HP 1100 Series
Thermostatted
Column
Compartment

Reference Manual

HP Part No. G1316-90002

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WARNING

For details of safety, see Safety Information on page 192.

Warning Symbols Used In This Book

The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect the apparatus against damage.

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Reference Manual

In This Book

This manual contains technical reference information about the HP 1100 Series thermostatted column compartment. The manual describes the following:

- installing the column compartment,
- introduction to the column compartment and its optimization,
- diagnostics and troubleshooting,
- repairing the column compartment,
- parts and materials, and
- theory of operation.

1

Installing the Column Compartment

How to install the thermostatted column compartment

Site Requirements

A suitable environment is important to ensure optimum performance of the column compartment.

Power Consideration

The column compartment power supply has wide-ranging capability (see Table 1). It accepts any line voltage in the above mentioned range. Consequently there is no voltage selector in the rear of the column compartment. There are also no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

WARNING **To disconnect the column compartment from line, unplug the power cord. The power supply still uses some power, even if the power switch on the front panel is turned off.**

WARNING **Shock hazard or damage of your instrumentation can result, if the devices are connected to a line voltage higher than specified.**

Power Cords

Different power cords are offered as options with the column compartment. The female end of each of the power cords is identical. It plugs into the power-input socket at the rear of the column compartment. The male end of each of the power cords is different and designed to match the wall socket of a particular country or region.

WARNING **Never operate your instrumentation from a power outlet that has no ground connection. Never use a power cord other than the HP power cord designed for your region.**

WARNING **Never use cables other than the ones supplied by Hewlett-Packard to ensure proper functionality and compliance with safety or EMC regulations.**

Bench Space

The column compartment dimensions and weight (see Table 1) allow to place the column compartment on almost any desk or laboratory bench. It needs an additional 2.5 cm (1.0 inches) of space on either side and approximately 8 cm (3.1 inches) in the rear for the circulation of air and electric connections.

If the bench should carry a complete HP 1100 Series system, make sure that the bench is designed to carry the weight of all the modules.

The detector should be operated in a horizontal position.

Environment

Your column compartment will work within specifications at ambient temperatures and relative humidity as described in Table 1.

CAUTION

Do not store, ship or use your column compartment under conditions where temperature fluctuations could cause condensation within the column compartment. Condensation will damage the system electronics. If your column compartment was shipped in cold weather, leave it in its box and allow it to warm slowly to room temperature to avoid condensation.

Physical Specifications

Table 1 Physical Specifications

Type	Specification	Comments
Weight	10.2 kg (22.5 lbs)	
Dimensions (width × depth × height)	410 × 435 × 140 mm (16.1 × 17 × 5.5 inches)	
Line Voltage	100 – 120 or 220 – 240 VAC, ± 10 %	Wide-ranging capability
Line frequency	50 or 60 Hz, ± 5 %	
Power consumption	320 VA	Maximum
Ambient operating temperature	0 – 55 °C (32 – 131 °F)	
Ambient non-operating temperature	-40 – 70 °C (-4 – 158 °F)	
Humidity	<95 %, at 25 – 40 °C (77 – 104 °F)	Non-condensing
Operating altitude	Up to 2000 m (6500 ft.)	
Non-operating altitude	Up to 4600 m (14950 ft.)	For storing the instrument
Safety standards: IEC, CSA, UL, EN	Installation Category II, Pollution Degree 2	

Unpacking the Column Compartment

Damaged Packaging

If the delivery packaging shows signs of external damage, please call your Hewlett-Packard sales and service office immediately. Inform your service representative that the column compartment may have been damaged during shipment.

CAUTION

If there are signs of damage, please do not attempt to install the column compartment.

Delivery Checklist

Ensure all parts and materials have been delivered with the column compartment. The delivery checklist is shown in Table 2. Please report missing or damaged parts to your local Hewlett-Packard sales and service office.

Table 2 **Column Compartment Delivery Checklist**

Description	Quantity
Thermostatted column compartment	1
Power cable	1
CAN cable (HP part number 5181-1516)	1
Column switching valve	optional
Reference Manual	1
Accessory kit (see Table 3)	1

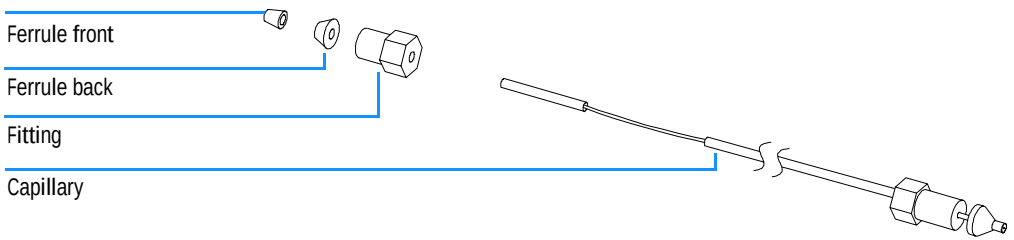
Accessory Kit Contents

Table 3 **Accessory Kit Contents (HP part number G1316-68705)**

Description	HP Part Number	Quantity
Tubing flexible (to waste) for re-order 5 m	5062-2463	1.2 m
Capillary, 90 mm lg, 0.17 i.d., fittings need to be assembled	G1316-87300	1
Ferrule front SST	0100-0043	2
Ferrule back SST	0100-0044	2
Fitting SST	79814-22406	2
Column-identification tag	*	1
Column clip	**	2
ESD Wrist Strap	9300-1408	1

* for reordering use part number 5062-8588 that comprises a kit with 3 column identification tags
** for reordering use part number 5063-6526 that comprises a kit with 6 column clips

Figure 1 **Capillary (Column-Heat Exchanger) Parts**



Optimizing the Stack Configuration

If your column compartment is part of a HP 1100 Series system, you can ensure optimum performance by installing the following configuration. This configuration optimizes the system flow path and ensures minimum delay volume

Figure 2 **Recommended Stack Configuration (Front View)**

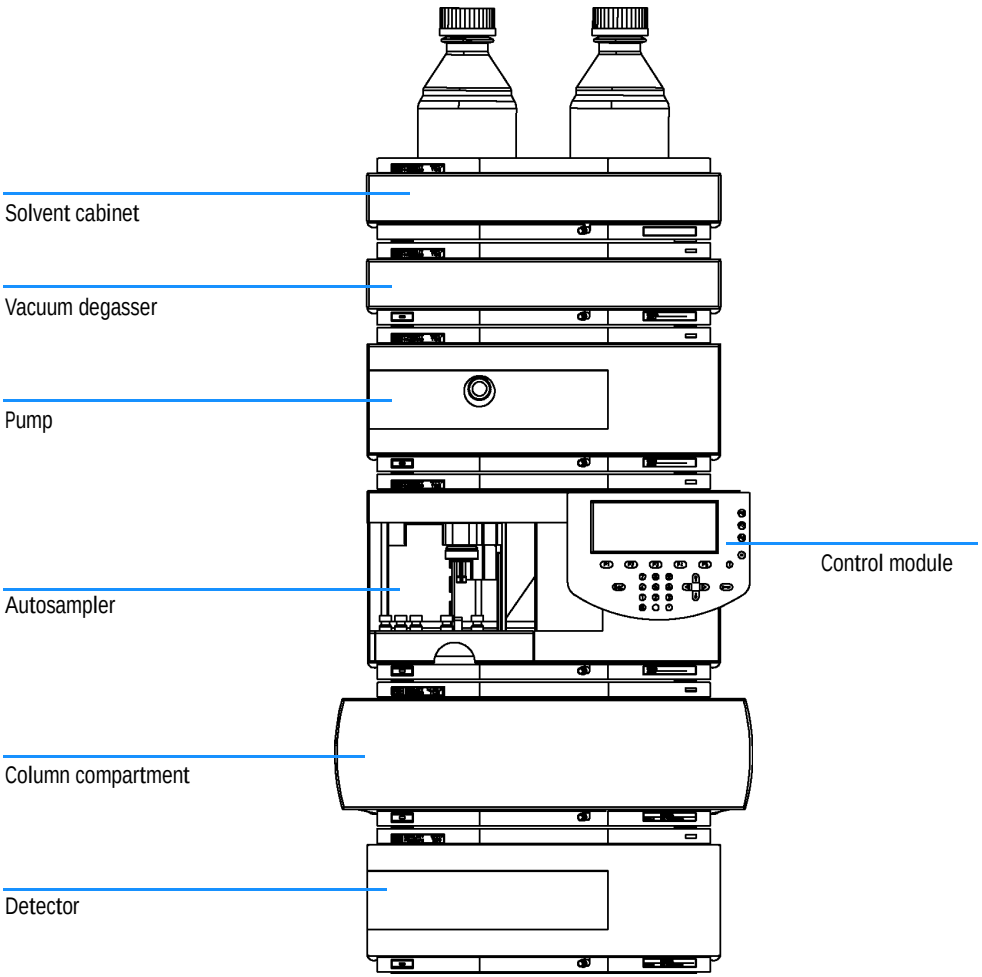
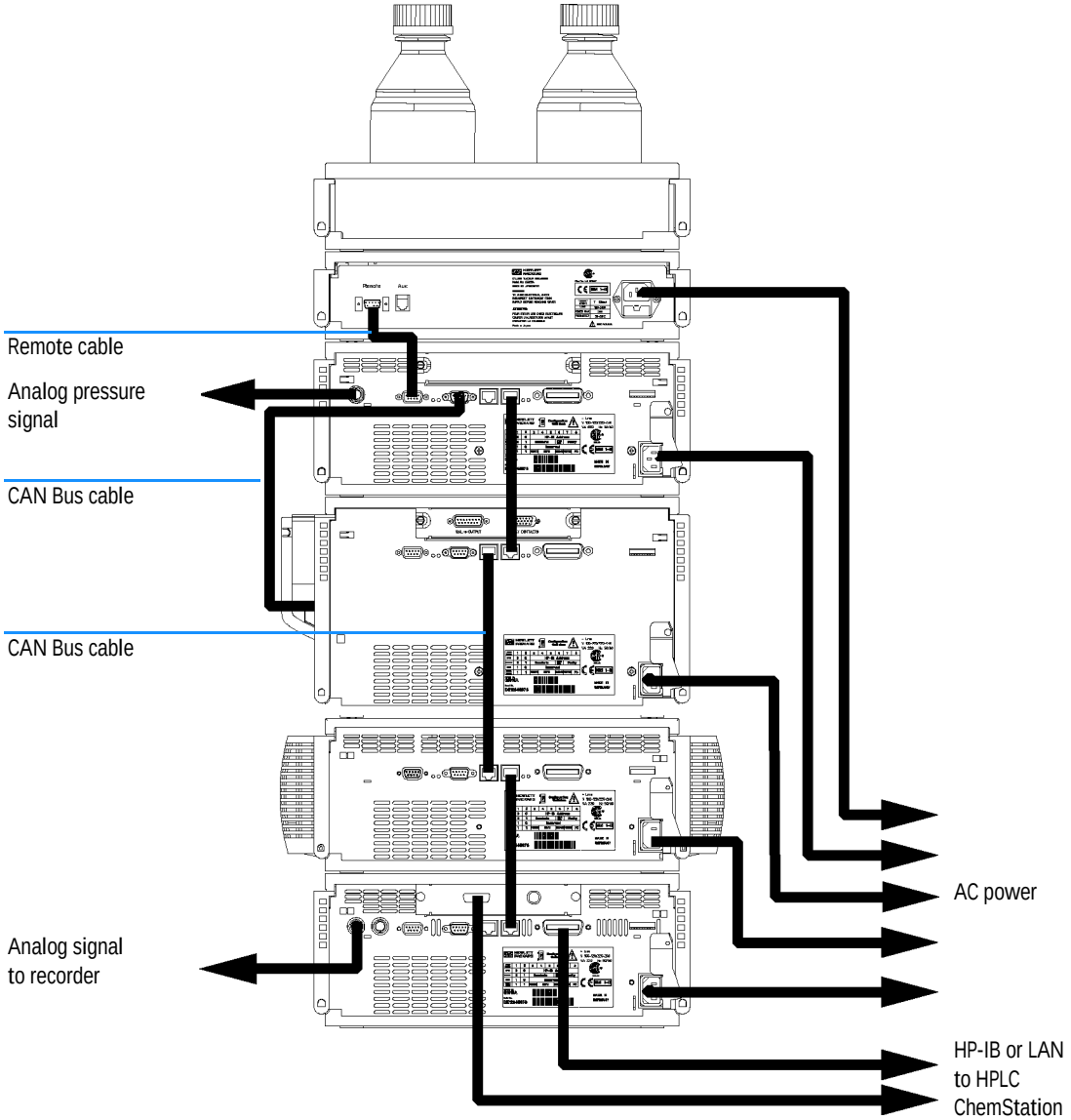


Figure 3 **Recommended Stack Configuration (Rear View)**



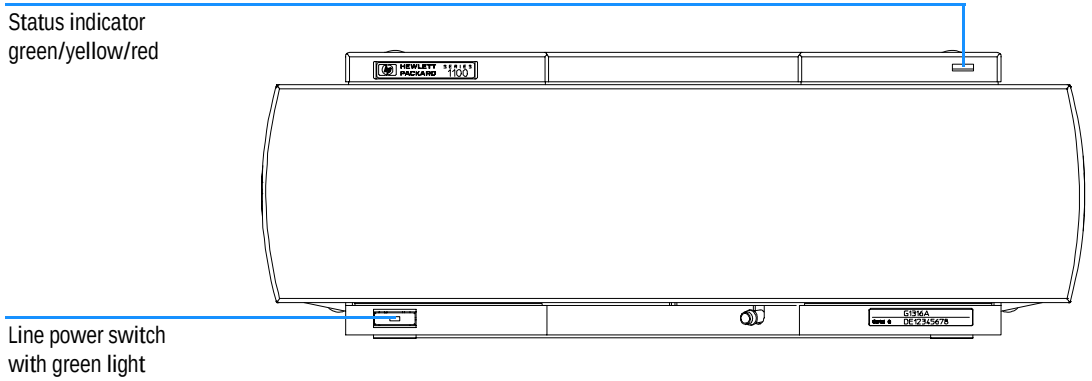
Installing the Column Compartment

Preparations	Locate bench space. Provide power connections. Unpack the Column compartment.
Parts required	Column compartment Power cord, for other cables see text below and “Cable Overview” on page 118.

1 Place the column compartment in the stack or on the bench in a horizontal position.

2 Ensure the power switch at the front of the column compartment is OFF.

Figure 4 **Front View of the Thermostatted Column Compartment**



3 Connect the power cable to the power connector at the rear of the column compartment.

4 Connect the CAN cable to other HP 1100 Series modules.

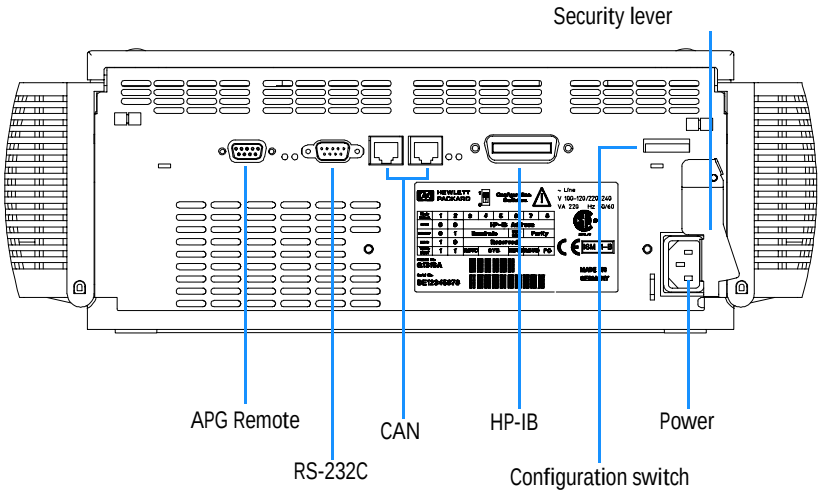
5 If a HP ChemStation is the controller, connect either

- ❏ the HP-IB cable to the detector or
- ❏ the LAN connection to the LAN interface board in the detector.

6 Connect the APG Remote cable (optional) for non-HP 1100 Series instruments.

7 Turn on power by pushing the button at the lower left side of the column compartment. The status LED should shine green.

Figure 5 **Rear View of the Thermostatted Column Compartment**



NOTE The column compartment is turned on when the line power switch is pressed and the green indicator lamp is illuminated. The column compartment is turned off when the line power switch is protruding and the green light is off.

WARNING **To disconnect the column compartment from line, unplug the power cord. The power supply still uses some power, even if the power switch at the front panel is turned off.**

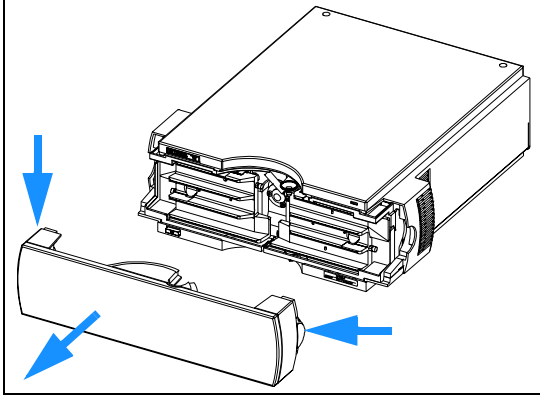
NOTE The column compartment was shipped with default configuration settings. For changing of these setting, see “Setting the 8-bit Configuration Switch” on page 156.

Flow Connections of the Column Compartment

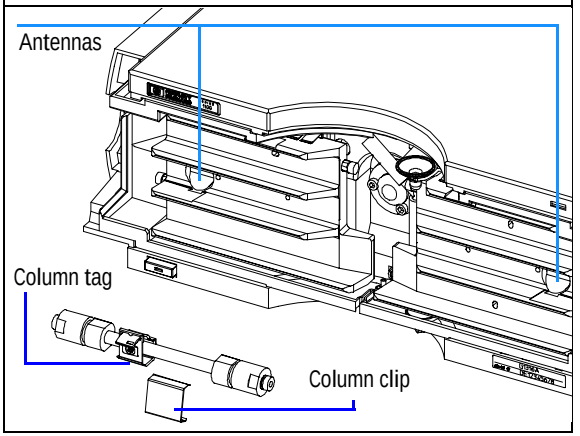
WARNING **When working with solvents please observe appropriate safety procedures (for example, goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the solvent vendor, especially when toxic or hazardous solvents are used.**

Preparations	Install the column compartment
Parts required	Other modules Parts from accessory kit, see “Accessory Kit Contents” on page 14 and/or from capillary kit column switching valve, see “Column Switching Valve” on page 111 Two wrenches 1/4 – 5/16 inch for capillary connections

1 Press release buttons and remove front cover to gain access to heater area.



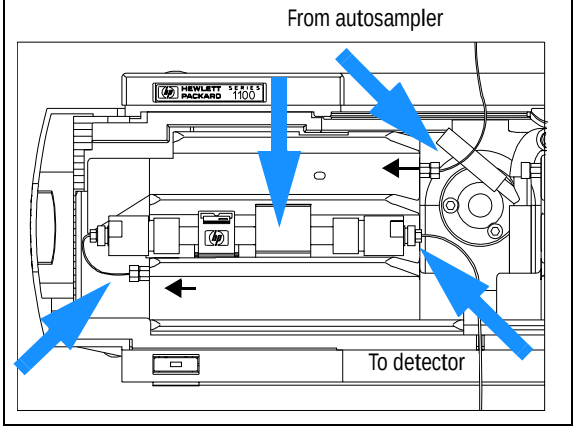
2 The column compartment is equipped with an column-identification system that can read column tags.



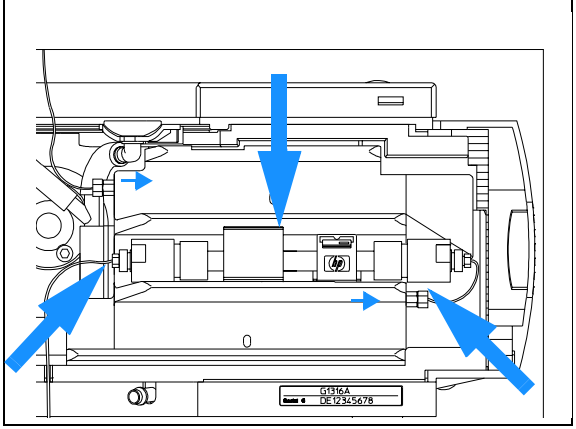
For more information on column identification, see “Column-Identification System” on page 137.

The internal volumes of the heat exchanger assemblies comprise a volume of 3 µl (left) and 6 µl (right). The internal capillary diameter is 0.17 mm.

3 Place the column on the left heat exchanger assembly and connect the capillaries to the column.

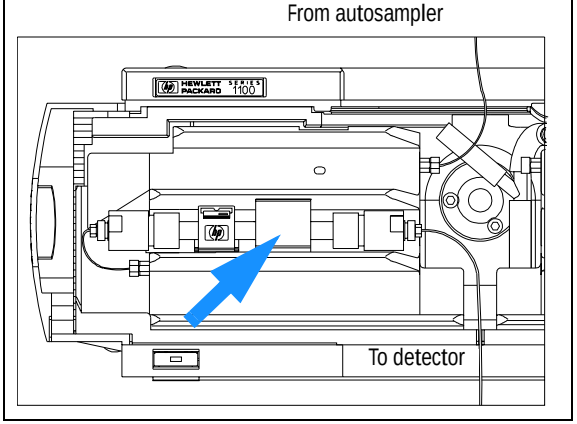


4 Or place the column on the right heat exchanger assembly and connect the capillaries to the column.



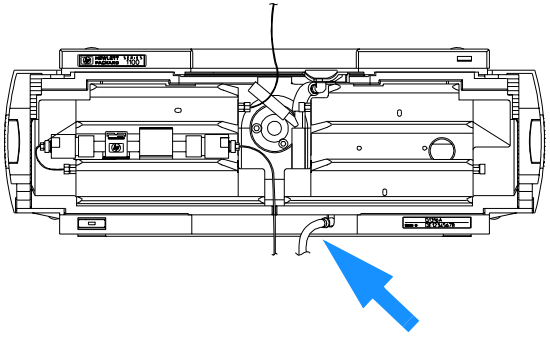
To connect the column selection valve, see “Column Switching Valve (Optional)” on page 140.

5 Fix the column with the column clip from the accessory kit.

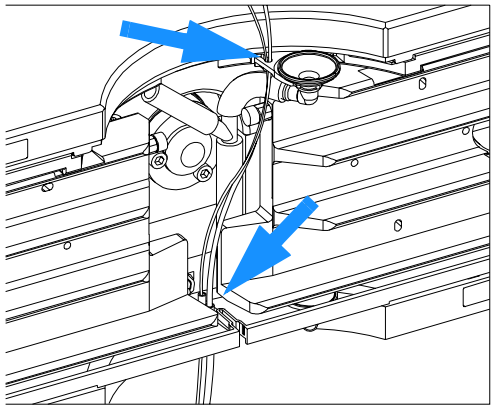


If your accessory kit was shipped without the column clip, you may order them. Refer to “Accessory Kit Contents” on page 14 for part number information.

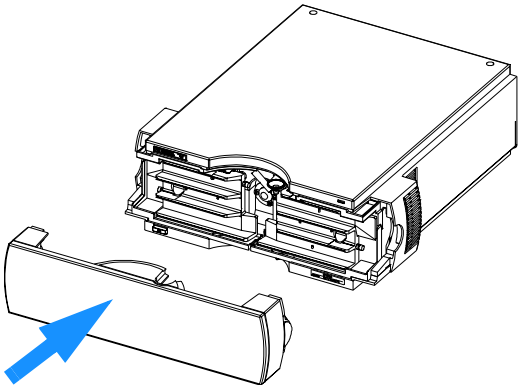
6 If the column compartment is not part of a HP 1100 Series system, or if an HP 1100 Series Autosampler is located on top, connect the corrugated tubing to the waste outlet.



7 Route tubings from modules above through the openings in the funnel holder (top) and the plastic bottom part. Remove small plastic plugs first.



8 Close the front cover and replace the front cover.



The installation of the column compartment has now been completed.

2

How to optimize the Column Compartment

An introduction to the column compartment's optimization

Optimizing the Column Compartment

For best performance results of the column compartment follow the following hints:

- Use short connection capillaries and place them close to the heat exchanger. This will reduce heat dissipation and external band-broadening.
- Use the left heat exchanger for small volume columns, for example, 2–3 mm i.d. columns at flow rates of less than 200 µl/min.
- For even lower band-broadening, the heat exchanger can be by-passed and the column is placed well between the heat exchanger fins.
- Keep the left and right heat exchanger temperature the same unless you do specific applications.
- Assure that the front cover is always closed.

3

Troubleshooting and Test Functions

The column compartment's built-in troubleshooting and test functions

Troubleshooting and Test Functions

This chapter describes the instrument's built in troubleshooting and test functions.

Status Indicators

The instrument is provided with two status indicators which indicate the operational state (prerun, run, and error states) of the instrument. The status indicators provide a quick visual check of the operation of the instrument.

Error Messages

In the event of an electronic, mechanical or hydraulic failure, the instrument generates an error message in the user interface. The following pages describe the meaning of the error messages. For each message, a short description of the failure, a list of probable causes of the problem, and a list of suggested actions to fix the problem are provided.

Thermostat Function Test

The thermostat function test evaluates the heating and cooling efficiency of the two peltier elements.

Temperature Calibration and Verification

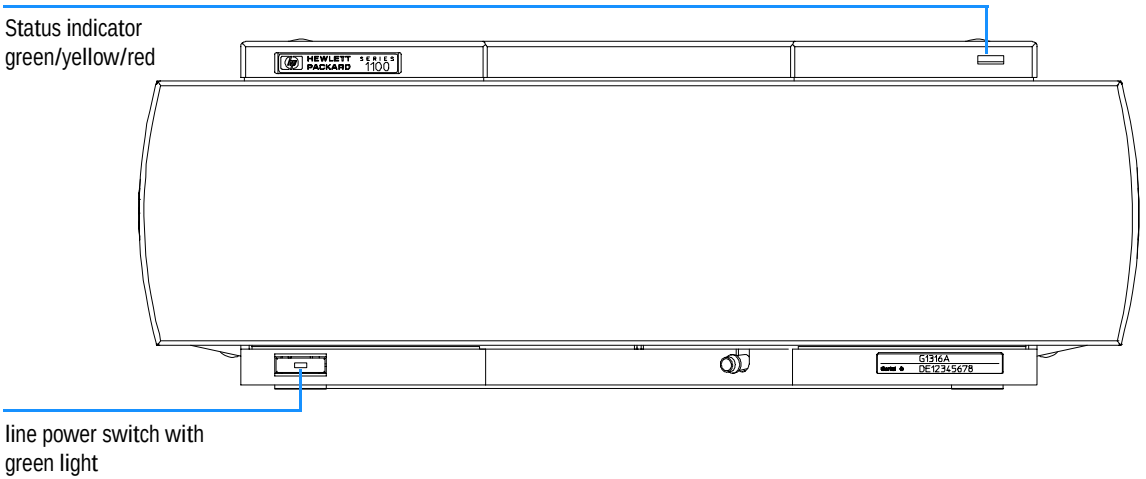
The temperature calibration and verification procedure enables the instrument temperature to be measured against an external, calibrated measuring device. Normally, temperature calibration is not required throughout the lifetime of the instrument. However, in order to comply with local regulatory requirements, calibration and verification may be required.

The following sections describe these functions in detail.

Status indicators

Two status indicators are located on the front of the instrument. The lower left indicates the power supply status, the upper right indicates the instrument status.

Figure 6 **Location of Status indicators**



Power Supply Indicator

The power supply indicator is integrated into the main power switch. When the indicator is illuminated (*green*) the power is *ON*.

Instrument Status Indicator

The instrument status indicator indicates one of four possible instrument conditions:

- When the status indicator is *OFF* (and power switch indicator is on), the instrument is in a *prerun* condition, and is ready to begin an analysis.
- A *green* status indicator, indicates the instrument is performing an analysis (*run* mode).
- A *yellow* indicator indicates a *not-ready* condition. The instrument is in a not-ready state when it is waiting for a specific condition or action to be completed (for example, immediately after changing a setpoint), or while a self-test procedure is running.
- An *error* condition is indicated when the status indicator is *red*. An error condition indicates the instrument has detected an internal problem which affects correct operation of the instrument. Usually, an error condition requires attention (for example, leak, defective internal components). An error condition always interrupts the analysis.

Error Messages

Error messages are displayed in the user interface when an electronic, mechanical, or hydraulic (flow path) failure occurs which requires attention before the analysis can be continued (for example, repair, frit exchange, exchange of consumable is necessary). In the event of such a failure, the red status indicator at the front of the column compartment is switched on, and an entry is written into the instrument logbook.

This section describes the meaning of error messages, and provides information on probable causes and suggested actions how to recover from error conditions.

Timeout

The timeout threshold was exceeded.

Probable Causes

- The analysis was completed successfully, and the timeout function switched off the pump as requested.
- A not-ready condition was present during a sequence or multiple-injection run for a period longer than the timeout threshold.

Suggested Actions

❏ Check the logbook for the occurrence and source of a not-ready condition. Restart the analysis where required.

Shutdown

An external instrument has generated a shut-down signal on the remote line.

The instrument continually monitors the remote input connectors for status signals. A LOW signal input on pin 4 of the remote connector generates the error message.

Probable Causes

- Leak detected in an external instrument with a remote connection to the system.
- Shut-down in an external instrument with a remote connection to the system.
- The degasser failed to generate sufficient vacuum for solvent degassing.

Suggested Actions

❏ Fix the leak in the external instrument before restarting the pump module.

❏ Check external instruments for a shut-down condition.

❏ Check the degasser module for an error condition. Refer to the *Reference Manual* for the HP 1100 Series vacuum degasser.

Remote Timeout

A not-ready condition is still present on the remote input.

When an analysis is started, the system expects all not-ready conditions (e.g. a not-ready condition during detector balance) to switch to run conditions within one minute of starting the analysis. If a not-ready condition is still present on the remote line after one minute the error message is generated.

Probable Causes

- Not-ready condition in one of the instruments connected to the remote line.
- Defective remote cable.
- Defective components in the instrument showing the not-ready condition.

Suggested Actions

❏ Ensure the instrument showing the not-ready condition is installed correctly, and is set up correctly for analysis.

❏ Exchange the remote cable.

❏ Check the instrument for defects (refer to the instrument's reference documentation).

Synchronization Lost

During an analysis, the internal synchronization or communication between one or more of the modules in the system has failed.

The system processors continually monitor the system configuration. If one or more of the modules is no longer recognized as being connected to the system, the error message is generated.

Probable Causes

- CAN cable disconnected.
- Defective CAN cable.
- Defective main board in another module.

Suggested Actions

❏ Ensure all the CAN cables are connected correctly.

❏ Switch off the system. Restart the system, and determine which module or modules are not recognized by the system.

❏ Ensure all CAN cables are installed correctly.

Leak

A leak was detected in the column compartment module.

The signals from the two temperature sensors (leak sensor and board-mounted temperature-compensation sensor) are used by the leak algorithm to determine whether a leak is present. When a leak occurs, the leak sensor is cooled by the solvent. This changes the resistance of the leak sensor which is sensed by the leak-sensor circuit on the CCM board.

Probable Causes

- Condensation.
- Loose column fittings.
- Broken capillary.
- Leaking column-switching valve seal.

Suggested Actions

- ❏ Use a higher temperature setpoint.
- ❏ Ensure all fittings are tight.
- ❏ Exchange defective capillaries.
- ❏ Exchange the valve seal.

Leak Sensor Open

The leak sensor in the column compartment module has failed (open circuit).

The current through the leak sensor is dependent on temperature. A leak is detected when solvent cools the leak sensor, causing the leak-sensor current to change within defined limits. If the current falls outside the lower limit, the error message is generated.

Probable Causes

- Leak sensor not connected to the CCM board.
- Defective leak sensor.

Suggested Actions

❏ Ensure the leak sensor is connected correctly.

❏ Exchange the leak sensor.

Leak Sensor Short

The leak sensor in the column compartment module has failed (short circuit).

The current through the leak sensor is dependent on temperature. A leak is detected when solvent cools the leak sensor, causing the leak-sensor current to change within defined limits. If the current increases above the upper limit, the error message is generated.

Probable Causes

- Defective leak sensor.

Suggested Actions

❏ Exchange the leak sensor.

Compensation Sensor Open

The ambient-compensation sensor (NTC) on the CCM board in the column compartment module has failed (open circuit).

The resistance across the temperature compensation sensor (NTC) on the CCM board is dependent on ambient temperature. The change in resistance is used by the leak circuit to compensate for ambient temperature changes. If the resistance across the sensor increases above the upper limit, the error message is generated.

Probable Causes

- Defective CCM board.

Suggested Actions

❏ Exchange the CCM board.

Compensation Sensor Short

The ambient-compensation sensor (NTC) on the CCM board in the column compartment module has failed (short circuit).

The resistance across the temperature compensation sensor (NTC) on the CCM board is dependent on ambient temperature. The change in resistance is used by the leak circuit to compensate for ambient temperature changes. If the resistance across the sensor falls below the lower limit, the error message is generated.

Probable Causes

- Defective CCM board.

Suggested Actions

❏ Exchange the CCM board.

Left Fan Failed

The left cooling fan in the column compartment has failed.

The hall sensor on the fan shaft is used by the CCM board to monitor the fan speed. If the fan speed falls below 2 revolutions/second for longer than 5 seconds, the error message is generated.

Probable Causes

- Fan cable disconnected.
- Defective fan.
- Defective CCM board.

Suggested Actions

❏ Ensure the fan is connected correctly.

❏ Exchange fan.

❏ Exchange the CCM board.

Right Fan Failed

The right cooling fan in the column compartment has failed.

The hall sensor on the fan shaft is used by the CCM board to monitor the fan speed. If the fan speed falls below 2 revolutions/second for longer than 5 seconds, the error message is generated.

Probable Causes

- Fan cable disconnected.
- Defective fan.
- Defective CCM board.

Suggested Actions

❏ Ensure the fan is connected correctly.

❏ Exchange the fan.

❏ Exchange the CCM board.

Open Cover

The top foam has been removed.

The sensor on the CCM board detects when the top foam is in place. If the foam is removed, the fan is switched and peltier elements are switched off, and the error message is generated.

Probable Causes

- The top foam was removed during operation.
- Foam not activating the sensor.

Suggested Actions

❏ Replace the top foam.

❏ Exchange the foam.

