Installation manual

UNITY-xr
Contents

1. Preface ........................................................................................................................................... 4
   1.1 Notices ....................................................................................................................................... 4
   1.2 Warranty ................................................................................................................................. 4
   1.3 Regulatory compliance .......................................................................................................... 4
   1.4 Important safety warnings ..................................................................................................... 5
      1.4.1 Labels/symbols ................................................................................................................ 5
      1.4.2 Mains voltages .................................................................................................................. 5
      1.4.3 High temperatures ........................................................................................................... 6
      1.4.4 Cleaning and decontamination ....................................................................................... 6
   1.5 Environment operating conditions ....................................................................................... 7
      1.5.1 Temperature ...................................................................................................................... 7
      1.5.2 Humidity .......................................................................................................................... 7
      1.5.3 Altitude ............................................................................................................................. 7
   1.6 Technical Specifications ........................................................................................................ 7
      1.6.1 Physical properties ........................................................................................................... 7
      1.6.2 Electrical properties ......................................................................................................... 7
   1.7 Technical support contact details ........................................................................................ 7

2. UNITY-xr Pre-installation Check List ...................................................................................... 8
   2.1 Recommended computer specification for UNITY-xr control .............................................. 8
   2.2 GC equipment requirements ................................................................................................ 8
      2.2.1 Access into the GC oven .................................................................................................. 8
      2.2.2 GC configuration/parameter selection ............................................................................ 8
   2.3 Laboratory location ................................................................................................................ 9
      2.3.1 Space requirements .......................................................................................................... 9
      2.3.2 Quality of the laboratory air ............................................................................................ 9
      2.3.3 Quality of the laboratory gas lines .................................................................................. 9
   2.4 Services .................................................................................................................................... 9
      2.4.1 Power ............................................................................................................................... 9
      2.4.2 Pressure controlled supply of dry air or nitrogen (purge gas) ........................................ 9
      2.4.3 Pressure controlled carrier gas supply .......................................................................... 9
      2.4.4 Filters ............................................................................................................................... 10

3. Installing UNITY-xr ..................................................................................................................... 11
   3.1 Unpacking UNITY-xr ............................................................................................................. 11
   3.2 Connections to UNITY-xr ..................................................................................................... 11
      3.2.1 Gas connections ............................................................................................................... 12
      3.2.2 UNITY-xr with Electronic Carrier Control (ECC) .......................................................... 12
      3.2.3 UNITY-xr without Electronic Carrier Control (ECC) / T’d option ................................ 13
      3.2.4 Cable connections .......................................................................................................... 14
   3.3 Installing the Transfer Line ..................................................................................................... 14
      3.3.1 Installing the Transfer Line onto the GC ...................................................................... 14
3.3.2 Installing the fused silica transfer line insert ................................................................. 16
3.3.3 Connecting the transfer line to UNITY-xr ................................................................. 18
3.4 Installing the cold trap ......................................................................................................... 22
3.5 Check for gas leaks ............................................................................................................ 24
4. Installing Markes Instrument Control (MIC) software ......................................................... 26
   4.1 System Configuration ........................................................................................................ 26
   4.2 Running the software ....................................................................................................... 26
      4.2.1 Configuring the software ............................................................................................ 26
      4.2.2 Detecting the UNITY-xr ............................................................................................. 30
5. Installation qualification ......................................................................................................... 31
   5.1 Leak Testing ....................................................................................................................... 31
   5.2 Conditioning the cold trap .............................................................................................. 31
   5.3 System checkout .............................................................................................................. 33
6. Appendix .................................................................................................................................. 34
   6.1 UNITY-xr Electronic Gas Control with the Agilent 6890GC .............................................. 34
      6.1.1 Procedure .................................................................................................................... 34
      6.1.2 6890 inlet settings ........................................................................................................ 35
   6.2 UNITY-xr Electronic Gas Control with the Agilent 7890GC ............................................ 36
      6.2.1 Procedure .................................................................................................................... 36
      6.2.2 7890 Inlet Setup .......................................................................................................... 37
      6.2.3 7890 Inlet Settings ....................................................................................................... 37
   6.3 UNITY-xr Electronic Gas Control with the Shimadzu QP 2010 (Plus) GCMS fitted with AFC .............................................................................................................................. 38
      6.3.1 Gas connections between UNITY-xr and the Shimadzu AFC .................................... 38
      6.3.2 Configuring the Shimadzu GC software ....................................................................... 39
      6.3.3 Flow stability ................................................................................................................ 40
      6.3.4 Ready / Start connections between UNITY-xr and Shimadzu GC .............................. 41
   6.4 UNITY-xr Electronic Gas Control with the Thermo DPFC .............................................. 42
      6.4.1 Procedure .................................................................................................................... 42
      6.4.2 Configuring the Thermo GC software .......................................................................... 42
   6.5 UNITY-xr Electronic Gas Control with the Thermo 1300 Series GC ............................ 43
      6.5.1 Installing the Markes TD to the Thermo Scientific TRACE Series 1300 GC .......... 43
   6.6 Testing the ECC setup ....................................................................................................... 46
1. Preface

This manual provides detailed instructions on the use of the UNITY-xr. It details the software/hardware interface and procedure for the installation of this instrument.

1.1 Notices

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Markes International.

Please note that the material contained in this document is subject to being changed, without notice, in future editions. Markes International shall not be liable for errors or for incidental or consequential damages in connection with the supply, use or performance of this document or of any information contained herein, unless a separate agreement between Markes International and the user should take precedence.

1.2 Warranty

UNITY-xr is designed for laboratory use only. It is not intended for use in domestic establishments or establishments directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes. Where equipment is used in a field placement environment, care must be taken to ensure that the instrument is not exposed to detrimental conditions, i.e. rain, wind, or sun. Exposure may diminish the performance, cause damage to the instrument and/or cause the equipment to become unsafe to the user.

