

# Combustion-IC-System



## Manual – Short Instructions

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# **Combustion-IC-System**

## **Manual – Short Instructions**

Technical Communication  
Metrohm AG  
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# 1 About these short instructions

These Short Instructions contain important information about the Combustion IC system. In addition to an introduction and safety instructions, you can find a description of the Combustion IC system and information on installing the 920 Absorber Module and its interfaces to the Combustion-IC-System. You can download the detailed manual for the 920 Absorber Module as a PDF file from the Internet (<https://www.metrohm.com>).



## 2 Introduction

### 2.1 The Combustion IC system

#### 2.1.1 Overview

Combustion is a sample preparation technique that uses burning to digest a sample. Solid, liquid and gaseous samples that are flammable can be digested using combustion. Combustion IC is particularly suited for determining the following elements:

	1	2	13	14	15	16	17	18
	Ia							VIIa
1 (K)	001 H 1.00794	IIa	IIIa	IVa	Va	VIa	VIIa	002 He 4.002602
2 (L)	003 Li 6.941	004 Be 9.012182	005 B 10.811	006 C 12.0107	007 N 14.00674	008 O 15.9994	009 F 18.998403	010 Ne 20.1797
3 (M)	011 Na 22.98977	012 Mg 24.305	013 Al 26.981538	014 Si 28.0855	015 P 30.973761	016 S 32.066	017 Cl 35.4527	018 Ar 39.948
4 (N)	019 K 39.0983	020 Ca 40.078	031 Ga 69.723	032 Ge 72.61	033 As 74.9216	034 Se 78.96	035 Br 79.904	036 Kr 83.8
5 (O)	037 Rb 85.4678	038 Sr 87.62	049 In 114.818	050 Sn 118.71	051 Sb 121.76	052 Te 127.6	053 I 126.90447	054 Xe 131.29
6 (P)	055 Cs 132.90545	056 Ba 137.327	081 Tl 204.3833	082 Pb 207.2	083 Bi 208.98038	084 Po [209]	085 At [210]	086 Rn [222]
7 (Q)	087 Fr [223]	088 Ra [226]	113 Uut [287]	114 Uuq [289]	115 Uup [288]	116 Uuh [292]	117 Uus	118 Uuo

Figure 1 Detectable elements

An additional instrument is required for the determination of gaseous samples: the LPG/GSS Module (AJ) (2.136.0720) or the GLS Sampler CIC (TEI) (2.0136.0630).

## 2.1.2 System description

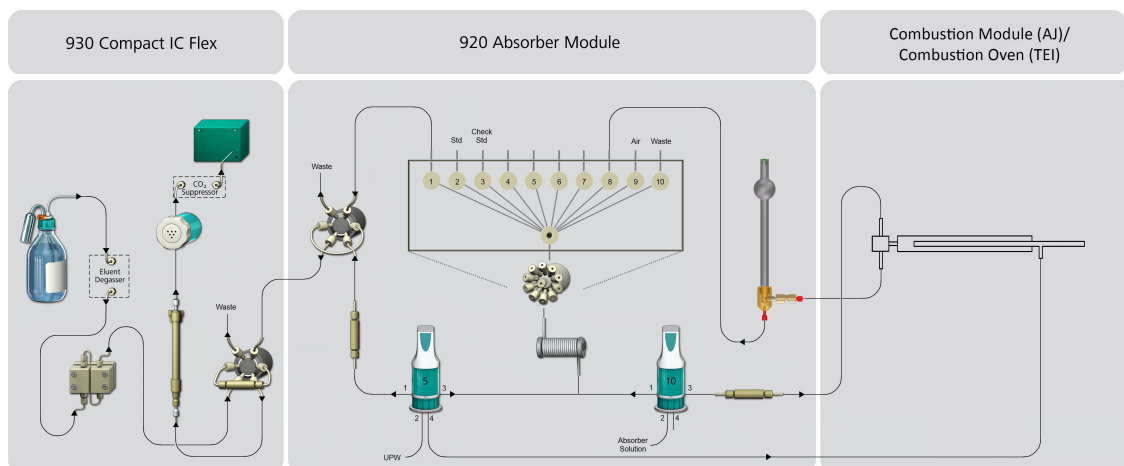


Figure 2 Overview – CIC system

The sample is combusted in the Combustion Module (AJ) / Combustion Oven (TEI).

The gases generated during combustion are dissolved into an absorber solution in the 920 Absorber Module and are optimized for analysis using suitable sample preparation techniques.

In the end, the absorption solution is preconcentrated in an ion chromatograph and analyzed.

The entire process is controlled and monitored using MagIC Net software. The analysis data is saved in the software's database.

## 2.1.3 Sequence of a determination

A determination in the Combustion IC system runs according to the following diagram:

