TD-4100 ON-LINE HYDROCARBON IN WATER MONITOR



TURNER DESIGNS
Hydrocarbon Instruments

2023 North Gateway, Suite 101 Fresno, CA 93727 USA
Tel: +1 559 253 1414 Fax:: +1 559 253 1090
Sales & Marketing E: sales@oilinwatermonitors.com
Application Support E: service@oilinwatermonitors.com
Website: www.oilinwatermonitors.com

Revision A *4/18/2006*

Special Note to Readers

Turner Designs Hydrocarbon Instruments, hereinafter known as TDHI, have made every reasonable effort to ensure the accuracy and completeness of this revision of the document. However, we encourage all readers to provide us with suggestions for overall improvement. Please report errors, omissions, or inconsistencies to TDHI.

About This Guidance

This guide provides detailed instructions for the design, site preparation, installation, operation, and maintenance of the TD-4100 on-line hydrocarbon monitor. This document is divided into the following chapters:

Preface: Includes special notes to readers, and safety protocol used within the guidance, along with the guidance table of contents.

Section 1 – INTRODUCTION: Details the theory of operation of the TD-4100 on-line hydrocarbon in water monitor.

Section 2 – DESIGN INFORMATION: Details typical applications; and location, offsite, and process considerations.

Section 3 – INSTALLATION: Details the typical TD-4100 installation program from receipt of instrument through mounting the instrument, and completing piping and electrical connection.

Section 4 – OPTIONS & ACCESSORIES: Details instrument options and accessories including: design, installation, start up, operations, maintenance, troubleshooting, and spares information for each option.

Section 5 – START UP: Details a typical TD-4100 start up program.

Section 6 – CALIBRATION: Details the typical calibration types.

Section 7 – OPERATION: Provides routine unit tour checks to ensure continued trouble-free performance of the TD-4100.

Section 8 – TROUBLESHOOTING: Provides a troubleshooting guide for the base instrument. Refer to OPTIONS & ACCESSOIES section for options troubleshooting information.

Section 9 – MAINTENANCE: Provides routine procedures that must be performed to ensure continued trouble-free performance of the TD-4100.

Section 10 – CHARTS: Provides a TD-4100 quick start flow chart, and a key sequence menu chart.

Section 11 – GENERAL ARRANGEMENT DRAWINGS: Includes a typical non-hazardous location TD-4100 general arrangement drawing and a typical hazardous location TD-4100 general arrangement drawing.

Section 12 – FORMS: Includes a copy of the Customer Application Survey used to communicate the application details to TDHI to access the viability of your application, a

copy of the Installation Checklist to permit your accessing the TD-4100's preparedness for commissioning, a Commissioning Checklist to document the TD-4100 configurations, a copy of the Troubleshooting Worksheet to help with troubleshooting, and a copy of the Typical Instrument Data Sheet to help with instrument specification.

Section 13 – GLOSSARY: Provides a reference list of TD-4100 terms and definitions.

Section 14 – LEGAL & WARRANTY: Details legal and warranty information and provides contact information for both domestic and international dealers / representatives.

Safety

The design of the TD-4100 includes many safety features. Nevertheless, there are hazardous areas within the TD-4100 and operational hazards associated with the TD-4100. For the purposes of this guidance, safety hazards are categorized as Electrical, Ultraviolet Light, and Acid.

Electrical Symbol

The TD-4100 may be powered either by 115-230VAC 50/60 Hz 1ф or 21-56 VDC. Site-specific procedures should be followed consistent with the instrument power supply configuration.



NOTICE: When performing procedures described in this guidance, heed all caution and warning signs to avoid damaging static sensitive components, and contacting sensing high voltage power circuitry (up to 1000 VDC).

Ultraviolet Radiation Symbol

The TD-4100 uses ultraviolet light for detection purposes. Exposure to ultraviolet radiation can cause permanent damage to the eyes and blindness.



NOTICE: TDHI recommend you wear approved protective goggles whenever there is a potential for exposure to ultraviolet radiation from the ultraviolet lamp. If you do not have access to approved protective goggles, TDHI recommend electrically isolating the instrument before opening either the view port cover or removing or exchanging the lamp.

Acid Symbol

To removing scale build up from the TD-4100 optical windows and/or sample conditioning system, it may require preparation of, and working with, dilute hydrochloric acid. Exposure to concentrated hydrochloric acid can cause sever burns if it comes in contact with skin and can cause permanent damage eyes. This guidance describes preparation and working with these solutions. Heed all caution and warning signs and site-specific procedures to avoid acid exposure.



NOTICE: Site-specific procedures should be followed when handling and working with hydrochloric acid solutions, which should include PPE and acid handling apparatus.

Notice, Warning, and Caution Symbol

This document provides:



NOTE: Statements that convey important information.



WARNING: Statements that identify conditions or practices that could result in personal injury.



CAUTION: Statements that point out conditions or practices that could result in damage to the TD-4100 or violation of application regulations.

TABLE OF CONTENTS

Special Note to Readers ii
About This Guidance ii
Safety iii
Electrical Symbol iii
Ultraviolet Radiation Symbol iii
Acid Symbol iii
Notice, Warning, and Caution Symbol iv
TABLE OF CONTENTS v
1 INTRODUCTION 1-1
Theory of Operation 1-1
Non Aromatic Hydrocarbon and Hydrocarbon Mixtures 1-2
2 DESIGN INFORMATION 2-1
Response to your Customer Application Survey 2-2
TDHI say they can measure your oil in water 2-2
2.1 Analyzer Location 2-2
2.1.1 Environmental Conditions 2-2
2.1.2 Site Considerations 2-3
2.1.3 Mounting Considerations 2-3
2.2 Offsite Requirements 2-5
2.2.1 Electrical Power 2-5
2.2.2 Instrument Air 2-5
2.2.2.1 Design Information 2-5
2.2.2.2 Installation – Piping Connection 2-6
2.2.3 Cooling Water (Option) 2-6
2.2.3.1 Design Information 2-6
2.2.3.2 Installation – Piping Connection 2-6
2.3 Process Requirements 2-7

2.3.1 Analyzer Sample Return / Sample Drain 2-7
2.3.1.1 Design Information 2-7
2.3.1.2 Installation – Piping Connection 2-8
2.3.2 Analyzer Sample Supply 2-8
2.3.2.1 Design Information 2-9
2.3.2.2 Installation – Piping Connection 2-10
2.3.2.3 Operational Considerations 2-11
2.4 Typical Installation Drawings 2-12
2.5 Analyzer Calibration 2-16
2.5.1 Raw Fluorescence Calibration 2-16
2.5.2 Direct Callibration 2-16
2.5.3 Correlation Calibration 2-16
2.6 Approval Qualifications 2-17
2.6.1 International Maritime Organization IMO Qualifications 2-17
2.6.2 United States Coast Guard (USCG) Qualifications 2-18
2.7 TDHI Design Review 2-19
3 INSTALLATION 3-1
3.1 Typical Installation Program 3-1
3.1.1 Unpack the Analyzer 3-1
3.1.2 Part Number Legend 3-4
3.1.3 Typical Weight Reporting 3-5
3.1.4 Typical Weight Reporting 3-6
3.1.5 Installing the Analyzer Wall Mounting Strut Frame 3-8
3.1.6 Installing the Bubbletrap 3-8
3.1.7 Installing the Flowcell Drain 3-10
3.1.8 Install Compressed Air Water Trap Bowl 3-11
3.1.9 Completing the Electrical Hookup 3-12
3.1.10 User External System-Function Alarm 3-13
3.1.11 Monitor Terminal Strip 3-13
3.1.12 Completing the Piping Tie-Ins 3-14
4 OPTIONS & ACCESSORIES 4-1
4.1 Options 4-1
4.2 Accessories 4-2
4.2.1 Materials Supplied with the TD-4100 4-2
4.2.2 Accessories and Spares Supplied at Additional Cost 4-3

4.3 Hazardous Area Purge System 4-4
4.3.1 Class 1 Division 2 Certified Safety Air Purge System 4-4
4.3.1.1 Design Information 4-4
4.3.1.2 Installation – Piping Connection 4-4
4.3.1.3 Installation – Electrical Connection 4-5
4.3.1.4 Start Up 4-5
4.3.1.5 Operations 4-6
4.3.1.6 Maintenance 4-6
4.3.1.7 Troubleshooting 4-6
4.3.1.8 Spares 4-6
4.4 Analyzer Power and Control Options 4-7
4.4.1 Power Supply 4-7
4.4.1.1 90 - 240 VAC, 50 / 60Hz (standard configuration) 4-7
4.4.1.1.1 Design Information 4-7
4.4.1.1.2 Installation – Electrical Connection 4-7
4.4.1.2 21-56 VDC Power Option 4-8
4.4.1.2.1 Design Information 4-8
4.4.1.2.2 Installation – Electrical Connection 4-8
4.4.1.3 Start Up 4-9
4.4.1.4 Troubleshooting 4-9
4.4.1.5 Spares 4-10
4.4.2 Alarm Outputs 4-10
4.4.2.1 Design Information – Solid State AC Relays (Standard) 4-11
4.4.2.2 Design Information – Solid State DC Relays (Optional) 4-11
4.4.2.3 Installation – Electrical Connection 4-11
4.4.2.3.2 Alarm Monitor Connections 4-11
4.4.2.3.2 Alarm Monitor and Process Connections 4-11
4.4.2.4 Start Up 4-12
4.4.2.5 Troubleshooting TD-4100 Alarms 4-12
4.4.2.6 Spares 4-13
4.4.3 Analog Output 4-14
4.4.3.1 4 – 20 and 0 – 20 mA Output (Standard) 4-14
4.4.3.1.1 Design Information 4-14
4.4.3.1.2 Installation – Electrical Connection 4-14
4.4.3.2 HART™ Output (Optional) 4-14
4.4.3.2.1 Design Information 4-14
4.4.3.2.2 Installation – Electrical Connection 4-15
4.4.3.3 Start up 4-15
4.4.3.4 Troubleshooting 4-15
4.4.3.5 Spares 4-16
4.5 Ambient Temperature Options 4-17

4.5.1 Enclosure Vortex Air Cooler 4-17
4.5.1.1 Design Information 4-17
4.5.1.2 Start Up 4-18
4.5.1.3 Operations 4-18
4.5.1.4 Maintenance 4-18
4.5.1.5 Troubleshooting 4-19
4.5.1.6 Spares 4-19
4.6 Sample Cooler Option 4-20
4.6.1 Design Information 4-20
4.6.1.1 Installation – Piping Connection 4-21
4.6.1.2 Start Up 4-21
4.6.1.3 Operations 4-21
4.6.1.4 Maintenance 4-21
4.6.1.5 Troubleshooting 4-22
4.6.1.6 Spares 4-22
4.7 Wetted Materials Options 4-23
4.8 Air Supply Options 4-24
4.8.1 Site Air is not Instrument Quality (Permanent Membrane Air Dryer Option) 4-24
4.8.1.1 Design Information 4-25
4.8.1.2 Installation – Piping Connection 4-26
4.8.1.3 Start Up 4-26
4.8.1.4 Operations 4-26
4.8.1.5 Maintenance 4-26
4.8.1.5.1 Procedure for Element Replacement 4-27
4.8.1.6 Troubleshooting 4-28
4.8.1.7 Spares 4-28
4.8.2 Air Compressor (Air Supply Option) 4-29
4.8.2.1 Design Information 4-29
4.8.2.2 Installation – Electrical Connection 4-30
4.8.2.3 Installation – Location 4-30
4.8.2.4 Installation – Piping Connection 4-31
4.8.2.5 Start Up 4-31
4.8.2.6 Operations 4-31
4.8.2.7 Maintenance 4-32
4.8.2.8 Troubleshooting 4-33
4.8.2.9 Spares 4-35
4.9 Optical Kit 4-36
4.9.1 Spares 4-36
4.10 IMO Datalogger 4-38

4.10.1 Design Information 4-38
4.10.2 Installation - Location 4-39
4.10.3 Installation - Mounting 4-39
4.10.4 Installation – Electrical Connections 4-39
4.10.5 Start Up 4-43
4.10.6 Operations 4-43
4.10.7 Maintenance 4-45
4.10.8 Troubleshooting 4-46
4.10.9 Spares 4-46

4.11 Sample Port 4-47
4.11.1 Introduction 4-47
4.11.2 Operations 4-47

5 START UP 5-1
5.1 Application Specialist Assisted 5-1
5.2 Non-application Specialist Assisted 5-1
5.3 Typical Start up Sequence 5-3
5.3.1 Start up Sequence Stage 1 5-3
5.3.2 Start up Sequence Stage 2 5-4
5.3.3 Start up Sequence Stage 3 5-5
5.3.3.1 Enter Master ID 5-6
5.3.3.2 Configure Relay Output Shelf State 5-7
5.3.3.3 Test Analyzer Relay Outputs 5-8
5.3.3.4 Tune Analyzer Analog Output 5-9
5.3.3.5 Set Analyzer Display Units 5-11
5.3.4 Start up Sequence Stage 4 5-12
5.3.4.1 Monitor and Set Zero Alarm – Relay A (System-function Alarm) 5-12
5.3.4.2 Monitor and Set Early Warning Alarm – Relay B (Sample-level alarm) 5-14
5.3.4.3 Monitor and Set High Alarm – Relay A (System-function Alarm) 5-15
5.3.4.4 Set the Alarm Delay 5-16
5.3.5 Start up Sequence Stage 5 5-17
5.3.5.1 Configure Analog Output Low Limit 5-17
5.3.5.2 Configure Analog Output High Limit 5-18
5.3.6 Start up Sequence Stage 6 5-20
5.3.7 Start up Sequence Stage 7 5-23
5.3.7.1 Analyzer Sensitivity 5-23

6 CALIBRATION 6-1
6.1 Introduction 6-1
6.1.1 Direct Calibration 6-1
6.1.1.1 Raw Fluorescence 6-1
6.1.1.2 Quantitative Calibration 6-1
6.1.1.3 Selecting Raw Fluorescence or Quantitative Direct Calibration Mode 6-2
6.1.2 Correlation Calibration 6-2
6.2 Application Specialist Assisted 6-4
6.2.1 Raw Fluoresence 6-4
6.2.2 Direct Calibration 6-5
6.2.3 Correlation Calibration 6-5
6.2.4 Training 6-6
6.3 Non-application Specialist Assisted 6-7
6.4 RAW FLUORESCENCE CALIBRATION 6-8
6.4.1 When Prompted Enter User ID 6-9
6.4.2 Reset Calibration Data to Default 6-10
6.4.3 Blank Calibration Sequence (Optional, If Blank Available) 6-11
6.4.4 Monitor Level Display 6-12
6.4.5 Set CheckPOINT™ Solid Standard 6-13
6.5 DIRECT CALIBRATION 6-15
6.5.1 When Prompted Enter User ID 6-16
6.5.2 Reset Calibration Data to Default 6-17
6.5.3 Standard Preparation 6-18
6.5.4 Blank Calibration Sequence 6-19
6.5.5 Calibration Solution Sequence 6-20
6.5.6 Calibration Standard Concentration Entry 6-22
6.5.7 Set CheckPOINT™ Solid Standard 6-24
6.6 CORRELATION CALIBRATION 6-26
6.6.1 When Prompted Enter User ID 6-27
6.6.2 Reset Calibration Data to Default 6-28
6.6.3 Sample Collections 6-29
6.6.4 Develop the Calibration Curve 6-31
6.6.5 Calculate the Calibration Range Limits 6-32
6.6.6 Setting the Calibration Range Limits 6-33
6.6.7 Set CheckPOINT™ Solid Standard 6-36
6.6.8 Artificially Creating A Low Concentration Standard (Optional) 6-37

6.7 CHECKPOINT™ SOLID STANDARD USE AND ADJUSTMENT 6-38
6.8 PREPARING 0 – 20 PPM CALIBRATION STANDARD SOLUTIONS 6-44
6.9 PREPARING 20 - 200 PPM CALIBRATION STANDARD SOLUTIONS 6-50
7 OPERATIONS 7-1
7.1 Getting Started 7-1
7.1.1 Home Screen 7-1
7.1.2 Alarms 7-1
7.2 Routine Unit Tours 7-3
7.3 Increase LCD Contrast 7-4
7.4 Decrease LCD Contrast 7-4
7.5 Entering User ID 7-5
7.6 Entering Master ID 7-6
7.7 Changing User ID 7-7
7.8 Correcting a Numeric Data Entry 7-9
7.9 Reviewing Instrument Firmware 7-10
7.10 Reviewing Diagnostic Screens 7-11
7.11 Reviewing Master Diagnostic Screens 7-12
7.12 Displaying Current Alarms 7-13
7.13 Displaying Alarm History 7-13
7.14 System-function Alarm Troubleshooting 7-14
7.15 Clearing Alarm History 7-15
7.16 Testing System-function Alarm Relay “A” 7-16
7.17 Testing Sample-level Alarm Relay “B” 7-18
7.18 Tune the Low Analog Output Level 7-20
7.19 Tune the High Analog Output Level 7-22
7.20 Setting the Calibration Standard Concentration [Screen 0] 7-24
7.21 Setting the Display Units [Screen 1] 7-26

7.22 Configuring the System-function Alarm Relay “A” [Screen 2] 7-27
7.23 Configuring the Sample-level Alarm Relay “B” 7-28
7.24 Zero Alarm Monitoring [Screen 3] 7-29
7.25 Zero Alarm Level [Screen 3] 7-30
7.26 Early Warning Alarm Monitoring [Screen 4] 7-32
7.27 Early Warning Alarm Level [Screen 4] 7-33
7.28 High Alarm Monitoring [Screen 5] 7-35
7.29 High Alarm Level [Screen 5] 7-36
7.30 Setting the Alarm Delay [Screen 6] 7-38
7.31 Configuring the Analog Output Low Limit Value [Screen 7] 7-39
7.32 Configuring the Analog Output High Limit Value [Screen 8] 7-40
7.33 Reviewing Relay Status [Screen 9] 7-42
7.34 Reviewing Calibration Data 7-43
8 TROUBLESHOOTING 8-1
8.1 Troubleshooting Guide 8-2
9 MAINTENANCE 9-1
9.1 Routine Maintenance 9-1
9.2 Weekly Maintenance Checks 9-2
9.3 Six Month Maintenance 9-4
9.3.1 Lamp Replacement 9-4
9.3.2 Desiccant Plug Replacement 9-7
9.3.3 Activated Carbon Canister Air Filter Replacement 9-8
9.4 Four Year Maintenance 9-11
9.4.1 Optical Filter and Lamp Replacement Sequence 9-11
9.4.2 Sample Block Removal and Installation 9-12
9.4.3 Emission Filter Inspection / Replacement 9-16
9.4.4 Excitation Optical Window Inspection / Replacement 9-18
9.4.5 Excitation Filter Replacement 9-20
9.4.6 NVRAM Replacement 9-22

9.5 Maintenance as Required or as Directed by TDHI 9-26
9.5.1 Optical Window Cleaning 9-26
9.5.2 Cleaning Flow Cell and Sample Tubing Offline 9-27
9.5.3 Cleaning Flow System Online 9-32
9.5.4 Preparing Acidic Cleaning Solutions 9-33
9.5.5 Replacing Calibration Bottle Valve Gasket 9-34
9.5.6 LCD Ribbon Cable Replacement 9-35
9.5.7 LCD Display Replacement 9-39
9.5.8 Keypad Replacement 9-43
9.5.9 Power Supply and Power Supply Fuse Replacement 9-48
9.5.10 Firmware Replacement 9-52
9.5.11 Motherboard Replacement 9-56
10 CHARTS 10-1
10.1 Quick Start Guide 10-1
10.2 Key Sequence Chart 10-5
11 GENERAL ARRANGEMENT DRAWINGS 11-1
11.1 Non-Hazardous Location Base Configuration 11-2
11.2 Hazardous Location Base Configuration 11-7
12 FORMS 12-1
12.1 Customer Application Survey 12-1
12.2 Installation Checklist 12-5
12.2.1 Location & Mounting 12-5
12.2.2 Electrical and Control 12-5
12.2.3 Instrument Air 12-5
12.2.4 Cooling Water (Optional, for Sample Cooler) 12-6
12.2.5 Sample Supply 12-6
12.2.6 Sample Drain / Sample Return 12-6
12.2.7 Additional Equipment / Supplies Required 12-6
12.3 Commissioning Checklist 12-8
12.4 Troubleshooting Worksheet 12-10
12.4.1 General Information 12-10
12.4.2 Physical Inspection 12-11
12.5 Typical Instrument Data Sheet 12-12

13 GLOSSARY 13-1

14 LEGAL & WARRANTY 14-1

14.1 Copyrights 14-1

14.2 Trademarks 14-1

14.3 Right of Change 14-1

14.4 Warranty 14-1

14.5 Warranty Service within the United States of America 14-2

14.6 Warranty Service outside of the United States of America 14-2

14.7 Out-of-Warranty Service 14-3

14.8 International Dealers and Representatives 14-4

14.9 Domestic Representatives 14-9

1 INTRODUCTION

The TD-4100 on-line hydrocarbon in water monitor detects aromatic hydrocarbons in water using fluorometry in combination with a proprietary falling-stream flow cell.

The TD-4100 is able to activate process control devices to stop, divert, or dilute process streams, and permits process monitoring through system-function, and sample-level alarm contact and analogue sample level outputs.

Compared with other hydrocarbon in water detection methods such as ultraviolet or infrared spectrophotometry, the TD-4100 offers:

1. Higher intrinsic sensitivity, from 100 to 1000 times greater than pure absorption detection methods;
2. High selectivity, by “targeted hydrocarbon” optical tuning, minimizing chemical interferences and sample turbidity false alarms; and
3. Low maintenance due to the non-contact, non-fouling falling stream flow cell and the analyzer design which has only one moving part.

Theory of Operation

TD-4100 measures the sample hydrocarbon level via fluorescence. Fluorescent hydrocarbons absorb light at one wavelength and almost instantly emit light at a longer wavelength.

Fluorometers contain five important components:

1. Light Source
2. Excitation Filter
3. Sample Cell
4. Emission Filter
5. Light Detector

The TD-4100 electronics and a highly sensitive light detector allow oil to be detected from the parts-per-million (PPM) to parts-per-billion (PPB) range.

1. Light Source

The TD-4100 light source emits photons over a wide range of wavelengths. The photons from this light source pass through an excitation filter, which narrows the range of wavelengths illuminating the oil in water sample flowing through the falling stream Flow Cell (the TD-4100 Sample Cell).

2. Excitation Filter

The range of wavelengths transmitted through the excitation filter is selected by TDHI to excite the “targeted hydrocarbon” and minimize the impact of other constituents in the water.

3. Sample Cell

While falling through the sample cell, the “targeted hydrocarbon” and possibly other constituents in the water absorb the excitation light and emit longer wavelength light called “fluorescence light”.

4. Emission Filter

The emitted light passes through an emission filter, which narrows the range of wavelengths reaching the photomultiplier tube detector (the TD-4100 light detector).

The range of wavelengths transmitted through the emission filter is selected by TDHI to optimize “target hydrocarbon” response and meet the user required detection range while minimizing the impact of chemical interferences and sample turbidity.

5. Light Detector

When a photon reaches the photomultiplier tube detector, a pulse of electricity is produced. The TD-4100 counts these pulses to determine the “targeted hydrocarbon” concentration in the water falling through the falling stream Flow Cell.

Non Aromatic Hydrocarbon and Hydrocarbon Mixtures

Although not all of the hydrocarbon or hydrocarbon mixtures are aromatic, there are traces of aromatic hydrocarbons in almost all unrefined and refined petroleum products and some non-petroleum products, such as turpentine.

If the proportion of aromatic compounds to total hydrocarbon is constant or nearly constant, fluorescence may be used to provide quantitative oil in water analysis, as the fluorescence intensity per unit concentration is unique to each hydrocarbon or hydrocarbon mixture.

If the proportion of aromatic compounds to total hydrocarbon is not constant, fluorescence may be used to provide semi-quantitative oil in water analysis and may or may not provide quantitative oil in water analysis.

By way of example, if you want to measure crude oil that contains mostly aliphatic hydrocarbons, how can you measure it with fluorescence, which only detects aromatic hydrocarbons?

If the concentration of aliphatic hydrocarbons is proportional to the concentrations of aromatic hydrocarbons, the TD-4100 would be calibrated against the total crude oil concentration comprising both aliphatic and aromatic hydrocarbons.

2 DESIGN INFORMATION

TDHI have successfully applied the TD-4100 to monitor:

1. Oil Content in Bilge Water including fuel oils and lubricating oils.
2. Hydrocarbons in Clean or River Water including cooling water monitoring, steam condensate monitoring, drinking water intake monitoring, and crude oil cargo heater returns.
3. Hydrocarbons in Wastewater including refinery wastewater treatment plant outfalls, industrial wastewater treatment plant outfalls, bilge and ballast water, and desalter tailwater.
4. Process Industries: Turpentine water separator monitoring, and hydrocarbons in reaction water monitoring.



NOTE: Please complete and submit a Customer Application Survey to TDHI for expert advice directly, or through your local TDHI Dealer or Agent (contact information provided in Section 1 Preface and Section 14 Legal & Warranty).

The TD-4100 has been successfully applied to detect the presence of the following fluorescent oils:

1. BTEX compounds (Benzene, Toluene, Ethylbenzene and Xylene)
2. Condensate (natural unrefined light hydrocarbons)
3. Crude oil
4. Diesel
5. Gasoline
2. Heavy fuel oil
3. Jet fuel
4. Kerosene
5. Lubricating oils
6. Phenol

The TD-4100 has been successfully applied to detect the presence of the following non-fluorescent oils when found in combination with the fluorescent oils listed above:

1. Alcohols
2. Aliphatics (straight chain hydrocarbons)
3. Glycol
4. Animal-derived oils
5. Plant-derived oils

Response to your Customer Application Survey

TDHI, after reviewing your Customer Application Survey:

1. May advise you the TD-4100 is able to meet your application and performance requirements and inform you of the recommended optical configuration.
2. May ask you for clarification and / or request you submit additional information and / or samples to ensure the success of your application.
3. May advise you the application as defined in the Customer Application Survey is not viable and suggest common alternatives to your stated requirements.
4. May advise you the application is not viable.

TDHI states they can measure your oil in water

Proper locating of the analyzer, process and offsite connection, and thoughtful consideration of analyzer options and accessories will insure rapid and reliable installation, and trouble free operation of the TD-4100.

2.1 Analyzer Location

2.1.1 Environmental Conditions

1. The TD-4100 enclosure is qualified NEMA 4X, and is suitable for either indoor or outdoor use. The TD-4100 enclosure:
    a. Provides a degree of protection against falling rain, splashing and hose-directed water;
    b. Is undamaged by the formation of ice; and
    c. Resists corrosion.



NOTE: If the TD-4100 is to be installed outdoors, it should be protected from direct sunlight to prevent heat build-up in the electronics enclosure.

2. Due to the operation limits of the PMT detector, the TD-4100:
    a. Must be installed in a location below 6550 ft [2000 m];
    b. Must not be operated in environments containing high helium levels (such as is used in saturation diving); and
    c. Must not be exposed to temperatures greater than 120°F [49°C]. If it is possible the ambient temperature may exceed 120°F [49°C], the vortex air cooler must be specified.

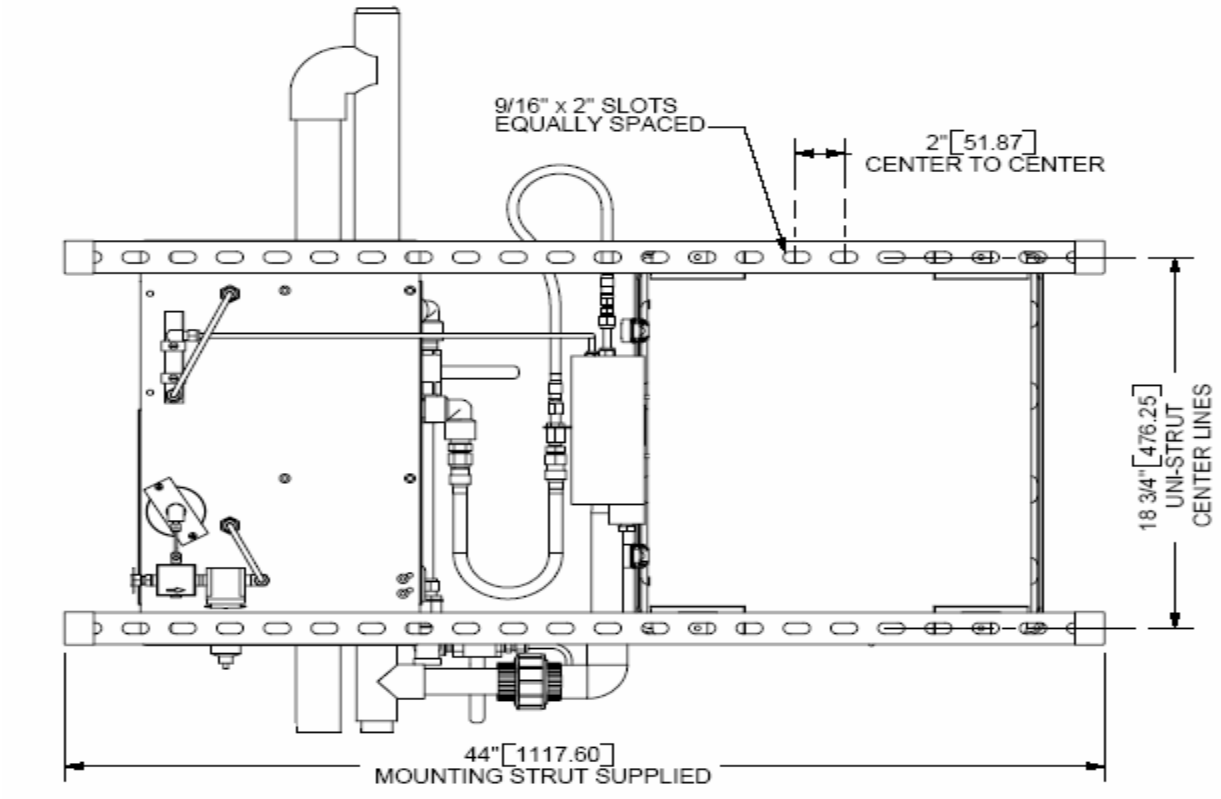
3. Due to operational limits of the LCD display, the TD-4100 must not be exposed to temperatures below than 32°F [0°C].

2.1.2 Site Considerations

1. The analyzer is electromagnetic frequency (EMF) protected. However, TDHI recommends the analyzer be installed a minimum of 10 ft [3 m] from strong electromagnetic field sources such as alternators / generators or large electric motors.
2. The standard TD-4100 is designed to be installed in non-hazardous. To meet hazardous location requirements or provide additional weather protection, the TD-4100 may be fitted a safety air purge system to meet
    a. CEC/NEC Class 1 Division 2 Group A, B, C & D T6 certified

2.1.3 Mounting Considerations

1. The analyzer, as confirmed by IMO/USCG certification testing operates as designed at angles of inclination up to 22.5º in any plane. However, TDHI recommends the installation and operation within 10° of vertical, and if installed shipboard as near the ship's center of gravity or centerline as practical.
2. The TD-4100 analyzer wall mounting strut frame is 3'8" [1.118 m] wide by 1'6¾" [0.476 m] high. The analyzer wall mounting strut frame is designed to bolt directly to a hard vibration free surface according to the template below.



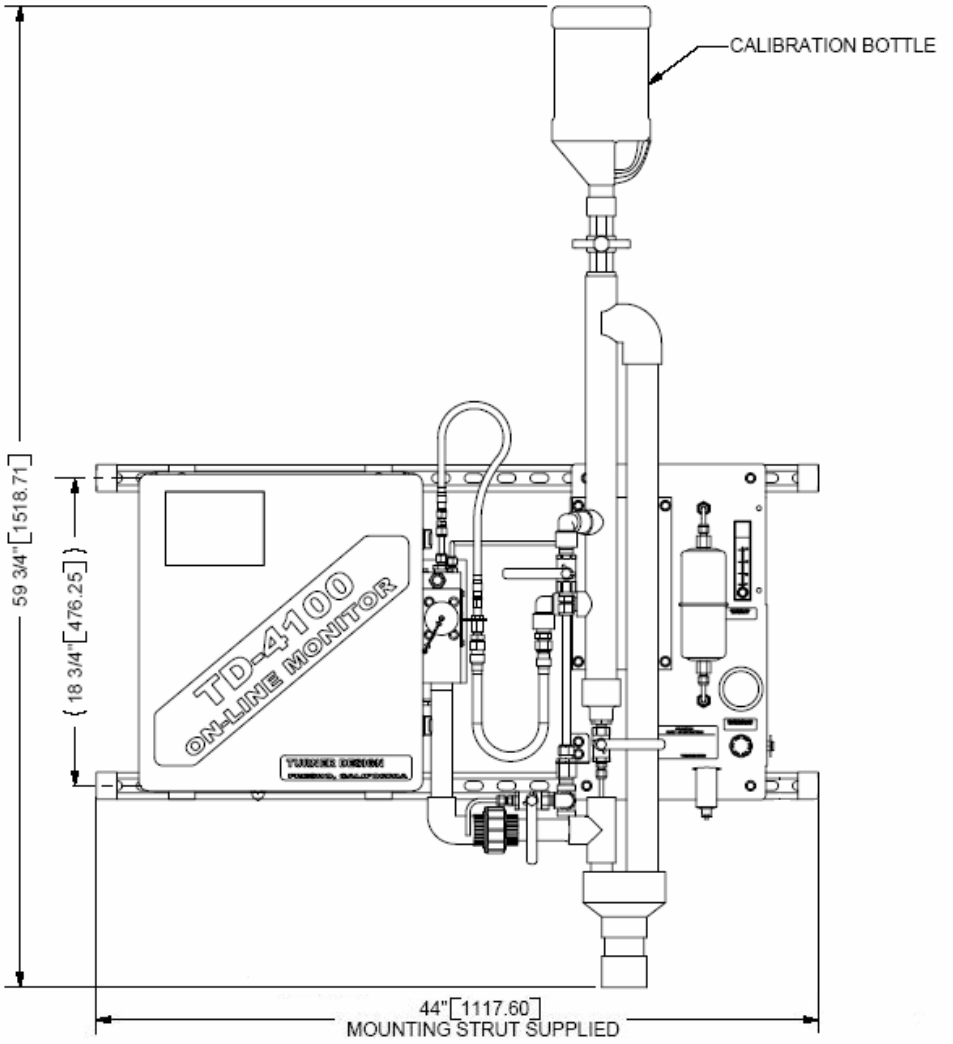
3. The analyzer, as confirmed during IMO/USCG certification testing has no major resonant frequency between 1.2 and 80 Hz, and after being tested in each of the three planes at 30 Hz with an acceleration of ± 0.7g for two hours continued to operate as designed. However, TDHI recommends installing vibration isolators consistent with site-specific requirements if the TD-4100 is to be installed where continuous high vibration is anticipated or in a seismically active area.



NOTE: TDHI, if requested, will offer recommendations or fit analyzers out with vibration isolators / seismic protection.

NOTE: If the analyzer is fitted with TDHI-fitted vibration isolators, the analyzer depth increases by 1" [0.025 m].

4. The TD-4100 analyzer installation envelope is 3'8" [1.118 m] wide by 11¾" [0.300 m] deep x 4'11¾" [1.520 m] high. Provide 51" [1.29 m] clearance above the TD-4100 bottom mounting rail for the calibration bottle as shown below. To ensure ease of access for maintenance, TDHI recommend an additional 1'8" [0.508 m] minimum clearance about the instrument.



2.2 Offsite Requirements

2.2.1 Electrical Power

Please refer to Section 4.4 Analyzer Power and Control Options.

2.2.2 Instrument Air

The TD-4100 requires an instrument air supply to:

1. Prevent condensation on, and fouling of, the optical windows;
2. Pressurize and purge the analyzer electronics enclosure for hazardous location applications if the safety air purge system is specified; and
3. Provide analyzer electronics enclosure cooling if the vortex air cooler is specified.

2.2.2.1 Design Information

The instrument air supply must be between 60 and 100 psig, [4.15 and 6.90 bar(g)], unless the permanent membrane air dryer and pre-filter option is specified which requires between 90 and 120 psig, [6.10 and 8.27 bar(g)].

To prevent condensation on, and fouling of, the optical windows, the “Air Curtain” pressure regulator must be adjusted between 10 and 20 psig [0.7 and 1.7 bar(g)], and the “Air Curtain” variable area meter must be set at 15 SCFH [0.425 sm^3/hr].

To establish total anticipated air consumption, refer to Section 4 OPTIONS & ACCESSORIES which details individual option air requirements.

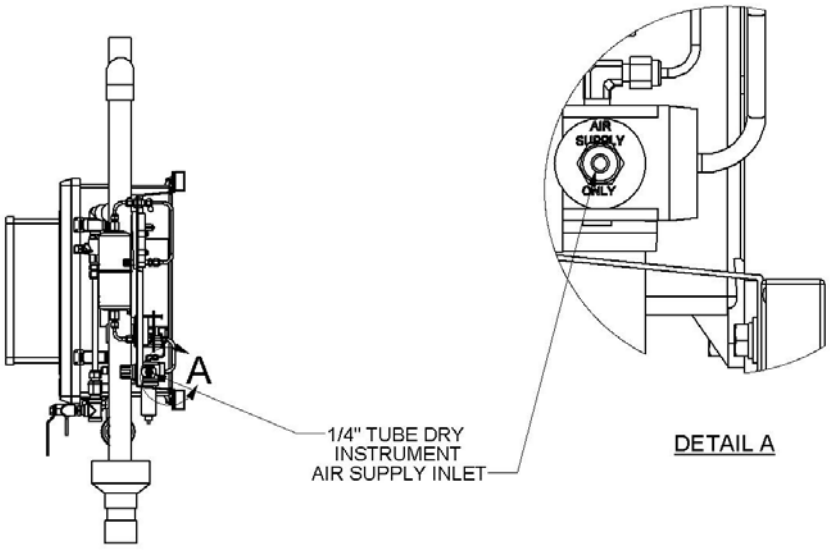
By way of example, if a TD-4100 is fitted with a CEC/NEC Class 1 Division 2 Group A, B, C & D T6 certified protective purge and no other options, the anticipated air consumption would be 15 SCFH (Air Curtain) + 85 SCFH (Purge protective gas) or 100 SCFH [2.8 sm^3/hr].



CAUTION: The TD-4100 air supply must be instrument quality as defined in ISA-S7-0.01-1996, Section 5 and ISO 8573.1, wherein the air must be:

1. Free of particulate matter above 1 micron;
2. Have an oil (liquid and gas) content below 0.008 PPM wt/wt [0.02 mg/m^3]; and
3. Have a dew point at least 18°F [10°C] below ambient temperature to which any part of the instrument air system is exposed, and shall under no circumstance exceed 39°F [3.9°C] at line pressure.

2.2.2.2 Installation – Piping Connection



All analyzer air consumers are fed from a common analyzer air supply. To connect the TD-4100 to the facility instrument air supply, use either a ¼" NPT (not available on TD-4100 fitted with safety air purge system) or a ¼" tube fitting.

2.2.3 Cooling Water (Option)

The TD-4100 requires a cooling water supply and return when a sample cooler is specified.

2.2.3.1 Design Information

All sample coolers are sized to meet application requirements. TDHI requires the following information to complete the sample cooler sizing:

1. Cooling water supply temperature and pressure;
2. Cooling water return temperature and pressure limits if any;
3. Sample supply temperature, pressure and condition (liquid volume fraction); and
4. Sample fouling propensity (clean, average, dirty).



NOTE: TDHI will, after completing preliminary sample cooler sizing, submit design details to the user for their review prior to TDHI-arranging cooler fabrication.

2.2.3.2 Installation – Piping Connection

The sample cooler is supplied loose to be installed by the user in the sample supply line.

The sample cooler cooling water inlet and outlet piping connection size is defined during the sample cooler sizing process but are typically either ½" or ¾" FNPT.

2.3 Process Requirements

2.3.1 Analyzer Sample Return / Sample Drain

The TD-4100 requires a sample drain connection to dispose of:

1. The sample after analysis; and
2. Solids separated from the sample in the sample delivery / conditioning system.

2.3.1.1 Design Information

The sample drain must be capable of passing onto an unrestricted atmospheric drain:

1. 2 USGPM, [8 L/min] of sample;
2. Solids separated evolved in the sample delivery / conditioning system.

TDHI recommends a minimum 2" (5.08 cm) open drain connection.



CAUTION: Connecting the TD-4100 to a closed drain system without the provided drain cup can cause immediate and severe damage to the instrument as well as present a safety hazard.

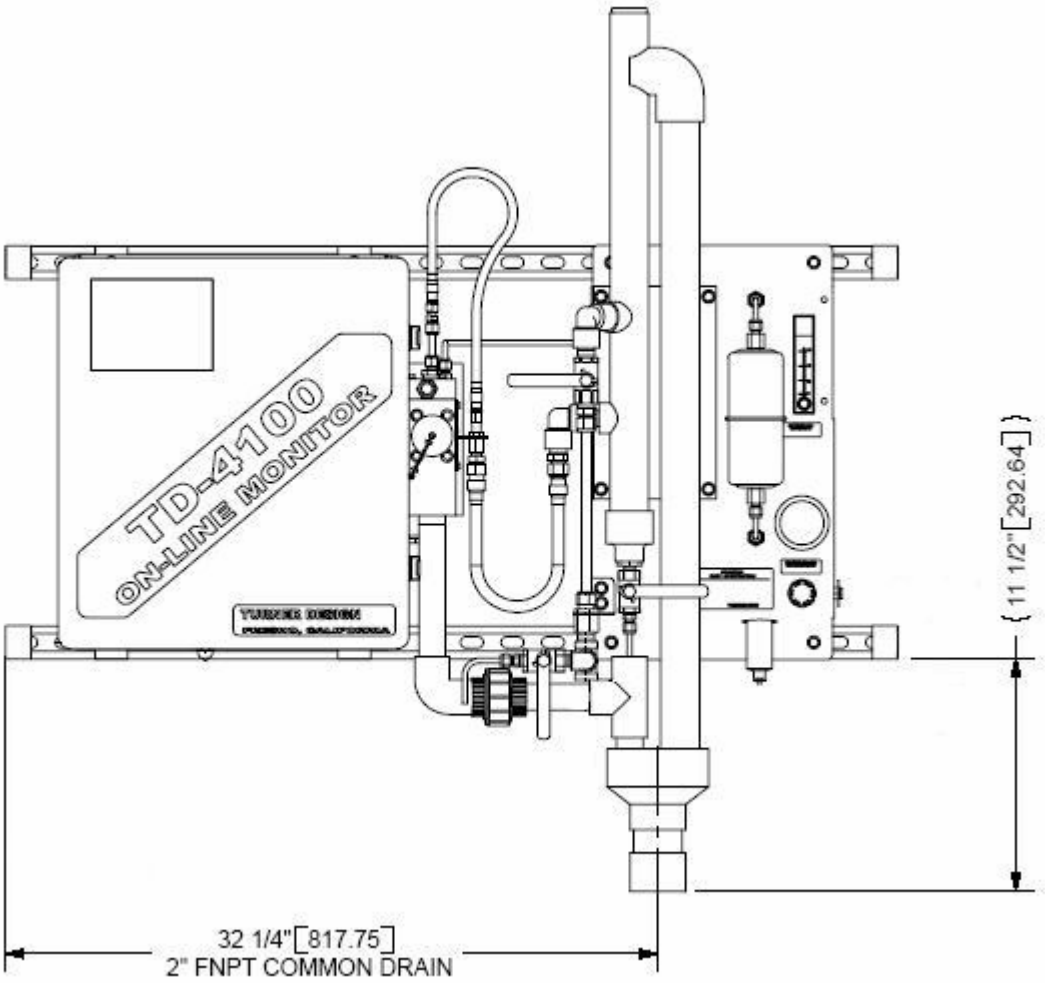
The TD-4100 drain assembly is designed to prevent stray light from entering the sample block and to prevent flooding of the flow cell when permitted to gravity drain to an atmospheric drain collection system.

If stray light is permitted to enter the sample block, it will find its way to the PMT and cause false high readings and / or PMT output saturation (quenching).



NOTE: If any TD-4100 drain assembly modifications are contemplated, contact TDHI for advice regarding material selection and fit-up to ensure the planned modification excludes light from entering the sample cell.

2.3.1.2 Installation – Piping Connection



To connect the TD-4100 to the facility open drain, use a 2" MNPT fitting

2.3.2 Analyzer Sample Supply

The TD-4100 requires the following.

1. A sample supply flow of 1 to 2 USGPM [3.8 to 8 L/min].

NOTE: The maximum sample flow is 2.5 USGPM [9.5 L/min] above which the sample conditioning systems drain is overwhelmed. The minimum sample flow is 1 USGPM [3.8 L/min] below which distortion of the falling stream flow profile causes reading errors.

2. A sample supply pressure of 5 to 20 psig [0.34 to 1.36 bar(g)].



NOTE: The maximum sample pressure permitted is 20 psig [3.4 bar(g)] determined by possible cavitation across the sample water inlet valve.

3. A sample supply temperature of 32°F to 140°F [0°C to 60°C]. If the sample temperature is between 140 and 190°F [60 and 88°C], the stainless steel bubbletrap must be specified. If the sample temperature is above 190°F [88°C], the sample cooler must be specified.



NOTE: To provide maximum system performance, a lower sample temperature is preferred.

4. A sample supply temperature fluctuation less than ±10°F [±5.5°C] outside start up and shut down operations. If the anticipated temperature fluctuation is greater than ±10°F [±5.5°C], TDHI should be consulted to minimize the impact of temperature fluctuations on analyzer readings (up to 0.1% /°F [0.2% /°C]). To limit temperature fluctuation, TDHI may recommend that the sample cooler be specified.
5. A sample supply oil concentration within the monitor's measurement range.
6. A stabilized sample, degassed to near atmospheric pressure prior to the sample point to avoid overwhelming the analyzer sample conditioning system.
7. A sample supply sediment loading below 10 lb / 1000 bbl [0.3 kg/m^3]. If the anticipated sediment loading is above this level, TDHI should be consulted regarding possible additional sample conditioning requirements.
8. A sample supply pH of 2 to 10. If a pH below 2 or above 10 is possible / expected, TDHI should be consulted regarding possible quenching and interference with phenol applications.
9. A sample supply treated with an aromatic-free chemical if bacterial growth is possible / expected.

2.3.2.1 Design Information

TDHI recommends using:

1. An engineered sample quill to ensure a representative sample is available to the analyzer;
2. Line specification isolation valves consistent with site standards to permit analyzer maintenance; and
3. An engineered sample line size and route to ensure minimum sample transport time and to minimize the possibility of sample stratification and / or gas, liquid, or solid traps.



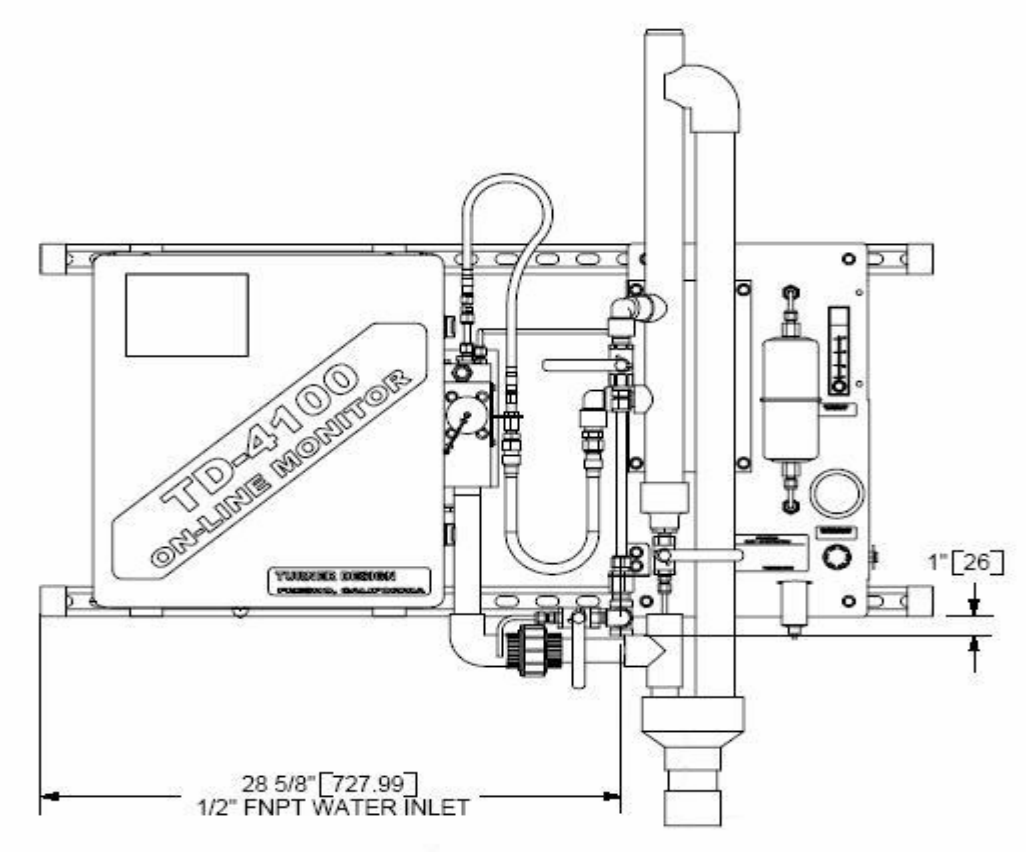
NOTE: If the sample point is on a disposal line that runs downhill after the sample point prior to discharge, be aware that when the disposal line is full, the sample point may be under vacuum.

NOTE: To ensure continuous readings, the sample system must remain flooded and deliver 1 to 2 USGPM [3.8 to 7.4 L/min] sample flow to the analyzer above 5 psig [0.34 bar(g)]. To ensure the sample system remains flooded, TDHI recommends the sample point be installed ahead of a level or back pressure control valve or similar line feature.

TDHI recognizes all line sizing involves trade-offs between pressure loss, material cost, support requirements, line erosion, and transport time. All other things equal, TDHI recommends a sample line size between of ½" to ¾" and sample line lengths less than 25 feet [8.0 m] to be in compliance with IMO regulations.

NOTE: If you have any concerns regarding sample system design, please feel free to contact TDHI prior to design freeze to ensure the greatest chance for success of your application.

2.3.2.2 Installation – Piping Connection



To connect the TD-4100 to the sample supply, use a ½" MNPT fitting.

2.3.2.3 Operational Considerations

When designing the sample delivery system, TDHI recommend the user design the sample delivery system to deliver 2.5 USGPM [9.5 L/min] at 7 psig [0.5 bar(g)], and fine tune the sample flow using the sample inlet valve.

2.4 Typical Installation Drawings

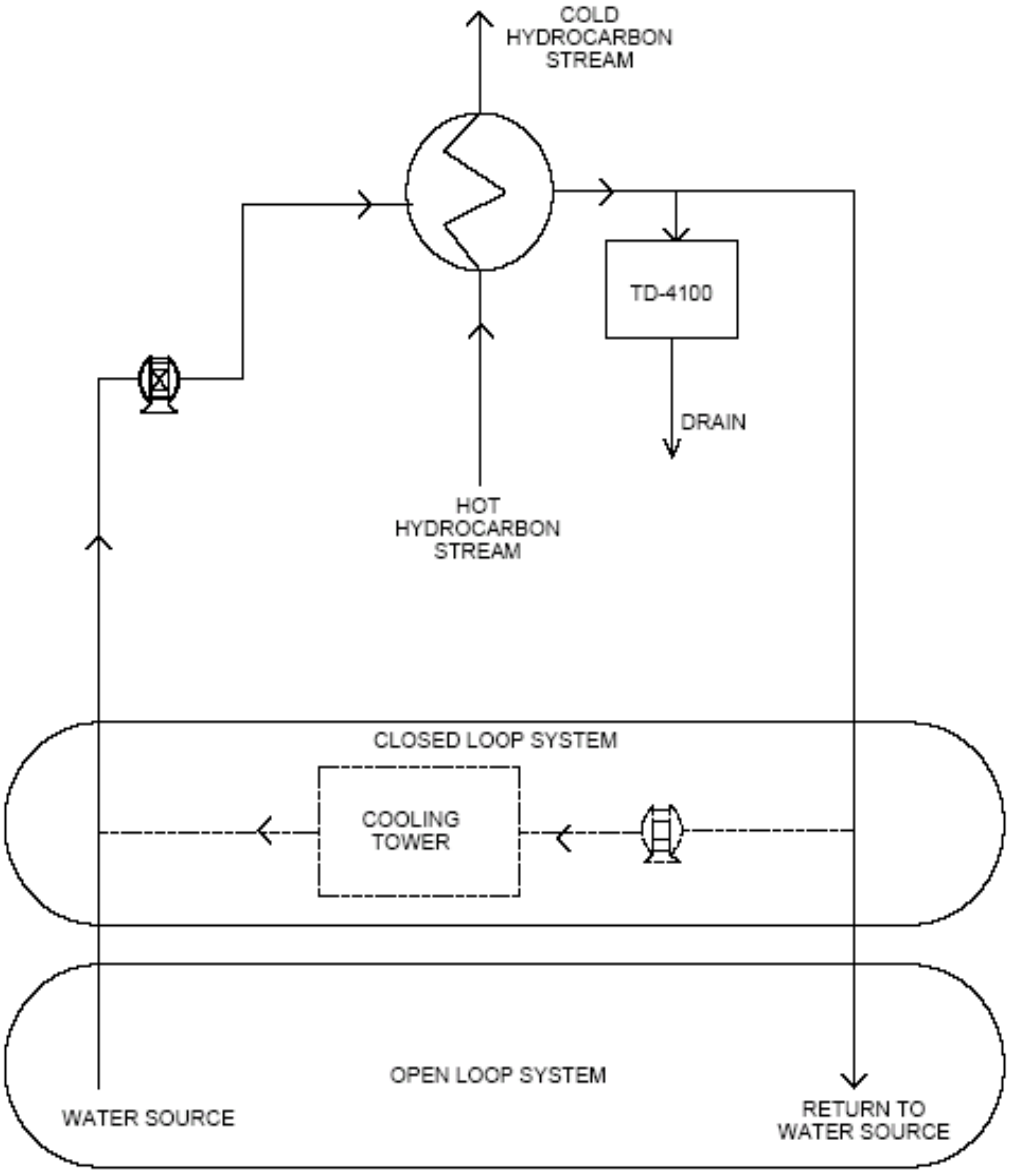


Figure 2.4.1 Typical cooling system installation.

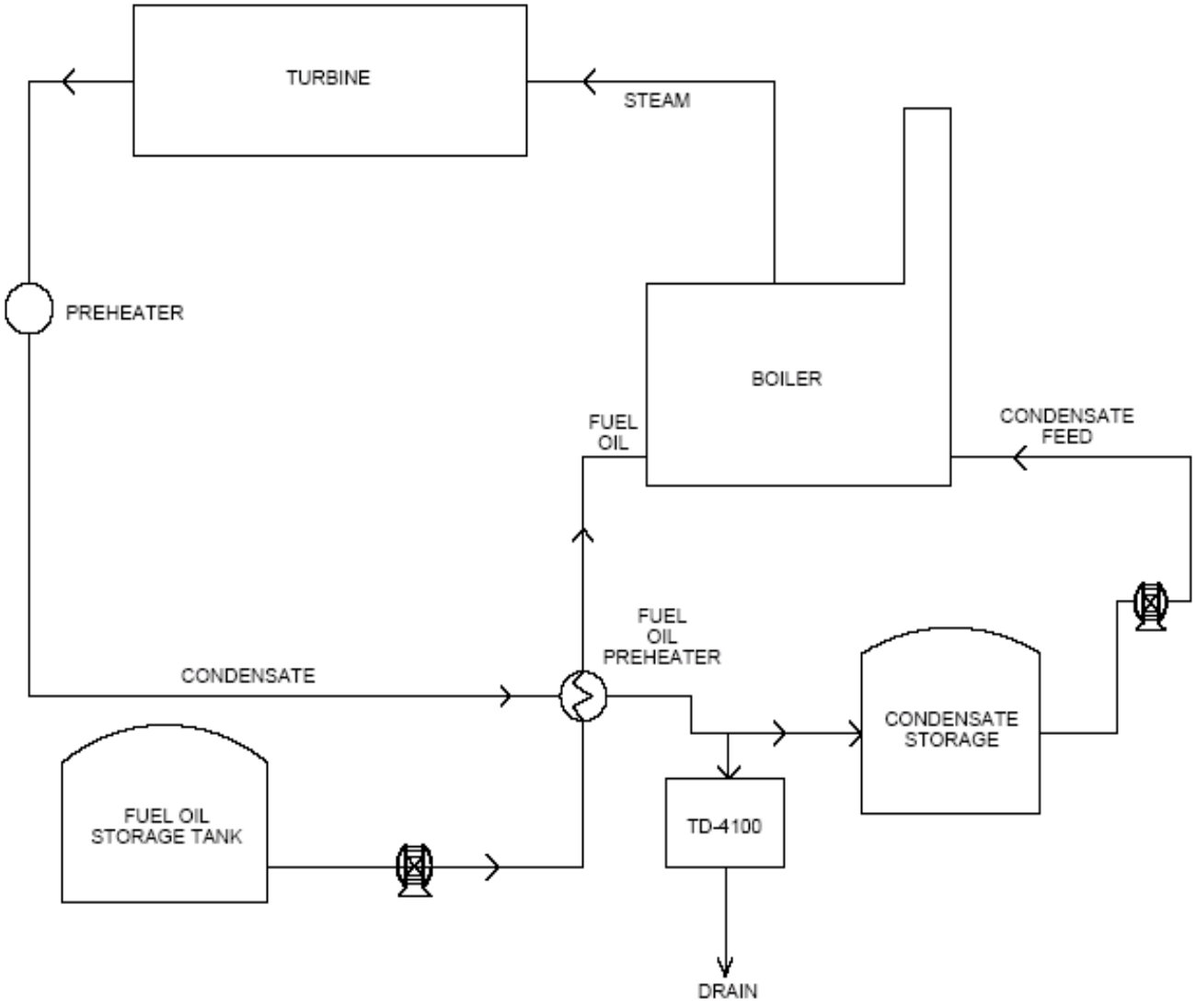


Figure 2.4.2 Typical steam condensate application

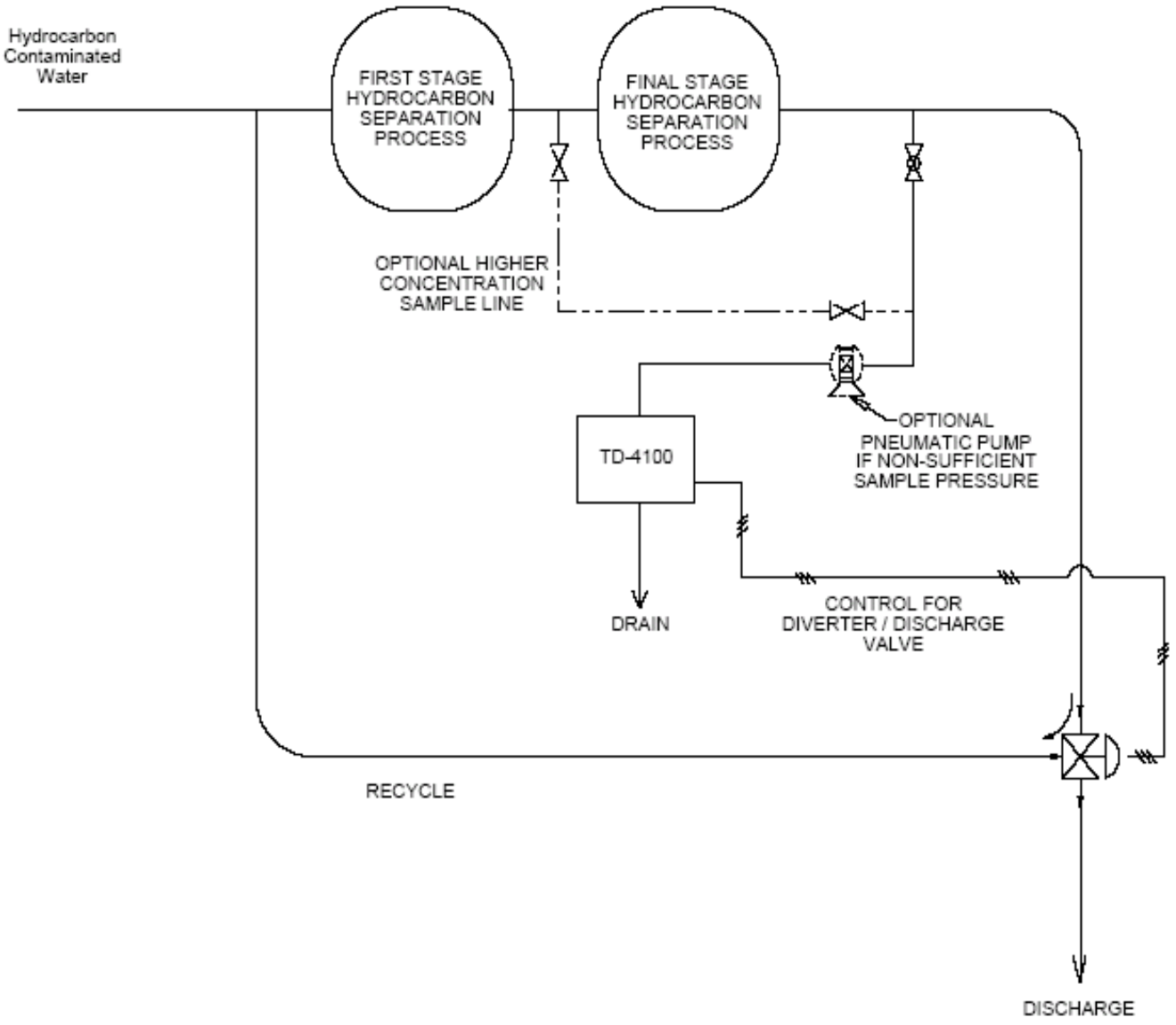


Figure 2.4.3 Typical wastewater application.

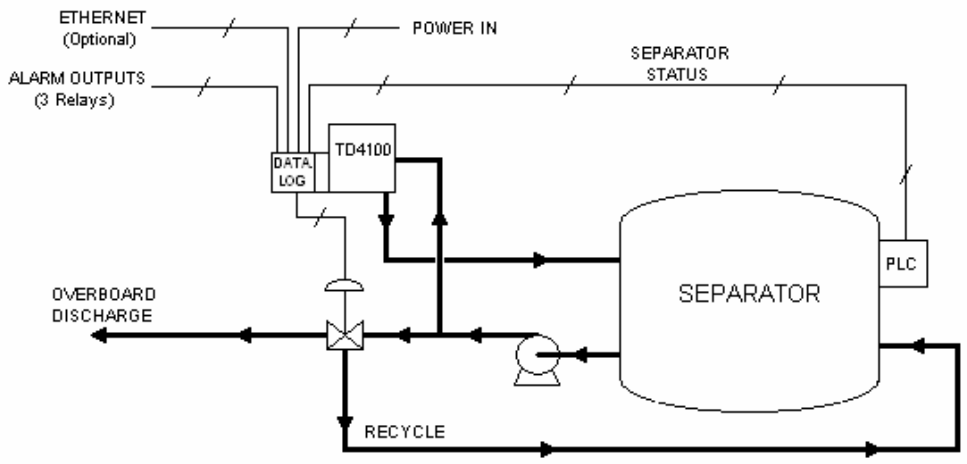


Figure 2.4.4 Typical bilge water application

2.5 Analyzer Calibration

2.5.1 Raw Fluorescence Calibration

Raw fluorescence calibration of the TD-4100 is employed when concentration information is unknown or not necessary, when the hydrocarbon of interest is unknown or not available, and/or when blank water is not available. A baseline is established and the alarm action level is established at some point above the baseline. Raw fluorescence provides trend-only information. For further information please refer to Section 6.4 Raw Fluorescence Calibration.

2.5.2 Direct Calibration

Direct calibration of the TD-4100 is accomplished by presenting a calibration standard of known hydrocarbon in water concentration and a blank to the analyzer.

The calibration standard may often be prepared when blank water and pure hydrocarbon are available, with blank water used for the blank. The calibration standard is normally prepared by adding a known amount of the hydrocarbon of interest (usually refined) into 2-propanol (also called isopropanol or isopropyl alcohol), then adding the hydrocarbon / 2-propanol solution to blank water and agitating the mixture vigorously.

Applications that often permit direct calibration include cooling water monitoring, storm water monitoring, steam condensate monitoring, drinking water intake monitoring, crude oil cargo heater return monitoring, turpentine-water separator monitoring, and some hydrocarbon in wastewater monitoring.

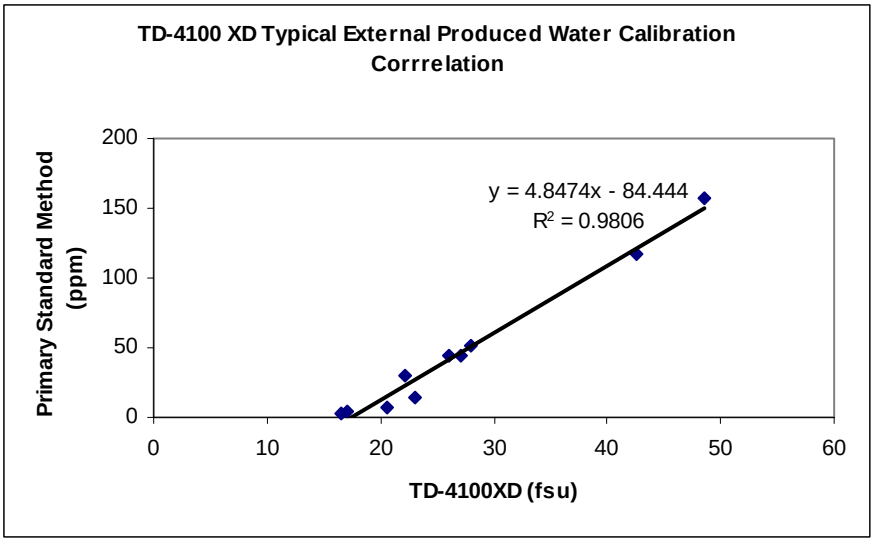
Applications that occasionally permit direct calibration are oil in reaction water monitoring, refinery wastewater treatment plant outfall monitoring, industrial wastewater treatment plant outfall monitoring, bilge and ballast water monitoring, and desalter tailwater monitoring. Successful direct calibration for these applications requires access to source water, and either the majority hydrocarbon or the least fluorescent hydrocarbon. Please contact TDHI to assist in establishing if direct calibration of the TD-4100 may be possible with your application.