Cover Violation

The column compartment was switched on with the top cover and foam open.

The sensor on the CCM board detects when the top foam is in place. If the column compartment is switched on with the foam removed, the processor switches off the peltier elements after a short delay, and the error message is generated.

Probable Causes

- The column compartment was switched on with the top cover and foam removed.

Suggested Actions

❏ Replace the top cover and foam.

Left Temperature Timeout

The temperature of the left heat exchanger did not reach the temperature setpoint within the timeout threshold.

Probable Causes

- Timeout threshold too short.
- Defective left heater assembly.
- Defective CCM board.

Suggested Actions

- ❑ Increase the timeout threshold value.
- ❑ Exchange the heater assembly.
- ❑ Exchange the CCM board.

Right Temperature Timeout

The temperature of the right heat exchanger did not reach the temperature setpoint within the timeout threshold.

Probable Causes

- Timeout threshold too short.
- Defective right heater assembly.
- Defective CCM board.

Suggested Actions

❏ Increase the timeout threshold value.

❏ Exchange the heater assembly.

❏ Exchange the CCM board.

Defective Temperature Sensor

Defective Temperature Sensor 0:left column.

Defective Temperature Sensor 1:left heatsink.

Defective Temperature Sensor 2:right column.

Defective Temperature Sensor 3:right heatsink.

Defective Temperature Sensor 4:ambient-correction sensor (located on left flex board).

One of the temperature sensors has failed.

The CCM board monitors the signal from the sensor continually. If the signal is missing or out of range, the error message is generated.

Probable Causes

- Flex board not connected (only if all left or right sensor error messages appear simultaneously).
- Defective heater assembly.
- Defective CCM board.

Suggested Actions

❏ Ensure the flex board is connected correctly.

❏ Exchange the heater assembly.

❏ Exchange the CCM board.

Heater Profile

Heater Profile 0: left heater.

Heater Profile 2: right heater.

The temperature warm-up (or cooling) profile of the heater is incorrect.

When the temperature setpoint is changed, the heater begins heating (or cooling) the column heat exchanger. During this time, the processor monitors the temperature change, and checks if the temperature profile is changing in the correct direction. If the temperature is not changing as expected, the error message is generated.

Probable Causes

- Defective heater assembly.
- Defective CCM board.

Suggested Actions

❑ Exchange the heater assembly.

❑ Exchange the CCM board.

Valve Failed

Valve Failed 0:failed to switch to the position where ports 1 and 2 are connected.

Valve Failed 1:failed to switch to the position where ports 1 and 6 are connected.

The column-switching valve failed to switch.

The switching of the column-switching valve is monitored by two micro switches on the valve assembly. The switches detect the successful completion of the valve movement within a predefined time window. If the valve fails to reach the end point, or fails to reach the end point within the time window, the error message is generated.

Probable Causes

- Defective column-switching valve.
- Defective CCM board.

Suggested Actions

❏ Exchange the column-switching valve.

❏ Exchange the CCM board.

Column Temperature

Column Temperature 0: left heater.

Column Temperature 2: right heater.

The temperature of the column heat exchanger has exceed the maximum limit.

For safety reasons, the maximum column heat-exchanger temperature is 105 ºC. If an electronic failure occurs which causes the heater to heat continually, the current is switched off when the temperature exceeds 105 ºC, and the error message is generated.

Probable Causes

- Defective heater assembly.
- Defective CCM board.

Suggested Actions

❏ Exchange the heater assembly.

❏ Exchange the CCM board.

Heatsink Temperature

Heatsink Temperature 0: left heater.

Heatsink Temperature 2: right heater

The temperature of the Peltier heatsink has exceed the maximum limit.

The maximum temperature of the Peltier heatsink is 70 ºC. If an electronic failure occurs which causes the heatsink to reach 70 ºC, the current is switched off and the error message is generated.

Probable Causes

- Defective heater assembly.
- Defective CCM board.

Suggested Actions

❏ Exchange the heater assembly.

❏ Exchange the CCM board.

Defective Heater Circuit

The electronic circuit for control of the heater assemblies is defective.

The processor checks the function of the heater circuits continually. If a defect is detected in the control circuit, the processor switches off the heater (peltier) assemblies, and the error message is generated.

Probable Causes

- Defective CCM board.

Suggested Actions

❏ Exchange the CCM board.

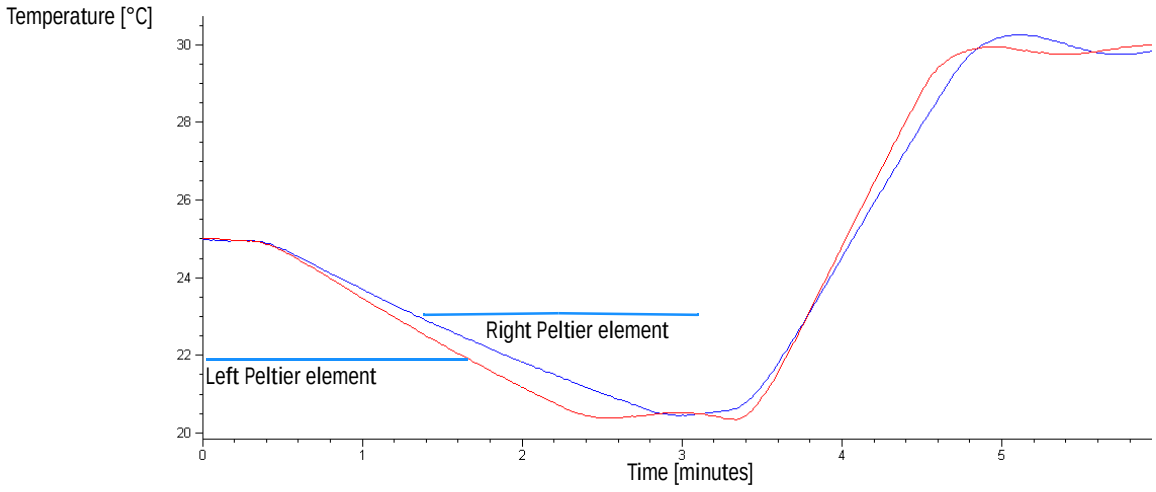
Thermostat Function Test

The thermostat function test is used to evaluate the cooling and heating performance of the two peltier elements.

Description

When the test is started, both heat exchangers are cooled initially to 25 °C. This temperature is held for 12 seconds, and then the setpoint is changed to 20 °C. The time required to reach 20 °C is a measure of the cooling efficiency of the peltier elements. At 3.5 minutes, the setpoint is changed to 30 °C, and both elements begin heating. The time required to reach 30 °C is a measure of heating efficiency. A typical thermostat function test profile is shown in Figure 7.

Figure 7 **Typical Thermostat Function Test Profile**



Evaluating the Thermostat Function Test

During the cooling phase, the Peltier elements should cool at a rate of >2 °C minute. During the heating phase, the temperature change should be >3 °C/minute. Defective thermostat components may cause cooling or heating rates to fall outside these limits.

Function Test Failed

Probable Causes

- Column compartment cover not installed correctly (bad insulation).
- Air intake blocked (insufficient air flow for cooling).
- Poor peltier efficiency (if setpoint temperatures can still be reached, and are stable, there is no requirement to exchange the heater assembly).
- Defective sensors on flex board.
- Defective heater assembly.

Suggested Actions

❏ Ensure cover is installed correctly.

❏ Ensure sufficient space is available for air circulation (see “Bench Space” on page 11).

❏ Exchange the heater assembly.

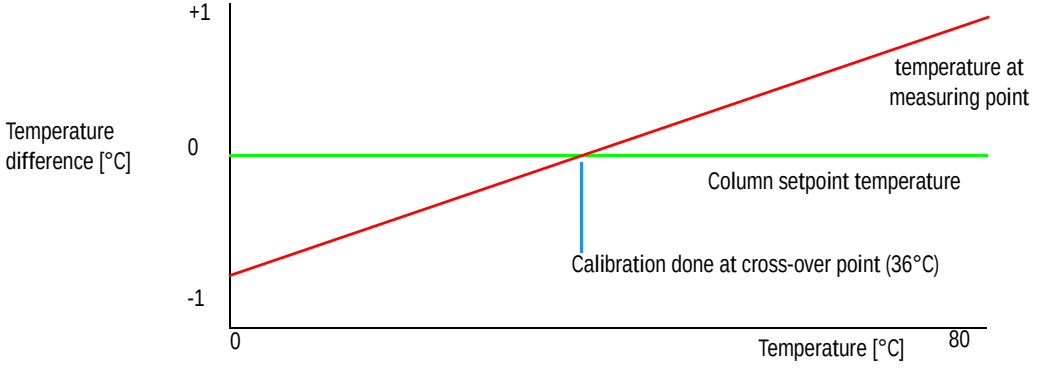
Temperature Calibration

Temperature Calibration Principle

The actual temperatures of the column heat exchangers (left and right) are dependent on the column setpoint temperature. For setpoint temperatures above 36 °C, the heat exchangers are heated to a temperature slightly above the setpoint temperature. Conversely, for setpoint temperatures below 36 °C, the heat exchangers are maintained at a temperature slightly below the setpoint temperature. This fine temperature correction compensates for the small amount of heat exchange through the instrument housing, and ensures the column is always maintained at the setpoint temperature.

At 36 °C, the column setpoint and heat-exchanger temperatures are equal (temperature cross-over point). This is the temperature at which a calibrated measuring device can be used to calibrate the column thermostat

Figure 8 **1-Point Calibration at the Temperature Cross-Over Point.**



Temperature Calibration

The column thermostat is calibrated correctly when the measured temperature (using the external measuring device, see “Temperature Calibration Procedure” on page 55) and the cross-over temperature (36 °C) of both heat exchangers (left and right) are within ± 0.5 °C.

Temperature Calibration Procedure

Tools required	Temperature measuring device (see note below)
Parts required	HP calibration kit G1316-68707 containing: Thermal pad (qty=20) 5042-1315 and spring G1316-01200

NOTE For the measuring and calibration process Hewlett Packard recommends a measuring device that provides the necessary resolution and precision. Contact the local Hewlett-Packard support representative for ordering information.

1. Install the temperature sensor (see “Installing the Temperature Sensor” on page 57).
2. Select the column-compartment temperature calibration mode in the user interface.
3. Wait for the temperature to stabilize at the calibration temperature (36 °C).
4. Measure the temperature of the heat exchanger.
5. If the measured temperature deviates by more than ± 0.5 °C from the actual temperature, enter the measured value in the measured-temperature field for the left heat exchanger.
6. Install the sensor at the measurement point on the right heat exchanger. Repeat the calibration procedure for the right heat exchanger.

Limits

After calibration, the measured temperature and the calibration temperature should be within ± 0.5 °C. The maximum deviation which can be adjusted is ± 1.8 °C. If the measured value and the calibration value differ by more than ± 8 °C, this is an indication that a problem exists, see “Calibration Problems” on page 56.

Calibration Problems

If the temperature cannot be calibrated, check the following:

- Thermostat front cover is closed correctly.
- The measuring device is functioning correctly, and is calibrated according to the manufacturers instructions.

Hardware Failures

Probable hardware failures leading to a failed calibration procedure are:

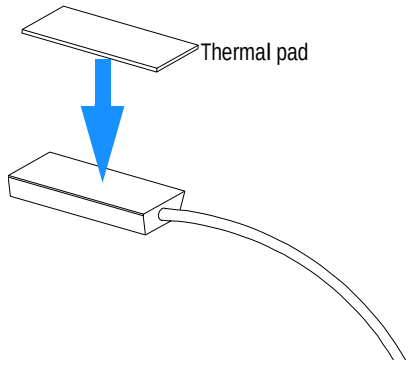
- Defective or wrongly calibrated measuring device.
- Defective heater assembly.
- Defective ambient-temperature sensor.
- Defective CCM board.

Installing the Temperature Sensor

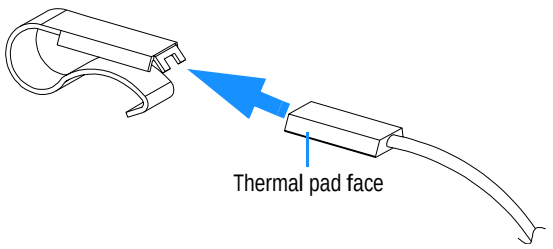
Installation of the temperature sensor is required for the temperature calibration and temperature verification procedures.

NOTE The figures below refer to a specific type of temperature sensor (Heraeus, Quat340, quartz surface-temperature measurement sensor). Other sensors may require a different fixing.

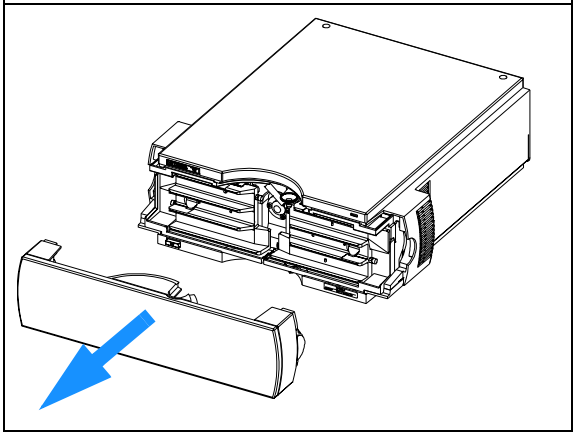
1 Attach the thermal pad from the HP Calibration Kit onto the temperature sensor.



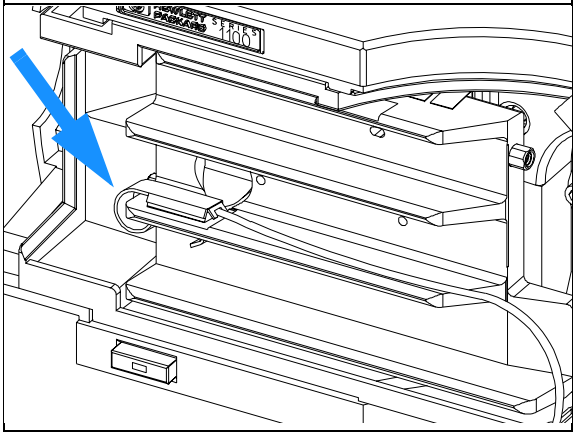
2 Insert the temperature sensor into the spring. Ensure the face of the thermal pad faces downwards.



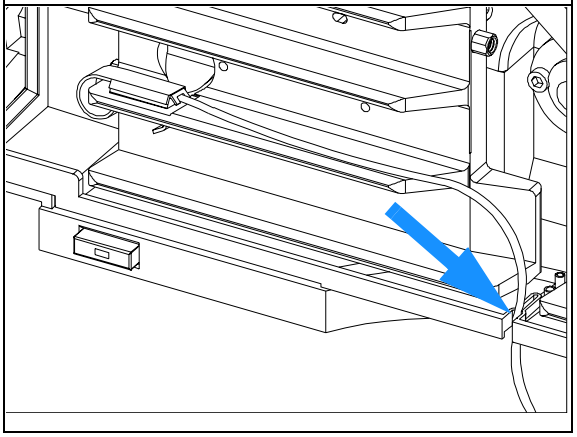
3 Remove the front cover.



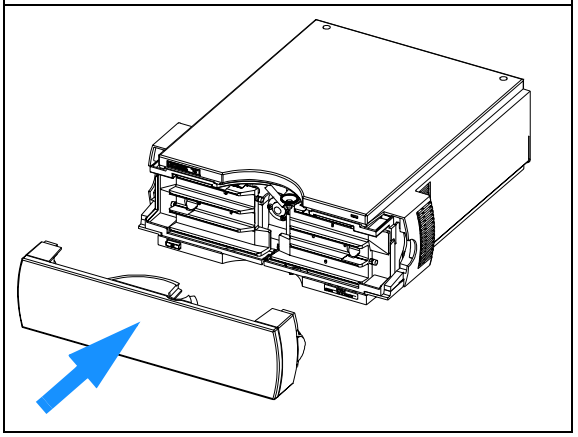
4 Install the temperature sensor at the measurement position on the left heat exchanger.



5 Route the sensor wire through the slit in the leak tray.



6 Replace the front cover.



4

Repairing the Column Compartment

Instructions on how to repair the column compartment

Repairing the Column Compartment

Simple Repairs

The column compartment is designed for easy repair. The most frequent repairs such as change of column and column switching valve head parts can be done from the front of the column compartment with the column compartment in place in the system stack. These repairs are described in “Simple Repairs” on page 64.

Exchanging Internal Parts

Some repairs may require exchange of defective internal parts. Exchange of these parts requires removing the column compartment from the stack, removing the covers, and disassembling the column compartment. The security lever at the power input socket prevents that the column compartment cover is taken off when line power is still connected. These repairs are described in “Exchanging Internal Parts” on page 70.

WARNING

To prevent personal injury, the power cable must be removed from the column compartment before opening the column compartment cover. Do not connect the power cable to the column compartment while the covers are removed.

When working with solvents please observe appropriate safety procedures (for example, goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the solvent vendor, especially when toxic or hazardous solvents are used.

CAUTION

Electronic boards and components are sensitive to electronic discharge (ESD). In order to prevent damage always use an ESD protection (for example, the ESD wrist strap from the accessory kit) when handling electronic boards and components, see “Using the ESD Strap” on page 62.

CAUTION

The column compartment has two heat exchanger assemblies that might be hot. If so, allow them to cool down before starting repairs.

Cleaning the Column Compartment

The column compartment case should be kept clean. Cleaning should be done with a soft cloth slightly dampened with water or a solution of water and a mild detergent. Do not use an excessively damp cloth that liquid can drip into the column compartment.

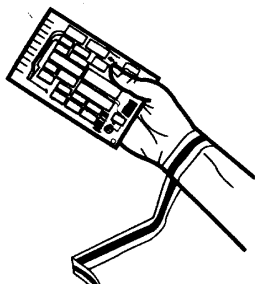
WARNING **Do not let liquid drip into the column compartment. It could cause shock hazard and it could damage the column compartment.**

Using the ESD Strap

Electronic boards are sensitive to electronic discharge (ESD). In order to prevent damage, always use an ESD strap supplied in the standard accessory kit (see “Accessory Kit” on page 117) when handling electronic boards and components.

1. Unwrap the first two folds of the band and wrap the exposed adhesive side firmly around your wrist.
2. Unroll the rest of the band and peel the liner from the copper foil at the opposite end.
3. Attach the copper foil to a convenient and exposed electrical ground.

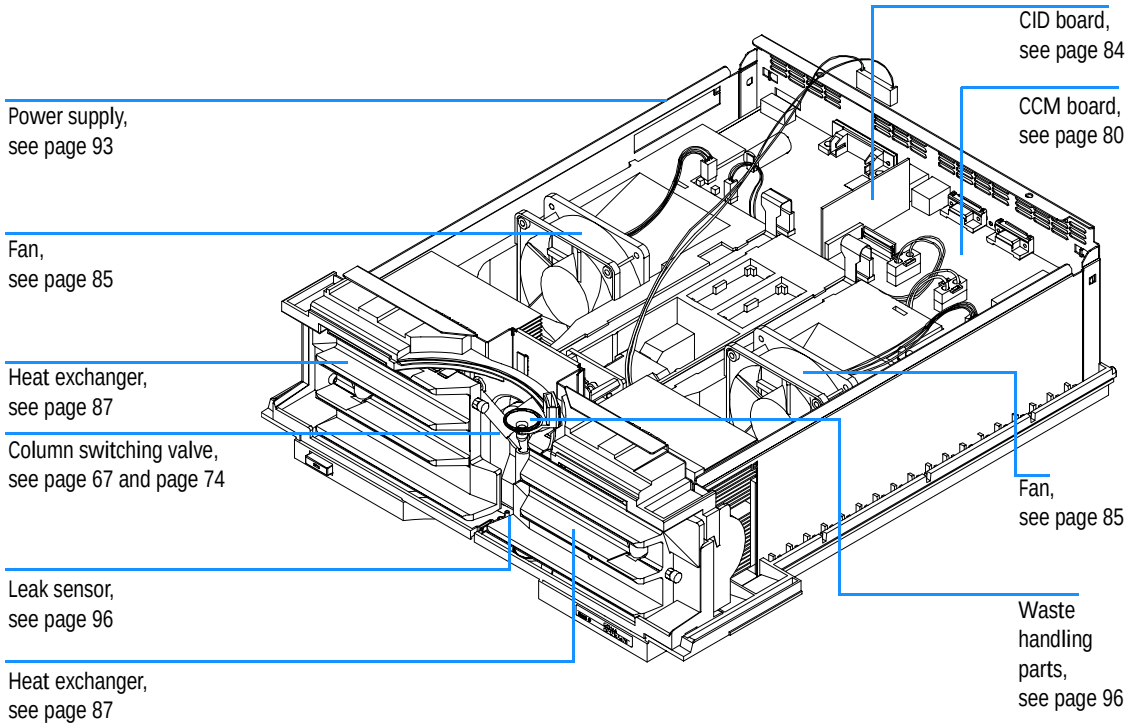
Figure 9 **Using the ESD Strap**



Overview

Figure 10 shows the main assemblies and their locations which can be repaired.

Figure 10 **Overview on Repair Procedures**



Simple Repairs

The following sections describe repairs that can be done without opening the main cover.

Table 4 **Simple Repairs**

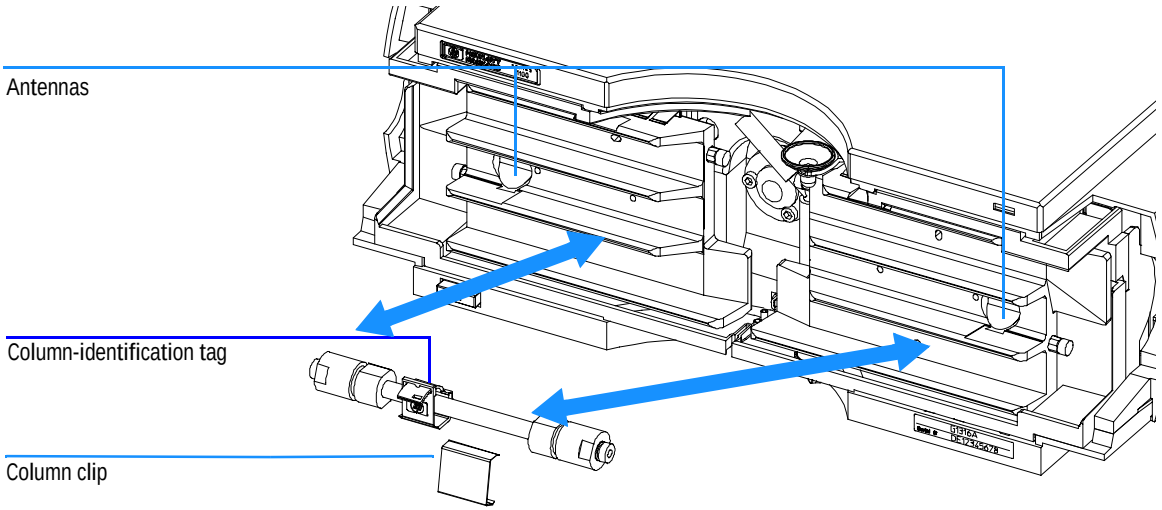
Procedure	Typical Frequency	Notes
“Changing Column Identification Tags” on page 65	When column performance or new application requires a change	
“Replacing Head Parts of Column Switching Valve” on page 67	When the valve performance shows indication of leakage or wear	
“Correcting Leaks” on page 69	If leak has occurred	Check for leaks

Changing Column Identification Tags

Frequency	If column is used on the opposite heat exchanger or a tag is added to a new column.
Parts required	Column identification tag, pack of 3, 5062-8588

The column compartment is equipped with an column-identification system, that stores column specific information. Two identification antennas are incorporated in the heat exchanger assemblies.

Figure 11 **Location of Column Identification System**



When correctly placed on the heat exchanger, the distance between tag and antenna is 1–2 mm. This is the optimum distance for proper function. The identification tag can be easily removed from the column.

NOTE For small diameter columns, a cable tie wrap should be used, to fix the column identification tag at the column. Assure that the tie wrap is not blocking the front cover.

NOTE There is a difference in attaching the identification tag to the column depending on which heat exchanger it will be located, see Figure 12 and Figure 13. The HP logo should be always at the front side.

Figure 12 **Column-Identification Tag for Left Heat Exchanger**

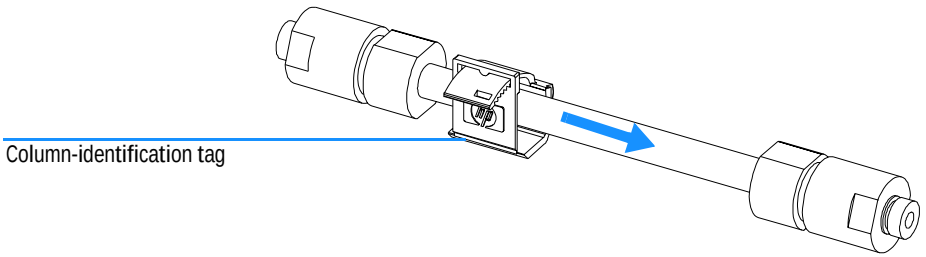
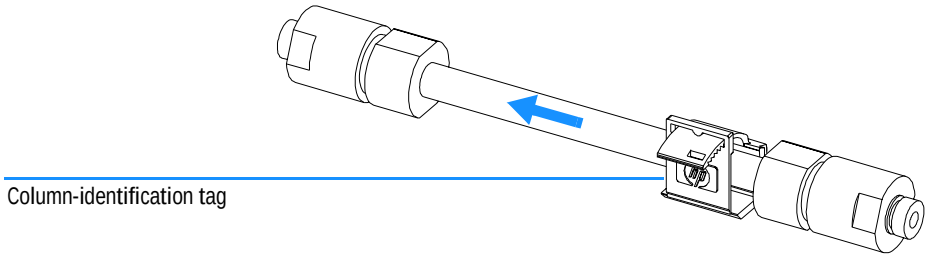


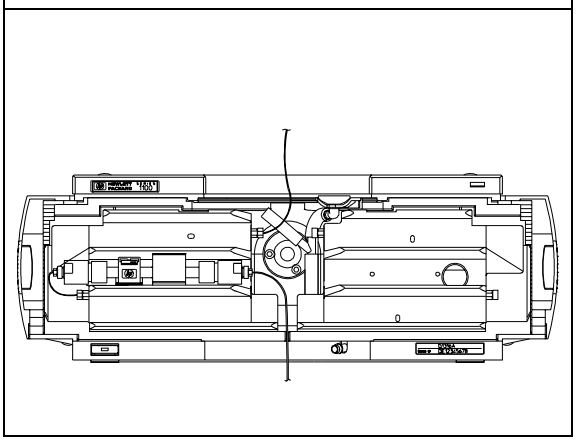
Figure 13 **Column-Identification Tag for Right Heat Exchanger**



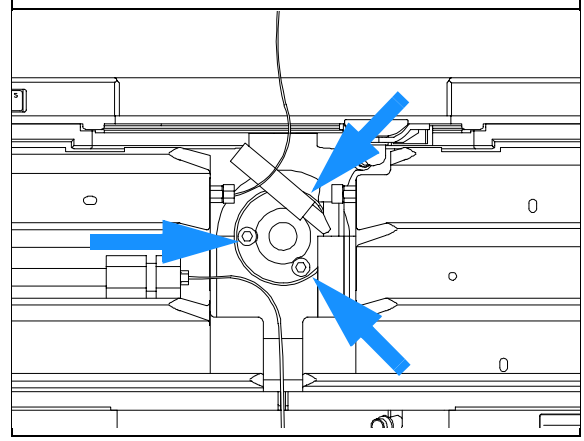
Replacing Head Parts of Column Switching Valve

Frequency	If valve leaks
Tools required	1/4 inch wrench 9/64 inch hex key
Parts required	Screws 1535-4857, stator head 0100-1850, stator face assembly 0100-1851, rotor seal 3 grooves (tefzel) 0100-1854, rotor seal 3 grooves (Vespel) 0100-1855, isolation seal 0100-1852, stator screws 1535-4857

1 Remove capillaries from ports 1, 5, and 6.



2 Loosen each fixing stator screws two turns at a time. Remove bolts from head.



4 Remove the stator head and the ceramic stator face.

5 Remove the stator ring.

6 Remove the rotor seal (and isolation seal if damaged or contaminated).

7 Install the new isolation seal (if required). Ensure the metal spring inside the ring faces towards the valve body.

8 Install the new rotor seal.

9 Replace the stator ring. Ensure the stator ring is flush against the valve body.

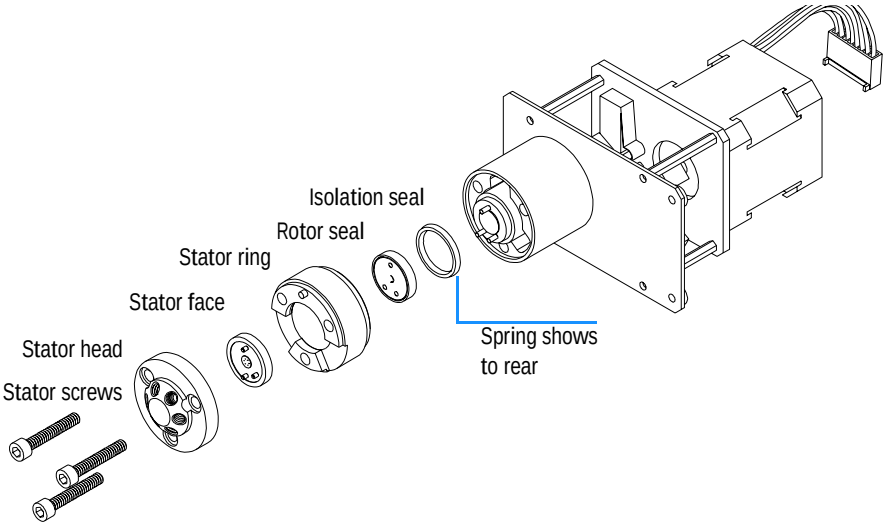
10 Place the new (if required) ceramic stator face in place on the stator head. Reinstall the stator head.

11 Insert the stator screws in the stator head. Tighten the screws alternately two turns at a time until the stator head is secure.

12 Reconnect the pump capillaries to the valve ports. Slide the waste tube into the waste holder in the leak tray.

13 Perform a pressure-tightness test to ensure the valve is pressure tight to 400 bar.

Figure 14 **Column Switching Valve Parts**

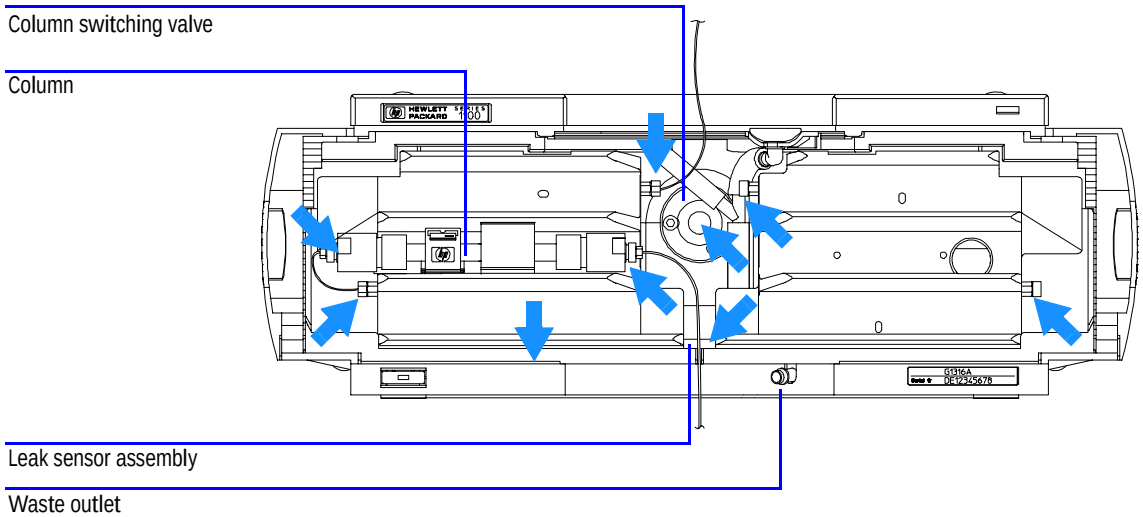


Correcting Leaks

When required	If a leakage has occurred at the heat exchanger or at the capillary connections or at the column switching valve
Tools required	Tissue Wrench 1/4 – 5/16 inch for capillary connections

1. Remove the front cover.
2. Use tissue to dry the leak sensor area.
3. Observe the capillary connections and the column switching valve for leaks and correct, if required.
4. Replace the front cover.

Figure 15 **Possible Leak Areas**



Exchanging Internal Parts

WARNING **The following procedures require opening the main cover of the column compartment. Always ensure the column compartment is disconnected from the line power when the main cover is removed. The security lever at the power input socket prevents that the column compartment cover is taken off when line power is still connected.**

WARNING **To disconnect the column compartment from line, unplug the power cord. The power supply still uses some power, even if the switch on the front panel is turned off.**

WARNING **When working with solvents please observe appropriate safety procedures (for example, goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the solvent vendor, especially when toxic or hazardous solvents are used.**

NOTE The electronics of the column compartment will not allow operation of the module when the top cover and the top foam are removed. A safety light switch on the main board will inhibit the operation of the fans immediately. Voltages for the other electronic components will be turned off after 30 seconds. The status lamp will light red and an error will be logged into the logbook of the user interface. Always operate the column compartment with the top covers in place.

CAUTION Electronic boards and components are sensitive to electronic discharge (ESD). In order to prevent damage always use an ESD protection (for example, the ESD wrist strap from the start up kit) when handling electronic boards and components, see “Using the ESD Strap” on page 62.

CAUTION  The column compartment has two heater assemblies that might be hot. If so, allow them to cool down before starting repairs.