If the equipment is not used in a way specified by Markes International, the safety protection provided by the equipment may be reduced. Furthermore, system failures arising from such use may not be covered in standard warranty and/or service contract agreements.

1.3 Regulatory compliance

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

The instrument complies with the essential requirements of the following applicable European Directives, and carries the CE mark accordingly:

- Low voltage Directive 2014/35/EU
- EMC Directive 2014/30/EU
- ROHS Directive 2011/65/EU

The instrument conforms to the following product safety standards:

- IEC 61010-1/EN 61010-1
- Canada: CSA C22.2 No.61010-1
- USA: ANSI/UL 61010-1.

The instrument conforms to the following regulation on electromagnetic compatibility (EMC):

- IEC 61326-1/EN 61326-1.
1.4 Important safety warnings

There are several important safety notices to keep in mind when installing and using this instrument.

1.4.1 Labels/symbols

Throughout this manual symbols will appear where carrying out an operation may involve hazards. Symbols and warnings also appear on the instrument, and these should be adhered to at all times. Markes International can accept no liability for failure to do so.

- **BURN HAZARD**
  A hot surface may result in a burn injury.

- **INSTRUMENT/PART DAMAGE**
  Damage to the instrument or module may occur. This damage may not be covered under the standard warranties.

- **LIFTING HAZARD**
  Injury may occur if proper lifting procedures are not followed.

- **WARNING**
  General warning symbol to alert the user that personal injury or instrument damage may occur if the instrument is improperly used or if instructions are not followed correctly.

- **DISPOSAL**
  This label indicates the instrument must not be disposed in regular waste but in accordance with the WEEE scheme.

1.4.2 Mains voltages

- Ensure at all times that the plug (electrical isolator) can be easily and quickly accessed during equipment use.

- The instrument must be suitably earthed via the power cord.

  **NOTE:** Voltages within the instrument will be a maximum of 24 V. Although there is decreased risk of serious injury, these internal voltages should still be treated as dangerous. Contact with any live parts may cause personal injury and/or instrument damage.
1.4.3 High temperatures

- Several parts of the UNITY-xr can be operated at high temperatures. Contact with these zones whilst the system is in operation can cause serious burn injury. These zones are:
  - Heated valve.
  - Tube oven.
  
  See Section 3 for the location of these zones. Both these zones are labelled with ‘Burn hazard’ labels similar to that shown above.

- ALWAYS operate the instrument with the covers in place to avoid accidental contact with these zones.

- Due to the high temperatures involved in the flow path, other zones of the instrument will be at higher temperatures during operation. These may not on visual inspection be obvious to the user. These zones are:
  - The insulation of the GC transfer line.
  - Top and side covers (especially directly above the heated valve).

  See Section 3 for the location of these zones.

1.4.4 Cleaning and decontamination

Please consult Markes International or your local agent for information on decontamination or the use of cleaning agents.

**NOTE:** Incorrect cleaning/decontamination could result in damage to the instrument.
1.5 Environment operating conditions

The instrument should be protected from conditions that could cause exposure to frost, dew, percolating water, rain, excessive direct sunlight, etc.

Performance can be affected by sources of heat and cold from heating, air conditioning systems, or drafts.

It is advisable to operate the system in a clean laboratory environment, with minimal atmospheric concentrations of organic vapours.

1.5.1 Temperature

Recommended operating ambient temperature range is 15 to 30°C.

1.5.2 Humidity

Recommended operating humidity range is 5 to 95% non-condensing.

1.5.3 Altitude

This product should not be operated above 2000m (~6500ft).

NOTE: For storage or shipping the allowable temperature range is -40 to 70°C and the allowable humidity range is 5-95% non-condensing. After instrument exposure to extremes of temperature or humidity, allow 2 hours for return to the recommended ranges before switching on.

1.6 Technical Specifications

1.6.1 Physical properties

Height: 46 cm (18.1”)
Width: 16 cm (6.3”)
Depth: 54 cm (21.3”)
Weight: 16 kg (35 lbs)

1.6.2 Electrical properties

Maximum Power: 650 W
Line voltage: 100-240 V (automatically selected)
Frequency: 50/60 Hz
Input inrush current (A): <40 A (cold start)

1.7 Technical support contact details

In the first instance please contact your distributor. If they are unable to resolve your query, please contact Markes International (details below).

Website: www.markes.com
E-Mail: support@markes.com
Telephone: +44 (0)1443 230935 (UK office)
          +49 (0)6102 8825569 (German Office)
          +1 866 483 5684 (US office (toll-free))
2. **UNITY-xr Pre-installation Check List**

2.1 **Recommended computer specification for UNITY-xr control**

The minimum PC specifications are:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>2 GHz Pentium (or equivalent)</td>
</tr>
<tr>
<td>RAM</td>
<td>1 GB</td>
</tr>
<tr>
<td>Free Disk Space</td>
<td>40 MB (for installation)</td>
</tr>
<tr>
<td>Operating system</td>
<td>Windows 7, 8.1 or 10</td>
</tr>
<tr>
<td>Minimum resolution</td>
<td>1024 x 768</td>
</tr>
<tr>
<td>Other requirements</td>
<td>Windows compatible keyboard and mouse, one free USB port.</td>
</tr>
</tbody>
</table>

**NOTE:** If the UNITY-xr is to be installed with additional accessories e.g. ULTRA-xr, check the USB requirements of the accessories before installation.

2.2 **GC equipment requirements**

UNITY-xr is usually connected to a gas chromatograph configured with appropriate conventional or mass spectrometer (MS) detectors. No conventional GC injector is required for UNITY-xr operation. Ready and external start connections are required on the GC.

2.2.1 **Access into the GC oven**

The UNITY-xr heated transfer line is lined with 0.25 mm I.D., 0.35 mm O.D. uncoated deactivated fused silica which butt connects with the capillary analytical column inside your GC oven.

