



MT/DW

Stack and Tray Coolers for Agilent LC/GC Injectors

User Manual



Agilent Technologies

Notices

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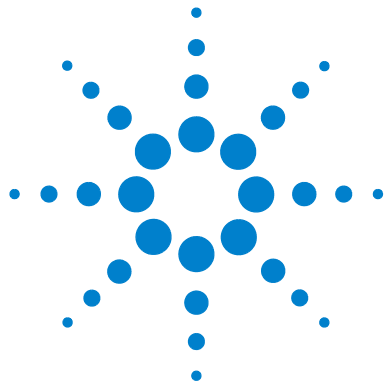
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Safety Information

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Safety Information



General Considerations

The MT/DW Stack and Tray Coolers for Agilent LC/GC Injectors User Manual and the corresponding Addendum for a specific module must be consulted by the user under all circumstances before a unit is put in use.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The user shall be made aware that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

When using the MT/DW Tray and Stack Coolers, follow the generally accepted procedures for quality control and methods development.

When you use the MT/DW Tray and Stack Coolers in the field of chromatographic analysis and you observe a change in the retention of a particular compound, in the resolution between two compounds, or in peak shape, immediately determine the reason for the changes. Until you determine the cause of a change, do not rely on the separation results.

Electrical Hazards

Every analytical instrument has specific hazards, so be sure to read and comply with the following precautions. They will help ensure the safe, long-term use of your MT/DW Tray and Stack Coolers.

The Installation Category (Over voltage Category) for this instrument is Level II. The Level II Category pertains to equipment that receives its electrical power from the local level, such as an electrical wall outlet.

Only use fuses of the type and current rating specified. Do not use repaired fuses and do not short-circuit the fuse holder.



The supplied power cord must be inserted into a power outlet with a protective earth contact (ground). When using an extension cord, make sure that the cord also has an earth contact.



Do not change the external or internal grounding connections. Tampering with or disconnecting these connections could endanger you and/or damage the MT/DW Tray and Stack Coolers .

The instrument is properly grounded in accordance with these regulations when shipped. You do not need to make any changes to the electrical connections or the instrument's chassis to ensure safe operation.



The combination of a MT/DW Tray and Stack Coolers with a LC/MS System does require the safety measure as described by the LC/MS System manufacturer. Detailed instructions for the safety grounding on the LC/MS system are outlined in the corresponding operating/installation manual.

Agilent Technologies recommends to use a grounding cable connected on one side at the Injection Valve, Loop or any other suitable direct metallic contact and the other side at an appropriate grounding point at the LC/MS System. This supplementary grounding measure will support the safety strategy of the LC/MS System manufacturer.



Do not turn the instrument on if you suspect that it has incurred any kind of electrical damage. Instead disconnect the power cord and contact a Agilent Technologies representative for a product evaluation. Do not attempt to use the instrument until it has been evaluated. Electrical damage may have occurred if the MT/DW Tray and Stack Coolers shows visible signs of damage, exposure to any liquids or has been transported under severe stress.

Damage can also result if the instrument is stored for prolonged periods under unfavorable conditions (e.g. subjected to heat, water, etc.).



In any case disconnect the power cord(s) from the power supply or from the different power supplies if optional devices are installed before attempting any type of maintenance.

Capacitors inside the instrument may still be charged even if the instrument is turned off.

1 Safety Information

Safety Information



To avoid damaging electrical parts, do not disconnect an electrical assembly while power is applied to the MT/DW Tray and Stack Coolers. Once the power is turned off, wait approximately 30 seconds before you disconnect an assembly.

The instrument includes a number of integrated circuits. These circuits may be damaged if exposed to excessive line voltage fluctuations and/or power surges.



Never try to repair or replace any components of the instrument that is not described in this manual without the assistance of a Agilent Technologies representative.

There are no operator-serviceable or replaceable parts inside the power supply(ies) or in the MT/DW Tray and Stack Coolers. If a power supply is not functioning, contact a Agilent Technologies representative.



The power supply for the MT/DW Tray and Stack Coolers Instrument has the symbols 1/0 on the label for the power switch to switch ON/OFF.

Any additional power supply for other devices like, Cooled Stack or a Valve Module shows the symbols as shown below on the label for the power switch:



The symbols shall warn the user that in a emergency case more than one power supply has to be turned OFF or more than one power cord has to be pulled from power supply or from the wall outlet to shut down the complete MT/DW Tray and Stack Coolers.

If the basic MT/DW Tray and Stack Coolers is installed, than a single power supply is installed only. Turning OFF the power supply or pulling this single power cord in an emergency case will stop the complete MT/DW Tray and Stack Coolers.

It is important that the power supply (ies) are in a location where the power ON and OFF switch is accessible and easy to operate, and where it is possible to unplug the AC power cord from the power supply/wall outlet in case of emergency.

Other Hazards



To avoid injury during MT/DW Tray and Stack Coolers operation, keep your hands away from the syringe.



Do not operate the MT/DW Tray and Stack Coolers without the safety shield. The safety shield must be installed for safe operation.



To avoid injury, observe safe laboratory practice when you handle solvents, change tubing, or operate the MT/DW Tray and Stack Coolers. Know the physical and chemical properties of the solvents you use. See the Material Safety Sheets from the manufacturer for the solvents in use.



Use caution when working with any polymer tubing under pressure:

- Always wear eye protection when near pressurized polymer tubing.
- Do not use polymer tubing that has been severely stressed or kinked.
- Do not use polymer tubing, in particular not PEEK or Tefzel tubing, with Tetrahydrofuran (THF), Dimethylsulfoxid (DMSO), chlorinated organic solvents, concentrated mineral acids, such as Nitric, Phosphoric or Sulfuric acids, or any related compounds to above listings.



Do not use vials without a sealing cap, microtiter or deepwell plates without a plate seal. Vapor phase from organic solvents can be hazardous and flammable. Acidic vapor phase can cause corrosion to critical mechanical parts.



Disposal

Do not dispose of this equipment or parts thereof unsorted in municipal waste. Follow local municipal waste ordinances for proper disposal provisions to reduce the environmental impact of waste electrical and electronic equipment (WEEE). European Union customers: Call your local customer service representative responsible for the PAL System for complimentary equipment pick-up and recycling.



Lithium battery

An onboard lithium battery buffers the electronic memories, when the instrument is turned off. Replace it only with the same or equivalent type recommended by the equipment manufacturer.

Battery: Panasonic VL 2330, soldered directly on the electronic board. Discharged lithium batteries shall be disposed off locally according to national waste disposal regulations for batteries.

There are no operator-serviceable parts on the electronic boards. If an electronic board fails, contact a Agilent Technologies representative.

Table 1 Commonly Used Symbols

Symbol	Description
	Caution or refer to User Manual
	Caution, Risk of Needle-Stick Puncture
	Caution, Hot Surface or High Temperature
	Direct Current
	Alternating Current
	Protective Conductor Terminal, Ground
	Fuse
I	Electrical Power ON. Used with Main MT/DW Tray and Stack Coolers Power Supply.
0	Electrical Power OFF. Used with Main MT/DW Tray and Stack Coolers Power Supply.
	Electrical Power ON for Only Part of the System. Used with Optional Device(s)
	Electrical Power OFF for Only Part of the System. Used with Optional Device(s)
	Caution, Risk of Electrical shock (high voltage)
	Disposal, Do not dispose in municipal waste. Follow local waste regulations to reduce electrical and electronic waste (WEEE).

1 **Safety Information**

Safety Information



2

How to Use this Manual

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How to Use this Manual

All models are grouped in the family of Temperature Controllable Stacks / Tray Coolers. All models are standalone units with built-in controller for power and temperature, independent of the PAL System. The same type of power supply is used in all models; settings for Stacks and Tray Cooler do differ. This Addendum describes all types:



Figure 1 Stack Cooler DW



Figure 2 Stack Cooler MT



Figure 3 Stack Cooler 2DW



Figure 4 Tray Cooler

The major sections of this User Manual are:

- Safety Information
- Installation of Temperature Controllable Stacks and Tray Coolers
- Operation of Temperature Controllable Stacks and Tray Coolers
- Maintenance
- Error Messages
- Appendices

The Appendices provide information on Stack and Tray Cooler options and spare parts.

