Hardware Manual

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ReactIR™ 45P

Process Chemistry Understanding

METTLER TOLEDO

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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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1

Introduction

ReactIR™ 45P is a dedicated industrial process monitoring system designed to operate safely in the harsh plant environment, while monitoring critical reaction components in real time using *in situ*, mid-infrared measurements. The main control system is a Web application (iC Process) that monitors your chemistry continuously or in batch mode while communicating critical reaction variables to your Distributed Control System (DCS) or OPC-UA external systems. The remote software (iC IR) enables users to connect to the ReactIR 45P base unit for viewing real time, *in situ* reaction monitoring information that can be used to make process decisions or to establish future monitoring strategies.

ReactIR 45P is equally compatible with a laboratory environment to monitor small-scale reactions for better understanding of the chemistry prior to installation in a production environment. In this case, iC IR is the primary control software offering all the benefits of a lab-based ReactIR product.

Note: In a laboratory environment, iC IR can be used alone as the control software.

This document contains instructions for site preparation, technical specifications, instrument configurations, routine operation, general safety notes, and care and maintenance information. If you are viewing this document electronically, click any blue-colored link to go to the related information and instructions.

Should you have questions that are not addressed in this document, please contact your local METTLER TOLEDO office or our Customer Care Department using the information under "Service and Technical Assistance" on page 9.

Related Documents

The following documents are shipped with the ReactIR 45P instrument:

- "ReactIR 45P Hardware Manual" (MK-PB-0085-AC)—This document
- "ReactIR 45P IPac Guide" (MK-PB-0093-AC)—Installation and system readiness information and procedures
- "ReactIR 45P Safety Manual" (MK-PB-0086-AC)—In Appendix C on page 67

The iC IR Documentation Portfolio contains the iC IR installation Guide and Software User Guide, along with user guides for the optional software.

Documents listed below are on the iC Process Documentation Portfolio installed with iC Process software:

- "iC Process Installation Guide" (MK-PB-0072-AC)
- "iC Process Software User Guide (MK-PB-0074-AC)—Instructions on how to use the iC Process Web application software to control the instrument and the iC Process task

pane in iC IR software to create templates for process methods and to connect to the instrument for batch or real-time analysis.

- ″QuickRef-iC Process for Operators (MK-PB-0077-AC)

Symbols in this Manual

To help you recognize information, the following symbols appear throughout this manual. Please pay particular attention to the sections marked by these symbols.

Table 1-1 Warnings, Cautions, and Notes

	**WARNING**—Extremely important safety information—Failure to observe the warning may result in serious personal injury or equipment damage.
	**Caution**—Important information that tells you how to prevent damage to equipment or to avoid a situation that may cause minor injury.
Note:	Information to which you should pay special attention.

General Policies

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

Installation Policy

Site preparation for the ReactIR 45P equipment is the end user's responsibility. Structural installation details, particularly for installations in hazardous environments, should be prepared and supervised by a certified and registered professional engineer who is properly qualified to assure a safe installation at your site.

METTLER TOLEDO is not licensed to provide certification of mechanical, structural, or piping designs that may be required for installation of the ReactIR 45P system into specific applications. Such designs must be prepared and supervised by a certified and registered professional engineer in your organization.

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 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 ReactIR 45P. 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 ReactIR 45P 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 9.

Non-iCare subscribers may request a quote for an upgrade by contacting their local salesperson or Customer Care.

Training Programs

Training for the hardware and software is available through the users' Web site (see link above) and through your METTLER TOLEDO TAC. Use the contact information on page 9.

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. To arrange for specific application assistance from a METTLER TOLEDO Technology and Applications Consultant or for general assistance, contact Mettler-Toledo AutoChem, Inc. through the toll-free number below.

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

Service and Technical Assistance

2

Product Description

This chapter includes the following sections:

- "Overview of the ReactIR 45P System" on page 11
- "ReactIR 45P System Components" on page 15
- "ReactIR 45P Sampling Technology Configurations" on page 20
- "ReactIR 45P Mounting Configurations" on page 21

Overview of the ReactIR 45P System

The ReactIR 45P is a unique process-hardened FTIR spectrometer designed to fit into nearly any space. It requires only power, purge, and communication connectivity to monitor critical reaction components in real time using *in situ,* mid-infrared measurements. Capable of tracking key reactants, products, by-products, and intermediates, the ReactIR 45P system provides value in rapidly improving process development efficiency and safety of liquid-based chemistry. Transfer of a ReactIR 45P monitoring strategy to full scale production leads to a reduction in either batch cycle time or variance from norm in continuous process.

The ReactIR 45P has two configuration options—Normal Location (NL) or Hazardous Location (HL). The ReactIR 45P base unit is the same for both configurations, so a qualified METTLER TOLEDO Field Service Engineer (FSE) can easily convert the NL model to an HL configuration by installing a purge and pressurization module that allows safe use in a Class I/Division 1 and Zone 1 classified area. Direct transfer of the instrument from the lab to the plant can be an advantage for seamless transition of equipment and methodology, thus saving time, cost, and resource.

Note: Sensor sampling technology interfaces are sold separately.

Note: Safety information specific to the Normal Location and the Hazardous Location are in ReactIR 45P Safety Manual" in Appendix F on page 77.

The ReactIR 45P system is an automated product that uses METTLER TOLEDO proprietary software, iC IR, to provide mid-infrared data collection and analysis without the need for an expert. Typically, iC IR is used in a laboratory environment, but it can be used with a ReactIR 45P in a lab or as part of a scale-up campaign.

iC Process is the Web-based software application for the ReactIR 45P instrument that communicates through your LAN for easy access by operators in the control room and process chemists at their desk. iC IR software enables process chemists to design experiments that will be used to create methods in iC Process. A process chemist can view iC Process real-time processing in iC IR and analyze results from real-time or post-processing for use in adjusting methods or designing campaigns.

Definition of Terms

Refer to the "ReactIR 45P IPac Guide" for terminology related to iC Process software including definitions for the system readiness functional tests.

Single Beam—A single beam is the energy profile (intensity versus wavenumber) of the ReactIR with or without a sample in contact with the sensor. Single beam can refer to a background (without chemistry sample) or a sample (with chemistry). A single beam spectrum is later "ratioed" against a background to create an infrared fingerprint (absorbance versus wavenumber).

Stirling Engine—A Stirling Engine cools the MCT detector without requiring liquid nitrogen.

Sampling Technology—An interchangeable sensor and conduit combination placed on the base unit to analyze chemistry (see "ReactIR 45P Sampling Technology Configurations" on page 20).

IPA—Instrument Performance Assurance (IPA) module to validate and calibrate laser frequency based on the NIST standard for polystyrene. The IPA module is included in the EQPac (see Appendix A on page 57).

ServicePac—METTLER TOLEDO service package offerings (IPac Starter-Pac, iPac Quality-Pac, or EQPac Quality-Pac).

IPac Starter-Pac—Initial Qualification Package (IPac) for basic installation to ensure that the ReactIR 45P meets the manufacturing specifications and quality assurance outlined in the 'IPac Starter-Pac.' This service is included with system installation.

IPac Quality-Pac—Initial Qualification Package (IPac) for additional validation of the instrument and installation. The IPac Quality-Pac is designed for a regulated environment. This service package, sold separately, includes Instrument Performance Assurance (IPA) module (see "IPA Module" on page 61).

EQPac Quality-Pac—Equipment Qualification Package (EQPac) for installation in a regulated environment and subject to regulatory compliance guidelines. The EQPac Quality-Pac goes beyond system installation to provide a lifetime qualification record of the installation, operation, performance, and maintenance. This service package, sold separately, provides comprehensive details to meet the requirements for installing ReactIR 45P in a Class I/Division 1 or Zone 1 (ATEX) environment. Includes Instrument Performance Assurance (IPA) module (see "IPA Module" on page 61).

ReactIR 45P NL Base Unit

Figure 2-1 ReactIR 45P NL–Base unit with optional Air Handling Unit and FiberConduit sampling technology

The ReactIR 45P NL base unit system includes:

- Stirling Engine MCT (SE-MCT) or DTGS detector
- Communication via RJ45 terminated Ethernet cable
- 100–240VAC 50/60Hz (autoswitching)
- Air Handling Unit (optional)
- RTD Module for DS FiberConduit Probes (optional)
- Frame (optional)
- One Year System Warranty (includes sampling technology purchased with system). System warranty ends one year after installation or fifteen months after shipment.

ReactIR 45P HL Base Unit

The HL configuration is designed for use in potentially explosive atmospheres.

Figure 2-2 ReactIR 45P HL—Base unit with purge system (on optional frame with Air Handling Unit)

The ReactIR 45P HL system includes:

- Stirling Engine MCT or DTGS detector
- Communication via 100m fiber optic cable
- 100/240VAC 50/60Hz (autoswitching)
- Purge and pressurization
- Air Handling Unit (optional)
- RTD Module for DS FiberConduit Probes
- Frame (optional)
- Safety certification compatible with ClassI/Division 1 and Zone 1 area of intended use
- One Year System Warranty (Includes sampling technology purchased with system.) System warranty ends one year after installation or fifteen months after shipment.

ReactIR 45P System Components

Components in a ReactIR 45P configuration include the base unit, sampling technology, and operating software.

Do not open the ReactIR 45P enclosure. There are no user-serviceable parts inside a ReactIR 45P base unit. Contact your METTLER TOLEDO Field Service Engineer (FSE) for all service needs.

- Base unit—NL or HL
- Software
- Sampling Technology

Figure 2-3 ReactIR 45P NL system base unit with FiberConduit sampling technology

Also available are sampling technologies shown in Figure 2-4.

Table 2-1 ReactIR 45P NL Base Unit External Component Descriptions

	Component	Description
1	**ReactIR 45P enclosure**	Primary component of the system containing electrical and optical devices
2	**Thermoelectric (TE) Cooler**	For maintaining a constant internal enclosure temperature during daily and seasonal climate variations.
3	**NL Purge/Power/ Communications Module**	Component of the base unit that interfaces external purge, power, and communications utility to the instrument.
4	**Sampling Interface Module (SIM) flange**	Connection point for sampling technology compatible with the instrument, such as a FiberConduit probe.

Table 2-1 ReactIR 45P NL Base Unit External Component Descriptions (continued)

	Component	Description
5	**Air Handling Unit**	Optional pressure/flow regulator for instrument quality dry air input to system.
6	**Frame**	Optional mounting equipment for the base unit and NL purge, power, and communications module, and optional Air Handling Unit.

ReactIR 45P HL

The ReactIR 45P HL configuration includes all the NL components plus a hazardous location purge, pressure, and communications module.

Figure 2-4 ReactIR 45P HL base unit with representative sampling technologies

Table 2-2 ReactIR 45P HL Base Unit External Component Descriptions

	Component	Description
All ReactIR 45P NL components, plus:		
6	**HL Purger/Power/ Communications Module**	Component of the base unit that interfaces external purge, power, and communications utility to the instrument.

HL Purge/Power/Communications Module

An HL model ReactIR 45P includes a special module for purge, power, and communications.The purge/pressurization system applies power to the ReactIR 45P analyzer after the enclosure is completely purged and pressurized.

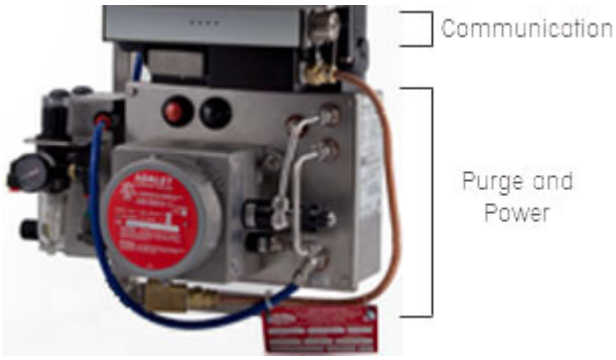


Figure 2-5 ReactIR 45P HL Purge/Power/Communications module

Figure 2-5 includes the optional Air Handling Unit.

Note:	A ReactIR 45P NL unit can be converted to an HL unit at the factory by adding the Purge, Power, and Communication module to the base unit.

Software

In addition to the base unit, ReactIR 45P systems require instrument control software:

- iC IR software
- iC Process software

iC Process Software

iC Process is the Web-based application for the ReactIR 45P instrument that communicates through your LAN for easy access by operators in the control room and process chemists at their desk. The unique iC Processuser interface offers an immediate visual understanding of batch or continuous reaction dynamics and any process upsets that may occur. Key information can be sent to the Distributed Control System (DCS) via Modbus TCP/IP or communicated via OPC-UA .

Communication can be via two types of media—Ethernet connection (NL) or fiber optics (HL through purge, power, and communications module).

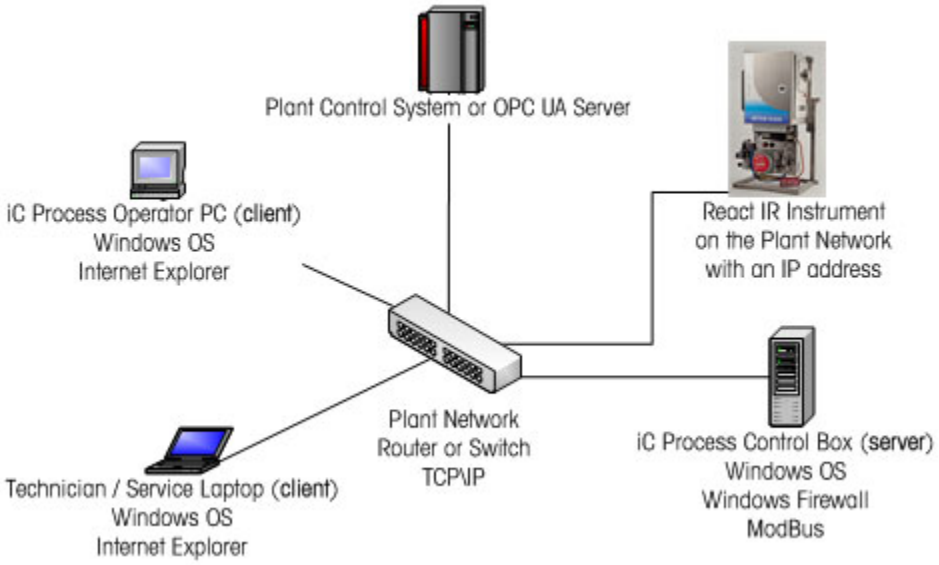


Figure 2-6 iC Process LAN communications diagram

Ethernet Communications (NL Configuration)

In a Normal Location (NL) configuration, the ReactIR 45P connects to a control computer via Ethernet communication through your LAN. Specifications are in Table 3-2 on page 28. As the customer, you are responsible for establishing connectivity to the control computer by plugging in the RJ45 connector on the power and communications cable into your LAN.

Fiber Optic Communications (HL Configurations)

In a Hazardous Location (HL) configuration, the ReactIR 45P connects through your LAN to a control computer via fiber optic communication. The fiber optic originates at the breakout box and terminates at your LAN interface.

Note: To communicate via Ethernet from the LAN to your control computer, you will need to supply a device that converts fiber optic to Ethernet (see optional "Media Converter Kit" on page 58). You are responsible for establishing connectivity to the control computer.

Fiber optic cable specifications in Table 3-3 on page 29 describe the cable provided by METTLER TOLEDO. The cable is typically used as a riser cable and is type OFNR. Data communication networks commonly use duplex patch cables. The Duplex Fiber provides two channels for transmit and receive.

iC Process is the key link to deliver the protocol developed in the laboratory into the kilo lab, pilot plant, or production environment.

Key features include:

- Seamless pathway from lab to plant
- Transfer methods developed in the lab to process methods
- Simple interface for operators
- Data analysis for experts
- Standard interface to DCS

iC IR Software

The ReactIR 45P system is an automated product that uses Mettler-Toledo AutoChem, Inc. proprietary software, iC IR, to provide infrared data collection and analysis possible without the need for an expert. iC IR is the result of many years of evolution through valuable customer feedback that offers powerful reaction analysis functions with an easy-to-use graphical user interface. As a wizard-based application, iC IR guides a user through the experience of collecting, analyzing, and visualizing data so important to gaining real time insight into their chemistry. In essence, iC IR allows chemists to focus on solving chemistry problems instead of learning instrumentation and analysis procedures. Typically, iC IR is used in a laboratory environment, but it can be used with a ReactIR 45P in a lab or as part of a scale-up campaign.

Key features include:

- Record *in situ* reaction spectra
- Record pure component reference spectra
- Real-time peak profiling
- Real-time component analysis (ConcIRT LIVE)
- Real-time solvent/water vapor subtraction
- Linked Views (3D surface, 2D spectra, profile trends, event viewer)
- Replay reaction data.
- Export data to Excel
- Export graphs to Word
- Compare results from multiple experiments
- Manage libraries of reference spectra
- Univariate and Multivariate Modeling (optional iC Quant add-on)

iC IR experiments can be saved as templates that an Administrator imports into iC Process software to create process methods. Refer to the "iC Process Software User Guide."

Note: Although iC Process and iC IR can each be used to control the ReactIR 45P instrument, only one software system can be in control at a time. Refer to Appendix C on page 676 for instructions on how to change from one control software to the other.

ReactIR 45P Sampling Technology Configurations

In addition to normal location (NL) and hazardous location (HL) configuration components, a ReactIR 45P system includes the following options for the optical assemblies required with the sampling technology:

"Mirror Conduit" on page 20

"FiberConduit" on page 21

"DS Micro Flow Cell" on page 21

Mirror Conduit

ReactIR 45P connects directly to your process chemistry with a selection of mirror conduit sampling technologies that receive a Sentinel™ probe.

K4 Conduit

ReactIR 45P can connect to your process chemistry through a K4 mirror conduit that receives a Sentinel probe sampling technology. Use of K4 or K6 mirror conduits with a Sentinel probe requires direct connection to the SIM and provides a single point sampling of liquid-base chemistry.

Figure 2-7 K4 mirror conduit

K6 Conduit

The ReactIR 45P can use the K6 mirror conduit that receives a 6mm or 16mm AgX probe.

Figure 2-8 K6 mirror conduit

FiberConduit

ReactIR 45P can connect to your process chemistry through a FiberConduit™ probe. Use of this integral conduit and probe requires direct connection to the SIM flange of the base unit for single point sampling OR dual connection to the MultiplexIR for multi-point sampling of liquid-based chemistry. FiberConduit probes are available in a choice of sizes and sensor materials.

Figure 2-9 FiberConduit

DS Micro Flow Cell

ReactIR 45P can connect to your continuous flow chemistry through a DS Micro Flow Cell sampling technology. A single optical interface module attaches to the ReactIR 45P SIM flange to receive the flow cell. Please refer to the "ReactIR Sampling Technology Guide" chapter on how to connect and use DS Micro Flow Cells.

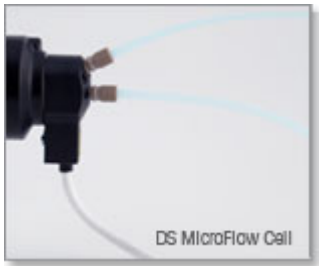


Figure 2-10 DS Micro Flow Cell

ReactIR 45P Mounting Configurations

The ReactIR 45P base unit can be mounted using 6mm or 1/4-inch minimum diameter stainless steel bolts (customer-provided). The ReactIR 45P has mounting tabs on the base unit enclosure as well as mounting tabs on the optional frame. Without the optional frame, the base unit can be directly mounted at the area of intended use. With the optional frame, the base unit is secured to the frame at the factory. The frame is then mounted in the area of intended use. For dimensions of the NL and HL configurations with and without the frame, refer to "System Dimensions" on page 23.

ReactIR 45P Mounting Configurations

3

Specifications

In addition to the specifications in the "ReactIR 45P Safety Manual", this chapter includes:

- "Operating Temperature Range" on page 23
- "System Dimensions" on page 23
- "Sampling Technology and Conduit Purge" on page 28
- "Communications" on page 28

Refer to the ReactIR 45PSafety Manual in Appendix F on page 77 for safety specifications.

Specifications include those provided by METTLER TOLEDO and those that are your responsibility as the end user. An electronic Pre-Installation Checklist that describes the end-user's responsibilities is sent with the system installation schedule (see sample form in Appendix E on page 73).

Operating Temperature Range

The environmental (ambient) temperature operating range is: 0°C to 35°C (32°F to 95°F).

This range allows the ReactIR 45P to maintain a constant enclosure temperature for producing optimal analytical measurements. Any environmental temperature outside the operating temperature range may affect the precision or accuracy of the process measurements. The air to the Thermoelectric (TE) cooler is critical for maintaining a fully operational ReactIR 45P in this temperature range.

System Dimensions

The diagrams in this section show the dimensions of the ReactIR 45P base unit with or without the optional frame. Also included are the dimensions for the purge/pressurization required for the hazardous location configuration.

- "ReactIR 45P NL—Base Unit Dimensions (without Frame)" on page 24
- "ReactIR 45P NL—Base Unit (with Frame)" on page 25
- "ReactIR 45P HL—Base Unit Dimensions (without Frame)" on page 26
- "ReactIR 45P NL—Base Unit (with Frame)" on page 25

Allow additional space for the sampling technology.