It is important that the heated and insulated portion of the transfer line extends as far as the skin of the GC oven such that the GC oven heating begins at the point where heating of the transfer line ends. A 25 mm diameter access hole is thus required into the GC, with a 6.5 mm hole in the GC inner oven wall. Further information is provided in Section 3.5.

2.2.2 **GC configuration/parameter selection**

From a GC perspective, UNITY-xr may simply be regarded as a multipurpose, stand alone GC injector for capillary or 1/8 inch packed columns. No conventional GC injector is required for UNITY-xr operation. The rest of the GC system - column, oven, data handling, detector, etc. - should be configured and used, as per normal chromatographic practice for the analytes of interest.

If multiple applications are to be carried out or if samples are uncharacterised; for example when monitoring unknown atmospheres, a good general purpose GC configuration comprises 25-30 m, 0.25mm or 0.32 mm ID, 1 or 2 µm phase thickness bonded methyl silicone capillary column with a FID or mass spectrometer detector.
2.3 Laboratory location

2.3.1 Space requirements
UNITY-xr can sit either side of the gas chromatograph, and be installed into the GC oven (i.e through the wall/roof of the oven or through an injection port).

Efficient cold trap cooling requires at least a 10 cm gap on both sides of UNITY-xr

2.3.2 Quality of the laboratory air
UNITY-xr is a powerful concentration device and is often used to determine trace levels of organic analytes. It is advisable to store and operate UNITY-xr in a clean laboratory environment with minimal atmospheric concentrations of organic vapours.

2.3.3 Quality of the laboratory gas lines
As UNITY-xr is a concentrator, even trace level contaminants in laboratory gas lines can cause significant interference in the chromatograms produced.

Recommended gas lines are refrigeration-grade copper tubing connected using approved swage-fittings.

Laboratory gas line joints and connections must never be brazed.

Position the gas supplies as close as possible to the analytical system i.e. such that the gas lines are as short as possible.

Use a high quality, stainless steel diaphragm cylinder head regulator for the carrier gas supply.

2.4 Services

2.4.1 Power
UNITY-xr is automatically compatible with all conventional mains power supplies ranging from 100 to 240 V and 50 or 60 Hz. It is not necessary to manually select or switch voltages. The maximum power consumption of UNITY-xr is 650 W.

2.4.2 Pressure controlled supply of dry air or nitrogen (purge gas)
UNITY-xr requires a pressure-regulated supply of dry air or nitrogen (dewpoint lower than -50°C) at between 50 and 60 psi both to actuate the main valve and to purge the cold trap box.

It is recommended that a secondary pressure regulator be used to control the supply of dry gas to UNITY-xr in addition to that controlling the general laboratory line pressure. Any conventional pressure regulator should suffice for this and suitable pneumatic control may already be available on your GC. Alternatively, Markes International Ltd. supply a pneumatic control accessory (P/N U-GAS01) for both air and carrier gas.

It is recommended that the pressure in the laboratory air line be at least 10 psi higher than that supplied to UNITY-xr.

2.4.3 Pressure controlled carrier gas supply
Helium is invariably used as the carrier gas for capillary chromatography and nitrogen for packed column or sensor work.

5.0 grade (i.e. 99.999%) or higher purity helium / nitrogen gas is recommended in either case.
UNITY-xr requires a regulated supply of carrier gas at a pressure to suit the analytical column / system selected. The UNITY-xr gas flow path has minimum (<2 psi) impact on total system impedance. Suitable pneumatic control for the carrier gas may already be available on your GC. The performance of most common capillary columns is optimised at between 1 and 2 ml/min typically requiring between 10 and 30 psi head pressure.

Previously approved and correctly rated external gas regulator should be used with this unit. Maximum inlet pressure must not exceed 60 psi.

The pressure in the laboratory carrier gas line should be at least 10 psi higher than that supplied to UNITY-xr.

2.4.4 Filters

Deoxo and organic filters should be included in the carrier gas line just upstream of connection to the UNITY-xr - GC analytical system (see Accessories for Thermal Desorption catalogue).
3. Installing UNITY-xr

3.1 Unpacking UNITY-xr

Before unpacking the instrument ensure that the installation site meets the minimum specifications as described in Section 2, and that the GC/GCMS and data system is installed and operating correctly.

Remove the instrument from its packaging. It is strongly recommended that the instrument packaging is retained for future use if ever the system is to be shipped using conventional carriers. Shipping the instrument in non-standard packaging may irreversibly damage the equipment and invalidate the warranty. It is recommended that two people unpack the instrument to minimise the lifting hazard.

Check the packing list included with the instrument to confirm the condition and completeness of ship kit and report any problems i.e. missing or damaged parts.

3.2 Connections to UNITY-xr

UNITY-xr to GC cable
SERUTE-5142 = AGILENT GC
SERUTE-5143 = THERMO GC
SERUTE-5144 = VARIAN GC
SERUTE-5141 = SHIMADZU/OTHER GC

Power cable and on/off switch
Serial port connection to PC
Pressure outlet (for ECC control)
Carrier inlet 60 psi max.
Purge Air in ~ 50 psi
3.2.1 Gas connections

Connect the 4mm od nylon purge gas line to the inlet on the back of the U-GAS01 regulator then connect the outlet to the back of the UNITY-xr. Purge gas should be set to approximately 50 psi.

The UNITY-xr ships ready for Electronic Carrier Control (ECC), it is recommended however that the carrier gas is connected to the inlet on the back of the U-GAS01 or similar step down regulator to step down the carrier pressure supply to the GC (Carrier pressure should be set between 0 and 60psi depending on dimensions of the GC column installed). The outlet for the carrier gas is then connected from the step down regulator to the ECC module that will be supplying carrier gas to the instrument.

3.2.2 UNITY-xr with Electronic Carrier Control (ECC)

If using the UNITY-xr with ECC then the carrier gas and septum purge lines are connected up directly as shown in the schematic below. Ensure that the inlet settings on the GC are set up correctly for this. The instructions for this process are described in the Appendix for most common GCs.