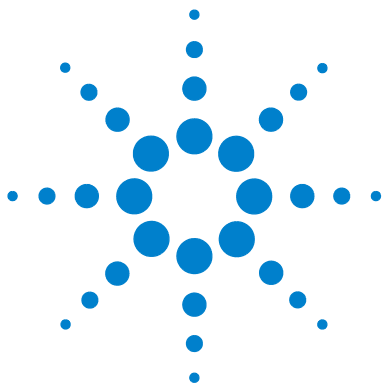
This Addendum is intended for frequent or new PAL System users who are experienced at using automated systems to run analytical methods.

NOTE

The PAL System must be installed and set up properly before controllable Stack or Tray Cooler Option operating instructions can be applied.

2 How to Use this Manual

How to Use this Manual



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Stack Cooler DW General System Overview



Figure 5 Stack Cooler DW and Power Supply with built-in control unit.

Specifications

Sample Capacity	6 trays with 54 positions for 2 mL vials or 6 deepwell or standard microtiter-plates with 96 positions or 6 microtiter-plates with 96/384 positions
Temperature Control (settable)	+4 to +40 °C in 0.1 °C increments Peltier element
Temperature Cooling	The specification for the Stack Cooler DW temperature cooling is defined as: $T_{\Delta} = \geq 14.0\text{ °C}$ within 60 min. $T_{\Delta} = T_{\text{Roomtemperature}} - T_{\text{Stack Cooler DW}}$ A temperature difference of 14.0 °C between room temperature ($22 \pm 2\text{ °C}$) and the Stack Cooler DW must be reached within 60 min.

NOTE

The control unit and the resulting temperature display on the Stack Cooler DW (display) are determinative; no comparison to an independent temperature measurement device is necessary.

Dimensions and Weights (Stack Cooler DW)

Table 2 Dimensions and Weights (Stack Cooler DW)

Stack Cooler DW	Dimensions (mm)			Weight (kg)
	Width	Depth	Height	
Module PNo.				
6 DW Stack Cooler	244	450	236	7.70
Power Supply				
Power Supply with built-in Control Unit	135	235	75	1.15

Operating and Environmental Requirements (Stack Cooler DW)

Table 3 Operating and Environmental Requirements (Stack Cooler DW)

Parameter	Requirements
Operating Temperature Range	4 to 40 °C (39 to 104 F)
Maximum Relative Humidity	75 %, non-condensing
Bench Space	At least 5 cm (2 in) at the rear, space for air circulation. Access to power switch(es) and power cord(s). Clean, level and smooth surface. Solid bench plate.
Vibration	Negligible
Static electricity	Negligible
Altitude Limitations	None

Stack Cooler MT General System Overview

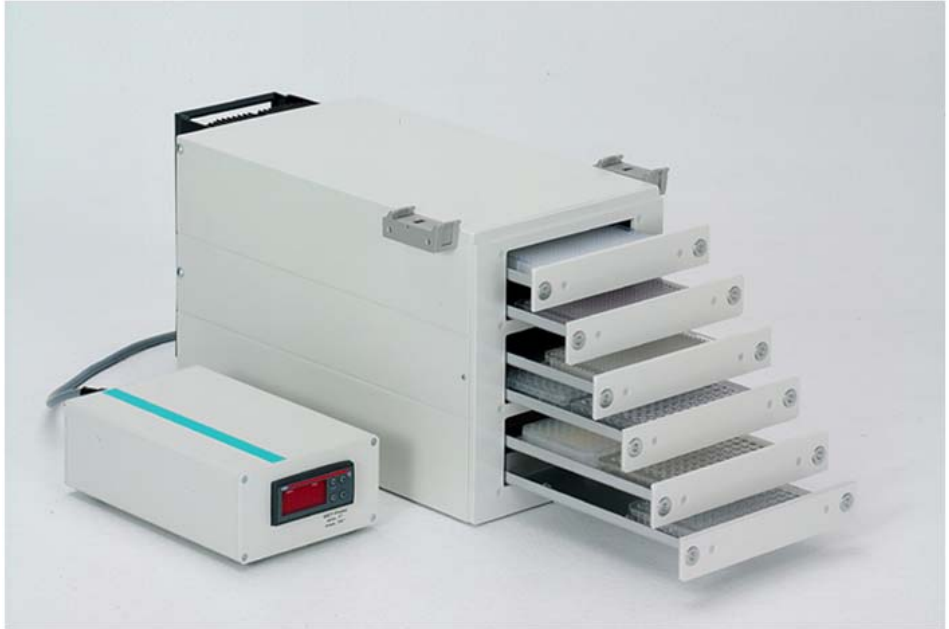


Figure 6 Stack Cooler MT and Power Supply with Built-in Control Unit

Specifications

Sample Capacity	12 microtiter-plates with 96 positions or 12 deepwell microtiter-plates with 96/384 positions
Temperature Control (settable)	+4 to +40 °C in 0.1 °C increments Peltier element
Temperature Cooling	The specification for the Stack Cooler MT temperature cooling is defined as: $T_{\Delta} = \geq 14.0\text{ °C}$ within 60 min. $T_{\Delta} = T_{\text{Roomtemperature}} - T_{\text{Stack Cooler MT}}$ A temperature difference of 14.0 °C between room temperature ($22 \pm 2\text{ °C}$) and the Stack Cooler MT must be reached within 60 min.

NOTE

The control unit and the resulting temperature display on the Stack Cooler MT (display) are determinative; no comparison to an independent temperature measurement device is necessary.

Dimensions and Weights (Stack Cooler MT)

Table 4 Dimensions and Weights (Stack Cooler MT)

Stack Cooler MT	Dimensions (mm)			Weight
Module PNo.	Width	Depth	Height	(kg)
12 MT Stack Cooler	244	450	236	7.70
Power Supply				
Power Supply with built-in Control Unit	135	235	75	1.15

Operating and Environmental Requirements

Table 5 Stack Cooler MT Operating and Environmental Requirements

Parameter	Requirements
Operating Temperature Range	4 to 40 °C (39 to 104 F)
Maximum Relative Humidity	75 %, non-condensing
Bench Space	At least 5 cm (2 in) at the rear, space for air circulation. Access to power switch(es) and power cord(s). Clean, level and smooth surface. Solid bench plate.
Vibration	Negligible
Static electricity	Negligible
Altitude Limitations	None

Stack Cooler 2DW General System Overview

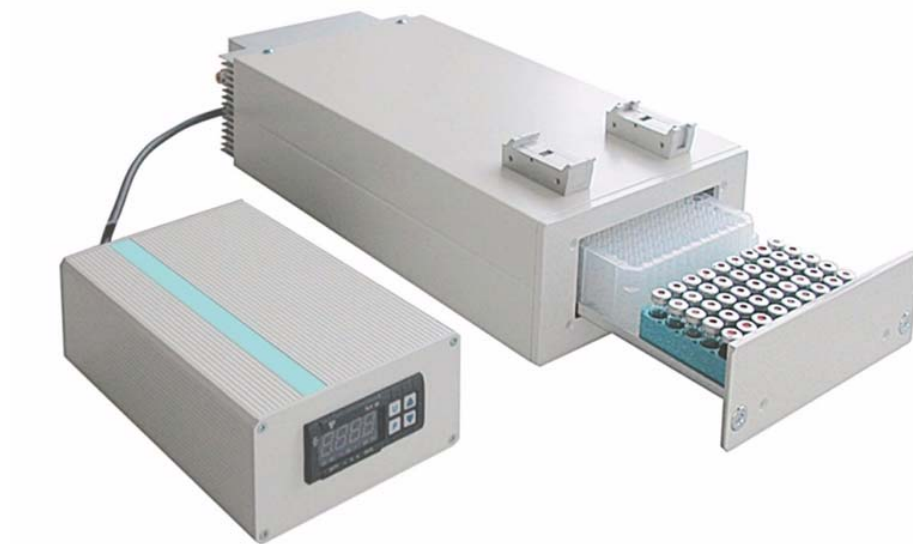


Figure 7 Stack Cooler 2DW and Power Supply with Built-in Control Unit

Specifications

Sample Capacity	2 trays with 54 positions for 2 mL vials or 2 deepwell or standard microtiter-plates with 96 positions or 2 microtiter-plates with 96/384 positions
Temperature Control (settable)	+4 to +40 °C in 0.1 °C increments Peltier element
Temperature Cooling	The specification for the Stack Cooler 2DW temperature cooling is defined as: $T_{\Delta} = \geq 14.0\text{ °C within 60 min.}$ $T_{\Delta} = T_{\text{Roomtemperature}} - T_{\text{Stack Cooler 2DW}}$ A temperature difference of 14.0 °C between room temperature (22 ± 2 °C) and the Stack Cooler 2DW must be reached within 60 min.

