

# Addendum

## **iSeries Instruments**

Part Number 104633-00

24Mar2023

## About This Addendum

This addendum provides information that describes software updates and corrections for *iSeries* manuals.

The addendum is organized as follows:

- Universal updates for all *iSeries* manuals
- Updates for selected manuals

## Universal Updates for All *iSeries* Manuals

**Cover** Add “UKCA” certification.

**Chapter 1 - Introduction** This section describes the updates and corrections that apply to the “Introduction” chapter.

**Environmental Conditions** Intended for Indoor Use Only at 0-95% relative humidity, non-condensing and at altitudes  $\leq 2000\text{m}$   
Main supply voltage fluctuations -  $\pm 5\%$   
Overvoltage Category – III  
Pollution Degree of the intended environment – 2  
Degree of ingress protection (IEC 60529) – IPX0  
Supply cord – UL Listed minimum 18AWG three conductors

### **Multiple Connects via Ethernet and NTP Network Time Protocol Support**

In the features list, replace the associated feature with the following:

- C-Link, MODBUS, Geysitech (Bayern-Hessen), streaming data, and NTP (Network Time Protocol) protocols. Simultaneous connections from different locations over Ethernet.

### **Analog Output Over/Under Range Clamping**

In the “Specifications” section, replace the analog outputs description with the following:

---

|                |   |
|----------------|---|
| 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 |
|----------------|---|

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### **Serial Settings Support**

In the “Specifications” section, replace the serial ports description with the following:

---

|              |   |
|--------------|---|
| Serial Ports | 1 RS-232 or RS-485 with two connectors, baud rate 1200–115200, data bits, parity, and stop bits, protocols: C-Link, MODBUS, Geysitech (Bayern-Hessen), and streaming data (all user selectable) |
|--------------|---|

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## **Chapter 2 - Installation**

This section describes the updates and corrections that apply to the “Installation” chapter.

In the “Setup” section, add the following reference in the step for connecting a recording device to the rear panel connector:

“Instrument Controls > I/O Configuration” in the Operation chapter.

### **Add Device Connection Information**

If your manual does not include the “Connecting External Devices” section, add the following information after the “Setup” section. Change the figure and table numbering as appropriate for your manual.

## **Connecting External Devices**

Several components are available for connecting external devices to iSeries instruments.

These connection options include:

- Individual terminal board PCB assemblies
- Terminal block and cable kits (optional)
- Individual cables (optional)

For detailed information on the optional connection components, refer to the “Optional Equipment” chapter. For associated part numbers, refer to “External Device Connection Components” in the “Servicing” chapter.

## Terminal Board PCB Assemblies

The terminal board PCB assembly is a circuit board with a D-Sub connector on one side and a series of screw terminals on the other. This assembly provides a convenient mechanism for connecting wires from a data system to the analyzer’s I/O connectors.

The following terminal board PCB assemblies are available for iSeries instruments:

- I/O terminal board PCB assembly, 37 pin (standard)
- D/O terminal board PCB assembly, 37 pin (standard)
- 25-pin terminal board PCB assembly, (included with optional I/O Expansion Board)

### I/O Terminal Board

Figure x-x shows the recommended method for attaching the cable to the terminal board using the included tie-down and spacer. Table x-x identifies the connector pins and associated signals.

**Note** Not all of the I/O available in the instrument is brought out on this terminal board, if more I/O is desired, an alternative means of connection is required. ▲

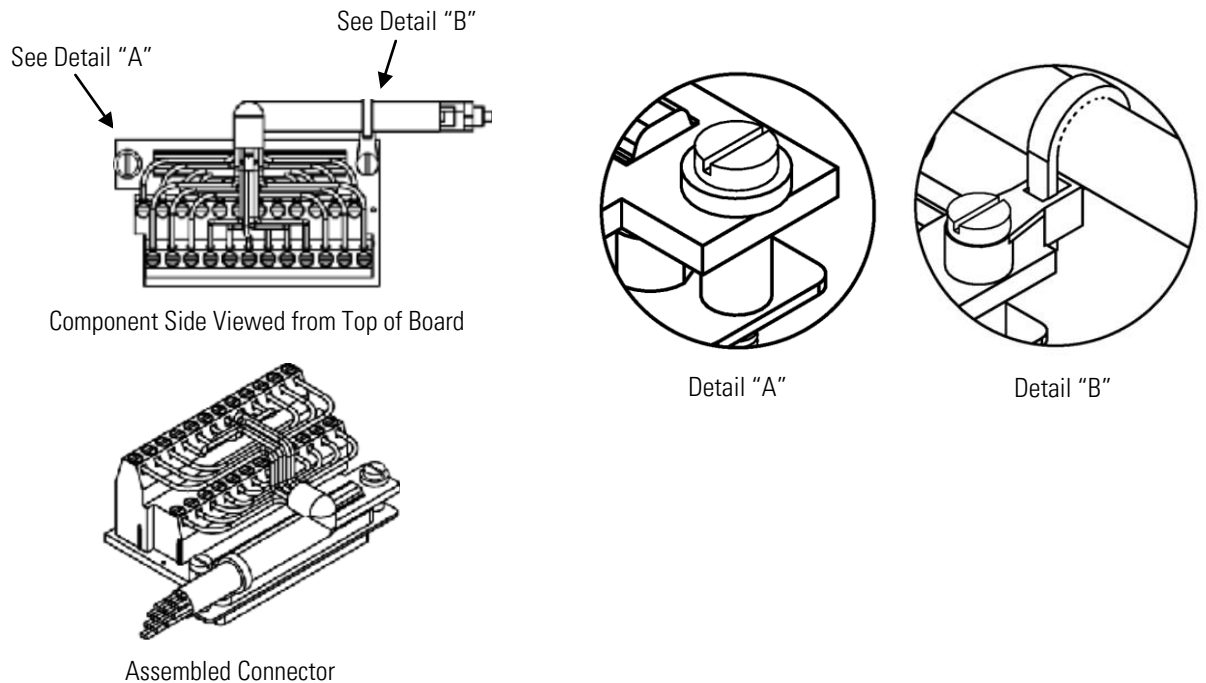


Figure x-x. I/O Terminal Board Views

Table x-x. I/O Terminal Board Pin Descriptions

| Pin | Signal Description | Pin | Signal Description |
|-----|--------------------|-----|--------------------|
| 1   | Analog1            | 13  | Power_Fail_NC      |
| 2   | Analog ground      | 14  | Power_Fail_COM     |
| 3   | Analog2            | 15  | Power_Fail_NO      |
| 4   | Analog ground      | 16  | TTL_Input1         |
| 5   | Analog3            | 17  | TTL_Input2         |
| 6   | Analog ground      | 18  | TTL_Input3         |
| 7   | Analog4            | 19  | TTL_Input4         |
| 8   | Analog ground      | 20  | Digital ground     |
| 9   | Analog5            | 21  | TTL_Input5         |
| 10  | Analog ground      | 22  | TTL_Input6         |
| 11  | Analog6            | 23  | TTL_Input7         |
| 12  | Analog ground      | 24  | Digital ground     |

**D/O Terminal Board**

Figure x-x shows the recommended method for attaching the cable to the terminal board using the included tie-down and spacer. Table x-x identifies the connector pins and associated signals.

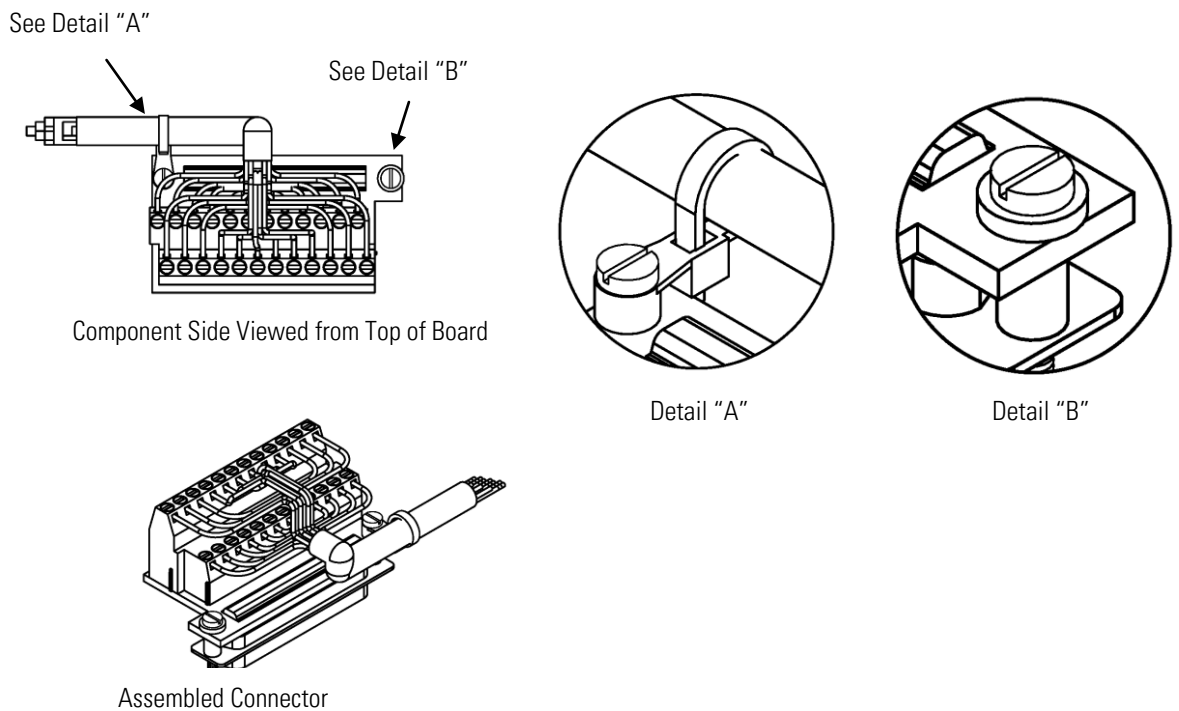


Figure x-x. D/O Terminal Board Views

Table x-x. D/O Terminal Board Pin Descriptions

| Pin | Signal Description | Pin | Signal Description     |
|-----|--------------------|-----|------------------------|
| 1   | Relay1_ContactA    | 13  | Relay7_ContactA        |
| 2   | Relay1_ContactB    | 14  | Relay7_ContactB        |
| 3   | Relay2_ContactA    | 15  | Relay8_ContactA        |
| 4   | Relay2_ContactB    | 16  | Relay8_ContactB        |
| 5   | Relay3_ContactA    | 17  | Relay9_ContactA        |
| 6   | Relay3_ContactB    | 18  | Relay9_ContactB        |
| 7   | Relay4_ContactA    | 19  | Relay10_ContactA       |
| 8   | Relay4_ContactB    | 20  | Relay10_ContactB       |
| 9   | Relay5_ContactA    | 21  | Solenoid_Drive_Output1 |
| 10  | Relay5_ContactB    | 22  | +24V                   |
| 11  | Relay6_ContactA    | 23  | Solenoid_Drive_Output2 |
| 12  | Relay6_ContactB    | 24  | +24V                   |

**25-Pin Terminal Board**

The 25-pin terminal board is included with the I/O Expansion Board.

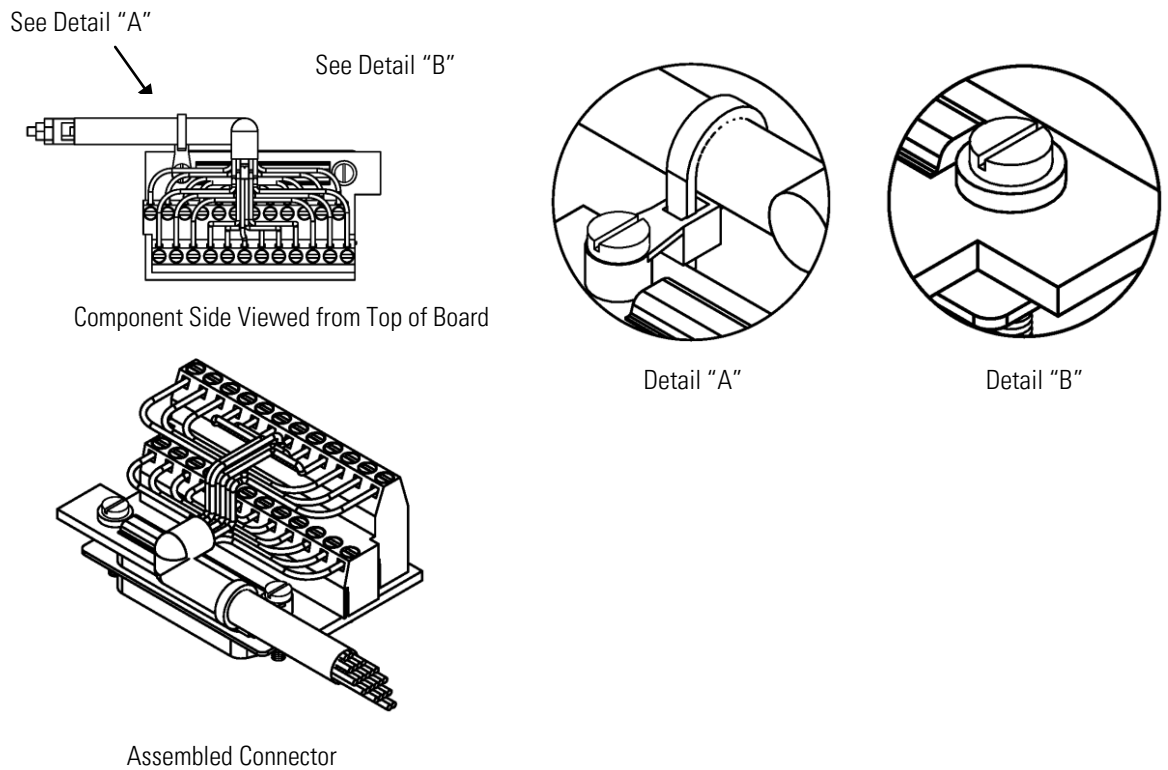


Figure x-x. 25-Pin Terminal Board Views

Table x-x. 25-Pin Terminal Board Pin Descriptions

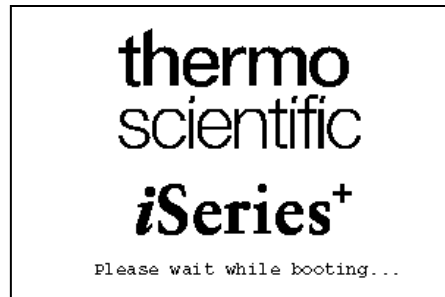
| Pin | Signal Description | Pin | Signal Description |
|-----|--------------------|-----|--------------------|
| 1   | IOut1              | 13  | Analog_In1         |
| 2   | GND_ISO            | 14  | Analog_In2         |
| 3   | IOut2              | 15  | Analog_In3         |
| 4   | GND_ISO            | 16  | GNDD               |
| 5   | IOut3              | 17  | Analog_In4         |
| 6   | GND_ISO            | 18  | Analog_In5         |
| 7   | IOut4              | 19  | Analog_In6         |
| 8   | GND_ISO            | 20  | GNDD               |
| 9   | IOut5              | 21  | Analog_In7         |
| 10  | GND_ISO            | 22  | Analog_In8         |
| 11  | IOut6              | 23  | GNDD               |
| 12  | GND_ISO            | 24  | GNDD               |

## Chapter 3 - Operation

This section describes the updates and corrections that apply to the “Operation” chapter.

### Power-Up Screen

Replace the Thermo Electron Corporation power-up screen with the Thermo Scientific power-up screen.



**Status Bar** In the “Run Screen” section, add the following that describes the new status bar icons.

“The status bar displays the time, the password (lock) icon, service (wrench) icon, alarm (bell) icon, and optional zero/span sample solenoid valve status, if installed.”

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

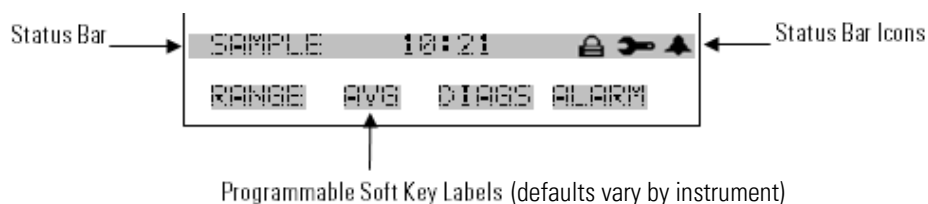
## Status Bar Icons

The password (lock) icon indicates that no parameter changes can be made from the front panel.



The alarm (bell) icon indicates that an alarm is active.

The service (wrench) icon indicates that the instrument is in the service mode.



### Change Status Bar “Alarm” to Bell Icon

Change the “Alarm” references on the status bar to the bell icon or remove the reference. The “Alarm” references have been replaced with status bar icons described previously in this document.



### Degree Symbol

Screens which show temperature values should include the degree symbol “°” not just the “C” for Celsius units. The degree symbol has been added to all screens that were missing it.

### Update Datalogging Settings

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 and srecs. 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. For example, an srec containing just the current concentration level could be generated every five minutes while an lrec containing a full set of diagnostic data could be generated once every hour.

The analyzer’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, concentration

and error flags, the analyzer can store data once each minute for four months (>190,000 records).

### **Add Span and BKG**

Add “Span” and “BKG” to default lrec and output lists.

### **Reset to Default Content**

Replace the “Reset to Default Content” description, under Datalogging, with the following:

The Reset to Default Content screen is used to reset all of the datalogging field items to default values for the selected record type. For more information, about selecting the content of logged data fields, see “Select Content” described previously.

### **Add Serial Settings Menu and Support**

Add Serial Settings to the Communications Settings menu as follows:

Main Menu > Instrument Controls > **Communication Settings**.

```
COMMUNICATION SETTINGS:
>SERIAL SETTINGS
  INSTRUMENT ID
  COMMUNICATION PROTOCOL
  STREAMING DATA CONFIG
  TCP/IP SETTINGS

RANGE  AVG  DIAGS  ALARM
```

Add Serial Settings descriptions and menu including Data Bits, Parity, and Stop Bits.

**Note** The Baud Rate and RS-232/485 selections were moved from the Communications Settings menu to the Serial Settings screen. ▲

### **Serial Settings**

The Serial Settings menu is used for serial communications control and configuration. In the Main Menu, choose Instrument Controls > Communication Settings > **Serial Settings**.



```

SERIAL SETTINGS:
>BAUD RATE          9600
DATA BITS           8
PARITY              NONE
STOP BITS           1
RS-232/485 SEL     RS-232

RANGE  AVG  DIAGS  ALARM

```

**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 analyzer’s default baud rate is set to 9600 to provide backwards compatibility with the older C-series analyzers.

```

BAUD RATE:
CURRENTLY:          9600
SET TO:             19200 ?

  ↑↓ CHANGE VALUE
  ← SAVE VALUE

RANGE  AVG  DIAGS  ALARM

```

**Data Bits**

The Data Bits Screen is used to set the number of serial data bits. Selections of 7 or 8 are available (defaults to 8).

```

DATA BITS:
CURRENTLY:          8
SET TO:             7 ?

  ↑↓ CHANGE VALUE
  ← SAVE VALUE

RANGE  AVG  DIAGS  ALARM

```

**Parity**

The Parity screen is used to select the parity bit for the serial port. Selections of NONE, EVEN, or ODD are available (defaults to NONE).

```

PARITY:
CURRENTLY:      NONE
SET TO:         NONE

      ↑↓ CHANGE VALUE
      ← SAVE VALUE

RANGE  AVG  DIAGS  ALARM

```

**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 (defaults to 1).

```

STOP BITS:
CURRENTLY:      1
SET TO:         2      ?

      ↑↓ CHANGE VALUE
      ← SAVE VALUE

RANGE  AVG  DIAGS  ALARM

```

**Replace Equipment  
Damage Alert**

Replace the Equipment Damage alert in the “RS-232/RS-485 Selection” section with the following:



**Equipment Damage** Disconnect the serial cable before changing RS-232 and RS-485 selection to prevent damage to any equipment currently connected to the analyzer. ▲

**Add Network Time  
Protocol Server**

Add Network Time Protocol Server (NTP SVR) to the TCP/IP Settings menu as follows:

Main Menu > Instrument Controls > Communication Settings > **TCP/IP Settings**.

```

TCP/IP SETTINGS:
>USE DHCP      OFF
IP ADDR        192.168.1.200
NETMASK        255.255.255.0
GATEWAY        192.168.1.15
HOST NAME      iSeries
NTP SVR        192.168.1.15

RANGE  AVG  DIAGS  ALARM

```

Add NTP Server IP Address description and screen:

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 Controls > Communication Settings > TCP/IP Settings > **NTP Server**.

```
NTP SERVER IP ADDRESS:
CURRENT: 192.168.1.20
SET TO: 192.168.001.01
      ←→ MOVE CURSOR
      ↑↓ CHANGE VALUE
      ← SAVE
RANGE  AVG  DIAGS  ALARM
```

**Add Local/Remote to Non Alarm Status Items Menu**

Main Menu > Instrument Controls > I/O Configuration > Output Relay Settings > Relay 1-10 > Instrument State > Non-Alarm, add Local/Remote to the Non Alarm Status Items menu.

List May Vary Based on Instrument

```
NON ALARM STATUS ITEMS:
>NONE          ←--
AUTORANGE
LOCAL/REMOTE
SERVICE
UNITS
ZERO MODE
SPAN MODE      ↓
RANGE  AVG  DIAGS  ALARM
```

**Add Available I/O Note**

In the “Digital Input Settings” section, under Instrument Controls, add the following note, if it is not already included:

**Note** Not all of the I/O available in the instrument is brought out on the supplied terminal board, if more I/O is desired, an alternative means of connection is required. ▲

**Add Allow Over/Under Range to Output Channels Menu**

Add Allow Over/Under Range to Output Channels Screen and add the Allow Over/Under Range screen as follows:

Main Menu > Instrument Controls > I/O Configuration > **Analog Output Config.**

```

OUTPUT CHANNELS:
>ALLOW OVER/UNDER RANGE
ALL VOLTAGE CHANNELS
ALL CURRENT CHANNELS
VOLTAGE CHANNEL 1
VOLTAGE CHANNEL 2
VOLTAGE CHANNEL 3
VOLTAGE CHANNEL 4
↓
RANGE  AVG  DIAGS  ALARM

```

### Allow Over/Under Range Screen

The Allow Over/Under Range screen, in Analog Output Configuration under I/O Configuration, 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 Instrument Controls > I/O Configuration > Analog Output Config > **Allow Over/Under Range**.

```

ALLOW OVER/UNDER RANGE:
CURRENTLY:                OFF
SET TO:                   ON  ?
← TOGGLE VALUE
RANGE  AVG  DIAGS  ALARM

```

### Update Number of Table Points Description

Replace the “Number of Table Points”, under Analog Input Configuration under I/O Configuration, description with the following:

The Number of Table Points screen allows the user to select how many points are used in the analog input conversion table. 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 (0-10.5 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.

### Screen Contrast

In the first paragraph, in Screen Contrast under Instrument Controls, change “increments of 10” to “increments of 5.” Add the following three notes to the Instrument Controls > Screen Contrast section:

**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, select Instrument Controls > **Screen Contrast** and adjust the screen contrast. If the content on the screen is not visible, use the “set contrast 10” C-Link command to set screen contrast to mid range, then optimize the contrast. See “Contrast Levels” in the “C-Link Protocol Commands Appendix” section of this document for more information on this command. ▲

### Add Timezone Screen

Add “Timezone Screen” selection to the Instrument Controls menu

```
INSTRUMENT CONTROLS:
>AUTO/MANUAL MODE
FLASH LAMP
DATA LOGGING SETTINGS
COMMUNICATION SETTINGS
I/O CONFIGURATION
TEMPERATURE COMPENSATION
PRESSURE COMPENSATION ↓

RANGE  AVG  DIAGS  ALARM

SCREEN CONTRAST
SERVICE MODE
DATE/TIME
TIMEZONE
```

Add Timezone Screen description and screen display:

The Timezone 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 the CLINK “TZ” command (see Appendix B). The selections are: UTC, EST (UTC-5), CST (UTC-6), MST (UTC-7), PST (UTC-8), YST (UTC-9), HST (UTC-10), NST (UTC-11), DLW (UTC-12), CET (UTC+1), EET (UTC+2), BST (UTC+3), DLT (UTC+4), ECH (UTC+5), FOX (UTC+6), GLF (UTC+7), CCT (UTC+8), JST (UTC+9), GST (UTC+10), LMA (UTC+11), DLE (UTC+12), EDT (UTC-5/4), CDT (UTC-6/5), MDT (UTC-7/6), and PDT (UTC-8/7)

In the Main Menu, choose Instrument Controls > **Timezone**.

```

TIMEZONE FOR TIMESERVER:
CURRENTLY: UTC
SET TO: EDT (UTC-5/4)

      ↑↓ CHANGE VALUE
      ← SAVE VALUE

RANGE  AVG  DIAGS  ALARM

```

**Digital Inputs**

Replace the Digital Inputs description, under the Diagnosis menu, with the following:

The Digital Inputs screen (read only) displays the state of the 16 digital inputs. Pull-ups are provided on all the inputs, so if nothing is connected they will read (1), if an input is brought to ground, it will read (0).

**Zero and Span Check**

Replace the Zero and Span Check description, under the Alarms menu, with the following:

The Zero and Span Check screen allows the user to view the status of the most recent zero/span checks and set the maximum check offsets. An alarm will be triggered if a zero or span check indicates drift that exceeds the offset value. The zero and span check screens are visible only if the zero/span check option is enabled. Their functions are similar.

**Zero and Span Auto Calibration**

Replace the Zero and Span Auto Calibration description, under the Alarms menu, with the following:

The Zero and Span Auto Calibration screens (read only) allow the user to view the status of the most recent auto background calibration or span calibrations. The zero and span auto calibration screens are visible only if the zero/span check option is enabled and the zero or span cal reset function is enabled.

**Add Wait 30 Seconds Note**

Add the following note to all pressure, flow, and temperature sensor calibration screens in the Service menu.

**Note** Wait at least 30 seconds for the reading to stabilize before saving the value. ▲

**Lock/Unlock and Local/Remote Operation**

Add the following below “Lock Instrument” in the “Password Menu” section:

If the instrument keyboard is locked via the front panel using Password > **Lock Instrument**, the instrument reports being in Remote mode. In this

mode, the keypad is locked, data can be viewed but not changed using the front panel interface, and the remote “Set” commands are active.

If the instrument keyboard is unlocked via the front panel using Password > **Unlock Instrument**, the instrument reports being in Local mode, the front panel interface is unlocked, and data can be changed from the front panel.

Refer to the “C-Link Protocol Commands” appendix for detailed information about “mode”, “allow mode”, and “power up mode” commands.

**Add Ext Alarms**

Add “Ext Alarms” to the list of Other Measurements in the Datalogging Settings menu, Streaming Data Configuration menu, Analog Output Configuration menu, and Digital Inputs screen. Note that Ext Alarms is displayed in the Alarms menu if it was previously selected in the Digital Inputs screen.

**Add Dilution Ratio**

Add “Dilution Ratio” to the list of Other Measurements in the Datalogging Settings menu, Streaming Data Configuration menu, Analog Output Configuration menu, and Digital Inputs screen.

**Change Gas Units to Lower Case**

Change gas units in the screens to lower case.