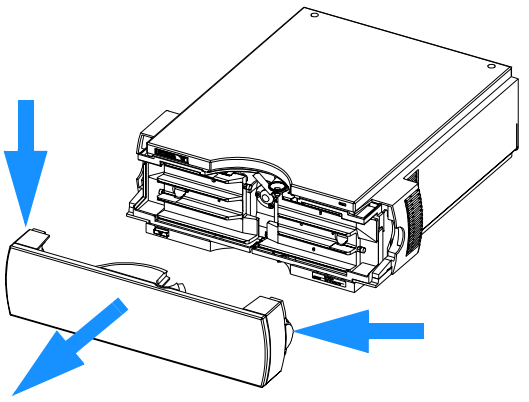
Removing the Top Cover and Foam

When required	For all repairs inside the column compartment
Tools required	Screwdriver Pozidriv 1 PT3
Parts required	Depends on the work inside and the following procedures

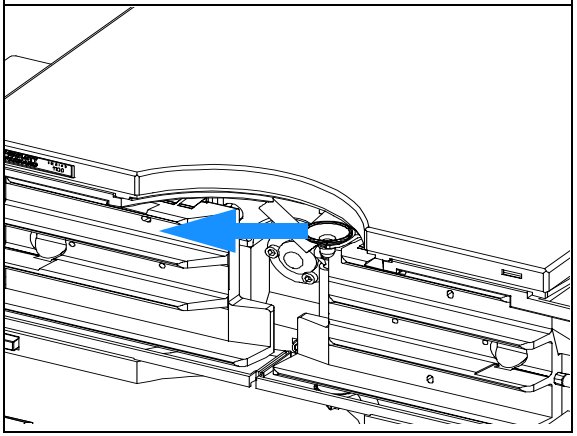
Preparations for this procedure:

- ❏ Turn off the column compartment.
- ❏ Disconnect the power cable.
- ❏ Disconnect capillaries.
- ❏ Remove column compartment from stack and place it on the working bench.

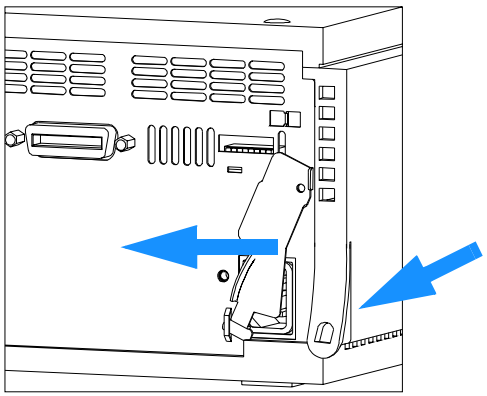
1 Press the release buttons and remove the front cover.



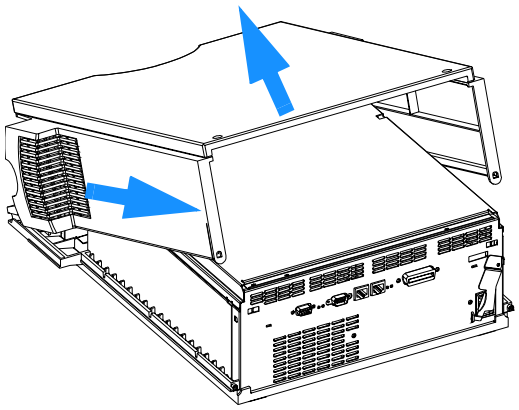
2 Pull the leak funnel out of the leak funnel holder.



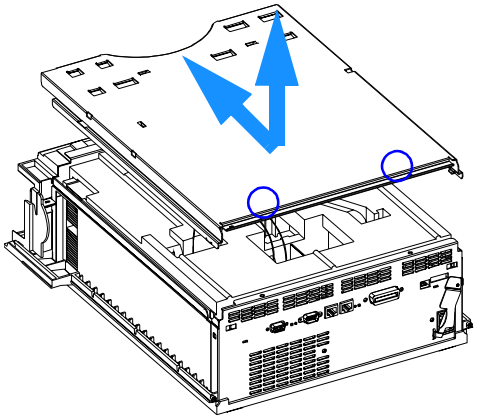
3 Move the power lock across the power inlet and lift the clips on the rear of the cover.



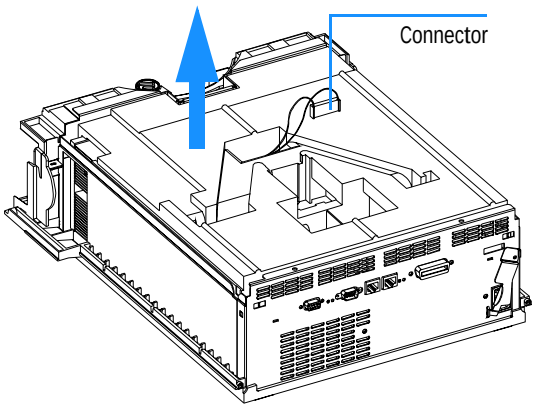
4 Lift the cover up and slide it towards the rear.



5 Unscrew the screws at the rear of the top plate, slide the plate towards the front and remove it.



6 If installed. disconnect the connector of the column switching valve from column compartment and remove the top foam.

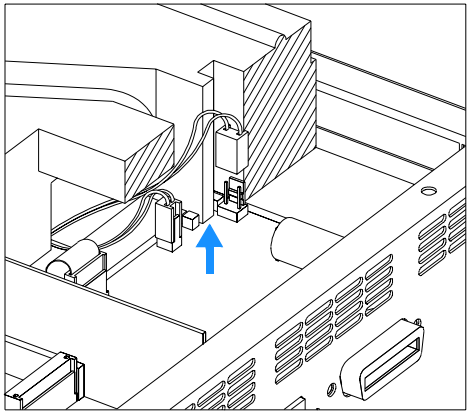


Do not connect a power plug to the column compartment after removing the top covers.

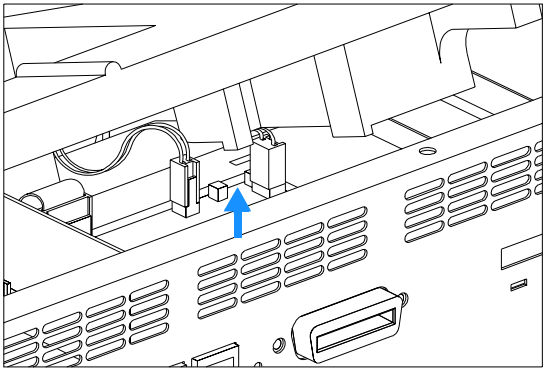
A safety light switch on the main board will turn off fan (immediately) and electronics (after 30 seconds) to avoid the operation with removed covers. An error will be generated (status lamp lights red) and the logbook will show an error message.

The next figures show the position of the light switch on the board.

7 Position of the foam in the safety light switch.



8 Position of safety light switch on the main board when removing the foam.



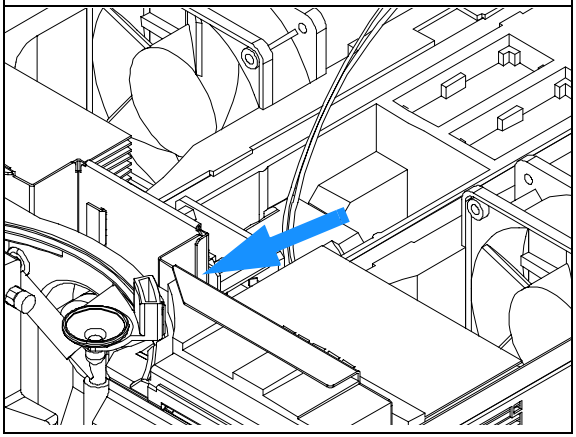
Removing the Column Switching Valve

When required	If valve failed or bottom foam part has to be removed for other replacements
Tools required	Screwdriver Pozidriv 1 PT3 Wrench 1/4 – 5/16 inch for capillary connections

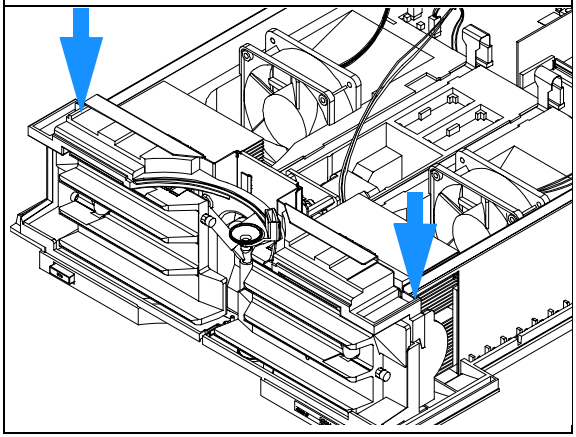
Preparations for this procedure:

- ❏ Turn off the column compartment.
- ❏ Disconnect the power cable.
- ❏ Disconnect capillaries.
- ❏ Remove column compartment from stack and place it on the working bench.
- ❏ Remove the front cover, top cover and top foam section, see “Removing the Top Cover and Foam” on page 71.

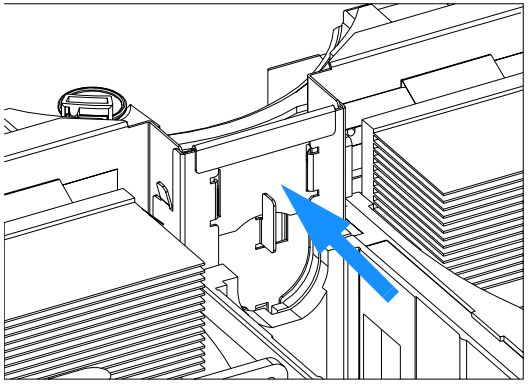
1 Disconnect the grounding connection of the valve at the Z-panel.



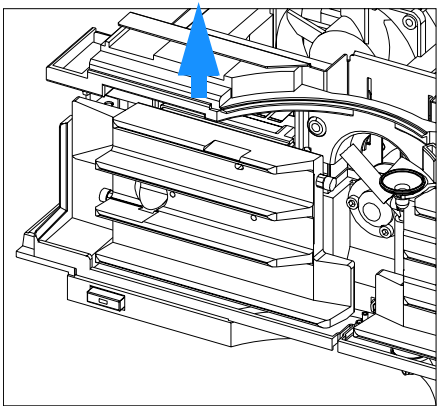
2 Unscrew the Z-panel.



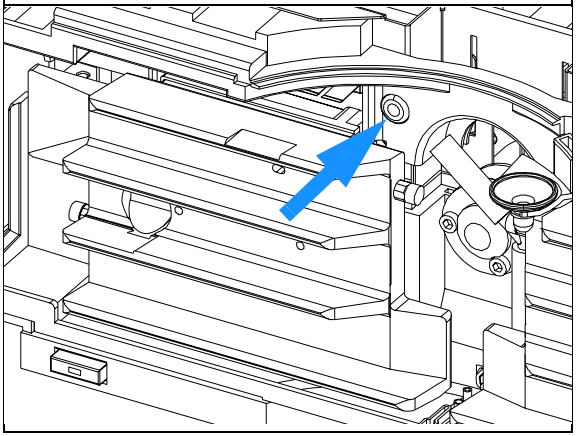
3 Press against the rear of the Z-panel to release the metal plate from the guide and pull it carefully upwards.



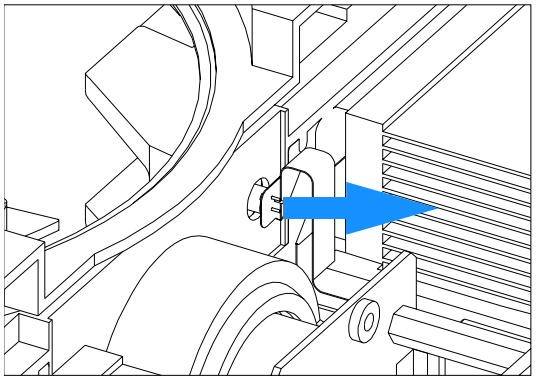
4 Lift the Z-panel together with the top plastic panel half-way out of the guide.



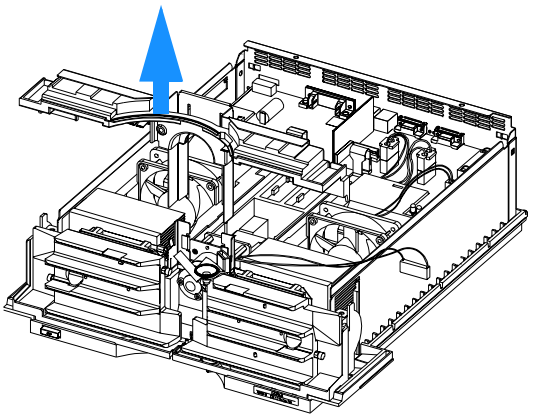
5 Locate the ambient temperature sensor in the top plastic part and push it towards the rear.



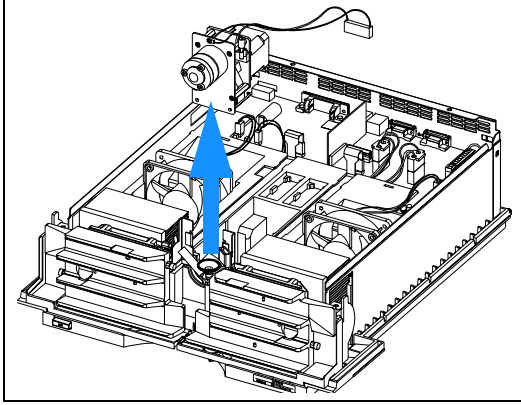
6 Carefully remove the ambient temperature sensor plugged into the rear of the top plastic panel.



7 Pull the top plastic panel together with the Z-panel completely out of the guide.



8 Remove the Valve from its location.



For the installation refer to “Installing the Column Switching Valve” on page 77.

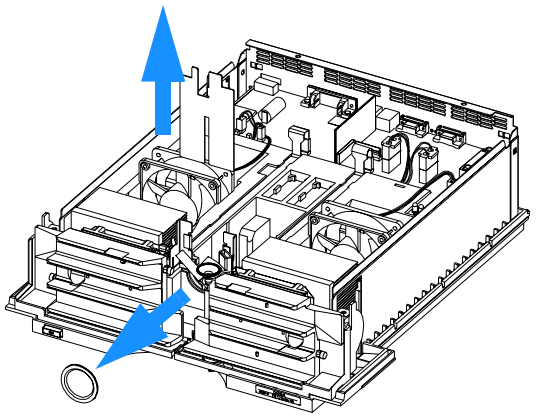
Installing the Column Switching Valve

When required	For first time installation or after it was removed
Tools required	Screwdriver Pozidriv 1 PT3 Wrench 1/4 – 5/16 inch for capillary connections

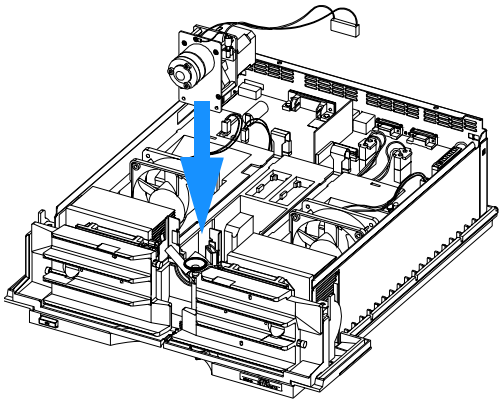
Preparations for this procedure are:

- ❏ The column compartment is open as described in “Removing the Column Switching Valve” on page 74.

1 If no column switching valve was installed, remove the RFI-shield and the plastic cover (no longer used).

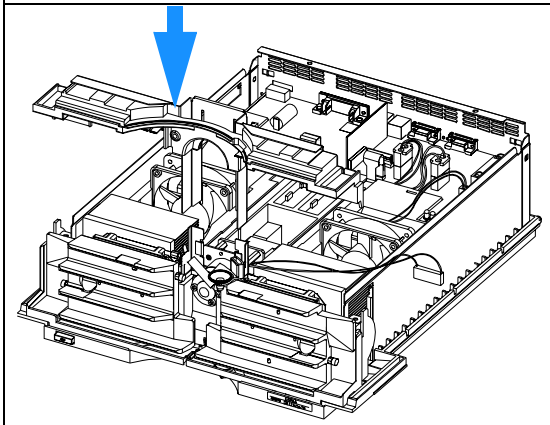


2 Replace the valve into its location.

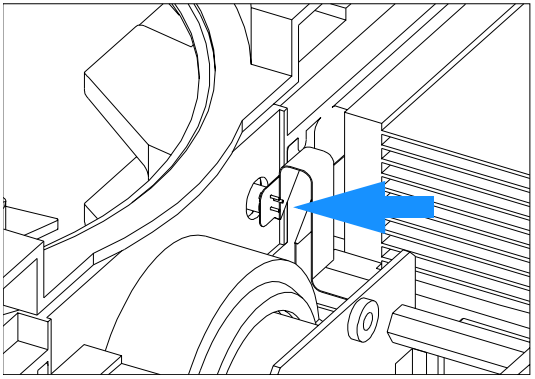


Ensure that during the next steps the flexible cables close to the heat exchanger assemblies are not damaged.

3 Carefully insert the top plastic panel together with the Z-panel into the guide and press it half-way down.



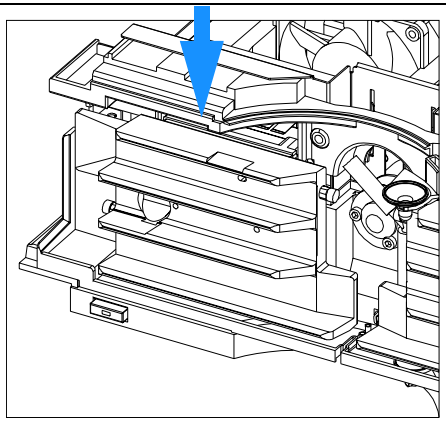
4 Carefully plug the ambient temperature sensor into the rear of the top plastic panel.



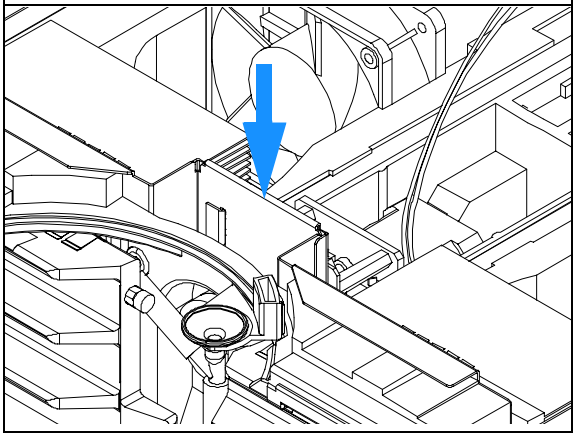
Ensure that the ambient temperature sensor is completely plugged into the rear of the top plastic panel.

Ensure that during the next steps the flexible cables close to the heat exchanger assemblies are not damaged.

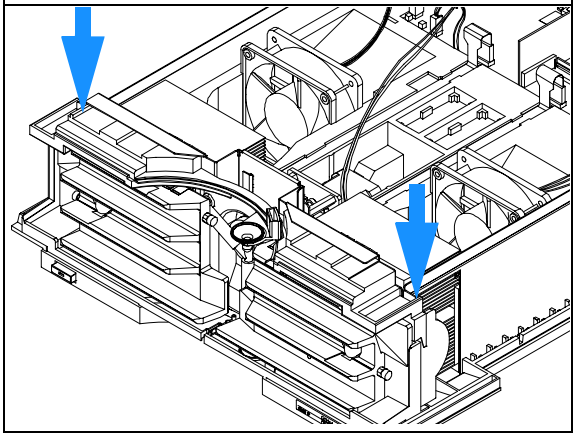
5 Press the Z-panel together with the Top Plastic Panel completely down.



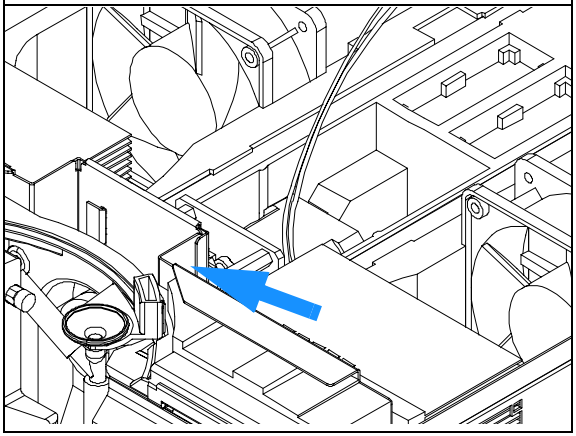
6 Press down completely until it clicks into its holding position.



7 Fix the Z-panel with the two screws.



8 Reconnect the grounding connection of the valve at the Z-panel.



9 Replace the foam section, the top cover and front cover, see “Installing the Foam and the Top Cover” on page 102.

10 Replace the column compartment into stack.

11 Reconnect capillaries.

12 Reconnect the power cable.

13 Turn on the column compartment.

Exchanging the Column Compartment Main (CCM) Board

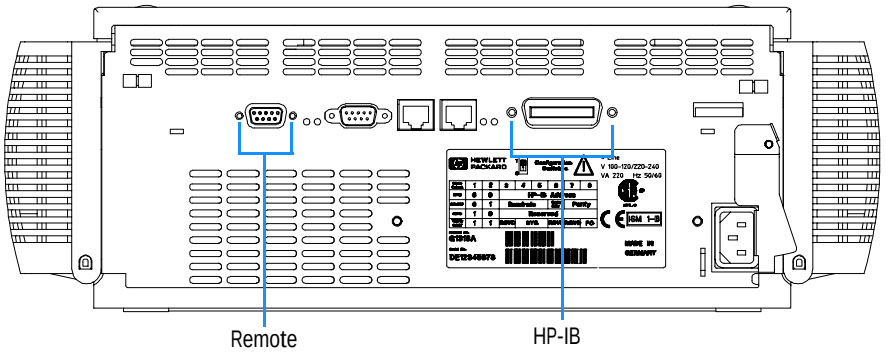
When required	If board is defective or for repair on other assemblies
Tools required	Screwdriver Pozidriv 1 PT3 Hexagonal wrench 5 mm Hexagonal wrench 7 mm
Parts required	Column compartment main board CCM G1316-69520 (exchange assembly)

1 Switch off the column compartment, and disconnect the cables.

2 Remove column compartment from stack and place it on the working bench.

3 Remove the front cover, top cover and top foam section, see “Removing the Top Cover and Foam” on page 71.

Figure 16 **Unscrew Connectors from Board**

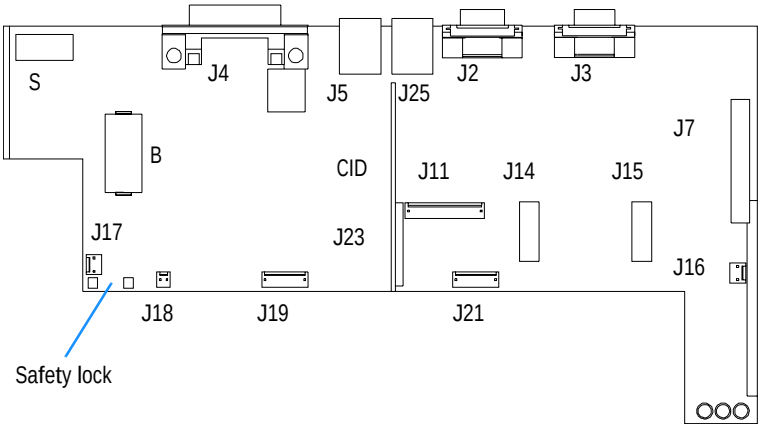


4 Use a 5 mm and 7 mm wrench to unscrew the REMOTE and the HP-IB connector.

5 Disconnect all connectors from the processor board.

Figure 17 **Location of connectors**

J2 - RS-232C
J3 - REMOTE
J4 - HP-IB
J5/25 - CAN
J7 - Power Supply
J11 - Column Switching Valve
J14 - Heat Exchanger Assembly (left)
J15 - Heat Exchanger Assembly (right)
J16- Fan Assembly (right)
J17 - Fan Assembly (left)
J18 - Leak Sensor
J19 - Flexboard (left)
J21 - Flexboard (right)
J23 - Column Identification Board (CID)
B - Battery
S - Configuration Switch



6 Remove the processor board. Place the board on the ESD kit.

7 In most cases the RFI spring plate remains on the interface connectors of the board. Carefully remove the spring plate and place it back into its position in the instrument before installing a new board.

8 On the new board check the switch setting of address switch S1, see “Setting the 8-bit Configuration Switch” on page 156.

NOTE An incorrect switch setting (e.g., TEST/BOOT) may cause the module to turn in a basic mode (yellow or red flashing status light). In such a case turn off the module, re-set the address switches, and turn on the module again.

9 Install the new processor board and reconnect the connectors.

10 Refit the screws at the REMOTE and HP-IB connectors.

11 Replace the foam section, the top cover and front cover, see “Installing the Foam and the Top Cover” on page 102.

12 Replace column compartment into the stack and reconnect the cables.

NOTE If a new CCM board is installed, update the serial number information of the column compartment in the user interface, see. procedure below.

13 Check the firmware revision of the module. If the firmware revision is older than the current firmware revision of the module, update the firmware using the standard firmware update procedure, see “Replacing the Column Compartment’s Firmware” on page 106.

Entering the Serial Number using the Control Module

1 Connect the control module to the column compartment. Turn on the column compartment.

2 In the control module, press System (F5), then Records (F4). Using the up/down arrows, make sure that the column compartment is highlighted.

3 Press FW Update (F5). Now, press the m key. This will display a box which says ‘Update Enter Serial#’.

4 Press Enter. This will display the box labeled Serial#.

5 Letters and numbers are created using the up and down arrows. Into the box labeled Serial#, enter the 10-character serial number for the column compartment. When the 10-character serial number is entered, press Enter to highlight the complete serial number. Then, press Done (F6).

NOTE For firmware revisions below A02.00 it is very important never to press Done if the Serial# box is blank. In this case, the module can no longer be recognized by either the control module or the ChemStation. The main board must then be replaced.

6 Turn the column compartment off, then on again. The Records screen should display the correct serial number for this module.

7 If a ChemStation is also connected, re-boot the ChemStation now as well.

Entering the Serial Number using the ChemStation

Module serial numbers are entered by typing specific commands into the command line at the bottom of the main user interface screen.

1 To enter a module serial number, type the following command into the command line:

```
print sendmodule$(lthm, "ser YYYYYYYYYY")
```

Where: YYYYYYYYYY is the 10-character serial number of the module in question.

NOTE The first two characters are letters, which should be capitalized.

The reply line will respond with RA 0000 SER followed by the module serial number you just entered.

2 Turn off the column compartment, then on again. Then, re-boot the ChemStation. If the serial number you have just entered is different than the original module serial number, you will be given the opportunity to edit the configure 1100 access screen during the re-boot of the ChemStation.

3 After boot-up, the serial number you have just entered can be seen under the Instrument menu of the main user interface screen. The serial number of the column compartment can also be seen by typing the following command into the command line:

```
print sendmodule$ (lthm, "ser?")
```

The reply line will give the module serial number.

Replacing the Column Identification Module (CID) Board

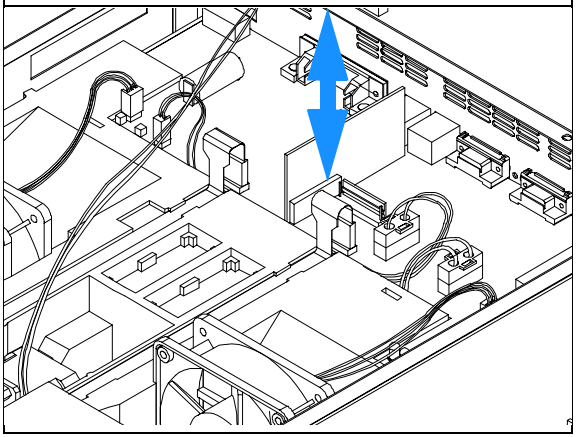
The column identification module board (CID) is plugged onto the column compartment main (CCM) board.

When required	If board is defective
Tools required	Screwdriver Pozidriv 1 PT3 Hexagonal wrench 5 mm Hexagonal wrench 7 mm
Parts required	Column identification module board (CID) G1316-66503

Preparations for this procedure:

- ❏ Turn off the column compartment.
- ❏ Disconnect the power cable.
- ❏ Disconnect capillaries.
- ❏ Remove column compartment from stack and place it on the working bench.
- ❏ Remove the front cover, top cover and top foam section, see “Removing the Top Cover and Foam” on page 71.

1 Carefully exchange the CID board.



2 Replace the foam section, the top cover and front cover, see “Installing the Foam and the Top Cover” on page 102.

Exchanging the Fan

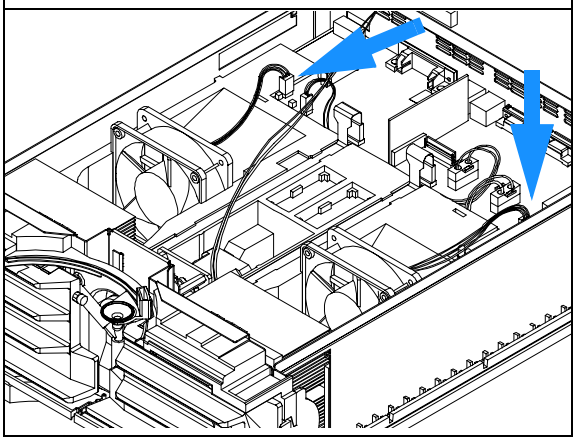
When required	If the fan is defective or noisy or for repair of other assemblies
Tools required	Screwdriver Pozidriv 1 PT3
Parts required	Fan assembly 3160-1017

CAUTION The fan must be installed in the correct orientation to ensure optimum cooling and operation of the column compartment.

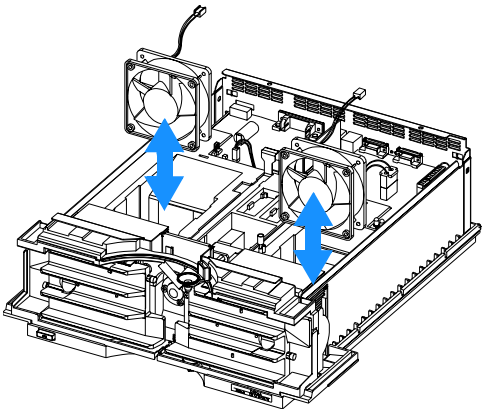
Preparations for this procedure:

- ❏ Turn off the column compartment.
- ❏ Disconnect the power cable.
- ❏ Disconnect capillaries.
- ❏ Remove column compartment from stack and place it on the working bench.
- ❏ Remove the front cover, top cover and top foam section, see “Removing the Top Cover and Foam” on page 71.

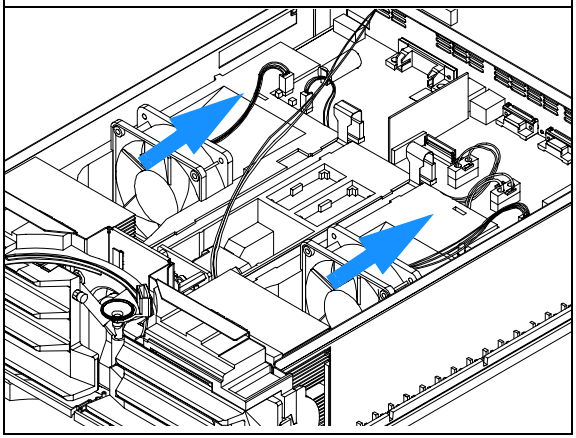
1 Disconnect the fan assembly from the processor board.



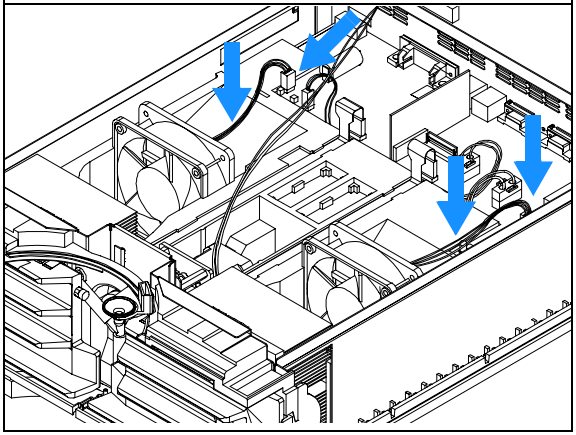
2 Replace the fan assembly. Ensure correct fan orientation.



3 The arrow on the fan should correspond with the direction of air flow which is from the front to the rear of the column compartment.



4 Reconnect the fan assembly to the processor board and check that the cable of the left fan is correctly in the foam channel to assure correct closing of the foam parts.



5 Replace the foam section, the top cover and front cover, see “Installing the Foam and the Top Cover” on page 102.

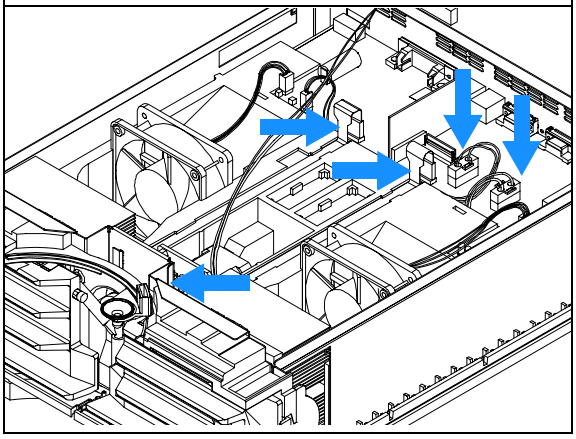
Removing the Heat Exchanger Assemblies

When required	If the heater is leaking, blocked or does not heat/cool or other assemblies have to be removed
Tools required	Screwdriver Pozidriv 1 PT3 Wrench 1/4 – 5/16 inch for capillary connections
Parts required	Heat exchanger assembly (left) G1316-60007, includes ambient temperature sensor Heat exchanger assembly (right) G1316-60006

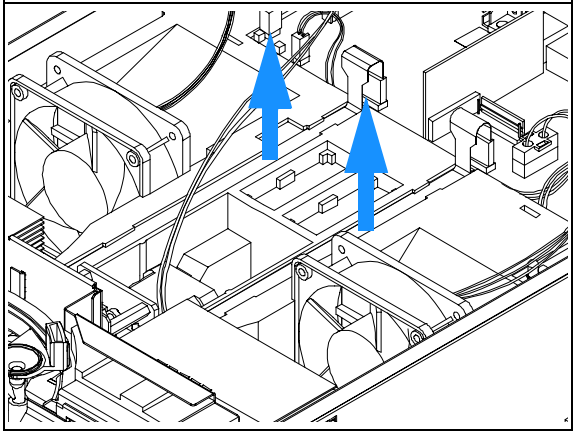
Preparations for this procedure:

- ❏ Turn off the column compartment.
- ❏ Disconnect the power cable.
- ❏ Disconnect capillaries.
- ❏ Remove column compartment from stack and place it on the working bench.
- ❏ Remove the front cover, top cover and top foam section, see “Removing the Top Cover and Foam” on page 71.