**NOTE:** If ECC is not available/required please refer to section 3.2.3 to de-configure ECC on UNITY-xr.
3.2.3  **UNITY-xr without Electronic Carrier Control (ECC) / T’d option**

If ECC is not available / required then it is possible to reconfigure the UNITY-xr with the septum purge line removed.

![Image showing reconfiguration steps]

- Remove the right hand lower panel.
- Disconnect the 1/16” t-piece shown.
- Replace t-piece with a 1/16” union (SERZ-0119), supplied in the shipping kit, connecting the 2 vertical lines.

The two gas lines (carrier and septum purge) from the ECC module on the GC should be connected externally together via a 1/8” t-piece as shown below. The third arm of the t-piece should be connected via 1/16” – 30/1000” i.d. stainless tubing to the ‘Carrier Inlet’ on the back of UNITY-xr.

**NOTE:** If stainless steel tubing is unavailable, green PEEK tubing can be used in its place.

![Diagram showing gas line configuration]

In this alternate configuration there is less need to regulate the carrier gas supply to the EPC module as close to the UNITY-xr supply pressure in order to get stable behaviour.
3.2.4 Cable connections

Connect the power cable (SERZ-0024).
Connect the UNITY-xr to the PC using the serial cable supplied in the shipping kit (SERZ-0189). If there are no available serial ports on the PC, use the USB-Serial cable (U-USBSR) provided.
Connect the GC cable. Depending upon the GC that is being used a different connection cable will be required:

SERUTE-5142 = AGILENT GC
SERUTE-5143 = THERMO GC
SERUTE-5144 = VARIAN GC
SERUTE-5141 = SHIMADZU / OTHER GC

3.3 Installing the Transfer Line

UNITY-xr is supplied with a universal transfer line (SERUTE-5330-xr) to convey desorbed analytes from UNITY-xr to a gas chromatograph or other analytical system. The sample path utilises a deactivated fused silica line (0.25 mm I.D. and 0.35 mm O.D.) heated over its entire length by means of a distributed heater and at the GC end by heat conduction from the GC oven. The line is 1.4 m long, which is sufficient to reach most gas chromatographs even when a mass spectrometer is attached.

NOTE: The parts supplied can be used in other combinations to suit particular instrument configurations.

3.3.1 Installing the Transfer Line onto the GC

There are two options for transfer line installation; one requires use of a hole in the top, side or back of the GC oven, while the other option is to gain access via an unused heated injector port.

Option 1 – Through Hole in Oven Wall

1. Locate a hole in the inner oven wall with a corresponding hole leading to the outside of the instrument.
2. Where necessary, displace the oven insulation material such that the transfer line heater can be fitted directly against the external face of the inner oven wall.
3. Place one of the washers provided in the UNITY-xr shipping kit on the external face of the inner oven wall, over the hole through which the transfer line will be passed.
   NOTE: A number of different washers are provided. The washer required will be determined by the hole in the oven through which the transfer line will pass.
4. Fit the GC end of the UNITY-xr transfer line through the hole in the washer and on through the hole in the GC oven wall such that the end of the heated section of transfer line is in contact with the washer and held tightly against the external face of the internal oven wall.
5. Place a second washer over the UNITY-xr transfer line so that it can be secured against the internal face of the GC oven wall.

6. Fit the clamp (SERUTD-1125) onto the transfer line, followed by the spacer (SERUTD-1232) secure with the M6 nut supplied with the transfer.
Option 2 – Through Heated Injector Port

**NOTE:** This option is only suitable if the inlet will not be required at any time.

1. Remove components from the injector (e.g. septum, liner etc.) to enable the transfer line to pass through unobstructed.

2. As the entry hole will generally be larger than the diameter of the metal line sleeve, one or more of the large washers supplied will be needed.

3. When in operation the injector body should be heated, and should be set to run at a temperature equal to the UNITY-xr flow path temperature setting.

3.3.2 *Installing the fused silica transfer line insert*

Once the heated line has been fitted to the GC, the fused silica plus associated PTFE sleeving (SERUTE-5099) (see shipping kit) are pushed from the GC end, along the 1/8-inch aluminium tube until they protrude from the other (UNITY-xr) end of the transfer line.

Trim the PTFE sleeve to ensure enough fused silica is exposed.
Connect the fused silica transfer line to the GC column with a press-fit (C-QSC10) or alternative connector.

1. Push fused silica back into sleeve

2. Cut away enough sleeve so that ~20cm fused silica is exposed at either end
3.3.3 Connecting the transfer line to UNITY-xr

Place UNITY-xr on the bench on the most convenient side of your gas chromatograph. Ensure that the transfer line will reach from the top of UNITY-xr to the selected entry point into the GC oven.

Ensure that UNITY-xr is switched off and cool. Remove the front top cover by pulling it up vertically.

Remove the heated valve shield by removing the two screws shown and then pulling it forwards and upwards.
Remove the back cover by sliding it backwards.

Place the 1/16 x 0.4 mm (U-FV001 (pk 10)) ferrule onto the union then thread the 1/16-inch stainless steel Swagelok type nut (SERZ-0157) on loosely.

Pull ~ 20 cm of fused silica from the PTFE line casing. Cut off the first few mm of fused silica using an approved capillary cutting tool.

Make a mark 20 mm from the end of the fused silica using typing white-out fluid or an alternative marker.

Gently feed the fused silica through the 1/16” nut and ferrule until the mark is reached.

Tighten the nut to trap the fused silica and then tighten a further 1/2 turn using one of the 8 mm wrenches (spanners) provided in the shipping kit.

Do not over tighten or the ferrule will become distorted.
Carefully bring the clamp plate, PTFE plate and shield tube down into the position with the shield tube covering the union nut.

The shield tube should be positioned such that the 1/16th side tubing projects though one of the cutouts.