**Change LPM to L/min**

Change LPM in the screens to L/min.

**Chapter 6 – Troubleshooting**

This section describes the updates and corrections that apply to the “Troubleshooting” chapter.

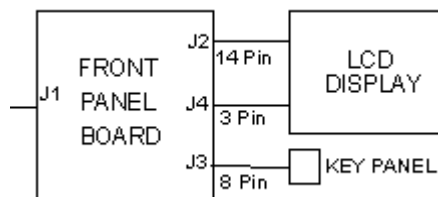
**Add Cause and Action Descriptions**

In the “Troubleshooting – Measurement Failures” troubleshooting table, add the following highlighted Possible Cause and Action descriptions:

| Malfunction                                 | Possible Cause  | Action  |
|---|---|---|
| Analog signal doesn't match expected value. | Software has not been configured.                       | Verify that the selected analog output has been properly configured to match the data system.   |
|   | Analog output goes above full-scale value or below zero | By default, a 5% over and under range on the analog outputs is provided. If this is not desirable due to system restrictions, it may be turned off in the INSTRUMENT CONTROLS > I/O CONFIGURATION > ANALOG OUTPUT CONFIG screens. |

### Change Number of Pins on Board-Level Connection Diagram

If not already corrected, in the “Board-Level Connection Diagrams” section, change the number of pins on the front panel board to 14 pins for J2 and 3 pins for J4:



### Change Pin 13 Description on I/O Expansion Board

In the “I/O Expansion Board Connector Pin Descriptions” table, change the description of pin 13 from NC to Current Output Return.

### Add Digital and Analog Descriptions to Ground Pins

In the Motherboard Connector Pin Descriptions table add “Digital” and “Analog” descriptions to the 37-pin I/O Connector Label as follows:

Add “**Digital**” to pins 2, 5, 13, 22, 26, and 32

Add “**Analog**” to pins 16, 18, 19, 35, and 37

## Chapter 7 – Servicing

This section describes the updates and corrections that apply to the “Servicing” chapter.

### Equipment Damage – Static Electricity Damage

Replace the Equipment Damage precaution statement for static electricity with the following:



**Equipment Damage** Some internal components can be damaged by small amounts of static electricity. A properly ground 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. \*

### Add Device Connection Information

If your manual does not include the “External Device Connection Components” section, add the following information after “Cable List.” Change the table numbering as appropriate for your manual.



## External Device Connection Components

Table x-x lists the standard and optional cables and components used for connecting external devices such as PCs and data loggers to an iSeries instrument.

Table x-x. 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 (optional)  |
| 102888-00   | Terminal Board PCB Assembly, DB37F (standard)                                   |
| 102891-00   | Terminal Board PCB Assembly, DB37M (standard)                                   |
| 103084-00   | Terminal Board PCB Assembly, DB25M (included with optional I/O Expansion Board) |

### Replace Fan Replacement Procedure

Replace the “Fan Replacement” procedure with the following Fan/Filter Replacement procedure:

### Fan/Filter Replacement

Use the following procedure to replace the rear panel fan and the filter.

Equipment Required:

- Fan
- Fan filter
- Philips screwdriver



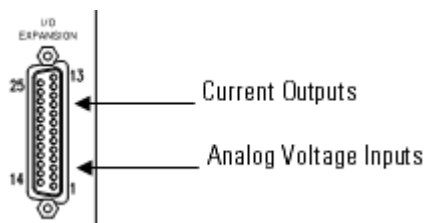
**Equipment Damage** Some internal components can be damaged by small amounts of static electricity. A properly ground antistatic wrist strap must be worn while handling any internal component. \*

1. Turn instrument OFF, unplug the power cord, and remove the cover.

2. Remove the fan guard and filter from the rear of the instrument by unsnapping it.
3. If the fan is not being replaced, install the new filter, snap it into place, and skip the remaining steps.
4. If possible, disconnect the fan power cable from the fan, otherwise disconnect the cable from the measurement interface board.
5. Remove the four fan mounting screws along with nuts and washers and remove the fan.
6. Install a new fan following the previous steps in reverse order.

### Correct Pin Designations on I/O Expansion Connector

In the “Analog Output Testing” section, correct the I/O Expansion connector pin designations to the following:



### LCD Module Replacement

In the “LCD Module Replacement” procedure, change Step 4 to the following:

4. Slide the LCD module out towards the center of the instrument.

Add the following note at the end of the “LCD Module Replacement” procedure.

**Note** The optimal contrast will change from one LCD screen to another. After replacing the LCD screen, the contrast may need to be reset. If the content on the screen is visible, select Instrument Controls > **Screen Contrast** and adjust the screen contrast. If the content on the screen is not visible, use the “set contrast 10” C-Link command to set screen contrast to mid range, then optimize the contrast. See the “C-Link Protocol Commands” appendix for more information on this command. \*

## Chapter 8 – System Description

### Add Connection Information

This section describes the updates and corrections that apply to the “System Description” chapter.

Add the following to the “Ethernet Connection” section:

“Up to three simultaneous connections are allowed per protocol.”

### Update Analog Voltage Inputs Description

Replace the “Analog Voltage Inputs (Optional)” description with the following:

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 (0-10.5 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 10.5 volts.

### Add Over and Under Range Information

Add the following to the “Analog Voltage Outputs” and “Analog Current Outputs (Optional)” sections.”

“At least 5% of full-scale over and under range are also supported, but may be overridden in software if required.”

### RS-232 Connection

Change the caption of Table 8-1 to: “RS-232 DB9 Connector Pin Configuration.”

### RS-485 Connection

Change the caption of Table 8-2 to: “RS-485 DB9 Connector Pin Configuration.”

## Chapter 9 – Optional Equipment

### Add 25-Pin Terminal Board Assembly Reference

Change the description of the retrofit rack in Table 9-3 to the following:

This configuration is intended for direct replacement of a C-Series instrument in an existing rack. The rail mounting location is lower on the case and the front mounting screw slots are in non-standard EIA locations.

If your manual does not include the “25-Pin Terminal Board Assembly” reference, add the following information after “I/O Expansion Board Assembly.”

## 25-Pin Terminal Board Assembly

The 25-pin terminal board assembly is included with the I/O expansion board. Refer “Terminal Board PCB Assemblies” in the “Installation” chapter for information on attaching the cable to the connector board. For associated part numbers, refer to “External Device Connection Components” in the “Servicing” chapter.

### Add Optional Cables

If your manual does not include the “Cables” reference, add the following information after “I/O Expansion Board Assembly.” Change the table numbering as appropriate for your manual.

## Cables

Table x-x identifies the optional individual cables that are available for the instrument and provides the cable color codes. For associated part numbers, refer to “External Device Connection Components” in the “Servicing” chapter.

**Note** Table x-x 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 x-x. Cable Options

| Description       | Cable Length |
|-------------------|--------------|
| DB37M to open end | Six feet     |
| DB37F to open end | Six feet     |
| DB25M to open end | Six feet     |
| RS-232            |              |

Table x-x. 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   |

| Pin | Color        | Pin | Color             |
|-----|--------------|-----|-------------------|
| 9   | GRAY         | 27  | PIND/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 |

## C-Link Protocol Commands Appendix

### Add Command Response Descriptions

This section describes the updates and corrections that apply to the “C-Link Protocol Commands” appendix.

Add the following new command response table to the C-Link Protocol Commands appendix under Commands:

**Table x-x.** Command Response Error Descriptions

| Command Response       | Description  |
|------------------------|--|
| too high               | Supplied value is higher than the upper limit  |
| too low                | Supplied value is lower than the lower limit   |
| invalid string         | Supplied string invalid (typically because a letter was detected when the value should be numeric) |
| data not valid         | Supplied value is not acceptable for entered command   |
| can't, wrong settings  | Command not allowed for current measurement mode   |
| can't, mode in service | Command not allowed while instrument is in service mode  |

### Add Connection Information

Add the following to the end of the first paragraph and to the “Accessing Streaming Data” section:

“Up to three simultaneous connections are allowed per protocol.”

**Update Table B-1** Add “/sets” following “Reports” in the analog iout range and analog vout range command descriptions.

Replace the “alarm trig conc” description with the following:

“Reports/sets current concentration alarm trigger sense.”

**Replace Erec Description** Replace the errec description in the “C-Link Protocol Commands” table with the following:

Returns a snapshot of the main operating conditions (measurements and status) in the specified format.

Replace the errec description in the errec command with the following:

This command returns a snapshot of the main operating conditions (measurements and status) at the time the command is issued. The example that follows shows a typical response.

The format is defined by the current settings of the “format” and “errec format” commands. For details on errec 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.

**Add Service Mode Section** After the “Entering Units in PPB” section, add the following:

**Convert Concentration Formats** Convert concentration formats from xxxxE+yy to x.xxxE+yy. The *iSeries* uses more standard script than the C-Series by placing only one digit to the left of the decimal.

**Service Mode** If the Service Mode is active, C-Link “set” commands are not allowed. This is to prevent parameters from being changed remotely while the unit is being serviced locally.

**Update Lrec Mem Size** Replace the lrec mem size description with the following:

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

## Update Set Layout Ack

Replace the set layout ack description with the following and add the table:

This command disables the stale layout/layout change indicator (\*) that is attached to each response if the erez layout has changed since the last time erez layout was requested.

**Table x-x.** Set Layout Ack Values

| <i>Value</i> | <b>Function</b>      |
|--------------|----------------------|
| 0            | Do nothing (default) |
| 1            | Append "*"           |

## Change Flags Field

Change the 2-bit flags field that reported Local/Remote/Service to Service on/off and Password Lock on/off. The most significant bit of the 2-bit fields is Service Status and the least significant bit is for Password Lock status.

1= ON

0= OFF

## Replace DHCP Descriptions

Replace DHCP associated descriptions with the following:

### **set dhcp onoff**

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.

**Note** When changing the IP address, the netmask address, or the gateway address, you must cycle power to the instrument before the change takes effect. Until you cycle power, the address assigned by the DHCP server will still be used and reported as the current address. \*

## Add Note to Addr GW, Addr IP, and Addr NM Commands

Add the following note to the addr gw, addr IP, and addr nm commands:

**Note** This command cannot be used when DHCP is on. Refer to the DHCP command that follows for additional information. \*

## Alarm Internal Temp Command

Change alarm internal temp command format from “internal alarm temp” to “alarm internal temp” in the examples and associated set commands.

## Alarm Pressure Command

Change alarm pressure command format from “pressure alarm” in the example to “alarm pressure.”

**Alarm Sample Flow Command** If the instrument includes the alarm sample flow command, the response is formatted to be three digits to the right of the decimal, such as 0.350 lpm instead of one digit to the right of the decimal.

**Clr Records Command** Change clear records command format from “clear records” to “clr records” in the example.

**Contrast Levels** Screen contrast levels can now be changed in 5% increments instead of 10% increments. Refer to the following “Contrast Levels” table.

**Table x-x.** Contrast Levels

| <i>Level</i> | <b>Contrast Level</b> |
|--------------|-----------------------|
| 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%                   |
| 16           | 80%                   |
| 17           | 85%                   |
| 18           | 90%                   |
| 19           | 95%                   |
| 20           | 100%                  |

**Gas Unit Command** Change “set gas *unit*” to “set gas **unit** *unit*”.



## Add Scratch Pad Description

Add the following scratch pad description to the list sp, set copy sp to lrec/srec/stream, set copy lrec/srec/stream to sp, sp field, and set sp field commands:

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.

## Add the Allow Mode Command

Add the Allow Mode command to the “Commands List” section and the “Communications Configuration” section as follows:

---

|                |   |
|----------------|---|
| allow mode cmd | Reports/sets the current set allow mode command |
|----------------|---|

---

---

### allow mode cmd

This command reports the current allow mode setting: 1 = allow “set mode local” or “set mode remote” commands; 0 = ignore “set mode local” or “set mode remote” commands. The default value is 0; ignore the commands (refer to the table that follows). The example that follows 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. Refer to the table that follows.

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 will not change the instrument lock status** (this is for compatibility with systems expecting an “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 example that follows sets the instrument to accept the “set mode local” or “set mode remote” commands.

```
Send:          set allow mode cmd 1
Receive:       set allow mode cmd 1 ok
```

**Table x-x.** Allow Mode Command Values

| <i>Value</i> | <b>Allow Mode Command</b> |
|--------------|---------------------------|
| 0            | Ignore (default)          |
| 1            | Accept                    |

### **Add the Power Up Mode Command**

Add the Power Up Mode command to the “Commands List” section and the “Communications Configuration” section as follows:

---

|               |   |
|---------------|---|
| power up mode | Reports/sets the power up mode as local or remote |
|---------------|---|

---

#### **power up mode**

This command reports the current power up mode setting, where *value*, is either 0 = local/unlocked or 1 = remote/locked. The default value is 0; power up in local/unlocked mode. The example that follows 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).

If the instrument is set to power up in the local/unlocked 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 example that follows sets the instrument to power up in remote/locked mode.

Send: set power up mode 1  
Receive: set power up mode 1 ok

**Table x-x.** Power Up Mode Values

| <i>Value</i> | <b>Power Up Mode Command</b> |
|--------------|------------------------------|
| 0            | Local/Unlocked (default)     |
| 1            | Remote/Locked Mode           |

### Add the Addr NTP Command

Add the Addr NTP command to the “Commands List” section and the “Communications Configuration” section as follows:

---

|          |  |
|----------|--|
| addr ntp | Reports the IP address for the NTP time server |
|----------|--|

---

---

#### **addr ntp**

This command reports the IP address for the NTP time server. See “Network Time Protocol Server” in the “Communications Settings” section of the “Operation” chapter for more information.

Send: addr ntp  
Receive: addr ntp 192.168.1.2

#### **set addr ntp *address***

This command sets the NTP time server *address*, where *address* consists of four numbers ranging from 0-255 inclusive, separated by “.”.

Send: set addr ntp 192.168.1.2  
Receive: set addr ntp 192.168.1.2 ok

### Add the TZ Command

Add the tz command to the “Commands List” section and the “Communications Configuration” section as follows:

---

|    |  |
|----|--|
| tz | Reports/sets the tz timezone string for the NTP server |
|----|--|

---

---

#### **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 time 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

**Add the Menutext Command**

Add the Menutext command to the “Commands List” section and the “Keys Display” section as follows:

---

|          |   |
|----------|---|
| menutext | Displays the text of the menu item where the cursor is currently positioned |
|----------|---|

---

---

**menutext**

This command displays the text of the menu item where the cursor is currently positioned. The example that follows shows that the cursor is positioned at the instrument controls menu item.

Send: menutext  
Receive: menutext main menu instrument controls

**Add C-link MODBUS Related Commands**

Add the following C-link MODBUS related commands to the “Commands List” section and the “I/O Configuration” section as follows:

---

|                                      |   |
|--------------------------------------|---|
| mb read coils <i>start count</i>     | Reports the current state of the MODBUS coils (digital outputs)       |
| mb read registers <i>start count</i> | Reports the current state of the MODBUS registers (analog outputs)    |
| set mb write coil <i>coil state</i>  | Sets the current state of the MODBUS coil <i>coil</i> (digital input) |

---

---

**mb read coils *start count***

*start* = index of first coil, *count* = number of coils to report.

This command reports the current state of the MODBUS coils (digital outputs). Output is in binary format with the coil *start* appearing as the right-most bit.

Send: mb read coils 1 15  
Receive: mb read coils 1 15 000000100000001

---

**mb read registers *start count***

*start* = index of first register (must be odd number), *count* = number of registers to report (must be even), each pair of registers is reported as a float.

This command reports the current state of the MODBUS registers (analog outputs). Output is in floating point format with the pair of registers *start* and *start+1* appearing as the left-most value.

Send:           mb read registers 5 4  
Receive:        mb read registers 5 4 552629.000000 55998800.000000

---

**set mb write coil *coil state***

*coil* = index of coil to be set, *state* = 1 or 0

This command sets the current state of the MODBUS coil *coil* (digital input). *Coil* has an offset of 100 (that is, the first write coil is address 101).

Send:           set mb write coil 104 1  
Receive:        set mb write coil 104 1 ok

## Add Zero and Span Commands

Add the following zero and span commands to the “Commands List” section and to the “Calibration” section as follows:

---

|                |   |
|----------------|---|
| span dev       | Reports/sets span deviation (maximum span check offset)     |
| zero dev       | Reports/sets zero deviation (maximum zero check offset)     |
| span cal reset | Reports/sets span cal reset on/off                          |
| span dur       | Reports/sets how long span gas is sampled by the instrument |
| zero cal reset | Reports/sets zero cal reset on/off                          |
| zero dur       | Reports/sets how long zero gas is sampled by the instrument |
| zs period      | Reports/sets zero/span period                               |
| zs avg time    | Reports/sets zero/span averaging time                       |

---

---

**span dev**

This command reports the span deviation (span check offset). The example that follows reports that the span deviation is 1 ppb.

Send:           span dev  
Receive:        span dev 1.000 E+00

**set span dev *value***

This command sets the span deviation (span check offset) to *value*, where *value* is a floating-point representation of the gas concentration in current selected units. The example that follows sets the span deviation to 345 ppb.

```
Send:      set span dev 345
Receive:   set span dev 345 ok
```

---

**zero dev**

This command reports the zero deviation (maximum zero check offset). The example that follows reports that the zero deviation is 10 ppb.

```
Send:      zero dev
Receive:   zero dev 1.000 E+01
```

**set zero dev**

This command sets the zero deviation (maximum zero check offset) to *value*, where *value* is a floating-point representation of the gas concentration in current selected units. The example that follows sets the zero deviation to 10 ppb.

```
Send:      set zero dev 1.000 E+01
Receive:   set zero dev 1.000 E+01 ok
```

---

**span cal reset**

This command reports that the span cal reset is on or off. The example that follows reports that the span cal reset is on.

```
Send:      span cal reset
Receive:   span cal reset on
```

**set span cal reset *onoff***

This command sets the span cal reset to on or off. The example that follows sets the span cal reset to off.

```
Send:      set span cal reset off
Receive:   set span cal reset off ok
```

---

**zero cal reset**

This command reports that the zero cal reset is on or off. The example that follows reports that the zero cal reset is off.

```
Send:      zero cal reset
Receive:   zero cal reset off
```

**set zero cal reset *onoff***

This command sets the zero cal reset on or off. The example that follows turns the zero cal reset off.

```
Send:          set zero cal reset off
Receive:       set zero cal reset off ok
```

---

**span dur**

This command reports the span duration. The example that follows reports that the span duration min is 10 minutes.

```
Send:          span dur
Receive:       span dur 10 min
```

---

**set span dur *value***

This command sets span duration to *value* where *value* represents the span duration in minutes. The example that follows sets the span duration to 15 minutes.

```
Send:          set span dur 15
Receive:       set span dur 15 ok
```

---

**zero dur**

This command reports the zero duration. The example that follows reports that the zero duration is 10 minutes.

```
Send:          zero dur 10
Receive:       zero dur 10 ok
```

---

**set zero dur *value***

This command sets the zero duration to *value* where *value* represents the zero duration in minutes. The example that follows sets the zero duration to 15 minutes.

```
Send:          set zero dur 15
Receive:       set zero dur 15 ok
```

---

**zs period**

This command reports the zero/span (zs) period. The example that follows reports that the zero/span period is 24 hours.

```
Send:          zs period
Receive:       zs period 24 hr
```

### **set zs period *value***

This command sets zero/span (zs) period to *value*, where *value* represents the zero/span period in hours. The example that follows sets the zero/span period to 24 hours.

```
Send:          set zs period 24
Receive:       set zs period 24 hr ok
```

---

### **zs avg time**

This command reports the zero/span (zs) averaging time in seconds. The example that follows reports that the zero/span averaging time is 30 seconds, according to the Averaging Times table in this appendix.

```
Send:          zs avg time
Receive:       zs avg time 5:30 sec
```

### **set zs avg time**

This command sets the zero/span averaging time, according to the Averaging Times table. The example that follows sets the zero/span averaging time to 120 seconds.

```
Send:          set zs avg time 8
Receive:       set zs avg time 8 ok
```

## **Add the Version Command**

Add the Version command to the “Commands List” section and the “Diagnostics” section as follows:

---

|         |  |
|---------|--|
| version | Reports version of all the firmware components |
|---------|--|

---

### **version**

This command reports the version of all the firmware components. The example that follows shows a list of firmware components that were displayed by issuing the version command. The components displayed will vary depending on the configuration of the instrument.

```
Send:          version
Receive:       version

                Program = 01.05.79.225
                Library = 01.01.60.167
                Kernel = 2.4.24-uc0-003-Thermo
                Board = 81, File = /usr/application.hex
                Board App = 11.3.100 BI 4.0.97
                File App = 11.3.100 BI 4.0.97
                Board = 84, File = /usr/application.hex
                Board App = 11.3.100 BI 4.0.97
```



## MODBUS Protocol Appendix

This section describes the updates and corrections that apply to the “MODBUS Protocol” appendix.

### Update Serial Communication Parameters

Update the Serial Communication Parameters section as follows:

|                     |   |
|---------------------|---|
| 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) |

### Add Connection Information

Add the following to the “TCP Communication Parameters” section:  
“Up to three simultaneous connections are supported over Ethernet.”

### Add Service Mode Note

Add the following note to the (0x05) Force (Write) Single Coil section:

**Note** This function will not work if the instrument is in service mode. \*

### Add Notes to MODBUS Commands Supported Section

In the “MODBUS Commands Supported” section (also shown as the “MODBUS Addresses Supported” section in some manuals) add the following notes to the Tables as indicated:

**Table C–1** through **Table C–3** list the MODBUS addresses supported for the Model *xxi*.

**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 instrument. \*

**Note** Coil status 1 indicates active state. \*

**Table C–1.** Read Coils for *xxi*

| Coil Number | Status                              |
|-------------|-------------------------------------|
| 0           | INVALID                             |
| 1           | (add your instrument specific data) |

| Coil Number | Status |
|-------------|--------|
| (end)       | (end)  |

In addition to the coils listed in the Read Coils table, coils in the Write Coils table can also 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 instrument. \*

**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 *xxi*

| Register Number | Variable                            |
|-----------------|-------------------------------------|
| 0               | INVALID                             |
| 1&2             | (add your instrument specific data) |
| (end)           | (end)                               |

**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 instrument. \*

**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 instrument detects the change and triggers the appropriate action. \*

**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). \*

**Table C–3.** Write Coils for *xxi*

| Coil Number | Action Triggered                    |
|-------------|-------------------------------------|
| 100         | INVALID                             |
| 101         | (add your instrument specific data) |

| Coil Number | Action Triggered |
|-------------|------------------|
| (end)       | (end)            |

In addition to the coils listed in the Write Coils table, coils in the Read Coils table can also be read.

### Reading a Write Coil

To read a write coil, issue a read coil command for that coil. For example to view the state of write coil 101, issue a “read coil 101”.

### Replace Tables in the MODBUS Commands Supported Section

In the “MODBUS Commands Supported” section (also shown as the “MODBUS Addresses Supported” section in some manuals) replace the appropriate Tables in your manual with the following Tables and associated text:

## 42i Series

In the following Tables, repeated numbers are used to indicate different functions based on the instrument used.

Read Registers for 42i

| Register Number | Variable | Used Exclusively In                       |
|-----------------|----------|---|
| 0               | INVALID  |   |
| 1&2             | NO       | 42i, 42iHL, 42iLS, 42iTL, 42iJ, 17i, 42iY |
| 3&4             | NO2      | 42i, 42iHL, 42iLS, 42iTL, 42iJ, 17i       |
| 3&4             | DIF      | 42iY                                      |
| 5&6             | Nox      | 42i, 42iHL, 42iLS, 42iTL, 42iJ, 17i, 42iD |
| 5&6             | Noy      | 42iY                                      |
| 7&8             | NH3      | 17i                                       |
| 9&10            | NT       | 17i                                       |
| 11&12           | LOW NO   | 42i, 42iHL, 42iLS, 42iTL, 17i, 42iY       |
| 13&14           | LOW NO2  | 42i, 42iHL, 42iLS, 42iTL, 17i             |
| 13&14           | LOW DIF  | 42iY                                      |
| 15&16           | LOW Nox  | 42i, 42iHL, 42iLS, 42iTL, 17i, 42iD       |
| 15&16           | LOW Noy  | 42iY                                      |
| 17&18           | LOW NH3  | 17i                                       |
| 19&20           | LOW NT   | 17i                                       |
| 21&22           | HIGH NO  | 42i, 42iHL, 42iLS, 42iTL, 42iJ, 17i, 42iY |
| 23&24           | HIGH NO2 | 42i, 42iHL, 42iLS, 42iTL, 17i             |

| <b>Register Number</b> | <b>Variable</b>              | <b>Used Exclusively In</b>   |
|------------------------|------------------------------|--|
| 23&24                  | HIGH DIF                     | 42iY   |
| 25&26                  | HIGH Nox                     | 42i, 42i HL, 42i LS, 42i TL, 17i, 42i D  |
| 25&26                  | HIGH Noy                     | 42iY   |
| 27&28                  | HIGH NH3                     | 17i  |
| 29&30                  | HIGH NT                      | 17i  |
| 31&32                  | RANGE                        |  |
| 33&34                  | RANGE                        |  |
| 35&36                  | INTERNAL TEMPERATURE         |  |
| 37&38                  | CHAMBER TEMPERATURE          |  |
| 39&40                  | COOLER TEMPERATURE           |  |
| 41&42                  | NO2 CONVERTER TEMP           | 42i, 42i HL, 42i LS, 42i TL, 42i J, 17i, 42i D   |
| 43&44                  | EXT CONV TEMP                | 17i, 42i Y   |
| 45&46                  | PERM OVEN GAS TEMPERATURE    | Perm Span Option   |
| 47&48                  | PERM OVEN HEATER TEMPERATURE | Perm Span Option   |
| 49&50                  | CHAMBER PRESSURE             |  |
| 51&52                  | SAMPLE FLOW                  | 42i, 42i HL with Bypass Flow Option, 42i LS, 42i TL, 42i J, 17i, 42i Y, 42i D              |
| 53&54                  | PMT VOLTS                    |  |
| 55&56                  | ANALOG IN 1                  | I/O Expansion Board Option<br>42i TL, 42i J, 17i, 42i Y                                    |
| 55&56                  | ANALOG IN 1                  | I/O Expansion Board Option<br>42i, 42i HL, 42i LS, 42i D, if Output Conc Cal Option is OFF |
| 55&56                  | NO BKG                       | 42i, 42i HL, 42i LS, 42i D, if Output Conc Cal Option is ON                                |
| 57&58                  | ANALOG IN 2                  | I/O Expansion Board Option<br>42i TL, 42i J, 17i, 42i Y                                    |
| 57&58                  | ANALOG IN 2                  | I/O Expansion Board Option<br>42i, 42i HL, 42i LS, 42i D, if Output Conc Cal Option is OFF |
| 57&58                  | Nox BKG                      | 42i, 42i HL, 42i LS, 42i D, if Output Conc Cal Option is ON                                |

