

M315X-HT Series
M315X6-HT / M315X8-HT



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Contents

| | | |
|----------|--|-----------|
| 1 | General Information | 5 |
| 1.1 | Information about the user manual | 5 |
| 1.1.1 | Legend | 5 |
| 1.2 | Safety | 5 |
| 1.2.1 | Safety Notifications/Warnings | 6 |
| 1.3 | Limit of Liability and Warranty | 6 |
| 1.4 | Unpacking the Instrument | 6 |
| 1.5 | Service Request, Repair, or Support | 7 |
| 1.6 | Shipments to LumaSense for Repair | 7 |
| 1.7 | Transport, Packing, Storage | 7 |
| 1.8 | Disposal / decommissioning | 8 |
| 2 | Introduction | 9 |
| 2.1 | CE Declaration | 9 |
| 2.2 | Technical Data | 9 |
| 2.2.1 | M315X6-HT | 9 |
| 2.2.2 | M315X8-HT | 10 |
| 2.3 | Dimensions | 11 |
| 2.3.1 | M315X6-HT | 11 |
| 2.3.2 | M315X8-HT | 12 |
| 2.3.3 | Controller | 13 |
| 3 | Installation | 15 |
| 3.1 | Air Outlet Clearance | 15 |
| 3.2 | Line Voltage | 15 |
| 3.3 | RS232C Communication | 15 |
| 4 | Operation | 17 |
| 4.1 | Starting Up | 17 |
| 4.1.1 | Front Panel Push Buttons | 17 |
| 4.2 | Operating the unit | 17 |
| 4.2.1 | Changing the Setpoint | 17 |
| 4.2.2 | Changing Temperature Units | 18 |
| 4.3 | Calibrating the unit | 18 |
| 4.3.1 | Calibrating using the iTools software | 19 |
| 4.3.2 | Calibrating using front panel push buttons | 21 |
| 4.4 | Other Controller Modes | 22 |
| 4.4.1 | View Output Power | 22 |
| 4.4.2 | PID Tuning Constants | 22 |
| 4.4.3 | Uniformity Adjustments | 22 |
| 4.5 | Shutting Down | 23 |
| 5 | Serial Communications | 25 |

| | |
|---|-----------|
| 5.1 RS232 | 25 |
| 5.1.1 Serial Communications Settings | 26 |
| 5.2 RS485 Option | 27 |
| 6 Maintenance | 29 |
| 6.1 Emitter heater Life | 29 |
| 6.2 Safety Interlocks | 29 |
| 6.3 Periodic Inspections | 29 |
| 6.4 Internal Fuse List for M315X6-HT & X8-HT | 29 |
| 6.5 Cleaning | 29 |
| 6.6 Heater Element Replacement | 29 |
| Appendix A: Calibration & Emissivity | 31 |
| Radiometric Method | 31 |
| Calibration Certificate | 31 |
| Emissivity | 32 |
| Index | 33 |

1 General Information

1.1 Information about the user manual

Congratulations on choosing the high quality and highly efficient Mikron blackbody.

This manual provides important information about the instrument and can be used as a work of reference for installing, operating, and maintaining your blackbody. It is important that you carefully read the information contained in this manual and follow all safety procedures before you install or operate the instrument.

To avoid handling errors, keep this manual in a location where it will be readily accessible.

1.1.1 Legend



Note: The note symbol indicates tips and useful information in this manual. All notes should be read to effectively operate the unit.



Warning/Caution/Danger: Denotes information critical to avoiding damage to the equipment or avoiding personal injury. **When this symbol is found on the instrument it indicates a potential hazard. Consult the documentation before proceeding with any actions.**



Warning Electrical Shock Hazard: This equipment is to be serviced by trained personnel only.



Protective Earth: Provided for identification of the protective earth (green or green/yellow) supply system conductor.



Hot Surface: Indicates this (these) surface(s) may be hot enough to burn.

1.2 Safety

This manual provides important information on safely installing and operating the M315X6-HT or M315X8-HT blackbody. Several sections of this manual provide safety warnings to avert danger. These safety warnings are specified with a warning symbol. You must read and understand the contents of this manual before operating the instrument even if you have used similar instruments or have already been trained by the manufacturer.

It is also important to continually pay attention to all labels and markings on the instrument and to keep the labels and markings in a permanent readable condition.



Warning: The blackbody is only to be used as described in this manual. It is recommended that you only use accessories provided by the manufacturer.



Danger: When the blackbody is at temperatures 300 °C and above, the radiant energy is enough to melt thermoplastic, burn combustible items and flesh just a few inches away! This is especially true from 500 to 600 °C! Be aware of items mounted in front of the emitter plate when operating at 200 °C and above.

1.2.1 Safety Notifications/Warnings

- In addition to presenting a potential fire hazard, high voltage and high temperature can damage equipment and cause severe injury or death. When using this instrument, follow all instructions carefully.
- Do not use the M315X-HT for any purpose other than the function for which it was designed: a high temperature blackbody radiance temperature source.
- Only replace the power cable with an equal, approved cable.
- Only remove cabinet covers during operation for troubleshooting.



Warning: High voltages and currents are present inside the enclosure.

- Do not attempt to operate with any of the safety features bypassed or disconnected.

Do not place this unit where it will be subject to excessive shock, vibration, dirt, moisture, oil, or other liquids.

1.3 Limit of Liability and Warranty

All general information and notes for handling, maintaining, and cleaning this instrument are offered according to the best of our knowledge and experience.

All Mikron blackbodies from LumaSense Technologies have a regionally effective warranty period. Please check our website at <http://info.LumaSenseinc.com/warranty> for up-to-date warranty information. This warranty covers manufacturing defects and faults which arise during operation, only if they are the result of defects caused by LumaSense Technologies.

The warranty is VOID if the instrument is disassembled, tampered with, altered, or otherwise damaged without prior written consent from LumaSense Technologies; or if considered by LumaSense Technologies to be abused or used in abnormal conditions.

1.4 Unpacking the Instrument

When unpacking and inspecting your system components, you need to do the following:

1. Check all materials in the container against the enclosed packing list.



Note: LumaSense Technologies cannot be responsible for shortages against the packing list unless a claim is immediately filed with the carrier. Final claim and negotiations with the carrier must be completed by the customer.

2. Carefully unpack and inspect all components for visible damage.
3. Save all packing materials, including the carrier's identification codes, until you have inspected all components and find that there is no obvious or hidden damage.



Note: Before shipment, each instrument is assembled, calibrated, and tested at the LumaSense Factory. If you note any damage or suspect damage, immediately contact the carrier and LumaSense Technologies, Inc.

1.5 Service Request, Repair, or Support

Contact LumaSense Technologies Technical Support in case of a malfunction or service request. Provide clearly stated details of the problem as well as the instrument model number and serial number. Upon receipt of this information, Technical Support will attempt to locate the fault and, if possible, solve the problem over the telephone.

If Technical Support concludes that the instrument must be returned to LumaSense Technologies for repair, they will issue a Return Material Authorization (RMA) number.

Return the instrument upon receipt of the RMA number, transportation prepaid. Clearly indicate the assigned RMA number on the shipping package exterior. Refer to Section **1.6, Shipments to LumaSense for Repair**, for shipping instructions.

