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## Imperium 10010W Thermal System

THM-SYS-10W2-01

### User Manual



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# General Safety Instructions

**Follow all WARNINGS to prevent personal injury or death.**

- WARNING:** Dangerously high voltages that could kill you are present in the electrical system. Before doing any electrical work, disconnect the electrical power.
- WARNING:** Do not attempt to perform electrical or refrigeration work if you are not qualified. This manual is not a substitute for electrical or refrigeration training.
- WARNING:** Before working near moving parts, disconnect the electrical power. Keep all guards and shields in place. Because of the automatic pressure system, condenser fans and refrigeration compressors can start at ANY time while the main power is connected—even when the chamber is not operating.
- WARNING:** Do not operate this system unless it is completely assembled.
- WARNING:** Use this system only for testing the products it was designed to test. Do not test products in the chamber that could burn, explode, or emit toxic fumes at high temperatures.
- WARNING:** Make sure the thermal head is latched onto a socket or affixed to a device via boom stand before operating. Before disconnecting the thermal head, make sure the temp has returned to at or near room temp.
- WARNING:** The thermal head is equipped with an internal force control system. This system should only be activated while the thermal head is affixed to a device under test. Operating this function while the head is not affixed can cause personal injury or damage to the device head.
- WARNING:** This system operates at extreme temperatures. To prevent severe burns or frostbite, avoid contact with air, objects, and surfaces that are hot or cold.
- WARNING:** The system contains *Tetrafluoroethane (R-134a)* as a refrigerant. R-134a is an approved long-term replacement for CFC-based refrigerants and an approved ozone depleting substance (ODS) alternative. In the event that the system is damaged, general work clothing, leather gloves, and eye protection should be worn to prevent exposure to refrigerants. The system also contains Polyolester (POE) oil, which is used by the compressor. Contact Ironwood Electronics for the MSDS for either of these internal fluids.
- WARNING:** This manual has important safety information. Keep this manual in a place where it will be available to anyone working with the chamber.

***Follow all CAUTIONS to prevent equipment damage.***

- CAUTION:** The system is equipped with a refrigeration system. After transportation the system must be left on a level surface for at least 1 hour before powering on to allow for the compressor oil to drain back to its' base. Running the system before the time has elapsed could damage the compressor and is not covered under warranty.
- CAUTION:** The system is equipped with a dry air purge system, this system must be active whenever the temperature control system is active. Operating without an active dry air supply or one not rated at the correct specification will cause condensation to form at the test site and thermal head. This can cause damage to the device under test and the thermal head. **Dry air must be used during test.**
- CAUTION:** Do not shut down or remove power from the system until the thermal head temperature has returned to ambient. Shutting down the system when the thermal head temperature is high, can allow the heat to continue building, causing damage to components. Shutting down the system when the thermal head temperature is low, can allow for coolant to continue to cool, potentially freezing and rupturing coolant lines or tanks.
- CAUTION:** Do not tip the system more than 30° during operation. Doing so can result in reduced system capacity or damage the compressor.
- CAUTION:** Directly connect the system to a dedicated electrical outlet in accordance with local codes. Do not use an extension cord or power strip to connect the system to an electrical outlet. If the supplied power cable is too short, consult with Ironwood Electronics for the appropriately rated replacement.
- CAUTION:** Be sure there is at least 12 inches of space along the sides and rear of the system for adequate ventilation. System performance will be reduced if ventilation is constrained.
- CAUTION:** This system employs an overload protection (fuse). If the fuse blows unplug the system and remove the blown fuse from the compartment located directly below the AC cord plugin. Fuse must be a 5 x 20mm cartridge style rated at 10 A and 250 V. Please contact Ironwood Electronics for suitable replacements.