NOTE

The control unit and the resulting temperature display on the Stack Cooler 2DW (display) are determinative; no comparison to an independent temperature measurement device is necessary.

Dimensions and Weights

Table 6 Dimensions and Weights (Stack Cooler 2DW)

Stack Cooler 2DW	Dimensions (mm)			Weight
Module PNo.	Width	Depth	Height	(kg)
2 DW Stack Cooler	197	450	97	3.70
Power Supply				
Power Supply with built-in Control Unit	135	235	75	1.15

Operating and Environmental Requirements

Table 7 Stack Cooler 2DW Operating and Environmental Requirements

Parameter	Requirements
Operating Temperature Range	4 to 40 °C (39 to 104 F)
Maximum Relative Humidity	75 %, non-condensing
Bench Space	At least 5 cm (2 in) at the rear, space for air circulation. Access to power switch(es) and power cord(s). Clean, level and smooth surface. Solid bench plate.
Vibration	Negligible
Static electricity	Negligible
Altitude Limitations	None

Installing Support Leg in Combination with Table-positioned PAL System

A support leg is provided with Stack Cooler 2DW. This support must be installed for PAL installations that are positioned on a table and not attached to a GC instrument. The weight imbalance can cause tip-over during movement.

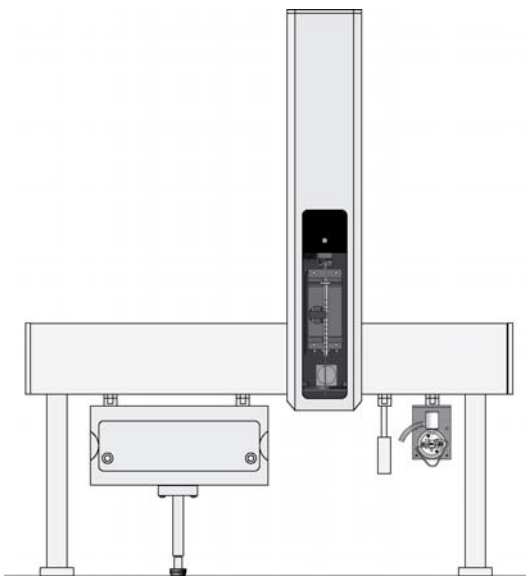


Figure 8 Stack Cooler 2DW, Installation of Support-leg, Front-view

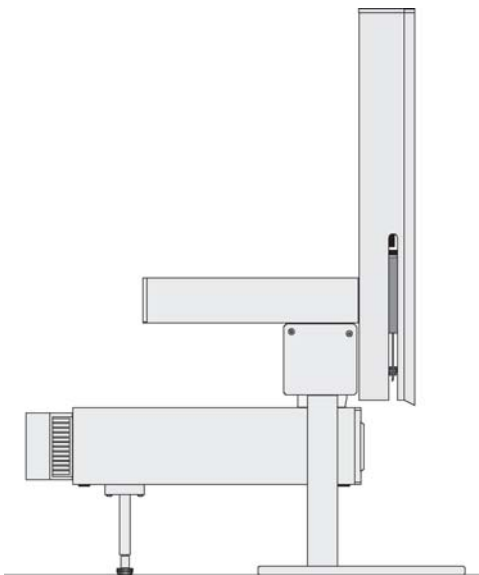


Figure 9 Stack Cooler 2DW, Installation of the Support-leg, Side view

Tray Cooler General System Overview



Figure 10 Tray Cooler and Power Supply with Built-in Control Unit

The PAL Tray Cooler is available in two versions. The above picture shows the common version of the Tray Cooler with a sample capacity as described below. The second version, Tray Cooler2, has longer legs to allow transport of 20 mL vials.

Specifications

Sample Capacity	1 PAL tray 2 mL or 1 PAL tray 1 mL or 1 microtiter- or deepwell-plate (96/384 wells) 1 PAL tray 20 mL (Tray Cooler2 only)
Temperature Control (settable)	+4 to +70 °C in 0.1 °C increments Peltier element
Temperature Cooling	The specification for the Tray Cooler temperature cooling is defined as: $T_{\Delta} = \geq 14.0\text{ °C}$ within 60 min. $T_{\Delta} = T_{\text{Roomtemperature}} - T_{\text{Tray Cooler}}$ A temperature difference of 14.0 °C between room temperature ($22 \pm 2\text{ °C}$) and the Tray Cooler must be reached within 60 min.

NOTE

The control unit and the resulting temperature display of the Tray Cooler (display) are determinative; no comparison to an independent temperature measurement device is necessary.

Dimensions and Weights

Table 8 Dimensions and Weights (Tray Cooler)

Tray Cooler	Dimensions (mm)			Weight
	Width	Depth	Height	
Module PNo.				(kg)
Standard Trays 78 x 1 mL/ 98 x 2 mL V	135	350	155	3.90
Special Mounting Kit for LC Injectors	135	350	155	3.90
Standard Trays 32 x 10 /20 mL	135	350	175	4.30
Power Supply				
Power Supply with built-in Control Unit	135	235	75	1.15

Operating and Environmental Requirements

Table 9 Tray Cooler Operating and Environmental Requirements

Parameter	Requirements
Operating Temperature Range	4 to 70 °C)
Maximum Relative Humidity	75 %, non-condensing
Bench Space	At least 5 cm (2 in) at the rear, space for air circulation. Access to power switch(es) and power cord(s). Clean, level and smooth surface. Solid bench plate.
Vibration	Negligible
Static electricity	Negligible
Altitude Limitations	None

Electrical Specifications

Table 10 Electrical Specifications

Parameter	Requirement
Protection Class ¹	Class I
Over Voltage Category ²	Category II
Pollution Degree ³	2
Moisture Protection ⁴	Normal (IPX0)
Stack / Tray Cooler (Peltier element)	
Input voltage	24 VDC
Input current	2.7 A
Power Supply for Stack / Tray Cooler	
Input line voltage	Grounded AC, 100 to 240 V
Input line frequency	50 /60 Hz
Input power	2 A
Output voltage	24 VDC
Output current	4.5 A
Output fuse	T3.15 A/250 V

¹ Protection class describes the insulating scheme used in the instrument to protect the user from electrical shock. Class I identifies a single level of insulation between live parts (wires) and exposed conductive parts (metal panels), in which the exposed conductive parts are connected to a grounding system. In turn this grounding system is connected to the third pin (ground pin) on the electrical power plug.

² Over Voltage category II pertains to instruments that receive their electrical power from a local level such as an electrical wall outlet.

³ This is a measure of pollution on electrical circuits that may produce a reduction of the dielectric strength or surface resistivity. Degree 2 refers to normally only non-conductive pollution. Occasionally, however, a temporary conductivity caused by condensation must be expected.

⁴ Normal (IPX0) – IPX0 means that there is NO Ingress Protection against any type of dripping or sprayed water. The X is a place holder to identify protection against dust if applicable.

Hardware and Software Requirements

Hardware Requirements

The Stack and Tray Cooler models can be used in combination with the 1290 Infinity LC Injector HTS (80 cm X axis) and 1290 Infinity LC Injector HTC (50 cm X axis).

If the Stack Cooler 2DW is used in combination with an LC Injector HTC/HTS System, it is necessary to use the provided supporting leg for the stack. This support stabilizes the entire system and prevents tip-over during movements. See [“Installing Support Leg in Combination with Table-positioned PAL System”](#) on page 26.

The Stack Cooler 2DW can be installed in combination with Agilent GC Injection System and is the preferred choice over a Tray Cooler for many applications.

The models Stack DW and Stack MT cannot be used in combination with a gas chromatographic system. The dimension (height) and the weight of the devices are the limiting factors. However, a custom solution could make a Stack Cooler necessary on the PAL System. If this solution has to be provided, is it necessary to use a system with 120 cm X-axis to provide enough room to freely suspend the Stack module (away from the GC frame). But it is mandatory to support the Stack module, e.g. from the table to the bottom of the Stack.

