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CI SYSTEMS

ControlMaster

SR-800R

Extended Area Blackbody

Operation Manual

Manual P/N: 605-7040, Rev D **June 2013**

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Preface

Scope of This Manual

This manual provides all the required information for installing, operating, and maintaining the SR-800R Extended Area Blackbody ControlMaster. The manual is intended for use by operator-level personnel.

Contents of This Manual

The manual includes the following chapters:

Chapter 1: **Introduction & General Information**

Serves as introduction to the SR-800R Extended Area Blackbody, providing the SR-800R main features, general system technical data, and specifications.

Chapter 2: **Description**

Provides a description of the structure and assemblies of the SR-800R. Operational algorithm, based on a general block diagram, is also provided in this chapter.

Chapter 3: **Operation**

Details the operating procedures of the SR-800R.

Chapter 4: **Handling & Installation**

Provides general instructions for transporting, storing, unpacking, and installing the SR-800R.

Chapter 5: **Maintenance**

Provides safety and troubleshooting maintenance information, and step-by-step instructions on how to perform preventive and scheduled maintenance tasks on the SR-800R.

Chapter 6: **SR-800R Communication Protocol**

Defines the communications protocol between the ControlMaster Blackbody and the HOST.

Chapter 7: **Removable Sensors**

Provides the removal and installation procedures for the Removable Emitter Sensor.

Chapter 8: **SR-800R Blackbody Refrigerated Circulator for LT Blackbody Option**

Provides instructions for setting up, operating, handling and dismantling the circulation system.

Chapter 9: **Operating the SR-800R via the Remote Control Program**

Provides step-by-step instructions for using the SR-800R Remote Control program.

Appendix A: Calibration Methods

Introduce CI Systems' Blackbodies calibration methodologies.

Index

Provides, in alphabetical order, a list of keywords to be found throughout this manual.

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List of Updates (Effective Pages)

No.	Date	Description	Page Number
A	September 2009	New Release	All
B	September 2010	Addition of 2" and 14/20" Blackbodies	All
C	June 2012	Technical Updates, Formats	All
D	June 2013	- Addition of the LT Blackbody option - Technical Updates, Formats	All

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List of Acronyms and Abbreviations

AC:	Alternate Current
BB:	Blackbody
BIT:	Built In Test
CPU:	Central Processing Unit
DC:	Direct Current
EFL:	Effective Focal Length
EOM:	End Of Message
FIFO:	First In First Out
FPA:	Focal Plane Array
FLIR:	Forward Looking IR
GPIB:	General Purpose Interface Bus
IO:	Input Output
LAN:	Local Array Network
LCD:	Liquid Crystal Display
MCC:	Motion Control Card
MMI:	Man Machine Interface
MRTD:	Minimum Resolvable Temperature Difference
NIST:	National Institute of Standards and Technologies
PAC:	Power Amplifier Card
PRT:	Platinum Resistance Thermometer
PS:	Power Supply
TSC:	Temperature Sense Card
TTL:	Transistor Transistor Logic

Applicable Documents

N/A

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Safety Instructions Summary

Safety Conventions

In this manual, safety information is presented as warnings, cautions, and notes.

WARNING

An operating procedure, practice, and so forth, which if not correctly followed, could result in personal injury, or loss of life.

CAUTION

An operating procedure, practice, and so forth, which if not strictly observed, could result in damage to, or destruction of equipment.

NOTE

An operating procedure, practices, and so forth, which is essential to highlight.

WARNING

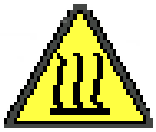
Handle this product only as instructed in this manual. Do not attempt to operate or maintain this product in a manner not specifically stated in this manual. Failure to comply could result in injury to personnel and/or damage to equipment.

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WARNING

The fuse is powered even when the SR-800R is OFF. Before replacing the fuse, power-off the SR-800R and disconnect the power cable from mains. Failure to comply may result in injury to personnel and/or damage to equipment.



HOT SURFACE

The Blackbody may contain hot surfaces. Do not attempt to touch the Blackbody surfaces during operation. If necessary, use the Blackbody carrying handle. Failure to comply may result in injury to personnel.



CAUTION

Power-off the SR-800R before disconnecting or replacing any SR-800R cable. Failure to comply may result in damage to equipment.

Always observe standard safety precautions during the installation, operation, and maintenance of this product.

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1. Introduction & General Information

This chapter serves as an introduction to the SR-800R Extended Area Blackbody, and provides the SR-800R principal features, general system technical data, and specifications.

1.1 SR-800R Overview

The removable sensor feature represents yet another advance in blackbody technology by CI Systems. This innovation provides a much-improved method of maintaining the instrument's calibration, assuring high accuracy and reducing downtime to nearly zero.

The blackbody no longer needs to be sent back to the factory or service center for calibration - or even taken out of service to be calibrated by an in-house calibration department.

The calibration of the blackbody can be updated where it is used - requiring no special tools, no expensive equipment, no specially trained technicians and almost no downtime.

The calibration procedure simply involves ordering a freshly calibrated sensor and replacing the old sensor with the new one. Details of the process provided in this document will assure that the instrument stays calibrated, accurate, NIST traceable - cost effectively - for one more year.

Figure 1-1: SR-800R Extended Area Blackbodies



The new configuration allows users to replace emitter and target sensors with freshly calibrated sensors in a matter of minutes - virtually eliminating downtime, by avoiding the need to send the entire instrument for calibration.

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Advantages of the removable BB are:

- The removable probes are longer and are placed deeper into the emitter plate, delivering even greater accuracy.
- All other performance specifications for the new blackbodies will maintain their high standards.

Here's how simple it is (refer to Chapter 7 for step-by-step instructions on how to replace a sensor):

1. Order a new calibrated sensor/s from CI Systems.
2. Replace the old sensor/s with the new one.
3. Upload the calibration data (via your PC).

Now your test station is back in operation - fully calibrated and NIST traceable.

However, users who prefer to carry out calibration themselves can do so using the CK-800R Calibration Kit.

For more details about calibration methods, refer to Appendix A: Calibration Methods.

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1.2 Features

The SR-800R Extended Area Blackbody has the following principal features:

- Superior resolution to mºK
- High uniformity
- Wide range of temperatures with different ranges available upon request
- Quick and convenient annual calibration using a removable sensor
- Built-in MRTD testing for added efficiency
- Built-in tests to shorten maintenance time
- Low acoustical noise
- Interchangeable heads using the same controller
- Configurable resolution and stability
- Calibrated radiation heads independent of the controller
- Ethernet, GPIB (IEEE-488) and RS232 communication ports
- Remote control over a local area network
- Large, color LCD display
- Touch screen user interface
- Ability to control up to four motorized wheels
- 2", 4"…20" standard heads (other head dimensions available upon request).
- Seven general purpose I/O ports (five outputs and two inputs)
- Compact and portable controller
- 19" rack mount kit included
- Certificate of calibration traceable to NIST
- Certified to MIL-PRF-2800F CLASS 3, CE, and FCC
- Windows CE operating system

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1.3 General Specifications

Table 1-1: SR-800R General Specifications

Set point Resolution:	0.001°C
Readout Resolution:	0.001°C
Operating Voltage:	90-240VAC, 50/60 Hz
Operating Temperature:	0°C to 50°C
Storage Temperature:	-20°C to 70°C
Relative Humidity:	95% non condensing
Controller Dimensions:	342x310x133 mm, 3U Height
Controller Weight:	10 Kg

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2. Description

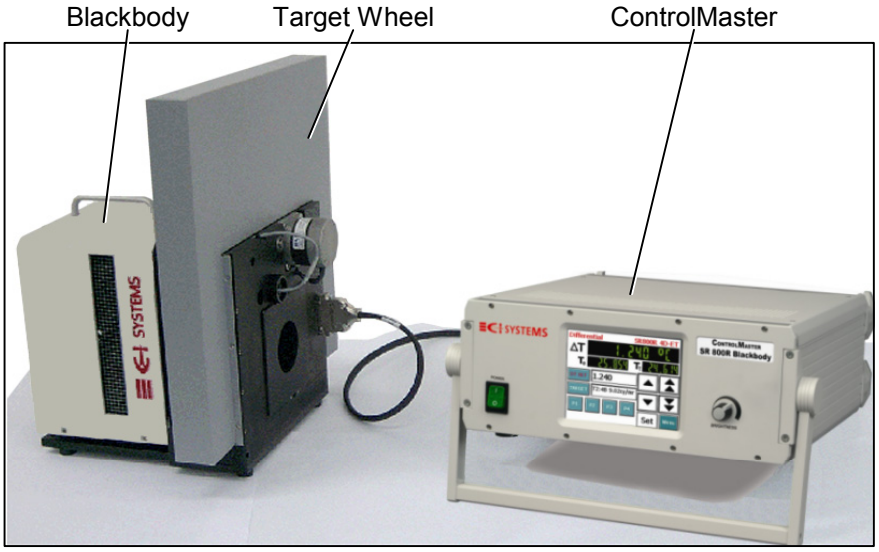
This chapter describes the structure and assemblies of the SR-800R. Theories, based on a general block diagram, are also provided in this chapter.

2.1 System Main Assemblies

The SR-800R operates as a complete stand-alone system (″Master″) or may be integrated as part of an Electro-optics Test System (″Slave″).

The following describes the assemblies that may be part of the SR-800R System. The assemblies are:

Figure 2-1: SR-800R Basic Configuration



- **SR-800R Controller**.
- **Blackbodies**: the SR-800R Controller can simultaneously control various models of Blackbodies (for information on the models and their specifications, refer to the SR-800R data sheets).
- **Host Computer**: used for remote control of the SR-800R Controller when the SR-800R Controller is integrated as part of an Electro-optics Test System.
- **Motorized Target Wheels**: the SR-800R Controller can operate and control up to four stepper-motors. One of the implementations of a motion-controlled device is the motorized target-wheel. Several predefined target-wheels can be controlled by the SR-800R Controller.

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- **Motorized Stages**: the SR-800R Controller can operate and control up to four stepper-motors. One of the implementations of a motion-controlled device is the motorized stage.
- **I/O Devices**: the SR-800R Controller can drive up to five output devices (24V, 100mA), and monitor two input devices (TTL-to-24V).
- **Communication Protocols**: the SR-800R Controller is equipped with several communication protocols (to be used either when the SR-800R Controller is integrated as part of an EO (Electro-Optic) test system, or when it is connected to a local network). Only one protocol can be active. The communication protocols are:
  - LAN: standard LAN Ethernet communication port: may be used when the SR-800R Controller operates under the control of a host computer, either directly or via the computer network.
  - RS232: standard RS232 communication port: may be used when the SR-800R Controller operates under the control of a host computer, or operates under the control of the EO Test System computer.
  - GPIB: standard GPIB communication port, may be used when the SR-800R Controller operates under the control of a host computer, or operates under the control of the EO Test System computer.

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2.2 Blackbodies Overview

Two types of Blackbodies are available:

2.2.1 Absolute Mode Blackbodies

The Absolute Mode BB (Blackbody) consists of an emitter plate, which is thermoelectrically heated or cooled to a pre-defined absolute temperature.

One PRT (Platinum Resistance Thermometer) is mounted in the emitter and is used by the controller to measure the emitter temperature.

The efficiency of the thermoelectric modules is ensured by a heat sink and a fan.

The emitter plate is painted with an high-emissivity paint.

The BB fan is also controlled by the controller. The fan operates mainly to maintain emitter temperatures lower than the ambient temperature, or when cooling down.

2.2.2 Differential Mode Blackbodies

The Differential Mode BB consists of an emitter plate, which is thermoelectrically heated or cooled with respect to the target temperature (thus, the differential temperature between the Emitter and the target is controlled). The target plate is mounted in front of the emitter surface. The efficiency of the thermoelectric modules is ensured by a heat sink and a fan.

Mounted in the emitter and target plates are two PRT sensors, used by the controller to measure their temperature difference. The target is clamped to the target holder with captive screws and can be easily replaced. The motorized target-wheel (RAD) option can also be used.

Both the emitter and the target plates are painted with a highly emissive paint.

The Differential Mode BB can also be operated in the Absolute Mode. Nevertheless, the operator must not disconnect the target sensors, as they provide the target temperature to the controller. The controller uses the target temperature as an indicator of the ambient temperature required controlling the Blackbody fan operation.

NOTE

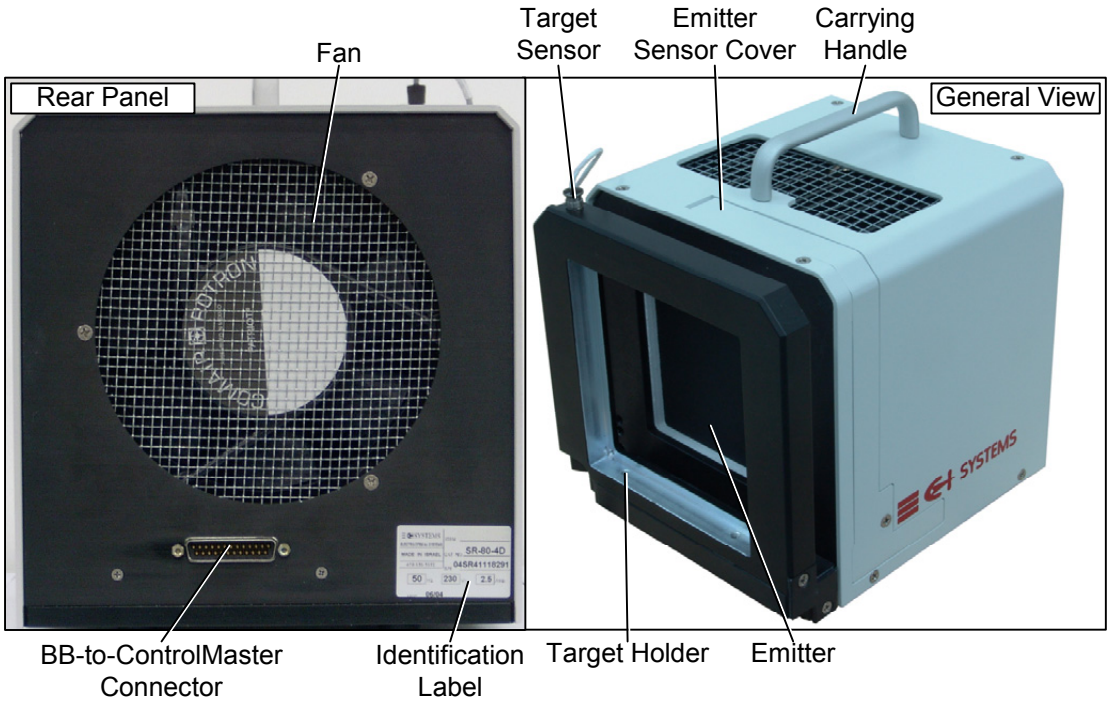
The temperature range of Differential Mode blackbodies are limited to the Absolute Mode temperature range.

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CAUTION

Damaged or scratched paint will degrade the surface emissivity. Always handle the blackbody and targets with care and avoid touching the painted surfaces with bare hands.

Figure 2-2: Blackbody Components



The BB contains a Temperature Sensor Card (TSC), which is used for:

- Reading the emitter and target temperature
- Storing the BB temperature calibration data
- Storing the BB identification data (Model, S/N, etc.)
- Storing the sensors data
- Digital communication with the SR-800R Controller

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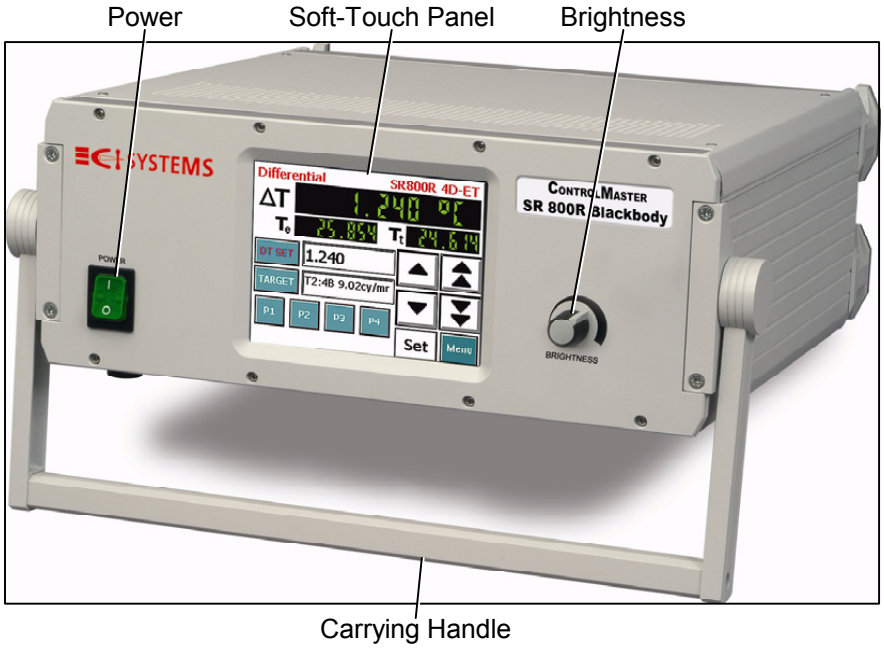
2.3 Controls & Indicators

Table 2-1 depicts all controls and indicators used for operating the SR-800R (see Figure 2-3).

Table 2-1: Controls & Indicators

No.	Name	Type/Function
1.	Power	Two-position green colored switch used to toggle ON/OFF power supply to the SR-800R.
2.	Soft-Touch Panel	Soft-touch LCD colored panel used as the MMI of the SR-800R.
3.	Brightness	A linear potentiometer used to set the LCD screen brightness.
4.	Carrying Handle	Used when the SR-800R is functioning as a portable device.

Figure 2-3: Controls & Indicators



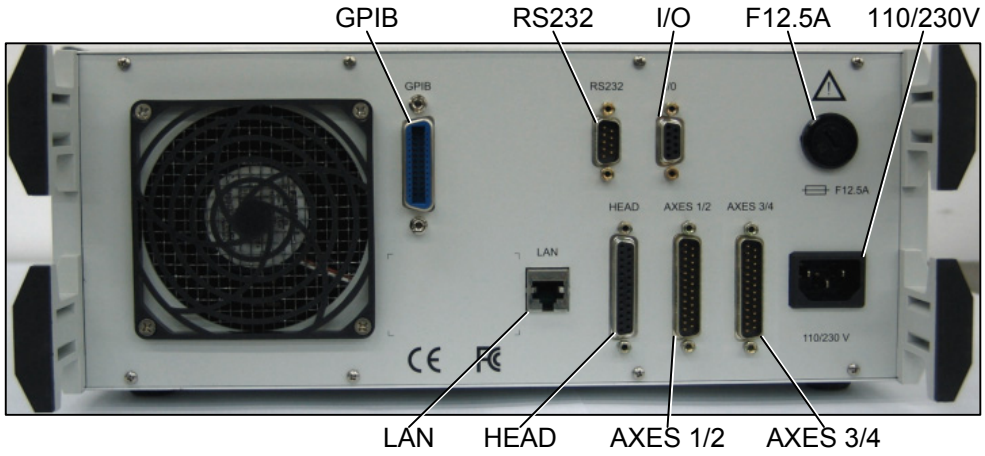
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2.4 Cables & Connectors

2.4.1 Connectors

The SR-800R connectors are shown in Figure 2-4:

Figure 2-4: Connectors



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2.4.2 Cables

Table 2-2 lists the SR-800R cabling.

Table 2-2: Cables

#	Name	Length (meters)		From	To	Function
		Standard	Max			
1.	110/230V	---	2.5m 16AWG	Mains	SR-800R	SR-800R operation power. **CAUTION** Always disconnect the power cable from Mains before replacing the fuse or performing any maintenance activities on the SR-800R.
2.	F12.5A	---	---	----------		The SR-800R fuse is used to protect the SR-800R components from over-current. The fuse is powered even when the SR-800R is OFF. **CAUTION** Always disconnect the power cable from Mains before replacing the fuse or performing any maintenance activities on the SR-800R.
3.	I/O	---	20m	SR-800R	I/O devices	A D-type 9-pin female connector - contains five general-purpose output channels, and two general-purpose inputs, used to drive or sense devices that may be connected to these channels.
4.	RS232	4m	15m	SR-800R	Host Computer	Standard RS232 communication port (D-type 9-pin male connector) used when the SR-800R Controller operates under the control of a host computer, or connected to the system computer.

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#	Name	Length (meters)		From	To	Function
		Standard	Max			
5.	GPIB	4m (single load)	2m (x5 loads)	SR-800R	Host Computer	Standard IEEE-488 GPIB communication port used when the SR-800R Controller operates under the control of a host computer, or connected the system computer.
6.	LAN	4m	15m	SR-800R	Host Computer	Standard LAN Ethernet communication port (RJ45 connector) used when the SR-800R Controller operates under the control of a host computer, either directly or via the computer network.
7.	HEAD	4m	20m	SR-800R	Blackbody	A D-type 25-pin female connector - the SR-800R Controller-to-Blackbody connection used to power the head and communicate (digitally) with the temperature sensor card, located inside the Blackbody.
8.	AXES 1/2	4m	20m	SR-800R	Two Stepper-motors	A D-type 25-pin male connector - used to control up to two step-motor devices (such as Target-Wheels and Stage).
9.	AXES 3/4	4m	20m	SR-800R	Two Stepper-motors	A D-type 25-pin male connector - used to control up to two step-motor devices (such as Target-Wheels and Stage).

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2.4.3 I/O Connector Pinout

Table 2-3 lists the I/O Connector Pinout:

Table 2-3: I/O Connector Pinout

Pin #	Signal Name	Function	Voltage (V)	Current (mA)
1	OUT1	Output Drive	24 ±1 V	100 (Max.)
2	OUT3	Output Drive	24 ±1 V	100 (Max.)
3	GND	Ground	----	----
4	IN1	Input Signal	0-24 V Threshold = 2.5 V	High Impedance
5	IN2	Input Signal	0-24V Threshold = 2.5V	High Impedance
6	OUT2	Output Drive	24±1 V	100 (Max.)
7	OUT4	Output Drive	24±1 V	100 (Max.)
8	OUT5	Output Drive	24±1 V	100 (Max.)
9	GND	Ground	----	----

2.4.4 RS232 Connector Pinout

Table 2-4 lists the RS232 Connector Pinout:

Table 2-4: RS232 Connector Pinout

Pin #	Signal Name	Function	Max Voltage (V)	Max Current (mA)
1	DCD	Data Carrier Detect	± 25	± 2
2	RXD	Received Data	± 25	± 15
3	TXD	Transmitted Data	± 7.5	± 2
4	DTR	Data Terminal Ready	± 7.5	± 15
5	GND	Ground	----	----
6	DSR	Data Set Ready	± 25	± 2
7	RTS	Request To Send	± 7.5	± 15
8	CTS	Clear To Send	± 25	± 2
9	RING	Ring Indicator	± 25	± 2

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2.4.5 LAN Connector Pinout

Table 2-5 lists the LAN Connector Pinout:

Table 2-5: LAN Connector Pinout

Pin #	Signal Name	Function	Max Voltage (V)	Max Current (mA)
1	TXP	Transmitted Data +	7	----
2	TXN	Transmitted Data -	7	----
3	RXP	Received Data +	7	----
4	RXN	Received Data -	7	----
5	----	Not used	----	----
6	----	Not used	----	----
7	----	Not used	----	----
8	----	Not used	----	----

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2.4.6 GPIB Connector Pinout

Table 2-6 lists the GPIB Connector Pinout:

Table 2-6: GPIB Connector Pinout

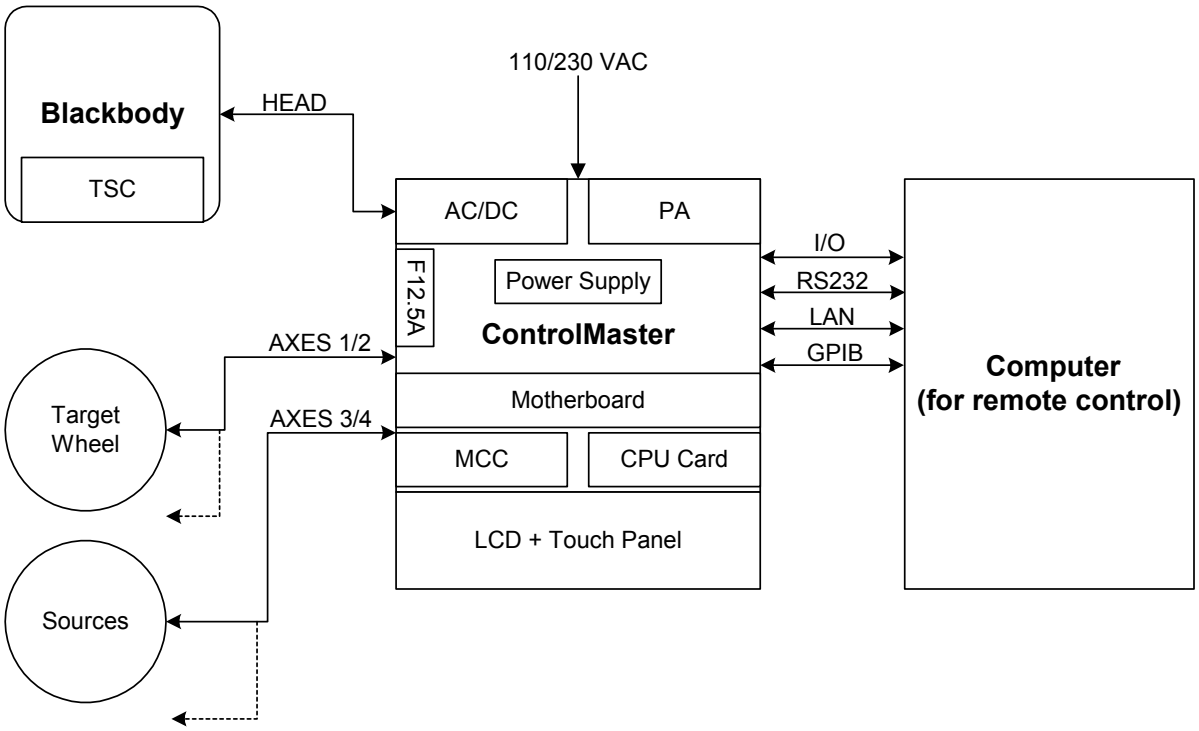
Pin #	Signal Name	Function	Max Voltage (V)	Max Current (mA)
1	DIO1	Data IO1	TTL	2
2	DIO2	Data IO2	TTL	2
3	DIO3	Data IO3	TTL	2
4	DIO4	Data IO4	TTL	2
5	EOI	End Of Identity	TTL	2
6	DAV	Data Valid	TTL	2
7	NRFD	Ready For Data	TTL	2
8	NDAC	Data Accept	TTL	2
9	IFC	Interface Clear	TTL	2
10	SRQ	Status Request	TTL	2
11	ATN	Attention	TTL	2
12	SHIELD	Connected to the shield	----	----
13	DIO5	Data IO5	TTL	2
14	DIO6	Data IO6	TTL	2
15	DIO7	Data IO7	TTL	2
16	DIO8	Data IO8	TTL	2
17	GND	Ground	----	----
18	GND	Ground	----	----
19	GND	Ground	----	----
20	GND	Ground	----	----
21	GND	Ground	----	----
22	GND	Ground	----	----
23	GND	Ground	----	----
24	GND	Ground	----	----

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2.5 SR-800R Block Diagram Description

Figure 2-5 depicts the SR-800R schematics:

Figure 2-5: Schematics



- **Power Supply**:
  used as the SR-800R main power supply (24VDC/4A).
- **LCD**:
  the SR-800R display (320x240 resolution).
- **Inverter**:
  the LCD backlight high-voltage power supply.
- **Touch Panel**:
  the "input" device, where the operator operates the SR-800R by pressing on the LCD Touch Panel.
- **Motherboard & Card Cage**:
  used to house the CPU and the MCC cards, as well as supply power to the SR-800R cards (3.3 V/15 W, and ±5 V/15 W).
- **CPU Card**:
  used to manage and control the entire SR-800R operation (model: SH3 80 MIPS).

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- **Motion Control Card (MCC)**:
  used to control and drive up to four stepper-motors.
- **AC/DC Converter Card (ACDC)**:
  used to convert the Mains input power (110V/220VAC) into ±45VDC. Two card grades are available (grades A and C). The grades differ in their throughput-power. Compatibility is required between the card grade and Blackbody type/model.
- **Power Amplifier Card (PA)**:
  provides a controlled power to the Blackbody (depending on the Blackbody type). The PA is powered by the AC/DC Converter Card.
  Two card grades are available (grades A and C). The grades differ in their throughput-power. Compatibility is required between the card grade and Blackbody type/model.
- **Temperature Sensor Card (TSC)**:
  located in the Blackbody. The card is used to sense the Blackbody temperature, to store the BB temperature calibration data, to store the BB identification data (Model, S/N, etc.), and to interface with the SR-800R Controller.

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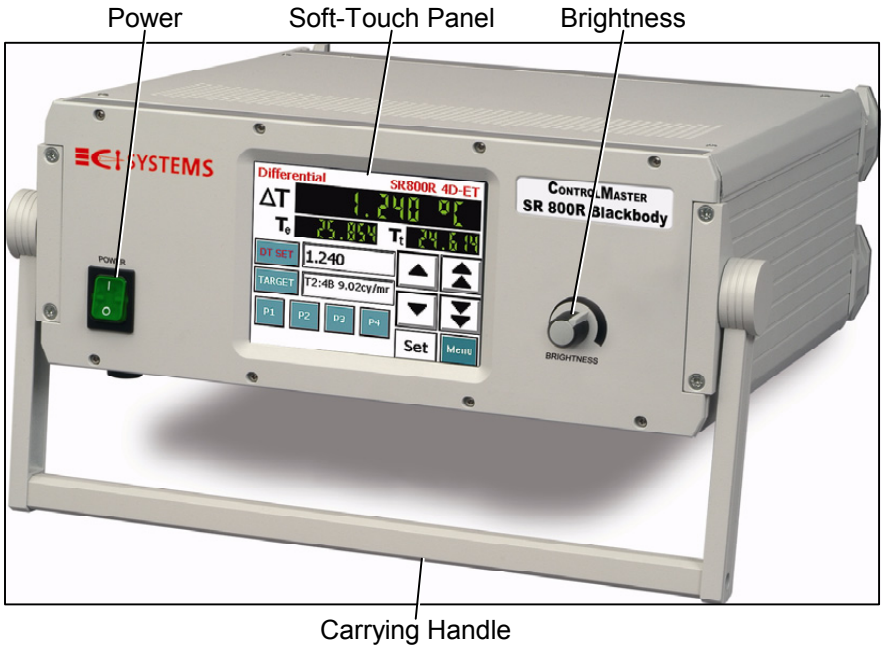
3. Operation

This chapter details the operating procedures of the SR-800R.

3.1 Powering-on the SR-800R

Power-on the SR-800R using the Power switch (see Figure 3-1).

