Partisol 2000*i* Air Sampler/ Partisol 2000*i*-D Dichotomous Air Sampler

Instruction Manual

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WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:

Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State, and this product should be disposed of or recycled through them. Further information on Thermo Fisher Scientific's compliance with these Directives, the recyclers in your country, and information on Thermo Fisher Scientific products which may assist the detection of substances subject to the RoHS Directive are available at: www.thermo.com/WEEERoHS.

About This Manual

This manual provides information about installing, operating, maintaining, and servicing the Partisol 2000*i* Air Sampler and the Partisol 2000*i*-D Dichotomous Air Sampler. It also contains important alerts to ensure safe operation and prevent equipment damage.

The manual is organized into the following chapters and appendices to provide direct access to specific operation and service information.

- Chapter 1 "Introduction" introduces the user to the advanced features of the Partisol 2000*i* and Partisol 2000*i*-D and describes the flow and sampling configurations of the system. It also discusses the flow control scheme used in the unit.
- Chapter 2 "Installation" describes how to unpack, set up, and start up the Sampler.
- Chapter 3 "Filter Handling and Exchange" provides procedures for handling, exchanging and transporting filters.
- Chapter 4 "Partisol 2000i Inlet Conversion" provides procedures for configuring the Sampler with a variety of inlet systems.
- Chapter 5 "Operational Modes" describes the different operating modes used on the Sampler.
- Chapter 6 "Sampler Settings" describes the different options available for programming the Sampler.
- Chapter 7 "Sampler Operation" describes how to verify the Sampler's characteristics prior to starting a sampling run, programming a sampling run, and retrieving data.
- Chapter 8 "Calibration" provides procedures for calibrating the Sampler and calibration setup.
- Chapter 9 "Firmware Screen Descriptions" describes the front panel display screens, the front panel pushbuttons, and the menu-driven firmware.
- Chapter 10 "Preventive Maintenance" provides maintenance procedures to ensure reliable and consistent instrument operation.
- Chapter 11 "Troubleshooting" presents guidelines for diagnosing Sampler failures, isolating faults, and includes recommended actions for restoring proper operation.

- Chapter 12 "Servicing" presents safety alerts for technicians working on the Sampler, step-by-step instructions for repairing and replacing components, and a replacement parts list. It also includes contact information for product support and technical information.
- Chapter 13 "Electronics" provides a description of the system electronics and input/output connections.
- Appendix A "Warranty" is a copy of the warranty statement.
- Appendix B "C-Link Protocol Commands" provides a description of the C-Link protocol commands that can be used to remotely control a Sampler using a host device such as a PC or datalogger.
- Appendix C "MODBUS Protocol" provides a description of the MODBUS Protocol Interface which is supported both over RS-232/485 (RTU protocol) as well as TCP/IP over Ethernet.
- Appendix D "Communications Using iPort or RPComm" describes RPComm communications software package which provides interactive remote communications with Partisol instrumentation.
- Appendix E "AK Protocol" provides a description of the AK protocol commands that can be used to remotely control a Partisol 2000*i* and 2000*i*-D using a host device such as a PC or a datalogger.

Safety

Review the following safety information carefully before using the Sampler. This manual provides specific information on how to operate the Sampler. If the Sampler is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

The seller cannot foresee all possible modes of operation in which the user may attempt to utilize this instrumentation. The user assumes all liability associated with the use of this instrumentation. The seller further disclaims any responsibility for consequential damages. Use of this product in any manner not intended by the manufacturer will void the safety protection provided by the equipment, and may damage the equipment and subject the user to injury.

Safety and Equipment Damage Alerts

This manual contains important information to alert you to potential safety hazards and risks of equipment damage. Refer to the following types of alerts you may see in this manual.

Safety and Equipment Damage Alert Descriptions

Alert	Description
DANGER	A hazard is present that could result in death or serious personal injury if the warning is ignored. ▲
WARNING	A hazard or unsafe practice could result in serious personal injury if the warning is ignored. ▲
CAUTION	A hazard or unsafe practice could result in minor to moderate personal injury if the warning is ignored. ▲
Equipment Damage	A hazard or unsafe practice could result in property damage if the warning is ignored. ▲

Safety and Equipment Damage Alerts in this Manual

Alert	Description
WARNING	If the Sampler is mounted on a stand, it could fall or tip over in high wind conditions if the stand is not properly anchored. ▲
	The service procedures in this manual are restricted to qualified service personnel only. ▲
	If the equipment is operated in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. ▲
CAUTION	If the LCD panel breaks, do not let the liquid crystal contact your skin or clothes. If the liquid crystal contacts your skin or clothes, wash immediately using soap and water. ▲
Equipment Damage	Do not attempt to lift the instrument by the cover or other external fittings.
	The stand must be anchored when installed outdoors to prevent tipping of the Sampler and/or stand in high winds.
	Some internal components can be damaged by small amounts of static electricity. A properly grounded antistatic wrist strap must be worn while handling any internal component. If an antistatic wrist strap is not available, be sure to touch the instrument chassis before

Alert	Description
	touching any internal components. When the instrument is unplugged, the chassis is not at earth ground. ▲
	Disconnect the serial cable before changing RS-232 and RS-485 selection to prevent damage to any connected equipment. ▲
	Do not use solvents or other cleaning products to clean the outside case. ▲
	Do not remove the LCD panel or frame from the LCD module. ▲
	The LCD polarizing plate is very fragile, handle it carefully. ▲
	Do not wipe the LCD polarizing plate with a dry cloth, as it may easily scratch the plate. ▲
	Do not use alcohol, acetone, MEK or other ketone based or aromatic solvent to clean the LCD module, but rather use a soft cloth moistened with a naphtha cleaning solvent. ▲
	Do not place the LCD module near organic solvents or corrosive gases. ▲
	Do not shake or jolt the LCD module. ▲

FCC Compliance

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note This equipment has been tested and found to comply within the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his or her own expense. ▲

Electrical and Safety Conformity

This product has been tested by ETL Testing Laboratories, and has been documented to be in compliance with the following U.S., Canadian, and EU standards:

UL Standard 61010-1

CAN/CSA C22.2 NO. 61010-1

EN61010-1

Thermo Fisher Scientific certifies that this product operates in compliance with the EC Directive 89/336/EEC with reference to electrical emissions and immunity. Specifically, the equipment meets the requirements of EN55011 Group 1, Class B (Emissions) and EN55082-1 (Immunity).

The hardware has been tested for personal or fire safety hazards, and meets the requirements of UL/CSA/EN61010-1/UL61010-1 (Safety) in fulfillment of EU Directive IEC 61326-1.

IEC 60529
Issued:2001/01/01 Ed:2.1 Degrees of Protection Provided by Enclosures (IP Code); COR. No.1:2003; COR. No.2:2007; COR. No.3:2009

U.S. EPA Quality Assurance Specifications

This operating manual includes references to the U.S. Environmental Protection Agency (EPA) 2.12 *Quality Assurance Handbook,* Volume II, Part II. Partisol Samplers that are installed as part of a U.S. EPA monitoring network, or which must meet U.S. EPA monitoring requirements, should refer to the procedures found in the U.S. EPA 2.12 *Quality Assurance Handbook*. The 2.12 *Quality Assurance Handbook* provides general EPA-recommended guidance and, in some cases, may provide additional, more detailed or more recent guidance.

A copy of the U.S. EPA 2.12 *Quality Assurance Handbook* can be obtained from the AMTIC web site: http://www.epa.gov/ttn/amtic/pmqa.html, the QC coordinator at any EPA Regional Office, or from the Monitoring and Quality Assurance Group (MD- 14), U.S. EPA, Research Triangle Park, NC 27711.

WEEE Symbol

The following symbol and description identify the WEEE marking used on the instrument and in the associated documentation.

Symbol	Description
	Marking of electrical and electronic equipment which applies to waste electrical and electronic equipment falling under the Directive 2002/96/EC (WEEE) and the equipment that has been put on the market after 13 August 2005. ▲

Equipment Rating

The following information can be used to determine the power service requirements of this product:

Line Voltage

115VAC, 50-60Hz, 10 Amp

220-240VAC, 50-60Hz, 5 Amp

Patents, Copyrights and Trademarks

This instrumentation from Thermo Fisher Scientific is covered by pending patents in the United States of America and other countries.

Where to Get Help

For additional assistance, worldwide service is available from Thermo Fisher Scientific. Contact one of the phone numbers below for product support and technical information or visit us on the web at www.thermo.com/aqi.

Toll Free U.S. only 1-866-282-0430

U.S., Latin America, and Canada 1-508-520-0430

Europe +31 76 579 5555

China +86 10 8419 3588

Asia Pacific +91 22 27781102

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Chapter 1
Introduction

The Thermo Fisher Scientific Air Sampling Systems include two single event samplers; a single filter Sampler, the Partisol 2000*i* Ambient Sampler (2000*i*), and a dichotomous Sampler, the Partisol 2000*i*-D Dichotomous Ambient Sampler (2000*i*-D). The two samplers draw a particulate-laden ambient air stream through a sample inlet and then through 47 mm diameter sample filter(s) automatically at a user-defined time or other condition. The Partisol 2000*i* and 2000*i*-D Samplers are designed to be installed at outdoor sampling locations without additional protection from the elements.

For details of the Sampler's advanced features, and product specifications, see the following topics:

- "Overview" on page 1-1
- "Advanced Features" on page 1-4
- "Partisol 2000i Configuration" on page 1-7
- "Partisol 2000i-D Configuration" on page 1-10
- "Specifications" on page 1-14

Overview

The Partisol 2000*i* Air Sampler (Figure 1–1) was designed to conform to the U.S. EPA Federal Reference Method for fine particulate sampling. The hardware was designed meet or exceed the requirements of CFR 40 Part 50 Appendix L and related drawings supplied by the U.S. EPA. In addition, the Sampler can be configured to sample TSP, PM_1, or other parameters through the use of appropriate inlets.

The Partisol 2000*i*-D provides a convenient means of collecting high quality samples of fine and coarse ambient particulate matter. Like the Model 2000*i*, the Model 2000*i*-D was designed to conform to U.S. EPA specifications for regulatory sampling.

The Partisol 2000*i*-D Sampler (Figure 1–2) operates by splitting a PM_{10} sample stream into its fine ($PM_{2.5}$) and coarse fractions (particles between 2.5 and 10 microns in size) using a U.S. EPA designed virtual impactor for the 2.5 micron cutpoint. The system collects particulate matter on two 47 mm diameter filters simultaneously. Users can determine the coarse and fine particle fractions by weighing the two corresponding collection filters and PM_{10} is determined by adding the totals of the fine and coarse PM fractions. The simultaneous sampling of fine and coarse PM can be important for source identification, since these particle size fractions often have different origins, elemental analysis of the filters can reveal information concerning the sources of the collected particles, differentiated by particle size.

Both the Partisol 2000*i* and 2000*i*-D sample using standard 47 mm filters and a variety of filter materials are available in this size. The type of filter media used for sampling depends on the specific requirements of the samples being collected. For $PM_{2.5}$ and PM_{coarse} sampling the U.S. EPA requires the use of Teflon® filters, while PM_{10} sampling is typically performed using TX40, quartz fiber, or Teflon filters. Other agencies may require the use of different media for regulatory sampling and other media is available for special applications.

The updated design of the samplers utilizes a common enclosure and other components to simplify the use and servicing of the samplers. The two samplers contain straightforward filter changer mechanisms for easy filter exchange, microprocessor control with internal data storage. A built-in sample pump provides the vacuum required to pull the air flow through the sample filters and mass flow controllers. The mass flow controllers are controlled as an active volumetric flow control system to maintain constant volumetric flow at the sampler inlet as required by the U.S. EPA.

As with other manual sampling devices, the filters used in the Partisol 2000*i* and 2000*i*-D Samplers must be conditioned and weighed before exposure, and then conditioned and weighed again after use to determine the mass of the particulate matter collected during the sample exposure time. The Partisol hardware stores the data relevant to each collection period in its internal data logger for viewing and/or retrieval after the fact. Such information includes the total volume sampled (computed in both volumetric and standard terms to comply with different regulations around the world), total collection time, and the average ambient temperature and pressure during the collection period. In addition, the device stores interval data records every five minutes to keep a record of the temperature of the ambient air and sample filter.

Figure 1–1. Partisol 2000*i* and 2000*i*-D Air Sampler

Inlet System

The Partisol 2000*i* can be configured to operate with a variety of inlet systems depending on the type of sampling being performed. For most configurations, a standard PM_{10} inlet is used, operating at a flow rate of 16.7 L/min (1 m^3/hr) to provide the initial D_{50} particle size cutoff. For PM_{10} sampling, a straight downtube with adapter is installed inside the enclosure. For $PM_{2.5}$ sampling, the U.S. EPA requires the use of VSCC or WINS Impactor after the PM_{10} inlet and this device is installed inside the enclosure. Additional size sampling may be accomplished through the use of a TSP (total suspended particulate matter) inlet or a PM_1 cyclone.

The Partisol 2000*i*-D uses a PM_{10} inlet operating at 16.7 L/min (1 m^3/h) to provide the initial D_{50} particle size cutoff at a 10 micron diameter. The virtual impactor, or "dichotomous splitter," is located after the inlet, and two separate flow controllers maintain the fine particle stream at 15.0 L/min and the coarse particle stream at 1.67 L/min.

Internal Data Storage and Data I/O

Both systems permit the same range of programming, data input, and storage features.

Internal data storage and data input and output features allow meteorological data and information from other external sources to be averaged and stored. Built-in sensors measure ambient conditions, including temperature, atmospheric pressure and relative humidity.

These systems record information by exposed filter (filter data), 5-minute period (interval data) and by meteorological values and information received from other sources (user data) at user-defined intervals. They compute sampled volumes in both volumetric and standard terms to comply with different regulations around the world.

Programming

Users can define various sampling programs, in addition to the standard 24-hour, midnight-to-midnight implementation. Conditional sampling can be based upon data collected by the sampler using sensors built into the sampler or from external sources in the form of analog input levels.

Advanced Features

This section lists some of the advanced features of the Partisol 2000*i* and 2000*i*-D:

Partisol 2000*i* Features

The following is a list of some of the advanced features of the 2000*i*:

- Operational simplicity, performance audits and stored data retrieval are made possible through an embedded microprocessor and menu-driven software.
- An active, volumetric flow-control system maintains a constant volumetric flow rate at the levels specified by the user (default of 16.7 L/min) by incorporating a mass flow controller and ambient temperature and pressure sensors. Sampled volumes are reported in volumetric and standard terms. The Sampler uses a reliable sample pump.
- The U.S. EPA-designated $PM_{2.5}$ inlet system provides a 2.5 µm cut point by incorporating a PM_{10} inlet at the entrance to the hardware and a $PM_{2.5}$ VSCC or WINS impactor inside its enclosure.
- The sampler uses standard 47 mm filters housed in convenient reusable cassettes. These cassettes are mounted in a single-filter tray for easy exchange and transportation to and from the sampling site.

- The temperature of the collection filter is maintained within 5 °C of the outdoor ambient temperature by a continuous filter compartment ventilation system.
- Interval data are stored every 5 minutes, and include the 5-minute averages of the filter temperature, ambient temperature, ambient pressure and average flow rate. Data storage continues during and after the exposure of the collection filter. The Sampler has a capacity greater than 86 days of interval data (five minute logging with six data items).
- A record of filter data is stored for each filter used in the Sampler and includes all U.S. EPA-specified values such as error condition flagging, and average temperatures and pressures. Filter data records also include sampled volume in volumetric and standard terms, and meteorological and analog input data averaged over the collection period. The Sampler can store 32 filter data records.
- The Sampler stores records of user input data every 30 minutes by default.
- User input data storage rates and variables are user selectable.
- The sampler ships with UL-, CSA- and CE-equivalent electrical and safety approvals.
- Inputs received from external sources in analog voltage form are converted to engineering units through user-defined formulas.
- Ethernet and serial interfaces for data transfer to or from a personal computer (PC) or other digital device allows interval, filter and input data to be retrieved conveniently. The Sampler's standard configuration includes basic PC-based communication software for bidirectional information exchange with the system.
- Automatic leak check.
- Low maintenance requirements due to durable components and a long life vacuum pump.
- Data can be retrieved using Ethernet, serial, or USB.

Partisol 2000*i*-D Features

The following is a list of some of the advanced features of the 2000*i*-D:

- PM_{10} sample stream split into fine ($PM_{2.5}$) and coarse (particles between 2.5 and 10 microns in size) fractions using a U.S. EPA-designed virtual impactor.
- Particulate matter is collected on two separate 47 mm diameter filters simultaneously.
- An active, volumetric flow control system maintains two constant volumetric flow rates at the levels specified by the user (default of 16.7 L/min, split into 15.0 L/min and 1.67 L/min) by incorporating two separate mass flow controllers, and one ambient temperature sensor and one pressure sensor. Sampled volumes are reported in volumetric and standard terms. The Sampler uses a reliable sample pump.
- The temperature of each collection filter is maintained within 5 °C of the outdoor ambient temperature by a continuous filter compartment ventilation system.
- The sampler uses standard 47 mm filters housed in convenient reusable cassettes. These cassettes are mounted in a single-filter tray for easy exchange and transportation to and from the sampling site.
- Operational simplicity, performance audits and stored data retrieval are made possible through an embedded microprocessor and menu-driven software.
- Interval data are stored every 5 minutes, and include the 5-minute averages of the filter temperature, ambient temperature, ambient pressure and average flow rate. Data storage continues during and after the exposure of the collection filter. The Sampler has a capacity greater than 86 days of interval data (five minute logging with six data items).
- A record of filter data is stored for each sampling event used in the Sampler and includes all U.S. EPA-specified values such as error condition flagging, and average temperatures and pressures. Filter data records also include sampled volume in volumetric and standard terms, and meteorological and analog input data averaged over the collection period. The Sampler can store 32 filter data records.
- The Sampler stores records of user input data every 30 minutes by default.
- Inputs received from external sources in analog voltage form are converted to engineering units through user-defined formulas.
- User input data storage rates and variables are user selectable.

- The Sampler is easily transported due to its compact form and lightweight design. Its low noise level makes it appropriate for indoor monitoring.
- Ethernet and serial interfaces for data transfer to or from a personal computer (PC) or other digital device allows interval, filter and input data to be retrieved conveniently. The Sampler's standard configuration includes basic PC-based communication software for bidirectional information exchange with the system.
- Automatic leak check.
- Low maintenance requirements due to durable components and a long life vacuum pump.
- Data can be retrieved using Ethernet, serial, or USB.

Partisol 2000*i* Configuration

The Partisol 2000*i* flow schematic provides an overview of the hardware's flow and electronic connections (Figure 1–2). The schematic shows a PM_{10} inlet that is followed by a downtube and $PM_{2.5}$ cut device. For U.S. EPA regulatory sampling the $PM_{2.5}$ cut device must be either a $PM_{2.5}$ VSCC or a WINS Impactor and is installed inside the sampler enclosure. Other agencies may have different requirements for the devices used for providing the proper D_{50} sampling. The standard sampler configuration uses a PM_{10} inlet followed by an appropriate device inside the sampler. For sampling particle size cut points the following options are available:

TSP sampling – Replace PM_{10} inlet with the proper TSP inlet and insert the pass through tube and adapter.

PM_{10} sampling – Insert the pass through tube and adapter in the sampler.

$PM_{2.5}$ sampling – Replace the pass through tube with the VSCC, SCC, or WINS impactor. For U.S. EPA sampling, either the VSCC or WINS impactor may be used.

PM_1 sampling – replace the pass through tube with a PM_1 cyclone.

A 47 mm filter is housed in a filter cassette that the user installs in a cassette carrier into the sampler.

The U.S. EPA prescribes the use of Teflon filter material for reference $PM_{2.5}$ and PM_{coarse} sampling, while PM_{10} measurements are generally accomplished using TX40 (Teflon-coated glass fiber), quartz fiber or Teflon materials. A range of other materials can be used in the 47 mm format for special applications.

In the Partisol samplers, the 47 mm filter is housed in a filter cassette that the user installs in a single-event filter tray. The tray makes the easy exchange of filters possible in the sampler's filter exchange mechanism, and minimizes the chances of fingers coming into contact with the collection filter.

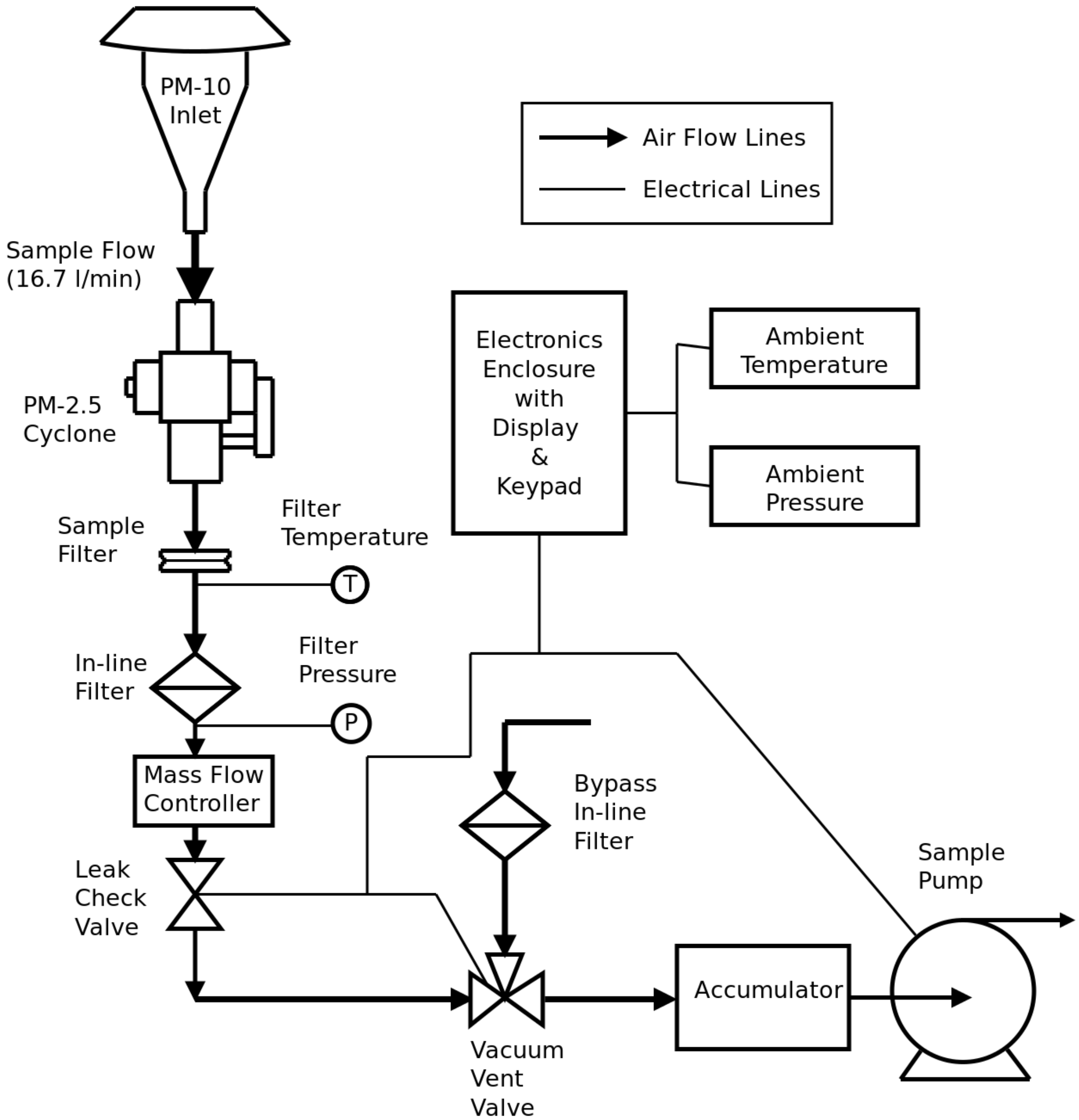


Figure 1–2. Partisol 2000*i* Flow Schematic

An in-line filter downstream of the sample filter protects the mass flow controller from any particles that may remain in the air flow. The mass flow controller operates under the control of the sampler's microprocessor, and maintains the sample stream at a constant *volumetric* flow rate (16.7 L/min default) through the use of ambient temperature and pressure sensors. The accumulator minimizes pulsations caused by the vacuum pump.

The Partisol Sampler maintains a constant volumetric flow rate at the set point entered by the user (usually 16.7 L/min), and reports sampled volumes

(m^3) in both volumetric and standard terms in accordance with U.S. EPA guidelines. The sampling system determines the ambient temperature and pressure for flow rate calculations through the use of sensors that continually provide updated information to the microprocessor system.

The mass flow sensor in the Partisol 2000*i* is calibrated at a temperature of 0 °C and pressure of 1 Atmosphere (1013.2 millibars or 760 mmHg). The instrument uses the measured ambient temperature and pressure to sample at the correct volumetric flow rate. Using this information, the microprocessor calculates the correct mass flow set point (Flow $Rate_{STP}$) required to achieve the desired volumetric flow setting:

$$\text{Flow Rate}_{\text{STP}} = \text{Flow Rate}_{\text{Vol}} \text{ x } \frac{273.15}{\text{Curr Temp} + 273.15} \text{ x } \frac{\text{Curr Pres}}{760}$$

where:

Flow $Rate_{STP}$ =	Control set point of the mass flow meter (equivalent flow at 0 °C and 1 Atmosphere).
Flow $Rate_{Vol}$ =	Volumetric flow rate set point (L/min) as entered by the user in the Setup screen. This value is 16.7 L/min (1 m^3/h) for most applications.
Current Temp =	The current temperature (°C) as measured by the temperature sensor mounted on the down tube of the Sampler.
Current Pres =	The current pressure (mmHg) as measured by the pressure transducer in the Sampler's enclosure.

The Partisol 2000*i* automatically determines the sampled volume in volumetric and standard m^3 for each filter exposed, and stores this information internally for later viewing or downloading.

For $PM_{2.5}$ and PM_{coarse} sampling, the mass concentration data reported to the U.S. EPA must be in volumetric m^3, which simply involves the integration of the above volumetric flow rate over the sampling period, without any further adjustment. For PM_{10} sampling, the mass concentration data reported to the US EPA must be adjusted to standard conditions. Since the sampler provides the collected volume data automatically, no additional calculations are required after the completion of sampling to determine either standard or volumetric values.

To report volumes in standard terms, the user must ensure that the standard temperature and standard pressure parameters are set to their proper values. In many countries, standard volumes are defined in terms of 760 mmHg pressure and 25 °C temperature. Flow volumes referenced internally by the Sampler to 0 °C are converted to standard conditions using the following computation:

$$\text{Volume}_{\text{EPA}} = \text{Volume}_{\text{STP}} \times \frac{\text{Std Temp} + 273.15}{273.15} \times \frac{760 \text{ mm Hg}}{\text{Std Pres}}$$

Partisol 2000*i*-D Configuration

The Partisol 2000*i*-D Dichotomous Air Sampler collects both *coarse* and *fine* particulate matter (PM) on two separate filters. *Coarse* PM is defined as particles with a diameter between 2.5 and 10 microns. *Fine* PM is defined as particles with a diameter of less than 2.5 microns. The sampler consists of two sample flows directed through two 47 mm filters — a low flow (1.67 L/min) for coarse particulate and a high flow (15 L/min) for fine particulate (Figure 1–3).

The U.S. EPA prescribes the use of Teflon filter material for reference $PM_{2.5}$ and PM_{coarse} sampling, and for U.S. EPA sampling Teflon filters are sinstalled in both sample positions in the Partisol 2000*i*-D. For other types of sampling a range of other materials can be used in the 47 mm format, incuding TX40 (Teflon-coated glass fiber) and quartz fiber filters. Other materials are available for special applications.

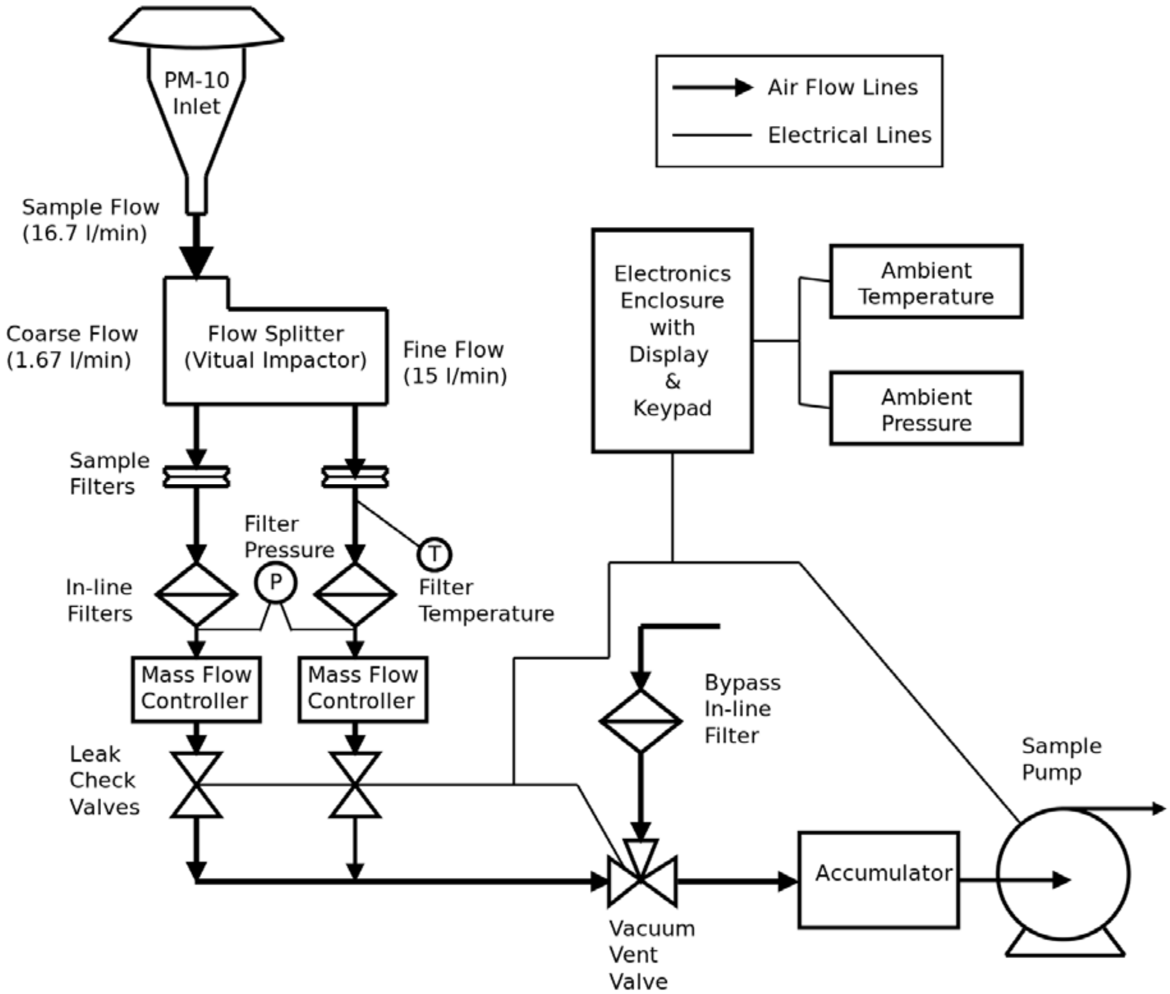


Figure 1–3. Partisol 2000*i*-D Flow Schematic

The 2000*i*-D maintains two constant volumetric flow rates at the set points defined by the instrument (15.0 L/min and 1.67 L/min defaults), and reports sampled volumes (m^3) in volumetric and standard terms. The sampling system determines the ambient temperature and pressure for flow rate calculations through the use of sensors that provide continually updated information to the microprocessor system. Two in-line particle trap filters downstream of the sample filters protect the mass flow controllers from any particles that may remain in the air flow. The accumulator minimizes pulsations caused by the vacuum pump.

For size separation, the ambient particles are sampled through a PM_{10} size selective inlet. This impactor-type inlet traps particles that have a diameter that is equal to or larger than 10 microns while allowing the smaller particles to move onward toward the virtual impactor or dichotomous splitter. The dichotomous sampler's virtual impactor then separates the *coarse* and *fine* particles using the anisokinetic sampling theory. Simply stated, the 16.7 L/min total air flow is split into a 1.67 L/min *coarse* fraction flow and 15 L/min *fine* fraction flow (Figure 1–3). This mismatch in flow rates allows the *coarse* particle fraction to follow the straight path of the minor (1.67 L/min) flow, while the *fine* particle fraction follows both the minor and major (15 L/min) flow paths.

The Dichotomous Partisol Sampler maintains the two constant volumetric flow rates (15.0 L/min and 1.67 L/min), and automatically determines the sampled volumes (m^3) in volumetric and standard terms for each filter exposed, and stores this information internally for later viewing or downloading.

Three formulas are required for the mass concentration ($\mu g/m^3$) computation of *fine* PM ($PM_{2.5}$), *coarse* PM (PM_{10} minus $PM_{2.5}$), and PM_{10}:

For *fine* PM:

$$C_f = \frac{M_f}{V_f} \qquad (1)$$

For *coarse* PM:

$$C_c = \frac{M_c}{V_t} - \left(\frac{V_c}{V_t}\right) C_f \qquad (2)$$

For PM_{10} (in volumetric terms):

$$C_t = C_f + C_c \qquad (3)$$

To calculate the PM-10 value in standard terms:

$$C_{t\,std} = \frac{M_f + M_c}{V_{t\,std}}$$

The symbols in equations (1), (2), and (3) represent:

C_f = mass concentration [$\mu g/m^3$] of *fine* particle fraction

C_c = mass concentration [$\mu g/m^3$] of *coarse* particle fraction

C_t = mass concentration [$\mu g/m^3$] of PM-10

M_f = mass [µg] collected on *fine* particle fraction filter

M_c = mass [µg] collected on *coarse* particle fraction filter

V_f = volume [m³] of air sampled through *fine* particle fraction filter

V_c = volume [m³] of air sampled through *coarse* particle fraction filter

V_t = volume [m³] of air sampled through both *fine* and *coarse* particle fraction filter (total volume)

Example: During a 24-hour sample run 2.4 m³ of air is sampled through the *coarse* fraction filter and 21.6 m³ of air is sampled through the *fine* fraction filter. Laboratory analysis (sample filter equilibration and subsequent weighing on a microbalance) determines that the mass collected on the *coarse* fraction filter is 768 µg, while the mass collected on the *fine* fraction filter is 846 µg. What is the mass concentration of *fine* PM, *coarse* PM and PM_{10}?

For *fine* PM (using equation 1):

$$C_f = \frac{846}{21.6} = 39.17\ \mu g/m^3$$

For *coarse* PM (using equation 2):

$$C_c = \frac{768}{24} - \left(\frac{2.4}{24}\right) 39.17 = 28.8\ \mu g/m^3$$

For PM_{10} (using equation 3):

$$C_t = 39.17 + 28.8 = 67.97\ \mu g/m^3$$

To report volumes in standard terms, the user must ensure that the standard temperature and standard pressure parameters in the Instrument Setup screen are set to their proper values. In many countries, standard volumes are defined in terms of 760 mmHg pressure and 25 °C temperature. Flow volumes referenced internally by the Sampler to 0 °C are converted to standard conditions using the following computation:

$$\text{Volume}_{EPA} = \text{Volume}_{STP} \times \frac{\text{Std Temp} + 273.15}{273.15} \times \frac{760 \text{ mm Hg}}{\text{Std Pres}}$$

Specifications

Table 1–1 lists the Partisol 2000*i* and 2000*i*-D performance specifications.

Table 1–1. Specifications

Safety/Electrical Designations	Meets the following safety and electrical designations: CE: EN550011 Group 1, Class B (Emissions); EN55082-1 (Immunity); EN611010-1 (Safety) ETL: UL- and CSA-equivalent approval IEC 60529 IPX1
Operating Temperature	-40 °C to +50 °C
Flow Rate	5 to 18 volumetric liters per minute (2000*i* only)
Weight	2000*i* - 82 lb (37.2 kg) 2000*i*-D - 85 lb (38.6 kg)
Power Requirements	10 Amp @ 115 VAC, 50/60Hz 5 Amp @ 220-240 VAC, 50/60Hz
Enclosure	14.6 D x 18.5 W x 25.5 H in. (37.1 x 47.0 x 64.8cm), and 30.4 in. (77.2cm) with the inlet connector
Stand Top Section	14 x 30.8 x 27.1 in. (35.6 x 78.2 x 68.8cm)
Footprint	42.0 x 18.1 in. (107 x 46.0 cm)
Internal Data Storage	Greater than 86 days of interval data (five minute logging with six data items)
Analog Outputs	6 voltage outputs; 0–100 mV, 1, 5, 10 V (user selectable), 5% of full scale over/under range (user selectable), 12 bit resolution, measurement output user selectable per channel
Digital Outputs	1 power fail relay Form C, 10 digital relays Form A, user selectable alarm output, relay logic, 100 mA @ 200 VDC
Digital Inputs	16 digital inputs, user select programmable, TTL level, pulled high
Serial Ports	1 RS-232 with two connectors, baud rate 1200–115200, data bits, parity, and stop bits, protocols: C-Link, MODBUS, and streaming data (all user selectable)
Ethernet connection	RJ45 connector for 10/100Mbs Ethernet connection, static or dynamic TCP/IP addressing
USB	USB 2.0, full speed, 12 Mbps; and low speed, 1.5 Mbps

Chapter 2
Installation

Follow the recommendations and procedures in this chapter when installing the Partisol 2000*i* and 2000*i*-D:

- "Lifting" on page 2-1
- "Standard Hardware Configurations" on page 2-1
- "Partisol Stand" on page 2-7
- "Hardware Considerations" on page 2-10
- "Adjusting the Screen Contrast" on page 2-11

Lifting

When lifting the instrument, use a procedure appropriate to lifting a heavy object, such as, bending at the knees while keeping your back straight and upright. Grasp the instrument at the bottom in the front and at the rear of the unit. Although one person can lift the unit, it is desirable to have two persons lifting, one by grasping the bottom in the front and the other by grasping the bottom in the rear.

Equipment Damage Do not attempt to lift the instrument by the cover or other external fittings. ▲

Standard Hardware Configurations

The following is a list of the standard components for the 2000*i* and the 2000*i*-D.

Partisol 2000*i*

Partisol 2000*i* Sampler with WINS $PM_{2.5}$, VSCC impactor, or pass through adapter tube:

PM_{10} inlet

Filter transport container with 2 cassettes and carriers

3 rainhoods and associated hardware

Sample tube

Partisol stand

Ambient temperature sensor and cable

Flow audit adapter

Solid filter leak check/separator disk

9-to-9 pin null modem computer cable

Null modem adapter

Operating manual

Quick start guide

*i*Port package

RPComm package

Partisol 2000*i*-D

Partisol 2000*i*-D Dichotomous Sampler with virtual impactor:

PM_{10} Inlet

Anti-static filter transport container

2 dual filter carriers

4 filter cassettes

3 rainhoods and associated hardware

Sample tube

Partisol stand

Ambient temperature sensor and cable

2 Solid filter leak check/separator disks

Flow audit adapter

9-to-9 pin null modem computer cable

Null modem adapter

Operating manual

Quick start guide

*i*Port package

RPComm package

Setting up the Sampler

Use the following procedure to set up the Sampler. The following instructions apply to both the Partisol 2000*i* and Partisol 2000*i*-D Ambient Samplers.

1. When moving the instrument, be sure to lift the unit by using the two handles.

2. Cut any tie wraps and remove any transport restraints from inside the Sampler enclosure.

3. Install the large rainhood on the right side of the enclosure (Figure 2–1). The rainhood should cover both air filters.

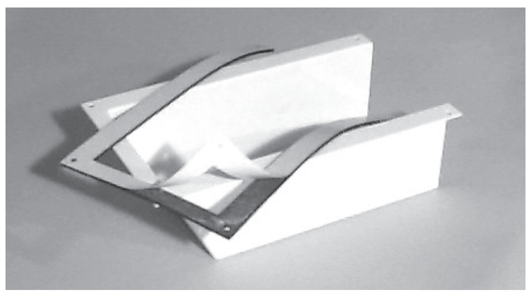


Figure 2–1. Rainhood and Self Stick Gasket

   a. Peel back the paper facing of the larger gasket and apply it to the larger rainhood.

   b. Place the large rainhood, with its gasket attached, on the enclosure (Figure 2–2).

   c. Secure the rainhood to the unit using four #10-32 x 1/2" slot bind head screws.

Figure 2–2. Sampler with a Large Rainhood Installed on the Right Side Panel of the Unit and a Small Rainhood on Left

4. Install the two small rain hoods. One rain hood is installed on the left side of the enclosure and the other on the back. Each rain hood covers one fan opening.
   a. Peel back the paper facing of one of the smaller gaskets and apply it to one of the smaller rainhoods.
   b. Place the small rainhood, with its gasket attached, on the enclosure.
   c. Secure the rainhood to the unit using four #10-32 x 1/2" slot bind head screws.
   d. Repeat this procedure for the other small rainhood.

5. Install the sample tube and PM_{10} inlet (Figure 2–3).

Note If using an inlet other than a PM_{10} inlet as described in this section, follow the instructions that were provided with that inlet. ▲

Note Examine the sample tube. Some sample tubes are machined down to a smaller diameter on both ends. The machining on one end extends for 5 cm (2 inches), while the machining on the opposite end extends only 3 cm (1.25 inches). ▲

   a. Insert the end of the sample tube, with the 5 cm (2 inches) machined section, into the bulkhead of the Sampler. Ensure that the tube is pushed into the enclosure through the final O-ring until it stops.

b. Turn the dome connector on the bulkhead to ensure a tight grip.

c. Place the PM_{10} inlet on the end that has 3 cm (1.25 inches) of machining. Ensure that the tube is pushed past the inlet's two O-rings (which provide some resistance) until it stops.

In its final sampling configuration, the entrance to the inlet must be approximately 2 m (±0.2m) above the ground (6 to 7 feet). The stand (57-004644) that comes with the Sampler provides a convenient means of installing the Sampler to the correct height requirements.

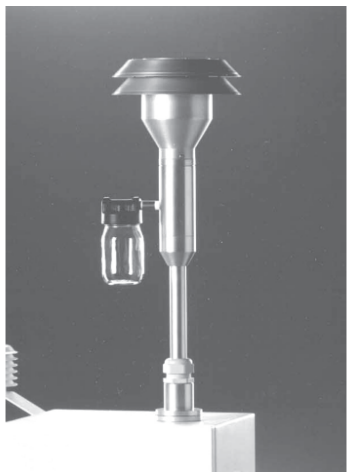


Figure 2–3. Sample Tube with the PM_{10} Inlet Installed

6. Connect the unit to the electrical power source following all local regulations. Be sure to fulfill all safety and regulatory requirements for the hardware.

   For 115 VAC configurations, the standard three-pronged U.S. plug is provided at the end of the power cord. The unit is properly grounded and use of a ground fault interrupter is not necessary.

   For 220-240 VAC configurations, no electrical plug is provided at the end of the power cord. This line must be wired in accordance with local safety codes.

7. Install the ambient temperature sensor.

   a. Locate the two screws on the left side of the enclosure.

   b. Remove the two screws. Be sure to retain the washers. This will expose two holes.

   c. Locate the ambient temperature probe assembly in the compilation package.

d. Secure the assembly to the enclosure using the screws and washers previously removed (Figure 2–4).

IMPORTANT Place the washers between the ambient temperature bracket and the enclosure – not under the head of the screw – to keep water from leaking into the electronics compartment. ▲

e. Plug the ambient temperature probe into the connector on the back panel of the Sampler labeled "Ambient Temperature" (Figure 2–5).

Figure 2–4. Ambient Temperature Probe Assembly Mounted on the Enclosure

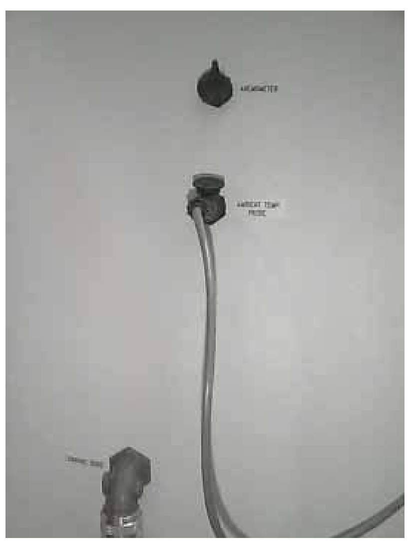


Figure 2–5. Ambient Temperature Probe Plugged into the "Ambient Temperature" Connector

8. For all Partisol Samplers, a second device will be installed inside the Sampler enclosure, and will vary depending on the model of the Sampler and the desired cut-point of the device.

   For PM_{10} sampling with the Partisol 2000*i*, a straight down-tube along with an adapter with a v-seal attached is inserted into the Sampler. Follow the instructions to install the straight down-tube in the Sampler as provided in "Converting a Partisol 2000i from a PM2.5 Sampler to a PM10 Sampler" on page "4-4".

   For $PM_{2.5}$ sampling with the Partisol 2000*i*, an appropriate $PM_{2.5}$ cut device, or fractionator, must be installed. The U.S. EPA requires that either a VSCC or WINS impactor be used for regulatory $PM_{2.5}$ sampling. Other agencies may require other cut devices such as the SCC. Follow the instructions to install the VSCC or other cyclone in the Sampler and for instructions on preparing and installing the WINS impactor as provided in "Converting a Partisol 2000i from a PM10 Sampler to a PM2.5 Sampler" on page "4-7".

   The Partisol 2000*i*-D uses a Dichotomous Splitter (or Virtual Impactor) to divide the sampled PM into a $PM_{2.5}$ fraction and a PM_{coarse} fraction. If not already installed, refer to "Virtual Impactor Maintenance Partisol 2000i-D" on page 10-12 for instructions on preparing and installing the Virtual Impactor into the Sampler.

9. Install 47 mm filter(s) into the Sampler in the manner described in "Filter Handling and Exchange" on page 3-1. The Partisol 2000*i* Sampler uses a single filter and the Partisol 2000*i*-D uses two filters to collect the sample. Prior to performing a sample, perform a leak check as described "External Leak Check" on page 7-4.

Partisol Stand

The Partisol stand (57-004644) keeps the inlet at the appropriate height. Figure 2–6 shows the unit mounted on the stand.

WARNING If the Sampler is mounted on a stand, it could fall or tip over in high wind conditions if the stand is not properly anchored. ▲

Figure 2–6. Sampler Mounted on Optional Stand

Use the following procedure to assemble the stand.

Note Figure 2–7 contains a list of parts and assembly information for the stand. Put this hardware together in accordance with Figure 2–7 and the "Sampler Stand Parts List" that follows. ▲

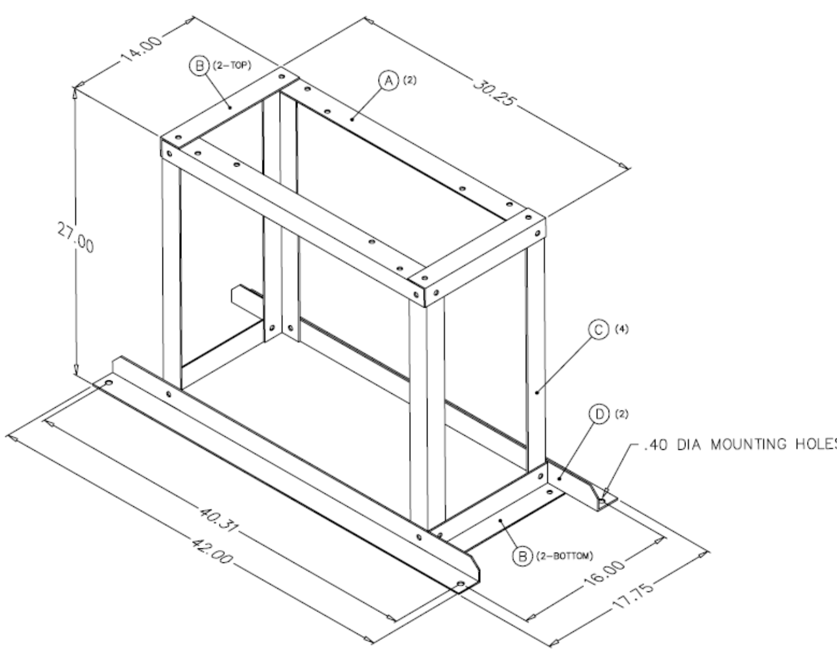


Figure 2–7. Assembly Information for the Sampler Stand

Sampler Stand Parts List

A (2) Top front and top back (36-005479)

B (4) Top right, top left, bottom right, bottom left (36-005476)

C (4) Legs (36-005478)

D (2) Bottom front and bottom back (36-005477)

E (4) Hex head bolt 1/4-20 x 3/8" (21-001291-0006)

F (20) Hex head bolt 1/4-20 x 3/4" (21-001291-0012)

G (24) Flat washer, 1/4" (21-001275)

H (24) Split ring washer, 1/4" (21-000848)

IMPORTANT Always remember to place the split ring washer between the head of the bolt and the washer. ▲

1. Assemble the bottom of the stand by laying out the front, back and sides (Figure 2–8).

2. Place one leg on each inside corner and fasten with F, G and H hardware (Figure 2–7).

3. Attach the top front and back to the outside of the legs with F, G and H hardware (Figure 2–7). Do not tighten.

4. Fasten the right and left rails to the legs and top front and back rails with F, G and H hardware (Figure 2–7).

5. Tighten all hardware.

6. Place the Sampler onto the stand and secure using E, G, and H hardware (Figure 2–7).

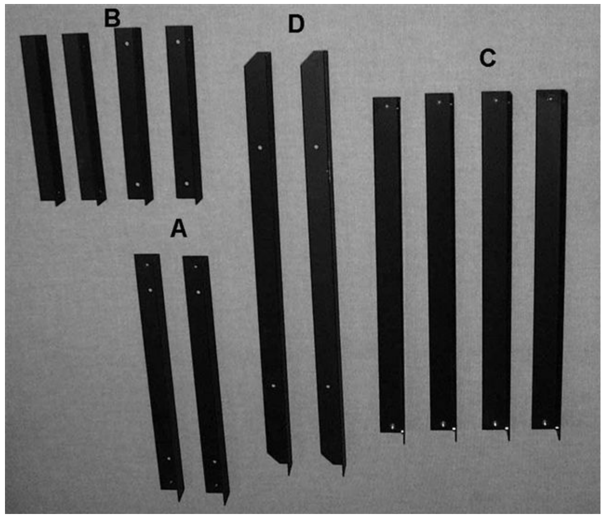


Figure 2–8. Sampler Stand Components

Hardware Considerations

A number of internal systems of the Sampler are designed to maintain acceptable operating conditions within the hardware.

Filter Compartment Fan Operation

There are three modes of operation for the filter compartment fan: Always On, Always Off, and Auto.

- In the Always On mode, the fan is always on until it is turned off manually.
- In the Always Off mode, the fan is always off until it is turned on manually.
- In the Auto mode, the fan turns on if the filter compartment temperature is greater than 2 °C above the ambient temperature. The fan turns off if the filter compartment temperature falls below the ambient temperature. Auto mode is the default setting.

Pump Fan Operation

The sample pump is always running when sampling takes place. If the filter compartment temperature exceeds 15 °C, and the sample pump is running, the pump fan in the pump compartment initiates. The pump fan stops running once the temperature falls below 10 °C. However, the pump fan will not initiate if the sample pump is not running, regardless of the temperature measured in the filter compartment.

When the Sampler is turned ON, the sample pump starts automatically. If the ambient temperature is below 10 °C, the pump will continue running until the ambient temperature exceeds 10 °C. After instrument start up when the device is not sampling, the sample pump initiates if the ambient temperature falls below 10 °C for 30 seconds. If the sample pump does initiate due to low temperatures, it stops running when the ambient temperature exceeds 10 °C.

When the pump is running during cold weather, but not sampling, the flow through the pump enters the system through the vacuum vent valve when not actually sampling, but is in Wait or Stop modes. This does not affect the filter that is in sampling position.

Electronics Compartment Heater Operation

The heater in the electronics compartment turns on when the electronics compartment temperature falls below 5 °C. The heater turns OFF when the electronics compartment temperature rises above 10 °C.

Turning on the Partisol Sampler

Follow the procedures outlined in this section and "Filter Handling and Exchange" on page 3-1, before attempting to operate the Sampler. Power can be applied to the unit once the sampling system has been wired to a main electrical source of the proper voltage in accordance with local standards.

IMPORTANT Ensure that all applicable safety standards are met before applying power to the hardware. ▲

Use the following procedure to turn on the Sampler.

1. Press the power switch on the main panel to its "ON" (1) position to activate the Sampler.

2. If necessary adjust the liquid crystal display (LCD) to view the display. Refer to "Adjusting the Screen Contrast" below for instructions.

   Once the power switch is pressed, the pump in the unit may start up momentarily. This is the default setting of the unit in case it is being turned on under extreme cold conditions where additional heat is necessary to warm the electronics.

Adjusting the Screen Contrast

The Screen Contrast display is used to change the contrast of the display. Values between 0 and 100% in increments of 5 are available. It may be necessary to change the screen contrast if the instrument is operated at extreme temperatures or lighting conditions.

Note The optimal contrast will change with changes in temperature. ▲

If the display contrast is not optimal, but the content on the screen is visible, in the Main Menu, choose Service > **Screen Contrast**, or press the CTRST soft key on the front panel, and adjust the screen contrast by pressing ↑ or ↓ as appropriate to change the contrast. Press ↵ to save the setting.

If the content on the screen is not visible, press the leftmost front panel soft key once (the CTRST soft key), press ↑ or ↓ as appropriate to adjust the screen contrast, and press ↵ to save the setting. You can also use the "set contrast 10" C-Link command to set the screen contrast to mid range, and then optimize the contrast. Refer to the "Hardware Configuration" on page B-20 in the "C-Link Protocol Commands" Appendix for more information on this command.

- In the Main Menu, choose Service > **Screen Contrast**.

```
SCREEN CONTRAST:
 CURRENTLY:          50 %
    SET TO:          60 % ?

            ↑↓ CHANGE VALUE
             ↵ SAVE VALUE

 CTRST SSET  INSTS  STAT
```

Chapter 3
Filter Handling and Exchange

This section explains how to perform the initial inspection and the equilibrium and weighing (before and after sampling) of the 47 mm filters used in the Partisol 2000*i* and 2000*i*-D Samplers. This section also describes how to insert and remove the filter cassettes in the Sampler, and calculate the 24-hour mass concentration average, as found in the U.S. EPA 2.12 *Quality Assurance Handbook*, Volume II Part II Section 7: Filter Preparation and Analysis, Section 8 Field Operation and Section 11: Calculations, Validation and Reporting of $PM_{2.5}$ Monitoring Data. Use the filter log on Page 12-10 for record keeping.

For details, see the following topics:

Filter Handling and Initial Inspection

The Partisol 2000*i* can be configured to sample a wide range of ambient PM sizes, including TSP, PM_{10}, $PM_{2.5}$, and PM_1. It is important that the proper filter material be used when collecting different PM size ranges as certain filter materials are required for different types of sampling.

The only filter media currently approved by the U.S. EPA for reference method sampling of $PM_{2.5}$ and PM_{coarse} fractions is a 47 mm diameter, 2 µm pore-size Teflon filter. These filters can be purchased from Thermo Fisher Scientific in the following form:

PTFE (Teflon) filters, 2.0 µm pore size, box of 50 (10-002322-0050)

You may use other filters or materials for other types of sampling, depending upon local regulations. For example, the U.S. EPA allows the use of Pallflex TX40 (Teflon coated glass fiber) filters, quartz fiber filters and Teflon material for PM_{10} sampling.

The Partisol 2000*i*-D is specifically designed for sampling $PM_{2.5}$ and PM_{coarse} and as such the use of 47-mm diameter, 2 µm pore-size Teflon filters must be used for U.S. EPA regulatory sampling for both the fine and coarse samples. Other types of filters or filter materials may be used for other types of sampling, or depending upon local regulations.

Ensure that your filters are clean and do not touch them with your fingers. Filters should be stored at the laboratory in petri dishes or some other protective housing, and should be transported to and from the sampling site in the a filter cassette in the provided sample transport container.. Use non-serrated forceps to handle the 47 mm filters.

Inspect each filter visually for integrity before use. Check for the following:

- Pinholes
- Chaff or flashing
- Loose material
- Discoloration
- Non-uniformity

Pre-Sampling Filter Equilibration

Use the following procedure to equilibrate the 47 mm filters before use.

Refer to the U.S. EPA 2.12 *Quality Assurance Handbook*, Section 7 for additional details on filter handling and equilibration. Use petri dishes to store filters in the laboratory.

1. Place a label on the cover of each petri dish and number each dish.

2. Place the petri dish cover under the bottom half of the dish.

3. Place each inspected filter into a separate petri dish.

4. Record the filter number, relative humidity, temperature, date and time at the beginning of equilibration.

5. Equilibrate each filter for at least 24 hours under the following conditions:

   The equilibration room must be held at a constant relative humidity between 30% and 40% relative humidity, with a variability of not more than ±5% relative humidity. The equilibration room must be held at a constant temperature between 20 °C and 23 °C with a variability of not more than ±2 °C.

Pre-Sampling Filter Weighing

Use the following procedure to weigh the 47 mm collection filters (tare weight) before sampling. Refer to U.S. EPA 2.12 *Quality Assurance Handbook*, Section 7.

1. Ensure that each filter has been equilibrated for at least 24 hours before weighing.

2. Filters must be weighed on a microbalance with a resolution of at least 1 μg (0.001 mg). Be sure to warm up the balance before weighing filters.

3. Weigh each filter at least once (three times recommended), recording the mass in grams (Figure 3–1). The average mass reading is the initial filter weight, W_i (g). Use appropriate techniques to neutralize static charges on the filter. This pre-sampling weighing must take place within 30 days of the sampling period.

4. Immediately place each weighed filter into an open filter cassette (59-004648-0001) (Figure 3–2) that has a serial number etched on the screen. Configure the screen so that screen number is visible from below. These filter cassettes also are referred to as having "serialized" screens. Close the filter cassette by snapping its top part onto its bottom section. Ensure that the top and bottom pieces of the cassette are pushed completely together.

Figure 3–1. Positioning a 47 mm Filter on a Balance

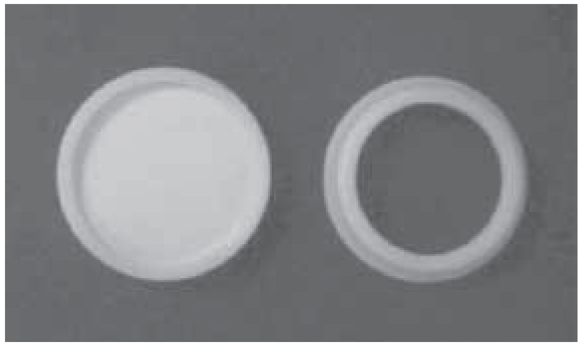


Figure 3–2. 47 mm Filter Placed in Bottom Section of Cassette. Top Part of Cassette Shown on Right.

5. Record the serial number of the filter cassette.

6. Place the filter cassette with its 47 mm filter installed into the filter carrier (55-004847), and place the entire assembly into the metal transport container (Figure 3–3) as specified in the U.S. EPA 2.12 *Quality Assurance Handbook*, Sectioin 7. The container should be identified appropriately using a sticker or other system, and should contain a foam liner to ensure a snug fit.

Figure 3–3. Filter Cassette Carrier in Transport Container for Partisol 2000*i*.

7. If the Sampler is a Partisol 2000*i*-D, the filter cassette carrier will have filter storage locations for two filter cassettes. Ensure that the proper loaded filter cassette is installed in the proper position of the filter cassette carrier. The $PM_{2.5}$, or fine, sample filter will be loaded in the rear position and the PM_{coarse} sample filter will be loaded in the front position.

Figure 3–4. Filter Cassette Carrier 2000*i*-D

8. Document the relative humidity, temperature, date and time of the initial weighing.

9. The "zero" reading of the microbalance should be verified between each filter weighing.

Filter Exchange

Collection filters must be transported carefully in the provided transport containers to and from the sampling site, as specified in the U.S. EPA 2.12 *Quality Assurance Handbook*, Section 8. As specified in the *Quality Assurance Handbook*, the transport containers must be conductive or static free. The transport container used for the Partisol 2000*i* is a metal container, while the container provided for the Partisol 2000*i*-D is made of anti-static plastic.

Use the following procedure to exchange each filter cassette:

1. Determine from the Main Screen whether the unit is still sampling, i.e., whether it is in the Sampling Operating Mode (SAMPLE on the left side of the Status Bar of the screen). The Main Screen displays the current time/date, as well as the programmed starting and ending time/date. If the device is still in its Sampling Operating Mode, allow it to complete its current sampling program before executing the steps below. Refer to Chapter 9 "Firmware Screen Descriptions".

2. If the device is in the Stop or Error Operating Mode, press the ▶ key on the keypad to return the Sampler to the Stop Operating Mode. This causes the Sampler to write the final information to the current record of filter data, and must take place before removing a currently-installed filter.

3. Pull the handle of the filter exchange mechanism toward the front of the instrument to lower the filter platform and expose the filter cassette in its carrier. (Figure 3–5 and Figure 3–6) Note: These photos illustrate the procedure on the Partisol 2000*i* Sampler, but the procedure is identical for the 2000*i*-D.

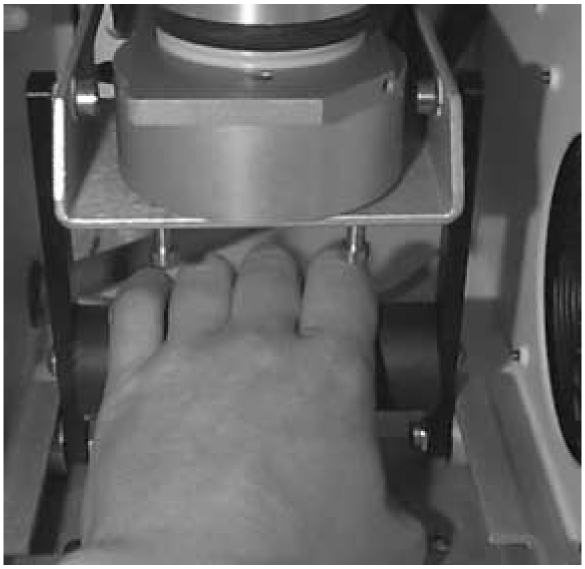


Figure 3–5. Gripping handle of Filter Exchange

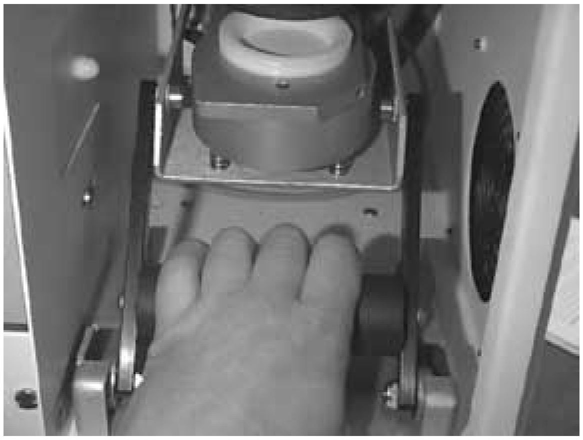


Figure 3–6. Pulling Back on Handle of Filter Exchange

4. If a filter currently resides in the Sampler, remove the filter carrier with its installed filter cassette and 47 mm filter (Figure 3–7), and place this assembly into the filter transport container. Close the filter transport container and keep it sealed until the assembly arrives at the laboratory.

Note The filter must be removed from the Sampler within 96 hours of the end of sample collection according to the current U.S. EPA guidelines as found in the U.S. EPA 2.12 *Quality Assurance Handbook*, Secion 7. ▲

5. Perform any required maintenance on the system, including servicing the PM_{10} inlet and the VSCC or WINS $PM_{2.5}$ Impactor, if necessary

6. Remove the filter carrier containing the set of filters to be exposed from its transport container (Figure 3–3).

7. Carefully insert the filter carrier with its installed filter cassettes and new 47 mm filters into the lower part of filter exchange mechanism (Figure 3–7). The carrier contains a slot in the rear of the carrier that fits into a pin in the rear of the filter exchange mechanism and a hole in the front of the carrier that fits into a pin at the front of the lower part of the filter exchange mechanism.

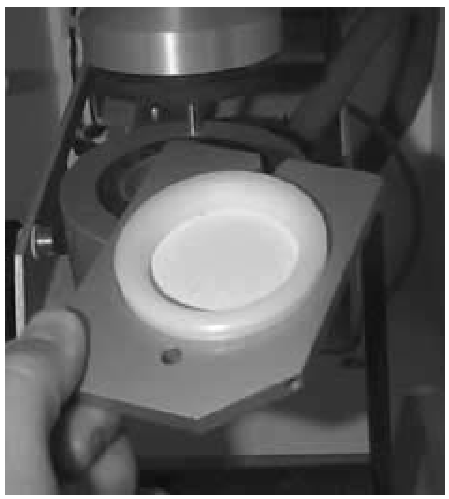


Figure 3–7. Inserting/Removing Filter Cassette in Filter Cassette Carrier in the Partisol 2000*i*

Figure 3–8. Inserting/Removing Filter Cassette in Filter Cassette Carrier in the Partisol 2000*i*-D

8. Push the handle of the filter exchange mechanism toward the back of the instrument to raise the filter platform and enclose the filter cassette (Figure 3–5 and Figure 3–6).

9. Press the button to enter the main menu and then select Sample Setup. Change the parameters shown in this screen to define the sampling program of the newly-installed filter. Be sure to save the new parameters before leaving the Sample Setup screen. Refer to Chapter 7 "Sampler Operation" for full details on programming the Sampler to collect a sample and Chapter 9 "Firmware Screen Descriptions".

10. Return to the Run Screen by pressing the button.

11. Press the button to leave the Stop Operating Mode and enter either the Wait or Sampling Operating Mode. The unit will prompt the operator to verify that this is the correct action. The unit will automatically execute the sampling program defined in the Filter Setup Screen of step 9 above.

12. If an exposed filter was removed from the Sampler in step 4 above, press from the run screen to enter the menu and select View Data records. Move the cursor to the type of data to view, Filter, User, or Interval, and press . Scroll through the records on screen to view the desired data record.

13. Record the information required for data computation and quality assurance purposes. At a minimum, this would usually include the volume sampled (Vol), the flow rate coefficient of variation (%CV), the total sampling time (Tot), the largest difference between the ambient and filter temperatures (Delta T), and the status code (Stat).

Note The information contained in the Filter Data, Interval Data, and User Data may be downloaded from the Sampler using a USB memory stick or onto personal computer (PC) using software and a cable provided with the Sampler. ▲

Note Collection filters should be transported carefully in the metal/anti-static transport containers provided with the Sampler to and from the sampling site as specified in the U.S. EPA 2.12 *Quality Assurance Handbook*, Section 8. ▲

Post Collection Equilibration

Use the following procedure to equilibrate the 47 mm filters after sampling.

1. Separate the filter from the cassette with the optional filter cassette separator tool (38-004892) as shown in Figure 3–9.

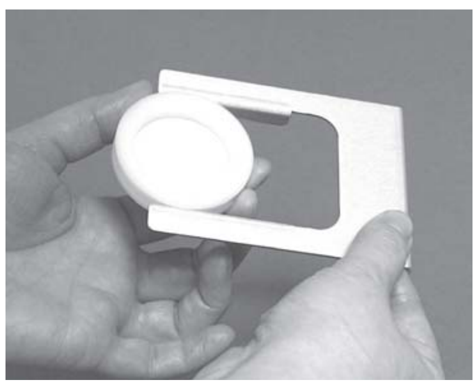


Figure 3–9. Filter Cassette Separator Tool

2. Remove the 47 mm filter from the filter cassette and set the filter in its petri dish. The cassette can then be used to hold other filters once it has been cleaned.

3. Examine the filter for defects that may have occurred during sampling, and for evidence of leaks in the filter cassette. To check for leaks in the filter cassette, check the filter for pronounced radial streaks that extend beyond the exposed area of the filter.

4. Place the petri dish cover under the bottom half of the dish.

5. Place a paper towel over the open petri dish during equilibration.

6. Record the filter number, relative humidity, temperature, and date and time at the beginning of this post-collection equilibration.

7. Equilibrate each filter for at least 24 hours under the following conditions:

   The equilibration room must be held at a constant relative humidity between 30% and 40%, with a variability of not more than ±5% relative humidity.

   The equilibration room must be held at a constant temperature between 20 °C and 23 °C, with a variability of not more than ±2 °C.

Post Collection Weighing

Use the following procedure to weigh the 47 mm filters after sampling.

1. Ensure that the filters have been equilibrated for at least 24 hours before weighing.

2. Filters must be weighed on a microbalance with a resolution of at least 1 μg (0.001 mg). Ensure that the balance has been allowed to warm up before weighing filters.

3. Remove the filter from its petri dish.

4. Weigh each filter at least once (three times recommended), recording the mass in grams (Figure 3–10). The average mass reading is the final filter weight, W_f (g).

5. Return the filter to its petri dish, place the petri dish cover over it and store it for archival purposes.

6. Document the relative humidity, temperature, and date and time of the post-collection weighing.

7. The “zero” reading of the microbalance should be verified between each filter weighing.

8. Determine the net mass filter loading (DW) by subtracting the average initial filter weight (W_i computed in Step 3 of "Pre-Sampling Filter Weighing" on page 3-3) from the final filter weight (W_f computed in Step 4 above). Ensure that the figures used in this computation were obtained from the same filter and balance.

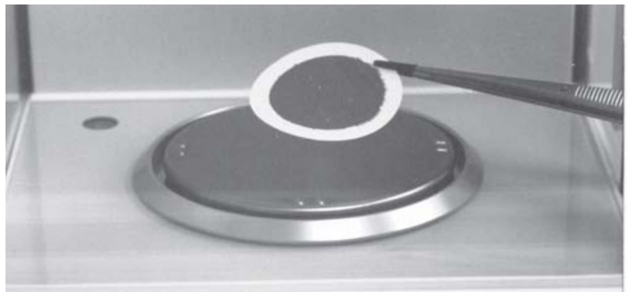


Figure 3–10. Placing a Used 47 mm Filter on a Balance

Computation of Mass Concentration

Note Refer to the U.S. EPA 2.12 *Quality Assurance Handbook*, Section 11. ▲

Compute the average mass concentration (MC) of particulate matter during the sampling period using the following formula with the information previously assembled:

$$MC = \frac{DW \times 10^6}{V}$$

where:

DW = the net change in the mass (g) of the 47 mm filter between the initial weighing and the post-collection weighing, as computed in Step 8 of "Post Collection Weighing".

10^6 = Conversion factor from grams (g) to micrograms (µg).

V = the volume drawn through the filter, as obtained from the Sampler. For U.S. EPA $PM_{2.5}$, this must be volumetric m^3. Other sampling standards require that the standard volume be used. The Partisol 2000*i* and Partisol 2000*i*-D Samplers report volumes in both the actual or standard volume.

For 24-hour $PM_{2.5}$ concentration averages to be valid without adjustment for U.S. EPA reporting purposes, the total sampling time must be between 23 and 25 hours, and other requirements must also be met, as referenced in the U.S. EPA 2.12 *Quality Assurance Handbook*, Section 8. The Sampler also indicates to the user which, if any, status conditions were encountered during sampling.

