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Part Number: LMS3860

Hot Plate with GPIB Control



Operator's Manual

Revision A
October 2025

Safety

1

WARNINGS



WARNING

WARNING: This system is intended to be used as an accessory to a Power Device Analyzer. Do not use this system for any other purpose.



Electrical Hazard

WARNING: Only a qualified Electrician should access the interior of the REB and/or perform service on the system.

WARNING: The system voltage must be configured in the REB before connecting to a power source.

WARNING: This system is not equipped with a power plug. A power plug must be installed by a qualified electrician after the system voltage has been configured. The plug must match the voltage configuration.

WARNING: Before servicing the equipment, set the REB power switch to the OFF position and disconnect the power cord from the main power source.



Hot Surface

WARNING: The Hot Plate can reach temperatures in excess of +255°C. Always verify the hot plate is at ambient temperatures before touching or handling.

WARNING: The Hot Plate can only be cooled by ambient air. Even when power is off, the hot plate can be hot.

WARNING: A heat shield is located approximately 6.35mm below the lower surface of the hot plate. Even with the heat shield, the bottom of the hot plate can be unsafe to touch.

Installation & Operation

Introduction

This chapter provides information for the installation and operation of the hot plate and Remote Electrical Box (REB). The hot plate is designed to be used as an accessory with a Power Device Analyzer.

The hot plate is a nickel-plated temperature plate sized to customer specifications. It is designed to be mounted in a Power Device Analyzer. The plate is controlled by a Remote Electrical Box (REB) with a built-in Watlow PM PLUS9 temperature controller.

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Section A: Installation

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Physical Description and Requirements

Thermal Platform Dimensions	The hot plate is sized to specification. Refer to customer order or specification sheet for exact dimensions.
Remote Electrical Box (REB) Dimensions	Height: 5.4" (13.72 cm) Width: 11.9" (30.23 cm) Depth: 9.7" (24.6 cm) Umbilical to Tester Length: 59.0" (approx. 1.5 m)
Electrical Requirements	Voltage: 100-120 or 200-240 VAC (configured in REB) Phase: Single Phase Frequency: 50/60Hz Current: 10 Amps Power Cord Length: 116.4" (approx. 3 m) Power Cord Plug: not supplied, install plug based on voltage configuration
Temperature Range	Ambient to +255°C. Failsafe set at +265°C

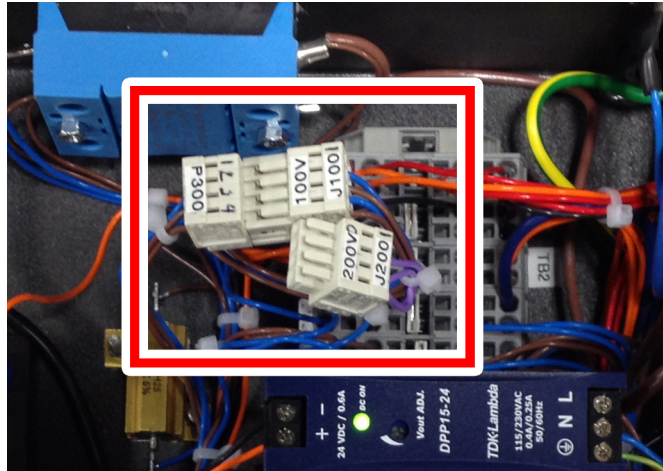
Configuring the Voltage (100-120VAC or 200-240VAC Operation)

The hot plate is designed to operate using a 100-120VAC or a 200-240VAC power source. The REB must be configured to match the supplied voltage.



Electrical Hazard

ONLY A QUALIFIED ELECTRICIAN SHOULD ACCESS THE INTERIOR OF THE REB.