System Dimensions

ReactIR 45P NL—Base Unit Dimensions (without Frame)

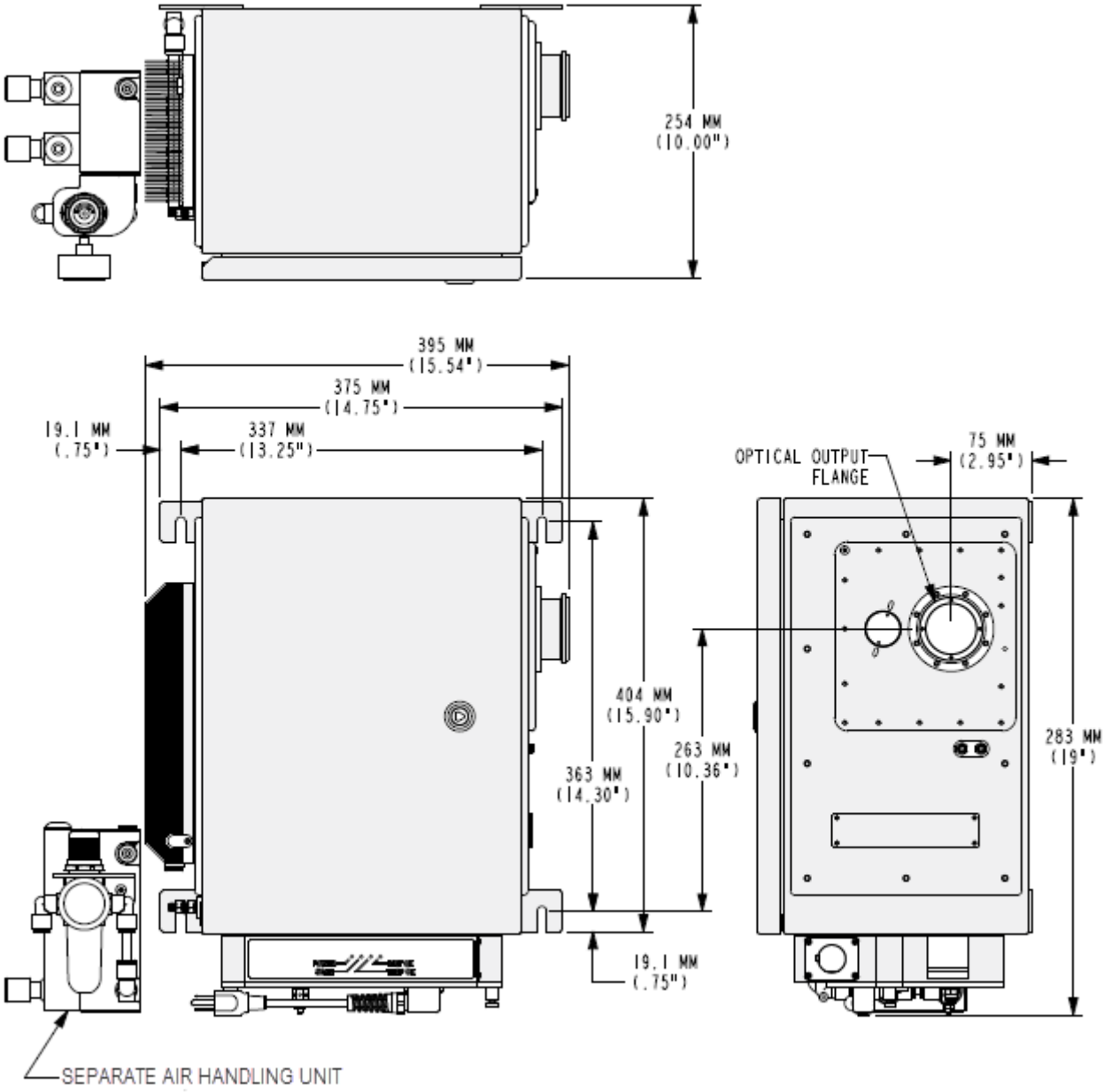


Figure 3-1 ReactIR 45P NL—without frame

ReactIR 45P NL—Base Unit (with Frame)

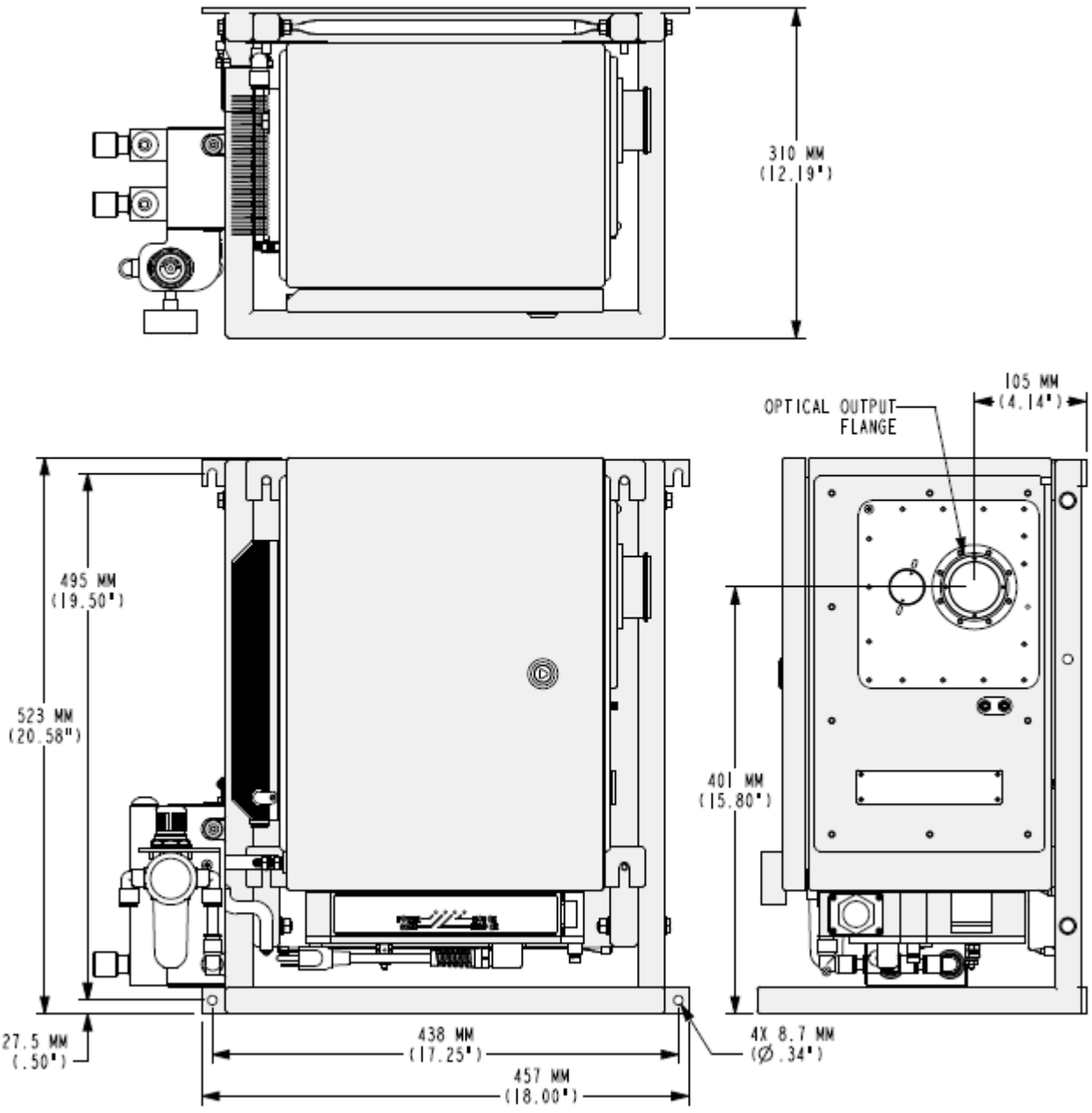


Figure 3-2 ReactIR 45P NL with frame

ReactIR 45P HL—Base Unit Dimensions (without Frame)

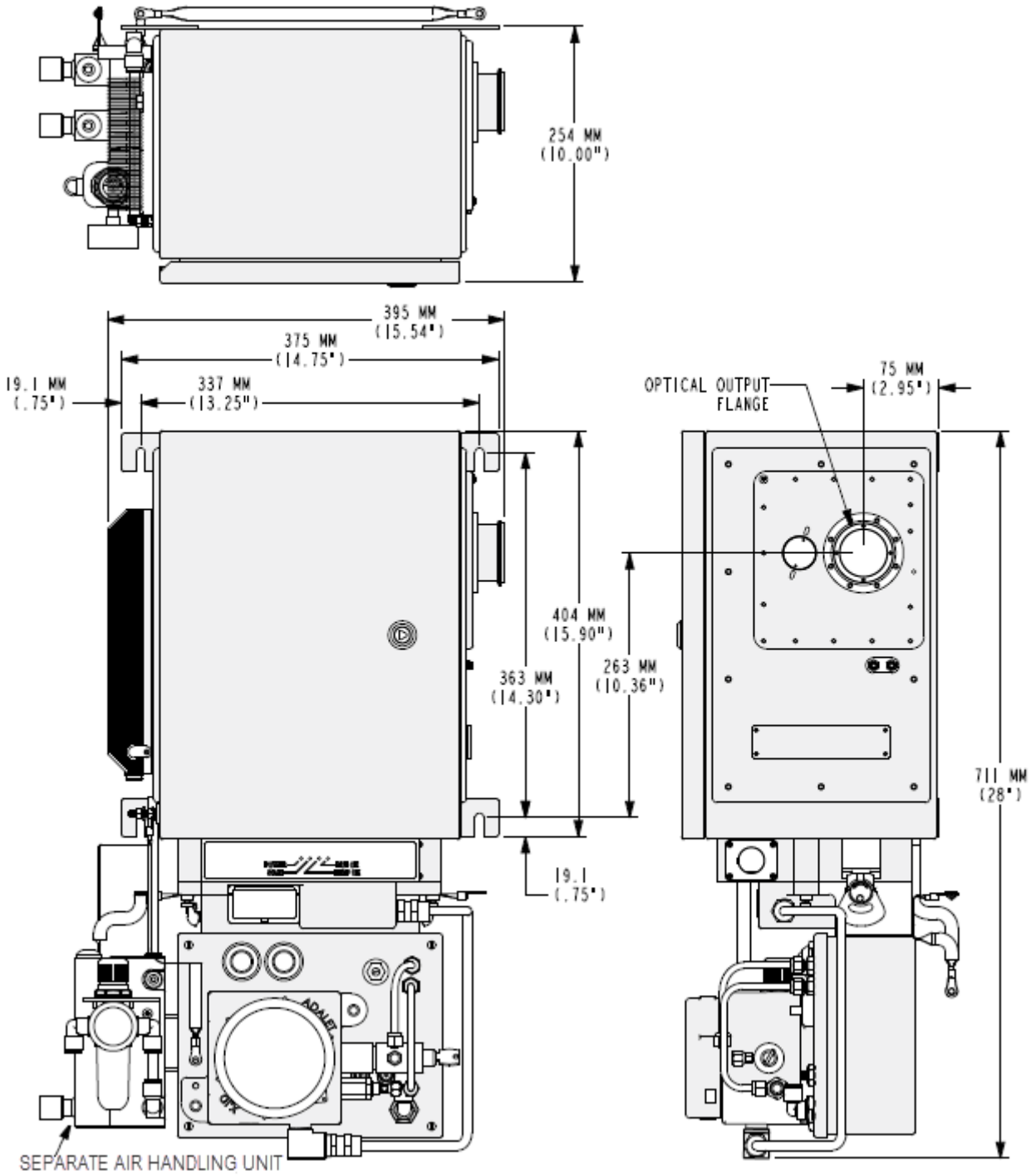


Figure 3-3 ReactIR 45P HL—without frame

ReactIR 45P HL—Base Unit Dimensions (with Frame)

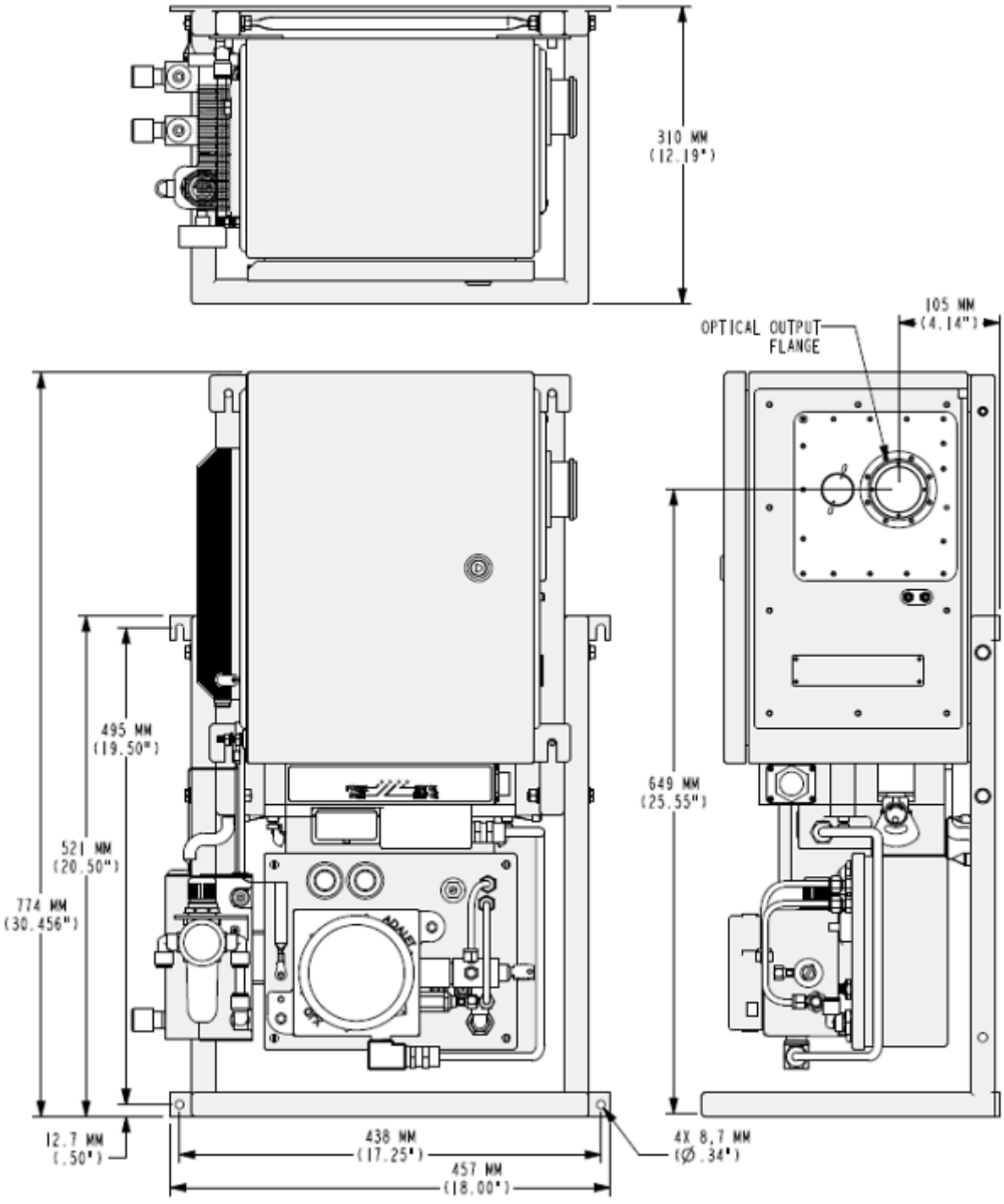


Figure 3-4 ReactIR 45P HL—with frame

Sampling Technology and Conduit Purge

The mirror conduit sampling technologies require a supply of instrument quality purge air to assure maximum infrared measurement performance. Refer to the "ReactIR 45P IPac Guide" installation chapter for a diagram of suggested items to supply purge air to the sampling technology in a ReactIR 45P.

Table 3-1 Sampling Technology Air Purge Specifications

Specification	Details
Inlet Pressure Range	Minimum of 5psi (0.34bar) to a Maximum of 10psi (0.7bar)
Minimum Flow (during rapid exchange)	0.5cfm (14LPM) to 1cfm (28LPM)
Dryness	–100°F (–73°C) dew point
CO_2 Free (for specific applications)	Less than 1 PPM
Filtered Air Minimum Particle Size	5 microns
Fitting Connection	1/4-inch (6.35 mm) hose barb, quick-connect fitting

Communications

ReactIR 45P communicates through your Local Area Network (LAN) to a control computer. Users with access to the LAN and server connected to the ReactIR 45P are then able to implement a reaction monitoring strategy and view the outcome in real time.

Table 3-2 describes the NL Ethernet cable and Table 3-3 describes the HL fiber optic cable.

Table 3-2 ReactIR 45P-to-LAN Ethernet Cable Specifications (NL)

Specification	Details (Ethernet)
Connectors (2)	RJ45
Diameter	Ethernet cable connectors in the zip cord are 3mm or 0.11inches.
Length	10 feet

The fiber optic cable is included with the HL configuration.Replacement cables must match the specifications of the cable provided and can be purchased from METTLER TOLEDO.

Table 3-3 ReactIR 45P-to-LAN Fiber Optic Cable Specifications (HL)

Specification	Details (Fiber Optic)
Connectors (2)	Type—LC LC Duplex Industrial–to–LC Duplex Jumper with dust caps
Materials	Two channel 50mm/125µm multimode optical fiber, OFNR
Bend Radius (Minimum)	■ 10.5cm (installation) ■ 7.0cm (operation)
Crush Resistance	2200 N/cm

Control Computer

The ReactIR 45P communicates via TCP/IP to a control computer on your LAN that runs iC Process Web application software.The control computer operates as a server so authenticated users can access as a client. A specific ReactIR 45P instrument is identified as a 'slave' with an IP address. A user opens a Windows Explorer window and specifies the iC Process server.

iC IR users can view and analyze ReactIR 45P batch and continuous process data through the iC IR 'Process' task pane in the iC IR toolbox.

Note: In a laboratory or scale-up operation, the ReactIR 45P NL can be controlled by the iC IR software. The instrument can only be controlled by one software at a time. If is necessary to switch control, follow the procedure in Appendix C.

Control Computer Specifications

- The iC Process control computer must have the minimum system requirements specified in the "iC Process Installation Guide."
- The PC that runs the iC IR software must meet the system requirements specified in the "iC IR Installation Guide."

In addition to the software installation guides, please refer to the "ReactIR 45P IPac Guide" for additional information on software as part of the overall system installation.

Communications

4

Routine Operation

ReactIR 45P system readiness is checked during the final phase of initial installation according to the ReactIR 45P IPac Starter-Pac, IPac Quality-Pac, or EQPac, as applicable. The "ReactIR 45P IPac Guide" describes the system installation and system readiness tests, so refer to the guide, as needed.

This chapter describes the routine operation of a ReactIR 45P including the steps you follow to easily implement the product. Also included are suggestions on the most efficient way to use the ReactIR 45P to monitor chemistry in a laboratory, kilo lab, or production environment.

WARNING—Use of this product in a manner not specified by the manufacturer may result in serious injury and/or damage to the equipment and will void the warranty, the protection provided by the equipment may be impaired.

ReactIR 45P LED Indicators

Four LED indicators on the panel below of the ReactIR 45P base unit enclosure show the status of the instrument as it relates to power, scanning/communication, and readiness. Frequent check of these indicators enables recognition of instrument conditions that may require attention to assure measurement accuracy (see Figure 4-5). A fully functional instrument will yield solid blue Power, Temp OK, and MCT OK indicators and a flashing blue Scan indicator.

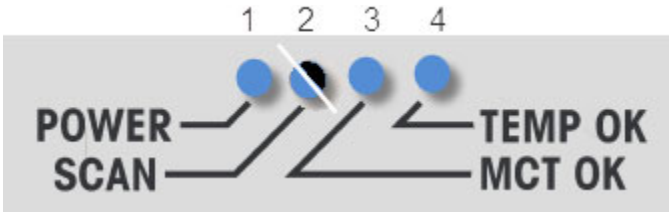


Figure 4-5 ReactIR 45P LED Indicators (fully functional state)

Table 4-1 ReactIR 45P LED Indicators

LED		Status	Description
1	Power	**OFF**	ReactIR 45P is without power.
		Blue—Solid	System is powered.

Table 4-1 ReactIR 45P LED Indicators (continued)

LED		Status	Description
2	Scan	**OFF**	System not scanning.
		Blue—Flashing	System is scanning and sending data to software application. Scanning occurs during a live experiment, when the scanning phase reaction analysis is in process.
3	MCT OK	**Blue**—Solid *	Stirling MCT temperature has reached its set point. Time required is several minutes.
		OFF	Fault condition (MCT detector).Normal (DTGS detector)
4	Temp OK	**Blue**—Solid	Modulator temperature has reached its set point. Time required may be up to four (4) hours.
		OFF	Fault condition.

***** Not applicable with DTGS detector.

LED states that are highlighted in Table 4-1, above, indicate a fully operational system. Refer to Chapter 6, "Troubleshooting" for tips on things to check to achieve operational LED status.

Preparing ReactIR 45P System for Use

ReactIR 45P can operate using iC IR software in a laboratory environment or iC Process combined with iC IR in a campaign or production environment. The control software for routine operation can be either iC IR or iC Process.

Note: To run the instrument using the software that is **not** currently controlling the ReactIR 45P instrument, you must change the control to the software of choice. See instructions in page 67.

The procedures below assume the ReactIR 45P system is installed and the instrument communication with the control software has been established during system installation and readiness testing.

1. Ensure the ReactIR 45P Starter-Pac, IPac, or EQPac documents are complete.
2. Verify the enclosure door is locked.

3. Apply air to the ReactIR 45P system as specified in the ReactIR 45P IPac Guide. Table 4-2 shows the operating parameters for air pressure and flow.

Note: A correction is necessary to set the flow meter. For example, at 80 psig air supply pressure the flow rate at the flow meter should be set to 1.6 SCFM (4 SCFM divided by 2.5 (correction factor)). Refer to the graph in Appendix D on page 71 to calculate the correction factor.

Table 4-2 Operating Parameters—ReactIR 45P

Parameter	HL Settings		NL Settings	
	To Enclosure:	To TE Cooler:	To Enclosure:	To TE Cooler:
Minimum air pressure	4.1 barg (60 psig) 6.9 barg (100 psig)		4.1 barg (60 psig) 6.9 barg (100 psig)	
Maximum air pressure				
Minimum purge time	5-10 minutes		10 minutes	
Minimum purge flow rate	4 SCFM	4 SCFM	5 SCFH	4 SCFM
Maximum purge flow rate	8 SCFM	8 SCFM	(4.7LPM) 10 SCFH	8 SCFM

4. Apply power to the ReactIR 45P NL system.

Note: This step only applies to the NL configuration. The purge/pressurization system in a ReactIR 45P HL system applies power after the enclosure is fully purged and pressurized.

Connect Sampling Technology to ReactIR 45P Base Unit

During system installation, the purchased sampling technology is connected to the base unit and the system is aligned and tested with the installed sampling technology. This step only applies if you are changing sampling technologies.

1. Attach the sampling technology to the SIM flange on the right side of the ReactIR 45P base unit enclosure. Refer to the "ReactIR 45P IPac Guide' for detailed steps.
2. If applicable, apply air to sampling technology. Mirror conduit sampling technologies and Sentinel probes require clean, dry instrument air.