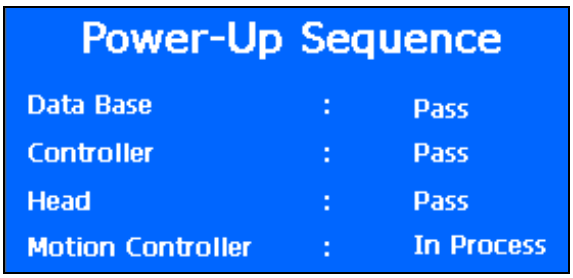
Figure 3-1: Controls & Indicators



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The SR-800R starts to boot. Upon boot completion, the SR-800R initiates BIT (Built-In Tests) while displaying the following Power-Up Sequence window:

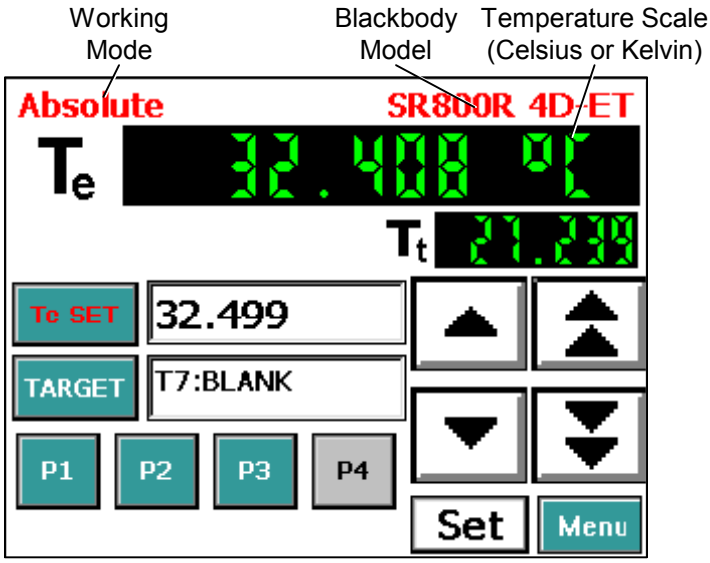
Figure 3-2: Power-Up Sequence Message



If any malfunction is detected during the BIT process, a "Fail" notification is displayed, instead of the "Pass" notification. The power-up sequence continues, however.

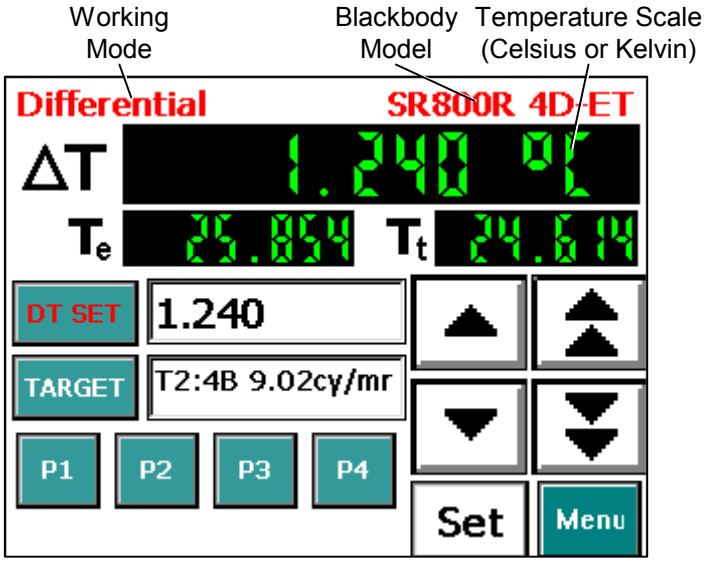
- Upon BIT completion and pending pre-setup of the SR-800R, the **Temperature Control** window opens in either the **Absolute** or **Differential** working modes (for step-by-step instructions on how to change the working mode, see Section 3.2.3.1: Mode).

Figure 3-3: Absolute Mode Window Description



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Figure 3-4: Differential Mode Window Description



The power-on sequence is completed. The SR-800R is ready for operation (see Section 3.2).

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3.2 Operation Procedures

The SR-800R operation includes the following:

- Absolute Mode Window (Section 3.2.1)
- Differential Mode Window (Section 3.2.2)
- Menu Window (Section 3.2.3), that includes:
  - Mode (Section 3.2.3.1)
  - Preset Setup (Section 3.2.3.2)
  - Motion Control (Section 3.2.3.3)
  - IO Control (Section 3.2.3.4)
  - MRTD (Section 3.2.3.5):
    - Using Radiometric Offset in MRTD Tests (Section 3.2.3.5.1)
    - MRTD Test Window (Section 3.2.3.5.2)
    - Setting-Up the MRTD Test (Section 3.2.3.5.3)
    - MRTD Test - Run Window (Section 3.2.3.5.4)
  - Options (Section 3.2.3.6):
    - Motion Setup (Section 3.2.3.6.1)
    - Settings (Section 3.2.3.6.2)
    - Communications (Section 3.2.3.6.3)
    - Re-Store Factory (Section 3.2.3.6.4)
    - Touch Panel Calibration (Section 3.2.3.6.5)
    - Temperature (see Section 3.2.3.6.6)
  - About (Section 3.2.3.7)

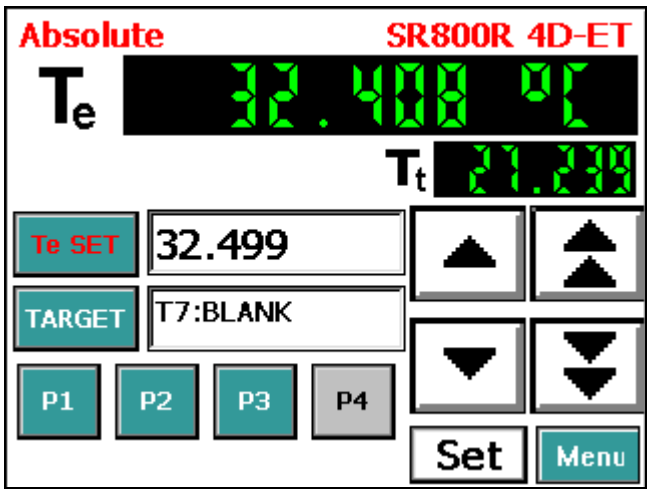
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3.2.1 Absolute Mode Window

(See Figure 3-5)

Upon pre-settings (see Section 3.2.3.1: Mode), the Absolute Mode Window opens immediately after powering-on the SR-800R and on completion of the SR-800R boot process (see Section 3.1: Powering-on the SR-800R):

Figure 3-5: Absolute Mode Window



In the Absolute Mode Window you can:

- Set the temperature of the Blackbody Emitter (**Te SET**)
- Select a target for use during tests (**TARGET**).
- Select a pair of **Te SET** and **TARGET** or only **Te SET** from a predefined Preset list (for detailed information on how to predefine the list, see Section 3.2.3.2: Preset Setup).

To use the Absolute Mode Window:

1. Set the temperature of the Blackbody Emitter (default selection):

   a. Press Te SET. The Te SET **Te SET** button turns red and the temperature adjustment is enabled.

   To cancel press Te SET again.

   b. To set a temperature use one of the following:
   - Press on the up/down arrows:

   The ⏫⏬ buttons increase/decrease the value by 0.1°.

   The 🔼🔽 buttons increase/decrease the value by 0.001°.

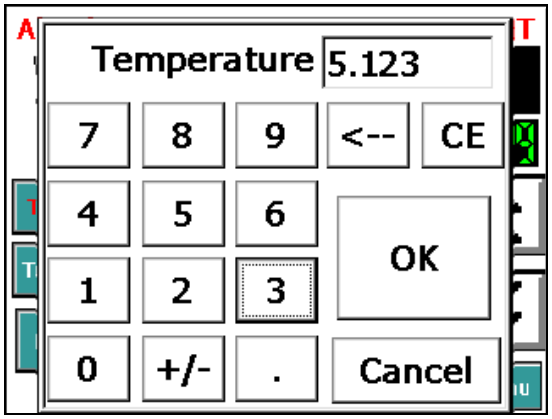
   - Press Set to execute your settings.

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OR:

- Press **Te SET** numeric-edit field 5.123.
  The following floating Keypad opens:

Figure 3-6: Using the Floating Keypad



- Type in the desired temperature (by pressing the desired numbers) and press OK.

Results:
+ The Absolute Mode Window re-opens.
+ The **Te** field continuously displays the temperature of the Blackbody Emitter.
+ The **Tt** field continuously displays the target temperature.
+ The **Te SET** button blinks until the Emitter temperature reaches the requested temperature in the **Te SET** field.

2. **Select a target for use** from the default axis:
   a. Press TARGET (in some cases, the **TARGET** button can be labeled as **SOURCE** or **FILTER**).
      - The **TARGET** button turns red and the target selection is enabled.
   b. Select a target by using the up/down arrows. The target name is displayed in the **TARGET** field.
   c. Press Set to execute your settings.
      - The Target-Wheel starts to rotate toward the selected target.
      - The **TARGET** button blinks until the selected target is valid.
   d. To define the target parameters see Section 3.2.3.6.1: Motion Setup.
   e. To select a target from another axis/Target-Wheel see Section 3.2.3.6.2: Settings.

OR: Press on the **TARGET** numeric-edit field 5.123. The Motion Control window opens (see Section 3.2.3.3: Motion Control). Select a Target and press Go. The Main Window re-opens.

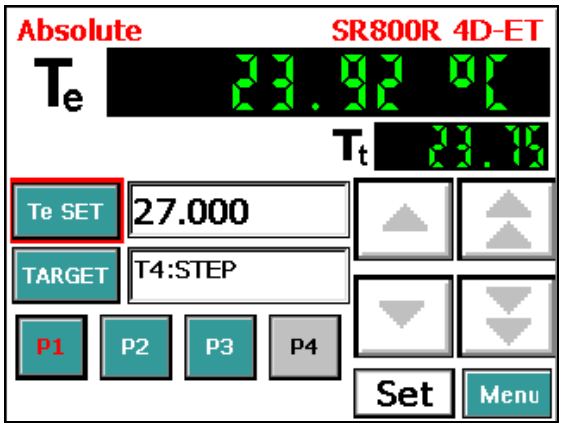
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3. **To select a preset** - a combination of **Te SET** and **TARGET**, Source or Filter, or only **Te SET** from a predefined Preset list (for detailed information on how to predefine the settings, see Section 3.2.3.2: Preset Setup). The first four presets can be selected directly from the Main Window, as follows:
   a. From the Main Window (one of four): press one of the preset buttons (P1 - P4; P1 in this example). The **P1** button 

turns red (a gray button - 

, is invalid; no Preset is available):

Figure 3-7: Selecting a Preset Using the Preset Buttons



   b. Press 

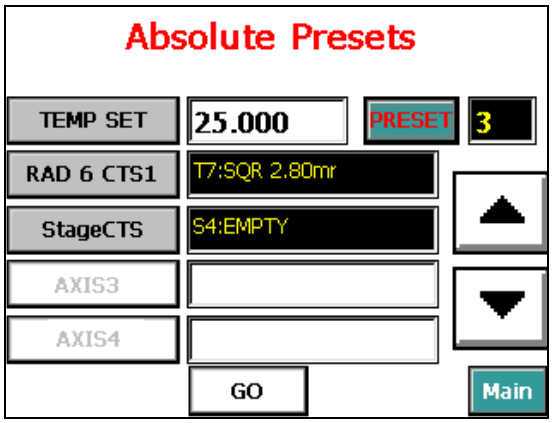
to execute your selection.
   - The **Te** field continuously displays the temperature of the Blackbody Emitter.
   - The **Tt** field continuously displays the target temperature.
   - The **TARGET** field is updated with the preset and the target is selected on the Target Wheel.
   - The **P1** button blinks until the Emitter temperature reaches the requested temperature in the **Te SET** field.

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To select another preset (beyond the first four):

c. From the Main Window press one of the Preset buttons (**P1 - P4**) twice in succession. The following window opens:

Figure 3-8: Selecting a Preset from the Preset Menu



d. Use the **Up** / **Down** buttons to review/select another Preset.

e. Press Go.
- The Main Window re-opens.
- The double-pressed **P** button is re-programmed with the new Preset.
- The **Te** field continuously displays the temperature of the Blackbody Emitter.
- The **Tt** field continuously displays the target temperature.
- The **TARGET** field is updated with the preset and the target is selected on the Target Wheel.
- The **P** button blinks until the Emitter temperature reaches the requested temperature in the **Te SET** field.

You have completed the setting of the Blackbody temperature, using the Absolute Mode.

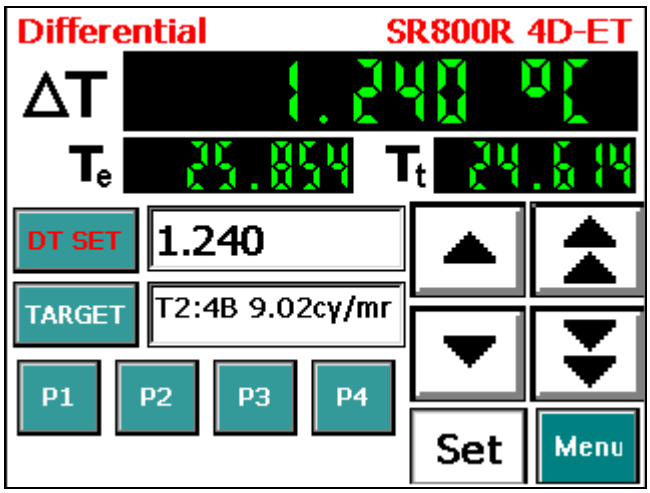
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3.2.2 Differential Mode Window

(See Figure 3-9)

Upon pre-settings (see Section 3.2.3.1: Mode), the Differential Mode Window opens immediately after powering-on the SR-800R and upon completion of the SR-800R boot process (see Section 3.1: Powering-on the SR-800R):

Figure 3-9: Differential Mode Window



In the Differential Mode Window you can:

- Set the temperature difference between the Blackbody Emitter and the target (**DT SET**).
- Select a target for use during tests (**TARGET**).
- Select a pair of **ΔT SET** and **TARGET** or only **ΔT SET** from a predefined Preset list (for detailed information on how to predefine the list, see Section 3.2.3.2: Preset Setup).

To use the Differential Mode Window:

1. **Set the temperature difference between the Blackbody Emitter and the target** (default selection):
   a. Press DT SET. The **DT SET** button turns red and temperature setting is enabled.
   b. To set a temperature use one of the following:
   - Press the up/down arrows:

   The ⏫⏬ buttons increase/decrease the value by 0.1°.

   The 🔼🔽 buttons increase/decrease the value by 0.001°.

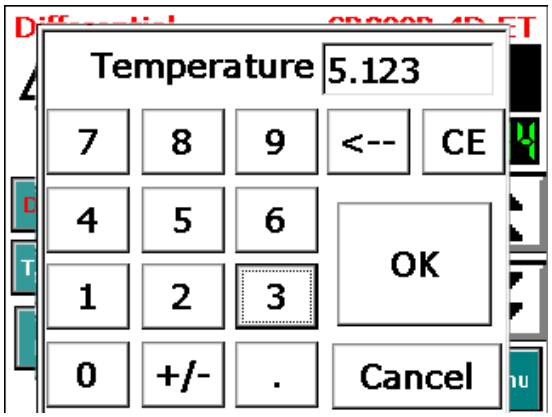
   - Press Set to execute your settings.

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OR:

- Press the **DT SET** numeric-edit field 5.000.
  The following floating Keypad opens:

Figure 3-10: Using the Floating Keypad



- Enter the desired temperature (by pressing the desired numbers) and press OK.

Results:
+ The Differential Mode Window re-opens.
+ The **Te** field continuously displays the temperature of the Blackbody Emitter.
+ The **Tt** field continuously displays the target temperature.
+ The **DT SET** button blinks until the Emitter temperature reaches the requested temperature difference in the **Te** field.

2. **Select a target for use** from the default axis:
   a. Press TARGET (in some cases, the **TARGET** button can be labeled as **SOURCE** or **FILTER**).
      - The **TARGET** button turns red and the target selection is enabled.
   b. Select a target by using the up/down arrows. The target name is displayed in the **TARGET** field.
   c. Press Set to execute your settings.
      - The Target-Wheel starts to rotate toward the selected target.
      - The **TARGET** button blinks until the selected target is valid.
   d. To define the target parameters see Section 3.2.3.6.1: Motion Setup.
   e. To select a target from another axis/Target-Wheel see Section 3.2.3.6.2: Settings.

OR: Press the **TARGET** numeric-edit field T5:4B 14.11cy/. The Motion Control window opens (see Section 3.2.3.3: Motion Control). Select a Target and press Go. The Main Window re-opens.

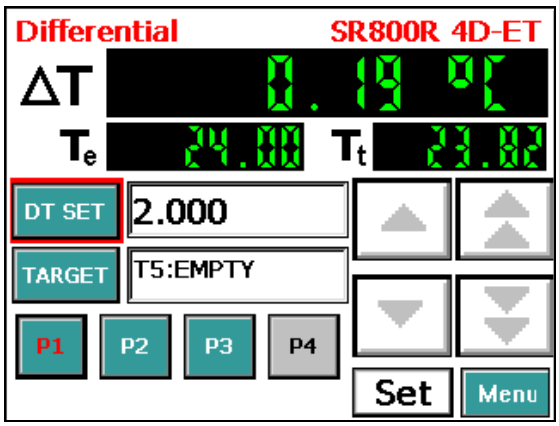
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3. **To select a preset -** (a combination of **ΔT SET** and **TARGET**, Source or Filter, or only **ΔT SET** from a predefined Preset list (for detailed information on how to predefine the settings, see Section 3.2.3.2: Preset Setup). The first four presets can be selected directly from the Main Window, as follows:
   a. From the Main Window (one of four): press one of the preset buttons (P1 - P4; P1 in this example). The **P1** button 

turns red (a gray button - 

, is invalid; no Preset is available):

Figure 3-11: Selecting a Preset Using the Preset Buttons



   b. Press 

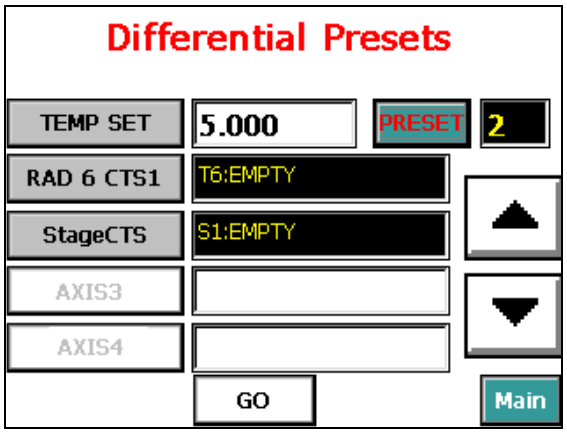
to execute your selection.
   - The **ΔT** field continuously displays the temperature of the Blackbody Emitter.
   - The **Tt** field continuously displays the target temperature.
   - The **TARGET** field is updated with the preset and the target is selected on the Target Wheel.
   - The **P1** button blinks until the Emitter temperature reaches the requested temperature in the **DT SET** field.

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To select another preset (beyond the first four):

c. From the Main Window press one of the Preset buttons (**P1 - P4**) twice in succession. The following window opens:

Figure 3-12: Selecting a Preset from the Preset Menu



d. Use the **Up** / **Down** buttons to review/select another Preset.

e. Press Go.
- The Main Window re-opens.
- The double-pressed **P** button is re-programmed with the new Preset.
- The **ΔT** field continuously displays the temperature of the Blackbody Emitter.
- The **Tt** field continuously displays the target temperature.
- The **TARGET** field is updated with the preset and the target is selected on the Target Wheel.
- The **P** button blinks until the Emitter temperature reaches the requested temperature in the **DT SET** field.

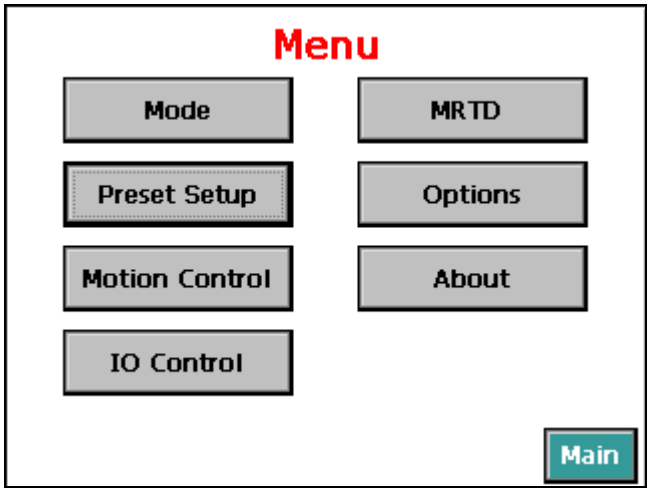
You have set the temperature of the Blackbody Emitter, using the Differential Mode, and selected a target for use during tests.

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3.2.3 Menu Window

To open the Menu Window press Menu (located either on the **Absolute** or **Differential** main window). The following menu opens:

Figure 3-13: Menu Window



The Menu Window includes:

- Mode (Section 3.2.3.1)
- Preset Setup (Section 3.2.3.2)
- Motion Control (Section 3.2.3.3)
- IO Control (Section 3.2.3.4)
- MRTD (Section 3.2.3.5)
- Options (Section 3.2.3.6)
- About (Section 3.2.3.7)

To close and return to the Main window press Main.

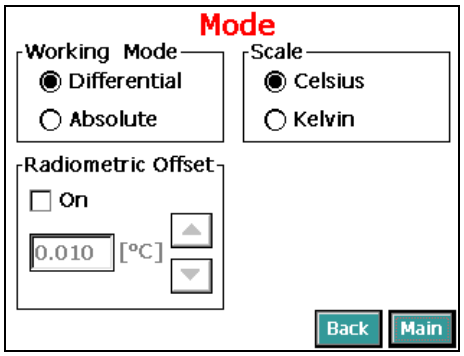
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3.2.3.1 Mode

The **Mode** window allows you to change some default parameters of the SR-800R Main window.
To open the **Mode** window:

1. From the Menu Window, press Mode. The following window opens:

Figure 3-14: Mode



2. Set the **Working Mode**:
   a. To work in **Absolute** mode select the **Absolute** radio-button (see Section 3.2.1: Absolute Mode Window).
   b. To work in **Differential** mode select the **Differential** radio-button (see Section 3.2.2: Differential Mode Window).
3. Set the temperature **Scale** (Kelvin or Celsius) that is to be displayed in the main window (in either the Absolute or Differential modes):
   a. To display the temperature measurements in Celsius, select the **Celsius** radio-button.
   b. To display the temperature measurements in Kelvin select the **Kelvin** radio-button.

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4. Set the **Radiometric Offset** (active only in the Differential Mode; a compensation of temperature deviations, resulting from ambient conditions:

NOTE

In addition, the Radiometric Offset is active only when the selected target temperature offset value is Zero, see Section 3.2.3.6.1.2: Target Setup.

   a. Select the **On** checkbox to enable the **Radiometric Offset** settings.

   b. Set the offset by using the  up/down arrows (0.001° resolution) *OR* press the Radiometric Offset numeric-edit field  to open the floating Keypad and enter the required offset by pressing the desired number keys, and then press . The **R** letter is displayed in the main window, next to the **ΔT** sign - .

To close and return to the last opened window (the Menu Window) press . To close and return to the Main window press .

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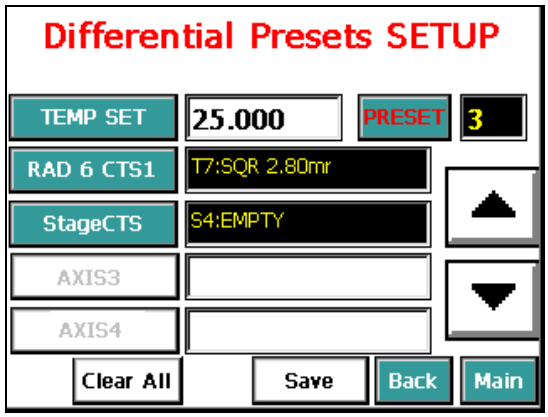
3.2.3.2 Preset Setup

The **Preset Setup** window allows you to define temperature set point or sets of temperature/target pairs to be used in the Absolute Mode Window and Differential Mode Window.
To update the presets for Absolute mode the current temperature control working mode must be Absolute, and for updating Differential presets, the working mode must be Differential (see Section 3.2.3.1: Mode).
To open the **Preset Setup** window (Differential Mode example):

1. From the Menu Window, press 

. The following window opens:

Figure 3-15: Preset Setup

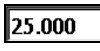


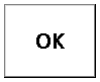
To set a new list or update a predefined list:

2. Press 

. The **PRESET** button turns red.
3. Select a **Preset No** by using the  up/down arrows.
4. **Set the temperature**:
   a. Press 

. The **TEMP SET** button turns red and the temperature setting is enabled.
      To cancel press 

again.
   b. Press the **TEMP SET** numeric-edit field 

. A floating Keypad opens.
   c. Enter the required value by using the Keypad (for negative values, first type the value and then the minus sign).
   d. Press 

to set the temperature and close the Keypad.

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5. **Select a target** (to select a target from another axis/Target-Wheel, see Section 3.2.3.6.2: Settings):
   a. Press an **AXIS** button (or another axis button, if valid). The **AXIS** button turns red and target selection is enabled.
   To cancel press the **AXIS** button again.
   b. Press  to select the required target (a blank field selection is acceptable, e.g., the current target selection remains as is).
6. Press Save to save your settings.
7. To set new or update an existing Preset No repeat steps 2-6.
8. To clear the entire list settings press Clear All.
9. To close and return to the last opened window (the Menu Window) press Back.
10. To close and return to the Main window press Main.

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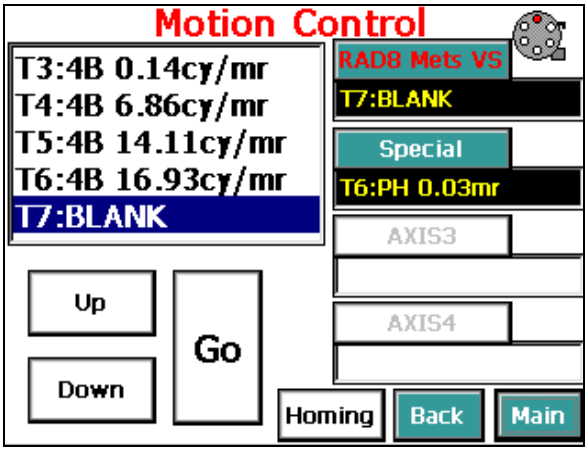
3.2.3.3 Motion Control

The **Motion Control** window allows you to control and select any target from the available axes (up to four axes).

To open the **Motion Control** window:

From the Menu Window press Motion Control. The following window opens:

Figure 3-16: Motion Control



To select a target of an axis (AXIS#1 in this example):

1. Press the **AXIS1** button (**RAD8 Mets VS** in this example).
   - The **AXIS1** button turns red.
   - A list of all **AXIS1** available targets is displayed at the window left pane.
2. Press the required target name (you may browse the list by using the **Up** / **Down** buttons). The target name is displayed under the selected axis button.
3. Press Go.
   - The selected axis/target-wheel rotates until the required target reaches its position.
   - The axis button remains red.
4. To select a target from another axis/target-wheel repeat steps 1-3, replacing **AXIS1** with another available axis.
5. In order to reset the target-wheel/axis press Homing. The target-wheel rotates to its Home position, and then the selected target reaches its position.
6. To close and return to the last opened window (the Menu Window) press Back.
7. To close and return to the Main window press Main.

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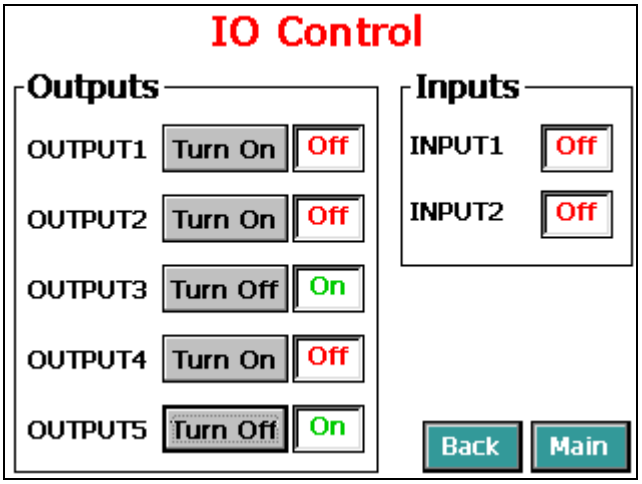
3.2.3.4 IO Control

The IO Control window allows you to control and monitor the I/O devices, connected to the I/O connector, which is located on the rear panel of the controller.

To open the IO Control window:

From the Menu Window press IO Control. The following window opens:

Figure 3-17: IO Control



To control and monitor up to five available **Output** channels:

1. To switch **ON** any output press Turn On.
   - The **Turn On** button changes to **Turn Off**.
   - The **Off** message changes to the On **On** message.
2. To switch **OFF** any output press Turn Off.
   - The **Turn Off** button changes to **Turn On**.
   - The **On** message changes to the Off **Off** message.

If valid, you can monitor up to two **Inputs**:

- The On **On** message indicates that the input device is active (above a predefined threshold).
- The Off **Off** message indicates that the input device is inactive (below a predefined threshold).

To close and return to the last opened window (the Menu Window) press Back.

To close and return to the Main window press Main.

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3.2.3.5 MRTD

The SR-800R provides the ability to run a semi-automatic **MRTD** Test.

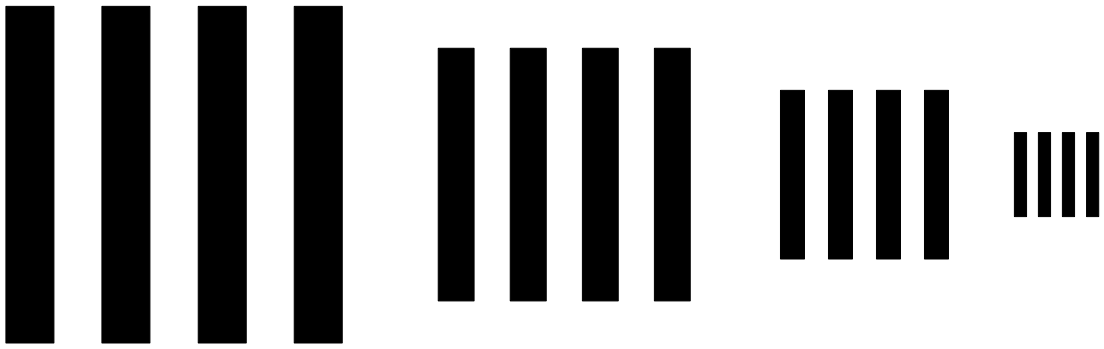
MRTD (Minimum Resolvable Temperature Difference) is the equivalent Blackbody temperature difference between a standard target at a given spatial frequency and its background, such that, the target is "just resolved" by the observer.

In this test, the observer typically looks at a sequence of 4-bar targets at different spatial frequencies (see Figure 3-18). An MRTD curve is drawn as a function of the spatial frequency.

NOTE

"Just resolved" is the term used for the particular point at which, in the eyes of the observer, there is a transition between being able to resolve the target's individual features, and not being able to resolve them.

Figure 3-18: MRTD - Typical 4-Bar Targets



3.2.3.5.1 Using Radiometric Offset in MRTD Tests

The Radiometric Offset can be used to shorten the duration of MRTD Tests. A Radiometric Offset is defined as a constant temperature deviation added, artificially, to the real Blackbody differential temperature.

This feature is used to compensate an error in FLIR interpretation of infrared scenes. These can be caused by phenomena such as: minute differences in the emissivity of the Blackbody emitter versus a target due to the "Cavity Effect" on the emitter. The effect is interpreted as an apparent temperature difference.