For further information please refer to Section 6.5 Direct Calibration.

2.5.3 Correlation Calibration

Correlation calibration of the TD-4100 may be used for all applications but must be used where blank water and / or pure hydrocarbon are unavailable. Applications that must use correlation calibration include degasser discharges, and crude oil tank bottoms.

Correlation calibration as the name suggests requires correlation of the TD-4100 raw readings against the site-specific total oil and grease standard method. If no site-specific standard method exists TDHI recommends the *Fast*HEX™ Method.



Once the correlation calibration curve is established the curve may be entered into the TD-4100 using the CheckPOINT™ solid standard. For further information please refer to Section 6.6 Correlation Calibration.

2.6 Approval Qualifications

2.6.1 International Maritime Organization IMO Qualifications

NOTE: The initial numbers in this section correspond with the paragraph numbers of IMO MEPC.60(33) Guidelines and Specifications for Pollution Prevention Equipment for Machinery Space Bilges of Ships.

4.2.3 For hazardous locations meter operation, the meter must be installed, operated, and maintained in accordance with the manufacturer's instructions and warnings detailed in Section 4.3 Hazardous Area Purge System.

4.2.4 Common household detergents are recommended for cleaning all but hard scale from the unit, which requires dilute hydrochloric acid. TDHI notes that if the detergent is not completely rinsed off, the meter's accuracy may be affected.

4.2.5 The meter is normally unaffected by the type of oil it is detecting. However, TDHI is able to adjust the meter for specific oil types. To have the meter calibrated for the type of oil it is detecting the user must send an oil sample to TDHI so an oil-specific calibration may be made at the factory, prior to sending the meter to the user. Otherwise, the instrument will be calibrated with user- or factory-selected calibration solutions.

4.2.7 The TD-4100 system-function alarm should be monitored to alert the crew of the ship of meter anomalies that may affect the meter reading, and the TD-4100 sample-level alarm (Alarm A) will be set at 15 PPM to communicate with the associated datalogger. Both the system-function alarm and sample-level alarm should be connected to provide fail-safe operation.

4.2.8 The meter will be calibrated at the factory. The instrument cannot be re-calibrated in the field except by a TDHI-authorized representative. The drift and repeatability can be checked with the CheckPOINT™ Solid Standard.

4.2.9 The meter must be used with the provided datalogger. The interconnections between the meter and datalogger must be done according to Section 4.10 IMO Datalogger.

4.2.10 The meter's zero alarm will be activated when clean water is run through the instrument or no water is flowing to the instrument. The installed seals prevent manipulation of the meter.

5.2.2 The TD-4100 provides 2 (two) SPST alarm outputs, a system-function alarm output, and a sample-level alarm output, and a 4-20 mA analog output which are connected to the associated datalogger. The datalogger has 4 (four) outputs: TD-4100 system alarm, 15 ppm alarm, zero alarm, and separator system alarm.

6.2.1 TDHI recommends a maximum allowable pumping distance between the mixture being sampled and the meter be 25 feet [8 meters] using a maximum ¾" (18 mm) sample supply line.

6.2.2 TDHI, will upon request provide assistance to the user with meter location, sampling port locations and general installation requirement for optimal meter performance. However, TDHI recommends reviewing the Design, Installation, and Operating Guide installation section prior to submitting such a request.

6.2.3 The TD 4100 standard analog output option is 4-20 mA to connect a data logger for meter operation record keeping.



NOTE: The initial numbers in this section correspond with the paragraph numbers of IMO MEPC.60(33) ANNEX Part 2 Test and Performance Specifications for Type Approval of Oil Content Meters for Bilge Alarms.

2.2.8 The TD-4100 zero alarm will be set to report loss of flow through the analyzer. The zero alarm activates the zero alarm, which will be monitored by the datalogger to alert the crew of the ship of loss of flow through the analyzer or clean water running through the instrument.

2.2.13 Common household detergents are recommended for cleaning all but hard scale from the unit, which requires dilute hydrochloric acid. TDHI notes that if the detergent is not completely rinsed off, the meters accuracy may be affected.

2.6.2 United States Coast Guard (USCG) Qualifications



NOTE: The initial numbers in this section correspond with the paragraph numbers of USCG 46 CFR 162.050 Pollution Prevention Equipment.

ALL No Qualifications (same as IMO qualifications).

2.7 TDHI Design Review

If upon completion of your preliminary analyzer design you wish to have a TDHI application specialist review and comment on the design, please contact TDHI applications group at:

Tel: +1 559 253 1414, Fax: +1 559 253 1090, or

Email: sales@oilinwatermonitors.com

Normally TDHI design review turn around is five working days after receipt of your preliminary design information

3 INSTALLATION

The TD-4100 is shipped mounted to an analyzer structural frame. Please refer to Section 11.1 detailing the Non-Hazardous Location Base Configuration and Section 11.2 detailing the Hazardous Location Base Configuration.

3.1 Typical Installation Program

3.1.1 Unpack the Analyzer



Figure 3.1.1.1

Upon receipt of the analyzer, inspect the shipping container for physical damage. Register any anomaly with TDHI and the shipping company.



Figure 3.1.1.2

Remove the shipping bands. Grasp the box handles at either end.



Figure 3.1.1.3

Lift the shipping box lid from the box.



Figure 3.1.1.4

The monitor, monitor components, and accessories will be packed a shown.



Figure 3.1.1.5

Remove the accessories and packing material to expose the monitor.



Figure 3.1.1.6

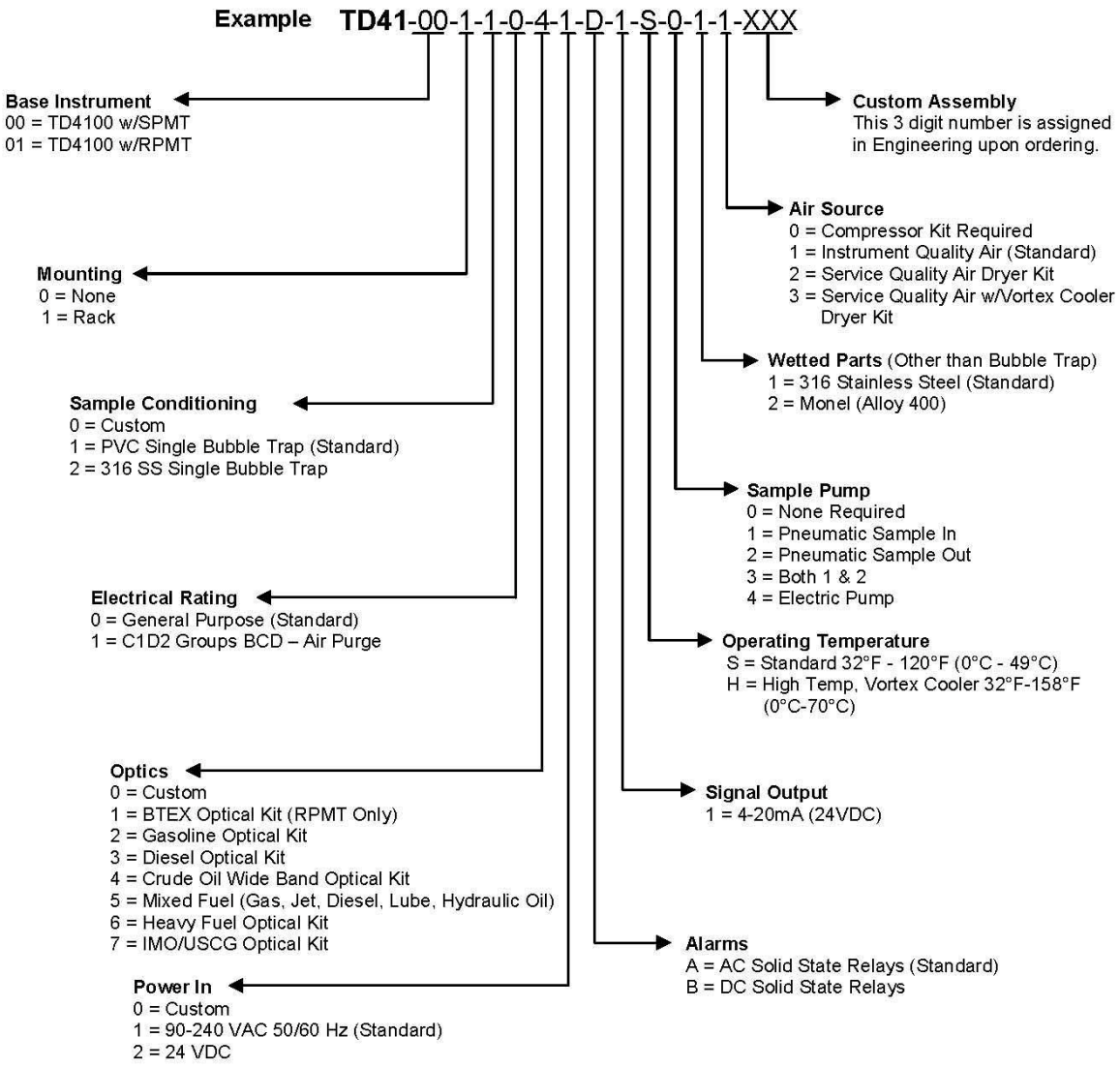
Lift the monitor from the box as shown.



NOTE: Set aside analyzer accessories in a secure area so they are available to the commissioning team when required.

3.1.2 Part Number Legend

Top Level Part Number
Model TD4100



3.1.3 Typical Packing List

The typical packing list includes user information, purchase order, and sales order information, instrument serial number, and a list of all part numbers included in the order similar to that detailed in the following tables.

PART NUMBER	DESCRIPTION	QUANTITY
Items factory installed onto analyzer wall mounting stud frame include:		
4100020	TD-4100 (Standard PMT) Electronics Enclosure	If specified
4100030	TD-4100 (Red PMT) Electronics Enclosure	If specified
4100162	Rack Mount System	1
4100258	PVC De-Aerator Assembly	If specified
4100259	316 Stainless Steel De-Aerator Assembly	If specified
4100920	CEC/NEC Class 1 Division 2 Groups C & D Certified Safety Air Purge System	If specified
4100901*	BTEX Optical Kit	Defined by TDHI
4100902*	Gasoline Optical Kit	Defined by TDHI
4100903*	Diesel Optical Kit	Defined by TDHI
4100904*	Wide Band Crude Oil Optical Kit	Defined by TDHI
4100905*	Mixed Fuel Optical Kit	Defined by TDHI
4100907*	Heavy Fuel Optical Kit	Defined by TDHI
100406*	IMO / USCG Oil Content Meter Optical Kit	Defined by TDHI
100068	Analyzer Enclosure Vortex Cooler	If specified
100362	IMO Datalogger	If specified
100528	Sample Port	1
*(A spare lamp is located in the optical kit box, which is located in box marked P/N 4100-110.)		

Items which are shipped loose within the shipping crate may include the following:

PART NUMBER	DESCRIPTION	QUANTITY
Items shipped loose, packaged, and secured in the monitor shipping crate include:		
4100110	Accessory Kit	1
4100933*	CheckPOINT™ 4100 Solid Calibration Check Standard (Orange)	If specified
4100934*	CheckPOINT™ 4100 Solid Calibration Check Standard (Blue)	If specified
4100924	Permanent Membrane Air Dryer & Pre-Filter Kit	If specified
4100956	Permanent Membrane Air Purifier Spares Kit	If specified
4100946*	Two Year Spares Kit, Quartz Lamp Optical Systems	If specified
4100949*	Two Year Spares Kit, Near UV Lamp Optical Systems	If specified
4100948	Standard Activated Carbon Filter Spares	If specified
*(CheckPOINT™ and Optical System Spares align with optical kit.)		

Items which are shipped separately or part of the shipment include the following:

PART NUMBER	DESCRIPTION	QUANTITY
Other Items		
Crating	Crating, Cardboard Box or Wooden Crate	As required
100410	Sample Cooler	If specified
4100925	Air Supply Kit	If specified

3.1.4 Typical Weight Reporting

The weight report includes the analyzer and the analyzer option and accessories weight data, and the shipping container weight and dimension information.

The dry weight of the base instrument is 64 lbs [29 kg] and the wet weight is 70 lbs [32 kg].

To establish the total dry weight of the optioned analyzer and shipping weights and dimensions, refer to the following tables.

PART NUMBER	DESCRIPTION	WEIGHT
Items Factory Installed Onto Analyzer Structural Frame Could Include:		
4100259	316 Stainless Steel De-Aerator Assembly (base instrument assumes PVC De-Aerator Assembly)	16 lb [7.3 kg]
4100920	CEC/NEC Class 1 Division 2 Groups C & D Safety Air Purge	10 lb [4.5 kg]
100068	Analyzer Enclosure Vortex Cooler	12 lb [5.5 kg]
100362	IMO Datalogger	15 lb [6.8 kg]

PART NUMBER	DESCRIPTION	WEIGHT
Items shipped loose and packaged and secured in the analyzer shipping crate Include:		
4100-111	Accessory Kit	5 lb [2.25 kg]
4100-933*	CheckPOINT™ 4100 Solid Calibration Check Standard (Orange)	2 lb [0.9 kg]
4100-934*	CheckPOINT™ 4100 Solid Calibration Check Standard (Blue)	2 lb [0.9 kg]
4100-924	Permanent Membrane Air Dryer & Pre-Filter Kit	12 lb [5.5 kg]
4100-956	Permanent Membrane Air Dryer Spares Kit	5 lb [2.25 kg]
4100-946*	Two Year Spares Kit, Clear Quartz Lamp Optical Systems	2 lb [0.9 kg]
4100-948	Standard Activated Carbon Filter Spares Kit	6 lb [2.7 kg]

PART NUMBER	DESCRIPTION	QUANTITY
Other Items		
Crate	Crate, Cardboard Box 57” L x 25” W x 15” H [1.448 m L x 0.635 m W x 0.38 m H]	26 lb [12 kg]
IMO Crate	Crate, Cardboard Box, IMO 69” L x 25” W x 15” H [1.75 m L x 0.635 m W x 0.38 m H]	36 lb [16.3 kg]
4100918	Chemistry Calibration Kit	20 lb [9.1 kg]
100410	Analyzer Sample Cooler	25 lb [11.5 kg]
4100-925	Air Supply Kit	118 lb [53.5 kg]

By way of example, if a domestic user orders a TD-4100 fitted with a Class 1 Division 2 safety air purge system and no other options:

1. The anticipated dry weight would be 64 lb (Base Analyzer) + 10 lb (Class 1 Division 2 Safety Air Purge) or 74 lb [33.6 kg];
2. The anticipated shipping weight would be 74 lb (as above) + 26 lb (Crate) or 100 lb [45.4 kg]; and
3. The shipping crate dimensions would be 57” L x 25” W x 15” H [1.448 m L x 0.635 m W x 0.38 m H].

3.1.5 Installing the Analyzer Wall Mounting Strut Frame

The TD-4100 is attached to a stainless steel analyzer wall mounting strut frame ready to be wall-mounted. Refer to Section 2.1 Analyzer Location for analyzer site considerations, dimensions, and recommended analyzer clearances.

Mount the analyzer wall mounting strut frame using screws or bolts appropriate to the mounting surface.



NOTE: Mounting screws, studs, or bolts are not supplied. The maximum screw, stud, or bolt size supported is 1/2” [12 mm]

3.1.6 Installing the Bubbletrap

The PVC or stainless steel bubbletrap is not attached to the instrument during shipment and must be attached.



Figure 3.1.5.1

Locate the bubbletrap assembly, inlet valve assembly, inlet tube, inlet connection/sample port assembly, and associated fasteners.



Figure 3.1.5.2

Attach the inlet valve assembly to the bubbletrap as shown.



Figure 3.1.5.3

Attach the inlet tube and inlet connection/sample port assembly to the bubbletrap assembly as shown.



Figure 3.1.5.4

Attach the bubbletrap to the support panel with the four ¼" bolts and washers. Each bolt for the PVC bubbletrap requires a flat washer and a split washer. The bolts for the PVC bubbletrap are the longer bolts. Each bolt for the stainless steel bubbletrap requires a split washer.

Attach the sample inlet assembly bracket to the support panel with the two ¼" bolts and washers. Each both requires a split washer placed on the bolt first and then a flat washer. For the PVC bubbletrap these bolts are the shorter length bolts.



Figure 3.1.5.5

Install the gooseneck bottom hose between the bubbletrap outlet fitting and the bulkhead fitting located on the side of the flowcell. IMPORTANT: Use two wrenches to tighten the fittings at each end.

3.1.7 Installing the Flowcell Drain

The PVC or stainless steel flowcell drain is not attached to the instrument during shipment and must be attached.

1. If not already disconnected, disconnect the union fitting in the flowcell drain.
2. Attach the drain tube to the bottom of the flowcell and tighten until snug. (IMPORTANT: Do not overtighten as this may crack the flowcell).
3. Align the union connection toward the bubbletrap drain.
4. Place the larger opening of the T-fitting below the bubbletrap sediment drain tube.
5. Attach the union connection on the bubbletrap drain.
6. Attach the provided drain cup to the user-installed drain system. Position the drain cup below the bubbletrap and flowcell drains.



Figure 3.1.6.1

Installed flowcell drain and drain cup. Supporting drain pipe for drain cup not shown.

3.1.8 Install Compressed Air Water Trap Bowl

The compressed air water trap bowl is shipped separately to prevent damage and must be attached.

1. Locate the compressed air water trap bowl.
2. Align the bayonet fittings of the compressed air water trap bowl with the openings in the water trap.
3. Push the water trap bowl upward with force.
4. Turn the water trap bowl clockwise to engage the bayonet fittings.



Figure 3.1.7.1

Water trap bowl properly installed.

3.1.9 Completing the Electrical Hookup



WARNING: Electrical connections should be made only by trained service personnel or certified electrician, and should only be completed in accordance with site isolation and safe work practices.



NOTE: Never run signal wires in conduit or cable with power wiring. Use separate conduit or cable runs and separate entries into the analyzer enclosure. The bottom of the analyzer enclosure has three 7/8" diameter conduit / cable gland knockouts fitted with oil tight rubber hole seals. It also has two ½" openings fitted with sealed cable glands.



NOTE: TDHI recommend the following minimum conductor / cable sizing

1. Analyzer Power 3C 12 AWG [2.5 mm^2 or 6530 circ. Mils];
2. Analyzer Alarm 2 of 3C 14 AWG or 1 of 4C 14A WG [1.5 mm^2 or 4110 circ. Mils]; and
3. Analyzer Analog 1 Pr 18 AWG [0.75 mm^2 or 1620 circ. Mils] twisted and screened.

Refer to Section 4.4.1 Power Supply for detailed power connection details.

Refer to Section 4.4.2 Alarm Outputs for detailed system-function and sample-level alarm contact connection details.

Refer to Section 4.4.3 Analog Output for detailed sample level connection details.

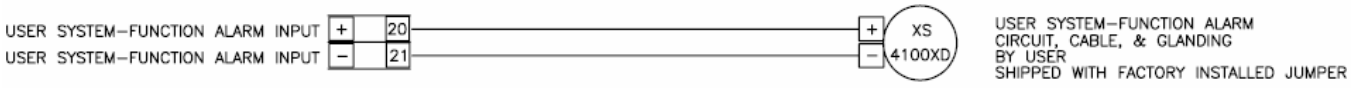
3.1.10 User External System-Function Alarm

To connect an external alarm that will be processed by the analyzer as a system-function alarm:

1. Remove the jumper between terminals 20 and 21; and
2. Connect these terminals to a dry contact device / circuit capable of switching a 3-6 W load at 12 VDC.



NOTE: When the device contacts are closed, the user system-function alarm input is clear, and when the device contacts are open, the user system-function alarm input is active.



3.1.11 Monitor Terminal Strip

The TD-4100 terminal strip is located at the bottom of the analyzer enclosure and may be accessed by opening the analyzer enclosure door.

To connect a wire to the terminal strip, insert the "terminal strip tool" (a small screwdriver supplied with the instrument) into the square hole on the terminal. Press the tool firmly into the hole to open the terminal. While maintaining pressure on the tool, insert the wire from below into the terminal. Release the pressure on the tool and the wire will be "latched" into the terminal. Tug the wire to make sure it is firmly latched.

To disconnect a wire from the terminal strip, insert the terminal strip tool into the square hole on the terminal. While pressing the tool firmly into the hole to open the terminal, pull the wire out of the terminal.

.



NOTE: TDHI recommends using fine stranded conductor cables and using ferules to ensure solid connection to the analyzer terminal strip.

If the TD-4100 is not to be put in service soon after terminations are finished, install instrument preservation and secure the analyzer in line with site procedures.

3.1.12 Completing the Piping Tie-Ins

Refer to Section 2.2.2.2 detailing the instrument air **Installation – Piping Connection**.

Refer to Section 2.2.3.2 detailing the cooling water **Installation – Piping Connection** (if specified).

Refer to Section 2.3.1.2 detailing the sample return / sample drain **Installation – Piping Connection**.

Refer to Section 2.3.2.2 detailing the sample supply **Installation – Piping Connection**.



NOTE: For additional reference details, refer to Section 11.1 **Non-Hazardous Location Base Configuration** and 11.2 **Hazardous Location Base Configuration** typical general arrangement drawings.



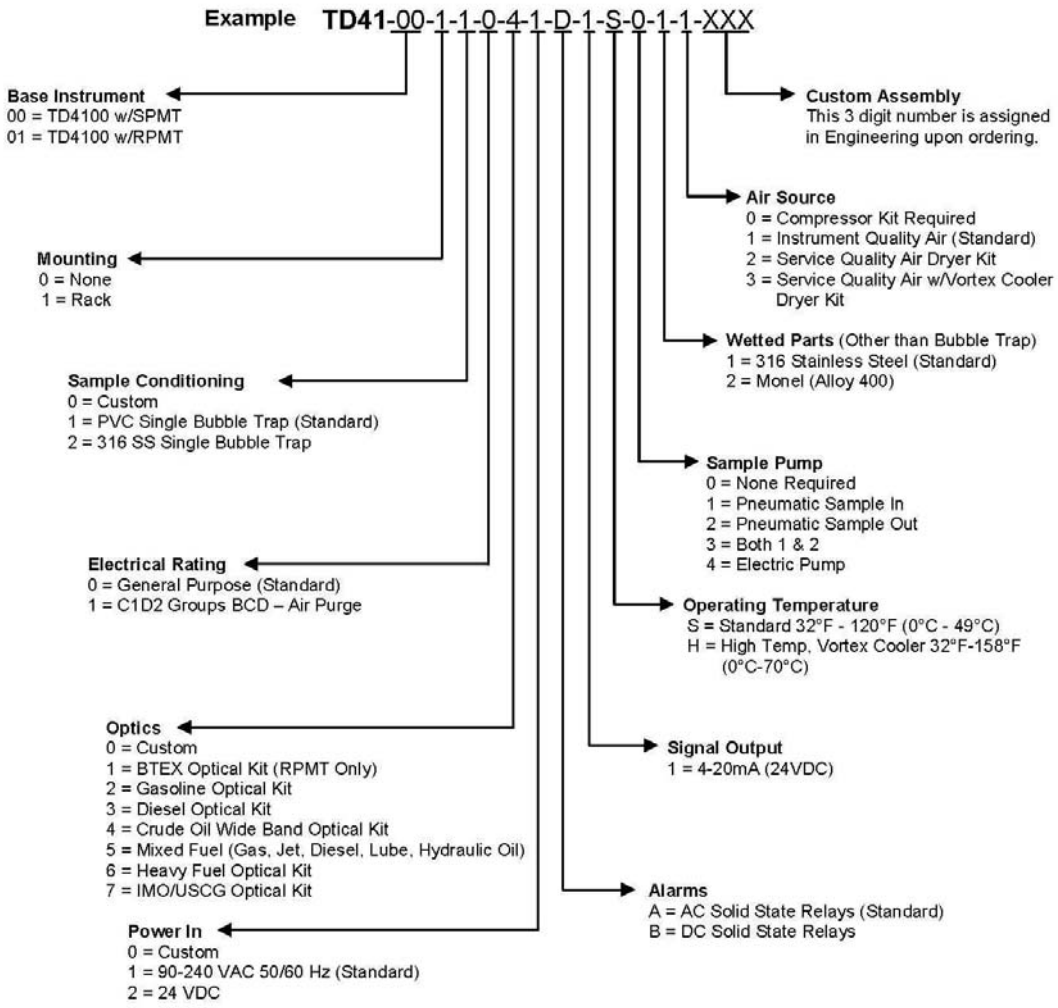
NOTE: When the TD-4100 installation is mechanically complete, fill out the **Installation Checklist** located in Section 12.2 before operating the unit. Please contact TDHI if assistance is required during installation.

4 OPTIONS & ACCESSORIES

4.1 Options

Many options are available for the TD-4100. Each option is described in subsequent subsections.

Top Level Part Number
Model TD4100



4.2 Accessories

4.2.1 Materials Supplied with the TD-4100

The Accessories Kit, P/N 4100-110 contains the following:

Part Number	Quantity	Description
139-0600	1	Terminal strip tool
138-1050	1	Brush – Cuvette 3 mm & 5 mm
138-1085	1	Brush – Clean Out, ¼" Diameter
138-1092	1	Brush – Clean out, 2" Diameter
989-0410	1	Wash Bottle – Polyethylene Wash
800-0160	1 pkg	Cotton Cleaning Swabs, w/o Adhesive
4100-115	1 (two items)	Calibration Bottle Kit – TD-4100
4100-116	2	Calibration Valve – TD-4100

Calibration Solution Bottle Kit, P/N 4100-115 contains two calibration bottles equipped with valves. One is labeled calibration solution and one is labeled blank. For IMO certified applications, these bottles are not used by end-user except for introducing cleaning solutions.

Additional Parts included in the accessories box packages are items that are removed from the instrument for shipping purposes. Installation of these items is described in the Installation Section and the instruction sheet included with the particular part.

Part Number	Quantity	Description
4100-MAN	3 (normally)	Manual – TD-4100 On-Line Monitor
Documents	1 pkg	Instrument Documents and Certificates Package
On-Line Bubbletrap	1	Bubbletrap and Mounting Hardware
Inlet Assembly	1	Bulkhead Fitting/Bracket/Tubing/Valve
Sample Tubing	1	Flexible Braided Hose, ½"
Air Filter Bowl	1	Air Filter Water Trap Bowl
Drain Assembly	1	Flowcell Drain Plumbing Assembly

On-Line Bubbletrap removes suspended solids and dissolved gas from the sample stream, and provides a constant sample stream flow to the falling stream flow cell. The on-line bubble trap is removed from the instrument for shipping and must be installed.



NOTE: Do not modify the in-line bubble trap.

4.2.2 Accessories and Spares Supplied at Additional Cost

TD-500™ Oil in Water Analyzer and accessories

4100-918 Chemistry Calibration Kit

4100-933 CheckPOINT™ 4100 Solid Calibration Check Standard (Blue)

4100-934 CheckPOINT™ 4100 Solid Calibration Check Standard (Orange)

4100-946 Two Year Clear Quartz UV Spares Kit

4100-949 Two Year Near UV Spares Kit

4100-956 Two Year Pre-Filter Membrane Air Filter Spares Kit

4100-948 Two Year Activated Carbon Air Filter Spares Kit



NOTE: TDHI recommends purchasing consumable spare parts necessary for operation and routine maintenance of the instrument for two years.

4.3 Hazardous Area Purge System

To meet hazardous area classification requirements the TD-4100 may be fitted with a purge system.

The TD-4100 base configuration is suitable for indoor or outdoor use in non-hazardous areas. The TD-4100 may optionally be fitted with a CEC/NEC Class 1 Division 2 Groups A, B, C & D T6 certified purge system. The TD-4100 is not available with an ATEX/CENELEC/IEC certified purge system.

4.3.1 Class 1 Division 2 Certified Safety Air Purge System

When fitted, the TD-4100 is certified for use in a CEC/NEC Class 1 Division 2 Groups A, B, C, & D T6 hazardous location. This particular purge system does not allow the TD-4100 to be used in Class 1, Division 1, ATEX Zone 2, or ATEX Zone 1 hazardous area locations.

4.3.1.1 Design Information

1. Minimum flow of protective gas during purge cycle: 85 SCFH [2.4 sm^3/hr]
2. Minimum purge time: 15 minutes
3. Minimum overpressure: 0.15" H_20 [0.37 mbar]
4. Maximum overpressure: 0.50" H_20 [1.24 mbar]
5. Design overpressure: 0.25" H_20 [0.62 mbar]
6. Design leakage rate: up to 100%



WARNING: The TD-4100 enclosure should not be opened unless power is removed or the area has been properly tested and is known to be non-hazardous. After the enclosure has been opened, if the area or enclosure has been properly tested and found to be hazardous, power to the TD-4100 should not be restored until the enclosure has been pre-purged for at least fifteen (15) minutes, during which time the equivalent to five (5) times the volume of free space in the enclosure has been exchanged.



NOTE: Review the enclosure protection system tags and labels, and vendor information included in the accessory package carefully before operating the TD-4100.

NOTE: No modification of the purge device is permitted.

4.3.1.2 Installation – Piping Connection

For purge air supply connection information, please refer to **Design Information** Section 2.2.2.

4.3.1.3 Installation – Electrical Connection

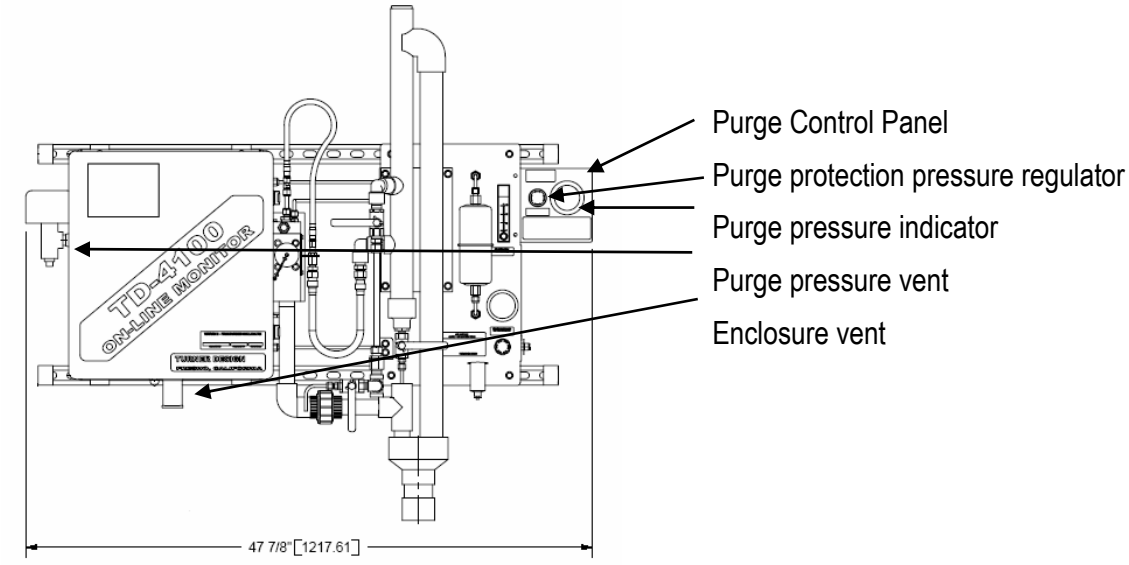
For power and control connection information, please refer to Section 4.4 Analyzer Power and Control Options.

The safety air purge system has an electrical switch to indicate loss of enclosure air purge pressure. This switch is located inside of the TD-4100 enclosure below the terminal strip and may be connected up to be normally open or normally closed. The pressure switch is set to 0.15" H_20 [0.37 mbar]. The SPDT switch contact rating is 15 A, 120-480 VAC. The pressure switch electrical connections are accessed by removing the cover plate on the pressure switch. Do not adjust the pressure set-point.

4.3.1.4 Start Up

Prior to energizing the TD-4100:

1. Turn off the remote power feed breaker for the TD-4100;
2. Close the enclosure purge protection pressure regulator. (To close, lift the regulator knob to unlock the regulator, then turn the knobs fully counterclockwise);
3. Ensure the area and enclosure has been properly tested and is known to be non-hazardous;
4. Switch on the internal power switch;
5. Ensure that analyzer enclosure door is clean, secure, and sealed and the other enclosure openings are clean and secure (including the enclosure vent, and purge pressure vent); and
6. Ensure the facility air supply is open to the analyzer.



7. Slowly open the enclosure purge protection pressure regulator until the purge pressure indicator indicates between 0.25" H_2O [0.62 mbar]. Once set, lock the regulator by depressing the knob.
8. After 15 minutes energize the TD-4100 power feeder breaker.

4.3.1.5 Operations

As part of routine unit tours, confirm:

1. The enclosure door is clean, secure, and sealed and the other enclosure openings are clean and secure (including the enclosure vent, and purge pressure vent); and
2. The enclosure purge pressure indicator indicates between 0.15 and 0.35" H_2O [0.37 and 0.87 mbar]. (If not, adjust the enclosure purge protection pressure regulator.)

4.3.1.6 Maintenance

As long as air is instrument quality, no maintenance is anticipated. If the air is not instrument quality, TDHI requires specifying the permanent membrane air dryer and pre-filter kit.



WARNING: Using wet, non-instrument quality compressed air can cause damage to the instrument and present a safety hazard. Moisture will accumulate inside of the electronics enclosure where voltages of up to 1000 VDC are present.

4.3.1.7 Troubleshooting

To troubleshoot, follow instructions provided in the vendor information included in the accessory package.

4.3.1.8 Spares

None anticipated nor provided.

4.4 Analyzer Power and Control Options

4.4.1 Power Supply

The TD-4100 may optionally be powered from one of two power sources.

1. 90-240 VAC 50 / 60Hz ± 10% 1Φ (standard configuration); and
2. 21-56 VDC ± 10% (DC power option).



CAUTION: The TD-4100 must not be subject to transient over voltages according to INSTALLATION CATAGORY II Pollution Degree 2 in accordance with IEC664.



CAUTION: Fusing protects the TD-4100. However, external branch circuit protection must be provided in line with site-specific code and facility requirements. The TD-4100 instrument supply wire rating should be at least 16 A, 300 V, 60°C.



WARNING: The TD-4100 enclosure should not be opened unless power is removed or the area has been properly tested and is known to be non-hazardous. It is normally not necessary to open the enclosure.



NOTE: Read all the enclosure tags and labels carefully before applying power to the TD-4100.

4.4.1.1 90 - 240 VAC, 50 / 60Hz (standard configuration)

4.4.1.1.1 Design Information

Electrical supply feed through: suitable for ½" NPT conduit or cable fitting

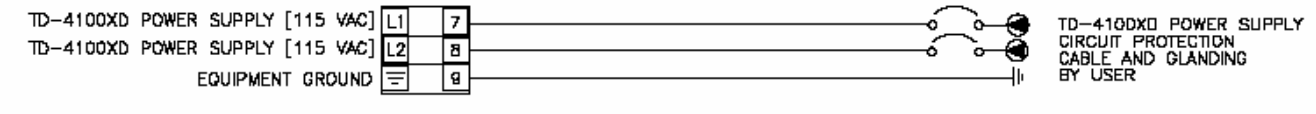
Maximum power consumption is 200 Watts

Design power consumption is 20 – 50 Watts dependent upon options fitted.

4.4.1.1.2 Installation – Electrical Connection

For user 90 - 240 VAC 50 / 60Hz ± 10% 1Φ supply, connect L1 to terminal 7, L2 to terminal 8, and the ground [earth] to terminal 9.

NOTE: TDHI recommends using a switched neutral breaker, if compatible with site-specific code and facility external branch circuit protection requirements.



4.4.1.2 21-56 VDC Power Option

4.4.1.2.1 Design Information

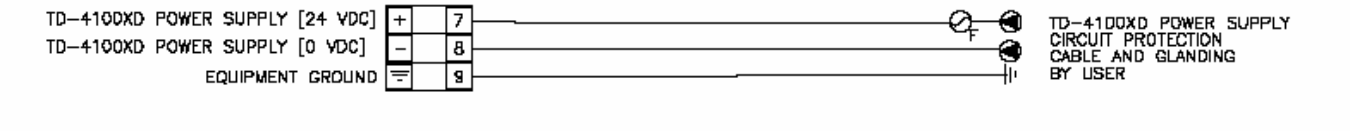
Electrical supply feed through: suitable for ½" NPT conduit or cable fitting.

Design power consumption: 200 Watts at initial start-up (4 seconds or less) and then 20 – 50 Watts during operation dependent upon options fitted.

4.4.1.2.2 Installation – Electrical Connection

For user 21-56 VDC ± 10% supply, connect +21-56 VDC to terminal 7, 0 VDC to terminal 8, and the ground [earth] to terminal 9.

NOTE: TDHI recommends fusing the +21-56 VDC supply, if compatible with site-specific code and facility external branch circuit protection requirements.



4.4.1.3 Start Up



Turn the main power switch on, then close and secure and seal the analyzer door.

Main power switch

Relay A circuit breaker

Relay B circuit breaker

4.4.1.4 Troubleshooting



WARNING: The TD-4100 enclosure should not be opened unless power is removed or the area has been properly tested and is known to be non-hazardous.

PROBLEM	CAUSE	SOLUTION
Power applied but analyzer doesn't power up.	Analyzer powered up but LCD contrast turned to low setting	Repeatedly Key "↑" to increase LCD contrast.
	External power switch off	Turn on power at external (user-provided) switch or breaker.
	Main power switch off.	Open the enclosure door and turn on the main power switch. Clean, secure, and seal the enclosure door.
	External branch circuit protection tripped or isolated	Reset / reinstate external branch circuit protection.
	Polarity incorrect (DC Power Option)	Confirm +21-56 VDC power lead connected to Terminal 7 and 0 VDC power lead connected to Terminal 8.

PROBLEM	CAUSE	SOLUTION
	Internal power supply fuse blown	Check all other possibilities first. Then open enclosure by breaking tamper-resistant seals. See Maintenance section for fuse replacement
Power applied but monitor LCD flashes repeatedly without fully starting (DC Power Option only)	Power source not capable of providing initial start-up current.	Increase power source current.



NOTE: Check all possible problems and causes before checking analyzer power supply fuse.

4.4.1.5 Spares

Spare power supply fuses are available separately.

PART NUMBER	DESCRIPTION	QUANTITY
100375	Power Supply Fuses	3

4.4.2 Alarm Outputs

The TD-4100 provides 2 (two) SPST alarm outputs. Relay "A" is the system-function alarm output and relay "B" is the sample-level alarm output. The relays are solid state and are supplied as defined by the Alarm Code:

1. 10 A inductive at 24-280 VAC solid state relays (standard AC solid state relays); and
2. 5 A inductive at 12-48 VDC solid state relays (optional DC solid state relays).

The alarm outputs are solid state and have a minimum load rating of 40 mA rms and a maximum off-state leakage current at rated voltage is 10 mA rms.

An active system-function alarm indicates a component critical to the operation and safety of the analyzer may have malfunctioned.

Internal system-function alarms are raised in response to:

1. UV source lamp failure;
2. Chopper motor speed out of range; and
3. High or low photomultiplier tube power draw;

The system-function alarm output may additionally be configured by the user to report a loss of flow through the analyzer flow cell (zero alarm), and / or report a reading above a user defined high alarm level (high alarm).

The sample-level alarm reports above a user defined intermediate alarm level which is above the zero alarm level and below the high alarm level.

4.4.2.1 Design Information – Solid State AC Relays (Standard)

The solid state AC alarm outputs offer maximum load rating of 10 A inductive at 24-280 VAC and have a minimum load rating of 40 mA rms. The maximum off-state leakage current at the rated voltage is 10 mA rms. The solid state AC relays do not work with direct current circuits.

4.4.2.2 Design Information – Solid State DC Relays (Optional)

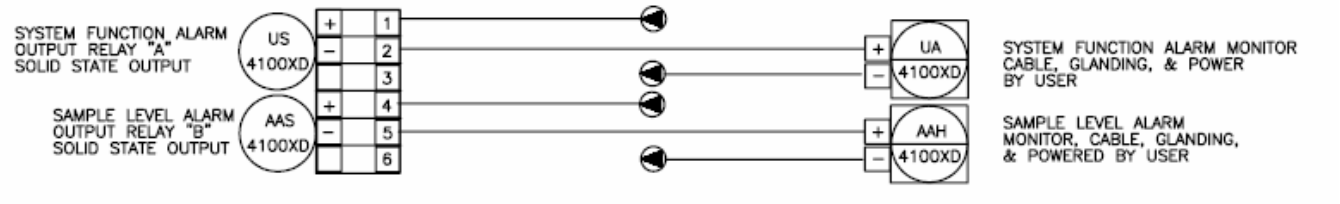
The optional solid state DC alarm outputs offer a maximum load rating of 5 A inductive at 12-48 VDC and have a minimum load rating of 40 mA . The maximum off-state leakage current at the rated voltage is 10 mA . The solid state DC relays do not work with alternating circuits.

4.4.2.3 Installation – Electrical Connection

4.4.2.3.1 Alarm Monitor Connections

The system-function alarm is normally connected to an alarm monitor configured to provide a fail-safe alarm. To connect to the system-function alarm relay terminate the alarm power to Terminal 1 and the alarm return to Terminal 2. To provide a fail-safe alarm, set the relay for normally open (NO) operation as detailed in Section 7.22 and 7.23. For energize-to-alarm operation, set the relay for normally closed (NC) operation as detailed in Section 7.22 and 7.23

As with the system-function alarm, if the sample-level alarm is to be connected to an alarm monitor, it is normally configured to provide a fail-safe alarm. To connect to the sample-level alarm relay terminate the alarm power to terminal 4 and the alarm return to terminal 5. To provide a fail-safe alarm, set the relay for normally open (NO) operation as detailed in Section 7.22 and 7.23. For energize-to-alarm operation, set the relay for normally closed (NC) operation as detailed in Section 7.22 and 7.23.

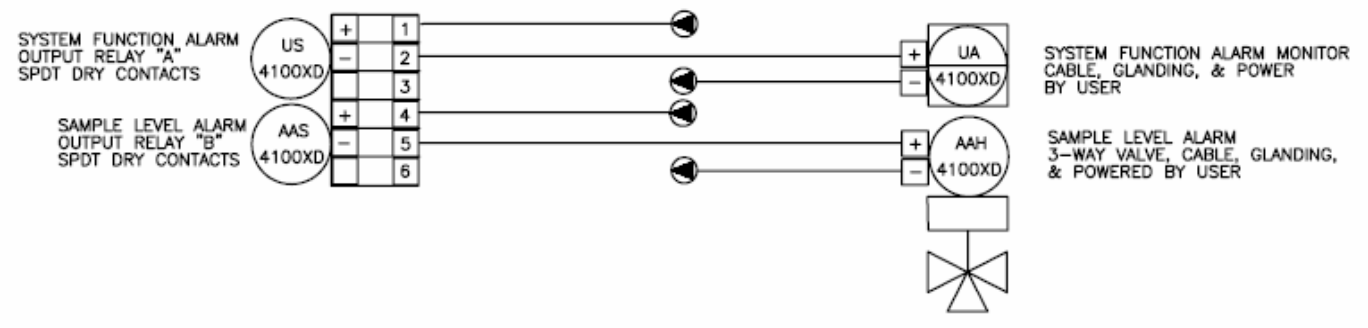


4.4.2.3.2 Alarm Monitor and Process Control Connections

The system-function alarm is normally connected to an alarm monitor configured to provide a fail-safe alarm. To connect to the system-function alarm relay terminate the alarm power to terminal 1 and the alarm return to terminal 2. To provide a fail-safe alarm, set the relay for normally open (NO) operation as detailed in Section 7.22 and 7.23. For

energize-to-alarm operation, set the relay for normally closed (NC) operation as detailed in Section 7.22 and 7.23.

When used for direct process control, the sample-level alarm is normally configured to provide a fail-safe alarm. For fail-safe alarm operation, connect the process control 3-way valve power to terminal 4 and the 3-way valve supply to terminal 5. To provide a fail-safe operation, set the relay for normally open (NO) operation as detailed in Section 7.22 and 7.23. For energize-to-alarm operation, set the relay for normally closed (NC) operation as detailed in Section 7.22 and 7.23.



4.4.2.4 Start Up



NOTE: Read all the enclosure tags and labels carefully before applying power to the TD-4100.

After setting the alarm limits as per Sections 7.24 through 7.29, TDHI recommends testing the operation of the alarm as per Sections 7.16 and 7.17.

4.4.2.5 Troubleshooting TD-4100 Alarms



WARNING: The TD-4100 enclosure should not be opened unless power is removed or the area has been properly tested and is known to be non-hazardous.

PROBLEM	CAUSE	SOLUTION
Alarm does not trigger relay	Alarm configuration not as per user understanding.	Review and revise alarm settings as necessary.
	External circuit power.	Confirm power available to interrogate contacts, external circuit integrity, external end device integrity, and external circuit polarity.

PROBLEM	CAUSE	SOLUTION
	External circuit load below relay minimum rating.	Replace external device with one with a rating that matches the solid state output or introduce an artificial load.
	Relay Circuit Breaker tripped.	Once the external circuit integrity is verified, open the enclosure door and replace the breaker.
	Contact rating exceeded.	Install circuit protection consistent with the contact ratings, replace the component causing the overload, and replace the relay circuit breaker.

4.4.2.6 Spares

None anticipated or provided.

4.4.3 Analog Output

The TD-4100 may optionally be fitted with one of 4 analog output configurations, which are defined by the analog output option:

1. 0-20 or 4-20 mA (standard);
2. HART (optional).

4.4.3.1 4 – 20 and 0 – 20 mA Output (Standard)

The normal provided configuration of the instrument is 4 – 20 mA. The output may be adjusted to deliver a 0 – 20 mA output.

4.4.3.1.1 Design Information

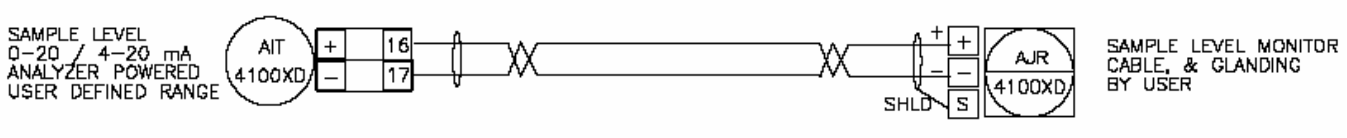
The mA sample level analog output is powered by the TD-4100 and is able to drive across a maximum total loop resistance of 500 Ω.

4.4.3.1.2 Installation – Electrical Connection

The sample level 0-20 / 4-20 mA analog output is powered by the TD-4100, and the positive is connected to Terminal 16 and the negative to Terminal 17.



NOTE: The screen is normally floated at the analyzer and grounded [earthed] at the analog monitor to avoid potential ground loops and to minimize potential signal interference.



4.4.3.2 HART™ Output (Optional)

4.4.3.2.1 Design Information

The HART™ sample level analog output is powered by the user analog monitor and must be between 12-30 VDC.

Using any HART™ compatible monitoring system, the HART™ option permits the user to read the pre-programmed instrument tag number and process loop identifiers, and the instrument analog output.

The HART™ option does not support bi-directional communication, remote configuration, nor does it permit viewing or interacting with the local LCD keyboard from a remote location.

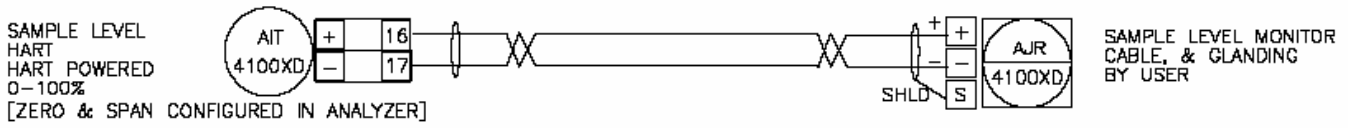
NOTE: The instrument tag number must be programmed by TDHI during the instrument manufacture.

4.4.3.2.2 Installation – Electrical Connection

The sample level HART™ analog output is powered by the analog monitor, and the positive is connected to Terminal 16 and the negative to Terminal 17.



NOTE: The screen is normally floated at the analyzer and grounded [earthed] at the analog monitor to avoid potential ground loops and to minimize potential signal interference.



4.4.3.3 Start up



NOTE: Read all the enclosure tags and labels carefully before applying power to the TD-4100.

After setting the analog output limits as per Sections 7.31 and 7.32, TDHI recommends testing and tuning the analog output as per Sections 7.18 and 7.19.

4.4.3.4 Troubleshooting



WARNING: The TD-4100 enclosure should not be opened unless power is removed or the area has been properly tested and is known to be non-hazardous.

PROBLEM	CAUSE	SOLUTION
Reading does not respond to changing sample concentration.	Optional HART™ analog monitor not providing power	Review analog monitor configuration to ensure monitor powers loop.
	mA analog monitor providing power	Review analog monitor configuration to ensure monitor does not power loop.

PROBLEM	CAUSE	SOLUTION
	Analog output configuration error	Review and adjust the analog output low and high limits as per Sections 7.31 and 7.32.
		Review and adjust the analog output tuning as per Sections 7.18 and 7.19.
Reading clipping at high oil in water concentrations	Analog output range does not align with analog monitor range	Review and adjust the analog output high limit as per Section 7.32.
Reading on analyzer LCD does not correspond to reading on analog monitor.	Analog output range does not align with analog monitor range	Review and adjust the analog output low and high limits as per Sections 7.31 and 7.32.
	Analog Output tuning not completed	Review and adjust the analog output tuning as per Sections 7.18 and 7.19.

4.4.3.5 Spares

None anticipated nor provided.

4.5 Ambient Temperature Options

The design operating temperature limits are dictated by the operational limits of the photomultiplier tube, the LCD display, and to avoid condensation and corrosion damage to the TD-4100.

If the annual site ambient temperature ranges:

1. Between 32°F [0°C] and 120°F [49°C], specify the standard instrument configuration;
2. Between 32°F [0°C] and 158°F [70°C], specify the vortex air cooler option; and
3. Between -4°F [-20°C] and 32°F [0°C], install in a heated environment to maintain the ambient temperature above 32°F [0°C].

4.5.1 Enclosure Vortex Air Cooler

The enclosure vortex cooler is designed to ensure stable performance of TD-4100 at high ambient temperatures. The vortex cooler is powered by compressed air and generates a vortex from which hot and cold air streams are separated. The hot air stream is exhausted from the enclosure, and the cold air stream is routed onto heat sensitive components in the TD-4100 enclosure.

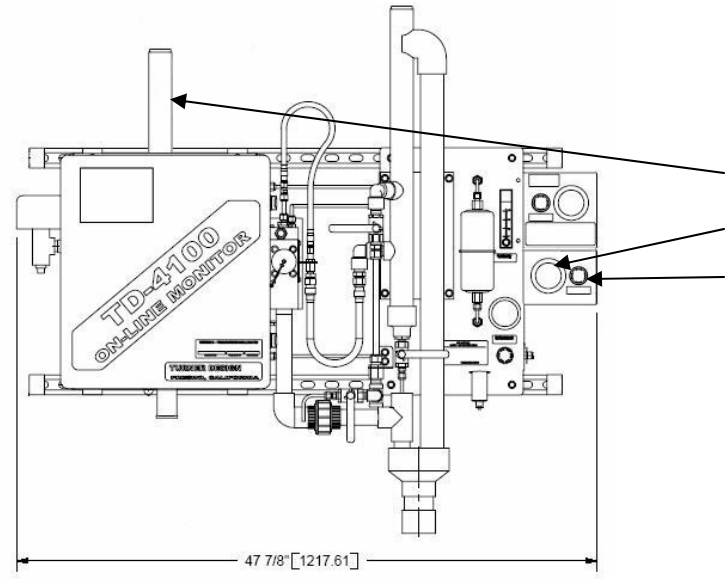
4.5.1.1 Design Information

The unit is designed for continuous operation.

1. Design cooling capacity: 120 Watts.
2. Design enclosure temperature: 70°F [39°C] below ambient.
3. Design air supply pressure: 60 to 100 psig [4.2 to 7 bar(g)].
4. Design air supply temperature: 70°F [21°C].
5. Design air consumption: 480 SCFH [13.6 sm^3/hr].
6. Maximum working pressure of vortex cooler: 150 psig [10.5 bar(g)].
7. Maximum noise level: 83 db.

The vortex air cooler absolutely requires instrument quality air as defined in Section 4.8. Using wet or oily compressed air will cause severe damage to the instrument and present a safety hazard to the operator.

4.5.1.2 Start up



Adjust the vortex cooler supply regulator to display 50 psig [3.45 bar(g)].

Vortex cooler

Vortex cooler supply gauge

Vortex cooler supply regulator

4.5.1.3 Operations

If in hot weather, the vortex cooler supply air temperature exceeds 70°F [21°C] or if the ambient temperature exceeds 170°F [76.5°C], it may be necessary to increase the vortex cooler supply regulator pressure to maintain the cabinet internal temperature below the vortex cooler enclosure design temperature of 100°F [37.75°C].

During routine unit tours, if during hot weather a perceptible increase in signal to noise ratio is observed, it may be due to a high enclosure temperature. Confirm the enclosure cooler is operating.

4.5.1.4 Maintenance

Vortex coolers provide exceptional reliability and no maintenance is anticipated. Note that the use of the vortex cooler may increase the maintenance intervals of the user-provided or TDHI-provided compressed air drying and filtration system.

4.5.1.5 Troubleshooting

PROBLEM	CAUSE	SOLUTION
Analog monitor trend shows an increase in signal to noise ratio.	High ambient temperature causing the PMT temperature to exceed above 120°F [49°C]	Increase air supply pressure to vortex cooler.
	High vortex cooler air supply temperature reducing efficiency of the vortex cooler causing the PMT temperature to exceed above 120°F [49°C]	Increase air supply pressure to vortex cooler.
	Direct sunlight impinging on the electronics enclosure causing a heat build-up in the electronics enclosure causing the PMT temperature to exceed above 120°F [49°C]	Short term: increase air supply pressure to vortex cooler. Long term: install a sunshade to reduce the solar radiation load on the electronics enclosure.
Water and/or oil observed exiting from lower enclosure vent.	Compressed air supply is not instrument-quality. This is a very serious situation that needs to be immediately addressed.	Determine cause of wet and/or oily compressed air or obtain permanent membrane air dryer and pre-filter system from vortex air cooler system.

4.5.1.6 Spares

None anticipated nor provided.

4.6 Sample Cooler Option

The TD-4100 base configuration does not include a sample cooler but requires a sample supply temperature below 140°F [60°C] or 190°F [88°C] if the stainless steel bubbletrap is specified and a sample supply temperature fluctuation less than ±10°F [±5.5°C] outside start up and shut down operations.

If the anticipated sample supply temperature is above 190°F [88°C] or the anticipated sample supply temperature fluctuation is greater then ±10°F [±5.5°C] outside start up and shut down operations, the TD-4100 must optionally be fitted with a sample cooler .



NOTE: To provide maximum system performance, a lower sample temperature is preferred.

4.6.1 Design Information

All sample coolers are sized to meet application requirements. To permit TDHI to complete the sample cooler sizing, we require the following information.

1. Cooling water supply temperature and pressure;
2. Cooling water availability;
3. Cooling water return temperature and pressure limits, if any;
4. Sample supply temperature, pressure, and condition (liquid volume fraction); and
5. Sample fouling propensity (clean, average, dirty).



NOTE: TDHI will submit, upon completion of preliminary sample cooler sizing, design details to the user for their review prior to arranging fabrication.

Sample coolers are provided with stainless steel shells and tubes but, as required, are available in other alloys consistent with the specified wetted material code.

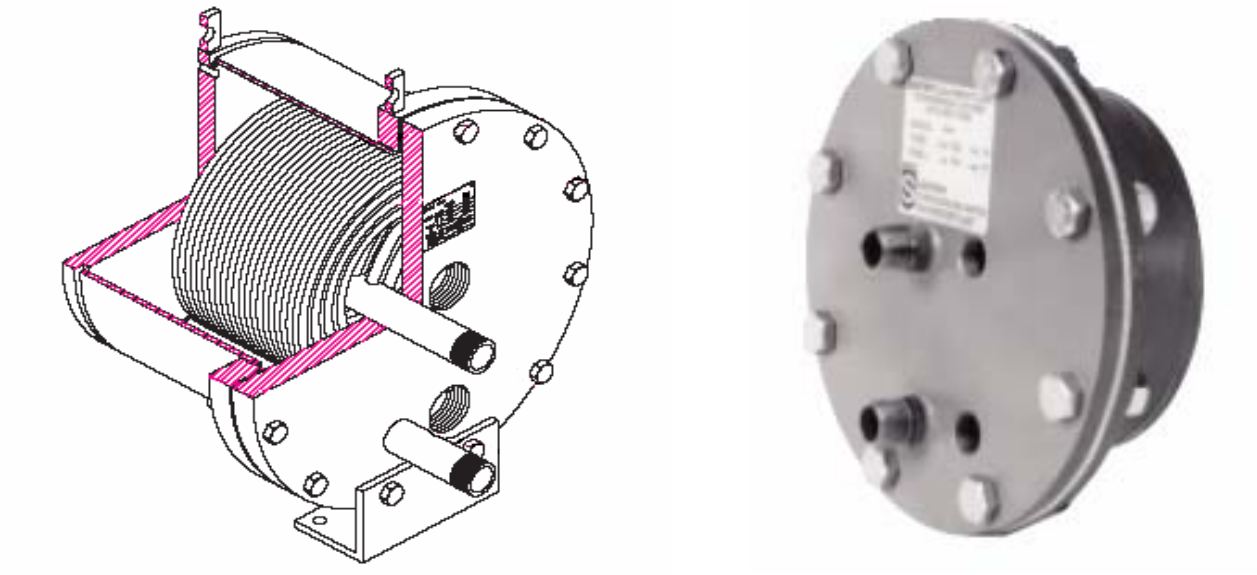
Typical cooler operational limits are:

1. Shell side pressure ratings to 1200 psig [83 bar(g)];
2. Tube side pressure rating to 10,000 psig [690 bar(g)]; and
3. Temperature rating to 1500°F [815°C].

For safety reasons, the user may wish to install an alarm or automatic control system that monitors the flow of cooling water and shuts off sample flow in the event the cooling water supply fails.

4.6.1.1 Installation – Piping Connection

The sample cooler is user-mounted separately from the instrument. Connections must be made between the sample cooler and the instrument sample inlet.



The sample cooler cooling water inlet and outlet piping connection size is defined during the sample cooler sizing process but are typically either ½" or ¾" FNPT.

4.6.1.2 Start Up

Prior to introducing sample to the analyzer, open the cooling water supply and return lines, and confirm cooling water flow through the cooler. Once flow is established, sample may be introduced into the analyzer as required.

4.6.1.3 Operations

As part of routine unit tours, confirm that whenever sample flow is directed to the analyzer, the cooling water supply and return are open, and confirm water flow to the cooler.

4.6.1.4 Maintenance

If cooling water fouling is common, it may be necessary to backwash the shell side on a routine basis.

If there are low sample flow rates with heavy sediment loads or where bacterial growth is expected and not treated, it may be necessary to backwash the tube side on a routine basis.

4.6.1.5 Troubleshooting

PROBLEM	CAUSE	SOLUTION
Sample temperature above 200°F [93°C]	Tube side fouling.	Backwash and, if necessary, inspect and clean exchanger tube side
	Shell side fouling.	Backwash and, if necessary, inspect and clean exchanger shell side.
	Cooling water isolated.	Open cooling water supply and return isolation valves.

4.6.1.6 Spares

None anticipated or provided.

4.7 Wetted Materials Options

The TD-4100 base configuration is fitted with thermoplastic and stainless steel wetted parts. The temperature limitations of the base configuration are 32 – 140°F [0 – 60°C]. The TD-4100 may optionally be fitted with all stainless steel wetted parts to increase the temperature range to 190°F [88°C] or provide better corrosion resistance to the sample water. Other wetted materials options such as Alloy 400 (Monel) or Hastelloy C-276 are available.



NOTE: TDHI will, upon request, investigate special wetted parts requirements.



NOTE: Non-metal wetted parts include Teflon in all wetted materials options.

4.8 Air Supply Options



CAUTION: The TD-4100 air supply must be instrument quality as defined in ISA-S7-0.01-1996, Section 5 and ISO 8573.1, wherein the air must be:

1. Free of particulate matter above 1 micron;
2. Have an oil (liquid and gas) content below 0.008 PPM wt/wt [0.02mg/m^3]; and
3. Have a dew point at least 18°F [10°C] below ambient temperature to which any part of the instrument air system is exposed, and under no circumstance, shall exceed 39°F [3.9°C] at line pressure.

The TD-4100 base configuration requires instrument quality air between 60 and 100 psig, [4.15 and 6.90 bar(g)].

If the site air supply:

1. Is of instrument quality, specify the standard instrument configuration without any additional filters;
2. Is not of instrument quality, specify the permanent membrane air dryer and pre-filter system option; or
3. No air supply exists and a compressor may be located in a non-hazardous location, specify the air supply system option.

4.8.1 Site Air is not Instrument Quality (Permanent Membrane Air Dryer and Pre-Filter System Option)

Membrane dryer and pre-filter assemblies are sized by TDHI to meet option requirements.



NOTE: The user must send untreated analyzer air supply temperature and pressure information to TDHI to have the membrane dryer and pre-filter assembly sized by TDHI.

The TDHI-supplied membrane dryer and pre-filter assembly features:

1. Pilot operated, pneumatically actuated automatic drains to reliably discharge collected liquid; and
2. Differential pressure indicators to advise users to replace filter and pre-filter elements.

4.8.1.1 Design Information

The membrane dryer, pre-filter assemblies are shipped loose and are to be installed by the user in the air supply upstream of the analyzer. The assemblies are fitted with mounting hardware to permit bolting them to a user supplied and installed structural support. Both inlet and outlet air connections are ½" NPT or ¼" tube.

1. Maximum working pressure: 250 psig [17.25 bar(g)].
2. Maximum working temperature: 150°F [66°C].
3. Air supply inlet size: 1/2" NPT(F) and / or ¼" Tube.
4. Design supply pressure 90 to 120 psig [6.2 to 8.25 bar(g)].



CAUTION: Repair or replace worn or damaged parts immediately. Do not alter or modify the air dryer, pre-filter assembly.

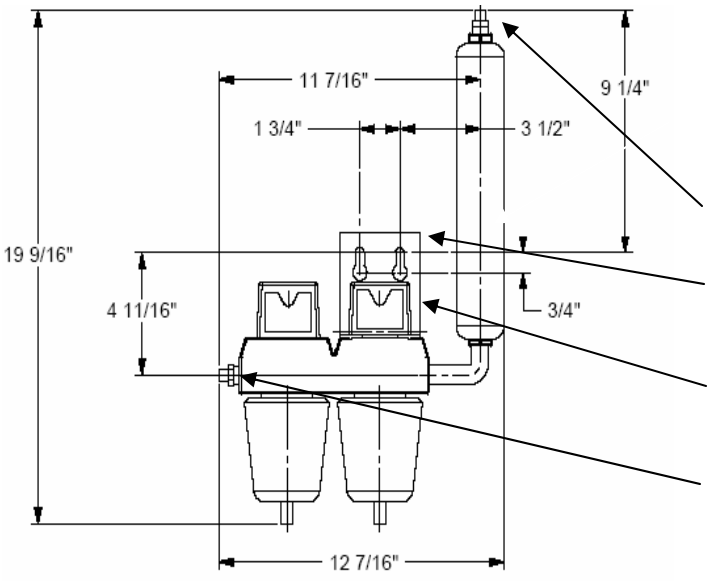


WARNING: Do not exceed the maximum working pressure of the air dryer, pre-filter assembly.



NOTE: Read all the air dryer, pre-filter assembly tags, labels, and vendor information included in the accessory package carefully before operating the TD-4100 air dryer, pre-filter assembly.

4.8.1.2 Installation – Piping Connection



Connect the membrane dryer and pre-filter assembly to site air using the provided ¼" tube fitting or remove for a ½" NPT fitting. If the high-capacity membrane dryer and pre-filter assembly for a vortex air cooler is used, then the inlet connection must be ½" NPT.

Air supply ¼" tube or ½" NPT outlet

Assembly mounting plate

Filter maintenance indicators

Air supply ¼" tube or ½" NPT inlet

4.8.1.3 Start Up

Prior to pressurizing the air membrane dryer and pre-filter assembly, ensure:

a) The filter cartridges are installed;
b) The membrane dryer vents are clean and unobstructed; and
c) The auto drains are closed.

After these checks, the air membrane dryer and pre-filter assembly may be pressurized and opened to the analyzer. If starting from zero pressure, it is necessary to temporarily seal the auto drains with two fingers until sufficient backpressure is obtained.

4.8.1.4 Operations

As part of routine unit tours, confirm:

1. The membrane dryer vents are clean and unobstructed;
2. The filter maintenance indicators indicate the filters are not spent; and
3. Check for leaks (other then the dryer vents) and tighten as necessary.

4.8.1.5 Maintenance

If the moisture content is high, it may be necessary to manually blow down and clean the filter automatic water dump valves.

Replace the filter cartridges when the maintenance indicators indicate it is required or every six months, whichever is sooner.

Maintenance Schedule

FREQUENCY	ACTION
Six months	Replace the two filter cartridges.

4.8.1.5.1 Procedure for Element Replacement



WARNING: The filters are pressure containing devices. Depressurize before servicing. If the filter has not been depressurized before disassembly, an audible alarm will sound when the bowl begins to be removed from the head. If this occurs, stop disassembly, isolate, and completely depressurize filter before proceeding.

1) Isolate filter or shut off air supply.
2) Depressurize filter by slowly opening manual drain valve.
3) Remove bowl by pushing bowl up, turning bowl 1/8 turn to your left, and pull bowl straight down.
4) Clean filter bowl.
5) Replace element with same type (note that there are two different element types). Pull off old element and discard. Make certain o-ring inside top of replacement element is in place and push element onto filter head. Handle elements by bottom end cap only.
6) After making certain that o-ring and wave spring inside top of bowl are in place, reassemble bowl to head.
7) Remove filter isolation or turn on air supply.
8) Repressurize the filters as in Section 4.8.1.3 Startup.