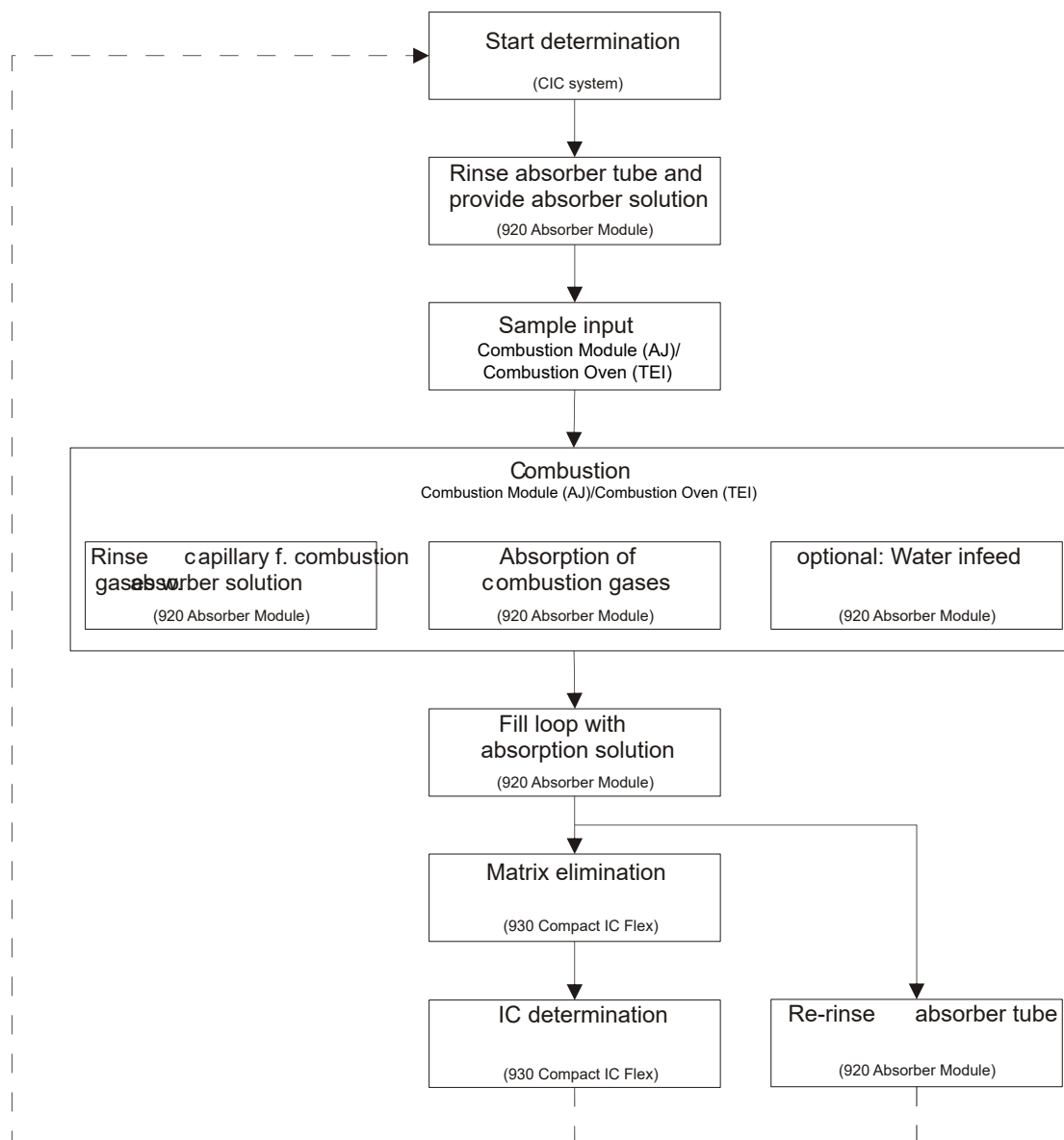


Figure 3 Sequence of the determination



#### NOTE

##### Do not mix these up!

- **Absorber solution:** e.g.  $\text{H}_2\text{O}_2$  solution for oxidizing sulfur oxides.
- **Absorption solution:** Combustion gases dissolved in the absorber solution.

The determination is controlled entirely by MagIC Net. You can find a detailed description of the sequence in the online help for MagIC Net under the title "Combustion sequence".

## 2.2 Intended use

The present system is suitable for processing chemicals and flammable samples. Usage of the Combustion IC system therefore requires the user to have basic knowledge and experience in handling toxic and caustic substances. Knowledge regarding the application of fire prevention measures prescribed for laboratories is also mandatory.

## 2.3 Safety instructions

### 2.3.1 General notes on safety



#### WARNING

---

Operate this instrument only according to the information contained in this documentation.

This instrument left the factory in a flawless state in terms of technical safety. To maintain this state and ensure non-hazardous operation of the instrument, the following instructions must be observed carefully.

### 2.3.2 Electrical safety

The electrical safety when working with the instrument is ensured as part of the international standard IEC 61010.



#### WARNING

---

Only personnel qualified by Metrohm are authorized to carry out service work on electronic components.



#### WARNING

---

Never open the housing of the instrument. The instrument could be damaged by this. There is also a risk of serious injury if live components are touched.

There are no parts inside the housing which can be serviced or replaced by the user.



### 2.3.4 Flammable solvents and chemicals

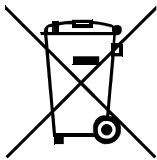


#### WARNING

All relevant safety measures are to be observed when working with flammable solvents and chemicals.

- Set up the instrument in a well-ventilated location (e.g. fume cupboard).
- Keep all sources of flame far from the workplace.
- Clean up spilled liquids and solids immediately.
- Follow the safety instructions of the chemical manufacturer.

### 2.3.5 Recycling and disposal



Properly dispose of chemicals and of the product to reduce negative effects on the environment and public health. Local authorities, waste disposal companies or dealers provide more detailed information on disposal. Observe the WEEE EU directive (WEEE = Waste Electrical and Electronic Equipment) for the proper disposal of waste electronic equipment within the European Union.