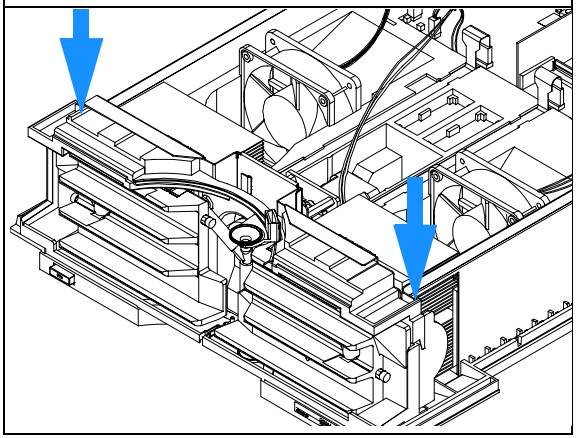
1 Disconnect the heat exchanger cables from the processor board and the grounding connection of the column switching valve.



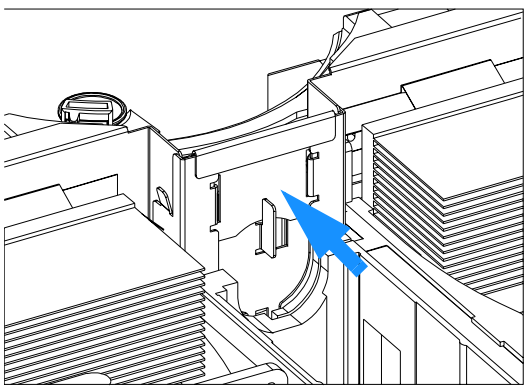
2 Carefully pull out the heater cables out of the foam channels.



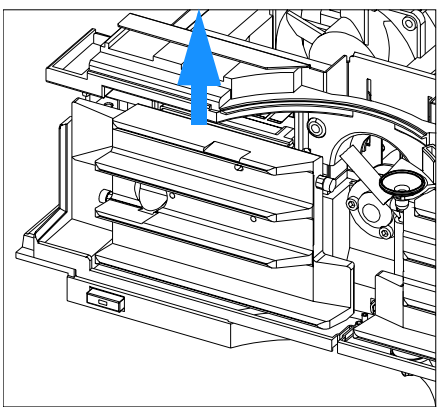
3 Unscrew the Z-panel.



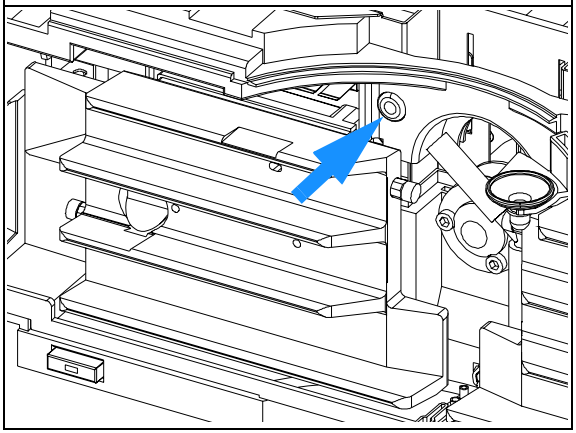
4 Press against the rear of the Z-panel to release the metal plate from the guide and pull it carefully upwards.



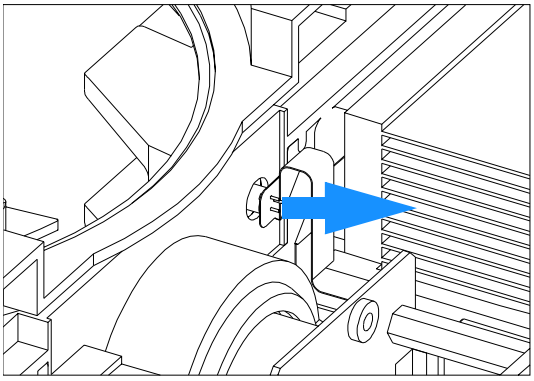
5 Lift the Z-panel together with the top plastic panel half-way out of the guide.



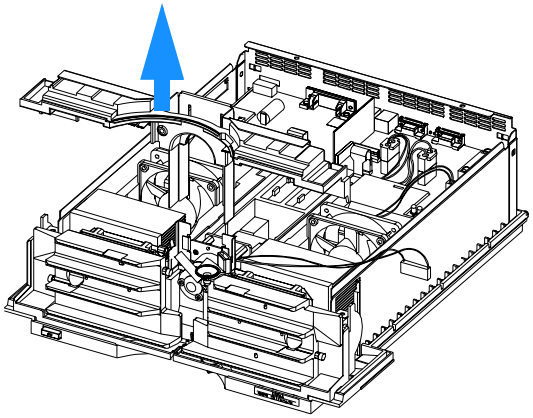
6 Locate the ambient temperature sensor in the top plastic part.



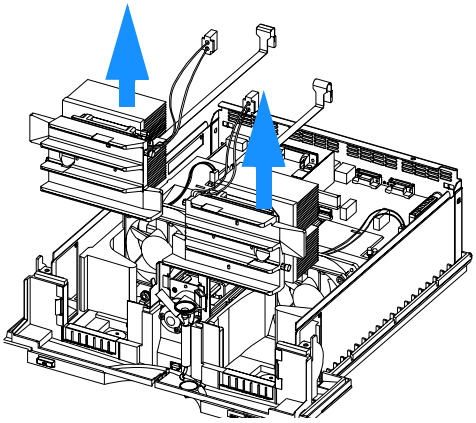
7 Carefully remove the ambient temperature sensor plugged into the rear of the top plastic panel.



8 Carefully pull out the top plastic panel together with the Z-panel completely.



9 Remove the heat exchanger assembly.

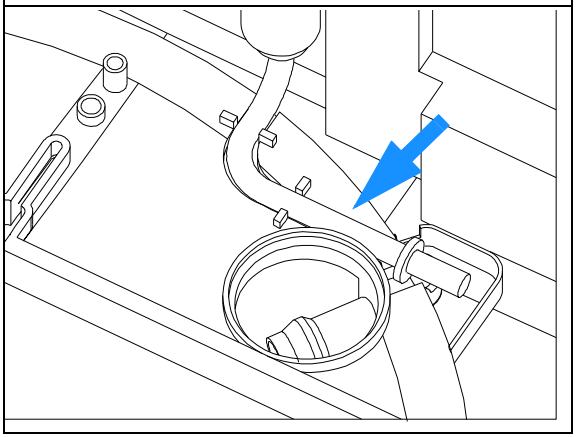


The repair level of the heat exchanger assemblies is the complete assembly.

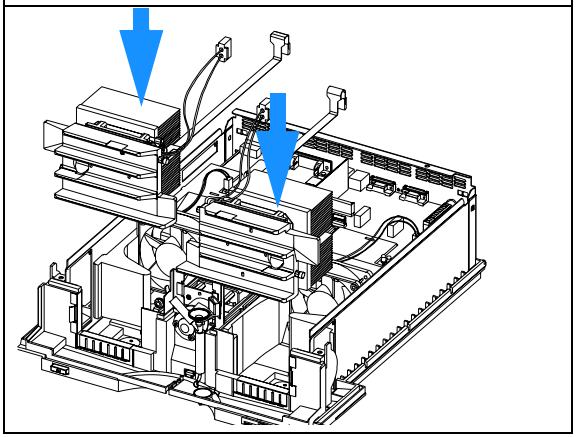
Installing the Heat Exchanger Assemblies

When required	If the heat exchanger is leaking, blocked or does not heat/cool or other assemblies have to be removed
Tools required	Screwdriver Pozidriv 1 PT3 Wrench 1/4 – 5/16 inch for capillary connections
Parts required	Heat exchanger assembly (left) G1316-60007, includes ambient temperature sensor Heat exchanger assembly (right) G1316-60006

1 Replace the leak tubing assembly into its location on leak base. Ensure that it keeps in this position during the next steps.

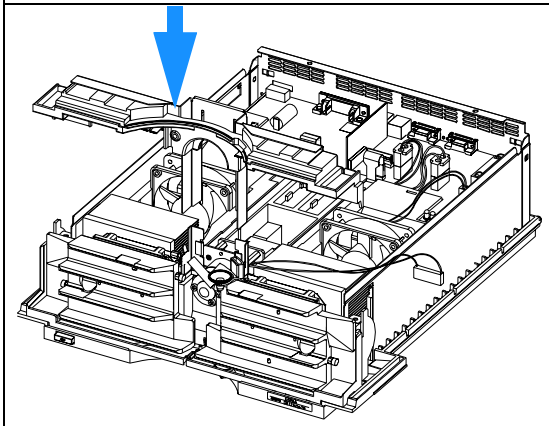


2 Replace the heat exchanger assembly. A screwdriver might be helpful to insert the silicon isolation.

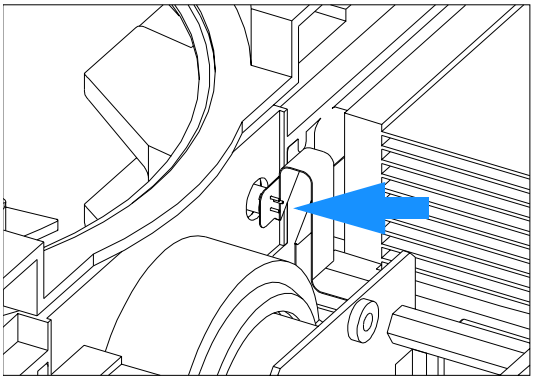


Ensure that during the next steps the flexible cables close to the heat exchanger assemblies are not damaged.

3 Carefully insert the top plastic panel together with the Z-panel into the guide and press it half-way down.



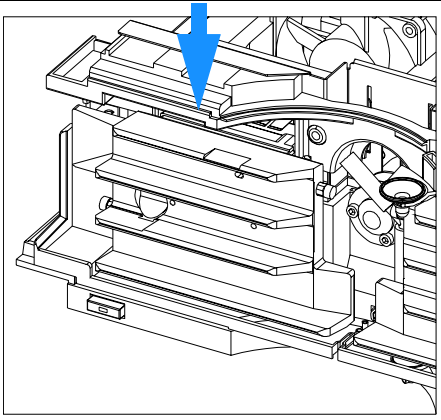
4 Carefully plug the temperature sensor into the rear of the top plastic panel.



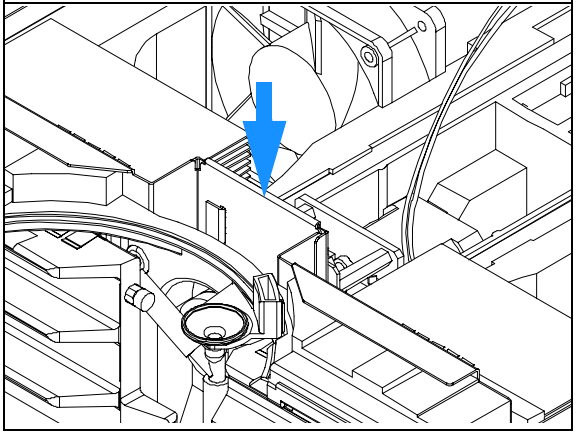
Ensure that the ambient temperature sensor is completely plugged into the rear of the top plastic panel.

Ensure that the flexible cables close to the heat exchanger assemblies are not damaged.

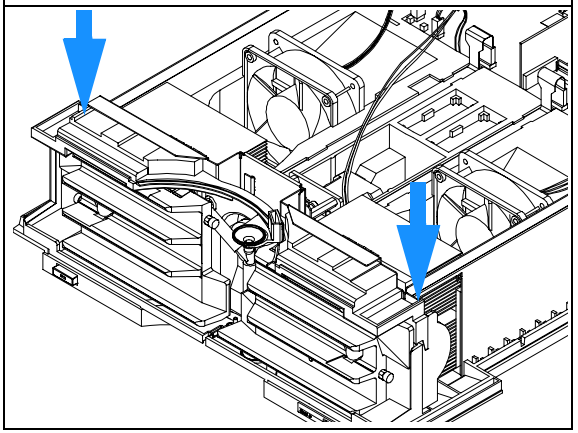
5 Press the Z-panel together with the top plastic panel completely down.



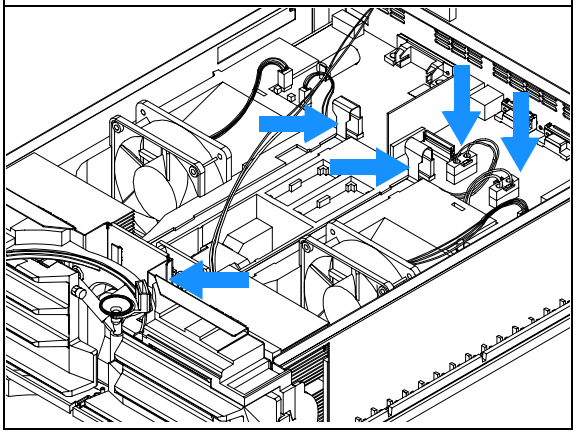
6 Press down completely until it clicks into its holding position.



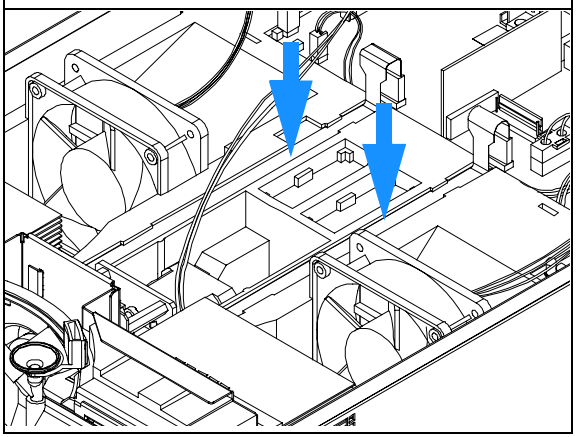
7 Fix the Z-panel with the two screws.



8 Reconnect the heat exchanger cables to the processor board and the grounding connection of the column switching valve.



9 Carefully replace the heat exchanger cables into the foam channels.



10 Replace the foam section, the top cover and front cover, see “Installing the Foam and the Top Cover” on page 102.

11 Replace the column compartment into stack.

12 Reconnect capillaries.

13 Reconnect the power cable.

14 Turn on the column compartment.

Exchanging the Power Supply

When required	If defective
Tools required	Screwdriver Pozidriv 1 PT3 Wrench 1/4 – 1/5 inch Wrench 5 mm and 7 mm
Parts required	Power supply 0950-2528

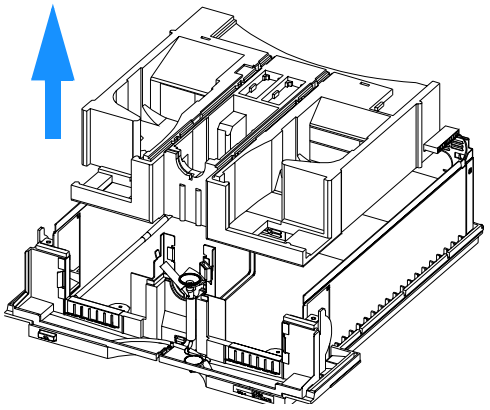
NOTE The repair level of the power supply assembly is exchange of the complete assembly. No serviceable parts inside.

1. Switch off the column compartment, and disconnect the cables.
2. Remove column compartment from stack and place it on the working bench.
3. Remove the front cover, top cover and top foam section, see “Removing the Top Cover and Foam” on page 71.
4. Remove the column switching valve (if installed), see “Removing the Column Switching Valve” on page 74.
5. Remove the processor board, see “Exchanging the Column Compartment Main (CCM) Board” on page 80.
6. Remove the fan assemblies, see “Exchanging the Fan” on page 85.
7. Remove the heat exchanger assemblies, see “Removing the Heat Exchanger Assemblies” on page 87.

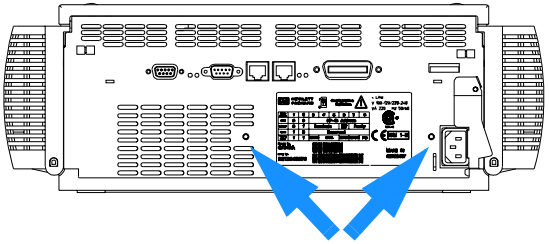
NOTE The leak tubing assembly might fall out of its position.

8. Remove the leak sensor cable out of the foam channel.

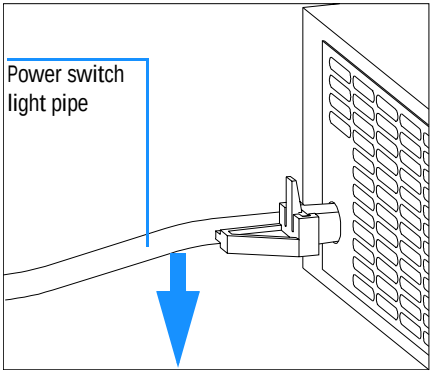
15 Carefully remove the bottom foam.



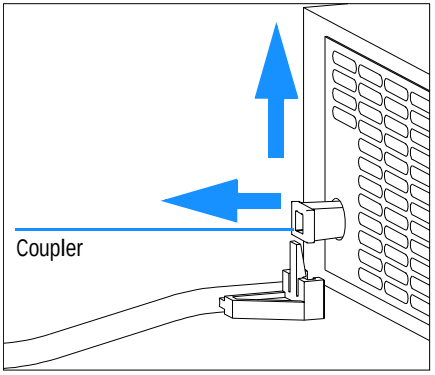
16 Unscrew the power supply at the rear of the column compartment.



17 Press down the power switch light pipe to remove it from the coupler.

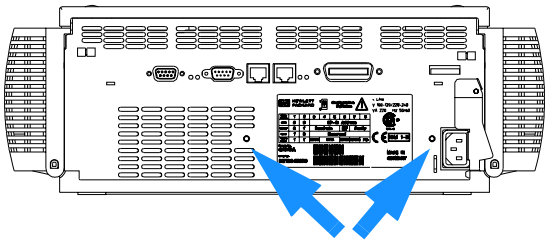


18 Remove the power supply completely. Re-use the coupler on the new power supply.

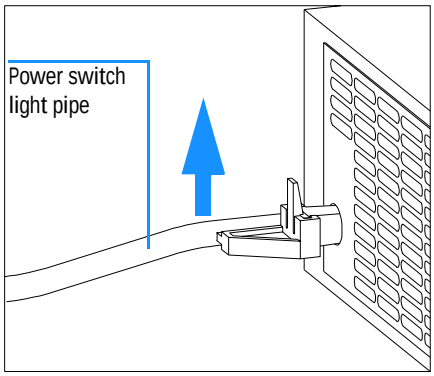


The repair level of the power supply assembly is exchange of the complete assembly. No serviceable parts inside.

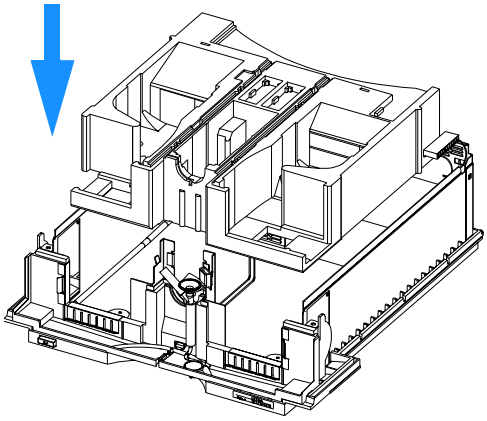
19 Insert the power supply into its location and fix it with the screw at the rear panel.



20 Press down and clip in the power switch light pipe into the power supply.



21 Reinstall bottom foam part.



22 Reinstall the processor board, see “Exchanging the Column Compartment Main (CCM) Board” on page 80.

23 Reinstall the fan assemblies, see “Exchanging the Fan” on page 85.

24 Reinstall the heat exchanger assemblies, see “Installing the Heat Exchanger Assemblies” on page 90.

25 Replace the foam section, the top cover and front cover, see “Installing the Foam and the Top Cover” on page 102.

26 Replace column compartment into the stack.

27 Reconnect the power cable and turn on the column compartment.

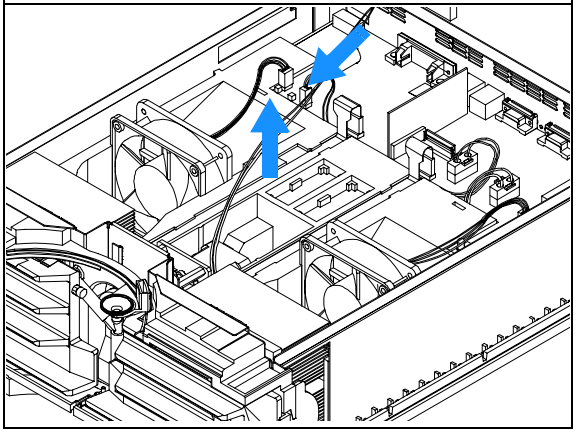
Replacing the Leak Sensor or Leak Base

When required	If leak sensor is defective or leak base is damaged
Tools required	Screwdriver Pozidriv 1 PT3 Screwdriver flat blade Wrench 1/4 – 1/5 inch Hexagonal wrench 3 mm
Parts required	Leak sensor assembly 5061-3356 Leak base G1316-43101 (part of leak panel kit G1316-68700)

Preparations for this procedure:

- ❏ Switch off the column compartment, and disconnect the power cable.
- ❏ Remove column compartment from stack and place it on the working bench.
- ❏ Remove the front cover, top cover and top foam section, see “Removing the Top Cover and Foam” on page 71.

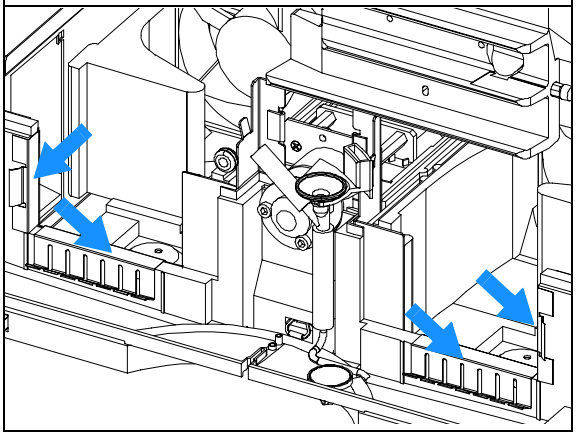
1 Disconnect the leak sensor assembly from the processor board and pull the cable out of the foam channel.



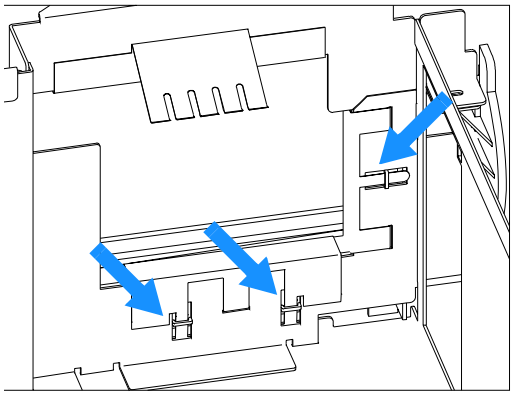
2 Remove the column switching valve (if installed), see “Removing the Column Switching Valve” on page 74.

3 Remove the heat exchanger assemblies, see “Removing the Heat Exchanger Assemblies” on page 87.

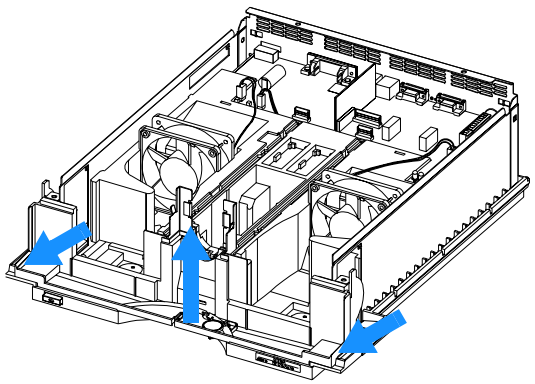
4 Locate the clips.



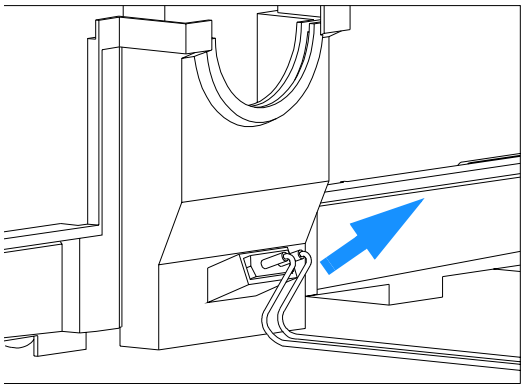
5 Remove the clips (shown from the inside of the column compartment) on both sides using a flat screwdriver.



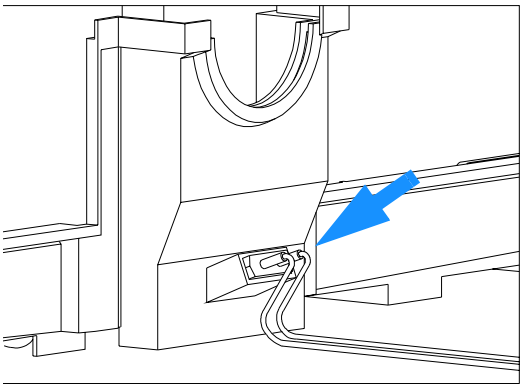
6 Remove the leak base from the cabinet by unlocking it with a flat blade on the right and left side of the leak base.



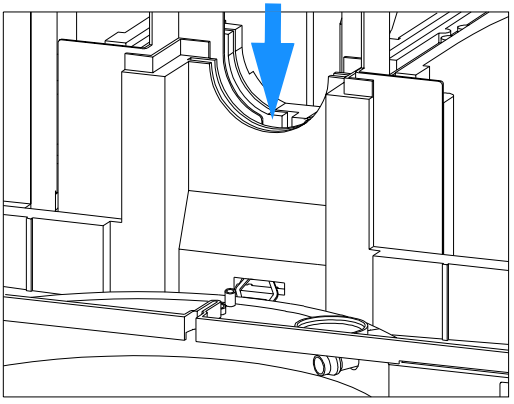
7 Remove the leak sensor assembly from the rear of the leak base.



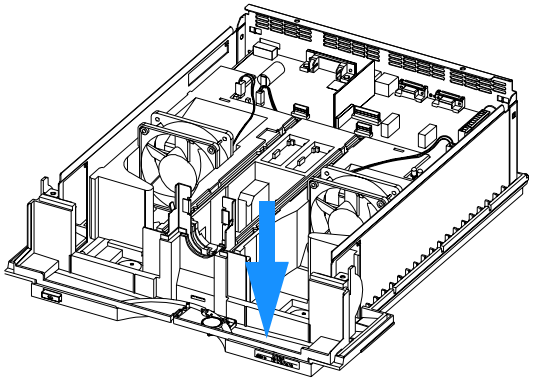
8 Replace the leak sensor assembly into the leak base.



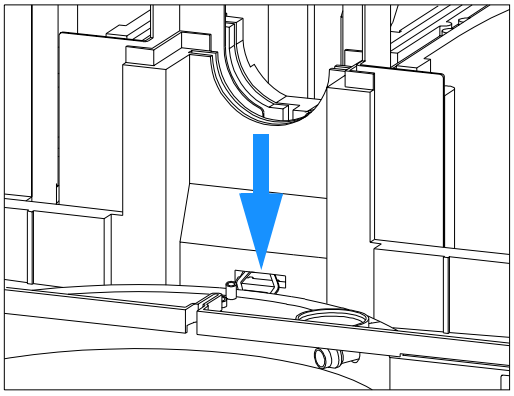
9 Route the leak sensor cable through the z-panel into the left foam channel.



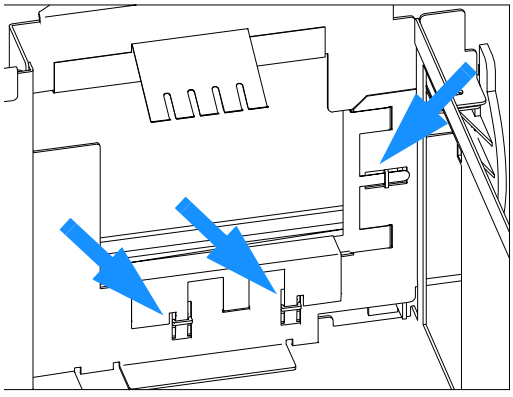
10 Replace the leak base into the cabinet until it clicks into the cabinet. Insert the right side first.



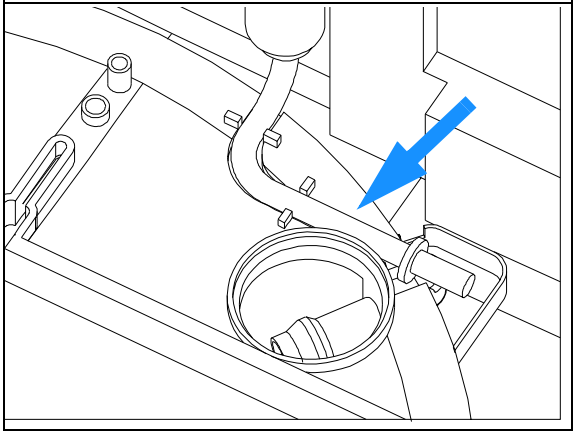
11 Position the leak sensor so that it does not touch the bottom of the leak base.



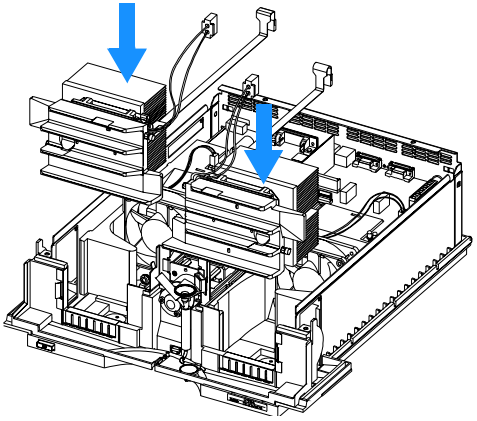
12 Replace the clips (shown from the inside of the column compartment) on both sides using a flat screwdriver.



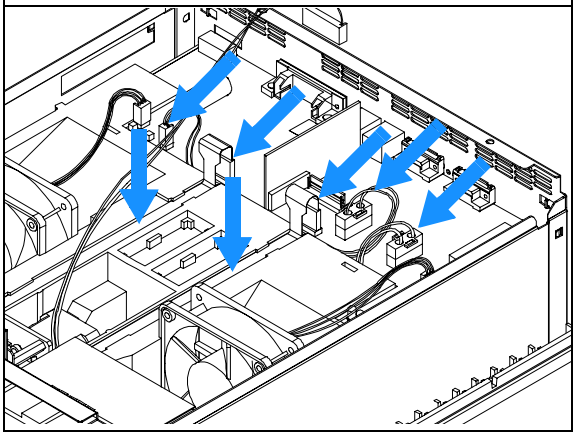
13 Replace the leak tubing assembly into its location on leak base. Ensure that it keeps in this position during the next steps.



14 Replace the heat exchanger assemblies, see “Installing the Heat Exchanger Assemblies” on page 90.



15 Reconnect the leak sensor and heat exchanger cables to the processor board and place the cables in the foam channel.



16 Replace the foam section, the top cover and front cover, see “Installing the Foam and the Top Cover” on page 102.

17 Replace the column compartment into the stack.

18 Reconnect the cables.

19 Turn on the column compartment.

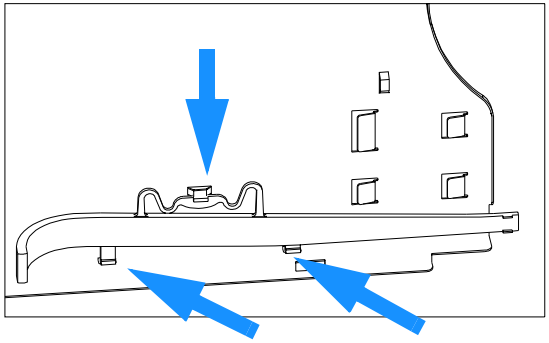
Replacing Status Light Pipe

When required	When part is broken
Tools required	Screwdriver Pozidriv 1 PT3
Parts required	Status light pipe 5041-8384

Preparations for this procedure:

❏ Remove the front cover and top cover, see “Removing the Top Cover and Foam” on page 71.

1 The status light pipe is clipped into the top cover.



2 Replace the foam section, the top cover and front cover, see “Installing the Foam and the Top Cover” on page 102.

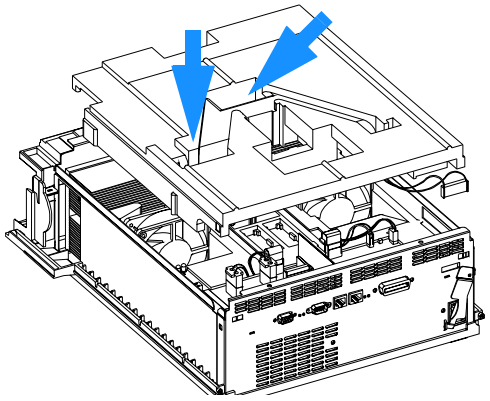
3 Replace the column compartment into the stack and reconnect the cables and capillaries.

4 Turn on the column compartment.

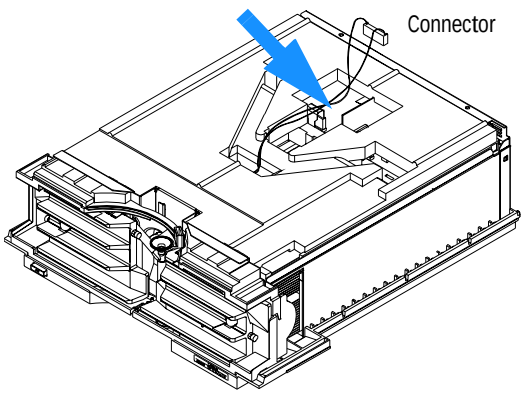
Installing the Foam and the Top Cover

When required	When all repairs have been completed
Tools required	Screwdriver Pozidriv 1 PT3
Prerequisites	The column compartment is open and other procedures have been carried out

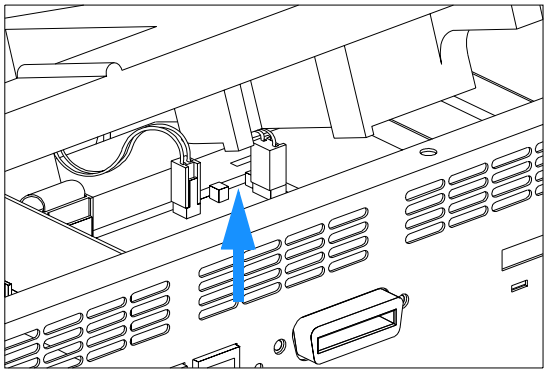
1 Route the valve connector through the top foam and carefully fit the top foam into the column compartment.