NOTE: Make certain o-ring is generously lubricated with silicon-based grease.



NOTE: Wave spring ends should be pointed down to prevent the wave spring from interfering with reassembly.

4.8.1.6 Troubleshooting

PROBLEM	CAUSE	SOLUTION
Moisture accumulating in TD-4100 air dryer bowl, air curtain flowmeter, on optical windows, or in TD-4100 electronics enclosure.	Air dryer not reducing dew point to 18°F [10°C] below ambient.	Ensure membrane dryer vents are clean and unobstructed, and auto drains on pre-filters are operating correctly.
	Pre-Filter cartridge overloaded.	Replace pre-filter cartridge.
Air leaking from auto drain valve	Auto drain valve manually open.	Twist auto drain valve to shut.
	Insufficient backpressure during initial pressurization.	Temporarily place finger on bottom of auto drain valve to seal. Remove when sufficient backpressure is present.
Differential gauge in red zone.	Cartridge is spent.	Replace cartridge.
Vortex cooler operation causing condensation in the electronics enclosure.	Air dryer not reducing dew point to 18°F [10°C] below ambient.	Ensure membrane dryer vents are clean and unobstructed, and auto drains on pre-filters are operating correctly.

4.8.1.7 Spares

The 2-year air dryer, pre-filter assembly spares kit available from TDHI is detailed in the following table.

PART NUMBER	DESCRIPTION	QUANTITY
4100-956	Permanent Membrane Air Dryer Pre-Filter Spares Kit (Normal Capacity)	
040-4202	Air Filter Cartridge	4
040-4554	Oil Filter Cartridge	4
100391	Permanent Membrane Air Dryer Pre-Filter Spares Kit (High Capacity)	
100392	Air Filter Cartridge	4
100393	Oil Filter Cartridge	4

4.8.2 Air Compressor (Air Supply Option)

Air compressor systems are sized by TDHI to meet option requirements, and include an air membrane dryer and pre-filter assembly.

The TDHI-supplied compressor systems feature ASME coded volume tanks and ASME volume tank pressure safety valves, 100% oil free operation, pressure gauges, local pressure switch control, and manual drains.

4.8.2.1 Design Information

Follow manufacturer's mounting, electrical, and piping connection guidance to ensure safe start up and operation of the compressor.

The air compressor must:

1. Pump only clean, dry air (water vapor, oil-based contaminants, or other liquids must be filtered out);
2. Operate at 32 to 104°F [0°C to 40°C];
3. Be protected from dirt and moisture;
4. Not pump flammable or explosive gases or be used in an atmosphere that contains such gases;
5. Not pump corrosive gases or particulate laden air as these will damage the compressor;
6. Be mounted on a stable, rigid operation surface (to reduce noise, and vibration shock mounts are recommended); and
7. Be exhausted to a safe area away from materials that may be damaged by hot exhaust.

The air compressor and the membrane dryer and pre-filter assembly are shipped loose and are to be installed by the user.



WARNING: The air compressor is not area rated and must be installed in and take suction from a non-hazardous location.

The user is also responsible for electrically fitting out and protecting the compressor in accordance with site-specific requirements, and for completing piping between the discharge of the compressor and the TD-4100 air connection point.

To understand membrane dryer and pre-filter assembly option information, refer to Section 4.8.1 Permanent Membrane Air Dryer and Pre-Filter.

1. Design operating air pressure output: 80 to 100 psi(g) [5.5 to 7 bar(g)].
2. Operating voltage: 110 – 130 VAC. The motor horsepower is 1/3 hp [0.25 kW].



CAUTION: Repair or replace worn or damaged parts immediately. Do not alter or modify the air compressor system.



NOTE: Read all the air compressor system tags, labels, and vendor information included in the accessory package carefully before operating the TD-4100 air compressor.

4.8.2.2 Installation – Electrical Connection



WARNING: Electrical connections should be made only by trained service personnel or certified electrician, and should only be completed in accordance with site isolation and safe work practices.

See vendor manual for specific instructions. The air compressor is not provided with a power connection cable or wiring.

4.8.2.3 Installation – Location

When choosing the compressor location, ensure the following are considered:

1. Heat generated during compression.
2. Operating noise during cycling.
3. Access for maintenance.
4. All manufacturer's recommendations.

The standard air compressor dimensions are 26" [66 cm] long x 21" [53.3 cm] high x 14" [35.6 cm] wide. The standard air compressor mounts to a horizontal surface on a 16" [40.6 cm] long x 12" [30.5 cm] wide rectangular pattern. The maximum bolt diameter for mounting is 3/8" [9.5 mm]. Make sure the manual drain is accessible. See Section 4.8.1.2 for permanent membrane air dryer system mounting.

4.8.2.4 Installation – Piping Connection



The compressor manual drain and the compressor air volume tank outlet are ¼" tube (standard), ¼" NPT (standard), ½" tube (high capacity), or ½" NPT (high capacity).

Plumb the air compressor supply outlet to the permanent membrane air dryer system (see Section 4.8.1.2) inlet with the supplied tubing and fittings. Plumb the permanent membrane air dryer system outlet to the instrument air inlet of the TD-4100.

CAUTION: Do not support inlet or outlet piping on the compressor inlet and outlet ports.

4.8.2.5 Start Up

Prior to operating the compressor, bump the compressor to ensure the motor is turning the proper direction. Incorrect rotation will quickly burn out the compressor motor.

Follow manufacturers start up directions to ensure a safe start up to the compressor. See the separate manufacturer's manual for the air compressor.

4.8.2.6 Operations

As part of routine unit tours, confirm:

1. The air compressor is cycling as per pressure control settings;
2. If the relative humidity is higher then 35%, then manually blow down the volume tank daily or as experience dictates;

NOTE: Do not allow excessive moisture to accumulate in the tank.

3. The membrane dryer vents are clean and unobstructed;
4. The filter maintenance indicators indicate the filters are not spent; and
5. Check for leaks (other then the dryer vents) and tighten as necessary.

4.8.2.7 Maintenance



NOTE: If unit is operated at maximum duties in a fairly clean, 65 to 75ºF [18 to 24ºC] ambient temperature with a 35% relative humidity, the first complete inspection and maintenance is anticipated after 4000 hours of operation. Earlier maintenance may be required depending upon the environment.

See the manufacturer's manual for specific maintenance instructions. Follow manufacturer's maintenance procedures to assure the product's performance and service life. Typical checks include:

1. Checking the intake and exhaust filters after the first 500 hours of operation. Clean filters and determine how frequently filters should be checked during future operation.
2. Checking the thickness of the rider ring and replacing as required. It should measure greater than .055" [1.4 mm].
3. Checking the filter felt and replace if it is covered with contamination or shows signs of increasing differential pressure.
4. Checking for damage of external accessories including relief valves and gauges.
5. Checking the air filter cartridge. A dirty filter restricts air flow and causes the compressor to run hotter resulting in longer operating cycles.
6. Cleaning the motor regularly. Dirt and film buildup on the outer shell adversely affects the compressor's ability to dissipate heat.
7. Permanent membrane dryer and pre-filter kit.
    a. If the moisture content is high, it may be necessary to manually blow-down and clean the filter automatic water dump valves.
    b. Replace the filter cartridges every six months or when the maintenance indicators indicate it is required whichever comes first.

Maintenance Schedule

FREQUENCY	ACTION	DESCRIPTION
Daily	Inspect pressure.	Compressor should cycle on at 80 psi(g) [5.52 bar(g)] and cycle off at 100 psig [6.89 bar(g)].
	Blow down tank.	Open tank vent and allow liquid to drain.
Three weeks	Check intake and exhaust filters.	Clean filters if dirty. Replace if excessively dirty or damaged.

FREQUENCY	ACTION	DESCRIPTION
	Check differential pressure gauges on permanent membrane air dryer and pre-filter system.	Replace filter element if in red zone.
Six months	Check thickness of rider ring.	Replace if less than 0.055" [1.4 mm].
	Check filter felt.	Replace if contaminated or increases differential pressure.
	Check relief valve.	Replace if not functional.
	Check pressure gauge.	Replace if not functional.
	Check outside of motor and compressor.	Clean and remove dirt and film to prevent heat accumulation.
	Air filter cartridges on permanent membrane air dryer and pre-filter system.	Replace as directed in Section 4.8.1.

4.8.2.8 Troubleshooting

PROBLEM	CAUSE	SOLUTION
Unit stalls after vacuum or pressure starts building up in receiver.	Power source voltage does not match the motor nameplate.	Check voltage and wiring connections against diagram on nameplate. Single voltage motors will operate only at designated voltage.
Motor will not start.	Compressor power isolated or disconnected.	Reconnect electrical supply to compressor.
	Compressor feeder cable undersized.	Ensure cable sizing is as per manufacturer's recommendations.
	Power source voltage does not match the motor nameplate.	Check voltage and wiring connections against diagram on nameplate. Single voltage motors will operate only at designated voltage.
	Other.	Contact TDHI and they will contact your local manufacturer Distributor/Representative or Authorized Service Facility.
Motor starts at 0 psig [0 bar(g)] but will not start under load:	Worn or dirty discharge check valve.	Clean / replace discharge check valve.

PROBLEM	CAUSE	SOLUTION
	Motor tripped on thermal overload.	Wait for the thermal overload to reset before attempting to restart. Replace defective overload switch.
	The motor may be damaged and requires service.	Contact TDHI and they will contact your local manufacturer Distributor/Representative or Authorized Service Facility.
Motor starts intermittently.	Worn or dirty pressure-switch points.	Check points and clean dirt buildup. If worn, replace as required.
Unit cycles On-Off more often than when first installed.	Air volume tank high water level.	Check air volume tank and drain water that has accumulated.
Unit or motor is running more often than when first installed.	Air delivery system leaks. Load changes due to wear of sample supply or return pump, or vortex cooler cooling requirements.	Check for system leaks through pipes, fittings, and seals. Repair as necessary.
	Dirty air filters.	Check and clean filters
	Compressor head dirty.	Check for buildup of foreign material on head
	Compressor wear.	Check valves and rings for wear and damage
Air receiver loses pressure.	Air delivery system leaks.	Check for system leaks through pipes, fittings, and seals. Repair as necessary.
	Worn or dirty discharge check valve.	Inspect the check valve to see if it is allowing air pressure to leak back into unit.
	Compressor head assembly air leaks.	Use soap to check for bubbles after the compressor has stopped for a few minutes, and repair air leaks as necessary.
Differential gauge in red zone.	Air filter cartridge is spent.	Replace air filter cartridge.
Air leaks from automatic drain of permanent membrane air dryer and pre-filter system.	Insufficient backpressure.	Temporarily block off the vent with fingers to establish sufficient backpressure.
	Drain vent is open.	Close the drain vent.

4.8.2.9 Spares

The 2-year compressor and air dryer and pre-filter assembly spares kits are available from TDHI is detailed in the following table. TDHI recommends maintaining at least one complete compressor spares kit at all times.

PART NUMBER	DESCRIPTION	QUANTITY
100376	Compressor Spares Kit	1
Contains		
100377	Felt	1
100378	Head Gasket	1
100379	Outlet Valve	1
100380	Inlet Valve	1
100381	Cylinder Gasket	1
100382	Piston Ring	2
100383	Piston Seal	2
100384	Rider Ring	1
4100-956	Air Purifier Spares Kit	
040-4202	Air Filter Cartridge	4
040-4554	Oil Filter Cartridge	4

4.9 Optical Kit

After reviewing your Customer Application Survey Form, TDHI application specialists will define the optical configuration of the instrument to provide high "targeted hydrocarbon" sensitivity while minimizing chemical interferences and sample turbidity interference.

In addition to the Customer Application Survey Form, TDHI application specialists may ask for clarification and / or request you submit additional information and / or samples to ensure the correct optical configuration is provided to ensure success of your application.

4.9.1 Spares



NOTE: Due to deterioration of the lamp over time, TDHI recommends purchasing lamp spares kits necessary for operation and routine maintenance of the instrument for two years.



NOTE: To check the integrity and stability of the TD-4100, TDHI recommends purchasing a CheckPOINT™ solid standard. The CheckPOINT™ is necessary for initial instrument checks and routine diagnostic checks.



NOTE: Due to deterioration of certain optical filters over time, TDHI recommends replacing the optical filters ever four years ahead of the monitor maintenance every four years.

TDHI will recommend the correct optical kit, and either the blue or orange CheckPOINT™ solid standard, in line with the TD-4100 optical configuration.

PART NUMBER	DESCRIPTION	QUANTITY
4100-933	CheckPOINT™ 4100 Solid Calibration Check Standard (Blue)	1
4100-934	CheckPOINT™ 4100 Solid Calibration Check Standard (Orange)	1
4100-946	Clear Quartz Lamp Spares Kit	1
040-4202	Black Viton™ gasket	2
040-4554	Lamp housing cover gasket	2
10-046	Clear quartz mercury vapor lamp	4
139-0600	Pocket clip screwdriver	1
4000-970	Desiccant plugs	1 Package of 3
800-0160	Cotton buds without adhesive	4 Packages
4100-949	Near UV Lamp Spares Kit	1
040-4202	Black Viton™ gasket	2
040-4554	Lamp housing cover gasket	2
10-049	Near UV lamp	4
139-0600	Pocket clip screwdriver	1
4000-970	Desiccant plugs	1 Package of 3
800-0160	Cotton buds without adhesive	4 Packages

4.10 IMO Datalogger

The IMO Datalogger is required for oil content monitoring applications covered by USCG CFR 46 Part 162.050 and/or IMO MEPC 107(49) regulation. The datalogger will store oil content monitoring information including concentrations, alarms, and maintenance activities for at least 18 months as required by IMO regulations. The datalogger data is tamperproof according to USDA 21 CFR Part 11.



CAUTION: The IMO datalogger must be installed, operated, and maintained according to this manual to remain in compliance with IMO regulations. Any activities regarding the IMO datalogger other than described here may jeopardize compliance with IMO regulations and may be documented by the IMO datalogger.



CAUTION: Failure to install, operate, and maintain the TD-4100 Oil Content Meter and IMO Datalogger according to these directions may cause oil discharges in violation of IMO regulations. All directions in this manual must be followed exactly to remain in compliance.



CAUTION: Extremely high concentrations greater than 100 ppm oil content can cause false readings and may cause accidental discharge of high oil content water. This monitor is to be used in conjunction with a 15 ppm certified bilge separation system. We suggest a latch system on the vessel's diverter valve and an independent analysis to determine recovery from extreme upset conditions.

The following alarm conditions are monitored and recorded by the IMO datalogger: oil content meter system function, 15 ppm oil content, 12 ppm oil content warning alarm, zero or clean water alarm, bilge separator function, and oil content meter maintenance. In addition, the measured oil content is periodically recorded. In the event of an alarm, the datalogger records the date, time, alarm status, and bilge separator status.

4.10.1 Design Information

There are two power supply options for the IMO datalogger. The power supply option must be selected at the time of order and cannot be changed without purchase of a new IMO datalogger.

1. 100 – 240 VAC (50 / 60 Hz)
2. 24 VDC

Enclosure size:	12" (305 mm) x 12" (305 mm) x 14" (356 mm)
Enclosure rating:	NEMA 4X (with door closed)
Actual size (panel mount):	5.67" (144 mm) x 5.67" (144 mm) x 6.9" (175 mm) deep

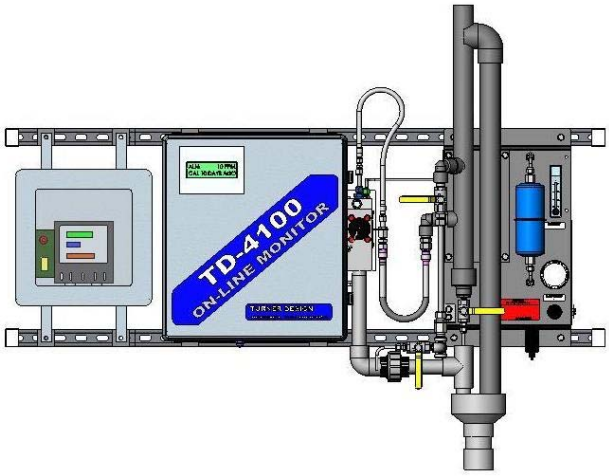
Data Logger Power consumption:	20 VA (AC) or 20 W (DC) maximum, note that this is in addition to instrument power consumption
Operating temperature:	32 – 104°F (0 – 40°C)
Relative humidity:	10 – 90% RH
Output:	Four relay outputs
Alarm output rating	240 VAC, 2 A maximum

4.10.2 Installation – Location

The IMO datalogger is permanent mounted on a Unitstrut frame with the TD-4100. If the IMO datalogger is removed from the frame, it must be mounted within a 3 ft [1 m] radius of the output electrical connection of the TD-4100 Oil Content Monitor to enable use of the supplied electrical and signal cables. The cable connections between the monitor and datalogger must not be removed or disabled, otherwise an alarm event will be recorded and the IMO certification will be invalidated.

4.10.3 Installation – Mounting

The IMO datalogger enclosure is mounted onto the TD-4100 frame. The datalogger should not be removed from the TD-4100 frame unless absolutely necessary. If moving is necessary, the cable connections must be maintained at all times to prevent an alarm event.



4.10.4 Installation – Electrical Connections

The electrical and signal cables between the TD-4100 Oil Content Meter and the IMO Datalogger are already connected and should not be disturbed. The customer will need to connect the following connections to the IMO datalogger:

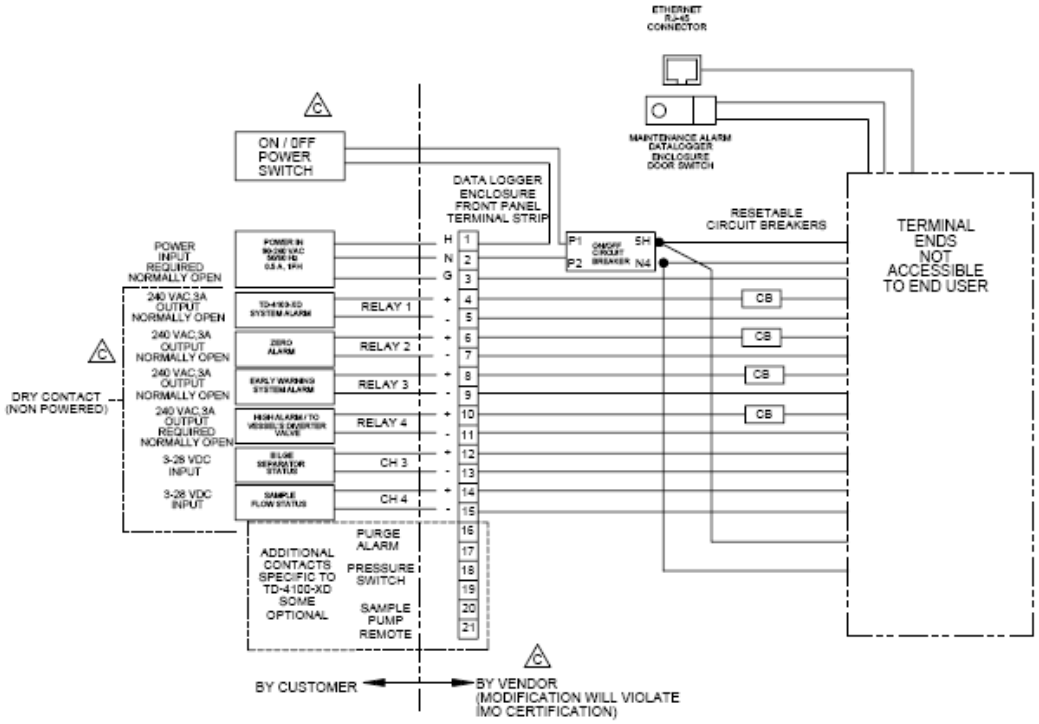
1. Power: Either 90-240 VAC 50/60 Hz, 200 W, 1 phase (standard) or 24 VDC, 200 W (optional). This input is required.
2. High Alarm (15 ppm) to Vessel's Diverter Valve: 240 VAC at 2 A non-powered output, normally open (close on alarm). This output is required and is recorded in IMO datalogger. This output must be connected to the vessel's diverter valve. If oil content concentrations greater than 30 ppm may occur, we suggest a latching status of the vessel diverter valve and then manual release upon sample collection and analysis to determine that the concentration has returned below 15 ppm.
3. Bilge Separator Status: 3-28 VDC input, 70 mA maximum, input when bilge separator is operating. This input is required and is recorded in IMO datalogger.
4. Sample Flow Status: 3-28 VDC input, 70 mA maximum, input when sample is flowing to IMO bilge alarm monitor. This input is required and is recorded in IMO datalogger.
5. Zero Alarm: 240 VAC at 2 A non-powered output, normally open (close on clean water flow or no water flow). This output is optional but is recorded in IMO datalogger.
6. Early Warming Alarm: 240 VAC at 2 A non-powered output, normally open (close on early warming alarm). This output is optional but is recorded in IMO datalogger.
7. Purge Alarm: See appropriate safety air purge system section of manual. This output is optional and is not recorded in IMO datalogger.

The IMO datalogger system also has an Ethernet RJ-45 connector to allow downloading of data.

Please see the attached wiring diagram for specific connection information. All connections on the terminal strip are capable of handling wire sizes 10 - 20 AWG [0.2 - 6 mm^2]. The IMO datalogger system outputs are protected by resetable 2 A circuit breakers. The power input to the IMO datalogger also supplies power to the TD-4100 Oil Content Meter. The IMO Datalogger system has two ¾" [19 mm] cable glands capable of handling overall cable diameters of 0.67 – 1.03" [17.0 – 26.2 mm] and one ½" [12 mm] cable gland capable of handling overall cable diameters of 0.49 – 0.82" [12.4 – 20.8 mm].



WARNING: The cable connections between the IMO datalogger and TD-4100 should not be accessed or modified. Doing so will violate IMO certification. Opening the enclosure will require breaking tamper-resistant seals required by IMO regulations.





CAUTION: The TD-4100 and IMO Datalogger must not be subject to transient over voltages according to INSTALLATION CATAGORY II Pollution Degree 2 in accordance with IEC664.



CAUTION: Fusing protects the TD-4100 and IMO Datalogger. However, external branch circuit protection must be provided in line with site-specific code and facility requirements. The TD-4100 and IMO Datalogger power supply wire rating should be at least 16 A, 300 V, 60°C.



WARNING: The TD-4100 enclosure and IMO Datalogger should not be opened unless power is removed or the area has been properly tested and is known to be non-hazardous. It is normally not necessary to open the enclosure. Opening the enclosure will require breaking tamper-resistant seals required by IMO regulations.



NOTE: Read all the enclosure tags and labels carefully before applying power to the TD-4100 and IMO Datalogger.

Connect the 15 ppm alarm output from the IMO datalogger to the vessel's diverter valve system as shown in the diagram below. This alarm output is not powered by the IMO Datalogger, so it must be powered externally. The rating of this contact output is 240 VAC, 2 A maximum.

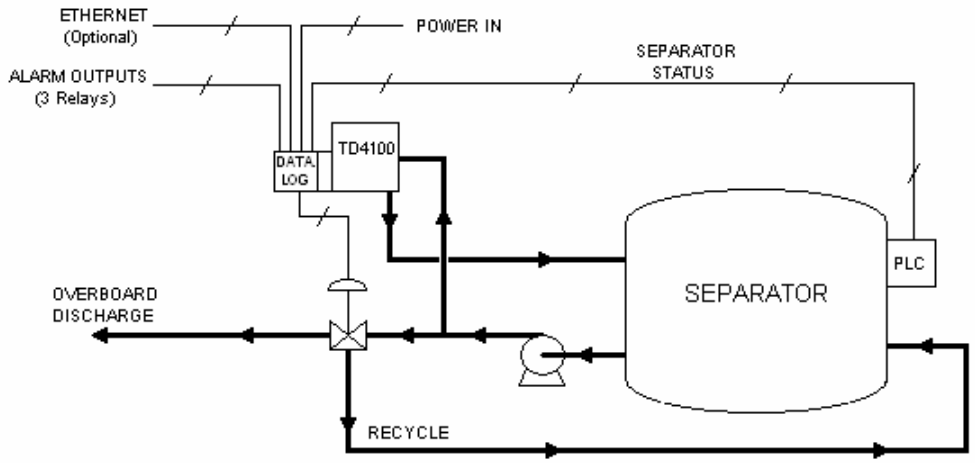
Connect the bilge separator operation status input to the IMO Datalogger as shown in the diagram above. This input is not powered by the IMO Datalogger, so it must be powered externally. The maximum rating of this input is 24 VDC at 70 mA. This input should be powered when the bilge separator is operating and not powered when the bilge separator is not operating.

Connect the sample flow status input to the IMO Datalogger as shown in the diagram above. This input is now powered by the IMO Datalogger, so it must be powered externally. The maximum rating of this input is 24 VDC at 70 mA. This input should be powered when the bilge water is flowing to the monitor and not powered when bilge water is not flowing.

(Optional) If a remote indication of the TD-4100 Oil Content Meter operational status alarm is desired, connect the operational status alarm output as shown in the diagram below. This alarm output is not powered by the IMO Datalogger, so it must be powered externally. The rating of this contact output is 240 VAC, 2 A maximum. This contact output will open upon power or system failure.

(Optional) If a remote indication of the TD-4100 Oil Content Meter zero or clean water alarm is desired, connect the zero or clean water alarm output as shown in the diagram below. This alarm output is not powered by the IMO Datalogger, so it must be powered externally. The rating of this contact output is 240 VAC, 2 A maximum. This contact output will open upon power or system failure.

(Optional) If a remote indication of the TD-4100XD Oil Content Meter early warning alarm is desired, connect the early warning alarm output as shown in the diagram above. This alarm output is not powered by the IMO Datalogger, so it must be powered externally. The rating of this contact output is 240 VAC, 2 A maximum. This output will be normally open and close upon the concentration reaching the early warning alarm concentration (12 ppm)



Typical Installation

4.10.5 Start Up

After the IMO Datalogger has been connected with power and alarm inputs and outputs as described above, first make sure the interior system power circuit breaker is on. Then turn on the power switch on the side of the IMO Datalogger enclosure. Both the IMO Datalogger and the TD-4100 Oil Content Meter have a short warm-up time.

If the IMO Datalogger enclosure door is open, a MAINTENANCE ALARM will appear, but will be turned off when the door is closed.

The IMO Datalogger is pre-programmed according to IMO regulation and password protected. Do not change the settings.



CAUTION: Changing the IMO Datalogger settings other than described in this manual will invalidate the IMO certification and will be recorded.

When the power is turned on a POWER ON marker appears in the datalog. If no bilge water is flowing, then various alarms such as ZERO ALARM, SAMPLE FLOW STATUS, and BILGE SEPARATOR STATUS will appear in the datalog.

4.10.6 Operations

The following alarms and indications are possible on the IMO Datalogger:

POWER ON	Indicates that the power has been turned on.
ZERO ALARM	Indicates that clean water or no water is flowing through the monitor. Note that when bilge water sample is first supplied to the oil content monitor's sample inlet, there will be a 1 minute delay before the bilge water sample flows through the flowcell. Thus, the ZERO ALARM will initially be on.
HIGH 15 PPM ALARM	Indicates that the oil content is 15 ppm or higher.
12 PPM WARNING ALARM	Indicates that the oil content is 12 ppm or higher.
SAMPLE FLOW STATUS	Indicates that bilge water is flowing to the monitor.
BILGE SEPARATOR STATUS	Indicates that the bilge separator is operating.
MAINTENANCE ALARM	Indicates that the oil content monitor and IMO datalogger are being maintained. Occurs when IMO datalogger enclosure door is opened.

All of these alarms have both on and off status indicators that are both displayed and recorded.

Normal IMO Datalogger Screen

The normal IMO datalogger screen will display the current readings and alarms in a chart form. The alarms will also be recorded in the datalogger.

The oil content level will be displayed by a red marker and a red line. The concentration is displayed on the right in ppm.

The bilge separator status will be displayed by a green marker and a green line. The status level will be displayed on the right in %. A reading of 2% or higher indicates that the bilge separator is operational.

The sample flow status will be displayed by a blue marker and a blue line. The status level will be displayed on the right in %. A reading of 1% or higher indicates that the bilge water is flowing to the monitor.

The oil content meter system status is displayed by a purple marker and purple line. The status level is displayed on the right in %. A reading of 3.7% indicates that the oil content monitor is functioning properly.

The maintenance status is displayed by a blue marker and a blue line. The status level is displayed on the right in %. A reading of 3.9% or greater indicates that the oil content monitor and/or IMO Datalogger are in maintenance mode.

Pressing the key under MAINMENU returns the display to the normal IMO datalogging screen.

IMO Datalogger Event Records Screen

The IMO Datalogger event records screen displays the event records along with their time and date, but does not display the continuous system inputs and outputs. The event records screen is updated each time a recordable event takes place.

The event records screen is accessed by pressing the button under MESSAGES. The Review key and subsequent displayed keys allow reviewing the entire event records history.

- Green events indicate normal status and user information.
- Red events indicate a warning message or problem associated with the datalogger function, not the oil content meter or separation system.
- Blue events indicate an alarm or input on.
- Magenta events indicate an alarm or input off.

Pressing the button under BACK returns to the normal IMO datalogging screen.

4.10.7 Maintenance

Whenever maintenance is performed either on the IMO Datalogger system or the oil content meter, the IMO Datalogger system enclosure door should be opened to allow triggering a maintenance event. Maintenance performed without opening the enclosure door and triggering the maintenance event will be assumed by the IMO Datalogger system and regulatory bodies as incorrect and questionable use and operation.



NOTE: Unless accessing the IMO Datalogger keypad or performing maintenance, keep the IMO Datalogger enclosure cover door closed to protect the datalogger from dust and water.



WARNING: The IMO Datalogger enclosure should not be opened unless the area has been properly tested and is known to be non-hazardous.



NOTE: Always open the IMO Datalogger enclosure door to cause a maintenance event record whenever performing maintenance on the IMO Datalogger system or oil content meter. Failure to do so will be recorded as questionable or incorrect operation of the oil content meter system.

Battery

The memory back-up battery must be regularly replaced at times of factory re-calibration, but is not user-replaceable. The battery switch is not user-accessible and should not be turned off.



CAUTION: Do not turn off the battery switch on the IMO Datalogger.

Backlights

At room temperature and maximum brightness, the backlight mean time till failure is 15,000 hours minimum. At extended temperatures, these times are reduced. The brightness and contrast are factory-set and not user adjustable. They are set for balancing readability against backlight life.

Operating Temperature

Prolonged operation at temperatures over 122°F [50^{0}C] will cause degradation of the display and may lead to other damage. If the unit has been moved from a cold environment to a warm one, ensure that the unit has reached a minimum operating temperature of 54^{0}F [12°C] or is left to stand for one hour at room temperature before applying power, to ensure no condensate remains in the unit.

Front Panel

Care should be taken with the front panel of the datalogger when handling or accessing the unit. Sharp and hard objects may pierce the front panel and damage the display. Abrasive materials will damage the front panel.

Calibration of IMO Datalogger

Re-calibration of the datalogger is recommended at oil content meter re-calibration intervals. The re-calibration must be done either at TDHI or by a THDI-authorized representative.

Calibration of Oil Content Meter

The oil content meter must be periodically re-calibrated according to the intervals specified on the supplied calibration certificate. The re-calibration must be done either at TDHI or by a THDI-authorized representative. Not all dealers are authorized to perform this work.

4.10.8 Troubleshooting

The IMO Datalogger system is protected by a resetable circuit breaker within the system power switch. If the circuit breaker has switched off, turn on the power switch again. The IMO Datalogger contains an internal fuse that cannot be user-replaced.

The system outputs are protected by resetable circuit breakers. If the alarm events are recorded on the datalogger system, but not reaching an external location, reset the circuit breaker by pressing the circuit beaker knob.

The IMO datalogger is factory set-up and configured. There are no user-changeable features other than described here. Changing features other than described here will violate the IMO certification. There are no user serviceable components within the IMO datalogger other than described here.



CAUTION: Do not attempt to change the parameter settings of the datalogger other than as described here in this section. The programmed parameter settings are specified by IMO regulations and are password protected.

4.10.9 Spares

There are no interior user-serviceable parts inside of the IMO Datalogger. The IMO Datalogger battery mentioned here must be replaced by TDHI or a TDHI-authorized representative since it involves breaking and replacing tamper-resistant seals required by IMO regulations.

PART NUMBER	DESCRIPTION	QUANTITY
100415	Datalogger battery	1

4.11 Sample Port

4.11.1 Introduction

The sample port allows you to collect a water sample for analysis or comparison. If you are performing a correlation calibration, you will need to collect samples from the sample port while noting the reading on the display screen. If you are using actual water samples for a standard, you will need to collect the water sample while calibrating the monitor. This collected sample would be analyzed by a laboratory method to determine the calibration concentration to be input into the monitor.

4.11.2 Operations

Prior to collection of any water sample, the sample port should be purged with the flowing sample for at least one (1) minute so that the collected sample is representative of the flowing sample.

When opening the sample port, be sure that is does not reduce the flow to the monitor so that overflow no longer occurs. You should still observe water sample exiting the overflow tube into the drain cup when the sample port is open. In some case, you may need to open the sample inlet valve further to allow sufficient sample flow to the monitor and the sample port.

5 START UP

5.1 Application Specialist Assisted

TDHI recommend new users specify application specialist assistance to ensure a trouble free start up.

To ensure application specialist availability for your start up, contact TDHI at least 1 month prior to the anticipated start up date. After being contacted, TDHI will assign you an application specialist who will provide assistance during your application start up.

Upon being assigned your project, the application specialist will issue an Installation Checklist for you to complete and return, and will follow up with you to confirm the installation and start up schedule, and to ensure any work permits / training / travel arrangements are in place to meet your start up time line.

Prior to committing to travel, the application specialist will need to ensure the analyzer installation is complete and complies with:

i. The environmental requirements as detailed in Section 2.1.1 Environmental Conditions;
ii. The site requirements as detailed in Section 2.1.2 Site Conditions;
iii. The mounting arrangements as detailed in Section 2.1.3 Mounting Considerations;
iv. The offsite requirements and connection details as described in Section 2.2 Offsite Requirements; and
v. The process requirements and connection details as described in Section 2.3 Process Requirements.

The application specialist will also confirm application details, feed availability, and any other necessary logistical details.



NOTE: TDHI provide both start up (for new users) and calibration assistance (for new users and for experienced users developing new applications).

NOTE: For new users or experienced users wishing a high level of onsite support, TDHI provide package pricing for start up and calibration assistance (commissioning), as well as non package pricing for onsite calibration assistance.

An applications specialist assisted start up typically takes one to two days onsite assuming sample availability, and the analyzer installation complies with the design guidelines.

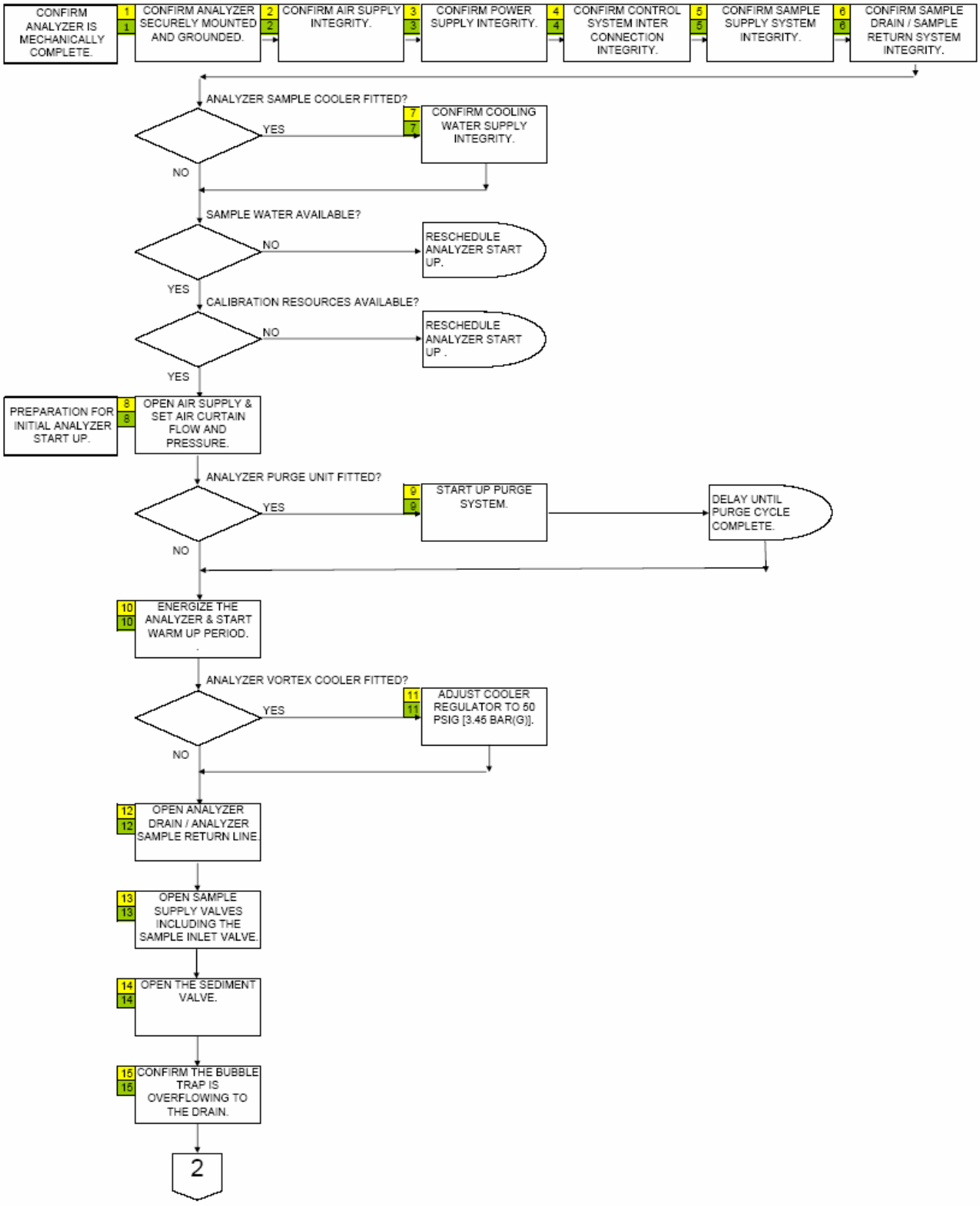
5.2 Non-application Specialist Assisted

If you opt not to include a TDHI application specialist as a member of your start up team, they are available to provide remote assistance normally within a 24 hour period and may be contacted at:

Tel: +1 559 253 1414, Fax: +1 559 253 1090, or
Email: service@oilinwatermonitors.com

5.3 Typical Start up Sequence

5.3.1 Start up Sequence Stage 1



5.3.2 Start up Sequence Stage 2

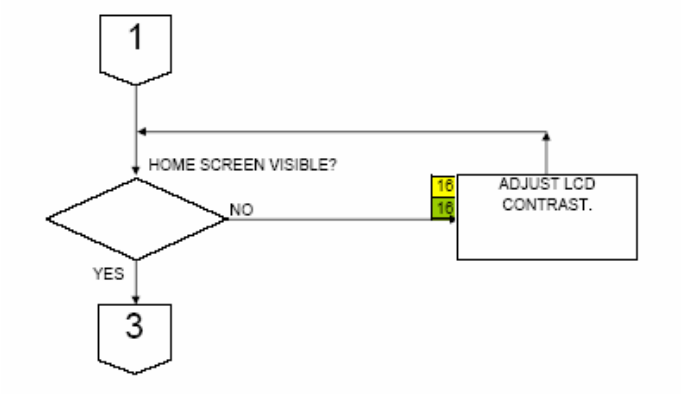




Figure 5.3.2.1

Power up screen.



Figure 5.3.2.2

Select “Home” screen.



Figure 5.3.2.3

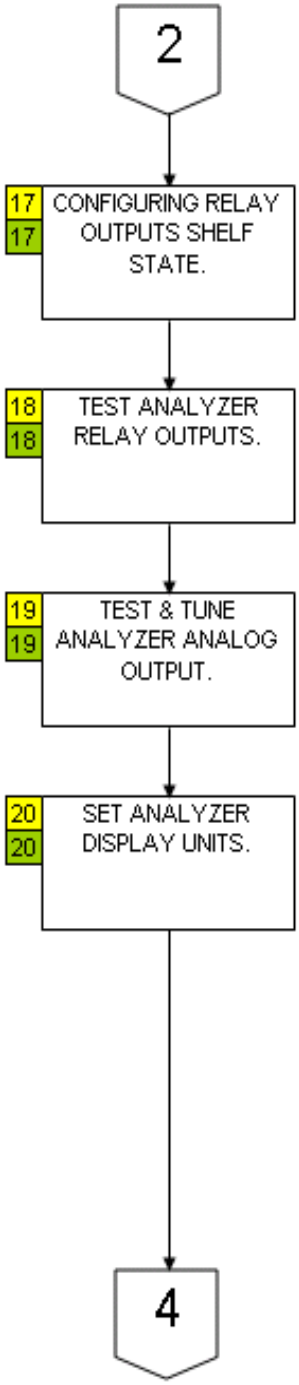
Key “⇓” to decrease LCD contrast 1 unit.



Figure 5.3.2.4

Key “⇑” to increase LCD contrast 1 unit.

5.3.3 Start up Sequence Stage 3



5.3.3.1 Enter Master ID



Figure 5.3.3.1.1

Select “Home” screen.



Figure 5.3.3.1.2

Select configuration screen “#”.

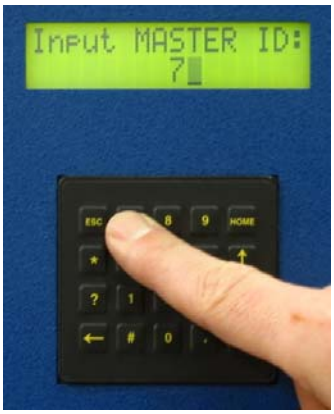


Figure 5.3.3.1.3

Key MASTER ID.



Figure 5.3.3.1.4

Key MASTER ID.



Figure 5.3.3.1.5

Key MASTER ID.



Figure 5.3.3.1.6

Key MASTER ID.



Figure 5.3.3.1.7

Select “Enter” to accept MASTER ID.



Figure 5.3.3.1.8

Return “Home” when finished.

5.3.3.2 Configure Relay Output Shelf State



Figure 5.3.3.2.1

Select configuration screen “2”.



Figure 5.3.3.2.2

Select “1” to change ‘Relay A’ operation.



Figure 5.3.3.2.3

Select “Enter” to toggle operation options.

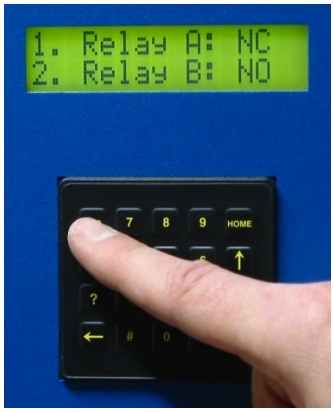


Figure 5.3.3.2.4

Select “ESC” to accept option.



Figure 5.3.3.2.5

Select “2” to change ‘Relay B’ operation.



Figure 5.3.3.2.6

Select “Enter” to toggle operation options.



Figure 5.3.3.2.7

Select “ESC” to accept option.



Figure 5.3.3.2.8

Return “Home” when finished.

5.3.3.3 Test Analyzer Relay Outputs



Figure 5.3.3.3.1

Select configuration screen "★".



Figure 5.3.3.3.2

Select "Enter" to go to 2nd screen.



Figure 5.3.3.3.3

Select "Enter" to go to 3rd screen.



Figure 5.3.3.3.4

Select "1" to test relay output A.



Figure 5.3.3.3.5

Select "Enter" to toggle relay output A state.



Figure 5.3.3.3.6

Select "Enter" to toggle relay output A state.



Figure 5.3.3.3.7

Select "ESC" to return to 3rd diagnostic screen.



Figure 5.3.3.3.8

Select "2" to test relay output B.



Figure 5.3.3.3.9

Select “Enter” to toggle relay output B state.



Figure 5.3.3.3.10

Select “Enter” to toggle relay output B state.



Figure 5.3.3.3.11

Select “ESC” to return to 3rd diagnostic screen.

5.3.3.4 Tune Analyzer Analog Output



Figure 5.3.3.4.1

Select “Enter” to go to 4th screen.



Figure 5.3.3.4.2

Select “Enter” to go to 5th screen.



Figure 5.3.3.4.3

Select 4 mA to test analog output low limit.



Figure 5.3.3.4.4

Tune 4 mA output level to match monitor.



Figure 5.3.3.4.5

Tune 4 mA output level to match monitor.



Figure 5.3.3.4.6

Tune 4 mA output level to match monitor.



Figure 5.3.3.4.7

Tune 4 mA output level to match monitor.



Figure 5.3.3.4.8

Tune 4 mA output level to match monitor.



Figure 5.3.3.4.9

Return to 5th diagnostic screen to confirm analog output low limit setting.



Figure 5.3.3.4.10

Select 20 mA to test analog High Limit.



Figure 5.3.3.4.11

Tune 20 mA output level to match monitor.



Figure 5.3.3.4.12

Tune 20 mA output level to match monitor.



Figure 5.3.3.4.13

Tune 20 mA output level to match monitor.



Figure 5.3.3.4.14

Tune 20 mA output level to match monitor.



Figure 5.3.3.4.15

Tune 20 mA output level to match monitor.



Figure 5.3.3.4.16

Return to 5th diagnostic screen to confirm analog output high limit setting.



Figure 5.3.3.4.17

Return Home when finished.

5.3.3.5 Set Analyzer Display Units



Figure 5.3.3.5.1

Select configuration screen “1”.



Figure 5.3.3.5.2

Select “Enter” to change value.



Figure 5.3.3.5.3

Select “Enter” to toggle options.



Figure 5.3.3.5.4

Select “Enter” to toggle options.



Figure 5.3.3.5.5

Select “Enter” to toggle options.



Figure 5.3.3.5.6

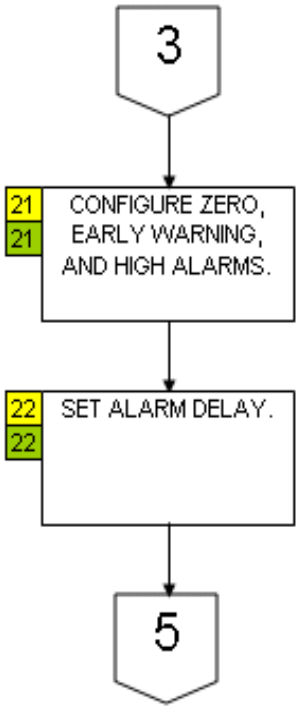
Select “ESC” to accept option.



Figure 5.3.3.5.7

Return “Home” when finished.

5.3.4 Start up Sequence Stage 4



5.3.4.1 Monitor and Set Zero Alarm – Relay A (System-function alarm)



Figure 5.3.4.1.1

Select “Home” screen.



Figure 5.3.4.1.2

Select configuration screen “3”.



Figure 5.3.4.1.3

Select “Enter” to change value.



Figure 5.3.4.1.4

Select “1” to change monitoring options.



Figure 5.3.4.1.5

Select “Enter” to toggle monitor options.



Figure 5.3.4.1.6

Select “ESC” to accept option.



Figure 5.3.4.1.7

Select “2” to change monitoring level value.



Figure 5.3.4.1.8

Key in alarm level.

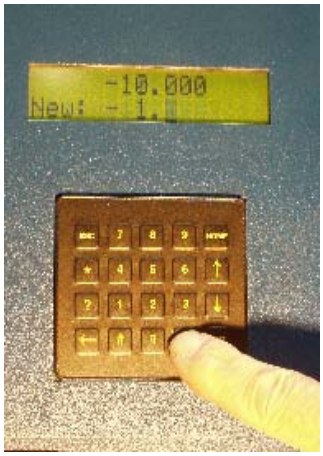


Figure 5.3.4.1.9

Key in alarm level.



Figure 5.3.4.1.10

Key in alarm level.

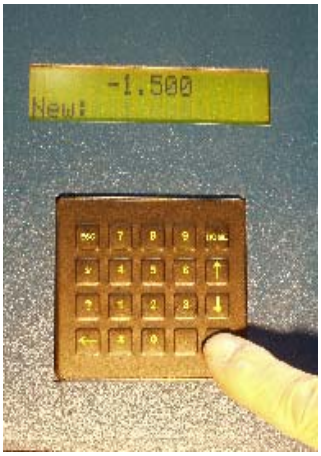


Figure 5.3.4.1.11

Select “ENT” to enter and accept value.



Figure 5.3.4.1.12

Select “ESC” to confirm value change.



Figure 5.3.4.1.13

Return “Home” when finished.



Figure 5.3.4.2.1

Select configuration screen “4”.



Figure 5.3.4.2.2

Select “Enter” to change value.



Figure 5.3.4.2.3

Select “1” to change monitoring options.



Figure 5.3.4.2.4

Select “Enter” to toggle monitor options.



Figure 5.3.4.2.5

Select “ESC” to accept option.



Figure 5.3.4.2.6

Select “2” to change monitoring level.



Figure 5.3.4.2.7

Key in alarm level.



Figure 5.3.4.2.8

Key in alarm level.



Figure 5.3.4.2.9

Select “Enter” to accept value.



Figure 5.3.4.2.10

Select “ESC” to confirm value.



Figure 5.3.4.2.11

Return “Home” when finished.

5.3.4.3 Monitor and Set High Alarm – Relay A (System-function alarm)



Figure 5.3.4.3.1

Select configuration screen “5”.



Figure 5.3.4.3.2

Select “Enter” to change value.



Figure 5.3.4.3.3

Select “1” to change monitoring options.



Figure 5.3.4.3.4

Select “Enter” to toggle monitor options.



Figure 5.3.4.3.5

Select “ESC” to accept option.

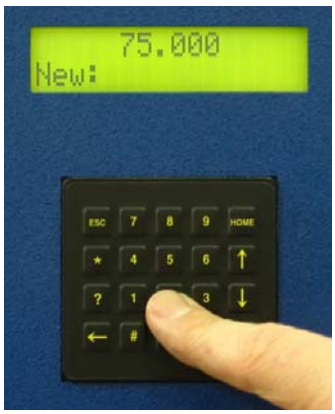


Figure 5.3.4.3.6

Select “2” to change monitoring level.



Figure 5.3.4.3.7

Key in alarm level.



Figure 5.3.4.3.8

Key in alarm level.



Figure 5.3.4.3.9

Key in alarm level.



Figure 5.3.4.3.10

Select “Enter” to accept value.



Figure 5.3.4.3.11

Select “ESC” to confirm value.



Figure 5.3.4.3.12

Return “Home” when finished.

5.3.4.4 Set the Alarm Delay

The Analyzer Alarm Delay delays the reporting of function and sample-level alarms to the analyzer alarm relays and analyzer alarm system.



Figure 5.3.4.4.1

Select configuration screen “6”.



Figure 5.3.4.4.2

Select “Enter” to change value.



Figure 5.3.4.4.3

Key in alarm delay value.



Figure 5.3.4.4.4

Select “Enter” to accept value.



Figure 5.3.4.4.5

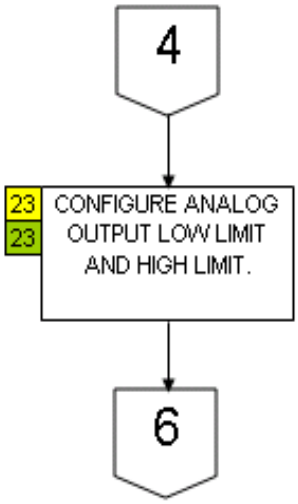
Select “ESC” to confirm value.



Figure 5.3.4.4.6

Return “Home” when finished.

5.3.5 Start up Sequence Stage 5



5.3.5.1 Configure Analog Output Low Limit



Figure 5.3.5.1.1

Select “Home” screen.



Figure 5.3.5.1.2

Select configuration screen “7”.



Figure 5.3.5.1.3

Select “Enter” to change value.



Figure 5.3.5.1.4

Key in analog output low limit value.



Figure 5.3.5.1.5

Select “Enter” to accept value.



Figure 5.3.5.1.6

Select “ESC” to confirm value.



Figure 5.3.5.1.7

Return “Home” when finished.

5.3.5.2 Configure Analog Output High Limit



Figure 5.3.5.2.1

From the “Home” screen.



Figure 5.3.5.2.2

Select configuration screen “8”.



Figure 5.3.5.2.3

Select “Enter” to change value.



Figure 5.3.5.2.4

Key in analog output high limit value.



Figure 5.3.5.2.5

Key in analog output high limit value.



Figure 5.3.5.2.6

Key in analog output high limit value.



Figure 5.3.5.2.7

Select “Enter” to accept value.

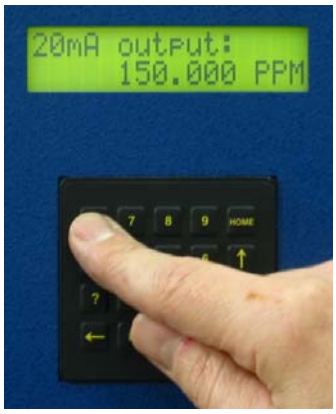


Figure 5.3.5.2.8

Select “ESC” to confirm value.



Figure 5.3.5.2.9

Return “Home” when finished.

5.3.6 Start up Sequence Stage 6

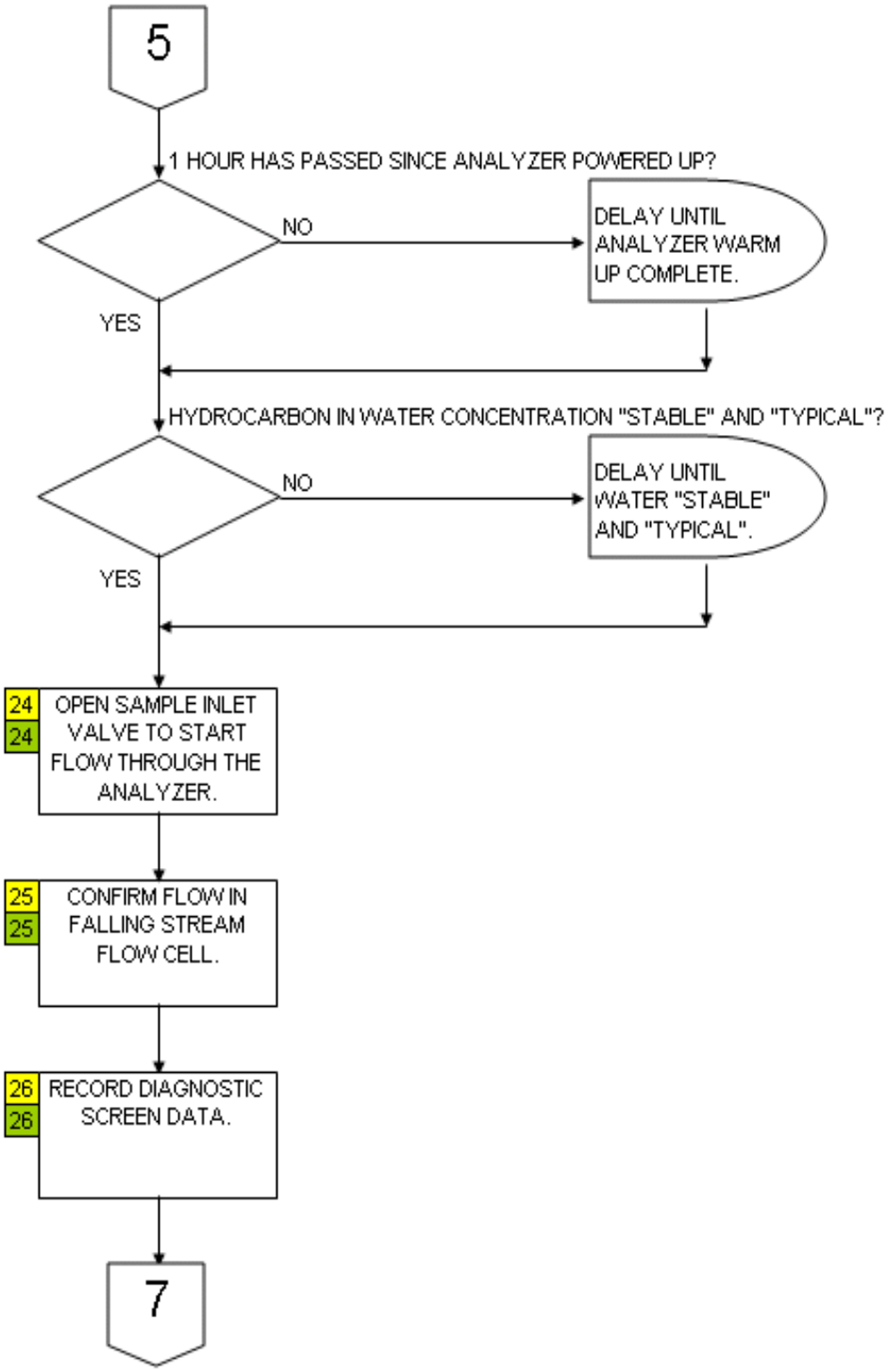




Figure 5.3.6.1

Warm-up analyzer for 1 hour minimum.



Figure 5.3.6.2

Open sample inlet valve and confirm flow in the flow cell



Figure 5.3.6.3

Select “Home” screen.



Figure 5.3.6.4

Select configuration screen “✶”.



Figure 5.3.6.5

Record the diagnostic readings on the Commissioning Checklist.



Figure 5.3.6.6

Select “Enter” to go to 2nd screen.



Figure 5.3.6.7

Select “Enter” to go to 3rd screen.



Figure 5.3.6.8

Select “Enter” to go to 4th screen.



Figure 5.3.6.9

Select “Enter” to go to 5th screen.



Figure 5.3.6.10

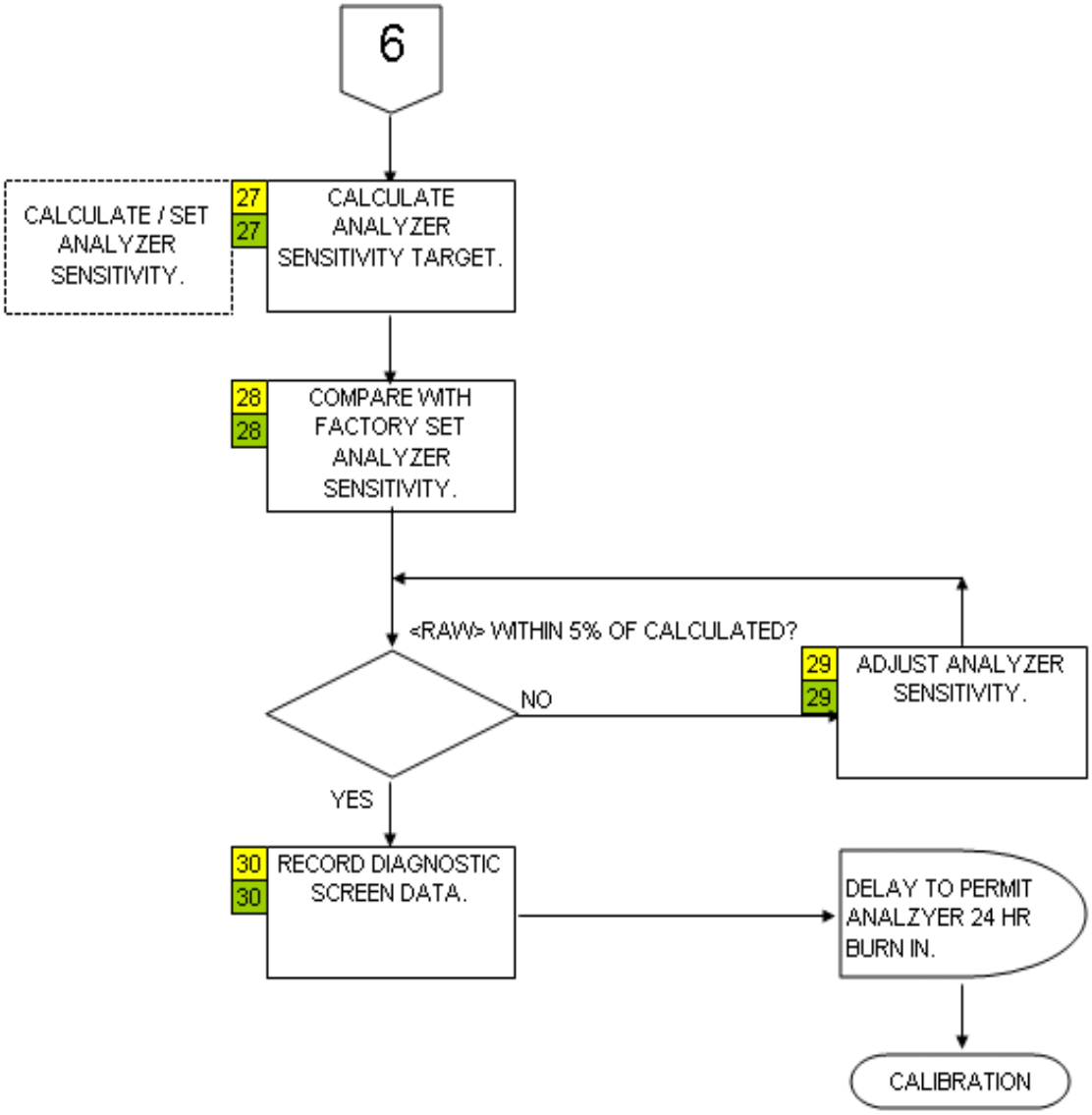
Select “Enter” to go to 6th screen.



Figure 5.3.6.11

Return “Home” when finished.

5.3.7 Start up Sequence Stage 7



5.3.7.1 Analyzer Sensitivity

The basic sensitivity of the TD-4100 is initially set at the factory to 300 V. The sensitivity level must be changed from the initial setting at the site with site-specific samples.

The Sensitivity Screw is used to set the basic TD-4100 operating (sensitivity) level of the instrument. This screw controls the amount of light in the reference path, which controls the high voltage to the light detector (PMT). The higher the amount of light in the reference path, the lower the PMT power requirement and the lower the sensitivity. The lower the amount of light in the reference path, the higher the PMT power requirement and the higher the sensitivity.

More sensitivity is required for low hydrocarbon concentrations, dirty water, or colored water. Less sensitivity is required for high hydrocarbon concentrations, or very clear water. The clearer the water, the better the signal to noise ratio (signal to blank ratio), and the lower the concentration that can be detected



NOTE: To calculate the initial sensitivity target, you must know the oil in water concentration of the sample flowing through the analyzer flow cell. The initial sensitivity target = 100*(sample oil in water concentration – analog output low limit) / (analog output high limit – analog output low limit).

By way of example, with a sample oil in water concentration of 40 PPM, an analog output lower limit of 0 PPM, and an analog output high limit of 200 PPM, the initial sensitivity target = 100*(40 PPM – 0 PPM) / (200 PPM – 0 PPM) = 100*(40-0)/(200-0) = 20. Note that this formula does not work for all situations.

Once the sensitivity level is set for the site specific conditions, it is not necessary to adjust the operating level unless:

1. A different optical kit is installed in the analyzer;
2. The application changes wherein the target hydrocarbon concentration is much higher or much lower than when initially set;
3. The background changes causing the analyzer raw reading to normally read below 0 or above 1000.



Figure 5.3.7.1.1

Select “Home” screen.



Figure 5.3.7.1.2

Select configuration screen “✶”.



Figure 5.3.7.1.3

Select “Enter” to go to 2nd screen.



Figure 5.3.7.1.4

Check if the [Raw] value is within 5% of the calculated target (21 – 19 in our example).



Figure 5.3.7.1.5

Remove the sensitivity adjustment screw weather proof cap.



Figure 5.3.7.1.6

Using a slot screwdriver, adjust the sensitivity screw.



Figure 5.3.7.1.7

Adjust until the [Raw] value is within 5% of the calculated target.



Figure 5.3.7.1.8

Record the diagnostic readings on the Commissioning Checklist.



Figure 5.3.7.1.9

Select “Home” screen.



Figure 5.3.7.1.10

Select configuration screen “✶”.



Figure 5.3.7.1.11

Select “Enter” to go to 2nd screen.



Figure 5.3.7.1.12

Select “Enter” to go to 3rd screen.



Figure 5.3.7.1.13

Select “Enter” to go to 4th screen.



Figure 5.3.7.1.14

Select “Enter” to go to 5th screen.



Figure 5.3.7.1.15

Select “Enter” to go to 6th screen.



Figure 5.3.7.1.16

Burn-in analyzer sensitivity setup for 24 hours.

6 CALIBRATION

6.1 Introduction

The TD-4100 may be calibrated to provide raw fluorescence, qualitative, and quantitative measurements of targeted fluorescent hydrocarbons in water. The TD-4100 can be calibrated directly using two solutions: a standard of known concentration or may be correlated to a secondary method.

6.1.1 Direct Calibration

6.1.1.1 Raw Fluorescence

This method is most often used in environmental remediation applications when blank water and pure hydrocarbon are not available.

Raw fluorescence measurements demonstrate an upset condition but do not provide quantitative information, although the fluorescent response of the fluorescent hydrocarbons present in the sample is proportional to the fluorescent hydrocarbons concentration. The TD-4100 response may be correlated to a secondary measurement method such as an oil and grease measurement. If done this procedure is called a response calibration.



NOTE: When calibrating the analyzer sensitivity is set with a representative process sample which contains the targeted fluorescent hydrocarbon.

When the TD-4100 is calibrated for raw fluorescence measurements, the analyzer simply tracks and displays a relative fluorescence signal of targeted fluorescent hydrocarbons. The relative concentration of fluorescent hydrocarbon is displayed as a dimensionless value. The qualitative measurement also allows the TD-4100 to be correlated against a secondary method (i.e. U.S. EPA Method 413.1 Oil & Grease, U.S. EPA Method 1664 Hexane-Extractable Materials, infrared absorption, or total petroleum hydrocarbons by gas chromatography).

6.1.1.2 Quantitative Calibration

This method is used in applications where the actual concentration of fluorescent hydrocarbons in the water sample is required and when blank water and pure hydrocarbon are available.

