAM will send a standby command to all controllers. A controller, upon receiving the command, will respond accordingly to its present mode of operation:

- a- If the controller is in closed-loop mode, the setpoint becomes 200 degrees F (93°C) regardless of the setpoint switch setting. The Remote Standby Indicator (the decimal of the last digit) will be

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on, indicating that the remote standby function is active.

b- If the controller is in open-loop mode, the power output is reduced to 1/4 of the value adjusted by the power control knob. Notice that the % power display will show the reduced value. The remote standby indicator will be on.

## **F. Faults**

### **1- Overtemperature alarm:**

A constant overtemperature alarm is most likely caused by a shorted triac in the controller or incorrect or shorted mold wiring. Switch module power off as quickly as possible and replace controller or correct wiring error. Check for thermocouple or heater cross wiring.

### **2- Undertemperature alarm:**

Undertemperature alarm is normal during system start- up before the setpoint is reached. If under temperature persists, a No Heat fault will occur.

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3- Thermocouple open or reversed:

If any TC fault is detected during closed-loop operation, the output power will be cut off. If it is necessary to apply power to the load during a TC fault condition, the controller can be switched to manual mode. The output power will be a function of the manual control knob setting. Since the controller is now operating in open-loop mode, extreme care must be taken when adjusting to prevent excess output power which would overheat the load.

4- No heat fault:

The IMP series controller has included in its microprocessor a program which detects that the temperature is not rising as it should in response to full power output. "No Heat" is defined as the condition under which the temperature does not increase more than 2 degrees F during a 60-second interval during start-up. It takes 60 seconds to detect "No Heat" when power is first turned on in closed-loop mode, and longer if CompuStep is active.

In the beginning of the CompuStep mode, only a small amount of power is applied to the load and the rate of temperature rise could be less than 2 degrees F (1°C) in 60 seconds. In order to compensate for this, the test is not performed until one minute after power is turned on. By that time, enough power is being applied to the load to sustain the rate of 2 degrees F (1°C) in 60 seconds. It takes 1 minute, 60 seconds to detect "No Heat" in CompuStep mode when power is first turned on. When "No Heat" alarm is detected, output power is cut off.

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What to do:

- A. Try resetting the controller by turning its AC power OFF and then ON.
- B. If “No Heat” persists, then the problem could be one of the following.
  - a- Open heater or load.
  - b- Thermocouple shorted. Switch to manual mode to override this condition.
  - c- Load circuit open. This can be caused by an open power cable, an open connector or a failed triac in the controller. Exchange the module with a known good module to eliminate suspect triac or module.
  - d- Slow heater. Use higher power heater or operate in manual mode until setpoint is achieved.
  - e- Thermocouple too far away from heat source which causes less than 2 degrees F (1°C) rise in 60 seconds due to thermal lag. Move thermocouple as close to heater as possible or use heater with built in thermocouple.
  - f- To defeat “No Heat” circuit, if not used or required, remove jumper J4 and that circuit will no longer be active.

User’s Selected Jumper Option

- 1- For degree Celsius operation,  
install jumper on PC board marked J1
- 2- For 50 Hz operation  
install jumper on PC board marked J2

Since the microprocessor reads the status of the jumpers during power up, the power has to be turned off and on again in order to activate the jumper function.

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- 3- For 120 Vac input operation,  
install the 2 jumpers on the PC board as shown.
  - 4- For 240 Vac input operation,  
install the 1 jumper on the PC board as shown.

*Note:*  
*prior to installing a*

# OPERATING INSTRUCTIONS

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## Model SAM Communications Module

### Section I. Installation

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#### CAUTION

Never insert or remove the module from a main frame with the AC power on. Always switch the module or main frame to "off." Hazardous potentials exist on components inside both the module and main frame. Always disconnect the AC power to the main frame when servicing.

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SAM must be used in conjunction with a model "MFC" communications-type main frame, and one or more IMP type microprocessor-based temperature controllers. It is shipped from the factory ready to use. No special preparation is required.

#### Installation Procedure:

- 1.1 Carefully unpack module. SAM may be plugged into any unused zone of the main frame.\*
- 1.2 Release locking device by gently pulling push-pull fastener away from the front panel.
- 1.3 Line up module printed circuit board with respective main frame guides. Insert module firmly, making sure rear connectors are fully engaged.
- 1.4 Lock module into place by depressing push-pull fastener.