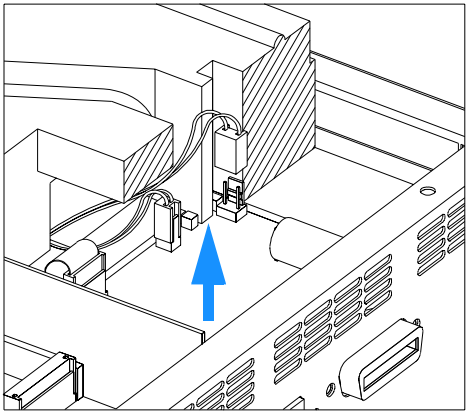
2 Reconnect the valve connector to the main board.



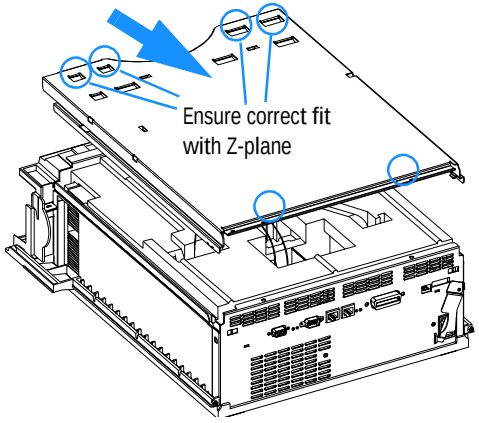
3 Make sure that the foam is installed correctly and is located in the safety light switch.



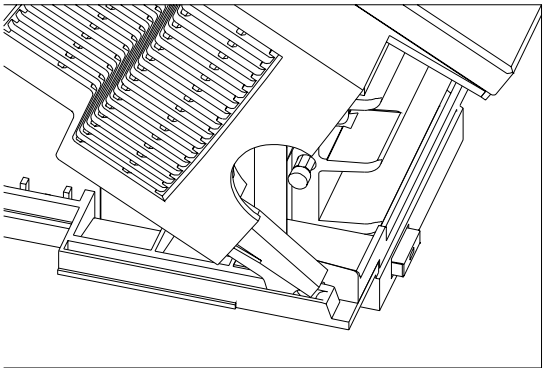
4 Position of the foam in the safety light switch.



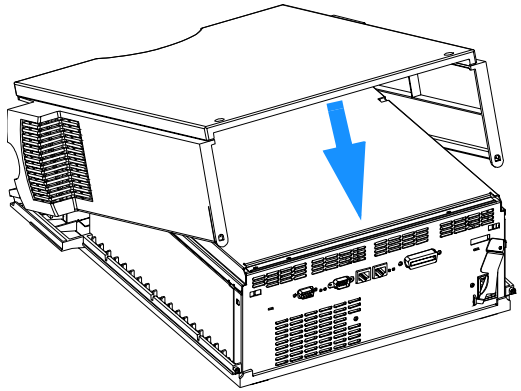
5 Place the top plate on the foam and slide it towards the rear and fix the screws at the rear of the top plate.



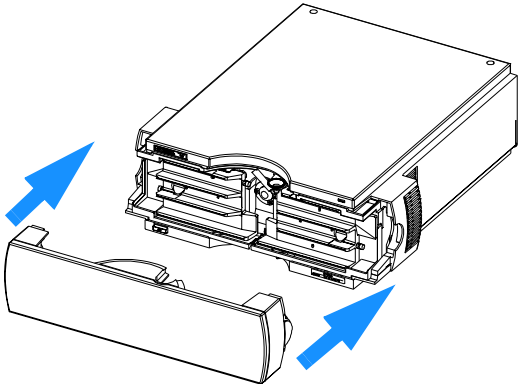
6 Place the top cover into the guides.



7 Replace the cover.



8 Replace the front panel.



9 Replace the column compartment into the stack.

10 Reconnect the cables.

11 Turn on the column compartment.

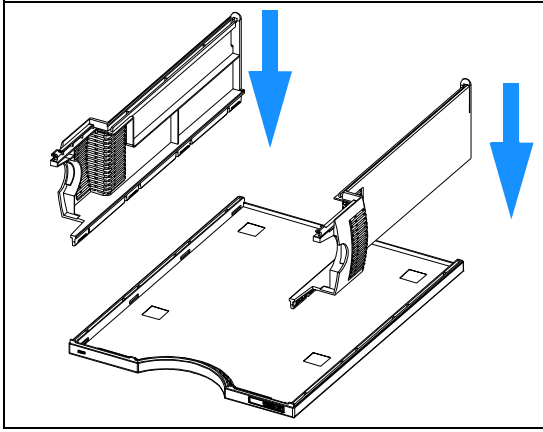
Assembling the Main Cover

When required	If cover was broken
Tools required	None
Parts required	Plastics kit G1316-68703 (includes base, top, left and right)

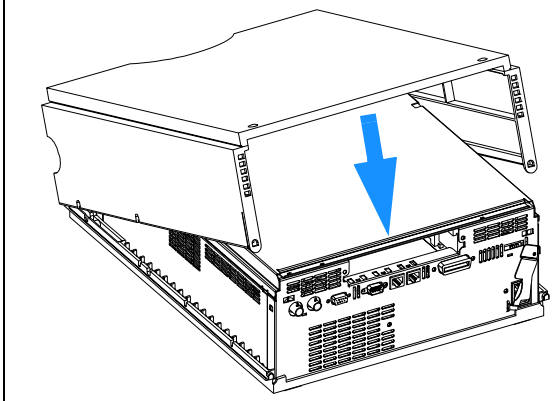
NOTE The plastics kit contains all parts, but it is not assembled.

WARNING **In case you insert the left or right side in the opposite position, you may not be able to remove the side from the top part.**

1 Place the top part on the bench and insert the left and right side into the top part.



2 Replace the cover.



3 Replace the column compartment into the stack and reconnect the cables and capillaries.

4 Turn on the column compartment.

Replacing the Column Compartment's Firmware

The installation of new firmware is required

- if new version solves problems of currently installed version.
- if after exchange of the processor board (CCM) the version on board is older than previous installed one.

To upgrade the column compartment's firmware the following steps have to be performed:

1. Load the firmware into the column compartment, see the help system of your user interface.
2. Perform a "Temperature Calibration Procedure" on page 55 to add the recalibration parameters into the board's memory (only necessary if a temperature calibration was done before).
3. If the CCM board was exchanged, re-enter the serial number information of the column compartment through the user interface, see "Entering the Serial Number using the Control Module" on page 82 or "Entering the Serial Number using the ChemStation" on page 83.

4

Identifying Parts and Materials

Detailed illustrations and listings for parts and materials identification

Figure 9 **Overview on Main Assemblies**

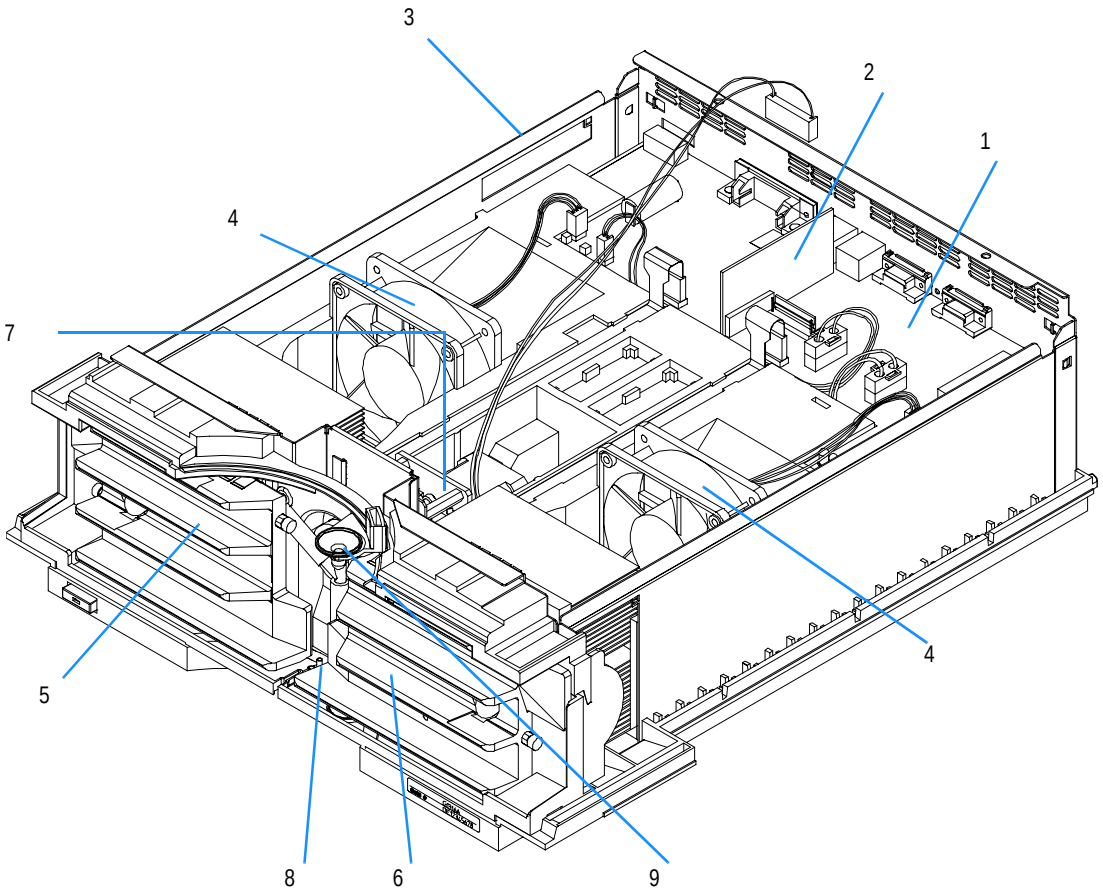


Table 4 Main Assemblies

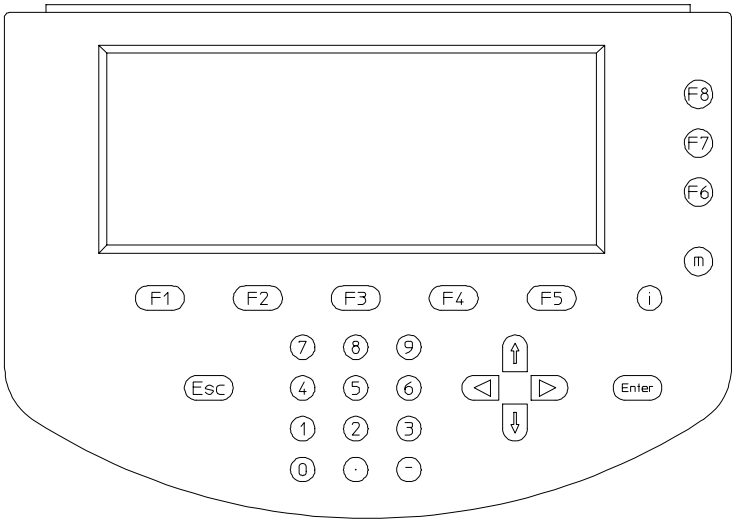
Item	Description	HP Part Number
1	Column compartment main board CCM (exchange part)	G1316-69520
	Hexagonal nut for HP-IB connector	0380-0643
	Hexagonal nut for RS-232 connector	1251-7788
	Cable CAN to HP 1100 Series modules	5181-1516
2	Column identification board CID	G1316-66503
3	Power supply assembly, additional power and status light parts, see page 115	0950-2528
4	Fan assembly	3160-1017
5	Heater (left)	G1316-60007
6	Heater (right)	G1316-60006
7	Column switching valve (optional), additional column switching valve parts, see page 111	0101-0920
8	Leak sensor assembly	5061-3356
9	Leak handling parts	See page 116
	Low dispersion capillary (0.12 mm i.d., 70 mm)	G1316-87303
	Capillary Kit Column Switching, see page 111	G1316-68708
	Front cover and plastic parts (housing)	See page 113
	Sheet metal parts	See page 112
	Foam parts	See page 114

Control Module

Table 5 **Control Module Parts**

Item	Description	HP Part Number
	Control Module, replacement part including cable	G1323-67001
	Plastic Housing Kit, includes front, back and a clamp	5062-8583
	CAN cable HP 1100 module to control module	G1323-81600

Figure 10 **Control Module**

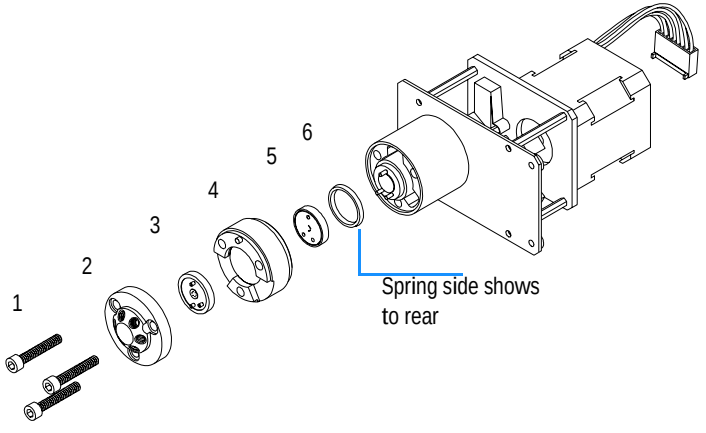


Column Switching Valve

Table 6 **Column Switching Valve Parts**

Item	Description	HP Part Number
	Column switching valve kit, includes valve and Capillary Kit CSV	G1353-68700
	Column switching valve (complete assembly)	0101-0920
	Capillary Kit Column Switching includes two capillaries (0.17mm i.d., 180 mm) and three capillaries (0.17 mm i.d., 90 mm)	G1316-68708 G1313-87305 G1316-87300
1	Stator screws	1535-4857
2	Stator Head	0100-1850
3	Stator face	0100-1851
4	Stator ring	
5	Rotor seal 3 grooves (Tefzel)	0100-1854
	Rotor seal 3 grooves (Vespel)	0100-1855
6	Isolation seal	0100-1852

Figure 11 **Column Switching Valve Parts**

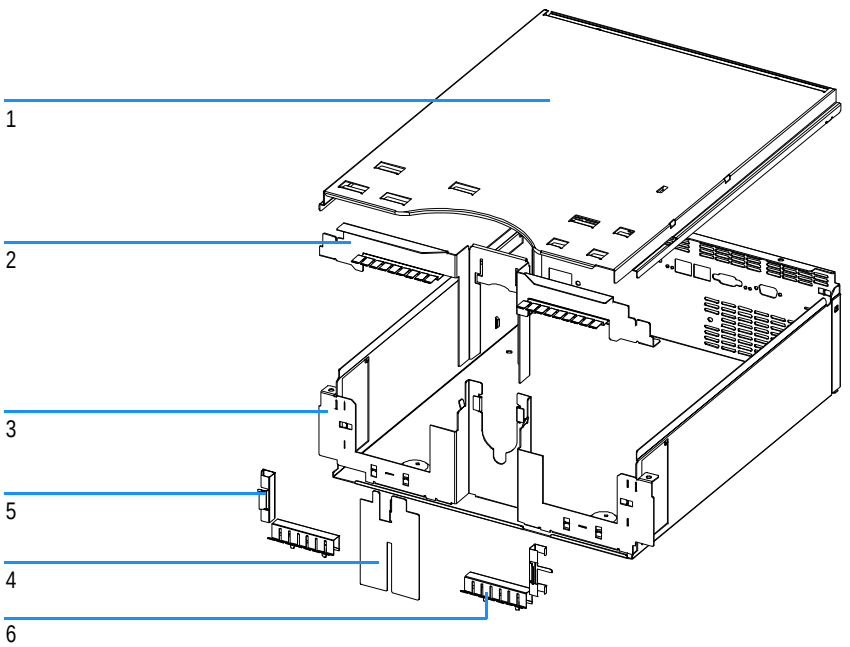


Sheet Metal Kit

Table 7 **Sheet Metal Kit Parts**

Item	Description	HP Part Number
	Sheet metal kit includes items 1, 2 and 3	G1316-68701
4	RFI shield	G1316-00600
5	RFI spring side	G1316-09100
6	RFI spring bottom	G1316-09102

Figure 12 **Sheet Metal Kit Parts**



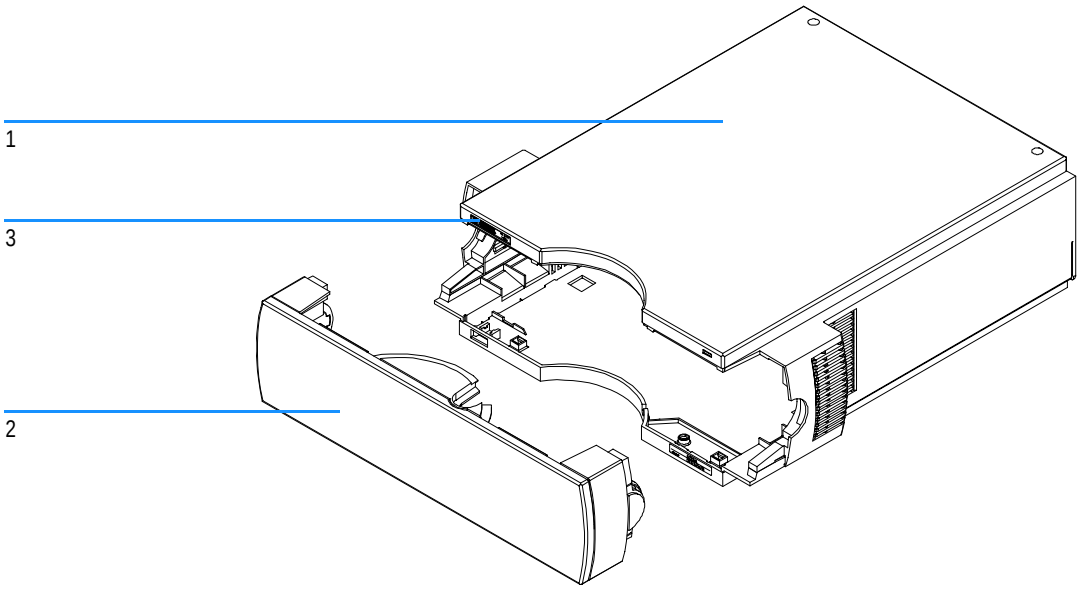
Plastic Parts

Table 8 **Plastic Parts**

Item	Description	HP Part Number
1	Plastic kit, includes base, sides and top	G1316-68703
2	Front cover	G1316-68704
3	Name plate HP 1100 Series	5042-1312

NOTE For correct assembling of the top and sides, see “Assembling the Main Cover” on page 105.

Figure 13 **Plastic Parts**



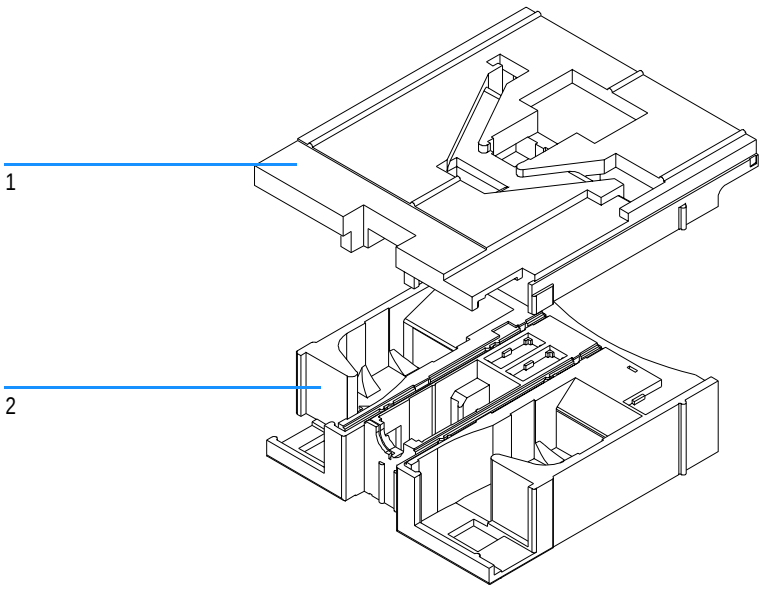
Foam Parts

Table 9 **Foam Parts**

Item	Description	HP Part Number
1, 2	EPP foam kit, includes 1 and 2	G1316-68702
1	Top	
2	Base	

NOTE Do not order the individual part numbers mentioned on the foam.

Figure 14 **Foam Parts**

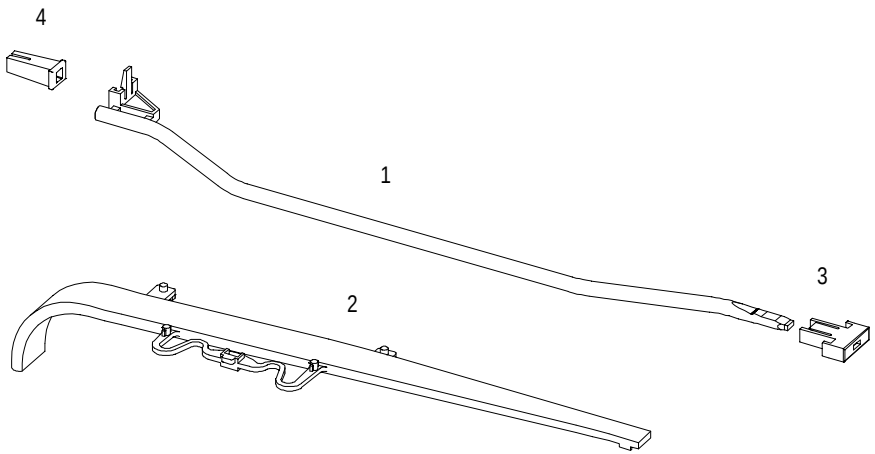


Power and Status Light Pipes

Table 10 **Power and Status Light Pipes**

Item	Description	HP Part Number
	Power supply assembly	0950-2528
1	Power light pipe	5041-8382
2	Status light pipe	5041-8384
3	Power switch button	5041-8381
4	Coupler for power supply actuator	5041-8383

Figure 15 **Power and Status Light Pipes**

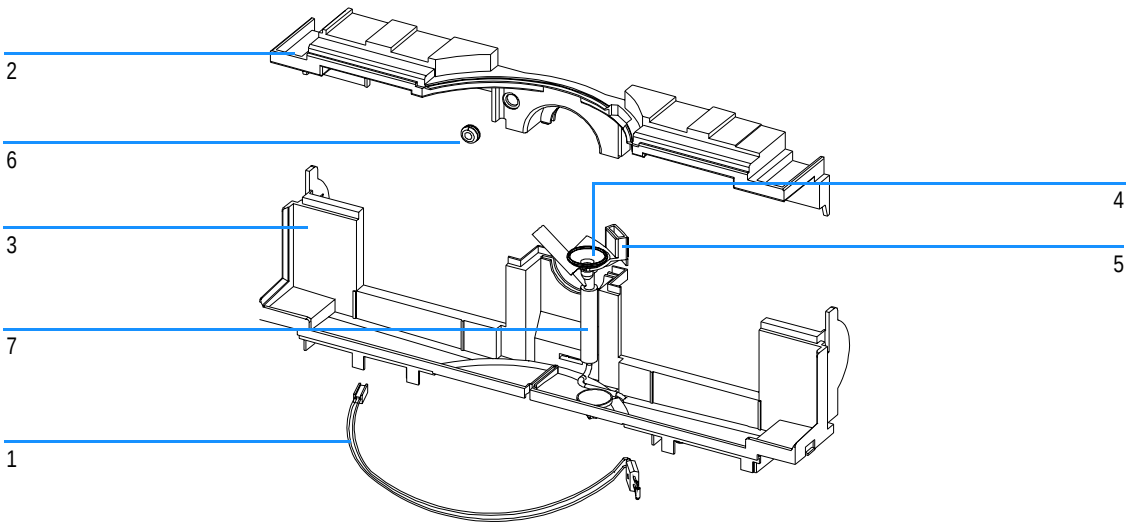


Leak Parts

Table 11 **Leak Parts**

Item	Description	HP Part Number
1	Leak sensor	5061-3356
2, 3	Leak Kit, includes leak top and leak base	G1316-68700
4	Leak funnel	5041-8388
5	Leak funnel holder	G1316-42300
6	O-ring for ambient temperature sensor	0400-0002
7	Waste assembly, includes complete Y-tubing assembly with leak funnel	G1316-60002
	Waste tubing 1200 mm long (part of accessory kit)	0890-1711

Figure 16 **Leak Parts**



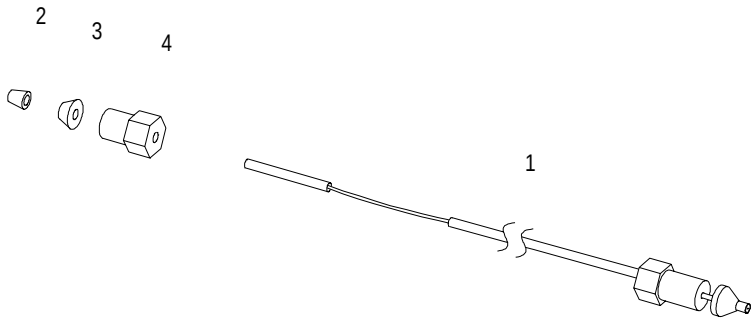
Accessory Kit

This kit contains some accessories and tools needed for the installation and repair of the column compartment.

Table 12 **Accessory Kit Parts Listing**

Item	Description	HP Part Number
	Accessory kit	G1316-68705
	Column identification tag (blank) for re-ordering use (pack of 3)	5062-8588
	ESD wrist strap	9300-1408
	Column clip, quantity=2, for re-order use (pack of 6)	5063-6526
1	Capillary column-heat exchanger 90 mm lg, 0.17 i.d. (not assembled) contains items 2, 3 and 4	G1316-87300
2	Ferrule front SST, quantity=2	0100-0043
3	Ferrule back SST, quantity=2	0100-0044
4	Fitting SST, quantity=2	79814-22406

Figure 17 **Capillary (Column-Heat Exchanger) Parts**



Cable Overview

WARNING **Never use cables other than the ones supplied by Hewlett-Packard to ensure proper functionality and compliance with safety or EMC regulations.**

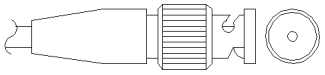
Table 13 **Cable Overview**

Type	Description	HP Part Number
Analog cables	HP 3390/2/3 integrators	01040-60101
	HP 3394/6 integrators	35900-60750
	HP 35900A A/D converter	35900-60750
	General purpose (spade lugs)	01046-60105
	HP 3390/2/3 integrators	01040-60101
Remote cables	HP 3390 integrator	01046-60203
	HP 3392/3 integrators	01046-60206
	HP 3394 integrator	01046-60210
	HP 3396A (Series I) integrator	03394-60600
	HP 3396 Series II / HP 3395A integrator, see page 124	
	HP 3396 Series III / HP 3395B integrator	03396-61010
	HP 1100 / HP 1050 modules / HP 1046A FLD	5061-3378
	HP 1046A FLD	5061-3378
	HP 35900A A/D converter	5061-3378
	HP 1040 diode array detector	01046-60202
	HP 1090 liquid chromatographs	01046-60202
	Signal distribution module	01046-60202

Table 13 **Cable Overview, continued**

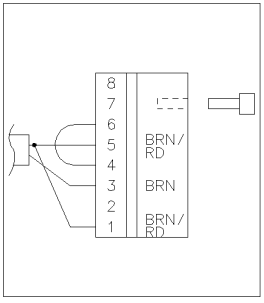
Type	Description	HP Part Number
BCD cables	HP 3392/3 integrators	18594-60510
	HP 3396 integrator	03396-60560
	General purpose (spade lugs)	18594-60520
Auxiliary	HP 1100 Series vacuum degasser	G1322-61600
CAN cables	HP 1100 module to module, 0.5 m	5181-1516
	HP 1100 module to module, 1 m	5181-1519
	HP 1100 module to control module	G1323-81600
External contacts	HP 1100 Series interface board to general purpose	G1103-61611
HP-IB cable	HP 1100 module to HP ChemStation, 1 m	10833A
	HP 1100 module to HP ChemStation, 2 m	10833B
RS-232 cable	HP 1100 module to a computer This kit contains a 9-pin female to 9-pin female null modem (printer) cable and one adapter.	34398A
LAN cable	Twisted pair cross over LAN cable, 10 feet long (for point to point connection)	5183-4649
	Category 5 UTP cable, 8 m long (for hub connections)	G1530-61480

Analog Cables

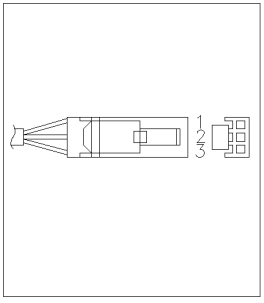


One end of these cables provides a BNC connector to be connected to HP 1100 Series modules. The other end depends on the instrument to which connection is being made.

HP 1100 to HP 3390/2/3 Integrators

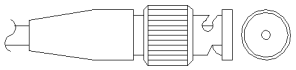
Connector 01040-60101	Pin HP 3390/2/3	Pin HP 1100	Signal Name
	1	Shield	Ground
	2		Not connected
	3	Center	Signal +
	4		Connected to pin 6
	5	Shield	Analog -
	6		Connected to pin 4
	7		Key
	8		Not connected

HP 1100 to HP 3394/6 Integrators

Connector 35900-60750	Pin HP 3394/6	Pin HP 1100	Signal Name
	1		Not connected
	2	Shield	Analog -
	3	Center	Analog +

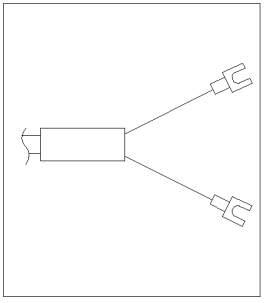
HP 1100 to BNC Connector

Connector 8120-1840	Pin BNC	Pin HP 1100	Signal Name
	Shield	Shield	Analog -
	Center	Center	Analog +



HP 1100 to General Purpose

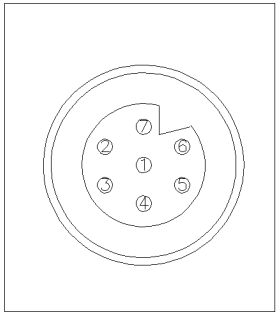
Connector 01046-60105	Pin HP 3394/6	Pin HP 1100	Signal Name
	1		Not connected
	2	Black	Analog -
	3	Red	Analog +



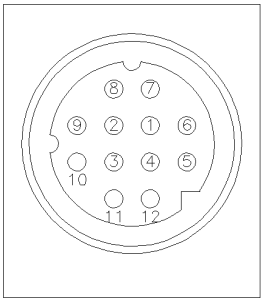
Remote Cables

One end of these cables provides a Hewlett-Packard APG (Analytical Products Group) remote connector to be connected to HP 1100 Series modules. The other end depends on the instrument to be connected to.

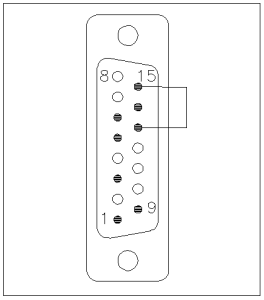
HP 1100 to HP 3390 Integrators

Connector 01046-60203	Pin HP 3390	Pin HP 1100	Signal Name	Active (TTL)
	2	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	7	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	NC	7 - Red	Ready	High
	NC	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low

HP 1100 to HP 3392/3 Integrators

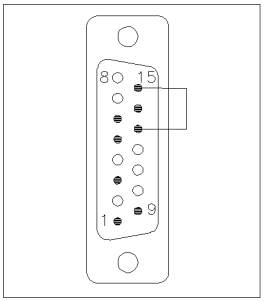
Connector 01046-60206	Pin HP 3392/3	Pin HP 1100	Signal Name	Active (TTL)
	3	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	11	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	9	7 - Red	Ready	High
	1	8 - Green	Stop	Low
4 - Key	NC	9 - Black	Start request	Low

HP 1100 to HP 3394 Integrators

Connector 01046-60210	Pin HP 3394	Pin HP 1100	Signal Name	Active (TTL)
	9	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	3	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	5,14	7 - Red	Ready	High
	6	8 - Green	Stop	Low
	1	9 - Black	Start request	Low
	13, 15		Not connected	

NOTE START and STOP are connected via diodes to pin 3 of the HP 3394 connector.

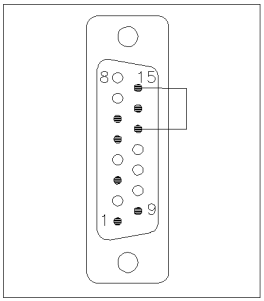
HP 1100 to HP 3396A Integrators

Connector 03394-60600	Pin HP 3394	Pin HP 1100	Signal Name	Active (TTL)
	9	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	3	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	5,14	7 - Red	Ready	High
	1	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low
	13, 15		Not connected	

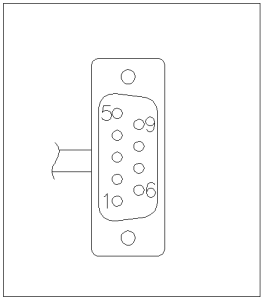
HP 1100 to HP 3396 Series II / HP 3395A Integrators

Use the cable 03394-60600 and cut pin #5 on the integrator side. Otherwise the integrator prints START; not ready.