The TD-4100 may be calibrated by a 1-point calibration method, using a standard of known concentration and a blank.

When the TD-4100 is calibrated for quantitative measurements, the system simply tracks and displays the actual concentration of fluorescent hydrocarbons in water

compared to two known concentrations of standard water samples used to calibrate the instrument. The concentration of fluorescent hydrocarbon is displayed as either PPM, PPB, or dimensionless as defined by the user.

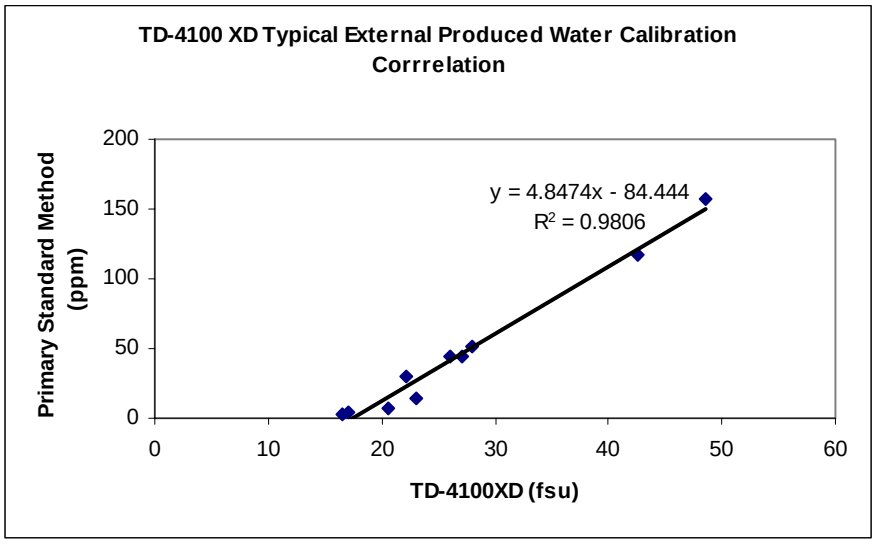
6.1.1.3 Selecting Raw Fluorescence or Quantitative Direct Calibration Mode

Direct Calibration Mode	Advantage	Disadvantage	Application
Raw Fluorescence	1. Preparation of standard calibration solution(s) is not required; 2. Target hydrocarbons are measured relative to the sample stream; and 3. Target hydrocarbons are not measured in reportable concentration units.	1. Target hydrocarbons cannot be reported in concentration units; 2. Alarms are activated relative to changes from set values; and 3. Instrument may not read zero when no target hydrocarbons are present in the sample stream.	1. Raw fluorescence is excellent for trend monitoring. It allows tracking of targeted hydrocarbons without the need to calibrate the system.
1-Point Qualitative Calibration	1. Target hydrocarbons are monitored relative to a known standard calibration point; and 2. Target hydrocarbons may be measured in reportable concentration units.	1. Requires preparation of standard calibration solution; and 2. Requires a "blank" containing no measurable hydrocarbon.	1. 1-Point calibration is the most accurate for measuring absolute concentration of target hydrocarbons; and 2. 1-Point calibration supports regulatory reporting of target hydrocarbon concentrations.

6.1.2 Correlation Calibration

Correlation calibration of the TD-4100 may be used for all applications but must be used where blank water and / or pure hydrocarbon are unavailable. Applications that must use correlation calibration include light and heavy crude oil and gas condensate in produced water, degasser discharges, and crude oil tank bottoms.

Correlation calibration, as the name suggests, requires correlation of the TD-4100 raw readings against the site-specific total oil and grease standard method. If no site-specific standard method exists, TDHI recommend the *Fast*HEX™ Method.



Once the correlation calibration curve is established, the curve may be entered into the TD-4100 using the CheckPOINT™ solid standard.

6.2 Application Specialist Assisted

TDHI recommends new users and experienced users developing new applications specify application specialist assistance to ensure the analyzer calibration meets project requirements.

To ensure application specialist availability for your calibration program, contact TDHI at least one month prior to the anticipated calibration date. After being contacted, TDHI will assign you an application specialist who will provide assistance during your application calibration.

Upon being assigned your project, the application specialist will discuss in detail your Installation Checklist and the Commissioning Checklist which will be completed during the calibration program.

Prior to committing to travel, the application specialist will need to ensure the analyzer startup is complete and any work permits / training / travel arrangements are in place to meet your calibration program time line.

6.2.1 Raw Fluorescence

If the application requires raw fluorescence calibration, the applications specialist will confirm:

1. The user's perception of the application matches the CUSTOMER APPLICATION SURVEY and application data sheet including;
    a. Source and type of hydrocarbons that may be in the water during upsets,
    b. Source and type of water,
    c. Alarm point(s);
2. The user or contract service provider will have onsite and available for use 100 mL of 95% or greater purity 2-propanol (also called isopropanol or isopropyl alcohol) and one liter of purified water; and
3. Onsite availability of instrument accessories purchased with the instrument, specifically the calibration bottles, calibration bottle valves, cleaning swabs, cleaning wash bottle, spare lamp, and fuses.

An applications specialist assisted raw fluorescence calibration application requires one onsite day assuming the analyzer setup is complete, live samples are available, and the analyzer installation complies with the design guidelines.

An applications specialist assisted raw fluorescence calibration commissioning (which includes start-up, calibration assistant, and training) typically requires two onsite days given the same assumptions as above.

6.2.2 Direct Calibration

If the application requires a direct calibration, the application specialist will confirm:

1. The user's perception of the application matches the CUSTOMER APPLICATION SURVEY and application data sheet including:
    a. The source and type of pure hydrocarbon to be monitored;
    b. The source and type of blank water;
    c. The instrument measurement range;
    d. The calibration concentration(s); and
    e. Alarm concentration(s);
2. The user or contract service provider will have onsite and available for use one-liter of 95% or greater purity 2-propanol (also called isopropanol or isopropyl alcohol), and one-liter of purified water; and
3. Onsite availability of the instrument accessories purchased with the instrument, specifically the calibration bottles, calibration bottle valves, cleaning swabs, cleaning wash bottle, spare lamp, and fuses.

An applications specialist assisted direct calibration application typically requires one onsite day assuming the analyzer startup is complete, live samples are available, and the analyzer installation complies with the design guidelines.

An applications specialist assisted direct calibration commissioning (which includes startup and calibration assistance, and training) typically requires two onsite days given the same assumptions as above.

6.2.3 Correlation Calibration

If the application requires a correlation calibration, the application specialist will confirm:

1. The user's perception of the application matches the CUSTOMER APPLICATION SURVEY and application data sheet including:
    a. The source and type of hydrocarbon to be monitored;
    b. The source and type of water to be monitored;
    c. The instrument measurement range;
    d. The calibration concentration(s);
    e. Alarm concentration(s); and
    f. The method used for bench-top oil & grease analysis;
2. Onsite availability of the instrument accessories purchased with the instrument, specifically the calibration bottles, calibration bottle valves, cleaning swabs, and cleaning wash bottle, spare lamp, and fuses;
3. All supplies and equipment for the laboratory oil & grease analysis method will be present, operational, and available during the calibration. A typical

calibration will require 20 or more grab sample analyses. However, supplies should be available for conducting 60 or more grab sample analyses; and

4. Trained personnel will be provided by the user or contract service provider who can run the grab sample laboratory.

An applications specialist assisted correlation calibration application typically requires two to three onsite days assuming the analyzer startup is complete, live samples are available, and the analyzer installation complies with the design guidelines.

An applications specialist assisted correlation calibration commissioning (which includes startup and calibration assistance, and training) typically requires three to four onsite days given the same assumptions as above.

The calibration of the TD-4100 by correlation requires a TDHI-approved laboratory grab sample analysis method for oil & grease concentrations. TDHI-approved laboratory oil & grease measurement methods and equipment are listed below (the criterion for this list is the method's ability to correlate to oil & grease concentrations measured by the U.S. EPA 413.1 and U.S. EPA 1664 Methods):

1. TDHI TD-360 *Fast*HEX™ Method;
2. TDHI TD-3100 *Fast*HEX™ Method;
3. TDHI TD-500 *Fast*HEX™ Method;
4. Horiba OCM Method with Horiba S-316 solvent;
5. Miram/Foxboro Freon/Infrared Absorbance Method;
6. U.S. EPA Method 413.2;
7. U.S. EPA Method 418.1;
8. U.S. EPA Method 1664 (this is not a field portable method); and
9. U.S. EPA Method 413.1 (this is not a field portable method).

If the grab sample oil & grease concentrations at the site are currently being measured by a method other than those listed above, please contact TDHI regarding the method's suitability for the calibration. Please provide TDHI with a written procedure.

6.2.4 Training

As calibration and commissioning assistance includes training of the user personnel who will be involved with all aspects of the instrument, the personnel will need to be present during portions or the entirety of the commissioning. The user or contract service provider must provide trained personnel who can run the laboratory grab sample oil & grease analysis during the commissioning.

Instrument Training typically covers:

1. Principle of Operation;
2. Components of Instrument and Settings;
3. Sample Flow System;
4. Air Curtain System;
5. Air Purge System;

6. Optical System;
7. Electronic System;
8. Instrument Calibration;
9. Use of Solid Standard;
10. Maintenance of Instrument; and
11. Documentation of Instrument Settings.



NOTE: TDHI provides both startup (for new users) and calibration assistance (for new users and for experienced users developing new applications).

NOTE: For new users or experienced users wishing a high level of onsite support, TDHI provides package pricing for startup and calibration assistance (commissioning), as well as non package pricing for onsite calibration assistance.

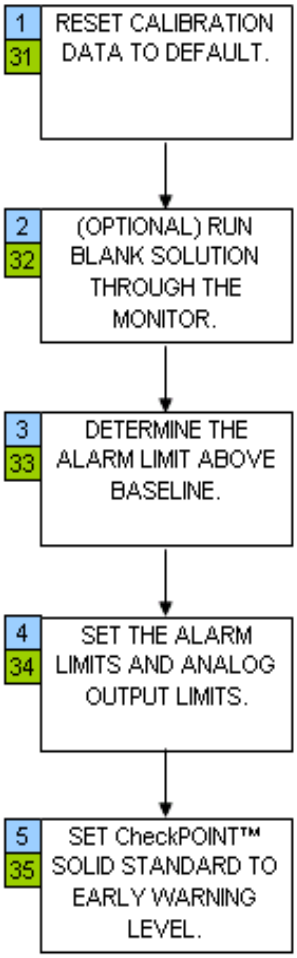
6.3 Non-application Specialist Assisted

If you opt not to include a TDHI application specialist as a member of your calibration team, they are available to provide remote assistance normally within a 24 hour period and may be contacted at:

Tel: +1 559 253 1414, Fax: +1 559 253 1090, or
Email: service@oilinwatermonitors.com

6.4 RAW FLUORESCENCE CALIBRATION

This calibration method is suitable for applications where a blank water does not exist, a calibration solution cannot be created, and concentration information is not desired or possible.



6.4.1 When Prompted Enter User ID



Figure 6.4.1.1

ID input prompt display.

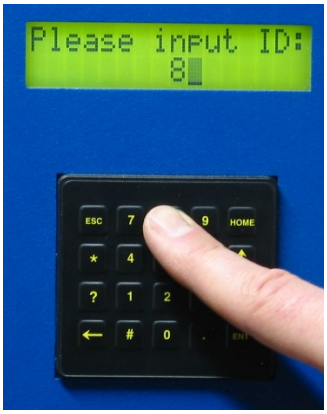


Figure 6.4.1.2

Key User ID.



Figure 6.4.1.3

Key User ID.



Figure 6.4.1.4

Key User ID.



Figure 6.4.1.5

Key User ID.



Figure 6.4.1.6

Select “Enter” to accept User ID.

6.4.2 Reset Calibration Data to Default

You must first reset the analyzer calibration data to defaults. If not already changed, set the monitor concentration units display option to NO UNIT as described in Section 7.21 Setting The Display Units [Screen 1].

NOTE: The Calibration Data is factory set to default.



Figure 6.4.2.1

To reset monitor calibration data, return to the "HOME" screen.



Figure 6.4.2.2

Select configuration screen "ENT".



Figure 6.4.2.3

Proceed to the 'Calibration' submenu by keying "1".



Figure 6.4.2.4

To reset calibration, select 'Reset Cal' by keying "3".



Figure 6.4.2.5

To reset the calibration to default, key "✶" 5 times. The 1st "✶".



Figure 6.4.2.6

The 2nd "✶".



Figure 6.4.2.7

The 3rd "✶".



Figure 6.4.2.8

The 4th "✶".

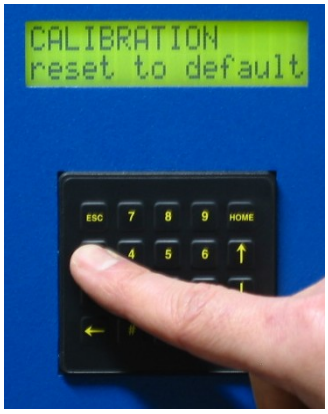


Figure 6.4.2.9

The 5th "✶".



Figure 6.4.2.10

Once reset, return to the 'Calibration' submenu by keying "ESC".

6.4.3 Blank Calibration Sequence (Optional, If Blank Available)

The blank calibration sequence is optional and is only used if blanking the instrument is practical or desired. If a blank water is not available or is expected to vary considerably, skip this section.



Figure 6.4.3.1

Close the monitor inlet valve and completely open the bubble trap drain valve



Figure 6.4.3.2

After the bubble trap has completely drained, close the bubble trap drain valve.



Figure 6.4.3.3

Remove the bubble trap cap and place the blank calibration bottle and valve inside of the bubble trap.



Figure 6.4.3.4

Select 'Blank' by keying "1" to begin the Blank Calibration.



Figure 6.4.3.5

Proceed to monitoring the Blank reading by keying "ENT".



Figure 6.4.3.6

Open the calibration bottle valve completely and allow blank to flow into the monitor.



Figure 6.4.3.7

After the reading stabilizes, key "0" to start blank calibration.



Figure 6.4.3.8

After 5 seconds, the monitor has completed the 'Blank' calibration.



Figure 6.4.3.9

Return to the 'Calibration' submenu by keying "ENT".



Figure 6.4.3.10

Press "HOME" to return to the HOME screen.

6.4.4 Monitor Level Display

The monitor will now display the contamination level present in the water in numbers that are proportional to concentration. Higher numbers will indicate more contamination and lower numbers will indicate less contamination. If the monitor was blanked, then contamination levels or background changes that produce less fluorescence response than the blank water will be displayed as negative numbers.

The monitor readings are best evaluated as a trend of whether the contamination level is increasing or decreasing. An alarm set point can be established in the instrument based upon either how many times above normal readings or based upon the instrument measurement of a known contaminated water sample. See Sections 7.24 through 7.30 for setting alarm levels and delay periods.

6.4.5 Set CheckPOINT™ Solid Standard

Prior to setting the CheckPOINT™ solid standard:

1. Isolate the analyzer sample stream;
2. Allow the in-line bubble trap column to drain through the in-line bubble trap drain valve; and
3. Clean the optical windows.

To permit evaluation of analyzer stability over time and periodic testing of the sample-level alarm functionality, TDHI recommends setting the CheckPOINT™ solid standard just above the configured early warning level .



Figure 6.4.5.1

Install the CheckPOINT™ as per Section 6.7 CHECKPOINT™ SOLID STANDARD USE AND ADJUSTMENT.



Figure 6.4.5.2

Select “Home” screen by pressing “HOME”.



Figure 6.4.5.3

Allow the reading on the HOME screen to stabilize.



Figure 6.4.5.4

Adjust the CheckPOINT™ to read the desired early warning level.



Figure 6.4.5.5

Adjust until the required early warning level ± 0.25% is set.



Figure 6.4.5.6

Record the final setting of the CheckPOINT™.



Figure 6.4.5.7

Remove the CheckPOINT™ and replace the four plugs.



Figure 6.4.5.8

Reinstate normal flow through the analyzer, and install the sticky label with the reading and date on the CheckPOINT™ handle.

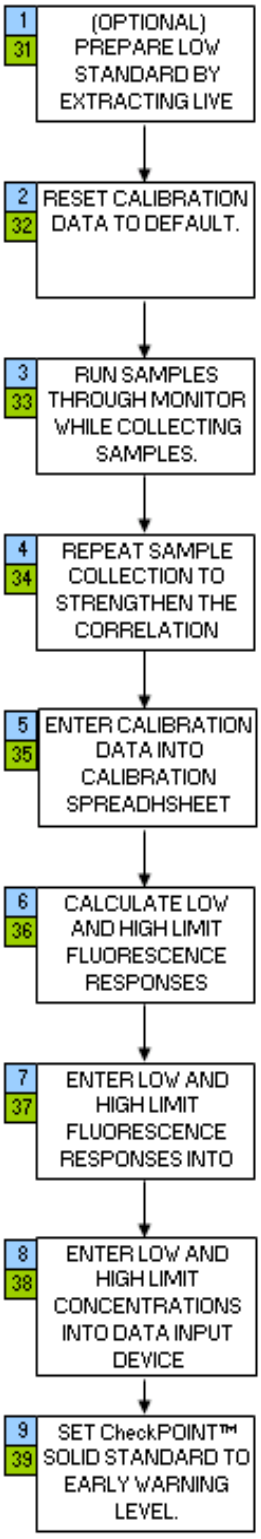


Figure 6.4.5.9

Complete the Commissioning Checklist, maintain the original in your instrument files, and forward a copy to TDHI.

6.5 DIRECT CALIBRATION

Note: This calibration method is not applicable to produced water or refinery wastewater. DO NOT USE THIS METHOD FOR PRODUCED WATER OR REFINERY WASEWATER. For recommendations on the best calibration method, contact TDHI.



6.5.1 When Prompted Enter User ID



Figure 6.5.1.1

ID input prompt display.

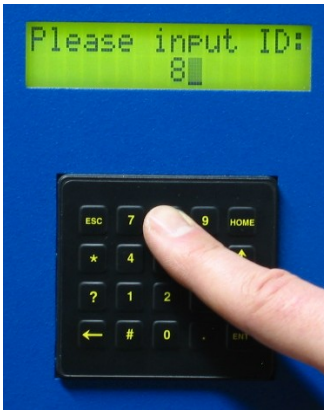


Figure 6.5.1.2

Key User ID.



Figure 6.5.1.3

Key User ID.



Figure 6.5.1.4

Key User ID.



Figure 6.5.1.5

Key User ID.



Figure 6.5.1.6

Select “Enter” to accept User ID.

6.5.2 Reset Calibration Data to Default

You must first reset the analyzer calibration data to defaults. If not already changed, set the monitor concentration units display option to the desired concentration units as described in Section 7.21 Setting the Display Units [Screen 1].

NOTE: The Calibration Data is factory set to default.



Figure 6.5.2.1

To reset monitor calibration data, return to the "HOME" screen.



Figure 6.5.2.2

Select configuration screen "ENT".



Figure 6.5.2.3

Proceed to the 'Calibration' submenu by keying "1".



Figure 6.5.2.4

To reset calibration, select 'Reset Cal' by keying "3".



Figure 6.5.2.5

To reset the calibration to default, key "✶" 5 times. The 1st "✶".



Figure 6.5.2.6

The 2nd "✶".



Figure 6.5.2.7

The 3rd "✶".



Figure 6.5.2.8

The 4th "✶".

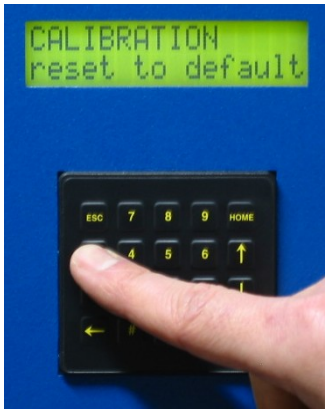


Figure 6.5.2.9

The 5th "✶".



Figure 6.5.2.10

Once reset, return to the 'Calibration' submenu by keying "ESC".

6.5.3 Standard Preparation

Prior to completing a direct calibration, prepare the Calibration Standard Solution as per Section 6.8, PREPARING 0-20 PPM CALIBRATION STANDARD SOLUTIONS, and Section 6.9 PREPARING 20-200 PPM CALIBRATION STANDARD SOLUTIONS, as required. The blank water choice is extremely important. Blank water is defined at the same water as being monitored but without targeted hydrocarbons present. The same blank water is used both for the blank solution and the calibration solution preparation.

Once the Blank and Calibration Standard Solution are prepared, you are ready to calibrate the monitor.

6.5.4 Blank Calibration Sequence

The blank is set in the monitor to establish the zero baseline. The value of the blank can be anywhere between 0 – 2000 fluorescence units. The response of the blank displayed during the calibration is in fluorescence units. The blank response in applications involving clean or pure water will be very low; whereas applications involving dirty water (river water) will have higher blank responses.



Figure 6.5.4.1

Close the monitor inlet valve and completely open the bubble trap drain valve



Figure 6.5.4.2

After the bubble trap has completely drain, close the bubble trap drain valve.



Figure 6.5.4.3

Remove the bubble trap cap and place the blank calibration bottle and valve inside of the bubble trap.



Figure 6.5.4.4

Select ‘Blank’ by keying “1” to begin the Blank Calibration.



Figure 6.5.4.5

Proceed to monitoring the Blank reading by keying “ENT”.



Figure 6.5.4.6

Open the calibration bottle valve completely and allow blank to flow into the monitor.



Figure 6.5.4.7

After the reading stabilizes, key “0” to start blank calibration.



Figure 6.5.4.8

After 5 seconds, the monitor has completed the ‘Blank’ calibration.



Figure 6.5.4.9

Return to the ‘Calibration’ submenu by keying “ENT”.

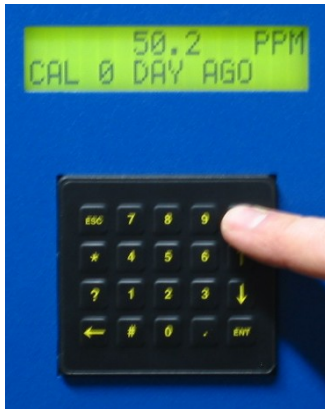


Figure 6.5.4.10

Press “HOME” to return to the HOME screen.

6.5.5 Calibration Solution Sequence

NOTE: TDHI recommends using a standard concentration equal to or slightly lower than the analog output high limit value, and confirming linearity of response using a prepared sample at the early warning (sample level) alarm point.

NOTE: TDHI recommend a calibration standard raw reading between 700 and 1000. If reading is outside this range, adjust the sensitivity to provide this raw response level and repeat the high standard calibration sequence after a 1 hour analyzer sensitivity setup burn in. However, in many cases involving hydrocarbons with low fluorescence response, it may not be possible to achieve a reading between 700 to 1000 fluorescence units.



Figure 6.5.5.1

Close the monitor inlet valve and completely open the bubble trap drain valve



Figure 6.5.5.2

After the bubble trap has completely drained, close the bubble trap drain valve.



Figure 6.5.5.3

Remove the bubble trap cap and place the calibration solution bottle and valve inside of the bubble trap.



Figure 6.5.5.4

Select 'Std' by keying "2" to begin the Calibration Standard calibration.



Figure 6.5.5.5

Key "ENT" to monitor the Calibration Solution reading.



Figure 6.5.5.6

Open the calibration bottle valve completely and allow calibration solution to flow into the monitor.



Figure 6.5.5.7

Observe the fluorescence response of the calibration standard. Ideally, it should be between 700 and 1000.



Figure 6.5.5.8

If necessary, key "↑" one or more times to raise the response to between 700 and 1000.



Figure 6.5.5.9

If necessary, key "↓" one or more times to decrease the response to below 1000.



Figure 6.5.5.10

After the reading stabilizes and is between 700 to 1000, key "✶" to start Calibration Solution calibration.



Figure 6.5.5.11

After 5 seconds, the monitor has completed the 'Cal Std' calibration.



Figure 6.5.5.12

Return to the 'Calibration' submenu by keying "ENT".



Figure 6.5.5.13

Press "HOME" to return to the HOME screen.



Figure 6.5.5.14

Remove the calibration bottle, replace the bubbletrap cap, and allow the bubbletrap to drain.

6.5.6 Calibration Standard Concentration Entry

Once the Calibration Standard calibration has been completed, enter the Calibration Standard Concentration value used in the Calibration Standard Calibration sequence.

The blank concentration is automatically set to 0 and cannot be changed.

By way of example, to enter the Calibration Standard Concentration of 47.8 PPM, perform the following steps.

.

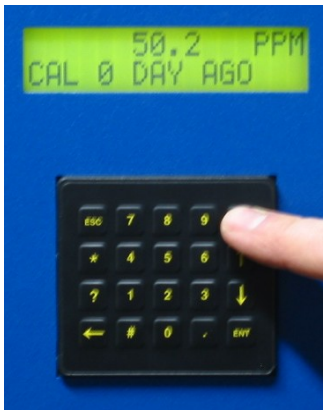


Figure 6.5.6.1

From the 'Calibration' submenu, return to the "HOME" screen.



Figure 6.5.6.2

Select configuration screen "0".



Figure 6.5.6.3

To enter a new Calibration Standard Concentration, key “ENT”.



Figure 6.5.6.4

Key in the new Calibration Standard Concentration (10 PPM).



Figure 6.5.6.5

Key in the new Calibration Standard Concentration (10 PPM).



Figure 6.5.6.6

Key “ENT” to accept the new Calibration Standard Concentration value.



Figure 6.5.6.7

Key “ESC” to confirm the new Calibration Standard Concentration value.



Figure 6.5.6.8

Return to the HOME screen by pressing the “HOME” key.

6.5.7 Set CheckPOINT™ Solid Standard

Prior to setting the CheckPOINT™ solid standard:

4. Isolate the analyzer sample stream;
5. Allow the in-line bubble trap column to drain through the in-line bubble trap drain valve; and
6. Clean the optical windows.

To permit evaluation of analyzer stability over time and periodic testing of the sample-level alarm functionality, TDHI recommends setting the CheckPOINT™ solid standard just above the configured early warning level .



Figure 6.5.7.1

Install the CheckPOINT™ as per Section 6.7 CHECKPOINT™ SOLID STANDARD USE AND ADJUSTMENT.



Figure 6.5.7.2

Select “Home” screen by pressing “HOME”.



Figure 6.5.7.3

Allow the reading on the HOME screen to stabilize.



Figure 6.5.7.4

Adjust the CheckPOINT™ to read the desired early warning level.



Figure 6.5.7.5

Adjust until the required early warning level ± 0.25% is set.



Figure 6.5.7.6

Record the final setting of the CheckPOINT™.



Figure 6.5.7.7

Remove the CheckPOINT™ and replace the four plugs.



Figure 6.5.7.8

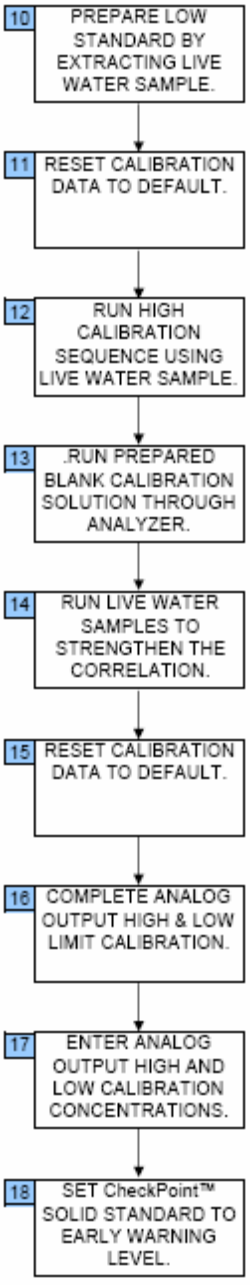
Reinstate normal flow through the analyzer, and install the sticky label with the reading and date on the CheckPOINT™ handle.



Figure 6.5.7.9

Complete the Commissioning Checklist, maintain the original in your instrument files, and forward a copy to TDHI.

6.6 CORRELATION CALIBRATION



6.6.1 When Prompted Enter User ID



Figure 6.6.1.1

ID input prompt display.

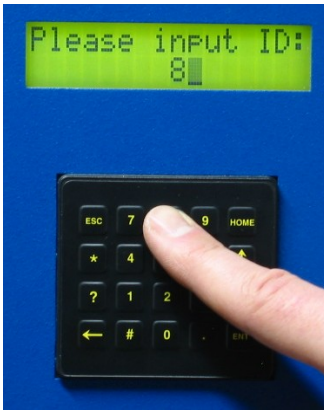


Figure 6.6.1.2

Key User ID.



Figure 6.6.1.3

Key User ID.



Figure 6.6.1.4

Key User ID.



Figure 6.6.1.5

Key User ID.



Figure 6.6.1.6

Select “Enter” to accept User ID.

6.6.2 Reset Calibration Data to Default

You must first reset the analyzer calibration data.

NOTE: The Calibration Data is factory set to default.

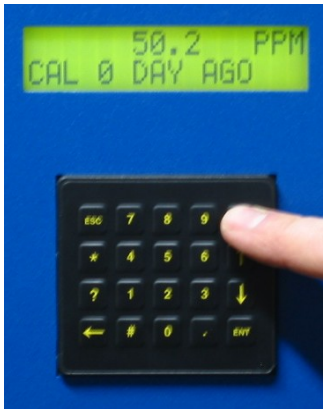


Figure 6.4.1.2

To reset analyzer calibration data, return to the “HOME” screen.



Figure 6.4.1.2

Select configuration screen “ENT”.



Figure 6.4.1.3

Proceed to the ‘Calibration’ submenu by keying “1”.



Figure 6.4.1.4

To reset calibration, select ‘Reset Cal’ by keying “3”.



Figure 6.4.1.5

To reset the calibration to default, key “✶” 5 times. The First “✶”.



Figure 6.4.1.6

The Fifth “✶”.



Figure 6.4.1.7

Once reset, return to the 'Calibration' submenu by keying "ESC".

6.6.3 Sample Collections

To begin the correlation calibration, adjust the treatment process so that you obtain a higher hydrocarbon in water concentration. Note that the expected hydrocarbon in water concentration should still be within the instrument's desired measurement range and instrument's linear measurement range. The instrument's measurement range will be 0 to 1000 fluorescence units displayed on the HOME screen.

Repeat the listed steps with at least three or more higher concentration samples. Then repeat the listed steps with at least three or more intermediate concentration samples. Finally repeat the listed steps with at least three or more lower concentrations samples. Note that the treatment process may need to be adjusted to create different hydrocarbon in water concentrations.



Figure 6.6.3.1

Open the sample inlet valve to flow "live" sample to the monitor.



Figure 6.6.3.2

Note the fluorescence response on the HOME Screen.



Figure 6.6.3.3

Collect a water sample at the sample port.



Figure 6.6.3.4

Record the fluorescence response displayed on the HOME screen.



Figure 6.6.3.5

Complete bench-top Oil & Grease analysis.



Figure 6.6.3.6

Record the Oil & Grease concentration next to the corresponding fluorescence response.

6.6.4 Develop the Calibration Curve

To reduce potential calibration error, confirm the measurement range by collecting and analyzing samples throughout the range of interest.

NOTE: Record the monitor's HOME Screen fluorescence reading while collecting the sample for analysis.

Enter the field data into the Excel™ calibration data spreadsheet to calculate the least squares calibration values, and correlation coefficient R^2 (defining the quality of the fit).

NOTE: TDHI recommends establishing the quality of fit by analyzing at least three low concentration samples, three normal concentration samples, and three high concentration samples.

NOTE: TDHI prefers providing these samples by adjusting the process but, if necessary, the samples may be taken upstream in the water treatment process (to provide higher concentrations) and presented to the analyzer directly from sample containers into the isolated in-line bubble trap.

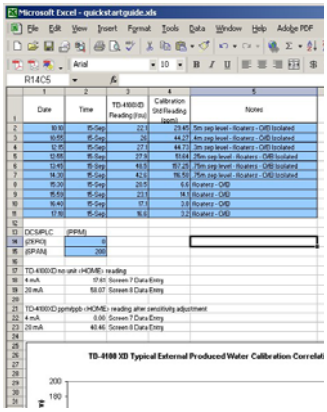


Figure 6.6.4.3

The calibration Excel™ Spreadsheet calculates the least squares upper concentration limit and the lower concentration limit, and the correlation coefficient R^2. TDHI recommends an R^2 greater than 0.80.

If the R^2 is less than 0.80, consult your distributor or TDHI.



Figure 6.6.4.1

Obtain all of the measurements recorded on a calibration data sheet.

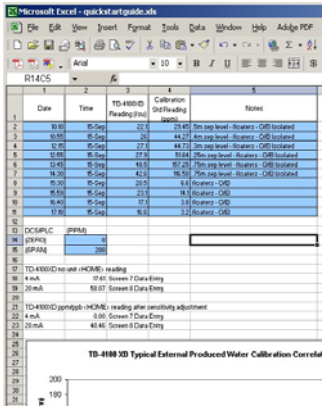


Figure 6.6.4.2

Transfer readings to correlation calibration Excel™ Spreadsheet.

6.6.5 Calculate the Calibration Range Limits

After entering the calibration data into the spreadsheet, the spreadsheet automatically calculates the best-fit concentrations for the lower concentration and higher concentration limits.

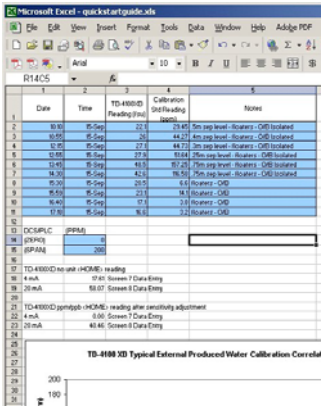


Figure 6.6.5.1

Obtain the best-fit upper concentration and lower concentration limits from the spreadsheet.



Figure 6.6.5.2

Write these values on the calibration data sheet at the bottom.



Figure 6.6.5.3

If the best-fit low standard is much less than zero, go to Section 5.3.7.1 Analyzer Sensitivity to increase the instrument sensitivity setting. You will now need to repeat the entire calibration procedure after adjusting the instrument sensitivity.

6.6.6 Setting the Calibration Range Limits

The calibration range limits are entered into the TD-4100 as the 4 mA and 20 mA settings.



Figure 6.6.6.1

Press the “HOME” key.



Figure 6.6.6.2

Select configuration screen “7”.



Figure 6.6.6.3

Select “Enter” to change value.



Figure 6.6.6.4

Key in analog output low limit value corresponding to the lower concentration limit.



Figure 6.6.6.5

Select “Enter” to accept value.



Figure 6.6.6.6

Select “ESC” to confirm value.

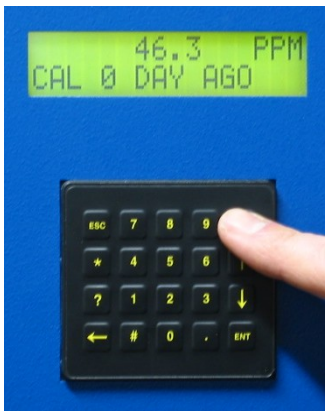


Figure 6.6.6.7

Return “Home” when finished.

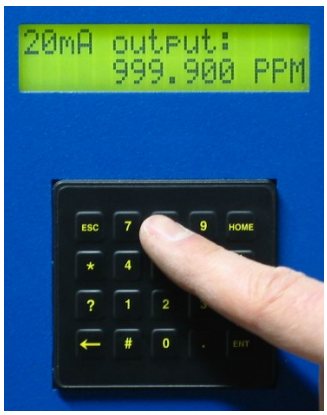


Figure 6.6.6.8

Enter the lower concentration limit into the control system to which the 4-20 mA output will be sent, i.e., 4 mA = 0 ppm.



Figure 6.6.6.9

Select configuration screen “8”.



Figure 6.6.6.10

Select “Enter” to change value.



Figure 6.6.6.11

Key in 20 mA output value.



Figure 6.6.6.12

Key in 20 mA output value.

Figure 6.6.6.13

Key in 20 mA output value.



Figure 6.6.6.14

Select “Enter” to accept value.

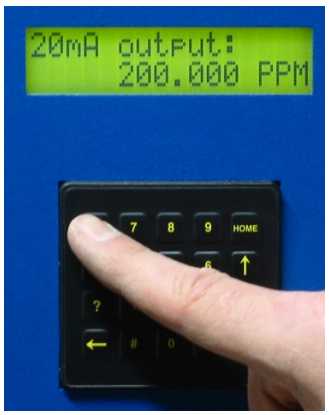


Figure 6.6.6.15

Select “ESC” to confirm value.



Figure 6.6.6.16

Return “Home” when finished.

Figure 6.6.6.17

Enter the upper concentration limit into the control system to which the 4-20 mA output will be sent, i.e., 20 mA = XX ppm.

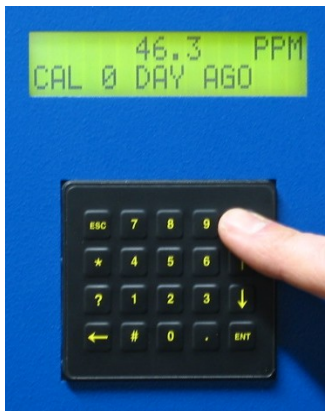


Figure 6.6.6.18

The HOME Screen readings will be in fluorescence and proportional to the concentration. The control system to which the 4-20 mA output is sent is scaled linearly between the lower concentration limit and the upper concentration limit.

6.6.7 Set CheckPOINT™ Solid Standard

Prior to setting the CheckPOINT™ solid standard:

7. Isolate the analyzer sample stream;
8. Allow the in-line bubble trap column to drain through the in-line bubble trap drain valve; and
9. Clean the optical windows.

To permit evaluation of analyzer stability over time and periodic testing of the sample-level alarm functionality, TDHI recommends setting the CheckPOINT™ solid standard just above the configured early warning level .



Figure 6.6.7.1

Install the CheckPOINT™ as per Section 6.7 CHECKPOINT™ SOLID STANDARD USE AND ADJUSTMENT.



Figure 6.6.7.2

Select “Home” screen by pressing “HOME”.



Figure 6.6.7.3

Allow the reading on the HOME screen to stabilize.



Figure 6.6.7.4

Adjust the CheckPOINT™ to read the desired early warning level.



Figure 6.6.7.5

Adjust until the required early warning level ± 0.25% is set.



Figure 6.6.7.6

Record the final setting of the CheckPOINT™.



Figure 6.6.7.7

Remove the CheckPOINT™ and replace the four plugs.



Figure 6.6.7.8

Reinstate normal flow through the analyzer, and install the sticky label with the reading and date on the CheckPOINT™ handle.



Figure 6.6.7.9

Complete the Commissioning Checklist, maintain the original in your instrument files, and forward a copy to TDHI.

6.6.8 Artificially Creating A Low Concentration Standard (Optional)

A low concentration standard can optionally be prepared by extracting a large volume of produced water with a suitable extraction solvent and then employing the remaining water sample as a standard. Seawater or tap water will not produce the same response on the TD-4100 as a created blank water and should not be used as a blank for produced water. Below is a procedure for creating an artificial low standard solution.

1. Collect a produced water sample in the provided TD-4100 calibration solution bottle, filling the bottle about ¾ full.
2. Add 10 mL of concentrated hydrochloric acid to the produced water sample.
3. Add about 300 mL of *n*-hexane or other suitable extraction solvent.
4. Place the calibration bottle valve on the bottle and tighten. Close the calibration bottle valve.
5. Vigorously shake the solutions while periodically venting the bottle through the calibration bottle valve. Shake the solutions for two minutes.
6. Allow the bottle to stand to allow the solvent layer to thoroughly separate from the water.
7. Drain the extracted water sample into the TD-4100 blank solution bottle. If the extraction solvent is heavier than water, then you can drain the lower water layer into the blank solution bottle through the calibration bottle valve. If the extraction solvent is heavier than water, you will need to first drain off the extraction solvent through the calibration bottle valve. Discard the extraction solvent.
8. The blank produced water sample is now available for calibration of the TD-4100.

6.7 CHECKPOINT™ SOLID STANDARD USE AND ADJUSTMENT

The TD-4100 CheckPOINT™ Solid Standard is used to verify electronic and optical performance of the analyzer.

NOTE: The CheckPOINT™ Solid Standard is not compatible with some instrument optical configurations and will not be provided in such cases.



Figure 6.7.1

The CheckPOINT™ is packed in a hard case to permit transfer to the field without damage.



Figure 6.7.2

Tools included with the CheckPOINT™ include:

1. The TD-4100XD CheckPOINT™;
2. Sample block screw plug removal tool (knife);
3. Attenuation screw adjustment tool (3/32” Allen wrench);
4. Ball plunger adjustment tool (slot screwdriver).
5. Identifier Stickers; and
6. CheckPOINT™ manual.



Figure 6.7.3

Prior to test fitting the CheckPOINT™ in the sample block:

1. Close the sample outlet valve; and
2. Carefully use the knife to remove the four plastic screw recess plugs and store in a secure place.

NOTICE: Personnel removing the view port cover must meet facility requirements for exposure to ultraviolet radiation, including wearing protective goggles or safety glasses. TDHI recommends wearing approved protective goggles or safety glasses when completing this procedure.



Figure 6.7.4

Prior to test fitting the CheckPOINT™ in the sample block:

1. Remove the sample block view port cover;
2. Dry the optical windows if wet; and
3. Dry the sample water droplet(s) remaining on the flow cell nozzle with tissue paper.

NOTE: If water droplets are allowed to gather on the CheckPOINT™, the reading will be unstable.
Test fit the CheckPOINT™ into the sample block with the flat part of the standard facing up.



Figure 6.7.5

If the CheckPOINT™ does not fit securely into the sample block, or if the alignment pins do not fit into the screw holes, the ball plunger screws must be adjusted. If the fit is too loose, adjust the ball plunger screws clockwise. If the fit is too tight, adjust the ball plunger screws counter clockwise.
Adjust the ball plunger screws a maximum of 1/8 of a turn before test fitting again. Fine adjustment (less than 1/8 of a turn) may be necessary to complete CheckPOINT™ fit up.

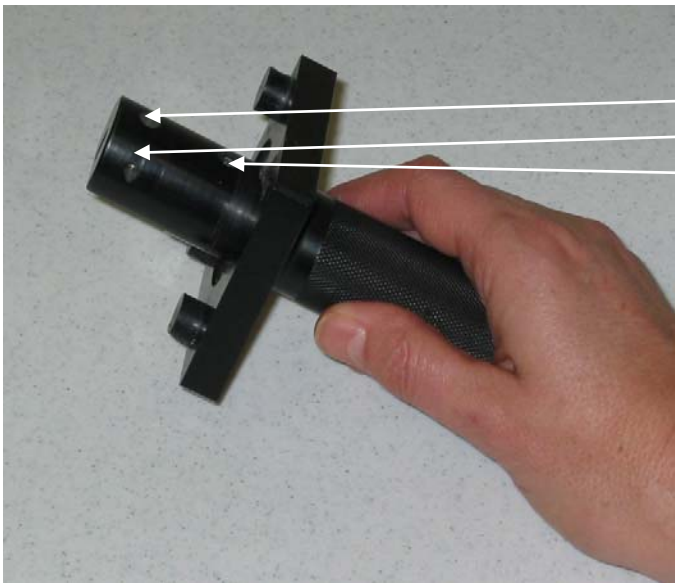


Figure 6.7.6

Primary Attenuation Screw
Primary Attenuation Lock Setscrew
Backup Attenuation Screw

NOTE: The CheckPOINT™ is shipped from the factory with the long (50-100% attenuation) screw installed in the primary location and the short (0-50% attenuation) screw installed in the backup location with 50% of the optical material exposed.



Figure 6.7.7

Once the ball plungers are adjusted, insert the CheckPOINT™ in the sample block and allow the Home screen reading to stabilize.

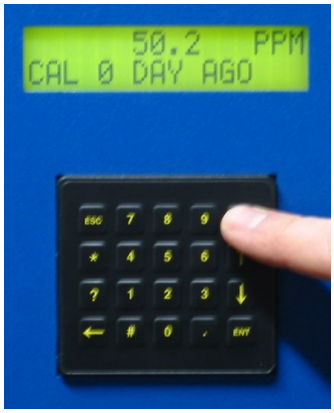


Figure 6.7.8

The reading should compare with the reading noted on the factory analyzer datasheet (at initial power-up) or with the previous site reading (maintained in the site analyzer log).

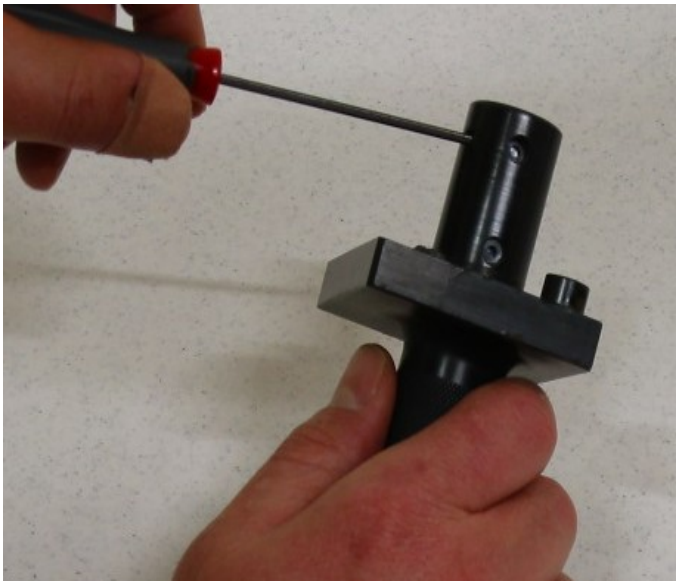


Figure 6.7.9

Adjust the primary attenuation lock setscrew so it just makes contact with the primary attenuation screw to permit adjustment of the primary attenuation screw.

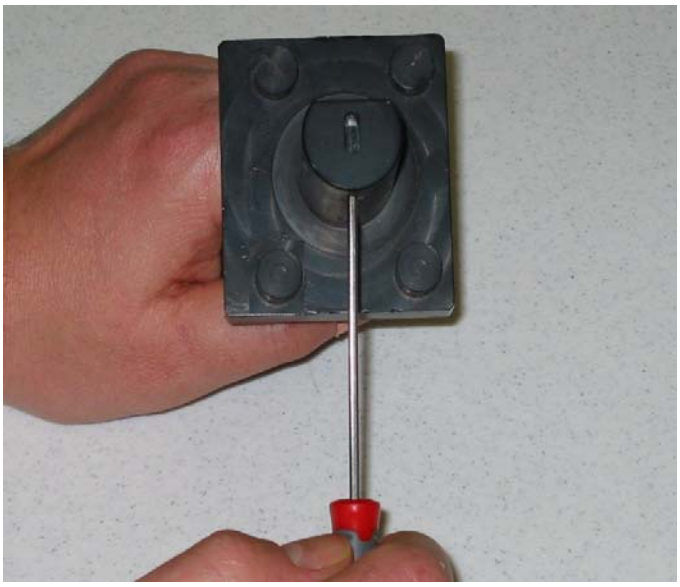


Figure 6.7.10

TDHI recommends adjusting the primary attenuation screw to read close to the sample level (early warning) analyzer alarm point to permit routine alarm monitor testing and to provide a baseline for analyzer optical stability testing over time.

NOTE: With some optical filter kits such as the Mixed Fuel Optical Filter Kit, the reading with 50% attenuation will be off scale. To provide a reading in range, adjust the primary attenuation screw to expose 15-25% of the optical material.

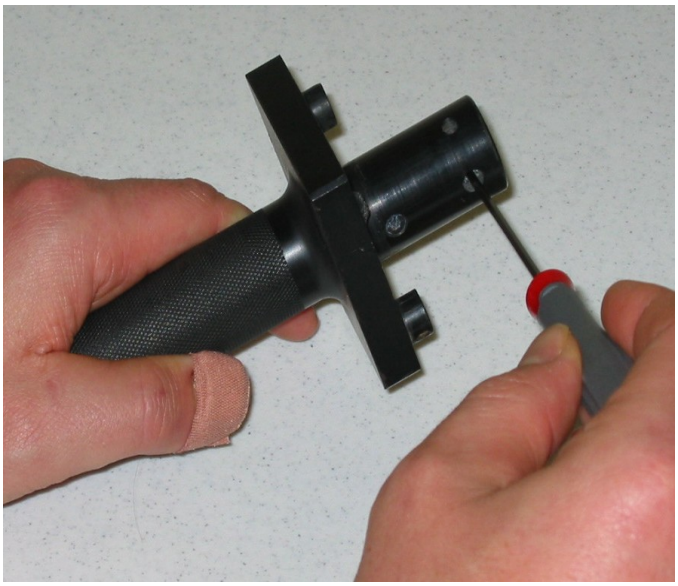


Figure 6.7.11

If the long (50-100% attenuation) attenuation screw does not permit adjustment to provide the desired reading:

1. Remove the long attenuation screw from the primary attenuation screw location.
2. Remove the short attenuation screw from the backup attenuation screw location and install it in the primary attenuation screw location.

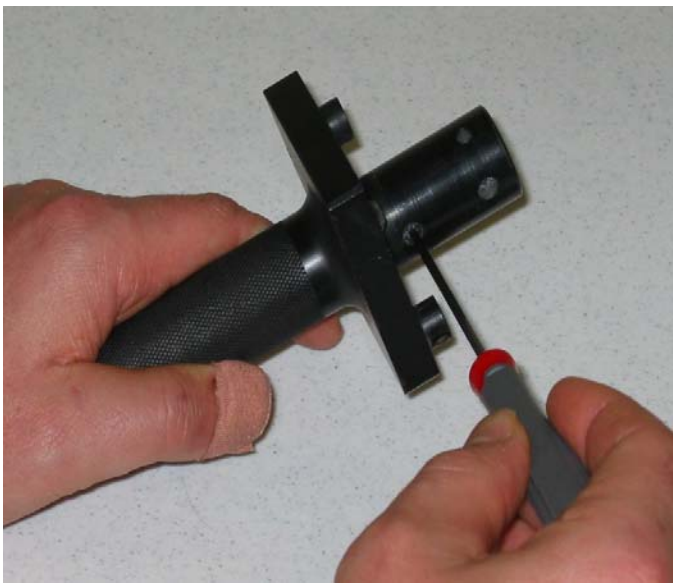


Figure 6.7.12

Install the long attenuation screw in the backup location.

NOTE: Be careful not to cross thread the attenuation screw.
NOTE: Never allow the primary or backup attenuation screws to stick out beyond the perimeter of the CheckPOINT™.

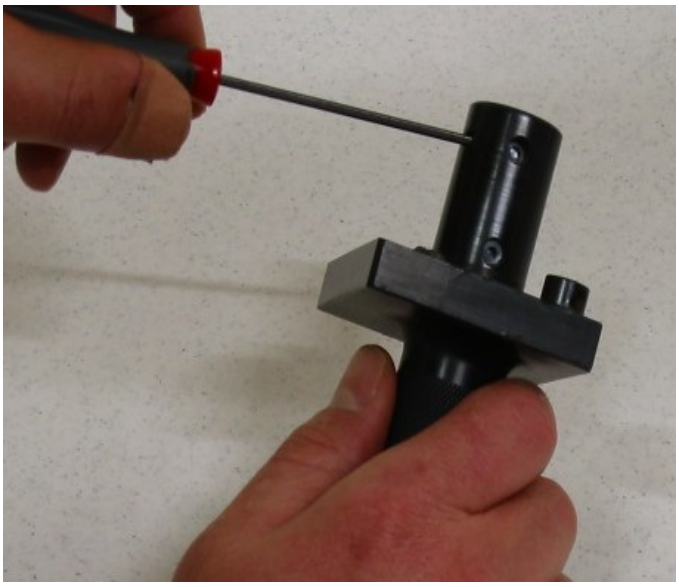


Figure 6.7.13

After the primary attenuation screw is adjusted, gently lock it into position with the primary attenuation lock setscrew.
Record the final reading on the round sticker and affix it to the end of the CheckPOINT™ handle for easy reference.

NOTE: Do not over tighten the primary attenuation lock setscrew as over tightening may change the reading of the CheckPOINT™.

NOTE: TDHI recommends recording the time and date and final reading in the site analyzer log for future reference.

To resume online monitoring:

1. Remove the CheckPOINT™ from the sample block;
2. Install the view port cover;
3. Reinstate the plastic screw plugs; and
4. Open the sample inlet valve to allow sample to flow to the monitor.

6.8 PREPARING 0-20 PPM CALIBRATION STANDARD SOLUTIONS

NOTE: Standard solutions preparation is not applicable for produced water or correlation calibration applications.

Prepare a 1000-ppm stock concentration solution by diluting 100 µL of the hydrocarbon into 100 mL total volume of 95% purity or higher 2-propanol (also called isopropanol or isopropyl alcohol).



Figure 6.8.1

1. Collect or prepare a sample of the hydrocarbon of interest; and
2. Obtain 95% purity or greater 2-propanol (also called isopropanol or isopropyl alcohol).

NOTE: Rubbing alcohol (76% purity) is not acceptable.



Figure 6.8.2

3. Tools required (available in Calibration Kit, Part Number 4100-918) include:
   a. 10 mL disposable pipette and pipette helper;
   b. 10-100 µL micropipetter and disposable tips;
   c. 100 mL volumetric flask with stopper; and
   d. 250 mL beaker to permit transfer of the 1,000-ppm stock concentration solution into the 1 United States Gallon High Calibration Standard bottle.

NOTE: The 1 United States Gallon Calibration Standard Solution bottle is not part of the Calibration kit, P/N 4100-918.



Figure 6.8.3

Transfer approximately 90 mL of 2-propanol to the 100 mL volumetric flask.

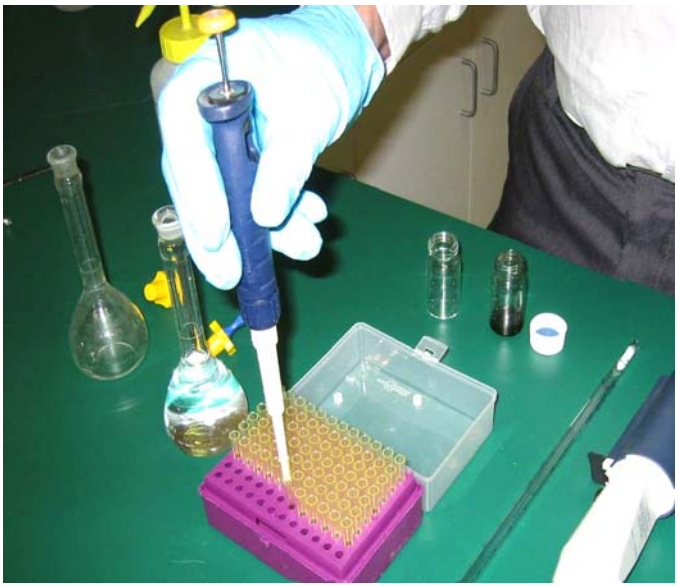


Figure 6.8.4

Mount a 200 µL disposable tip on the 10-100 µL micropipetter.



Figure 6.8.5

Adjust 10-100 µL micropipetter to draw 100 µL.



Figure 6.8.6

Pipette 100 µL of pure hydrocarbon.



Figure 6.8.7

Transfer the 100 µL pipette to the volumetric flask containing approximately 90 mL of 2-propanol.



Figure 6.8.8

Top up the 100 mL volumetric flask with 2-propanol to the 100 mL mark.



Figure 6.8.9

Install the 100 mL volumetric flask stopper and shake the flask to dissolve the pure hydrocarbon in the 2-propanol.

NOTE: If the pure hydrocarbon does not dissolve easily, it may be necessary to use an ultrasonic bath to dissolve the pure hydrocarbon in the 2-propanol.

You now have a 1000-ppm stock concentration solution.

NOTE: The stock solution may be stored for no more than 24 hours if tightly capped.



Figure 6.8.10

Transfer the 1000-ppm stock solution to the 250 mL beaker to permit transfer of the 1000-ppm stock concentration solution into the 1 United States Gallon Calibration Solution bottle.



Figure 6.8.11

Overfill the Blank Solution bottle (above the 1 United States Gallon mark) and under fill the Calibration Solution bottle (below the 1 United States Gallon mark) with the site's blank water.



Figure 6.8.12

Insert a 10 mL disposable pipette into the 10-mL pipette helper.

To prepare 1 United States Gallon of Calibration Standard Solution, dilute the following volumes of 1000-ppm stock solution into 1 United States Gallon of the site's blank water.

High Cal. Std.	100-ppb	500-ppb	1-ppm	5-ppm	10-ppm	15-ppm	20-ppm
1000-ppm stock	0.38 mL	1.9 mL	3.8 mL	19.0 mL	37.9 mL	56.8 mL	75.8 mL

.



Figure 6.8.13

Pipette the volume of 1000-ppm stock solution, noted in the table above, to prepare your required Calibration Standard Solution.

NOTE: For a 10-ppm Calibration Standard Solution, transfer 3 x 10 mL plus 1 x 7.9 mL for a total of 37.9 mL.



Figure 6.8.14

Top up the Calibration Solution bottle to the 1 Unities States Gallon mark with site water from the Blank Solution bottle.



Figure 6.8.15

Install the Calibration Solution bottle cap and shake the bottle to mix the calibration solution.

You now have your Calibration Solution and Blank Solution bottles.

NOTE: The prepared Calibration Solution should be used within 30 minutes of preparation. If storage longer than 30 minutes is necessary, store the calibration solution in a glass stopped container, not in the plastic calibration bottle.

NOTE: To prepare 4 L of Calibration Standard Solution, dilute the following volumes of 1000-ppm stock solution into 4 L of the site's blank water.

High Cal. Std.	100-ppb	500-ppb	1-ppm	5-ppm	10-ppm	15-ppm	20-ppm
1000-ppm stock	0.4 mL	2.0 mL	4.0 mL	20.0 mL	40.0 mL	60.0 mL	80.0 mL

6.9 PREPARING 20-200PPM CALIBRATION STANDARD SOLUTIONS

NOTE: Standard solutions preparation is not applicable for produced water or correlation calibration applications.

Prepare a 10,000-ppm stock concentration solution by diluting 1000 µL of the hydrocarbon into 100 mL total volume of 99% purity or higher 2-propanol (also called isopropanol or isopropyl alcohol).



Figure 6.9.1

1. Collect or prepare a sample of the hydrocarbon of interest; and
2. Obtain 99+% purity or greater 2-propanol (also called isopropanol or isopropyl alcohol).

NOTE: Rubbing alcohol (76% purity) is not acceptable.



Figure 6.9.2

3. Tools required (available in Calibration Kit, Part Number 4100-918) include:
   a. 10 mL disposable pipette and pipette helper;
   b. 10-100 µL micropipetter and disposable tips;
   c. 100 mL volumetric flask with stopper; and
   d. 250 mL beaker to permit transfer of the 10,000-ppm stock concentration solution into the 1 United States Gallon High Calibration Standard bottle.

NOTE: The 1 United States Gallon Calibration Solution Standard bottle is not part of the Calibration Kit, P/N 4100-918



Figure 6.9.3

Transfer approximately 90 mL of 2-propanol to the 100 mL volumetric flask.

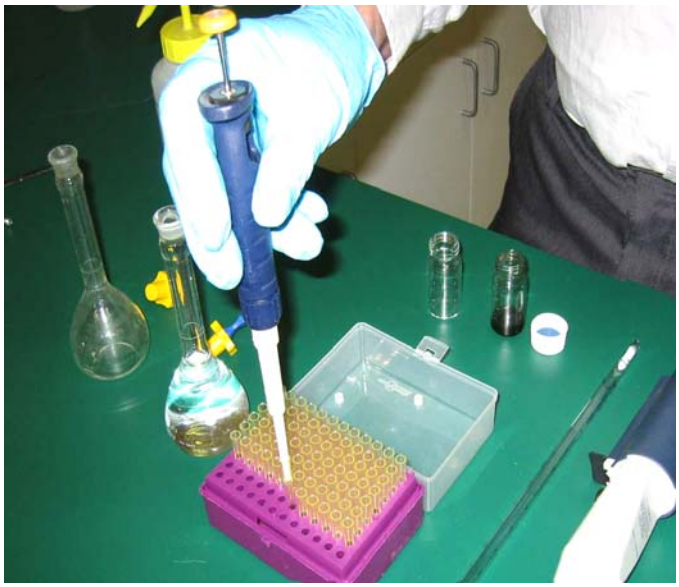


Figure 6.9.4

Mount a 1000 µL disposable tip on the 100-1000 µL micropipetter (blue plunger handle and blue tips).



Figure 6.9.5

Adjust 100-1000 µL micropipetter to draw 1000 µL.



Figure 6.9.6

Pipette 1000 µL of pure hydrocarbon



Figure 6.9.7

Transfer the 1000 µL pipette to the volumetric flask containing approximately 90 mL of 2-propanol.



Figure 6.9.8

Top up the 100 mL volumetric flask with 2-propanol to the 100 mL mark.



Figure 6.9.9

Install the 100 mL volumetric flask stopper and shake the flask to dissolve the pure hydrocarbon in the 2-propanol.

NOTE: If the pure hydrocarbon does not dissolve easily, it may be necessary to use an ultrasonic bath to dissolve the pure hydrocarbon in the 2-propanol.

You now have a 10,000-ppm stock concentration solution.

NOTE: The stock solution may be stored for no more than 24 hours if tightly capped.



Figure 6.9.10

Transfer the 10,000-ppm stock solution to the 250 mL beaker to permit transfer of the 10,000-ppm stock concentration solution into the 1 United States Gallon Calibration Solution bottle.



Figure 6.9.11

Overfill the Blank Solution bottle (above the 1 United States Gallon mark) and under fill the Calibration Solution bottle (below the 1 United States Gallon mark) with the site's blank water.



Figure 6.9.12

Insert a 10 mL disposable pipette into the 10-mL pipette helper.

To prepare 1 United States Gallon of Calibration Standard Solution, dilute the following volumes of 10,000-ppm stock solution into 1 United States Gallon of the site's blank water.

High Cal. Standard	20-ppm	25-ppm	50-ppm	75-ppm	100-ppm	150-ppm	200-ppm
10,000-ppm stock	7.6 mL	9.5 mL	19.0 mL	24.8 mL	37.9 mL	56.8 mL	75.8 mL



Figure 6.9.13

Pipette the volume of 10,000-ppm stock solution, noted in the table above, to prepare your required Calibration Solution.

NOTE: For a 100-ppm Calibration Standard Solution, transfer 3 x 10 mL plus 1 x 7.9 mL for a total of 37.9 mL.



Figure 6.9.14

Top up the Calibration Solution bottle to the 1 United States Gallon mark with site water from the Blank Solution bottle.



Figure 6.9.15

Install the Calibration Solution bottle cap and shake the bottle to mix the calibration solution.

You now have your Calibration Solution and Blank Solution bottles.

NOTE: The prepared Calibration Solution should be used within 30 minutes of preparation. If storage longer than 30 minutes is necessary, store the calibration solution in a glass stopped container, not in the plastic calibration bottle.

NOTE: To prepare a 4 L of Calibration Standard Solution, dilute the following volumes of 10,000-ppm stock solution into 4 L of the site's blank water.

High Cal. Standard	20-ppm	25-ppm	50-ppm	75-ppm	100-ppm	150-ppm	200-ppm
10,000-ppm stock	8.0 mL	10.0 mL	20.0 mL	30.0 mL	40.0 mL	60.0 mL	80.0 mL

7 OPERATIONS

7.1 Getting Started

7.1.1 Home Screen



Figure 7.1.1.1

The HOME screen displays the current oil in water concentration and the number of days of operation since the last analyzer calibration.



Figure 7.1.1.2

When an alarm is active, the HOME screen additionally displays “ALM” blinking in the upper left hand corner and the keypad emits a continuous beeping. The TD-4100 has four alarm management and display functions:

1. To review active alarms see Displaying Current Alarms;
2. To review the alarms that have been active in the analyzer since the last alarm reset see Displaying Alarm History;
3. To clear the analyzer alarm log see Clearing Alarm History; and
4. To permit System-function Alarm Troubleshooting

7.1.2 Alarms

Alarms built into the TD-4100 inform the user of system-function alarms and sample-level alarms.

An active system-function alarm indicates a system component may be defective or may have malfunctioned. System-function alarms are provided for:

1. The Lamp;
2. The Chopper;
3. The Photomultiplier Tube detector;
4. Loss of flow in the flow cell (zero alarm);
5. Abnormally high oil in water reading (high alarm); and
6. A user external alarm.

System-function alarms operate relay “A” and is normally used to report to an alarm monitor. If a system-function alarm is active, analyzer calibration is locked out until the system-function alarm(s) clears.

System-function alarm	Delay	Alarm	Normal
Lamp	1 minute	OFF	ON
Chopper RPM	2 minute	<500 RPM	588 to 612 RPM
Photomultiplier Tube	3 minute	< 25 or > 1000	25 to 1000
DIN user external alarm	User set. See **Setting the Alarm Delay** [default 1 minute; range 1 to 999.9 minutes].	OFF	ON
Zero Alarm	User set. See **Setting the Alarm Delay** [default 1 minute; range 0.1 to 999.9 minutes].	User set. See **Zero Alarm Monitoring** and **Zero Alarm Level** [default -10.0; range -999.9 to -1].	User set. See **Zero Alarm Monitoring** and **Zero Alarm Level** [default -10.0; range -999.9 to -1].
High Alarm	User set. See **Setting the Alarm Delay** [default 1 minute; range 0.1 to 999.9 minutes].	User set. See **High Alarm Monitoring** and **High Alarm Level** [default 100.0; range 0 to 999.9].	User set. See **High Alarm Monitoring** and **High Alarm Level** [default 100.0; range 0 to 999.9].

An active sample-level alarm indicates the sample oil in water content has exceeded the early warning alarm level. The sample-level alarm operates relay "B" and is normally used to:

1. Report to an alarm panel or operator station alerting the user of a high reading or

2. Directly for process control, such as closing discharge valves and opening reprocessing valves.

System-function alarm	Delay	Alarm	Normal
Early Warning Alarm	User set. See **Setting the Alarm Delay** [default 1 minute; range 0.1 to 999.9 minutes].	User set. See **Early Warning Alarm** Monitoring and **Early Warning Alarm** Level [default 50.0; range 0 to 999.9].	User set. See **Early Warning Alarm** Monitoring and **Early Warning Alarm** Level [default 50.0; range 0 to 999.9].

