# 828 IC Dual Suppressor


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Instructions for Use
8.828.1003

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# 828 IC Dual Suppressor

## Instructions for Use

8.828.1003 09.2002 / pkl

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1st Edition 2002

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**LEDs**

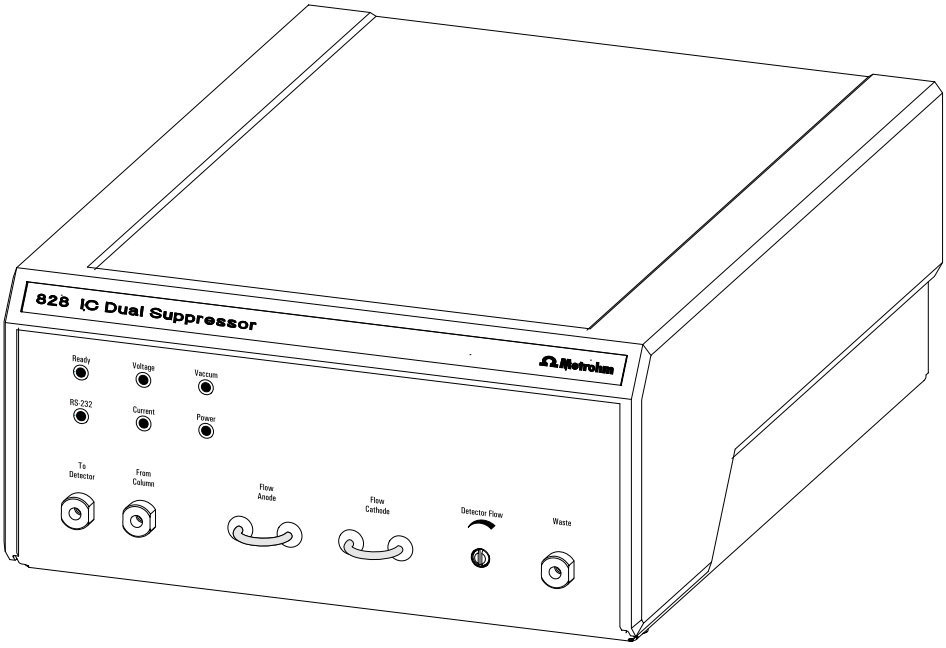
# 1 Introduction

## 1.1 Instrument description

The **828 IC Dual Suppressor** is a continuous, regeneration-free solid phase suppressor which is used to increase the sensitivity of the detection of anions in ion chromatography.

As well as the usual chemical suppression of the carbonate/bicarbonate background, in a second suppression step the suppressor also removes dissolved $CO_2$ in order to reduce the background conductivity of the mobile phase even further. This results in an improved signal-to-noise ratio; peak areas in the ppm-range and above are increased by approx. 30%. At the same time the areas of the injection peak (water dip) and the system peak are reduced to a minimum. The reduction of the injection peak means that the detection of early-eluting anions is improved; the reduction of the system peak allows the detection of anions which coelute with the system peak. The baseline drift is also minimized when carbonate/bicarbonate gradients are used.

In Metrohm IC systems the 828 IC Dual Suppressor can be remotely controlled via a remote interface. It can also be combined with all other commercially available HPLC systems.



# 1.2 How it works

The 828 IC Dual Suppressor is used to increase the sensitivity of the detection of anions in conductivity measurements. It is installed between the separation column and the conductivity detector. The IC Dual Suppressor consists of a suppressor cell, a direct current source and a degassing unit. After it enters the suppressor cell the eluent containing the sample ions is split proportionally toward the detector, anode and cathode as shown in Figure 1.

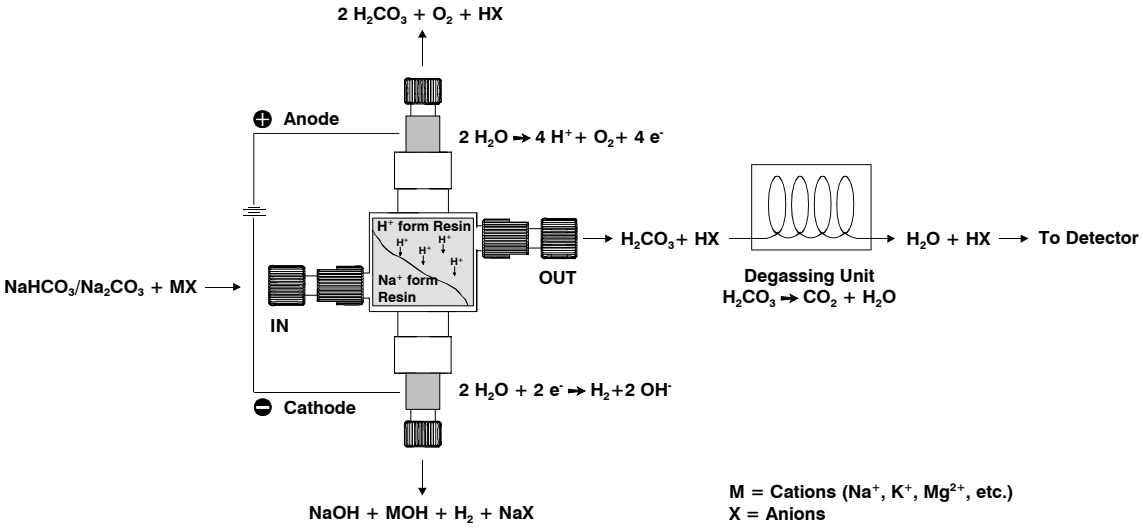



***Figure 1: Dual suppressor flow diagram***

Three processes take place simultaneously in the 828 IC Dual Suppressor:

1. As the eluent and the sample ions emerge from the separation column an acid/base reaction converts them to their protonated forms. The cell is packed with a strong cation exchanger which is present in protonated form. The following exchange reactions occur in the suppressor:

   **Eluent:**

   **$NaOH + Resin\text{-}SO_3^-H^+ \rightarrow Resin\text{-}SO_3^-Na^+ + H_2O$**

   or

   **$NaHCO_3/Na_2CO_3 + Resin\text{-}SO_3^-H^+ \rightarrow Resin\text{-}SO_3^-Na^+ + H_2CO_3$**

   **Sample:**

   **$MX + Resin\text{-}SO_3^-H^+ \rightarrow Resin\text{-}SO_3^-M^+ + HX$**

   **$X = Cl^-, NO_3^-, Br^-$, etc.**

The counter ions ($Na^+$) of the eluent are exchanged for the hydrogen ions ($H^+$) of the resin in the cell. If NaOH is used as the eluent then water will be formed; if $NaHCO_3/Na_2CO_3$ is used as the eluent then carbon dioxide is produced. At the same time the counter ions of the sample ($M^+$ = metal cation) are exchanged for protons from the resin. Together with the sample anions these form acids which have an increased conductivity, e.g. hydrochloric acid, nitric acid, etc. This provides an improved signal-to-noise ratio and an improved detection sensitivity.

**2.** During the operation of the 828 IC Dual Suppressor a direct current is constantly applied to the suppressor cell electrodes.

Water in the cell is electrolyzed and the following electrode reactions take place:

**Anode:** $2\ H_2O \rightarrow 4\ H^+ + O_2(g) + 4\ e^-$

**Cathode:** $2\ H_2O + 2\ e^- \rightarrow 2\ OH^- + H_2(g)$

At the anode hydrogen ions and gaseous oxygen are produced; at the cathode hydroxide ions and gaseous hydrogen. In this way the hydrogen ions produced at the anode continuously regenerate the cation exchanger. The sodium cations of the eluent and the cations of the sample wander toward the cathode in the direct current field. The eluate that leaves the suppressor cell on the cathode side contains the hydroxide salts of these cations, gaseous hydrogen and some sample anions (in the form of their sodium salts). The eluate at the anode side contains carbonic acid or water together with gaseous oxygen and some sample ions (protonated form). The protonated sample anions are eluted toward the detector with carbonic acid or water.

**3.** After leaving the suppressor cell all eluates pass through a degassing unit. Oxygen and hydrogen are removed from the eluate flows at the anode and cathode sides respectively before they reach the waste container. The eluate at the **OUT** connection (see Figure 1, Figure 10) contains the sample anions and carbonic acid (if a carbonate/bicarbonate eluent is used) and passes the degassing unit before reaching the conductivity detector. In the degassing unit the carbonic acid dissociates to form carbon dioxide and water. Carbon dioxide is removed and water remains.

This further reduces the background conductivity of the eluate to provide improved sensitivity and a more stable baseline. This means that it is possible to use carbonate/bicarbonate gradients. The injection peak (water dip), which is often overlapped by quickly eluting anions, and the system peak, which interferes with the detection of anions which coelute with it, are eliminated.

