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PGC5000

Process gas chromatograph



Measurement made easy

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1 Glossary

ACL	Access Control List
AOC	Absence of Condition
BIOS	Basic Input/Output System
CAN	Controller Area Network
CPU	Central Processing Unit
DID	Discharge Ionization Detector
DSP	Digital Signal Processor
DTC	Digital Temperature Controller
EPC	Electronic Pressure Controller
ESD	Electrostatic Discharge
FID	Flame Ionization Detector
FPD	Flame Photometric Detector
I/O	Input/Output
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LSV	Liquid Sample Valve
LUI	Local User Interface (operational software interface located on the Master Controller)
MC	Master Controller
PC	Personal Computer
PCB	Printed Circuit Board
PDO	Process Data Object
PGC	Process Gas Chromatograph
PIC	Programmable Integrated Circuit
POST	Power-On Self Test
PTFE	Polytetrafluoroethylene
RAM	Random Access Memory
RTC	Real Time Clock
RTD	Resistance Temperature Detector
SBC	Single Board Computer
TCD	Thermal Conductivity Detector
TCF	Time Coded Function
USB	Universal Serial Bus

2 Safety and symbols

The following symbols are used in this manual to alert the user to possible hazards and to provide additional information.



Indicates that the referred item can be hot and should not be touched without care.



Indicates that a risk of electrical shock and/or electrocution exists.



Indicates a potential hazard which could cause serious injury and/or death, or indicates the presence of a hazard which could result in corruption of software or damage to equipment or property.



Indicates that referenced items are susceptible to Electrostatic Discharge (ESD) damage and should not be touched without ESD safe handling tools.



Alerts the user to pertinent facts and conditions.

3 Introduction

3.1 General

The PGC5000 Series Process Gas Chromatograph (analyzer) separates and measures the individual components of gas or liquid samples. It automatically samples and analyzes process streams, using the analyzer's Master Controller to control analytical functions.

The PGC5000 analyzer is compatible with early versions (before version 4) of the STAR Data Management System.

Each analyzer has a temperature code (T-Rating) listed on the nameplate. This T-Rating indicates the temperature classification of the area in which the analyzer has been designed to operate. T-Ratings and area classifications for analyzer locations are determined and supplied by the customer.

The analyzer consists of a Master Controller and associated ovens (see Figure 3.1).

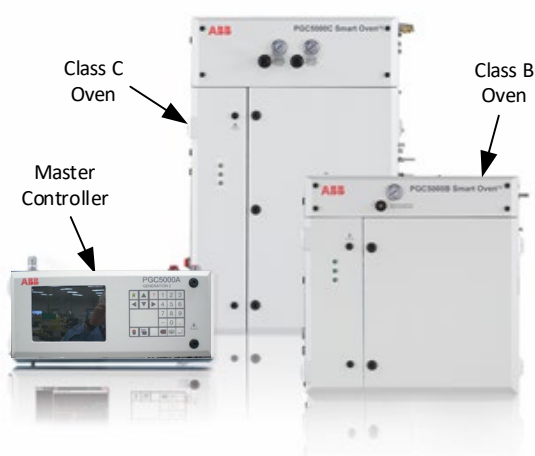


Fig. 3.1. Typical PGC5000 with Associated Ovens

An Important Documents CD-ROM comes with the analyzer. Included on this CD are data sheets, installation drawings, and replacement parts lists needed to support installation and operation of the analyzer. This manual refers to these data sheets and drawings as the "Data Package."

3.2 Drawings

Since analyzer configuration depends on the particular application, this manual does not contain generic engineering drawings and diagrams. You should utilize the drawings, diagrams and replacement parts lists provided on the Data Package supplied with your analyzer to ensure you are using the correct ones for your system.

3.3 Master controller

The Master Controller can support up to four ovens, in any combination of Class B and Class C ovens, depending on detector configurations. If internal I/O modules are utilized, the maximum number of ovens per Master Controller is limited to three.

The Master Controller contains a Card Cage with a Single Board Computer (SBC) PCB, a Power Supply, one or more Oven Controller PCBs, and optional Wago input/output modules. The front panel assembly has a liquid crystal display (LCD), keypad, and front panel board. Later versions of the front panel assembly have a touchscreen.

3.4 Class B oven

The Class B Oven, which comes in liquid and vapor versions, houses an isothermal oven which contains the analytical columns, detector, detector amplifier, temperature controller, control valves, and sample valve. The Class B Oven has one detector and a maximum of four valves.

3.4.1 Liquid version

The liquid version incorporates a liquid sample valve (LSV) as the input to the analysis. The duration of an analysis depends on the application and consists of the following:

- The liquid sample valve injects a fixed volume of sample into a vaporizing chamber.
- “Sweep gas” transports sample out of the vaporizing chamber.
- Carrier transports the vaporized sample into the column.
- The column then separates the components and passes them into the detector.
- The detector measures the sample across the range of high to low concentration.

The liquid sample valve is externally mounted on the right side of the Oven Compartment and extends through the isothermal oven, allowing direct injection. It is actuated by a solenoid valve located in the Oven Electronics Compartment. The liquid sample valve captures a specific volume of liquid sample below its bubble point, injects it into a temperature controlled (vaporizing) chamber of the LSV, which then sends the vaporized sample into the oven.

3.4.2 Vapor version

The vapor version has a vapor input to the analysis, so it does not require a liquid sample valve. The duration of an analysis cycle depends on the applications and consists of the following:

- Carrier gas transports the vaporized sample through the columns.
- The column then separates the components and passes them into the detector.
- The detector measures the sample across the range of high to low concentration.

3.5 Class C oven

The Class C Oven contains the same components as the Class B Oven, but it has the capability to handle more oven components. The Class C Oven has a maximum of two detectors and a maximum of six valves.

3.6 Air purge systems

The analyzer is suitable for a Class 1 Division 2 hazardous location, or an Ex Zone 2 area, without purge and pressurization protection. Purge and pressurization protection of the electronics enclosure is required for a Class 1 Division 1 location, or an Ex Zone 1 area. Refer to the analyzer nameplate for purge and pressurization specifications.

3.7 System variations

This manual supports the basic PGC5000 analyzer. An appendix to the main manual presents additional instruction for special applications such as PGC5000TPGC (temperature programmed GC), PGC5007 (fuel sulfur GC), and PGC5009 (fast GC).

4 Maintenance

4.1 Equipment and supplies required

Factory Data Sheets from the Data Package
Flow measuring device

4.2 Preventive maintenance

The oven design is specifically designed to eliminate the need for extensive and complex maintenance. Where preventive maintenance procedures require particular time frames or intervals, maintain an inspection log and inspection data. Figure 4.1 lists inspection routines, with recommended time intervals for each routine. In addition, verify analyzer using a validation sample periodically to ensure operating efficiency.



To aid in preventive maintenance, keep reference chromatograms for comparison and assisting with early detection of issues as described in the Troubleshooting section.

INTERVAL	ROUTINE
Daily/Weekly	<p>Perform a visual inspection of the analyzer and sample system.</p> <p>Check:</p> <ul style="list-style-type: none"> • Instrument air supply • Sample system flows and pressures • Cylinder gas pressures; replace as necessary
Weekly/Monthly	<p>Verify calibrate and calibrate as necessary.</p> <p>Compare resultant chromatograms with those in Data Package.</p> <p>Check/set analytical flows and pressure as necessary per factory data package.</p> <p>Backup controller tables after calibration and/or any changes to system operational parameters.</p>
Monthly/Quarterly	<p>Check carrier line dryers; change as necessary to prevent pressure drop.</p> <p>Check all filters; clean or replace as necessary.</p> <p>Inspect analytical valves for wear and proper operation; replace as necessary.</p> <p>Check physical condition of analyzer for corrosion, rust, etc.; take corrective action as necessary.</p>

Fig. 4.1. Maintenance Schedule

4.2.1 Gas cylinder replacement

When you use two cylinders to supply a gas, connect the cylinders in an automatic switchover configuration to ensure continuous flow to the analyzer when replacing an exhausted cylinder. In this configuration, the second cylinder switches in automatically when the first cylinder is exhausted (100 psig or less). When your inspection indicates an exhausted cylinder, replace the cylinder with another containing the specified gas.

When you use a single cylinder to supply a gas, check the cylinder regularly and replace it when the pressure falls below 100 psig, using another cylinder containing the specified gas.

4.2.2 Cleaning



Prior to cleaning the analyzer, turn off the power to the unit. Avoid using chemical agents which might damage the component parts of the analyzer.

Clean the analyzer as often as environmental conditions require. Accumulation of dirt in certain oven subassemblies can cause overheating and component failure, because dirt on components acts as insulating material preventing efficient heat dissipation.

Remove loose dirt accumulated on the outside of the analyzer with a soft cloth or a small paint brush.

Remove any remaining dirt with a soft cloth dampened in a mild solution of water and detergent. Do not use abrasive cleaners on the analyzer.

Remove dust in the inside of the oven, to eliminate electrical conductivity, and possible short circuits under high humidity conditions.



The best way to clean the interior is to dislodge the accumulated dust with dry, low-velocity air and then remove any remaining dirt with a soft paint brush and vacuum cleaner.

4.3 System backup

Before attempting any maintenance on a PGC5000 Series analyzer confirm a current backup of the operating system and configuration files are available. If unavailable, follow the instructions in the Diagnostics and Troubleshooting section of this manual to complete the process following the procedures in File Management section of the manual.

4.4 USB connectors

The Master Controller contains three Universal Serial Bus (USB) connectors located inside the enclosure on the left side of the Single Board Computer. These connectors are for backup, restore and upgrading the PGC5000 software and firmware (see Figure 4.2).

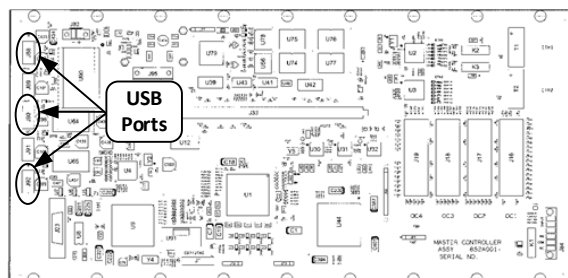


Fig. 4.2. Single Board Computer USB Ports

5 Diagnostics and troubleshooting

5.1 General

This section contains troubleshooting for the PGC5000 Master Controller and attached ovens. The analyzer is equipped with visual indicators allowing the user quick identification and issue resolution.

5.1.1 Power-on self-test

On power up, the main duties of Power-on Self-Test (POST) are handled by the BIOS, which may hand some of these duties to other programs designed to initialize very specific peripheral devices, notably for video and CANBus initialization.

The POST process tests the basic integrity of the analyzer’s boards during every startup cycle. The POST Failure indicator is triggered if any of the process tests fail.

If the analyzer triggers the POST Failure indicator, reboot the Master Controller and watch the Local User Interface (LUI) display screen for “Red” text. The “Red” text reveals the board subsystem having the initialization problem.

5.1.2 Indicator boxes and hex codes

Some functions have associated indicator boxes (diagnostic displays) and hexadecimal (Hex) codes displayed on the Setup Tab>Status sub-tab (see Figure 5.1, which shows the DTC1 screen). The indicator boxes, when filled (black), indicate the named action. The hex codes represent error codes. When submitting an issue to ABB support, always include a screen capture, or record and include the filled indicator boxes and hex codes shown on the display. Include with your report all screens that apply (i.e., Oven, EPC DTC, and zones).

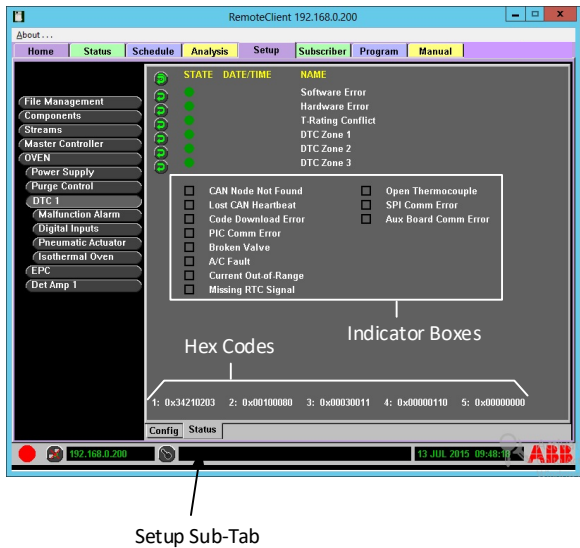


Fig. 5.1. Indicator Boxes and Hex Codes



Not all indicator boxes denote issues with the system, but they represent processes in action.

The following table gives possible issue resolutions where applicable.

Source	Group	Issue	Resolution
Missing Device	Oven	Board did not report to Oven Controller at startup.	Check power to board. Check CAN connections. Contact ABB.
Mismatched Device	Oven	Board identity does not match configuration file.	Contact ABB. Check configuration file.
Inaccessible Device	Oven	Board communication not viable.	Check CAN connection to Wago module. Refer to Wago documentation.
Duplicate Device	Oven	Two devices have the same CAN node ID.	Correct by changing the node ID of one of the duplicate boards.
Extra Device	Oven	A board that responded to the Oven Controller is not listed in the system configuration.	Contact ABB for more information. Remove board.
PIC Comm Error (Hardware Error)	DTC#	DSP and PIC supervisor have stopped communicating.	Replace DTC Digital PCB.
Broken valve (Hardware Error)	DTC#	Valve failed startup test.	Check solenoid block cable. Replace faulty solenoid if problems persist.
AC Fault (Hardware Error)	DTC#	DTC did not detect AC or power to heater failed.	Check AC connections to DTC assembly. T-Rating faults can also cause this symptom.
Current out-of-range (Hardware Error)	DTC#	Internal power test failed.	Check heater(s) to verify proper resistance. Check heater connections.
CAN node not found	DTC#	Device did not communicate with Oven Controller or go online.	Check board LEDs for error.
Lost CAN heartbeat	DTC#	Device stopped communicating.	Check board LEDs for error. Check CANbus.
Code download error	DTC#	Failed to send executable code to device.	Check board LEDs for error.
Unexpected heater voltage	DTC#, Isothermal oven	Internal power test failed.	Can be a result of PIC supervisor shutdown or T-Rating failure. Verify heaters and temperature feedback. Check for other faults.
T-Rating mismatch	DTC#, Isothermal oven	System information does not match DTC internal setting.	Contact ABB.
Low air or carrier pressure	DTC#, Isothermal oven	Air or carrier pressure switch is open.	Verify proper air or carrier pressure and increase if necessary. If pressure is correct, replace switch.
Temperature reading invalid	DTC#, Isothermal oven	DTC unable to read temperature.	Replace temperature probe. Possibly replace DTC Digital Board.
CAN node not found	EPC	Device did not communicate with Oven Controller or go online.	Check board LEDs for error.
Lost CAN heartbeat	EPC	Device stopped communicating.	Check board LEDs for error. Check CANbus.
Code download error	EPC	Failed to send executable code to device.	Check board LEDs for error.
Barometric pressure low	EPC	Status only.	Not applicable.
Barometric pressure high	EPC	Status only.	Not applicable.
Ambient temperature low	EPC	Status only.	Not applicable.
Ambient temperature high	EPC	Status only.	Not applicable.
Zone plateau	EPC, Carrier#	Status only.	Not applicable.

Source	Group	Issue	Resolution
Zone In Band	EPC, Carrier#	Status only.	Not applicable.
Zone Fail Zero	EPC, Carrier#	Possible defective EPC sensor board. Zone zeroed before pressure stabilized at zero PSI.	Correctly zero the zone. Replace EPC sensor as necessary.
Zone Enabled	EPC, Carrier#	Status only.	Not applicable.
CAN node not found	Oven Det. Ampl#	Device did not communicate with Oven Controller or go online.	Check board LEDs for error.
Lost CAN heartbeat	Oven Det. Ampl#	Device stopped communicating.	Check board LEDs for error. Check CANbus.
Code Download Error	Oven Det. Ampl#	Failed to send executable code to device.	Check board LEDs for error.
RTC Failure	Oven Det. Ampl#	RTC signal missing or irregular.	Check CAN connections. Check power and ground connections. Check chassis ground connection to Oven Electronics door.

5.2 Power

If the Master Controller or Ovens do not power on, check for power related problems including external power, fusing, and breaker boxes for possible issues.

5.2.1 Power failure recovery

The Master Controller and Ovens power on, but the schedule does not start. The schedule will not start until the Oven has met the minimal temperature requirements established in the Setup Tab. For more information refer to the Operating Instructions OI/PGC5000, which provides more information on restarts after power failure in the Power Failure setup paragraph of the Schedule Tab section.

5.2.2 Oven LED indicators

Three Light Emitting Diodes (LEDs) located on the left front of each oven indicate the current status of the oven (see Figure 5.2).

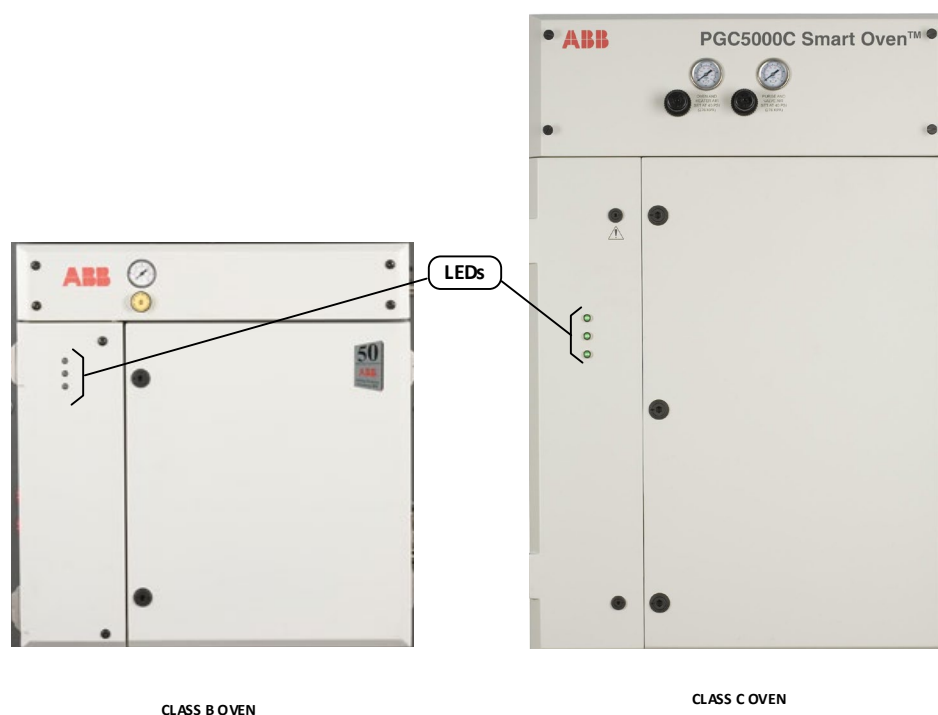


Fig 5.2. Oven LED Location

If the LEDs are not illuminated, check power to the unit. If the top LED is GREEN and flashing, the system is initializing. For all other instances use the table below.

LED	Red	Amber	Green
Top	Oven Idle	Future Use	Executing Analysis
Middle	DTC Malfunction Purge Alarm T-Rating Mismatch/Violation Zone Temp Alarm/Violation Zone Voltage Error	Low Oven Air and/or Carrier Gas Alarm	DTC Operation Normal
Bottom	FID/FPD Flame Out	Future Use	FID/FPD Flame Ignited

5.2.3 System board battery

The System Board Battery is a small rectangular boxed object (“Snap Hat”) located in the middle of the Single Board Computer (SBC) in the Master Controller. In the unlikely event the battery fails, it can be replaced.

Failure symptoms: System Clock resets when system is powered off.

Removal procedures: Place fingers or tool on both sides of the battery. Apply equal force to both sides and pull it away from the SBC.

Installation Procedures: Locate battery connection base on the SBC. Ensure all four connection pins are straight and free of contaminants. Align pins with base, push in firmly.

5.3 Board level light emitting diodes

Most circuit boards installed in the Master Controller and Ovens are equipped with light emitting diodes (LEDs). The LEDs can display ongoing activity (communications, activation, etc.) and some are programmed to display diagnostic error codes.

The displayed activity and error codes are used to troubleshoot or confirm the ongoing functions of the analyzer system. Not all LEDs are assigned blinking response states. They are primarily used for debugging when no user interface is available.

5.3.1 Single board computer

The SBC PCB has eight LEDs, numbered CR1 through CR8 left to right (see Figure 5.3). These LEDs are connected to GPIO pins on the MPC8309 processor and are turned on and off with firmware.

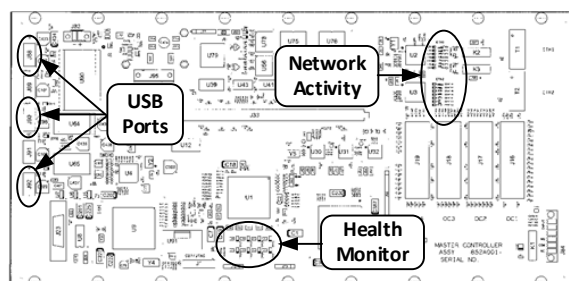


Fig. 5.3. SBC LEDs

The USB Port Activity light identifies activity on the Universal Serial Busses. One is used to connect to the front panel.

The Health Monitor lights display the status of the system (see Figure 5.4).

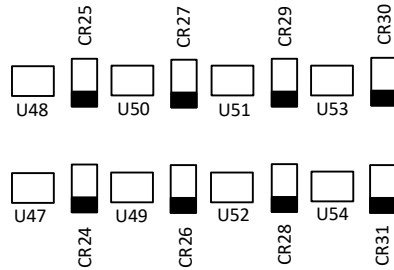


Fig. 5.4. SBC Health Monitor LEDs

The Health Monitor lights are identified as follows:

- CR30 = Health Monitor. 1 Second Blink rate if healthy
- CR24 = Heart Beat. 1 Second Blink rate if controller is alive
- CR26 = Currently interrupt from Oven Controller Board
- CR31 = Red light if error occurred while booting
- CR25,27,29 and 30 = Error code

Boot Phase (see Figure 5.3):

CR31 (lower right) red blinking means error; otherwise should be off. The top row forms error/ progress code:

- 0x01 = initial startup
- 0x02 = finished USB stick reconnoiter for upgrade.bin
- 0x03 = finished USB stick reconnoiter for PGC5000.bin
- 0x04 = finished NAND reconnoiter for PGC5000.bin
- 0x05 = finished loading '.bin' file
- 0x0E = no PGC5000.bin or upgrade.bin located
- 0x0F = start to execute .bin file

System Phase (see Figure 5.3):

- CR24 (lower left) System Task heartbeat green blinking
- CR30 (upper right) Health Monitor heartbeat green blinking
- CR26 (right of CR24) green blinking based upon OC interrupts
- CR31 (lower right) red (if error)
- CR28 (left of CR31) off; the top row forms error code if CR28/CR31 is off/red
 - 0x03 = unable to open Address Space file
 - 0x04 = unable to read a file
 - 0x05 = detected CRC mismatch
 - 0x07 = kernel loader returned error
 - 0x09 = unable to open Executables.txt

Oven Interface (task OCSE) Errors:

- CR31 (lower right) off
- CR28 (left of CR31) red

The top row forms error code if CR28/CR31 is red/off

- 0x06 = code_loader error on OC code file or Executables.txt
- 0x07 = too many TCOFs for DPM method table
- 0x08 = too many entries for DPM ApData
- 0x09 = configuration restriction violated
- 0x0A = insufficient local memory

The Network Activity lights display network activity and configuration. The lights are viewed from top to bottom (see Figure 5.5).








CR3		Full duplex
CR2		10 Megabit
CR4		Link
CR5		Transmit
CR6		Receive
CR1		100 Megabit
CR7		Collision

Fig. 5.5. Network Connectivity Indicator Lights

5.3.2 Oven controller pcb

There are four large LEDs at the top, front edge (closest to the front door) of the Oven Controller (OC) PCB, arranged in a 2 by 2 square as shown in Figure 5.6:

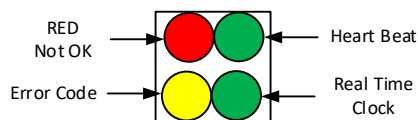


Fig. 5.6. Oven Controller PCB Communication Indicators

Upper right:	Green – heartbeat that blinks being lit more than off at about once per second
Lower right:	Green – blinks whenever a RTC signal is present; blinks faster when a method is active
Lower left:	Amber – blinks slowly after power-up while the oven devices are being downloaded code
Upper left:	Red – turns on when an error occurs; if heartbeat is blinking, then red indicates a loss of the life indicator from the master controller; it will turn off if the Master Controller recovers.

Errors during startup will blink the lower left LED with a code that can be counted between pauses:

- 1 No initialized DPM
- 2 Unable to create virtual clock
- 3 Unable to create DPM exception handler
- 4 Unable to initialize RTC
- 5 Unable to create tasks
- 6 CAN comm error (not reliable)
- 7 Miscellaneous startup error
- 8 CAN asynchronous receive error
- 9 RTC asynchronous receive error
- 10 Error trying to start remote CAN node
- 11 Error during shutdown

When power is applied to the board, via the system power, the lower pair alternately blink for a few seconds indicating the bootloader is functioning and loading the oven controller code from the master controller. If the bootloader fails, the two LEDs will blink in unison five times and stop with an error code:

Off	Green	Invalid code size
Amber	Off	No code file
Amber	Green	No initialized DPM

Six small LEDs on the populated side of the Oven Controller PCB reflect CAN activity. CAN A refers to the oven fiber CANBus; CAN B refers to the optional electrical CANBus; CAN C refers to the optional fiber CANBus. Under normal operation

these LEDs blink green; they may appear solid during heavy traffic. If a CAN communication error is detected, an LED will turn red.