*\*Note: SAM will work in any main frame zone. A heater connected to a zone with a SAM inserted will not affect operation of the module.*

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## **Section II. General Specifications**

<b>Standby Temperature</b>	200 deg F (93 deg C)
<b>AC Input Requirements</b>	240 Vac +10% -20%, 48-63 Hz (standard) 120 Vac (Available)
<b>Alarm Limits</b>	+/- 30 deg F (17 deg C) when used with an IMP
<b>Alarm Output (Audible)</b>	Over Temperature: 2 KHz tone at 2 Hz interval Under Temperature: 1 KHz tone at 1Hz interval
<b>Alarm Output (Visual)</b>	Over Temperature: 2 Hz flashing rate Under Temperature: 1 Hz flashing rate
<b>Output Connector</b>	AMP MIL-style connector (4 Pin) providing Normally Closed and Normally Opened relay contacts. (5 amps maximum)
<b>Communication Capacity</b>	50 zones maximum



# QUICK REFERENCE GUIDE

## SPEAKER

FAST HIGHER TONE = OVER TEMPERATURE 30°F (17°C) OR MORE ABOVE SETPOINT  
 SLOW LOWER TONE = UNDER TEMPERATURE 30°F (17°C) OR MORE BELOW SETPOINT

## LOW TEMP ALARM MODE SWITCH

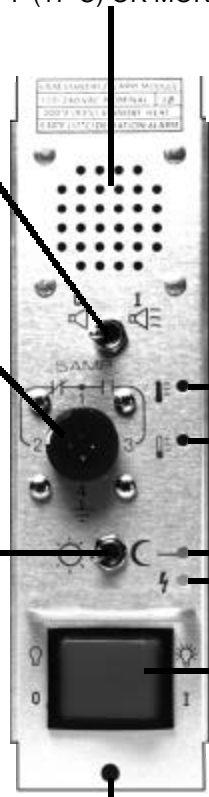
- ◀ LOW TEMP ALARM MODE INHIBIT
- ◀ LOW TEMP ALARM ACTIVE

## EXTERNAL OUTPUT CONNECTOR

- ⚡ PINS 1&2 - N.C. RELAY CONTACTS
- ⚡ PINS 1&3 - N.O. RELAY CONTACTS

## STANDBY ON-OFF SWITCH

- ☀ DAY USE OR NORMAL
- ☾ NIGHT USE OR STANDBY (YELLOW STANDBY LED ILLUMINATES)



OVER TEMP. LED (red)

UNDER TEMP. LED (red)

STANDBY LED (yellow)

POWER ON LED

POWER SWITCH

☀ ON



☾ OFF

LOCKING DEVICE



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### Section III. Basic Operation

- 3.1 Select Normal or Standby Mode.
- 3.2 Select Low Temperature Alarm Mode.
  - 3.2.1. Low Temperature Alarm Inhibit  : Speaker will be off and output relay inactive in the event of low temperature condition (useful during start-up procedures).
  - 3.2.2. Low Temperature Alarm Active  : 30°F (17°C) or more below IMP setpoint temperature will sound alarm and energize output relay contacts.
- 3.3. Turn Power On-Off Switch to "ON" position.
- 3.4. Alarm indications are automatic.  
(see detailed operation)

### Section IV. Detailed Operation

- 4.1 Normal or Standby Operation
  - a. Normal  : In this mode the standby feature is defeated and temperature control is in accordance with the IMP controller(s) settings.
  - b. Standby  : With the toggle switch in this position, the standby mode is engaged. This will set the temperature of all IMP controllers operating in automatic mode to a standby temperature of 200 deg F (93 deg C).
    - (1) Any IMP controller operating in manual mode will have its output power level reduced to 1/4 of its present level.
    - (2) When SAM and IMP controller(s) are in use at normal operating temperature [setpoint above 230 deg F (119 deg C)], switching to standby mode will result in an over temperature alarm until all zones cool down to below 230 deg F (110 deg C).