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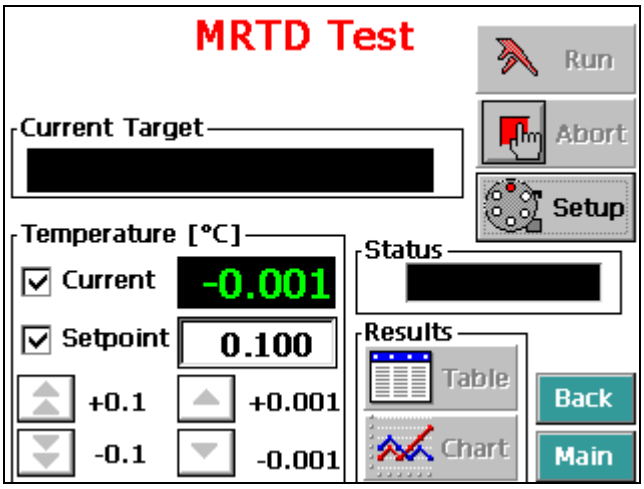
3.2.3.5.2 MRTD Test Window

The **MRTD** Test window is used for performing Subjective MRTD Tests.

To open the **MRTD** window:

From the Menu Window press MRTD. The following window opens:

Figure 3-19: MRTD Test



The **MRTD Test** window includes the following tasks:

- Setting-Up the MRTD Test (see Section 3.2.3.5.3)
- MRTD Test - Run Window (see Section 3.2.3.5.4)

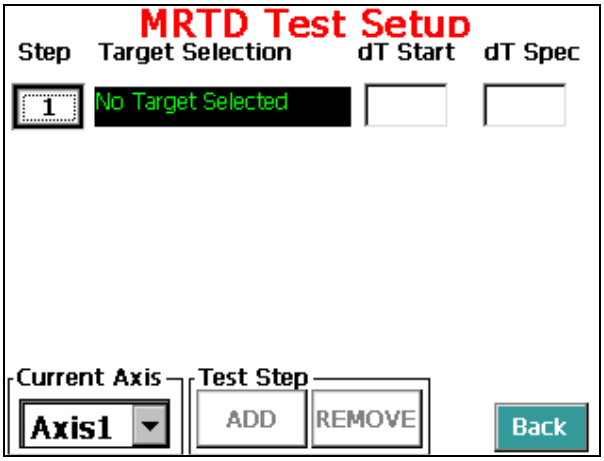
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3.2.3.5.3 Setting-Up the MRTD Test

1. From the MRTD Test Window press 

. The following **MRTD Test Setup** window opens (if the EFL parameter is not defined in the Axis Setup window, this window will not open; refer to Section 3.2.3.6.1.1):

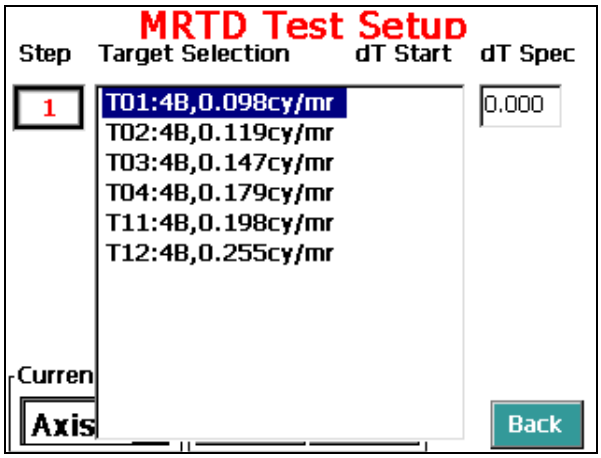
Figure 3-20: MRTD Test Setup (1 of 5)



2. To select the desired axis (Target-Wheel) select the axis from the **Current Axis** pull-down list. The selected axis is displayed on the **Current Axis** field.
3. **To setup up to five pairs of temperature and target**:
   a. Press the last available **Step** number button (#1 - 

in this example).
   - The **Step** number turns red.
   - The following window opens, listing all possible 4-bar targets of the selected target-wheel:

Figure 3-21: MRTD Test Setup (2 of 5)



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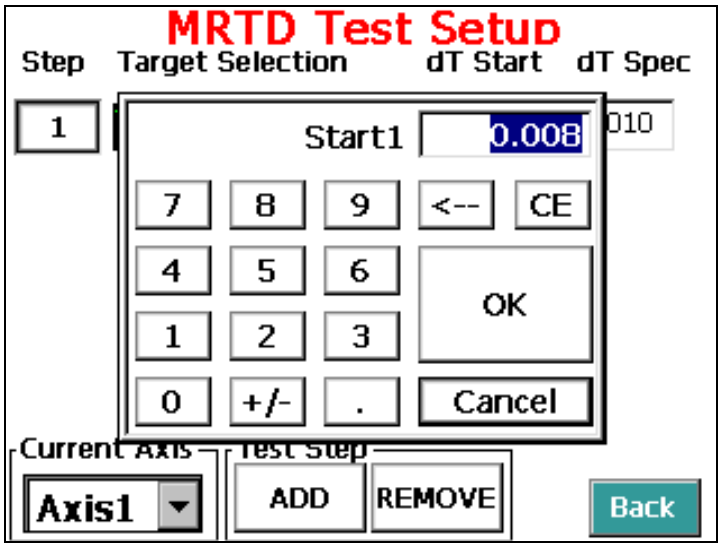
b. Select the target with the smallest spatial frequency (**T01** in this example), and press the last available **Step** number (#1 in this example).

c. Press the **dT Spec** field . A floating Keypad opens.

d. Using the Keypad enter a value related to the selected spatial frequency according to the FLIR MRTD specifications, , and then press OK.
- The floating Keypad closes.
- The value you entered is displayed in the **dT Spec** field.

e. Press the **dT Start** field . A floating Keypad opens:

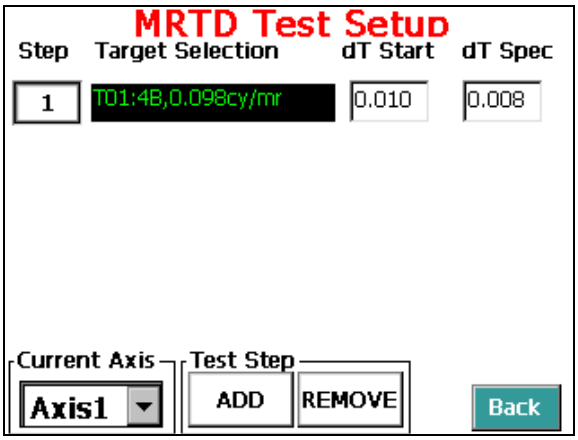
Figure 3-22: MRTD Test Setup (3 of 5)



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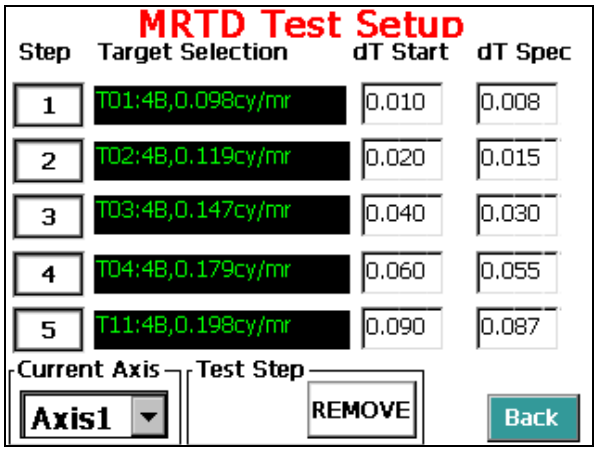
f. Using the Keypad enter the starting temperature set point (**dT Start** > **dT Spec**), and click OK.
- The floating Keypad closes.
- The entered value is displayed in the **dT Start** field:

Figure 3-23: MRTD Test Setup (4 of 5)



4. **To add another set of target and temperature**:
   a. Press ADD. Another line for the next target set is displayed under **Step** #1.
   b. Repeat step 2, replacing **Step** #1 with the next step number. A general view of five steps/frequencies is displayed as shown below:

Figure 3-24: MRTD Test Setup (5 of 5)



5. To remove/delete the last line of the target press REMOVE. The last line is deleted (pressing **Remove** again will delete the last remaining line).
6. Press Back to close and return to the MRTD main window.

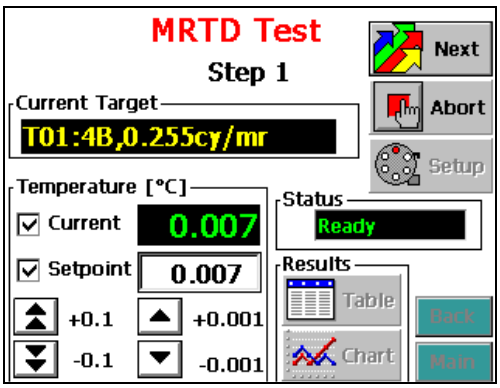
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3.2.3.5.4 MRTD Test - Run Window

1. From the MRTD Test Window, press 

. The window characteristics change to the following:

Figure 3-25: MRTD Test Run



- The 

Run button is temporarily replaced with the 

Wait button and then to the 

Next button.
- The 

Abort button becomes active.
- The 

Setup button becomes non-active.
- The message **Step 1** is displayed on the top of the window.
- The **Setpoint** field shows the **DT Start** temp of **Step 1** and the current field shows the actual temperature (you may clear the temperature values by clearing the **Current** and **Setpoint** selections).
- The **MRTD Test** is initiated while the **Status** field displays the 

Not Ready indication. The **Current** target color becomes red to indicate a transient situation for the temperature and target of **Step 1** on the MRTD test.
- When the target has reached its position and the BB temperature has stabilized, the **Status** field displays the 

Ready indication, and the red target color turns yellow.

2. Observe the target on the FILR monitor and change the temperature by using the **Temperature** up/down arrows. Wait until the temperature has stabilized, and the 

Ready indication is re-displayed in the **Status** field.

3. When you have reached the "Just Resolved" point, proceed to the next step, and press 

.
Now the controller changes the **Setpoint** temp to the negative value of the **Step 1 DT Start**. Wait for stabilization.

4. Upon completion of the positive and negative **dT**, pressing 

will change the **Target** and the **dT** to the next step.

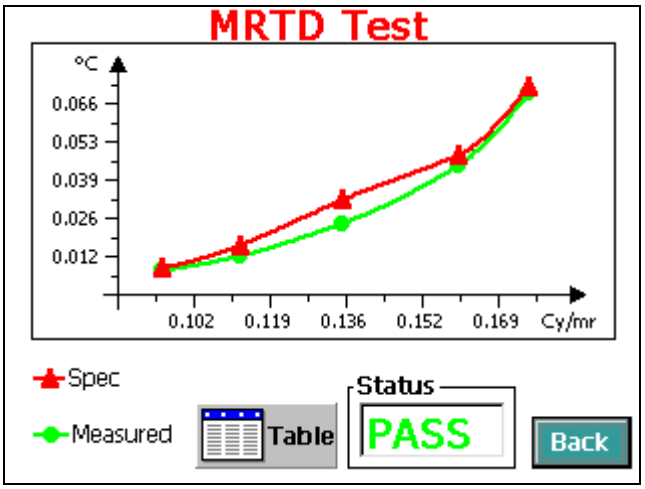
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5. Repeat steps 2-4 (up to 5 times). The MRTD is calculated using the following equation:

$$MRTD(f) = \frac{|\Delta T(Positive) - \Delta T(Negative)|}{2}$$

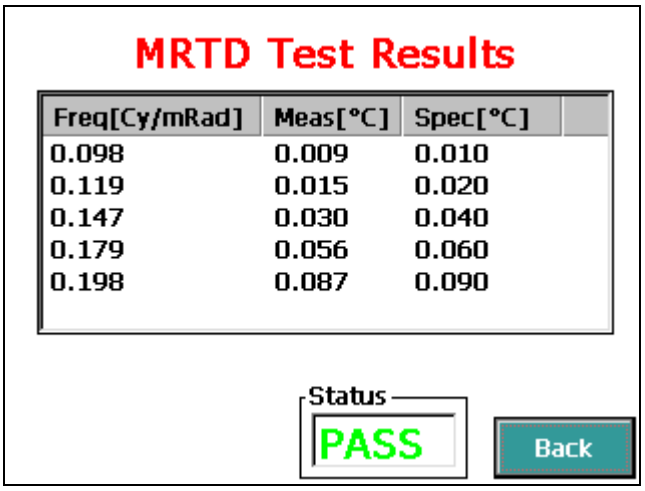
Upon completion, the following **MRTD Test** Results Chart is displayed:

Figure 3-26: MRTD Test Results Chart



6. You may press Table to view the MRTD Test results in a table format:

Figure 3-27: MRTD Test Results Table



7. You may stop running the MRTD test at any time by pressing Abort.

To close and return to the last opened window (Figure 3-26) press Back.

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3.2.3.6 Options

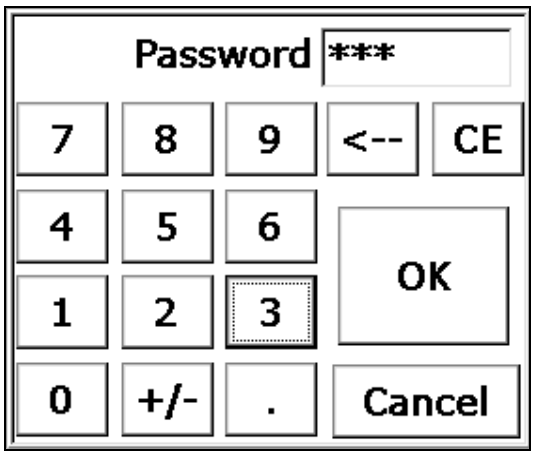
The Options window allows authorized users to access some special utilities.

NOTE

A password is required for using the **Options** window.

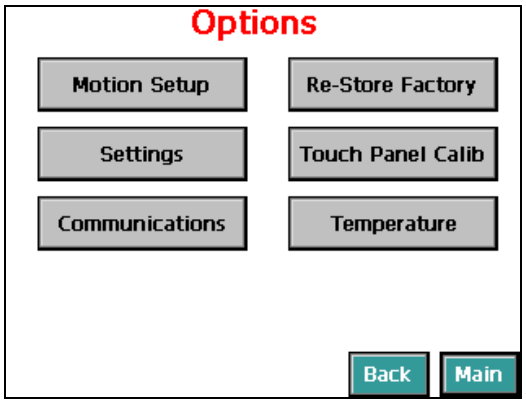
1. From the Menu Window, press Options. the following Password dialog-box opens:

Figure 3-28: Password



2. Using the Keypad enter your password, default **123**, and press OK. The following **Options** window opens:

Figure 3-29: Options



To close and return to the last opened window (the Menu Window) press Back.

To close and return to the Main window press Main.

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The Options window includes:

- Motion Setup (see Section 3.2.3.6.1)
- Settings (see Section 3.2.3.6.2)
- Communications (see Section 3.2.3.6.3)
- Re-Store Factory (see Section 3.2.3.6.4)
- Touch Panel Calibration (see Section 3.2.3.6.5)
- Temperature (see Section 3.2.3.6.6)

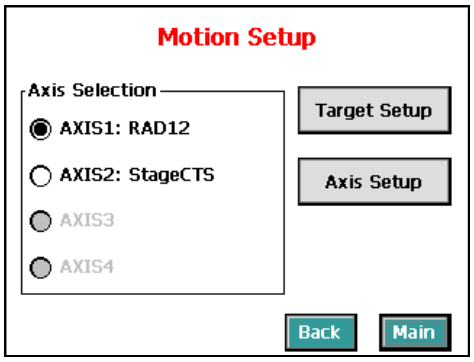
3.2.3.6.1 Motion Setup

The **Motion Setup** window allows you to setup axis and target list, defined in a target-wheel.

To open the **Motion Setup** window:

From the Options window press Motion Setup. The following window opens:

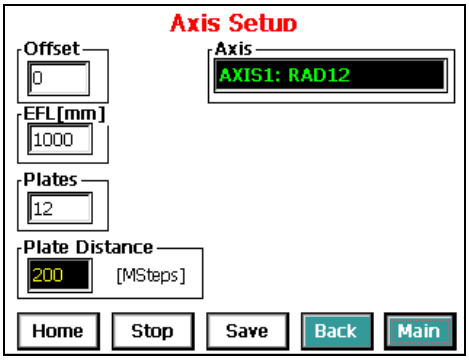
Figure 3-30: Motion Setup



3.2.3.6.1.1 Axis Setup

1. Press Axis Setup. The following **Axis Setup** window opens:

Figure 3-31: Axis Setup



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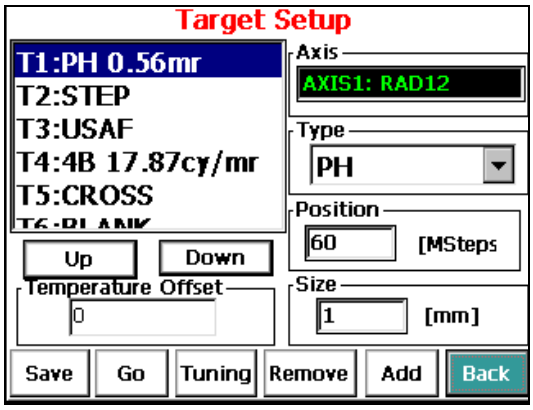
2. **Offset**:
   To Insert Either Positive or Negative Global Positioning Offset:
   a. Press the **Offset** field [0]. A floating Keypad opens.
   b. Using the Keypad enter the **Offset** value (in MSteps) and press [OK]. The Keypad closes and the Offset value is displayed in the **Offset** field.
   c. Press [Save] to save your changes.
3. **EFL** (Effective Focal Length of the Collimator):
   The controller automatically calculates the target angular size, or the spatial frequency, of each 4-bar target in the system using the EFL value and the target size (in mm). It is mainly used for MRTD tests.
   To Insert the EFL Value of Your Optical Test Setup:
   a. Press the **EFL** field [1000]. A floating Keypad opens.
   b. Using the Keypad enter your value (in mm) and press [OK]. The Keypad closes and the EFL value is displayed in the **EFL** field.
   If the value is set to **0**, all the target sizes will be displayed in units of **mm**; otherwise, the target sizes are displayed in mRads or Cy/mRad.
   c. Press [Save] to save your changes.
4. **Plate Distance**:
   The **Plate Distance** value indicates the distance between each of two consecutive plates (measured in wheel MSteps). If each plate holds only one target in its center, then the distance between targets is equal to the plate's distance. The controller automatically calculates and updates the **Plates Distance** parameter according to the **Plates** value.
   To update the Plates value:
   a. Press the **Plates** field [12]. A floating Keypad opens.
   b. Using the Keypad enter your value (in MSteps) and press [OK]. The Keypad closes and the Plates value is displayed in the **Plates** field.
   c. Press [Save] to save your changes.

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3.2.3.6.1.2 Target Setup

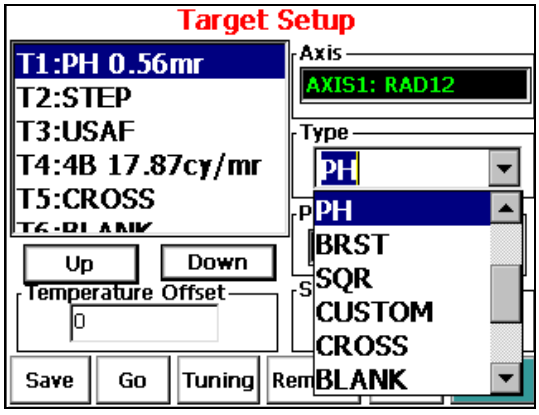
1. Press Target Setup. The following **Target Setup** window opens:

Figure 3-32: Target Setup



2. **To Change/Update the Type of an Existing Target**:
   a. Select a target from the list (you may browse the list by using the **Up / Down** buttons).
   b. From the **Type** pull-down menu select a new target type.

Figure 3-33: Target Setup - Type Pull-Down Menu



   c. Press Save, and confirm the modification to the target setup.

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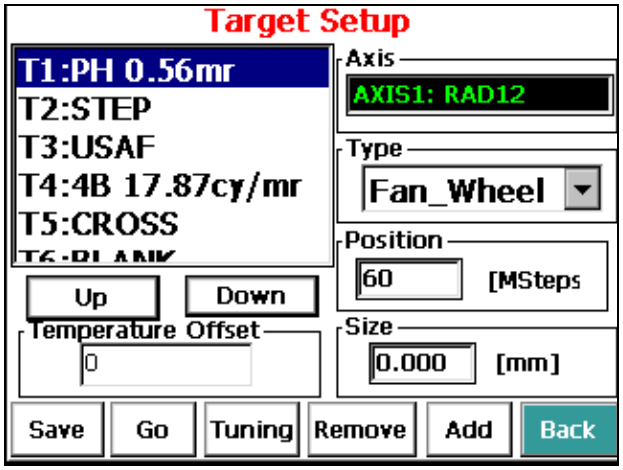
3. **To Change/Edit The Target Name Definition**:
   a. Press the list box twice in succession (T1: PH in this example).
   b. Use the Keypad to enter \ edit the target name:

Figure 3-34: Alphanumeric Keypad



   c. Complete the action by pressing **OK**, or discard the changes by pressing **Cancel**.
   d. Press Save to save the new settings.

Figure 3-35: Saving New Settings



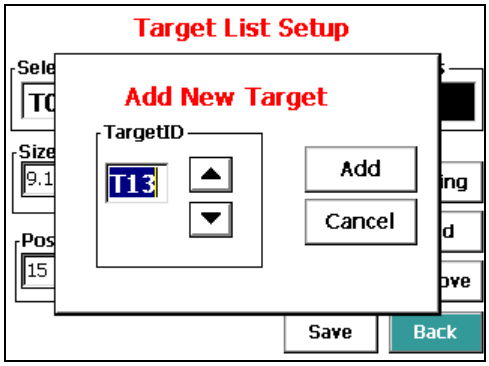
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4. **To Change/Update the Size of an Existing Target**:
   a. Select a target from the list (you may browse the list by using the **Up / Down** buttons).
   b. Press the **Size** field [0]. A floating Keypad opens.
   c. Using the Keypad enter the new target size (mm), and press [OK]. The floating Keypad closes, and the new target size is displayed in the **Size** field.
   d. Press [Save], and confirm the modified Target Setup.
5. **To Change/Update the Position of an Existing Target**:
   a. Select a target from the list (you may browse the list by using the **Up / Down** buttons).
   b. Press the **Position** field [60]. A floating Keypad opens.
   c. Using the Keypad enter the new target position (MSteps), and press [OK]. The floating Keypad closes, and the new target position is displayed in the **Position** field.
   d. Press [Save], and confirm the modified Target Position.
   e. To verify the target new positioning press [Go] and check that the target wheel rotates to the desired location.
6. **To Set the Temperature Offset**: The temperature offset settings should be carried out for every target. If the **Temperature Offset = 0**, then the system is using the **Radiometric Offset** value, providing that the Radiometric Offset is set to **On** (see Section 3.2.3.1, step 4):
   a. In the **Differential Mode** window set the **DT** to **0** and select a target (see Section 3.2.2).
   b. Aim a FLIR towards the Focal Plane/Blackbody and check for differences. If there are any, change the DT until no differences are observed.
   c. Record the **DT** value.
   d. Open the **Target Setup** window (see Figure 3-35).
   e. Select the same target as selected in step a and enter the recorded **DT** value in the **Temperature Offset** field (recorded in step c).
   f. Click [Save].
   g. Repeat steps a - f for the entire targets.

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7. **To Add a New Target** (up to 64 targets can be defined in the target list):
   a. Select a target from the list (you may browse the list by using the **Up / Down** buttons).
   b. Press Add. The following **Add New Target** window opens:

Figure 3-36: Adding a New Target to the Target List



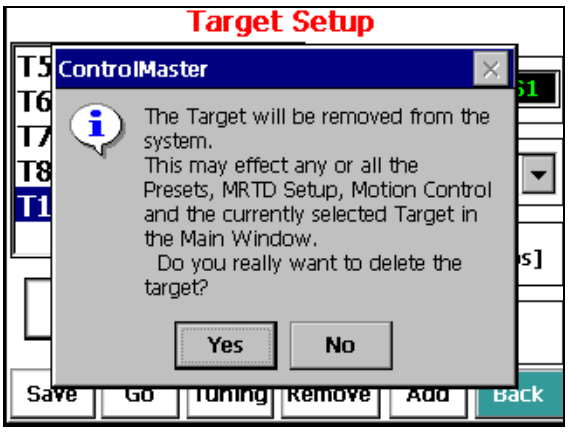
   c. Select the **TargetID #** and press ADD. The window closes.
   d. Select the target **Type** (see step 2).
   e. Set the target Name (see step 3).
   f. Define the target **Size** (in mm, see step 4).
   g. Define the target **Position** (in Msteps, see step 5).
   h. Press Save, and confirm the modification of the Target Setup.

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8. **To Remove an Existing Target**:
   a. Select a target from the list (you may browse the list by using the **Up / Down** buttons).

   b. Press [Remove]. A dialog-box opens prompting you to confirm the removal:

Figure 3-37: Target Removal



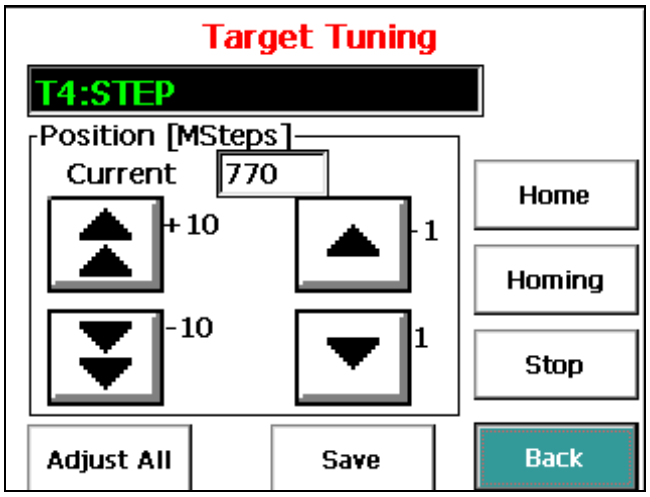
   c. Press [Yes] to confirm the removal.

   d. Press [Save]. The removed target is no longer displayed in the **Select Target** list.

9. **Target Tuning** (fine-tuning the Positioning of the Targets on the Target-Wheel):
   a. Select a target from the list (you may browse the list by using the **Up / Down** buttons).

   b. Press [Tuning]. The following **Target Tuning** window opens, while the Target Wheel rotates to the selected target position:

Figure 3-38: Target Type/Tuning



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c. Observe the FLIR video and check the actual target position. If it is far from the desired position press the **Current** field and insert the estimated position (in micro-step units), using the floating Keypad. Wait for the Target Wheel to change its position.

d. Use the Up/Down arrows to fine-tune the position. The Target Wheel reacts immediately.

e. Press Homing to verify the target new position.

f. Press Save to save your changes.

g. Press Back to return to the Target Setup window.

h. Repeat steps a - g to tune all the remaining targets.

NOTE

If each wheel plate contains only one target and target T01 is already fine- tuned, then you can fine-tune all the remaining targets automatically by pressing the Adjust All **Adjust All** button.

NOTE

To immediately stop the Target-Wheel rotation press Stop. This causes an error in the absolute position of the wheel. Therefore you have to press Homing before continuing the tuning process.

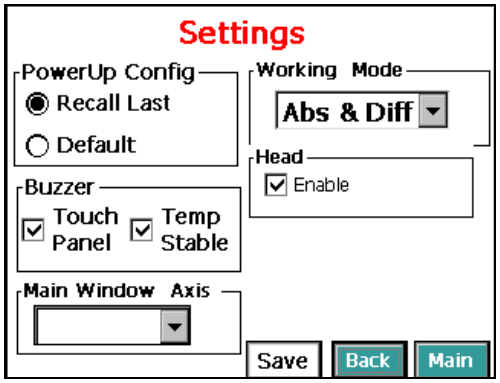
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3.2.3.6.2 Settings

The **Settings** window allows you to set some defaults parameters of the SR-800R Controller.

From the Options window, press Settings. The following window opens:

Figure 3-39: Settings



1. **To Set the PowerUp Configuration**:

   a. If you want the SR-800R to boot each time you turn the system ON with the last settings before it was turned OFF, select the **Recall Last** option.
   The affected settings are:
   - The last **Set Temperature** of the Absolute/Differential.
   - The last **Temperature Scale** (Celsius/Kelvin).
   - The **Radiometric Offset** (On/Off).
   - The last status of the **IO_Out Ports** (On/Off).
   - The last selected target.

   b. If you want the SR-800R to boot with the system defaults settings, select the **Default** option.
   The system defaults are:
   - Absolute temperature of 25°C and Differential temperature of 0°C.
   - The **Temperature Scale** is Celsius.
   - The **Radiometric Offset** is Off.
   - The **IO_Out Ports** are Off.

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2. **To Set the Buzzer Configuration**:
   a. If you want to enable or disable the Touch Panel Buzzer you can select/deselect the **Touch Panel** checkbox.

   b. If you want to enable or disable an audible beep when the temperature is stable you can select/deselect the **Temp Stable** checkbox.

3. **To Set the Main Axis**:
   You can select the motion control axis that is controlled via the Main window (the **TARGET** button) by selecting it from the available axis list of the Main Window Axis.

4. **To Set the Blackbody Head Type of the SR-800R**: use the drop-down menu to select the Head type of the blackbody. There are 2 types that can be defined: **Abs&Diff** and **Abs only**. **Abs Only** is a must if the target sensor is disconnected or not exist.

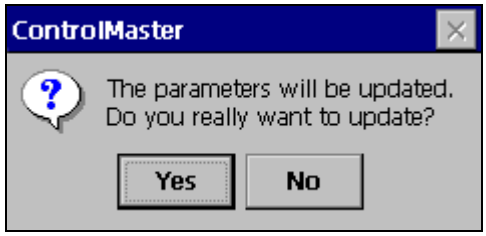
NOTE

Blackbodies that operate in **Abs&Diff** mode require that the Head be connected to Target Sensor. Otherwise, the system will not operate correctly.

A factory supplied Differential head can always operate in **Abs** mode but an **Abs Only** factory supplied head cannot operate in Differential mode.

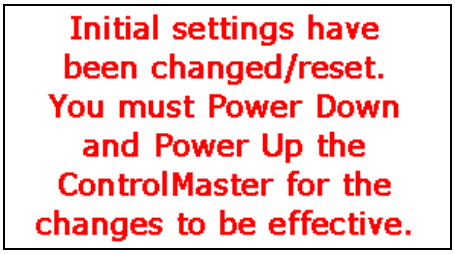
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5. **To Enable/Disable working with an Head** (for example, using the SR-800R as a motion-controller only):
   a. Select/deselect the **Head Enable** checkbox. When disabled the Head is disconnected from the Blackbody and only the Motion Control is active in the system.
   b. Upon selection, the following opens prompting you to re-boot the SR-800R:



   c. Confirm the parameter updates by pressing **Yes**.

Figure 3-40: Reboot Message



   d. Turn the SR-800R OFF and ON. Note that the display of the Main and Menu windows has been changed.
6. Press Save to update the settings in the system.
7. To close and return to the last opened window (the Options window) press Back.
8. To close and return to the Main window press Main.

