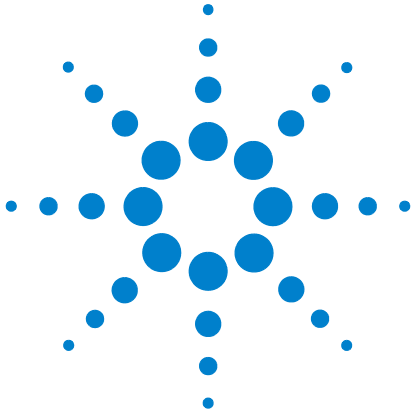

Agilent G1888 Headspace Sampler

Service Manual

Agilent Technologies

Notices

Manual Part Number

G1888-90020

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Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Contents

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1 Notices

Before Servicing the Headspace Sampler

Important safety warnings

There are several important safety notices that you should always keep in mind when using the Headspace Sampler (HS).

Dangerous Voltages

Many internal parts of the Headspace Sampler carry dangerous voltages.

If the HS is connected to a power source potentially dangerous voltages exist on:

- The wiring between the HS power cord, main switch, and the 24 volt power supply
- The power supply itself
- The wiring from the power supply to the voltage selector
- The wiring from the voltage selector to the transformer
- All electronics boards in the HS
- The internal wires and cables connected to these boards
- The wires for any heater (such as the oven)

To avoid a potential shock hazard when using liquid solution to locate leaks, turn the main power switch off and disconnect the main power cord. Be careful not to spill leak solution on electrical leads.

WARNING **All these parts are shielded by covers. With the covers in place, it should be difficult to accidentally make contact with dangerous voltages. Unless specifically instructed to, never remove a cover unless the heated zones are turned off.**

WARNING **If the power cord insulation is frayed or worn, replace the cord.**

Harmful Electrostatic Discharge

Electrostatic discharge is a threat to Headspace Sampler electronics.

The printed circuit (PCA) boards in the HS can be damaged by electrostatic discharge. If you must handle a board wear a grounded wrist strap and take other antistatic precautions. Wear a grounded wrist strap any time you must remove the electronics cover.

Hot Surfaces

Many parts of the HS operate at temperatures high enough to cause serious burns. These parts include but are not limited to:

- The carousel and its contents
- The sample probe/loop assembly

Always cool these areas of the HS to room temperature before working on them. They will cool faster if you first set the temperature of the heated zone to room temperature. Turn the zone off after it has reached the setpoint.

If you must perform maintenance on hot parts wear gloves.

Gases

- Do not use flammable carrier gases.
- Do not use hydrogen as a carrier gas in the Headspace Sampler. Hydrogen creates a potential explosion hazard due to the venting of gases during operation and “standby”.
- Wear eye protection when using compressed gas to avoid eye injury.
- Fasten all compressed gas cylinders securely to an immovable structure or permanent wall.
- Do not put gas cylinders in the path of a hot air vent (including a GC oven exhaust).

Safety and regulatory certifications

The Headspace Sampler conforms to the following safety standards:

- Canadian Standards Association (CSA): C22.2 No. 1010.1
- CSA/Nationally Recognized Test Laboratory (NRTL): UL 61010A–1
- International Electrotechnical Commission (IEC): 61010–1
- EuroNorm (EN): 61010–1

The Headspace Sampler conforms to the following regulations on Electromagnetic Compatibility (EMC) and Radio Frequency Interference (RFI):

- CISPR 11/EN 55011: Group 1, Class A
- IEC/EN 61326
- AUS/NZ

This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB—001 du Canada.

The Headspace Sampler is designed and manufactured under a quality system registered to ISO 9001.

The Agilent Technologies Headspace Sampler meets the following IEC (International Electro-Technical Commission) classifications: Safety Class I, Transient Overvoltage Category II, Pollution Degree 2.

This unit has been designed and tested in accordance with recognized safety standards and is designed for use indoors. If the HS is used in a manner not specified by the manufacturer, the protection provided by the HS may be impaired. Whenever the safety protection of the Agilent Headspace Sampler has been compromised, disconnect the unit from all power sources and secure the unit against unintended operation. Refer servicing to qualified service personnel. Substituting parts or performing any unauthorized modification to the HS may result in a safety hazard.

Symbols

Warnings in the manual or on the Headspace Sampler must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions violates safety standards of design and the intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

See accompanying instructions for more information

Indicates a hot surface.

Indicates hazardous voltages.

Indicates earth (ground) terminal.

Indicates potential explosion hazard.

Indicates radioactivity hazard.

Indicates electrostatic discharge hazard.

Indicates that you must not discard this electrical/electronic product in domestic household waste.

Electromagnetic compatibility

This device complies with the requirements of CISPR 11. Operation is subject to the following two conditions:

1 This device may not cause harmful interference.

2 This device must accept any interference received, including interference that may cause undesired operation.

If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try one or more of the following measures:

1 Relocate the radio or antenna.

2 Move the device away from the radio or television.

3 Plug the device into a different electrical outlet, so that the device and the radio or television are on separate electrical circuits.

4 Make sure that all peripheral devices are also certified.

5 Make sure that appropriate cables are used to connect the device to peripheral equipment.

6 Consult your equipment dealer, Agilent Technologies, or an experienced technician for assistance.

7 Changes or modifications not expressly approved by Agilent Technologies could void the user's authority to operate the equipment.

Sound emission certification for Federal Republic of Germany

Sound pressure

Sound pressure Lp < 68 dB(A) according to DIN-EN 27779 (Type test).

Schalldruckpegel

Schalldruckpegel LP < 68 dB(A) nach DIN-EN 27779 (Typprufung).

Tools required for service

Small Phillips head screwdriver

Large Phillips head screwdriver

7x8 mm wrench 2 pieces 1340407010

6x7 mm wrench 2 pieces 1340407011

8x10 mm wrench 2 pieces 1340407012

Hex L wrench 2.5 mm 1341002500

Hex L wrench 3 mm 134120300

Alignment tools G1888-80000

Chain tensioning tool 1400900029

Figure 1 Wrenches 7/8mm

Fuses

Table 1 Fuses

Location	Description	Part number
F1 Power distribution PCA	Interchangeable bussmann 5 x 20 mm, Type: GMD D1A (T 1A 250 V), CSA	384-1595011-HSP
F3 and F4 Power distribution PCA	Interchangeable bussmann 5 x 20 mm, Type: GMD (F 6A 125 V), CSA	384-1295001-HSP
Main fuses on power switch	10 amp, fast acting, 250 V, 5x20 mm	5188-1157
Transformer fuse	8 amp, fast acting, 250 V, 5x20 mm	5188-1158

See also Table 36, “Avaliable fuses for older models”,” on page 287.

1 Notices

2
Instrument Configuration

Overview

The transfer line from the Headspace Sampler (HS) can be connected to the GC inlet in two ways:

Using the needle For manual pressure control (MPC), a needle is connected to the end of the transfer line and inserted through the GC inlet septum. This allows rapid changeover between headspace sampling and manual or automatic liquid sampler (ALS) injections.

Direct connection For electronic pressure control (EPC), the HS transfer line is inserted into the carrier gas line by cutting the line from the GC gas control and the inlet. Fittings and additional tubing route the carrier gas to the sampler and then back, via the transfer line, to the inlet gas supply. This requires some cutting and connecting and complicates changeover, but allows the GC to control carrier gas flow through the sampler. It is best for dedicated use of a GC with a HS.

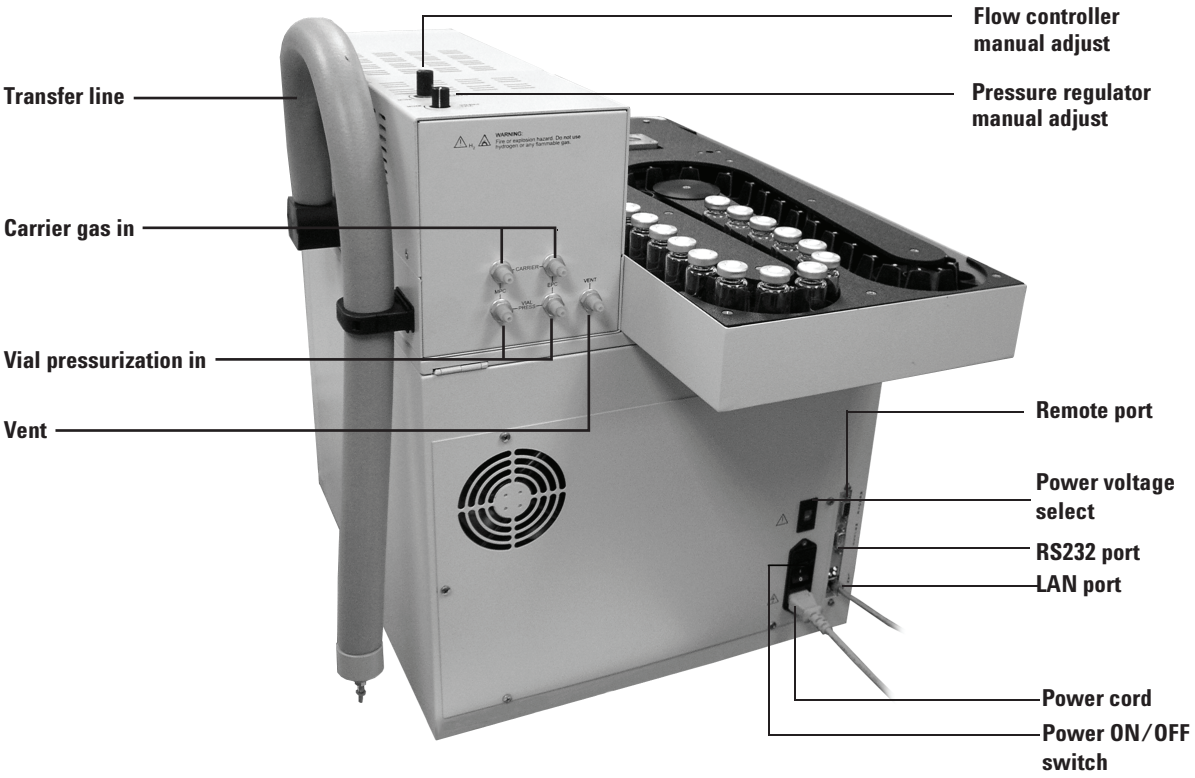


Figure 2 Connections on the back of the Headspace Sampler

Cable Connections

The Headspace Sampler is used with a Gas Chromatograph, and often with a Chemstation, a printer, and other accessories. These instruments must be synchronized to function properly. Common cabling configurations are shown in Figure 3.

Cables

1. **8121-0940, Cable, 7.5-m 100-BaseT LAN**
2. **G1530-60930, 2-m APG remote cable, 9-pin male to 9-pin male**
3. **G1530-60600, 2-m RS-232 cable, 9-pin female to 9-pin female**
4. **G1530-61200, 2-m APG Y-cable, two 9-pin male, one 9-pin female**
5. **8121-1013, USB-DB9 RS-232 adapter cable**

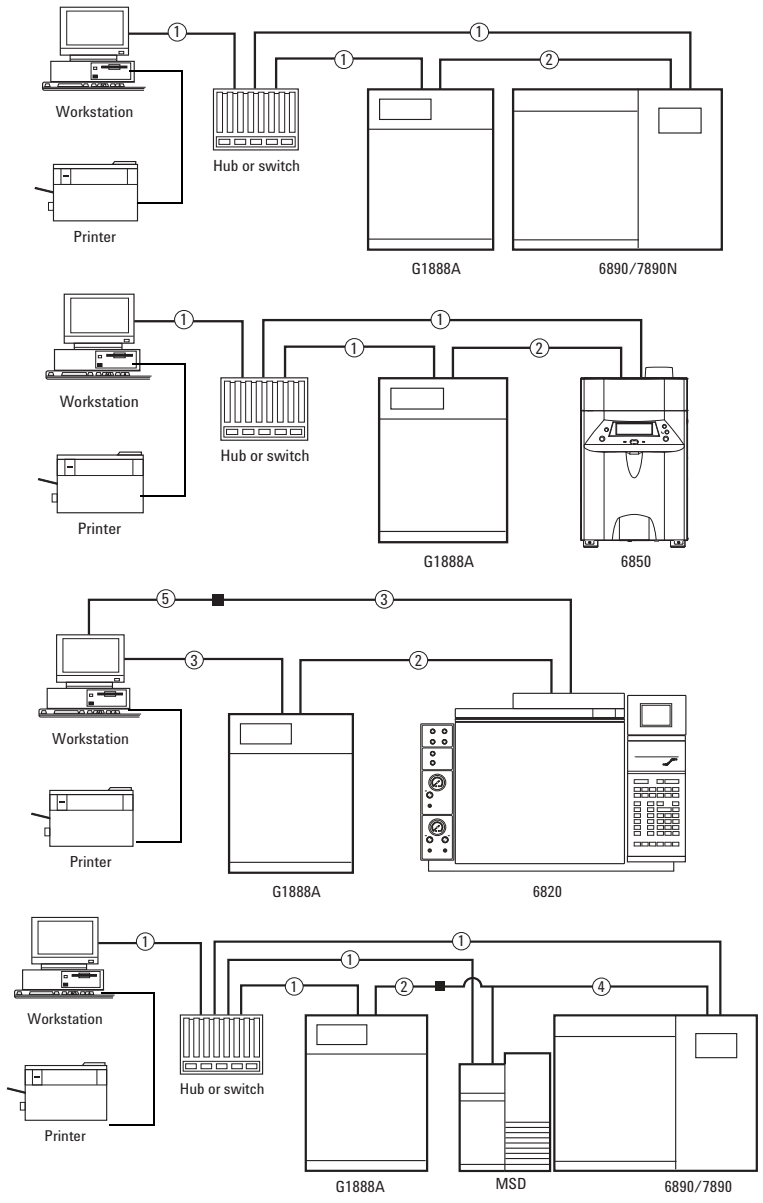


Figure 3 Common cabling configurations

Power cord

The power cord is country dependant.

Table 2 Power cords - country specific

Country	Description	Part number
Argentina		8120-6869
Australia/NZ	C13, 10 amp	8120-1369
Chile	C13, 10 amp	8120-6978
China	C13, 10 amp	8121-0723
DK/Greenland	C13, 10 amp	8120-3997
Europe	C13, 10 amp	8120-1689
GB/HK/SG/MY	C13, 10 amp	8120-8705
India/South Africa	C13, 10 amp	8120-4211
Israel	C13, 10 amp	8120-5182
Japan	C15, 15 amp	8120-5342
Korea	C13, 10 amp	8121-1226
Switzerland	C13, 10 amp	8120-2104
US/CA/TW/TH	C13, 13 amp	8120-1992

Power setting

The power selector switch is set to 230 VAC at the factory. Change it if necessary.

Failure to change the power cord / fuse pair could result in blown fuses or damage to the instrument.

Communication cables

RS-232 and remote start/stop

Part numbers:

- G1530-60600, 2-m RS-232 (Included in ship kit page 283)
- G1530-60930 Remote start/stop cable (Included in ship kit page 283)
- G1530-61200 2-m APG Y-cable available for GC-MSD system A remote start/stop is required to start a GC or GC-MSD system.

For 4890, 5890, 6820 systems RS-232 is required to use control software or the diagnostic utility.

LAN

Part number:

- 8121-0940 7.5-m 100-BaseT LAN cable

For 6850, 6890 and 7890 systems LAN is recommended to use control software or the diagnostic utility.

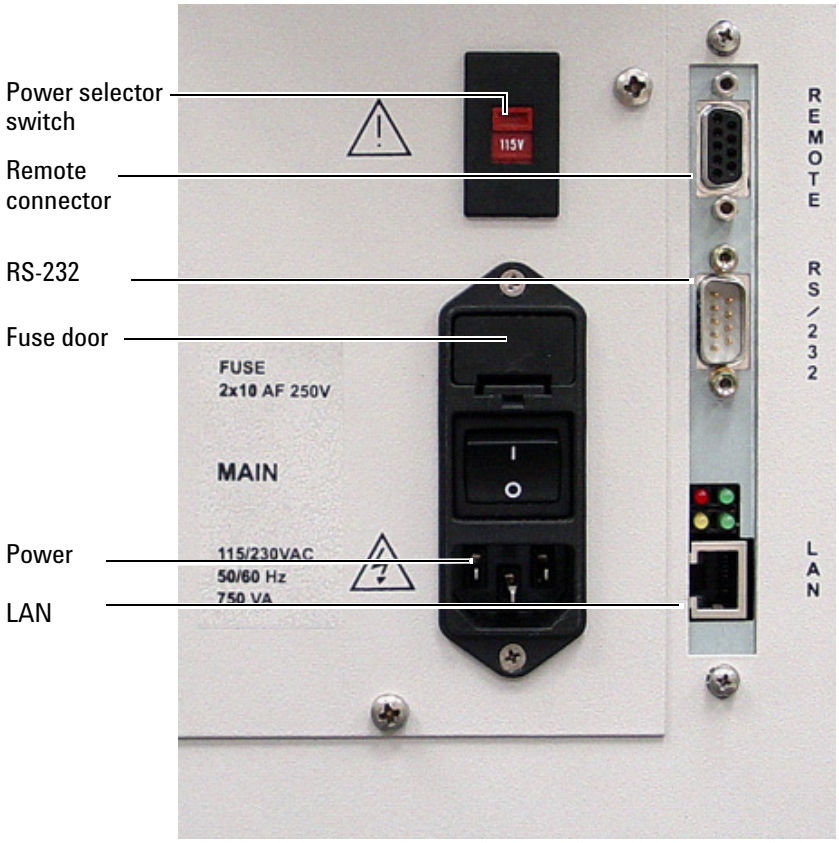


Figure 4 Cable connections

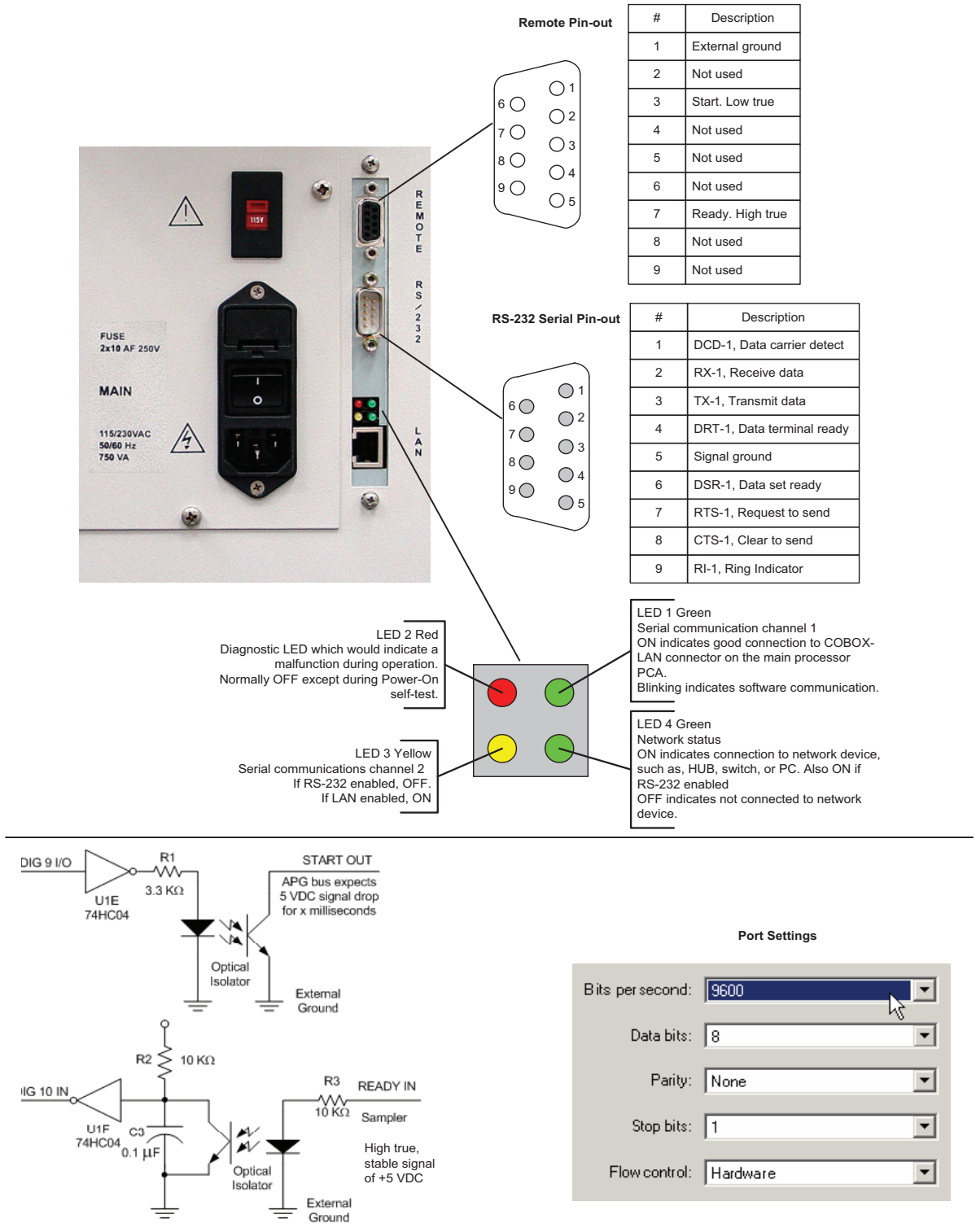


Figure 5 Cable connection details

Headspace Sampler to Gas Chromatograph Connection

EPC and MPC

The Headspace Sampler uses two gas flows, Carrier gas flow and Vial pressurization flow. These may be set independently for either Manual Pressure Control (MPC) or Electronic Pressure Control (EPC).

When a flow path is set for manual pressure control, it uses the manual flow or pressure controller built into the HS.

When a flow path is set for electronic pressure control, the GC electronically controls flow and pressure.

Toggle the flow mode between EPC and MPC using the switches under the lid (Figure 6). Carrier gas and vial pressurization gas do not have to be set to the same flow mode.

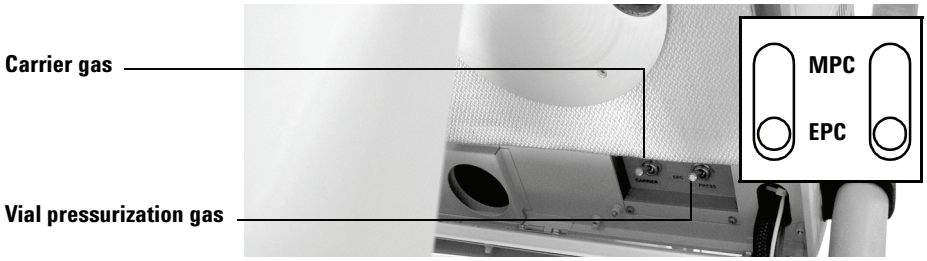


Figure 6 EPC/MPC toggle switches

Four 1/8–inch Swagelok® bulkhead fittings are provided at the rear of the pneumatic compartment for connecting vial pressure and carrier gas lines. Two fittings are for MPC, and two fittings are for EPC.

Figure 7 MPC and EPC connections

Common carrier gas connections

GC inlet with MPC from Headspace Sampler

If the Headspace Sampler uses MPC for the carrier gas, the transfer line connects to the GC inlet by a needle passing through the inlet septum. Attach a regulated source gas line to the connector marked Carrier MPC line, the upper left gas connector on the back of the G1888. See the “MPC connections” section in the *G1888 Site Prep and Installation Guide*.

Split/splitless inlet with EPC control or MMI

The GC inlet control channel supplies carrier gas to the Headspace Sampler. See the section titled “Direct connection from the transfer line to a split/splitless inlet” in the *G1888 Site Prep and Installation Guide*.

VI inlet with EPC control

The carrier gas from the GC EPC module is routed to the connector marked Carrier EPC line, the upper right gas connector on the back of the G1888. See the “VI inlet” section in the *GC Maintenance Manual* for more information.

Vial pressurization gas connection

The vial pressurization gas can be configured in 2 different ways.

Manual Pressure Control (MPC) from Headspace Sampler

Attach a regulated source gas line to the connector marked Vial Press MPC line, the lower left gas connector on the back of the G1888. See the “MPC connections” section in the *G1888 Site Prep and Installation Guide*.

Electronic pressure Control (EPC) from GC

Attach a gas line from one channel of the GC EPC module through a bleed weldment into the connector marked Vial Press EPC line, the lower middle gas connector on the back of the G1888. See the “EPC connections” section in the *G1888 Site Prep and Installation Guide*.

Headspace Sampler vent connection

The vent connection can be configured in 2 different ways.

Direct to atmosphere

If the components of this gas are expected to be toxic or noxious, place the HS within a fume hood or attach a vent system, at atmospheric pressure, to the port on the HS. Use a 1/8-inch Swagelok fitting for the connection. See the “Venting Requirements” section in the *G1888 Site Prep and Installation Guide*.

Pneumatics Control Module (PCM) from GC 7890

The 7890 PCM provides constant pressure at the G1888 Headspace Sampler sample vial vent. Constant pressure at the vent improves run-to-run reproducibility in vapor phase component concentrations passed to the GC for quantitative analysis. See G3476-90011 for installation details.

MPC connections

If both the carrier gas and vial pressurization gas are MPC, install a T-fitting to the on/off valves. Run a line from a pressure-regulated gas source to the T-fitting as shown in Figure 8.

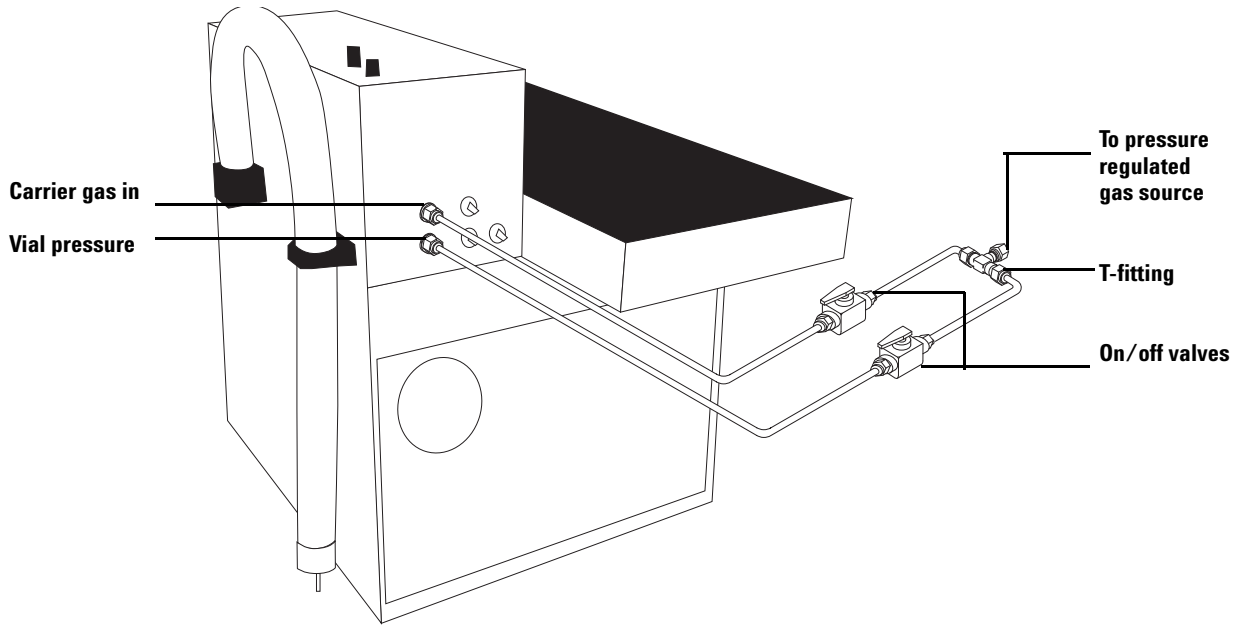


Figure 8 Carrier and vial pressure connections

If only one gas input fitting uses MPC, run a line from a pressure-regulated gas source directly to the on/off valve connected to the MPC gas input fitting.

Figure 9 Plumbing MPC

EPC using 6850 and 6890 GCs

See the “Installation” chapter in the *Site Prep and Installation manual*.

An Auxiliary gas channel in the GC supplies vial pressurization gas. The following steps describe installation for a 6890 GC with EPC control of headspace. The installation procedure is similar for a 6850 GC.

1. If the GC does not have an Auxiliary EPC module, install the G1940A Headspace Interface Kit. Follow the instructions provided with that kit.
2. Install the external HS interface kit (Part number G1888-60705) into the GC. Follow the procedure for installing onto a back-pressure regulated system.
3. Locate the block on the Auxiliary EPC module that connects the three gas outlet tubes for the auxiliary channels to the pneumatics module.
4. Remove the screw that holds the block to the pneumatics module. Pull the block free of the module and rotate it so that the frits are on top. See Figure 10.

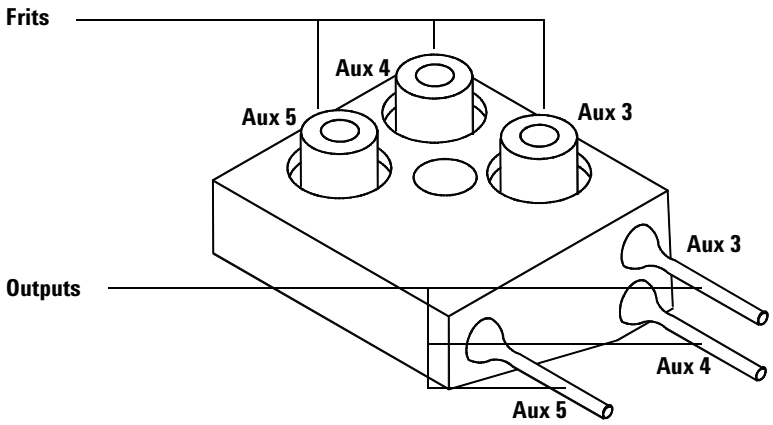


Figure 10 The auxiliary EPC module gas outlet block

5 Choose a channel for the vial pressurization control. Remove that channel's frit from the block. Remove the O-ring that seals the channel.

6 Place an O-ring on a zero-resistance brass tube frit (part number G1570-20540). Place the O-ring/frit combination in the block.

7 Reconnect the block to the pneumatics module. Tighten the screw.

8 Use tubing and Swagelok fittings to connect the appropriate Auxiliary module output, the bleed weldment, and the vial pressure fitting to the on/off valve on the back of the Headspace Sampler as shown in Figure 11. Do not disturb the brass end on the bleed weldment.

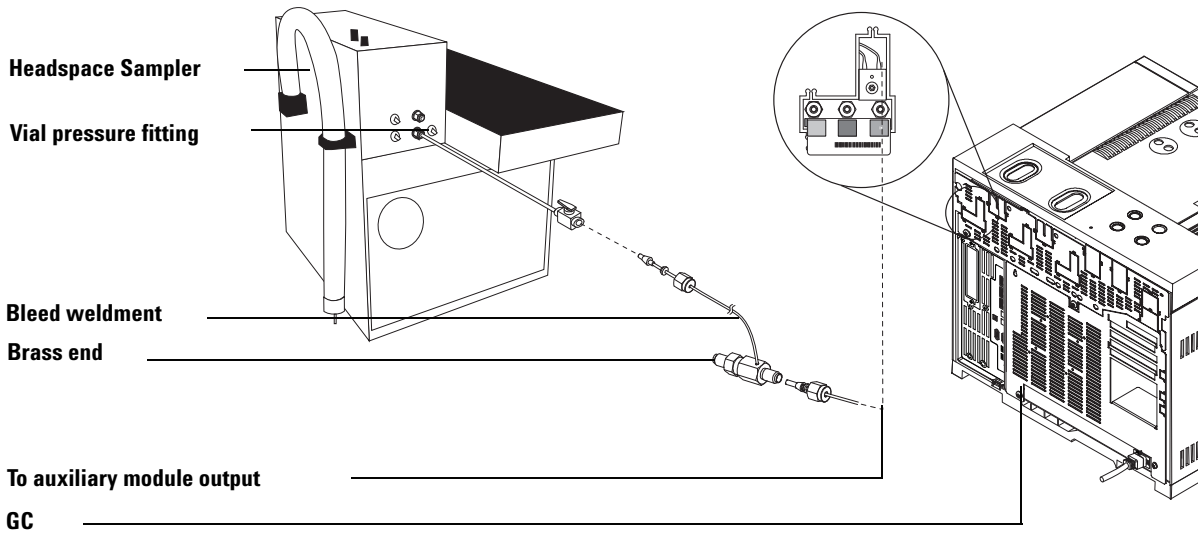


Figure 11 Connecting the Headspace Sampler to the auxiliary module

Figure 12 Plumbing EPC to GC

EPC using 7890 GC

For detailed instructions see the *7890A GC to the G1888A Headspace Sampler manual* part number G3476-90011.

The installation is similar to the 6850/6890 procedure except that the frits are in a different location.

1. Remove the pneumatics cover from the top of the GC.
2. Locate the EPC module for the HS.
3. Remove the tube to the selected channel (1 screw). This exposes the frit location.

4 Inspect the frit location. It should have no frit at all or, if a frit is present, it must be an open tube.

5 Replace the frit if necessary or simply remove it and store it in a clean place.

6 The O-ring must be present. Reinstall the tube and secure with the screw.

Advantages and disadvantages of EPC vs. MPC

Table 3 Advantages and disadvantages of EPC vs. MPC

	Carrier		Vial pressurization	
Inlet type	**MPC**	**EPC**	**MPC**	**EPC**
All	• User must measure flows and calculate split ratio. • Setpoint not stored with GC method.	• Accurate EPC pressures and split ratios. • Setpoints stored with GC method	• Less stable • Requires adjustments • Easier to move HSS to another GC without an Aux EPC module	• More stable • Easier to transfer application to another system • Setpoint saved with GC method • Better for regulated customer
Volatiles		• Best sensitivity • Smallest volume • Most inert		
Split/splitless capillary	• More inert • Better sensitivity than splice • Easy to remove and replace with ALS			
Cool on-column	• Closest to a splitless injection mode			
PTV		• Potential for using concentration mode		

3
Vial Tray Components

Overview

The vial tray is located on top of the Headspace Sampler (HS) to the left of the oven. The tray contains a flexible tray chain composed of 70 links. Each link is a ring capable of holding a sample vial. The tray chain can more forward and backward along its path to deliver any sample vial to the carousel lifter. See Figure 13.

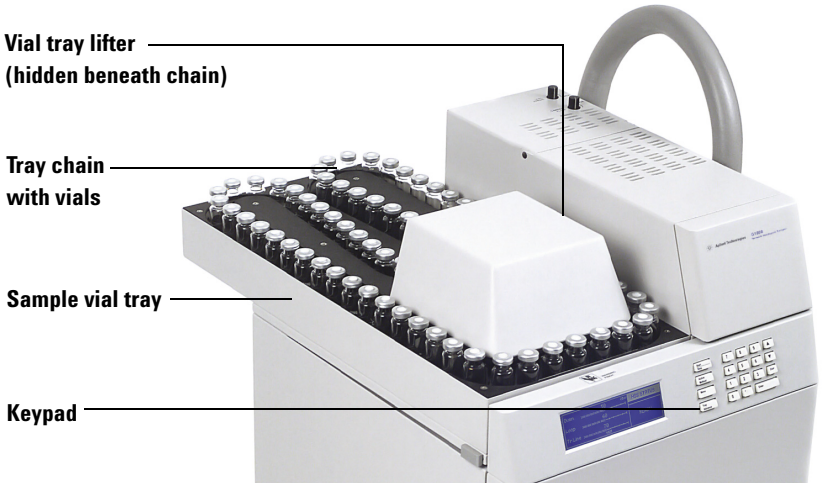


Figure 13 Headspace Sampler vial tray and keypad

The keypad on the front of the HS controls the tray chain position. Some service procedures require tray chain movement.

Dust, broken glass, and spills can cause enough resistance to reduce the life of the components and cause vial handling problems.

Over time, the following may occur:

- Tray chain may loosen causing vial not dropped errors.
- Tray motor and shutter motor drive belts may wear causing tray and shutter errors.
- Tray chain hinges may break causing tray errors.

There are 3 key adjustments to the tray compartment that should always be performed in this order:

1 Adjust tray chain tension.

2 Align the tray/shutter drive assembly.

3 Align the tray position 1 sensor.

Replacement Parts

Headspace Samplers with serial numbers less than IT00604011 have grey external skins. Current HS models are white in color.

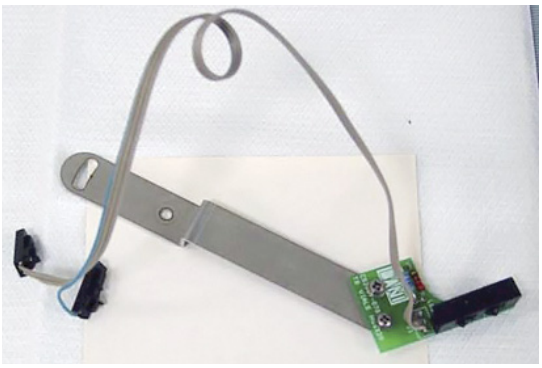


Figure 14 0410105006 Vial present sensor assembly, discontinued replaced with part shown in Figure 15

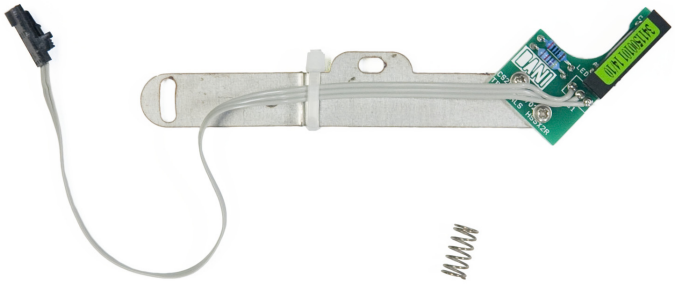


Figure 15 0410105106 Vial present sensor assembly (with spring)

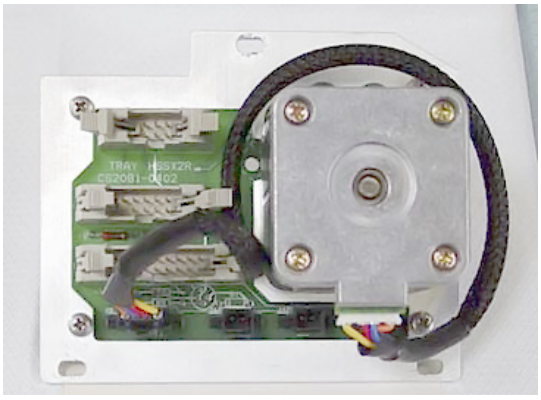


Figure 16 0410105021 Shutter motor-sensor assembly

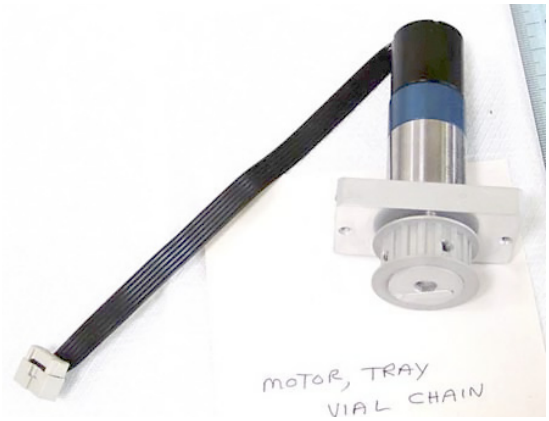


Figure 17 0410105019 Tray drive motor

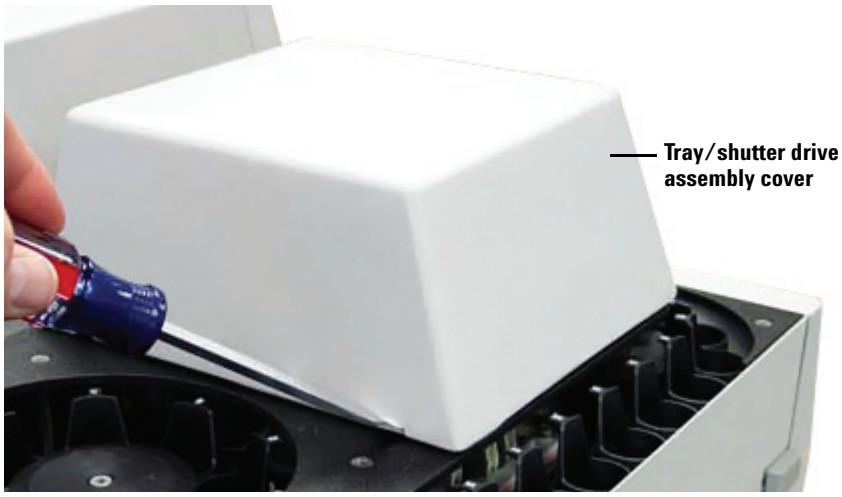


Figure 18 6310103107 Tray/shutter drive assembly cover, old color
6310103126 Tray/shutter drive assembly cover, new color

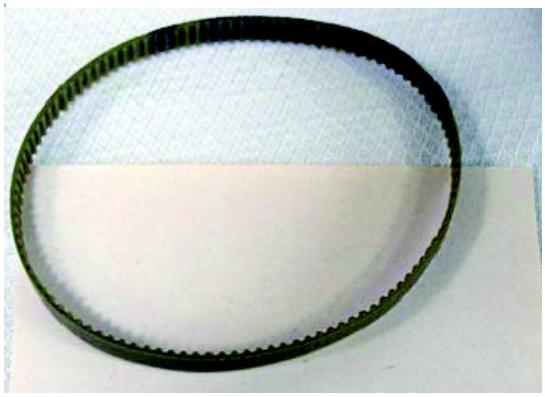


Figure 19 2283000015 Belt, shutter drive

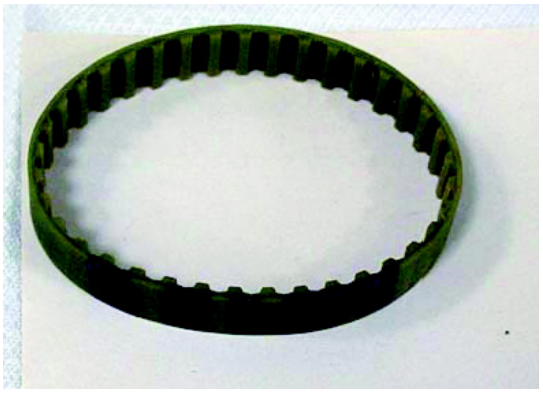


Figure 20 2283000016 Belt, tray drive

Figure 21 2181212004 Clip ring, tray chain pulley

Figure 22 0410205001 Tray chain link repair kit

Figure 23 2283500020 Pulley, tray chain

Figure 24 2285000001 Tray chain assembly

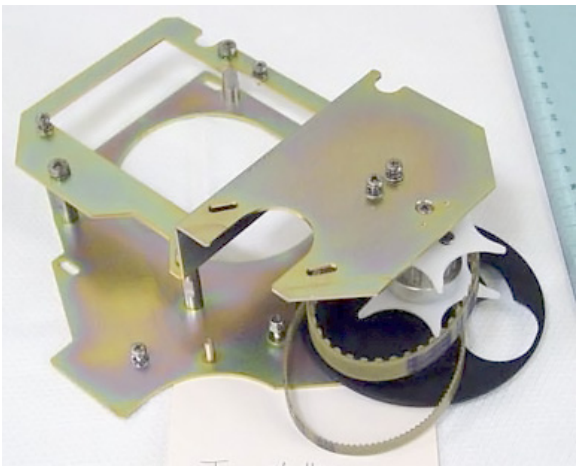


Figure 25 0410105022 Tray/shutter drive assembly,discontinued replaced with part shown in Figure 26

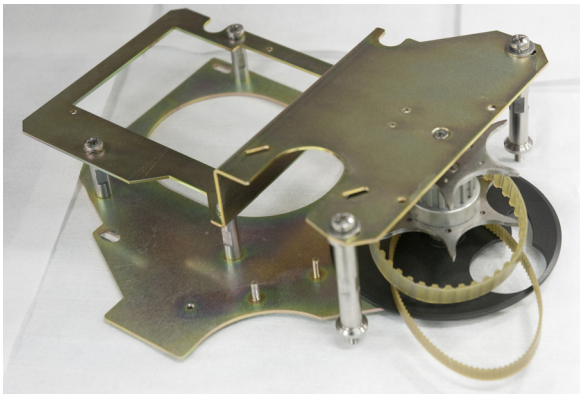


Figure 26 0410105022 Tray/shutter drive assembly

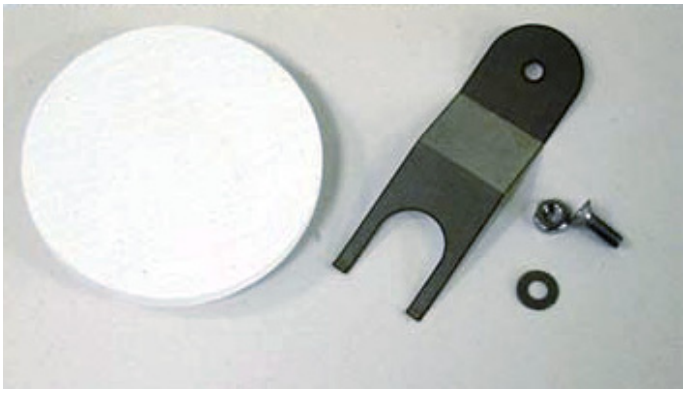


Figure 27 0410105005 Insulation disk and retainer

Figure 28 6410216136 Pulley standoff 5.7 cm

Figure 29 6410216137 Tray pulley standoff 6.9 cm

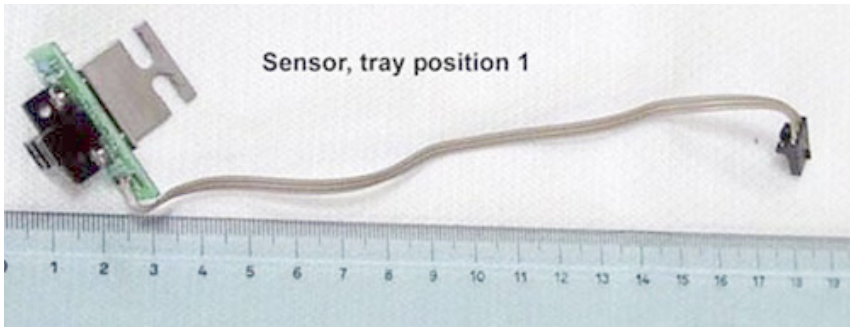


Figure 30 0410105020 Tray position 1 sensor

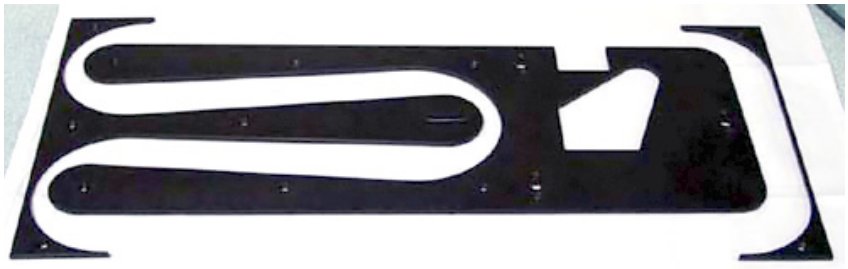


Figure 31 0410205005 Tray cover, 3 pieces

Illustrated Parts Breakdown

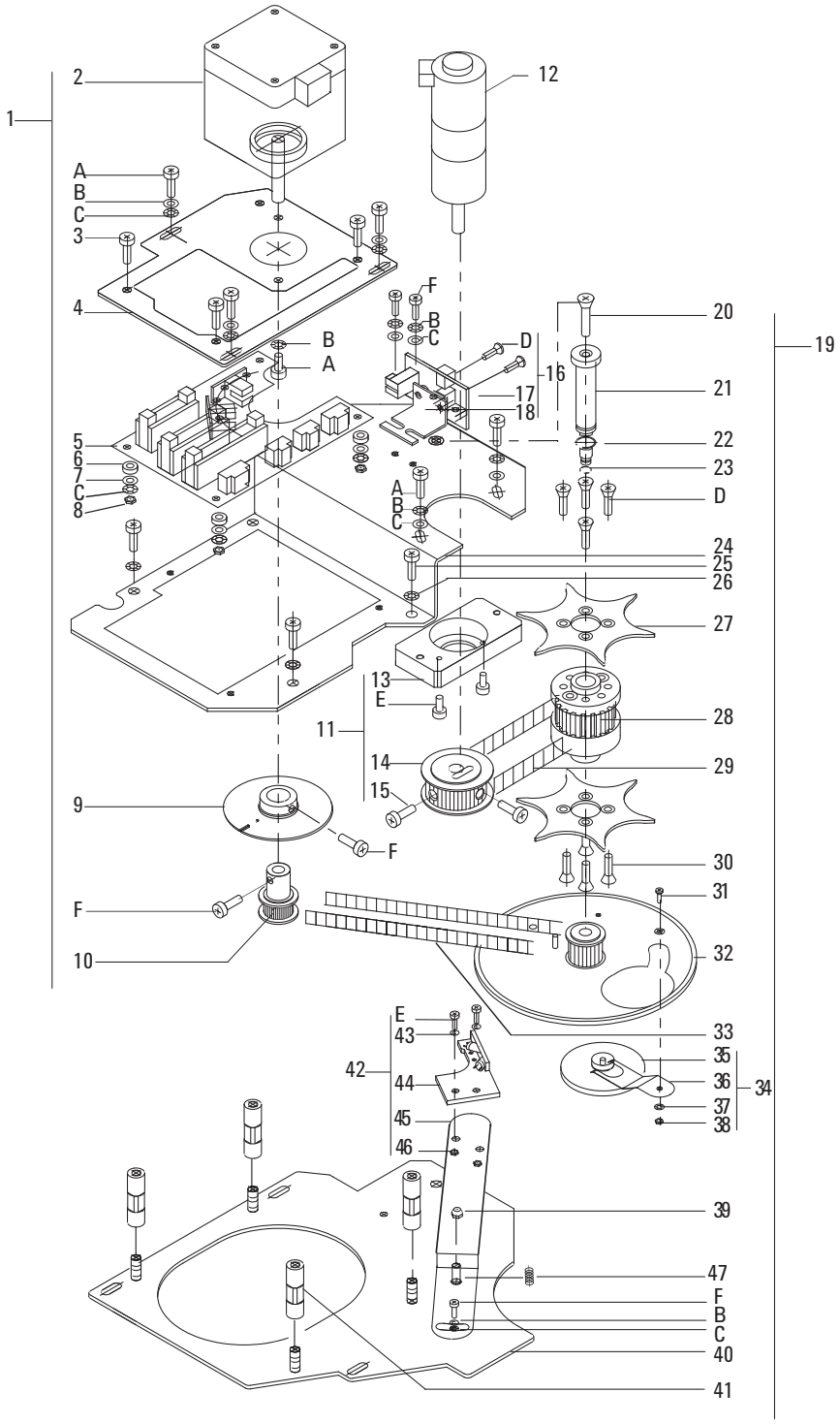


Figure 32 Tray motor group IPB

Table 4 Tray motor group

	Description	Part Number	Qty
1	**Motor-sensor assembly, shutter** consists of parts 2 through 10	**0410105021**	**1**
2	Stepper motor		1
3	Screw		3
4	8 cm x 10 cm aluminum bracket		1
5	Printed circuit assembly		1
6	Spacer		3
7	Flat washer		3
8	Nut		3
9	Disk		1
10	Pulley		1
11	**Tray vial chain motor assembly** consists of parts12 through 15	**00410105019**	**1**
12	Tray motor		1
13	Bracket		1
14	Pulley		1
15	Screw		2
16	**PCA, tray position 1 sensor assembly** consists of parts 17 through 18	**0410105020**	**1**
17	Optical sensor		1
18	Bracket		1
19	**Tray shutter drive assembly** consists of parts 20 through 41	**0410105022**	**1**
20	Screw		1
21	Axel		1
22	Spring clip		1
23	Spring clip		1
24	Top bracket		1
25	Screw		3
26	Toothed washer		3
27	Sprocket		2

Table 4 Tray motor group (continued)

28	Pulley		1
29	Tray drive belt	2283000016	1
30	Screw		4
31	Screw		1
32	Shutter		
33	Shutter drive belt	2283000015	1
34	**Shutter insulation disk assembly** consists of parts 35 through 38	**0410105005**	1
35	Insulation disk		1
36	Spring clamp		1
37	Flat washer		1
38	Nut		1
39	Nut		1
40	Bottom bracket		1
41	Spacer		4
42	**PCA, vial present sensor assembly** consists of parts 43 through 47	**0410105106**	1
43	Flat washer		2
44	Vial present sensor		1
45	Bracket		2
46	Nut		1
47	Spring		1

Table 5 Tray motor group associated screws and washers

	Description	**Part Number**	**Qty**
A	Screw		6
B	Flat washer		7
C	Toothed washer		10
D	Screw		6
E	Screw		4
F	Screw		3

Replacement Procedures

Tray/shutter drive assembly and tray chain

Required tools

6 mm open end wrench

Phillips screwdriver

Flat-blade screwdriver

Tray chain tensioning tool

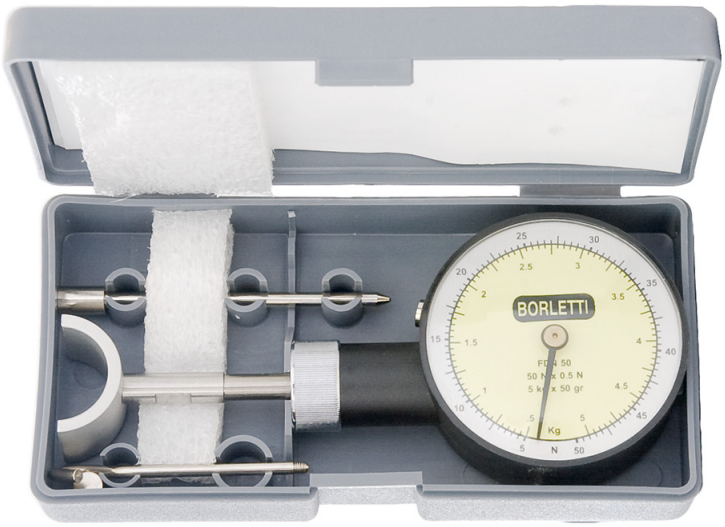


Figure 33 1400900029 Tray chain tensioning tool

Replacement parts

0410105021 Shutter motor-sensor assembly

0410105022 Tray/shutter drive assembly

2285000001 Tray chain

0410105005 Insulation disk and retainer

Remove the tray/shutter drive assembly and tray chain

1 Pry the tray/shutter drive assembly cover off with a flat-blade screwdriver.

Figure 34 Tray/shutter drive assembly cover

2 Remove all screws (circled in Figure 35) fastening the three tray covers.

Figure 35 Tray covers

3 Remove the ribbon cables from the tray/shutter drive assembly.

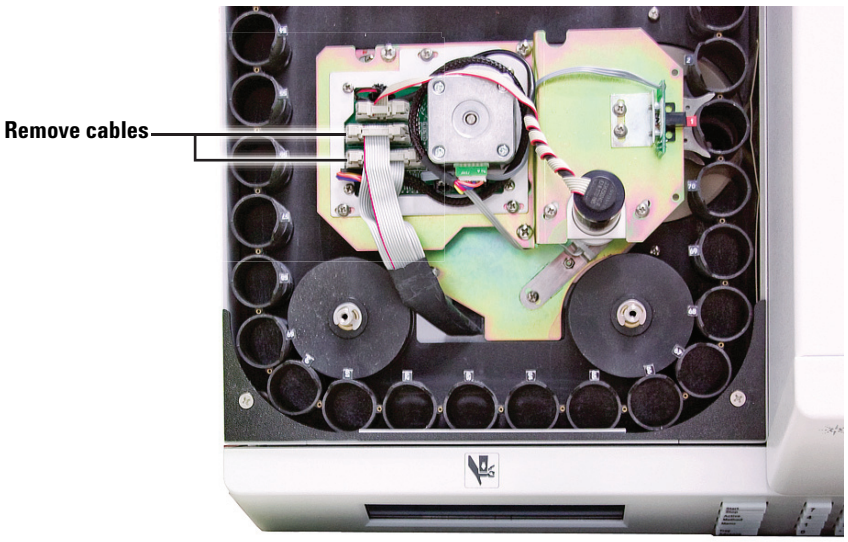


Figure 36 Tray/shutter drive assembly ribbon cables

4 Use a 6 mm wrench to loosen the tensioning pulley shown in Figure 37.

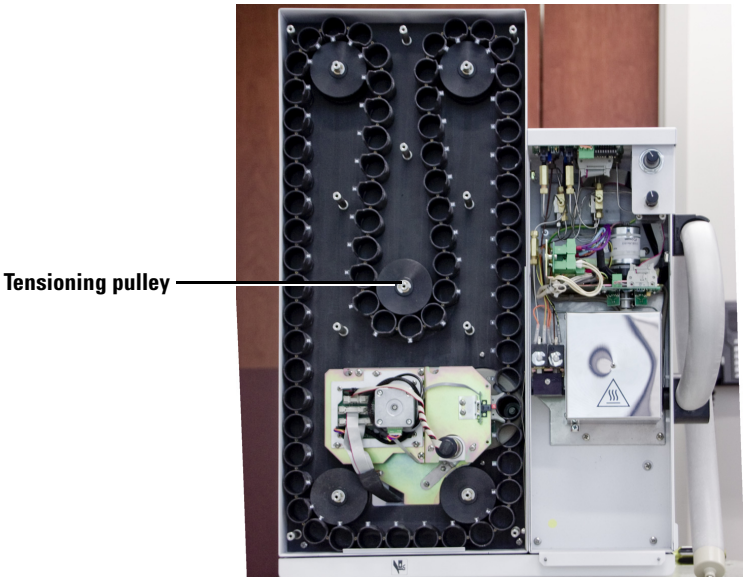


Figure 37 Tensioning pulley

5 Remove the 3 screws* (circled in Figure 38) and lock washers. Remove the tray/shutter drive assembly.
* There are 4 screws on the new tray/shutter drive assembly.

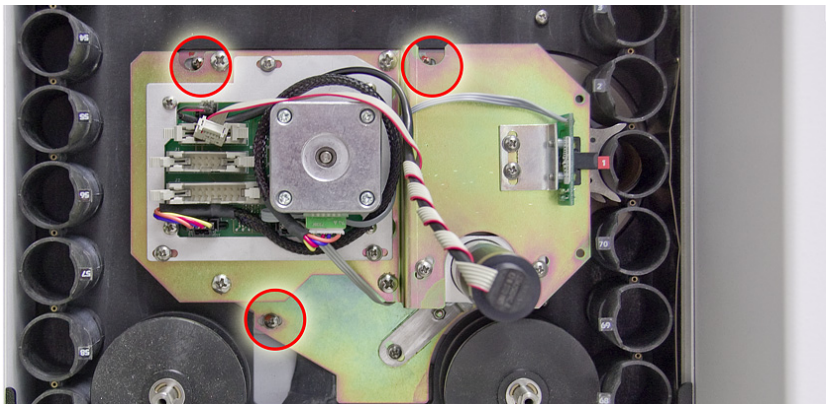


Figure 38 Tray/shutter drive assembly removal

6 Do not disassemble this component. Clean off any dust or dirt from the assembly, especially the four optical sensors: position 1 sensor, vial sensor, and two shutter sensors.