7.2 Routine Unit Tours



Figure 7.2.1

As part of routine unit tours, open the view port cover and confirm:

1. The opical windows, flow nozzle exit, and air channels are clean; and
2. The falling stream is uniform and shows a slight tapering from the top of the flow cell to the bottom.

Also complete unit tour checks as defined in OPTIONS & ACCESSORIES operations sections



NOTICE: Personnel removing the view port cover must meet facility requirements for exposure to ultraviolet radiation, including wearing protective goggles. As a minimum, TDHI recommend wearing approved protective goggles when completing this procedure



Figure 7.2.2

Check that water can be observed exiting from the overflow tube of the bubbletrap as shown. If water cannot be seen exiting the overflow tube, increase the sample flowrate into the monitor by opening the sample inlet valve. If sample inlet valve is completely open, try throttling back the bubbletrap drain valve, but do not completely close the bubbletrap drain valve.

7.3 Increase LCD Contrast

The LCD contrast may be increased to adjust for ambient light conditions. To change the contrast, perform the following steps.

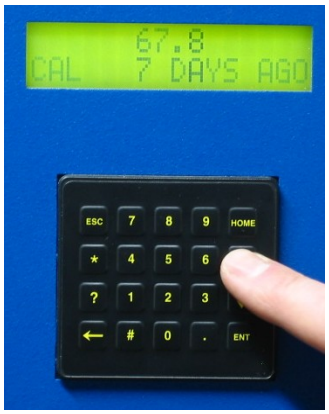


Figure 7.3.1

Key "⇑" to increase LCD contrast one unit.

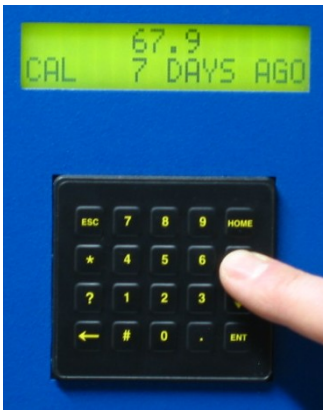


Figure 7.3.2

Key "⇑" to increase LCD contrast one unit.



Figure 7.3.3

Key "⇑" to increase LCD contrast one unit.



Figure 7.3.4

Key "⇑" to increase LCD contrast one unit.

7.4 Decrease LCD Contrast

The LCD contrast may be decreased from the factory default (full brightness) to adjust for ambient light conditions. To change the contrast, perform the following steps.



Figure 7.4.1

Key "⇓" to decrease LCD contrast one unit.



Figure 7.4.2

Key "⇓" to decrease LCD contrast one unit.



Figure 7.4.3

Key "⇓" to decrease LCD contrast one unit.



Figure 7.4.4

Key "⇓" to decrease LCD contrast one unit.

7.5 Entering User ID

To change analyzer configuration, excluding changing User ID and testing and tuning 4 mA and 20 mA output levels, you must be logged into the analyzer at a User level. Once logged into the analyzer, your login remains active until 15 minutes after your last keystroke or the analyzer power is cycled. To log into the analyzer when prompted to input ID, perform the following steps.



Figure 7.5.1

ID input prompt display.



Figure 7.5.2

Key User ID.



Figure 7.5.3

Key User ID.



Figure 7.5.4

Key User ID.



Figure 7.5.5

Key User ID.



Figure 7.5.6

Select “Enter” to accept User ID.

7.6 Entering MASTER ID

To change analyzer User ID, and to test and tune 4 mA and 20 mA output levels, you must be logged into the analyzer at a MASTER level. Once logged into the analyzer, your login remains active until 15 minutes after your last keystroke or the analyzer power is cycled. To log into the analyzer as a MASTER, perform the following steps.

NOTE: You may also enter the MASTER ID in response to the "ID input prompt display" (see Entering MASTER ID).

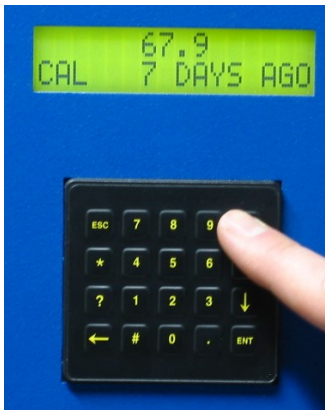


Figure 7.6.1

Select "Home" screen.



Figure 7.6.2

Select configuration screen "#".



Figure 7.6.3

Key MASTER ID.

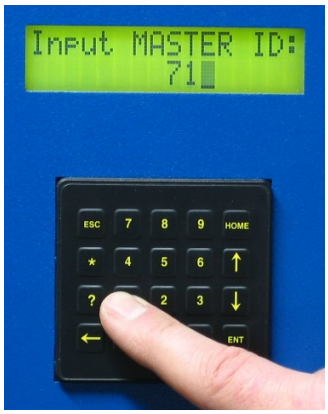


Figure 7.6.4

Key MASTER ID.



Figure 7.6.5

Key MASTER ID.



Figure 7.6.6

Key MASTER ID.



Figure 7.6.7

Select "Enter" to accept MASTER ID.

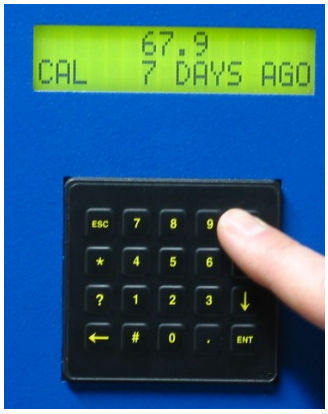


Figure 7.6.8

Return "Home" when finished.

7.7 Changing User ID

The factory default User ID “8520” may be changed to any 4 digit password or left at the factory default. To change the User ID, perform the following steps.

NOTE: MASTER ID login required (see Entering MASTER ID).

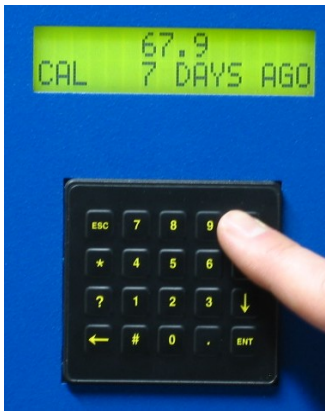


Figure 7.7.1

Select “Home” screen.



Figure 7.7.2

Select configuration screen “#”.



Figure 7.7.3

Select “Enter” to change User ID.



Figure 7.7.4

Key new User ID.



Figure 7.7.5

Key new User ID.



Figure 7.7.6

Key new User ID.

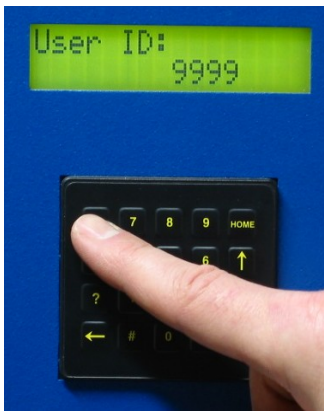


Figure 7.7.7

Key new User ID.



Figure 7.7.8

Select “Enter” to accept User ID.

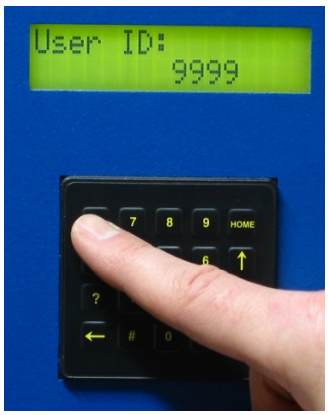


Figure 7.7.9

Select “Escape” to confirm User ID.

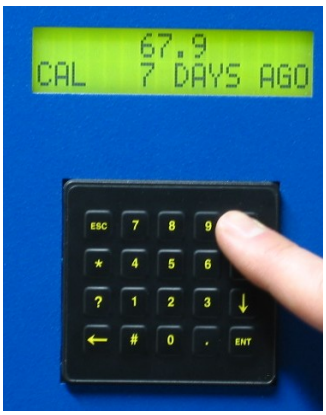


Figure 7.7.10

Return “Home” when finished.

7.8 Correcting A Numeric Data Entry

To correct numeric data entry, perform the following steps.

NOTE: The TD-4100 checks the validity of all system value entries. If a value or entry is invalid, an "Invalid Input" warning will be displayed. To clear the warning, press "ESC" to clear the warning, then reaffirm your data and enter the correct system value.



Figure 7.8.1

To enter the value of 1.5, key in "1".



Figure 7.8.2

Oops, you keyed in the value "1" twice.



Figure 7.8.3

Select "⇐" to delete 2nd "1".



Figure 7.8.4

Key decimal point ".".



Figure 7.8.5

Key in "5".



Figure 7.8.6

Select "Enter" to accept value.

7.9 Reviewing Instrument Firmware

The instrument firmware level is displayed at power up and may be accessed anytime as per below. The screen is displayed for 5 seconds and then returns to the “Home” screen. To review the firmware version, perform the following steps.



Figure 7.9.1

Select “Home” screen.



Figure 7.9.2

Select configuration screen “?”.

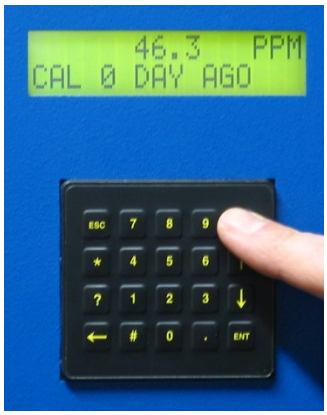


Figure 7.9.3

Return “Home” when finished.

7.10 Reviewing Diagnostic Screens

Diagnostic screens are provided to interrogate the health of the analyzer, to set analyzer outputs, and to establish system alarm causality. To review the screens, perform the following steps.

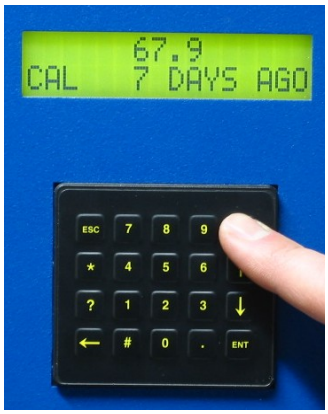


Figure 7.10.1

Select "Home" screen.



Figure 7.10.2

Select configuration screen "✶".

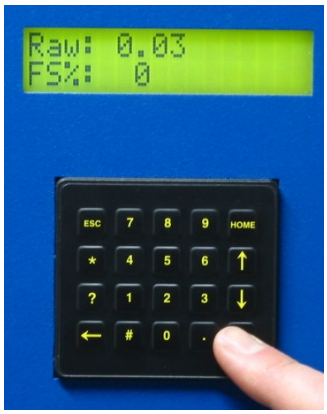


Figure 7.10.3

Select "Enter" to go to 2nd screen.



Figure 7.10.4

Select "Enter" to go to 3rd screen.



Figure 7.10.5

Select "Enter" to go to 4th screen.



Figure 7.10.6

Select "Enter" to go to 5th screen.

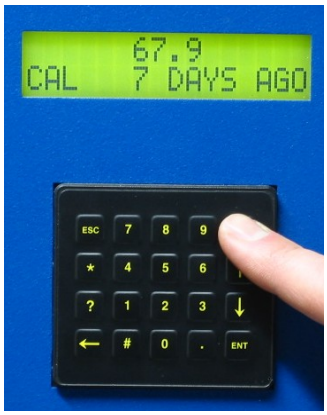


Figure 7.10.7

Return "Home" when finished.

7.11 Reviewing Master Diagnostic Screens

Diagnostic screens are provided to interrogate the health of the analyzer, to set analyzer outputs, and to establish system alarm causality. To review the master diagnostic screens, perform the following steps.

NOTE: MASTER ID login required (see **Entering** MASTER ID).

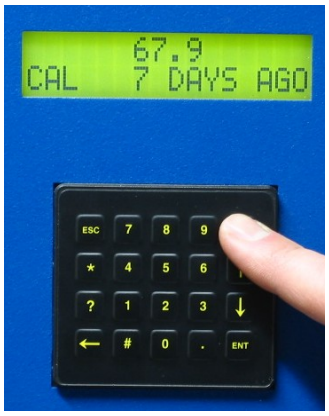


Figure 7.11.1

Select “Home” screen.



Figure 7.11.2

Select configuration screen “✶”.

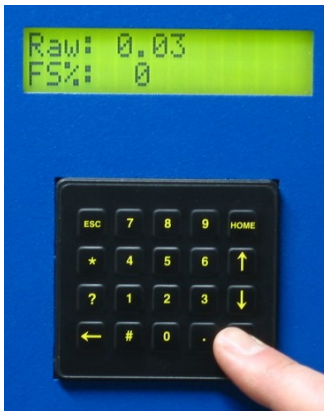


Figure 7.11.3

Select “Enter” to go to 2nd screen.



Figure 7.11.4

Select “Enter” to go to 3rd screen.



Figure 7.11.5

Select “Enter” to go to 4th screen.



Figure 7.11.6

Select “Enter” to go to 5th screen.



Figure 7.11.7

Select “Enter” to go to 6th screen.

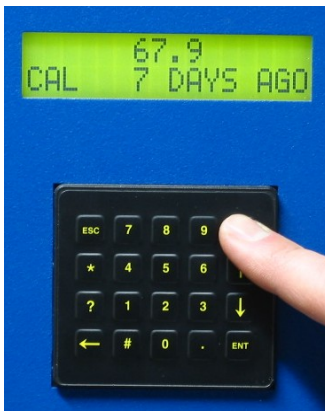


Figure 7.11.8

Return “Home” when finished.

7.12 Displaying Current Alarms

Current active alarms may be reviewed on the LCD as required. To review current active alarms, perform the following steps.



Figure 7.12.1

Select "Home" screen.



Figure 7.12.2

Select configuration screen "ESC".



Figure 7.12.3

Return "Home" when finished.

7.13 Displaying Alarm History

If a system, zero, early warning, and / or high alarm has occurred since the last alarm history reset, an alarm flag is set indicating that at least one alarm of the indicated type has occurred. In the example below, no system, zero, or high alarms have occurred but at least one early warning alarm has occurred since the last alarm history reset. To review the alarm history, perform the following steps.



Figure 7.13.1

Select "Home" screen.



Figure 7.13.2

Select configuration screen "⇐".



Figure 7.13.3

Return "Home" when finished.

7.14 System-function Alarm Troubleshooting

To troubleshoot a system-function alarm, proceed to the 1st diagnostic screen.

1. If Lamp = OFF, a UV source lamp alarm is active;
2. If the chopper motor speed falls below 500 RPM, a chopper motor alarm is active;
3. If the photomultiplier power falls below 25 volts or exceeds 1000, a photomultiplier HV alarm is active
4. If Din = OFF, a user set alarm is active.

To establish the system alarm cause, perform the following steps.

NOTE: In the example, the cause of the system alarm is the user-connected digital input.

NOTE: If a system alarm is active, analyzer calibration is inhibited until the system alarm is cleared.



Figure 7.14.1

Select “Home” screen.



Figure 7.14.2

Select configuration screen “✶”.

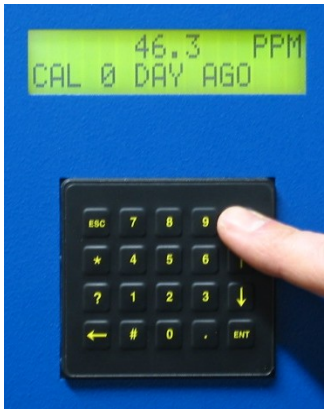


Figure 7.14.3

Return “Home” when finished.

7.15 Clearing Alarm History

Alarm history may be cleared at any time. To clear the alarm history, perform the following steps.



Figure 7.15.1

Select "Home" screen.



Figure 7.15.2

Select configuration screen "⇐".



Figure 7.15.3

Key "★" 5 times to clear. The 1st "★".



Figure 7.15.4

The 2nd "★".



Figure 7.15.5

The 3rd "★".



Figure 7.15.6

The 4th "★".



Figure 7.15.7

The 5th "★".



Figure 7.15.8

Return "Home" when finished.

7.16 Testing System-function Alarm Relay “A”

To test relay “A”, perform the following steps.

NOTE: When you ‘Return “Home” when finished’, relay “A” assumes the state defined by the relay “A” logic.



Figure 7.16.1

Select “Home” screen.



Figure 7.16.2

Select configuration screen “✶”.

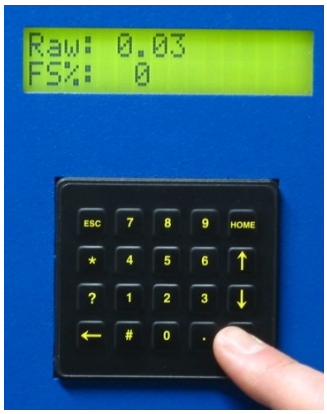


Figure 7.16.3

Select “Enter” to go to 2nd screen.



Figure 7.16.4

Select “Enter” to go to 3rd screen.



Figure 7.16.5

Select “1” to toggle ‘Relay A’.



Figure 7.16.6

Select “Enter” to toggle ‘Relay A’.



Figure 7.16.7

Select “Enter” to toggle ‘Relay A’.



Figure 7.16.8

Select “Enter” to toggle ‘Relay A’.

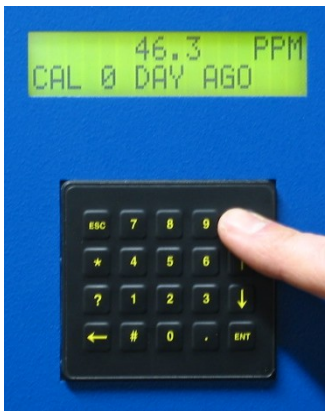


Figure 7.16.9

Return “Home” when finished.

7.17 Testing Sample-level Alarm Relay “B”

To test rely “B”, perform the following steps.

NOTE: When you ‘Return “Home” when finished’, relay “B” assumes the state defined by the relay “B” logic.



Figure 7.17.1

Select “Home” screen.



Figure 7.17.2

Select configuration screen “✶”.

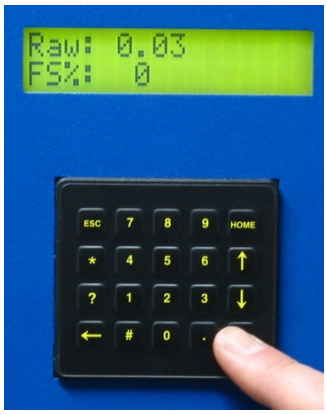


Figure 7.17.3

Select “Enter” to go to 2nd screen.



Figure 7.17.4

Select “Enter” to go to 3rd screen.

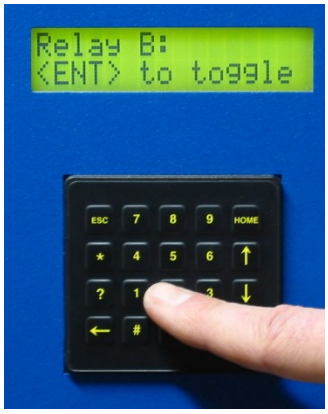


Figure 7.17.5

Select “2” to toggle ‘Relay B’.

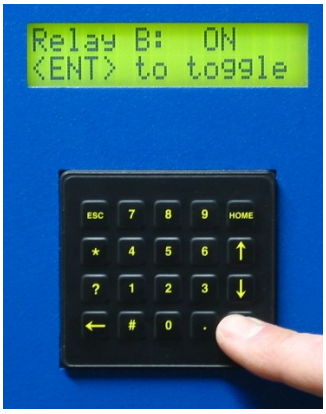


Figure 7.17.6

Select “Enter” to toggle ‘Relay B’.



Figure 7.17.7

Select “Enter” to toggle ‘Relay B’.



Figure 7.17.8

Select “Enter” to toggle ‘Relay B’.

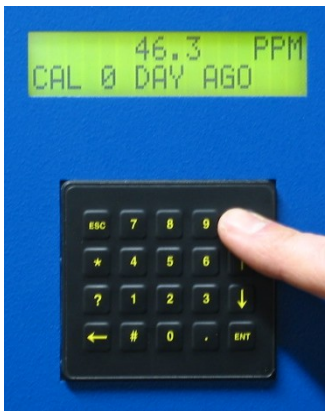


Figure 7.17.9

Return “Home” when finished.

7.18 Tune the Low Analog Output Level

An instrument diagnostic screen is provided to permit testing and tuning the analyzer low analog output level to match the low analog input of your analog monitoring system. To tune the low analog output, perform the following steps.

NOTE: MASTER ID login required (see Entering MASTER ID).

NOTE: The low analog output level may be set to 0 to support 0-20mA analog monitoring systems.



Figure 7.18.1

Select "Home" screen.



Figure 7.18.2

Select configuration screen "✶".



Figure 7.18.3

Select "Enter" to go to 2nd screen.



Figure 7.18.4

Select "Enter" to go to 3rd screen.



Figure 7.18.5

Select "Enter" to go to 4th screen.



Figure 7.18.6

Select "Enter" to go to 5th screen.



Figure 7.18.7

Select "1" to tune 4mA output.



Figure 7.18.8

Select "⇑" to increase or "⇓" to decrease.



Figure 7.18.9

Select "⇑" to increase or "⇓" to decrease.

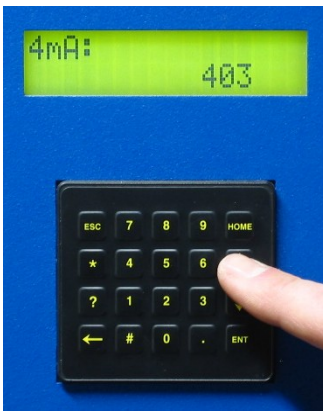


Figure 7.18.10

Select "⇑" to increase or "⇓" to decrease.



Figure 7.18.11

Select "⇑" to increase or "⇓" to decrease.



Figure 7.18.12

Select "⇑" to increase or "⇓" to decrease.



Figure 7.18.13

Select "ESC" to confirm value.



Figure 7.18.14

Return "Home" when finished.

7.19 Tune the High Analog Output Level

An instrument diagnostic screen is provided to permit testing and tuning the analyzer high analog output level to match the analog high analog input of your analog monitoring system. To tune the high analog output, perform the following steps.

NOTE: MASTER ID login required (see Entering MASTER ID).



Figure 7.19.1

Select “Home” screen.



Figure 7.19.2

Select configuration screen “✶”.



Figure 7.19.3

Select “Enter” to go to 2nd screen.



Figure 7.19.4

Select “Enter” to go to 3rd screen.



Figure 7.19.5

Select “Enter” to go to 4th screen.



Figure 7.19.6

Select “Enter” to go to 5th screen.



Figure 7.19.7

Select “2” to test or tune 20mA output.



Figure 7.19.8

Select “⇑” to increase or “⇓” to decrease.



Figure 7.19.9

Select "⇑" to increase or "⇓" to decrease.



Figure 7.19.10

Select "⇑" to increase or "⇓" to decrease.



Figure 7.19.11

Select "⇑" to increase or "⇓" to decrease.



Figure 7.19.12

Select "⇑" to increase or "⇓" to decrease.



Figure 7.19.13

Select "ESC" to confirm value.



Figure 7.19.14

Return "Home" when finished.

7.20 Setting the Calibration Standard Concentration [Screen 0]

When completing a calibration, it is necessary to enter the Calibration Standard concentrations. To change the Calibration Standard Concentration, perform the following steps.

NOTE: User ID login required (see Entering User ID).



Figure 7.20.1

Select "Home" screen.



Figure 7.20.2

Select configuration screen "0".



Figure 7.20.3

Select "Enter" to change value.



Figure 7.20.4

Key in new Calibration Standard value.



Figure 7.20.5

Key in new Calibration Standard value.



Figure 7.20.6

Key in new Calibration Standard value.



Figure 7.20.7

Select "Enter" to accept value.



Figure 7.20.8

Select "ESC" to confirm value.

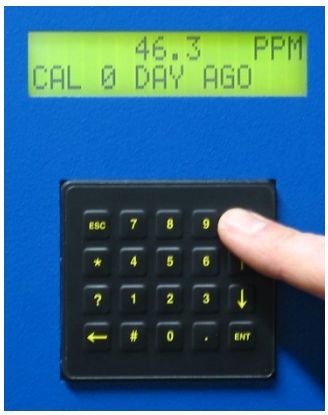


Figure 7.20.9

Return “Home” when finished.

7.21 Setting the Display Units [Screen 1]

The analyzer may be configured to display oil in water concentration in PPM, PPB, or NO UNITS. The factory default is “NO UNITS”. To change the analyzer display units, perform the following steps.

NOTE: User ID login required (see **Entering User ID**).



Figure 7.21.1

Select “Home” screen.



Figure 7.21.2

Select configuration screen “1”.



Figure 7.21.3

Select “Enter” to change value.

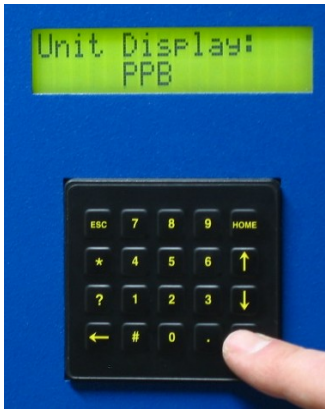


Figure 7.21

Select “Enter” to toggle options.

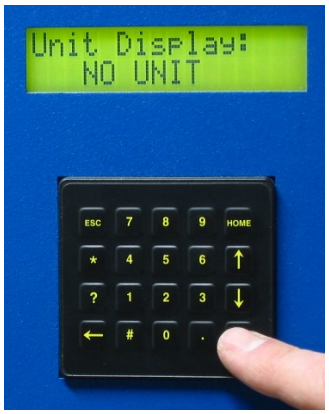


Figure 7.21.

Select “Enter” to toggle options.



Figure 7.21.6

Select “Enter” to toggle options.



Figure 7.21.7

Select “ESC” to accept option.



Figure 7.21.8

Return “Home” when finished.

7.22 Configuring the System-function Alarm Relay "A" [Screen 2]

System-function alarm relay "A" operation may be set for Normally Open operation (the factory default) or Normally Closed operation as required. System-function alarm relay "A" operates in response to system-function alarms and may be configured to operate in response to a zero alarm or a high alarm. System-function alarm relay "A" is normally used to report to an alarm panel or operator station alerting the user of meter anomalies that may affect the meter reading. To change the alarm relay "A" operation, perform the following steps.

NOTE: User ID login required (see Entering User ID).

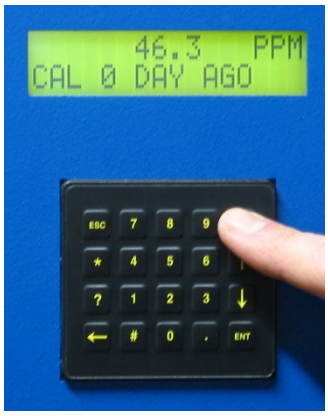


Figure 7.22.1

Select "Home" screen.



Figure 7.22.2

Select configuration screen "2".



Figure 7.22.3

Select "1" to change 'Relay A' operation.



Figure 7.22.4

Select "Enter" to toggle operation options.

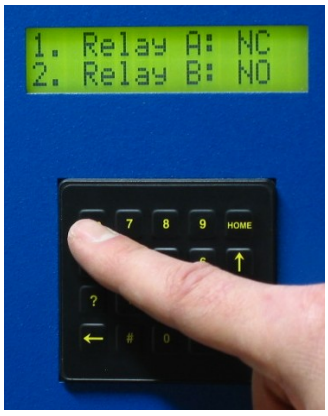


Figure 7.22.5

Select "ESC" to accept option.



Figure 7.22.6

Return "Home" when finished.

7.23 Configuring the Sample-level Alarm Relay “B” [Screen 2]

Sample-level alarm relay “B” operation may be selected for Normally Open operation (the factory default) or Normally Closed operation as required. Sample-level alarm relay “B” may be configured to operate in response to an early warning alarm. Sample-level alarm relay “B” is normally used to report to an alarm panel or operator station alerting the user of a high reading, or directly for process control such as closing discharge valves and opening reprocessing valves. To change the alarm relay “B” operation, perform the following steps.

NOTE: User ID login required (see Entering User ID).

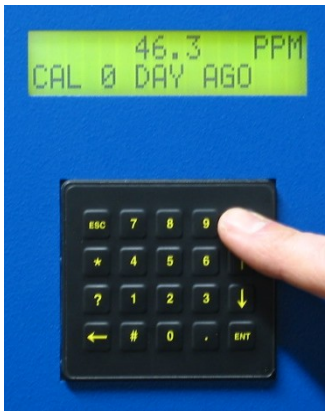


Figure 7.23.1

Select “Home” screen.



Figure 7.23.2

Select configuration screen “2”.



Figure 7.23.3

Select “2” to change ‘Relay B’ operation.



Figure 7.23.4

Select “Enter” to toggle operation options.



Figure 7.23.5

Select “ESC” to accept option.



Figure 7.23.6

Return “Home” when finished.

7.24 Zero Alarm Monitoring [Screen 3]

Zero alarm monitoring is, by default, deactivated. Zero alarm monitoring must be activated to operate the system-function alarm relay "A" and report to the analyzer alarm system. The zero alarm is normally used to report a loss of flow in the flow cell to an alarm panel or operator station alerting the user of meter anomalies that may affect the meter reading. To activate or deactivate the zero alarm monitoring, perform the following steps.

NOTE: User ID login required (see Entering User ID).

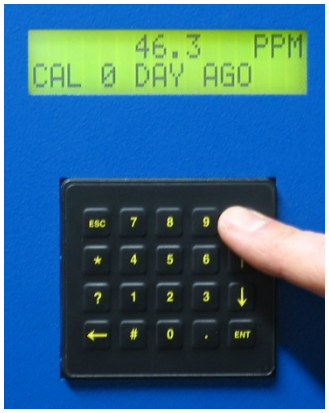


Figure 7.24.1

Select "Home" screen.



Figure 7.24.2

Select configuration screen "3".



Figure 7.24.3

Select "Enter" to change value.



Figure 7.24.4

Select "1" to change monitoring options.



Figure 7.24.5

Select "Enter" to toggle monitor options.



Figure 7.24.6

Select "ESC" to accept option.

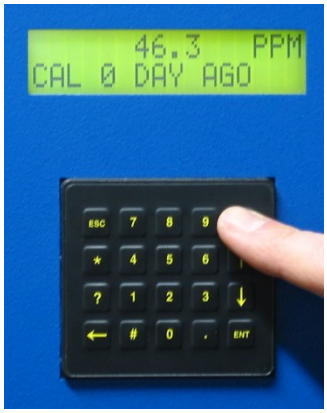


Figure 7.24.7

Return "Home" when finished.

7.25 Zero Alarm Level [Screen 3]

If it is activated, the zero alarm level triggers the zero alarm. The zero alarm level must be between –999.9 and -1.000. To change the zero alarm level, perform the following steps.

NOTE: User ID login required (see Entering User ID).

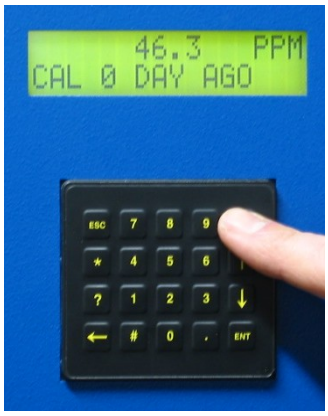


Figure 7.25.1

Select “Home” screen.



Figure 7.25.2

Select configuration screen “3”.



Figure 7.25.3

Select “Enter” to change value.



Figure 7.25.4

Select “2” to change monitoring level value.



Figure 7.25.5

Key in alarm level.



Figure 7.25.6

Key in alarm level.



Figure 7.25.7

Key in alarm level.



Figure 7.25.6

Key “ENT” to accept the value.



Figure 7.25.8

Select “ESC” to confirm value change.



Figure 7.25.9

Select “ESC” to confirm settings.

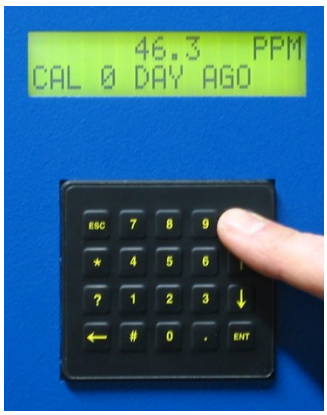


Figure 7.25.10

Return “Home” when finished.

7.26 Early Warning Alarm Monitoring [Screen 4]

Early Warning Alarm monitoring is, by default, deactivated. The alarm monitoring must be activated to operate sample-level alarm relay “B” and report to the analyzer alarm system. The early warning alarm is normally used to report to an alarm panel or operator station alerting the user of a high reading, or directly for process control such as closing discharge valves and opening reprocessing valves. To activate or deactivate the early warning alarm monitoring, perform the following steps.

NOTE: User ID login required (see Entering User ID).

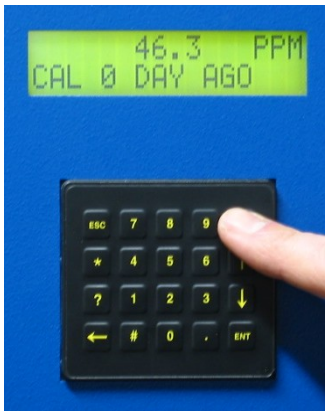


Figure 7.26.1

Select “Home” screen.

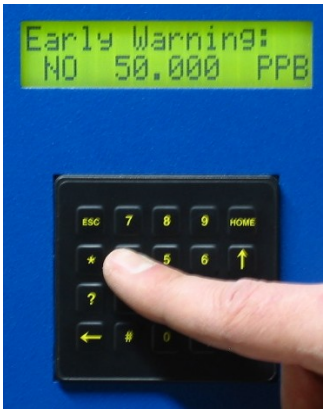


Figure 7.26.2

Select configuration screen “4”.



Figure 7.26.3

Select “Enter” to change value.



Figure 7.26.4

Select “1” to change monitoring options.

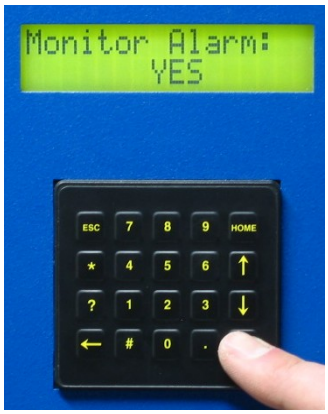


Figure 7.26.5

Select “Enter” to toggle monitor options.



Figure 7.26.6

Select “ESC” to accept option.



Figure 7.26.7

Return “Home” when finished.

7.27 Early Warning Alarm Level [Screen 4]

If it is activated, the early warning alarm level triggers the early warning alarm. The early warning alarm level must be greater than the zero alarm level, less than the high alarm level, and it must be between 0 and 999.9. To change the early warning alarm level, perform the following steps.

NOTE: User ID login required (see Entering User ID).



Figure 7.27.1

Select “Home” screen.



Figure 7.27.2

Select configuration screen “4”.

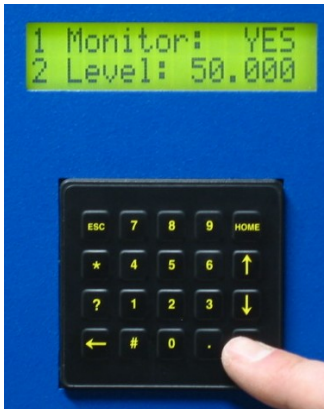


Figure 7.27.3

Select “Enter” to change value.



Figure 7.27.4

Select “2” to change monitoring level.



Figure 7.27.5

Key in alarm level.



Figure 7.27.6

Key in alarm level.



Figure 7.27.7

Select “Enter” to accept value.



Figure 7.27.8

Select “ESC” to confirm value.

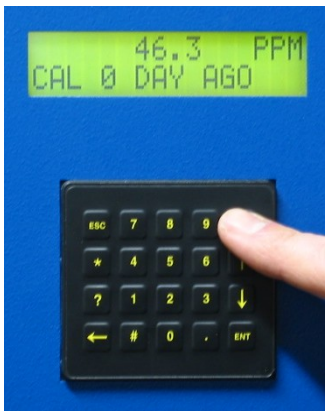


Figure 7.27.9

Return “Home” when finished.

7.28 High Alarm Monitoring [Screen 5]

High alarm monitoring is, by default, deactivated. High alarm monitoring must be activated to operate the system-function alarm relay "A" and report to the analyzer alarm system. The high alarm is normally used to report a high reading to an alarm panel or operator station alerting the user of meter anomalies that may affect the meter reading. To activate or deactivate the high alarm monitoring, perform the following steps.

NOTE: User ID login required (see Entering User ID).



Figure 7.28.1

Select "Home" screen.

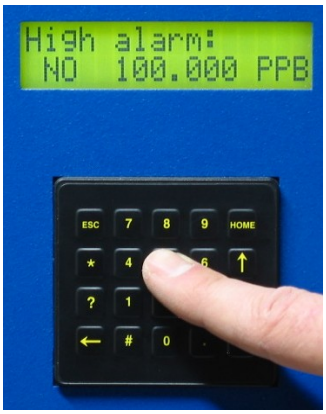


Figure 7.28.2

Select configuration screen "5".



Figure 7.28.3

Select "Enter" to change value.



Figure 7.28.4

Select "1" to change monitoring options.

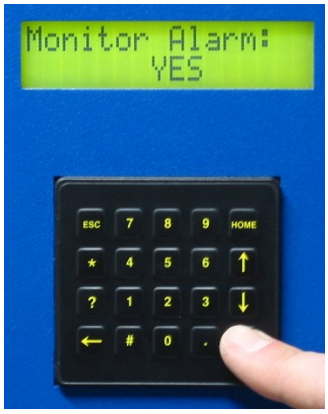


Figure 7.28.5

Select "Enter" to toggle monitor options.



Figure 7.28.6

Select "ESC" to accept option.

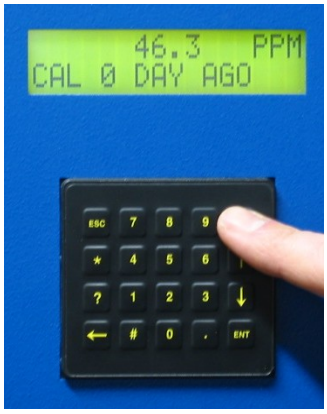


Figure 7.28.7

Return "Home" when finished.

7.29 High Alarm Level [Screen 5]

If it is activated, the high alarm level triggers the high alarm. The high alarm level must be greater than the early warning alarm level and must be between 0.0 and 999.9. To change the high alarm level, perform the following steps.

NOTE: User ID login required (see **Entering User ID**).



Figure 7.29.1

Select “Home” screen.



Figure 7.29.2

Select configuration screen “5”.

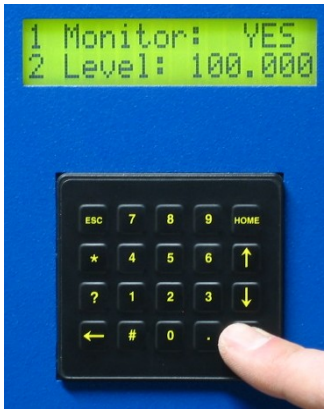


Figure 7.29.3

Select “Enter” to change value.



Figure 7.29.4

Select “2” to change monitoring level.



Figure 7.29.5

Key in alarm level.



Figure 7.29.6

Key in alarm level.

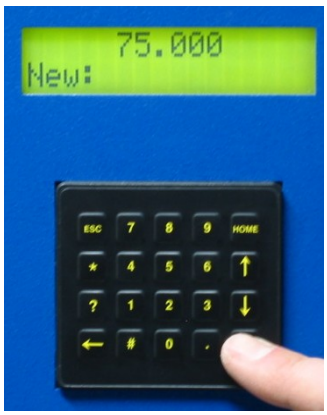


Figure 7.29.7

Select “Enter” to accept value.

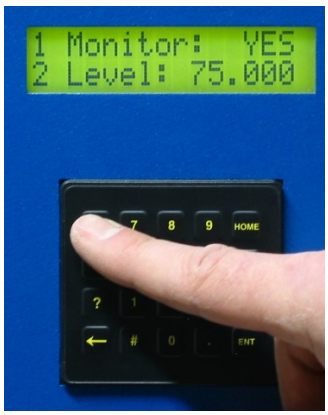


Figure 7.29.8

Select “ESC” to confirm value.

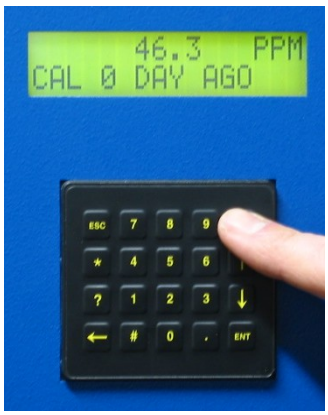


Figure 7.29.9

Return “Home” when finished.

7.30 Setting the Alarm Delay [Screen 6]

The alarm delay function affects:

1. The loss of flow in the flow cell (zero alarm);
2. Abnormally high hydrocarbon level in water reading (high alarm);
3. Warning hydrocarbon in water reading (early warning); and
4. User external alarm system-function, sample-level alarm relays, and analyzer alarm system responses.

These responses are delayed by the alarm delay value prior to operating either system-function alarm relay "A"' (system, zero, and high), sample-level alarm relay "B" (early warning), or reporting to the analyzer alarm system. If the alarm condition clears prior to exceeding the alarm delay period, the alarm relay will not operate and the analyzer alarm system will not report the condition. The alarm delay may be set between 0.1 and 999.9 minutes. To change the alarm delay, perform the following steps.

NOTE: User ID or login required (see Entering User ID).



Figure 7.30.1

Select "Home" screen.



Figure 7.30.2

Select configuration screen "6".



Figure 7.30.3

Select "Enter" to change value.



Figure 7.30.4

Key in alarm delay value.



Figure 7.30.5

Select "Enter" to accept value.



Figure 7.30.6

Select "ESC" to confirm value.

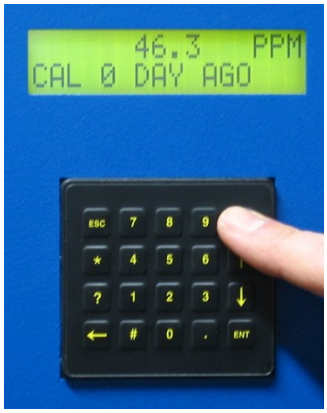


Figure 7.30.7

Return "Home" when finished.

7.31 Configuring the Analog Output Low Limit Value [Screen 7]

The 4mA output configuration sets the value in display units that represents the analog output low limit value. The value selected must be less than the analog output high limit level and must be between 0 and 999.8. To change the analog low limit value, perform the following steps.

NOTE: User ID or login required (see Entering User ID).



Figure 7.31.1

Select “Home” screen.



Figure 7.31.2

Select configuration screen “7”.



Figure 7.31.3

Select “Enter” to change value.



Figure 7.31.4

Key in analog output low limit value.



Figure 7.31.5

Select “Enter” to accept value.



Figure 7.31.6

Select “ESC” to confirm value.

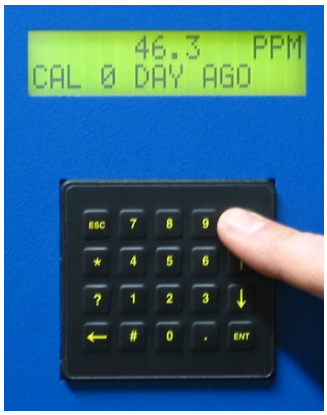


Figure 7.31.7

Return “Home” when finished.

7.32 Configuring the Analog Output High Limit Value [Screen 8]

The 20mA output configuration sets the value in display units that represents the analog output high limit value. The value selected must be greater than the analog output low limit level and must be between 0.1 and 999.9. To change the analog output high limit value, perform the following steps.

NOTE: User ID login required (see Entering User ID).



Figure 7.32.1

Select “Home” screen.



Figure 7.32.2

Select configuration screen “8”.



Figure 7.32.3

Select “Enter” to change value.



Figure 7.32.4

Key in 20mA output value.



Figure 7.32.5

Key in 20mA output value.



Figure 7.32.6

Key in 20mA output value.



Figure 7.32.7

Select “Enter” to accept value.

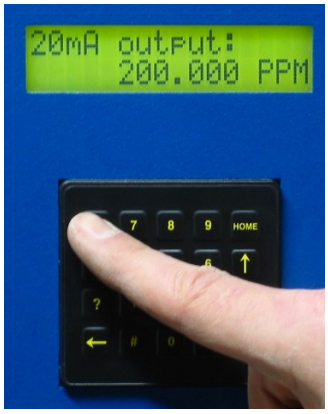


Figure 7.32.8

Select “ESC” to confirm value.

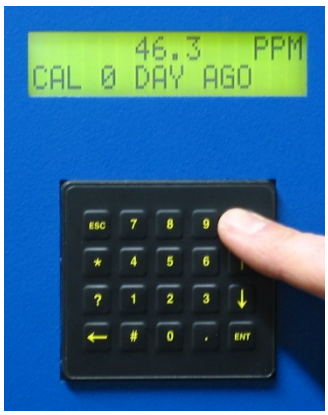


Figure 7.32.9

Return “Home” when finished.

7.33 Reviewing Relay Status [Screen 9]

Current status of the relay outputs may be reviewed on the LCD as required. To review the current relay status, perform the following steps.



Figure 7.33.1

Select “Home” screen.

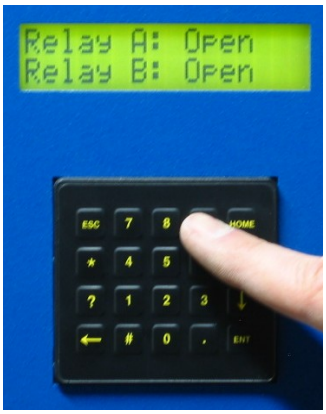


Figure 7.33.2

Select configuration screen “9”.



Figure 7.33.3

Return “Home” when finished.

7.34 Reviewing Calibration Data

Current calibration data may be reviewed on the LCD as required. To review the current calibration data, perform the following steps.



Figure 7.34.1

Select “Home” screen.



Figure 7.34.2

Select configuration screen “Enter”.



Figure 7.34.3

Select “2” to review calibration data.



Figure 7.34.4

Return “Home” when finished.

8 TROUBLESHOOTING

Because of the complexity of the TD-4100, it is important to collect diagnostic data prior to attempting to troubleshoot problems. To simplify this data collection, refer to Section 12.4 Troubleshooting Worksheet is provided.



NOTE: Have a copy of the completed Troubleshooting Worksheet at hand prior to contacting TDHI applications specialists for assistance.



NOTE: Please see OPTIONS & ACCESSORIES section for options maintenance requirements, schedules, and troubleshooting.

This guide assumes you have resolved all problems related to system-function alarms. By way of example, a lamp failure established through Section 7.14 System-function Alarm Troubleshooting may lead to other alarm messages, which could all be resolved by simple lamp replacement detailed in the maintenance Section 9.3.1 Lamp Replacement.

Generally speaking, if no system-function alarms are active and the CheckPOINT™ standard reports the early warning alarm (if setup as per instructions in Sections 6.4.5, 6.5.7, and 6.6.7), the analyzer electronics and optics are functioning correctly.

TDHI suggest the following analyzer troubleshooting sequence.

1. If any system-function alarms are active, use the Section 7.14 System-function Alarm Troubleshooting to diagnose and resolve the cause of the alarm.
2. Read the CheckPOINT™ to confirm analyzer optics and electronics stability.
3. Compare system values and calibration data recorded in the Troubleshooting Worksheet with those recorded on the Commissioning Checklist when the analyzer was commissioned and address any differences using the below.
4. Confirm there have been no changes to the water or target hydrocarbon chemistry since the last calibration.
5. Review the OPTIONS & ACCESSORIES troubleshooting guides for installed options and accessories.
6. If the problem remains, contact TDHI applications group for troubleshooting assistance.



WARNING: The TD-4100 enclosure should not be opened unless power is removed or the area has been properly tested and is known to be non-hazardous.

8.1 Troubleshooting Guide

PROBLEM	CAUSE	SOLUTION
Home screen displays > 999.0 indicating the sample reading exceeds 999.	Standard solution values are incorrect.	Review Section 7.20 Setting the Calibration Standard Concentration. Ensure it is entered as per the Commissioning Checklist completed during the analyzer commissioning.
	Analyzer sensitivity set too high.	Set the Analyzer Sensitivity as in Section 5.3.7.1. Then recalibrate the analyzer.
Home screen displays maximum reportable limit. NOTE: The maximum reportable limit = [Calibration Standard Concentration] x (1000 / calibration standard fluorescence response)	Analyzer sensitivity set too high.	Set the Analyzer Sensitivity as in Section 5.3.7.1. Then recalibrate the analyzer.
Home screen displays < 0.0 indicating the sample is reading below the blank.	Background response of sample has decreased below the blank.	This may be a normal situation in many applications. If decline is excessive, recalibrate the monitor by appropriate method.
	Flow in flow cell has fallen off due to fouled flow cell hose, flow cell nozzle, etc.	Thoroughly clean the analyzer as detailed in Section 9.5.1 Cleaning Flow Cell Nozzle and Hose and 9.5.2 Optical Window Cleaning.
	Sample cooler fouling.	See Section 4.6.1.5 Troubleshooting.
	Incorrect lamp or optical filters installed.	Visually inspect the lamp and optic filters, and compare them against the analyzer packing list.
	Blank sample contaminated with target hydrocarbon.	Recalibrate using “blank” containing no measurable target hydrocarbon.

PROBLEM	CAUSE	SOLUTION
Home screen displays 0.0	Sample has same reading as blank.	This may be a normal situation in many applications.
	Standard solution values are incorrect.	Review Section 7.20 Setting the Calibration Standard Concentration. Ensure it is entered as per the Commissioning Checklist completed during the analyzer commissioning.
Screen blank or black.	LCD contrast changes with ambient light and temperature.	If the screen is blank, Increase the LCD Contrast. If the screen is black, Decrease the LCD Contrast.
	Ambient temperature below -32°F [0°C].	Increase the ambient temperature.
Analyzer will not calibrate.	System-function alarm active.	Follow System-function Alarm Troubleshooting to clear alarm.
	Failure to complete entire calibration sequence.	Reset Calibration Data to Default and recalibrate the analyzer.
DIN is not operating properly.	A user set alarm fault.	Confirm integrity of the external device, external wiring and connections, and the analyzer terminal strip connections.
Condensation and or salt formation on the flow cell optical windows.	Air curtain flow or pressure set incorrectly.	Adjust the “Air Curtain” regulator to provide 10 and 20 psig [0.7 and 1.4 bar(g)] supply pressure, and the “Air Curtain” variable area meter to deliver 15 SCFH [0.425 sm^3/hr].
	Loss of analyzer instrument air.	Investigate and resolve.
	Fouling of the flow cell nozzle	Clean the flow cell nozzle as per Section 9.5.1 Cleaning Flow Cell Nozzle and Hose, and check air channels and clean as necessary.

PROBLEM	CAUSE	SOLUTION
Analyzer readings do not correspond to grab sample laboratory target hydrocarbon analysis. NOTE: For correlation calibrations or other calibration types, it is extremely rare that the readings ever agree exactly.	Fouling of optical windows is causing low readings.	Clean optical windows.
	Changes to the water or target hydrocarbon chemistry since the last calibration.	Recalibrate the monitor.
	Moisture ingress into optical filter housings.	Remove and clean / replace the optical filters, and replace the descant plug as necessary. NOTE: If the moisture ingress is due to wet air, contact TDHI to order the permanent membrane air dryer and pre-filter option. NOTE: If the moisture ingress is due to the drain backing up, contact TDHI to order a ¾" sample return drain overflow tube.
	Aging of optical filters is causing high readings.	Remove and clean / replace the optical filters, and replace the descant plug.
Home screen display does not change when calibration solutions are flowing through the analyzer.	Fouling of optical windows.	Clean optical windows.
	Incorrect optical kit installed.	Check analyzer packing list against installed optical kit. Contact TDHI to resolve.
	Analyzer sensitivity set too low.	Set the Analyzer Sensitivity and recalibrate the analyzer.
	Standard solution value is incorrect.	Review Section 7.20 Setting the Calibration Standard Concentration. Ensure it is entered as per the Commissioning Checklist completed during the analyzer commissioning.
Alarm relays do not activate alarm circuit	Alarm relay circuit is not externally powered.	Externally power the alarm relay circuit.
	Wrong type of power is applied to relay circuit.	Apply proper power type depending upon relay type.
	Insufficient load on relay circuit.	Increase load on relay circuit.
4-20 mA output is not correct	4 mA and 20 mA setting incorrect.	Correctly set 4 mA and / or 20 mA settings.
	Signal circuit is being externally powered.	Do not externally power the signal circuit, except if optional HART signal output option is installed.
	500 Ω circuit load is exceeded.	Reduce circuit load below 500 Ω.

9 MAINTENANCE

Once installed, the TD-4100 requires routine maintenance to ensure continued trouble-free performance. The frequency of maintenance is determined by the characteristics of the water being monitored. Typically, low hydrocarbon concentration applications and those with high sediment loading or untreated bacterial growth require higher maintenance.

The TD-4100 needs to be periodically correlated to a secondary analysis method determined by application requirements using the CheckPOINT™ readings to baseline the analyzer.

If the TD-4100 is to be shutdown for an extended period, TDHI recommends:

1. Cleaning the in-line bubble trap (brushes provided in the accessory kit);
2. Cleaning the flow cell windows, nozzle, and hose;
3. Maintaining the “Air Curtain” and purge systems (if fitted); and
4. Maintaining the power on.



NOTE: Please see OPTIONS & ACCESSORIES section for option maintenance requirements and schedules.

9.1 Routine Maintenance

For the purposes of this guidance, routine maintenance is divided into five sections.

1. Weekly Maintenance Checks
2. Six Month Maintenance
3. Four Year Maintenance
4. Maintenance As Required or Directed by TDHI

9.2 Weekly Maintenance Checks

Description	Purpose	Maintenance Routine
Ensure the excitation and emission filter windows are free of particulates, residual film, and moisture.	Windows that are not clear and clear will reduce the signal.	Close the sample inlet valve and use 2-propanol (isopropanol or isopropyl alcohol) dispensed from the squeeze wash bottle, and cotton swabs provided to clean the windows as discussed in Section 9.5.1 Optical Window Cleaning. If scale has built up, use the dilute acid cleaning solution prepared in Section 9.5.4 Preparing Acidic Cleaning Solutions. Once clean, use window cleaning solution on a lint-free tissue to polish the windows.
	Moisture on outside of windows will reduce the signal and could indicate incorrect “Air Curtain” supply flow, or pressure, or that “Air Curtain” channels are clogged.	Adjust the “Air Curtain” regulator to provide 10 and 20 psig [0.7 and 1.4 bar(g)] supply pressure, and the “Air Curtain” variable area meter to deliver 15 SCFH [0.425 sm^3/hr]. Clean the flow cell nozzle in Section 9.5.2 Cleaning Flow Cell and Sample Tubing Offline.
	Moisture inside windows will reduce the signal and could indicate consumed descant plug and/or defective seals between the filter housing and flow cell.	Replace the descant plug if it is deep pink as per Section 9.3.2 Desiccant Plug Replacement. To inspect / replace the seals between the filter housing and flow cell, see Section 9.4.1 Optical Filter and Lamp Replacement Sequence.
Ensure the falling stream is uniform and shows a slight taper from the top of the flow cell to the bottom.	A falling stream that is not uniform leads to unstable readings, and indicates the flow cell nozzle and / or flow cell hose are dirty.	Clean the flow cell nozzle and hose according to Section 9.5.2 Cleaning Flow Cell and Sample Tubing Offline.
Check the descant plug and replace if deep pink.	Moisture inside windows protected by the descant plug will reduce the signal.	Replace the descant plug as per Section 9.3.2 Desiccant Plug Replacement.

Description	Purpose	Maintenance Routine
Check air flow and pressure of "Air Curtain", and Hazardous Area purge, if fitted.	To ensure "Air Curtain" and Hazardous Area purge systems are operating properly.	Adjust the "Air Curtain" regulator to provide 10 and 20 psig [0.7 and 1.4 bar(g)] supply pressure, and the "Air Curtain" variable area meter to deliver 15 SCFH [0.425 sm^3/hr]. Adjust purge air as per Section 4.3 Hazardous Area Purge System.
Take CheckPOINT™ reading.	To establish if the instrument requires calibration	When reading outside site standards, arrange to recalibrate the analyzer.
Inspect all hoses and piping connections.	To detect potential failures.	Replace / tighten as necessary.
Inspect sample lines and in-line bubble trap for scale build up.	To maintain design sample flow to the flow cell.	If scale has built up, use the dilute acid cleaning solution prepared in Section 9.5.4 Preparing Acid Cleaning Solutions and 9.5.3 Cleaning Flow System Online. Use the brushes provided in the accessories package to clean the sample lines and in-line bubble trap.

9.3 Six Month Maintenance

9.3.1 Lamp Replacement



Figure 9.3.1.1

Isolate and lock out analyzer power.

Loosen the 6 lamp housing cover screws and, when loose, carefully remove the lamp housing cover.

NOTE: The lamp housing cover screws are fitted with nylon retaining washers so you need not remove the screws completely to remove the lamp housing cover.

NOTE: The lamp housing cover is fitted with a gasket that may stick to the lamp housing, so you may need to gently pry the cover off to separate the cover from the lamp housing.



Figure 9.3.1.2

When the lamp housing cover is removed, inspect the lamp housing cover gasket.

If damaged, replace the gasket by peeling the old gasket off and removing any residual adhesive left on the lamp housing cover. Remove adhesive cover from the new lamp housing cover gasket and apply to the lamp housing cover

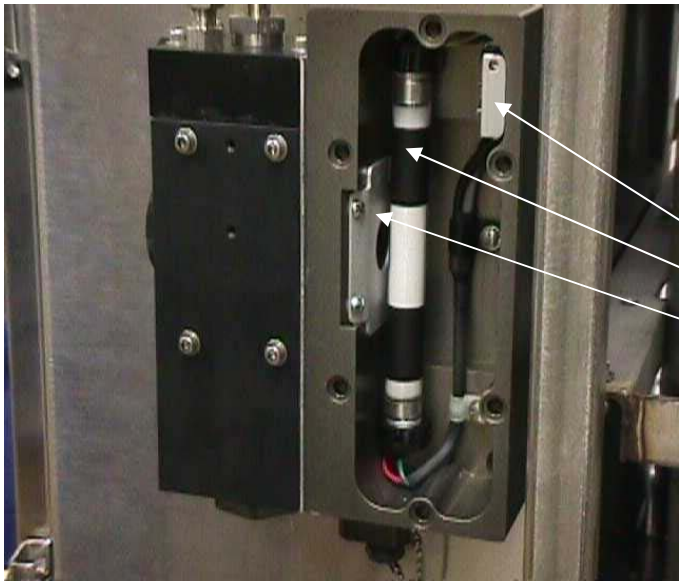


Figure 9.3.1.3

With the lamp housing cover removed, inspect the lamp housing and, if necessary, clean the lamp housing cover gasket mounting flange.

Lamp housing door safety interlock switch

Lamp

Excitation filter holder

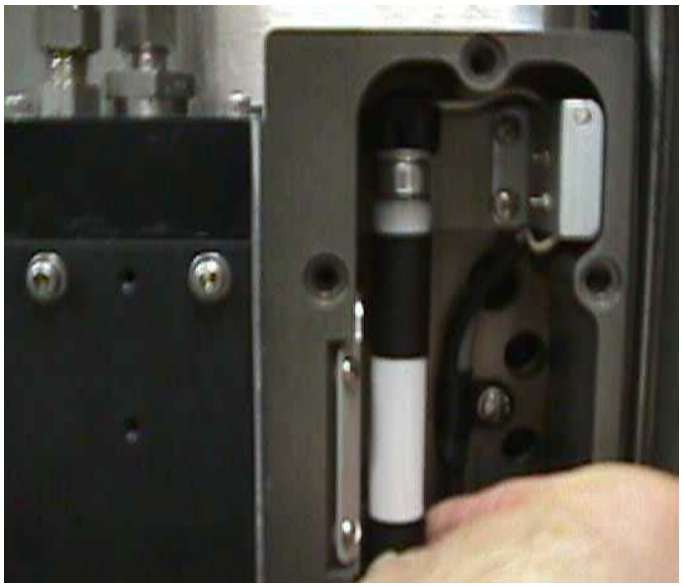


Figure 9.3.1.4

Remove the lamp from the lamp housing by rotating it to the left or right a ¼ turn, holding only the taped portion. The lamp may now be easily removed from the lamp holder.

NOTE: Body oil on the surface of the lamp will reduce the lamp effectiveness and lamp life.

Install the lamp into the lamp housing by fitting the pins in the holder and rotating the lamp to the left or right a ¼ turn holding only the lamp-taped portion.

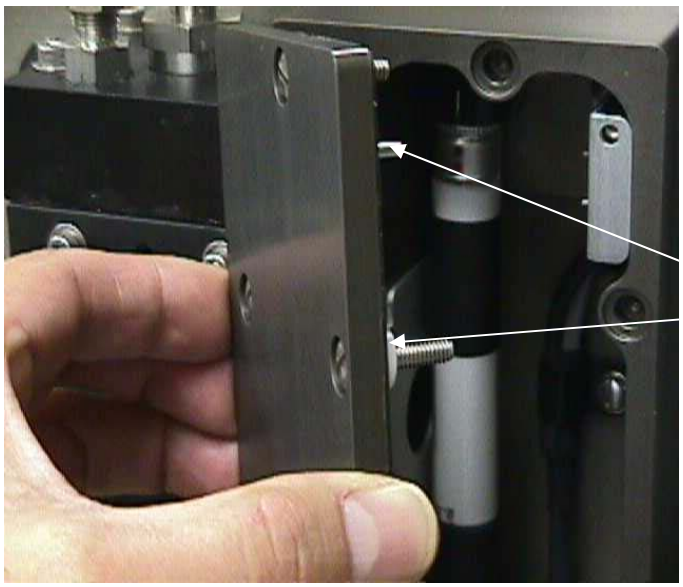


Figure 9.3.1.5

When replaced, reinstall the lamp housing cover ensuring the alignment pin is in the upper right corner. The cover safety interlock pin, when correctly installed, operates the lamp safety interlock switch.

Lamp housing cover safety interlock pin

Ensure nylon screw retaining washers are fitted.



Figure 9.3.1.6

Carefully tighten the 6 lamp housing cover screws to ensure even compression of the lamp housing cover gasket.

Reinstate analyzer power.



NOTE: After replacing the lamp confirm the monitor calibration using the CheckPOINT™. If a significant error is found, recalibrate the monitor. For critical applications, it is recommended to recalibrate the instrument each time the lamp is changed.

9.3.2 Desiccant Plug Replacement



Figure 9.3.2.1

Remove desiccant plug from the flow cell by loosing the plug in a counter clockwise direction.

NOTE: The desiccant plug should be replaced every six months or sooner if the plug paper has turned pink or if the flow cell has flooded.

NOTE: The desiccant plug is a two-piece component. When removing the plug from the flow cell, if the plug separates, ensure both pieces are completely removed.



Figure 9.3.2.2

Install a new desiccant plug into the flow cell by gently tightening the new plug in a clockwise direction until snug.

9.3.3 Activated Carbon Canister Air Filter Replacement



Figure 9.3.3.1

Isolate and lock out analyzer compressed air supply.

Allow the air pressure to decrease to ambient pressure.

Obtain a new activated carbon canister air filter.

Locate the exhausted activated carbon canister air filter.



Figure 9.3.3.2

Loosen the tube fittings at each end between the panel bulkhead fittings and the curved air tube fittings. Remove the entire assembly from the monitor.



Figure 9.3.3.3

Loosen and remove the pipe fittings at each end of the air filter.



Figure 9.3.1.4

Place new Teflon thread tape on each end of the air filter.



Figure 9.3.3.5

Reassembly and attach the air filter in the reverse order of the steps given above. Tighten the pipe fittings at each end of the air filter just enough to allow the curved tubes to match with the bulkhead fittings on the panel.

Remove the compressed air supply isolation and turn on.

Check for leaks.

9.4 Four Year Maintenance

9.4.1 Optical Filter and Lamp Replacement Sequence

Use the following sections, in sequence, to clean and change the optical filters, optical windows, and lamp.

9.4.2 Sample Block Removal and Installation

9.4.3 Emission Filter Inspection / Replacement

9.4.4 Excitation Optical Filter Window Inspection / Replacement

9.4.5 Excitation Filter Replacement

9.3.1 Lamp Replacement

9.4.2 Sample Block Removal and Installation



NOTE: After replacing the lamp and optical filters, the monitor must be recalibrated.

9.4.2 Sample Block Removal and Installation



Figure 9.4.2.1

Isolate and lock out analyzer power, sample inlet, drain outlet, and analyzer air supply.

Remove the air curtain air supply tubing from the top of the sample block.



Figure 9.4.2.2

Disconnect the flow cell inlet hose from the flow cell nozzle assembly using two 9/16” wrenches.



Figure 9.4.2.3

Using large adjustable pliers, carefully remove the union fitting on the flow cell drain. Remove the tee drain fitting. Do not loose the O-ring in the union fitting.



Figure 9.4.2.4

Carefully loosen and remove the flow cell drain fitting from the flow cell.



Figure 9.4.2.5

Use a 5/8" wrench to remove the nut from the bulkhead tube fitting on the flow cell.



Figure 9.4.2.6

Carefully use the knife to remove the four plastic screw hole plugs and store them in a secure place.



Figure 9.4.2.7

Using a 9/64” Allen key wrench, remove the four (8-32 2-½) sample block lamp housing Allen key retaining screws and washers, and store them in a secure place.

NOTE: It may be necessary to use needle nose pliers to remove the Allen key retaining screws and washers.



Figure 9.4.2.8

Using a 9/64” Allen key wrench, remove the four (8-32 3) sample block analyzer enclosure Allen key retaining screws and washers, and store them in a secure place.



Figure 9.4.2.9

Gently remove the sample block from the sample block mounting standoffs, fitted on the analyzer enclosure, by moving it to the right.



Figure 9.4.2.10

NOTE: The mounting standoff location

Sample block mounting standoff

NOTE: To install the sample block, reverse the above sequence. When tightening the sample block Allen key retaining screws, use care to torque them in such a way as to draw the block up squarely against the analyzer enclosure (first) and the lamp housing (second).