Capillaries and tubings

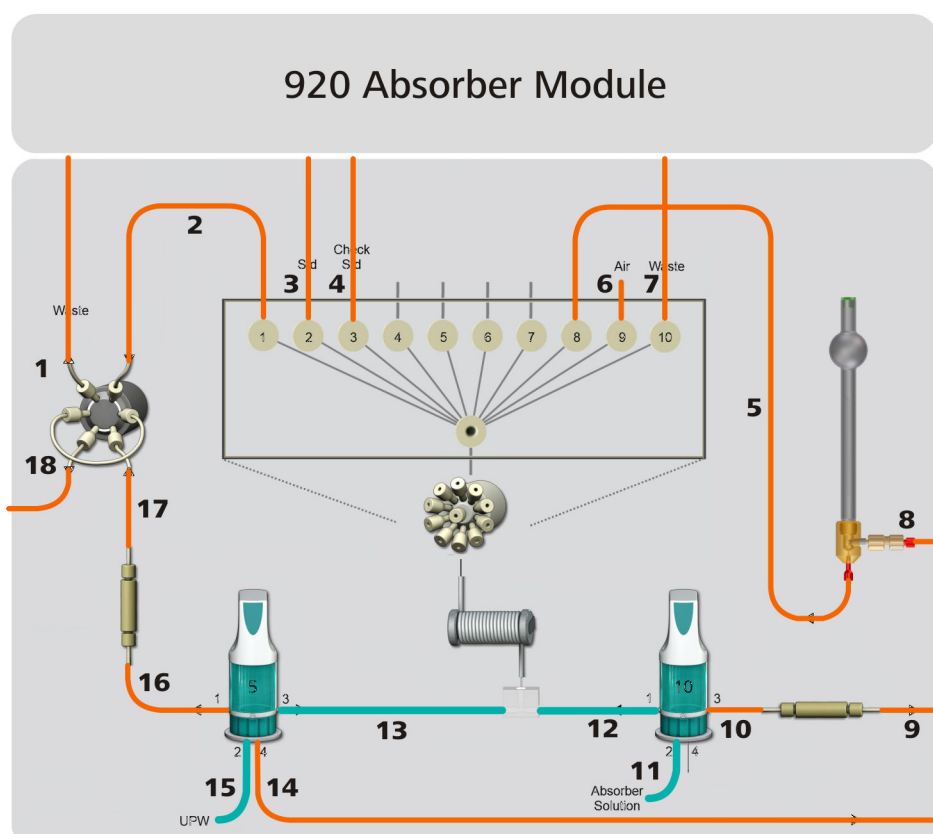


Figure 4 Capillaries and tubings in use – Overview

**1 PTFE capillary, 0.75 mm ID / 3 m (6.1803.160)**  
Connection between the 6-port valve and the waste container.

**3 PTFE capillary, 0.75 mm ID / 3 m (6.1803.160)**  
Approx. 80 cm. Connection between the 10-port valve and the bottle with the standard solution.

**5 PTFE capillary, 0.75 mm ID / 3 m (6.1803.160)**  
Approx. 60 cm. Connection between the 10-port valve and the absorber tube.

**7 PTFE capillary, 0.75 mm ID / 3 m (6.1803.160)**  
Connection between the 10-port valve and the waste container.

**2 PEEK capillary, 0.5 mm ID / 15 cm (6.1831.040)**  
Connection between the 6-port valve and the 10-port valve.

**4 PTFE capillary, 0.75 mm ID / 3 m (6.1803.160)**  
Approx. 80 cm. Connection between the 10-port valve and the bottle with the check standard.

**6 PTFE capillary, 0.75 mm ID / 3 m (6.1803.160)**  
Approx. 5 cm. For aspirating air segments.

**8 Combustion Module (AJ): PTFE capillary 1/8 in. OD / 1/16 in. ID / 1.5 m | Combustion Oven (TEI): PTFE capillary 1/8 in. OD / 1/16 in. ID / 5 m**  
Connection between the absorber tube and the Combustion Module (AJ) / Combustion Oven (TEI).



<p><b>9 Combustion Module (AJ): PTFE capillary 0.5 mm ID / 3 m (6.1803.030)   Combustion Oven (TEI): PTFE capillary 0.8 mm ID / 2.5 m (capillary absorber solution)</b> Connection between the Metrosep A Trap 1 - 100/4.0 trap column (6.1014.000) and the Combustion Module (AJ) / Combustion Oven (TEI).</p>	<p><b>10 PTFE capillary, 0.5 mm ID / 3 m (6.1803.030)</b> Approx. 20 cm. Connection between the Dosino with the absorber solution and the Metrosep A Trap 1 - 100/4.0 trap column (6.1014.000).</p>
<p><b>11 FEP tubing M6 for 920 150 cm (6.1805.030) with FEP aspiration tubing (6.1819.100)</b> Aspiration tubing for the absorber solution. Connection between the Dosino with the absorber solution and the bottle with the absorber solution.</p>	<p><b>12 FEP tubing M6 for 920, 13 cm (6.1805.010)</b> Connection between the Dosino with the absorber solution and the T connector.</p>
<p><b>13 FEP tubing M6 for 920, 13 cm (6.1805.010)</b> Connection between the Dosino with ultrapure water and the T connector.</p>	<p><b>14 Combustion Module (AJ): PTFE capillary 0.5 mm ID / 3 m (6.1803.030)   Combustion Oven (TEI): PTFE capillary 0.8 mm ID / 2.5 m (6.07311.310)</b> Connection between the Dosino with ultrapure water and the Combustion Module (AJ) / Combustion Oven (TEI).</p>
<p><b>15 FEP tubing M6 for 920 150 cm (6.1805.030) with FEP aspiration tubing (6.1819.100)</b> Aspiration tubing for ultrapure water. Connection between the Dosino with the water bottle.</p>	<p><b>16 PTFE capillary, 0.5 mm ID / 3 m (6.1803.030)</b> Approx. 30 cm. Connection between the Dosino with ultrapure water and the Metrosep I Trap 1 - 100/4.0 trap column (6.1014.200).</p>
<p><b>17 PTFE capillary, 0.5 mm ID / 3 m (6.1803.030)</b> Approx. 40 cm. Connection between the Metrosep I Trap 1 - 100/4.0 trap column (6.1014.200) and the 6-port valve.</p>	<p><b>18 PTFE capillary, 0.5 mm ID / 3 m (6.1803.030)</b> Connection between the 6-port valve and the 930 Compact IC Flex.</p>

### Colored sleeves

Different liquids move throughout the 920 Absorber Module. In order to provide you an overview of the different flow paths, we recommend using the provided colored sleeves as follows to code the capillaries that route the distinct liquids:

Table 1 Recommended color codes for the flow paths

Liquid	Colored sleeve
Ultrapure water	blue

Liquid	Colored sleeve
Absorber solution	yellow
Standard solution	black
Check standard	red
Waste	white

**NOTE**

The colored sleeves are heat-shrink tubing; this means they shrink when they are exposed to heat.