7 Carefully remove the tray chain assembly using both hands.

Replace the tray chain and tray/shutter drive assembly

1 Place the tray chain assembly around the pulleys as shown in Figure 39.

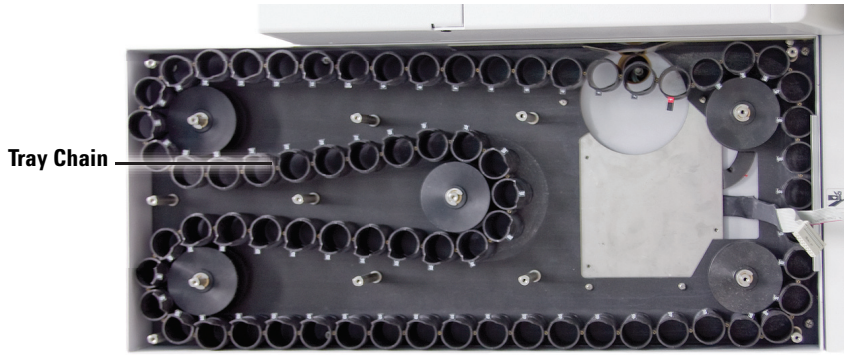


Figure 39 Tray chain assembly

2 Remove the standoff shown in Figure 40.

3 Position the tray chain tensioning tool. Do not push on the chain.

Figure 40 Tensioning tool

4 With the tensioning tool in place, grip the gauge on the tool and while holding the tool perfectly horizontal, push against the tensioning pulley until the gauge reads 3.5 kg. Hold the tools's reset button while pushing. See Figure 40. Tighten the nut on top of the tensioning pulley to secure its position. Keep holding the reset button and monitoring the gauge on the tool while tightening.

5 Replace the standoff that was removed in step 2.

6 Replace the insulation disk. If the retaining spring appears bent or does not hold the disk on the pin, replace the spring.

7 If the belts for the tray and shutter drives are worn, ask the customer to consider replacing the tray/shutter drive assembly.

8 Align the "Tray/shutter drive assembly", see page 56.

9 Place the tray/shutter drive assembly in position on the tray as shown in Figure 41.

10 Secure the tray/shutter drive assembly using screws and lock washers. See Figure 38.

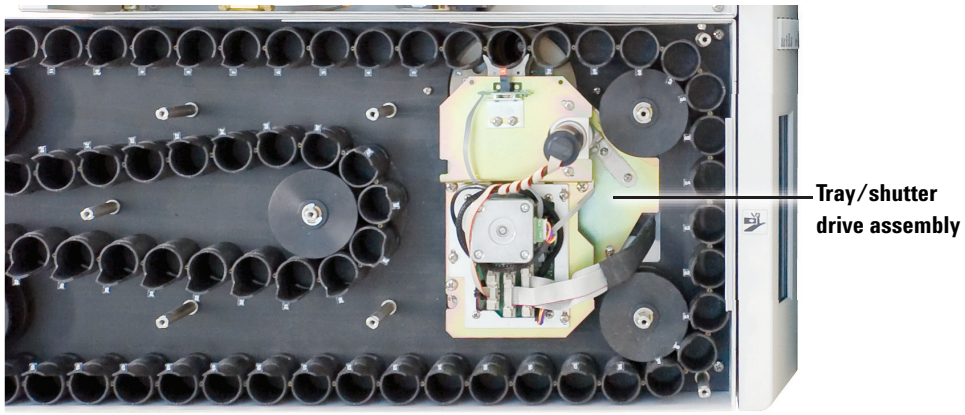


Figure 41 Tray/shutter drive assembly

11 Replace the ribbon cables. See Figure 36.

12 Align the assembly with the optical alignment tools. See "Tray chain alignment" on page 60.

13 Place the tray covers back on the HS. Install and tighten all screws on the cover.

14 Run the strife test with vials to make sure the vials can be delivered to and from the HS oven. See "Strife test" on page 239.

15 Select **Clear** to end the test.

Alignment Procedures

Tray/shutter drive assembly

Adjust the sensor disk with respect to the shutter position after performing the following tasks:

- Replace or loosen 0410105021 shutter motor-sensor assembly. See Figure 16 on page 41.
- Replace or loosen 2283000015 shutter drive belt. See Figure 19 on page 42.
- Replace 0410105022 tray/shutter drive assembly. See Figure 25 on page 44.
- Intermittent shutter failures after checking all 5 VDC and ground connections.

There are two optical sensors under the shutter motor. These sensors read a disk containing one slot.

- One sensor reads the slot to indicate the mid position and allows the tray lifter to raise.
- The other sensor reads the slot to locate the open position and allows the tray lifter to raise or lower the vial to the carousel.

The closed position is not as critical. The stepper motor is told to move a number of steps past the mid position.

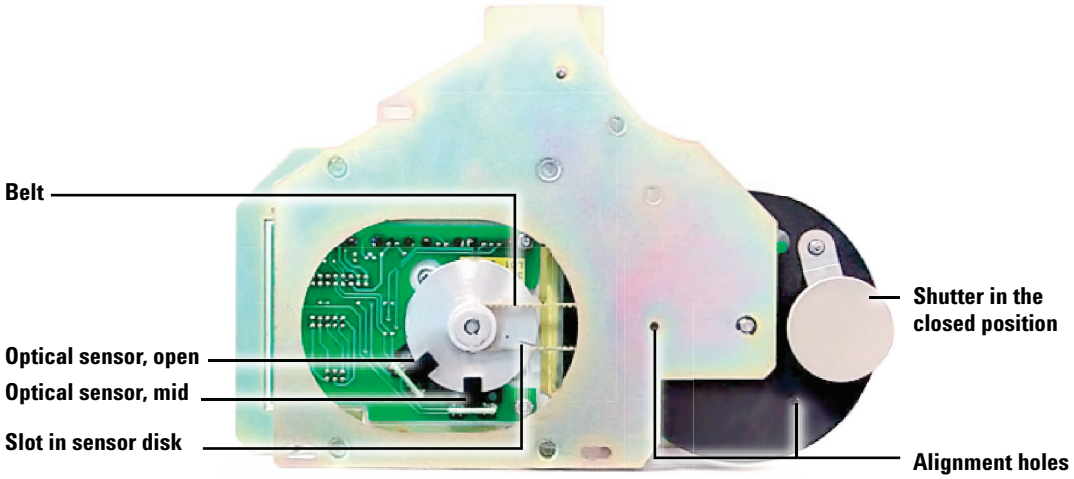


Figure 42 The slotted disk and optical sensors

Required tools

No. 1 Phillips screwdriver with narrow handle

2.5 mm allen wrench

Replacement parts

0410105021 Shutter motor-sensor assembly

2283000015 Shutter drive belt

0410105022 Tray/shutter drive assembly

Align the tray/shutter drive assembly

This procedure assumes that you have removed the tray/shutter drive assembly from the Headspace Sampler. See "Remove the tray/shutter drive assembly and tray chain" on page 51 if needed. When installing this assembly check the belt tension, align the tray/shutter drive assembly, and align the position 1 sensor, as described here.

1 Inspect the shutter belt. Make sure it is properly fitted on both pulleys.

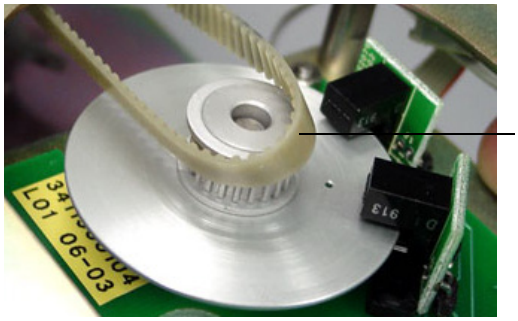


Figure 43 Incorrect position of shutter belt

2 Press on the belt to check the tension. It should be tight enough to hold the belt to the gear teeth without putting strain on motor axle. If the tension needs adjustment, loosen the three screws shown in Figure 45 and slide the shutter motor-sensor assembly as needed. Tighten the screws when finished.

Figure 44 Correct shutter belt tension

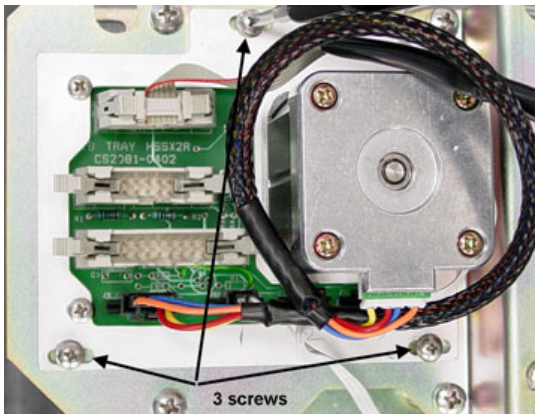


Figure 45 Shutter motor-sensor assembly screws

3 Align the holes in the shutter and bracket. Place a 2.5-mm allen wrench or piece of 1/16-inch tubing through both the hole shown here and the hole in the disk shown in Figure 42.

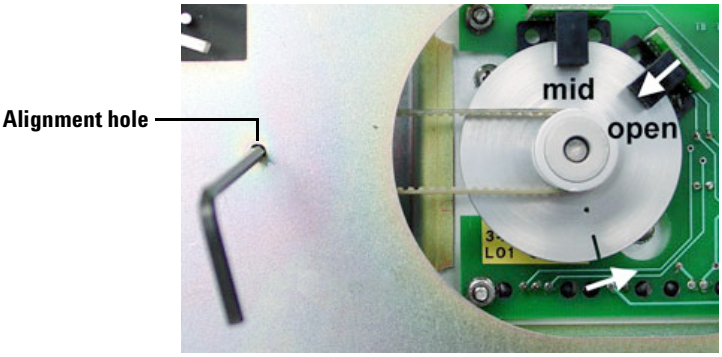


Figure 46 Bracket alignment hole

4 Find the screw that holds the sensor disk to the pulley axle. Loosen the screw. Keep the screwdriver in this location.

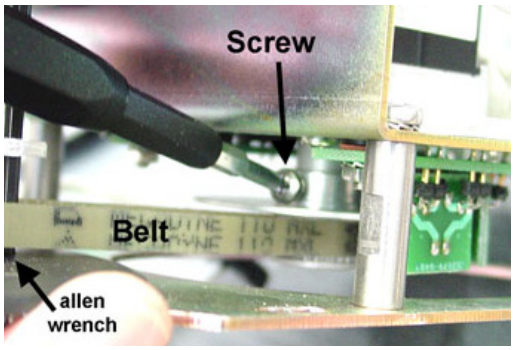


Figure 47 Sensor disk

5 Align the sensor disk slot under the optical sensor for the open position. Note that there is a hole in the disk at the same radius. Tighten the pulley axle screw.

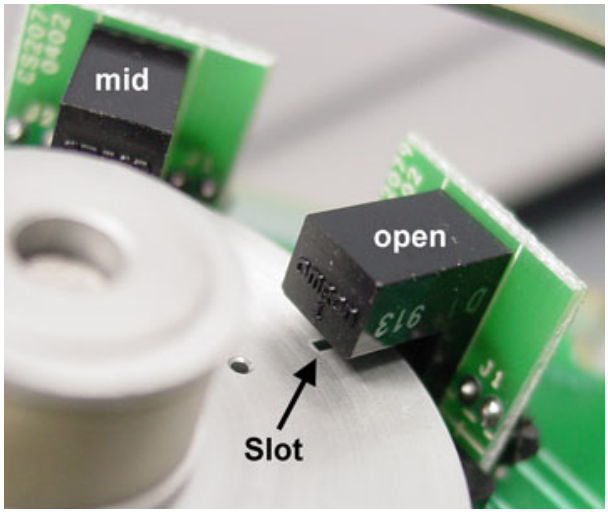


Figure 48 Optical sensor open position

6 To verify the alignment, reassemble the tray components, make any other adjustments and run the strife test. See "Strife test" on page 239.

Tray chain alignment

Before performing this procedure, the Headspace Sampler with carousel/oven group must already be aligned.

Required tools

Phillips screwdriver

Replacement batteries for the light source tool

G1888-80000 Optical alignment tools

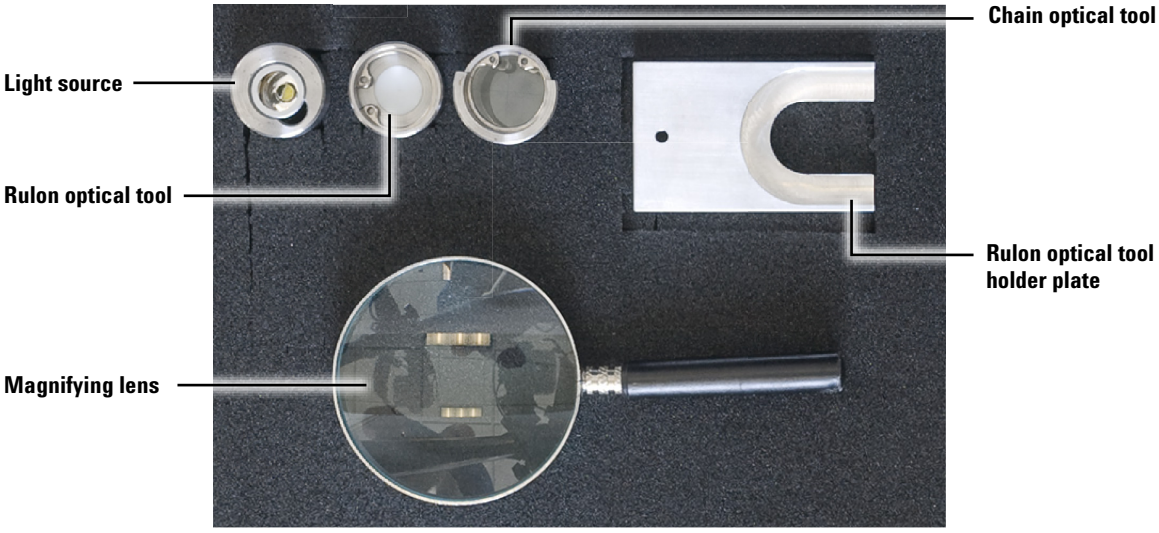


Figure 49 G1888-80000 Optical alignment tools

Replacement parts

Not required.

Align the tray chain

There are four procedures required to align the tray chain:

1. Prepare the HS and position the optical alignment tools.
2. Align the chain with the optical tool.
3. Make alignment corrections.
4. Verify the alignment using the optical tool.

Procedure 1: Prepare the Headspace Sampler and position the optical alignment tools

1 The HS must have the carousel and oven group already aligned. Check that the lifters are aligned with the carousel and that the carousel is aligned with the rulon bushing.

2 Remove the tray/shutter drive assembly cover. See Figure 34 on page 51.

3 Remove the screws and the center cover. See Figure 65 on page 73.

4 Make sure the tray/shutter drive assembly screws are tight. See Figure 38 on page 53 for the screw locations.

5 Turn the HS on. Turn off the heated zones by going into **active method > heated zones**. Scroll to each zone and Press **0** then **Enter.** Wait until the HS completes homing.

6 Wait until the temperature of the oven and sample port is **less than 50°C**.

7 Install the rulon optical tool in the rulon bushing. The rulon optical tool contains a dot on one surface. The dot faces upwards into the rulon bushing as shown in Figure 50.

Figure 50 The orientation of the rulon optical tool

8 Secure the rulon optical tool with the thermocouple cover as shown in Figure 51. If the rulon bushing is longer than the plate see step 9. If the rulon bushing is secure, go to step 10.

Figure 51 The thermocouple cover secures the tool

9 If an extended length rulon bushing is installed, use the plate that is included in the alignment kit to hold the rulon optical tool. See Figure 52. Place a piece of paper over the carousel so that the screw does not fall into the oven.

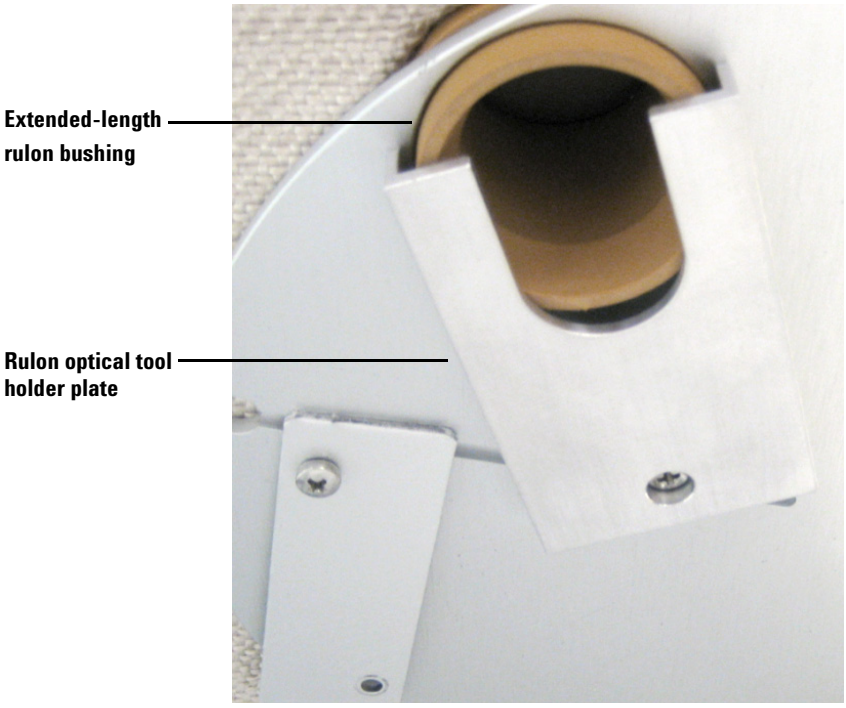


Figure 52 Plate to hold extended length rulon bushing

10 Be sure the oven is less than 50 °C. Turn on the light source tool and place it in the carousel at position one. Close the lid.

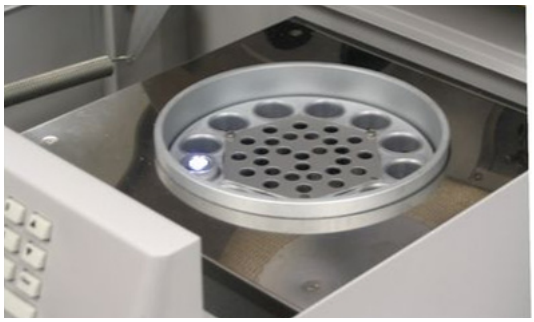


Figure 53 Light source tool in the carousel

11 Place the chain optical tool in the chain at position 1.

Figure 54 Chain optical tool in the chain

12 Check the chain optical tool and make sure that the notch in the chain matches the hole in the tool.

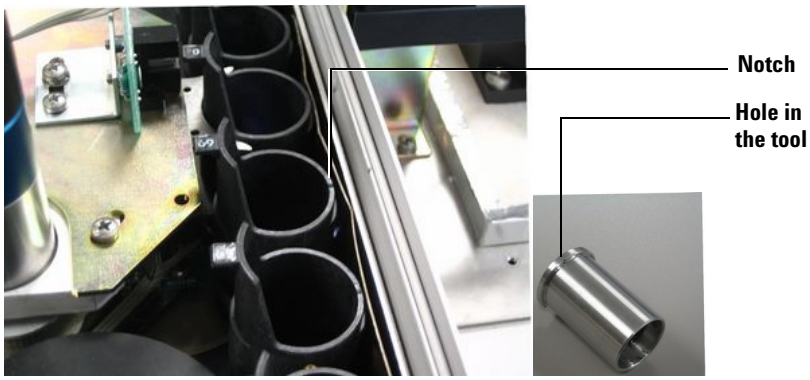


Figure 55 Location of chain notch and tool hole

13 Use a reference sprocket position. Mark a sprocket position with a marker. Perform the Y and X alignment with the tray link in this sprocket. After aligning, check the alignment in each sprocket position.

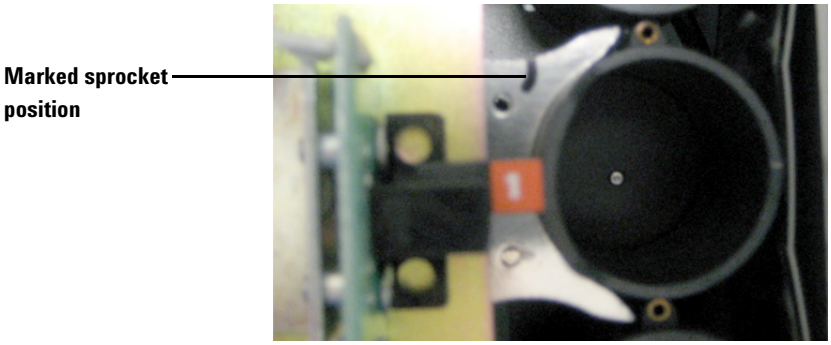


Figure 56 Marked sprocket position

14 Make sure that the shutter is closed. See page 76.

15 Home the chain. See page 76.

16 Open the shutter to mid position. See page 76.

Procedure 2: Align the chain with the optical tool

The optical tool is directly above the rulon tool. If the chain alignment is correct, the dot on the surface of the rulon tool appears in the center of the concentric circles on the lens of the optical tool.

The optical tool contains two sets of cross hairs, one on the top lens and one on the bottom lens. These cross hairs are used to align your vision directly down the center of the tool.

1 Look through the optical tool. Move your head until the cross hairs line up in the center. Note the position of the dot.

Figure 57 shows cross hairs out of alignment indicating that even though the dot is in the middle circle your vision is not directed down the center of the optic tool.

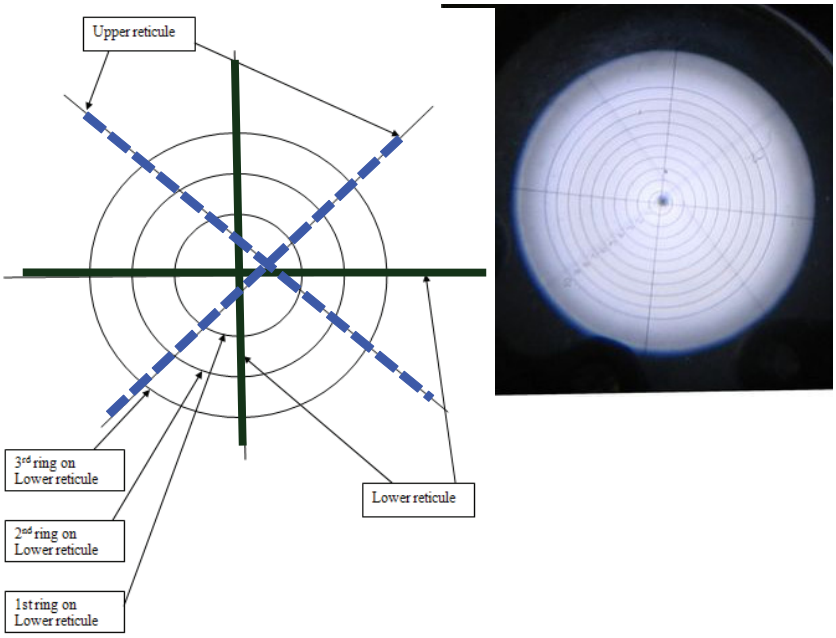


Figure 57 The cross hairs do not line up (parallax)

Figure 58 shows correct cross hair alignment. The dot shows alignment is out in both the X and Y axis.

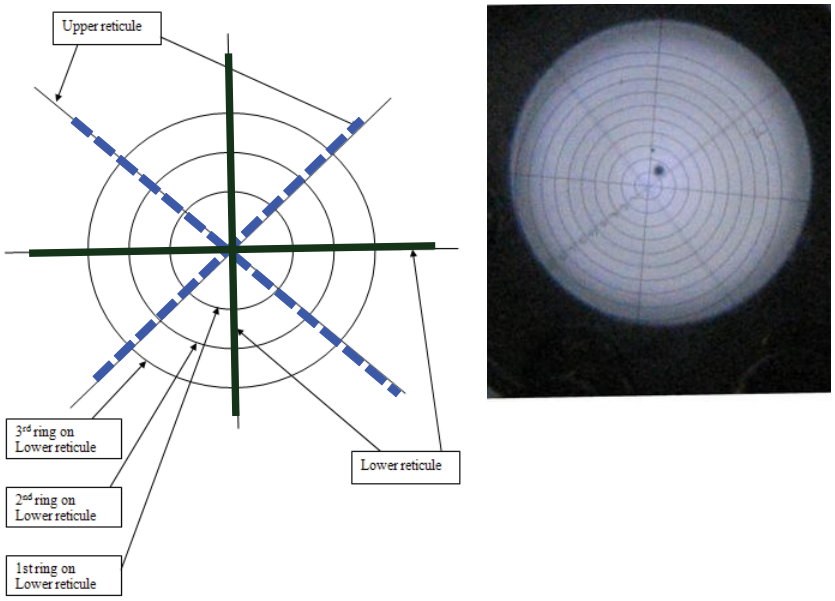


Figure 58 The parallax is good, indicating your head position is correct

2 If the dot is within the center circle go to "Procedure 4: Verify the alignment through the optical tool" on page 70. If the dot is not inside the center circle continue to "Procedure 3: Make alignment corrections" on page 66.

Procedure 3: Make alignment corrections

1 If the dot needs to be moved left or right to be in the middle circle, adjust the X (Tray/shutter drive assembly).

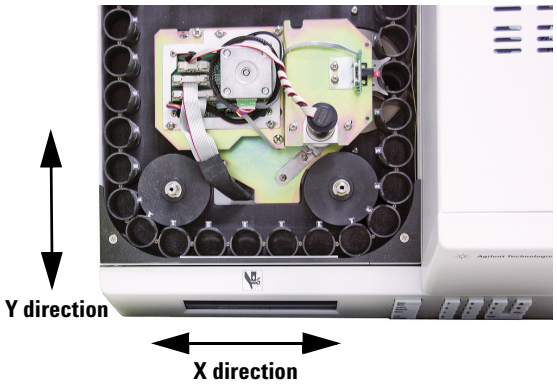


Figure 59 X and Y directions for alignment corrections

2 If the dot needs to be moved front or back to be in the middle circle, adjust the Y (position 1 sensor).

3 In many cases both X and Y need to be aligned. Adjust the X axis first. If the chain is not out of alignment in the X direction go to "Adjust the Y axis–Tray position one sensor" on page 68.

First adjust the X axis–Tray/shutter drive assembly

If the chain is out of alignment in the X direction:

1 Loosen the three screws that secure the tray/shutter drive assembly as shown in Figure 60. New hardware revisions have four screws. Adjust the left to right position of the tray/shutter drive assembly to minimize the error in the X direction.

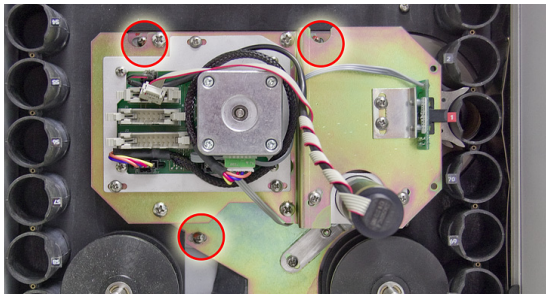


Figure 60 The location of the three tray/shutter drive assembly screws

2 If the tray base plate is interfering with the shutter, perform steps 3 and 4.

3 Loosen the four screws attaching the black tray base plate. See Figure 61. The figure shows the tray with the tray/shutter drive assembly removed for a better view of the screws, but you do not remove the tray/shutter drive assembly for this procedure.

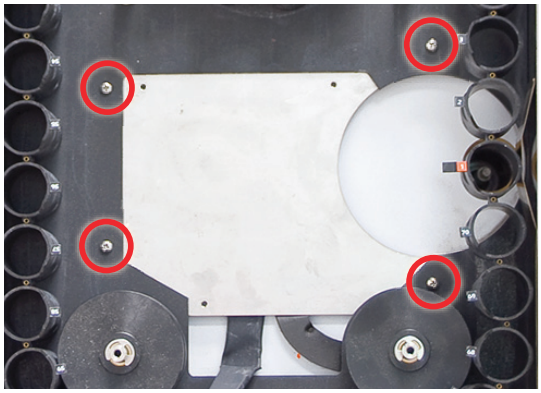


Figure 61 The four base plate screws.

4 Move the base plate in the direction of the sample port. Tighten the base plate screws.

5 Adjust the tray/shutter drive assembly in the X direction and tighten the screws.

6 Check for interference between the base plate and the shutter. If the interference still exists repeat steps 1 through step 6.

CAUTION It is important that the shutter has clearance on all sides. Check that you can see light on all edges of the shutter.

7 To recheck the alignment go to "Procedure 4: Verify the alignment through the optical tool" on page 70.

Adjust the Y axis–Tray position one sensor

If the chain is out of alignment in the Y direction:

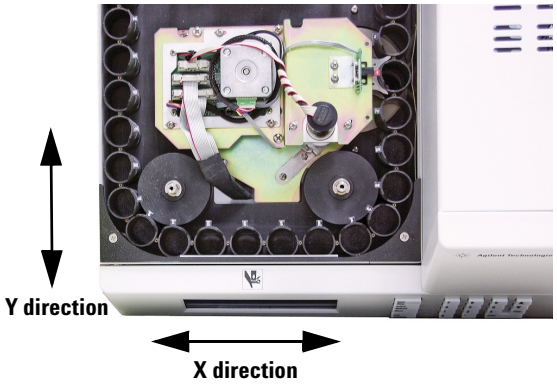


Figure 62 X and Y directions for alignment corrections

1 Open the shutter. See page 76.

2 Loosen the two screws on the "tray position-one" sensor and move the sensor in the "Y" direction.

3 Advance the tray one position forward and then one position back.

4 Check if the Y axis is aligned using the optical alignment tool.

5 If the Y axis is not aligned, repeat steps 2 through 4.

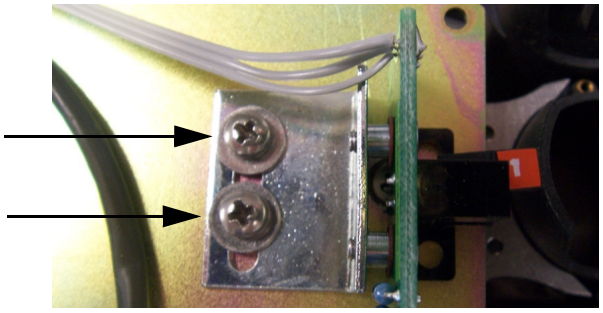


Figure 63 Screws that secure the tray position one sensor

6 When the dot is aligned on the X axis (Y=0) tighten the screws on the “tray position one” sensor.

7 Do a final alignment check. Go to “Procedure 4: Verify the alignment through the optical tool” on page 70.

Procedure 4: Verify the alignment through the optical tool

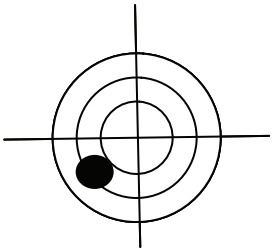
1 Close the shutter. See page 76.

2 Home the chain. See page 76.

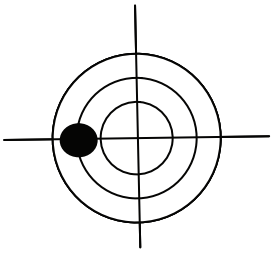
3 Open the shutter at least half way. See page 76.

4 Observe the dot in the optical tool with the cross hairs aligned.

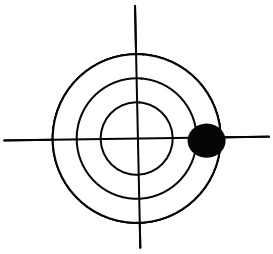
X and Y both need adjustment. See "Procedure 3: Make alignment corrections" on page 66.



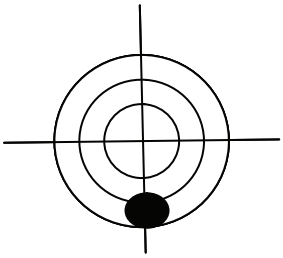
The HS is aligned in the Y direction. X needs adjustment. See "First adjust the X axis–Tray/shutter drive assembly" on page 67.



The HS is aligned in the Y direction. X needs adjustment. See "First adjust the X axis–Tray/shutter drive assembly" on page 67.



The HS is aligned in the X direction. Y needs adjustment. See "Adjust the Y axis–Tray position one sensor" on page 68.



5 Close the shutter. See page 76.

6 Check to make sure the tray/shutter drive assembly, position 1 sensor, and base plate screws are tight.

7 Rotate the chain three full revolutions. This will put the chain back at home with the mark at position 1.

8 Check the alignment with the optical tool one final time.

9 Check that the tray lifter does not hit the shutter. To do this, open the shutter to mid position, raise the tray lifter.

10 Make sure that the tray chain link sits correctly in the tray motor group sprocket.

11 Check the alignment in each HS sprocket position. Check this by viewing the alignment of vial position 1, rotate the tray chain, check the alignment. Repeat this step three times. If the alignment changes in different sprocket positions, the tray motor group assembly needs to be replaced.

12 Remove all of the alignment tools.

13 Replace the tray cover and the tray/shutter drive assembly cover.

This completes the chain alignment procedure.

Optical vial sensor (Vial present sensor)

There is an optical sensor at the base of the tray drive sprocket that senses the presence of a vial. The sensor senses the reflective surface of the vial through a slot in the tray chain links. The sensor looks for a vial just before and after a vial is delivered to or returned from the carousel.

Adjust the optical vial sensor after replacing this sensor.

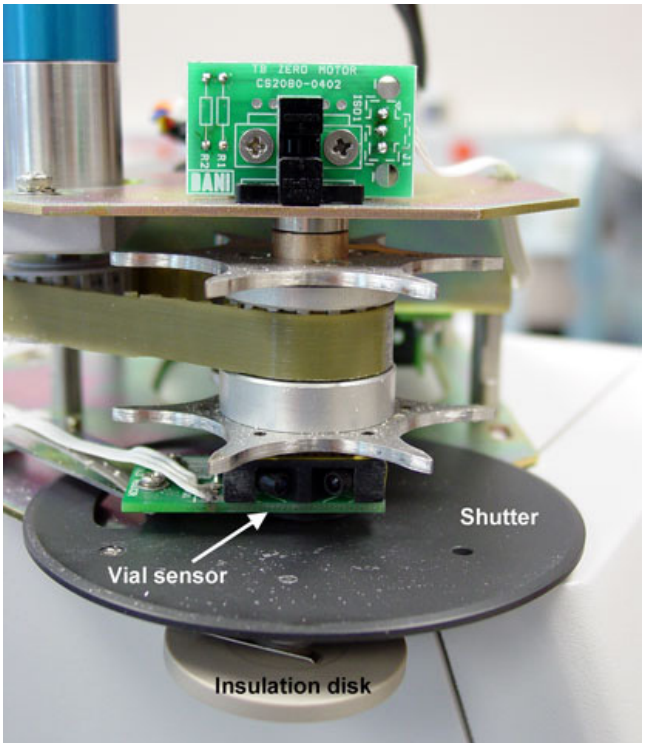


Figure 64 Vial sensor

Required tools

No. 1 Phillips screwdriver

Headspace vial

Volt meter with small probes

Replacement part

0410105106 Vial present sensor assembly

Align the optical vial sensor

1 Power ON the HS. Place a vial in tray position 1.

2 Remove the tray/shutter drive assembly cover. See Figure 34 on page 51.

3 Remove the screws and the center cover as shown in Figure 65.

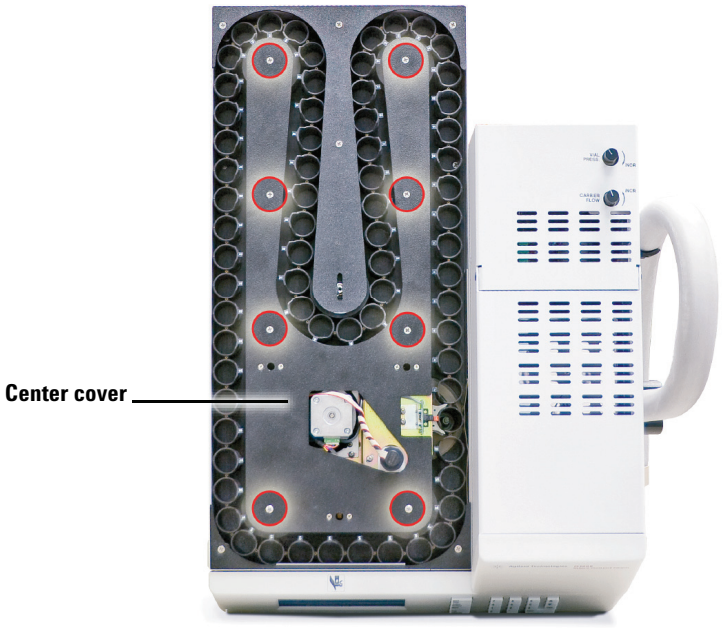


Figure 65 The center cover

4 With the tray at position 1, measure the voltage across the vial sensor connectors shown in Figure 66. There are two revisions of the hardware. Check the picture to determine where to place your voltage probes.

- Set your voltmeter to measure Volts DC. Make sure your voltmeter has very sharp tipped probes. Sharp tipped probes are important for an accurate measurement.
- Stand at the front of the instrument. Place the positive probe of the voltmeter on the middle pin of the vial sensor (output). Place the negative probe on the right pin which is closest to the pneumatics cover (ground). The pin on the far left is 5 V.
- With a vial present approximately 0 volt should be measured.
- Remove the vial, approximately 5 volts should be measured.

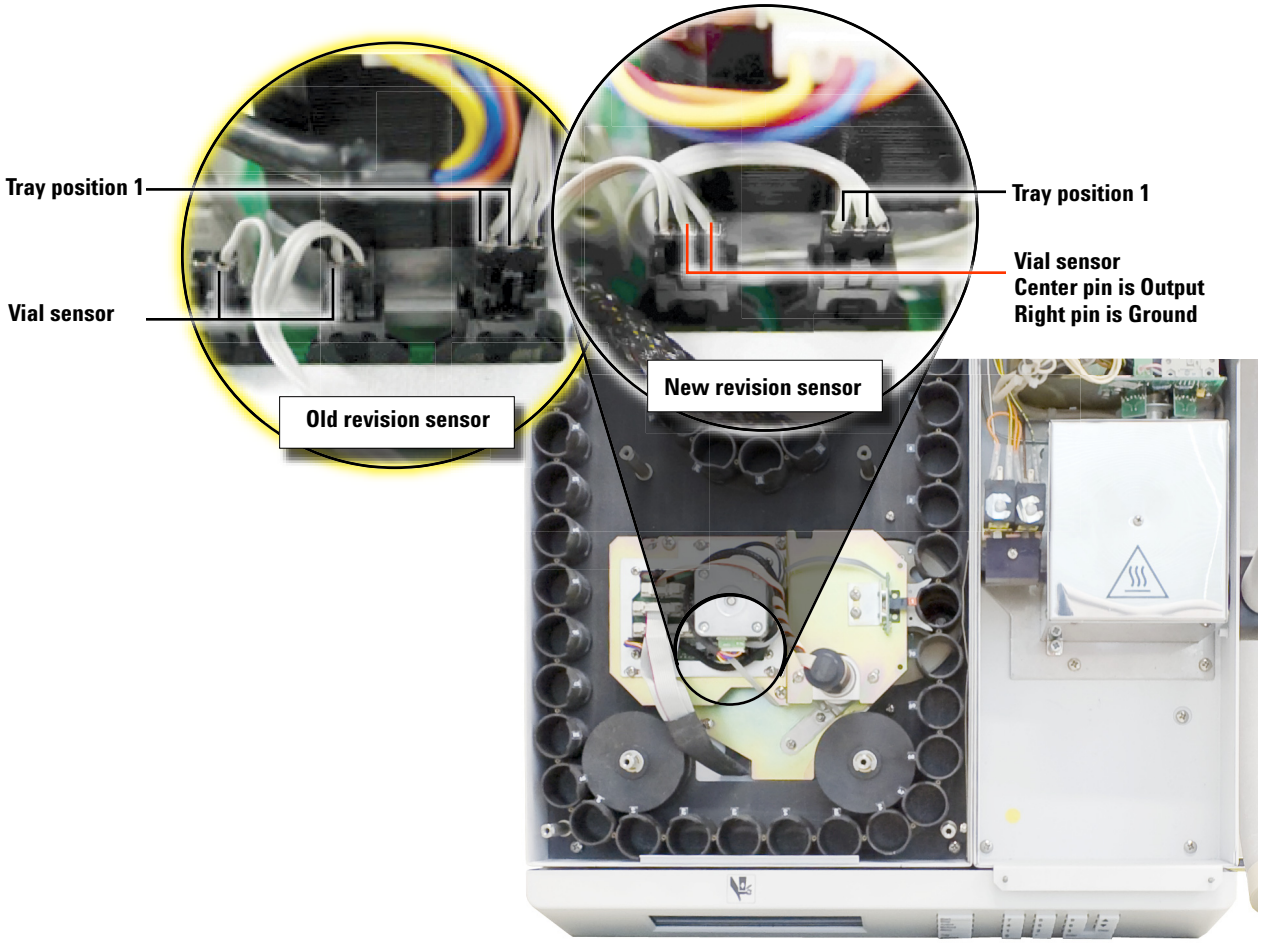


Figure 66 Old and new revisions of the optical vial sensor

5 Check that the optical vial sensor is aligned with the slot in the tray chain link. See Figure 67 and Figure 68. If the slot is too high or low, adjust the bracket height. If the slot needs to be closer or farther away, adjust the piviot point.

- To adjust the bracket height, tighten the nut at the pivot point until the bottom of the bracket touches the top of the spring. See Figure 68.
- To adjust the pivot point, loosen the screw shown and pivot the vial sensor. When the vial sensor detects the vial, tighten the screw to secure the position of the sensor. See Figure 69.

Figure 67 Slots in the tray chain links

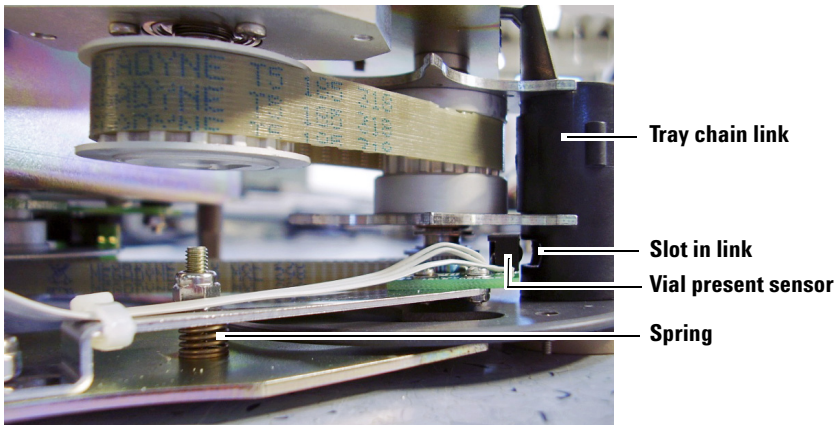


Figure 68 Vial sensor with spring and tray chain link

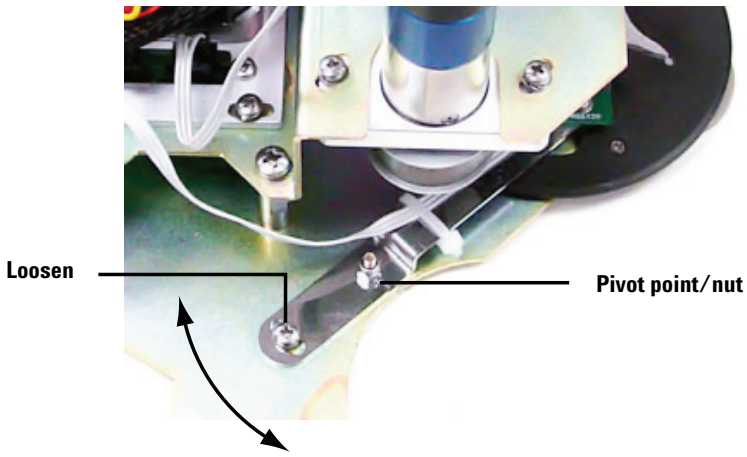


Figure 69 Vial sensor screw and pivot point

Advanced Functions

Chain homing

1. From the main screen press **Menu** then ↑ repeatedly until the screen highlights **advanced functions**.
2. Press **Enter > 5**, then ↓ repeatedly until the screen highlights **Tray**.
3. Press **1** and then **5**.

Shutter opening

1. From the main screen press **Menu** then ↑ repeatedly until the screen highlights **advanced functions**.
2. Press **Enter > 5,** then ↓ repeatedly until the screen highlights **Shutter.**
3. Press **1** to open to mid position. Press **1** again to open to full position.

Shutter closing

1. From the main screen press **Menu** then ↑ repeatedly until the screen highlights **advanced functions**.
2. Press **Enter > 5,** then ↓ repeatedly until the screen highlights **Shutter**.
3. Press **0** to close to mid position. Press **0** again to close completely.

Advancing the tray

1. From the main screen press **Menu** then ↑ repeatedly until the screen highlights **advanced functions**.
2. Press **Enter > 5,** then ↓ repeatedly until the screen highlights **Tray.**
3. Press **1** to advance forward, **0** to go backward.
4. To rotate the tray press **1** and then **5**.

4
Oven

Overview

The vial oven is where the vials heat during thermal and chemical stabilization. The setpoint temperature range is 40 °C to 230 °C.

The oven contains a circular aluminum sample carousel that holds twelve 10-mL or 20-mL sample vials. Sample vials are transferred from the chain on top of the Headspace Sampler (HS) to the heated carousel inside the oven to equilibrate before sampling.

A resistance band heater heats the oven. A fan in the center of the carousel circulates the air to maintain uniform temperature. The carousel can shake at two speeds to help components achieve an equilibrium between volatiles in the sample and volatiles in the empty space above it quicker. Mechanical rods move vials down into the oven and up to the sample probe needle for extraction.

Replacement Parts

Headspace Samplers with serial numbers less than IT00604011 have grey external skins. Current HS models are white in color.

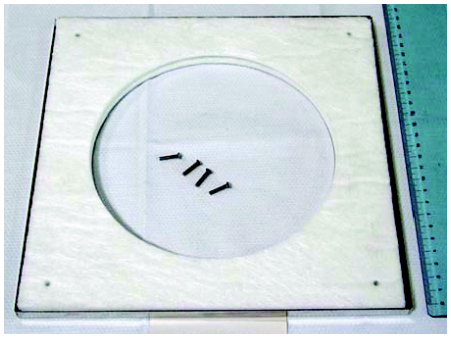


Figure 70 0410105032 Top, oven enclosure

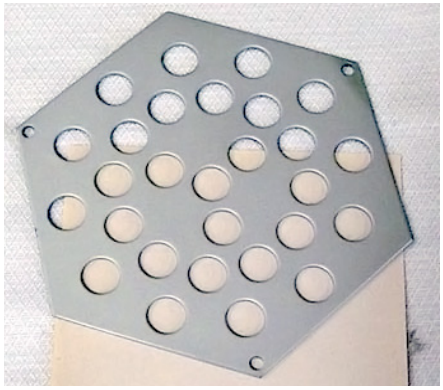


Figure 71 6310103026 Screen, oven fan

Figure 72 0410105029 Heater sensor assembly, oven

Figure 73 3700500902 Oven fan blades with setscrew

Figure 74 6310090035 Carousel, 12 position

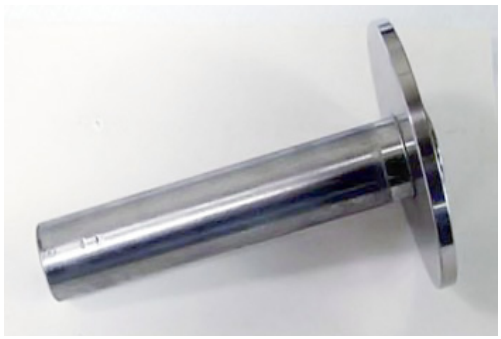


Figure 75 6410216138 Shaft, carousel

Figure 76 6410302066 Bushing, carousel shaft top

Figure 77 6410204041 Collar, carousel

Figure 78 0410105013 Base, carousel compartment

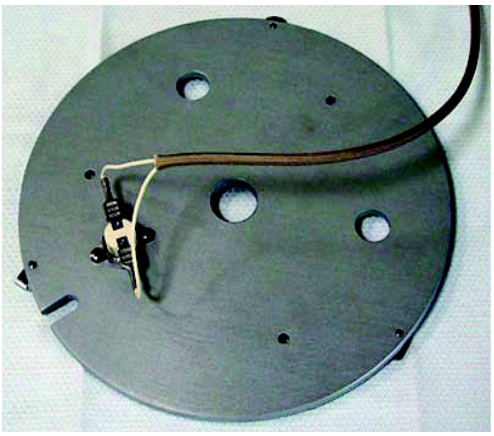


Figure 79 0410105025 Base, carousel compartment with switch

Figure 80 3070000010 Thermoswitch, oven max temperature

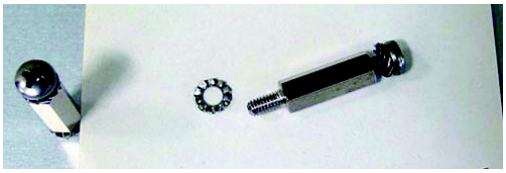


Figure 81 0410205003 Standoff, oven fan

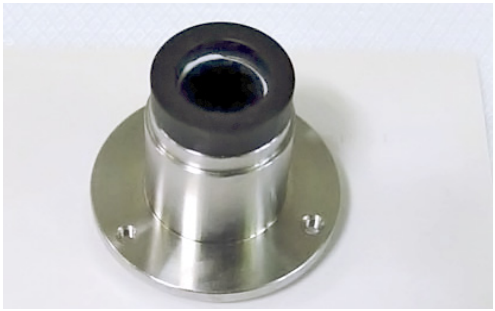


Figure 82 2195140001 Sleeve, carousel

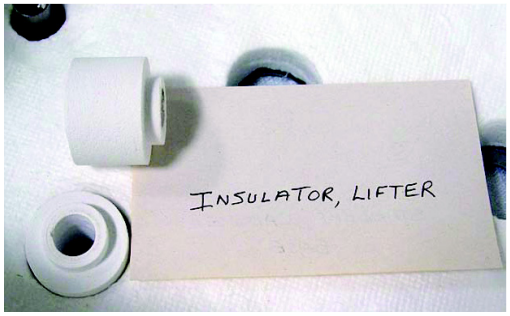


Figure 83 6410202002 Sleeve, ceramic lifter rod

Figure 84 2195140002 Spacer, oven heater block base

Figure 85 0410105027 Enclosure, oven

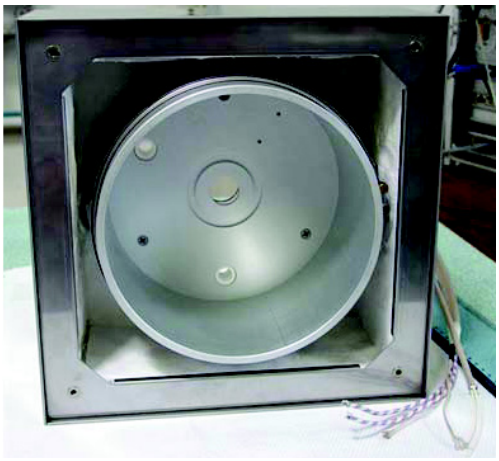


Figure 86 0410105033 Oven enclosure with carousel enclosure

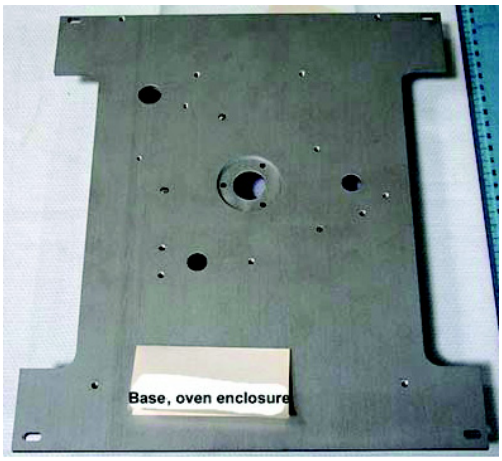


Figure 87 6410216084 Base, oven enclosure

Figure 88 2180036007 Washer, carousel shaft bottom teflon

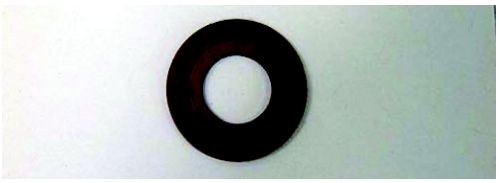


Figure 89 2180037001 Washer, carousel shaft top rulon

Figure 90 2283000006 Belt, carousel drive

Figure 91 0410105008 Disk, carousel sensor

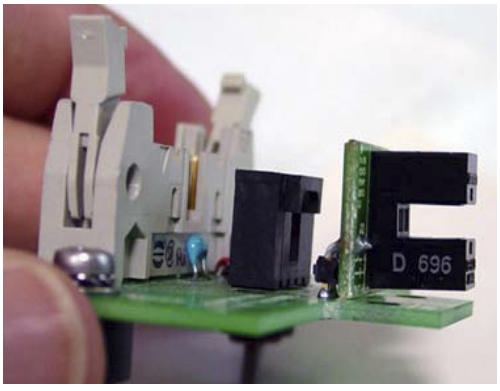


Figure 92 3411500107 Carousel sensor

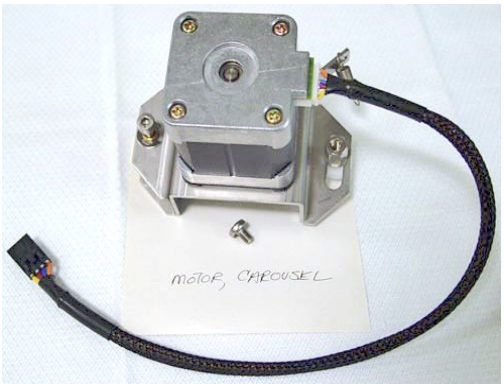


Figure 93 0221670000 Carousel stepper motor assembly

Figure 94 0410105028 Oven fan motor assembly

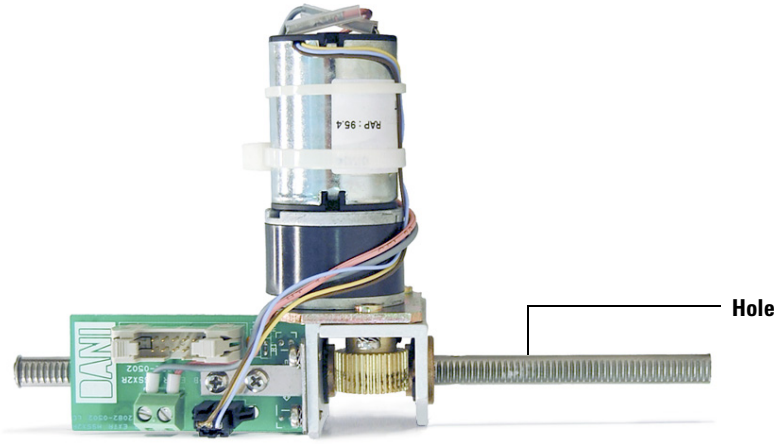


Figure 95 0410105002 Lifter assembly, sample probe

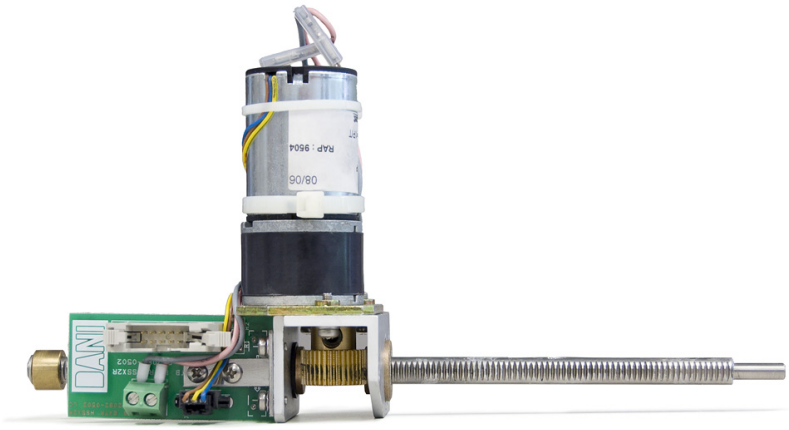


Figure 96 0410105003 Lifter assembly, tray

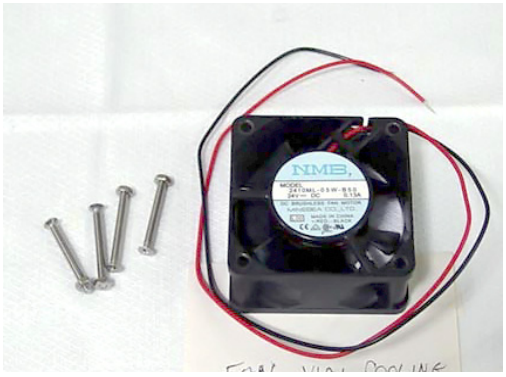


Figure 97 0410105030 Fan, vial cooling

Figure 98 3641500008 Relay, oven heater

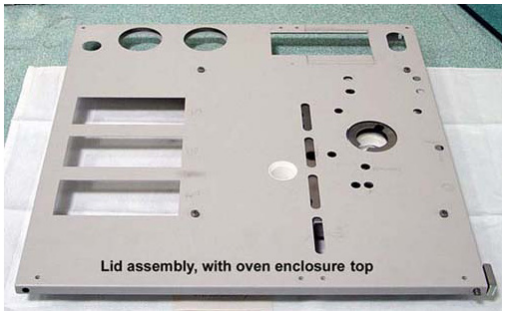


Figure 99 0410105024 Lid assembly with oven enclosure top, old color
0410105124 Lid assembly with oven enclosure top, new color

Figure 100 0410105031 Frame, old color
0410105131 Frame, new color

Figure 101 0410205002 Latch, lid closure

Figure 102 301-019-HSP Lid lever lock

Illustrated Parts Breakdown

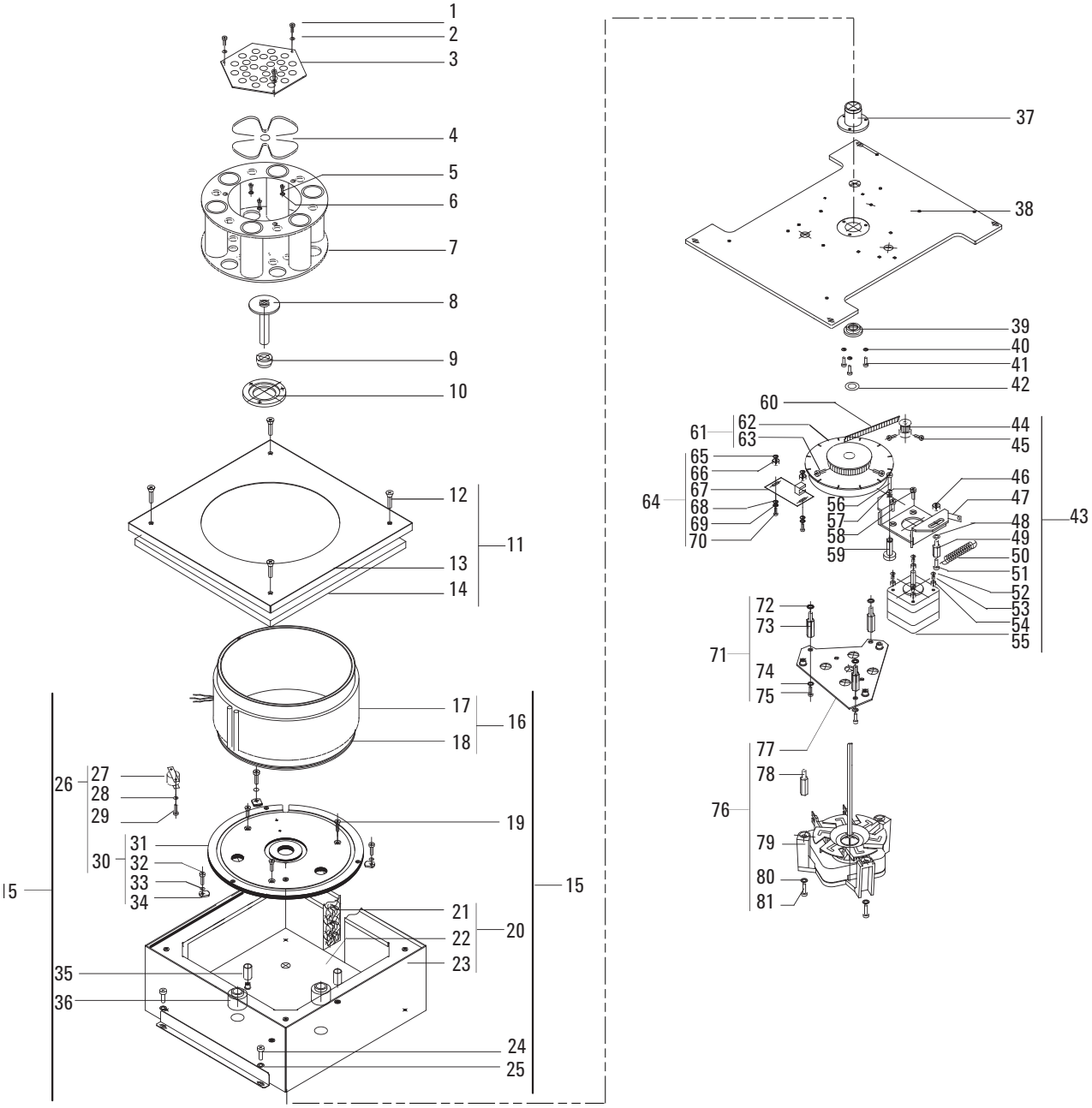


Figure 103 IPB Oven and carousel

Table 6 Oven and carousel IPB

	Description	Part Number	Qty
1	Screw M3x6	2020403006	3
2	Toothed washer	2171304030	3
3	Oven fan screen	631010326	1
4	Fan blades	3700500902	1
5	Screw M3x10	2020403010	3
6	Toothed washer	2171304030	3
7	Carousel, 12 position	6310090035	1
8	Carousel shaft	6410216138	1
9	Bushing, carousel shaft	6410302066	1
10	Carousel collar	6410204041	1
11	**Top of oven enclosure assembly** consists of parts 12 through 14	**0410105032**	**1**
12	Screw M3x16	2060403016	4
13	Oven enclosure top	6310103025	1
14	Insulation	1171210008	2
15	**Oven enclosure with carousel enclosure** consists of parts 16 through 36	**0410105033**	**1**
16	**Oven heater sensor assembly** consists of parts 17 through 18	**0410105029**	**1**
17	Heater	9101030001	1
18	Carousel enclosure	9011090003	1
19	Screw M4x20	2060404020	3
20	**Oven enclosure assembly** consists of parts 21 through 23	**0410105027**	**1**
21	Oven insulation	1171210003	1
22	Oven base	1171210007	1
23	Oven external covering	1211109032	1
24	Screw M4x6	2020404006	2
25	Toothed washer	2171304040	2
26	**Base and switch assembly** consists of parts 27 through 34	**0410105025**	**1**

Table 6 Oven and carousel IPB (continued)

27	Switch, oven max temperature	3070000010	1
28	Toothed washer	2171304030	2
29	Screw M3x6	2020403006	2
30	**Carousel compartment base assembly** consists of parts 31 through 34	**0410105013**	**1**
31	Carousel compartment base	6410106046	1
32	Screw M3x10	2020403010	3
33	Toothed washer	2171304030	3
34	Clip	6310206011	3
35	Spacer, oven heater block base	2195140002	3
36	Sleeve, ceramic lifter rod	6410202002	2
37	Sleeve, carousel	2195140001	1
38	Base, oven enclosure	6410216084	1
39	Bushing, carousel shaft bottom	6410302067	1
40	Toothed washer	2171304030	3
41	Screw M3x8	2020403008	3
42	Washer, carousel shaft bottom, teflon	2180036007	1
43	**Carousel motor assembly** consists of parts 44 through 59	**0221670000**	**1**
44	Small pulley	2283500008	1
45	Screw M3x6	2020403006	2
46	Set piece	2195310012	1
47	Tensioning bracket	6410110100	1
48	Flat washer	2170204040	1
49	Nut post	2190164010	1
50	Spring	2351500030	1
51	Screw M4x10	2020404010	1
52	Flat washer	2170204030	4
53	Spacer	2195040010	4
54	Chock	5282003502	4
55	Stepping motor	6410090081	1
56	Allen Screw M4x30	2030404030	1
57	Washer	2181212003	1
58	Screw M3x10	2020403010	4

Table 6 Oven and carousel IPB (continued)

59	Brass bushing	2195310013	1
60	Belt, carousel drive	2283000006	1
61	**Carousel sensor disk assembly** consists of parts 62 through 63	**0410105008**	**1**
62	Disk, carousel sensor	2283500022	1
63	Screws M4x12	2030404012	2
64	**PCA carousel sensor assembly** consists of parts 65 through 70	**3411500107**	**1**
65	Flat washer	2191320306	2
66	Spacer	2180042001	2
67	PCA carousel sensor	34411500107	1
68	Flat washer	2170204030	2
69	Toothed washer	2171304030	2
70	Screw M2x16	2020403016	2
71	**Oven fan standoff assembly** consists of parts 72 through 75	**0410205003**	**1**
72	Lock washer	2171304030	3
73	Standoff	2190164020	3
74	Lock washer	2171304040	3
75	Screw	2020404008	3
76	**Oven fan motor assembly** consists of parts 77 through 81	**0410105028**	**1**
77	Motor plate	6410216060	1
78	Standoff	2190164015	3
79	Motor	3700500001	1
80	Toothed washer	2171304040	4
81	Screw M4x12	2020404012	3

Replacement Procedures

Accessing the components from the bottom panel

The following components are accessed from the bottom of the HS:

- Carousel sensor
- Oven fan motor assembly
- Carousel stepper motor assembly
- Lifter assembly, sample probe
- Lifter assembly, tray
- Disk, carousel sensor

To remove the bottom cover of the HS:

1. Disconnect the power cord and LAN or RS232 cables from the back of the HS.
2. Disconnect the gases.
3. Carefully lean the HS back. Rest the back of the vial tray on the table.
4. Use a No.1 Phillips screwdriver to remove the four screws that hold the bottom cover in place. Remove the cover and set it to the side.