| <b>Register Number</b> | <b>Variable</b>           | <b>Used Exclusively In</b>   |
|------------------------|---------------------------|--|
| 59&60                  | ANALOG IN 3               | I/O Expansion Board Option<br>42i TL, 42i J, 17i, 42i Y                                    |
| 59&60                  | ANALOG IN 3               | I/O Expansion Board Option<br>42i, 42i HL, 42i LS, 42i D, if Output Conc Cal Option is OFF |
| 59&60                  | LOW NO COEF               | 42i, 42i HL, 42i LS, 42i D, if Output Conc Cal Option is ON                                |
| 61&62                  | ANALOG IN 4               | I/O Expansion Board Option<br>42i TL, 42i J, 17i, 42i Y                                    |
| 61&62                  | ANALOG IN 4               | I/O Expansion Board Option<br>42i, 42i HL, 42i LS, 42i D, if Output Conc Cal Option is OFF |
| 61&62                  | LOW NO <sub>2</sub> COEF  | 42i, 42i HL, 42i LS, 42i D, if Output Conc Cal Option is ON                                |
| 63&64                  | ANALOG IN 5               | I/O Expansion Board Option<br>42i TL, 42i J, 17i, 42i Y                                    |
| 63&64                  | ANALOG IN 5               | I/O Expansion Board Option<br>42i, 42i HL, 42i LS, 42i D, if Output Conc Cal Option is OFF |
| 63&64                  | LOW NO <sub>x</sub> COEF  | 42i, 42i HL, 42i LS, 42i D, if Output Conc Cal Option is ON                                |
| 65&66                  | ANALOG IN 6               | I/O Expansion Board Option<br>42i TL, 42i J, 17i, 42i Y                                    |
| 65&66                  | ANALOG IN 6               | I/O Expansion Board Option<br>42i, 42i HL, 42i LS, 42i D, if Output Conc Cal Option is OFF |
| 65&66                  | HIGH NO COEF              | 42i, 42i HL, 42i LS, 42i D, if Output Conc Cal Option is ON                                |
| 67&68                  | ANALOG IN 7               | I/O Expansion Board Option<br>42i TL, 42i J, 17i, 42i Y                                    |
| 67&68                  | ANALOG IN 7               | I/O Expansion Board Option<br>42i, 42i HL, 42i LS, 42i D, if Output Conc Cal Option is OFF |
| 67&68                  | HIGH NO <sub>2</sub> COEF | 42i, 42i HL, 42i LS, 42i D, if Output Conc Cal Option is ON                                |
| 69&70                  | ANALOG IN 8               | I/O Expansion Board Option<br>42i TL, 42i J, 17i, 42i Y                                    |
| 69&70                  | ANALOG IN 8               | I/O Expansion Board Option<br>42i, 42i HL, 42i LS, 42i D, if Output Conc Cal Option is OFF |

| <b>Register Number</b> | <b>Variable</b>                     | <b>Used Exclusively In</b>                                  |
|------------------------|-------------------------------------|---|
| 69&70                  | HIGH Nox COEF                       | 42i, 42i HL, 42i LS, 42i D, if Output Conc Cal Option is ON |
| 71&72                  | OZONATOR FLOW                       |   |
| 73&74                  | PREREACTION                         | 42i TL, 42i Y   |
| 75&76                  | LOW PREREACTION                     | 42i TL, 42i Y   |
| 77&78                  | HIGH PREREACTION                    | 42i TL, 42i Y   |
| 79&80                  | NO CORRECTED CONC                   | O <sub>2</sub> Sensor Option                                |
| 81&82                  | NO <sub>2</sub> CORRECTED CONC      | O <sub>2</sub> Sensor Option                                |
| 83&84                  | Nox CORRECTED CONC                  | O <sub>2</sub> Sensor Option                                |
| 85&86                  | NH <sub>3</sub> CORRECTED CONC      | O <sub>2</sub> Sensor Option                                |
| 87&88                  | NT CORRECTED CONC                   | O <sub>2</sub> Sensor Option                                |
| 89&90                  | LOW NO CORRECTED CONC               | O <sub>2</sub> Sensor Option                                |
| 91&92                  | LOW NO <sub>2</sub> CORRECTED CONC  | O <sub>2</sub> Sensor Option                                |
| 93&94                  | LOW Nox CORRECTED CONC              | O <sub>2</sub> Sensor Option                                |
| 95&96                  | LOW NH <sub>3</sub> CORRECTED CONC  | O <sub>2</sub> Sensor Option                                |
| 97&98                  | LOW NT CORRECTED CONC               | O <sub>2</sub> Sensor Option                                |
| 99&100                 | HIGH NO CORRECTED CONC              | O <sub>2</sub> Sensor Option                                |
| 101&102                | HIGH NO <sub>2</sub> CORRECTED CONC | O <sub>2</sub> Sensor Option                                |
| 103&104                | HIGH Nox CORRECTED CONC             | O <sub>2</sub> Sensor Option                                |
| 105&106                | HIGH NH <sub>3</sub> CORRECTED CONC | O <sub>2</sub> Sensor Option                                |
| 107&108                | HIGH NT CORRECTED CONC              | O <sub>2</sub> Sensor Option                                |
| 109&110                | CAPILLARY TEMP                      | 17i   |
| 111&112                | O <sub>2</sub> %                    | Internal O <sub>2</sub> Sensor Option                       |
| 113&114                | O <sub>2</sub> SENS TEMP            | Internal O <sub>2</sub> Sensor Option                       |

| Register Number | Variable            | Used Exclusively In            |
|-----------------|---------------------|--------------------------------|
| 115&116         | NO HOURLY           | 42i J                          |
| 117&118         | NO2 HOURLY          | 42i J                          |
| 119&120         | Nox HOURLY          | 42i J                          |
| 121&122         | EXT ALARMS          |                                |
| 123&124         | AMBIENT PRESSURE    | Ambient Pressure Sensor Option |
| 125&126         | NO BACKGROUND       |                                |
| 127&128         | NOX BACKGROUND      |                                |
| 129&130         | LOW NO COEF         |                                |
| 131&132         | LOW NO2 COEF        |                                |
| 133&134         | LOW Nox COEF        |                                |
| 135&136         | HIGH NO COEF        |                                |
| 137&138         | HIGH NO2 COEF       |                                |
| 139&140         | HIGH Nox COEF       |                                |
| 141&142         | NO ZERO TIME        | China DAS Option               |
| 143&144         | Nox ZERO TIME       | China DAS Option               |
| 145&146         | LOW NO SPAN TIME    | China DAS Option               |
| 147&148         | LOW NO2 SPAN TIME   | China DAS Option               |
| 149&150         | LOW Nox SPAN TIME   | China DAS Option               |
| 151&152         | HIGH NO SPAN TIME   | China DAS Option               |
| 153&154         | HIGH NO2 SPAN TIME  | China DAS Option               |
| 155&156         | HIGH Nox SPAN TIME  | China DAS Option               |
| 157&158         | NO ZERO DRIFT       | China DAS Option               |
| 159&160         | Nox ZERO DRIFT      | China DAS Option               |
| 161&162         | LOW NO SPAN DRIFT   | China DAS Option               |
| 163&164         | LOW NO2 SPAN DRIFT  | China DAS Option               |
| 165&166         | LOW Nox SPAN DRIFT  | China DAS Option               |
| 167&168         | HIGH NO SPAN DRIFT  | China DAS Option               |
| 169&170         | HIGH NO2 SPAN DRIFT | China DAS Option               |
| 171&172         | HIGH Nox SPAN DRIFT | China DAS Option               |
| 173&174         | LOW NO SPAN CONC    | China DAS Option               |

| Register Number | Variable            | Used Exclusively In |
|-----------------|---------------------|---------------------|
| 175&176         | LOW NO2 SPAN CONC   | China DAS Option    |
| 177&178         | LOW Nox SPAN CONC   | China DAS Option    |
| 179&180         | HIGH NO SPAN CONC   | China DAS Option    |
| 181&182         | HIGH NO2 SPAN CONC  | China DAS Option    |
| 183&184         | HIGH Nox SPAN CONC  | China DAS Option    |
| 185&186         | LOW NO RANGE CONC   | China DAS Option    |
| 187&188         | HIGH NO RANGE CONC  | China DAS Option    |
| 189&190         | LOW NO2 RANGE CONC  | China DAS Option    |
| 191&192         | HIGH NO2 RANGE CONC | China DAS Option    |
| 193&194         | LOW Nox RANGE CONC  | China DAS Option    |
| 195&196         | HIGH Nox RANGE CONC | China DAS Option    |
| 197&198         | DILUTION RATIO      |                     |

#### Read Coils for 42i

| Coil Number | Status       | Used Exclusively In                       |
|-------------|--------------|---|
| 0           | INVALID      |   |
| 1           | AUTORANGE    |   |
| 2           | LOCAL/REMOTE |   |
| 3           | SERVICE      |   |
| 4           | UNITS        |   |
| 5           | ZERO MODE    | Zero/Span Option                          |
| 6           | SPAN MODE    | Zero/Span Option                          |
| 7           | NO MODE      | 42i, 42iHL, 42iLS, 42iTL, 42iJ, 17i, 42iY |
| 8           | Nox MODE     | 42i, 42iHL, 42iLS, 42iTL, 42iJ, 17i, 42iD |
| 8           | Noy MODE     | 42iY                                      |
| 9           | Nt MODE      | 17i                                       |



| <b>Coil Number</b> | <b>Status</b>            | <b>Used Exclusively In</b>  |
|--------------------|--------------------------|---|
| 10                 | PRE MODE                 | 42iTL, 42iY   |
| 11                 | GEN ALARM                |   |
| 12                 | NO CONC MAX ALARM        | 42i, 42iHL, 42iLS, 42iTL, 42iJ, 17i, 42iY                               |
| 13                 | NO CONC MIN ALARM        | 42i, 42iHL, 42iLS, 42iTL, 42iJ, 17i, 42iY                               |
| 14                 | NO2 CONC MAX ALARM       | 42i, 42iHL, 42iLS, 42iTL, 42iJ, 17i                                     |
| 14                 | DIF CONC MAX ALARM       | 42iY  |
| 15                 | NO2 CONC MIN ALARM       | 42i, 42iHL, 42iLS, 42iTL, 42iJ, 17i                                     |
| 15                 | DIF CONC MIN ALARM       | 42iY  |
| 16                 | Nox CONC MAX ALARM       | 42i, 42iHL, 42iLS, 42iTL, 42iJ, 17i, 42iD                               |
| 16                 | Noy CONC MAX ALARM       | 42iY  |
| 17                 | Nox CONC MIN ALARM       | 42i, 42iHL, 42iLS, 42iTL, 42iJ, 17i, 42iD                               |
| 17                 | Noy CONC MIN ALARM       | 42iY  |
| 18                 | NH3 CONC MAX             | 17i   |
| 19                 | NH3 CONC MIN             | 17i   |
| 20                 | Nt CONC MAX              | 17i   |
| 21                 | Nt CONC MIN              | 17i   |
| 22                 | INT TEMP ALARM           |   |
| 23                 | CHAMB TEMP ALARM         |   |
| 24                 | COOLER TEMP ALARM        |   |
| 25                 | NO2 CONVERTER TEMP ALARM | 42i, 42iHL, 42iLS, 42iTL, 42iJ, 17i, 42iD                               |
| 26                 | EXT CNV TEMP             | 17i, 42iY   |
| 27                 | PERM OVEN GAS TEMP ALARM | Perm Span Option  |
| 28                 | PRESSURE ALARM           |   |
| 29                 | FLOW ALARM               | 42i, 42iHL with Bypass Flow Option, 42iLS, 42iTL, 42iJ, 17i, 42iY, 42iD |

| <b>Coil Number</b> | <b>Status</b>                | <b>Used Exclusively In</b>            |
|--------------------|------------------------------|---------------------------------------|
| 30                 | OZONE FLOW<br>ALARM          |                                       |
| 31                 | MOTHERBOARD<br>STATUS ALARM  |                                       |
| 32                 | INTERFACE BD<br>STATUS ALARM |                                       |
| 33                 | I/O EXP BD STATUS<br>ALARM   | I/O Expansion Board Option            |
| 34                 | AUTORANGE                    |                                       |
| 35                 | CONC ALARM                   |                                       |
| 36                 | SAMPLE MODE                  |                                       |
| 37                 | PURGE MODE                   | Zero/Span Option                      |
| 38                 | EXT CONV STAT                | 17i, 42iY                             |
| 39                 | ZERO CHECK/CAL<br>ALARM      | Zero/Span Option                      |
| 40                 | SPAN CHECK/CAL<br>ALARM      | Zero/Span Option                      |
| 41                 | O2 SENSOR<br>ALARM           | Internal O <sub>2</sub> Sensor Option |
| 42                 | CONC ERROR                   | 42iJ                                  |
| 43                 | NO RANGE 1                   | 42iJ                                  |
| 44                 | NO RANGE 2                   | 42iJ                                  |
| 45                 | NO RANGE 3                   | 42iJ                                  |
| 46                 | NO RANGE 4                   | 42iJ                                  |
| 47                 | NO RANGE 5                   | 42iJ                                  |
| 48                 | NO2 RANGE 1                  | 42iJ                                  |
| 49                 | NO2 RANGE 2                  | 42iJ                                  |
| 50                 | NO2 RANGE 3                  | 42iJ                                  |
| 51                 | NO2 RANGE 4                  | 42iJ                                  |
| 52                 | NO2 RANGE 5                  | 42iJ                                  |
| 53                 | Nox RANGE 1                  | 42iJ                                  |
| 54                 | Nox RANGE 2                  | 42iJ                                  |
| 55                 | Nox RANGE 3                  | 42iJ                                  |
| 56                 | Nox RANGE 4                  | 42iJ                                  |
| 57                 | Nox RANGE 5                  | 42iJ                                  |
| 58                 | CALIBRATION                  | 42iJ                                  |

| Coil Number | Status                    | Used Exclusively In                 |
|-------------|---------------------------|-------------------------------------|
| 59          | CAL FAIL ALARM            | 42i J                               |
| 60          | EXT ALARM 1               |                                     |
| 61          | EXT ALARM 2               |                                     |
| 62          | EXT ALARM 3               |                                     |
| 63          | AMBIENT PRESSURE ALARM    | Ambient Pressure Sensor Option      |
| 64          | SYSTEM CAL MODE EXT ALARM | China DAS Option                    |
| 65          | BLOWBACK MODE EXT ALARM   | China DAS Option                    |
| 66          | NORMAL MODE               | China DAS Option                    |
| 67          | GENERAL TEMP ALARM        | China DAS Option                    |
| 68          | PNEUMATICS PLUG EXT ALARM | China DAS Option                    |
| 69          | AIR LOW EXT ALARM         | China DAS Option                    |
| 70          | INTENSITY EXT ALARM       | China DAS Option                    |
| 71          | DETECTOR SIGNAL EXT ALARM | China DAS Option                    |
| 72          | EXTERNAL SPAN MODE        | Perm Span Option with External Span |

**Table** Write Coils for 42i

| Coil Number | Action Triggered | Coil Group     | Used Exclusively In                            |
|-------------|------------------|----------------|--|
| 100         | INVALID          |                |  |
| 101         | ZERO MODE        | Zero/Span Mode | Zero/Span Option                               |
| 102         | SPAN MODE        | Zero/Span Mode | Zero/Span Option                               |
| 103         | NO MODE          | Measure Mode   | 42i, 42i HL, 42i LS, 42i TL, 42i J, 17i, 42i Y |
| 104         | NOX MODE         | Measure Mode   | 42i, 42i HL, 42i LS, 42i TL, 42i J, 17i, 42i D |
| 104         | Noy MODE         | Measure Mode   | 42i Y  |
| 105         | Nt MODE          | Measure Mode   | 17i  |

| <b>Coil Number</b> | <b>Action Triggered</b>      | <b>Coil Group</b> | <b>Used Exclusively In</b>            |
|--------------------|------------------------------|-------------------|---------------------------------------|
| 106                | PRE MODE                     | Measure Mode      | 42iTL, 42iY                           |
| 107                | SET BACKGROUND               |                   |                                       |
| 108                | CAL TO LO SPAN               |                   |                                       |
| 109                | AOUTS TO ZERO                | Analog Out Test   | I/O Expansion Board Option            |
| 110                | AOUTS TO FS                  | Analog Out Test   | I/O Expansion Board Option            |
| 111                | CAL TO HI SPAN               |                   |                                       |
| 112                | TELEM TROUBLE                |                   | 42iJ                                  |
| 113                | HOURLY AVG RST               |                   | 42iJ                                  |
| 114                | ZERO/PURGE CAL               |                   | 42iJ                                  |
| 115                | SPAN/PURGE CAL               |                   | 42iJ                                  |
| 116                | ZERO/SPAN/PURGE              |                   | 42iJ                                  |
| 117                | EXT ALARM 1                  |                   |                                       |
| 118                | EXT ALARM 2                  |                   |                                       |
| 119                | EXT ALARM 3                  |                   |                                       |
| 120                | PURGE MODE                   |                   | 42iJ                                  |
| 121                | BLOWBACK MODE<br>EXT ALARM   |                   | China DAS Option                      |
| 122                | PNEUMATICS PLUG<br>EXT ALARM |                   | China DAS Option                      |
| 123                | AIR LOW EXT ALARM            |                   | China DAS Option                      |
| 124                | INTENSITY EXT<br>ALARM       |                   | China DAS Option                      |
| 125                | DETECTOR SIGNAL<br>EXT ALARM |                   | China DAS Option                      |
| 126                | SYSTEM CAL MODE              |                   | China DAS Option                      |
| 127                | EXTERNAL SPAN<br>MODE        |                   | Perm Span Option with External Span   |
| 128                | O2 BACKGROUND                |                   | Internal O <sub>2</sub> Sensor Option |
| 129                | O2 SPAN                      |                   | Internal O <sub>2</sub> Sensor Option |

## 43i Series

In the following Table, repeated numbers are used to indicate different functions based on the instrument used.

Read Registers for 43*i*

| Register Number | Variable                             | Used Exclusively In  |
|-----------------|--------------------------------------|--|
| 0               | INVALID                              |  |
| 1&2             | SO2 CONC                             | 43 <i>i</i> , 43 <i>i</i> J, 43 <i>i</i> HL, 43 <i>i</i> TLE, 450 <i>i</i> without SO <sub>2</sub> Scrubber Option |
| 3&4             | H2S                                  | 450 <i>i</i> without SO <sub>2</sub> Scrubber Option   |
| 5&6             | CS                                   | 450 <i>i</i> without SO <sub>2</sub> Scrubber Option   |
| 7&8             | LOW SO2 CONC (Dual/Auto Range mode)  | 43 <i>i</i> , 43 <i>i</i> J, 43 <i>i</i> HL, 43 <i>i</i> TLE, 450 <i>i</i> without SO <sub>2</sub> Scrubber Option |
| 9&10            | LOW H2S                              | 450 <i>i</i> without SO <sub>2</sub> Scrubber Option   |
| 11&12           | LOW CS                               | 450 <i>i</i> without SO <sub>2</sub> Scrubber Option   |
| 13&14           | HIGH SO2 CONC (Dual/Auto Range mode) | 43 <i>i</i> , 43 <i>i</i> J, 43 <i>i</i> HL, 43 <i>i</i> TLE, 450 <i>i</i> without SO <sub>2</sub> Scrubber Option |
| 15&16           | HIGH H2S                             | 450 <i>i</i> without SO <sub>2</sub> Scrubber Option   |
| 17&18           | HIGH CS                              | 450 <i>i</i> without SO <sub>2</sub> Scrubber Option   |
| 19&20           | RANGE (SO2) (Dual/Auto Range mode)   |  |
| 21&22           | INTERNAL TEMP                        |  |
| 23&24           | CHAMBER TEMP                         |  |
| 25&26           | H2S CNV TEMP                         | 450 <i>i</i> with Internal Converter   |
| 27&28           | PERM OVEN GAS TEMPERATURE            | Perm Span Option   |
| 29&30           | PERM OVEN HEATER TEMPERATURE         | Perm Span Option   |
| 31&32           | CHAMBER PRESSURE                     |  |
| 33&34           | SAMPLE FLOW                          |  |
| 35&36           | PMT VOLTS                            |  |
| 37&38           | FLASH VOLTS                          |  |
| 39&40           | FLASH REF                            |  |
| 41&42           | ANALOG IN 1                          | I/O Expansion Board Option   |
| 43&44           | ANALOG IN 2                          | I/O Expansion Board Option   |

| Register Number | Variable            | Used Exclusively In                               |
|-----------------|---------------------|---|
| 45&46           | ANALOG IN 3         | I/O Expansion Board Option                        |
| 47&48           | ANALOG IN 4         | I/O Expansion Board Option                        |
| 49&50           | ANALOG IN 5         | I/O Expansion Board Option                        |
| 51&52           | ANALOG IN 6         | I/O Expansion Board Option                        |
| 53&54           | ANALOG IN 7         | I/O Expansion Board Option                        |
| 55&56           | ANALOG IN 8         | I/O Expansion Board Option                        |
| 57&58           | SO2 HOURLY          | 43 <i>i</i> J                                     |
| 59&60           | H2S HOURLY          | 43 <i>i</i> J                                     |
| 61&62           | CS HOURLY           | 43 <i>i</i> J                                     |
| 63&64           | EXT ALARMS          |   |
| 65&66           | O2 %                | Internal O <sub>2</sub> Sensor Option             |
| 67&68           | O2 SENS TEMP        | Internal O <sub>2</sub> Sensor Option             |
| 69&70           | H2S SCRUB           | 450 <i>i</i> with SO <sub>2</sub> Scrubber Option |
| 71&72           | LOW H2S SCRUB       | 450 <i>i</i> with SO <sub>2</sub> Scrubber Option |
| 73&74           | HIGH H2S SCRUB      | 450 <i>i</i> with SO <sub>2</sub> Scrubber Option |
| 75&76           | SO2 COR             | Internal O <sub>2</sub> Sensor Option             |
| 77&78           | LOW SO2 COR         | Internal O <sub>2</sub> Sensor Option             |
| 79&80           | HIGH SO2 COR        | Internal O <sub>2</sub> Sensor Option             |
| 81&82           | SO2 BKG             |   |
| 83&84           | LOW SO2 COEF        |   |
| 85&86           | HIGH SO2 COEF       |   |
| 87&88           | SO2 ZERO TIME       | China DAS Option                                  |
| 89&90           | LOW SO2 SPAN TIME   | China DAS Option                                  |
| 91&92           | HIGH SO2 SPAN TIME  | China DAS Option                                  |
| 93&94           | SO2 ZERO DRIFT      | China DAS Option                                  |
| 95&96           | LOW SO2 DRIFT       | China DAS Option                                  |
| 97&98           | HIGH SO2 DRIFT      | China DAS Option                                  |
| 99&100          | LOW SO2 SPAN CONC   | China DAS Option                                  |
| 101&102         | HIGH SO2 SPAN CONC  | China DAS Option                                  |
| 103&104         | LOW SO2 RANGE CONC  | China DAS Option                                  |
| 105&106         | HIGH SO2 RANGE CONC | China DAS Option                                  |
| 107&108         | DILUTION RATIO      |   |

## Read Coils for 43*i*

| <b>Coil Number</b> | <b>Status</b>   | <b>Used Exclusively In</b>   |
|--------------------|---|--|
| 0                  | INVALID   |  |
| 1                  | AUTORANGE   |  |
| 2                  | LOCAL/REMOTE  |  |
| 3                  | SERVICE   |  |
| 4                  | UNITS (0 = ppm or ppb; 1 = mg/m <sup>3</sup> or µg/m <sup>3</sup> ) |  |
| 5                  | ZERO MODE   | Zero/Span Option   |
| 6                  | SPAN MODE   | Zero/Span Option   |
| 7                  | SAMPLE MODE   |  |
| 8                  | SO <sub>2</sub> MODE  | 43 <i>i</i> , 43 <i>i</i> J, 43 <i>i</i> HL, 43 <i>i</i> TLE, 450 <i>i</i> without SO <sub>2</sub> Scrubber Option |
| 9                  | CS MODE   | 450 <i>i</i> without SO <sub>2</sub> Scrubber Option   |
| 10                 | GEN ALARM   |  |
| 11                 | SO <sub>2</sub> CONC MAX ALARM                                      | 43 <i>i</i> , 43 <i>i</i> J, 43 <i>i</i> HL, 43 <i>i</i> TLE, 450 <i>i</i> without SO <sub>2</sub> Scrubber Option |
| 12                 | SO <sub>2</sub> CONC MIN ALARM                                      | 43 <i>i</i> , 43 <i>i</i> J, 43 <i>i</i> HL, 43 <i>i</i> TLE, 450 <i>i</i> without SO <sub>2</sub> Scrubber Option |
| 13                 | H <sub>2</sub> S CONC MAX   | 450 <i>i</i> without SO <sub>2</sub> Scrubber Option   |
| 14                 | H <sub>2</sub> S CONC MIN   | 450 <i>i</i> without SO <sub>2</sub> Scrubber Option   |
| 15                 | CS CONC MAX   | 450 <i>i</i> without SO <sub>2</sub> Scrubber Option   |
| 16                 | CS CONC MIN   | 450 <i>i</i> without SO <sub>2</sub> Scrubber Option   |
| 17                 | INTERNAL TEMP ALARM   |  |
| 18                 | CHAMB TEMP ALARM  |  |
| 19                 | CONVERTER TEMP  | 450 <i>i</i> with Internal Converter   |
| 20                 | PERM GAS TEMP   | Perm Span Option   |
| 21                 | PRESSURE ALARM  |  |
| 22                 | SAMPLE FLOW ALARM   |  |
| 23                 | FLASH REF ALARM   |  |
| 24                 | FLASH VOLTAGE ALARM   |  |
| 25                 | MOTHERBOARD STATUS ALARM  |  |
| 26                 | MEASUREMENT INTERFACE BOARD STATUS ALARM                            |  |

| Coil Number | Status                                   | Used Exclusively In                 |
|-------------|--|-------------------------------------|
| 27          | I/O EXP BD STATUS ALARM                  | I/O Expansion Board Option          |
| 28          | CONC ALARM                               |                                     |
| 29          | PURGE MODE                               | Zero/Span Option                    |
| 30          | ZERO CHK/CAL ALARM<br>(Zero/Span Option) | Zero/Span Option                    |
| 31          | SPAN CHK/CAL ALARM<br>(Zero/Span Option) | Zero/Span Option                    |
| 32          | SPAN 1 MODE                              | Dual Span Option                    |
| 33          | SPAN 2 MODE                              | Dual Span Option                    |
| 34          | CONC ERROR                               | 43iJ                                |
| 35          | SO2 RANGE 1                              | 43iJ                                |
| 36          | SO2 RANGE 2                              | 43iJ                                |
| 37          | SO2 RANGE 3                              | 43iJ                                |
| 38          | SO2 RANGE 4                              | 43iJ                                |
| 39          | SO2 RANGE 5                              | 43iJ                                |
| 40          | CALIBRATION                              | 43iJ                                |
| 41          | CAL FAIL ALARM                           | 43iJ                                |
| 42          | EXT ALARM 1                              |                                     |
| 43          | EXT ALARM 2                              |                                     |
| 44          | EXT ALARM 3                              |                                     |
| 45          | O2 CONC MAX ALARM                        | O2 Sensor Option                    |
| 46          | O2 CONC MIN ALARM                        | O2 Sensor Option                    |
| 47          | SYSTEM CAL MODE EXT<br>ALARM             | China DAS Option                    |
| 48          | BLOWBACK MODE EXT<br>ALARM               | China DAS Option                    |
| 49          | NORMAL MODE                              | China DAS Option                    |
| 50          | GENERAL TEMP ALARM                       | China DAS Option                    |
| 51          | PNEUMATICS PLUG EXT<br>ALARM             | China DAS Option                    |
| 52          | AIR LOW EXT ALARM                        | China DAS Option                    |
| 53          | INTENSITY EXT ALARM                      | China DAS Option                    |
| 54          | DETECTOR SIGNAL EXT<br>ALARM             | China DAS Option                    |
| 55          | EXTERNAL SPAN MODE                       | Perm Span Option with External Span |