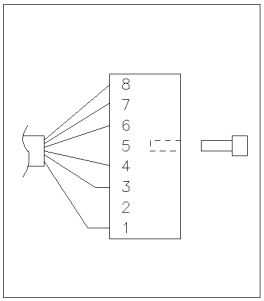
HP 1100 to HP 3396 Series III / 3395B Integrators

Connector 03396-61010	Pin HP 33XX	Pin HP 1100	Signal Name	Active (TTL)
	9	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	3	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	14	7 - Red	Ready	High
	4	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low
	13, 15		Not connected	

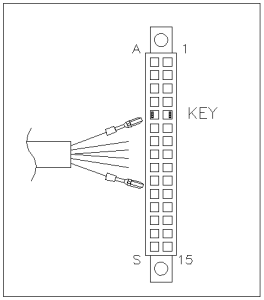
HP 1100 to HP 1050, HP 1046A or HP 35900 A/D Converters

Connector 5061-3378	Pin HP 1050 / …	Pin HP 1100	Signal Name	Active (TTL)
	1 - White	1 - White	Digital ground	
	2 - Brown	2 - Brown	Prepare run	Low
	3 - Gray	3 - Gray	Start	Low
	4 - Blue	4 - Blue	Shut down	Low
	5 - Pink	5 - Pink	Not connected	
	6 - Yellow	6 - Yellow	Power on	High
	7 - Red	7 - Red	Ready	High
	8 - Green	8 - Green	Stop	Low
	9 - Black	9 - Black	Start request	Low

HP 1100 to HP 1090 LC, HP 1040 DAD or Signal Distribution Module

Connector 01046-60202	Pin HP 1090	Pin HP 1100	Signal Name	Active (TTL)
	1	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	4	3 - Gray	Start	Low
	7	4 - Blue	Shut down	Low
	8	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	3	7 - Red	Ready	High
	6	8 - Green	Stop	Low
5 - Key	NC	9 - Black	Start request	Low

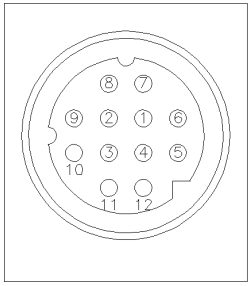
HP 1100 to General Purpose

Connector 01046-60201	Pin Universal	Pin HP 1100	Signal Name	Active (TTL)
		1 - White	Digital ground	
		2 - Brown	Prepare run	Low
		3 - Gray	Start	Low
		4 - Blue	Shut down	Low
		5 - Pink	Not connected	
		6 - Yellow	Power on	High
		7 - Red	Ready	High
		8 - Green	Stop	Low
		9 - Black	Start request	Low

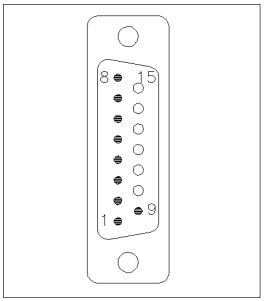
BCD Cables

One end of these cables provides a 15-pin BCD connector to be connected to the HP 1100 Series modules. The other end depends on the instrument to be connected to.

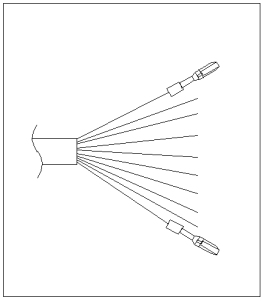
HP 1100 to HP 3392/3 Integrators

Connector 18584-60510	Pin HP 3392/3	Pin HP 1100	Signal Name	BCD Digit
 6 - Key	10	1	BCD 5	20
	11	2	BCD 7	80
	3	3	BCD 6	40
	9	4	BCD 4	10
	7	5	BCD 0	1
	5	6	BCD 3	8
	12	7	BCD 2	4
	4	8	BCD 1	2
	1	9	Digital ground	
	2	15	+ 5 V	Low

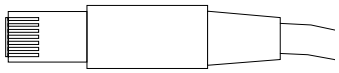
HP 1100 to HP 3396 Integrators

Connector 03396-60560	Pin HP 3392/3	Pin HP 1100	Signal Name	BCD Digit
	1	1	BCD 5	20
	2	2	BCD 7	80
	3	3	BCD 6	40
	4	4	BCD 4	10
	5	5	BCD 0	1
	6	6	BCD 3	8
	7	7	BCD 2	4
	8	8	BCD 1	2
	9	9	Digital ground	
	NC	15	+ 5 V	Low

HP 1100 to General Purpose

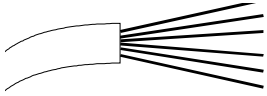
Connector 18594-60520	Wire Color	Pin HP 1100	Signal Name	BCD Digit
	Green	1	BCD 5	20
	Violet	2	BCD 7	80
	Blue	3	BCD 6	40
	Yellow	4	BCD 4	10
	Black	5	BCD 0	1
	Orange	6	BCD 3	8
	Red	7	BCD 2	4
	Brown	8	BCD 1	2
	Gray	9	Digital ground	
	White	15	+5 Vt	Low

Auxiliary Cable

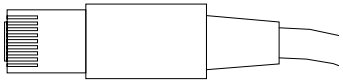


One end of this cable provides a modular plug to be connected to the HP 1100 Series vacuum degasser. The other end is for general purpose.

HP 1100 Series Degasser to general purposes

Connector G1322-61600	Color	Pin HP 1100	Signal Name
	White	1	Ground
	Brown	2	Pressure signal
	Green	3	
	Yellow	4	
	Grey	5	DC + 5 V IN
	Pink	6	Vent

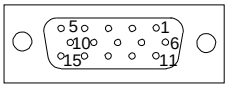
CAN Cable



Both ends of this cable provide a modular plug to be connected to HP 1100 Series module's CAN-bus connectors.

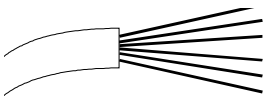
HP 1100 module to module, 0.5 m	5181-1516
HP 1100 module to module, 1 m	5181-1519
HP 1100 module to control module	G1323-81600

External Contact Cable



One end of this cable provides a 15-pin plug to be connected to HP 1100 Series module's interface board. The other end is for general purpose.

HP 1100 Series Interface Board to general purposes

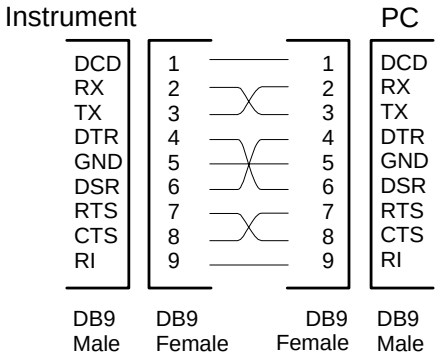
Connector G1103-61611	Color	Pin HP 1100	Signal Name
	White	1	EXT 1
	Brown	2	EXT 1
	Green	3	EXT 2
	Yellow	4	EXT 2
	Grey	5	EXT 3
	Pink	6	EXT 3
	Blue	7	EXT 4
	Red	8	EXT 4
	Black	9	Not connected
	Violet	10	Not connected
	Grey/pink	11	Not connected
	Red/blue	12	Not connected
	White/green	13	Not connected
	Brown/green	14	Not connected
	White/yellow	156	Not connected

RS-232C Cable Kit

This kit contains a 9-pin female to 9-pin female null modem (printer) cable and one adapter. Use the cable and adapter to connect Hewlett-Packard instruments with 9-pin male RS-232C connectors to most PCs or printers.

HP 1100 module to PC

RS-232C Cable Kit HP 34398A



LAN Cables

Recommended Cables

For point to point connection (not using a network hub) use a twisted pair cross over LAN cable (HP P/N 5183-4649, 10 feet long).

For standard network connections using a hub use category 5 UTP cables, (HP P/N G1530-61480, 8 m long).

5

Introduction to the Column Compartment

An introduction to the column compartment, instrument overview, theory of operation, external communication and internal connectors

Introduction to the Column Compartment

The HP 1100 Series thermostatted column compartment is a stackable temperature-controlled column compartment for HPLC. It is available as standalone module or as a component of a HP 1100 Series system. It is used for heating and cooling to meet extreme requirements of retention time reproducibility.

The main features of this column compartment are:

- Peltier heating and cooling from 10 degrees below ambient up to 80 °C with high heating and cooling speeds for maximum application flexibility and stability,
- holds up to three 30-cm columns and optimized design gives minimum dead volumes and maximum efficiency,
- two independently programmable heat exchangers contribute volumes of only 3 and 6 µl,
- electronic column-identification module as standard for GLP documentation of column type, and major column parameters,
- optional high-quality Rheodyne® column switching valve with ceramic stator-face assemblies for prolonged lifetime.

For specifications, “Performance Specifications” on page 186.

System Overview

The Concept of Heating and Cooling

The design of this thermostatted column compartment uses column heating and cooling devices with Peltier elements. The solvent entering the column compartment is heated up or cooled down to a settable temperature with two low-volume heat exchangers (3 µl on left side, 6 µl on right side), made of a short piece of capillary 0.17 mm i.d. leading through a heat exchanger. The heat exchanger is designed such that it can function simultaneously as an air heater. The surface of the heat exchanger is shaped such that the area around the column is kept on similar temperature level as the liquid running through the column. This is done by thermal convection and radiation between the heat exchanger fins. With this design it is ensured that the column and the solvent flowing through it, are almost at the same temperature.

Actual temperature control is accomplished at the heat exchanger. The solvent cools down or heats up on its transfer from the heating block to the column inlet. This depends on several factors: flow rate, setpoint temperature, ambient temperature and column dimensions.

For example, temperature setpoint is 40 °C. The heat-exchanger temperature is controlled at 40.8 °C and at the column entry there could be 39.8 °C.

The actual temperature displayed on the user interface is always the derived temperature taken at the heat exchanger, corrected by the offset explained above.

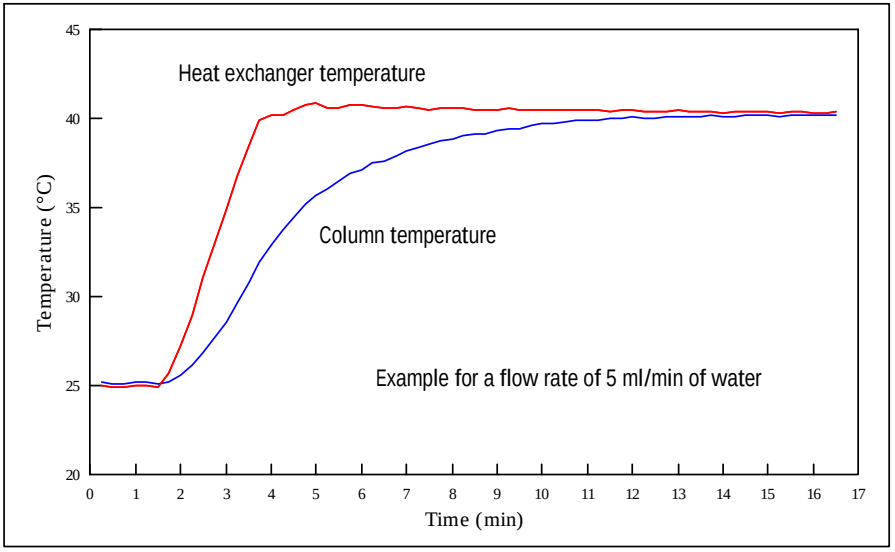
NOTE

Default mode: heater actual, column ± offset
Corrected mode: heater ± offset, column actual

Any type of heated column compartment brings one important consequence for column temperature equilibration. Before an equilibrium is reached the whole mass of column, column packing and solvent volume inside the column has to be brought to the selected temperature. This depends on several factors: flow rate, setpoint temperature, ambient temperature and column dimensions. The higher the flow rate, the faster the column equilibrates (due to thermostatted mobile phase).

Figure 18 shows a setpoint temperature of 40 °C. Some time after entering the setpoint the heat exchanger has reached its temperature and the control activity starts. The TEMPERATURE NOT READY signal will be cancelled 20 seconds after the sensed temperature was within a range of ± 0.5 °C of the setpoint (other values are settable from the user interface). However this does not mean that the column is at the correct temperature. The equilibration of the column can take longer. Stability of the high pressure readings is a good indication for equilibrium.

Figure 18 **Equilibration of Heat Exchanger and Column Temperature**



The temperature calibration and verification is described in “Temperature Calibration Procedure” on page 55.

Column-Identification System

The HP 1100 Series thermostatted column compartment is equipped with a column-identification system. This allows to write and to read column-specific information to and from the column-identification tag.

Figure 19 **Column-Identification System**

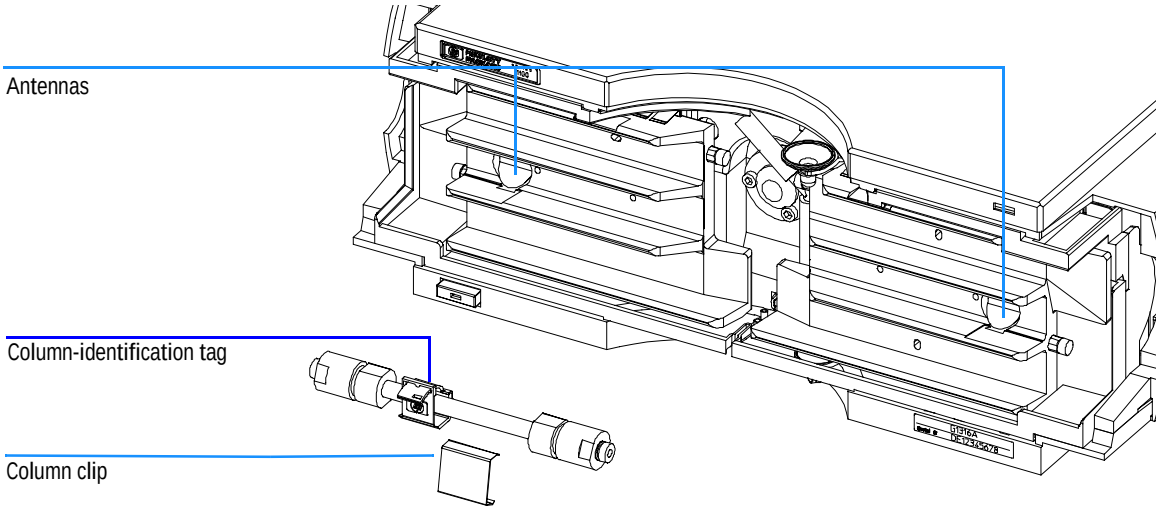


Table 14 shows the information that can be stored:

Table 14 **Column-Identification Module Information**

Item	Example	Comment
Product number	79916OD-552	
Serial number	950522	Date of manufacturing
Batch number	1675	
Geometry [mm]	100 × 2.1	
Stationary phase	ODS Hypersil	
Particle size	10 µm	

Table 14 **Column-Identification Module Information, continued**

Item	Example	Comment
Number of injections	1267	See Note below.
Maximum pressure allowed [bar]	400	
Maximum temperature recommended [°C]	70	
Maximum pH recommended	12	
Column void volume [ml]		

The number of injections will be updated each run to create a column lifecycle (history). The user interface allows to edit all information.

NOTE If a column switching valve (see page 140) is installed in the module, the update of the number of injections depends on the position of the column switching valve. For example, if the left column is selected, the right column is not updated, and vice versa.

If no column switching valve is installed both sides are updated at the same time.

Column-Identification Tag

When correctly placed on the heat exchanger, the distance between tag and antenna is 1–2 mm. This is the optimum distance for proper function. The identification tag can be easily removed from the column.

NOTE For small diameter columns, a cable tie wrap should be used, to fix the column-identification tag at the column (in case you modify your own column). Assure that the tie wrap is not blocking the front cover.

NOTE There is a difference in attaching the identification tag to the column depending on which heat exchanger it will be located, see Figure 20 and Figure 21. The HP logo should be always at the front side.

Figure 20 **Column-Identification Tag for Left Heat Exchanger**

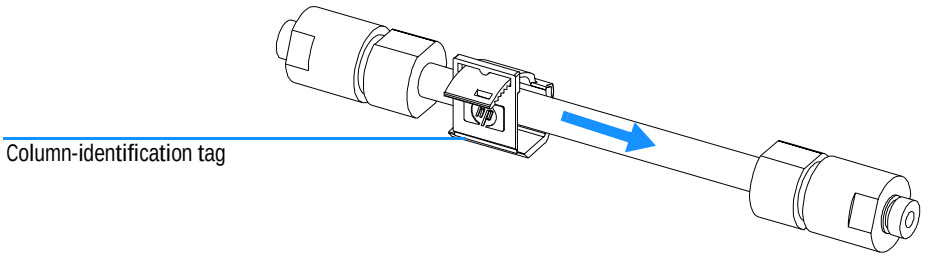
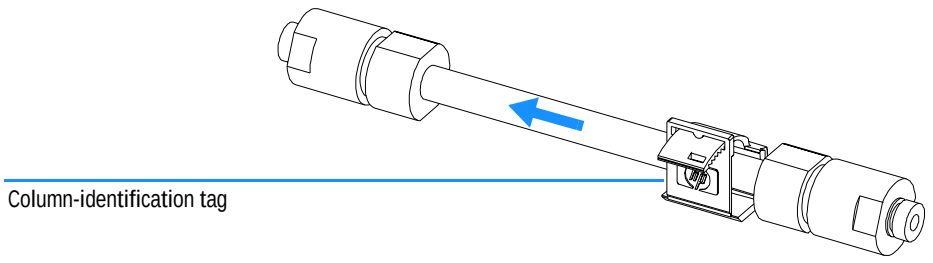


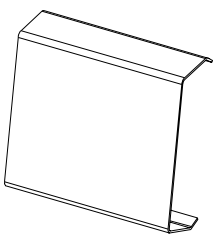
Figure 21 **Column-Identification Tag for Right Heat Exchanger**



Column Clip

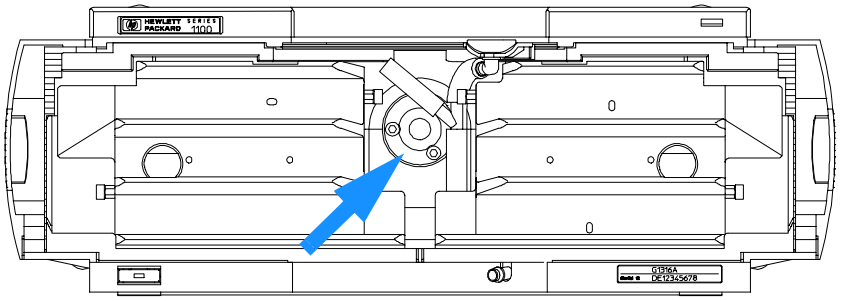
For better positioning of the column on the heat exchanger a column clip is available (part of accessory kit, “Accessory Kit” on page 117).

Figure 22 **Column Clip**



Column Switching Valve (Optional)

Figure 23 **Location of Column Switching Valve**



Two Column Selection

The valve can select either column 1 or column 2. The offline column is sealed by connecting head to rail. Switching should be done when the flow is off and the pressure is zero.

Figure 24 **Column 1 Active**

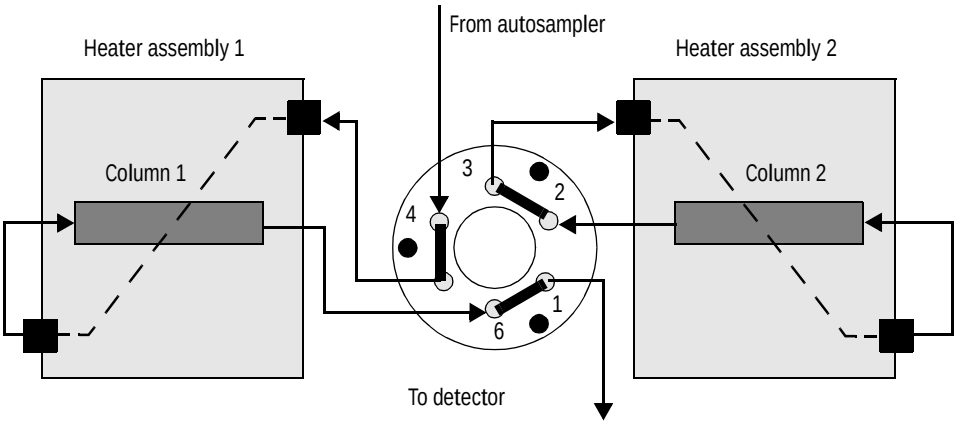
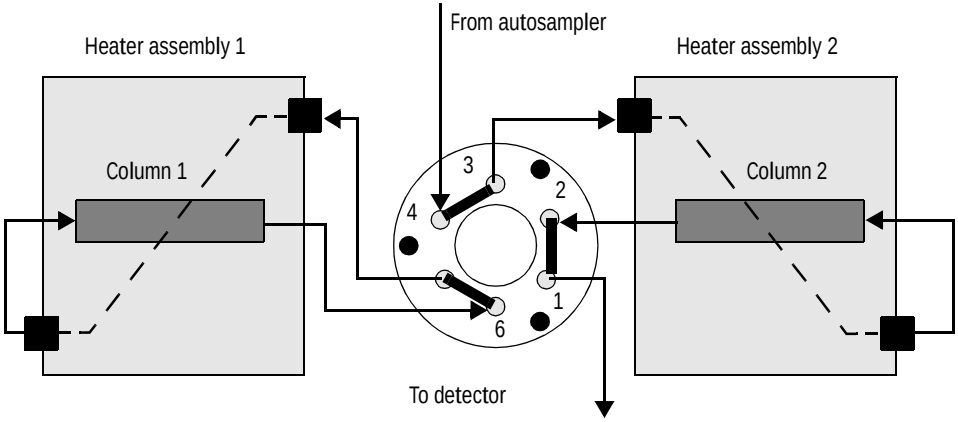


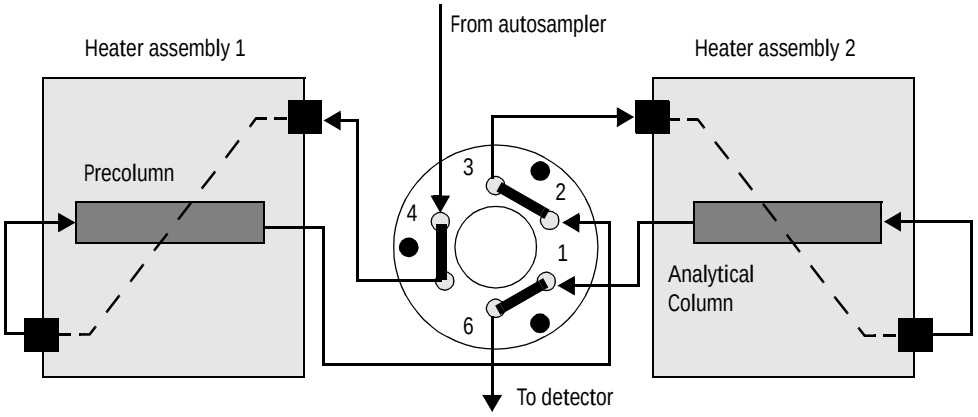
Figure 25 **Column 2 Active**



Precolumn Back-flushing

The sample is injected into series-connected precolumn and analytical column. After the valve has switched, the analytical column flow continues in normal direction. Only the precolumn is back-flushed, eluting highly retained peaks directly to the detector.

Figure 26 **Precolumn Back-flushing**

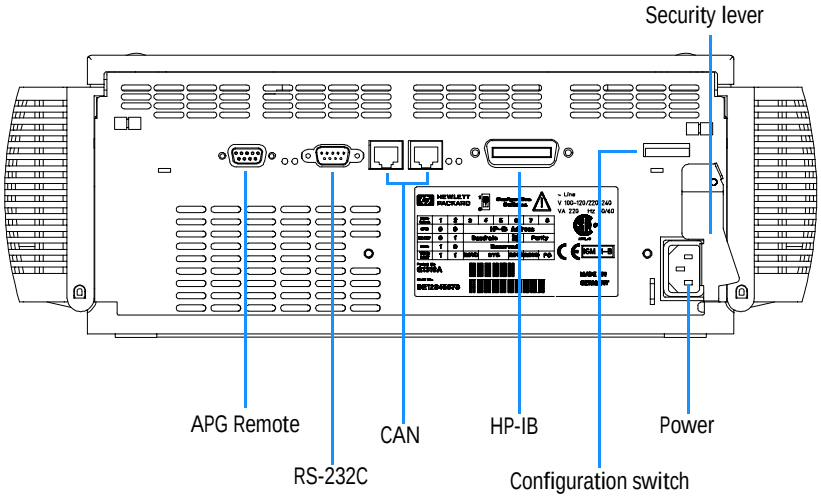


Electrical Connections

- The HP-IB connector is used to connect the column compartment with a computer. The address and control switch module next to the HP-IB connector determines the HP-IB address of your column compartment. The switches are preset to a default address (see Table 16 on page 153 or see Table 20 on page 157) and is recognized once after power is switched on.
- The CAN bus is a serial bus with high-speed data transfer. The two connectors for the CAN bus are used for internal HP 1100 Series module data transfer and synchronization.
- The REMOTE connector may be used in combination with other analytical instruments from Hewlett-Packard if you want to use features such as common shut down, prepare, and so on.
- With the appropriate software, the RS-232C connector may be used to control the module from a computer through a RS-232C connection. This connector is activated and can be configured with the configuration switch next to the HP-IB connector (see “Communication Settings for RS-232C Communication” on page 158). See your software documentation for further information
- The power input socket accepts a line voltage of 100–120 or 220–240 volts AC ± 10 % with a line frequency of 50 or 60 Hz. Maximum power consumption is 320 VA. There is no voltage selector on your column compartment because the power supply has wide-ranging capability. There are no externally accessible fuses, because automatic electronic fuses are implemented in the power supply. The security lever at the power input socket prevents that the column compartment cover is taken off when line power is still connected.

WARNING **Never use cables other than the ones supplied by Hewlett-Packard to ensure proper functionality and compliance with safety or EMC regulations.**

Figure 27 **Electrical Connections**



Instrument Layout

The industrial design of the column compartment incorporates several innovative features. It uses HP's E-PAC for housing the electronics and mechanical assemblies. This concept is based upon the use of expanded polypropylene (EPP) layers of foam plastic spacers into which the mechanical and electronic boards components of the column compartment are placed. This is then housed in a metal inner cabinet which is then enclosed by a plastic external cabinet. The advantages of this packaging technology are:

- virtual elimination of fixing screws, bolts or ties, reducing the number of components and increasing the speed of assembly and disassembly,
- the plastic layers have air channels molded into them so that cooling air can be guided exactly to the required locations,
- the plastic layers help cushion the electronic and mechanical parts from physical shock, and
- the metal inner cabinet shields the internal electronics from electromagnetic interference and also helps to reduce or eliminate radio frequency emissions from the column compartment.

The Electronics

The electronics are comprised of four main components:

- **column compartment main board** (CCM), see page 146 .
- column identification board (CID), see “Column-Identification Module” on page 147
- **power supply**, see page 161 .

Column Compartment Main Board (CCM)

This board controls all information and activities of all assemblies within the column compartment. The operator enters parameters, changes modes and controls the column compartment through interfaces (CAN, HP-IB, LAN or RS-232C), connected to the user-interfaces. Figure 28 on page 148 and Figure 29 on page 149 show block diagrams of this board.

ASIC — Application Specific Integrated Circuit

The 304-pin application-specific integrated circuit (ASIC) provides interfacing to external devices through drivers, including HP-IB, LAN, CAN, APG Remote. It is directly connected to the 4 control LEDs located near the connectors on this board and the 8-bit configuration switch which is used to configure the address for the HP-IB communication, baud rate for RS-232C transfer, and so on. For switch settings, refer to “HP 1100 Series Interfaces” on page 152 and “Setting the 8-bit Configuration Switch” on page 156.

In addition the ASIC controls and drives module specific functions and reads static status signals. It controls the cooling fans via the PWM (pulse width modulation) drivers. Movement of the cooling fans is sensed by the microprocessor.

Peltier Driver

There are two identical Peltier element drivers in the module. Their temperatures are controlled and measured on the hot and cold side of the Peltier elements by the micro-controller.

Valve Driver

One valve driver is used for the operation of an optional Column Switching Valve.

Electronic Fuses

The circuits that are connected to + 36 V are fused on the board electronically. This prevents the damage to components.

Column-Identification Module

The column-identification module (CID) is seated on the CCM board (see “Overview on Repair Procedures” on page 63) and allows to write and read column specific information (type, maximum pressure, number of injections, and so on, see “Column-Identification System” on page 137) to/from the column storage device via antennas in the heater assemblies. The number of injections will be updated each run to create a column lifecycle (history). The user interface allows to edit all information.

Diagnostic A/D Converter

The diagnostic A/D converter senses currents and voltages of the Peltier elements and converts the analog signals into digital values. When values are outside of the normal range, an appropriate error message is generated. It is also used for option identification.

Leak Converter

This block consists of a PTC (resistor with positive temperature coefficient) for the leak identification and a NTC (resistor with negative temperature coefficient) for the ambient temperature measurement. This ensures that temperature changes are not identified as leak. A leak would cool down the PTC and its change in resistance results into a leak signal. The signals are converted by the A/D converter.

Fan Drives

The variable revolution of the fans are controlled by the main processor depending on the internal heat distribution in the module. The fans provide a PWM signal which is proportional to the revolution. This fan status signal is used for diagnostics (defect recognition).

On-board Battery

An on-board lithium battery buffers the electronic memories when the column compartment is turned off.

For safety information on lithium batteries see “Lithium Batteries Information” on page 195.

Interfaces

For detailed information on interfaces see “HP 1100 Series Interfaces” on page 152.

Figure 28 **Block Diagram Column Compartment Main Controller Functionality**

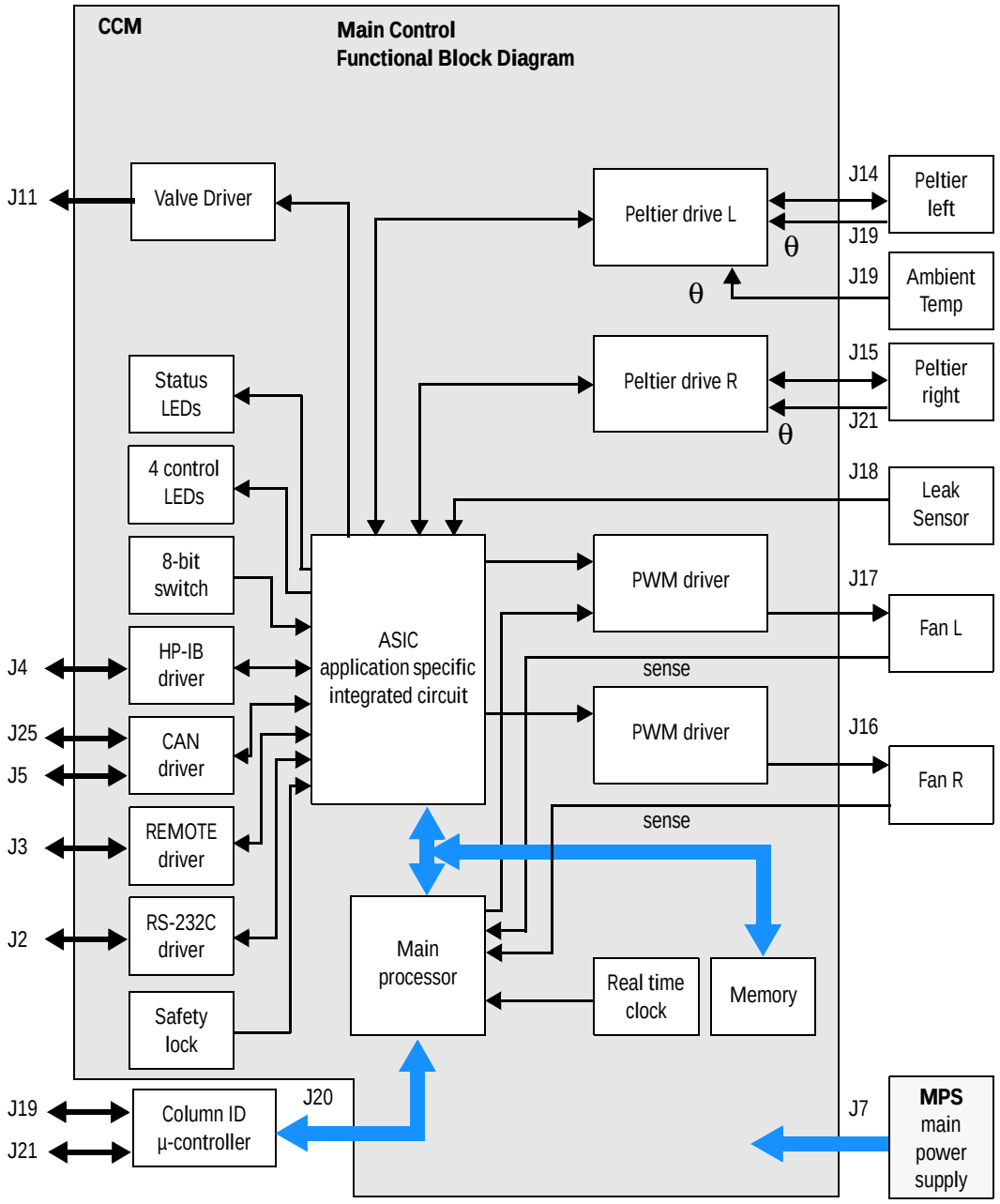
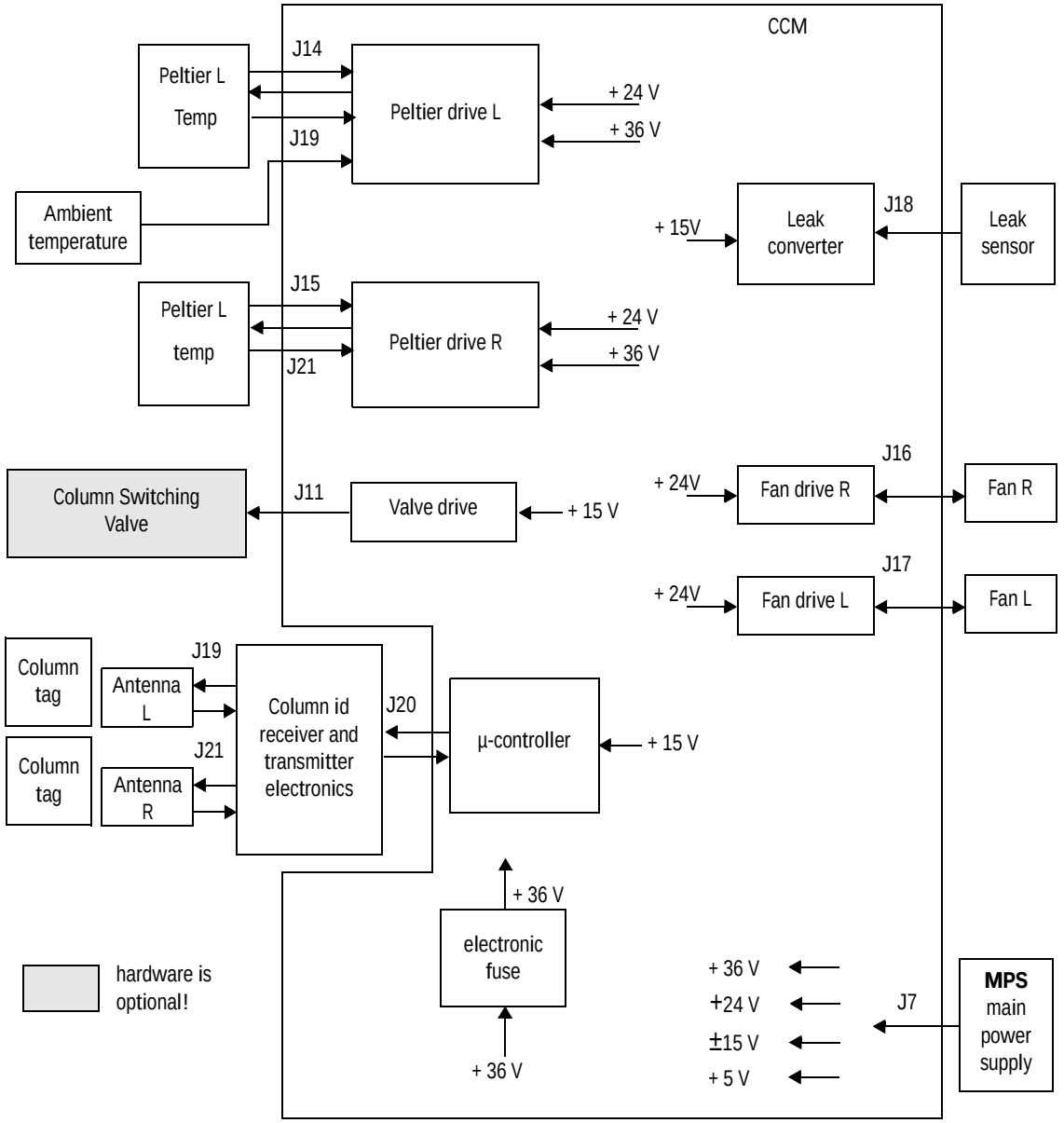


Figure 29 **Interconnection Diagram Column Compartment Main Board**



Firmware Description

The firmware of the instrument consists of two independent sections:

- a non-instrument specific section, called ‘resident system’,
- an instrument specific section, called ‘main system’.