If a Tray Cooler is installed, it is necessary to provide enough room between the Peltier device (fan) and the table surface or the GC device. See also [“Installing the Stack / Tray Cooler”](#) on page 37.

NOTE

Removing hot air from the Peltier element is crucial for all Stack /Tray cooler models. See Operating and Environmental Requirements tables above in the respective sections.

Software Requirements

Software Requirements

The Stack/Tray Cooler modules are operated and temperature-controlled by their own power supply, independent of the LC/GC Injection System. For firmware control, the same concept is used as with all other TrayHolders. Adding Firmware Object Lists to the System Firmware will link and make available for use Trays, TrayHolders, and TrayTypes.

The Stack/Tray Cooler Options are compatible with PAL Firmware level 2.0.X or higher.

For more details see [“PAL Firmware and PAL Firmware Object Installation for Temperature Programmable Stacks or Tray Coolers”](#) on page 41.

3 Specifications

Hardware and Software Requirements



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Installation of Temperature Controllable Stacks and Tray Coolers

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Stack / Tray Cooler Object Positioning 48



Unpacking the Components

The Stack or Tray Cooler is shipped in one box.

Check the following items for completeness:

- Stack / Tray Cooler Module
- Power supply with built-in control unit
- Power cable
- CD-ROM with software to add new Objects to the PAL System (Object Manager Software)
- MT/DW Stack and Tray Coolers for Agilent LC/GC Injectors - User Manual

NOTE

The Temperature Control Unit for the Stack / Tray Cooler does not allow the user to enter different levels of programming functions. The program is factory pre-set, downloaded to each temperature control unit at the factory.

A power supply programmed for the Stack Cooler cannot be used for a Tray Cooler. To identify the two units, see labeling on the rear cover of the power supply.

Installing the Stack / Tray Cooler

Installing a Stack Cooler

Preparations

To install the Stack Coolers in combination with a LC/GC Injection System, proceed as described below:

Before beginning the assembling process, determine approximately where the Stack Cooler is to be located. If the Stack Cooler is to be installed on an existing System, the LC Injection Valve, the Wash Station or other objects (module) may need to be shifted. Remember to reposition the objects according to the User Manual.

CAUTION

Instability

It is important that the LC Injection System be placed on a solid, level support surface.

→ To avoid instability, make sure that the Stack Cooler rests on the surface at all four corners.

NOTE

Stack coolers models DW and MT cannot be attached to a GC Injection System. The height and weight of the Stack Cooler are the limiting factors.

A Stack Cooler 2DW can be installed on a LC Injection System as well as on a GC Injection System. If installed on an LC System, use the provided supporting leg (third leg) to avoid tipping over the System. See [“Specifications”](#) on page 25.

- 1 Loosen the two Torx screws on the mounting clamps located on the left and right hand side of the Stack Cooler.
- 2 Carefully lift the X-Crossrail assembly on top of the Stack Cooler with the mounting clamp teeth fit into the grooves on the bottom of the X- Crossrail.
- 3 Be sure that the clamps fit completely into the grooves. Tighten the two Torx screws alternately until the two mounting clamps are firmly in place.
- 4 Double check whether the Stack Cooler clamps are correctly attached to the X-Crossrail.

Installing a Tray Cooler

Before beginning the assembly process, determine approximately where the Tray Cooler will be located. If the Tray Cooler is to be installed with an existing System, the LC injection valve, the wash station or any other object (module) may need to be shifted. Remember to re-position the objects according the User Manual.

NOTE

If the device is placed over a heated zone (e.g. gas chromatograph) the space must be increased and, if possible, warm air should be actively removed (external fan).

Figure 11 on page 39 is an example. The Tray Cooler above the top cover of the gas chromatograph does not have enough space to remove hot air. The Peltier element would labor within a short time in such a situation. A possible solution is demonstrated by the X-axis extension kit. The extension allows positioning the Tray Cooler away from the heated zone. In this way even Tray Cooler2, with longer legs, can be installed for 20 mL vials.

Be aware that the position of the GC injectors requires an extension kit for the right or left side.

To install the Tray Cooler in combination with a LC/GC Injection System, proceed as described below:

- 1** Loosen the two Torx screws on the mounting clamps located on the left and right hand sides of the Tray Cooler.
- 2** Attach the Tray Cooler to the X-Crossrail assembly with the mounting clamp teeth fit into the grooves on the bottom of the X-Crossrail.
- 3** Be sure that the clamps fit completely into the grooves. Tighten the two Torx screws alternately until the two mounting clamps are firmly in place.
- 4** Double check whether the Tray Cooler clamps are correctly attached to the X-Crossrail (see the corresponding figure in the User Manual).

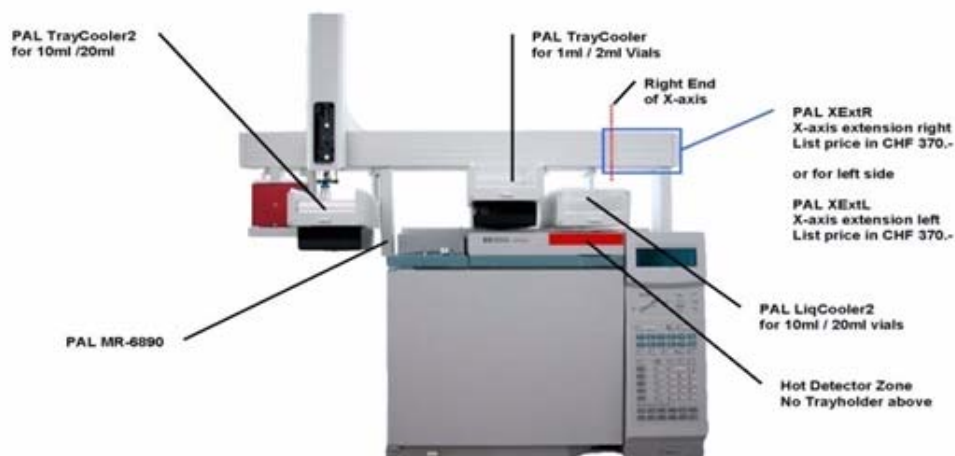


Figure 11 Tray Cooler Installed on Gas Chromatograph, Example of Installation in Combination with X-Axis Extension Kit

Electrical Connections

Installing the Power Supply

The power supply for the Stack / Tray Cooler has a built-in control unit with display.

- 1** Locate the power supply and the AC power cable.
- 2** Set the power supply switch to **OFF** position.
- 3** Connect the open end of the DC power cable from the Stack/Tray Cooler to the power supply connector labeled with Peltier Thermostat.
- 4** Connect the female end of the AC power cable to the power supply, then connect the male end to an AC power outlet.
- 5** Set the switch on the power supply to the ON position.
- 6** Observe the display. It should read the preset temperature of +10 °C.

PAL Firmware and PAL Firmware Object Installation for Temperature Programmable Stacks or Tray Coolers

PAL Firmware Installation for Stacks / Tray Coolers

The Cooled Stack Option requires PAL Firmware level 2.0.X or higher. In case a lower firmware level is installed on the unit in use, it is mandatory to upgrade the firmware to the current level.

NOTE

The 24-Tray maximum number is a firmware limitation. This firmware limitation is independent of the physical space available to attach a Stack or Tray Cooler to the X-axis. (See [“Hardware and Software Requirements”](#) on page 32.)

4 Installation of Temperature Controllable Stacks and Tray Coolers

PAL Firmware and PAL Firmware Object Installation for Temperature Programmable Stacks or Tray Coolers

PAL Firmware Object Installation for Stacks / Tray Coolers

If the revision level of the computer installed PAL Object Manager List is lower than K, copy the provided "Stack Coolers" or Tray Coolers folder from the CD-ROM to the Object Lists folder which has been installed by the Object Manager. This software is usually installed in the following path:

C:\Program Files\PAL\Object Manager\Object Lists

Object List for Stack Coolers

1 Start Object Manager.

The **"Stack Coolers"** folder should be visible in the folder list as shown in the **"Choose Object List Folder"** window on the left side of the Object Manager program window.