Figure 104 The bottom cover

Accessing carousel components

1 Slide the two locking tabs on either side of the HS to release the lid. Raise the lid until it locks in an open position.

Figure 105 The locking tabs for the lid

Carousel sensor

Required tools

Phillips screwdriver

Mirror

Replacement part

3411500107 Carousel sensor

Remove the carousel sensor

1 Remove the bottom cover. See "Accessing the components from the bottom panel"on page 94.

2 Place a piece of paper over the power supply to block small screws and washers that might fall.

3 Remove the ribbon cable and stepper motor cable. See Figure 106.

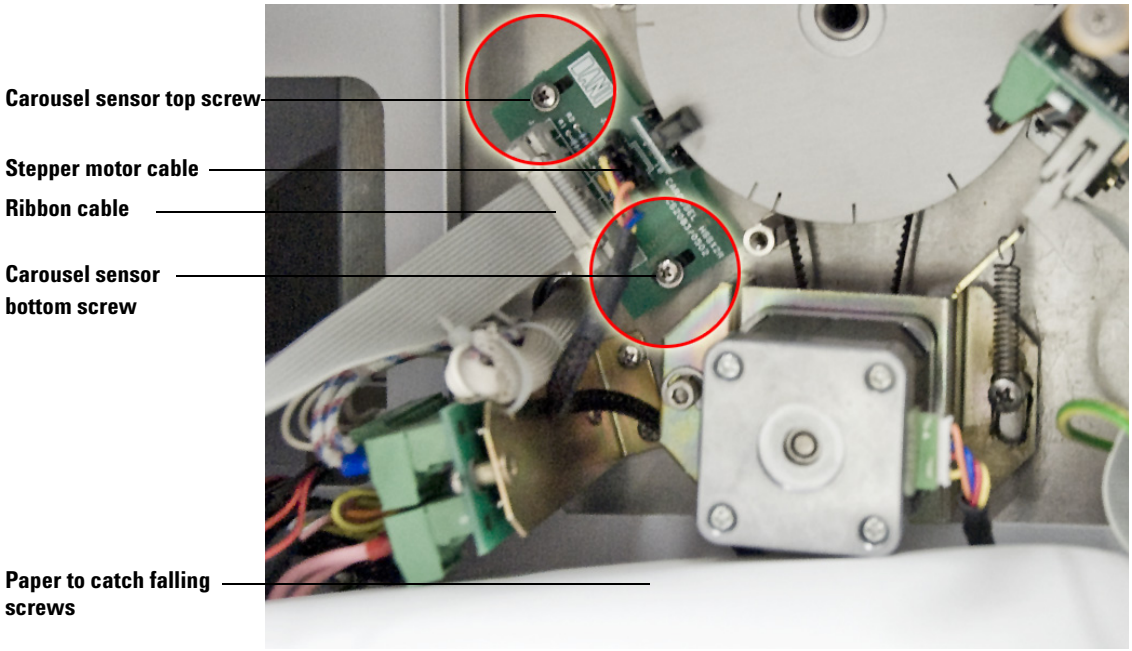


Figure 106 Removing the carousel sensor

CAUTION The carousel stepper motor cable wires are fragile. Be careful not to damage the cables.

4 Remove the bottom Phillips screw from the carousel sensor. Let the sensor slide down clear of the carousel disk.

5 Remove the top Phillips screw from the carousel sensor. Remove the sensor from the HS.

Replace the carousel sensor

1 Place a piece of paper over the power supply to block small screws and washers that might fall.

2 Place the sensor in the HS chassis and loosely fasten the top screw.

CAUTION Do not allow the disk to damage the sensor.

3 Rotate the sensor into position as shown in Figure 107.

4 Use a mirror to make sure that the disk is centered between the sensor.

Figure 107 Disk centered between carousal sensor

5 Insert and tighten the bottom screw. Tighten the top screw.

6 Plug the stepper motor cable into the 4-prong female jack in the sensor motor chassis. Plug in the ribbon cable. See Figure 106.

7 Replace the HS bottom cover. Set the HS upright.

8 Align the carousel. See “Align the carousel”on page 115.

Oven fan motor

Required tools

Phillips screwdriver

Needle nose pliers

Replacement parts

0410105028 Oven fan motor

3700500902 Oven fan blades

Remove the oven fan motor

1 Remove the fan blades. See "Remove the oven fan and carousel"on page 111.

2 Remove the bottom cover. See "Accessing the components from the bottom panel"on page 94.

3 Place a piece of paper over the power supply to block small screws and washers that might fall.

4 Remove the three large Phillips screws securing the fan motor to the chassis. See Figure 108.

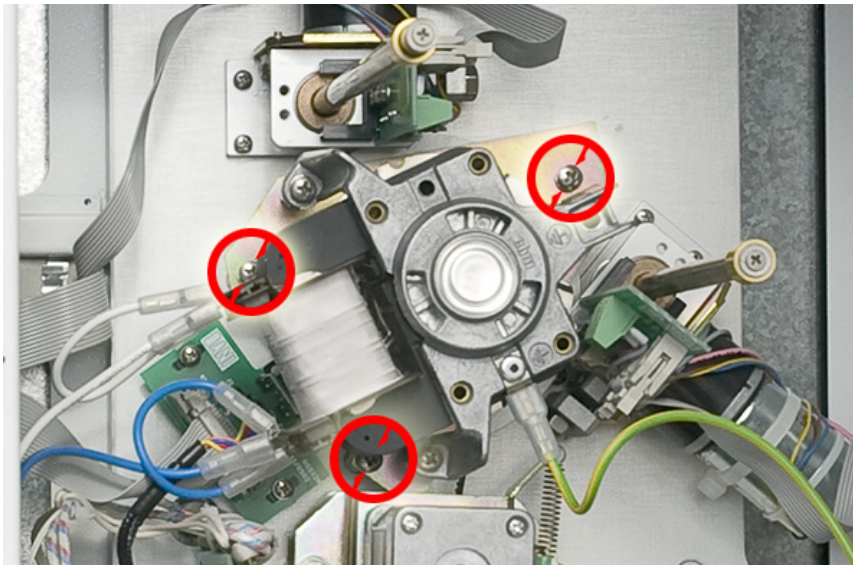


Figure 108 Oven fan motor screws and cables

5 Pull the oven fan motor assembly out of the chassis.

CAUTION Cable wire connections are fragile.

6 Remove the white and blue cables using needle nose pliers.

7 Remove the green and yellow cable using needle nose pliers.

Replace the oven fan motor

1 Place a piece of paper over the power supply to block small screws and washers that might fall.

2 Place the motor in the HS chassis and line up the motor screw holes with the threaded posts in the HS chassis. See Figure 109.

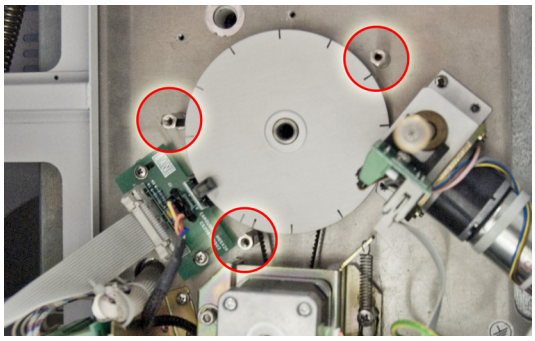


Figure 109 Threaded posts for oven fan motor

3 Check that the motor shaft is centered in the carousel shaft in the oven. If it is not centered, the fan shaft will scrape against the carousel shaft. To adjust the fan shaft adjust the three standoffs under the motor.

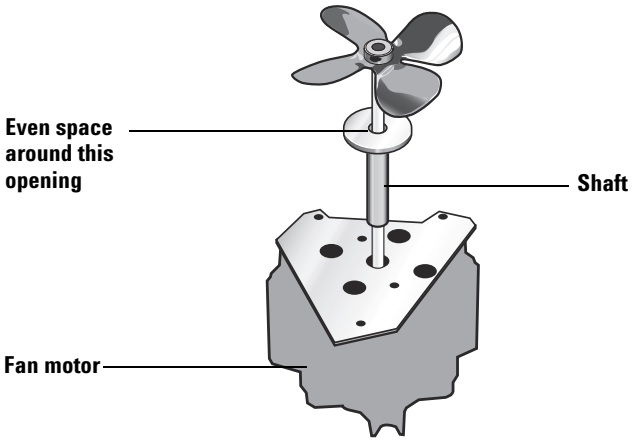


Figure 110 Motor shaft centered in the carousel shaft

4 Insert and fasten the three large Phillips screws.

5 Replace the two blue wires, two white wires, and the green/yellow wire as shown in Figure 108.

6 Replace the HS bottom cover. Set the HS upright.

7 Replace the oven fan blade and oven fan cover. See "Replace the oven fan and carousel"on page 112.

Carousel stepper motor

Required tools

Phillips screwdriver

Allen wrench

Replacement part

0221670000 Carousel stepper motor

The parts in Figure 111 come with the stepper motor. This is the new revision. Older revisions either have no set piece or have a plastic set piece.

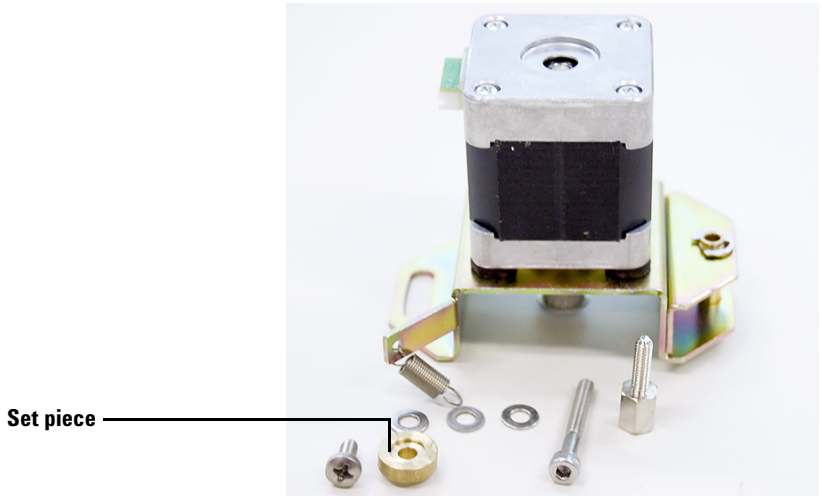


Figure 111 Parts included with the stepper motor

Remove the stepper motor

1 Remove the bottom cover if needed. See "Accessing the components from the bottom panel"on page 94.

2 Place a piece of paper over the power supply to block small screws and washers that might fall.

3 Unplug the stepper motor cable from the carousel sensor.

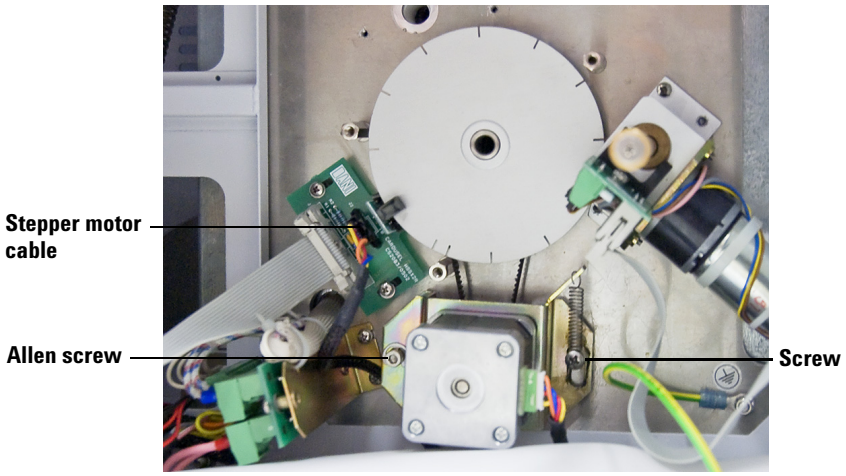


Figure 112 Removing the stepper motor

4 Undo the screws that connect the motor to the HS chassis. See Figure 112.

5 Lift the stepper motor out of the HS.

Replace the stepper motor

1 Place a piece of paper over the power supply to block small screws and washers that might fall.

2 Make sure the belt is set on the carousel disk. Pull the belt a few inches in each direction. See Figure 113.

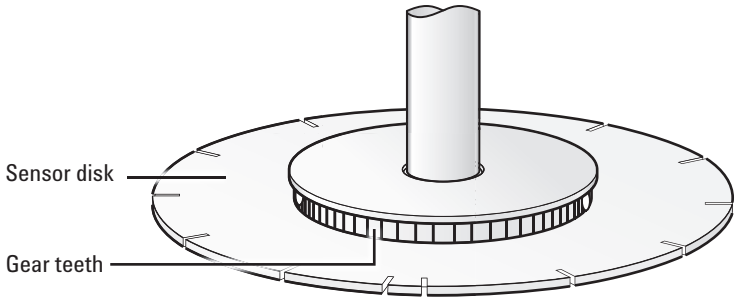


Figure 113 Toothed gear on carousel sensor disk (underside)

3 Assemble the nut post, washer, spring, and Phillips screw as shown in Figure 114. Loosely screw the spring to the nut fitting. The screw should be loose enough to allow the spring to freely rotate. Place the assembled screw in the stepper motor assembly as shown in Figure 115.

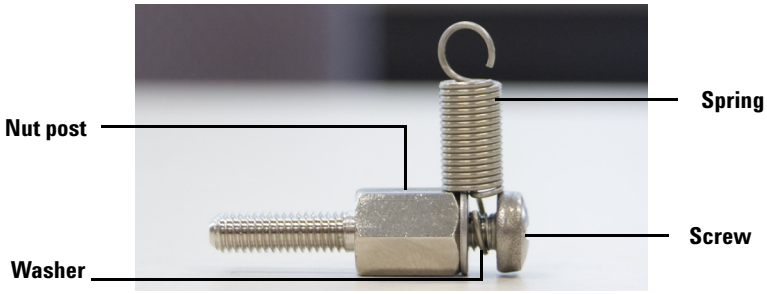


Figure 114 Assembled spring

4 Place the washers and brass bushing on with the allen screw. Place the allen screw in the stepper motor assembly as shown in Figure 115.

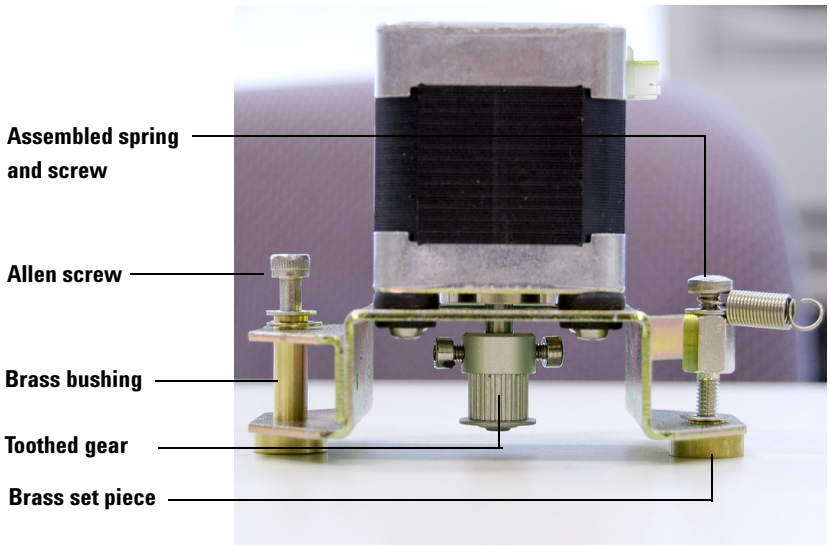


Figure 115 Connector screws placed in the motor assembly

5 Hook the belt to the toothed gear on the motor assembly. Use an allen wrench to help set the belt on the gear.

6 Line up the screw holes and place the assembly on the HS chassis. Finger-tighten both the nut post and the allen screw to the HS chassis.

7 Test the belt to make sure it is securely set on both gears. Move the belt along its path and watch for both the motor cylinder and carousel wheel to rotate with the belt.

8 Hook the spring onto the stepper motor arm. See Figure 116.

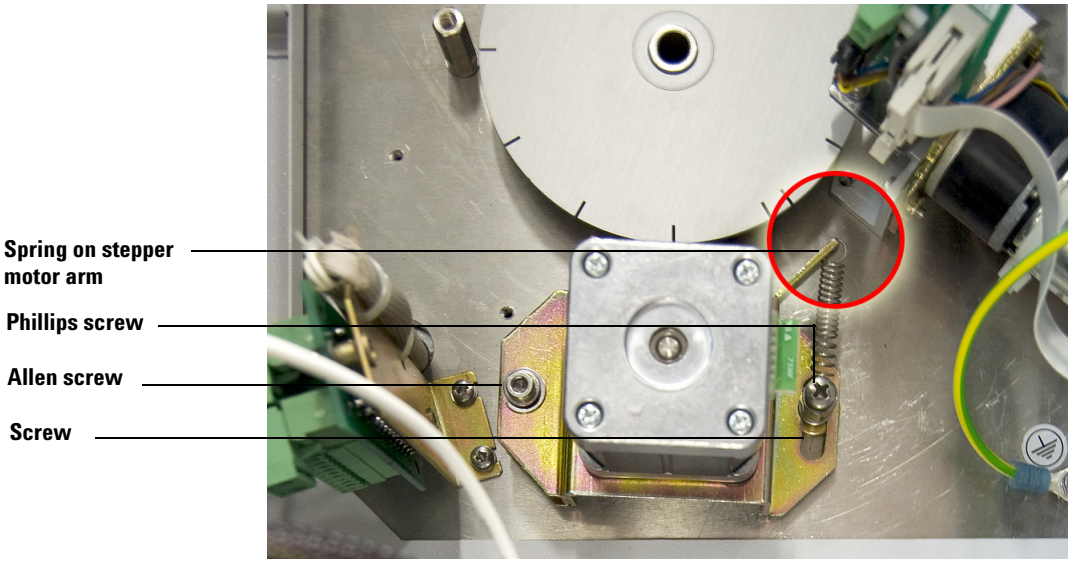


Figure 116 Spring attached to the stepper motor arm

9 Tighten the Phillips screw securing the spring.

10 Move the belt again. Tension should be applied to the belt by the spring.

11 Attach the cable between the carousel sensor and the stepper motor. See Figure 112 on page 101.

12 Replace the bottom cover.

13 Align the carousel. See "Align the carousel"on page 115.

Lifter assemblies

There are two lifter assemblies in the Headspace Sampler:

- The sample probe lifter assembly
- The tray lifter assembly

See Figure 117 for the location of each assembly.

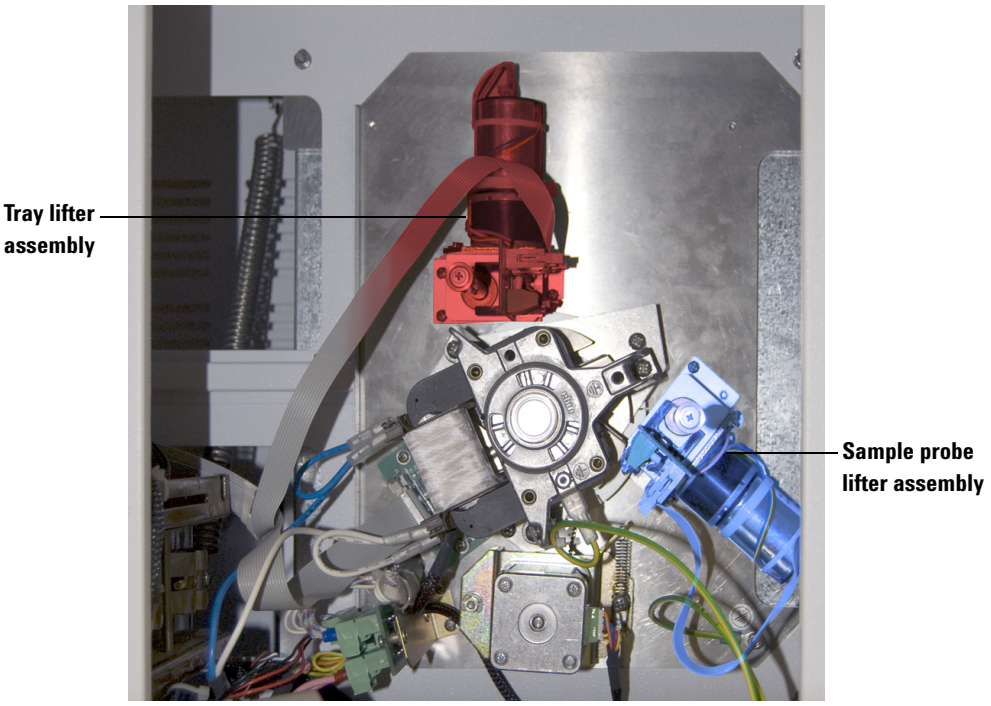


Figure 117 The two lifter assemblies shown from the bottom of the Headspace Sampler.

The lifters are attached to the base of the oven compartment with 3 sets of screws and washers. The brass gear on the motor raises and lowers a toothed rod.

The tray lifter is under carousel position 1. It lowers vials from the vial chain to the carousel and vice-versa.

The sampling lifter is under carousel position 9. It raises vials from the carousel up to the sampling needle and lowers them back to the carousel.

An optical sensor reads a hole in the rod at the bottom of each lifter's travel.

The motor's encoder counts motor turns to the correct height.

The lifters are almost identical. The rod on the tray lifter is longer and has a tapered tip to fit through shutter in the "mid" position.

The removal and installation procedures for each assembly are identical aside from the location of the assemblies. This manual gives instructions for the removal and installation of the sample probe lifter assembly. Use these same instructions for the tray lifter assembly.

CAUTION Failure may occur if lifter rod hole is dirty. Make sure it is clean.

CAUTION Never put oil or grease on rods. The rods have self-lubricating bushings.

Required tool

No. 1 Phillips screwdriver

Replacement parts

0410105003 Lifter assembly, tray

0410105002 Lifter assembly, sample probe

Remove the lifter assembly

1. Remove the bottom cover. See “Accessing the components from the bottom panel”on page 94.
2. Place a piece of paper over the power supply to block small screws and washers that might fall.
3. Detach the ribbon cable shown in Figure 118.
4. Remove the 3 Phillips screws shown in Figure 118 that hold the lifter motor to the HS chassis.
5. Pull the lifter motor assembly out of the chassis.

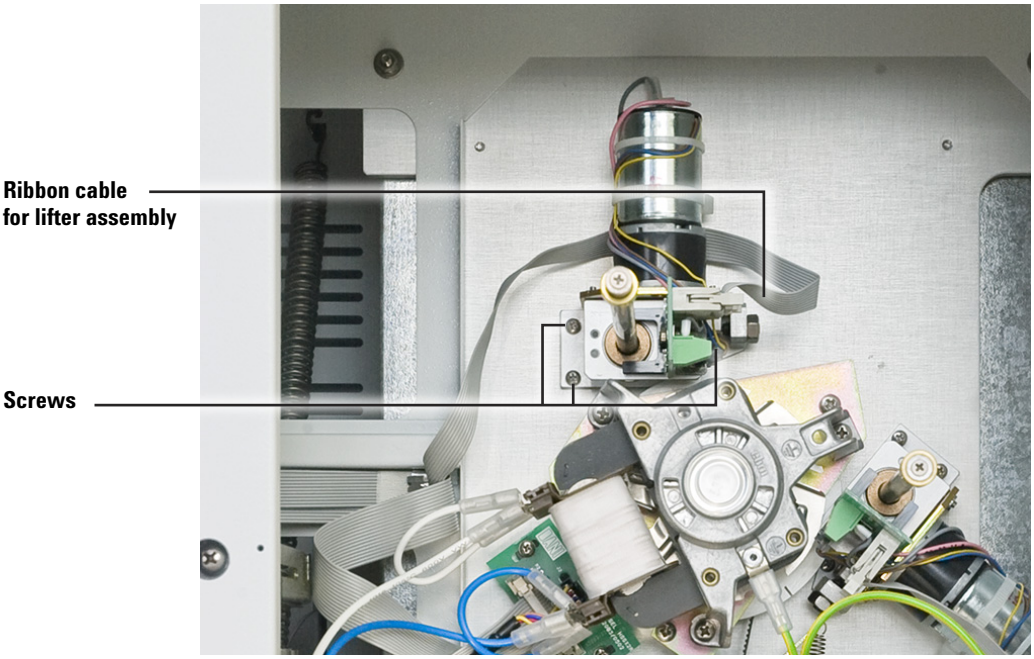


Figure 118 The tray lifter assembly in the Headspace Sampler

Replace the lifter assembly

1 Place a piece of paper over the power supply to block small screws and washers that might fall.

2 The hole in the lifter rod must be above the optical sensor. See Figure 119 for orientation.

3 Slide the brass ring on the end of the lifter arm all of the way towards the bottom of the arm. See Figure 119 for orientation.

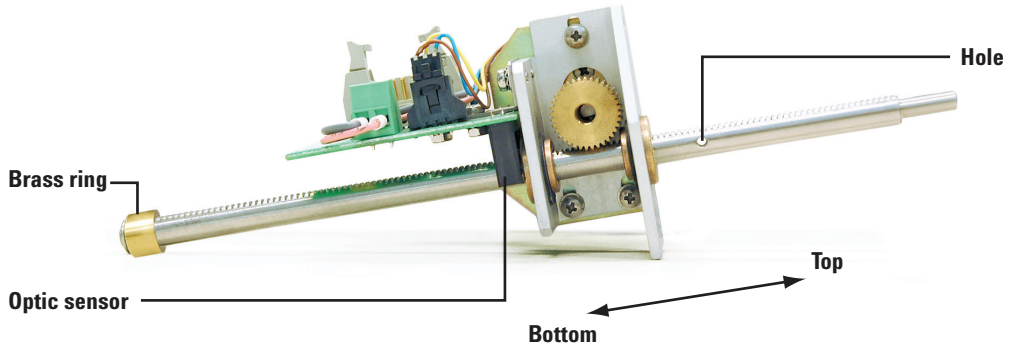


Figure 119 Orientation of the tray lifter assembly

4 Insert the lifter rod into the chassis.

5 Line the screw holes up with the chassis holes. Secure the assembly to the chassis with 3 Phillips screws. See Figure 118.

6 Attach the ribbon cable. Be careful to attach the proper ribbon to the lifter motor.

7 Replace the bottom cover and set the HS upright.

8 Connect all cables and gas lines.

9 Power on the HS. The self-test for the lifter assembly should pass.

10 Use manual operation, advanced function 5 to move the lifter up and down.

Carousel sensor disk

Required tools

Allen wrench

Mirror

Replacement parts

3700500902 Carousel shaft

0410105008 Carousel sensor disk

Remove the carousel sensor disk

1. Remove the bottom cover. See “Accessing the components from the bottom panel”on page 94.
2. Place a piece of paper over the power supply to block small screws and washers that might fall.
3. Remove the fan motor. See “Remove the oven fan motor”on page 98.
4. Remove the carousel sensor. See “Remove the carousel sensor”on page 96.
5. Remove the stepper motor. See “Remove the stepper motor”on page 100.
6. The sensor disk is secured by two allen screws set in the large toothed gear on the back of the disk. The gear is completely obscured by the sensor disk, so use a mirror to see the screws. Loosen the screws and remove the disk.

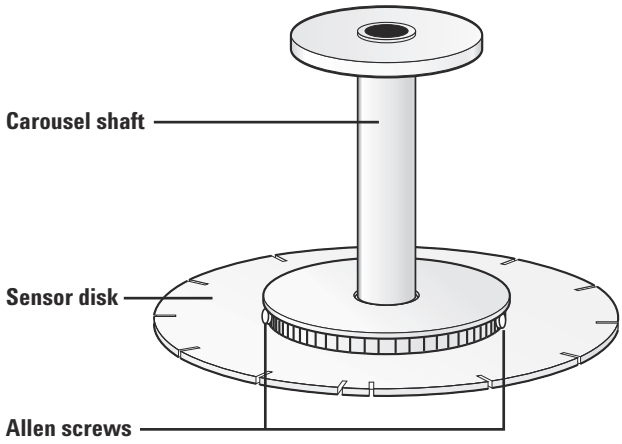


Figure 120 Screws securing the carousel sensor disk

Replace the carousel sensor disk

1. Place a piece of paper over the power supply to block small screws and washers that might fall.
2. If the carousel drive belt is worn, ask the customer to consider replacing it.
3. Place the carousel drive belt over the carousel sensor disk and slide the sensor disk over the carousel shaft.
4. Tighten the 2 allen screws holding the disk to the shaft. See Figure 120 on page 108.
5. Install the stepper motor. See "Replace the stepper motor"on page 101.
6. Install the carousel sensor. See "Replace the carousel sensor"on page 97.
7. Install the fan motor. See "Replace the oven fan motor"on page 99.
8. Install the bottom cover.
9. Align the carousel. See "Align the carousel"on page 115.

Oven fan and carousel

Required tools

Pencil

No. 1 Phillips screwdriver

2.5-mm hex wrench

Replacement parts

0410105029 Oven heater sensor assembly

3070000010 Oven thermoswitch

3641500008 Oven heater relay

6310090035 12-position carousel

6310103026 Oven fan screen

WARNING **Power OFF the HS unless you are verifying the repair. Use caution around the oven fan blades and hot surfaces. Also be careful with screws and washers. If you drop any screws or washers, find them before verifying your repair.**

Access the components

1 Power OFF the HS.

When the HS is on, if the shaft is bumped the carousel stepper motor is activated. Before starting this process, make sure the HS is off.

2 Raise the lid of the HS until the support bracket snaps into place.

3 Lower both lifters so they are clear of the carousel.

Remove the oven fan and carousel

1 Turn the carousel so that position 1 lines up perfectly with the lifter tray. Draw a pencil line on the oven wall next to the mark on the carousel that indicates position 1.

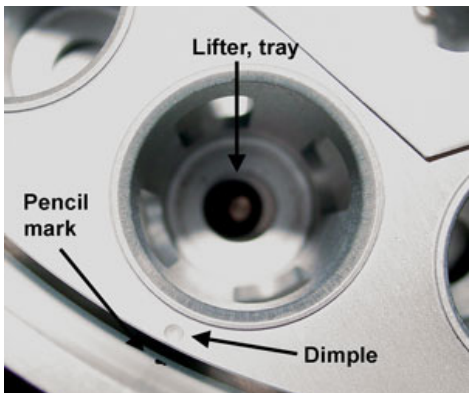


Figure 121 Pencil mark position 1

2 Remove the 3 screws and washers that attach the oven fan screen then remove it.

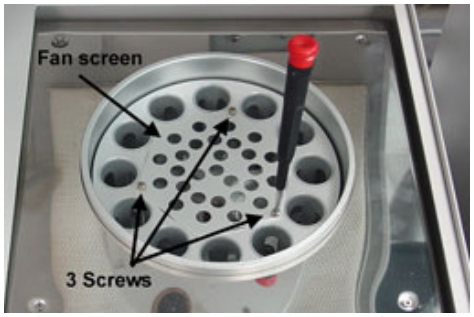


Figure 122 Oven fan screen

3 Using an allen wrench loosen the setscrew that holds the fan blades to the motor shaft and remove the blades.

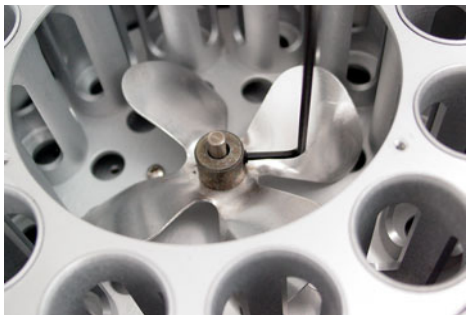


Figure 123 Fan blade setscrew

4 Remove the 3 setscrews and locking washers that attach the carousel to the collar with Phillips screwdriver.

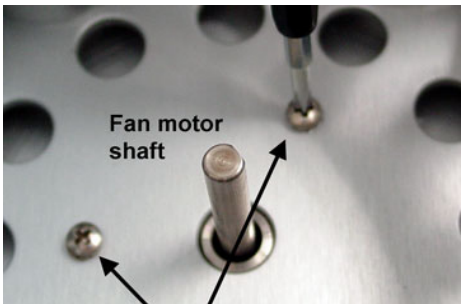


Figure 124 Carousel screws

5 Carefully lift the carousel out of the HS chassis.

Replace the oven fan and carousel

1 Place the carousel onto the collar.

2 Align 3 holes to the collar.

3 Start the screws into the 3 holes on the collar. Do not tighten. The carousel should turn freely without rotating the carousel shaft.

4 Proceed to step 3 of "Align the carousel"on page 115.

Oven band heater/oven thermoswitch

Required tools

Allen wrench 3-mm

Phillips screwdriver

Replacement parts

0410105029 Oven heater sensor assembly

3070000010 Oven thermoswitch

Remove the oven band heater

1. Remove the fan and carousel. See “Remove the oven fan and carousel”on page 111.
2. Close the lid of the HS.
3. Remove the carousel sensor disk. See “Remove the carousel sensor disk”on page 108.
4. The heater and sensor wires for the oven band heater are on the left side. Trace the wires to their two connectors and unplug them.
5. Return the HS to the upright position and raise the lid.
6. Remove the carousel along with its shaft, rulon washer, and locking collar.
7. Remove the three screws attaching the carousel compartment base to the oven enclosure base.

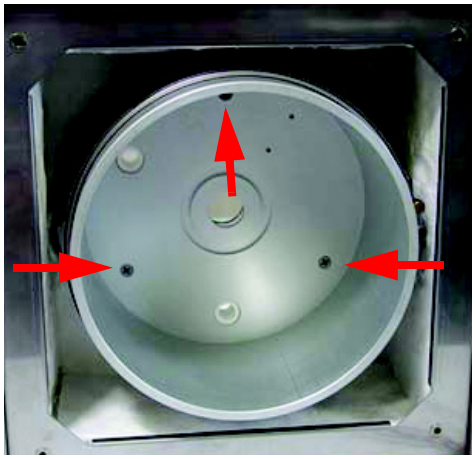


Figure 125 Three screws attaching carousel compartment and oven enclosure base

8 Remove the three front screws that hold the top trim around the oven cover.

9 Remove the four screws holding the oven enclosure top.

10 The top trim piece should lift a sufficient amount to allow removal of the oven enclosure top from beneath.

11 Remove the insulation from under the oven enclosure top.

12 Remove the carousel oven base, sides, and oven band heater.

13 If replacing the band heater, remove the heater sensor assembly from the carousel compartment base by loosening the three retaining clips with a 3-mm allen wrench.

14 If replacing the oven max temperature thermoswitch, remove it from the underside of the carousel compartment base.

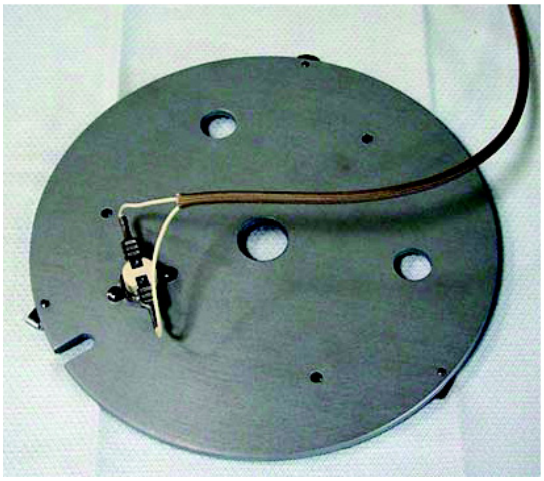


Figure 126 Oven thermoswitch and carousel compartment base

Align the carousel

You must align the carousel after removing or loosening the screws holding the carousel to the collar and shaft, after replacing the carousel sensor, loosening the setscrews on the carousel positioning disk, or removing the disk.

1 Perform steps 1-6 on page 110.

2 Loosen the 3 screws that hold the carousel to the collar. The carousel should turn freely without rotating the carousel shaft.

3 Power ON the HS. Wait until the carousel homes.

4 Turn the carousel so that position 1 lines up perfectly with the lifter tray. Double-check the position of the pencil mark.

5 Carefully tighten the 3 screws that secure the carousel to the collar without moving the carousel. Use a technique similar to tightening lug nuts on the wheel of your car. Screw in one screw a turn or 2. Then go to the next and turn it in a few turns. Then go to the next.

Figure 127 Tighten the carousel screws

6 Use Manual Operation, **Advanced Function 5**, Carousel keys **0** and **1** to move the carousel clockwise and counterclockwise. Double-check that the hole in the carousel lines up with the lifters. If the holes do not line up, go back to step 2 under aligning the carousel.

7 Power OFF the HS.

8 Replace the fan blades. Make sure the setscrew is tight.

9 Replace the fan screen.

Verify the alignment

1 Set up the vials.

2 Run the strife test. See “Strife test”on page 239.

3 Allow all vials to load and unload.

Vial Not Dropped and Lifter errors

If the carousel is not properly aligned, the hole in the lid will not line up with the cylindrical vial holder (or rulon bushing) in the carousel. The result is a “Vial Not Dropped” error. Also if the alignment is off by more that a few millimeters, the holes in the carousel for the lifters will not line up. The result is “Lifter” errors.

The carousel is secured to the shaft and drive mechanism by a collar and 3 screws. By loosening these screws, you can turn the carousel so that position 1 lines up over the tray lifter and position 9 lines up over the sampling probe lifter.

5 Pneumatics

Overview

The G1888 Headspace Sampler (HS) heats and, if desired, agitates a partially-filled sample vial to achieve an equilibrium between volatiles in the sample and volatiles in the empty space above it. It then samples this headspace and transfers the volatiles to a gas chromatograph for analysis.

The following is the normal sequence for a single run.

1. The HS is in standby condition between samples. Setpoints are those left by the previous method. Carrier gas flows through the sample loop, transfer line, and GC column.
2. Load the desired method. The setpoints change accordingly and the Waiting for Ready period begins.
3. This is a good time to prepare the samples if this has not already been done. Load them into the sample tray (chain).
4. When the oven temperature has equilibrated, the HS becomes Ready.
5. Start the method. The link chain moves the first vial into position, the shutter opens, and the vial lifter lowers the vial into the oven carousel. The shutter closes.
6. If the method calls for agitation (shaking), the carousel shakes for the specified time.
7. The sample vial remains in the carousel for a specified time to allow the volatiles in the sample to equilibrate with the empty space above it.
8. When the GC is ready, sampling begins.
   a. The carousel moves the sample vial under the injection probe.
   b. The probe lifter raises the vial to the stationary probe, which pierces the vial septum.
   c. Pressurization gas flows into the vial.
   d. The sampling valve rotates to the Load position. The pressurization gas in the vial forces the volatiles into the sampling loop.
   e. The sampling valve rotates to the Inject position. Carrier gas flushes the volatiles in the loop through the transfer line to the GC. The GC run begins.
9. The probe lifter moves the sample vial back to the carousel.
10. The carousel moves the vial to the shutter position, the shutter opens, the vial lifter returns the vial to the link chain, and the shutter closes. Depending on the timing there may be multiple vials in the oven heating at the same time.
11. The system waits for the next sample.

Carrier and pressurization gas supplies

These gases can be controlled in two ways:

- By an EPC module in the GC
- By a flow or pressure controller in the HS

The plumbing in the HS is identical for the two gases, except that a flow controller is used for the carrier gas and a pressure regulator is used for the pressurization gas.

There are two gas control systems in the HS, one for the carrier gas and one for the pressurization gas.

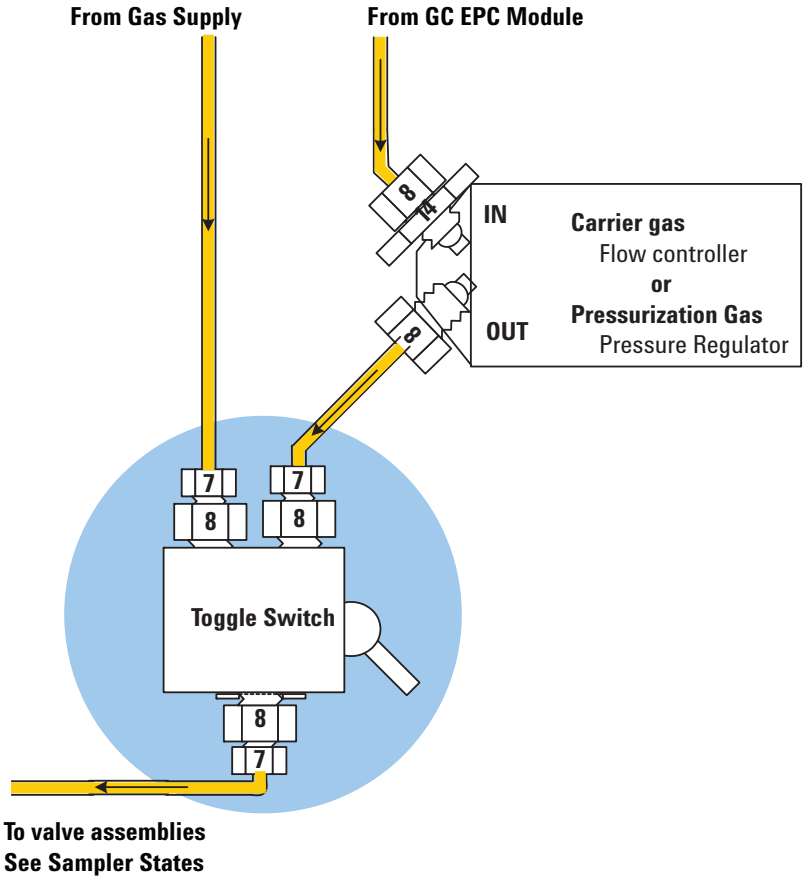


Figure 128 Carrier and pressurization gas control in the HS

Headspace Sampler states

Standby

This is the resting position between samples. The flow paths are flushed to get ready for samples and carrier gas flows to the GC to protect the column and detector.

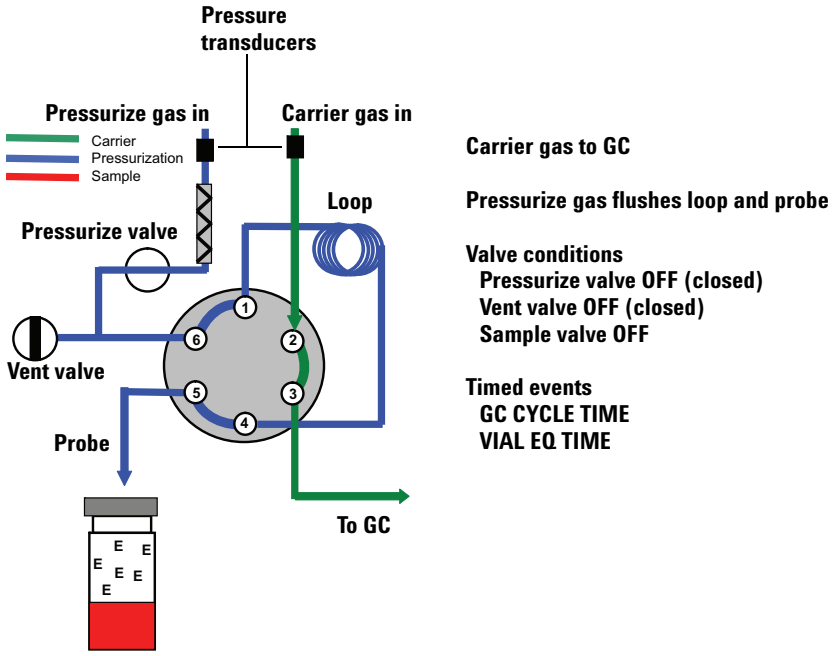
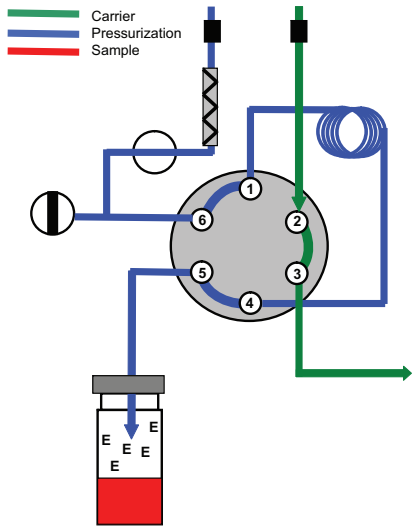


Figure 129 State 1–Standby

Vial pressurization

To prepare for vial pressurization the pressurization valve is turned off. When it begins the pressurization valve opens. A sample vial is raised to the sampling probe. This pierces the vial septum and compresses a spring that will later free the vial from the probe. Pressurizing gas flows through the 6-port valve and sample loop, and into the vial.



Carrier gas to GC

Vial raised onto probe

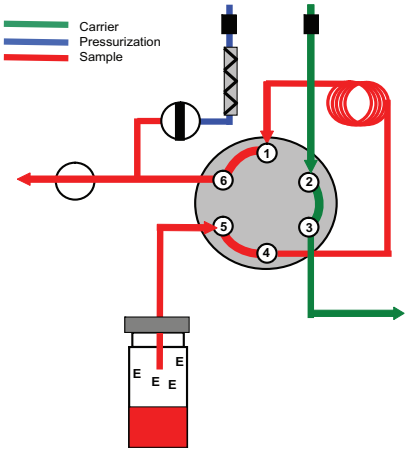
Valve conditions
Pressurize valve closed, then open after vial is raised
Vent valve OFF (closed)
Sample valve OFF

Timed events
PRESSURIZE TM

Figure 130 State 2–Pressurize the vial

Filling the sample loop

The pressurized gas in the vial forces sample into and through the sample loop.



Carrier gas to GC

Probe in vial

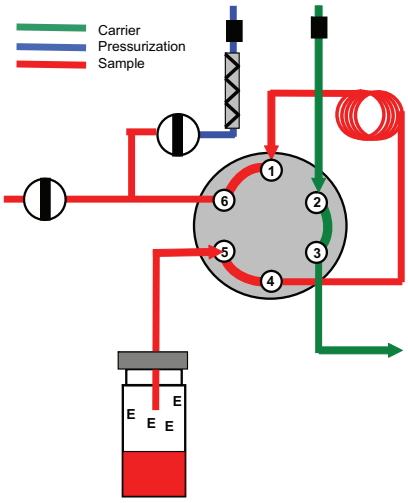
Valve conditions
Pressurize valve ON (closed)
Vent valve ON (open)
Sample valve OFF

Timed events
LOOP FILL TIME

Figure 131 State 3–Fill the sample loop

Loop equilibration

This is a pressure and temperature equilibration period.



Carrier gas to GC

Probe in vial

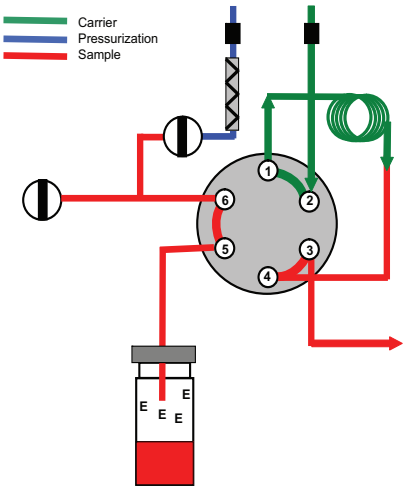
Valve conditions
Pressurize valve ON (closed)
Vent valve OFF (closed)
Sample valve OFF

Timed events
LOOP EQ TIME

Figure 132 State 4–Loop equilibration

Sample injection

The sampling valve operates, inserting the sample loop into the carrier gas flow path. The carrier pushes the loop contents through the transfer line to the GC inlet. After **INJECT TIME** expires, the HS returns to the standby state to get ready for the next sample.



Carrier gas flushes loop to GC

Probe in vial

Valve conditions
Pressurize valve ON (closed)
Vent valve OFF (closed)
Sample valve ON

Timed events
INJECT TIME

Figure 133 State 5–Inject the sample

Replacement Parts

Headspace Samplers with serial numbers less than IT00604011 have grey external skins. Current HS models are white in color.