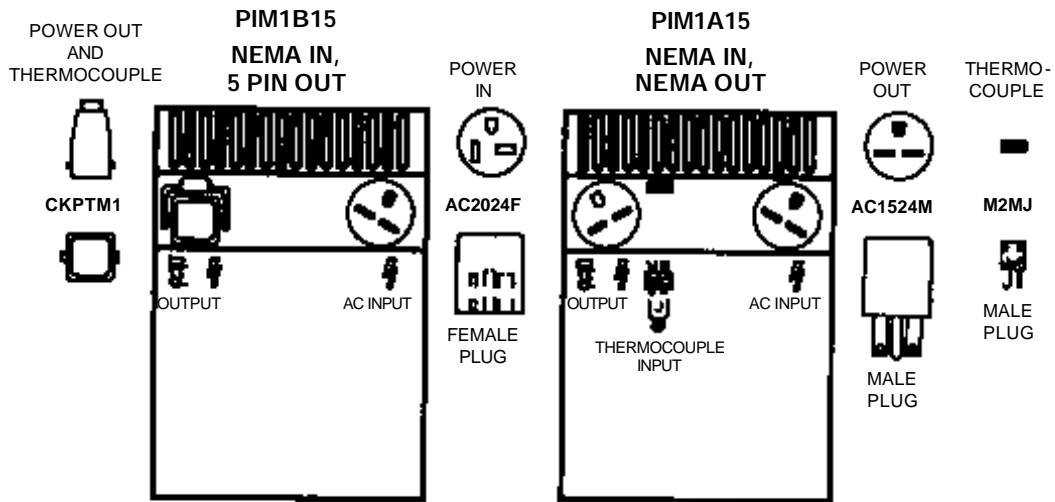
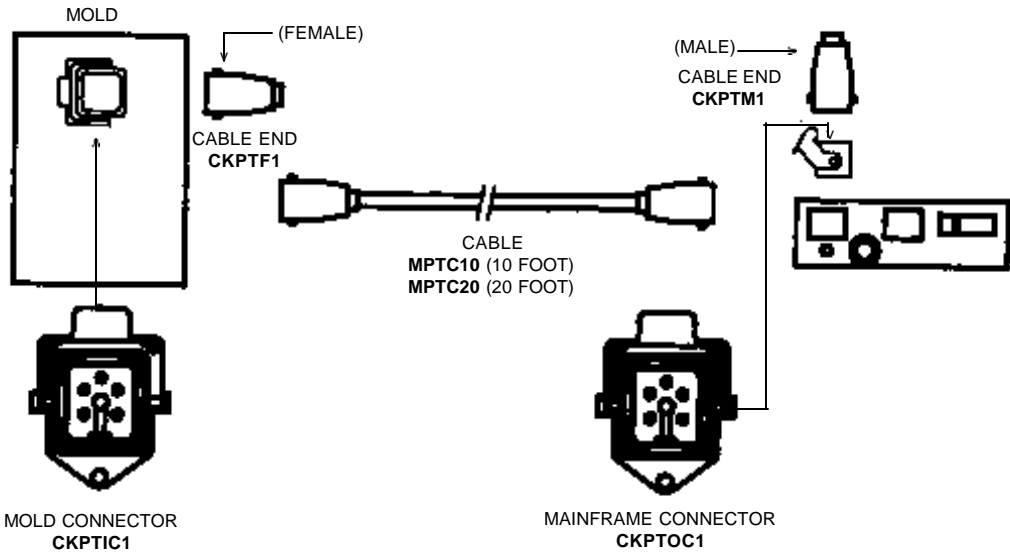
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- 4.2 Alarm Indications: When an overtemperature or undertemperature condition exists in any zone occupied by an IMP controller, both audio (tones) and visual (LED) alarms will occur in the SAM.
- a. Over Temp.  : Occurs when an IMP thermocouple is 30 deg F (17 deg C) or more above setpoint. The speaker will emit a higher pitched audio tone of about 2 KHz repeating about twice per second. At the same time, the over temperature LED will flash, and relay closure will occur.
  - b. Under Temp.  : Occurs when an IMP-15 thermocouple is 30 deg F (17 deg C) or more below setpoint. The speaker will emit a lower pitched audio tone of about 1 KHz repeating about once per second. At the same time, the undertemperature LED will flash, and relay closure will occur.
  - c. Over Temp. Alarm Priority: If an overtemperature and undertemperature condition exist simultaneously from more than one IMP controller, SAM will indicate only the overtemperature condition. SAM will not recognize any undertemperature condition, until all overtemperature alarms have been cleared.
- 4.3 Front Panel Output Connector: A set of relay contacts are available at this connector for use with external equipment if desired. Observe the 5 amp maximum contact rating. Pins 1 and 2 have normally closed (N.C.) contacts. Pins 1 and 3 have normally opened (N.O.) contacts.
- a. During either an over-or under-temperature alarm condition, the relay will be energized.
  - b. Relay operation is defeated when the Low Temperature Alarm mode switch is in the Inhibit () position. (This will be clarified in the next section.)

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- 4.4 Low Temperature Alarm Mode Switch: This switch gives the operator the ability to defeat both the low temperature audio alarm, and output connector relay operation. This feature is useful to avoid sounding an alarm during startup or cooling down procedures. The undertemperature LED is unaffected by this switch. All overtemperature alarm indications are also unaffected by this switch.
- a. Low Temp. Alarm Active  : In this position, undertemperature alarm indications operate normally.
  - b. Low Temp. Alarm Inhibit  : In this position, an undertemperature condition of 30 deg F (17 deg C) or more below setpoint will *not* sound the audio alarm. Also, the output connector relay will *not* be energized. The undertemperature LED is unaffected, and will flash as usual.
- 4.5 Remote Standby Option: It is possible to wire the main frame for remote standby operation as outlined in the following procedure.
- a. Locate the appropriate communications connector for the zone to be occupied by the SAM. This is on the upper strip of connectors on the rear of the model “MFC” main frame.
  - b. Carefully wire an isolated set of normally open relay contacts, rated at 5 volts and 1/2 amp, to pins 8 and 12 of the main frame connector. Note that this relay is not included.
  - c. When the remote relay is energized, SAM will be placed in the standby mode of operation.
  - d. A SAM must be installed for this option to work.

# NOTES

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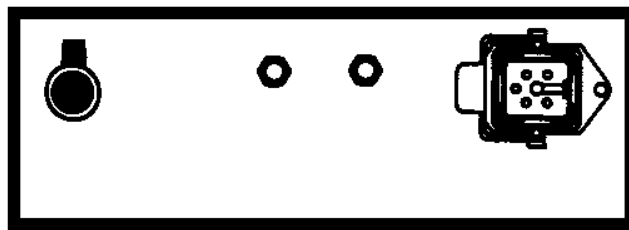
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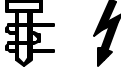
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PIM1A10  
POWER CORD IN,  
5 PIN OUT



  
AC INPUT

  
OUTPUT

5 PIN CONNECTOR  
WIRING