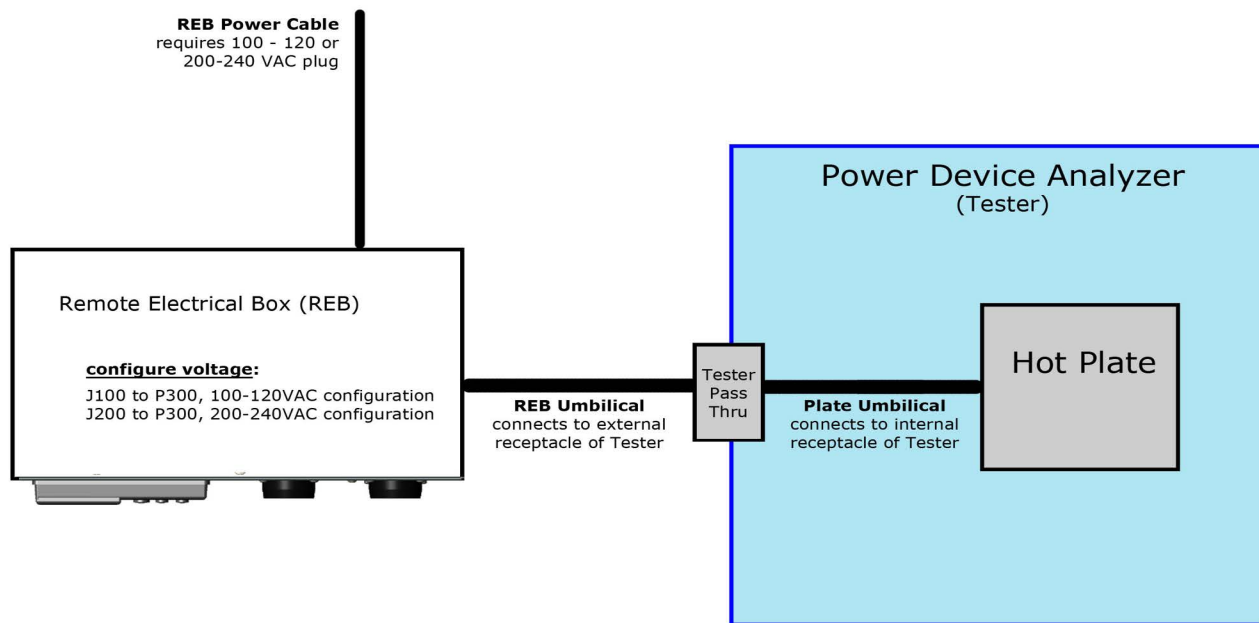
100-120VAC configuration
shown in picture
(J100 connected to P300)

NOTE: Factory default is set to 200-240VAC configuration

To configure the voltage:

1. Make sure the REB power cord is disconnected from the facility power source.
2. Remove the screws securing the REB cover. Retain the hardware.
3. In the REB cabinet, locate the J100, J200, and P300 connectors.
4. Configure the system for the desired voltage:
Connect J100 to P300 for a 100-120VAC configuration
OR
Connect J200 to P300 for a 200-240VAC configuration.
5. Replace the REB cover and secure with screws.
6. The system voltage is now configured.

Interconnects



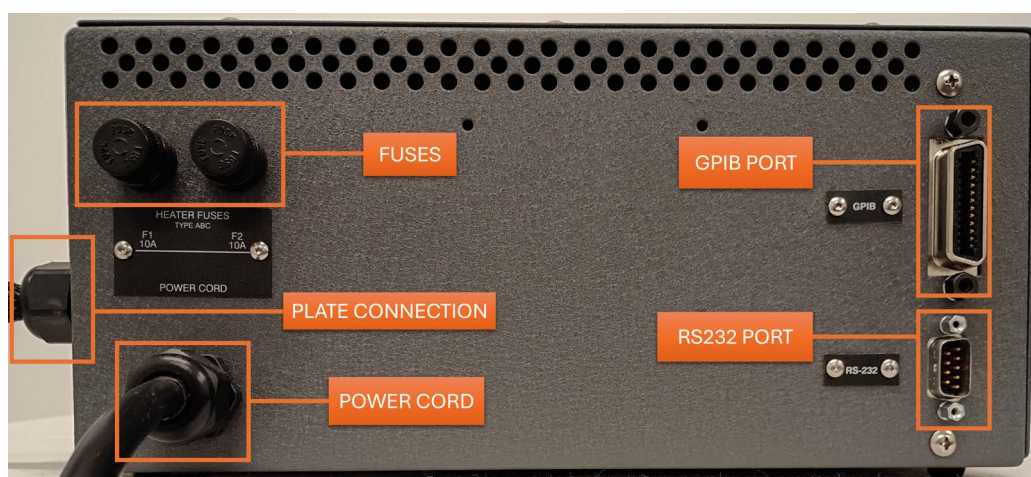
NOTE: Refer to the Power Device Analyzer instructions for more detail.