## Dry air supply requirements

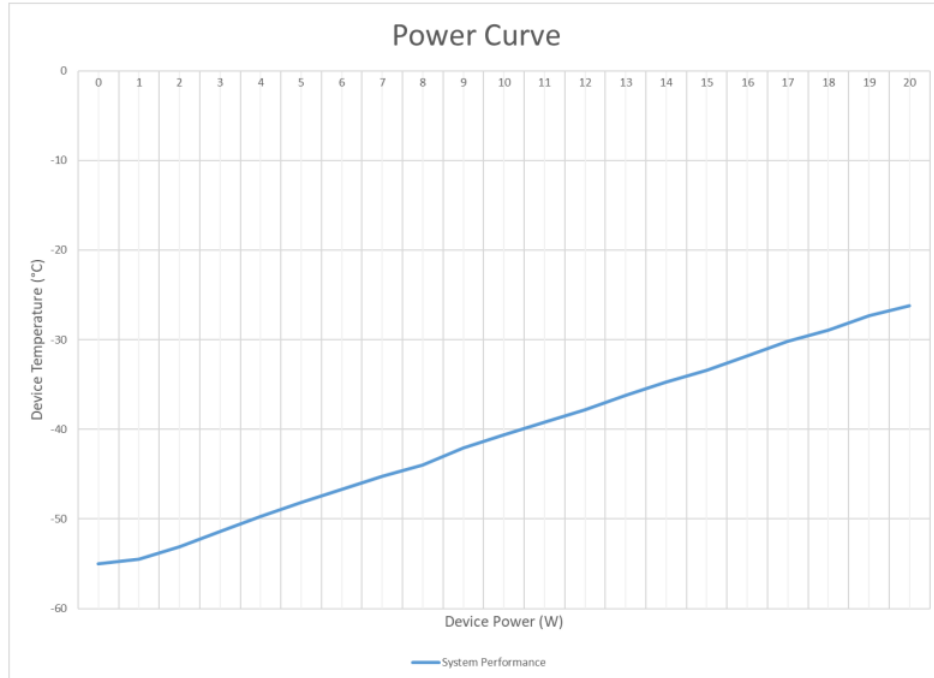
It is your responsibility to provide proper dry air to the system. Improper dry air can cause damage to the thermal checks and device under test.

**NOTE:** Any failures due to improper dry air supply and not covered under warranty.

To reach full system performance @-55°C the air dryer should be rated for a dew point of at least -55°C. Consult your air dryer specification to determine its rating or consult the operator of the lab space. The compressed air should also be able to reach at least 90 PSI and 0.5 cfm for proper operation of the force control systems.

## Performance Specifications

	<b>THM-SYS-10W2-01</b>
<b>Temperature range</b>	-55°C to 150°C
<b>Cooling Power</b>	10 W @ -40°C
<b>Temperature control tolerance</b>	±0.2°C
<b>Temperature sensor</b>	NTC Thermistor
<b>Transition rates</b>	Up to 80°C/min
<b>Remote interface</b>	Serial over USB-A
<b>Automated DUT force control</b>	System controlled up to 80 kgf
<b>DUT Dimensions</b>	1.5 x 1.5 mm to 35 x 35 mm (standard head)
<b>Air Specifications</b>	
Compressor Pressure (psi)	90psi Min – 130 Max
Compressor Flow rate (cfm)	0.5 cfm Min
Rated Dew point	-55°C
<b>Dimensions</b>	
Exterior dimensions (W x D x H)	265.5 x 409.96 x 156.97 mm 10.45 x 16.14 x 6.18 in
Weight (System)(Head)	(18.5 lb)(3 lb) (8.4 kg)(1.4 kg)
Thermal head	70 x 70 x 60 mm
Thermal head length	0.5 – 2 m
<b>System Requirements</b>	
Electrical	100 – 240 VAC ~7.0 A 50-60 Hz
Ambient temperature	0°C to 30°C
Ambient Humidity	90% Max



# Installation

## Location

Note the following when choosing a location for the chamber:

1. Heat is produced when the chamber operates; enough ventilation must be provided to prevent excess heat build-up. At least 12 inches of space around the system is recommended for maximum performance.
2. The system has a refrigeration system and must not operate at an incline  $>30^\circ$ . The included bail arm can elevate the system to within this requirement.
3. The system must "settle" more than 1 hour each time it is moved to ensure the condenser oil has time to settle back to the bottom.

## Environmental

<b>Coolant</b>	<b>40% Glycol/Water Mixture</b>
<b>Ambient (Operation)</b>	<b>0°C to 30°C</b>
<b>Ambient (Storage)</b>	<b>-20°C to 50 °C</b>
<b>Weight</b>	<b>8.4 kg (18.5 lb)</b>
<b>Size</b>	<b>265.5 x 409.96 x 156.97 mm (10.45 x 16.14 x 6.18 in)</b>
<b>Indoor/Outdoor Use</b>	<b>Indoor</b>
<b>Altitude</b>	<b>2000m</b>
<b>Overvoltage Category</b>	<b>OVC I</b>
<b>Pollution Degree</b>	<b>PD 2</b>