Figure 134 0410105016 Pneumatics compartment cover, old color
0410105116 Pneumatics comopartment cover, new color

Figure 135 1300502506 Tube, probe to 6-port valve deactivated

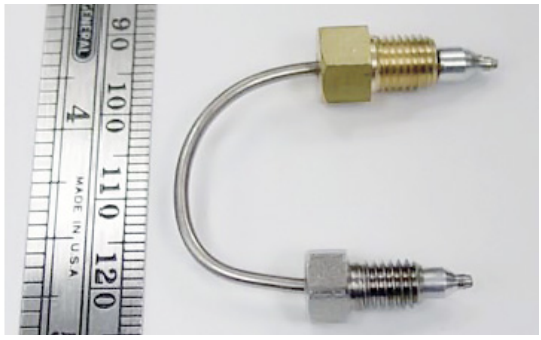


Figure 136 1300530005 Tube, switch to brass tee

Figure 137 1300530006 Tube, switch to flow controller

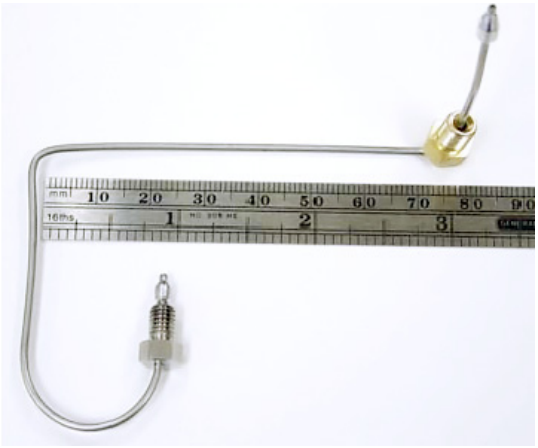


Figure 138 1300530007 Tube, switch to pressure regulator

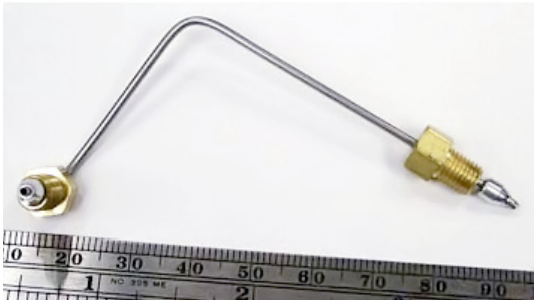


Figure 139 1300530008 Tube, flow controller to bulkhead

Figure 140 1300530009 Tube, pressure regulator to bulkhead

Figure 141 1300530010 Tube, tee to pressure PCA

Figure 142 1300530011 Tube, tee to 6-port valve carrier

Figure 143 2321390008 Flow restrictor

Figure 144 1300530001 Tube, vent deactivated

Figure 145 1300530002 Tube, vial pressure valve to union

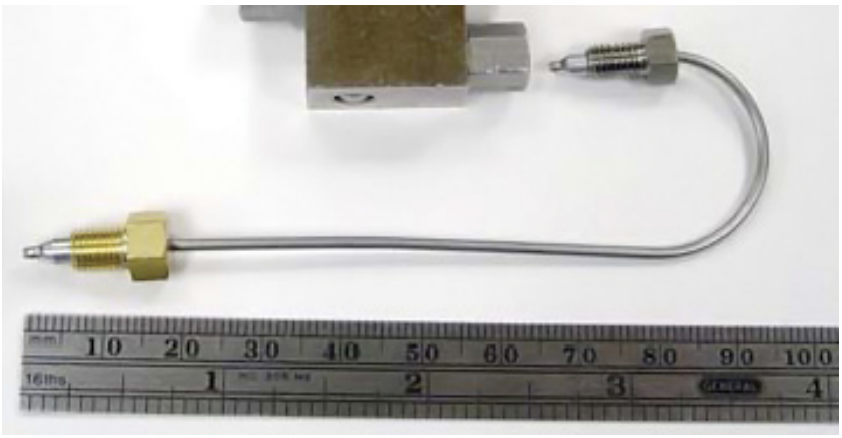


Figure 146 1300530004 Tube, switch to bulkhead

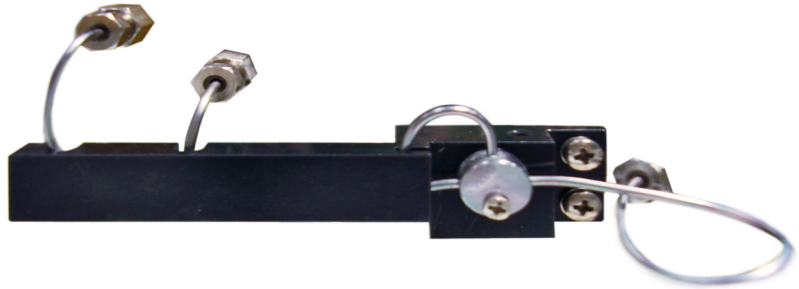


Figure 147 0410105017 Tubing, solenoids to 6-port, deactivated

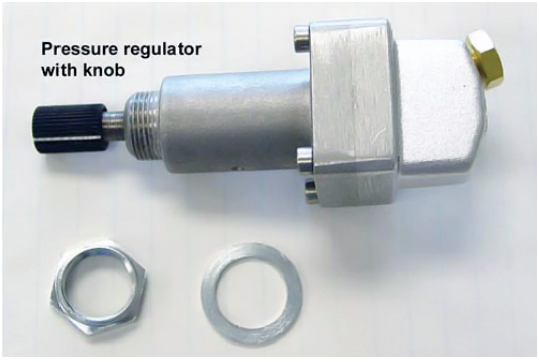


Figure 148 0410105007 Pressure regulator with knob

Figure 149 0410105010 Flow controller with knob

Figure 150 0410105018 Switch, pneumatic mode

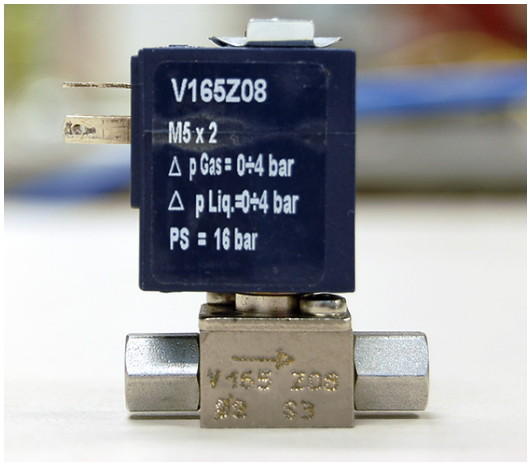


Figure 151 3600500001 Valve, solenoid vent kalrez

Figure 152 3600500002 Valve, solenoid vial pressurization

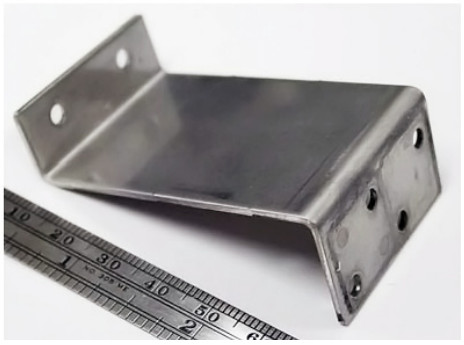


Figure 153 6550119125 Bracket, solenoid valves

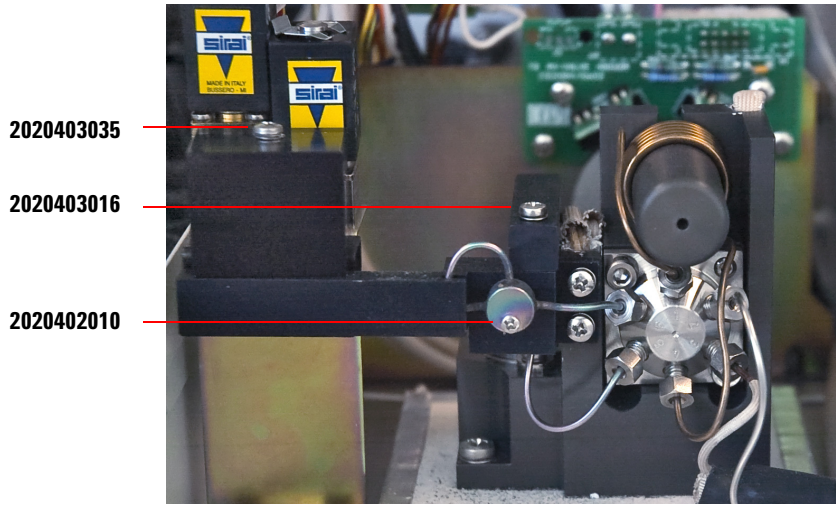


Figure 154 2020403035, 2020402010, 2020403016 Pneumatic screws

Figure 155 9040700026 Valve, 6-port sampling

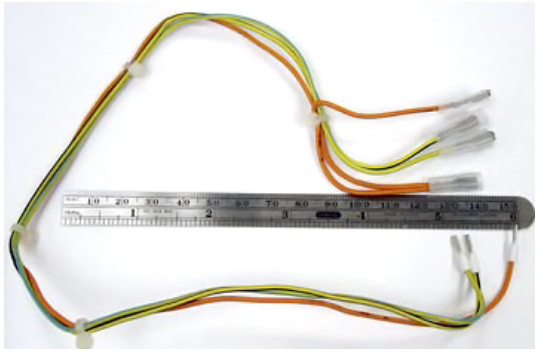


Figure 156 5104319115 Cable assembly, solenoid valves

Figure 157 6410090050 Strain relief septum nut

Figure 158 0410103101 Transferline deactivated 0.8 SILTEK

Figure 159 0410105014 Holder, transfer line

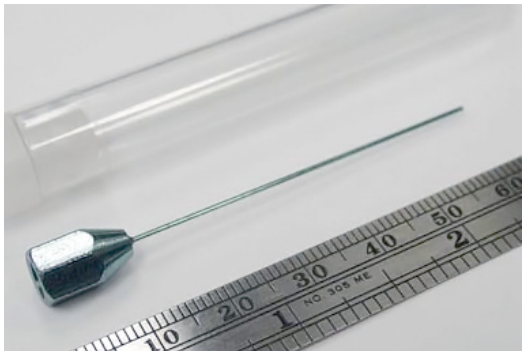


Figure 160 2322590004 Needle, transfer line deactivated OD 0.5

Figure 161 6410202015 Needle guide

Figure 162 6550209030 Sample probe holder

Figure 163 2322700011 Sample probe deactivated

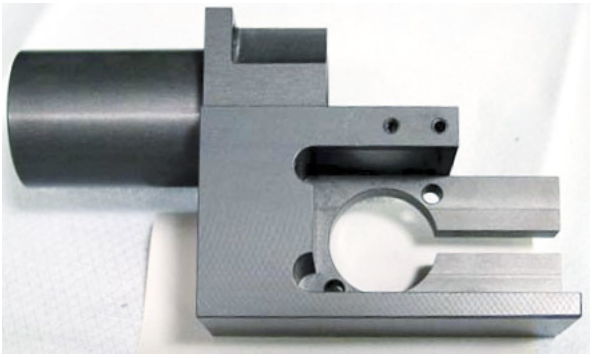


Figure 164 9110509015 Heater block, loop

Figure 165 0410105009 Mandrel, loop holder with screw

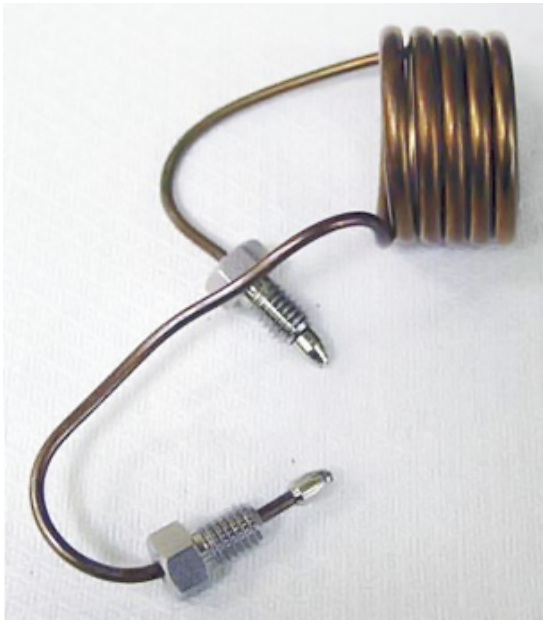


Figure 166 2321700003 Sample loop, 1 mL deactivated

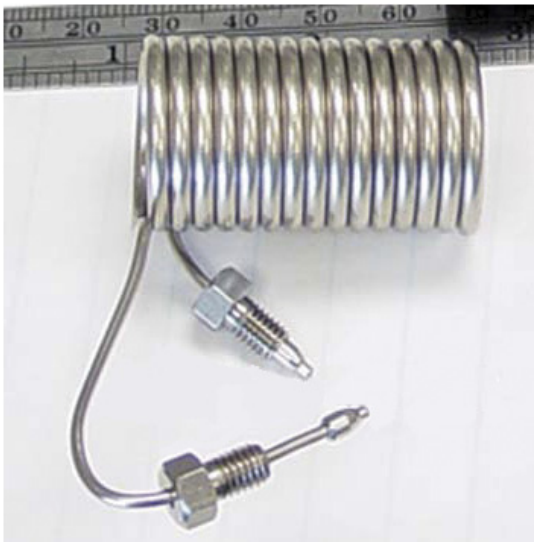


Figure 167 2321700004 Sample loop, 3 mL deactivated

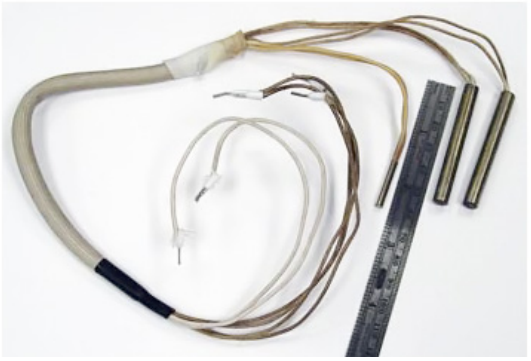


Figure 168 0410105036 Heater sensor assembly, loop

Figure 169 0410205004 Heater block, tube from probe

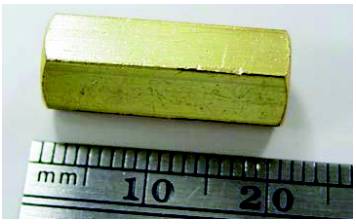


Figure 170 2302533140 M6 union, brass

Figure 171 2304533140 Tee, brass

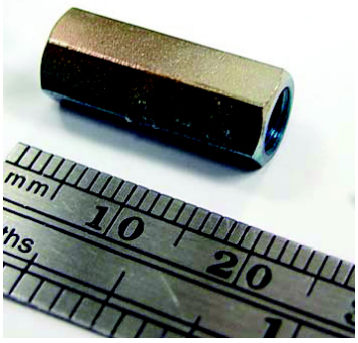


Figure 172 2307230001 Union, zero dead volume, deactivated

Figure 173 2307833900 Bulkhead fitting

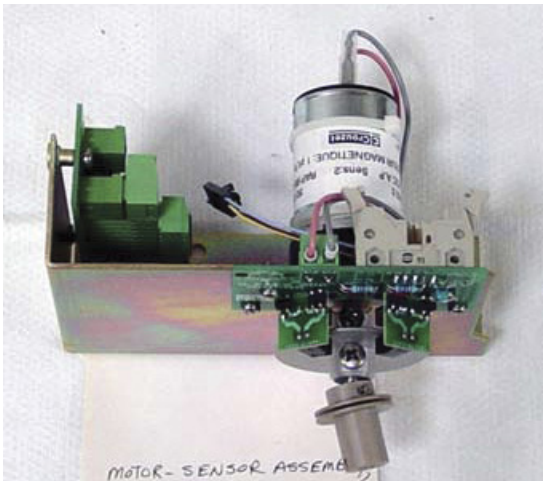


Figure 174 0410105004 Motor-sensor assembly, 6-port valve

Figure 175 0410105015 Cover, loop heated zone

Illustrated Parts Breakdown

Pneumatic compartment IPB

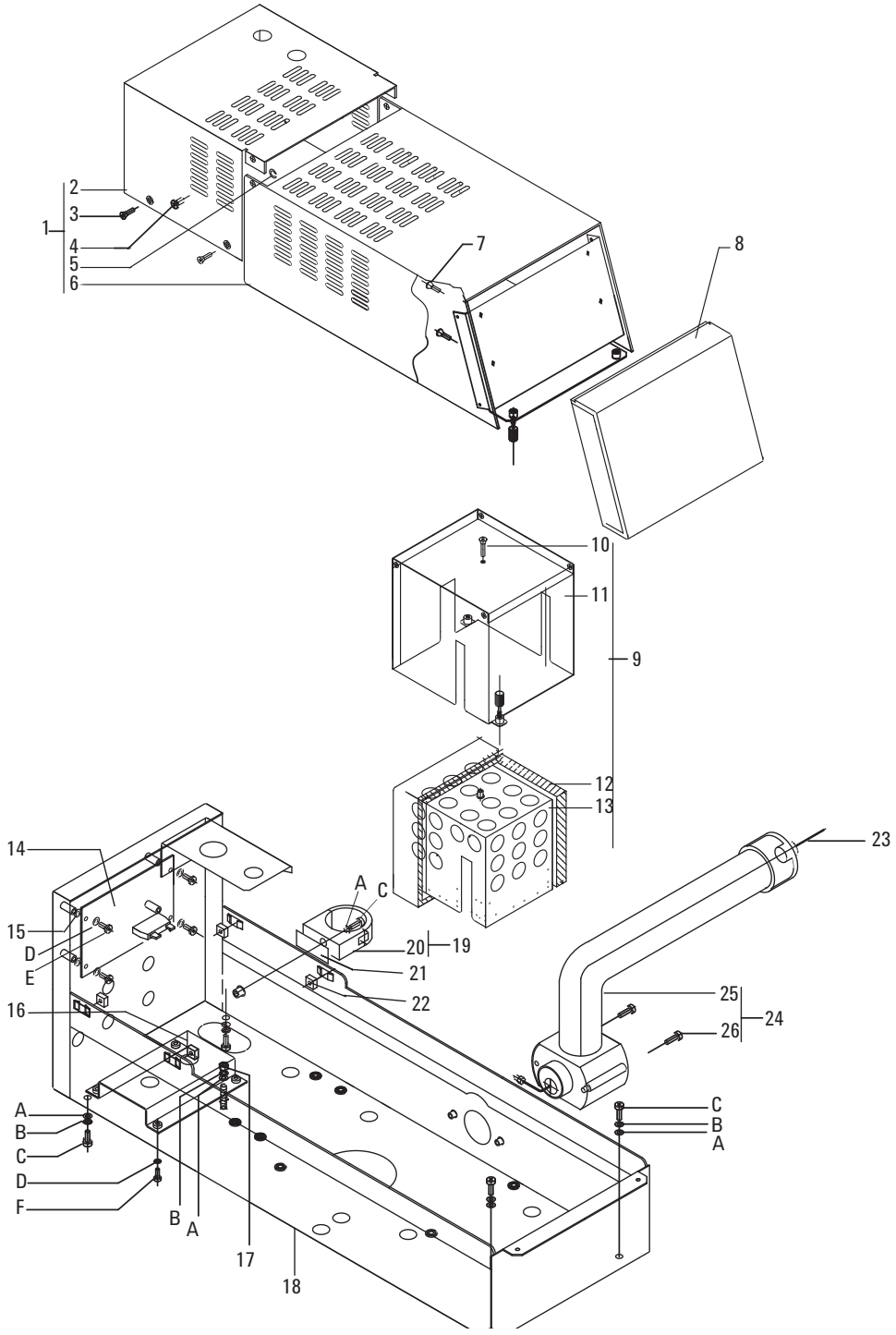


Figure 176 Pneumatics covering IPB

Table 7 Pneumatics compartment IPB

	Description	Part Number	Qty
1	**Pneumatics cover assembly** consists of parts 2 through 8	**0410105016 Old color** **0410105116 New color**	**1**
2	Back cover, pneumatics compartment	6310103106 Old color	1
3	Screw M4x10	2060404010	4
4	Hinge pin	2060404010	2
5	Spring clip	2181212002	2
6	Hinged cover, pneumatics compartment	6310103016 Old color	1
7	Screw M2.9x9.5	2114042909	4
8	Front cover, pneumatics compartment	6310103092 Old color	1
9	**Loop heated zone cover assembly** consists of parts 10 through 13	**0410105015 Old color** **0410105115 New color**	**1**
10	Screw M3x20	2060403020	1
11	Cover, loop heated zone	6310103085	1
12	Insulation	1171210001	1
13	Insulation support	6310119235	1
14	Pressure sensor PCA	3411500115	1
15	Flat fiber washer	2180043001	6
16	Toggle switch bracket	6410119065	1
17	Square washer M4	2150104040	2
18	Pneumatic compartment	6310110001	1
19	**Holder, transfer line assembly** consists of parts A, C, and 20	**0410105014**	**1**
20	Holder, transfer line	5264550001	1
21	Biadhesive tape (4cm)	5265500002	1
22	Square washer	2161011001	4
23	Needle, transfer line deactivated OD 0.5 Needle, transfer line deactivated OD 0.7	2322590004 2322590005	1 1
24	**Transfer line assembly** consists of parts 25 through 26	**0410103101**	**1**
25	Transfer line deactivated 0.8 SILTEK Transfer line SILTEK 1mt B-MODEL HSS	0410103101	1
26	Screw M3x12	2030403012	2

Table 8 Pneumatic covering associated screws and washers

	Description	Part Number	Qty
A	Flat washer	2170204040	15
B	Toothed washer	2171304040	18
C	Screw M4x10	2020404010	12
D	Toothed washer	2171304030	24
E	Screw M3x6	2020403006	10
F	Screw M3x8	2020403008	14

Pneumatic compartment IPB

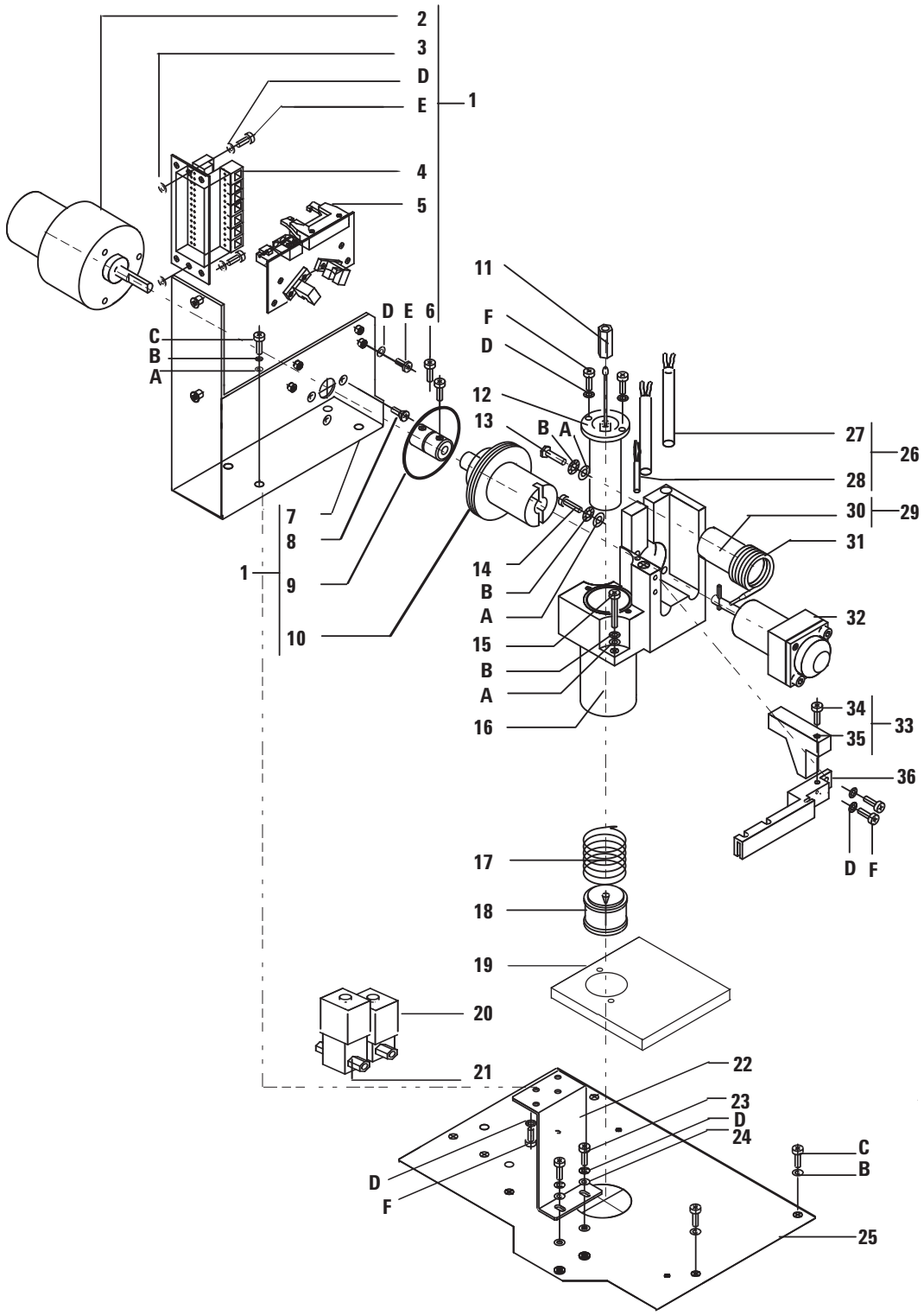


Figure 177 Pneumatics compartment IPB

Table 9 Pneumatic compartment IPB

	Description	Part Number	Qty
1	**Motor, sensor assembly** consists of parts 2 through 10	**0410105004**	**1**
2	Valve motor - 24 VDC	3701509002	1
3	Flat fiber washer	2180043001	6
4	Terminal block, 6-port valve	3411500116	1
5	Sensor, 6-port valve	3411500102	1
6	Screw M4x6	2020404006	2
7	Bracket, motor support	6550119055	1
8	Screw M3x8	2060403008	3
9	Motor-sensor disk	6410204035	1
10	Coupling	2311500003	1
11	Union, zero dead volume deactivated	2307230001	1
12	Sample probe holder	6550209030	1
13	7-mm bolt	2040404016	1
14	Screw M4x12	2030404012	1
15	Screw M4x25	2020404025	2
16	Heater block, loop and sampling probe	9110509015	1
17	Spring, vial push	2351500035	1
18	Needle guide	6410202015	1
19	Insulation block	6410106045	1
20	Valve, solenoid vial pressurization	3600500002	1
21	Valve, solenoid vent kalrez	3600500001	1
22	Bracket, solenoid valves	6550119125	1
23	Screw M3x10	2020403010	2
24	Flat washer	2170204030	2
25	Pneumatics base	6410216081	1
26	**Heater, sensor assembly** consists of parts 27 through 28	**0410105036**	**1**
27	Heater	9100005005	2
28	Sensor	3831019003	1

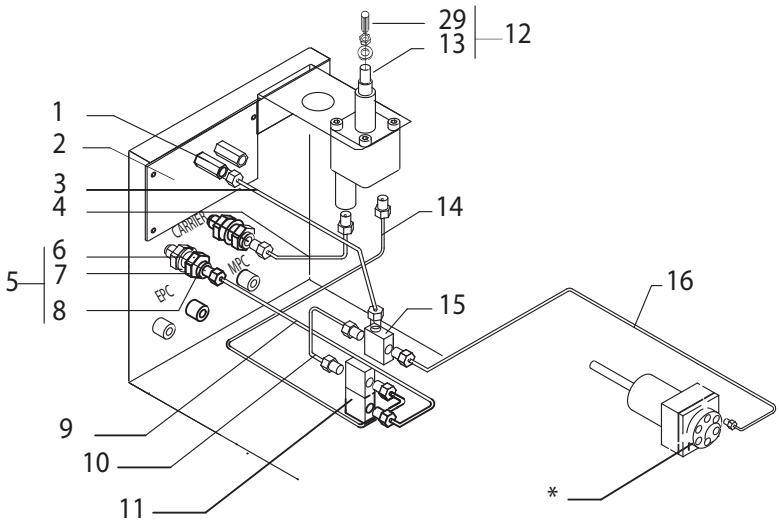
Table 9 Pneumatic compartment IPB (continued)

29	**Mandrel assembly** consists of parts 13, 30, A, and B	**0410105009**	**1**
30	Mandrel, loop holder	9110600021	1
31	Loop, sample 3 ml deactivated Loop, sample 1 ml deactivated	2321700004 2321700003	1 1
32	Valve, 6-port sampling	9040700026	1
33	**Probe heater block assembly** consists of parts 34 through 35	**0410205004**	**1**
34	Screw M3x16	2020403016	1
35	Heater block, tube from probe	9103010006	1
36	Tubing, solenoids to 6-port deactivated	0410105017	1

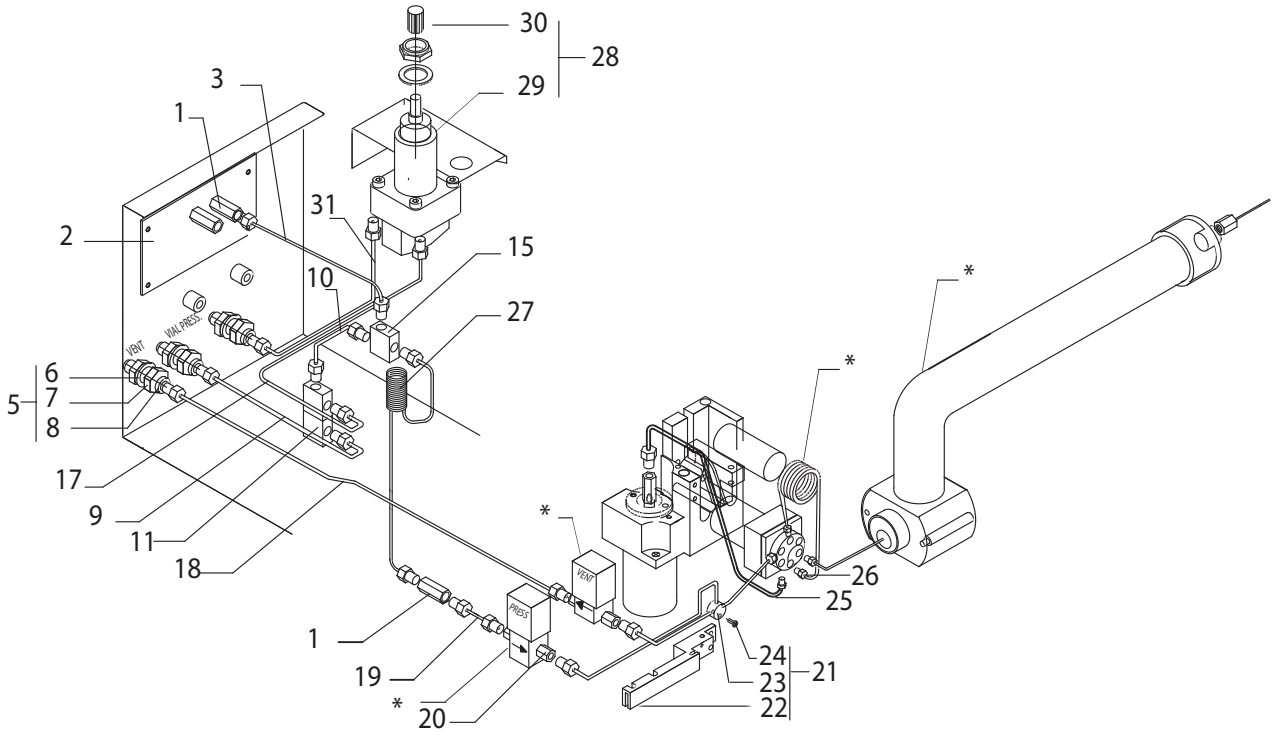
Table 10 Pneumatic compartment associated screws and washers

	Description	Part Number	Qty
A	Flat washer	2170204040	15
B	Toothed washer	2171304040	18
C	Screw M4x10	2020404010	12
D	Toothed washer	2171304030	24
E	Screw M3x6	2020403006	10
F	Screw M3x8	2020403008	14

Pneumatic tubing IPB



Carrier gas pneumatic system for the Headspace Sampler



Vial pressurization gas pneumatic system for the Headspace Sampler

Figure 178 Pneumatic tubing IPB

Table 11 Pneumatic tubing IPB

	Description	Part Number	Qty
1	M6 union brass	2302533140	3
2	Pressure sensor board	3411500115	1
3	Tube, tee to pressure PCA	1300530010	2
4	Tube, flow controller to bulkhead	1300530008	1
5	**Bulkhead fitting assembly** consists of parts 6 through 8	**2307833900**	**5**
6	Washer	2180014004	5
7	Nut	2160014003	5
8	Connector	2305533141	5
9	Tube, switch to bulkhead	1300530004	2
10	Tube, switch to brass tee	1300530005	2
11	Switch, pneumatic mode	0410105018	2
12	**Flow controller assembly** consists of parts 13 and 29	**0410105010**	**1**
13	Flow controller	9050790001	1
14	Tube, switch to flow controller	1300530006	1
15	Brass tee	2304533140	2
16	Tube, tee to 6-port valve carrier	1300530011	1
17	Tube, switch to pressure regulator	1300530007	1
18	Tube, vent deactivated	1300530001	1
19	Tube, vial pressure valve to union	1300530002	1
20	Union	2303002051	4
21	**Tubing assembly, solenoids to 6-port deactivated** consists of parts 22 through 24	**0410105017**	**1**
22	Base of solenoid tubing assembly		1
23	Union	2307601001	1
24	Screw M2x10	2020402010	1
25	Tube, probe to 6-port deactivated	1300502506	1
26	Ferrule, pneumatics tubing to 6-port valve Nut, pneumatics tubing to 6-port valve	1925820870 1925820830	
27	Flow restrictor	2321390008	1

Table 11 Pneumatic tubing IPB (continued)

28	**Pressure regulator assembly** consists of parts 28 and 29	**0410105007**	**1**
29	Pressure regulator	9050590004	1
30	Knob	2272000001	2
31	Tube, pressure regulator to bulkhead	1300530009	1

* See Figure 177, “Pneumatics compartment IPB”,” on page 140

Replacement Procedures

Access pneumatics components

Required tool

Phillips screwdriver

Replacement parts

Does not apply

Remove the pneumatic covers

1 Raise the lid of the HS.

2 Use a Phillips screwdriver to loosen the two screws at the front of the sample cover shown below.

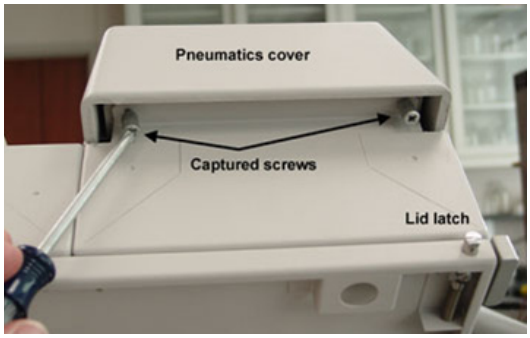


Figure 179 Screws under lip of pneumatics cover

3 Lower the lid of the HS.

4 Raise the pneumatics cover.

5 Remove the two Phillips screws from the left side.

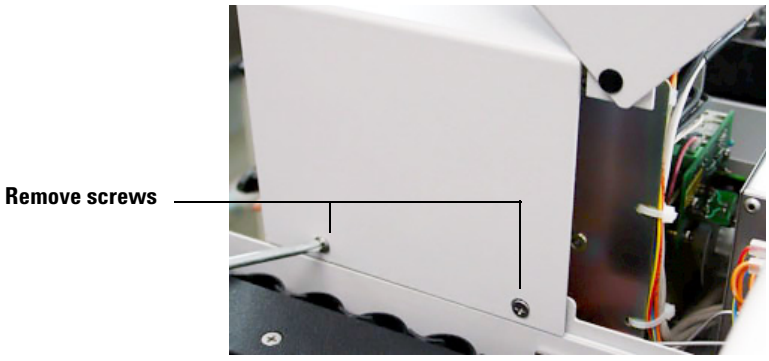


Figure 180 Screws on left side of pneumatics cover

6 Use short or ratchet driver to remove 2 Phillips screws from right side.

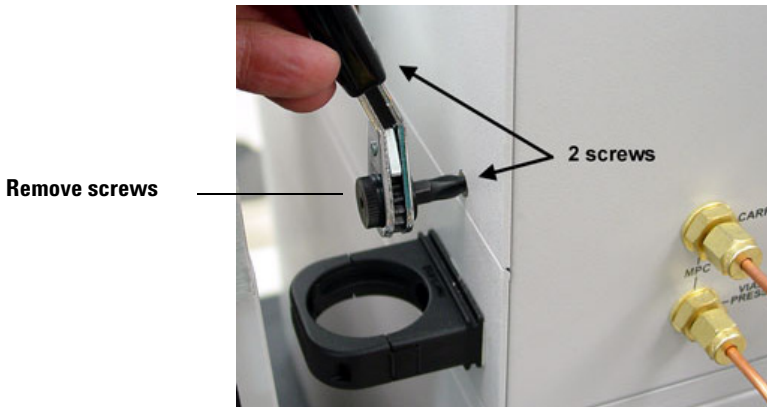


Figure 181 Screws on right side of pneumatics cover

7 Carefully lift cover to remove.

Figure 182 Access to pressure transducers, tubing, and manual regulators

8 Loosen the two screws on the loop cover.

Figure 183 Screws to insulated cover of loop and valve heated zone

9 Carefully lift off cover.

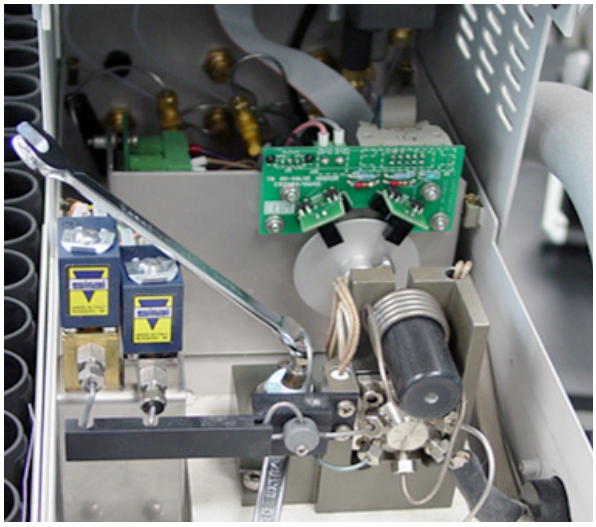


Figure 184 Access to loop and valve heated zone

Pneumatic tubing

Most tubing uses a swagelock connection.

Required tools

7/16 inch wrench

9/16 inch wrench

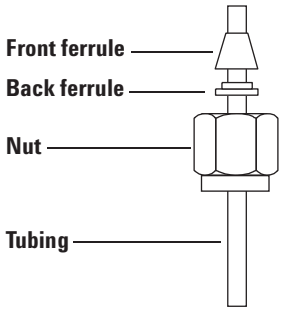
Replacement parts

See “Replacement Parts”on page 123 and

See “Pneumatic tubing IPB”on page 143.

Making a Swagelok connection

1 Place a Swagelok nut, back ferrule, and front ferrule to the tubing as shown in Figure 185.



IMPORTANT!
The narrow end of the back ferrule fits into the rear of the front ferrule.

Figure 185 Swagelok nuts and ferrules

2 Clamp a stainless steel plug or similar fitting in a bench vise.

3 Push the tubing into the stainless steel plug. Make sure that the front ferrule is touching the plug. Slide the Swagelok nut over the ferrule and thread it onto the plug. See Figure 186.

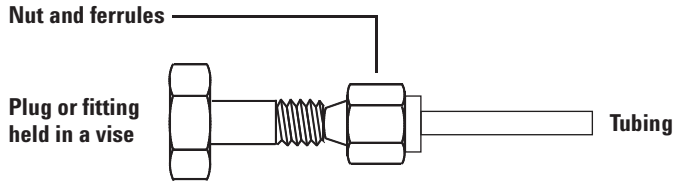


Figure 186 Assembling the fitting for a swagelok connection

4 Push the tube fully into the plug, then withdraw it approximately 1 to 2 mm. Finger-tighten the nut.

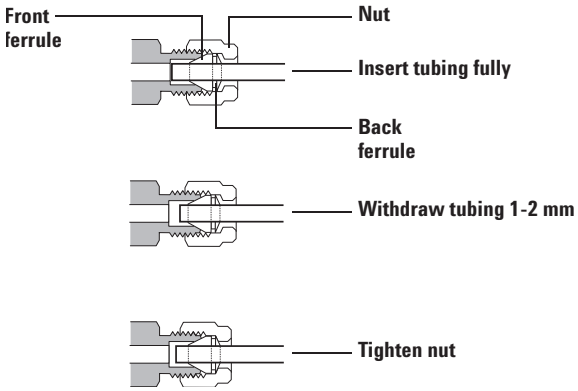


Figure 187 Insert the tubing for a swagelok connection

5 Mark the nut with a pencil line.

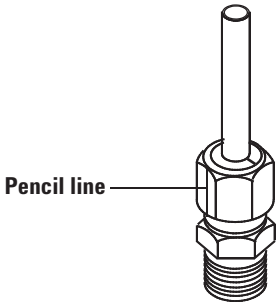


Figure 188 Mark the fitting for a swagelok connection

6 For 1/8-inch Swagelok fittings, use a pair of 7/16-inch wrenches to tighten the fitting 3/4 of a turn. For 1/4-inch fittings, use a pair of 9/16-inch wrenches to tighten them 1-1/4 turn.

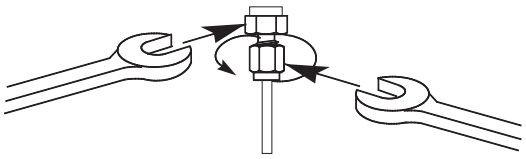


Figure 189 Final tightening for a swagelok connection

7 Remove the plug from the fitting. To connect the tubing, with nut and ferrules, to another fitting, finger-tighten the nut, then use a wrench to tighten it 3/4 of a turn (1/8-inch fittings) or 1-1/4 of a turn (1/4-inch fittings).

8 A correctly-swaged connection is shown in Figure 190. Note that the end of the tubing in a correctly-swaged fitting is not crushed and does not interfere with the action of the ferrules.

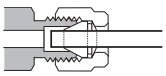


Figure 190 Completed fitting for a swagelok connection

Sample loop

The loop zone controls the temperature of the valve, and the sample loop. The setpoint range of the loop is 45 to 250 °C. Keep the loop temperature 10 to 15 °C higher than the vial temperature for most operations.

Required tool

7-mm wrench

Replacement parts

2321700003 Sample loop, 1 mL deactivated

2321700004 Sample loop, 3 mL deactivated

Remove the sample loop

1 Remove the plumbing from the 6-port valve by using a 7-mm wrench to loosen the two nuts connecting the sample loop to ports 1 and 4 of the 6-port valve.

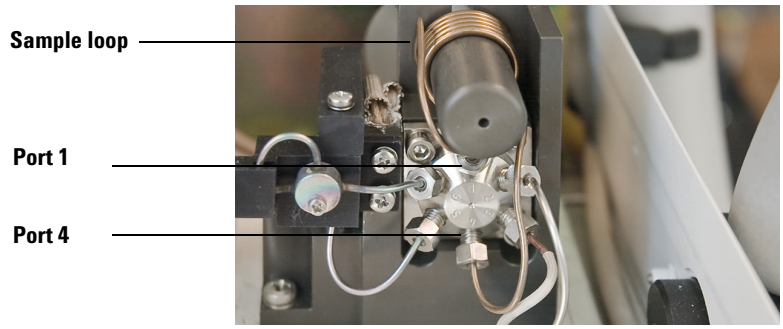


Figure 191 Ports 1 and 4 on the 6-port sampling valve

2 Slide the sample loop off the mandrel.

Replace the sample loop

1 Slide the new sample loop onto the mandrel.

CAUTION Do not bend the deactivated sample loop or the coating will break and compromise inertness.

2 Reverse the steps given above to reassemble the HS.

3 Perform a leak test on fittings before replacing the insulation and manifold cover.

Sample probe

Required tools

Two 7-mm wrenches

Tweezers

Replacement part

2322700011 Sample probe, deactivated

Remove the sample probe

1 Loosen the Phillips screw shown below.

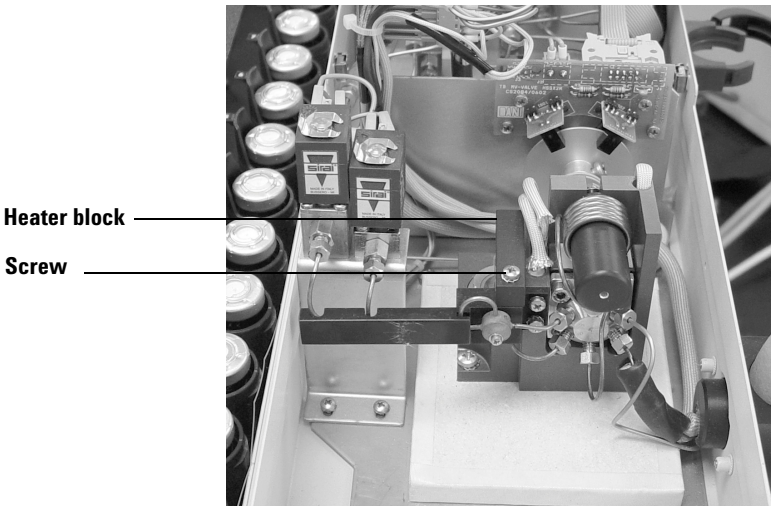


Figure 192 Location of the heater block and screw

2 Lift out the heater block covering the sampling probe.

3 To disconnect the plumbing from the sampling probe support the zero dead volume union with a 7-mm wrench and remove the nut with another 7-mm wrench.

CAUTION Do not bend any tubing or the coating will break and compromise inertness.

4 Loosen the connection to port 5 on the 6-port valve. Lift the tube off of the sample probe and swivel out of the way.

5 Loosen and remove the zero dead volume union.

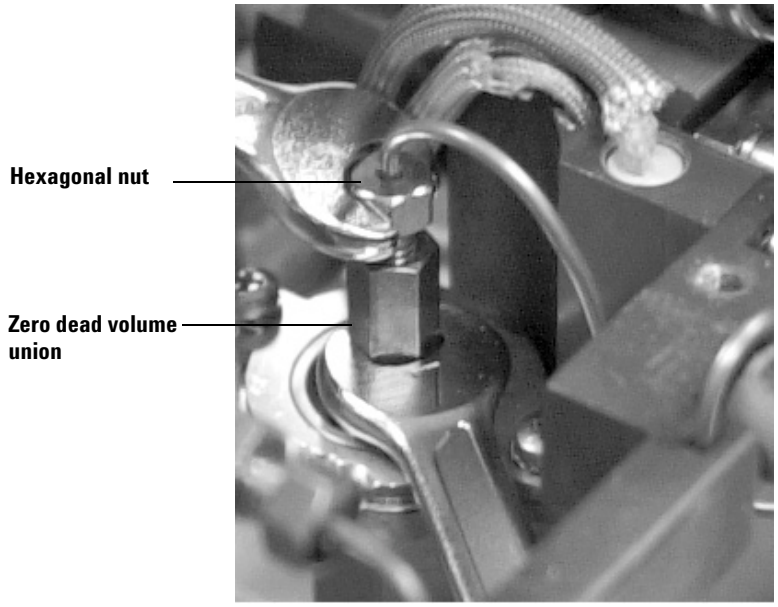


Figure 193 Location of the zero dead volume union and hexagonal nut

6 Pick up the sampling probe with tweezers and remove it from the HS.

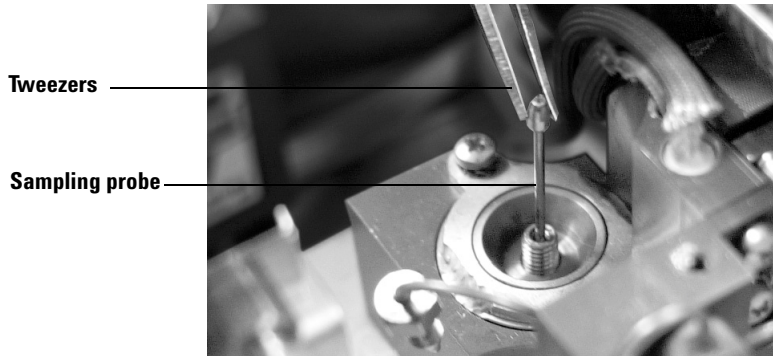


Figure 194 Removing the sampling probe

Replace the sample probe

1 Insert a new sampling probe.

2 Reverse the previous steps to reassemble the HS.

3 Tighten each fitting and perform a leak test before replacing the insulation and cover.

Transfer line

This line connects the Headspace Sampler to the GC. The transfer line is 85 cm long and made of deactivated stainless steel. The temperature range of the transfer line is 50 to 250 °C.

Required tools

Phillips screwdriver

Flat-blade screwdriver

7-mm wrench

Replacement parts

0410103101 Transfer line deactivated 0.8 SILTEK

0410105014 Holder, transfer line

2322590005 Needle, transfer line deactivated OD 0.7

2322590004 Needle, transfer line deactivated OD 0.5
Use for on-column injection and other inlets

Remove the transfer line

1. Access the pneumatic components. See “Access pneumatics components”on page 146.
2. Remove the transfer line from connection 3 of the 6-port valve.
3. Trace the transfer line heater and sensor wires back to the terminal block. Unplug the heater line and the sensor lines.
4. Use a flat-blade screwdriver to remove the sensor wires from the plug.

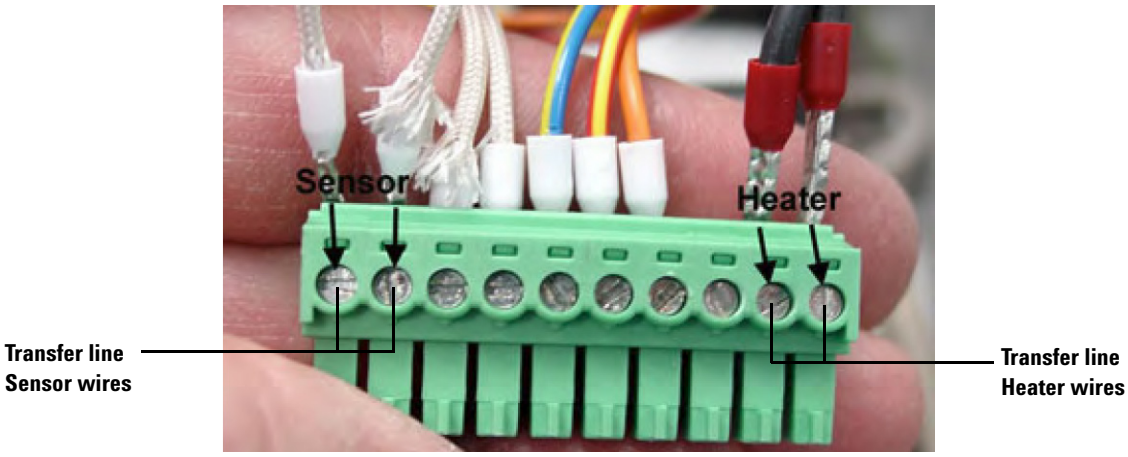


Figure 195 Transfer line wires - sensor and heater

5 Use a flat-blade screwdriver to remove the heater wires from the plug.

6 Remove the two screws holding the transfer line to the side panel then remove the transfer line.

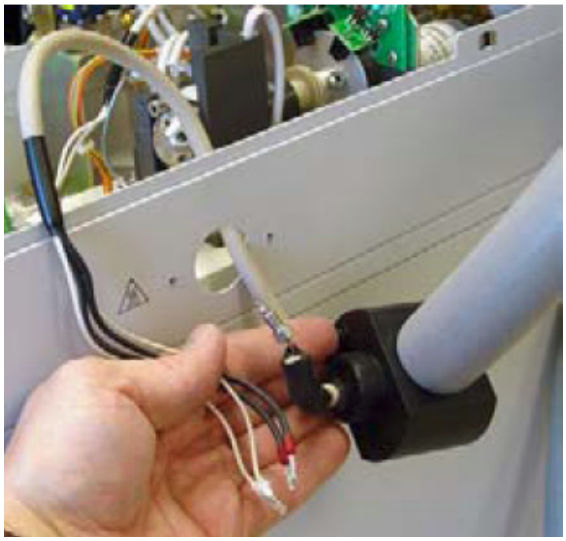


Figure 196 Transfer line - side panel view

Replace the transfer line

1 Reverse the steps given above to install the transfer line.

2 Perform a leak test on fittings before replacing the insulation and manifold cover.

6-port valve

Required tools

Phillips screwdriver

Allen wrench

Two 7-mm wrenches

Replacement part

9040700026 Valve, 6-port sampling

1925820830 Nut, pneumatics tubing to 6-port valve

1925820870 Ferrule, pneumatics tubing to 6-port valve

Removing the 6-port valve

1 Access the pneumatic components. See “Access pneumatics components”on page 146.

2 Remove the six tubing lines from the 6-port valve.

3 Use an allen wrench to remove the two bolts holding the 6-port valve to the heater block.

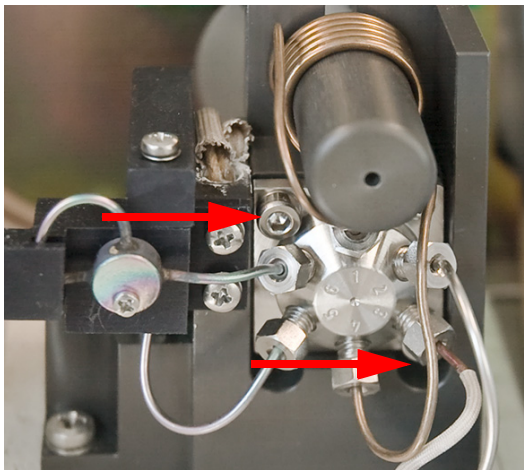


Figure 197 Two bolts on 6-port valve

4 Pull the 6-port valve forward to remove it from the heater block. The valve uncouples from the motor-sensor assembly.

Installing the 6-port valve

1 Reverse the steps given above to install the 6-port valve.

2 Perform a leak test on fittings before replacing the insulation and manifold cover.

Heaters

Required tools

Phillips screwdriver

Flat-blade screwdriver

Replacement part

0410105036 Heater sensor assembly, loop

Removing the heaters

1 Access the pneumatic components. See “Access pneumatics components”on page 146.

2 Unplug the heater connector JP1 and the sensor line connector from the terminal block.

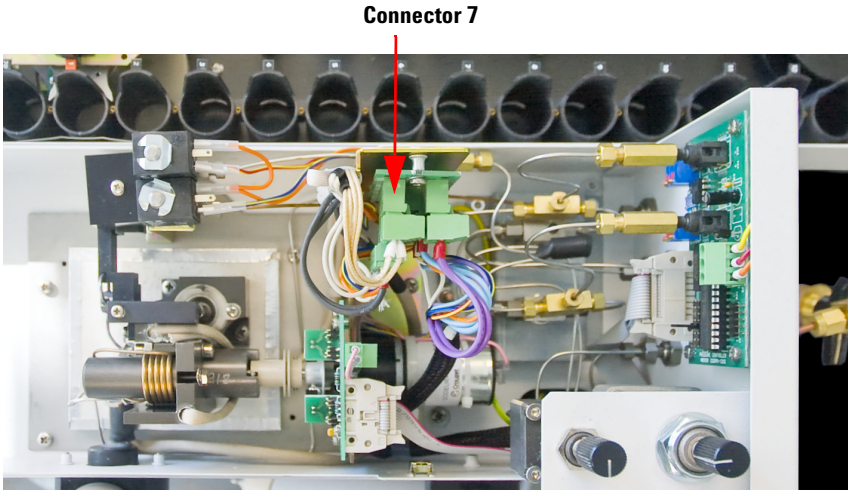


Figure 198 Removing the loop heater sensor assembly

3 Use a flat-blade screwdriver to remove the wires from the heater plug J1A and the sensor wire plug J2A.

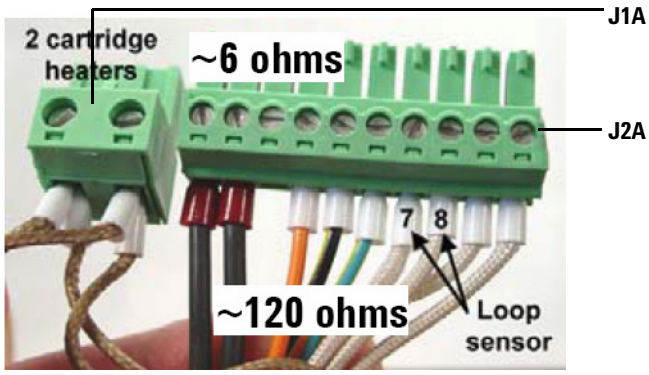


Figure 199 Heater plug J1A and sensor wire plug J2A

4 Remove the heaters and sensors from the heater block.

Install the loop heater

Reverse the steps given above to install the loop heaters and sensors.

6-port valve motor assembly

Required tool

Phillips screwdriver

Replacement part

0410105004 6-port valve motor assembly

Removing the motor assembly

1 Access the pneumatic components. See “Access pneumatics components”on page 146.

2 Unplug the four plugs from the terminal block.

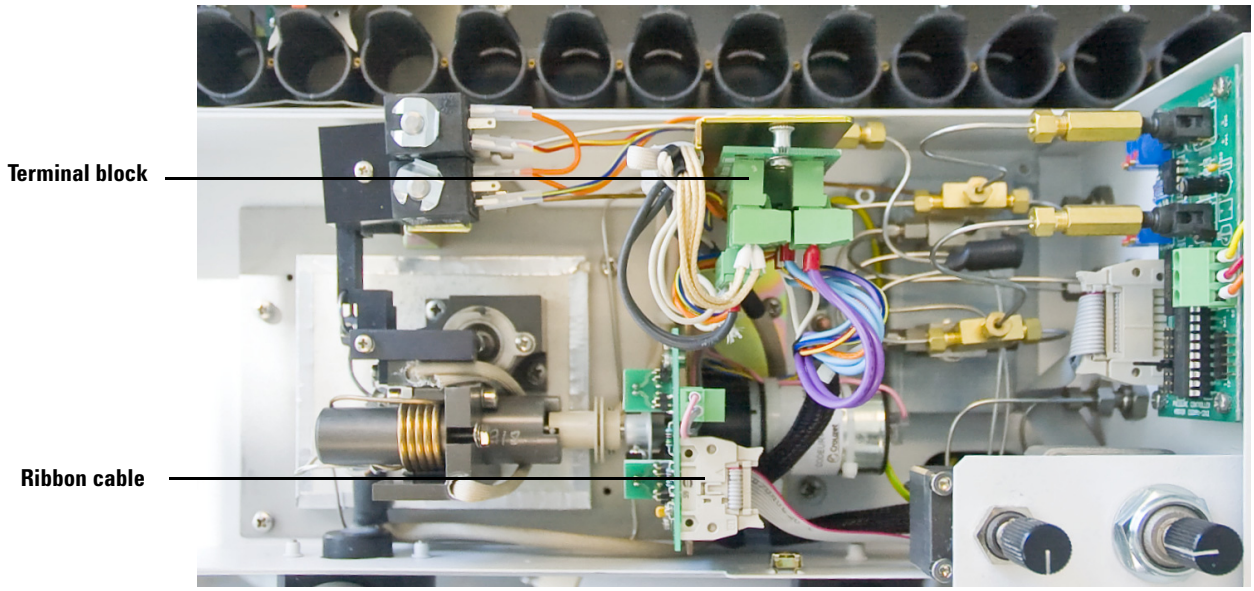


Figure 200 Terminal block

3 Unplug the ribbon cable from the MV-valve terminal block.

4 Use a Phillips screwdriver to remove the screws holding the base of the motor assembly.

5 Remove the motor assembly.

Install the motor assembly

Reverse the steps given above to install the 6-port valve motor assembly.

6 Electrical

Overview

The electrical components that make up the Headspace Sampler (HS) are listed in the following table.

Components are controlled by an on-board processor using a serial bus. External control is provided by the keyboard and display component and software running in a Chemstation.

Table 12 Electrical components

Qty	Description	Part number
7	**Power components**	
	• 24 VDC power supply	3856000004
	• 5 VDC power supply	3411500110
	• Transformer	0410105026
	• Oven heater relay	3641500008
	• Voltage selector switch	3821019002
	• Line filter	3840300011
	• Line module	5404020001
6	**Motors**	
	• 6-Port valve motor	3701509002
	• Tray motor	0410105019
	• Tray lifter motor	0410105021
	• Oven fan motor	3700500001
	• Shutter motor	0410105021
	• Carousel motor	6410090081
4	**Heaters**	
	• Oven band heater	9101030001
	• Loop temperature cartridge heater	0410105036
	• Loop heater block cartridge heater	9110509015
	• Transfer line (contains heater and sensor)	0410103101
14	**Sensors**	
	• Sample lifter optical sensor	0410105002
	• Tray lifter optical sensor	0410105003

Table 12 Electrical components (continued)

	• 6-port valve optical sensor	0410105004
	• Vial present sensor optical sensor	0410105106
	• Carousel sensor optical sensor	0410105008
	• Tray position 1 sensor optical sensor	0410105020
	• Shutter sensor(2) optical sensor	0410105021
	• Optical sensor	
	• Oven temperature sensor	0410105029
	• Loop temperature sensor	3831019003
	• Transferline (contains heater and sensor)	0410103101
	• Carrier gas pressure sensor	3411500115
	• Vial pressure sensor	3411500115
4	**Fans**	
	• Power supply cooling	0410105012
	• Vial cooling fan (2)	0410105030
	• Oven fan	3700500902
2	**Solenoid valves**	
	• Vial pressurization	3600500002
	• Solenoid vent	3600500001
6	**Printed Circuit Assembly**	
	• Motor controller 1	3411500111
	• Motor controller 2	3411500112
	• Temperature controllers 1 & 2	3411500113
	• Pressure sensors	3411500115
	• Main processor	3411500114
1	**Interfaces**	
	• Keypad and display	0410105134 - new color 0410105034 - old color
2	**Ribbon cables**	
	• Control harness, ribbon cable	5104309004
	• Communications harness, ribbon cable	5104309005

Table 12 Electrical components (continued)

1	**Cable Assembly**	
	• Solenoid valves, cable assembly	5104319115
1	**Wiring harness**	
	• PCA power supply, harness	5104319108

Table 13 Power cords - country specific

Country	Description	Part number
Argentina		8120-6869
Australia/NZ	C13, 10 amp	8120-1369
Chile	C13, 10 amp	8120-6978
China	C13, 10 amp	8121-0723
DK/Greenland	C13, 10 amp	8120-3997
Europe	C13, 10 amp	8120-1689
GB/HK/SG/MY	C13, 10 amp	8120-8705
India/South Africa	C13, 10 amp	8120-4211
Israel	C13, 10 amp	8120-5182
Japan	C15, 15 amp	8120-5342
Korea	C13, 10 amp	8121-1226
Switzerland	C13, 10 amp	8120-2104
US/CA/TW/TH	C13, 13 amp	8120-1992

Table 14 Fuses

Location	Description	Part number
F1 Power distribution PCA	Interchangeable Bussmann 5 x 20 mm, Type: GMD D1A (T 1A 250 V), CSA	384-1595011-HSP
F3 and F4 Power distribution PCA	Interchangeable Bussmann 5 x 20 mm, Type: GMD (F 6A 125 V), CSA	384-1295001-HSP
Main fuses on power switch	10 amp, fast acting, 250 V, 5x20 mm	5188-1157
Transformer fuse	8 amp, fast acting, 250 V, 5x20 mm	5188-1158

See also Table 36, “Avaliable fuses for older models”,” on page 287.

