StarterPac

FlowIR™

Real-Time Analysis of Continuous Reactions

METTLER TOLEDO

In conformance with the European Directive 2002/96/EC on Waste from Electrical and Electronic Equipment (WEEE), this device may not be disposed of in domestic waste. This also applies to countries outside the EU, per their specific requirements.

Please dispose of this product in accordance with local regulations at the collecting point specified for electrical and electronic equipment.

If you have any questions please contact the responsible authority or the distributor from which you purchased this device.

Should this device be passed onto other parties for private or professional use, the content of this regulation must also be related.

Thank you for your contribution to environmental protection.

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Introduction

FlowIR™ is a dedicated flow chemistry monitoring system designed to operate in real time using *in situ*, mid-infrared measurements and connect to standard flow chemistry using Omnifit fittings. Designed with the flow sensor component integrated in the ReactIR base unit, the FlowIR system is easy for the flow chemist to monitor continuous flow chemistry.

This document contains instructions and checklists for site preparation and installation. Site preparation is the end user's responsibility. Installation and initial operational performance testing is done by a METTLER TOLEDO Field Service Engineer (FSE). Standard, non-regulatory installations follow the checklist in this document. Expanded service contracts follow an IPac or EQPac installation and qualification protocol with separate documents.

Retain this document with the hardware manual for reference and use the Installation Checklist to verify system installation and function after moving it or as part of standard operating procedures.

Related Documents

Documents listed below are embedded in Appendix A.

- "FlowIR StarterPac Pre-Installation Checklist" (MK-VL-0039-AC)
- "FlowIR StarterPac Installation Checklist" (MK-VL-0038-AC)

Should you have questions that are not addressed in this document or the hardware manual, please contact your local METTLER TOLEDO office or our Customer Care Department using the information under "Service and Technical Assistance" on page 8.

If you are viewing this document electronically, click any blue-colored link to go to the related information and instructions.

General Policies

METTLER TOLEDO equipment is subject to the installation, repair, and computer service policies described below.

Installation Policy

Site preparation for the FlowIR system equipment is the user's responsibility. Structural installation details should be prepared and supervised by a certified and registered professional engineer who is properly qualified to assure a safe installation at your site.

Repair Policy

METTLER TOLEDO warrants its products against defects in materials and workmanship for twelve months from the date of installation or fifteen months from the date of shipment. For

details, please refer to the warranty provided with the instrument. For assistance, please contact your Technical and Applications Consultant (TAC) or send an email to **AutoChemCustomerCare@mt.com**.

It is recommended that you retain the original packing materials in the event you need to return the FlowIR system. If factory service is required, your METTLER TOLEDO service engineer will issue you a Return Material Authorization (RMA) form.

Computer Service Policy

If a computer is included as part of your FlowIR system, it will be from a major manufacturer such as Dell. In the U.S. and some European countries, the manufacturer will provide warranty service if required. METTLER TOLEDO can assist in diagnosing problems with computers, but the computer manufacturer will provide parts and labor for repairs under the service contract.

Software Upgrades

When applicable, upgrades to the instrument and office software are available for iCare subscribers. When a new release or service pack is available, all iCare subscribers with a valid subscription will be notified via email so they can download the installer from the AutoChem Community Web site, https://community.autochem.mt.com. Access to the site requires a password that you can request from the home page. You can also contact Customer Care or your METTLER TOLEDO Technology and Applications Consultant (TAC) using the information on page 8. Non-iCare subscribers may request a quote for an upgrade by contacting their local salesperson or Customer Care.

Training Programs

Training for FlowIR systems is available from the AutoChem Community Web site and through your METTLER TOLEDO TAC. Contact **AutoChemCustomerCare@mt.com**. For information on training programs, see the users' Web site, http://community.autochem.mt.com. Access to the site requires a login and password that you can request at the site.

Service and Technical Assistance

METTLER TOLEDO has offices around the world. Contact the Mettler-Toledo AutoChem, Inc. headquarters in the USA for technical support or service. For specific application assistance at any time, contact a METTLER TOLEDO Technology and Applications Consultant (TAC) through the toll-free number below.

Mettler-Toledo AutoChem, Inc.	
(Columbia, MD headquarters) http://www.mt.com/ReactIR http://www.mt.com/iCIR	Tel: **+ 1.410.910.8500** Fax: **+1.410.910.8600** Email: **AutoChemCustomerCare@mt.com** Toll Free: **+1.866.333.6822**

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Installation

This chapter provides procedures on how to install or reinstall a FlowIR system. A 'StarterPac Installation Checklist' is provided for installations in **non-regulatory** * environments.

* Note:	**IPac for Regulatory Environments**—METTLER TOLEDO offers an Instrument Qualification Package (IPac) service at a nominal fee. IPac service delivers comprehensive test procedures and verification records on installation and operation to assist you in meeting regulatory requirements. When applicable, the IPac replaces the 'StarterPac Installation Checklist' procedure.

Basic installation includes site preparation performed by you and installation performed by a METTLER TOLEDO Field Service Engineer. The scope covers the following actions with steps documented in the 'StarterPac Installation Checklist' form available on page 41:

- Site requirements verification ("FlowIR StarterPac Pre-Installation Checklist" on page 39)
- System inspection and setup
- Document software version and revision level
- System configuration
- Installation summary checklist
- Document test results for ongoing comparison
- System Acceptance

As stated in the note above, METTLER TOLEDO provides installation of the FlowIR at no charge to the customer in a non-regulatory environment—one that requires minimal qualification of installation and operation. In addition to verifying the site preparation and receipt of ordered parts (including service agreements/programs), the 'StarterPac Installation Checklist' covers all aspects of the final stages of system installation to ensure that the FlowIR meets the manufacturing specifications and quality assurance in a non-regulatory environment.

Acceptance Criteria

The 'StarterPac Installation Checklist' requires approval signatures from the METTLER TOLEDO AutoChem Field Service Engineer and your Company Project Leader.

Note:	Place the signed checklist in a readily accessible location for reference during system service or maintenance.

Site Preparation (Customer Responsibility)

Permanent or temporary installation site for a FlowIR system must include the following items:

- Electrical supply
- Space preparation
- Environment preparation

A METTLER TOLEDO Field Service Engineer will install the FlowIR system upon completion of the site preparation. To facilitate rapid completion of installation and operation testing at the time of installation, please complete the site preparation requirements "FlowIR StarterPac Pre-Installation Checklist" on page 39.

Installation Instructions

This section describes the procedures for installing the FlowIR.

1. Confirm Site Readiness

A METTLER TOLEDO Field Service Engineer (FSE) will check the FlowIR installation site in accordance with the product requirements and complete the first section of the 'StarterPac Installation Checklist' (page 41) based on the "FlowIR StarterPac Pre-Installation Checklist" on page 39. Customers can speed this process by assuring the site is ready prior to arrival of the FSE. The critical elements are power, environmental temperature, and space.

Proceed to the next step only after confirming the site is ready.

2. Verify Hardware Configuration/Order Validation

Using the 'StarterPac Installation Checklist,' perform a visual inspection of the shipment for the items on the checklist. In addition to components shown in the upcoming figures, there is a set of country-specific adapters for the base unit power supply.

Non-Heated Flow Cell Head Configuration

Ethernet cable

FlowIR base unit

Power Supply

3.   1.   2.