Ensure System is Powered Up At Least Four (4) Hours

Note: Before taking critical measurements, the ReactIR 45P system must be powered on for at least four (4) hours so the instrument electronics are warmed up.

1. Verify that the blue Power LED (indicator 1 in Figure 4-5) on the front of the instrument is lit (solid blue).

2. Verify that the Scan LED (indicator 2 in Figure 4-5) on the front of the instrument is lit and flashing blue.
3. Verify the MCT OK and TEMP OK lights are illuminated (solid blue), indicating all functions are operational. For a DTGS detector, the MCT OK light does not light. TEMP OK indicates DTGS detector readiness.

Verify Control Software is Communicating with Instrument

1. Turn on the remote computer and start the iC Process (or iC IR) control software. Instrument Configuration for the ReactIR 45P should already be complete as part of the "ReactIR 45P IPac Guide" procedure.
2. Connect to the instrument through the control software.

Simple Steps to a Successful Experiment

Getting the most out of your ReactIR 45P requires simple steps that lead to the monitoring of your chemistry. The data will then be of the highest quality for easy conversion to chemical information that you can use for better understanding of the reaction dynamics. All of the actions center around gaining maximum performance of the ReactIR 45P through the iC IR software tools. Once complete, you can be certain that the infrared fingerprints accurately reflect chemical changes pertinent to your chemistry.

We recommend iC Process users switch control to iC IR for steps "3. Align Probe" and "4. Clean the Sensor" for the best tools to align and clean the sensor. Once these steps are complete you can switch control back to iC Process for background collection using your routine iC Process method.

Below are the steps:

"1. See An Overview of the Process" on page 34
"2. Interface Sampling Technology with Your Chemistry" on page 35
"3. Align Probe" on page 39
"4. Clean the Sensor" on page 40
"5. Collect a Background" on page 44
"6. Set the Data Collection Parameters" on page 48

Refer to "Best Practices" on page 49 for additional guidelines.

1. See An Overview of the Process

The following useful references are available to help you learn more on this subject:

"Experiment Setup in iC IR" (MK-PB-0013-AC)—Included in your product documentation portfolio available through iC IR Help > Show Documentation Portfolio. This is a Quick

Reference guide that provides instructions on the basics of ReactIR 45P hardware and iC IR software for starting an experiment.

"iC IR Guided Tour"—A link to the tour is in the More Information section of the iC IR software Start Page. The tour is a video that provides a concise overview of the software with special attention to efficiently collecting data and converting it to information. To review a specific part of the tour, click the small 'Jump to' link above the tour window and select from the drop-down list.

Figure 4-6 Guided Tour segment selection link

"iC Process for Operators" (MK-PB-0077-AC)—Included in your product documentation portfolio that is on the iC Process installation media. This is a Quick Reference guide that provides an overview of instructions for the operator who routinely monitors the ReactIR 45P instrument through iC Process.

"iC Process Software User Guide" (MK-PB-0074-AC)—Included in your product documentation portfolio that is on the iC Process installation media. This is the full user guide on how to implement, manage, and operate the iC Process Web application. It includes instructions on service mode and how to use iC IR software with iC Process.

2. Interface Sampling Technology with Your Chemistry

Interfacing the sampling technology with your chemistry will lead to data and information about the reaction, thus meeting the purpose behind your purchase of the ReactIR 45P. The method for interfacing to your chemistry

In the lab, start by placing the reaction vessel within reach of the probe end of the sampling technology or within flow distance of the DS Micro Flow Cell.

For monitoring in large scale vessels, begin by inserting the sampling technology into the specific probe interface supplied by METTLER TOLEDO. Read further for instructions on how to install a probe into the interface, such as a dip tube.

In the Lab

In the laboratory, aReactIR 45P system typically uses DS FiberConduit single-probe or dual-probe sampling technology. When monitoring continuous flow chemistry, the DS Micro Flow Cell sampling technology can be used.

DS FiberConduit—Single Probe

A short procedure will establish the correct orientation of the probe tip in the reaction vessel before adding solvent and reagents. You will need an adaptor to assure a secure fit of the probe in one of the vessel ports. Check with your Technical Applications Consultant (TAC) to make sure you have the appropriate adaptor for your specific vessel.

1. Once you have the right adapter, simply insert the probe through the adaptor and secure with the plastic compression fitting. This step can be done prior to or after inserting the adaptor into the reaction vessel.

Figure 4-7 DS FiberConduit with adapter in common reaction vessels

2. Adjust the insertion depth of the probe into the vessel to assure complete coverage of the tip throughout the experiment. The vessel contents should be empty at this point to collect an 'air background'

DS Micro Flow Cell

Monitoring reaction chemistry requires injection of solvent and reagents or flow of the liquid solution into the DS Micro Flow Cell. Establish connections to the cell using the specified Omnifit-style fittings (not provided). Mate the opposite end to the reaction chemistry to allow continuous flow. Alternately, create a shorter length of tubing to afford easy injection of solvent and reagents.

For additional instructions on the subject please read the Quick Reference Guide: "Connecting a DS Micro Flow Cell" that ships with the DS Micro Flow Cell sampling technology and is included in the ReactIR and iC IR documentation portfolio.

Note:	Be sure to collect an 'air background' before introducing liquid reaction chemistry into the DS Micro Flow Cell.

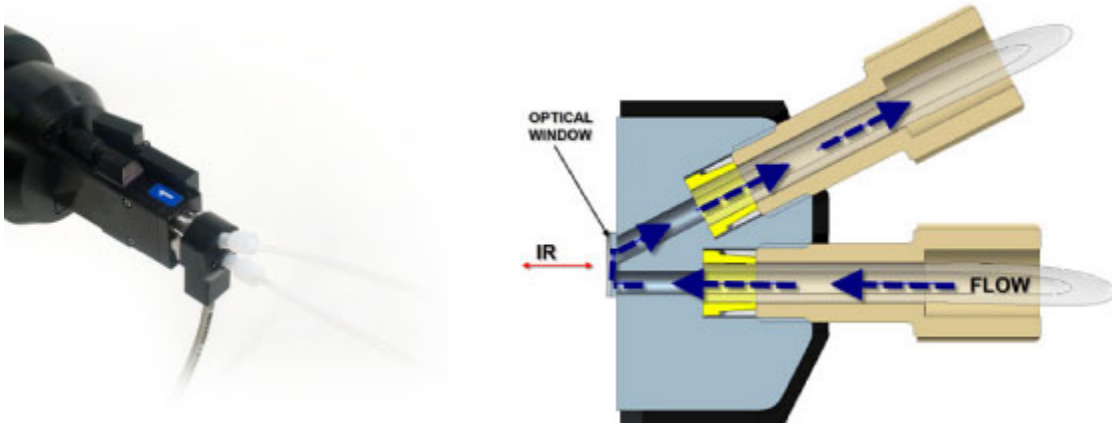


Figure 4-8 DS Micro Flow Cell (heated model shown on left)

DS Fiber-to-Gas Cell

Monitoring reaction gases requires connection to the Gas Cell through 1/8" input and output ports. You supply the gas sample and hardware to adjust flow and pressure.

Note:	Be sure to collect an 'air background' before introducing gas samples into the Gas Cell.

In Kilo Labs, Pilot Plants, or Production

In larger vessels, the ReactIR 45P sampling technologies can interface with your chemistry through the optional dip tube, bottom-outlet drain valves, or flow cells.

Dip Tube Adapter

METTLER TOLEDO offers a dip tube adapter kit for the 6-inch or 9-inch FiberConduit probes. The adapter hold the probe securely inside the dip tube. METTLER TOLEDO provides an engineering drawing 055-97-000 with steps to fabricate the dip tube and weld it to the coupling provided in the adapter kit. A quick reference sheet identified below ships with the adapter kit to provide step-by-step instructions on how to integrate your ReactIR FiberConduit probe into the dip tube.

MK-PB-0081-AC "Inserting ReactIR FiberConduit Probe in Dip Tube"

High-Pressure Probe Adapter

METTLER TOLEDO offers a high-pressure adapter for use with FiberConduit probes. Two NPT fitting sizes are available—3/8 or 1/2-inch NPT in sizes for 6.35 or 9.5.

A quick reference sheet that ships with the adapter assembly provides step-by-step instructions to prepare the adapter and insert a FiberConduit probe into it.

MK-PB-0089-AC "Using a High-Pressure ReactIR Probe Adapter"

SchuF Bottom-Outlet Drain Valve

Refer to the SchuF adapter instructions on how to install the adapter in a drain valve, Then, insert a ReactIR FiberConduit probe into the SchuF adapter according to the instructions. Contact SchuF, as necessary.

Flow Cells

Refer to page 38 for instructions on how to integrate a Sentinel in a Process Stream using an adapter specially designed by METTLER TOLEDO. Sampling technologies that use a Sentinel include:

- DS Fiber-to-Sentinel
- K4 Mirror Conduit-to-Sentinel

Reaction vessels (large volume flow cells, high pressure autoclaves) with a proprietary connection design are necessary to insert and secure a Sentinel probe in contact with liquid chemistry. Each Sentinel comes with the hardware and liquid seal to safely secure the connection. Check with your Technical Applications Consultant (TAC) to make sure you have the appropriate vessel and fitting to safely secure the connection.

Note: Be sure to collect an 'air background' before introducing liquid reaction chemistry into the DS Fiber-to-Sentinel or K4 Mirror Conduit-to-Sentinel.

Integration to a Process Stream

When the sampling technology interfaces to the process stream using a flow cell especially designed by METTLER TOLEDO for your application, tighten the Sentinel bolts (eight 10-32 x 0.75 SHCS bolts) according to the required torque specifications.

Note: If the installation uses a probe rather than a Sentinel, skip this procedure.

1. Using a torque wrench, tighten the bolts of the Sentinel to two torque values.
   a. First, tighten each bolt, sequentially, to 40 in/lbs.
   b. Then, return to bolt #1 and tighten each bolt to 60–75 in/lbs.

2. Tighten the bolts in the numerical sequence illustrated in Figure 4-9.

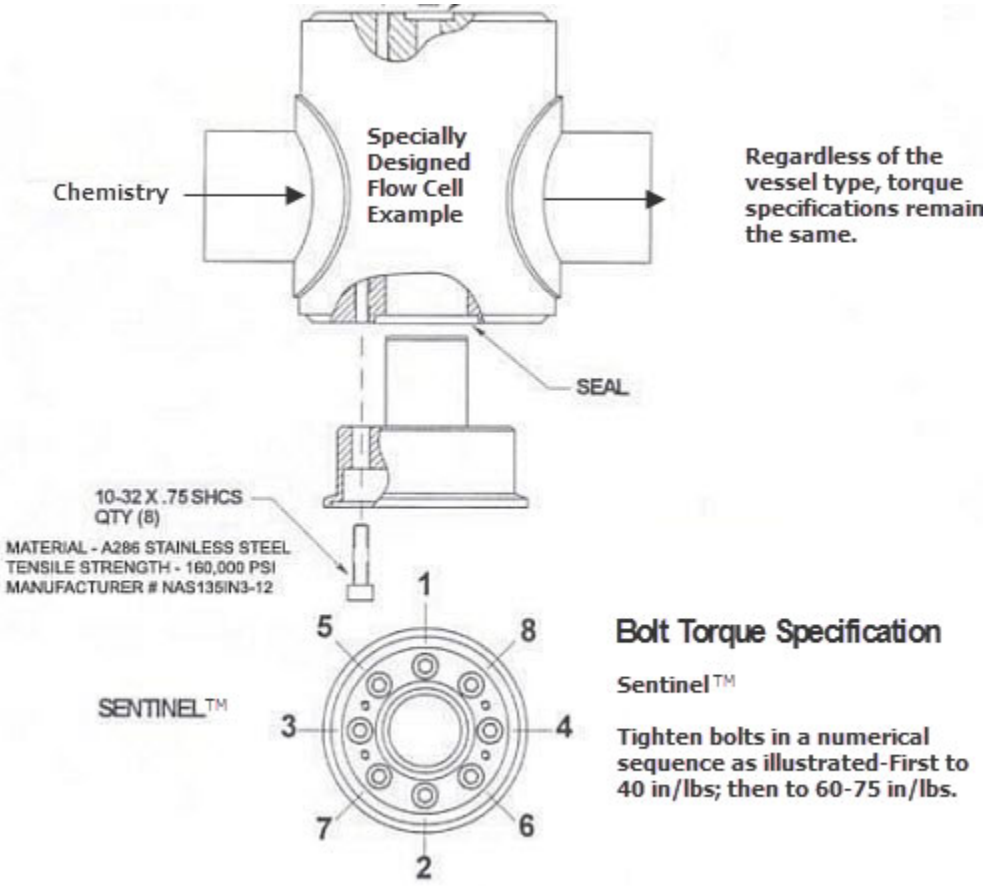


Figure 4-9 Bolt torque specifications for a Sentinel

Apply the same torque specifications for installation of a Sentinel in a cross special.

3. Align Probe

We recommend checking alignment before each experiment using a simple software wizard. The purpose is to assure the energy of the system (source) properly travels from the origin to the sample and then to the detector. By aligning maximum energy through this optical pathway, the ReactIR 45P will yield an infrared fingerprint characteristic of the chemistry in contact with the sampling technology (sensor).

A successfully completed ServicePac document is the prerequisite for routine use of the Align Probe wizard prior to an experiment. (Refer to the iC Process Software User Guide for the corresponding alignment procedure.)

The steps below describe alignment through the wizard in iC IR software:

1. Click **Configure Instrument** on the iC IR Start Page.
2. Proceed through the wizard by clicking **Next** until you reach the 'Align Probe' window.

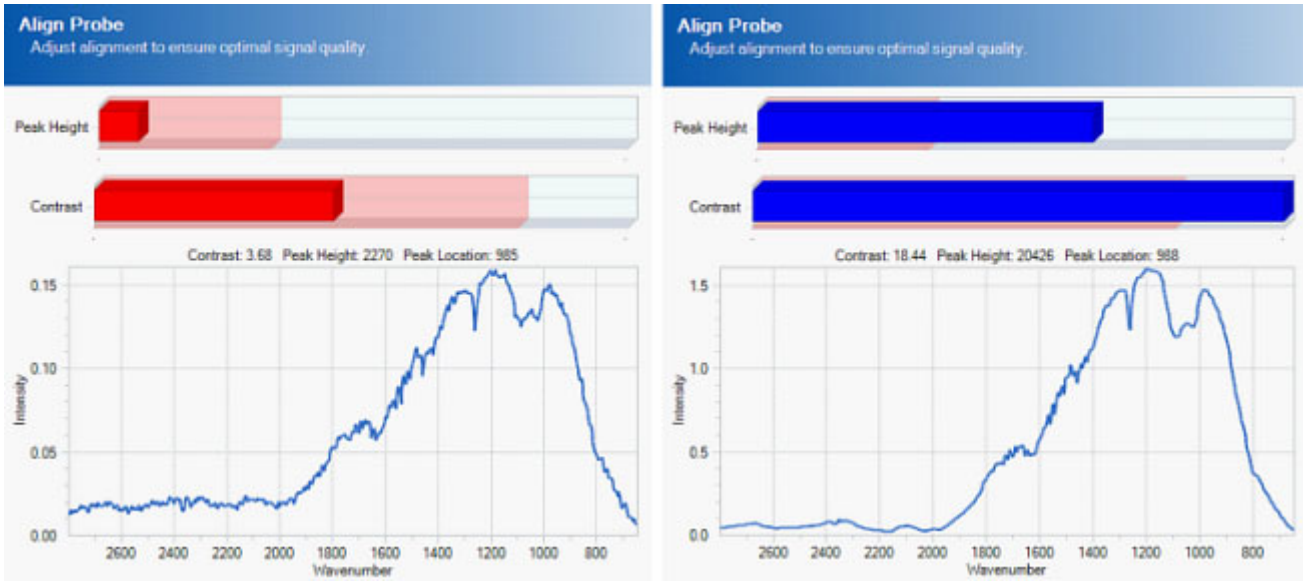


Figure 4-10 Align Probe wizard—From red to blue bars

3. Check the Peak Height and Contrast bars at the top of the Align Probe window.
   - If the indicator bars are both Blue, then alignment is OK.
   - If the indicator bars are Red, exit and return to the alignment procedures in the "ReactIR 45P IPac Guide" to adjust the following:

     DS Fiber-to-Sentinel—This step is not necessary for DS FiberConduit Probe, Micro Flow Cell, or Fiber-to-Gas Cell sampling technologies.

     Detector Preamp—Refer to advanced alignment gain adjustment steps in the "ReactIR 45P IPac Guide."

   Note: Only use the instructions that relate to hardware adjustments, not the software steps to view peak height and contrast. The Align Probe wizard will react to any adjustments to the hardware.

4. If the indicator bars are still Red after sampling technology and/or detector preamp adjustment, exit the wizard to adjust the fixed mirror per the instructions "ReactIR 45P IPac Guide."

4. Clean the Sensor

Cleaning the probe or DS Micro Flow Cell is recommended after each experiment. This action eliminates any chance of observing infrared fingerprints from a previous reaction or sample measurement, thus assuring an accurate representation of the reaction of interest. Follow the

instructions under "4. Clean the Sensor" on page 40 to properly clean either type of sampling technology.

Although you will clean the 'wetted' surfaces of the probe or DS Micro Flow Cell, the most important part is the sensor (DiComp or SiComp in most cases) since it is the true sampling surface when measuring reaction chemistry. The sensor is at the tip of a probe and inside the cavity volume of a DS Micro Flow Cell. Both sampling technology types are accessible for liquid and physical cleaning.

The iC IR 'Clean Probe' wizard dramatically speeds the cleaning process. (Refer to the "iC Process Software User Guide" for related procedures using iC Process.) Once in the wizard, you can quickly determine whether cleaning is necessary, as well as observe the impact of the clean method. The following images show possible types of 'dirty' sensors and the desirable end result.

Peaks pointing in the positive direction indicate one of two situations.

- **Sensor has materials present on the surface** relative to the last background measurement, likely taken immediately after cleaning the sensor. This is a common occurrence if the probe has not been cleaned following an experiment. Enough residual reaction mixture is on the sensor to yield an infrared fingerprint. If you do not clean before the next experiment the residue can cause inaccurate measurement of reaction component trends.
- **Residual cleaning solvent is present on the sensor surface.** Wait for the solvent to dry, assuming no residue will result, or wipe with a clean kimwipe. If a residue persists, choose another solvent for a final rinse.

Dirty Sensor Examples

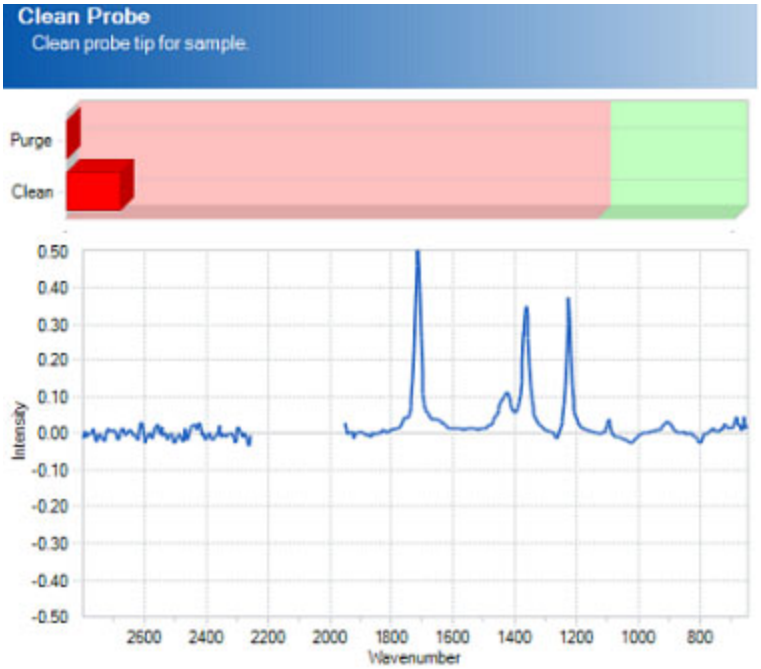


Figure 4-11 'Dirty' sensor—Prior reaction mixture or insufficient drying time of cleaning solvent

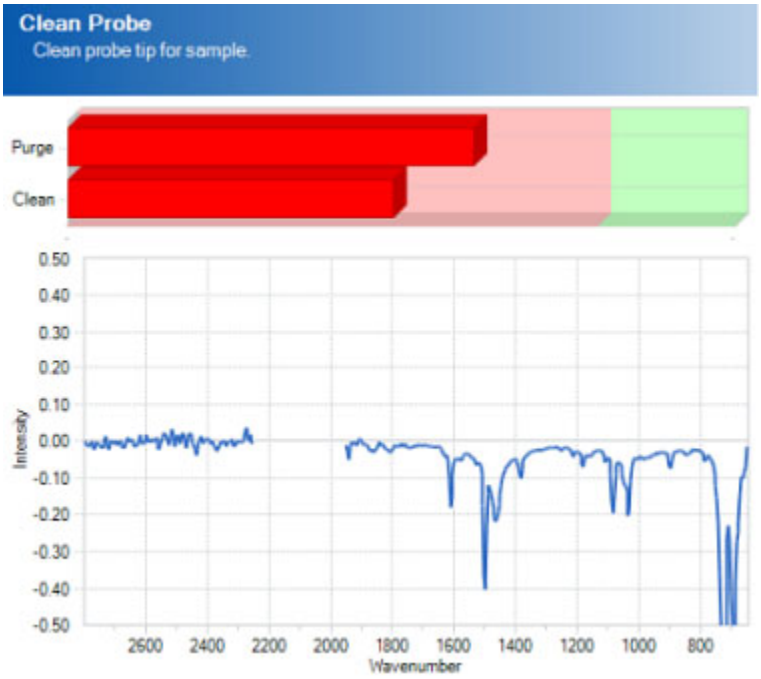


Figure 4-12 'Dirty' sensor—Poor cleaning method and subsequent collection of new background

Peaks pointing in the negative direction are a result of cleaning a residue off the sensor relative to the last background measurement. For example, not cleaning the residue from the a previous experiment (as above) and collecting a new air background will essentially include the residue in the background spectrum. When you finally clean the sensor, the negative peaks will appear since the residue is no longer present on the sensor relative to the original background spectrum.