9.4.3 Emission Filter Inspection / Replacement

Prior to inspecting and / or replacing the emission filter, you must remove the analyzer sample block. Refer to Section 9.4.2 Sample Block Removal and Installation.



Figure 9.4.3.1

Remove the view port cover from the front of the sample block.

Insert your finger through the view port opening in the front of the sample block and push the emission filter housing out of its seat.

NOTE: The emission filter housing is located to the immediate left of the view port opening.

Inspect the sample block inside surfaces and clean as needed.

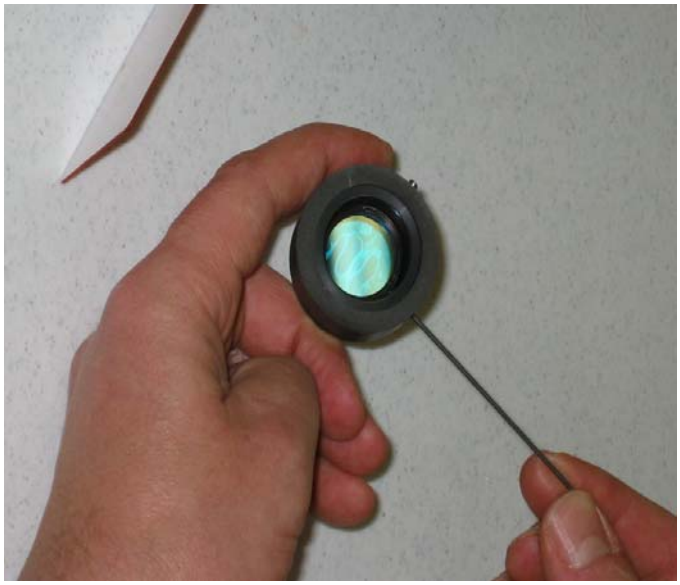


Figure 9.4.3.2

With the window of the emission filter housing facing down, use a .050 hex key wrench to loosen the .050" set screw, which is located on the side of the filter housing that secures the optical filter in place.

Turn the filter housing upside down and allow the optical filter to fall into your hand / or onto some soft padding material.

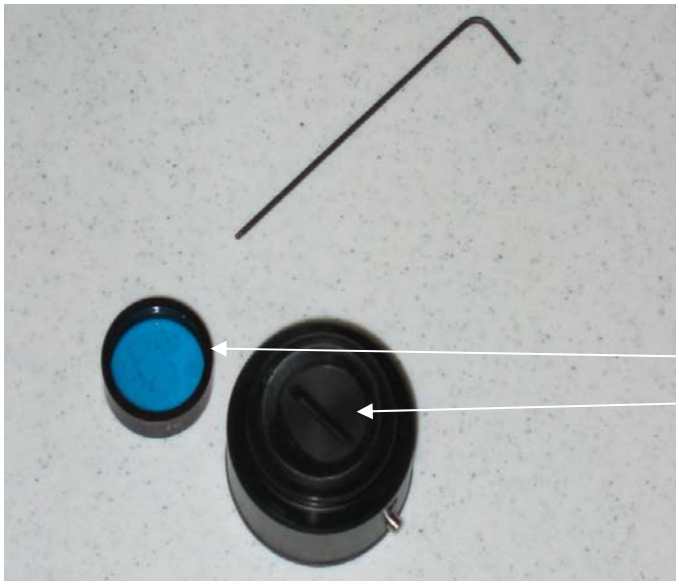


Figure 9.4.3.3

Inspect the exposed window surface of the filter housing for dirt or dampness.

NOTE: If the emission filter housing window is dirty or damp, clean the window surface thoroughly and to prevent recurrence, confirm sample block seal integrity and replace the desiccant plug.

Emission filter should be clean and dry.

Optical window should be clean and dry.



Figure 9.4.3.4

If replacing the optical filter, carefully install the new optical filter into the filter housing with the brightest mirrored side towards the window.

NOTE: Ensure the filter is clean and use caution not to get body oil or dirt on any of the optical surfaces when installing.

Ensure that the filter is properly seated in the housing and tighten the .050" set screw. Do not over tighten.

Push the emission filter housing back into the sample block until it is properly seated.

9.4.4 Excitation Optical Window Inspection / Replacement

Prior to inspecting and / or replacing the excitation optical window, remove the analyzer sample block. Refer to Section 9.4.2 Sample Block Removal and Installation.



Figure 9.4.4.1

Remove the view port cover from the front of the sample block.

Insert your finger through the view port opening in the front of the sample block and push the excitation optical window housing out of its seat.

NOTE: The excitation optical window housing is located immediately opposite the view port opening.

Inspect the sample block inside surfaces and clean as needed.



Figure 9.4.4.2

Inspect the exposed optical window surface of the excitation window housing for dirt or dampness.

NOTE: If the excitation optical window is dirty or damp, clean the window surface thoroughly and, to prevent recurrence, confirm sample block seal integrity and replace the desiccant plug.

Optical window should be clean and dry.

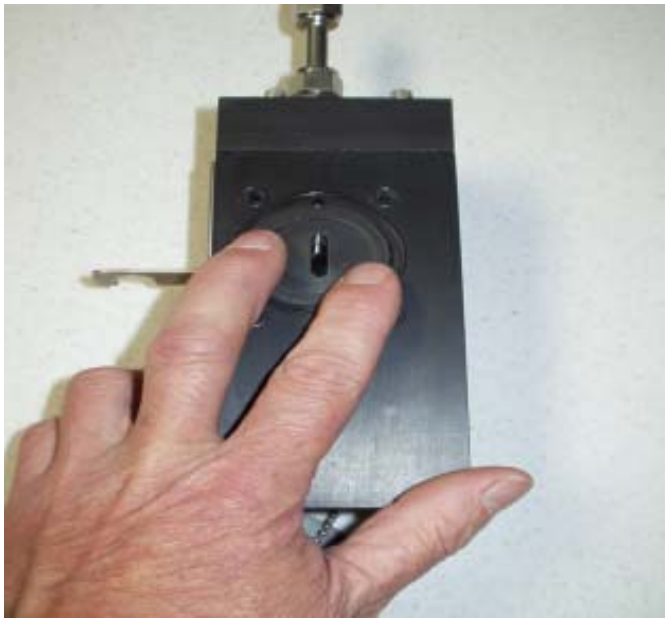


Figure 9.4.4.3

Push the excitation optical window housing back into the sample block until it is properly seated.

Install the view port cover into the front of the sample block.

9.4.5 Excitation Filter Replacement

Prior to inspecting and / or replacing the excitation filter, you must first remove the analyzer lamp housing cover and lamp. Refer to Section 9.3.1 Lamp Replacement.

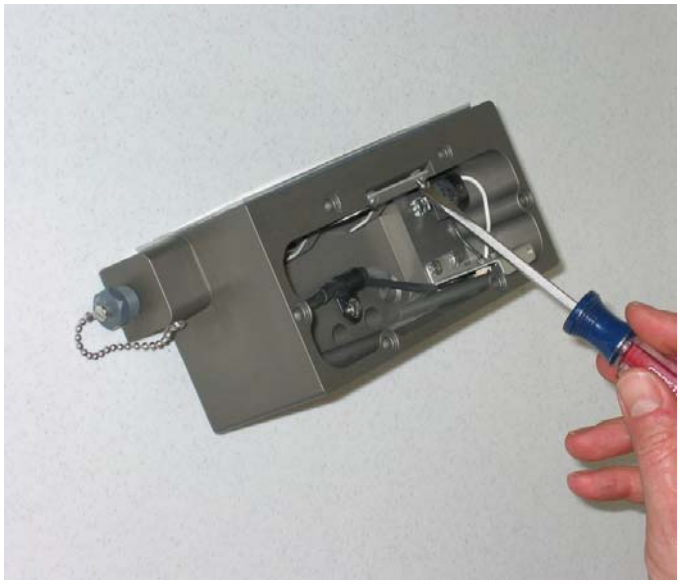


Figure 9.4.5.1

Loosen the 2-excitation filter bracket screws and, when loose, carefully remove the excitation filter bracket.

NOTE: The excitation filter bracket screws are fitted with nylon retaining washers so you need not remove the screws completely to remove the excitation bracket.

NOTE: This picture shows the lamp housing removed from the enclosure for clarity. The lamp housing does not require removal from the enclosure to replace excitation filters.

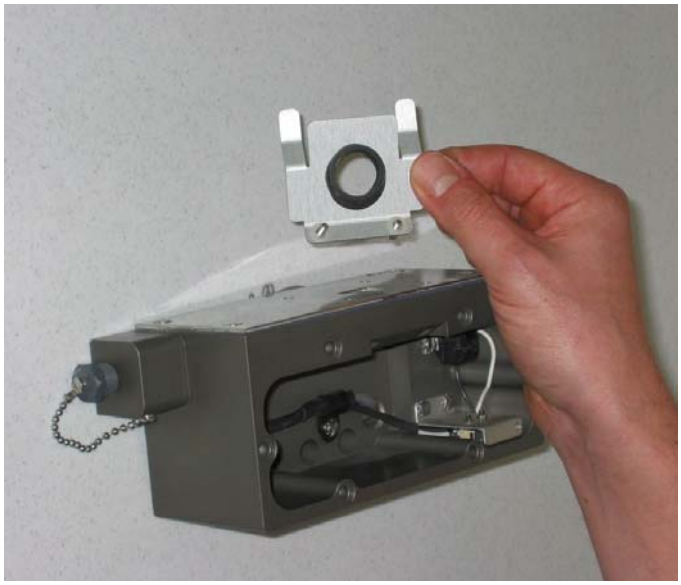


Figure 9.4.5.2

Remove excitation filter bracket from the lamp housing.

Once removed, remove all fiber washers and foam spacers from the lamp housing.



Figure 9.4.5.3

Carefully remove the excitation filter from the lamp housing.

If replacing the optical filter, install a fiber washer followed by the excitation filter with the brightest mirrored side toward the lamp. Then install another fiber washer followed by a foam spacer.

NOTE: Ensure the filter is clean and use caution not to get body oil or dirt on any of the optical surfaces when installing, and ensure the fiber washers and foam spacer do not block any of the light path.

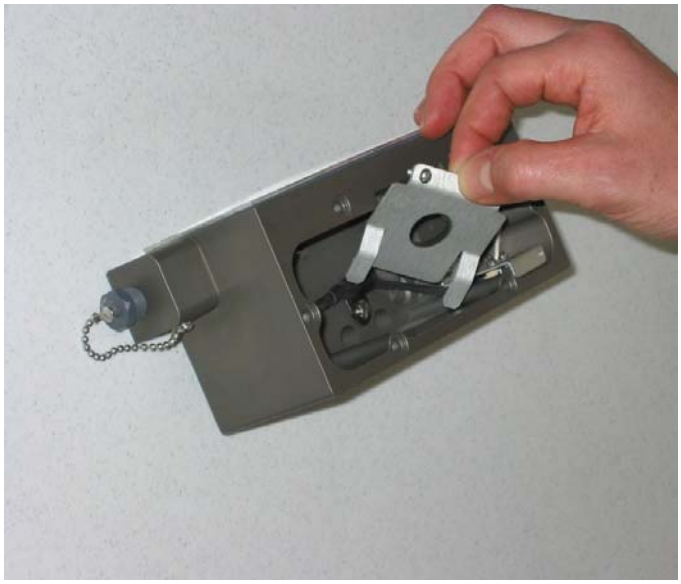


Figure 9.4.5.4

Ensure that the two Nylon retaining washers are still attached to the two screws on the excitation bracket. Then install the excitation bracket and tighten excitation bracket screws.

Install the new lamp by placing the lamp in the lamp holder, and turning the lamp to the left or right a ¼ turn until the lamp locks into position.

Ensure that the six Nylon retaining washers are installed onto the six screws on the lamp housing cover. Then install the cover onto the lamp housing and tighten the lamp housing screws.

9.4.6 NVRAM Replacement



Figure 9.4.6.1

Isolate and lock out analyzer power at the remote power breaker.

NOTE: Lethal voltages are present inside of the monitor when power is supplied to the monitor.

Isolate and lock out the power to the alarm relay circuits.

Open the analyzer enclosure door. Using a Phillips screwdriver, carefully remove the two screws on the right side of the enclosure.



Figure 9.4.6.2

Close the monitor enclosure door. Using a Phillips screwdriver, carefully remove the four screws on the left side of the enclosure.

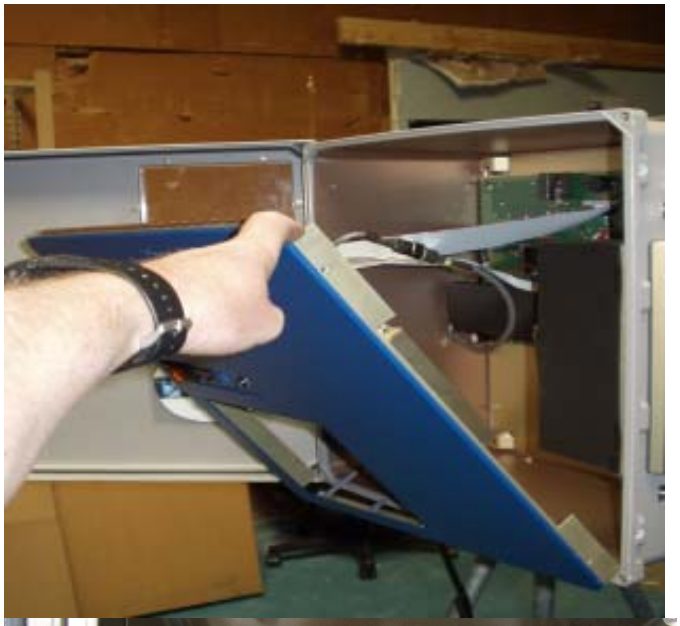


Figure 9.4.6.3

Remove the terminal strip cover panel.

Carefully pull out and down the monitor interior panel to expose the backside of the panel. You may need to remove the electrical connections from the monitor terminal strip.

Support the top of the monitor interior panel while working. Do not allow the monitor interior panel to hang from the attached wires.

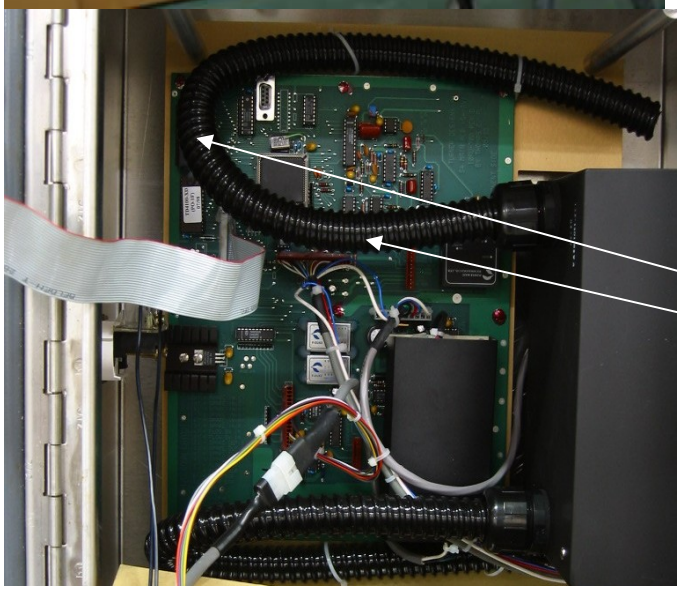


Figure 9.4.6.4

Once the analyzer access panel is removed, it may be necessary to remove the upper enclosure air circulation hose (if fitted) to gain access to the analyzer NVRAM.

NVRAM location

Upper enclosure air circulation hose

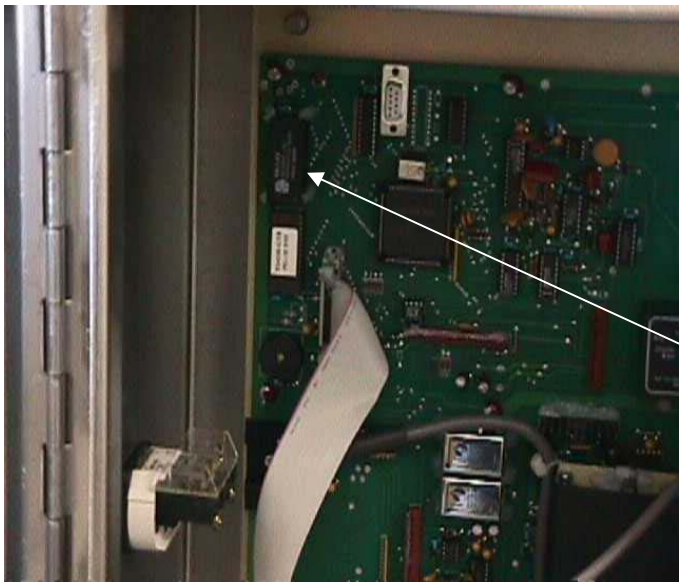


Figure 9.4.6.5

Once the upper enclosure air circulation hose has been removed, put on an electrostatic discharge (ESD) strap, and cut away the tape holding the NVRAM to the socket.

NVRAM location



Figure 9.4.6.6

Remove the NVRAM with the integrated circuit extraction tool.

NOTE: When extracting the NVRAM, pull squarely on the chip to ensure the pins do not bend.

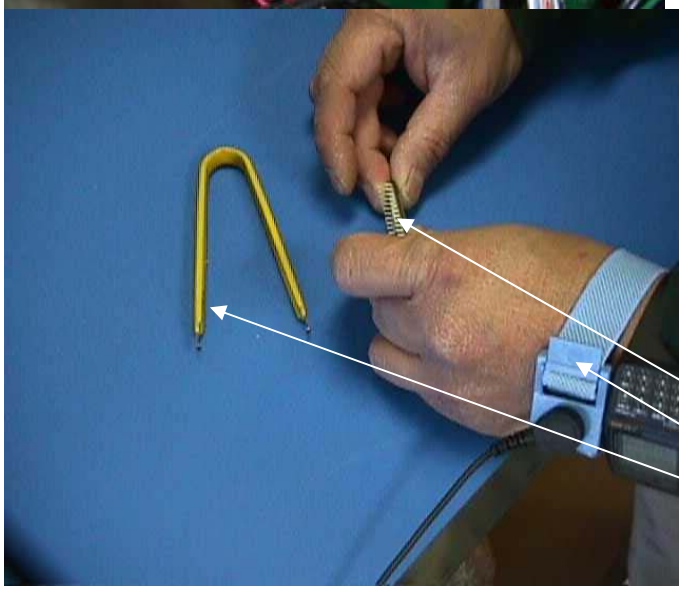


Figure 9.4.6.7

While wearing the ESD strap, remove the new NVRAM from its storage container and inspect it to ensure the pins are straight (perpendicular to the NVRAM body).

NOTE: The NVRAM will fit into the socket only if the pins are straight. If the pins are not straight, carefully bend both rows of pins evenly against a flat tabletop.

Bending the NVRAM pins straight

Electrostatic Discharge Strap

Integrated Circuit Extraction tool

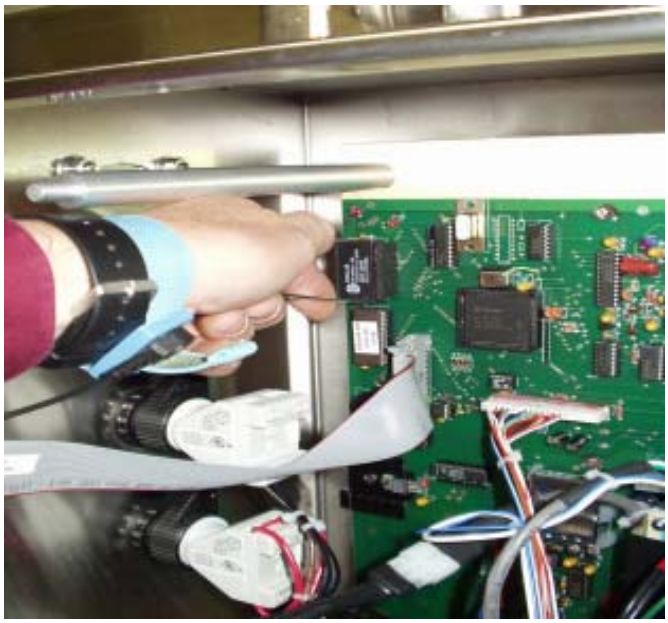


Figure 9.4.6.8

Align the pins of the new NVRAM to the socket on the motherboard, and using an integrated circuit installation tool, seat the NVRAM all the way into the socket.



Figure 9.4.6.8

If the power connections to the monitor terminal strips were removed, replace the power connections in the correct order. Carefully push the monitor interior panel back into the normal location but do not replace the screws holding the panel yet. Apply power to the monitor. Verify that the monitor functions correctly. The monitor will recognize that a new NVRAM has been entered. Press ENT key when requested. If the monitor does not function properly, check the connection after power has been isolated from the monitor.

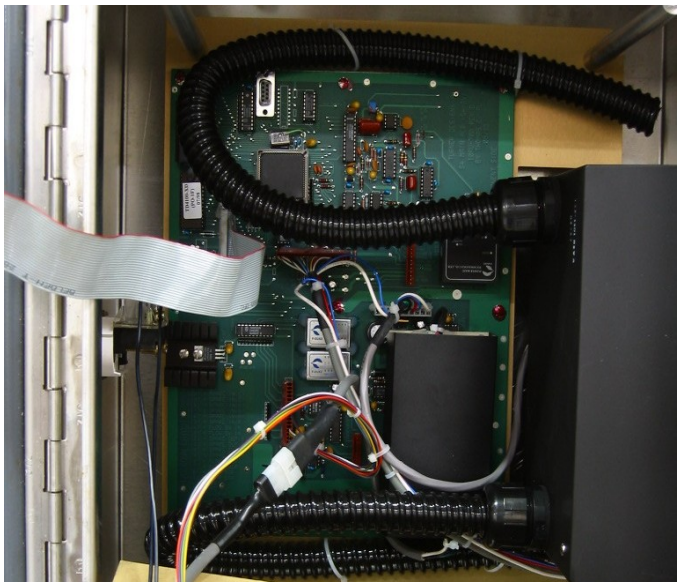


Figure 9.4.6.9

Isolate and lock out the power to the monitor again. Carefully pull down and out the monitor interior panel. Install new tape to NVRAM and socket. Reinstate the upper enclosure air circulation hose (if fitted).



Figure 9.4.6.10

Position the monitor interior panel in the correct location again. Carefully align the interior panel so that the mounting holes align. A flat-blade screwdriver may need to be positioned between the interior panel and the monitor enclosure to help the holes align. Carefully re-install the six mounting screws. Be careful not to strip the screw treads on the interior panel.

Re-attach the power, alarm relay circuits, and analog circuit.

Remove the power isolation to the monitor. Turn on the power to the monitor.

9.5 Maintenance As Required or as Directed by TDHI

9.5.1 Optical Window Cleaning

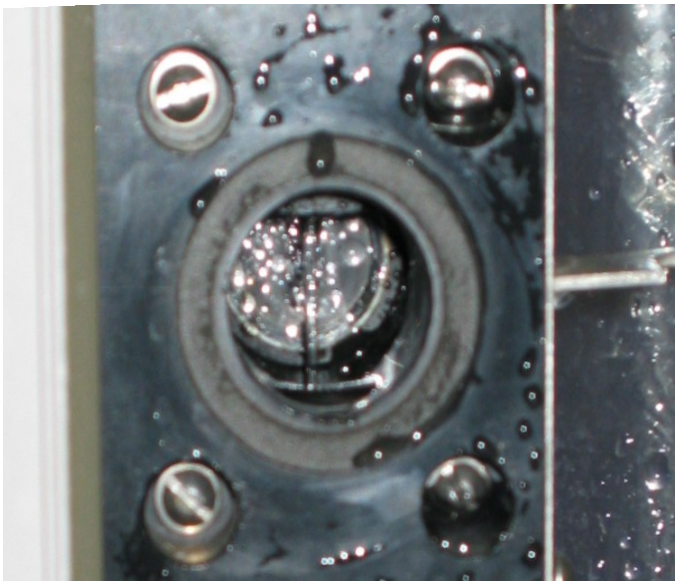


Figure 9.5.1.1

Shut off sample flow to the monitor.

Remove the flow cell viewport plug cover and the viewport plug.

If the windows are covered in moisture due to splashing, it is necessary to clean the optical windows.



Figure 9.5.1.2

Clean the excitation optical window (in the back) and the emission optical window (on the side) with 2-propanol (isopropanol or isopropyl alcohol) and the provided cotton swabs. If solids have deposited on the optical windows, used deionized water to clean the windows. Use a second cotton swab to dry the optical windows.

Replace the flow cell viewport plug and viewport plug cover.

Resume sample flow.

9.5.2 Cleaning Flow Cell and Sample Tubing Offline

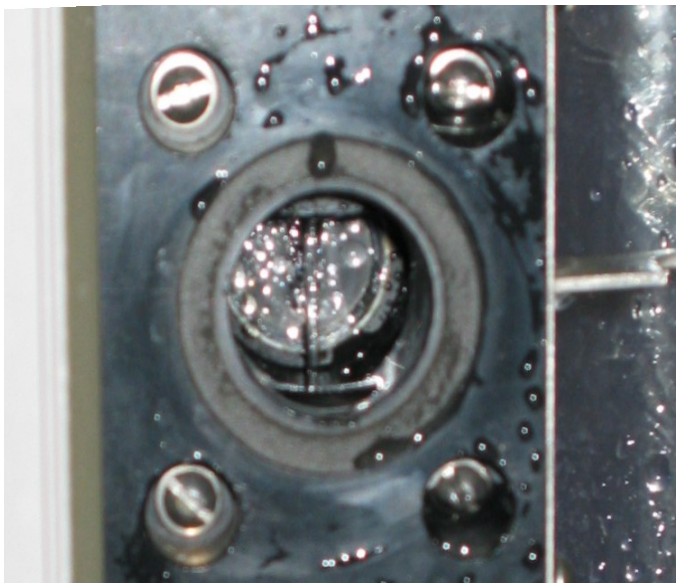


Figure 9.5.2.1

If the windows are covered in moisture due to splashing and the sample flow through the flow cell has necked down, even though the in-line bubble trap is overflowing properly to the drain, it is necessary to clean the flow cell nozzle and hose.



Figure 9.5.2.2

Isolate and lock out sample flow. Allow sample to completely drain.

Using two 9/16” wrenches, disconnect the tube fittings between the flowcell nozzle and the upper sample hose.



Figure 9.5.2.3

Using a 9/16” wrench and a ¾” wrench, disconnect the upper sample hose from the bulkhead fitting attached to the flowcell.



Figure 9.5.2.4

Use the smallest provided brush to clean the interior of the upper sample hose. Do not use any other cleaning device other than the provided brush. 2-Propanol (isopropanol or isopropyl alcohol) may be used to clean the hose interior with the brush.



Figure 9.5.2.5

Use the smallest provided brush to clean the flowcell nozzle. 2-Propanol may be used to help clean the flowcell nozzle. You must clean the resulting splashes off of the optical windows.



Figure 9.5.2.6

Using a ¾" wrench and a 7/8" wrench, remove the lower sample hose from the bulkhead fitting attached to the flowcell. Allow the sample to drain from this lower sample hose.



Figure 9.5.2.7

Use the smallest provided brush to clean the interior of the bulkhead fitting mounted to the flowcell.

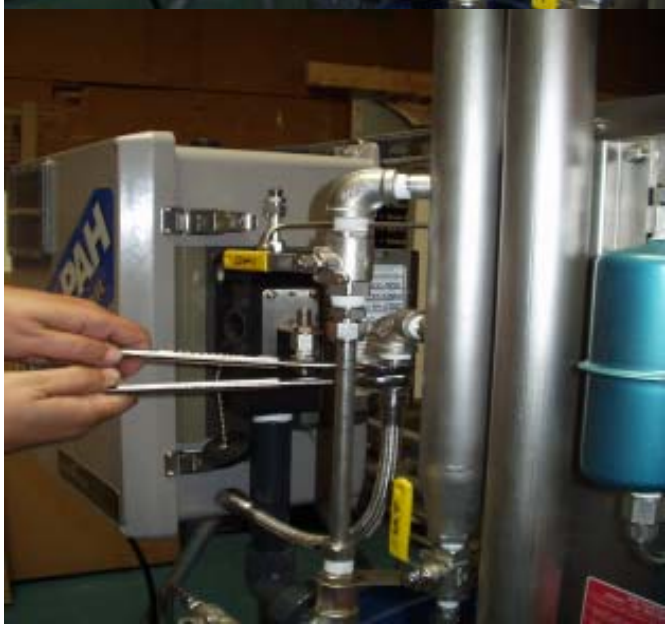


Figure 9.5.2.8

Using two 7/8" wrenches remove the lower sample hose from the bubbletrap connection.



Figure 9.5.2.9

Use the medium-sized provided brush to clean the lower sample hose. 2-Propanol may be used to help with this cleaning.



Figure 9.5.2.10

Reattach the lower sample hose to the bulkhead fitting and the bubbletrap. Tighten connections slightly past finger-tight.



Figure 9.5.2.11

Reattach the upper sample hose to the flow cell nozzle and bulkhead fitting. Tighten connections just past finger-tight.

Clean optical windows as in Section 9.5.1.



Figure 9.5.2.12

Remove the cap from the top of the bubbletrap. Use the largest brush to clean the bubbletrap interior. 2-Propanol, dilute detergent solution, or a dilute acid solution may be used to help clean the bubbletrap. Replace the cap of the bubbletrap.

Resume the sample flow.

9.5.3 Cleaning Flow System Online



Figure 9.5.3.1

To clean the flow cell nozzle assembly and flow cell inlet hose during operation, prepare a dilute detergent solution (Alconox® or similar) to remove hydrocarbon contamination.

Prepare the dilute detergent solution using warm water in the high standard calibration bottle. Use water below 120°F [49°C] to avoid sample bottle distortion.

Use the high standard calibration bottle and bottle valve to introduce the cleaning solution into the short in-line bubble trap column. Once the bottle is empty, close the calibration bottle valve and then flow through a bottle of clean water to flush residual detergent to ensure accurate readings.



Figure 9.5.3.2

If, in addition to hydrocarbon contamination, scale has built up in the flow cell nozzle assembly and flow cell inlet hose, they must be additionally cleaned with a dilute acid cleaning solution.

Prior to completing the dilute acid cleaning, prepare Calibration Standard Solutions as per Section 9.5.4 Preparing Acidic Cleaning Solutions, as required.

Once the dilute acid cleaning solution temperature is below 120°F [49°C], to avoid distorting the sample bottle, use the high standard calibration bottle and bottle valve to introduce the dilute acid cleaning solution into the short in-line bubble trap column. Once the bottle is empty, close the calibration bottle valve and then flow through a bottle of clean water to flush residual acid.

9.5.4 Preparing Acidic Cleaning Solutions

To remove scale from the optical windows and other areas where, in your experience, scale develops, it is necessary to prepare and use a diluted solution of hydrochloric acid.



WARNING: Concentrated hydrochloric acid is hazardous and can cause severe burns if it comes in contact with your skin and blindness if it comes in contact with your eyes.

Personnel performing this dilution procedure must meet facility requirements for acid handling, including wearing proper clothing and using any required apparatus. As a minimum, TDHI recommend wearing safety glasses and acid resistant gloves when completing this procedure.



WARNING: Always add acid to water when diluting acids. Dangerous splattering of acid can occur due to heat generated if water is added to acid.

Dilute 36% purity hydrochloric acid by slowly adding 1 part acid to 1 part water while stirring.

To prepare 2 liters of cleaning solution, add 1 liter of water to a minimum 3-liter container. Then, while stirring the 3-litre container, slowly add 1 liter of 36% purity hydrochloric acid.

Allow the cleaning solution to cool below 140°F (60°C) before using it to clean analyzer components.

9.5.5 Replacing Calibration Bottle Valve Gasket



Figure 9.5.5.1

Clean calibration valve thoroughly.

Remove old calibration valve gasket using a pair of needle nose pliers.

Install new calibration valve gasket by finger.

Calibration Valve Gasket

9.5.6 LCD Ribbon Cable Replacement



Figure 9.5.6.1

Isolate and lock out analyzer power at the remote power breaker.

NOTE: Lethal voltages are present inside of the monitor when power is supplied to the monitor.

Isolate and lock out the power to the alarm relay circuits.

Open the analyzer enclosure door. Using a Phillips screwdriver, carefully remove the two screws on the right side of the enclosure.



Figure 9.5.6.2

Close the monitor enclosure door. Using a Phillips screwdriver, carefully remove the four screws on the left side of the enclosure.



Figure 9.5.6.3

Remove the terminal strip cover panel.

Carefully pull out and down the monitor interior panel to expose the backside of the panel. You may need to remove the electrical connections from the monitor terminal strip.

Support the top of the monitor interior panel while working. Do not allow the monitor interior panel to hang from the attached wires.



Figure 9.5.6.4

Locate the ribbon cable running from the LCD board to the motherboard. Carefully cut the silicon glue on the ribbon cable connector on the motherboard. Push back the latches on the ribbon cable connector. Carefully pull the ribbon cable from the connector on the motherboard.



Figure 9.5.6.5

Carefully cut the silicon glue on the ribbon cable connector on the LCD board. Push back the latches on the ribbon cable connector. Carefully pull the ribbon cable from the connector on the LCD board.

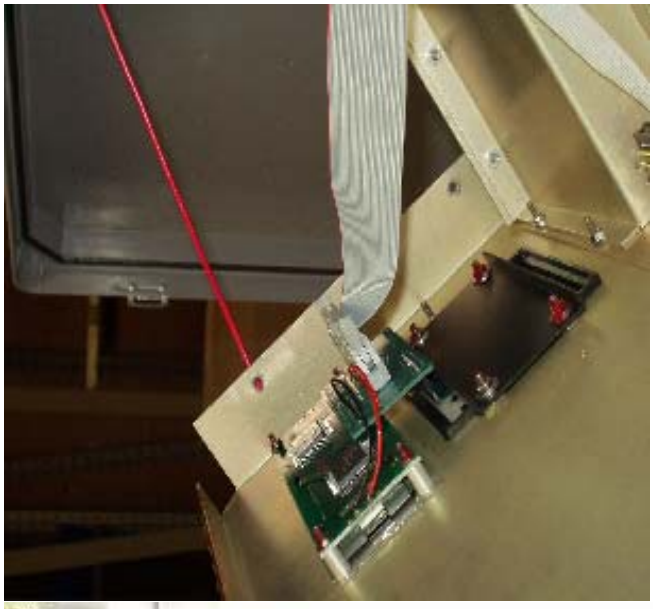


Figure 9.5.6.6

Attach the new ribbon cable to the ribbon cable connector on the LCD board noting the proper orientation. Push up the latches to retain the ribbon cable. Do not replace the silicon glue yet.



Figure 9.5.6.7

Attach the new ribbon cable to the ribbon cable connector on the motherboard noting the proper orientation. Push up the latches to retain the ribbon cable. Do not replace the silicon glue yet.



Figure 9.5.6.8

If the power connections to the monitor terminal strips were removed, replace the power connections in the correct order. Carefully push the monitor interior panel back into the normal location but do not replace the screws holding the panel yet. Apply power to the monitor. Verify that the LCD display functions correctly. If the LCD display does not function properly, check the connections after power has been isolated from the monitor.



Figure 9.5.6.9

Isolate and lock out the power to the monitor again. Carefully pull down and out the monitor interior panel. Apply silicon glue (GE Silicon II™ caulking) to the ribbon cable latches.



Figure 9.5.6.10

Position the monitor interior panel in the correct location again. Carefully align the interior panel so that the mounting holes align. A flat-blade screwdriver may need to be positioned between the interior panel and the monitor enclosure to help the holes align. Carefully re-install the six mounting screws. Be careful not to strip the screw treads on the interior panel.

Re-attach the power, alarm relay circuits, and analog circuit.

Remove the power isolation to the monitor. Turn on the power to the monitor.

9.5.7 LCD Display Replacement



Figure 9.5.7.1

Isolate and lock out analyzer power at the remote power breaker.

NOTE: Lethal voltages are present inside of the monitor when power is supplied to the monitor.

Isolate and lock out the power to the alarm relay circuits.

Open the analyzer enclosure door. Using a Phillips screwdriver, carefully remove the two screws on the right side of the enclosure.



Figure 9.5.7.2

Close the monitor enclosure door. Using a Phillips screwdriver, carefully remove the four screws on the left side of the enclosure.



Figure 9.5.7.3

Remove the terminal strip cover panel.

Carefully pull out and down the monitor interior panel to expose the backside of the panel. You may need to remove the electrical connections from the monitor terminal strip.

Support the top of the monitor interior panel while working. Do not allow the monitor interior panel to hang from the attached wires.



Figure 9.5.7.4

Carefully cut the silicon glue on the ribbon cable connector on the LCD board. Push back the latches on the ribbon cable connector. Carefully pull the ribbon cable from the connector on the LCD board.

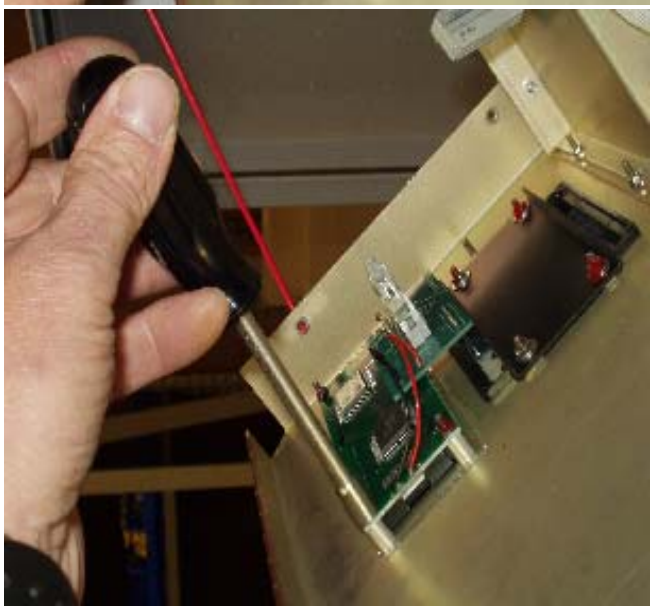


Figure 9.5.7.5

Using a 3/16" nutdriver or wrench, remove the four nuts that secure the LCD Assembly to the front panel. Note that there may be paint over the studs.



Figure 9.5.7.6

Install a new LCD Assembly onto the studs with four nuts. Apply nail polish or paint to the studs and nuts.

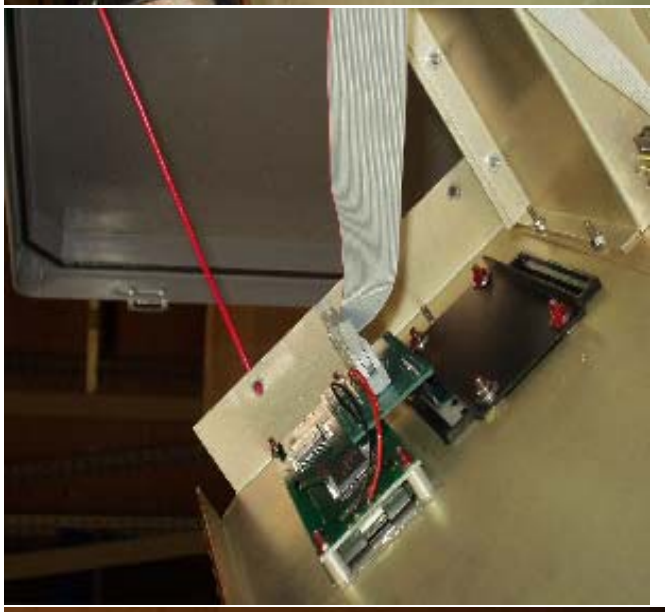


Figure 9.5.7.7

Attach the ribbon cable to the ribbon cable connector on the LCD board noting the proper orientation. Push up the latches to retain the ribbon cable. Do not replace the silicon glue yet.



Figure 9.5.7.8

If the power connections to the monitor terminal strips were removed, replace the power connections in the correct order. Carefully push the monitor interior panel back into the normal location but do not replace the screws holding the panel yet. Apply power to the monitor. Verify that the LCD display functions correctly. If the LCD display does not function properly, check the connection after power has been isolated from the monitor.



Figure 9.5.7.9

Isolate and lock out the power to the monitor again. Carefully pull down and out the monitor interior panel. Apply silicon glue (GE Silicon II™ caulking) to the ribbon cable latches.



Figure 9.5.7.10

Position the monitor interior panel in the correct location again. Carefully align the interior panel so that the mounting holes align. A flat-blade screwdriver may need to be positioned between the interior panel and the monitor enclosure to help the holes align. Carefully re-install the six mounting screws. Be careful not to strip the screw treads on the interior panel.

Re-attach the power, alarm relay circuits, and analog circuit.

Remove the power isolation to the monitor. Turn on the power to the monitor.

9.5.8 Keypad Replacement



Figure 9.5.8.1

Isolate and lock out analyzer power at the remote power breaker.

NOTE: Lethal voltages are present inside of the monitor when power is supplied to the monitor.

Isolate and lock out the power to the alarm relay circuits.

Open the analyzer enclosure door. Using a Phillips screwdriver, carefully remove the two screws on the right side of the enclosure.



Figure 9.5.8.2

Close the monitor enclosure door. Using a Phillips screwdriver, carefully remove the four screws on the left side of the enclosure.



Figure 9.5.8.3

Remove the terminal strip cover panel.

Carefully pull out and down the monitor interior panel to expose the backside of the panel. You may need to remove the electrical connections from the monitor terminal strip.

Support the top of the monitor interior panel while working. Do not allow the monitor interior panel to hang from the attached wires.



Figure 9.5.8.4

Carefully cut the silicon glue on the ribbon cable connector on the back of the keypad. Push back the latches on the ribbon cable connector. Carefully pull the ribbon cable connector from the pins on the back of the keypad.

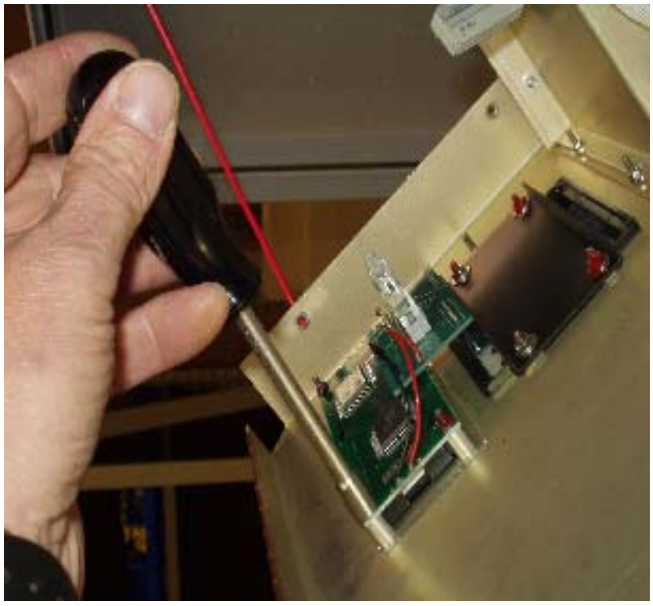


Figure 9.5.8.5

Using a 3/16" nutdriver or wrench, remove the four nuts that secure the LCD/Keypad Assembly to the front panel. Note that there may be paint over the studs.

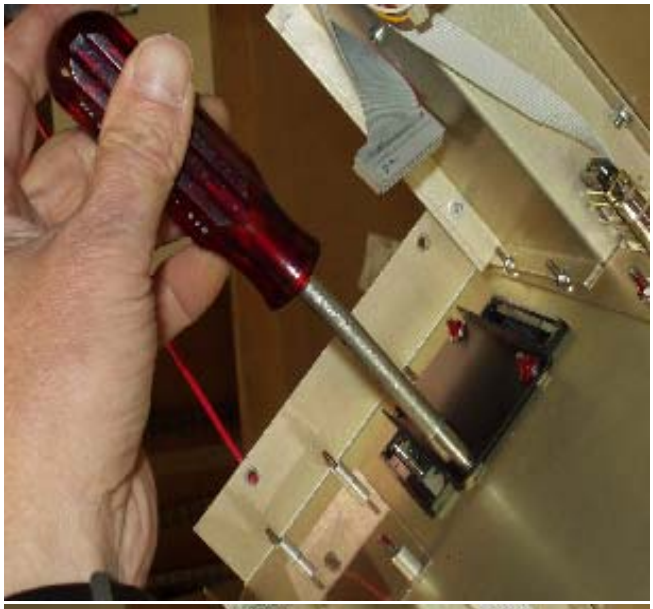


Figure 9.5.8.6

Using a ¼" nutdriver or wrench, remove the four nuts and washers from the keypad holding plate mounting studs. Note that there will be paint on the studs.

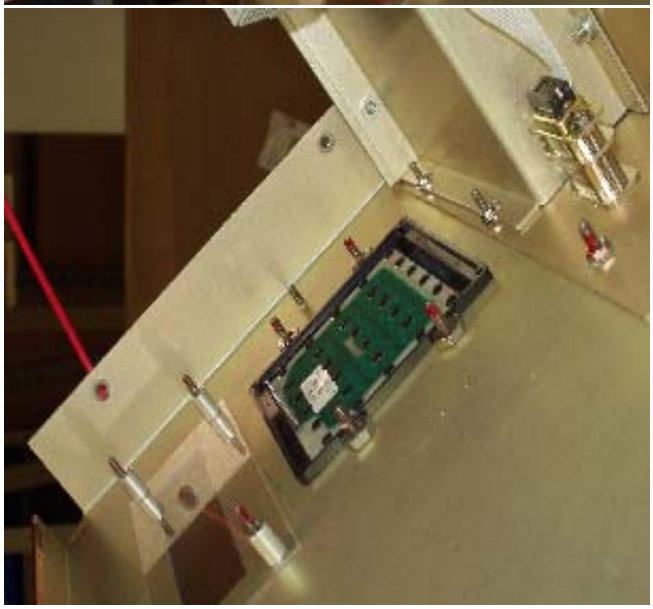


Figure 9.5.8.7

Remove the keypad holding plate and the keypad. Mount a new keypad in the opening.



Figure 9.5.8.8

Replace the keypad holding plate onto the studs. Replace the washers and nuts on the studs. The flat washer is positioned against the plate and the lock washer is positioned between the flat washer and the nut. Replace the paint on the studs with nail polish or paint.



Figure 9.5.8.9

Install a new LCD Assembly onto the studs with four nuts. Apply nail polish or paint to the studs and nuts.

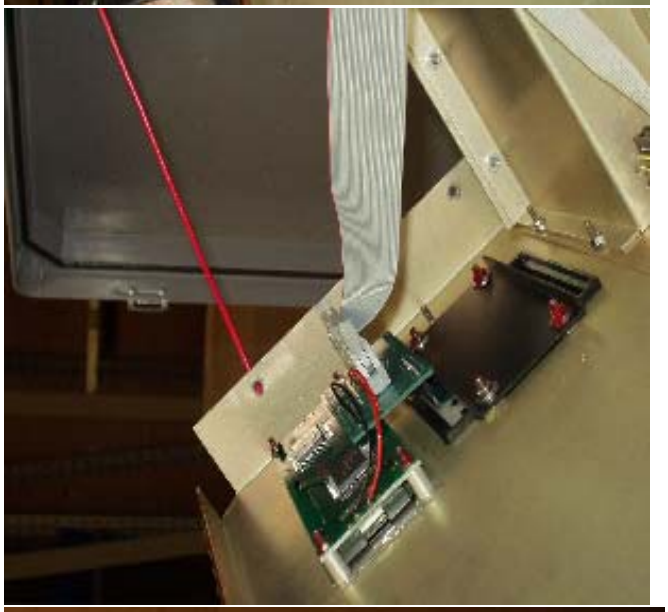


Figure 9.5.8.10

Attach the ribbon cable to the pins on the motherboard noting the proper orientation. Push up the latches to retain the ribbon cable. Do not replace the silicon glue yet.



Figure 9.5.8.11

If the power connections to the monitor terminal strips were removed, replace the power connections in the correct order. Carefully push the monitor interior panel back into the normal location but do not replace the screws holding the panel yet. Apply power to the monitor. Verify that the keypad functions correctly. If the keypad does not function properly, check the connection after power has been isolated from the monitor.



Figure 9.5.8.12

Isolate and lock out the power to the monitor again. Carefully pull down and out the monitor interior panel. Apply silicon glue (GE Silicon II™ caulking) to the ribbon cable latches.



Figure 9.5.8.13

Position the monitor interior panel in the correct location again. Carefully align the interior panel so that the mounting holes align. A flat-blade screwdriver may need to be positioned between the interior panel and the monitor enclosure to help the holes align. Carefully re-install the six mounting screws. Be careful not to strip the screw treads on the interior panel.

Re-attach the power, alarm relay circuits, and analog circuit.

Remove the power isolation to the monitor. Turn on the power to the monitor.

9.5.9 Power Supply and Power Supply Fuse Replacement



Figure 9.5.9.1

NOTE: The power supply is voltage (AC or DC) dependent.

Isolate and lock out analyzer power at the remote power breaker.

NOTE: Lethal voltages are present inside of the monitor when power is supplied to the monitor.

Isolate and lock out the power to the alarm relay circuits.

Open the analyzer enclosure door. Using a Phillips screwdriver, carefully remove the two screws on the right side of the enclosure.



Figure 9.5.9.2

Close the monitor enclosure door. Using a Phillips screwdriver, carefully remove the four screws on the left side of the enclosure.



Figure 9.5.9.3

Remove the terminal strip cover panel.

Carefully pull out and down the monitor interior panel to expose the backside of the panel. You may need to remove the electrical connections from the monitor terminal strip.

Support the top of the monitor interior panel while working. Do not allow the monitor interior panel to hang from the attached wires.

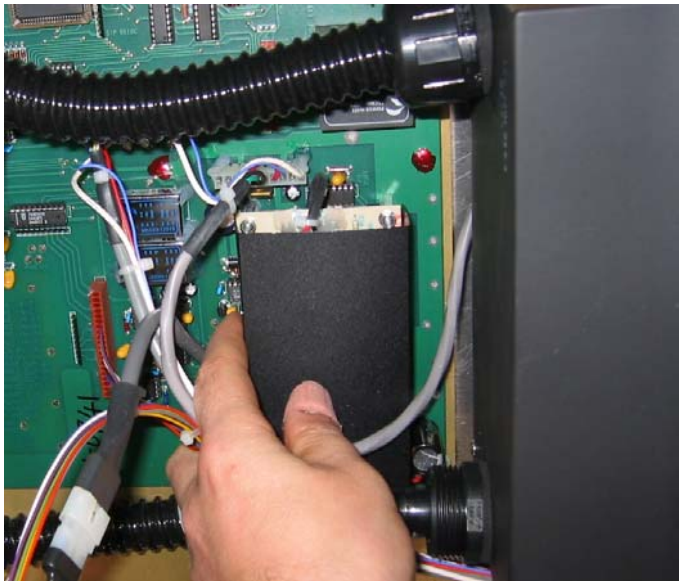


Figure 9.5.9.4

Locate the motherboard.

Grasp the power supply cover and slip the cover out from under the power supply stand offs

NOTE: The corners of the power supply cover are slotted to capture the power supply standoffs.

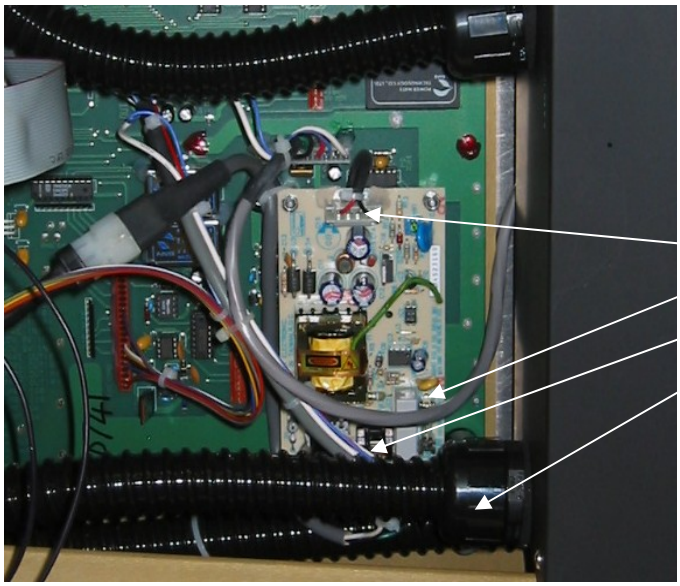


Figure 9.5.9.5

Once the power supply cover is removed, it may be necessary to remove the enclosure lower air circulation hose to gain access to the power supply.

Power supply load cable and connector

Power supply fuse

Power supply line cable and connector

Enclosure lower air circulation hose (optional item)

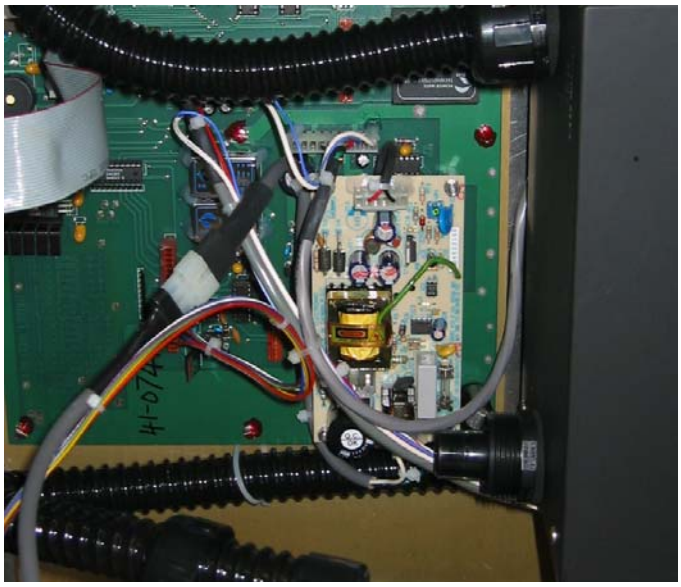


Figure 9.5.9.6

With the enclosure air circulation hose removed (if installed, the 5A 250 VAC fuse, P/N 100375 may be replaced using needle nose pliers or a fuse puller. Replace the enclosure air circulation hose, if installed. If the fuse only needs to be replaced, go to Figure 9.5.9.10.

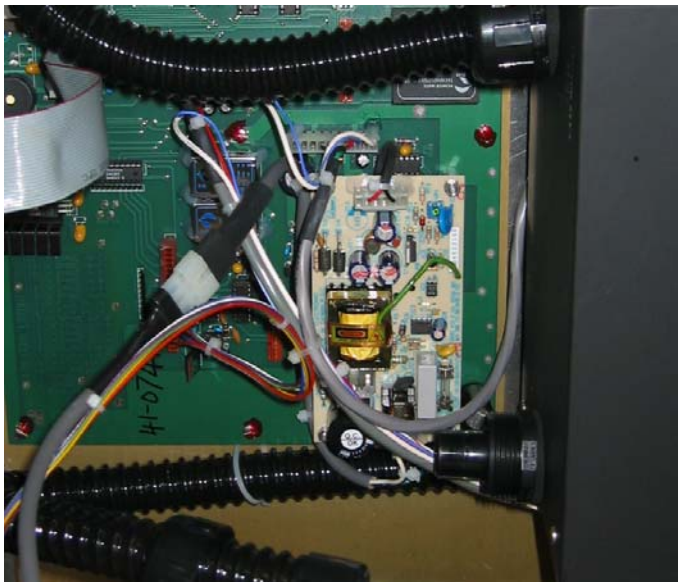


Figure 9.5.9.7

If the power supply is to be replaced, carefully cut the silicon glue holding the power supply line and power output line to the power supply board. Disconnect the power supply line and load connectors, and remove the power supply retaining nuts. Once removed, lift the power supply from the standoffs.

Replace the power supply in the same orientation. Tighten the power supply retaining nuts, then reconnect the power supply line and load connectors. Do not replace the silicon glue yet.



Figure 9.5.9.8

If the power connections to the monitor terminal strips were removed, replace the power connections in the correct order. Carefully push the monitor interior panel back into the normal location but do not replace the screws holding the panel yet. Apply power to the monitor. Verify that the monitor functions correctly. If the monitor does not function properly, check the connection after power has been isolated from the monitor.

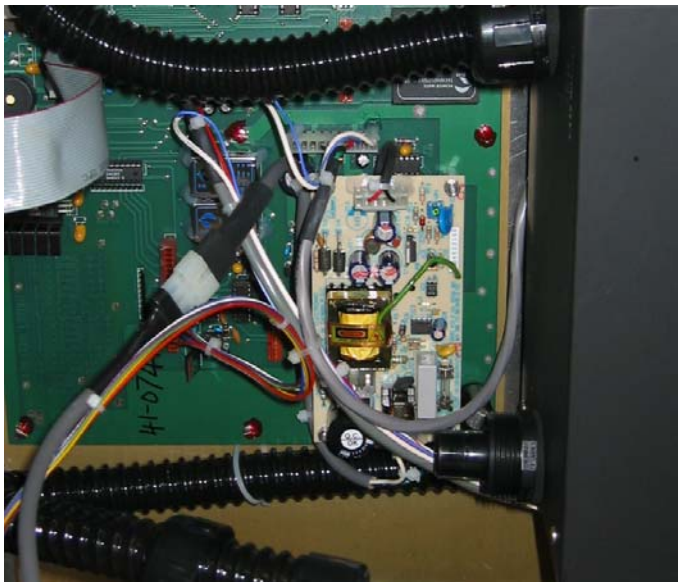


Figure 9.5.9.9

Isolate and lock out the power to the monitor again. Carefully pull down and out the monitor interior panel. Apply silicon glue (GE Silicon II™ caulking) to both power supply connections.

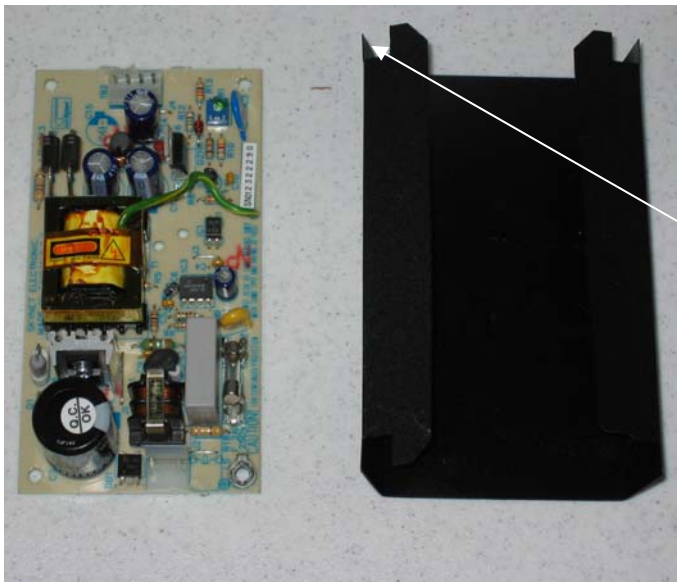


Figure 9.5.9.10

Replace the power supply cover over the power supply. You will need to bend the corners over the standoffs.

NOTE: The slotted corners on the power supply cover that capture the power supply standoffs.



Figure 9.5.9.11

Position the monitor interior panel in the correct location again. Carefully align the interior panel so that the mounting holes align. A flat-blade screwdriver may need to be positioned between the interior panel and the monitor enclosure to help the holes align. Carefully re-install the six mounting screws. Be careful not to strip the screw treads on the interior panel.

Re-attach the power, alarm relay circuits, and analog circuit.

Remove the power isolation to the monitor. Turn on the power to the monitor.

9.5.10 Firmware Replacement



Figure 9.5.10.1

Isolate and lock out analyzer power at the remote power breaker.

NOTE: Lethal voltages are present inside of the monitor when power is supplied to the monitor.

Isolate and lock out the power to the alarm relay circuits.

Open the analyzer enclosure door. Using a Phillips screwdriver, carefully remove the two screws on the right side of the enclosure.



Figure 9.5.10.2

Close the monitor enclosure door. Using a Phillips screwdriver, carefully remove the four screws on the left side of the enclosure.



Figure 9.5.10.3

Remove the terminal strip cover panel.

Carefully pull out and down the monitor interior panel to expose the backside of the panel. You may need to remove the electrical connections from the monitor terminal strip.

Support the top of the monitor interior panel while working. Do not allow the monitor interior panel to hang from the attached wires.

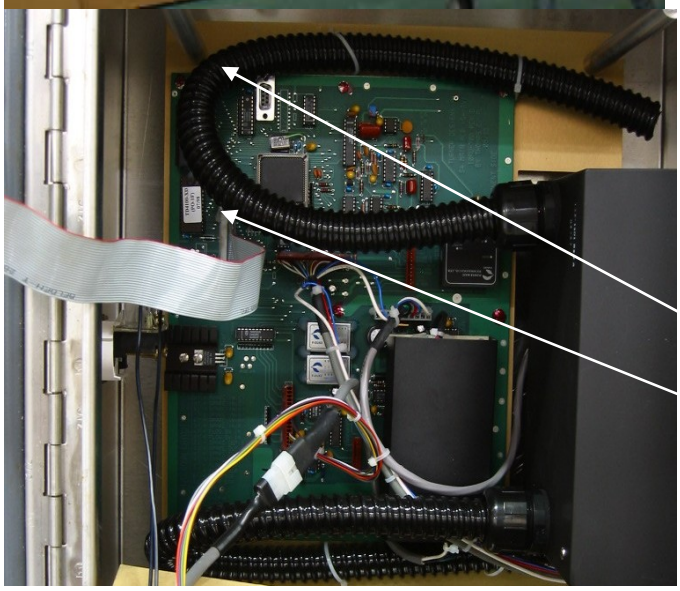


Figure 9.5.10.4

Once the analyzer access panel is removed, it may be necessary to remove the upper enclosure air circulation hose (optional item) to gain access to the analyzer firmware.

Upper enclosure air circulation hose (optional item)

Firmware location

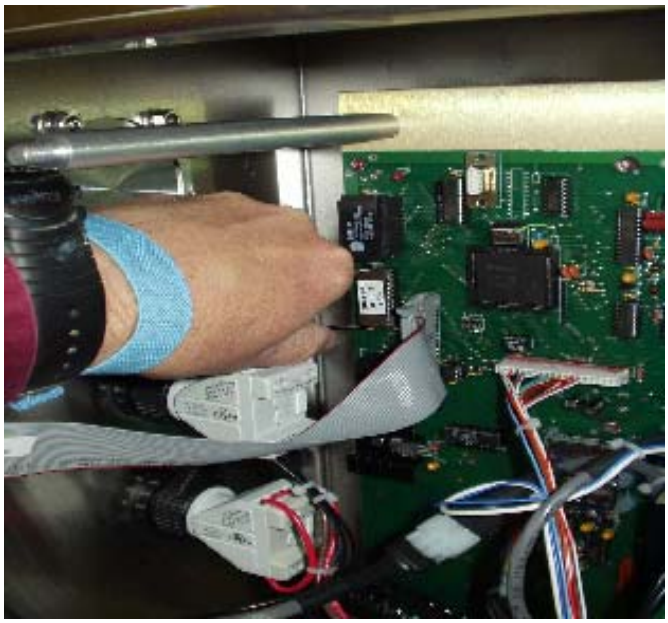


Figure 9.5.10.5

Once the upper enclosure air circulation hose has been removed (if installed), put on an electrostatic discharge (ESD) strap, and use an integrated circuit (IC) extraction tool to remove the firmware (EEPROM).

NOTE: When extracting the firmware, pull squarely on the EEPROM to ensure the pins do not bend.

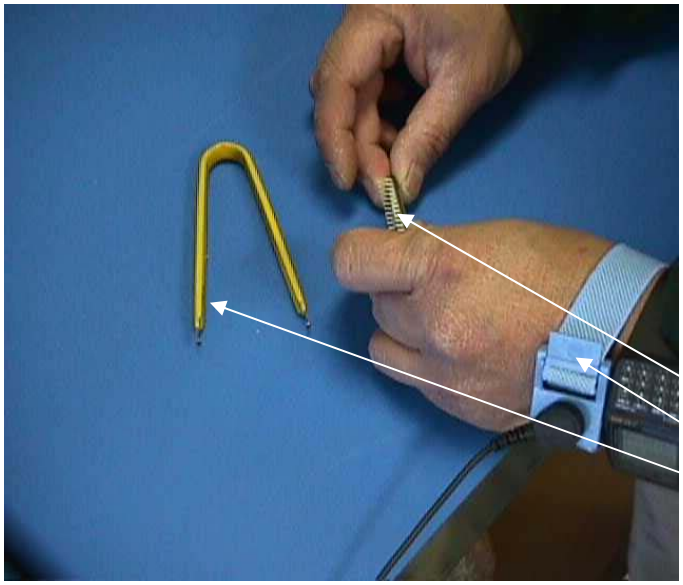


Figure 9.5.10.6

While wearing the ESD strap, remove the new EEPROM from its storage container and inspect it to ensure the pins are straight (perpendicular to the EEPROM body).

NOTE: The EEPROM will fit into the socket only if the pins are straight. If the pins are not straight, carefully bend both rows of pins evenly against a flat tabletop.

Bending the EEPROM pins straight

Electrostatic Discharge Strap

Integrated Circuit Extraction tool



Figure 9.5.10.7

Align the pins of the new EEPROM to the socket on the motherboard, and carefully using an integrated circuit installation tool or your hand, seat the EEPROM all the way into the socket.



Figure 9.5.10.8

If the power connections to the monitor terminal strips were removed, replace the power connections in the correct order. Carefully push the monitor interior panel back into the normal location but do not replace the screws holding the panel yet. Apply power to the monitor. Verify that the monitor functions correctly. If the monitor does not function properly, check the connection after power has been isolated from the monitor.