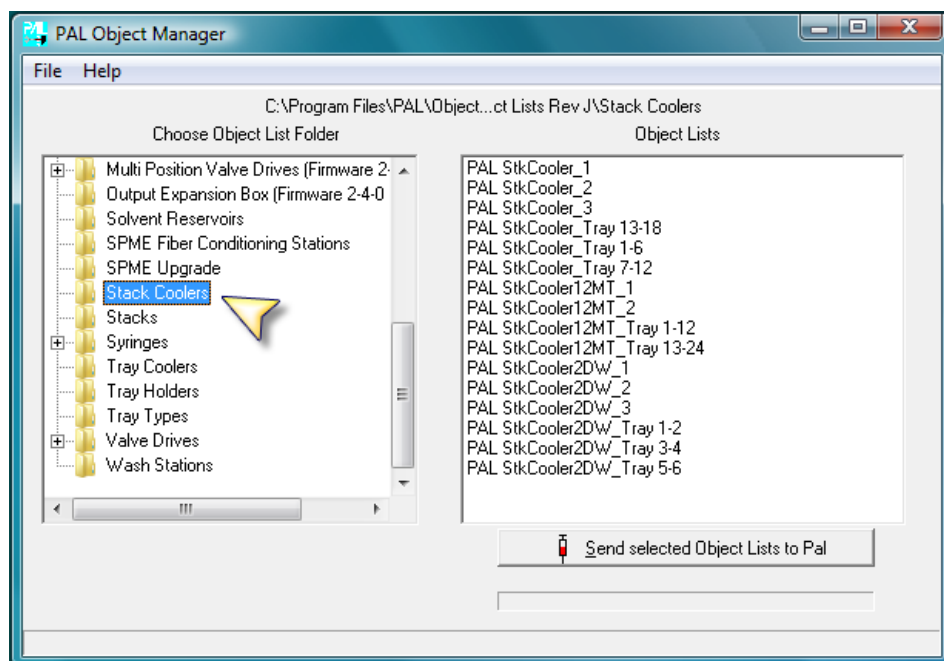


Figure 12 PAL Object Manager Choose Object List Folder

PAL Firmware and PAL Firmware Object Installation for Temperature Programmable Stacks or Tray Coolers

- 2 Select the Object Lists **PAL StkCooler_1** as shown in the example below. **Send the selected PAL Firmware Object(s) to PAL.**

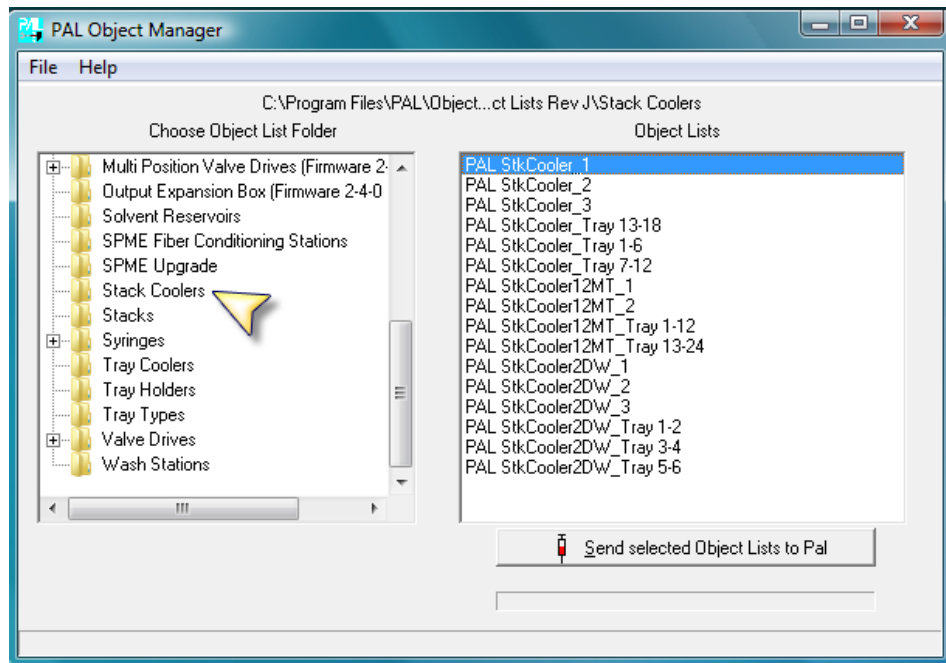


Figure 13 PAL Object Manager PAL StackCooler DW Object List

- 3 Note the name given to the various Object Lists. The variants **_1**, **_2**, or **_3** define the number of the Cooled Stack. Example: Cooled Stack DW, Stack number 1, 2, or 3.

NOTE

The object name **PAL StkCooler** is identical to **PAL Stck Cooler** or **PAL Stack Cooler 6DW**. Sometimes the term **CStack 6DW** is used for the same device.

Differentiating Trays with numbers, for example **_Tray7-12**, allows having one Stack Cooler 6DW with Tray 1 to 6 and a second CStack 6DW with Trays numbered from 7 to 12. For routine work it is easier for the user to differentiate

- Cooled Stack 6DW #1, Trays 1 to 6
- Cooled Stack 6DW #2, Trays 7 to 12
- Cooled Stack 6DW #3, Trays 13 to 18

4 Installation of Temperature Controllable Stacks and Tray Coolers

PAL Firmware and PAL Firmware Object Installation for Temperature Programmable Stacks or Tray Coolers

Selection of Firmware Object List for Stack Cooler MT

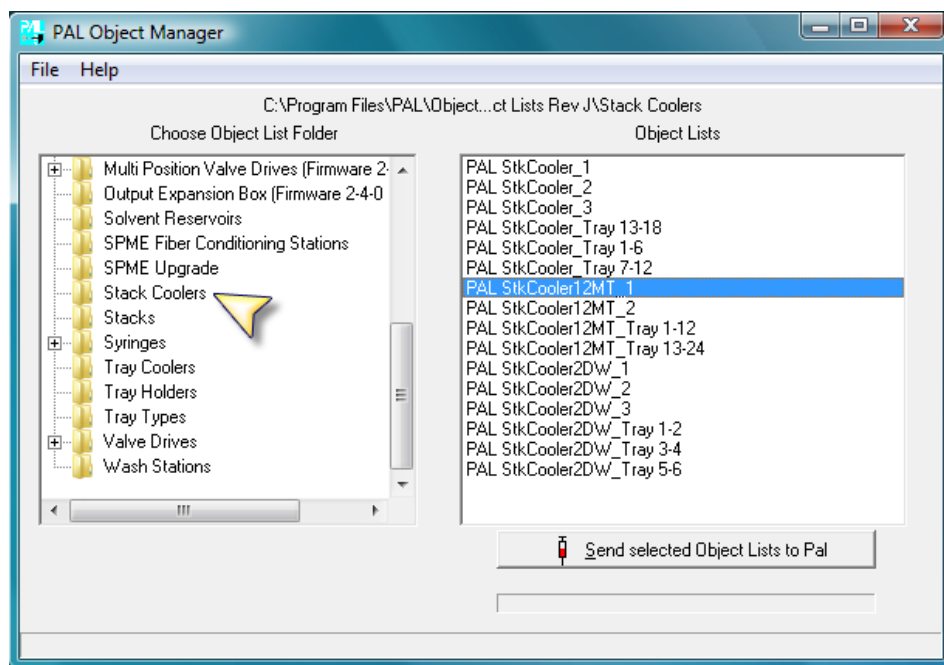


Figure 14 PAL Object Manager PAL Stack Cooler MT Object List

Selection of a Firmware Object List for Stack Cooler 2DW

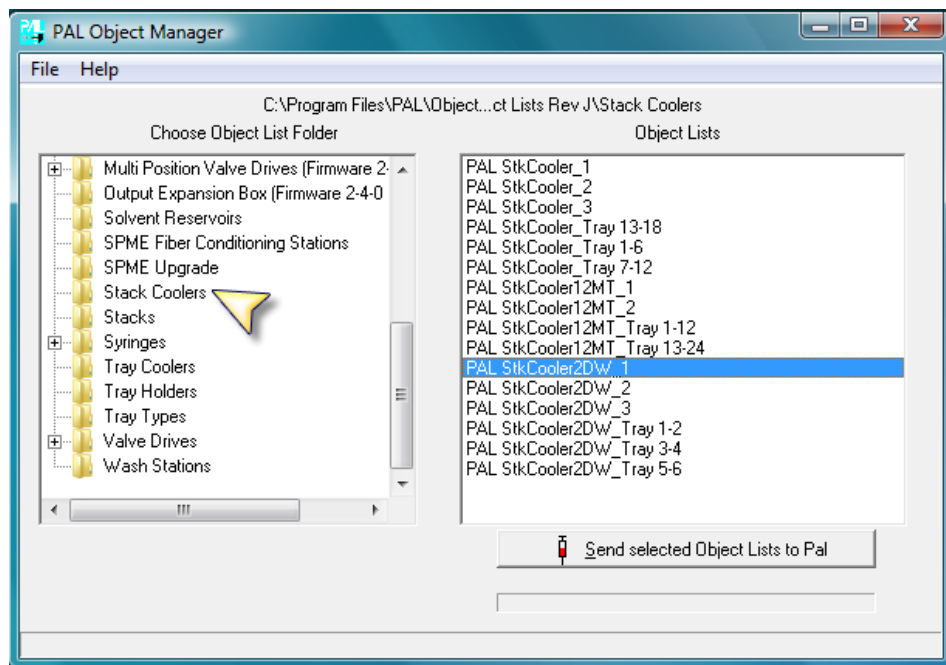


Figure 15 PAL Object Manager PAL Stack Cooler 2DW Object List

4 Installation of Temperature Controllable Stacks and Tray Coolers

PAL Firmware and PAL Firmware Object Installation for Temperature Programmable Stacks or Tray Coolers