## Write Coils for 43*i*

| <b>Coil Number</b> | <b>Action Triggered</b>      | <b>Coil Group</b> | <b>Used Exclusively In</b>   |
|--------------------|------------------------------|-------------------|--|
| 100                | INVALID                      |                   |  |
| 101                | ZERO MODE                    | Zero/Span Mode    | Zero/Span Option   |
| 102                | SPAN MODE                    | Zero/Span Mode    | Zero/Span Option   |
| 103                | SO2 MODE                     | Measure Mode      | 43 <i>i</i> , 43 <i>i</i> J, 43 <i>i</i> HL, 43 <i>i</i> TLE, 450 <i>i</i> without SO <sub>2</sub> Scrubber Option |
| 104                | CS MODE                      | Measure Mode      | 450 <i>i</i> without SO <sub>2</sub> Scrubber Option   |
| 105                | SET BACKGROUND               |                   |  |
| 106                | CAL TO LOW SPAN              |                   |  |
| 107                | AOUTS TO ZERO                | Analog Out Test   | I/O Expansion Board Option   |
| 108                | AOUTS TO FS                  | Analog Out Test   | I/O Expansion Board Option   |
| 109                | CAL TO HIGH SPAN             |                   |  |
| 110                | SPAN 1 MODE                  | Zero/Span Mode    | Dual Span Option   |
| 111                | SPAN 2 MODE                  | Zero/Span Mode    | Dual Span Option   |
| 112                | TELEM TROUBLE                |                   | 43 <i>i</i> J  |
| 113                | HOURLY AVG RST               |                   | 43 <i>i</i> J  |
| 114                | ZERO/PURGE CAL               |                   | 43 <i>i</i> J  |
| 115                | SPAN/PURGE CAL               |                   | 43 <i>i</i> J  |
| 116                | ZERO/SPAN/PURGE              |                   | 43 <i>i</i> J  |
| 117                | EXT ALARM 1                  |                   |  |
| 118                | EXT ALARM 2                  |                   |  |
| 119                | EXT ALARM 3                  |                   |  |
| 120                | PURGE MODE                   | Zero/Span Mode    | 43 <i>i</i> J  |
| 121                | BLOWBACK MODE<br>EXT ALARM   |                   | China DAS Option   |
| 122                | PNEUMATICS PLUG<br>EXT ALARM |                   | China DAS Option   |
| 123                | AIR LOW EXT<br>ALARM         |                   | China DAS Option   |
| 124                | INTENSITY EXT<br>ALARM       |                   | China DAS Option   |
| 125                | DETECTOR SIGNAL<br>EXT ALARM |                   | China DAS Option   |
| 126                | SYSTEM CAL MODE              |                   | China DAS Option   |

| Coil Number | Action Triggered   | Coil Group | Used Exclusively In                 |
|-------------|--------------------|------------|-------------------------------------|
| 127         | EXTERNAL SPAN MODE |            | Perm Span Option with External Span |

## 48i Series

Read Registers for 48i

| Register Number | Variable     | Used Exclusively In           |
|-----------------|--------------|-------------------------------|
| 0               | INVALID      |                               |
| 1&2             | CO           | 48i, 48i TLE, 48i HL          |
| 3&4             | LO CO        | 48i, 48i TLE, 48i HL          |
| 5&6             | HI CO        | 48i, 48i TLE, 48i HL          |
| 7&8             | RANGE STATUS |                               |
| 9&10            | S/R          |                               |
| 11&12           | LO S/R       |                               |
| 13&14           | HI S/R       |                               |
| 15&16           | INT TEMP     |                               |
| 17&18           | BENCH TEMP   |                               |
| 19&20           | NONE         |                               |
| 21&22           | PERM OVN GAS | Permeation Span Source Option |
| 23&24           | PERM OVN HTR | Permeation Span Source Option |
| 25&26           | BENCH PRES   |                               |
| 27&28           | SAMPLE FLOW  |                               |
| 29&30           | INTENSITY    |                               |
| 31&32           | MOTOR SPEED  |                               |
| 33&34           | ANALOG IN 1  | I/O Expansion Board Option    |
| 35&36           | ANALOG IN 2  | I/O Expansion Board Option    |
| 37&38           | ANALOG IN 3  | I/O Expansion Board Option    |
| 39&40           | ANALOG IN 4  | I/O Expansion Board Option    |
| 41&42           | ANALOG IN 5  | I/O Expansion Board Option    |
| 43&44           | ANALOG IN 6  | I/O Expansion Board Option    |
| 45&46           | ANALOG IN 7  | I/O Expansion Board Option    |
| 47&48           | ANALOG IN 8  | I/O Expansion Board Option    |
| 49&50           | CO2          | 410i                          |

| Register Number | Variable       | Used Exclusively In   |
|-----------------|----------------|---|
| 51&52           | LO CO2         | 410 <i>i</i>  |
| 53&54           | HI CO2         | 410 <i>i</i>  |
| 55&56           | BIAS SUPPLY    |   |
| 57&58           | HCI            | 15 <i>i</i>   |
| 59&60           | LO HCI         | 15 <i>i</i>   |
| 61&62           | HI HCI         | 15 <i>i</i>   |
| 63&64           | SCRUBBER EFF   | Zero Air Scrubber Option  |
| 65&66           | LO CO HOURLY   | 48 <i>i</i> J   |
| 67&68           | EXT ALARMS     |   |
| 69&70           | O2 %           | Internal O <sub>2</sub> Sensor Option                                   |
| 71&72           | O2 SENS TEMP   | Internal O <sub>2</sub> Sensor Option                                   |
| 73&74           | N2O            | 46 <i>i</i>   |
| 75&76           | LO N2O         | 46 <i>i</i>   |
| 77&78           | HI N2O         | 46 <i>i</i>   |
| 79&80           | CO COR         | 48 <i>i</i> , 48 <i>i</i> HL with Internal O <sub>2</sub> Sensor Option |
| 81&82           | LO CO COR      | 48 <i>i</i> , 48 <i>i</i> HL with Internal O <sub>2</sub> Sensor Option |
| 83&84           | HI CO COR      | 48 <i>i</i> , 48 <i>i</i> HL with Internal O <sub>2</sub> Sensor Option |
| 85&86           | CO2 COR        | 410 <i>i</i> with Internal O <sub>2</sub> Sensor Option                 |
| 87&88           | LO CO2 COR     | 410 <i>i</i> Internal O <sub>2</sub> Sensor Option                      |
| 89&90           | HI CO2 COR     | 410 <i>i</i> Internal O <sub>2</sub> Sensor Option                      |
| 91&92           | BACKGROUND     |   |
| 93&94           | LO COEFF       |   |
| 95&96           | HIGH COEFF     |   |
| 97&98           | DILUTION RATIO |   |

#### Read Coils for 48*i*

| Coil Number | Status       | Used Exclusively In |
|-------------|--------------|---------------------|
| 0           | INVALID      |                     |
| 1           | AUTORANGE    |                     |
| 2           | LOCAL/REMOTE |                     |
| 3           | SERVICE      |                     |
| 4           | UNITS        |                     |

| <b>Coil Number</b> | <b>Status</b>         | <b>Used Exclusively In</b> |
|--------------------|-----------------------|----------------------------|
| 5                  | ZERO MODE             | Zero/Span Option           |
| 6                  | SPAN MODE             | Zero/Span Option           |
| 7                  | SAMPLE MODE           |                            |
| 8                  | GEN ALARM             |                            |
| 9                  | CONC MAX              |                            |
| 10                 | CONC MIN              |                            |
| 11                 | INT TEMP              |                            |
| 12                 | BENCH TEMP            |                            |
| 13                 | PRESSURE              |                            |
| 14                 | SAMPLE FLOW           |                            |
| 15                 | INTENSITY             |                            |
| 16                 | MOTOR SPEED           |                            |
| 17                 | BIAS VOLTAGE          |                            |
| 18                 | MB STATUS             |                            |
| 19                 | MIB STATUS            |                            |
| 20                 | I/O BD STATUS         | I/O Expansion Board Option |
| 21                 | CONC ALARM            |                            |
| 22                 | PURGE MODE            | Zero/Span Option           |
| 23                 | SCRUB TST<br>MODE     | Zero Air Scrubber Option   |
| 24                 | ZERO CHK/CAL<br>ALARM | Zero/Span Option           |
| 25                 | SPAN CHK/CAL<br>ALARM | Zero/Span Option           |
| 26                 | CONC ERROR            | 48iJ                       |
| 27                 | CO RANGE 1            | 48iJ                       |
| 28                 | CO RANGE 2            | 48iJ                       |
| 29                 | CO RANGE 3            | 48iJ                       |
| 30                 | CO RANGE 4            | 48iJ                       |
| 31                 | CO RANGE 5            | 48iJ                       |
| 32                 | CALIBRATION           | 48iJ                       |
| 33                 | CAL FAIL ALARM        | 48iJ                       |
| 34                 | EXT ALARM 1           |                            |
| 35                 | EXT ALARM 2           |                            |

| Coil Number | Status       | Used Exclusively In                   |
|-------------|--------------|---------------------------------------|
| 36          | EXT ALARM 3  |                                       |
| 37          | O2 MAX ALARM | Internal O <sub>2</sub> Sensor Option |
| 38          | O2 MIN ALARM | Internal O <sub>2</sub> Sensor Option |

Write Coils for 48*i*

| Coil Number | Action Triggered | Coil Group      | Used Exclusively In        |
|-------------|------------------|-----------------|----------------------------|
| 100         | INVALID          |                 |                            |
| 101         | ZERO MODE        | Zero/Span Mode  | Zero/Span Option           |
| 102         | SPAN MODE        | Zero/Span Mode  | Zero/Span Option           |
| 103         | SET BACKGROUND   |                 |                            |
| 104         | CAL TO LO SPAN   |                 |                            |
| 105         | AOUTS TO ZERO    | Analog Out Test | I/O Expansion Board Option |
| 106         | AOUTS TO FS      | Analog Out Test | I/O Expansion Board Option |
| 107         | CAL TO HI SPAN   |                 |                            |
| 108         | SCRUBBER TEST    |                 | Zero Air Scrubber Option   |
| 109         | TELEM TROUBLE    |                 | 48 <i>i</i> J              |
| 110         | HOURLY AVG RST   |                 | 48 <i>i</i> J              |
| 111         | ZERO/PURGE CAL   |                 | 48 <i>i</i> J              |
| 112         | SPAN/PURGE CAL   |                 | 48 <i>i</i> J              |
| 113         | ZERO/SPAN/PURGE  |                 | 48 <i>i</i> J              |
| 114         | EXT ALARM 1      |                 |                            |
| 115         | EXT ALARM 2      |                 |                            |
| 116         | EXT ALARM 3      |                 |                            |
| 117         | PURGE MODE       |                 | 48 <i>i</i> J              |

## **49i and 49i PS**

Read Registers for 49i

| <b>Register Number</b> | <b>Variable</b> | <b>Used Exclusively In</b>       |
|------------------------|-----------------|----------------------------------|
| 0                      | INVALID         |                                  |
| 1&2                    | O3              | 49i                              |
| 3&4                    | LO O3           | 49i                              |
| 5&6                    | HI O3           | 49i                              |
| 7&8                    | RANGE STATUS    |                                  |
| 9&10                   | INTENSITY A     |                                  |
| 11&12                  | INTENSITY B     |                                  |
| 13&14                  | NOISE A         |                                  |
| 15&16                  | NOISE B         |                                  |
| 17&18                  | FLOW A          |                                  |
| 19&20                  | FLOW B          |                                  |
| 21&22                  | PRESSURE        |                                  |
| 23&24                  | BENCH TEMP      |                                  |
| 25&26                  | LAMP TEMP       |                                  |
| 27&28                  | O3 LAMP TEMP    | 49i/PS, Internal Ozonator Option |
| 29&30                  | ANALOG IN 1     | I/O Expansion Board Option       |
| 31&32                  | ANALOG IN 2     | I/O Expansion Board Option       |
| 33&34                  | ANALOG IN 3     | I/O Expansion Board Option       |
| 35&36                  | ANALOG IN 4     | I/O Expansion Board Option       |
| 37&38                  | ANALOG IN 5     | I/O Expansion Board Option       |
| 39&40                  | ANALOG IN 6     | I/O Expansion Board Option       |
| 41&42                  | ANALOG IN 7     | I/O Expansion Board Option       |
| 43&44                  | ANALOG IN 8     | I/O Expansion Board Option       |
| 45&46                  | O3 OUT CONC     | 49i/PS                           |
| 47&48                  | O3 HOURLY       | 49i/J                            |
| 49&50                  | EXT ALARMS      |                                  |
| 53&54                  | O3 BACKGROUND   |                                  |
| 55&56                  | O3 LO COEF      |                                  |
| 57&58                  | O3 HI COEF      |                                  |

## Read Coils for 49i

| <b>Coil Number</b> | <b>Status</b>  | <b>Used Exclusively In</b>       |
|--------------------|----------------|----------------------------------|
| 0                  | INVALID        |                                  |
| 1                  | AUTORANGE      |                                  |
| 2                  | SERVICE        |                                  |
| 3                  | UNITS          |                                  |
| 4                  | ZERO MODE      | Sample/Cal Option                |
| 5                  | SPAN MODE      | Sample/Cal Option                |
| 6                  | SAMPLE MODE    |                                  |
| 7                  | O3 LEVEL 1     |                                  |
| 8                  | O3 LEVEL 2     |                                  |
| 9                  | O3 LEVEL 3     |                                  |
| 10                 | O3 LEVEL 4     |                                  |
| 11                 | O3 LEVEL 5     |                                  |
| 12                 | PURGE MODE     | Sample/Cal Option                |
| 13                 | GEN ALARM      |                                  |
| 14                 | CONC MAX       |                                  |
| 15                 | CONC MIN       |                                  |
| 16                 | BENCH TEMP     |                                  |
| 17                 | BNCH LMP TEM   |                                  |
| 18                 | O3 LAMP TEMP   | 49i PS, Internal Ozonator Option |
| 19                 | PRESSURE       |                                  |
| 20                 | FLOW A         |                                  |
| 21                 | FLOW B         |                                  |
| 22                 | INTENSITY A    |                                  |
| 23                 | INTENSITY B    |                                  |
| 24                 | CONC ALARM     |                                  |
| 25                 | ZERO CHK/CAL   | Sample/Cal Option                |
| 26                 | SPAN CHK/CAL   | Sample/Cal Option                |
| 27                 | O3 LEVEL 1 CHK |                                  |
| 28                 | O3 LEVEL 2CHK  |                                  |
| 29                 | O3 LEVEL 3 CHK |                                  |
| 30                 | O3 LEVEL 4CHK  |                                  |
| 31                 | O3 LEVEL 5 CHK |                                  |

| <b>Coil Number</b> | <b>Status</b>  | <b>Used Exclusively In</b> |
|--------------------|----------------|----------------------------|
| 32                 | MB STATUS      |                            |
| 33                 | MIB STATUS     |                            |
| 34                 | I/O BD STATUS  | I/O Expansion Board Option |
| 35                 | LOCAL/REMOTE   |                            |
| 36                 | CONC ERROR     | 49 <i>i</i> J              |
| 37                 | O3 RANGE 1     | 49 <i>i</i> J              |
| 38                 | O3 RANGE 2     | 49 <i>i</i> J              |
| 39                 | O3 RANGE 3     | 49 <i>i</i> J              |
| 40                 | O3 RANGE 4     | 49 <i>i</i> J              |
| 41                 | O3 RANGE 5     | 49 <i>i</i> J              |
| 42                 | CALIBRATION    | 49 <i>i</i> J              |
| 43                 | CAL FAIL ALARM | 49 <i>i</i> J              |
| 44                 | EXT ALARM 1    |                            |
| 45                 | EXT ALARM 2    |                            |
| 46                 | EXT ALARM 3    |                            |
| 47                 | SOLENOID 1     |                            |
| 48                 | SOLENOID 2     |                            |
| 49                 | SOLENOID 3     |                            |
| 50                 | SOLENOID 4     |                            |
| 51                 | SOLENOID 5     |                            |
| 52                 | SOLENOID 6     |                            |
| 53                 | SOLENOID 7     |                            |
| 54                 | SOLENOID 8     |                            |
| 55                 | SOLENOID 9     |                            |
| 56                 | SOLENOID 10    |                            |
| 57                 | SOLENOID 11    |                            |
| 58                 | SOLENOID 12    |                            |
| 59                 | SOLENOID 13    |                            |
| 60                 | SOLENOID 14    |                            |
| 61                 | SOLENOID 15    |                            |
| 62                 | SOLENOID 16    |                            |
| 63                 | O3 LEVEL 6     |                            |



## Write Coils for 49*i*

| Coil Number | Action Triggered | Coil Group      | Used Exclusively In                      |
|-------------|------------------|-----------------|--|
| 100         | INVALID          |                 |  |
| 101         | ZERO MODE        | Zero/Span Mode  | Sample/Cal Option                        |
| 102         | SPAN MODE        | Zero/Span Mode  | Sample/Cal Option                        |
| 103         | OZONATOR LVL 1   |                 | 49 <i>i</i> PS, Internal Ozonator Option |
| 104         | OZONATOR LVL 2   |                 | 49 <i>i</i> PS, Internal Ozonator Option |
| 105         | OZONATOR LVL 3   |                 | 49 <i>i</i> PS, Internal Ozonator Option |
| 106         | OZONATOR LVL 4   |                 | 49 <i>i</i> PS, Internal Ozonator Option |
| 107         | OZONATOR LVL 5   |                 | 49 <i>i</i> PS, Internal Ozonator Option |
| 108         | SET BACKGROUND   |                 |  |
| 109         | CAL TO LO SPAN   |                 |  |
| 110         | CAL TO HI SPAN   |                 |  |
| 111         | OZONATOR SLND    |                 |  |
| 112         | AOUTS TO ZERO    | Analog Out Test | I/O Expansion Board Option               |
| 113         | AOUTS TO FS      | Analog Out Test | I/O Expansion Board Option               |
| 114         | PUMP OFF         |                 |  |
| 115         | TELEM TROUBLE    |                 | 49 <i>i</i> J                            |
| 116         | HOURLY AVG RST   |                 | 49 <i>i</i> J                            |
| 117         | ZERO/PURGE CAL   |                 | 49 <i>i</i> J                            |
| 118         | SPAN/PURGE CAL   |                 | 49 <i>i</i> J                            |
| 119         | ZERO/SPAN/PURGE  |                 | 49 <i>i</i> J                            |
| 120         | EXT ALARM 1      |                 |  |
| 121         | EXT ALARM 2      |                 |  |
| 122         | EXT ALARM 3      |                 |  |
| 123         | PURGE MODE       |                 | 49 <i>i</i> J                            |
| 124         | OZONATOR LVL 6   |                 | 49 <i>i</i> PS, Internal Ozonator Option |

## 51*i*

### Read Registers for 51*i*

| Register Number | Variable | Used Exclusively In |
|-----------------|----------|---------------------|
| 0               | INVALID  |                     |

| Register Number | Variable        | Used Exclusively In        |
|-----------------|-----------------|----------------------------|
| 1&2             | THC             |                            |
| 3&4             | AVG THC         |                            |
| 5&6             | HI THC          |                            |
| 7&8             | LO THC          |                            |
| 9&10            | DET TEMP        |                            |
| 11&12           | FILTER TEMP     |                            |
| 13&14           | PUMP TEMP       |                            |
| 15&16           | FLAME TEMP      |                            |
| 17&18           | INT TEMP        |                            |
| 19&20           | AIR PRESSURE    |                            |
| 21&22           | SAMPLE PRESSURE |                            |
| 23&24           | FUEL PRESSURE   |                            |
| 25&26           | RAW FID SIGNAL  |                            |
| 27&28           | ANALOG IN 1     | I/O Expansion Board Option |
| 29&30           | ANALOG IN 2     | I/O Expansion Board Option |
| 31&32           | ANALOG IN 3     | I/O Expansion Board Option |
| 33&34           | ANALOG IN 4     | I/O Expansion Board Option |
| 35&36           | ANALOG IN 5     | I/O Expansion Board Option |
| 37&38           | ANALOG IN 6     | I/O Expansion Board Option |
| 39&40           | ANALOG IN 7     | I/O Expansion Board Option |
| 41&42           | ANALOG IN 8     | I/O Expansion Board Option |
| 43&44           | EXT ALARMS      |                            |

#### Read Coils for 51*i*

| Coil Number | Status       | Used Exclusively In |
|-------------|--------------|---------------------|
| 0           | INVALID      |                     |
| 1           | LOCAL/REMOTE |                     |
| 2           | SERVICE      |                     |
| 3           | ZERO MODE    | Zero/Span Option    |
| 4           | SPAN MODE    | Zero/Span Option    |
| 5           | SAMPLE MODE  |                     |
| 6           | PURGE MODE   | Zero/Span Option    |

| <b>Coil Number</b> | <b>Status</b>       | <b>Used Exclusively In</b> |
|--------------------|---------------------|----------------------------|
| 7                  | IDLE MODE           |                            |
| 8                  | GEN ALARM           |                            |
| 9                  | CONC ALARM          |                            |
| 10                 | CONC MAX            |                            |
| 11                 | CONC MIN            |                            |
| 12                 | INT TEMP ALARM      |                            |
| 13                 | DET TEMP ALARM      |                            |
| 14                 | FILT TEMP ALARM     |                            |
| 15                 | PUMP TEMP ALARM     |                            |
| 16                 | AIR PRESSURE ALARM  |                            |
| 17                 | SAMP PRESSURE ALARM |                            |
| 18                 | FUEL PRESSURE ALARM |                            |
| 19                 | FLAME OUT           |                            |
| 20                 | SIGNAL STR          |                            |
| 21                 | OVER RANGE          |                            |
| 22                 | HEATER FAIL         |                            |
| 23                 | SENSOR FAIL         |                            |
| 24                 | ZERO NOISE ALARM    |                            |
| 25                 | ZERO CHK/CAL        | Zero/Span Option           |
| 26                 | SPAN CHK/CAL        | Zero/Span Option           |
| 27                 | BIAS VOLTAGE        |                            |
| 28                 | MB STATUS           |                            |
| 29                 | MIB STATUS          |                            |
| 30                 | I/O BD STATUS       | I/O Expansion Board Option |
| 31                 | EXT ALARM 1         |                            |
| 32                 | EXT ALARM 2         |                            |
| 33                 | EXT ALARM 3         |                            |

### Write Coils for 51*i*

| Coil Number | Action Triggered | Coil Group      | Used Exclusively In        |
|-------------|------------------|-----------------|----------------------------|
| 100         | INVALID          |                 |                            |
| 101         | ZERO MODE        | Zero/Span Mode  | Zero/Span Option           |
| 102         | SPAN MODE        | Zero/Span Mode  | Zero/Span Option           |
| 103         | SET BACKGROUND   |                 |                            |
| 104         | SET IDLE MODE    |                 |                            |
| 105         | CAL TO SPAN      |                 |                            |
| 106         | AOUTS TO ZERO    | Analog Out Test | I/O Expansion Board Option |
| 107         | AOUTS TO FS      | Analog Out Test | I/O Expansion Board Option |
| 108         | EXT ALARM 1      |                 |                            |
| 109         | EXT ALARM 2      |                 |                            |
| 110         | EXT ALARM 3      |                 |                            |

## *55i*

### Read Registers for 55*i*

| Register Number | Variable     | Used Exclusively In |
|-----------------|--------------|---------------------|
| 0               | INVALID      |                     |
| 1&2             | METHANE      |                     |
| 3&4             | NMHC         |                     |
| 5&6             | THC          |                     |
| 7&8             | DET TEMP     |                     |
| 9&10            | FILTER TEMP  |                     |
| 11&12           | COLUMN TEMP  |                     |
| 13&14           | FLAME TEMP   |                     |
| 15&16           | INT TEMP     |                     |
| 17&18           | AIR PRES     |                     |
| 19&20           | CARRIER PRES |                     |
| 21&22           | FUEL PRES    |                     |
| 23&24           | RAW SIGNAL   |                     |

| Register Number | Variable       | Used Exclusively In        |
|-----------------|----------------|----------------------------|
| 25&26           | FLAME STATUS   |                            |
| 27&28           | CH4 PK HT      |                            |
| 29&30           | CH4 PK RT      |                            |
| 31&32           | CH4 BASELINE   |                            |
| 33&34           | CH4 LOD        |                            |
| 35&36           | NM PK HT       |                            |
| 37&38           | NM PK AREA     |                            |
| 39&40           | NM BASE START  |                            |
| 41&42           | NM BASE END    |                            |
| 43&44           | NM LOD         |                            |
| 45&46           | NM START IDX   |                            |
| 47&48           | NM END IDX     |                            |
| 49&50           | NM MAX SLOPE   |                            |
| 51&52           | NM MIN SLOPE   |                            |
| 53&54           | NM DATA POINTS |                            |
| 55&56           | ANALOG IN 1    | I/O Expansion Board Option |
| 57&58           | ANALOG IN 2    | I/O Expansion Board Option |
| 59&60           | ANALOG IN 3    | I/O Expansion Board Option |
| 61&62           | ANALOG IN 4    | I/O Expansion Board Option |
| 63&64           | ANALOG IN 5    | I/O Expansion Board Option |
| 65&66           | ANALOG IN 6    | I/O Expansion Board Option |
| 67&68           | ANALOG IN 7    | I/O Expansion Board Option |
| 69&70           | ANALOG IN 8    | I/O Expansion Board Option |
| 71&72           | EXT ALARMS     |                            |

#### Read Coils for 55i

| Coil Number | Status       | Used Exclusively In |
|-------------|--------------|---------------------|
| 0           | INVALID      |                     |
| 1           | LOCAL/REMOTE |                     |
| 2           | SERVICE      |                     |
| 3           | CAL MODE     |                     |
| 4           | CAL CHK MODE |                     |

| <b>Coil Number</b> | <b>Status</b>    | <b>Used Exclusively In</b> |
|--------------------|------------------|----------------------------|
| 5                  | RUN MODE         |                            |
| 6                  | IDLE MODE        |                            |
| 7                  | INJECT           |                            |
| 8                  | ZERO MODE        |                            |
| 9                  | SPAN MODE        |                            |
| 10                 | GEN ALARM        |                            |
| 11                 | CH4 CONC MAX     |                            |
| 12                 | CH4 CONC MIN     |                            |
| 13                 | NM CONC MAX      |                            |
| 14                 | NM CONC MIN      |                            |
| 15                 | INT TEMP ALARM   |                            |
| 16                 | DET TEMP ALARM   |                            |
| 17                 | FILT TEMP ALARM  |                            |
| 18                 | COLUMN TEMP      |                            |
| 19                 | AIR PRESSURE     |                            |
| 20                 | CARRIER PRESSURE |                            |
| 21                 | FUEL PRESSURE    |                            |
| 22                 | FLAME OUT        |                            |
| 23                 | CH4 OVERRANGE    |                            |
| 24                 | NM OVERRANGE     |                            |
| 25                 | CAL FAILURE      |                            |
| 26                 | HEATER FAIL      |                            |
| 27                 | SENSOR FAIL      |                            |
| 28                 | BIAS VOLTAGE     |                            |
| 29                 | DATA INTEG       |                            |
| 30                 | CH4 SPAN CHK     |                            |
| 31                 | NM SPAN CHK      |                            |
| 32                 | WINDOWS SANE     |                            |

| Coil Number | Status        | Used Exclusively In        |
|-------------|---------------|----------------------------|
| 33          | MB STATUS     |                            |
| 34          | MIB STATUS    |                            |
| 35          | I/O BD STATUS | I/O Expansion Board Option |
| 36          | EXT ALARM 1   |                            |
| 37          | EXT ALARM 2   |                            |
| 38          | EXT ALARM 3   |                            |