Replacement Parts

Headspace Samplers with serial numbers less than IT00604011 have grey external skins. Current HS models are white in color.

Figure 201 0410105012 Fan, power supply

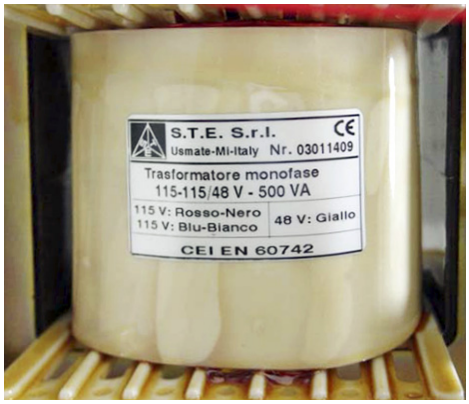


Figure 202 0410105026 Transformer

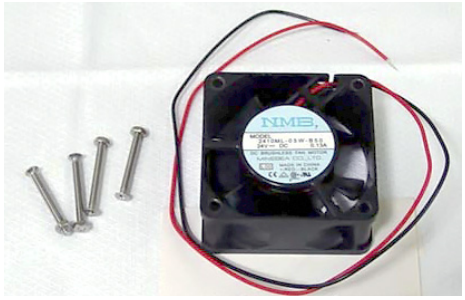


Figure 203 0410105030 Fan, vial cooling

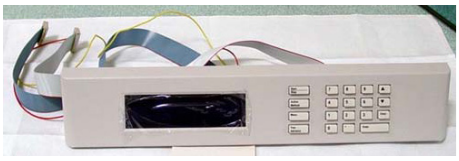


Figure 204 0410105034 Display keypad assembly, old color
0410105134 Display keypad assembly, new color

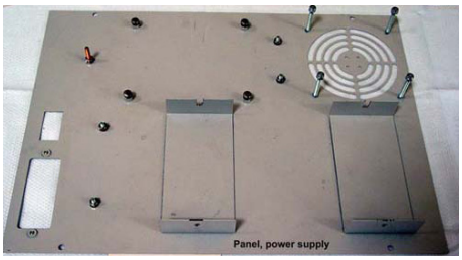


Figure 205 0410105035 Panel, power supply, old color
0410105135 Panel, power supply, new color

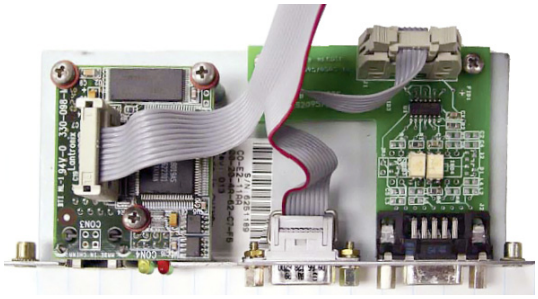


Figure 206 0410105040 Communications board

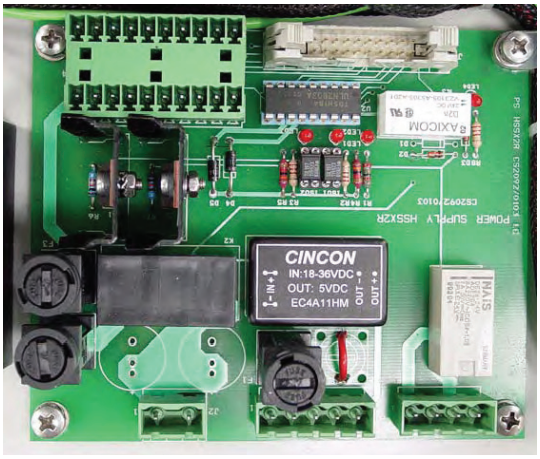


Figure 207 3411500110 Power distribution plus 5 VDC

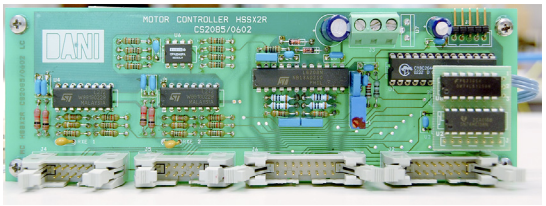


Figure 208 3411500111 Motor controller 1

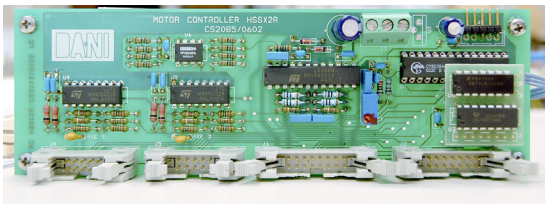


Figure 209 3411500112 Motor controller 2

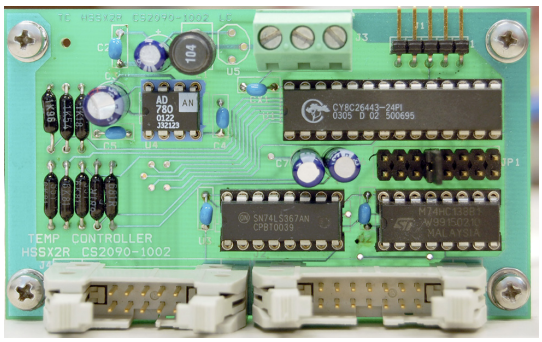


Figure 210 3411500113 Temperature controllers 1 and 2

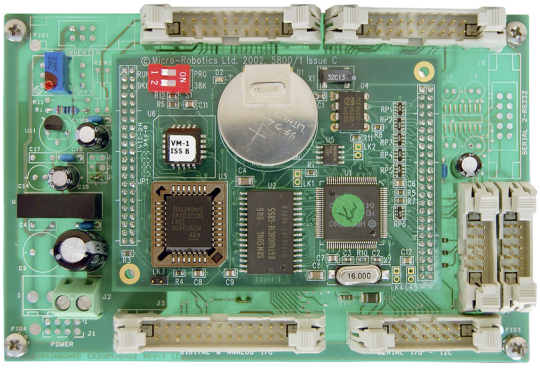


Figure 211 3411500114 Processor board

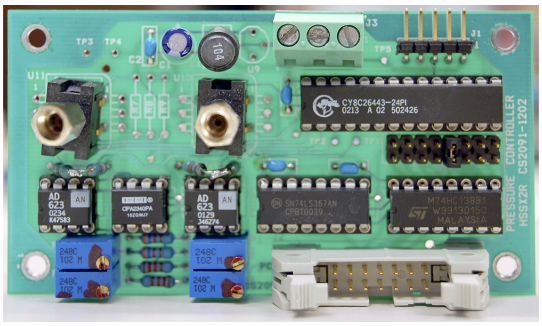


Figure 212 3411500115 Pressure sensor board

Figure 213 3641500008 Relay, oven heater

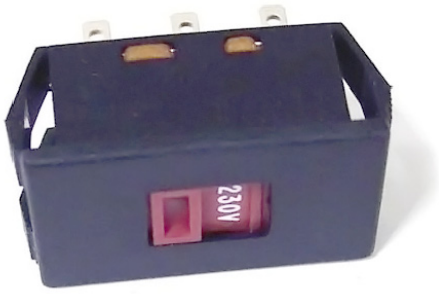


Figure 214 3821019002 Switch, voltage selector

Figure 215 3840300011 Line filter

Figure 216 3856000004 Power supply, 24 VDC

Figure 217 5404020001 Line module

Figure 218 6550106033 Front panel old color / 6550106036 New color

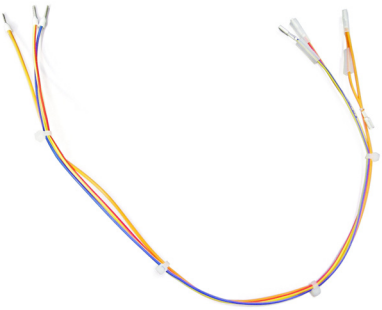


Figure 219 5104319115 Cable assembly, solenoid valves

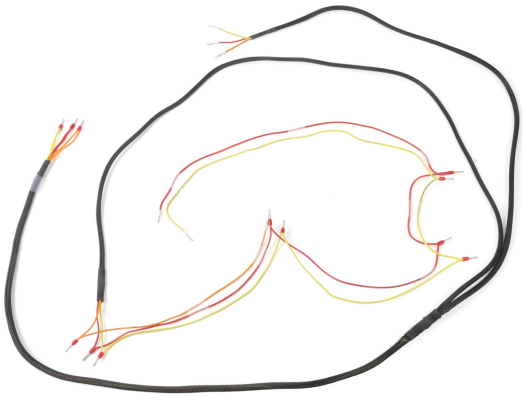


Figure 220 5104319108 PCA power supply harness

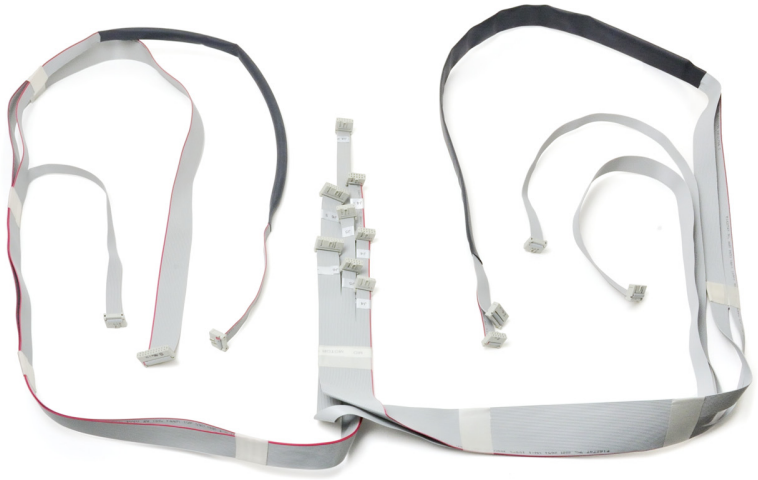


Figure 221 5104309004 Control harness, ribbon cable

Figure 222 5104309005 Communications harness, ribbon cable

Replacement Procedures

Tools

- A well-equipped toolkit (screwdrivers, wrenches, etc.)
- Digital meter (VDC and Ohms)
- Pointed set of probes for the meter
- 10-pin and 16-pin test jumpers
- Metal paper clips
- Reference materials (manuals)

General comments

When measuring resistance, the power is off. When measuring voltage, the power is on.

Be careful with all wires. They snap off easily.

- **Yellow wires** are ground
- **Red wires** are 5 volts
- **Orange wires** are 24 volts

Measurements

- Power OFF - resistance (ohms)
- Power ON - voltages (VDC)

Accessing the components

Accessing the components inside the front panel

1 Remove all sample vials from the vial tray.

2 Slide the two locking tabs on either side of the HS to release the lid. Raise the lid until it locks in an open position.

Figure 223 The locking tabs for the lid

3 Using a 3 mm hex key, unfasten the two captive screws on the bottom front panel of the HS.

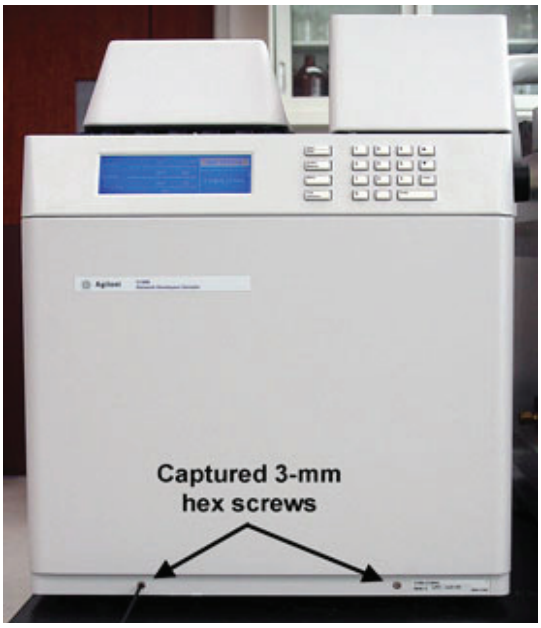


Figure 224 The captive screws securing the front panel

4 Lift the front panel out of its slot. Gently place the panel on the workbench face-down hanging from two nylon lines.

Figure 225 The lid raised and the front panel open

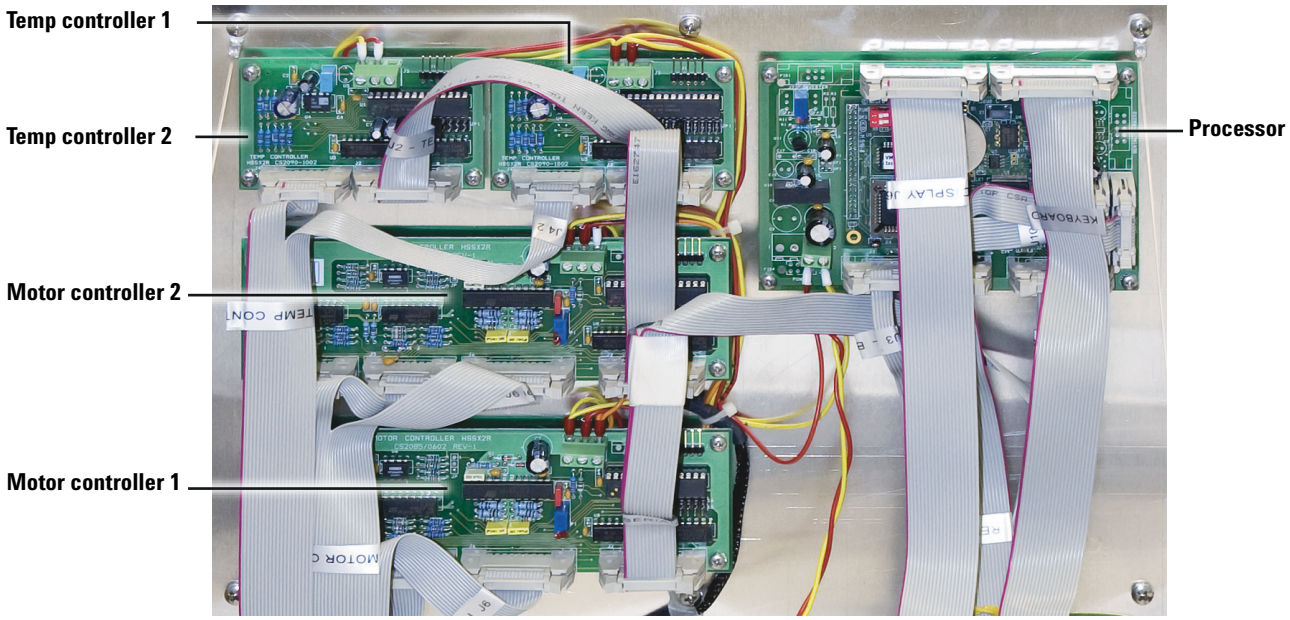


Figure 226 Inside the front panel

Accessing the components inside the rear panel

1 Power OFF and disconnect the power cord.

2 Remove the six Phillips screws.

3 Carefully lower the back panel.

Figure 227 Accessing the PCAs inside the rear panel

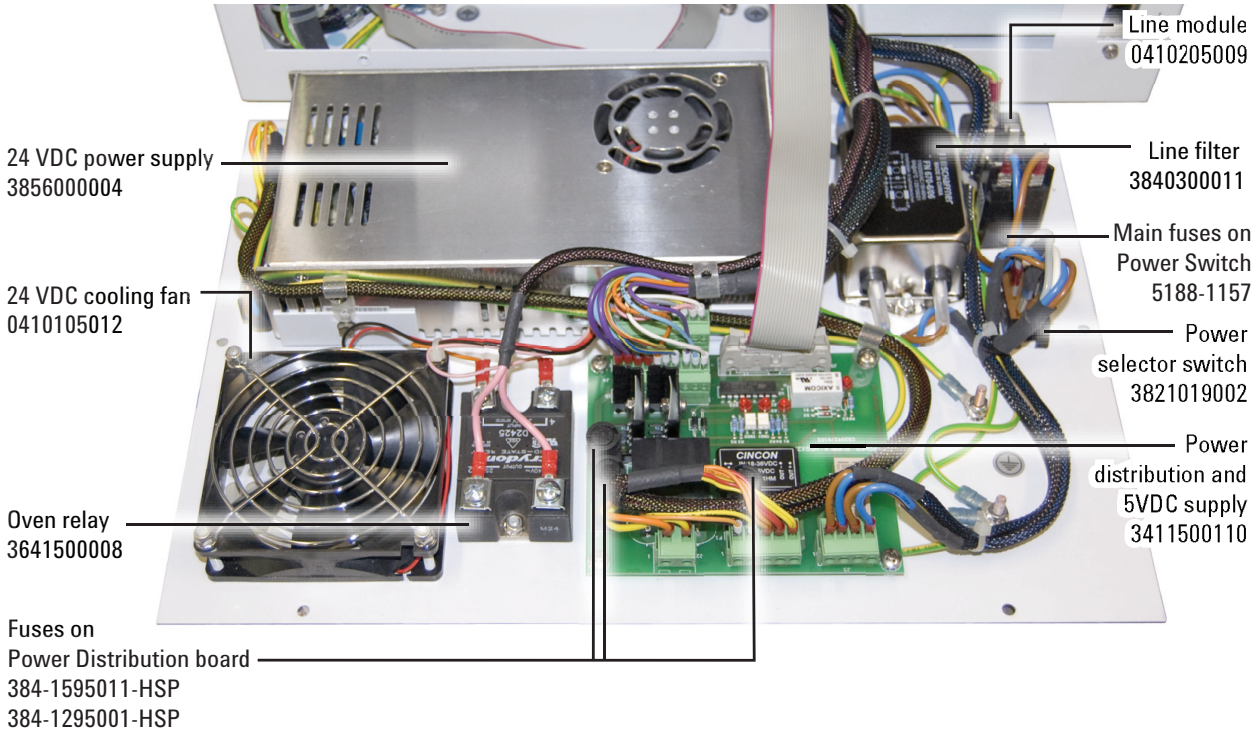


Figure 228 Inside the rear panel

Accessing the components inside the pneumatics compartment

1 Raise the lid of the HS.

2 Use a Phillips screwdriver to loosen the two screws at the front of the sample cover shown below.

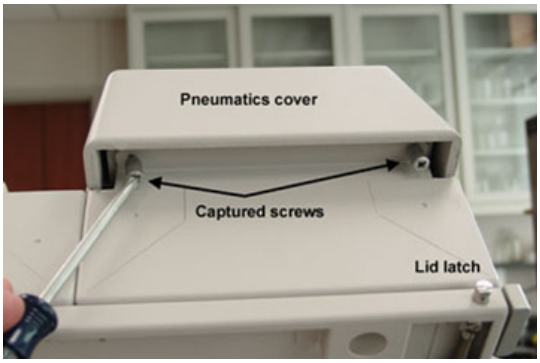


Figure 229 Screws under lip of pneumatics cover

3 Lower the lid of the HS.

4 Raise the pneumatics cover.

5 Remove the two Phillips screws from left side.

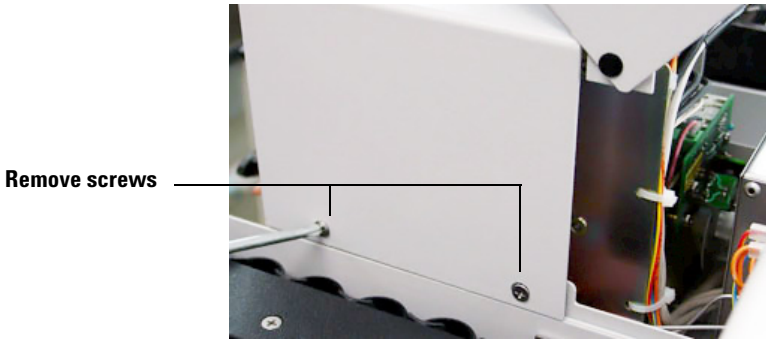


Figure 230 Screws on left side of pneumatics cover

6 Use short or ratchet driver to remove the two Phillips screws from right side.

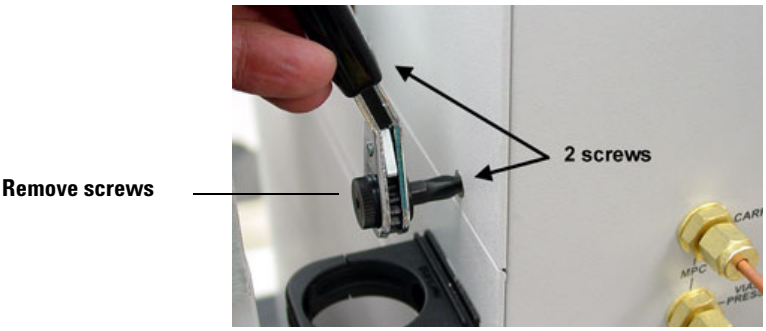


Figure 231 Screws on right side of pneumatics cover

7 Carefully lift cover.

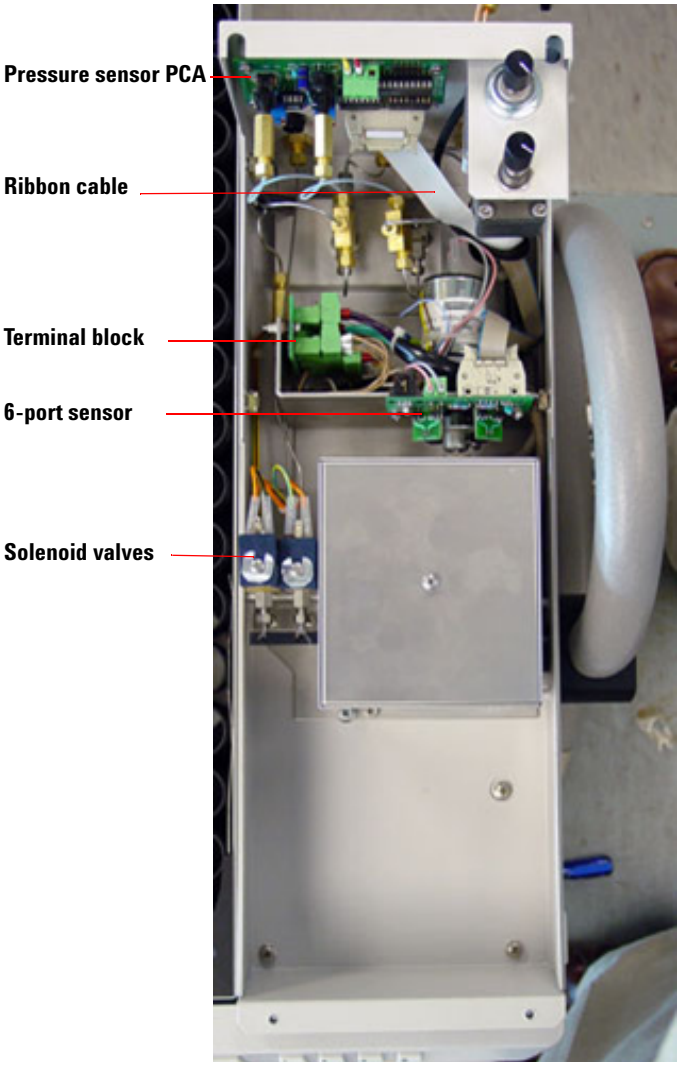


Figure 232 Inside the pneumatics compartment

Transformer

Required tools

Phillips screwdriver

Small flat-blade screwdriver

Replacement part

0410105026 Transformer

Removing the Transformer

1 Remove the bottom cover. See “Accessing the components from the bottom panel”on page 94.

2 Remove the two Phillips screws closest to the bottom opening that hold the transformer in place. The transformer is heavy so do not remove the other two screws yet. See Figure 233.

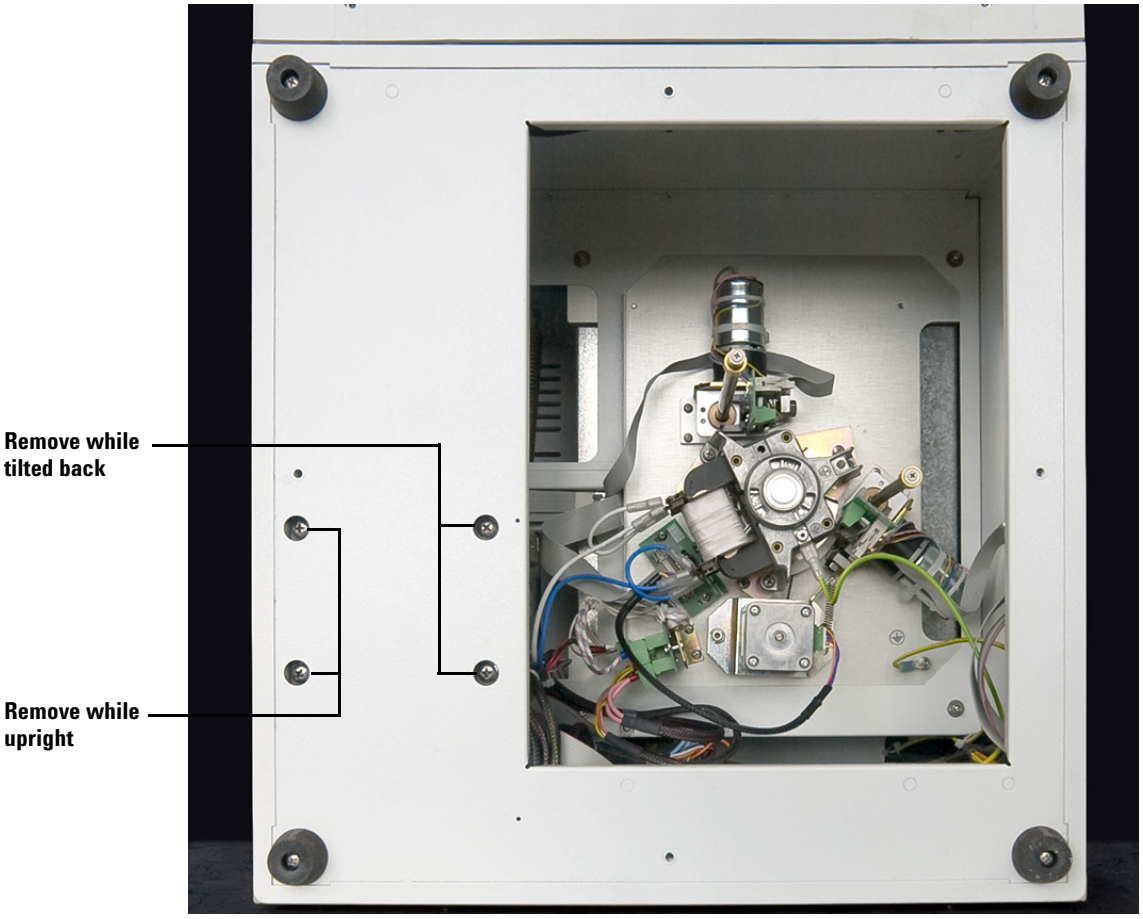


Figure 233 The transformer screws

3 Set the HS upright. Position it so two of the transformer screw holes hang over the edge of the work bench and are accessible from below. Remove the remaining two screws.

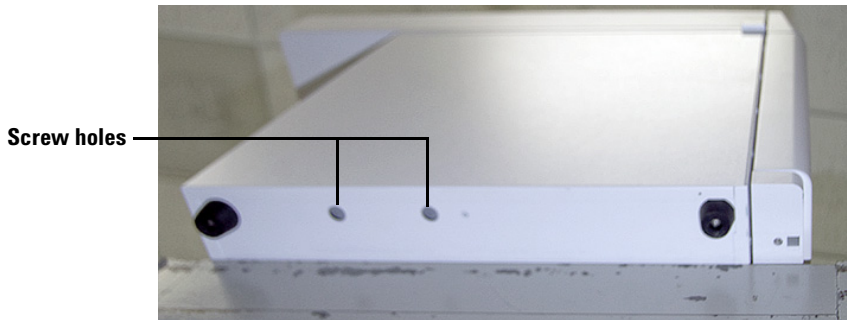


Figure 234 Two transformer screw holes accessible

4 Slide the HS completely on to the work bench. Remove the back panel (with electronics attached). See "Accessing the components inside the rear panel"on page 175.

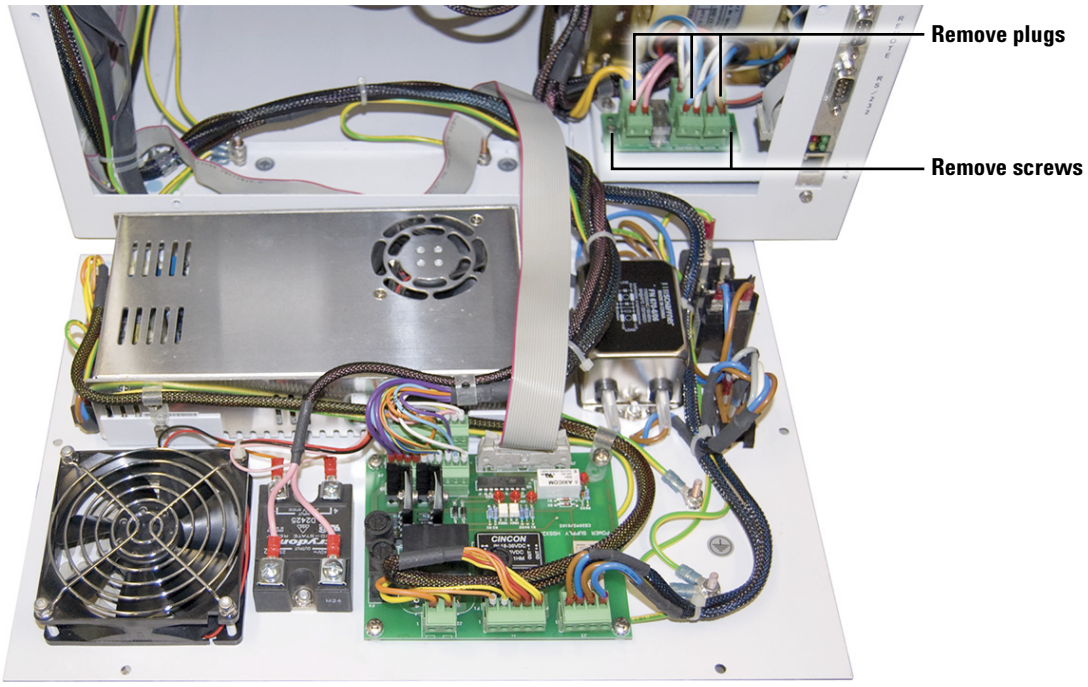


Figure 235 Removing the transformer board

5 Unplug the connectors from the transformer board located in front of the transformer.

6 Use a small flat-blade screwdriver to remove the transformer wires from the transformer board connectors.

7 Remove the two Phillips screws from the transformer board. See Figure 235. Remove the transformer board.

8 Cut twist ties attached to the transformer wire harness where needed.

9 Remove the transformer from the HS chassis. Take care since the transformer is heavy.

Installing the Transformer

1 Due to the weight of the transformer, it is difficult to secure the four bottom screws while the HS is on its side. Position the HS so two of the screw holes hang over the edge of the work bench and are accessible from below. See Figure 234.

2 Align the four threaded clips over each screw hole before positioning the transformer in the HS chassis. The clips are easily reached through the open back panel.

3 Place the transformer in position through the open back panel and line up the screw holes.

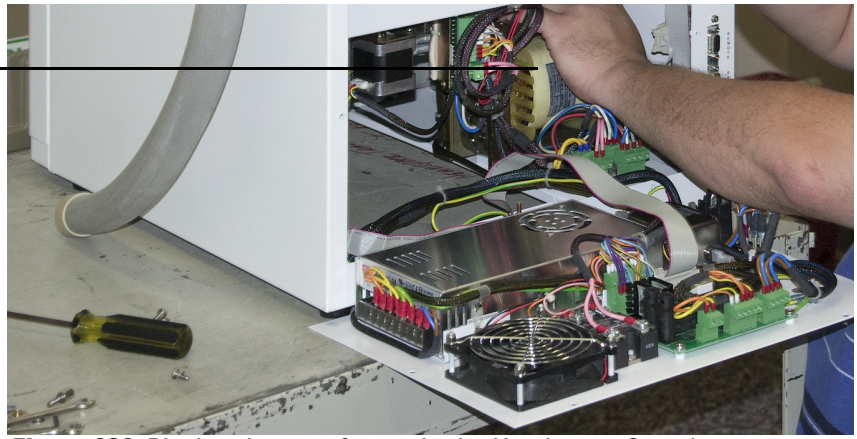


Figure 236 Placing the transformer in the Headspace Sampler

4 From below, insert the first two Phillips screws into the transformer and tighten.

5 Slide the HS completely onto the table.

6 Flip the HS to expose the bottom panel.

7 Insert the two remaining screws and tighten until snug.

8 Replace the bottom panel and set the HS upright.

9 Replace the transformer board and reconnect the cables leading to the transformer and oven fan. See Figure 235.

Temperature controllers 1 and 2

This procedure is valid for both temperature controllers. The difference between the temperature controllers is the location of the jumper pin on JP1.

- Temperature Controller 1 JP1 jumper location = 3
- Temperature Controller 2 JP1 jumper location = 4

Firmware on this board can not be upgraded in the field.

Temperature controller 1 performs the following functions:

- Controls loop and transfer line temperature
- Reads loop and transfer line sensors and compares with setpoints.
- Uses set of resistors as a reference to measure temperature.
- Tells the 5 VDC power supply PCA to close a relay to send 24 VDC to power the loop or transfer line heater.
- Turns solenoid valves ON and OFF.

Temperature controller 2 performs the following functions:

- Controls oven temperature.
- Reads oven sensor and compares with setpoint.
- Uses set of resistors as a reference to measure temperature.
- Tells 5 VDC power supply PCA to turn on 48 VAC relay to heat oven.

Replacement part

3411500113 Temperature Controller 1 and 2

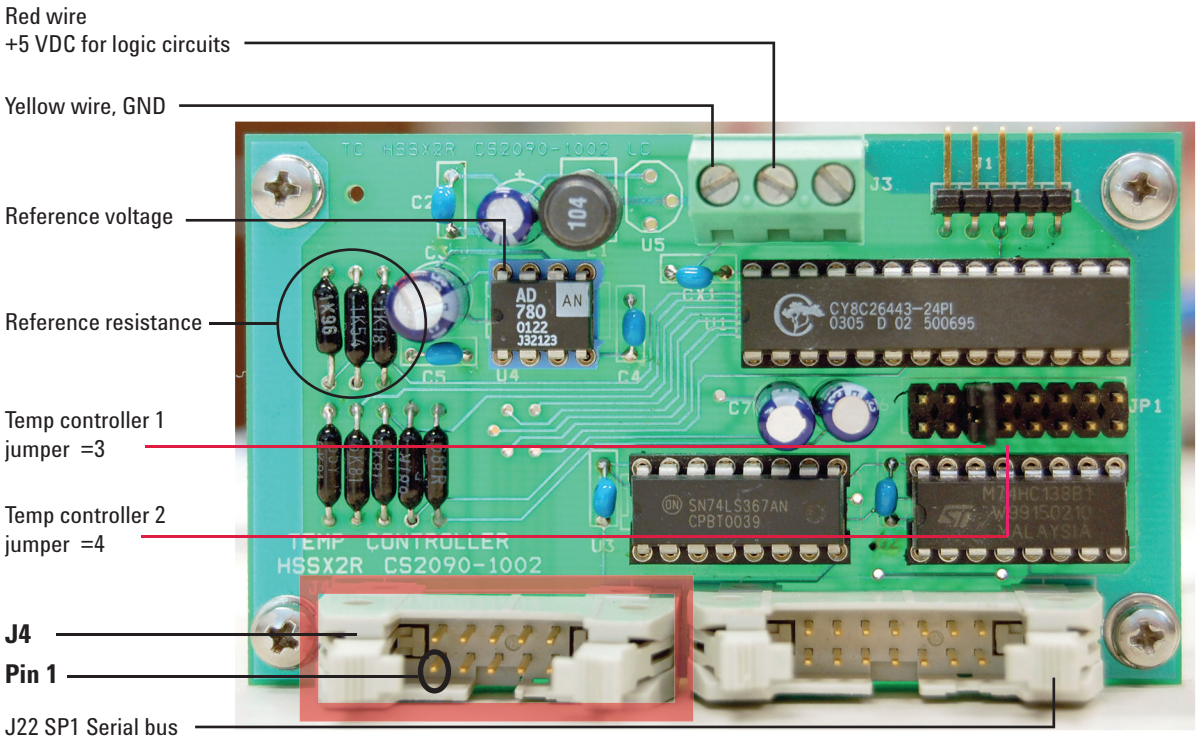
Remove the temperature controllers

1. Power OFF and disconnect the power cord.
2. Remove the HS front cover. See “Accessing the components inside the front panel”on page 173.
3. Unplug the ribbon cables. See Figure 237.
4. Use a screwdriver to remove the 5-volt power cables.
5. Remove the screws in the corners of the board and then remove the temperature controller PCA.

Replace the temperature controllers

1 Set the jumper pin on JP1 to the same location as the board which is being replaced.

2 Installation is the reverse of the above steps.



J4 cable pin-outs for Temp controller 1

1 Loop sensor	2 Transfer line sensor
3 AGND	4 AGND
5 Loop FET	6 Transfer line FET
7 I/O, Pres. Valve	8 I/O, Vent Valve
9 I/O	10 Ground

J4 cable pin-outs for Temp controller 2

1 Oven sensor	2 not used
3 AGND	4 not used
5 Relay	6 not used
7 I/O	8 I/O
9 I/O	10 Ground

Figure 237 Temperature controllers 1 and 2

Motor controllers 1 and 2

The procedure to remove either motor controller 1 or 2 is identical. However MC1 and MC2 are not interchangeable. Firmware on this board can not be upgraded in the field.

Motor controller 1 controls the following motors and receives input from the following sensors:

- Drives tray motor and reads position 1 and vial present optical sensors.
- Drives lifter tray motor and reads its hole.
- Drives shutter motor and reads its 2 optical sensors.
- SPI address = 1

Motor controller 2 controls the following motors and receives input from the following sensors:

- Drives sampling valve motor and reads its 2 optical senors.
- Drives lifter sampling motor and reads its hole.
- Drives carousel motor and reads its optical sensor.
- SPI address = 2

Replacement parts

3411500111 Motor Controller 1

3411500112 Motor Controller 2

Remove the motor controllers

1. Power OFF and disconnect the power cord.
2. Remove the HS front cover. See “Accessing the components inside the front panel”on page 173.
3. Unplug the ribbon cables. See Figure 238.
4. Unplug the power cables.
5. Remove the screws in the corners of the board and then remove the motor controller PCA.

Replace the motor controllers

Installation is the reverse of the above steps.

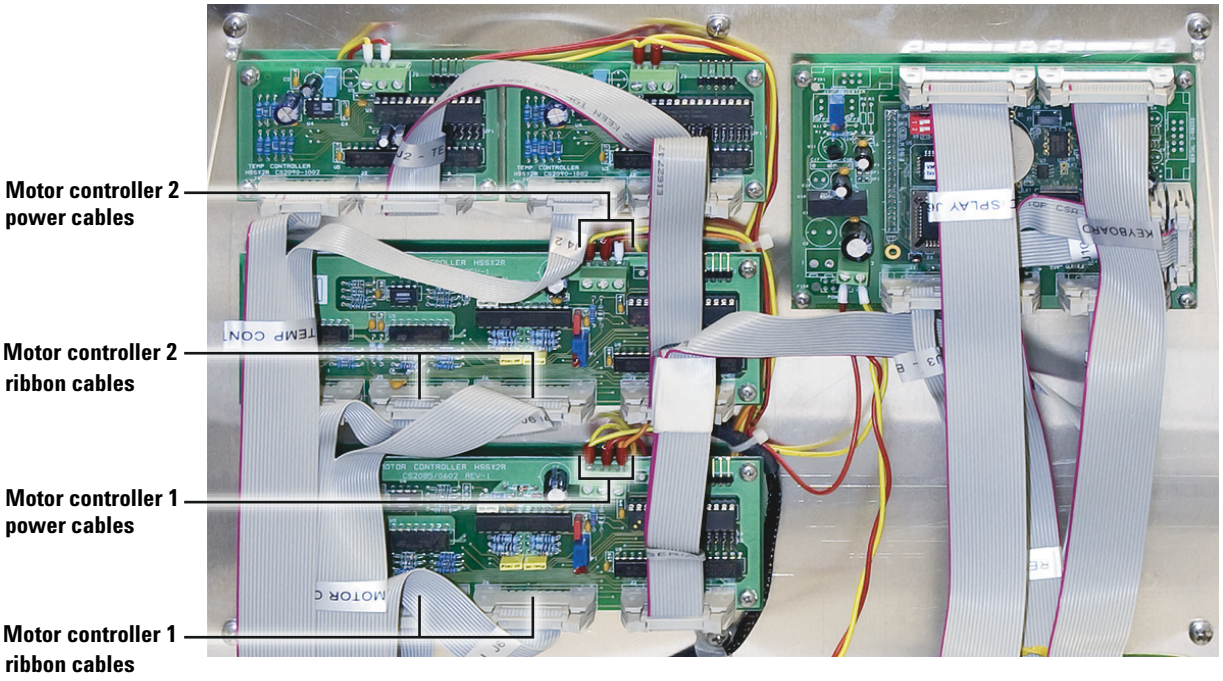


Figure 238 Motor controllers 1 and 2

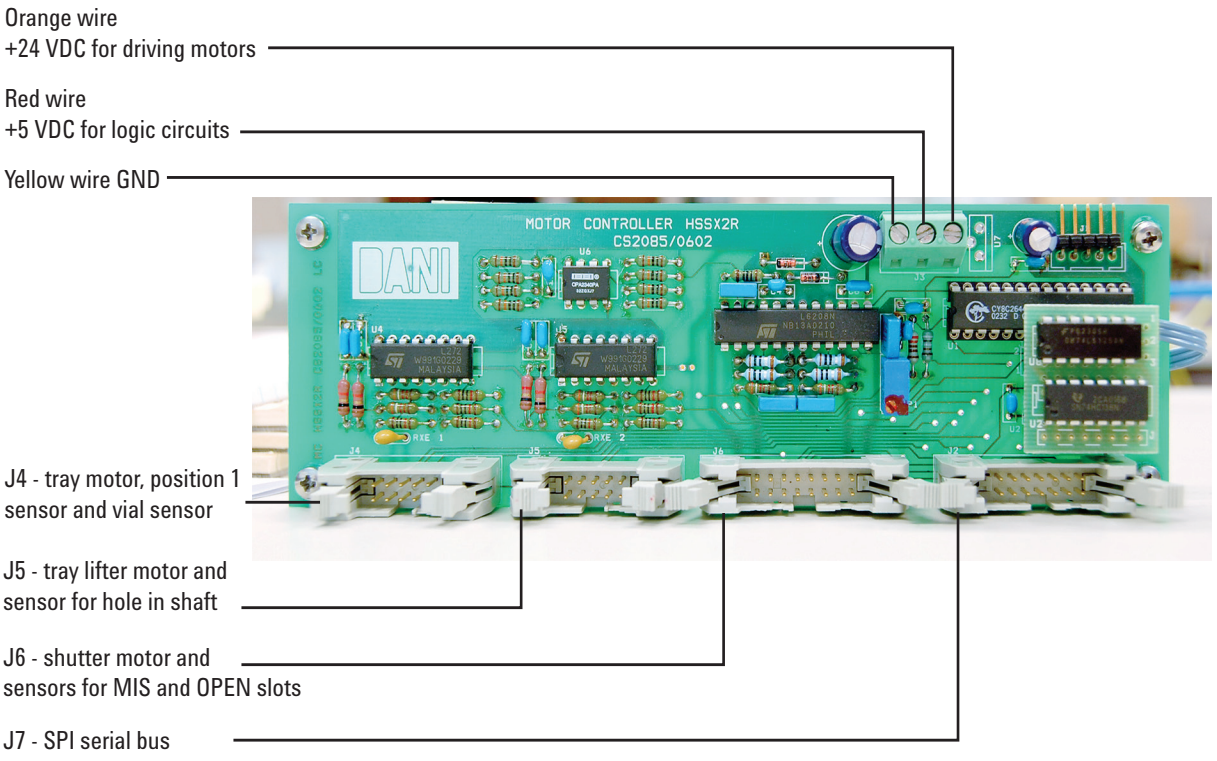


Figure 239 Motor controller 1

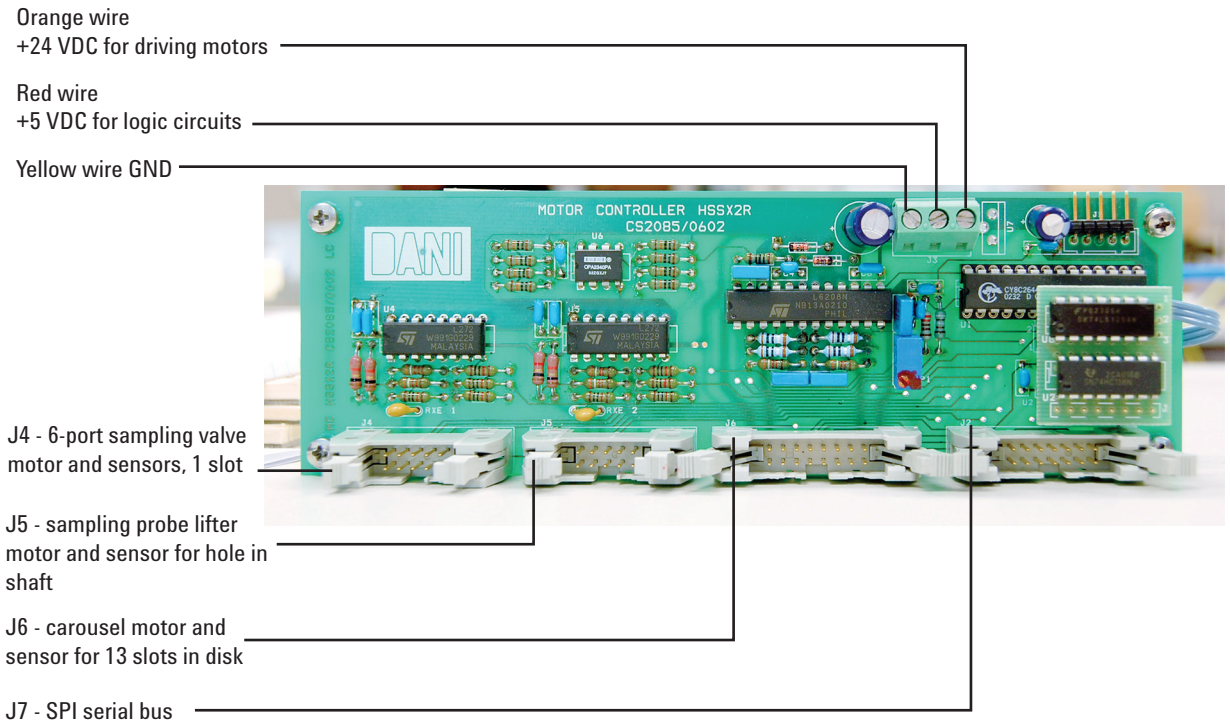


Figure 240 Motor controller 2

Pressure sensor

The pressure sensors reads carrier gas pressure or vial pressure using pressure transducers and provides this information to the processor board. Both channels are calibrated at the factory. ***Do not touch gain or offset in the field.*** The pressure sensor uses SPI address = 5.

Firmware on this board can not be upgraded in the field.

Replacement part

3411500115 Pressure sensor board

Remove the pressure sensor board

1 Power OFF and disconnect the power cord.

2 Open the pneumatics cover. See "Accessing the components inside the pneumatics compartment"on page 176.

3 Unplug the ribbon cable. See Figure 241.

4 Use a screwdriver to remove the power cables.

CAUTION Use a wrench to hold the fitting on the transducer and another wrench to hold the gas line nut. The transducer is fragile. Do not damage it while loosening the connection.

5 Disconnect the two gas lines using two wrenches.

6 Remove the screws in the corners of the board and remove the pressure controller PCA.

Replace the pressure sensor board

1 Set the jumper on pin 5 of JP1.

2 Installation is the reverse of the above steps.

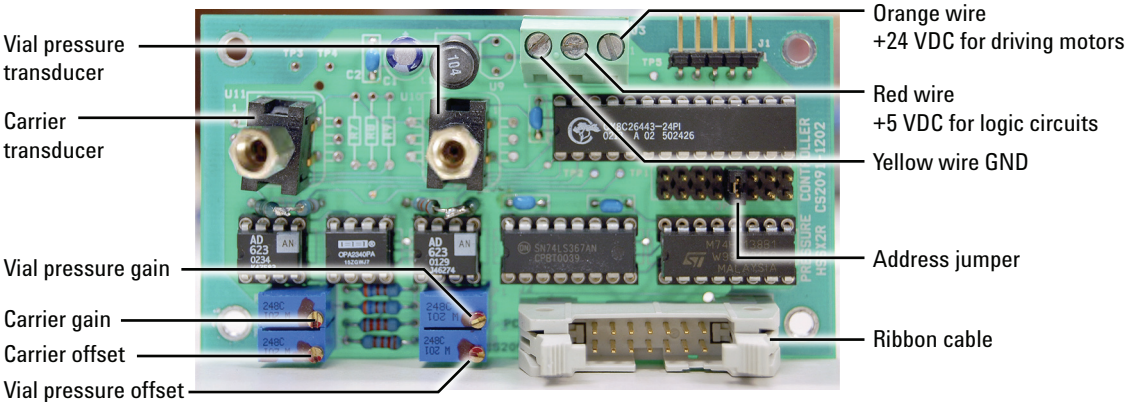


Figure 241 Pressure sensor board

Processor

The processor is the main controller and on-board computer. The firmware on this board is flashable.

The main processor performs the following functions:

- Receives instructions from keypad and external software applications
- Sends instructions to peripheral PCAs
- Continually monitors their status
- Sends status to display and external software applications

Replacement part

3411500114 Processor board

Remove the processor board

1 Power OFF and disconnect the power cord.

2 Remove the HS front cover. See “Accessing the components inside the front panel”on page 173.

3 Unplug the ribbon cables from the board. Label the cables as you disconnect them. See Figure 242.

4 Use a screwdriver to remove the power cables.

5 Remove the screws in the corners of the board and remove the processor board.

Adjust the contrast of the display screen

1 Connect the processor board.

1 Turn the HS power ON.

2 Locate the potentiometer. See Figure 242.

3 Turn the red screw with a flat blade screwdriver while looking at the display screen.

Replace the processor board

Installation is the reverse of the above steps.

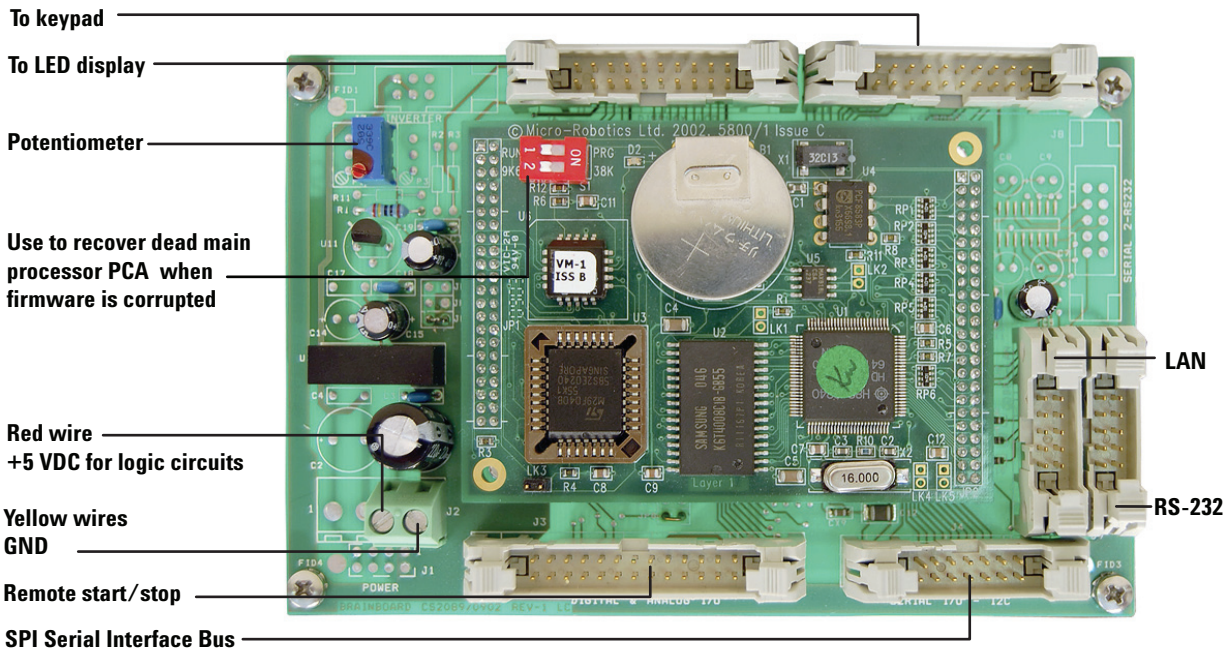


Figure 242 Processor board

Communications board

The communications board contains connectors and converters for external communications:

- LAN to RS-232 and vice-versa.
- Generates remote start/stop signal.
- Passes RS-232.
- Connects directly to main processor PCA.

Replacement part

0410105040 Communications board

Remove the communications board

To replace the communications board:

1 Power OFF and disconnect the power cord.

2 Remove the HS rear panel. See “Accessing the components inside the rear panel”on page 175.

3 Unplug the ribbon cables. See Figure 244.

4 Remove the two attachment screws located on the back panel. See Figure 243.

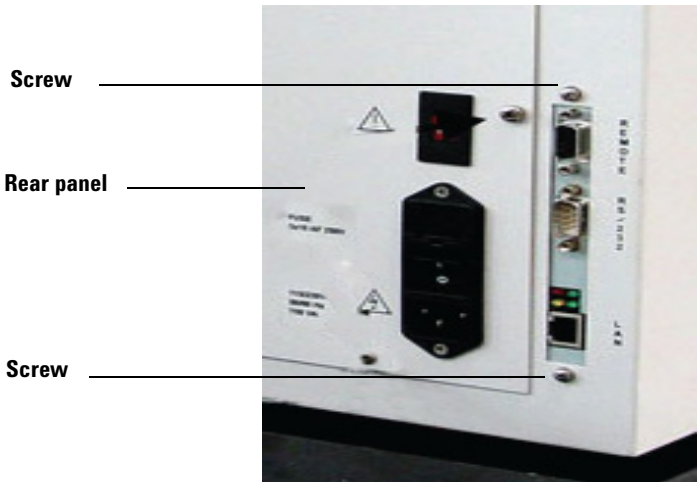


Figure 243 Screws attaching the communications board

5 Remove the communications board.

Replace the communications board

Installation is the reverse of the above steps.

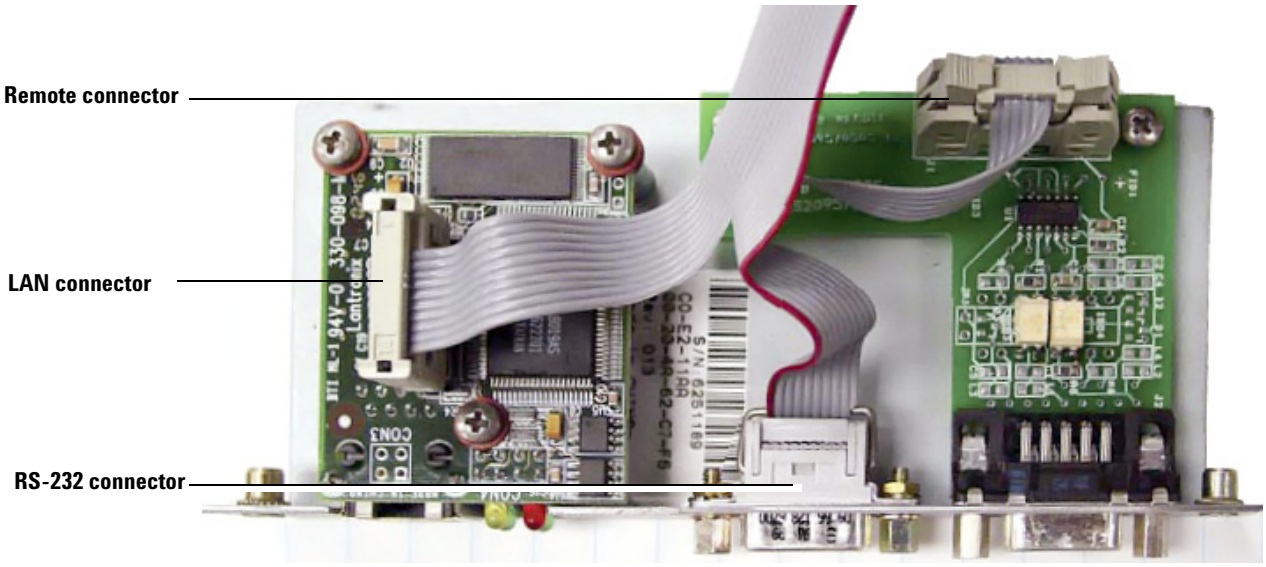


Figure 244 Communications board

Operating Descriptions

Solenoid valve

The orange wire is always a24 VDC when measured against ground (HS chassis). *Please pay attention, orange wire is not common ground it is common 24V.*

Red/yellow and blue/yellow wires will change voltage (when measured against ground) depending on valve states.

Vo = orange wire voltage
Vry = red/yellow voltage
Vby = blue /yellow voltage

Pressurization valve is normally open (ON). A de-energized solenoid valve coil maintains gas flow through valve.

- Vry = 24V (measurement of red/yellow wire against ground)
- Vo – Vry = 0V (measure across orange wire and red/yellow wire)

When pressurization valve is closed (OFF) energizing solenoid valve stops gas flow through valve.

- Vry = 0V (measurement of red/yellow wire against ground)
- Vo – Vry = 24V (measure across orange wire and red/yellow wire)

Vent valve is normally closed (OFF).

- Vby = 24V (measurement of blue/yellow wire against ground)
- Vo – Vby = 0V (measure across orange wire and blue/yellow wire)

When vent valve is open (ON).