CR2	CAN A transmit
CR4	CAN A receive
CR6	CAN B transmit
CR8	CAN B receive
CR11	CAN C transmit
CR13	CAN C receive

On the unpopulated side of the Oven Controller PCB, CR9 is a small green LED which when lit, means the OC is in a hold state. The OC PCB comes up in this state. Once the Master Controller initializes the DPM between the two, the Master Controller will release the OC PCB, at which time CR9 will go off.

5.3.3 DTC digital pcb, version 1

The DTC digital board has four LEDs (CR1 to CR4) on the upper edge, beside the solenoid cable connector, as shown in Figure 5.7. They are numbered from left to right.

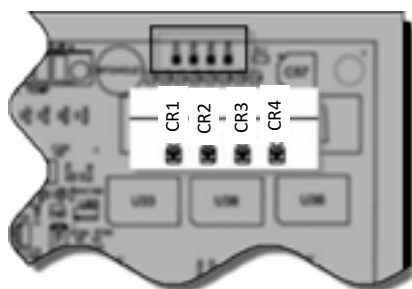


Fig. 5.7. Location of DTC Digital Board LEDs

Their normal operation indications are:

CR1:	Green, blinking more on than off once per second (heartbeat.) Amber, blinking. The bootloader operation is executing.
CR2:	Green, blinking, rapid rate (noticeably faster than CR1); indicates method executing and Real Time Clock signal present. Amber, blinking, slow rate. No method executing and an RTC signal is present.
CR3:	Green, solid: AC power present at the DTC analog board. Red, solid: no power detected. Example: A T-rating error will shut down control and disable power resulting in a red LED.
CR4:	Off during normal operation.

On the Power-up Cycle, the four LEDs indicate the processes attempted if the DSP fails (none are blinking):

CR1	CR2	CR3	CR4	
off	red	off	off	CAN initialization error
off	amber	off	off	application initialization error
red	red	off	off	CAN node/network setup error
green	red	off	off	no other node on CAN bus
amber	red	green	off	programming failed during last power-up
amber	amber	green	off	watchdog timeout during last power-up
red	off	green	off	power-up state chip inaccessible
red	amber	green	off	invalid power-up state
red	amber	off	off	reload in progress
off	off	green	off	start hardware setup
off	green	off	off	bootloader CAN setup
off	off	amber	off	DSP initialization
red	amber	red	off	EEPROM access error
off	off	red	off	bootloader initialization
off	amber	amber	off	CANopen setup

amber	off	off	off	temperature zone setup
amber	off	amber	off	temperature conversion setup
amber	amber	off	off	A/D converter setup
amber	amber	amber	off	number valves detection
off	amber	red	off	reload CANopen from EEPROM
off	red	red	off	CAN PDO setup
red	off	red	off	start DTC initialization
red	red	off	off	valve testing and initialization
red	red	red	off	safety switch testing initialization
amber	off	green	off	PIC initialization
amber	off	red	off	signal testing initialization
amber	amber	green	off	purge testing initialization
amber	amber	red	off	miscellaneous initialization

CR3 is set red and CR4 is set amber upon receiving an NMT reset command from the OC. If the DSP can successfully reset, all the LEDs will be turned off and then altered again during normal execution.

Specific CR4 functions: After the DTC becomes operational, unhandled interrupts might occur. These are reflected by a staying solid red or blinking CR4.

A blinking red CR4 will blink for a count, pause, and then blink repeat the count again (continuously). Count the blinks between pauses and determine the cause using the following list:

<u>Blinks</u>	<u>Source</u>
1	(unused)
2	(rfu)
3	non-maskable
4	illegal operation
5	data logger
6	RTOS
7	Emulation
8	CPU timer 1
9	CPU timer 2

When a solid re CR4 occurs, the status of CR1 through 3 identify the interrupt source:

<u>CR1</u>	<u>CR2</u>	<u>CR3</u>	<u>CR4</u>	<u>Source</u>
off	off	amber	red	INT1.x
off	amber	off	red	INT2.x
off	amber	amber	red	INT3.x
amber	off	off	red	INT4.x
amber	off	amber	red	INT5.x
amber	amber	off	red	INT6.x
amber	amber	amber	red	INT7.x
off	off	red	red	(rfu)
off	red	off	red	(rfu)
off	red	red	red	reprogram flash memory
red	off	off	red	erase flash memory
red	off	red	red	user trap
red	red	off	red	test
red	red	red	red	misc. disabled source
green	green	red	red	SCI-A RX
green	red	green	red	SCI-A TX
green	red	red	red	SCI-B RX
red	green	green	red	SCI-B TX
red	green	red	red	eCAN 0
red	red	green	red	eCAN 1

5.3.4 DTC digital pcb, version 2

This DTC digital PCB has eight LEDs (CR1 to CR8) on the upper left-hand edge for basic troubleshooting. CR1 through CR6 are Green; CR7 and CR8 are Red. Their display condition (On, Off, Solid or Blinking) indicates the board state.

CR1: Green, Blinking	Blinks when the downloaded code is running.
CR2: Green	Indicates method execution in progress.
CR3: Blinking	RTC signal is detected.
CR4: Blinking	AC Power present.
CR5: Blinking	PIC communication present..
CR6: Blinking	During Initial Power on
OFF	Application code running.
CR7: Blinking	T-Rating Error
Blinking (unison CR1)	No power to DTC board
CR8: OFF	Normal Operation

If the Digital Signal Processor (DSP) system fails during power-up, the LED bank indicates what was being attempted. No green LEDs (CR1 to CR6) are blinking and CR7 and CR8 are off. CR1 (MSB) through CR6 form a binary code as follows:

000001	CAN initialization error
000010	application initialization error
000011	CAN node/network setup error
000100	no other node on CANBus, still trying
000101	CAN and application timer engaged
000110	reload in progress
000111	CAN disabled, reload jumping to start over
001000	bootloader initialization
001001	bootloader CAN setup
001010	bootloader start hardware setup
001011	bootloader end hardware setup
001100	bootloader received reset application
100001	bootloader flash erase in progress
110011	bootloader flash program in progress
111111	bootloader flash program complete
001110	start board setup
001111	start DSP initialization
010000	end DSP initialization
010001	Analog/Digital initialization
010010	temperature zone setup
010011	temperature conversion setup
010100	number valves detection
010101	end board setup
010111	start DTC initialization
011000	valve initialization
011001	safety switch initialization
011010	PIC initialization
011011	signal testing initialization
011100	purge testing initialization
011101	miscellaneous initialization
011110	end DTC initialization
100000	start setup CANopen
100001	CAN PDO setup
100010	end setup CANopen
100100	solenoid start initialization
100101	solenoid access
100110	solenoid test
100111	solenoid reverse test
101000	solenoid test complete
101001	solenoid end initialization
101111	received reset application

If CR7 remains solid red and CR8 is OFF, an unexpected fatal condition occurred. CR1 (MSB) through CR6 form a binary code as follows indicating the error:

000001	flash erase error
000010	flash write error
000011	powerfail interrupt
001000	no viable CANbus detected after 10 tries
001001	no auxiliary board detected

If CR7 and CR8 stay solid red (after the Digital Temperature Controller is operational) an unhandled interrupt has occurred. CR1 (MSB) through CR6 form a binary code indicating the error as follows:

000001	INT1.x
000010	INT2.x
000011	INT3.x
000100	INT4.x
000101	INT5.x
000110	INT6.x
000111	SCI-A RX
001000	SCI-A TX
001001	SCI-B RX
001010	SCI-B TX
001011	eCAN 0
001100	eCAN 1
001101	user trap
001110	PIE_RESERVED
001111	rsvd_ISR
010000	CPU timer 1
010001	CPU timer 2
010010	data logger
010011	RTOS
010100	emulation
010101	non-maskable
010110	illegal operation

Other LEDs also indicate various procedures, as noted on the previous figure, occurring via the board and are noted below:

CR10:	Green. Blinking	CANBus active.
CR12:	Green, Blinking	CANBus active.
CR13:	Red, blinking	Power to zone 2 heater.
CR14:	Red, blinking	Power being applied to zone 3 heater.
CR15:	Red, blinking	Power being applied to zone 4 heater.
CR16:	Red, blinking	Power being applied to zone 5 heater.
CR17:	Red, blinking	Power being applied to zone 1 heater.
CR18:	Red	PIC has enabled the main heater switch.
CR20:	Green	DSP power voltages good
	Red	DSP Power issue

5.3.5 Detector CANbus node identification

The Detector CANbus node identification is set at the factory by jumpers per ABB Bulletin 851J003. This bulletin is supplied with all replacement detector amplifiers. The bulletin covers all jumper settings required for any detector amplifier. To ensure correct jumper settings are applied to the new detector amplifier, take a picture of the original detector amplifier and reference this picture when applying jumpers to the new board.

5.4 Indicator troubleshooting procedures

Most system errors are identified by the Condition Monitoring System, resulting in indicator activation. If an indicator is placed in one or more of the user defined Status Tab scopes, it reflects in the Master Rollup Indicator located at the bottom left corner of the Local User Interface (LUI) or Remote Client display (see Figure 5.8).

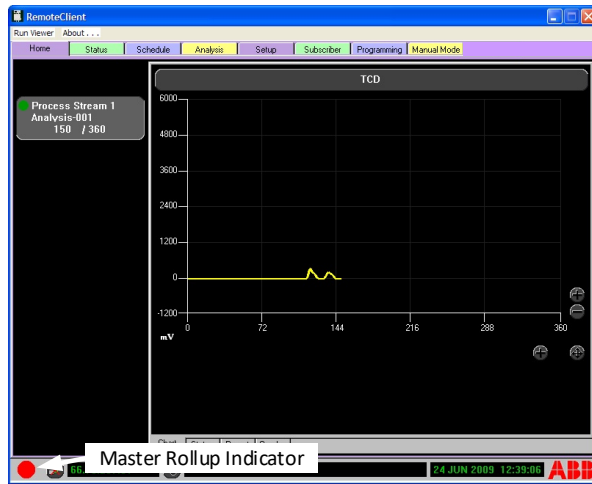


Fig. 5.8. Master Rollup Indicator Location

5.4.1 Identifying issues

Use the following steps to identify issues.

1. If the Status Indicator is RED, YELLOW or BLUE (triggered), select the Home Tab and note the running analysis button.
2. If an analysis button indicator light is not GREEN, select the analysis button; then the Status sub-tab; locate the triggered indicator(s); identify the issue. Refer to the Status Indicator table in this section for issue resolution.
3. If all analysis button indicators are GREEN, go to the Status Tab. Check the scope sub-tabs (located at the top of the display) for triggered indicators.
4. Select the scope displaying the triggered indicator; locate the activated indicator(s); refer to the Status Indicator table later in this section for issue resolution.



Some Status Scopes have multiple sub-scopes to choose from or may require using the 'Page Down' icon to view all indicators.

If not assigned to a scope, a "Triggered" Indicator on the Status Tab, (displaying red, yellow or blue) is not reflected at the Status Indicator. It maintains a green (good) status.

5.4.2 Correcting issues

Correct an issue by removing the condition which triggered the indicator. This includes removal and replacement of PCBs, adjusting parameter limits or simply acknowledging the indicator by using the reset button.



If the triggering condition still exists, the indicator will re-trigger after pressing the reset button.

5.5 Status indicators

The following table lists all available indicators under the Status Tab>All sub-tab. This table describes the triggering condition and resolution to clear the condition. Where more than one indicator may be present a range is given (e.g., 1-4). Refer to the Glossary section for abbreviation explanations.

Column	Description
Indicator:	"Name" listed on Status Tab screen
Issue:	Possible problem triggering indicator
Reset:	Displays the means of reset. The 'Absence of Condition' (AOC) is the most common. If an indicator is marked HOLD, the AOC becomes manual reset.
Source:	"Group," listed on Status Tab screen, is the most likely origin of the triggering condition.

INDICATOR	ISSUE	RESOLUTION (CHECK & CORRECT)	RESET	SOURCE
Power Fail	MC recovers from power failure	Reset indicator at Status Tab	Manual	MC
POST failure	Power On Self-Test fails Displays RED text on MC screen	Cycle power. If POST error persists, note error and contact ABB Support.	AOC	MC
Network Comm Failure	Communication to an Active Subscriber fails	Subscriber comm path incomplete, IP address correct. Subscriber is powered off. Routing tables (if applicable)	AOC	MC
Purge Alarm MC	Purge failure	Correct purge issue (if installed)	AOC	MC
Comm Failure Oven 1-4)	Oven Controller (OC) # CANBus Communication fails between OC board and oven (s) or the SBC fails to initiate the OC.	Power to board. CAN connections at oven. Fiber connections at oven. Oven Controller Board. OCB termination. Power down Master Controller and re-seat OC. Possible bad OC.	AOC	MC
Software Error	Software Faults at the OC Rollup	Check Oven Group Indicators to refine search.	AOC	Oven#
DTC Failure	Roll up of all DTC indicators	Check oven.DTC Group Indicators for more information.	AOC	Oven#
EPC Failure	Rollup of all EPC indicators	Power on board. CANbus connections. Check oven.EPC indicators for more Information.	AOC	Oven#
DET Failure	Roll up of all detector indicators	Check oven.det indicators for more information.	AOC	Oven#
Purge Fail Oven	Purge fails for this zone	Correct purge issue (if installed).	AOC	Oven#
Extended I/O Fault	Error Condition detected on the External I/O controller	Refer to external I/O and OC documentation.	AOC	Oven#
Software Error	Roll up of software faults at the DTC	Check the DTC and DTC Zone indicators.	AOC	OVEN.DTC1

INDICATOR	ISSUE	RESOLUTION (CHECK & CORRECT)	RESET	SOURCE
Hardware Error	Roll up of all DTC indicators	Check oven.DTC Group Indicators for more information.	AOC	OVEN.DTC1
T-Rating Conflict	DTC -Rating does not match As-Built T-Rating	Possible configuration error; contact ABB for more information.	AOC	OVEN.DTC1
DTC Zone (1-3)	Temperature zone fault	Check Oven.DTC#.Tz.# indicators for more information.	AOC	OVEN.DTC1
Temperature Sensor Fault	RTD or thermocouple reading out of range	Measure resistance of RTD with one lead disconnected; should measure about 425 ohms at room temperature. Replace as necessary. Disconnect TC and use a TC tested to verify proper operation of the TC. Replace as necessary. Refer to oven wiring diagram for RTC and TC connections.	AOC	Oven.DTC#.Tz.#
Over Temp	Zone temperature exceeded oven T-rating	Defective temperature sensor. Check temperature probe as described in Over Temp Resolution in this section. Contact ABB for more information.	System power MUST be cycled to clear fault.	Oven.DTC#.Tz.#
Low Temp	Temperature out of range (low)	Check setting at Setup Tab>Oven>DTC# Button. Adjust as needed.	AOC	Oven.DTC#.Tz.#
High Temp	Temperature out of range (high)	Check setting at Setup Tab>Oven>DTC# Button. Adjust as needed.	AOC	Oven.DTC#.Tz.#
Out of Control	Temperature deviates > $\pm 10^{\circ}$ from setpoint	Check analysis temperature control TCF settings. Check zone indicators and Diagnostic Displays.	AOC	Oven.DTC#.Tz.#
Ramp Out of Control	Temperature deviates > $\pm 10^{\circ}$ from setpoint during Temperature Ramp	Check analysis temperature control TCF settings. Check zone indicators and Diagnostic Displays.	AOC	Oven.DTC#.Tz.#
DTC Digital Input 1	Low oven purge air pressure. Open on alarm.	Check purge pressure settings at oven's front panel gauge. Adjust as necessary. Check instrument air supply pressure. Check oven gauge pressure switch.	AOC	Oven#DTC#.1
DTC Digital Input 2	Differential Pressure Sensor	Check purge pressure settings at oven's front panel gauge. Adjust as necessary. Check instrument air supply pressure. Check oven gauge pressure switch. Ensure all oven doors are closed and secure.	AOC	Oven#DTC#.2
DTC Digital Input 3	Temperature Programmed Oven Purge Air Pressure	Check purge pressure setting at oven's front panel gauge. Adjust as necessary. Check instrument air supply pressure. Check oven purge pressure switch.	AOC	Oven#DTC#.3
DTC Digital Input 4-14	Optional hardware inputs. Open on alarm or action request input.	Verify input is functioning properly.	AOC	Oven#DTC#.4-14

INDICATOR	ISSUE	RESOLUTION (CHECK & CORRECT)	RESET	SOURCE
DTC Digital Input 15	Electronic Section Purge Alarm Input	Check purge pressure setting at oven's front panel gauge. Adjust as necessary. Check instrument air supply pressure. Check oven purge pressure switch. Ensure all oven doors are closed and secure.	AOC	Ovn#DTC#.15
DTC Digital Input 16	Purge Alarm Override	Verify input device is functioning properly.	AOC	Ovn#DTC#.16
Alarm Relay Override	Open input overrides the common alarm output.	Verify proper operation of common Alarm override switch.	AOC	Ovn#DTC#.D1
Software Error	Roll up of software faults at the DTC	Check the EPC and EPC Group Zibe more information.	AOC	Ovn#.EPC
Hardware Error	Roll up of detector diagnostics at the EPC	Check the EPC and EPC Group Zibe more information.	AOC	Ovn#.EPC
EPC Zone (1-10)	Rollup of Zone (1-10) Indicators	Check EPC Zone specific indicators and correct as necessary.	AOC	Ovn#.EPC(1-10)
Prsr Sensor Fault	Defective pressure sensor	Replace pressure sensor if needed.	AOC	Ovn#.EPC.PZ.#
Low Pressure	Pressure out of range (low) Zone's inlet filter plugged	Adjust pressure zone's low limit under the Setup Tab. Verify supply pressure to the zone. Correct as necessary. Replace EPC sensor or solenoid valve as necessary. Replace as necessary. Leak check analyzer and supply lines.	AOC	Ovn#.EPC.PZ.#
High Pressure	Pressure out of range (high)	Adjust pressure zone's high limit under the Setup Tab. Replace EPC sensor or solenoid valve as necessary.	AOC	Ovn#.EPC.PZ.#
Out of Control	Pressure deviates $\geq \pm 3.575$ psi from setpoint Possible leak	Check analysis pressure control TCF settings. Check Zone indicators and Diagnostic Displays. Leak check analyzer	AOC	Ovn#.EPC.PZ.#
Ramp Out of Control	Pressure deviates $\geq \pm 3.575$ psi from setpoint during Pressure Ramp	Check analysis pressure control TCF settings. Check Zone indicators and Diagnostic Displays.	AOC	Ovn#.EPC.PZ.#
Software Error	Rollup of software faults at the Det Amp	Check indicators and diagnostic Displays at Detector Amplifier	AOC	Ovn#.DTM#
Hardware Error	Rollup of detector indicators	Check detector indicators for more information and Diagnostic Displays at Detector Amplifier.	AOC	Ovn#.DTM#
Detector Fault	TCD Master Digital board has detected a fault	Detector amplifier fault. Replace amplifier assembly.	AOC	Ovn#.DTM#.TCD.#
Flame Out	FID or FPD flame not detected	Check utilities, igniter including fuel, burner, connection. Verify flows, burner air.	AOC	Ovn#.DTM#.FID/FPD#
Autoignite Limit	Retry of Automatic Ignites has been exceeded	Check utilities, igniter including fuel, burner, connection. Verify flows, burner air.	AOC	Ovn#.DTM#.TCD.#
Autzero Conflict	Autozero attempted during peak measurement	Move autozero TCF to a time into analysis when a component is not being measured.	AOC	Ovn#.DTM#.TCD.#
Offline (Configured Streams)	Stream in offline state	Information Only.	AOC	Stream

INDICATOR	ISSUE	RESOLUTION (CHECK & CORRECT)	RESET	SOURCE
Low-Low Concentration	Concentration is below Low-Low Setpoint	Information Only. Adjust Limits under the Setup tab as needed.	When reported.	Component
Low Concentration	Concentration is below Low Setpoint but above Low-Low Setpoint	Information Only. Adjust Limits under the Setup tab as needed.	When Reported	Component
High Concentration	Concentration exceeds the High Setpoint but below High-High Setpoint	Information Only. Adjust Limits under the Setup tab as needed	When reported	Component
High-High Concentration	Concentration exceeds the High-High Setpoint	Information Only. Adjust Limits under the Setup tab as needed	When reported	Component
RF Low Limit	Calculated response factor out of range (low) (% of deviation from previous RF)	Information Only. Adjust Limits under the Setup tab as needed.	When recalibrated	Component
RF High Limit	Calculated response factor out of range (high) % of deviation from previous RF)	Information Only. Adjust Limits under the Setup tab as needed	When recalibrated	Component
Retention Time Low	Retention time is below Low Setpoint	Information Only. Adjust Limits under the Setup tab as needed.	When Reported	Component
Retention Time High	Retention time exceeds High Setpoint	Information Only. Adjust Limits under the Setup tab as needed. Possible leak. Possible defective EPC pressure sensor. Possible plugged inlet filter.	When reported	Component
Validation	Measurement out of range (% of deviation from known standard)	Information Only. Adjust Limits under the Setup tab as needed. Flows incorrectly set. Defective EPC sensor.	Wen revalidated	Component
Missing Component	No peak found matching a component defined in the analysis	Information. Edit analysis as needed.	When reported	Analysis
Unknown Component	Peak detected in the analysis and not defined in the method	Check flows. Verify correct operation of all analytical valves. Verify sample flow to oven.	When Reported	Analysis
Sample Flow Lost	Future functionality: Sample flow is lost	Restore Sample flow. Replace sample flow switch as necessary	AOC	Analysis
Digin Check TCF	Programmable Input checks	See Digital inut TCF in Operating Instructions.	AOC	Analysis
Psrs Check TCF	Pressure Check failed	See pressure check TCF in Operating Instructions.	AOC	Analysis
Invalid Analysis	Analysis failed validation	1. From Analysis tab edit Analysis to meet requireemnts. 2. User controlled.	AOC	Analysis
Analysis Aborted	1. Analysis does not complete analysis due to temperature, pressure and/or digital input programmed command. 2. User intervention using Stop Now command. 3. Related oven issues.	1. Check Pressure, Temperature and/or Digital Inputs. Correct problem accordingly. 2. User controlled. 3. Check oven related indicators for more information.	AOC	Analysis
Offline	Schedule Offline: Oven is powered down	Information Only. Resets when oven power is restored.	AOC	Schedule
Idle	Schedule Stopped or paused	Information Only.	AOC	Schedule

INDICATOR	ISSUE	RESOLUTION (CHECK & CORRECT)	RESET	SOURCE
Calibrating	Schedule running an analysis on Calibration Stream	Information Only.	AOC	Schedule
Validating	Schedule running an analysis on a Validation Stream	Information Only.	AOC	Schedule
Script Not Found	Script specified in TCF cannot be located	Ensure Script is in the Script library.	Next Run	Script
Missing Report	Script cannot find the report to be modified	Edit the analysis under the Analysis tab. Script tCF must have a time greater than the analysis cycle time.	Next Run	Script
Run Time Exceeded	Script exceeded allotted runtime	From Programming tab, check script logic, increase Max Runtime variable.	Next Run	Script
User Error #1 – 10	Script Asserts Error #1 – 10	User programmable indicators. Information Only.	Next Run	Script
Node Loss	Device no longer reachable on SHS CANbus	Check cables and communication path on SHS CANbus.	AOC	SHS
New Node	Device added to SHS CANbus	Information Only.	AOC	SHS
Address Conflict	Two devices with same address on SHS CANbus	Check SHS Node ID on device.	AOC	SHS
Invalid State	Combination of valve states not allowed	Correct Valve conflicts.	AOC	DVM
Vol Flow Low Low	Volumetric Flow lower than Low Low Limit	Information Only.	AOC	ARV
Vol Flow Low	Volumetric Flow lower than Low Limit	Information Only.	AOC	ARV
Vol Flow High	Volumetric Flow exceeds High Limit	Information Only.	AOC	ARV
Vol Flow High High	Volumetric Flow exceeds High High Limit	Information Only.	AOC	ARV
Pressure Low Low	Pressure lower than Low Low Limit	Information Only.	AOC	ARV
Pressure Low	Pressure lower than Low Limit	Information Only.	AOC	ARV
Pressure High	Pressure exceeds High Limit	Information Only.	AOC	ARV
Pressure High High	Pressure exceeds High High Limit	Information Only.	AOC	ARV
Temp Low Low	Temperature lower than Low Low Limit	Information Only.	AOC	ARV
Temp Low	Temperature lower than Low Limit	Information Only.	AOC	ARV
Temp High	Temperature exceeds High Limit	Information Only.	AOC	ARV
Temp High High	Temperature exceeds High High Limit	Information Only.	AOC	ARV
Vol Flow Low Low	Volumetric Flow lower than Low Low Limit	Information Only.	AOC	FastLoop
Vol Flow Low	Volumetric Flow Lower than Low Limit			

INDICATOR	ISSUE	RESOLUTION (CHECK & CORRECT)	RESET	SOURCE
Vol Flow High	Volumetric Flow exceeds High Limit	Information Only.	AOC	FastLoop
Vol Flow High High	Volumetric Flow exceeds High High Limit	Information Only.	AOC	FastLoop
Pressure Low Low	Pressure lower than Low Low Limit	Information Only.	AOC	FastLoop
Pressure Low	Pressure lower than Low Limit	Information Only.	AOC	FastLoop
Pressure High	Pressure exceeds High Limit	Information Only.	AOC	FastLoop
Pressure High High	Pressure exceeds High High High Limit	Information Only.	AOC	FastLoop
Temp Low Low	Temperature lower than Low Low Limit	Information Only.	AOC	FastLoop
Temp Low	Temperature lower than Low Limit	Information Only.	AOC	FastLoop
Temp High	Temperature exceeds High Limit	Information Only.	AOC	FastLoop
Temp High High	Temperature exceeds High High High Limit	Information Only.	AOC	FastLoop
Loop DP Low Low	Loop Differential Pressure lower than Low Low Limit	Information Only.	AOC	FastLoop
Loop DP Low	Loop Differential Pressure lower than Low Limit	Information Only.	AOC	FastLoop
Loop DP High	Loop Differential Pressure exceeds High Limit	Information Only.	AOC	FastLoop
Loop DP High High	Loop Differential Pressure exceeds High High High Limit	Information Only.	AOC	FastLoop



“#” is used in place of numbers to eliminate repeats in multiple card and oven systems. "Information Only" signifies the set indicator is activated in response to the setup criteria. It does not necessarily identify a fault.