Object Lists for Tray Coolers

The PAL Firmware Objects and Objects Lists for the PAL Tray Cooler modules are selected identically to the PAL Stack Coolers, as described above.

See [Figure 16](#) on page 46 and [Figure 17](#) on page 47 as examples.

- 1 Select the window **Choose Object List folder** on the left side of the Object Manager program window.

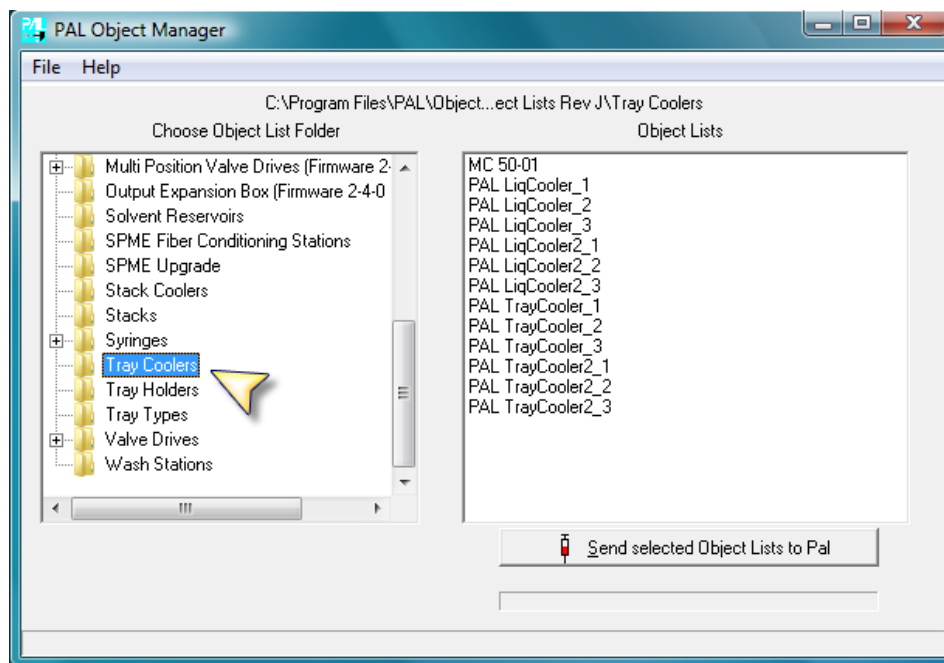


Figure 16 PAL Object Manager Choose Object List Folder for Tray Cooler

- 2 Select the Object Lists **PAL_StkCooler_1**. (See [Figure 17](#) on page 47.)

PAL Firmware and PAL Firmware Object Installation for Temperature Programmable Stacks or Tray Coolers

- 3 Send the selected PAL Firmware Object(s) to PAL.

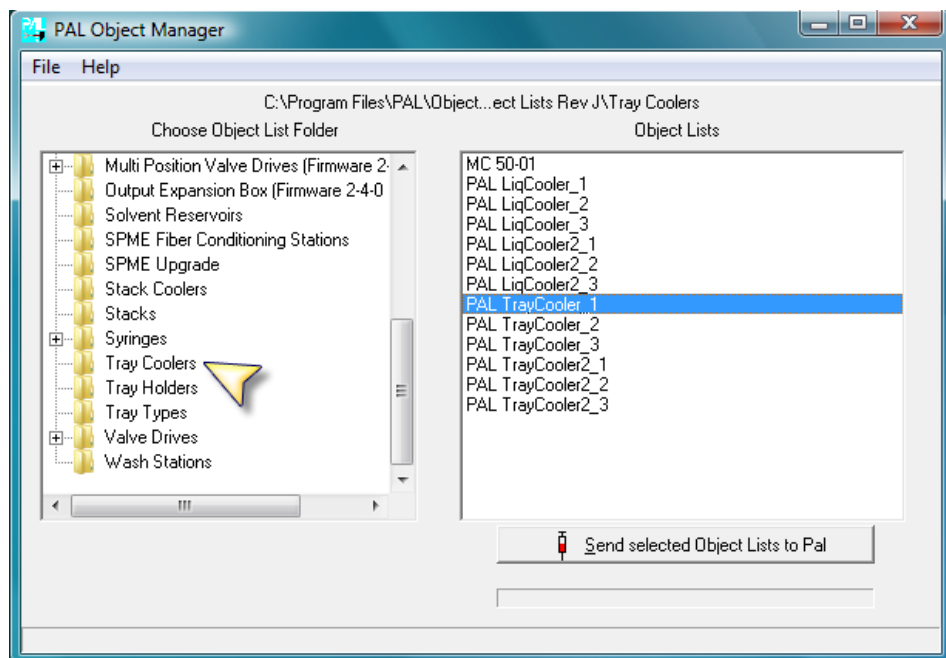


Figure 17 PAL Object Manager PAL Tray Cooler Object List

Stack / Tray Cooler Object Positioning

For the Object Stack/Tray Cooler, the X-, Y-, Z-axes must be properly positioned in the PAL System. Follow the instructions described in the PAL System User Manual.

WARNING

Hazardous and flammable solvents and vapor phases

Vapor Phase from organic solvents can be hazardous and flammable.

Acidic vapor phase can cause corrosion to critical mechanical parts.

→ Do not use vials without a sealing cap, Microtiter- or Deepwell-Plates without a plate seal.

After X-, Y-, Z-axis positioning of Stack Cooler model 6DW or 12MT, add the following steps to verify the correct installation of the module:

- 1** Close the drawer manually.
- 2** Path: Menu/Setup/Objects/TrayHolders/select corresponding device. Select function key **F1Check Pos.**
The injection unit moves to the predefined position.
- 3** Open the bottom drawer manually.
- 4** Remember the Z-value. Turn the Z-axis all the way down to check that the black needle guide of the injection unit fits neatly into the position hole of the drawer.
- 5** If the position is proper, turn the injection unit slider back to the original Z-value. Close drawer.
- 6** If the position is off by as little as one or two millimeters, compensate for any discrepancy in the X-, Y-position seen between the upper and lower drawer.
- 7** If the position is off by more than one or two millimeters, check the bracket attachment of the module to the X-axis carefully. If in doubt loosen the claws again and reposition the unit on the X-axis.

- 8 If this action is not successful, check the X- to Y-axis angle and the Y- to Z-axis angle. If one of these angles is not 90 ° , make corrections. Ensure also that the Y-axis runs parallel to the open drawer. If this is not the case the bracket alignment is probably out of square.

NOTE

The Y-axis tolerance for the teaching point is limited at 129.4 mm. When defining the position of the Stack Cooler, it is important to stay within this tolerance with the reference point at the top drawer.

4 Installation of Temperature Controllable Stacks and Tray Coolers

Stack / Tray Cooler Object Positioning



5 Operation of Temperature Controllable Stacks and Tray Coolers

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Temperature Setting, Control and Alarm

Temperature Setting

Turning the power **ON** (I) at the power supply module puts the control unit into self-check mode. The set value for temperature will display after a few seconds.

The Cooler temperature has been preset by the factory at +10 °C.