Chapter 4
Partisol 2000*i* Inlet Conversion

The 2000*i* Sampler can be configured with a variety of inlet systems. This section describes the components of the $PM_{2.5}$ VSCC inlet and WINS inlet Sampler configurations, the PM_{10} Sampler configuration, and the procedures for converting the Sampler from a $PM_{2.5}$ to a PM_{10} Sampler or from a PM_{10} to a $PM_{2.5}$ Sampler. Because the Partisol 2000*i*-D comes equipped with a PM_{10} inlet and virtual impactor for $PM_{2.5}$ and PM_{coarse} sampling, this section does not apply to the Partisol 2000*i*-D.

For details, see the following topics:

- "Partisol 2000i PM2.5 VSCC Components" on page 4-1
- "Partisol 2000i PM2.5 WINS Components" on page 4-2
- "Partisol 2000i PM10 Components" on page 4-3
- "Converting a Partisol 2000i from a PM2.5 Sampler to a PM10 Sampler" on page 4-4
- "Converting a Partisol 2000i from a PM10 Sampler to a PM2.5 Sampler" on page 4-7

Partisol 2000*i* $PM_{2.5}$ VSCC Components

The following components comprise the VSCC inlet configuration as shown in Figure 4–1 and Figure 4–2.

Figure 4–1. $PM_{2.5}$ VSCC Cyclone, VSCC Adapter, Sample Tube, and U.S. EPA PM_{10} Inlet

Figure 4–2. Partisol 2000*i* Sampler with VSCC Cyclone Installed

Partisol 2000*i* $PM_{2.5}$ WINS Components

The following components comprise the $PM_{2.5}$ WINS inlet configuration as shown in Figure 4–3 and Figure 4–4.

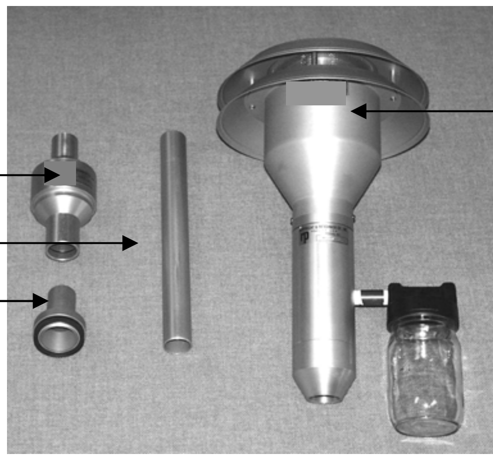


Figure 4–3. WINS Impactor, Adapter, Sample Tube, and U.S. EPA PM_{10} Inlet

Figure 4–4. Sampler with WINS Impactor Installed

Partisol 2000*i* PM$_{10}$ Components

The following components comprise the PM$_{10}$ inlet configuration as shown in Figure 4–5 and Figure 4–6.

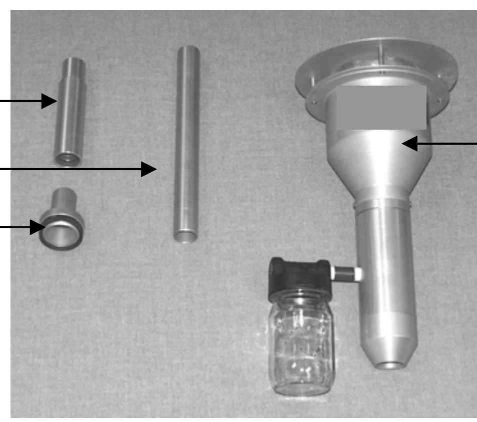


Figure 4–5. Straight Tube, Straight Tube Adapter, Sample Tube, and Traditional PM$_{10}$ Inlet

Figure 4–6. Sampler with Straight Tube Installed

Converting a Partisol 2000*i* from a $PM_{2.5}$ Sampler to a PM_{10} Sampler

Use the following procedure to convert a Partisol 2000*i* configured as a $PM_{2.5}$ Sampler to a PM_{10} Sampler.

1. Open the Partisol 2000*i* enclosure door to access the filter exchange mechanism.

2. Pull the filter exchange mechanism toward you to open the filter exchange mechanism.

3. Lift the rollers through the slots in the left-hand and right-hand guides (Figure 4–7).

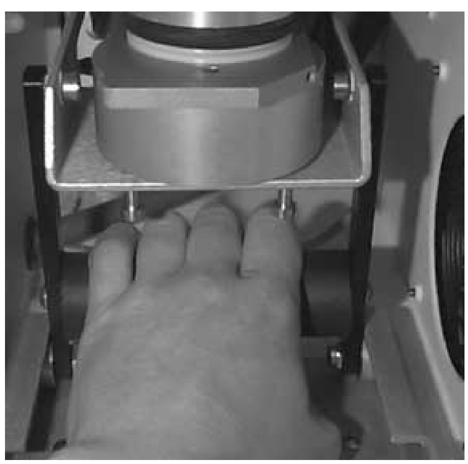


Figure 4–7. Opening the Filter Exchange Mechanism

4. Allow the filter platform to settle downward, and remove the VSCC or WINS impactor and adapter by pulling them straight downward.

5. Remove the adapter (Figure 4–8) from the VSCC (or WINS impactor) and attach it to the straight tube.

Figure 4–8. Adapter for the VSCC, WINS Impactor and Straight Tube

6. Install the straight tube with the adapter into the Partisol 2000*i* enclosure by pushing them straight upward until they hit a stop (Figure 4–9).

Figure 4–9. Straight Tube and Adapter Installed Inside the Enclosure

7. Raise the filter platform to allow the filter exchange mechanism rollers to drop into the slots in the lower guide (Figure 4–10).

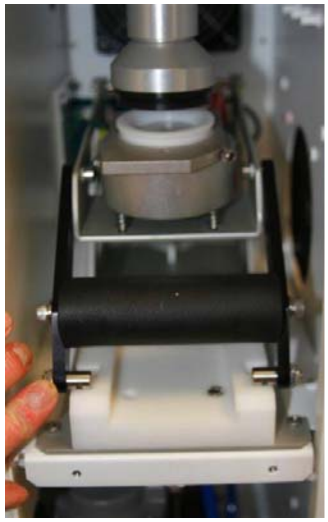


Figure 4–10. Filter Exchange Rollers Shown on Top of Lower Guide

8. Install a filter carrier (with filter cassette) into the filter exchange mechanism and close the mechanism by pushing the handle toward the back of the enclosure (Figure 4–11).

Figure 4–11. Filter Cassette Installed in the Sampler

Figure 4–12. PM_{10} Inlet on the Sample Tube

The Partisol 2000*i* Sampler is now configured for PM_{10} sampling. There is no difference in Sampler programming or operation with the Sampler configured as a PM_{10} or $PM_{2.5}$ Sampler. The Sampler properly measures and calculates sample volumes in Standard and Volumentric conditions regardless of the Sampler configuration.

Note Make sure that the filter cassettes, tranport containers, and data sheets are clearly labeled as PM_{10} sampling filters or sampling data when you install the PM_{10} inlet and straight tube on the Partisol 2000*i* Sampler. Also ensure that the proper filters are used for the type of sampling being performed. ▲

PM_{10} is reported to a standard temperature and standard pressure. Set the standard temperature to values appropriate for the specific location and agency. The U.S. EPA requires that these values be 25 °C for temperature and the standard pressure be 760 mmHg. Refer to “Standard Temperature” on page 9-24 and “Standard Pressure” on page 9-25.

Converting a Partisol 2000*i* from a PM_{10} Sampler to a $PM_{2.5}$ Sampler

Converting a PM_{10} configured Sampler to a Sampler configured for $PM_{2.5}$ sampling can be accomplished by removing the PM_{10} pass through adapter tube, and installing the VSCC, or WINS impactor, and adapter. Follow the Steps for converting a Sampler from a $PM_{2.5}$ configuration to a PM_{10} configuration, but in reverse order as described below.

Use the following procedure to convert a PM_{10} Sampler to a $PM_{2.5}$ Sampler.

1. Open the Partisol 2000*i* enclosure door to access the filter exchange mechanism.

2. Pull the filter exchange mechanism toward you to open the filter exchange mechanism.

3. Lift the rollers through the slots in the left-hand and right-hand guides (Figure 4–7).

4. Allow the filter platform to settle downward, and remove the VSCC or WINS impactor and adapter by pulling them straight downward.

5. Remove the V-seal adapter from straight tube and install onto VSCC or WINS impactor.

6. Install the VSCC or WINS impactor with the adapter into the enclosure by pushing them straight upward until they hit a stop.

7. Install a filter carrier (with filter cassette) into the filter exchange mechanism and close the mechanism by pushing the handle toward the back of the enclosure.

The Partisol 2000*i* in now configured as a $PM_{2.5}$ Sampler (Figure 4–13). There is no difference in Sampler programming or operation with the Sampler configured as a PM_{10} or $PM_{2.5}$ Sampler. The Sampler properly measures and calculates sample volumes in Standard or Volumentric conditions regardless of the Sampler configuration.

Figure 4–13. Partisol 2000*i* $PM_{2.5}$ with VSCC

Note **Note** Make sure that the filter cassettes, tranport containers, and data sheets are clearly labeled as PM_{10} sampling filters or sampling data when you install the PM_{10} inlet and straight tube on the Partisol 2000*i* Sampler. Also ensure that the proper filters are used for the type of sampling being performed. ▲

Chapter 5
Operational Modes

This chapter describes the different operational modes and operation after a power failure. For details, see the following topics:

- "Partisol Operational Modes" on page 5-1
- "Operation after a Power Failure" on page 5-4

Partisol Operational Modes

The Partisol Sampler operates using a number of different operating modes and includes: Stop, Wait, Sampling, Done, and Audit. The Sampler displays its current operating mode in the Status Bar on the Main screen. For details, see the following topics:

Note In the original Partisol Samplers, the Sampler mode was changed from Stop mode to Run or Wait modes by pressing the Run/Stop button on the key pad. In the new iSeries based Partisol Samplers, there is no explicit Run/Stop button. Instead, the same action is accomplished by pressing the ▶ (Run) key when the full run screen is displayed. ▲

Stop Mode

In the Stop Operating Mode (STOP), the user exchanges filter cassettes and defines the sampling program using the Filter Setup screen. As this is the only non-operational mode, all user-definable system parameters may be edited with the Sampler in this state. Pressing ▶ in the run screen with the hardware in this mode causes the Sampler to advance to the Wait or Sampling Operating Modes.

Wait Mode

The Partisol system resides in this operating mode (WAIT) until the user-defined starting time/date is achieved. At that point, the device automatically enters the Sampling Operating Mode and begins sample collection. Pressing ▶ with the main run screen displayed and the hardware in the Wait mode offers the user the choice of entering the Audit or Stop operating modes. Editing of sample information is not allowed in this mode.

Sampling Mode

While in the Sampling mode, the Sampler is currently in a user-defined sampling interval. Except in the case of Advanced sampling with conditions, the unit will draws ambient air in through its sampling system at the volumetric flow rates specified by the user. For the Partisol 2000*i* the default flow rate is 16.67 L/min and for the Partisol 2000*i*-D the default flow is 1.67 L/min for the coarse flow channel and 15 L/min for the fine flow channel. The sample will continue unless the sample flow rates deviate from their set points by 10% or more for more than 60 seconds or until the ending time/date is reached.

If the sample flow rate deviates from the defined setpoints, the unit will enter the Error mode and it will stop sampling. The software will register an "S1" Status Code and remain until the user resets the unit.

Pressing ▶, when in the Sampling mode, offers the user the choice of entering the Audit mode (for exchanging or cleaning the inlets or performing a Sampler audit) or the Stop mode.

Once the ending time/date is reached, the unit automatically enters the Done Operating Mode if the current status code is "Ok," or enters the Error Operating Mode if the Sampler has encountered a status condition (See Status Codes on page 9-62). Editing of sample information is not allowed in this mode.

Done Mode

The Sampler enters Done at the completion of its sampling program if it encountered no status conditions during sample collection (that force the end of sampling). Pressing ▶ with the run screen displayed with the hardware in this mode causes the Sampler to return to the Stop Operating Mode.

Note Do not exchange filter cassettes with the Sampler in Done mode. Return to the Stop Operating Mode before exchanging the collection media. ▲

Error Mode

The Sampler proceeds to Err mode at the completion of its sampling program if it encountered a status condition during sample collection (status code is not "Ok"), or if it encounters the flow rate deviation condition, "S1" (See Status Codes on page 9-62). Pressing ▶ in the Main screen with the hardware in this mode causes the Sampler to return to the Stop Operating Mode.

Note Do not exchange filter cassettes with the Sampler in Err mode. Return to the Stop Operating Mode before exchanging the collection media. ▲

The sequence of steps required to operate the Sampler are as follows:

- *Exchange the Filter and Define the Sampling Program*. With the hardware in the Stop Operating Mode, define the sampling program in the Sample Setup screen (refer to Chapter 7 "Sampler Operation" and Chapter 9 "Firmware Screen Descriptions") and install a new filter cassette (refer to Chapter 3 "Filter Handling and Exchange").
- *Press to Execute the Sampling Program*. Press while in run screen to enter the Wait Operating Mode. The Sampler automatically advances from this mode to the Sampling Operating Mode when it arrives at the starting time/date. Once sampling is complete, the hardware proceeds to the Done or Error Operating Mode, depending upon the existence of any status codes.
- *Press to Return to the Stop Operating Mode*. With the Sampler in either the Done or Error Operating Mode, press in the run screen to return to the Stop Operating Mode. After returning to this state, exchange the sample filter and define the sampling program for the next filter to be exposed.

The Sampler completes the information recorded for each exposed filter in the filter data record when the user returns the Sampler to the Stop Operating Mode from one of its operational modes (Wait, Sampling, Done, and Error).

Audit Mode

The Audit mode takes the unit off line and allows the user to exchange or clean components in the sampling train. Leak checks and flow verifications can also be done with the Sampler in the Audit mode. Audit and verification details are provided in this chapter.

Accessing the Audit Mode

Press to display the Main Menu. In the Main Menu, scroll to Audit and Calibration, and press . In the Audit and Calibration menu, scroll to Audit mode and press . At the Audit mode screen, press to enter the Audit mode, and press to confirm the change.

At this point, the Sampler will suspend all regular operations until you complete your audit. After the audit is complete, exit the Audit mode. Press repeatedly to display the Main Menu. In the Main Menu, scroll to Audit and Calibration, and press . In the Audit and Calibration menu, scroll to Audit mode and press . At the Audit

Mode screen, press to exit the Audit mode, and press to confirm the change. Press to resume regular operations.

Operation after a Power Failure

The Partisol Sampler performs the following actions upon resumption of power if a power failure occurs while the Sampler is in its Sampling Operating mode:

- If the power outage is longer than 60 seconds, the hardware registers a "Z" status condition and stores the starting time and date of the power failure in the current record of filter data.
- If ending sampling conditions (time/date) are not yet reached for the filter that is in sampling position upon resumption of the power supply, the Sampler continues its sampling program in the Sampling Operating mode. The "Z" status condition will be retained in the filter data record. Otherwise, it enters either the Done or Error Operating Modes, depending upon the existence of any status conditions.
- If the hardware is not in the Sampling Operating Mode at the time of the power failure, the unit resumes operation in its pre-outage operating mode upon restoration of power.

Chapter 6
Sampler Settings

This section describes the different options available for programming the Partisol 2000*i* and 2000*i*-D Samplers. This section includes Instrument Setup which describes programming the default setting of the Sampler, including sample type, default sample start and stop times, and other instrument settings. See the note below that applies to the 2000*i*-D only.

For details, see the following topics:

- "Instrument Setup" on page 6-1
- "System Setup" on page 6-5

IMPORTANT The information in this section provides information specific to the Partisol 2000*i*-D version of the Sampler. ▲

The dichotomous splitter installed in the Partisol 2000*i*-D Sampler has the fine particulate matter ($PM_{2.5}$), high flow channel (15.0 L/min) located at the rear of the sampling compartment and a coarse particulate matter (PM_{coarse}), low flow (1.67 L/min) channel located in the front sampling compartment.

In the software screens on the Partisol 2000*i*-D, the high flow (15.0 L/min), $PM_{2.5}$ channel, is shown as "Flow" and the filter in the high flow sampling position is "Filter," and the low flow (1.67 L/min), PMc channel, is "Flow 2" and the filter in the low flow sampling position is "Filter 2." This same terminology also applies to the Filter ID and Cassette ID items in the software. Where the information provided refers to either Flow, or Filter, the same information and steps are required for Flow 2 and Filter 2.

Instrument Setup

The Instrument Setup screens set the global default sampling parameters for the numerous programming options available. The default sample setup and fefault sample times screens allow the user to set default sampling parameters. The System Setup screen defines whether the Sampler uses the default Ambient Temperature and Pressure settings, or Standard Temperature and Pressure settings for maintaining and reporting flow rates in volumetric or standard terms. The current local time and date are also set in the Instrument Setup screens.

Default Sample Setup

The Default Sample Setup screen allows the user to define global settings such as the sample definition method (default programming method), the default sample start time and duration, filter type and the default sample flow rate.

To access the Default Sample Setup menu, press repeatedly to display the Main Menu, select Instrument Setup > Default Sample Setup. Refer to the "Firmware Screen Descriptions" chapter for complete details on the Instrument Setup menu items.

Setup the instrument default sampling parameters by entering the Default Sample Parameters screen. The following fields make up the Sample Setup screen.

Sample Method Definition

This parameter allows the user to select the type of sampling program: Basic, Time2, or Advanced. Basic 24-hour continuous sampling is the unit's default setting. Sampling programs are described in the sections below and in Chapter 9 "Firmware Screen Descriptions".

Basic Sampling Method

The Basic Filter program is the most commonly used sampling program. In this program, the Sampler changes filter cassettes and samples continuously for the same duration with each filter installed in the Sampler.

Start Time - The Start Time parameter defines the time of day (hh.mm) at which sampling is to begin.

Stop Time - The End Time parameter defines the time of day (hh.mm) at which sampling is to end.

ID1, ID2 - The Sample Setup screen contains two user-definable identification fields that are each 32 characters long. Refer to Chapter 9 "Firmware Screen Descriptions" for instructions on how to edit the Filter ID fields.

Time 2 Sampling Method

The Time 2 sampling method allows the user to sample for two different scheduled intervals on the same sampling filter. This feature will turn the sampling flow on at the beginning of the sample run, stop sampling for the programmed period of time, and resume sampling on the same filter for another programmed interval.

Start Time 1 - The Start Time 1 parameter defines the time and date that the Sampler will begin sampling for the desired sample filter.

Stop Time 1 - The Stop Time 1 parameter defines the time and date that the Sampler will stop sampling for the filter. The Sampler will enter wait mode at Stop Time 1, and will stop sampling until Start Time 2.

Sampler Start Time 2 - The Start Time 2 parameter defines the time and date that the Sampler will resume sampling on the filter.

Stop Time 2 - The Stop Time 2 parameter defines the time and date that the Sampler will stop sampling for the filter number displayed in the filter field. The Stop Time 2 instructs the Sampler to end the sampling run.

In the Time 2 Sampling method, Start Time 1 and Stop Time 1 must always be less than Start Time 2 and Stop Time 2.

Advanced Filter Method

The Advanced Filter method provides access to additional sample programming parameters beyond the standard time-based sampling capabilities of the Sampler. The user can select up to three conditions that must be met for sampling to take place. The unit will flow ambient air through the filter if the conditions are met, and discontinue the flow if the conditions are not met without advancing a filter during the programmed sampling duration.

Start Sample Time - The Start Sample Time parameter defines the time and date that the Sampler will begin sampling.

Stop Sample Time - The Stop Sample parameter defines the time and date that the unit will stop sampling.

Cond, Min, Max - The Sampler allows you to use the values of up to three input variables to control conditional sampling. These three terms (Condition, Minimum and Maximum) are joined together as “and” functions to form the circumstances under which sampling takes place. A value of “------” for the Condition parameter indicates that a particular term is not used.

The permissible values of the Condition parameter are as follows:

------ Condition not used

TEMP Current ambient temperature (°C)

PRES Current ambient pressure (mmHg)

%RH Current relative humidity (%)

WNDSPD Current wind speed (km/h)

WNDDIR Current wind direction (deg)

AI1Current A/I 1 (engineering units)

AI2Current A/I 2 (engineering units)

AI3Current A/I 3 (engineering units)

AI1AVE Average A/I 1 (engineering units)

AI2AVE Average A/I 2 (engineering units)

AI3AVE Average A/I 3 (engineering units)

%FLOW Sample flow rate (L/min)

The Minimum and Maximum parameters define the range for each condition during which sampling should take place.

No conditional sampling takes place if the value of all three Condition parameters is "------."

With the values entered in the Advanced Filter Setup screen, sampling on will begin any time after midnight on July 24, 1998, when the ambient temperature is between 25 °C and 55 °C and the relative humidity is between 40% and 85%. The Sampler will continue to flow ambient air through the sampling filter as long as both conditions are met. The Sampler will stop the flow through the filter at any time that either condition is not met. The Sampler will cycle the ambient air flow through the filter On and Off for the duration of the sampling run depending upon the ambient conditions. The filter will be exchanged at the programmed Stop Sample time regardless of the sampling conditions at that moment. The filter also will be exchanged regardless of the sampling conditions that occurred during the last programmed sampling duration.

It is possible that a filter will not have ambient air flowing through it at all during its programmed sampling duration. If the sampling conditions are not met during a programmed sampling duration, and the filter does not have any ambient air flowing through it, the filter will still be exchanged at the programmed Stop Sample time.

Default Filter Type

This parameter allows the user to identify the filter type. The default for this parameter is "P" (EPA Filter). The user can select another alphabetic character to identify another filter type as the default filter.

Sample Flow Rate

The default flow rate parameter determines the sample flow rate (volumetric L/min).

For the Partisol 2000*i* Sampler, the flow rate is typically 16.7 L/min.

The Partisol 2000*i*-D Sampler uses two flow controllers to maintain the flow through the fine and coarse channels of the sampler. For the Sampler to operate properly and collect $PM_{2.5}$ and PM_{coarse}, the flows are set to 15 L/min for the fine flow (Flow) and 1.67 L/min for the coarse flow (Flow2).

Default Sample Times

The Default Sample Start time is used to set the default starting time for the selected sampling program in hh:mm. 00:00 is the system default for this parameter.

Start Time

The Start Time is used to set the default starting time for the selected sampling program in hh:mm. 00:00 is the system default for this parameter.

Default Sample Duration

This parameter allows the user to select the sampling duration for the selected sampling program in hhh:mm. The default for this parameter is 24:00.

System Setup

The System Setup screen allows the user to define global parameters for the operation of the Partisol Sampler, such as the current time and date. The following fields make up the System Setup screen.

Average Temp

The Average Temperature (°C) is used by the Sampler to maintain the proper volumetric sample flow rate. The default value of Average Temperature is 99, indicating that the Sampler should use the reading from the external temperature sensor to maintain a constant volumetric flow rate.

Standard Temp

The Standard Temperature (°C) is used by the Sampler to report flow rate results in standard terms. The default setting for Standard Temperature is 25 °C, which may need to be changed to match conventions in different parts of the world. The default setting for Standard Temperature does not have any effect on the volumetric flow rate and actual volume calculations by the unit. This value is used to calculate standard sample volumes.

Average Pressure

The Average Pressure (mmHg) is used by the Sampler to maintain the proper volumetric sample flow rate. The default value of Average Pressure is 999, indicating that the unit should use the reading from the Sampler's ambient pressure sensor to maintain a constant volumetric flow rate.

Standard Pressure

The Standard Pressure (mmHg) is used by the Sampler to report the flow rate results in standard terms. The default setting of Standard Pressure is 760. The default setting for Standard Pressure does not have any effect on the volumetric flow rate and actual volume calculations by the unit. This value is used to calculate standard sample volumes.

Filter Fan

This parameter controls the filter fan. If this field is set to On, the filter fan will run continuously. If this field is set to Auto, the filter fan will only initiate if the temperature of the filter and ambient air differs by 2 °C. If the Filter Fan field is set to Off, the filter fan will not initiate at all.

Auto Run

If no keys are pressed for 3 hours and the Auto Run feature is On, the unit will automatically enter the Wait or Sampling mode and not wait for the operator to press .

Site Identification

The Site ID information has two 32-character fields. The user can enter site identification numbers using one or both fields. If no entry is made in these fields then no site identification numbers will appear in the Sampler’s data output from this screen.

Current Date/Time

The Current date and time parameter are the current local date and time (or other standard time selected by the user) expressed by default as hh:mm and the current local date expressed by default as yyyy/mmm/dd.

Chapter 7
Sampler Operation

This section explains how to verify the Sampler's performance characteristics prior to starting a sampling run, programming a sampling run for a midnight-to-midnight, 24-hour sample, and retrieving data after a sampling run in the field.

Thermo Fisher Scientific recommends that the verification/audit tests described below be performed *after every four weeks of routine operation*. However, individual monitoring organizations may abide by different standards. Refer to the U.S. EPA 2.12 *Quality Assurance Handbook*, Section 8 for EPA verification schedule requirements.

The verification procedures are similar for the two types of Partisol Samplers, the Partisol 2000*i* and Partisol 2000*i*-D. These procedures are described so they can be used by operators of both Samplers. In specific instances where the procedures need to differentiate between the 2000*i* and the 2000*i*-D, the information will be specifically indicated. Follow these steps to verify Sampler performance characteristics prior to starting or during a sampling run.

For details, see the following topics:

- "Sampler Performance Verification" on page 7-1
- "Programming a Sample Run" on page 7-11
- "Post-Sampling Verification and Data Retrieval" on page 7-14

Sampler Performance Verification

Use the following procedure to perform the pre-sampling verification procedure:

Note Refer to Chapter 6 "Sampler Settings" for more detailed information on programming the sampler for performance verification. ▲

1. For these audit procedures, prepare a set of audit cassettes with filters and solid leak check disks for use during the audit. Two cassettes are required for a complete audit of the Partisol 2000*i* Sampler. (Two pairs of cassettes, one each open and a blocked leak check disk, are required for the Partisol 2000*i*-D.)

The audit cassettes include an open test cassette p/n 36-012077 and a blocked test filter cassette p/n 36-012078. Prior to installing the filters or solid leak check discs in the cassettes, clean the filter cassettes with a clean cloth and alcohol to remove any oil or other material. Prepare the external leak check cassettes by installing clean, unused 47 mm filters into the filter cassette. Place the filter cassettes with 47 mm filters installed into the filter cassette carrier. Prepare the internal leak check cassette by installing a solid disk (36-004768) into the clean filter cassette.

2. If the Sampler is not already on, turn on the Sampler by pressing the power switch on the main panel to its "ON" position. The Sampler may be in the Stop Mode or in audit mode to perform the verification audits. If the Sampler is in the Stop Mode proceed with the verification audit. If the Sampler is running a sample and an audit must be performed, interrupt the sample by entering the audit mode. When the audit is completed, replace the current sample filter and resume the sample.

3. Enter the Audit mode by pressing , scrolling to Audit and Calibration, and pressing to display the Audit and Calibration menu. With the cursor at Audit Mode, press to display the Audit Mode screen, press to enter the Audit mode, and press to confirm the setting. Press to return to the Audit and Calibration menu.

4. If a sample filter is installed in the Sampler, remove the currently installed sample filter, in its filter cassette carrier, from the Sampler and store in the sample carrier box until the end of the audit.

Verifying the Ambient Air Temperature

Use the following procedure to verify the ambient temperature measured by the Sampler:

1. Determine the current temperature (°C) at the ambient temperature sensor using an external thermometer [°C = 5/9 x (°F - 32)].

2. Verify that the value of Amb Temp displayed in the Audit screen is within ±2 °C of the measured temperature. If the value is not within the limits, perform a calibration when the Sampler is not in Sample mode.

Verifying the Filter Temperature

Use the following procedure to verify the filter temperature. The process is similar for both the 2000*i* and the 2000*i*-D, since both Samplers have a single filter temperature probe in the sampler. Photos are provided for both models to show the position of the filter temperature sensor.

Note Refer to Section 6 of the U.S. EPA 2.12 *Quality Assurance Handbook* for further information on the filter temperature audit. ▲

1. Verify the Sampler's filter temperature by measuring the temperature (°C) (°C = 5/9 x (°F - 32)) at the location of the filter temperature sensor in the Partisol Sampler using an external thermometer. Figure 7–1 shows the position of the filter temperature sensor in the Partisol 2000*i* and Figure 7–2 shows the Partisol 2000*i*-D.

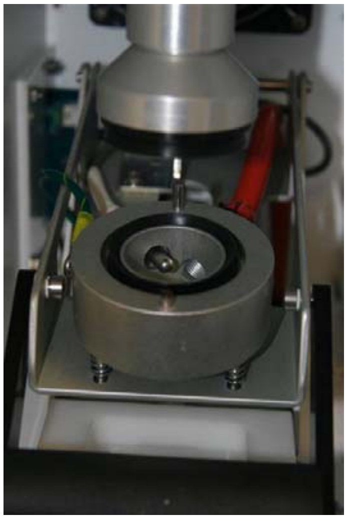


Figure 7–1. Filter Temperature Probe Location in Partisol 2000*i*

Figure 7–2. Filter Temperature Probe Location in Partisol 2000*i*-D

2. Verify that the value for the temperature displayed as "Filter Temp" in the Audit screen is within ±2 °C of the measured temperature. If this is not the case, perform the filter temperature calibration procedure on page 8-4.

Verifying the Ambient Pressure

Verify the Sampler's ambient pressure by measuring the current ambient station pressure in mmHg (i.e., absolute pressure, not corrected to sea level). Verify that the value for ambient pressure displayed in the Audit screen is within ±10 mmHg of the measured ambient pressure. If the value is not within the limits, perform a calibration when the Sampler is not in Sample mode.

- To convert from Atmospheres @ 0 °C to mmHg, multiply by 760.
- To convert from millibars to mmHg, multiply by 0.75012.
- To convert from inches Hg @ 32 °F to mmHg, multiply by 25.4.

Verifying the Ambient Relative Humidity

Use the following procedure to verify the ambient relative humidity.

1. Determine the current ambient relative humidity (%).

2. Verify that the value for Ambient RH in the Audit screen is within ±1.5 percentage points of the measured ambient relative humidity. If this is not the case, perform the ambient relative humidity calibration procedure.

External Leak Check

Note To ensure leak tightness, ensure that clean, undamaged test cassettes are used when performing the external leak check. ▲

1. Install the leak test filter cassettes. The Partisol 2000*i* requires a single filter cassette and the Partisol 2000*i*-D requires two filter cassettes. Carefully insert the filter cassette carrier into the lower part of the filter exchange mechanism. The carrier contains a slot and hole that fit into the appropriate locations of the lower part of the filter exchange mechanism. Push forward on the handle of the filter exchange mechanism to raise the filter platform and enclose the filter cassette.

Figure 7–3. Filter Cassette and Carrier Installed into Filter Exchange Mechanism in the Partisol 2000*i*

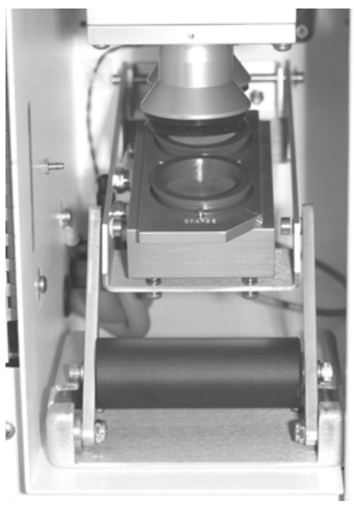


Figure 7–4. Filter Cassettes and Carrier Installed into Filter Exchange Mechanism in the Partisol 2000*i*-D

2. Press to return to the Audit and Calibration menu.

3. Carefully remove the PM_{10} inlet from the Sampler and install the supplied flow audit adapter on the end of the sample tube (Figure 7–5). Turn the valve on the flow audit adapter to its closed position.

Figure 7–5. Flow Audit Adapter Installed

4. Scroll to Leak Checks, press ↵, scroll to External, and press ↵. The following message displays:

   MAKE SURE THAT FILTER IS IN PLACE AND LEAK CHECK ADAPTER IS CLOSED!!!

   Press ➡ to begin testing.

5. A Pass or Fail message will display at the end of the leak check cycle. The leak check pass criterion is a pressure drop of 25 mmHg or less. The Sampler will display a message at the end of the cycle indicating the vacuum loss (mmHg) during the 60 second leak check, and a pass or fail message. Open the manual valve on the Sampler then release the vacuum (slowly) by opening the flow audit adapter valve. (For more information on the leak check, see "External Leak Check" on page 7-4.)

6. If a leak check fail message is displayed on the screen, check the tube connections in the Sampler (including the flow audit adapter), ensure that the filter cassette is properly installed and a proper seal is in place and repeat the leak check procedure.

7. If leak check fails a second time, the leak is external to the filter. Isolate the leak and repair.

8. After a successful leak check, slowly open the valve on the flow audit adapter.

9. If not performing a flow verification, restore the sampling hardware to its original state by removing the flow metering hardware and reinstalling the PM_{10} inlet on the sample tube. Remove the filter cassette from the Sampler and discard the installed filter.

Flow Verification

Perform the temperature verification, pressure verification, and a leak check before performing the flow verification procedure.

Note Ensure that the filter cassette carrier previously installed in the Sampler (which was used to perform the external leak check) remains in the unit for the flow verification. ▲

While the flow verification procedures are similar for the Partisol 2000*i* and Partisol 2000*i*-D, since the Partisol 2000*i*-D Sampler uses two flow sensors to control the sample flows for the $PM_{2.5}$ and PM_{coarse} flow channels, the verification procedures are presented for each Sampler.

Note If you are using a Streamline Pro MultiCal System or other direct reading flow audit device, follow these instructions. If using a Streamline FTS, follow the instructions later in the manual. The proper values for the Streamline FTS constants can be entered into the Sampler for proper calculation of the measured flow values. ▲

If you are not using the Streamline Pro or FTS systems to audit the flow of the Samper, you may need to install the flow audit adapter (57-000618) onto the end of the sample tube (Figure 7–5). If you will be using the flow audit adapter, ensure that you install it onto the end of the sample tube with its valve in the open position.

Flow controllers require a 15 minute warm-up prior to first reading. All subsequent readings should be taken 2-3 minutes (minimum) thereafter.

Flow Audit/Verification – Partisol 2000*i*

Use the following procedure to perform a flow audit on the Partisol 2000*i*:

1. Remove the flow audit adapter used during the leak check and install the Streamline Pro on the sample tube (Figure 7–6). Other flow meters may require the use of the flow audit adapter (valve open) to measure flow.

Figure 7–6. Streamline Pro Installed on External Sample Tube

2. Press repeatedly to display the Main Menu. Scroll to Audit and Calibration, press , scroll to Audit, press , scroll to Flow, press to turn on the flow, and wait for the flow to stabilize. The default sample flow should be 16.7 L/min, unless it was changed in the default settings of the Sampler. Record the flow rate from the Streamline Pro and the Sampler.

3. Press to turn Off the flow. The measured flow should be within ±5% of the displayed Cur Flow. If this is not the case, perform the flow calibration procedure.

4. Remove the audit cassettes with the filters installed.

5. To resume sampling, install or replace the sampling cassette with sampling filter installed. Reinstall the PM_{10} inlet on the sample tube.

6. Press to restart the Sampler and continue the current sampling program.

Flow Audit/Verification – Partisol 2000*i*-D

Use the following procedure to perform a flow audit on the 2000*i*-D:

The audit procedure is similar to that of the Partisol 2000*i* single sample version of the Sampler. The main steps of the audit are the same, but must be performed twice, once for the $PM_{2.5}$ flow channel and once for the PM_{coarse} flow channel.

1. Remove the flow audit adapter and install the Streamline Pro on the sample tube (Figure 7–7). Other flow meters may require the use of the flow audit adapter (valve open) to measure flow.

Figure 7–7. Streamline Pro Installed on External Sample Tube

2. Check the Fine, or high flow channel first. This is designated Flow on the Sampler screen.

3. Press ■ repeatedly to display the Main Menu. Scroll to Audit and Calibration, press ↵, scroll to Audit, press ↵, scroll to Flow, press → to turn on the flow and wait for the flow to stabilize. The default sample flow should be 15 L/min, unless it was changed in the default settings of the Sampler. Record the flow rate from the Streamline Pro and the Sampler.

4. Press ← to turn Off the flow. The measured flow should be within ±5% of the displayed Current Flow. If this is not the case, perform the flow rate calibration procedure.

5. Check the Coarse, or low flow channel second. This is designated Flow 2 in the Sampler.

6. Press ■ repeatedly to display the Main Menu. Scroll to Audit and Calibration, press ↵, scroll to Audit, press ↵, scroll to Flow2, press → to turn on the flow, and wait for the flow to stabilize. The default sample flow should be 1.67 L/min, unless it was changed in the default settings of the Sampler. Record the flow rate from the Streamline Pro and the Sampler.

7. Press ⬅ to turn Off the flow. The measured flow should be within ±5% of the displayed Current Flow. If this is not the case, perform the Flow Rate Calibration procedure.

8. To resume sampling, install or replace the sampling cassette with sampling filter installed. Reinstall the PM_{10} inlet on the sample tube.

9. Press ▶ to restart the Sampler and continue the current sampling program.

Internal Leak Check

Use the following procedure to perform an internal leak check. This test will require a blocked test cassette p/n 36-012078.

1. Install the filter cassette carrier containing the filter cassette with blocked test cassette installed into the Sampler and push on the handle to move the filter cassette carrier into the sampling position.

2. Press ■ to return to the Audit and Calibration menu.

3. Scroll to Leak Checks, press ↵, with the cursor at Internal, press ↵.

   The following message displays:

   MAKE SURE THAT A LEAK CHECK DISK IS IN THE SAMPLE FILTER LOCATION!!

   Press ➡ to begin testing.

4. A Pass or Fail message will display at the end of the leak check cycle. A pressure drop of 140 mmHg or less is the Sampler's leak check pass criteria. Record the reading on the vacuum gauge. This reading should not drop by more than 140 mmHg during this 60 second period. This corresponds to a leak of 80 mL/min. If this reading does drop by more than 140 mmHg during this 60 second period, trace the internal flow paths to identify problems in tubing or connections.

5. If a Fail message is displayed, remove the filter cassette carrier and check the seals and repeat the leak check test. If the system fails the leak check a second time, the leak is before the test cassette. Isolate the the leak and repair.

6. Remove the filter cassette from the Sampler.

7. Remove the leak check disk from the filter cassette.

8. Install the PM_{10} inlet onto the end of the sample tube.

Programming a Sample Run

This section describes the procedures for programming the Sampler for a sampling run using the Basic Sampling method. This procedure describes the process for both the Partisol 2000*i* and the Partisol 2000*i*-D. Where appropriate, the differences are described in the procedure.

A filter cassette carrier with a 47 mm filter(s) must be installed in the hardware before starting the sampling run. The filter cassette carrier used with the Partisol 2000*i* holds a single filter cassette while the filter cassette carrier used in the Partisol 2000*i*-D holds two filter cassettes.

Use the following procedure to program the Sampler for a sampling run. Refer to the "Firmware Screen Descriptions" chapter that follows for detailed information about the screens in this procedure.

Note The front panel pushbuttons shown in the following procedure are used to traverse the screens and menus. Figure 9–2. Front Panel Pushbuttons on page 9-2 displays these front panel pushbuttons and Table 9–1 on page 9-3 describes their functions. ▲

If the Sampler is not in the Stop Mode, press the button when in the run screen to enter the Stop Mode.

Accessing the Main Menu – To access the Main Menu, press repeatedly until the Main Menu appears.

1. If the Sampler is in the Wait mode or Sample mode, press to enter the Stop mode.

Note The Sampler cannot be programmed for a sample while in Wait, Sample, or Done modes. If currently sampling, wait until sample is complete before proceeding. ▲

If the Sampler is in the Audit mode, press repeatedly to display the Main Menu, scroll to Audit and Calibration and press to display the Audit and Calibration menu, with the cursor at Audit mode, press to display the Audit Mode screen. In the Audit

Mode screen, press ↵ to exit Audit mode and press ➡ to confirm the change and turn off Audit mode.

2. On the Main screen, confirm that the date and time are correct.

   If the date or time is not correct, in the Main Menu, scroll to Instrument Setup and press ↵ to display Instrument Setup menu, scroll to Date/Time and press ↵ to display the Date and Time screen. In the Date and Time screen, press ↵ to access the Edit mode and follow the screen directions to edit the date and/or time. When the changes are complete, press ↵ to save the changes. Press ◼ to return to the Instrument Setup menu.

3. Confirm that the Site ID is correct. In the Main Menu, scroll to Instrument Setup and press ↵ to display the Instrument Setup menu. In the Instrument Setup menu, scroll to Site ID, press ↵, and confirm that the Site ID is correct.

   If the Site ID is not correct, scroll to the incorrect Site ID, press ↵ to display the alphanumeric entry screen, enter the correct Site ID description, and save it.

   For information on the Site ID, refer to "Site ID" on page 9-35.

   For information on how to use the alphanumeric entry screen, refer to "Alphanumeric Entry Screen" on page 9-4.

4. Press ◼ repeatedly to return to the Main Menu. In the Main Menu with the cursor at Sample Setup, press ↵ to display the Sample Setup menu. The Sample Setup menu allows you to choose modes such as:

   - Apply EPA Times which is a shortcut key for midnight-to-midnight, 24-hour sampling
   - Apply Default Times which automatically applies the default time settings that are programmed in the default Sample Setup menu located in the Instrument Setup Screen

   To apply EPA default conditions (midnight-to-midnight, 24-hour sampling) scroll to Apply EPA Times in the Sample Setup menu, press ↵ to display the Apply EPA Times screen, and press ➡ to set the EPA times.

   To Apply Default Times, scroll to Apply Default Times in the Sample Setup menu, press ↵ to display the Apply Default Times screen, and press ➡ to set the default times.

Use the following procedure to set sample parameters manually.

1. At Sample Setup, scroll to Sample, press and use the pushbuttons as indicated on the screen to set the sample start time and date. Alternately, press again and use the pushbuttons to select a field and change the value. Note that holding the pushbutton down causes the value to increment faster. When the start time setting is complete, scroll to Save and press to save the start time and date. Press repeatedly to return to the Sample 1 menu.

2. At the Sample menu, scroll to Stop, press , and use the pushbuttons as indicated on the screen to set the sample stop time and date. When the stop time setting is complete, scroll to Save and press to save the start time and date. Press to return to the Sample menu.

3. At the Sample menu, scroll to Filter ID, and press to display the Filter ID screen. Use the pushbuttons as indicated on the screen to set the Filter ID number, and press to save the setting. Press to return to the Sample menu.

   On a 2000*i*-D Sampler, scroll to Filter2 ID, and press to display the Filter2 ID screen. Use the pushbuttons as indicated on the screen to set the Filter2 ID number, and press to save the setting. Press to return to the Sample 1 menu.

4. At the Sample menu, scroll to Cassette ID, and press to display the Cassette ID screen. Use the pushbuttons as indicated on the screen to set the Cassette ID number, and press to save the setting. Press to return to the Sample menu.

   On a 2000*i*-D Sampler, scroll to Cassette2 ID, and press to display the Cassette2 ID screen. Use the pushbuttons as indicated on the screen to set the Cassette2 ID number, and press to save the setting. Press to return to the Sample 1 menu.

5. At the Sample menu, scroll to Filter Type, and press to display the Filter Type screen. Use the pushbuttons as indicated on the screen to change the Filter Type, and press to save the setting. Press to return to the Sample menu.

   On a 2000*i*-D Sampler, scroll to Filter2 Type, and press to display the Filter2 Type screen. Use the pushbuttons as indicated on the screen to change the Filter2 Type, and press to save the setting. Press to return to the Sample Setup menu.

6. After programming the Sampler, press ▶ ▶ to enter the Wait mode.

7. When the clock time equals the sample start time, the Sampler will automatically enter the Sampling Mode and begin the sampling run.

8. When the clock time equals the sample stop time, the Sampler will automatically end the sampling run, and enter the Done Mode. If a status condition occurred during the sampling run, the Error Mode will display instead of the Done Mode.

9. Press ▶ to enter the Stop Mode before exchanging filter cassettes or retrieving data on the sampling run.

Post-Sampling Verification and Data Retrieval

This section describes the procedures for verifying the sampling run status and retrieving the sampling run data.

1. After the sampling run is complete, press ▶ when in the main screen to enter the Stop Mode.

2. Remove the filter cassette carrier from the Sampler by pulling on the handle of the filter exchange mechanism. Place the entire assembly in the provided filter cassette transport container.

3. Check the sampling run status on the Main screen. Note any status code other than “OK.” If there were any status codes other than “OK,” verify the validity of the sampling run from the output of the Filter Data. The filter data can be viewed onscreen as described below or downloaded from the Sampler.

4. Prior to leaving the Sampler, either record data from the Sampler onto a sampling run log sheet, or download the data from the Sampler.

5. Perform any necessary scheduled maintenance.

6. Insert a new filter cassette assembly with a 47 mm filter into the filter exchange mechanism. Push the handle to raise the platform, and enclose the filter cassette in the sampling position and program the Sampler for the next sampling run.

Viewing and Downloading Stored Data

The Sampler stores three types of data in its internal data logger: filter data, interval data, and user data. This information is stored in separate circular buffers whose contents can be viewed on the screen of the Sampler and/or downloaded. Once these buffers are filled, the oldest data points are replaced with the most recent information ("first in, first out"). The following describes the types of data stored internally in the hardware:

- **Filter Data** - Each record in this buffer contains information for a different collection filter exposed to the sample stream. The Sampler has a capacity of 32 records of filter data.

Data for each filter used in the Sampler are stored as a separate record of filter data. The Sampler displays the following filter data fields in the Filter Data screen:

Filter_ID, Cassette_ID - The Filter ID and Cassette ID fields display the user-defined information entered prior to sampling in the Sample Setup Screen.

Start_Date, Time - These two fields display the starting time/date (hh.mm yy/mm/dd) entered by the user.

Start_Date_actual, Time - These fields show the actual starting time/date (hh.mm yy/mm/dd) at which the unit began sampling.

Stop_Date, Time - These two fields display the stop time/date (hh.mm yy/mm/dd) entered by the user.

Stop_Date_actual, Time - These fields show the actual starting time/date (hh.mm yy/mm/dd) at which the unit began sampling.

Total_Sample_time - This is the actual total elapsed sample time (hh.mm)

Flow_min, Flow_ave, Flow_max - These are the minimum, average, and maximum volumetric flow rates (L/min) during the sampling period for the flow in a Partisol 2000*i* and the main flow in a Partisol 2000*i*-D.

Flow_COV - The coefficient of variation is equal to the standard deviation of the five-minute flow rate averages divided by the average flow rate (16.7 L/min by default for a Partisol 2000*i* and 15 L/min for a Partisol 2000*i*-D). This value is then multiplied by 100 to yield the %COV value shown on the run screen and Filter Data records. If this value is greater than 4 (4%), the Sampler displays the "O1" status code.

Sampled_Volume, Sampled_Volume_std - The Total volume (in m^3) sampled through the filter is recorded in these records. Both the actual and standard volumes are recorded. In a Partisol 2000*i*-D, this value is the volume of the main or $PM_{2.5}$ sample.

Ambient_Temp_min, Ambient_Temp_avg, Ambient_Temp_max - The Sampler displays the minimum, average and maximum ambient temperatures (°C) encountered during sampling.

Filter_Temp_min, Filter_Temp_avg, Filter_Temp_max - The Sampler shows the minimum, average and maximum filter temperatures (°C) encountered during sampling.

Ambient_Press_min, Ambient_Press_avg, Ambient_Press_max - The Sampler indicates the minimum, average and maximum ambient pressures (mmHg) encountered during sampling

Delta Temp, Date_Max_Temp, Time - These fields are the maximum difference (°C) between the filter and ambient temperatures during and after sample collection, as well as time/date (hh.mm yy/mm/dd) at which the Sampler recorded the deviation.

Site_ID_1, Site_ID_2 - These are the Site ID values entered in the Instrument Setup screen.

Status_Codes - This field lists the instrument status codes recorded at the end of the sample. See Table 9–5 for the list of possible status codes.

Valid_Samp_Time - This is the valid sample time in minutes.

Wind_Speed_avg, Wind_Velocity_avg, Wind_Direction_avg - The Sampler indicates the average wind speed, velocity, and direction encountered during sampling.

Ambient_%RH_min, Ambient_%RH_avg, Ambient_%RH_max - The Sampler indicates the minimum, average and maximum ambient %RH encountered during sampling

Valid_Samp2_Time, Total_Samp2_Time - These are the valid Sample2 times recorded for the second sample period when the Sampler is operated in Time2 Sample Mode.

Filter2_ID, Cassette2_ID - The Filter ID and Cassette ID fields display the user-defined information entered prior to sampling in the Sample Setup Screen

Flow2_min, Flow2_avg, Flow2_max - These are the minimum, average, and maximum volumetric flow rates (L/min) during the sampling period for Flow2 in a Partisol 2000*i*-D.

Flow2_COV - The coefficient of variation is equal to the standard deviation of the five-minute flow rate averages divided by the average flow rate (1.67 L/min by default for Flow 2 in a Partisol 2000*i*-D). This value is then multiplied by 100 to yield the %COV value shown on the run screen and Filter Data records. If this value is greater than 4 (4%), the Sampler displays the "O2" status code.

Sampled2_Volume, Sampled2_Volume_std - For a Partisol 2000*i*-D Sampler the Total volume (in m^3) sampled through Filter2 is recorded in these records. Both the actual and standard volumes are recorded.

PM10_Sample_vol - The PM_{10} sample Volume is the cumulative sample volume for PM_{10} sample. For the Partisol 2000*i*, this will equal the Volume (std) and for a Partisol 2000*i*-D Sampler, this will equal the sum of the sample Volume std) and sample Volume2 (std).

Power_fail_time(s) - At the end of the filter data records, up to ten time fields (hh.mm) that indicate the starting time of all power outages longer than 60 sec that occur during sampling.

- **Interval Data** - The Sampler writes a new record of interval data every five minutes. Each record contains the latest five-minute average of the ambient temperature, filter temperature, and ambient pressure.

Time, Date - The ending time/date (hh.mm yy/mm/dd) of the five minuteinterval whose information is being displayed.

Flags - This field is the current instrument status flag indicator.

T-Amb - The Amb Temp field displays the five-minute average of the ambient temperature (°C).

T-Flt - The Filt Temp field displays the five-minute average of the filter temperature (°C).

P-Amb - The Amb Pres field displays the five-minute average of the ambient pressure (mmHg).

Flow - The Flow field displays the five-minute average of the sample flow rate (volumetric L/min). For the Partisol 2000*i*-D Sampler, this will be the main or $PM_{2.5}$ flow channel.

Flow2 - The Flow2 field displays the five-minute average of the sample flow rate (volumetric L/min). For the Partisol 2000*i*-D Sampler, this will be the main or $PM_{2.5}$ flow channel.

- **User Data** - The Sampler writes a record of User data at the time interval set by the operator. The Sampler is shipped with default storage variables and is set to store the values at an interval of every 30 minutes. The Sampler operator can change the storage interval and the variables stored in the user records on the Sampler. Refer to Chapter 9 "Firmware Screen Descriptions" for instructions on how to set the User data storage interval and the storage variables. The default variables stored by the Sampler are:

Time, Date - Date and time at the end of the recording period.

Flags - Status flags recorded by the instrument at the end of the recorindingperiod.

Flow - Average sample flow over the recording period. This is the sample flow in a Partisol 2000*i* and the main or $PM_{2.5}$ flow in a Partisol 2000*i*-D.

Flow2 - Average sample flow2 over the recording period. This is the coarse flow in a Partisol 2000*i*-D

p-amb - Average ambient pressure over the recording period.

p-flt - Average filter pressure over the recording period.

p-flt2 - Average Filter2 pressure over the recording period.

t-amb - Average ambient temperature over the recording period.

t-flt - Average filter temperature over the recording period.

t-fcmp - Average filter compartment temperature over the recording period.

t-delta - Average difference between the filter temperature and ambient temperatures over the recording period.

%RH - Average ambient %RH over the recording period.

w spd, wdir, w vel - Average wind speed, wind direction, and wind velocity over the recording period.

elap-tm - Current elapsed sample time at the end of the recording period.

Stat Code - Instrument status codes present at the end of the recording period.

USB Data Download

Data can be displayed on the screen or downloaded to a personal computer (PC), or a USB memory device.

1. To download the sample data from the Sampler using a USB memory device (USB stick), insert the USB stick into an available USB port on the front of the electronics enclosure of the Sampler.

2. Press and scroll down to locate the USB menu item on the Main Menu and press ↵. The available USB ports will be displayed.

3. Select the port used in Step 1 and press ↵. The list of available USB actions is shown. Scroll to instrument sample data, select Export Data logs and press ↵.

4. Select the desired data records to download and follow the instructions on the instrument display. When complete, remove the USB stick from the Sampler.

5. Press repeatedly to return to the Main Menu.

Data Download via RS-232

Use the following procedure to download data from the Sampler using the RS-232 communications port and a personal computer.

If the Sampler has not been previously set up for data transfer to a PC, check the RS-232 setup in the Serial Settings menu. Press repeatedly to return to the Main Menu. In the Main Menu, scroll to Instrument Setup and press . At the Instrument Setup menu, scroll to Communications and press . At the Commmunication Settings menu, with the cursor at Serial Settings, press to display the Serial Settings menu.

1. Connect the PC to the Sampler with the 9-to-9 pin RS-232 null modem cable. Use RPComm or any other data transfer program to transfer data from the Sampler to the PC. Refer to "Communications Using iPort or RPComm" in Appendix D for instructions on how to load the RPComm software into your PC, and how to use RPComm to transfer data from the unit to your PC.

2. Check that the communication protocol is set to AK Protocol. If the protocol is not AK, at the Commmunication Settings menu, scroll to Communication Protocol, and press to display the Communication Protocol menu. Use the pushbuttons to display AK, and press to save the setting. Press repeatedly to return to the Main Menu.

3. To display filter data, in the Main Menu, scroll to View Records, press , with the cursor at Filter, press to display the filter records. Filter Record 1 is the oldest record. Filter Record 2 is the most recent record of the 32 maximum filters.

   Press or to display the different filter types. Press or to display the individual records.

Display Sampler Data

Use the following procedure to display Sampler Data on the instrument LCD display.

1. To display filter data, in the Main Menu, scroll to View Records, press ↵, with the cursor at Filter, press ↵, to display the filter records. Filter Record 1 is the oldest record. Filter Record 2 is the most recent record of the 32 maximum filters.

2. Press ← or → to display the different filter types. Press ↑ or ↓ to display the individual records.

3. Scroll up or down through the filter record data to locate the desired filter record. Scroll right to locate the status conditions that may have been present during the sample run. The status information is also provided with the downloaded instrument data. Record data from the Filter Data screen onto a sampling run log sheet if desired. If there were any status codes other than "OK," verify the validity of the sampling run by pressing scrolling to view the specific Status Codes.

Identifying Sampler Status

Check the sampling run status on the Main screen, and note if the alarm indicator is present. If the alarm indicator is displayed, press the STATS soft key to display any status errors that are currently set. The Status screen displays current staus conditions, but does not display status conditions from previous completed samples. Refer to Chapter 9 "Firmware Screen Descriptions" for more information on the status codes.

Chapter 8
Calibration

This section contains the procedures needed to perform calibrations on the Sampler. Calibrations should be performed when the instrument is in Service mode. Thermo Fisher Scientific strongly advises that the calibrations described in this section be performed in the order presented. Refer to the "Firmware Screen Descriptions" chapter for detailed information about the screens and parameters in these calibration procedures.

For details, see the following topics:

Calibration Setup

For these calibration procedures, prepare a set of audit cassettes with filters and solid leak check disks for use during the audit. Two cassettes are required for a complete audit of the Partisol 2000*i* Sampler. (Two pairs of cassettes, one each open and a blocked leak test cassette, are required for the Partisol 2000*i*-D.)

The audit cassettes include an open leak check cassette and a blocked leak check cassette. Prior to installing the filters or solid leak check discs in the cassettes, clean the filter cassettes with a clean cloth and alcohol to remove any oil or other material. Prepare the external leak check cassettes by installing clean, unused 47 mm filters into the filter cassette. Place the open filter test casssettes into the filter cassette carrier.

Remove any completed filter samples from the Partisol Sampler and place them in the Sampler carrier box.

1. Press repeatedly to display the Main Menu, scroll to Service mode and press . In the Service Mode screen, press to toggle the Service mode to On. Press to return to the Main Menu.

2. Display the Audit and Calibration Menu by pressing , scrolling to Audit and Calibration, and pressing to display the Audit and Calibration menu.

3. Enter the Calibration menu by pressing , scrolling to Audit and Calibration, and pressing to display the Audit and Calibration menu. With the cursor at Calibration, press to display the Calibration menu.

Ambient Air Temperature Calibration

Use the following procedure to calibrate the ambient air temperature.

Note The Service mode must be set to ON to perform the following procedure. To turn the Service mode ON, refer to Step 1 in "Calibration Setup" in this section. ▲

1. If the calibration will be done at ambient conditions, the reference temperature measurement can be taken with the probe installed in the radiation sensor.

   If the calibration is done at a temperature lower and/or higher than ambient temperature, loosen the two screws on either side of the temperature probe on the ambient temperature assembly and remove the probe from the radiation shield. The reference and Sampler probe should be banded together and immersed to the same depth in an insulated constant temperature bath or block. Reference and Sampler probes should be equilibrated at temperature for at least 5 minutes before the temperature is measured.

   In the Calibration menu, Scroll to Ambient Temp and press .

2. At the Ambient Temperature Calibration screen, use the pushbuttons to enter the reference value in °C [°C = 5/9 x (°F - 32)], and press to save the value. The Sampler automatically adjusts the corresponding offset based on this input.

3. If removed, reinstall the ambient temperature probe in the radiation shield, and tighten the two screws on either side of the probe.

Ambient Pressure Calibration

Use the following procedure to perform an ambient pressure calibration.

1. Press [■] to return to the Calibration menu, scroll to Ambient Pres and press [↵].

2. Determine the current ambient station pressure in mmHg (absolute pressure, not corrected to sea level).

   To convert from Atmospheres @ 0 °C to mmHg, multiply by 760.

   To convert from millibars to mmHg, multiply by 0.75012.

   To convert from inches Hg @ 32 °F to mmHg, multiply by 25.4.

3. Enter the measured ambient pressure and press [↵]. The Sampler automatically adjusts the corresponding offset based on this input.

Filter Pressure Calibration

Use the following procedure to perform a Filter Pressure calibration and a Filter2 Pressure calibration.

1. Press [■] to return to the Calibration menu, scroll to Filter Pres and press [↵].

2. Determine the current ambient station pressure in mmHg (absolute pressure, not corrected to sea level).

   To convert from Atmospheres @ 0 °C to mmHg, multiply by 760.

   To convert from millibars to mmHg, multiply by 0.75012.

   To convert from inches Hg @ 32 °F to mmHg, multiply by 25.4.

3. Enter the measured ambient pressure and press [↵]. The Sampler automatically adjusts the corresponding offset based upon this input.

4. If the Sampler is a Partisol 2000*i*-D, repeat these steps to calibrate the filter2 pressure sensor.

Filter Compartment Temperature Calibration

Use the following procedure to calibrate the filter compartment temperature.

1. Press to return to the Calibration menu, scroll to F Comp Temp and press .

2. Determine the current temperature (°C) at the location of the filter compartment probe in the ventilated filter compartment of the Partisol Sampler using an external thermometer, [°C = 5/9 x (°F - 32)].

3. At the F Comp Temp screen, use the pushbuttons to enter the reference value in °C [°C = 5/9 x (°F - 32)] and press to save the value. The Sampler automatically adjusts the corresponding offset based on this input.

Filter Temperature Calibration

Use the following procedure to perform a filter temperature calibration.

1. Press to return to the Calibration menu, scroll to Filter Temp and press .

   If the calibration is done at a temperature lower or higher than ambient temperature, the reference thermometer and Sampler probe should be banded together and immersed to the same depth in an insulated constant temperature bath or block. Reference and Sampler probes should be equilibrated at temperature for at least 5 minutes before the temperature is measured.

2. Determine the current temperature (°C) at the location of the sample filter in the Sampler using an external thermometer, [°C = 5/9 x (F – 32)].

3. At the Calibrate Filter Temperature screen, enter the reference temperature reading in °C [°C = 5/9 x (°F - 32)] and press to save the value. The Sampler automatically adjusts the corresponding offset based upon this input.

Flow Calibration

In order to ensure proper operation of the Sampler, periodic flow calibrations may be required. Before performing flow calibrations, refer to local agency requirements and the U.S. EPA 2.12 *Quality Assurance Handbook,* Volume II for guidance.

The flow calibration procedures for the Partisol 2000*i* and the Partisol 2000*i*-D are similar. The Partisol 2000*i* contains a single flow sensor, operating at a default flow rate of 16.7 L/min. The Partisol 2000*i*-D contains two flow sensors, with the high flow sensor operating at a flow rate of 15 L/min and the low flow sensor operating at a flow rate of 1.67 L/min. The calibration procedures that follow can be used for both Partisol Sampler models.

The calibration of the flow controllers in the Partisol Samplers can be performed using either a three point calibration or a five point calibration for each flow sensor. The procedure for a three point calibration is described in this manual. To perform a five point calibration, the same basic procedure is followed, with the difference being the use of two additional calibration setpoints. Refer to “Flow Calibration Setup” on page 9-26 to convert the Sampler from a three point calibration to a five point calibration.

Flow Calibration Setup

If you are using the Streamline FTS Flow Transfer Standard to calibrate the flow of the Partisol Sampler, perform the following steps to enter the m and b constants from the FTS sensors into the Sampler. This will allow the operator to enter the sensor pressure drop (in inches of H_2O) and the Sampler will then calculate the actual flow automatically.

Enter the m and b constants for the FTS sensor(s) into the Sampler. If the Sampler is a Partisol 2000*i*, enter a single set of constants. If the Sampler is a 2000*i*-D, enter constants for two flow sensors. To use the FTS as the calibration device, use the following procedure.

1. Press repeatedly to display the Main Menu, scroll to Instrument Setup and press to display the Instrument Setup menu. Scroll to Flow Calibration Setup and press to display the Flow Calibration Setup menu.

2. Scroll to Use FTS Constants and press to toggle the value from No to Yes. To turn Off the use of the FTS constants, toggle the value to No.

3. Scroll to Flow and press to display the Cal Setup Flow menu.

4. Scroll to FTS Constant M and press to display the FTS Constant M screen. Enter the proper value for the constant and press.

5. Press to display the Cal Setup Flow menu.

6. Repeat Step 4 for Constant B.

7. Press repeatedly to return to the Main Menu.

   If the FTS was previously used to calibrate the Sampler and a direct read device, such as the Streamline Pro, is to be used for calibration, FTS Constants must be turned Off.

   To turn FTS Constants Off, perform Steps 1 and 2 above. Press repeatedly to return to the Main Menu.

Flow Calibration – Partisol 2000*i*

Use the following procedure to perform a flow calibration.

1. Prior to performing a Flow Calibration, perform the temperature and pressure calibrations, and external leak test procedures described in this chapter. The filter cassette used to perform the external leak test should remain in the sample position for the flow calibration.

2. Carefully remove the PM_{10} inlet from the Sampler.

3. Install the audit filter cassettes prepared as described earlier in this section. The Partisol 2000*i* requires a single filter cassette. Carefully insert the filter cassette carrier into the lower part of the filter exchange mechanism. The carrier contains a slot and hole that fit into the appropriate locations of the lower part of the filter exchange mechanism. Push forward on the handle of the filter exchange mechanism to raise the filter platform and enclose the filter cassette.

4. Attach the Flow Calibration device to the sample tube. Other flow meters may require the use of the flow audit adapter (54-004811), which should be installed with its valve open. If using Streamline FTS Flow Transfer Standard (57-04506- 0001), ensure that the m and b constants are entered into the instrument and the Use FTS Constants is set to Yes as described in the section on Flow Calibration Setup above.

5. Press [■] repeatedly to return to the Main Menu. Scroll to Audit and Calibration and press [↵] to display the Audit and Calibration menu. Scroll to Calibration and press [↵] to display the Calibration menu. Scroll to Flow and press [↵] to display the Calibration For Flow menu.

   Flow controllers require a 15 minute warm-up prior to first reading. All subsequent readings should be taken 2-3 minutes (minimum) thereafter.

6. Default calibration setpoints are already entered into the Sampler. Thermo recommends that these setpoints be used as they are configured for 10% above and below the usual setpoint.

   For the Partisol 2000*i* Sampler, the following values are recommended for a three-point calibration of the 16.7 L/min flow rate setpoint:

   Setpoint 1 (Min Flow): 15.0 L/min (10% below the usual 16.7 L/min set point)

   Setpoint 2: The usual 16.7 L/min setpoint

   Setpoint 3 (Max Flow): 18.4 L/min (10% above the usual 16.7 L/min set point)

   For all desired operating setpoints, Thermo Fisher Scientific recommends the minimum and maximum setpoints be 10% above and 10% below the normal operating flow setpoint.

7. Scroll to Setpoint 1 and press [↵] to display the Setpoint 1 screen. The Sampler will automatically open the proper valves and start the pump. After a few seconds the flow will stabilize to the desired setpoint.

8. After the flow stabilizes, enter the actual flow rate measured by the Flow Calibration Device installed in Step 4 above.

   If using the Streamline FTS, instead of entering the flow value measured by the Flow Calibration Device, enter the pressure drop (in inches of H_2O) in the Actual Flow field. The system will automatically calculate the proper actual flow using the pressure drop and the measured values of ambient pressure and temperature.

9. Press [■] to return to the Calibration for Flow Menu.

10. Repeat Steps 6-8 for the remaining flow setpoints. The Sampler will automatically calculate the Slope and Intercept when the calibration is complete.

11. Restore the sampling hardware to its original state by removing the Flow Calibration Device from the sample tube and reinstalling the inlet.

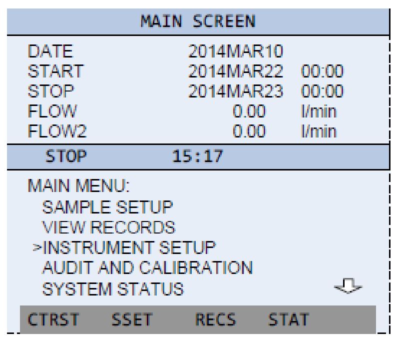
Note It is not necessary to remove the filter cassette used for the leak check and flow calibration from the sampling position, since the Sampler automatically replaces this cassette with a new one upon entering the Sample Operating mode. ▲

Flow Calibration – Partisol 2000*i*-D

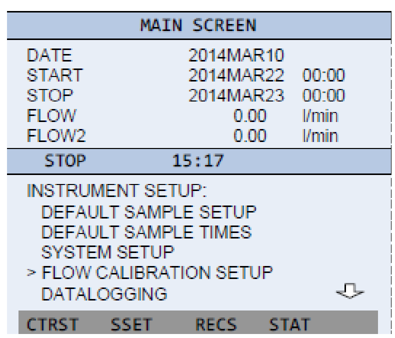
Use the following procedure to perform a flow calibration.

1. Make sure the Dual Flow is enabled from the calibration setup flow 2 screen.

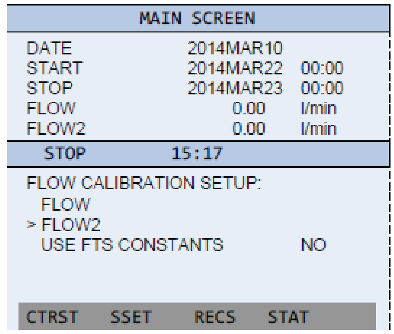
   a. Go to main menu, scroll to Instrument Setup, press enter



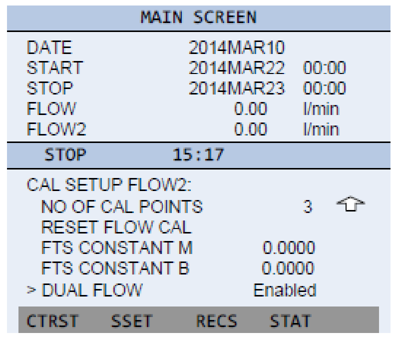
   b. Scroll to Flow Calibration Setup, press enter



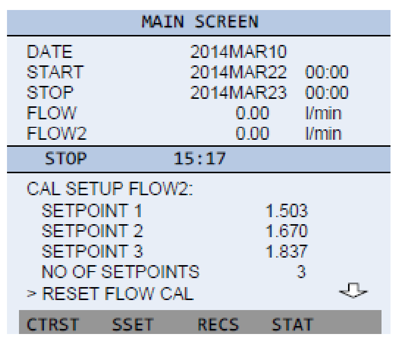
   c. Scroll to Flow 2, press enter



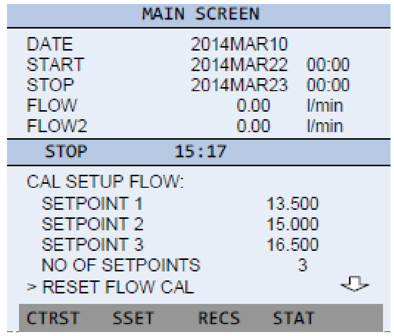
d. Scroll to bottom of screen and Enable Dual Flow



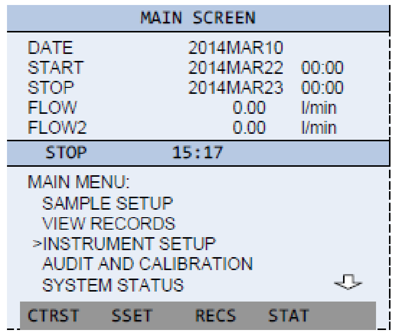
e. While in setup for Flow 2 calibration, verify calibration setup and make changes as necessary. Flow 2 is the 5 LPM flow channel; operational setpoint is 1.67 LPM



f. Use the menu key to escape back to the flow calibration menu and use the flow to verify the 20 LPM flow channel calibration settings. Operational for Flow is 15.00 LPM



g. Use the menu key to escape back to the main menu



2. Turn on the service mode from the main menu. Service mode is enabled when the wrench icon is present in the status bar to the right of the clock.

3. From the main menu, go to Audit and Calibration and scroll to the Calibration menu item.

4. Before performing the flow calibration make sure the Ambient Temperature and Pressure have been calibrated and are currently indicating valid measurements that meet the audit criterion. Unit must also be leak free, pass a leak test prior to calibration.

Using the Flow Calibration Cassette:

If you do not have the Flow Calibration Cassette, skip to "Using the Solid Leak Check Disc:".

Figure 8–1. Flow Calibrationi Cassette

5. Scroll to Flow to perform the calibration of the 20 LPM or Fine Sample channel.

6. Open the filter exchanger and place the Flow Calibration Cassette in the Coarse (Front) position of the dual holder. Place a regular cassette with filter media in the Fine (Back) position of the dual holder.

Figure 8–2. Flow Calibration Cassette in the Front Position

7. Place the dual filter holder in the filter exchange mechanism and close the filter exchange mechanism making sure the seals are not compromised.

Figure 8–3. Dual Filter Holder in the Filter Exchange

Figure 8–4. Filter Exchange Closed

8. Place the NIST Flow Meter on the inlet sample tube and properly zero the flow meter.

9. Start the calibration by pressing enter from the Flow calibration screen while the cursor is position in front of Start Calibration.