FlowIR sampling technology
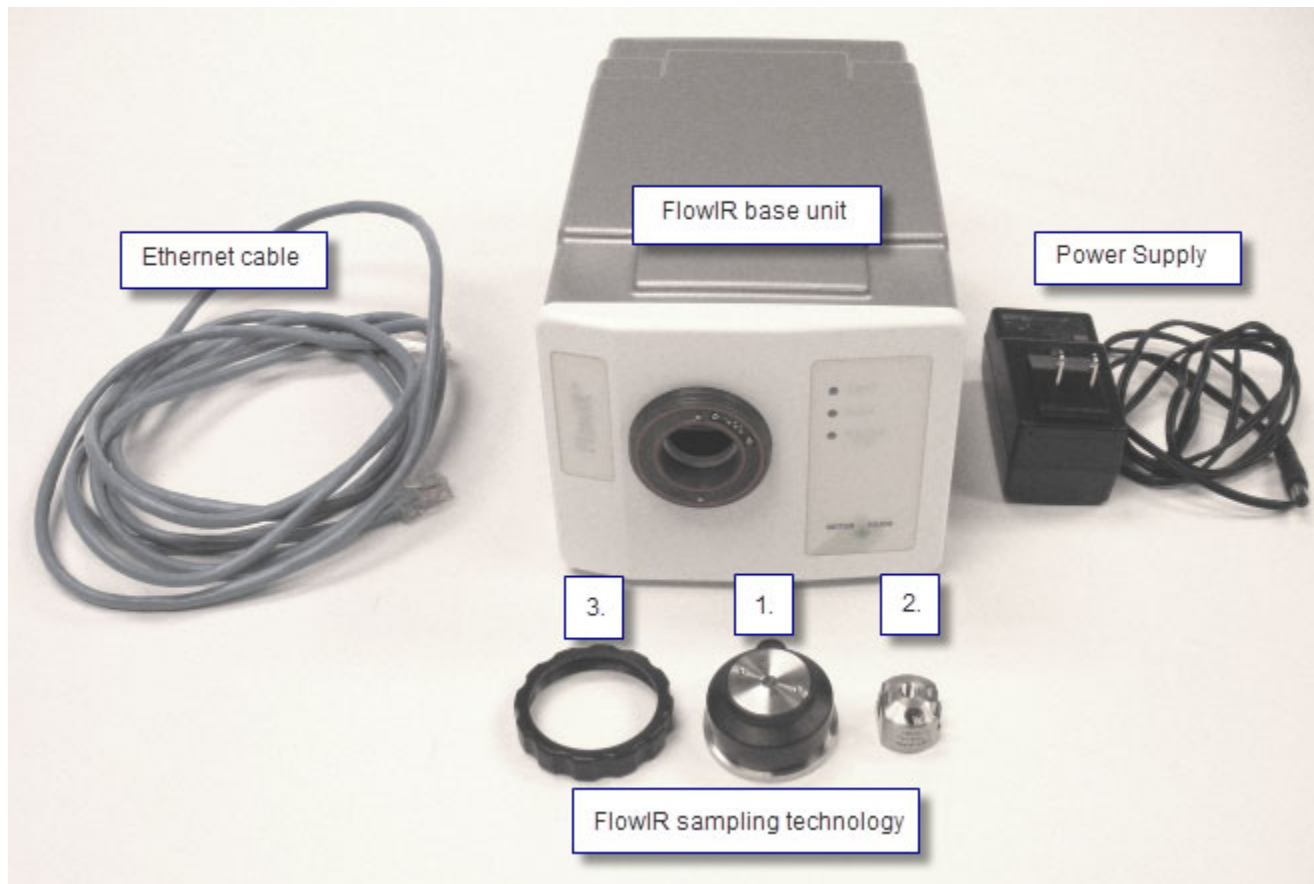
Figure 2-1 FlowIR—Non-heated Flow Cell Head configuration

Heated Flow Cell Head Configuration
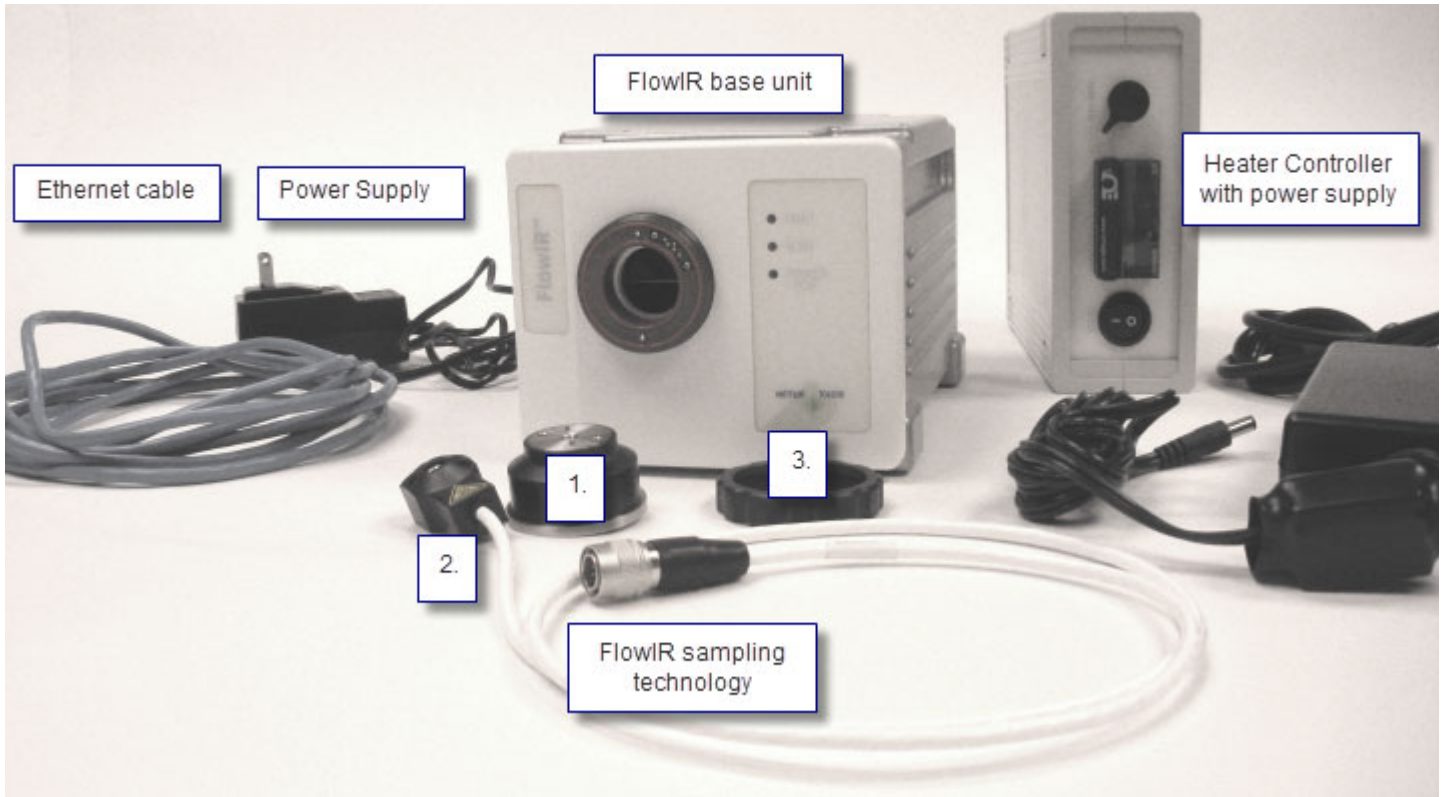
Figure 2-2 FlowIR—Heated Flow Cell Head configuration

Sampling Technology

Sampling Technology components are purchased separately and include options described in the Product Description chapter of the "FlowIR Hardware Manual." Figure 2-2 shows the heated configuration that includes:

1. FlowIR Sensor
2. Heated Flow Cell Head (with Heater Controller)
3. Retaining nut for sensor

Complete the sampling technology section with the information specific to the type of technology ordered. Enter N/A (not applicable) for sections that do not apply to the customer order. Record the 'wetted materials' and 'pressure/temperature' specifications for the sampling technology. Any items that are missing should be entered into the non-conformances section of the form with an action plan to resolve.

Hardware and Software

All items in this section of the 'StarterPac Installation Checklist' form should be with the order. Check the items that are with shipment. Any items that are missing should be entered into the non-conformances section of the form with an action plan to resolve.

Optional Software

Check the items with the shipment that cross reference to the customer order. Enter N/A in the check box if the customer did not order that item. Any items that are missing should be entered into the non-conformances section of the form with an action plan to resolve.

Documentation

All items in this section of the 'StarterPac Installation Checklist' form should be with the order, with the exception of the Certificate of Conformity for Sampling Technology as the customer may not have ordered this item with the base unit. Check the items that are with the shipment. Any items that are missing should be entered into the non-conformances section of the form with an action plan to resolve.

3. Install iC IR Software and Confirm Hardware Service Agreement

Before setting up the communications between a computer and the FlowIR, verify that the PC meets the specifications in the "iC IR Installation Guide." You will need iC IR Instrument License, included with your order, to operate the FlowIR instrument.

1. Insert the iC IR installation CD in the PC and click **Install iC IR #.# (setup.exe)** from the welcome page.
2. Install the software according to the wizard-guided steps.
   Refer to the "iC IR Installation Guide" for additional installation information on administering preferences, licensing, and sharing data between iC/iControl software applications.
3. Confirm the following information on the 'StarterPac Installation Checklist' ():
   In the **Software Install** section of the form, enter the version number for the iC IR software shipped with the FlowIR order.
   In the **Hardware Service Agreement** section of the form, record the FlowIR and Sensor coverage the customer ordered. Otherwise enter the standard warranty coverage information.

4. Establish System Connections

Complete the System Connections checklist in the 'StarterPac Installation Checklist' (page 41) while progressing through these instructions that will assure all ReactIR system hardware is in the proper location with connectivity to utilities, computer, and sampling technology.