- Vby = 0V (measurement of blue/yellow wire against ground)
- Vo – Vby = 24V (measure across orange wire and blue/yellow wire)

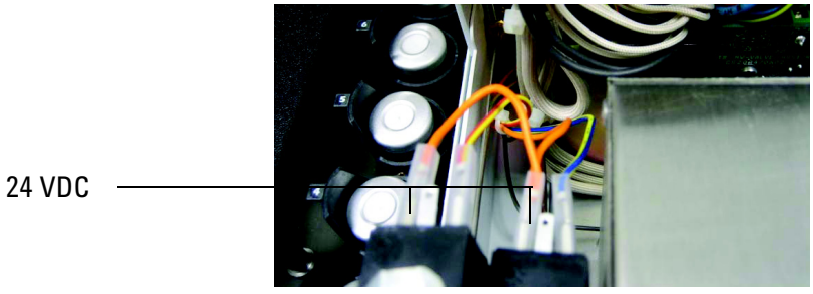


Figure 245 Solenoid valve wiring

Tray

The main processor PCA sends commands over the serial bus to address 1, the motor controller 1 PCA board, to run the tray motor a fixed number of revolutions at a specified rotational speed. To locate the number 1 vial position, the motor is sent a signal to run until the position 1 optical sensor detects the position 1 tab on the tray chain. When the position 1 optical sensor I/O pin's measured voltage reads 0.2 VDC or less, the tray has vial 1 in the home position. When the position 1 optical sensor I/O pin's measured voltage is closer to 4.8 VDC the vial is not in position 1. From the vial 1 position, the main processor PCA keeps track of the number of revolutions it travels from the oven entry (home) location. It knows how many revolutions from the home location that every other vial's position on the chain is located, and can therefore send any vial location on the tray to the oven entry (home) location.

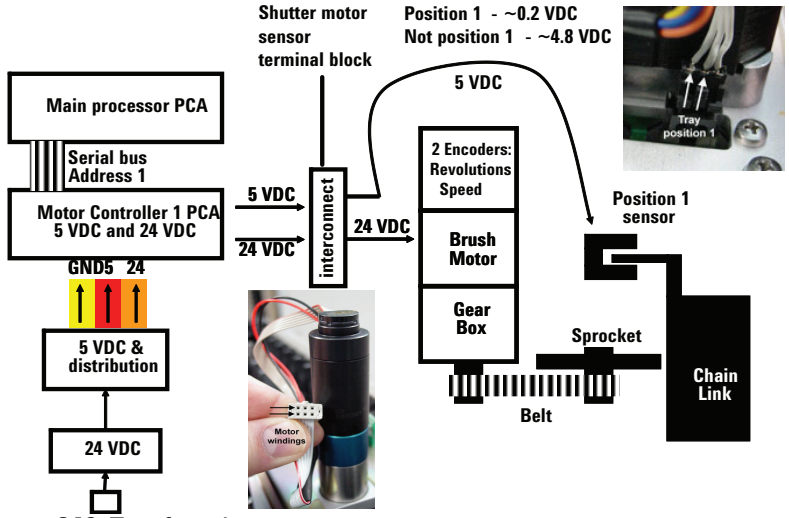


Figure 246 Tray function

The 24 VDC power supply provides 24 VDC power to the 5 VDC & distribution board where part of it is converted to 5 VDC and sent to the motor controller 1 PCA board along with 24 VDC power. The 24 VDC power is used by the motor controller 1 PCA board to power three motors including the tray motor. The ribbon cable attached to J4 on the motor controller 1 PCA board runs to connector J1 on the shutter motor-sensor terminal block and carries the 24 VDC motor drive, the 5 VDC and ground to the position 1 optical sensor and the I/O return signal from the position 1 optical sensor. The optical sensor attaches to connector J4 and the tray motor connector J3 on the shutter motor-sensor terminal block.

Shutter

The main processor PCA sends commands over the serial bus to address 1, the motor controller 1 PCA board, to run the shutter stepper motor in a clockwise or counterclockwise rotation until stopped by an optical sensor or rotation count. To locate the OPEN shutter position, the motor is sent a signal to run until the OPEN position optical sensor detects the disk slot. To locate the MID shutter position, the motor is sent a signal to run until the MID position optical sensor detects the disk slot. To close the shutter, the shutter motor is run a fixed number of revolutions past the MID position.

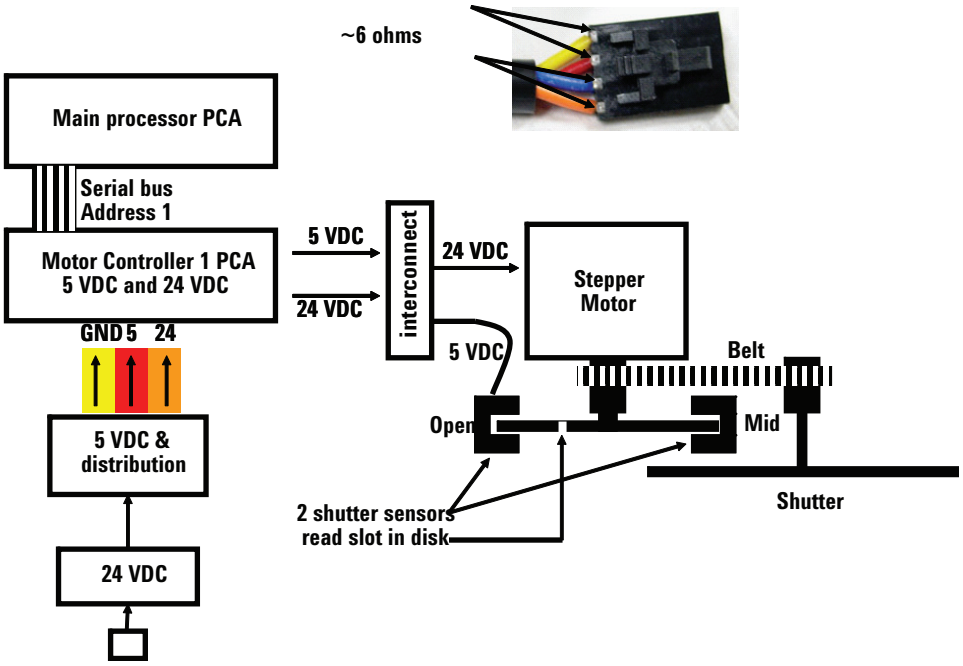


Figure 247 Shutter function

The 24 VDC power supply provides 24 VDC power to the 5 VDC & distribution board where part of it is converted to 5 VDC and sent to the motor controller 1 PCA board along with 24 VDC power. The 24 VDC power is used by the motor controller 1 PCA board to power three motors including the shutter motor. The ribbon cable attached to J6 on the motor controller 1 PCA board runs to connector J2 on the shutter motor-sensor terminal block and carries the 24 VDC motor drive, the 5 VDC and ground to the MID and OPEN position optical sensor and the I/O return signals from the MID and OPEN position optical sensors which are mounted to the bottom of the shutter motor-sensor terminal block. The shutter motor attaches to connection J5 of the shutter motor-sensor terminal block.

Tray lifter

The main processor PCA sends commands over the serial bus to address 1, the motor controller 1 PCA board, to run the tray lifter motor in a clockwise or counterclockwise rotation until stopped by an optical sensor or rotation count. To locate the home (lowered) position, the motor is sent a signal to run until the home optical sensor detects a hole in the threaded drive. To lift the vial to the tray, the tray lifter motor is run a fixed number of revolutions past the home position. To lower the tray lifter to the home position, the motor is sent a signal to run in the opposite direction (from lifting) until the optical sensor detects the hole in the shaft at which point the motor stops. With the vial lifter in the home position the carousel can rotate if the sampler probe lifter is also in the home (lowered) position.

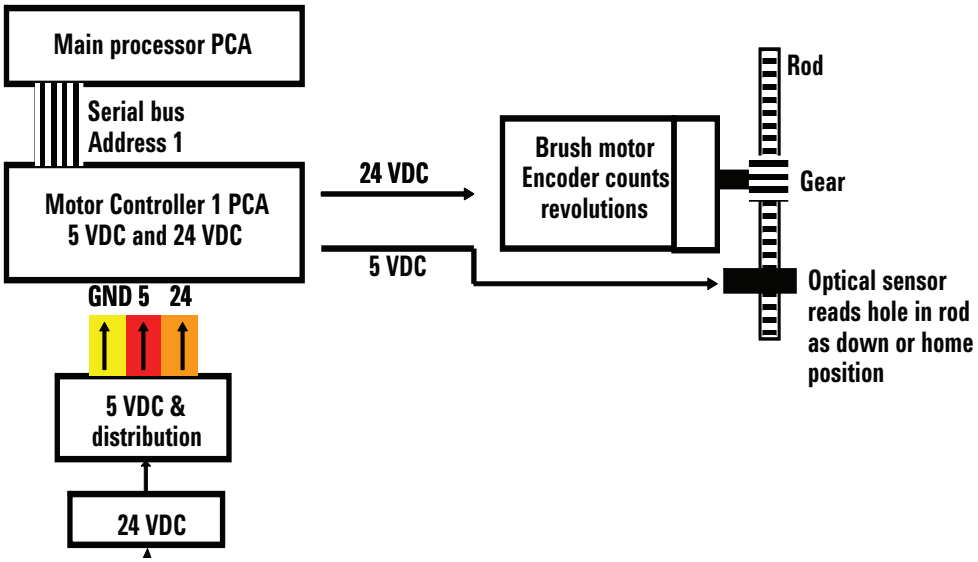


Figure 248 Tray lifter function

The 24 VDC power supply provides 24 VDC power to the 5 VDC & distribution board where part of it is converted to 5 VDC and sent to the motor controller 1 PCA board along with 24 VDC power. The 24 VDC power is used by the motor controller 1 PCA board to power three motors including the tray lifter motor. The ribbon cable attached to J5 on the motor controller 1 PCA board runs to connector J1 on the tray lifter terminal block and carries the 24 VDC motor drive, the 5 VDC and ground to the sensors and the sensor I/O return signals from the home position optical sensors which is mounted to the bottom of the tray lifter motor terminal block and the motor revolution counter. The tray lifter motor attaches to connection J2 of the tray lifter motor terminal block and the motor revolution counter attaches to J3.

Vial sensor

The main processor PCA sends commands over the serial bus to address 1, the motor controller 1 PCA board, to determine if a vial is present in the vial location over the oven opening. When the vial present optical sensor I/O pin's measured voltage reads 0.2 VDC or less, the tray has a vial in the location over the oven opening. When the vial present optical sensor I/O pin's measured voltage is closer to 4.8 VDC the vial is not in position over the oven opening.

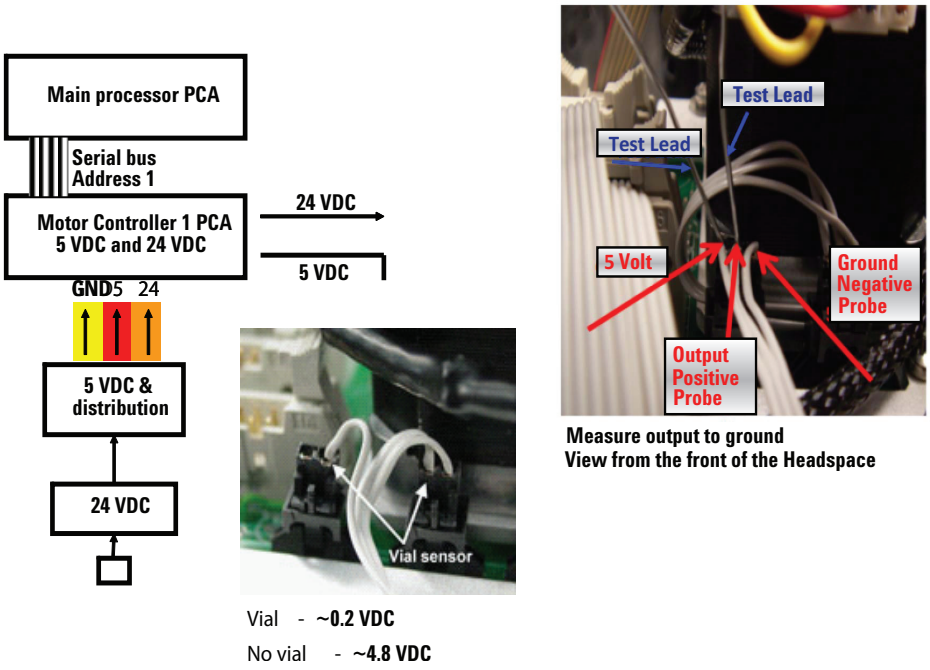


Figure 249 Vial sensor function

The 24 VDC power supply provides 24 VDC power to the 5 VDC & distribution board where part of it is converted to 5 VDC and sent to the motor controller 1 PCA board. The ribbon cable attached to J4 on the motor controller 1 PCA board runs to connector J1 on the shutter motor-sensor terminal block and carries the 5 VDC and ground to the vial present optical sensor and the I/O return signal from the vial present optical sensor. The vial present optical sensor attaches to connector J4 on the shutter motor-sensor terminal block.

Carousel

The main processor PCA sends commands over the serial bus to address 2, the motor controller 2 PCA board, to run the Carousel stepper motor until stopped by an optical sensor or rotation count. To locate the carousel's home position, the motor is sent a signal to run until the optical sensor detects a disk slot spaced fewer motor revolutions apart than the other 12 slots (13 slots total). From the home position, each slot in the disk represents a known carousel vial location. With both vial lifters in their home position the carousel can rotate.

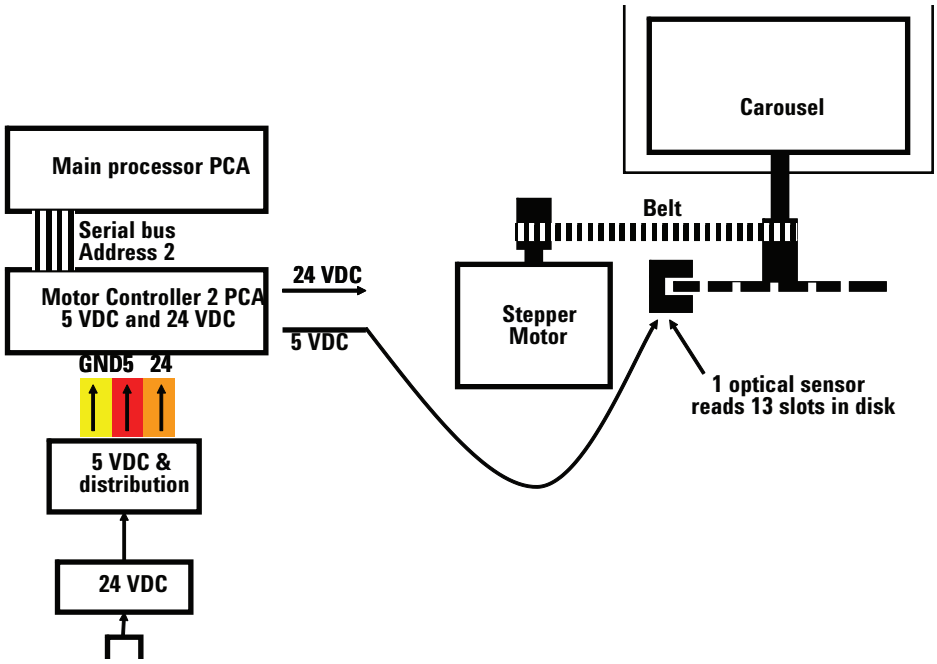


Figure 250 Carousel function

The 24 VDC power supply provides 24 VDC power to the 5 VDC & distribution board where part of it is converted to 5 VDC and sent to the motor controller 2 PCA board along with 24 VDC power. The 24 VDC power is used by the motor controller 2 PCA board to power three motors including the Carousel motor. The ribbon cable attached to J6 on the motor controller 2 PCA board runs to connector J1 located on the carousel terminal block and it carries the 24 VDC for motor drive, the 5 VDC and ground to the optical sensor and the sensor I/O return signal. The optical sensor is mounted on the carousel terminal block. The carousel motor attaches to connection J2 of the Carousel terminal block.

Sampler probe lifter

The main processor PCA sends commands over the serial bus to address 2, the motor controller 2 PCA board, to run the sample probe lifter motor in a clockwise or counterclockwise rotation until stopped by an optical sensor or rotation count. To locate the home (lowered) position, the motor is sent a signal to run until the home optical sensor detects a hole in the threaded drive. To lift the vial to the sample probe, the sample probe lifter motor is run a fixed number of revolutions past the home position. To lower the sample probe lifter to the home position, the motor is sent a signal to run in the opposite direction (from lifting) until the optical sensor detects the hole in the shaft at which point the motor stops. With the vial lifter in the home position the carousel can rotate if the tray lifter is also in the home (lowered) position.

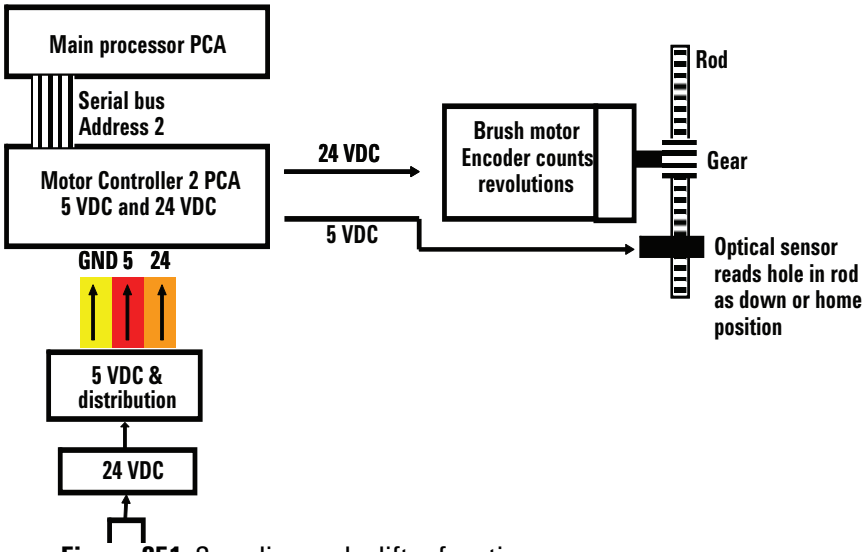


Figure 251 Sampling probe lifter function

The 24 VDC power supply provides 24 VDC power to the 5 VDC & distribution board where part of it is converted to 5 VDC and sent to the motor controller 2 PCA board along with 24 VDC power. The 24 VDC power is used by the motor controller 2 PCA board to power three motors including the sample probe lifter motor. The ribbon cable attached to J5 on the motor controller 2 PCA board runs to connector J1 on the sample probe lifter terminal block and carries the 24 VDC motor drive, the 5 VDC and ground to the sensors and the sensor I/O return signals from the home position optical sensor which is mounted to the bottom of the sampler probe lifter terminal block and the motor revolution counter. The sampler probe lifter motor attaches to connection J2 of the sampler probe lifter terminal block and the motor revolution counter attaches to connection J3.

Solenoid valves

The solenoid valves receive 24 volt power to one side of their solenoid coil whenever the HS is powered. The other side of the coil is either grounded (energized) or isolated from ground (de-energized) by control circuits on temperature controller 1 PCA.

The main processor PCA communicates with the temperature controller 1 PCA over the serial bus using address 3. It can send a command to the temperature controller 1 PCA to energize or de-energize the vial pressurization and vent solenoid valves.

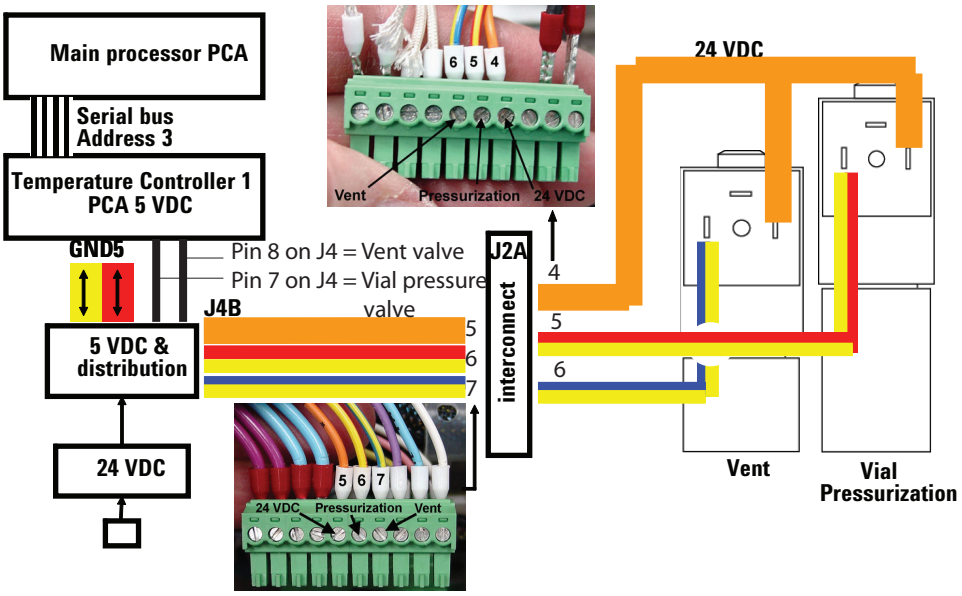


Figure 252 Solenoid valves function

Pin 7 on ribbon connector JP4 of the temperature controller 1 PCA is grounded to close the normally open vial pressurization valve or isolated from ground to open the valve. Likewise, pin 8 on ribbon connector JP4 of the temperature controller 1 PCA is grounded to open the normally closed vent valve or isolated from ground to close the valve.

The 5 VDC & Distribution board supplies 24 VDC to both solenoid valves. Additionally, the red/yellow vial pressurization and the green/yellow vent valve wires are passed through this board using the ribbon cable connecting to the temperature controller 1 PCA.

Oven heated zone

The transformer converts filtered line voltage to 48 V for the oven heater. The 48 V fused supply from the transformer to the oven heater is controlled by energizing the oven relay when heating is required. When the relay is energized, LED 1 is lit. The fuse for the heater is located in the transformer terminal block. The heater is attached to pins 1 and 2 on connector J1a of the oven terminal block and the 48 V supply from the relay is attached to pins 1 and 2 of connector J1B.

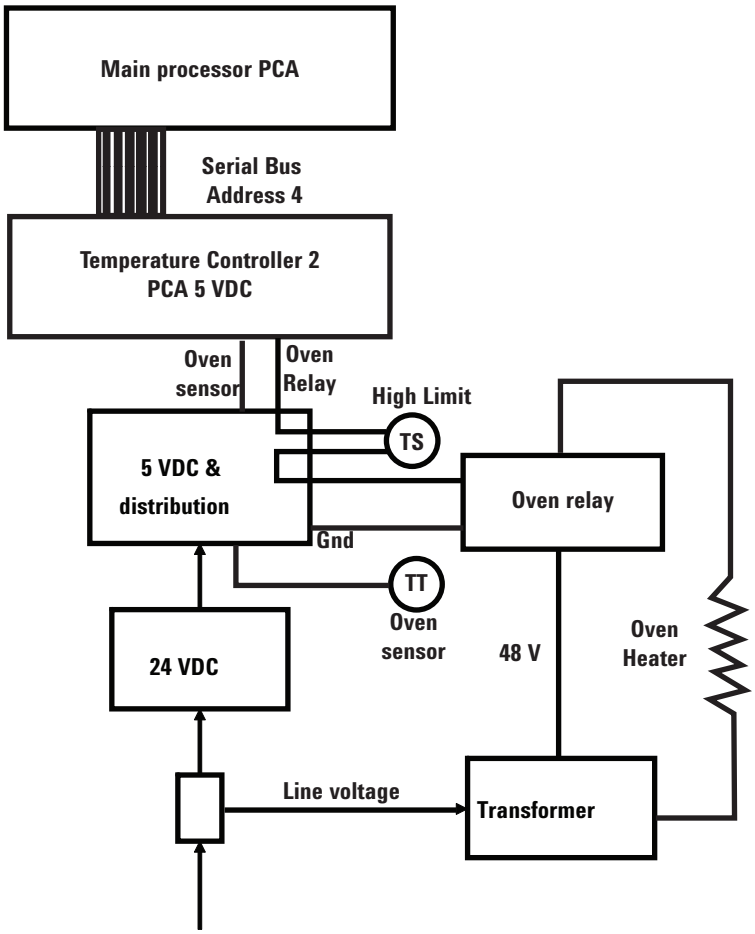


Figure 253 Oven heated zone

The main processor PCA sends the oven temperature setpoint over the serial bus to address 4, the temperature controller 2 PCA board which stores the setpoint. This setpoint is compared to the actual oven temperature which is measured by a pt 100 temperature sensor located in the oven. If the setpoint temperature is greater than the oven temperature, temperature controller 2 PCA board sends a signal to close the oven heater

relay and provide 48 V power to the oven heater. The signal to power the oven relay is located on pin 5 of J4 on the temperature controller 2 PCA board. This signal wire is connected to pin 5 of the power supply board. The control power to energize the oven heater relay is supplied on pins 1 and 2 of connector J4A on the power supply board. An oven high temperature switch opens the oven heater relay shutting down the oven heater if a safe oven temperature is exceeded. When this happens, LED 4 on the power supply is lit. This temperature limit switch is wired to pins 5 and 6 of the oven terminal block at connector J2A and exits the terminal block on pins 5 and 6 of connector J2B. These wires are then attached to pins 7 and 8 of connector J4A on the power supply board.

A pt 100 temperature sensor transmits an oven temperature signal to temperature controller 2 PCA. The pt 100 temperature sensor changes resistance as the temperature changes. This change in resistance is used to control the temperature of the oven. The temperature sensor is attached to the oven terminal block at connector J2A located in the bottom of the HS. From here the temperature sensor wires exit the oven terminal block at connector J2B pins 8 and 9 which run to the power supply board connector J4B pins 9 and 10. The temperature signal exits the power supply board at connector J5 pins 1 (oven sensor) and 3 (AGND) and enter the temperature controller 2 PCA at connector J4 pins 1 (oven sensor) and 3 (AGND).

Loop heated zone

The main processor PCA sends the loop temperature setpoint over the serial bus to address 3, the temperature controller 1 PCA board which stores the setpoint. This setpoint is compared to the actual loop temperature which is measured by a pt 100 temperature sensor located in the sample probe structure. If the setpoint temperature is greater than the loop temperature, temperature controller 1 PCA board sends a signal to the power board loop heater FET to provide 24 V power to the loop heater. When the loop heater is active, LED 2 on the power supply board lights. Fuse 4 (6 A, 125 V) located on the power supply board protects the power circuit.

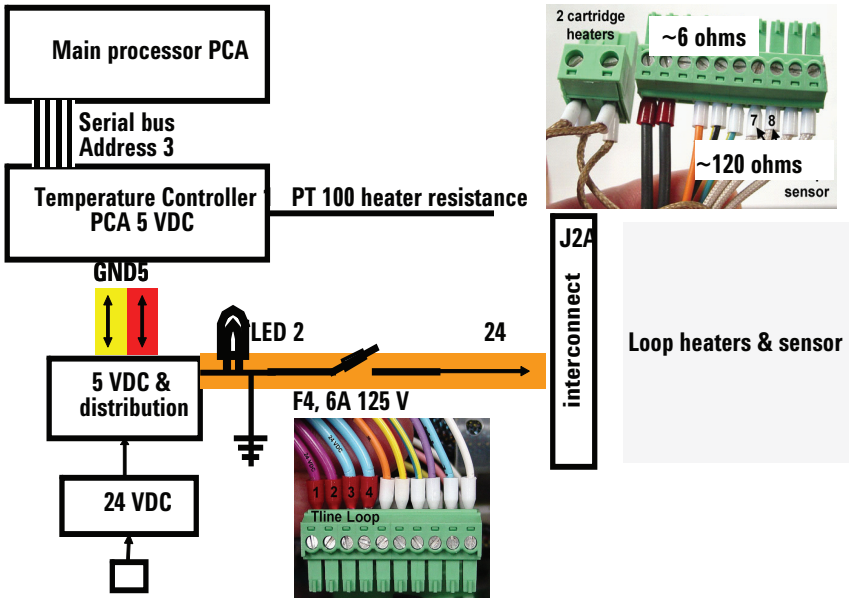


Figure 254 Loop heated zone

This signal from temperature controller 1 PCA is output from pin 5 of connector J4 and travels to pin 5 of connector J5 on the power supply board. The 24 V output of the FET exits pins 1 and 2 of connector J4B on the power supply board and run to pins 1 and 2 of connector J1B on the pneumatic compartment terminal block. The loop heater is connected to pins 1 and 2 of connector J1A of the terminal block.

The loop temperature sensor located in the sample probe structure is attached to pins 7 and 8 of connector J2A on the pneumatic compartment terminal block. The signal exits the terminal block on pins 7 and 8 of connector J2B and runs to pins 8 and 9 of connector J4B of the power supply board. The temperature signal exits the power supply board pins 1 and 3 of connector J5 and enters the temperature controller 1 PCA board on pins 1 (loop sensor) and 3 (AGND) of connector J4.

Transfer line heated zone

The main processor PCA sends the transfer line temperature setpoint over the serial bus to address 3, the temperature controller 1 PCA board which stores the setpoint. This setpoint is compared to the actual transfer line temperature which is measured by a pt 100 temperature sensor located in the transfer line. If the setpoint temperature is greater than the transfer line temperature, temperature controller 1 PCA board sends a signal to the power board transfer line heater FET to provide 24 V power to the transfer line heater. When the transfer line heater is active, LED 3 on the power supply board lights. Fuse 3 (6 A, 125 V) located on the power supply board protects the power circuit.

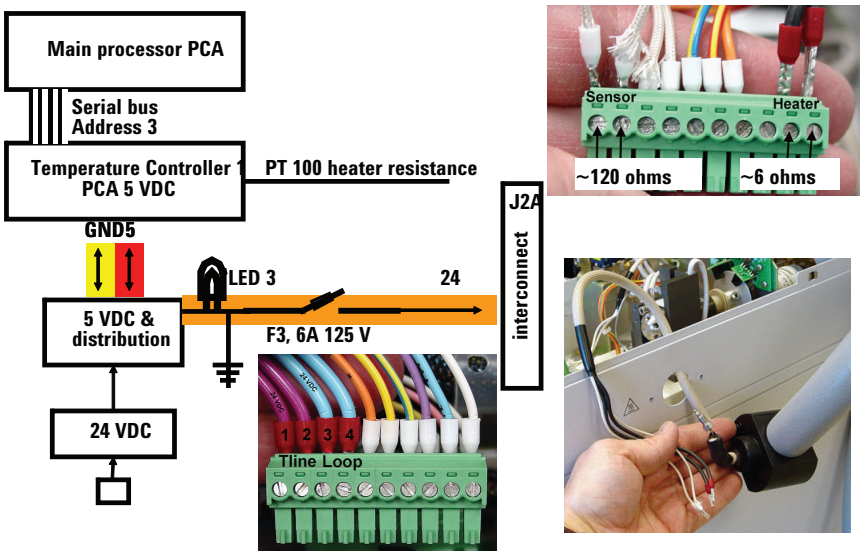


Figure 255 Transfer line heated zone

This signal from temperature controller 1 PCA is output from pin 6 of connector J4 and travels to pin 6 of connector J5 on the power supply board. The 24 V output of the FET exits pins 3 and 4 of connector J4B on the power supply board and run to pins 1 and 2 of connector J2B on the pneumatic compartment terminal block. The transfer line heater is connected to pins 1 and 2 of connector J2A of the terminal block.

The transfer line temperature sensor located in the transfer line is attached to pins 9 and 10 of connector J2A on the pneumatic compartment terminal block. The signal exits the terminal block on pins 9 and 10 of connector J2B and runs to pins 9 and 10 of connector J4B of the power supply board. The temperature signal exits the power supply board pins 2 and 3 of connector J5 and enters the temperature controller 1 PCA board on pins 2 (loop sensor) and 3 (AGND) of connector J4.

Pressure sensor

The pressure sensor located on the pneumatics compartment's rear panel has two pressure transducers. One transducer measures vial pressurization and the other transducer measures carrier gas pressure. These pressures are converted to digital values and read by the main processor PCA using serial bus address 5.

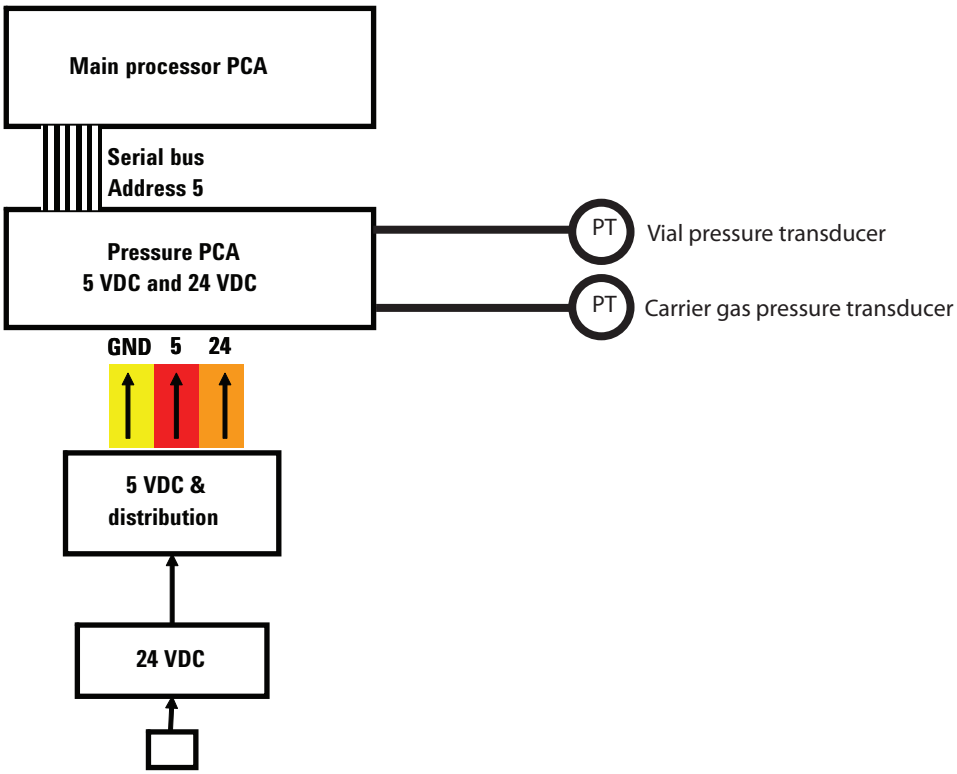


Figure 256 Pressure sensor function

Cabling

PCA boards

The processor board communicates via ribbon cables with:

- 2 Temperature controller PCAs
- 2 Motor controller PCAs
- Pressure transducer PCA
- Communications PCS
- Keypad
- Display

The front panel contains several controller PCAs. See “Accessing the components inside the front panel”on page 173 for details on opening the front panel.

Most connections are made with ribbon cables. Each ribbon cable is labeled with the name of its corresponding PCA board. For details see Figure 258, “Ribbon cable connections inside front panel”,” on page 205.

The power supply for each PCA comes from a bundle of wires that runs up the center of the front panel and branches off to each board. For details see Figure 259, “PCA Power wiring harness”,” on page 206 and Figure 260, “PCA Voltage and serial bus addresses”,” on page 207.

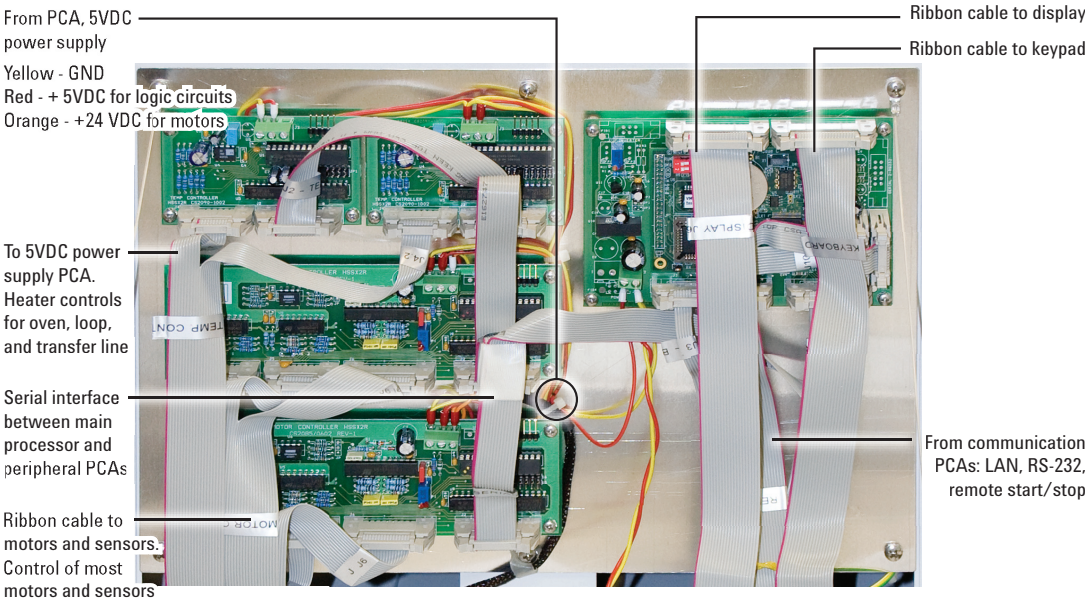


Figure 257 Cabling in front panel

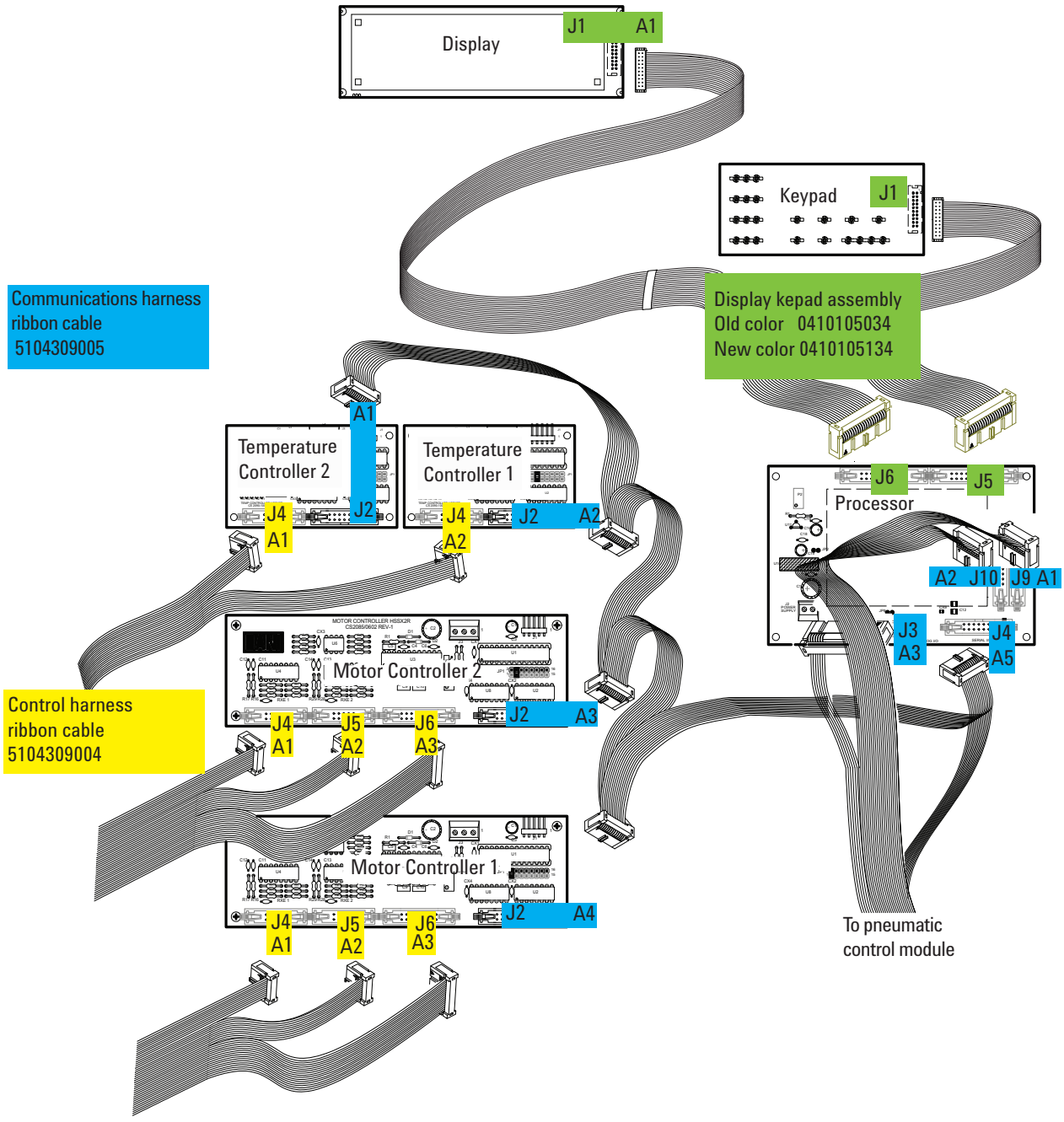


Figure 258 Ribbon cable connections inside front panel

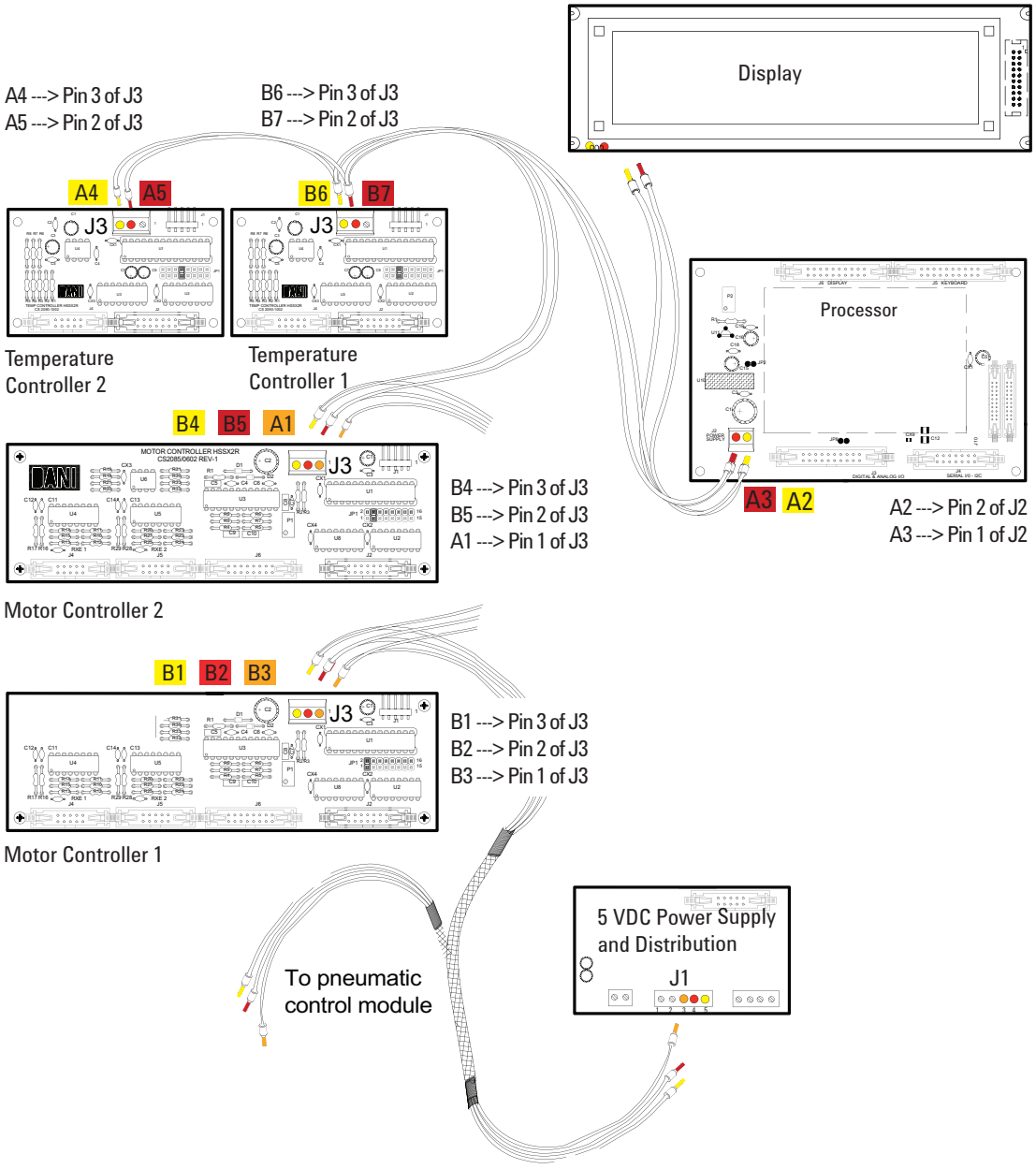


Figure 259 PCA Power wiring harness

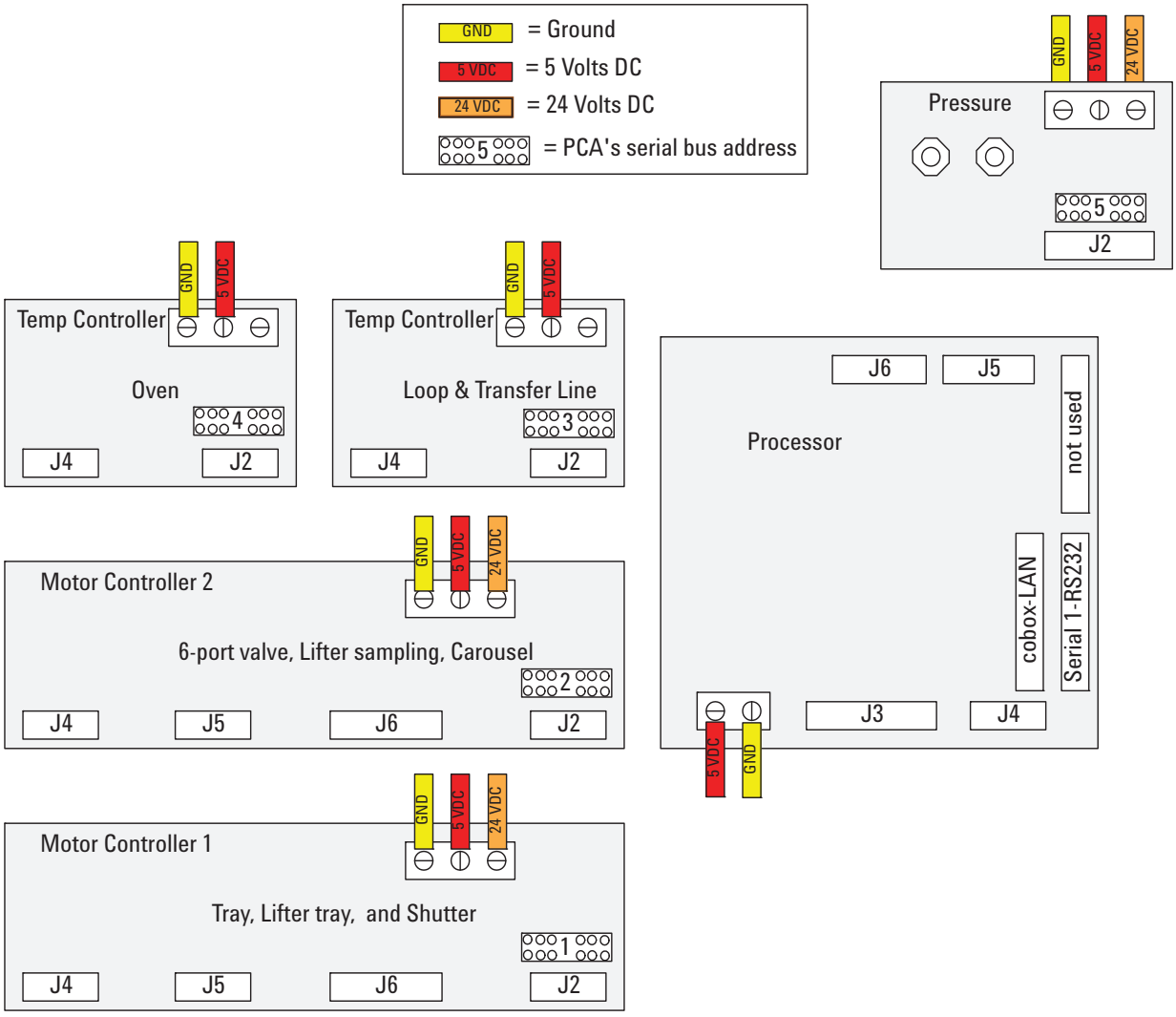


Figure 260 PCA Voltage and serial bus addresses

Power distribution

5 VDC Power distribution

The 5 VDC supply and power distribution board is located on the inside face of the HS back panel. See “Accessing the components inside the rear panel”on page 175 for details.

This board contains three fuses. See Figure 261 for locations and Table 35 on page 287 for part numbers.

- Fuse 1 – 1A, 250 V, Protects the motor controller circuits
- Fuse 3 – 6A, 125 V, Protects the transfer line heater circuit
- Fuse 4 – 6A, 125 V, Protects the loop heater circuit

This board also contains four LED indicators. See Figure 261:

- LED 1 – Oven heater
  ON when 5 VDC sent to close oven relay and provide 48VAC to the oven heater
- LED 2 – Loop cartridge heater
  ON when 5 VDC sent to close on-board relay and provide 24VDC to the loop cartridge heater
- LED 3 – Transfer line heater
  ON when 5 VDC sent to close on-board relay and provide 24VDC to transfer line heater
- LED 4 – Oven max temperature indicator
  ON when the oven max temperature switch opens

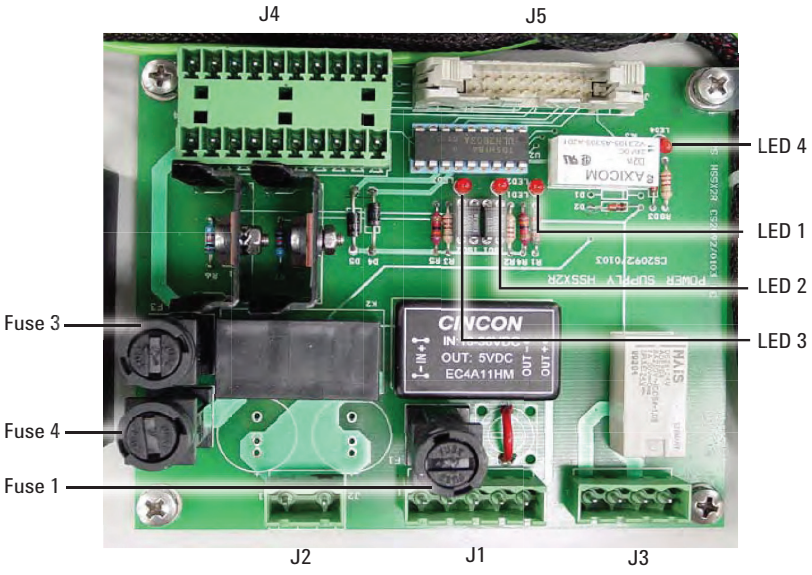


Figure 261 5 VDC supply and power distribution board fuses and LEDs

Power distribution for heated zones

Figure 262 shows power distribution associated with the heated zones including fuses, LEDs, and test points.

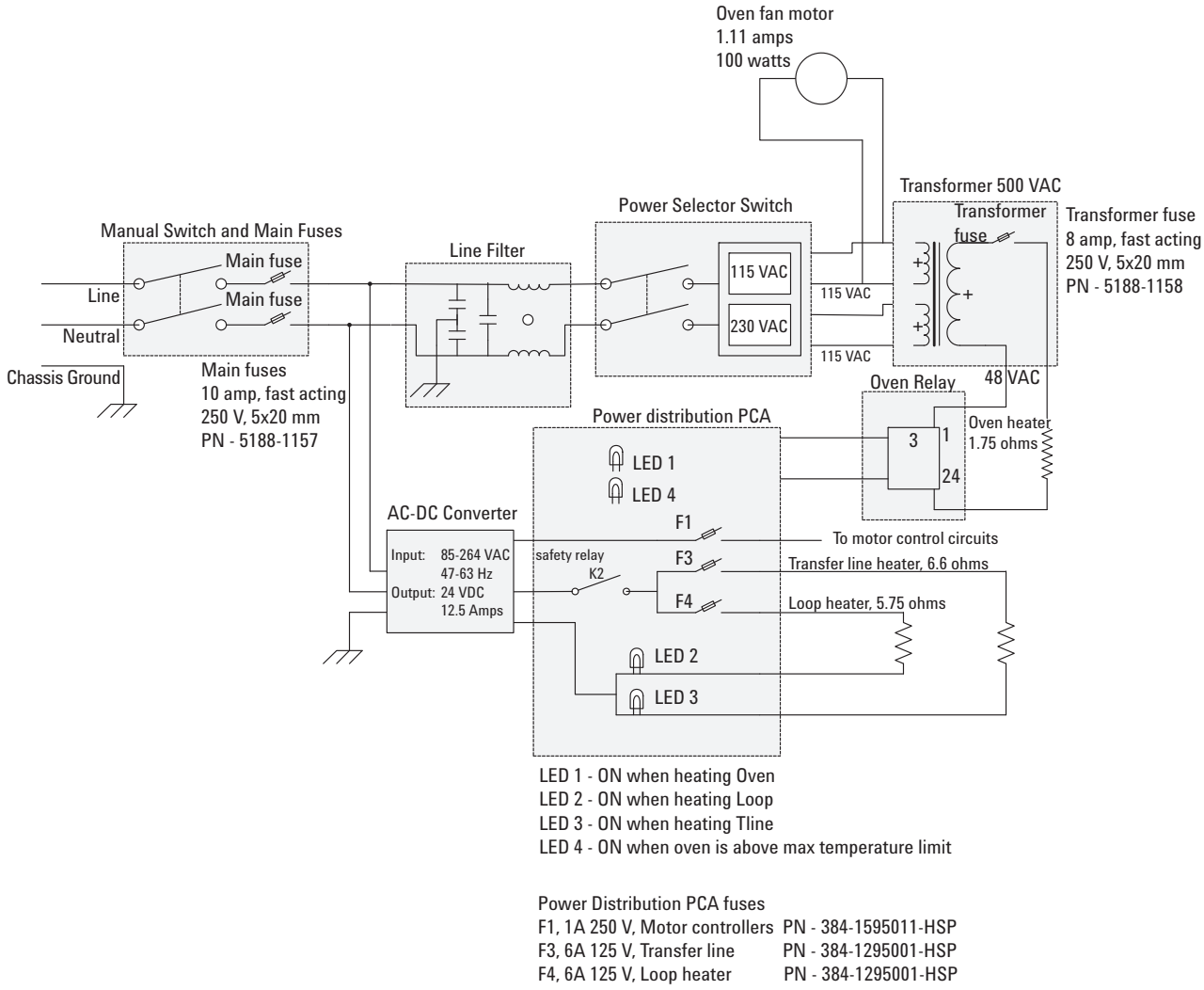


Figure 262 Power distribution

Electrical schematic

Continued on next page

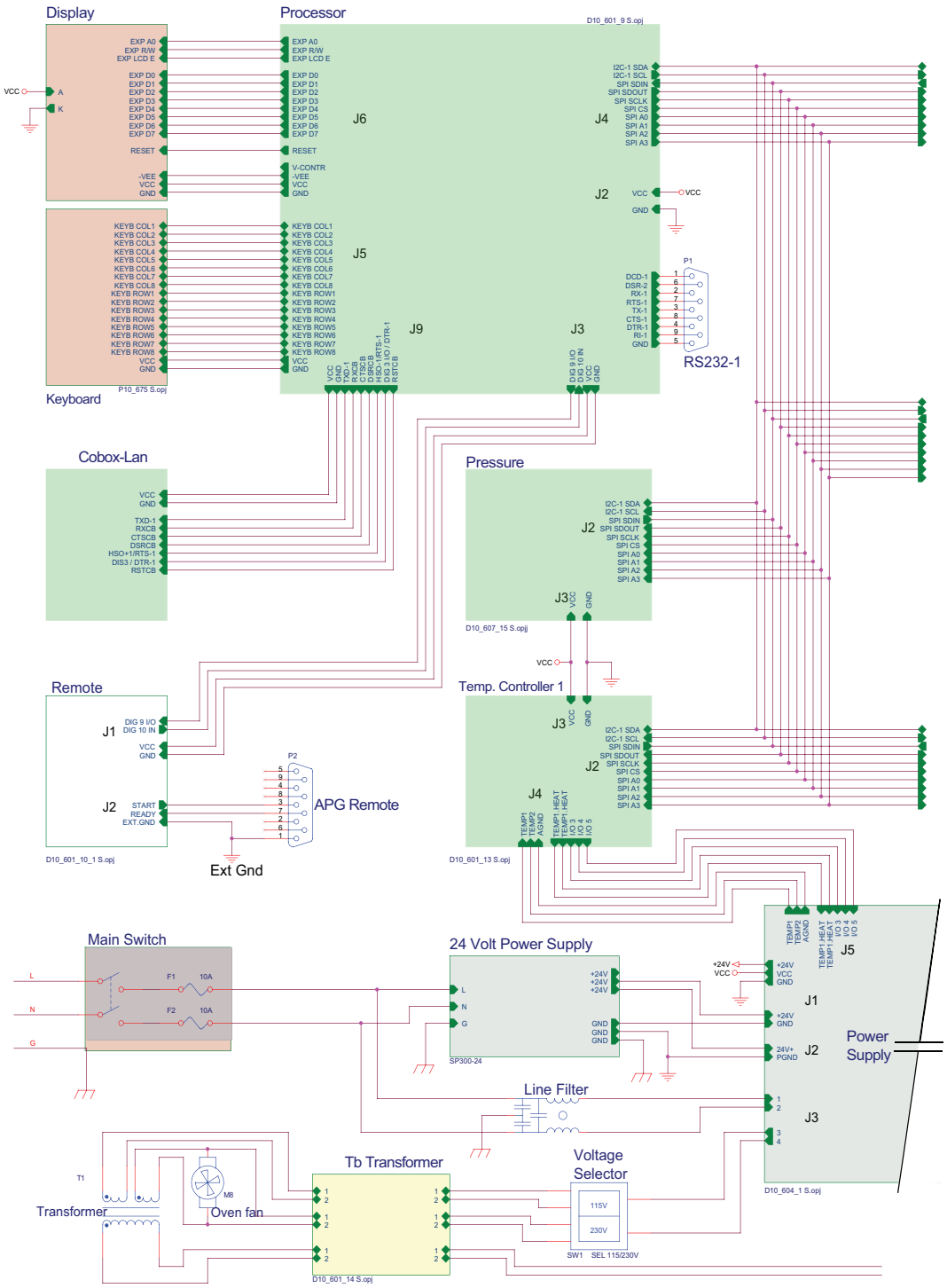


Figure 263 Electrical schematic - part A

Electrical schematic

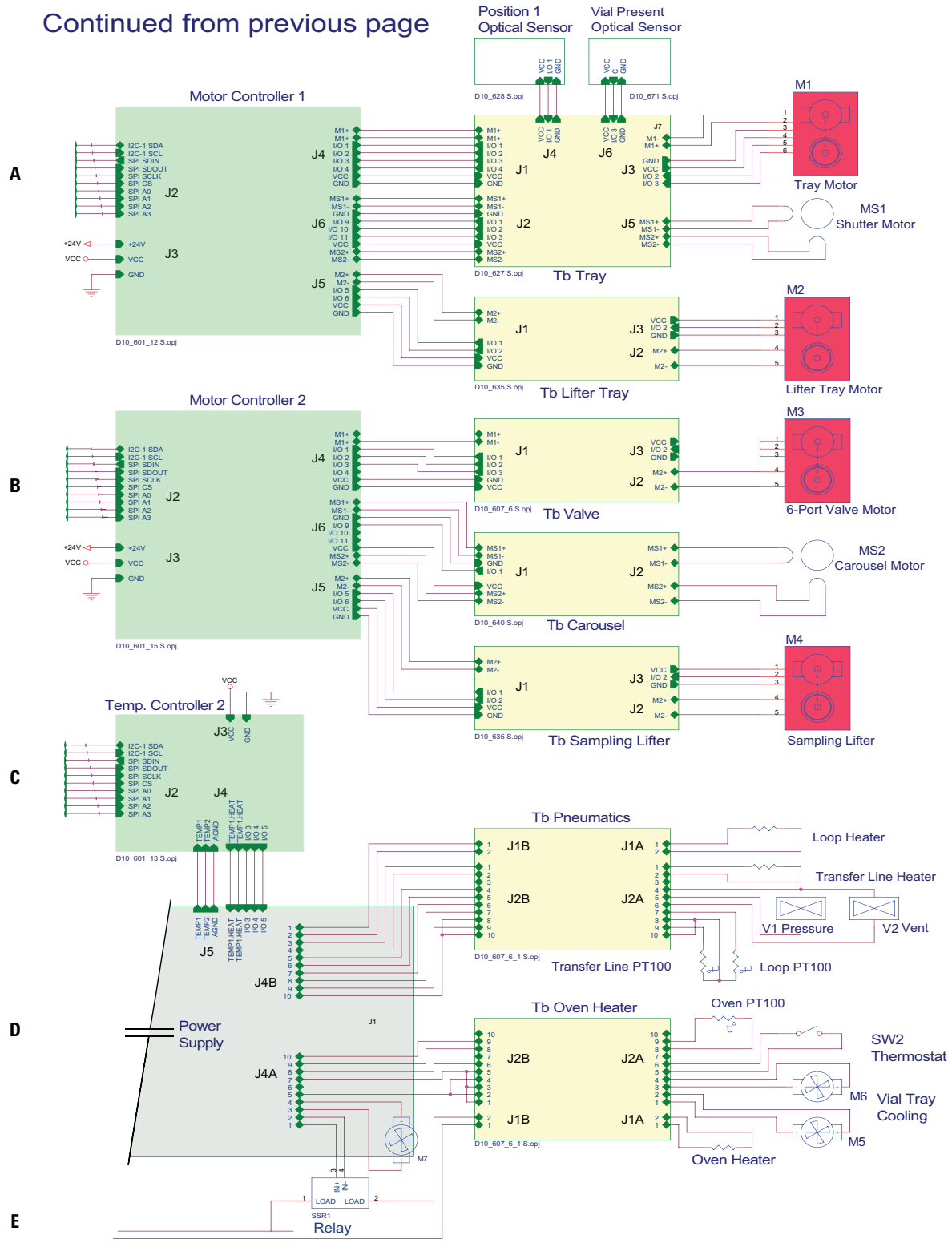


Figure 264 Electrical schematic - part B

7
Firmware and Updating Firmware

Firmware Overview

At the time of this publication there are eight firmware revisions. You can view the firmware revision installed on your HS from Advanced Function 19 or from the Power ON self-test.