10. The unit should begin to bring the flow up to the first set point. **ALLOW THE FLOW TO STABILIZE FOR AT LEAST 15 MINUTES. THIS WILL ACT AS THE FLOW CONTROLLER WARM-UP PERIOD.**

11. Perform the flow calibration as the operating manual describes, when the measured flow is stable for each point aproximately 2-3 minutes for each point enter the actual value as measured by your flow meter.

12. At the end of the calibration the unit will display the calculated intercept or offset and span values necessary to linearize the flow sensor to the operational range.

13. Open the filter exchange mechanism and place the flow calibration cassette in the Fine (Back) position of the holder. Move the regular cassette with filter media to the Coarse (Front) position of the holder.

Figure 8–5. Flow Calibration Cassette in the Back Position

14. Place the dual filter holder in the filter exchange mechanism and close the filter exchange mechanism making sure the seals are not compromised.

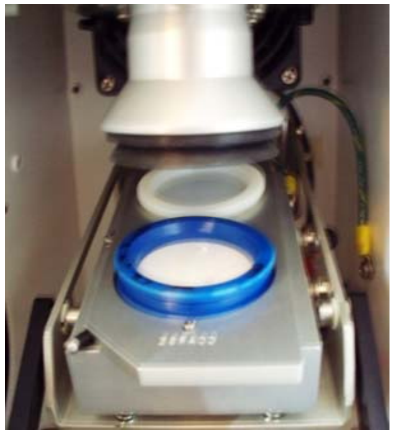


Figure 8–6. Dual Filter Holder in the Filter Exchange

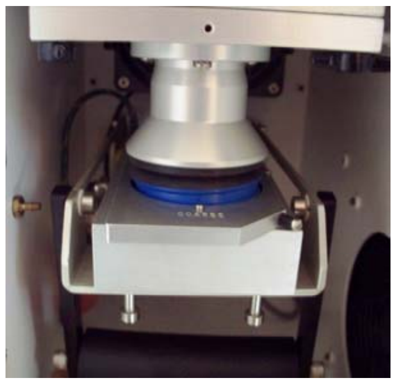


Figure 8–7. Filter Exchange Closed

15. From the calibration screen scroll to Flow2 AND PRESS ENTER. Begin the calibration the unit should begin to bring the flow up to the first set point. **ALLOW THE FLOW TO STABILIZE FOR AT LEAST 15 MINUTES. THIS WILL ACT AS THE FLOW CONTROLLER WARM-UP PERIOD.**

16. Following the 15 minute warm-up take a stabilized flow reading and enter the measured value for each point. Wait 2-3 minutes for each point after the first for stabilized reading and measurement.

17. At the end of the calibration the unit will display the calculated intercept or offset and span values necessary to linearize the flow sensor to the operational range.

18. Calibration procedure complete perform the audit per the operating manual procedure.

Using the Solid Leak Check Disc:

Continue with the following.

Figure 8–8. Solid Leak Check Disk

19. Scroll to Flow to perform the calibration of the 20 LPM or Fine Sample channel.

20. Open the filter exchanger and remove the dual transport holder. Place the Solid Leak Check Cassette in the Coarse (Front) position of the dual holder. Place a regular cassette with filter media in the Fine (Back) position of the dual holder.

Figure 8–9. Solid Leak Check Cassette in the Front Position

21. Pull the filter exchanger assembly forward aligning the rollers with the opening in the track. Pull the bottom part of the holder out of the track allowing you room to access the flow connections on the left side of the filter holder bottom plate.

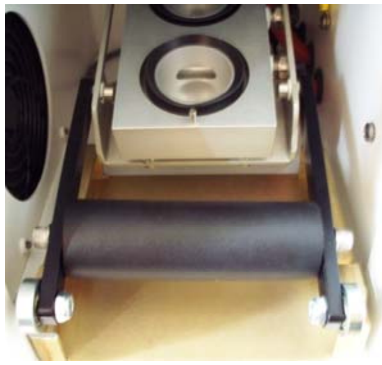


Figure 8–10. Pull Forward on Handle of Filter Exchange

22. Disconnect the Coarse flow tube from the front elbow fitting. These are push connect fittings; you must pull back on the collet of the elbow and then pull the hose with the barb to stem fitting out of the elbow.

23. Leave the end of the hose open to the compartment air.

Figure 8–11. End of Hose Open to the Compartment Air

24. Align the roller assembly to the openings in the track and return the holder into the track.

25. Place the dual filter holder in the filter exchange mechanism and close the filter exchange mechanism making sure the seals are not compromised. Make sure you do not pinch the coarse flow tubing and that it is still open to the compartment air.

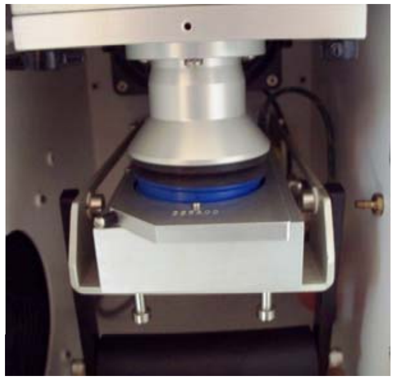


Figure 8–12. Filter Exchange Closed

26. Place the NIST Flow Meter on the inlet sample tube and properly zero the flow meter.

27. Start the calibration by pressing enter from the Flow calibration screen while the cursor is position in front of Start Calibration.

28. The unit should begin to bring the flow up to the first set point. **ALLOW THE FLOW TO STABILIZE FOR AT LEAST 15 MINUTES. THIS WILL ACT AS THE FLOW CONTROLLER WARM-UP PERIOD.**

29. Perform the flow calibration as the operating manual describes. When the measured flow is stable for each point approximately 2-3 minutes, enter the actual value as measured by your flow meter.

30. At the end of the calibration the unit will display the calculated intercept or offset and span values necessary to linearize the flow sensor to the operational range.

31. Open the filter exchange mechanism and remove the dual filter holder place the solid leak check cassette in the Fine (Back) position of the holder. Move the regular cassette with filter media to the Coarse (Front) position of the holder.

Figure 8–13. Solid Leak Check Cassette in the Back Position

32. Pull the filter exchanger assembly forward aligning the rollers with the opening in the track. Pull the bottom part of the holder out of the track allowing you room to access the flow connections on the left side of the filter holder bottom plate.

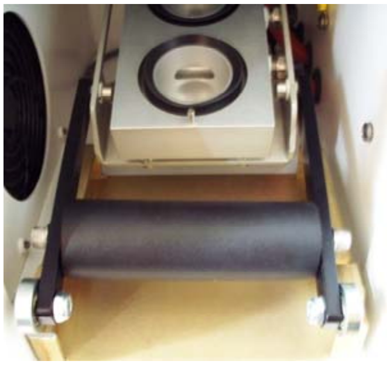


Figure 8–14. Pull Forward on Handle of Filter Exchange

33. Reconnect the Coarse flow tube to the front elbow fitting. Make sure the fitting is fully inerted into the elbow, you can feel it hit the stop. Disconnect the Fine flow hose from the back elbow fitting.These are push connect fittings; you must pull back on the collet of the elbow and then pull the hose with the barb to stem fitting out of the elbow.

34. Leave the end of the hose open to the compartment air.

Figure 8–15. End of Hose Open to the Compartment Air

35. Align the roller assembly to the openings in the track and return the holder into the track.

36. Place the dual filter holder in the filter exchange mechanism and close the filter exchange mechanism making sure the seals are not compromised. Make sure you do not pinch the coarse flow tubing and that it is still open to the compartment air.

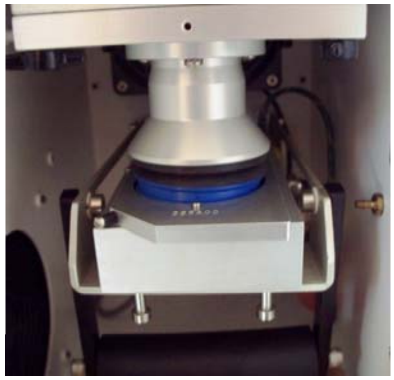


Figure 8–16. Filter Exchange Closed

37. From the calibration screen scroll to Flow2 AND PRESS ENTER. Begin the calibration. The unit should begin to bring the flow up to the first set point. **ALLOW THE FLOW TO STABILIZE FOR AT LEAST 15 MINUTES. THIS WILL ACT AS THE FLOW CONTROLLER WARM-UP PERIOD.** After the first point please wait 2-3 minutes for the flow to stabilize at the setpoint before entering the measured flow.

38. At the end of the calibration the unit will display the calculated intercept or offset and span values necessary to linearize the flow sensor to the operational range.

39. Open the filter exchange mechanism and remove the dual filter holder.

40. Pull the filter exchanger assembly forward aligning the rollers with the opening in the track. Pull the bottom part of the holder out of the track allowing you room to access the flow connections on the left side of the filter holder bottom plate.

41. Reconnect the Fine flow tube to the front elbow fitting. Make sure the fitting is fully inerted into the elbow; you can feel it hit the stop.

42. Calibration procedure is complete. Perform flow audit per the operating manual instruction.

Chapter 9
Firmware Screen Descriptions

This chapter describes the front panel display screens, front panel pushbuttons, and menu-driven firmware. For details, see the following topics:

- "Display" on page 9-1
- "Pushbuttons" on page 9-2
- "Firmware Overview" on page 9-4
- "Sample Setup Menu" on page 9-8
- "View Records Menu" on page 9-12
- "Instrument Setup Menu" on page 9-19
- "Audit and Calibration Menu" on page 9-53
- "System Status" on page 9-62
- "Service Menu" on page 9-69
- "Service Mode" on page 9-89

Display

The 320 x 240 graphics liquid-crystal display (LCD) shows the instrument parameters, instrument controls, help, and error messages (Figure 9–1). Some menus contain more items than can be displayed at one time. For these menus, use [↑] and [↓] to move the cursor up and down to each item.

Figure 9–1. Front Panel Display

CAUTION If the LCD panel breaks, do not let the liquid crystal contact your skin or clothes. If the liquid crystal contacts your skin or clothes, wash it off immediately using soap and water. ▲

Pushbuttons

The Pushbuttons allow the user to traverse the various screens/menus (Figure 9–2).

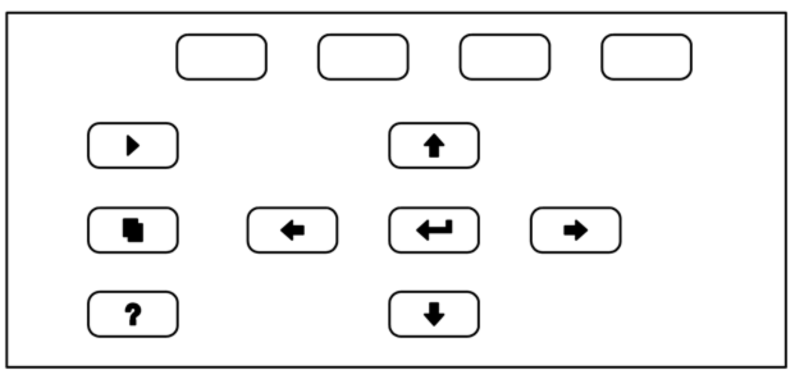


Figure 9–2. Front Panel Pushbuttons

Table 9–1 lists the front panel pushbuttons and their functions.

Table 9–1. Front Panel Pushbuttons

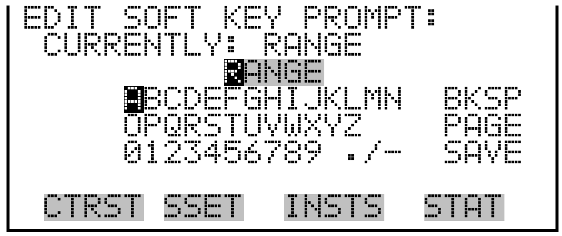
Key Name	Function
= Soft Keys	The (soft keys) are used to provide shortcuts that allow the user to jump to user selectable menu screens. For more information on processing soft keys, see "Soft Keys."
▶ = Run	The ▶ is used to display the Run screen. The Run screen normally displays the current readings.
= Menu	The is used to display the Main Menu when in the Run screen, or to back up one level in the menu system. For more information about the Main Menu, see "Main Menu" later in this chapter.
? = Help	The ? is context-sensitive, that is, it provides additional information about the screen that is being displayed. Press ? for a brief explanation about the current screen or menu. Help messages are displayed using lower case letters to easily distinguish them from the operating screens. Press ▶ to return to the Run screen, or any other key to exit a help screen.
↑ ↓ = Up, Down ← → = Left, Right	The four arrow pushbuttons (↑, ↓, ←, and →) move the cursor up, down, left, and right or change values and states in specific screens.
↵ = Enter	The ↵ is used to select a menu item, accept/set/save a change, and/or toggle On/Off functions.

Soft Keys

The soft keys are multi-functional keys that use part of the display to identify their function. The soft keys provide a shortcut to the most often used menus and screens. They are located directly underneath the display, and user-defined labels in the lower part of the display indicate the function of each key at that time.

To change a soft key, place the menu cursor ">" on the item of the selected menu or screen you wish to set. Press → followed by the selected soft key within 1 second of pressing the right-arrow key. The "edit soft key prompt" will be displayed for configuration of the new label.

Note Not all menu items may be assigned to soft keys. If a particular menu or screen item cannot be assigned, the "edit soft key prompt" screen will not come up upon entering right-arrow-soft key combinations. All items under the Service menu (including the menu itself) cannot be assigned soft keys. ▲



Alphanumeric Entry Screen

The alphanumeric entry screen is used to enter strings consisting of letters, numbers, and other characters. The cursor may be positioned within the entry line using the ← and → keys. If a character is entered over an existing character, that character will be overwritten. Use the ↑ and ↓ keys to switch between the entry line and the keyboard as well as to move within the keyboard. To select a character to add to the string, use the cursor keys to position the cursor over the desired character, and then press the ↵ key to add that character to the entry line.

On the right side of the keyboard are special functions. BKSP is used to move the cursor in the entry line one place to the left, deleting the character that was to the left of the cursor and moving any character at or to the right of the cursor one place to the left. PAGE is used to change the keyboard character page. For the English language, this switches between upper and lower-case alphabetic characters. SAVE stores the string from the entry line into the parameter. Alternately, if the active cursor is moved to the entry line, ↵ may be pressed to store the string from the entry line into the parameter.

Firmware Overview

The instrument utilizes the menu-driven firmware as illustrated by the flowchart in Figure 9–3. The Power-Up Screen (page 9-6) is displayed each time the instrument is turned on. This screen is displayed while the instrument is warming up and performing self-checks.

After the warm-up period, the Run screen is automatically displayed. The Run screen is the normal operating screen. This screen provides the current instrument readings along with some additional information concerning the instrument status. You can customize the appearance and contents of the Run screen. See "Run Screens" on page 9-71. From the Run screen, the Main Menu can be displayed by pressing .

The Main Menu contains a list of submenus. Each submenu contains related instrument settings. This chapter describes each submenu and screen in detail. Refer to the appropriate sections for more information.

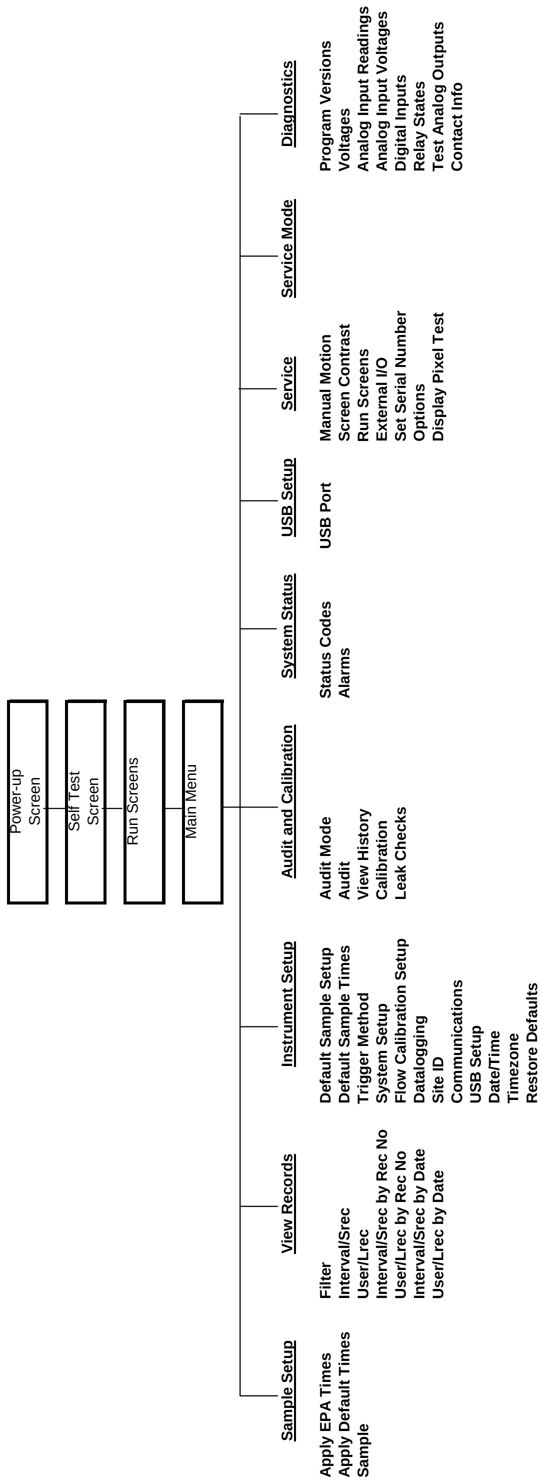
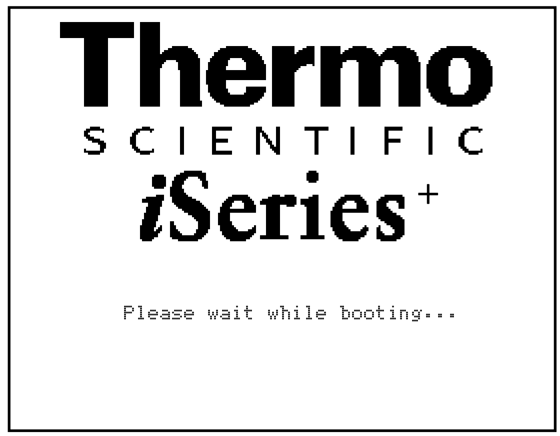


Figure 9–3. Partisol 2000*i* and 2000*i*-D Flowchart of Menu-Driven Firmware

Power-Up Screen

The Power-up screen is displayed when power is applied to the instrument. This screen is displayed while the internal components are warming up and diagnostic checks are being performed.

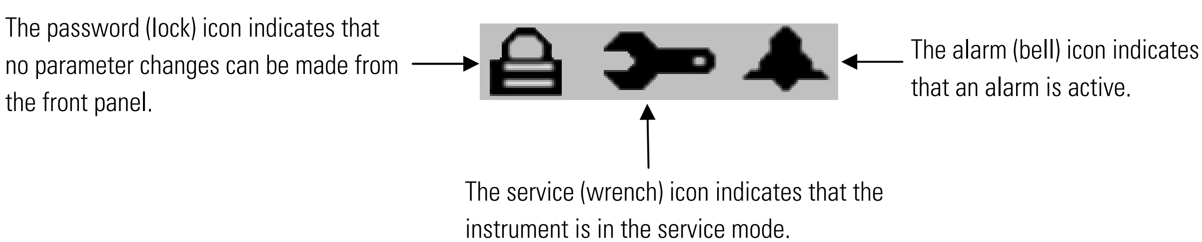


Run Screen

The Run screen (also referred to as the Main screen) displays the current readings. The status bar displays the time, the password (lock) icon, service (wrench) icon, alarm (bell) icon, and solenoid valve status, if installed.

Note Time is always displayed in 24-hour format. ▲

Status Bar Icons



The exact layout of the Run screen varies depending on the instrument configuration. A typical Run screen is shown in the following illustration.

The status bar displays the current time (24-hour format), alarm, service, and password icons.

The word “STOP” on the left of the status bar indicates the Sampler is in “STOP” mode. Other modes appear in the same area of the display.

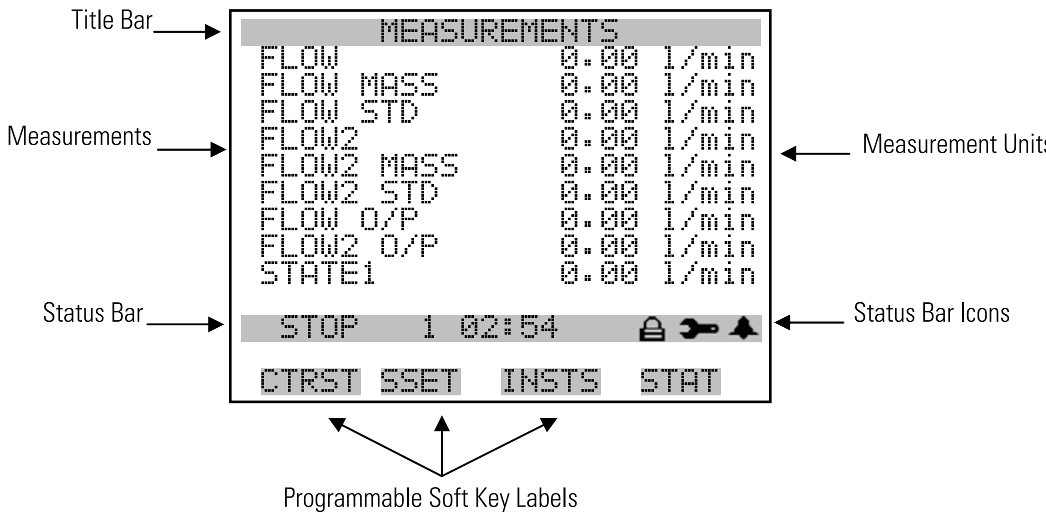
The default programmable soft key labels for this instrument are:

CTRST – Contrast

SSET – Sample setup

INSTS – Instrument setup

STAT – Status Codes screen



Custom Run Screens

A Custom Run Screens can be configured to display selected parameters. For more information on custom run screens, see "Run Screens" on page 9-71".

Main Menu

The Main Menu contains a number of submenus. Instrument parameters and settings can be read and modified within the submenus according to their function. The measurement readings appear above the Main Menu and submenus in every screen. The Service menu is visible only when the instrument is in the Service mode.

Note The Service mode should be turned Off when not in use, as it prevents remote operation. ▲

- Use ⬆ and ⬇ to move the cursor up and down.
- Press ↵ to make a selection.
- Press ■ to return to the Main Menu or ▶ to return to the Run screen.

```
      MAIN SCREEN
 DATE      2010OCT11
 START     2010OCT11 19:00
 STOP      2010OCT12 19:00
 FLOW          0.00 L/min
 FLOW2         0.00 L/min
  STOP     22:54
MAIN MENU:
>SAMPLE SETUP
 VIEW RECORDS
 INSTRUMENT SETUP
 AUDIT AND CALIBRATION
 SYSTEM STATUS

 CTRST SSET  INSTS  STAT
 USB
 SERVICE
 SERVICE MODE
 DIAGNOSTICS
```

Sample Setup Menu

The Sample Setup menu allows the user to set default sampling parameters for the operation of the Sampler, such as Apply EPA Times which is a shortcut key for midnight-to-midnight, 24-hour continuous sampling, and Apply Default Times, which automatically applies the default time settings.

The parameters in this screen can be edited while the unit is sampling. However, the changes that are input while the unit is sampling will not take effect until the user selects Save on the screen. At this point, the system saves the changes and the unit begins to sample using the changed parameters.

- In the Main Menu, choose **Sample Setup**.

```
SAMPLE SETUP:
>APPLY EPA TIMES
 APPLY DEFAULT  TIMES
 SAMPLE    2010AUG25 23:00



 CTRST SSET  INSTS  STAT
```

Apply EPA Times

The Apply EPA Times screen is used to automatically apply midnight-to-midnight, 24-hour continuous sampling EPA times.

- In the Main Menu, choose Sample Setup > **Apply EPA Times**.

```
APPLY EPA TIMES:

 ABORT - NO CHANGE
➡ SET EPA TIMES


 CTRST SSET  INSTS  STAT
```

Apply Default Times

The Apply Default Times screen is used to automatically apply the default time settings.

- In the Main Menu, choose Sample Setup > **Apply Default Times**.

```
APPLY SET DEFAULT TIMES:

 ABORT - NO CHANGE
➡ SET DEFAULT TIMES


 CTRST SSET  INSTS  STAT
```

Sample

The Sample screen provides sampling parameters and filter identification for the filter(s) in the sampler.

- In the Main Menu, choose Sample Setup > **Sample**.

```
SAMPLE:                BASIC
>START    2010JAN02 19:00
 STOP     2010JAN03 18:00
 DURATION         24h 00m
 FILTER BLANK          NO
 FILTER ID           1007 ⬇

 CTRST SSET  INSTS  STAT
 CASSETTE ID         4007
 FILTER TYPE            P
 FILTER2 ID          2007
 CASSETTE2 ID           0
 FILTER2 TYPE           P
```

Start

The Start parameter defines the time and date that the Sampler will begin sampling for the associated filter.

- In the Main Menu, choose Sample Setup > Sample **> Start**.

```
START TIME FOR SAMPLE 1:
>MON 2010 JAN 20 19:00
 PREV DAY ←    NEXT DAY →
 PREV HR  ←    NEXT HR  →
 MIDNIGHT
 SAVE

 CTRST SSET  INSTS  STAT
```

Stop The Stop parameter defines the time and date that the unit will stop sampling for the associated filter number.

- In the Main Menu, choose Sample Setup > Sample **> Stop**.

```
STOP TIME FOR SAMPLE 1:
>TUE 2010 JAN 21 18:00
 PREV DAY ←    NEXT DAY →
 PREV HR  ←    NEXT HR  →
 MIDNIGHT
 SAVE

 CTRST SSET  INSTS  STAT
```

Filter Blank **2000*i*** - This parameter is either Yes or No, and it defines whether the specified filter number is intended to be used as a sampling filter or a blank filter. If you set this parameter to Yes, the filter will be a blank filter.

2000*i*-D - This parameter is either Yes or No and it defines whether the filter numbers are intended to be used as sampling filters or blank filters. If you set this parameter to Yes, the filter will be a blank filter.

- In the Main Menu, choose Sample Setup > Sample **> Filter Blank**.

```
FILTER IS A BLANK:
  CURRENTLY:        YES
     SET TO:         NO ?

           ↵ TOGGLE VALUE

 CTRST SSET  INSTS  STAT
```

Filter ID

Filter ID is used to enter the filter's serial number. This field displays the Filter ID numbers for the filters that are in sampling position. Filter ID numbers also can be entered for each sampling and blank filter in this screen.

If the ID number is "0," the Sampler will automatically assign a filter identifier.

2000*i*-D - The Filter2 ID screen is used to enter the filter's serial number or the 2000*i*-D.

- In the Main Menu, choose Sample Setup > Sample **> Filter ID/Filter2 ID**.

```
FILTER ID:
 CURRENTLY:      2000
    SET TO:    002000

 ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Cassette ID

Cassette ID is used to enter the filter cassette screen serial number. Cassette ID numbers are entered, incremented and edited in the manner described above for Filter ID numbers.

The Cassette2 ID screen is used to enter the cassette number for the 2000*i*-D.

- In the Main Menu, choose Sample Setup > Sample **> Cassette ID/Cassette2 ID**.

```
CASSETTE ID:
 CURRENTLY:      2000
    SET TO:    002000

 ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Filter Type

Filter Type is used to change the filter type, such as "P" for an EPA supplied filter. The user can select another alphabetic character to identify different filter types.

The Filter2 Type screen is used to change the filter type for the 2000*i*-D.

- In the Main Menu, choose Sample Setup > Sample **> Filter Type/Filter2 Type**.

```
FILTER TYPE:INSERT SAMPLE
CURRENTLY:             A
   SET TO:             A

↑↓ CHANGE VALUE    ↵ SAVE
CTRST SSET  INSTS  STAT
```

View Records Menu

The View Records Menu items are used to view stored records. The Sampler stores three types of data in its internal data logger: filter data, interval data, and user data. This information can be viewed on the Sampler screen and/or downloaded through USB, RS232, or Ethernet. If the storage capacity for the particular data is reached, the oldest data points are replaced with the most recent information ("first in, first out").

Filter Data - Each record in this data contains information for a different collection filter exposed to the sample stream. The filter data screens contain information about the operation and status of the Sampler while each filter was exposed, calculated averages of filter data recorded by the Sampler, and a list of the unit's recorded power failures during sampling. The Sampler has a capacity of 32 records of filter data.

Interval Data - The Sampler writes a new record of interval data every 5 minutes. Each record contains the latest 5-minute average of the filter temperature, ambient temperature, ambient pressure and average flow rate. The Sampler has a capacity of greater than 86 days of interval data (five minute logging with six data items).

User Data - The Sampler stores calculated averages of meteorological data and other information at the rate specified by the user. The Sampler has a capacity of greater than 17 days of input data at the default settings (one minute logging with 18 data items).

- In the Main Menu, choose **View Records**.

```
VIEW RECORDS:
>FILTER              0 RECS
 INTERVAL/SREC     325 RECS
 USER/LREC        538  RECS
 INTERVAL/SREC BY REC NO
 USER/LREC BY REC NO

 CTRST SSET  INSTS  STAT
  INTERVAL/SREC BY DATE
  USER/LREC BY DATE
```

Filter

Data for each filter exposed in the Sampler are stored as a separate record of filter data. Filter record screens include:

Filter Record ID

Filter Record Time

Filter Record Filter

Filter Record Filter2*

Filter Record Ambient

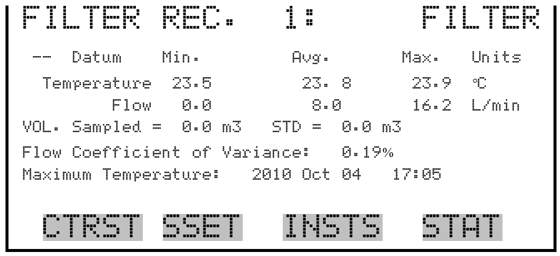
Filter Record Power Fail

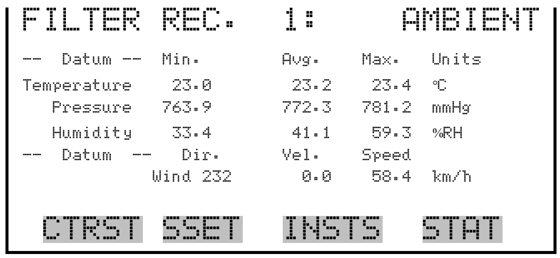
Filter Record Status

- In the Main Menu, choose View Records > **Filter**.

```
FILTER REC.  1:        ID
Site1"                      "
Site2"                      "
Filt1"                  1004"
  F2:"                  2136"
Cass:"                  3225"
  C2:"                     0"

 CTRST SSET  INSTS  STAT
```

```
FILTER REC.  1:      TIME
 -- Datum  -- --  DATE      --  TIME
    Set START     2010-Oct-04   16:00
    Set STOP      2010-Oct-05   16:00
 Actual START     2010-Oct-04   16:54
 Actual STOP      2010-Oct-04   15:05
SAMPLING: Valid = 00:05         Total =       00:05

 CTRST SSET  INSTS  STAT
```





Format of Filter Data Records

Each filter data record contains:

Filter ID (32-character string)

Cassette ID (32 character string)

Set Start Date (yyyy/mm/dd)

Set Start Time (hh:mm)

Actual Start Date (yyyy/mm/dd)

Actual Start Time (hh:mm)

Set Stop Date (yyyy/mm/dd)

Set Stop Time (hh:mm)

Actual Stop Date

Actual Stop Time
Total Sampling Time (hh:mm)
Average Flow (volumetric L/min)
Flow Coef of Variation (%)
Sampled Volume (m^3)
Sampled Volume (std) (m^3)
Minimum Ambient Temperature (°C)
Average Ambient Temperature (°C)
Maximum Ambient Temperature (°C)
Minimum Filter Temperature (°C)
Average Filter Temperature (°C)
Maximum Filter Temperature (°C)
Minimum Ambient Pressure (mmHg)
Average Ambient Pressure (mmHg)
Maximum Ambient Pressure (mmHg)
Maximum Temperature Difference (°C)
Date of Max Temp Diff ("yyyy/mm/dd")
Time of Max Temp Diff (hh:mm)
Site ID1 (32-character string)
Site ID2 (32-character string)
Status Codes (hexadecimal summation)
Valid Sampling Time (hh:mm)
Minimum Flow (volumetric L/min)
Maximum Flow (volumetric L/min)
Average Wind Speed (km/h)
Average Wind Velocity (km/h)
Average Wind Direction (degrees)
Minimum Ambient RH (%)
Average Ambient RH (%)
Maximum Ambient RH (%)
Valid Sampling Time (mmmm)
Total Sampling Time (mmmm)
Filter Identification 2*
Cassette Identification 2*
Flow Minimum 2 (L/min)*
Flow Average 2 (L/min)*
Flow Maximum 2 (L/min)*
Sampled Volume 2 (m^3)*
Filter Temperature Minimum 2 (°C)*
Filter Temperature Average 2 (°C)*
Filter Temperature Maximum 2 (°C)*
Filter Temperature Difference 2*
Date 2 of Max Temp Diff (yyyy/mm/dd)*

Time 2 of Max Temp (hh:mm)*
PM 10 Sample Volume*
Power Failure Date (yyyy/mm/dd)
Power Failure Time (hh:mm)
*2000*i*-D only

Interval/Srec

The Sampler stores the following as 5-minute interval data.

Ambient Temp
Filter Temp
Ambient Pres
Flow
Filter2 Temp*
Flow2*
*2000*i*-D only

It writes a new record of interval data every 5 minutes on a continuous basis, and has months of capacity before it overwrites the oldest records.

- In the Main Menu, choose View Records > **Interval/Srec**.

```
time    date     flags
04:40 05/04/10  20130100
04:45 05/04/10  20130100
04:50 05/04/10  20130100
04:55 05/04/10  20130100
 ↑↓ PGUP/DN   ←→ PAN L/R

CTRST SSET  INSTS  STAT
```

User/Lrec

The User/Lrec screen displays averaged meteorological and input data at the interval specified by the user. The default averaging/storage interval is one minute. The Sampler has the capacity to retain more than 17 days of input data (at one minute logging of 18 data items) before it overwrites the oldest records.

Default setup:

Flow
Flow2*
Ambient Pres
Filter Pres
Filter2 Pres*
Pump Pres
Ambient Temp
Filter Temp

Filter2 Temp*

Filter Compartment Temp

Temp Delta

Temp2 Delta*

Relative Humidity

Wind Speed

Wind Direction

Wind Velocity

Elapsed Time

Status Code Flags

*2000*i*-D only

- In the Main Menu, choose View Records > **User/Lrec**.

```
time    date     flags
04:40 05/04/10  20130100
04:45 05/04/10  20130100
04:50 05/04/10  20130100
04:55 05/04/10  20130100
 ↑↓ PGUP/DN   ←→ PAN L/R

CTRST SSET  INSTS  STAT
```

Interval/Srec by Record Number

The Interval/Srec by Record Number screen is used to select the starting point from which to display the number of previous records. The Sampler writes a new record of interval data every 5 minutes. Each record contains the latest 5-minute average of the following:

Ambient Temp

Filter Temp

Ambient Pres

Flow

Filter2 Temp*

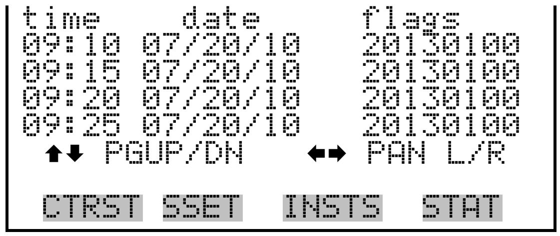
Flow2*

*2000*i*-D only

- In the Main Menu, choose View Records > **Interval/Srec by Rec No**.

```
SET # BACK FROM CURRENT:
                 0000000
 TOTAL INTERVALS:    308

          ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE   ↵ SAVE

CTRST SSET  INSTS  STAT
```

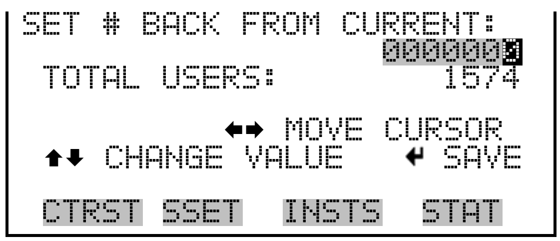
Use ↑ ↓ to input the set back number as appropriate and press ↵ to save the selected records.



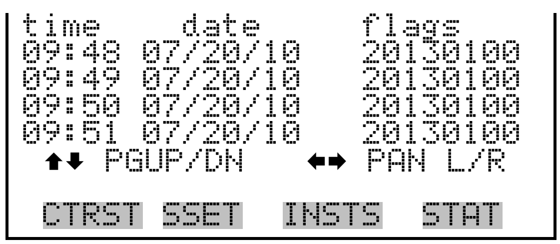
User/Lrec by Record Number

The User/Lrec by Record Number screen is used to select the starting point from which to display the number of previous records.

- In the Main Menu, choose View Records > **User/Lrec by Record Number**.



Use ↑ ↓ to input the set back number as appropriate and press ↵ to save the records.



Interval/Srec by Date

The Interval/Srec by Date screen allows the user to select a starting point from which to view logged interval/srec records. The first logged data record that is displayed is the first record after the specified time in the Date and Time screen.

- In the Main Menu, choose View Records > **Interval/Srec by Date**.

```
DATE AND TIME:
 07 JUN 2010  12:32
 ↑↓ CHG DAYS
 → SET CURSOR TO MONTHS
 ↵ ACCEPT AS SHOWN


 CTRST SSET  INSTS  STAT
```

Use → to select the date and time. Use ↑ ↓ to change the date and time, and press ↵ to display the records.

User/Lrec by Date

The User/Lrec By Date screen allows the user to select a starting point from which to view logged user/lrec records. The first logged data record that is displayed is the first record after the specified time in the Date and Time screen.

- In the Main Menu, choose View Records > **User/Lrec by Date**.

```
DATE AND TIME:
 07 JUN 2010  12:32
 ↑↓ CHG DAYS
 → SET CURSOR TO MONTHS
 ↵ ACCEPT AS SHOWN


 CTRST SSET  INSTS  STAT
```

Use → to select the date and time. Use ↑ ↓ to change the date and time, and press ↵ to display the records.

Instrument Setup Menu

The Instrument Setup menu is used to specify the system and instrument control parameters such as, default sample setup, default sample times, trigger method, system setup parameters, flow calibration setup, datalogging, site ID, communications, USB setup, date/time, timezone, and password.

- In the Main Menu, choose **Instrument Setup**.

```
INSTRUMENT SETUP:
>DEFAULT SAMPLE SETUP
 DEFAULT SAMPLE TIMES
 ADVANCED TRIGGER
 SYSTEM SETUP
 FLOW CALIBRATION          ↓

 CTRST SSET  INSTS  STAT

 DATALOGGING
 SITE ID
 COMMUNICATIONS
 USB SETUP
 DATE/TIME
 TIMEZONE
 PASSWORD
 RESTORE DEFAULTS
```

Default Sample Setup

The Default Sample Setup menu allows the user to define global sampling parameters for the operation of the Sampler, such as the sample definition method (default programming method), the default sample start time and duration, filter type, and the default sample flow rate.

Flow rates are model dependent:

2000*i*: Flow = 16.67 L/min

2000*i*-D: Flow = 15.00 L/min; Flow2 = 1.67 L/min

IMPORTANT Flow2 Rate and Filter2 Type apply only to the Partisol 2000*i*-D. ▲

- In the Main Menu, choose Instrument Setup > **Default Sample Setup**.

```
DEFAULT SAMPLE SETUP:
>METHOD            TIME 2
 FLOW RATE     15.00 l/min
 FLOW2 RATE     1.67 l/min
 FILTER TYPE           A
 FILTER2 TYPE          A ↓

 CTRST SSET  INSTS  STAT
```

Method

The Method screen allows the user to select the type of sampling program such as Basic (default), Time, Time 2, Advanced, and Episodic.

- In the Main Menu, choose Instrument Setup > Default Sample Setup > **Method**.

```
SAMPLE METHOD:
 CURRENTLY:     BASIC
    SET TO:     BASIC

 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Flow Rate/Flow2 Rate

The Flow Rate screen is used to change the sample flow rate (flow rates for the 2000*i*-D) for each sample.

2000*i* - Typically, flow rate is set to 1.67 L/min.

2000*i*-D - Typically, flow rate is set to 15.0 L/min and flow2 rate is set to 1.67 L/min.

- In the Main Menu, choose Instrument Setup > Default Sample Setup > **Flow Rate/Flow2 Rate**.

```
SET FLOW RATE:
 CURRENTLY:     15.00 L/min
    SET TO:     15.00 L/min

 ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE     ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Filter Type/Filter2 Type

The Filter Type screen allows the user to identify the filter type.

The Filter2 Type screen (2000*i*-D only) is used to identify the filter type for the 2000*i*-D.

- In the Main Menu, choose Instrument Setup > Default Sample Setup > **Filter Type/Filter2 Type**.

```
FILTER TYPE:
 CURRENTLY:             A
    SET TO:             A

 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Default Sample Times

The Default Sample Times menu is used to set the default start time (start time2 2000*i*-D only), duration/duration2 (2000*i*-D only).

- In the Main Menu, choose Instrument Setup > **Default Sample Times**.

```
DEFAULT SAMPLE TIMES:
>START TIME    04:00
 DURATION     24h 00m



 CTRST SSET  INSTS  STAT
```

Start Time

The Default Starting Time screen allows the user to set the default starting time. Start Time.

- In the Main Menu, choose Instrument Setup > Default Sample Times > **Start Time/Start Time2**.

```
DEFAULT STARTING TIME:
 CURRENTLY:    11:00
    SET TO:    11:00

 ←→ SELECT FIELD
 ↑↓ CHANGE VALUE   ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Duration

The Duration screen allows the user to adjust the default sample duration for the selected sampling program. Duration2 is for the 2000*i*-D only.

- In the Main Menu, choose Instrument Setup > Default Sample Times > **Duration**.

```
DURATION:
 CURRENTLY:      24h 00m
    SET TO:      24h 00m

 ←→ SELECT FIELD
 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Trigger Method

The Trigger Method menu allows the user to choose trigger of either Advanced or Episodic.

- In the Main Menu, choose Instrument Setup > **Trigger Method**.

```
ADVANCED TRIGGER:
>TRIGGER 1
 TRIGGER 2
 TRIGGER 3


 CTRST SSET  INSTS  STAT
```

Setup Trigger 1-3

The Setup Trigger screen allows the user to choose trigger. The following example shows wind direction as the current signal.

- In the Main Menu, choose Instrument Setup > Advanced Trigger > **Setup Trigger 1-3**.

```
SETUP TRIGGER 1:
>SIGNAL     WIND DIRECTION
 MINIMUM VAL     270  deg
 MAXIMUM VAL     360  deg
 RANGE              0 - 360

 CTRST SSET  INSTS  STAT
```

Signal

The Signal screen allows the user to select signal for the selected trigger.

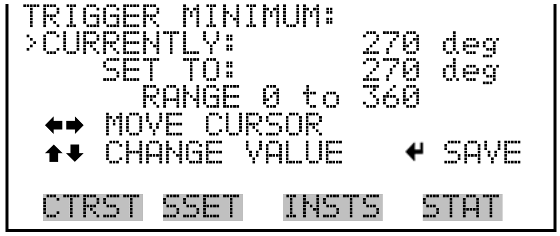
- In the Main Menu, choose Instrument Setup > Advanced Trigger > Setup Trigger 1-3 > **Signal**.

```
SELECT TRIGGER:
>NO CONDITION
 AMB TEMPERATURE
 AMB PRESSURE
 REL HUMIDITY
 WIND SPEED

 CTRST SSET  INSTS  STAT
 WIND DIRECTION
 SAMPLE FLOW RATE
 ANALOG INPUT 1-8
 AVG ANALOG IN 1-8
 DIGITAL INPUT 1-8
```

Minimum and Maximum Trigger

The Minimum Trigger screen allows the user to set trigger minimum value. The minimum and maximum trigger screens function the same way.

- In the Main Menu, choose Instrument Setup > Advanced Trigger > Setup Trigger 1-3 > **Trigger Minimum**.



System Setup

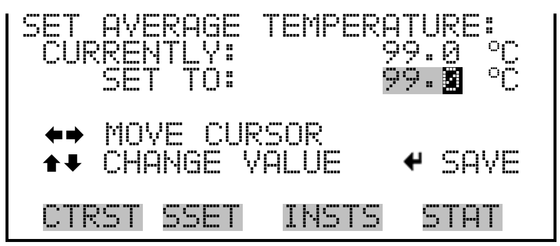
The System Setup menu allows the user to define global parameters for the operation of the Sampler, such as the current time and date, default time and date formats, and to set up the Sampler for remote RS-232 operation.

- In the Main Menu, choose Instrument Setup > **System Setup**.

Average Temperature

The Average Temperature screen is used to adjust the average temperature. The default for this parameter is 99 °C indicating that the unit should use the reading from the external temperature sensor to maintain a constant volumetric flow rate.

- In the Main Menu, choose Instrument Setup > System Setup > **Avg Temperature**.



Standard Temperature

The Standard Temperature screen is used by the Sampler to report flow rate results in standard terms. The default setting for Standard Temperature is 99 °C, which may need to be changed to match conventions in different parts of the world. The default setting for Standard

Temperature does not have any effect on the volumetric flow rate and actual volume calculations by the unit.

- In the Main Menu, choose Instrument Setup > System Setup > **Std Temperature**.

```
SET STANDARD TEMPERATURE:
 CURRENTLY:        25.0 °C
    SET TO:        25.0 °C

  ←→ MOVE CURSOR
  ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Average Pressure

The Average Pressure screen is used by the Sampler to maintain the proper volumetric sample flow rate. The default value of Average Pressure is 999 mmHg, indicating that the unit should use the reading from the Sampler's ambient pressure sensor to maintain a constant volumetric flow rate.

- In the Main Menu, choose Instrument Setup > System Setup > **Avg Pressure**.

```
SET AVERAGE PRESSURE:
 CURRENTLY:       999 mmHg
    SET TO:       999 mmHg

  ←→ MOVE CURSOR
  ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Standard Pressure

The Standard Pressure is used by the Sampler to report the flow rate results in standard terms. The default setting of Standard Pressure is 999 mmHg. The default setting for Standard Pressure does not have any effect on the volumetric flow rate and actual volume calculations by the unit.

- In the Main Menu, choose Instrument Setup > System Setup > **Std Pressure**.

```
SET STANDARD PRESSURE:
 CURRENTLY:       760 mmHg
    SET TO:       760 mmHg

  ←→ MOVE CURSOR
  ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Filter Fan

The Filter Fan screen controls the filter fan operating mode. If this field is set to Always On, the filter fan will run continuously. If this field is set to Automatic, the filter fan will only initiate if the temperature of the filter and ambient air differs by 2 °C. If the Filter Fan field is set to Always Off, the filter fan will not initiate at all. When you set this field to Always Off, the filter temperature range error code (that initiates the filter fan in the Automatic setting) will be disabled.

- In the Main Menu, choose Instrument Setup > System Setup > **Filter Fan**.

```
FILTER FAN MODE:
 CURRENTLY:     AUTOMATIC
    SET TO:     AUTOMATIC

 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Auto Run

The Auto Run screen is used to set the Auto Run mode to On/Off. If no keys are pressed for three hours and the Auto Run feature is On, the unit will automatically enter the Wait or Sampling mode from the Stop mode.

- In the Main Menu, choose Instrument Setup > System Setup > **Auto Run**.

```
AUTO RUN MODE:
 CURRENTLY:           OFF
    SET TO:            ON ?

              ↵ TOGGLE VALUE

 CTRST SSET  INSTS  STAT
```

Flow Calibration Setup

The Flow Calibration Setup menu is used to setup flow calibration. Flow 2 is used with the 2000*i*-D.

- In the Main Menu, choose Instrument Setup > **Flow Calibration Setup**.

```
FLOW CALIBRATION SETUP:
>FLOW
 FLOW2
 USE FTS CONSTANTS      NO


 CTRST SSET  INSTS  STAT
```

Flow/Flow2

The Flow Cal Setup menu presents the parameters used to setup flow calibration.

- In the Main Menu, choose Instrument Setup > Flow Calibration Setup > **Flow/Flow2**.

```
CAL SETUP FLOW:
>SETPOINT 1         12.000
 SETPOINT 2         13.000
 SETPOINT 3         15.000
 NO OF CAL POINTS        3
 RESET FLOW CAL          ↓

 CTRST SSET  INSTS  STAT
 FTS CONSTANT M     0.0000
 FTS CONSTANT B     0.0000
```

Setpoint 1-5

The Setup Setpoint screen allows the user to adjust the setpoint.

- In the Main Menu, choose Instrument Setup > Flow Calibration Setup > Flow > **Setpoint 1-5**.

```
SETUP SETPOINT 1:
 CURRENTLY:  12.000 L/min
    SET TO:  12.000 L/min

 ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Number of Cal Points

The Set Number of Points screen allows the user to adjust the number of points.

- In the Main Menu, choose Instrument Setup > Flow Calibration Setup > Flow > **No of Cal Points**.

```
SET NUMBER OF POINTS:
 CURRENTLY:          5
    SET TO:          5

 ↑↓ CHANGE VALUE    ↵ SAVE
 CTRST SSET  INSTS  STAT
```

Reset Flow Cal

The Reset Flow Cal menu item is used to reset the flow calibration parameters.

- In the Main Menu, choose Instrument Setup > Flow Calibration Setup > Flow > Reset Flow Cal > press ↵ to reset the flow calibration parameters.

FTS Constant M/B

The Flow Constant M/B screen allows the user to adjust the setpoint. The Flow Constant B screen functions in the same manner as the Flow Constant M screen shown in the example.

- In the Main Menu, choose Instrument Setup > Flow Calibration Setup > Flow > **FTS Constant M**.

```
FTS CONSTANT M:
 CURRENTLY:         0.0000
    SET TO:         0.0000

 ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE     ↵ SAVE
 CTRST SSET  INSTS  STAT
```

Datalogging

The *i*Series instruments include a built-in data logging capability as a standard feature. The operator is allowed to create two different types of records, which for historical reasons are named lrecs (long records) and srecs (short records). Each record can contain up to 32 different fields or data items, and records can be created at user-defined intervals ranging from 1 to 60 minutes.

Record generation is tied to the instrument's real-time clock. For example, if the logging period for srecs is set to 30 minutes, a new srec will be generated on every hour and every half hour (10:00, 10:30, 11:00 …). Lrecs and srecs can be interleaved.

The Sampler's computer system includes three megabytes of flash memory, which is enough to store a full lrec containing 32 data items and a full srec containing 32 items once each minute for a week (>20,000 total records).

If logging is limited to the minimum content of date, time, readings, and error flags, the Sampler can store data once each minute for approximately three months (>190,000 records).

- In the Main Menu, choose Instrument Setup > **Datalogging**.

```
DATALOGGING:
>SELECT CONTENT
 COMMIT CONTENT
 RESET TO DEFAULT CONTENT
 CONFIGURE DATALOGGING
 ERASE USER DATA LOG        ⬇

 CTRST SSET  INSTS  STAT
 ERASE INTERVAL LOG
 ERASE FILTER LOG
```

Select Content

The Select Content submenu displays a list of 32 record fields to use to configure the data to be logged. When a field is selected, a submenu list appears of the items to choose from to assign to those fields. Item types are Other Measurements and Analog Inputs (if the I/O expansion board is installed). These record fields comprise a temporary list of items for the selected record type that must be committed via the datalogging menu before the changes will apply. Note that committing any changes to this list will erase all currently logged data for the selected record type only, as the format of the stored data is changed.

- In the Main Menu, choose Instrument Setup > Datalogging > **Select Content**.

```
USER FIELDS:
>FIELD 1              FLOW
 FIELD 2             FLOW2
 FIELD 3             FLOWT
 FIELD 4             MFLOW
 FIELD 5            MFLOW2 ⬇

 CTRST SSET  INSTS  STAT
 FIELD 32             NONE
```

Fields 1-32

The field data submenu displays a list of the types of data that can be logged for the current field. Choices include Other Measurements and Analog Inputs (if the I/O expansion board is installed).

- In the Main Menu, choose Instrument Setup > Datalogging Settings > Select Content > **Field 1–32**.

```
DATA IN LREC FIELD  1:
>OTHER MEASUREMENTS
 ANALOG INPUTS
 NON-MEASUREMENTS
 OTHER MEASUREMENTS 2

 CTRST SSET  INSTS  STAT
```

Other Measurements

The Other Measurements screen allows the user to assign one of the other available measurement types to the selected record field. The selected item is shown by "<--" after it. Note that at this point, pressing indicates that these are proposed changes as opposed to implemented changes. To change the selected record format and erase record log file data, see "Commit Content" that follows.

- In the Main Menu, choose Instrument Setup > Datalogging Settings > Select Content > *select field* > **Other Measurements**.

```
OTHER MEASUREMENTS:
>NONE
 FLOW VOL                   <--
 FLOW2 V VOL
 FLOW TOTAL
 FLOW COV                     ↓

 CTRST SSET  INSTS  STAT
  FLOW2 COV
  VOLUME
  VOLUME2
  AMBIENT PRES
  FILTER PRES
  FILTER2 PRES
  AMB PRES AVG
  FLT PRES AVG
  FLT2 PRES AVG
  AMB TMP 5MIN
  FLT TMP 5MIN
  FLOW 5MIN
  FLOW2 5MIN
```

Analog Inputs

The Analog Inputs screen allows the user to select the parameter (none or analog inputs 1–8) to the selected record field. If the I/O expansion board is not present, Analog Inputs will not be available. The selected item is shown by "<--" after it. Note that at this point, pressing indicates that these are proposed changes as opposed to implemented changes. To change the selected record format and erase record log file data, see "Commit Content" that follows.

- In the Main Menu, choose Instrument Setup > Datalogging Settings > Select Content > *select field* > **Analog Inputs**.

```
ANALOG INPUTS:
>NONE
 ANALOG IN 1
 ANALOG IN 2
 ANALOG IN 3
 ANALOG IN 4

 CTRST SSET  INSTS  STAT
```

Non-Measurements

The Non-Measurements screen allows the user to select a status related item that will be included in the selected data field.

- In the Main Menu, choose Instrument Setup > Datalogging Settings > Select Content > *select field* > **Non-Measurements**.

```
NON- MEASUREMENTS:
>NONE
 FILTER ID
 FILTER2 ID
 CASS ID
 CASS2 ID

 CTRST SSET  INSTS  STAT
 START DATE
 ELAPSED TIME
 TIME
 DATE
 DATE/TIME
 EXT ALARMS
 STATUS CODES
```

Other Measurements 2

The Other Measurements 2 screen allows the user to select an item that will be included in the selected data field.

- In the Main Menu, choose Instrument Setup > Datalogging Settings > Select Content > *select field* > **Other Measurements 2**.

```
OTHER MEASUREMENTS 2:
>NONE
 AMBIENT TEMP
 FILTER TEMP
 COMPRT TEMP
 ELEC TEMP                    ⬇

 CTRST  SSET   INSTS   STAT
  TEMP DLT
  TEMP DLT MAX
  RELATIVE HUM
  WIND SPEED
  WIND DIR
  WIND SPD AVG
  WIND VEL
  WIND VEL AVG
  WIND DIR AVG
```

Commit Content

The Commit Content screen is used to save any changes that have been made to any of the record fields for the selected record type. Saving changes will erase record log file data for that record type. If no changes have been made "NO CHANGES TO RECORD LIST!" will appear.

IMPORTANT Be aware that performing this action will delete all of your logged data. ▲

- In the Main Menu, choose Instrument Setup > Datalogging > **Commit Content**.

```
CHANGE USER FORMAT AND
ERASE USER LOG FILE DATA?
                 ↵ COMMIT



 CTRST  SSET   INSTS   STAT
```

```
CHANGE USER FORMAT AND
ERASE USER LOG FILE DATA?
                 ↵ COMMIT
ARE YOU SURE YOU WANT TO?
PRESS ➡ TO CONFIRM CHANGES

 CTRST  SSET   INSTS   STAT
```

Reset to Default Content

The Reset to Default Content screen is used to reset the logging settings to default for the selected record type.

IMPORTANT Be aware that performing this action will delete all of your logged data. ▲

In the Main Menu, choose Instrument Setup > Datalogging > **Reset to Default Content**.

```
RESET USER DATA AND
ERASE USER LOG FILE DATA?
                ↵ RESET



 CTRST SSET  INSTS  STAT
```

```
RESET USER DATA AND
ERASE USER LOG FILE DATA?
                ↵ RESET
ARE YOU SURE YOU WANT TO?
PRESS ➡ TO CONFIRM RESET


 CTRST SSET  INSTS  STAT
```

Configure Datalogging

The Configure Datalogging menu is used to configure the datalogging for the currently selected record type.

- In the Main Menu, choose Instrument Setup > Datalogging > **Configure Datalogging**.

```
DATALOGGING SETTINGS:
>LOGGING PERIOD MIN      1
 MEMORY ALLOCATION %    70
 DATA TREATMENT        AVG
 FLAG STATUS DATA      OFF


 CTRST SSET  INSTS  STAT
```

Logging Period Min

The Logging Period Min screen is used to select the time period in minutes between logged data points for the selected record type (srec or lrec). The list of choices includes: Off, 1, 5, 15, 30, and 60 minutes (default).

- In the Main Menu, choose Instrument Setup > Datalogging > Configure Datalogging > **Logging Period Min**.

```
SET PERIOD FOR USER:
 CURRENTLY:        1 MIN
    SET TO:        1 MIN

 ⬆⬇ CHANGE VALUE   ↵ SAVE


 CTRST SSET  INSTS  STAT
```

Memory Allocation Percent

The Memory Allocation Percent screen is used to select the percentage of each record type for both srecs and lrecs. The "other" type is set to 100% which is the specified value. Percentages between 0 and 100% are available in increments of 10. Changing this value erases logs for both srecs and lrecs.

- In the Main Menu, choose Instrument Setup > Datalogging > Configure Datalogging > **Memory Allocation Percent**.

```
SET PERCENT USERS:
 CURRENTLY:          70%
    SET TO:          70%
 THIS WILL ERASE ALL LOGS!
 PRESS ➡ TO CONFIRM CHANGE
 ⬆⬇ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Data Treatment

The Data Treatment screen is used to select the data type for the selected record type: whether the data should be averaged over the interval, the minimum or maximum used, or the current value logged.

- In the Main Menu, choose Instrument Setup > Datalogging > Configure Datalogging > **Data Treatment**.

```
SET USER DATA TYPE:
 CURRENTLY:  AVG
    SET TO:  CUR          ?

 ⬆⬇ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Flag Status Data

The Flag Status Data screen is used to select the data treatment for the selected record type: whether the data should be averaged over the interval, the minimum or maximum used, or the current value logged.

- In the Main Menu, choose Instrument Setup > Datalogging > Configure Datalogging > **Flag Status Data**.

```
SET USER FLAG STATUS DATA:
 CURRENTLY:  OFF
    SET TO:   ON          ?

 ⬆⬇ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Erase User Data Log

The Erase User Data Log screen is used to erase all saved data for the selected record type (either all short records or all long records, not both). When you press ➡ to erase, the screen displays an "Erasing – Please Wait" message to confirm the erasure.

- In the Main Menu, choose Instrument Setup > Datalogging > **Erase User Data Log**.

```
ERASE USER LOG:
 PRESS ➡ TO ERASE
 PRESS   TO CANCEL


 CTRST SSET  INSTS  STAT
```

```
ERASE USER LOG:
 PRESS ➡ TO ERASE

  ERASING - PLEASE WAIT
 CTRST SSET  INSTS  STAT
```

Erase Interval Log

The Erase Interval Log screen is used to erase all saved data. When you press ➡ to erase, the screen displays an "Erasing – Please Wait" message to confirm the erasure.

- In the Main Menu, choose Instrument Setup > Datalogging > **Erase Interval Log**.

```
ERASE INTERVAL LOG:
 PRESS ➡ TO ERASE
 PRESS   TO CANCEL


 CTRST SSET  INSTS  STAT
```

```
ERASE INTERVAL LOG:
 PRESS ➡ TO ERASE

  ERASING - PLEASE WAIT
 CTRST SSET  INSTS  STAT
```

Site ID

The Site ID menu is used to enter Sampler site location information.

- In the Main Menu, choose Instrument Setup > **Site ID**.

```
SITE ID:
>ID
 ID2



 CTRST SSET  INSTS  STAT
```

The Site ID screen has two 32-character fields. The user can enter site identification numbers using one or both fields. If no entry is made in these fields then no site identification numbers will appear in the Sampler's data output from this screen. The Site ID2 screen items are used in the same manner as the Site ID1 screen items.

- In the Main Menu, choose Instrument Setup > Site ID > **ID/ID2**.

```
SITE ID1:

 █
    ABCDEFGHIJKLMN  BKSP
    OPQRSTUVWXYZ    PAGE
    0123456789 ./-  SAVE

 CTRST SSET  INSTS  STAT
```

Communications

The Communication Settings menu is used for communications control and configuration.

- In the Main Menu, choose Instrument Setup > **Communications**.

```
COMMUNICATION SETTINGS:
>SERIAL SETTINGS
 INSTRUMENT ID
 COMMUNICATION PROTOCOL
 STREAMING DATA CONFIG
 TCP/IP SETTINGS

 CTRST SSET  INSTS  STAT
```

Serial Settings

The Serial Settings menu is used for serial communications control and configuration.

- In the Main Menu, choose Instrument Setup > Communications > **Serial Settings**.

```
SERIAL SETTINGS:
>BAUD RATE             9600
 DATA BITS                8
 PARITY                NONE
 STOP BITS                1
 RS-232/485 SEL      RS-232

 CTRST SSET   INSTS   STAT
```

Baud Rate The Baud Rate screen is used to set the RS-232/RS485 interface baud rate. Baud rates of 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200 are available. The Sampler's default baud rate is set to 9600 to provide backwards compatibility with the older C-series analyzers.

- In the Main Menu, choose Instrument Setup > Communications > Serial Settings > **Baud Rate**.

```
BAUD RATE:
 CURRENTLY:            9600
    SET TO:           19200 ?

           ↑↓ CHANGE VALUE
            ↵ SAVE VALUE

 CTRST SSET   INSTS   STAT
```

Data Bits The Data Bits screen is used to set the number of serial data bits. Selections of 7 or 8 are available, with 8 being the default value.

- In the Main Menu, choose Instrument Setup > Communications > Serial Settings > **Data Bits**.

```
DATA BITS:
 CURRENTLY:               8
    SET TO:               7 ?

           ↑↓ CHANGE VALUE
            ↵ SAVE VALUE

 CTRST SSET   INSTS   STAT
```

Parity The Parity screen is used to select the parity bit for the serial port. Selections of NONE, EVEN, or ODD are available, with NONE being the default value.

- In the Main Menu, choose Instrument Setup > Communications > Serial Settings > **Parity**.

```
PARITY:
 CURRENTLY:          NONE
    SET TO:           ODD ?

            ↑↓ CHANGE VALUE
             ↵ SAVE VALUE

 CTRST SSET  INSTS  STAT
```

Stop Bits

The Stop Bits screen is used to select the number of stop bits for the serial port. Selections of 1 and 2 are available, with 1 being the default value.

- In the Main Menu, choose Instrument Setup > Communications > Serial Settings > **Stop Bits**.

```
STOP BITS:
 CURRENTLY:             1
    SET TO:             2 ?

            ↑↓ CHANGE VALUE
             ↵ SAVE VALUE

 CTRST SSET  INSTS  STAT
```

RS-232/RS-485 Selection

The RS-232/RS-485 Selection screen allows the user to choose between the RS-232 or RS-485 specification for serial communication.

Equipment Damage Disconnect the serial cable before changing the RS-232 and RS-485 selection to prevent damage to any equipment currently connected to the instrument. ▲

- In the Main Menu, choose Instrument Setup > Communications > Serial Settings > **RS-232/485 Sel**.

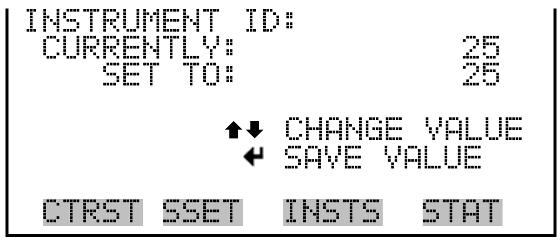
```
RS-232/RS-485 SELECT:
      ** WARNING **
  DISCONNECT THE SERIAL
  CABLES BEFORE CHANGING
      THE SELECTION!
            ↵ TO CONTINUE

 CTRST SSET  INSTS  STAT
```

```
RS-232/RS-485 SELECT:
 CURRENTLY:       RS-232
    SET TO:       RS-485 ?
MAKE SURE THAT THE CABLE
IS OFF: PRESS ➡ TO CONFIRM
           ↵ TOGGLE VALUE

 CTRST SSET  INSTS  STAT
```

Instrument ID

The Instrument ID screen allows the operator to edit the instrument identification number (ID). The ID is used to identify the instrument when using the C-Link or MODBUS protocols to control the instrument or collect data. It may be necessary to edit the ID number if two or more of the same instrument are connected to one computer. Valid instrument ID numbers are from 0 to 127.

- In the Main Menu, choose Instrument Setup > Communications > **Instrument ID**.



Communication Protocol

The Communication Protocol screen is used to select the communication protocol used for serial communications. Possible settings are C-link, streaming, and MODBUS.

C-link Protocol - C-link is a bi-directional protocol that provides access to all instrument functions including reading analog values or variables, reading the status of the digital outputs of the instrument, and triggering or simulating the activation of a digital input to the instrument. Refer to Appendix B for detailed C-link information.

Streaming Protocol - The streaming protocol provides a one-way reporting capability in which data records are exported to a serial device on a regular basis without prompting.

MODBUS protocol – The MODBUS protocol is a serial communications protocol that allows for communication between devices connected to the same network.

The MODBUS protocol support for the Partisol 2000*i* and 2000*i*-D enables the user to read analog values or variables, read the status of the digital outputs of the instrument, and to trigger or simulate the activation of a digital input to the instrument. Refer to “MODBUS Protocol” on page C-1 for detailed MODBUS protocol information.

- In the Main Menu, choose Instrument Setup > Communications > **Communication Protocol**.

```
COMMUNICATION PROTOCOL:
 CURRENTLY:        CLINK
    SET TO:    STREAMING ?

            ↑↓ CHANGE VALUE
             ↵ SAVE VALUE

 CTRST SSET  INSTS  STAT
```

Streaming Data Configuration

The Streaming Data Configuration menu is used to select the 8 output items that will be included in a streaming record, set the streaming interval and data format, and add or delete the "timestamp" and "data label" from each record.

- In the Main Menu, choose Instrument Setup > Communications > **Streaming Data Config**.

```
STREAMING DATA CONFIG:
>INTERVAL          10 SEC
 ADD LABELS            NO
 PREPEND TIMESTAMP    YES
 ADD FLAGS            YES
 ITEM 1              FLOW ↓

 CTRST SSET  INSTS  STAT

 ITEM 8             T-AMB
```

Streaming Data Interval

The Streaming Data Interval screen is used to adjust how frequently a streaming data record is exported. The following interval times are available: 1, 2, 5, 10, 20, 30, 60, 90, 120, 180, 240, and 300 seconds.

- In the Main Menu, choose Instrument Setup > Communications > Streaming Data Config > **Interval**.

```
STREAMING DATA INTERVAL:
 CURRENTLY:        10 SEC
    SET TO:        10 SEC

            ↑↓ CHANGE VALUE
             ↵ SAVE VALUE

 CTRST SSET  INSTS  STAT
```

Add Labels

The Add Labels screen allows the operator to toggle between Yes and No. If set to Yes, then each data point in the streaming record will have a label attached.

- In the Main Menu, choose Instrument Setup > Communications > Streaming Data Config > **Add Labels**.

Prepend Timestamp

The Prepend Time Stamp screen allows the operator to toggle between Yes and No. If set to Yes, then each streaming data record will start with a time and date stamp indicating when that record was generated.

- In the Main Menu, choose Service > Communications > Streaming Data Config > **Prepend Timestamp**.

Add Flags

The Add Flags screen allows the operator to toggle between Yes and No. If set to Yes, then each streaming data record will include a set of flags that indicate various diagnostic or alarm conditions.

- In the Main Menu, choose Instrument Setup > Communications > Streaming Data Config > **Add Flags**.

Item Number

The Item selection screen shows the operator which data fields will be included in the streaming records and also allow those selections to be edited. The editing function operates in a manner that is similar to the Select Content submenu that is used to configure the data logging. When the item number is selected, the submenu displays a list of data fields that can be included in the streaming records. The available fields are organized into the following groups; Other Measurements, Analog Inputs, and Non-Measurements. If the I/O expansion board is not present, Analog Inputs will not be available.

- In the Main Menu, choose Instrument Setup > Communications > Streaming Data Config > **Item (1-8)**.

```
CHOOSE STREAM DATA:
>MEASUREMENTS
 OTHER MEASUREMENTS
 ANALOG INPUTS
 NON-MEASUREMENTS

 CTRST SSET  INSTS  STAT
```

Measurements

The Measurements screen lists data fields. It allows the user to select an item that will be included in the streaming record, such as flow out or sample time.

- In the Main Menu, choose Instrument Setup > Communications > Streaming Data Config > Item # > **Measurements**.

```
MEASUREMENTS:
>NONE
 AMBIENT TEMP
 FILTER TEMP
 COMPRT TEMP
 ELECT TEMP                      ↓

 CTRST SSET  INSTS  STAT
 TEMP DLT
 TEMP DLT MAX
 RELATIVE HUM
 WIND SPEED
 WIND DIR
 WIND SPD AVG
 WIND VEL
 WIND VEL AVG
 WIND DIR AVG
```

Other Measurements

The Other Measurements screen lists data fields (Table 9–2). It allows the user to select an item that will be included in the streaming record, such as ambient pressure or flow volume. Flow2 Volume, Flow2 COV, Volume 2, Filter2 Pres, and Filter2 Pres Avg are used with the 2000*i*-D only.

- In the Main Menu, choose Instrument Setup > Communications > Streaming Data Config > Item # > **Other Measurements**.

```
OTHER MEASUREMENTS:
>NONE
 FLOW VOL
 FLOW2 VOL
 FLOW TOTAL
 FLOW COV                        ↓

 CTRST SSET  INSTS  STAT
 FLOW2 COV
 VOLUME
 VOLUME2
 AMBIENT PRES
 FILTER PRES
 FILTER2 PRES
 AMB PRES AVG
 FLT PRES AVG
 FLT2 PRS AVG
 AMB TMP 5MIN
 FLT TMP 5MIN
 FLOW 5MIN
 FLOW2 5MIN
```

Table 9–2. Data in Streaming Records – Other Measurements

Data	Description
None	Leaves that record field blank
Flow Volume	The volumetric flow for the fine channel measured in L/min
Flow2 Volume	The volumetric flow for the coarse channel measured in L/min
Flow Total	The total volumetric flow in L/min.
Flow COV	Coefficient of variation for volumetric flow for the fine channel
Flow2 COV	Coefficient of variation for volumetric flow for the coarse channel
Volume	Total sample volume for the fine channel in liters
Volume2	Total sample volume for the coarse channel in liters
Ambient Pressure	Ambient pressure in mmHg
Filter Pressure	Pressure in mmHg at the filter for the fine channel
Filter2 Pressure	Pressure in mmHg at the filter for the coarse channel
Ambient Pressure Average	Average ambient pressure in mmHg
Filter Pressure Average	Average pressure in mmHg at the filter for the fine channel
Filter2 Pressure Average	Average pressure in mmHg at the filter for the coarse channel
Ambient Temperature 5-min Average	Average ambient temperature over previous 5 minutes
Filter Temperature 5-min Average	Average filter temperature over previous 5 minutes
Flow 5-min Average	Average flow over previous 5 minutes
Flow2 5-min Average	Average flow2 over previous 5 minutes

Analog Inputs

The Analog Inputs screen lists analog inputs (Table 9–3). It allows the user to select an analog input signal (none or analog inputs 1-8) that will be included in the streaming record. If the I/O expansion board is not present, Analog Inputs will not be available.

- In the Main Menu, choose Instrument Setup > Communications > Streaming Data Config > Item # > **Analog Inputs**.