To connect the hot plate to the Remote Electrical Box:

1. Install the hot plate into the tester.
2. Place the REB outside the tester.
3. Connect the plate umbilical to the tester pass through. The plate umbilical will typically connect to a port labeled "THERMAL PLATE."
4. Connect the REB umbilical to the tester pass through.
5. Install a power plug onto the REB Power Cable.
NOTE: The power plug should be a 100-120VAC plug or a 200-240VAC plug depending on the REB voltage configuration. Only a qualified electrician should install the power plug.
6. Connect the REB power cable to facility power.
7. The hot plate and REB are now connected and ready to operate.

Section B: Operation

Controls, Indicators, Ports



Control / Indicator / Port	Description
WATLOW CONTROLLER PM9 PLUS	Temperature controller for the hot plate. Refer to the Watlow User's Manual (PM9 PLUS PID/Integrated Controller) for controller specifications. Plate Temperature - displays the current temperature of the hot plate. Plate Set Point - displays the current set point of the hot plate. Left / Right Keys: press to change the hot plate set point. NOTE: Upper limit is factory set to +250°C.
FAILSAFE button	Illuminates RED when the hot plate trips the failsafe or when an umbilical is disconnected. Press to reset. The failsafe is factory set to +265°C. The hot plate must be below +255°C and all umbilicals must be properly connected to reset the failsafe.
PLATE ENABLE button	Press to enable/disable heating power to the hot plate. Button illuminates green when heating power is enabled. Hot plate will not drive to the set point until the PLATE ENABLE button is pressed.
POWER SWITCH	Press to turn on/off power to the Remote Electrical Box.
FUSES	REB is equipped with (2) 10 AMP, ABC-type fuses. Fuses are labeled F1 and F2.
GPIB port	A standard IEEE, GPIB communications port. Used for RS-485 remote communications.
RS232 port	RS232 communications are not yet supported.
POWER CORD	Main power cord for the system. Cord is not equipped with a power plug. A 100V or 200V plug must be attached by a qualified electrician.
Hot Plate Hole Pattern (not shown)	Hot plate is configured with a hole pattern for fixturing devices to the plate. Refer to hot plate specification for more detail.

Turning On the REB and Hot Plate

Once the voltage is configured and all the power and communication interconnects have been made, the system is ready to be powered on. To turn on the system:

1. Plug the REB power cord into a power outlet, 100V or 200V depending on configuration and power plug.
2. Press the POWER SWITCH on the REB. The REB and Watlow Controller will turn on. The FAILSAFE button will illuminate RED for less than 5 seconds during the startup.
3. The system is now ready to operate.

Running to Set Points (Watlow Controller)

Once the system is turned on, the hot plate can run to the desired set points. To run the hot plate to a set point:

1. Use the LEFT / RIGHT Keys on the Watlow Controller to enter the desired the set point.
2. Press the PLATE ENABLE button to enable heating power to the hot plate. Once the button is pressed, the hot plate will drive to the temperature set in the Watlow controller. Press the PLATE ENABLE button at any time to stop heating power to the hot plate.