Slip the colored sleeve over the capillary and secure it to the desired spot by heating it, for example by using a hairdryer.

## 3.2 Dosino for ultrapure water

### 3.2.1 Connecting the ports – Overview

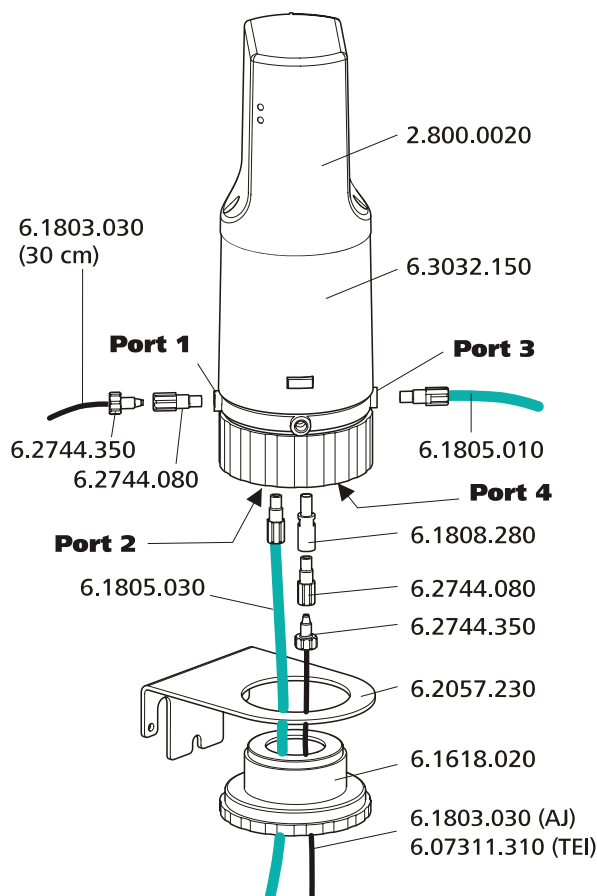


Figure 5 Connect the Dosino for ultrapure water



Next steps

Connect capillary/ tubing at port ...	... to
1	Metrosep I Trap 1 - 100/4.0 (6.1014.200) trap column inlet
2	Water bottle
3	T connector (6.1808.060)
4	Combustion oven inlet (see chapter 3.6.1, page 16)

You can find detailed instructions in the manual for the 920 Absorber Module.

### 3.3 Dosino for the absorber solution

#### 3.3.1 Connecting the ports – Overview

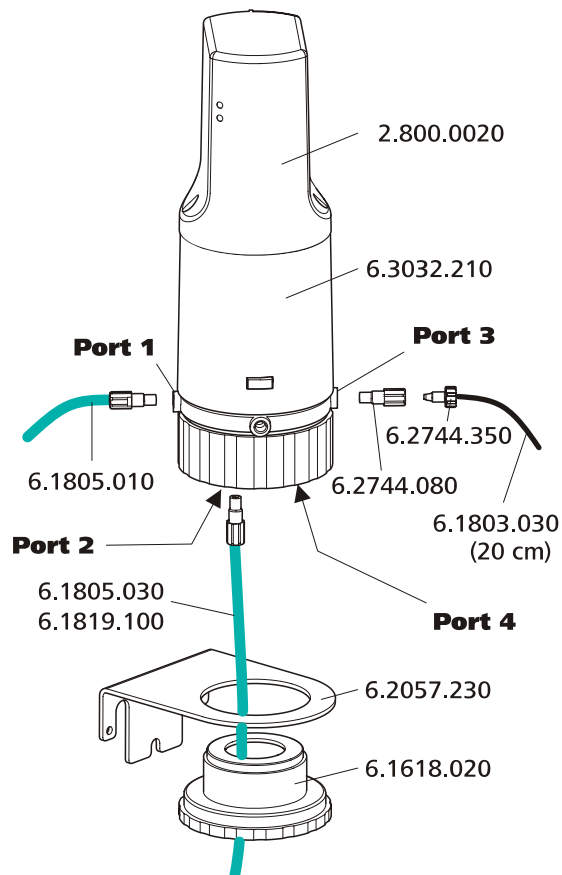


Figure 6 Connect the Dosino for the absorber solution

Next steps

Connect capillary/ tubing at port ...	... to
1	T connector (6.1808.060)
2	Bottle with the absorber solution
3	Connect the Metrosep A Trap 1 – 100/4.0 inlet

You can find detailed instructions in the manual for the 920 Absorber Module.

### 3.4 10-port-valve

#### 3.4.1 Connecting the ports

The transfer tubing and capillaries for all of the liquids being used are connected to the 10-port valve.

#### Connecting the 10-port valve

Connect the ports of the 10-port valve according to the following figure:



#### NOTE

We recommend connecting the central port first.

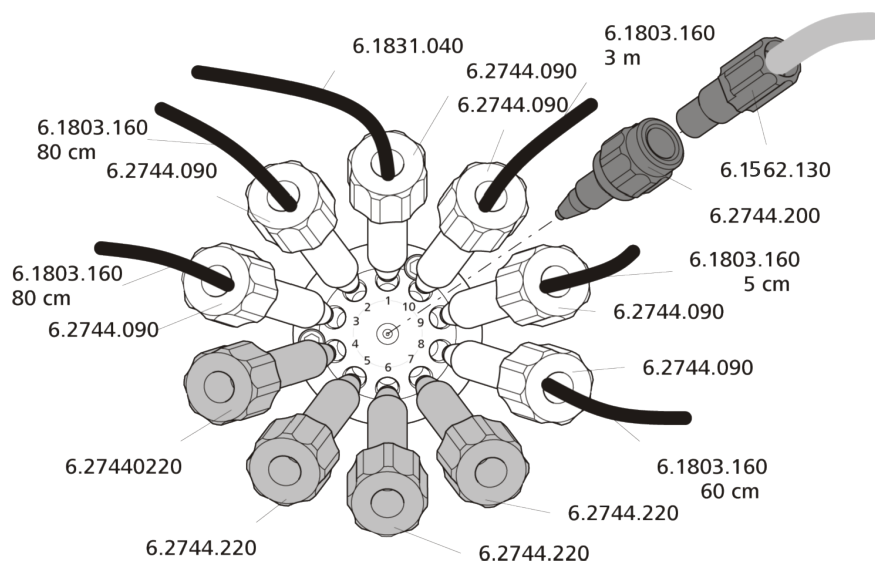


Figure 7 Connecting the 10-port valve



Next step

Connect capillary/ tubing at port ...	... to
1	6-port valve (see chapter 3.5, page 14)
2	Bottle with standard solution
3	Bottle with check standard
8	Absorber tube
10	Waste container