The main processor has the only updatable firmware. All other firmware is non-flashable.

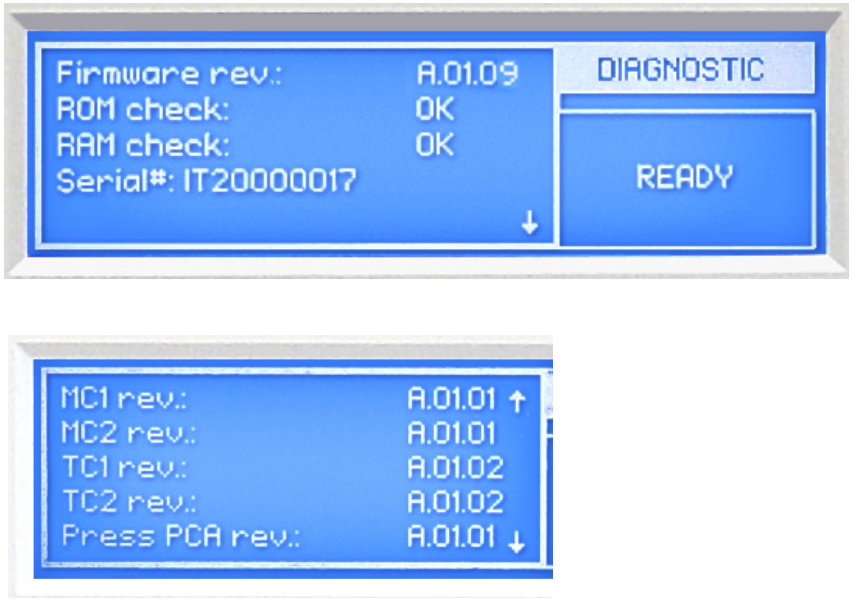


Figure 265 Firmware display screens

Updating Firmware

Methods of updating main processor firmware

- Advanced Function 5 diagnostic utility
- Agilent GC firmware update utility
- Through a HyperTerminal
- Through Instrument Utilities

Advanced function 5

1 Launch the diagnostic utility and connect to the HS.

2 Backup any customer methods and temperature zone calibration data. Select **Advanced Tests > Advanced Functions > Backup > Restore Headspace Data**.

3 Select **Advanced Tests > Advanced Functions > Update Firmware**.

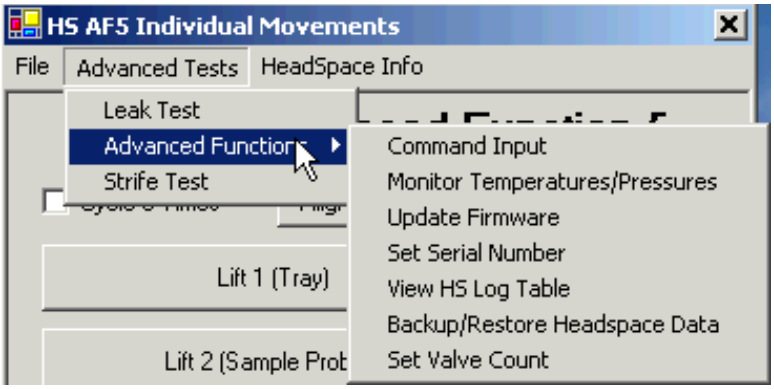


Figure 266 The advanced functions menu

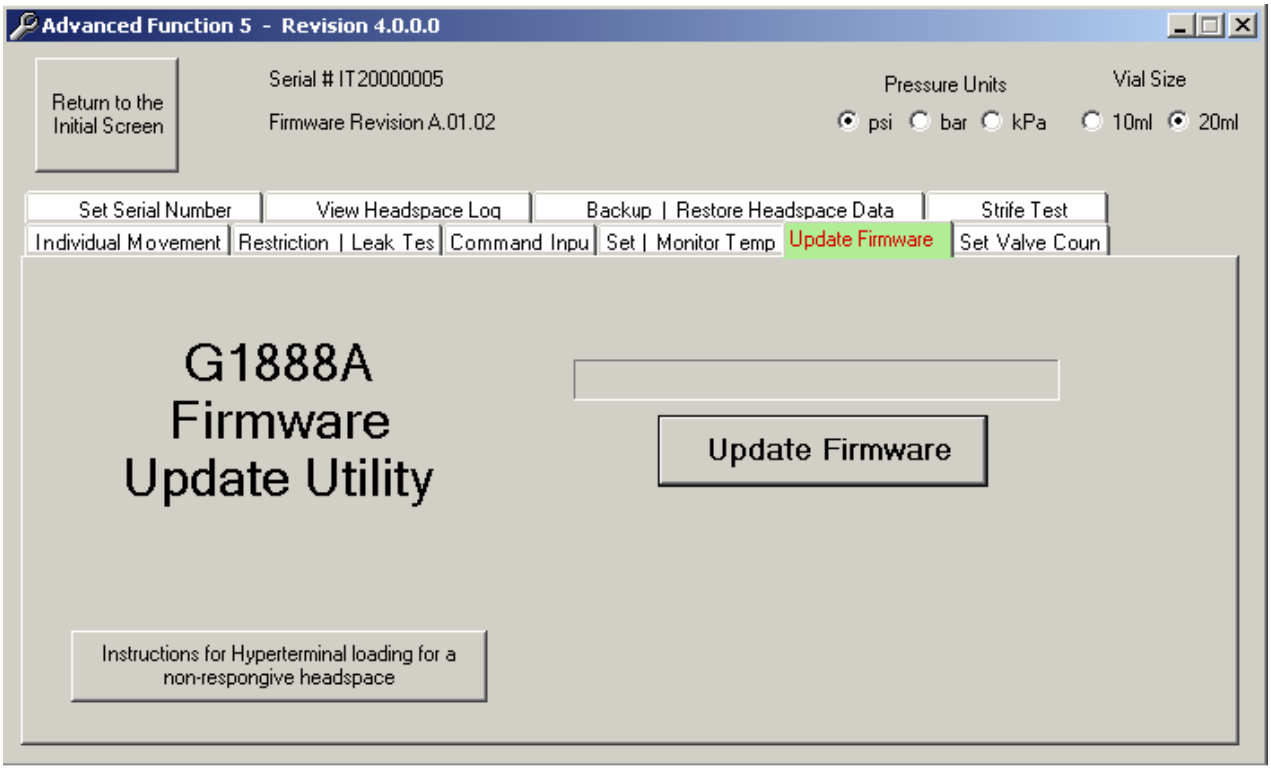


Figure 267 Update firmware with Advanced Function 5

4 When prompted browse and select the **<firmware>.txt** file.

Progress can be monitored by the progress bar. It will display the current record, total number of records and percentage of completion.

When **Update Firmware** is pressed, a **file open** box dialog is opened. When the proper firmware update file is selected, (.txt extension), the file is checked to insure that all lines conform to the proper construct for firmware update. If the file is ok, the firmware update will then proceed.

Filename of firmware update is displayed.

Response from the HS is displayed.

Agilent GC firmware update utility

1 Launch Agilent GC firmware update utility.
2 Select update G1888 HS.
3 Connect to HS.
4 When prompted select the **<firmware>.txt** file.
5 Power cycle the HS.

HyperTerminal

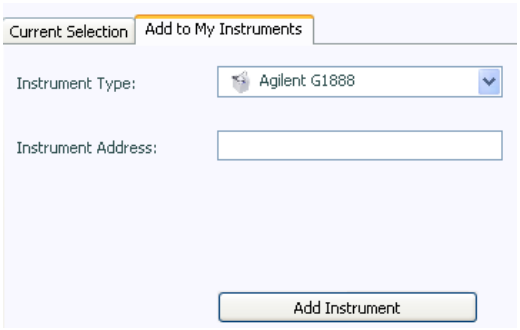
1 Select **Start > Accessories > Communications, > HyperTerminal.**
2 Configure the connection for LAN or RS-232.
3 Send commands to HS.
4 When prompted select **Transfer > Send text file**.
5 Browse and select the **<firmware>.txt** file.

Instrument Utilities

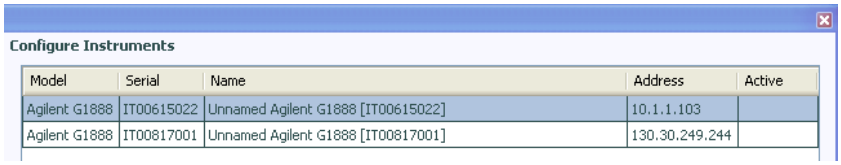
To update the firmware using Instrument Utilities you must first configure the instrument and then update the firmware.

Configure the Instrument

1 Start **Instrument Utilities**.
2 In the explorer pane, select **Configuration > Instruments**.
3 In the **Add to My Instruments** panel, select Agilent G1888 as the **Instrument Type**.
4 Enter the **Instrument Address**. If you are connected via RS232, you must type in the COM port (for example COM1). If you are connected VIA LAN, type in the IP address. Then select **Add Instrument**.



5 The instrument appears under **Configure Instruments**. Close the configuration screen.



Update Firmware

The Firmware Update utility requires full control of the instrument. Be sure to disconnect any Agilent data systems before using the Firmware Update utility.

Once you connect to an instrument in the **Firmware Update** screen, no other tasks can be performed on the instrument until you **Disconnect**.

The software maintains configuration information (including serial number) and the *active* method when updating a HS. However, any stored methods are lost. Click **Restore** to restore the active method after updating firmware.

1 Make sure the instrument is turned on and not in use.

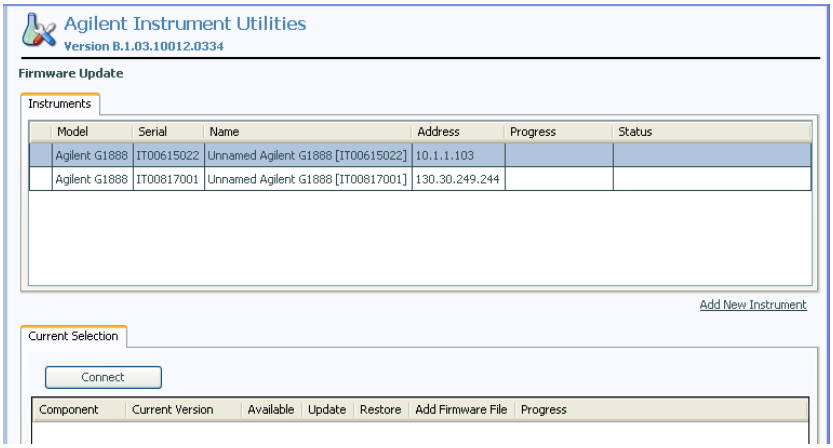
2 Record any local methods. (Methods stored in the HS will be lost during update.)

3 Start **Instrument Utilities**.

4 In the explorer pane, select **Firmware Update**.

5 In the **Firmware Upddate** screen, select the desired instrument from the **Instruments** list and select **Connect**.

- If the instrument is not available, select **Add New Instrument** to open **Configure Instruments**. (See "Configure the Instrument"on page 217). Add the new instrument, then return to firmware update.



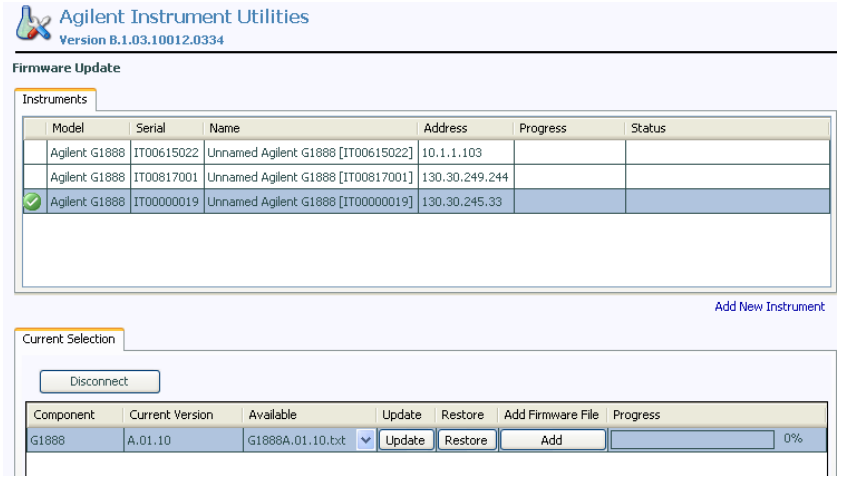
6 Under **Current Selection**, select the desired firmware version from the **Available** drop-down list. If the desired firmware version is not available, add it as follows:

   a Go to the Agilent web site at http://www.chem.agilent.com/en-US/Support/Downloads/firmware/Pages/default.aspx.

   b Download the updated firmware for your instrument type.

   c Unzip the firmware file(s).

   d In the **Firmware Update** utility, click **Add**. Browse to and select the files unzipped in the previous step. The new firmware version will now appear in the **Available** drop-down list



7 Select **Update**.

8 When prompted, save the active method and configuration data. You will restore the data from this file in a later step.

WARNING **Do not turn off power to the device during firmware update.**

9 When the process completes, the instrument reboots. Reconnect to the instrument, then select **Restore**. Select the previously-saved data file to restore the active method.

10 To disconnect the firmware update utility from the instrument, select **Disconnect.**

G1888 HS only: If the HS firmware update fails, you will not be able to reconnect to the instrument. The HS front display will be blue, with no text. The software will prompt if you would like to connect to the instrument in recovery mode. Follow the steps described in "Recovering from the blue screen using Instrument Utilities"on page 220.

Recovering from Corrupt Installations

- Instrument Utilities can be used to recover from corrupt installations.
- Hyperterminal or Advanced 5 can be used to recover from corrupt installations.
- LAN can not be used when recovering from corrupt installations.

Recovering from the blue screen using Instrument Utilities

Only perform this procedure after a failed firmware update. Turn on the headspace sampler (HS). The display will be blue, with no text. You will not be able to connect to the HS using a LAN connection.

NOTE You may receive a prompt to recover the headspace sampler for other reasons, for example, if the G1888 is turned off, or if the IP address is changed, or if the instrument is in use by another computer. Only recover the HS after a firmware update fails and the HS display is blue, with no visible text.

The recovery process requires the following:

- An RS-232 cable (part number G1530-60600)
- A properly-configured COM port on the Instrument Utilities computer
- A properly-configured COM port on the Lab Advisor computer
- A 3-mm hex wrench
- ESD wrist strap (to prevent damage to the HS electronics)

Recover the HS as described below.

1. If you have been prompted by the software to attempt recovery of the HS, click **No**. You need to perform a few hardware steps before attempting recovery. Leave the Firmware Update interface open.
2. Set up the computer COM port. On most computers, the COM (serial port) needed will be COM1. (Computers can have port extenders installed, and also certain devices create additional COM ports. However, the one you need to modify is the one for the serial connection on the PC.) These changes require administrative privileges.

- On Windows Vista or 7, open the Control Panel, then open Device Manager > Ports.
- On Windows XP, open the Start menu, then right-click My Computer. Select Manage, then open Device Manager > Ports.

If you need help making the settings for the COM ports, open the operating system help and search for “COM port.”

Set up the COM port to use the following settings:

- Bits per second - 9600
- Data bits - 8
- Parity - None
- Stop bits - 1
- Flow control - Hardware

3 Connect the RS 232 cable between the HS and the PC.

4 Turn on the HS.

WARNING **Hazardous voltages are present when the front cover is open.**

CAUTION To prevent damage to the HS electronics, wear an ESD wrist strap when accessing the HS components.

5 Access the electronics boards. See “Accessing the components”on page 173.

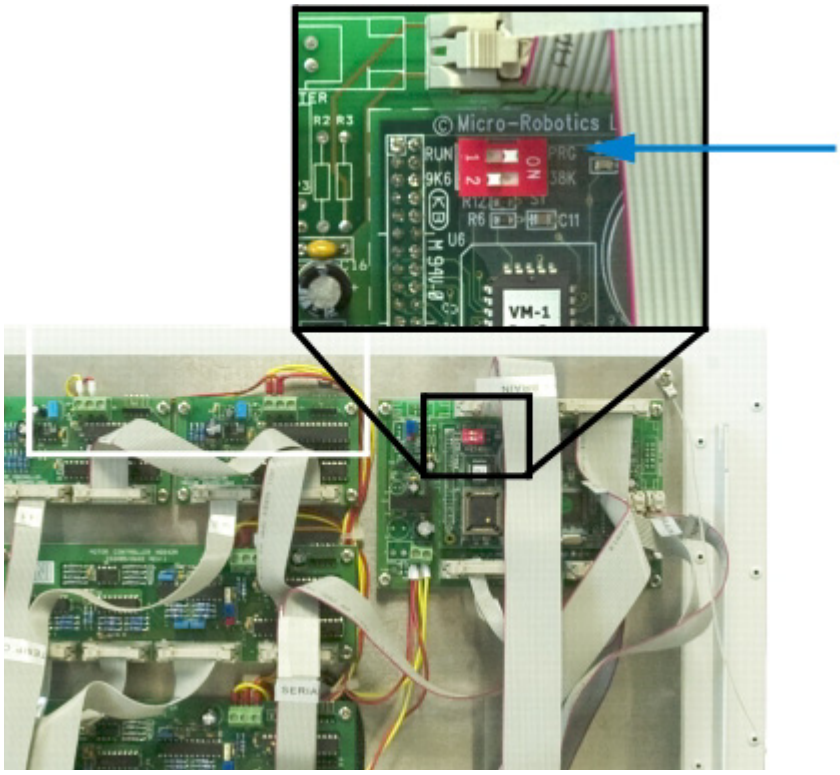
6 If not open, start the **Instrument Utility**. If not open, start Lab Advisor.

7 From the explorer pane, select **Firmware Update**.

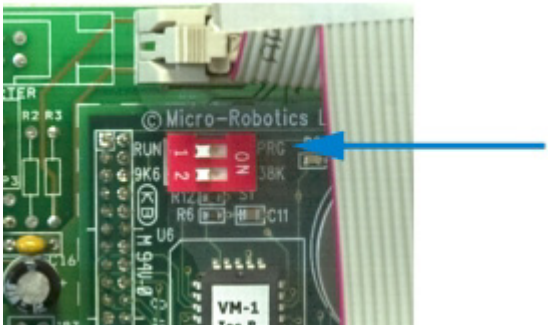
8 Select the desired instrument from the **Instrument** list and select **Connect**.

9 When the software fails to connect to the HS, the software will prompt you to attempt recovery. Click **Yes**. The software opens serial communications using the COM port. If the connection fails, recheck the port settings and verify that the cable is properly connected between the HS and the PC.

10 When prompted to toggle the main processor PCS switch to PROGRAM mode, locate the DIP switch and toggle it to ON / PRG as shown below. Click **Continue**.



11 When prompted to return the switch to RUN mode, set the switch as shown below. Click **Continue**.



12 The software will re-download the firmware.

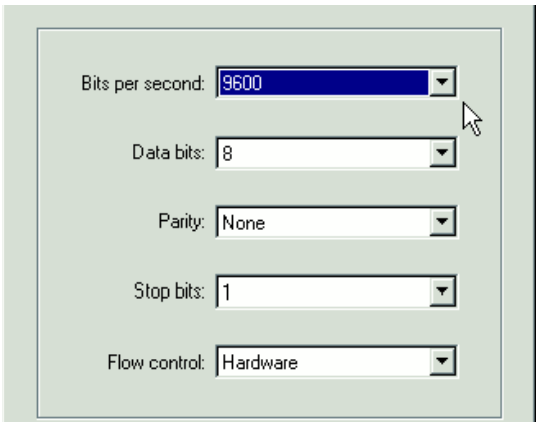
13 When complete, power cycle the HS. After reboot, the display should appear normal.

14 Reconnect to the instrument and click **Restore**. Select the previously-saved data file to restore the active method.

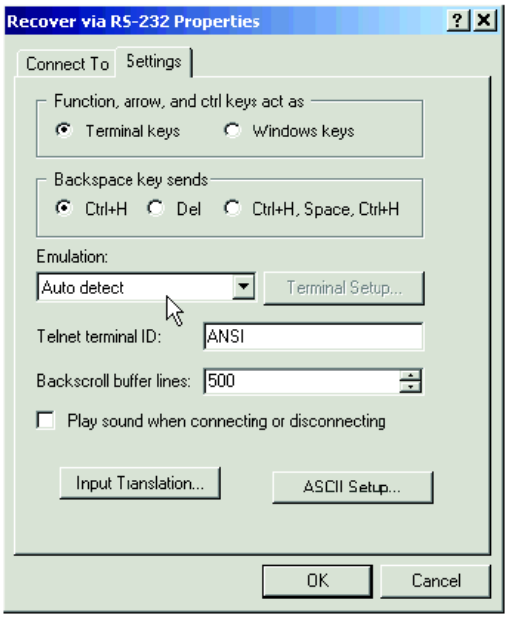
Recovering from the blue screen using Hyperterminal

If the Headspace Sampler's display is blank, follow these instructions to recover:

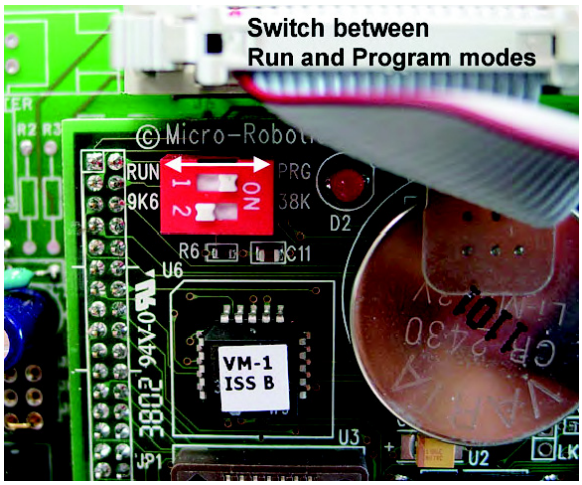
1 Connect the G1530-60600 RS-232 cable between the PC and the HS. Make sure the PC port is set correctly.



2 Launch HyperTerminal, select the appropriate COM port, and configure the connection properties the same way you would for a normal firmware update. Start the connection.



3 Access the main processor PCA and move switch 1 to PRG or program mode.



4 The Sampler replies with this message. **Enter S**.

```
VM-1 Control Computer running Venom-SC
Version 2003 01 15
Copyright 2000-2003 Micro-Robotics Ltd.
Clear memory: Y/N/S ?
```

5 Type: **-->stop all > Enter** .

6 Type **-->protect(0) > Enter.**

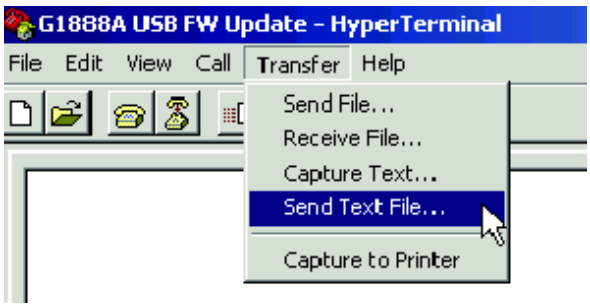
7 Move switch 1 to **Run** mode. **Erasing app. area...Done**.

8 Second prompt appears when you toggle switch back to **Run** mode. **-->**

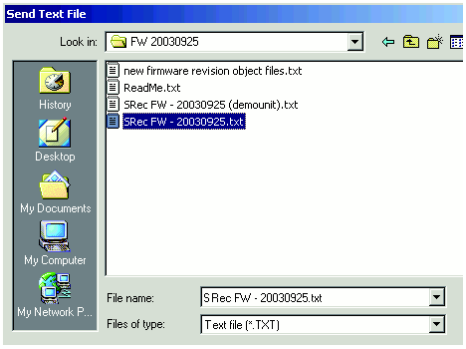
9 Type **-->-->protect(128).**

```
Send S-Records now
50000    50010    50020
```

10 Select **Transfer > Send Text File.**



11 Browse and select the text file that contains the firmware.



12 If the recovery is successful, you should get this message at the end of the download:

```
6E460     6E470     6E480     6E490
6E500     6E510     6E520     6E530
6E5A0     6E5B0     6E5C0     6E5D0
6E640     6E650     6E660     6E670
6E6E0     6E6F0     6E700     6E710
6E780     6E790     6E7A0     6E7B0
Download done
Copied to trash
 -->
```

13 Disconnect HyperTerminal from the HS and power cycle the HS.

8
Error Messages

Overview

This chapter will help you recover from most of the problems that occur while operating the Headspace Sampler (HS). It is separated into three main types of error messages:

- Errors with a diagnostic message
- Internal communication
- Errors without a diagnostic message

Errors With A Diagnostic Message

110 Oven Sensor Error

Oven sensor open or disconnected.

111 Oven Sensor Error

Oven sensor short or damaged.

112 Oven Temp Error

Oven temp higher than expected.

Is oven set 10 below loop?

SVC: Left temp controller 1 PCA, calibration

113 Oven Temp Error

Oven temp lower than expected.

Is oven lid closed?

SVC: Left temp controller 1 PCA, calibration, power config, TPCA F3

120 Loop Sensor Error

Loop sensor open or disconnected.

121 Loop Sensor Error

Loop sensor short or damaged.

122 Loop Temp Error

Loop temperature higher than expected.

Is Loop temp set 10 above oven?

SVC: Right temp controller 2 PCA, calibration

123 Loop Temp Error

Loop temp lower than expected.

Is Loop cover on?

SVC: Right temp controller 2 PCA, calibration, Power PCA F3

130 Transfer Line Sensor Error

Transfer line sensor open or disconnected.

131 Transfer Line Sensor Error

Transfer line sensor short or damaged.

132 Transfer Line Temp Error

Transfer line temp higher than expected.

SVC: Right temp controller 1 PCA

133 Transfer Line Temp Error

Transfer line temp lower than expected.

SVC: Right temp controller 2 PCA, Power PCA F3

210 Tray Too Slow Error

This error results when the tray motor encoder senses an obstruction.

Please check and clear any obstruction to the tray chain.

SVC: Tray friction, adjustment, motor, bottom motor controller 1 PCA

211 Tray Motor Encoder Error

This error results when the tray motor encoder is not responding.

SVC: tray motor, bottom motor controller 1 PCA

212 Tray Position 1 Error

This error results when the tray position 1 sensor is not found after several attempts.

Check the tray chain tension and tray position 1 alignment.

Check for tray interference.

SVC: tray motor, sensor, bottom motor controller 1 PCA

219 Tray Lock

This component did not FAIL. It is disabled to protect the HS. View information for FAIL items only.

220 Shutter Error

This error results when the shutter stepper motor senses an obstruction or cannot find its home position.

SVC: shutter motor-sensor assembly and bottom motor controller 1 PCA

229 Shutter Lock

This component did not FAIL. It is disabled to protect the HS. View information for FAIL items only

230 Lifter 1 Error

This error results when the tray lifter motor encoder senses an obstruction or cannot find its home position.

Please check and clear any obstruction to the lifter. Also check the shutter and carousel alignment.

SVC: Lifter 1, carousel alignment, bottom motor controller 1 PCA

239 Lifter 1 Lock

This component did not FAIL. It is disabled to protect the HS. View information for FAIL items only.

240 Lifter 2 Error

This error results when the tray lifter motor encoder senses an obstruction or cannot find its home position.

Please check and clear any obstruction to the lifter. Make sure you have the correct vial size setting; Advanced Function 12. Also check the carousel alignment.

SVC: Lifter 2, carousel alignment, top motor controller 2 PCA

249 Lifter 2 Lock

This component did not FAIL. It is disabled to protect the HS. View information for FAIL items only.

250 Carousel Error

This error results when the carousel motor encoder senses an obstruction or cannot find its position.

Please check and clear any obstruction to the carousel. Also check the carousel alignment.

SVC: carousel motor, sensor, alignment, top motor controller 2 PCA

259 Carousel Lock

This component did not FAIL. It is disabled to protect the HS. View information for FAIL items only.

260 6-port Valve Error

This error results when the 6-port valve motor encoder senses an obstruction or cannot find its home position.

Please check and clear any obstruction to the valve motor linkage. Also check the for any rubbing on the back side of the insulated cover to the loop heated zone.

SVC: 6-port valve motor-sensor assembly, top motor controller 2 PCA

300 Pressure Error

Number series for pressure errors. Not implemented.

400 Power Error

Number series for power errors. Not implemented.

Internal Communication Serial I/O Errors

These errors indicate a bad connection between the main processor PCA and peripheral PCAs.

510 Serial I/O Error

SVC: connections and PCAs: main PCA J4 and bottom motor controller 1 PCA J2

520 Serial I/O Error

SVC: connections between main PCA J4 and top motor controller 2 PCA J2

530 Serial I/O Error

SVC: connections between main PCA J4 and left temp controller 2 PCA J2

540 Serial I/O Error

SVC: connections between main PCA J4 and right temp controller 2 PCA J2

550 Serial I/O Error

SVC: connections between main PCA J4 and top motor controller 2 PCA J2

560 Serial I/O Error

SVC: connections between main PCA J4 and Pressure PCA J2

600 - 605 Serial I/O Error

SVC: update firmware for main PCA

Errors Without A Diagnostic Message

These errors appear in the lower right-hand corner of the display. They do not have diagnostic information for them at this time.

GC is not ready

GC is not ready when the HS is ready to inject the sample vial. Advanced Function 9, Check GC Ready must be set to WAIT.

GC not properly connected. GC cycle time setpoint too short.

Press START/STOP button to stop analysis and recover all vials from oven to tray. Check GC_READY signal connection.

RAM error

Checksum on HS data stored in non-volatile memory is wrong.

A debug information on which part of non-volatile memory has caused the problem is present in diagnostic menu.

This can happen only at HS start-up.

Press CLEAR to clear all non volatile HS memory and restart the HS.

The HS will restore all default values for methods and configuration parameters.

Vial not dropped

This error results when a vial is not successfully lowered from the tray to the carousel. This information is provided by the TB-vials sensor to electronics. A sensor checks for a vial after the tray lifter lowers the vial. Check the following:

- Tray belt tension
- Tray position 1 alignment (see “Align the carousel”on page 115).
- Carousel alignment
- Obstructions or dirt

If this error is reported and the vial did drop or is still in the tray, check the vial sensor (see step 4 on page 73).

Remove all vials

This error is caused by incoherence between vial positions in the oven carousel and information about vial positions stored in HS memory.

This error may appear while the HS is trying to recover vials after a vial handling error or after you press the Stop button. The message indicates that the HS found vials in an unexpected carousel location. Carefully remove all vials from the heated carousel and reset the HS with Advanced Function 10. You can also restart the HS.

Vial not found in oven

This error may appear while the HS is trying to recover vials after a vial handling error or after you press the stop button. The message indicates that the HS did not find a vial in the carousel where it expected to find the vial. Carefully remove all vials from the heated carousel and reset the HS with Advanced Function 10. You can also restart the HS.

If this error, **Vial not found**, is reported and the vial is still in the tray, check the vial sensor (see step 4 on page 73).

Tray full!

This error may appear while the HS is trying to recover vials after n vial handling error or after you press the stop button. The message indicates that the HS tray is full and it cannot check for vials in the carousel. It is not possible to check if there are vials in the oven because there isn't an empty vial location on the tray.

Carefully remove one vial from the tray and reset the HS with Advanced Function 10. You can also restart the HS.

Temperature actual reads “open” or “short”

If the actual temperature reads "open" or "short", the temperature sensor for that zone is disconnected or damaged.

Zone at or near ambient

If the actual temperature is near ambient, please check the following:

- Zone setpoint is "0" or OFF.
- The fuse for the heated zone is blown.

Zone does not stabilize

If the actual oven temperature is slow to respond or does not reach the setpoint, please check the following:

- The oven lid is closed and the latches locked.
- The loop heated zone cover sits flush with the base of the pneumatic compartment.
- If the voltage at the electrical outlet is from 90 to 132 VAC, the line voltage selector switch is set to 115 VAC.

Analysis aborted Oven Temp. Error

Oven temperature was out of range for more than 6 seconds during a run. Run interrupted.

Check the following:

- The oven lid is closed and the latches locked.
- The loop heated zone cover sits flush with the base of the pneumatic compartment.

Press START/STOP button to stop analysis and recover all vials from oven to tray

Analysis aborted Loop Temp. Error

Loop temperature was out of range for more than 6 seconds during a run. Run interrupted.

Check the following:
- The oven lid is closed and the latches locked.
- The loop heated zone cover sits flush with the base of the pneumatic compartment.

Press START/STOP button to stop analysis and recover all vials from oven to tray

Analysis aborted Tr.line Temp. Error

Transfer line temperature was out of range for more than 6 seconds during a run. Run interrupted.
Check the following:
- The oven lid is closed and the latches locked.
- The loop heated zone cover sits flush with the base of the pneumatic compartment.

Press START/STOP button to stop analysis and recover all vials from oven to tray

9 Troubleshooting

Tests Overview

This section should help you recover from most of the problems that you might see while operating the Headspace Sampler (HS).

Diagnostic error messages can have values of OK, LOCK, or FAIL.

FAIL errors point to the component that requires troubleshooting.

Strife test

A strife test can be used to test mechanical parts and vial handling.

Running the strife test is recommended after the alignment, replacement, or adjustment of a mechanical part.

Two different strife routines are now available. One expects to have all seventy vials loaded in the tray, the other expects to have no vials in the tray. In previous revisions of firmware, only one strife routine (that accepts an undefined number of vials [from 0 to 70] in the tray) was available.

The strife routines execute the same mechanical movements , but they handle information received from the Vial Present Sensor differently.

If the strife routine expecting all vials in the tray doesn't "see" a vial at any tray position, it stops immediately showing an error on the local display

If the strife routine expecting no vials in the tray does "see" a vial at any tray position, it stops immediately showing an error on the local display.

Procedure for HS revision A.01.09 or less with or without vials.

1. Put from 0 to 70 vials in the HS vial tray of the selected vial size.
2. Start the strife test by going to the main menu and typing **Clear > dot > 9 > ↓ > N > Enter** on the HS keypad. **N** equals the number of times to run the test. If **N** = **0**, the test runs continously.
3. Observe that vials are successfully loaded and unloaded from the carousel.
4. Stop the test by pressing **Clear** on the HS keypad.

Procedure for HS revision A.01.10 with vials

1. Put 70 vials in the HS vial tray of the selected vial size.
2. Start the strife test by by going to the main menu and typing **Clear > dot > 9 > ↓ > N > Enter** on the HS keypad. **N** equals the number of times to run the test. If **N** = **0**, the test runs continously.
3. Observe that the 70 vials are successfully loaded and unloaded from the carousel.
4. Stop the test by pressing **Clear** on the HS keypad.

Procedure for HS revision A.01.10 without vials.

1 Empty the HS vial tray.

2 Start the strife test by by going to the main menu and typing **Clear > dot > 8 >** ↓ **> N > Enter** on the HS keypad. **N** equals the number of times to run the test. If **N** = **0**, the test runs continously.

3 Stop the test by pressing **Clear** on the HS keypad.

Chain method test

A chain method test can be used for repair centers. It will run the strife test and 3 different methods a defined number of times.

1 Start the chain method test by by going to the main menu and typing **Clear > dot > 1 >** ↓ **> N** on the HS keypad. **N** equals the number of times to run the chain method test.

2 Stop the test by pressing **Clear** on the HS keypad.

Checking the Headspace Sampler for leaks

This procedure checks the GC/HS system to find out if a leak is in the HS/carrier gas supply or GC capillary inlet/septum purge/split vent system. Half-Splitting the carrier system:

- Isolates the G1888 carrier pneumatics from the GC Capillary Inlet.
- Tests the carrier flow path in the HS and proportional control valve 1 and the flow sensor in the GC inlet EPC module.

The integrity of the test is dependant on the accuracy and stability of the GC EPC flow sensor.

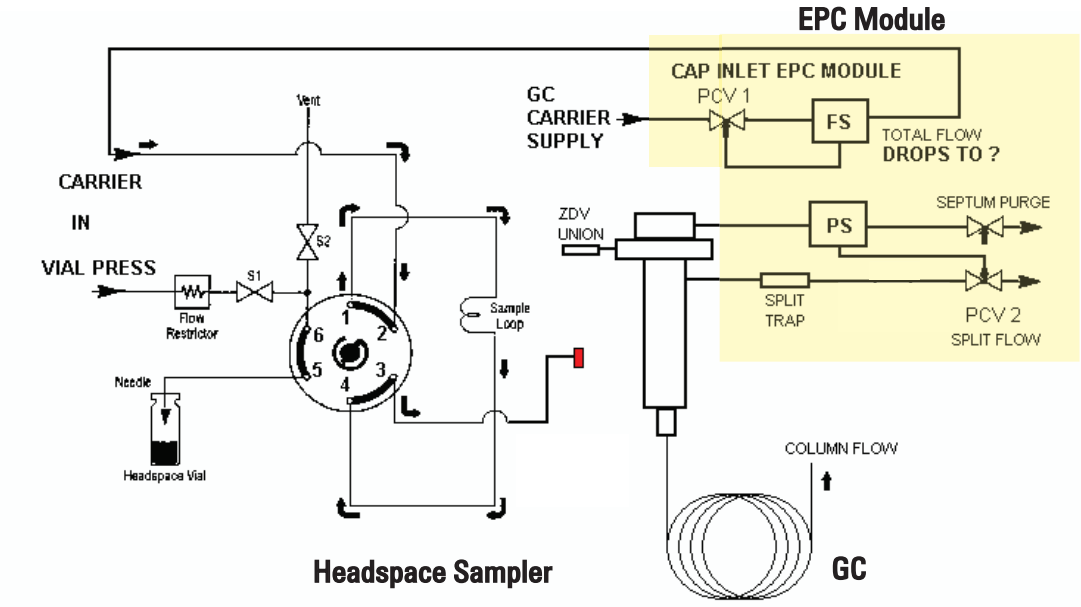


Figure 268 Carrier gas flow for leak test

1 Disconnect the G1888 transfer line from the GC inlet.

2 Seal the open end of the transfer line.

3 Make sure the inlet is in Split Mode.

4 Set inlet total flow to 60 mL/min.

5 If the HS/carrier gas system is leak free, the total flow will drop to 0 mL/min. The time for the flow to drop will be dependent on the volume of the tubing connecting the GC EPC module to the carrier fitting of the HS and the volume of the loop in the HS.

6 If the total flow is greater than zero, the HS carrier system is leaking at this rate. Perform the leak test in the next section to isolate and fix the leak.

This test should be repeated in both positions of the 6-port valve in the HS using Advance Function 5. This will check for leaks while carrier flow is configured to pass through or bypass the sample loop.

Headspace Sampler leak test

Before performing this test, perform “Checking the Headspace Sampler for leaks”on page 240 to rule out a leaking GC capillary inlet system.

This procedure describes how to:

- Check for leaks in the toggle valves
- Check for restrictions in the flow path associated with filling the sample loop
- Check for leaks in the carrier flow path
- Check for leaks in the vial pressurization flow path
- Check for leaks across the ports of the 6-port sampling valve

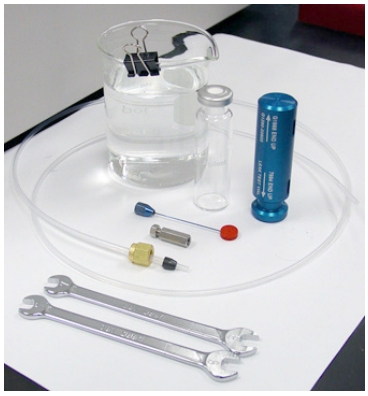
Symptoms associated with restrictions include no peaks or loss of sensitivity. This is often caused by the swelling of the solenoid vent valve seals or the build up of residues in the vent tube.

Symptoms associated with leaks include high detector backgrounds and loss of sensitivity. The most common leaks are at the connections of the transfer line, external plumbing, and sample probe union.

The leak test is partially automated either by using Advanced Function 18, Leak Test or by using the leak test feature of the Advanced Function 5 diagnostic utility. The complete procedure takes about 1 hour.

If you are using Advanced Function 18, pressing **Clear** stops the test, returns the vials, and resets the valves to standby mode.

Required tools



Beaker of water
20-mL capped vial
Leak Test Kit, G1888-60701
7 × 8-mm wrenches, 1340407010
Small flat screwdriver

Leak test the toggle valves

1 Connect a gasline to the EPC pressurization gas fitting on the back of the instrument (see Figure 7 on page 31).

2 Attach a tube to the MPC pressurization gas fitting.

3 Place the end of the tube into a beaker of water.

If bubbles come out of the tube connected to the MPC fitting while the EPC pressurization is being used, the toggle valve is leaking.

The same procedure can be used to test the toggle valve on the carrier side (see Figure 280 on page 256).

General flow of procedure

This table summarizes the steps that make up the leak test procedure.

Leak Location	Computer Display	Action
	`18. Leak Test`	Check the plumbing and set up the tools and tubing. Select the test. **Menu > Advanced Function > 18 Leak Test > Enter**
Loop fill restrictions	`Vent restriction test WITH loop Pressurizing 0.2 Loop fill 0.3`	• Listen for the click of the vent valve. • Watch for the stream of bubbles in the beaker of water after the vent valve switches on. • Normal duration: 4 to 5 seconds
	`Vent restriction test WITHOUT loop Pressurizing 0.2 Loop fill 0.3`	Same as before, except you're checking for flow without the sampling loop. Normal duration: 3 to 4 seconds
		Decide if you should continue.
Fitting leaks	`Pressure decay test, Loop in Vial Carrier (PSI) 25.6 Vial (PSI) 25.4`	Carrier ports: 2, 3 Vial pressurization ports: 1, 4, 5, 6
6-port valve leaks	`Pressure decay test, Loop in Vial Carrier (PSI) 0.1 Vial (PSI) 25.4`	Remove plug from transfer line
	`Pressure decay test, Loop in Vial Carrier (PSI) 25.6 Vial (PSI) 0.2`	Carefully lift lid to remove sample probe from leak test vial.
		Decide if you should continue.
Fitting leaks	`Pressure decay test, Loop in Carrier Carrier (PSI) 26.1 Vial (PSI) 26.0`	Carrier ports: 1, 2, 3, 4 Vial pressurization ports: 5, 6
6-port valve leaks	`Pressure decay test, Loop in Carrier Carrier (PSI) 0.1 Vial (PSI) 26.0`	Remove plug from transfer line.
	`Pressure decay test, Loop in Carrier Carrier (PSI) 26.1 Vial (PSI) 0.2`	Carefully lift lid to remove sample probe from leak test vial
		Decide if you should continue.

Setting up and starting the tests

1 For the restriction test, attach 1/8-inch OD tubing to the vent with a ferrule and brass cap. Finger tighten.

2 Place the end of the tube into the beaker of water. See Figure 269.

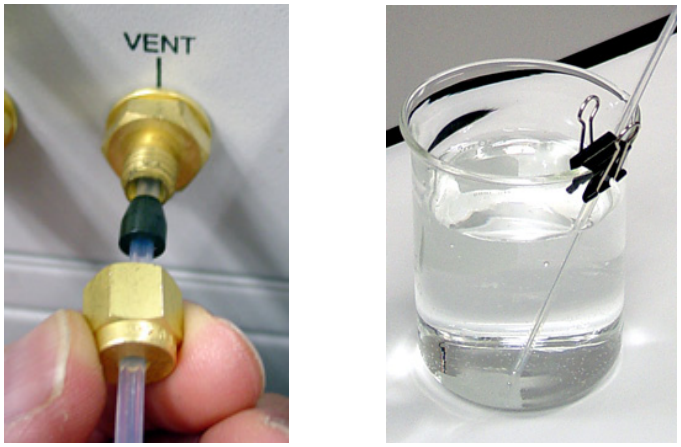


Figure 269 Tubing for restriction test

3 This procedure expects that your HS has a shutoff valve on the carrier flow path and the vial pressurization flow path. Use these valves to separate the flow paths from the gas source. The shutoff valves shipped with the Sampler.

If the HS is configured for manual pneumatic control, (See Figure 270) the lines on the upstream side of the valves go to the pressure regulator of your gas distribution system or cylinder.

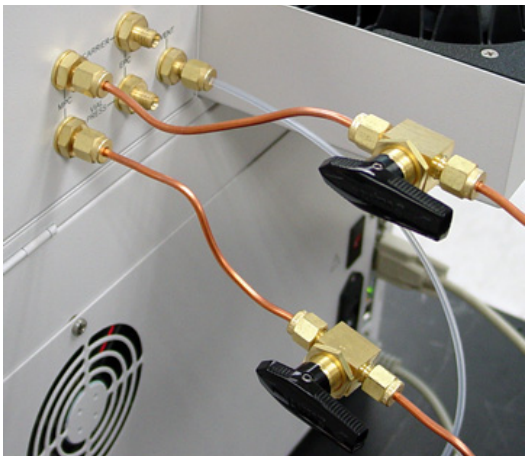


Figure 270 Manual pressure control shutoff valves

- Turn the manual flow controller to maximize carrier flow. This reduces the time to equilibrate the flow path.
- Turn the manual pressure regulator to maximize vial pressure. This reduces the time to equilibrate flow path.

If the HS is configured for electronic pneumatic control (EPC) or a mix of sources, add a tee so that both flow paths are pressurized by the source for the Vial Pressurization pressure. See Figure 271.

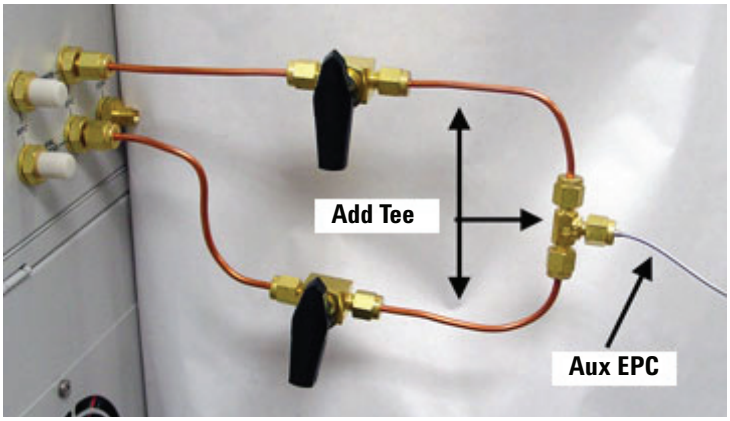


Figure 271 Electronic pneumatic control shutoff valves

4 Change the pressure units to psi. This setting has a better resolution than kPa or bar. Select **Advanced Functions >6. > Pressure Units.**

Figure 272 Change the pressure units to PSI

5 Set the source pressures to about 30 psi or 200 kPa. For MPC, adjust the source pressure regulator. For EPC, set the AUX EPC pressure.

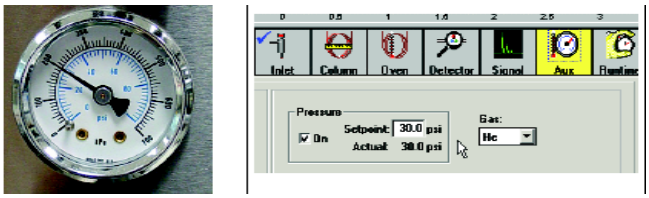


Figure 273 Set source pressures to 30 PSI

6 Disconnect the transfer line from the inlet. If you are using a transfer line needle, plug off the end with a septa. If there is no needle, cap off the end with a union and plug. See Figure 274.

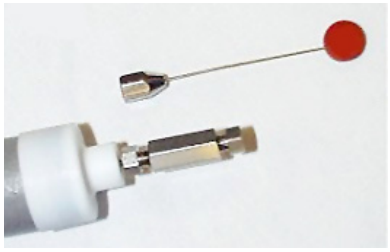


Figure 274 Disconnect the transfer line

7 Place unused, capped vial in tray position 1. The vial size must match the vial size that you specify under the **Vial Size parameter**: 10-mL or 20-mL. (The first part of the leak test method uses the vial size parameter to determine how far to lift the vial.)

8 Place the aluminum leak test vial in tray position 2. If you do not have this tool place a 20-mL capped vial. It is very important that the vial cap is sealed tightly.

Figure 275 Leak test vial placement

9 Select **Menu > Advanced Function > 18. Leak Test > Enter.** The shortcut is **Advanced Function > .8**. Press **Enter** again to begin the test.

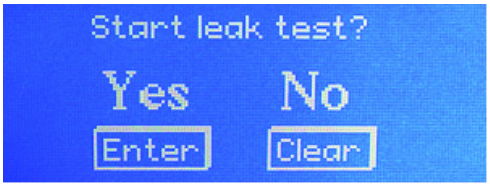


Figure 276 Start leak test

Restriction test

1 At the start of the restriction test the HS loads the vial from tray position 1 into the oven carousel and positions it under the sample probe and lifts the vial onto the sample probe. The valve is positioned so that the pressurization gas flows through the sample loop into the vial.

2 The pressurization valve opens and pressurizes the vial for 0.2 minutes. After 0.2 minutes, the pressurization valve closes.

```
Vent restriction test
WITH loop
Pressurizing 0.2
```

3 The vent valve opens for 0.3 minutes. Watch the beaker of water. After the click of the vent valve, you should observe bubbles from the tip of the tube. Normal behavior is a burst of bubbles that slows and stops after about 4 to 5 seconds._____ seconds.

```
Vent restriction test
WITH loop
Loop Fill 0.3
```

4 The HS switches the 6-port valve to the inject position. Here the pressure gas flows directly to the vial, bypassing the sample loop.

5 The pressurization valve opens and pressurizes the vial for 0.2 minutes. After 0.2 minutes, the pressurization valve closes.

6 The vent valve opens for 0.3 minutes

```
Vent restriction test
WITHOUT loop
Pressurizing 0.2
```

7 Watch the beaker of water. After the click of the vent valve, you should observe bubbles from the tip of the tube. Normal

behavior is a burst of bubbles that slows and stops after about 3 to 4 seconds._____ seconds.

```
Vent restriction test
WITHOUT loop
Loop Fill 0.3
```

8 Before you continue, make a decision based on your observations. If there are restrictions, turn to "Troubleshooting vent restrictions"on page 253. If there are no restrictions, continue with the pressure decay tests.

Pressure decay tests overview

If you have completed a restriction test (see page 248) and there are no restrictions, continue with the pressure decay test. At the end of the restriction tests, the HS returns the vial to tray position 1 and loads the leak test vial or 20-mL vial in tray position 2 to plug the sample probe.

Using the shutoff valves at the back of the HS, you will pressurize the flow paths and watch for a pressure decay.

Each pressure decay test is made up of four steps. During each test you will:

1 Pressurize the flow path long enough for the pressure to be equalized across the manual pneumatic controls and the flow restrictor.

2 Seal the flow path.

3 Monitor the pressure for 5 minutes.

4 Record the results. The pressure should decay less than 2 psi over 5 minutes.

If you are checking for leaks in tube fittings, you will do this two times:

- Once with the sampling loop in the vial pressurization flow path (standby mode).
- Once with the sampling loop in the carrier flow path (inject mode).

To fix a leak from a tube fitting, carefully tighten the connection. Where the tubing nut, tubing ferrule, or sealing surface is damaged, replace the part.

If you are checking for leaks across the 6-port sampling valve, you will do this four times: two times in standby mode and two times in inject mode.

To fix a leak from the 6-port valve, replace the valve.

Pressure decay test part 1: Fittings check with Loop in vial pressurization flow path

```
Pressure decay test,
Loop in Vial
Carrier (PSI) 25.6
Vial (PSI) 25.4
```

1 Wait a full 5 minutes for the flow paths to pressurize.

2 Turn off the shutoff valves at the back of the HS.

3 Record the time and initial pressure values in the table.

4 After 5 minutes, record the time and final pressure values in Table 15 on page 250.

Before you continue, make a decision based on your observations. If there are leaks, turn to "Troubleshooting leaks at fittings in standby mode"on page 254. If there are no leaks, continue with the next pressure decay test.

Table 15 Record pressure decay test data here

Test	T_{final}	$T_{initial}$	$P_{initial}$	P_{final}
Vial pressurization Part 1				
Vial pressurization Part 2				
Carrier Part 3				
Carrier Part 4				

Pressure decay test part 2: 6-port Valve Check with Loop in vial pressurization flow path

```
Pressure decay test
Loop in Vial
Carrier (PSI) 0.1
Vial (PSI) 25.4
```

1 Open the nut or septum on the transfer line to depressurize the carrier flow path. Monitor the vial pressurization flow path. The carrier (PSI) should drop within a minute to almost 0 psi.

2 Record the time and initial vial pressure value in the table.

3 After 5 minutes, record the time and final pressure value in Table 15 on page 250.

4 Reconnect the plug on the transfer line. Open the shutoff valve to pressurize the carrier flow path. The carrier (PSI) should recharge within a minute.

5 Open the lid to depressurize the vial pressurization flow path. The vial (PSI) should drop within a minute to almost 0 psi.

6 Turn off the carrier shutoff valve at the back of the HS.

7 Record the time and initial carrier pressure value in the table.

8 After 5 minutes, record the time and final pressure value in Table 15 on page 250.

Before you continue, make a decision based on your observations. If there are no leaks across the ports of the 6-port valve, continue with the next pressure decay test. If there is a leak, replace the 6- port valve.

Pressure decay test part 3: Fittings check with Loop in carrier flow path

```
Pressure decay test,
Loop in Carrier
Carrier (PSI) 26.1
Vial (PSI) 26.0
```

1 If there is no leak, press the **Enter** button and open the shutoff valves. The 6-port valve will rotate so the loop is in the carrier flow path. This is the inject mode.

2 Wait a full 5 minutes for the flow paths to pressurize and equilibrate.

3 Turn off the shutoff valves at the back of the HS.

4 Record the time and initial pressure values in the table.

5 After 5 minutes, record the time and final pressure values in Table 15 on page 250.

Before you continue, make a decision based on your observations. If there are leaks, turn to "Troubleshooting leaks at fittings in inject mode"on page 255. If there are no leaks, continue with the next pressure decay test.

Pressure decay test part 4: 6-port Valve with Loop in carrier flow path

```
Pressure decay test,
```

```
Loop in Carrier
Carrier (PSI) 0.1
Vial (PSI) 26.0
```

1. Open the nut or septum on the transfer line to depressurize the carrier flow path. Monitor the vial pressurization flow path. The carrier (PSI) should drop within a minute to almost 0 psi.
2. Record the time and initial vial pressure value in the table.
3. After 5 minutes, record the time and final pressure value in Table 15 on page 250.
4. Reconnect the plug on the transfer line. Open the shutoff valve to pressurize the carrier flow path. The carrier (PSI) should recharge within a minute.
5. Open the lid to depressurize the vial pressurization flow path. The vial (PSI) should drop within a minute to almost 0 psi.

   ```
   Pressure decay test,
   Loop in Carrier
   Carrier (PSI) 26.1
   Vial (PSI) 0.2
   ```
6. Turn off the carrier shutoff valve at the back of the HS.
7. Record the time and initial vial pressure value in the table.
8. After 5 minutes, record the time and final pressure value in Table 15 on page 250.

Before you continue, make a decision based on your observations. If there are no leaks across the ports of the 6-port valve, press **Clear**. The HS will reset the valves and return the vial to tray position 2.

If there is a leak, replace the 6-port valve.