# 1.3 Parts and controls

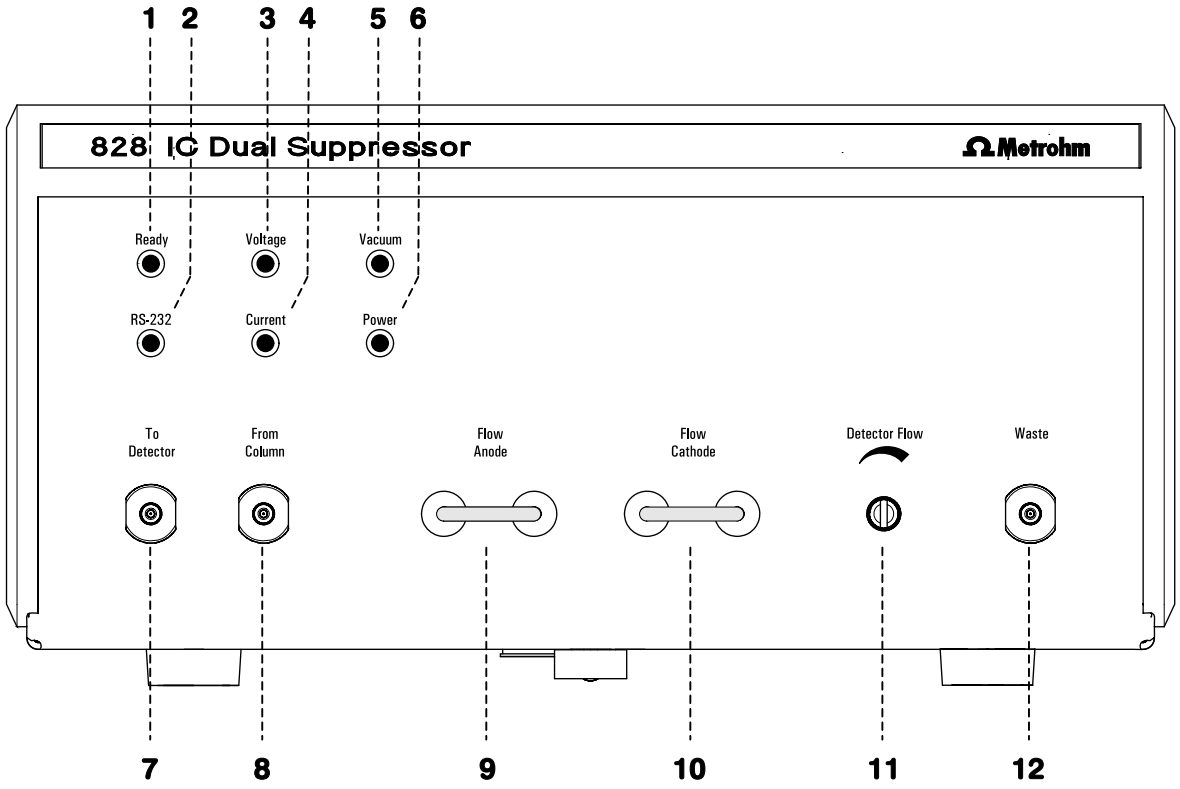



***Figure 2: Front panel of the 828 IC Dual Suppressor***

**LEDs**
The color of the LED indicates the instrument status.

**1 Ready**
**Green:** the suppressor is ready for an analysis.
**Red:** an error has occurred.

**2 RS-232**
**Green:** data transfer via RS 232 connection **13**, only for service purposes.

**3 Voltage**
**Green:** the voltage applied to the suppressor cell is within the limits for normal operation.
**Red:** the voltage is outside the operating limits.

**4 Current**
**Green:** current is flowing across the suppressor cell.

**5 Vacuum**
**Green:** the vacuum has operating pressure.
**Red:** insufficient vacuum. A leak is present or the set value has not been reached within 30 minutes of the instrument being switched on.

**6 Power**
**Green:** the Dual Suppressor is switched on, mains voltage is applied.

**7 To Detector**
Inlet connection to detector, connection for 6.1831.010 PEEK Capillary with 6.2744.010 PEEK Pressure screw

**8 From Column**
Outlet connection from column, connection for 6.1831.010 PEEK Capillary with 6.2744.010 PEEK Pressure screw

**9 Flow Anode**
For a visual check of the anode eluate. The liquid from the anode passes through the FEP tubing before entering the degassing unit. In normal operation oxygen bubbles should be seen regularly.

**10 Flow Cathode**
For a visual check of the cathode eluate. The liquid from the cathode passes through the FEP tubing before entering the degassing unit. In normal operation hydrogen bubbles should be seen regularly.

**11 Detector Flow**
The flow to the detector can be regulated with a screwdriver.

**12 Waste**
Outlet to waste container, connection for 6.1803.020 PTFE Tubing with 6.2744.010 PEEK Pressure screw

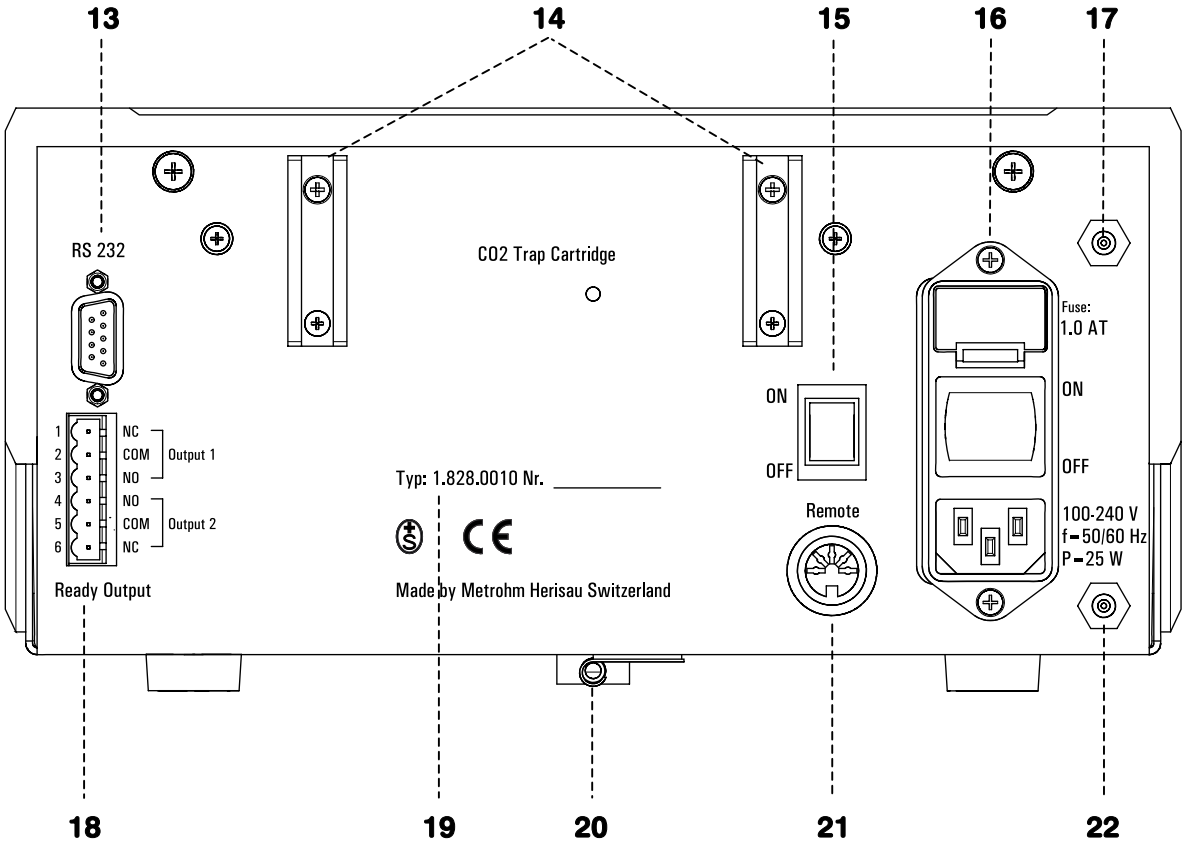



***Figure 3: Rear panel of the 828 IC Dual Suppressor***

**13 RS 232**
Interface for service purposes

**14 $CO_2$ Trap Cartridge**
Holder for $CO_2$ absorber-cartridge for cleaning the incoming air

**15 Remote switch**
Activates the remote control of the Dual Suppressor via the **Remote** connector:
**I = ON 0 = OFF**

**16 Fuse holder**
For slow blow fuse 1.0 AT, U.600.0016
**Mains switch**
For switching instrument on/off:
**I = ON 0 = OFF**
**Mains connector**
For mains connection see Section 2.3

**17 Vacuum pump inlet**
Connected to 6.2837.000, see Section 2.2.1

**18 Ready Output**
6-pin connector, used as fault switch, carries status signals (ready/not ready) to external instruments.