You can find detailed instructions in the manual for the 920 Absorber Module.

## 3.5 6-port valve

### 3.5.1 Connecting the ports

#### Connecting the 6-port valve

Connect the ports of the 6-port valve according to the following figure:

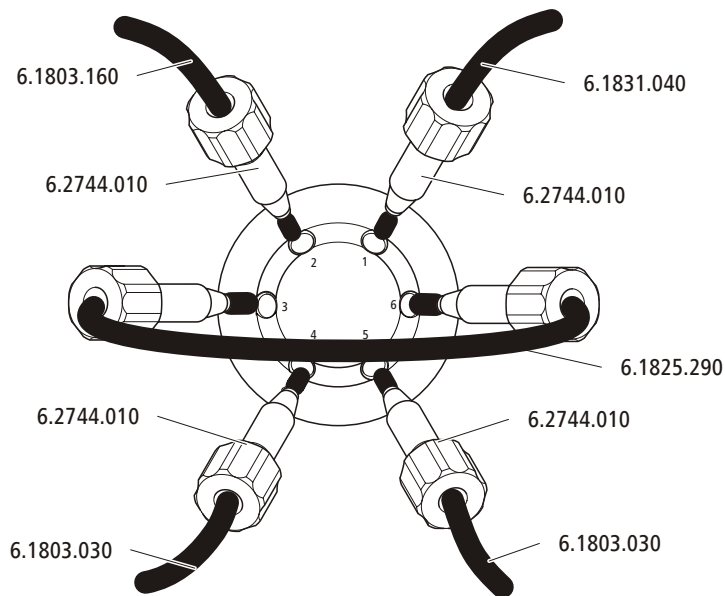


Figure 8 Connecting the 6-port valve

Next steps

Connect capillary/ tubing at port ...	... to
2	Waste container

Connect capillary/ tubing at port ...	... to
4	930 Compact IC Flex ( <i>see chapter 3.6.5, page 21</i> )
5	Metrosep I Trap1 - 100/4.0 (6.1014.200)

You can find detailed instructions in the manual for the 920 Absorber Module.

## 3.6 Connecting the 920 Absorber Module to the remaining components

### Combustion Module (AJ)

Three capillaries are routed out at the right side of the Combustion-IC-System.

- The capillary connected to port 4 of the Dosino for ultrapure water is marked with a blue colored sleeve.
- The capillary connected to the outlet of the Metrosep A Trap 1 – 100/4.0 is marked with a yellow colored sleeve.
- The thicker capillary installed at the inlet of the absorber tube is routed out under the door.

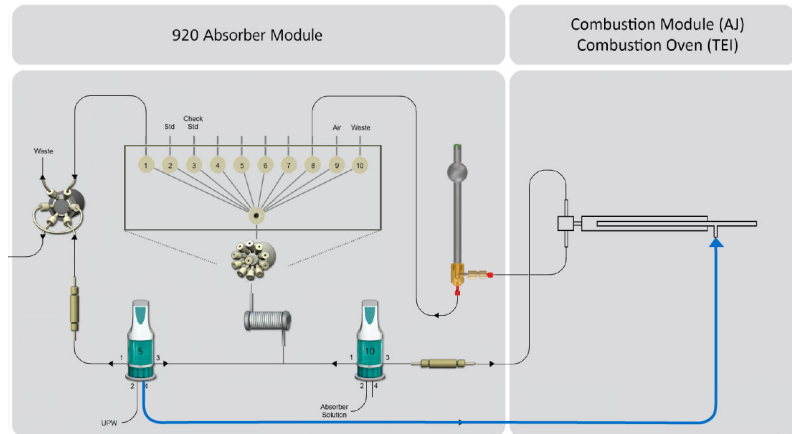
### Combustion Oven (TEI)

Three capillaries are routed out at the back and/or left side of the Combustion Oven (TEI).

- The capillary connected to port 4 of the Dosino for ultrapure water is marked with a blue colored sleeve. The capillary is part of 6.07311.310. The other end of the capillary is already connected.
- The capillary connected to the outlet of the Metrosep A Trap 1 – 100/4.0 is marked with a yellow colored sleeve. The other end of the capillary is already connected to the oven outlet.
- The thicker capillary installed at the inlet of the absorber tube is routed out at the rear. The other end of the capillary is already connected to the oven outlet.



### 3.6.1 Connecting the Combustion Module (AJ) inlet: water infeed



#### Connecting the capillary for the water infeed at the inlet of the combustion tube

##### 1 Feeding the capillary into the Combustion Module (AJ)

Feed the capillary with the blue colored sleeve into the inside through the round opening up on the left side wall of the Combustion Module (AJ) and route it to the right side of the Combustion Module (see Chapter "Installing the Combustion Module after transportation or storage" in the Combustion Module operating instructions).

##### 2 Shortening the capillary

Shorten the capillary using the capillary cutter so that it can be connected to the combustion tube's inlet easily.