Resident System

This resident section of the firmware is identical for all HP 1100 series modules. Its properties are:

- the complete communication capabilities (HP-IB, CAN, LAN and RS-232C),
- memory management,
- ability to update the firmware of the ‘main system’.

Main System

Its properties are:

- the complete communication capabilities (HP-IB, CAN, LAN and RS-232C),
- memory management,
- ability to update the firmware of the ‘resident system’.

In addition the main system comprises the instrument functions that are divided into common functions like

- run synchronization via APG remote
- error handling,
- diagnostic functions and so on,

or module specific functions like

- internal events such as heater control, column identification,
- and so on.

Firmware Updates

Firmware updates can be done using your user interface:

- hand-held control module with files from a PC-card or
- HP ChemStation with files from floppy disk

The file naming conventions are:

xxxx-vvv.DLB, where

xxxxis the product number, e.g. 1316 for the G1316A TCC, and
vvvis the revision number, for example 106 is revision 1.06

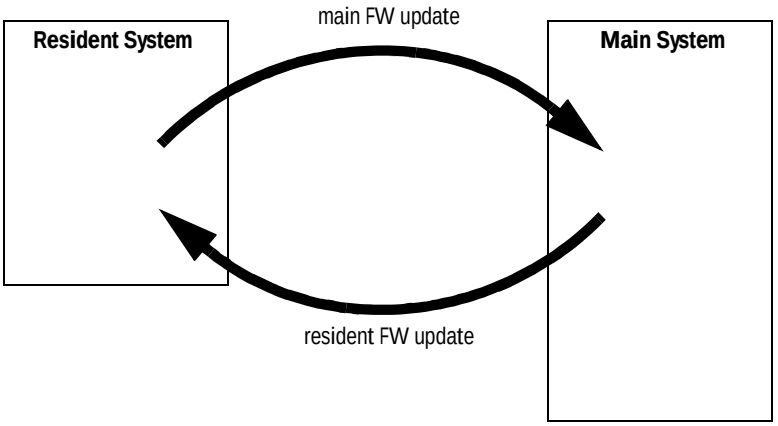
For instructions refer to your user interface.

NOTE

Update of main system can be done in the resident system only.

Update of the resident system can be done in the main system only.

Figure 30 **Firmware Update Mechanism**



HP 1100 Series Interfaces

The HP 1100 Series modules provide the following interfaces:

Table 15 HP 1100 Series Interfaces

Interface Type	Pumps	Autosampler	DA Detector MW Detector FL Detector	VW Detector RI Detector	Thermostatted Column Compartment	Vacuum Degasser
CAN	Yes	Yes	Yes	Yes	Yes	No
HP-IB	Yes	Yes	Yes	Yes	Yes	No
RS-232C	Yes	Yes	Yes	Yes	Yes	No
Remote	Yes	Yes	Yes	Yes	Yes	Yes
Analog	Yes	No	2 ×	1 ×	No	Yes*
Interface board	Yes	Yes	Yes	Yes	No	No

* The vacuum degasser will have a special connector for specific use. For details see description of main board.

- CAN connectors as interface to other HP 1100 Series modules,
- HP-IB connector as interface to the HP ChemStation,
- RS-232C as interface to a computer,
- REMOTE connector as interface to other HP products,
- analog output connector(s) for signal output, and
- interface slot for specific interfacing (external contacts, BCD, LAN and so on).

For identification and location of the connectors see Figure 5 on page 18.

WARNING **Never use cables other than the ones supplied by Hewlett-Packard to ensure proper functionality and compliance with safety or EMC regulations, see “Cable Overview” on page 118.**

HP-IB Interface

The HP-IB connector is used to connect the module with a computer. The address and control switches next to the HP-IB connector determine the HP-IB address of your module. The switches are preset to a default address and recognized by the operating software from Hewlett-Packard.

Table 16 **Default Addresses**

Autosampler	28	Autosampler	28
Pump	22	RID	29
FLD	23		
VWD	24	Autosampler (HP 1050)	11
HP 8453A	25	Pump (HP 1050)	12
DAD/MWD	26	VWD (HP 1050)	10
Column Compartment	27	DAD (HP 1050)	17

CAN Interface

The CAN is an intermodule communication interface. It is a 2 wire serial bus system supporting high speed data communication and real-time requirement.

Remote Interface

The APG Remote connector may be used in combination with other analytical instruments from Hewlett-Packard if you want to use features as common shut down, prepare, and so on.

Remote control allows easy connection between single instruments or systems to ensure coordinated analysis with simple coupling requirements.

The subminiature D connector is used. The module provides one remote connector which is inputs/outputs (wired-or technique).

To provide maximum safety within a distributed analysis system, one line is dedicated to SHUT DOWN the system's critical parts in case any module detects a serious problem. To detect whether all participating modules are switched on or properly powered, one line is defined to summarize the POWER ON state of all connected modules. Control of analysis is maintained

by signal readiness READY for next analysis, followed by START of run and optional STOP of run triggered on the respective lines. In addition PREPARE and START REQUEST may be issued. The signal level are defined as:

- standard TTL levels (0 V is logic true, + 5 V is false)
- fan-out is 10,
- input load is 2.2 kOhm against + 5 V, and
- output are open collector type, inputs/outputs (wired-or technique).

Table 17 **Remote Signal Distribution**

Pin	Signal	Description
1	DGND	Digital ground
2	PREPARE	(L) Request to prepare for analysis (for example, calibration, detector lamp on). Receiver is any module performing preanalysis activities.
3	START	(L) Request to start run / timetable. Receiver is any module performing run-time controlled activities.
4	SHUT DOWN	(L) System has serious problem (for example, leak: stops pump). Receiver is any module capable to reduce safety risk.
5		Not used
6	POWER ON	(H) All modules connected to system are switched on. Receiver is any module relying on operation of others.
7	READY	(H) System is ready for next analysis. Receiver is any sequence controller.
8	STOP	(L) Request to reach system ready state as soon as possible (for example, stop run, abort or finish and stop injection). Receiver is any module performing run-time controlled activities.
9	START REQUEST	(L) Request to start injection cycle (for example, by start key on any module). Receiver is the autosampler.

RS-232C

The RS-232C connector is used to control the column module from a computer through RS-232C connection, using the appropriate software. This

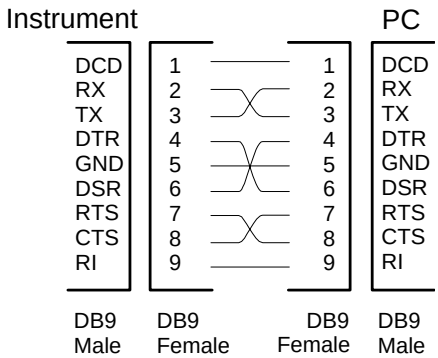
connector can be configured with the configuration switch module next to the HP-IB connector.

The RS-232C is designed as DCE (data communication equipment) with a 9-pin male SUB-D type connector. The pins are defined as:

Table 18 **RS-232C Connection Table**

Pin	Direction	Function
1	In	DCD
2	In	RxD
3	Out	TxD
4	Out	DTR
5		Ground
6	In	DSR
7	Out	RTS
8	In	CTS
9	In	RI

Figure 31 **RS-232 Cable**

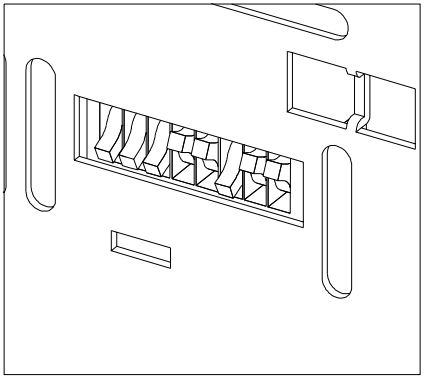


Setting the 8-bit Configuration Switch

The 8-bit configuration switch is located next to the HP-IB connector. Switch settings provide configuration parameters for HP-IB address, serial communication protocol and instrument specific initialization procedures.

Figure 32 **8-bit Configuration Switch**

Factory setting is shown for column compartment



.

Table 19 **8-bit Configuration Switch**

Mode Select	1	2	3	4	5	6	7	8
HP-IB	0	0		HP-IB Address				
RS-232C	0	1	Baudrate			Data Bits	Parity	
Reserved	1	0	Reserved					
TEST/BOOT	1	1	RSVD	SYS		RSVD	RSVD	FC

Switches 1 and 2 define which set of parameters (for example, for HP-IB, RS-232C, and so on) will be changed. Once the change has been completed, the instrument must be powered up again in order to store the values in the non-volatile memory.

Here the parameters are kept, independently if you turn the column compartment off and on again. They will be kept until the same set of parameters is subsequently changed and power is reset. All other previously stored configuration settings are still being kept in non-volatile memory.

In this manner you can store more than one set of parameters, for example, for HP-IB and RS-232C, using the same 8-bit configuration switch twice.

HP-IB Default Addresses

If you just want to change the HP-IB address and need a detailed procedure, refer to the *Installing Your* HP *ChemStation System* handbook. Default HP-IB address is set to the following addresses:

Table 20 **Default Addresses for HP 1100 Series Modules**

Module	Address	Binary Address
Pump	22	0 0 0 1 0 1 1 0
FLD	23	0 0 0 1 0 1 1 1
VWD	24	0 0 0 1 1 0 0 0
HP 8453A	25	0 0 0 1 1 1 0 1
DAD/MWD	26	0 0 0 1 1 0 1 0
Column compartment	27	0 0 0 1 1 0 1 1
Autosampler	28	0 0 0 1 1 1 0 0
RID	29	0 0 0 1 1 1 0 1

where 0 means that the switch is down and 1 means that the switch is up.

Communication Settings for RS-232C Communication

The communication protocol used in the column compartment supports only hardware handshake (CTS/RTR).

Switches 1 in down and 2 in up position define that the RS-232C parameters will be changed. Once the change has been completed, the column instrument must be powered up again in order to store the values in the non-volatile memory.

Table 21 **Communication Settings for RS-232C Communication**

Mode Select	1	2	3	4	5	6	7	8
RS-232C	0	1	Baudrate			Data Bits	Parity	

Use the following tables for selecting the setting which you want to use for RS-232C communication. The number 0 means that the switch is down and 1 means that the switch is up.

Table 22 **Baudrate Settings**

Switches			Baud Rate	Switches			Baud Rate
3	4	5		3	4	5	
0	0	0	9600	1	0	0	9600
0	0	1	1200	1	0	1	14400
0	1	0	2400	1	1	0	19200
0	1	1	4800	1	1	1	38400

Table 23 **Data Bit Settings**

Switch 6	Data Word Size
0	7 Bit Communication
1	8 Bit Communication

Table 24 **Parity Settings**

Switches		Parity
7	**8**	
0	0	No Parity
1	0	Odd Parity
1	1	Even Parity

One start bit and one stop bit are always used (not selectable).

Per default, the module will turn into 19200 baud, 8 data bit with no parity.

Forced Cold-Start Settings

Switches 1 and 2 do not force storage of this set of parameters in non-volatile memory. Returning the switches 1 and 2 to other positions (other than being both up) will allow for normal operation.

CAUTION

A forced cold start erases all methods and data stored in non-volatile memory. Exceptions are diagnose and repair logbooks which are saved from being erased.

If you use the following switch settings and power the column compartment up again, a forced cold start has been completed.

Table 25 **Forced Cold Start Settings**

Mode Select	1	2	3	4	5	6	7	8
TEST/BOOT	1	1	0	0	0	0	0	1

To return to normal operation, set switches back to your HP-IB or RS 232C configuration settings.

Stay Resident Settings

Firmware update procedures may require this mode in case of firmware loading errors.

Switches 1 and 2 do not force storage of this set of parameters in non-volatile memory. Returning the switches 1 and 2 to other positions (other than being both up) will allow for normal operation.

If you use the following switch settings and power the instrument up again, the instrument firmware stays in the resident part, that is, it is not operable as a column compartment. It only uses basic functions of the operating system, for example, for communication.

Table 26 **Stay Resident Settings**

Mode Select	1	2	3	4	5	6	7	8
TEST/BOOT	1	1	0	0	1	0	0	0

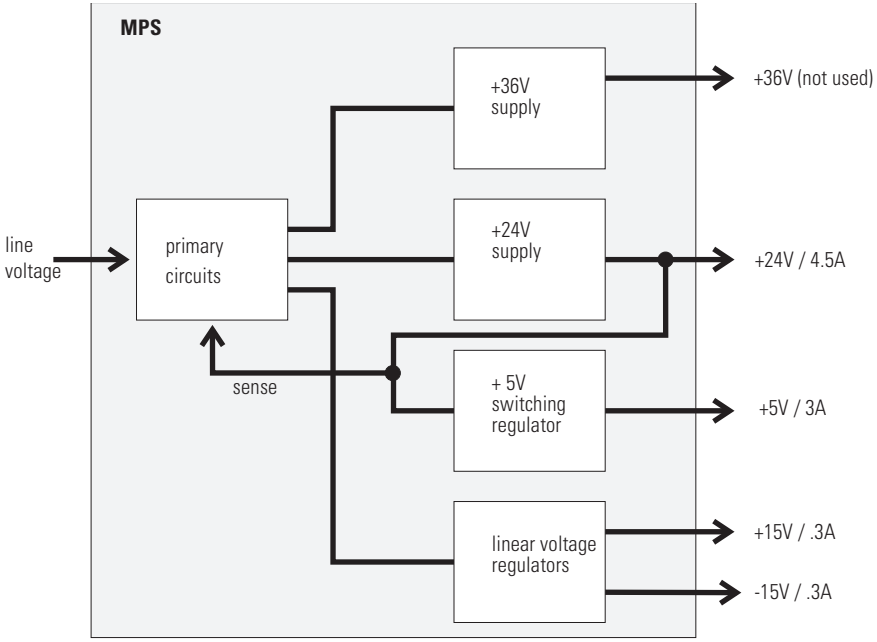
To return to normal operation, set switches back to your HP-IB or RS 232C configuration settings.

The Main Power Supply Assembly

The main power supply comprises a closed assembly (no on-site repair possibility).

The power supply provides all DC voltages used in the module except for the voltages supplied by the lamp power supply to the deuterium and tungsten lamps in the detectors. The line voltage can vary in a range from 100 – 120 or 220 – 240 volts AC ± 10 % and needs no manual setting.

Figure 33 **Main Power Supply (MPS) Block Diagram**



WARNING **To disconnect the instrument from line, unplug the power cord. The power supply still uses some power, even if the power switch on the front panel is turned off.**

No accessible hardware fuse is needed because the main power supply is safe against any short circuits or overload conditions on the output lines. When overload conditions occur, the power supply turns off all output voltages. Turning the line power off and on again resets the power supply to normal operation if the cause of the overload condition has been removed.

An over-temperature sensor in the main power supply is used to turn off output voltages if the temperature exceeds the acceptable limit (for example, if the cooling fan of the instrument fails). To reset the main power supply to normal operating conditions, turn the instrument off, wait until it is approximately at ambient temperature and turn the instrument on again.

The following table gives the specifications of the main power supply.

Table 27 **Main Power Supply Specifications**

Maximum power	130 W	Continuous output
Line Input	100 – 120 or 220 – 240 volts AC ± 10 %, line frequency of 50/60 Hz	Wide ranging
Output 1	+ 24 V / 4.5 A (maximum)	total power consumption of + 24 V and + 36 V must not exceed 107 W.
Output 2	+ 36 V / 2.5 A (maximum)	
Output 3	+ 5 V / 3 A	
Output 4	+ 15 V / 0.3 A	
Output 5	- 15 V / 0.3 A	

6

Control Module Screens for the HP 1100 Column Compartment

This chapter is intended to introduce an operator to the screens available for operation of the HP 1100 thermostatted column compartment (TCC) with the HP 1100 control module.

Please use the manual of control module for further detailed reference.

Major keys on the HP 1100 Control Module

ESC	Return to previous screen and scroll through top layer views (Analysis, Settings)
m	Open context sensitive menus
i	Information/help
Enter	Store changed parameters or execute the choice from a pull-down menu
On/Off	Switch on heater(s)
Start	Start a run
Plot	View the chromatogram
Views	Change between view of analysis - status - system screens

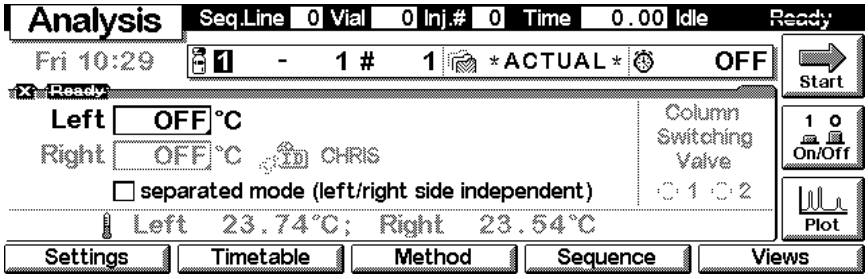
NOTE The screens shown on the next pages are based on the following firmware revisions:
Control Module firmware revision B.01.01 (G1323B).
HPLC Module firmware revision 3.8x

NOTE In case the control module's display seems to be frozen (hang-up due to a communication problem on the CAN bus, unplug the control module from the HPLC module and reconnect.

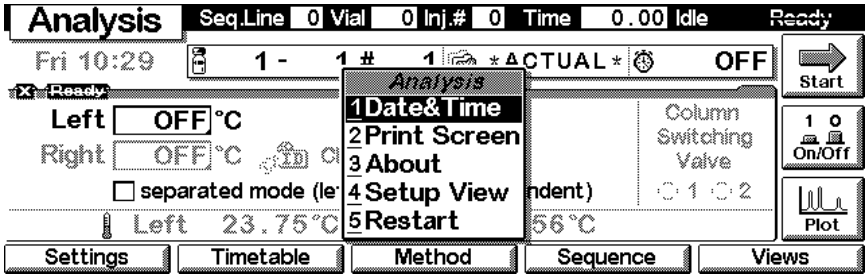
Screens available from the Analysis screen

The Analysis screen

This is the wake-up screen, if the HP 1100 thermostatted column compartment is the only configured HP 1100 module. It is used to enter the most common TCC method parameters. If no column switching valve (optional) is installed, the part is grayed out.

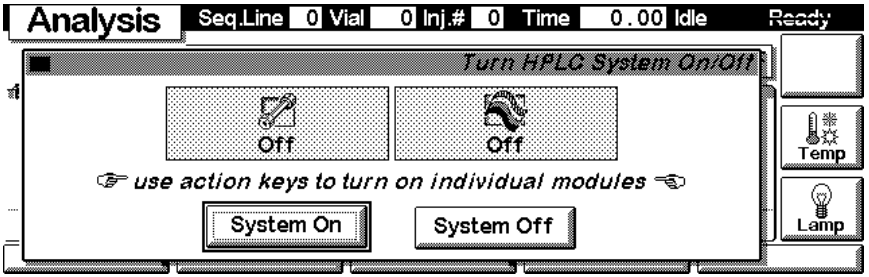


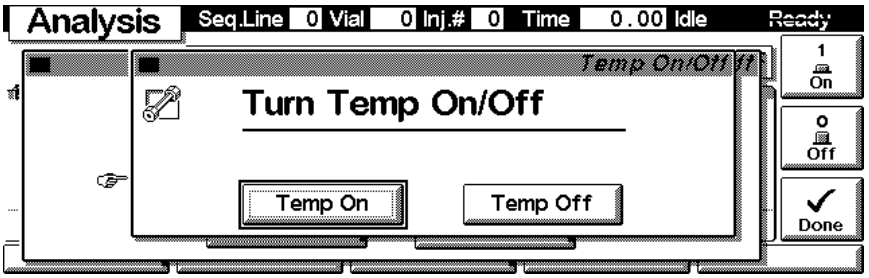
The **m**-key allows access to the context sensitive menu. **Setup view** leads you to add sections for additional HP 1100 modules. **Restart** re-boots the control module.



Heater ON/OFF

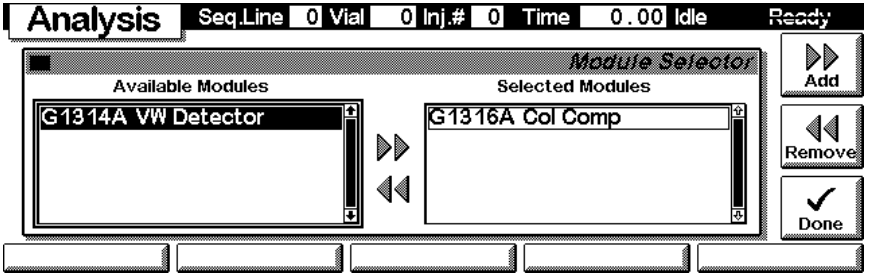
Use the F8 key (**On/Off**) to turn on the heater(s). If more than one module is available, select the F7 key (**Temp**).



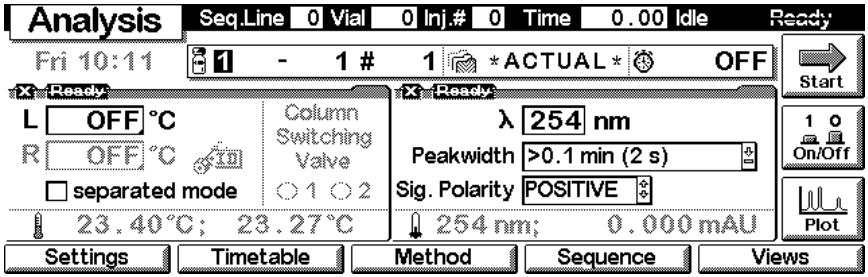


Setup View

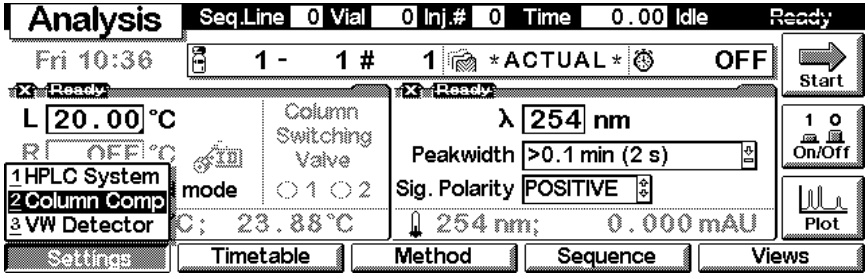
In the Setup view, e.g. another module can be added to the view.



Here, e.g. the variable wavelength detector parameters are shown on the display as well. The number of parameters on the display are restricted as additional modules are added. Maximum 4 modules are shown automatically. If more modules are in the system, you have to chose in Setup view.

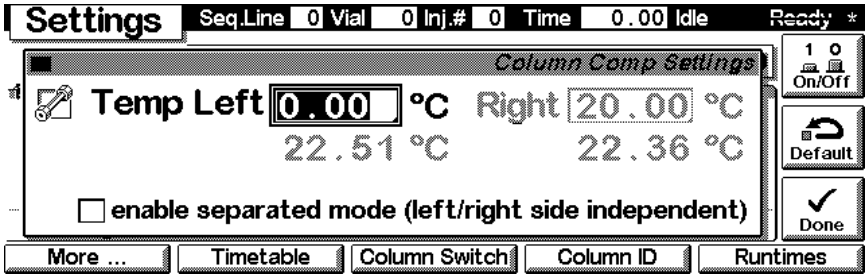


With the **Settings** key you open a pull-down menu where you can select the column compartment module.

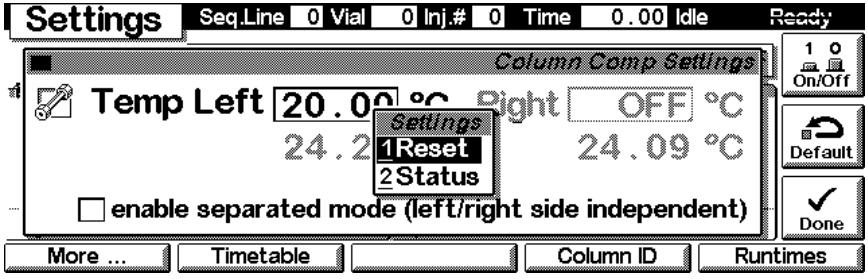


Settings

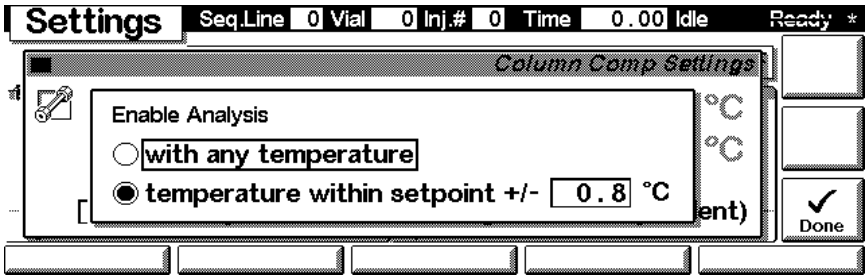
Within the **Settings** you can change the TCC parameters and with a different set of parameters available through the F1-5 keys. The F3 key is only available when the column switching valve is installed (optional). F7 key resets the TCC to default values. F8 opens a window to turn on the heater(s).



Use the **m**-key for the context sensitive menu. The **Status** command pulls up a monitor screen displaying signals and spectra as programmed. **Reset** will load the TCC default parameters.

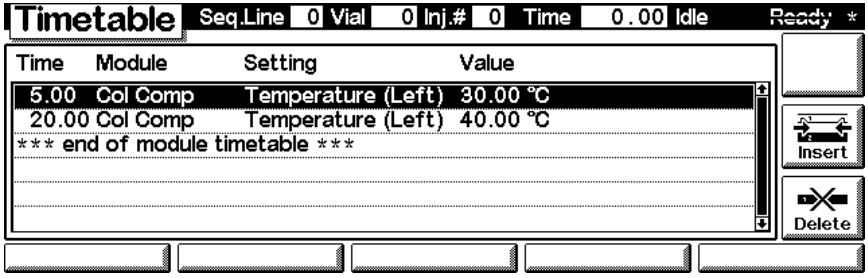


Use F1-key (**More**). You can enter special TCC setpoints that enables the analysis either with any temperature or within a specified range.

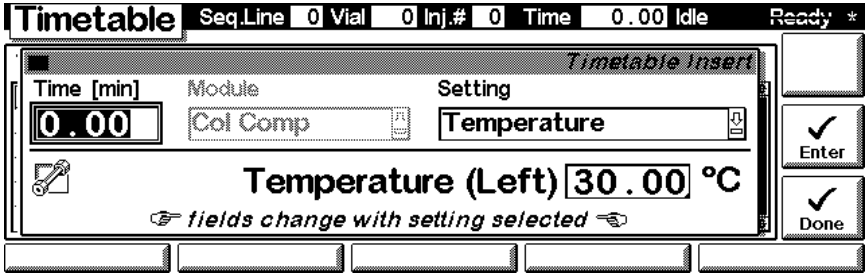


Settings - Timetable

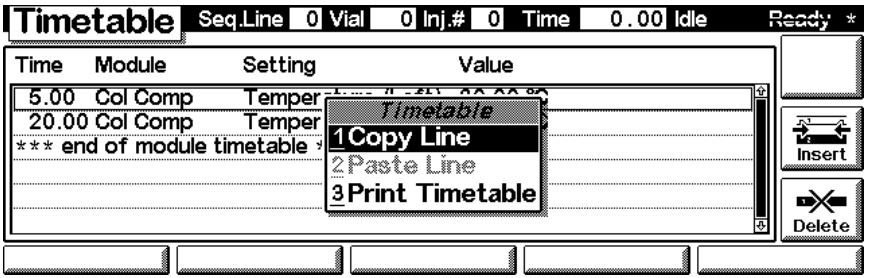
With the F2 key (**Timetable**) you can list the timetable for the TCC. Press F7 key (**Insert**) to add entries or F6 key (**Delete**) to remove entries.



Press the F7 key (**Insert**) to add a timetable events. Use the F6 key (**Done**) to view the entered lines of the timetable.

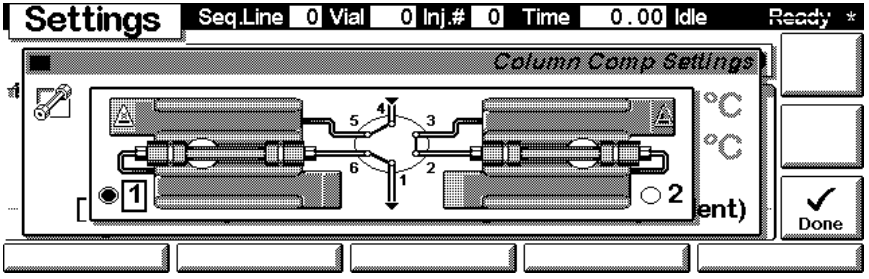


Use the **m**-key for the context sensitive menu. It gives you additional tools for the timetable.



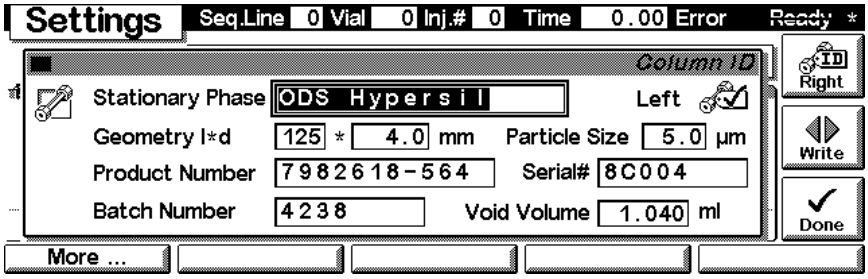
Settings - Column Switching Valve

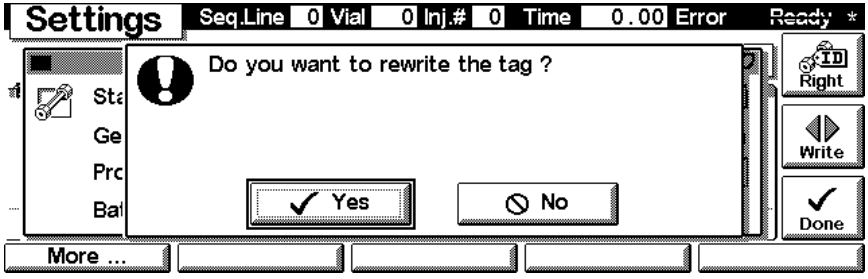
With the F3 key (**Column Switch**) you have access to the column switching valve, see “Column Switching Valve (Optional)” on page 140. You can select either the left or right column.



Settings - Column ID

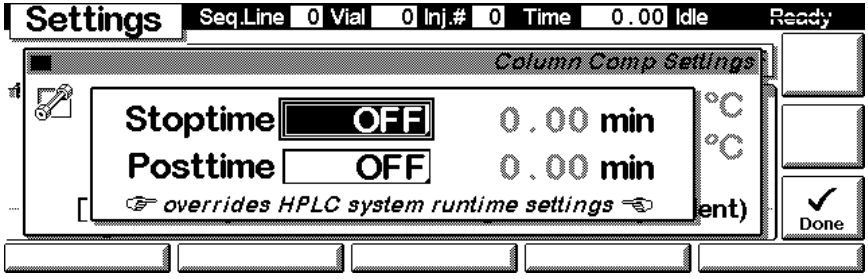
With the F4 key (**Column ID**) you have access to the column id tag information, see “Column-Identification System” on page 137. Pressing F1 key (**More**) shows the rest of the parameters (inclusive # of injections). You can overwrite the information and press F7 key (**Write**) to transfer the new information into the column tag. F8 key (**Right**) changes to the right column id tag information (if installed).



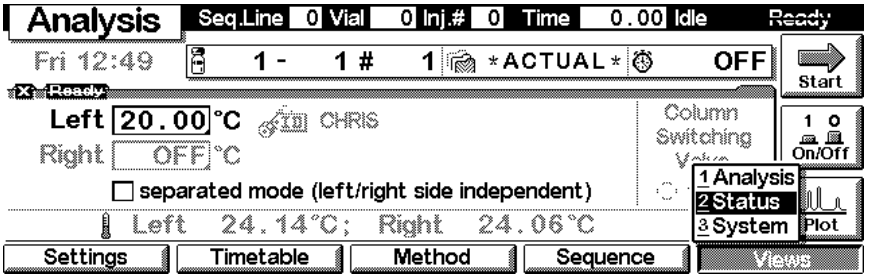


Settings - Run times

With the F5 key (**Runtimes**) you can change the stop time and the post-run time.