Technical Support can be contacted by telephone or email:

Santa Clara, California

- Telephone: +1 408 727 1600 or +1 800 631 0176
- Email: support@LumaSenseinc.com

Frankfurt, Germany

- Telephone: +49 (0) 69 97373 0
- Email: eusupport@LumaSenseinc.com

1.6 Shipments to LumaSense for Repair

All RMA shipments of LumaSense Technologies instruments are to be prepaid and insured by LumaSense assigned shipper. For overseas customers, ship units air-freight, priority one.

The instrument must be shipped in the original packing container or its equivalent. LumaSense Technologies is not responsible for freight damage to instruments that are improperly packed.

Contact us to obtain an RMA number (if one has not already been assigned by Technical Support). Clearly indicate the assigned RMA number on the shipping package exterior.

Send RMA Shipments to your nearest technical service center:

Santa Clara, California

LumaSense Technologies, Inc.
3301 Leonard Court
Santa Clara, CA 95054 USA
Telephone: +1 408 727 1600
+1 800 631 0176

Email: support@LumaSenseinc.com

Frankfurt, Germany

LumaSense Technologies GmbH
Kleyerstr. 90
60326 Frankfurt
Germany
Telephone: +49 (0)69-97373 0

Email: eusupport@LumaSenseinc.com

1.7 Transport, Packing, Storage

With faulty shipping, the instrument can be damaged or destroyed. To transport or store the instrument, please use the original box or a box padded with sufficient shock-absorbing material. For storage in humid areas or shipment overseas, the device should be placed in welded foil (ideally along with silica gel) to protect it from humidity.

The blackbody is designed for a storage temperature of -20 to 80 °C with non-condensing conditions. Storing the instrument out of these conditions can cause damage or result in malfunction of the blackbody.

1.8 Disposal / decommissioning



Inoperable blackbodies must be disposed of in compliance with local regulations for electro or electronic material.

2 Introduction

The M315X-HT blackbody calibration sources are designed to satisfy the exacting parameters of Infrared focal plane array detectors, thermal imaging, and FLIR systems testing in projection scene and field applications. These calibration sources combine high emissivity along with unchallenged stability and uniformity.

The M315X-HT blackbody sources are resistively heated by precision heating elements to provide uniform temperature distributions. The two-piece system is comprised of controller module and a separate enclosure for the emitter source with available aperture sizes from 4 x 4 inch (101 x 101 mm) up to 12 x 12 inch (305 x 305 mm), and temperature ranges from ambient + 5.0° to 600.0 °C. Emitter source temperature control is carried out by a precision digital PID controller, mounted in a 7.67" x 17" bench mount enclosure. An exceptionally stable RTD (1/3 DIN) ensures long-term temperature stability of the system.

RS232C for remote control of set points and other critical parameters of the controller is standard. Optional RS485 output is available for remote operation.

2.1 CE Declaration

For information on the current CE certification, visit www.lumasenseinc.com.

2.2 Technical Data

2.2.1 M315X6-HT

| | |
|---|--|
| Temperature Range: | Ambient + 5 ... 600 °C (+ 9 ... 1112 °F) |
| Temperature Uncertainty ¹ : | ± 1 °C @ T < 100 °C ... ± 2 °C @ T = 600 °C |
| Display Accuracy vs. NIST Calibration: | See supplied NIST calibration report |
| Temperature Resolution: | 0.1 °C |
| Stability ² : | ± 0.2 °C in still air environment |
| Source Non-Uniformity: (in 4" x 4" region) | ± 1.5 °C @ 200 °C ± 2 °C @ 400 °C ± 3 °C @ 500 °C ± 6 °C @ 600 °C |
| Exit Port Diameter: | 152 mm x 152 mm (6" x 6") |
| Heated Emitter Shape: | Flat Plate |
| Emissivity ε: | ~ 1.00 effective emissivity @ 8 ... 14 μm |
| Standard Calibration Method: | Radiometric |
| Temperature Sensor: | Precision platinum RTD |
| Warm-up Time: | ~ 30 min ambient ... 500 °C |
| Slew Rate to 1 °C Stability ³ : | ~ 30° / min T < 300 °C ~ 15° / min T > 300 °C |
| Slew Rate to 0.1 °C Stability ³ : | Approximately 30 minutes between Δ 100 °C setpoints |
| Remote Set Point: | Via RS232 (standard) or RS485 (optional) |
| Method of Control: | Digital PID Controller |
| Operating Ambient Temp.: | 10 °C ... 40 °C |
| Cooling: | Fan cooled, air inlet on rear panel |
| Operating Humidity: | < 90% non-condensing |

| | |
|------------------------------------|---|
| Blackbody Dimensions (H x W x D): | 417.6 mm x 406.4 mm x 371.4 mm (16.44" x 16" x 14.62") |
| Controller Dimensions (H x W x D): | 195 mm x 432 mm x 576 mm (7.67" x 17" x 22.66") |
| Blackbody Weight: | ~ 47 lbs (21.3 kg) |
| Controller Weight: | ~ 16 lbs (7.3 kg) |
| CE Certified: | Yes |
| Power Requirements: | M315X6-HT – PN 19100-4: 220 ... 240 V AC @ 50 & 60 Hz 4050 VA |

2.2.2 M315X8-HT

| | |
|--|--|
| Temperature Range: | Ambient + 5 ... 600 °C (+ 9 ... 1112 °F) |
| Temperature Uncertainty ¹ : | ± 1 °C @ T < 100 °C ... ± 2 °C @ T = 600 °C |
| Display Accuracy vs. NIST Calibration: | See supplied NIST calibration report |
| Temperature Resolution: | 0.1 °C |
| Stability ² : | ± 0.2 °C in still air environment |
| Source Non-Uniformity: (in 6" x 6" region) | ± 1.5 °C @ 200 °C ± 2 °C @ 400 °C ± 3 °C @ 500 °C ± 6 °C @ 600 °C |
| Exit Port Diameter: | 203 mm x 203 mm (8" x 8") |
| Heated Emitter Shape: | Flat Plate |
| Emissivity ε: | ~ 1.00 effective emissivity @ 8 ... 14 μm |
| Standard Calibration Method: | Radiometric |
| Temperature Sensor: | Precision platinum RTD |
| Warm-up Time: | ~ 30 min ambient ... 500 °C |
| Slew Rate to 1 °C Stability ³ : | ~ 20°/min T < 300 °C ~ 10°/min T > 300 °C |
| Slew Rate to 0.1 °C Stability ³ : | Approximately 30 minutes between Δ 100 °C setpoints |
| Remote Set Point: | Via RS232 (standard) or RS485 (optional) |
| Method of Control: | Digital PID Controller |
| Operating Ambient Temp.: | 10 °C ... 40 °C |
| Cooling: | Fan cooled, air inlet on rear panel |
| Operating Humidity: | < 90% non-condensing |
| Blackbody Dimensions (H x W x D): | 417.6 mm x 406.4 mm x 389.2 mm (16.44" x 16" x 15.32") |
| Controller Dimensions (H x W x D): | 195 mm x 432 mm x 576 mm (7.67" x 17" x 22.66") |
| Blackbody Weight: | ~ 84 lbs (38.1 kg) |
| Controller Weight: | ~ 16 lbs (7.3 kg) |
| CE Certified: | Yes |
| Power Requirements: | M315X8-HT (EU) – PN 19200-5: 220 ... 240 V AC @ 50 & 60 Hz 4050 VA |