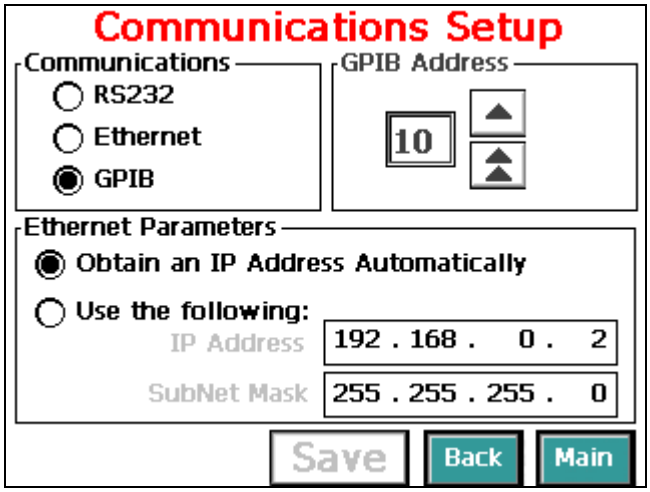
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3.2.3.6.3 Communications

The **Communications** window allows you to set some defaults parameters of the SR-800R Controller.

From the Options window, press Communications. The following window opens:

Figure 3-41: Communications Setup



1. To set the **Control Mode**:

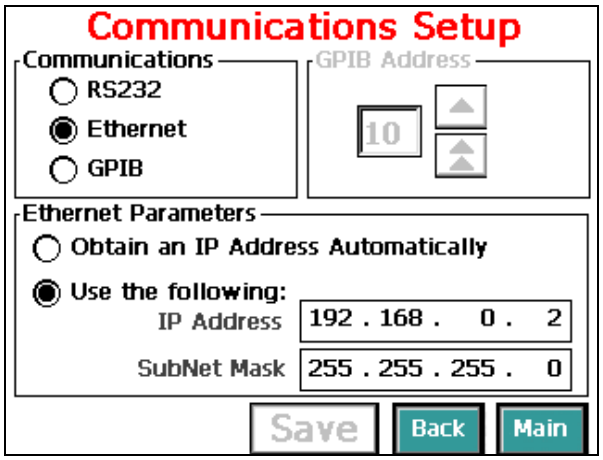
   a. This window allows you to select the preferred communication protocol (RS232, Ethernet or GPIB) for remote control communication with a computer.
   If you choose the Ethernet (LAN) option, you must either obtain an IP address **automatically** from the Network server or define the IP address "manually" by setting the IP address and SubNet Mask. The settings can be changed by clicking on each three consecutive numbers/value and typing the new number/value. You can also connect the SR-800R directly to a computer (not through the local network). In this case you must use a "Direct LAN" or crossover cable (this may be ordered from CI-Systems). You need also to change the setting of your computer (the computer IP address should not conflict with the SR-800R IP address - default is 192.168.0.2).
   If you choose the GPIB (IEEE-488) option you also must choose the GPIB address (1 to 15) by using the arrows (default address is **10**).

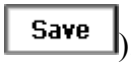
   b. To save the settings press Save.

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2. To connect the SR-800R to a computer via "Direct LAN":
   a. Basic Assumptions:
      - It is assumed that the Host Computer is running under Windows XP or 2000.
      - The Host Computer does not have a DHCP server running or it has been disabled.
      - The Host Computer and the SR-800R are connected to each other with a Direct Link LAN cable. This is necessary since the Host Computer and the SR-800R are not connected via a LAN Hub. The Direct Link Cable can be obtained through CI Systems or purchased at any computer store.
   b. Follow these steps to connect:
      - In order to communicate via the LAN both the Host Computer and the ControlMaster must be set up with compatible IP addresses. Usually when connected via a DHCP network server, this is done automatically. In cases where there is no in house network and/or for security reasons the connection needs to be direct, use the Direct Link method.
      - The LAN can be used to remotely connect to the SR-800R by implementation of the communications protocol.
      - It is also needed for updating the SR-800R application program via the SR-800R Update Utility.
   c. Setup the Communication Setup window as shown in Figure 3-42:

Figure 3-42: Communications Setup (Direct LAN setup)



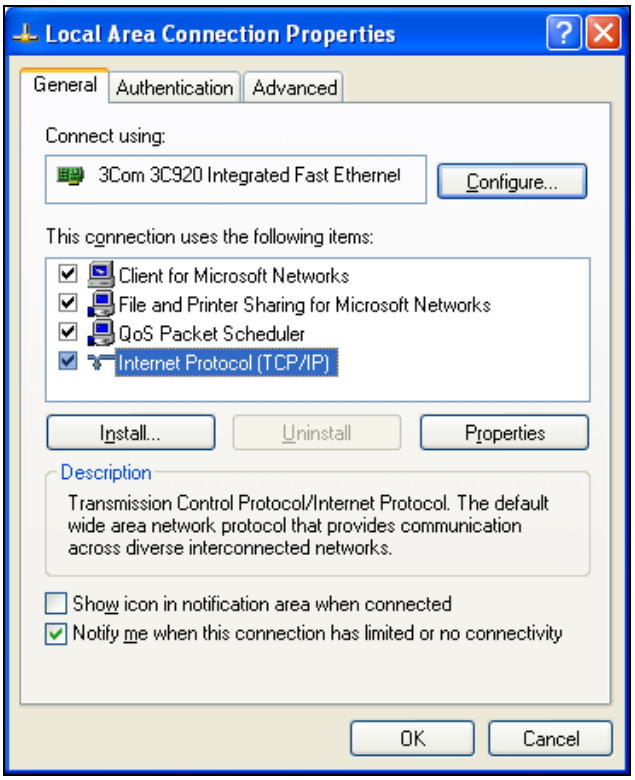
   d. To save the setting, press **Save** (

).
   The SR-800R will update the changes and then require you to re-boot the controller.
   The new settings will be valid only after the controller has powered up again.

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3. To setup the Host Computer for Direct Link (in cases where there is no in-house network and/or for security reasons):
   a. From the computer Start menu select Network Connections (Start → Settings → Network Connections → Local Area Connection) The following window opens:

Figure 3-43: Setting Up the Host Computer for Direct Link

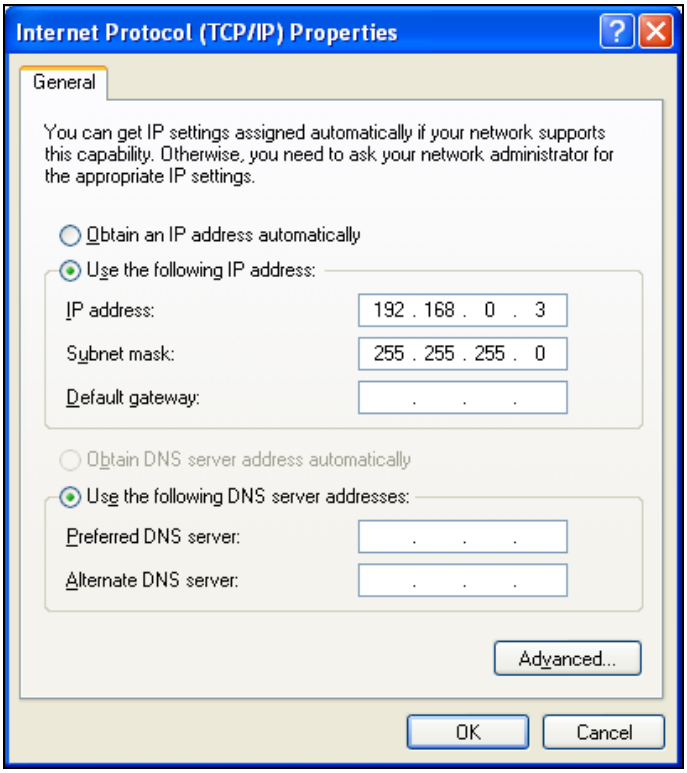


   b. Select the **Internet Protocol (TCP/IP)** and click Properties. The **Internet Protocol (TCP/IP) Properties** window opens.

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c. Change settings as shown in Figure 3-44:

Figure 3-44: Setting Up the Internet Protocol (TCP/IP)



d. Click OK when completed.
The Host Computer is now setup with an IP Address compatible with the SR-800R.

4. Connect the Direct Link Cable between the Ethernet Output Socket on the Host Computer with the LAN Output socket on the SR-800R.

You should now be able to communicate directly with the SR-800R.

NOTE

To restore to the original settings, on the Host Computer, set the TCP/IP Properties back to **Obtain an IP Address Automatically** and on the SR-800R restore the Communication Type that was active, such as, GPIB, or RS232 etc via the Communications Setup window.

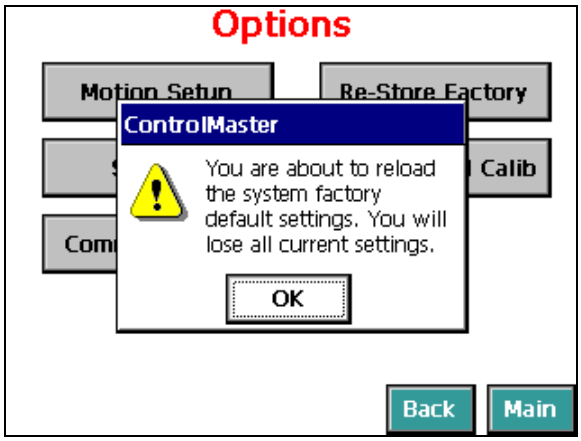
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3.2.3.6.4 Re-Store Factory

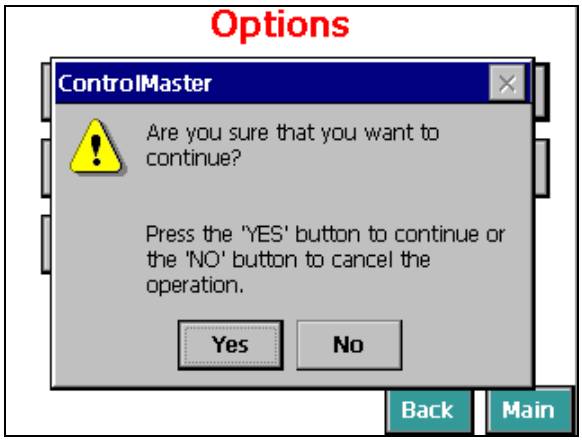
The **Re-Store Factory** window allows you to set the initial factory default parameters of the SR-800R Controller.

1. From the Options window, press Re-Store Factory. The following window opens:

Figure 3-45: Re-Store Factory Defaults



2. Press OK to continue. The following opens:



3. To confirm and restore the factory-defaults press Yes.
   To cancel, press No.

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3.2.3.6.5 Touch Panel Calibration

The **Touch Panel Calibration** option allows you to calibrate the SR-800R Controller Soft-Touch Panel.

NOTE

Use a stylus to calibrate the Touch Panel.

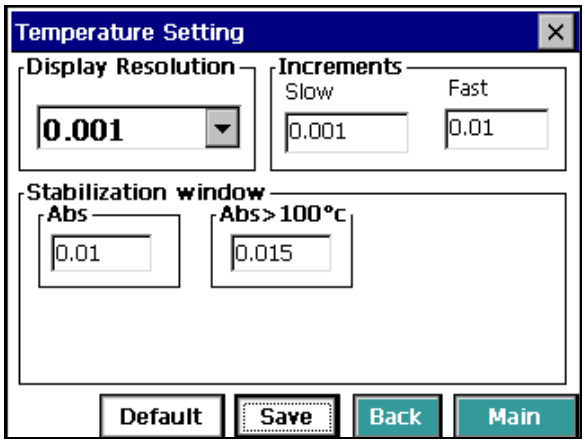
1. From the Options window, press Touch Panel Calib.
2. Follow the prompts. Hold the stylus for at least two seconds on each cross-sign. Upon completion, the Options window re-opens.

3.2.3.6.6 Temperature

The **Temperature** option allows you to set: the temperature display resolution, the arrow increments and the temperature stabilization attributes.

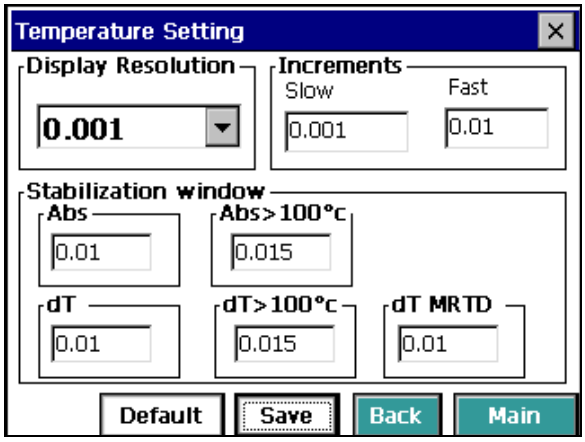
1. From the Options window, press Temperature. Pending on the blackbody working mode, the following window opens:

Figure 3-46: Absolute Temperature Setting



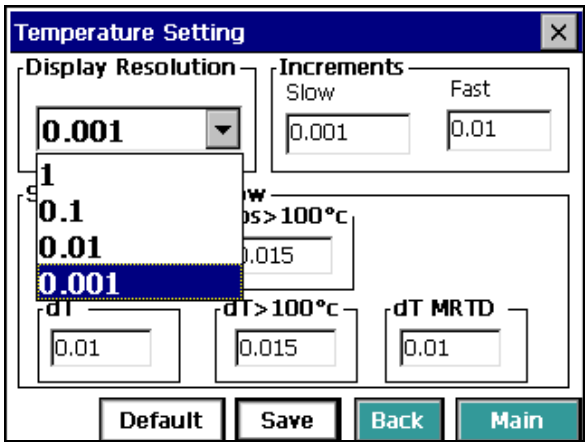
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Figure 3-47: Differential Temperature Setting



2. Select the resolution of the Temperature value display from the **Display Resolution** drop-down list:

Figure 3-48: Temperature Display Resolution Setting



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3. Enter the **Slow** and **Fast** arrow Increments (any decimal value).
4. Enter the **Stabilization Window** values.

NOTES

- The **Slow Increments** value must be lower than the **Fast** value.
- It is recommended that the **Stabilization Window** value should be higher than the **Display Resolution** value.
- The **Slow Increment** value must be higher than the **Display Resolution** value.
- The **dT MRTD** field is used for MRTD stabilization only.

5. To restore the temperature window values press Default (the default values are as shown in Figure 3-47).
6. Press Save to update the settings in the system.
7. To close and return to the last opened window (the Options window) press Back.
8. To close and return to the Main window press Main.

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3.2.3.7 About

The **About** window provides general information related to the SR-800R hardware and software.

1. To open the **About** window, click 

in the Menu Window. The following **About ControlMaster** window opens:

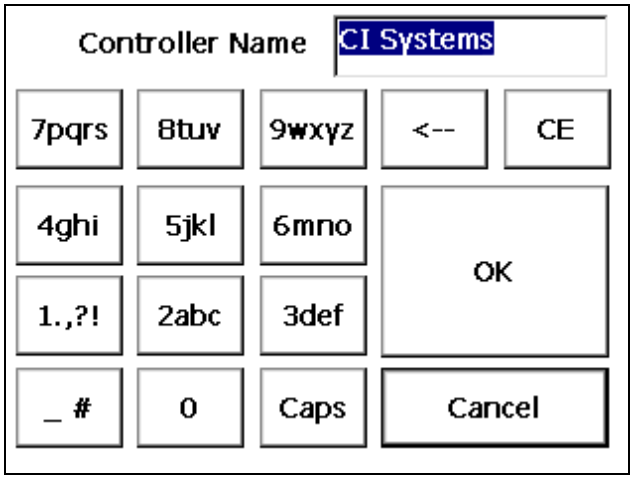
Figure 3-49: About



2. To change the Controller Name:
   a. Press the **Controller Name** field 

. A floating Alphanumerical Keypad opens:

Figure 3-50: Changing the Controller Name (1 of 3)



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b. Using the Keypad enter the new Controller Name and press OK (**CustomerName** in this example). The following dialog-box opens:

Figure 3-51: Changing the Controller Name (2 of 3)



c. Press Yes to approve your changes. The About window re-opens with the new updated Controller Name:

Figure 3-52: Changing the Controller Name (3 of 3)



3. To close and return to the last opened window (the Menu Window) press Back.

4. To close and return to the Main window press Main.

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4. Handling & Installation

This chapter explains how to transport, store, unpack, and install the SR-800R.

This chapter includes step-by-step instructions for the following tasks:

- Transportation (Section 4.1)
- Storage (Section 4.2)
- Installation (Section 4.3)

4.1 Transportation

The SR-800R can be transported by land, sea, or air while packed in its original packaging.

4.2 Storage

While packed in its original packaging, the SR-800R can be stored in the following conditions:

- Temperature range: -20°C to +70°C
- Relative humidity: 5%-95% (non condensing)

4.3 Installation

CAUTION

Tighten all screws using hand-torque only. Failure to comply may result in damage to equipment.

The SR-800R installation includes the following main stages:

- Unpacking (see Section 4.3.1)
- Installation (see Section 4.3.2)

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4.3.1 Unpacking

1. Verify that the number of packages in the delivery matches the number of packages stated in the attached packing list.
2. Visually inspect all packages for traces of excessive moisture or external damage.
3. Carefully open each package, observing handling labels ("this side up", "open this end", and the like).

4.3.2 Installation

The SR-800R can be installed in two configurations:

- Portable Configuration (see Section 4.3.2.1)
- 19" Rack Mount Configuration (see Section 4.3.2.2)

4.3.2.1 Portable Configuration

This procedure provides step-by-step instructions on how to install the SR-800R to be operated as a portable unit. To install:

1. Unpack the SR-800R.
2. Open the carrying handle, as shown in Figure 4-1.
3. Place the SR-800R on the Bench.

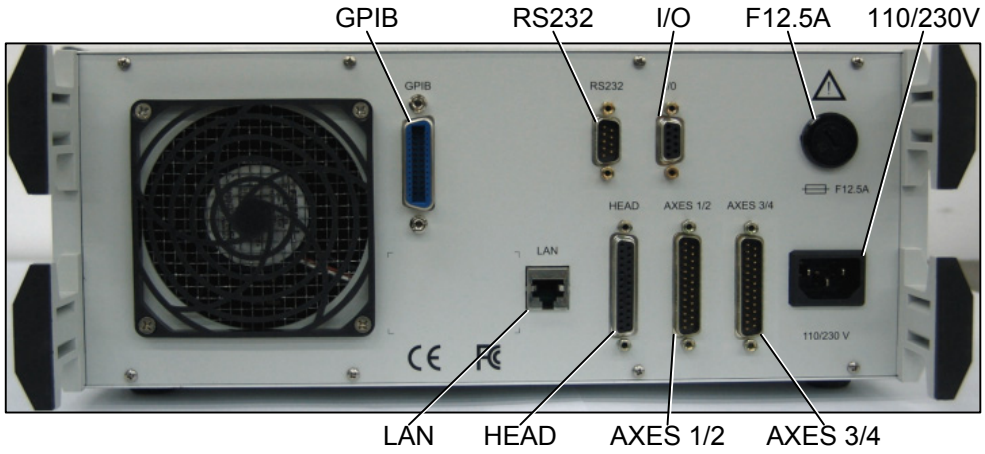
Figure 4-1: Portable Configuration



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4. Connect cables:
   a. Connect the HEAD cable between the SR-800R-HEAD connector and the Blackbody connector (see Figure 4-2).
   b. Connect all the other cables you might use (such as AXES 1/2, AXES 3/4, I/O, LAN, RS232, and GPIB).
   c. Connect the power cable between the SR-800R-110/230V connector and Mains (see Figure 4-2).

Figure 4-2: Connectors



Now you have completed installation of the SR-800R as a portable unit. The SR-800R is ready for operation.

For information on how to use and operate the SR-800R, refer to Chapter 3 of this manual.

CAUTION

Power-off the SR-800R before disconnecting or replacing any SR-800R cable. Failure to comply may result in damage to equipment.

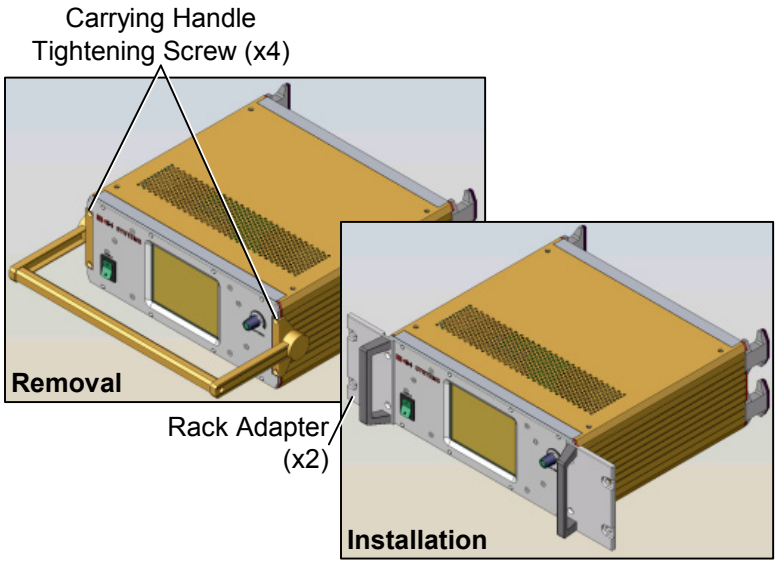
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4.3.2.2 19" Rack Mount Configuration

This procedure provides step-by-step instructions for installing the SR-800R in a rack. To install:

1. Unpack the SR-800R.
2. Install the SR-800R on the rack:
   a. Remove two screws from each side, tightening the carrying handle to the SR-800R, and remove the carrying handle (see Figure 4-3).
   b. Instead of the removed carrying handle, install the rack adapters by using the removed four screws (see Figure 4-3).
   c. Install the SR-800R in the rack.

Figure 4-3: 19" Rack Mount Configuration (typical)



3. Connect the cables (see Figure 4-2):
   d. Connect the HEAD cable between the SR-800R-HEAD connector and the Blackbody connector.
   e. Connect all the other cables you might use (such as AXES 1/2, AXES 3/4, I/O, LAN, RS232 and GPIB).
   f. Connect the power cable between the SR-800R-110/230V connector and Mains.
4. Power-on the SR-800R (see Section 3.1).

You have completed installation of the SR-800R in a rack. The SR-800R is ready for operation.

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5. Maintenance

This chapter provides safety and troubleshooting maintenance information, and step-by-step instructions on how to perform preventive and scheduled maintenance tasks on the SR-800R.

5.1 Safety Precautions



WARNING

The fuse is powered even when the SR-800R is OFF. Before replacing the fuse, power-off the SR-800R and disconnect the power cable from mains. Failure to comply may result in injury to personnel and/or damage to equipment.



HOT SURFACE

The Blackbody may contain hot surfaces. Do not attempt to touch the Blackbody surfaces during operation. If necessary, use the Blackbody carrying handle. Failure to comply may result in injury to personnel.



CAUTION

Power-off the SR-800R before disconnecting or replacing any SR-800R cable. Failure to comply may result in damage to equipment.

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5.2 Maintenance Concept

I-Level maintenance technicians are authorized to perform the following maintenance tasks on the SR-800R:

- Troubleshooting (Section 5.3)
- Preventive/Scheduled Maintenance Tasks (Section 5.4)

5.3 Troubleshooting

This section includes description of the troubleshooting principle followed by a list of all-possible failure symptoms and instructions for locating them.

Table 5-1 details how to troubleshoot failures that may occur while using the SR-800R.

Table 5-1: Troubleshooting

Message No.	Failure Message	Probable Cause of Failure/ Action
25	"ERROR: Could not open the Remote Communications Channel."	Inspect the communication cables. Restart the controller.
30	"ERROR: IO Port Short-Circuit! Please check the short-circuit in the IO output accessories or cables and restart the system."	Fix the shorted circuit. Restart the controller.
31	"ERROR: Power Amplifier Short Circuit. The Power Amplifier has been shut down. Possible causes are: -Electrical short circuit inside the Black Body head. -Short circuit in the interconnect cable. Please fix the problem and restart the system."	Fix the shorted circuit. Restart the controller.
32	"WARNING: The Control Master cannot reach the required differential temperature (dT), because the absolute Te temperature value cannot be above XX[1] degrees. You must select a lower dT value."	Re-enter new dT values.

[1]: A parametric value; taken from the actual screens.

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Message No.	Failure Message	Probable Cause of Failure/ Action
33	"WARNING: The Control Master cannot reach the required differential temperature (dT), because the absolute Te temperature value cannot be below XX[1] degrees. You must select a higher dT value."	Re-enter new dT values.
34	"ERROR: The Black Body XX[1] temperature has passed the absolute maximum value of XX[1]. The Power Amplifier has been shut down. Turn off the system and wait at least 5 minutes before powering up again."	Follow the on-screen text and instructions.
49	"ERROR: Motor is not found!!."	Verify the AXIS cable connections. The motor is malfunctioned.
50	"ERROR: Motion Control Card Detection Failure. All the axes are disabled. Call CI-Systems for assistance."	Contact CI Systems technical support.
51	"ERROR: VCO frequency measurement failed. All the axes are disabled. Call CI-Systems for assistance."	Contact CI Systems technical support.
52	"ERROR: VCO frequency is out of range. All the axes are disabled. Call CI-Systems for assistance."	Contact CI Systems technical support.
54	"ERROR: MCC Card axis XX[1] test failed. This axis is disabled."	Contact CI Systems technical support.
57	"ERROR - Could not establish communications with the Head. You must power down the unit and check the cable to the Head. Contact CI for further assistance if this error continues to appear."	Follow the on-screen text and instructions. Contact CI Systems technical support.
58	"ERROR: The Black Body Head Model Type is not defined properly. Contact a CI Qualified Technician."	Contact CI Systems technical support.

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Message No.	Failure Message	Probable Cause of Failure/ Action
60	"ERROR: There is a mismatch between the controller and the Head. The ControlMaster cannot drive the version of the Black Body Head. The Controller PA is Grade is XX[1] and the Head PA Grade is XX[1]. Contact a CI Qualified Technician."	Follow the on-screen text and instructions. Contact CI Systems technical support.
66	"ERROR: The Black Body head fan is not running. The temperature control may not work properly."	Contact CI Systems technical support.
68	"ERROR: Emitter sensor is disconnected. The temperature control is disabled."	Contact CI Systems technical support.
69	"ERROR: Target sensor is disconnected. The temperature control is disabled."	Contact CI Systems technical support.
70	"ERROR: Emitter sensor short circuit. The temperature control is disabled."	Contact CI Systems technical support.
71	"ERROR: Target sensor short circuit. The temperature control is disabled."	Contact CI Systems technical support.
72	"ERROR: Emitter sensor malfunction. The temperature control is disabled. Please fix the problem and restart the system."	Contact CI Systems technical support.
73	"ERROR: Target sensor malfunction. The temperature control is disabled. Please fix the problem and restart the system."	Contact CI Systems technical support.
74	"WARNING: Power amplifier temperature sensor malfunction. Call CI-Systems for assistance."	Contact CI Systems technical support.
77	"ERROR: Incompatible ACDC and PA Cards detected in system."	Contact CI Systems technical support.
79	"WARNING: You cannot run the MRTD Test. There are no 4 Bar Target Wheels defined in axis. Contact CI for further information."	Contact CI Systems technical support.
81	"You cannot run MRTD Test without first having defined the Effective Focal Length, EFL, for the selected axis in the system."	Contact CI Systems technical support.

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Message No.	Failure Message	Probable Cause of Failure/ Action
82	"ERROR: Power amplifier Over Temperature!! The Power amplifier card temperature has passed XX[1][°C]. The temperature control is disabled." Possible causes are: 1. The vent holes of the Control Master enclosure are blocked. 2. The Controller fan is not rotating properly. Fix the problem and restart the system."	Contact CI Systems technical support.
95	"ERROR: Controller fan malfunction. The temperature control is disabled. Please fix the problem and restart the system."	Follow the on-screen text and instructions. Contact CI Systems technical support.
96	"ERROR: The Power Amplifier VCChigh Voltage is too high (VCC=48.4V, VCCmax=47.0V). The temperature control is disabled."	Follow the on-screen text and instructions. Contact CI Systems technical support.
97	"WARNING: The Power Amplifier VCClow Voltage is out of range (VCC=25.6V, VCCmin=17.0V, VCCmax=23.0V). The system may not work properly."	Follow the on-screen text and instructions. Contact CI Systems technical support.
98	"WARNING: Invalid Power Amplifier output voltages (V1=16.1V, V2=29.1V, VCC=37.3V, Dvmin=2.0V, Dvmax=8.5V). The system may not work properly."	Follow the on-screen text and instructions. Contact CI Systems technical support.
107	"WARNING: Check the cable connection of the Axis."	Verify the AXIS cable connection.
117	"WARNING: You cannot run a MRTD Test. The Axis is not a Target Wheel."	Follow the on-screen text and instructions. Contact CI Systems technical support.
148	"ERROR: one or more Axis3 parameters are incorrectly defined. The axis will be disabled."	Follow the on-screen text and instructions. Contact CI Systems technical support.

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Message No.	Failure Message	Probable Cause of Failure/ Action
163	"WARNING: The HEAD SELF CALIBRATION is Out of Tolerance. Reboot the controller. If the warning re-occurs, contact CI for further assistance."	The ambient temperature changing too fast. Contact CI Systems technical support.
164	"WARNING: PID Coefficient Table does not cover the full operating range of the currently defined Head. Contact CI for further assistance."	Contact CI Systems technical support.
167	"ERROR: Slow increment is lower than display resolution, Please fix this value"	Enter slow increment value that is higher than the display resolution.
169	"WARNING: Stabilization window is lower than the display resolution. Please fix this value"	Enter stabilization window value that is higher than the display resolution.

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5.4 Preventive/Scheduled Maintenance Tasks

The SR-800R Preventive/Scheduled maintenance includes the following tasks:

- Visual Inspection (see Section 5.4.1)
- Cleaning (see Section 5.4.2)
- Calibration Procedures (see Section 5.4.3)

5.4.1 Visual Inspection

1. Clean all SR-800R subassemblies using a soft cloth, soaked in authorized cleaning material (IPA or similar).
2. Search for and tighten any loose part (screws, connectors, etc.).
3. Verify the tightening and proper connection of all cable connectors.

5.4.2 Cleaning

1. Wipe all SR-800R sub assemblies using a soft hairbrush.
2. Clean all SR-800R subassemblies using a soft cloth, soaked in authorized cleaning material (IPA or similar).

5.4.3 Calibration Procedures

The Calibration Table of the SR-800R Blackbody family is stored in the blackbodies. Therefore, only the sensor needs to be calibrated.

The sensor shall be periodically calibrated once a year.

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5.5 Fuse Replacement

WARNING

The fuse is powered even when the SR-800R is OFF. Before replacing the fuse, power-off the SR-800R and disconnect the power cable from mains. Failure to comply may result in injury to personnel and/or damage to equipment.

Tools:

Flathead Screwdriver.

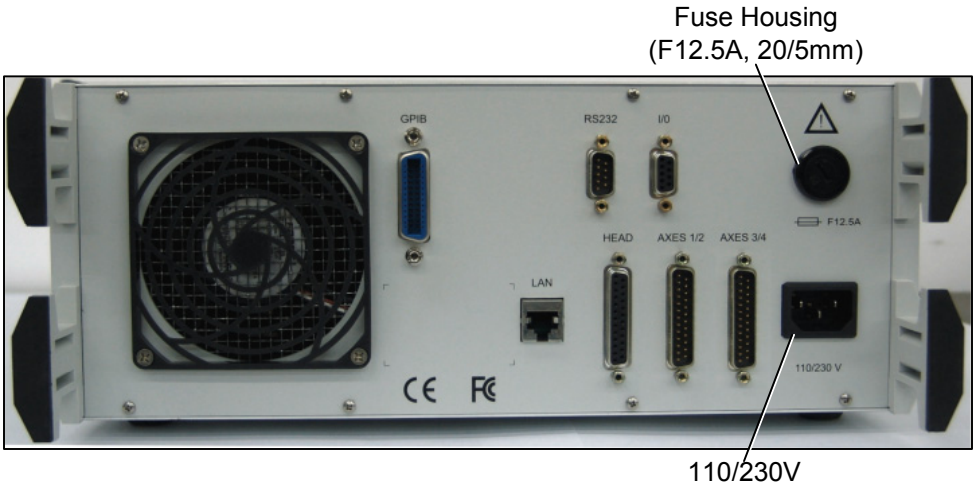
Parts:

Fuse, type: F12.5A, size: 20/5mm.