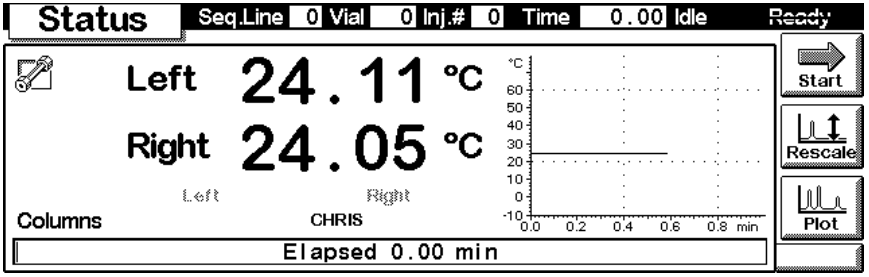


Press F5 key (**Views**) and select **Status**.



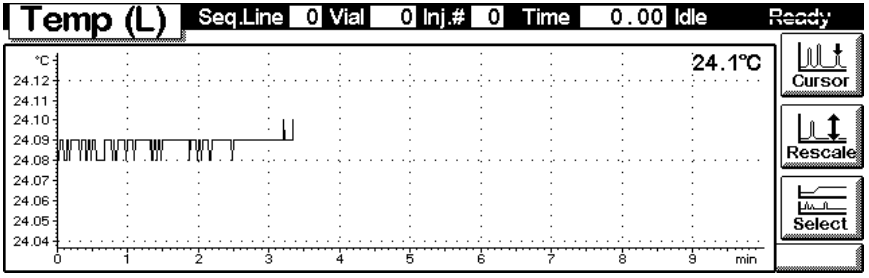
Status

This is an example if an HP 1100 TCC is configured standalone. Information on the actual temperature setting (left and right), column name, elapsed run time, messages and the signal plot are shown. Press key F8 (**Start**) to start a run, key F7 (**Rescale**) to maximize the signal.

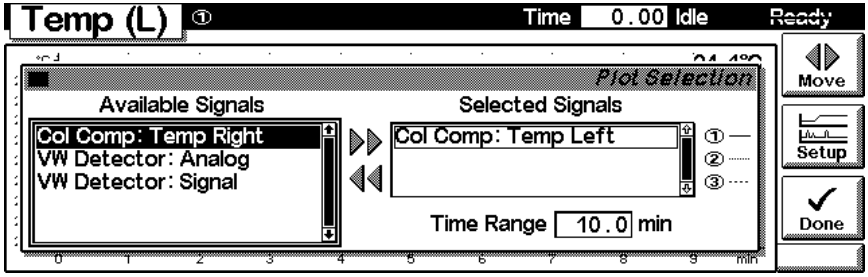


Signal plot

Press F6 key (**Plot**) to enter the plot screen (available also from the **Analysis** and **System** screen). Here you can observe the online signal(s). To add additional online signals (maximum 3), press F6 key (**Select**). If more than one signal is configured (see next), use the 1-2-3 number key to switch between the signals.

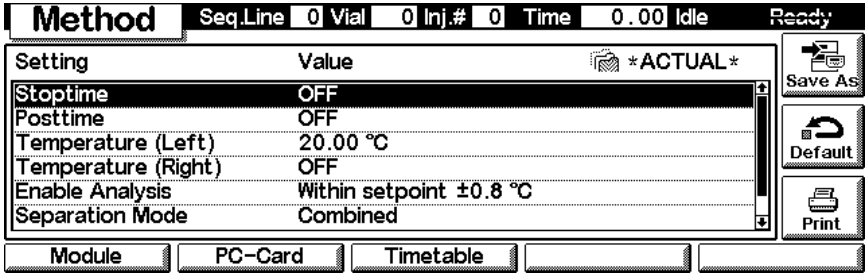


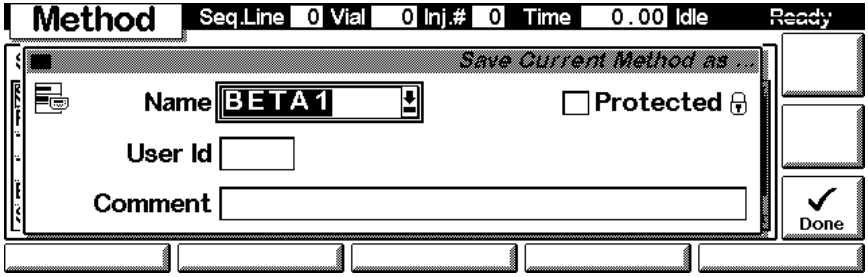
Press F6 key (**Select**). Here you can add additional online signals (maximum are 3). Additional signals could be also pressure or detector signals from other modules. Use the Right/Left arrows to switch between Available and Selected Signals. Use the F8 key (**Move**) to enter available signals into the box for selected signals or vice versa.



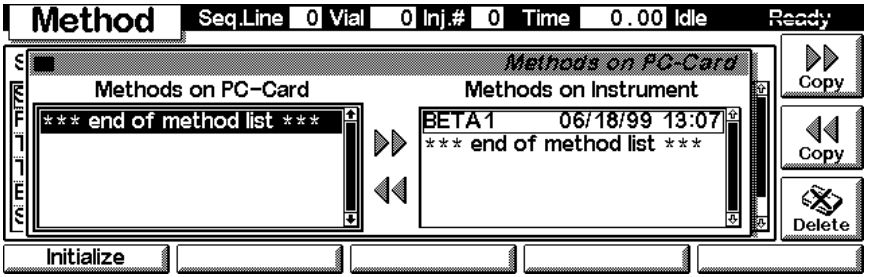
Method screens

On the **Analysis** screen use the F3 key (**Method**) to view the parameters in a method and F8 key (**Save As**) to save the method in the module(s). The PC-Card key is only active when a PCMCIA card is inserted in the control module.





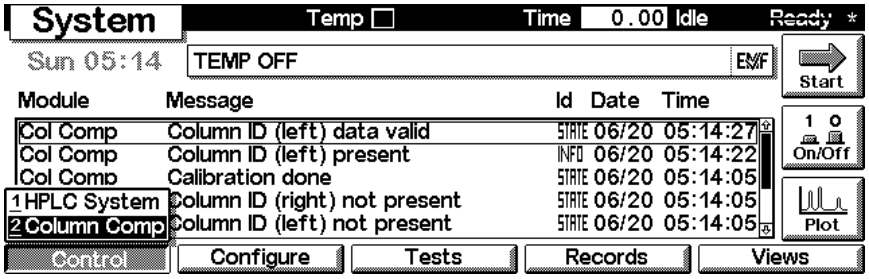
Use F2 key (**PC-Card**) to save a method on a PCMCIA card. Use the Right/Left arrows to switch between PC-Card and Instrument window. Use the UP/Down arrows to select the method. Use the F7/F8 keys (**Copy**) to enter available signals into the box for selected signals or vice versa.



Screens available from the System screen

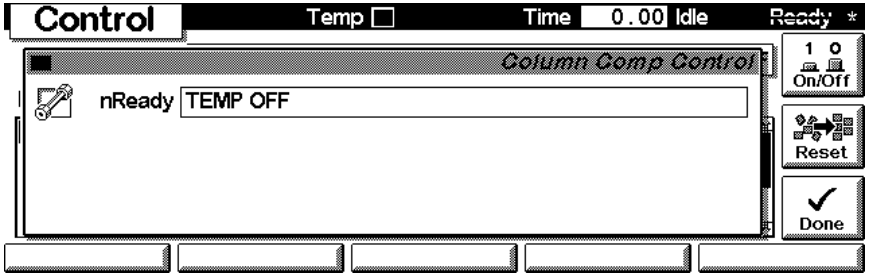
System screen

Use the Esc key to receive **Views** on the F5 key. Choose **System** from the pull-down menu. This screen shows the last activities in the system.



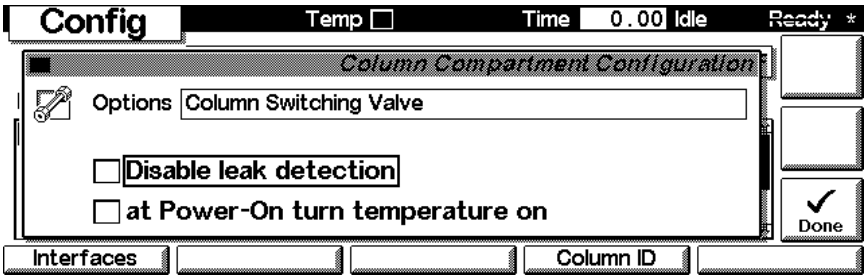
System - Control

Use the F1 key (**Control**) to select the TCC. Here you receive information about the not-ready conditions if needed. F2 key (**Reset**) does a re-initialization of the TCC.

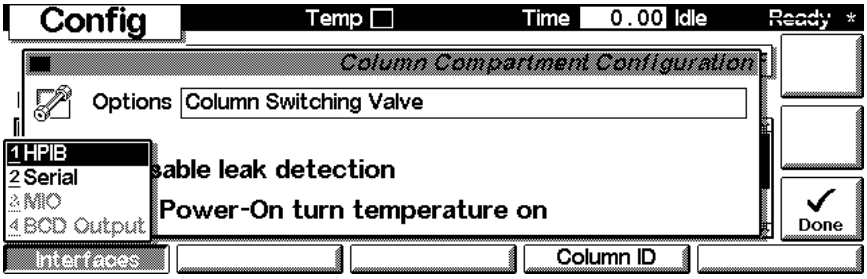


System - Configuration

On the **System** screen use the F2 key (**Configure**) to select the TCC. Here you define further special setpoints for the TCC operation. The option line informs about a column switching valve, if installed (optional),.



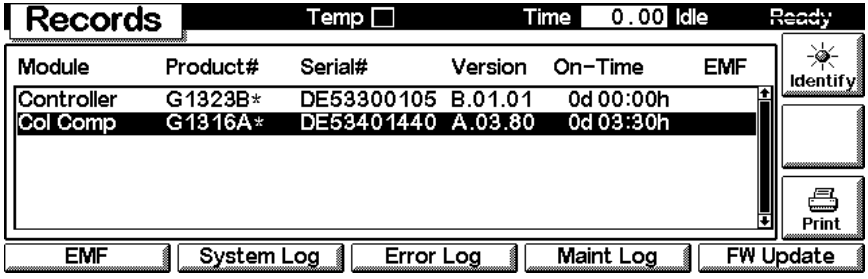
Use the F1 key (**Interfaces**) to access the interface settings (if required).



Screens available from the Records screen

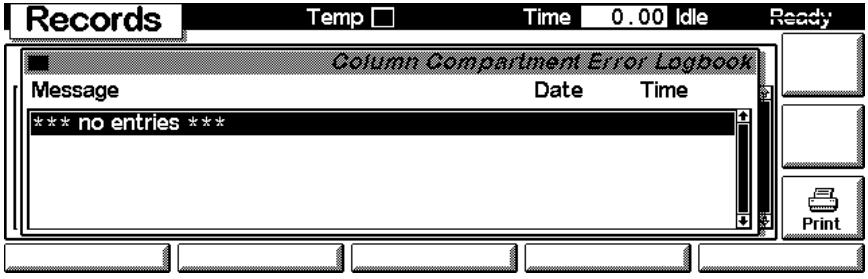
Records screen

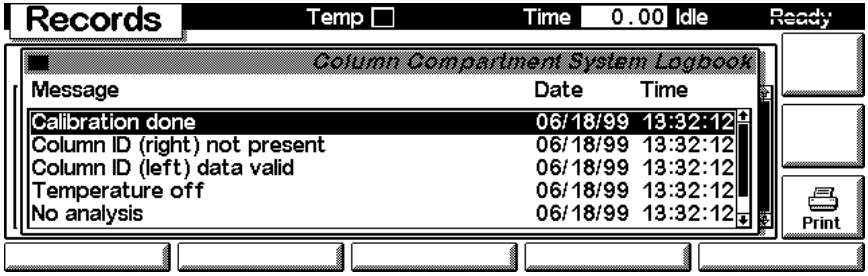
Use the Esc key to receive **Views** on the F5 key. Choose **System** from the pull-down menu. Use the F4 key (**Records**) to select the TCC. Errors are reported either into the **System Log** (F2) or **Error Log** (F3).



System / Error Log

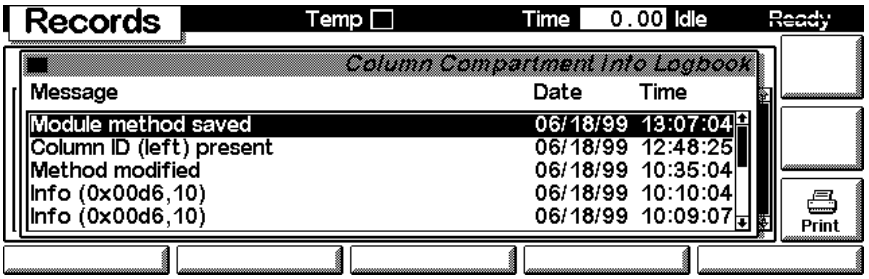
Use the F2 key (**System Log**) or F3 key (**Error Log**) to look for errors.





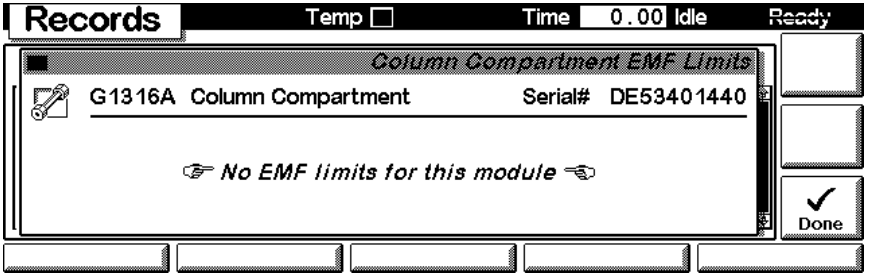
Info Log

Use the **m**-key to receive a pop-up menu, Select **Info Log**. A list of the last events are listed. For troubleshooting reasons they can be printed or saved to a file on the PCMCIA card (using the **m**-key for the context sensitive menu).



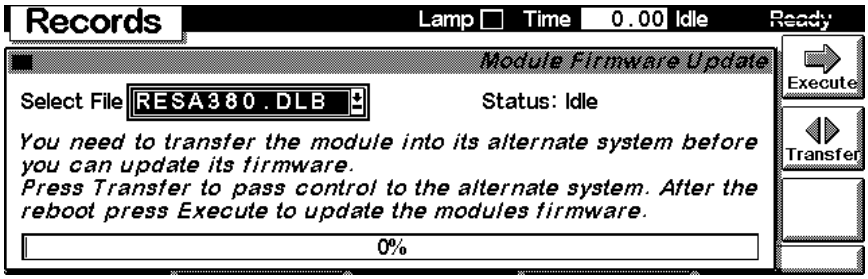
EMF (Early Maintenance Feedback)

Using the F1 key (**EMF**) enters the EMF section. There are no EMF setting possible on the TCC.

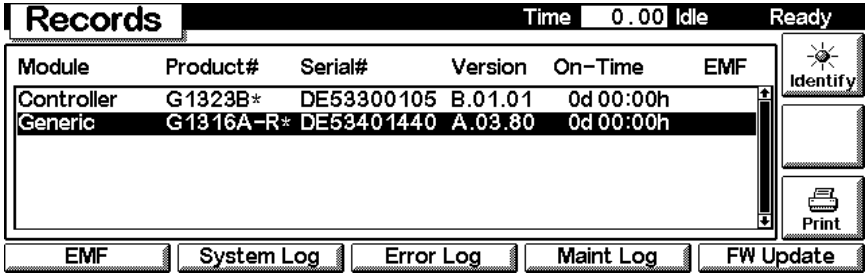


Firmware Update

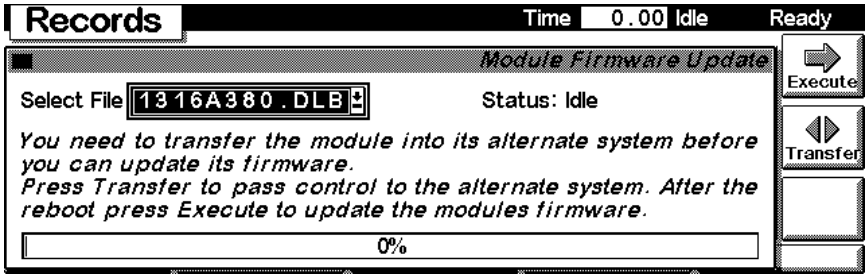
Use the Esc key to receive **Views** on the F5 key. Choose **System** from the pull-down menu. Use the F3 key (**Records**) to select the TCC. Use the F5 key (**FW Update**) to enter the Update section. If you want to update the resident firmware (together with specific main firmware revisions), select the a file from the PCMCIA card (RESnnnn.DLB) and press execute. If you want to update the main firmware, press F7 key (**Transfer**) to turn the module into the resident mode (LED on module should blink yellow).



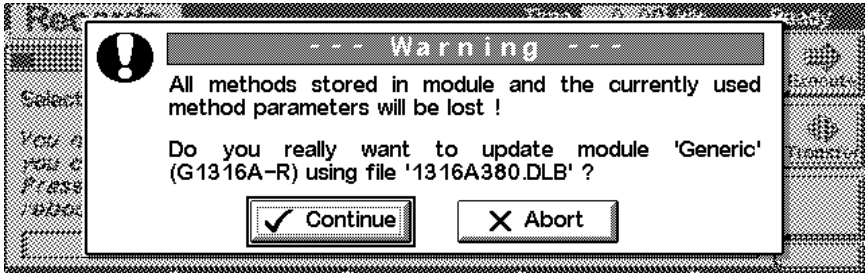
Use the **Esc** key to receive **Views** on the F5 key. Choose **System** from the pull-down menu. Use the F3 key (**Records**) to select the **Generic** module. In this screen the resident firmware revision is shown.



Use the F5 key (**FW Update**) to enter the Update section. Select the a file from the PCMCIA card (1316nnnn.DLB) and press execute. When the update has finished, press F7 key (**Transfer**) to return the module into the normal mode (LED on module should stay yellow).

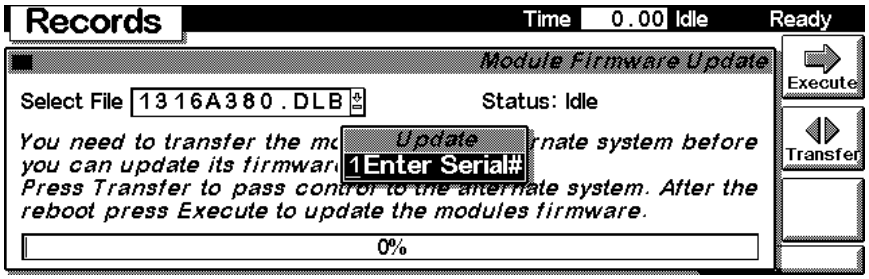


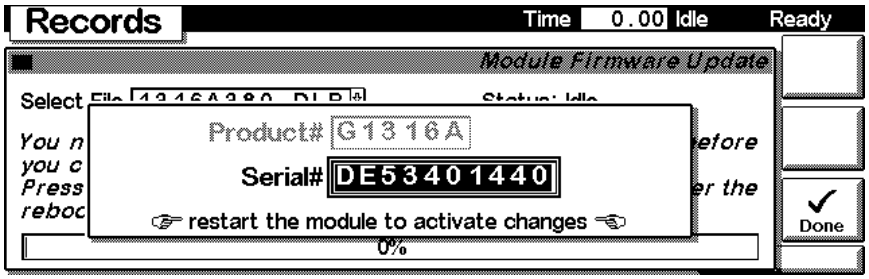
If you have not saved your methods, please do it before continuing. Otherwise they will be overwritten during the update process.



Changing the serial number

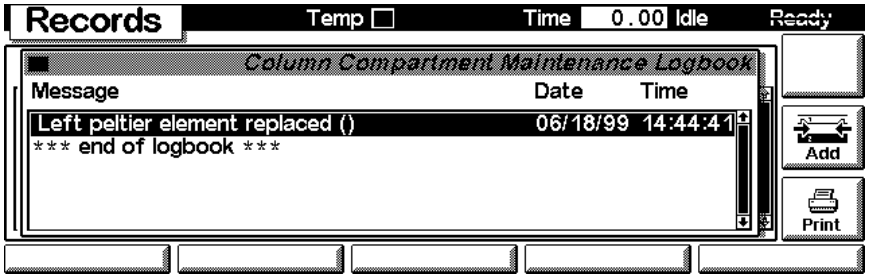
In case the serial number of the module has to be added, use the **m**-key to open the menu **Enter Serial#**. The serial number becomes active after restart of the module.



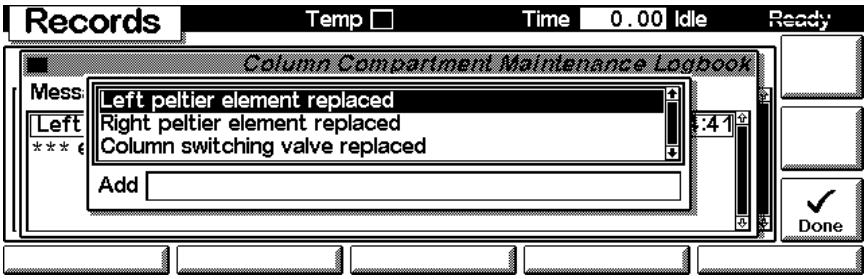


Maintenance activities

On the Records screen use the F4 key (**Maint log**) to view and edit the maintenance logbook.



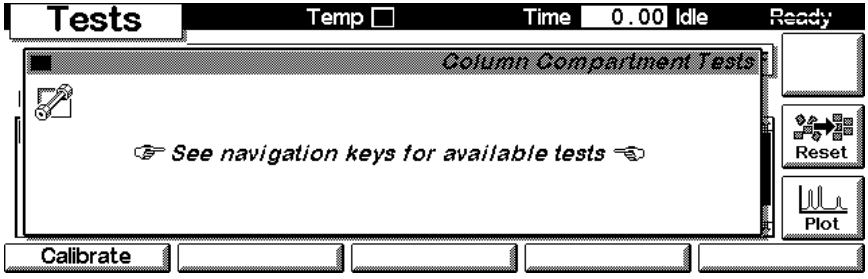
Use the F7 key (**Add**) to add new maintenance activities. If an activity is not listed, you can type the activity into the line “Add” using the control modules key pad.



Diagnostics and Tests

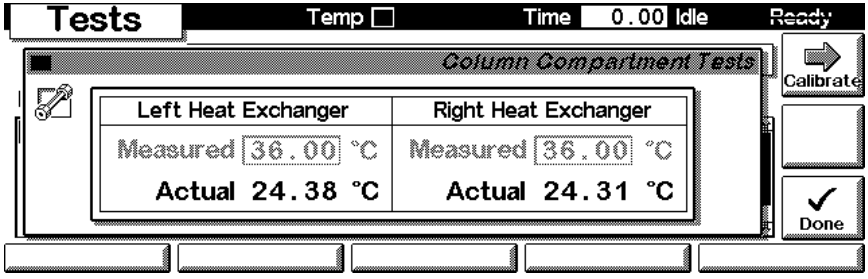
Tests screen

Use the Esc key to receive **Views** on the F5 key. Choose **System** from the pull-down menu. Use the F3 key (**Tests**) to select the TCC. F7 key (**Reset**) resets the module and F6 key (**Plot**) opens the plot window.



Calibration

With F1 key (**Calibrate**) the recalibration of the TCC can be accessed. Refer to “Temperature Calibration” on page 53 for more information before starting this function. with F8 key (**Calibrate**).



7

Specifications

Performance specifications of the thermostatted column compartment

Performance Specifications

Table 28 **Performance Specifications HP 1100 Series Thermostatted Column Compartment**

Type	Specification	Comments
Temperature range	10 degrees below ambient to 80 °C	
Temperature stability	± 0.15 °C	
Temperature accuracy	± 0.8 °C	
	± 0.5 °C	With calibration
Column capacity	Three 30 cm	
Warm-up/cool-down time	5 minutes from ambient to 40 °C	
	10 minutes from 40 – 20 °C	
Dead volume	3 µl left heat exchanger	i.d. 0.17 mm
	6 µl right heat exchanger	
Dimensions (h × w × d)	140 × 410 × 435 mm (5.5 × 16 × 17 inches)	
Weight	10.2 kg (22.5 lbs)	
Communications	Controller-area network (CAN), HP-IB, RS-232C, APG Remote: ready, start, stop and shut-down signals, LAN optional	
Safety and maintenance	Extensive diagnostics, error detection and display (through control module and HP ChemStation), leak detection, safe leak handling, leak output signal for shutdown of pumping system. Low voltages in major maintenance areas.	
GLP features	Column-identification module for GLP documentation of column type, see “Column-Identification System” on page 137	

Table 28 **Performance Specifications HP 1100 Series Thermostatted Column Compartment,**

Type	Specification	Comments
Housing	All materials recyclable.	

NOTE All specifications are valid for distilled water at ambient temperature (25 °C), set point at 40 °C and a flow range from 0.2–5 ml/min.

Warranty Statement

All Chemical Analysis Products

Hewlett-Packard (HP) warrants its chemical analysis products against defects in materials and workmanship. For details of the warranty period in your country, call HP. During the warranty period, HP will, at its option, repair or replace products which prove to be defective. Products that are installed by HP are warranted from the installation date, all others from the ship date.

If buyer schedules or delays installation more than 30 days after delivery, then warranty period starts on 31st day from date of shipment (60 and 61 days, respectively for products shipped internationally).

HP warrants that its software and firmware designed by HP for use with a CPU will execute its programming instructions when properly installed on that CPU. HP does not warrant that the operation of the CPU, or software, or firmware will be uninterrupted or error-free.

Limitation of Warranty

Onsite warranty services are provided at the initial installation point. Installation and onsite warranty services are available only in HP service travel areas, and only in the country of initial purchase unless buyer pays HP international prices for the product and services. Warranties requiring return to HP are not limited to the country of purchase.

For installation and warranty services outside of HP's service travel area, HP will provide a quotation for the applicable additional services.

If products eligible for installation and onsite warranty services are moved from the initial installation point, the warranty will remain in effect only if the customer purchases additional inspection or installation services, at the new site.

The foregoing warranty shall not apply to defects resulting from:

1 improper or inadequate maintenance, adjustment, calibration, or operation by buyer,

2 buyer-supplied software, hardware, interfacing or consumables,

3 unauthorized modification or misuse,

4 operation outside of the environmental and electrical specifications for the product,

5 improper site preparation and maintenance, or

6 customer induced contamination or leaks.

THE WARRANTY SET FORTH IS EXCLUSIVE AND NO OTHER WARRANTY, WHETHER WRITTEN OR ORAL, IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Limitation of Remedies and Liability

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. IN NO EVENT SHALL HP BE LIABLE FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES (INCLUDING LOSS OF PROFITS) WHETHER BASED ON CONTRACT, TORT OR ANY OTHER LEGAL THEORY.

Responsibilities of the Customer

The customer shall provide:

1 access to the products during the specified periods of coverage to perform maintenance,

2 adequate working space around the products for servicing by HP personnel,

3 access to and use of all information and facilities determined necessary by HP to service and/or maintain the products (insofar as these items may contain proprietary or classified information, the customer shall assume full responsiblity for safeguarding and protection from wrongful use),

4 routine operator maintenance and cleaning as specified in the HP operating and service manuals, and

5 consumables such as paper, disks, magnetic tapes, ribbons, inks, pens, gases, solvents, columns, syringes, lamps, septa, needles, filters, frits, fuses, seals, detector flow cell windows, and so on.

Responsibilities of Hewlett-Packard

Hewlett-Packard will provide warranty services as described in Table 29.

Table 29 **Warranty Services**

Services During Warranty*	Warranty Period**	Type
HP 1100 Series HPLC Modules	1 Year	Onsite
LC supplies and accessories	90 Days	Onsite
Columns and consumables***	90 Days	Return to HP
Gas Discharge and Tungsten Lamps	30 Days	Return to HP
Repairs performed onsite by HP****	90 Days	Onsite

* This warranty may be modified in accordance with the law of your country. Please consult your local HP office for the period of the warranty, for shipping instructions and for the applicable wording of the local warranty.

** Warranty services are included as specified for Analytical products and options purchased concurrently provided customer is located within a HP defined travel area. HP warranty service provides for 8 a.m. to 5 p.m. on-site coverage Monday through Friday, exclusive of HP holidays.

*** Columns and Consumables are warranted to be free from defects for a period of 90 days after shipment and will be replaced on a return-to-HP basis if unused.

**** HP repair warranty is limited to only the item repaired or replaced.

Safety Information

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard assumes no liability for the customer's failure to comply with these requirements.

General

This is a Safety Class I instrument (provided with terminal for protective earthing) and has been manufactured and tested according to international safety standards.

Operation

Before applying power, comply with the installation section. Additionally the following must be observed.

Do not remove instrument covers when operating. Before the instrument is switched on, all protective earth terminals, extension cords, auto-transformers, and devices connected to it must be connected to a protective earth via a ground socket. Any interruption of the protective earth grounding will cause a potential shock hazard that could result in serious personal injury. Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any intended operation.

Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, and so on) are used for replacement. The use of repaired fuses and the short-circuiting of fuseholders must be avoided.

Some adjustments described in the manual, are made with power supplied to the instrument, and protective covers removed. Energy available at many points may, if contacted, result in personal injury.

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible. When inevitable, this should be carried out by a skilled person who is aware of the hazard involved. Do not attempt internal service or adjustment unless another person, capable of

rendering first aid and resuscitation, is present. Do not replace components with power cable connected.

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Do not install substitute parts or make any unauthorized modification to the instrument.

Capacitors inside the instrument may still be charged, even though the instrument has been disconnected from its source of supply. Dangerous voltages, capable of causing serious personal injury, are present in this instrument. Use extreme caution when handling, testing and adjusting.

Safety Symbols

Table 30 shows safety symbols used on the instrument and in the manuals.

Table 30 **Safety Symbols**

Symbol	Description
	The apparatus is marked with this symbol when the user should refer to the instruction manual in order to prevent risk of harm to the operator and protect the apparatus against damage.
	Indicates dangerous voltages.
	Indicates a protected ground terminal.
	The apparatus is marked with this symbol when hot surfaces are available and the user should not touch it when heated up.

WARNING **A warning alerts you to situations that could cause physical injury or damage to the equipment. Do not proceed beyond a warning until you have fully understood and met the indicated conditions.**

CAUTION A caution alerts you to situations that could cause a possible loss of data. Do not proceed beyond a caution until you have fully understood and met the indicated conditions.

Lithium Batteries Information

WARNING

Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the equipment manufacturer. Lithium batteries may not be disposed-off into the domestic waste.

Transportation of discharged Lithium batteries through carriers regulated by IATA/ICAO, ADR, RID, IMDG is not allowed. Discharged Lithium batteries shall be disposed off locally according to national waste disposal regulations for batteries.

ADVARSEL

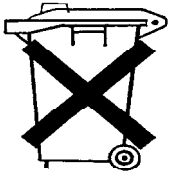
Lithiumbatteri - Eksplosionsfare ved fejlagtic handtering. Udskiftning ma kun ske med batteri af samme fabrikat og type. Lever det brugte batteri tilbage til leverandoren.

ADVARSEL

Lithiumbatteri - Eksplosionsfare. Ved udskiftning benyttes kun batteri som anbefalt av apparatfabrikanten. Brukt batteri returneres appararleverandoren.

NOTE

Bij dit apparaat zijn batterijen geleverd. Wanneer deze leeg zijn, moet u ze niet weggooien maar inleveren als KCA.



Radio Interference

Manufacturer's Declaration

This is to certify that this equipment is in accordance with the Radio Interference Requirements of Directive FTZ 1046/1984. The German Bundespost was notified that this equipment was put into circulation, the right to check the series for compliance with the requirements was granted.

Test and Measurement

If test and measurement equipment is operated with equipment unscreened cables and/or used for measurements on open set-ups, the user has to assure that under operating conditions the radio interference limits are still met within the premises.

Sound Emission

Manufacturer's Declaration

This statement is provided to comply with the requirements of the German Sound Emission Directive of 18 January 1991.

This product has a sound pressure emission (at the operator position) < 70 dB.

- Sound Pressure Lp < 70 dB (A)
- At Operator Position
- Normal Operation
- According to ISO 7779:1988/EN 27779/1991 (Type Test)

Solvent Information

Observe the following recommendations on the use of solvents.

Flow Cell

Avoid the use of alkaline solutions (pH > 11) which can attack quartz and thus impair the optical properties of the flow cell.

Solvents

Always filter solvents through 0.4 µm filters, small particles can permanently block the capillaries. Avoid the use of the following steel-corrosive solvents:

- Solutions of alkali halides and their respective acids (for example, lithium iodide, potassium chloride, and so on).
- High concentrations of inorganic acids like nitric acid, sulfuric acid especially at higher temperatures (replace, if your chromatography method allows, by phosphoric acid or phosphate buffer which are less corrosive against stainless steel).
- Halogenated solvents or mixtures which form radicals and/or acids, for example:

  $2CHCl_3 + O_2 \rightarrow 2COCl_2 + 2HCl$

  This reaction, in which stainless steel probably acts as a catalyst, occurs quickly with dried chloroform if the drying process removes the stabilizing alcohol.
- Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, di-isopropylether) such ethers should be filtered through dry aluminium oxide which adsorbs the peroxides.
- Solutions of organic acids (acetic acid, formic acid, and so on) in organic solvents. For example, a 1-% solution of acetic acid in methanol will attack steel.
- Solutions containing strong complexing agents (for example, EDTA, ethylene diamine tetra-acetic acid).
- Mixtures of carbon tetrachloride with 2-propanol or THF.

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For the latest information on products and services visit our worldwide web site on the Internet at:

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Select “Products” - “Chemical Analysis”

It will provide also the latest firmware of the HP 1100 series modules for download.

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Are the instructions clear and complete?	Yes	No
Are there enough examples and illustrations?	Yes	No
Are concepts explained clearly?	Yes	No

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1 = Inadequate. 2 = Adequate. 3 = Superior.

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Glossary	1	2	3
Illustrations	1	2	3
Examples	1	2	3
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HP 1100 Series Thermostatted Column Compartment
Reference Manual
G1316-90002 Third edition 07/99 Printed in Germany

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About This Edition

Third edition, 07/99

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In This Book

This manual contains technical reference information about the HP 1100 Series thermostatted column compartment. The manual describes the following:

- installing the column compartment,
- the column compartment optimization,
- diagnostics and troubleshooting,
- repairing the column compartment,
- parts and materials,
- introduction to and theory of operation, and
- screens of local control module.

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