## Setting Up the System

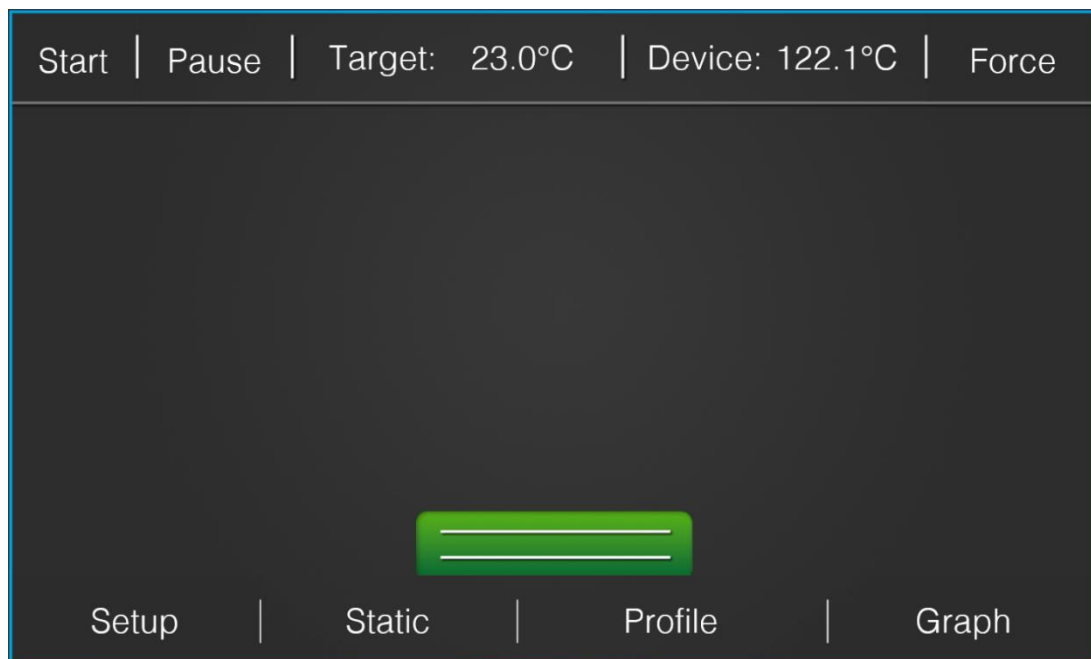


1. Make sure the AC Power Input is in the “off” position. Connect the supplied power cord and plug the system into an appropriate electrical outlet. **NOTE: the system requires a grounded electrical connection, do not operate if there is not an electrical ground.**
2. Connect a 6mm dry air tube from your lab’s air supply to the quick disconnect on the back of the system.
3. Connect the thermal head connection with the appropriate thermal head for your socket or application. This connection is keyed to only go on one way, the 4 gold contacts on the male and female will be aligned. Slight pressure is needed to start the thread. Screw down thermal head coupling nut until it comes to a stop. Do not overtighten this connection, once it’s comes to a stop the system is connected.
4. Set the dry air supply to a value of 5. If condensation is still forming on the test fixture check that the dry air supply is rated at a dew point of -55°C. If this is confirmed increase the air flow by quarter turn increments until condensation no longer forms. If the value exceeds 8 reach out to Ironwood Electronics support.
5. Open the coolant fill port and verify the fill tank is between 50 – 80% filled. Do not overfill as the fill port cap needs space to seal on.

## Starting Up the System

1. Once the system is setup, power on the system by flipping the AC power input switch.
2. The system will go through an internal 10 second startup procedure. If no system errors are displayed the system is ready for operation.

## Operation





The system software consists of a static operation ribbon on the top which is accessible from all software modes and a pop-up menu on the bottom used to move between the different menus. The standard overlay is made up of the following components:

1. Start- Touching the start button will begin either a static or profile mode test depending on which mode is enabled. When a test is running the start button will be lit, including during remote operation.
2. Pause- When a test is running, touching the pause button will freeze the current test at the temperature it is controlling at. To resume the test touch the pause button again. The button will be lit while the system is paused. NOTE: the thermal system will still be active while paused but the set point will not follow its schedule till the system is un-paused.
3. Target- This displays the current temperature target for the system. While a program is running this display will reflect the current set point in the program schedule.
4. Device- This displays the current temperature of the thermal head.
5. Force- Touching the force button will enable the force control on the thermal head and turn on the dry air supply. To adjust the force applied through the thermal head see “Setup Menu” later in this section. The force button will be lit when activated. Touch the force button again to disable the force and dry air system. CAUTION: Be sure to only touch this button when the thermal head is properly secured on the socket or boom stand.
6. Setup- Touching the setup button will change the screen to the setup menu.
7. Static- Touching the static button will change the screen to the static menu. Use this mode for manual thermal testing.
8. Profile- Touching the profile button will change the screen to the profile menu. Use this mode for automatic thermal testing.
9. Graph- Touching the graph button will change the screen to the graph menu. This displays a real time graph.

## ***Test Setup***

### ***Socket setup***

1. Mount the socket to your test board, refer to the socket manual/drawing for mounting directions.
2. Align the 2 alignment pins on the bottom of the thermal head to the socket alignment holes.
3. Firmly press down on the thermal head until the thermal head “clicks” into place.
4. Verify the thermal head is securely attached.
5. Set the socket force under the setup menu.
6. Touch the “Force” button and verify the socket is electrically connected.

### ***Boom Stand Setup***

1. Screw the thermal head into the boom stand, if the thermal head was supplied with an adapter first mount that to the thermal head before the boom stand.
2. Position the thermal head above the device to be tested.
3. Move the thermal head in the z direction until the outer gasket firmly seals to the board.

4. Tighten the boom stand to lock the thermal head in place over the board. CAUTION: The boom stand must be firmly secured to the table and cannot use a tabletop stand.
5. Set the socket force to 5 Kgf.
6. Touch the “Force” button and verify the thermal head does not move in the z direction.

## Setup Menu



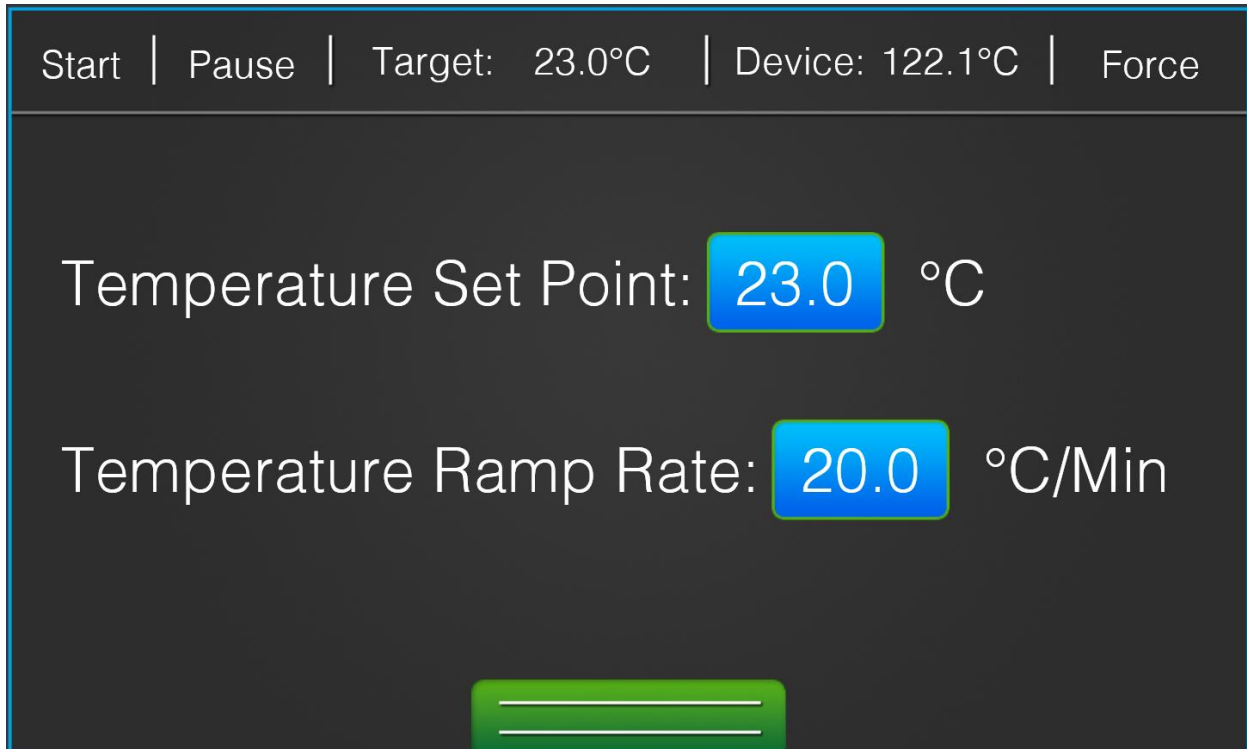
## Socket Force

The socket force button is used to adjust the amount of compressive force to the device under test. The value can only be set at a value between 0 to 80 Kgf. Refer to the socket drawing for the required force for the socket. If a force is not given contact Ironwood Electronics to get the correct value.