When the sensor is 'dirty,' repeat the following steps until you see green indicator bars and a flat spectrum line:

1. Clean the sensor free of any visible residue.
2. Check sensor cleanliness using 'Clean Probe' wizard.

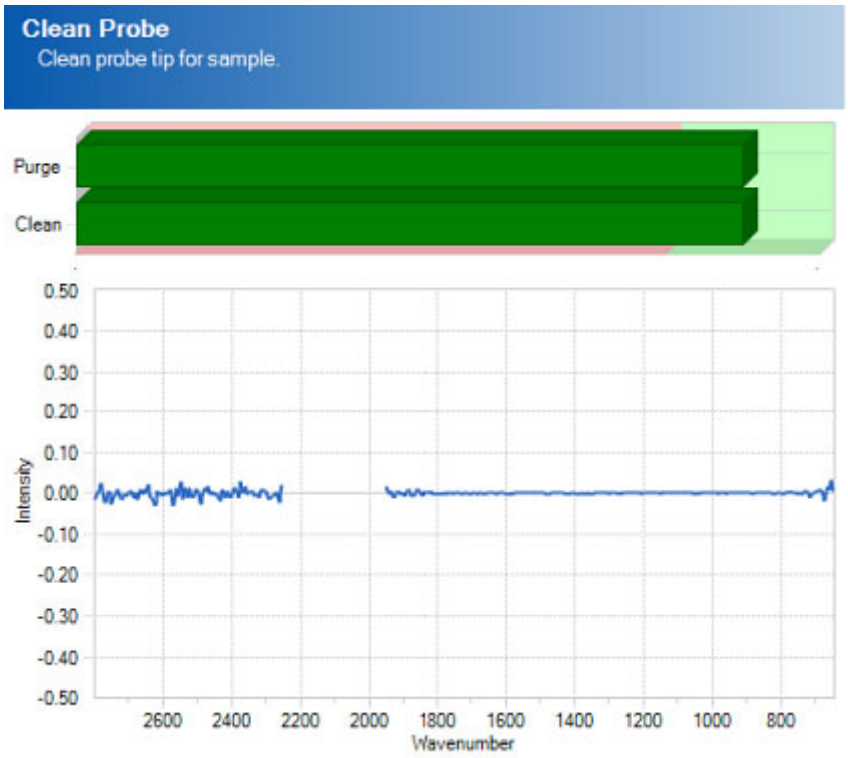


Figure 4-13 'Clean' sensor—Green indicator bars and flat spectral line

- If positive peaks are present, repeat the cleaning process until green indicator bars appear and a flat spectral line is present, proceed through the wizard.
- If negative peaks are present:
  a. Collect a new background by clicking **Back** in the New Experiment wizard until you reach the 'Name Experiment File' page.
  b. Click **Configure Instrument**.
  c. Click **Next** to reach the 'Collect Clean Reference' page.
  d. Click **Collect Background** to apply the new background to the 'Clean Sensor' wizard.

e. Click **Next** and then **Finish** to return to New Experiment wizard.

f. Proceed to 'Clean Probe' page.

g. If negative peaks persist then repeat the process or change cleaning solvent until green indicator bars appear and a flat spectral line is present.

5. Collect a Background

Collection of a background can be accomplished in iC IR or iC Process depending on which software you choose to control the ReactIR 45P. In this section we teach you the importance of collecting a background that applies to either control software. The software steps may be different but the tips and hints to collect a quality background are the same. The collection of an air background prior to each experiment is the single-most important step in getting high quality infrared data out of a fully functional ReactIR 45P. Every sample measurement following this step will use the background to 'ratio out' all infrared absorbing materials in the optical path and the source intensity profile. The end result is an infrared fingerprint of absorbance versus wavenumber of only the reaction mixture components. A flat baseline will appear at whatever wavenumbers are non-absorbing by the chemistry.

For example, water vapor will always be present in the ReactIR 45P at a very small and constant concentration, and the air background will show the characteristic fingerprint. Subsequent collection of air samples will also contain the water vapor in the raw single beam (intensity versus wavenumber). However, subsequent ratio of sample to background single beam eliminates the water vapor to produce a flat zero absorbance in air. Note in Figure 4-14

that all other absorbing features (sensor, AgX, source energy profile) also ratio out of the sample spectrum. This processing is a routine step in an infrared spectroscopy measurement that the software performs automatically.

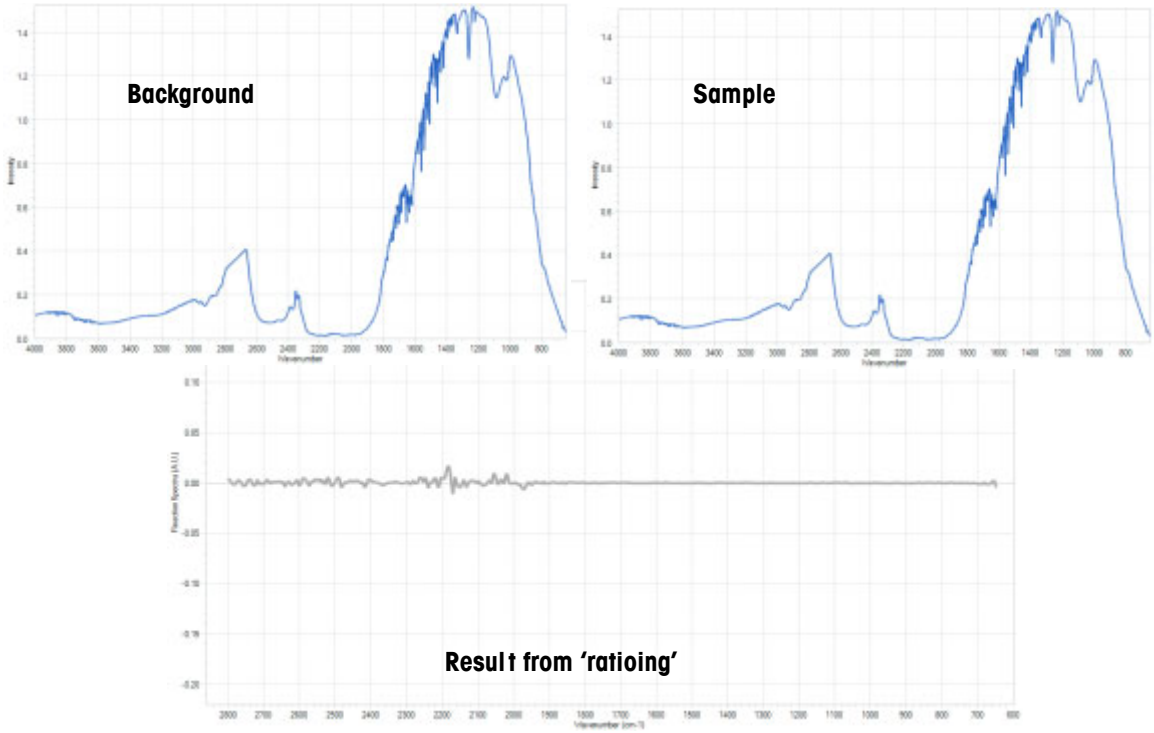


Figure 4-14 Water Vapor in background and sample (plus the result of 'ratioing')

Results from Infrequent Background Collection

Infrequent collection of air backgrounds will produce infrared fingerprints that lack the peak definition to properly trend reaction components. You can identify these cases by observing the shape of the infrared fingerprints, specifically in the baseline.

The following images show common examples of baseline 'wag,' negative peaks, and abnormal peaks:

Figure 4-15 shows baseline 'wag' due to change in optical alignment or no collection of air background from experiment to experiment. This normally occurs when you start a new experiment without collecting a new background

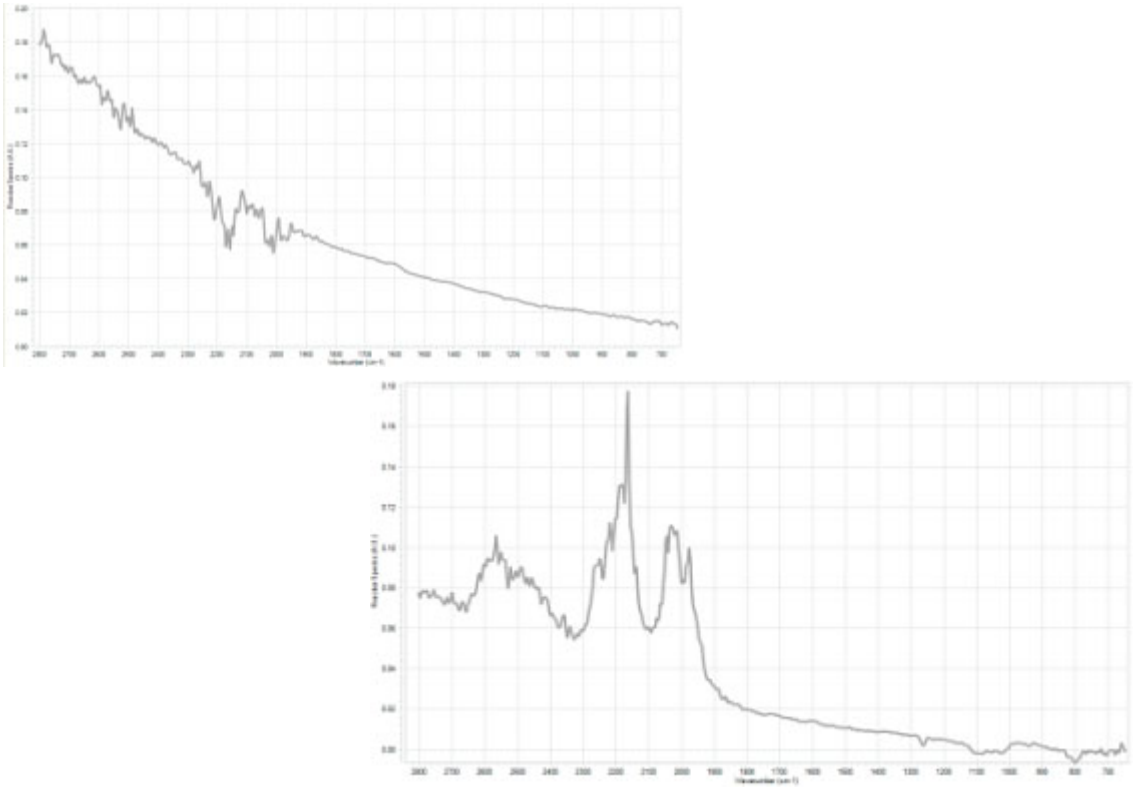


Figure 4-15 Baseline 'wag'

Below is an example of negative peaks that result from an unclean sensor.

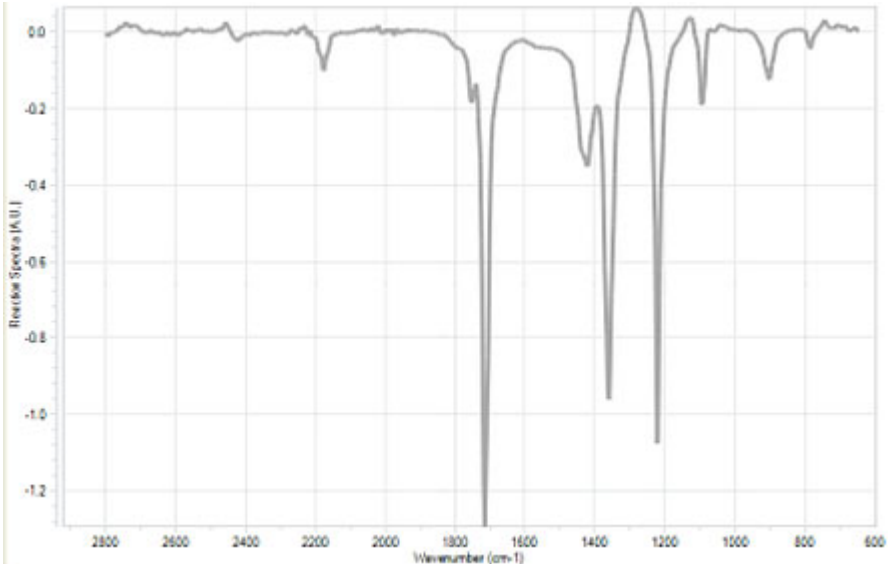


Figure 4-16 Negative peaks due to unclean sensor

The following example shows abnormal peaks due to a change in the type of sensor (DiComp to SiComp) without collecting a new air background:

Figure 4-17 Abnormal peaks from changed sensor without new background

Background Collection Procedure

1. Collect a new background prior to each experiment by clicking the **Collect Background** button in the New Experiment wizard. The button is located on the Collect Background wizard window.

2. When the background spectrum turns green, the background sample collection is complete.

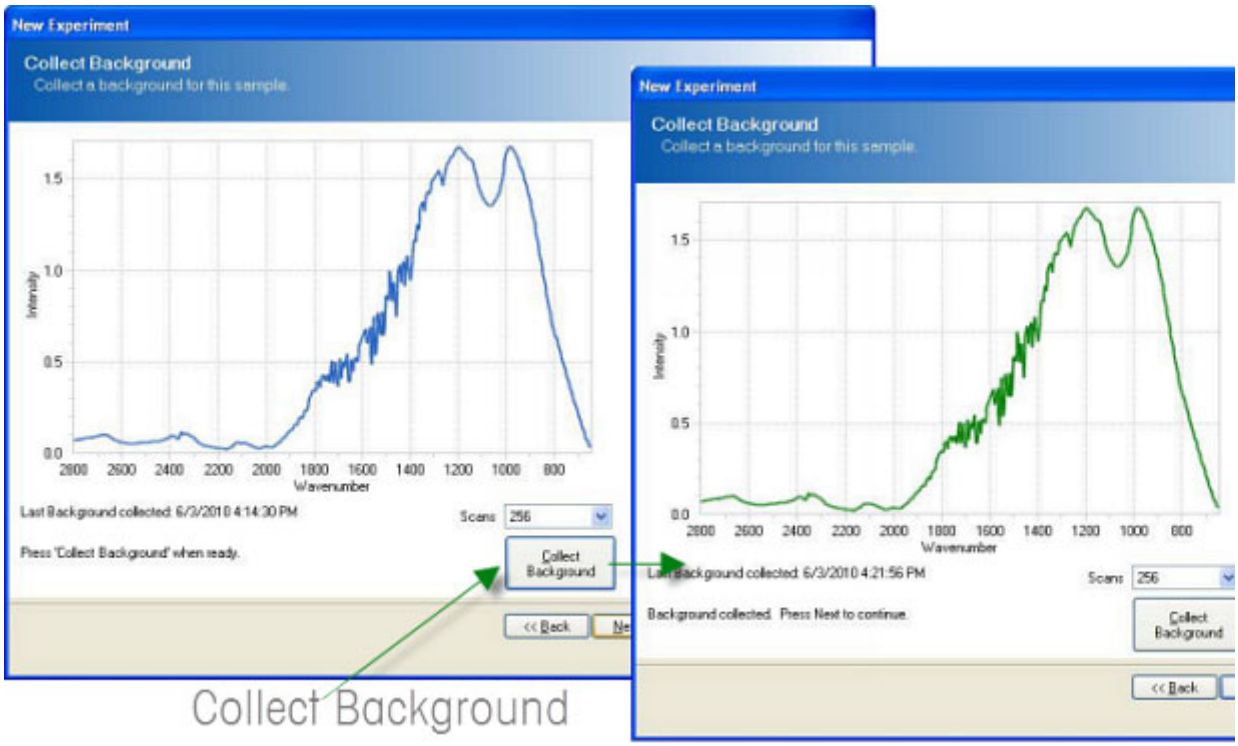


Figure 4-18 Reference background

6. Set the Data Collection Parameters

There are a number of data collection parameters worthy of user intervention and understanding to potentially maximize infrared measurement sensitivity and chemical trend information. Keep in mind that iC IR and iC Process provide default parameters that account for the most common applications to speed the experiment collection workflow, but you can choose to adjust the settings. Here are the more common parameters and how they impact the infrared measurements during an experiment. The software prompts you for these parameters during the New Experiment process.

Gain

In some cases the gain of the detector requires adjustment to allow maximum sensitivity of the mid-infrared measurement. Users can make the adjustment should the peak height value with the current sampling technology be less than 20,000. Refer to the IPac Guide for the Gain adjustment procedure.

Scans/Sample

The number of scans per sample is an automatic setting depending on your choice of Interval and Resolution. Users can alter the parameter to a maximum allowable setting to gain the best contrast of infrared fingerprints, which leads to the best possible identification of peaks to trend reaction components.

Phases

Add and edit phases for the experiment. Define each phase with a specific duration and measurement interval. Phases enable your to vary the sampling interval at different times throughout the experiment. Phases will execute in sequence.

Collection Interval

You may choose to shorten or lengthen the collection interval to match the chemistry kinetics. Use a short interval during active portions of the experiment to capture fast changes. With this feature, you can monitor long experiments while keeping file sizes small.

Experiment Duration

Choose the total time for the experiment or each phase with this parameter. We recommend extending the total time for the experiment beyond normal expectations during the investigation of new chemistry to gain maximum information. Data is cheap!

Best Practices

- **Identify Correct Sampling Technology**—Make sure concentration of the species of interest is within the detection limits of the ReactIR 45P system and sampling technology with your system. A good rule of thumb for a ReactIR 45P and standard sampling technology is a detection limit of 0.1wt% for a moderate infrared absorber.
- **Measure Pure Reaction Components**—Whenever possible, measure the infrared fingerprints of pure reagents and products. This action speeds the identification of specific peaks in the reaction mixture that allow accurate trending of a particular component over time. An alternate approach is to add reagents one-at-a-time (refer to the best practice later in this list).

  For users monitoring chemistry using iC Process, establish an experiment template in iC IR that contains the trends important to track for your chemistry. At that time, an operator can collect pure component spectra to clearly identify mid-infrared peaks necessary to create trend charts. Select the iC IR template from iC Process as a method that essentially becomes the monitoring strategy for the large scale chemical process.

- **Check Sensor Coverage**—After adding the solvent, make sure no bubbles appear on the sensor, especially in aqueous systems. Otherwise the detection limit will be higher than expected due to incomplete coverage of the sensor. Remove the bubbles with a sweeping motion across the sensor using a spatula or wooden end of a cotton swab. Rapid stirring can sometimes remove the bubbles as well.

  While this step is not possible in large scale vessel, normal agitation of the liquid chemistry will assure sensor coverage without bubbles.
- **Check Probe Immersion**—The probe must remain in the reaction mixture at all times to properly measure infrared fingerprints. Check for immersion before starting the experiment, and include stirring if applicable.
- **Begin Experiment with Solvent Only**—After collecting an air background, add the solvent only and begin the measurement of infrared fingerprints. Wait for several measurements before adding reagents to get a clear identification of fingerprints for solvent and distinguishable peaks for reagents.

  iC Process users will already have a monitoring strategy that no longer requires this step. Furthermore, the large scale chemistry may not allow sequential addition of solvent and reagents per the standard operating procedure.
- **Add Annotations (iC IR only)**—Label the beginning and end of additions, results from grab samples, modifications in reaction parameters, and observations regarding the physical changes in the reaction mixture. Any one or all of these events help explain the infrared fingerprint changes for a better understanding of the chemistry.
- **Add Reagents One-at-a-Time**—The addition of reaction components should occur in sequence whenever possible. Collect at least four spectra between each addition to clearly identify infrared fingerprint features specific to the component that will later help define peak trends.

  iC Process users will already have a monitoring strategy that no longer requires this step. Furthermore, the large scale chemistry may not allow sequential addition of solvent and reagents per the standard operating procedure.
- **Correlate Offline Analysis**—ReactIR 45P produces infrared fingerprints that show component absorbance, which is proportional to concentration. This fact offers correlation to offline analysis of grab samples to create concentration trends for component peaks that are isolated. Full quantitative analysis is also an option for overlapping peaks with the use of iC Quant, a methods development software tool.
- **Check Sensor Cleanliness and Record a Dry Sensor Background whenever Possible between Batch Reactions at Large Scale**—This action affords the best quality trend charts of the next batch to accurately monitor reaction onset, progress, and end-point.

5

Care and Maintenance

The ReactIR 45P system care and maintenance chapter includes the following sections:

"Maintaining the ReactIR 45P System" on page 51

"Shutdown and Startup" on page 52

"ReactIR 45P Relocation, Packaging, and Storage" on page 53

Note: There are no user-serviceable parts inside a ReactIR 45P base unit.

WARNING—To reduce the risk of ignition of hazardous atmospheres, disconnect from the supply circuit before opening. keep assembly tightly closed when in operation.

Maintaining the ReactIR 45P System

Checklists of regular maintenance tasks that should be performed on a daily, monthly, and yearly schedule are in Appendix A, "Optional Accessories". The tasks in the monthly list assume that you have performed the daily maintenance tasks. The yearly list includes tasks that only qualified METTLER TOLEDO service engineers should perform.

- Daily Mantenance Checklist on page 64
- Monthly Maintenance Checklist on page 66

The customer assumes responsibility for maintaining a logbook to record and monitor the operation and performance of the ReactIR 45P. Reproduce the checklist forms as needed.

Note: Messages display on the iC Process Home page when preventive maintenance should be scheduled. Refer to the "iC Process Software User Guide" for details.

Component Life

There are no user-replaceable parts in a ReactIR 45P system enclosure. All replacements are performed by a trained and qualified METTLER TOLEDO Field Service Engineer (FSE). When planning for cost of ownership, consider the normal life expectancy of the following components:

14124080—Stirling Engine MCT Detector (8,000 hours)

14147003—ReactIR™ Mounted Source Element (2–4 years)

14103308—Media Converter - 100 Base TX-FX Converter (3–5 years)

Service Contracts

METTLER TOLEDO offers service contracts for your ReactIR 45P product to assist you with maintaining maximum functionality and performance. Contact your Mettler-Toledo AutoChem, Inc. representative anytime to discuss the details using the METTLER TOLEDO part number below.