### Write Coils for 55*i*

| Coil Number | Action Triggered | Coil Group      | Used Exclusively In        |
|-------------|------------------|-----------------|----------------------------|
| 100         | INVALID          |                 |                            |
| 101         | START RUN        |                 |                            |
| 102         | START CAL        |                 |                            |
| 103         | START CAL CHK    |                 |                            |
| 104         | STOP             |                 |                            |
| 105         | INJECT           |                 |                            |
| 106         | BACKFLUSH        |                 |                            |
| 107         | SET IDLE MODE    |                 |                            |
| 108         | AOUTS TO ZERO    | Analog Out Test | I/O Expansion Board Option |
| 109         | AOUTS TO FS      | Analog Out Test | I/O Expansion Board Option |
| 110         | EXT ALARM 1      |                 |                            |
| 111         | EXT ALARM 2      |                 |                            |
| 112         | EXT ALARM 3      |                 |                            |

## **60*i***

### Read Registers for 60*i*

| Register Number | Variable |
|-----------------|----------|
| 0               | INVALID  |
| 1&2             | NONE     |
| 3&4             | NONE     |
| 5&6             | NONE     |

| <b>Register Number</b> | <b>Variable</b>      |
|------------------------|----------------------|
| 7&8                    | NONE                 |
| 9&10                   | CO CONCENTRATION     |
| 11&12                  | NO CONCENTRATION     |
| 13&14                  | NONE                 |
| 15&16                  | CO2 CONCENTRATION    |
| 17&18                  | NONE                 |
| 19&20                  | NONE                 |
| 21&22                  | NONE                 |
| 23&24                  | NONE                 |
| 25&26                  | NOX CONCENTRATION    |
| 27&28                  | O2 CONCENTRATION     |
| 29&30                  | SO2 CONCENTRATION    |
| 31&32                  | NO2 CONCENTRATION    |
| 33&34                  | ANALOG IN 1          |
| 35&36                  | ANALOG IN 2          |
| 37&38                  | ANALOG IN 3          |
| 39&40                  | ANALOG IN 4          |
| 41&42                  | ANALOG IN 5          |
| 43&44                  | ANALOG IN 6          |
| 45&46                  | ANALOG IN 7          |
| 47&48                  | ANALOG IN 8          |
| 49&50                  | BENCH PRESSURE       |
| 51&52                  | SOURCE TEMPERATURE   |
| 53&54                  | BENCH TEMPERATURE    |
| 55&56                  | DETECTOR TEMPERATURE |
| 57&58                  | CHANNEL 2 ABSORBANCE |
| 59&60                  | CHANNEL 3 ABSORBANCE |
| 61&62                  | CHANNEL 4 ABSORBANCE |
| 63&64                  | CHANNEL 5 ABSORBANCE |
| 65&66                  | CHANNEL 6 ABSORBANCE |
| 67&68                  | CHANNEL 7 ABSORBANCE |
| 69&70                  | CHANNEL 8 ABSORBANCE |
| 71&72                  | CHANNEL 9 ABSORBANCE |



| Register Number | Variable                            |
|-----------------|-------------------------------------|
| 73&74           | CHANNEL 10 ABSORBANCE               |
| 75&76           | CHANNEL 11 ABSORBANCE               |
| 77&78           | CHANNEL 12 ABSORBANCE               |
| 79&80           | CO (contents current selected cyl)  |
| 81&82           | CO2 (contents current selected cyl) |
| 83&84           | NO (contents current selected cyl)  |
| 85&86           | NO2 (contents current selected cyl) |
| 87&88           | SO2 (contents current selected cyl) |
| 89&90           | O2 (contents current selected cyl)  |
| 91&92           | NONE                                |
| 93&94*          | EXTERNAL ALARMS                     |
| 95&96           | REFERENCE INTENSITY                 |
| 97&98           | NONE                                |
| 99&100*         | ALARM FLAGS (C-link)                |
| 101&102         | DEW POINT                           |
| 103&104         | BLOWBACK PRESSURE (system only)     |
| 105&106         | PROBE FILTER TEMP (system only)     |
| 107&108         | PROBE BARREL TEMP (system only)     |
| 109&110         | CHILLER TEMP (system only)          |
| 111&112         | UMBILICAL ZONE 1 TEMP (system only) |
| 113&114         | UMBILICAL ZONE 2 TEMP (system only) |
| 115&116*        | CALIBRATION STATUS                  |
| 117&118*        | FLAGS (C-link)                      |
| 119&120*        | DIGITAL INPUT STATUS                |
| 121&122*        | UNITS FLAGS                         |
| 123&124         | SYSTEM PUMP ON                      |

#### Read Coils for 60i

| Coil Number | Status       |
|-------------|--------------|
| 0           | INVALID      |
| 1           | LOCAL/REMOTE |
| 2           | SERVICE      |

| <b>Coil Number</b> | <b>Status</b>                   |
|--------------------|---------------------------------|
| 3                  | SAMPLE MODE                     |
| 4                  | ZERO MODE                       |
| 5                  | SPAN MODE                       |
| 6                  | CYLINDER 1 ACTIVE               |
| 7                  | CYLINDER 2 ACTIVE               |
| 8                  | CYLINDER 3 ACTIVE               |
| 9                  | CYLINDER 4 ACTIVE               |
| 10                 | CYLINDER 5 ACTIVE               |
| 11                 | CYLINDER 6 ACTIVE               |
| 12                 | BLOWBACK                        |
| 13                 | PURGE                           |
| 14                 | CHECK CAL                       |
| 15                 | EVENT RUNNING                   |
| 16                 | GENERAL ALARM                   |
| 17                 | CONC MAX CO ALARM               |
| 18                 | CONC MIN CO ALARM               |
| 19                 | CONC MAX CO2 ALARM              |
| 20                 | CONC MIN CO2 ALARM              |
| 21                 | CONC MAX NO ALARM               |
| 22                 | CONC MIN NO ALARM               |
| 23                 | CONC MAX NO2 ALARM              |
| 24                 | CONC MIN NO2 ALARM              |
| 25                 | CONC MAX NOX ALARM              |
| 26                 | CONC MIN NOX ALARM              |
| 27                 | CONC MAX O2 ALARM               |
| 28                 | CONC MIN O2 ALARM               |
| 29                 | CONC MAX SO2 ALARM              |
| 30                 | CONC MIN SO2 ALARM              |
| 31                 | INTERNAL TEMP ALARM             |
| 32                 | BENCH TEMP ALARM                |
| 33                 | DETECTOR TEMP ALARM             |
| 34                 | UMB Z1 TEMP ALARM (system only) |
| 35                 | UMB Z2 TEMP ALARM (system only) |

| <b>Coil Number</b> | <b>Status</b>                         |
|--------------------|---------------------------------------|
| 36                 | PROBE FILTER TEMP ALARM (system only) |
| 37                 | PRESSURE ALARM                        |
| 38                 | SAMPLE FLOW ALARM                     |
| 39                 | CAL FLOW ALARM                        |
| 40                 | DEWPOINT ALARM                        |
| 41                 | REF INTENSITY ALARM                   |
| 42                 | MB STATUS ALARM                       |
| 43                 | MIB STATUS ALARM                      |
| 44                 | I/O BOARD STATUS ALARM                |
| 45                 | DETECTOR BOARD STATUS ALARM           |
| 46                 | MODEL 62i STATUS ALARM                |
| 47                 | EXTERNAL ALARM 1 ALARM                |
| 48                 | EXTERNAL ALARM 2 ALARM                |
| 49                 | EXTERNAL ALARM 3 ALARM                |
| 50                 | "NO" DILUTION                         |
| 51                 | "NO" OZONATOR                         |
| 52                 | CAL THROUGH SYSTEM                    |
| 53                 | PROBE BARREL TEMP ALARM (system only) |
| 54                 | CAL FAILED                            |

Write Coils for 60i

| <b>Coil Number</b> | <b>Action Triggered</b> | <b>Coil Group</b> |
|--------------------|-------------------------|-------------------|
| 100                | INVALID                 |                   |
| 101                | AOUTS TO ZERO           | Analog Out Test   |
| 102                | AOUTS TO FS             | Analog Out Test   |
| 103                | SELECT CYLINDER 1       | CYLINDER          |
| 104                | SELECT CYLINDER 2       | CYLINDER          |
| 105                | SELECT CYLINDER 3       | CYLINDER          |
| 106                | SELECT CYLINDER 4       | CYLINDER          |
| 107                | SELECT CYLINDER 5       | CYLINDER          |
| 108                | SELECT CYLINDER 6       | CYLINDER          |
| 109                | RUN EVENT 1             | EVENT             |

| <b>Coil Number</b> | <b>Action Triggered</b>      | <b>Coil Group</b> |
|--------------------|------------------------------|-------------------|
| 110                | RUN EVENT 2                  | EVENT             |
| 111                | RUN EVENT 3                  | EVENT             |
| 112                | RUN EVENT 4                  | EVENT             |
| 113                | RUN EVENT 5                  | EVENT             |
| 114                | RUN EVENT 6                  | EVENT             |
| 115                | RUN EVENT 7                  | EVENT             |
| 116                | RUN EVENT 8                  | EVENT             |
| 117                | RUN EVENT 9                  | EVENT             |
| 118                | RUN EVENT 10                 | EVENT             |
| 119                | RUN EVENT 11                 | EVENT             |
| 120                | RUN EVENT 12                 | EVENT             |
| 121                | RUN EVENT 13                 | EVENT             |
| 122                | RUN EVENT 14                 | EVENT             |
| 123                | RUN EVENT 15                 | EVENT             |
| 124                | RUN EVENT 16                 | EVENT             |
| 125                | INITIATE PURGE               | EVENT             |
| 126                | ACTIVATE CHECK CAL           |                   |
| 127                | TRIGGER EXTERNAL ALARM 1     |                   |
| 128                | TRIGGER EXTERNAL ALARM 2     |                   |
| 129                | TRIGGER EXTERNAL ALARM 3     |                   |
| 130                | TRIGGER BLOWBACK             |                   |
| 131                | TRIGGER WATER SLIP ALARM     |                   |
| 132                | HALT EVENTS/SEQUENCE/AUTOCAL |                   |
| 133                | RUN SEQUENCE 1               | EVENT             |
| 134                | RUN SEQUENCE 2               | EVENT             |
| 135                | SPAN MODE                    | CALIBRATION       |
| 136                | ZERO IR MODE                 | CALIBRATION       |
| 137                | ZERO O2 MODE                 | CALIBRATION       |
| 138                | SPAN NOX MODE                | CALIBRATION       |
| 139                | OZONATOR                     | CALIBRATION       |
| 140                | STORE CAL                    | CALIBRATION       |
| 141                | STORE 1                      | CALIBRATION       |
| 142                | STORE 2                      | CALIBRATION       |

| Coil Number | Action Triggered | Coil Group    |
|-------------|------------------|---------------|
| 143         | COMPUTE NO2 SPAN | CALIBRATION   |
| 144         | SPAN O2          | CALIBRATION   |
| 145         | SAVE CALS        | SAVES TO FILE |

## ***80i***

Read Registers for 80*i*

| Register Number | Variable                       |
|-----------------|--------------------------------|
| 0               | INVALID                        |
| 1&2             | Hg <sup>0</sup> CONCENTRATION  |
| 3&4             | Hg <sup>2+</sup> CONCENTRATION |
| 5&6             | Hg <sup>t</sup> CONCENTRATION  |
| 7&8             | Hg <sup>0</sup> RANGE          |
| 9&10            | Hg <sup>2+</sup> RANGE         |
| 11&12           | Hg <sup>t</sup> RANGE          |
| 13&14           | INTENSITY                      |
| 15&16           | INTERNAL TEMPERATURE           |
| 17&18           | CHAMBER TEMPERATURE            |
| 19&20           | PROBE TEMPERATURE              |
| 21&22           | CONVERTER TEMPERATURE          |
| 23&24           | UMBILICAL TEMPERATURE          |
| 25&26           | VENTURI PRESSURE               |
| 27&28           | ORIFICE PRESSURE               |
| 29&30           | DILUTION AIR PRESSURE          |
| 31&32           | BLOWBACK PRESSURE              |
| 33&34           | EDUCTOR PRESSURE               |
| 35&36           | VACUUM PRESSURE                |
| 37&38           | FLOW                           |
| 39&40           | PMT VOLTS                      |
| 41&42           | CHAMBER PRESSURE               |
| 43&44           | PROBE SPAN                     |
| 45&46           | Hg <sup>0</sup> SPAN           |

| <b>Register Number</b> | <b>Variable</b>                                |
|------------------------|--|
| 47&48                  | Hg <sup>t</sup> SPAN                           |
| 49&50                  | Hg <sup>0</sup> BACKGROUND                     |
| 51&52                  | Hg <sup>t</sup> BACKGROUND                     |
| 53&54                  | Hg <sup>0</sup> COEFFICIENT                    |
| 55&56                  | Hg <sup>t</sup> COEFFICIENT                    |
| 57&58                  | PROBE FAILSAFE TEMPERATURE                     |
| 59&60                  | DILUTION FACTOR                                |
| 61&62                  | ANALOG IN 1                                    |
| 63&64                  | ANALOG IN 2                                    |
| 65&66                  | ANALOG IN 3                                    |
| 67&68                  | ANALOG IN 4                                    |
| 69&70                  | ANALOG IN 5                                    |
| 71&72                  | ANALOG IN 6                                    |
| 73&74                  | ANALOG IN 7                                    |
| 75&76                  | ANALOG IN 8                                    |
| 77&78                  | PROBE NUMBER                                   |
| 79&80                  | Hg <sup>0</sup> INSTRUMENT DRIFT CONCENTRATION |
| 81&82                  | Hg <sup>0</sup> INSTRUMENT DRIFT TIME          |
| 83&84                  | Hg <sup>t</sup> INSTRUMENT DRIFT CONCENTRATION |
| 85&86                  | Hg <sup>t</sup> INSTRUMENT DRIFT TIME          |
| 87&88                  | Hg <sup>0</sup> SYSTEM DRIFT CONCENTRATION     |
| 89&90                  | Hg <sup>0</sup> SYSTEM DRIFT TIME              |
| 91&92                  | Hg <sup>t</sup> SYSTEM DRIFT CONCENTRATION     |
| 93&94                  | Hg <sup>t</sup> SYSTEM DRIFT TIME              |
| 95&96                  | CALIBRATOR ACTUAL CONCENTRATION                |
| 97&98                  | LAMP TEMPERATURE                               |
| 99&100                 | OXIDIZER TEMPERATURE                           |
| 101&102                | OXIDATION                                      |
| 103&104                | INTEGRITY                                      |
| 105&106                | UMBILICAL TEMP 2                               |
| 107&108                | EXTERNAL ALARMS                                |
| 109&110                | 84i PERM GEN RATIO                             |
| 111&112                | 84i PERM GAS TEMP                              |

| Register Number | Variable                  |
|-----------------|---------------------------|
| 113&114         | 84i PERM OVEN HEATER TEMP |
| 115&116         | 84i CAPILLARY TEMP        |
| 117&118         | 84i PRESSURE              |

#### Read Coils for 80i

| Coil Number | Status  |
|-------------|---|
| 0           | INVALID                                       |
| 1           | SERVICE                                       |
| 2           | HG <sup>0</sup> MODE                          |
| 3           | HG <sup>t</sup> MODE                          |
| 4           | HG <sup>0</sup> /HG <sup>t</sup> MODE         |
| 5           | SAMPLE MODE                                   |
| 6           | INSTRUMENT ZERO MODE                          |
| 7           | INSTRUMENT SPAN MODE                          |
| 8           | ORIFICE ZERO MODE                             |
| 9           | ORIFICE SPAN MODE                             |
| 10          | SYSTEM ZERO MODE                              |
| 11          | SYSTEM SPAN MODE                              |
| 12          | BLOWBACK MODE                                 |
| 13          | GENERAL ALARM                                 |
| 14          | INTERNAL TEMPERATURE ALARM                    |
| 15          | CHAMBER TEMPERATURE ALARM                     |
| 16          | CHAMBER PRESSURE ALARM                        |
| 17          | SAMPLE FLOW ALARM                             |
| 18          | INTENSITY ALARM                               |
| 19          | Hg <sup>0</sup> CONCENTRATION, MAXIMUM ALARM  |
| 20          | Hg <sup>0</sup> CONCENTRATION, MINIMUM ALARM  |
| 21          | Hg <sup>2+</sup> CONCENTRATION, MAXIMUM ALARM |
| 22          | Hg <sup>2+</sup> CONCENTRATION, MINIMUM ALARM |
| 23          | Hg <sup>t</sup> CONCENTRATION, MAXIMUM ALARM  |
| 24          | Hg <sup>t</sup> CONCENTRATION, MINIMUM ALARM  |
| 25          | MOTHERBOARD STATUS ALARM                      |

| <b>Coil Number</b> | <b>Status</b>                            |
|--------------------|--|
| 26                 | MEASUREMENT INTERFACE BOARD STATUS ALARM |
| 27                 | I/O BOARD STATUS ALARM                   |
| 28                 | 80I STATUS ALARM                         |
| 29                 | ZERO CHECK/CAL ALARM                     |
| 30                 | SPAN CHECK/CAL ALARM                     |
| 31                 | PROBE DILUTION ALARM                     |
| 32                 | SYSTEM DILUTION ALARM                    |
| 33                 | PROBE ZERO CHECK/CAL ALARM               |
| 34                 | SYSTEM ZERO CHECK/CAL ALARM              |
| 35                 | GENERAL PROBE ALARM                      |
| 36                 | PROBE 1 SELECTED                         |
| 37                 | UNUSED                                   |
| 38                 | UNUSED                                   |
| 39                 | UNUSED                                   |
| 40                 | LOCAL/REMOTE                             |
| 41                 | OXIDIZER CAL MODE                        |
| 42                 | HYDRATOR                                 |
| 43                 | PROBE 1 STATUS                           |
| 44                 | UNUSED                                   |
| 45                 | UNUSED                                   |
| 46                 | UNUSED                                   |
| 47                 | EXTERNAL ALARM                           |
| 48                 | OXIDIZER Hg                              |
| 49                 | OXIDIZER Cl <sub>2</sub>                 |
| 50                 | OXIDIZER PURGE                           |
| 51                 | THC ZERO MODE                            |
| 52                 | THC SPAN MODE                            |
| 53                 | PERMEATION SPAN MODE                     |
| 54                 | 84i CONNECT A                            |
| 55                 | 84i CONNECT B                            |
| 56                 | 84i GAS TEMP                             |
| 57                 | 84i OVEN TEMP                            |
| 58                 | 84i CAPILLARY TEMP                       |



| <b>Coil Number</b> | <b>Status</b>   |
|--------------------|-----------------|
| 59                 | 84i FLOW        |
| 60                 | 84i PRESSURE    |
| 61                 | 84i STATUS      |
| 62                 | OXIDIZER STATUS |

### Write Coils for 80i

| <b>Coil Number</b> | <b>Action Triggered</b>               | <b>Coil Group</b> |
|--------------------|---------------------------------------|-------------------|
| 100                | INVALID                               |                   |
| 101                | Hg <sup>0</sup> MODE                  | Measure Mode      |
| 102                | Hg <sup>t</sup> MODE                  | Measure Mode      |
| 103                | Hg <sup>0</sup> /Hg <sup>t</sup> MODE | Measure Mode      |
| 104                | INSTRUMENT ZERO MODE                  | Zero/Span Mode    |
| 105                | INSTRUMENT SPAN MODE                  | Zero/Span Mode    |
| 106                | ORIFICE ZERO MODE                     | Zero/Span Mode    |
| 107                | ORIFICE SPAN MODE                     | Zero/Span Mode    |
| 108                | SYSTEM ZERO MODE                      | Zero/Span Mode    |
| 109                | SYSTEM SPAN MODE                      | Zero/Span Mode    |
| 110                | BLOWBACK SYSTEM MODE                  | Zero/Span Mode    |
| 111                | BLOWBACK STINGER MODE                 | Zero/Span Mode    |
| 112                | SET BACKGROUND                        |                   |
| 113                | SET SPAN COEFFICIENT                  |                   |
| 114                | PROBE SELECT 1                        | Probe Select      |
| 115                | PROBE SELECT 2                        | Probe Select      |
| 116                | PROBE SELECT 3                        | Probe Select      |
| 117                | PROBE SELECT 4                        | Probe Select      |
| 118                | SYSTEM SPAN 1                         | System Span       |
| 119                | SYSTEM SPAN 2                         | System Span       |
| 120                | SYSTEM SPAN 3                         | System Span       |
| 121                | SYSTEM SPAN 4                         | System Span       |
| 122                | SYSTEM SPAN 5                         | System Span       |
| 123                | SYSTEM SPAN 6                         | System Span       |
| 124                | OXIDIZER CAL MODE                     | Zero/Span Mode    |

| <b>Coil Number</b> | <b>Action Triggered</b>  | <b>Coil Group</b> |
|--------------------|--------------------------|-------------------|
| 125                | SPIKING                  |                   |
| 126                | INSTRUMENT SPAN 1        | Instrument Span   |
| 127                | INSTRUMENT SPAN 2        | Instrument Span   |
| 128                | INSTRUMENT SPAN 3        | Instrument Span   |
| 129                | HYDRATOR ALARM           |                   |
| 130                | EXTERNAL ALARM           |                   |
| 131                | THC ZERO MODE            | THC               |
| 132                | THC SPAN MODE            | THC               |
| 133                | THC BLOWBACK             | THC               |
| 134                | PERM SPAN                | 84i Perm          |
| 135                | UNUSED                   |                   |
| 136                | 84i CONNECT B            | 84i Perm          |
| 137                | SET Hg <sup>0</sup> SPAN | Measure Mode      |
| 138                | SET Hg <sup>t</sup> SPAN | Measure Mode      |

## ***81i***

Read Registers for 81 *i*

| <b>Register Number</b> | <b>Variable</b>        | <b>Used Exclusively In</b> |
|------------------------|------------------------|----------------------------|
| 0                      | INVALID                |                            |
| 1&2                    | Hg CONCENTRATION       |                            |
| 3&4                    | Hg SPAN                |                            |
| 5&6                    | Hg FLOW                |                            |
| 7&8                    | DILUTION FLOW          |                            |
| 9&10                   | COOLER TEMPERATURE     |                            |
| 11&12                  | AMBIENT TEMPERATURE    |                            |
| 13&14                  | PRESSURE               |                            |
| 15&16                  | COOLER SET TEMPERATURE |                            |
| 17&18                  | ANALOG IN 1            | I/O Expansion Board Option |
| 19&20                  | ANALOG IN 2            | I/O Expansion Board Option |
| 21&22                  | ANALOG IN 3            | I/O Expansion Board Option |
| 23&24                  | ANALOG IN 4            | I/O Expansion Board Option |

| Register Number | Variable    | Used Exclusively In        |
|-----------------|-------------|----------------------------|
| 25&26           | ANALOG IN 5 | I/O Expansion Board Option |
| 27&28           | ANALOG IN 6 | I/O Expansion Board Option |
| 29&30           | ANALOG IN 7 | I/O Expansion Board Option |
| 31&32           | ANALOG IN 8 | I/O Expansion Board Option |
| 33&34           | EXT ALARMS  |                            |
| 35&36           | Hg RANGE    |                            |

#### Read Coils for 81i

| Coil Number | Status                    | Used Exclusively In |
|-------------|---------------------------|---------------------|
| 0           | INVALID                   |                     |
| 1           | SERVICE                   |                     |
| 2           | HG SPAN BIT 1             |                     |
| 3           | HG SPAN BIT 2             |                     |
| 4           | HG SPAN BIT 3             |                     |
| 5           | GENERAL ALARM             |                     |
| 6           | STANDBY MODE              |                     |
| 7           | INSTRUMENT ZERO MODE      |                     |
| 8           | INSTRUMENT SPAN MODE      |                     |
| 9           | ORIFICE ZERO MODE         |                     |
| 10          | ORIFICE SPAN MODE         |                     |
| 11          | SYSTEM ZERO MODE          |                     |
| 12          | SYSTEM SPAN MODE          |                     |
| 13          | COOLER TEMPERATURE ALARM  |                     |
| 14          | AMBIENT TEMPERATURE ALARM |                     |
| 15          | PRESSURE ALARM            |                     |
| 16          | Hg FLOW ALARM             |                     |
| 17          | DILUTION FLOW ALARM       |                     |
| 18          | CONCENTRATION ALARM       |                     |
| 19          | MOTHERBOARD STATUS ALARM  |                     |
| 20          | MEASUREMENT               |                     |

| Coil Number | Status                       | Used Exclusively In        |
|-------------|------------------------------|----------------------------|
|             | INTERFACE BOARD STATUS ALARM |                            |
| 21          | I/O BOARD STATUS ALARM       | I/O Expansion Board Option |
| 22          | LOCAL/REMOTE                 |                            |
| 23          | EXT ALARM 1                  |                            |
| 24          | EXT ALARM 2                  |                            |
| 25          | EXT ALARM 3                  |                            |

Write Coils for 81*i*

| Coil Number | Action Triggered     | Coil Group      | Used Exclusively In        |
|-------------|----------------------|-----------------|----------------------------|
| 100         | INVALID              |                 |                            |
| 101         | INSTRUMENT ZERO MODE | Zero/Span Mode  |                            |
| 102         | INSTRUMENT CAL MODE  | Zero/Span Mode  |                            |
| 103         | ORIFICE ZERO MODE    | Zero/Span Mode  |                            |
| 104         | ORIFICE CAL MODE     | Zero/Span Mode  |                            |
| 105         | SYSTEM ZERO MODE     | Zero/Span Mode  |                            |
| 106         | SYSTEM CAL MODE      | Zero/Span Mode  |                            |
| 107         | STANDBY              |                 |                            |
| 108         | AOUTS TO ZERO        | Analog Out Test | I/O Expansion Board Option |
| 109         | HG SPAN BIT 1        | Span Level      |                            |
| 110         | HG SPAN BIT 2        | Span Level      |                            |
| 111         | HG SPAN BIT 3        | Span Level      |                            |
| 112         | AOUTS TO FS          | Analog Out Test | I/O Expansion Board Option |
| 113         | EXT ALARM 1          |                 |                            |
| 114         | EXT ALARM 2          |                 |                            |
| 115         | EXT ALARM 3          |                 |                            |
| 116         | RANGE 20             |                 | High Hg Level Variant      |
| 117         | RANGE 30             |                 | High Hg Level Variant      |
| 118         | RANGE 50             |                 | High Hg Level Variant      |
| 119         | RANGE 300            |                 | High Hg Level Variant      |