To change the value make following steps:

- 1** Press **P** briefly (less than 2 seconds) until **SP1** is displayed.
- 2** Use the increment/decrement keys to select the desired value.
- 3** Press **P** again.

NOTE

Pressing the **P** for 2 s or longer will access the programming level. Values like: **OPeR**, **ConF**, **OFF**, **rEG**, **tune** and **OPLO** can be accessed in the menu by selecting the increment/decrement keys. All these menu items are blocked for the user.

Leaving the unit untouched for approximately 2 min will return the display to the current temperature reading information.

Turning the device off/on will reinstate the temperature display.

The **U** key is blocked by factory programming.

There are indicators below the display digits that show which relay is in use, **OUT1** or **OUT2**. The arrows indicate if the unit is heating or cooling.

< heating — temperature within range of set point > cooling

Temperature Control

As described in the “Specifications” on page 17, the cooling/heating capacity of a temperature control device based on the Peltier technique is always related to room temperature. Only a limited maximum temperature difference from ambient temperature can be achieved. PAL Stack/Tray Cooler modules should reach a minimum difference of 14 °C (T_{Δ}).

The controller allows a setting range for the temperature of:

- Stack Cooler: +1 to 45 °C
- Tray Cooler: +1 to 70 °C

This wider control range, which is greater than the specification limits (+4 to 40 °C, respectively + to 70 °C), provides cooling or heating when the ambient temperature is too high or too low to easily reach the desired temperature. Heating to a higher temperature could be important for metabolism or kinetics studies at the human body temperature level of 37 °C.

The cooling option is usually necessary to protect the sample from ambient temperature during the analytical run time. Stack/Tray Cooler devices are rarely used to store a sample at a given temperature for a longer time period.

The measured and displayed temperature represents the temperature in the compartment and not in the sample liquid. To check the temperature control, an independent temperature probe is inserted from the front by removing one plastic screw from the front cover. Position the probe in the middle of the drawer where the Tray separator projects up. Tape the probe to the metal plate of the drawer.

To reach +4 in the analytical solution, program a set value lower than +4. The material used for the sample may be glass, polypropylene, polyethylene, or similar polymer products. All of these have excellent insulating properties.

If the sample has to be cooled as low as +4, it is advisable to cool the sample Tray first in a refrigerator before the Tray is placed into a Stack/Tray Cooler module. This shortens cool-down time considerably.

Temperature Alarm

For a Stack Cooler module the upper limit is protected by an internal alarm point at 55 °C, and for a Tray Cooler device at 72 °C. Reaching this point in a single fault situation causes the Temperature Control Unit to automatically force cooling to the extent possible. (The alarm is not audible.) At the same time a corresponding Error message is displayed.

Explanations, see “[Error Messages](#)” on page 63.

A fuse to prevent overheating is built in for unattended automated runs. The Peltier element will turn off automatically at $+72 \pm 5$ °C. A damaged over-temperature fuse must be replaced by an authorized representative of Agilent Technologies.

In case of error, check the following points systematically:

- Corresponding error message (see “[Error Messages](#)” on page 63.
- Verify whether the appropriate power supply is being used for Stack Cooler and for Tray Cooler.
- Turn off the power supply, wait for a few minutes, turn it on again. The alarm should be off. If the alarm is still on, observe the corresponding error message.

Temperature Stability

The Stack / Tray Cooler is basically a thermostatted sample tray that keeps the analytical sample below or above ambient temperature.

Agilent Technologies recommends the following guidelines:

- 1 Switch on the Stack / Tray Cooler at least 30 min before the analytical routine run will be started at +10 °C or 75 min if operated at +4 °C.
- 2 For high-throughput analysis – typical cycle time of 60 s or less per analysis – leave the drawers open between injections.
- 3 For longer cycle times it is recommended to use the PAL System option to close the drawer after each sampling.

Changing Restore Mode - Keep Drawer OPEN or CLOSED during Run

NOTE

The preset mode for the Stack Cooler in combination with the PAL System will close the drawers after sampling during an analytical run. To change this mode, complete the following steps starting at the top-level command from the control terminal:

Path: Menu / F3-Setup / Objects / Trayholders / CStack / Restore Mode change default value **Sample** to **Auto** press **HOME**.

CStack = example only.

Explanation **F3-Setup**: select Setup / press F3 / activate **Setup** /.

Condensation Build-Up

Condensation Build-up in Stack Coolers

Condensation build-up is directly related to the temperature and relative humidity/temperature in ambient air (dew point). Long term tests showed very little build-up of condensation in an environment of relative humidity up to 60 % and 22 ± 2 °C ambient temperature.

Condensation at the back of the compartments will be channeled to the drain outlet labeled Condensation Drain at the lower rear of the Stack Cooler. The outlet is plugged with a paper filter. This helps to evaporate the collected water in the drain line using the excess heat from the Peltier element. A drain line from the outlet to a reservoir bottle is not necessary under normal conditions.

WARNING

Gas under pressure

→ If a flush gas is used as described below, it is the user's responsibility to assure that a two-stage safety pressure regulator device is installed between the gas supply and the Stack Cooler.

WARNING

Fire and explosion hazard

→ Do not use any flammable or explosive gas such as hydrogen.

If the Stack Cooler is operated under severe conditions, a flow of dry and clean (oil-free) air or nitrogen could be used to dry the compartments continually. Connect the corresponding gas line to the Swagelok fitting (1/8) at the rear of the Stack Cooler labeled Flush Gas. A flow of approximately 300 –400 ?L/min is required to keep the compartments moisture free.

If acidic vapor phase is anticipated due to the application, it is recommended to use the same gas line connection to flush a stream of inert gas, such as nitrogen or helium, into the compartments. A stream of a few mL/min can help to avoid corrosion of the rolls.

NOTE

Agilent Technologies recommends checking regularly for condensation build-up.

It is good practice to clean the inside of the Stack Cooler when changing the analytical samples. It is advisable to dry out the Stack Cooler at ambient temperature at regular intervals. Open the drawers 1 to 5 cm for air circulation. The compartment drying frequency depends greatly on surrounding conditions.

Condensation Build-up in Tray Coolers

Condensation build-up is directly related to the temperature and relative humidity/temperature in ambient air (dew point). Long term tests showed little build up of condensation in an environment of relative humidity up to 60 % and 22 +/- 2 °C ambient temperature.

A built-in drain line, as installed in a Stack Coolers, is not provided in a Tray Cooler.

It is good practice to install the Plexiglas lid whenever possible to avoid condensation build-up. For certain applications it is not possible to have a lid installed, for example if a vial has to be transported to an Agitator or a Barcode Reader. In certain situations the height of the vial is the limiting factor for installing a lid. Operating a Tray Cooler under such disadvantageous conditions requires some on-site improvisation. A simple foil or lid with cut-outs for the vials will limit condensation build-up dramatically.

NOTE

Agilent Technologies recommends checking regularly for condensation build-up. It is good practice to clean the inside of the Tray Cooler when changing the analytical samples. It is advisable to dry out the Tray Cooler at ambient temperature in regular intervals.

NOTE

For certain applications a change from a Tray Cooler to Stack 2DW Cooler may be indicated. As long as deep well, microtiter plates, or 2 mL vials (TrayType VT54) need to be handled, this change would be positive in regard to condensation build-up and it would double the capacity of the Trays.

5 Operation of Temperature Controllable Stacks and Tray Coolers

Condensation Build-Up



6 Maintenance

Maintenance 60



Maintenance

Performing maintenance regularly will help ensure the accuracy and precision of the LC/GC Injection System. Suggested intervals for maintenance procedures to ensure uninterrupted operation are given below.

If you use the system extensively (for example, nights and weekends), or if you use aggressive solvents, you may need to perform maintenance procedures more frequently.

Table 11 Stack/Tray Cooler Maintenance

Maintenance Step	Interval
Clean the outside of the instrument. Use only a soft, lint-free cloth dampened with mild soap and water.	Weekly or as needed.
Clean and dry the inside of the instrument if necessary, including compartments, rolls and rails. Use only a soft, lint-free cloth.	Daily or as needed.
Clean and grease the rolls and the rails (only stack coolers).	• Once a year without acidic vapor exposure. • If acids are used for the sample solution and the Stack Cooler DW is exposed to the vapor, the cleaning should be done more frequently. Interval as required. • A positive stream of inert gas, like Nitrogen or Helium, can prevent corrosion. See "Condensation Build-up in Tray Coolers" on page 57 .