5.6 Operation troubleshooting

This subsection provides troubleshooting information by category. Included in this information are symptoms, causes, and suggestions for further fault isolation.

5.6.1 Baseline noise

The baseline (detector signal) with no sample injection appears as noise similar in appearance to “grass” on a two dimensional drawing in the graphics display. The baseline is observed on the Manual Mode tab of the Master Controller.

Cause: Baseline or detector noise can result from contaminated carrier, makeup gas, tubing or regulators. This type of contamination is much less pronounced with a TCD than for an FID. Other causes include defective filaments (TCD), detector wiring, or electrical noise in the detector electronics or power supplies.

Check the background level by going to the Setup Tab>FID button and with the flame lit manually, AUTO ZERO the baseline. (The AUTO ZERO OFFSET for an FID should be > 10 mv.)

5.6.2 Baseline or signal offset

The baseline (detector signal) is continually offset to the positive or the negative with no short term drift up or down scale.

Causes:

1. Incorrect temperatures. Inspect temperature settings and correct if necessary.

2. Contaminated or missing carrier gas, hydrogen fuel or burner air. Verify the supplied cylinders are analytical grade. Replace cylinders one at a time; activate the pressure zones and relight the flame. Observe the baseline to isolate possible contaminated cylinder. Replace cylinder as necessary.
3. Contaminated tubing (normally a startup issue). Locate supply cylinders as close as possible to the analyzer. Connect them using a clean piece of tubing. Activate the pressure zones and relight the flame. Observe the baseline to isolate possible contaminated tubing. Replace tubing as necessary.
4. Leaks. Pressure test supply lines from the source to the analyzer and pressure test the analyzer. Correct leaks as necessary. Activate the pressure zones and relight the flame. Observe the baseline on the Manual Mode tab to verify noise issue has been resolved.
5. Contaminated FID assembly. The FID may become contaminated due to flooding columns with liquid hydrocarbons or running analyses with the flame out for long periods of time.
6. FID electrical failure. Disconnect the coaxial cable at the FID Amplifier assembly. Observe the baseline on the Manual Mode tab. If baseline noise is not present, replace the coaxial cable. If it is still present reconnect the coaxial cable. Replace the FID Amplifier assembly.
7. TCD detector balance. If the detector is not balanced between the reference and measurement filaments, balance is needed.
8. TCD filament failure. Replace the filaments.
9. FPD baseline characterized by random noise and/or spikes. FPD noise is generally the result of electrical noise or contamination.

5.6.3 No peaks

This generally indicates that either no sample was injected, or the injected sample is not being detected or processed.

No peak detection could be caused by any one of the following:

1. No sample flowing to the sample valve. Verify sample is flowing to the sample valve.
2. No carrier gas supplied to the analyzer. Verify air supply pressure and replace bottle as necessary.
3. No air to the sample valve actuator. Verify air supply pressure and replace bottle as necessary.
4. Baseline offset is extreme. Check for contaminated carrier, fuel and bottle, as necessary.
5. Column broken or connection in the column train is disconnected. Replace or reconnect column. Leak check analyzer and set flows.
6. Low zone temperatures. Check system indicators for more details.
7. Analysis entries. Review analysis and correct as necessary.
8. Sample valve failure. Manual verify that valves are operating. Manually verify that solenoid valves are operating. Service valves or replace solenoid as applicable. Replace DTC Master Digital.
9. Failed Detector Amplifier PCB.

5.6.4 Double sampling

The chromatogram peaks appear to have double apexes. The trailing peak apex is generally smaller than the leading one due to the first having the greater sample size. Double sampling issues are isolated to the sample valve. Generally the first injection occurs when the valve is turned on (valve stem inserted into the injection chamber). The second injection is made when the valve is turned off (the valve stem is withdrawn from the injection chamber).

Cause: Worn liquid sample valve. Service the liquid sample valve.

5.6.5 Mystery peaks

Chromatograph displays extra peaks or a noted difference in composite chromatograph appearance from that of the calibration.

Cause: If only present on calibration sample and not on process, verify that the correct calibration and proto fuel samples are being analyzed. Possibly a new calibration blend has been installed that contains a blending error. Perhaps the wrong calibration sample has been selected or incorrect analysis is attached to it.

If mystery peaks are present on all process or calibration samples, the analyzer is experiencing a sampling problem. The sample valve seals may be leaking. The sample valve may be double sampling (see "Double Sampling"). The sample stem may be scratched or deformed. Peaks may also be originating from a previous analysis cycle.

Check to ensure correct process stream is aligned with sample system.

5.6.6 Individual peak missing on report

Chromatogram indicates all peaks are present; however, the data report shows the peak to be nonexistent or unknown.

The gating in the method needs to be modified to ensure gating of the missing peak in the report. This can be done by modifying the gate ON/OFF time in the method table.

5.6.7 Chromatogram oversized or off scale

The chromatogram or peak areas are excessively large.

Causes;

1. Wrong carrier gas. Verify the correct carrier gas is being used.
2. Splitter out of adjustment (liquid sample). Adjust splitter (if installed) per factory data sheet as necessary.
3. Sample size too large (vapor sample). Manually verify block and bleed valves are functioning, if applicable; correct as necessary. Verify the analyzer's sample vent is not restricted. Verify sample flow into analyzer is correct.

5.6.8 Variable sample size

Variable sample size can cause a non-repeatability of peak concentrations if the peak area is varying.

Causes:

1. Fluctuating sample size (liquid sample): Verify sample flow to analyzer. Verify sample is single phase. Verify splitter vent is unrestricted.
2. Fluctuating sample size (vapor sample): Verify block and bleed valve vent is unrestricted, if applicable. Verify sample vent pressure is not fluctuating. Verify sample flow to analyzer is not fluctuating. Verify sample flow to analyzer is correctly set to 100 ml maximum. Possible leak in sample inject valve.

5.6.9 Variable retention times

Variable retention times can result in non-repeatability.

Causes:

1. Varying Carrier flow rate. Verify instrument air is per specification. Check oven indicators for more details. Monitor oven purge pressure. Possible defective air purge regulator.
2. Varying oven temperature. Verify instrument air is per specification. Check oven indicators for more details. Monitor oven purge pressure. Possible defective air purge regulator
3. Leak in column train. Leak check analyzer.
4. Contact the ABB factory for assistance in testing the functionality of the EPC Proportional Valves as well as Pressure Sensors in the EPC block.

5.6.10 Reduced peak size

The chromatogram or peaks have reduced in size from that of a previous analysis.

Causes:

1. Wrong carrier gas. Verify the correct carrier gas is being used.
2. Excessive sample splitting (liquid sample). Verify splitter vent flow is per factory data sheet.
3. Sample size too small. Residue in the LSV stem's sample groove (liquid sample); service LSV. Verify sample flow to analyzer coating on walls of the sample loop (vapor sample); clean or replace sample loop.
4. Detector gain (TCD only). Check detector gain jumper and adjust if necessary. Replacement TCD may not be correctly jumpered. Compare jumpers to original TCD and correct as necessary.
5. Check that there are no leaks present on the valves and all make/break connections.
6. Inspect CP Valve sliders (if installed) for scratches and grooves.

5.6.11 Loss of power

If X purge system is installed, analyzer power will be removed and cannot be restored until purge air is restored.

Causes:

1. Air supply shut off.
2. Purged areas have leaks. Leak check with leak detector.
3. Purge air switches are defective. Replace purge switches.

4. Purge, atmospheric vents plugged. Inspect and clear vents.
5. Tubing to and from pressure switches leaking or disconnected. Inspect and replace if necessary.
6. Purge orifice is obstructed. Remove obstruction.

5.6.12 Flame out led on (flame will not ignite)

Flame Out LED on and continued attempts to light the flame have failed..

Causes:

1. Insufficient burner fuel and/or air. Check flows.
2. Plugged vent line. Check cell vent for restriction. Possible plugged breather assembly.
3. Defective igniter.
 - a. Measure resistance of the igniter at TB16 pins 3 and 4; it should be less than one ohm. Replace as necessary.
 - b. Measure voltage at TB16 pins 3 and 4 with igniter turned on; 2.0 VAC indicates an open igniter, 1.5 to 1.6 VAC indicates a good igniter.
 - c. 0 VAC indicates an electrometer problem or the electrometer is not receiving the ignite signal from the A/D board.
4. Incorrect flame out indication. Measure thermocouple voltage at TB16 pins 1 and 2 on the electrometer PCB. With the flame lit the reading should be greater than 2.5 mv.
 - a. If the voltage is greater than 2.5 mv the electrometer is defective.
 - b. If the voltage is less than 2.5 mv check flows and correct as necessary.
 - c. Inspect thermocouple for damage and replace as necessary.
 - d. Inspect jet tip for corrosion and restriction, and replace as necessary.

5.7 Software

A software repair can be as simple as restarting the system or may require performing a System Recovery from files created and saved on a USB flash drive. In the unlikely event a system recovery is needed, it is easy to do so using a recovery image created from the Local User Interface using the Setup Tab. The USB flash drive created contains a System Recovery image including all the software files originally installed on your analyzer at the factory and changes made prior to the last backup.



It is important that you perform the system restore in the order described in this document.

5.7.1 System backup, restore and recovery

From the **Setup** tab the PGC5000 has several recovery options available (see Figure 5.9). The options allow restore point creation and/or chromatogram data file copy or deletion

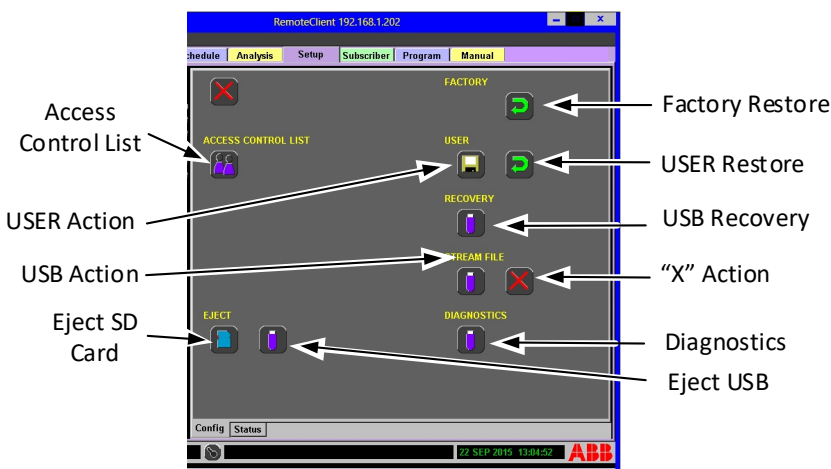


Fig. 5.9. Recovery and Backup Options

Before starting any maintenance it is recommended that you create a restore point in the system local memory using the USER Action icon as a precautionary measure.

If only option names show, you do not have enough rights to use the backup and restore options.



Stop all schedules before creating a recovery USB or backing up the stream files to a USB flash drive.

ACCESS CONTROL LIST – Selecting the Access Control List (ACL) icon displays a dialog box containing a list of users, passwords, and access levels that is distributed, encrypted and persisted at each device. The ACL can be modified from a PGC5000 (LUI or Remote Client), VNSA, or a STAR Client. If the analyzer is secured, any user with supervisory rights can modify the ACL. If the PGC5000 is unsecured, everyone has the ability to modify the ACL.



Stop all schedules before restoring from a recovery USB flash drive.

FACTORY – Selecting the Restore Settings icon restores the analyzer to the factory configuration. All user configuration changes to the system will be lost.

USER – Selecting the Save icon creates a User Restore point. The system copies all configuration files from the working directory to the Restore directory on the analyzer. You should create a restore point prior to making any changes or updates to the analyzer.

Selecting the Restore Settings icon restores the system to the user created restore point. It copies the configuration files from the Restore directory to the Working directory of the Master Controller and restarts the system.



Creating the recovery drive takes several minutes. Wait for the “Operation Completed” message before ejecting and removing the USB thumb drive. Remove and store the Recovery drive in a safe place.

You must use a USB drive having 32 gb or less. If you use a USB drive larger than 32 gb, the system will appear to write the data to the drive and give a “Creation Complete” message, but no data will be on the drive.

RECOVERY – Selecting the USB Flash Drive Operation icon creates a recovery drive on the USB flash drive inserted in the Master Controller Single Board Computer. This operation takes up to thirty minutes to complete depending on system configuration. The user restore director is NOT saved to the Recovery drive.

To restore the system from an unrecoverable lockup or after replacing the Single Board Computer, install the USB flash drive and apply power to the system. The Master controller formats the flash memory and copies all of the files from the USB flash drive to the system's flash memory. Wait for the Upgrade Complete message to appear. Select the USB Eject icon and wait for the Eject Complete message to appear. Remove the USB drive and cycle power on the Master Controller to reboot.

STREAM FILE – Selecting the USB Flash Drive Operation icon copies all stored chromatogram files on the system to the flash drive inserted in the Master Controller SBC board. Copying the data files will take several minutes. Wait for the Operation Complete message to appear. Select the USB Eject icon and wait for the Eject Complete message to appear and then remove the USB flash drive.

Selecting the Delete Icon deletes all saved chromatograms and report files on the system. It does not delete analyses saved in the Analysis Config folder or Analysis Library folder.

DIAGNOSTICS – Selecting the USB Flash Drive Operation icon will copy all diagnostic files to a USB drive inserted in the Master Controller SBC board. Diagnostic files are used to diagnose errors and events in software. These files are for factory use and troubleshooting purposes. The copying of the files should take only a few minutes. Wait for the Operation Complete

message to appear. Select the USB Eject icon and wait for the Eject Complete message to appear and then remove the USB flash drive.

EJECT – Selecting the USB Flash Drive or the SD Card icon allows you to safely eject the USB Flash Drive or SD Card from the Single Board Computer PCB in the Master Controller. Wait for the Eject Complete message before removing the USB Flash Drive or SD Card. Report storage will automatically revert to RAM disk when the SD Card is not present.

5.7.2 System backup, restore and recovery error messages

The PGC5000 Backup / Restore and Recovery options include error diagnostics. Figure 5.10 shows a message display sample.



Fig. 5.10. Information/Error Popup Box

The following popup messages may display during restore and recovery operations.

Message	Meaning / Issue / Fix
Factory Configuration Restore\Configuration Missing!	Button pressed, but a Factory Configuration is not in local memory.
Invalid Configuration Host Mismatch Warning!	Host Name in the configuration doesn't match the Host Name on the Master Controller. If configuration is determined to agree with analyzer perform a soft reset to correct mismatch warning.
Invalid Configuration Model Manager Task not started	There is an error in one of the configuration files: Call ABB support.
Restore Point Configuration Capture Complete	Restore Point has been written to the USB flash drive.
Stream Data Files Capture Complete	Backup of Stream Data is complete.
Stream Data Files Delete Complete	Stream Files Deleted.
Stream Data Files No USB Drive Found	No USB flash drive found. Insert USB flash drive in Master Controller Board.
USB Recovery Drive Creation Complete	Recovery data has been saved to the USB flash drive.
USB Recovery Drive No USB Drive Found	No USB flash drive found. Insert USB flash drive in Master Controller Board.
User Configuration Restore No Restore Point Found	No Restore point files found. Restore has not been created.

5.8 Restarting the analyzer

Restarting is the simplest repair method for the analyzer. When restarted, the Master Controller reloads the operating system and software into its memory.

When the Master Controller's power is cycled, it forces the analyzer to clear and reload the configuration files into Random Access Memory (RAM), allowing the system to reinitialize all attached ovens and connected equipment.

To restart the analyzer:

1. Remove power to the Master Controller (turn OFF).
2. Restore power to the Master Controller.
3. It is not necessary to cycle oven power.

5.9 Upgrading software

Software upgrades may be available through the ABB Support on a need basis. Please follow the reporting guidelines as described in the Section 8 of these instructions.

5.10 Optional discharge ionization detector

The Discharge Ionization Detector (DID) consists of a detector unit and a power supply (see Figure 5.11).

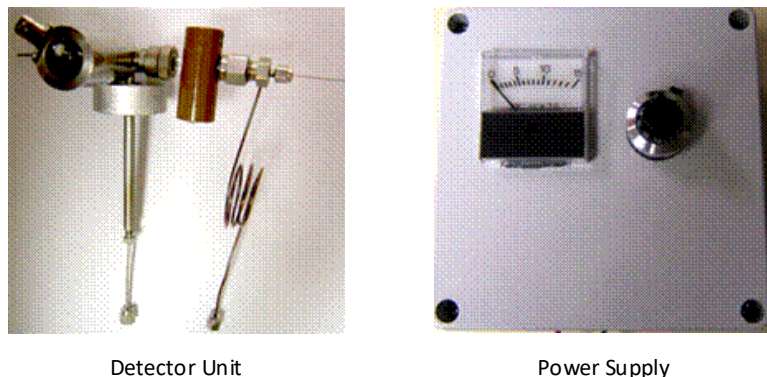


Fig. 5.11. Discharge Ionization Detector

This procedure describes general troubleshooting procedures, issues and resolutions for the optional Discharge Ionization Detector.

Verify that:

- System has power.
- All switches and gas settings are at the correct positions.
- Column has proper flow rates and pressures.
- Plasma shield is in place on the reactor.
- Plasma center rod is grounded to the oven chassis.
- Bias tube is connected to a bias voltage source.

Identify whether the problem is with the oven or the detector. In general, if the problem is with retention times but not sensitivity, look for problems with the oven, especially the valves or column connections.

Next determine the last thing done to the system. In general, this is the best place to begin the troubleshooting process.

If these steps identify that the problem is with the detector, use the following subsections to identify and correct the problem.

5.10.1 Plasma will not light

No power: If the fuse is good, contact ABB customer support for further assistance.

Air in plasma: The presence of too much air in the plasma will often cause the plasma not to light. Allow the system to purge with the reaction gas for at least 15 minutes. If the plasma still will not initiate, check for air leaks in all of the fittings.

Back pressure too high: If a restriction in the exhaust line is too high, the detector plasma will not light. Replace the exhaust/signal tube with a new one and see if the plasma will light.

Wrong plasma gas: If there is another gas besides helium or argon, the plasma will not light.

5.10.2 No signal

No power to plasma power supply: If the fuse is good, contact ABB customer support for further assistance.

Verify power to plasma: Observe the plasma tube with the lights off. There should be a pink or almost white glow in the plasma tube. If the tube is very blue and the signal is low, there is nitrogen in the plasma. This may be because the wrong

reaction gas is connected, there is an air leak, or there is no reaction gas flow. Turn off the power to the plasma and check the gas supply. Check for leaks and check flow rate.

Signal cable problem: Verify that the collector shield BNC fitting contacts the exhaust tube.

1. Remove the BNC cable from the collector shield.
2. Verify contact between the center pin of the BNC and the exhaust tube, using a volt-ohm-milliammeter (VOM) or continuity tester.
3. Reconnect the BNC cable to the collector shield.
4. Verify the cable is connected to the collector shield and the electrometer board.

Verify bias voltage: Using a VOM, measure the voltage at the bias rod. The voltage should be 110 volts between the rod and the oven chassis.

5.10.3 Low signal

No restrictor: The detector is not as sensitive when no restriction is on the exhaust flow. Verify that the restrictor in place is a 0.1 id tube. If you are unsure, replace the restrictor with one of known dimensions.

Low or no bias voltage: Verify the connection of bias voltage to the bias voltage rod. If necessary, verify that bias voltage is present on the bias voltage rod by connecting a volt-ohm-milliammeter to the bias rod (red lead) and ground (black lead). The voltage should be at least 110 volts.

Leakage in the chromatographic system: Verify the retention times for the components of interest. If these are correct, check for leakage on all the fittings on the detector end of the system. If the retention times have shifted, look for leaks on the valve rod.

Wrong reaction gas: Using nitrogen as the reaction gas will cause low signal. Verify that the proper reaction gas is being used.

Improper restrictor in place: Too large of a restrictor results in poor plasma performance, leading to low sensitivity. Verify that the proper restrictor is in place, or replace the restrictor with one of known proper dimensions.

High response and shifted retention times: This is a problem that may be caused by a restriction in the exhaust tube. In this case, the retention times for the analyses will have shifted later in the chromatogram.

1. Visually inspect the exhaust tube to identify any materials that may be plugging the tube.
2. Insert a syringe cleaning wire into the exhaust tube.

If these actions do not resolve the problem, replace the exhaust tube with a new one.

5.10.4 Noisy

Bad electrical connections: Check the signal cable connection and the bias voltage cable connection. Check the signal cable shield for fit. This fitting should be snug for best performance. Verify the connection between ground and ground.

Leak: Especially true when operating in the helium ionization detection (HID) mode. If the detector is being very noisy, check all fittings within the oven system for leaks. Verify the installation of or replace the PTFE noise shield in the top nut.

Plasma electrode too close to Swagelok fitting: The plasma O-ring on the plasma tube is meant to prevent this issue. If this appears to be the case:

1. Turn off the power to the plasma.
2. Remove the plasma shield.
3. Remove the plasma tube from the top nut.
4. Install or replace the plasma O-ring on the plasma tube.
5. Reinstall the plasma tube.
6. Re-attach the plasma shield.
7. Turn on power to the plasma.

5.10.5 High baseline

Bad gas: When operating in the HID mode, background signal is directly linked to the quality of the gases being used.

Therefore, at a minimum, it is important to have an oxygen scrubber, a water scrubber, and a hydrocarbon scrubber in line when you are operating in HID mode. When the highest sensitivity is desired, the detector should be operated with a getter to remove the residual oxygen and nitrogen often found in UHP helium.

Air leak: If there is an air leak in the system before the detector, the presence of oxygen and nitrogen will cause a high baseline and a noisy signal. Generally, an air leak at the detector will cause a low signal (due to the presence of nitrogen in the plasma) rather than a high signal. If a high signal is encountered and a leak is suspected, verify the fittings before the detector (i.e., the injector and the injector gas supply lines).

5.10.6 Drifting baseline

Pressure control problems: Pressure controls not providing a consistent, pulse free, flow rate to the detector will lead to detector drift and noise. Monitor the pressure gauges on the supply cylinder and measure the flow out of the exhaust port over a one hour period to verify correct flow conditions.

Column bleed: If the system is running isothermally, the changing baseline may be due to column bleed. This is especially problematic when using packed columns. Verify that the system is leak free. Ensure that there is on oxygen in the system. Re-condition, rinse, or replace the column.

Plasma cell leak: If the base of the plasma cell is not well sealed, it is possible to see a rise in the baseline. Initially this may appear as column bleed, but the signal will settle down once the oven returns to an isothermal mode. Reset the plasma cell in the Swagelok fitting and tighten to make it leak free.

Contamination or late-eluting components: Alter the cycle time of injections to determine if the drifting baseline changes location. If it does, it is possible that there is a late eluting component or contamination that is coming off the column several runs later. If this is the case:

1. Install filters to eliminate the contamination.
2. Extend the run time to get the material off the column.
3. Extend the instrument cycle time to elute the material prior to the next analysis.

5.10.7 Spikes

Loose connections: Verify the signal cable is securely attached to the electrometer and to the BNC fitting on the collector shield. Verify that the signal spring contacts the exhaust tube.

Missing ground leads: Verify that the ground lead from the plasma center electrode is connected. If not, turn off the power to the plasma and re-connect the center electrode ground lead. Verify that the main power supply ground lead is connected to an appropriate oven chassis ground point.

Defective bias voltage: If the bias voltage is not stable, it is possible to get signal spikes. Verify the bias voltage and stability using a VOM connected between the bias voltage rod and the oven chassis ground.

5.10.8 Shifting retention times

If compounds elute early, the wrong restrictor may be in place. If the restrictor has recently been replaced, it is likely that a restrictor is being used that has an inside diameter that is too large. Replace it with a new restrictor of known dimensions and verify performance.

6 Component repair

6.1 General

6.1.1 Preparation and procedures

The following instructions assume that all equipment has been properly installed and checked, that the analyzer has been application engineered, and that temperature controllers, alarm switches and other adjustments have been properly set.



Ensure no hazardous or flammable gases are present in the immediate area of the analyzer, as they may create the potential for fire, explosion, and damage to property and injury to personnel.

6.1.2 Electrostatic discharge information

A discharge of static electricity can damage static-sensitive devices or microcircuitry. Proper packaging and grounding techniques are necessary precautions to prevent damage. To prevent electrostatic damage, observe the following precautions:

- Transport products in static-safe containers such as conductive tubes, bags, or boxes.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-free stations.
- Cover workstations with approved static-dissipating material. Use a wrist strap connected to the work surface and properly grounded tools and equipment.
- Keep the work area free of nonconductive materials such as ordinary plastic assembly aids and foam packing.
- Always be properly grounded when touching a static-sensitive component or assembly.
- Avoid touching pins, leads, or circuitry.
- Use conductive field service tools.