ReactIR 45P Base Unit:

14696672 EQPac Quality-Pac, ReactIR 45P
14690709 IPac Quality-Pac, ReactIR 45P
14690665 Extended Warranty, ReactIR 45P, Two Years
14690666 Extended Warranty, ReactIR 45P, Three Years
14690667 Contract, ReactIR 45P, Preventive Maintenance
14690668 Contract, ReactIR 45P, Full Coverage Service
14690669 Contract, ReactIR 45P, Full Coverage Service, Two Years
14690670 Contract, ReactIR 45P, Full Coverage Service, Three Years

ReactIR 45P Sampling Technologies:

14690672 Extended Warranty, DS FiberConduit Probe, Two Years
14690673 Extended Warranty, DS FiberConduit Probe, Three Years
14690674 Contract, DS FiberConduit Probe, Add-On Full Coverage Service
14690675 Contract, DS FiberConduit, Full Coverage Service
14690676 Contract, DS FiberConduit, Full Coverage Service, Two Years
14690677 Contract, DS FiberConduit, Full Coverage Service, Three Years
14690678 Extended Warranty, DS Micro Flow Cell, Two Years
14690679 Extended Warranty, DS Micro Flow Cell, Three Years
14690680 Contract, DS Micro Flow Cell, Add-On Full Coverage Service
14690681 Contract, DS Micro Flow Cell, Full Coverage Service
14690682 Contract, DS Micro Flow Cell, Full Coverage Service, Two Years
14690683 Contract, DS Micro Flow Cell, Full Coverage Service, Three Years

Shutdown and Startup

If the ReactIR 45P must be shut down for periods of weeks, but **not** moved or disassembled, follow the instructions below to best prepare for rapid restart.

Shutdown Procedure

1. Verify that no software operations are in process and exit the iC Process or iC IR control software.
2. Remove power from the ReactIR 45P instrument by unplugging or terminating power at the supply line.
3. Maintain a purge 5psi, 0.5CFM to the sampling technology, if applicable.

4. Keep the enclosure door closed at all times after removing power.
5. Should the shut down last more than a week, we recommend applying power weekly for four hours each time. This practice will assure the unit is functional and ready for normal operation to resume.

Startup Procedure

1. Apply power to the system based on the model, as follows:
   - ReactIR 45P HL—Follow the steps for starting the system in the Hazardous Location (HL) Safety chapter of the" ReactIR 45P Safety Manual."
   - ReactIR 45P NL—Follow the steps for starting the system in the Normal Location (NL) Safety chapter of the" ReactIR 45P Safety Manual."

   A copy of the safety manual is in Appendix F on page 77.
2. For K4 and K6 mirror conduit sampling technologies, check and establish the purge utilities, if applicable. See "Sampling Technology and Conduit Purge" on page 28.

ReactIR 45P Relocation, Packaging, and Storage

To prevent and minimize damage to the instrument, follow the instructions below to prepare the ReactIR 45P for relocation, shipment, and storage.

Shutdown

1. Follow the steps under "Shutdown Procedure" on page 52.
2. Disconnect power, air, and network connections.
3. Remove purge from sampling technology, if applicable.
4. Remove the sampling technology using the instructions in step 3 on page 54 and cover the base unit optical port.

   Warning: Do not touch the optical window (zinc selenide) to avoid loss of mid-infrared measurement performance.
5. Cover the open ends of the conduit to prevent contamination by liquid or dust particles.
6. Keep enclosure door closed during storage.

Special Care of Sampling Technologies

If the FiberConduit, Sentinel (liquid sampling sensors), DS Micro Flow Cell (continuous flow chemistry), or Mirror conduit are needed at the new site or must be stored, follow the instructions below.

1. Remove the sampling technology probe from the reaction vessel per your standard operating instructions

2. Clean the probe/sensor of the sampling technology with a solvent that will dissolve the product.
3. Prepare the sampling technology (conduit and probe) for shipment or storage as follows:
   Sentinel—Detach the conduit from the Sentinel and cover the Sentinel with RED caps supplied with initial shipment.

   Note: Do not touch the back of the Sentinel or allow the contact of any liquid or dust particles.

   FiberConduit—Detach the conduit from the ReactIR 45P SIM flange. For DS FiberConduit probes, be sure to cover the DS end with the built-in slide cover. For 'bell end' style FiberConduit probes, be sure to cover with a RED cap supplied at time of initial shipment.

   DS Micro Flow Cell—Detach the Micro Flow Cell and cover the DS end using the built-in slide cover.

   Mirror Conduit—Detach the conduit from the ReactIR 45P SIM flange and cover with a RED cap supplied at time of initial shipment.
4. Package the sampling technology, separately, and store in a cool dry place. Use the original packaging if possible.

Packaging Specifications for Shipment

- Complete the procedures in the previous sections under "Shutdown" and "Special Care of Sampling Technologies".
- To maximize protection of the ReactIR 45P during transport, we highly recommend that the instrument be shipped in its original shipment crate.

Reinstalling the ReactIR 45P

Depending on your service agreement, contact METTLER TOLEDO for reinstallation or follow the installation instructions in the "ReactIR 45P IPac Guide."

6

Troubleshooting

This section highlights the most common troubleshooting issues for the ReactIR 45P system.

Table 6-1 Troubleshooting

Problem	Cause	Solution
Power LED light is OFF	■ Power cable disconnected	■ Connect power cable.
	■ Power cable faulty	■ Check your incoming supply line and cable.
	■ Internal power integrity in question	■ Contact METTLER TOLEDO.
Scan LED light is OFF	■ Communications cable disconnected from base unit or computer	■ Connect communications cable.
	■ Ethernet or fiber optic cable is faulty.	■ Contact METTLER TOLEDO.
iC IR not communicating with base unit	■ Ethernet or fiber optic communications cable disconnected from base unit or computer	■ Connect communications cable.
	■ Ethernet or fiber optic cable faulty	■ Contact METTLER TOLEDO.
iC Process not communicating with base unit	■ Check IP address ■ Check with your IT personnel with reference to the iC Process Installation.	■ Check IP address (Connect button in iC IR; Instrument Configure > Instrument Settings tab in iC Process).
iC IR toolbox does not show a "Process" task pane	■ Preference is not set to show the task pane.	■ Check Tools > Preferences from iC IR file menu and verify the "Show iC Process task pane" check box is selected.
MCT OK LED light is OFF	■ Detector type is DTGS	■ LED only applies to MCT detector.
	■ MCT is not at operational temperature.	■ Wait 15 minutes from time of observation to allow MCT to reach operating temperature.
	■ iC Process is in OFF-LINE mode.	■ Go ONLINE, collect a background or enter the Service Mode.
	■ MCT is OFF during periods set by user for extending lifetime (iC IR).	■ Check Tools > Preferences in iC IR to adjust, if necessary.
	■ Stirling engine nearing end of life (8,000 hours) prompt appears in software.	■ Contact to schedule service.
	■ Stirling engine is faulty	■ Contact METTLER TOLEDO.

Table 6-1 Troubleshooting (continued)

Problem	Cause	Solution
TEMP OK LED light is OFF	■ Modulator temperature is not at operational set point.	■ Check air supply and pressure to TE cooler. ■ Wait an additional 30 minutes from time of first observation to allow modulator to reach operating temperature.
	■ TE Cooler is faulty	■ Contact METTLER TOLEDO.
Align bars are RED	■ Using an 'old' background	■ Clean probe tip and take a new background.
Negative peaks present in infrared data	■ Unclean sensor surface	■ Clean probe tip and take a new background
User manipulation of 3D Surface Viewer in iC IR is slow to respond	■ Video graphics card driver insufficient to support action	■ Verify graphics card meets System Requirements shown in "iC IR Installation Guide."
		■ Set Surface Viewer Preference to "Use alternate rendering" in iC IR Tools >
Peak height is below 12,000	■ Insufficient mid-infrared source energy reaching the detector.	■ Check sampling technology connection. ■ Check detector configuration for the right selection of SE MCT or DTGS. ■ Check alignment of necessary components in the system. ■ Adjust detector gain. ■ Contact METTLER TOLEDO.
Contrast indicator turns RED or message appears stating value is too low	■ Insufficient mid-infrared source energy reaching the sampling technology sensor.	■ Check sampling technology connection. ■ Check detector configuration for the right selection of SE MCT or DTGS. ■ Check alignment of necessary components in the system. ■ Adjust detector gain. ■ Contact METTLER TOLEDO.

A

Optional Accessories

This appendix describes the optional equipment available for a ReactIR 45P system.

Air Handling Unit

The ReactIR 45P system requires an Air Handling Unit.

- Air Handling Unit (Part Number 14474493) from METTLER TOLEDO controls pressure and flow to the ReactIR 45P NL enclosure and TE cooler unit.
- Air Handling Unit (Part Number 14474494) controls pressure and flow to theReactIR 45P HL purge/pressurization system and TE cooler unit.

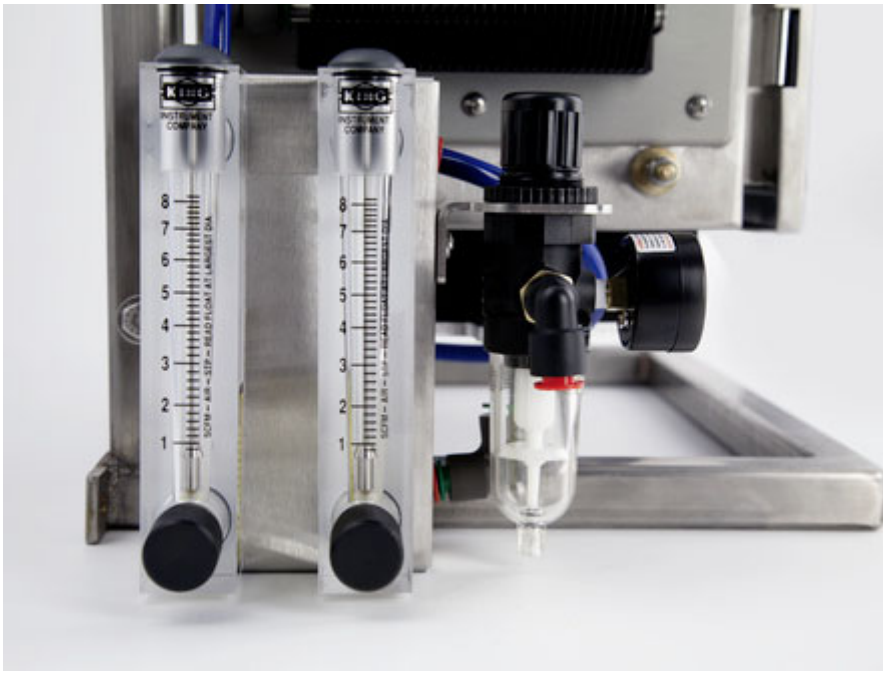


Figure A-1 Air Handling Unit

Base Unit Frame

The optional ReactIR 45P mounting frame holds the enclosure, optional Air Handling Unit, and the purge/power/communication module. Available to customers as an option (Part Number 14123486), the frame is compatible with all ReactIR 45P configurations.

Figure A-2 Frame for NL (on left) and HL (on right)

Media Converter Kit

METTLER TOLEDO offers a media converter kit (Part Number 14474499) to allow direct remote access to ReactIR 45P using an Ethernet connection to your desktop or notebook computer. The fiber optic cable from the ReactIR 45P connects to the media converter. Output from the converter is an Ethernet cable to connect to the PC with a UTP (RJ45) port.

Figure A-3 Media Converter Kit

DS Probe RTD Module

Note: The RTD interface module is standard on the ReactIR 45P HL system.

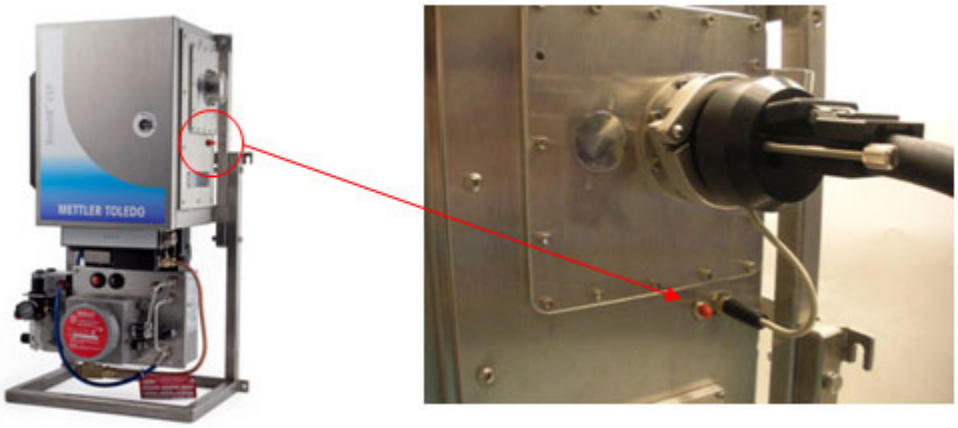


Figure A-4 DS FiberConduit Probe with RTD module

The ReactIR 45P Probe RTD (Resistive Temperature Device) interface module (Part Number 14474495) is an option for ReactIR 45P NL systems. The RTD reads probe temperature while monitoring liquid based chemistry. The RTD module is compatible with DS FiberConduit probes and may require a single optical interface with RTD cable.

Purchase of this option requires after system installation requires return of the unit to factory for integration, test, and safety labeling.

NL Power/Communications Module

Convert a ReactIR 45P HL (CID1 or Zone 1) to a ReactIR 45P NL general purpose configuration using a ReactIR 45P NL Power/Communications module (Part Number 14474490).

Figure A-5 ReactIR 45P NL Purge/Power/Communications module

This conversion is provides ease of use (space and utilities) in a laboratory environment to perform reaction analysis and establish process monitoring strategy. Be aware that the conversion VOIDS certification for safe use of ReactIR 45P Base Unit in Hazardous Locations.

Purchase of this option after initial system installation requires return of the unit to factory for integration and testing, plus removal of the Hazloc compliance labeling.

HL Purge/Power/Communications Module

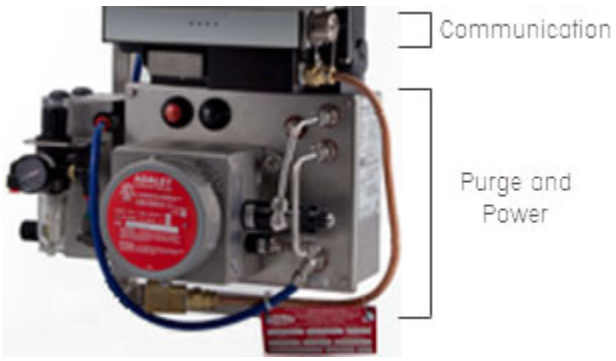


Figure A-6 ReactIR 45P HL Purge/Power/Communications module (with Air Handling Unit)

Easily convert a ReactIR 45P NL configuration to a ReactIR 45P HL (CID1 or ATEX) configuration with a ReactIR 45P HL Power and Purge Unit (Part Number 14474489). The conversion will allow safe use in Class I/Division 1 or Zone 1 area classification. See the specific details of area compliance in the Hazardous Location Safety chapter of Appendix F, "ReactIR 45P Safety Manual".

Purchase of this option after initial system installation requires return of the unit to factory for integration, test, and safety compliance labeling.

EQPac or IPac—Quality-Pacs for ReactIR 45P

An EQPac Quality-Pac is a service offering (Part Number 14696672) that includes site preparation, on-site installation, completion of installation documentation, and Instrument Performance Assurance (IPA) validation service. Equipment Qualification procedures and documentation cover the life of the instrument including maintenance, and are suitable for use in regulated environments that are subject to regulatory compliance guidelines. This option also includes fundamental service and maintenance training, as well as the IPA hardware module.

An IPac Quality-Pac service option (Part Number 14690709) provides expanded validation of the instrument and installation in a regulated laboratory environment. This option also includes the IPA module.

IPA Module

Customers that order the EQPac or IPac Quality-Pac service offerings for ReactIR 45P will receive an Instrument Performance Assurance (IPA) hardware module to validate the instrument calibration by comparing polystyrene peak heights to the NIST standard. If the validation procedure indicates that the instrument should be re-calibrated, an instrument calibration can be initiated by an authorized user.

The built-in design offers a significant user operation advantage in comparison to the external IPA module.There is no need to remove sampling technology to perform the validation or calibration test—simply operate the procedure through software commands.

Periodic instrument calibration is available through the Performance Qualification attribute of the EQPac service. METTLER TOLEDO service engineers will perform the calibration and issue a certificate valid for a set period of time.

IPA Module

B

Maintenance Checklists

This appendix includes checklist forms for regular maintenance.

Maintenance

Checklists for regular maintenance tasks:

- "Daily Maintenance Checklist" on page 64
- "Monthly Maintenance Checklist" on page 66

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

Daily Maintenance Checklist

Perform a daily check the following items for NL and HL systems:

Table B-1 ReactIR 45P Daily Maintenance Checklist

Task (NL and HL)	Remarks	Check
Check fiber optic or Ethernet connection	Verify the communications connection: ■ ReactIR 45P HL—Fiber optic LC connectors are attached to the fiber optic port. ■ ReactIR 45P NL—Ethernet RJ45 connector is attached to LAN port. (Refer to the "ReactIR 45P IPac Guide.")	**Fiber Optic or Ethernet Connection** [ ] Connected [ ] Disconnected
Perform visual inspection of the ReactIR 45P instrument	Verify that sampling technology and base unit are securely connected.	**Visual Inspection** [ ] Conduit connected to base unit [ ] DS Single Optical Interface, if applicable [ ] Multi-probe Optical Interface Module, if applicable [ ] K4 Mirror Conduit, if applicable [ ] K6 Mirror Conduit, if applicable [ ] Probe connected to conduit: [ ] Sentinel, if applicable [ ] 16mm probe, if applicable [ ] DS FiberConduit to Single Optical Interface, if applicable [ ] DS FiberConduit to Multiple Optical Interface, if applicable [ ] Disconnected If any disconnection, note the location: _____
	Verify that the probe is connected to sampling point.	[ ] Sentinel, or probe, or DS Micro Flow Cell connected to sampling point. [ ]:Disconnected
Check air input connections	Verify the connections.	**Air input supply line** [ ] Connected [ ] Disconnected

Table B-1 ReactIR 45P Daily Maintenance Checklist (continued)

Task (NL and HL)	Remarks	Check
Check air pressure and flow	Check the pressure and flow specifications for operation of the HL or NL system as specified in the "Operating Parameters—ReactIR 45P" on page 33. Record the starting pressure and flow values.	**Pressure:** _____ **Flow:**_____
Check Operational Status LED indicators on base unit front panel	LED lights should be in the following state if fully operational. Power—Solid BLUE Scan—Flashing BLUE MCT OK—Solid BLUE TEMP OK—Solid BLUE (See page 31.)	**Operational Status** [ ] Power [ ] Scan [ ]MCT OK [ ] TEMP OK Record any variance and contact METTLER TOLEDO service.
Record Peak Height and Contrast	To get an exact value, enter the Service mode in iC Process or the Contrast Test in iC IR to record the most recent value using a clean, dry sensor. NOTE: If values are 20% less than the magnitude at time of installation then contact METTLER TOLEDO service. (Refer to system readiness test instructions in the "ReactIR 45P IPac Guide.")	**Peak Height** Value_____ **Contrast** Value_____

Contact METTLER TOLEDO if any checklist items require service.

Monthly Maintenance Checklist

This checklist assumes that the daily maintenance tasks have been performed.

Task	Remarks	Check
Visually check ZnSe lens	Remove sampling technology at the base unit. Check the appearance of the ZnSe window in the base unit. Window should be clear.	[ ] Window is clear. [ ] Window is cloudy.
Run three iterations of the Performance test and record Signal-to-Noise (SNR) of clean, dry sensor.	Compare the average of the monthly SNR values to the SNR factory specification for your sampling technology and type of detector (see factory specifications in instructions). It is not necessary to run all 10 iterations—Run three and record the average SNR value. **In iC Process**: ■ Log on to the ReactIR 45P instrument as an Administrator or Service user and run the Performance Test. ■ Compare to factory standards in the "ReactIR 45P IPac Guide." **In iC IR**: ■ Go to the Test Instrument task pane in the Toolbox, and run the Performance Test. ■ Compare to factory specifications in the IPac Guide. For performance testing in each software system, refer to system readiness test instructions in the "ReactIR 45P IPac Guide."	**Performance Test** [ ] Three iterations performed. [ ] Signal-to-Noise (SNR) value is equal to or greater than at time of installation. SNR average value: _____ NOTE: If values are 20% less than the magnitude at time of installation, contact METTLER TOLEDO service. Refer to your ReactIR 45P ServicePac document for values at time of installation.

Contact METTLER TOLEDO if any checklist items require service.

C

Switching Control Software

Note: Even though a ReactIR 45P instrument can be controlled by iC IR or iC Process software, only **one software system can control the instrument at the same time**.

iC Process is the primary control software for a ReactIR 45P instrument. However, iC IR software can be used in the laboratory to develop models and trends that transfer Critical Control Parameters (CCP) from the laboratory to the production environment. Use the procedures in this appendix to switch control between the two software systems, if applicable.

"Switch from iC Process to iC IR" on page 68

"Switch from iC IR to iC Process" on page 70

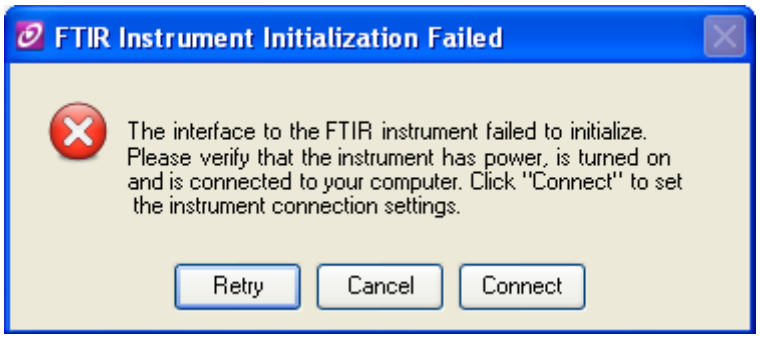
Switch from iC Process to iC IR

To switch control of the ReactIR 45P from iC Process software to iC IR, it is necessary to stop the iC Process service and connect to the instrument through iC IR.