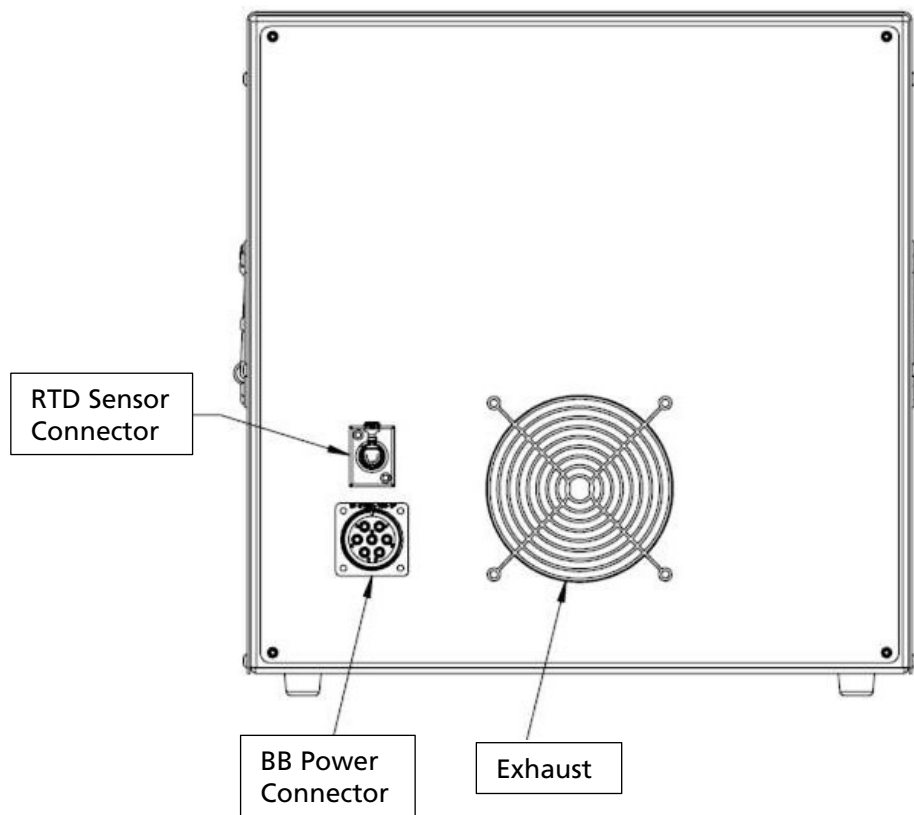
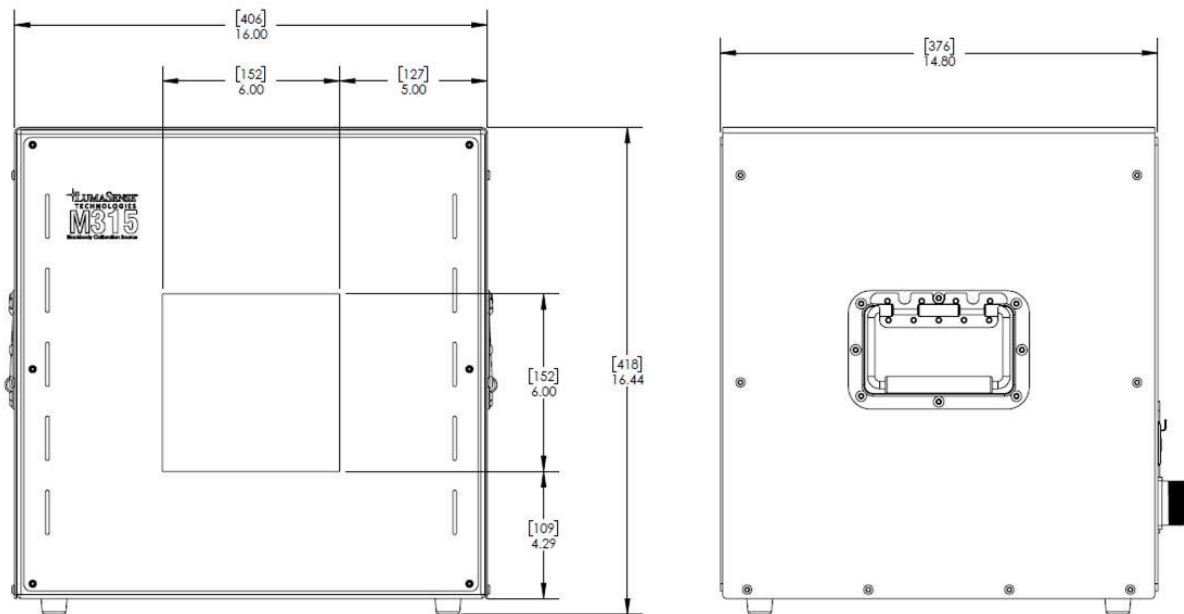
¹ Accuracy calibration performed radiometrically, the uncertainty of emissivity and transfer standard are already included.

² Provided stable AC mains voltage and minimum air flow across the exit port or emitter plate

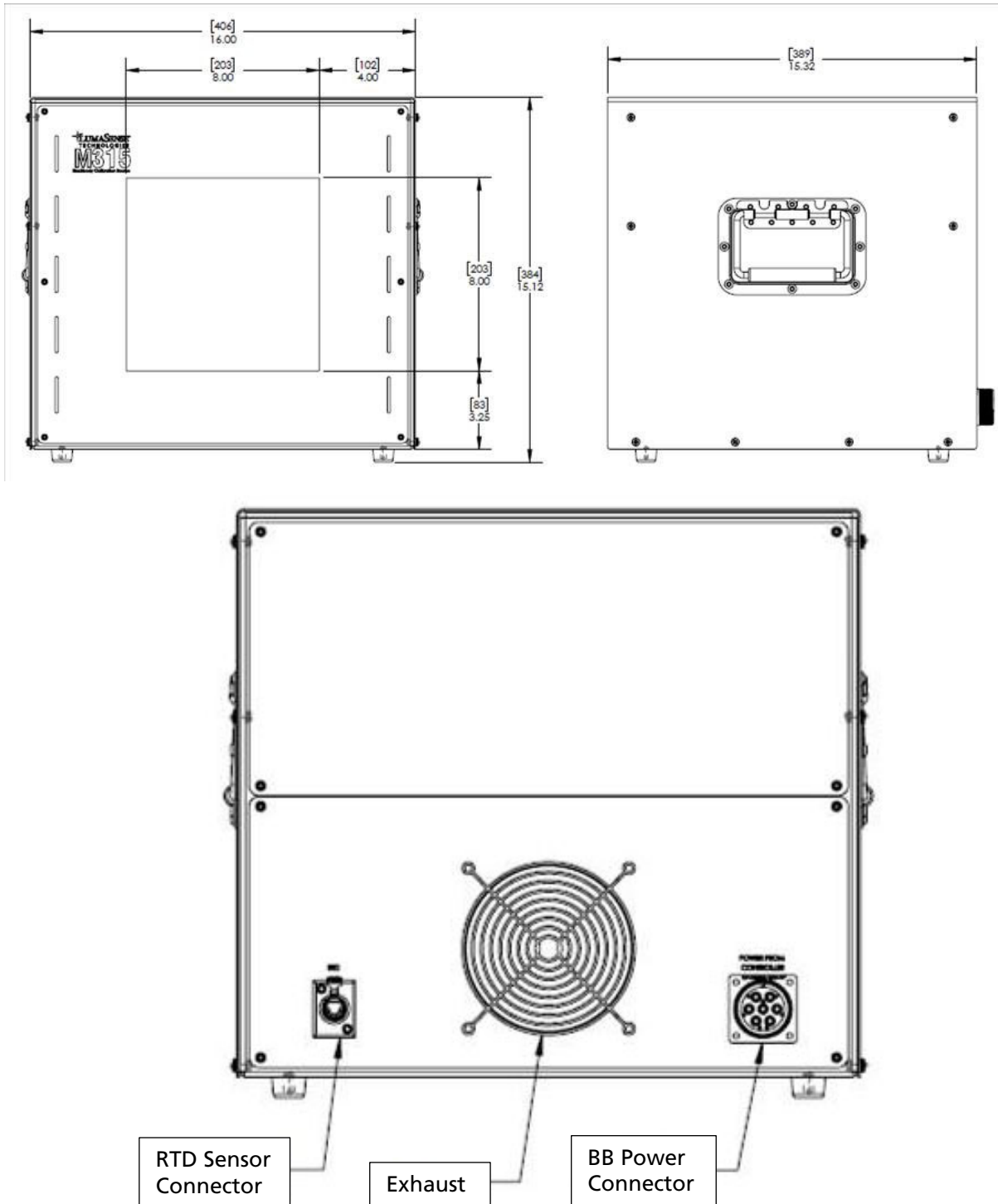
³ Typical. Can vary from unit to unit.