NOTE: The LEFT / RIGHT keys can be pressed at any time to change the temperature set point during operation.

Using the Plate Enable Button

Pressing the PLATE ENABLE button will enable or disable the hot plate.

When the green light is ON, the plate is enabled and ready for heating power.

When the green light is OFF, the plate is disabled, heating power is removed from the plate.

NOTE: A failsafe condition will remove heating power from the plate regardless of the PLATE ENABLE button's state. In a failsafe condition, it is possible for the green light to be OFF while the PLATE ENABLE button is pressed in. If the PLATE ENABLE button is in this state during a failsafe condition, be aware that heating power will automatically be enabled and the green light will illuminate once the failsafe is cleared.

Using the Failsafe Button

The failsafe is designed to disable heating power to the hot plate if the plate's temperature reaches +265°C or if either of the umbilicals are disconnected. The failsafe can be reset by pressing the red failsafe button after the plate cools to within the systems operating range of +255°C.

Other possible causes for the failsafe engaging:

- The failsafe illuminates briefly during system startup. This is normal operation and no corrective actions are required.
- Faulty REB or PLATE Umbilicals connections can cause a failsafe condition. Check the integrity of all umbilical connections. Verify that the pins are not bent or damaged.

If the hot plate is cool and all connections have been verified and the failsafe can not be reset, contact the inTEST Thermal Solutions Service Department: service@inTESTthermal.com

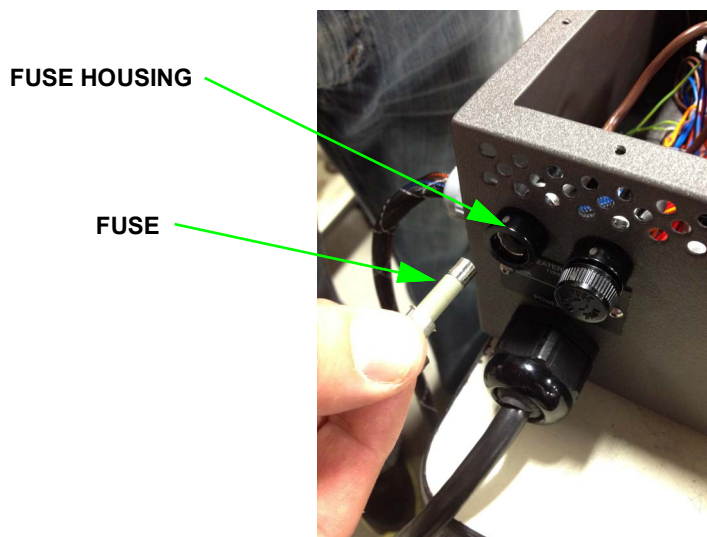
Cleaning

The REB cabinet is epoxy powder coated and is very tough. However, use solvents with caution and avoid abrasives when cleaning the cabinet surfaces. A damp cloth is often all that is needed to keep the cabinet looking good.

The working surface of the platform is electroless nickel. Avoid abrasives and be cautious with scrapers, as maintaining the flatness of the surface is important for effective thermal transfer. Solvents of almost any type can be used on the working surface, but care should be taken to avoid chemicals that react with aluminum. If solvents are used, do not pour the solvent onto the surface. Use a cloth or paper with some solvent already on it to prevent leaking solvent down the sides of the plate where damage could occur.

Replacing Fuses

Fuses F1 and F2 are located at the rear panel of the REB. They are both 10amp ABC type fuses. Gently push in and turn counter clockwise to open the fuse housing and access the fuse.



Support

inTEST Thermal Solutions is committed to assisting end users and technicians maintain operational systems that are highly reliable.

inTEST Thermal Solutions offers the following support services:

Customer Training

Formal technical training courses are available. Training courses cover the theory of operation and the maintenance procedures for the system. For further information, contact the inTEST Thermal Solutions Service Department.