Note: DO NOT proceed with the 'System Start Up' section until all applicable check boxes are complete.

Locate FlowIR Base Unit and Computer at Site

1. Place the base unit in the predetermined customer location per the site preparation requirements.
2. In addition, place the computer in a suitable work location that allows connectivity through an Ethernet cable.

Connect power

Power connections as well as ethernet communications connections to the computer are made at the back of the FlowIR base unit.
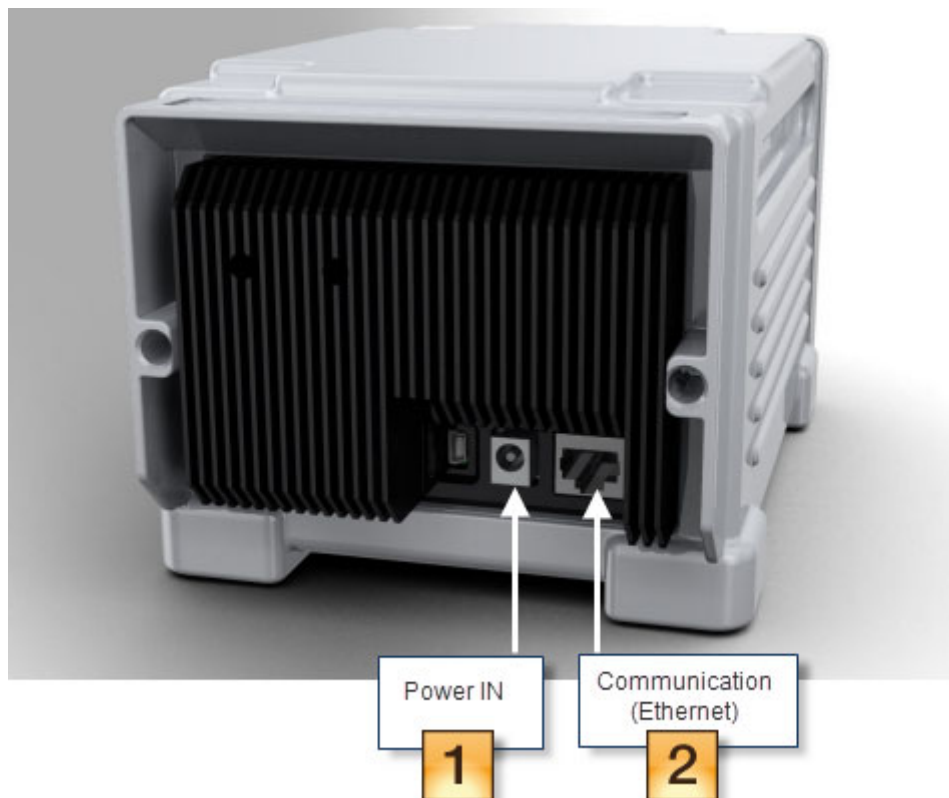
Figure 2-3 Connection points at back panel of FlowIR

1. Ensure that your power supply meets the specifications in the site preparation (pre-installation) checklist on page 39.

2. Connect the power supply supplied to the unique connector on the back panel of the FlowIR (#1 IN Figure 2-3).

3. Check the country-specific adapter that slides into the power supply and change it, as applicable. The power supply includes county-specific adapters.

   a. Press down and push out the standard adapter from the power supply.

Figure 2-4 Power supply—Country-specific adapter

   b. Select the appropriate country-specific adapter and slide it into the power supply.

4. Connect the opposite end into a mains power socket.

Connect Ethernet Cable

1. Connect the Ethernet communications cable to the right-most unique connector on the back panel of theFlowIR (#2 in Figure 2-3).

Figure 2-5 FlowIR—Power and communications connected

2. Connect the opposite end of the Ethernet communications cable to an Ethernet port on the computer where the iC IR software will be installed.

5. Connect Sampling Technology

Follow the steps below to connect the sampling technology ordered to the Sampling Technology Interface (SIM) on the front panel of the FlowIR (Figure 2-6).

FlowIR Sensor and Flow Cell Head

Figure 2-6 FlowIR with heated flow cell sampl ing technology

Note:	The FlowIR Sensor and its retaining nut are now together as a single assembly.

1. Turn the FlowIR Sensor so the three RTD pins and the two pin-hole guides are facing you. Orient the sensor so the two pin-hole guides align vertically with the pins on the base unit SIM. The three RTD pins also align with the holes in the SIM.

Figure 2-7 FlowIR Sensor—RTD connection pins (3) and pin-hole guides (2) to base unit

2. Insert the sensor into the SIM and push it in gently to complete the connection.

Figure 2-8 FlowIR Sensor—Connected to base unit

3. Rotate the retaining nut clockwise to secure the sensor to the base unit.

4. Insert the Flow Cell Head into the Sensor, taking care to align the two vertical holes on the head with the vertical dowel pins on the Sensor.

Figure 2-9   FlowIR Sensor—Locating dowel pins receive flow cell head

5. Using the 3/32 allen wrench provided with the flow cell head, tighten the two 4040 captive screws on the outside of the heated head to secure it to the Sensor. On a non-heated head, insert the screws (provided) and tighten them with the allen wrench.
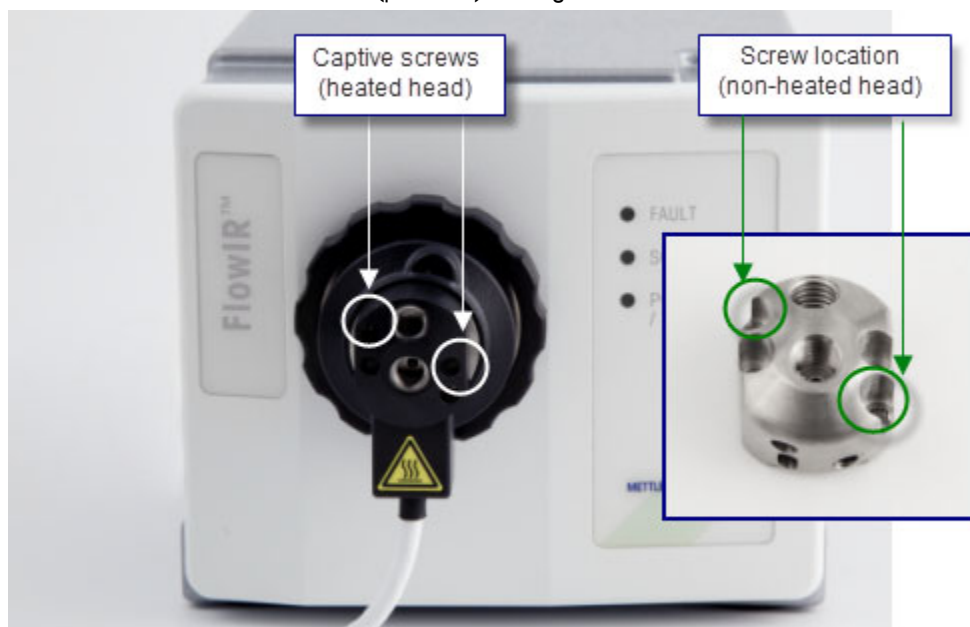
Figure 2-10 FlowIR Flow Cell Head (heated)—Secured to sensor

6. Connect Heater Controller (if applicable)

For the heated model FlowIR flow cell head only:

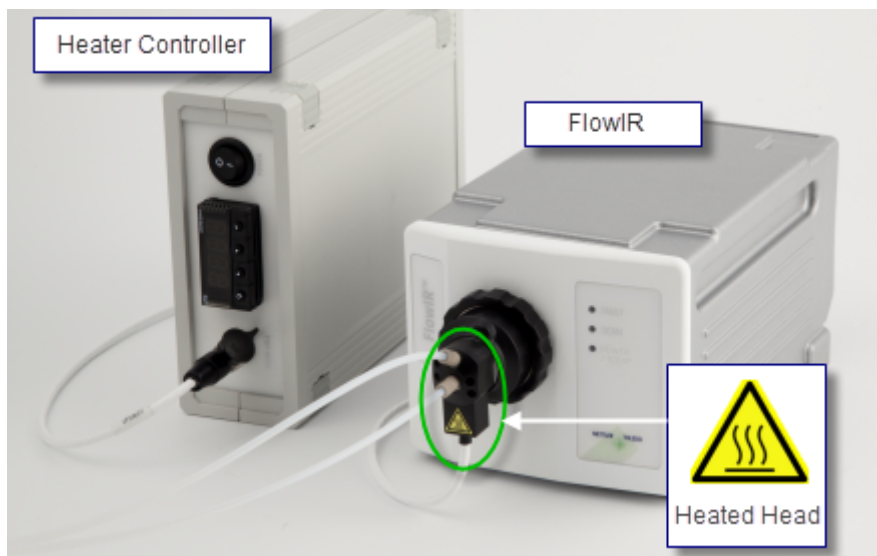1. Connect the heated flow cell head to the front of the heater controller.