Secure the transfer line to UNITY-xr using four M4 nuts.

Plug the 2 transfer line connectors highlighted into their respective sockets on the top deck of the instrument.
Insert the split filter tube (SERUTD-5065) and secure with the handle, ensure the heated valve assy. does not move. If it does move check the tube alignment. Replace the back cover.
### 3.4 Installing the cold trap

Ensure that UNITY-xr is switched off and cool. Remove the front top cover by pulling it vertically.

Remove the heated valve shield by removing the two screws shown and then pulling it forwards and upwards.

Remove the internal black cover by removing the screws highlighted and carefully pulling it upwards.
Loosen the screw at the bottom of the trap pneumatics assembly
Disconnect the 2 solenoid connections. Gently pull the trap pneumatic assembly towards the front of the instrument.
Once clear of the screw, pull the pneumatics up and off the brass guiding block and rotate to the right.

1. Place the trap alignment tool into the cold trap box.
2. The tool should pass smoothly up to the o-ring in the heated valve before further gentle pressure moves the tool another 1-2 mm.
   If the tool does not move smoothly past the point where it leaves the cold trap box there may be a misalignment problem.
3. Remove the trap alignment tool
   NEVER SWITCH UNITY-xr ON WITH THE TRAP ALIGNMENT TOOL INSTALLED
Holding onto the trap as close as possible to the cold trap box, gently push the trap into the cold trap box.

**DO NOT APPLY EXCESSIVE FORCE TO THE QUARTZ COLD TRAP.**

If in doubt practice with the trap alignment tool supplied in the shipping kit.

**NEVER SWITCH UNITY-xr ON WITH THE TRAP ALIGNMENT TOOL INSTALLED.**

Push the trap in until it passes the o-ring.

Bring the pneumatic assembly back down onto the brass guiding block and relocate the screw in the slot.

Push the assembly gently back in the horizontal plane, taking care to align the trap and stainless steel connector.

**MISALIGNMENT CAN CAUSE THE END OF THE QUARTZ TRAP TO SNAP**

Apply gentle steady pressure to push the trap into the sealing O-ring located inside the steel trap connector. If the pneumatics assembly does slide easily onto the cold trap remove trap pneumatics and check seating of the o-ring.

Keep hold of the pneumatics while re-tightening the screw firmly.

Refit all covers.

### 3.5 Check for gas leaks

Once the transfer line, split tube and trap have been installed, the carrier gas can be switched on (0-60psi depending on the GC column installed). Check for any leaks using available total flow readouts or/and by checking all connections with a helium detector.
Switch on the dry purge gas supply (recommended line pressure is 50-60psi). Check for any leaks by switching off the supply at the U-GAS01 or step down regulator and checking that the pressure gauge does not drop quickly.
4. Installing Markes Instrument Control (MIC) software

Locate the Markes Instrument Control (MIC) software CD supplied in the shipping kit. Insert the CD into the appropriate compartment of the PC and follow the instructions on the screen. Once the UNITY-xr software has been loaded onto your PC you can access the program from Start > Programs or install an appropriate shortcut.

All USB drivers should then be installed from the software CD by locating the appropriate driver executable files (.exe) and running.

4.1 System Configuration

There are two UNITY-xr instrument configurations available, the UNITY-xr with manual control and UNITY-xr with electronic control depending if MFC’s are installed.

The UNITY-xr can be installed as a stand-alone injector but also has the option of being upgraded and combined with other Markes accessories (ULTRA-xr, Air Server-xr, CIA Advantage-HL and the CIA Advantage-T). Any additional accessories added to the UNITY-xr will determine the system configuration and will need to be considered when configuring the software.

4.2 Running the software

4.2.1 Configuring the software

With the UNITY-xr switched off, start the software either by double clicking the MIC icon placed on the desktop or from Start > Programs.

The following Connecting window will appear, click Configure to open the Configuration page.

Highlight UNITY-xr from the available options section, and then click the right arrow to move the selection into the current configuration section. The list of available options will then update and allow the configuration of any additional accessories in the same way, if applicable.
Once the current configuration section is correct the communications port section will update and allow the default communications ports to be changed if necessary by clicking on the drop down box and then clicking on the correct Com port in the list.

The correct ports will depend on the PC setup and can be checked by opening up the device manager window on the PC. Make sure that the UNITY-xr coms cable is initially disconnected from the PC, when it is then plugged in the UNITY-xr com port will appear, make note of its com port and then ensure the correct one is selected in the instrument configuration page as shown. In the example below, there were initially no Com ports to show, then Com4 appeared when the UNITY-xr cable was connected.
To set up the MFC's and carrier gas options, click onto the **Gas and Flows** Tab.

Any MFC's detected will be shown, along with their address and available gases. To designate the MFC's, click on the drop down box for the MFC using Address 1 and select Unity Split then click on the drop down box for the MFC using Address 2 and select Unity Trap.

If no MFCs are present then the message ‘No MFCs Detected’ will be displayed on this tab.

Select the appropriate carrier gas, e.g. Helium, from those available in the carrier gas drop down box.

![Instrument configuration](image)

Click on the **GC Interface** Tab and check that the default logic is set correctly. Both GC start (out) and GC ready (in) should be as indicated on the labels attached to the GC cable. Check the correct operation of the GC ready signal. If the signal appears inverted i.e. software reports GC not ready when GC is ready, then change the GC Ready (In) logic.
After making any necessary changes in the **Configuration** or **Gas & flows** Tab click 'OK' and the following message appears, Click ‘OK’ to close the software.

On reopening the software will be correctly configured.
4.2.2 Detecting the UNITY-xr

Ensure that all gas supplies to the system - especially the dry air or nitrogen purge gas used for UNITY-xr valve actuation and purging the cold trap box - are on.

Having checked the above, switch UNITY-xr on using the switch located on the back panel of UNITY-xr.