## **146i**

### Read Registers for 146i

| <b>Register Number</b> | <b>Variable</b> | <b>Used Exclusively In</b>    |
|------------------------|-----------------|-------------------------------|
| 0                      | INVALID         |                               |
| 1&2                    | GAS CONC        |                               |
| 3&4                    | TARGET GFLOW    |                               |
| 5&6                    | ACTUAL GFLOW    |                               |
| 7&8                    | TARGET ZFLOW    |                               |
| 9&10                   | ACTUAL ZFLOW    |                               |
| 11&12                  | TARGET TFLOW    |                               |
| 13&14                  | ACTUAL TFLOW    |                               |
| 15&16                  | O3 CONC         | Photometer Option             |
| 17&18                  | PERM CONC       | Permeation Span Source Option |
| 19&20                  | PRESSURE        | Photometer Option             |
| 21&22                  | BENCH TEMP      | Photometer Option             |
| 23&24                  | LAMP TEMP       | Photometer Option             |
| 25&26                  | O3 LAMP TEMP    | Ozonator Option               |
| 27&28                  | INTENSITY       | Photometer Option             |
| 29&30                  | NOISE           | Photometer Option             |
| 31&32                  | ANALOG 1        | I/O Expansion Board Option    |
| 33&34                  | ANALOG 2        | I/O Expansion Board Option    |
| 35&36                  | ANALOG 3        | I/O Expansion Board Option    |
| 37&38                  | ANALOG 4        | I/O Expansion Board Option    |
| 39&40                  | ANALOG 5        | I/O Expansion Board Option    |
| 41&42                  | ANALOG 6        | I/O Expansion Board Option    |
| 43&44                  | ANALOG 7        | I/O Expansion Board Option    |
| 45&46                  | ANALOG 8        | I/O Expansion Board Option    |
| 47&48                  | PERM GAS TMP    | Permeation Span Source Option |
| 49&50                  | EXT ALARMS      |                               |
| 51&52                  | AMBIENT TEMP    |                               |

## Read Coils for 146i

| <b>Coil Number</b> | <b>Status</b> | <b>Used Exclusively In</b>                |
|--------------------|---------------|---|
| 0                  | INVALID       |   |
| 1                  | GAS BIT 1     |   |
| 2                  | GAS BIT 2     |   |
| 3                  | GAS BIT 3     | Six Valve Option                          |
| 4                  | SPAN BIT 1    |   |
| 5                  | SPAN BIT 2    |   |
| 6                  | SPAN BIT 3    |   |
| 7                  | O3/PERM BIT 1 | Ozonator or Permeation Span Source Option |
| 8                  | O3/PERM BIT 2 | Ozonator or Permeation Span Source Option |
| 9                  | O3/PERM BIT 3 | Ozonator or Permeation Span Source Option |
| 10                 | O3/PERM BIT 4 | Ozonator or Permeation Span Source Option |
| 11                 | PHOTO BIT 1   | Photometer Option                         |
| 12                 | PHOTO BIT 2   | Photometer Option                         |
| 13                 | GAS A         |   |
| 14                 | GAS B         |   |
| 15                 | GAS C         |   |
| 16                 | GAS D         | Six Valve Option                          |
| 17                 | GAS E         | Six Valve Option                          |
| 18                 | GAS F         | Six Valve Option                          |
| 19                 | OZONATOR      | Ozonator Option                           |
| 20                 | PERM OVEN     | Permeation Span Source Option             |
| 21                 | USER 1        |   |
| 22                 | USER 2        |   |
| 23                 | USER 3        |   |
| 24                 | USER 4        |   |
| 25                 | USER 5        |   |
| 26                 | USER 6        |   |
| 27                 | USER 7        |   |
| 28                 | USER 8        |   |
| 29                 | GEN ALARM     |   |
| 30                 | AMBIENT TEMP  |   |
| 31                 | O3 LAMP TEMP  | Ozonator Option                           |

| <b>Coil Number</b> | <b>Status</b>   | <b>Used Exclusively In</b>    |
|--------------------|-----------------|-------------------------------|
| 32                 | PERM GAS TEMP   | Permeation Span Source Option |
| 33                 | PRESSURE        | Photometer Option             |
| 34                 | PHOT BENCH TEMP | Photometer Option             |
| 35                 | PHOT LAMP TEMP  | Photometer Option             |
| 36                 | PHOT INTENSITY  | Photometer Option             |
| 37                 | O3 LEVEL        | Photometer Option             |
| 38                 | MB STATUS       |                               |
| 39                 | MIB STATUS      |                               |
| 40                 | I/O BD STATUS   | I/O Expansion Board Option    |
| 41                 | LOCAL/REMOTE    |                               |
| 42                 | SERVICE         |                               |
| 43                 | EXT ALARM 1     |                               |
| 44                 | EXT ALARM 1     |                               |
| 45                 | EXT ALARM 1     |                               |
| 46                 | STANDBY         |                               |
| 47                 | UNUSED          | Unused                        |
| 48                 | USER 9          |                               |
| 49                 | USER 10         |                               |
| 50                 | USER 11         |                               |
| 51                 | USER 12         |                               |
| 52                 | USER 13         |                               |
| 53                 | USER 14         |                               |
| 54                 | USER 15         |                               |
| 55                 | USER 16         |                               |

## Write Coils for 146i

| Coil Number | Action        | Coil Group              | Used Exclusively In                       |
|-------------|---------------|-------------------------|---|
| 100         | INVALID       |                         |   |
| 101         | GAS BIT 1     | Gas Bit                 |   |
| 102         | GAS BIT 2     | Gas Bit                 |   |
| 103         | GAS BIT 3     | Gas Bit                 | Six Valve Option                          |
| 104         | SPAN BIT 1    | Span Bit                |   |
| 105         | SPAN BIT 2    | Span Bit                |   |
| 106         | SPAN BIT 3    | Span Bit                |   |
| 107         | O3/PERM BIT 1 | O <sub>3</sub> Perm Bit | Ozonator or Permeation Span Source Option |
| 108         | O3/PERM BIT 2 | O <sub>3</sub> Perm Bit | Ozonator or Permeation Span Source Option |
| 109         | O3/PERM BIT 3 | O <sub>3</sub> Perm Bit | Ozonator or Permeation Span Source Option |
| 110         | O3/PERM BIT 4 | O <sub>3</sub> Perm Bit | Ozonator or Permeation Span Source Option |
| 111         | PHOTO BIT 1   | Photo Bit               | Photometer Option                         |
| 112         | PHOTO BIT 2   | Photo Bit               | Photometer Option                         |
| 113         | AOUTS TO ZERO | Analog Out Test         | I/O Expansion Board Option                |
| 114         | AOUTS TO FS   | Analog Out Test         | I/O Expansion Board Option                |
| 115         | EXT ALARM 1   |                         |   |
| 116         | EXT ALARM 2   |                         |   |
| 117         | EXT ALARM 3   |                         |   |

## **2000i, 2000iD, 2025i, 2025iD**

### Read Registers for 2000i, 2000iD, 2025i, 2025iD

| Register Number | Variable        | Used Exclusively In |
|-----------------|-----------------|---------------------|
| 0               | INVALID         |                     |
| 1&2             | FLOW VOLUME     |                     |
| 3&4             | FLOW2 VOLUME    | 2000i-D, 2025i-D    |
| 5&6             | FLOW TOTAL      |                     |
| 7&8             | FLOW COVARIANCE |                     |



| Register Number           | Variable                 | Used Exclusively In        |
|---------------------------|--------------------------|----------------------------|
| 9&10                      | FLOW2 COVARIANCE         | 2000i-D, 2025i-D           |
| 11&12                     | VOLUME                   |                            |
| 13&14                     | VOLUME2                  | 2000i-D, 2025i-D           |
| 15&16                     | AMBIENT PRESSURE         |                            |
| 17&18                     | FILTER PRESSURE          |                            |
| 19&20                     | FILTER2 PRESSURE         | 2000i-D, 2025i-D           |
| 21&22                     | PUMP PRESSURE            |                            |
| 23&24                     | AMBIENT PRESSURE AVERAGE |                            |
| 25&26                     | FILTER PRESSURE AVERAGE  |                            |
| 27&28                     | FILTER2 PRESSURE AVERAGE | 2000i-D, 2025i-D           |
| 29&30                     | PUMP PRESSURE AVERAGE    |                            |
| 31&32                     | AMBIENT TEMPERATURE      |                            |
| 33&34                     | FILTER TEMPERATURE       |                            |
| 35&36                     | FILTER2 TEMPERATURE      | 2000i-D, 2025i-D           |
| 37&38                     | COMPARTMENT TEMPERATURE  |                            |
| 39&40                     | ELECTRONICS TEMPERATURE  |                            |
| 41&42                     | TEMPERATURE DELTA        |                            |
| 43&44                     | TEMPERATURE2 DELTA       | 2000i-D, 2025i-D           |
| 45&46                     | TEMPERATURE DELTA MAX    |                            |
| 47&48                     | TEMPERATURE2 DELTA MAX   | 2000i-D, 2025i-D           |
| 49&50                     | RELATIVE HUMIDITY        |                            |
| 51&52                     | WIND SPEED               |                            |
| 53&54                     | WIND DIRECTION           |                            |
| 55&56                     | WIND SPEED AVERAGE       |                            |
| 57&58                     | WIND VELOCITY            |                            |
| 59&60                     | WIND VELOCITY AVERAGE    |                            |
| 61&62                     | WIND DIRECTION AVERAGE   |                            |
| 63&64<br>through<br>89&90 | NOT USED                 |                            |
| 91&92                     | ANALOG IN 1              | I/O Expansion Board Option |
| 93&94                     | ANALOG IN 2              | I/O Expansion Board Option |
| 95&96                     | ANALOG IN 3              | I/O Expansion Board Option |

| Register Number | Variable                  | Used Exclusively In        |
|-----------------|---------------------------|----------------------------|
| 97&98           | ANALOG IN 4               | I/O Expansion Board Option |
| 99&100          | ANALOG IN 5               | I/O Expansion Board Option |
| 101&102         | ANALOG IN 6               | I/O Expansion Board Option |
| 103&104         | ANALOG IN 7               | I/O Expansion Board Option |
| 105&106         | ANALOG IN 8               | I/O Expansion Board Option |
| 105&106         | FLAGS                     |                            |
| 105&106         | AMBIENT TEMP 5MIN AVERAGE |                            |
| 107&108         | FILTER TEMP 5MIN AVERAGE  |                            |
| 109&110         | FILTER2 TEMP 5MIN AVERAGE | 2000i-D, 2025i-D           |
| 111&112         | FLOW 5MIN AVERAGE         |                            |
| 113&114         | FLOW2 5MIN AVERAGE        | 2000i-D, 2025i-D           |

## **5014i, 5030i**

Read Registers for 5014i, 5030i

| Register Number | Variable            | Used Exclusively In |
|-----------------|---------------------|---------------------|
| 0               | INVALID             |                     |
| 1&2             | PMa                 |                     |
| 3&4             | NOT USED            |                     |
| 5&6             | BAROMETRIC PRESSURE |                     |
| 7&8             | VACUUM              |                     |
| 9&10            | NOT USED            |                     |
| 11&12           | FLOW PRESSURE       |                     |
| 13&14           | NOT USED            |                     |
| 15&16           | AMBIENT RH          |                     |
| 17&18           | SAMPLE RH           |                     |
| 19&20           | NOT USED            |                     |
| 21&22           | AMBIENT TEMPERATURE |                     |
| 23&24           | BOARD TEMPERATURE   |                     |
| 25&26           | FLOW TEMPERATURE    |                     |
| 27&28           | NOT USED            |                     |
| 29&30           | NOT USED            |                     |

| <b>Register Number</b> | <b>Variable</b>          | <b>Used Exclusively In</b> |
|------------------------|--------------------------|----------------------------|
| 31&32                  | NOT USED                 |                            |
| 33&34                  | FLOW VOL                 |                            |
| 35&36                  | NOT USED                 |                            |
| 37&38                  | BETA                     |                            |
| 39&40                  | ANALOG IN 1              | I/O Expansion Board Option |
| 41&42                  | ANALOG IN 2              | I/O Expansion Board Option |
| 43&44                  | ANALOG IN 3              | I/O Expansion Board Option |
| 45&46                  | ANALOG IN 4              | I/O Expansion Board Option |
| 47&48                  | ANALOG IN 5              | I/O Expansion Board Option |
| 49&50                  | ANALOG IN 6              | I/O Expansion Board Option |
| 51&52                  | ANALOG IN 7              | I/O Expansion Board Option |
| 53&54                  | ANALOG IN 8              | I/O Expansion Board Option |
| 55&56                  | BETA RAW                 |                            |
| 57&58                  | ALPHA RAW                |                            |
| 59&60                  | AVERAGE PM               |                            |
| 61&62                  | NOT USED                 |                            |
| 63&64                  | MASS                     |                            |
| 65&66                  | NOT USED                 |                            |
| 67&68                  | BETA ZERO                |                            |
| 69&70                  | NOT USED                 |                            |
| 71&72                  | NEPHELOMETER             | 5030I                      |
| 73&74                  | NOT USED                 |                            |
| 75&76                  | NOT USED                 |                            |
| 77&78                  | NOT USED                 |                            |
| 79&80                  | NOT USED                 |                            |
| 81&82                  | NOT USED                 |                            |
| 83&84                  | SHARP                    | 5030I                      |
| 85&86                  | NOT USED                 |                            |
| 87&88                  | AVERAGE SHARP            | 5030I                      |
| 89&90                  | NOT USED                 |                            |
| 91&92                  | EXTERNAL ALARMS          |                            |
| 93&94                  | NEPHELOMETER TEMPERATURE | 5030I                      |
| 95&96                  | NEPHELOMETER RH          | 5030I                      |

| Register Number | Variable             | Used Exclusively In |
|-----------------|----------------------|---------------------|
| 97&98           | NEPHELOMETER IRED    | 5030I               |
| 99&100          | NEPHELOMETER REF     | 5030I               |
| 101&102         | BETA REF             |                     |
| 103&104         | NOT USED             |                     |
| 105&106         | COMMON FLAGS         |                     |
| 107&108         | BETA DETECTOR FLAGS  |                     |
| 109&110         | NOT USED             |                     |
| 111&112         | COMP MASS            |                     |
| 113&114         | NOT USED             |                     |
| 115&116         | AVERAGE NEPHELOMETER | 5030I               |
| 117&118         | HIGH VOLTAGE         |                     |
| 119&120         | NOT USED             |                     |
| 121&122         | NEPHELOMETER GAIN    | 5030I               |
| 123&124         | SFACT                | 5030I               |
| 125&126         | PM_LT                | 5030I               |
| 127&128         | NH_LT                | 5030I               |

#### Read Coils for Model 5014*i*, 5030*i*

| Coil Number | Status              | Used Exclusively In |
|-------------|---------------------|---------------------|
| 0           | INVALID             |                     |
| 1           | LOCAL/REMOTE        |                     |
| 2           | SERVICE             |                     |
| 3           | NOT USED            |                     |
| 4           | GENERAL ALARM       |                     |
| 5           | CONCENTRATION ALARM |                     |
| 6           | INSTRUMENT ALARMS   |                     |
| 7           | DETECTOR ALARMS     |                     |
| 8           | NOT USED            |                     |
| 9           | RH/TEMP ALARMS      |                     |
| 10          | PRES/VAC ALARMS     |                     |
| 11          | FLOW ALARMS         |                     |

| <b>Coil Number</b> | <b>Status</b>             | <b>Used Exclusively In</b> |
|--------------------|---------------------------|----------------------------|
| 12                 | NOT USED                  |                            |
| 13                 | NOT USED                  |                            |
| 14                 | NOT USED                  |                            |
| 15                 | EXT ALARM 1               |                            |
| 16                 | EXT ALARM 2               |                            |
| 17                 | EXT ALARM 3               |                            |
| 18                 | FILTER TAPE COUNT ALARM   |                            |
| 19                 | FILTER TAPE CHANGE ALARM  |                            |
| 20                 | BETA ALARM                |                            |
| 21                 | NEPHELOMETER SAMPLE ALARM | 5030I                      |
| 22                 | NEPHELOMETER TEMP ALARM   | 5030I                      |
| 23                 | NEPHELOMETER RH ALARM     | 5030I                      |
| 24                 | AMBIENT RH ALARM          |                            |
| 25                 | SAMPLE RH ALARM           |                            |
| 26                 | AMBIENT TEMP ALARM        |                            |
| 27                 | FLOW TEMP ALARM           |                            |
| 28                 | BAROMETRIC PRESSURE ALARM |                            |
| 29                 | VACUUM ALARM              |                            |
| 30                 | FLOW ALARM                |                            |
| 31                 | SHARP ALARM               | 5030I                      |
| 32                 | NEPHELOMETER ALARM        | 5030I                      |
| 33                 | FLAG A                    |                            |
| 34                 | FLAG B                    |                            |

## **5020i**

### Read Registers for 5020i

| <b>Register Number</b> | <b>Variable</b>  | <b>Used Exclusively In</b>                 |
|------------------------|------------------|--|
| 0                      | INVALID          |  |
| 1&2                    | CONTINUOUS SO2   |  |
| 3&4                    | CONTINUOUS SO4   |  |
| 5&6                    | BATCH SO4        |  |
| 7&8                    | F0 AVERAGE       |  |
| 9&10                   | F0 STD DEV       |  |
| 11&12                  | F0 POINTS        |  |
| 13&14                  | F1 AVERAGE       |  |
| 15&16                  | F1 STD DEV       |  |
| 17&18                  | F1 POINTS        |  |
| 19&20                  | SMP AVERAGE      |  |
| 21&22                  | SMP STD DEV      |  |
| 23&24                  | SMP POINTS       |  |
| 25&26                  | FILTER BKG       |  |
| 27&28                  | INT TEMP         |  |
| 29&30                  | CHAMBER TEMP     |  |
| 31&32                  | CNV TEMP TOP     |  |
| 33&34                  | CNV TEMP BTM     |  |
| 35&36                  | PERM OVEN GAS    | Internal Zero/Span Perm Span Source Option |
| 37&38                  | PERM OVEN HTR    | Internal Zero/Span Perm Span Source Option |
| 39&40                  | CHAMBER PRESSURE |  |
| 41&42                  | SAMPLE FLOW      |  |
| 43&44                  | PMT VOLTS        |  |
| 45&46                  | FLASH VOLTS      |  |
| 47&48                  | FLASH REF        |  |
| 49&50                  | ANALOG IN 1      | I/O Expansion Board Option                 |
| 51&52                  | ANALOG IN 2      | I/O Expansion Board Option                 |
| 53&54                  | ANALOG IN 3      | I/O Expansion Board Option                 |
| 55&56                  | ANALOG IN 4      | I/O Expansion Board Option                 |

| Register Number | Variable     | Used Exclusively In        |
|-----------------|--------------|----------------------------|
| 57&58           | ANALOG IN 5  | I/O Expansion Board Option |
| 59&60           | ANALOG IN 6  | I/O Expansion Board Option |
| 61&62           | ANALOG IN 7  | I/O Expansion Board Option |
| 63&64           | ANALOG IN 8  | I/O Expansion Board Option |
| 65&66           | CONV FLOW    |                            |
| 67&68           | AMBIENT TEMP |                            |
| 69&70           | AMBIENT PRES |                            |
| 71&72           | SO2 CAL COEF |                            |
| 73&74           | SO2 CAL BKG  |                            |
| 75&76           | EXT ALARMS   |                            |
| 77&78           | STP/AMBIENT  |                            |

#### Read Coils for Model 5020*i*

| Coil Number | Status                               | Used Exclusively In |
|-------------|--------------------------------------|---------------------|
| 0           | INVALID                              |                     |
| 1           | SERVICE                              |                     |
| 2           | ZERO MODE                            |                     |
| 3           | SPAN MODE                            |                     |
| 4           | SAMPLE MODE                          |                     |
| 5           | FILTER MODE                          |                     |
| 6           | PURGE MODE                           |                     |
| 7           | GEN ALARM                            |                     |
| 8           | SO4 CONC ALARM (MAX)                 |                     |
| 9           | SO4 CONC ALARM (MAX)                 |                     |
| 10          | INT TEMP ALARM                       |                     |
| 11          | CHAMB TEMP ALARM                     |                     |
| 12          | CONV TEMP ALARM                      |                     |
| 13          | CONV TEMP DIFF ALARM                 |                     |
| 14          | PERMEATION SPAN<br>SOURCE TEMP ALARM |                     |
| 15          | AMB TEMP ALARM                       |                     |
| 16          | AMB PRESSURE ALARM                   |                     |

| Coil Number | Status                   | Used Exclusively In        |
|-------------|--------------------------|----------------------------|
| 17          | CHAMB PRESSURE ALARM     |                            |
| 20          | SAMPLE FLOW ALARM        |                            |
| 21          | CONVERTER FLOW ALARM     |                            |
| 22          | FLASH REF ALARM          |                            |
| 23          | FLASH VOLTAGE ALARM      |                            |
| 24          | AUTO TIMING ALARM        |                            |
| 25          | DATA WARNING ALARM       |                            |
| 26          | ZERO CHK/CAL ALARM       |                            |
| 27          | SPAN CHK/CAL ALARM       |                            |
| 28          | MB STATUS ALARM          |                            |
| 29          | MIB STATUS ALARM         |                            |
| 30          | I/O BD STATUS ALARM      | I/O Expansion Board Option |
| 31          | EXT CONV BD STATUS ALARM |                            |
| 32          | LOCAL/REMOTE             |                            |
| 33          | EXT ALARM 1              |                            |
| 34          | EXT ALARM 2              |                            |
| 35          | EXT ALARM 3              |                            |

Write Coils for 5020*i*

| Coil Number | Action Triggered | Coil Group         | Used Exclusively In        |
|-------------|------------------|--------------------|----------------------------|
| 100         | INVALID          |                    |                            |
| 101         | ZERO MODE        | Zero/Span Mode     |                            |
| 102         | SPAN MODE        | Zero/Span Mode     |                            |
| 103         | SAMPLE MODE      | Sample/Filter Mode |                            |
| 104         | FILTER MODE      | Sample/Filter Mode |                            |
| 105         | SET BACKGROUND   |                    |                            |
| 106         | CAL TO SPAN      |                    |                            |
| 107         | AOUTS TO ZERO    | Analog Output Test | I/O Expansion Board Option |
| 108         | AOUTS TO FS      | Analog Output Test | I/O Expansion Board Option |



| Coil Number | Action Triggered | Coil Group | Used Exclusively In |
|-------------|------------------|------------|---------------------|
| 109         | EXT ALARM 1      |            |                     |
| 110         | EXT ALARM 2      |            |                     |
| 111         | EXT ALARM 3      |            |                     |

## Geysitech (Bayern-Hessen) Protocol Appendix

This section describes the updates and corrections that apply to the “Geysitech (Bayern-Hessen) Protocol” appendix.

### Update Serial Communication Parameters

Update the Serial Communication Parameters section as follows:

|                     |   |
|---------------------|---|
| 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) |

### Add Connection Information

Add the following to the “TCP Communication Parameters” section:  
 “Up to three simultaneous connections are supported over Ethernet.”

### Add Basic Command Structure

Add the following to the “Basic Command Structure” section:  
 “Block Check Characters <BCC> may be added to the command to prevent processing invalid commands.”

### Change Block Checksum

Change the Block Checksum <BCC> heading to “Block Checksum Characters <BCC>”.

In the first sentence of the description change “The block checksum is” to “The Block Checksum Characters are”.

### Add Serial Number Field

A Geysitech serial number has been added in the response to a Geysitech protocol DA command. In the “Basic Command Structure” section, replace the last example in the section with the following text and two examples:

The Geysitech serial number defaults to zero. To set the Geysitech serial number select Main Menu > Instrument Controls > Communication Settings > **Geysitech Serial No.**

**Example of response to DA command from an instrument with Geysitech serial number set to 000.** The Geysitech serial number is **bold** in the example.

Geysitech Protocol with transmission of three concentrations (Instrument ID is 1, Operation Status is 03, Error Status is 04):

Data Query String: <STX>DA<CR>

Reply String:

```
<STX>MD03<SP>001<SP>+2578+01<SP>03 <SP>04<SP>0000000000 <SP>002 <SP>
    ↑          ↑                  ↑
    Address  First Concentration(E-format)=25.78        Address+1

+5681+00<SP>03<SP>04<SP>0000000000<SP>003<SP>+1175+01<SP>03<SP>04<SP>
    ↑          ↑          ↑
    Second Concentration = 5.681        Address+2    Third Concentration=11.75
```

**000**0000000<SP><CR>

**Example of response to DA command from an instrument with Geysitech serial number set to 123.**

Data Query String: <STX>DA<CR>

Reply String:

```
<STX>MD03<SP>001<SP>+2578+01<SP>03 <SP>04<SP>12300000000 <SP>002 <SP>
    ↑          ↑                  ↑
    Address  First Concentration(E-format)=25.78        Address+1

+5681+00<SP>03<SP>04<SP>12300000000<SP>003<SP>+1175+01<SP>03<SP>04<SP>
    ↑          ↑          ↑
    Second Concentration = 5.681        Address+2    Third Concentration=11.75
```

**123**00000000<SP><CR>

# Updates for Specific Manuals

The following updates apply to only the specific manuals listed.

## 42i

### **Change Default Chamber Temp Control/Alarm Limits**

In the “Operation” chapter at Main Menu > Alarms > Chamber Temp, change the default chamber temperature control/alarm limit references in associated text and screens from 47 °C to 48 °C and 51 °C to 52 °C.

### **Ozonator Safety Update**

In the “Operation” chapter at Main Menu > Service > Ozonator Safety, add the following highlighted text to the first paragraph as indicated in the following example:

The Ozonator Safety screen is used to turn the ozonator safety feature on or off. If the ozonator safety is turned off, the ozonator will always be on, even if the converter is not up to temperature. The ozonator shuts off if there is a converter temperature alarm or an ozone flow alarm. If the safety override is on, the instrument generates an ozone flow alarm.

## 42i TL

### **Zero/Span Averaging Time Update**

In the “Operation” chapter, in the Instrument Controls Menu, change the list of available averaging times from: “1, 2, 5, 10, 20, 30, 60, 90, 120, 180, 240, and 300 seconds” to: “10, 20, 30, 60, 90, 120, 180, 240, and 300 seconds”

### **Auto/Manual Mode Update**

In the “Operation” chapter, in the Instrument Controls Menu, remove the last sentence “In the manual modes, additional averaging times of 1, 2, and 5 seconds are available from the Averaging Times screen.”

### **Monitoring Signals Update**

In the “System Description” chapter, at the Monitoring Signals description, replace the second paragraph with the following:

“In auto mode, every ten seconds the NO/NO<sub>x</sub> solenoid and the Prereactor solenoid switch and the processor waits three seconds for the reaction chamber to flush and stabilize. After those three seconds, it accumulates the signal counts for seven seconds before again switching the solenoids. This results in three raw signals: NO, NO<sub>x</sub>, and Prereactor.”

### **Measurement Calculations Update**

In the “System Description” chapter, at the Measurement Calculations description, replace the first sentence with the following:

“The calculation of the NO, NO<sub>x</sub>, and Prereactor concentrations is lengthy and uses the high-level processor to provide the most accurate readings.”