Repair Service

inTEST Thermal Solutions maintains a fully equipped repair center at the factory plant for warranty and non-warranty repairs. For further information on module and circuit board repairs, our exchange program, and the availability of spare parts, contact the inTEST Thermal Solutions Service Department.

Before returning any module or circuit board for repair, contact the Service Department to obtain a Return Authorization (RA) number.

Spare Parts

Electrical and mechanical replaceable parts for the System can be obtained through your local inTEST Thermal Solutions representative, or directly from the inTEST Thermal Solutions Service Department. When ordering, be sure to specify the:

- Quantity
- Part number
- Description
- Reference designation (if any)
- Complete model number and serial number of your system

For your convenience, Spare Parts Kits are available for different levels of service activity.

Contact Support

Contact the Service Department by one of the following means:

inTEST Thermal Solutions Technical Support	
1.800.558.5080	Toll Free Telephone (service calls only)
service@inTESTthermal.com	e-mail Address
781.688.2300	inTEST Thermal Solutions Main Telephone



ATTENTION

1. Please note that the 1-800 toll free telephone number is dedicated to Service Department calls only. It is not possible to dial this number and to transfer to other departments within inTEST Thermal Solutions Corporation.

2. The main telephone number, 781.688.2300, should be used for non-service related calls.

Before You Call

You can help us support your machine in a timely fashion by having on-hand System Information, Model, and Serial Number.

Model and Serial Number information can be found on the system nameplate, typically located on the rear panel of the thermal platform or remote electrical box.

Remote Communications GPIB Interface & Commands

Introduction

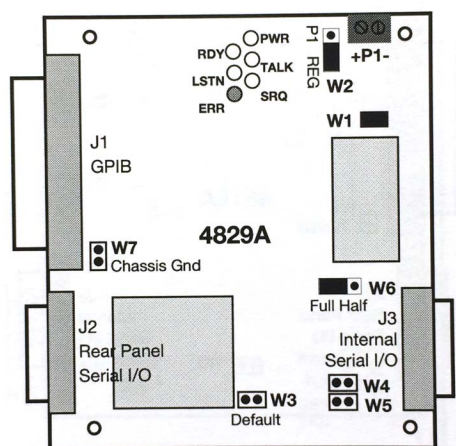
By connecting a computer to the GPIB interface located at the rear of the controller box, the hot plate can be controlled via remote communications. The rear I/O panel is clearly labeled with 2 remote interface ports, GPIB and RS232. DO NOT connect to the RS232 port for GPIB communications.

Topics in this Section

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GPIB Board Jumper Settings

The GPIB board (P/N 4829A) is factory configured with the following jumper settings:



W1 Closed (Installed)
W2 REG
W4 Open (Not Installed)
W5 Open (Not Installed)
W6 Full

Command Syntax

A full list of commands and queries is included in this document. There are 4 different syntax standards used in the command set:



ATTENTION

Modbus commands should not be mixed on the same command line with IEEE-488.2 and SCPI commands to prevent query errors and confusing the GPIB-to-Modbus interface. It is recommended that carriage return <CR> and line feed <LF> be used between commands.

1. GPIB (General Purpose Interface Bus, IEEE-488.2)

example: *IDN?

Queries the machine to identify itself.

2. SCPI (Standard Commands for Programmable Instruments)

example: SYST:COMM:GPIB:ADDR?

Queries the GPIB Address.

3. Modbus 16 Bit

Commands require the address of the register to be included in the syntax.

Queries require both the address of the register and the quantity of registers to be included in the syntax.

Query example: R? 2186, 1

This queries the temperature change rate (or ramp rate).

R? is the query

2186 is the address of the first register to read

1 is the quantity of registers to read

4. Modbus floating point

These commands require the address of the register to be included in the command syntax. Floating point queries do NOT require the quantity of registers to be included.