NOTE: adjusting the socket force value while the force button is lit will not update the force system. The system must first be stopped for adjustments to take effect.

## Performing a test

### Static Mode



The static mode screen is made up of the temperature set point and ramp rate buttons.

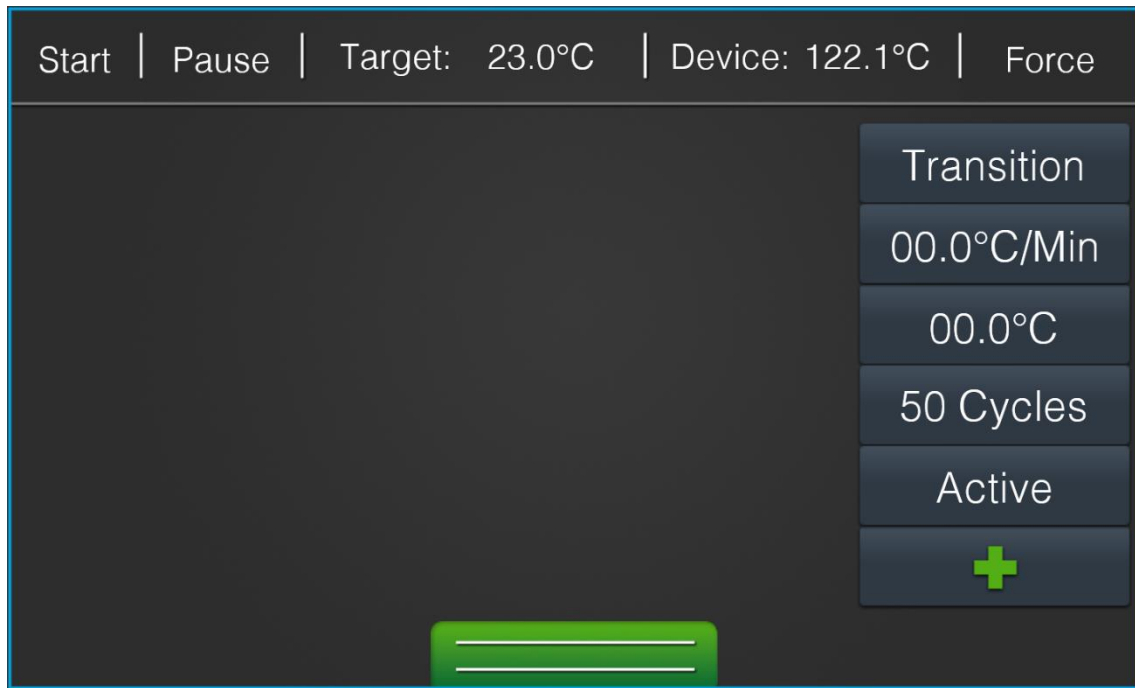
To adjust the temperature set point, touch the associated blue button and set the desired temperature.

To adjust the ramp rate, touch the associated blue button and set the desired ramp rate.

Once the desired values are selected, touching start will enable the thermal control system to drive to the set point at the given ramp rate.

NOTE: adjusting the values while the start button is lit will not update the thermal system. The system must first be stopped for adjustments to take effect.

## Profile Mode



## Remote Mode

To access the remote port, you will need a USB-A to USB-B cable. Insert the USB-B connector to the “Remote” port on the front of the system and connect the USB-A connector to a serial machine, using the setting shown below. The current supported commands are as follows:

Serial Port Options

Port:

Baudrate:

Data Bits:

Parity:

Stop Bits:

Flow Control:  CTS  
 DTR  
 XON

Software Supported Flow Control  
 Block Keystrokes while flow is halted

Initial Line States when Port opens:

DTR On       DTR Off  
 RTS On       RTS Off

“Start the system” – this command will start the system heating or chilling at the current set parameters.