6.1.3 Powering down the analyzer system

1. Obtain proper work permits such as hot work, etc.
2. Stop all analyses.
3. Turn power to the analyzer OFF.
4. Turn heater air OFF.
5. Open oven door and let oven cool to room temperature.
6. When oven is cool, turn off all gases.

6.1.4 Equipment and supplies required

The following tools and equipment may be required to repair and replace system components.

Tools and tool kits:

- Standard tools
- Liquid Sample Valve Tool Kit 791K009-1
- CP Valve Tool Kit 754K003-1
- EPC Kit 801K005-1

Equipment:

- Leak testing solution
- Flow Meter
- Grounding strap or equivalent

6.2 Master controller cabinet

The Master Controller houses the following components, located as shown in Figure 6.1.

- Single Board Computer (SBC) and Card Cage Assembly
- Oven Controller PCB
- Power Supply
- Optional Wago Modules (input/output option)

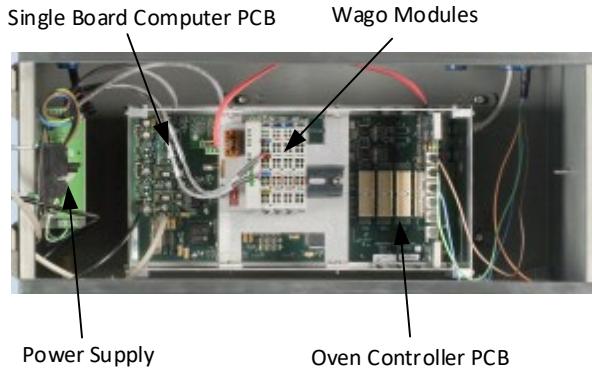


Fig. 6.1. Master Controller Component Locations

The Master Controller also has the network interface connections, which are located at the back of the Card Cage, on the top right.

The following subsections give specification and removal procedures for components installed in the Master Controller.

6.2.1 SBC and card cage assembly

The SBC and Card Cage Assembly is installed as a single unit, mounted on the back of the Master Controller.

Card Cage removal and replacement procedure:

1. Disconnect all Power and cables.
2. Remove Oven Controller PCBs and retain for re-installation.
3. Unscrew the four thumb screws at bottom on both sides of the cage.
4. Slide cage out.
5. To replace, reverse order.

SBC PCB removal and replacement procedure:

1. Remove Card Cage as described in the previous paragraph.
2. Remove the screws holding the SBC to the Card Cage, and retain the screws for re-installation.
3. Remove the SBC PCB.
4. Place the new SBC PCB on the back of the Card Cage.
5. Insert the screws that hold the SBC in place.
6. Install the Card Cage in the Master Controller, as described in the previous paragraph.

System Board Battery: This is a small rectangular boxed object ("Snap Hat") located in the middle of the SBC. While it is the unlikely the battery will fail, it can be replaced.

- Failure symptoms: System Clock resets when system is powered off.
- Removal procedures: Place fingers or tool on both sides of the battery. Apply equal force to both sides and pull away from the SBC.
- Installation Procedures: Locate battery connection base on the SBC. Ensure all four connection pins are straight and free of contaminants. Align pins with base, push in firmly.

6.2.2 Oven controller pcb

Oven Controller PCB removal and replacement procedure:

1. Remove power from unit and follow plant documentation procedures.
2. Label (noting position and orientation) and remove all cables attached to the board.



If equipped with a Wago module, ensure electrical CAN connection is removed from the top of the controller board before sliding board out.

3. Release board clips at top and bottom.
4. Slide board out.
5. Reverse steps to replace board.

6.2.3 Power supply

Power Supply removal and replacement procedure:

1. Disconnect the wires to the Power Supply and tag them for reconnection.
2. Using a flat blade screwdriver, release the Power Supply from the DIN rail and remove it from the Master Controller.
3. Install the new Power Supply onto the DIN rail.
4. Connect the power input wiring at the bottom of the new Power Supply, to L (line), N (neutral), and earth ground.
5. Connect the output wiring at the top of the new Power Supply (using either set of connections), to the "+" and "-" connections. Insert one wire in each terminal, when possible. If there is a ground wire, connect it to one of the "-" connections.

6.2.4 Optional wago modules

Wago module removal and replacement procedure:

1. On the Wago module assemblies to be replaced, tag all connecting cables (see Figure 6.2)

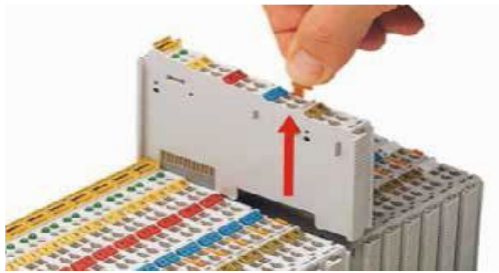


Fig. 6.2. Removing a Wago Module

2. Disconnect the cables from the modules to be replaced.
3. To release a Wago module from the DIN rail, pull the release tab on the module. The release tab is indicated by the red arrow shown in Figure 6.2.
4. Install each new Wago module onto the DIN rail, being careful to align the tongue and groove joints on adjacent modules.
5. Reconnect the cables removed in step 2.

6.3 Master controller cabinet door

The back of the Master Controller front door assembly comes complete with the Front Panel PCB, Liquid Crystal Display, Touch Panel Controller, and associated cables (see Figure 6.3).

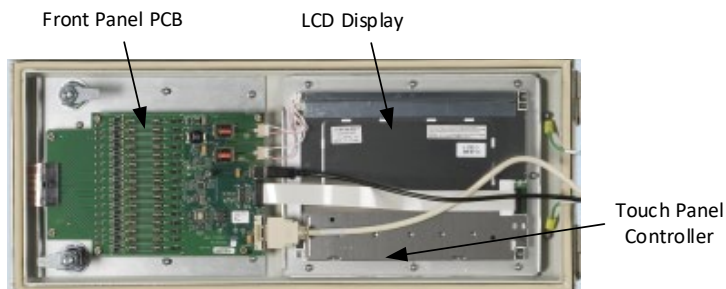


Fig. 6.3. Master Controller Front Door

6.3.1 Front panel pcb



Transformers for the backlight converter are protected on this. Be careful when opening and closing the Master Controller door to ensure safety.

Removal and replacement procedure for the PCB assembly (see Figure 6.3).

1. Remove power from unit and follow plant documentation procedures.
2. Label all cables attached to PCB assembly (noting position and orientation).



The upper power cables are secured with cable ties and must be cut. Be extremely careful when removing the ribbon cable as the pins can be easily bent.

-
3. Remove all cables from the PCB assembly.
 4. Remove and set aside the six screws holding the PCB assembly.
 5. Remove the PCB assembly.
 6. Reverse steps to replace the PCB assembly.
-



The power cable ties must be replaced to meet certification requirements.

6.3.2 Liquid crystal display assembly

Removal and replacement procedure for the LCD Panel (see Figure 6.3).

1. Remove power from unit and follow plant documentation procedures.
2. Label all cables attached to PCB Assembly (noting position and orientation).



The upper power cables are secured with cable ties and must be cut. Be extremely careful when removing the ribbon cable as the pins can be easily bent.

-
3. Remove the cables from the right side of the PCB assembly.
 4. Remove and set aside the four hex nuts holding the panel to the front screen board clips at top and bottom.
 5. Slide the board over the studs.
 6. Reverse steps to replace the LCD Panel.
-



The power cable ties must be replaced to meet certification requirements.

6.4 Oven component locations

6.4.1 Class B oven component locations, version 1

The oven components are mounted on the inside of the door and within the electronics compartment. The compartment or compartments are on the left side of the version 1 Class B oven. See Figure 6.4 for component locations.

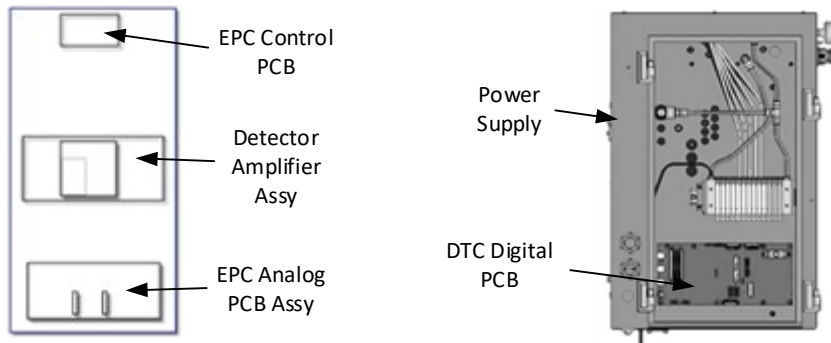


Fig. 6.4. Class B1 Components

6.4.2 Class B oven component locations, version 2

Version 2 of the Class B Oven incorporates PCBs mounted on the inside of the front and side doors and on walls of the electronics compartment (see Figure 6.5). Before removing any boards ensure power is off and cable routing is noted. Some boards may require address and termination change as noted.

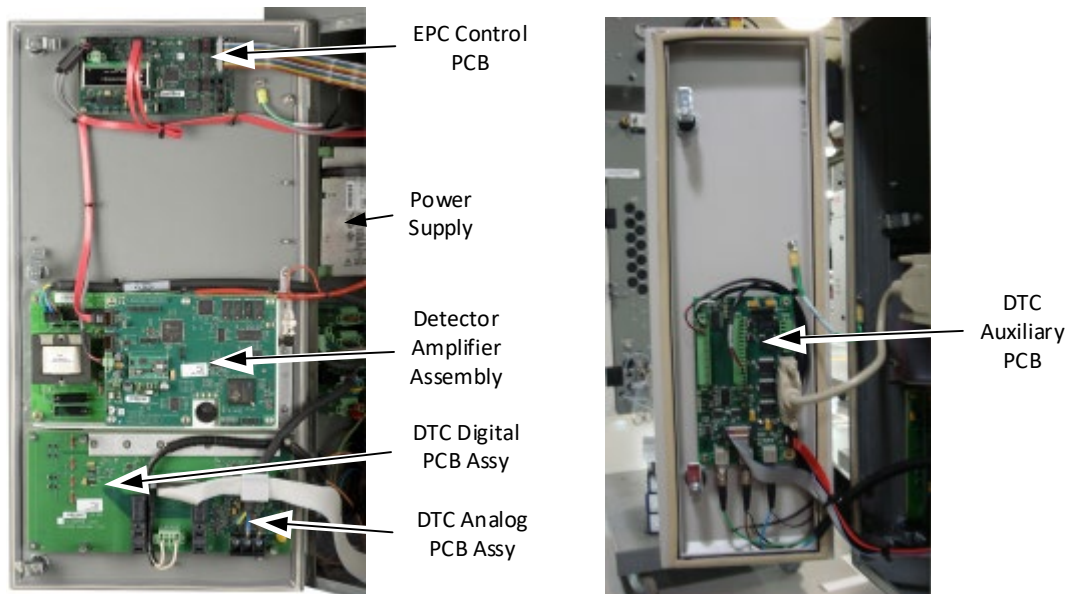


Fig. 6.5. Class B2 Oven Component Locations

6.4.3 Class C oven component locations

The Class C Oven incorporates PCBs mounted on the inside of the front and side doors and on walls of the electronics compartment (see Figure 6.6). Before removing any boards ensure power is off and cable routing is noted. Some boards may require address and termination changes.

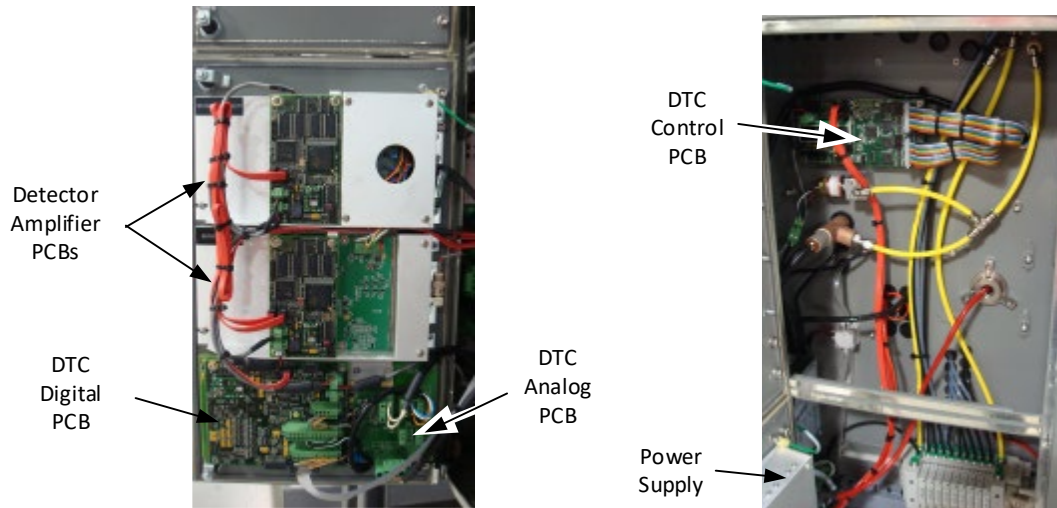


Fig. 6.6. Class C Oven Component Locations

6.5 Replacing the EPC control pcb

In the Class B Oven, the EPC Control PCB is attached to inside of electronics compartment door (left side of oven). In the Class C Oven, it is attached to inside of upper electronics compartment door (left side of oven).



Always note routing and marking of cables (pin 1 location, etc.). Note jumpers and move to replacement board as necessary.

1. Remove cables using proper tools.
2. Undo hex head screws and remove board.
3. Attach updated or new board to door, starting with the center top screw. (Do not tighten).
4. Adjust board, aligning all outer screw holes with mounts.
5. Tighten all screws.
6. Attach cables.
7. Test.

6.6 Repairing the epc control assembly



To ensure integrity of the components within the EPC, use the tools in EP Service Tool Kit 801K005-1 when disassembling or assembling the EPC Control Assembly.

6.6.1 Preparation



Before performing EPC repair, you must turn off power to the analyzer as described in the following steps.



Be sure that the EPC Control Assembly has cooled to ambient temperature (approximately one hour) before proceeding.



Use an ESD wrist strap and proper grounding procedures before handling any components in the EPC Control Assembly.

1. On the Background screen, press the F1 (Exit to Commands) soft key.
2. On the Commands screen, cursor to ANALYSIS CONTROL, if necessary, and press the F2 (Start/Stop Analysis) soft key.
3. On the Start/Stop Analysis screen, cursor to End of Analysis? and press the F2 (Stop Analyzer) soft key. The analyzer will stop at the end of the analysis.
4. Remove power from the analyzer and ensure that power to the analyzer remains removed throughout the EPC repair process.
5. If an extended turn-off is necessary:
 - a. Turn off sample supply and burner fuel.
 - b. Allow analyzer to cool to ambient temperature.
 - c. Turn off remaining flows at their sources and plug all vents.

6.6.2 Removing the epc control assembly



This procedure is not required if you are only replacing EPC components.

1. Perform the "Preparation" procedure.
2. Remove the four screws holding the top panel on the front of the oven.
3. Remove the top plate of the oven.
4. Remove the ten screws holding the EPC Control Assembly and cover, and remove the cover; retain the screws for later use.
5. Using a right-angle wrench, remove the two screws holding the EPC Control Assembly in place.
6. Remove the three fittings from the back of the EPC Control Assembly.
7. Open the front door of the oven.
8. Remove the three fittings from the bottom of the EPC Control Assembly.
9. Open the left side door of the Class B Oven or the top left side door of the Class C Oven.
9. Open the Controller front door to gain access to the backplane board.

10. On the wall inside the left side of the oven, remove the lock nut on the pipe nipple which retains the EPC Panel cables (see Figure 6.7, which shows Class C oven).

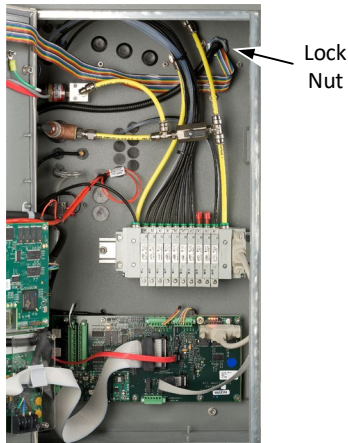


Fig. 6.7. EPC Cable Lock Nut

11. Disconnect the EPC feedthrough tube nuts.
12. Disconnect the plug that connects the EPC wires to the Power Distribution block.
13. Tag the wires on the plug and then remove the wires from the plug; retain the plug for wiring the new unit.
14. On the EPC Control PCB on the side wall of the oven, disconnect the EPC Control Assembly ribbon cable from J1.
15. Carefully remove the cables and EPC Control Assembly from the analyzer.

6.6.3 Installing the EPC control assembly

1. Carefully install the Control Assembly and its associated components.
2. From the top of the oven, install the two screws that hold the EPC Control Assembly in place.
3. Reconnect the three fittings to the bottom of the EPC Control Assembly.
4. Reconnect the three fittings at the back of the EPC Control Assembly
5. Reinstall the EPC Control Assembly cover, inserting and tightening the ten screws holding it in place.
6. Reconnect the EPC feedthrough tube nuts.
7. On the EPC Control PCB on the left side door, reconnect the EPC Control Assembly ribbon cable to J1.
8. Connect the EPC Control Assembly power wires to the connector removed earlier and then plug it into the Power Distribution board.
9. Close the left side door of the oven (upper left door of the Class C Oven).
10. Hold the top plate of the oven in place and then install and tighten the four screws.
11. Close the oven front door.

6.6.4 Removing a sensor pcb

The Zones are arranged in the EPC Control Assembly enclosure with Zone 1 on the left and Zone 5 on the right (see Figure 6.8).

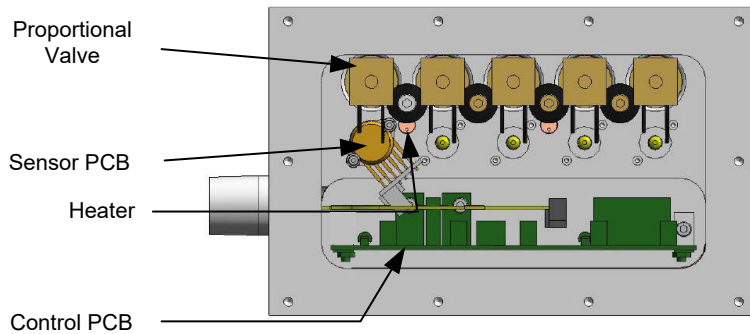


Fig. 6.8. EPC Control Assembly Components

1. Perform the "Preparation" procedure.
2. Remove the four screws holding the top panel on the front of the oven.
3. Remove the ten screws holding the EPC Control Assembly cover and remove the cover; retain the screws for later use.
4. Unplug the large ribbon cable from the Control PCB and fold it back to your left and out of the way (see Figure 6.9).

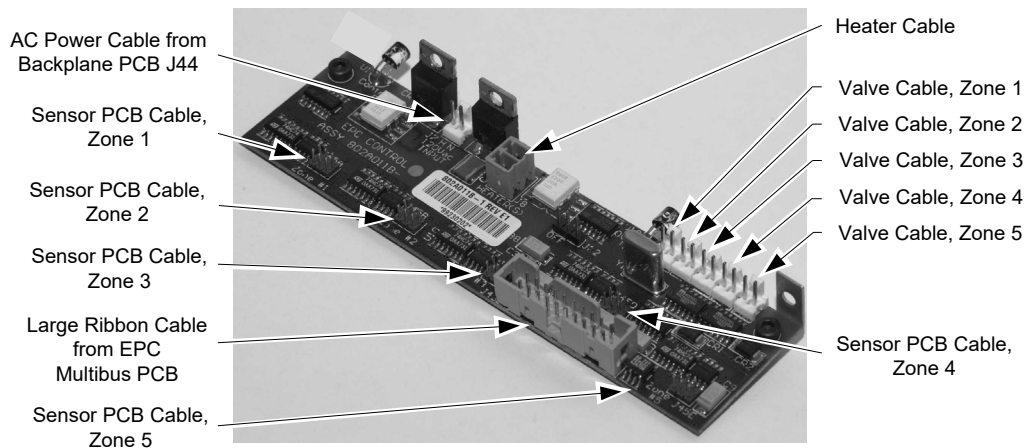


Fig. 6.9. EPC Control PCB Cabling

5. Locate the Sensor PCB to be replaced.



If more than one zone is being replaced, they must be replaced starting with the highest numbered zone (right side) and proceeding to the lowest numbered zone (left side).

6. Unplug the Sensor PCB from the Controller PCB.
7. Using a 1.5 mm hex socket wrench, loosen the screws that retain the Sensor PCB.
8. Slide the Sensor PCB out from under the mounting plate and remove it from the EPC Controller Assembly.

6.6.5 Installing a new sensor pcb

Install the new Sensor PCB, using Figure 6.10 as a guide.

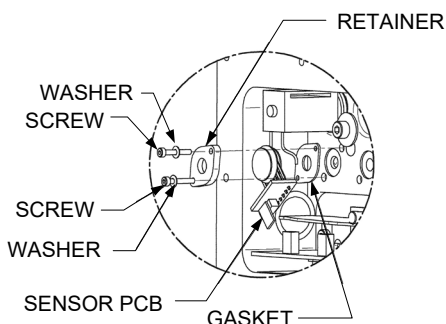


Fig. 6.10. Installing the New Sensor PCB

1. Place a Belleville washer on each mounting screw, with the rounded side toward the screw.
2. Place the screws through the holes in the mounting plate.
3. Place the gasket on the end of the two screws, with enough screw thread showing through the gasket to start the screws into the hole.
4. Insert the screws into the hole in the block, just far enough to hold them in place.
5. Place the Sensor PCB into position between the plate and the gasket, with the cable at the bottom right edge.
6. Slightly tighten the two screws evenly, removing any play in the assembly (but applying no torque) and ensuring it is mounted straight up and down.
7. Tighten one screw, using torque limiting screwdriver ABB Tool 801Z003-1, set at 1 in.-oz.
8. Tighten the second screw to 2 in.-oz.
9. Retighten the first screw to 3 in.-oz.
10. Retighten the second screw to 4 in.-oz.
11. Retighten the first screw to 5 in.-oz.
12. Retighten the second screw to 6 in.-oz.
13. Retighten the first screw to 7 in.-oz.
14. Retighten the second screw to 7 in.-oz.
15. Plug the Sensor PCB cable into the corresponding connector on the Control PCB.
16. If another Sensor PCB Assembly needs to be replaced, repeat the appropriate steps to remove the old Sensor PCB Assembly and install a new one. Be careful to observe the precautions stated in the Note at the beginning of this procedure.
17. Reconnect the large ribbon cable to the Control PCB.
18. Ensure that the flame-proof or explosion-proof surfaces of the cover or the body of the Control Assembly are not damaged.
19. Reinstall the EPC Control Assembly cover and insert the ten screws and tighten them to 16 in.-lb, using ABB Tool TL1000/TL1002.
20. Reinstall the EPC cover panel and insert the four screws.

6.6.6 Removing a proportional valve

1. Perform the "Preparation" procedure.
2. Remove the four screws holding the top panel on the front of the oven.
2. Remove the ten screws holding the EPC Control Assembly cover and retain the screws for later use.
4. Unplug the large ribbon cable from the Control PCB and fold it back to your left and out of the way.
5. Locate the valve to be replaced (See Figure 6.8).
6. Disconnect the valve cable at the connector on the Control PCB.



You may need to remove the Sensor PCB cable from the Control PCB to allow access to the connector of some zones.

7. Using 3 mm hex socket wrench ABB Tool TL1009, remove the screws and washers that secure the valve in place.
8. Firmly grasp the valve and remove it from the enclosure.

6.6.7 Installing a new proportional valve

1. Before inserting the new valve, check the position of the o-ring on the valve.
2. If the o-ring is positioned at top of groove, use a solder aid or non-metal pick to roll the o-ring down to the bottom of the groove. The o-ring must not be twisted.
3. Insert the new valve into its position in the enclosure. The wires coming out of the coil should face the Control PCB (See Figure 6.7).
4. Assemble the spring or Belleville washer and hex socket head screw, ensuring that the concave side of the washer is facing away from the head of the screw.
5. Start the screw with the spring washer in the hole next to the valve.
6. Press down on the center of the valve and finish tightening the screw.
7. Insert and tighten the second screw and washer, if applicable.
8. Plug all cables back into their corresponding connectors on the Control PCB.
9. If another proportional valve needs to be replaced, repeat the appropriate steps to remove the old valve and install a new one.
10. Reinstall the EPC Control Assembly cover and insert the ten screws and tighten them to 16 in.-lb, using ABB Tool TL1000/TL1002. Ensure that the flame-proof or explosion-proof surfaces of the cover or the body of the Control Assembly are not damaged.
11. Reinstall the top panel and tighten the four screws.

6.6.8 Removing the control pcb

1. Perform the "Preparation" procedure.
2. Remove the four screws holding the top panel on the front of the oven.
3. Remove the ten screws holding the EPC Control Assembly cover using ABB Tool TL1009 and remove the cover. Be careful not to damage the flame-proof or explosion-proof surfaces of the cover or the body of the Control Assembly.
4. Unplug the large ribbon cable from the Control PCB and fold it back to the left and out of the way (see Figure 6.9).
5. Unplug all valve, sensor PCB, and heater cables.
6. Using 2.5 mm hex socket wrench ABB Tool TL1007, remove three screws and washers (two from the triacs and one from the PCB mounting bracket at the right side of the PCB).
7. Pull the Control PCB straight out of the enclosure toward you.
8. Remove fish paper isolator (do not throw away).
9. With a clean cloth, clean thermal joint compound off the enclosure.