Figure 2-11 Flow Cell Head (heated model) connection to heater controller

2. Connect the power cable to the back of the heater controller.

Figure 2-12 Heater Controller—Power supply

3. When you are ready to monitor flow chemistry, apply power to the heater controller and allow time for the head to reach the programmed temperature

> **Note:** Depending on the temperature selected on the heater controller, this can take 5-10 minutes.
> See "E. Use Heater Controller (if applicable)" on page 26 for instructions on using the heater controller.

7. Start Up System

Now that the FlowIR connections are complete, the last step is to confirm the system is capable of reaching a state of readiness for operational testing or implementation. Use the checklist in the 'StarterPac Installation Checklist' (page 41) to assess readiness as you proceed with the following instructions. The FSE will record any non-conformances with an action plan to resolve.

1. **Confirm the Power LED** illuminates on the base unit front panel. This event will happen after connecting the power supply to the unit and supply line.

> **Note:** Initially, the POWER LED is amber.

2.   Verify the ethernet cable is connected between the FlowIR base unit and the iC IR computer. Then, power ON the iC IR computer.

3. If the Found New Hardware wizard appears, point to the folder where the drivers were installed during software installation.
    Default installation folder: Program Files > METTLER TOLEDO > iC IR #.# >Installation folder > FTIR Device Driver >icbm.

4. Check the LED indicators on the front of the FlowIR to verify the POWER LED has changed from amber to solid blue.

> **Note:** POWER LED color must be solid blue before you start the iC IR software.

Figure 2-13 Power LED ON and changed from amber to blue

5. Start the iC IR software after the Power LED changes from amber to solid blue.

6. **Confirm the Scan LED** illuminates and flashes repeatedly. The flashing occurs after connection of the cable between the base unit and computer, and when both devices are ON.

Figure 2-14 Power and Scan LEDs

8. Confirm Optional Software Modules

Confirm that purchased optional software and software add-ons launch.

■   iC Kinetics is a separate software application with its own Start Page.

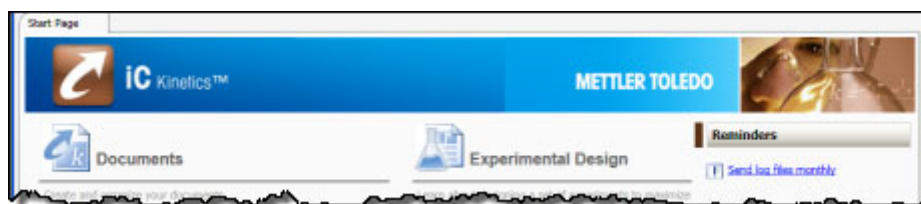**Figure 2-15 iC Kinetics Start Page**

■ iC Quant or ConcIRT Pro appear as Data-to-Information (D2i) documents from the iC IR Start Page.
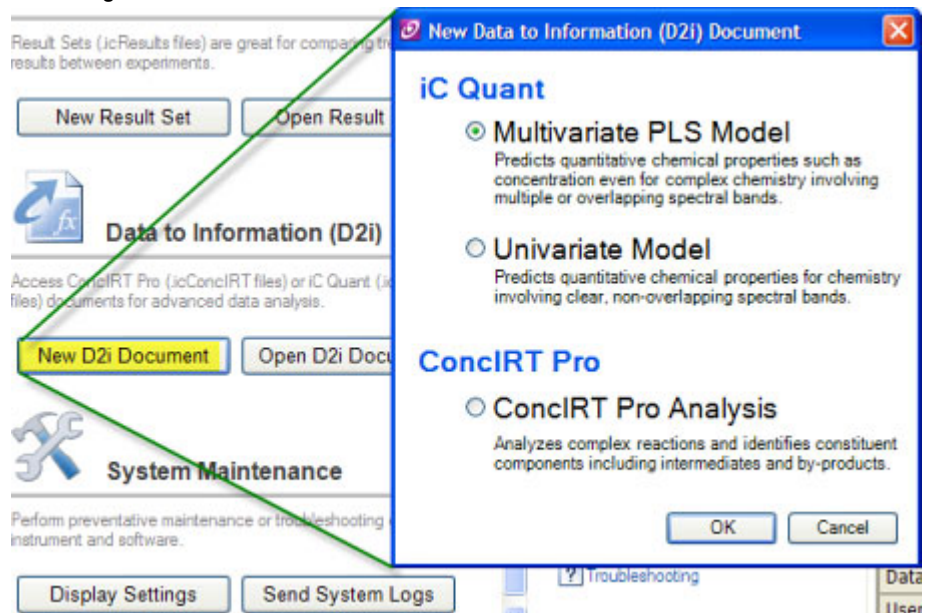
Figure 2-16 Optional add-on software

Proceed to Chapter 3, "Operational Readiness" for the last phase of installation.

3

Operational Readiness

Upon completion of the system installation, a METTLER TOLEDO AutoChem Field Service Engineer will go through the system readiness portion of the FlowIR 'StarterPac Installation Checklist' on page 41. The checklist includes the steps necessary to test the system in a non-regulatory environment and includes a place to record the results.

Note:	Please follow the test procedures completely to ensure the comprehensive results.

Operational tests can also be performed periodically, according to your standard operating procedure. Duplicate the 'StarterPac Installation Checklist' to independently verify product functionality. We recommend this process following storage, relocation, or months of infrequent use.

This chapter describes the procedures for operational readiness in the following sections:

1. Prepare FlowIR System for Use

Proceed through the System Readiness section of the 'StarterPac Installation Checklist' to record actions necessary to prepare for monitoring flow chemistry. By this point the unit should be ON for four (4) hours and the iC IR software ready to use on the computer.

A. Confirm the FlowIR is ON for Four Hours

1. Ensure the 'StarterPac Installation Checklist' is complete (page 41).

Note:	For startup immediately following installation, this step will not be necessary unless you are relocating the product.

2. Apply power to the FlowIR analyzer, if not already powered.

IMPORTANT / CRITICAL!	FROM A COLD START: Allow a minimum of **four (4) hours warm-up time** before proceeding to make any gain adjustments to the system. DO NOT PROCEED until the unit has been allowed to warm up.

B. Launch the iC IR Software

1. Turn on the iC IR computer.
2. Start the iC IR software from the Start menu or by clicking the desktop icon.

C. Switch Flow Heads (as applicable)

A FlowIR Flow Cell Head is available with one of two volume options—10 or 50 microliters and in heated or non-heated models (refer to the Product Description chapter of the "FlowIR Hardware Manual" for sampling technology options).

To switch one flow cell head for another:

1. Loosen the two screws that hold the head to the Sensor using the 3/32" allen key, provided. The screws are captive on the non-heated head and non-captive on a non-heated head.
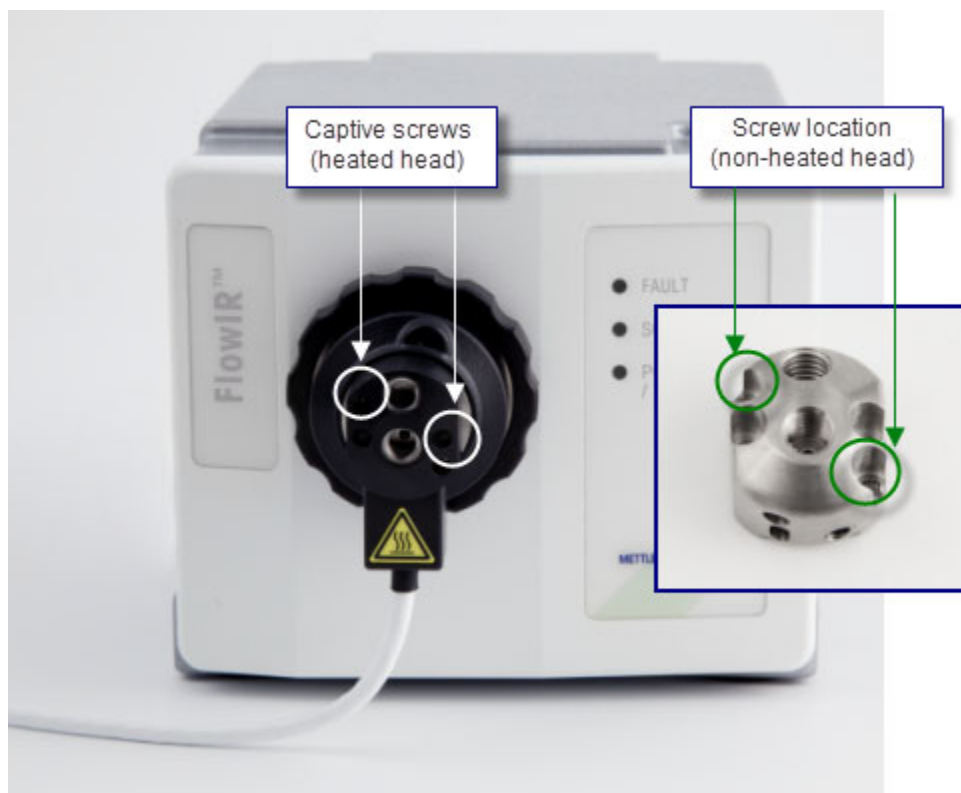
Figure 3-1 FlowIR Flow Cell Heads—Captive and non-captive screws

2. Carefully pull the flow cell head straight off the vertical dowel pins in the FlowIR Sensor and store it in the original container. When removing a non-heated head, take care to store the non-captive screws.