“Stop the system” – this command will stop the system heating or chilling.

“System status” – this command outputs the status of the system.

“Set temp = XX.X” – this command will set the device temperature at the specified value.

“Set ramp = XX.X” – this command will set the device temperature ramp rate at the specified value.

“Read temp” – this command output the device temperature.

“Enable force control” – this command will enable the device force at the current set force.

“Disable force control” – this command will disable the device force.

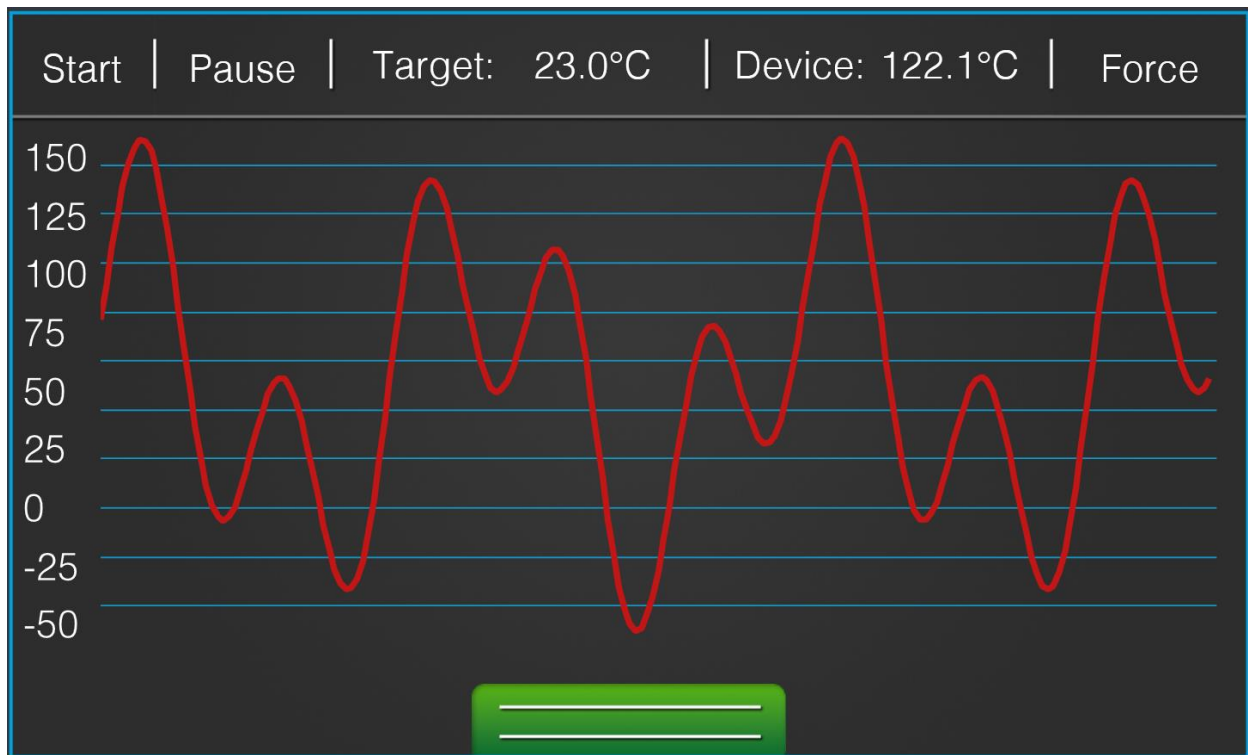
“Set force = XX.X” – this command will set the system force at the specified value.

“Read force” – this command outputs the system set force.

“Force status” – this command outputs the status of the force control system.

*NOTE: Commands are case sensitive.*

## Graph Mode



## ***What to Do if the System Doesn't Operate***

Here are a few troubleshooting steps for common issues that may be experienced by the user:

1. If the system does not turn on, make sure the AC power inlet is in the on position and the system is plugged into an appropriate power outlet.
2. If the force activation does not move the thermal plunger, make sure you are supplying enough compressed air to the system through the 6mm port on the back of the system.
3. If dry air is not flowing over your device or you are experiencing frost formation, make sure the manual flow valve is set to a high enough value on the front of the system. This value should not exceed a rate where no frost formation is observed.
4. If you get an error on your screen, make sure the thermal head is fully threaded on the quick disconnect.

If these solutions do not solve your issue, please reach out to Ironwood Electronics support.