6.6.9 Installing a new control pcb

1. On the new Control PCB, place a thin layer of thermal joint compound on all sides and the bottom of each RTD, and on the back of each triac.
2. Insert the Control PCB into enclosure with components and connectors facing up.
3. Align RTDs with the holes in the enclosure and ensure the RTDs are inserted in the holes flush with the enclosure.
4. Using 2.5 mm hex socket wrench ABB Tool TL1007, attach the Control PCB to the enclosure with three screws and washers (or four screws and washers if this is an older version of the Control PCB).
5. Insert the fish paper insulator between the enclosure and the back side (solder side) of the Control PCB.
6. Plug all cables back into their corresponding connectors on the Control PCB.
7. Reinstall the EPC Control Assembly cover and then insert the ten screws and tighten them to 16 in.-lb, using ABB Tool TL1000/TL1002. Ensure that the flame-proof or explosion-proof surfaces of the cover or the body of the Control Assembly are not damaged.
8. Reinstall the top panel and tighten the four screws.

6.6.10 Removing the heater



Be sure that the EPC Control Assembly has cooled to ambient temperature (approximately one hour) before proceeding.



Use an ESD Wrist strap and proper grounding procedures before handling any components in the EPC Control Assembly.

-
1. Perform the "Preparation" procedure.
 2. Remove the four screws holding the top panel on the front of the oven.
 3. Remove the ten screws holding the EPC Control Assembly cover and retain the screws for later use.
 4. Unplug the large ribbon cable from the Control PCB and fold it back to your left and out of the way.
 5. Locate the Sensor PCBs for Zones 1 and 2 (see Figure 6.9).
 6. Using 1.5 mm hex socket wrench ABB Tool TL1001/TL1003, remove screws and plates that mount the Sensor PCBs and set these screws and plates aside for later use.
 7. Remove the Sensor PCBs and set them aside for later reinstallation. Do not remove the Sensor cable connected to the Control PCB.
 8. Unplug the heater connector from the Control PCB.
 9. Carefully extract the heater from its cavity in the enclosure.
 10. Remove the connector from the heater, using a small screwdriver.

6.6.11 Installing a new heater

1. With the new heater in hand, cut heater leads to 3-1/2 inches long.
2. Strip 1/8 inch of insulation off each heater lead.
3. Install the connector on the leads.
4. Place a thin layer of anti-seize compound on the new heater.
5. Insert the new heater in its cavity in the enclosure, making sure it goes all the way down in the cavity.
6. Clean any anti-seize compound residue from the enclosure.
7. Plug the heater connector into the Controller PCB.
8. Replace the Sensor PCBs, following steps 3 through 8 of "Installing a Sensor PCB."
9. Ensure that the flame-proof or explosion-proof surfaces of the cover or the body of the Control Assembly are not damaged.
10. Reinstall the EPC Control Assembly cover and then insert the ten screws and tighten them to 16 in.-lb, using ABB Tool TL1000/TL1002.
11. Reinstall the top panel and tighten the four screws.

6.7 Flame ionization detector amplifier assembly

In the Class B Oven, the FID Amplifier Assembly is attached to inside of electronics compartment door (left side of oven) on the center section of the door. In the Class C Oven, it is attached to inside of upper electronics compartment door (left side of oven), on the upper section of the door. Dual Detectors are located on upper section of lower door.

Removal and replacement:

1. Remove cables using proper tools. If necessary, tag the cables to ensure they are returned to the correct places.
2. Remove the FID coaxial cable from the right side of the assembly.
3. Remove the nuts at the left side of the amplifier mounting plate.
4. Remove the nuts at the right side of the amplifier mounting plate.
5. Remove FID amplifier assembly by sliding the mounting plate to the right.
6. Install replacement FID amplifier assembly.
7. Reinstall all nuts and tighten.
8. Reinstall the coaxial cable on the right side of the assembly.
9. Attach all other cables.
10. Test.

6.8 Flame photometric detector electrometer

In the Class B oven, the FPD Electrometer is attached to inside of electronics compartment door (left side of oven) on the center section of the door. In the Class C Oven, it is attached to inside of upper electronics compartment door (left side of oven), on the upper section of the door.

Removal and replacement:

1. Remove cables using proper tools. If necessary, tag the cables to ensure they are returned to the correct places.
2. Remove the nuts on the left side of the assembly mounting plate.
3. Remove the nuts on the right side of the amplifier mounting plate.
4. Remove FPD Electrometer by sliding the mounting plate to the right.
5. Install replacement FPD Electrometer.
6. Reinstall all nuts and tighten.
7. Attach cables.
8. Test.

6.9 Thermal conductivity detector amplifier assembly

In the Class B Oven, the TCD Amplifier Assembly is attached to inside of electronics compartment door (left side of oven) on the center section of the door. In the Class C Oven, it is attached to inside of the lower electronics compartment door (left side of oven), on the upper section of the door. Dual Detectors are located on the upper section of the lower door.

Removal and replacement:

1. Remove cables using proper tools. If necessary, tag the cables to ensure they are returned to the correct places.
2. Remove the nuts at the left side of the assembly mounting plate.
3. Remove the nuts at the right side of the amplifier mounting plate and retain the ground lug for reinstallation.
4. Remove TCD Amplifier Assembly by sliding the mounting plate to the right.
5. Install replacement TCD Amplifier Assembly.
6. Install ground lug under nut at the right side of the assembly and install and tighten the nut.
7. Reinstall all other nuts and tighten.
8. Attach cables.
9. Test.

6.10 Replacing the dtc analog pcb, version 1

In the Class B Oven, the DTC Analog PCB is attached to inside of electronics compartment door (left side of oven) on the lower section of the door. In the Class C Oven, it is attached to inside of the lower electronics compartment door (left side of oven), on the lower section of the door.



Note cable routing and markings (locate Pin 1 on the cable).

Removal and replacement:

1. Remove zone cables (sensor and heater) using small standard screwdriver.
2. Loosen screw on Zone board connector and unplug board (if equipped).
3. Loosen and remove oven heater connection and master digital interface cable.
4. Remove power cable (note color coding on wires and their position).
5. Remove hex head screws attaching the heat sink from the outside of the oven door.
6. Remove the remaining hex head bolts on the inside of the door and set the board aside.
7. Apply thermal grease to the heat sink of the new board.
8. Loosely attach the board to the inside of the oven door using the hex head bolts.
9. Align and reattach the heat sink to the door from the outside.
10. Tighten inside screws.
11. Attach main power cable.
12. Carefully reinstall the master digital interface cable and oven heater connection.
13. Tighten screws to secure oven heater power connector.
14. Install zone board and tighten mounting screw.
15. Reinstall zone board cables and tighten screws to secure the connectors.
16. Test.

6.11 Replacing the optional zone board

In both the Class B and Class C oven, a maximum of two optional Zone Boards are attached to the DTC Master Analog board.



Note cable routing and markings (locate pin 1 on the cable).

Removal and replacement:

1. Remove attached cables. Loosen screws and remove attached cables.
2. Loosen mounting screw and remove zone board.
3. Carefully install new zone board and tighten mounting screw.
4. Reinstall zone board cables and tighten screws to secure the connectors.
5. Test.

6.12 Replacing the digital pcb, version 1

In the Class B Oven, the DTC Digital PCB is attached to inside of electronics compartment door (left side of oven) on the lower section of the door. In the Class C Oven, it is attached to inside of the lower electronics compartment door (left side of oven), on the lower section of the door.

Removal and replacement:

1. Remove all cables.
2. Remove eight hex head screws.
3. Remove the PCB.
4. Install the new PCB.
5. Insert and tighten eight hex head screws.
6. Reinstall all cables.

6.13 Replacing the oven indicator pcb

In both the Class B and Class C Ovens, the Oven Indicator PCB is attached to the inside of the front electronics compartment door (left side of oven).



Note cable routing and markings (locate pin 1 on the cable).

Removal and replacement:

1. Loosen and remove all cables.
2. Remove the hex head screws holding the PCB.
3. Remove the Oven Indicator PCB.
4. Reverse steps to install the new Oven Indicator PCB.

6.14 Replacing the dtc master analog board, version 2

In the Class B Oven, the DTC Analog PCB is attached to inside of electronics compartment door (left side of oven) on the lower section of the door. In the Class C Oven, it is attached to inside of the lower electronics compartment door (left side of oven), on the lower section of the door.



Note cable routing and markings (locate Pin 1 on the cable).

Removal and replacement:

1. Tag cables to ensure they are reinstalled in the same locations.
2. Remove all cables.
3. Remove the six screws holding the DTC Digital PCB to the DTC Analog PCB.

4. Remove the DTC Digital PCB.
5. Remove hex head screws attaching the heat sink from the outside of the oven door.
6. Remove the remaining hex head bolts on the inside of the door.
7. Remove the DTC Analog PCB.
8. Apply thermal grease to the heat sink of the new DTC Analog PCB.
9. Loosely attach the board to the inside of the oven door using the hex head bolts.
10. Align and reattach the heat sink to the door, from the outside.
11. Tighten the inside screws.
12. Install the DTC Digital PCB.
13. Insert and tighten the six screws holding the DTC Digital PCB.
14. Resinstall all cables.
15. Test.

6.15 Replacing the dtc digital pcb, version 2

In the Class B Oven, the DTC Digital PCB is attached to inside of electronics compartment door (left side of oven) on the lower section of the door. In the Class C Oven, it is attached to inside of the lower electronics compartment door (left side of oven), on the lower section of the door.



Note cable routing and markings (locate pin 1 on the cable).

Removal and replacement:

1. Loosen and remove all cables.
2. Remove the hex head screws holding the PCB.
3. Remove the DTC Digital PCB.
4. Reverse steps to install the new DTC Digital PCB.

6.16 Replacing the dtc auxiliary pcb

In both the Class B and Class C Ovens, the DTC Auxiliary PCB is attached to the lower section of the inside of the front electronics compartment door (left side of oven).



Note cable routing and markings (locate pin 1 on the cable).

Removal and replacement:

1. Loosen and remove all cables.
2. Remove the hex head screws holding the PCB.
3. Remove the DTC Auxiliary PCB.
4. Reverse steps to install the new DTC Auxiliary PCB.

6.17 Replacing the power distribution board

In the Class B Oven, the Power Distribution Board is attached to inside of electronics compartment door (left side of oven) on the back wall of the compartment. In the Class C Oven, it is attached to inside of the lower electronics compartment door (left side of oven), on the back wall of the compartment.



Note cable routing and markings (plug locations, markings).

Removal and replacement:

1. Loosen and remove all wired plugs.
2. Remove fuse and blank plugs, and retain for new board.
3. Install fuse and blank plugs in new board.

-
4. Reinstall fuse and blanks in unused plugs.
 5. Attach new board to mounting bracket using hex head screws.
 6. Reattach all plugs and tighten.
 7. Test.

7 Subassembly repair

7.1 Column repair

7.1.1 Column removal

1. If analyzer is running and a column is to be replaced, stop the analysis.
2. Reduce Isothermal Oven temperature by reducing oven air pressure to zero psig.
3. Wait for columns to cool to room temperature
4. Power down analyzer.
5. Shut off all utility gases (carrier(s), burner air and hydrogen fuel, as applicable).
6. Open isothermal oven door.
7. Note column connections.



Mark capillary columns with white-out at the back of the tubing nut before removing to insure correct insertion depth of replacement column.

8. To remove the column, loosen the fittings on both ends of the column and gently extract the column from the respective fitting connections.
9. Loosen any screw securing the column to the column mounting brackets and remove the column.

7.1.2 Packed column installation

1. Install the column, orienting it in such a way that each end can be connected to the fittings without restricting operation of the analytical valves installed.
2. Fasten and secure column in place at the column mounting bracket with the retaining screws.
3. Insert the column end into the appropriate fitting connection and finger-tighten the nut, then tighten it an additional 1/4 turn.
4. Apply carrier gas and leak check. Further tighten the two fittings as necessary if leaks are found.
5. Close and secure the Isothermal Oven door.
6. Apply air and makeup gases.
7. Allow zone temperatures to stabilize.
8. Check/set carrier flows per data sheet.

7.1.3 Capillary column installation

Inspect the ends of the column. The ends should be round and burr free. If either column end is not round or burr free, the column end must be trimmed as described in "Cutting capillary columns."

1. Insert the end of the column through the back of the tubing nut.
2. Insert the column through the new ferrule.
3. Slide the ferrule down the length of the column (approximately three inches).
4. Cut the column as described in "Cutting Capillary Columns."
5. Connect the column and finger-tighten; then tighten an additional ¼- turn with an open-end wrench.
6. Test the column for a secure connection by gently pulling the column at the 1/8-inch tubing nut. Correct any withdrawal. Continue tightening the nut until the column is secure at the fitting.
7. Repeat steps 1 through 6 for the other end of the column.
8. For columns connected to an FID:
 - a. Insert the column end into the FID analysis inlet connection until it stops against the jet.
 - b. Withdraw the column approximately 1/16-inch and tighten the nut finger-tight. Tighten the nut an additional 1/4-turn with an open-end wrench.
 - c. Check it for a secure fit.



If a metal capillary column is used, particular care should be taken to ensure that the column does not contact the jet. The metal column will conduct electricity and could cause an electrical short at the jet.

9. Turn on carrier gas

10. Turn on analyzer.
11. Set carrier pressure and purge column for at least 30 minutes and leak check. NOTE: SNOOP™ IS NOT recommended for leak checking capillary columns.
12. Perform the PGC5000 series startup procedure as described in the Operation Guide (OI/PGC5000).

7.1.4 Cutting capillary columns

The procedure for cutting glass or metal capillary columns is the same, except that a small sharp file may be used to score metal columns.



Do not use high speed cutting wheels or grinders to cut capillary columns. This type of cutting generates heat that can damage the column and the resultant column cuttings could plug the column.

1. Use a diamond or ceramic scoring tool to score the surface of the outside tubing wall approximately one inch from the end of the column. Take care not to cut through the tubing wall.
2. Wipe the scored area clean to prevent material from entering the column.
3. Secure the column with your fingers 1/2-inch on each side of the score and gently bend the tubing at the score, in the direction opposite the score.
4. When the score point opens, bend the tubing back towards the score. The tubing should make a clean break.
5. Inspect the end of the column for roundness and ensure it is burr free. If the end is not round and burr free, repeat the procedure until it is.
6. The column is now ready for installation.

7.2 Repairing the flame ionization detector

Refer to Figure 7.1 for FID component location.

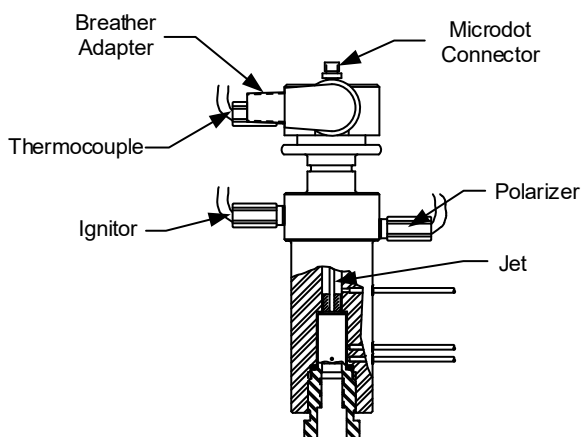


Fig. 7.1. Flame Ionization Detector

This repair should only be attempted by people who are properly trained and possess the expertise for this repair.

Before disposing of any residual insulating materials, ensure that disposal methods comply with all applicable regulatory restrictions.



It is the customer's responsibility to ensure that the area is safe and hazard free, and will remain so the entire time the analyzer is open. This responsibility includes ensuring adequate ventilation in analyzer shelter and obtaining proper work permits, etc.

The thermocouple, polarizer and igniter assembly elements are fragile and can be easily damaged if not handled with extreme care. Do not touch the end of the elements.

7.2.1 FID cell access

1. If power is applied to the analyzer, turn it off.
2. Turn off oven air to the Isothermal Oven and allow all temperature zones to cool.
3. Turn off carrier and other utility gases, as applicable.
4. Open the isothermal oven door.

7.2.2 Replacing the breather

1. Loosen the breather set screw using a 0.050-inch Allen wrench, then extract the adapter fitting from the detector.
2. Using a 9/16-inch open-end wrench and a 1/2-inch backup wrench, disconnect 1/4-inch vent connection from breather.
3. Remove the breather with adapter fitting from the analyzer oven.
4. Remove adapter fitting from breather using 3/4-inch and 1/2-inch open-end wrenches.
5. Using a 3/4-inch open-end wrench and a 1/2-inch backup wrench, remove the 1/4-inch male connector from the existing breather.
6. Remove existing PTFE tape from the nipple of the adapter fitting and apply new tape.
7. Remove the existing PTFE tape from the male connector and apply new tape.
8. Install the detector outlet adapter into the breather and finger tighten. Finish tightening using 3/4-inch and 1/2-inch open-end wrenches.
9. Install the 1/4-inch male connector into the breather using 3/4-inch and 1/2-inch open-end wrenches.
10. Connect the 1/4-inch detector vent tubing to the breather. Finger tighten, then tighten with a 9/16-inch open-end wrench and a 1/2-inch backup wrench.
11. Ensure the detector vent o-ring is in place in the adapter fitting.
12. Finish installing the breather by inserting the cylindrical end of the adapter fitting completely into the detector outlet and tightening the set screw with a 0.050-inch hex key wrench. Note the set screw will fit into the groove of the adapter fitting when it is installed correctly.
13. Reconnect the red coaxial cable to the top of the detector.
14. Close and secure the isothermal oven door.

7.2.3 Replacing the thermocouple assembly

1. Locate the thermocouple assembly as identified by the two red and black wires.
2. If applicable, remove any cable ties and free the wiring to expose the wire splices.
3. Cut and remove the heat shrink and glass tape from the red and black wires to expose the soldered connections.
4. Using a 40 watt soldering iron, disconnect the wiring splice.
5. Using a 3/8-inch open-end wrench, carefully remove the thermocouple. Note its location for reassembly.
6. Carefully insert the replacement thermocouple into the detector body and finger-tighten, taking care not to damage it. Finish tightening using a 3/8-inch open-end wrench.
7. Roll each end of the red and black wires of the new thermocouple assembly between your forefinger and thumb, causing the wire ends to be tightly spiral wrapped.
8. Using the 40 watt soldering iron and approved high temperature solder, "tin" the wire ends.
9. Spread or expand the end of approved heat shrink to allow easy installation over the solder connection.
10. Install the heat shrink over each of the wires and slide it as far as possible from the connection. This will prevent premature shrinking of it when the connection is soldered.
11. Overlap the "tinned" ends of the red wire from the analyzer electronics and red element assembly wire, then solder the wires together using approved high temperature solder and the 40 watt soldering iron.
12. Repeat step 11 for the black wire.
13. Apply a short wrap of glass tape over each connection.
14. Slide the heat shrink over the soldered connection and shrink it with a heat gun.
15. Reconnect the red coaxial cable to the top of the detector.
16. Close and secure the isothermal oven door.

7.2.4 Replacing the polarizer

1. Locate the polarizer as identified by the element with the single green wire.
2. If applicable, remove any cable ties and free the wiring to expose the wire splice.
3. Cut and remove the heat shrink and glass tape from the green wire to expose the soldered connection.
4. Using a 40 watt soldering iron, disconnect the wire splice.
5. Using a 3/8-inch open-end wrench, carefully remove the polarizer assembly.
6. Carefully insert the replacement polarizer into the detector body and finger tighten, taking care not to damage it. Finish tightening using a 3/8-inch open-end wrench.

7. Roll each end of the green wire of the new polarizer between your forefinger and thumb, causing the wire ends to be tightly spiral wrapped.
8. Using the 40 watt soldering iron and approved high temperature solder, "tin" the wire ends.
9. Spread or expand the end of approved heat shrink to allow easy installation over the solder connection.
10. Install heat shrink over each wire and slide it as far as possible from the connection. This will prevent premature shrinking when the connection is soldered.
11. Overlap and solder the "tinned" ends of the green wire from the wiring harness and the green polarizer assembly wire using approved high temperature solder and 40 watt soldering iron.
12. Apply a short wrap of glass tape over the connection.
13. Slide the heat shrink over the taped connection and shrink it with a heat gun.

7.2.5 Replacing the igniter assembly

1. Locate the igniter identified by the element with the two white wires.
2. If applicable, remove any cable ties and free the wiring to expose the wire splices.
3. Cut and remove the heat shrink and glass tape from the two white wires to expose the soldered connections.
4. Using a 40 watt soldering iron, disconnect the wiring splice.
5. Using a 3/8-inch open-end wrench, continue loosening and carefully remove the Igniter assembly.
6. Carefully insert the replacement igniter into the detector body and finger tighten, taking care not to damage it. Finish tightening using a 3/8-inch open-end wrench.
7. Roll each end of the two white wires of the new igniter between your forefinger and thumb, causing the wire ends to be tightly spiral wrapped.
8. Using the 40 watt soldering iron and approved high temperature solder, "tin" the wire ends.
9. Spread or expand the end of approved heat shrink to allow easy installation over the solder connection.
10. Overlap and solder the "tinned" ends of one wire from the wiring harness and one white igniter assembly wire and solder the wires together using approved high temperature solder and 40 watt soldering iron.
11. Repeat this operation for the remaining white wire.
12. Apply a short wrap of glass tape over each connection.
13. Slide the heat shrink over the taped connection and shrink it with a heat gun.

7.2.6 Cleaning the fid jet

CENELEC and CSA flame ionization detectors are identified by the presence of three packing adapter nuts (5/8-inch, 1/2-inch and 7/16-inch). Other models contain only two packing adapter nuts (5/8-inch and 1/2-inch).

1. On CENELEC AND CSA models, loosen the 7/16-inch packing adapter nut using a 7/16-inch open-end wrench, backed up with a 1/2-inch open-end wrench on the 1/2-inch packing adapter nut. Continue to loosen by hand until disconnected.
2. For all models, loosen the 1/2-inch packing adapter nut using a 1/2-inch open-end wrench with a 5/8-inch open-end back-up wrench. Continue to loosen by hand until disconnected.
3. Withdraw the column and associated ferrules and adapters from the detector.
4. Loosen the 5/8-inch adapter fitting from the bottom of the detector. Extract the jet with the adapter fitting from the jet cavity in the detector. (It may be necessary to loosen or remove the polarizing voltage nut to get the jet to drop out of the detector.)
5. Inspect the end of the jet for damage. It should not be pitted or plugged. If pitted, replace with a new jet.
6. Insert a 0.016-inch diameter piano wire into the jet and rod it out. If the piano wire will not pass through, replace the jet.
7. Using a syringe, protective equipment and clothing, flush the jet with a mild solvent such as acetone; then blow dry with 15 psig clean air, nitrogen or helium.
8. Use a 5/8-inch adapter fitting to insert the jet into the jet cavity. Finger tighten and finish tightening using a 5/8-inch open-end wrench.
9. Insert the column end, ferrule and adapter nut into the detector inlet and finger tighten.
10. If the ferrule was loose and slides any length on the column, continue to push the column into the detector inlet until it stops.
11. Withdraw the column approximately one mm and tighten the 1/2-inch adapter nut finger tight.
12. Tighten the nut 1/4 turn more with a 1/2-inch open-end wrench, then check it for a secure fit by gently attempting to pull the column slightly away from the detector. Carefully tighten the adapter until the column is secure.
13. For CENELEC and CSA models, slide the 7/16-inch packing adapter nut and ferrule toward the detector and install finger tight. Tighten the nut an additional 1/4 turn with a 7/16-inch open-end wrench.

7.2.7 Replacing the fid cable assembly



This procedure requires a special tool, Insertion Tool ABB P/N TL799M013-1, to assist in passing the cable through the insulation between the Electronic Housing and the Oven.

1. Cut the cable just below where it passes through the Oven into the Electronics Housing and remove the cable from the Oven.
2. Disconnect the other end of the cable from the FID Amplifier Assembly and remove the cable from the Electronics Housing.
3. Remove the grommets from the grommet holes (located in the side of the Electronics Housing and the side of the Oven) that will accommodate the routing of the new cable.
4. The new FID Cable Assembly has a Microdot connector on one end and a BNC connector on the other end (see Figure 7.2). Screw the Microdot connector end of the new cable assembly into the Insertion Tool.

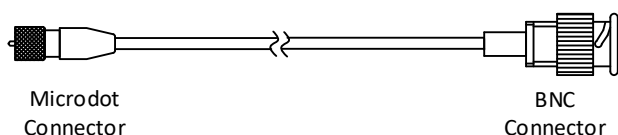


Fig. 7.2. FID Cable Assembly

5. Pass the Insertion Tool through the grommet holes from the Electronics Housing to the Oven.
6. Remove the Insertion Tool from the cable connector.
7. Make a slit in each grommet from the outer diameter to the inner hole. (This is necessary because the cable connector will not pass through the grommet.)
8. Position the cable in the grommets in the Electronics Housing and the Oven.
9. Push the grommets into the grommet holes.
10. Connect the cable connectors to their respective locations (BNC connector to the FID Amplifier Assembly and Microdot connector to the top of the detector).

7.3 Repairing the single port thermal conductivity detector

Refer to Figure 7.3 for Single Port TCD component location.