Troubleshooting vent restrictions

Observation	Possible cause
WITH loop – no bubbles, no burst, long slow release of bubbles WITHOUT loop – normal	• Restricted or clogged sample loop. • Restricted or clogged 6-port valve at ports 1 and 4. • Disconnected sampling loop.
For both WITH and WITHOUT loop: No burst, but long slow release of bubbles.	• Restriction in flow path from sample probe to vent bulkhead fitting. • Vent valve seals swollen.
No bubbles with or without loop	• Large leak or disconnected tubing at 6-port sampling valve. • No sample probe. • Defective pressurization valve (won't open). • Defective vent valve (won't energize or open). • Plugged vent tube.
No bubbles and no valve clicks	• Disconnected or faulty wiring to solenoid valves. • Solenoid valve not getting 24 VDC to energize. • Disconnected at PCA, 5 VDC, and power distribution. • Defective temperature controller PCA 2, top right-hand position.

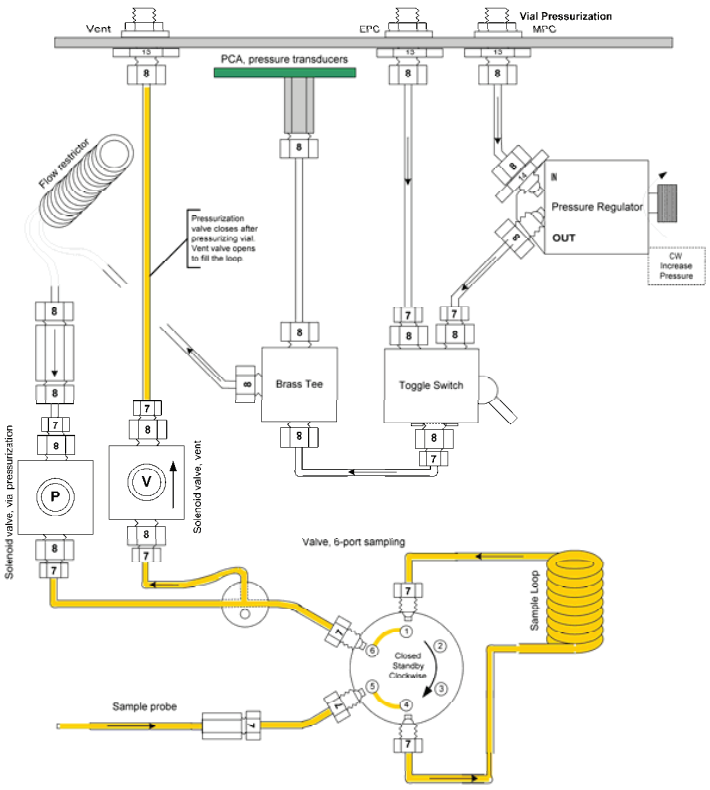


Figure 277 Troubleshooting vent restrictions

Troubleshooting leaks at fittings in standby mode

Observation	Possible cause
Pressure decay for carrier ≥ 2 psi	• 6-port valve fittings at ports 2 and 3. • Fittings from 6-port valve to bulkhead fitting.
Pressure decay for vial pressurization ≥ 2 psi	• 6-port valve fittings at ports 1, 4, 5, and 6. • Fittings from sample probe to bulkhead fitting.
0 psi < Pressure decay < 2 psi	• If the pressure decay for a flow path passes the criteria but is greater that 0 psi, there is a leak in that flow path. • For some applications where sensitivity is very important, you should troubleshoot and attempt to find the fitting(s) that are causing the leak.

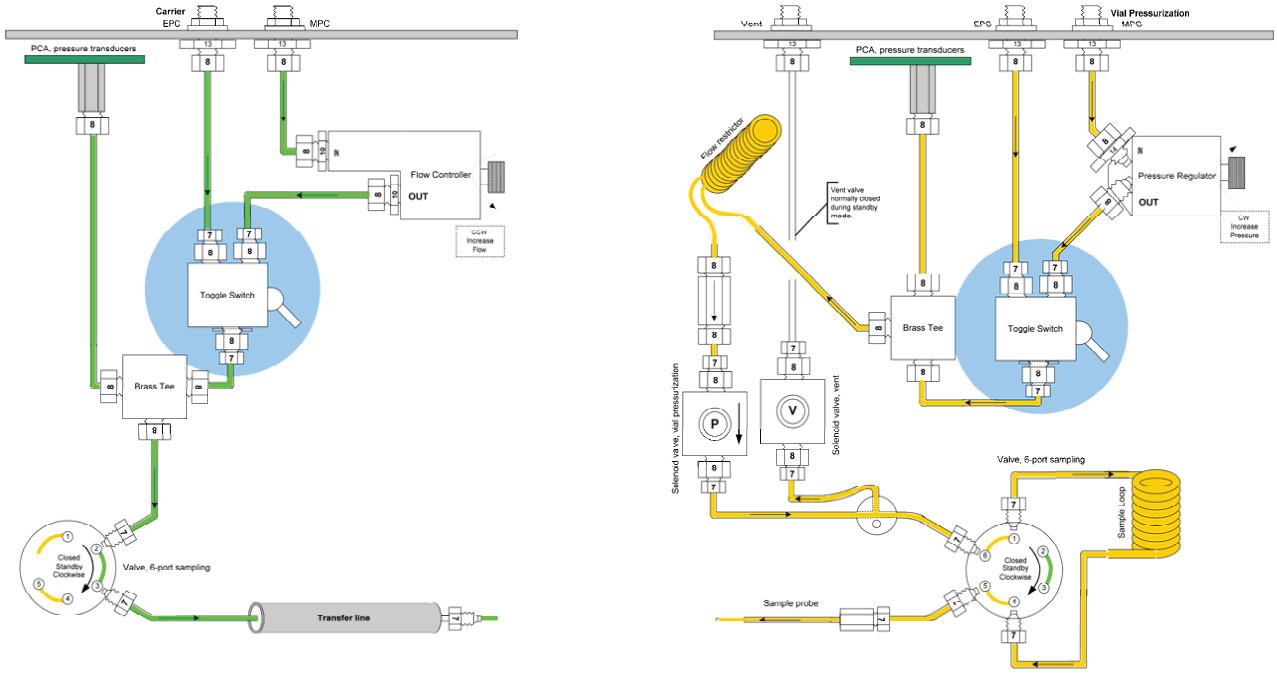


Figure 278 Troubleshooting leaks at fittings in standby mode

Troubleshooting leaks at fittings in inject mode

Observation	Possible cause
Pressure decay for carrier ? 2 psi	• 6-port valve fittings at ports 1, 4, 5, and 6. • Fittings from 6-port valve to bulkhead fitting.
Pressure decay for vial pressurization ? 2 psi	• 6-port valve fittings at ports 2 and 3. • Fittings from sample probe to bulkhead fitting.
0 psi < Pressure decay < 2 psi	• If the pressure decay for a flow path passes the criteria but is greater that 0 psi, there is a leak in that flow path. • For some applications where sensitivity is very important, you should troubleshoot and attempt to find the fitting(s) that are causing the leak.

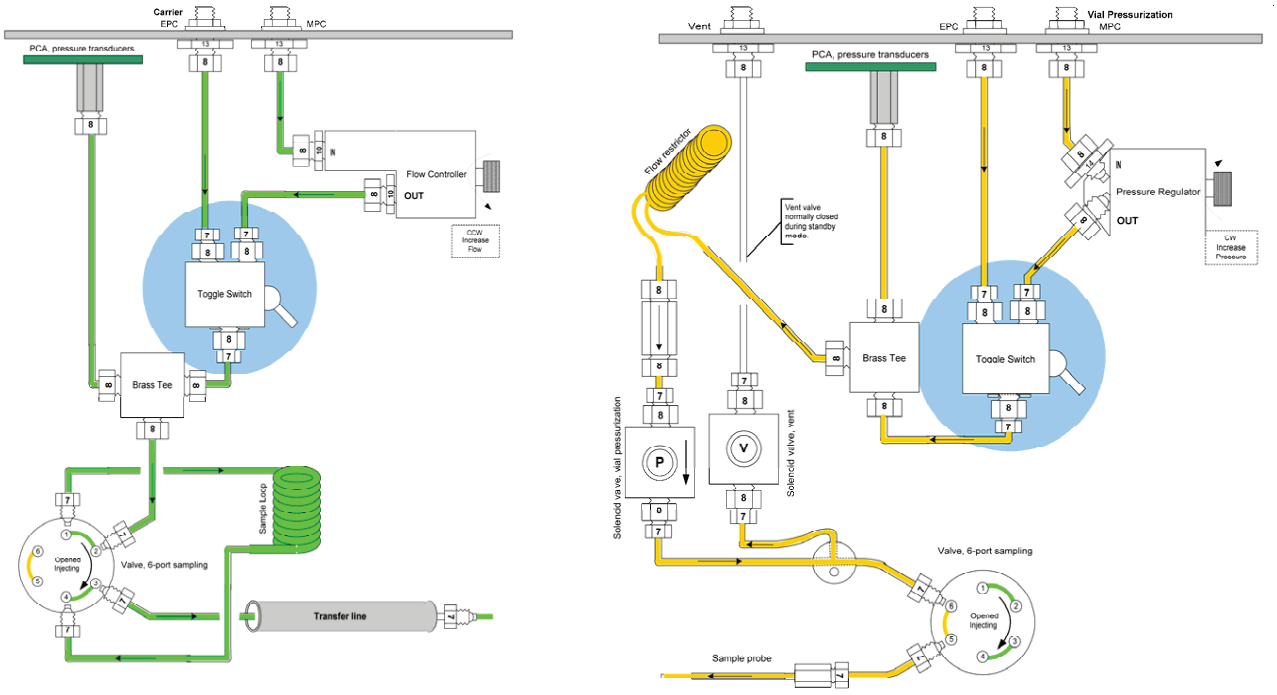


Figure 279 Troubleshooting leaks at fittings in inject mode

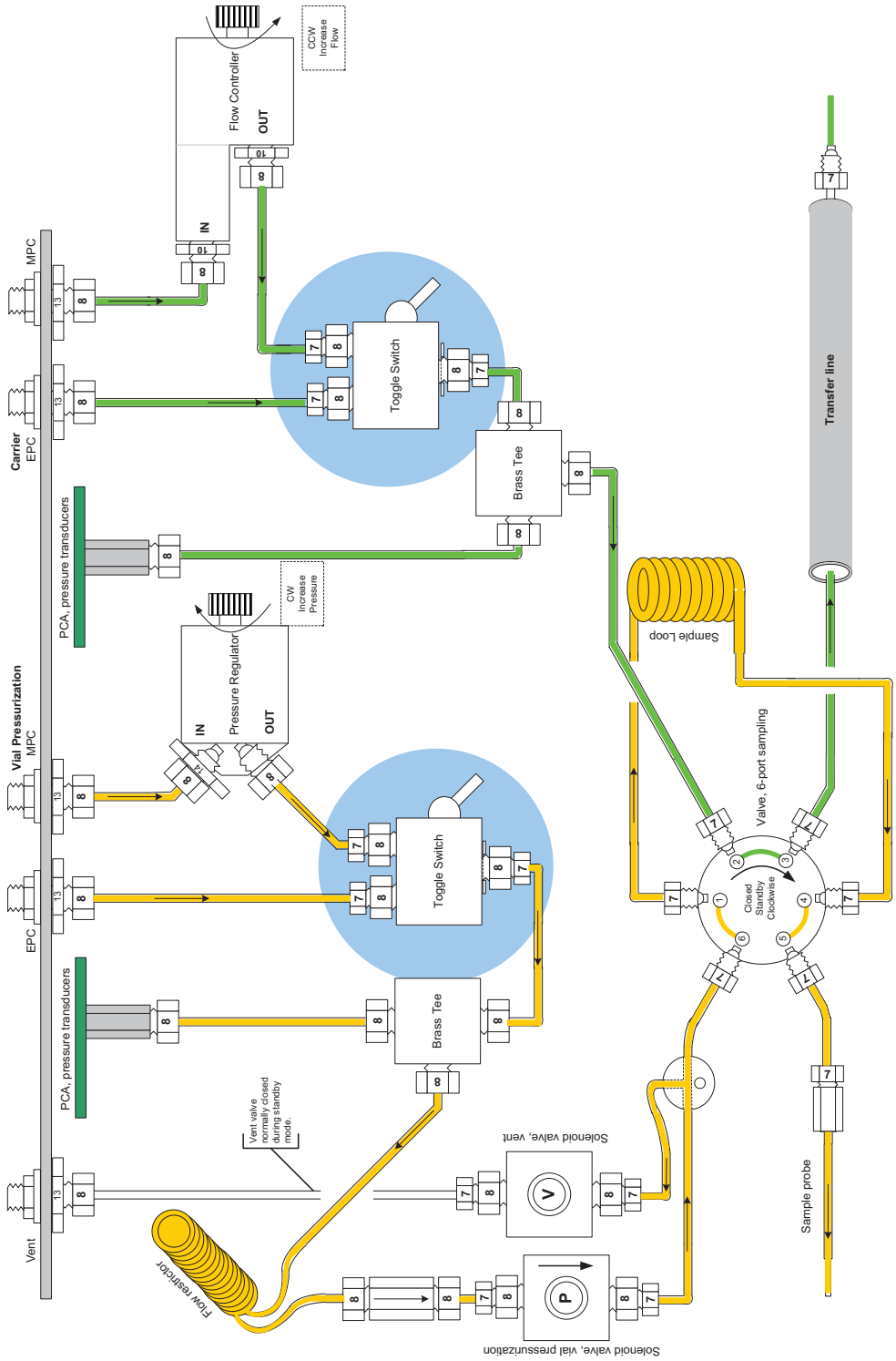


Figure 280 Flow path - standby

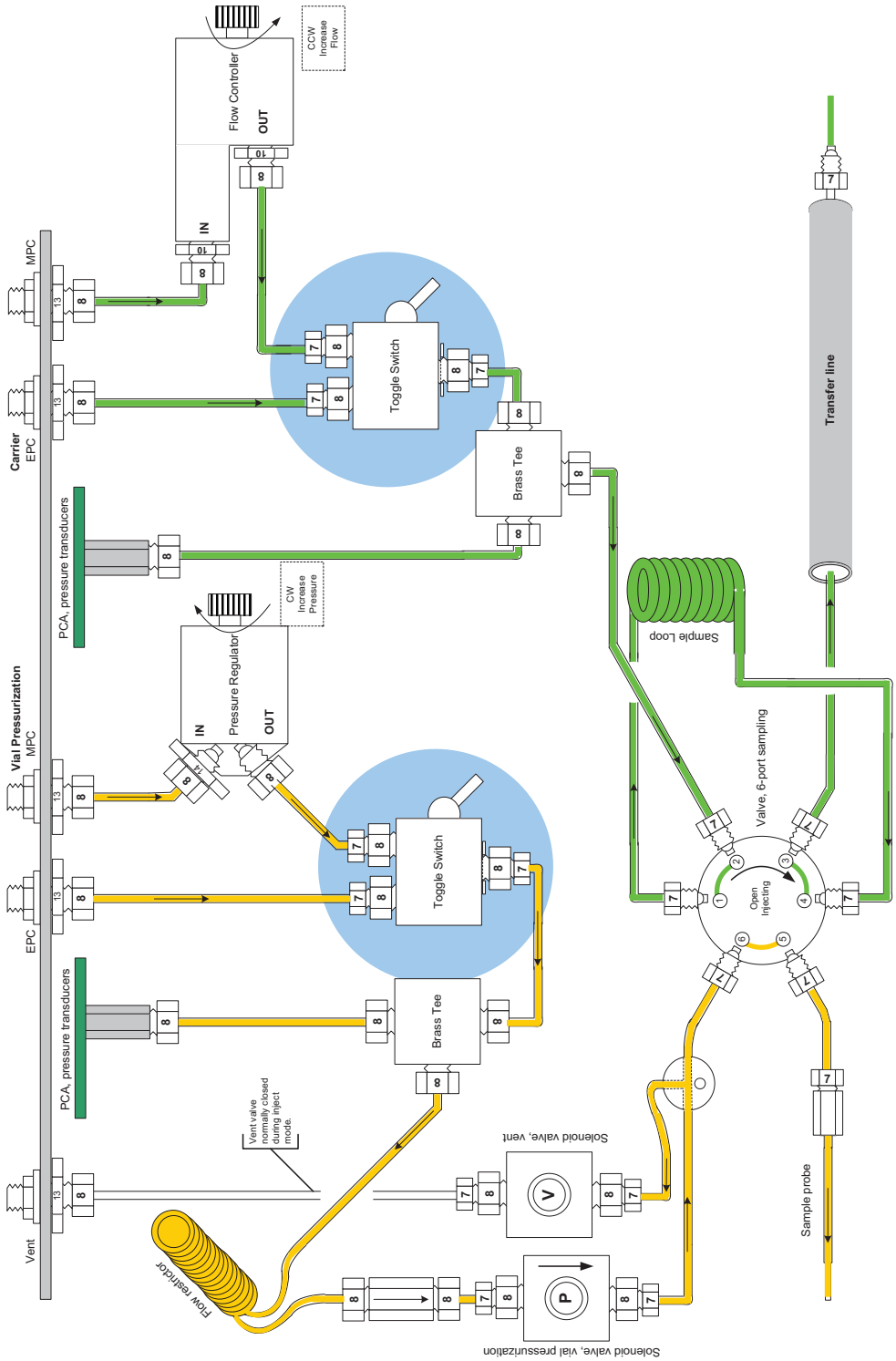


Figure 281 Flow path - inject

Chromatographic Results

No peaks or reduced sensitivity

No peaks result from the sample not reaching the GC detector. To see why, check these general areas:

- GC
- Source of gas to the HS
- Sample vial
- Flow paths that load the sample loop and carry the sample to the inlet

1 Verify that your GC system is working properly. In most cases, you can inject a small quantity of internal or calibration standard directly into the inlet.

2 Check the sample vial for cracks or defective seal.

3 For the HS, check for the following:

- The source gas for vial pressurization is connected to the correct bulkhead fittings for your configuration. MPC: 60-80psi. EPC: A pressure above the pressure inside the sample vial after equilibration. Usually 10 to 20 psi.
- The source gas for the carrier is connected to the correct bulkhead fittings for your configuration. MPC: 60-80psi. EPC: the inlet pressure setting. In GCs with electronic pneumatic controls, a lack of flow from the headspace to inlet usually causes an inlet shutdown error.
- The pneumatic toggle switch for vial pressurization is set correctly for your configuration. The pneumatic toggle switch for carrier is set correctly for your configuration. In GCs with electronic pneumatic controls, a lack of flow from the headspace to the inlet usually causes an inlet shutdown error.
- There is a flow of carrier gas from the HS to the GC inlet. For MPC, the carrier pressure is set so that the HS provides most of the flow to the inlet.
- Check for restrictions that block the flow path for filling the sample loop. The flow path starts at the sample probe and runs to the bulkhead fitting. See “Headspace Sampler leak test”on page 242.
- Check for leaks in the carrier flow path. The flow path starts at the sample probe and ends at the GC inlet. See “Headspace Sampler leak test”on page 242.

Poor retention time reproducibility

Poor retention time repeatability results from changes in the time the sample reaches the GC detector.

Check these general areas: the GC and HS flow paths.

- Check for leaks and restrictions in the carrier flow path. The flow path starts at the sample probe and ends at the GC inlet. See “Headspace Sampler leak test”on page 242.

Poor area count repeatability

Poor area count reproducibility results from changes in the amount of sample reaching the GC detector. Check these general areas:

- GC
- Sample preparation
- Sample vial
- Equilibration of the sample vial

1. Check the sample vials that show low area counts for cracks, defective seals, and poor crimps.
2. Verify that your GC system is working properly. If you can mount an automatic liquid sampler over the inlet, you can inject a sequence of internal or calibration standard directly into the inlet and check the area count repeatability.
3. For the HS, check for the following:
   - If you have the **Check GC Ready** setting set to **WAIT**, the vial equilibration times may vary. Increase the **GC Cycle Time** or select a different **Check GC Ready** setting.
   - Poor choice of equilibration temperature or time. For the best repeatability, the analytes in the sample and in the headspace of the vial must reach static equilibrium. Increase the equilibration time and increase the oven heated zone temperature.
   - If it is a liquid sample, try shaking to speed up equilibration.
   - Check for inconsistent sample preparation technique and vial cap crimping.

Carryover in air or solvent blanks

In theory, if you run a blank after a sample, you would expect no peaks in your chromatogram except for the analytes from the lab air or solvent that is trapped in the sample vial. Carryover results when sample condenses on the flow path or is trapped in unswept areas from a sample injection. When you run a blank you see small quantities of these analytes.

Carryover decreases for each run

If you run a series of solvent blanks and the amount of carryover decreases by a factor of 5 to 10 for each run, the carryover is probably due to an unswept area. Please check the following:

- Transfer line connection to the GC inlet

Caryover does not decrease for each run

If you run a series of solvent blanks and the amount of carryover does not decay for each run, the carryover is probably due to analytes absorbed or condensed on the flow path or in the inlet. Please check the following:

- Poor choice of heated zone temperature settings
- Unswept areas in flow path
- Poor choice of vial pressurization pressure or time
- Flow path contamination
- Poor choice of inlet

Unwanted background noise or peaks

In theory, if you run a sample, you would expect no unrecognized peaks in your chromatogram. Unwanted peaks or ghost peaks result when some unknown is present in your sample vial or flow path.

1. Verify that your GC system is working properly. In most cases, you can inject a small quantity of internal or calibration standard directly into the inlet.
2. For the HS, please check for the following:
   - Possible contamination in sample preparation materials and techniques.
   - Leaks and restrictions in the carrier flow path. The flow path starts at the sample probe and ends at the GC inlet. See “Headspace Sampler leak test”on page 242.
   - Possible contamination in lab air. Run a standard after purging the vial headspace with nitrogen or argon.

Pressure Readings

GC goes not ready during a run

When using the AUX EPC to pressurize the vial, it is normal for the GC to go “not ready” for 10 to 20 seconds during the sample extraction.

The tubing from the AUX EPC module to the shutoff valve is 1/16-inch OD tubing. The tubing from the shutoff valve is about 6 inches of 1/8-inch OD copper tubing. If the 1/8-inch tubing is longer, it can cause a problem.

GC pressure reading does not match Headspace Sampler pressure reading

The instruments use a different type of sensor and the two sensors are calibrated using different processes.

If there are severe differences in the pressure check for leaks and restrictions. See “Headspace Sampler leak test”on page 242.

If pressures are below normal operating pressures, check the following:

- Check the pressure of the gas source (tank, generator, or manifold). For example, the tank may be low on pressure.
- Make sure the shutoff valves on the back of the HS are on.
- Check for leaks between the source and the bulkhead fittings of the GC (EPC) or HS (MPC).
- Check for large restrictions or leaks in the HS. See“Headspace Sampler leak test”on page 242.

Synchronization with GC start

GC does not start

If the HS is not starting the GC, please check the following:

- The **Remote Start/Stop** cable connection
- The **Check for Ready** setting, **Advanced Function 9**

Run is aborted

If the run is aborted, please check for ready settings: **Advanced Function 9.**

Communication with PC

This type of problem results from a break in the communication between the computer and the HS. Please check the cable connections between the computer and the HS.

To correct an invalid serial number

For some instruments (including the 78xx series GCs and the G1888 HS), the software detects whether or not the instrument serial number is valid. If the software discovers an invalid serial number, do the following:

1. Go to the instrument and record its serial number, including all letters and numbers. A GC's serial number tag is located on the bottom right front of the GC, below the keypad.
2. Click **Set Serial Number**.
3. When prompted, enter the serial number exactly as it appears on the serial number tag.
   - Use the drop-down list to select the initial letters of the serial number.
4. Click **Set Serial Number**. The instrument reboots once or twice, depending on the model. Look for a success message in the **Serial Number** dialog box. When the serial number has been successfully applied, close the **Serial Number** dialog.

Lantronix Cobox micro LED patterns

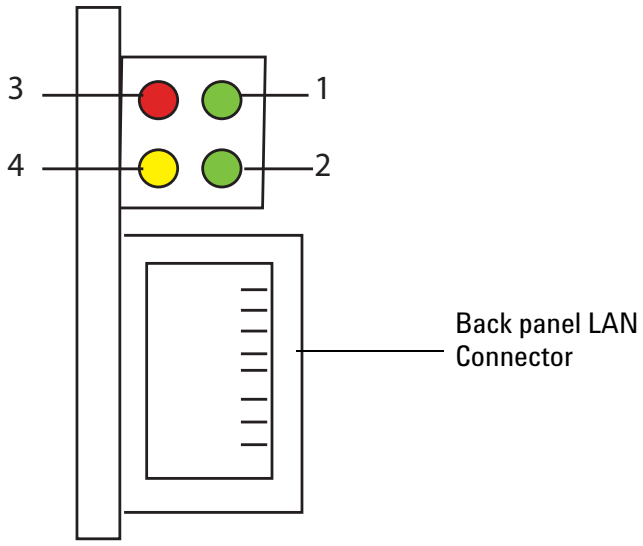


Figure 282 Lantronix cobox micro LED indicator

LED 1

- Indicates the status of channel 1
- GREEN channel 1 LED
- Solid - channel 1 is idle.
- Blinking - channel is connected over the network
- This LED is also used for diagnostic and error detection when combined with LED 3 (Red). See below.

LED 2

- Indicates network connectivity
- GREEN Network Link LED

LED 3

- Indicates a series of diagnostic patterns when combined with LED 1
- RED Error and diagnostic LED
- If the Red LED is on or blinking, the Green LED will give a diagnostic code.

  RED LED SOLID ON, GREEN LED BLINKING

  - 1x: EPROM checksum error
  - 2x: RAM error
  - 3x: Network controller error

- 4x: EEPROM checksum error
- 5x: Duplicate IP address on the network

RED LED BLINKING, GREEN LED BLINKING

- 4x: The network connection is faulty. This should only appear after power up. Even though the Micro is going into operation mode, the problem will potentially persist.
- 5x: No DHCP response was received

LED 4

- Indicates the status of channel 2.
- YELLOW Channel 2 LED
- Solid - channel 2 is idle.
- Blinking - channel is connected over the network.

Improving LAN communications

Before starting the procedure to improve LAN communications:

1. Measure the resistance between the LAN Cobox and ground. If there is a reasonable resistance <0.5 ohms, then the LAN communication intermittence has some other cause.
2. Check the following for a LAN connection:
   - The HS and computer have compatible network addresses. For example, the IP address are compatible on the same network.
   - The Enable RS-232 setting is OFF - Advanced Function 16.
   - The LAN address is correct - Advanced Function 14. Must reset or power cycle for IP address to take effect.

Required tools

Flat-blade screwdriver

Mirror

#1 Phillips screwdriver

2.5 mm Hex Driver

Multimeter

Scissors

Replacement parts

2190-0638 Metal washer

2020403008 Screw

1400-0249 Small cable tie

1400-0308 Large cable tie

ESD Wrist strap

Procedure for improving LAN communications

1. Ground the LAN card.
2. Disconnect the power cord from the HS.
3. Remove the back cover of the HS.

4 Remove the two screws that hold the bracket for the LAN card.

Figure 283 The LAN card screws

5 Use a mirror to view the inside of the back panel. Using a flat-blade screwdriver, scrape the paint on the inside of the chassis surrounding the two slots for the LAN board bracket.

6 Remove the three screws that hold the LAN card to the bracket.

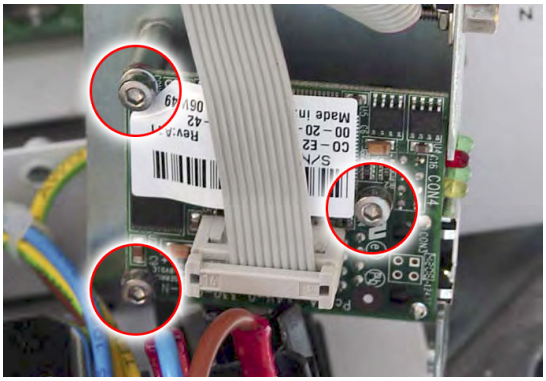


Figure 284 LAN card bracket screws

7 Place the metal washer between the screw and the LAN card. Place the insulating washer on the backside of the LAN card.

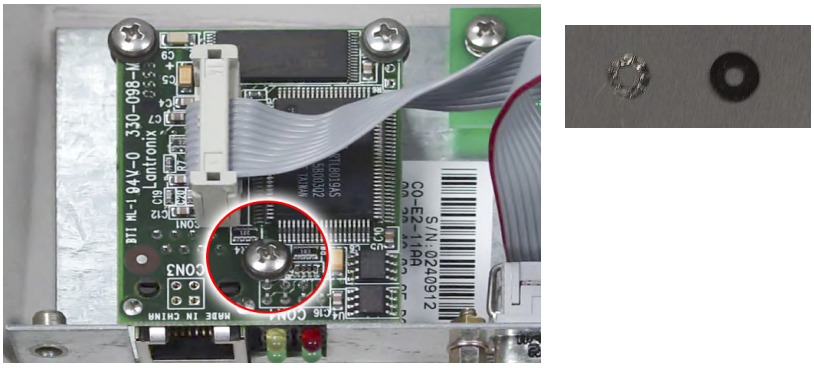


Figure 285 Insulating the LAN card

8 Use a multimeter to measure the resistance of the LAN card. Have one pin on the grounding screw of the LAN card as shown and put the other pin on chassis ground. If the measured resistance is above 0.5 ohms, repeat steps 1-3.

9 Using the ping command, test the connection using the command window of your PC.

Cable Routing

1 Check the routing of the signal cable and ground cable to the power supply. Reroute if necessary with cable ties.

2 Fasten the back panel.

Check the following for an RS-232 connection:

- The com port settings are: Bits per second: 9600; Data bits: 8; Parity: None; Stop bits: 1; Flow control: Hardware.
- The Enable RS-232 setting is ON - Advanced Function 16. No reset required.

Memory and Processor Errors

These errors result from defects in firmware or defective main processor PCA.

Blank Display

A blank display results from an interrupted or incomplete firmware update. The HS fans are running, there is no self-test, and the display is lighted but blank. See “Recovering from Corrupt Installations”on page 220.

Power ON, No Response / Instrument Dead

This symptom results when the line voltage from the wall outlet is not reaching the internal power supplies of the HS. Please check the following:

- HS line module fuses open or blown. Also check the power selector switch setting. Fuses will blow if switch is set to 115 VAC and the line voltage is 220-260 VAC.
- Power cord not connected.
- Power ON switch, set to OFF.
- Line voltage not available at electrical outlet.

Vial Handling

Most problems with vial handling are due to the vials themselves or to misalignment, not to part failures.

- Check that vial labels are properly applied: flat without bumps, no loose label ends, etc.
- Look for old labels stuck in chain links.
- Check chain links for cleanliness. If necessary, remove and clean chain. While chain is removed, clean tray surface.

Vial present sensor

This sensor checks that a vial is in position before and after it is moved between the chain and the oven. For details, see “Optical vial sensor (Vial present sensor)”on page 72.

Tray position 1 sensor

This sensor is located near the Vial Present sensor. See “Optical vial sensor (Vial present sensor)”on page 72.

Optical alignment

These procedures ensure that the chain, tray lifter, carousel, and related parts are aligned.

See “Align the tray chain”on page 60.

Carousel and lifter alignment

The lifter cannot deliver vials to the carousel if the two parts are not aligned.

See “Align the carousel”on page 115 and “Lifter assemblies”on page 104.

Chain tensioning

If the chain is too loose, the links may not align properly with the carousel and the tray lifter. If it is too tight, the chain may bind and overload the drive motor.

Chain tension should be checked periodically. See “Replace the tray chain and tray/shutter drive assembly”on page 54.

MeOH Test

The methanol (MeOH) test makes 20 injections from one vial, using a sample of approximately 10 µL of methanol in 10 mL of water (1000 ppm) in a 20-mL vial. The normal extended equilibration time is not used. A GC cycle time is selected that is appropriate for the column.

Using this short cycle time, the true equilibrium of the headspace is never reached. However since all timing, temperatures and pressures are constant, the resulting intermediate equilibrium soon becomes constant after several injections, and the final stability of this equilibrium is measured. Of the 20 injections made from one vial, the first 10 are rejected as these injections are required to establish the stability. The final 10 injections of the 20 injection sequence are observed, and the relative standard deviation of the areas obtained are considered to be within specification when they are less than 1%.

Since the possible causes of failure are all hardware related (the exception is a leaking vial), the test proves excellent in determining whether a hardware fault exists with the system. For each of the 20 injections, the HS has pressurized, vented and injected identically.

The methanol test is done using one vial, eliminating variation from sample preparation.

This mix should be easy to find in almost any lab. Using a 10-mL disposable pipette, pipette 10 mL of deionized water into a 20-mL vial. Using a 10-µL syringe, inject 10-µL of reagent grade methanol onto the wall of the vial. Wipe the tip of the needle on the vial wall. After capping the vial, invert it several times to wash the methanol off of the wall.

Vials and caps: 20-mL Headspace sample vials (144 vials per box), part number 5182-0837 and vial caps (100/pkg), part number 5183-4477.

Headspace conditions

Table 16 Headspace conditions

Parameter	Value
Heated zones	Oven 60, Loop 110, Transfer line 120
Timed events	GC cycle time 2.0, equilibration time 5.0, vial pressurization 0.20, vent time 0.20, loop equilibration 0.05, injection time 0.5 minutes
Vial parameters	1, 1, 0 (no shake)
Pressurization	Vial 15 psi, Carrier ~16 psi
Standard nickel flow-path	1mL loop, passed leak test
Advanced function 8	8, 20 injections per vial, multiple puncture mode
Advanced function 9	GC READY NO
Chain method	1+2+3+4

Method parameters

If the HS software is used, the method parameters must be set as follows. Apply the method to Locations 1-4.

Table 17 Method parameters

Parameter	Value
Oven temperature	60
Sample valve temperature	110
Transfer line temperature	120
GC cycle time	2
Vial equilibration time	5
Vial pressurization time	0.2
Sample loop fill time	0.2
Loop equilibration time	0.05
Sample injection time	0.5
Sample matrix	Water
Sample matrix boiling point	100

Table 17 Method parameters (continued)

Parameter	Value
Vial range	Start vial 1, end vial 1
Shaking	None
Parameter increment, non-chain use only	None
Extractions per vial	20
Multiple puncture	On

The progress of the analysis can be easily identified on the HS display. These are the monitored values.

After setting the HS conditions, you should end the program so that it doesn't interfere with the HS timing.

Column conditions

The column conditions are as follows. After setting the conditions, we allowed the FID to stabilize overnight.

Table 18 Column conditions

Parameter	Value
Column	1
Mode	Const Pressure
Inlet	Front/Back
Detector	Front/Back
Outlet psi	Ambient
Helium pressure	16.27 psi
Helium Flow	3.8 mL/min
Average velocity	55 cm/sec
Column	HP 19091J-413, HP-5 5% Phenyl methyl siloxane
Initial pressure	16.27 psi
Run Time	40

Oven conditions

The oven conditions are as follows. The GC cycle time on the HS was set to 2.0 minutes.

Table 19 Oven conditions

Parameter	Value
Oven	On
Initial temperature	60
Hold 1	40
Post run	50
Maximum temperature	325
Equilibration min.	0

Split/splitless inlet conditions

The inlet conditions for the split/splitless inlet are as follows. Adjust the measured split vent flow to 100 mL/min manually, using the HS flow controller. This means 50 mL/min comes from the HS and 50 mL/min from the GC.

Table 20 Inlet conditions

Parameter	Value
Mode	Split
Gas	Helium
Heater	On, 200 °C
Pressure	On, 16.27 psi
Total flow	On, 56 mL/min
Split ratio	13.2
Split flow	50 mL/min
Gas saver	20 min, 2 min

Flame ionization detector conditions

The flame ionization detector (FID) conditions are as follows.

Table 21 Detector conditions

Parameter	Value
Heater	300 °C
H2 flow	30 mL/min
Air flow	400 mL/min
Makeup flow	N2, 21.2 mL/min
Makeup mode	Const. Col + Makeup
Flame	On
Lit offset	2

Signal parameters

The signal parameters are as follows.

Table 22 Signal parameters

Parameter	Value
Signal 1	Det, Front detector/Back detector
Data rate	20 Hz
Minimum peak width	0.01 min
Save data	All
Start	0
Stop	40

Interpreting results

The criteria currently in use:

The last 10 peaks area RSD lower than 1% and the mean area higher than 140 pA*s. Typical values are 0.3% area RSD and 160 pA*s for area mean.

The test may fail for the following reasons:

Table 23 Problems and symptoms

Problem	Symptom
Leaking vial	RSD% > 1 and one or more peak areas are high or low RSD% > 1 and peak areas change randomly
Leaks within HS	RSD% > 1 and one or more peak areas are high or low RSD% > 1 and peak areas change randomly
Defective valves (also intermittent)	RSD% > 1 and one or more peak areas are high or low RSD% > 1 and peak areas change randomly Missing peaks
Blocked flow paths (also intermittent)	RSD% > 1 and one or more peak areas are high or low RSD% > 1 and peak areas change randomly
Irreproducible timing	RSD% > 1 and one or more peak areas are high or low Retention times change
Vial pressure instability	RSD% > 1 and one or more peak areas are high or low RSD% > 1 and peak areas change randomly
Temperature instability	RSD% > 1 and peak areas change randomly
Contamination	Ghost peak(s)
	Peak areas are < 140 pA
	RSD% > 1 and peak areas increase or decrease

Troubleshooting Electronics

What makes the control circuit work?

- Appropriate voltages applied to heaters, motors, solenoid valves, sensors, and PCAs.
- Resistances read from PT100 sensors at each heated zone.
- Commands sent between PCAs through a serial bus.

General approach to troubleshooting

- Check the working component.
- Trace the voltage from the working component back to the source.
- Check the 5 VDC and ground to the controller PCAs.

Checking the working components

- Will it respond to Advanced Function 5 commands?
- Will it run in TEST MODE?
- Does it have a pulse?
  - Motors: resistance
  - Heaters: resistance
  - PT100 sensors: resistance
  - Optical sensors: 0 and 5 VDC

Tracing the 24 VDC back to the source

- At the working component
- At the peripheral PCA or distribution PCA
- At the 24 VDC power supply

Checking the ground and 5 VDC

- At each peripheral PCA
- At the main processor PCA
- At the 5 VDC power supply

10 Parts

List of Consumable Parts

Table 24 G1888A Network Headspace Sampler supplies

Description	Part number
Needles	
Needle, transfer line, deactivated, 0.5 mm od	2322590004
Needle, transfer line, deactivated, 0.7 mm od	2322590005
Fittings	
Union, zero dead volume, deactivated	2307230001
Bulkhead fitting, stainless steel	2307833901
Union, M6, brass	2302533140
Union, M5, brass	2302532140
Tee, brass	2304533140
Valves	
Valve, solenoid, vent kalrez	3600500001
Valve, solenoid, vial pressurization	3600500002
Tubing and Transfer Lines	
Strain relief septum nut	31-205-HSP
Sample probe, deactivated	2322700011
Sample loop, 3 mL, deactivated	2321700004
Tube, probe to 6-port valve, deactivated	1300502506
Tube, solenoids to 6-port valve, deactivated	0410105017
Tube, vent, deactivated	1300530001
Tube, tee to pressure PCA	1300530010
Transfer line, deactivated	0410103101
Repair, Leak Test, and OQ/PV Supplies	
Tray chain link repair kit	0410205001
Headspace leak test kit	G1888-60701
OQ/PV Headspace Sample	5182-9733

Table 25 Headspace Sampler vials

Description	Unit	Part number
Certified Flat Bottom Headspace Crimp Top Glass Vials		
20 mL, clear, 23 × 75 mm	100/pkg	5182-0837
10 mL, clear, 23 × 46 mm	100/pkg	5182-0838
20 mL, amber, 23 × 75 mm	100/pkg	5067-0226
10 mL, amber, 23 × 46 mm	100/pkg	5067-0227
Certified Rounded Bottom Headspace Crimp Top Vials		
20 mL, clear, 23 × 75 mm	100/pkg	5183-4474
10 mL, clear, 23 × 46 mm	100/pkg	5183-4475
Certified Headspace Screw Top Vials for G1888A Sampler and CTC CombiPAL		
20 mL, clear, 23 × 75 mm	100/pkg	5188-2753
10 mL, clear, 23 × 46 mm	100/pkg	5188-5392
20 mL, amber, 23 × 75 mm	100/pkg	5188-6537
10 mL, amber, 23 × 46 mm	100/pkg	5188-6638

Table 26 Headspace Sampler caps and septa

Description	Specification	Unit	Part number
Certified 20 mm Headspace Crimp Caps with Septa			
Silver aluminum, PTFE/silicone septa	-60 °C to 180 °C	100/pkg	5183-4477
Silver aluminum, safety feature, PTFE/silicone septa	-60 °C to 180 °C	100/pkg	5183-4478
Silver aluminum, molded PTFE/butyl septa	-40 °C to 125 °C	100/pkg	5183-4479
Certified Ultra Clean 18 mm Screw Top Caps with Septa			
Silver, 1.5 mm PTFE/silicone septa (top white, bottom blue)	to 100 °C	100/pkg	5188-2759
20 mm Headspace Crimp Caps with Septa			
Silver aluminum, safety feature, molded PTFE/butyl septa	-40 °C to 125 °C	100/pkg	5173-4480
20 mm Crimp Caps (no septa)			
Silver aluminum, one-piece		100/pkg	9301-0721
Silver aluminum, one-piece, safety feature		100/pkg	9301-0778

Table 26 Headspace Sampler caps and septa (continued)

Description	Specification	Unit	Part number
20 mm Headspace Septa			
Gray PTFE/butyl molded	-40 °C to 125 °C	100/pkg	9301-0976
Tan PTFE/white silicone	-60 °C to 180 °C	100/pkg	9301-0719

Table 27 Headspace Sampler vial convenience kits

Description	Specification	Unit	Part number
20 mL Headspace crimp top, flat bottom vials, silver aluminum one-piece crimp caps with safety feature, molded gray PTFE/black butyl septa	< 125 °C	100/pkg	5182-0839
20 mL Headspace crimp top, flat bottom vials, silver aluminum one-piece crimp caps with safety feature, molded gray PTFE/black butyl septa	< 180 °C	100/pkg	5182-0840

Ship Kit

Table 28 Headspace Sampler ship kit

Description	Base unit	Quantity	Part number
Needle, Headspace Transfer Line 0.7mm OD	EA	1	2322590005
Liner, direct, 2mm ID, deactivated	EA	1	5181-8818
Flat bottom Headspace vials, 20ml, 100PK	PK	1	5182-0837
11mm lowbld septa 5 pk	PK	1	5182-3413
HS Al crimp cap, PTFE/Si sep, 20mm, 100PK	PK	1	5183-4477
Agilent G1888 Network HS Supp	EA	1	5989-0490EN
Cable, w/conn, 80-1000 V, telecom	EA	1	8121-0940
Crimper, 20mm Seals	EA	1	9301-0720
MPC Plumbing Kit	EA	1	G1290-60515
Cable, RS232, 9F/9F	EA	1	G1530-60600
Cable, Remote, 6890, 9M/9M	EA	1	G1530-60930
Headspace Leak Test Kit	EA	1	G1888-60701
G1888A EPC Plumbing Kit	EA	1	G1888-60705
Headspace User Information CD-ROM	EA	1	G1888-90010
Certificate of Similarity	EA	1	G1888-90200
Strain Relief Septum Nut	EA	1	6410090050
Wrenches, 7x8-mm Set of 2	EA	1	1340407010
MPC Plumbing Kit		0	G1290-60515
1/8 Union Tee Brass Swagelok	EA	1	0100-0090
1/8 Nut & Ferrule Set Brass Swagelok	EA	2	5181-7481
1/8" Ball Valve	EA	2	0100-2144
Copper tubing, 1/8" 12 ft. length	EA	1	5021-7107
Headspace Leak Test Kit		0	G1888-60701
Plug, 1/8' tube Fitting, Nylon	EA	3	0100-2414
M5 Plug, Brass	EA	2	2301102140
M6 Plug, Brass	EA	2	2301103140
M5 Union, Brass	EA	2	2302532140
M6 Union, Brass	EA	2	2302533140

Table 28 Headspace Sampler ship kit (continued)

Description	Base unit	Quantity	Part number
Ferrule Pk, Vespel, for G1888-60701 kit	EA	1	5188-2755
11mm lowbld septa 5 pk	PK	1	5182-3413
Headspace Leak Test Vial	EA	1	G1290-20600
Tubing, 1/16" ID x 1/8" OD x 4', Teflon	EA	1	G1290-80050
Headspace Leak Test Quick Reference	EA	1	G1888-90011
Nut 1/8" Tubing Brass	EA	1	0100-0058
G1888A EPC Plumbing Kit			G1888-60705
Tube, 520MM	EA	1	1530-2167
Pressure bleed weldmt	EA	1	19258-60530
Union, for use with the G1888A Headspace	EA	2	2307232901
1/8 Nut & Ferrule Set Brass Swagelok	EA	2	5181-7481
Knife file	EA	1	8755-0099
Tube Zero Restrictor	EA	3	G1570-20540
O-Ring, 2-010, Fluoroelastomer, 5PK	EA	1	5188-6405

Enhanced PM Kit

Table 29 G1888-60704 G1888A enhanced PM kit

Description	Base Unit	Quantity	Part number
Transferline, Deactivated	EA	1	0410103101
Tube, vent deactivated	EA	1	1300530001
GEN Accessory Carton	EA	1	19256-80075
Valve, Solenoid Vent Kalrez	EA	1	3600500001
Valve, Solenoid for Vial Pressurization	EA	1	3600500002
Valve, 6-Port Sampling	EA	1	9040700026
Cable Tie .062-.625-DIA .091-WD NYL	EA	5	1400-0249

EPC Plumbing Kit

Table 30 G1888-60705 G1888A EPC plumbing kit

Description	Base Unit	Quantity	Part number
Tube, 520MM	EA	1	1530-2167
Pressure bleed weldmt	EA	1	19258-60530
Union, for use with the G1888A Headspace	EA	2	2307232901
1/8 Nut & Ferrule Set Brass Swagelok	EA	2	5181-7481
Knife File	EA	1	8755-0099
Tube Zero Restrictor	EA	3	G1570-20540
O-Ring, 2-010, Fluoroelastomer, 5PK	EA	1	5188-6405

PM Kit with 1 -mL Loop

Table 31 G1888-60702 G1888A PM kit with 1-mL loop

Description	Base Unit	Quantity	Part number
Insulation Disk, Shutter	EA	1	0410105005
Tube, probe to 6-port valve, deactivated	EA	1	1300502506
Union, zero dead volume, deactivated	EA	1	2307230001
Tubing, Solenoids to 6-Port, Deactivated	EA	1	0410105017
Sample loop, 1- ml, deactivated	EA	1	2321700003
Sample probe, deactivated	EA	1	2322700011
SNR Box	EA	1	5062-3586

PM Kit with 3-mL Loop

Table 32 G1888-60703 G1888A PM kit with 3-mL loop

Description	Base Unit	Quantity	Part number
Insulation Disk, Shutter	EA	1	0410105005
Tube, probe to 6-port valve, deactivated	EA	1	1300502506
Union, zero dead volume, deactivated	EA	1	2307230001
Tubing, Solenoids to 6-Port, Deactivated	EA	1	0410105017
Sample loop, 3- ml, deactivated	EA	1	2321700004
Sample probe, deactivated	EA	1	2322700011
SNR Box	EA	1	5062-3586

Headspace Leak Test Kit

Table 33 G1888-60701 Headspace Sampler leak test kit

Description	Base Unit	Quantity	Part number
Plug, 1/8" Tube Fitting, Nylon	EA	3	0100-2414
M5 Plug, Brass	EA	2	2301102140
M6 Plug, Brass	EA	2	2301103140
M5 Union, Brass	EA	2	2302532140
M6 Union, Brass	EA	2	2302533140
Ferrule Pk, Vespel, for G1888-60701 kit	EA	1	5188-2755
11MM Lowbld septa 5 PK	PK	1	5182-3413
Headspace Leak Test Vial	EA	1	G1290-20600
Tubing, 1/16" ID x 1/8" OD x 4', Teflon	EA	1	G1290-80050
Headspace Leak Test Quick Reference	EA	1	G1888-90011
Nut 1/8" Tubing Brass	EA	1	0100-0058

Power Cords

Table 34 Power cords - country specific

Country	Description	Part number
Argentina		8120-6869
Australia/NZ	C13, 10 amp	8120-1369
Chile	C13, 10 amp	8120-6978
China	C13, 10 amp	8121-0723
DK/Greenland	C13, 10 amp	8120-3997
Europe	C13, 10 amp	8120-1689
GB/HK/SG/MY	C13, 10 amp	8120-8705
India/SouthAfrica	C13, 10 amp	8120-4211
Israel	C13, 10 amp	8120-5182
Japan	C15, 15 amp	8120-5342
Korea	C13, 10 amp	8121-1226
Switzerland	C13, 10 amp	8120-2104
US/CA/TW/TH	C13, 13 amp	8120-1992

Fuses

Table 35 Fuses

Location	Description	Part number
F1 Power distribution PCA	Interchangeable Bussmann 5 x 20 mm, Type: GMD D1A (T 1A 250 V), CSA	384-1595011-HSP
F3 and F4 Power distribution PCA	Interchangeable Bussmann 5 x 20 mm, Type: GMD (F 6A 125 V), CSA	384-1295001-HSP
Main fuses on power switch	10 amp, fast acting, 250 V, 5x20 mm	5188-1157
Transformer fuse	8 amp, fast acting, 250 V, 5x20 mm	5188-1158

Table 36 Avaliable fuses for older models

Description	Part number
Fuse 5 x 20 1A T	384-1595001-HSP
Fuse 5 x 20 2A T	384-1695001-HSP
Fuse 5x20 3A T	384-1695003-HSP
Fuse 5 x 20 500MA	384-1695004-HSP

Parts List

Table 37 Replacement parts

Description	Part number
Carousel motor & tensioning bracket	0221670000
Transferline deactivated 0.8 SILTEK	0410103101
Lifter assembly, sample probe	0410105002
Lifter assembly, tray	0410105003
Motor-sensor assembly, 6-port valve	0410105004
Insulation disk, shutter	0410105005
PCA, vial present sensor	0410105106
Pressure regulator with knob	0410105007
Disk, carousel sensor	0410105008
Mandrel, loop holder with screw	0410105009
Flow controller valve with knob	0410105010
Fan, power supply	0410105012
Base, carousel compartment	0410105013
Holder, transfer line	0410105014
Cover, loop heated zone *old color* for units before SN IT00604011	0410105015
Cover, pneumatics compartment *old color* for units before SN IT00604011	0410105016
Tubing, solenoids to 6-port, deactivated	0410105017
Switch, pneumatic mode	0410105018
Motor, tray vial chain	0410105019
PCA, tray position 1 sensor	0410105020
Motor-sensor assembly, shutter	0410105021
Tray-shutter drive assembly	0410105022
Lid assembly with oven enclosure top *old color* for units before SN IT00604011	0410105024
Base, carousel compartment with switch	0410105025
Transformer	0410105026
Enclosure, oven	0410105027

Table 37 Replacement parts (continued)

Description	Part number
Motor, oven fan	0410105028
Heater sensor assembly, oven	0410105029
Fan, vial cooling	0410105030
Frame, Headspace chassis	0410105031
Top, oven enclosure	0410105032
Oven enclosure with carousel enclosure	0410105033
Display keypad assembly	0410105034
Panel, power supply	0410105035
Heater sensor assembly, loop	0410105036
CO-BOX RS232 (PCA Communications)	0410105040
Cover, loop heated zone * New Color* for units after SN IT00604011	0410105115
Cover pneumatics compartment * New Color* for units after SN IT00604011	0410105116
Lid assembly with oven enclosed top *New Color* for units after SN IT00604011	0410105124
Frame, Headspace chassis *New Color* for units after SN IT00604011	0410105131
Display, keypad assembly *New Color* for units after SN IT00604011	0410105134
Panel, power supply *New Color* for units after SN IT00604011	0410105135
Tray chain link repair kit	0410205001
Latch, lid closure	0410205002
Standoff, oven fan	0410205003
Heater block, tube from probe, includes screw	0410205004
Cover, tray 3 pieces	0410205005
Heater block, solenoid valves	0410205007
Line module with fuse holder and fuses	0410205009
Insulation	1171210001
Oven base insulation	1171210003
Oven base	1171210007

Table 37 Replacement parts (continued)

Description	Part number
Oven top insulation	1171210008
Oven external covering	1211109032
Dani red septa 100/pk D20SIL/PTFE	1260995003
Tube, sample probe to 6-port valve deactivated	1300502506
Tube, vent deactivated	1300530001
Tube, vial pressure valve to union	1300530002
Tube, switch to bulkhead	1300530004
Tube, switch to brass tee	1300530005
Tube, switch to flow controller	1300530006
Tube, switch to pressure regulator	1300530007
Tube, flow controller to bulkhead	1300530008
Tube, pressure regulator to bulkhead	1300530009
Tube, tee to pressure PCA	1300530010
Tube, tee to 6-port valve carrier	1300530011
Wrenches, 7x8-mm set of 2	1340407010
Wrenches, 6x7-mm set of 2	1340407011
Wrenches, 8x10-mm set of 2	1340407012
Hex, L-wrench, 2.5-mm	1341002500
Hex L-wrench, 3-mm	1341203000
Nut, pneumatics tubing to 6-port valve	1925820830
Ferrule, pneumatics tubing to 6-port valve	1925820870
Screw M2x10	2020402010
Screw M3x6	2020403006
Screw M3x8	2020403008
Screw M3x10	2020403010
Screw M2x16	2020403016
Pneumatic screw	2020403035
Screw M4x6	2020404006
Screw, phillips pan head M4 x 8 SS	2020404008
Screw M4x10	2020404010
Screw M4x12	2020404012

Table 37 Replacement parts (continued)

Description	Part number
Screw M4x25	2020404025
Screw M4x12	2030404012
Allen Screw M4x30	2030404030
7 mm bolt	2040404016
Screw M3x8	2060403008
Screw M3x16	2060403016
Screw M3x20	2060403020
Screw M4x10	2060404010
Hinge pin	6410316040
Screw M4x20	2060404020
Screw M2.9x9.5	2114042909
Square washer M4	2150104040
Nut	2160014003
Square washer	2161011001
Flat washer	2170204030
Flat washer	2170204040
Toothed washer	2171304030
Washer, tooth locking, 4.0 SS	2171304040
Washer	2180014004
Washer, teflon, carousel shaft bottom	2180036007
Washer, rulon, carousel shaft top	2180037001
Spacer	2180042001
Flat fiber washer	2180043001
Spring clip	2181212002
Washer	2181212003
Clip ring, tray chain pulley	2181212004
Nut post	2190164010
Standoff	2190164015
Standoff	2190164020
Flat washer	2191320306
Spacer	2195040010

Table 37 Replacement parts (continued)

Description	Part number
Sleeve, carousel	2195140001
Spacer, oven heater block base	2195140002
Nylon spacer	2195310012
Brass bushing	2195310013
Knob	2272000001
Carousel belt	2283000006
Shutter belt	2283000015
Tray belt	2283000016
Small pulley	2283500008
Pulley, tray chain	2283500020
Disk, carousel sensor	2283500022
Vial chain assembly	2285000001
M5 plug, brass	2301102140
M6 plug, brass	2301103140
M5 union, brass	2302532140
M6 union, brass	2302533140
Union	2303002051
Tee, brass	2304533140
Connector	2305533141
Union, zero dead volume, deactivated	2307230001
Union 5M SS	2307232901
Union	2307601001
Tubing, 6-port valve to solenoid valves SILTEK	2307601004
Bulkhead fitting	2307833900
Bulkhead fitting, SS	2307833901
Coupling	2311500003
Sample loop 100 ul SILTEK	2320346020
Flow restrictor	2321390008
Sample loop, 1-mL deactivated	2321700003
Sample loop, 3-mL deactivated	2321700004
Needle, transfer line deactivated OD 0.5	2322590004

Table 37 Replacement parts (continued)

Description	Part number
Needle, transfer line deactivated OD 0.7	2322590005
Sample probe, for G1888A, deactivated	2322700011
Spring	2351500030
Spring, vial push	2351500035
Thermoswitch, oven	3070000010
Sensor, 6-port	3411500102
PCA, carousel sensor	3411500107
PCA, power distribution plus 5 VDC	3411500110
PCA, motor controller 1	3411500111
PCA, motor controller 2	3411500112
PCA, temperature controller	3411500113
PCA main Processor	3411500114
Pressure sensor PCA	3411500115
Terminal block, 6-port	3411500116
Valve, solenoid vent kalrez	3600500001
Valve, solenoid vial pressurization	3600500002
Relay, oven heater	3641500008
Motor	3700500001
Fan blades, oven with setscrew	3700500902
Valve motor-24 VDC	3701509002
Switch, voltage selector	3821019002
Sensor	3831019003
Line filter	3840300011
Power supply, 24 VDC	3856000004
Ribbon cable, control harness	5104309004
Ribbon cable, communication harness	5104309005
Harness, PCA power supply	5104319108
Cable assembly, solenoid valves	5104319115
Holder, transfer line	5264550001
Biadhesive tape 4 cm	5265500002
Chock	5282003502

Table 37 Replacement parts (continued)

Description	Part number
Line module	5404020001
Valve, solenoid vial pressurization	3600500002
Carousel, 12 position	6310090035
Hinged Cover, pneumatics compartment *Id color*	6310103016
Oven enclosure top	6310103025
Screen, oven fan	6310103026
Cover, loop heated zone	6310103085
Front cover, pneumatics compartment *old color*	6310103092
Trim center	6310103095
Back Cover, pneumatics compartment *old color*	6310103106
Tray motor group cover *old color*	6310103107
Tray motor group cover *new color*	6310103126
Pneumatic compartment	6310110001
Insulation support	6310119235
Clip on carousel base assembly	6310206011
Strain relief septum nut	6410090050
Stepping motor	6410090081
Insulation block	6410106045
Carousel compartment base	6410106046
Tensioning bracket	6410110100
Toggle switch bracket	6410119065
Sleeve, ceramic lifter rod	6410202002
Sleeve, rulon J oven cover (rulon bushing)	6410202011
Needle guide	6410202015
Motor-sensor disk	6410204035
Collar, carousel	6410204041
Motor plate	6410216060
Pneumatics base	6410216081
Base, oven enclosure	6410216084
Standoff, tray pulley 5.7 cm	6410216136
Standoff, tray cover 6.9 cm	6410216137

Table 37 Replacement parts (continued)

Description	Part number
Shaft, carousel	6410216138
Standoff, center tray pulley	6410216141
Bushing, carousel shaft top	6410302066
Bushing, carousel shaft bottom	6410302067
Front panel *old color* - before SN IT00604011	6550106033
Front panel *new color* - after SN IT00604011	6550106036
Bracket, motor support	6550119055
Bracket, solenoid valves	6550119125
Sample probe holder	6550209030
Carousel enclosure	9011090003
Valve, 6-port sampling	9040700026
Flow controller	9050790001
Heater	9100005005
Oven band heater	9101030001
Heater block, tube from probe	9103010006
Heater block, loop	9110509015
Mandrel, loop holder	9110600021
PCA carousel sensor	34411500107
MPC plumbing kit	G1290-60515
Headspace leak test kit	G1888-60701
G1888A PM Kit with 1-mL Loop	G1888-60702
G1888A PM Kit with 3-mL Loop	G1888-60703
G1888A enhanced PM kit	G1888-60704
G1888A EPC plumbing kit	G1888-60705
Pressure regulator	9050590004

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