If communications between the PC and UNITY-xr are established successfully the instrument status will change to Idle. If for some reason, communication is not established the instrument status will remain as Offline.

If for some reason, a configured instrument is not detected, the configuration page will automatically reopen. Ensure that the correct PC Com port is selected, click ‘OK’ twice and allow the software to close for configuration.
5. Installation qualification

5.1 Leak Testing

Right-click on the Instrument Status Icon and select ‘Direct Control’.

Load a tube into the tube oven and then click ‘Pressurise’ in the Manual Leak Test section. Once the pressure in the Markes TD status has stabilised, click ‘Leak Test’. Ensure the pressure does not fall at this stage to confirm the UNITY-xr is leak tight. Should the pressure fall, then a leak checking procedure should commence using a helium leak detector to determine the source of the leak. Resolve and re-test. Once the instrument is demonstrated to be leak tight, the cold trap should be conditioned.

5.2 Conditioning the cold trap

**CAUTION:** Do not exceed the cold trap temperature limits when conditioning the cold trap. Refer to the Trap Certificate supplied with the cold trap to confirm the maximum temperatures.

Click the Method Editor tile on the MIC home screen, open the Template Methods folder in the top left corner and choose the ‘TD-Trap Heat’ method to modify.
Ensure that there is a pre-trap fire purge time of at least 1.0 min and that the “Trap High (C)” is compatible with the temperatures given in the Trap Certificate. If any of the default settings are changed the software will prompt you to save it with a new method name.

Click the Sequencer tile on the MIC homepage, and run a blank sample. To select the appropriate Trap conditioning method (either the default method or a modified one if the conditions required are different from the default) double left click in the method column and choose from the list that appears.

NOTE: The tube number entered into the sequence becomes irrelevant when running a tube conditioning method.
5.3 System checkout

- With “Split On in Standby” selected of at least 20ml/min, ensure air/water background of MS is within operational limits.
- Confirm the calibration of any mass flow controllers is correct using a flow meter.
- Create a new TD- 2-3 stage desorb method using the parameters set out in documentation supplied with check standard QQR-0190.
- Using suitable GC(MS) parameters for the analysis of benzene, toluene, xylene, camphene and di-octyl phthalate run the check standard.
- Assess the results, comparing against the example chromatogram.
- If the customer GC conditions prevent analysis of this standard (e.g. the wrong GC column is installed), a customer standard should be run as an alternative.
- Right click on the Instrument status and select ‘System Info’. Create a copy of the calibration settings and record.
- Once all checks are complete, replace all covers.
6. Appendix

6.1 UNITY-xr Electronic Gas Control with the Agilent 6890GC

NOTE: To complete this installation the following 6890 parts are recommended. They can be ordered directly from Agilent.

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>G2131-80500</td>
<td>Replacement 2 port EPC block</td>
<td>1</td>
</tr>
<tr>
<td>1390-1022</td>
<td>Screw</td>
<td>1</td>
</tr>
</tbody>
</table>

However, if these parts are not available at installation both the carrier gas and septum purge lines running between the EPC module and the Split/Splitless injector must be cut and extended using 1/8” unions and green PEEK tubing in order to facilitate connection to UNITY-xr.

NOTE: When installing onto an existing 6890GC the firmware on the GC must be A.03.08 or later (for A-series) or N.04.09 (for N-series). To check the firmware version, use the keyboard on the GC, press > Options > Diagnostics > Instrument Status and then scroll down to ‘Version’ where you will see the version of the firmware running on the instrument.

6.1.1 Procedure

• Remove the top rear cover on the GC to provide access to the EPC module that is going to be used to regulate the carrier gas supply to UNITY-xr.

Removing the rear panel to access EPC modules

• Remove the 3 port EPC block assembly from the split/splitless EPC module.

• Fit the replacement EPC block assembly, and route the 1/16” tubing through the rear panel of the GC and towards the UNITY-xr.
Location of EPC module with the 2 port EPC block fitted

- If a replacement EPC block assembly is not available, the septum purge and carrier gas lines must be cut, extended, using 1/8" brass unions and 1/16" green PEEK tubing, and routed through the rear panel of the GC towards UNITY-xr. The lengths of PEEK tubing used should be no longer than required to reach the UNITY-xr.

Carrier and septum purge lines extended with unions and PEEK tubing

The stainless steel tubing for the carrier supply line is 1/16" while the septum purge line is 2 mm and will require a different ferrule when connected to the 1/8" brass union.

**NOTE:** two 1/8" brass unions, 3 m of 1/16" green PEEK tubing and 1/8" graphitized vespel ferrules, including one for 2 mm tubing, are all contained within the Agilent GC Installation Kit.

- Connect the carrier gas supply line to the ‘Carrier Inlet’ port of UNITY-xr and connect the septum purge line to the ‘Pressure Outlet’ port.

### 6.1.2 6890 inlet settings

Before the column pressure value is set, the MODE of operation of the inlet has to be configured.

For correct control of UNITY-xr the mode must be set only to SPLITLESS, and not split.

In addition the splitless purge time value must be set to 999.99 minutes directly through the keyboard of the GC (6890 firmware revision A.03.08 or later required). This value cannot be set using the
Chemstation software as the number is rounded to 1000.0 minutes. Setting this value forces the split/splitless inlet to remain permanently in the splitless mode.

The purge flow value is irrelevant. Once the split/splitless inlet has been configured as described the column head pressure can be setup to give the desired flow rate/velocity down the column.

6.2 \textbf{UNITY-xr Electronic Gas Control with the Agilent 7890GC}

\textbf{NOTE:} To complete this installation the following 7890 parts are recommended. They can be ordered directly from Agilent.

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>G3430-60011</td>
<td>Replacement hoodlum block assemblies</td>
<td>1</td>
</tr>
</tbody>
</table>

However, if these parts are not available at installation both the carrier gas and septum purge lines running between the EPC module and the Split/Splitless injector must be cut and extended using 1/8” unions and green PEEK tubing in order to facilitate connection to UNITY-xr.