Procedure (see Figure 5-1):

1. Power-off the SR-800R.
2. Disconnect the power cable from mains.
3. Remove the fuse housing using a Flathead screwdriver.
4. Replace the fuse.
5. Re-install the fuse housing and tighten using a Flathead screwdriver.
6. Reconnect the power cord to mains.
7. Power-on the SR-800R.

Figure 5-1: Fuse Replacement



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6. SR-800R Communication Protocol

This chapter defines the communications protocol between the ControlMaster Blackbody and the HOST.

The digital link may be based on an Ethernet, GPIB or an Asynchronous Serial hardware configuration.

Data is transmitted by using ASCII Text characters except where noted for downward compatibility between the **ControlMaster** and CI's SR80 Blackbody Controllers.

YOU MUST wait for the system to power-up (e.g., Main window opens, prior to attempting to communicate with the ControlMaster).

Note that when working via the Remote Control program, error messages could appear on the window.

6.1 Requirements

6.1.1 Electrical Interface

(See Section 3.2.3.6.2: Settings)

- RS232 Serial Communications Port: Asynchronous, serial, RS232 @ 9600 BAUD
- Ethernet Port: 10 BaseT
- GPIB (IEEE-488)

6.1.2 Communication Sequence & Timing

The Host, i.e., the computer, initiates communication with the ControlMaster by transmitting a message. Each message contains command bytes and an end of message byte.

- The space between successive transferred bytes shall not exceed 0.1 mSec.
- There shall be a minimum of 300 mSec between message transmissions, unless noted otherwise.
- The ControlMaster responds to messages at maximum rate of 3 messages per second, unless otherwise specified.

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6.1.3 Transferred Data Format

- RS232: Each byte will be transferred serially as follows:
  - 1 START bit.
  - 8 data bits (transferred data), LSB (D0) first.
  - 1 STOP bit.
  - No parity.
- Ethernet: Data is sent in packets. The protocol implemented is based on TC/PIP. The SR-800R uses a built-in server port of 5200 to respond to client requests. For customers interested in using Ethernet, CI can provide a sample program demonstrating the operation of the protocol.
- GPIB: DATA is sent in a Byte-Wide bus via IEEE-488 Control Connections.

6.1.4 Naming Bits

The Most Significant Bit (MSB) in each byte is named D7.

6.1.5 Command Message Structure

Each Command contains a **CommandBody** and a **CommandOperandBody**:

- The **CommandBody** and **CommandOperandBody** are separated by a **Space** ASCII Text Character, 0x20 Hex, symbolized by **Space** sign.
- The **CommandOperandBody** contains the command operands. There may be from no operands to a few operands in the CommandOperandBody. Each Operand is separated by a **Comma** ASCII Text Character, 0x2C Hex. This is symbolized by the **Comma** sign.
- Commands are case insensitive unless otherwise noted.

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6.1.6 End of Message (EOM)

- RS232 Communications Mode: when the ControlMaster is set to communicate via RS232 communications, the EOM string is required. The EOM is different when the ControlMaster receives data or transmits data to a host device.
- Data Reception by the ControlMaster from the Host computer: the End of Message is defined as an ASCII Carriage Return, i.e., 0x0D Hex, CR, character (only for RS232, otherwise it is Empty), and is symbolized by the EOM symbol. This is used by the ControlMaster to identify the completion of the reception of the data or command.
- Data Transmission by the ControlMaster to the Host computer: the End of Message is defined as an ASCII Carriage Return + Line Feed, i.e., 0x0D0A Hex, CR + LF, characters (only for RS232, otherwise it is Empty), and is symbolized by the EOM symbol. The ControlMaster transmits a message to the Host; it terminates the message with the End of Message (EOM).

NOTE

The EOM is required only for RS232!

6.1.7 Error Messages

The ControlMaster returns two types of error messages:

- **InvalidCommand**:
  This indicates that the Host sent an invalid command or message that does not exist.

*	I	n	v	a	l	i	d	C	o	m	m	a	n	d	*	EOM

- **InvalidOperand**:
  This indicates that the Host sent a valid command, however one or more of the command operands was invalid. The **ControlMaster** was unable to process the command.

*	I	n	v	a	l	i	d	O	p	e	r	a	n	d	*	EOM

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6.2 Communication Protocol

Table 6-1: Communication Protocol - Commands Summary

Command Category	Description	Remarks
Axes:		
GETAXISSTATUS	Returns Axis Motion Status.	
AXISHOMING	Perform Axis Homing Sequence.	
SETTARGET	Move to Selected Position in the current selected active Axis.	Replaces SA
SA[2]	Move to selected position in Axis	See SETTARGET
SETACTIVEAXIS	Sets the desired Axis to be active for operation	
GETACTIVEAXIS	Get the current Active Axis in the System	
GETNUMBEROFAXES	Retrieve the current number of Axes and their String IDs	
RA[2]	Retrieve the current target position from the selected axis	
GETTARGETLIST	Retrieves current Axis's Target List	
GETTARGETFREQUENCY	Get the Spatial Frequency of the 4 Bar Target in the selected Axis.	
GETAXISEFL	Get the Effective Focal Length that the selected Target Axis is set to.	
Temperature Control:		

[2]: Complies with the SR-80 Command Format.

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Command Category	Description	Remarks
CM[2]	Set Temperature Control Operating Mode.	See SETMODE
GETMODE	Get Current Temperature Control Mode.	
GETTARGETTEMPERATURE	Get Current Target Temperature.	Replaces RT
GETTEMPERATURE	Get the current temperature measurement per the current Temperature Control Mode.	
GETTEMPERATURERANGE	Get the Absolute and Differential Working Temperature Range of the Controller.	Replaces RG
RG[2]	Get the Absolute and Differential Working Temperature Range of the Controller depending on the current temperature mode.	See GETTEMPERATURERANGE
ISTEMPERATURESTABLE	Monitor Whether Temperature is within stable Setpoint conditions.	
RD[2]	Get Current Differential Temperature.	
RE[2]	Get Current Emitter or Absolute Temperature.	
RT[2]	Get Current Target Temperature.	See GETTARGETTEMPERATURE
SETMODE	Set Temperature Control Operating Mode.	Replaces CM

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Command Category	Description	Remarks
SETTEMPERATURE	Set Temperature of Controller per current Temperature Operating Mode.	Replaces ST
ST[2]	Set Temperature of Controller per current Temperature Operating Mode.	See SETTEMPERATURE
RR[2]	Get Radiometric Offset Value.	
SR[2]	Set Radiometric Offset Value.	
IO:		
GETINPUTSTATUS	Get IO Input State.	
OUTPUTENABLE	Enable IO Output Driver.	
SETOUTPUT	Set IO Output State.	
General:		
ECHO	Echo Command.	
SETPRESET	Set Preset Number - **Activates** the requested preset.	
GETMAXPRESETCOUNT	Get the Current Number of Presets defined in the System.	
*IDN?	Identify Controller.	GPIB command only!
RV[2]	Retrieve the Controller SW Version.	
GETBITERROR	Get the Online BIT Error of the Controller.	
GETSYSTEMINFO	Retrieve controller SN, SW Version etc.	Replaces RV
CALIBRATETOUCHPANEL	Calibrate the Touch Panel.	

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Command Category	Description	Remarks
SETREMOTETYPE	Set the remote communications type between the Host and the ControlMaster.	Ethernet, GPIB or RS232
GETABSOLUTESETPOINT	Get the Current Absolute Temperature set point.	
GETDIFFERENTIALSETPOINT	Get the Current Differential Temperature set point.	
SETCOMPUTERNAME	Computer Nickname used to identify the controller when communicating with it.	
DM^2	Display Mode	

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6.2.1 SETMODE

- **Summary**: This is used to set the current temperature mode.
  NOTE: It replaces the CM command.
- **Note:** This command may take some time. Allow at least 1-2 seconds before checking the mode with the **GetMode** Command.

S	E	T	M	O	D	E	Space	Mode	EOM

- **Input Operand**: Mode - This is an integer value defining the temperature mode to set the system:
  - 1 = Absolute.
  - 2 = Differential.
  - 3 = Differential with Radiometric Offset Correction
- **Return Values**: None

6.2.2 GETAXISSTATUS

- **Summary**: This command retrieves the current motion status of the requested Axis. This command may not indicate movement if called immediately after calling the SetTarget, AxisHoming, etc. commands. Wait for about one (1) second before calling this command.

G	E	T	A	X	I	S	S	T	A	T	U	S	Space	nAxisNumber	EOM

- **Input Operand**: - NAxisNumber - A value from 1 to 4 representing the axis to be accessed. If no Axis number is provided, the command will return the status of combined axes in motion. This means that if any of the axes in the system are in motion, then the result will be 1 (in Motion); otherwise 0, i.e., Stopped.
- **Return Values**:
  - -1 = Error
  - 0 = Stopped
  - 1 = In Motion
  - 2 = In Home Position (this is a momentary value when the axis is in motion and is passing through Home).

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6.2.3 AXISHOMING

- **Summary**: This command starts the Axis Homing Sequence. The selected axis will rotate in a predefined direction to the Home Position and then return back to its last position. This is used to "zero" any potential offset buildup for the specified axis.
- **Note**: you must wait till the Homing is completed before issuing new commands.

A	X	I	S	H	O	M	I	N	G	Space	AxisNumber	EOM

- **Input Operand**: AxisNumber - a value between 1 to 4, representing the axis to be accessed. If no axis number is provided, then the command will default to AXIS 1.
- **Return Values**: None.

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6.2.4 SETTARGET

- **Summary**: This command moves the currently selected Active Axis to the desired Target Position. Use this command to replace the SA Command for new applications.
- **Note**: You must not attempt to move to a new target position while the axis is in motion. Query for motion status by using the GetAxisStatus Command.
  This command replaces the SA command.
- **Reference Command**: see SetActiveAxis GetAxisStatus.

S	E	T	T	A	R	G	E	T	Space	TargetNumber	EOM

- **Alternate Representation**:

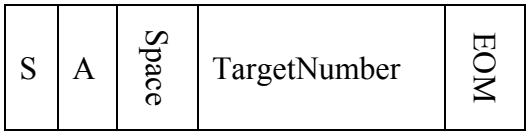
S	E	T	T	A	R	G	E	T	Space	TargetIDString	EOM

- **Input Operand**: TargetNumber - this is a value between 1 and the number of Targets/Filters/Sources on the currently selected axis. Any value out of range will result in an invalid operand.
- **Alternate Representation**: TargetIDString - this is the string representation of the targets. There can be 3 types axes in any system. They are designated, (T)arget Wheel, (F)ilter Wheel and (S)ource Stage. The target position is designated from '01' to 'nn', i.e., the number in the system. The **TargetIDString** can be as follows:
  - T01 to Tnn for Axis Type: Target Wheel
  - S01 to Snn for Axis Type: Source Stage
  - F01 to Fnn for Axis Type: Filter Wheel
  - 'nn' is the number of 'targets' in the system
- **Note**: For target numbers requiring less than 2 digits, such as target 1 to target 9, the **TargetIDString** can be either T1 or T01, etc., whichever is easier to implement.
  A value out of range will result in an invalid operand.
- **Return Values**: None

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6.2.5 SA

- **Summary**: This command moves **Axis1** to the desired Target Position. This is an old style SR80 Command. It is not recommended for new applications.
- **Note**: You must not attempt to move to a new target position while the Axis is in motion. Query the motion status by using the GetAxisStatus Command. This command is replaced by the SetTarget Command and should be not used for new applications.
- SR-80 command format compliance.
- **Reference Command**: SetTarget, GetAxisStatus. SetActiveAxis



- **Input Operand**: TargetNumber. This is a value between 1 and the number of Targets/Filters/Sources on Axis1. Any value out of range will result in an invalid operand.
- **Return Values**: None

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6.2.6 SETACTIVEAXIS

- **Summary**: This command sets the desired axis to be active for Target/Axis operations. There can be only 1 axis active at a time. For systems that have more than 1 axis, such as, a **Target** Wheel and a **Filter** Wheel, or **Source** Stage, use the SetActiveAxis to select the desired wheels.
- **Notes**:
  - The system stores this value and will power-up with the last active axis set.
  - There is an alternate representation of this command, which can be used.
  - You can query the system with the GetActiveAxis command to retrieve the current active axis.
- **Reference Command**: GetActiveAxis, SetTarget

S	E	T	A	C	T	I	V	E	A	X	I	S	Space	AxisNumber	EOM

- **Alternate Representation**:

S	E	T	A	C	T	I	V	E	A	X	I	S	Space	AxisNumberID	EOM

- **Input Operand**: AxisNumber - this is a value between 1 and 4.
- **Alternate Representation**: AxisNumberID - this is a string value between 'Axis1' and 'Axis4'.
- **Return Values**: None
- **Note**: Once the selected axis is set, use the SetTarget command to move the wheel/stage to the desired location.

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6.2.7 GETACTIVEAXIS

- **Summary**: This command retrieves the current active axis String ID in the system. There can be only 1 active axis in the system at any given time.
- **Note**: Use the **SetActiveAxis** command to select the active axis.
- **Reference Command**: SetActiveAxis

G	E	T	A	C	T	I	V	E	A	X	I	S	EOM

- **Input Operand**: None
- **Return Values**: ActiveAxisID - return the Active Axis String ID. This can be one of the following strings; 'Axis1', 'Axis2', 'Axis3', or 'Axis4'. **If there are no valid axes in the system, then it will return an operand error**.

6.2.8 GETNUMBEROFAXES

- **Summary**: This command retrieves the number of axes in the system and their string IDs. It can send up to 5 comma-delimited parameters. The first parameter is the number of axes in the system and the rest are the String IDs for each valid axis. It will always respond with at least one parameter.
  If there are no axes in the system, then the command returns 0.
- **Reference Command**: GetActiveAxis, SetActiveAxis

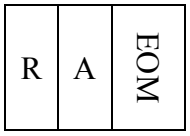
G	E	T	N	U	M	B	R	O	F	A	X	E	S	EOM

- **Input Operand**: None
- **Return Values**:
  - **Return1** - Number of axes in the system. For none, return 0. There can be up to 4 axes in a system.
  - **Return2-5** - **ActiveAxisID**s for each axis in the system.
- **Example**: assume system with two axes and they are connected to Axis1 and Axis2; (Target Wheel and Filter Wheel), then the command will respond: **2**, **Axis1**, **Axis2**

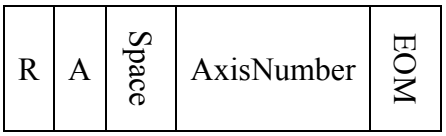
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6.2.9 RA

- **Summary**: This command retrieves the current target position from the selected axis. As long as the selected axis is in motion, then the command will return the last selected target position. Once the axis stops its motion, then the command will return the new current position of the target. Use the **GetAxisStatus** command to query axis motion.
  This is a multifunction command supporting the old style SR80 BlackBody command format and has been expanded to support new functionality for the SR-800R.
  In its base form, no operands are needed. It will return the current target position of **Axis1** in the system.
  In its expanded form it uses a single operand to determine which axis to retrieve the information from.
  If no axes are present in the system, then it will return an **Operand Error**. Use the **GetNumberOfAxes** Command to query for axes in the system prior to using this command.
- SR-80 command format compliance.
- **Reference Command**: GetAxisStatus, SetActiveAxis**,** GetActiveAxis, GetNumberOfAxes



- **Expanded Format**:



- **Input Operand**: None or 1 AxisNumber = A value from 1 to 4 representing the axis to be accessed.
- **Return Values**: The command returns the current target position number for the requested axis. This can be a value from 1 to the number of Targets in the desired axis.
- **Example**: Assume system with 2 axes and they are connected to **Axis1** and **Axis2**; (Target Wheel and Filter Wheel), then the command will respond to the following scenarios:
  - **Axis1** is motion from Target 2 to Target 5.
  - The Host sends a **RA 2** or just the **RA** command. The response will be **2**.
  - **Axis1** stops its motion, and then its response will be **5**.
  - **Axis1** and **Axis2** are in the system and the user uses the **RA 3** command. The response will be Operand Error.

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6.2.10 GETTARGETLIST

- **Summary**: This command returns the current axis's Target List. The user first queries the number of targets that exist for the current axis and then returns the specified Target ID and Target Name Pair. If the input operand is out of range or if there are no targets/axis in the system, then a command operand error occurs. Use the SetActiveAxis to select the desired axis.
- **Reference Command**: GetActiveAxis, SetActiveAxis

G	E	T	T	A	R	G	E	T	L	I	S	T	Space	nOperandVal	EOM

- **Input Operand**: nOperandVal
  - 1 == Get number of Targets (nNumberOfTargets)
  Range (1 - nNumberOfTargets) == Return the Target ID and then the Target Name delimited by a comma.
  Example:
  GetTargetList -1 == Returns a value of **33** for 33 Targets in the system
  GetTargetList 5 == Returns data for target 5, **T05, T05: FB 3.445 cy/mrad**
- **Return Values**: see example above.

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6.2.11 GETTARGETFREQUENCY

- **Summary**: This command retrieves the Spatial 4 Bar Target Frequency of specified target in the axis. This command has no meaning for targets other than 4 Bar.

G	E	T	T	A	R	G	E	T	F	R	E	Q	U	E	N	C	Y	Space	nAxisNumber	Comma	nTargetNumber	EOM

- **Input Operand**: **AxisNumber** - a value that is in the range from 1 to 4 representing the axis to be accessed.
- **TargetNumber**: This is a value between 1 and the number of Targets/Filters/Sources on the currently selected axis.
  Any Value out of range will result in an invalid operand.
- **Return Values**: Return1 - Can return one of the following results:
  - Spatial Frequency in units of cy/Mrad
  - 0 - If Selected Target is not of Type 4Bar then
  - -1 - If the Target Units are not in cy/Mrad, i.e., they are in millimeters (the EFL of the ControlMaster must be set different to 0 - see Section 3.2.3.6.1.1: Axis Setup).

6.2.12 GETAXISEFL

- **Summary**: This command retrieves the selected axis's Effective Focal Length Setting. This command has meaning only for axes that are defined as a Target Wheel. When the EFL is defined that is greater than 0, then the Targets are defined in units of cy/Mrad; otherwise, they are in millimeters.

G	E	T	T	A	X	I	S	E	F	L	Space	nAxisNumber	EOM

- **Input Operand**: AxisNumber - A value that is in the range from 1 to 4 representing the Axis to be accessed.
  Any value out of range will result in an invalid operand.
- **Return Values**: Return1 - can return one of the following results:
  - 0 - Not defined, i.e., Target units are in [mm] for axis's defined as Target Wheel
  - nSize - The size in mm.

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6.2.13 CM

- **Summary**: This command sets the Temperature Control Mode.
- **Note**: This command may take some time. Allow at least 1-2 seconds before checking the mode with the **GetMode** Command.

NOTE

This is an Old Style Command that is used for downward compatibility to CI's SR80 BlackBody Controllers. **NOT** Recommended For Use - see the SETMODE command (Section 6.2.1) for replacement.

C	M	Space	Mode	EOM

- SR-80 command format compliance.
- **Input Operand**: Mode
  - 1 = Absolute
  - 2 = Differential
  - 3 = Differential with Radiometric Offset Correction
- **Return Values**: None.

6.2.14 ECHO

- **Summary**: This command is used to check that the unit is communicating. It echoes the received input message back to the Host.

E	C	H	O	Space	Message String	EOM

- **Input Operand**: Message String - to be echoed back to the Host. The maximum length should not exceed 100 characters.
- **Return Values**: Returns the message string.

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6.2.15 SETPRESET

- **Summary**: This command is used to activate the requested Preset Number. Presets can be generated by the ControlMaster (see Section 3.2.3.2: Preset Setup). Query the ControlMaster with the **GetMaxPresetCount** command to find out the current number of presets in the system. It should be done prior calling to **SetPreset**. If an invalid Preset is sent, the ControlMaster responds with an Operand Error.
- **Reference Commands**: GetMaxPresetCount

S	E	T	P	R	E	S	E	T	Space	PresetNumber	EOM

- **Input Operand**: PresetNumber - A valid Preset Number that is in the system. The user must know in advance the current number of presets in the system (see **GetMaxPresetCount**)
- **Return Values**: None

6.2.16 GETMAXPRESETCOUNT

- **Summary**: This is used to return the current number of Presets that are defined in the controller.
- **Reference Commands**: SetPreset

G	E	T	M	A	X	P	R	E	S	E	T	C	O	U	N	T	EOM

- **Input Operand**: None
- **Return Values**: MaxPresetCount - The current number of Presets in the system.

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6.2.17 GETINPUTSTATUS

- **Summary**: This command is used to get the current status of the selected Input IO.

G	E	T	I	N	P	U	T	S	T	A	T	U	S	Space	InputChannel	EOM

- **Input Operand**: InputChannel - There are 2 input digital IO channels in the system. Valid values are either **1** or **2**.
  If no InputChannel number is provided then the command will default to InputChannel 1.
- **Return Values**:
  - 0 = Low
  - 1 = High

6.2.18 OUTPUTENABLE

- **Summary**: This command is used to enable the IO Output Driver circuitry. This command must precede any activity that uses the IO Output Port. See the related **SETOUTPUT** t command hat is used to control the state of the output.
- **Reference Command**: SETOUTPUT

O	U	T	P	U	T	E	N	A	B	L	E	Space	State	EOM

- **Input Operand**: **S**tate - State can be either 0 for OFF (Disabled) or 1 for ON (Enabled)
- **Return Values**: None

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6.2.19 SETOUTPUT

- **Summary**: This command is used to set the state of the desired IO Output. There are five IO Outputs that can be controlled. Before you can use these IO Outputs, you must enable them by calling the **OUTPUTENABLE** command.
- **Reference Command**: OUTPUTENABLE

S	E	T	O	U	T	P	U	T	Space	OutputNumber	Comma	State	EOM

- **Input Operand**: OutputNumber - can be a value of from 1 to 5.
  State - State can be either 0 for OFF (Disabled) or 1 for ON (Enabled)
- **Return Values**: None

6.2.20 GETMODE

- **Summary**: This is used to get the current the current temperature control mode.
- **Reference Command**: SetMode.

G	E	T	M	O	D	E	EOM

- **Input Operand**: None.
- **Return Values**:
  - 1 = Absolute.
  - 2 = Differential.
  - 3 = Differential with Radiometric Offset Correction

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6.2.21 *IDN?

- **Summary**: This command is used to display the Controller Identification from a GPIB communications device. A controller will respond to this command by sending the following information: Controller Model (SR-800R, SR200, etc.), Controller Serial Number, and its Software Version.
- **Note**: This command is a **GPIB** specific command which when used, interrogates the GPIB Bus to identify controllers that are connected in the system. This will not work for RS232/Ethernet communications mode.
- **Reference Command**: None

*	I	D	N	?	EOM

- **Input Operand**: None
- **Return Values**: Returns Controller Identification with its Serial Number.

6.2.22 GETTARGETTEMPERATURE

- **Summary**: This command is used to return the current Target Sensor Temperature. When no target exists in the system then an **Invalid Operand** Message is returned.
- This command replaces the RT command.

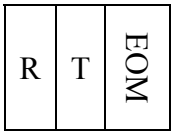
G	E	T	T	A	R	G	E	T	T	E	M	P	E	R	A	T	U	R	E	EOM

- **Input Operand**: None.
- **Return Values**: Target Sensor Temperature with 3-digit accuracy.

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6.2.23 RT

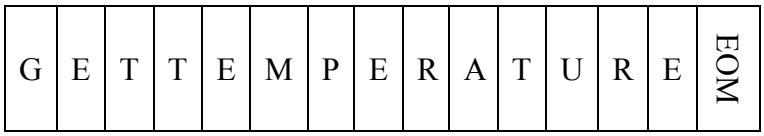
- **Summary**: This command is used to get the current Target temperature.
- **Note**: An old style SR-80 command - should not be used for new applications. It is replaced by the GetTargetTemperature command.



- SR-80 command format compliance.
- **Input Operand**: One.
- **Return Values**: Current Target Temperature with 3-digit accuracy.

6.2.24 GETTEMPERATURE

- **Summary**: This command is used to display the current temperature of the system depending on the current Temperature Control mode, i.e., if Mode =1, then the returned temperature is the Absolute Temperature. If Mode = 2, then the Differential Temperature is returned.



- **Input Operand**: None.
- **Return Values**: The Current Temperature with 3-digit accuracy.

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6.2.25 ISTEMPERATURESTABLE

- **Summary**: Use this command to monitor whether the temperature has reached a stable condition.
- **Note**: If this command is called immediately after calling the SetTemperature or ST commands, then it may not show that the temperature is not stable. Wait one (1) second before using this command.

I	S	T	E	M	P	E	R	A	T	U	R	E	S	T	A	B	L	E	EOM

- **Input Operand**: None.
- **Return Values**:
  - 0 = No
  - 1 = Yes

6.2.26 RD

- **Summary**: This command is used to get the current differential temperature, i.e., the difference between the emitter and the ambient (Target) temperature.

R	D	EOM

- SR-80 command format compliance.
- **Input Operand**: None.
- **Return Values**: Current Differential Temperature with 3-digit accuracy.

6.2.27 RE

- **Summary**: This command is used to get the current emitter temperature.

R	E	EOM

- SR-80 command format compliance.
- **Input Operand**: None.
- **Return Values**: Current Emitter Temperature with 3-digit accuracy.

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6.2.28 SETTEMPERATURE

- **Summary**: This command is used to set the current temperature of the ControlMaster. This is dependent on the current temperature operating mode, i.e., Absolute or Differential. If the temperature is out of the working range of the unit, then an **Operand Error** will occur.
- **Note**: This command replaces the **ST** command for new applications.
- **Reference Commands**: GETTEMPERATURERANGE, SETMODE.

S	E	T	T	E	M	P	E	R	A	T	U	R	E	Space	TemperatureValue	EOM

- **Input Operand**: TemperatureValue - This is the desired set point value of the temperature. It is a numeric value with up to 3-digit decimal point accuracy.
- **Return Values**: None.

6.2.29 ST

- **Summary**: This command is used to set the current temperature of the ControlMaster. This is dependent on the current temperature operating mode, i.e., Absolute or Differential. If the temperature is out of the working range of the unit, then a **Operand Error** will occur.
- **Note**: This is an old style SR-80 command. It is not recommended for use in new applications. It is replaced by **SetTemperature**.
- **Reference Command**: SetTemperature

S	T	Space	TemperatureValue	EOM

- SR-80 command format compliance.
- **Input Operand**: TemperatureValue - This is the desired set point value of the temperature. It is a numeric value with up to 3-digit decimal point accuracy.
- **Return Values**: None.

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6.2.30 RR

- **Summary**: This command is used to get the radiometric offset value. This value has meaning only if the SetMode is 3, i.e., differential with radiometric offset.
- **Reference Command**: SetMode, GetMode

R	R	EOM

- SR-80 command format compliance.
- **Return Values**: RadiometricOffset - returns the current offset value with 3-digit accuracy.

6.2.31 SR

- **Summary**: This command is used to set the radiometric offset value. This value has meaning only if the SetMode is 3, i.e., differential with radiometric offset.
- **Reference Command**: SetMode, GetMode

S	R	dRadiometricOffset	EOM

- SR-80 command format compliance.
- **Input Operand**: dRadiometricOffset - set the current offset value with 3-digit accuracy. The range is between (+/-) 1 Degrees.

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6.2.32 GETSYSTEMINFO

- **Summary**: Use this command to retrieve general system information. The command returns the system parameters depending on the input operand request value. Up to 7 different System Parameters can be returned.

G	E	T	S	Y	S	T	E	M	I	N	F	O	Space	nInfoRequest	EOM

- **Input Operand**: nInfoRequest.
- **Return Values**:
  - For nInfoRequest == 1 - String - Controller Model.
  - For nInfoRequest == 2 - String- Controller SN (may be alphanumeric).
  - For nInfoRequest == 3 - String - Head Model.
  - For nInfoRequest == 4 - String - Head SN.
  - For nInfoRequest == 5 - String - Software Version.
  - For nInfoRequest == 6 - String - Application Name.
  - For nInfoRequest == 7 - String - Computer Name.

6.2.33 GETABSOLUTESETPOINT

- **Summary**: Use this command to return the current absolute temperature set point.

G	E	T	A	B	S	O	L	U	T	E	S	E	T	P	O	I	N	T	EOM

- **Input Operand**: None
- **Return Values**: The current absolute temperature set point with 3-digit resolution

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6.2.34 GETDIFFERENTIALSETPOINT

- **Summary**: Use this command to display the current differential temperature set point.

G	E	T	D	I	F	F	E	R	E	N	T	I	A	L	S	E	T	P	O	I	N	T	EOM

- **Input Operand**: None
- **Return Values**: The current differential temperature set point with 3-digit resolution

6.2.35 SETCOMPUTERNAME

- **Summary**: This command sets the computer name of the ControlMaster. It is used to easily identify different ControlMasters in the system. It is like a nickname for the unit.

S	E	T	C	O	M	P	U	T	R	N	A	M	E	Space	StringName	EOM

- **Input Operand**: StringName - This is the alphanumeric computer name to set. The name should not be longer than 20 characters. It can include spaces. No special characters are allowed, such as '\' or '*' or carriage return.
- **Return Values**: None

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6.2.36 GETTEMPERATURERANGE

- **Summary**: Use this command to return the absolute and differential temperature ranges of the controller. Return 4 values delimited by commas.
- **Notes**:
  - For an Absolute Head Model only, the values returned for the minimum/maximum differential temperatures will be 0 (see Return3 and Return4).
  - This command replaces the RG command for new applications.

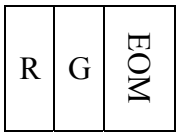
G	E	T	T	E	M	P	E	R	A	T	U	R	E	R	A	N	G	E	EOM

- **Input Operand**: None.
- **Return Values**:
  - Return1 - double - Minimum Absolute Temperature.
  - Return2 - double - Maximum Absolute Temperature.
  - Return3 - double - Minimum Differential Temperature.
  - Return4 - double – Maximum Differential Temperature.