**19 Type** and **serial number**

**20 Drain**
Drain port outlet for liquids

**21 Remote**
Remote interface for remote control by external instruments.

**22 Vacuum pump exhaust**

# 1.4 Information about the Instructions for Use

*Please study these Instructions for Use carefully before you start to use the 828 IC Dual Suppressor. The instructions contain information and warnings that must be observed by the user in order to guarantee the safe use of the instrument. Please keep these instructions near the instrument so that they are always to hand when required.*

## 1.4.1 Organization

These **8.828.1003 Instructions for Use** for the 828 IC Dual Suppressor provide you with a comprehensive overview of the installation, startup, troubleshooting and technical specifications of the instrument. The installation instructions are arranged as follows:

**Sect. 1 Introduction**
General description of the instrument, operating parts and controls, and safety notes

**Sect. 2 Installation**
Installation of the instrument, mains connection, connection of the accessories, connection to IC system

**Sect. 3 Operation**
Information about the operation of the 828 IC Dual Suppressor

**Sect. 4 Troubleshooting - Problems**
Possible faults and their remedies

**Sect. 5 Care and maintenance**
Care and maintenance of the instrument

**Sect. 6 Appendix**
Technical data, standard equipment, optional accessories, warranty and declaration of conformity, index

In order to find the information you require about the 828 Dual Suppressor you should either use the **Contents** or the **Index**.

### 1.4.2 Notation and pictograms

The following notation and pictograms (symbols) are used in these Instructions:

| 15 | 828 parts and controls |
|---|---|
|  | **Danger/Warning**<br>This symbol indicates a possible risk of death or injury to the user and possible damage to the instrument or its components by electricity. |
|  | **Danger/Warning**<br>This symbol indicates a possible risk of death or injury to the user and possible damage to the instrument or its components. |
|  | **Attention**<br>This symbol indicates important information that you should read before continuing. |
|  | **Information**<br>This symbol indicates additional information and tips which may be of particular use to you. |

# 1.5 Safety notes

***Warning!***
*This instrument should only be used in accordance with the information given in these Instructions for Use.*

## 1.5.1 Electrical safety

Electrical safety when handling the 828 IC Dual Suppressor is guaranteed within the scope of Standard IEC 61010. However, please observe the following points:

- **Mains connection**

*The **mains connection** and checking the **mains fuse** must be carried out according to the information given in Section 2.3.*

- **Opening the 828 IC Dual Suppressor**

*If the 828 IC Dual Suppressor is connected to the mains supply then it must neither be opened nor should any parts be removed from it, as otherwise the risk of contact with current-carrying assemblies exists. This is why the instrument should be separated from all voltage sources before being opened. Please make sure that the **mains cable is pulled out from mains connector 16!***

- **Protection against electrostatic charges**

*Electronic components are sensitive to electrostatic charges and can be destroyed by a discharge. Before touching any assembly within the 828 IC Dual Suppressor you should ground yourself and any tool you are using by grasping a grounded object (e.g. the instrument housing or a radiator) in order to eliminate any electrostatic charge which may be present.*

## 1.5.2 General safety measures

- **Liquid handling**

*Check all inlet and outlet tubing for leaks at regular intervals. Observe the appropriate regulations concerning the handling of flammable and/or toxic solutions and their disposal.*

# 2 Installation

## 2.1 Instrument setup

### 2.1.1 Packaging

The 828 IC Dual Suppressor and its specially packed accessories are supplied in very protective special packaging which contains a shock-absorbing plastic foam lining. The instrument itself is contained in an dustproof evacuated polyethylene bag. Please store this packaging in a safe place; it is the only way in which the safe transport of the instrument can be guaranteed.

### 2.1.2 Checks

Please check that the delivery is complete and undamaged immediately on receipt (compare with delivery note and list of accessories given in Section 6.2). If transport damage is evident please refer to the information given in Section 6.4 “Warranty”.

### 2.1.3 Location

Place the instrument on a suitable vibration-free laboratory bench, protected as much as possible from corrosive atmospheres and contact with chemicals.

Choose a location where the temperature is usually between +5 °C and +45 °C. The instrument should be protected against excessive variations in temperature and direct sunlight.

# 2.2 Connecting the accessories

## 2.2.1 Attaching the $CO_2$ absorber cartridge

A **6.2837.000 $CO_2$ Absorber Cartridge** is included in the standard accessories of the IC Dual Suppressor. It is attached as follows:

**1 Mount Cartridge Holders 6.2027.070**

- Remove the lower screws of the holders **14** with a Philips screwdriver.
- Insert the Cartridge holders 6.2027.070 into the holders **14** from below.
- Reattach the screws.

**2 Attach $CO_2$ Absorber Cartridge**

- Push the $CO_2$ Absorber Cartridge into the clamps of the cartridge holders.
- Remove the yellow stopper which seals the cartridge inlet and connect the $CO_2$ absorber cartridge to vacuum inlet **17** using the **6.1816.030 Silicone tubing**.

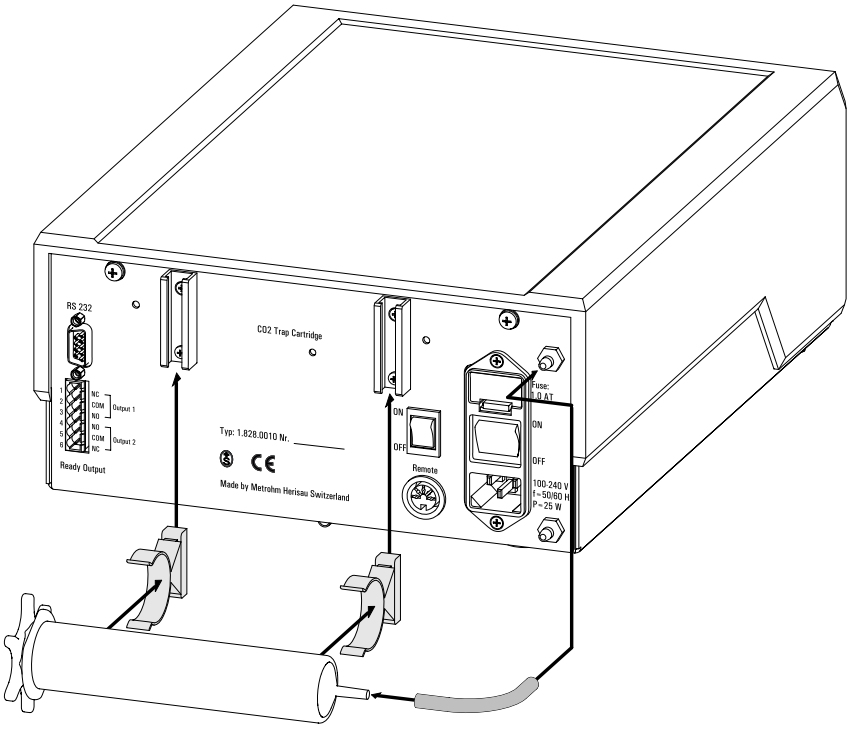



***Figure 4: Attaching the $CO_2$ absorber cartridge***

*Use the yellow stopper to close off the $CO_2$ absorber cartridge inlet whenever the 828 IC Dual Suppressor is not to be used for a longer period. This increases the working life of the cartridge.*

# 2.3 Mains connection

*Please observe the following rules when connecting the instrument to the electricity supply. If the instrument is operated with an incorrectly set mains voltage and/or an incorrect mains fuse then it represents a fire hazard!*

## 2.3.1 Mains voltage

All power supplies from 100 V to 240 V with 50/60 Hz can be connected to the mains input of the 828 IC Dual Suppressor. Adaptation to the mains supply used is carried out automatically.

## 2.3.2 Fuse

A 1.0 A fuse (slow blow) is contained in the fuse holder of the 828 IC Dual Suppressor.

*Make sure that the instrument is never operated with a different type of fuse as otherwise it represents a fire hazard!*

### Changing the fuse

**1 Pull out mains cable**

Switch off the instrument and remove the mains cable from mains supply connection **16** of the 828 IC Dual Suppressor.

**2 Remove the fuse holder**

Use a screwdriver to loosen the fuse holder beside the mains supply connection (see Figure 3) and remove it completely.

**3 Changing the fuse**

Change the fuse if necessary and replace it in the fuse holder. Use only a fuse with the following specifications.

**1.0 A fuse (slow blow)** Metrohm No. U.600.0016

**4 Re-insert fuse holder**

### 2.3.3 Mains cable and mains connection

#### Mains cable

The instrument is supplied with one of the following mains cables

- 6.2122.020 with SEV 12 plug (Switzerland, ...)
- 6.2122.040 with CEE(7), VII plug (Germany, ...)
- 6.2133.070 with NEMA 5-15 plug (USA, ...)

which has three wires and is fitted with a plug with a grounding pin. If a different plug has to be used then the yellow/green wire (IEC standard) must be connected to the grounding pin (Protection class I).

*Any interruption to the grounding inside or outside the instrument can represent a hazard!*

#### Mains connection

Insert the mains cable into **mains connector 16** of the 828 IC Dual Suppressor.

### 2.3.4 Switching the instrument on/off

The 828 IC Dual Suppressor is switched on and off with **mains switch 16**. When the instrument is switched on the "**Power**" **6** LED lights up.