> **Note:** **Switching FlowIR Sensor**—If you need to switch to another FlowIR Sensor due to changes in your flow chemistry, this is the point where you remove the sensor and replace it with one that is made of the appropriate material (DiComp or SiComp). Follow the steps under 'Connect Sampling Technology' in your 'FlowIR StarterPac.'

3. Insert the new Flow Cell Head into the Sensor, taking care to align the two vertical holes on the head with the vertical dowel pins on the Sensor.
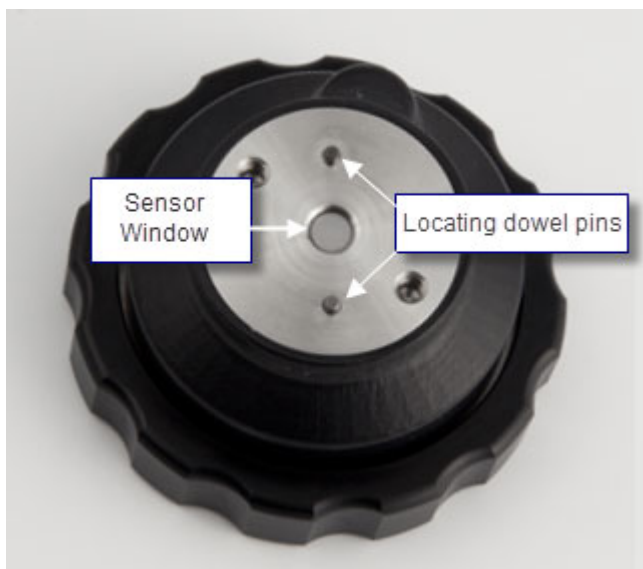
Figure 3-2   FlowIR Sensor—Locating dowel pins receive flow cell head

D. Install Flow Tubing and Fittings in Prescribed Flow Direction

Once a flow cell head is connected to the Sensor at the front of the FlowIR base unit, the next step is to connect your flow chemistry to the flow cell head in the prescribed flow direction. A specific direction of flow to the FlowIR Flow Cell is required to ensure the chemistry comes in proper contact with the sensor. Figure 3-3 shows the correct direction for incoming and outgoing flow.

1. Prepare FlowIR System for Use

1. Connect your Omnifit-style fittings securely to the flow cell head.
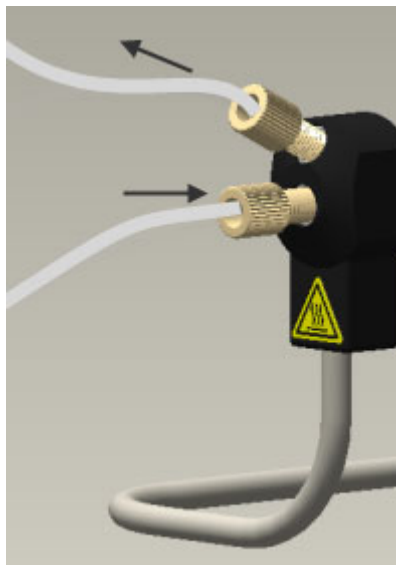
Figure 3-3 FlowIR Flow Cell Head (heated)—With Omnifit-style fittings

2. Connect your flow tubing to the fittings in the following direction:
- Incoming flow enters at the center of the flow cell head.
- Outgoing flow exits from the top fitting.

If you have the heated model, set the heat to the desired temperature as described next, and monitor the chemical spectroscopy though iC IR software.

E. Use Heater Controller (if applicable)

The temperature for a FlowIR Heated Flow Cell Head is factory set at a low temperature. Before using the heated model, set the temperature according to the flow chemistry being monitored. Once heated, the flow cell head can be extremely hot.

Caution—Use diligence when setting heater controller temperatures. Temperature settings must be at least 25°C (77°F) below flammable set point for the flow chemistry.

WARNING—A warning label on the heated head reminds you that it can be hot. Do not touch until the heated head has had adequate time to cool down from a high temperature setting.

The heated head has a built-in thermal cut-off switch set to shut down at temperatures above 120°C (248°F).

Use the buttons on the front of the heater controller to set the temperature required for your flow chemistry, as follows:
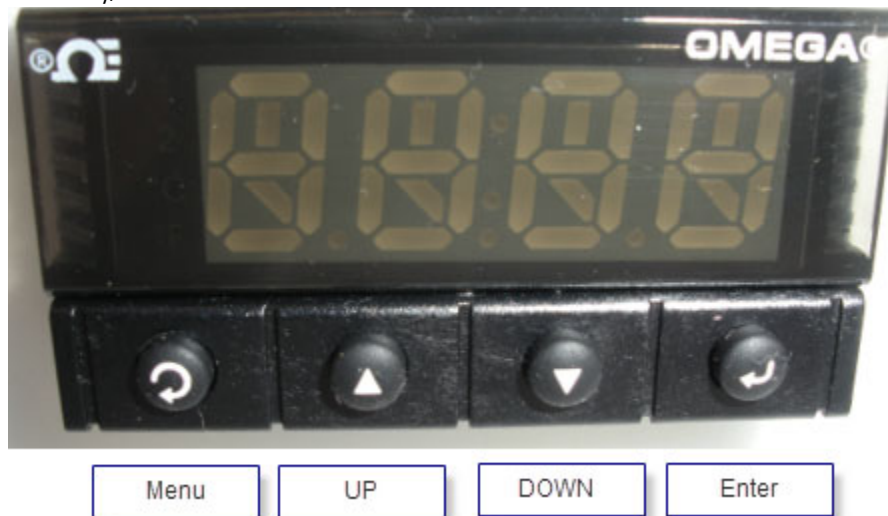
Figure 3-4 Heater Controller—Setting buttons

	1. Press the **Menu** button and cycle to the **SP1** menu option.
	2. Press the **Enter** button to go into temperature setting mode.
	3. Press the temperature **UP** and **DOWN** buttons to cycle to the required temperature.FlowIR temperature control can range from ambient (+/–5°C) to 120°C (+/–1°C).
	4. Press **Enter** to save the temperature setting.
	5. Press **Menu** again to return to the default menu setting.

2. Configure Instrument in Software

Specific settings in iC IR software drive the FlowIR to collect data in a manner appropriate for the product configuration and chemistry monitoring objective. You can then be confident that the infrared fingerprints are accurate representations of chemical changes. The software provides recommended default settings to speed the process.

A. Establish Instrument Connection through Software

1. **Start** iC IR software.
   Using the computer mouse, point to the iC IR icon on the Windows desktop and double-click on the icon.