NOTE

Recommended Grease

- Grease: PAL Lub Kit: approx. 8 g grease and brush Grease Temperature Range: -130 to +150/+200 °C

NOTE

There are no operator-serviceable or replaceable parts inside the power supply(ies) or the LC/GC Injection System. In case of failure, contact a representative of Agilent Technologies.

NOTE

In Power Supply MN 03-00, revision level F, a fan is installed in the housing to cool the electronic components. Cooling with the fan will prolong the life of the electronic components. The Power Supply can still be operated even if the fan fails. The temperature will not reach a critical safety level without cooling. Safety tests have been successfully passed without fan cooling.



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Error Messages

The temperature control unit for the Cooler (Peltier element) can display feedback messages in the form of Error Messages.

Other messages such as **ErAT** and **noAT** are suppressed and are not of use in this application.

NOTE

The Temperature Control Unit for the Stack / Tray Cooler does not allow the user to enter different levels of programming functions. The program is factory pre-set, downloaded to each Temperature Control Unit at the factory. A power supply programmed for the PAL Stack Cooler cannot be used for a PAL Tray Cooler.

To identify the two units, check the information on the rear of the units, Regulator Settings for Stack Cooler or for Tray Cooler.

Error Probe

Probable cause

- 1 DC cable disconnected or in short circuit
Connection mistake.
- 2 Damaged Probe.

Suggested actions

- Check of connection between power supply and Cooler.
- Check of signal probe (ex: NTC measure the resistance: $25\text{ }^{\circ}\text{C} = 10\text{ k}\Omega$). Check the set point for the desired temperature.
- Turn OFF/ON the unit. Initialize the Temperature Control Unit to normal level. Check the set point for the desired temperature.
- Check of connection between power supply and Cooler.
- Check of signal probe (ex: NTC measure the resistance: $25\text{ }^{\circ}\text{C} = 10\text{ k}\Omega$). Check the set point for the desired temperature.
- Turn OFF/ON the unit. Initialize the Temperature Control Unit to normal level. Check the set point for the desired temperature.

UUUU

Under Range

Probable cause

- 1** Measured variable is below the sensor limit

Suggested actions

- Check of connection between power supply and Cooler.
- Check of signal probe (ex: NTC measure the resistance: 25 °C = 10 kΩ). Check the set point for the desired temperature.
- Turn OFF/ON the unit. Initialize the Temp. Control Unit to normal level. Check the set point for the desired temperature.

0000

Over Range

Probable cause

- 1** Measured variable is above the sensor limit

Suggested actions

- Check of connection between power supply and Cooler.
- Check of signal probe (ex: NTC measure the resistance: 25 °C = 10 kΩ). Check the set point for the desired temperature.
- Turn OFF/ON the unit. Initialize the Temp. Control Unit to normal level. Check the set point for the desired temperature.

LbA

Loop Break Alarm

Probable cause

- 1 Loop break alarm is interrupted.

Suggested actions

- Check the set point for the desired temperature.
- Turn OFF/ON the unit. Initialize the Temp. Control Unit to normal level.

ErEP

EPROM

Probable cause

- 1 Error in Eprom

Suggested actions

Press key **P**



8 Appendices

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Spare Parts for Stack Cooler [74](#)



Definition of Terms

Job Queue

A Job Queue is a list of sample processing Jobs. Jobs are executed in the order displayed on the JOB QUEUE menu screens. New Jobs may be added to the queue while samples are being processed.

Job

A Job contains the information needed by the MT/DW Tray and Stack Coolers to process multiple samples by the same processing steps. The elements of a Job are a Method and a Tray that define the location of the samples to be processed. For identification, Jobs are automatically numbered from 01 to 99 and then restarting with 01 when they are added to the Job Queue.

Cycle

A Cycle consists of the specific operations necessary to process one sample. The Cycle operations are repeated for each sample within a Job. Cycles are designed for specific applications.

Method

A Method defines how the samples are processed. The elements of a Method are a Cycle, a Syringe and a Parameter List. Methods have names with up to eight characters and can be edited, copied, and deleted.

Method Parameters

Method Parameters are associated with the Cycle operations. User-assigned Parameter values define how a processing operation is performed. A zero Parameter value will disable a Cycle operation. Cycle Parameters are application-specific.

Tray Holder

A Tray Holder can hold one or more trays. Each Tray Holder has a reference position (X-, Y-, Z-coordinates) that defines its location.

Tray

A Tray holds multiple samples. Trays are defined by designating the Tray Type (see below) and the Tray Holder. Tray names are used to identify the sample source within a Job.

Tray Type

A Tray Type defines the pattern and sampling sequence of sample locations within a Tray.

Stack

A Stack is a particular type of Tray Holder that is designed to hold micro-plates. A six-drawer Stack holds 12 standard microplates, two in each drawer.

A three-drawer Stack holds six deep-well micro-plates, two in each drawer.

Object Manager

Software to load an Object List to an instrument if a Module (hardware module) has been added to the System. In a special mode Object Manager can also be used to create and maintain Object Lists.

Object List

If a Module (hardware) is added to an instrument, several Objects have to be loaded into the firmware. These Objects are collected in an Object List and stored in a file with the extension *.pol.

Object Lists are delivered together with Object Manager Software and are grouped into folders for the different kind of Modules (e.g. Syringes, Tray Holders, Valve Drives). The name of an Object List starts with the Module part number with variants added (e.g. first or second Stack). The name of the root folder includes the revision which is dependent on the firmware version (e.g. **Object Lists Rev. K** for firmware 2.X and 3.X).

Object Class

Each Object belongs to an Object Class (e.g. Syringes, Trays, Injectors).

The Object Class defines the Items of an Object.

Object Item

An Object contains several Items which can be numerical values with a physical unit (e.g. X-, Y-, Z-Position, Penetration, Syringe Scale Length, Syringe Volume) or references to other objects.

NOTE

The term Parameter is reserved for ATOM Parameter (Firmware commands to be used for a Cycle).

Objects

Objects are data structures describing the properties of physical modules. Certain modules (e.g. a Stack) require several objects.

Module

Hardware module, either part of a standard system configuration (e.g. Agilent LC Injectors HTC/HTS, Agilent GC Sampler 80/120) or an optional addition (e.g. SPME Upgrade for Agilent GC Injector, MT/DW Tray, Stack, and Cooler Upgrades for Agilent LC Injectors HTC/HTS). The term Module is intentionally used to differentiate from Object, which is reserved for the Firmware Object.

Naming Convention

This section recommends standard naming convention for MT/DW Tray and Stack Coolers Trays, Tray Types, and Tray holders. Following these conventions will allow MT/DW Tray and Stack Coolers to be pre-configured for certain applications, will simplify software backups and application development, and will improve technical support and training.

Table 12 Naming Convention

Tray Type	Tray Description
VT200	Vial Tray, 200 positions (10 x 20) For 7 mm micro-vials, 1 mL
VT98	Vial Trays, 98 positions (7 x 14) For 12 mm vials, 2 mL
VT78	Vial Tray, 78 positions (6 x 13) For 7 mm micro-vials, 1 mL (opposite side of 98 positions Tray)
VT54	Vial Tray, 54 positions (6 x 9) For 12 mm vials, 2 mL
VT21	Vial Tray, 21 Positions (7 x 14) For 12 mm vials, 2 mL (opposite side of 32 positions Tray)
VT32-10	Vial Tray, 32 positions (4 x 8) For 23 mm headspace vials, 10 mL
VT32-20	Vial Tray, 32 positions (4 x 8) For 23 mm headspace vials, 20 mL
MT96	Standard 96-position shallow microplate
DW96	Deep well 96-position microplate
MT384	High density 384-position shallow microplate

Spare Parts for Stack Cooler

Item	#	p/n	Description
1	1	G4270-01000	Faceplate Stack Cooler 6DW
2	1	G4270-02000	Faceplate Stack Cooler 12MT
3	1	G4270-67100	Kit with replacement screws for Stack Cooler drawer front, consisting of: 20 pcs. M3x16 20 pcs. M3x8

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In this book

The manual contains technical reference information about the MT/DW Stack and Tray Coolers for Agilent LC/GC Injectors.

The manual describes the following:

- safety information,
- specifications,
- installation,
- operation,
- maintenance.

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