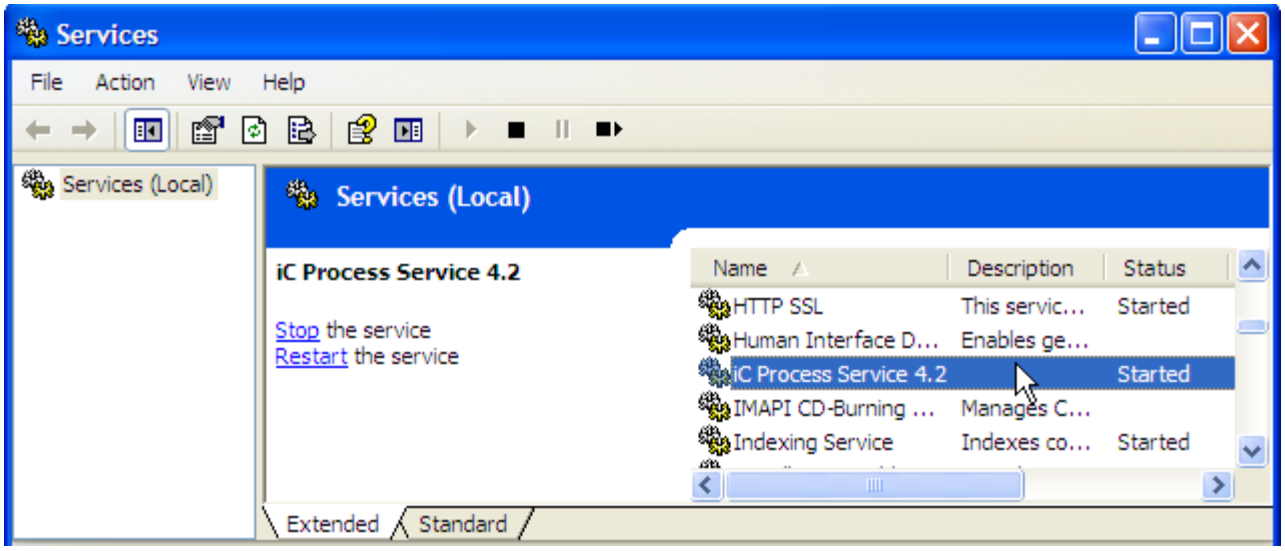
Follow the procedures to switch control to iC IR software.

Note: You will need the IP address of the ReactIR 45P instrument to transfer control. Refer to the iC Process Instrument Configuration page.

The following message appears in iC IR when you attempt to control a ReactIR 45P instrument currently under iC Process control. Leave this message open and proceed to Administrative tools to stop the iC Process Service.

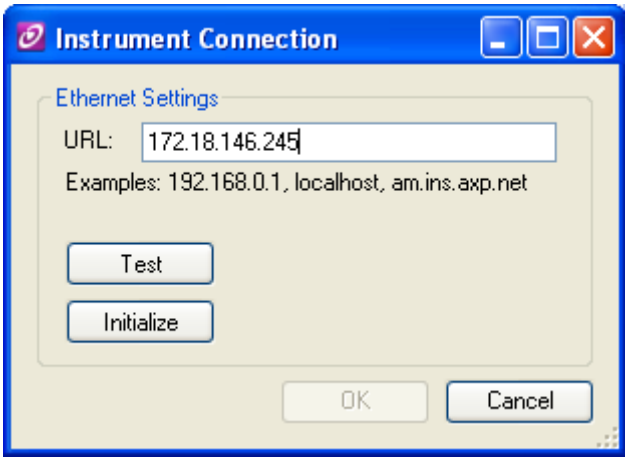


1. Go to the Services for the iC Process control computer. (In WIndows XP, the location is Control Panel > Administrative Tools > Services.)
2. Select iC Process Service 4.x.
3. Click **Stop**.



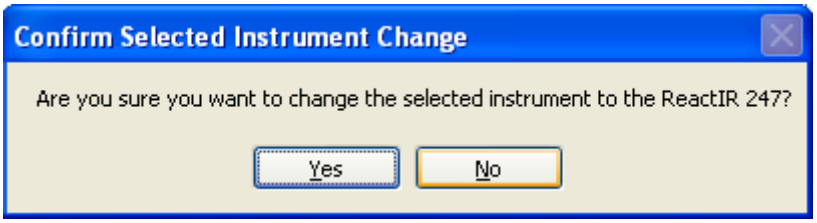
4. Return to the open iC IR "FTIR Instrument Initialization Failed" message.

5. Click **Connect** and enter the instrument's IP address in the URL field.



   h. Click **Test** to 'ping' the instrument at the specified address.
   i. Then, click **Initialize** to take control of the instrument in iC IR.

6. Click **Yes** in the confirmation box.

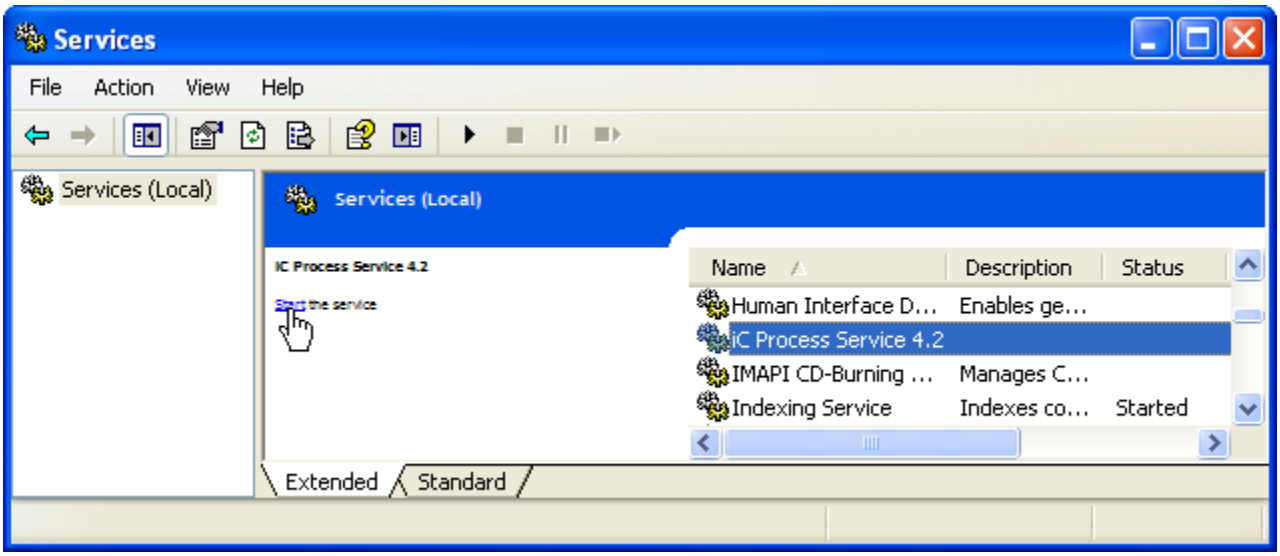


Switch from iC IR to iC Process

If the ReactIR 45P is under the control of iC IR and you want to change to control by iC Process, follow the procedure below.

Note: This instruction assumes the ReactIR 45P instrument has already been added to iC Process and configured. Refer to the "iC Process Software User Guide or the iC Process Installation Guide."

1. Close the iC IR software application.
2. Go to the Services for the iC Process control computer. (In WIndows XP, the location is Control Panel > Administrative Tools > Services.)
3. Select iC Process Service 4.x.
4. Click **Start**.



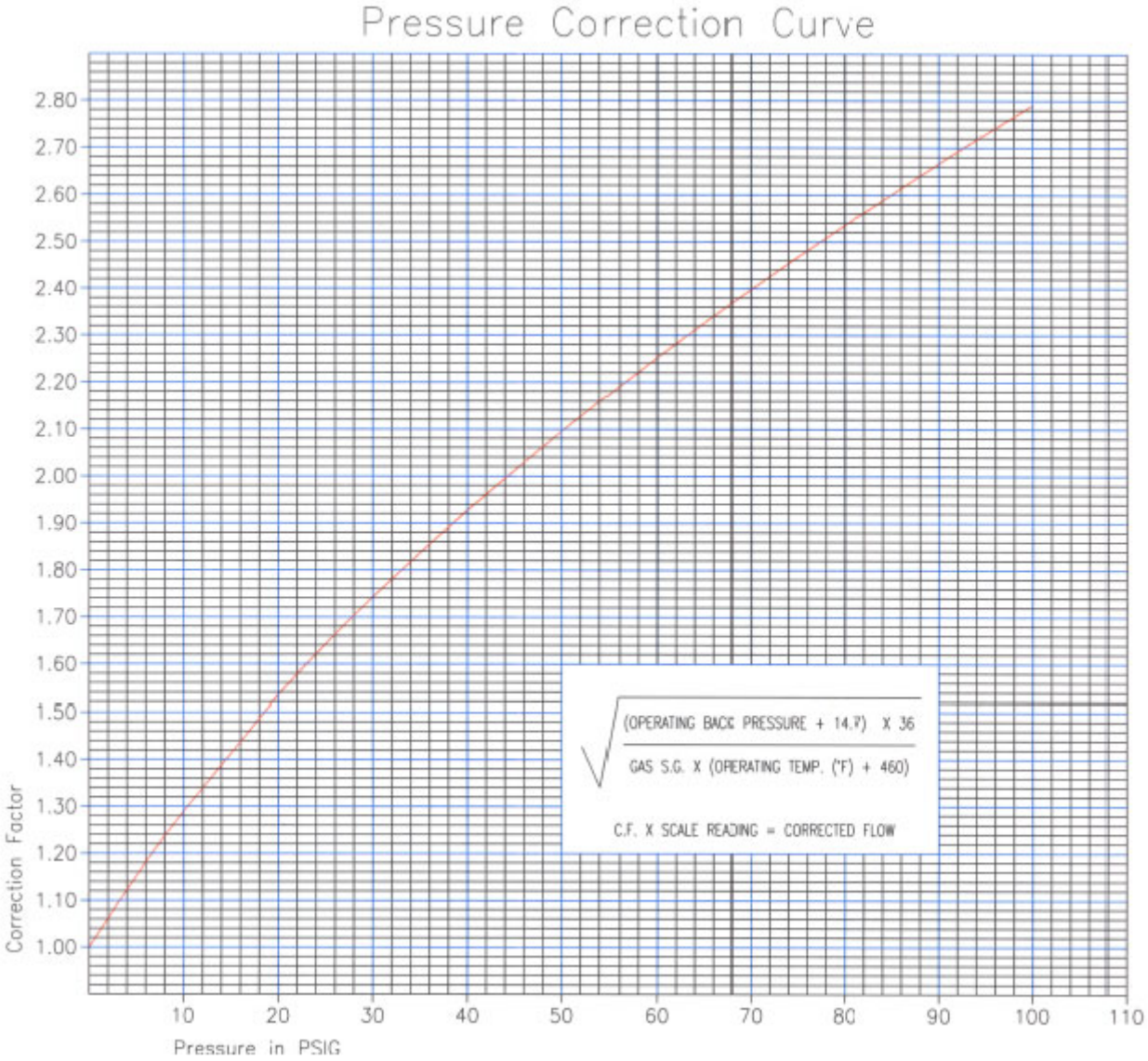
5. Proceed to your Web browser to connect to iC Process as a client.

D

Correcting Air Flow Meter

The minimum flow rate represents an air supply line pressure at ambient pressure. Considering the air supply pressure requirement (Table 4-2 on page 33) is greater than ambient conditions (60-100psig), the actual measurement at the flow meter will be lower than the minimum flow rate requirement. Table D-1 shows the correction factor to properly set the flow rate at the flow meter. For example, at 80 psig air supply pressure the flow rate at the flow meter should be set to 1.6 SCFM (4 SCFM divided by 2.5—the correction factor).

Table D-1 Pressure Correction Curve



E

ReactIR 45P Pre-Installation Checklist

A sample checklist begins on the next page.

Pre-Installation

METTLER TOLEDO Service
Customer Care
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

ReactIR™ 45P Pre-Installation Checklist

Use this checklist to verify that all prerequisite steps have been completed before a scheduled ReactIR™ 45P system installation. Items on this checklist must be completed prior to 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

The ReactIR™ 45P can be directly mounted by the base unit mounting tabs using 6mm or 1/4-inch minimum diameter stainless steel bolts (customer-provided). With the optional frame configuration, the base unit is secured to the frame at the factory. The frame has mounting tabs for installation in the area of intended use. Space requirements are as follows:

Size-NL w/Frame (HxWxD):	523 x 457 x 310mm 21 x 18 x 12 inches	**Weight-NL w/Frame:**	37.0kg (83lbs)
Size-HL w/Frame (HxWxD):	774 x 457 x 310mm 31 x 18 x 12 inches	**Weight-HL w/Frame:**	45.4kg (100lbs)
Temperature Range:	0°C to 35°C (32°F to 95°F)		
External Components:	Allow adequate space around the ReactIR™ 45P system for conduit and probe. The probe conduit should not bend beyond 30cm (11.8 inches) and should not be put into an "S" shape.		
Temperature Conditions:	Locate the ReactIR™ 45P system where it is readily accessible. If the unit is outdoors in warmer climates, it must be shaded from direct sunlight.		

☐ Site Preparation —Utilities (Electric)

Verify that a power outlet is accessible in the area of intended use for the ReactIR™ 45P and control computer. Power specifications are as follows:

AC Power:	100-240VAC	**Max Current:**	5A	**Frequency:**	50/60Hz
Power Cord:	ReactIR™ 45P (NL) systems are provided with a power cord. ReactIR™ 45P (HL) systems require an external power connection to the inlet and must be made using an appropriately approved and suitably rated cable, gland, or conduit fitting (customer-provided) in accordance with country and local electrical codes.				
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.				

Pre-Installation

☐	Site Preparation —Utilities (Air/Gas)

The ReactIR™ 45P requires clean, dry, instrument quality air regulated for pressure / flow to the base unit and TE Cooler. Sampling Technology may also require clean, dry, instrument quality air for purge. Quality of the air or gas supply must meet the specifications of the American National Standards Institute/Instrument Society of America (ANSI/AISA) S7.0.01-1996 Quality Standard for Instrument Air. The air/gas specifications are as follows:

Min/Max Pressure (NL):	4.1 barg to 6.9 barg (60-100psig)	**Min/Max Flow (NL):**	5 to 10 SCFH
Min/Max Pressure (HL):	4.1 barg to 6.9 barg (60-100psig)	**Min/Max Flow (HL):**	4 to 8 SCFM
Air Quality:	Clean (< 0.1ppm CO2), dry (< 1ppm water vapor at -100°F/-73.3°C dewpoint) Instrument Grade Air, Nitrogen or equivalent inert gas.		

☐	Site Preparation —Utilities (Communication)

The ReactIR™ 45P communicates via TCP/IP to a control computer on your LAN. ReactIR™ 45P (NL) systems require an Ethernet communication cable. The ReactIR™ 45P (HL) systems require a fiber optic communication cable and may require a media converter for connection to your LAN. Communication specifications are as follows:

Ethernet:	Connection Type - RJ45	**Fiber Optics:**	Connection Type - LC

☐	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 Installation Guide" and/or "iC Process 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 ReactIR™ 45P system.

User Comments for METTLER TOLEDO Field Service Engineer:

Name:		Date:	
Signature ReactIR 45P User:			

F

ReactIR 45P Safety Manual

The ReactIR 45P Safety Manual begins on the next page. Ensure that all users of the system read and observe the care, use, and safety information in the Safety Manual.

Caution—If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Safety Manual

November 2011

MK-PB-0086-AC Rev A

DCN 441

ReactIR™ 45P

Process Chemistry Understanding

METTLER TOLEDO

9 November 2011

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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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1

General Safety

ReactIR™ 45P is real-time *in situ* Process Analytical Technology (PAT) tool designed for mid-infrared (FTIR) based process monitoring in normal or classified area environments. The ReactIR 45P system provides critical reaction information during campaigns to ensure reaction compliance and safety through full time production monitoring.

Caution—Read this safety manual before product installation, operation, and maintenance. Failure to follow these instructions could result in personal injury and/or product damage that could void the warranty.

This safety manual applies to ReactIR 45P normal location (NL) and hazardous location (HL) configurations and is a supplement to the "ReactIR 45P Hardware Manual."

Note: General safety information for both configurations is covered in this chapter. Specific safety information for the normal location is in Chapter 2 and specific hazardous location safety information is in Chapter 3.

Per the ISO 9001 procedures followed at METTLER TOLEDO, the ReactIR 45P system adheres to applicable regulations and standards in the area of intended use. Requirements for compliance with local regulations may be different. The end user of the equipment is responsible for compliance with all local, corporate, or other applicable regulations.

Caution—If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

WARNING—There are no user-serviceable parts inside a ReactIR 45P system. Contact your METTLER TOLEDO Field Service Engineer (FSE) for all service needs.

Laser Classification

All ReactIR 45P instruments are in compliance with the U.S Department of Health and Human Services (DHHS) Radiation Performance and in accordance with International Standards.

Class 1 Laser Product

Compliant with **21 CFR 1040.10** and **1040.11**

except for deviations per Laser Notice 50, dated June 24, 2007

and

Compliant with **IEC 60825-1**

The following label appears on the ReactIR 45P enclosure:

Figure 1-1 Laser label

CE Compliance

ReactIR 45P systems have been tested and comply, as required, with the Electromagnetic Capability (EMC) Directive and Low Voltage Directory (LVD).

- **EMC Directive 2004/108/EC**
  IEC 61326-1: Electrical Equipment for Measurement, Control and Laboratory Use
- **Low Voltage Directive 2006/95/EC**
  EN61010-1:2001 Safety requirements for electrical equipment for measurement, control, and laboratory use

CE compliance for European ReactIR models is only certified for permanent installations when power is wired through metal conduit.

Caution—The CE mark applies only to unmodified instruments supplied by METTLER TOLEDO.

NRTL Certification

The ReactIR 45P is MET NRTL Listed under E112462.

Figure 1-2 MET marking

ReactIR 45P System ID Label

All ReactIR 45P NL and HL systems have the following label with product identification and electrical load information:

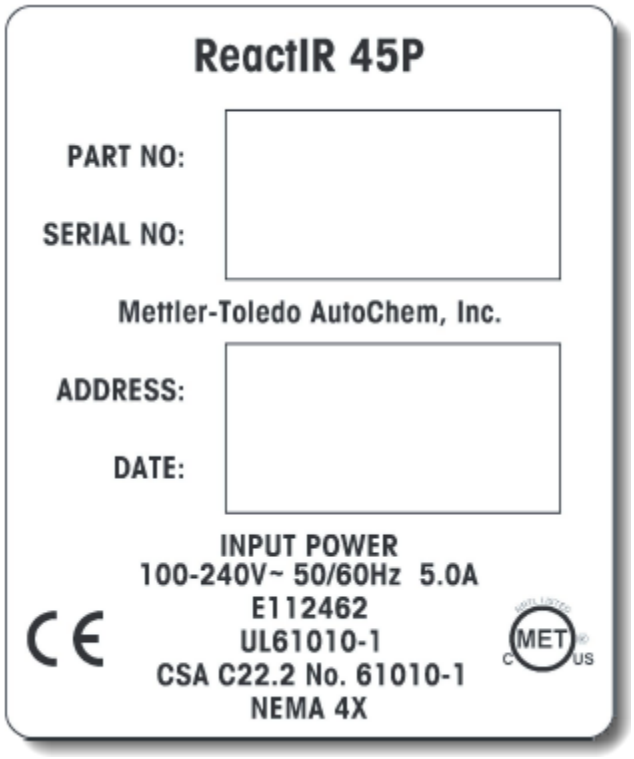


Figure 1-3 ReactIR 45P product identification label with electrical load specifications

ReactIR 45P Configurations

The ReactIR 45P has two configuration options—Normal Location (NL) or Hazardous Location (HL). The HL configuration includes integral purge and pressurization technology. Both configuration have an optional Air Handling Unit or require a user-supplied air pressure and flow regulator. The ReactIR 45P base unit is the same for both configurations, so a qualified METTLER TOLEDO Field Service Engineer (FSE) can convert the NL model to an HL, if required.

- **ReactIR 45P HL base unit with a purge/pressurization system** for use in potentially explosive atmospheres. Safety information specific to the Hazardous Location configuration is in Chapter 3, "Hazardous Location (HL) Safety."

Figure 1-4 ReactIR 45P—HL (Hazardous Location) system, with optional Air Handling Unit

- **ReactIR 45P NL base unit for use in normal locations**. Safety information specific to the Normal Location is in Chapter 2, "Normal Location (NL) Safety.".

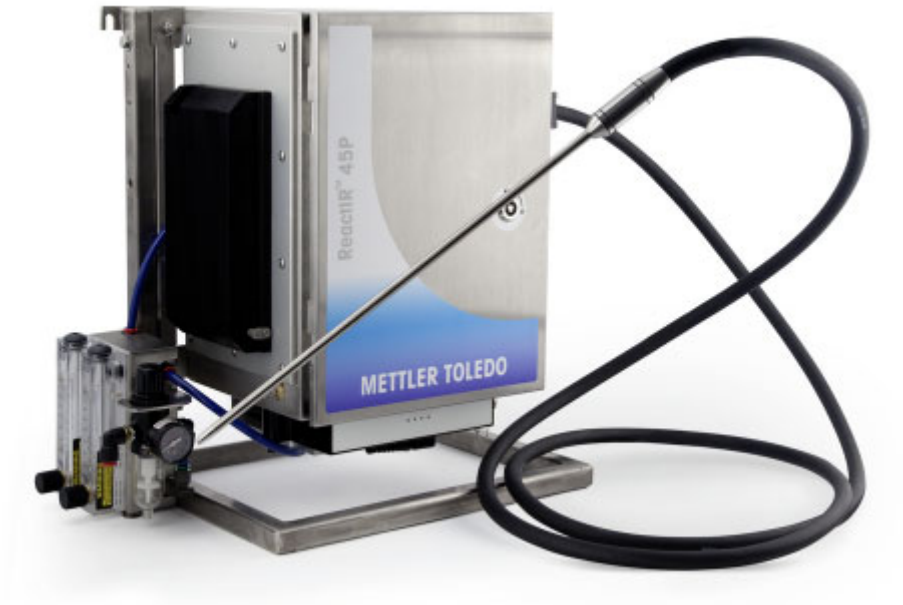


Figure 1-5 ReactIR 45P–NL (Normal Location) system, with optional Air Handling Unit and FiberConduit sampling technology

General Safety Considerations

Caution—There are no user-serviceable parts inside a ReactIR 45P base unit. Contact your METTLER TOLEDO Field Service Engineer for all service needs.