   You will see the Start Page for iC IR software.
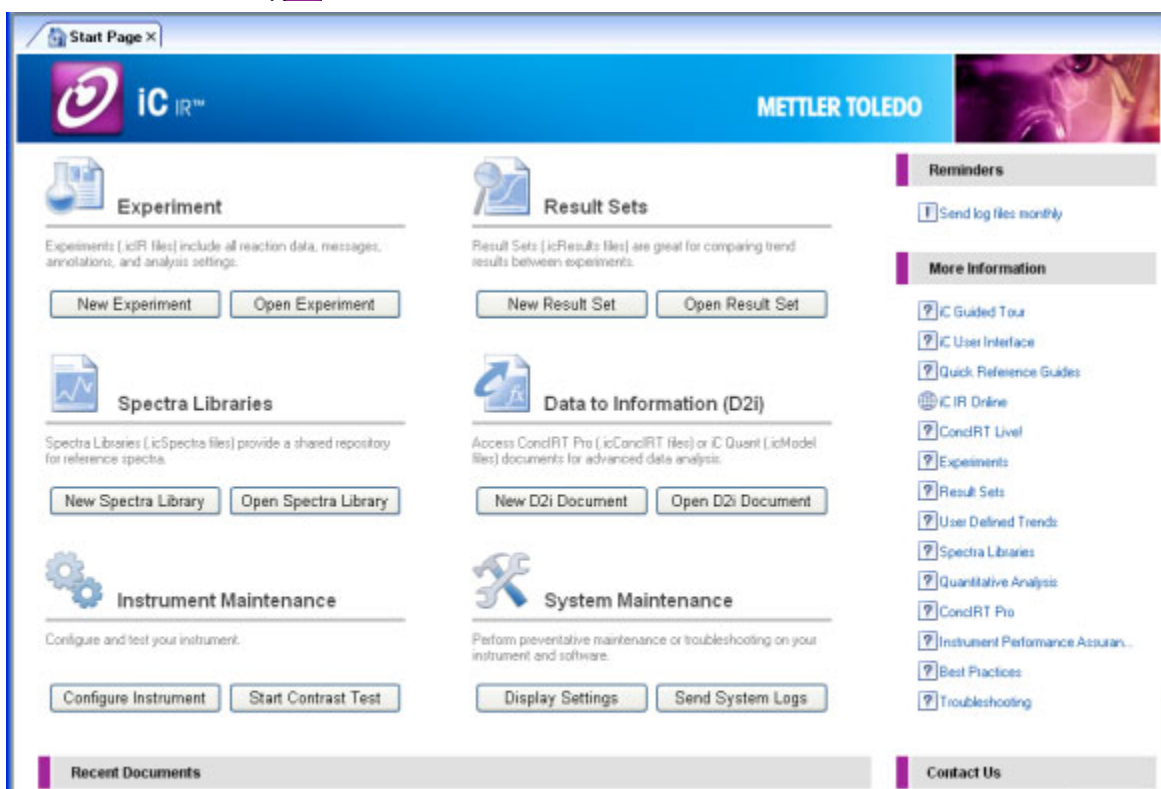
Figure 3-5 iC IR Start Page

2. Click **Configure Instrument** from the Start Page.
3. Select FlowIR in the 'Instrument' drop-down list.
4. Click **Connect**.
   a. Enter IP address—**192.168.1.2**

    b.   Click **Test**. The connection test should succeed.

    c.   Click **Initialize**. Initialization should succeed.

> **Note:**   After successful initialization, the FlowIR LED should be in the following states (shown in Figure 2-14 on page 21):
>
> POWER / TCP/IP—solid blue   SCAN—flashing blue

B. Establish Instrument and Probe Sampling Technology Settings

1.   Click **Configure Instrument** on the Start Page, if not already there.

2.   Set the following parameters to match the configuration of the FlowIR, if not already done at the factory. Record these settings in the 'StarterPac Installation Checklist.'

    • Probe Interface—FlowIR Sensor (sampling technology)

    • Probe Tip—**SiComp** or **DiComp**

C. Establish Acquisition Settings

1.   Click **Configure Instrument** on the Start Page, if not already there.

2.   Set the following parameters in the 'Probe acquisition' section to the 'normal' selection. Record these settings in the 'StarterPac Installation Checklist.'

    • Resolution—Normal (8 wavenumbers)

    • Spectral Range—Preset with the probe interface and probe tip settings

3.   Gain Adjustment—**232** (default).

> **Notes:** ■ The default gain may require adjustment for optimal Peak Height. If the 'Align Probe' page later in the installation wizard does not show a peak height with the acceptable range, click the Back button and adjust the gain.
>   ■ Peak height intensity should range between 16,000 and 24,000.

4.   Set the Scan/Sample parameter to **128 scans**.

5.   Set the Apodization Method to Happ-Genzel through the **Edit** button in the 'Instrument' section.

D. Complete Configure Instrument Wizard

1.   Click **Next** in the Configure Hardware & Software Settings window.

2.   Click **Next** in the Prepare to Clean Probe window.

3.   Click **Next** in the Align Probe window as long as the Peak Height range is between 16,000 and 24,000. If necessary, adjust the gain per step 3 under "C. Establish Acquisition Settings".

4.   Click **Collect Background** in the Collect Clean Reference Background window.

5.   Click **Finish**.

3. Record Performance Values

By design the FlowIR Flow Cell and the detector in the FlowIR base unit are prealigned at the factory so the process to enable the rapid implementation of the system for the FlowIR is quick and easy.

The Contrast and Align test provides a baseline Peak Height and Contrast for future reference. Proceed through the checklist in the Performance Values section of the 'StarterPac Installation Checklist' to record actions necessary to reach functional testing.

Note:	By this point, the unit should be ON for 4 hours and the iC IR software ready to use on the computer (see section: "1. Prepare FlowIR System for Use" on page 23). Remember that use of the form is optional after initial installation by a METTLER TOLEDO Field Service Engineer.

The purpose of alignment is to assure the energy of the system (source) properly travels from the origin to the sample and then to the detector. Maximum energy reaching the detector through this optical pathway will yield an infrared fingerprint characteristic of the chemistry in contact with the sampling interface (sensor). Over time these fingerprints accurately represent the flow chemistry dynamics that assist you in understanding the reaction mechanism and pathway.

A. Record Instrument Contrast and Align Values

1. In the iC IR Toolbox, click on the **Test Instrument** task pane.
2. Verify that the appropriate instrument configuration settings appear for sampling technology: Interface—**FlowIR Sensor**, Tip—**DiComp** or **SiComp**, and **DTGS detector**.
3. Select **Contrast and Align** and click **Start**.

Test mode
- ⦿ Contrast and Align
- ○ Performance
- ○ Stability
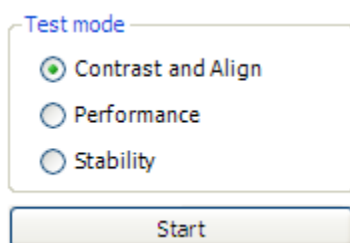
Start

4. Record the Peak Height, Contrast, and Peak Location values in the 'StarterPac Installation Checklist.'

Figure 3-6 and Figure 3-7 show the characteristic shape of the single beam from each type of sensor.
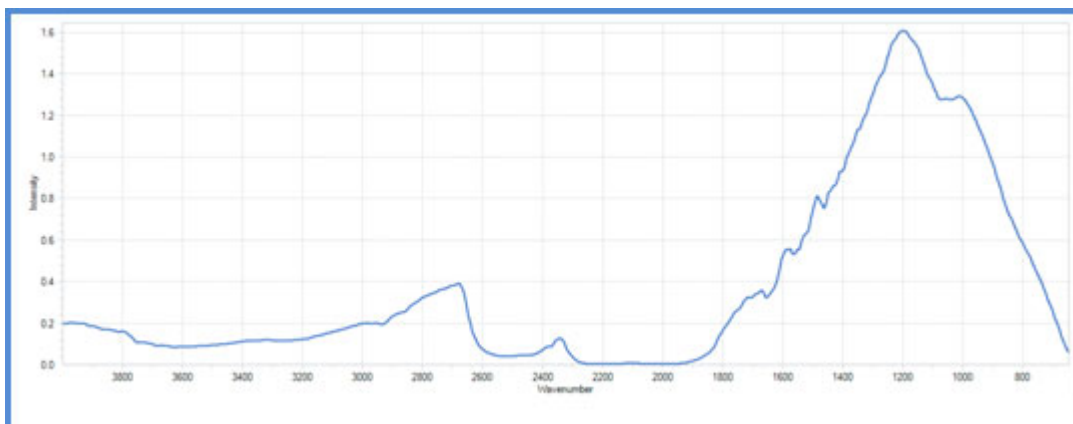
Figure 3-6 DiComp single beam from FlowIR Sensor
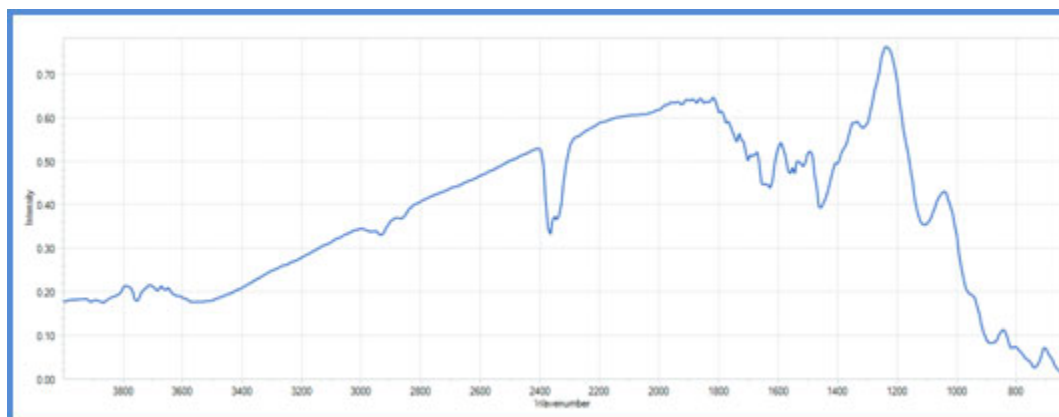
Figure 3-7 SiComp single beam from FlowIR Sensor

4. Perform Functional Testing

This section addresses the performance and stability of the FlowIR base unit and sampling technology. Measurements are recorded in the 'StarterPac Installation Checklist' where space is provided for up to two sampling technologies at time of purchase. The Product Description chapter of the "FlowIR Hardware Manual" lists the standard sampling technology available for use with the FlowIR.