```
ANALOG INPUTS:
>NONE
 ANALOG IN 1
 ANALOG IN 2
 ANALOG IN 3
 ANALOG IN 4
 CTRST SSET  INSTS  STAT

 ANALOG IN 8
```

Table 9–3. Data in Streaming Records – Analog Inputs

Data	Description
None	Leaves that record field blank.
Analog In 1-8	Tracks voltage inputs from external devices.

Non-Measurements

The Non-Measurements screen lists status information items available for streaming records (Table 9–4). It allows the user to select a status related item that will be included in the streaming record. Filter2 ID and Cass2 ID are used with the 2000*i*-D only.

- In the Main Menu, choose Instrument Setup > Communications > Streaming Data Config > Item # > **Non-Measurements**.

```
NON- MEASUREMENTS:
>NONE
 FILTER ID
 FILTER2 ID
 CASS ID
 CASS2 ID
 CTRST SSET  INSTS  STAT

 START DATE
 STOP DATE
 ELAPSED TIME
 TIME
 DATE
 DATE/TIME
 EXT ALARMS
 STATUS CODES
```

Table 9–4. Data in Streaming Records – Non-Measurements

Data	Description
None	Leaves that record field blank.
Filter ID	Filter ID number entered for sample setup
Filter2 ID	Filter ID number entered for sample setup (2000*i*-D only)
Cass ID	Cassette ID number entered for sample setup
Cass2 ID	Cassette ID number entered for sample setup (2000*i*-D only)
Start Date	Start date of the current or next filter period
Stop Date	Stop date of the current or next filter period
Elapsed Time	Total sampling time for the current filter
Time	Current instrument time in hours and minutes (hh:mm)
Date	Current year, month and date (yyyy_mon_dd)
Date/Time	Current date and time (yyyy_mon_dd hh:mm)
External Alarms (Flag)	32-bit value shows state of external alarms
Status Codes	Binary representation of the status code shown on System Status. See "PRC Values Defined by Codes" on page E-24 for detailed information.

TCP/IP Settings

The TCP/IP Settings menu is used for defining parameters that are required for Ethernet communications.

Note The instrument power must be cycled after any of these parameters have been changed for the change to take effect. ▲

- In the Main Menu, choose Instrument Setup > Communications > **TCP/IP Settings**.

```
TCP/IP SETTINGS:
>USE DHCP                OFF
 IP ADDR      192.168.1.60
 NETMASK     255.255.252.0
 GATEWAY        192.168.1.1
 HOST NAME          iseries↓

 CTRST SSET  INSTS  STAT

 NTP SVR      192.168.1.200
```

Use DHCP

The Use DHCP screen is used to specify whether to use DHCP or not. When DHCP is enabled, the network dynamically provides an IP address for the instrument. The instrument's power must be cycled for a change to this parameter to take affect. For additional information, see the DHCP command in the "C-Link Protocol Commands" appendix.

- In the Main Menu, choose Instrument Setup > Communications > TCP/IP Settings > **Use DHCP**.

```
DHCP:
 CURRENTLY:           OFF
    SET TO:            ON ?

           ↵ TOGGLE VALUE
CYCLE POWER TO CHANGE DHCP

 CTRST SSET  INSTS  STAT
```

IP Address

The IP Address screen is used to edit the IP address. The IP address can only be changed when DHCP is Off. If DHCP is On, the instrument will respond with "Not Settable if DHCP is On." For more information on DHCP, see "Use DHCP" described previously.

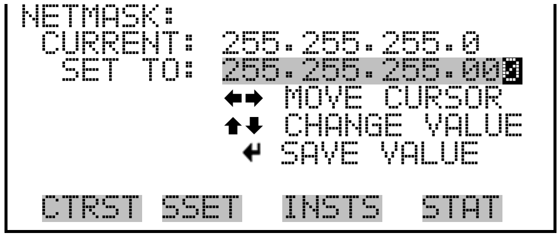
- In the Main Menu, choose Instrument Setup > Communications > TCP/IP Settings > **IP Address**.

```
IP ADDRESS:
 CURRENT: 192.168.1.200
  SET TO: 192.168.001.010
          ←→ MOVE CURSOR
          ↑↓ CHANGE VALUE
           ↵ SAVE VALUE

 CTRST SSET  INSTS  STAT
```

Netmask

The Netmask screen is used to edit the netmask. The netmask is used to determine the subnet on which the instrument can directly communicate to other devices. The netmask can only be changed when DHCP is Off. If DHCP is On, the instrument will respond with "Not Settable if DHCP is On." For more information on DHCP, see "Use DHCP" in this chapter.

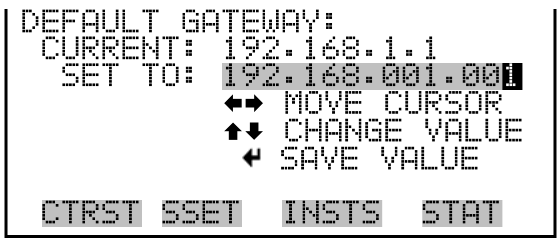
- In the Main Menu, choose Instrument Setup > Communications > TCP/IP Settings > **Netmask**.



Default Gateway

The Default Gateway screen is used to edit the gateway address. The default gateway can only be changed when DHCP is Off. If DHCP is On, the instrument will respond with "Not Settable if DHCP is On." For more information on DHCP, see "Use DHCP" in this chapter. Any traffic to addresses that are not on the local subnet will be routed through this address.

- In the Main Menu, choose Instrument Setup > Communications > TCP/IP Settings > **Gateway**.



Host Name

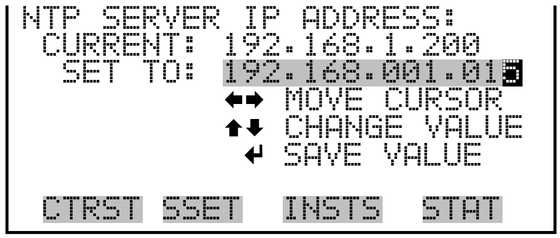
The Host Name screen is used to edit the host name. When DHCP is enabled, this name is reported to the DHCP server.

- In the Main Menu, choose Instrument Setup > Communications > TCP/IP Settings > **Host Name**.

Network Time Protocol Server

The Network Time Protocol (NTP) Server screen is used to edit the IP address of the NTP server. An NTP server may be used to periodically synchronize the instrument's real-time clock with a standard. More information about the NTP servers and a list of public servers may be found at http://www.ntp.org.

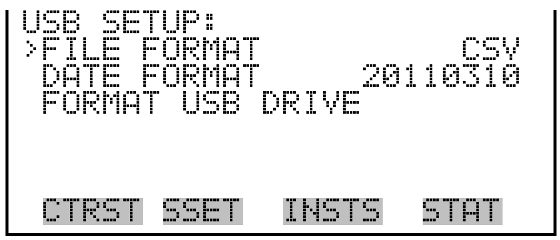
- In the Main Menu, choose Instrument Setup > Communications > TCP/IP Settings > **NTP SVR**.



USB Setup

The USB Setup menu is used to configure removable USB devices to export data logs and audit history to a USB memory device, backup and restore the configuration, and update the firmware from a file on a USB memory device.

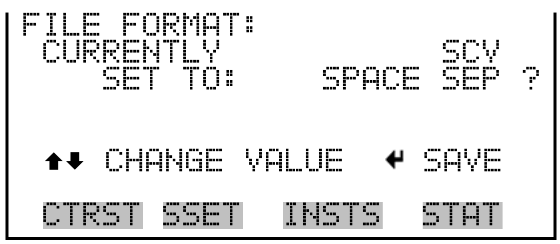
- In the Main Menu, choose Instrument Setup > **USB Setup**.



File Format

The File format screen is used to select the format of the export data log files.

- In the Main Menu, choose Instrument Setup > USB Setup > **File Format.**



Date Format

The Date format screen is used to change the formatting of the date field in export data log files. On saving, the screen responds with SAVING.

- In the Main Menu, choose Instrument Setup > USB Setup > **Date Format**.

```
DATE FORMAT:
 CURRENTLY        MM-DD-YY
    SET TO:     DDMONYYYY ?

 ↑↓ CHANGE VALUE   ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Format USB Drive

The Format USB Drive screen is used to format the USB memory device. Once confirmed the screen will respond with “Formatting”, “Successful” or “Failed”.

IMPORTANT The drive will be formatted with FAT file system and you will lose all data on that USB memory device. ▲

- In the Main Menu, choose Instrument Setup > USB Setup > **Format USB Drive**.

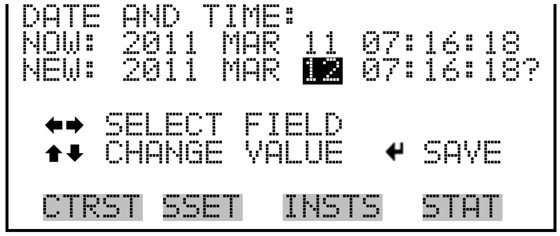
```
FORMAT FRONT DRIVE:
ERASES ALL FILES!

      ARE YOU SURE?
 PRESS ➡ TO CONFIRM
 PRESS ▤ TO CANCEL

 CTRST SSET  INSTS  STAT
```

```
FORMAT FRONT DRIVE:

      FORMATTING ...

  ERASING - PLEASE WAIT
 CTRST SSET  INSTS  STAT
```

Date/Time

The Date/Time screen allows the user to view and change the system date and time (24-hour format). The internal clock is powered by its own battery when instrument power is off.

- In the Main Menu, choose Instrument Setup > **Date/Time**.

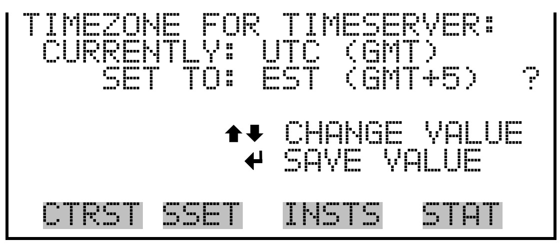


Timezone for Timeserver

The Timezone for Timeserver screen is used to set the timezone for the NTP time server. This should be set to the timezone that the instrument is located in. If the exact timezone is not shown in the list, it may be entered via a CLINK command (see Appendix B "C-Link Protocol Commands"). The selections are: UTC (GMT), EST (GMT+5), CST (GMT+6), MST (GMT+7), PST (GMT+8), YST (GMT+9), HST (GMT+10), NST (GMT+11), DLW (GMT+12), CET (GMT-1), EET (GMT-2), BST (GMT-3), DLT (GMT-4), ECH (GMT-5), FOX (GMT-6), GLF (GMT-7), CCT (GMT-8), JST (GMT-9), GST (GMT-10), LMA (GMT-11), DLE (GMT-12), EDT (GMT+5/4), CDT (GMT+6/5), MDT (GMT+7/6), and PDT (GMT+8/7)

Note The current timezone may say NULL before the timezone is set for the first time, or if the timezone was cleared with a C-link command. ▲

- In the Main Menu, choose Instrument Setup > **Timezone**.



Password Menu

The Password menu allows the user to configure password protection. If the instrument is "locked," none of the settings may be changed via the front panel user interface, but they can still be changed via Remote operation. When the front panel is locked, the user can still navigate the menu and view data, instrument parameters and settings, but nothing can be changed. The password (lock) icon on the right side of the status bar indicates that the password lock is active.

The items visible under the password menu are determined by the instrument's password status.

- In the Main Menu, choose Instrument Setup > **Password**.

```
PASSWORD MENU:
>SET PASSWORD
 LOCK INSTRUMENT
 CHANGE PASSWORD
 REMOVE PASSWORD
 UNLOCK INSTRUMENT

 CTRST SSET  INSTS  STAT
```

Set Password

The Set Password screen is used to set the password that is used to unlock the front panel. The Set Password screen is shown if the instrument is unlocked and the password is not set.

- In the Main Menu, choose Instrument Setup > Password > **Set Password**.

```
ENTER NEW PASSWORD:


     ABCDEFGHIJKLMN  BKSP
     OPQRSTUVWXYZ    PAGE
     0123456789 ./-  SAVE
 CTRST SSET  INSTS  STAT
```

Lock Instrument

The Lock Instrument screen is used to lock the instrument's front panel so users can not change any settings from the front panel. The Lock Instrument screen is shown if the instrument is unlocked and the password is set.

Lock/Unlock and Local/Remote Operation

If the instrument is locked via the front panel using Password > **Lock Instrument**, the instrument reports being in Remote mode. In this mode, the front panel is "locked," data and settings can be viewed, but not changed using the front panel interface, and the remote "Set" commands are active.

If the instrument is unlocked via the front panel using Password > **Unlock Instrument**, the instrument reports being in Local mode, the front panel interface is unlocked, and settings can be changed from the front panel.

- In the Main Menu, choose Instrument Setup > Password > **Lock Instrument**.

```
LOCK FRONT PANEL:
   PRESSING ENTER WILL
PREVENT USER FROM CHANGING
 CONFIG FROM FRONT PANEL
 ↵ LOCK AND RETURN TO RUN

 CTRST SSET  INSTS  STAT
```

Unlock Instrument

The Unlock Instrument screen is used to enter the password to unlock the front panel. The Unlock Instrument screen is shown if the instrument is locked.

- In the Main Menu, choose Instrument Setup > Password > **Unlock Instrument**.

```
ENTER NEW PASSWORD:


     ABCDEFGHIJKLMN  BKSP
     OPQRSTUVWXYZ    PAGE
     0123456789 ./-  SAVE
 CTRST SSET  INSTS  STAT
```

Change Password

The Change Password screen is used to change the password that is used to unlock the instrument's front panel. The Change Password screen is shown if the instrument is unlocked.

- In the Main Menu, choose Instrument Setup > Password > **Change Password**.

```
ENTER NEW PASSWORD:


     ABCDEFGHIJKLMN  BKSP
     OPQRSTUVWXYZ    PAGE
     0123456789 ./-  SAVE
 CTRST SSET  INSTS  STAT
```

Remove Password

The Remove Password screen is used to erase the current password and disable password protection. The Remove Password screen is shown if the instrument is unlocked and the password is set.

- In the Main Menu, choose Instrument Setup > Password > **Remove Password**.

```
REMOVE PASSWORD:
   PRESSING ENTER WILL
 REMOVE CURRENT PASSWORD
   AND DISABLE LOCKING
       ↵ REMOVE PASSWORD

 CTRST SSET  INSTS  STAT
```

Restore Defaults

The Restore Defaults screen is used to reset the user calibration and configuration values to defaults.

In the Main Menu, choose Instrument Setup > **Restore Defaults.**

```
RESTORE DEFAULTS:
 RESTORES USER DEFAULTS

      ARE YOUURE?
 PRESS ➡ TO CONFIRM
 PRESS   TO CANCEL

 CTRST SSET  INSTS  STAT
```

```
RESTORE DEFAULTS:
 RESTORES USER DEFAULTS

 RESET TO DEFAULT CONTENT


 CTRST SSET  INSTS  STAT
```

Audit and Calibration Menu

The Audit and Calibration menu provides the parameters for the audit and calibration functions.

- In the Main Menu, choose **Audit and Calibration**.

```
AUDIT AND CALIBRATION:
>AUDIT MODE
 AUDIT
 VIEW AUDIT HISTORY
 CALIBRATION
 LEAK CHECKS             ⬇

 CTRST SSET  INSTS  STAT
```

Audit Mode

The Audit mode takes the unit off line and allows the user to exchange or clean components in the sampling train. Leak checks and flow verifications can also be done with the Sampler in the Audit mode.

- In the Main Menu, choose Audit and Calibration > **Audit Mode**.

```
AUDIT MODE:
 ENTER AUDIT MODE

      ARE YOU SURE?
 PRESS ➡ TO CONFIRM
 PRESS   TO CANCEL

 CTRST SSET  INSTS  STAT
```

Audit

The Audit menu displays parameters used to perform an audit. Filter2 Pres and Flow2 are used with the 2000*i*-D only.

- In the Main Menu, choose Audit and Calibration > **Audit**.

```
AUDIT:
>AMBIENT TEMP   -99.9  °C
 AMBIENT PRES       0 mmHg
 FILTER TEMP    -99.9  °C
 AMBIENT RH         0 %
 FILTER PRES        0 mmHg⬇

 CTRST SSET  INSTS  STAT

 FILTER2 PRES       0 mmHg
 FLOW            0.00 L/min
 FLOW2           0.00 L/min
 FTS FLOW        0.00 L/min
```

Ambient Temperature

The Ambient Temperature menu is used to adjust the associated reference value.

- In the Main Menu, choose Audit and Calibration > Audit > **Ambient Temp**.

```
AMBIENT TEMPERATURE
>RECORD REF
 VIEW HISTORY




 CTRST SSET  INSTS  STAT
```

Record Reference

The Enter Reference Value screen is used to adjust the reference value.

- In the Main Menu, choose Audit and Calibration > Audit > Ambient Temperature > **Record Ref**.

```
ENTER REFERENCE VALUE:
 AMBIENT TEMP
  MEASURED      99.0  °C
 REFERENCE      99.0  °C
 ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

View History

The View History screen is used to view history.

- In the Main Menu, choose Audit and Calibration > Audit > Ambient Temperature > **View History**.

```
VIEW HISTORY:






 CTRST SSET  INSTS  STAT
```

The following items items in the Audit menu are used in the same manner as the Ambient Temperature screen.

- Audit
  - Ambient Temp
    - Record Ref
    - View History
  - Ambient Pres
    - Record Ref
    - View History
  - Filter Temp
    - Record Ref
    - View History
  - Ambient RH
    - Record Ref
    - View History
  - Filter Pres
    - Record Ref
    - View History
  - Filter2 Temp
    - Record Ref
    - View History
  - Filter2 Pres
    - Record Ref

View History
Flow
Record Ref
View History
Flow2
Record Ref
View History

Calibration

The Calibration menu displays calibration related menu items. Filter2 Pres and Flow2 are used with the 2000*i*-D only.

- In the Main Menu, choose Audit and Calibration > **Calibration**.

```
CALIBRATION:
>AMBIENT TEMP   -99.9  °C
 AMBIENT PRES       0  mmHg
 FILTER TEMP    -99.9  °C
 FILTER PRES        0  mmHg
 FLOW            0.00 L/min ↓

 CTRST SSET  INSTS  STAT

 FILTER2 PRES       0  mmHg
 FLOW2           0.00 L/min
 AMBIENT RH         0  %
```

Calibrate Ambient Temperature

The Calibrate Ambient Temperature screen displays the current averaged values of the ambient temperature (°C), as measured by the external temperature sensor.

- In the Main Menu, choose Audit and Calibration > Calibration > **Ambient Temp**.

```
CALIBRATE AMBIENT TEMP:
 CURRENTLY:       -99.0  °C
    SET TO:       -99.0  °C

 ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Ambient Pressure

The Calibrate Ambient Pressure screen displays the current and latest averaged values of the ambient pressure (mmHg), as measured by a sensor located inside the Sampler enclosure.

- In the Main Menu, choose Audit and Calibration > Calibration > **Ambient Pres**.

```
CALIBRATE AMBIENT PRES:
 CURRENTLY:        000 mmHg
    SET TO:        000 mmHg

 ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Filter Temperature

The Calibrate Filter Temperature screen displays the current averaged values of the filter #1 (high flow filter) temperature (°C).

The Calibrate Filter2 Temperature screen (2000*i*-D only) displays the current and latest averaged values of the filter #2 (low flow filter) temperature (°C). The Calibrate Filter2 Temperature screen (2000*i*-D only) items are used in the same manner as the Calibrate Filter Temperature screen items.

- In the Main Menu, choose Audit and Calibration > Calibration > **Filter Temp/Filter2 Temp**.

```
CALIBRATE FILTER TEMP:
 CURRENTLY:        -99.9  °C
    SET TO:        -99.9  °C

 ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Filter Pressure

The Calibrate Filter Pressure screen is used to calibrate filter pressure. The Calibrate Filter2 Pressure screen items are used in the same manner as the Calibrate Filter Pressure screen items.

- In the Main Menu, choose Audit and Calibration > Calibration > **Filter Pres/Filter2 Pres**.

```
CALIBRATE FILTER PRES:
 CURRENTLY:        000 mmHg
    SET TO:        000 mmHg

 ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Flow

The Calibration for Flow menu is used to calibrate flow. The Calibration for Flow2 menu items are used in the same manner as the Calibration for Flow menu items.

- In the Main Menu, choose Audit and Calibration > Calibration > **Flow**.

```
CALIBRATION FOR FLOW:
>POINT 1
 POINT 2
 POINT 3
 POINT 4
 POINT 5                     ↓
 CTRST SSET  INSTS  STAT
 SLOPE                   1.00
 INTERCEPT               0.00
 CAL SETUP
```

Setpoint 1-5 for Flow

The Setpoint for Flow screen is used to calibrate the flow.

- In the Main Menu, choose Audit and Calibration > Calibration > Flow > **Point 1-5**.

```
SP 1 FOR FLOW:       12.000
>FLOW MEASURED      ACTUAL
 STORED  12.00      12.000
 LIVE    0.000      12.000
         ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE   ↵ SAVE
 CTRST SSET  INSTS  STAT
```

Slope

The Slope menu item is a display only screen.

Intercept

The Intercept menu item is a display only screen.

Cal Setup

The Cal Setup Flow screen provides parameters for flow calibration setup.

- In the Main Menu, choose Audit and Calibration > Calibration > Flow > **Cal Setup**.

```
FLOW CAL SETUP:
>SETPOINT 1
 SETPOINT 2
 SETPOINT 3
 SETPOINT 4
 SETPOINT 5                ↓

 CTRST SSET  INSTS  STAT
 NO OF CAL POINTS      1.00
 RESET FLOW CAL  0.00
 FTS CONSTANT A
 FTS CONSTANT B
```

Setpoint 1-5

The Setup Setpoint screen is used to adjust the setpoint.

- In the Main Menu, choose Audit and Calibration > Calibration > Flow > Cal Setup > **Setpoint 1-5**.

```
SETUP SETPOINT:
 CURRENTLY     12.000 l/min
    SET TO:    12.000 l/min

            ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE   ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Number of Cal Points

The Set Number of Points screen is used to select the number of calibration points.

- In the Main Menu, choose Audit and Calibration > Calibration > Flow > Cal Setup > **No of Cal Points**.

```
SET NUMBER OF POINTS:
 CURRENTLY             5
    SET TO:            5

 ↑↓ CHANGE VALUE   ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Reset Flow Cal

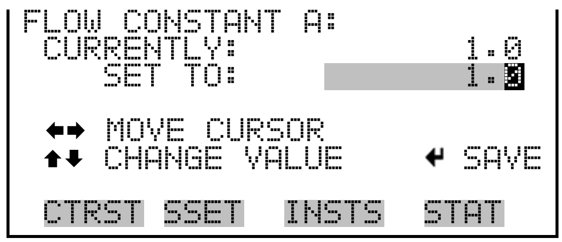
Reset Flow Cal menu item is used to reset the flow calibration to the default value.

- In the Main Menu, choose Audit and Calibration > Calibration > Flow > Cal Setup > **Reset Flow Cal**.

Flow Constant A/B

From In the Main Menu, choose Instrument Setup > Flow Calibration Setup > Flow **> FTS Constant A**. The Flow Constant A screen allows the user to adjust the setpoint. The FTS Constant B screen is used in the same manner as the FTS Constant A screen.

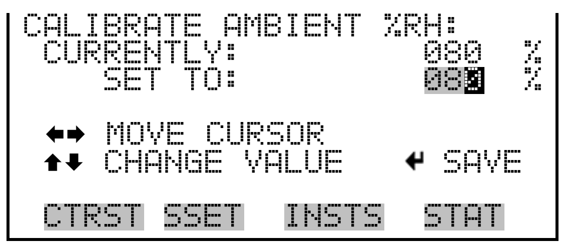
- In the Main Menu, choose Audit and Calibration > Calibration > Flow > Cal Setup > **Flow Constant A/B**.



Ambient RH

The Calibrate Ambient RH screen contains the current and latest averaged values of the ambient relative humidity (%), as measured by a sensor located in the ventilated filter compartment.

- In the Main Menu, choose Audit and Calibration > Calibration > **Ambient RH**.



Leak Checks

The Leak Check menu provides access to the internal leak check parameters and the external leak check parameters used in performing leak checks.

- In the Main Menu, choose Audit and Calibration > Calibration > **Leak Checks**.

```
LEAK CHECK:
>INTERNAL
 EXTERNAL




 CTRST SSET  INSTS  STAT
```

Leak Check Internal

The Leak Check Internal screen is used to perform an internal leak check.

- In the Main Menu, choose Audit and Calibration > Calibration > Leak Checks > **Internal**.

```
LEAK CHECK INTERNAL:

 MAKE SURE THAT A LEAK
 CHECK DISK IS IN THE
 SAMPLE FILTER LOCATION!!
 PRESS → TO BEGIN TESTING

 CTRST SSET  INSTS  STAT
```

```
LEAK CHECK INTERNAL:
 FILTER PRES:          80
 TARGET:               55
 VALVES AND PUMP ON
 WAITING FOR PRESSURE
 PRESSURE NOT REACHED !!

 CTRST SSET  INSTS  STAT
```

Leak Check External

The Leak Check External screen is used to perform an external leak check.

- In the Main Menu, choose Audit and Calibration > Calibration > Leak Checks > **External**.

```
LEAK CHECK EXTERNAL:

 MAKE SURE THAT FILTER IS
 IN PLACE AND LEAK CHECK
 ADAPTER IS CLOSED!!!
 PRESS → TO BEGIN TESTING

 CTRST SSET  INSTS  STAT
```

```
LEAK CHECK EXTERNAL:
 FILTER PRES:          80
 TARGET:               55
 VALVES AND PUMP ON
 WAITING FOR PRESSURE
 PRESSURE NOT REACHED !!

 CTRST SSET  INSTS  STAT
```

System Status

The System Status menu is used for choosing to access system status codes and alarms.

- In the Main Menu, choose **System Status**.

```
SYSTEM STATUS:
>STATUS CODES           *
 ALARMS                 1




 CTRST SSET  INSTS  STAT
```

Status Codes

The Status Codes screen displays a list and description of the currently active status conditions. Refer to Table 9–5 for a list of the status codes.

With the occurrence of any status conditions, the unit will display a Bell in the status bar on the main screen. The single or double-letter abbreviation for the situation that applies will be displayed in the Status Codes Screen.

In the case of multiple status conditions, the Sampler displays the single- or double-letter codes and text for each status condition in the Status Codes screen along with the description of the status code. To clear the status codes, press ↵ and the Sampler will prompt to verify clearing of the status codes.

The unit stores all status conditions that apply to each exposed filter in the filter data storage buffer.

- In the Main Menu, choose System Status > **Status Codes**.

```
STATUS CODES:
>AMBIENT (A)
 FILTER TEMP (T)
 ELECT TEMP (E)



 CTRST SSET  INSTS  STAT
```

Table 9–5. Status Codes

Status Codes	Description
Ok	No current status conditions.
M	Flash Memory. The Sampler detected an error in its flash memory.
Z	Power Failure. A power outage occurred during sampling on the current filter. Power outage events of less than 60 seconds are not logged by the Sampler.
F1	Flow Out of Range. The measured sample flow rate through the flow channel deviated by ± 5% from its set point for more than 5 minutes.
F2	Flow 2 Out of Range. The measured sample flow rate through the flow channel deviated by ± 5% from its set point for more than 5 minutes.
S	User Pressed Stop. The user pressed the Run button while the unit was in the WAIT or SAMP (sampling) mode.
S1	Flow Stop. The measured sample flow rate through the flow channel deviated by ± 10% from its set point for more than 60 seconds. This is a critical status condition, causing the Sampler to enter the Error or Wait Operating mode and the status lights to blink.
S2	Flow 2 Stop. The measured sample flow rate through the flow channel deviated by ± 10% from its set point for more than 60 seconds. This is a critical status condition, causing the Sampler to enter the Error or Wait Operating mode and the status lights to blink. (This status code applies to the 2000*i*-D only.)
A	Ambient temperature sensor. The ambient temperature sensor was not installed correctly or indicated an invalid value. For ambient temperature, this corresponds to a reading of less than -60 °C or greater than 70 °C.
T	Filter Temperature. One of the filter compartment temperature sensors was not installed correctly or was out of range, i.e., less than -60 °C or greater than 70 °C.
PA	Ambient Pressure Sensor. The ambient pressure sensor is not installed correctly or is indicating an invalid value (less than 300 mmHg or greater than 900 mmHg).
E	Electronics Temperature. The temperature of the unit's electronics compartment was outside of its usual operating range, i.e., less than 0 °C or greater than 70 °C.
R1	Filter Temperature 1 Range. The measured temperature of Filter #1 (high flow filter) exceeded the measured ambient temperature by more than 5° C for more than 30 consecutive minutes.
R2	Filter Temperature 2 Range. The measured temperature of Filter #2 (low flow filter) exceeded the measured ambient temperature by more than 5 °C for more than 30 consecutive minutes.
O1	Coefficient of Variation 1. The coefficient of variation of the sample flow #1 rate (high flow), expressed as a percentage, was greater than 2 (2%) during the exposure of a filter.

Status Codes	Description
O2	Coefficient of Variation 2. The coefficient of variation of the sample flow #2 rate (low flow), expressed as a percentage, was greater than 2 (2%) during the exposure of a filter.
P	Elapsed Sample Period. For sampling programs of ≥12 hour duration without conditional sampling, the Sampler issues this status code if the elapsed time of a sample differed by ±1 hour from the selected duration. Sampling programs of less than 12 hours will not indicate an elapsed time error.
L	Leak Check Failed. This error code will appear if the leak check failed. A leak check fails if the vacuum created in the sampling system leaks at a rate of 25 mmHg or greater, which is equal to the maximum leak rate of 80 mL/min that is indicated as acceptable by the U.S. EPA.
D	Audit Performed. This status condition indicates to the user that an audit was performed during sampling. It does not indicate an error. It is for information purposes only. This status code appears only in the filter data screen.
B	Blank Filter. Indicates that “sample” was a zero time blank.
V	Hi Wait Flow. This status condition indicates there is flow greater than 1 L/min through the system in Wait mode, when there should be no flow.

Alarms

The Alarms menu displays a list of items that are monitored by the Sampler. When an alarm is detected, the status of that associated item will go from OK to FAIL. The number of alarms detected is displayed to indicate how many alarms have occurred. If no alarms are detected, the number zero is displayed.

The motherboard status, interface board status, and I/O expansion board status (if installed) indicate that the power supplies are working and connections are successful. There are no setting screens for these alarms.

- In the Main Menu, choose System Status > **Alarms**.

```
ALARMS:
>ALARMS DETECTED          1
 MOTHERBOARD STATUS      OK
 INTERFACE STATUS      FAIL
 I/O EXP STATUS          OK


 CTRST SSET  INSTS  STAT
```

USB Menu

The USB menu is used for interacting with a USB memory device. The USB memory device must be formatted as FAT file system. (Most USB memory devices are already formatted with a FAT file system.) Refer to "USB Setup" on page 9-48 for detailed USB setup information.

Note The USB Menu is visible only when a USB memory device is connected to the USB port on the front panel and when the Sampler is in the Service mode. Refer to the "Service Mode" on page 9-89 for information on the Service mode. ▲

- In the Main Menu, choose **USB**.

```
USB:
>FRONT USB PORT




 CTRST SSET  INSTS  STAT
```

USB Port

The USB Port menu is used to export data logs and audit history to a USB memory device, backup and restore the configuration, and update the firmware from a file on a USB memory device.

Note All examples refer to Front USB port, however the user may set a port other than USB. ▲

- In the Main Menu, choose USB > **Front USB Port**.

```
FRONT USB PORT:
>EXPORT DATA LOGS
 EXPORT AUDIT HISTORY
 BACKUP CONFIGURATION
 UPDATE FIRMWARE

 CTRST SSET  INSTS  STAT
```

Export Data Logs

The Export Data Logs screen is used to export the interval/srec, user/lrec, and filter/frec data to a USB memory device.

The file name format for export data logs is: 2000i_*xxxxx_y_zzz*.dat

Where:

xxxxx = USB ID

y = type of data, either: U = user/lrec
I = interval/srec
F = filter/frec

zzz = file index number which increments every time a file is exported

To export a data log, scroll to the menu item in the Export Data Logs screen, and press

The Export Data Logs screen shows the total number of records for the data type. When the data type is selected, all of the associated records are exported to the USB memory device and stored in the 2000i directory in a file with a name such as, 2000i_*xxxxx_y_zzz*.dat. Refer to "Datalogging" on page B-11 for detailed information on filter/frec, user/lrec, and interval/srec data log formatting.

The Export Data Logs screen indicates the status of the process and then displays the name of the file stored on the USB memory device.

- In the Main Menu, choose USB > Front USB Port > **Export Data Logs**.

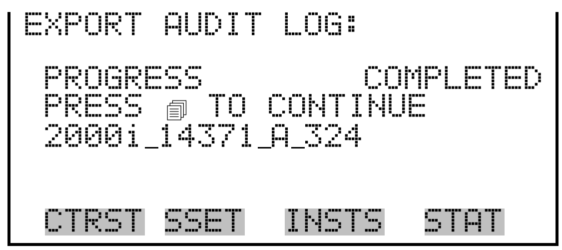
```
EXPORT DATA LOGS:
>FILTER              12 RECS
 INTERVAL/SREC       97 RECS
 USER/LREC          486 RECS


 CTRST SSET  INSTS  STAT
```

```
EXPORT FILTER DATA LOG:

 PROGRESS               10%



 CTRST SSET  INSTS  STAT
```

Export Audit History

The Export Audit History screen is used to export an audit history to a USB memory device.

- In the Main Menu, choose USB > Front USB Port > **Export Audit History**.



Backup Configuration

The Backup Configuration function is used to backup the instrument configuration parameters. To backup the existing configuration, from the Front USB Port menu select Backup Configuration, and press ↵. The Backup Configuration screen displays the progress of the backup process as a percentage and then displays the name of the file stored on the USB memory device. The file will be stored in the 2000*i* directory on the USB memory device with a .tbf extension.

The file name format for backup configuration 2000*i* is:
2000*i_xxxxx_yyy.tbf*

Where:

xxxxx = USB ID from the setup procedure

yyy = file index which increments every time you save

- In the Main Menu, choose USB > Front USB Port > **Backup Configuration**.

```
BACKUP CONFIGURATION:
 PROGRESS        COMPLETED
 PRESS ▤ TO CONTINUE
 2000i_54211_C_144


 CTRST SSET  INSTS  STAT
```

Restore Configuration

The Restore Configuration function is used to restore the instrument configuration parameters from a configuration file stored on the USB memory device. To restore a configuration, from the Front USB Port menu, scroll to Restore Configuration, and press ↵. From the Select Config Restore File menu, select the configuration file to restore, and press ↵.

The menu displays the 32 most recent .tbf files in the 2000*i* directory on the USB memory device.

- In the Main Menu, choose USB > Front USB Port > **Restore Configuration**.

```
SELECT CONFIG RESTORE FILE
>2000i_01060_003
 2000i_01071_002
 2000i_01071_001
 2000i_02081_000


 CTRST SSET  INSTS  STAT
```

Update Firmware

The Update Firmware function is used to update firmware from a firmware file stored on the USB memory device. To update the firmware, from the Front USB Port menu, scroll to Update Firmware, and press ↵. Select the firmware file to restore from the Select FW Update File menu, and press ↵.

The menu displays the 32 most recent 2000*i**.cramfs files in the root directory of the USB memory device. An "*" is displayed on the version number. In the following screen, the "*" indicates that 020709 is the version number.

- In the Main Menu, choose USB > Front USB Port > **Update Firmware**.

```
SELECT FW UPDATE FILE
>2000i020709*
 2000i020709*
 2000i030511
 2000i020612

 CTRST SSET  INSTS  STAT
```

Service Menu

The Service menu provides access to all critical operating and configuration parameters, and advanced diagnostic functions.

Access to Service menus should usually be restricted to trained service technicians, since changes in this portion of the firmware can result in instrument malfunctions that could be difficult to diagnose and correct.

Note The Service mode must be On to access the Service Menu. Refer to the "Service Mode" on page 9-89 for information on the Service mode. ▲

- In the Main Menu, choose **Service**.

```
SERVICE SETTINGS:
>MANUAL MOTION
 SCREEN CONTRAST
 RUN SCREENS
 EXTERNAL I/O
 SET SERIAL NUMBER      ↓

 CTRST SSET  INSTS  STAT

 OPTIONS
 DISPLAY PIXEL TEST
```

Manual Motion

The Manual Motion allows the user to choose manual motion menu.

- In the Main Menu, choose Service > **Manual Motion**.

```
MANUAL MOTION TESTS:
>PUMP CONTROL            0
 VACUUM VENT             0
 FLOW LEAK               0
 FLOW2 LEAK              0
 HEATER CONTROL          0↓

 CTRST SSET  INSTS  STAT

 FC FAN ACT              0
 PUMP FAN ACT            0
 DISCREET ACTIONS
```

Discrete Actions

The Discrete Actions allows the user to choose direct action menu.

- In the Main Menu, choose Service > Manual Motion > **Discrete Actions**.

```
DISCRETE SOLENOID TEST:
>FLOW LEAK               0
 FLOW2 LEAK              0
 HEATER CONTROL          0
 FC FAN ACT              0
 PUMP FAN ACT            0↓

 CTRST SSET  INSTS  STAT

 AUX 24 ACT              0
 MODEM ACT               0
```

Screen Contrast

The Screen Contrast screen is used to change the contrast of the display. Values between 0 and 100% in increments of 5 are available. Changing the screen contrast may be necessary if the instrument is operated at extreme temperatures or lighting conditions.

Notes The optimal contrast will change with changes in temperature. ▲

The optimal contrast will change from one LCD screen to another. If the LCD screen is replaced, the contrast may need to be reset. ▲

If the display contrast is not optimal, but the content on the screen is visible, in the Main Menu, choose Service > **Screen Contrast**, or press the CTRST soft key on the front panel, and adjust the screen contrast. If the content on the screen is not visible, use the “set contrast 10” C-Link command to set the screen contrast to mid range, and then optimize the contrast. Refer to the “Hardware Configuration” section on page B-20 in the “C-Link Protocol Commands” Appendix for more information on this command.

- In the Main Menu, choose Service > **Screen Contrast**.

```
SCREEN CONTRAST:
 CURRENTLY:          50 %
    SET TO:          60 % ?

              ↑↓ CHANGE VALUE
               ↵ SAVE VALUE

 CTRST SSET  INSTS  STAT
```

Run Screens

The Select Run Screen menu is used to define and edit a custom Run screen. When the instrument is turned on, screen 5 is the default screen.

- In the Main Menu, choose Service > **Run Screens**.

```
SELECT RUN SCREEN:
>RUN SCREEN 5





 CTRST SSET  INSTS  STAT
```

The Select Run Screen menu is used to select a Run screen to edit and to display the Edit Run Screen menu.

- In the Main Menu, choose Service > **Run Screens >** ***Select a Run Screen***.

Edit Run Screen

The Edit Run Screen menu is used to edit the contents of the selected custom Run screen. This menu allows the user to edit the Run screen title, toggle the Run screen On and Off, specify the number of items to be displayed on the Run screen (1-10), and to assign a parameter to each item.

```
EDIT RUN SCREEN:
>EDIT TITLE
 ENABLED                OFF
 NUMBER OF ITEMS          8
 ITEM 1        ANALOG IN 1
 ITEM 2        ANALOG IN 2↓

 CTRST SSET  INSTS  STAT
 ITEM 10              NONE
```

Edit Title

The Edit Title screen is used to edit the contents of the title bar on the selected Custom Run screen. The default Run Screen title is Screen 5.

- In the Main Menu, choose Service > **Run Screens > *Select a Run Screen*** > **Edit Title**.

Enabled

The Enabled screen is used to toggle the selected custom Run screen On and Off. When a Run screen is On, it will be displayed when using ↑ ↓ to scroll through the available Run screen displays. When a Run screen is Off, it will be skipped when scrolling through the Run screen displays. For example, if Run screens 2 and 3 are set to Off, scrolling down through the available Run screen displays will display only Run screens 1, 4, and 5.

Note You cannot scroll through Run screens when a menu screen is displayed. ▲

- In the Main Menu, choose Service > **Run Screens > *Select a Run Screen*** > **Enabled**.

Number of Items

The Number of Items menu selection is used to set the number of instrument readings to display on the custom Run screen. A maximum of 10 items can be displayed on a Run screen. A Run screen configured for 5 items or less displays the items in the large font; a Run screen with 6-10 items displays the items in the small font.

- In the Main Menu, choose Service > **Run Screens > *Select a Run Screen*** > **Number of Items**.

```
SET NUMBER OF ITEMS:
 CURRENTLY:        5
    SET TO:        4   ?

↑↓ CHANGE VALUE    ↵ SAVE
 CTRST SSET  INSTS  STAT
```

Item *Number*

The Item *number* menu selection is used to assign a selected parameter to a position in the Run screen display list. Item 1 is displayed at the top of the list. If "None" is selected, the associated item will not be displayed on the Run screen and will skip to the next item.

The available data fields are organized into the following groups; Other Measurements, Other Measurements 2, Analog Inputs, and Non-Measurements. If the I/O expansion board is not present, Analog Inputs will not be available.

- In the Main Menu, choose Service > **Run Screens > *Select a Run Screen*** > **Item *number***.

```
SELECT RUN SCREEN ITEM:
>OTHER MEASUREMENTS
 ANALOG INPUTS
 NON-MEASUREMENTS
 OTHER MEASUREMENTS 2

 CTRST SSET  INSTS  STAT
```

Other Measurements

The Other Measurements screen allows the user to select an item that will be included in the Run screen, such as flow volume or pump pressure. Refer to Item Number described previously.

- In the Main Menu, choose Service > **Run Screens > *Select a Run Screen*** > Item *number* > **Other Measurements**.

```
OTHER MEASUREMENTS:
>NONE
 FLOW VOL            <--
 FLOW2 VOL
 FLOW TOTAL
 FLOW COV              ↓

 CTRST SSET  INSTS  STAT

 FLOW2 COV
 VOLUME
 VOLUME2
 AMBIENT PRES
 FILTER PRES
 FILTER2 PRES
 AMB PRES AVG
 FILT PRES AVG
 FILT2 PRS AVG
```

Table 9–6. Data in Run Screens – Other Measurements

Data	Description
None	Leaves that record field blank
Flow Volume	The volumetric flow for the fine channel measured in L/min
Flow2 Volume	The volumetric flow for the coarse channel measured in L/min
Flow Total	The total volumetric flow in L/min.
Flow COV	Coefficient of variation for volumetric flow for the fine channel
Flow2 COV	Coefficient of variation for volumetric flow for the coarse channel
Volume	Total sample volume for the fine channel in liters
Volume2	Total sample volume for the coarse channel in liters
Ambient Pressure	Ambient pressure in mmHg
Filter Pressure	Pressure in mmHg at the filter for the fine channel
Filter2 Pressure	Pressure in mmHg at the filter for the coarse channel
Ambient Pressure Average	Average ambient pressure in mmHg
Filter Pressure Average	Average pressure in mmHg at the filter for the fine channel
Filter2 Pressure Average	Average pressure in mmHg at the filter for the coarse channel

Other Measurements 2

The Other Measurements 2 screen allows the user to select an item that will be included in the Run screen, such as flow volume or pump pressure. Refer to Item Number described previously.

- In the Main Menu, choose Service > **Run Screens >** ***Select a Run Screen*** > Item *number* > **Other Measurements 2**.

```
OTHER MEASUREMENTS 2:
>NONE
 AMBIENT TEMP          <--
 FILTER TEMP
 COMPRT TEMP
 ELECT TEMP              ↓

 CTRST SSET  INSTS  STAT

 ELECT TEMP
 TEMP DLT
 TEMP DLT MAX
 RELATIVE HUM
 WIND SPEED
 WIND DIR
 WIND SPD AVG
 WIND VEL
 WIND VEL AVG
 WIND DIR AVG
```

Table 9–7. Data in Run Screen – Other Measurements 2

Data	Description
None	Leaves that record field blank
Ambient Temp	The ambient temperature in °C
Filter Temp	The temperature at filter 1 in °C
Comprt Temp	The temperature of the filter compartment in °C
Elect Temp	The temperature of the electronics enclosure in °C
Temp Dlt	The temperature of filter 1 minus the ambient temperature in °C
Temp Dlt Max	The maximum temperature difference of filter 1 over the sample period in °C
Relative Hum	The relative humidity in percent
Wind Speed	The wind speed in km/hr
Wind Dir	The wind direction in degrees (0-360)
Wind Spd Avg	The wind speed average in km/hr
Wind Vel	The wind velocity in km/hr
Wind Vel Avg	The wind velocity average in km/hr
Wind Dir Avg	The wind direction average in km/hr

Analog Inputs

The Analog Inputs screen lists analog inputs (Table 9–8). It allows the user to select an analog input signal (none or analog inputs 1-8) that will be included in the Run screen. If the I/O expansion board is not present, Analog Inputs will not be available. Refer to Item Number described previously.

- In the Main Menu, choose Service > **Run Screens >** ***Select a Run Screen*** > Item *number* > **Analog Inputs**.

```
ANALOG INPUTS:
>NONE
 ANALOG IN 1           <--
 ANALOG IN 2
 ANALOG IN 3
 ANALOG IN 4              ↓

 CTRST SSET  INSTS  STAT
```

```
 ANALOG IN 8
```

Table 9–8. Data in Run Screen – Analog Inputs

Data	Description
None	Leaves that record field blank.
Analog In 1-8	Tracks voltage inputs from external devices.

Non-Measurements

The Non-Measurements screen lists status information items available for a Run screen. It allows the user to select a status related item that will be included in the Run screen. Refer to Item Number described previously.

- In the Main Menu, choose Service > **Run Screens >** ***Select a Run Screen*** > Item *number* > **Non-Measurements**.

```
NON-MEASUREMENTS:
>NONE
 FILTER ID             <--
 FILTER2 ID
 CASS ID
 CASS2 ID                 ↓

 CTRST SSET  INSTS  STAT
```

```
 START DATE
 STOP DATE
 ELAPSED TIME
 TIME
 DATE
 DATE/TIME
 EXT ALARMS
 STATUS CODES
```

I/O Configuration

The I/O Configuration menu deals with configuration of the Sampler's I/O system. The analog input configuration is displayed only if the I/O expansion board option is installed.

Note The digital outputs may take up to one second after the assigned state occurs to show up on the outputs. ▲

- In the Main Menu, choose Service > **External I/O**.

```
I/O CONFIGURATION:
>OUTPUT RELAY SETTINGS
 DIGITAL INPUT SETTINGS
 ANALOG OUTPUT CONFIG
 ANALOG INPUT CONFIG

 CTRST SSET  INSTS  STAT
```

Output Relay Settings

The Output Relay Settings menu displays a list of the 10 digital output relays available, and allows the user to select the instrument parameter or logic state to change for the relay selected.

- In the Main Menu, choose Service > External I/O > **Output Relay Settings**.

```
OUTPUT RELAY SETTINGS:
>1   NOP        GEN ALARM
 2   NOP        MB STATUS
 3   NOP       MIB STATUS
 4   NOP    I/O BD STATUS
 5   NOP     LOCAL/REMOTE ↓

 CTRST SSET  INSTS  STAT
 10  NOP          SERVICE
```

- In the Main Menu, choose Service > External I/O > Output Relay Settings > ***select relay (1-10)***.

```
OUTPUT RELAY SETUP:
>LOGIC STATE          OPEN
 INSTRUMENT STATE




 CTRST SSET  INSTS  STAT
```

Logic State

The Logic State screen is used to change the I/O relay to either normally open or normally closed.

- In the Main Menu, choose Service > External I/O > Output Relay Settings > Select relay 1-10 > Logic > **Press** ↵ **to toggle and set the logic state open or closed**.

Instrument State

The Instrument State submenu allows the user to select the instrument state that is assigned to the selected relay output. A submenu lists signal types of either alarm or non-alarm to choose from.

- In the Main Menu, choose Service > External I/O > Output Relay Settings > Select relay 1-10 > **Instrument State**.

```
CHOOSE SIGNAL TYPE:
>ALARMS
 NON-ALARM




 CTRST SSET  INSTS  STAT
```

Alarms

The Alarms Status Items screen allows the user to select the alarm status for the selected relay output. The selected item is shown by “<--” after it.

- In the Main Menu, choose Service > External I/O > Output Relay Settings > Select relay 1-10 > Instrument State > **Alarms**.

Note The I/O BD STATUS alarm is only present if the I/O expansion board is installed. ▲

```
ALARM STATUS ITEMS:
>NONE                 <--
 GEN ALARM
 MB STATUS
 MIB STATUS
 I/O BOARD STATUS

 CTRST SSET   INSTS   STAT
```

Non-Alarm

The Non-Alarm status screen allows the user to select the non-alarm status for the selected relay output. The selected item is shown by "<--" after i

- In the Main Menu, choose Service > External I/O > Output Relay Settings > Select relay 1-10 > Instrument State > **Non-Alarm**.

```
NON ALARM STATUS ITEMS:
>NONE
 LOCAL/REMOTE
 SERVICE


 CTRST SSET   INSTS   STAT
```

Digital Input Settings

The Digital Input Settings menu displays a list of the 16 digital inputs available, and allows the user to select the instrument parameter or logic state to change for the relay selected. The actual use of these inputs will vary based on the application.

Note The digital inputs must be asserted for at least one second for the action to be activated. ▲

Note Not all of the I/O available in the instrument are brought out on the supplied terminal board, if more I/O is desired, an alternative means of connection is required. ▲

- In the Main Menu, choose Service > External I/O > **Digital Input Settings**.

```
DIGITAL INPUT SETTINGS:
>1   NOP              STOP
 2   NOP             START
 3   NOP   TRIGGER SAMPLE
 4   NOP    AOUTS TO ZERO
 5   NOP      AOUTS TO FS
 CTRST SSET  INSTS  STAT
 16   NOP     EXT ALARM 1
```

Logic State

The Logic State screen is used to change the I/O relay to either normally open or normally closed. The default state is open, which indicates that a relay connected between the digital input pin and ground is normally open and closes to trigger the digital input action. If nothing is connected to the digital input pin, the state should be left at open to prevent the action from being triggered.

- In the Main Menu, choose Service > External I/O > Digital Input Settings > *Select relay (1-16)* > **Press ↵ to toggle and set the logic state open or closed**.

```
DIGITAL INPUT SETUP:
>LOGIC STATE          OPEN
 INSTRUMENT ACTION



 CTRST SSET  INSTS  STAT
```

Instrument Action

The Instrument Action screen allows the user to select the instrument state that is tied to the selected digital input.

- In the Main Menu, choose Service > External I/O > Digital Input Settings > *Select relay (1-16)* > **Instrument Action**.

```
CHOOSE ACTION:
>NONE                  <--
 STOP
 START
 TRIGGER SAMPLE
 AOUTS TO ZERO
 CTRST SSET  INSTS  STAT
 AOUTS TO FS
 EXT ALARM 1
 EXT ALARM 2
 EXT ALARM 3
```

Analog Output Configuration (Select Channel)

The Analog Output Configuration menu displays a list of the analog output channels available for configuration. Channel choices include all voltage channels, all current channels, individual voltage channels 1-6, and individual current channels 1-6 (if the I/O expansion board option is installed). Configuration choices include selecting range, setting minimum/maximum values, and choosing signal to output. The Allow Over/Under Range item scales the output to allow the operator to detect signals that have gone outside the normal range.

- In the Main Menu, choose Service > External I/O > **Analog Output Configuration**.

```
OUTPUT CHANNELS:
>ALLOW OVER/UNDER RANGE
 ALL VOLTAGE CHANNELS
 ALL CURRENT CHANNELS
 VOLTAGE CHANNEL 1
 VOLTAGE CHANNEL 2          ⬇

 CTRST SSET  INSTS  STAT

 VOLTAGE CHANNEL 6
 CURRENT CHANNEL 1-6
```

Allow Over/Under Range

The Allow Over/Under Range screen is used to select whether or not the analog outputs are allowed to exceed the maximum selected value of 100 mV, 1 V, 5 V, 10 V, or 20 mA or the minimum selected value of 0 V, 0 mA, or 4 mA. By default this parameter is set to on, and 5% over and under range is allowed for all analog output channels.

- In the Main Menu, choose Service > External I/O > Analog Output Configuration > **Allow Over/Under Range**.

```
ALLOW OVER/UNDER RANGE:
 CURRENTLY:           ON
    SET TO:          OFF  ?

            ↵ TOGGLE VALUE

 CTRST SSET  INSTS  STAT
```

Analog Output Configuration (Select Action)

The Analog Output Configuration menu displays a list of the analog output configuration choices from which the user selects the parameter to adjust for the selected output channel. Configuration choices include selecting the range, setting minimum/maximum values, and choosing the signal to output.

- In the Main Menu, choose Service > External I/O > Analog Output Configuration > **All Voltage Channels, All Current Channels, Voltage Channel 1–6 or Current Channel 1–6**.

```
ANALOG OUTPUT CONFIG:
>SELECT RANGE
 SET MINIMUM VALUE
 SET MAXIMUM VALUE
 CHOOSE SIGNAL TO OUTPUT


 CTRST SSET  INSTS  STAT
```

Select Range

The Select Range screen is used to select the hardware range for the selected analog voltage output channel. Possible ranges for the voltage outputs are: 0-100 mV, 0-1, 0-5, and 0-10 V. Possible ranges for the current outputs are: 0-20 mA and 4-20 mA.

- In the Main Menu, choose Service > External I/O > Analog Output Configuration > *select channel* > **Select Range**.

```
SELECT OUTPUT RANGE:
 SELECTED OUTPUT:    V ALL
 CURRENTLY:        0-10V
    SET TO:       0-100mV ?

 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Minimum and Maximum Value

The Minimum Value screen is used to edit the zero (0) to full-scale (100) value in percentages for the selected analog output channel. See Table 9–9 for a list of choices. The Minimum and Maximum Value screens function the same way.

- In the Main Menu, choose Service > External I/O > Analog Output Configuration > > *select channel* > > **Set Minimum Value** or **Set Maximum Value**.

```
MINIMUM OUTPUT PERCENT:
 SELECTED OUTPUT:     V1
 CURRENTLY:          N/A %
    SET TO:      0000.0 % ?

 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Table 9–9. Analog Output Zero and Full Scale Values

Output	Zero % Value	Full Scale 100 % Value
Flow Volume	0 L/min	20 L/min
Flow2 Volume	0 L/min	5 L/min
Flow Total	0 L/min	20 L/min - 2000*i* 25 L/min - 2000*i*-D
Flow COV	0%	5%
Flow2 COV		
Volume	0 m^3	24 m^3
Volume2		
Ambient Pressure	500 mmHg	800 mmHg
Ambient Pressure Average		
Filter Pressure	0 mmHg	800 mmHg
Filter2 Pressure		
Filter Pressure Average		
Filter2 Pressure Average		
Ambient Temperature	-60 °C	60 °C
Filter Temperature		
Filter Compartment Temperature		
Electronics Compartment Temperature	-60 °C	80 °C
Temperature Change	0 °C	10 °C
Max. Temperature Change		
Ambient RH	0%	100%
Wind Speed	0 km/hr	180 km/hr
Wind Speed Average		
Wind Direction	0°	360°
Wind Direction Average		

Wind Velocity	0	180 km/hr
Wind Velocity Average		
Everything Else	0 units	100 units

Choose Signal to Output

The Choose Signal to Output screen displays a submenu list of the analog output signal group choices. Group choices include Measurements, Other Measurements, and Analog Inputs. If the I/O expansion board is not present, Analog Inputs will not be available. This allows the user to select the output signal to the selected output channel. See Table 9–10 for a list of items for each signal group choice.

- In the Main Menu, choose Service > External I/O > Analog Output Configuration > *Select Channel* > Choose Signal To Output > ***Choose a signal type***.

```
CHOOSE SIGNAL TYPE:
>CONCENTRATIONS
 OTHER MEASUREMENTS
 ANALOG INPUTS


 CTRST SSET  INSTS  STAT
```

```
CHOOSE SIGNAL -    CONC
 SELECTED OUTPUT:    V1
 CURRENTLY: PM
    SET TO: NONE        ?

 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Table 9–10. Signal Types Group Choices

Measurements	Other Measurements	Analog Inputs
None	None	None
Ambient Temp	Flow Vol	Analog IN 1
Filter Temp	Flow2 Vol	Analog IN 2
Comprt Temp	Flow Total	Analog IN 3
Elect Temp	Flow COV	Analog IN 4
Temp Dlt	Flow2 COV	Analog IN 5
Temp Dlt Max	Volume	Analog IN 6

Measurements	Other Measurements	Analog Inputs
Relative Hum	Volume2	Analog IN 7
Wind Speed	Ambient Pres	Analog IN 8
Wind Dir	Filter Pres	
Wind Speed Avg	Filter2 Pres	
Wind Vel	Amb Pres Avg	
Wind Vel Avg	Filt Pres Avg	
Wind Dir Avg	Filt2 Prs Avg	

Analog Input Configuration

The Analog Input Configuration menu displays a list of the 8 analog input channels available for configuration. This screen is only displayed if the I/O expansion board option is installed. Configuration includes entering descriptor, units, decimal places, and choice of 2-10 table points, and corresponding number of points selected.

- In the Main Menu, choose Service > External I/O > **Analog Input Configuration**.

```
ANALOG INPUT CONFIG:
>CHANNEL 1            IN1
 CHANNEL 2            IN2
 CHANNEL 3            IN3
 CHANNEL 4            IN4
 CHANNEL 5            IN5↓

 CTRST SSET  INSTS  STAT
 CHANNEL 8            IN8
```

```
ANALOG INPUT 01 CONFIG:
>DESCRIPTOR           IN1
 UNITS                  V
 DECIMAL PLACES         2
 TABLE POINTS           2
 POINT 1                ↓

 CTRST SSET  INSTS  STAT
 POINT 2
```

Descriptor

The Descriptor screen allows the user to enter the descriptor for the selected analog input channel. The descriptor is used in datalogging and streaming data to report what data is being sent out. The descriptor may be from 1 to 3 characters in length, and defaults to IN1to IN8 (user input channel number).

- In the Main Menu, choose Service > External I/O > Analog Input Configuration > *select channel (1-8)* > **Descriptor**.

```
ANALOG INPUT DESCRIPTOR:
 CURRENTLY: IN1
            IN1
     ABCDEFGHIJKLMN  BKSP
     OPQRSTUVWXYZ    PAGE
     0123456789 ./-  SAVE

 CTRST SSET  INSTS  STAT
```

Units

The Units screen allows the user to enter the units for the selected analog input channel. The units are displayed on the diagnostic screen and in datalogging and streaming data. The units may be from 1 to 3 characters in length, and defaults to V (volts).

- In the Main Menu, choose Service > External I/O > Analog Input Configuration > *select channel (1-8)* > **Units**.

```
ANALOG INPUT UNITS:
 CURRENTLY: V
            V
     ABCDEFGHIJKLMN  BKSP
     OPQRSTUVWXYZ    PAGE
     0123456789 ./-  SAVE

 CTRST SSET  INSTS  STAT
```

Decimal Places

The Decimal Places screen allows the user to select how many digits are displayed to the right of the decimal, from 0 to 6, with a default of 2.

- In the Main Menu, choose Service > External I/O > Analog Input Configuration > *select channel (1-8)* > **Decimal Places**.

```
DECIMAL PLACES:
 CURRENTLY:          2
    SET TO:          3 ?

           ↑↓ INC/DEC
            ↵ SAVE VALUE

 CTRST SSET  INSTS  STAT
```

Number of Table Points

The Number of Table Points screen allows the user to select how many points are used in the analog input conversion table for the selected channel. The instrument uses linear interpolation between the points in this table to determine what the reading value is, based on the analog input voltage. Each point in the table consists of an analog input voltage value (0-10 V) and a corresponding reading value. Only two points are necessary for linear inputs, however, a larger number of points may be used to approximate non-linear inputs. The points range from 2 to 10, with a default of 2.

- In the Main Menu, choose Service > External I/O > Analog Input Configuration > *select channel (1-8)* > **Table Points**.

```
NUMBER OF TABLE POINTS:
 CURRENTLY:           2
    SET TO:          10 ?

          ↑↓ INC/DEC
           ↵ SAVE VALUE

 CTRST SSET  INSTS  STAT
```

Table Point

The Table Point submenu allows the user to set up an individual table point.

- In the Main Menu, choose Service > External I/O > Analog Input Configuration > *select channel (1-8)* > **Point (1-2)**.

```
TABLE POINT 01 CONFIG:
>VOLTS                0.00
 USER VALUE           0.00



 CTRST SSET  INSTS  STAT
```

Volts

The Volts screen allows the user to set the input voltage for the selected table point in the conversion table, from 0.00 to 10. The default table is a two-point table with point 1: 0.00 V = 000.0 U and point 2: 10.00 V = 10.0 U, where U is the previously entered unit of measure.

- In the Main Menu, choose Service > External I/O > Analog Input Configuration > *select channel* > *select point* > **Volts**.

```
TABLE POINT 01 VOLTS:
 CURRENTLY:         0.00
    SET TO:        00.00
          ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

User Value

The User Value screen allows the user to set the output value for the corresponding input voltage for the selected table point in the conversion table, from -9999999 to 99999999. The default table is a two-point table with point 1: 0.00 V = 000.0 U and point 2: 10.00 V = 10.0 U, where U is the previously entered unit of measure.

In the Main Menu, choose Service > External I/O > Analog Input Configuration > *select channel* > *select point* > **User Value**.

```
TABLE POINT 01 USER VAL:
 CURRENTLY:         0.00
    SET TO:      00000.00
          ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Set Serial Number

The Set Serial Number screen is used to set or reset the serial number.

- In the Main Menu, choose Service > **Set Serial Number**.

```
SET SERAIL NUMBER:
 CURRENTLY:     00000000
    SET TO:      00000.00
          ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE    ↵ SAVE

 CTRST SSET  INSTS  STAT
```

Options Menu

The Options screen is used to enable/disable the I/O board presence in the instrument.

- In the Main Menu, choose Service > **Options**.

```
OPTIONS:
>ENABLE I/O BOARD      YES



 CTRST SSET  INSTS  STAT
```

Enable I/O Board

When an I/O expansion board is removed from the instrument, the Enable I/O Board menu item should be set to "No" to prevent an I/O board alarm from being triggered.

When the instrument includes an I/O board, the Enable I/O Board menu item should be set to Yes so that an alarm will be generated if the board fails.

At the Options menu, scroll to Enable I/O Board and press ↵ to toggle the function to Yes/No as appropriate.

Display Pixel Test

The Display Pixel Test is used to test the LCD display. The display pixel test screen is visible only when the instrument is in Service mode. For more information on the Service mode, see "Service Mode" earlier in the chapter.

In the Main Menu, choose Service > **Display Pixel Test**.

```
DISPLAY PIXEL TEST:
 DURING TEST PRESS   OR →
 TO EXIT, ← TO TOGGLE

       ↵ BEGIN TEST
         GO BACK TO MENU
 CTRST SSET  INSTS  STAT
```

Service Mode

The Service Mode screen is used to turn the Service mode On and Off.

- In the Main Menu, choose **Service mode,** and press ↵ to toggle the Service mode On and Off.

```
SERVICE MODE:
  CURRENTLY:         OFF
     SET TO:          ON ?

            ↵ TOGGLE VALUE

 CTRST SSET  INSTS  STAT
```

Diagnostics

The Diagnostics menu provides access to diagnostic information and functions. This menu is useful when troubleshooting the instrument. The analog input readings and analog input voltages are displayed only if the optional I/O expansion board is installed.

- In the Main Menu, choose **Diagnostics**.

```
DIAGNOSTICS:
>PROGRAM VERSIONS
 VOLTAGES
 ANALOG INPUT READINGS
 ANALOG INPUT VOLTAGES
 DIGITAL INPUTS                ↓

 CTRST SSET   INSTS   STAT

 RELAY STATES
 TEST ANALOG OUTPUTS
 CONTACT INFORMATION
```

Program Versions

The Program Versions screen (read only) shows the version numbers of the programs installed. Prior to contacting the factory with any questions regarding the instrument, please note the product model name and the program version numbers.

- In the Main Menu, choose Diagnostics > **Program Versions**.

```
PROGRAM VERSIONS:
    PRODUCT: MODEL   2000i
    VERSION:  00.06.73.087
   FIRMWARE:     11.09.123


 CTRST SSET   INSTS   STAT
```

Voltages

The Voltages menu displays the current diagnostic voltage readings. This screen enables the power supply to be quickly read for low or fluctuating voltages without having to use a voltage meter. The I/O Board item is displayed only if the optional I/O expansion board is installed.

- In the Main Menu, choose Diagnostics > **Voltages**.

```
VOLTAGES:
>MOTHERBOARD
 INTERFACE BOARD
 I/O BOARD



 CTRST SSET  INSTS  STAT
```

Motherboard Voltages

The Motherboard Voltages screen (read only) is used to display the voltage readings on the motherboard.

- In the Main Menu, choose Diagnostics > Voltages > **Motherboard**.

```
MOTHERBOARD VOLTAGES:
   3.3 SUPPLY        3.3 V
   5.0 SUPPLY        5.1 V
  15.0 SUPPLY       15.2 V
  24.0 SUPPLY       24.1 V
  -3.3 SUPPLY       -3.3 V

 CTRST SSET  INSTS  STAT
```

Interface Board Voltages

The Interface Board Voltages screen (read only) is used to display the voltage readings on the measurement interface board.

- In the Main Menu, choose Diagnostics > Voltages > **Interface Board**.

```
INTERFACE BOARD VOLTAGES:
>  3.3 SUPPLY          3.4
   5.0 SUPPLY          5.1
  15.0 SUPPLY         15.2
  24.0 SUPPLY         24.2


 CTRST SSET  INSTS  STAT
```

I/O Board Voltages

The I/O Board Voltages screen (read only) is used to display the voltage readings on the I/O expansion board. This menu is displayed only if the optional I/O expansion board is installed.

- In the Main Menu, choose Diagnostics > Voltages > **I/O Board**.

```
I/O BOARD VOLTAGES:
   3.3 SUPPLY          3.3 V
   5.0 SUPPLY          5.0 V
  24.0 SUPPLY         24.0 V
  -3.3 SUPPLY         -3.3 V

 CTRST SSET  INSTS  STAT
```

Analog Input Readings

The Analog Input Readings screen (read only) displays the eight user-scaled analog input readings (if the I/O expansion board option is installed).

- In the Main Menu, choose Diagnostics > **Analog Input Readings**.

```
ANALOG INPUT READINGS:
>IN1               -0.57 V
 IN2               -0.57 V
 IN3               -0.57 V
 IN4               -0.57 V
 IN5               -0.57 V   ↓

 CTRST SSET  INSTS  STAT
```

Analog Input Voltages

The Analog Input Voltages screen (read only) displays the eight raw analog input voltage readings (if the I/O expansion board option is installed).

- In the Main Menu, choose Diagnostics > **Analog Input Voltages**.

```
ANALOG INPUT VOLTAGES:
>ANALOG IN 1        6.24 V
 ANALOG IN 2        4.28 V
 ANALOG IN 3        0.00 V
 ANALOG IN 4        0.00 V
 ANALOG IN 5        0.00 V↓

 CTRST SSET  INSTS  STAT

 ANALOG IN 8        0.00 V
```

Digital Inputs

The Digital Inputs screen (read only) displays the state of the 16 digital inputs. If nothing is connected to an input, the internal electronics will pull the voltage up to high and the input will read (1). If a device is connected to an input, the user configures whether the relay is normally open or normally closed. This will dictate whether the input is brought to high (1) or to ground (0) to call for an action.

- In the Main Menu, choose Diagnostics > **Digital Inputs**.

```
DIGITAL INPUTS:
>INPUT 1                1
 INPUT 2                1
 INPUT 3                1
 INPUT 4                1
 INPUT 5                1↓

 CTRST SSET  INSTS  STAT
```

```
 INPUT 16               1
```

Relay States

The Relay States screen displays the state of the ten digital outputs and eight solenoid outputs, and allows toggling of the state to either On (1) or Off (0). The relays are restored to their original states upon exiting this screen.

- In the Main Menu, choose Diagnostics > **Relay States**.

  Press ↵ to toggle the relay state open and closed.

```
RELAY STATE:
>OUTPUT     1           1
 OUTPUT     2           0
 OUTPUT     3           0
 OUTPUT     4           1
 OUTPUT     5           0↓

 CTRST SSET  INSTS  STAT
```

```
 OUTPUT    10           0
```

Test Analog Outputs

The Test Analog Outputs menu is used to set each of the analog output channels to zero or full scale. Channel choices include all analog outputs, six voltage channels, and six current channels (if the I/O expansion board option is installed).

- In the Main Menu, choose Diagnostics > **Test Analog Outputs**.

```
TEST ANALOG OUTPUTS:
>ALL
 VOLTAGE CHANNEL 1
 VOLTAGE CHANNEL 2
 VOLTAGE CHANNEL 3
 VOLTAGE CHANNEL 4       ↓

 CTRST SSET  INSTS  STAT
```

```
 VOLTAGE CHANNEL 6
 CURRENT CHANNEL 1-6
```

Set Analog Outputs

The Set Analog Outputs screen contains three choices: Set to full-scale, set to zero, or reset to normal. Full-scale sets the analog outputs to the full-scale voltage, zero sets the analog outputs to 0 volts, and reset returns the output to normal operation. The analog outputs are returned to normal operation upon exiting this screen. The following example shows the screen when all analog outputs are set to "normal" operating mode.

- In the Main Menu, choose Diagnostics > Test Analog Outputs > **ALL, Voltage Channel 1–6**, or **Current Channel 1–6**.

```
SET ANALOG OUTPUTS:
 SETTING:             ALL
 OUTPUT SET TO:     NORMAL
 ⬆ SET TO FULL SCALE
 ⬇ SET TO ZERO
 ⬅ RESET TO NORMAL

 CTRST SSET  INSTS  STAT
```

Contact Information

The Contact Information screen displays the customer service information.

- In the Main Menu, choose Diagnostics > **Contact Information**.

```
CONTACT INFORMATION:

 CALL CENTER: 508-520-0430
 WEB        WWW.THERMO.COM



 CTRST SSET  INSTS  STAT
```

Chapter 10

Preventive Maintenance

The Technical Support Department at Thermo Fisher Scientific can be consulted in the event of problems. In any correspondence with the factory, please note both the serial number and program number of the instrument.

This chapter provides the following troubleshooting and service support information:

Note The routine maintenance consists of the following procedures performed at the indicated intervals. ▲

Safety Precautions

Read the safety precautions in the "About This Manual" section at the front of this manual before performing any actions listed in this chapter.