Caution—If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

The following general safety guidelines apply to all ReactIR 45P models:

- Verify that the model received matches the purchase order and specification sheet.
- Ensure all operators are properly trained to follow safe operating and maintenance procedures as described in ths manual.
- Wear appropriate safety equipment during installation, operation, and maintenance, as outlined in your standard operation procedures.
- Always ensure that product use conforms with all applicable local laws, regulations, and codes.

Safety Symbols

Safety information for the ReactIR 45P instrument is marked by the following symbols:

	**Caution** Risk of danger
	**Earth (Ground)**

Safe Installation and Operation

A qualified METTLER TOLEDO representative installs and commissions the ReactIR 45P instrument and trains key personnel on how to use the equipment and software.

Caution—Improper installation and operation of the ReactIR 45P can result in safety hazards.

Power Supply

Caution—Safe installation of the ReactIR 45P requires caution when connecting electrical power to the unit.

Caution—Do not supply power to the system using any power cord except one that meets local and national standard codes.

Caution—In hazardous area classifications, the power connection must be made via a certified power cord (see "Installation—Electrical Wiring" on page 24).

Electrical Consumption

The primary ReactIR 45P label (Figure 1-3) on the enclosure exterior provides ready reference to the electrical consumption for proper safety.

Circuit Breaker

Caution—End user must provide dedicated power line with circuit breaker clearly marked and easily accessible by the user. Wiring should withstand at least 10 Amps.

Earth Grounding

Safety earth/ground. Use a ground strap with minimum 12 AWG. A 6mm (1/4″) stud is located on the left side of the ReactIR 45P enclosure, below the thermoelectric (TE) cooler. Refer to the NL location drawing on page 15 or the HL location drawing on page 26.

Over-Temperature Protection

Note: The ReactIR 45P base unit contains a thermal cut-off system.

Mounting

Caution—Locate the ReactIR 45P system where it is readily accessible. If the unit is outdoors in warmer climates, it must be shaded from direct sunlight.

Caution—Ensure that installation location includes adequate clearance for the probe FiberConduit™ to bend. Bend radius is 30cm (11.8 inches).

Caution—To mount the system, use four 6mm (1/4 inch) stainless steel bolts (not included) to secure the ReactIR 45P to a vertical, flat structure capable of supporting 45kg (100 lbs) with the HL configuration or 37kg (83 lbs) for the NL configuration. Mounting tabs are located at the corners of the base unit and frame. Refer to the specifications chapter in the hardware manual for mounting tabs locations and dimensions.

Transport

Caution—Remove the sampling technology conduit prior to moving the ReactIR 45P instrument from one sampling point to another. Transport the base unit to a new location making sure to use equipment suitable for the weight. If necessary, separately transport the sampling technology with conduit.

Figure 1-6 Warning—Remove sampling technology

Maintenance Safety

A certified METTLER TOLEDO Field Service Engineer must ensure that the system is powered off and cooled down before unlocking and opening the enclosure door. In HL configurations, a label (Figure 3-2) on the enclosure lists safety warnings for the purged/pressurized enclosure.

Caution—There are no user-serviceable parts inside a ReactIR 45P base unit. Contact your METTLER TOLEDO Field Service Engineer for all service needs.

Cleaning Instructions

Follow the cleaning instructions below for ReactIR 45P systems.

- Ensure the system is powered off before doing any cleaning.
- Clean all exterior surfaces with water and mild detergent.
- Be careful not to submerse any parts of the system in washing liquid.
- Be certain to dry all surfaces of the system after washing to avoid pooling of any liquid.

Air Filter

The Air Handling Unit filter should be inspected as part of regular maintenance. Inspection schedule shall be part of the end user's standard operating procedure and shall depend on use. Replace the filter, when necessary.

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. To arrange for specific application assistance from a METTLER TOLEDO Technology and Applications Consultant or for general assistance, contact Mettler-Toledo AutoChem, Inc. through the toll-free number below.

Mettler-Toledo AutoChem, Inc. **7075 Samuel Morse Drive** **Columbia, MD 21046** (Columbia, MD headquarters)	Tel: **+ 1.410.910.8500** Fax: **+1.410.910.8600** Email: **AutoChemCustomerCare@mt.com** Toll Free: **+1.866.333.6822**

2

Normal Location (NL) Safety

This chapter identifies safety standards and specifications for safe use of the ReactIR 45P NL instrument in unclassified areas, referred to as 'normal locations.' Review Chapter 1, "General Safety" for information that applies to all ReactIR 45P systems.

The ReactIR 45P NL is fully compliant with the United States and Canadian safety standards listed on the safety label for operation in normal locations. The ReactIR 45P identification label (Figure 1-3 on page 7) includes electrical load specifications.

Caution—There are no user serviceable parts inside the system. Contact a METTLER TOLEDO Field Service Engineer for all service needs.

Refer to "Maintenance Safety" on page 12 for information on maintenance and service.

Safety Specifications

Table 2-1 ReactIR 45P NL Safety Specifications

Specification	Details
Base Unit Enclosure	316 Stainless steel, IP54 18 x 16 x 10.5 inches (H x W x D) 457 x 406 x 267 mm
Key	Non-sparking
Frame	Stainless steel 787 x 457 x 305mm (H x W x D) 31 x 18 x 12inches
Weight with frame	37kg (83lbs)
Power	Voltage: **100–240V~** Frequency: **50/60Hz** Max. Current: **5A**
Power Cord	Plug specified at time of order per local electrical codes.
Fuses (2)	6A 250V 5x20mm slow-acting
Ambient Temperature Range	0°C to 35°C (32°F to 95°F)
Maximum Surface Temperature	Less than or equal to 135°C (275°F)
RTDs (2) (optional)	PT100 Intrinsically Safe (IS), 3V, 1mA
Purge Air	Dry, instrument quality
Purge Input Pressure Range	4.1 to 6.9 barg (60 to100 psig)
Purge Flow Rate	4.7 Lpm (10SCFH)

System Inputs and Outputs (NL)

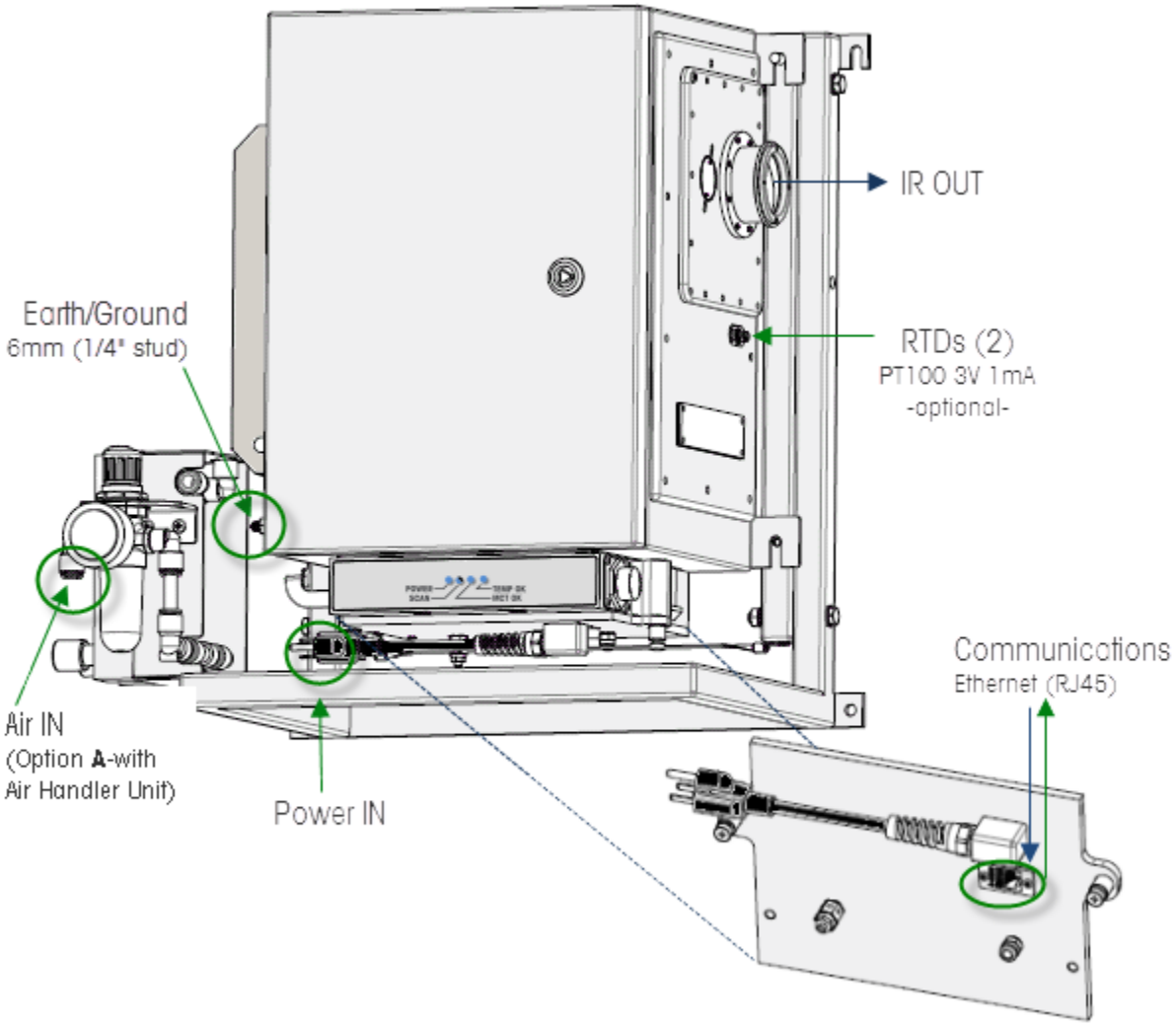


Figure 2-1 ReactIR 45P NL input and output connections (with Air Handling Unit)

Installation—Power and Air Input

1. Connect the power cord, located below the ReactIR 45P main enclosure (Figure 2-2), to external power.

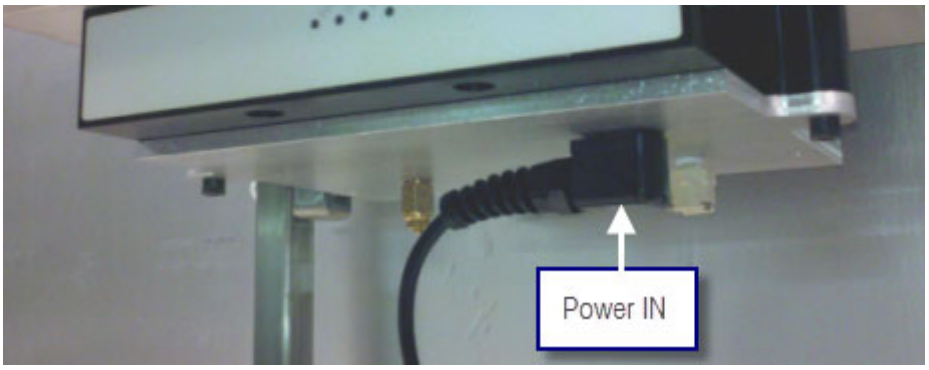


Figure 2-2 Power connection inputs—ReactIR 45P NL

2. Connect a 12 AWG grounding strap to the earth/ground stud on the left side of the enclosure, below the thermoelectric (TE) cooler (Figure 2-1).
3. Connect clean, dry instrument-quality air to the air input on the optional Air Handling Unit (option A in Figure 2-1).
   With air input option B, the Air Handling Unit is customer-supplied. Connect the air tubing (provided) to the quick-connect fittings at the two option B inputs (Figure 2-3).

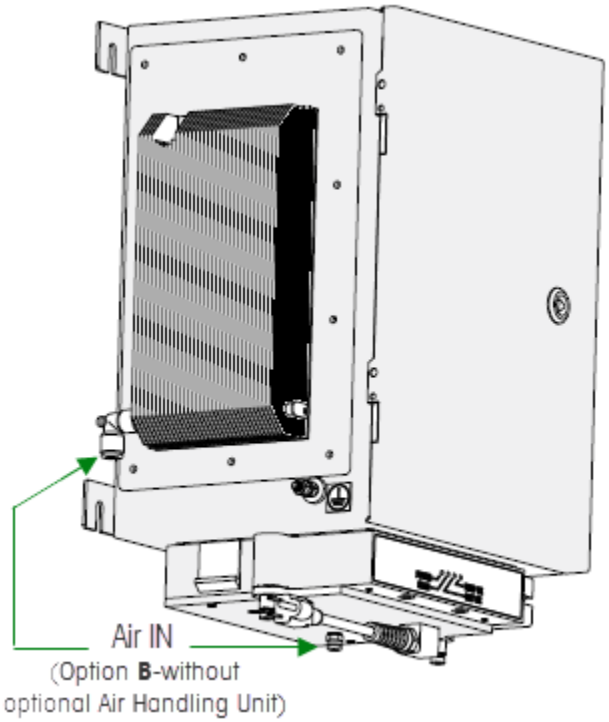


Figure 2-3 Air inputs—ReactIR 45P NL without frame and Air Handling Unit

Key to Secure ReactIR 45P System

The enclosure door is secured by a keyed lock. Before operation, ensure that the ReactIR 45P enclosure door is locked.

Starting the ReactIR 45P NL System

After the ReactIR 45P system has been installed and commissioned for use, review Chapter 1, "General Safety" and follow the steps below to start up the system for regular operation:

1. Verify the enclosure door is securely locked.
2. Apply 4.1–6.9 barg (60-100psig) of clean dry instrument air.

Caution—Pressure shall not exceed 6.9barg (100psig).

3. Regulate the air flow to the enclosure at 5SCFH and to the TE cooler at 4SCFM.
4. Connect the ReactIR 45P system country-specific power cord to the power supply that meets specifications on page 13.

The ReactIR 45P system is ready for use.

Stopping the ReactIR 45P System

To stop the ReactIR 45P system, disconnect the external power (Figure 2-2).

3

Hazardous Location (HL) Safety

This chapter identifies the area classification for safe use of the ReactIR 45P HL instrument in hazardous locations per Class I/Division 1 and ATEX (pending) standards.

- CID1 applies to NA locations for Class I/ Division 1
- ATEX applies to EU locations for Zone 1 (pending)

Review the information in Chapter 1, "General Safety" that applies to all ReactIR 45P systems. The ReactIR 45P identification label (Figure 1-3 on page 7) includes electrical load specifications.

Caution—Area of intended use must meet the following requirements:

- The Compressor intake must be located in unclassified location.
- Noncombustible material will be used for the intake line.
- A separate power source will be used for the protective gas.

Table 3-3 and Table 3-4 list the ReactIR 45P power and purge/pressurization specifications.

Declaration of Conformity

Refer to the D of C certificate shipped with the ReactIR 45P system.

Safety Certification/Area Classification

The ReactIR 45P (HL) is fully compliant with safety standards for operation in hazardous locations as specified in the safety labels shown in Figure 3-1. The table below lists the equipment characteristics.

Table 3-1 ReactIR 45P Hazardous Location Equipment Characteristics

Characteristic	CID1 (NA)	ATEX (EU)—pending
Flammable Gas	**Class I**	**Zone 1**
Area Classification	**Division 1**	
Gas Group	**Group B**	**Group IIB + H2**
Temperature	**T4**	**T4**

Class I/Division 1 Certificate

Refer to the certificate in Appendix A on page 32.

EC Type Examination Certificate (pending)

Refer to the certificate in Appendix A page 32.

Safety Marking Labels (HL)

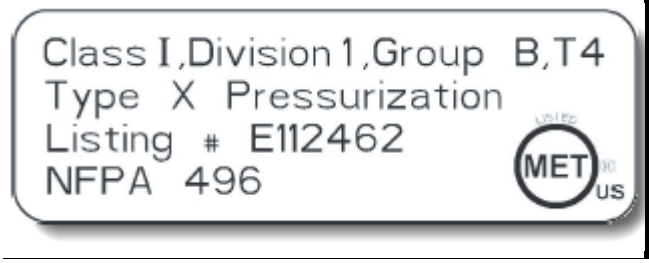
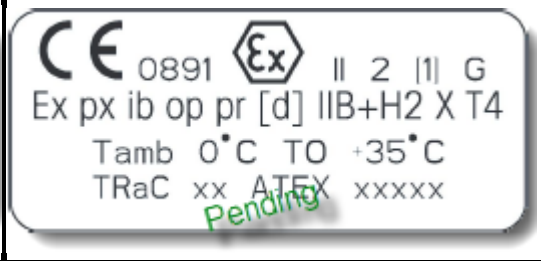
Class I / Division 1 (North America)	ATEX (European Union)—PENDING
	

Figure 3-1 ReactIR 45P HL—Safety marking labels

Safety Specifications

- "Materials of Construction" on page 19
- "ReactIR 45P HL Base Unit" on page 19
- "ReactIR 45P HL Purge/Pressurization System" on page 20
- "Enclosure Warning Label" on page 20
- "Purge and Pressurization Label" on page 21
- "System Inputs and Outputs (HL)" on page 23
- "Circuit Breaker" on page 24
- "Fiber Optic Cable" on page 24
- "Installation—Electrical Wiring" on page 24
- "Installation—Air" on page 27
- "Keys to Secure ReactIR 45P System" on page 29

Materials of Construction

All ReactIR 45P models have the materials of construction specified in Table 3-2.

Table 3-2 ReactIR 45P Materials of Construction

Specification	Details
Base Unit Enclosure	316 Stainless steel, IP54, NEMA 4x
Enclosure Door Seals	Bisco HT-805(s) with silicone PSA
MiniPurge Control Unit (CU)	Stainless steel
MiniPurge Interface Unit (MIU)	Cast aluminum enclosure
Electrical Conduit	1850 Pyrotenax copper industrial wiring cable, 3 conductor 16 AWG, 600V
O-rings	Silicone
Frame	316 Stainless steel
Labels	Chemically resistant polymer

ReactIR 45P HL Base Unit

Table 3-3 ReactIR 45P HL Base Unit Safety Specifications

Specification	Details
Base Unit Enclosure	18 x 16 x 10.5 inches (H x W x D) 457 x 406 x 267 mm
Base Unit with Frame	787 x 457 x 305mm (H x W x D) 31 x 18 x 12inches
Weight with frame	45.4kg (100lbs)
Power	Voltage: **100–240V~** Frequency: **50/60Hz** Max. Current: **5A**
Fuses	6A 250V 5x20mm slow-acting (2)
Ambient Temperature Range	0°C to 35°C (32°F to 95°F)
Maximum Surface Temperature	T4: Less than or equal to 135°C (275°F)
RTDs (2)	PT100 Intrinsically Safe (IS), 3V, 1mA
Fiber Optic Cable	LC Duplex Industrial–to–LC Duplex Jumper with dust caps equal (100m). METTLER TOLEDO P/N 14705015
Key	Non-sparking

ReactIR 45P HL Purge/Pressurization System

Table 3-4 ReactIR 45P HL Purge/Pressurization Specifications

Specification	Details
EXPO MiniPurge Control Unit (CU)	Stainless steel
Key	Non-sparking
EXPO MiniPurge Interface Unit (MIU)	Cast aluminum enclosure
EXPO Safety Manual	D805 Manual (ML 496)
Protective Gas	Dry air, Instrument quality Temperature of air not to exceed 35°C (95°F)
Internal Free Volume	24 Liters (1Cu Ft)
Purge Input Pressure Range	4.1 to 6.9 barg (60 to100 psig)
Minimum Purge Flow Rate (during rapid exchange)	113 Lpm (4 SCFM)
Minimum Purge Duration	5 minutes
Maximum Purge Duration	10 minutes
Minimum Overpressure	2.5 mbarg (1.0″ H_2O)
Maximum Overpressure	7.5 mbarg (3.0″ H_2O)
Maximum Leakage Rate	57 Lpm (2 SCFM)

Enclosure Warning Label

The following label appear on the enclosure door of ReactIR 45P enclosure to warn of the potential risk and advise on the appropriate actions:

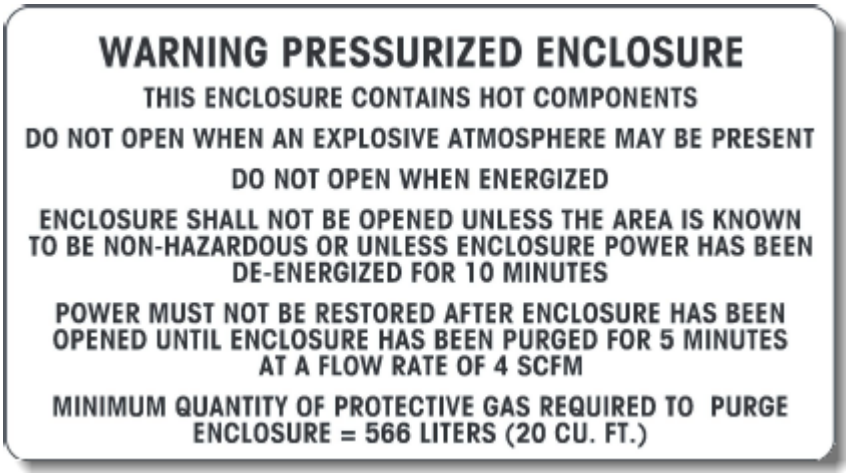


Figure 3-2 Enclosure warning labels

Purge and Pressurization Label

The ReactIR 45P uses an EXPO purge and pressurization system to establish and maintain safe operation in a hazardous location. The following label appear on the ReactIR 45P enclosure to notify the user of the purge specifications and enclosure limitations.

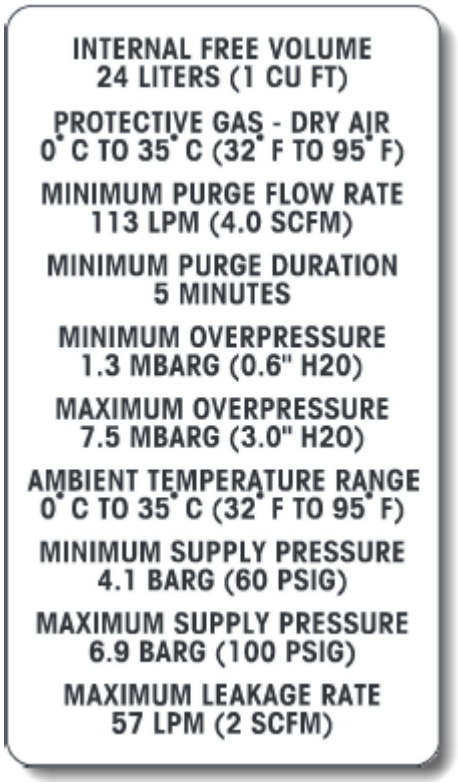


Figure 3-3 ReactIR 45P HL purge and pressurization safe use label

The warning label on the enclosure (Figure 3-2 on page 20) specifies the minimum quantity of air required to purge the enclosure.