Command example: WF 2160, TTT

This command writes the temperature set point

W is the write command

F identifies the command as a Floating Point command

2160 is the register address

TTT is an integer that reflects the desired value chosen by the user

Setup Commands

Command	Command Description
*IDN?	Query system identification number
SYST:COMM:PIB:ADDR NN	Write GPIB address. 4 is DEFAULT. Valid addresses are 1 to 20 & 22 to 30 NOTE: Changing the GPIB address setting during a remote session will disconnect the remote session. Changing the address during remote operations sets the controller to a different address than the computer is using to send commands and queries.
SYST:COMM:PIB:ADDR?	Query GPIB address.
SYST:COMM:SER:RS485 ON SYST:COMM:SER:RS485 OFF	Turn on/off RS-485 communications port, which allows communications with Modbus commands (16-bit and floating point). OFF is the default state. The RS-485 port must be turned on after a reset command (*RST).
*SAV 0	Save I/O Configuration to Non-Volatile Memory
*RST	Reset command that restores the system to a power-up state. IEEE-488 interface will be unchanged; including instrument address, status byte, and ESR register. Disables the trigger function and pulses the reset output signal. NOTE: After sending *RST command, the Modbus port will be turned off. Use the following command to turn the Modbus port back on after reset: SYST:COMM:SER:RS485 ON
W 1838, NN	Set temperature units for the local controller (Watlow PM PLUS9). NN is an integer: 15 = °C (by default) 30 = °F Does NOT set units for remote communications.
R? 1838, 1	Query temperature units (Local)
W 2490, NN	Set temperature units for remote communications. NN is an integer: 15 = °C (by default) 30 = °F Does NOT set units for the local controller.
R? 2490, 1	Query temperature units (Remote)

Command	Command Description
W 1880, NN	Set Heating run mode. NN is an integer: 10 = Auto (this is ON). This is the DEFAULT. 62 = OFF (idle) The green PLATE ENABLE button must be pressed for the plate to drive to set point temperature. Refer to Chapter 2: Installation & Operation for more detail on local operations and the PLATE ENABLE button. When operating remotely, the PLATE ENABLE button must be pressed and left in the ON position. This command allows remote operators to turn on/off heating while the button remains in the pressed position.  ATTENTION If this command is set to OFF (62), the plate cannot heat, even if the PLATE ENABLE button is pressed by local operators. It is recommended that this command be set to Auto (10) and enter an ambient set point (25°C) before ending any remote sessions.
R? 1880, 1	Query heating run mode setting.
W 886, N	Set frequency configuration. N is an integer: 4 = 60Hz (by default) 3 = 50Hz
R? 886, 1	Query frequency configuration.

Error and Status Commands

Command	Command Description																																				
E?	Read and clear Modbus error register: 0 = No Errors Present 1 = Exception Code 1 2 = Exception Code 2 3 = Exception Code 3 100 = CRC Error 101 = Timeout error indicates no characters received in the response message 2nn = Partial or corrupted message received, where nn is the number of receive bytes.																																				
*ESR?	Read and clear event status register: <table><tr><th>Bit</th><th>Bit Weight</th><th>Event</th><th>Description</th></tr><tr><td>7</td><td>128</td><td>PON</td><td>The Power-on event occurs at power turn-on and can be used to signal a power off-on occurrence.</td></tr><tr><td>6</td><td>64</td><td>Modbus Error</td><td>Modbus Error detected. Reading the Modbus Error Register clears this bit.</td></tr><tr><td>5</td><td>32</td><td>Cmd</td><td>Command Error</td></tr><tr><td>4</td><td>16</td><td>Exc</td><td>Execution Error includes EDR not set and missing listen handshake.</td></tr><tr><td>3</td><td>8</td><td>Flash</td><td>Flash data corrupted.</td></tr><tr><td>2</td><td>4</td><td>Query</td><td>Query error, data not read or read attempt with no data.</td></tr><tr><td>1</td><td>2</td><td>not used</td><td></td></tr><tr><td>0</td><td>1</td><td>OPC</td><td>Operation Complete has no meaning in the 80x3s.</td></tr></table>	Bit	Bit Weight	Event	Description	7	128	PON	The Power-on event occurs at power turn-on and can be used to signal a power off-on occurrence.	6	64	Modbus Error	Modbus Error detected. Reading the Modbus Error Register clears this bit.	5	32	Cmd	Command Error	4	16	Exc	Execution Error includes EDR not set and missing listen handshake.	3	8	Flash	Flash data corrupted.	2	4	Query	Query error, data not read or read attempt with no data.	1	2	not used		0	1	OPC	Operation Complete has no meaning in the 80x3s.
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R? 362, 1	Read probe error status: 61 = None 127 = Shorted 65 = Open																																				