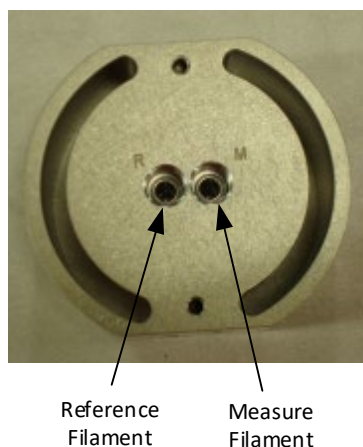


Fig. 7.3. Single Port TC Detector



It is the customer's responsibility to ensure that the area is safe and hazard free, and will remain so the entire time the analyzer is open. This responsibility includes ensuring adequate ventilation in analyzer shelter and obtaining proper work permits, etc.

1. If power is applied to the analyzer, turn it off.
2. Turn off oven air to the Isothermal Oven and allow all temperature zones to cool.
3. Open the isothermal oven door.
4. Isolate carrier and all utility gases

7.3.1 Removing the filaments

1. Use a Phillips screwdriver to loosen the two Phillips head screws located on the front underside of the mounting bracket.
2. Remove the mounting bracket cover by sliding it out and away from the detector assembly.
3. Remove the insulating material from the mounting bracket.
4. If they are not already labeled, label the wire pair connected to the measurement filament "M" and the wire pair connected to the reference filament "R".
5. If the detector filament wiring connections are spliced, perform steps 6 through 8. If they are not spliced, go to step 9.
6. Position the detector wiring such that the wired splices can be accessed.
7. Cut and remove the heat shrink from each of the spliced filament wire connections to expose the soldered connections.
8. Using a 40 watt soldering iron, de-solder and disconnect the wire splices.
9. If the detector filament wiring connections are not spliced, cut the existing detector harness wires approximately three inches from the detector end.
10. Remove the harness retaining clamp and free the harness.
11. Clean the area around the two detector filaments to reduce the chance of foreign particles entering the detector cavity when the filaments are removed.
12. Loosen the two detector filament retaining gland nuts with a 3/8-inch open-end wrench. Continue to loosen by hand.
13. Carefully extract the filaments from the detector cell cavity.

7.3.2 Installing the filaments



Replacement filament installation kits are supplied with two cable glands, a wire spreader, 736 RTV, high temperature solder, and heat shrink.

1. Cut the four filament wires approximately the same length as the wires on the filaments that were removed.
2. Insert one pair of filament wires through the threaded end of the gland nut, then carefully insert the filament into the detector cell cavity marked "M" (measurement). Position the filament with filament wire in the direction of the flow.
3. Slide the nut down the length of the wires to insert and align it with the measurement cavity.
4. Tighten the cable gland finger tight, and then finish tightening with a 3/8-inch open-end wrench.
5. Insert the second pair of filament wires through the threaded end of the gland nut, then carefully insert the filament into the detector cell cavity marked "R" (reference). Position the filament with filament wire in the direction of the flow.
6. Slide the nut down the length of the wires to insert and align it with the reference cavity.
7. Tighten the cable gland finger tight, and then finish tightening with a 3/8-inch open-end wrench.
8. Using wire strippers, remove approximately 1/4 inch of insulation from the end of each detector filament wire.

7.3.3 Filament checkout

1. Connect multimeter leads to each wire of the measurement filament (installed in the detector cavity labeled "M"). The resistance measurement should be approximately 40 ohms.
2. Connect multimeter leads to each wire of the reference filament (installed in the detector cavity labeled "R"). The resistance measurement should be within one ohm of the measurement filament resistance.
3. If the resistance measurements are not within one ohm of each other, ensure the multimeter is connected and functioning correctly, and that the correct meter function is selected.
4. If the detector filaments are not in tolerance, the detector filaments are defective. The filaments must be replaced and the checkout repeated.
5. Neither filament should contact the detector cell body. Connect the multimeter leads to one of the filament wires and the detector cell body. The meter reading should range from several hundred megohms to infinity.

6. Repeat this measurement for each of the other three filament wires. If all resistance measurements are correct, go to "Connecting the Filaments." If any resistance is too low, go to step 8.
7. If the resistance measurement is approximately 20 ohms, filament being tested is contacting the internal wall of the detector cell cavity. When this occurs, carefully loosen the gland of the suspect filament. Continue to loosen by hand and withdraw first the gland, then the filament from the detector cell body (taking care not to touch or damage the filament).
8. Inspect the filament for damage or bending. If it is damaged, the filament pair will have to be replaced.
9. If the filament is slightly bent, use small needle nose pliers to gently and carefully bend it straight.
10. If the filament orientation now appears to be correct, reinstall the detector filament and repeat the complete checkout. If it fails again, replace the detector filament pair and repeat the checkout.
11. If the filament is damaged during this attempted correction process, the filament pair will have to be replaced.

7.3.4 Leak test

1. Restore carrier to the analyzer and establish carrier flow to both the measurement and reference ports of the detector.
2. Verify carrier and reference flow using a flow meter. Typically the flows should be 30 to 40 cc per minute if packed columns are used, 10 to 15 cc per minute if 0.53 mm ID capillary columns are used, and 3 to 5 cc per minute if 0.32 mm ID capillary columns are used.
3. Cap the TCD vents to pressure up the TCD.
4. Test for leaks around the detector filament gland nut with a nonconductive liquid leak detection solution. Correct all leaks before proceeding.
5. Shut off the carrier supply to the analyzer.
6. Gently remove any excess leak detection solution with a soft cloth or tissue and blow dry with 15 psig clean dry air, helium or nitrogen.
7. Slowly loosen and remove the cap nuts installed in step 3.

7.3.5 Connecting the filaments

1. Roll the ends of each stripped harness wire between your thumb and index finger to tightly spiral wrap the wire ends.
2. Using a 40 watt soldering iron and approved high temperature solder, "tin" each of the harness wire ends.
3. Roll the ends of each stripped filament wire between your thumb and index finger to tightly spiral wrap the wire ends.
4. Using a 40 watt soldering iron and approved high temperature solder, "tin" each of the filament wire ends.
5. Install approved heat shrink over each of the four filament wires, and slide it as far from the free wire end as possible.
6. Select a harness assembly wire with the "R" label designation and overlap the "tinned" ends of this harness wire with one of the reference filament wires.
7. Solder the wires using a 40 watt soldering iron and approved high temperature solder. Apply solder sparingly, allowing it to flow evenly. Do not overheat the solder or a high resistance connection could result.
8. Repeat steps 6 and 7 for the remaining harness wire labeled "R" and reference filament wire.
9. Repeat steps 6 through 8 for harness wires labeled "M" and the measurement wires.
10. Slide heat shrink over each connection and shrink with a heat source.

7.3.6 Potting the filaments (CENELEC and CSA only)

Perform this procedure if you know that your analyzer is constructed to CENELEC or CSA specifications or if the existing detector filament is potted.

1. Gently slide the insulation sheath out of and away from the gland nut.
2. Using a syringe filled with Silastic compound "Dow 736 RTV," completely fill the gland cavity with the Silastic compound.
3. With the insulation still pulled away from the gland nut, use needle nose pliers to install the wire spreader.
4. Separate and insert filament wires into the slots on either side of the spreader. The spreader should be positioned between the end of the sheath insulation and the back of the gland nut.
5. Press the spreader into the recess in the gland nut. The retainer must be installed such that it is not in any way tilted. It is normal for the retainer to protrude slightly from the gland recess.
6. Slide the sheath insulation toward the wire spreader until it contacts the face of the spreader.

7.3.7 Re-installing mounting bracket cover

1. Reinstall the insulating material.
2. Reinstall mounting bracket cover.
3. Use a Phillips screwdriver to secure the mounting bracket cover with the two Phillips head screws removed in "Removing the filament" procedure.

7.4 Repairing the multiport thermal conductivity detector



This repair should only be attempted by people who are properly trained and possess the expertise for this repair.

7.4.1 Accessing the detector

1. Turn off power to the analyzer.
2. Turn off instrument air.
3. Turn off carrier and other gases, as applicable.
4. Allow detector assembly and columns to cool.
5. Open the main front door of the oven.
6. Open the side door of the oven (top door in Class C Oven).
7. On the wall of the side compartment, loosen the three screws on the bracket that secures the TCD assembly. (This allows the detector assembly to rotate for ease of access.)
7. Rotate the top of the TCD to the front of the analyzer. (Tubing into and out of TCD may need to be tagged and removed).
8. Remove the TCD cover by removing eight screws securing the cover.

7.4.2 Removing the filaments

Special tool required: Adjustable 0-90 in./lb torque wrench

1. Perform "Accessing the detector."
2. Remove the clear sheaving from all filament leads.
3. Unsolder wires connected to the filaments using a 40 watt soldering iron.
4. Using a 11/32 deep well socket, loosen the gland nuts securing the filaments.
5. Continue loosening and remove the filament from the detector assembly by hand.

7.4.3 Installing new filaments



Filament Replacement Kit 865K001-1 includes a set of four filaments, four gland nuts, and a wire splice kit.

-
1. Carefully install the new filaments and gland nuts; being careful to not damage the filament.
 2. Install the filaments so they are facing in the direction of flow into the detector housing.
-



Not following the torque pattern described in the next step can result in permanent damage to the detector block.

-
3. Using a 11/32 deep well socket torque each gland nut individually in a clockwise pattern in 10 IN/LB increments, until 90 in./lbs is reached on all nuts.
 4. Install a one inch piece of PTFE sleeving onto each filament lead and trim leads to ¼ inch above sleeving
 5. Measure the resistance of all filaments. They should be 40-42 ohms at room temperature. All filaments should be within one ohm of each other.
 6. Verify the filaments are not in contact with the detector housing. Measure the resistance from one filament lead to the block. It should read infinity. Repeat for all filaments.
 7. Leak check the filaments
 8. Cap the TCD cell vents
 9. Ensure the wires removed from the filaments are not in contact with the detector block or each other or remove the AC power connectors at the bridge amplifiers.
 10. Turn on carrier gas and utilities.
 11. Restore power to the oven.
 12. Set carrier pressures as per the data sheet.
 13. Wait five to ten minutes for the pressures to equilibrate in the analyzer.
 14. Check for leaks around the filaments.
-



ABB recommends using an alcohol such as Methanol to check for leaks as it dries quickly and leaves no residue.

15. Power down the oven.
16. Isolate carrier and utility gases.
17. Slowly loosen and remove cell vent caps.
18. Reconnect the bridge amplifier's AC power connectors and tighten the connector screws.
19. Cut off a short piece of each wire and remove ¼ inch of insulation.
20. Tin wire using 40 watt soldering iron.
21. Refer to Figure 7.4 for wiring color code.

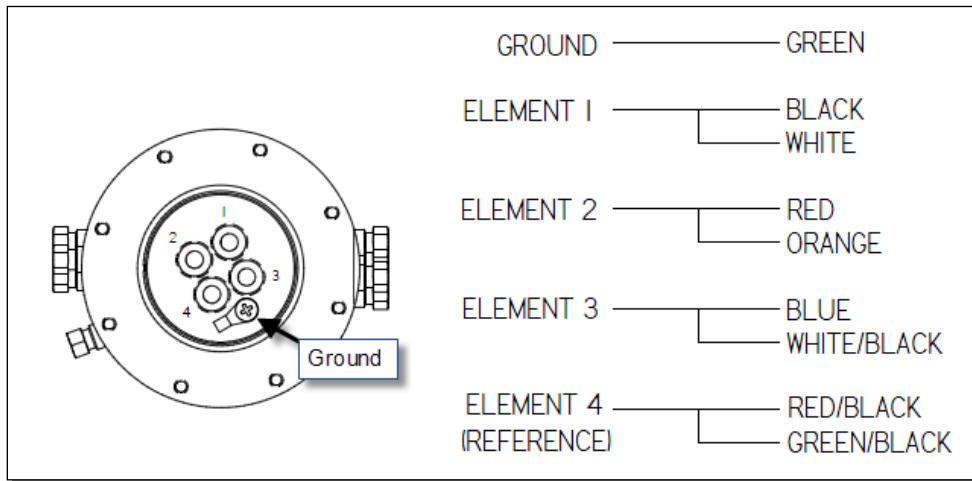


Fig. 7.4. Multiport Filament Layout

22. Route wires as shown in Figure 7.5 and solder to filament leads using a 40 watt soldering iron.

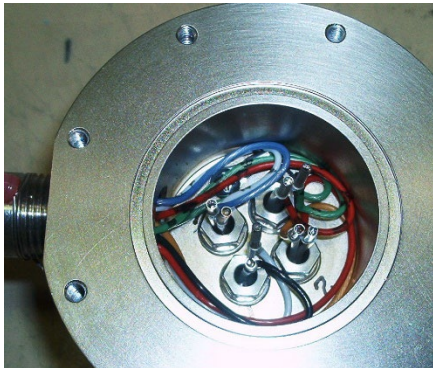


Fig. 7.5. Filament Wiring Location

23. Cover each solder connection with ½ inch of clear shrink sleeving and shrink with a heat gun. Pinch the open end of the sleeving together while still hot, to close the end of the sleeving.
24. Install o-ring as necessary into o-ring groove of cell body.
25. Re-install cover and screws removed in step 7.4.1.
26. Torque screws to 16 in./lbs.
27. Reposition detector and tighten the three brackets in the electronics housing to secure.

7.5 Repairing the flame photometric detector

7.5.1 Replacing the photomultiplier assembly



It is the customer's responsibility to ensure that the area is safe and hazard free, and will remain so the entire time the analyzer is open. This responsibility includes ensuring adequate ventilation in analyzer shelter and obtaining proper work permits, etc.

Do not remove the light pipe from the photomultiplier assembly as this will exhaust the purge gas which is necessary for proper operation.

1. Turn off oven air to the isothermal oven; de-activate all heated zones under the set-up tab and allow all temperature zones to cool.
2. Remove oven power.
3. Open the door on the left side of the analyzer.
4. Disconnect the cables to the Photomultiplier Assembly and set them aside.
5. Remove the four screws securing the Photomultiplier Assembly to the analyzer, being careful to retain the screws to reinstall the Photomultiplier Assembly.
6. Carefully pull the Photomultiplier Assembly straight out of the analyzer.
7. Reinstall the Photomultiplier Assembly in reverse order of removing it.

7.5.2 Replacing the burner block

Refer to Figure 7.6 while performing this procedure.

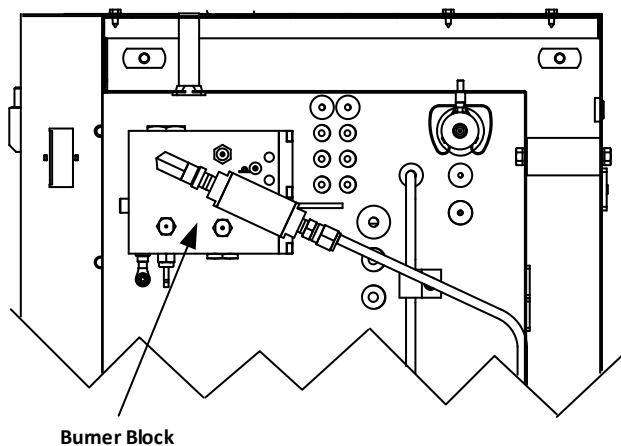


Fig. 7.6. Burner Block

1. Remove power from the analyzer.
2. Turn off oven air to the isothermal oven and allow all temperature zones to cool.
3. Turn off air supply to air cleanup unit.
4. Open the isothermal oven door.
5. Disconnect the thermocouple leads from the Burner Block.
6. Disconnect the heater leads from the Burner Block.
7. Disconnect the temperature sensor leads from the Burner Block, if installed.
8. Disconnect the sample line from the Burner Block.
9. Disconnect the vent line from the Burner Block.
10. Disconnect the hydrogen (H₂) and carrier lines from the Burner Block.
11. Remove the bracket screws that fasten the Burner Block to the oven.
12. Slide the Burner Block off the end of the Photomultiplier Assembly and remove the Burner Block from the oven.
13. Install the new Burner Block in reverse order of removing it.

7.5.3 Replacing the burner block o-rings

Refer to Figure 7.7 when performing this procedure.

Perform steps 1 through 4 of "Replacing the Burner Block."

To remove a particular O-Ring, carefully remove the associated connector and then remove the O-Ring.

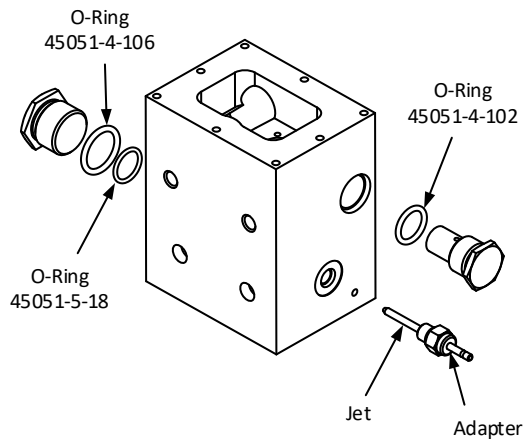


Fig. 7.7. Burner Block Cross Section (showing O-rings)

1. Perform steps 1 through 4 of "Replacing the Burner Block."
2. To remove a particular o-ring, carefully remove the associated connector and then remove the o-ring.
3. Lubricate the new O-Ring with a slight film of silicone grease.
4. Insert the new O-Ring and reinstall the connector.

7.5.4 Replacing the jet

Refer to Figure 7.7 when performing this procedure.

1. Perform steps 1 through 4 of "Replacing the Burner Block."
2. Carefully remove the Adapter.
3. If the Jet came out with the Electrode Nut, carefully remove the Jet from the Electrode Nut.
4. If the Jet did not come out with the Adapter, carefully remove the Jet from the Burner Block by pulling it straight down.
5. Insert the new Jet into the Electrode Nut until it seats fully.
6. Carefully install and tighten the Electrode Nut.

7.6 Liquid sample valve repair

The analyzer's sample lines are connected to the liquid sample valve as shown in Figure 7.8.

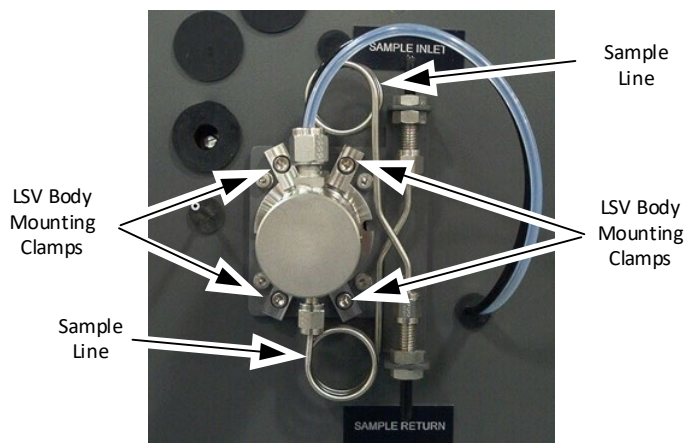


Fig. 7.8. Liquid Sample Valve

It is also important to use two wrenches when tightening the sample line connections. One wrench must be used to back up the force applied to tighten the fitting. Direct wrench force (not using a back-up wrench) will damage the seals and possibly bend the stem.

Sample will spill or leak out during this procedure. Consult MSDS sheets on file at your location for safety requirements.



Sample valve repair may necessitate the venting of flammable substances into the atmosphere surrounding the analyzer. Remove power from all sources of ignition in the immediate area. Do not open any purged enclosures that remain powered.

Ensure proper safety equipment is worn, such as rubber gloves and face shield or safety glasses.

It is the customer's responsibility to ensure that the area is safe and hazard-free, and will remain so the entire time the analyzer is open. This responsibility includes ensuring adequate ventilation in analyzer shelter and obtaining proper work permits, etc.



To ensure the integrity of the components within the Liquid Sample Valve (LSV), use the tools in LSV Tool Kit 791K009-1 when assembling or disassembling the LSV.

7.6.1 LSV disassembly on the analyzer

See Figure 7.9 for typical sample valve component location.

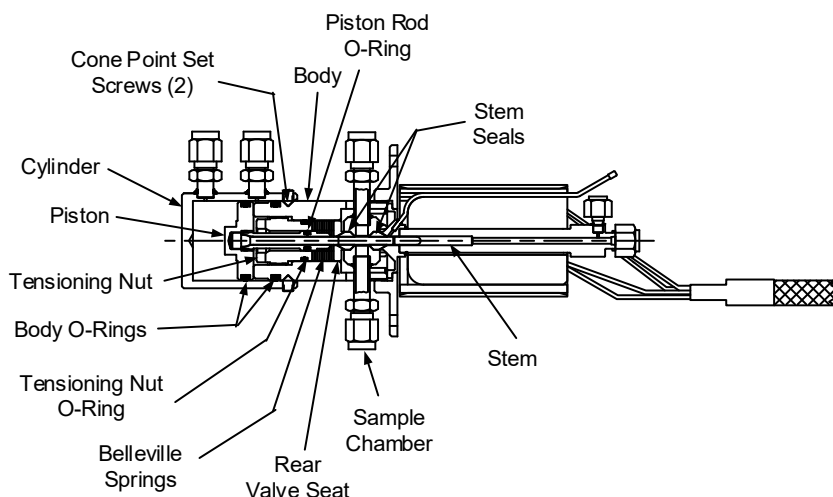


Fig. 7.9. Liquid Sample Valve Component Location

1. Stop the analysis at the end of a cycle.
2. Remove power from the analyzer.
3. Allow all temperature zones to cool, maintaining flow while the columns are cooling.
4. Turn off carrier, sample and air to the analyzer.
5. Open the isothermal oven door.
6. Verify that the bolt keeping the vaporizer from turning is tightened to 25 in-lb.
7. Disconnect the tubing coils from the Liquid Sample Valve.
8. Remove the two **cone point set screws** from the **cylinder**.
9. Slide the **cylinder** off the **piston** and **body**.
10. Using a hex key wrench, rotate the **tensioning nut** counterclockwise until the assembly is loose.
11. Unscrew the **body** from the **flange** and **vaporizer chamber**.
12. Withdraw the **piston** and the **piston rod** from the **tensioning nut**.
13. This will free the **seals** from the **stem**.
14. Replace the **seals**.
15. Inspect the stem for visible imperfections. If imperfections are found, replace the stem.
16. Remove the **rear valve seat** from the **body**.
17. Remove the 15 **Belleville springs** from the **body**.
18. Inspect the **body O-rings** for visible imperfections. If imperfections are found, remove the **body O-rings** from the **body** and **piston**.
19. Unscrew the **piston rod** from the **piston** and extract the **stem assembly** from the **piston rod**.
20. Inspect the **piston rod O-ring** for visible imperfections. If imperfections are found, remove the **piston rod O-ring** from the **piston rod**.
21. Unscrew the **tensioning nut** from the **body**.
22. Inspect the **tensioning nut O-ring** for visible imperfections. If imperfections are found, remove the **O-ring** from the **tensioning nut**.

7.9.2 LSV reassembly on the analyzer



In all steps the lubricant used is High Vacuum Grease, ABB part number 006904-1.

1. Clean the **seals** with acetone and air dry them.
2. Clean the **sample chamber** with acetone and air dry it.

3. Lightly lubricate the **tensioning nut O-Ring** and the Tensioning Nut threads, internal threads and bore of the **body** with High Vacuum Grease.
4. Install the **O-ring** onto the **Tensioning Nut**.
5. Screw the **tensioning nut** into the **body** until the bottom of the nut grooves is approximately flush with the ears on the back of the body.
6. Lightly lubricate the **piston rod O-ring** and the threads of the **piston rod**.
7. Install the **piston rod O-ring** onto the **piston rod**. Do not allow grease to enter the small hole through the center of the piston.
8. Insert the **stem** into the rear of the **piston rod**.
9. Screw the **piston rod** into the **piston** and tighten to 27 to 30 in-lb. Do not overtighten or bend the rod or stem! Do not allow grease to contact the stem.
10. Lightly lubricate the **body O-rings**.
11. Install the **body O-rings** onto the **body** and the **piston**.
12. Insert the **piston** and the **piston rod** into the **sleeve**, being careful not to cut the O-ring. Fully insert the **piston** until it contacts the stops.
13. Stack the **15 Belleville springs** onto the 1/4-inch thin wall plastic tubing, as shown in Figure 7.10.

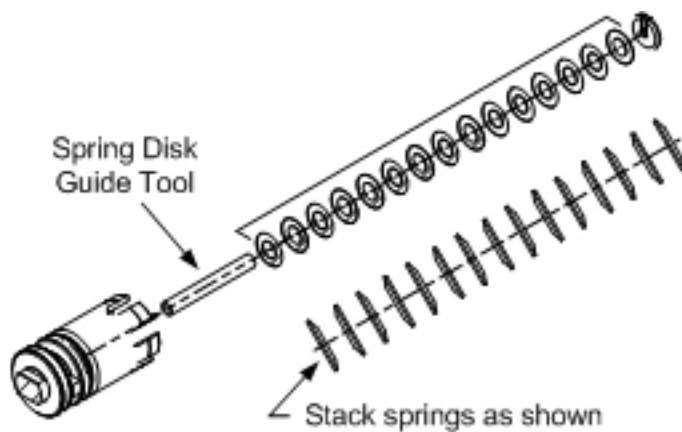


Fig. 7.10. Stacking the Belleville Springs

14. Using the tubing only as a guide, slide the **Belleville springs** over the **stem** into the bore of the **body**.
15. Install the **rear valve seat** over the **stem** and let it rest against the **Belleville springs**. Do not allow the seat to scratch the stem.
16. Clean all the exposed area of the **stem** with acetone to ensure the stem and groove are free of grease and contamination.