# 2.4 Connecting to a modular gradient IC system

The 828 IC Dual Suppressor allows the sensible use of the gradient technique with carbonate/bicarbonate eluents for the first time. The installation of the 828 IC Dual Suppressor in the system that is most frequently used, a binary gradient system, is described below.

The required instrument configuration corresponds to the **Modular IC System 10** (**MIC 10)**, an anion system using binary high-pressure gradients with chemical suppression. It consists of the 762 IC Interface, 732 IC Detector, 733 IC Separation Center (1-channel), 828 IC Dual Suppressor, two 709 IC Pumps and a gradient mixing spiral with T-piece and downline pulsation dampener.

The electrical and wet-chemistry connections of this system and its control using the «**IC Net 2.1**» software are described below.

## 2.4.1 Electrical connections

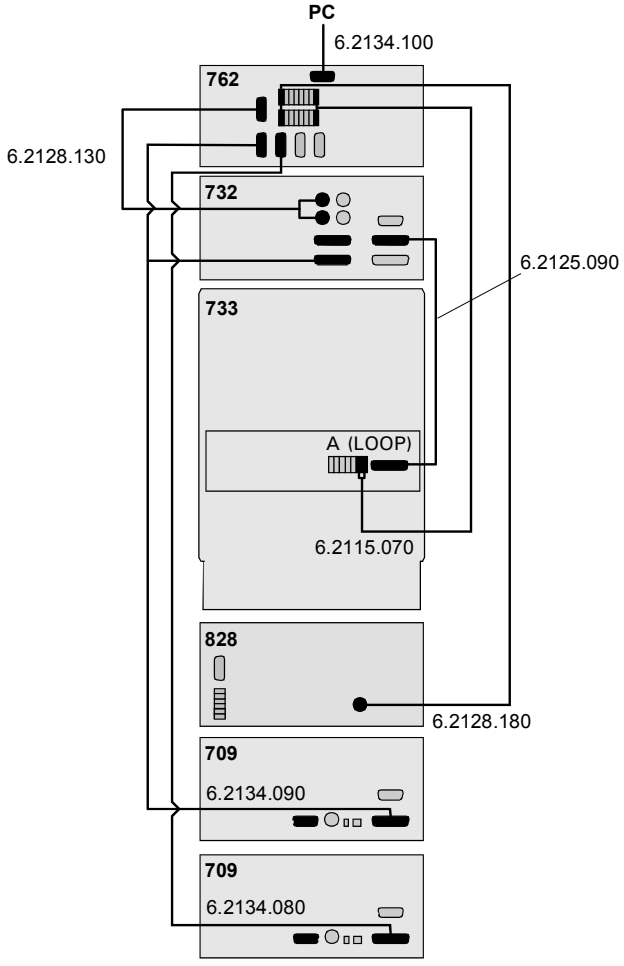



***Figure 5: Electrical connections in the MIC 10 system***

The electrical connections in the system consisting of the 762 IC Interface, 732 IC Detector, 733 IC Separation Center (1-channel), 828 IC Dual Suppressor and two 709 IC Pumps are shown in Figure 5:

## 2.4.2 Connecting the IC Dual Suppressor

The following diagram shows how the system is arranged:

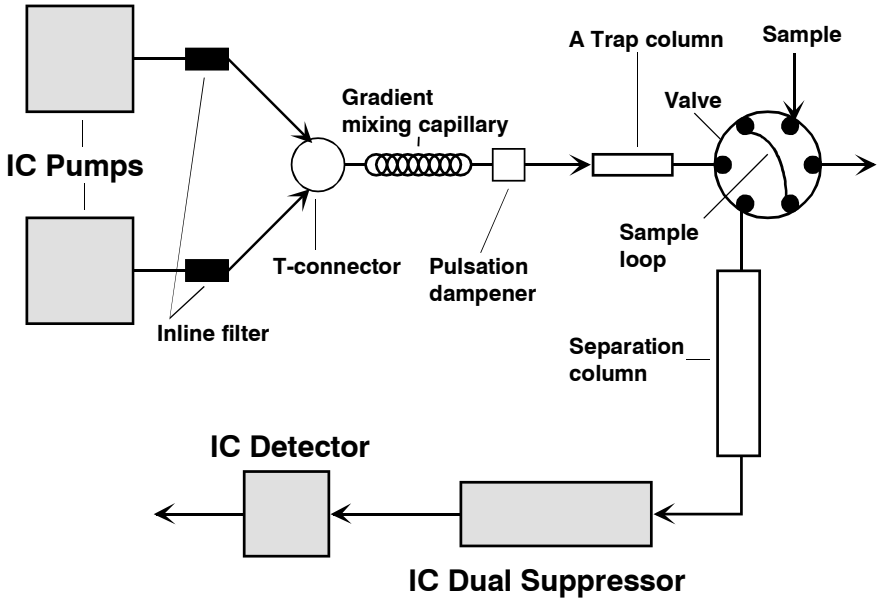



***Figure 6: Flow diagram of the MIC 10***

All the components should be connected as shown in Figure 6, which also provides a flow diagram for the sample.

The installation of the other components is described in detail in the appropriate Instructions for Use.

The 828 IC Dual Suppressor is inserted between the separation column and the detector. The following connections must be made:

*Please ensure that the liquid connections between the separation column outlet, the Dual Suppressor and the detector inlet are as short as possible and use a narrow diameter capillary, e.g. 6.1831.010 PEEK Capillary (included as standard). In this way you minimize the dead volumes and reduce the peak broadening of the signal.*

### 1 From Column

- Connect the outlet of the separation column in the 733 IC Separation Center with the inlet of the 828 IC Dual Suppressor "**From Column**" **8**. Use a **6.1831.010 PEEK Capillary** (i.d. = 0.25 mm, o.d. = 1/16") and a **6.2744.010 Pressure screw** for this (both included in standard equipment).

### 2 To Detector

- Use another piece of **6.1831.010 PEEK Capillary** (i.d. = 0.25 mm, o.d. = 1/16"), further **6.2744.010 Pressure screws** and a **6.2744.040 Coupling** (all included in standard equipment) to connect the outlet of the 828 IC Dual Suppressor "**To Detector**" **7** with the inlet of the conductivity detector in the 732 IC Detector.

### 3 Detector outlet

- Mount the **6.1803.090 PTFE Capillary** (i.d. = 1/16", o.d. = 0.25 mm, 15 m) as a **backpressure capillary** between the detector outlet and the waste container. Use a **6.2744.010 Pressure screw** and a **6.2744.040 Coupling** (all included in standard equipment) for this.

*The backpressure capillary is required to ensure the correct ratio between the flow rates at the outlets of the suppressor cell, see Section 3.5.*

*Check this ratio the **first time** that a system in which the 828 IC Dual Suppressor has been newly installed is started up; a detailed description is given in Section 3.5.1.*

### 4 To Waste

- Connect outlet "**Waste**" **12** of the 828 IC Dual Suppressor to a waste container. Use the **6.1803.020 PTFE Tubing** (i.d. = 0.97 mm, o.d. = 1.57 mm) and a **6.2744.010 Pressure screw** (both included in standard equipment) for this.

*PEEK capillaries that are to be provided with new connections must have a perfect and plane cutting surface. This is best obtained by using the optionally available **6.2621.080 Capillary cutter** .*

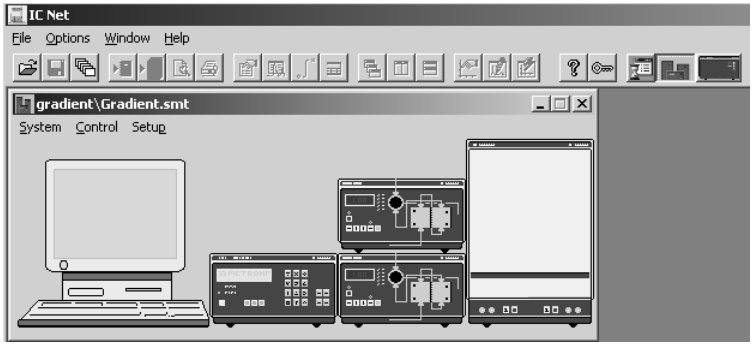
### 2.4.3 Settings in IC Net 2.1

On the rear panel of the 828 IC Dual Suppressor switch **remote switch 15** to "**ON**" and also switch **mains switch 16** to "**ON**". The Dual Suppressor can now be controlled by an external instrument.

Start the IC Net 2.1 software and open the "**New System Wizard**" under "**File/ New/System...**.". This wizard will guide you through the installation of a new system. Use it to create a system file, e.g. "Gradient.smt" for your modular gradient system. During the installation you will be asked about the components of your system. Enter the 762 IC Interface, 732 IC Detector, 733 IC Separation Center (1-channel) and the two 709 IC Pumps as a Solvent Delivery Unit (SDU) with two pumps to the system. A detailed description of this procedure is given in the **8.110.8221 Instructions for Use** for the Metrodata «**IC Net 2.1**» software.