In the “System Description” chapter, at the Measurement Calculations description, replace the second paragraph with the following:

“Next, the uncorrected NO, NO<sub>x</sub>, and Prereactor values are determined according to a unique averaging algorithm which minimizes errors resulting from rapidly changing concentrations. This algorithm results in NO, NO<sub>x</sub>, and Prereactor values which are stored in RAM in a circular buffer that holds all the ten second data from the previous five minutes. This data is averaged over the selected time interval, which can be any multiple of ten between 10 and 300 seconds.”

In the “System Description” chapter, at the Measurement Calculations description, replace the first two sentences of the third paragraph with the following:

“The background values for NO, NO<sub>x</sub>, and Prereactor which are corrected for pressure and temperature are subtracted from their respective averages. The Prereactor value is then subtracted from the NO and NO<sub>x</sub> values to provide dynamic background correction. The NO reading is corrected by the stored span factor and by the pressure and temperature factors.”

### **Output Communication Update**

In the “System Description” chapter, at the Output Communication description, replace the last sentence of the first paragraph with the following:

“The display is updated every 10 seconds.”

### **Appendix B Measurements Update**

In Appendix B “C-Link Protocol Commands”, the “Measurements” section “avg time” command, remove selections 0 (1 second), 1 (1 second), 2 (2 seconds), and 3 (5 seconds).

## **42i Y**

### **Change Ozone Particulate Filter Description**

In the “Optional Equipment” chapter, replace the following description for the “Ozone Particulate Filter”:

The ozone particulate filter minimizes the potential for contamination of the capillary and reaction chamber by trapping any particulate matter before passing through the capillary and reaction chamber.

## **42i TL and 42i Y**

### **Add Ranges to Specifications**

In the “Introduction” chapter, add 500 and 1000 ppb, and 500 and 1000 µg/m<sup>3</sup> to the Specifications table as shown in the highlighted example that follows:

**Table 1–4.** Model 42*i* Trace Level Specifications

|               |   |
|---------------|---|
| Preset ranges | 0-5, 10, 20, 50, 100, 200, 500, 1000 ppb                  |
|               | 0-10, 20, 50, 100, 200, 500, 1000, 2000 µg/m <sup>3</sup> |

**Add Displayed Pressure is Measured in Pre-reactor Mode**

In the “Operation” chapter, at Main Menu > Instrument Controls, add “The displayed pressure is measured in pre-reactor mode.” as shown in the highlighted example that follows:

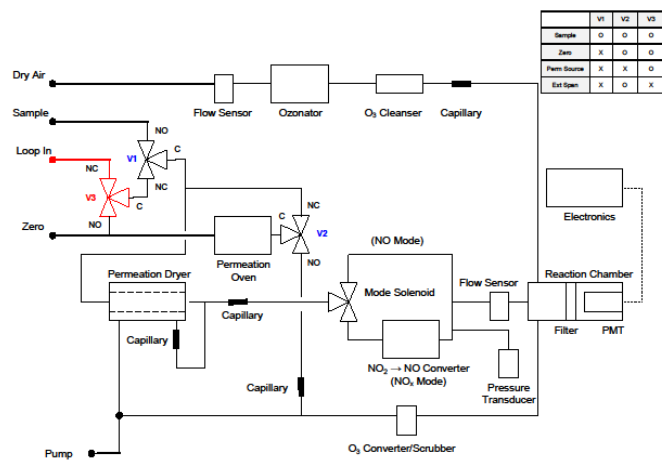
When pressure compensation is on, the first line of the display represents the current pressure in the reaction chamber. When pressure compensation is off, the first line of the display shows the factory standard pressure of 300 mmHg. The displayed pressure is measured in pre-reactor mode.

**42i and 43i**

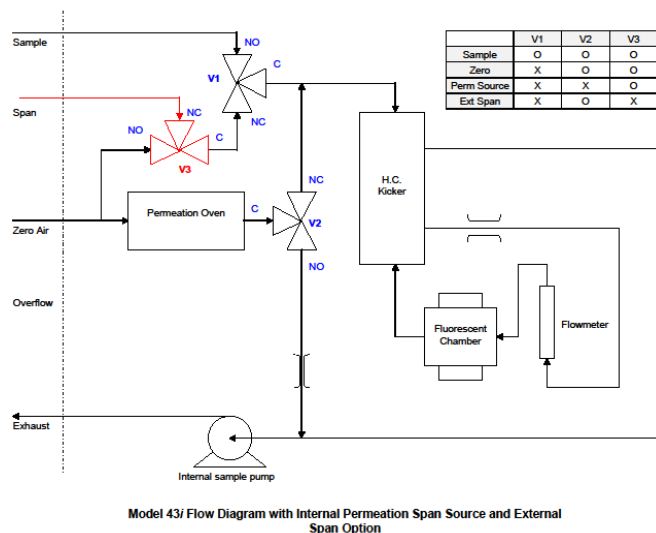
**Internal Permeation Span Source with External Span Option**

This information applies to the Models 42*i* and 43*i* only, and should be inserted into Chapter 9 “Optional Equipment” after the “Internal Permeation Span Source” section.

This option adds an external span source to the internal permeation span source option, so additional span checks may be performed using a gas cylinder instead of the permeation span source. A source of span gas is connected to the “LOOP IN” port on the Model 42*i* or the “SPAN” port on the Model 43*i*. Span gas should be supplied at atmospheric pressure. It may be necessary to use an atmospheric dump bypass plumbing arrangement to accomplish this. See the “Installation” and “Operation” chapters for more information.



Model 42*i* Flow Diagram with sample permeation dryer, internal permeation source and external span option



The external span mode may be selected by the following methods:

- Pressing the RUN button on the run screen to toggle between SAMPLE, ZERO, SPAN, EXTSPAN
- Setting up a digital input for the “EXT SPAN MODE” function and triggering the input
- CLINK command “set ext span”
- Modbus External Span Mode write coil 27 in the Model 42*i* or 43*i*

The external span mode must be triggered by one of the methods above, it cannot be triggered periodically using the ZERO/SPAN CHECK menu.

- The external span mode is reported using the following methods:
- “EXTSPAN” displayed on the status bar on the front panel display
- Setting up a digital output for the “EXT SPAN MODE” function and reading the output
- CLINK command “gas mode” (will return “gas mode ext span”)
- Modbus External Span Mode read coil 72 in the Model 42*i* or read coil 55 in the Model 43*i*

## **42i, 42i HL, 42i LS, 42i TL, 42i Y, and 17i**

### **Add Note to Streaming Data Configuration**

In the “Operation” chapter, at Main Menu > Instrument Controls > Communication Settings > Streaming Data Config, add the following note:

**Note** The selected item list is different depending on the AUTO/MANUAL MODE and RANGE MODE settings. Changing either of these settings will produce a different set of streaming data items. If either of these modes is going to be changed on a regular basis, then the user must configure each set of data separately after changing the modes to each setting. ▲

### **Add Note to Analog Output Configuration**

In the “Operation” chapter, add the following note at Main Menu > Instrument Controls > I/O Configuration > Analog Output Config; and also at Main Menu > Instrument Controls > I/O Configuration > Analog Output Config > Select Channel > Choose Signal To Output:

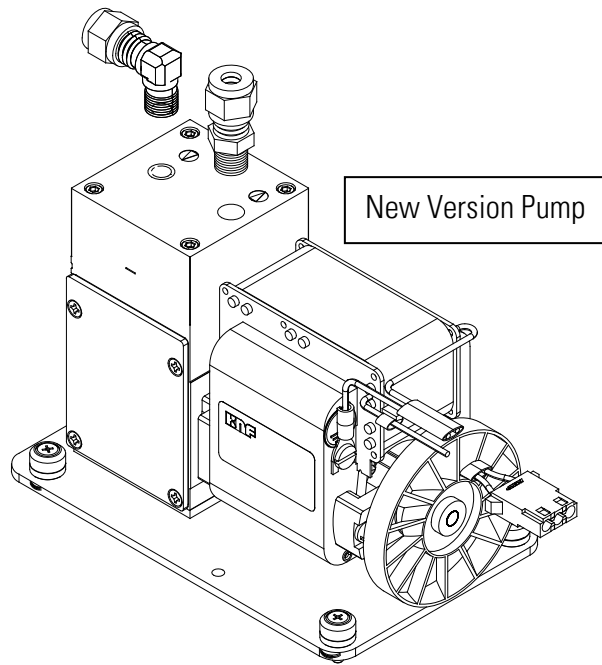
**Note** The settings are different depending on the AUTO/MANUAL MODE and RANGE MODE settings. Changing either of these settings will produce a different set of analog output data items. If either of these modes is going to be changed on a regular basis, then the user must configure each set of data separately after changing the modes to each setting. ▲

## **42i, 42i LS, 42i NOx, 43i HL**

### **Add Rebuild Procedure for New Version Pump**

A new version pump has been added to the 42i, 42i LS, 42i NOx, and 43i HL. This pump is interchangeable with the old pump. It retains the same part number, but requires a different repair kit. The new version pump includes the repair kit part number of the on the pump label, the old pump does not.

This section provides the repair procedure for the new version pump and includes a pump rebuild kit part number to be added to the “Replacement Parts List” in the “Servicing” chapter.



In the “Preventive Maintenance” chapter at “Pump Rebuilding”, add the following rebuilding procedure for the new version pump.

Use the following procedure to rebuild the pump. Refer to the illustration.

Equipment Required:

Pump repair kit



**Equipment Damage** Some internal components can be damaged by small amounts of static electricity. A properly ground antistatic wrist strap must be worn while handling any internal component. ▲

### Disassembly

1. Turn instrument OFF, unplug the power cord, and remove the cover.
2. The compressor housing cover must be removed to gain access to the inside of the compressor housing. Remove the four compressor housing cover screws and then remove the cover. Re-use any gasketing. Remove any debris that may have accumulated in the bottom of the compressor housing.
3. Remove the four top plate screws and remove the top plate. Note the positioning of the flapper plate relative to the valve ports on the top plate and bottom plate. Lift off the flapper plate.



4. Remove the bottom plate.
5. Check that all parts are free from dirt and clean as necessary. **DO NOT** scratch the parts.
6. **Removal of the old diaphragm:** Rotate the fan so that the diaphragm is positioned at the top dead center. This will help unseat the edge of the diaphragm. If required, push up from underneath the diaphragm or use a non-metallic tool to pry up the diaphragm from the housing groove. Unscrew the old diaphragm by turning it counterclockwise using both hands. **DO NOT** use tools!

**Note** Take care not to lose the shim rings positioned between the diaphragm and connecting rod, as the same shim rings must be used during re-assembly. ▲

### **Assembly with New Diaphragm and Valve**

1. Place the shim rings removed in the previous step onto the threaded stud of the new diaphragm. Carefully screw the new diaphragm into the connecting rod. Turn the diaphragm until is snug, then lift and grip the edges of the diaphragm at 7 and 2 o'clock and tighten firmly using both hands. **DO NOT** use tools!
2. Turn the fan until the diaphragm is flat across (mid-point of the stroke). With the diaphragm centered over the compressor housing, firmly seat the diaphragm edge into the compressor housing groove.
3. Place the clean bottom plate onto the compressor housing using the reference mark made earlier to ensure the correct orientation. Then place the new flapper on top of the intermediate plate.

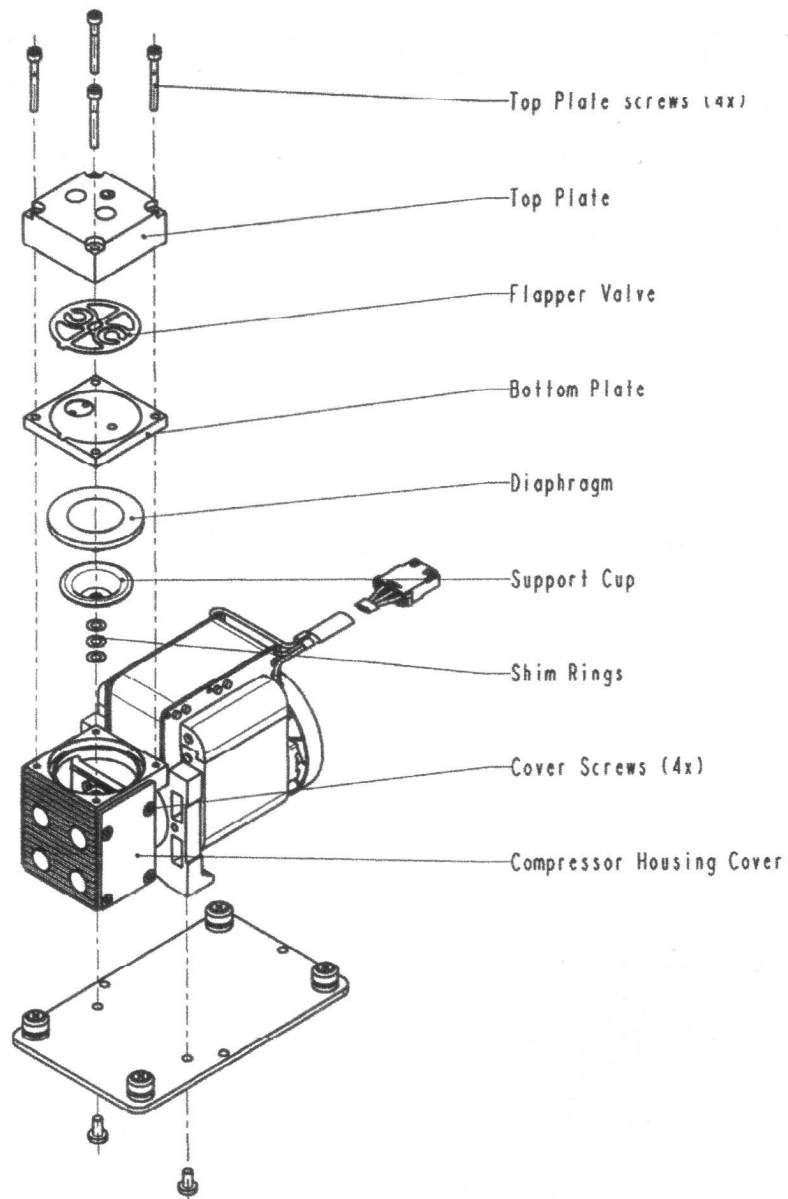


Figure x-x. Rebuilding the Pump

4. Place the clean top plate on top of the bottom plate using the reference mark made earlier to ensure the correct orientation. Tighten the four top plate screws snugly in a diagonal pattern and then tighten to a maximum torque of 6-7 inch-lbs. Turn the fan by hand to confirm that the pump turns freely.
5. Replace the compressor housing cover and gasket. Install the four cover screws. Do not over-tighten.

## Add Part Number of New Version Pump to Replacement Parts List

In the “Servicing” chapter at “Replacement Parts List”, add the following part number and description of the new version pump repair kit below the existing pump repair kit part number as follows:

---

107751-00

Pump Repair Kit (for pump 101011-00 new version)

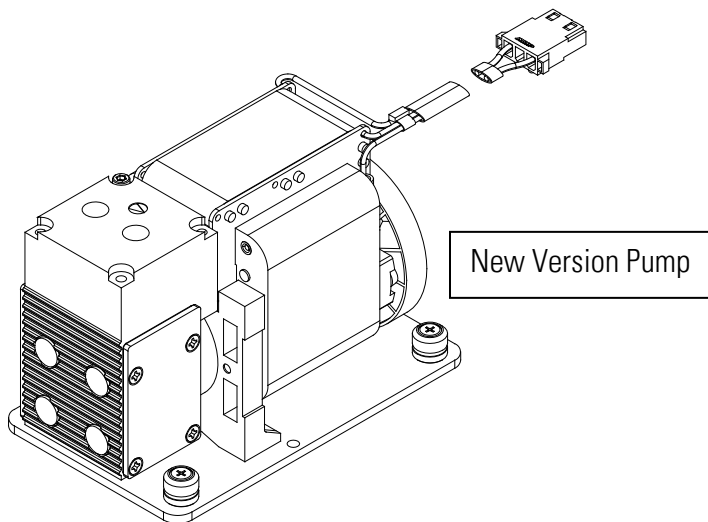
---

## 43i, 43i TLE, 48i, 48i TLE, 48i HL, 410i, 450i, and 5020i

### Add Rebuild Procedure for New Version Pump

A new version pump has been added to the 43i, 43i TLE, 48i, 48i HL, 410i, 450i, and 5020i. This pump is interchangeable with the old pump. It retains the same part number, but requires a different repair kit. The new version pump includes the repair kit part number on the pump label, the old pump does not.

This section provides the repair procedure for the new version pump and includes a pump rebuild kit part number to be added to the “Replacement Parts List” in the “Servicing” chapter.



In the “Preventive Maintenance” chapter at “Pump Rebuilding”, add the following rebuilding procedure for the new version pump.

Use the following procedure to rebuild the pump.

Equipment Required:

Pump repair kit



**Equipment Damage** Some internal components can be damaged by small amounts of static electricity. A properly ground antistatic wrist strap must be worn while handling any internal component. ▲

### Disassembly

1. Turn instrument OFF, unplug the power cord, and remove the cover. Make a sketch of the position of any tubes and fittings for ease of re-assembly later.
2. Mark the position of the pump top plate, bottom plate and compressor housing relative to each other by drawing a line on the edges with a pencil or marker to ensure proper re-assembly.
3. The aluminum compressor housing cover must be removed to gain access to the inside compressor housing. Remove the four screws and then remove the cover. Re-use any gasketing. Remove any debris that may have accumulated in the bottom of the compressor housing.
4. Remove the four top plate screws and remove the top plate. Note the positioning of the flapper valve relative to the valve ports on the top plate and bottom plate. Lift off the flapper valve.
5. Remove the bottom plate.
6. Check that all parts are clean from dirt and clean as necessary. DO NOT scratch the parts.
7. **Removal of the old diaphragm:** Rotate the fan so that the diaphragm is positioned at the top dead center. This will help unseat the edge of the diaphragm. If required, push up from underneath the diaphragm or use a non-metallic tool to pry up the diaphragm from the housing groove. Unscrew the old diaphragm by turning it counterclockwise using both hands. **DO NOT** use tools!

**Note** Take care not to lose the shim rings positioned between the diaphragm support cup and connecting rod, as the same shim rings must be used during re-assembly. ▲

While unscrewing the diaphragm with one hand, use your other hand to secure the support cup and shim ring(s) onto the diaphragm stud. Lift the diaphragm, support cup and shim ring(s) from the pump.

The compressor housing cover must be removed to gain access to and secure the support cup and shim ring(s) onto the stud. Note that the quantity and thickness of the shim ring(s) will vary from pump to pump. Parts removed must be replaced exactly as found. If repairing multiple pumps, take care not to mix parts.

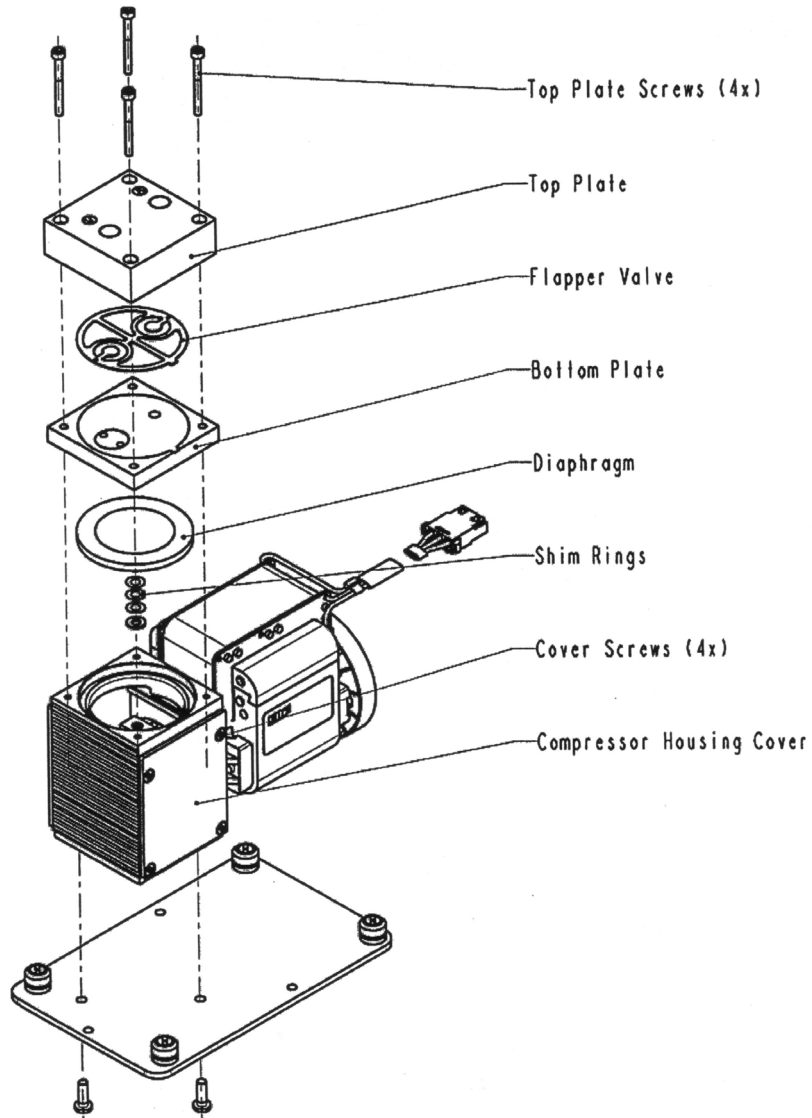


Figure x-x. Rebuilding the Pump

**Assembly with New Diaphragm and Valve**

1. Place the parts removed in the previous step onto the threaded stud of the new diaphragm. Carefully screw the new diaphragm into the connecting rod. Secure the support cup and small parts onto the diaphragm stud using a technique similar to that used during removal. It is helpful to hold the connecting rod at a slight angle until the threads are started. Spin the diaphragm on until it is snug, then lift and

grip the edges of the diaphragm at 7 and 2 o'clock and tighten firmly using both hands. **DO NOT** use tools!

**Tip:** If the pump is loose and not mounted, position and hold the pump with the motor shaft vertical when starting the threaded diaphragm stud into the connecting rod. This helps to prevent the small parts from falling off the stud.

2. Turn the fan until the diaphragm is flat across (mid-point of the stroke). With the diaphragm centered over the compressor housing, firmly seat the diaphragm edge into the compressor housing groove.
3. Place the clean bottom plate onto the compressor housing using the reference mark made earlier to ensure the correct orientation. Then place the new flapper on top of the intermediate plate.
4. Place the clean top plate on top of the bottom plate using the reference mark made earlier to ensure the correct orientation. Tighten the four top plate screws snugly in a diagonal pattern and then tighten to a maximum torque of 6-7 inch-lbs. Turn the fan by hand to confirm that the pump turns freely.
5. Replace the compressor housing cover and gasket. Install the four cover screws. Do not over-tighten.

### **Add Part Number of New Version Pump to Replacement Parts List**

In the “Servicing” chapter at “Replacement Parts List”, add the following part number and description of the new version pump repair kit below the existing pump repair kit part number as follows:

---

|           |  |
|-----------|--|
| 108002-00 | Pump Repair Kit (for pump 101426-00 new version) |
|-----------|--|

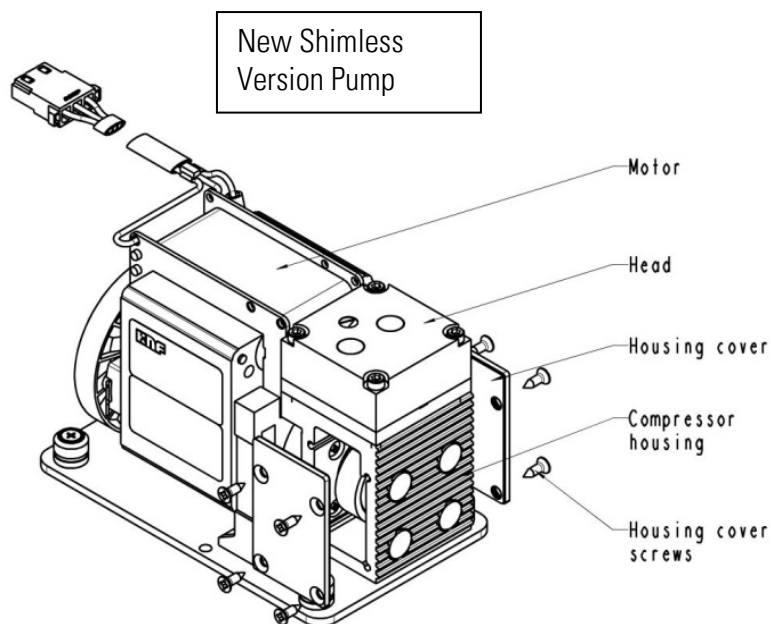
---

**43i, 43i TL, 48i, 48i HL, 48i TLE, 49i, 49i PS, 146i, 410i, 450i, 5020i and 42i NOy**

### **Add Rebuild Procedure for New Shimless Version Pump**

A new version pump has been added to the 43i, 43i TL, 48i, 48i HL, 48i TLE, 49i, 49i PS, 146i, 410i, 450i, 5020i, and 42i NOy. This pump is interchangeable with the old pump. It has a new part number 111553-00 and uses the same rebuild kit as the new version pump. The new shimless version pump includes the repair kit part number on the pump label.

This section provides the repair procedure for the new shimless version pump and includes a pump rebuild kit part number to be added to the “Replacement Parts List” in the “Servicing” chapter.



In the “Preventive Maintenance” chapter at “Pump Rebuilding”, add the following rebuilding procedure for the new version pump.

Use the following procedure to rebuild the pump.

Equipment Required:

Pump repair kit



**Equipment Damage** Some internal components can be damaged by small amounts of static electricity. A properly ground antistatic wrist strap must be worn while handling any internal component. ▲

### Disassembly

1. Turn instrument OFF, unplug the power cord, and remove the cover. Make a sketch of the position of any tubes and fittings for ease of re-assembly later.
2. Mark the position of the pump head plate, intermediate plate and compressor housing relative to each other by drawing a line on the edges with a pencil or marker to ensure proper re-assembly.
3. The aluminum compressor housing cover must be removed to gain access to the inside of the compressor housing. Remove the four screws and then remove the cover. Re-use any gasketing. Remove any debris that may have accumulated in the bottom of the compressor housing.

4. Remove the four socket cap screws and remove the head plate. Note the positioning of the valve plate relative to the valve ports on the head plate and intermediate plate. Lift off the valve plate.
5. Remove the intermediate plate.
6. Check that all parts are clean from dirt and clean as necessary. **DO NOT** scratch the parts.
7. **Removal of the old diaphragm:** Rotate the fan so that the diaphragm is positioned at the top dead center. This will help unseat the edge of the diaphragm. If required, push up from underneath the diaphragm or use a non-metallic tool to pry up the diaphragm from the housing groove. Unscrew the old diaphragm by turning it counterclockwise using both hands. **DO NOT** use tools!

Lift the diaphragm from the pump. Parts removed must be replaced exactly as found. If repairing multiple pumps, take care not to mix parts.