Below is the EXPO purge/pressurization control unit identification and safety label that appears on the purge enclosure. Refer to the EXPO manual shipped with instrument for safety information. Manual name and number is on page 20.

Figure 3-4 EXPO MiniPurge Control System label

System Inputs and Outputs (HL)

Figure 3-5 shows the location of ReactIR 45P HL system inputs and outputs.

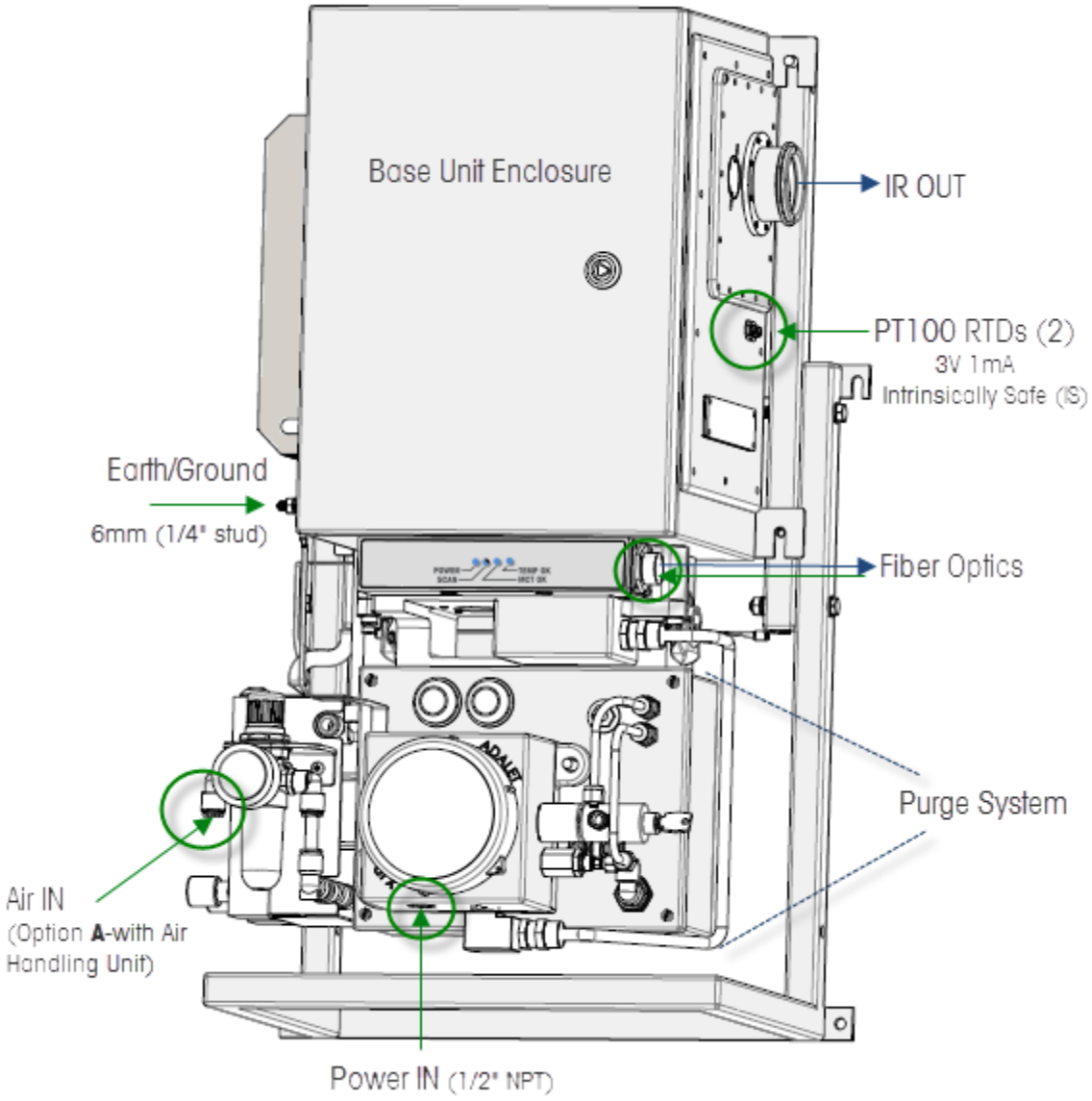


Figure 3-5 ReactIR 45P HL input and output connections (with Air Handling Unit)

The following label identifies the intrinsically safe Resistive Thermal Device (RTD) inputs on the right side of the enclosure when the RTD option is ordered:

Figure 3-6 RTD labels

Circuit Breaker

Caution—End user must provide dedicated power line with circuit breaker clearly marked and easily accessible by the user. Wiring should withstand 7 Amps.

Fiber Optic Cable

Caution—The fiber optic cable provided for communication between the ReactIR 45P system and the computer is designed so the coupling provides additional protective means that require a tool be used to connect and disconnect the cable.

Caution—Fiber optic cable must be routed in a customer-provided cable tray.

Installation—Electrical Wiring

1. Open the ReactIR 45P purge/pressurization enclosure. A certified METTLER TOLEDO Field Service Engineer FSE) opens the ReactIR 45P HL system during installation.

Caution—There are no user-serviceable parts inside the system. Contact a METTLER TOLEDO FSE for all service needs.

2. Attach a dedicated power supply line with a 1/2″ NPT fitting through the power input (Figure 4) and use the appropriate cable termination.

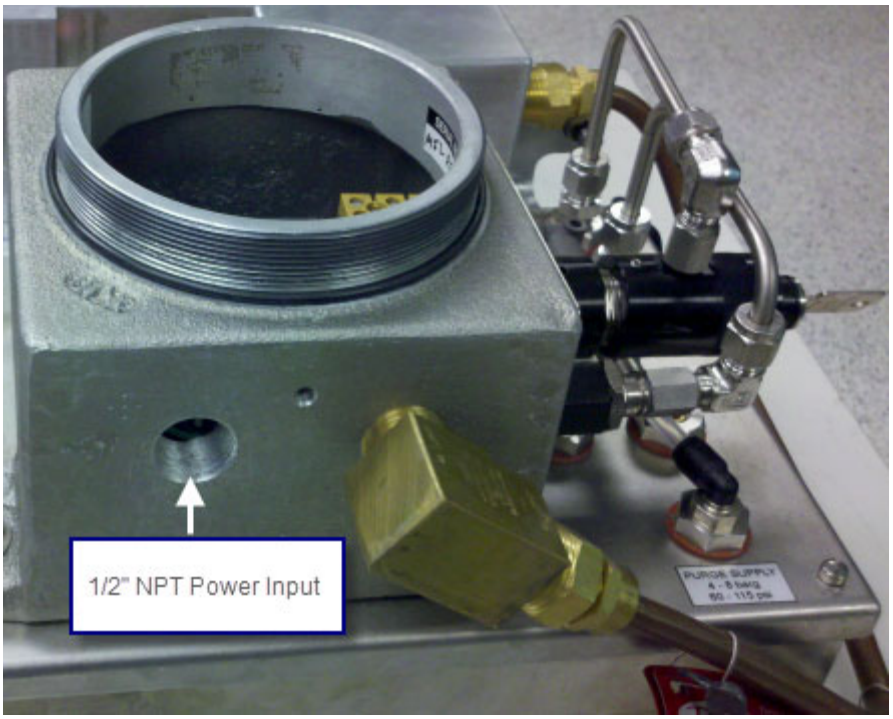


Figure 3-7 Power connection (ReactIR 45P HL)—1/2″ NPT input

WARNING—External power connection to the purge interface unit box providing power to the ReactIR 45P must be made using an appropriately approved and suitably rated cable, gland, or conduit fitting in accordance with country and local electrical codes.

3. Connect a 12 AWG grounding strap to the earth/ground stud on the left side of the enclosure, below the thermoelectric (TE) cooler.

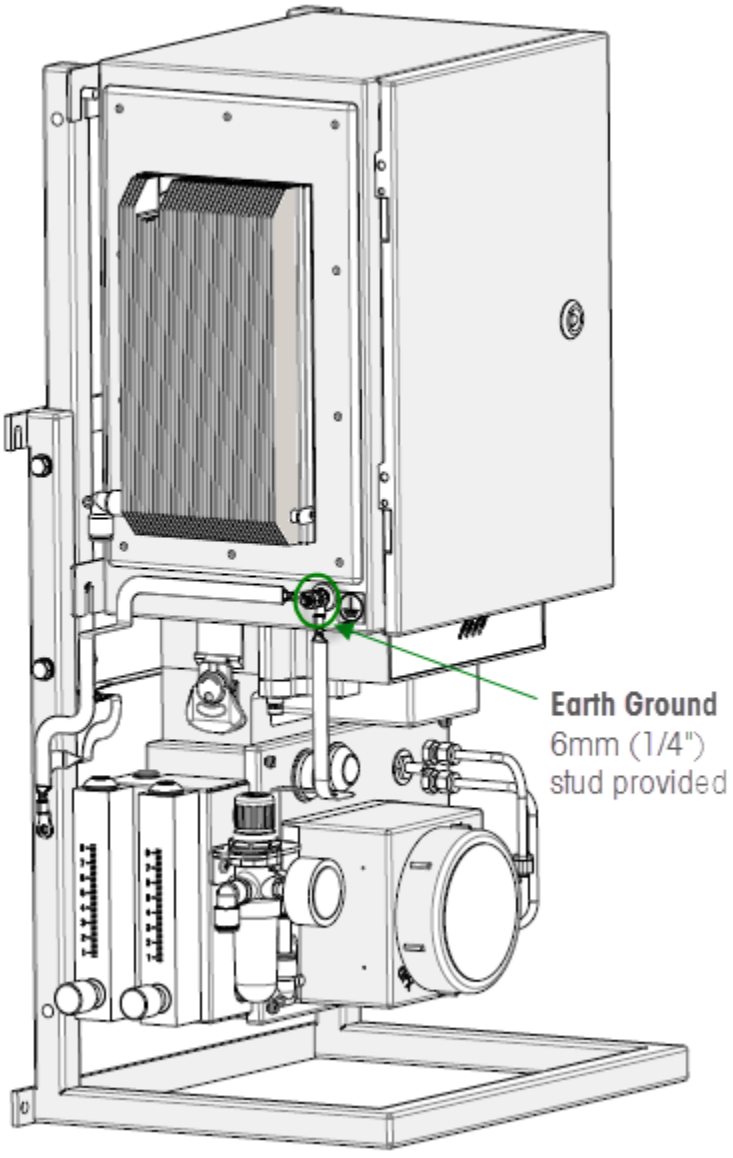


Figure 3-8 Earth/ground location (HL)

4. Connect the external power to the terminal block inside the purge/pressurization enclosure, according to Table 3-5 and shown in Figure 3-9.

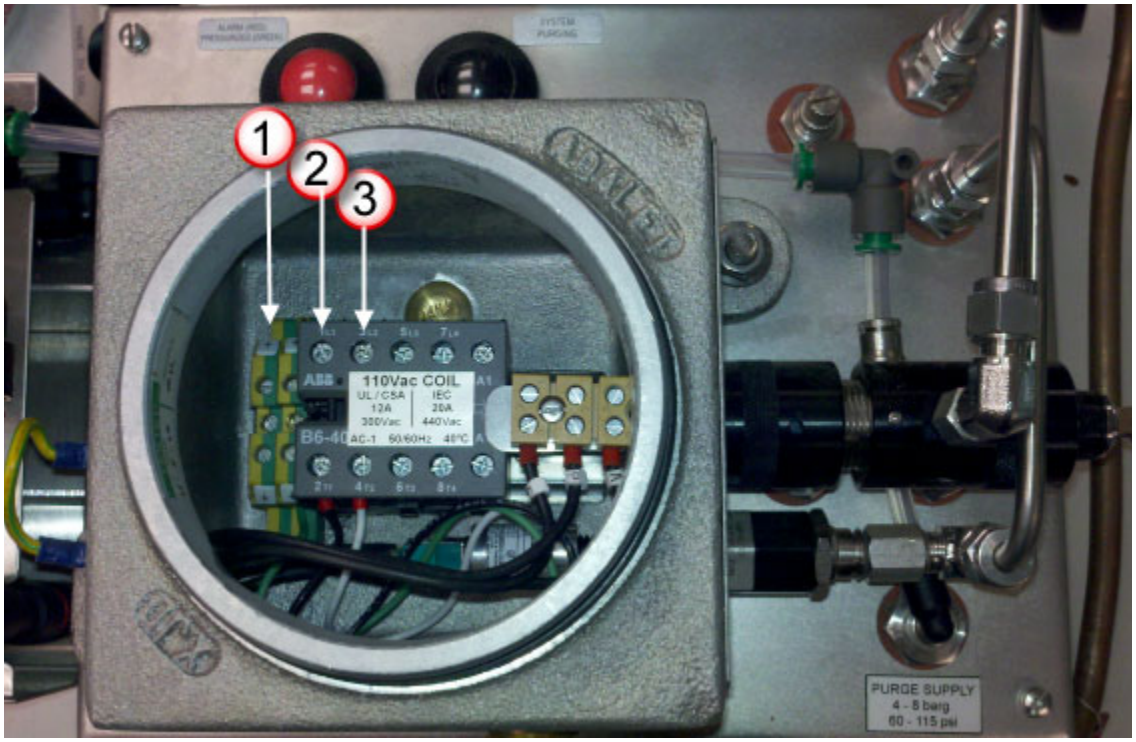


Figure 3-9 Power connection (ReactIR 45P HL)—Terminal block wiring

Table 3-5 Terminal Block Wiring

	Wire—EU	Wire—NA	Terminal	
1	**Yellow/Green**	**Green**	Ground	GND
2	**Brown**	**Black**	Line 1	1L1
3	**Blue**	**White**	Neutral	3L2

Installation—Air

Connect clean, dry instrument quality air supply that meets the specifications on the enclosure label (Figure 3-3 on page 21) and in the table on page 20) to the air input. See Figure 3-5 on page 23 for input location A.

For air input option B, the Air Handling Unit is customer-supplied. Connect 6mm air tubing (customer-supplied) to the two 6mm O.D. fittings provided at air inputs B. Air inlet to enclosure is shown in Figure 3-10.

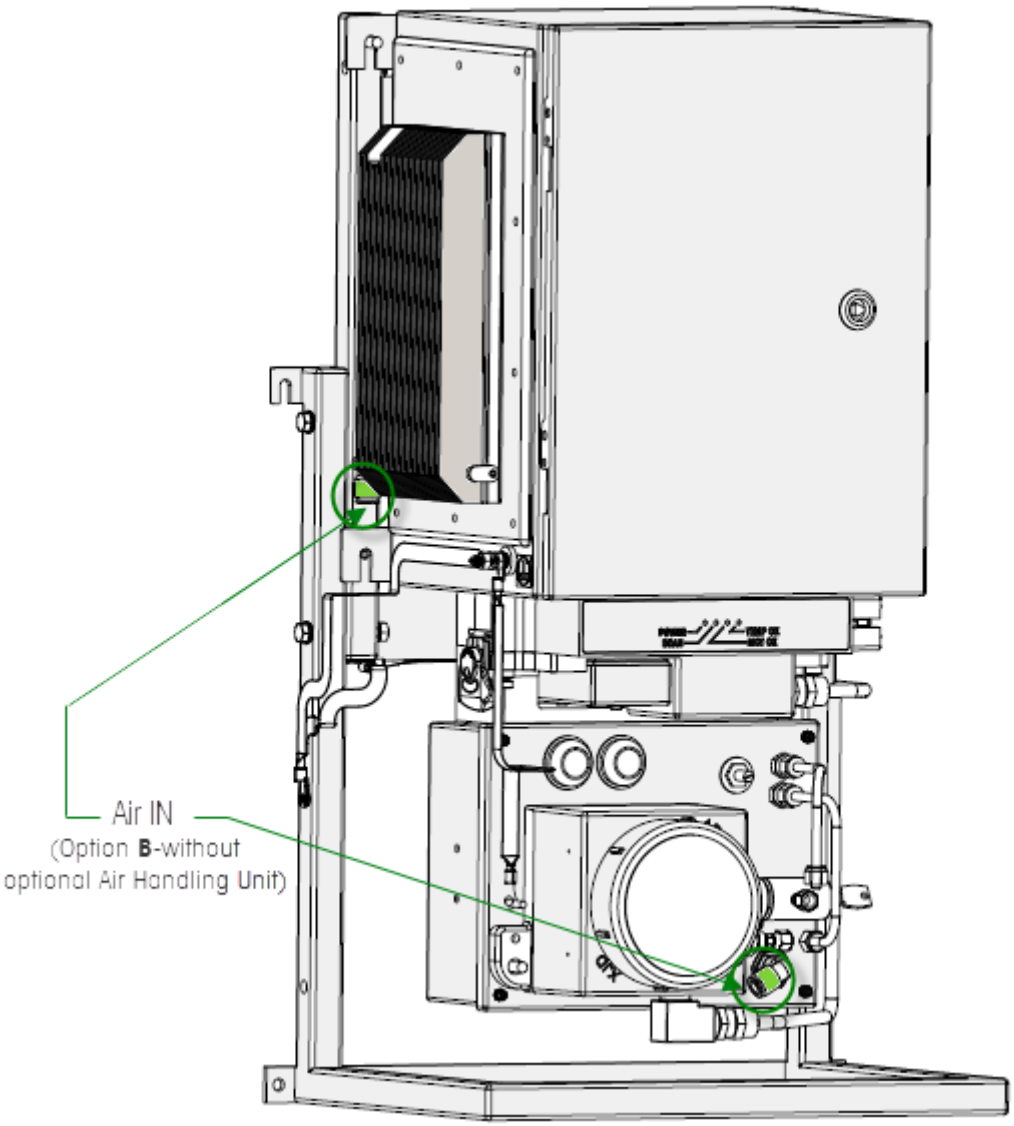


Figure 3-10 ReactIR 45P HL air inlets—Without optional Air Handling Unit

Special Conditions for Safe Use

Caution—If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Caution—There are no user-serviceable parts inside the system. Contact a METTLER TOLEDO Field Service Engineer for all service needs.

Refer to "Maintenance Safety" on page 12 for information on maintenance and service.

Allow the ReactIR 45P HL system to reach full purge and pressurization before use.

Caution—Power to the ReactIR 45P HL base unit is only applied after the purge/pressurization system attains a fully purged and pressurized state. If the ReactIR 45P HL system enclosure is not fully purged/ pressurized, the purge controller cuts power to the system.

Keys to Secure ReactIR 45P System

The enclosure door and the purge control are secured by key locks.

Before operation, ensure that key to the ReactIR 45P enclosure door and the key to the MiniPurge Control Unit (CU) are locked.

Caution—There are no user-serviceable parts inside the system. Contact a METTLER TOLEDO Field Service Engineer for all service needs.

Starting the ReactIR 45P HL System

After the ReactIR 45P system has been installed and commissioned for use, review the Chapter 1, "General Safety" and follow the steps below to start up the system for operation:

1. Verify the ReactIR 45P system enclosure and the purge/pressurization control unit are locked.
2. Apply 4.1–6.9 barg (60–100 psig) of clean, dry instrument quality air to the system.

   Caution—Pressure shall not exceed 6.9barg (100psig).

3. Regulate air flow to the enclosure at 8 SCFM and to the TE cooler at 4 SCFM.

4. Apply power to the ReactIR 45P purge/pressurization system and observe the MiniPurge indicators as the system goes through rapid exchange of enclosure air. The enclosure is fully purged and pressurized when the left indicator is green and the right indicator is black.
5. After the purge/pressurization completes and the enclosure is fully pressurized, the EXPO MiniPurge Interface Unit (MIU) releases power to the ReactIR 45P system.

The ReactIR 45P system is ready for use.

Stopping the ReactIR 45P HL System

Caution—If the ReactIR 45P HL system enclosure is not fully purged/ pressurized, the purge controller cuts power to the system.

A

Safety Certificates

This appendix includes:

"Class I/Division 1 Certificate" on page 32

"EC Type Examination Certificate" on page 33

Class I/Division 1 Certificate

MET LABORATORIES, INC.
CERTIFICATION RECORD

The applicant named below has been authorized by MET Laboratories, Inc. to represent the product(s) listed in this record as "MET Certified" and to mark this/these product(s) according to the terms and conditions of the MET Mark Utilization Agreement, MET Listing Reports, and the applicable marking agreements. Only the product(s) bearing the MET Mark and under a follow-up service are considered to be included in the MET Certification program. This certification has been granted under a System 3 program as defined in ISO Guide 67.

FILE NUMBER: E112462 **APPROVAL DATE:** July 12, 2011

REVISED: -

PRODUCT(S)	MODEL(S)	ELECTRICAL RATINGS
Process Monitoring System	ReactIR 45P	Hazardous and Normal Location Configuration Rated: 100-240 VAC, 50/60 Hz, 5.0 A Hazardous Location Configuration: Class I, Division 1, Groups B, T4

STANDARD NUMBER	STANDARD TITLE	EDITION
UL 61010-1/ CSA C22.2No. 61010-1	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use	2nd
NFPA 496	Standard for Purges and Pressurized Enclosures for Electrical Equipment	2008

MET LABORATORIES, INC. requires that any and all changes proposed in the previously identified product(s), that affects the information contained in the above referenced listing report, must be submitted to MET for evaluation prior to implementation to assure continued MET Certification status.

The above identified product(s) has/have been submitted by the applicant:

APPLICANT:

Mettler-Toledo AutoChem
7075 Samuel Morse Drive
Columbia, MD 21046

The covered products shall be subjected to follow-up inspections to ensure that the Certified product(s) are identical to the representative product sample evaluated by MET LABORATORIES, INC. and that all manufacturer's responsibilities are being fulfilled as specified in the MANUFACTURING RESPONSIBILITY section of the Certification report.

Rick Cooper
Director of Laboratory Operations,
Safety Laboratory

MET Laboratories, Inc. is accredited by OSHA and the Standards Council of Canada.
The Nation's First Nationally Recognized Testing Laboratory

NRTL

EC Type Examination Certificate

---PENDING---

EC Type Examination Certificate

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