2.3 Dimensions

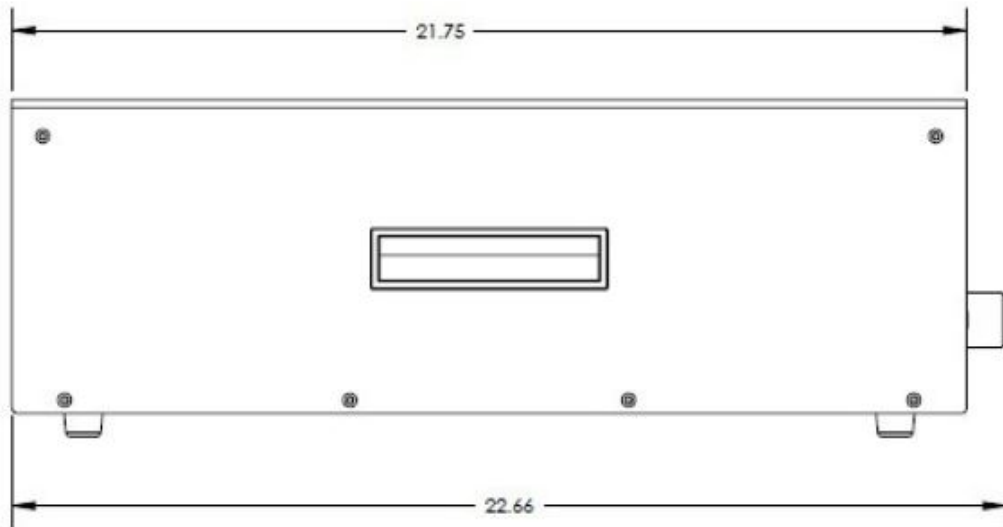
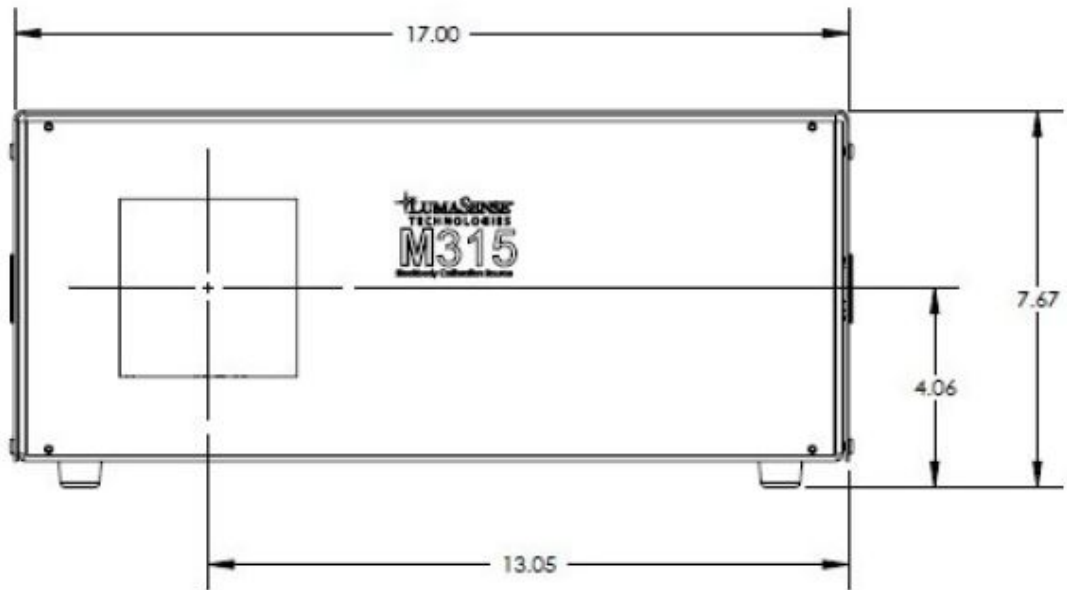
2.3.1 M315X6-HT



2.3.2 M315X8-HT



2.3.3 Controller



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3 Installation

Install the blackbody emitter in the desired location that preferably has no moving air near the emitter plate. Install the blackbody controller at the desired location keeping in mind the cable lengths and cooling requirements.



Danger: When the blackbody is at temperatures 300 °C and above, the radiant energy is enough to melt thermoplastic, burn combustible items and flesh just a few inches away! This is especially true from 500 to 600 °C! Be aware of items mounted in front of the emitter plate when operating at 200 °C and above.

3.1 Air Outlet Clearance

The heating system on the blackbody requires constant air flow in the enclosure for proper operation. The air outlet (fan) on the rear panel must not be obstructed. Allow at least 3 inches clearance for the outlet region. Blocking this port will degrade performance, cause failures, and void warranty.

3.2 Line Voltage

Read the specification label on the rear panel to ensure the AC LINE voltage you are about to use matches the voltage as shown on the specification label.

3.3 RS232C Communication

The M315X-HT has a serial communication port for automating the calibration process using a PC. Wiring to this port is covered in the section on Serial Communications Settings.

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4 Operation

4.1 Starting Up

Turn on the power switch/breaker and allow 20 seconds for the system to self-test.



Warning: Do not connect or disconnect while power is on. Do not attempt to operate without cables connected.

4.1.1 Front Panel Push Buttons



PAGE Engages access to controller parameters. Do not alter any configurations.



SCROLL Engages access to menu items underneath the Page menu. Allows viewing of output power, working setpoint, and target setpoint.



DWN/UP Used to raise and lower the temperature setpoint.

4.2 Operating the unit

4.2.1 Changing the Setpoint



Danger: When the blackbody is at temperatures 300 °C and above, the radiant energy is enough to melt thermoplastic, burn combustible items and flesh just a few inches away! This is especially true from 500 to 600 °C! Be aware of items mounted in front of the emitter plate when operating at 200 °C and above.