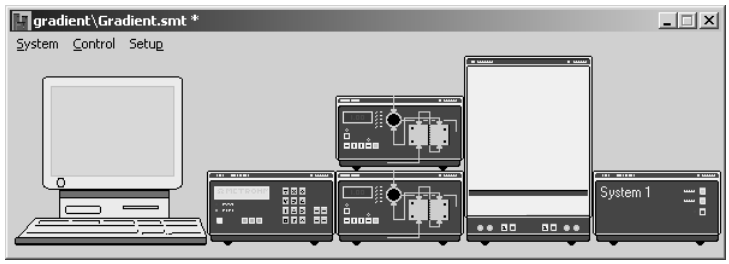
The 828 IC Dual Suppressor has not yet been integrated into the Version 2.1 of this software and cannot be selected from the list of devices. This means that you should configure the system without it; its control commands must then be entered manually.

When you have created the system file "Gradient.smt" the IC Net window will appear as follows:

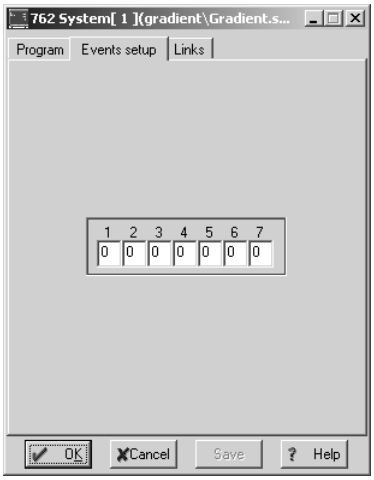



The instrument symbols of your detector, the Separation Center and the two pumps will already appear in your "Gradient.smt" system. As the Dual Suppressor is controlled via the 762 IC Interface, see Figure 5, you only have to integrate and configure the interface in the existing system:

- Select the 762 IC Interface under **Setup/New devices/Link to existing device**. The instrument symbol will be added to your system.



- **Double-click on the instrument symbol** of the 762 IC Interface to open its configuration menu and select the file card **Events setup**.




- The value of the event line, via which the Dual Suppressor will be controlled, must be set to 1. In this example this is Event Line 1, see Figure 5.
- Set **Event Line 1** to the value **1** and confirm with **OK**.

The 828 IC Dual Suppressor is now included in the system and will be controlled by the Metrodata IC Net 2.1 software. It is started together with the other hardware of the system "Gradient.smt" with **SYSTEM /Control/Startup hardware** and shut down with **SYSTEM /Control/Shutdown hardware**.

*In Metrodata IC Net software versions with version numbers higher than 2.1 the 828 IC Dual Suppressor will be preconfigured in the software just like all other Metrohm IC instruments. It can then be immediately installed in the New System Wizard. A detailed description can be found in the corresponding Instructions for Use of the software.*

# 2.5 Connecting to the 761 Compact IC

The installation of the 828 IC Dual Suppressor with the 761 Compact IC and control via the «**761 PC Software 1.1**» software is described below.

## 2.5.1 Electrical connection

The electrical connections of the system consisting of the 761 Compact IC and the 828 IC Dual Suppressor are made according to Figure 7:

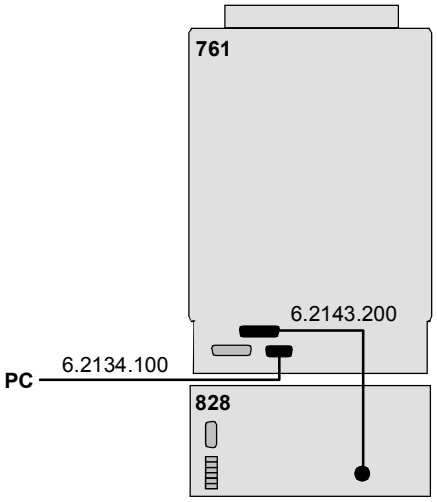



***Figure 7: Connecting the 828 IC Dual Suppressor to the 761 Compact IC***

## 2.5.2 Connecting the IC Dual Suppressor

*Please ensure that the liquid connections between the separation column outlet, the Dual Suppressor and the detector inlet are as short as possible and use a narrow diameter capillary, e.g. 6.1831.010 PEEK Capillary (included as standard). In this way you minimize the dead volumes and reduce the peak broadening of the signal.*

### 1 From Column

- Connect the outlet of the separation column in the 761 Compact IC to the inlet of the 828 IC Dual Suppressor "**From Column**" **8**. Use a **6.1831.010 PEEK Capillary** (i.d. = 0.25 mm, o.d. = 1/16") and a **6.2744.010 Pressure screw** (both included as standard) for this.

**2 To Detector**

- Use another piece of **6.1831.010 PEEK Capillary** (i.d. = 0.25 mm, o.d. = 1/16"), further **6.2744.010 Pressure screws** and a **6.2744.040 Coupling** (all included in standard equipment) to connect the outlet of the 828 IC Dual Suppressor "**To Detector**" **7** with the inlet of the conductivity detector in the 761 Compact IC.

**3 Detector outlet**

- Mount the **6.1803.090 PTFE Capillary** (i.d. = 1/16", o.d. = 0.25 mm, 15 m) as a **backpressure capillary** between the detector outlet and the waste container. Use a **6.2744.010 Pressure screw** and a **6.2744.040 Coupling** (all included in standard equipment) for this.

*The backpressure capillary is required to ensure the correct ratio between the flow rates at the outlets of the suppressor cell, see Section 3.5.*

*Check this ratio the **first time** that a system in which the 828 IC Dual Suppressor has been newly installed is started up; a detailed description is given in Section 3.5.1.*

**4 To Waste**

- Connect outlet "**Waste**" **12** of the 828 IC Dual Suppressor to a waste container. Use the **6.1803.020 PTFE Tubing** (i.d. = 0.97 mm, o.d. = 1.57 mm) and a **6.2744.010 Pressure screw** (both included in standard equipment) for this.

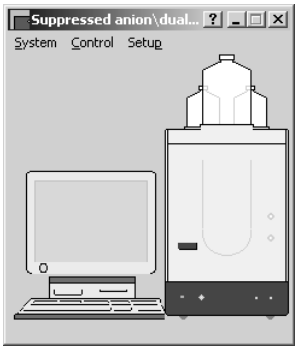
*PEEK capillaries that are to be provided with new connections must have a perfect and plane cutting surface. This is best obtained by using the optionally available **6.2621.080 Capillary cutter** .*

### 2.5.3 Settings for control by the 761 PC Software 1.1

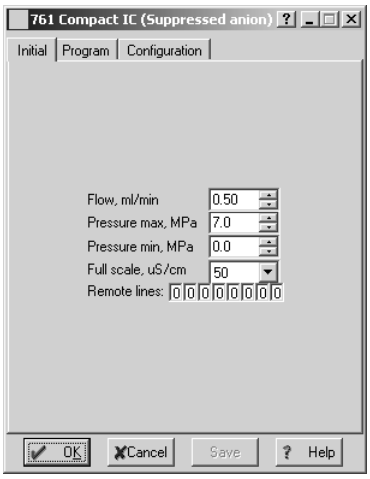
On the 828 IC Dual Suppressor switch **remote switch 15** to "**ON**" and also switch **mains switch 16** to "**ON**". The Dual Suppressor can now be controlled by an external instrument.

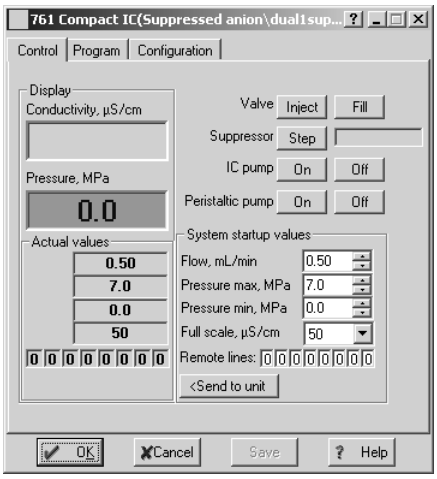
In the 761 PC Software 1.1 you must make the following settings:

- Start the 761 PC Software 1.1 and select your system.



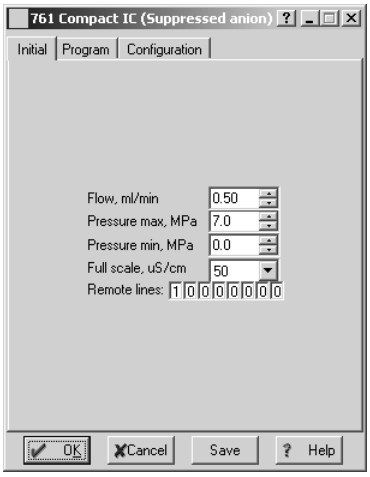

- Open the instrument control with a double-click on the instrument symbol of the Compact IC.