##### 3 Connecting the capillary

Three connections are located at the combustion tube's inlet:

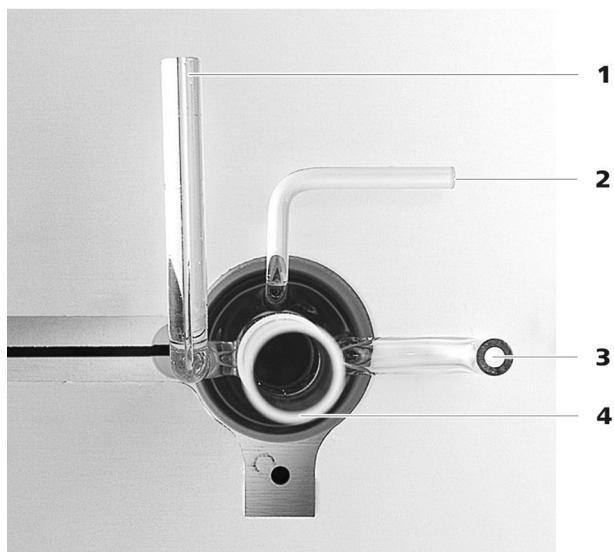


Figure 9 Combustion tube – Inlet

**1 Water infeed inlet**

Connection for the capillary with the blue colored sleeve (4-**14**).

**2 Flame sensor connection**

Connection for the flame sensor.

**3 Oxygen infeed**

Connection for the oxygen infeed.

**4 Sample inlet**

Solid and liquid samples: inlet for sample boats.

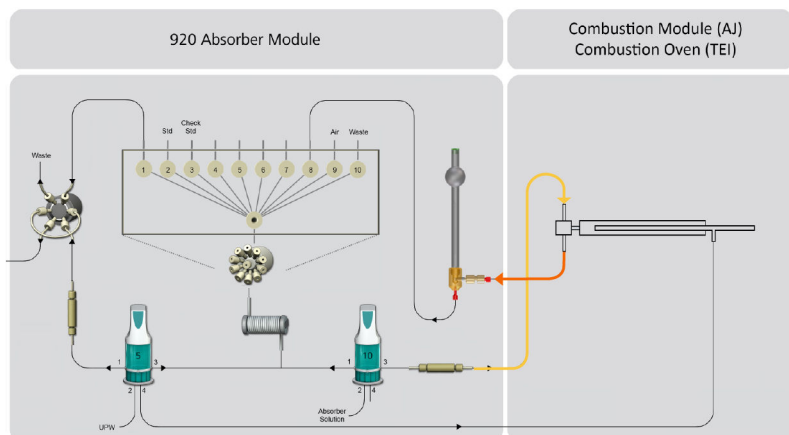
Gaseous samples: connection of the LPG/GSS module.

- Plug the capillary into a FAST connector (*see Chapter "Replacing tubing connections" in the Combustion Module operating instructions*).
- Carefully attach the FAST connector to the connector (9-**1**).

You can find information on connecting the flame sensor, the oxygen infeed and the ABD in the Combustion Module (AJ) operating instructions.



### 3.6.2 Connecting the Combustion Module (AJ) outlet: absorber solution



The capillary with the yellow colored sleeve and the thicker capillary are connected to the CIC T connector in the Combustion Module (AJ).

There are 2 connections on the CIC T connector in the Combustion Module (AJ):

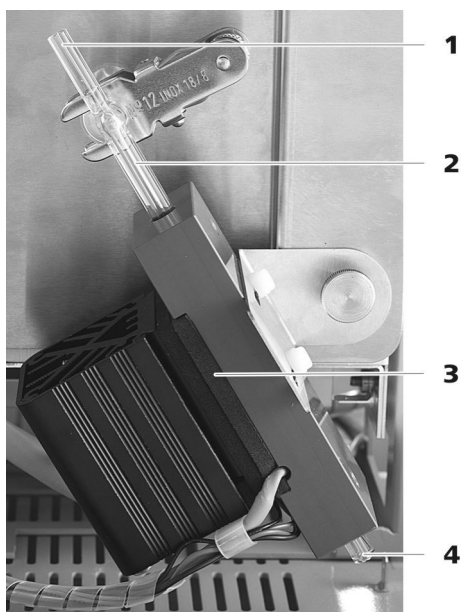


Figure 10 Combustion tube – Outlet

<p><b>1 Absorber solution connection</b> Connection for the capillary with the yellow colored sleeve (4-9).</p>	<p><b>2 T connector CIC (6.7301.210)</b> T connector on the combustion tube's outlet. For feeding the absorber solution in and removing the combustion gases.</p>
<p><b>3 Peltier cooler</b> For cooling the combustion gases at the combustion tube's outlet.</p>	<p><b>4 Combustion gases connector</b> Connector for the PTFE capillary, 1/8 in. / 1/16 in. ID / 1.5 m (6.1803.130) (4-8).</p>

### Connecting the capillary for the combustion gases

#### 1 Feeding the capillary into the Combustion Module (AJ)

- Push the loose end of the PTFE capillary 1/8 in. / 1/16 in. ID / 1.5 m (6.1803.130) (4-8) through the opening in the right-side door of the 920 Absorber Module.
- Guide the capillary inside through the round opening in the bottom of the Combustion Module (AJ).

#### 2 Shortening the capillary

Shorten the capillary using the capillary cutter so that it can be connected to the CIC T connector's outlet (10-4) easily.

#### 3 Connecting the capillary

- Insert the capillary into an angled FAST connector (6.7304.000).
- Carefully attach the FAST connector to the CIC T connector's outlet (10-4).

### Connecting the capillary for the absorber solution

#### 1 Feeding the capillary into the Combustion Module (AJ)

Guide the loose end of the capillary with the yellow colored sleeve inside through the round opening at the top in the left-side wall of the Combustion Module (AJ).

#### 2 Shortening the capillary

Shorten the capillary using the capillary cutter so that it can be connected to the CIC T connector's outlet (10-1) easily.