Press either the DWN/UP button on the controller. Each press will advance the setpoint 0.1 degree. To advance faster, press and hold for 5 seconds until it advances a few degrees/second. Let go when it is near the desired setpoint. Press again to bring it to the exact value desired. Note that this setpoint will be retained when power is turned off.



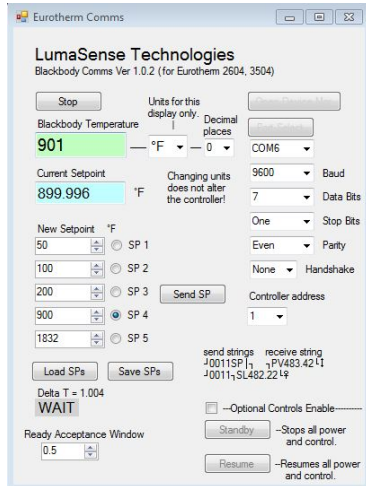
Blackbody Temperature

Blackbody Setpoint

Eurotherm controller

4.2.2 Changing Temperature Units

The blackbody controller is set to display in °C. To change temperature units, please consult factory for assistance. Our free software also will display any selected units on your Windows PC without altering the controller settings.



4.3 Calibrating the unit

This blackbody has a precision temperature sensor monitoring the emitter temperature. The RTD measurements are passed through a look-up table that ultimately provides the correct exit radiance temperature for the indicated temperature. This controller has been programmed to contain a custom look-up table that may be used to precisely calibrate the controller/indicator against reference sensor, in the normal case, a primary standard pyrometer at 8 ... 14 μm .

There are two methods available to achieve this adjustment:

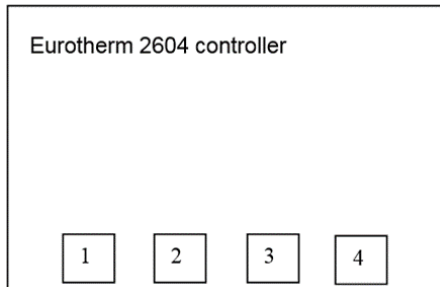
1. Using iTools software available from Eurotherm and serial communications.
2. Using only the front panel pushbuttons.

4.3.1 Calibrating using the iTools software

To use iTools, you must set the controller to Modbus communication mode:

Procedure to check and/or change the communication protocol to “Modbus” used with iTools and to “Ei Bisync” used with Mikron programs.

Place Eurotherm 2604 controller in CONFIG mode by pressing:



1. Press button 1 until 'ACCESS' appears.
2. Press button 2
3. Press 4 until 'CONFIG' appears. Wait.
4. Press 4 until '4' appears. Wait.
5. Press 1 until 'COMM' appears.
6. Press 2
7. Press 4 until 'H Module' appears.
8. Press 2. 'Ei Bisync' may be on display.
9. Press 4 until 'Modbus' appears. Wait for it to blink once.
10. Press 1 until 'ACCESS' appears.
11. Press 2
12. Press 4 until 'Level 3' appears. Wait.
13. Attach PC. Start iTools

To set the communication mode back to “Ei Bisync”, repeat the above steps except replace steps 8 and 9 with these:

14. Press 2 'Modbus' may be on display.
15. Press 4 until 'Ei Bisync' appears. Wait for it to blink once.

Controller Calibration (adjustment)

This blackbody has a precision temperature sensor monitoring the emitter temperature. The RTD measurements are passed through a look-up table that ultimately provides the correct exit radiance temperature for the indicated temperature. A separate calibration report is included.

This controller has been programmed to contain a custom look-up table that may be used to precisely calibrate the controller/indicator against reference sensor. The look-up table to the right appears as shown in the controller GUI interface (not supplied).

The logic of this table is: "when the sensor input measures the value shown in INPUT #, force the display to show the value in the corresponding OUTPUT # and do linear interpolation between points".

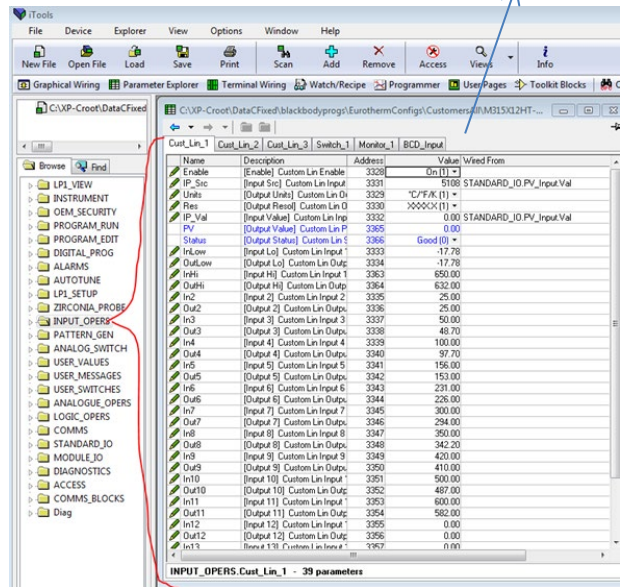
Adjust the OUT# points only to force your primary standard (either your Standard RTD or t/c placed in the spare calibration hole in the emitter plate, or your standard pyrometer) to read the correct temperature.

Any changes will immediately change the BB temperature and you must wait for it to re-stabilize at the corrected temperature. Large changes will interact with nearby points, so you must re-check nearby points when finished.

Note: You may download Eurotherm iTools Software from this web site:
<http://www.eurotherm.com/itools/itdnlds.htm>

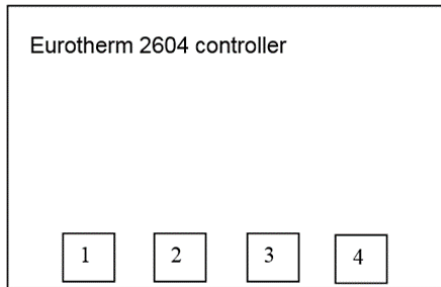
With this software and some practice, you will see this GUI interface screen. To permit iTools to talk to your blackbody, you will have to set the controller comm. port to "Modbus" mode.