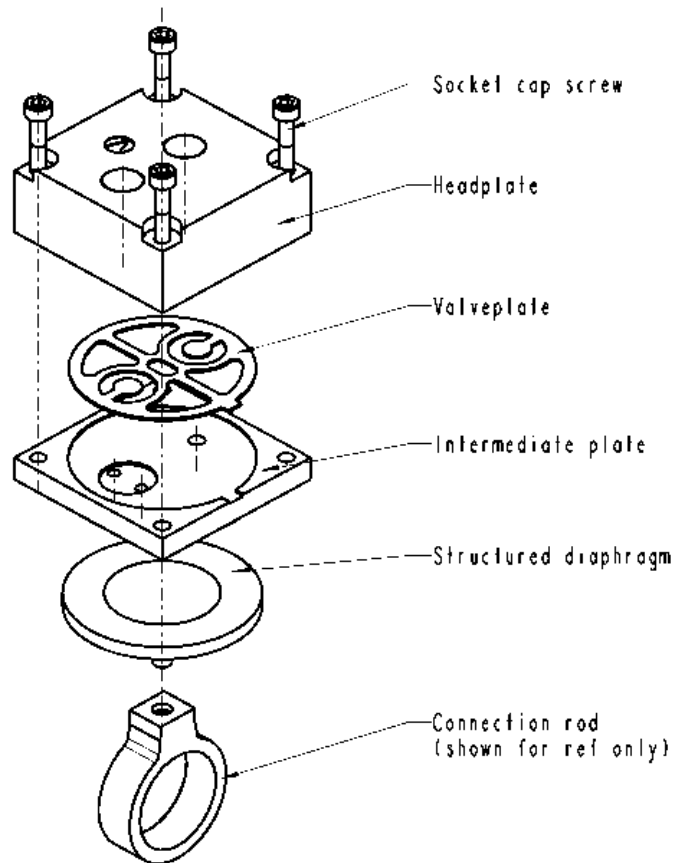


Figure x-x. Rebuilding the Pump



## Assembly with New Diaphragm and Valve

1. Carefully screw the new diaphragm (no shims are needed) into the connection rod. Secure the support cup and small parts onto the diaphragm stud using a technique similar to that used during removal. It is helpful to hold the connecting rod at a slight angle until the threads are started. Spin the diaphragm on until it is snug, then lift and grip the edges of the diaphragm at 7 and 2 o'clock and tighten firmly using both hands. **DO NOT** use tools!
2. Turn the fan until the diaphragm is flat across (mid-point of the stroke). With the diaphragm centered over the compressor housing, firmly seat the diaphragm edge into the compressor housing groove.
3. Place the clean intermediate plate onto the compressor housing using the reference mark made earlier to ensure the correct orientation. Then place the new valve plate on top of the intermediate plate.
4. Place the clean head plate on top of the intermediate plate using the reference mark made earlier to ensure the correct orientation. Tighten the four socket cap screws snugly in a diagonal pattern and then tighten to a maximum torque of 6-7 inch-lbs. Turn the fan by hand to confirm that the pump turns freely.
5. Replace the compressor housing cover and gasket. Install the four cover screws. Do not over-tighten.

## Add Part Number of New Shimless Version Pump to Replacement Parts List

In the "Servicing" chapter at "Replacement Parts List", add the following part number and description of the new version pump repair kit below the existing pump repair kit part number as follows:

---

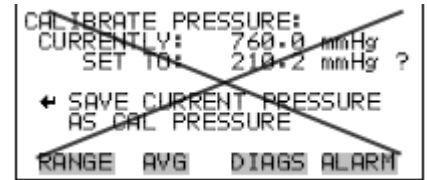
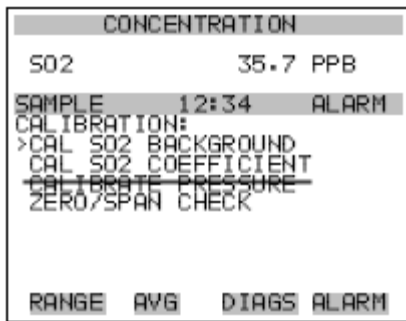
108002-00

Pump Repair Kit (for pump 111553-00 new shimless version)

---

## 42i and 43i - All Variants

In the "Operation" chapter, remove Cal Pressure screens (because they were never used), under calibration menus, as shown in the following example:

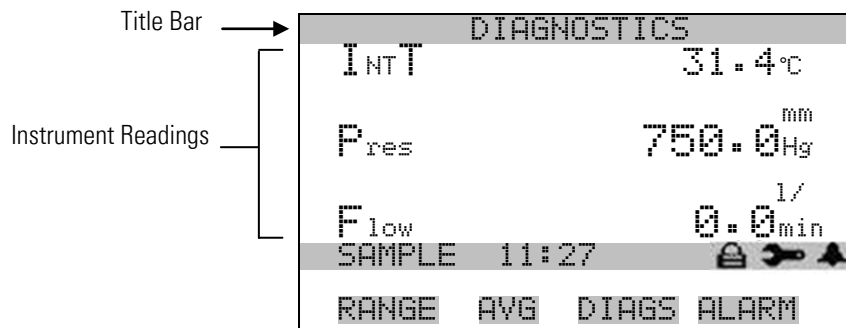


## 42i, 43i, and 48i - All Variants

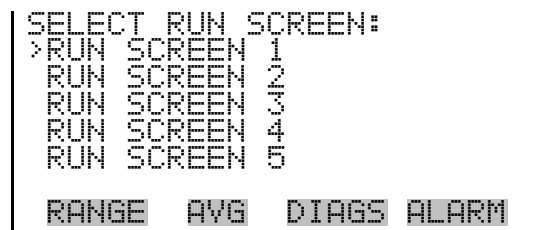
**Add Setup Run Screens** Add Setup Run Screens to the Service menu as follows:

**Setup Run Screens** The Setup Run Screens menu is used to define and edit up to five custom Run screens. The Setup Run Screens menu is visible only when the instrument is in the Service mode.

### Custom Run Screen



- In the Main Menu, choose Service > **Setup Run Screens**.



The Select Run Screen menu is used to display the Run screen editor.

- In the Main Menu, choose Service > Setup Run Screens > **Select a Run Screen**.

## Edit Run Screen

The Edit Run Screen menu is used to edit the contents of the custom run screen. This menu allows the user to edit the run screen title, toggle the run screen ON and OFF, and specify the number of items to be displayed on the Run screen (1-10).

### Edit Run Screen






```
EDIT RUN SCREEN:
>EDIT TITLE
ENABLED                                OFF
NUMBER OF ITEMS                        8
ITEM 1                                  TEMP
ITEM 2                                  PRES↓
RANGE  AVG  DIAGS  ALARM
ITEM 8                                FLOW
```

## Edit Title

The Edit Title screen is used to edit the contents of the title bar on the selected Custom Run screen.



- In the Main Menu, choose Service > Setup Run Screens > **Select a Run Screen** > **Edit Title**.

```
EDIT RUN SCREEN TITLE:
DIAGNOSTICS
ABCDEF GHIJKLMN BKSP
OPQRST UVWXYZ   PAGE
0123456789 . / - SAVE
RANGE  AVG  DIAGS  ALARM
```

Use , , , and  to position the cursor on the title, the characters, and the BKSP, PAGE, and SAVE selections. Use  to select a character or the BKSP, PAGE, and SAVE selections.

The BKSP selection is used to backspace the cursor in the title. The PAGE selection toggles the characters between upper case and lower case. The SAVE selection is used to save changes made to the 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 on Run screen 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, and Run screens 1, 4, and 5 are ON, scrolling down through the available Run screen displays will display only Run screens 1, 4, and 5.

- In the Main Menu, choose Service > Setup Run Screens > *Select a Run Screen* > **Enabled**.

```

ENABLE/DISABLE RUN SCREEN:
CURRENTLY:                OFF
SET TO:                   ON ?

      ← TOGGLE VALUE

RANGE  AVG  DIAGS  ALARM
  
```

**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 the 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 > Setup Run Screens > *Select a Run Screen* > **Number of Items**.

```

SET NUMBER OF ITEMS:
CURRENTLY:                5
SET TO:                   4 ?

↑↓ CHANGE VALUE    ← SAVE

RANGE  AVG  DIAGS  ALARM
  
```

**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.

**Note** The Analog Inputs selection is displayed only if the optional I/O expansion board is installed. ▲

- In the Main Menu, choose Service > Setup Run Screens > *Select a Run Screen* > **Item number**.

```

SELECT RUN SCREEN ITEM:
CONCENTRATIONS
OTHER MEASUREMENTS
ANALOG INPUTS

RANGE  AVG  DIAGS  ALARM

```

## Concentrations

The Concentrations screen is used to display a list of concentration parameters that can be specified for the selected item number.

- In the Main Menu, choose Service > Setup Run Screens > *Select a Run Screen* > Item *number* > **Concentrations**.

### 42i Screen

```

CONCENTRATIONS:
>NONE
NO
NO2
NOx
LO NO
LO NO2
LO NOx
RANGE  AVG  DIAGS  ALARM

```

```

HI NO
HI NO2
HI NOx
RANGE (NOx)

```

### 43i Screen

```

CONCENTRATIONS:
>NONE
SO2
LO SO2
HI SO2
RANGE (SO2)
RANGE  AVG  DIAGS  ALARM

```

### 48i Screen

```
CONCENTRATIONS:
>NONE
CO                                <---
RANGE STATUS

RANGE  AVG  DIAGS  ALARM
```

### Other Measurements

The Other Measurements screen is used to display a list of non-concentration parameters that can be specified for the selected item number.

- In the Main Menu, choose Service > Setup Run Screens > *Select a Run Screen* > Item number > **Other Measurements**.

### 42i Screen

```
OTHER MEASUREMENTS:
>NONE
INT TEMP
CHAMBER TEMP
COOLER TEMP
NO2 CNV TEMP
PERM OVN GAS
PERM OVN HTR
↓

RANGE  AVG  DIAGS  ALARM
```

```
CHAMBER PRES
FLOW
PMT VOLTS
OZONATOR FLOW
EXT ALARMS
NO2 RNGCNC
DILUTION RATIO
```

### 43i Screen

```
OTHER MEASUREMENTS:
>NONE
INT TEMP                                <---
CHAMBER TEMP
PERM OVN GAS
PERM OVN HTR
CHAMBER PRES
SAMPLE FLOW
↓

RANGE  AVG  DIAGS  ALARM
```

```
DILUTION RATIO
```

### 48i Screen

```
OTHER MEASUREMENTS:
>NONE
S/R
INTERNAL TEMP
CHAMBER TEMP
CHAMBER PRES
SAMPLE FLOW
INTENSITY
RANGE  AVG  DIAGS  ALARM
MOTOR SPEED
DILUTION RATIO
```

### Analog Inputs

The Analog Inputs screen is used to display a list of analog inputs that can be specified for the selected item number.

- In the Main Menu, choose Service > Setup 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
RANGE  AVG  DIAGS  ALARM
ANALOG IN 8
```

### Change Perm Oven Calibration Resistance

### 42i, 43i, 43i TLE and 146i

In the “Optional Equipment” chapter of instruments with the perm oven option, change the value of the resistance used in the procedures from 3.8K Ohms to 4.2K Ohms.

### Change Set PMT Voltage

### 43i All Variants

In the “PMT Voltage Adjustment” section of the “Operation” chapter, change the “Set PMT” voltage to include a minus sign as shown in the highlighted example that follows:

```

SET PMT VOLTAGE:
SET PMT:      -XXX.X V
COUNTS:      2254

      ↑↓ INC/DEC
      ← SAVE VALUE

RANGE  AVG  DIAGS  ALARM

```

### Change PMT Supply Voltage

In the “Interface Board Voltages” section of the “Operation” chapter, change the “PMT Supply” voltage to include a minus sign as shown in the highlighted example that follows:

```

INTERFACE BOARD VOLTAGES:
PMT SUPPLY      -XXX.X V
FLASH SUPPLY    1000.0 V
3.3 SUPPLY      3.3 V
5.0 SUPPLY      5.0 V
15.0 SUPPLY     15.0 V
-15.0 SUPPLY    -15.0 V
24.0 SUPPLY     24.0 V

RANGE  AVG  DIAGS  ALARM

```

### Add Teflon Particulate Filter

In the “Replacement Parts List” of the “Servicing” chapter, add the Teflon particulate filter option, if it is not already included:

---

|           |                                    |
|-----------|------------------------------------|
| 102701-00 | Teflon particulate filter (option) |
|-----------|------------------------------------|

---

### Replace Input Board Description and Part Number

In the “Replacement Parts List” of the “Servicing” chapter, replace the input board description and part number so that it will include the case:

---

|           |                      |
|-----------|----------------------|
| 102273-00 | Input Board Assembly |
|-----------|----------------------|

---

## 43i HL

### Heated Kicker Option

Add information for the heated kicker option to the 43i HL instruction manual as follows:

Add the following heated kicker description and part number to the “Replacement Parts List” in the “Servicing” chapter:

---

|           |                                    |
|-----------|------------------------------------|
| 104123-00 | Kicker Assembly, Heated (optional) |
|-----------|------------------------------------|

---



## Heated Kicker Replacement

Add the following heated kicker replacement procedure to the “Servicing” chapter:

Use the following procedure to replace the optional heated kicker assembly.

Equipment Required:

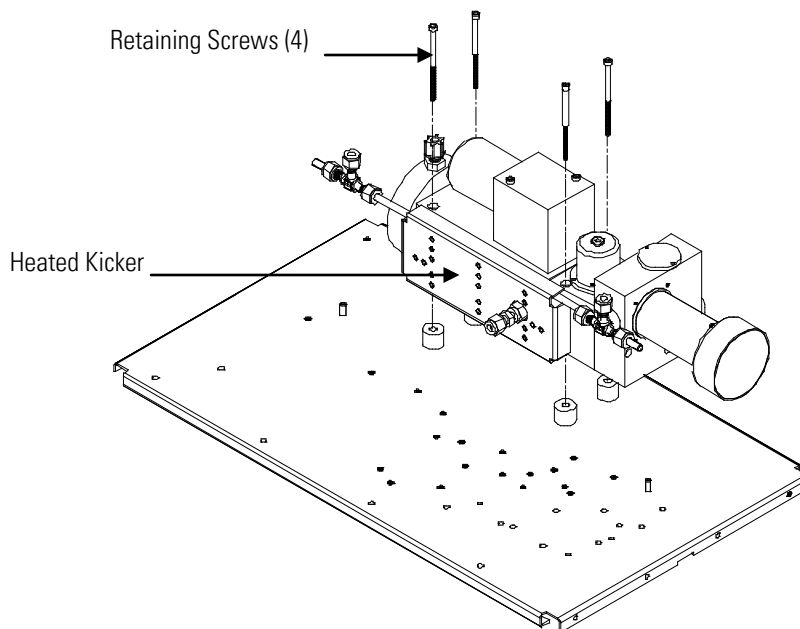
Heated kicker assembly (optional)

Allen wrench, 5/32-inch



**Equipment Damage** Some internal components can be damaged by small amounts of static electricity. A properly ground antistatic wrist strap must be worn while handling any internal component. ▲

1. Turn instrument OFF, unplug the power cord, and remove the cover.
2. Using a 5/32-inch Allen wrench, remove the four optical bench retaining screws.
3. Disconnect the plumbing connections as appropriate to gain enough clearance to lift the optical bench off the heated kicker. Carefully note the plumbing connections to facilitate reconnection.
4. Remove the heated kicker from the optical bench.
5. Install the new heated kicker assembly.
6. Reposition the optical bench on top of the heated kicker, insert and tighten the four optical bench retaining screws, and reconnect any plumbing connections by following the previous steps in reverse order.
7. Calibrate the instrument. Refer to the “Calibration” chapter in this manual.



### Replacing the Kicker Assembly (Optional Heated Kicker)

Add the following heated kicker description to the “System Description” chapter:

#### **Heated Hydrocarbon Kicker (Optional)**

The hydrocarbon kicker removes hydrocarbons from the gas stream while leaving the SO<sub>2</sub> concentration unaffected. It operates on a selective permeation principle using differential pressure to force hydrocarbon molecules to pass through the tube wall. The differential pressure is created across the tube wall as sample gas passes through a capillary tube which reduces its pressure. The sample gas is then fed to the shell side of the hydrocarbon kicker.

The optional heated hydrocarbon kicker is used in applications requiring more efficiency than the standard kicker. The heated kicker operates at the same temperature as the optical bench and requires no additional power.

Add the following heated kicker description to the “Optional Equipment” chapter:

#### **Heated Hydrocarbon Kicker**

The optional heated hydrocarbon kicker is used in applications requiring increased efficiency. The heated kicker operates at the same temperature as the optical bench and requires no additional power.

## **43i, 43i TLE, 43iHL and 450i**

### **Replace Flash Intensity (Photocell) Assembly Part Number**

In the “Replacement Parts List” of the “Servicing” chapter, replace the flash intensity (photocell) assembly part number:

---

|           |                                      |
|-----------|--------------------------------------|
| 120242-00 | Flash Intensity (Photocell) Assembly |
|-----------|--------------------------------------|

---

## **46i and 46iHL**

### **Replace Optical Switch Assembly, Purge option Part Number**

In the “Cable List” of the “Servicing” chapter, replace the optical switch assembly, purge option part number:

---

|           |                                       |
|-----------|---------------------------------------|
| 119733-01 | Optical Switch Assembly, Purge option |
|-----------|---------------------------------------|

---

## **46i, 46iHL, 48i, 48iTLE, and 48iHL**

### **Replace Optical Switch Part Number**

In the “Replacement Parts List” of the “Servicing” chapter, replace the optical switch part number:

---

|           |                |
|-----------|----------------|
| 119732-00 | Optical Switch |
|-----------|----------------|

---

## **49i and 49i PS**

### **Ozonator Solenoid**

Add the following ozonator solenoid description to the “Instrument Controls” menu in Chapter 3 following “Custom Levels.”

“The Ozonator Solenoid screen is used to switch the ozonator solenoid on and off. When the ozonator solenoid is on, the output of the internal ozonator is fed into the analyzer. When the ozonator solenoid is off, the output of the internal ozonator is fed to the manifold.”

### **Add “Pump Off” to Instrument Action List**

For 49i PS, in Chapter 3 at Digital Input Settings > Select Relay > **Instrument Action**, add “Pump Off” to the end of the Choose Action list.

For 49i PS, in Chapter 8 at the “Digital Inputs” section, add “Pump Off” to the digital input list.

### **Remove References to Ozonator Solenoid**

For 49i PS, remove references to “ozonator solenoid.”

## Replace Measurement Interface Board Description and Part Number

### 60i

In the “Replacement Parts List” of the “Servicing” chapter, replace the measurement interface board description and part number:

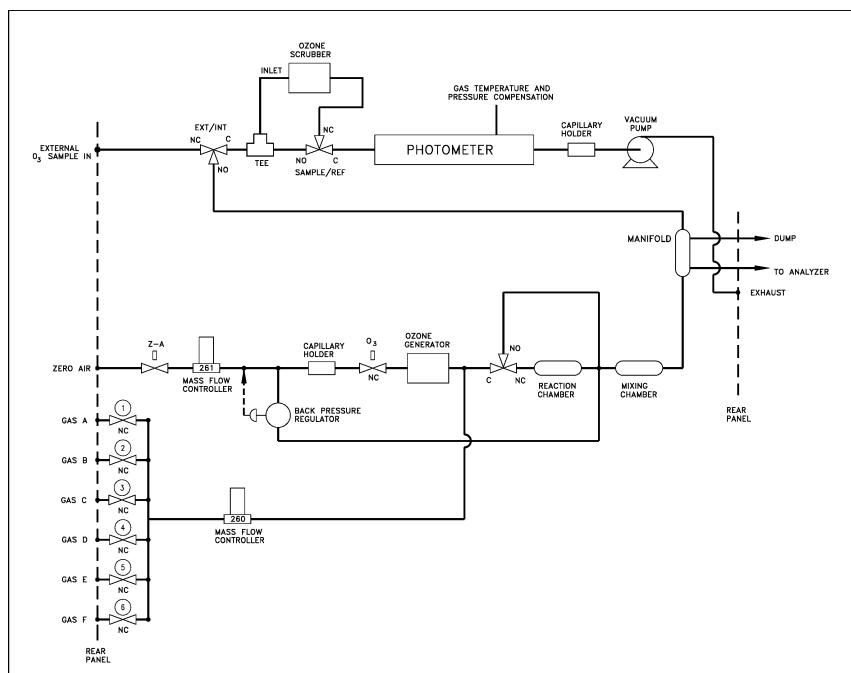
109031-00

Measurement Interface Board

### 146i

## Add New Scrubber Configuration

Add a new flow diagram to Chapter 1 “Introduction” to show the hardware/plumbing configuration for a standard gas dilution system with ozonator, photometer and scrubber options.



**Figure 1–7.** Standard Gas Dilution System with Ozonator, Photometer and Scrubber Options

## Add Photometer Timer Note

Add the following note to Chapter 1 “Photometer,” Chapter 3 “Run Screen,” “Operation” screen, “Flow Modes,” and Program > Events.

**Note** When the photometer is turned on, a 240-second countdown timer is initiated to allow the photometer lamp to stabilize. No O<sub>3</sub> measurements are taken until this time has elapsed. ▲

### Change Gas Setup Menu

In the “Gas Setup Menu” section of the “Operation” chapter, change “solenoid” to “input” and “GAS SOL” to “GAS INPUT” and update the screen example that follows:

```
GAS A SETUP:
>GAS NAME      GAS A
GAS INPUT      A
TANK CONC      100.000 PPM
ZERO           2000 PPM
SPAN 1         10.000 PPM
SPAN 2         8.000 PPM
SPAN 3         5.000 PPM

RANGE  AVG  DIAGS  ALARM
```

### Change Gas Solenoid Screen

In the “Gas Solenoid” section of the “Operation” chapter, change “SOLENOID” to “INPUT”, but leave allowable selections as-is.

### Add Note to Alarms Menu

If a particular subsystem is turned off, then its associated alarms will always be evaluated as OK. For example, if the ozonator lamp is not up to temperature, but the ozonator is turned off, then the ozonator lamp temperature alarm will read as OK until the ozonator is turned on.

### Add Flow Controller Calibration Note

Add the following note to the Zero Flow Calibration description and the Gas Flow Calibration description, in Chapter 3, under the Service section, and to the Mass Flow Controllers procedure in Chapter 4:

**Note** Turn off the ozonator, permeation oven, and photometer functions before performing a flow controller calibration, as these functions may affect the measured flow at the manifold. ▲

### Replace Valve Assembly Part Number

In the “Replacement Parts List” of the “Servicing” chapter, replace the solenoid, span gas part number:

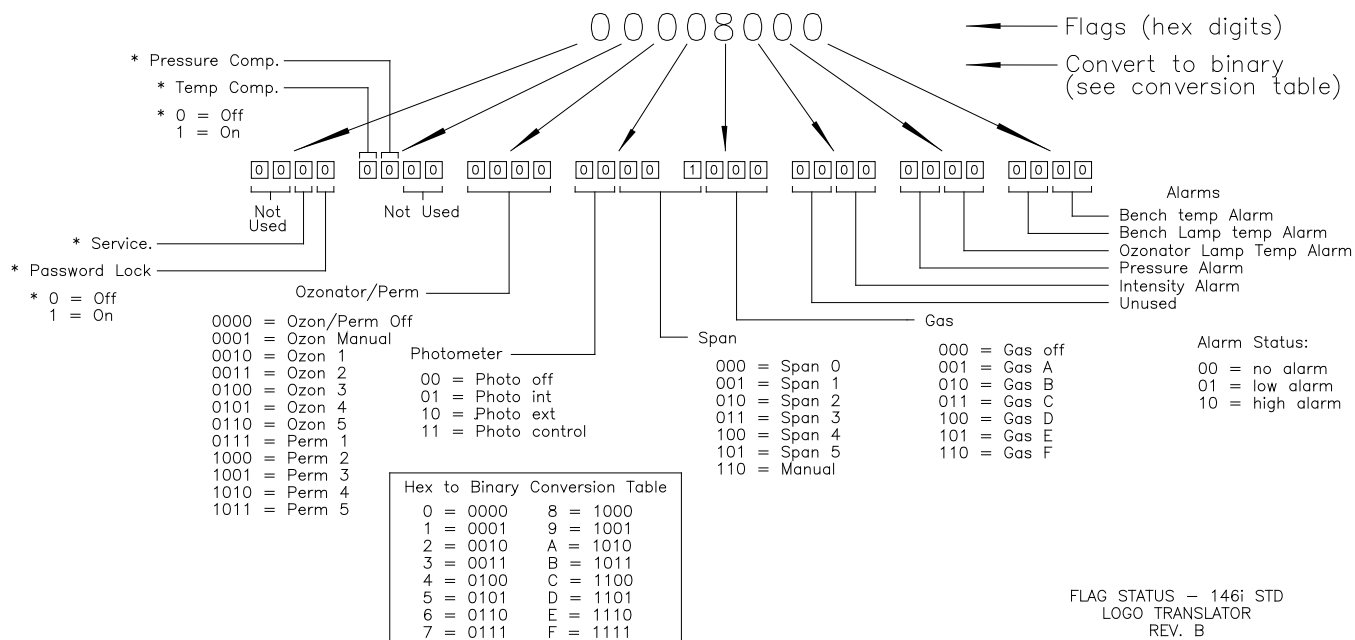
---

|           |                    |
|-----------|--------------------|
| 121261-00 | Solenoid, span gas |
|-----------|--------------------|

---

**Add Password Lock and Service to Flags Map**

Modify the Flags map, Figure B-1, to include Password Lock – fourth bit from the left, and Service - third bit from the left.



**Figure B-1. Flags**

**Add Selections to Gas Flow Controller**

At the Gas Flow Controller topic in the Service Menu section of the “Operation” chapter, add the following highlighted text to the end of the second sentence:

Allowable selections are: 25, 50, 100, 200, and 500 sccm; and 5, 10, 15, and 20 slm.

**Change Gas Units to Lower Case**

Change gas units in the screens to lower case.



**5020i**

**Add STP/Ambient**

Add “STP/Ambient” to the list of Other Measurements in the Datalogging Settings menu, Streaming Data Configuration menu, and Analog Output Configuration menu.

## 42i, 43i, 48i, 49i, 146i

### Chinese Language Support

*i*Series models 42*i*, 43*i*, 48*i*, 49*i* and 146*i* now include Chinese translations for the front-panel user interface. The following LANGUAGE screens have been added in the SERVICE menu. Use the UP and DOWN ARROW keys to select the desired language, then press the ENTER key to save the selection:



A special key sequence is available to jump into this language screen. From the MAIN MENU press the RIGHT ARROW key twice to jump into the language selection screen and select the desired language. Also, a new Clink “language” command has been added. Use “set language 1” to set the language to English or “set language 2” to set the language to Chinese, then use “set save params” to save the new setting.

## 2000i, 2000iD, 2025i, 2025iD

### Add UKCA to Certifications

On the cover, replace CE label with CE/UKCA label.

In the “Electrical and Safety Conformity” section, replace CE label with CE/UKCA label.

In the “Advanced Features” section (2000*i*/2000*i*D only), replace CE with CE/UKCA.

In the “Specifications” section, replace CE label with CE/UKCA label.

**Course PM Equation** Change the equation for *course* PM (using equation 2) from 28.8  $\mu\text{g}/\text{m}^3$  to 28.08  $\mu\text{g}/\text{m}^3$ .

### **5014i, 5030i**

**Add UKCA to Certifications** In the “Electrical/Safety Certifications” section, add UKCA.  
In the “Specifications” section, replace CE with CE/UKCA.