Record the type of sampling technology used in the functional test.

A. Performance Test—Record Signal-to-Noise Ratio (SNR)

A good measure of FlowIR performance is the Signal-to-Noise Ratio (SNR). This value represents a specific method of measurement at METTLER TOLEDO that historically defines performance according to the original design specification. Recording the value in the 'StarterPac Installation Checklist' will define the reference point for verification of FlowIR performance when executing the test at anytime in the future.

Before proceeding, be sure the system has been properly configured and aligned.

1. In the iC IR Toolbox, click on the **Test Instrument** task pane.
2. Select 'Performance' in Test mode section and click **OK**.
3. Enter **10** for the number of runs.
4. Set the Start/End region to the values that correspond to your sampling technology in Table 3-1. For example, in the case of a FlowIR Sensor (DiComp), the start value is 1142 and the end value is 1042cm^{-1}.

    > **Note:** The Start/ End region is defined by the type of sampling technology that is configured in the Configure Instrument wizard.

Table 3-1 Wavenumber Region by Sampling Technology

Sampling Technology	Wavenumber Region for SNR
FlowIR Sensor—DiComp	1142–1042 cm^{-1}
FlowIR Sensor—SiComp	2600–2500 cm^{-1}

5. Click **OK**.

    The system will collect 10 background / sample pairs. The parameters used for collection are 1 minute scan time and 4 cm^{-1} resolution.

    > **Note:** A corrected root mean square calculation is performed on each sample spectrum over the selected wavenumber region. The SNR is then calculated from the inverse of the corrected RMS.

6. Proceed to section "B. Performance Test—Record Acetone Peak Height" for instructions on the performance wizard window that appears immediately after the SNR test completion. You will record the SNR values with the average Acetone Peak Height value at the end of the next section.

B. Performance Test—Record Acetone Peak Height

Another good measure of FlowIR performance is the Acetone Peak Height. This value indicates sensor integrity in a Flow Cell by measuring the absorbance of neat acetone with your sampling technology. Recording the value in the 'StarterPac Installation Checklist' will define the reference point for verification of FlowIR performance when executing the test at anytime in the future.

Note:	The Acetone Peak Height window will appear immediately following completion of the SNR test described starting on page 32.

1. Enter **4** in the number field for the number of tests. This step instructs the system to collect four acetone spectra.

2. Ensure the sensor is clean and dry, and void of any potential contact with solvent or reaction mixture.

> | | |
> |---|---|
> | **Note:** | IMPORTANT: Only clean the sensor surface when the FlowIR Sensor is attached to the base unit. |

3. Select **OK** at the next message reminding you to have a clean, dry sensor. The system will collect a background (16 scans at 4 cm^{-1}).

4. Run or inject acetone through the flow cell input tube port, ensuring the sensor is completely submerged.

5. Select **OK**. The system will collect the requested number of acetone spectra. The Acetone Peak Height is calculated automatically by the following equation:

   Absorbance$_{1092}$ cm^{-1} – Absorbance $_{1018}$ cm^{-1} = Acetone Peak Height

6. Locate the SNR and Acetone Peak Height values in the 'PerfSNR<date><time>Results' tab on the iC IR Start Page.

7. Record the Average SNR, ANR, and Average Acetone Peak Height in the Functional Testing section of the 'StarterPac Installation Checklist.'

Note:	For future reference, the software saves the results in a default "test data" folder on the computer or the location specified in Preferences (Tools > Preferences).
	The default location is:
	C:\Documents and Settings*[username]*\My Documents\iC IR experiments.

C. Performance Test—Record Acetone-to-Noise Ratio (ANR)

Holistic measurement of FlowIR performance comes from the Acetone-to-Noise Ratio through a calculation using Signal to Noise and Acetone Peak Height. Knowing the energy throughput of the system (Signal to Noise) and sensor path length (Acetone Peak Height), we can calculate a value that best represents the performance across all FlowIR base units and applicable sampling technology. What the value actually gives you is assurance of chemistry

monitoring that affords detection of reaction start, progress, and end-point. Infrared fingerprints (data) over time will yield absorbance trends of key reaction species (information) at concentrations possible with the ANR value. The higher the ANR, the lower the detection limit of the FlowIR.

Recording the value in the 'StarterPac Installation Checklist' will define the reference point for verification of FlowIR performance when executing the test in the future.

1. Locate the SNR and Acetone Peak Height values in the 'PerfSNR<date><time>Results' tab on the iC IR Start Page.

2. Record the Average SNR and Average Peak Height.

    ANR is an automatic calculation in the software using the following formula:

    (Acetone Peak Height) x (Signal to Noise) = ANR

3. Record ANR value in the Functional Testing section of the 'StarterPac Installation Checklist.'

D. Stability Test—Record System Stability as a Function of Time

ReactIR stability is a measure of performance consistency over a period of time. Regular infrared measurements as a function of time, in the same manner as monitoring a reaction, reveal stability information through % Transmittance trends at specific wavenumber locations. This test uses the variation in the absorbance trends to measure FlowIR stability.

1. Verify the flow cell is NOT in contact with any chemicals, only air. IMPORTANT: Only clean the sensor surface when the FlowIR Sensor is attached to the base unit.

2. Verify the flow cell is clean and dry.

3. In the iC IR Toolbox, click on the **Test Instrument** task pane.

4. Select 'Stability' in the Test mode section and click **Start**.

    A window will appear prompting you to define the duration of the test and interval between data points.

5. Enter **240** in the Duration field and **60** in the Interval field. These parameters correspond to a 240-minute test that collects a spectrum every 60 seconds.

6. Click **OK** in the Stability window.

    The stability test will start by collecting a background and then successive sample spectra over the 240-minute period. The software automatically measures and plots the %Transmittance value at the wavenumbers corresponding to the sampling technology.

7. Record the average %Transmittance values in the 'StarterPac Installation Checklist' at the conclusion of the test. The values appear in the iC IR software 'Stability Test Results' tab under the 'Summary Results.'

E. Calibrate Resistive Temperature Device (RTD)

Calibration of the Resistive Temperature Device (RTD) within the FlowIR Sensor is a necessary step at installation to assure an accurate reading of the reaction temperature. FlowIR hardware will read the RTD and relay the value to the iC IR software for trending with other chemical information.

Note:	The calibration process for FlowIR with a non-heated flow cell head requires the use of an external calibrated temperature monitoring device such as a thermocouple, which serves as the reference of absolute temperature.

FlowIR without Heater Controller

1. Verify that the hardware and software are properly communicating (refer to the LED Indicators section in the "FlowIR Hardware Manual").
2. Open the **Configure Instrument** wizard.
3. Select RTD 1 and click **Calibrate** to launch the RTD calibration wizard.
4. Select the RTD1 row and highlight the RTD Device.
   a. Select 'new' using the drop down arrow and create a new name for the RTD.
   b. Click **Next**.
   c. Select the one-point calibration and click **Next**.
5. Place external calibrated temperature monitoring device directly on FlowIR Sensor (top is closest to RTD).

Figure 3-8 Monitoring device on sensor

6. Wait for the system to stabilize by observing a constant value at the calibrated temperature monitoring device.
7. Enter the actual value from the calibrated temperature monitoring device in the Reference Temperature section. Click **Next**.
8. Click **Save** to record the calibration.
9. Record the action as complete in the 'StarterPac Installation Checklist.'

4. Perform Functional Testing

FlowIR with Heater Controller

1. Verify that the hardware and software are properly communicating (refer to the LED Indicators section in the "FlowIR Hardware Manual").

2. Open the **Configure Instrument** wizard.

3. Select RTD 1 and click **Calibrate** to launch the RTD calibration wizard.

4. Select the RTD1 row and highlight the RTD Device.
   a. Select 'new' using the drop down arrow and create a new name for the RTD.
   b. Click **Next**.
   c. Select the two-point calibration and click **Next**.