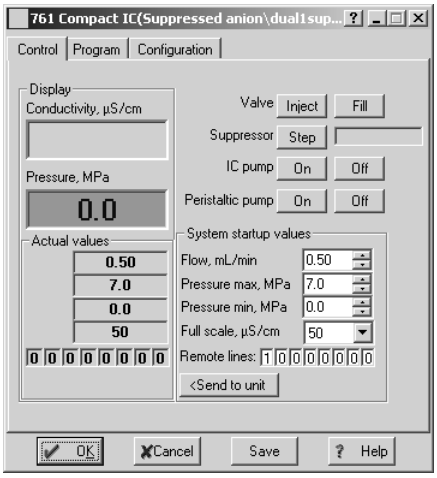



If your system is not yet connected to your workplace then the left-hand window will open, otherwise the right-hand window will open. In each case the procedure is the same:

- Set the value for **Remote Line 1** to **1**.




- Save the setting with "**Save**".

The 828 IC Dual Suppressor is now included in the system and will be controlled by the 761 PC Software 1.1. The 828 IC Dual Suppressor will be started as soon as your system is connected to the workplace and will be shut down together with the 761 Compact IC hardware with **System/Control/Shutdown hardware**.

# 3 Operation

## 3.1 General information

*No eluent should be pumped through the IC Dual Suppressor when it is switched off, or if an error occurs. Errors are indicated by red LEDs on the front panel. Faults which may occur during operation affect the voltage and the vacuum, which may be outside their specified values. Details can be found in Section 4 Troubleshooting - Problems.*

- During the starting sequence of the instrument (Section 3.6.1) wait until the vacuum LED lights up green before switching on the eluent pump.
- A **pressure sensor** in the instrument is used as the on/off switch for the electrolysis current of the cell. The current will only be switched on when a defined pressure has been achieved in the system after the instrument has been switched on, i.e. if no leaks are present. The "**Current**" **4** LED lights up green. If the pressure falls below the preset value for some time then the current will be switched off. This ensures that current will only be applied to the cell when liquid is flowing through the suppressor. This means that the 828 IC Dual Suppressor can remain switched on even when no eluent is flowing through it without being damaged. However, in such a case we do recommend that the IC Dual Suppressor is switched off.
- The 828 IC Dual Suppressor is designed for operation with a total flow rate of between 0.5 and 2.0 mL/min. Operating the suppressor with flow rates outside this range may either damage it or produce unsatisfactory results. At flow rates below 0.5 mL/min the built-up pressure may not be sufficient to switch on the current. This can cause the suppressor cell to become exhausted. Flow rates above 2.0 mL/min can create an overpressure in the system and alter the ratio between the eluates at the anode, cathode and detector outlet of the cell.

## 3.2 Eluent

The cation exchanger resin of the 828 IC Dual Suppressor allows the use of all the eluents normally used for suppressed ion chromatography such as hydroxide, borate and carbonate/bicarbonate eluents, although carbonate/bicarbonate eluents offer the greatest benefits when used with the 828 IC Dual Suppressor because of the removal of $CO_2$.

In order to achieve the best results you should only use ultrapure reagents and ultrapure water to prepare your eluents .

## 3.3 Capacity

The exchange capacity of the suppressor cell of the 828 IC Dual Suppressor is 50 mmol/L NaOH or 25 mmol/L $Na_2CO_3$ at a flow rate of 1 mL/min.

*Check whether the concentration of your eluent and the selected flow rate are appropriate for the capacity of the suppressor before you start to use it.*

Calculate the maximum "Total cation flow" for your eluent or gradient and your flow rate in milli-equivalents of cations that pass through the cell per minute (meq/min). The total amount of 0.05 meq/min must not be exceeded.

**Example**

An eluent with 5 mmol/L $Na_2CO_3$/5 mmol/L $NaHCO_3$ and a flow rate of 1.5 mL/min gives a value of 0.0225 meq/min for the total cation flow and is therefore within the capacity of the suppressor cell.

## 3.4 Degassing unit and $CO_2$ absorber cartridge

A further improvement of the signal from the 828 IC Dual Suppressor is achieved with carbonate/bicarbonate eluents by degassing the suppressor eluate before detection. Dissolved $CO_2$ is removed from the suppressor eluate with the result that the background conductivity is reduced, the signal-to-noise ratio is improved, the injection peak (water dip) and system peak are eliminated and the rise in the background conductivity with carbonate/bicarbonate gradients is suppressed.

The degassing unit consists of a vacuum pump, a vacuum chamber and a $CO_2$ absorber cartridge. In the vacuum chamber carbonic acid dissociates to form water and carbon dioxide. In order to prevent the formation of an equilibrium between the dissolved and gaseous $CO_2$ in the vacuum chamber, the vacuum pump works with a gas ballast. A small amount of ambient air is drawn in by the pump and passes through the vacuum chamber so that any $CO_2$ evolved is continuously

removed and the equilibrium for the breakdown of the carbonic acid is displaced even further toward the dissociated products. The $CO_2$ absorber cartridge is required to remove $CO_2$ and humidity from the drawn-in ambient air before it enters the degassing system. Exchanging the $CO_2$ absorber cartridge is described in Section 5.4.1.

The vacuum pump works at a constant speed and as soon as the vacuum reaches the preset working pressure LED "**Vacuum**" **5** lights up green.

## 3.5 Flow rate ratio

*Please ensure that the backpressure capillary is mounted at the outlet of the detector used, see Section 2.4.2, Section 2.5.2; it is required for the correct ratio between the flow rates.*

*Check this ratio between the flow rates before starting up the 828 IC Dual Suppressor for the first time.*

The 828 IC Dual Suppressor achieves its optimal performance when 40% of the total flow is eluted to the detector. The 828 IC Dual Suppressor is preadjusted for a total flow rate of 1 mL/min. At a total flow rate in the working range of 0.5 - 2.0 mL/min this flow ratio only changes slightly, but you should nevertheless check it when you alter the total flow rate.

If more than one detector is used in series downstream the IC Dual Suppressor then the ratio between the flow rates must be adjusted in order to compensate for the additional backpressures of the other detectors.

### 3.5.1 Setting the flow rates

The IC Dual Suppressor is designed to work at a flow rate to the detector of 40% ± 5% of a total flow rate of 1 mL/min.

The following instructions describe in detail how you can check the ratio between the flow rates and alter it if necessary:

**1 Preparation**

Set the flow rate at the pump to 1 mL/min and wait for 10 minutes.

**2 Measurement**

Measure the volume **V** or the weight **m** of the liquid which elutes from the backpressure capillary in 3 minutes.

### 3 Calculation

Use the following equation to calculate the fraction of the flow to the detector compared with the total flow rate of 1 mL/min:

**Detector flow fraction (in %) = (V/3 mL) x 100**
**or = (m/3 g) x 100**

If you check the detector flow for other total flow rates than 1 mL/min then change the denominator in the formulae accordingly.

### 4 Adjustment

If the detector flow fraction is not within the limits of 40% ± 5% then the ratio between the flow rates must be adjusted.

This is done by adjusting the setting screw "**Detector Flow**" **11** with a screwdriver.

- A clockwise rotation increases the detector flow rate fraction of the total flow rate.
- A counterclockwise rotation decreases the detector flow rate fraction of the total flow rate.

Proceed according to items 2 and 3 to check again whether the ratio between the flow rates is now correctly adjusted.

If it is impossible to set the correct ratio this indicates a blockage in the flow path, see Section 4 Troubleshooting - Problems.

The ratio between the flow rates can also be checked at the "**Waste**" **12** outlet of the 828 IC Dual Suppressor, where the eluates from the anode and cathode outlets of the suppressor cell escape. These flows should have a fraction of the total flow rate of 60% ± 5%.

# 3.6 Routine operation

## 3.6.1 Manual operation

### Start sequence

**1 Installation**

Install the 828 IC Dual Suppressor as described in Section 2.

- The remote connection from the suppressor to the 762 IC Interface (6.2128.180 Cable, Figure 5) or to the 761 Compact IC (6.2143.200 Cable, Figure 7) are not necessary for manual operation.
- The IC Dual Suppressor must be switched to manual operation, **remote switch 15 = OFF**.

**2 Switch on suppressor**

- Switch on the instrument with **mains switch 16**.

  The vacuum pump starts up and the LED "**Vacuum**" **5** will light up green as soon as the set working pressure is reached.

*Wait until the LED "**Vacuum**" **5** lights up green before continuing with step 3.*

**3 Switch on pump**

- Switch on the high pressure pump.

  After a short time the pump will build up pressure and, when the value set for the **pressure sensor** has been reached (see page 22), current is applied to the suppressor cell.
  The LED "**Current**" **4** lights up green. This process takes about 1 minute, but this time may vary depending on the set flow rate and the backpressure of the system. When the cell voltage lies within the given range then LED "**Voltage**" **3**, followed by LED "**Ready**" **1**, will light up green.

**4 Equilibrate**

- Wait 20-30 minutes until the 828 IC Dual Suppressor is equilibrated.

  The suppressor is fully equilibrated when the background conductivity remains constant and a stable baseline is obtained.