Temperature Limits Commands

Command	Command Description
WF 2166, TTT	Write upper temperature limit value. TTT is the temperature. DEFAULT is 265°C 265°C is 15°C above the system's 250°C upper temperature limit. This allows the plate to operate at its upper temperature limit without tripping the over temperature failsafe. DO NOT set the upper temperature limit above 265°C. If the upper limit is set above 265°C, the over temperature failsafe will trip and shut down all heating capabilities. Setting the upper temperature limit below 265°C is acceptable and recommended to protect the Unit Under Test (UUT) from higher temperatures.
RF? 2166	Query upper temperature limit value.

Basic Temperature Control Commands

Command	Command Description
WF 2160, TTT	Write set point temperature. DEFAULT is 25°C MAXIMUM is 250°C. DO NOT exceed the maximum value.
RF? 2160	Read set point temperature.
RF? 360	Query control probe temperature.

Advanced Temperature Control Commands

Command	Command Description
W 2186, NN	Turn ramp rate ON at set point change. NN is an integer: 62 = OFF (by default) 85 = ON, at set point change 88 = ON, at controller startup 13 = ON, at both controller startup and set point change
R? 2186, 1	Query ramp rate ON setting: 62 = OFF (by default) 85 = ON, at set point change 88 = ON, at controller startup 13 = ON, at both controller startup and set point change
W 2188, NN	Ramp scale, set to minutes or hours. NN is an integer: 57 = minutes (by default) 39 = hours
R? 2188, 1	Query ramp scale setting: 57 = minutes (by default) 39 = hours
WF 2192, T	Set ramp rate. T is the number of degrees per minute (or hour if ramp scale is set to hours).
RF? 2192	Query ramp rate setting.

Example Temperature Profile Program via GPIB Commands

NOTE: Controller front panel PLATE ENABLE BUTTON must be in the pressed (ON) position to control the hot plate temperature remotely.

```
*IDN?  
W 1880, 10  
WF 2160, 200  
RF? 360  
WF 2160, 25
```

This series of commands will do the following:

- [*IDN?]: Query system identification number.
- [W 1880, 10]: Enable heating. This allows the plate to begin heating. It will ramp to a temperature once a set point command is sent.
- [WF 2160, 200]: Write temperature set point of 200°C.
- [RF? 360]: Query control probe temperature.
- [WF 2160, 25]: Write ambient temperature of 25°C. The plate is returned to a safe, ambient temperature at the completion of the test.



Hot Surface

Plate will be still be HOT after commands are sent to return the plate to ambient temperature. GPIB commands prevent the plate from automatically heating to higher temperatures when the system is re-started. Commands DO NOT have any cooling function for the plate surface. The plate surface can only be cooled by the local environment.

Example Temperature Ramp Profile via GPIB Commands

NOTE: PLATE ENABLE BUTTON must be in the pressed (ON) position to control plate temperature remotely.

*IDN?
W 2186, 85
W 2188, 57
WF 2192, 3
W 1880, 10
WF 2160, 175
RF? 360
WF 2160, 25

This series of commands will do the following:

[*IDN?]: Query system identification number.

[W 2186, 85]: Turn on ramp rate at set point change.

[W 2188, 57]: Set ramp scale to minutes.