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6.2.37 RG

- **Summary**: Use this command to return the absolute and differential temperature ranges of the controller. The command returns the maximum/minimum temperature pair of the current working mode of the controller (i.e., Absolute or Differential).
- **Note**: This is an old style SR-80 command that is used for backward compatibility to CI SR80 BlackBody Controllers. Not recommended for use. See replacement command, **GetTemperatureRange**.
- **Reference Command**: GETTEMPERATURERANGE

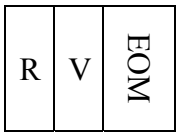


- SR-80 command format compliance.
- **Input Operand**: None
- **Return Values**:
  - Return1 - Integer - Maximum Absolute/Differential Temperature
  - Return2 - Integer - Minimum Absolute/Differential Temperature

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6.2.38 RV

- **Summary**: Use this command to retrieve the Controller Software Version.
- **Note**: This is an old style SR-80 command that is used for backward compatibility to CI SR-80 Blackbody Controllers. Not recommended for use. See replacement command, **GetSystemInfo**.
- **Reference Command**: GETSYSTEMINFO



- SR-80 command format compliance.
- **Input Operand**: None
- **Return Values**: Returns a string with the following information:
  - Company Name
  - Controller Model
  - Software Version
  - Controller Serial Number, e.g., **CI SR-800R V2.01 05SSR-800RC123451**

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6.2.39 GETBITERROR

- **Summary**: Use this command to retrieve the current online BIT (Built-In Test) Error Message Queue. This command can be used to query the system for controller errors. As long as there are no BIT errors, the command responds with the 'OK' string; otherwise a String FIFO Queue of the BIT Errors is outputted. This, however, is done only on demand, that is, the error messages are queued in the system until queried by the Host/User with the **GETBITERROR** command. Once all the stored messages in the queue have been retrieved, the command will display the OK message. This message is displayed until there is a new BIT error in the system.
- **Notes**:
  - If a BIT error occurs, this means some serious problem has occurred with the ControlMaster. It probably means that the Controller requires some attention and that the temperature control mechanism has been turned Off.
  - The BIT Error Messages includes the error number that can be used for troubleshooting (see Section 5.3: Troubleshooting).
  - The BIT Error Messages also includes system warning messages with their message ID that can be used for troubleshooting (see Section 5.3: Troubleshooting).

G	E	T	B	I	T	E	R	R	O	R	EOM

- **Return Values**: BITStringValue - This string is usually the 'OK' String unless there is a BIT Error. It then outputs the BIT Error Message.

6.2.40 DM

Summary: This command is used to set the Display Mode. This command is for backward compatibility to the SR80. It is essentially a dummy command (NOP). There is no need for this in the ControlMaster. **All the input values will have no effect**. It should not be used for new applications.

D	M	Space	nValve	EOM

- **Input Operand**:
  nValue - 1, 2, or 3.

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6.2.41 CALIBRATETOUCHPANEL

- **Summary**: Use this command to recalibrate the Touch Panel.

C	A	L	I	B	R	A	T	E	T	O	U	C	H	P	A	N	E	L	EOM

- **Input Operand**: None
- **Return Values**: None

6.2.42 SETREMOTETYPE

- **Summary**: Use this command to set the remote communications type between the Host Computer and the ControlMaster.
- **Note**: After sending this command, wait at least 5 seconds and then reboot the ControlMaster for the changes to take effect.

S	E	T	R	E	M	O	T	E	T	Y	P	E	Space	strRemoteType	EOM

- **Input Operand**: strRemoteType - Can be either **'Ethernet'**, **'GPIB'** or **'RS232'**
- **Return Values**: None

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6.2.43 Computer-to-GPIB Serial Poll Procedure

NOTE

This is a GPIB only command!

6.2.43.1 Description

The read status command indicates if long term operations have ended.

The response to this command is a single character. This character should be interpreted bit-by-bit. The status byte can be read by querying the Controller serially. This can be done at any time by the computer; although the Controller never initiates a Service Request (SRQ).

6.2.43.2 Response

- The Least Significant Bit (Bit #0) gives an indication of the Targets-Wheel (RAD) status:
  - A value of "0" means that the wheel is rotating,
  - A value of "1" means that the wheel has reached its final position.
- Bits #1, #2, and #4 are useable on the CTS-1 only.
- Bit #3 gives temperature status: a value of "1" means that the set point temperature has been reached.
- All other bits are set to "0".

(LSB)	0	Target Wheel	"0" = Rotating
	1	RAD SYNC	"1" = SYNC was found
	2	CTS-1 Stage	"0" = moving
	3	Temperature Stable	"1" = READY
	4	CTS-1 Stage Home	"1" = Home
	5	---	Always "0"
	6	Service Request	Always "0"
(MSB)	7	---	Always "0"

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7. Removable Sensors

This chapter describes the Removable Emitter Sensor removal and installation procedures that are performed on two types of blackbodies.

IMPORTANT

It is essential to update the calibration tables after replacing the Emitter and/or Temperature sensors!

7.1 General

The process of the Removable Sensor replacement includes two main stages:

- Replacement of the Sensor
- Update of the Calibration Table (a must!)

The following sections provide the procedures:

- Section 7.2: Emitter Sensor Replacement
- Section 7.3: Target Sensor Replacement
- Section 7.4: Updating the Calibration Tables

CAUTION

Shut down the power supply prior to any action taken. Allow adequate time for the Emitter to cool down.

Avoid bending the sensor wire and the connections between wire to sensor/USB connector. The sensor is fragile - take care.

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7.2 Emitter Sensor Replacement

This section includes step-by-step procedures for replacing the Emitter sensor in the following blackbody types:

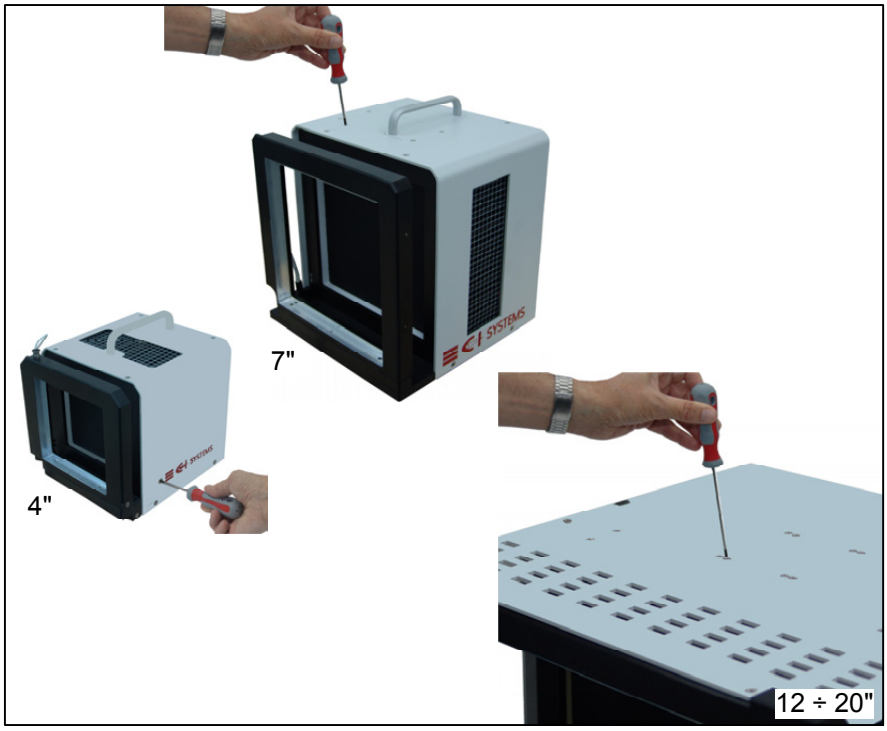
- 4 ÷ 20" Blackbodies (see Section 7.2.1)
- 2" Blackbodies (see Section 7.2.2)

7.2.1 4 ÷ 20" Blackbodies

7.2.1.1 Removal

1. Remove the screws securing the Sensor Cover:

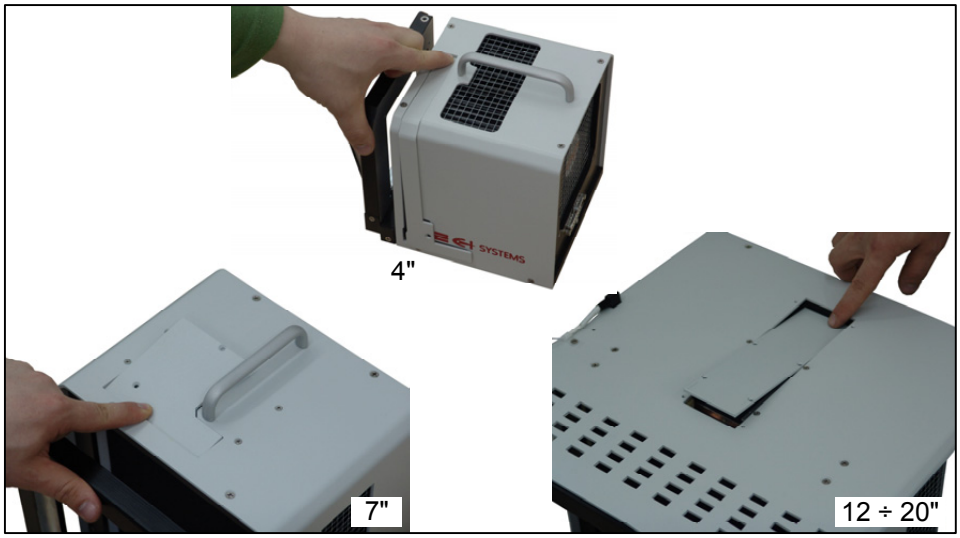
Figure 7-1: Typical Sensor Cover Removal/Installation (1 of 2)



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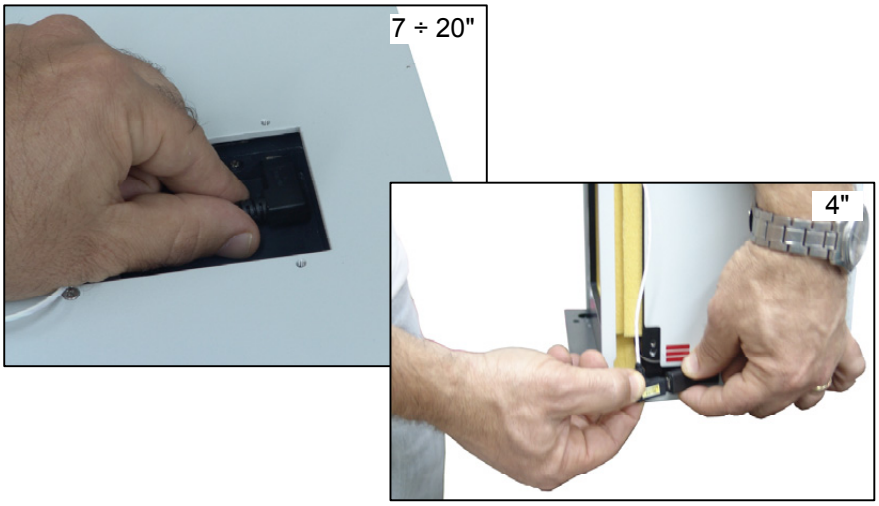
2. Carefully remove the Sensor Cover by pressing on the cover:

Figure 7-2: Typical Sensor Cover Removal/Installation (2 of 2)



3. Disconnect the Sensor male connector from the Blackbody:

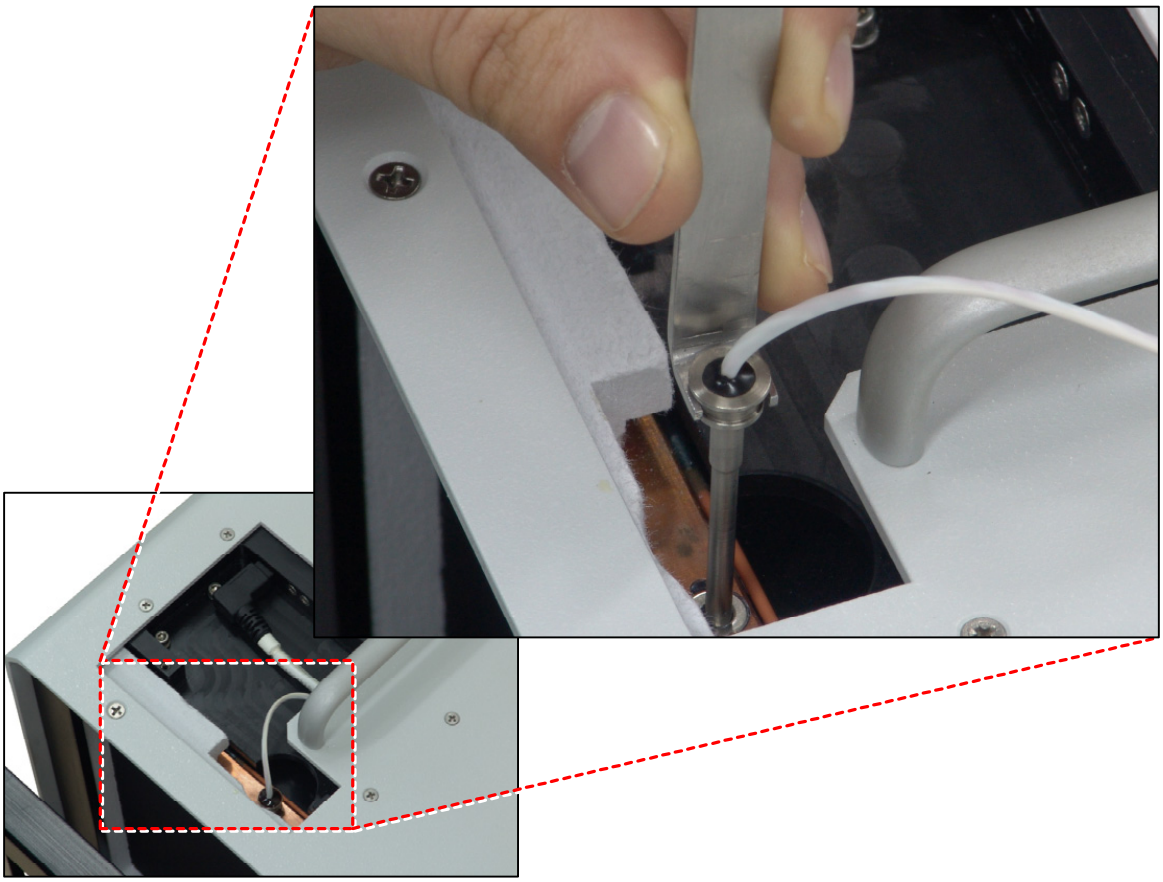
Figure 7-3: Sensor Cable-connector (typical)



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4. Pull out the Emitter Sensor from its port using the dedicated jig:

Figure 7-4: Emitter Sensor Replacement (typical)



NOTE

The inserted sensor is held in place by way of a built-in magnet; therefore, a reasonable force is required to separate the sensor from its port.

5. Remove the sensor and store it in its package to avoid damage.

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6. Clean the Sensor port using the plastic straw that has been supplied:
   a. Insert the plastic straw into the Sensor port.
   b. Rotate the plastic straw several times in the Sensor port.
   c. Remove the plastic straw from the Sensor port.

Figure 7-5: Sensor Port Cleaning (typical)

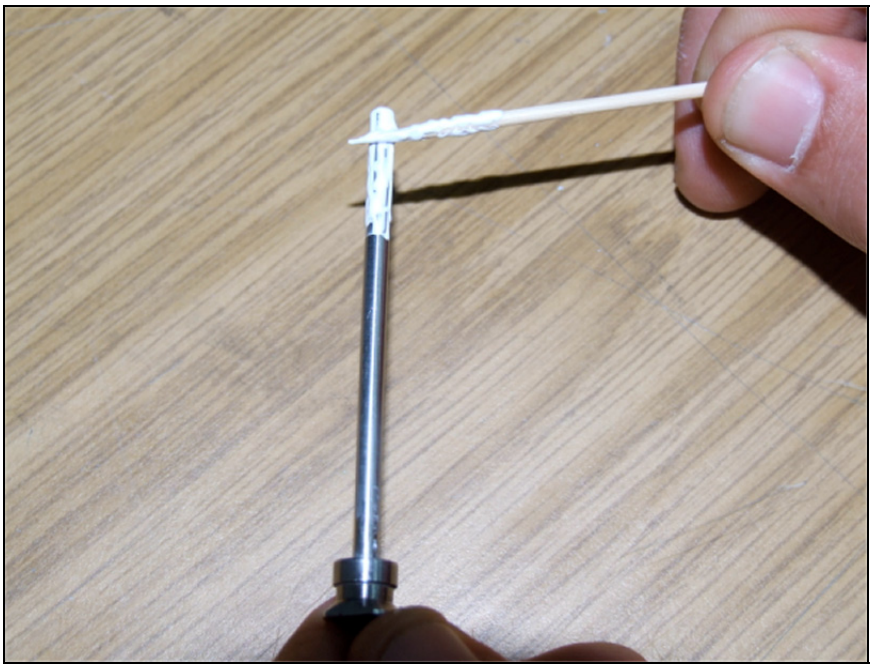


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7.2.1.2 Installation

1. Apply a thin layer of thermal grease (supplied with the kit) on the bottom section of the sensor (approx. 1cm on the free end of the sensor), using a toothpick:

Figure 7-6: Greasing the Sensor



2. Insert the sensor into the Emitter port until the magnet secures it.
3. Connect the Sensor male connector to the Blackbody (see Figure 7-3).
4. Arrange the sensor's wiring so that the installing the cover will not damage it.
5. Place the Sensor Cover and tighten the cover fasteners (see Figure 7-1).

NOTE

When placing the sensor cover ensure that there is no obstruction and the cover closes easily. Do not use excessive force.

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7.2.2 2" Blackbodies

7.2.2.1 Removal

1. Disconnect the Emitter Sensor cable-connector (marked as **EMT**):

Figure 7-7: Emitter Sensor Cable-Connector (2" Blackbodies)



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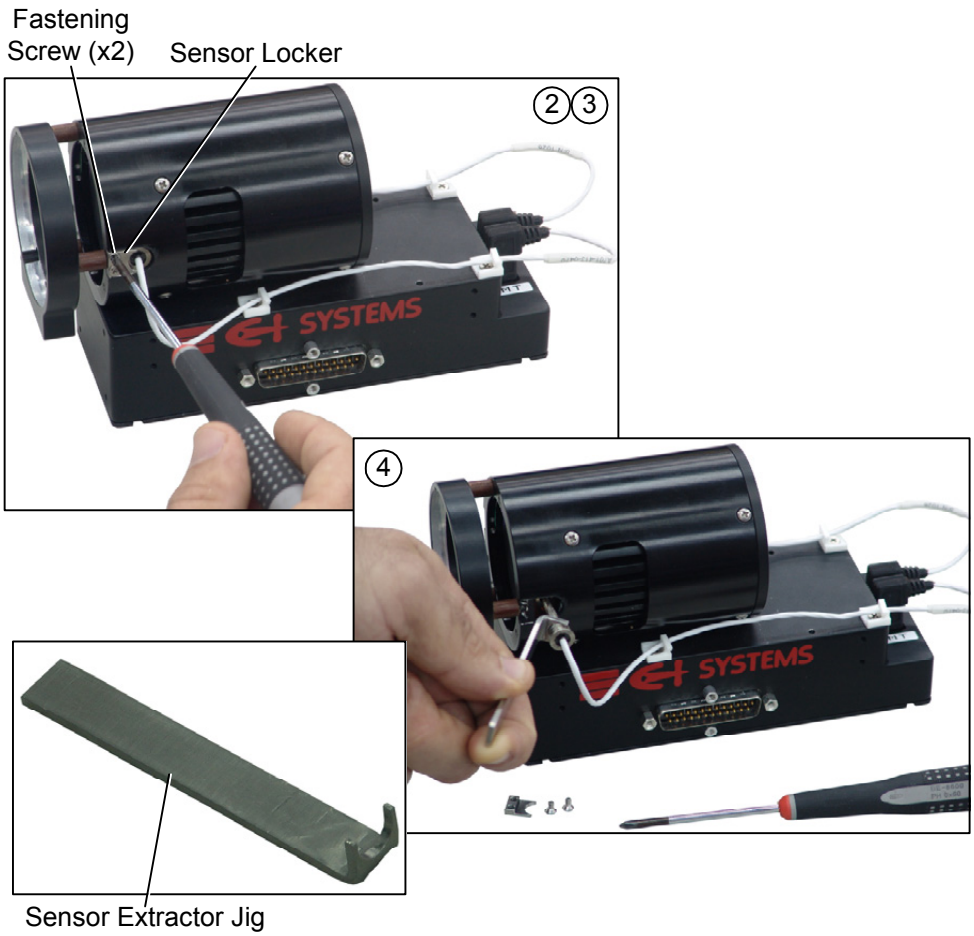
2. Remove the two Phillips screws securing the Sensor Locker to the Blackbody.
3. Remove the Sensor Locker (see Figure 7-8).

NOTE

The inserted sensor is held in place by way of a built-in magnet; therefore, a reasonable force is required to separate the sensor from its port.

4. Remove the Emitter Sensor using the **Sensor Extractor Jig** (the jig is supplied with the new sensors):

Figure 7-8: Emitter Sensor Replacement (2" Blackbodies)



5. Store the sensor in its package to avoid damage.

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7.2.2.2 Installation

1. Clean the Sensor port using the plastic straw (supplied with the new sensor):
   a. Insert the plastic straw into the Sensor port.
   b. Rotate the plastic straw several times in the Sensor port.
   c. Remove the plastic straw from the Sensor port.
2. Apply a thin layer of thermal grease (supplied with the new sensor) on the bottom section of the sensor (approx. 1 cm on the free end of the sensor), using a toothpick (see Figure 7-6).
3. Insert the sensor into the port until the magnet secures it (see Figure 7-8).
4. Place the Sensor Locker and secure using the two screws (see Figure 7-8).
5. Connect the Sensor cable-connector (marked as **EMT**, see Figure 7-7).
6. Arrange the sensor cable.

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7.3 Target Sensor Replacement

This section includes step-by-step procedures for replacing the Target sensor in the following blackbody types:

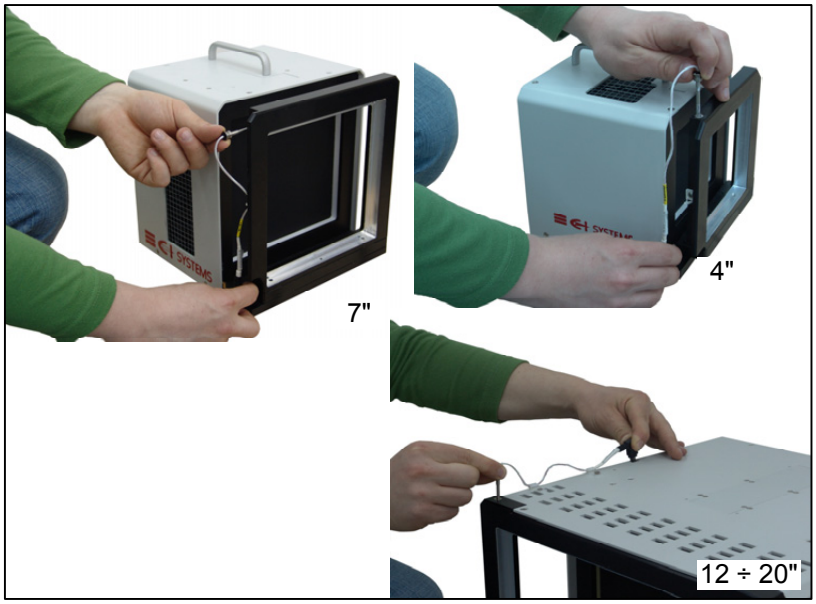
- 4 ÷ 20" Blackbodies (see Section 7.3.1)
- 2" Blackbodies (see Section 7.3.2)

7.3.1 4 ÷ 20" Blackbodies

7.3.1.1 Removal

1. Disconnect the Sensor male connector from the Blackbody:

Figure 7-9: Sensor Cable-Connector (typical)



2. Hold the sensor itself and carefully pull it out (do not pull it by its cable).

NOTE

The inserted sensor is secured to the emitter by way of a built-in magnet. Therefore, a reasonable force is required to separate the sensor from the emitter.

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3. Remove the sensor and store it in its package to avoid damage.
4. Clean the Sensor port using the plastic straw that has been supplied:
   a. Insert the plastic straw into the Sensor port.
   b. Rotate the plastic straw several times in the Sensor port.
   c. Remove the plastic straw from the Sensor port.

7.3.1.2 Installation

1. Apply a thin layer of thermal grease (supplied with the kit) on the bottom section of the sensor (approx. 1cm on the free end of the sensor), using a toothpick (see Figure 7-6).
2. Insert the sensor into the Emitter port until the magnet secures it.
3. Connect the Sensor male connector to the Blackbody (see Figure 7-9).

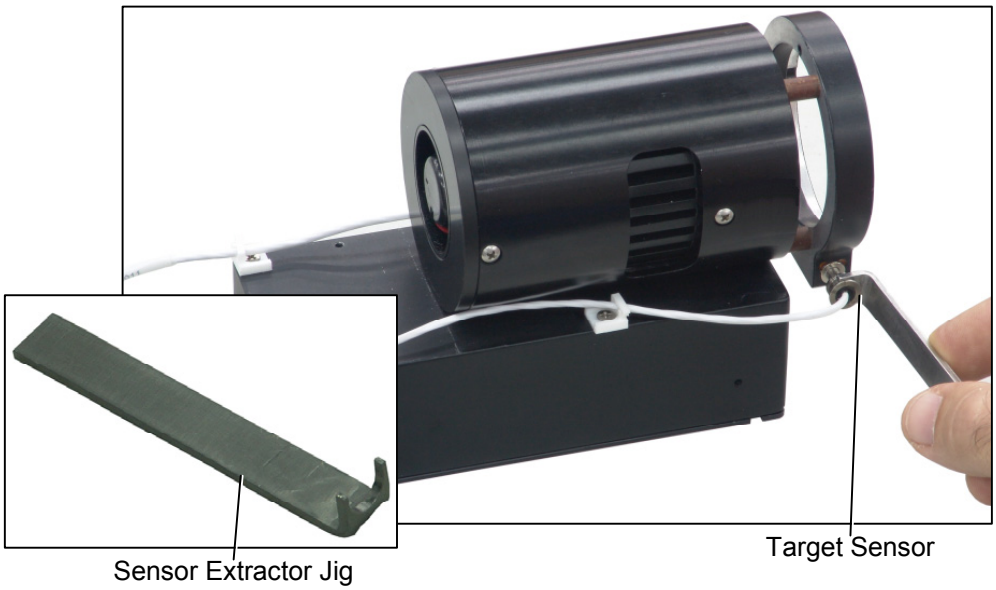
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7.3.2 2" Blackbodies

7.3.2.1 Removal

1. Disconnect the Target Sensor cable-connector (marked as **TRG**, see Figure 7-7).
2. Remove the Target Sensor using the **Sensor Extractor Jig** (the jig is supplied with the new sensors):

Figure 7-10: Target Sensor Replacement (2" Blackbodies)



NOTE

The inserted sensor is held in place by way of a built-in magnet; therefore, a reasonable force is required to separate the sensor from its port.

3. Store the sensor in its package to avoid damage.

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7.3.2.2 Installation

1. Clean the Sensor port using the plastic straw (supplied with the new sensor):
   a. Insert the plastic straw into the Sensor port.
   b. Rotate the plastic straw several times in the Sensor port.
   c. Remove the plastic straw from the Sensor port.
2. Apply a thin layer of thermal grease (supplied with the new sensor) on the bottom section of the sensor (approx. 1cm on the free end of the sensor), using a toothpick (see Figure 7-6).
3. Insert the sensor into the port until the magnet secures it (see Figure 7-10).
4. Connect the Sensor cable-connector (see Figure 7-7).
5. Arrange the sensor cable.

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7.4 Updating the Calibration Tables

This section provides step-by-step instructions on how to download the new replaced sensor calibration data into the blackbody.

7.4.1 Required Equipment

- A PC with WIN-XP Operating System.
- One of the following communication methods: an available RS232 port, Ethernet port or NI GPIB XP card installed in the PC.

7.4.2 Prerequisites

Install the Removable Sensor Utilities program:

1. Launch the Removable Sensor Utilities installation CD.
2. Follow the prompts (do not change all default settings). At the end of installation, the Removable Sensor Utilities icon is added to your Desktop.

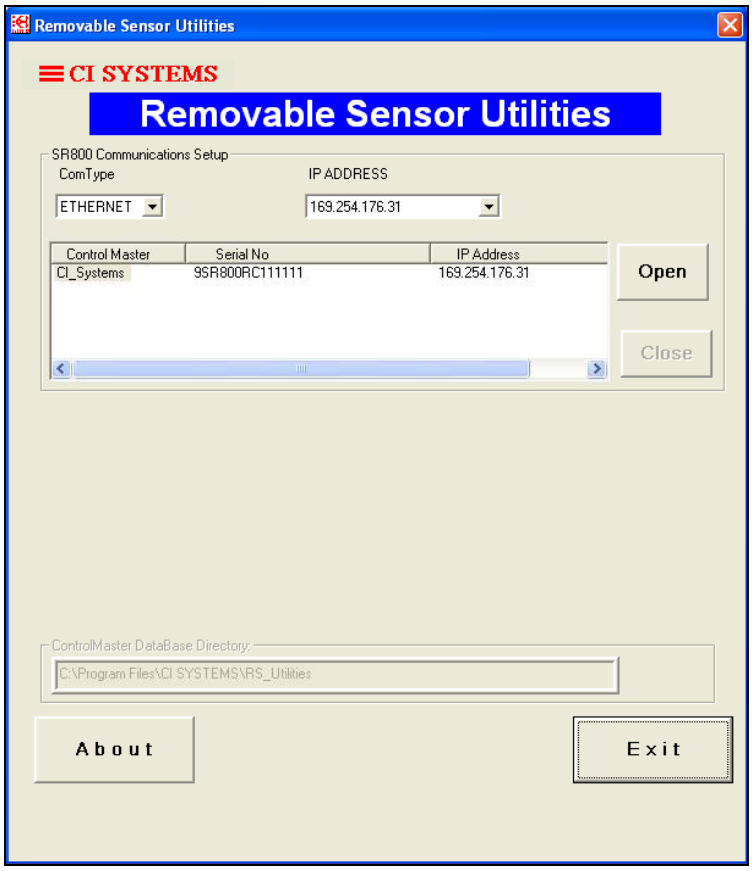
7.4.3 Procedure

1. Preparations:
   a. Pending on your preferable communication protocol (RS232, Ethernet or GPIB), connect the SR-800R Controller to the PC.
   b. Switch ON the SR-800R Controller (see Figure 3-1) and wait until the completion of the BIT sequence.
   c. Switch ON the PC.
   d. Launch the Calibration CD (the Calibration CD is found in the supplied Removable Sensor Kit).