Routine Maintenance Items

The routine maintenance of the Partisol Samplers consists of the following procedures performed at the indicated intervals (U.S. EPA 2.12 *Quality Handbook*, Section 9):

Filter Cassettes - Inspect filter cassettes for contamination or damage after every use. Discard any damaged cassettes. Wipe with a clean dry cloth as required. Additional filter cassettes can be ordered from Thermo Fisher Scientific (59-005923-0001). Do not expose the filter cassettes to temperatures above 50 °C.

Upper and Lower Cassette Seals - Inspect the seals that rest against the filter cassette every time a filter is exchanged. Wipe the seals with a clean dry cloth as required. Inspect the seals once a year for drying and cracking, and replace them if necessary (22-002182). (22-005958 (top seal) and 22-005957 (bottom seal)).

External Leak Check - Perform an external leak check after every 5 days of inlet usage.

Internal Leak Check - Perform an internal leak check after every 4 weeks or every month of inlet usage.

PM-10 Inlet - Clean the PM_{10} inlet after every 30 days of use.The inlet must be cleaned when the unit is not sampling.

In-line Filter - Exchange the large in-line filter in the Sampler every six months of operation (32-002643). Turn off the Sampler prior to replacing the filter.

Rain hoods and Air Screens - Clean the air screens located under the Sampler's rain hoods every 6 months, or as necessary.

Pump - The pump has a lifetime of approximately 12-18 months. If the pump's performance deteriorates, it should be rebuilt using the Pump Rebuild Kit (59-012071) (one kit is required for each rebuild), or replaced with a new pump.

Partisol 2000*i* Maintenance Items

In addition to routine maintenance, see the following for Partisol 2000*i*:

$PM_{2.5}$ VSCC Cyclone - Clean the VSCC every 30 days of sampling. The cyclone must be cleaned when the unit is not sampling.

WINS $PM_{2.5}$ Impactor - Clean or change out the impactor well of the WINS $PM_{2.5}$ impactor after every five sampling days. The impactor must be cleaned when the unit is not sampling.

Partisol 2000*i*-D Maintenance Items

In addition to routine maintenance, see the following for Partisol 2000*i*-D:

PM_{10} Virtual Impactor - Clean the virtual impactor every 30 days to prevent contamination and to maintain proper performance. The virtual impactor must be cleaned when the unit is not sampling.

Inlet Maintenance

Thermo Fisher Scientific recommends that users clean their size-selective inlets every 14 days of sampling to prevent contamination and to maintain proper performance. This includes the PM_{10} inlet, the VSCC or other Cyclone, and the WINS impactor. Remove all inlets from the unit, clean and check O-rings for signs of damage or wear. Full maintenance procedures for each type of device are provided in this chapter.

Cleaning the PM_{10} Inlet

This section describes the procedures used to clean the PM_{10} inlet (57-000596).

Supplies and tools recommended for maintenance:

Ammonia-based, general-purpose cleaner

Cotton swabs

Small soft-bristle brush

Paper towels

Distilled water

Silicone-based stopcock grease

Small screwdriver

Small crescent wrench

Pocket knife

PM_{10} Inlet Removal and Disassembly

Use the following procedure to remove and dissemble the PM_{10} inlet.

1. To remove the inlet, lift the entire inlet assembly upward off the 1-1/4-inch O.D. sample tube.

2. Disassemble the upper and lower inlet halves by unscrewing counterclockwise the top acceleration assembly from the lower collector assembly (Figure 10–1).

Top Acceleration Assembly Cleaning and Maintenance

Use the following procedure to clean and maintain the top accelerator assembly.

1. Mark the top plate deflector cone and lower plate with a pencil scribe to facilitate proper orientation when reassembling the assembly after cleaning and maintenance.

2. Using a Phillips-blade screwdriver, remove the four pan head screws from the top of the top plate. Lift the top plate off the four, threaded, spacer standoffs and set aside.

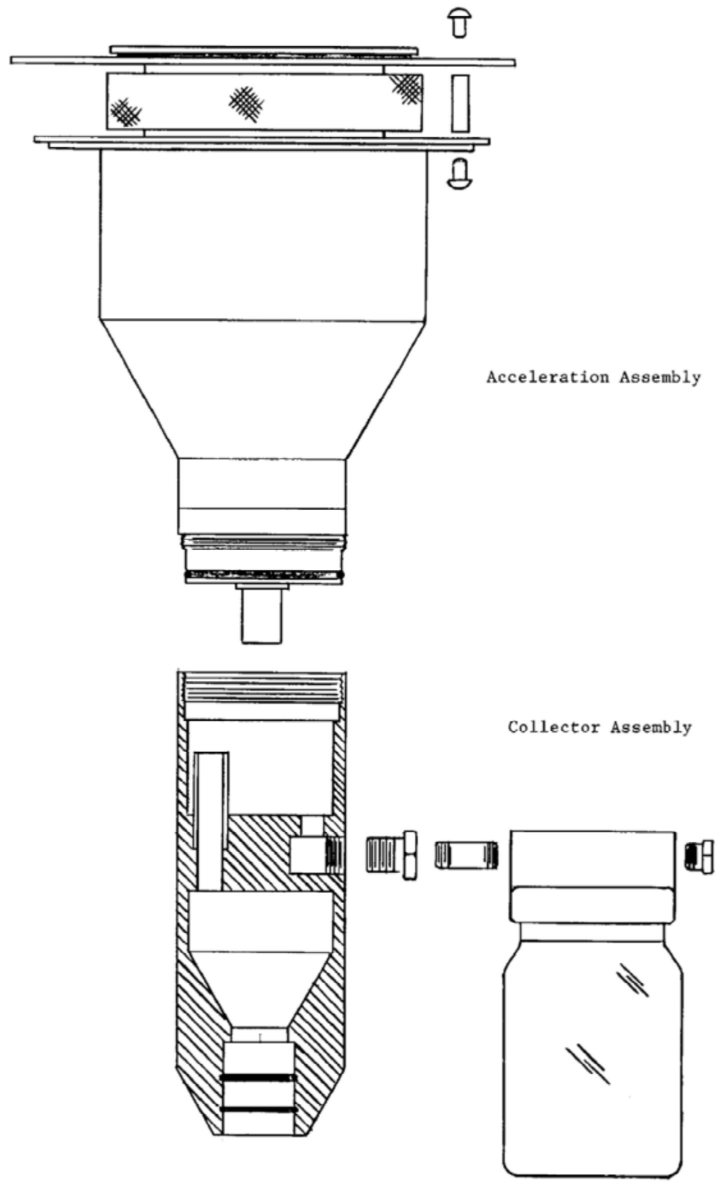


Figure 10–1. PM_{10} Inlet Showing Traditional Inlet (EPA Inlet is Similar)

3. Inspect the insect screen for contamination or fraying. Clean the screen by lifting it off the lower plate rain deflector and brushing or rinsing it with water until it is clean. Dry and reinstall.

4. Using a general-purpose cleaner with a paper towel, clean the top plate deflector cone and internal wall surface of the acceleration assembly.

Note Be sure that after cleaning the assembly the acceleration nozzle is clean. If not, use a cotton swab and cleaner to remove any contamination. ▲

5. Inspect the large diameter, impactor nozzle O-ring for damage or wear. Replace it, if necessary. If the O-ring is still in good condition, apply a thin film of silicone grease to the O-ring. Also, apply a light coating of silicone grease to the aluminum threads of the acceleration assembly.

6. After reinstalling the bug screen, align the top plate markings with the lower plate markings. The four holes in the top plate should align with the four spacer standoffs. Insert the top plate into the lower plate and tighten the four pan-head screws.

Lower Collector Assembly Cleaning and Maintenance

Use the following procedure to clean and maintain the lower collector assembly.

Note Most of the contamination in the inlet is usually found on the collector plate. ▲

1. Using a general-purpose cleaner with a paper towel, clean the collector assembly walls and three vent tubes. You may need to use a cotton swab to clean these vent tubes. Also, clean the bottom side of the collector assembly.

2. Using a cotton swab, clean the weep hole in the collector plate where the moisture runs out to the moisture trap. Remove the rain jar and clean it. Inspect the rain jar's brass nipple fitting to ensure that it is secure and free from blockages. When reinstalling the rain jar, place a light coating of silicone grease on the gasket inside the cap of the rain jar. This will ensure a leak-free fit.

3. Inspect the two inlet-to-inlet, tube sealing O-rings for damage or wear. Replace, if necessary. Apply a light coating of silicone grease to these O-rings to ensure that a seal is made when they are reinstalled on the 1-1/4-inch OD sample tube.

4. Clean the lower collector assembly's threads to ensure a tight seal when the two halves are reassembled.

PM_{10} Inlet Reassembly and Reinstallation

Use the following procedure to reassemble and reinstall the PM_{10} Inlet.

1. Reassemble the top and bottom inlet assemblies until the threads tighten. Hand-tighten only.

2. Replace the inlet on the 1-1/4-inch OD sample tube. Take care not to damage the internal O-rings.

Cyclone Maintenance

The use of "Cyclone" in this section refers to the three types of Cyclones available for the Partisol 2000*i* Sampler.

- $PM_{2.5}$ VSCC
- $PM_{2.5}$ SCC
- PM_1 SCC

Only the $PM_{2.5}$ VSCC is approved for use in a Partisol 2000*i* for official U.S. EPA $PM_{2.5}$ sampling. Other Cyclones may be approved for $PM_{2.5}$ (or PM_1) sampling by other agencies.

To use the Cyclone fractionator in EPA-designated reference and equipment Samplers, you must clean the fractionator every 30 days of operation. If you will be sampling at different cycles, you can lengthen the interval between cleanings proportionately. For example, if you will be sampling on a 1-in-6 day sampling cycle, you must clean the Cyclone fractionator within each 180-day period (as opposed to the 30-day period for everyday sampling sites). Refer to Figure 10–2 for cyclone components.

Note SCC maintenance and assembly is similar to the VSCC. These figures and instructions depict the $PM_{2.5}$ VSCC cyclone. ▲

Figure 10–2. Main Components of the Cyclone Fractionator

Cyclone maintenance and performance verification can be performed while in the Stop, Wait or Sampling modes. If the Sampler is in the Stop mode, press and select Audit and Calibration > Audit Mode, and press to change to the Audit mode.

If the Sampler is in the Wait or Sampling modes, press to enter Audit mode. The Sampler will display the Audit Confirmation screen. Press to enter Audit mode.

Note The Audit Confirmation screen also will give you the option to select Stop or Resume if currently in wait or sample mode, in addition to Audit. ▲

IMPORTANT If you are performing an audit from the Sampling mode and you choose Stop in the Audit Confirmation screen, the Sampler will not resume sampling (after your audit procedures are finished) at the set points that you previously entered, but will remain in Stop mode until is pressed. The next programmed sample will be performed. ▲

Cyclone Inlet Cleaning

Use the following procedure to clean the Cyclone fractionator (Figure 10–3). Always remove any sample filters from the samper prior to performing any maintenance.

1. Remove the cyclone from its installed position in the Sampler. The remove of the cyclone is described in the Sampler audit/verification section above.

2. Remove the Partisol 2000*i* Sampler adapter from the cyclone.

3. Unscrew the top cap and grit pot from the cyclone.

4. Wet a lint-free wipe with water and remove all visible deposits from the inside of the cyclone. You will most likely find the deposits at the bottom of the cone in the top cap, and on the inside of the grit cap.

5. Inspect all O-rings for shape and integrity. If necessary, replace the O-rings with others of the same size and material (Buna-N elastomer).

6. Lubricate the O-rings with a light silicone grease.

Note You must properly lubricate the transfer tube O-rings to facilitate future disassembly of the transfer tube from the fractionator. ▲

7. Install the grit pot and top cap onto the cyclone.

8. Install the transfer tube onto the cyclone.

9. Install the adapter on the cyclone and insert the cyclone into the Sampler.

10. Perform a system leak check.

11. If in the Audit mode, at the Main Menu, select Audit and Calibration > Audit Mode, and press ↵ to turn Off the Audit mode.

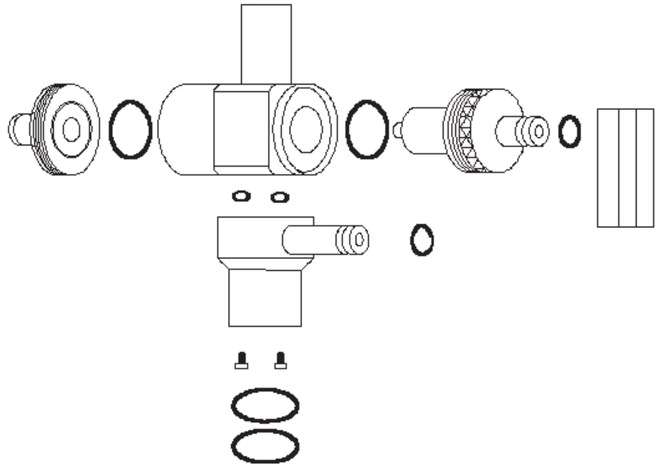


Figure 10–3. Cyclone Fractionator Components

WINS $PM_{2.5}$ Impactor Maintenance

If the Sampler is equipped with a WINS impactor for $PM_{2.5}$ sampling, use the following procedures to remove, clean, and reinstall the WINS $PM_{2.5}$ impactor. Always remove any sample filters from the samper prior to performing any maintenance.

WINS Impactor Removal

Use the following procedure to remove the WINS $PM_{2.5}$ impactor.

1. WINS impactor maintenance and performance verification can be performed while in the Stop, Wait or Sampling Modes. If the Sampler is in the Stop mode, press [■] and select Audit and Calibration > Audit Mode, and press [↵] to change to the Audit mode.

   If the Sampler is in the Wait or Sampling modes, press [▶] to enter the Audit mode. The Sampler will display the Audit Confirmation screen. Press [➔] to enter Audit mode.

Note The Audit Confirmation screen also will give you the option to select Stop or Resume if currently in wait or sample mode, in addition to Audit. ▲

IMPORTANT If you are performing an audit from the Sampling mode and you choose Stop in the Audit Confirmation screen, the Sampler will not resume sampling (after your audit procedures are finished). You will need to program the next sample period and will remain in Stop mode until [▶] is pressed. ▲

2. Remove the WINS Impactor from its installed position in the Sampler. The remove of the WINS Impactor is described in the Sampler audit/verification section above.

3. Separate the adapter from the WINS impactor (Figure 10–4).

Figure 10–4. Adapter and WINS Impactor

WINS Impactor Cleaning

Use the following procedure to clean the WINS impactor.

1. Unscrew the two halves of the WINS impactor to separate its top piece from its bottom section. This exposes the impactor assembly.

2. Remove the impactor assembly from the bottom section of the WINS impactor (Figure 10–5).

Figure 10–5. Upper and Lower Sections of the Impactor Assembly (on left and right sides of figure)

3. With a dry paper towel, wipe off the inside surfaces of the WINS impactor. A general-purpose cleaner can be used, if necessary.

4. Inspect all O-rings in the top and bottom sections of the WINS impactor for damage and replace them, if necessary. Apply a thin coating of O-ring lubricant onto the O-rings, if necessary.

5. Remove the top of the impactor assembly by lifting upward.

6. Remove any filters that may have been previously installed, and clean the top and bottom of the impactor assembly using a dry paper towel. A general-purpose cleaner can be used, if necessary.

7. Inspect the O-ring in the top section of the impactor assembly for damage and replace it, if necessary. Apply a thin coating of O-ring lubricant onto the O-ring, if necessary.

8. Place a new 37 mm borosilicate, glass-fiber filter (32-004294) onto the bottom of the impactor assembly.

9. Place 42 to 44 drops of impactor oil (59-004292) onto the filter (Figure 10–6).

Figure 10–6. Coating the 37 mm Glass Filter with Oil

10. Place the top of the impactor assembly onto the bottom section.

11. Place the impactor assembly into the bottom section of the WINS impactor.

12. Screw the top of the WINS impactor back onto the bottom section. Ensure that the WINS impactor remains in the upright orientation so that the oil in the impactor assembly does not spill.

13. Multiple WINS impactors can be prepared in this manner at one time and kept for later use.

WINS Impactor Reinstallation

Use the following procedure to reinstall the WINS Impactor:

1. Attach the adapter to the lower section of the WINS impactor.

2. Push the WINS impactor (with its adapter attached) upward into the WINS impactor mounting sleeve.

3. Pass the rollers of the filter exchange mechanism through the slots in the left-hand and right-hand guides.

4. Allow the filter exchange mechanism to open fully.

5. Insert the filter cassette carrier (with a filter cassette installed) into the filter platform by matching the slot and hole in the filter cassette carrier with the appropriate hardware.

6. Push the handle of the filter exchange mechanism toward the back to install the filter cassette.

7. Perform a system leak check.

8. If in the Audit mode, at the Main Menu, select Audit and Calibration > Audit Mode, and press ↵ to turn off the Audit mode.

Virtual Impactor Maintenance Partisol 2000*i*-D

Use the following procedures to remove, clean, and reinstall the virtual impactor that is used in the Partisol 2000*i*-D Sampler.

Virtual impactor maintenance and performance verification can be performed while in the Stop, Wait, or Sampling modes. If the Sampler is in the Stop Mode, press and select Audit and Calibration > Audit Mode, and press ↵ to change to the Audit mode.

If the Sampler is in the Wait or Sampling Modes, press to enter Audit mode. The unit then will display the Audit Confirmation screen. Press to enter Audit mode.

Note The Audit Confirmation screen also will give you the option to select Stop or Resume if currently in wait or sample mode, in addition to Audit. ▲

IMPORTANT If you are performing an audit from the Sampling mode and you choose Stop in the Audit Confirmation screen, the Sampler will not resume sampling (after your audit procedures are finished). You will need to program the next sample period and will remain in Stop mode until is pressed. ▲

Virtual Impactor Cleaning Partisol 2000*i*-D

Use the following procedure to clean and maintain the virtual impactor.

Tools/materials required:

Ammonia-based, general-purpose cleaner

O-ring grease

Phillips screwdriver

1. Open the two clips that hold main body of the virtual impactor to the nozzle housing (Figure 10–7 and Figure 10–8) and remove the main body (probe housing and attached bottom plate) from the Sampler.

2. Remove the three nuts that attach the nozzle housing to the top of the Sampler and remove the nozzle housing (Figure 10–7 and Figure 10–8).

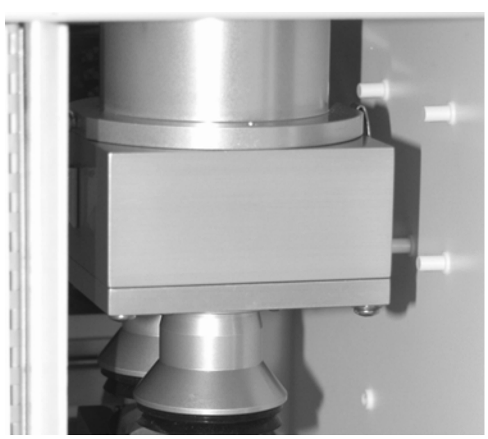


Figure 10–7. The Virtual Impactor Installed

3. Unscrew the four screws on each corner of the bottom section of the virtual impactor. Separate its probe housing from its base plate.

4. Use water and a mild detergent to wash the inside surfaces of the nozzle housing, probe housing and base plate. A general-purpose cleaner can be used, if necessary.

5. Inspect all O-rings in each section of the virtual impactor for damage and replace them, if necessary. Apply a thin coating of O-ring lubricant onto the O-rings, if necessary.

6. Reassemble the base plate and probe housing by replacing the four screws. Be sure to insert the tube in the bottom plate into the tube that protrudes from the bottom of the probe housing.

7. Install the nozzle housing into the top of the Sampler using the three nuts.

8. Install the main body of the virtual impactor into the nozzle housing using the two clips.

9. Perform a system leak check.

10. If in the Audit mode, at the Main Menu, select Audit and Calibration > Audit and press ↵ to turn Off the Audit mode.

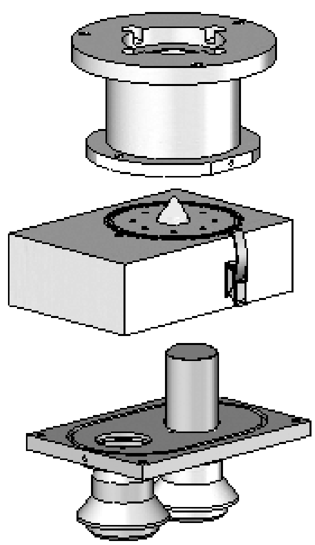


Figure 10–8. Drawing of Disassembled Virtual Impactor

V-Seals Cleaning and Replacement

The V-Seals in the Partisol 2000*i* and 2000*i*-D Samplers require periodic maintenance. The V-seals should be checked every four weeks and replaced as necessary. In addition, anytime there is a suspected leak in the system that can be attributed to the V-seals, they should be checked and replaced if necessary.

The V-seal cleaning and replacement procedures for the Partisol 2000*i* and 2000*i*-D are similar. The Partisol 2000*i* has one pair of V-seals in the filter tray and the Partisol 2000*i*-D has two pairs for V-seals. In addition, the 2000*i*-D has a V-seal in the inlet adapter.

1. Ensure the Sampler is not sampling and is in Stop mode.

2. Open the door of the Partisol Sampler.

3. Open the filter exchange mechanism by pulling on its handle (Figure 10–9 and Figure 10–10).

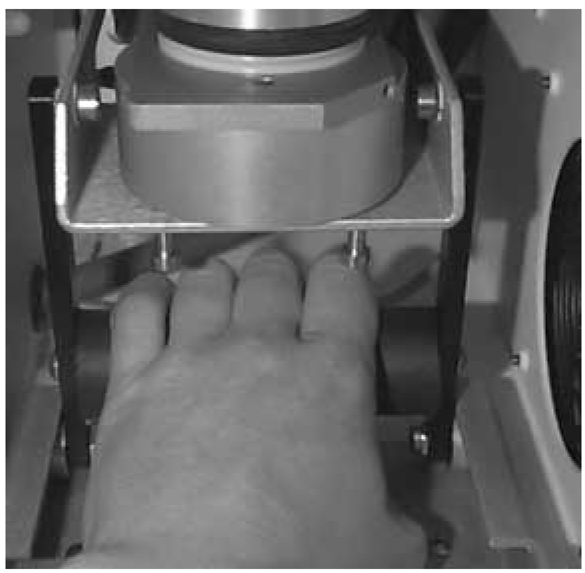


Figure 10–9. Grasping the Handle of the Filter Exchange Mechanism

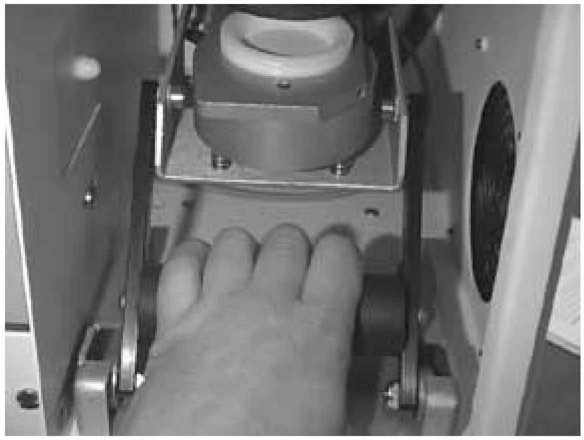


Figure 10–10. Pulling Backward on the Handle of the Filter Exchange Mechanism

4. Release the handle and allow it to drop down.

5. Remove the filter cassette carrier from the filter platform. If the sample has been interrupted for an audit, store the filter in the cassette carrier box until ready to resume sampling.

6. Push the filter exchange mechanism toward the back slightly, and lift the rollers through the slots in the left-hand and right-hand guides (Figure 10–11).

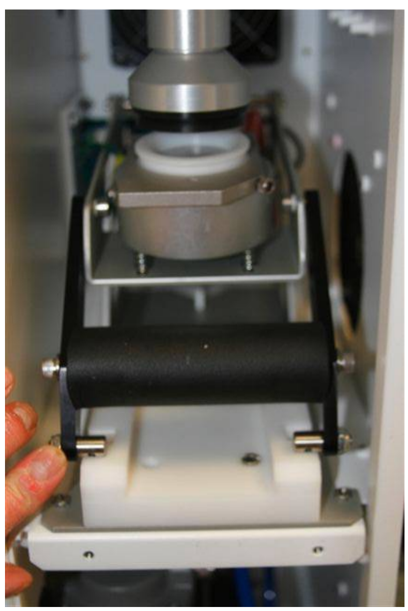


Figure 10–11. Lifting the Rollers through the Guide Slots

7. Allow the filter platform to settle downward.

8. If the Sampler is a Partisol 2000*i*, remove the VSCC, WINS impactor, or downtube, and adapter. If the Sampler is a Partisol 2000*i*-D, remove the virtual impactor.

9. Remove the seals from the adapter and filter tray and replace. The lower seals are replaced with PN 22-010318 and the upper seals are PN 22-005957. The upper seal is located on the adapter in 2000*i* and the virtual impactor in a 2000*i*-D (Figure 10–12 and Figure 10–13).

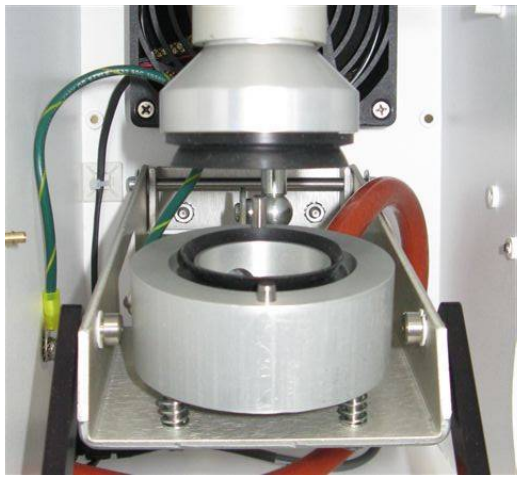


Figure 10–12. Upper and Lower V-Seals on Partisol 2000*i*

Figure 10–13. Upper and Lower V-Seals on Partisol 2000*i*-D

10. If the Sample is a Partisol 2000*i*-D, the following steps show how to access the V-seal on the inlet adapter. This V-seal is hidden by the virtual impactor, which will need to be removed prior to inspecting the v-seal. Follow the instructions in the previous section on cleaning the

vitual impactor to remove the virtual impactor to access the V-seal (Figure 10–14).

Figure 10–14. V-Seal on Inlet Adapter Tube on 2000*i*-D

In-Line Filters Replacement

The in-line filters (32-002643) are located in the lower section of the Sampler, behind the sample pump, and protect the Sampler's flow controllers from particulate matter in the flow controller lines. The 2000*i* contains one inline filter; the 2000*i*-D contains two inline filters.

Use the following procedure to exchange the particle trap filters.

1. Turn Off the Sampler.

2. Locate the in-line filters behind the sample pump.

3. Remove and replace the filters.

4. Turn on the Sampler and perform a system leak check.

Service Locations

For additional assistance, worldwide service is available from Thermo Fisher Scientific. Contact one of the phone numbers below for product support and technical information or visit us on the web at www.thermo.com/aqi.

Toll Free U.S. only 1-866-282-0430

U.S., Latin America, and Canada 1-508-520-0430

Europe +31 76 579 5555

China +86 10 8419 3588

Asia Pacific +91 22 27781102

Chapter 11
Troubleshooting

This chapter includes the following troubleshooting information designed to help identify Sampler problems:

Diagnostics

Diagnostic information that might be useful in troubleshooting hardware problems can be found in the Diagnostics menu.

The Diagnostics menu presents a series of information screens that are organized to show pressures, voltages, temperatures, and other information describing the Sampler's current state. Table 11–1 lists the Diagnostics menu items and describes their function. Refer to the "Diagnostics" on page 9-90 for detailed information about the Diagnostics menu.

Table 11–1. Diagnostic Menu Selections

Menu Item	Description
Program Versions	Shows the version numbers of the installed programs (read only).
Voltages	Displays the current diagnostic voltage readings (read only).
Analog Input Readings	Displays the eight user-scaled analog readings (if the I/O expansion board option is installed).
Analog Input Voltages	Displays the eight raw analog voltage readings (if the I/O expansion board option is installed).
Digital Inputs	Displays the state of the 16 digital inputs (read only).
Relay States	Displays the state of the ten digital outputs, eight solenoid outputs, and allows toggling of the state to either On (1) or Off (0).
Test Analog Outputs	Used to set each of the analog output channels to zero or full scale. Channel choices include all analog outputs, six voltage channels, and six current channels (if the I/O expansion board option is installed).
Contact Information	Displays telephone numbers of the customer service support centers.

System Status

The System Status menu provides access to system troubleshooting information including status codes and alarms. The Status Codes screen displays a description of the currently active status conditions. Refer to Table 9–5 on page 9-63 for a list of the status codes.

- In the Main Menu, choose System Status > **Status Codes**.

Alarms

When an alarm is detected, the status of that associated item will go from OK to FAIL. The Alarms menu displays a list of items that are monitored by the Sampler. Refer to "Alarms" on page 9-64 for additional alarms information.

- In the Main Menu, choose System Status > **Alarms**.

Troubleshooting Guide

This troubleshooting guide is designed to help isolate and identify instrument problems. Table 11–2 provides general troubleshooting information and indicates the checks that you should perform if you experience an instrument problem.

For additional service assistance, see "Service Locations" on page 11-22.

Table 11–2. Troubleshooting Guide

Malfunction	Possible Cause	Action
Does not start (The display does not illuminate, light on power switch does come On, and the pump motor is not running.)	No power or wrong power configuration	Check the line to confirm that power is available and that it matches the voltage and frequency configuration of the instrument.
	Main fuses blown or missing	Unplug the power cord, open the fuse drawer on the back panel, and check the fuses visually or with a multimeter. Replace fuses as necessary.
	Bad switch or wiring connection	Unplug the power cord, disconnect the switch and check operation with a multimeter. Replace switch as necessary.
Display does not come on - light on power switch does come On.	DC power supply failure	Check the green LED on the back edge of the power supply. If the LED is off, the power supply failed.
	Display failure	If possible, check instrument function through RS-232 or Ethernet.
		Reboot instrument.
	Ribbon cable disconnected	Check ribbon cable on side of display board.

Board-Level Connection Diagram

Figure 11–1 and Figure 11–2 can be used along with the connector pin descriptions in Table 11–3 through Table 11–6 to troubleshoot board-level faults.

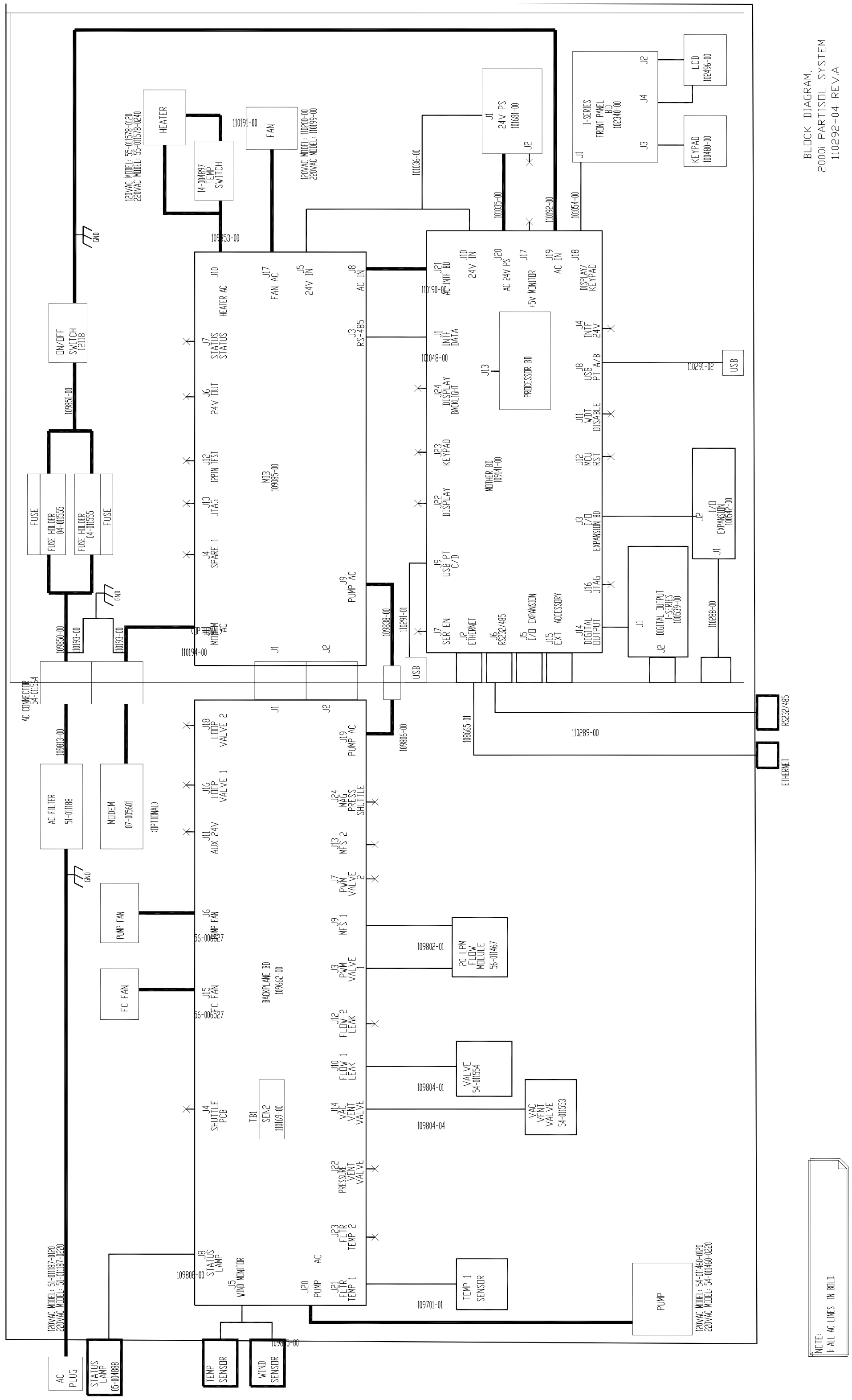


Figure 11–1. Board-Level Connection Diagram 2000*i*

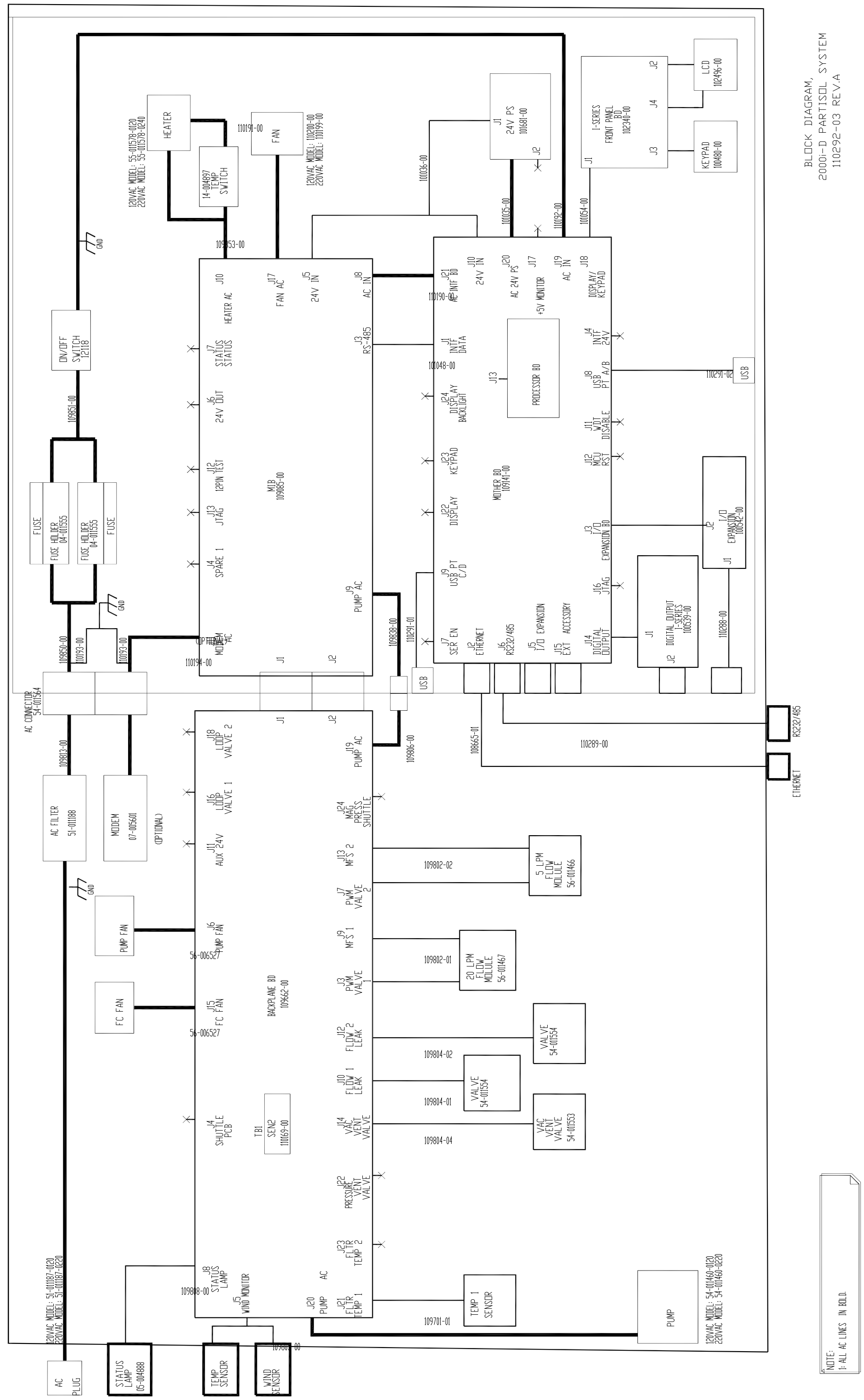


Figure 11–2. Board-Level Connection Diagram 2000*i*-D

Connector Pin Descriptions

The connector pin descriptions in Table 11–3 through Table 11–6 can be used along with the board-level connection diagrams to troubleshoot board-level faults.

Table 11–3. Motherboard Connector Pin Descriptions

Connector Label	Reference Designator	Pin	Signal Description
RS-485	J1	1	Ground
		2	RS485_P to Partisol Interface Board
		3	RS485_N to Partisol Interface Board
ETHERNET	J2	1	ETX1_P
		2	ETX1_N
		3	ERX1_P
		4	N.C.
		5	N.C.
		6	ERX1_N
		7	N.C.
		8	N.C.
I/O EXPANSION BOARD	J3	1	+15V
		2	+24V
		3	+24V
		4	GND
		5	GND
		6	GND
		7	RS485_P
		8	RS485_N
INTF 24V	J4	1	+24V
		2	GND
I/O EXPANSION CONNECTOR	J5	1	GNDC
		2	PFLT_NC
		3	GND
		4	DIGITAL_IN1
		5	DIGITAL_IN2

Connector Label	Reference Designator	Pin	Signal Description
		6	GND
		7	DIGITAL_IN5
		8	DIGITAL_IN7
		9	DIGITAL_IN8
		10	DIGITAL_IN9
		11	GND
		12	DIGITAL_IN13
		13	DIGITAL_IN15
		14	GND
		15	ANALOG_OUT1
		16	ANALOG_OUT2
		17	GNDA
		18	ANALOG_OUT5
		19	GNDA
		20	GNDA
		21	PFLT_COM
		22	PFLT_NO
		23	GNDA
		24	DIGITAL_IN3
		25	DIGITAL_IN4
		26	DIGITAL_IN6
		27	GNDA
		28	DIGITAL_IN9
		29	DIGITAL_IN11
		30	DIGITAL_IN12
		31	DIGITAL_IN14
		32	DIGITAL_IN16
		33	GNDA
		34	ANALOG_OUT2
		35	ANALOG_OUT4
		36	GNDA
		37	ANALOG_OUT6
USER RS-485/RS-232	J6	1	1A - N.C.

Connector Label	Reference Designator	Pin	Signal Description
		2	2A - RS485_IN_P / RX
		3	3A - RS485_OUT_N / TX
		4	4A - N.C.
		5	5A - GND
		6	6A - N.C.
		7	7A - RS485_OUT_P / RTS
		8	8A - RS485_IN_N / CTS
		9	9A - N.C.
		10	1B - N.C.
		11	2B - RS485_IN_P / RX
		12	3B - RS485_OUT_N / TX
		13	4B - N.C.
		14	5B - GND
		15	6B - N.C.
		16	7B - RS485_OUT_P / RTS
		17	8B - RS485_IN_N / CTS
		18	9B - N.C.
USB A&B	J8	1	VBUS_A
		2	VBUS_B
		3	USB_PORTA_N
		4	USB_PORTB_N
		5	USB_PORTA_P
		6	USB_PORTB_P
		7	GND
		8	GND
		9	GND
		10	GND
USB C&D	J9	1	VBUS_C
		2	VBUS_D
		3	USB_PORTC_N
		4	USB_PORTD_N
		5	USB_PORTC_P
		6	USB_PORTD_P
		7	GND

Connector Label	Reference Designator	Pin	Signal Description
		8	GND
		9	GND
		10	GND
24V IN	J10	1	+24
		2	GND
WATCH DOG DISABLE	J11	1	DISABLE
		2	GND
MCU RESET	J12	1	DISABLE
		2	GND
DIGITAL OUTPUT	J14	1	+15V
		2	+24V
		3	+24V
		4	GND
		5	GND
		6	GND
		7	RESET
		8	SPI_MISO
		9	SPI_MOSI
		10	SPI_CS2
		11	SPI_CLK
EXTERNAL ACCESSORY	J15	1	EXT_RS485_N
		2	EXT_RS485_P
		3	+5V 1/2A
		4	+5V 1/2A
		5	+5V 1/2A
		6	GND
		7	GND
		8	GND
		9	N.C.
		10	N.C.
		11	+24V1/2A
		12	+24V1/2A

Connector Label	Reference Designator	Pin	Signal Description
		13	+24V1/2A
		14	+24V1/2A
		15	+24V1/2A
JTAG	J16	1	TDO
		2	N.C.
		3	TDI
		4	N.C.
		5	TMS
		6	N.C.
		7	TCK
		7	N.C.
		9	GND
		10	N.C.
		11	N.C.
		12	N.C.
		13	N.C.
		14	N.C.
24V MONITOR	J17	1	+24V
		2	GND
LCD	J18	1	GND
		2	GND
		3	LCDOUT_CLK
		4	GND
		5	GND
		6	LCDOUT_LP
		7	LCDOUT_FLM
		7	LCDOUT4
		9	LCDOUT0
		10	LCDOUT5
		11	LCDOUT1
		12	LCDOUT6
		13	LCDOUT2
		14	LCDOUT7
		15	LCDOUT3

Connector Label	Reference Designator	Pin	Signal Description
		16	LCDBIAS
		17	+5V
		18	GND
		19	GND
		20	LCDOUT_ONOFF
		21	KEYPAD_ROW2
		22	KEYPAD_ROW1
		23	KEYPAD_ROW4
		24	KEYPAD_ROW3
		25	KEYPAD_COL2
		26	KEYPAD_COL1
		27	KEYPAD_COL4
		28	KEYPAD_COL3
		29	GND
		30	GND
		31	GND
		32	GND
		33	+24V
		34	+24V
AC IN	J19	1	NEUTRAL
		2	LIVE
		3	EARTH
AC 24V POWER SUPPLY	J20	1	NEUTRAL
		2	LIVE
		3	EARTH
AC INTF BOARD	J21	1	NEUTRAL
		2	LIVE
		3	EARTH
DISPLAY	J22	1	GND
		2	LCDOUT_CLK
		3	LCDOUT_LP
		4	LCDOUT_FLM
		5	GND

Connector Label	Reference Designator	Pin	Signal Description
		6	LCDOUT12
		7	LCDOUT13
		8	LCDOUT14
		9	LCDOUT15
		10	LCDOUT16
		11	LCDOUT17
		12	GND
		13	LCDOUT6
		14	LCDOUT7
		15	LCDOUT8
		16	LCDOUT9
		17	LCDOUT10
		18	LCDOUT11
		19	GND
		20	LCDOUT0
		21	LCDOUT1
		22	LCDOUT2
		23	LCDOUT3
		24	LCDOUT4
		25	LCDOUT5
		26	GND
		27	LCDOUT_ONOFF
		28	+3.3V
		29	+3.3V
		30	CONTRAST
KEYPAD	J23	1	KEYPAD_ROW1
		2	KEYPAD_ROW2
		3	KEYPAD_ROW3
		4	KEYPAD_ROW4
		5	KEYPAD_COL1
		6	KEYPAD_COL2
		7	KEYPAD_COL3
		8	KEYPAD_COL4
DISPLAY BACKLIGHT	J24	1	+24V 1/4A

Connector Label	Reference Designator	Pin	Signal Description
		2	GND
		3	+24V 1/4A
		4	GND
POWER SUPPLY TEST	J245	1	+5V
		2	+3.3V
		3	+15V
		4	-3.3V

Table 11–4. Backplane Board Connector Pin Descriptions

Connector Label	Reference Designator	Pin	Signal Description
MEASUREMENT INTERFACE BOARD 1	J1	1	N.C.
		2	N.C.
		3	N.C.
		4	N.C.
		5	TYPE_CODE0
		6	TYPE_CODE1
		7	FC1_MICROSW
		8	LIFT1_UP
		9	LIFT1_DN
		10	PUSH1_DN
		11	PUSH1_UP
		12	SHUT_EXT
		13	SHUT_RET
		14	REV_CODE
		15	FC2_MICROSW
		16	LIFT2_UP
		17	LIFT2_DN
		18	PUSH2_DN
		19	PUSH2_UP
		20	CH_15
		21	N.C.

Connector Label	Reference Designator	Pin	Signal Description
		22	PROP_VALVE1_P
		23	PGND
		24	PROP_VALVE2_P
		25	N.C.
		26	N.C.
		27	N.C.
		28	N.C.
		29	N.C.
		30	N.C.
		31	N.C.
		32	N.C.
		33	N.C.
MEASUREMENT INTERFACE BOARD 2	J2	1	+24V
		2	STATUS_LAMPS
		3	+15VA
		4	PGND
		5	FILTER_COMP_FANS
		6	AGND
		7	+5VD
		8	DGND
		9	10VA
		10	TEMP_FILTER1_SEN
		11	TEMP_FILTER2_SEN
		12	FCOMP_TEMP_SEN
		13	FCOMP_RH_SENSOR
		14	AMBTEMP_SENSOR
		15	WNDDIR_SENSOR
		16	WNDSPD_SENSOR
		17	MFS_1
		18	MFS_2
		19	PROP_VALVE1_PWM_P
		20	PROP_VALVE1_PWM_N
		21	PROP_VALVE2_PWM_P

Connector Label	Reference Designator	Pin	Signal Description
		22	PROP_VALVE2_PWM_N
		23	PUMP_RLY_NC
		24	PUMP_FAN
		25	VAC_VENT_VALVE
		26	PRESS_VENT_VALVE
		27	FLOW1_LEAK-VALVE
		28	FLOW2_LEAK-VALVE
		29	MAG_PRESS_VALVE
		30	SHUTTLE_VALVE
		31	LIFT_PUSH_VALVE
		32	SPARE
		33	+24V
PWM VALVE 1	J3	1	PROP_VALVE1_PWM_P
		2	PROP_VALVE1_PWM_N
SHUTTLE PCB	J4	1	DGND
		2	TYPE_CODE0
		3	TYPE_CODE1
		4	FC1_MICROSW
		5	LIFT1_UP
		6	+5VD
		7	DGND
		8	LIFT1_DN
		9	PUSH1_DN
		10	PUSH1_UP
		11	SHUT_RET
		12	+5VD
		13	DGND
		14	SHUT_ENT
		15	REV_CODE
		16	FC2_MICROSW
		17	LIFT2_UP
		18	+5VD
		19	DGND
		20	LIFT2_DN

Connector Label	Reference Designator	Pin	Signal Description
		21	PUSH2_DN
		22	PUSH2_UP
		23	CH_15
		24	+5VD
		25	DGND
		26	DGND
WIND MONITOR	J5	1	+15VA
		2	WNDDIR_SENSOR
		3	WNDSPD_SENSOR
		4	AMBTHEMP_SENSOR
		5	+15VA
		6	AGND
PUMP FAN	J6	1	+24V
		2	PUMP_FAN
PWM VALVE 2	J7	1	PROP_VALVE2_PWM_P
		2	PROP_VALVE2_PWM_N
STATUS LAMP1	J8	1	+24V
		2	STATUS_LAMPS
MFS 1	J9	1	MFS_1
		2	N.C.
		3	AGND
		4	+10VA
FLOW1 LEAK VALVE	J10	1	+24V
		2	FLOW1_LEAK-VALVE
AUX 24V	J11	1	+24V
		2	SPARE
FLOW2 LEAK VALVE	J12	1	+24V
		2	FLOW2_LEAK-VALVE
MFS 2	J13	1	MFS_2
		2	N.C.
		3	AGND
		4	+10VA
AC IN	J19	1	AC IN
		2	NEUTRAL

Connector Label	Reference Designator	Pin	Signal Description
PUMP AC	J20	1	PUMP_AC
		2	NEUTRAL
		3	EARTH
FILTER 1 TEMP	J21	1	TEMP_FILTER1_MON
		2	+15VA
PRESSURE VENT VALVE	J22	1	+24V
		2	PRESS_VENT_VALVE
FILTER 2 TEMP	J23	1	TEMP_FILTER2_MON
		2	+15VA
MAG SHUTTLE LIFT VALVE	J24	1	+24V
		2	+24V
		3	+24V
		4	MAG_PRESS-VALVE
		5	SHUTTLE_VALVE
		6	LIFT_PUSH_VALVE
RH SENSOR	TB1	1	FCOMP_RH_SENSOR
		2	AGND
		3	+5VD

Table 11–5. Partisol Measurement Interface Board Connector Pin Descriptions

Connector Label	Reference Designator	Pin	Signal Description
BACKPLANE BOARD 1	J1	1	N.C.
		2	N.C.
		3	N.C.
		4	N.C.
		5	TYPE_CODE0
		6	TYPE_CODE1
		7	FC1_MICROSW
		8	LIFT1_UP
		9	LIFT1_DN
		10	PUSH1_DN

Connector Label	Reference Designator	Pin	Signal Description
		11	PUSH1_UP
		12	SHUT_EXT
		13	SHUT_RET
		14	REV_CODE
		15	FC2_MICROSW
		16	LIFT2_UP
		17	LIFT2_DN
		18	PUSH2_DN
		19	PUSH2_UP
		20	CH_15
		21	N.C.
		22	PROP_VALVE1_P
		23	PGND
		24	PROP_VALVE2_P
		25	N.C.
		26	N.C.
		27	N.C.
		28	N.C.
		29	N.C.
		30	N.C.
		31	N.C.
		32	N.C.
		33	N.C.
BACKPLANE BOARD 2	J2	1	+24V
		2	STATUS_LAMPS
		3	+15VA
		4	PGND
		5	FILTER_COMP_FANS
		6	AGND
		7	+5VD
		8	DGND
		9	10VA
		10	TEMP_FILTER1_SEN
		11	TEMP_FILTER2_SEN

Connector Label	Reference Designator	Pin	Signal Description
		12	FCOMP_TEMP_SEN
		13	FCOMP_RH_SENSOR
		14	AMBTEMP_SENSOR
		15	WNDDIR_SENSOR
		16	WNDSPD_SENSOR
		17	MFS_1
		18	MFS_2
		19	PROP_VALVE1_PWM_P
		20	PROP_VALVE1_PWM_N
		21	PROP_VALVE2_PWM_P
		22	PROP_VALVE2_PWM_N
		23	PUMP_RLY_NC
		24	PUMP_FAN
		25	VAC_VENT_VALVE
		26	PRESS_VENT_VALVE
		27	FLOW1_LEAK-VALVE
		28	FLOW2_LEAK-VALVE
		29	MAG_PRESS_VALVE
		30	SHUTTLE_VALVE
		31	LIFT_PUSH_VALVE
		32	SPARE
		33	+24V
RS-485	J3	1	DGND
		2	RS485_P
		3	RS485_N
SPARE 1	J4	1	SPARE1-1
		2	SPARE1-2
		3	SPARE1-3
		4	DGND
POWER SUPPLY	J5	1	+24V_IN
		2	PGND
+24V OUT	J6	1	+24V_IN
		2	PGND
STATUS LAMP1	J7	1	+24V

Connector Label	Reference Designator	Pin	Signal Description
		2	STATUS_LAMPS
AC IN	J8	1	LINE
		2	NEUTRAL
		3	EARTH
PUMP AC	J9	1	PUMP_AC
		2	NEUTRAL
		3	EARTH
HEATER AC	J10	1	HTR_AC_FUSED
		2	NEUTRAL
		3	EARTH
MODEM AC	J11	1	MOD_AC_FUSED
		2	NEUTRAL
		3	EARTH
12 PIN TEST	J12	1	+5VA
		2	EN5V
		3	+3.3VA
		4	DEN3V
		5	+10VA
		6	NC
		7	+15VA
		8	EN+15V
		9	NC
		10	EN-15V
		11	REF2.5V
		12	DGND
JTAG	J13	1	TDO
		2	N.C.
		3	TDI
		4	N.C.
		5	TMS
		6	N.C.
		7	TCK
		8	N.C.
		9	DGND

Connector Label	Reference Designator	Pin	Signal Description
		10	N.C.
		11	N.C.
		12	N.C.
WATCH DOG DISABLE	J14	1	WD EN
		2	DGND
LOOP CONTROL 1	J15	1	MFS_1FB
		2	COMMON_1
		3	PROP_VAL1
LOOP CONTROL 2	J16	1	MFS_2FB
		2	COMMON_2
		3	PROP_VAL2
FAN AC	J17	1	FAN_AC
		2	NEUTRAL
		3	EARTH

Table 11–6. I/O Expansion Board (Optional) Connector Pin Descriptions

Connector Label	Reference Designator	Pin	Signal Description
EXPANSION I/O	J1	1	Analog Voltage Input 1
		2	Analog Voltage Input 2
		3	Analog Voltage Input 3
		4	Ground
		5	Analog Voltage Input 4
		6	Analog Voltage Input 5
		7	Analog Voltage Input 6
		8	Ground
		9	Analog Voltage Input 7
		10	Analog Voltage Input 8
		11	Ground
		12	NC
		13	Current Output Return
		14	Ground
		15	Current Output 1

Connector Label	Reference Designator	Pin	Signal Description
		16	Current Output Return
		17	Current Output 2
		18	Current Output Return
		19	Current Output 3
		20	Current Output Return
		21	Current Output 4
		22	Current Output Return
		23	Current Output 5
		24	Current Output Return
		25	Current Output 6
MOTHER BD	J2	1	+5V
		2	+24V
		3	+24V
		4	Ground
		5	Ground
		6	Ground
		7	+RS485 to Motherboard
		8	-RS485 to Motherboard

Service Locations

For additional assistance, worldwide service is available from Thermo Fisher Scientific. Contact one of the phone numbers below for product support and technical information or visit us on the web at www.thermo.com/aqi.

Toll Free U.S. only   1-866-282-0430

U.S., Latin America, and Canada   1-508-520-0430

Europe   +31 76 579 5555

China   +86 10 8419 3588

Asia Pacific   +91 22 27781102

Chapter 12
Servicing

This chapter includes firmware update information, component parts lists, cable lists, and safety information:

Safety Precautions

Read the safety precautions before beginning any procedures in this chapter.

WARNING The service procedures in this manual are restricted to qualified service representatives. ▲

If the equipment is operated in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. ▲

CAUTION If the LCD panel breaks, do not let the liquid crystal contact your skin or clothes. If the liquid crystal contacts your skin or clothes, wash it off immediately using soap and water. ▲

Equipment Damage Some internal components can be damaged by small amounts of static electricity. A properly grounded antistatic wrist strap must be worn while handling any internal component. If an antistatic wrist strap is not available, be sure to touch the instrument chassis before touching any internal components. When the instrument is unplugged, the chassis is not at earth ground. ▲

Do not use solvents or other cleaning products to clean the outside case. ▲

Do not remove the LCD panel or frame from the LCD module. ▲

The LCD polarizing plate is very fragile, handle it carefully. ▲

Do not wipe the LCD polarizing plate with a dry cloth, as it may easily scratch the plate. ▲

Do not use alcohol, acetone, MEK or other Ketone based or aromatic solvents to clean the LCD module, but rather use a soft cloth moistened with a naphtha cleaning solvent. ▲

Do not place the LCD module near organic solvents or corrosive gases. ▲

Do not shake or jolt the LCD module. ▲

Firmware Updates

The firmware can be updated by the user in the field via the serial port, over the Ethernet, or from a file on a USB memory device. This includes both the main processor firmware and the firmware in all low-level processors. Refer to the *iPort* manual for the firmware update procedure when using the serial port or Ethernet. To update the firmware using USB memory device, use the following instructions:

1. Obtain the firmware update file and copy to the root directory of the USB memory device. The firmware can be downloaded from the customer area of the Thermo Fisher Scientific wbesite and should be copied to the root directory of the USB memory device.

2. The Sampler must be in Service mode to upload new firmware. Press , scroll to Service mode and press  to toggle the Service mode On.

3. Insert the USB memory device with the firmware update into the USB port on the Sampler.

4. Scroll to USB on the Main Menu and press ↵.

5. Select the USB port and press ↵.

6. Scroll to Firmware Update and press ↵.

7. The instrument will scan the USB memory device and locate installed firmware files on the device. Select the proper firmware update and press ↵.

8. Follow the instructions on the screen to update the instrument firmware. The Sampler should automatically restart after firmware update is complete. If not, remove the USB memory device and turn the power to the instrument Off and then back On.

The instrument firmware update is now complete.

Parts Lists

Refer to the Table 12–1 for Partisol 2000*i* and 2000*i*-D replacement parts. Items not marked with an asterisk are used with both the 2000*i* and 2000*i*-D. Items marked with a single asterisk (*) are used with the 2000*i* only. Items marked with a double asterisk (**) are used with the 2000*i*-D only.

Note Consumables including but not limited to lamps, fuses, and bulbs, are expressly excluded from the Thermo Fisher Scientific warranty. You may purchase consumable items from Thermo Fisher Scientific by calling our customer service department at 1-866-282-0430. ▲

Table 12–1. Partisol 2000*i* and 2000*i*-D Replacement Parts

Replacement Parts	Part Number
Electronics Enclosure w/Processor PCB, 120VAC*	56-011483-0137
Electronics Enclosure w/Processor PCB, 120VAC**	56-011483-0138
Electronics Enclosure w/Processor PCB, 240VAC*	56-011483-0237
Electronics Enclosure w/Processor PCB, 240VAC**	56-011483-0238
Electronics Module with Heater, 120VAC	56-011519-0120
Electronics Module with Heater, 240VAC	56-011519-0240
Heater & Fan Assembly, 120VAC	55-011578-0120
Heater & Fan Assembly, 240VAC	55-011578-0240
Filter Changer Assembly*	54-011627
Filter Changer Assembly**	54-011629

Accumulator Assembly	55-011465
Digital I/O PCB	100539-00
Measurement Interface PCB	109085-00
Mother Board PCB	109141-00
Arcturus PCB*	110570-37
Arcturus PCB**	110570-38
Power Supply, 24V	101681-00
Keypad Assembly	36-011484
LCD Assembly	102496-00
Vent Valve Assembly	56-012136-0002
Leak Check Valve Assembly, 20 L/min	56-012139-0001
Leak Check Valve Assembly, 5 L/min**	56-012139-0002
Fan Assembly, 24 Volt DC	109807-00
Flow Controller Assembly, 20 L/min	56-012100
Flow Controller Assembly, 5 L/min**	56-012099
Electronics Enclosure Assembly w/o Heater or Arcturus PCB	55-011483
Fuse, 120VAC, 10 Amp, Slo-Blow	103428-01
Fuse, 220VAC, 5 Amp, Slo-Blow	4523
Filter Cassettes and Accessories	**Part Number**
Partisol Filter Cassette	59-004648-0001
Pkg of 10 Partisol Filter Cassettes	59-004648-0010
Pkg of 25 Partisol Filter Cassettes	59-004648-0025
Pkg of 50 Partisol Filter Cassettes	59-004648-0050
Pkg of 5 Filter Cassette Screens	30-005147-0005
Anti-Static 3x5-inch Zip Lock Bags (1,000)	20-003772-1000
Tweezers	30-002566
Filter Cassette Removal Kit	59-004733
Filter Cassette Separator Tool	38-004892
Solid Filter Leak Check/Separator Disk	36-004768
Filter Cassette Screens (10)	59-005147-0010
Filter Cassette Shells (10)	59-005923-0010
Anti-Stick Rings (25)	32-003519
Upper Cassette Seal	22-010318
Lower Cassette Seal	22-005957
Kit, Flow Calibration 2000*i*-D	59-012290

Open Leak Test Filter Cassette	36-012077
Blocked Leak Test Filter Cassette	36-012078
Kit, Leak Test Filter Cassettes (contains 2 of each)	59-012079
Filter Media	**Part Number**
PTFE Filters, 2.0 µm, Box of 50	10-002322-0050
Pallflex TX40 Filters, Box of 100	10-002387-0100
Quartz Fiber Filters, Box of 100	10-002647-0100
Nylon 47 mm Filters, 1.2 µm, Box of 100	10-002544-0100
47 mm Anti-Stick Rings, Box of 100	32-003519
Hardware Items	**Part Number**
Inline Filter	32-002643
Foam Fan Covers, Pkg of 5	10-003092
Sampling Hardware	**Part Number**
Stand for Sampler	57-004644
Small Rain Hood	36-003817
Gasket for Small Rain Hood	33-002371
Large Rain Hood	38-004011
Gasket for Large Rain Hood	33-004201
Rain Hood Thumb Screws, qty 12 SS	59-005987-0012
Dome Connector for Sample Tube	13-004300
Wind Vane/Anemometer & 15 m Cable	59-004953
Radiation Shield	30-004215
Inlet Adapter*	36-011612
Inlet Adapter**	36-004427
O-rings for Inlet Adapter	22-002853-3026
Inlets and Accessories	**Part Number**
PM-10 Inlet	57-000596
Pass Through Adapter Tube*	57-005051
WINS PM-2.5 Impactor*	57-004006
PM-10 Inlet/PM-2.5 SCC Inlet Combo*	59-005944
PM-2.5 SCC*	57-005896
PM-10 Inlet/PM-2.5 VSCC Inlet Combo*	59-008978
PM-2.5 VSCC*	57-008976
PM-10 Inlet/PM-1 SCC Inlet Combo*	59-007942
PM-1 SCC*	10-007742

US TSP Inlet	10-002929
German TSP Inlet	57-002269
Traditional PM-10 Inlet	57-000596-0001
Traditional PM-10 Inlet to EPA PM-10 Inlet Conv. Kit*	55-004747
WINS Impactor Adapter*	55-007257
WINS Impactor Well Assembly*	55-004289
WINS Impactor Oil, 30mL*	59-004292
WINS Impactor Oil, 100mL*	59-004292-0100
O-ring, 1st stage/PM-10 inlet	22-002853-1036
O-ring, WINS impactor*	22-002853-3036
O-ring, WINS well assembly*	22-002853-3030
WINS Impactor/VSCC Seal Adapt*	36-004626
O-ring package, WINS Impactor/VSCC Seal Adapt*	22-002853-2726
Sample Tube	36-002344
WINS Impactor Shell*	55-005498
O-ring PM-10 Inlet and WINS*	22-002853-3026
O-ring, SCC*	22-000485-1028
O-ring, SCC*	22-000485-1026
O-ring, SCC*	22-000485-1015
O-ring package, VSCC*	59-008986
Partisol 2000*i*-D Splitter Assembly**	55-010275
Japanese PM-10 Inlet	57-004307
Partisol 2000*i* and 2000*i*-D Pumps	**Part Number**
Partisol Pump Rebuild Kit (1 required) (Thomas Pump)	32-008419
Vacuum Pump Exhaust Muffler (Thomas Pump)	32-002505
Sintered Filter for Pump (Thomas Pump)	32-002693
Eccentric & Bearing Assembly for Pump (Thomas Pump)	10-009531
Gray Replacement Fan for Pump (Thomas Pump)	10-009532-0GRY
White Replacement Fan for Pump (Thomas Pump)	10-009532-0WHT
Pump Fan Guard (Thomas Pump)	10-009533
Push Connect Fitting, Elbow (1/8NPT Thomas Pump)	32-008756
Pump Assembly, Gast, 120VAC	55-012135-0001
Pump Assembly, Gast, 240VAC	55-012135-0002
Push Connect Fitting, Elbow (1/4NPT Gast Pump)	32-010432
Pump, Rebuild kit, Diaphragm, Gast	59-012071

Miscellaneous Hardware	**Part Number**
Foam Fan Covers, qty 5	59-003092
Cooling Fan	56-006527
Rubber Foot, qty 1	33-006024
Key for Instrument Enclosure	20-005922
Door Hinge	33-005963
Partisol 2000*i* and 2000*i*-D Connectors and Cables	**Part Number**
9-to-9 Pin RS232 Cable	07-000587
9-to-25 Pin Serial Adapter	51-001079
9-to-25 Pin Modem Cable	51-002814
9-Pin Null Modem Adapter	10-005671
Null Modem (25-to-25 Pin)	10-002661
6-Pin Cable Connector	06-002454
25-Pin Wiring Adapter	06-004521-0025

Internal Cables

Table 12–2 lists the internal cables for the Partisol 2000*i* and 2000*i*-D.

Table 12–2. Partisol 2000*i* and 2000*i*-D Internal Cables

Part Number	**Description**
101035-00	Measurement Interface Board to 24V Power Supply
101036-00	24 V to Motherboard and Measurement Interface Board
101048-00	Motherboard RS-485 to Measurement Interface Board
101054-00	Motherboard to Display
108665-01	Ethernet Patch
109701-01 109701-02	Filter Temperature 1 Filter Temperature 2
109802-01 109802-02	Mass Flow Switch, 20 L/min Mass Flow Switch, 5 L/min
114648-01 114648-02 114648-04	Flow 1 Leak Valve Flow 2 Leak Valve Vacuum Vent Valve
109805-00	Weather Monitor
109806-00	Electronics Enclosure Bulkhead to Backplane Pump
109807-00	Fan Assembly, 24VDC
109808-00	Status Lamp
109813-00	Line Filter to IEC

Part Number	Description
109838-00	Measurement Interface Board to Electronics Enclosure Bulkhead
109850-00	IEC to Fuse
109851-00	Fuse to AC Switch
109853-00	Measurement Interface Board to Temperature Switch
110200-00	Measurement Interface Board to Heater Fan (120VAC)
110199-00	Measurement Interface Board to Heater Fan (240VAC Only)
110190-00	Motherboard to Measurement Interface Board
110191-00	Temperature Switch to Heater
110192-00	AC Switch to Motherboard
110193-00	IEC to Ground (2 required per instrument)
110194-00	Measurement Interface Board to Modem IEC
110288-00	I/O Expansion Board Patch
110289-00	RS-232 Patch
110291-00	USB Patch

External Device Connection Components

Table 12–3 lists the optional cables and components used for connecting external devices such as PCs and dataloggers to an *i*Series instrument.

Table 12–3. External Device Connection Components

Part Number	Description
102562-00	Terminal Block and Cable Kit (DB25) (optional)
102556-00	Terminal Block and Cable Kit (DB37) (optional)
102645-00	Cable, DB37M to Open End Cable, Six Feet (optional)
102646-00	Cable, DB37F to Open End, Six Feet (optional)
102659-00	Cable, DB25M to Open End, Six Feet (optional)
6279	Cable, RS-232 or RS-485 (optional)
102888-00	Terminal Board PCB Assembly, DB37F
102891-00	Terminal Board PCB Assembly, DB37M
103084-00	Terminal Board PCB Assembly, DB25M (optional) Included with optional I/O Expansion Board in all instruments.

Terminal Block and Cable Kits

The terminal block and cable kits provide a convenient way to connect devices to the instrument. These kits break out the signals on the rear panel connector to individual numbered terminals.

Two types of terminal block and cable kits are available. One kit is for the DB37 connectors and can be used for either the analog output connector or the relay output connector. The other kit is for the DB25 connector and can be used for the optional I/O expansion board. For associated part numbers, refer to "External Device Connection Components" on page 12-8.

Each kit consists of:

- one six-foot cable
- one terminal block
- one snap track

Note Supporting all of the connections on units with the optional I/O expansion board requires: ▲

- two DB37 kits
- one DB25 kit

External Cables

Table 12–4 identifies the optional individual cables that are available for the instrument and Table 12–5 provides the cable color codes. For associated part numbers, refer to "External Device Connection Components" on page 12-8.

Note Table 12–5 provides the color coding for both 25-pin cables and 37-pin cables. Color codes for pins 1-25 are for 25-pin cables; color codes for pins 1-37 are for 37-pin cables. ▲

Table 12–4. External Cables

Description	Cable Length
DB37M to open end	Six feet
DB37F to open end	Six feet
DB25M to open end	Six feet
RS-232 or RS-485	Six feet

Table 12–5. Color Codes for 25-Pin and 37-Pin Cables

Pin	Color	Pin	Color
1	BLACK	20	RED/BLACK
2	BROWN	21	ORANGE/BLACK
3	RED	22	YELLOW/BLACK
4	ORANGE	23	GREEN/BLACK
5	YELLOW	24	GRAY/BLACK
6	GREEN	25	PINK/BLACK
7	BLUE	End color codes for 25-pin cables continue for 37-pin cables.	
8	VIOLET	26	PINK/GREEN
9	GRAY	27	PINK/RED
19	WHITE	28	PINK/VIOLET
11	PINK	29	LIGHT BLUE
12	LIGHT GREEN	30	LIGHT BLUE/BROWN
13	BLACK/WHITE	31	LIGHT BLUE/RED
14	BROWN/WHITE	32	LIGHT BLUE/VIOLET
15	RED/WHITE	33	LIGHT BLUE/BLACK
16	ORANGE/WHITE	34	GRAY/GREEN
17	GREEN/WHITE	35	GRAY/RED
18	BLUE/WHITE	36	GRAY/VIOLET
19	VIOLET/WHITE	37	LIGHT GREEN/BLACK

Filter Log

This filter log can be used to keep track of all important readings associated with each exposed filter. Users are encouraged to make photocopies of the form on the following page or to use a similar format.