| Name | Description | Address | Value |
|--------|--|---------|------------|
| Res | [Output Resol] Custom Lin Output Resol | 3330 | XXXXXX (2) |
| IP_Val | [Input Value] Custom Lin Input Value | 3332 | 0.00 S |
| PV | [Output Value] Custom Lin PV | 3365 | Good (0) |
| Status | [Output Status] Custom Lin Status | 3366 | Good (0) |
| InLow | [Input Lo] Custom Lin Input 1 | 3333 | 0.00 |
| OutLow | [Output Lo] Custom Lin Output 1 | 3334 | 0.00 |
| InHi | [Input Hi] Custom Lin Input 16 | 3363 | 1150.00 |
| OutHi | [Output Hi] Custom Lin Output 16 | 3364 | 1150.00 |
| In2 | [Input 2] Custom Lin Input 2 | 3335 | 30.00 |
| Out2 | [Output 2] Custom Lin Output 2 | 3336 | 30.00 |
| In3 | [Input 3] Custom Lin Input 3 | 3337 | 50.00 |
| Out3 | [Output 3] Custom Lin Output 3 | 3338 | 50.00 |
| In4 | [Input 4] Custom Lin Input 4 | 3339 | 100.00 |
| Out4 | [Output 4] Custom Lin Output 4 | 3340 | 100.00 |
| In5 | [Input 5] Custom Lin Input 5 | 3341 | 156.00 |
| Out5 | [Output 5] Custom Lin Output 5 | 3342 | 156.00 |
| In6 | [Input 6] Custom Lin Input 6 | 3343 | 231.00 |
| Out6 | [Output 6] Custom Lin Output 6 | 3344 | 231.00 |
| In7 | [Input 7] Custom Lin Input 7 | 3345 | 419.60 |
| Out7 | [Output 7] Custom Lin Output 7 | 3346 | 419.60 |
| In8 | [Input 8] Custom Lin Input 8 | 3347 | 660.00 |
| Out8 | [Output 8] Custom Lin Output 8 | 3348 | 660.00 |
| In9 | [Input 9] Custom Lin Input 9 | 3349 | 961.78 |
| Out9 | [Output 9] Custom Lin Output 9 | 3350 | 961.78 |
| In10 | [Input 10] Custom Lin Input 10 | 3351 | 1084.70 |
| Out10 | [Output 10] Custom Lin Output 10 | 3352 | 1084.70 |
| In11 | [Input 11] Custom Lin Input 11 | 3353 | 1100.00 |
| Out11 | [Output 11] Custom Lin Output 11 | 3354 | 1100.00 |
| In12 | [Input 12] Custom Lin Input 12 | 3355 | 0.00 |
| Out12 | [Output 12] Custom Lin Output 12 | 3356 | 0.00 |
| In13 | [Input 13] Custom Lin Input 13 | 3357 | 0.00 |



4.3.2 Calibrating using front panel push buttons

To gain access to the custom look-up table, refer to the 4 square buttons on the face of the controller and use this procedure.



1. Press 1 until 'ACCESS' appears. If 'Access Level' and 'Level 1' appears, skip to step 3.
2. Press 2
3. Press 4 until 'Level 3' appears.
4. Press 4 until '3' appears. Wait.
5. Press 1 until 'INPUT OPERS' and 'Cust Lin 1 Page' appears.
6. Press 2. until display shows the 'Output #' that corresponds to the calibration point shown in the listing on the previous page.
7. Use DWN/UP buttons (3 and 4) to dial in the measured radiance temperature from a freezing point transfer device or other radiance standard.
8. Press 2 to view/change more correction points.
9. Press the round center button located above 2 and 3 to resume normal display until ready to lock controller.
10. When finished with all calibrations and to lock the controller, press 1 until 'ACCESS' appears.
11. Press 2
12. Press 3 until 'Level 1' appears.
13. Press the round center button located above 2 and 3.



Note: Calibration points do not have to be used as pre-programmed. To dial in a different calibration point, simply change an INPUT # and the corresponding OUTPUT# to be the new desired calibration point. Set the blackbody to the calibration temperature using its setpoint. When exit radiance data is measured, dial in the new OUTPUT # temperature as described above. All calibration points must be in ascending order!

Example: In place of Silver freezing point correction at 961.78 °C, you prefer to use 1000 °C.

1. Using the above steps, set INPUT 9 equal to 1000.0. Set OUTPUT 9 equal to 1000.0.
2. Allow blackbody to control and stabilize at 1000.0 °C.
3. With your radiance standard, you measure 1001.2 °C.
4. Use the above procedure to dial in 1001.2 in the OUTPUT 9 location.
5. Wait for blackbody to re-stabilize at 1000.0 and verify radiance temperature.

All corrections between calibration points are performed using straight-line interpolation.

4.4 Other Controller Modes

4.4.1 View Output Power

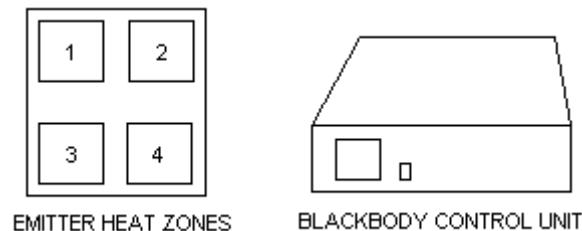
Press SCROLL button until Target OP is displayed. This number is the current power demand.

4.4.2 PID Tuning Constants

The PID tuning constants have been factory set for optimum performance. Altering these parameters will void the warranty and will require assistance from LumaSense to restore it.

4.4.3 Uniformity Adjustments

This M315X-HT has individual trimming adjustments for each heater section. This model has 4 adjustable heaters set as an array of 2 x 2. The adjustments are in the temperature controller firmware and were programmed at the factory for best uniformity near the high temperature limit. The zones are numbered corresponding to the positions shown above. If the upper left device requires being slightly cooler, adjust the zone number that matches the position shown below.



Please note that the sensing RTD is between positions position 1-2. Adjusting these zones will alter the temperatures of all other sections as the controller tries to recover.

Each zone relative output power is adjusted via the temperature controller's "Analog Operator" function. Instructions on how to access these adjustments is described in detail. In this blackbody, Analog Operator #1 = Zone #1, Analog Operator #2 = Zone #2, etc. The zone relative power coefficient ranges from 0 to 1 where 0 = 0% relative power, 1 = 100% relative power.

If you are going to alter these settings, please record the factory settings prior to any changes. The factory settings for this blackbody are:

Zone 1 (Analog Operator 1 Scalar) = _____

Zone 2 (Analog Operator 2 Scalar) = _____

Zone 3 (Analog Operator 3 Scalar) = _____

Zone 4 (Analog Operator 4 Scalar) = _____

Adjust zones only one at a time and allow at least 5 minutes run time before evaluating uniformity. Allow more time for more critical adjustments. Adjust relative power coefficients between 0 and 1 only. Make only small changes (steps of .02 or .05). One zone should remain at 1.0 if possible (usually zones 3 and 4 at the bottom of the emitter). It is possible to run all zones at less than 1 as long as one zone is at least 0.9, otherwise, there will not be enough power to reach the blackbody maximum temperature.

To adjust the zones:

1. Press the **PAGE** button. **ACCESS** appears in the lower display.
2. Press the **SCROLL** button. **LEVEL 1** appears in the lower display.
3. Press the **UP** button until **LEVEL 3** appears in the lower display.
4. Press the **UP** button until **3** appears and wait.
5. Press the **PAGE** button until **ANALOGUE OPERS** appears with **An 1 Page**.
6. Press the **UP** to select the desired **An #** (zone #).
7. Press the **SCROLL** button until **Operation** appears.
8. Press the **SCROLL** button until **Input 1** appears. (*Do not alter Input 2 Scalar!*)
9. Press the **UP** or **DOWN** buttons to set the new relative zone power coefficient only between 0 and 1.
10. Press the **SCROLL** button until **ANALOGUE OPERS** appears with **An 1 Page**.



Note: There is no need to “close the adjustment session” each time an adjustment is made. Go to steps 13 through 16 when completely finished with all adjusting.

11. Repeat steps 6 through 10 to adjust more zones. Once finished adjusting zones, proceed to step 12.
12. Press the **PAGE** button until **ACCESS** appears.
13. Press the **SCROLL** button.
14. Press the **DOWN** button until **LEVEL 1** appears and wait.
15. Press the center, round button to return to normal display.