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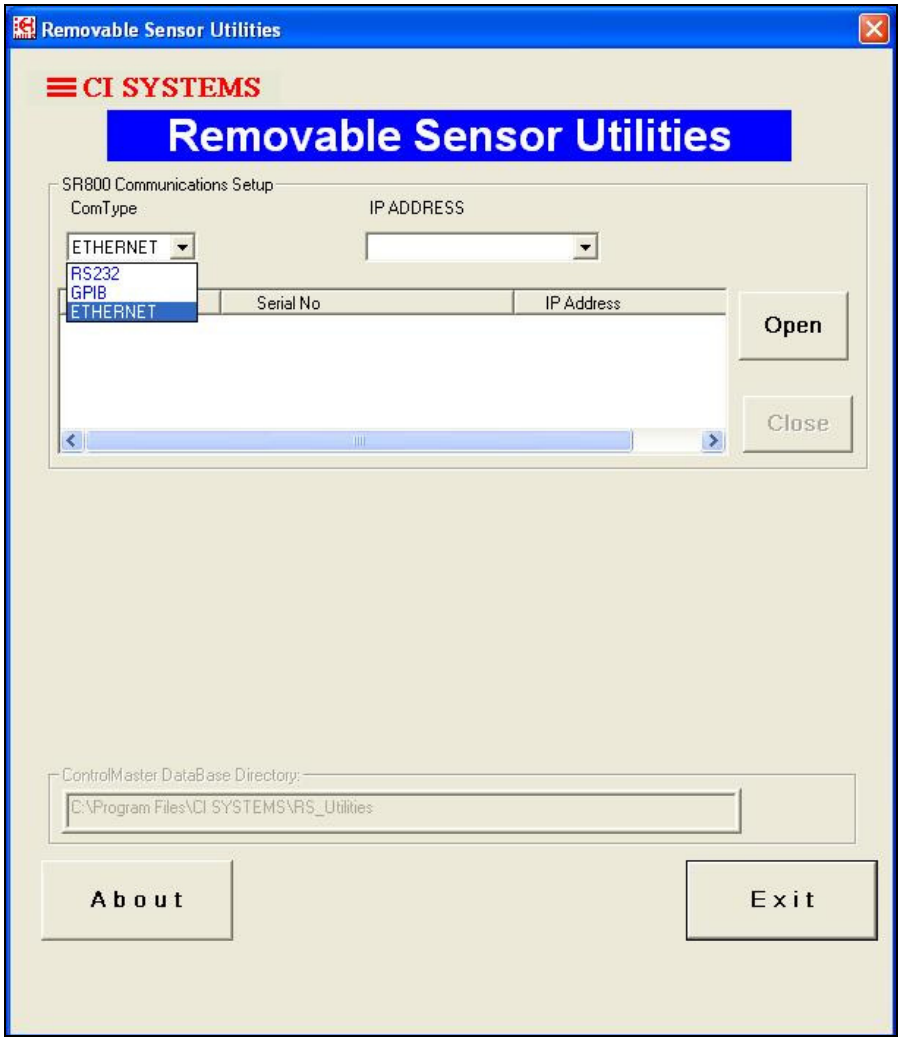
2. Launch the Removable Sensor Utilities program. The Removable Sensor Utilities program opens with the last selections (Ethernet in this example):

Figure 7-11: Removable Sensor Utilities Main Window



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3. Select one of the following the communication protocols, depending on your preferable communication protocol and Controller-to-PC cable connection:
   a. **Ethernet**:
      - From the **ComType** dropdown list select **Ethernet**. The following opens:

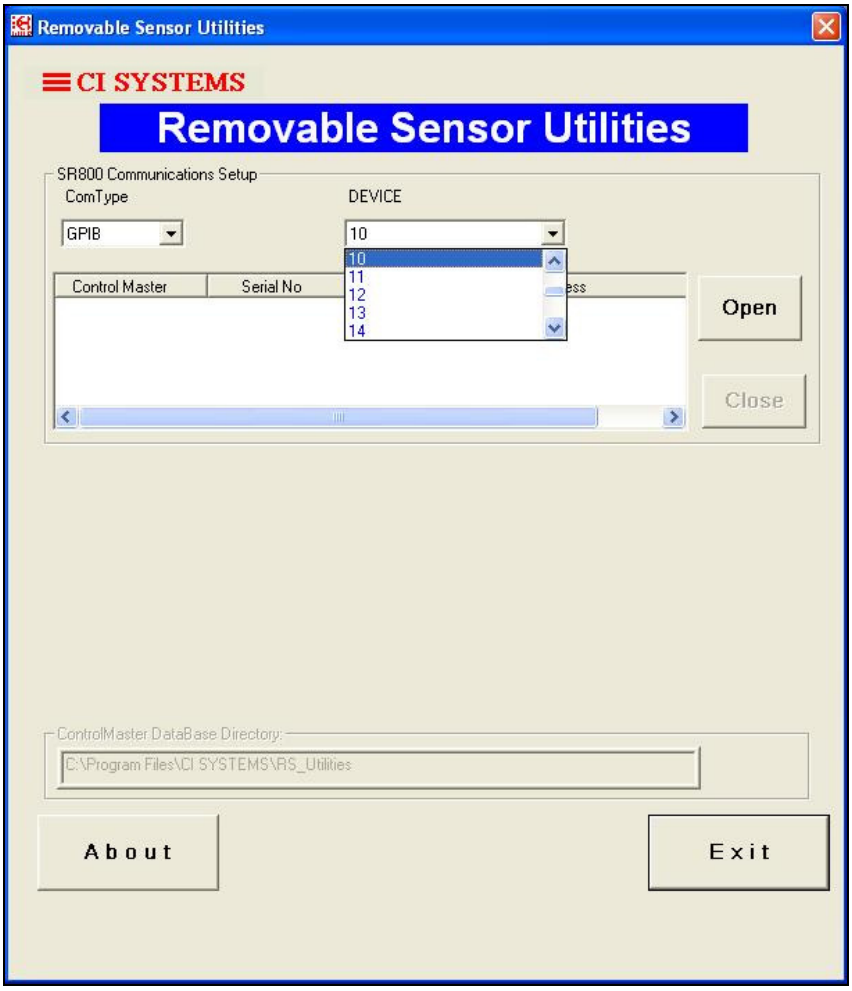


      - Enter the Controller IP Address in the **IP ADDRESS** field (the address can be viewed in the Controller About window).

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b. **GPIB**:

- From the **ComType** dropdown list select **GPIB**. The following opens:

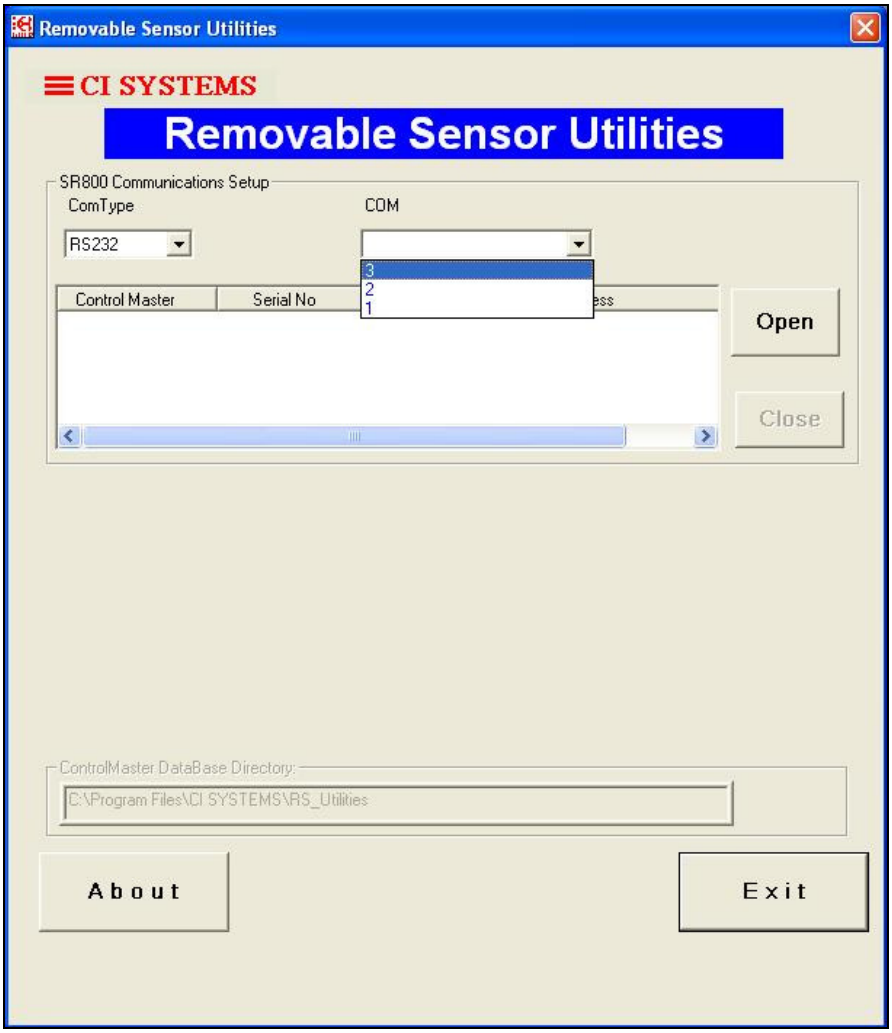


- Select the Controller GPIB Address from the **DEVICE** drop-down list (the address can be viewed in the Controller About window).

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c. **RS232**:

- From the **ComType** dropdown list select **RS232**. The following opens:



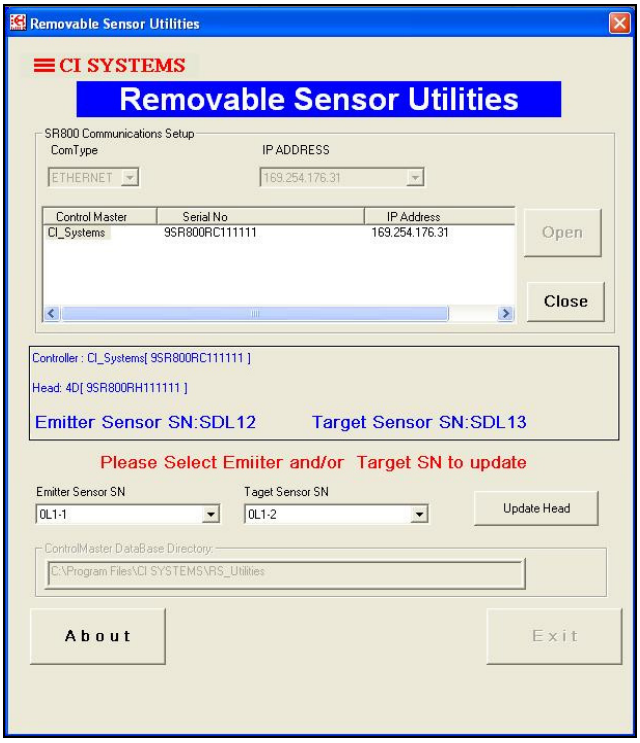
- Select the Controller COMM Address from the **COM** drop-down list (the address can be viewed in the Controller About window).

4. Select the connected controller from the **Control Master** list.

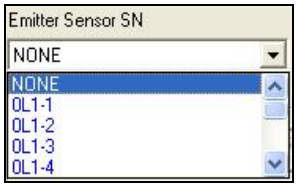
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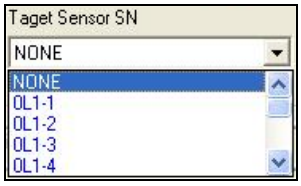
5. Click Open. Within a few seconds the following opens:

Figure 7-12: Emitter Sensor and/or Target Sensor Selection



6. Select the **Emitter Sensor S/N** and/or the **Target Sensor S/N** from the dropdown lists (the S/Ns are found in the supplied Removable Sensor Kit). Examples of the lists:



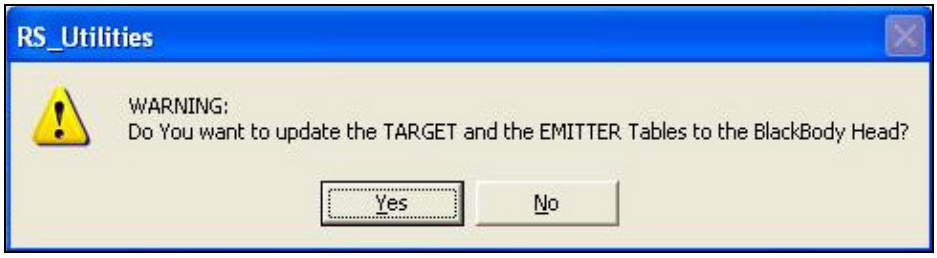


Upon selection, the Update Head becomes active.

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7. Click Update Head. The following dialog box opens:

Figure 7-13: Calibration Tables Update Approval



8. Click Yes. The Calibration Data is now downloaded into the Blackbody while the following opens:



9. Upon completion, the following opens prompting to restart the Controller:



10. Switch the Controller OFF and then ON. This completes the process.
11. Open the About window and check that the Te S/N and/or the Tt S/N values are updated according to the S/N of the new sensors.

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8. SR-800R Blackbody Refrigerated Circulator for LT Blackbody Option

This chapter provides instructions for setting up, operating, handling and dismantling the circulation system.

The chapter is comprised of the following sections:

- Section 8.1: Deliverables
- Section 8.2: Safety Precautions
- Section 8.3: Overview
- Section 8.4: Assembling the System
- Section 8.5: Disassembling the System
- Section 8.6: Hood (optional)



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8.1 Deliverables

- SR-800R Blackbody, consisting of:
  - Temperature Controller
  - Blackbody
  - Connection cables: Power cable, Head cable, RS-232 cable
  - Hood (optional)
- Refrigerated Circulator, consisting of:
  - Julabo Refrigerator unit
  - Cooling fluid
  - Two insulated pipes
  - Power cables
  - 100/220 VAC transformer (supplied only with the 100 V option)
  - Julabo Circulation System Operating Manual

8.2 Safety Precautions

- Read all safety instructions stated in the *Julabo Circulation System Operating Manual.*
- Hazards are posted throughout this manual and the *Julabo Circulation System Operating Manual.* Follow these hazards to avoid possible injuries to personnel and damage to equipment. Always follow your local safety precautions.
- Note that the refrigerator's total power consumption is 3,100W, use a suitable plug and power outlet.
- Exercise care never to spill cooling fluid on the Blackbody.
- Before starting the circulator, check the cooling fluid level. It must be higher than the heater/refrigerator coils.
- After running the circulator for a short time, check the cooling fluid level again. It may drop as the fluid fills the circulation piping. If it does, refill to the required level.
- If you intend to operate the SR-800R at low temperatures or sub-freezing temperatures, make sure that the Blackbody is placed in a humidity-free chamber; otherwise, ice/condensing will form on emitter plate.

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8.3 Overview

The SR-800R Refrigerated Circulation for the Low-Temperature Blackbody option system has been fitted with a fluid cooling and circulation system.

This system pumps a cooled/heated fluid into a network of cavities inside the Blackbody heatsink, in order to cool / heat it to temperatures selected using the SR-800R Controller.

The Low Temperature Blackbody includes the following:

- Julabo Circulation System (see Section 8.3.1)
- Blackbody (see Section 8.3.2)

8.3.1 Julabo Circulation System

For a description on the Julabo Circulation System refer to the *Julabo Circulation System Operating Manual*.



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8.3.2 Blackbody

Two types of Blackbodies are available: Differential and Absolute.

The Differential Blackbody components are:

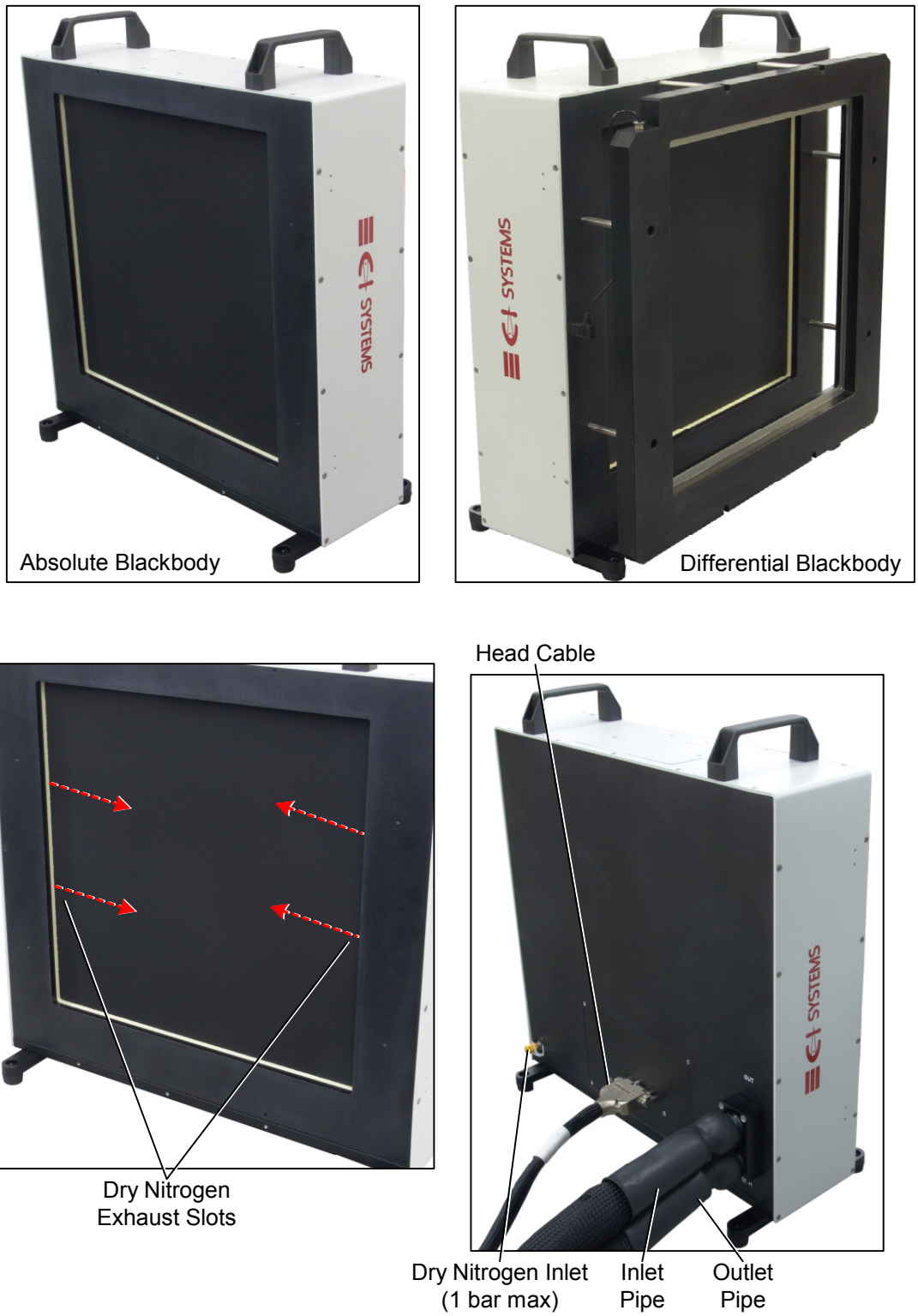
- **Head Cable**: the SR-800R Controller-to-Blackbody cable.
- **Inlet Pipe**: a pipe connecting the Julabo Circulation System to the Blackbody.
- **Outlet Pipe**: a pipe connecting the Blackbody to the Julabo Circulation System.
- **Dry Nitrogen Inlet**: external Dry Nitrogen inlet connector (1 bar max).
- **Dry Nitrogen Exhaust Slots**: nipples, located around the Blackbody emitter. The nipples are used to spread the Dry Nitrogen in order to prevent possible condensation on the Blackbody emitter surface when reaching temperatures lower then 5 ºC.

NOTE

The uniformity of the Blackbody could decrease when using the Dry Nitrogen.

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Figure 8-1: LT Blackbodies Description



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8.4 Assembling the System

The sequence in assembling the system is:

- Unpacking the Julabo Circulation System and Low-Temperature Blackbody (see Section 8.4.1)
- Connecting Pipes and Dry Nitrogen to the Low-Temperature Blackbody (see Section 8.4.2)
- Connecting Pipes to the Julabo Circulation System (see Section 8.4.3)
- Cable-Connection (see Section 8.4.4)
- Operation Instructions (see Section 8.4.5)

8.4.1 Unpacking the Julabo Circulation System and Low-Temperature Blackbody

1. Unpack the Julabo Circulation System and place it on site (refer to the *Julabo Circulation System Operating Manual*).
2. Unpack the Blackbody and place it on site at a distance of up to 4 meters from the Julabo Circulation System. A general view of the Blackbody packaging is shown in Figure 8-2:

Figure 8-2: Low-Temperature Blackbody Packaging



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3. If covered: release four captive screws that fasten the Blackbody Protective Cover and remove the cover.

Figure 8-3: Blackbody Protective Cover

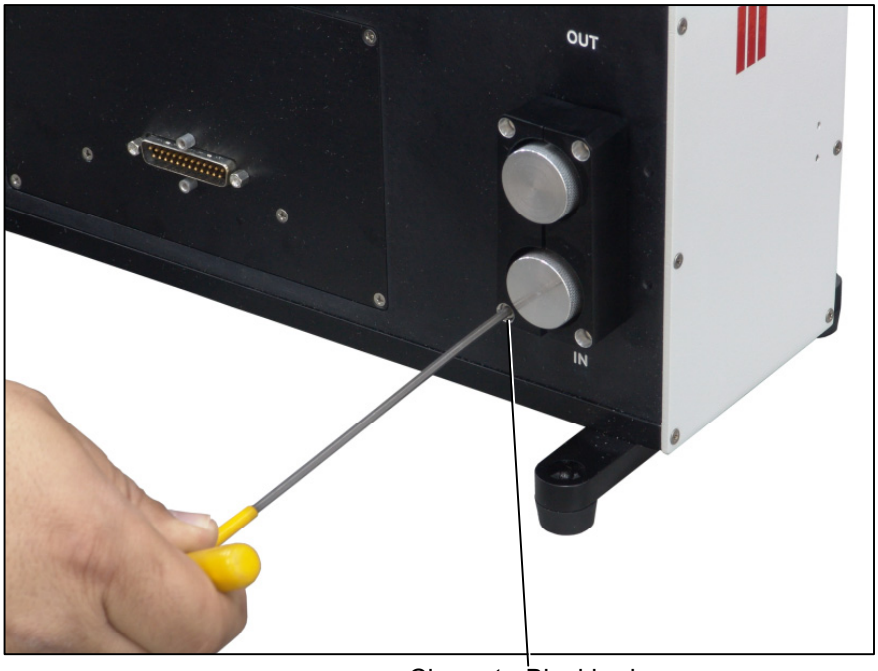


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8.4.2 Connecting Pipes and Dry Nitrogen to the Low-Temperature Blackbody

1. Remove the four Allen screws fastening the right-hand clamp and the left-hand clamp to the blackbody and remove the clamp.

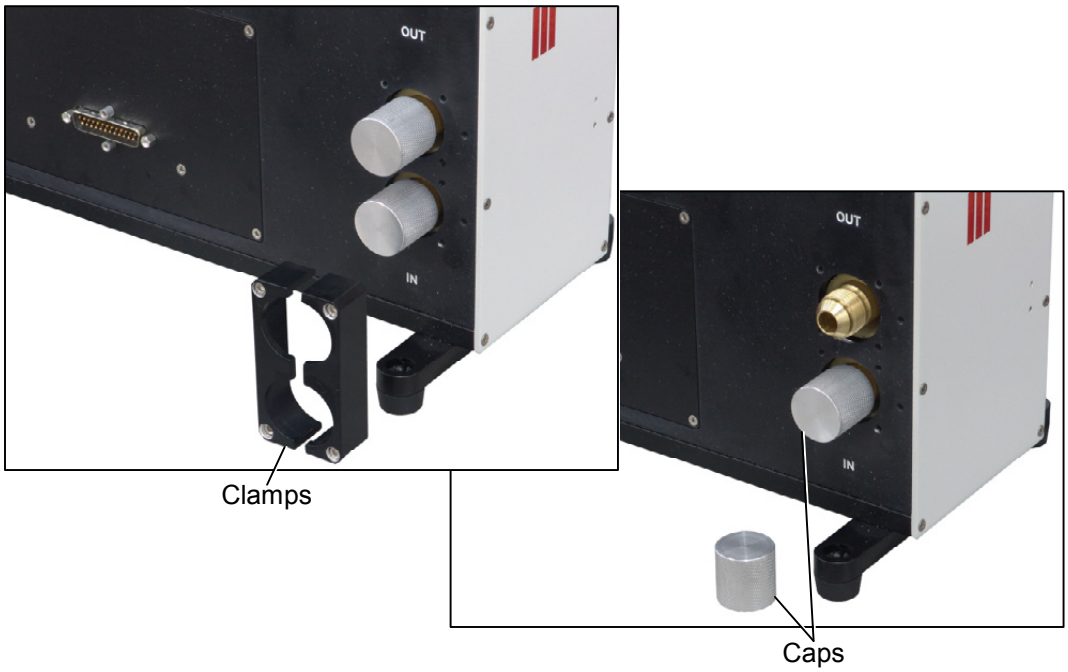
Figure 8-4: Connecting Pipes and Dry Nitrogen to the Low-Temperature Blackbody - Removal of Pipe Clamps



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2. Remove both pipe inlet caps and store them:

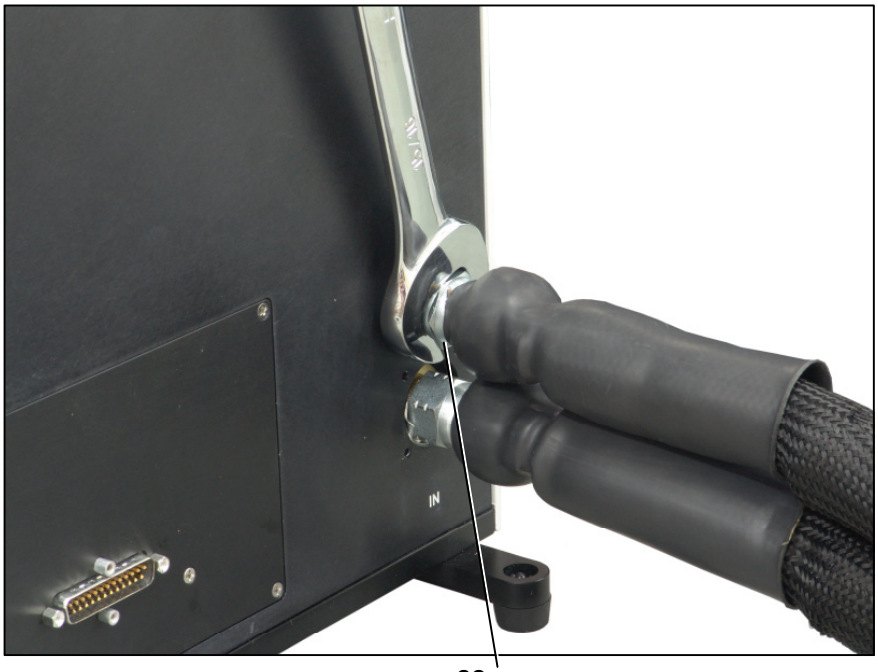
Figure 8-5: Connecting Pipes and Dry Nitrogen to the Low-Temperature Blackbody - Removal of Pipes Inlet Caps

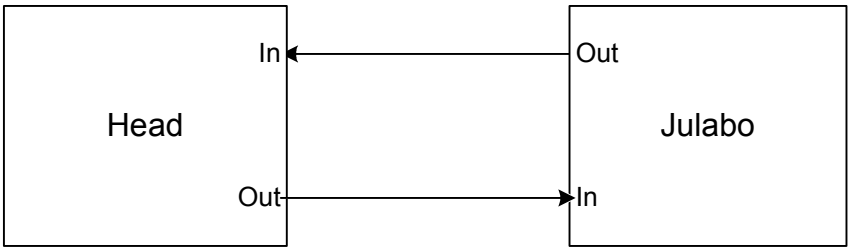


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3. Mount the Pipes and fasten using a 22 mm open-wrench (note the schematics for proper pipe connection):

Figure 8-6: Connecting Pipes and Dry Nitrogen to the Low-Temperature Blackbody - Fastening the Pipes

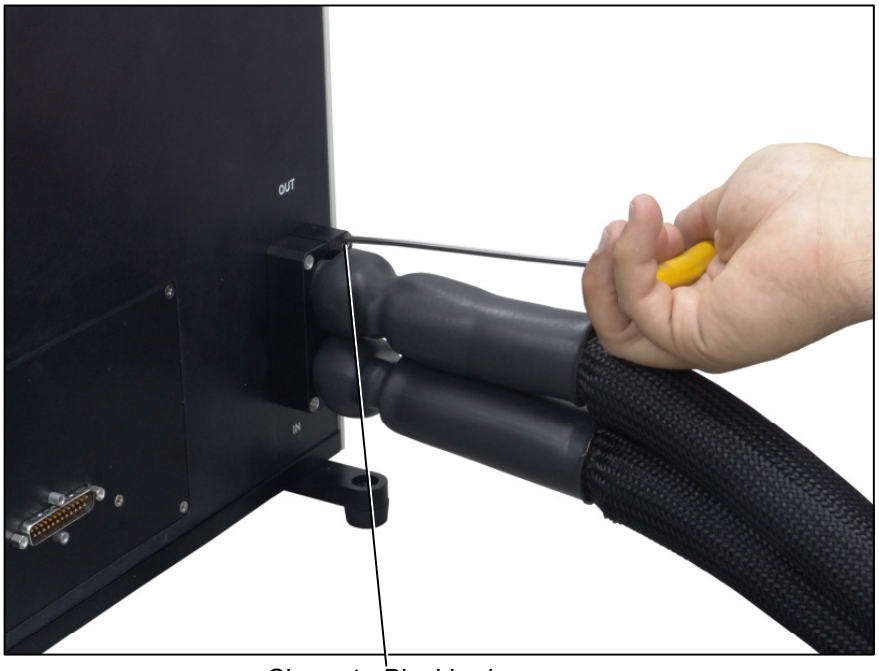




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4. Mount the right-hand pipes clamp and the left-hand pipes clamp and fasten to the Blackbody using the four Allen screws (see Figure 8-7):

Figure 8-7: Connecting Pipes and Dry Nitrogen to the Low-Temperature Blackbody - Fastening the Pipe Clamps



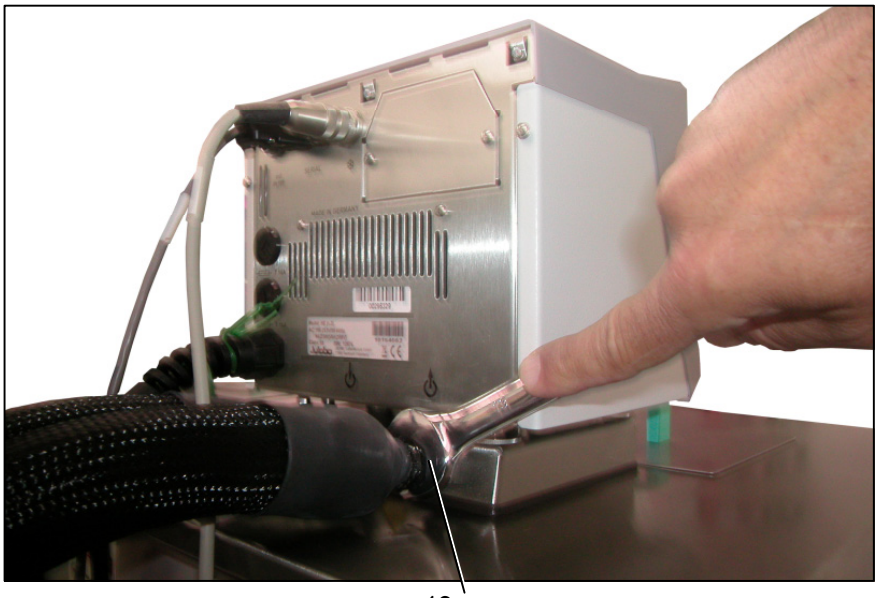
5. If needed, connect the Dry Nitrogen Source to the Blackbody **Dry Nitrogen Inlet** (1 bar max).