6.2.1 \textbf{Procedure}

- Remove the top rear cover on the GC to provide access to the EPC module that is going to be used to regulate the carrier gas supply to UNITY-xr.

- Remove the two hoodlum block assemblies, for the carrier supply and septum purge lines, from the split/splitless EPC module.

![EPC Module viewed from above](image1)

![EPC Module viewed from rear](image2)

Location of fixing screws for bulkhead connectors

- Fit the two replacement hoodlum block assemblies, and route the 1/16” tubing on both of these assemblies through the rear panel of the GC and towards the UNITY-xr.

  \textbf{NOTE:} the carrier gas supply line has a 1/8” termination at the TD end while the septum purge line terminates in 1/16” tubing.

- If replacement hoodlum block assemblies are not available, the septum purge and carrier gas lines must be cut, extended, using 1/8” brass unions and 1/16” green PEEK tubing, and routed through the rear panel of the GC towards UNITY-xr. The lengths of PEEK tubing used should be no longer than required to reach the UNITY-xr.
Carrier and septum purge lines extended with unions and PEEK tubing

The stainless steel tubing for the carrier supply line is 1/16” while the septum purge line is 2mm and will require a different ferrule when connected to the 1/8” brass union.

**NOTE:** two 1/8” brass unions, 3 m of 1/16” green PEEK tubing and 1/8” graphitized vessel ferrules, including one for 2 mm tubing, are all contained within the UNITY-xr shipping kit.

- Connect the carrier gas supply line to the ‘Carrier Inlet’ port of UNITY-xr and connect the septum purge line to the ‘Pressure Outlet’ port.

### 6.2.2 7890 Inlet Setup

There are several settings that must be implemented on the 7890 whenever the split/splitless EPC module is controlling the carrier gas supply to the UNITY-xr thermal desorber. In the Inlet settings the mode must be set to ‘Splitless’, the purge time must be set to exactly ‘999.99’ minutes and Gas saver should be set to ‘Off’. In the Instrument Configuration menu the Auto prep run should be set to ‘Off’.

Having completed this, the system should now be ready to use.

### 6.2.3 7890 Inlet Settings

If the pressure is not correctly controlled after inputting the above settings then turn ‘Auto prep run’ to ‘On’.
6.3  **UNITY-xr Electronic Gas Control with the Shimadzu QP 2010 (Plus) GCMS fitted with AFC**

**NOTE:** To complete this installation the specialised GM - 1/16” fittings must be ordered directly from Shimadzu prior to the installation. The parts required are as follows:

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>221-35003</td>
<td>Shimadzu fitting GM-1.6L</td>
<td>1</td>
</tr>
<tr>
<td>221-35004-91</td>
<td>Shimadzu fitting GM-1.6L</td>
<td>1</td>
</tr>
<tr>
<td>228-16000-84</td>
<td>Ferrules</td>
<td>4</td>
</tr>
<tr>
<td>228-16002-84</td>
<td>Nuts</td>
<td>2</td>
</tr>
</tbody>
</table>

6.3.1  **Gas connections between UNITY-xr and the Shimadzu AFC**

- The Shimadzu GC is fitted with two molecular sieve filters, one in the carrier gas line and one in the septum purge line. Remove the filter from the carrier gas line and replace with the Shimadzu fitting GM-1.6L. The filter on the septum purge line should remain in place to prevent back diffusion of air/water.
• The carrier gas out line from the Shimadzu AFC (“CG Out”) is now connected to the “Carrier Inlet” port on the back of UNITY-xr using a 1 m length of green PEEK tubing.

• The “Pressure Outlet” from the back of UNITY-xr is now connected - with a similar length of green PEEK tubing - to the molecular sieve filter on the septum purge line (and hence to the (“SP In”)) on the Shimadzu AFC. It is important that the two lengths of green PEEK tubing are the same length. Carrier gas is supplied and regulated upstream of the system in the supply line and it’s pressure is monitored downstream of the system in the septum purge line.

6.3.2 Configuring the Shimadzu GC software

• The inlet Split Mode on the Shimadzu GC must be set to Direct.
  a. To access the Split Mode press the “FLOW” key on the GC keypad.

  NOTE:  In the case of GCs with two or more AFC units it may be necessary to press the “FLOW” key repeatedly until the correct one is displayed.

  b. Move the flashing cursor over the “Split Mode” (type using the arrow keys on the GC keypad).

  c. Using the right arrow key, select “DIRECT” mode as shown, and press the “ENTER” key on the GC keypad.

  ![Setting Inlet Mode as Direct on Shimadzu GC](image)

• The AFC module allows read out of the total flow supplied to system - this is ideal for setting split and trap / desorb flows and for troubleshooting leaks.
  d. To view the total flow supplied press the “FLOW” key on the GC keypad as above.
  
  e. The Total Flow in ml/min is always displayed (above the Split Mode) as shown above.

• The septum purge flow should be set to a flow rate of around 5 ml/min
  f. To set the septum purge flow display the “FLOW” screen as described above.

  g. Press the button to the right of the “PF3” key (below the screen) as shown below. This displays a second set of commands for the PF keys.
Extending the PF commands

h. Select the purge command on “PF3” and enter the desired value. A flow rate of 2-5 ml/min is recommended.

6.3.3 Flow stability

AFC works with both impeded (traps containing porous polymer e.g. Tenax) and un-impeded (traps only containing carbon sorbents) traps, with no carrier gas instability generally noted (even with 90-100 psi supplied to the inlet of the AFC system). However should any instability in the carrier gas occur it may be necessary to dampen the reaction of the AFC controller.