Filter Log

Filter Number	Initial Conditioning	Initial Weighing		Filter Exposure		Post-Collection Conditioning	Post-Collection Weighing		DW	Concentration
	Conditions	Weights	Conditions	Exposure Period	Exposure Stats	Conditions	Weights	Conditions	W(F)-W(I)	DWx10^6/Volume
	RH: Temp: Date: Time:	W1: W2: W3: W(I):	RH: Temp: Date: Time:		Val Time: Tot Time: Volume:	RH: Temp: Date: Time:	W1: W2: W3: W(F):	RH: Temp: Date: Time:		
	RH: Temp: Date: Time:	W1: W2: W3: W(I):	RH: Temp: Date: Time:		Val Time: Tot Time: Volume:	RH: Temp: Date: Time:	W1: W2: W3: W(F):	RH: Temp: Date: Time:		
	RH: Temp: Date: Time:	W1: W2: W3: W(I):	RH: Temp: Date: Time:		Val Time: Tot Time: Volume:	RH: Temp: Date: Time:	W1: W2: W3: W(F):	RH: Temp: Date: Time:		
	RH: Temp: Date: Time:	W1: W2: W3: W(I):	RH: Temp: Date: Time:		Val Time: Tot Time: Volume:	RH: Temp: Date: Time:	W1: W2: W3: W(F):	RH: Temp: Date: Time:		
	RH: Temp: Date: Time:	W1: W2: W3: W(I):	RH: Temp: Date: Time:		Val Time: Tot Time: Volume:	RH: Temp: Date: Time:	W1: W2: W3: W(F):	RH: Temp: Date: Time:		
	RH: Temp: Date: Time:	W1: W2: W3: W(I):	RH: Temp: Date: Time:		Val Time: Tot Time: Volume:	RH: Temp: Date: Time:	W1: W2: W3: W(F):	RH: Temp: Date: Time:		
	RH: Temp: Date: Time:	W1: W2: W3: W(I):	RH: Temp: Date: Time:		Val Time: Tot Time: Volume:	RH: Temp: Date: Time:	W1: W2: W3: W(F):	RH: Temp: Date: Time:		
	RH: Temp: Date: Time:	W1: W2: W3: W(I):	RH: Temp: Date: Time:		Val Time: Tot Time: Volume:	RH: Temp: Date: Time:	W1: W2: W3: W(F):	RH: Temp: Date: Time:		

Service Locations

For additional assistance, worldwide service is available from Thermo Fisher Scientific. Contact us at one of the phone numbers below for product support and technical information or visit us on the web at www.thermo.com/aqi.

Toll Free U.S. only 1-866-282-0430

U.S., Latin America, and Canada 1-508-520-0430

Europe +31 76 579 5555

China +86 10 8419 3588

Asia Pacific +91 22 27781102

Chapter 13
Electronics and I/O Components

This chapter provides an overview of the electronic components and the input/output connections and functions. For details, see the following topics:

- "Electronics" on page 13-1
- "I/O Components" on page 13-2

Electronics

All electronics operate from a universal switching supply, which is capable of auto-sensing the input voltage and working over the entire operating range.

Internal pumps and heaters all operate on 110 VAC. An optional transformer is required if operating on the 210-250 VAC or 90-110 VAC ranges.

An on/off switch controls all power to the Samplers, and is accessible on the front panel.

Motherboard

The motherboard contains the main processor, power supplies, a sub-processor, and serves as the communication hub for the instrument. The motherboard receives operator inputs from the front panel mounted function key panel and/or over I/O connections on the rear panel, and sends commands to the other boards to control the functions of the instrument and to collect measurement and diagnostic information. The motherboard outputs instrument status and measurement data to the front-panel mounted graphics display and to the rear-panel I/O. The motherboard also contains I/O circuitry and the associated connector to monitor external digital status lines and to output analog voltages that represent the measurement data. Connectors located on the motherboard include:

External connectors include:

- RS-232/485 Communications
- Ethernet Communications
- USB Connector

- In addition to the standard connectors on the Sampler, connections are available that provide additional optional data I/O capabilities.
- I/O connector with Power Fail Relay, 16 Digital Inputs, and 6 Analog Voltage Outputs.

I/O Expansion Board

The I/O expansion board connects to the motherboard and adds the capability to input external analog voltage signals and to output analog currents via a connector located on the rear panel of the instrument. It contains local power supplies, a DC/DC isolator supply, a sub-processor, and analog circuits. Eight analog voltage inputs are provided with an input voltage range of 0V to10 VDC. Six current outputs are provided with a normal operating range of 0 to 20 mA. Current outputs may also be configured for a 4 to 20 mA range through the Sampler firmware.

Internal connectors include:

- Function key panel and Display
- Measurement Interface Board Data
- I/O Expansion Board Data
- Digital Output Board
- AC distribution

Digital Output Board

The digital output board connects to the motherboard and provides solenoid driver outputs and relay contact outputs to a connector located on the rear panel of the instrument. Ten relay contacts, normally open (with power off), are provided which are electrically isolated from each other. Eight solenoid driver outputs (open collector) are provided along with a corresponding +24 VDC supply pin on the connector.

I/O Components

External I/O is driven from a generic bus that is capable of controlling the following devices:

- Analog output (voltage and current)
- Analog input (voltage)
- Digital output (TTL levels)
- Digital input (TTL levels)

Note The sampler has spare solenoid valve drivers and I/O support for future expansion. ▲

Analog Voltage Outputs

The standard Sampler provides six analog voltage outputs. Each may be firmware configured for any one of the following ranges, while maintaining a minimum resolution of 12 bits:

- 0-100mV
- 0-1V
- 0-5V
- 0-10V

The user can calibrate each analog output zero and span point through firmware. At least 5% of full scale over and under range are also supported, but may be overridden in firmware if required.

The analog outputs may be assigned to any measurement or diagnostic channel with a user-defined range in the units of the selected parameter. The voltage outputs are independent of the current outputs.

Analog Current Outputs (Optional)

The optional I/O expansion board includes six isolated current outputs. These are firmware configured for any one of the following ranges, while maintaining a minimum resolution of 11 bits:

- 0-20 mA
- 4-20 mA

The user can calibrate each analog output zero and span point through firmware. At least 5% of full scale over and under range are also supported, but may be overridden in firmware if required.

The analog outputs may be assigned to any measurement or diagnostic channel with a user-defined range in the units of the selected parameter. The current outputs are independent of the voltage outputs. The current outputs are isolated from the instrument power and ground, but they share a common return line (Isolated GND).

Analog Voltage Inputs (Optional)

Eight analog voltage inputs are used to gather measurement data from third-party devices. The user may assign a label, unit, and a conversion table (2 to 10 points). Each point in the conversion table consists of an analog input voltage value (0-10 V) and a corresponding user-defined reading value. Only two points are necessary for linear inputs, however a larger number of points may be used to approximate non-linear inputs. All voltage inputs have a resolution of 12 bits over the range of 0 to 10 volts.

Digital Relay Outputs

The Sampler includes one power fail relay on the motherboard and ten digital output relays on the digital output board. These are reed relays rated for at least 500 mA @ 200 VDC.

The power fail relay is Form C (both normally open and normally closed contacts). All other relays are Form A (normally open contacts) and are used to provide alarm status and mode information from the Sampler, as well as remote control to other devices, such as for controlling valves during calibration. The user may select what information is sent out from each relay and whether the active state is open or closed.

Digital Inputs

Sixteen digital inputs are available which may be programmed to signal instrument modes and special conditions.

The actual use of these inputs will vary based on Sampler configuration.

The digital inputs are TTL level compatible and are pulled up within the Sampler. The active state can be user defined in the firmware.

Serial Ports

Two serial ports allow daisy chaining so that multiple Samplers may be linked using one PC serial port.

The standard bi-directional serial interface can be configured for either RS-232 or RS-485. The serial baud rate is user selectable in the firmware for standard speeds from 1200 to 115200 baud. The user can also set the data bits, parity, and stop bits. The following protocols are supported:

- C-Link
- Streaming Data
- MODBUS Slave
- AK

The Streaming Data protocol transmits user-selected measurement data via the serial port in real-time for capture by a serial printer, data logger, or PC.

RS-232 Connection

A null modem (crossed) cable is required when connecting the Sampler to an IBM-compatible PC. However, a straight cable (one to one) may be required when connecting the Sampler to other remote devices. As a general rule, when the connector of the host remote device is female, a straight cable is required and when the connector is male, a null modem cable is required.

Data Format:

1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200 BAUD

7 or 8 data bits

1 or 2 stop bits

No, odd, or even parity

All responses are terminated with a carriage return (hex 0D)

Refer to Table 13–1 for the RS-232 DB9 connector pin configuration.

Table 13–1. RS-232 DB9 Connector Pin Configuration

DB9 Pin	Function
2	RX
3	TX
7	RTS
8	CTS
5	Ground

RS-485 Connection

The instrument uses a four wire RS-485 configuration with automatic flow control (SD). Refer to Table 13–2 for the RS-485 DB9 connector pin configuration.

Table 13–2. RS-485 DB9 Connector Pin Configuration

DB9 Pin	Function
2	+ receive
8	- receive
7	+ transmit
3	- transmit
5	ground

Ethernet Connection

An RJ45 connector is used for the 10/100Mbps Ethernet connection supporting TCP/IP communications via standard IPV4 addressing. The IP address may be configured for static addressing or dynamic addressing (set using a DHCP server). Up to three simultaneous connections are allowed per protocol.

Any serial port protocols may be accessed over Ethernet in addition to the serial port.

External Accessory Connector

This port is used to communicate with smart external devices that may be mounted hundreds of feet from the Sampler using an RS-485 electrical interface.

USB Port

The USB port is USB 2.0, full speed, 12Mbps; and low speed, 1.5Mbps and is used for interacting with a USB memory device. The USB memory device must be formatted as FAT32. 4 gB or greater is recommended.

Appendix A
Warranty

Seller warrants that the Products will operate or perform substantially in conformance with Seller's published specifications and be free from defects in material and workmanship, when subjected to normal, proper and intended usage by properly trained personnel, for the period of time set forth in the product documentation, published specifications or package inserts. If a period of time is not specified in Seller's product documentation, published specifications or package inserts, the warranty period shall be one (1) year from the date of shipment to Buyer for equipment and ninety (90) days for all other products (the "Warranty Period"). Seller agrees during the Warranty Period, to repair or replace, at Seller's option, defective Products so as to cause the same to operate in substantial conformance with said published specifications; provided that (a) Buyer shall promptly notify Seller in writing upon the discovery of any defect, which notice shall include the product model and serial number (if applicable) and details of the warranty claim; (b) after Seller's review, Seller will provide Buyer with service data and/or a Return Material Authorization ("RMA"), which may include biohazard decontamination procedures and other product-specific handling instructions; and (c) then, if applicable, Buyer may return the defective Products to Seller with all costs prepaid by Buyer. Replacement parts may be new or refurbished, at the election of Seller. All replaced parts shall become the property of Seller. Shipment to Buyer of repaired or replacement Products shall be made in accordance with the Delivery provisions of the Seller's Terms and Conditions of Sale. Consumables, including but not limited to lamps, fuses, batteries, bulbs and other such expendable items, are expressly excluded from the warranty under this warranty.

Notwithstanding the foregoing, Products supplied by Seller that are obtained by Seller from an original manufacturer or third party supplier are not warranted by Seller, but Seller agrees to assign to Buyer any warranty rights in such Product that Seller may have from the original manufacturer or third party supplier, to the extent such assignment is allowed by such original manufacturer or third party supplier.

In no event shall Seller have any obligation to make repairs, replacements or corrections required, in whole or in part, as the result of (i) normal wear and tear, (ii) accident, disaster or event of force majeure, (iii) misuse, fault or negligence of or by Buyer, (iv) use of the Products in a manner for which they were not designed, (v) causes external to the Products such as, but not limited to, power failure or electrical power surges, (vi) improper storage and handling of the Products or (vii) use of the Products in combination with equipment or software not supplied by Seller. If Seller determines that Products for which Buyer has requested warranty services are not covered by the warranty hereunder, Buyer shall pay or reimburse Seller for all costs of investigating and responding to such request at Seller's then prevailing time and materials rates. If Seller provides repair services or replacement parts that are not covered by the warranty provided in this warranty, Buyer shall pay Seller therefor at Seller's then prevailing time and materials rates. ANY INSTALLATION, MAINTENANCE, REPAIR, SERVICE, RELOCATION OR ALTERATION TO OR OF, OR OTHER TAMPERING WITH, THE PRODUCTS PERFORMED BY ANY PERSON OR ENTITY OTHER THAN SELLER WITHOUT SELLER'S PRIOR WRITTEN APPROVAL, OR ANY USE OF REPLACEMENT PARTS NOT SUPPLIED BY SELLER, SHALL IMMEDIATELY VOID AND CANCEL ALL WARRANTIES WITH RESPECT TO THE AFFECTED PRODUCTS.

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Appendix B
C-Link Protocol Commands

This appendix provides a description of the C-Link protocol commands that can be used to remotely control the Partisol 2000*i* and 2000*i*-D Samplers using a host device such as a PC or a datalogger. C-Link protocol may be used over RS-232, RS-485, or Ethernet. C-Link functions can be accessed over Ethernet using TCP/IP port 9880.

Streaming data is sent out the serial port or the Ethernet port on a user-defined periodic basis. Streaming data over Ethernet is only generated when a connection is made on TCP port 9881.

Up to three simultaneous connections per protocol may be made over Ethernet.

For details, see the following topics:

Instrument Identification Number

Each command sent to the Sampler must begin with the American Standard Code for Information Interchange (ASCII) symbol or byte value equivalent of the instrument's identification number plus 128. For example, if the instrument ID is set to 25, then each command must begin with the ACSII character code 153 decimal. The Sampler ignores any command that does not begin with its instrument identification number. If the instrument ID is set to 0, then this byte is not required. For more information on changing Instrument ID, see "Instrument ID"on page 9-39.

Commands

The Sampler must be in the remote mode in order to change instrument parameters via remote. However, the command "set mode remote" can be sent to the Sampler to put it in the remote mode. Report commands (commands that don't begin with "set") can be issued either in the remote or local mode. For information on changing modes, see Chapter 9 "Firmware Screen Descriptions."

The commands can be sent in either uppercase or lowercase characters. Each command must begin with the proper instrument identification number (ASCII) character. The command in the example that follows begins with the ASCII character code 153 decimal, which directs the command to the 2000*i* and 2000*i*-D, and is terminated by a carriage return "CR" (ASCII character code 13 decimal).

<ASCII 153>	T	I	M	E	<CR>

If an incorrect command is sent, a "bad command" message will be received. The example that follows sends the incorrect command "set unit time 10:55" instead of the correct command "`set time 10:55`."

```
Send:          set unit time 10:55
Receive:       set unit time 10:55 bad cmd
```

The "save" and "set save params" commands stores parameters in FLASH. It is important that each time instrument parameters are changed, that this command be sent. If changes are not saved, they will be lost in the event of a power failure.

Commands List

Table B–1 lists the Partisol 2000*i* and 2000*i*-D Sampler C-Link protocol commands. The interface will respond to the associated command strings. Items marked with an "*" apply to the Partisol 2000*i*-D only.

Table B–1. C-Link Protocol Commands

Command	Description	Page
1	Simulates pressing soft key 1 pushbutton	B-18
2	Simulates pressing soft key 2 pushbutton	B-18
3	Simulates pressing soft key 3 pushbutton	B-18
4	Simulates pressing soft key 4 pushbutton	B-18
addr dns	Reports/sets dns address	B-22
addr gw	Reports/sets default gateway address	B-22
addr ip	Reports/sets IP address	B-23
addr nm	Reports/sets netmask address	B-23
addr ntp	Reports/sets IP address for network time protocol server	B-23
allow mode cmd	Reports/sets whether "set mode" locks instrument front panel	B-26
ambient pres	Reports the current valve for ambient pressure in mmHg	B-7
ambient rh	Reports the current value for ambient relative humidity in percent	B-8
ambient temp	Reports the current value for ambient temperature in degrees C	B-8
analog iout range	Reports analog current output range per channel	B-29
analog vin	Retrieves analog voltage input data per channel	B-30
analog vout range	Reports analog voltage output range per channel	B-30
audit history	Dumps audit history as a block of ASCII text	B-10
baud	Reports/sets current baud rate	B-24
clear filter log	Clears the filter log (frec) data stored in the instrument	B-18
clr lrecs	Clears away only long records that have been saved	B-11
clr records	Clears away all lrec and srec logging records that have been saved	B-11
clr srecs	Clears away only short records that have been saved	B-11
contrast	Reports/sets current screen contrast	B-20
copy lrec to sp	Sets/copies current lrec selection into the scratch pad	B-16
copy sp to lrec	Sets/copies current selections in scratch pad into lrec list	B-15
copy sp to srec	Sets/copies current selections in scratch pad into srec list	B-15
copy sp to stream	Sets/copies current selections in scratch pad into stream list	B-15

Command	Description	Page
copy srec to sp	Sets/copies current srec selection into the scratch pad	B-16
copy stream to sp	Sets/copies current streaming data selection into the scratch pad	B-16
data treatment lrec/srec	Reports/sets the current selection of data treatment for lrecs or srecs	B-11
date	Reports/sets current date	B-20
default params	Sets parameters to default values	B-21
dhcp	Reports/sets state of use of DHCP	B-24
diag volt iob	Reports diagnostic voltage level for I/O expansion board	B-11
diag volt mb	Reports diagnostic voltage level for motherboard	B-10
diag volt mib	Reports diagnostic voltage level for measurement interface board	B-10
dig in	Reports status of the digital inputs	B-31
din	Reports/sets digital input channel and active state	B-31
do (down)	Simulates pressing down pushbutton	B-18
dout	Reports/sets digital output channel and active state	B-31
dtoa	Reports outputs of the digital to analog converters per channel	B-31
ecomp temp	Reports the value for the electronics compartment temperature in degrees C	B-8
en (enter)	Simulates pressing enter pushbutton	B-18
er	Returns a brief description of the main operating conditions in the format specified in the commands	B-12
erec	Returns a brief description of the main operating conditions in the format specified in the command	B-12
erec format	Reports/sets erec format (ASCII or binary)	B-13
erec layout	Reports current layout of erec data	B-14
fcomp temp	Reports the filter compartment temperature in degrees C	B-8
filter pres	Reports the value for the filter pressure in mmHg	B-8
filter temp	Reports the value for the filter temperature in degrees C	B-8
filter2 pres*	Reports the value for filter2 pressure in mmHg	B-8
filter2 temp*	Reports the value for the filter2 temperature in degrees C	B-9
flags	Reports 8 hexadecimal digits (or flags) that represent the status of the Sampler.	B-7
flow actual	Reports the value for the actual flow (filter 1) in L/min	B-9
flow mass	Reports the value for the mass flow (filter 1) in L/min	B-9
flow std	Reports the value for the std flow (filter 1) in L/min	B-9

Command	Description	Page
flow2 actual*	Reports the value for the actual flow (filter 2) in L/min	B-9
flow2 mass*	Reports the value for the mass flow (filter 2) in L/min	B-9
flow2 std*	Reports the value for the std flow (filter 2) in L/min	B-9
format	Reports/sets current reply termination format	B-25
frec	Retrieves the most recent filter record	B-17
frec layout	Returns layout data for the frecs	B-18
frec x y	Retrieves filter record data	B-18
he (help)	Simulates pressing help pushbutton	B-18
host name	Reports/sets host name string	B-25
instr name	Reports instrument name	B-25
instrument id	Reports/sets instrument id	B-28
isc (iscreen)	Retrieves framebuffer data used for the display	B-19
layout ack	Disables stale layout/layout changed indicator (‘*’)	B-28
le (left)	Simulates pressing left pushbutton	B-18
list din	Lists current selection for digital input	B-32
list dout	Lists current selection for digital output	B-32
list lrec	Lists current selection lrec logging data	B-12
list sp	Lists current selection in the scratchpad list	B-12
list srec	Lists current selection srec logging data	B-12
list stream	Lists current selection streaming data output	B-12
list var aout	Reports list of analog output, index numbers, and variables	B-33
list var din	Reports list of digital input, index numbers, and variables	B-33
list var dout	Reports list of digital output, index numbers, and variables	B-33
lr	Outputs long records in the format specified in the command	B-12
lrec	Outputs long records	B-12
lrec format	Reports/sets output format for long records (ASCII or binary)	B-13
lrec layout	Reports current layout of lrec data	B-14
lrec mem size	Reports maximum number of long records that can be stored	B-14
lrec per	Reports/sets long record logging period	B-14
malloc lrec	Reports/sets memory allocation for long records	B-15
malloc srec	Reports/sets memory allocation for short records	B-15
me (menu)	Simulates pressing menu pushbutton	B-18
menutext	Displays the text of the menu item where the cursor is currently positioned	B-20

Command	Description	Page
mode	Reports operating mode in local, service, or remote	B-26
no of frecs	Reports the number of filter records stored in the instrument	B-18
no of lrec	Reports/sets number of long records stored in memory	B-15
no of srec	Reports/sets number of short records stored in memory	B-15
power up mode	Reports/sets the power up mode as local or remote	B-27
program no	Reports the type and program version of the instrument	B-28
pump pres	Reports the pump pressure in mmHg	B-8
push	Simulates pressing a key on the front panel	B-18
relay status	Reports/sets relay logic status to for the designated relay(s)	B-34
ri (right)	Simulates pressing right pushbutton	B-18
ru (run)	Simulates pressing run pushbutton	B-18
save	Stores parameters in FLASH	B-21
save params	Stores parameters in FLASH	B-21
sp field	Reports/sets item number and name in scratch pad list	B-16
sr	Reports last short record stored	B-12
srec	Reports maximum number of short records	B-12
srec format	Reports/sets output format for short records (ASCII or binary)	B-13
srec layout	Reports current layout of short record data	B-14
srec mem size	Reports maximum number of short records	B-14
srec per	Reports/sets short record logging period	B-14
stream per	Reports/sets current set time interval for streaming data	B-17
stream time	Reports/sets a time stamp to streaming data or not	B-17
time	Reports/sets current time (24-hour time)	B-21
tz	Reports/sets the timezone string for the network time protocol server	B-29
up	Simulates pressing up pushbutton	B-18
wind dir	Reports the wind direction in degrees (0-360)	B-9
wind speed	Reports the wind speed in km/h	B-9

Measurements

flags

To decode the flags, each hexadecimal digit is converted to binary as shown in Figure B–1. It is the binary digits that define the status of each parameter. The example shown in Figure B–1 indicates that the Sampler is in the Wait mode and is using the Basic sampling method.

```
Send:        flags
Receive:     flags 00120000
```

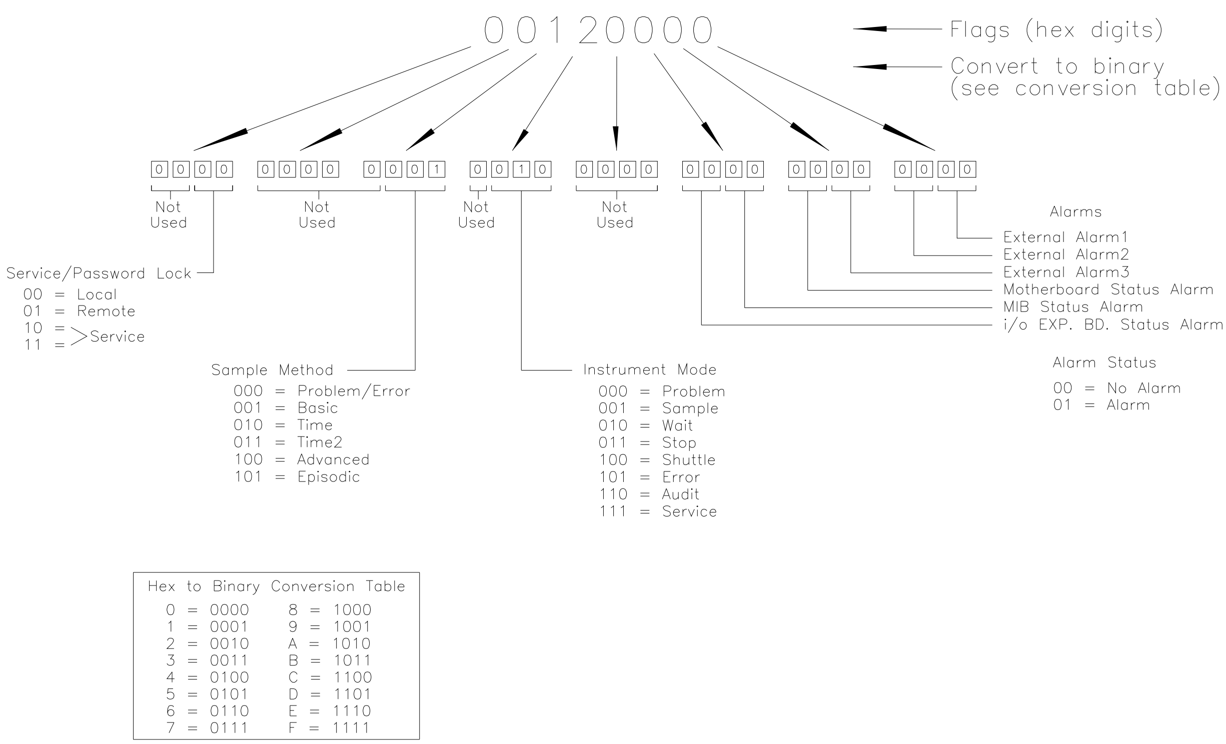


Figure B–1. Flags

ambient pres

This command reports the current value for the ambient pressure, in mmHg.

```
Send:        ambient pres
Receive:     ambient pres 761.8
```

ambient rh
This command reports the current value for ambient relative humidity, in percent.

```
Send:        ambient rh
Receive:     ambient rh 75.5
```

ambient temp
This command reports the current value for the ambient temperature in degrees C.

```
Send:        ambient temp
Receive:     ambient temp 24.1
```

ecomp temp
This command reports the value for the electronics compartment temperature in degrees C.

```
Send:        ecomp temp
Receive:     ecomp temp 30.3
```

fcomp temp
This command reports the filter compartment temperature in degrees C.

```
Send:        fcomp temp
Receive:     fcomp temp 20.4
```

pump pres
This command reports the pump pressure in mmHg.

```
Send:        pump pres
Receive:     pump pres 800.0
```

filter pres
This command reports the value for the filter pressure in mmHg.

```
Send:        filter pres
Receive:     filter pres 765.4
```

filter2 pres
This command reports the value for the filter2 pressure in mmHg.

```
Send:        filter2 pres
Receive:     filter2 pres 734.5
```

filter temp
This command reports the value for the filter temperature in degrees C.

```
Send:        filter temp
Receive:     filter temp 18.8
```

filter2 temp
This command reports the value for the filter2 temperature in degrees C.

```
Send:         filter2 temp
Receive:      filter2 temp 19.9
```

flow actual
This command reports the value for the actual flow (filter 1) in L/min.

```
Send:         flow actual
Receive:      flow actual 14.90
```

flow2 actual
This command reports the value for the actual flow (filter 2) in L/min.

```
Send:         flow2 actual
Receive:      flow2 actual 2.4
```

flow mass
This command reports the value for the mass flow (filter 1) in L/min.

```
Send:         flow mass
Receive:      flow mass 12.90
```

flow2 mass
This command reports the value for the mass flow (filter 2) in L/min.

```
Send:         flow2 mass
Receive:      flow2 mass 2.40
```

flow std
This command reports the value for the std flow (filter 1) in L/min.

```
Send:         flow std
Receive:      flow mass 12.20
```

flow2 std
This command reports the value for the std flow (filter 2) in L/min.

```
Send:         flow2 std
Receive:      flow2 mass 2.40
```

wind dir
This command reports the wind direction in degrees (0-360).

```
Send:         wind dir
Receive:      wind dir 269
```

wind speed
This command reports the wind speed in km/h.

```
Send:        wind speed
Receive:     wind speed 15.4
```

Diagnostics

audit history

This command dumps the audit history as a block of ASCII text.

```
Send:        audit history
Receive:     audit history

             Ambient Temperature in °C
             Time,Date,Reference,Actual

             Ambient Pressure in mmHg
             Time,Date,Reference,Actual
             12:03,2010Nov11,790.0,788.5

             Filter Temperature in °C
             Time,Date,Reference,Actual

             Ambient Humidity in %RH
             Time,Date,Reference,Actual
             12:08,2010Nov11,25.0,19.8

             Filter Pressure in mmHg
             Time,Date,Reference,Actual
             12:03,2010Nov11,790.0,787.1

             Filter2 Temperature in °C
             Time,Date,Reference,Actual

             Filter2 Pressure in mmHg
             Time,Date,Reference,Actual

             Flow in lpm
             Time,Date,Reference,Actual

             Flow2 in lpm
             Time,Date,Reference,Actual
```

diag volt mb

This command reports the diagnostic voltage measurements on the motherboard. The sequence of voltages is: Positive 24, positive 15, positive 5, positive 3.3, and negative 3.3. Each voltage value is separated by a space.

```
Send:        diag volt mb
Receive:     diag volt mb 24.1 14.9 4.9 3.2 -3.2
```

diag volt mib

This command reports the diagnostic voltage measurements on the measurement interface board. The sequence of voltages is: Positive 24, positive 15, negative 15, positive 5, and positive 3.3. Each voltage value is separated by a space.

```
Send:         diag volt mib
Receive:      diag volt mib 24.1 14.9 -14.9 4.9 3.2
```

diag volt iob

This command reports the diagnostic voltage measurements on the I/O expansion board. The sequence of voltages is: Positive 24, positive 5, positive 3.3, and negative 3.3. Each voltage value is separated by a space.

```
Send:         diag volt iob
Receive:      diag volt iob 24.1 4.9 3.2 -3.2
```

Datalogging

clr records

This command will clear all lrecs and srecs that have been saved.

```
Send:         clr records
Receive:      clr records ok
```

set clr lrecs
set clr srecs

These commands will clear only the lrecs or only the srecs that have been saved. The following example clears srecs.

```
Send:         set clr srecs
Receive:      set clr srecs ok
```

data treatment lrec
data treatment srec

These commands report the current selection of data treatment for concentrations in the lrecs or srecs. The following example reports the data treatment for concentrations in lrec as minimum.

```
Send:         data treatment lrec
Receive:      data treatment lrec min
```

set data treatment lrec *string*
set data treatment srec *string*
string = | cur | avg | min | max |

These commands set the data treatment to current, average, minimum, or maximum for the concentration values recorded in the lrecs or srecs. The following example sets the data treatment for concentrations in lrec as minimum.

```
Send:         set data treatment lrec min
Receive:      set data treatment lrec min ok
```

list lrec
list srec
list stream
list sp

These commands report the list of current selections for lrec logging data, srec logging data, streaming data output, or the scratch pad (sp) list.

The scratch pad is a temporary memory area which is used to set up lists of selections for lrec, srec, or streaming data items. The user can copy any of these lists to the scratch pad, modify individual elements in the list, then save the scratch pad back to the original list. Refer to the "sp field" command for information on how to edit the scratch pad.

The following example shows the list for streaming data output.

```
Send:        list stream
Receive:     list stream
             field index variable
             x x time
             1 1 flow
             2 16 t-amb
             3 17 t-flt
             4 6 vol
```

erec
er*xy*
x = | 0 | 1 | : Reply termination format (see "set format *format*" command)
y = | 0 | 1 | 2 | : Output format (see "set erec format *format*" command)

These commands return a snapshot of the main operating conditions (measurements and status) at the time the command is issued. The following example shows a typical response.

The format is defined within the command (in the case of er*xy*) or by the current settings of the "format" and "erec format" commands (in the case of erec). For details on erec formatting, see the "Record Layout Definition" section at the end of this appendix. For details on how to decode the flag fields within these records, see the "flags" command.

```
Send:        erec
Receive:     erec
             15:45 03-01-10 flags 130000
```

lrec
srec
lrec *rec num*
srec *rec num*
lr*xy rec num*
sr*xy rec num*

lrec *aa:bb oo-pp-qq yy*
srec *aa:bb oo-pp-qq yy*
rec = The starting record index number (1=most recent)
num = The number of records to return (1 to 10)
x = | 0 | 1 | : Reply termination format (see "set format *format*" command)
y = | 0 | 1 | 2 | : Output format (see "set lrec/srec format *format*" command)
aa = hours (01 to 23)
bb = minutes (01 to 59)
oo = month (01 to 12)
pp = day (01 to 31)
qq = year

These commands output lrec or srec logged data. The output format is determined by the "set lrec format", and "set srec format" commands. The logging time is determined by the "set lrec per" and "set srec per" commands. For details on how to decode the flag fields within these records, see Figure B–1.

```
Send:          lrec 5
Receive:       lrec 5
               12:30,2010Mar01,flags,20130000,flow,0.00,p-amb,778,p-
               flt,777,p-pmp,0.0,t-amb,24.6,t-flt,-99.9,t-
               fcmp,26.5,tdelt,-
               124.53,rh,9.5,wspd,1548.0,wdir,3096.0,wvel,242.5,elap-
               tm,1,statcode,00000402
```

lrec format
srec format
erec format
These commands report the output format for lrecs and srecs, and erec data in various formats such as ASCII without text, ASCII with text, or binary. The following example shows the output format for lrecs is ASCII with text, according to Table B–2.

```
Send:          lrec format
Receive:       lrec format 1
```

set lrec format *format*
set srec format *format*
set erec format *format*
These commands set the output format for lrecs and srecs, and erec data, according to Table B–2. The following example sets the lrec output format to ASCII with text.

```
Send:          set lrec format 1
Receive:       set lrec format 1 ok
```

Table B–2. Record Output Formats

Format	**Output Format**
0	ASCII no text
1	ASCII with text
2	Binary data

erec layout
lrec layout
srec layout

These commands reports the layout (string indicating the data formats) for data that is sent out in response to the erec, lrec, srec, and related commands For details on how to interpret the strings, see "Record Layout Definition" later in this appendix.

```
Send:        lrec layout
Receive:     lrec layout %s %s %lx %f %f %f %f %f %f %f %f %f %f %f
             %f %lx %lx
             t D L f f f f f f f f f f f f f A A
             flags flow p-amb p-flt p-pmp t-amb t-flt t-fcmp tdelt
             rh wspd wdir wvel elap-tm statcode
```

lrec mem size
srec mem size

These commands report the number of lrecs and srecs that can be stored with the current settings and the number of blocks reserved for lrecs and srecs. The example that follows shows that 1075 blocks were reserved for lrecs and the maximum number of lrecs that can be stored in memory is 241979. Memory allocation can be changed using the malloc command.

```
Send:        lrec mem size
Receive:     lrec mem size 241979 recs, 1075 blocks
```

lrec per
srec per

These commands report the lrecs and srecs logging period. The following example shows that the srec logging period is 5 minutes.

```
Send:        srec per
Receive:     srec per 5 min
```

set srec per *value*
set srec per *value*
value = | 1 | 5 | 15 | 30 | 60 |

These commands set the lrecs and srecs logging period to *value* in minutes. The following example sets the lrec logging period to 15 minutes.

```
Send:          set lrec per 15
Receive:       set lrec per 15 ok
```

no of lrec
no of srec
These commands report the number of lrecs and srecs stored memory. The following example shows that 50 lrecs have been stored in the memory.

```
Send:          no of lrec
Receive:       no of lrec 50 recs
```

malloc lrec
malloc srec
These commands report the currently set memory allocation for lrecs and srecs in percent of total memory.

```
Send:          malloc lrec
Receive:       malloc lrec 10 %
```

set malloc lrec *value*
set malloc srec *value*
value = 0 to 100

These commands set the percent of memory space allocated for lrecs and srecs to *value*, where *value* is a floating-point number representing percent. The following example sets the memory allocation for lrecs to 10%.

Note Issuing these commands will clear all the logged data in memory. All the existing records should be retrieved using appropriate commands, if required. ▲

```
Send:          set malloc lrec 10
Receive:       set malloc lrec 10 ok
```

set copy sp to lrec
set copy sp to srec
set copy sp to stream
These commands copy the current selections in scratch pad (sp) into the lrec, srec, or streaming data list.

The scratch pad is a temporary memory area which is used to set up lists of selections for lrec, srec, or streaming data items. The user can copy any of these lists to the scratch pad, modify individual elements in the list, then save the scratch pad back to the original list. For more information on how to edit the scratch pad, see the "sp field" command.

The following example copies the current list in scratch pad into the lrecs list.

```
Send:        set copy sp to lrec
Receive:     set copy sp to lrec ok
```

set copy lrec to sp
set copy srec to sp
set copy stream to sp

These commands copy the current contents of the lrec, srec, or streaming data list into the scratch pad (sp). These commands are useful in easy modification of current lrec, srec, or streaming data lists.

The scratch pad is a temporary memory area which is used to set up lists of selections for lrec, srec, or streaming data items. The user can copy any of these lists to the scratch pad, modify individual elements in the list, then save the scratch pad back to the original list. For more information on how to edit the scratch pad, see the "sp field" command.

The following example copies the current list of lrecs into the scratch pad.

```
Send:        set copy lrec to sp
Receive:     set copy lrec to sp ok
```

sp field *number*

This command reports the variable *number* and name stored at the index in the scratch pad list.

The scratch pad is a temporary memory area which is used to set up lists of selections for lrec, srec, or streaming data items. The user can copy any of these lists to the scratch pad, modify individual elements in the list, then save the scratch pad back to the original list.

The following example shows that field 5 in the scratch pad is set to index number 8, which is for internal temperature.

```
Send:        sp field 5
Receive:     sp field 5 8 int temp
```

set sp field *number value*

number = 1-32 for lrec and srec lists, 1-8 for streaming data lists

This command sets the scratch pad field *number* (item number in scratch pad list) to *value*, where *value* is the index number of a variable in the analog output variable list. Available variables and their corresponding index numbers may be obtained using the command "list var aout". The "set sp field" command is used to create a list of variables which can then be transferred into the lrec, srec, or streaming data lists, using the "set copy sp to lrec", "set copy sp to srec", or "set copy sp to stream" commands.

```
Send:        set sp field 1 5
Receive:     set sp field 1 5 ok
```

stream per

This command reports the current time interval in seconds for streaming data. The following example reports the streaming period is set to 10 seconds.

```
Send:          stream per
Receive:       stream per 10
```

set stream per *number value*

number value = | 1 | 2 | 5 | 10 | 20 | 30 | 60 | 90 |120 | 180 | 240 | 300 |

This command sets the time interval between two consecutive streaming data strings to *number value* in seconds. The following example sets the number value to 10 seconds.

```
Send:          set stream per 10
Receive:       set stream per 10 ok
```

stream time

This command reports if the streaming data string will have a time stamp attached to it or not, according to Table B–3. The following example reports that the streaming data shall not include a time stamp.

```
Send:          stream time
Receive:       stream time 0
```

set stream time *value*

This command enables *value*, where *value* is to attach or disable time stamp to streaming data string, according to Table B–3. The following example attaches a time stamp to streaming data.

```
Send:          set stream time 0
Receive:       set stream time 0 ok
```

Table B–3. Stream Time Values

Value	**Stream Time**
0	Disables time stamp to streaming data string
1	Attaches time stamp to streaming data string

frec

This command retrieves the most recent filter record. If there is no data, the command returns "NO DATA".

```
Send:          frec
Receive:       frec
               NO DATA
```

no of frecs
This command reports the number of filter records stored in the instrument

```
Send:        no of frecs
Receive:     no of frecs 32 frecs
```

frec layout
This command returns layout data for the frecs (for use by *i*Port only).

```
Send:        frec layout
Receive:     frec layout 678 32 β β
```

frec *x y*
x = The first record to be retrieved (1-32)
y = The number to retrieve from that point forward (1-10)

This command retrieves filter record data. If the number to be retrieved is greater than the TOTAL number available "out of range" will be returned. If the number to be retrieved combined with the number to start from goes off the end, fewer than requested will be returned. The following example retrieves 5 records starting 10 records back from the most recent.

```
Send:        frec 10 5
Receive:     testing for results
```

set clear filter log
This command clears the filter log (frec) data stored in the instrument. IMPORTANT: Filter log data will not be recoverable if this command is sent to the instrument.

```
Send:        set clear filter log
Receive:     set clear filter log
```

Keys/Display

push *button*

do	**ri**
down	**right**
en	**ru**
enter	**run**
he	**up**
help	**1**
le	**2**
left	**3**
me	**4**
menu	

button = | do | down | en | enter | he | help | le | left | me | menu | ri | right | ru | run | up | 1 | 2 | 3 | 4 |

These commands simulate pressing the front panel pushbuttons. The numbers represent the front panel soft keys, from left to right.

```
Send:          push enter
Receive:       push enter ok
```

isc
iscreen

These commands retrieve the framebuffer data used for the display on the *i*Series instrument. It is 19200 bytes in size, 2-bits per pixel, 4 pixels per byte arranged as 320 by 240 characters. The data is sent in RLE encoded form to save time in transmission. It is sent as a type '5' binary C-Link response with no checksum.

The RLE encoding consists of a 0 followed by an 8-bit count of consecutive 0xFF bytes. The following 'c' code will expand the incoming data.

```
void      unpackDisplay ( void far* tdib, unsigned char far* rlescreen )
{
int i,j,k;
unsigned char far *sc4bpp, *sc2bpp, *screen, *ptr;

   ptr = screen = (unsigned char far *)malloc(19200);
   //RLE decode the screen
   for (i=0; i<19200 && (ptr - screen) < 19200; i++)
   {
      *(ptr++) = *(rlescreen + i);
      if (*(rlescreen + i) == 0)
      {
         unsigned char rlecount = *(unsigned char *)(rlescreen + ++i);

         while (rlecount)
         {
            *(ptr++) = 0;
            rlecount--;
         }
      }
      else if (*(rlescreen + i) == 0xff)
      {
         unsigned char rlecount = *(unsigned char *)(rlescreen + ++i);

         while (rlecount)
         {
            *(ptr++) = 0xff;
            rlecount--;
         }
      }
   }
}
```

To convert this data into a BMP for use with Windows, it needs to be saved as a 4-bit-per-pixel gray-scale image. Also note that BMP files are upside down relative to this data, i.e. the top display line is the last line in the BMP.

menutext
This command displays the text of the menu item where the cursor is currently positioned. The following example shows that the cursor is positioned at the instrument controls menu item.

```
Send:        menutext
Receive:     menutext     main menu     instrument controls
```

Hardware Configuration

contrast
This command reports the screen's level of contrast. The following example shows the screen contrast is 50%, according to Table B–4.

```
Send:        contrast
Receive:     contrast 10:50%
```

set contrast *level*
This command sets the screen's *level* of contrast, according to Table B–4 The following example sets the contrast level to 50%.

```
Send:        set contrast 10
Receive:     set contrast 10 ok
```

Table B–4. Contrast Levels

Level	**Contrast Level**
0	0%
1	5%
2	10%
3	15%
4	20%
5	25%
6	30%
7	35%
8	40%
9	45%
10	50%
11	55%
12	60%
13	65%
14	70%
15	75%

Level	**Contrast Level**
16	80%
17	85%
18	90%
19	95%
20	100%

This command reports the current date. The following example reports the date as December 1, 2009.

```
Send:         date
Receive:      date 12-01-09
```

set date *mm-dd-yy*
mm = month
dd = day
yy = year

This command sets the date of the analyzer's internal clock. The following example sets the date to December 1, 2009.

```
Send:         set date 12-01-09
Receive:      set date 12-01-09 ok
```

set default params
This command sets all the parameters to their default values. This does not affect the factory-calibrated parameters.

```
Send:         set default params
Receive:      set default params ok
```

save
set save params
This command stores all current parameters in FLASH memory. It is important that each time instrument parameters are changed, that this command be sent. If changes are not saved, they will be lost in the event of a power failure. The following example saves the parameters to FLASH memory.

```
Send:         set save params
Receive:      set save params ok
```

time
This command reports the current time (24-hour time). The following example reports that the internal time is 2:15:30 pm.

```
Send:         time
Receive:      time 14:15:30
```

set time *hh:mm:ss*
hh = hours
mm = minutes
ss = seconds

This command sets the internal clock (24-hour time). The following example sets the internal time to 2:15 pm.

Note If seconds are omitted, the seconds default to 00. ▲

```
Send:         set time 14:15
Receive:      set time 14:15 ok
```

Communications Configuration

addr dns
This command reports the TCP/IP address for the domain name server.

```
Send:         addr dns
Receive:      addr dns 192.168.1.1
```

set addr dns *address*
This command sets the domain name server *address*, where *address* consists of four numbers ranging from 0-255 inclusive, separated by ".".

```
Send:         set addr dns 192.168.1.1
Receive:      set addr dns 192.168.1.1 ok
```

addr gw
This command reports the default TCP/IP gateway address.

```
Send:         addr gw
Receive:      addr gw 192.168.1.1
```

set addr gw *address*
This command sets the default gateway *address*, where *address* consists of four numbers ranging from 0-255 inclusive, separated by ".".

Note This command cannot be used when DHCP is on. Refer to the DHCP command that follows for additional information. ▲

```
Send:         set addr gw 192.168.1.1
Receive:      set addr gw 192.168.1.1 ok
```

addr ip
This command reports the IP address of the analyzer.

```
Send:        addr ip
Receive:     addr ip 192.168.1.200
```

set addr ip *address*
This command sets the analyzer's IP *address*, where *address* consists of four numbers ranging from 0-255 inclusive, separated by ".".

Note This command cannot be used when DHCP is on. Refer to the DHCP command that follows for additional information. ▲

```
Send:        set addr ip 192.168.1.200
Receive:     set addr ip 192.168.1.200 ok
```

addr nm
This command reports the IP netmask.

```
Send:        addr nm
Receive:     addr nm 255.255.255.0
```

set addr nm *address*
This command sets the netmask *address*, where *address* consists of four numbers ranging from 0-255 inclusive, separated by ".".

Note This command cannot be used when DHCP is on. Refer to the DHCP command that follows for additional information. ▲

```
Send:        set addr nm 255.255.255.0
Receive:     set addr nm 255.255.255.0 ok
```

addr ntp
This command reports the IP address for the network time protocol server. See "Network Time Protocol Server" in the Communications Settings" section of the "Operation" chapter for more information.

```
Send:        addr ntp
Receive:     addr ntp 10.209.43.237
```

set addr ntp *address*
This command sets the network time protocol server *address*, where *address* consists of four numbers ranging from 0-255 inclusive, separated by ".".

```
Send:        set addr ntp 10.209.43.237
Receive:     set addr ntp 10.209.43.237 ok
```

baud
This command reports the current baud rate for the serial port (RS232/RS485). The following example reports that the current baud rate is 9600 baud.

```
Send:        baud
Receive:     baud 9600
```

set baud *rate*
rate = | 1200 | 2400 | 4800 | 9600 | 19200 | 38400 | 57600 | 115200 |

This command sets the instrument baud rate to *rate*. The following example sets the instrument's baud rate to 9600.

Note After the command is sent, the baud rate of the sending device must be changed to agree with the instrument. ▲

```
Send:        set baud 9600
Receive:     set baud 9600 ok
```

dhcp
This command reports the current state of use of the Dynamic Host Configuration Protocol (DHCP) as on or off. DHCP is used to assign an IP address to the instrument automatically. The following example shows that DHCP is on.

```
Send:        dhcp
Receive:     dhcp on
```

set dhcp *onoff*
onoff = | on | off |

This command enables (*on*) and disables (*off*) the DHCP service. When DHCP is set to on, the instrument gets the IP address, the netmask address, and the gateway address from a DHCP server. When DHCP is set to off, the instrument gets these addresses from system memory. The following example sets the DHCP service to on.

Note If DHCP is changed from on to off and then the IP address, the netmask address, or the gateway address is changed, you must cycle power to the instrument before the change takes effect. Until you cycle the power, the address assigned by the DHCP server will still be used and reported as the current address. ▲

```
Send:         set dhcp on
Receive:      set dhcp on ok
```

format

This command reports the current reply termination format. The following example shows that the reply format is 00, which means reply with no checksum, according to Table B–5.

```
Send:         format
Receive:      format 00
```

set format *format*

This command sets the reply termination *format*, where *format* is set according to Table B–5. The following example sets the reply termination format to checksum.

```
Send:         set format 01
Receive:      set format 01 ok
```

Table B–5. Reply Termination Formats

Format	**Reply Termination**
00	<CR>
01	<NL> sum xxxx <CR>

where xxxx = 4 hexadecimal digits that represent the sum of all the characters (bytes) in the message

host name

This command reports the host name string. The following example reports the host name is set to *i*Series. This command returns "bad cmd" if no host name has been set.

```
Send:         host name
Receive:      host name iSeries
```

set host name *string*

This command sets the host name *string*, where *string* is 1-13 alphanumeric characters (with no spaces). The following example sets the host name to analyzer01. This command returns "bad cmd" if no host name has been set.

```
Send:         set host name analyzer01
Receive:      set host name analyzer01 ok
```

instr name

This command reports the instrument name.

```
Send:        instr name
Receive:     instr name
             Partisol Sampler
             Partisol Sampler
```

mode

This command reports what operating mode the instrument is in: local, service, or remote. The following example shows that the instrument is in the remote mode.

```
Send:        mode
Receive:     mode remote
```

set mode local

set mode remote

These commands set the instrument to local or remote mode. The following example sets the instrument to the local mode.

```
Send:        set mode local
Receive:     set mode local ok
```

allow mode cmd

This command reports the current allow mode setting: 1 = allow "set mode local" and "set mode remote" commands; 0 = ignore "set mode local" or "set mode remote"commands, according to Table B–6. The default value is 0; ignore the commands. The following example shows that the instrument is configured to ignore "set mode local" or "set mode remote" commands.

```
Send:        allow mode cmd
Receive:     allow mode cmd 0
```

set allow mode cmd *value*

This command is used to configure the instrument to *value*, where *value* is either 1 = accept or 0 = ignore the "set mode local" and "set mode remote" commands, according to Table B–6.

If the instrument is set to accept the commands (*value* = 1), the "set mode local" command will unlock the instrument and the keypad can be used to make changes via the front panel.

If the instrument is set to ignore the commands (*value* = 0), the instrument will respond with "ok" as if the command has been accepted and acted upon, **but it will not change the instrument lock status** (this is for compatibility with systems expecting and "ok" response).

Note The instrument will always respond to the command "mode" with the status of the password lock as "mode local" or "mode remote", regardless of the above setting. ▲

The following example sets the instrument to accept the "set mode local" and "set mode remote" commands.

```
Send:          set allow mode cmd 1
Receive:       set allow mode cmd 1 ok
```

Table B–6. Allow Mode Command Values

Value	**Allow Mode Command**
0	Ignore (default)
1	Accept

power up mode

This command reports the current power up mode setting to either 0 = local/unlocked or 1 = remote/locked, according to Table B–7. The default value is 0; power up in local/unlocked mode. The following example shows that the instrument is configured to power up in the remote/locked mode.

```
Send:          power up mode
Receive:       power up mode 1
```

set power up mode *value*

This command is used to configure the instrument to power up in the local/unlocked mode (*value* = 0*)* or the remote/locked mode (*value* = 1), according to Table B–7.

If the instrument is set to power up in the local/remote mode, the keypad can be used to make changes via the front panel. If the instrument is set to power up in the remote/locked mode, changes can not be made from the front panel. The following example sets the instrument to power up in remote/locked mode.

```
Send:          set power up mode 1
Receive:       set power up mode 1 ok
```

Table B–7. Power Up Mode Values

Value	**Power up Mode**
0	Local/Unlocked Mode (default)
1	Remote/Locked Mode

instrument id
This command reports the instrument id.

```
Send:        instrument id
Receive:     instrument id 12
```

set instrument id *value*
This command sets the instrument id to value, where value is a decimal number between 0 and 127 inclusive.

Note Sending this command via RS-232 or RS-485 will require the host to use the new ID for subsequent commands. ▲

```
Send:        set instrument id 12
Receive:     set instrument id 12 ok
```

program no
This command the type and program version of the instrument.

```
Send:        program no
Receive:     program no iSeries 2000iD 01.07.85.272
```

layout ack
This command reports the stale layout/layout change indicator (*) that is attached to each response if the erec layout has changed since the last time erec layout was requested, according to Table B–8. The following example reports that the instrument is configured to do nothing.

```
Send:        layout ack
Receive:     layout ack 0
```

set layout ack *value*
This command disables the stale layout/layout change indicator (*) that is attached to each response if the erec layout has changed since the last time erec layout was requested, according to Table B–8.

```
Send:        set layout ack
Receive:     set layout ack ok
```

Table B–8. Set Layout Ack Values

Value	Function
0	Do nothing (default)
1	Append "*"

tz
This command reports the "tz" timezone string for the NTP server. See "Network Time Protocol Server" in the "Communications Settings" section of the "Operation" chapter for more information.

```
Send:        tz
Receive:     tz EST+5EDT
```

set tz *string*
This command sets the timezone *string* for the instrument for use with the NTP server, where *string* is a standard timezone string. Common strings are listed in the "Timezone" screen description in Chapter 3.

```
Send:        set tz EST+5EDT
Receive:     set tz EST+5EDT ok
```

I/O Configuration

analog iout range *channel*
This command reports the analog current output range setting for *channel*, where *channel* must be between 1 and 6, inclusive. The following example reports current output channel 4 is in the 4-20 mA range, according to Table B–9. This command responds with "feature not enabled" if the I/O expansion board is not detected.

```
Send:        analog iout range 4
Receive:     analog iout range 4 2
```

set analog iout range *channel range*
This command sets analog current output *channel* to the *range* where *channel* is between 1 and 6 inclusive, and *range* is set according to Table B–9. The following example sets current output channel 4 to the 0-20 mA range. This command responds with "feature not enabled" if the I/O expansion board is not detected.

```
Send:        set analog iout range 4 1
Receive:     set analog iout range 4 1 ok
```

Table B–9. Analog Current Output Range Values

Range	**Output Range**
1	0-20 mA
2	4-20 mA
0 [cannot be set to this, but may report]	Undefined

analog vin *channel*

This command retrieves the analog voltage input *channel* data, both the calculated value and the actual voltage. In the following example, the "calculated" value of channel 1 is 75.325 degrees F, volts are 2.796. This command responds with "feature not enabled" if the I/O expansion board is not detected.

```
Send:         analog vin 1
Receive:      analog vin 1 75.325 2.796
```

analog vout range *channel*

This command reports the analog voltage output *channel* range, where *channel* is between 1 and 6 inclusive, according to Table B–10. The following example reports that analog voltage output channel 2 is set to 3 (1-10 V).

```
Send:         analog vout range 2
Receive:      analog vout range 2 3
```

set analog vout range *channel range*

This command sets analog voltage output *channel* to the range, where *channel* is between 1 and 6 inclusive, and *range* is set according to Table B–10. The following example sets channel 2 to the 0-10 V range.

```
Send:         set analog vout range 2 3
Receive:      set analog vout range 2 3 ok
```

Table B–10. Analog Voltage Output Range Values

Range	**Output Range**
1	0-1 V
2	0-100 mV
3	0-10 V
4	0-5 V
0 [cannot be set to this, but may report]	Undefined

dig in

This command reports the status of the digital inputs as a 4-digit hexadecimal string with the most significant bit (MSB) being input 16.

```
Send:         dig in
Receive:      dig in 0xff7f
```

din *channel*

This command reports the action assigned to the digital input *channel* and the index number of the corresponding active state. The following example reports the input 1 to be assigned an index number 1 corresponding to action of STOP with the active state being high.

```
Send:         din 1
Receive:      din 1 1 STOP high
```

set din *channel index state*

This command assigns digital input *channel* (1-16) to activate the action indicated by *index* (1-12), when the input transitions to the designated *state* (high or low). Use the “list var din” command to obtain the list of supported *index* values and corresponding actions. The following example sets the digital input channel 5 to 1 on a low-to-high transition.

```
Send:         set din 5 1 high
Receive:      set din 5 1 high ok
```

dout *channel*

This command reports the index number, output variable and the active state assigned to digital output *channel*. The following example reports output 4 to be assigned an index number 4 corresponding to action of “I/O board status”.

```
Send:         dout 4
Receive:      dout 4 4 I/O BD STATUS open
```

set dout *channel index state*

This command assigns digital output *channel* (1-10) to be assigned to the action associated with *index* (1-34), and assigns it an active state of *state* (open or closed). Use the “list var dout” command to obtain the list of supported index values and corresponding state. The following example sets the digital output channel 4 to state 11.

```
Send:         set dout 4 11 open
Receive:      set dout 4 11 open ok
```

dtoa *channel*

This command reports the outputs of the 6 or 12 Digital to Analog converters, according to Table B–11. The following example shows that the D/A #1 is 97.7% full-scale.

```
Send:         dtoa 1
Receive:      dtoa 1 97.7%
```

Note If the instrument is in a mode which does not provide a particular output, and that output is selected, the value will be 0.0. ▲

Note All channel ranges are user definable. If any customization has been made to the analog output configuration, the default selections may not apply. ▲

Table B–11. Default Output Assignment

D to A	Function	Assignment
1	Voltage Output	Flow Volume
2	Voltage Output	Not Assigned
3	Voltage Output	Not Assigned
4	Voltage Output	Not Assigned
5	Voltage Output	Not Assigned
6	Voltage Output	Not Assigned
7	Current Output	Flow Volume
8	Current Output	Not Assigned
9	Current Output	Not Assigned
10	Current Output	Not Assigned
11	Current Output	Not Assigned
12	Current Output	Not Assigned

list din
list dout

These commands report the current selection for the digital inputs or the digital outputs in the format. Output no Index number variable name active state. The active state for digital outputs is open or closed. The active state for digital inputs is high or low. Channels that have not been assigned a variable index are not displayed.

```
Send:         list dout
Receive:      list dout
```

```
output index variable state
1 1 GEN ALARM open
2 2 MB STATUS open
3 3 MIB STATUS open
4 4 I/O BD STATUS open
5 5 LOCAL/REMOTE open
6 6 SERVICE open
7 7 EXT ALARM 1 open
8 8 EXT ALARM 2 open
9 9 EXT ALARM 3 open
```

list var aout
list var dout
list var din

These commands report the list of index numbers, and the variables (associated with that index number) available for selection in the current mode for analog outputs, digital outputs, and digital inputs. The index number is used to insert the variable in a field location in a list using "set sp *field index*". The following example reports the list of analog outputs, index numbers, and variables.

```
Send:       list var aout
Receive:    list var aout
            index variable
             0 none
             1 flow
             2 flow2
             3 flowt
             4 COV
             5 COV2
             6 vol
             7 vol2
             8 p-amb
             9 p-flt
            10 p-flt2
            12 p-amb_a
            13 p-flt-a
            14 p-flt2-a
            16 t-amb
            17 t-flt
            19 t-fcmp
            20 t-ecmp
            21 tdelt
            23 tdltx
            25 rh
            26 wspd
            27 wdir
            28 wspda
            29 wvel
            30 wvela
            31 wdira
            32 fltid
```

```
33 flt2id
34 casid
35 cas2id
36 start
37 stop
38 elap-tm
41 tm
42 tm
43 tm
44 exfg
45 statcode
46 ain1
47 ain2
48 ain3
49 ain4
50 ain5
51 ain6
52 ain7
53 ain8
```

relay stat

This command reports the current relay logic as normally “open” or normally “closed,” if all the relays are set to same state, that is all open or all closed. The following example shows that the status of all the relays’ logic is set to normally “open”.

```
Send:         relay stat
Receive:      relay stat open
```

Note If individual relays have been assigned different logic, then the response would be a 4-digit hexadecimal string with the least significant byte (LSB) being relay no 1. ▲

For example:

```
Receive:      relay stat 0x0001 (indicates relay no 1 is set to
              normally open logic, all others are normally closed)
Receive:      relay stat 0x0005 (indicates relay no 1 and 3 are set
              to be normally open logic, all others are normally
              closed)
```

set relay open
set relay open *value*
set relay closed
set relay closed *value*

These commands set the relay logic to normally open or closed for relay number *value*, where *value* is the relay between 1 and 16. The following example sets the relay no 1 logic to normally open.

Note If the command is sent without an appended relay number, then all the relays are assigned the set logic of normally open/closed. ▲

```
Send:        set relay open 1
Receive:     set relay open 1 ok
```

Record Layout Definition

The erec, lrec, and srec layouts contain the following:

- A format specifier for parsing ASCII responses
- A format specifier for parsing binary responses,

In addition to these the erec layout contains

- A format specifier for producing the front-panel displays.

In operation, values are read in using either the ASCII or binary format specifiers and converted to uniform internal representations (32-bit floats or 32-bit integers). These values are converted into text for display on the screen using the format specifier for the front-panel display. Normally, the specifier used to parse a particular datum from the input stream will be strongly related to the specifier used to display it (e.g., all of the floating point inputs will be displayed with an 'f' output specifier, and all of the integer inputs will be displayed with a 'd' specifier).

Format Specifier for ASCII Responses

The first line of the Layout response is the scanf-like parameter list for parsing the fields from an ASCII ERec response. Parameters are separated by spaces and the line is terminated by a \n (the normal line separator character). Valid fields are:

```
%s  - parse a string
%d  - parse a decimal number
%ld - parse a long (32-bit) decimal number
%f  - parse a floating point number
%x  - parse a hexadecimal number
%lx - parse a long (32-bit) hex number
%*  - ignore the field
```

Note Signed versus unsigned for the integer values does not matter; it is handled automatically. ▲

Format Specifier for Binary Responses

The second line of the Layout response is the binary parameter list for parsing the fields from a binary response. Parameters MUST be separated by spaces, and the line is terminated by a '\n'. Valid fields are:

```
t - parse a time specifier (2 bytes)
D - parse a date specifier (3 bytes)
```

```
i - ignore one 8-bit character (1 byte)
e - parse a 24-bit floating point number (3 bytes: n/x)
E - parse a 24-bit floating point number (3 bytes: N/x)
f - parse a 32-bit floating point number (4 bytes)
c - parse an 8-bit   signed number (1 byte)
C - parse an 8-bit unsigned number (1 byte)
n - parse a 16-bit   signed number (2 bytes)
N - parse a 16-bit unsigned number (2 bytes)
m - parse a 24-bit   signed number (3 bytes)
M - parse a 24-bit unsigned number (3 bytes)
l - parse a 32-bit   signed number (4 bytes)
L - parse a 32-bit unsigned number (4 bytes)
```

Format Specifier for Front-Panel Layout

There is an optional single digit *d* which may follow any of the numeric fields which indicates that after the field has been parsed out, the resulting value is to be divided by 10^*d*. Thus the 16-bit field 0xFFC6 would be interpreted with the format specifier 'n3' as the number -0.058.

The subsequent lines in the ERec Layout response describe the appearance of the full panel. The full instrument panel as it appears on the screen has two columns of lines. Each line is composed of three major components: (1) a text field, (2) a value field, and (3) a button. None of these three components is required. The text field contains statically displayed text.

The value field displays values which are parsed out of the response to a DATA/ERec command. It also displays, though background changes, alarm status. The button, when pressed, triggers input from either a dialog box or a selection list. There are five kinds of buttons, B, I, L, T, and N.

Each line in the layout string corresponds to one line on the display. The layout string describes each of the three major fields as well as translation mechanisms and corresponding commands.

Text

The first field in the layout string is the text. It is delimited by a ':'. The string up to the first ':' will be read and inserted in the text field of the line.

Value String

This is followed by a possible string, enclosed in quotes. This is used to place a string into the value field.

Value Source

The value source, which is the item (or word) number in the DATA/ERec response, appears next. This is followed by an optional bitfield designator. The datum identified by the value source can be printed as a string 's', hexadecimal 'x', decimal 'd', or floating point 'f', or binary 'b' number. Typically, bitfield extractions are only done for decimal or hexadecimal numbers.

Floating-point numbers can be followed with an optional precision specifier which will be used as an argument to printf's %f format (e.g., a field of '4' would be translated into the printf command of '%.3f'). Alternately, the special character '*' can precede the precision specifier; this causes an indirection on the precision specifier (which now becomes a field number).

This is useful when formatting, for example, numbers which have varying precision depending on the mode of the instrument.

Binary numbers can also have an optional precision specifier which is used to determine how many bits to print. For example, the specifier 'b4' will print the lowest four bits of the parsed number.

There are serious restrictions on where an 's' field may appear: currently sources 1 and 2 must be 's', and no others may be 's'.

Alarm Information

The value source is followed by optional alarm information, indicated by a commercial at sign '@' with a source indicator and a starting bit indicator. All alarm information is presumed to be two bits long (low and high). The bitfield extraction is performed on the integer part of the source. Typical alarm information would appear as '@6.4'.

Translation Table

Then, there appears an optional translation table within braces '{}'. This is a string of words separated by spaces. An example translation table would be '{Code_0 Code_1 Code_2 Code_3}'. The value, once extracted is used as a zero-based index into the translation table to determine the string to display.

Selection Table

Then there appears an optional selection table within parentheses '(...)'. This is a string of numbers separated by spaces '(0 1)'. The selection table lists the translation table entries which the user may select from when setting the parameter. This is not necessarily the same as the entries which may be displayed.

Button Designator

Then there appears an optional button designator. This will be one of 'B', 'I', 'L', 'T', or 'N'.

B- Indicates a button which pops up an input dialog prompting the user for a new value using the designated input format. The input format is specified from the 'B' through the subsequent semicolon.

I—Indicates a button which pops up a selection list with input translation. That is, the values read are translated before they are compared to the selection list options.

L—Indicates a button which pops up a selection list without any translation. The output value is number of the selected option.

T—Indicates a button which pops up a selection list with output translation. The number of the option selected is used as an index into the translation table to generate an output string.

N—Indicates a button which only sends the subsequent command to the instrument. No user-prompting happens.

Examples

Some examples ('\n' is the C syntax for an end-of-line character):

```
'Temperatures\n'
```

This is a single text-only line.

```
'\n'
```

This is a single blank line.

```
' FLOW:3s\n'
```

This is a line which appears slightly indented. The text field is 'FLOW', the value is taken from the third element of the data response, and interpreted as a string.

```
' FLOW:18sBd.ddd;set no coef %s\n'
```

This is a line which also appears slightly indented. The next field is also 'NO', but the value is taken from the eighteenth element of the data response, again interpreted as a string. A button appears on this line which, when pressed, pops up an input dialog which will state "Please enter a new value for NO using a d.ddd format." The string entered by the user is used to construct the output command. If the user enters, for example, '1.234', the constructed command will be 'set no coef 1.234'.

```
' NO:21f{Code_0 Code_1 Code_2 Code_3 Code_4 Code_5 Code_6 Code_7
Code_8 Code_9 Code_10 Code_11}Lset range no %d\n'
```

This is a line which appears slightly indented, the title is again 'NO', and the value the twenty-first element of the data response, interpreted as a floating-point number. There is a no-translation button which creates a selection list of twelve "Code nn" options. The number of the user selection is used to create the output command.

```
'Mode:6.12-13x{local remote service service}(0 1)Tset mode %s\n'
```

This is a line which has a title of 'Mode', and value taken from the sixth field of the data response. There is a bitfield extraction of bits 12 through 13 from the source (the value type is not important here because the value is being translated to an output string). Once the bits have been extracted, they are shifted down to the bit-zero position. Thus, the possible values of this example will be 0 through 3. The translation list shows the words which correspond to each input value, the zeroth value appearing first (0 -> local, 1 -> remote, etc.). The selection list shows that only the first two values, in this case, are to be shown to the user when the button is pressed. The 'T' button indicates full translation, input code to string, and user selection number to output string.

```
'\xC'
```

This is a line that starts a new column (the \xC or ^L),

```
' Comp:6.11x{off on}Tset temp comp %s\n'
```

This shows that the bitfield end (the second part of a bitfield specification) is optional. The bitfield will be one bit long, starting in this case at the eleventh bit.

```
'Background:7f*8Bd.ddd;set o3 bkg %s\n'
```

This shows the use of indirect precision specifiers for floating point displays. The background value is taken from the 7th element, and the precision specifier is taken from the 8th. If the asterisk were not present, it would indicate instead that 8 digits after the decimal point should be displayed.

Appendix C
MODBUS Protocol

This appendix provides a description of the MODBUS Protocol Interface and is supported both over RS-232/485 (RTU protocol) as well as TCP/IP over Ethernet.

The MODBUS Commands that are implemented are explained in detail in this document. The MODBUS protocol support for the Sampler enables the user to perform the functions such as reading the various measurements and other analog values or variables, reading the status of the digital outputs, and to triggering or simulating the activation of a digital input to the Sampler. This is achieved by using the following supported MODBUS commands.

For details of the Partisol 2000*i* and 2000*i*-D MODBUS Protocol specification, see the following topics:

- "Serial Communication Parameters" on page C-1
- "TCP Communication Parameters" on page C-2
- "Application Data Unit Definition" on page C-2
- "Function Codes" on page C-3
- "MODBUS Addresses Supported" on page C-8

Additional information on the MODBUS protocol can be obtained at http://www.modbus.org. References are from MODBUS Application Protocol Specification V1.1a MODBUS-IDA June 4, 2004.

Serial Communication Parameters

The following are the communication parameters that are used to configure the serial port of the *i*Series to support MODBUS RTU protocol.

Number of Data bits	: 7 or 8
Number of Stop bits	: 1 or 2
Parity	: None, Odd, or Even
Data rate	: 1200 to 115200 Baud (9600 is default)

TCP Communication Parameters

*i*Series Instruments support the MODBUS/TCP protocol. The register definition is the same as for the serial interface. Up to three simultaneous connections are supported over Ethernet.

TCP connection port for MODBUS: 502

Application Data Unit Definition

Here are the MODBUS ADU (Application Data Unit) formats over serial and TCP/IP:

Serial:	Slave Address	Function Code	Data	Error Check
TCP/IP:	MBAP Header	Function Code	Data	

Slave Address

The MODBUS slave address is a single byte in length. This is the same as the instrument ID used for C-Link commands and can be between 1 and 127 decimal (i.e. 0x01 hex to 0x7F hex). This address is only used for MODBUS RTU over serial connections.

Note Device ID ‘0’ used for broadcast MODBUS commands, is not supported. Device IDs 128 through 247 (i.e. 0x80 hex to 0xF7 hex) are not supported because of limitations imposed by C-Link. ▲

MBAP Header

In MODBUS over TCP/IP, a MODBUS Application Protocol Header (MBAP) is used to identify the message. This header consists of the following components:

Transaction Identifier	2 Bytes	0x0000 to 0xFFFF (Passed back in response)
Protocol Identifier	2 Bytes	0x00 (MODBUS protocol)
Length	2 Bytes	0x0000 to 0xFFFF (Number of following bytes)
Unit Identifier	1 Byte	0x00 to 0xFF (Passed back in response)

A Slave address is not required in MODBUS over TCP/IP because the higher-level protocols include device addressing. The unit identifier is not used by the Sampler.

Function Code

The function code is a single byte in length. The following function codes are supported by the Sampler:

Read Coils	:	0x01
Read Inputs	:	0x02
Read Holding Registers	:	0x03
Read Input Registers	:	0x04
Force (Write) Single Coil	:	0x05
Read Exception Status	:	0x07

If a function code is received that is not in this list, and invalid function exception is returned.

Data

The data field varies depending on the function. For more description of these data fields, see "Function Codes" that follows.

Error Check

In MODBUS over Serial an error check is included in the message. This is not necessary in MODBUS over TCP/IP because the higher-level protocols ensure error-free transmission. The error check is a two-byte (16-bit) CRC value.

Function Codes

This section describes the various function codes that are supported by the Partisol 2000*i* and 2000*i*-D.

(0x01/0x02) Read Coils / Read Inputs

Read Coils/Inputs reads the status of the digital outputs (relays) in the Sampler. Issuing either of these function codes will generate the same response.

These requests specify the starting address, i.e. the address of the first output specified, and the number of outputs. The outputs are addressed starting at zero. Therefore, outputs numbered 1–16 are addressed as 0–15.

The outputs in the response message are packed as one per bit of the data field. Status is indicated as 1 = Active (on) and 0 = Inactive (off). The LSB of the first data byte contains the output addressed in the query. The other outputs follow toward the high order end of this byte, and from low order to high order in subsequent bytes. If the returned output quantity is not a multiple of eight, the remaining bits in the final data byte will be padded with zeros (toward the high order end of the byte). The Byte Count field specifies the quantity of complete bytes of data.