[WF 2192, 3]: Set ramp rate to 3°C per minute.

[W 1880, 10]: Enable heating. Plate will NOT drive to set temperature until a set point command is sent.

[WF 2160, 175]: Write set point of 175°C.

[RF? 360]: Query control probe temperature.

[WF 2160, 25] Write ambient temperature of 25°C. The plate is returned to a safe, ambient temperature at the completion of the test.



Hot Surface

Plate will be still be HOT after commands are sent to return the plate to ambient temperature. GPIB commands prevent the plate from automatically heating to higher temperatures when the system is re-started. Commands DO NOT have any cooling function for the plate surface. The plate surface can only be cooled by the local environment.

Warranty

A complete PDF version of terms and conditions is available here:

<http://www.intestthermal.com/terms>

Watlow PM PLUS9 controller is covered under warranty with Watlow Electric Manufacturing Co. inTEST Thermal Solutions and Sigma Systems bear no warranty responsibility for this electronic device.

WARRANTY, DISCLAIMER, AND DAMAGES:

Seller warrants its equipment to be free from defects in material and workmanship for a period of one (1) year from date of shipment to Buyer. Seller will repair, replace, or credit the Buyer's account at Seller's option for any such equipment that is found to be defective in such respects by Seller and that such equipment is returned to Seller, transportation prepaid, within one (1) year from date of shipment to Buyer, provided that such return has been authorized by Seller.

This warranty shall not apply to any equipment of Seller that has been subjected to electrical misuse, mechanical misuse, use in any manner contrary to instructions, improper installation, alteration, neglect, accident, abnormal conditions of operation, and shall not apply to any equipment that has been, or attempted to be, disassembled or repaired by any party other than Seller.

The sole exception to the preceding disclaimer is for equipment which has been, or attempted to be, disassembled or repaired after Buyer has received specific written authorization from Seller. Buyer shall not return any equipment without the prior authorization of Seller. Buyer shall afford Seller prompt and reasonable opportunity to inspect any such equipment. Seller shall have the right to final determination of existence and cause of any defect under this warranty.

This warranty shall not apply to any product if Buyer is responsible for a past due account with Seller or with Seller's reselling representatives. Lapses in warranty coverage for past due accounts do not extend the period of warranty coverage.

Equipment delivered by Seller shall not be considered as defective or out of compliance with the order if it satisfactorily fulfills Buyer's performance requirements though not in exact accordance with specifications or has been furnished by written or verbal agreement.

This warranty excludes normal wear and service items including (but not limited to) door seals, aperture or notch plugs, filters, and cryogenic coolant metering valves. Cryogenic coolant metering valves must be periodically serviced to maintain proper operation. The service interval for these valves is determined by use patterns and the quality and constancy of coolant delivery. Seller will review any valve failures that occur during the warranty period and will cover under this warranty any failures that Seller determines are a result of defects in the valve.

This warranty is null and void with respect to any product of Seller that has been resold by Buyer or has been moved by Buyer from its original delivery location unless Buyer has prior written acknowledgment by Seller that the warranty continues. In the event that the product is to be moved to another location, Seller may elect to cancel or modify this warranty and Seller's liability hereunder if Seller believes that warranty service will not be practical or that conditions of transport or operation pose additional risk to the covered equipment.

THIS WARRANTY SHALL BE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR A PARTICULAR PURPOSE. SELLER'S SOLE AND EXCLUSIVE LIABILITY HEREUNDER IN TORT, CONTRACT OR OTHERWISE, SHALL BE LIMITED TO THE COST OF REPAIR, REPLACEMENT, OR CREDIT TO BUYER'S ACCOUNT AT THE OPTION OF SELLER, FOR ANY SUCH DEFECTIVE EQUIPMENT. IN NO EVENT SHALL SELLER BE LIABLE FOR BUYER'S MANUFACTURING COSTS, LOST PROFITS, LOSS OF GOODWILL, OR ANY OTHER SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.