17. Slide the first cleaned **seal** over the **stem** using the “A” end of Seal Insertion Tool TL-791A006B. The 30° angle (pointed end) of the **seal** must face the **Belleville springs**. Figure 7.11 shows the orientation of the seal.

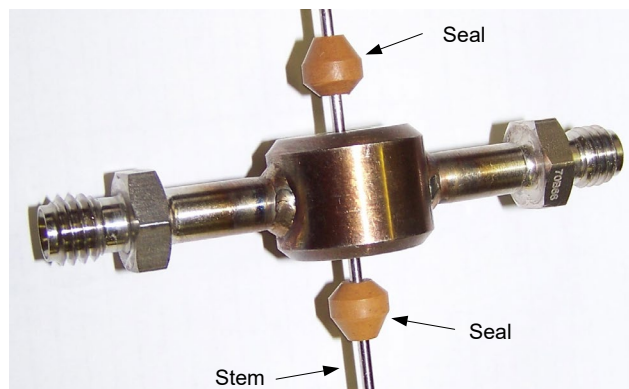


Figure 7.11. Installing the Stem Seals

18. Slide the cleaned **sample chamber** over the **stem** onto the **seal**.
19. Slide the second cleaned **seal** over the **stem** using the “B” end of Seal Insertion Tool TL-791A006B. The 30° angled (pointed end) of the **seal** faces out, away from the **sample chamber**. Figure 7.11 shows the orientation of the seal.
20. Lightly lubricate the threads on the **body**.
21. Retract the **stem** until it is flush with the front of the **seal**.
22. Screw the **body** into the **flange** against the **vaporizer chamber** until tight.
23. Push the **stem** into place.
24. The **sample chamber** should be loose in the assembly at this point. If not, back out the **tensioning nut** until the **sample chamber** is loose. Use the end of a 0.156 Allen wrench in the slot of the tensioning nut to adjust to the point of eliminating the longitudinal play of the sample chamber.
25. Tighten the **tensioning nut** in 24 1/4-turn increments (6 turns total) to load the **seals**.
26. Lightly lubricate the inside bore of the **cylinder**.
27. Align the fittings on the **cylinder** with the **sample chamber** tubes, or with air lines if servicing.
28. Slide the **cylinder** onto the **piston** and the **body**.
29. Install two **cone point set screws** into the **cylinder** and tighten into the groove on the **body**.
30. Reinstall tubing to the LSV, being careful to connect each line to the proper connection on the LSV.
31. Close the isothermal oven door.

7.6.3 Removing the LSV from the analyzer

1. Stop analysis at the end of a cycle.
2. Remove power from the analyzer.
3. Allow all temperature zones to cool, maintaining flow while the columns are cooling.
4. Turn off carrier, sample, and air to the analyzer.
5. Open the isothermal oven door.
6. Label all connections to the Liquid Sample Valve.
7. Disconnect all tubing from the Liquid Sample Valve.
8. Mark the analyzer and flange to ensure the flange is reinstalled in the correct orientation.
9. Remove the four screws holding the flange to the side of the analyzer.
10. Remove the Liquid Sample Valve to the workbench. The insulation and insulation retainer may move during LSV removal; retain them for later installation.
11. Close the isothermal oven door.

7.6.4 Installing the LSV on the analyzer

1. Open the isothermal oven door.
2. Install the Liquid Sample Valve on the analyzer, making sure the insulation and insulation retainer are in the proper location around the vaporizer.
3. Orient the flange so that the marks made at valve removal are lined up. This should have the sample chamber vertical, with the air connections at the top of the valve and the connection of the vaporizer chamber at the top.
4. Install the four screws holding the flange to the side of the analyzer and tighten the screws.

5. Reconnect all tubing on the Liquid Sample Valve.
6. Close the isothermal oven door.

7.7 CP valve repair

This section describes how to replace the CP Valve slider, wedges, valve plate, and o-rings. The bulletin applies to both the 40 psig and 60 psig valves (see Figure 7.12).

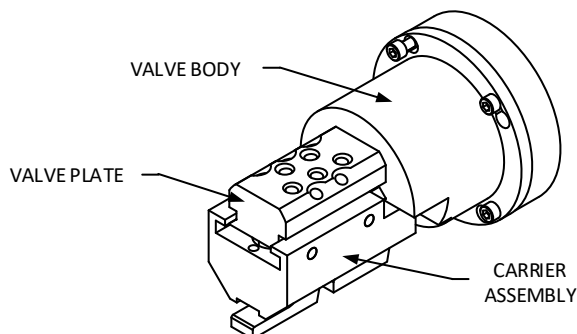


Fig. 7.12. Typical M2CP Valve

7.7.1 Preparation and safety



Ensure that there are no hazardous or flammable gases present in the immediate area of the analyzer. The purged electrical sections of the analyzer will be declassified when purge is removed, and a danger exists for fire, explosion, damage to property and injury or death to plant personnel during the nonpurged time. Obtain proper permits such as hot work, etc.

Ensure adequate ventilation in analyzer shelter.

1. Stop the analysis at the end of a cycle.
2. Turn off sample and air to the analyzer.



Verify that the oven is cool (ambient temperature) before removing carrier gas.

3. Turn off power and carrier gas.
4. Open the isothermal oven door.
5. Locate the valve to be repaired.

7.7.2 Replacing the slider

The Slider is part of the Carrier Assembly. To ensure you have the correct slider for your application, verify the slider part number from the Data Sheets supplied with your analyzer.

To replace the slider:

1. Perform the "Preparation and safety" procedure.
2. Open both Carrier Assembly latches by pulling down on the end of the latches.
3. Remove the Carrier Assembly from the Valve Plate and Valve Body, being careful to keep the latches in their open position.
4. Compare the old slider with the new slider to ensure they are the same.
5. Note the orientation of the slider's ports.
6. Remove the old slider from the Carrier Assembly.
7. Insert the new slider, ensuring that the ports are aligned in the same way as the old slider.
8. Wipe the bottom of the Valve Plate with methanol and a lint-free wipe to remove any slider residue or contamination.

9. Insert the Carrier Assembly on the Valve Plate.
10. Close the back Carrier Assembly latch. This ensures the Carrier Assembly is locked into the hole in the piston stem.
11. Close the front Carrier Assembly latch.

7.7.3 Replacing the wedges

The four wedges (part number 3527279-1), located on the Carrier Assembly, center the Valve Plate on the Carrier Assembly.

To replace the wedges:

1. Perform the "PREPARATION AND SAFETY" procedure.
2. Open both Carrier Assembly latches by pulling down on the end of the latches.
3. Remove the Carrier Assembly from the Valve Plate and Valve Body, being careful to keep the latches in their open position.
4. Remove the slider (see "REPLACING THE SLIDER").
5. Note the orientation of the wedges and push out each wedge from the outside of the Carrier Assembly.
6. Insert a wedge from the inside of the Carrier Assembly, being careful not to scratch the Carrier Assembly. Using a cold chisel, push the wedge into position, ensuring the back of the wedge is against the carrier body.
7. Repeat step 6 for the remaining wedges.
8. Reinstall the slider.
9. Insert the Carrier Assembly on the Valve Plate.
10. Close the back Carrier Assembly latch. This ensures the Carrier Assembly is locked into the hole in the piston stem.
11. Close the front Carrier Assembly latch.

7.7.4 Replacing the o-rings

Since the O-rings are inside the valve, you will have to remove the Valve Body from the analyzer. The O-rings come in a kit, with different kits for 40-psig and 60-psig CP valves (see Figure 7.13). The rework procedure is the same for both valves.

DESCRIPTION (dimensions are in inches)	PART NUMBER	
	40-PSIG KIT 764K001N-2	60-PSIG KIT 764K001N-1
O-Ring, Fluorocarbon, 1/4 x 1/8 x 1/16	45051-4-11	45051-4-11
O-Ring, Fluorocarbon, 2 x 1-7/8 x 1/16	45051-4-35	
O-Ring, Fluorocarbon, 1-3/4 x 1-1/2 x 1/8	45051-4-61	
O-Ring, Fluorocarbon, 1-3/8 x 1-1/4 x 1/16		45051-4-29
O-Ring, Fluorocarbon, 1-1/2 x 1-3/8 x 1/16		450501-4-31
Grease, Molykote 33	3616175-1	3616175-1

Fig. 7.13. O-Ring Kits



It is essential to the analyzer's operation that all valve ports remain correctly connected.

To replace the O-rings:

1. Perform the "PREPARATION AND SAFETY" procedure.
2. Tag each port connection to the valve, using the port numbers stamped on the Valve Plate.
3. Remove the port connections.
4. Remove the air connection on the Valve Body. (You do not have to remove the connection on the Mounting Plate that attaches to the analyzer.)
5. Using a 7/64-inch hex key wrench, loosen the four screws that attach the Valve Body to the Mounting Plate.
6. Rotate the Valve Body counterclockwise and remove it from the Mounting Plate.
7. Open both Carrier Assembly latches by pulling down on the end of the latches.

8. Remove the Carrier Assembly from the Valve Plate and Valve Body, being careful to keep the latches in their open position.
9. Push the piston rod into the Valve Body to release the piston, being careful not to scratch any valve surfaces.
10. Remove the piston and piston rod from the Valve Body.
11. Remove the piston rod O-ring and the piston O-ring.
12. Wipe all surfaces of the piston and piston rod to remove contamination.
13. Verify that the screw holding the piston rod to the piston is tight.
14. Lubricate one O-ring part number 45051-4-11 with Molykote 33.
15. Position O-Ring Tool part number 3122-1 over the piston rod (see Figure 7.14).

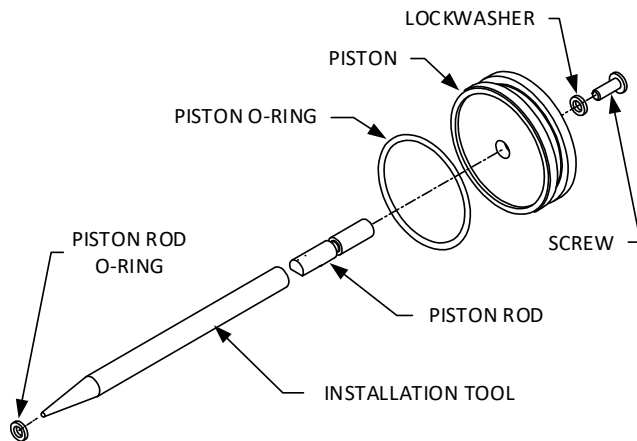


Fig. 7.14. Installing the O-Rings on the Piston Rod and Piston

16. Install the O-ring over the O-Ring Tool and into the O-ring groove on the piston rod.
17. Lubricate O-ring part number 45051-4-61 (40-psig valve) or 45051-4-29 (60-psig valve) with Molykote 33 and install it in the O-ring groove of the piston.
18. Remove the old O-ring from the Valve Body (see Figure 7.15).

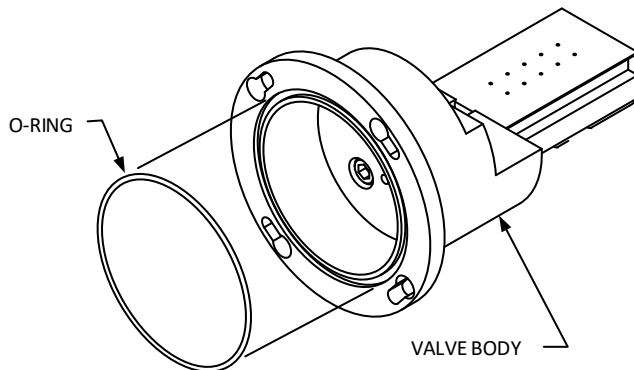


Fig. 7.15. Installing the O-Ring on the Valve Body

19. Wipe the inside of the Valve Body to remove contamination and old lubricant.
20. Inspect the piston rod bore to ensure the bore is clean.
21. Lubricate O-Ring part number 45051-4-35 (40-psig valve) or 45051-4-31 (60-psig valve) with Molykote 33 and install it in the O-ring groove in the Valve Body.
22. Lubricate the piston rod and the inside of the Valve Body (the piston housing area) with Molykote 33.
23. Insert the piston rod and piston rod assembly into the Valve Body. Before seating the piston, ensure the flat surface on the piston rod is facing up.
24. Insert the Carrier Assembly on the Valve Plate.
25. Close the back Carrier Assembly latch. This ensures the Carrier Assembly is locked into the hole in the piston stem.

26. Close the front Carrier Assembly latch.
27. Install the Valve Body over the screws on the Mounting Plate and rotate the Valve Body clockwise to seat it. The port connections must face the same direction as when it was originally installed.
28. Tighten the four screws securing the Valve Body to the Mounting Plate.
29. Reinstall the air connection onto the Valve Body.
30. Reinstall the port connections, being careful to get each connection to the correct port.
31. Perform a leak check on the valve.
32. Turn on carrier gas, air and power.
33. Check the operation of the valve.

7.7.5 Replacing the valve plate

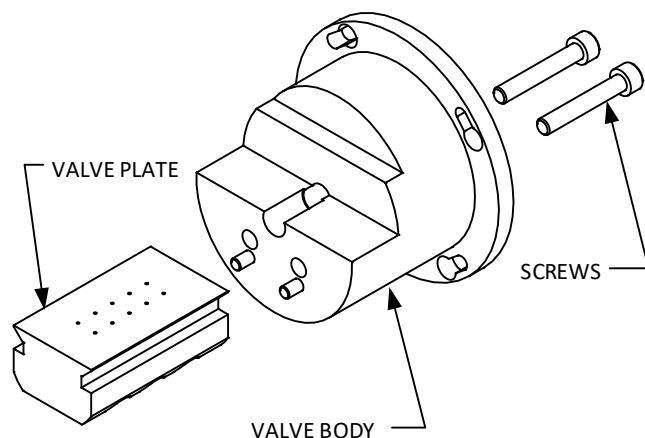


Fig. 7.16. Installing the Valve Plate on the Valve Body

1. Clean the inside counter-bored holes of the Valve Body to remove contamination and old sealant (see Figure 7.16).
2. Align the holes in the Valve Plate with the holes/dowels in Valve Body and set into place. Care should be taken not to damage the finish surface of the Valve Plate.
3. Dip the screws into RTV (Dow Corning #732 or GE #108) to within 1/8 inch from flat surface on bottom of the screw head.
4. Position screws through countered-bored holes in Valve Body and install into Valve Plate.
5. Tighten both screws securing the Valve Plate to the Valve Body. Screws should be torqued to 19 in. lbs.

7.8 Replacing diaphragm valves

Two models of diaphragm valves are used in some analyzers. These valves are differentiated by the number of screws in the valve cap, with one having four screws in the cap and the other having one screw in the cap.

7.8.1 Preparation



Ensure that there are no hazardous or flammable gases present in the immediate area of the analyzer. The purged electrical section of the analyzer will be declassified when purge is removed, and a danger exists for fire, explosion, damage to property and injury or death to plant personnel during the non-purged time. Obtain proper permits such as hot work, etc.

Ensure adequate ventilation in the analyzer shelter.

1. Stop the analysis at the end of a cycle.
2. Turn off sample and air to the analyzer.



Verify that the oven is cool (ambient temperature) before removing carrier gas.

3. Turn off power and carrier gas.
4. Open the isothermal oven door.
5. Locate the valve to be replaced.
6. Tag all valve connections.



Service or replacement of the O-rings, plungers, or springs must be performed at the factory. Do not disassemble the valve unless system malfunction is definitely isolated to the valve. Perform all other system checks first.

All disassembly operations must be performed in a clean, well-lighted area. Flush all hazardous or toxic materials from the valve before starting.

7.8.2 Removing a valve

1. With a 1/4-inch wrench, remove the connections from the valve cap.
2. With a 7/64-inch hex key wrench, loosen the clamp ring screw.
3. Remove the valve from the clamp ring and take it out of the analyzer.

7.8.3 Replacing the diaphragm (four screw type)

1. Remove the three screws around the outside of the valve (see Figure 7.17).

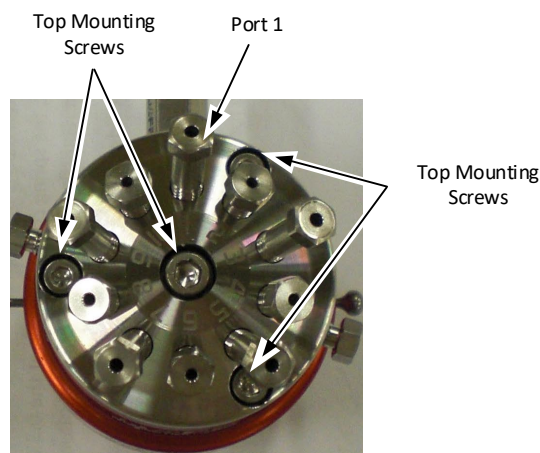


Fig. 7.17. Typical 4 Screw Cap, Showing Port 1 Orientation

2. Remove the center screw.
3. Lift the cap from the two alignment pins.
4. Set the cap aside in a safe, clean place, with the polished side up so that it does not get scratched.
5. With tweezers or a knife blade under the edge of the diaphragm, carefully lift and work the diaphragm off the alignment pin. Be careful not to tilt the valve, which could let the plungers fall out.
6. Set the valve on a clean surface, with the base down and the plungers up.
7. Put on powder-free gloves.
8. Remove the new diaphragm from its packaging.
9. Hold the diaphragm carefully by the edges so that the surface is not contaminated or damaged.
10. Install the diaphragm in place, making sure the diaphragm groove is aligned with the recess in the cylinder body.
11. Clean the cap thoroughly with an appropriate solvent and a clean tissue or cotton swab, taking care not to damage the surface.
12. Blow the cap with clean compressed gas to remove any lint left by the tissue or swab.
13. Install the cap over the alignment pins with port number 1 opposite the air inlet (see Figure 7.17).
14. Reinstall the longer screw into the center of the cap.
15. With a torque wrench, tighten this screw to 5 inch-pounds.
16. Reinstall the other three screws around the edges of the cap.
17. With a torque wrench, tighten the center screw to 20 inch-pounds.
18. With a torque wrench, tighten the other three screws to 20 inch-pounds.

7.8.4 Replacing the diaphragm (one screw type)

1. Remove the hex head cap screw from the center of the valve cap (see Figure 7.18).

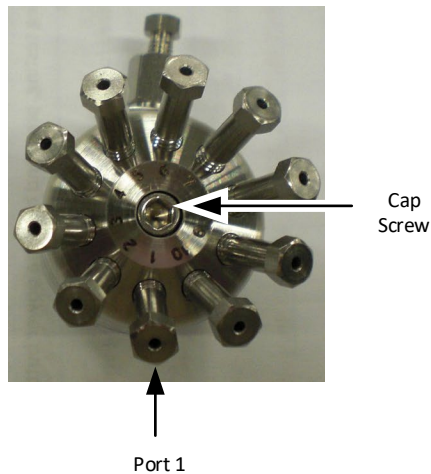


Fig. 7.18. Typical 1 Screw Cap, Showing Port 1 Orientation

2. Lift the cap from the two alignment pins.
3. Set the cap aside in a safe, clean place, with the polished side up so that it does not get scratched.
4. With tweezers or a knife blade under the edge of the diaphragm, carefully lift and work the diaphragm off the alignment pin. Be careful not to tilt the valve, which could let the plungers fall out.
5. Set the valve on a clean surface, with the base down and the plungers up.
6. Put on powder-free gloves.
7. Remove the new diaphragm from its packaging.
8. Hold the diaphragm carefully by the edges so that the surface is not contaminated or damaged.
9. Slide the diaphragm over the alignment pins with the side marked TOP toward the cap (away from the plungers).
10. Clean the cap thoroughly with an appropriate solvent and a clean tissue or cotton swab, taking care not to damage the surface.
11. Blow the cap with clean compressed gas to remove any lint left by the tissue or swab.
12. Install the cap over the alignment pins with port number 1 opposite the air inlet (see Figure 7.18).
13. Reinstall the hex head screw in the center of the cap.
14. With a torque wrench, tighten the screw to 45 inch-pounds.

7.8.5 Installing the new diaphragm valve

1. Place the valve in the clamp ring and rotate it to the orientation of the valve that was removed.
2. Using a 7/64-inch hex key wrench, tighten the clamp ring screw.
3. Install the connections to the valve cap, matching the numbering on the valve to the tags on the connections.
4. Using a 1/4-inch wrench, tighten each connection.

7.9 Optional discharge ionization detector

Replacing the reactor tube while it is in the oven is not advised. Due to the small pieces and awkward angles involved in the procedure, it is highly recommended the Discharge Ionization Detector (DID) be removed before attempting replacement. The detector is located in the oven as shown in Figure 7.19. Its Power Supply is located inside the oven's left side door (see Figure 7.20).

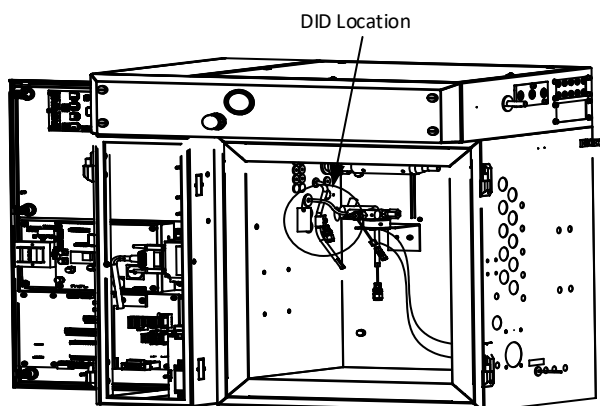


Figure 7.19. Discharge Ionization Detector



Power Supply

Figure 7.20. DID Power Supply

7.9.1 Scheduled maintenance

There are no parts within the detector, the power supply, or the electrometer that require scheduled maintenance.

7.9.2 Removing the detector

1. Disable the isothermal oven temperature zone.
2. Allow the oven to cool to room temperature.
3. Turn off power to the oven.
4. Turn off the plasma power supply switch (located on the top of the supply).
5. Wait at 30 seconds for the plasma to discharge.
6. Grasp the high voltage shield and remove the plasma high voltage lead from the plasma cell by pulling on the bayonet connector.
7. Loosen the inside closest nut to the detector body.
8. Loosen the 1/4-inch tube nut at the other end of the plasma cell.
9. Remove the plasma cell, being careful not to damage the center electrode ceramic.
10. Remove the Phillips head screw that secures the two halves of the high voltage shield and retain the screw.
11. Remove the high voltage shield.

7.9.3 Installing the detector

1. Install the high voltage shield on the replacement plasma cell.

2. Secure the shield with the Phillips head screw retained earlier.
3. Remove, inspect, and replace if necessary, the PTFE ferrule in the reaction gas assembly before continuing.



The plasma cell is marked with a dot on the end of the cell that installs in the detector body.

4. Install the unmarked end of the plasma cell into the reaction gas assembly. Use caution not to damage the center electrode ceramic.
5. Tighten the 1/4-inch tube nut finger tight only.
6. Verify the position of the center electrode ceramic. Viewed from the detector end of the plasma cell, the tip of the center electrode should protrude approximately 1/32-inch past the edge of the high voltage tube clamp.
7. To adjust, loosen the 5/32-inch tube nut on the back of the reactor gas assembly that secures the center electrode.
8. Position the center electrode and tighten the 5/32-inch tube nut.



There are two small parts behind the O-ring, a ceramic and a stainless steel noise shield. Be careful not to lose these parts.

If the parts fall out, replace them with the ceramic first and then the stainless steel noise shield.

9. Remove the closest nut, ferrule and O-ring from the detector body.
10. Slide the closest nut, ferrule and O-ring onto the marked end of the plasma cell.
11. Gently insert the plasma cell into the body of the detector until it stops.
12. Tighten the closest nut finger tight only.
13. While supporting the plasma cell, reconnect the plasma high voltage lead.
14. Reconnect the ground lead, if necessary.
15. Turn on power to the oven.
16. Purge the detector for at least five minutes with reactor gas.
17. Turn on the plasma power supply switch.
18. Enable isothermal oven temperature zone.
19. Allow the oven to heat and stabilize at temperature.
20. Allow the system to purge for five minutes prior to starting the plasma.

7.9.4 Replacing the exhaust tube

It is possible for the exhaust tube to become clogged and require replacement.

1. Remove the old exhaust tube.
2. Measure the insert depth from the tip of the tube to the back of the nut.
3. Disconnect the exhaust tube from the detector vent line.
4. Install a new exhaust tube in the Vespel ferrule on the upper 1/4-inch Swagelok fitting.
5. Connect the exhaust tube to the detector vent tubing.

7.9.5 Replacing the power supply

DID Power Supply removal and replacement procedure:

1. Turn off power to the analyzer.
2. Tag all cables connected to the Power Supply.
3. Remove the cables from the Power Supply.
4. Remove the Power Supply from the DIN rail.
5. Attach the new Power Supply to the DIN rail.
6. Reconnect all cables to the Power Supply.

8 Replacement parts

8.1 Ordering information



Since the particular application defines the component parts specific to any given system, please refer to the “Recommended Spare Parts Lists” in the analyzer’s Data Package to obtain the full and correct part number for the desired part or assembly.

8.1.1 Equipment identification

Include the following information, found in the Data Package and on the analyzer nameplate, in any communication concerning replacement parts or components:

- ABB Sales Order Number.
- Analyzer Model Number.
- Analyzer Part Number (P/N) and serial number.
- For serial numbered subassemblies such as PCBs, include the serial number and the part number (including dash number and revision letter) for the subassembly in the request. If a PCB requires conformal coating, prefix the PCB part number with the letters "CC."
- Applicable references from the “Recommended Spare Parts List” of the Data Package, included with each analyzer.
- Description of part.