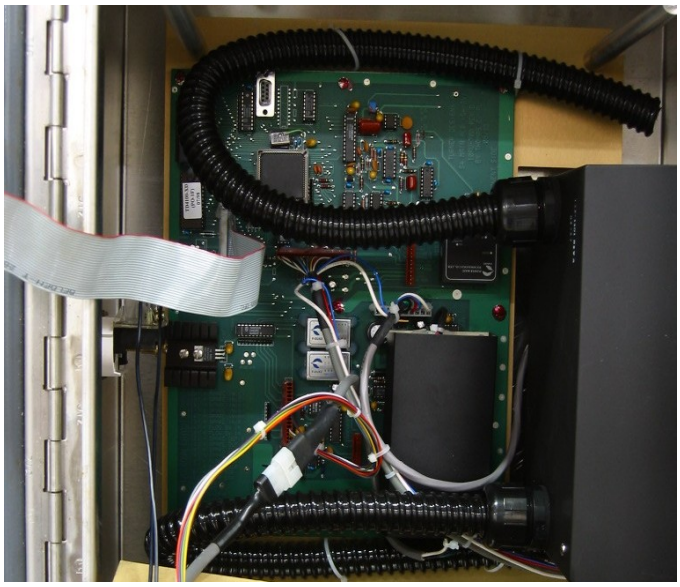


Figure 9.5.10.9

Isolate and lock out the power to the monitor again. Carefully pull down and out the monitor interior panel. Reinstate the upper enclosure air circulation hose (if fitted).



Figure 9.5.10.10

Position the monitor interior panel in the correct location again. Carefully align the interior panel so that the mounting holes align. A flat-blade screwdriver may need to be positioned between the interior panel and the monitor enclosure to help the holes align. Carefully re-install the six mounting screws. Be careful not to strip the screw treads on the interior panel.

Re-attach the power, alarm relay circuits, and analog circuit.

Remove the power isolation to the monitor. Turn on the power to the monitor.

9.5.11 Motherboard Replacement



Figure 9.5.11.1

Isolate and lock out analyzer power at the remote power breaker.

NOTE: Lethal voltages are present inside of the monitor when power is supplied to the monitor.

Isolate and lock out the power to the alarm relay circuits.

Open the analyzer enclosure door. Using a Phillips screwdriver, carefully remove the two screws on the right side of the enclosure.



Figure 9.5.11.2

Close the monitor enclosure door. Using a Phillips screwdriver, carefully remove the four screws on the left side of the enclosure.



Figure 9.5.11.3

Remove the terminal strip cover panel.

Carefully pull out and down the monitor interior panel to expose the backside of the panel. You may need to remove the electrical connections from the monitor terminal strip.

Support the top of the monitor interior panel while working. Do not allow the monitor interior panel to hang from the attached wires.

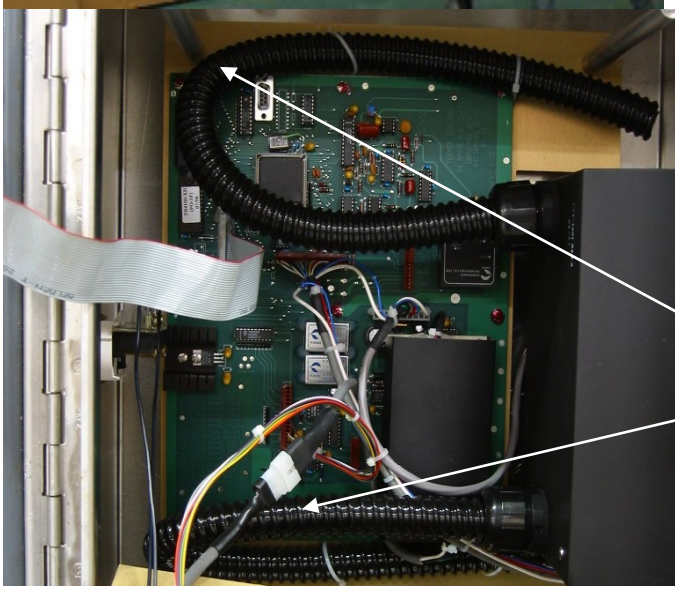


Figure 9.5.11.4

Once the analyzer access panel is removed, it may be necessary to remove the upper and lower enclosure air circulation hoses (optional items) after cutting the attachment bands.

Upper enclosure air circulation hose (optional item)

Lower enclosure air circulation hose (optional item)

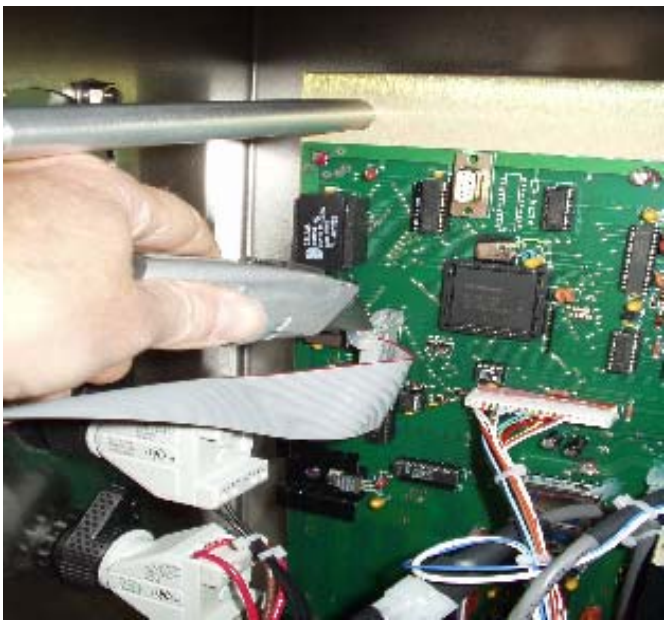


Figure 9.5.11.5

Put on a grounding strap to prevent static energy damage to the motherboard. Carefully cut away silicon glue from all connectors coming to the motherboard. Remove each connector from the motherboard.

Figure 9.5.11.6

Using a screwdriver remove all screws holding the motherboard to the rear mounting plate. Remove the motherboard from the enclosure and place on a grounded conductive surface.

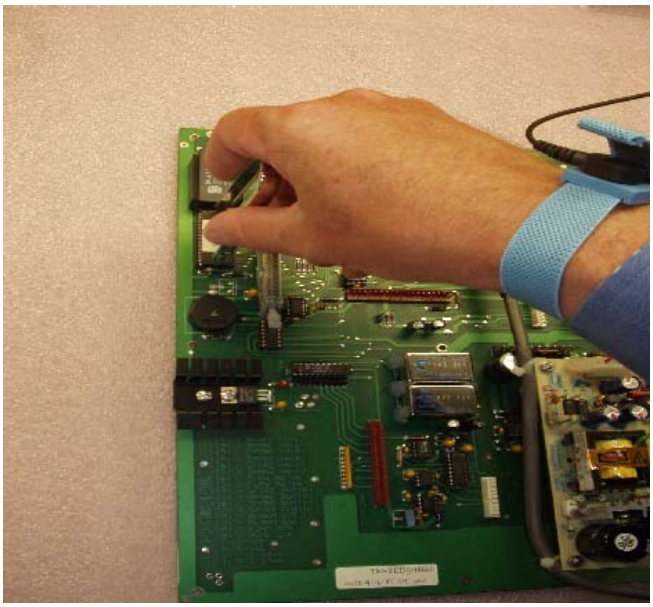


Figure 9.5.11.7

Use an integrated circuit (IC) extraction tool to remove the firmware (EEPROM).

NOTE: When extracting the firmware, pull squarely on the EEPROM to ensure the pins do not bend.

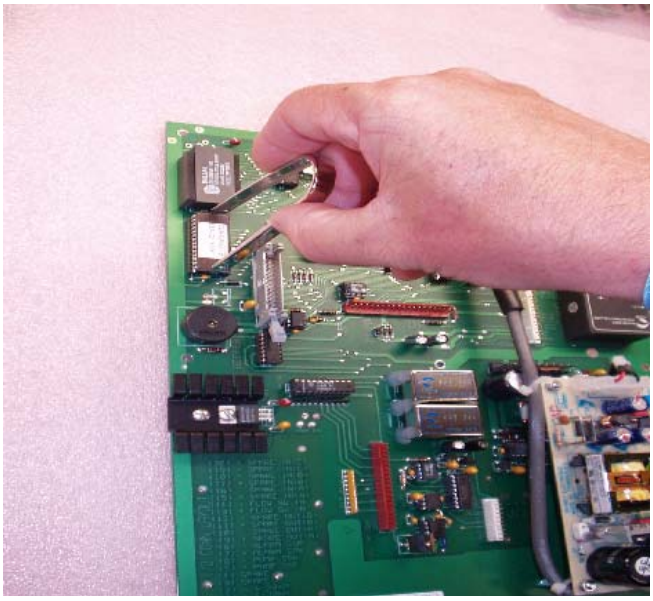


Figure 9.5.11.8

While continuing to wear the grounded wrist strap, align the pins of the EEPROM to the socket on the replacement motherboard, and carefully using an integrated circuit installation tool or your hand, seat the EEPROM all the way into the socket.

NOTE: The replacement motherboard does not have an EEPROM, so the existing EEPROM from the old board must be moved to the replacement motherboard.

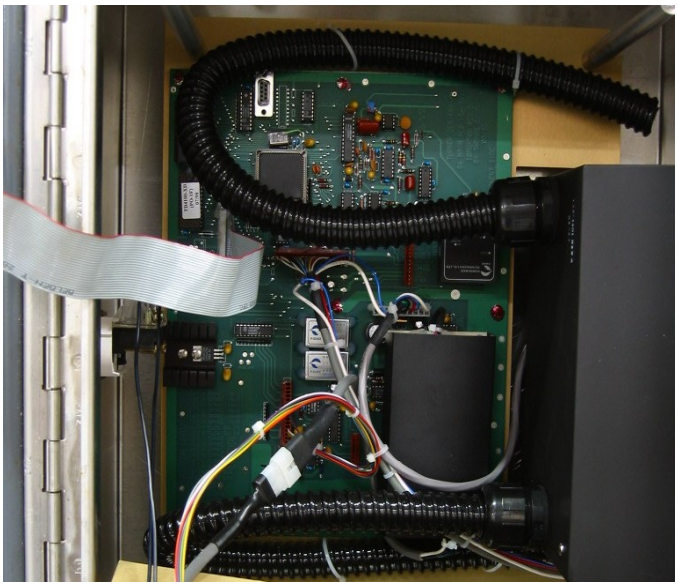


Figure 9.5.11.9

Place the new motherboard with the exchanged EEPROM into the enclosure and attach to the rear mounting frame with the screws. Replace the paint on the mounting screws.

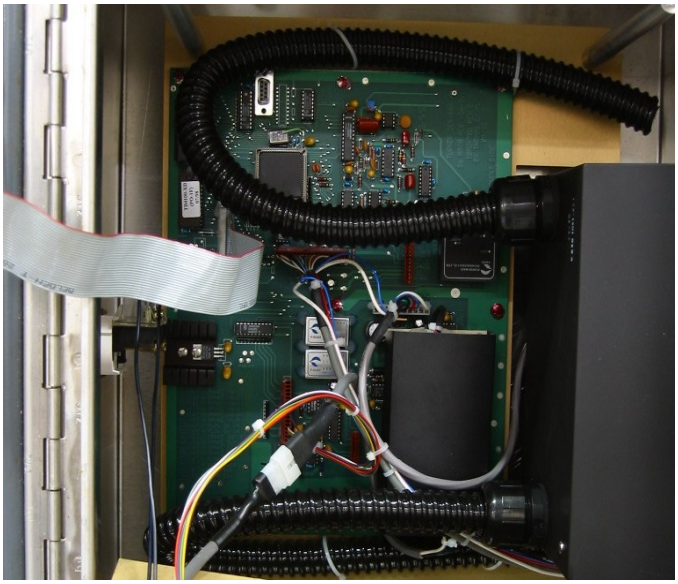


Figure 9.5.11.10

Attach all cable connectors to the appropriate pin locations on the motherboard in the correct orientation.



Figure 9.5.11.11

If the power connections to the monitor terminal strips were removed, replace the power connections in the correct order. Carefully push the monitor interior panel back into the normal location but do not replace the screws holding the panel yet. Apply power to the monitor. Verify that the monitor functions correctly. If the monitor does not function properly, check the connection after power has been isolated from the monitor.

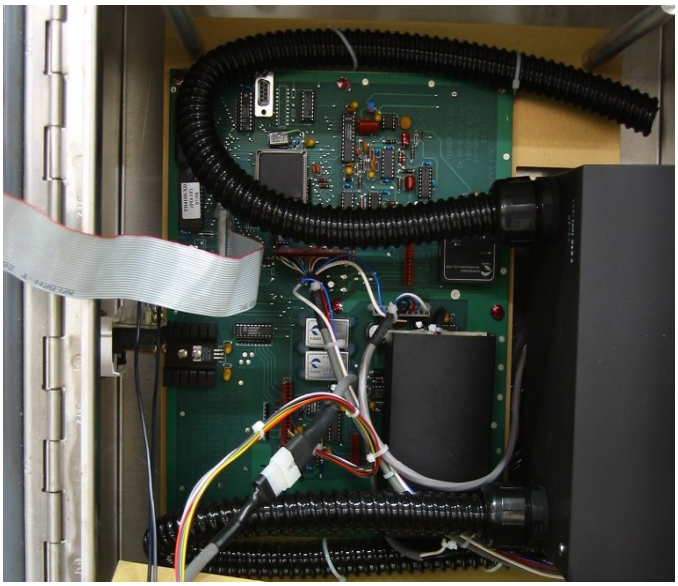


Figure 9.5.11.12

Isolate and lock out the power to the monitor again. Carefully pull down and out the monitor interior panel. Reinstate the upper enclosure air circulation hose (if fitted). Replace the silicon glue holding the connectors to the motherboard. Reattach the enclosure air circulation hoses and mounting straps, if fitted.



Figure 9.5.11.13

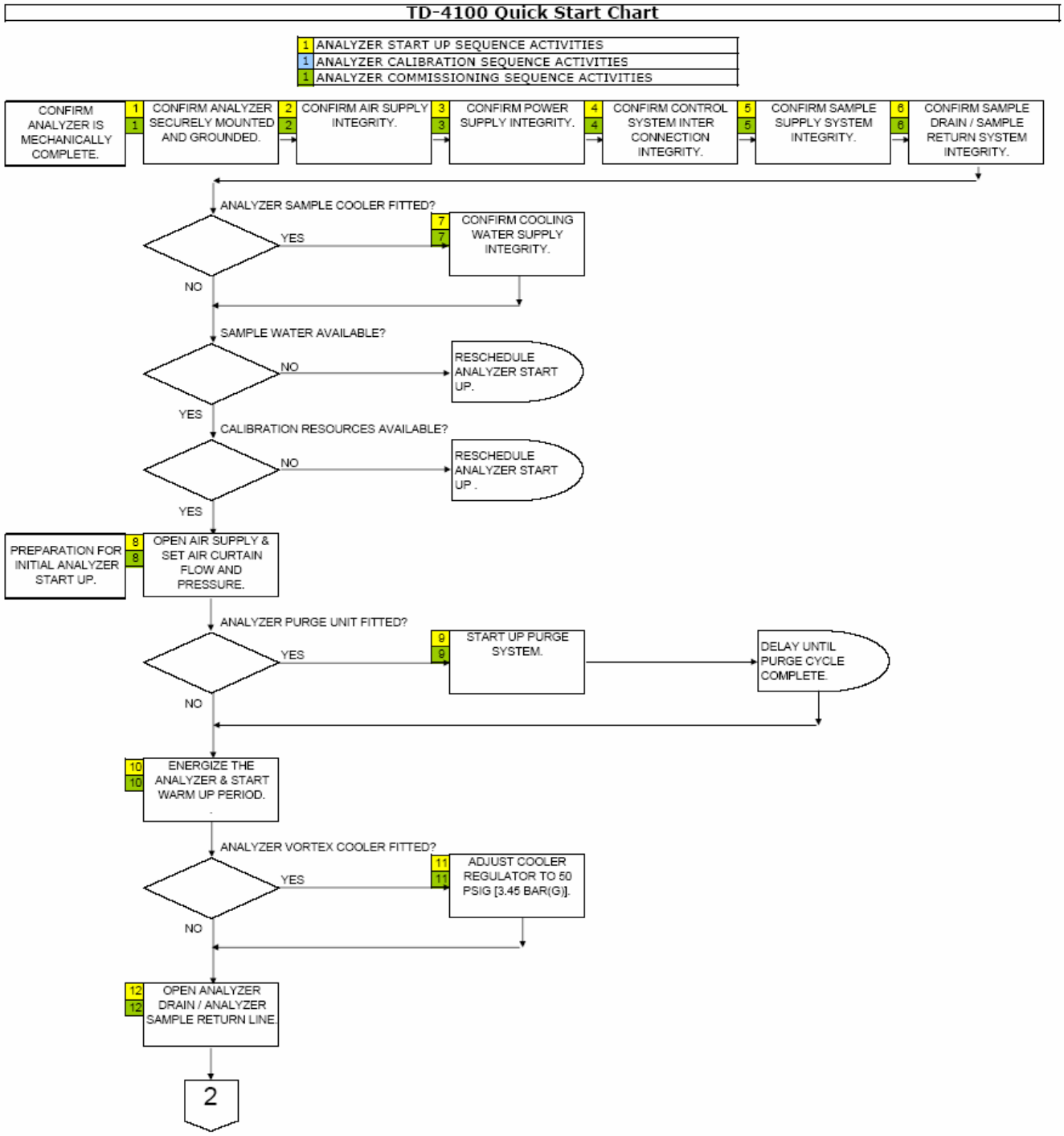
Position the monitor interior panel in the correct location again. Carefully align the interior panel so that the mounting holes align. A flat-blade screwdriver may need to be positioned between the interior panel and the monitor enclosure to help the holes align. Carefully re-install the six mounting screws. Be careful not to strip the screw treads on the interior panel.

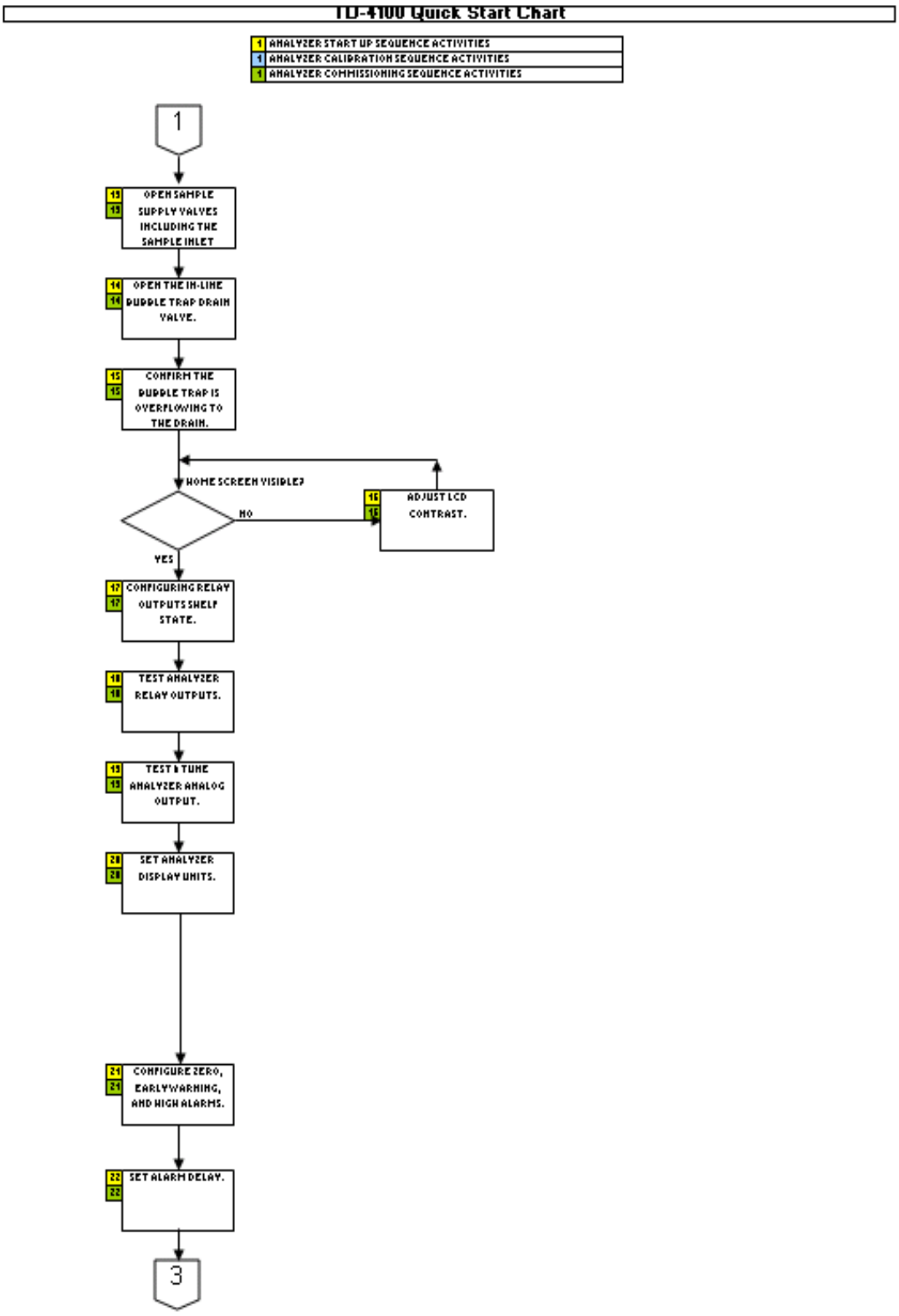
Re-attach the power, alarm relay circuits, and analog circuit.

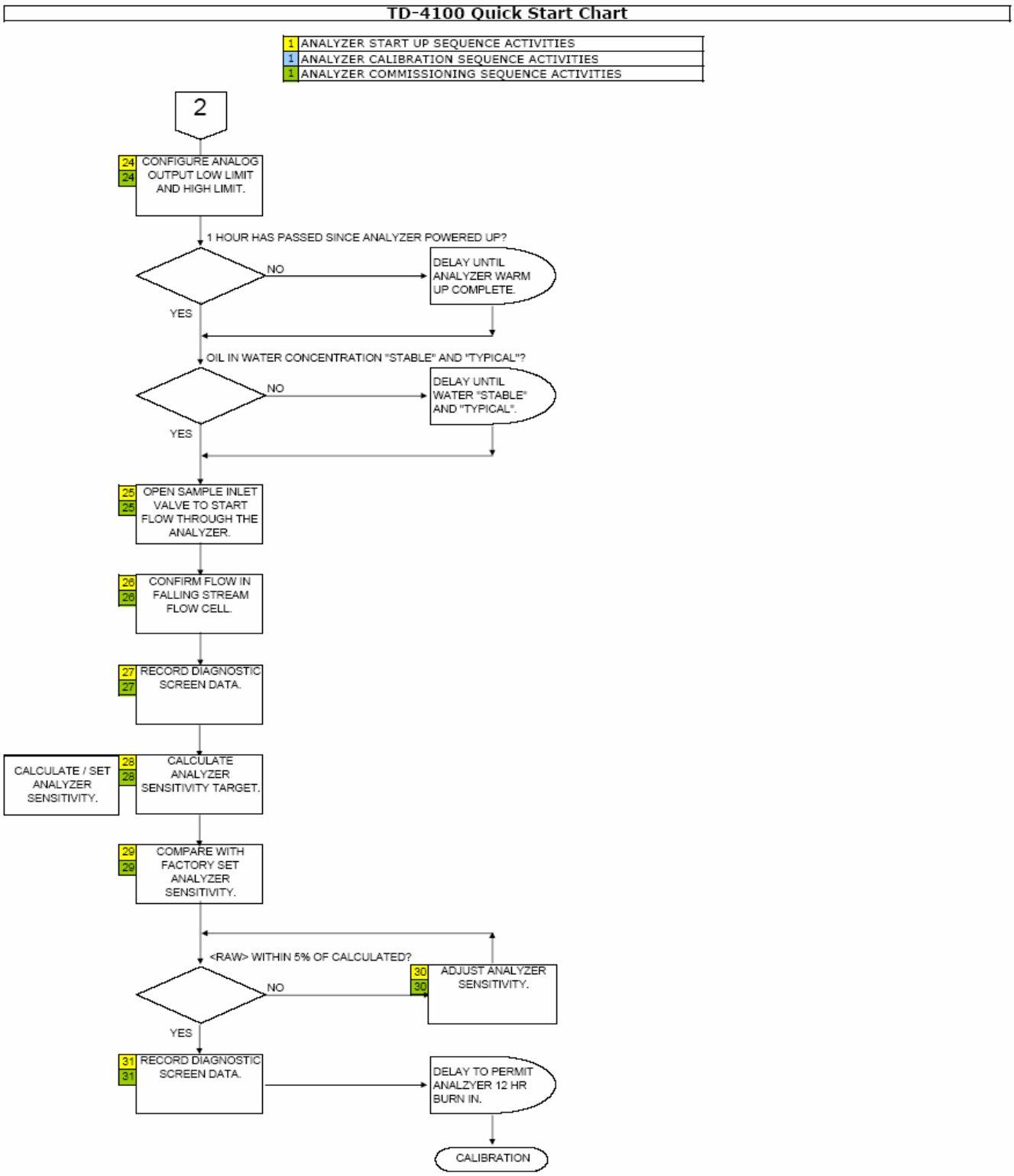
Remove the power isolation to the monitor. Turn on the power to the monitor.

10 CHARTS

10.1 Quick Start Guide

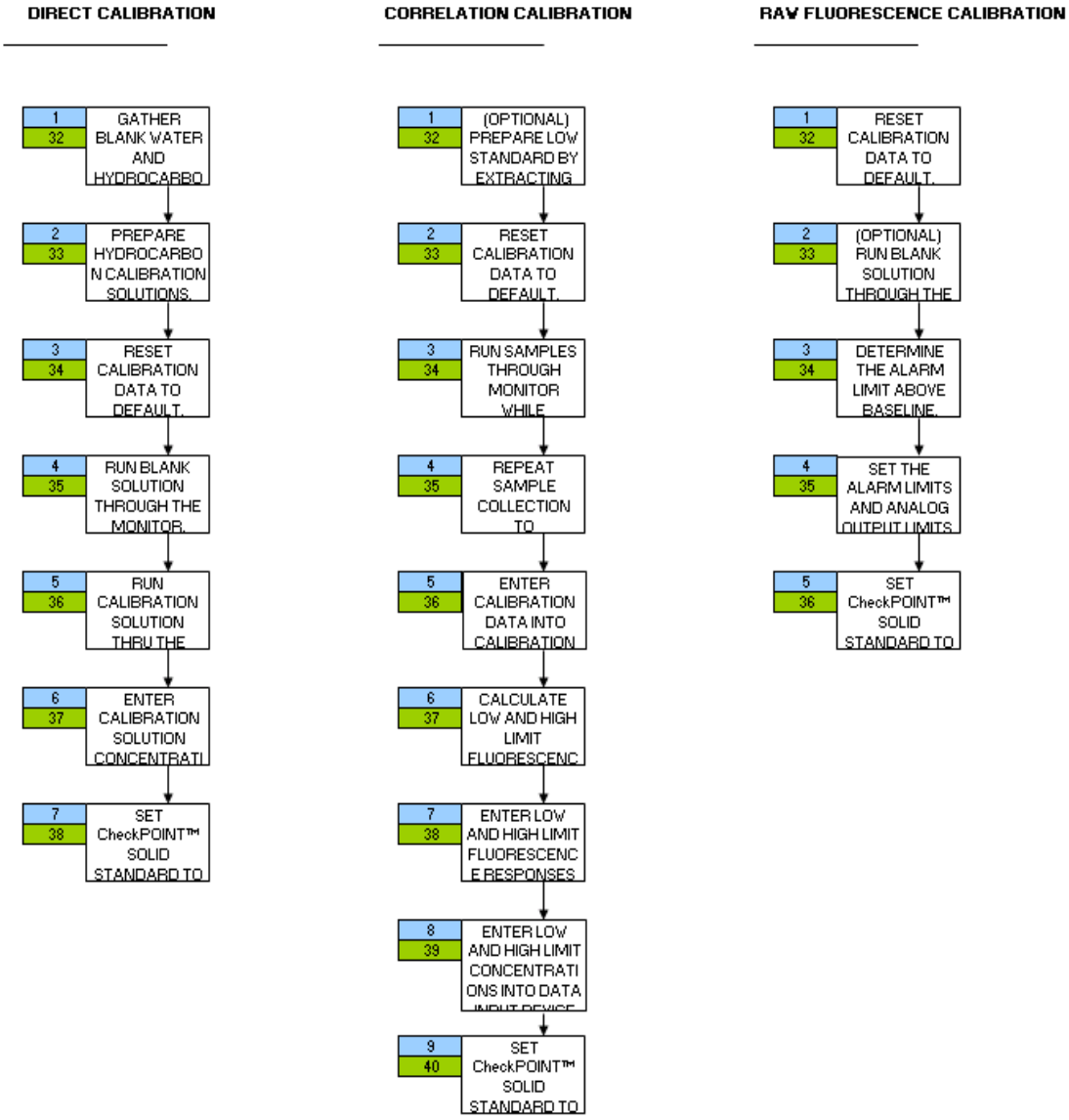



TD-4100 Quick Start Chart
1 ANALYZER START UP SEQUENCE ACTIVITIES
1 ANALYZER CALIBRATION SEQUENCE ACTIVITIES
1 ANALYZER COMMISSIONING SEQUENCE ACTIVITIES
1
13 OPEN SAMPLE SUPPLY VALVES INCLUDING THE SAMPLE INLET
14 OPEN THE IN-LINE BUBBLE TRAP DRAIN VALVE.
15 CONFIRM THE BUBBLE TRAP IS OVERFLOWING TO THE DRAIN.
HOME SCREEN VISIBLE?
NO
16 ADJUST LCD CONTRAST.
YES
17 CONFIGURING RELAY OUTPUTS SHELF STATE.
18 TEST ANALYZER RELAY OUTPUTS.
19 TEST & TUNE ANALYZER ANALOG OUTPUT.
20 SET ANALYZER DISPLAY UNITS.
21 CONFIGURE ZERO, EARLY WARNING, AND HIGH ALARMS.
22 SET ALARM DELAY.
3

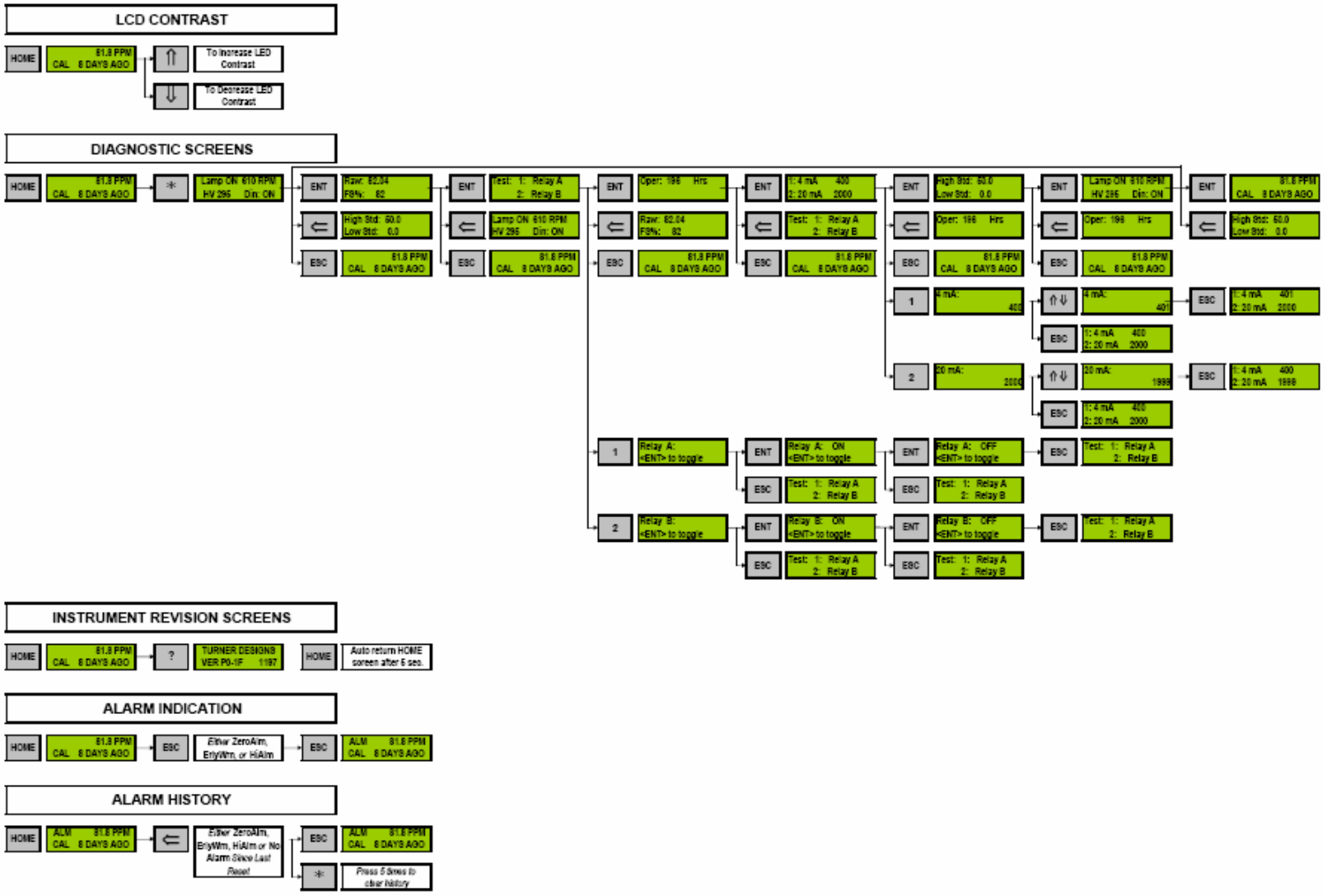

TD-4100 Quick Start Chart
1 ANALYZER START UP SEQUENCE ACTIVITIES
1 ANALYZER CALIBRATION SEQUENCE ACTIVITIES
1 ANALYZER COMMISSIONING SEQUENCE ACTIVITIES
2
24 CONFIGURE ANALOG OUTPUT LOW LIMIT AND HIGH LIMIT.
1 HOUR HAS PASSED SINCE ANALYZER POWERED UP?
NO
DELAY UNTIL ANALYZER WARM UP COMPLETE.
YES
OIL IN WATER CONCENTRATION "STABLE" AND "TYPICAL"?
NO
DELAY UNTIL WATER "STABLE" AND "TYPICAL".
YES
25 OPEN SAMPLE INLET VALVE TO START FLOW THROUGH THE ANALYZER.
26 CONFIRM FLOW IN FALLING STREAM FLOW CELL.
27 RECORD DIAGNOSTIC SCREEN DATA.
CALCULATE / SET ANALYZER SENSITIVITY.
28 CALCULATE ANALYZER SENSITIVITY TARGET.
29 COMPARE WITH FACTORY SET ANALYZER SENSITIVITY.
<RAW> WITHIN 5% OF CALCULATED?
NO
30 ADJUST ANALYZER SENSITIVITY.
YES
31 RECORD DIAGNOSTIC SCREEN DATA.
DELAY TO PERMIT ANALZYER 12 HR BURN IN.
CALIBRATION

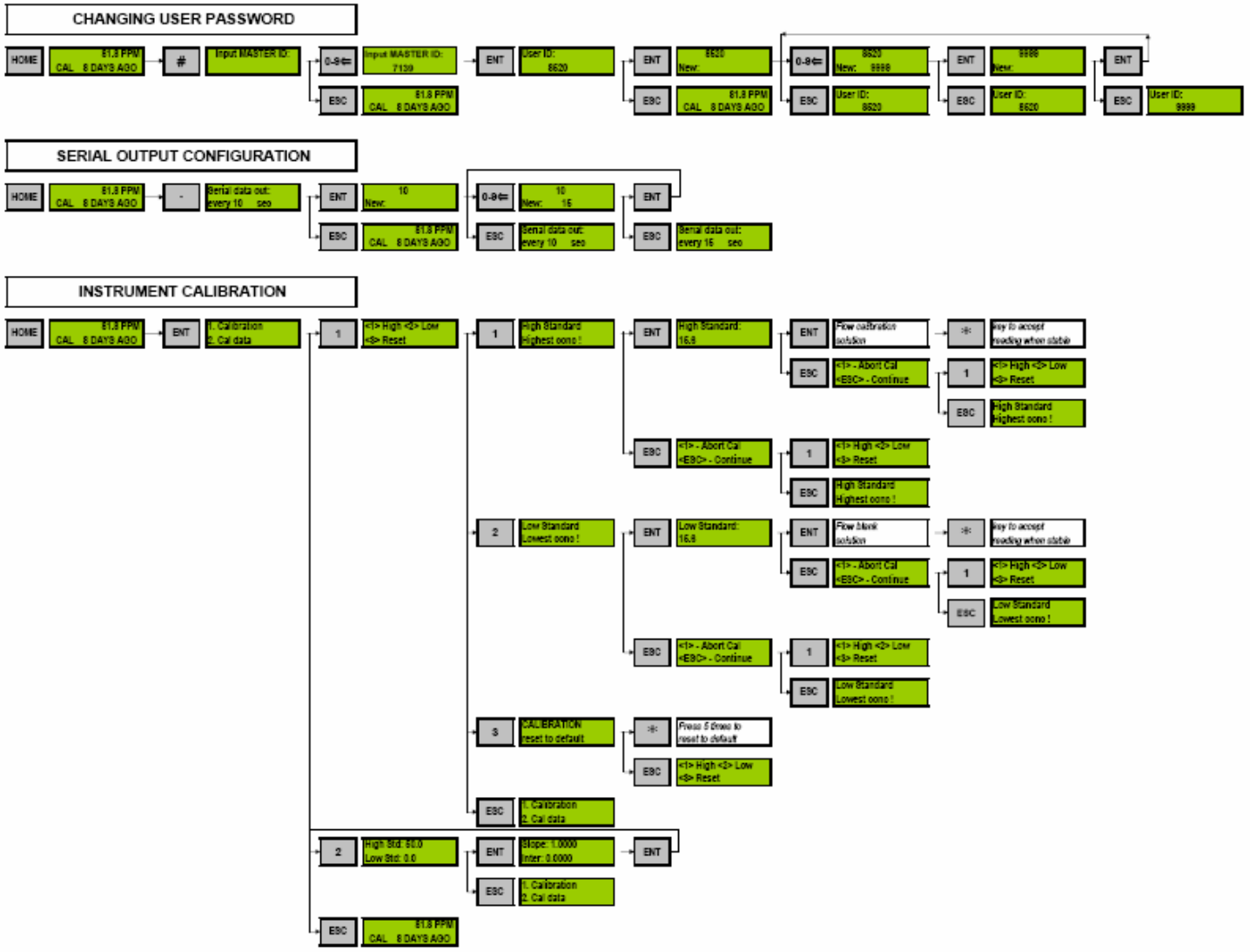
TD-4100 Quick Start Chart

1	ANALYZER START UP SEQUENCE ACTIVITIES
1	ANALYZER CALIBRATION SEQUENCE ACTIVITIES
1	ANALYZER COMMISSIONING SEQUENCE ACTIVITIES

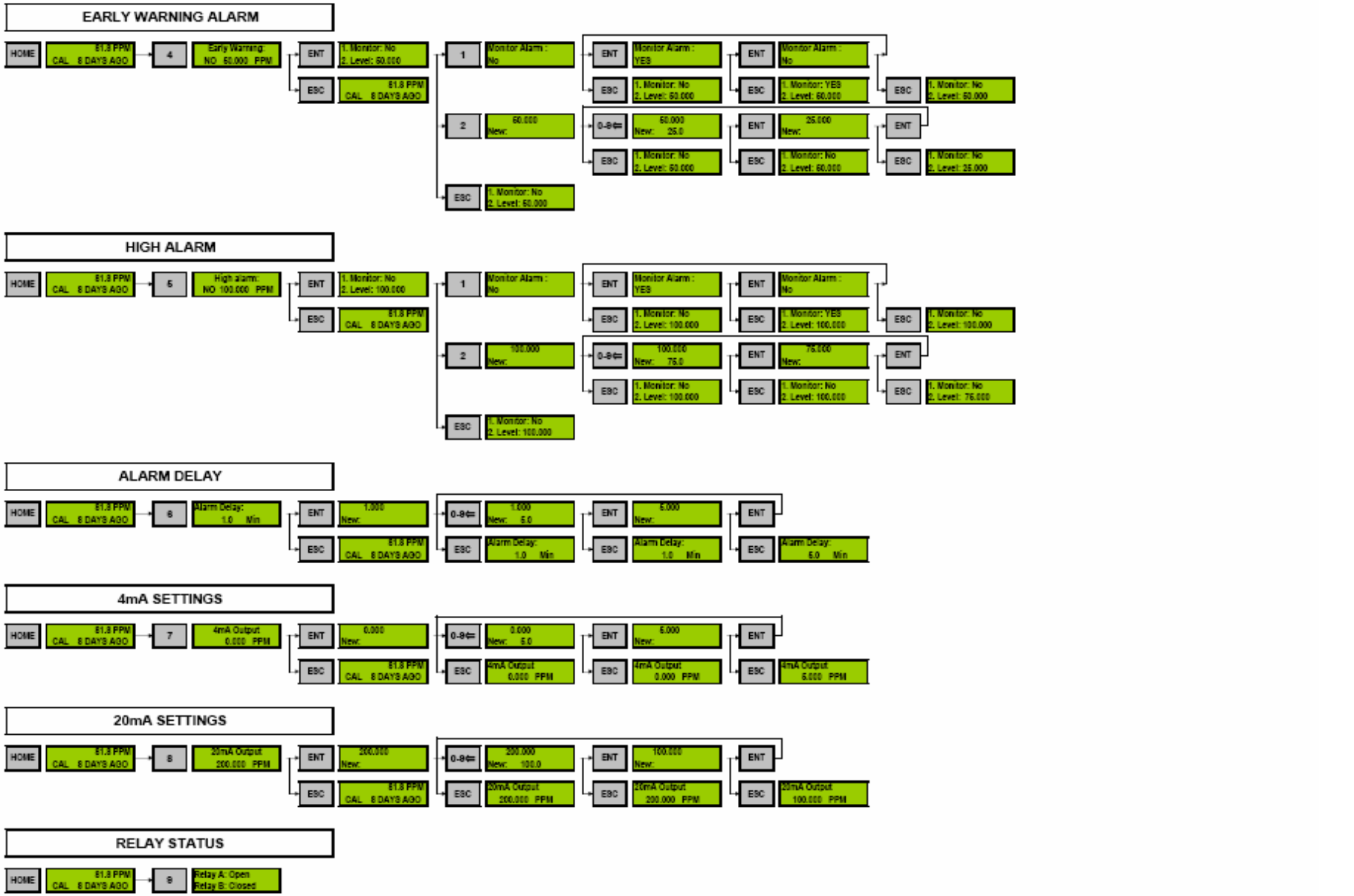


10.2 Key Sequence Chart




CHANGING USER PASSWORD
HOME
81.8 PPM
CAL 8 DAYS AGO
#
Input MASTER ID:
0-9⇐
Input MASTER ID:
7139
ESC
81.8 PPM
CAL 8 DAYS AGO
ENT
User ID:
8620
ENT
8620
New:
ESC
81.8 PPM
CAL 8 DAYS AGO
0-9⇐
8620
New: 9999
ESC
User ID:
8620
ENT
9999
New:
ESC
User ID:
8620
ENT
ESC
User ID:
9999
SERIAL OUTPUT CONFIGURATION
HOME
81.8 PPM
CAL 8 DAYS AGO
-
Serial data out:
every 10 seo
ENT
10
New:
ESC
81.8 PPM
CAL 8 DAYS AGO
0-9⇐
10
New: 15
ESC
Serial data out:
every 10 seo
ENT
ESC
Serial data out:
every 15 seo
INSTRUMENT CALIBRATION
HOME
81.8 PPM
CAL 8 DAYS AGO
ENT
1. Calibration
2. Cal data
1
<1> High <2> Low
<3> Reset
1
High Standard
Highest conc !
ENT
High Standard:
16.8
ENT
Flow calibration
solution
*
key to accept
reading when stable
ESC
<1> - Abort Cal
<ESC> - Continue
1
<1> High <2> Low
<3> Reset
ESC
High Standard
Highest conc !
ESC
<1> - Abort Cal
<ESC> - Continue
1
<1> High <2> Low
<3> Reset
ESC
High Standard
Highest conc !
2
Low Standard
Lowest conc !
ENT
Low Standard:
16.8
ENT
Flow blank
solution
*
key to accept
reading when stable
ESC
<1> - Abort Cal
<ESC> - Continue
1
<1> High <2> Low
<3> Reset
ESC
Low Standard
Lowest conc !
ESC
<1> - Abort Cal
<ESC> - Continue
1
<1> High <2> Low
<3> Reset
ESC
Low Standard
Lowest conc !
3
CALIBRATION
reset to default
*
Press 5 times to
reset to default
ESC
<1> High <2> Low
<3> Reset
ESC
1. Calibration
2. Cal data
2
High Std: 50.0
Low Std: 0.0
ENT
Slope: 1.0000
Inter: 0.0000
ENT
ESC
1. Calibration
2. Cal data
ESC
81.8 PPM
CAL 8 DAYS AGO

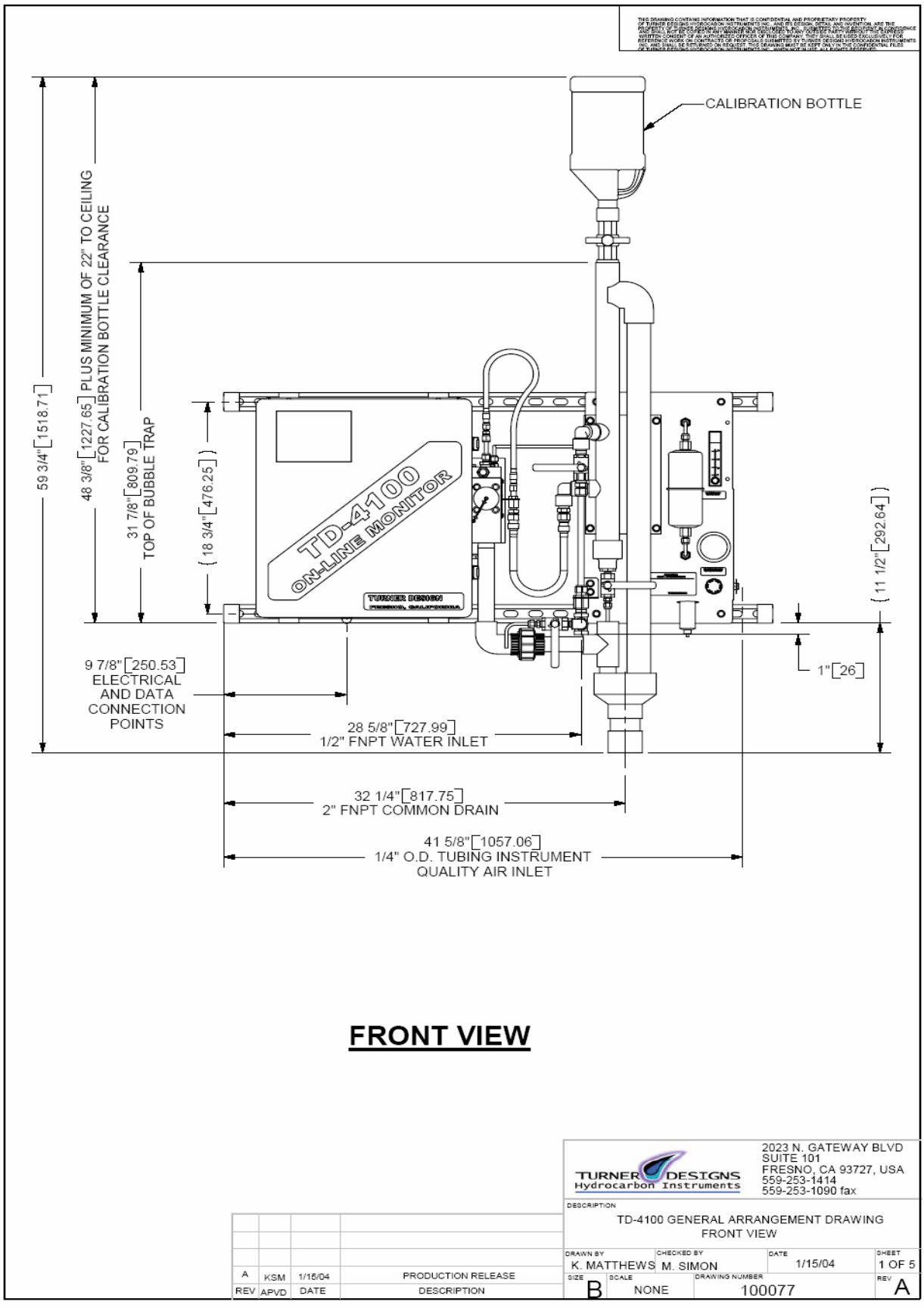

SET CALIBRATION LIMITS
HOME
81.8 PPM
CAL 8 DAYS AGO
0
<1> Hi Std Conc
<2> Low Std Conc
1
High Std Conc
50.000 PPM
2
Low Std Conc
0.000 PPM
ESC
ENT
New:
0-9
SET DISPLAY UNITS
Conc Units
Display Option
Unit Display:
NO UNIT
Unit Display:
PPM
Unit Display:
PPB
ALARM RELAY OPERATION
1. Relay A: NO
2. Relay B: NO
Relay A Ctrl:
NO
NC
Relay B Ctrl:
ZERO ALARM
Zero alarm:
NO 0.000 PPM
1. Monitor: No
2. Level: 0.000
Monitor Alarm :
No
YES
-10.000


EARLY WARNING ALARM
HOME
61.8 PPM
CAL 8 DAYS AGO
4
Early Warning:
NO 50.000 PPM
ENT
1. Monitor: No
2. Level: 50.000
ESC
61.8 PPM
CAL 8 DAYS AGO
1
Monitor Alarm :
No
ENT
Monitor Alarm :
YES
ESC
1. Monitor: No
2. Level: 50.000
ENT
Monitor Alarm :
No
ESC
1. Monitor: YES
2. Level: 50.000
ESC
1. Monitor: No
2. Level: 50.000
2
50.000
New:
0-9⇐
50.000
New: 25.0
ESC
1. Monitor: No
2. Level: 50.000
ENT
25.000
New:
ESC
1. Monitor: No
2. Level: 50.000
ENT
ESC
1. Monitor: No
2. Level: 25.000
ESC
1. Monitor: No
2. Level: 50.000
HIGH ALARM
HOME
61.8 PPM
CAL 8 DAYS AGO
5
High alarm:
NO 100.000 PPM
ENT
1. Monitor: No
2. Level: 100.000
ESC
61.8 PPM
CAL 8 DAYS AGO
1
Monitor Alarm :
No
ENT
Monitor Alarm :
YES
ESC
1. Monitor: No
2. Level: 100.000
ENT
Monitor Alarm :
No
ESC
1. Monitor: YES
2. Level: 100.000
ESC
1. Monitor: No
2. Level: 100.000
2
100.000
New:
0-9⇐
100.000
New: 75.0
ESC
1. Monitor: No
2. Level: 100.000
ENT
75.000
New:
ESC
1. Monitor: No
2. Level: 100.000
ENT
ESC
1. Monitor: No
2. Level: 75.000
ESC
1. Monitor: No
2. Level: 100.000
ALARM DELAY
HOME
61.8 PPM
CAL 8 DAYS AGO
6
Alarm Delay:
1.0 Min
ENT
1.000
New:
ESC
61.8 PPM
CAL 8 DAYS AGO
0-9⇐
1.000
New: 5.0
ESC
Alarm Delay:
1.0 Min
ENT
5.000
New:
ESC
Alarm Delay:
1.0 Min
ENT
ESC
Alarm Delay:
5.0 Min
4mA SETTINGS
HOME
61.8 PPM
CAL 8 DAYS AGO
7
4mA Output
0.000 PPM
ENT
0.000
New:
ESC
61.8 PPM
CAL 8 DAYS AGO
0-9⇐
0.000
New: 5.0
ESC
4mA Output
0.000 PPM
ENT
5.000
New:
ESC
4mA Output
0.000 PPM
ENT
ESC
4mA Output
5.000 PPM
20mA SETTINGS
HOME
61.8 PPM
CAL 8 DAYS AGO
8
20mA Output
200.000 PPM
ENT
200.000
New:
ESC
61.8 PPM
CAL 8 DAYS AGO
0-9⇐
200.000
New: 100.0
ESC
20mA Output
200.000 PPM
ENT
100.000
New:
ESC
20mA Output
200.000 PPM
ENT
ESC
20mA Output
100.000 PPM
RELAY STATUS
HOME
61.8 PPM
CAL 8 DAYS AGO
9
Relay A: Open
Relay B: Closed

11 GENERAL ARRANGEMENT DRAWINGS

Typical Non-Hazardous Location Base Configuration and Hazardous Location Base Configuration general arrangement drawings showing front, bottom, left, right, and back views are provided below. The features and functions of each labeled part on these general arrangement drawings are described in the GLOSSARY.

11.1 Non-Hazardous Location Base Configuration



FRONT VIEW

TURNER DESIGNS Hydrocarbon Instruments
2023 N. GATEWAY BLVD
SUITE 101
FRESNO, CA 93727, USA
559-253-1414
559-253-1090 fax

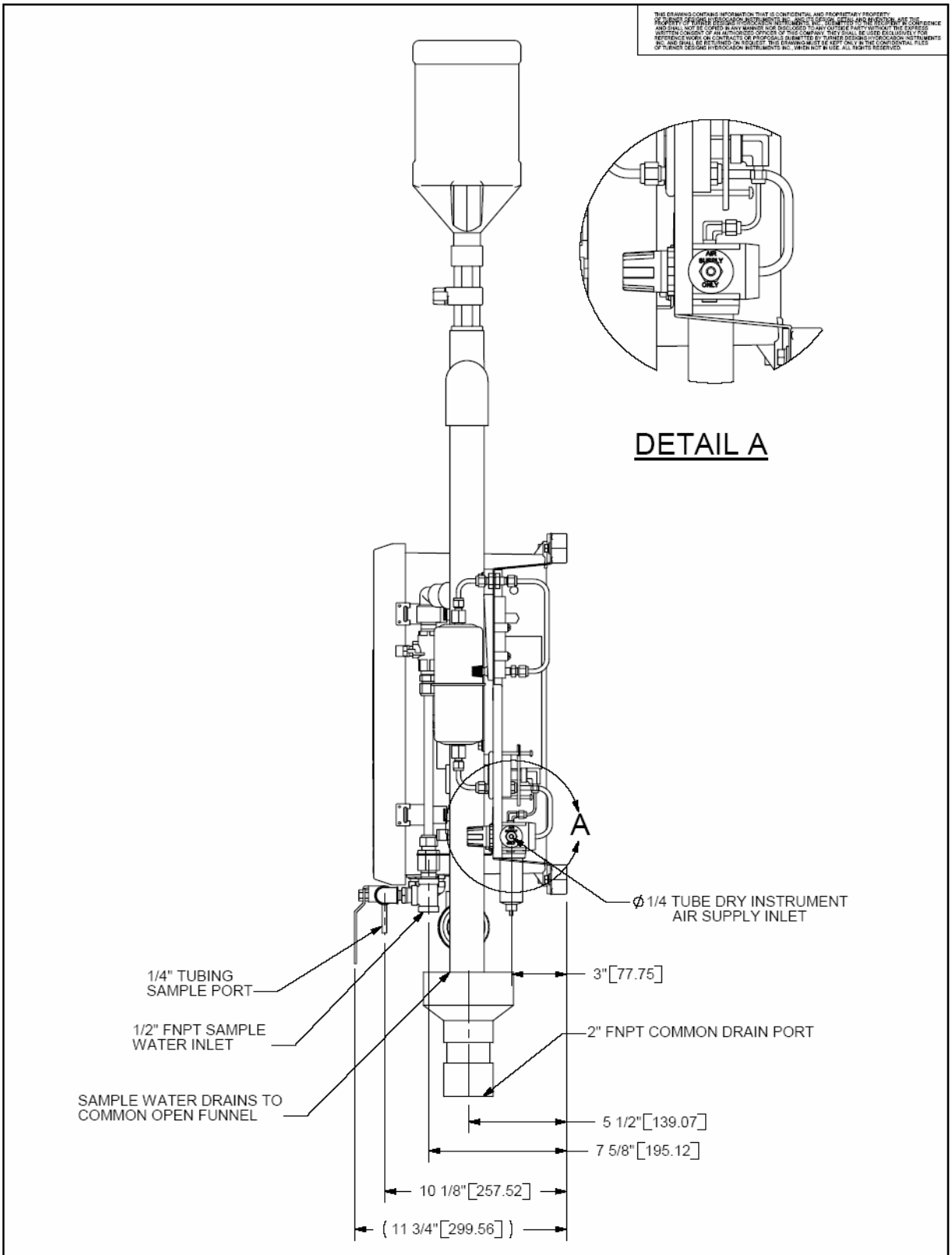
DESCRIPTION: TD-4100 GENERAL ARRANGEMENT DRAWING FRONT VIEW

DRAWN BY	CHECKED BY	DATE	SHEET
K. MATTHEWS	M. SIMON	1/15/04	1 OF 5

SIZE	SCALE	DRAWING NUMBER	REV
B	NONE	100077	A

REV	APVD	DATE	DESCRIPTION
A	KSM	1/15/04	PRODUCTION RELEASE

THIS DRAWING CONTAINS INFORMATION THAT IS CONFIDENTIAL AND PROPRIETARY PROPERTY OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. AND ITS DESIGN, DETAIL AND INVENTION, ARE THE PROPERTY OF TURNER DESIGNS HYDROCARBON INSTRUMENTS, INC. SUBMITTED TO THE RECIPIENT IN CONFIDENCE AND SHALL NOT BE COPIED IN ANY MANNER NOR DISCLOSED TO ANY OUTSIDE PARTY WITHOUT THE EXPRESS WRITTEN CONSENT AND AUTHORIZATION OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. NOR USED FOR REFERENCE WORK ON CONTRACTS OR PROPOSALS SUBMITTED BY OTHER DESIGN HYDROCARBON INSTRUMENTS INC. AND SHALL BE RETURNED ON REQUEST. THIS DRAWING MUST BE KEPT ONLY IN THE CONFIDENTIAL FILES OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. WHEN NOT IN USE. ALL RIGHTS RESERVED.



RIGHT VIEW

REV	APVD	DATE	DESCRIPTION
A	KSM	1/15/04	PRODUCTION RELEASE

TURNER DESIGNS Hydrocarbon Instruments

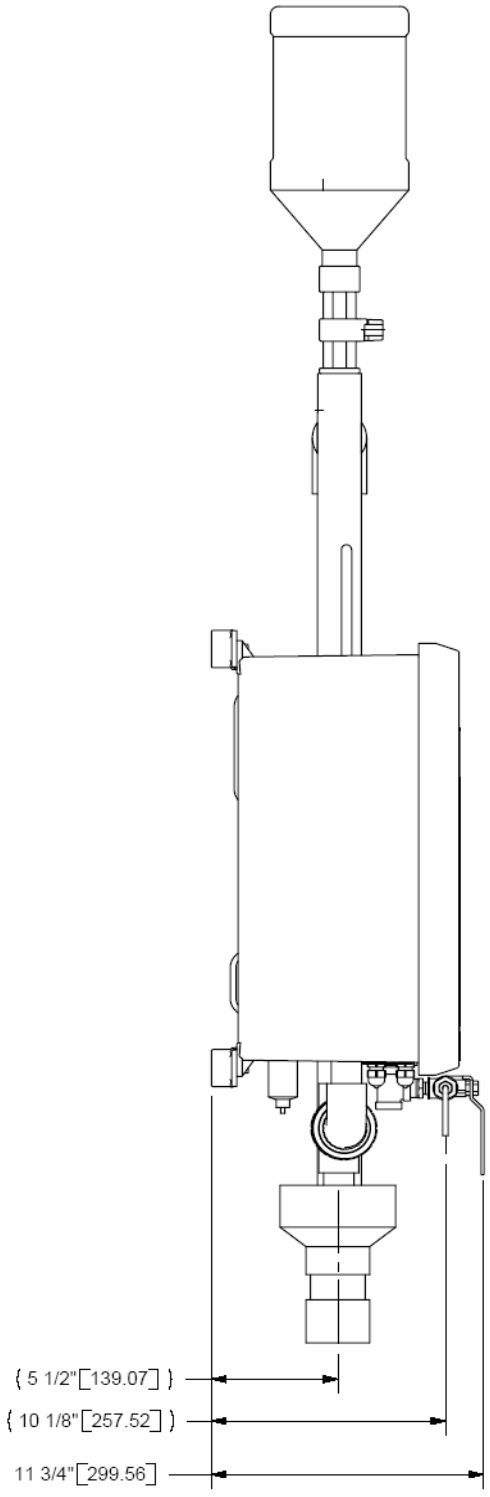
2023 N. GATEWAY BLVD
SUITE 101
FRESNO, CA 93727, USA
559-253-1414
559-253-1090 fax

DESCRIPTION: TD-4100 GENERAL ARRANGEMENT DRAWING RIGHT SIDE VIEW

DRAWN BY	CHECKED BY	DATE	SHEET
K. MATTHEWS	M. SIMON	1/15/04	2 OF 5

SIZE	SCALE	DRAWING NUMBER	REV
B	NONE	100077	A

THIS DRAWING CONTAINS INFORMATION THAT IS CONFIDENTIAL AND PROPRIETARY PROPERTY OF TURNER DESIGNS HYDROCARBON INSTRUMENTS, INC., AND ITS DESIGN, DETAIL, AND INVENTION ARE THE PROPERTY OF TURNER DESIGNS HYDROCARBON INSTRUMENTS, INC. SUBMITTED TO THE RECIPIENT IN CONFIDENCE AND SHALL NOT BE USED IN ANY MANNER DETRIMENTAL TO THE INTERESTS OF TURNER DESIGNS HYDROCARBON INSTRUMENTS, INC. WITHOUT THE WRITTEN CONSENT OF AN AUTHORIZED OFFICER OF THIS COMPANY. THEY SHALL BE USED EXCLUSIVELY FOR REFERENCE WORK ON CONTRACTS OR PROPOSALS SUBMITTED BY TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. AND SHALL BE RETURNED ON REQUEST. THIS DRAWING MUST BE KEPT ONLY IN THE CONFIDENTIAL FILES OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. WHEN NOT IN USE. ALL RIGHTS RESERVED.



LEFT VIEW

REV	APVD	DATE	DESCRIPTION
A	KSM	1/15/04	PRODUCTION RELEASE

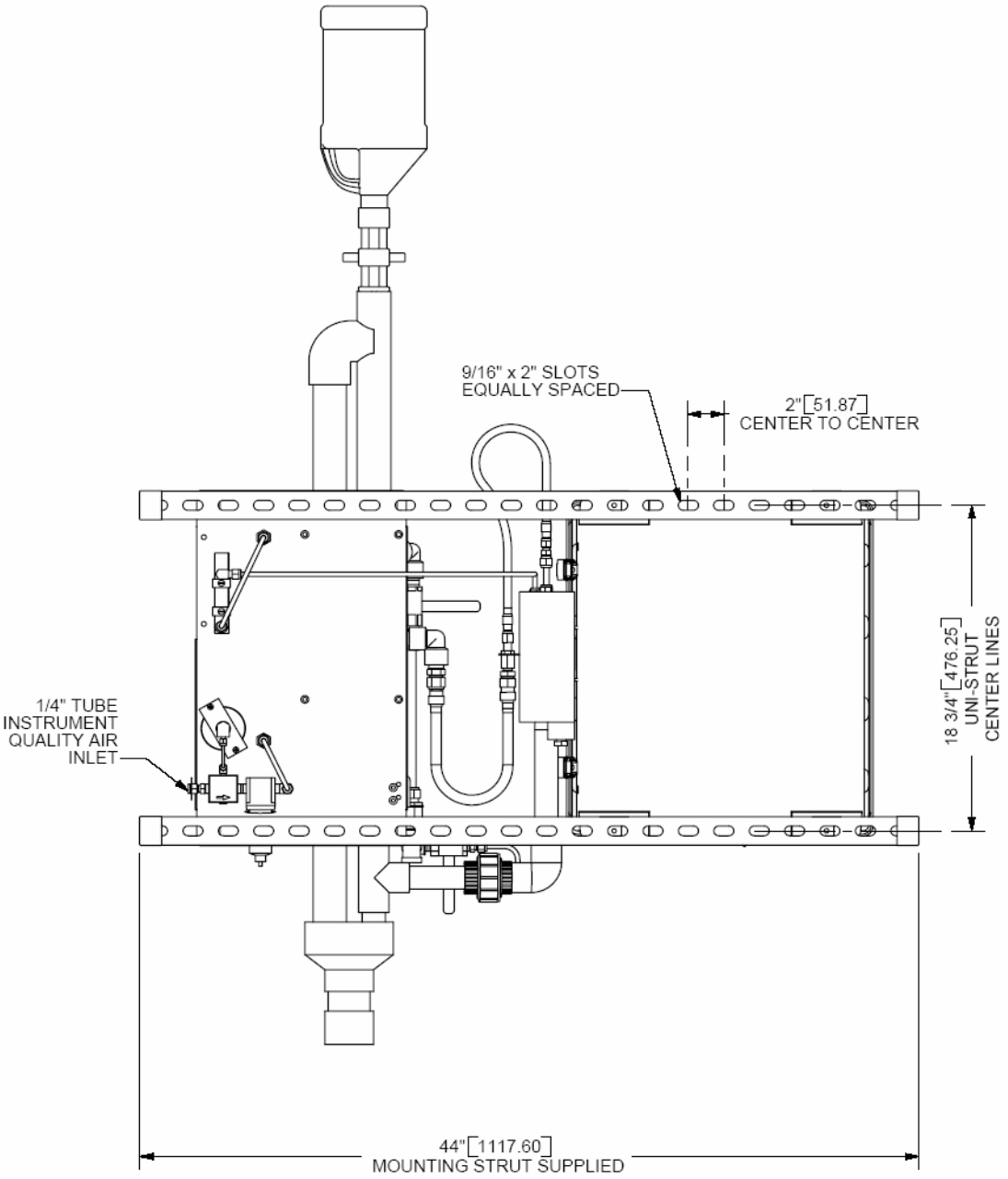
TURNER DESIGNS
Hydrocarbon Instruments
2023 N. GATEWAY BLVD
SUITE 101
FRESNO, CA 93727, USA
559-253-1414
559-253-1090 fax

DESCRIPTION: TD-4100 GENERAL ARRANGEMENT DRAWING
LEFT SIDE VIEW

DRAWN BY	CHECKED BY	DATE	SHEET
K. MATTHEWS	M. SIMON	1/15/04	3 OF 5

SIZE	SCALE	DRAWING NUMBER	REV
B	NONE	100077	A

THIS DRAWING CONTAINS INFORMATION THAT IS CONFIDENTIAL AND PROPRIETARY PROPERTY OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC., AND ITS DESIGN, DETAIL AND INVENTION, ARE THE PROPERTY OF TURNER DESIGNS HYDROCARBON INSTRUMENTS, INC. SUBMITTED TO THE RECIPIENT IN CONFIDENCE AND SHALL NOT BE COPIED IN ANY MANNER NOR DISCLOSED TO ANY OUTSIDE PARTY WITHOUT THE EXPRESS WRITTEN CONSENT OF AN AUTHORIZED OFFICER OF THIS COMPANY. THEY SHALL BE USED EXCLUSIVELY FOR REFERENCE WORK OR CONTRACTS OR PROPOSALS SUBMITTED BY TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. AND SHALL BE RETURNED ON REQUEST. THIS DRAWING MUST BE KEPT ONLY IN THE CONFIDENTIAL FILES OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC., WHEN NOT IN USE. ALL RIGHTS RESERVED.