*When you change the eluent you should first rinse the separation column without connecting the 828 IC Dual Suppressor. Pump the eluent through the system for about 5 min.*

*If you change the eluent type, particularly when changing from a strong to a weak eluent, then it may take longer to equilibrate the suppressor.*

**5 The system is now ready to carry out an analysis**

### Stop sequence

**1 Switch off pump**

*Step 2 is only necessary when the suppressor will not be used for more than one week; otherwise continue with step 3.*

**2 Rinse suppressor**

- Leave the suppressor switched on and rinse it with pure water for 15 min (1 mL/min).

**3 Switch off suppressor**

- Switch off the suppressor at **mains switch 16**.

*You can also leave the 828 IC Dual Suppressor switched on when it is not being used; this will not damage the instrument. However, when it is switched on the vacuum pump operates continuously. This is why we recommend that the 828 IC Dual Suppressor is always switched off when it is not being used in order not to unnecessarily shorten the working lives of the vacuum pump and $CO_2$ absorber cartridge. You should also seal the inlet of the $CO_2$ absorber cartridge when the 828 IC Dual Suppressor is not to be used for a longer period.*

**4 Storage**

These measures are only necessary when the IC Dual Suppressor will not be used for a long time.

- Remove the connections from the following inlets and outlets: "**To Detector**" **7**, "**From Column**" **8** and "**To Waste**" **12** and seal them with the original closures supplied with the instrument.

## 3.6.2 Software control

*The operation and functions of the two control programs **IC Net 2.1** and **761 PC Software 1.1** are identical in many respects. Where differences occur these are described separately for the particular software.*

## Start sequence

### 1 Installation

Install the 828 IC Dual Suppressor as described in Section 2.

- The IC Dual Suppressor must be switched on, **mains switch 16 = ON**, and also switched for remote operation, **remote switch 15 = ON**.

### 2 Start software

- Start the **IC Net 2.1** software or **761 PC Software 1.1**, open your system and connect it to the workplace.

  **761 PC Software 1.1:**
  The suppressor starts, the vacuum pump runs and, as soon as the set working pressure has been achieved, LED "**Vacuum**" **5** lights up green.

- Start your system with **Control/Startup hardware**.

  The system is run up, the high pressure pump starts working and the system is equilibrated.

  **IC Net 2.1:**
  The suppressor is started together with the rest of the system, the vacuum pump runs and, as soon as the set working pressure has been achieved, LED "**Vacuum**" **5** lights up green.

After a short time the pump will build up pressure and, when the value set for the **pressure sensor** has been reached (see page 22), current is applied to the suppressor cell. The LED "**Current**" **4** lights up green. This process takes about 1 minute, but this time may vary depending on the set flow rate and the backpressure of the system. When the cell voltage lies within the given range then LED "**Voltage**" **3**, followed by LED "**Ready**" **1**, will light up green.

*Please make sure that you **always** start your system with **Control/Startup hardware**. This is the only way to ensure that the 828 IC Dual Suppressor is controlled properly.*

*If you start the high pressure pump directly in the instrument window then the suppressor will **not** start up automatically with it. If this is not noticed for a long time there is the risk that the cation exchanger will become exhausted and have to be regenerated manually, see Section 5.5.1.*

### 3 Equilibrate

- Wait 20-30 minutes until the 828 IC Dual Suppressor is equilibrated.

  The suppressor is fully equilibrated when the background conductivity remains constant and a stable baseline is obtained.

*When you change the eluent you should first rinse the separation column without connecting the 828 IC Dual Suppressor. Pump the eluent through the system for about 5 min.*

*If you change the eluent type, particularly when changing from a strong to a weak eluent, then it may take longer to equilibrate the suppressor.*

**4 The system is now ready to carry out an analysis**

## Stop sequence

**1 Switch off system**

- Shut down the system with **Control**/**Shutdown hardware**. On the 828 IC Dual Suppressor the current to the suppressor cell and the vacuum pump are switched off.

If the IC Dual Suppressor is to be used again within a few days then no further measures are necessary.

*The following steps are only necessary if the suppressor will not be used for more than one week.*

**2 Rinse suppressor**

- Before switch-off let the system run with pure water for 15 min (1 mL/min); the suppressor must be working.

**3 Switch off suppressor**

- Shut down the system with **Control**/**Shutdown hardware**. On the 828 IC Dual Suppressor the current to the suppressor cell and the vacuum pump is switched off.
- Switch off the suppressor at **mains switch 16**.

*Seal the inlet of the $CO_2$ absorber cartridge when the 828 IC Dual Suppressor is not to be used for a longer period.*

**4 Storage**

These measures are only necessary when the IC Dual Suppressor will not be used for a long time.

- Remove the connections from the following inlets and outlets: "**To Detector**" **7**, "**From Column**" **8** and "**To Waste**" **12** and seal them with the original closures supplied with the instrument.

# 4 Troubleshooting - Problems

## 4.1 Remedying faults and problems

If difficulties occur during analyses with your IC system then it is best to search for their causes in the following sequence: **column → pump → eluent → IC system**. In the Instructions for Use of your MIC 10 Modular IC system or 761 Compact IC you will find an overview of possible faults together with their causes and remedies.

In addition to these general problems, the following section covers those problems which could arise from the use of the 828 IC Dual Suppressor.

## 4.2 Chromatography problems

| *Problem* | *Cause* | *Remedy* |
|---|---|---|
| **Poor peak shape** | • Dead volume in system. | • Check that the capillary connections are tight. Keep the length of the PEEK capillaries between the column and IC Dual Suppressor and between the IC Dual Suppressor and detector as short as possible and make sure that a capillary with the correct inner diameter is used (6.1831.010). |
| | • Weak eluent, unsuitable gradient program. | • Make up a new eluent, correct the gradient. |
| | • Space inside the suppressor cell. | • Exchange suppressor cell, see Section 5.5.2. |
| **Poor retention time reproducibility** | • Leak in the instrument. | • Check whether liquid is escaping from **drain 20**, replace leaking connections. |
| | • Flow rate ratio not correct. | • Check the flow rate ratio, Section 3.5. |
| | • Blockage in flow path. | • See Section 4.3. |
| | • High pressure in system. | • See Section 4.3. |

| | | |
|---|---|---|
| **Noisy or unstable baseline** | • Suppressor cell is not yet properly equilibrated with the eluent. | • Let the system run and wait until the suppressor is equilibrated. |
| | • $CO_2$ absorber cartridge is exhausted. | • Exchange the 6.2827.000 **$CO_2$ absorber cartridge**, see Section 5.4.1. |
| | • Fraction of volatile organic modifiers in eluent is too high. | • Make up a new eluent, refer to Section 3.2. |
| | • Flow rate ratio not correct. | • Check the flow rate ratio, Section 3.5. |
| | • Leak in the instrument. | • Check whether liquid is escaping from **drain 20**, replace leaking connections. |
| | • Blockage in flow path. | • See Section 4.3. |
| **Background conductivity too high** | • Eluent concentration incorrect. | • Make up a new eluent, take the capacity of the suppressor into account, see Section 3.3. |
| | • Eluent contaminated. | • Make up a new eluent, see Section 3.2. |
| | • $CO_2$ absorber cartridge is exhausted. | • Exchange the 6.2827.000 **$CO_2$ absorber cartridge**, see Section 5.4.1. |
| | • Flow rate ratio not correct. | • Check the flow rate ratio, Section 3.5. |
| | • Suppressor cell is exhausted. | • Regenerate the cell, proceed as described in Section 5.5.1. |
| | • Blockage in flow path. | • See Section 4.3. |

# 4.3 Instrument problems

| *Problem* | *Cause* | *Remedy* |
|---|---|---|
| **LED "Power" 1 does not light up / no LED lights up** | • **Remote** switch **15** switched to **ON** despite manual operation.<br>• Mains cable not connected.<br>• Fuse blown.<br>• Electronics fault. | • Switch off **remote** switch **15** = **OFF**.<br>• Connect the IC Dual Suppressor to the mains supply.<br>• Replace fuse, see Section 2.3.2<br>• Contact Metrohm Service. |
| **No flow at "Flow Anode" 9 or "Flow Cathode" 10** | • Blockage in flow path. | • See next box but one. |
| **High pressure in system** | • Pressure screws tightened up too much.<br>• Blockage in flow path. | • Loosen pressure screws a little or replace connection.<br>• See next box. |
| **Blockage in flow path** | • A capillary is blocked.<br>• The suppressor cell is blocked. | • Contact Metrohm Service; it may be necessary to replace the suppressor cell as described in Section 5.5.2. |
| **Liquid escapes from drain 20** | • Leak inside the instrument. | • Replace leaking connections, if the suppressor cell is leaking replace it as described in Section 5.5.2. |
| **LED "Vacuum" 5 is red** | • Leak in the vacuum chamber.<br>• Vacuum pump not working properly. | • Contact Metrohm Service.<br>• Contact Metrohm Service. |
| **LED "Current" 4 is not green** | • The **pressure sensor** (page 22) is not switching the electrolysis current on. | • Check whether the high pressure pump is running and that the set flow rate is correct, see Section 3.1.<br>• Check for leaks in the liquid connections and replace the connections if necessary. |
| **LED "Voltage" 3 is red** | • Suppressor cell not installed correctly.<br>• The suppressor cell is exhausted.<br>• The suppressor cell is faulty. | • Install the suppressor as described in Section 5.5.2.<br>• Regenerate the cell, proceed as described in Section 5.5.1.<br>• Exchange the suppressor cell as described in Section 5.5.2. |

# 5 Care and maintenance

## 5.1 Instrument care

The 828 IC Dual Suppressor requires adequate care. Excessive contamination of the instrument could interfere with its functions and reduce the working life of the really robust mechanism and electronics.