5. Heat the heated flow cell head to 35°F (1.7°C).

6. Wait for the system to stabilize by observing a constant value at the Heater Controller temperature display.

7. Enter the actual value from the Heater Controller in the Reference Temperature section. Click **Next**.

8. Heat the FlowIR Flow Cell by setting the setpoint on the Heater Controller to 100°F (37.8°C).

9. Wait for the system to stabilize by observing a constant value at the Heater Controller.

10. Click **Save** to record the calibration.

11. Record the action as complete in the 'StarterPac Installation Checklist.'

A

Checklists

This appendix includes checklist forms for use for site preparation and during installation and operation. Installation instructions begin on and operation instructions begin on .

Pre-Installation

Checklist of site preparation steps for the end user to complete before a schedule installation.

- ■

StarterPac Installation Checklist

Checklist of installation and operation steps for a FlowIR system in a non-regulatory environment:

- ■

Copy the checklist forms as often as needed, such as if you move the system or want to perform operational tests.

Note:	Retain the completed forms in a readily accessible location for reference during system service or maintenance.

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Pre-Installation

FlowIR™ StarterPac Pre-Installation Checklist

Use this checklist to verify that all prerequisite steps have been completed before a scheduled FlowIR system installation. Items on this checklist must be completed prior to the arrival of a METTLER TOLEDO Field Service Engineer (FSE) on site for startup of the instrument.

Date:		Company:		Address 1:	
Address 2:		City:		State:	
Zip/Country Code:		Country:		Status:	
Customer Name:		Email:		Phone:	
Model:		Serial #:		Type:	
Completed By:		Service #:		Form ID:	152

☐	Site Preparation—Space Requirement in Area of Intended Use

System can be installed either on a bench top or inside a fume hood. Verify installation accommodates the size and weight specifications of the instrument and external accessories:

Size (WxHxD):	137 x 116 x 241mm 5.4 x 4.6 x 9.5 inches	Weight:	28kg (6 lbs)
External Accessories:	Allow adequate space around instrument for FlowIR Sensor, changing of Flow Cell Heads, inserting flow chemistry tubing and the Power Supply.		

For heated configuration, include space for the heater controller with power supply:

Size (WxHxD):	157 x 62 x 200mm 6.2 x 2.5 x 7.8 inches	Weight:	0.82kg (1.8 lbs)

☐	Site Preparation —Utilities (Electric)

Verify that a power outlet is accessible in the area of intended use for the FlowIR base unit and the iC IR computer. Base unit power specifications are:

AC Power:	100-240 VAC, 0.25A (max)	DC Power:	12-13.6VDC, 2A Supplied (max)
Heater Controller:	24VDC, 3A (max)		
NOTE:	Power requirements do not include any additional device. Use of an AC line conditioner in areas where noisy power is known to exist is recommended. Line conditioner should have minimum power rating of 800 VA.		

☐	Site Preparation —Utilities (Communication)

Verify that connection points are available for Ethernet communication to your local area network (LAN). For connection of base unit and computer, METTLER TOLEDO provides a 2m (7ft) Ethernet communication cable.

☐	**Software Preparation —Computer**

Ensure that the control computer for the instrument is acquired (if applicable) and ready for software installation. Be sure the computer meets at least the minimum specifications in the "iC IR Software Installation Guide." For details about the computer specifications for PCs currently shipped with METTLER TOLEDO instruments and recommended for the optimal user experience, contact iC@mt.com.

☐	**Internal Paperwork and Approval for Installation**

If applicable, complete any necessary internal paperwork and approvals required within your organization for installation and start up of the FlowIR system.

☐	**Fluid Circulator, Tubing and Fittings**

Have a fluid circulator, tubing, and the specified Omnifit-style fittings available for system testing. Recommendations for Omnifit-style fittings are below:

	Omnifit Part Number	Details
For 1/16"OD Tubing	002119	PEEK™ Natural 1/4-28
	002122	PEEK™ Natural 1/4-28
	002310 (10 each)	One-piece PTFE ferrule for 1/4-28 fitting nuts
For 1/8"OD Tubing	002219	PEEK™ Natural 1/4-28
	002222	PEEK™ Natural 1/4-28
	002312 (10 each)	One-piece PTFE ferrule for 1/4-28 fitting nuts

FlowIR User Comments for METTLER TOLEDO Field Service Engineer:

Name:		Date:	

Signature FlowIR User:	

METTLER TOLEDO Service
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Toll Free: 866-333-6822 (MTAC)
autochemcustomercare@mt.com

7075 Samuel Morse Drive
Columbia, MD 21046
Phone: 410.910.8500 (Fax: 8600)
Website: www.mt.com/autochem

FlowIR™ StarterPac Installation Checklist

Date:		Company:		Address 1:	
Address 2:		City:		State:	
Zip/Country Code:		Country:		Status:	
Customer Name:		Email:		Phone:	
Model:		Serial #:		Type:	
Completed By:		Service #:		Form ID:	152

SITE REQUIREMENTS

All items from the Pre-Installation Checklist in StarterPac were completed:	

HARDWARE CONFIGURATION / ORDER VALIDATION

Sampling Technology	FlowIR Sensor:		Flow Cell Head Volume:	
	Flow Cell Head:		Heater Controller with Power Supply:	
	Wetted Materials:			
	Pressure/Temp:			

Hardware & Software	☐	FlowIR Base Unit	☐ Computer and Accessories	☐	iCIR Software CD
	☐	FlowIR Power Supply	☐ Country-Specific AC Power Adapter	☐	Ethernet Cable

Optional Software	☐	iC Quant	☐	ConcIRT Pro	☐ iC Kinetics	☐	iC Data Share

Documentation	☐ Certificate of Conformity for Sampling Technology	☐ Declaration of Conformance for FlowIR	
	☐ Product Documentation Portfolio (Installed with iCIR Software)		

SOFTWARE VERSION AND SERVICE AGREEMENT

Software Version	iCIR:		iC Quant:		ConcIRT Pro:		iC Kinetics:

Service Agreement	FlowIR Coverage:		Expiration Date:	
	Sensor Coverage:		Expiration Date:	

SYSTEM CONNECTIONS

☐ FlowIR base unit in hood or benchtop		☐ FlowIR Sensor connected	
☐ Computer located in a suitable work location		☐ Flow Cell Head connected to FlowIR Sensor	
☐ Ethernet communications connected to base unit and computer		☐ Heater controller connected to Flow Cell Head (if applicable)	
☐ Power connected at base unit and computer		☐ iCIR software installed	

SYSTEM STARTUP

☐ Power at base unit and computer is ON	☐ Scan LED flashes
☐ Power LED lights (amber) and changes to (solid blue)	☐ Fault LED is OFF
☐ iCIR software launches	☐ View live single beam in Contrast and Align test mode
☐ IP address confirmed through Test Instrument and Initialization	☐ Software Add-ONs installed and successfully launch (optional)

SYSTEM READINESS

☐ System ON for more than 4hrs	☐ Configure Instrument launched

SYSTEM CONFIGURATION IN SOFTWARE

Instrument:		Detector:		Resolution:		Spectral Range:	
Probe Interface:		Probe Tip:		Set Gain:		Apodization:	
IP Address:		Check RTD Box:		Scans/Sample:		Firmware:	

CONTRAST AND ALIGN TEST MODE VALUES

Peak Height:	Contrast:	Peak Location:

PERFORMANCE TEST VALUES

☐ Record Performance Values for Sampling Technology 1:	☐ Record Performance Values for Sampling Technology 2 (if applicable):
☐ Verify the Flow Cell Sensor is clean	☐ Verify the Flow Cell Sensor is clean (if applicable)
Signal to Noise Ratio (SNR):	Signal to Noise Ratio (SNR):
Acetone Peak Height (APH):	Acetone Peak Height (APH):
Acetone to Noise Ratio (ANR):	Acetone to Noise Ratio (ANR):

STABILITY TEST AND HEATER CONTROLLER FUNCTIONALITY

Record Stability Test Results:	Verify RTD and Heater Controller Functionality:
@ 1000 cm-1: @ 3000 cm-1:	☐ RTD Calibrated- FlowIR Sensor ☐ Heater Controller Box functions (if applicable)

TEST SPECIFICATIONS

	Sensor Type	Signal to Noise	Acetone Peak Height	Acetone to Noise	Stability
☐	DiComp	6000	0.25	1500	100%T +/- 4% (96-104%T)
☐	SiComp	2000	0.34	650	

FlowIR system functions in accordance with METTLER TOLEDO Test Specifications:	

Non-Conformances (include action to resolve):

Mettler-Toledo AutoChem, Inc. Field Service Engineer: Completed in due and proper manner			Responsible FlowIR User: Copy of this check record received	
Name:	Date:	Name:	Date:

Signature FSE:	
Signature FlowIR User:	

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