BACK VIEW

REV	APVD	DATE	DESCRIPTION
A	KSM	1/15/04	PRODUCTION RELEASE

TURNER DESIGNS Hydrocarbon Instruments

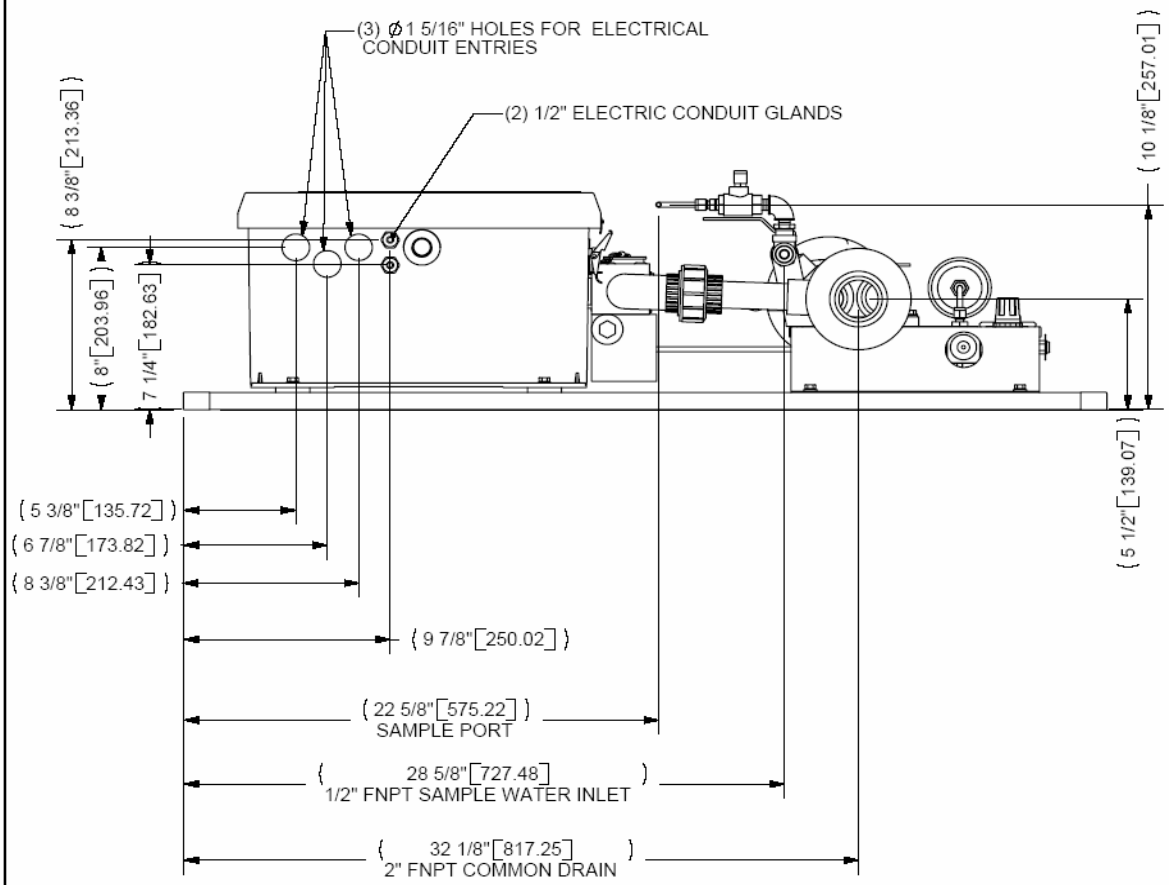
2023 N. GATEWAY BLVD
SUITE 101
FRESNO, CA 93727, USA
559-253-1414
559-253-1090 fax

DESCRIPTION: TD-4100 GENERAL ARRANGEMENT DRAWING
BACK VIEW

DRAWN BY	CHECKED BY	DATE	SHEET
K. MATTHEWS	M. SIMON	1/15/04	4 OF 5

SIZE	SCALE	DRAWING NUMBER	REV
B	NONE	100077	A

THIS DRAWING CONTAINS INFORMATION THAT IS CONFIDENTIAL AND PROPRIETARY PROPERTY OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC., AND ITS DESIGN, DETAIL AND INVENTION, ARE THE PROPERTY OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. SUBMITTED SOLELY FOR REFERENCE WORK ON CONTRACTS OR PROPOSALS SUBMITTED BY TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. AND SHALL BE RETURNED ON REQUEST. THIS DRAWING MUST BE KEPT ONLY IN THE CONFIDENTIAL FILES OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. WHEN NOT IN USE. ALL RIGHTS RESERVED.



BOTTOM VIEW

REV	APVD	DATE	DESCRIPTION
A	KSM	1/15/04	PRODUCTION RELEASE

TURNER DESIGNS Hydrocarbon Instruments

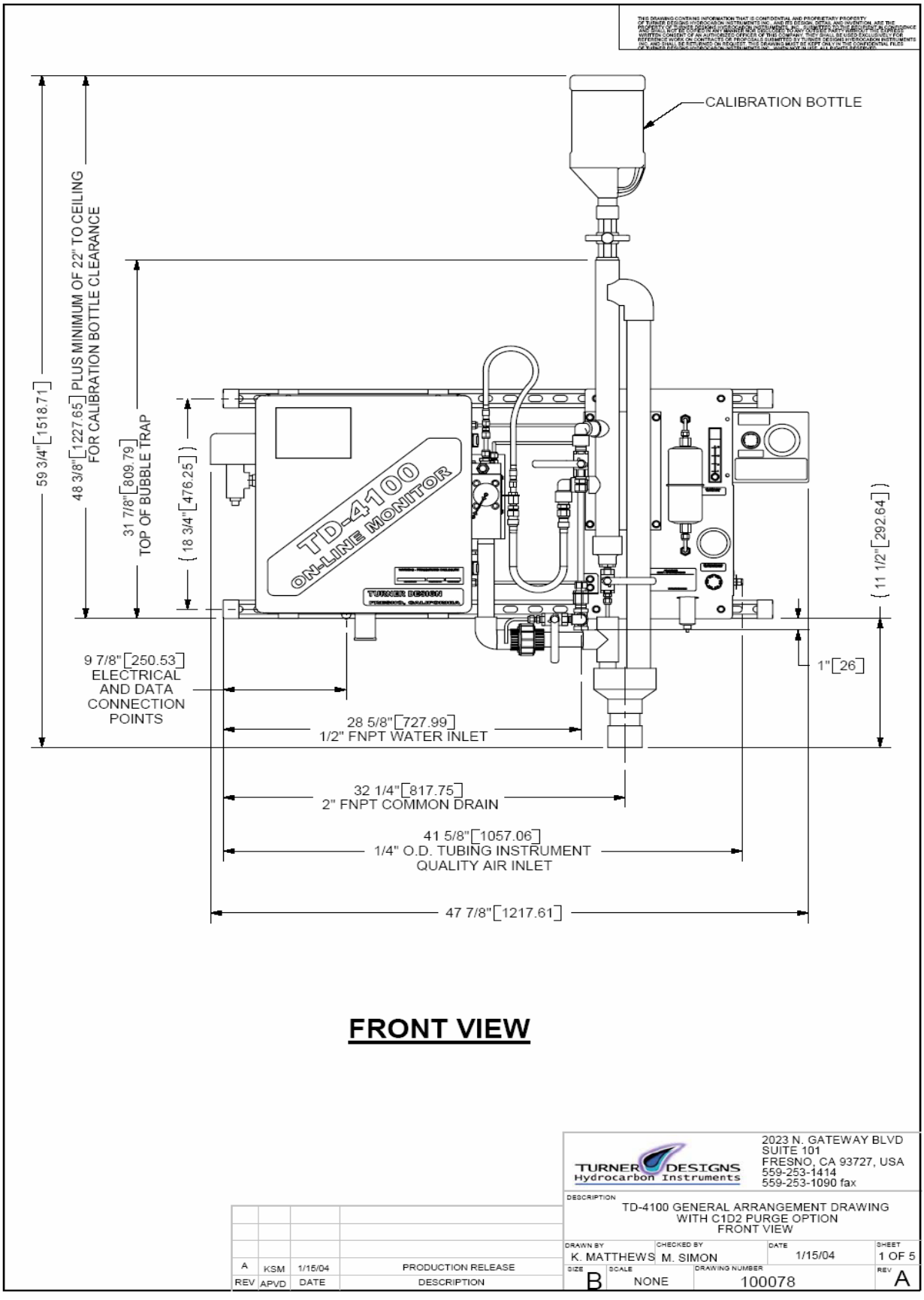
2023 N. GATEWAY BLVD
SUITE 101
FRESNO, CA 93727, USA
559-253-1414
559-253-1090 fax

DESCRIPTION: TD-4100 GENERAL ARRANGEMENT BOTTOM VIEW

DRAWN BY	CHECKED BY	DATE	SHEET
K. MATTHEWS	M. SIMON	1/15/04	5 OF 5

SIZE	SCALE	DRAWING NUMBER	REV
B	NONE	1000077	A

11.2 Hazardous Location Base Configuration



FRONT VIEW

TURNER DESIGNS Hydrocarbon Instruments
2023 N. GATEWAY BLVD
SUITE 101
FRESNO, CA 93727, USA
559-253-1414
559-253-1090 fax

DESCRIPTION: TD-4100 GENERAL ARRANGEMENT DRAWING WITH C1D2 PURGE OPTION FRONT VIEW

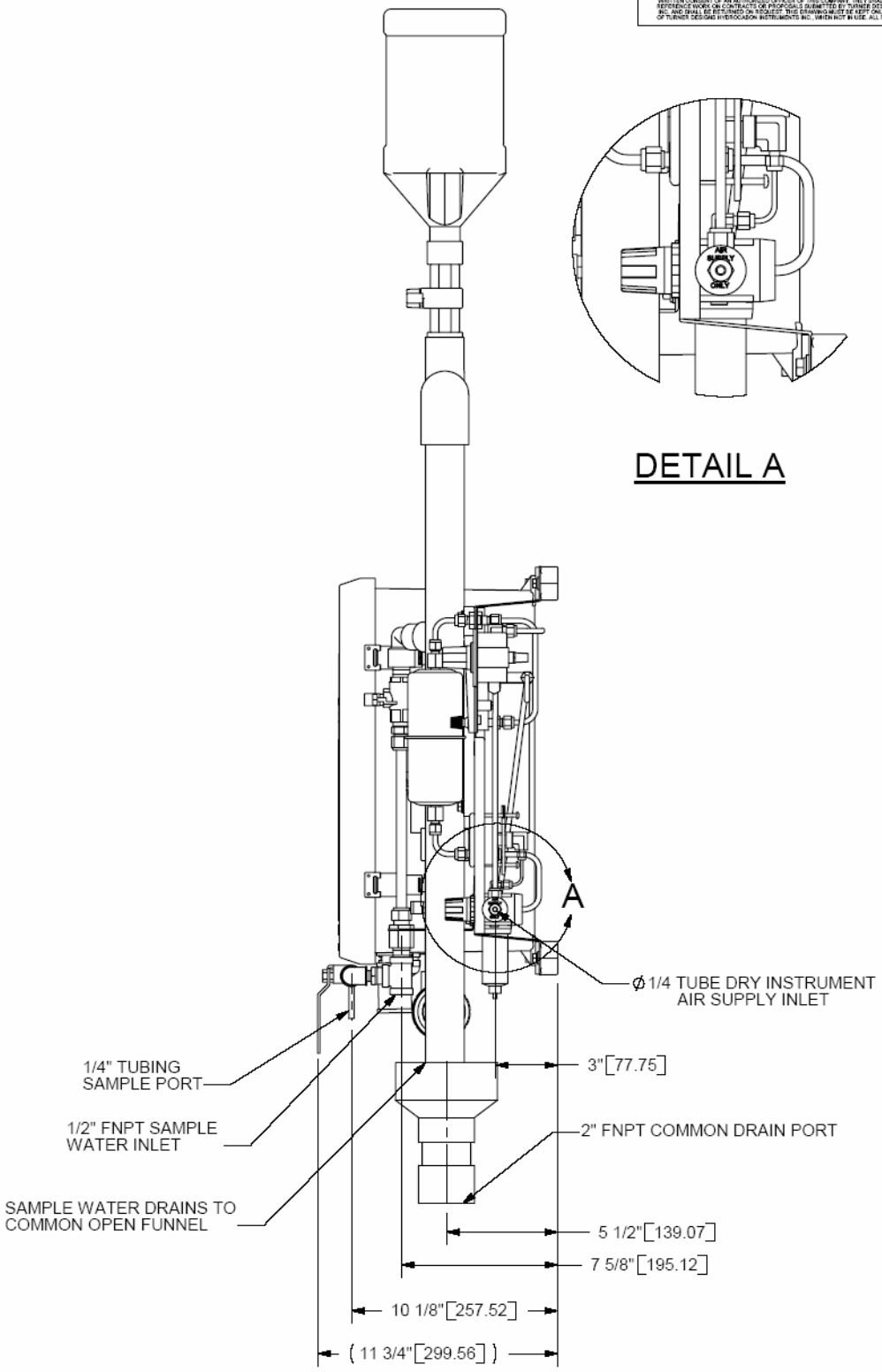
DRAWN BY	CHECKED BY	DATE	SHEET
K. MATTHEWS	M. SIMON	1/15/04	1 OF 5

SIZE	SCALE	DRAWING NUMBER	REV
B	NONE	100078	A

REV	APVD	DATE	DESCRIPTION
A	KSM	1/15/04	PRODUCTION RELEASE

THIS DRAWING CONTAINS INFORMATION THAT IS CONFIDENTIAL AND PROPRIETARY PROPERTY OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. AND IT IS SPECIFICALLY LOANED AND IMPARTED FOR THE EXCLUSIVE USE BY THE RECIPIENT AS A CONFIDENCE PROPERTY OF TURNER DESIGNS HYDROCARBON INSTRUMENTS, INC. SUBMITTED TO THE RECIPIENT IN CONFIDENCE AND SHALL NOT BE COPIED IN ANY MANNER NOR DISCLOSED TO ANY OUTSIDE PARTY WITHOUT THE EXPRESS WRITTEN CONSENT OF AN AUTHORIZED OFFICER OF THIS COMPANY. THEY SHALL BE USED EXCLUSIVELY FOR REFERENCE WORK ON CONTRACTS OR PROPOSALS SUBMITTED BY TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. AND SHALL BE RETURNED ON REQUEST. THIS DRAWING MUST BE KEPT ONLY IN THE CONFIDENTIAL FILES OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. WHEN NOT IN USE. ALL RIGHTS RESERVED.

DETAIL A



RIGHT VIEW

REV	APVD	DATE	DESCRIPTION
A	KSM	1/15/04	PRODUCTION RELEASE

TURNER DESIGNS Hydrocarbon Instruments

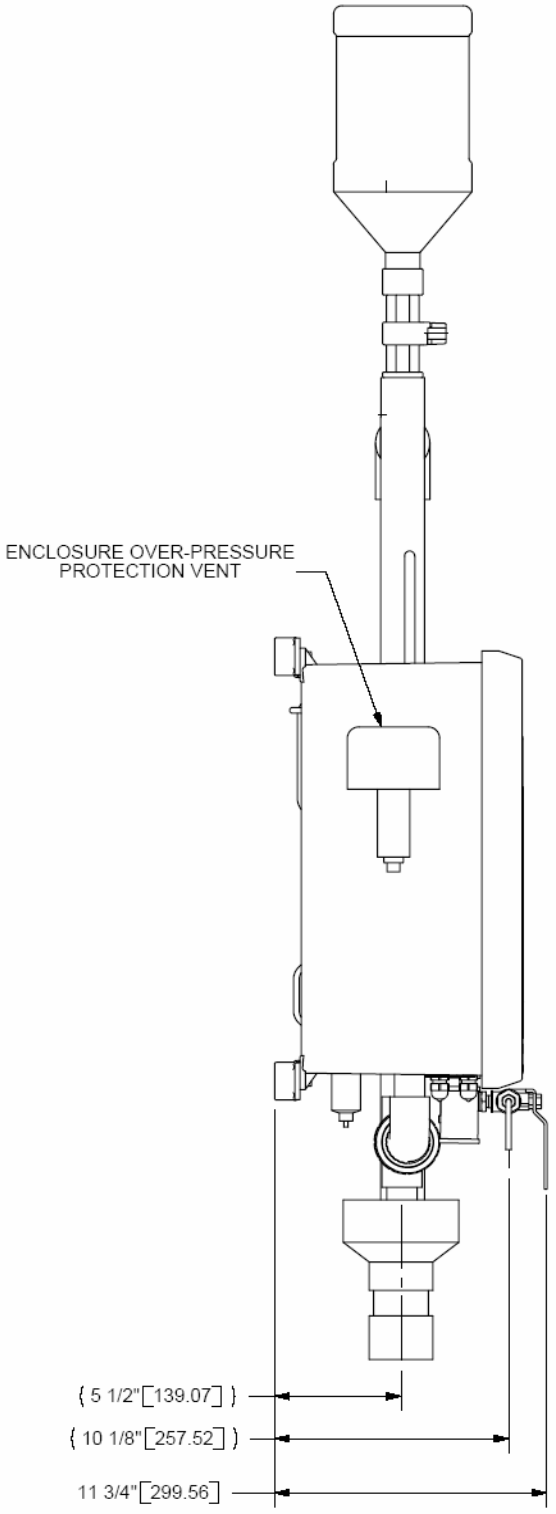
2023 N. GATEWAY BLVD
SUITE 101
FRESNO, CA 93727, USA
559-253-1414
559-253-1090 fax

DESCRIPTION: TD-4100 GENERAL ARRANGEMENT DRAWING WITH C1D2 PURGE OPTION RIGHT SIDE VIEW

DRAWN BY	CHECKED BY	DATE	SHEET
K. MATTHEWS	M. SIMON	1/15/04	2 OF 5

SIZE	SCALE	DRAWING NUMBER	REV
B	NONE	100078	A

THIS DRAWING CONTAINS INFORMATION THAT IS CONFIDENTIAL AND PROPRIETARY PROPERTY OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC., AND ITS DESIGN, DETAIL AND INVENTION ARE THE PROPERTY OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. SUBMITTED UPON REQUEST IS GRANTED ONLY ON THE CONDITION THAT NO COPY OR OTHER REPRODUCTION OR DISCLOSURE THEREOF SHALL BE MADE WITHOUT THE WRITTEN CONSENT OF AN AUTHORIZED OFFICER OF THIS COMPANY. THEY SHALL BE USED EXCLUSIVELY FOR REFERENCE WORK ON CONTRACTS OR PROPOSALS SUBMITTED BY TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. AND SHALL BE RETURNED ON REQUEST. THIS DRAWING MUST BE KEPT ONLY IN THE CONFIDENTIAL FILES OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC., WHEN NOT IN USE. ALL RIGHTS RESERVED.



LEFT VIEW

REV	APVD	DATE	DESCRIPTION
A	KSM	1/15/04	PRODUCTION RELEASE

TURNER DESIGNS Hydrocarbon Instruments

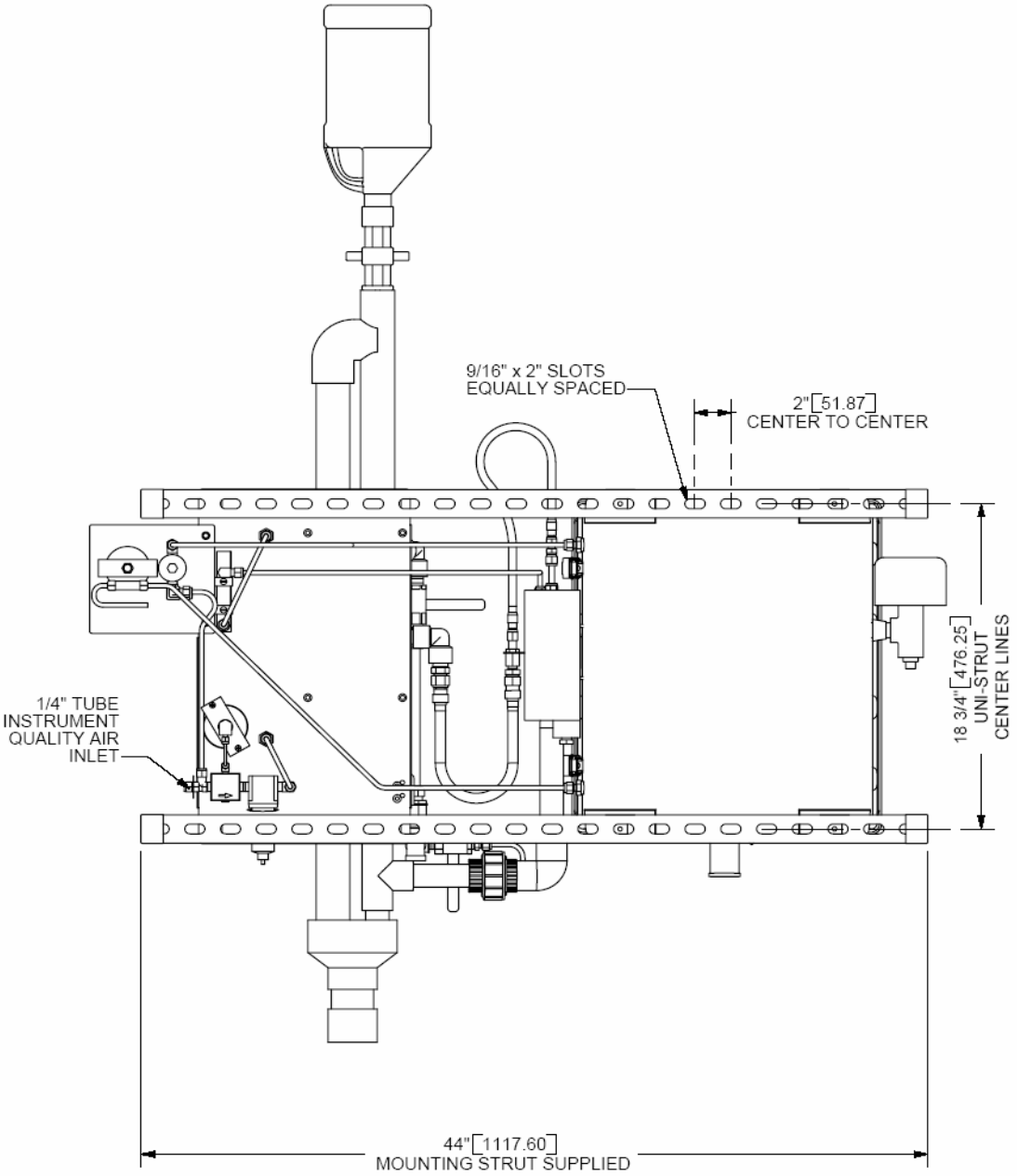
2023 N. GATEWAY BLVD
SUITE 101
FRESNO, CA 93727, USA
559-253-1414
559-253-1090 fax

DESCRIPTION: TD-4100 GENERAL ARRANGEMENT DRAWING
WITH C1D2 PURGE OPTION
LEFT SIDE VIEW

DRAWN BY	CHECKED BY	DATE	SHEET
K. MATTHEWS	M. SIMON	1/15/04	3 OF 5

SIZE	SCALE	DRAWING NUMBER	REV
B	NONE	100078	A

THIS DRAWING CONTAINS INFORMATION THAT IS CONFIDENTIAL AND PROPRIETARY PROPERTY OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC., AND ITS DESIGN, DETAIL AND INVENTION, ARE THE PROPERTY OF TURNER DESIGNS HYDROCARBON INSTRUMENTS, INC. SUBMITTED TO THE RECIPIENT IN CONFIDENCE AND SHALL NOT BE COPIED IN ANY MANNER NOR DISCLOSED TO ANY OUTSIDE PARTY WITHOUT THE EXPRESS WRITTEN CONSENT OF AN AUTHORIZED OFFICER OF THIS COMPANY. THEY SHALL BE USED EXCLUSIVELY FOR REFERENCE WORK ON CONTRACTS OR PROPOSALS SUBMITTED BY TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. AND SHALL BE RETURNED ON REQUEST. THIS DRAWING MUST BE KEPT ONLY IN THE CONFIDENTIAL FILES OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC., WHEN NOT IN USE. ALL RIGHTS RESERVED.



BACK VIEW

REV	APVD	DATE	DESCRIPTION
A	KSM	1/15/04	PRODUCTION RELEASE

TURNER DESIGNS
Hydrocarbon Instruments

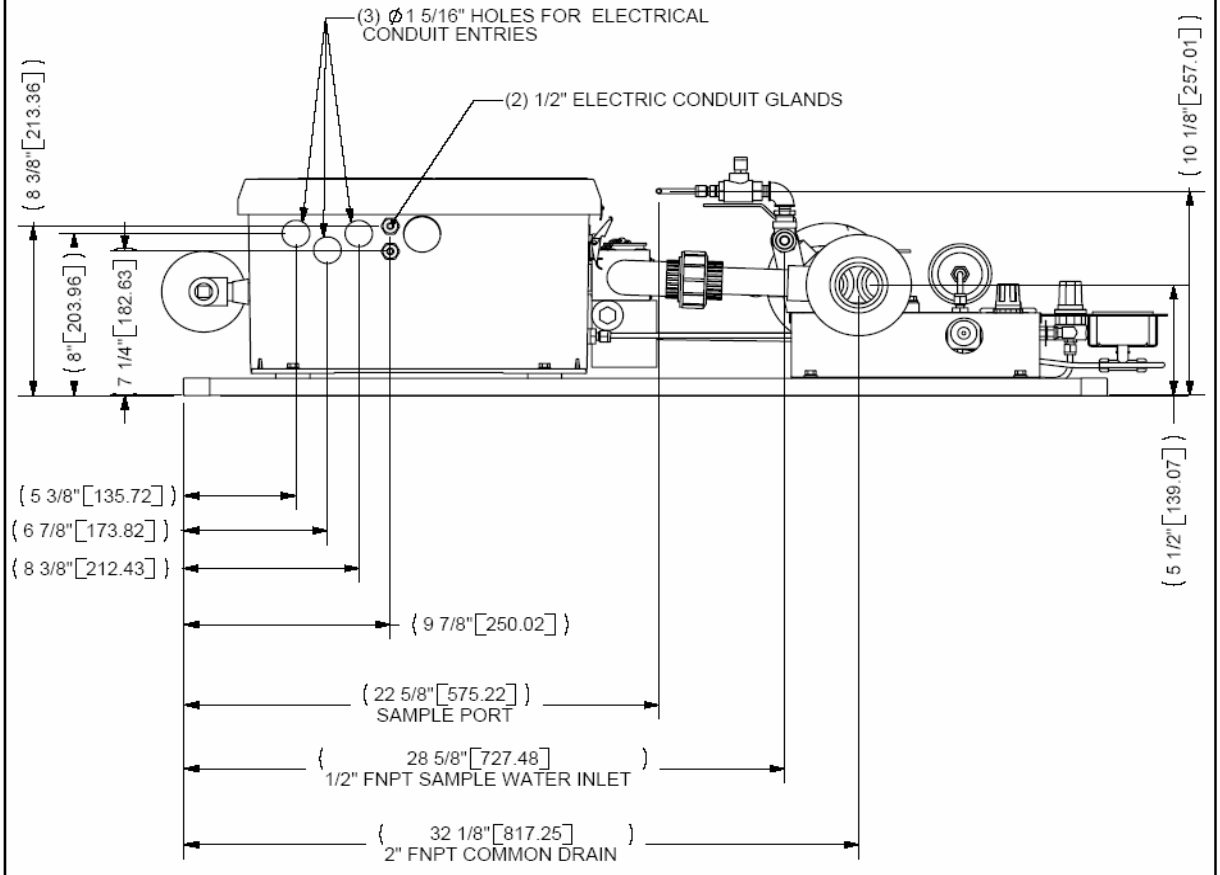
2023 N. GATEWAY BLVD
SUITE 101
FRESNO, CA 93727, USA
559-253-1414
559-253-1090 fax

DESCRIPTION: TD-4100 GENERAL ARRANGEMENT DRAWING
WITH C1D2 PURGE OPTION
BACK VIEW

DRAWN BY	CHECKED BY	DATE	SHEET
K. MATTHEWS	M. SIMON	1/15/04	4 OF 5

SIZE	SCALE	DRAWING NUMBER	REV
B	NONE	100078	A

THIS DRAWING CONTAINS INFORMATION THAT IS CONFIDENTIAL AND PROPRIETARY PROPERTY OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. AND ITS DESIGN, DETAIL AND INVENTION, ARE THE PROPERTY OF TURNER DESIGNS HYDROCARBON INSTRUMENTS, INC. SUBMITTED TO YOU IN CONFIDENCE AND SHALL NOT BE DISCLOSED IN WHOLE OR IN PART, DIRECTLY OR INDIRECTLY, TO ANY OTHER PARTY WITHOUT THE EXPRESS WRITTEN CONSENT OF AN AUTHORIZED OFFICER OF THIS COMPANY. THEY SHALL BE USED EXCLUSIVELY FOR REFERENCE WORK ON CONTRACTS OR PROPOSALS SUBMITTED BY TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. AND SHALL BE RETURNED ON REQUEST. THIS DRAWING MUST BE KEPT ONLY IN THE CONFIDENTIAL FILES OF TURNER DESIGNS HYDROCARBON INSTRUMENTS INC. WWW.NOTIFY.USE. ALL RIGHTS RESERVED.



BOTTOM VIEW

REV	APVD	DATE	DESCRIPTION
A	KSM	1/15/04	PRODUCTION RELEASE

TURNER DESIGNS Hydrocarbon Instruments

2023 N. GATEWAY BLVD
SUITE 101
FRESNO, CA 93727, USA
559-253-1414
559-253-1090 fax

DESCRIPTION: TD-4100 GENERAL ARRANGEMENT WITH C1D2 PURGE OPTION BOTTOM VIEW

DRAWN BY	CHECKED BY	DATE	SHEET
K. MATTHEWS	M. SIMON	1/15/04	5 OF 5

SIZE	SCALE	DRAWING NUMBER	REV
B	NONE	1000078	A

12 FORMS

12.1 Customer Application Survey

GENERAL INFORMATION

1. Contact Information.

Name_____
Department _____
Project Name _____
Project Location_____
Company _____
Address _____
_____
_____
_____
Phone _____
Fax _____
E-Mail _____

2. Application Location.

☐ Drilling Rig
☐ Drinking Water Plant
☐ FPSO or FSO Vessel
☐ Industrial Wastewater Treatment
☐ Mining Operation
☐ Offshore Oil/Gas Platform Facility
☐ Onshore oil/gas Production Facility
☐ Petrochemical Plant
☐ Power Plant
☐ Pulp or Paper Plant
☐ Refinery
☐ Ship
☐ Steel/ Aluminium Plant or Mill
☐ Other

_____

3. Application Type.

☐ Bilge / Ballast Water
☐ Boiler Feed Water
☐ Cooling Water
☐ Deck Drains
☐ Industrial Wastewater Effluent
☐ Industrial Wastewater Influent
☐ Municipal Water Plant Intake
☐ Oil Field Produced Water Discharge
☐ Oil Field Produced Water Injection
☐ Plant Process Water
☐ Remediation Water
☐ Storm Water
☐ Other

_____

4. Monitoring Application.

☐ Discharge Compliance
☐ Leak Detection
☐ Process Control
☐ Process Protection
☐ Spill Response
☐ Treatment Verification
☐ Other

_____

1. Is the water to be monitored by the TD-4100XD?

☐ Not currently monitored
☐ Monitored by sending grab samples to a lab
☐ Monitored using another online analyzer, if so please specify.

Manufacturer: _____
Model: _____

WATER INFORMATION

7. Specify the primary SOURCE of the water to be monitored.
   - ☐ Bilge / Ballast Water
   - ☐ Drinking / Tap Water
   - ☐ Ground Water
   - ☐ Lake
   - ☐ Oil/Gas Produced Water
   - ☐ Reaction Water
   - ☐ River
   - ☐ Sea Water
   - ☐ Steam Condensate
   - ☐ Other:

_____

8. If known, specify other chemicals that may be present in the water and their anticipated concentration. _____

   _____

   _____

   _____

9. Oil in Water Sample Temperature.

   Typical temperature:

   _____ ☐ °F ☐ °C

   Typical temperature range:

   _____ ☐ °F ☐ °C

10. Can you cool the sample if required?
    - ☐ Yes
    - ☐ No
    - ☐ Unknown

11. Water clarity.
    - ☐ Clear
    - ☐ Cloudy
    - ☐ Suspended solids measurement:

      _____ (%)
    - ☐ Turbidity measurement:

      _____ (NTU)
    - ☐ Other: _____

12. pH.

    Typical pH: _____

    Typical pH range: _____ to _____

OIL INFORMATION

13. Specify the Target Compound or Compound Type

- ☐ Aniline
- ☐ Benzene
- ☐ BTEX
- ☐ Condensate _____ °API
- ☐ Crude Oil _____ °API
- ☐ Diesel
- ☐ Ethyl Benzene
- ☐ Fuel Oil Number _____
- ☐ Gasoline
- ☐ Hydraulic Fluid, specify product name.

  _____
- ☐ Jet Fuel
- ☐ Lubricating Oil, specify product name.

  _____
- ☐ Phenol
- ☐ Toluene
- ☐ Xylenes
- ☐ Other by chemical name.

  _____

  Or specify product name.

  _____

14 Physical state of hydrocarbons in the water and expected concentration range.

- ☐ Dispersed droplets
- ☐ Emulsified
- ☐ Free, undissolved, floating
- ☐ Fully dissolved.

15 Concentration Range.

_____ (PPM) / (PPB)

MONITORING REQUIREMENTS

16 Monitoring Requirement.

- ☐ Quantitative
- ☐ Semi-quantitative (Raw Fluorescence)

17 Quantitative Reporting.

- ☐ Accuracy Required _____
- ☐ Maximum Detection Limit

  _____ (PPM) / (PPM)
- ☐ Minimum Detection Limit

  _____ (PPM) / (PPB)

18. Semi-Quantitative Reporting

- ☐ Upset Monitor
- ☐ Trend Monitor

CALIBRATION / CORRELATION INFORMATION

19. If the sample of interest is pure oil in clean water are clean water and pure oil available?

☐ Yes, proceed to question 21
☐ No, proceed to question 22

20. If the sample of interest contains various oils in clean water are clean water and pure oils available?

☐ Yes, proceed to question 21
☐ No, proceed to question 22

21 Do you have the facilities and equipment for preparing Target Compound calibration standards?

☐ Yes
☐ No
☐ Unknown

Proceed to Site Capabilities question 23.

22. The analyzer will need to be calibrated against the site-specific standard method if one exists. Please specify the total oil and grease measurement site-specific standard method.

☐ TDHI TD-360 *Fast*HEX™ Method
☐ TDHI TD-3100 *Fast*HEX™ Method
☐ TDHI TD-500 *Fast*HEX™ Method
☐ Horiba OCM Method with Horiba S-316 solvent
☐ Miram/Foxboro Freon / IR Absorbance Method
☐ U.S. EPA Method 413.2
☐ U.S. EPA Method 418.1
☐ U.S. EPA Method 1664 (<u>not</u> field portable)
☐ U.S. EPA Method 413.1 (<u>not</u> field portable)
☐ Colorimetric method, please specify and attach procedure. _____
_____
☐ Other, please specify and attach procedure.
_____
_____
☐ None, TDHI recommend the *Fast*HEX™ Method.

SITE CAPABILITIES

23. Specify what site oil in water equipment and standards are available.

☐ Analytical Equipment for Oil in Water is available at the site
Please specify.
Manufacturer _____
Model _____
☐ Analytical Methods for oil in water are available on site.
Please Specify Methods. _____
_____

24. Specify the experience of the operator of this equipment.

☐ A great deal of instrumentation experience
☐ Moderate instrumentation experience
☐ Little instrumentation experience

25. Specify the experience of the maintenance personnel of this equipment.

☐ A great deal of instrumentation experience
☐ Moderate instrumentation experience
☐ Little instrumentation experience

26. Please attach a sketch of water treatment process. Include the proposed location of the TD-4100 or mark up one of those included in Section 2.4 Typical Analyzer Process Flow Drawings.

12.2 Installation Checklist

This checklist outlines work that is required prior to installation of the TD-4100. If any of these requirements cannot be met, in some cases alternative installation procedures will provide reliable results; contact TDHI for site preparation support. Please check box when work or activity is complete.

12.2.1 Location & Mounting

- ☐ Analyzer installed out of direct sunlight.
- ☐ Analyzer installed below 6550 ft [2000 m] elevation.
- ☐ Analyzer installed in low helium environment.
- ☐ Analyzer installed where ambient temperatures are 32°F to 120°F [0°C to 49°C], unless a vortex cooler is specified.
- ☐ Analyzer installed more than 10 ft [3 m] from sources of strong electromagnetic fields.
- ☐ Analyzer installed in a non-hazardous location, unless a hazardous area safety purge option is specified.
- ☐ Analyzer is mounted within 10° of vertical (and if installed shipboard, as near the ships center of gravity or centerline as practical).
- ☐ If the analyzer is installed in a high vibration or seismically active area, vibration isolators are fitted.
- ☐ Clearance in front of the analyzer is at least 3' [0.9 m] to permit analyzer maintenance.

12.2.2 Electrical and Control

- ☐ Power supply connection details are as defined in Section 4.4.1 Power Supply, in-line with the power supply specified.
- ☐ System-function and sample level alarm connection details are as defined in Section 4.4.2 Alarm Outputs, in-line with the alarm relays specified.
- ☐ Sample level analog output connection details are as defined in Section 4.4.3 Analog Output, in-line with the analog output configuration specified.
- ☐ User external system-function input connection details are as defined in Section 3.1.5.1 User External System-Function Alarm, if used.

12.2.3 Instrument Air

- ☐ Analyzer air supply complies with ISA-S7-0.01-1996, Section 5 and ISO 8573.1, unless an air membrane dryer and pre-filter is specified.
- ☐ Analyzer air supply pressure must be between 60 and 100 psig, [408 and 680 kPa(g)], unless an air membrane dryer and pre-filter is specified which requires an air supply pressure between 90 and 120 psig, [612 and 817 kPa(g)].

- ☐ Analyzer air supply capable of analyzer air flow requirements detailed in Section 2.2.2 Instrument Air.
- ☐ Analyzer air supply connection details are as defined in Section 2.2.2.2 Installation – Piping Connections.

12.2.4 Cooling Water (Optional, for Sample Cooler)

- ☐ Analyzer cooling water supply details are as defined in the TDHI sample cooler design documentation, if a sample cooler is specified.

12.2.5 Sample Supply

- ☐ Analyzer sample supply flow must be between 2 to 3 USGPM, [7.5 to 11.5 L/min]. NOTE: The minimum sample flow is 1.5 USGPM [5.5 L/min], and the maximum sample flow is 4.5 USGPM, [17 L/min].
- ☐ Analyzer sample supply pressure must be between 5 and 20 psig, [34 and 136 kPa(g)]. If the sample pressure is below 5 psig [34 kPa(g)], a sample supply pump must be specified. NOTE: The maximum sample supply pressure is 20 psig [136 kPa(g)]. .
- ☐ Analyzer sample supply temperature must be between 32 to 190°F [0 to 88°C]. If the sample temperature is above 190°F [88°C] or if the operating sample supply temperature fluctuation is above ±10°F [±5.5°C], a sample cooler has been specified.
- ☐ Analyzer sample supply has been degassed to near atmospheric pressure prior to the sample point.
- ☐ Analyzer sample supply sediment loading is below 10 lb / 1000 bbl [0.3 kg/m^3] unless TDHI has specifically approved the application.
- ☐ Analyzer sample supply pH is between 2 and 10.
- ☐ Analyzer sample supply is treated with an aromatic-free chemical if bacterial growth is possible / expected.
- ☐ Analyzer sample supply connection details are as defined in Section 2.3.2.2 Installation – Piping Connections.

12.2.6 Sample Drain

- ☐ Analyzer sample drain system is capable of handling 4 USGPM [15.0 L/min] sample and solids separated in the sample delivery / conditioning system.
- ☐ Monitor has an open drain with the provided drain cup.
- ☐ Analyzer sample return drain connection details are as defined in Section 2.3.1.2 Installation – Piping Connection.

12.2.7 Additional Equipment / Supplies Required

- ☐ For correlation calibration applications, confirm the laboratory oil & grease analysis instrument, equipment, and supplies are available for measuring oil & grease concentrations of up to 60 grab samples.

- ☐ For demonstrating cleaning of optical windows during training and for direct calibration application standard preparation, ensure one liter of 2-propanol (isopropanol and isopropyl alcohol) is available.
- ☐ For direct calibration of the monitor, a 10 mL sample of the targeted hydrocarbon is present.
- ☐ For direct calibration of the monitor, laboratory ware for preparing calibration standard solutions is available or the P/N 4100-918 Chemistry Calibration Kit is available.
- ☐ For direct calibration of the monitor with heavy fuel oils (#6 fuel oil and like), a small ultrasonic bath is present for preparing calibration standard solutions.
- ☐ For demonstrating cleaning of optical windows during training, ensure one liter of purified water is available.

12.3 Commissioning Checklist

Installation Site Information		
Company		Commission Date
Address		Commissioning Technician
		Model #
		Serial #
		Optical Configuration
T:	F:	

Final Instrument Configuration			
Task	**Yes**	**No**	**Notes/Comments**
Electricity provided to instrument	☐	☐	
Air provided to instrument	☐	☐	
Water flowing through Flowcell	☐	☐	
Relays connected	☐	☐	
4-20 mA output connected	☐	☐	

Diagnostic Screens After Sensitivity Set		
Lamp: ☐ On ☐ Off	Din: ☐ On ☐ Off	Operation: hours
Speed: rpm	Raw: (normal conditions)	Blank:
HV: volts	FS%	Cal Std:
Diagnostic Screens After 24 Hour Burn In		
Lamp: ☐ On ☐ Off	Din: ☐ On ☐ Off	Operation: hours
Speed: rpm	Raw: (normal conditions)	Blank:
HV: volts	FS%	Cal Std:
Diagnostic Screens After Calibration Completed		
Lamp: ☐ On ☐ Off	Din: ☐ On ☐ Off	Operation: hours
Speed: rpm	Raw: (normal conditions)	Blank:
HV: volts	FS%	Cal Std:

Instrument Screens				
Screen 0	***Screen 1***	***Screen 2***	***Screen 3***	***Screen 4***
Calibration Solution	Concentration Units	Relay Control Settings	Zero Alarm Settings	Early Warning Settings
Value: ☐ ppm ☐ ppb ☐ no units	Value: ☐ ppm ☐ ppb ☐ no units	A: ☐ NO ☐ NC B: ☐ NO ☐ NC	Activated: ☐ Yes ☐ No Value:	Activated: ☐ Yes ☐ No Value:
Screen 5	***Screen 6***	***Screen 7***	***Screen 8***	***Screen 9***
High Alarm Settings	Alarm Delay Time	4 mA Settings	20 mA Settings	Relay Conditions
Activated: ☐ Yes ☐ No Value:	Minutes	Value: ☐ ppm ☐ ppb ☐ no units	Value: ☐ ppm ☐ ppb ☐ no units	A: ☐ OPEN ☐ CLOSED B: ☐ OPEN ☐ CLOSED

Calibration Procedure	
Calibration Standard:	Calibration Standard Value:
Blank:	Blank Value:

User Training			
Item	Initial	Item	Initial
1) Components of Instruments	[ ]	4) Configuration of Instrument Conditions	[ ]
2) Air Curtain & Water Flow Settings	[ ]	5) Calibration of Instrument	[ ]
3) Instrument Display Screens	[ ]	6) Maintenance of Instrument	[ ]

Comments/Notes
Solid Standard Setting:

Signatures	
User:	Date:
TDHI:	Date:

12.4 Troubleshooting Worksheet

12.4.1 General Information

Unit Serial Number:		
Description of Problem:		
Date / Time problem started:		
Describe any analyzer physical damage:		
Excitation Filter:	Emission Filter:	
Lamp:	Date of Last Calibration:	
Home Screen Display	System-Function Alarm	Sample Level Alarm
☐ PPM	☐ Cycles ON and OFF	☐ Cycles ON and OFF
☐ PPB	☐ Stays ON	☐ Stays ON
☐ No Unit	☐ Stays OFF	☐ Stays OFF
If “ALM” is blinking press <ESC> and record active alarms.		
☐ System	☐ ZeroAlm:	☐ ErlyWrn	☐ HighAlm

12.4.2 Physical Inspection

Is the main power switch on?		☐ YES	☐ NO
Date the analyzer was last cleaned:			
Analyzer was last cleaned with:	☐ Acid	☐ Detergent	☐ Water & Brushes
Tug each wire terminated to the analyzer terminal strip to confirm solid connection. If any are loose, record them			

12.4.3 System Value Record

Access Keystrokes	System Value	Value
<HOME><0>	Calibration Standard Concentration	
<HOME><1>	Concentration Units	
<HOME><2>	Relay A & Relay B Shelf State	Relay A: Relay B:
<HOME><3>	Zero Alarm	Monitor: Level:
<HOME><4>	Early Warning Alarm	Monitor: Level:
<HOME><5>	High Alarm	Monitor: Level:
<HOME><6>	Alarm Delay	
<HOME><7>	Analog Output Low Limit (4 mA)	
<HOME><8>	Analog Output High Limit (20 mA)	
<HOME><9>	Relay A & Relay B Status	Relay A: Relay B:
<HOME><?>	Software Version	
<HOME><←>	Alarm History	☐ System: ☐ ZeroAlm:
		☐ ErlyWrn: ☐ HighAlm:
<HOME><ENT><2>	Calibration Standard Readings	Calibration Standard:
		Blank:
<HOME><*>	Record Analyzer Diagnostics	Lamp:
		RPM:
		HV:
		Din:
<HOME><*><ENT>	Record Raw Fluorescence	Raw:
		%FS:
<HOME><*><ENT><ENT><1>	Toggle Relay A by pressing <ENT> repeatedly.	The external alarm / device switches on and off? ☐ YES ☐ NO
<HOME><*><ENT><ENT><2>	Toggle Relay B by pressing <ENT> repeatedly.	The external alarm / device switches on and off? ☐ YES ☐ NO

12.5 Typical Instrument Data Sheet

GENERAL	1	Tag No:	9	Project:	
	2	P&ID No:	10	Service:	
	3	Line No:	11	Location:	
	4	Ambient Temperature: to °F [°C]	12	Application:	
	5	Area Classification:	13	User:	
	6	Elevation: ft [m]	14	Instrument: TD-4100	
	7	He Atmosphere: Yes No	Level	15	Quotation:
	8	Vibration / Seismic: Yes No	Zone	16	Date:

PROCESS	17	Sample Supply	Pressure: PSIG [bar(g)]	25	Sample Return	Pressure:	"H_2O [mbar]
	18		Stabilized to: PSIG [bar(g)]	26		Fluctuation:	"H_2O [mbar]
	19		Temperature: to °F [°C]	27		Connection: 2" FNPT	
	20		Solids: lbs/1000 bbl [kg/m3]	28	Inst. Air Supply	Pressure:	PSIG [bar(g)]
	21		Connection: 1/2" FNPT	29		Temperature: to	°F [°C]
	22		Sample Block: Kynar®	30		Connection: 1/4" Tube or MNPT	
	23		Wetted Parts: Plastic 316SS	31		Consumption: Determined by Options Fitted	
	24		Line Length ft [m]	32	Cooling Water *	Temperature: to	°F [°C]
	25		Target Oil	33		Connection: 1/2" or 3/4" FNPT	
	26		Source Water	34		* If Sample Cooler Fitted	

TRANSMITTER	33	Measurement	Quantitative Qualitative	44	Alarms:	Sample Level:	Solid State AC or DC
	34		to PPB PPM	45		System Function:	Solid State AC or DC
	35	Principle:	UV Fluorescence	46	Analog Out	0-20 mA 4-20 mA HART™	
	36	Measuring Cell:	Free Fall Vertical	47	Power	115 50/60 VAC 230 50/60 VAC 24 VDC	
	37	Accuracy:	>1% (Typical)	48		50 Watts (Typical) 500 Watts (Maximum)	
	38	Repeatability:	>1%	49			
	39	Linearity:	R^2 > 90 (Typical)	50	Local Monitoring / Control	Keypad / Liquid Crystal Display	
	40	Sensitivity:	1 PPB - 1000 PPM (Typical)	51			
	41	Stability	< 10% drift in 6 months	52	Material:	Lamp Housing:	Epoxy Coated Aluminum
	42	Response Time:	9 second integration time	53		Electronics Enclosure:	FRP
	43			54		Wall Mounting Frame:	Stainless Steel Strut

NOTES	1
	2
	3
	4
	5
	6

Rev.	By	Chk	App	Date	Revision

2023 N. Gateway Blvd
Fresno, CA, USA 93727
Phone:+1 559 253-1414
Fax:+1 559 253-1090
service@oilinwatermonitors.com
www.oilinwatermonitors.com

TURNER DESIGNS
Hydrocarbon Instruments

Data Sheet: 1 of 1

Dwg. No | Rev:

13 GLOSSARY

Access Panel: The panel inside the analyzer enclosure door on which the main power switch, relay A and B circuit breakers, and the analyzer serial port are mounted. Inset in the access panel is a removable door which covers the analyzer terminal strip, and the enclosure pressure switch for the optional safety air purge system.

Air Control Panel: A panel which contains the air curtain supply system, the optional air-purge supply system, and optional vortex cooler supply system.

Air Curtain Flow Control Valve: A gas variable area meter and air control valve that allows you to change the rate of air flowing to the air curtain.

Air Curtain Pressure Regulator: An adjustable pressure regulator that allows you to set the pressure of the air flowing to the air flowing to the air curtain.

Air Curtain Pressure Gauge: A gauge which measures the pressure of the air curtain supply air.

Air Curtain Supply System: A subsystem that provides a stream of clean and dry air that is directed onto the optical windows of the Sample Block to prevent build-up of condensation on the windows.

Air Purge Enclosure Purge Protection Pressure Regulator: An adjustable pressure regulator that allows you to set the pressure of the air flowing to the analyzer electronics enclosure.

Air Purge Enclosure Purge Pressure Indicator: A pressure gauge monitoring electronic enclosure pressure.

Air Purge System (optional): This system permits operation of the analyzer in Class 1 Division 2 hazardous locations.

Alarm Relay Circuit Breakers: Relay A and Relay B output circuit breakers located to the right of the main power switch on the analyzer access panel.

Analyzer Wall Mounting Strut Frame: The stainless steel frame on which the analyzer and its options and accessories are mounted.

Blank: The solution containing no measurable target hydrocarbons, used in a direct calibration.

Calibration Bottle: A plastic bottle with a calibration mark that is used to flow calibration and cleaning solutions via the short in-line bubble trap column through the sample block.

Calibration Bottle Valve: A plastic ball valve which may be threaded onto the calibration bottle and is used to regulate the flow of calibration / cleaning solutions through the sample block.

Calibration Solution: Solution containing known quantity of the target hydrocarbon, used in direct calibration of the analyzer.

Enclosure Door: The exterior front access to the analyzer enclosure.

Enclosure Vent: A wire screen filter vent that allows air from the air purge to exit the enclosure.

Falling Stream Flow Cell: The non contact sample cell where the sample fluorescence is measured.

Flow Cell Drain: A thermoplastic tube which directs samples from the Falling Stream Flow Cell to the sample water drain. This tube also prevents stray light from entering the Falling Stream Flow Cell.

Flow Cell Desiccant Plug: A removable descant package mounted on the front of the sample block nozzle assembly which protects the optical filters from the affects of moisture.

In-Line Bubble Trap: A piping assembly that removes suspended solids and dissolved gas from the sample stream, and provides a constant sample stream flow to the falling stream flow cell.

In-Line Bubble Trap Drain Valve: A valve located at the sediment drain outlet of the in-line bubble trap, which allows sediment to drain from the in-line bubble trap.

Instrument Air Supply Inlet: A connection where instrument air is connected to the air control panel.

Keypad: A touch-sensitive keyboard that allows you to configure and monitor the analyzer.

Lamp Housing: The lamp located in this housing provides the ultraviolet light that induces fluorescence. The rated minimum TD-4100 lamp life is 8000 hours.

LCD Display: A Liquid Crystal Display (LCD) that displays analyzer information in response to keypad entries.

Maximum Reportable Concentration: The maximum concentration the monitor can read before the fluorescence response goes above 1000 units.

Main Power Switch: The main power switch for the TD-4100 system.

Overflow Tube: A component of the in-line bubble trap which allows the sample to constantly overflow to the sample water drain.

Analyzer Terminal Strip: A multiple-wire connector located behind the removable door located on the access panel.

Relay A: A solid-state SPST relay that permits remote monitoring of system-function alarm status.

Relay B: A solid-state SPST relay that permits remote monitoring of sample-level alarm status.

Removable Cap: The cap on the in-line bubble trap column, which may be removed to insert the Calibration Bottle and Calibration Bottle Valve.

Sample Block: The falling stream flow cell Kynar® assembly which contains the optical windows and emission optical filter.

Sample Inlet Valve: The valve that controls the sample flow to the in-line bubble trap.

Sample Port: A valve and tube provided on the in-line bubble trap inlet to permit grab sample collection for analysis.

Sample Water Drain: The analyzer drain.

Sensitivity Screw: This screw is used to set the analyzer sensitivity.

Sensitivity Screw Plug: A weatherproof plug which covers the sensitivity screw, which must be removed to allow sensitivity adjustments.

View Port Cover: A plug on the side of the Sample Block that may be removed to view the falling stream.

14 LEGAL & WARRANTY

14.1 Copyrights

All rights reserved. This document contains proprietary information of Turner Designs Inc., Sunnyvale, California, USA and Turner Designs Hydrocarbon Instruments Inc., Fresno California, USA embodying confidential information, ideas, and expressions. No part of this document may be reproduced or transmitted in any form or by any means, electronic, mechanical, or otherwise, without prior written permission from Turner Designs Hydrocarbon Instruments, Inc.

14.2 Trademarks

TD-4100, TD-3100, TD-360, and *Fast*HEX are a trademark of Turner Designs, Inc. TD-500 and TD-500D are trademarks of Turner Designs Hydrocarbon Instruments, Inc.

Other brand and product names are trademarks and/or registered trademarks of their respective holders.

14.3 Right of Change

Information in this document is subject to change without notice and does not represent a commitment on the part of Turner Designs Hydrocarbon Instruments, Inc.

For questions or comments about this manual, please contact:
Turner Designs Hydrocarbon Instruments, Inc.
2023 North Gateway Blvd., Suite 101
Fresno, CA 93727
United States of America
Tel: +1 559 253 1414 Fax: +1 559 253 1090
Email: service@oilinwatermonitors.com
Website: www.oilinwatermonitors.com.

14.4 Warranty

Turner Designs Hydrocarbon Instruments through Turner Designs warrants the TD-4100 and accessories to be free from defects in materials and workmanship under normal use and service for a period of one year from the time of initial purchase, unless an additional warranty period was purchased with the original order, with the following restrictions.

The instrument and accessories must be installed, powered, and operated in compliance with the directions in this TD-4100 Design, Installation, and Operations Manual, and directions accompanying the accessories.

Damage incurred in shipping is not covered.

Damage resulting from measurement of samples found to be incompatible with the materials used in the sample system is not covered.

Damage resulting from contact with corrosive materials or atmosphere is not covered.

Damage caused by modification of the instrument by the user is not covered.

The backlight on the digital display is warranted for 1800 hours of operation.

14.5 Warranty Service within the United States of America

Components potentially covered by warranty must be shipped freight pre-paid to Turner Designs Hydrocarbon Instruments. TDHI will make a determination upon inspection of the inoperable or damaged component to determine if the component is covered by warranty. In the event the component is covered by warranty, TDHI will repair the item at no cost and ship the component freight paid back to the customer. In the event the damage is not covered by warranty, an inspection charge will apply in addition to repair costs and return shipping costs.

To obtain service during the warranty period, the owner shall take the following steps.

Follow the instructions in Troubleshooting and Maintenance Sections.

Contact a Turner Designs Hydrocarbon Instruments representative at
T el: +1 559 253 1414, Fax: +1 559 253 1090, or
Email: service@oilinwatermonitors.com
and describe, as precisely as possible, the nature of the problem.

Carry out minor adjustments or tests as instructed by the Turner Designs Hydrocarbon Instruments representative.

If proper performance is not obtained after consultation with TDHI's service representative, obtain a RMA number from TDHI, and ship the instrument, prepaid, to

Turner Designs Hydrocarbon Instruments, Inc.
Attention RMA # _____
2023 North Gateway Blvd., Suite 101
Fresno, CA 93727
United States of America
Phone (559) 253-1414

You must obtain a RMA number prior to shipping the analyzer. The analyzer will be repaired and returned free of charge if the damage is covered by the warranty. This warranty service is provided to Turner Designs Hydrocarbon Instruments' users in the contiguous continental United States.

14.6 Warranty Service outside of the United States of America

Components potentially covered by warranty must be shipped freight pre-paid to Turner Designs Hydrocarbon Instruments. TDHI will make a determination upon inspection of the inoperable or damaged component to determine if the component is covered by warranty. In the event the component is covered by warranty, TDHI will repair the item at no cost; however, the customer is responsible for the shipping to and from our facility, including any potential customs clearance. In the event the damage is not covered by warranty, an inspection charge will apply in addition to repair costs and return shipping costs.

For users outside of the contiguous continental United States and who have purchased the equipment from a distributor, contact the distributor. If the purchase was direct, contact Turner Designs Hydrocarbon Instruments. We will repair at no charge but will not pay for

shipment, documentation, etc. These charges will be billed at cost. Current International and Domestic Dealers are listed in Sections 14.8 and 14.9 respectively.



NOTE: Under no conditions should the instrument or accessory be returned without notice. Prior correspondence is needed for the following reasons.

1. Many problems may be rectified on site.
2. The nature of the problem must be defined in detail to speed the repair of the instrument.
3. A RMA number must accompany the analyzer. This number is used to track the repair cycle.

14.7 Out-of-Warranty Service

Proceed exactly as for Warranty Service. Verbal or written support from Turner Designs Hydrocarbon Instruments' representative is free.

Repair Service will be billed for time, materials, customs clearance (if any), and return shipping. Shipment to Turner Designs Hydrocarbon Instruments must be prepaid. We strongly suggest you insure the monitor during shipment. If the repair service is not obtained, there is a minimum service charge for the inspection in addition to return shipping.

14.8 International Dealers & Representatives

ASIA

Region – Malaysia

Company:

EP Engineering Sdn. Bhd.
Unit C-3-8, Megan Phileo Promenade
189, Jalan Tun Razak
50400 Kuala Lumpur,
Malaysia

Principal contact:

Tack Kieng Tiong, Managing Director
Tel: 60-3-2162 2255
Fax: 60 3 2161 7550
Fax: 60 3 2163 5919 (alternate)
Email: ep-msia@tm.net.my

Region – Taiwan

Company:

Atlas Equipment
22F, No. 1, Pao Sheng Road
P.O. Box : 5-22
Yuan Ho City, Taipei Hsien,
Tawain ROC

Principal contact:

David Liu, President
Tel: 886 22 232 0556
Fax: 886-2-2231-6657
Fax: 886-22-231-6657 (Alternate)
Email: atlas@atlasgroup.com.tw

Region – Korea

Company:

Enock Engineering
2F., Sundo Bldg.
135-7, Munjeung-dong, Songpa-Ku
Seoul, 138-868
Korea

Principal contact:

SH Park
Tel: 822-565-8385 - Main
Fax: 822-565-8387
Email: enock@hitel.net

Region – AUSTRALIA

Company:

POGC, Sensor Technology
Howthorn House
79 Victoria Avenue
CHATSWOOD NSW 2067
Australia

Principal contact:

Simon Burns
Tel: 61 2 9 417 6688
Fax: 61 2 9417 6403
Fax: 61 2 9417 8570 (Alternate)
Email: sburns@halmel.com.au

AFRICA

Region - Nigeria

Company:

Craymond Nigeria Limited
46 Nembe Road
Rumuibekwe Estate
Port Harcourt, Nigeria

Principal contact:

Austin Chinda
Tel: 234-84-612-009
Fax: 234-84-612-040
Email: craymondng@aol.com

CANADA

Region – Central Canada

Company:
Akrulogic
116 Parkhurst Boulevard
Toronto, Ontario
Canada M4G 2E7

Principal contact:

Erik Zamurs
Tel: (416) 696-5576
Fax: (416) 696-7988
Email: ezamurs@compuserve.com
Website: http://www.akrulogic.com

Region - Western Canada

Company:

Benchmark Instrumentation and Analysis
Suite 44, #240-220 Baseline Road
Sherwood Park, Alberta
Canada T8C 1S8

Principal contacts:

Grant Shannon

Tel: (780) 922-2760 - Office
Fax: (780) 922-2796
Email: grant.shannon@Benchmarkinc.ca

Tod Martens

Tel: (780) 440-1356 - Office
Fax: (780) 462-0915
Email: tod.martens@benchmarkinc.ca

EUROPE

Region - United Kingdom / Ireland

Company:
Process Measurement & Analysis Ltd
Analysis House
6 Kelvin Park, Dock Rd
Birkenhead Merseyside
United Kingdom CH41 1LT

Principal Contact:

Andy Hinton-Lever
Tel: 44 151 649 8477
Fax: 44 151 647 7211
Email: sales@processmeasurement.uk.com

Region – The Netherlands

Company:

Kimman Process Solutions BV
Boelewerf 10-12
2987 VD
Ridderkerk-Bolnes
Netherlands

Principal contact:

Dick Verloop

Tel: 31 18046 4826 – Office
Fax: 31 18046 5938
Email: d.verloop@kimman-jisk.nl

Region – Germany

Company:

NordAn Tec GmbH
Friedhofsstrasse 26
27576 Bremerhaven
Germany

Principal contact:

Achim Loose
Tel: 49 471 890925
Fax: 49 471 890990
Email: loose@nordantec.de

Region – France

Company:

Autochim
55 rue de l'Auberpine
Antony Cedex 92168
France

Principal Contact:

Patrice Meyer
Tel: 33 01 4096 1122
Fax: 33 01 4096 1130
Email: Patrice.Meyer@autochim.com

Region – Eastern Europe

Company:

ECM ECO Monitoring – HBG
Rezedova 1
Bratislava 821 01
Slovak Republic

Principal contact:

Juraj Kaprinay
Tel: 421 7 522 7309 - Office
Fax: 421 7 233 167
Email: juraj.kaprinay@ecm.sk

MIDDLE EAST

Region – Kuwait

Company:

Al-Arfaj Engineering Co. W.L.L.
Al-Arfaj Complex
Block 1 / Floor 1 / Pepsi St
P.O. Box 391,
Shuwikh Industrial Area
Salmiya, 22004 Kuwait

Principal contacts:
Murlee Dharan
Tel: 965 4817448
Fax: 965 4817442 / 3
Email: arfaj@qualitynet.net

Region – Dubai

Company:

BDH Middle East
P.O. Box 28637
Beside D.E.W.A. Central Stores
Al Aweer Main Road,
Dubai - U.A.E.

Principal contact:

SM Murthy
Tel: 971 4 285 2211
Fax: 971 4 286 1331
Email: smmurthy@hotmail.com
Website: www.hochems.com

Region – Saudi Arabia

Company:

Diversified Lines Petroleum Services, Ltd.
Suite #24, 3rd Floor
Middle East Commercial Center
Dhahran Street
Al-Khobar
Saudi Arabia

Principal contact:

Pervaiz Kashmiri
Tel: 966 03 895 2792
Fax: 966 03 895 2449
Email: kashmiri@dlps.net

SOUTH AMERICA

Region - Brazil

Company:

Fluxo Solutions
Rua Baronessa de Bella Vista, 692
Sao Paulo 04612-002,
Brazil

Principal contact:

Sylvio Fonseca, Product Manager
Tel: 55 11 5098-6717
Fax: 55 11 5098-6712
Email: sylvio.fonseca@fluxosolutions.com.br

Region - Argentina

Company:

Equipos SA
Republica De La India 2967
11th Floor,
Buenos Aires, 1425
Argentina

Principal contact:

Francisco Pouzo, Marketing Manager
Tel: 54 11 4371-1007 Office
Fax: 54 11 4806-5129
Email: pouzo@sinectis.com.ar

14.9 Domestic Representatives

UNITED STATES

Region – Southern US (offshore applications)

Company:

Instrumentation Products
211 Antrim Drive, Suite A
PO Box 15613 (70895)
Baton Rouge, Louisiana
USA 70815

Principal contact:

Herb Ellenburg
Tel: (225) 293-2525
Fax: (225) 293-2526
Email: herb@ipcobr.com

Region – Texas/Louisiana (Onshore and Offshore Oil Production Only)

Company:

Oilfield Analytics
1510 Eldridge Pkwy, Suite 110
Box 161
Houston, Texas 77077-5359 USA

Principal Contact:

Jeff Keathley, President
Tel: (281) 506-9061
Fax: (281) 506-9061
Email: jeff@oilfieldanalytics.com