8.1.2 Master controller configuration identification

The Master Controller nameplate (see Figure 8.1) lists the Master Controller configuration information.

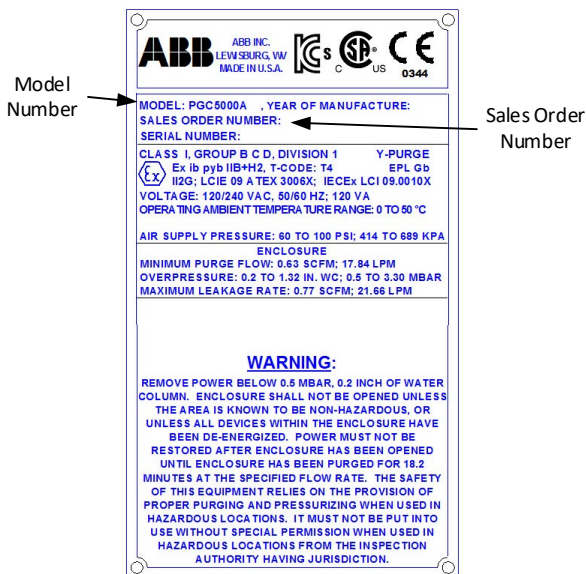


Fig. 8.1. Typical Master Controller Nameplate

The hardware configuration consists of the model number and sales order number.

8.1.3 Oven configuration identification

The Oven nameplate (see Figure 8.2) lists the Oven configuration information.

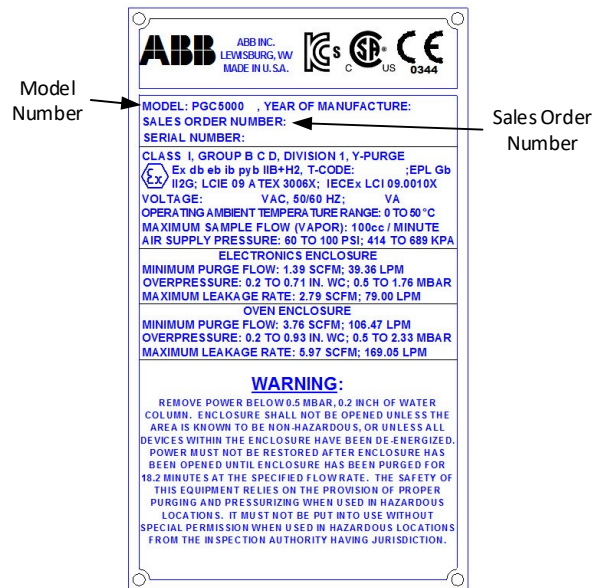


Fig. 8.2. Typical Oven Nameplate

8.1.4 Software configuration identification

The software version appears on the Setup>Master Controller>SBC Config Subtab (see Figure 8.3).

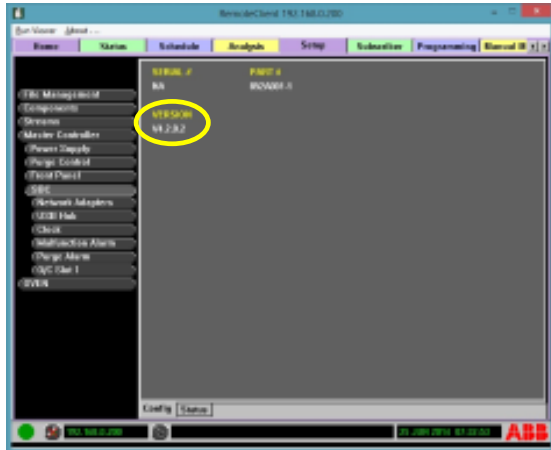


Fig. 8.3. Software Configuration Identification

8.1.5 How to order

Please contact your local ABB sales or service representative for specific instructions on ordering parts. Always include the information listed in Equipment Identification and Configuration Identification in your request.

The remainder of this section lists the replaceable parts and components by their location in the equipment. Part numbers and drawing numbers listed here are for identification purposes only. When you order parts for replacement, use the list of parts included in the Engineering Data Package provided with your equipment to ensure you have the correct version of each part.

8.2 Master controller

8.2.1 Back of door (see Figure 8.4)

Description	Part Number
Front Panel PCB, version 1	852A004-1
Front Panel PCB, version 2	852A009-1
LCD Display, version 1	857Z002-1
LCD Display, version 2	857Z039-1
Touch Panel Controller	857Z030-2

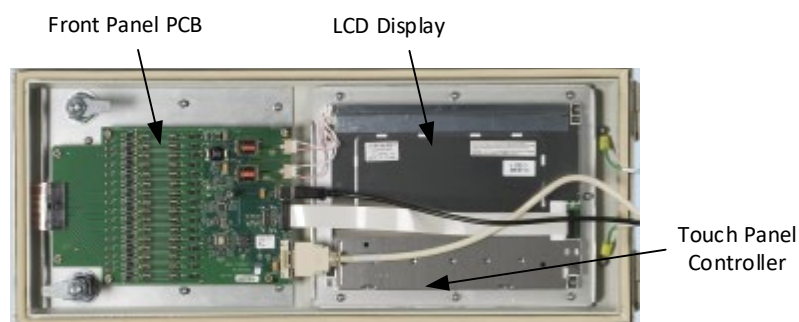


Fig. 8.4. Back of Door

8.2.2 Master controller chassis (see Figure 8.5)

Description	Part Number
Power Supply	857Z035-1
Single Board Computer PCB	852A001-1
Oven Controller PCB	852A002-1
Wago Control Module	866Z001-1
Wago End Module	866Z002-1
Wago 2 channel analog output, 4-20 mA	866Z003-1
Wago 4 channel analog output, 4-20 mA	866Z004-1
Wago 4 channel analog output, $\pm 10V$ / 0-10 V	866Z005-1
Wago 2 channel analog input, 0-10 V	866Z006-1
Wago 4 channel digital output, DC 24 V with low-side switching	866Z007-1
Wago 2 channel relay output, AC 30 V/DC 30 V	866Z008-1
Wago 4 channel digital input DC 5 V	866Z009-1
Wago DC 24 V/DC 230 V supply	866Z010-1
Wago 4 channel digital input, DC 24 V	866Z012-1
Wago 4 channel digital output, DC 24 V with high side switching	866Z013-1
Wago 2 channel analog input, 4-20 mA	866Z014-1

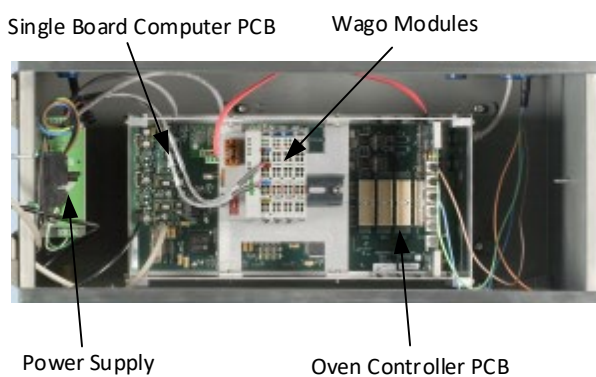


Fig. 8.5. Master Controller

8.3 Class B1 oven components

This section lists components specific to the Class B1 Oven. Components common to all Class B ovens are in 8.5.

8.3.1 Left side components (see Figure 8.6)

Description	Part Number
EPC Control PCB	852A004- _
TCD Amplifier Assembly	851A093- _
FID Amplifier Assembly, version 1	851A060- _
FID Amplifier Assembly, version 2	851A094- _
FPD Electrometer (not shown)	804A010-2
DTC Analog PCB Assembly	852A026-1
DTC Digital PCB Assembly	852A021-1
Power Supply	857Z035-2

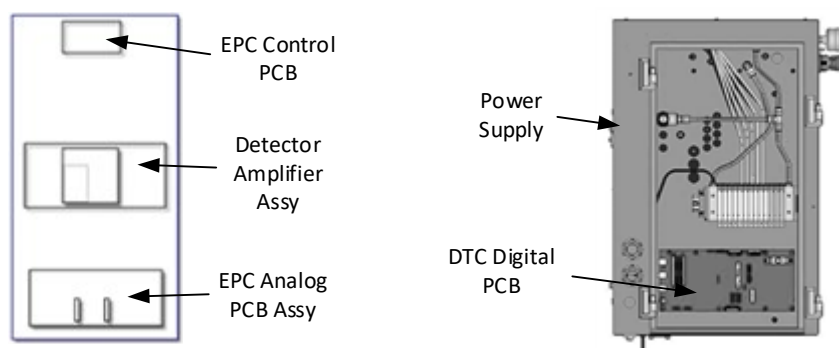


Fig. 8.6. Left Side Components

8.3.2 Left front door components (see Figure 8.7)

Description	Part Number
Oven Indicator PCB	852A025-1

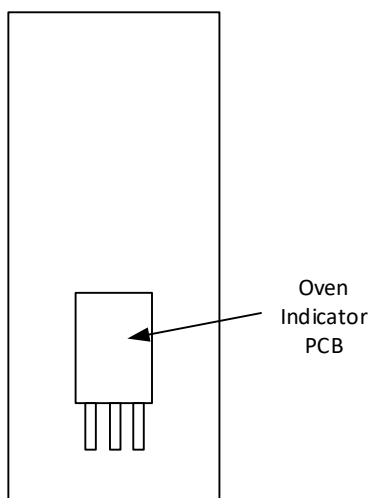


Fig. 8.7. Left Front Door

8.4 Class B2 oven components

This section lists components specific to the Class B2 Oven. Components common to all Class B ovens are in 8.5.

8.4.1 Left side components (see Figure 8.8)

<u>Description</u>	<u>Part Number</u>
EPC Control PCB	852A024- _
TCD Amplifier Assembly	851A093- _
FID Amplifier Assembly, version 1	851A060- _
FID Amplifier Assembly, version 2	851A094- _
FPD Electrometer (not shown)	804A010-2
DTC Analog PCB Assembly	852A027-1
DTC Digital PCB Assembly	852A028-1
Power Supply	857Z035-2

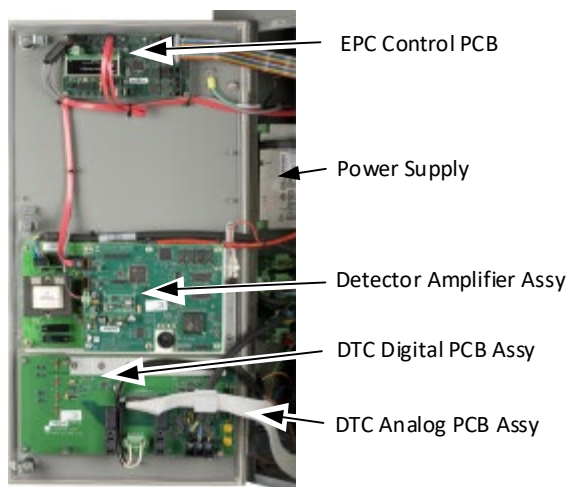


Fig. 8.8. Left Side Components

8.4.2 Left front door components (see Figure 8.9)

<u>Description</u>	<u>Part Number</u>
Oven Indicator PCB	852A029-1

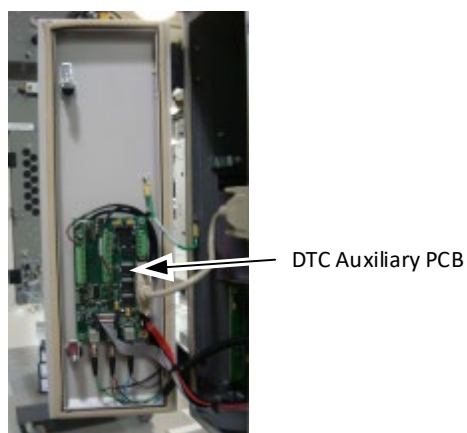


Fig. 8.9. Left Front Door

8.5 Class B main interior, both versions (see Figure 8.10)

Description	Part number
Oven Heater Kit, 115 V 1000 W	856Z003-1
Oven Heater Kit, 230 V 1000 W	856Z003-2
Oven Heater Kit, 115 V 500 W	856Z003-3
Oven Heater Kit, 230 V 500 W	856Z003-4
Temperature Sensor, Platinum	3617330-1
Makeup Valve	3616890-1
Splitter Valve	3616890-2
Metering Valve	3529409-1
Restrictor Valve	3616446-1
Diaphragm Valve, VALCO DV-22	8230442-1, -3, -4, -5 or -6
Diaphragm Valve, AFP ELDV2	851Z064-1, -2, -3, -4, -5, -6, -7, -8, -9, -10, -11, -12 or -13
Liquid Sample Valve (see 8.5.1)	
Flame Ionization Detector (see 8.5.2)	
Single-Port Thermal Conductivity Detector (see 8.5.3)	
Multiport Thermal Conductivity Detector (see 8.5.4)	
Flame Photometric Detector (see 8.5.5)	
Burner Block (see 8.5.6)	
M2CP Valve (see 8.5.7)	

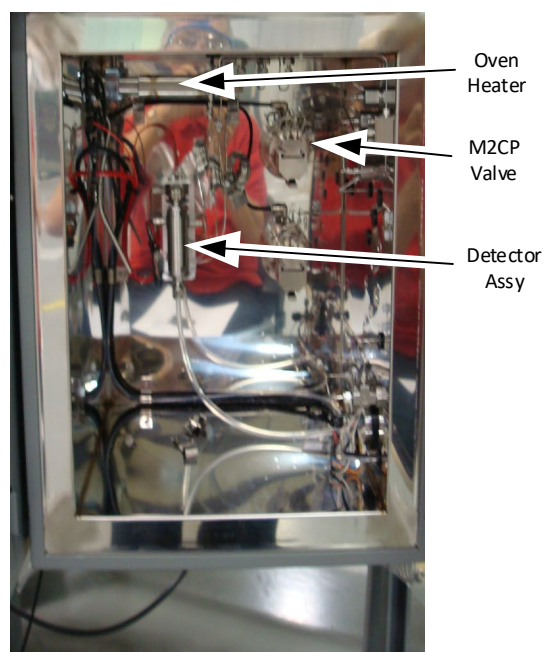


Fig. 8.10. Main Interior Components

8.5.1 Liquid sample valve (see Figure 8.11)

Description	Part Number
O-Ring Seal Kit	791K003N-1
0.125 inch Stem (per application)	791A008B-__
0.125 inch Seal (per application)	791M001B-__
0.062 inch Stem (per application)	791A009B-__
0.062 inch Seal (per application)	791M028B-__
Vaporizer (per application)	805A015-__
Seal Insertion Tool	TL-791A006B
LSV Fitting Kit, SST Swagelok	800K011-1
LSV Fitting Kit, Monel Gyrolok	800K011-2
LSV Fitting Kit, Monel Swagelok	800K011-3
LSV Fitting Kit, Hastelloy C Gyrolok	800K011-4
LSV Fitting Kit, Hastelloy C Swagelok	800K011-5

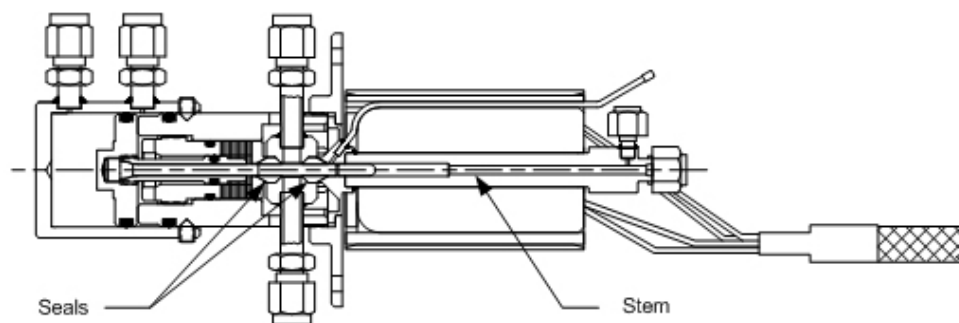


Fig. 8.11. Liquid Sample Valve

8.5.2 Flame ionization detector (see Figure 8.12)

Description	Part Number
Maintenance Kit	799K003-1
Jet	3617156-2
Ignitor Assy	794A007B-2
Thermocouple Assy	794A008B-1
Polarizer Assy	794A009B-1
Column kits are application dependent—see Data Package for correct part	
Capillary Column Kit NEC	799K001N-1
Packed Column Kit NEC	799K001N-2
Packed Column Kit CENELEC	799K001N-3
Capillary Column Kit CENELEC	799K001N-4
Wire Splice Kit	800K001-1
Microdot Cable Insertion Kit	799K006-1

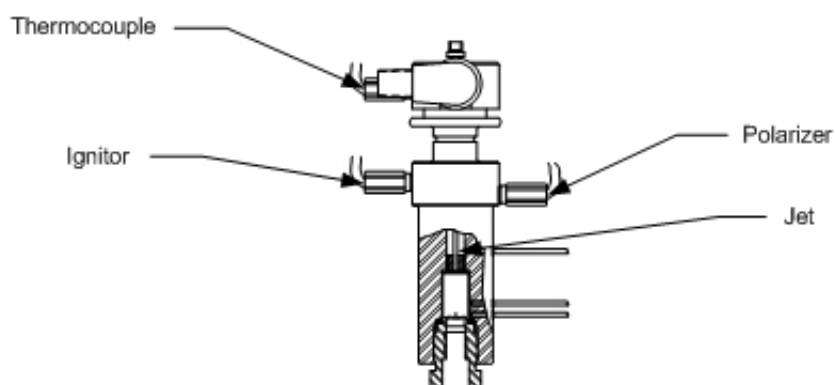


Fig. 812. FID Components

8.5.3 Single-port thermal conductivity detector (see Figure 8.13)

Description	Part Number
Filament Kit NEC	800K003-1
Filament Kit CENELEC/CSA	800K003-2

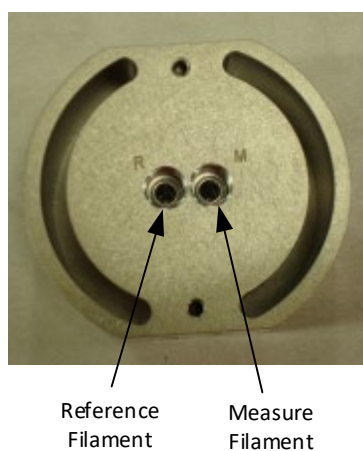


Fig. 8.13. Single-Port TCD Components

8.5.4 Multiport Thermal Conductivity Detector (see Figure 8.14)

<u>Description</u>	<u>Part Number</u>
Filament Kit	865K001-1

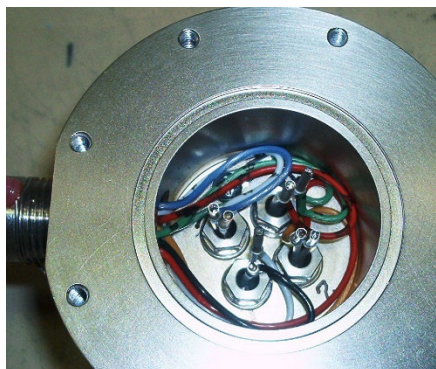


Fig. 8.14. Multiport TCD

8.5.5 Flame photometric detector

<u>Description</u>	<u>Part Number</u>
Transformer	3617648-1
Capillary Tubing, Burner Fuel	5514584-39
Coaxial Cable Assy	3528546-1
Photomultiplier Assy	804A003-1
Solenoid, 3 Way (for X Purge)	3616261-3
Pressure Sensor	3615565-6
Burner Block (see 8.5.6)	

8.5.6 Burner block components (see Figure 8.15)

Description	Part Number
Burner Block Assy	867A008-1
Adapter, Jet	804M004-1
Jet	3617432-1
O-Ring 15/16-in OD, Fluorocarbon	45051-4-106
O-Ring 11/16-in OD, Teflon	45051-5-18
O-Ring 3/4-in OD, Fluorocarbon	45051-4-102
Sulfur Addition Wafer	3617453-_

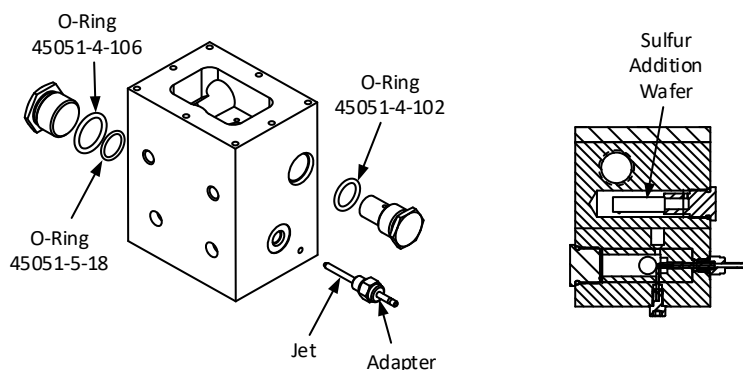


Fig. 8.15. Burner Block Components

8.5.7 M2CP valve (see Figure 8.16)

Description	Part Number
10 port Slider (per application)	764M005-_
6 port Slider (per application)	764M006-_
8 port Slider (per application)	764M007-_
8 port Backflush to Vent Slider (per application)	764M008-_
CP Valve Ports Field Service Kit, Stainless Steel	753K002N-11
CP Valve Ports Field Service Kit, Hastelloy	753K002N-21
CP Valve Ports Field Service Kit, Monel	753K002N-31
O-Ring Kit, 40 psi Valve	764K001N-2
Carrier Assy SPV	3527273-1
Wedge	3527279-1

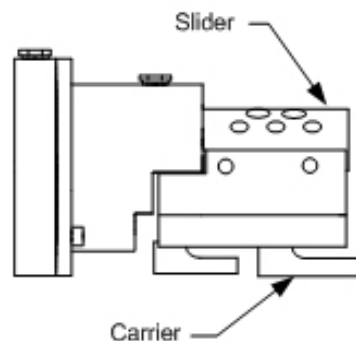


Fig. 8.16. M2CP Valve Components

8.5.8 Optional DID replacement parts (see Figure 8.17)

Part Number	Description	Quantity
852A038-1	Power Supply DBDID	1
885A005-1	Detector Cell Assembly DBDID	1
851K006-1	FID/DBDID Amplifier Kit (Order 851K006-1 Amp Kit to build the standard 851A094-11412 per included 851J003 bulletin.)	1

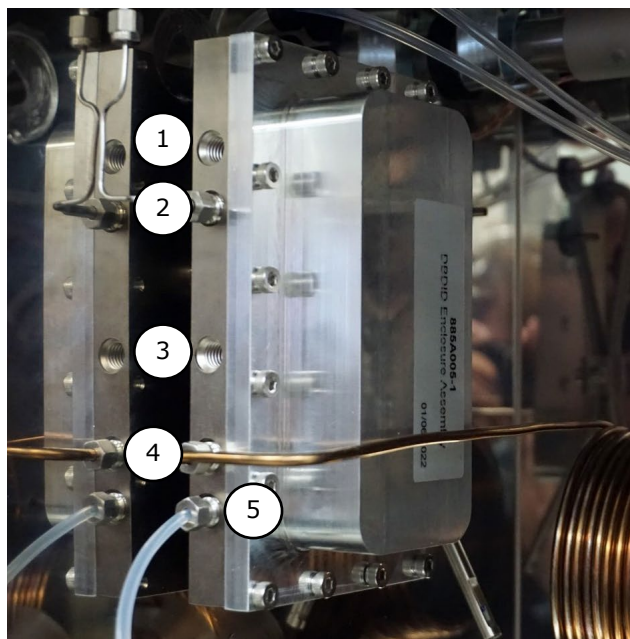


Fig. 8.17. DID Replacement Parts

Legend: Detector port identification

Item	Description
1	Purge gas inlet. (Detector assembly purge not used in most applications.) Flameproof breather must remain open or connected to optional purge system.
2	Reaction gas inlet (plasma gas)
3	Purge gas vent. (Detector assembly purge not used in most applications.) Flameproof breather must remain open or connected to optional purge system
4	Detector inlet (chromatograph column connection for analytes to the detector)
5	Detector vent

See the [PGC5000 Gas Chromatograph Dielectric Barrier Discharge Ionization Detector \(DBDID\) manual](#) for further information.

8.6 EPC control assembly (see Figure 8.18)

The EPC Control Assembly is located inside the top panel of the oven.

Description	Part Number
Proportional Valve	3617341-1
O-Ring Kit	801K001-1
Control PCB	802A011B-1
Sensor PCB Kit	801K007-2
Heater	81943A042-1
Metric Hex Key Wrenches	TL161-1
EPC Service Tool Kit	801K005-1

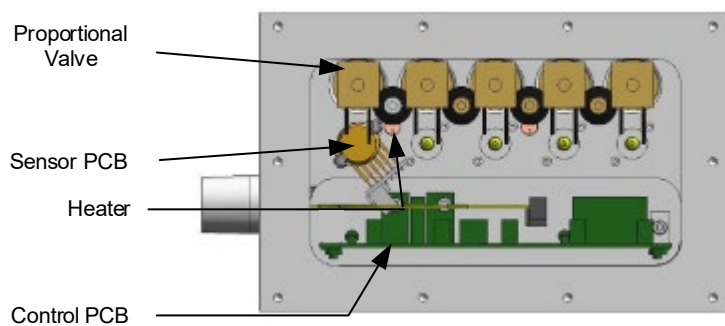


Fig. 8.18. EPC Control Assembly

8.7 Class c oven

The Class C Ovens have the same components as the Class B Ovens, although the quantities may differ.

NOTES

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