NOTES:

- Wait sufficient time between adjustments for everything to settle down.
- Use an IR imager capable of resolving less than 0.5 degrees/color.
- If above fails because the bottom may require more heat than the top, incrementally reduce zones 1 or 2 (top) and wait for result. This time, the plate temperature indication will change since power has been reduced to the region the RTD is sensing. The controller will compensate by increasing power which will raise the surrounding region temperatures. If the coefficients seem to require less than 0.5 to balance, set all zones to 1.0 and start over.

4.5 Shutting Down

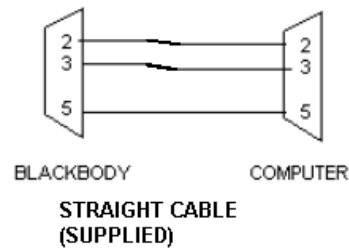
1. If the temperature is greater than 300 °C, adjust the setpoint to 25 °C and leave power on until below 300 °C.
2. Once below 300 °C, turn the power off using the power on/off switch.

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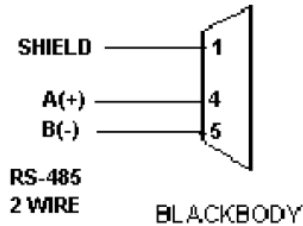
5 Serial Communications

The M315X6-HT / M315X8-HT s configured for is normally configured with a RS232 communication port.

RS232 - standard



RS485 - 2 Wire (Option)

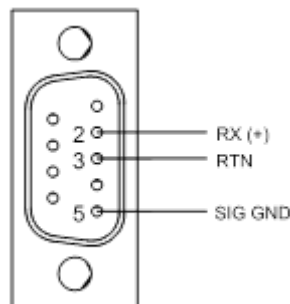


The controller has a distinct address. **The factory address setting is 1.**

5.1 RS232

This blackbody may have the option to communicate with the temperature controller via a PC or similar device. The DB-9 male connector is on the rear panel. Wiring is shown below. It is wired to operate with a standard through cable (not null modem). This method allows bi-directional data transfer via a three-conductor cable consisting of signal ground, receive input and transmit output. It is recommended for communication distances less than fifty feet between the computer terminal and the instrument. Note: Multiple instruments cannot be connected to the same port.

The RS232 port is optically isolated to eliminate ground loop problems. Typically, "DATA OUT" of the computer/terminal connects to the "RCV" terminal on the instrument. "DATA IN" connects to the "XMT" terminal. If shielded cable is used, it should be connected to the frame ground at one end only. Signal ground is to be connected at appropriate ground terminals. The blackbody frame ground is the shield connection for the communication port.

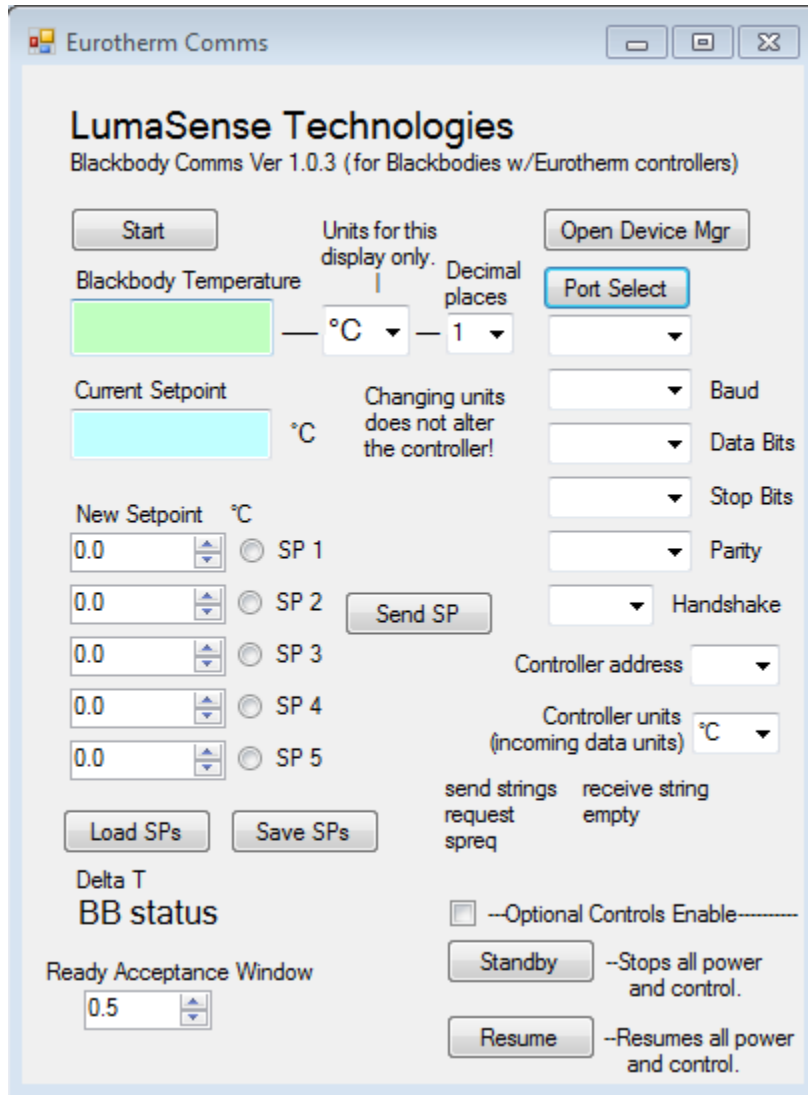


RS232 wiring

5.1.1 Serial Communications Settings

The communication settings are preset in our factory for 9600, E,7,1 and Address = 1.
You may download our Blackbody Communications program from this location:
<http://files.mikroninfrared.com/Blackbody/BlackbodyCommsSoftware-ver3.zip>

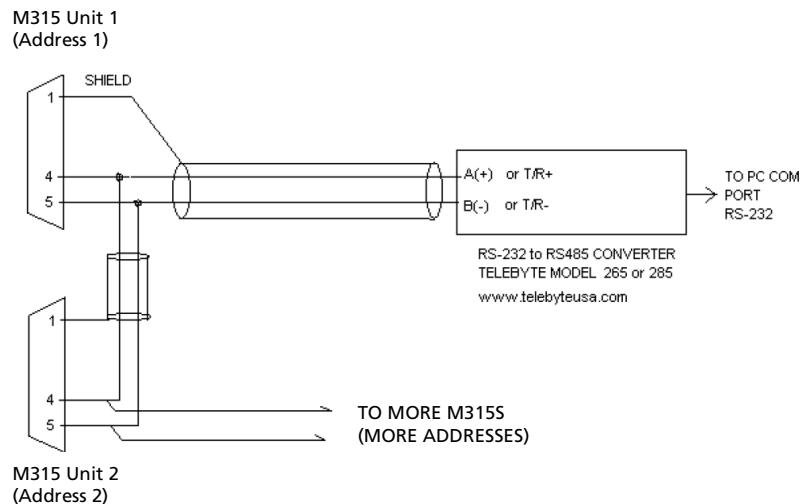
Connect your USB to RS232 converter to an open USB port on your PC. Your Eurotherm controller is set to EiBisync, 9600 Baud. The software manual is included with the download.



Blackbody Serial Communication Software

5.2 RS485 Option

RS485 two wire is available as an option. The connection scheme is shown below:



RS485 for multi-drop applications

Each M315X-HT address must be set to a different value.