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8.4.3 Connecting Pipes to the Julabo Circulation System

Mount the Pipes and fasten using a 19 mm open-wrench:

Figure 8-8: Connecting Pipes to the Julabo Circulation System - Fastening the Pipes



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8.4.4 Cable-Connection

1. Connect the Head cable between the Blackbody and the SR-800R Controller (see Figure 8-1).
2. Connect the Julabo Circulation System cables (see Figure 8-9):
   a. Connect the **RS-232 Cable** between the SR-800R Controller and the Julabo **SERIAL** cable-connector.
   Note that the Circulator provides three possibilities for the setpoint selection, i.e., Temperature Setting.
   At CI-Systems, the Circulator is set to work in the RS-232 mode with the following communication setup (for reference only):

   - Baud - 9600
   - Parity - None
   - Stop Bit - 1
   - Data Length - 8 Bit
   - Handshake - None

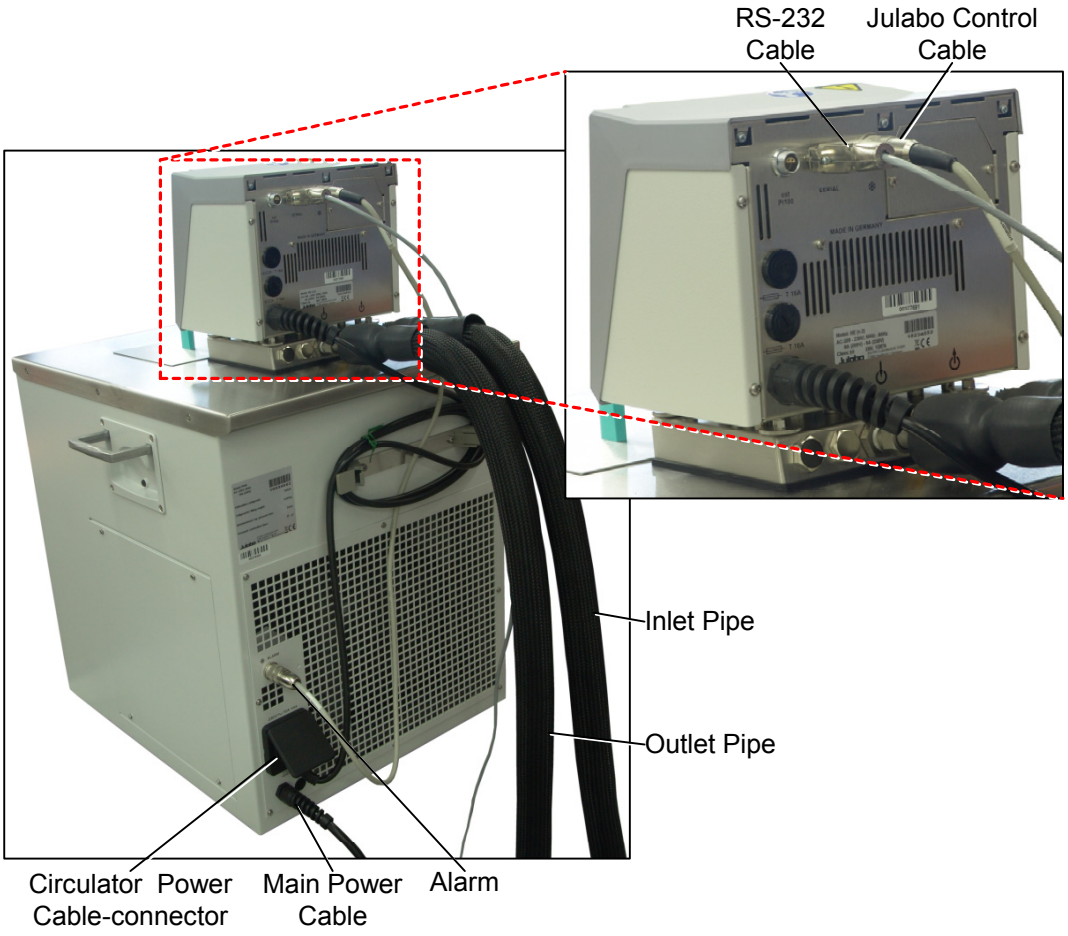
NOTE

Depending on the SR-800R Controller temperature setpoint, the only way to control the Julabo Circulation System temperature is by the SR-800R Controller and via the RS-232 communication port. Therefore, the SR-800R Controller RS-232 port cannot be used for other purposes.

   b. Connect the **Julabo Control Cable** between the Julabo Controller and the **ALARM** cable-connector.
   c. Connect the Julabo Controller Power Cable to the **Circulator Power cable-connector**.
   d. Connect the **Main Power Cable** to the Mains (either directly or via a 100 VAC transformer).

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Figure 8-9: Cable-Connection - Julabo Circulation System Cables



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8.4.5 Operation Instructions

1. Fill the Julabo Circulator with fluid, 30mm below the tank rim. Follow the instructions in the *Julabo Circulation System Operating Manual.*
2. Switch the Julabo Circulation System ON (both switches).
3. Switch the SR-800R Controller ON (see Section 3.1).

Figure 8-10: Operation Instructions - Switching the Circulation System ON



4. Wait 1 minute and refill fluid, if needed.

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5. Set the required temperature via the SR-800R Controller and wait until it reaches a stable temperature (a message is displayed: **Waiting for Refrigerator**).
Note that the Circulator temperature is set automatically by the SR-800R Controller and according to Table 8-1:

Table 8-1: SR-800R-to-Refrigerator Temperature Range

Refrigerator	SR-800R Temp. Range
-30ºC	-40ºC to -20ºC
-10ºC	-20ºC to 0ºC
+20ºC	0ºC to +40ºC
+60ºC	+40ºC to +80ºC
+100ºC	+80ºC to +150ºC

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8.5 Disassembling the System

The sequence in disassembling the system is:

- Shutting Down the System (see Section 8.5.1)
- Draining the Fluid from the Blackbody (see Section 8.5.2)
- Disconnecting the Pipes from the Blackbody (see Section 8.5.3)
- Disconnecting the Dry Nitrogen Source and Cables (see Section 8.5.4)
- Packing (see Section 8.5.5)

8.5.1 Shutting Down the System

1. Switch the SR-800R Controller OFF.
2. Switch OFF both Julabo Circulation System switches (refer to the *Julabo Circulation System Operating Manual*).

8.5.2 Draining the Fluid from the Blackbody

1. Drain the fluid from the Julabo Circulation System fluid tank (refer to the *Julabo Circulation System Operating Manual*).
2. Disconnect one of the pipes from the Julabo Circulation System. Using a high-pressurized air hose and hand piece, force all the cooling fluid out of the pipes and into the fluid tank.
3. Release and remove the Pipes from the Julabo Circulation System using a 19 mm open-wrench (see Figure 8-8).

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8.5.3 Disconnecting the Pipes from the Blackbody

1. Remove the Blackbody rear-side clamps (see Figure 8-7).
2. Release and remove the Pipes using 22 mm open-wrench (see Figure 8-6).
3. Re-install both pipe inlet caps (see Figure 8-5).
4. Re-install the Blackbody rear-side clamps (see Figure 8-4).

8.5.4 Disconnecting the Dry Nitrogen Source and Cables

1. Disconnect the Julabo Circulation System cables (see Figure 8-9):
   a. Disconnect the **Main Power Cable** from the Mains (connected either directly or via a 100 VAC transformer).
   b. Disconnect the Julabo Controller Power Cable from the **Circulator Power cable-connector**.
   c. Disconnect the **Julabo Control Cable** from the Julabo Controller and the **ALARM** cable-connector.
   d. Disconnect the **RS-232 Cable** from the SR-800 Controller and the Julabo **SERIAL** cable-connector.
2. Disconnect the Dry Nitrogen source from either the Blackbody Dry Nitrogen Inlet (see Figure 8-1) or from the optional Hood Dry Nitrogen Inlet (see Figure 8-12).
3. Disconnect the Head cable between the Blackbody and the SR-800R Controller (see Figure 8-1).

8.5.5 Packing

Pack the Blackbody in its original packaging (see Figure 8-2).

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8.6 Hood

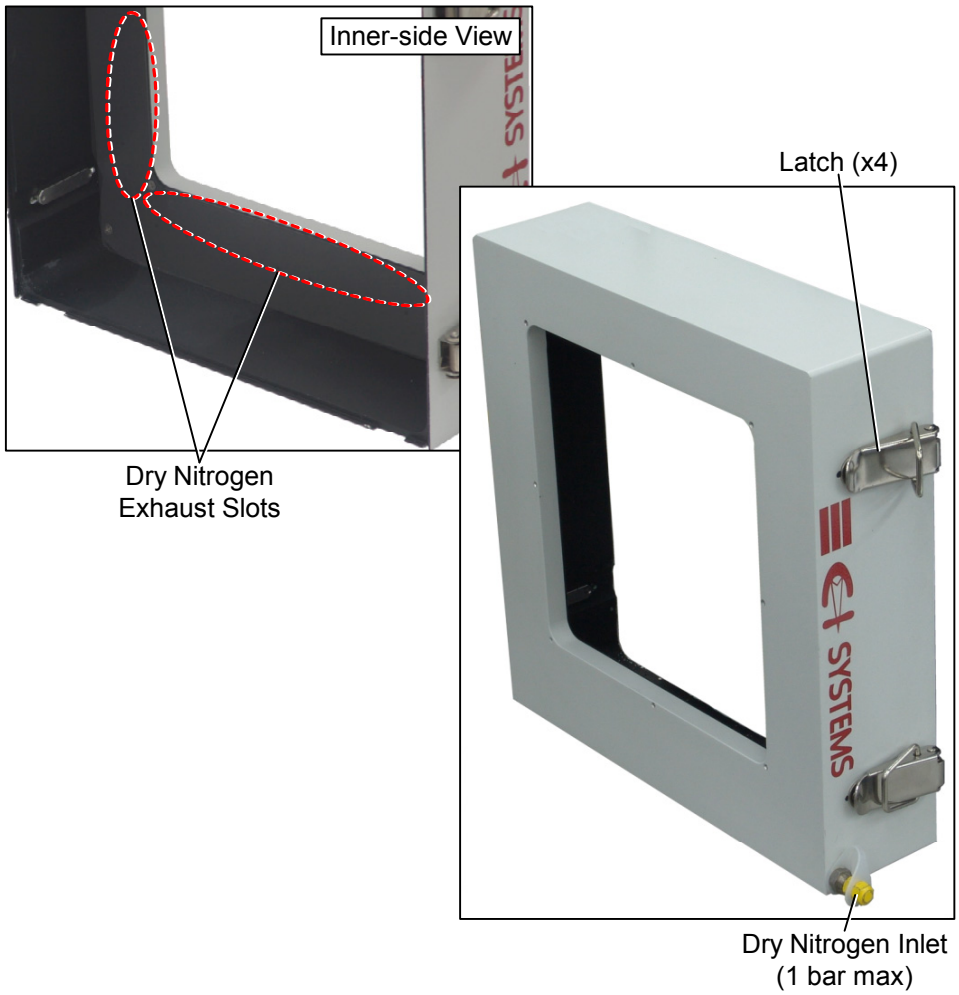
8.6.1 Overview

An optional Hood can be supplied separately. When mounted on the Blackbody and the UUT is placed in front of the Hood (with minimal air gap), dry Nitrogen is pumped to create a dry atmosphere with minimal turbulence (minimal pressure to create a positive pressure atmosphere).

The Hood main components are:

- **Dry Nitrogen Inlet** (1 bar max): the port to which the Dry Nitrogen is connected when using a Hood (instead of using the Blackbody Dry Nitrogen Inlet).
- **Latch**: four latches, used to attach the Hood to the Blackbody.
- **Dry Nitrogen Exhaust Slots**: nipples, located around the Hood inner-side. The nipples are used to flow the Dry Nitrogen around the Blackbody.

Figure 8-11: The LT Blackbodies Hood - Main Components



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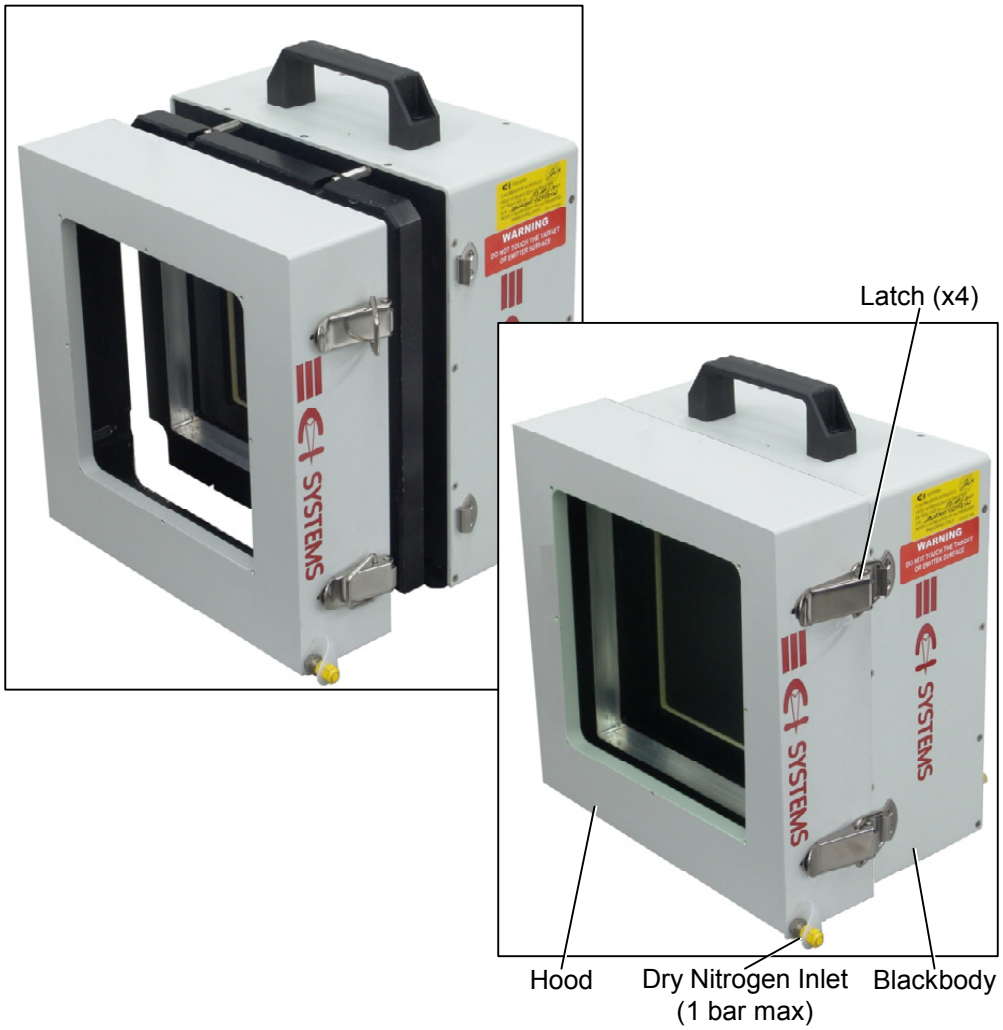
8.6.2 Mounting the Hood and Dry Nitrogen Connection

(See Figure 8-12)

To mount the optional Hood on the Blackbody:

1. Unpack the Hood and the Blackbody.
2. if disconnected from the Blackbody: attach the Hood to the Blackbody and fasten it using the four latches.
3. Connect the Dry Nitrogen Source (1 bar max) to the Hood Dry Nitrogen Inlet (instead of connecting the Dry Nitrogen Source to the Blackbody Dry Nitrogen Inlet).

Figure 8-12: Mounting the Hood and Dry Nitrogen Connection



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8.6.3 Removing the Hood

NOTE

This procedure is performed only if the optional Hood is installed.

1. Disconnect the Gas Source from the Hood Gas Inlet (see Figure 8-12).
2. Release the four latches and remove the Hood from the Blackbody (see Figure 8-12).

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9. Operating the SR-800R via the Remote Control Program

This chapter provides step-by-step instructions on how to use the SR-800R Remote Control program.

9.1 Overview

With the Blackbody Remote Control program you can setup and operate the SR-800R by using a standard PC and via a communication protocol.

With the Blackbody Remote Control program you can:

- Setup the PC-to-SR-800R communication protocol
- Control a Blackbody Temperature and Mode (either Absolute or Differential)
- Control Target Wheel or stage and select target/stage
- Control up to seven general purpose I/O ports (five outputs and two inputs)

9.2 Installing the SR-800R Remote Control Program

1. Launch the installation CD of the Blackbody Remote Control program.
2. Follow the prompts. Upon completion, a shortcut is added to the **Start** menu and the Blackbody Remote Control program icon 

is added on your Desktop.

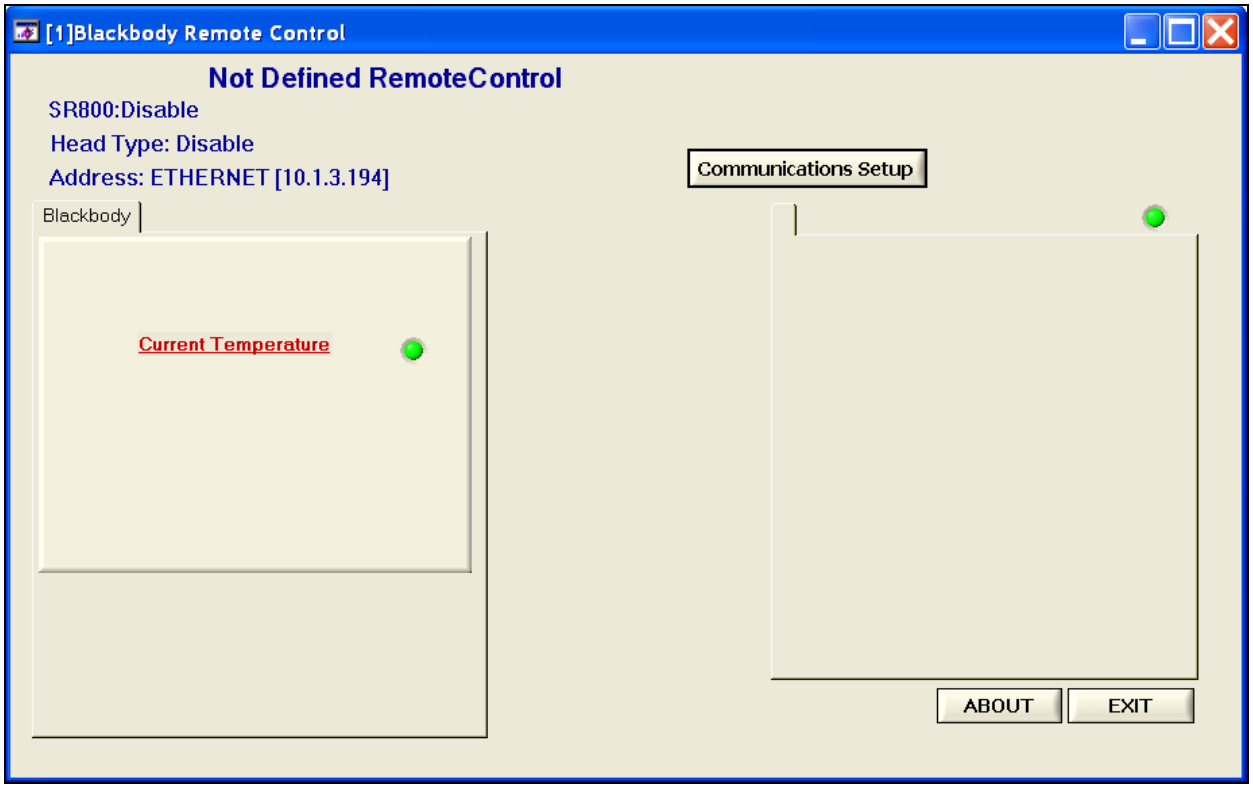
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9.3 Using the SR-800R Remote Control Program

9.3.1 Launching the SR-800R Remote Control Program

Click Blackbody Remote Control program icon located on your Desktop or from the Start menu. The following Main Window opens:

Figure 9-1: Blackbody Remote Control Program



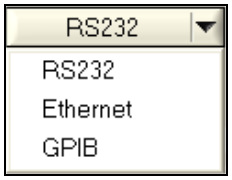
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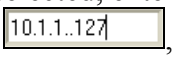
9.3.2 Setting of the Communication Protocol

Setup the communication protocol between the PC and the SR-800R as follows:

1. Set the SR-800R communication protocol of the SR-800R (see Section 3.2.3.6.3: Communications).
2. Click 

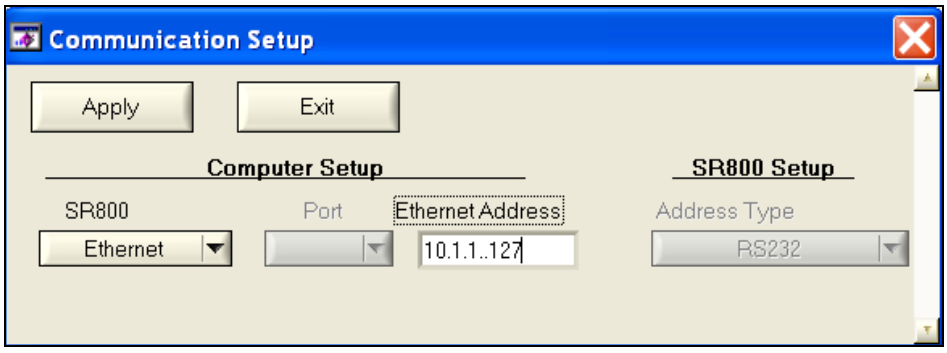
to open the Communication Setup dialog-box.
3. Set the communication protocol of the SR-800R (it should be identical to the settings of the Controller, default: GPIB - see Section 3.2.3.6.3: Communications) by selecting the communication protocol of the SR-800R from the SR-800R dropdown list:



4. If Ethernet is selected, enter the IP Address of the SR-800R in the **Ethernet Address** field 

, as shown in Figure 9-2 (it should be identical to the settings you made to the SR-800R according to Section 3.2.3.6.3: Communications):

Figure 9-2: Ethernet Communication Setup

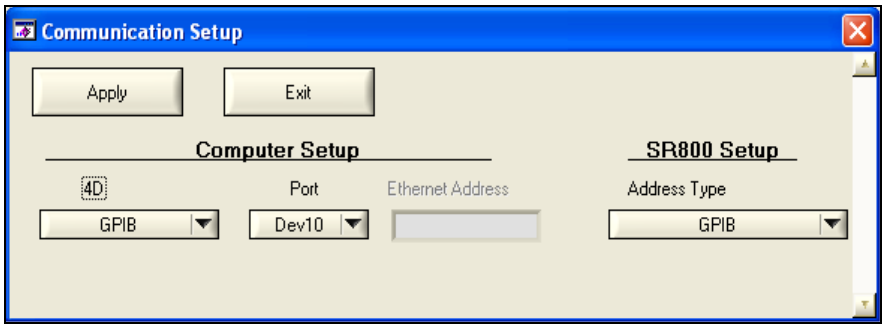


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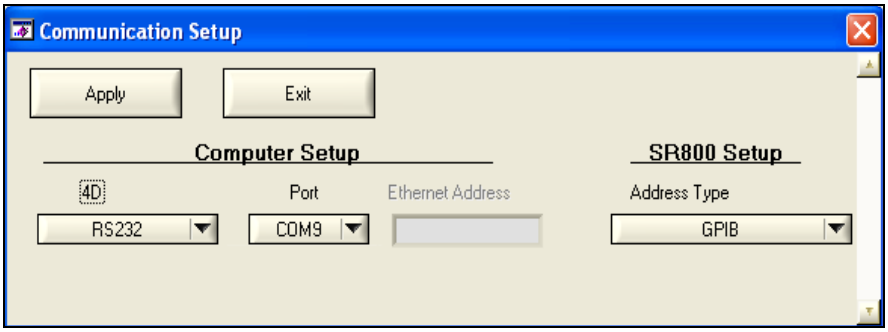
5. If **GPIB** is selected, select the SR-800R Port # from the **Port** drop-down list (**Dev10** in this example, the default Port #; it should be identical to the settings you made to the SR-800R according to Section 3.2.3.6.3: Communications):



Figure 9-3: GPIB Communication Setup



6. If RS232 is selected, select the COM # that is hard wired from the PC to the SR-800R (it should be identical to the settings you made to the SR-800R according to Section 3.2.3.6.3: Communications):



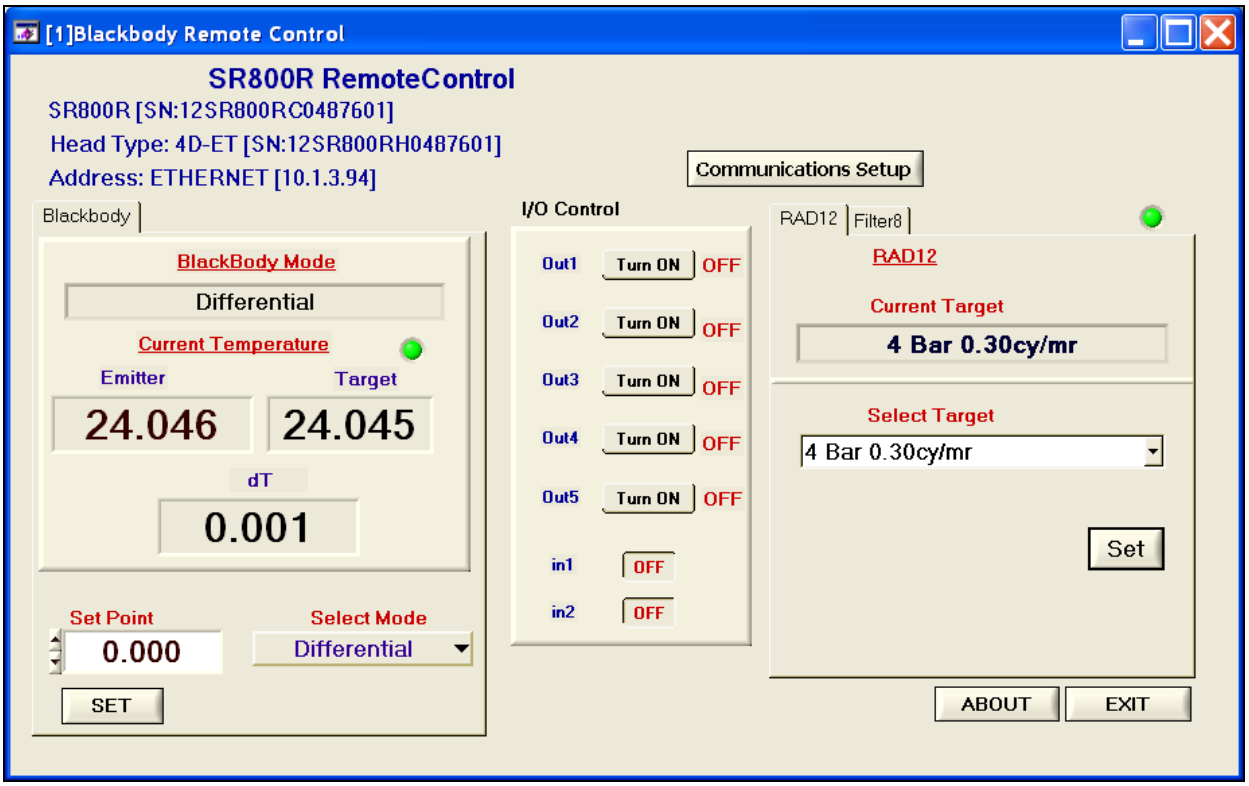
7. Click 

to apply your changes and to perform a communication with the SR-800R. A dialog-box opens prompting you to re-approve your settings. Click **OK**.

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8. Click Exit to close and return to the Main Window. The following opens. Note the examples of the identified Controller, Head, Address and RAD:

Figure 9-4: Main Window after Communication Setup



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9.3.3 Selecting a Target

(See Figure 9-1)

1. Select a Target from the **Select Target** drop-down list (the list is identical to the available targets in the axis). An example of a target list:



2. Click Set to rotate the Target Wheel to the selected target.

9.3.4 Settings of the Blackbody

(See Figure 9-1)

1. Select the Blackbody operation mode from the **Select Mode** dropdown list (either **Absolute** or **Differential**).
2. Set the required temperature of the Blackbody by using the **Set Point** up/down arrows (or double-click the **Set Point** field and type in a new value).

NOTE

Note that you may use the keyboard arrow keys (up/down and left/right) to set the required temperature of the Blackbody.

3. Click Set to update the Blackbody Set Point. The green indicator starts to blink. The green indicator stops blinking when the Blackbody has reached the desired temperature.
4. You may view the on going **Current Temperature** as sensed by the Emitter and Target Sensors.

9.3.5 Using the I/O Control Feature

This is identical to the operation of the ControlMaster IO Control window (see Section 3.2.3.4).

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9.3.6 Viewing the SR-800R Remote Control Program Version

1. Click About to view the SR-800R Remote Control Program Version. The following opens:

Figure 9-5: Blackbody Remote Control Program Version



2. Click OK to close and return to the Main Window.

9.3.7 Exiting the SR-800R Remote Control Program

Click Exit to close the SR-800R Remote Control Program and return to the Desktop.

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10. Appendix A: Calibration Methods

There are two different versions of SR800 extended area blackbodies supported by CI Systems, with two distinctly different calibration methodologies:

1. The original "fixed probe" SR800 blackbody systems are calibrated via a standalone calibration instrument (CK80 or CK800 depending on the date of manufacture). With this methodology, the temperature reading of the sensor permanently installed in the blackbody emitter plate is referenced to the reading of the master temperature sensor connected to the CK80/800 as the temperature is modulated across the entire operating range of the blackbody.
   The resultant offsets are programmed into a calibration table that is stored in the head of the blackbody. Calibration data generated by this method is influenced by slight thermal gradients that exist between the two physical locations where the temperature sensors are inserted into the emitter plate during calibration.
2. The newer SR-800R blackbody system is equipped with a removable temperature sensor. This sensor undergoes a standalone calibration in a thermal bath generating a new calibration table (resistance, Ω vs temperature, ºC). The resultant calibration table is programmed into the blackbody head. Because the TSC (Temperature Sense Card contained in the blackbody head) is a very accurate and consistent ohmmeter, a calibrated sensor can be fitted into any blackbody head and maintain calibration and traceability. With this method we only use one temperature sensor located in the emitter eliminating the need for a separate reference sensor located in a different spot on the emitter plate for calibration.
   With this methodology, the resulting temperature reading can be slightly different from the reading obtained using the original "fixed probe" calibration method due to the slight temperature gradients that can exist between two different sensor locations in the emitter plate. This temperature differential is easiest to witness at high temperatures, while at near ambient temperatures the difference between two methods is very small. The discrepancy is primarily driven by thermal gradients between different sensor locations and stays well within the overall system uncertainty specifications.

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While the new calibration method is based on the original methodology, ultimately, it is an improved way of maintaining traceability and calibration. For the new calibration method CI Systems uses a new temperature probe design (the new removable sensor is physically longer, placing it further from the relatively unstable emitter edge) that provides for improved accuracy over the earlier models.

CI blackbodies support both calibration methods. The temperature probe in the emitter in all cases is removable. One calibration option simply requires replacing the probe with a newly calibrated one; the other option treats the probe as non-removable and the blackbody system is calibrated using a CK800 calibration kit.

Please note that the two calibration methods, while falling within the overall system uncertainty, are not directly interchangeable and in order to maintain traceability, one of the two calibration methods has to be selected and used for the operational life of the test set.

Similarly, calibration of the target sensor in differential blackbodies will be accomplished in one of two ways:

1. Calibrate the target sensor in a differential manner using the CK800 calibration kit. This is accomplished by inserting the probe into a supplied copper block and comparing it to the new master sensor with the copper block stabilized at ambient temperature. The offset between the two sensors will be referenced out for the 0-50ºC temperature-range. Note that this method is only accurate for typical ambient temperatures of 20-25ºC.
2. When calibration is due, simply replace the target sensor with a new calibrated removable probe.

When a blackbody is due for calibration, CI Systems is supplying this calibration kit.

For customers utilizing the newer removable probe methodology, CI is supplying either one or two (for differential blackbodies) calibrated temperature sensors.

For customers who prefer to continue utilizing the older "fixed probe" calibration methodology, CI Systems is supplying the new calibration kit.

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