- Press the “FUNC” key on the GC keypad.
- Enter “7”, enter “5”, enter “1201”, enter “1”. This will display the “Flow Adjust” page.
- For instruments with two or more AFC units, press the “PF2” button to select the correct flow unit.
- Move the cursor to the “I Time” entry in the “Flow” column.
- Change the value from “1” to “4” then press the “Enter” key.
6.3.4 Ready / Start connections between UNITY-xr and Shimadzu GC

The remote cable connections between UNITY-xr and the GC are shown below. The UNITY-xr - GC cable (SERUTD-5095) has a 25-pin D-type connector at the UNITY-xr end and free wires at the GC end. Four wires need to be inserted into the connection block at the rear of the QP2010 as shown below.

![Diagram of connection block]

Ready / Start connections between UNITY-xr and QP 2010

When connected to the Shimadzu GCMS system the UNITY-xr ready (in) logic must be set to Open as shown below. To set the logic select view>options from the drop down menus to open the options dialogue box.

![Options dialogue box]

Setting the UNITY-xr GC Ready (in) logic to Open
6.4 UNITY-xr Electronic Gas Control with the Thermo DPFC

A UNITY-xr can be integrated into the DPFC system of a Thermo Trace Ultra or Focus GC. The DPFC module regulates the carrier gas supply upstream of the UNITY-xr and its pressure is monitored downstream of the system in the septum purge line of the DPFC module. The split line of the DPFC module remains unused.

6.4.1 Procedure

- The carrier gas supply and the septum purge lines that normally run from the DPFC to the split/splitless injector need to be cut and fitted with 1/8” brass unions (note: the carrier line requires use of graphitized vespel ferrule with the 2 mm hole – part number Z-0402).

- Extend these two lines with the length of green PEEK tubing so that they can reach the back panel of UNITY-xr. The carrier gas line from the DPFC module should be connected to the UNITY-xr ‘Carrier Inlet’ and the septum purge line should be connected to the ‘Pressure Outlet’.

![Schematic of connections made between DPFC module and UNITY-xr](image)

6.4.2 Configuring the Thermo GC software

Having completed the physical connection between the Thermo Focus or Trace GC and UNITY-xr the next step is to configure the inlet settings.

- The GC must be set up for back pressure regulation. To do this the DPFC must be removed and the switches set in the correct position for purge & trap. Setting up this configuration is described in the kit adapter for the purge and trap concentrator system installation guide.

- The inlet that is being used to control the UNITY-xr carrier gas supply should then be set to operate in split mode but the split flow should be set to zero (off).

- The only other important consideration is to ensure that the pressure of the carrier gas supplied to the DPFC module is only 10-15 psi greater than the pressure that the DPFC module is required to supply to UNITY-xr.
6.5 **UNITY-xr Electronic Gas Control with the Thermo 1300 Series GC**

A UNITY-xr can experience electronic pressure control using the Thermo 1300 series GC. Currently, full ECC control is not available, but the Thermo 1300 Series GC can be modified to supply a constant pressure or flow to the UNITY-xr. The UNITY-xr must be configured in the T’d EPC configuration (see section 3.2.3).

This setup enables carrier gas settings to be stored and recalled as part of the GC(MS) method and allows constant flow GC methods to be implemented. The solution is to install a standard Thermo Scientific headspace adapter onto a S/SL inlet (p/n 19050732; TriPlus 300 HS adapter kit for Instant connect SSL module). The carrier gas supply from this can be used to provide constant flow carrier gas supply to the GC as described in the note below.

**Note:** Changing split conditions on the TD or changing the trap hold time from one run to the next may change the relative retention times of early eluting compounds.

6.5.1 **Installing the Markes TD to the Thermo Scientific TRACE Series 1300 GC**

Carrier gas should be supplied via a GAS01 regulator or similar step down regulator to the inlet for the S/SL module. The carrier gas pressure should be supplied at no more than 10psi above the maximum pressure required during the GC oven program.

The TD transfer line should pass through an unused injector/detector port or through a modified panel on the right hand side of the TRACE Series 1300 GC and secured inside the oven. The fused silica can then be connected to the column via a glass QuickSeal connector or zero dead volume connector.

A standard Thermo Scientific Headspace adapter should be fitted on to the S/SL inlet. Connect a length of 1/16” tubing (shorter is better and stainless steel is preferred to PEEK on GCMS) to the port of the headspace adapter. Connect the other end of the 1/16” tubing to the carrier gas inlet on the rear of the TD. The underside (outlet) of the S/SL injector in the GC oven should be fitted with a blanking ferrule or nut.
Positioning of headspace adapter and attachment of 1/16" tubing from GC to TD.

This configuration provides simple forward pressure regulated carrier gas supply to the TD enabling constant pressure and constant flow carrier gas GC methods. An overall schematic is shown below.

Schematic of use of headspace adapter to supply carrier gas to the TD.
The GC inlet should be set up in the software in split mode with the split flow turned off to enable correct functioning of the S/SL module as shown below.

Example GC S/SL inlet configuration for S/SL control of carrier gas supply to the TD.
6.6 Testing the ECC setup

Once the connections and inlet settings have been correctly set up it is extremely important that the following test of the ECC carrier gas supply is carried out:

During the desorption of the UNITY-xr cold trap the total flow and pressure supply of the ECC module should be monitored. Both pressure and flow readings should be stable.

If there is any variation in the pressure reading of the ECC module, or if the flow fluctuates by more than 3mL/min, this indicates that the setup is not optimized. In such circumstances the reproducibility of analysis is likely to be poor.

ECC instability during trap desorption

Such fluctuations can normally be avoided by regulating the carrier gas supply to the ECC module to 10 psi above the greatest pressure required by the UNITY-xr in the course of a run, see below. This is almost always effective in removing any instability when using a constant pressure method, but may not be effective for constant flow methods.

Correct Setup of ECC Supply

In situations where the pressure and/or flow are unstable despite the appropriate regulation of the carrier gas supply there is an alternative configuration that should be employed. (Refer to section 3 for further information and installation instructions.)