Note The values reported may not reflect the state of the actual relays in the Sampler, as the user may program these outputs for either active closed or open. ▲

Request

Function code	1 Byte	0x01 or 0x02
Starting Address	2 Bytes	0x0000 to maximum allowed by Sampler
Quantity of outputs	2 Bytes	1 to maximum allowed by Sampler
Unit Identifier	1 Byte	0x00 to 0xFF (Passed back in response)

Response

Function code	1 Byte	0x01 or 0x02
Byte count	1 Byte	N (N = Quantity of Outputs / 8, if the remainder not equal to zero, then N=N+1)
Output Status	n Byte	N = N or N+1

Error Response

Function code	1 Byte	0x01 or 0x02
Exception code	1 Byte	01=Illegal Function, 02=Illegal Address, 03=Illegal Data, 04=Slave Device Failure

Here is an example of a request and response to read outputs 2–15:

Request

Field Name	*(Hex)*
Function	0x01
Starting Address Hi	0x00
Starting Address Lo	0x02
Quantity of Outputs Hi	0x00
Quantity of Outputs Lo	0x0D

Response

Field Name	*(Hex)*
Function	0x01
Byte Count	0x03
Output Status 2–10	0xCD
Output Status 11–15	0x0A

The status of outputs 2–10 is shown as the byte value 0xCD, or binary 1100 1101. Output 10 is the MSB of this byte, and output 2 is the LSB. By convention, bits within a byte are shown with the MSB to the left, and the LSB to the right. Thus the outputs in the first byte are '10 through 2', from left to right. In the last data byte, the status of outputs 15-11 is shown as the byte value 0x0A, or binary 0000 1010. Output 15 is in the fifth bit position from the left, and output 11 is the LSB of this byte. The four remaining high order bits are zero filled.

(0x03/0x04) Read Holding Registers / Read Input Registers

Read holding/input registers reads the measurement data from the Sampler. Issuing either of these function codes will generate the same response. These functions read the contents of one or more contiguous registers.

These registers are 16 bits each and are organized as shown below. All of the values are reported as 32-bit IEEE standard 754 floating point format. This uses 2 sequential registers, least significant 16 bits first.

Registers marked with an asterisk (*) are 32-bit unsigned integers or have to be interpreted as 32-bit unsigned integers.

The request specifies the starting register address and the number of registers. Registers are addressed starting at zero. Therefore registers numbered 1–16 are addressed as 0–15. The register data in the response message are packed as two bytes per register, with the binary contents right justified within each byte. For each register, the first byte contains the high order bits and the second contains the low order bits.

The status of outputs 2–10 is shown as the byte value 0xCD, or binary 1100 1101. Output 10 is the MSB of this byte, and output 2 is the LSB. By convention, bits within a byte are shown with the MSB to the left, and the LSB to the right. Thus, the outputs in the first byte are '10 through 2', from left to right. In the last data byte, the status of outputs 15-11 is shown as the byte value 0x0A, or binary 0000 1010. Output 15 is in the fifth bit position from the left, and output 11 is the LSB of this byte. The four remaining high order bits are zero filled.

Request

Function code	1 Byte	0x03 or 0x04
Starting Address	2 Bytes	0x0000 to maximum allowed by Sampler
Quantity of Registers	2 Bytes	1 to maximum allowed by Sampler

Response

Function code	1 Byte	0x03 or 0x04
Byte count	1 Byte	2 x N (N = quantity of registers)
Register value	N* x 2 Bytes	N = N or N+1

Error Response

Function code	1 Byte	Function code + 0x80
Exception code	1 Byte	01=Illegal Function, 02=Illegal Address, 03=Illegal Data, 04=Slave Device Failure

Here is an example of a request and response to read registers 10–13:

Request

Field Name	*(Hex)*
Function	0x03
Starting Address Hi	0x00
Starting Address Lo	0x09
No. of Registers Hi	0x00
No. of Registers Lo	0x04

Response

Field Name	*(Hex)*
Function	0x03
Byte Count	0x06
Register value Hi (10)	0x02
Register value Lo (10)	0x2B
Register value Hi (11)	0x00
Register value Lo (11)	0x00
Register value Hi (12)	0x00
Register value Lo (12)	0x64
Register value Hi (13)	0x00
Register value Lo (13)	0x64

The contents of register 10 are shown as the two byte values of 0x02 0x2B. Then contents of registers 11–13 are 0x00 0x00, 0x00 0x64 and 0x00 0x64 respectively.

(0x05) Force (Write) Single Coil

The force (write) single coil function simulates the activation of the digital inputs in the Sampler, which triggers the respective action.

This function code is used to set a single action to either On or Off. The request specifies the address of the action to be forced. Actions are addressed starting at zero. Therefore, action number 1 is addressed as 0. The requested On/Off state is specified by a constant in the request data field. A value of 0xFF00 requests the action to be On. A value of 0x0000 requests it to be Off. All other values are illegal and will not affect the output. The normal response is an echo of the request, returned after the state has been written.

Note This function will not work if the Sampler is in Service Level mode. ▲

Request

Function code	1 Byte	0x05
Starting Address	2 Bytes	0x0000 to maximum allowed by Sampler
Output Value	2 Bytes	0x0000 or 0xFF00

Response

Function code	1 Byte	0x05
Starting Address	2 Bytes	0x0000 to maximum allowed by Sampler
Output Value	2 Bytes	0x0000 or 0xFF00

Error Response

Function code	1 Byte	Function code + 0x80
Exception code	1 Byte	01=Illegal Function, 02=Illegal Address, 03=Illegal Data, 04=Slave Device Failure

Here is an example of a request to write Coil 5 On:

Request

Field Name	*(Hex)*
Function	05
Output Address Hi	00
Output Address Lo	05
Output Value Hi	FF
Output Value Lo	00

Response

Field Name	*(Hex)*
Function	05
Output Address Hi	00
Output Address Lo	05
Output Value Hi	FF
Output Value Lo	00

MODBUS Addresses Supported

Table C–1 through Table C–3 list the MODBUS addresses supported for the Partisol 2000*i* and 2000*i*-D.

IMPORTANT NOTE The addresses in the following tables are Protocol Data Unit (PDU) addresses. Verify the coil number on your MODBUS master to ensure that it matches the coil number on the Sampler. ▲

Note Coil status 1 indicates active state. ▲

Table C–1. Read Coils for 2000*i* and 2000*i*-D

Coil Number	Status
1	GENERAL ALARM
2	MOTHERBOARD STATUS ALARM
3	MEASUREMENT INTERFACE BOARD STATUS ALARM
4	I/O EXPANSION BOARD STATUS ALARM
5	LOCAL/REMOTE
6	SERVICE
7	EXTERNAL ALARM 1
8	EXTERNAL ALARM 2
9	EXTERNAL ALARM 3

In addition to the coils in Table C–1, the coils in Table C–3 are also available to be read.

IMPORTANT NOTE The addresses in the following tables are Protocol Data Unit (PDU) addresses. Verify the register number on your MODBUS master to ensure that it matches the register number on the Sampler. ▲

Note For additional information on how to read registers and interpret the data, refer to the "(0x03/0x04) Read Holding Registers / Read Input Registers" section in this appendix. ▲

Table C–2. Read Registers for 2000*i* and 2000*i*-D

Register Number	Variable	Model
40001&40002	FLOW VOLUME	
40003&40004	FLOW2 VOLUME	2000*i*-D only
40005&40006	FLOW TOTAL	
40007&40008	FLOW COVARIANCE	
40009&40010	FLOW2 COVARIANCE	2000*i*-D only
40011&40012	VOLUME	
40013&40014	VOLUME2	2000*i*-D only
40015&40016	AMBIENT PRESSURE	
40017&40018	FILTER PRESSURE	

Register Number	Variable	Model
40019&40020	FILTER2 PRESSURE	2000*i*-D only
40021&40022	PUMP PRESSURE	
40023&40024	AMBIENT PRESSURE AVERAGE	
40025&40026	FILTER PRESSURE AVERAGE	
40027&40028	FILTER2 PRESSURE AVERAGE	2000*i*-D only
40029&40030	PUMP PRESSURE AVERAGE	
40031&40032	AMBIENT TEMPERATURE	
40033&40034	FILTER TEMPERATURE	
40035&40036	FILTER2 TEMPERATURE	2000*i*-D only
40037&40038	COMPARTMENT TEMPERATURE	
40039&40040	ELECTRONICS TEMPERATURE	
40041&40042	TEMPERATURE DELTA	
40043&40044	TEMPERATURE2 DELTA	2000*i*-D only
40045&40046	TEMPERATURE DELTA MAX	
40047&40048	TEMPERATURE2 DELTA MAX	2000*i*-D only
40049&40050	RELATIVE HUMIDITY	
40051&40052	WIND SPEED	
40053&40054	WIND DIRECTION	
40055&40056	WIND SPEED AVERAGE	
40057&40058	WIND VELOCITY	
40059&40060	WIND VELOCITY AVERAGE	
40061&40062	WIND DIRECTION AVERAGE	
40063&40064 through 40089&40090	**Not Used**	
40091&40092	ANALOG IN 1 (I/O Expansion Board installed)	
40093&40094	ANALOG IN 2 (I/O Expansion Board installed)	
40095&40096	ANALOG IN 3 (I/O Expansion Board installed)	
40097&40098	ANALOG IN 4 (I/O Expansion Board installed)	
40099&40100	ANALOG IN 5 (I/O Expansion Board installed)	
40101&40102	ANALOG IN 6 (I/O Expansion Board installed)	
40103&40104	ANALOG IN 7 (I/O Expansion Board installed)	
40105&40106	ANALOG IN 8 (I/O Expansion Board installed)	

IMPORTANT NOTE The addresses in the following tables are Protocol Data Unit (PDU) addresses. Verify the coil number on your MODBUS master to ensure that it matches the coil number on the Sampler. ▲

Note Writing 1 to the coil number shown in the following table will initiate the "action triggered" listed in the table. This state must be held for at least 1 second to ensure the Sampler detects the change and triggers the appropriate action. For example, to trigger AOUTS to zero, write 1 to coil 101. To see the state of coil 101, issue a read coil 101. ▲

Note The coils within each coil group in the following table are mutually exclusive and will not be triggered if there is a conflict. Before you assert (1) one coil in a group, make sure the other coils in the group are de-asserted (0).

In addition to the coils in Table C–3, the coils in Table C–1 are also available to be read.

Table C–3. Write Coils for 2000*i* and 2000*i*-D

Coil Number	Action Triggered
101	STOP
102	START
103	TRIGGER SAMPLE
104	AOUTS TO ZERO
105	AOUTS TO FS
106	EXTERNAL ALARM 1
107	EXTERNAL ALARM 2
108	EXTERNAL ALARM 3

Appendix D
Communications Using *i*Port or RPComm

This appendix provides information for communications using *i*Port or RPComm.

*i*Port

*i*Port is a program designed to communicate exclusively with the Partisol 2000*i* and 2000*i*-D Samplers and other instruments from Thermo Fisher Scientific that are based on the same operating platform. *i*Port can communicate with the Samplers using TCP/IP Ethernet and RS-232 serial communications. These features enable full control of instruments by a remote device, such as a computer. *i*Port takes advantage of the instruments' rich command set and of Microsoft Windows to provide a robust remote interface. Refer to the *iPort Instruction Manual* part number 102606-00 for detailed information.

RPComm

Because the use of AK Protocol has been enabled on the Partisol 2000*i* and 2000*i*-D Samplers, RPComm can be used for communications with the Samplers. Because of the updated operating platform compared with the original Partisol series Samplers, not all functionality is available when using RPComm. RPComm is a communications software package for computers running Windows operating systems which provides interactive remote communications with Partisol instrumentation.

RPComm enables the user to:

- Download the data stored within the unit's data logger
- Schedule automatic data downloads
- Make multiple connections.

RPComm has two communication modes - direct and modem. Direct communication is accomplished when the unit has a direct cable connection with a personal computer (PC). Modem communication is accomplished when the unit has a connection with a PC through the use of a modem and phone line. Before modem communication is attempted, direct communication must be successfully completed. This will ensure that the PC and unit have been set up properly for communications.

Installing RPComm

The RPComm installation files can be downloaded from the Thermo Fisher Scientific home page on the Internet.

Obtaining RPComm Installation Files

Use the following procedures to obtain the RPComm installation files.

1. Access the Thermo Fisher Scientific home page on the Internet.

2. Log into the Customer Area of the website.

Note A password is required to access the Customer Area of website. Contact Thermo Fisher Scientific for password assignments. ▲

3. Locate the RPComm software and download the latest version.

Note If desired, the "changelog.txt" file can be downloaded and saved to a file. The changelog.txt file gives a description of the changes made with each revision of its RPComm program. ▲

4. After downloading is complete, exit the World Wide Web.

Installing RPComm onto a Computer

Perform the following steps to install RPComm onto a computer.

1. Exit all Windows programs. The RPComm installation and setup programs may not run properly if other programs are running.

2. Locate the setup file you downloaded from the Web site and start the setup program.

3. Press the "Next >" button when the RPComm Welcome screen appears and follow the instructions to install the program.

Note Refer to the RPComm manual for more instructions on installing and using RPComm. ▲

Updating the List of Program Register Codes in RPComm

All company instrumentation has a list of system variables that is specific to that type of monitor. A system variable is any value that is entered into, calculated by, or measured by the instrument. This list is called the Program Register Code (PRC) list.

When the Sampler's software is modified, the PRC list often is affected; usually, new PRCs must be added for software enhancement. If there are new PRCs, then the PRC list must be updated within the RPComm software program. This can be accomplished by:

- The entire RPComm program can be downloaded from the website (www.thermo.com) and installed on the computer. However, this is necessary only if the revision number of the RPComm software program has changed. Changes to the unit's operating software do not always require that you update the RPComm program.
- A new PRC list can be downloaded from the website and installed on your computer. This will update the PRC list within RPComm without having to reinstall the entire program.

Use the following procedure to update the PRC list within RPComm.

1. Go to the RPComm directory on your computer's hard drive and look at the files. The PRC lists are located in this directory. Determine which PRC list revision you have in your RPComm directory. The file name for the PRC lists have the following format:

   Rp2000n.nnn

   n.nnn = PRC list revision

2. Go to the Software to Download area of the website. If there is a new PRC list available for the Partisol-Plus Sampler, it will be listed on this web page.

3. There may be multiple PRC lists on this page, one for each instrument that RPComm supports. Determine if there is an updated PRC list for the Partisol Sampler. Select the appropriate PRC list and save it to a file.

Note Be sure to remember the folder the PRC list file is saved in. ▲

4. Disconnect from the Thermo Fisher Scientific Website.

5. If RPComm is running, exit the program.

6. Copy the downloaded PRC list to the RPComm directory on your computer's hard drive. The next time you execute RPComm, the program will automatically use the new PRC list in its operations.

Instrument Setup for Direct Communication using RPComm

To set up the Sampler for direct communication with a PC, you must use the 9-to-9 pin cable (07-000587) Null cable that is included in the compilation package.

Use the following procedure to set up the unit for direct communication.

1. Connect the one end of the 9-to-9 pin cable to one of your PC's serial (COM) ports. Be sure to note which serial port the cable is connected to.

2. Connect the other end of the 9-to-9 pin cable to the unit's RS232 connector to the front of the unit (Figure D–1).

Figure D–1. Connector Panel

3. From the unit's Main screen, press to display the main menu on the screen. Scroll to Instrument Setup and press . This displays the Instrument Setup Menu. Scroll down to Communnnications and press . Press again to enter the Serial Setup screen (Figure D–2).

4. On the RS232 Setup screen, ensure that the proper ser port settings are selected. These include the Baud rate, data bits, parity, stop bits and Rs-232/RS-485 selection. The default settings are 9600, 8, none, and

1. Change these as necessary for the proper settings for your communications setup.

Next, ensure that the communications protocol is set to AK. Press the once to return to the Communication Setup menu and scroll to Communications Protocol and press . Press the to select AK and press to save the change. Press repeatedly to return to the main menut. The sampler is now configured to communicate viea the serial port using AK protocol and RPComm. The unit is now set up for direct communication with a PC.

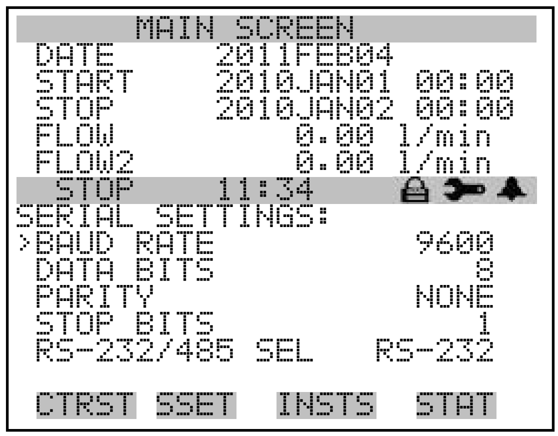


Figure D–2. Serial Setup Screen

Using RPComm

This section assumes that RPComm was installed in the default locations when the installation program was executed.

Executing RPComm

The Windows operating system screens shown in this section are from the Windows 95 operating system. These screens may vary slightly from your computer's screens if you are operating RPComm under the Windows 98 or Windows NT operating systems.

Use the following procedure to execute RPComm.

1. Initiate the RPComm software by selecting the "Start" button on your PC's screen, highlighting "Programs," and then highlighting "RPComm." Choose the RPComm icon to begin executing the RPComm program (Figure D–3).

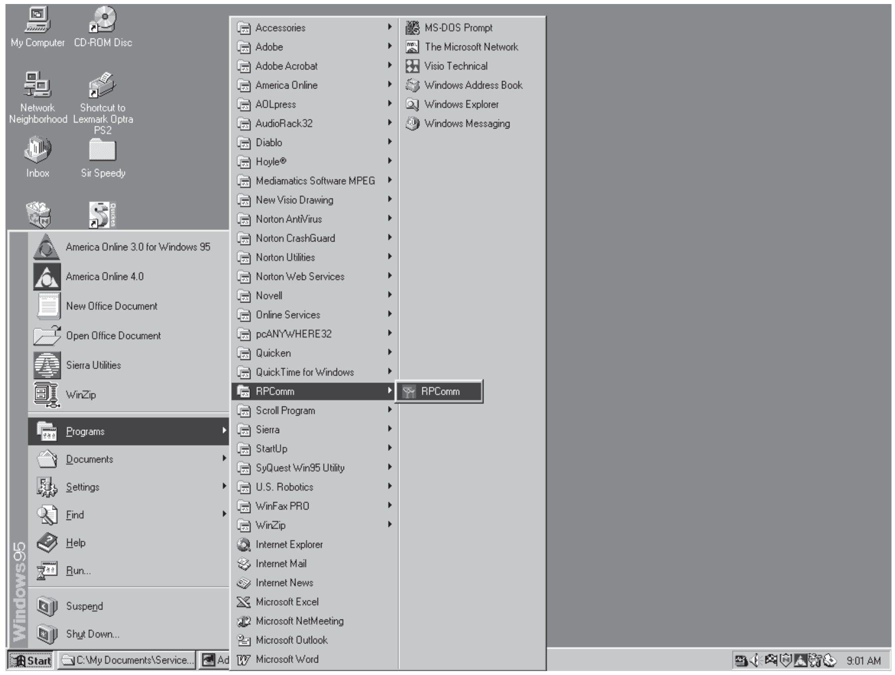


Figure D–3. Executing RPComm

2. When RPComm begins executing, two screens are always displayed: the Communicator Main screen and the Connect List screen (Figure D–4).

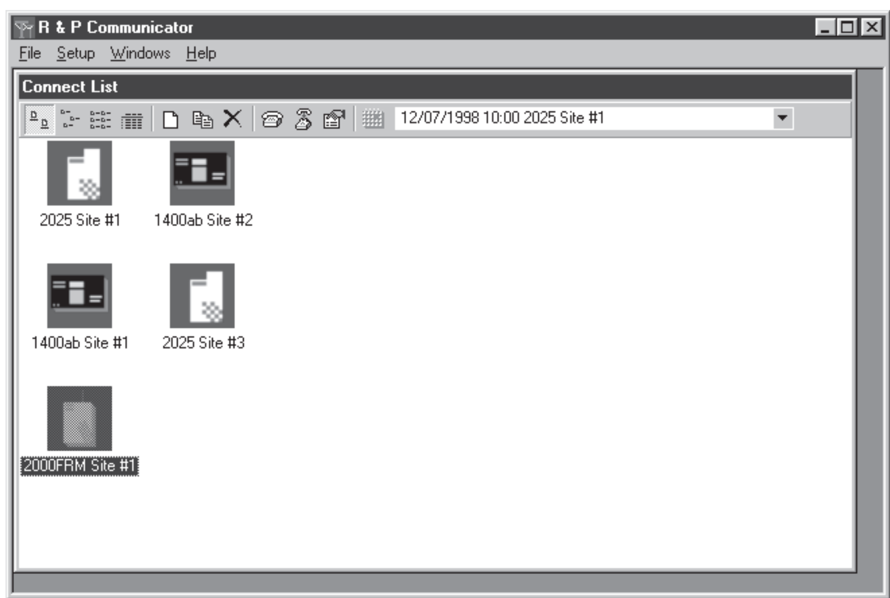


Figure D–4. Connect List Screen

Creating a New Connection

A connection is the hardware, software and proper settings that enables information to travel between your PC and unit. The hardware part of the connection is accomplished with the use of a 9-to-9 pin cable. The software part of the connection is accomplished when RPComm is executed. The proper settings must be set within RPComm to complete the connection.

Note The Windows operating system screens shown in this section are from the Windows 95 operating system. These screens may vary slightly from your computer's screens if you are operating RPComm under the Windows 98 or Windows NT operating systems. ▲

Use the following procedure to create a new connection.

1. With the Connect List screen displayed (Figure D–4), select the New Connection icon on the toolbar. The Connection Type screen will then be displayed (Figure D–5).

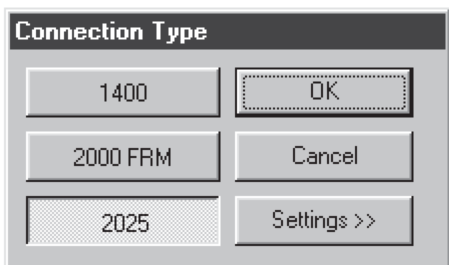


Figure D–5. Connection Type Screen

2. From the Connection Type screen, select the "2000" button and choose "Settings" to display the AK Protocol Setup screen (Figure D–6).

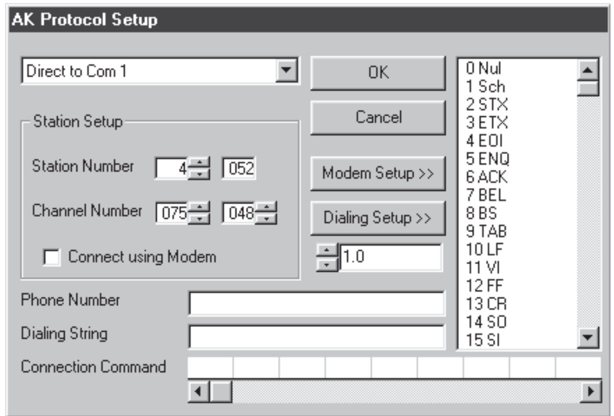


Figure D–6. AK Protocol Setup Screen

3. For a direct connection, the connection description box should read "Direct to Com x," where "x" is the serial (COM) port on your PC that the unit is connected to.

4. The Station Setup portion of the screen lists a Station Number (default = 4, 052) and Channel Number (Default = 075, 048). These values must match those entered into the unit on its RS232 Setup screen. Thermo Fisher Scientific recommends that these be left at their default values.

5. The description boxes for Phone Number, Dialing String and Connection Command are not used for a direct connection. The Modem Setup and Dialing Setup buttons also are not needed for a direct connection.

6. Select "OK" when the proper settings have been confirmed.

7. Choose "OK" from the Connection Type screen to finish the connection setup. "New Connection" will now be displayed in the Connect List screen. This name can be edited by highlighting the words "New Connection" and then selecting the words again. When the blinking cursor appears, the user can type the desired name. To save this new file name, press the Enter key on your PC's keyboard.

8. The connection should now be ready for use. However, because different instruments require different RS232 port settings, these values must sometimes be changed. To check these values, from the Connect List screen, select the "Setup" pull down menu and choose "RS232."

The Communication Port Setup screen will appear (Figure D–7). For the 2000, the settings should be: baud rate = 9600, data bits = 8, parity = none, stop bits = 1, flow control = none.

Note If you are using multiple connections to different instrument types and one instrument being used is a TEOM Series 1400 Ambient Particulate Monitor, the flow control setting should be RTS. ▲

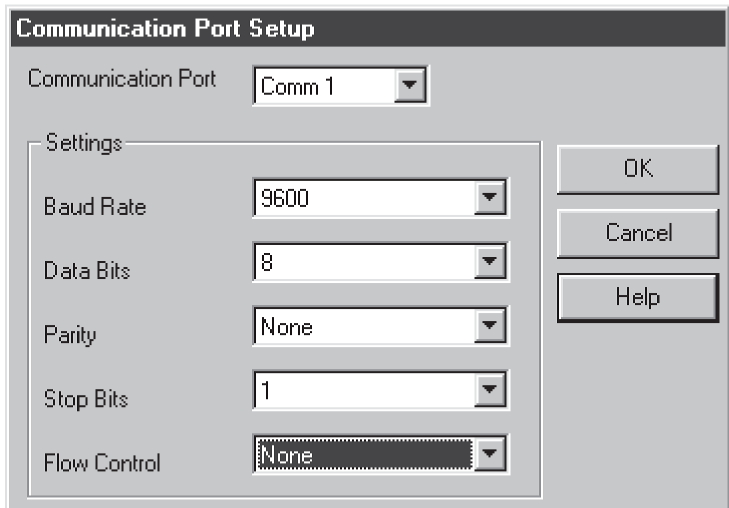


Figure D–7. Communication Port Setup Screen

9. If desired, additional connections can be defined using the above procedure. These new connections can connect various instrument types. When all new connections have been defined, they can be saved in a connection group. From the Communicator Main screen (Figure D–9), select the "File" pull down menu and choose "Save Group." The next time RPComm is executed, the connection group can be restored by choosing "Open Group" from the "File" pull down menu of the Communicator Main screen. A list of saved connection groups will be displayed in the Save Connection Group screen (Figure D–8). Choose the desired group and select "OK."

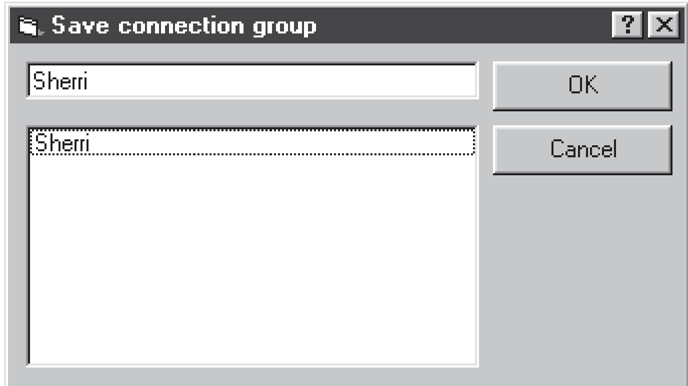


Figure D–8. Save Connection Group Screen

10. To connect to an instrument, highlight the desired connection and select the Connection icon on the tool bar. This will display the Partisol 2000*i* Main screen (Figure D–9).

Note If the connection is successful, the instrument's serial number will be displayed at the top of the screen. If the connection is not successful, or if there is no instrument attached, then the serial number area will be blank or will display "99999". ▲

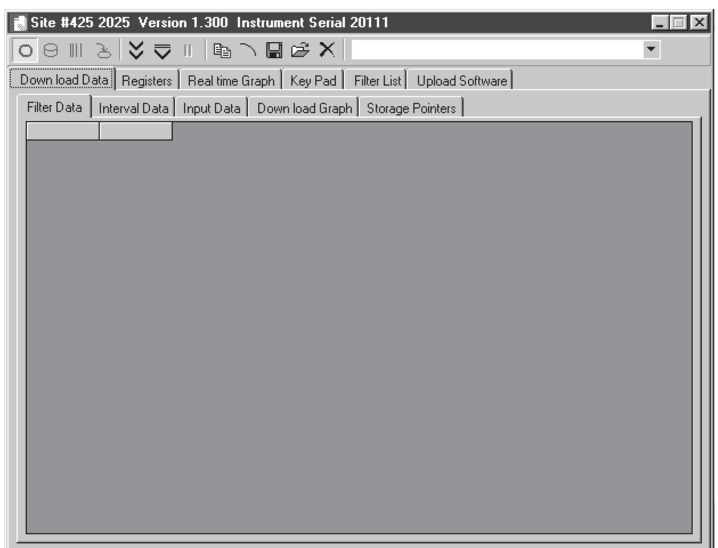


Figure D–9. Main Screen

Downloading Stored Data

There are three types of data stored in the unit's internal data logger: filter data, interval data and input data.

Note The Windows operating system screens shown in this section are from the Windows 95 operating system. These screens may vary slightly from your computer's screens if you are operating RPComm under the Windows 98 or Windows NT operating systems. ▲

Setting the Storage Pointer Positions

A storage pointer is a place marker in the internal data logger. When data is downloaded from a unit, the downloading begins at the storage pointer location and continues to the last written record. Once data has been downloaded, the storage pointer position is set to the end of the storage buffer so that the next time data is downloaded, only new data are output. However, if the user wishes to download data only from a particular date, for example, then the position of the storage pointer will need to be set. There are three storage pointers used in the Partisol 2000*i* and 2000*i*-D Samplers, one for each type of data (filter, interval and input).

To set the storage pointer positions, go to the RPComm Main screen (Figure D–9) and select the Storage Pointer tab. On the Storage Pointer screen (Figure D–10), the storage pointer location for each data type will be displayed. Refer to Figure D–11 for a compete description of the control buttons displayed on the Storage Pointer screen.

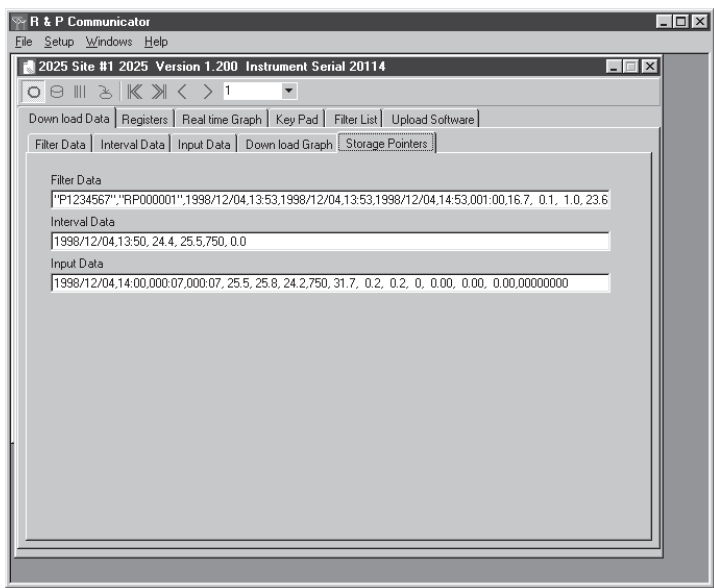


Figure D–10. Storage Pointer Screen

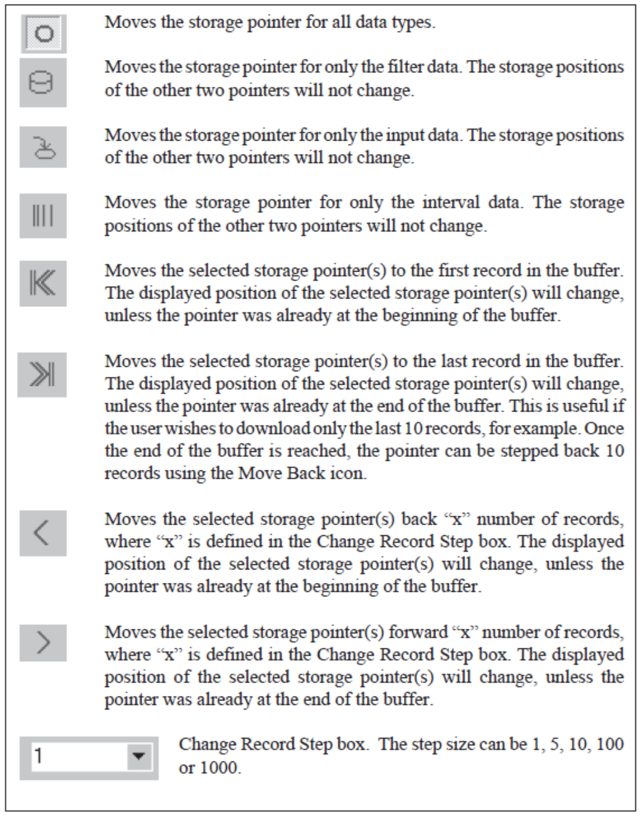


Figure D–11. Control Buttons on the Storage Pointer Screen

Downloading Data

Use the following procedure to download data from the internal data logger.

1. Before data are downloaded, the user should ensure that the storage pointer position(s) are correct. Set the storage pointer positions according to "Setting the Storage Pointer Positions" on page D-11, if necessary.

2. From the RPComm Main screen (Figure D–9), select the Download Data tab. Refer to Figure D–12 and Figure D–13 for a complete description of the control buttons displayed on the Download Data screen.

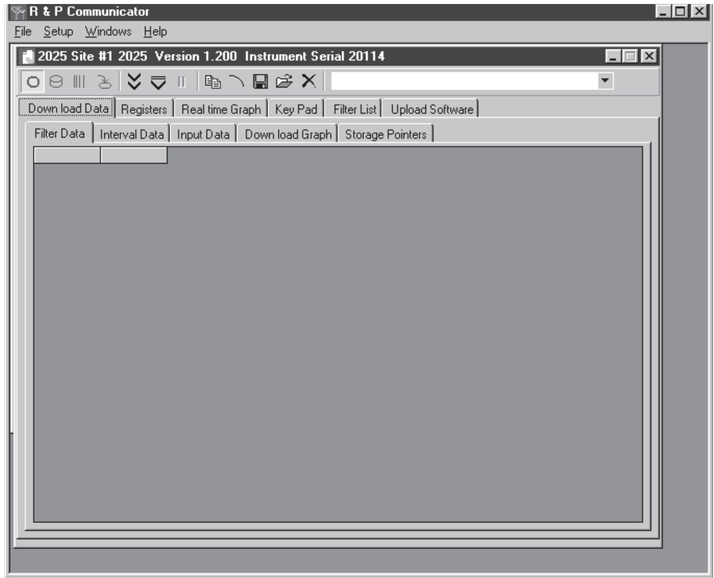


Figure D–12. Download Data Screen

Downloads all three type of data.

Downloads filter data only. Interval and input data will not be downloaded.

Downloads interval data only. Filter and input data will not be downloaded.

Downloads input data only. Filter and interval data will not be downloaded.

Downloads all stored data in the data buffer for the selected data types. After the data are downloaded, the storage pointer for the selected data type(s) will move to the end of the buffer. Once the data have been downloaded, each data type can be viewed by selecting the appropriate tab (Figures 10-17, 10-18 and 10-19).

Downloads data from the current storage pointer position(s) to the end of the data buffer for the selected data type(s). After the data are downloaded, the storage pointer for the selected data type(s) will move to the end of the buffer. Once the data have been downloaded, each data type can be viewed by selecting the appropriate tab (Figures 10-17, 10-18 and 10-19).

Aborts download. This action will set the storage pointer for the selected data type(s) to the record location where the download was aborted.

Copies selected data to the Windows clipboard. The data can then be imported and used in other programs (Section 10.2.4.1).

Sends selected data to the Download Graph tab. NOTE: Filter data cannot be graphed (Section 10.2.4.2).

Stores desired data to a file. The file is saved in a comma-delimited ASCII format (Section 10.2.4.3).

Opens a data file that has been previously saved to disk for display and graphing.

Clears data currently being displayed.

Downloaded 134 records 12/7/98 10:06:50 AM

When the download has been successfully completed, a message will appear in the Dialog box indicating how many records were downloaded. If multiple types of data were downloaded, the user can select the down arrow on the right of the Dialog box to see the results of each download type.

Figure D–13. Control Buttons on the Download Data Screen

Manipulating Downloaded Data

Once data has been downloaded, it can be manipulated for different uses. All data manipulation procedures listed in this section can be performed within RPComm without being connected to the unit.

Note The Windows operating system screens shown in this section are from the Windows 95 operating system. These screens may vary slightly from your computer's screens if you are operating RPComm under the Windows 98 or Windows NT operating systems. ▲

Copying Data to the Clipboard

Once data have been downloaded and displayed in RPComm, a selection of these data can be copied to the Windows clipboard for use in other applications.

Use the following procedure to copy data to the Windows clipboard.

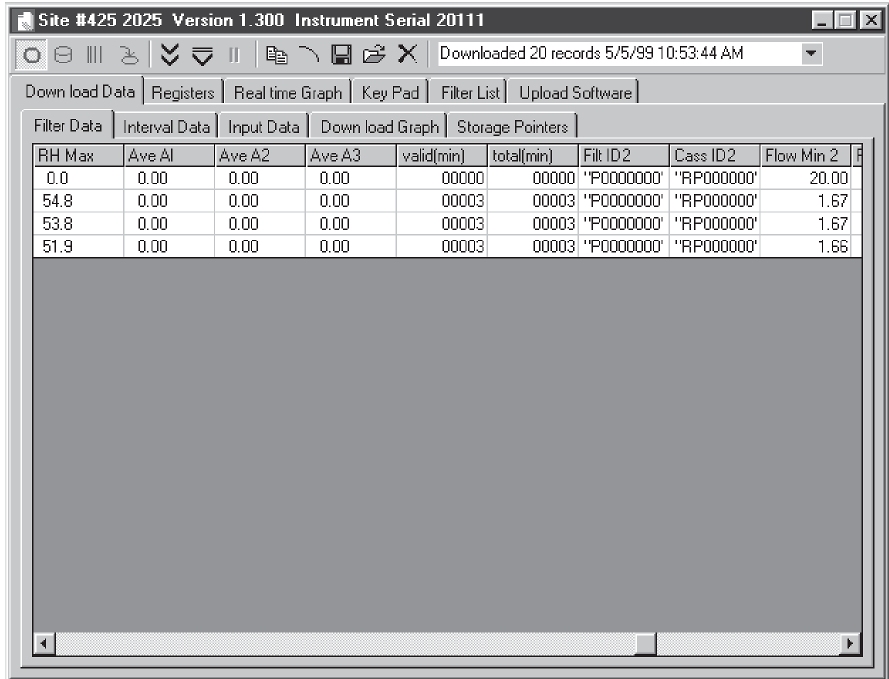
1. From the Partisol 2000*i* Main screen (Figure D–9), select the Filter Data, Interval Data or Input Data tab to display the desired data screen (Figure D–14, Figure D–15 or Figure D–16).

2. To select data, point your mouse cursor at the data cell where you wish to begin the selection. Press and hold down the left mouse button and drag the cursor until all the desired data is selected.

3. An alternate way to select data is to point the mouse cursor at the column heading where you wish to begin the selection. Press and hold down the left mouse button and drag the cursor across the columns until all the desired data is selected. This will choose all the data in the selected columns.

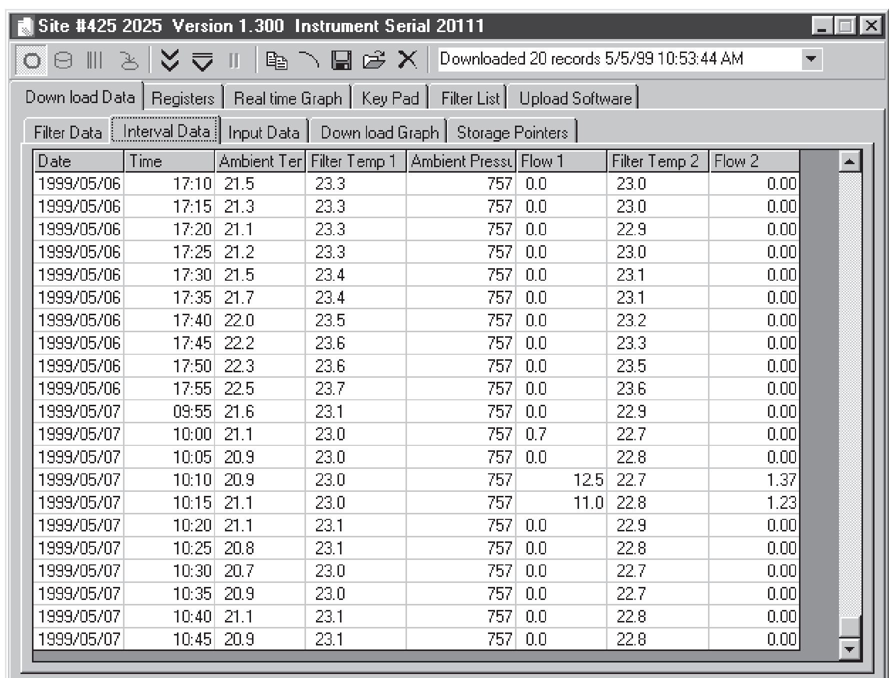
4. When the proper selection has been made, press the Copy icon. This will copy the selected data to the Windows clipboard. The data can then be pasted into another application.

Note When data are copied to the clipboard, it includes the heading information, even if the entire column was not selected. ▲



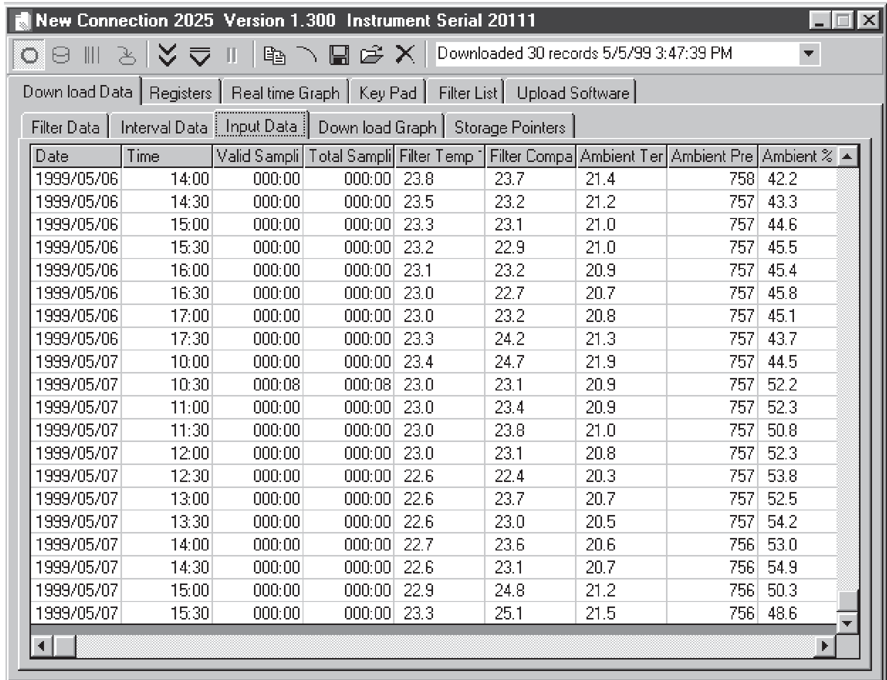
RH Max	Ave AI	Ave A2	Ave A3	valid(min)	total(min)	Filt ID2	Cass ID2	Flow Min 2
0.0	0.00	0.00	0.00	00000	00000	"P0000000'	"RP000000'	20.00
54.8	0.00	0.00	0.00	00003	00003	"P0000000'	"RP000000'	1.67
53.8	0.00	0.00	0.00	00003	00003	"P0000000'	"RP000000'	1.67
51.9	0.00	0.00	0.00	00003	00003	"P0000000'	"RP000000'	1.66

Figure D–14. Downloaded Filter Data



Date	Time	Ambient Ter	Filter Temp 1	Ambient Pressu	Flow 1	Filter Temp 2	Flow 2
1999/05/06	17:10	21.5	23.3	757	0.0	23.0	0.00
1999/05/06	17:15	21.3	23.3	757	0.0	23.0	0.00
1999/05/06	17:20	21.1	23.3	757	0.0	22.9	0.00
1999/05/06	17:25	21.2	23.3	757	0.0	23.0	0.00
1999/05/06	17:30	21.5	23.4	757	0.0	23.1	0.00
1999/05/06	17:35	21.7	23.4	757	0.0	23.1	0.00
1999/05/06	17:40	22.0	23.5	757	0.0	23.2	0.00
1999/05/06	17:45	22.2	23.6	757	0.0	23.3	0.00
1999/05/06	17:50	22.3	23.6	757	0.0	23.5	0.00
1999/05/06	17:55	22.5	23.7	757	0.0	23.6	0.00
1999/05/07	09:55	21.6	23.1	757	0.0	22.9	0.00
1999/05/07	10:00	21.1	23.0	757	0.7	22.7	0.00
1999/05/07	10:05	20.9	23.0	757	0.0	22.8	0.00
1999/05/07	10:10	20.9	23.0	757	12.5	22.7	1.37
1999/05/07	10:15	21.1	23.0	757	11.0	22.8	1.23
1999/05/07	10:20	21.1	23.1	757	0.0	22.9	0.00
1999/05/07	10:25	20.8	23.1	757	0.0	22.8	0.00
1999/05/07	10:30	20.7	23.0	757	0.0	22.7	0.00
1999/05/07	10:35	20.9	23.0	757	0.0	22.7	0.00
1999/05/07	10:40	21.1	23.1	757	0.0	22.8	0.00
1999/05/07	10:45	20.9	23.1	757	0.0	22.8	0.00

Figure D–15. Downloaded Interval Data



Date	Time	Valid Sampli	Total Sampli	Filter Temp	Filter Compa	Ambient Ter	Ambient Pre	Ambient %
1999/05/06	14:00	000:00	000:00	23.8	23.7	21.4	758	42.2
1999/05/06	14:30	000:00	000:00	23.5	23.2	21.2	757	43.3
1999/05/06	15:00	000:00	000:00	23.3	23.1	21.0	757	44.6
1999/05/06	15:30	000:00	000:00	23.2	22.9	21.0	757	45.5
1999/05/06	16:00	000:00	000:00	23.1	23.2	20.9	757	45.4
1999/05/06	16:30	000:00	000:00	23.0	22.7	20.7	757	45.8
1999/05/06	17:00	000:00	000:00	23.0	23.2	20.8	757	45.1
1999/05/06	17:30	000:00	000:00	23.3	24.2	21.3	757	43.7
1999/05/07	10:00	000:00	000:00	23.4	24.7	21.9	757	44.5
1999/05/07	10:30	000:08	000:08	23.0	23.1	20.9	757	52.2
1999/05/07	11:00	000:00	000:00	23.0	23.4	20.9	757	52.3
1999/05/07	11:30	000:00	000:00	23.0	23.8	21.0	757	50.8
1999/05/07	12:00	000:00	000:00	23.0	23.1	20.8	757	52.3
1999/05/07	12:30	000:00	000:00	22.6	22.4	20.3	757	53.8
1999/05/07	13:00	000:00	000:00	22.6	23.7	20.7	757	52.5
1999/05/07	13:30	000:00	000:00	22.6	23.0	20.5	757	54.2
1999/05/07	14:00	000:00	000:00	22.7	23.6	20.6	756	53.0
1999/05/07	14:30	000:00	000:00	22.6	23.1	20.7	756	54.9
1999/05/07	15:00	000:00	000:00	22.9	24.8	21.2	756	50.3
1999/05/07	15:30	000:00	000:00	23.3	25.1	21.5	756	48.6

Figure D–16. Downloaded Input Data

Storing Data to a File

Use the following procedure to save data to a file.

1. From the RPComm Main screen (Figure D–9), select the Filter Data, Interval Data or Input Data tab (Figure D–14, Figure D–15 or Figure D–16).

2. Select the Save icon. The Save Dialog box will appear and prompt the user for a file name. The default file name is:

   nnnnnxyy.txt

   where:

   nnnnnn = the unit's serial number

   x = data type (f = filter, i = interval, p = input)

   yy = file number (01, 02, etc.)

3. Once you have chosen a file name, select the "Save" button If more than one type of data has been downloaded, the Save Dialog box will appear again prompting the user for a file name for the next type of data. This will continue until all downloaded data have been saved.

4. These files will be saved in a comma-delimited ASCII format which can be imported into any spreadsheet program. The data include all column heading information.

Scheduling Data Downloads

One useful feature of RPComm is its automatic download capability. This feature allows the user to schedule automatic data downloads from a unit up to four times a day.

Note The Windows operating system screens shown in this section are from the Windows 95 operating system. These screens may vary slightly from your computer's screens if you are operating RPComm under the Windows 98 or Windows NT operating systems. ▲

Use the following procedure to schedule an automatic data download.

1. With the Connect List screen displayed (Figure D–4), select the Schedule Download icon. This will display the Schedule Downloads screen (Figure D–17).

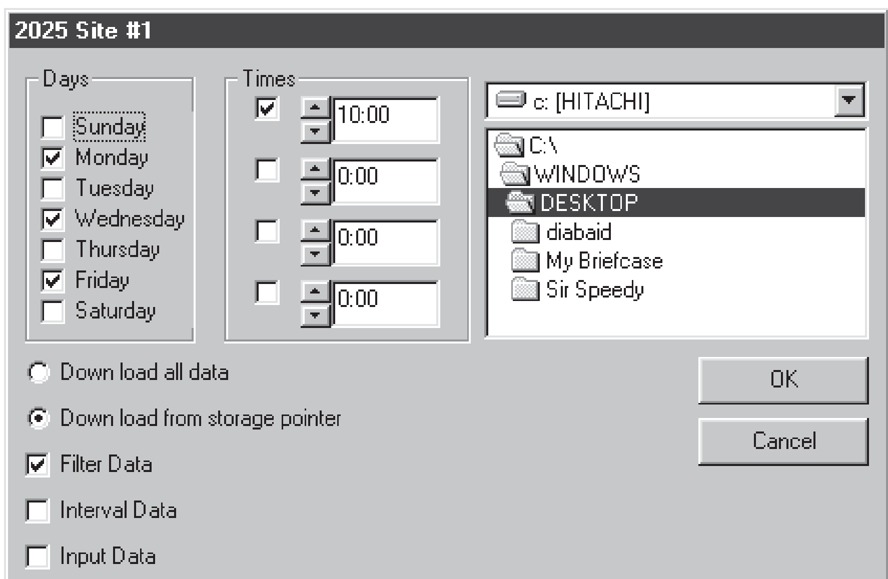


Figure D–17. Schedule Downloads Screen

2. Check the box next to the day(s) of the week that you want the data to be downloaded. You may choose a single day each week or any other combination of days.

3. Select the time(s) on the chosen day(s) that the data are to be downloaded. The data can be downloaded up to 4 times a day.

4. Select the directory location where you want the downloaded data to be stored. It is recommended that a separate directory be set up for data downloads and that the files be removed from this directory on a regular basis because the file serial number can track only 100 files. The data file will be saved under a file name according to the following convention:

   nnnnnxyy.txt

   where:

   nnnnnn = the unit's serial number

   x = data type (f = filter, i = interval, p = input)

   yy = file number (01, 02, etc.).

5. Select whether all of the data stored in the storage buffer will be downloaded at each scheduled time or if the download will begin at the storage pointer position.

6. Select which data files are to be downloaded. All three types of data can be chosen, if desired.

7. When the schedule has been completed, select "OK" to save your changes. The scheduled downloads for the next 24 hours are listed in the scheduled download list on the Connect List screen.

   For example, Figure D–18 shows a scheduled download for 12/7/1998 at 10:00 for unit 2000, site #1.

Figure D–18. Example of a Scheduled Download from the Connect List Screen

8. Data downloads can be scheduled for each connection listed in the connection list. If more than one download is scheduled for the same time, the downloads will occur in the order that they are listed in the Scheduled Download box.

During a scheduled download, RPComm assigns file numbers or names to the downloaded data according to the file numbers that already exist in the download directory. RPComm increments the file numbers by a value of one more than the largest file number that already exists in the download directory.

For example, if the download directory has one file in it with the number 20114f01.txt, at the next scheduled filter data download RPComm will assign the file name 20114f02.txt to the new downloaded data. The number “02” was the next available file number.

The new file numbers will always be incremented (by a value of one) during scheduled downloads regardless of file type. For example, if the download directory has three files in it with the numbers 20114i01.txt, 20114f02.txt and 20114p03.txt, at the next scheduled filter data download, RPComm will assign the file name 20114f04.txt to the new downloaded data. The number “04” was the next available file number.

If all three types of data (filter, interval and input) are downloaded at the same time, RPComm will give all three files the same number. If the download directory is empty and you schedule a download of all three types of data, RPComm will assign the following file names to the data: nnnnnf01.txt, nnnnni01.txt and nnnnnp01.txt (“nnnnn” is your unit’s serial number).

If the download directory already has files in it and you schedule a download of all three types of data, RPComm will increment the file numbers using the next highest available number. For example, if the download directory has two files in it with the names 31005f02.txt and 31005p04.txt, and you schedule a download of all three types of data, then RPComm will assign the following file names to the downloaded data: 31005f05.txt, 31005p05.txt and 31005i05.txt. The number “05” was the next available file number.

Viewing System Registers

A system register is a value entered into, calculated by, or measured by the unit. Examples of system registers are the unit’s serial number (entered into), the calibration constants (calculated by), and the ambient temperature (measured by). Every system register can be displayed by RPComm.

Use the following procedure to view system registers.

1. From the 2000 Main screen (Figure D–9), select the Registers tab to display the Registers screen (Figure D–19).

2. On the right portion of the Registers screen is a list of all the system registers. Using the scroll bar, examine the list of registers and place a checkmark next the registers that you wish to view. Or, if desired, select

the Select All Registers icon to choose all the registers. As registers are selected, they will appear on the left side of the screen.

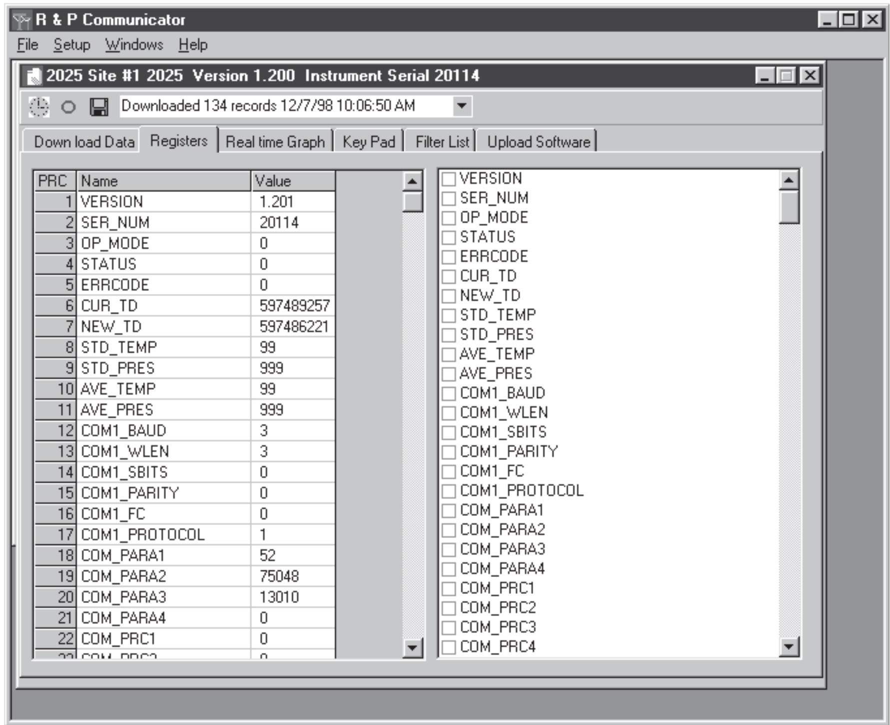


Figure D–19. Registers Screen

3. Select the Read Registers icon to read the selected registers from the unit. All the current values will appear in the list on the left side of the screen next to their corresponding label.

4. To save the register list to a file, select the Save icon. The user will then be prompted to select a location and file name. This list can be useful for troubleshooting.

PRComm Modem Communications

This section describes how to connect the Sampler to a modem for offsite communications and how to set up a serial switching device for use with multiple instruments.

Modem communications can be used to remotely download data from the unit, check instrument operation and to change system variables. All *i*Series instrumentation can be connected to a standard external modem for communications.

Standard Commercial External Modem Setup

Use the following procedure to set up an external commercial modem:

Required parts:

9M-to-9F pin straight-through serial cable (07-000587)

9M-to-9F pin null modem adapter (10-005671)

9-to-25 pin serial adapter (51-001079)

Commercial external modem

1. Connect your computer directly to the modem (follow the instruction manual that came with the modem).

2. Begin executing any communication software which will allow direct communications with the modem. Communication software is included with most modems.

3. Set the modem's communication parameters to work with the Sampler. A typical command string to send to the modem to configure it for use is:

   AT &F0 &C0 &D0 S0=1 &K0 &W0 &Y0

   where:

   AT Command prefix

   &F0 Software reset; restore default parameters

   &C0 Force DCD (Data Carrier Detect) "ON" at all times

   &D0 Ignore DTR (Data Terminal Ready) from instrument

   S0=1 Set auto answer to one ring

   &K0 Disable local flow control

   &W0 Store settings in profile "0"

   &Y0 Use stored settings in profile "0" on power up.

   Various commercial (especially older) modems may have different commands for the functions listed above. Consult your modem's instruction manual for the proper commands. Also, some modems limit the length of the command string that may be sent. The command string can be broken into two or more segments and sent individually.

4. Disconnect your computer from the modem.

5. Open the door to the Sampler. Attach the male end of the 9-to-9 pin cable to the RS232 connector on the front of the unit. Close the unit's door ensuring that the 9-to-9 pin cable is placed in one of the slots on the bottom of the door to allow it to close properly.

6. Attach the null modem adapter to the female end of the 9-to-9 pin cable.

Note Not all null modem adapters can be used in this application because pin connections are not standard. The null modem adapter (10-005671) that is available from Thermo Fisher Scientific is acceptable for use with the Sampler. ▲

7. If your modem is equipped with a 9-pin connector, attach the cable and null modem adapter to the modem. If your modem is equipped with a 25-pin connector, attach a 9-to-25 pin serial adapter to the null modem adapter and plug it into the modem.

Note Not all 9-to-25 pin serial adapters can be used in this application because pin connections are not standard. The 9-to-25 pin serial adapter (51-001079) that is available from Thermo Fisher Scientific is acceptable for use with the Sampler. ▲

8. Attach a phone line to the modem. The modem is now ready to communicate with the unit.

RPComm Setup for Use through a Modem

The first two steps of this procedure describe setting up the unit for direct communications. Direct communications must be successfully completed before modem communications are attempted. This will verify that RPComm and the unit have been configured properly.

Note The Windows operating system screens shown in this section are from the Windows 95 operating system. The screens may vary slightly if you are operating RPComm under the Windows 98 or Windows NT operating systems. ▲

1. Set up the Sampler for direct communications. Refer to "Instrument Setup for Direct Communication" on page D-4.

2. Create a new connection according to "Creating a New Connection" on page D-7 and verify that the unit is communicating properly.

Note If the connection is successful, the unit's serial number will be displayed at the top of the screen. If the connection is not successful or if there is no unit attached, then the serial number area will be blank or will display 99999. ▲

3. Disconnect the direct connection.

4. Set up the unit for modem communications according to "Standard Commercial External Modem Setup" on page D-21.

Note Thermo Fisher Scientific recommends that the modem connections be tested before the unit is placed in the field. The test will require the use of two phone lines. ▲

5. With the RPComm Connect List screen displayed (Figure D–20), select the name of the connection used to verify the direct connection above and choose the Edit Selected Connection icon. The Connection Type screen will then be displayed (Figure D–21).

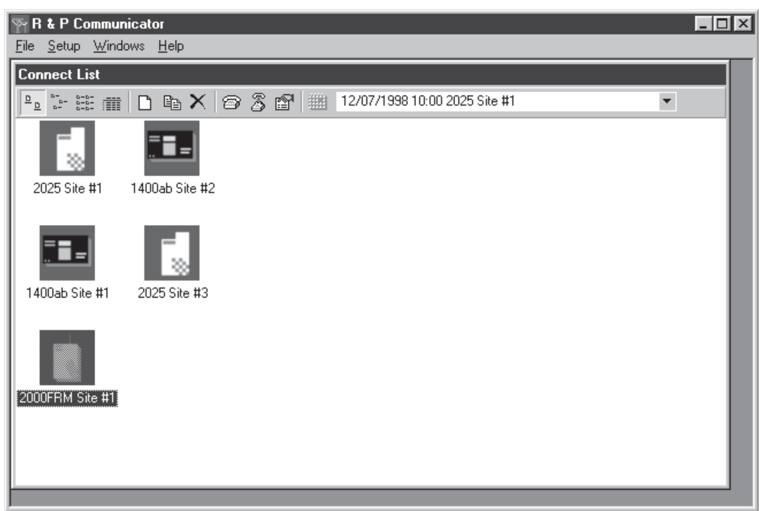


Figure D–20. Connect List Screen

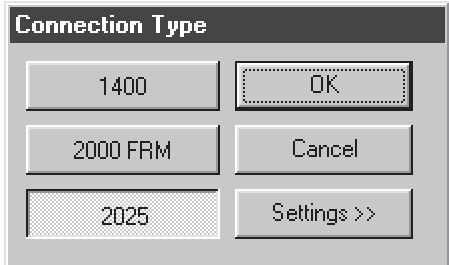


Figure D–21. Connection Type Screen

6. From the Connection Type screen, ensure that the correct instrument type is selected and select "Settings" to display the AK Protocol Setup screen (Figure D–22).

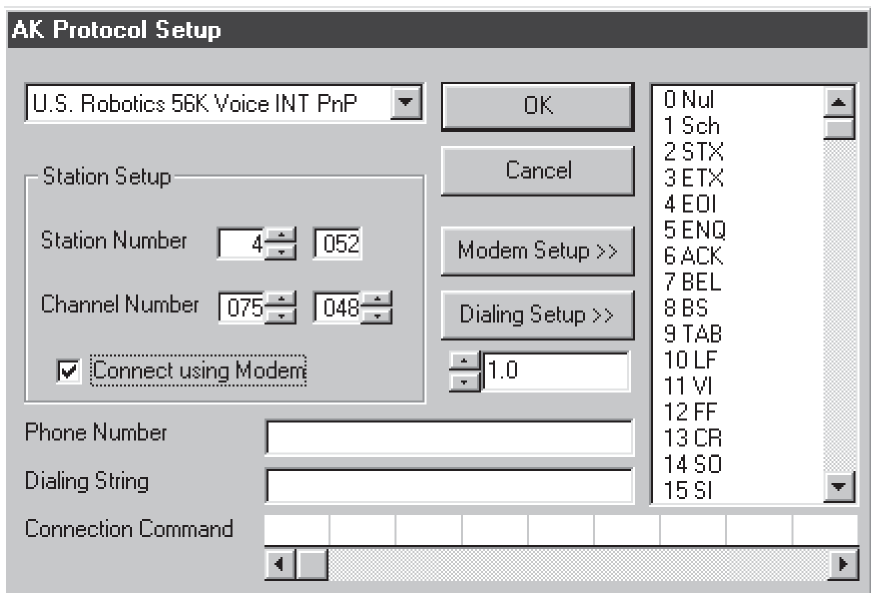


Figure D–22. AK Protocol Setup Screen

7. Place your cursor in the small white box located to the left of "Connect using Modem" and click once with your mouse. A checkmark should appear in the box.

8. To set up the unit for a modem connection, the Connection Description box (in the top left corner) should be set to your modem's description. In Figure D–22, the modem description is "U.S. Robotics 56K Voice INT PnP." The description will vary depending on factors such as your modem type, whether it is an internal or external modem and which COM port the modem is connected to.

9. The Station Setup portion of the screen should have been set when you established your direct connection (steps 1 and 2). Do not modify these settings.

10. Select the "Modem Setup >>" button to display the Modem Properties screen (Figure D–23).

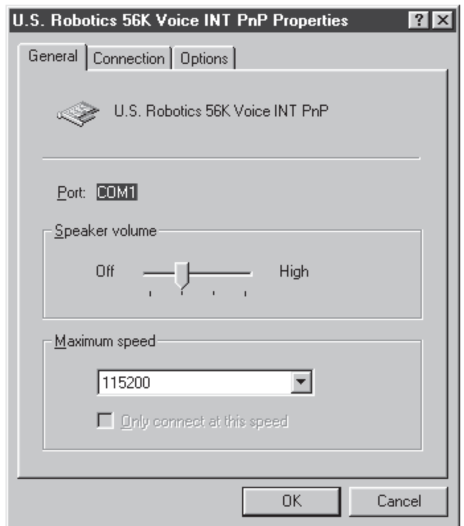


Figure D–23. Modem Properties Screen

11. Generally, the values that your system chooses for variables on this screen are appropriate for a proper connection. However, if your unit and modem experience communication difficulties, these setting may need to be altered. Contact your modem's manufacturer for more information, if necessary.

12. Select "OK" to exit the Modem Properties screen. The AK Protocol Setup screen (Figure D–22) will now appear as the active screen on your computer.

13. In the AK Protocol Setup screen, enter the phone number to be called in the "Phone Number" box at the bottom of the screen. Do not enter anything in the "Dialing String" box. This setting will be automatically configured by the system.

14. Select the "Dialing Setup >>" button to display the Dialing Properties screen (Figure D–24).

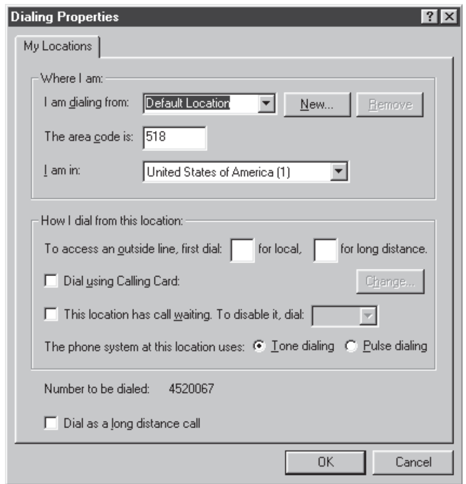


Figure D–24. Dialing Properties Screen

15. Fill in the required information on the Dialing Properties screen. Verify that the "Number to be dialed" shown at the bottom of the screen matches the phone number as it should be dialed. If the phone number is not correct, there is an error on this screen or you may have incorrectly entered the phone number on the AK Protocol Setup screen.

16. Select "OK" when the proper settings have been confirmed. This will return you to the AK Protocol Setup screen.

17. Select "OK" while in the AK Protocol Setup screen. This will return you to the Connection Type screen. To finish the connection setup, select "OK" while in the Connection Type screen.

18. To connect to your Sampler through the modem, highlight the connection name on the Connect List screen (Figure D–20) and then select the Connection icon on the tool bar. The modem connection will now be initiated. When communication is established, the Partisol 2000*i* Main screen will be displayed (Figure D–25).

Note If the connection is successful, the unit's serial number will be displayed at the top of the screen. If the connection is not successful or if there is no instrument attached, then the serial number area will be blank or will display "99999." If the modem loses its connection, wait at least 1 minute before trying to establish another connection. This allows the modem to reset itself. ▲

19. RPComm can now be used.

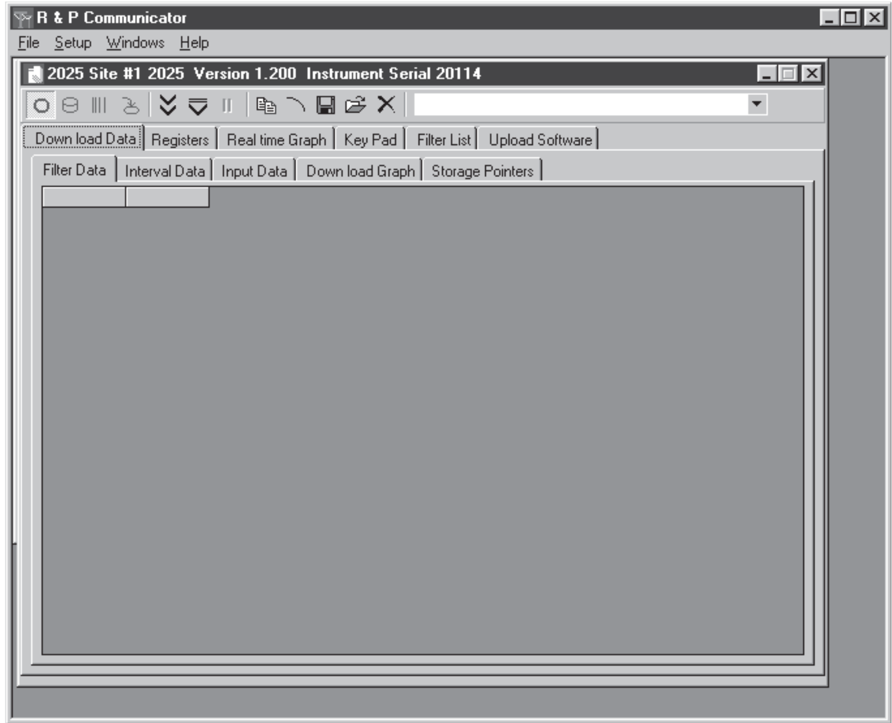


Figure D–25. Main Screen

Serial Switching Device Setup

For applications where two or more *i*Series instruments are installed at the same location, a serial switching device can be installed to help with communications. The serial switching device enables communication to occur with multiple instruments (including non-company serial devices) with the use of only one phone line. Command codes can be sent over the phone line to trigger a particular serial port and, therefore, allow communication with the connected instrument. RPComm can be configured to operate with these devices and send the required command codes.

Multiple Instruments of the Same Model

Refer to this section if you are connecting two or more instruments of the same model to a serial switching device.

Use the following procedure to set up a serial switching device.

1. Set up the unit for modem communications ("Standard Commercial External Modem Setup" on page D-21). Verify that modem communications to each instrument are successful before adding the serial switching device.

2. Obtain a serial switching device from a commercial manufacturer. It has been found that devices manufactured by Black Box Corp. work properly with its instrumentation, although other devices should function properly. The part number and cost of the device will vary depending on how many serial devices the user wishes to connect to it.

3. From the serial switching device's instruction manual, determine the command codes required to trigger activation of each serial port being used.

4. Unplug the serial cable and its adapter(s) from the modem and then plug the cable assembly into the serial switching device. Follow the instructions provided with the serial switching device to connect it to the modem.

Note Thermo Fisher Scientific recommends that the serial device's connections be tested before the unit is placed in the field. This test will require the use of two phone lines. ▲

5. With the RPComm Connect List screen displayed (Figure D–20), select the name of the connection used to verify the modem connection above and then choose the Edit Selected Connection icon. The Connection Type screen will then be displayed (Figure D–21).

6. From the Connection Type screen, ensure that the correct instrument type is selected and select "Settings" to display the AK Protocol Setup screen (Figure D–22).

7. From the list of command codes on the right side of the AK Protocol Setup screen, select the correct series of command codes needed to trigger the desired instrument. As codes are chosen, they will appear on the bottom of the screen in the Connection Command box. If a code is entered incorrectly, it can be deleted by selecting the code in the Connection Command box and pressing the Delete key on your computer's keyboard.

8. The remaining portions of the screen should have been set while establishing the modem connection (step 1). Do not modify these settings.

9. Select "OK" to exit the AK Protocol Setup screen. This will display the Connection Type screen.

10. Choose “OK” from the Connection Type screen to finish the connection setup.

11. To initiate a modem connection to a selected instrument, highlight the connection name on the Connect List screen (Figure D–20) and select the Connection icon on the tool bar. The connection to the instrument will be initiated and the proper command codes sent. When communication is established, the Partisol 2000*i* Main screen will be displayed (Figure D–25).