To change the address of an M315X-HT (if RS485 was ordered):

1. Press the **PAGE** button. **ACCESS** appears in the lower display.
2. Press the **SCROLL** button. **LEVEL 1** appears in the lower display.
3. Press the **UP** button until **LEVEL 3** appears in the lower display.
4. Press the **UP** button until **3** appears and wait until **PASS** appears.
5. Press the **PAGE** button until **H COMMS** appears.
6. Press the **UP** button until **J COMMS** appears. (J COMMS is the RS485 output)
7. Press the **SCROLL** button until **ADDRESS** appears.
8. Press the **UP** or **DOWN** buttons to set new address and wait.
9. Press the **PAGE** button until **ACCESS** appears.
10. Press the **SCROLL** button.
11. Press the **DOWN** button until **LEVEL 1** appears and wait.
12. Press the center, round button to return to normal display.



Note: A CD containing a sample program is included with your order. For more details on communications, refer to the electronic communication manual also found on the CD provided.

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6 Maintenance

6.1 Emitter heater Life

The life expectancy of the cavity depends on the time and temperature of operation. The higher the temperature, the shorter the life span. At temperatures near the upper end of the range, the life expectancy is shortened by approximately 30%.

6.2 Safety Interlocks

Automatic shut-down will occur if the region near the cavity housing exceeds ~115 °C. This thermal fuse must be replaced when over-temperature causes a shut down. The cooling fan will operate when power is on.

6.3 Periodic Inspections

Check periodically and upon every start up for unusual noises and smells when applying power.

6.4 Internal Fuse List for M315X6-HT & X8-HT

| Fuse Designator | Function | Ratings | Dimensions |
|-----------------|---------------------------------------|---------------------------|-------------|
| F1 | Temperature Controller – L1 | 250 V AC / 1A Fast Acting | 5 x 20 mm |
| F2 | Temperature Controller – L2 | 250 V AC / 1A Fast Acting | 5 x 20 mm |
| F3 | Blackbody Fan – L1 | 250 V AC / 1A Fast Acting | 5 x 20 mm |
| F4 | Blackbody Fan – L2 | 250 V AC / 1A Fast Acting | .25 x 1.25" |
| F5 | Controller Fan – L1 | 250 V AC / 1A Fast Acting | 5 x 20 mm |
| F6 | Controller Fan – L2 | 250 V AC / 1A Fast Acting | 5 x 20 mm |
| F7 | Blackbody Emitter Plate Zone 1 – Line | 250 V AC / 5A Fast Acting | .25 x 1.25" |
| F8 | Blackbody Emitter Plate Zone 2 – Line | 250 V AC / 5A Fast Acting | .25 x 1.25" |
| F9 | Blackbody Emitter Plate Zone 3 – Line | 250 V AC / 5A Fast Acting | .25 x 1.25" |
| F10 | Blackbody Emitter Plate Zone 4 – Line | 250 V AC / 5A Fast Acting | .25 x 1.25" |

6.5 Cleaning

Clean the outside of the cabinet with mild soapy solution and water only. Do not attempt to clean the emitter plate.

6.6 Heater Element Replacement

The M315X-HT heating element is not field replaceable since the cavity and elements are an integral assembly. Contact LumaSense for service if the heating element fails. (Check continuity of the thermal fuse first.)

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Appendix A: Calibration & Emissivity

Radiometric Method

In this method, calibration is based on the energy radiated from the emitter surface at a desired spectral band. This emitted radiation is compared with the primary blackbody calibration source with emissivity of greater than 0.998, using a precision transfer standard. The advantage of this technique is that the characteristic of emitter emissivity has already been calibrated into the system. An apparent emissivity of greater than 0.995 can be achieved. Recalibration or field calibration using this technique is more difficult and elaborate since highly precision primary blackbody calibration sources and transfer standard are needed.

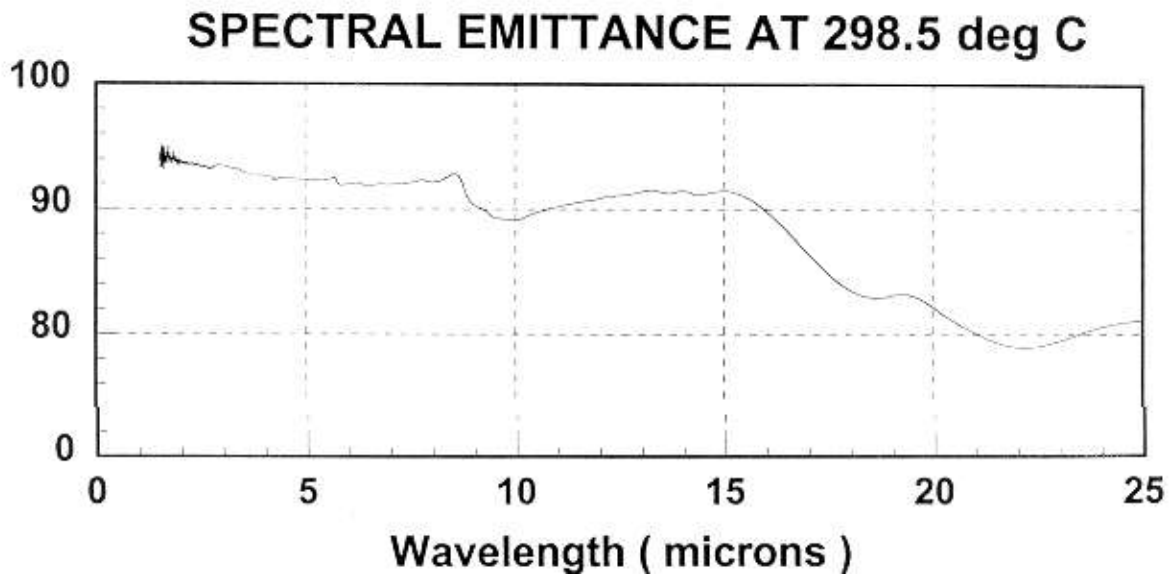
Calibration Certificate

The certificate of calibration of your blackbody source has been included with the shipment.

This certificate contains valuable information including traceability to NIST. Please observe recommended date of next calibration.

Emissivity

When measurements are required at wavelengths other than the one used for factory radiometric calibration, or if the calibration was done thermometrically (see above), the graph below provides emissivity vs. wavelength for this model. Integrating over the wavelength region of interest will provide the average emissivity for your measurement. If the blackbody was calibrated radiometrically, the apparent emissivity at 8-14 μm was normalized to 1.0. If the blackbody was calibrated thermometrically, the target emissivity vs. wavelength can be read directly from the graph.



Index

A

Appropriate use 9

C

Calibration Methods 31
Controller Modes 22

D

Disposal 8
Drawings 12

E

Emissivity 32

F

Fuse 29

G

General Information 5

I

Installation 15
Internal Fuse List 29

L

Liability 6

O

Operation 17

P

Packing 7
PID Tuning Constants 22
Push buttons 17

R

Repair 7
RS232 25
RS485 27

S

Safety 5
Serial Communications 25
 Settings 26
Service Request 7
Setpoint 17
Shutting Down 23
Starting Up 17
Storage 7
Support 7

T

Transport 7

U

Uniformity Adjustments 22
Unpacking the Instrument 6

W

Warnings 6
Warranty 6

Z

Zones 22

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