#### 3 Connecting the capillary

- Plug the capillary into a straight FAST connector (6.7304.010) (see Chapter "Replacing tubing connections" in the Combustion Module operating instructions).
- Carefully attach the FAST connector to the CIC T connector's outlet (10-1).



### 3.6.4 Connecting the Combustion Oven (TEI) outlet

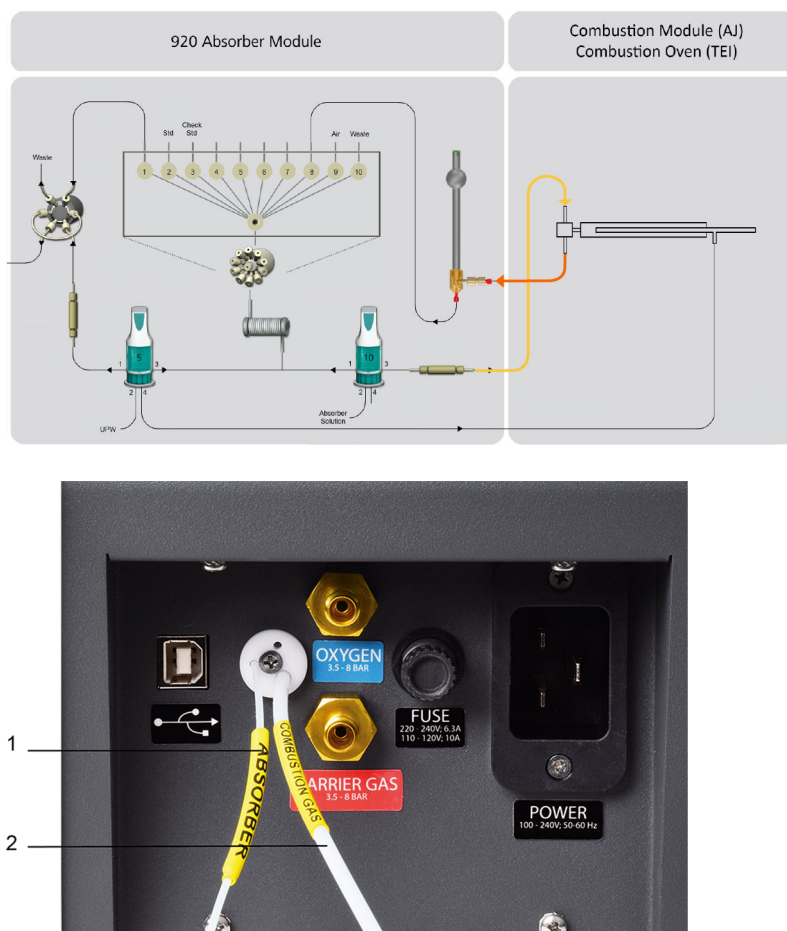


Figure 12 Combustion Oven (TEI) – Outlet

**1 Absorber solution capillary**

Capillary for the infeed of absorber solution at the tube outlet.

**2 Combustion gases capillary**

Capillary for transporting the combustion gases from the tube outlet to the absorber tube.

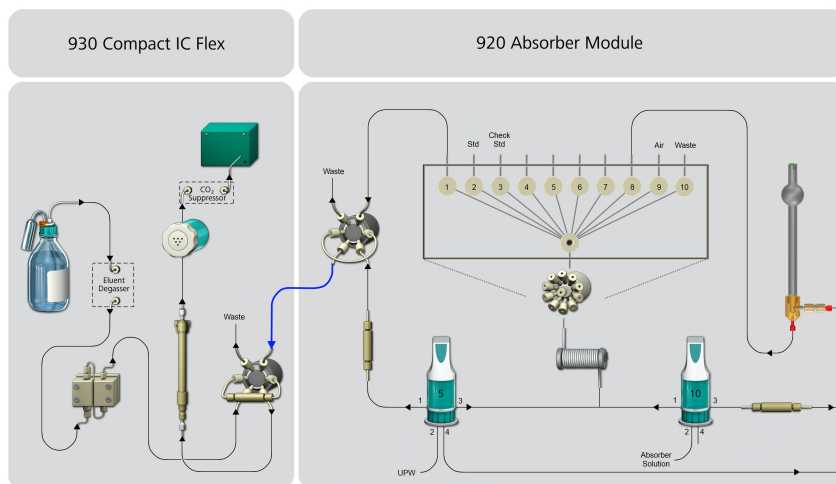
### 3.6.5 Connecting the 930 Compact IC Flex

Combustion Module (AJ): A capillary is routed out on the left side of the 920 Absorber Module.

Combustion Oven (TEI): A capillary is routed out on the right side of the 920 Absorber Module.

This capillary is connected to the injection valve of the 930 Compact IC Flex.

### 3.6 Connecting the 920 Absorber Module to the remaining components



#### Accessories

For this step you need:

- Capillary cutter (6.2621.080)

#### Connecting the 930 Compact IC Flex

- 1 ▪ Shorten the end of the capillary using the capillary cutter so that it can be connected to the injection valve of the 930 Compact IC Flex easily.
  - Connect the end of the capillary to port 1 of the injection valve (see manual for 930 Compact IC Flex).

**NOTE**

The process for connecting the respective instruments to a computer or a power supply is described in the respective manuals:

- 930 Compact IC Flex manual.
- 920 Absorber Module manual.
- Combustion Module (AJ) operating instructions (on the accompanying CD).
- Autosampler MMS 5000 (AJ) operating instructions (on the accompanying CD).
- LPG/GSS Module (AJ) manual (on the accompanying CD).
- Combustion Oven (TEI) manual (on the accompanying USB flash drive).
- Liquid Autosampler CIC (TEI) manual (on the accompanying USB flash drive)
- Solid Autosampler CIC (TEI) manual (on the accompanying USB flash drive).
- GLS Sampler CIC (TEI) manual (on the accompanying USB flash drive).

## 3.7 Connecting the LPG/GSS Module

The LPG/GSS Module is used for feeding gaseous samples to the Combustion Module.