## **Maintenance**

### ***Cleaning and Decontamination***

Cleaning and decontamination are crucial to ensure proper system performance. Before operation or application of TIM, make certain the thermal head, device, and socket are clear of any dirt or oils. It is recommended to wipe down contact surfaces on the thermal head with an alcohol wipe between uses.

NOTE: Alcohol wipe are only recommend to be used on the thermal head and may be used on test devices at your own risk.

### ***Temperature Calibration***

A method for temperature calibration is currently being worked on by Ironwood Electronics. Expected completion by year end of 2024.

## ***Coolant Fill***

Replacement Coolant may be purchased directly from Ironwood. DO NOT use coolants that are not supplied by Ironwood. It is recommended to replace the coolant after 1 year of use. You will need a 10mm hex wrench to access the coolant reservoir on the top of the system. Once open, siphon as much coolant as possible from the reservoir with a syringe. DO NOT clean the reservoir or introduce any contaminants to the coolant. Once the old coolant is siphoned and discarded, pour Ironwood's new coolant into the reservoir until the aluminum feature in the reservoir is fully submerged as seen below.



Be cautious not to overfill the reservoir. Place and tighten the reservoir lid ensuring there are no leaks. Be cautious not to overtighten/strip the plastic hex.

## **Service**

### ***Resetting the system***

The system can be restarted by switching the AC power inlet in the off position, waiting for 10 seconds, and then switching the AC power inlet back to the on position.

## Software Updates

1. Download software updates from <https://www.ironwoodelectronics.com/products/imperium-thermal-system-10010w/>
2. Once downloaded, move the file to empty flash drive. **This should be the only file on the flash drive.**
3. With the system off, insert the flash drive into the “software” port on the front of the system as seen below:



4. Power the system on. The screen will remain black for a few minutes while the update loads.
5. Once the screen powers back on, the latest software will be installed. Remove the flash drive from the software port and confirm the correct software is loaded by selecting the “setup” tab. The version of software will be displayed in the bottom right corner.
6. If the screen remains black for more than a few minutes or the software version did not change on your system, please contact support.



## ***Commercial Product Warranty***

Ironwood Electronics LLC (hereinafter referred to as “Ironwood”), warrants to the original purchaser that products sold shall be free from defects in material and workmanship for the warranty period not to exceed one year from the date of shipment. If buyer claims that a product violates such warranty, Ironwood, upon notice promptly given, will either examine the product at buyer’s site, or issue shipping instructions for return to Ironwood at buyer’s expense, transportation charges prepaid. Ironwood’s sole obligation under its warranty shall be, at its option, to repair, replace or refund the price of any product thereof which is proved to violate such warranty. In no event, whether based on contract, indemnity, warranty, tort (including negligence), strict liability or otherwise, shall Ironwood be liable to the buyer for special, indirect, incidental or consequential damages whatsoever including, without limitation, loss of profit or revenue.

The above warranty is buyer’s exclusive remedy and Ironwood hereby expressly disclaims all other warranties, express or implied, including the implied warranty of merchantability and the implied warranty of fitness for a particular purpose. The foregoing shall constitute the sole remedy of the buyer and the sole liability of Ironwood.

This Limited Warranty shall not apply to any product or component thereof which has been repaired or altered outside of Ironwood’s factory in any manner so as, in Ironwood’s sole judgment, to affect its serviceability, or to any product that has been subject to alteration, accident, misuse, abuse, neglect or normal wear. The Limited Warranty shall not apply to products which have been assembled or installed or used in a manner contrary to Ironwood’s printed instructions, or due to failure to follow Ironwood printed instructions for operation and maintenance. This product is designed and intended to be installed and operated in an enclosure that is sealed from the ambient environment. Exposure to water leakage into the enclosure and/or excessive condensation from exposure to humid ambient air during operation will void this warranty. Any technical assistance provided by Ironwood’s personnel or representatives in system design is construed to be a proposal and not a recommendation. The responsibility for determining feasibility rests with the user and should be subject to test. Only the terms expressed in this Limited Warranty shall apply and no distributor, corporation or individual is authorized to amend, modify or extend this warranty in any way on resale.

## ***Technical Support***

For technical support, submit a ticket by email directly to one of our team members or call Ironwood Electronics directly at [\(952\) 229-8200](tel:9522298200) to be transferred to our technical support team during business hours.

## **Appendix**