Note If the connection is successful, the unit’s serial number will be displayed at the top of the screen. Ensure that the correct serial number is displayed to verify that the proper command codes were sent and that the serial port trigger is functioning properly. If the connection is not successful or if there is no instrument attached, then the serial number area will be blank or will display “99999.” If the modem loses its connection, wait at least 1 minute before trying to establish another connection. This allows the modem to reset itself. ▲

12. RPComm can now be used as described in “RPComm” on page D-1.

13. To connect to a different instrument through the serial switching device, the current connection must be terminated. Enter the proper command codes for the desired instrument as described in step 7 and initiate the modem connection as explained in step 11. If the modem loses its connection, wait at least 1 minute before trying to establish another connection. This allows the modem to reset itself.

Multiple Instruments of Different Models

Refer to this section if two or more *i*Series instruments of different models are being connected to a serial switching device. The following combinations can be supported at this time:

Series 1400a Monitor and a Partisol 2000*i*-D

Partisol Model 2000 and a Partisol 2000*i*-D

Although RPComm supports both the Series 1400a monitor and the Partisol Model 2000-FRM Sampler, it is not possible to connect these instruments to a single serial switching device. This is because the Series 1400a monitor requires the local communication flow control to be set to “RTS/CTS” and the Partisol Model 2000-FRM monitor does not support any local communication flow control. If a Series 1400a monitor and a Partisol Model 2000-FRM Sampler are co-located, two modems and phone lines must be used for communications.

Connecting a Series 1400a and a Partisol 2000*i*-D

Use the following procedure to connect a Series 1400a monitor and a Partisol 2000*i*-D to a serial switching device.

1. Set up the 1400a monitor and Sampler for direct communications (“Instrument Setup for Direct Communication” on pge D-4).

2. Create a new connection to each instrument according to “Creating a New Connection” on page D-7 and verify that the units are communicating properly.

Note If the connection is successful, the unit’s serial number will be displayed at the top of the screen. If the connection is not successful or if there is no unit attached, then the serial number area will be blank or will display 99999. ▲

3. Once the RPComm software and instrument configurations have been verified, disconnect the direct connection.

4. Connect your computer directly to the modem that will be connected to the serial switching device (“RPComm Setup for Use through a Modem” on page D-22).

5. Begin executing any communication software which will allow direct communications with the modem. Communication software is usually included with most standard commercial modems. If no software program was included with your standard commercial modem, Hyper Terminal (which is included with the Windows operating system) can be used.

6. Set the modem’s communication parameters to work with the Series 1400a monitor. The following Table D–1 contains the commands that should be set and their corresponding command codes. Various commercial (especially older) modems may have different command codes for the functions listed. Consult your modem’s instruction manual for the proper commands.

Table D–1. Communication Parameters

Communication Parameter	Command Code
Software reset; restore default parameters	&F0
Force DCD (Data Carrier Detect) "ON" at all times	&C0
Ignore DTR (Data Terminal Ready) from instrument	&D0
Set auto answer to one ring	S0=1
Set local flow control to "RTS/CTS"	{varies}
Store settings in profile	"0" &W0
Use stored settings in profile "0" on power up.	&Y0

7. Disconnect your computer from the modem.

8. Attach the male end of the 9-to-9 pin cable to the RS232 connector on one of the instruments.

9. Attach the null modem adapter to the female end of the 9-to-9 pin cable.

Note Not all null modem adapters can be used in this application because pin connections are not standard. The null modem adapter (10-005671) that is available from Thermo Fisher Scientific is acceptable for use with the Sampler. ▲

10. If your modem is equipped with a 9-pin connector, attach the cable and null modem adapter to the modem. If your modem is equipped with a 25-pin connector, attach a 9-to-25 pin serial adapter to the null modem adapter and plug it into the modem.

Note Not all 9-to-25 serial pin adapters can be used in this application because pin connections are not standard. The 9-to-25 serial pin adapter (51-001079) that is available from Thermo Fisher Scientific is acceptable for use with the Sampler. ▲

11. Attach a phone line to the modem.

12. With the RPComm Connect List screen displayed (Figure D–20), select the name of one of the connections used to verify the direct

connection above and choose the Edit Selected Connection icon. The Connection Type screen will then be displayed (Figure D–21).

13. From the Connection Type screen, ensure that the correct instrument type is selected and select "Settings" to display the AK Protocol Setup screen (Figure D–22).

14. Place your cursor in the small white box located to the left of "Connect using Modem" and click once with your mouse. A checkmark should appear in the box.

15. To set up the unit for a modem connection, the Connection Description box (in the top left corner) should be set to your modem's description. In Figure D–22, the modem description is "U.S. Robotics 56K Voice INT PnP." The description will vary depending on factors such as your modem type, whether it is an internal or external modem and which COM port the modem is connected to.

16. The Station Setup portion of the screen should have been set when you established your direct connection. Do not modify these settings.

17. Select the "Modem Setup >>" button to display the Modem Properties screen (Figure D–23).

18. Generally, the values that your system chooses for variables on this screen are appropriate for a proper connection. However, if your unit and modem experience communication difficulties, these setting may need to be altered. Contact your modem's manufacturer for more information, if necessary.

19. Select "OK" to exit the Modem Properties screen. The AK Protocol Setup screen (Figure D–22) will now appear as the active screen on your computer.

20. In the AK Protocol Setup screen, enter the phone number to be called in the "Phone Number" box at the bottom of the screen. Do not enter anything in the "Dialing String" box. This setting will be automatically configured by the system.

21. Select the "Dialing Setup >>" button to display the Dialing Properties screen (Figure D–24).

22. Fill in the required information on the Dialing Properties screen. Verify that the "Number to be dialed" shown at the bottom of the screen matches the phone number as it should be dialed. If the phone number is not correct, there is an error on this screen or you may have incorrectly entered the phone number on the AK Protocol Setup screen.

23. Select "OK" when the proper settings have been confirmed. This will return you to the AK Protocol Setup screen.

24. Select "OK" while in the AK Protocol Setup screen. This will return you to the Connection Type screen. To finish the connection setup, select "OK" while in the Connection Type screen.

25. From the Communicator Main screen (which is located just behind the Connect List screen), select the "Setup" pull down menu and choose "RS232." The Communication Port Setup screen will appear. The settings on this screen should match the Series 1400a settings as shown in Figure D–26. Select "OK" to verify these settings.

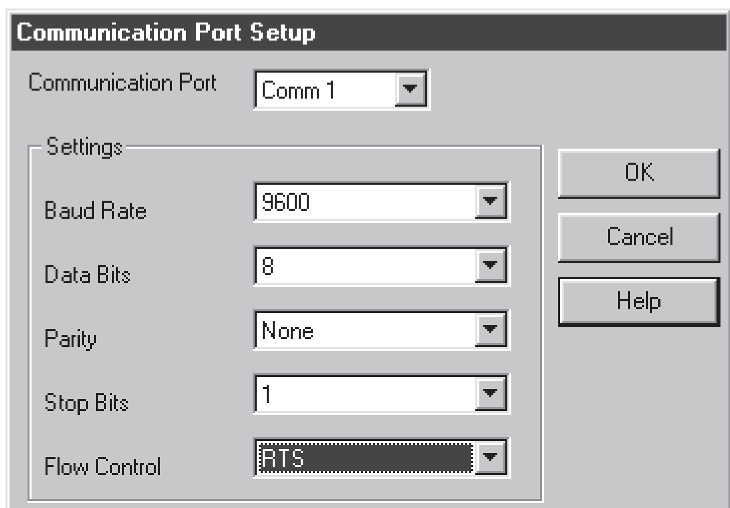


Figure D–26. Communications Port Setup Screen Configures for a 1400a Monitor

26. Connect to one of the instruments through the modem by highlighting the connection name on the Connect List screen (Figure D–20) and then select the Connection icon on the tool bar.

    The modem connection will now be initiated. When communication is established, the instrument's main screen will be displayed.

Note If the connection is successful, the unit's serial number will be displayed at the top of the screen. If the connection is not successful or if there is no instrument attached, then the serial number area will be blank or will display "99999." If the modem loses its connection, wait at least 1 minute before trying to establish another connection. This allows the modem to reset itself. ▲

27. Once you have verified the connection, disconnect the modem connection to the instrument.

28. Attach the male end of the 9-to-9 pin cable to the RS232 connector on the other instrument.

29. Repeat steps 12 through 27 for the other instrument.

30. Disconnect from the instrument.

31. Obtain a serial switching device from a commercial manufacturer. It has been found that devices manufactured by Black Box Corp. work properly with its instrumentation, although other devices should function properly. The part number and cost of the device will vary depending on how many serial devices the user wishes to connect to it.

32. From the serial switching device's instruction manual, determine the command codes required to trigger activation of each serial port being used.

33. Unplug the serial cable and its adapter(s) from the modem and then plug the cable assembly into the serial switching device. Follow the instructions provided with the serial switching device to connect it to the instruments and the modem.

34. With the RPComm Connect List screen displayed (Figure D–20), select the name of one of the connections used to verify the modem connection above and then choose the Edit Selected Connection icon. The Connection Type screen will then be displayed (Figure D–21).

35. From the Connection Type screen, ensure that the correct instrument type is selected and select "Settings" to display the AK Protocol Setup screen (Figure D–22).

36. From the list of command codes on the right side of the AK Protocol Setup screen, select the correct series of command codes needed to trigger the desired instrument. As codes are chosen, they will appear on the bottom of the screen in the Connection Command box. If a code is entered incorrectly, it can be deleted by selecting the code in the Connection Command box and pressing the Delete key on your computer's keyboard.

37. The remaining portions of the screen should have been set while establishing the modem connection. Do not modify these settings.

38. Select "OK" to exit the AK Protocol Setup screen. This will display the Connection Type screen.

39. Choose "OK" from the Connection Type screen to finish the connection setup.

40. Connect to one of the instruments by highlighting the connection name on the Connect List screen (Figure D–20) and select the Connection icon on the tool bar. The connection to the instrument will be initiated and the proper command codes sent. When communication is established, the instrument's main screen will be displayed.

Note If the connection is successful, the unit's serial number will be displayed at the top of the screen. Ensure that the correct serial number is displayed to verify that the proper command codes were sent and that the serial port trigger is functioning properly. If the connection is not successful or if there is no instrument attached, then the serial number area will be blank or will display "99999." If the modem loses its connection, wait at least 1 minute before trying to establish another connection. This allows the modem to reset itself. ▲

41. RPComm can now be used as described in "RPComm" on page D-1.

42. To connect to the other instrument through the serial switching device, the current connection must be terminated. Enter the proper command codes for the desired instrument as described above and initiate the modem connection. If the modem loses its connection, wait at least 1 minute before trying to establish another connection. This allows the modem to reset itself.

Connecting a Model 2000-FRM and a Partisol 2000*i*/2000*i*-D Sampler

Use the following procedure to connect a Partisol Model 2000-FRM Sampler and a Partisol 2000*i*/2000*i*-D Sampler to a serial switching device.

1. Set up the Partisol 2000-FRM Sampler and Partisol 2000*i*/2000*i*-D Sampler for direct communications ("Instrument Setup for Direct Communication" on page D-4).

2. Create a new connection to each instrument according to "Creating a New Connection" on page D-7 and verify that the units are communicating properly.

Note If the connection is successful, the unit's serial number will be displayed at the top of the screen. If the connection is not successful or if there is no unit attached, then the serial number area will be blank or will display 99999. ▲

3. Once the RPComm software and instrument configurations have been verified, disconnect the direct connection.

4. Connect your computer directly to the modem that will be connected to the serial switching device ("Standard Commercial External Modem Setup" on page D-21).

5. Begin executing any communication software which will allow direct communications with the modem. Communication software is usually included with most standard commercial modems. If no software program was included with your modem, Hyper Terminal (which is included with the Windows operating system) can be used.

6. Set the modem's communication parameters to work with the Partisol 2000*i*/2000*i*-D Sampler. A typical command string to send to the modem to configure it for use is:

   AT &F0 &C0 &D0 S0=1 &K0 &W0 &Y0

   where:

AT	Command Prefix
&F0	Software reset; restore default parameters
&C0	Force DCD (Data Carrier Detect) "ON" at all times

&D0	Ignore DTR (Data Terminal Ready) from instrument
S0=1	Set auto answer to one ring
&K0	Disable local flow control
&W0	Store settings in profile “0”
&Y0	Use stored settings in profile “0” on power up.

7. Disconnect your computer from the modem.

8. Attach the male end of the 9-to-9 pin cable to the RS232 connector on one of the instruments.

9. Attach the null modem adapter to the female end of the 9-to-9 pin cable.

Note Not all null modem adapters can be used in this application because pin connections are not standard. The null modem adapter (10-005671) that is available from Thermo Fisher Scientific is acceptable for use with the Sampler. ▲

10. If your modem is equipped with a 9-pin connector, attach the cable and null modem adapter to the modem. If your modem is equipped with a 25-pin connector, attach a 9-to-25 pin serial adapter to the null modem adapter and plug it into the modem.

Note Not all 9-to-25 pin serial adapters can be used in this application because pin connections are not standard. The 9-to-25 pin serial adapter (51-001079) that is available from Thermo Fisher Scientific is acceptable for use with the Sampler. ▲

11. Attach a phone line to the modem.

12. With the RPComm Connect List screen displayed (Figure D–20), select the name of one of the connections used to verify the direct connection above and choose the Edit Selected Connection icon. The Connection Type screen will then be displayed (Figure D–21).

13. From the Connection Type screen, ensure that the correct instrument type is selected and select “Settings” to display the AK Protocol Setup screen (Figure D–22).

14. Place your cursor in the small white box located to the left of "Connect using Modem" and click once with your mouse. A checkmark should appear in the box.

15. To set up the unit for a modem connection, the Connection Description box (in the top left corner) should be set to your modem's description. In Figure D–22, the modem description is "U.S. Robotics 56K Voice INT PnP." The description will vary depending on factors such as your modem type, whether it is an internal or external modem and which COM port the modem is connected to.

16. The Station Setup portion of the screen should have been set when you established your direct connection. Do not modify these settings.

17. Select the "Modem Setup >>" button to display the Modem Properties screen (Figure D–23).

18. Generally, the values that your system chooses for variables on this screen are appropriate for a proper connection. However, if your unit and modem experience communication difficulties, these setting may need to be altered. Contact your modem's manufacturer for more information, if necessary.

19. Select "OK" to exit the Modem Properties screen. The AK Protocol Setup screen (Figure D–22) will now appear as the active screen on your computer.

20. In the AK Protocol Setup screen, enter the phone number to be called in the "Phone Number" box at the bottom of the screen. Do not enter anything in the "Dialing String" box. This setting will be automatically configured by the system.

21. Select the "Dialing Setup >>" button to display the Dialing Properties screen (Figure D–24).

22. Fill in the required information on the Dialing Properties screen. Verify that the "Number to be dialed" shown at the bottom of the screen matches the phone number as it should be dialed. If the phone number is not correct, there is an error on this screen or you may have incorrectly entered the phone number on the AK Protocol Setup screen.

23. Select "OK" when the proper settings have been confirmed. This will return you to the AK Protocol Setup screen.

24. Select "OK" while in the AK Protocol Setup screen. This will return you to the Connection Type screen. To finish the connection setup, select "OK" while in the Connection Type screen.

25. From the Communicator Main screen (which is located just behind the Connect List screen), select the "Setup" pull down menu and choose "RS232." The Communication Port Setup screen will appear. The settings on this screen should match the Partisol 2000*i*/2000*i*-D Sampler settings as shown in Figure D–27.

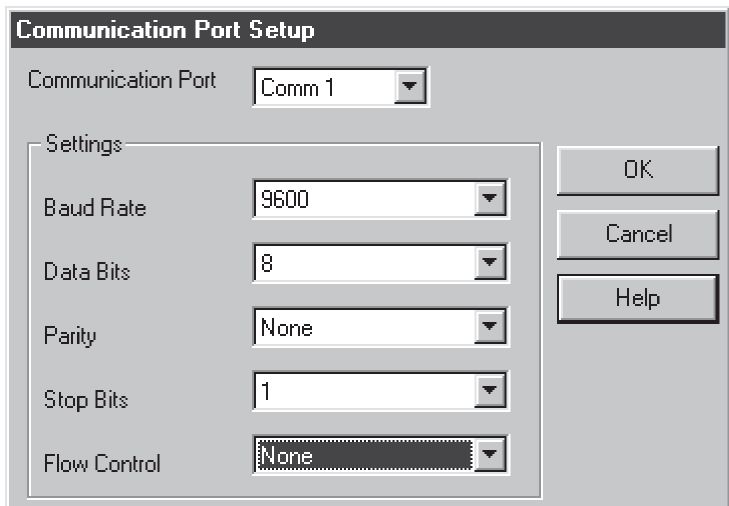


Figure D–27. Communication Port Setup Screen

26. Connect to one of the instruments through the modem by highlighting the connection name on the RPComm Connect List screen (Figure D–20) and then select the Connection icon on the tool bar. The modem connection will now be initiated. When communication is established, the instrument's main screen will be displayed.

Note If the connection is successful, the unit's serial number will be displayed at the top of the screen. If the connection is not successful or if there is no instrument attached, then the serial number area will be blank or will display "99999." If the modem loses its connection, wait at least 1 minute before trying to establish another connection. This allows the modem to reset itself. ▲

27. Once you have verified the connection, disconnect the modem connection.

28. Attach the male end of the 9-to-9 pin cable to the RS232 connector on the other instrument.

29. Repeat steps 12 through 27 for the other instrument.

30. Disconnect from the instrument.

31. Obtain a serial switching device from a commercial manufacturer. It has been found that devices manufactured by Black Box Corp. work properly with its instrumentation, although other devices should function properly. The part number and cost of the device will vary depending on how many serial devices the user wishes to connect to it.

32. From the serial switching device's instruction manual, determine the command codes required to trigger activation of each serial port being used.

33. Unplug the serial cable and its adapter(s) from the modem and then plug the cable assembly into the switching device. Follow the instructions provided with the serial switching device to connect it to the instruments and the modem.

34. With the RPComm Connect List screen displayed (Figure D–20), select the name of one of the connections used to verify the modem connection above and then choose the Edit Selected Connection icon. The Connection Type screen will then be displayed (Figure D–21).

35. From the Connection Type screen, ensure that the correct instrument type is selected and select "Settings" to display the AK Protocol Setup screen (Figure D–22).

36. From the list of command codes on the right side of the AK Protocol Setup screen, select the correct series of command codes needed to trigger the desired instrument. As codes are chosen, they will appear on the bottom of the screen in the Connection Command box. If a code is entered incorrectly, it can be deleted by selecting the code in the Connection Command box and pressing the Delete key on your computer's keyboard.

37. The remaining portions of the screen should have been set while establishing the modem connection. Do not modify these settings.

38. Select “OK” to exit the AK Protocol Setup screen. This will display the Connection Type screen.

39. Choose “OK” from the Connection Type screen to finish the connection setup.

40. Connect to one of the instruments by highlighting the connection name on the Connect List screen (Figure D–20) and select the Connection icon on the tool bar. The connection to the instrument will be initiated and the proper command codes sent. When communication is established, the instrument’s main screen will be displayed.

Note If the connection is successful, the unit’s serial number will be displayed at the top of the screen. Ensure that the correct serial number is displayed to verify that the proper command codes were sent and that the serial port trigger is functioning properly. If the connection is not successful or if there is no instrument attached, then the serial number area will be blank or will display “99999.” If the modem loses its connection, wait at least 1 minute before trying to establish another connection. This allows the modem to reset itself. ▲

41. RPComm can now be used as described in “RPComm” on page D-1.

42. To connect to the other instrument through the serial switching device, the current connection must be terminated. Enter the proper command codes for the desired instrument as described above and initiate the modem connection. If the modem loses its connection, wait at least 1 minute before trying to establish another connection. This allows the modem to reset itself.

Appendix E
AK Protocol

This appendix provides a description of the AK protocol commands that can be used to remotely control a Partisol 2000*i*/2000*i*-D using a host device such as a PC or a datalogger. AK protocol may be used over RS-232, RS-485, or Ethernet. AK functions can be accessed over Ethernet using TCP port 9883.

Up to three simultaneous connections per protocol may be made over Ethernet.

For details of the Partisol 2000*i*/2000*i*-D AK Protocol specification, see the following topics:

TCP Communication Parameters

*i*Series instruments support the AK protocol over TCP/IP. The register definition is the same as for the serial interface. Up to three simultaneous connections are supported over Ethernet.

TCP connection port for AK: 9883

Abbreviations Used

The following is a list of abbreviations used in this document:

<STX> is abbreviation for Start of Text (ASCII code 0x02)

<ETX> is abbreviation for End of Text (ASCII code 0x03)

<SP> is abbreviation for space (ASCII code 0x20)

Basic Command Structure

The following is the basic structure of an AK command for the Partisol 2000*i*/2000*i*-D.

All commands issued follow the message format:

<STX><4>AAAA<SP>argument<SP>argument<ETX>

Where:

AAAA = the 4-character command code

Response Format:

<STX><4>AAAA<SP>digit<SP>argument<ETX>

Where:

digit = a single digit alarm or status code condition indicator: 0 = no alarms or status codes; 1 = alarms or codes

Each command is framed by control characters, <STX> at the start and terminated with <ETX>.

Values within brackets are ASCII characters (see Abbreviations Used above).

Error messages are generated if a command cannot be executed at the current time or if the command parameters are out of range. 'BS' returned with a command indicates that the instrument is in the wrong state to execute the command. 'SE' indicates that at least one of the command's parameters is out of range or another error has occurred.

Commands List

Table E–1 lists the Sampler AK protocol commands. The interface will respond to the command strings outlined below.

Table E–1. Commands List

Command	Description	Page
AKID	Returns identification information	E-3
AREG	Ask Register Command. This allows the user to query the Sampler for the current value of any system variable (Program Register Code).	E-4
ASTO	Ask Storage Command. This allows the user to download a specified number of records from the internal data logger from the current position of the AK storage pointer. The location of this storage pointer may be defined by the SSTO command.	E-6
EREG	Enter Register Command. This allows the user to assign a new value to any system variable. Great care must be exercised in using this command, as the value of variables should be changed only when the monitor is in the appropriate operating mode.	E-7
ESAV	Saves parameters to flash as set by the EREG command.	E-8
SFxx (01, 02)	Set Function xx Command. This allows the user to send commands such as <RUN/STOP> to the unit. Each command is designated with a two-digit code, xx.	E-9
SSTO	Set Storage Command. This allows the user to change the location of the AK storage pointer in the internal data logger, and is used in conjunction with the ASTO command described above. The AK storage pointer is always located just following the last record transmitted through the RS232 port via the AK Protocol. If the circular buffer overwrites this location or if the ASTO or SSTO commands have not been used, the AK storage pointer resides at the oldest record in the internal data logger. The current record type affected by the SSTO command is denoted by PRC register 31.	E-10

AK Protocol

Retrieve ID Information (AKID)

COM 2-WAY SETTINGS		
RS-Para 1	52	ASCII code for the 1-digit Station Number (for example "4": 052). The Station number is always 1 digit in length.
RS-Para 2	75048	ASCII code representation of the 2-digit Channel Number (for example "K0": 075, 048). The Channel number is always 1 digit in length.
RS-Para 3	13010	Optional: Up to 3 ASCII codes can be added to response from instrument. In this case, <CR> and <LF> (ASCII codes 013 and 010) are appended to the response. Enter 0 if nothing is to be appended.
RS-Para 4	0	Not used.

Transmission to Instrument			Response from Instrument				
Byte	**Example**	**Description**	**B**	**No Err**	**Error**	**Description**
1	<STX>	ASCII code 002.	1	<STX>	<STX>	ASCII code 002.
2	4	1-digit Station Number, RS-Para 1.	2	4	4	1-digit Station Number, RS-Para 1.
3	A	4-digit Set Storage Marker command.	3	A	A	4-digit Set Storage Marker command.
4	K		4	K	K	
5	I		5	I	I	
6	D		6	D	D	
7	<space>	Space.	7	<space>	<space>	Space.
8	K	2-digit Channel Number, as defined by RS-Para 2.	8	0	0	Status conditions indicator.
9	0		9	<space>	<space>	ASCII code 003.
10	<space>	Space.	10	2	S	Up to 3 digits appended to the end of the response transmission according to the entry for RS-Para 3.
11	<ETX>		11	0	E	
12			12	2	<ETX>	
13			13	5	<CR>	
14			14	<space>	<LF>	
15			15	1		
16		ASCII code 003.	16			
17			17	4		
18			18	1		
19			19	6		
21			20	<ETX>		
21			21	<CR>		
22			22	<LF>		

AK Protocol

Ask Register Command (AREG)

COM 2-WAY SETTINGS

RS-Para 1	52	ASCII code for the 1-digit Station Number (for example "4": 052). The Station Number is always 1 digit in length.
RS-Para 2	75048	ASCII code representation of the 2-digit Channel Number (for example: "K0": 075, 048). The Channel Number is always 2 digits in length.
RS-Para 3	13010	Optional: Up to 3 ASCII codes can be added to response from instrument. In this case, <CR> and <LF> (ASCII codes 013 and 010) are appended to the response. Enter 0 if nothing is to be appended.
RS-Para 4	0	Not used.

Transmission to Instrument			Response from Instrument			
Byte	**Example**	**Description**	**B**	**No Err**	**Error**	**Description**
1	<STX>	ASCII code 002.	1	<STX>	<STX>	ASCII code 002.
2	4	1-digit Station Number, RS-Para 1.	2	4	4	1-digit Station Number, RS-Para 1.
3	A	Ask Register command. Enter the Program Register Code of the desired variable in bytes 21 to 23 below.	3	A	A	4-digit Ask Register command.
4	R		4	R	R	
5	E		5	E	E	
6	G		6	G	G	
7	<space>	Space.	7	<space>	<space>	Space.
8	K	2-digit Channel Number, as defined by RS-Para 2.	8	0	0	Number of current status conditions.
9	0		9	<space>	<space>	Space.
10	<space>	Space.	10	1	S	Program Register Code of the variable whose value is being requested. The PRC may be 1 to 3 characters long, and is not right-filled in the response.
11	1	Program Register Code of the variable whose value is being requested. The PRC may be up to 3 digits long. Do not right-fill if the PRC is less than 3 characters long.	11	2	E	
12	2		12	2	<ETX>	
13	2		13	<space>	<CR>	Space.
14	<ETX>	ASCII code 003.	14	1	<LF>	Current value of the variable referenced by the Ask Register command. NOTE: This value can be of varying length.
15			15	6		
16			16	.		
17			17	6		
18			18	9		
19			19	4		

AK Protocol						
Ask Register Command (AREG) (continued)						
Transmission to Instrument			**Response from Instrument**			
Byte	**Example**	**Description**	**B**	**No Err**	**Error**	**Description**
20			20	<ETX>		ASCII code 003.
21			21	<CR>		Up to 3 digits appended to the end of the response transmission, according to the entry for RS-Para 3.
22			22	<LF>		
23			23			
24			24			
25			25			
26			26			
27			27			
28			28			
29			29			
30			30			
31			31			
32			32			
33			33			
34			34			
35			35			
36			36			
37			37			
38			38			
39			39			
40			40			
41			41			
42			42			
43			43			
44			44			
45			45			
46			46			

AK Protocol

Ask Storage Command (ASTO)

COM 2-WAY SETTINGS		
RS-Para 1	52	ASCII code for the 1-digit Station Number (for example "4": 052). The Station Number is always 1 digit in length.
RS-Para 2	75048	ASCII code representation of the 2-digit Channel Number (for example: "K0": 075, 048). The Channel Number is always 2 digits in length.
RS-Para 3	13010	Optional: Up to 3 ASCII codes can be added to response from instrument. In this case, <CR> and <LF> (ASCII codes 013 and 010) are appended to the response. Enter 0 if nothing is to be appended.
RS-Para 4	0	Not used.

Transmission to Instrument

Byte	Example	Description
1	<STX>	ASCII code 002.
2	4	1-digit Station Number, RS-Para 1.
3	A	Ask Storage command. Enter the number of records to be downloaded from storage in bytes 11 to 13 below.
4	S	
5	T	
6	O	
7	<space>	Space.
8	K	2-digit Channel Number, as defined by RS-Para 2.
9	0	
10	<space>	Space.
11	5	The number of records to be downloaded from the instrument's storage. Downloading begins at the storage marker, which can be set using the SSTO command.
12	0	
13		
14	<ETX>	ASCII code 003.

SET CURRENT DATA STORAGE BUFFER	
0 in PRC 31	Filter Data
1 in PRC 31	Interval Data
2 in PRC 31	Input Data

Response from Instrument

B	No Err	Error	Description
1	<STX>	<STX>	ASCII code 002.
2	4	4	1-digit Station Number, RS-Para 1.
3	A	A	4-digit Ask Storage command.
4	S	S	
5	T	T	
6	O	O	
7	<space>	<space>	Space.
8	0	0	Number of current status conditions.
9	<space>	<space>	Space.
10	3	S	Records to be downloaded from storage. This can be smaller than requested number due to end of file. Storage marker moved to after last record transmitted. Not right-filled.
11	8	E	
12		<ETX>	
13	<ETX>	<CR>	ASCII code 003.
14	<CR>	<LF>	Up to 3 digits appended to the end of the response transmission, according to the entry for RS-Para 3.
15	<LF>		
16			

The instrument then transmits the number of storage records shown in response bytes 10 to 12 above. Each record is followed by <CR><LF>.

AK Protocol

Enter Register Command (EREG)

COM 2-WAY SETTINGS		
RS-Para 1	52	ASCII code for the 1-digit Station Number (for example "4": 052). The Station Number is always 1 digit in length.
RS-Para 2	75048	ASCII code representation of the 2-digit Channel Number (for example: "K0": 075, 048). The Channel Number is always 2 digits in length.
RS-Para 3	13010	Optional: Up to 3 ASCII codes can be added to response from instrument. In this case, <CR> and <LF> (ASCII codes 013 and 010) are appended to the response. Enter 0 if nothing is to be appended.
RS-Para 4	0	Not used.

Transmission to Instrument			Response from Instrument			
Byte	**Example**	**Description**	**B**	**No Err**	**Error**	**Description**
1	<STX>	ASCII code 002.	1	<STX>	<STX>	ASCII code 002.
2	4	1-digit Station Number, RS-Para 1.	2	4	4	1-digit Station Number, RS-Para 1.
3	E	Enter Register command. Enter the Program Register Code in bytes 21 to 23 below, and the new value of the variable in bytes	3	E	E	4-digit Enter Register command.
4	R		4	R	R	
5	E		5	E	E	
6	G		6	G	G	
7	<space>	Space.	7	<space>	<space>	Space.
8	K	2-digit Channel Number, as defined by RS-Para 2.	8	0	0	Number of current status conditions.
9	0		9	<space>	<space>	Space.
10	<space>	Space.	10	3	S	Program Register Code of the variable whose value was entered. The PRC may be 1 to 3 characters long, and is not right-filled in the response.
11	3	Program Register Code of the variable whose value is being entered. The PRC may be up to 3 digits long. Do not right-fill if the PRC is less than 3 characters long.	11	1	E	
12	1		12		<ETX>	
13			13	<ETX>	<CR>	ASCII code 003
14	<space>	Space.	14	<CR>	<LF>	Up to 3 digits appended to the end of the response transmission, according to the entry for RS-Para 3.
15	1	New value to be entered for variable referenced by Program Register Code in bytes 11 to 13 above. NOTE: The value entered may be of varying length.	15	<LF>		
16			16			
17			17			
18			18			
19	<ETX>	ASCII code 003.	19			

AK Protocol

Save Parameters (ESAV)

COM 2-WAY SETTINGS

RS-Para 1	52	ASCII code for the 1-digit Station Number (for example “4”: 052). The Station number is always 1 digit in length.
RS-Para 2	75048	ASCII code representation of the 2-digit Channel Number (for example “K0”: 075, 048). The Channel number is always 1 digit in length.
RS-Para 3	13010	Optional: Up to 3 ASCII codes can be added to response from instrument. In this case, <CR> and <LF> (ASCII codes 013 and 010) are appended to the response. Enter 0 if nothing is to be appended.
RS-Para 4	0	Not used.

Transmission to Instrument			**Response from Instrument**			
Byte	**Example**	**Description**	**B**	**No Err**	**Error**	**Description**
1	<STX>	ASCII code 002.	1	<STX>	<STX>	ASCII code 002.
2	4	1-digit Station Number, RS-Para 1.	2	4	4	1-digit Station Number, RS-Para 1.
3	E	4-digit Set Storage Marker command.	3	E	E	4-digit Set Storage Marker command.
4	S		4	S	S	
5	A		5	A	A	
6	V		6	V	V	
7	<space>	Space.	7	<space>	<space>	Space.
8	K	2-digit Channel Number, as defined by RS-Para 2.	8	0	0	Number of current status conditions.
9	0		9	<ETX>	<space>	ASCII code 003.
10	<ETX>	ASCII code 003.	10	<CR>	S	Up to 3 digits appended to the end of the response transmission according to the entry for RS-Para 3.
11			11	<LF>	E	
12			12		<ETX>	
13			13		<CR>	
14			14		<LF>	
15			15			
16			16			
17			17			
18			18			
19			19			

AK Protocol

Set Function Command (SFxx)

COM 2-WAY SETTINGS		
RS-Para 1	52	ASCII code for the 1-digit Station Number (for example "4": 052). The Station Number is always 1 digit in length.
RS-Para 2	75048	ASCII code representation of the 2-digit Channel Number (for example: "K0": 075, 048). The Channel Number is always 2 digits in length.
RS-Para 3	13010	Optional: Up to 3 ASCII codes can be added to response from instrument. In this case, <CR> and <LF> (ASCII codes 013 and 010) are appended to the response. Enter 0 if nothing is to be appended.
RS-Para 4	0	Not used.

Transmission to Instrument			Response from Instrument			
Byte	**Example**	**Description**	**B**	**No Err**	**Error**	**Description**
1	<STX>	ASCII code 002.	1	<STX>	<STX>	ASCII code 002.
2	4	1-digit Station Number, RS-Para 1.	2	4	4	1-digit Station Number, RS-Para 1.
3	S	Set Function command, where xx represents a 2-digit code. These codes are defined below.	3	S	S	4-digit Set Function command, with the 2-digit xx code corresponding to the function that was set.
4	F		4	F	F	
5	x		5	x	x	
6	x		6	x	x	
7	<space>	Space.	7	<space>	<space>	Space.
8	K	2-digit Channel Number, as defined by RS-Para 2.	8	0	0	Number of current status conditions.
9	0		9	<ETX>	<space>	Space.
10	<ETX>	ASCII code 003.	10	<CR>	S	Up to 3 digits appended to the end of the response transmission, according to the entry for RS-Para 3.
LISTING OF FUNCTION CODES (xx)			11	<LF>	E	
01 02 10 11 50	Run Stop Set Time Set Date Switch to "None" RS232 Mode		12		<ETX>	
			13		<CR>	
			14		<LF>	
			15			
			16			
			17			
			18			
			19			

AK Protocol

Set Storage Marker Command (SSTO)

COM 2-WAY SETTINGS		
RS-Para 1	52	ASCII code for the 1-digit Station Number (for example "4": 052). The Station Number is always 1 digit in length.
RS-Para 2	75048	ASCII code representation of the 2-digit Channel Number (for example: "K0": 075, 048). The Channel Number is always 2 digits in length.
RS-Para 3	13010	Optional: Up to 3 ASCII codes can be added to response from instrument. In this case, <CR> and <LF> (ASCII codes 013 and 010) are appended to the response. Enter 0 if nothing is to be appended.
RS-Para 4	0	Not used.

Transmission to Instrument			Response from Instrument			
Byte	**Example**	**Description**	**B**	**No Err**	**Error**	**Description**
1	<STX>	ASCII code 002.	1	<STX>	<STX>	ASCII code 002.
2	4	1-digit Station Number, RS-Para 1.	2	4	4	1-digit Station Number, RS-Para 1.
3	S	4-digit Set Storage Marker command.	3	S	S	4-digit Set Storage Marker command.
4	S		4	S	S	
5	T		5	T	T	
6	O		6	O	O	
7	<space>	Space.	7	<space>	<space>	Space.
8	K	2-digit Channel Number, as defined by RS-Para 2.	8	0	0	Number of current status conditions.
9	0		9	<ETX>	<space>	ASCII code 003.
10	<space>	Space.	10	<CR>	S	Up to 3 digits appended to the end of the response transmission, according to the entry for RS-Para 3.
11	B	New location of the Storage Marker. B: move to beginning of storage buffer, E: move to end of storage buffer. Enter positive numbers such as 250 to move forward by n records, and negative numbers such as -1000 to move backwards by n records. Do not right-fill.	11	<LF>	E	
12			12		<ETX>	
13			13		<CR>	
14			14		<LF>	
15			15			
16	<ETX>	ASCII code 003.	16			
17			17			
18			18			
19			19			

AK Protocol

Response if Command Addressed to Instrument is Unrecognizable

COM 2-WAY SETTINGS		
RS-Para 1	52	ASCII code for the 1-digit Station Number (for example "4": 052). The Station Number is always 1 digit in length.
RS-Para 2	75048	ASCII code representation of the 2-digit Channel Number (for example: "K0": 075, 048). The Channel Number is always 2 digits in length.
RS-Para 3	13010	Optional: Up to 3 ASCII codes can be added to response from instrument. In this case, <CR> and <LF> (ASCII codes 013 and 010) are appended to the response. Enter 0 if nothing is to be appended.
RS-Para 4	0	Not used.

Transmission to Instrument			Response from Instrument			
Byte	**Example**	**Description**	**B**	**No Err**	**Error**	**Description**
1			1		<STX>	ASCII CODE 002.
2			2		4	1-digit Station Number, RS-Para 1.
3			3		?	Question marks inserted in place of unrecognized command.
4			4		?	Question marks inserted in place of unrecognized command.
5			5		?	Question marks inserted in place of unrecognized command.
6			6		?	Question marks inserted in place of unrecognized command.
7			7		<space>	Space.
8			8		0	Number of current status conditions.
9			9		<space>	Space.
10			10		S	Syntax error.
11			11		E	Syntax error.
12			12		<ETX>	ASCII code 003.
13			13		<CR>	Up to 3 digits appended to the end of the response transmission, according to the entry for RS-Para 3.
14			14		<LF>	Up to 3 digits appended to the end of the response transmission, according to the entry for RS-Para 3.
15			15			
16			16			
17			17			
18			18			
19			19			

Program Register Codes

Table E–2 lists the Program Register Codes (PRC) supported for the Partisol 2000*i*/2000-*i*D.

Note In this table, "Codes*" indicates that the codes are defined later in this Appendix. ▲

Table E–2. Program Register Codes

Code	Description	Units	Range	Default	Edit Modes
0	Null	N/A	N/A	N/A	N/A
1	Software Version	N/A	N/A	N/A	None
2	Serial Number ID	N/A	N/A	N/A	NotRun
3	Operating Mode	Code*	0 - 6	N/A	None
4	Status Type (Internal)	Code*	0 - 2	0	None
5	Status Code (Internal)	Code*	see code desc	0	None
6	Current Time/Date (Internal)	sec	N/A	N/A	None
7	New Time/Date (disabled)	sec	0 – 2.15E9	0	None
8	Standard Temperature, set	°C	-50 – 50,99	99	Not Run
9	Standard Pressure, set	mmHg	500 – 900, 999	999	Not Run
10	Average Temperature, set	°C	-50 – 50, 99	99	Not Run
11	Average Pressure, set	mmHg	500 -900, 999	999	Not Run
16	Analog Output Voltage Channel 1	Code*	TBD	TBD	Anytime
17	Analog Output Voltage Channel 2	Code*	TBD	TBD	Anytime
18	Analog Output Voltage Channel 3	Code*	TBD	TBD	Anytime
19	Analog Output Voltage Channel 4	Code*	TBD	TBD	Anytime
20	Analog Output Voltage Channel 5	Code*	TBD	TBD	Anytime
21	Analog Output Voltage Channel 6	Code*	TBD	TBD	Anytime
22	Analog Output Current Channel 1	Code*	TBD	TBD	Anytime
23	Analog Output Current Channel 2	Code*	TBD	TBD	Anytime
24	Analog Output Current Channel 3	Code*	TBD	TBD	Anytime
25	Analog Output Current Channel 4	Code*	TBD	TBD	Anytime
26	Analog Output Current Channel 5	Code*	TBD	TBD	Anytime
27	Analog Output Current Channel 6	Code*	TBD	TBD	Anytime
31	Storage Download Type	Code*	0 -2	0	Anytime
44	Analog Input Reading 1	User defined	User defined	N/A	None

Code	Description	Units	Range	Default	Edit Modes
45	Analog Input Reading 2	User defined	User defined	N/A	None
46	Analog Input Reading 3	User defined	User defined	N/A	None
47	Analog Input Reading 4	User defined	User defined	N/A	None
48	Analog Input Reading 5	User defined	User defined	N/A	None
49	Analog Input Reading 6	User defined	User defined	N/A	None
50	Analog Input Reading 7	User defined	User defined	N/A	None
51	Analog Input Reading 8	User defined	User defined	N/A	None
52	Analog Input Voltages 1	Volts	0-10	N/A	None
53	Analog Input Voltages 2	Volts	0-10	N/A	None
54	Analog Input Voltages 3	Volts	0-10	N/A	None
55	Analog Input Voltages 4	Volts	0-10	N/A	None
56	Analog Input Voltages 5	Volts	0-10	N/A	None
57	Analog Input Voltages 6	Volts	0-10	N/A	None
58	Analog Input Voltages 7	Volts	0-10	N/A	None
59	Analog Input Voltages 8	Volts	0-10	N/A	None
60	Analog Output Voltage Range 1	Volts	1, 2, 4, 8*	4	Anytime
61	Analog Output Voltage Range 2	Volts	1, 2, 4, 8*	4	Anytime
62	Analog Output Voltage Range 3	Volts	1, 2, 4, 8*	4	Anytime
63	Analog Output Voltage Range 4	Volts	1, 2, 4, 8*	4	Anytime
64	Analog Output Voltage Range 5	Volts	1, 2, 4, 8*	4	Anytime
65	Analog Output Voltage Range 6	Volts	1, 2, 4, 8*	4	Anytime
72	Digital Output PRC 1	Code*	0-9	1	Anytime
73	Digital Output PRC 2	Code*	0-9	2	Anytime
74	Digital Output PRC 3	Code*	0-9	3	Anytime
75	Digital Output PRC 4	Code*	0-9	4	Anytime
76	Digital Output PRC 5	Code*	0-9	5	Anytime
77	Digital Output PRC 6	Code*	0-9	6	Anytime
78	Digital Output PRC 7	Code*	0-9	7	Anytime
79	Digital Output PRC 8	Code*	0-9	8	Anytime
80	Digital Output PRC 9	Code*	0-9	9	Anytime
81	Digital Output PRC 10	Code*	0-9	0	Anytime
82	Digital Output Logic 1	Code*	0-1	0	Anytime
83	Digital Output Logic 2	Code*	0-1	0	Anytime
84	Digital Output Logic 3	Code*	0-1	0	Anytime

Code	Description	Units	Range	Default	Edit Modes
85	Digital Output Logic 4	Code*	0-1	0	Anytime
86	Digital Output Logic 5	Code*	0-1	0	Anytime
87	Digital Output Logic 6	Code*	0-1	0	Anytime
88	Digital Output Logic 7	Code*	0-1	0	Anytime
89	Digital Output Logic 8	Code*	0-1	0	Anytime
90	Digital Output Logic 9	Code*	0-1	0	Anytime
91	Digital Output Logic 10	Code*	0-1	0	Anytime
125	Pump Pressure	mmHg	N/A	N/A	Never
126	Filter Pressure	mmHg	N/A	N/A	Never
127	Filter2 Pressure	mmHg	N/A	N/A	Never
129	Current Filter Exchange Step	Code*	0-16	0	None
130	Set Flow	L/min	020	0	Service
131	Set Flow2	L/min	020	0	Service
133	Flow	L/min	N/A	N/A	Never
134	Flow2	L/min	N/A	N/A	Never
136	Flow Standard	L/min	N/A	N/A	Never
137	Flow2 Standard	L/min	N/A	N/A	Never
139	Electronics Compartment Temp	°C	0-70	0	Never
140	Current Ambient Temperature	°C	-60 - 70	0	Never
141	Average Ambient Temperature	°C	N/A	0	Never
142	Current Ambient Pressure	mmHg	10-950	0	Never
143	Average Ambient Pressure	mmHg	N/A	0	Never
144	Current Ambient Relative Humidity	%	0 - 70	0	Never
145	Average Ambient Relative Humidity	%	N/A	0	Never
146	Current Filter Temperature 1	°C	-130	0	Never
147	Current Filter Temperature 2	°C	-130	0	Never
148	Current Filter Compartment Temperature	°C	-130	0	Never
149	Average Filter Temperature 1	°C	N/A	0	Never
150	Average Filter Temperature 2	°C	N/A	0	Never
151	Current Wind Direction	deg	N/A	0	Never
152	Average Wind Direction	deg	N/A	0	Never
153	Current Wind Speed	km/h	0 -180	0	Never
154	Average Wind Speed	km/h	N/A	0	Never

Code	Description	Units	Range	Default	Edit Modes
155	Wind Velocity	km/h	0 -180	0	Never
156	Input Data Averaging Period	min	1-99	30	Anytime
159	Default Start Time	sec	0 -86399	0	NotRun
160	Default Duration	sec	60-1203600	86400	NotRun
161	Defalt Repeat Time	sec	60-1203600	86400	NotRun
162	Default Filter Type	Code*	1-26	16	NotRun
163	Default Flow	L/min	1-20	0	NotRun
164	Default Flow 2	L/min	1-20	0	NotRun
165	Default Method	Code*	0 -5	0	NotRun
167	Sampling Start	Sec	0-2.14E9	0	None
168	Sampling Stop	Sec	0-2.14E9	0	None
169	Sampling Pause	Sec	0-2.14E9	0	None
170	Sampling Resume	Sec	0-2.14E9	0	None
171	Sample Filter Type	N/A	A-Z	P	None
172	Sample Filter 2 Type	N/A	A-Z	P	None
173	Sample Filter ID	N/A	0-9999999	0	None
174	Sample Filter 2 ID	N/A	0-9999999	0	None
175	Sample Cassette ID	N/A	0-9999999	0	None
176	Sample Cassette 2 ID	N/A	0-9999999	0	None
177	Sample Blank	Code*	0-1	0	None
178	Sample Condition 1	Code*	0-30	0	None
179	Sample Condition 2	Code*	0-30	0	None
180	Sample Condition 3	Code*	0-30	0	None
181	Condition Minimum 1	N/A	N/A	0	None
182	Condition Minimum 2	N/A	N/A	0	None
183	Condition Minimum 3	N/A	N/A	0	None
184	Condition Maximum 1	N/A	N/A	0	None
185	Condition Maximum 2	N/A	N/A	0	None
186	Condition Maximum 3	N/A	N/A	0	None
187	Sample Filter Type A1	N/A	0 -26	16	Anytime
188	Sample Filter Type A2	N/A	0 -26	16	Anytime
189	Sample Filter Type A3	N/A	0 -26	16	Anytime
190	Sample Filter Type A4	N/A	0 -26	16	Anytime
191	Sample Filter Type A5	N/A	0 -26	16	Anytime

Code	Description	Units	Range	Default	Edit Modes
192	Sample Filter Type A6	N/A	0 -26	16	Anytime
193	Sample Filter Type A7	N/A	0 -26	16	Anytime
194	Sample Filter Type A8	N/A	0 -26	16	Anytime
195	Sample Filter Type A9	N/A	0 -26	16	Anytime
196	Sample Filter Type A10	N/A	0 -26	16	Anytime
197	Sample Filter Type A11	N/A	0 -26	16	Anytime
198	Sample Filter Type A12	N/A	0 -26	16	Anytime
199	Sample Filter Type A13	N/A	0 -26	16	Anytime
200	Sample Filter Type A14	N/A	0 -26	16	Anytime
201	Sample Filter Type A15	N/A	0 -26	16	Anytime
202	Sample Filter Type A16	N/A	0 -26	16	Anytime
203	Sample Filter Type A17	N/A	0 -26	16	Anytime
204	Sample Filter Type A18	N/A	0 -26	16	Anytime
205	Sample Filter Type A19	N/A	0 -26	16	Anytime
206	Sample Filter Type A20	N/A	0 -26	16	Anytime
207	Sample Filter Type A21	N/A	0 -26	16	Anytime
208	Sample Filter Type A22	N/A	0 -26	16	Anytime
209	Sample Filter Type A23	N/A	0 -26	16	Anytime
210	Sample Filter Type A24	N/A	0 -26	16	Anytime
211	Sample Filter Type A25	N/A	0 -26	16	Anytime
212	Sample Filter Type A26	N/A	0 -26	16	Anytime
213	Sample Filter Type A27	N/A	0 -26	16	Anytime
214	Sample Filter Type A28	N/A	0 -26	16	Anytime
215	Sample Filter Type A29	N/A	0 -26	16	Anytime
216	Sample Filter Type A30	N/A	0 -26	16	Anytime
217	Sample Filter Type A31	N/A	0 -26	16	Anytime
218	Sample Filter Type A32	N/A	0 -26	16	Anytime
219	Sample Filter Type B1	N/A	0 -9999999	0	Anytime
220	Sample Filter Type B2	N/A	0 -9999999	0	Anytime
221	Sample Filter Type B3	N/A	0 -9999999	0	Anytime
222	Sample Filter Type B4	N/A	0 -9999999	0	Anytime
223	Sample Filter Type B5	N/A	0 -9999999	0	Anytime
224	Sample Filter Type B6	N/A	0 -9999999	0	Anytime
225	Sample Filter Type B7	N/A	0 -9999999	0	Anytime

Code	Description	Units	Range	Default	Edit Modes
226	Sample Filter Type B8	N/A	0 -9999999	0	Anytime
227	Sample Filter Type B9	N/A	0 -9999999	0	Anytime
228	Sample Filter Type B10	N/A	0 -9999999	0	Anytime
229	Sample Filter Type B11	N/A	0 -9999999	0	Anytime
230	Sample Filter Type B12	N/A	0 -9999999	0	Anytime
231	Sample Filter Type B13	N/A	0 -9999999	0	Anytime
232	Sample Filter Type B14	N/A	0 -9999999	0	Anytime
233	Sample Filter Type B15	N/A	0 -9999999	0	Anytime
234	Sample Filter Type B16	N/A	0 -9999999	0	Anytime
235	Sample Filter Type B17	N/A	0 -9999999	0	Anytime
236	Sample Filter Type B18	N/A	0 -9999999	0	Anytime
237	Sample Filter Type B19	N/A	0 -9999999	0	Anytime
238	Sample Filter Type B20	N/A	0 -9999999	0	Anytime
239	Sample Filter Type B21	N/A	0 -9999999	0	Anytime
240	Sample Filter Type B22	N/A	0 -9999999	0	Anytime
241	Sample Filter Type B23	N/A	0 -9999999	0	Anytime
242	Sample Filter Type B24	N/A	0 -9999999	0	Anytime
243	Sample Filter Type B25	N/A	0 -9999999	0	Anytime
244	Sample Filter Type B26	N/A	0 -9999999	0	Anytime
245	Sample Filter Type B27	N/A	0 -9999999	0	Anytime
246	Sample Filter Type B28	N/A	0 -9999999	0	Anytime
247	Sample Filter Type B29	N/A	0 -9999999	0	Anytime
248	Sample Filter Type B30	N/A	0 -9999999	0	Anytime
249	Sample Filter Type B31	N/A	0 -9999999	0	Anytime
250	Sample Filter Type B32	N/A	0 -9999999	0	Anytime
251	Sample Filter ID A1	N/A	0 -9999999	0	Anytime
252	Sample Filter ID A2	N/A	0 -9999999	0	Anytime
253	Sample Filter ID A3	N/A	0 -9999999	0	Anytime
254	Sample Filter ID A4	N/A	0 -9999999	0	Anytime
255	Sample Filter ID A5	N/A	0 -9999999	0	Anytime
256	Sample Filter ID A6	N/A	0 -9999999	0	Anytime
257	Sample Filter ID A7	N/A	0 -9999999	0	Anytime
258	Sample Filter ID A8	N/A	0 -9999999	0	Anytime
259	Sample Filter ID A9	N/A	0 -9999999	0	Anytime

Code	Description	Units	Range	Default	Edit Modes
260	Sample Filter ID A10	N/A	0 -9999999	0	Anytime
261	Sample Filter ID A11	N/A	0 -9999999	0	Anytime
262	Sample Filter ID A12	N/A	0 -9999999	0	Anytime
263	Sample Filter ID A13	N/A	0 -9999999	0	Anytime
264	Sample Filter ID A14	N/A	0 -9999999	0	Anytime
265	Sample Filter ID A15	N/A	0 -9999999	0	Anytime
266	Sample Filter ID A16	N/A	0 -9999999	0	Anytime
267	Sample Filter ID A17	N/A	0 -9999999	0	Anytime
268	Sample Filter ID A18	N/A	0 -9999999	0	Anytime
269	Sample Filter ID A19	N/A	0 -9999999	0	Anytime
270	Sample Filter ID A20	N/A	0 -9999999	0	Anytime
271	Sample Filter ID A21	N/A	0 -9999999	0	Anytime
272	Sample Filter ID A22	N/A	0 -9999999	0	Anytime
273	Sample Filter ID A23	N/A	0 -9999999	0	Anytime
274	Sample Filter ID A24	N/A	0 -9999999	0	Anytime
275	Sample Filter ID A25	N/A	0 -9999999	0	Anytime
276	Sample Filter ID A26	N/A	0 -9999999	0	Anytime
277	Sample Filter ID A27	N/A	0 -9999999	0	Anytime
278	Sample Filter ID A28	N/A	0 -9999999	0	Anytime
279	Sample Filter ID A29	N/A	0 -9999999	0	Anytime
280	Sample Filter ID A30	N/A	0 -9999999	0	Anytime
281	Sample Filter ID A31	N/A	0 -9999999	0	Anytime
282	Sample Filter ID A32	N/A	0 -9999999	0	Anytime
283	Sample Filter ID B1	N/A	0 -9999999	0	Anytime
284	Sample Filter ID B2	N/A	0 -9999999	0	Anytime
285	Sample Filter ID B3	N/A	0 -9999999	0	Anytime
286	Sample Filter ID B4	N/A	0 -9999999	0	Anytime
287	Sample Filter ID B5	N/A	0 -9999999	0	Anytime
288	Sample Filter ID B6	N/A	0 -9999999	0	Anytime
289	Sample Filter ID B7	N/A	0 -9999999	0	Anytime
290	Sample Filter ID B8	N/A	0 -9999999	0	Anytime
291	Sample Filter ID B9	N/A	0 -9999999	0	Anytime
292	Sample Filter ID B10	N/A	0 -9999999	0	Anytime
293	Sample Filter ID B11	N/A	0 -9999999	0	Anytime

Code	Description	Units	Range	Default	Edit Modes
294	Sample Filter ID B12	N/A	0 -9999999	0	Anytime
295	Sample Filter ID B13	N/A	0 -9999999	0	Anytime
296	Sample Filter ID B14	N/A	0 -9999999	0	Anytime
297	Sample Filter ID B15	N/A	0 -9999999	0	Anytime
298	Sample Filter ID B16	N/A	0 -9999999	0	Anytime
299	Sample Filter ID B17	N/A	0 -9999999	0	Anytime
300	Sample Filter ID B18	N/A	0 -9999999	0	Anytime
301	Sample Filter ID B19	N/A	0 -9999999	0	Anytime
302	Sample Filter ID B20	N/A	0 -9999999	0	Anytime
303	Sample Filter ID B21	N/A	0 -9999999	0	Anytime
304	Sample Filter ID B22	N/A	0 -9999999	0	Anytime
305	Sample Filter ID B23	N/A	0 -9999999	0	Anytime
306	Sample Filter ID B24	N/A	0 -9999999	0	Anytime
307	Sample Filter ID B25	N/A	0 -9999999	0	Anytime
308	Sample Filter ID B26	N/A	0 -9999999	0	Anytime
309	Sample Filter ID B27	N/A	0 -9999999	0	Anytime
310	Sample Filter ID B28	N/A	0 -9999999	0	Anytime
311	Sample Filter ID B29	N/A	0 -9999999	0	Anytime
312	Sample Filter ID B30	N/A	0 -9999999	0	Anytime
313	Sample Filter ID B31	N/A	0 -9999999	0	Anytime
314	Sample Filter ID B32	N/A	0 -9999999	0	Anytime
315	Sample Filter Cassette ID A1	N/A	0 -9999999	0	Anytime
316	Sample Filter Cassette ID A2	N/A	0 -9999999	0	Anytime
317	Sample Filter Cassette ID A3	N/A	0 -9999999	0	Anytime
318	Sample Filter Cassette ID A4	N/A	0 -9999999	0	Anytime
319	Sample Filter Cassette ID A5	N/A	0 -9999999	0	Anytime
320	Sample Filter Cassette ID A6	N/A	0 -9999999	0	Anytime
321	Sample Filter Cassette ID A7	N/A	0 -9999999	0	Anytime
322	Sample Filter Cassette ID A8	N/A	0 -9999999	0	Anytime
323	Sample Filter Cassette ID A9	N/A	0 -9999999	0	Anytime
324	Sample Filter Cassette ID A10	N/A	0 -9999999	0	Anytime
325	Sample Filter Cassette ID A11	N/A	0 -9999999	0	Anytime
326	Sample Filter Cassette ID A12	N/A	0 -9999999	0	Anytime
327	Sample Filter Cassette ID A13	N/A	0 -9999999	0	Anytime

Code	Description	Units	Range	Default	Edit Modes
328	Sample Filter Cassette ID A14	N/A	0 -9999999	0	Anytime
329	Sample Filter Cassette ID A15	N/A	0 -9999999	0	Anytime
330	Sample Filter Cassette ID A16	N/A	0 -9999999	0	Anytime
331	Sample Filter Cassette ID A17	N/A	0 -9999999	0	Anytime
332	Sample Filter Cassette ID A18	N/A	0 -9999999	0	Anytime
333	Sample Filter Cassette ID A19	N/A	0 -9999999	0	Anytime
334	Sample Filter Cassette ID A20	N/A	0 -9999999	0	Anytime
335	Sample Filter Cassette ID A21	N/A	0 -9999999	0	Anytime
336	Sample Filter Cassette ID A22	N/A	0 -9999999	0	Anytime
337	Sample Filter Cassette ID A23	N/A	0 -9999999	0	Anytime
338	Sample Filter Cassette ID A24	N/A	0 -9999999	0	Anytime
339	Sample Filter Cassette ID A25	N/A	0 -9999999	0	Anytime
340	Sample Filter Cassette ID A26	N/A	0 -9999999	0	Anytime
341	Sample Filter Cassette ID A27	N/A	0 -9999999	0	Anytime
342	Sample Filter Cassette ID A28	N/A	0 -9999999	0	Anytime
343	Sample Filter Cassette ID A29	N/A	0 -9999999	0	Anytime
344	Sample Filter Cassette ID A30	N/A	0 -9999999	0	Anytime
345	Sample Filter Cassette ID A31	N/A	0 -9999999	0	Anytime
346	Sample Filter Cassette ID A32	N/A	0 -9999999	0	Anytime
347	Sample Filter Cassette ID B1	N/A	0 -9999999	0	Anytime
348	Sample Filter Cassette ID B2	N/A	0 -9999999	0	Anytime
349	Sample Filter Cassette ID B3	N/A	0 -9999999	0	Anytime
350	Sample Filter Cassette ID B4	N/A	0 -9999999	0	Anytime
351	Sample Filter Cassette ID B5	N/A	0 -9999999	0	Anytime
352	Sample Filter Cassette ID B6	N/A	0 -9999999	0	Anytime
353	Sample Filter Cassette ID B7	N/A	0 -9999999	0	Anytime
354	Sample Filter Cassette ID B8	N/A	0 -9999999	0	Anytime
355	Sample Filter Cassette ID B9	N/A	0 -9999999	0	Anytime
356	Sample Filter Cassette ID B10	N/A	0 -9999999	0	Anytime
357	Sample Filter Cassette ID B11	N/A	0 -9999999	0	Anytime
358	Sample Filter Cassette ID B12	N/A	0 -9999999	0	Anytime
359	Sample Filter Cassette ID B13	N/A	0 -9999999	0	Anytime
360	Sample Filter Cassette ID B14	N/A	0 -9999999	0	Anytime
361	Sample Filter Cassette ID B15	N/A	0 -9999999	0	Anytime

Code	Description	Units	Range	Default	Edit Modes
362	Sample Filter Cassette ID B16	N/A	0 -9999999	0	Anytime
363	Sample Filter Cassette ID B17	N/A	0 -9999999	0	Anytime
364	Sample Filter Cassette ID B18	N/A	0 -9999999	0	Anytime
365	Sample Filter Cassette ID B19	N/A	0 -9999999	0	Anytime
366	Sample Filter Cassette ID B20	N/A	0 -9999999	0	Anytime
367	Sample Filter Cassette ID B21	N/A	0 -9999999	0	Anytime
368	Sample Filter Cassette ID B22	N/A	0 -9999999	0	Anytime
369	Sample Filter Cassette ID B23	N/A	0 -9999999	0	Anytime
370	Sample Filter Cassette ID B24	N/A	0 -9999999	0	Anytime
371	Sample Filter Cassette ID B25	N/A	0 -9999999	0	Anytime
372	Sample Filter Cassette ID B26	N/A	0 -9999999	0	Anytime
373	Sample Filter Cassette ID B27	N/A	0 -9999999	0	Anytime
374	Sample Filter Cassette ID B28	N/A	0 -9999999	0	Anytime
375	Sample Filter Cassette ID B29	N/A	0 -9999999	0	Anytime
376	Sample Filter Cassette ID B30	N/A	0 -9999999	0	Anytime
377	Sample Filter Cassette ID B31	N/A	0 -9999999	0	Anytime
378	Sample Filter Cassette ID B32	N/A	0 -9999999	0	Anytime
379	Sample Filter Blank A1	N/A	0 - 1	0	Anytime
380	Sample Filter Blank A2	N/A	0 - 1	0	Anytime
381	Sample Filter Blank A3	N/A	0 - 1	0	Anytime
382	Sample Filter Blank A4	N/A	0 - 1	0	Anytime
383	Sample Filter Blank A5	N/A	0 - 1	0	Anytime
384	Sample Filter Blank A6	N/A	0 - 1	0	Anytime
385	Sample Filter Blank A7	N/A	0 - 1	0	Anytime
386	Sample Filter Blank A8	N/A	0 - 1	0	Anytime
387	Sample Filter Blank A9	N/A	0 - 1	0	Anytime
388	Sample Filter Blank A10	N/A	0 - 1	0	Anytime
389	Sample Filter Blank A11	N/A	0 - 1	0	Anytime
390	Sample Filter Blank A12	N/A	0 - 1	0	Anytime
391	Sample Filter Blank A13	N/A	0 - 1	0	Anytime
392	Sample Filter Blank A14	N/A	0 - 1	0	Anytime
393	Sample Filter Blank A15	N/A	0 - 1	0	Anytime
394	Sample Filter Blank A16	N/A	0 - 1	0	Anytime
395	Sample Filter Blank A17	N/A	0 - 1	0	Anytime

Code	Description	Units	Range	Default	Edit Modes
396	Sample Filter Blank A18	N/A	0 - 1	0	Anytime
397	Sample Filter Blank A19	N/A	0 - 1	0	Anytime
398	Sample Filter Blank A20	N/A	0 - 1	0	Anytime
399	Sample Filter Blank A21	N/A	0 - 1	0	Anytime
400	Sample Filter Blank A22	N/A	0 - 1	0	Anytime
401	Sample Filter Blank A23	N/A	0 - 1	0	Anytime
402	Sample Filter Blank A24	N/A	0 - 1	0	Anytime
403	Sample Filter Blank A25	N/A	0 - 1	0	Anytime
404	Sample Filter Blank A26	N/A	0 - 1	0	Anytime
405	Sample Filter Blank A27	N/A	0 - 1	0	Anytime
406	Sample Filter Blank A28	N/A	0 - 1	0	Anytime
407	Sample Filter Blank A29	N/A	0 - 1	0	Anytime
408	Sample Filter Blank A30	N/A	0 - 1	0	Anytime
409	Sample Filter Blank A31	N/A	0 - 1	0	Anytime
410	Sample Filter Blank A32	N/A	0 - 1	0	Anytime
411	Site ID 1	N/A	0 - enter string (32-character max)	0	Anytime
412	Site ID 2	N/A	0 - enter string (32-character max)	0	Anytime
413	Separators	N/A	0 - 1	0	Not Run
414	Current Start Time	N/A	0	0	None
415	Pause Time	N/A	0	0	Anytime
416	Resume Time	N/A	0	0	None
417	Current Stop Time	N/A	0	0	Anytime
418	Current Filter 1 Type	N/A	0	0	None
419	Current Filter 2 Type	N/A	0	0	None
420	Current Filter 1 ID	N/A	0	0	None
421	Current Filter 2 ID	N/A	0	0	None
422	Current Cassette 1 ID	N/A	0	0	None
423	Current Cassette 2 ID	N/A	0	0	None
424	Current Sample A Blank	N/A	0	0	None
426	Sample 1 Volume	N/A	0	0	None
427	Sample 2 Volume	N/A	0	0	None
428	Sample 1 Volume Standard	N/A	0	0	None

Code	Description	Units	Range	Default	Edit Modes
429	Sample 2 Volume Standard	N/A	0	0	None
430	Valid Time	N/A	0	0	None
431	Total Time	N/A	0	0	None
432	Filter Count	N/A	0	0	None
433	Total Filter Count	N/A	0	0	None
434	Sampling Control	Code*	0 - 2	0	Anytime
435	Flow Error Action	Code*	0 - 1	err	Not Run
436	Filter Exchange Status	Code*	0 - 16	0	None
437	Autorun	Code*	0	0	Anytime

*Codes are defined later in this Appendix.

PRC Values Defined by Codes

Some of the Sampler's program register codes (PRC) have values that are defined by codes. These codes are defined in this section.

PRC 3: Operating Mode

0	SAMPLE
1	WAIT
2	STOP
3	SHUTTLE
4	ERROR
5	AUDIT
6	SERVICE

PRC 4: Status Type

0	OK	OK
1	WARNING	Status warning
2	CRITICAL	Cirtical warning (see PRC 5)

Note A status code value showing "00000001" indicates that there are no status codes (NONE). ▲

PRC 5: Status Code

(H)1		NONE
(H)2	M	MEMORY
(H)10	Z	POWER FAILURE
(H)20	F1	FLOW
(H)40	F2	FLOW2

(H)80	S1	STOP FLOW
(H)100	S2	STOP FLOW2
(H)200	A	AMBIENT
(H)400	T	FILTER TEMP
(H)800	E	ELECTRONICS TEMP
(H)1000	R1	TEMP DIFFERENCE
(H)2000	R2	TEMP2 DIFFERENCE
(H)4000	X	SHUTTLE
(H)8000	N	NO FILTERS
(H)10000	O1	FLOW VARIATION
(H)20000	O2	FLOW2 VARIATION
(H)40000	P	SAMPLE PERIOD
(H)80000	L	LEAK CHECK
(H)100000	D	AUDIT
(H)200000	B	BLANK FILTER
(H)400000	S	STOP MODE
(H)800000	V	HI WAIT FLOW

PRC 16 – PRC 27

0	None
1	FLOW VOL
2	FLOW2 VOL
3	FLOW TOTAL
4	FLOW COV
5	FLOW2 COV
6	VOLUME
7	VOLUME2
8	AMBIENT PRES
9	FILTER PRES
10	FILTER2 PRES
11	PUMP PRES
12	AMB PRES AVG
13	FLT PRES AVG
14	FLT2 PRES AVG
15	PMP PRES AVG
16	AMBIENT TEMP
17	FILTER TEMP
18	FILTER2 TEMP
19	COMPRT TEMP
20	ELECT TEMP
21	TEMP DLT
22	TEMP2 DLT
23	TEMP DLT MAX

24	TEMP2 DLT MX
25	RELATIVE HUM
26	WIND SPEED
27	WIND DIR
28	WIND SPD AVG
29	WIND VEL
30	WIND VEL AVG
31	WIND DIR AVG
32	FILTER ID
33	FILTER ID
34	CASSETTE ID
35	CASSETTE2 ID
36	START DATE
37	STOP DATE
38	ELAPSED TIME
39	FS STEP
40	FS STATUS
41	TIME
42	DATE
43	DATE/TIME
44	EXTERNAL ALARMS
45	STATUS CODES
46	ANALOG IN 1
47	ANALOG IN 2
48	ANALOG IN 3
49	ANALOG IN 4
50	ANALOG IN 5
51	ANALOG IN 6
52	ANALOG IN 7
53	ANALOG IN 8

PRC 31: Storage Download Type

0	FILTER DATA
1	INTERVAL DATA
2	INPUT DATA

PRC 60 – PRC 65: Analog Voltage Output Range

1	1 volt
2	100 millivolt
4	10 volt
8	5 volt

PRC 72 – PRC 81: Digital Output Instrument States

0	NONE
1	GENERAL ALARM
2	MOTHERBOARD STATUS
3	MEASUREMENT INTERFACE BOARD STATUS
4	I/O BOARD STATUS
5	LOCAL/REMOTE
6	SERVICE
7	EXTERNAL ALARM 1
8	EXTERNAL ALARM 2
9	EXTERNAL ALARM 3

PRC 82 – PRC 91: Digital Output Active State

0	NORMALLY CLOSED
1	NORMALLY OPEN

PRC 162: Default Filter Type

0	Space
1	A
2	B
3	C
4	D
5	E
6	F
7	G
8	H
9	I
10	J
11	K
12	L
13	M
14	N
15	O
16	P
17	Q
18	R
19	S
20	T
21	U
22	V
23	W
24	X

25	Y
26	Z

PRC 165: Sample Type

0	BASIC	24-hour Based Sampling
1	TIME	Time Base Continuous Sampling
2	TIME2	Time Base Cont. Samp/ two intervals
3	ADV	Conditional Sampling

PRC 177: Filter Blank Operation

0	No
1	Yes

PRC 178 - PRC 180: Sampling Conditions 1, 2, 3

0	NONE
1	AMBIENT TEMP (°C)
2	AMBIENT PRES (mmHg)
3	AMBIENT RH (%)
4	WIND SPEED (km/h)
5	WIND DIRECTION (deg)
6	PERCENT FLOW
7	AI1 NOW
8	AI2 NOW
9	AI3 NOW
10	AI4 NOW
11	AI5 NOW
12	AI6 NOW
13	AI7 NOW
14	AI8 NOW
15	AI1 AVE
16	AI2 AVE
17	AI3 AVE
18	AI4 AVE
19	AI5 AVE
20	AI6 AVE
21	AI7 AVE
22	AI8 AVE
23	DIG IN1
24	DIG IN2
25	DIG IN3
26	DIG IN4
27	DIG IN5
28	DIG IN6

29	DIG IN7
30	DIG IN8

PRC 434: Sampling Action Under Serial Control

0	Stop Sampling (Sampling Not Active)
1	Exchange Cassette, Goes to State 2 (Sampling Active)
2	Activate Sampling (Sampling Active)

PRC 437: Auto Run

0	OFF
1	ON