The LPG/GSS Module can be connected to the Combustion Module in two ways:

- Connection to the ABD  
See the manual for the LPG/GSS Module for instructions
- Connection directly to the inlet of the combustion tube

### Connecting the LPG/GSS Module to the combustion tube

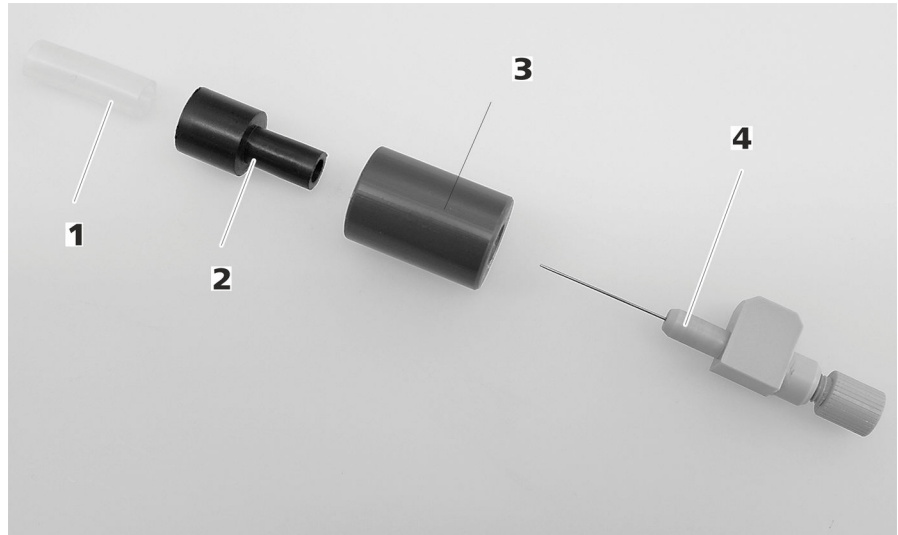
#### Prerequisites

- The Combustion Module and the LPG/GSS Module have to be switched off.

#### Accessories

- Oven coupling for LPG/GSS (6.730.4030)

- 1 Disassemble the individual components of the adapter.



<b>1</b>	<b>Protective sleeve</b>
<b>3</b>	<b>Plastic sleeve</b>

<b>2</b>	<b>FAST connector</b>
<b>4</b>	<b>Injection needle</b>

**2** Attach the FAST connector to the inlet of the combustion tube.



**3** Attach the plastic sleeve to the FAST connector.



**4** Insert the injection needle into the FAST connector.



## 4 Start-up

All of the Combustion IC system components have to be completely installed before putting the 920 Absorber Module into operation; this means:

- The Combustion Module including ABD and optional sampler (MMS 5000) and, if necessary, the LPG/GSS Module is installed according to the specifications in the Combustion IC operating instructions from Analytik Jena/TEI.
- The Combustion Oven (TEI) including, if applicable, Liquid Autosampler CIC, Solid Autosampler CIC and/or GLS Autosampler CIC from Trace Elemental Instruments is installed according to the operating instructions.
- The 920 Absorber Module is installed according to the specifications in the manual for the 920 Absorber Module and is connected to the Combustion Module (AJ) / Combustion Oven (TEI).
- The 930 Compact IC Flex (2.930.2560) is installed according to the specifications in the manual for the ion chromatograph and is connected to the 920 Absorber Module.
- The ion chromatograph is connected to a computer where the MagIC Net software and TEIS are installed. TEIS is only necessary for the Combustion Oven (TEI).

### Putting the Combustion IC system (AJ) into operation

#### 1 Starting the software

- Switch on the computer and start the software MagIC Net.
- Enter user name and password.

The software starts and shows the **Workplace** program part.

#### 2 Switching on the instruments

- Switch on the Combustion Module (AJ): the Combustion Module (AJ) and the MMS 5000 sampler (AJ) or the LPG/GSS Module (AJ), if present.
- Switch on the Combustion-IC-System.
- Switch on the ion chromatograph.  
MagIC Net detects all of the instruments and asks if they are to be saved to the device table.
- Confirm all of the prompts with **[Yes]**.

**NOTE**

It can sometimes happen that an instrument is not automatically recognized when it is newly connected to an existing system.

When an instrument is not automatically recognized, then the "basic initialization" has to be run in MagIC Net. Additional information concerning the basic initialization can be found in the MagIC Net online help or in the MagIC Net manual.

**3 Loading the method****Workplace ► Run**

- Select the **Equilibration** tab.
- In the **Method** field, load the **Preparation of Combustion IC** method.

**4 Starting the equilibration**

- Start the equilibration with **[Start HW]**.

The instrument is ready to measure as soon as equilibration has finished.

**Putting the Combustion IC system (TEI) into operation****1 Starting the software**

- Switch on the computer and start the MagIC Net software and TEIS.
- Enter the user name and the password in each software.

MagIC Net: The software starts and shows the **Workplace** program part.

TEIS: The software starts and shows the **Task Manager** program part.

**2 Switching on the instruments**

- Switch on the Combustion Oven (TEI) and the Liquid Autosampler CIC (TEI), Solid Autosampler CIC (TEI) or the GLS Sampler CIC (TEI), if present.
- Switch on the ion chromatograph and the 920 Absorber Module. MagIC Net detects both instruments and asks if they are to be saved to the device table.
- Confirm all of the prompts with **[Yes]**.

**3 Loading the method in MagIC Net**

**Workplace ► Run**

- Select the **Equilibration** tab.
- In the **Method** field, load the **Preparation of Combustion IC** method.

**4 Starting the equilibration of the ion chromatograph**

- Start the equilibration with **[Start HW]**.

The IC instrument is ready to measure as soon as equilibration has finished.

- 5** Start the equilibration of the Combustion Oven (TEI) and the Liquid Autosampler CIC (TEI), Solid Autosampler CIC (TEI) or the GLS Sampler CIC (TEI), if present, in the TEIS software.

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