Spilt chemicals and solvents should be removed immediately. The connections on the rear panel (and the mains connection in particular) should be protected against contamination.

*Although the design prevents liquid penetration to a great extent, if aggressive media should enter the housing then pull out the mains plug of the 828 IC Dual Suppressor immediately, in order to prevent massive damage to the instrument's electronics. In such a case please contact the Metrohm Service Department.*

*The instrument should only be opened by experienced users. Please observe the safety information given in Section 1.5.1.*

## 5.2 Maintenance by Metrohm Service

The maintenance of the 828 IC Dual Suppressor should take place within the framework of an annual service carried out by trained Metrohm technicians.

The Metrohm Service Department will provide competent advice about the care and maintenance of all Metrohm instruments.

## 5.3 Shutdown

If the 828 IC Dual Suppressor is not to be used for a long time then it should be rinsed with ultrapure water, see Sections 3.6.1 and 3.6.2 Stop sequence.

## 5.4 Regular maintenance

The 828 IC Dual Suppressor is a very robust instrument intended for virtually maintenance-free work. If it is used properly then only the $CO_2$ absorber cartridge needs to be replaced at regular intervals.

### 5.4.1 Replacing the $CO_2$ absorber cartridge

The $CO_2$ absorber cartridge must be replaced at regular intervals. The replacement interval depends on the operating time of the 828 IC Dual Suppressor and the laboratory surroundings. A color change indicates when the absorber material is exhausted. An exhausted cartridge is also indicated by an increased background conductivity and an unstable baseline.

*The $CO_2$ absorber cartridge contains alkali hydroxides. Please observe the appropriate regulations when handling and disposing of these chemicals.*

Attaching the $CO_2$ absorber cartridge is described in Section 2.2.1.

- Remove the exhausted cartridge in the opposite sequence to that described in Section 2.2.1 Point 2.
- Attach a new $CO_2$ absorber cartridge.

## 5.5 Unplanned maintenance work

If problems occur when using the 828 IC Dual Suppressor then it may be necessary to carry out the following maintenance work. Details about problems and their remedies are given in Section 4.1 Remedying faults and problems.

### 5.5.1 Regenerating the cation exchanger

The cation exchanger in the suppressor cell may become exhausted if the exchange capacity of the 828 IC Dual Suppressor is exceeded or if a fault occurs during operation. The following steps should be carried out to regenerate the cation exchanger.

**1 Prepare the system**

- Remove the column from the system and connect the suppressor to the high pressure pump.
- Switch off the 828 IC Dual Suppressor at **mains switch 16**.

**2 Regenerate the cation exchanger**

1. Rinse the system with ultrapure water for 15 min (1 mL/min) with the suppressor switched off (**mains switch 16 = OFF**).
2. Pump 25 mM sulfuric acid at 1 mL/min through the system for 30 min, the suppressor remains switched off (**mains switch 16 = OFF**).
3. Rinse the system with ultrapure water for 15 min (1 mL/min) with the suppressor switched off (**mains switch 16 = OFF**).

4. Pump ultrapure water at 1 mL/min through the system with the suppressor switched on (**mains switch 16 = ON**).

   When LED "**Voltage**" **3** lights up green continue for a further 30 min; the suppressor is then regenerated.

   If LED "**Voltage**" **3** turns red again then repeat rinsing step **3.** and continue with **4**. If the LED "**Voltage**" **3** still remains red then regeneration procedure **2. - 4.** must be repeated.

   If the suppressor cannot be regenerated then the suppressor cell must be replaced.

### 5.5.2 Replacing the suppressor cell

If the suppressor cell can no longer be regenerated then it must be replaced.

*As replacing the suppressor cell requires the instrument to be opened, this should only be carried out by experienced users. Please observe the safety information given in Section 1.5.1.*

*If the 828 IC Dual Suppressor is connected to the mains supply then it must neither be opened nor should any parts be removed from it, as otherwise the risk of contact with current-carrying assemblies exists. This is why the instrument should be separated from all voltage sources before being opened. Please make sure that the* ***mains cable is pulled out from mains connector* 16*!***

***Required tools:***

***1 Phillips screwdriver***
***1 Pliers***

**1 Preparation**

- Switch off the 828 IC Dual Suppressor at **mains switch 16**.
- Remove the mains cable from connection **16**.

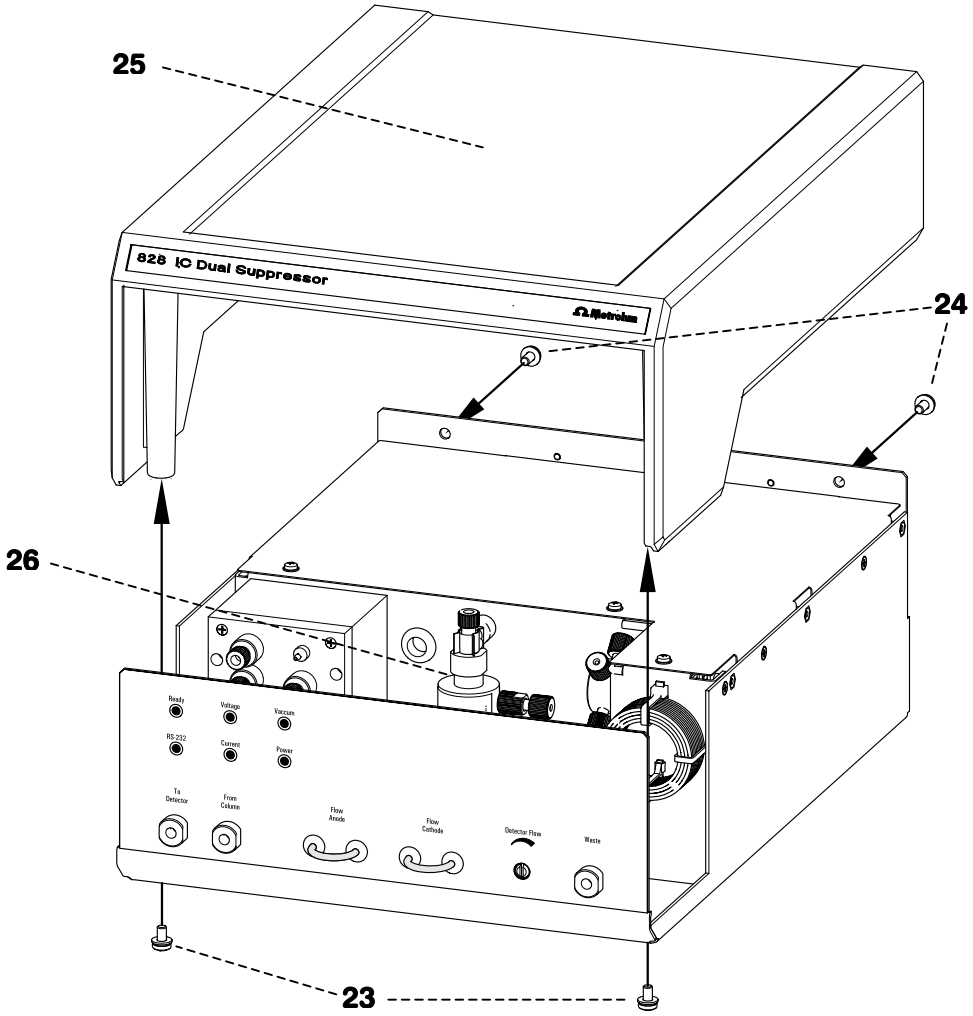



*Figure 8: Opening the instrument*

| | | | |
|---|---|---|---|
| **23** | **Front housing screws** | **24** | **Rear housing screws** |
| **25** | **Housing cover** | **26** | **Suppressor cell** |

### 2 Open the instrument

- Loosen the two front **housing screws 23** on the base of the IC Dual Suppressor, see Figure 8.
- Loosen the two **housing screws 24** at the top of the rear panel of the IC Dual Suppressor.
- Lift off **housing cover 25** upward.

### 3 Remove the suppressor cell

- Loosen the pressure screws on all four of the capillaries connected to **suppressor cell 26**, see Figure 9.
- The **suppressor cell 26** can be pulled forward out of the electrode clamp holders.

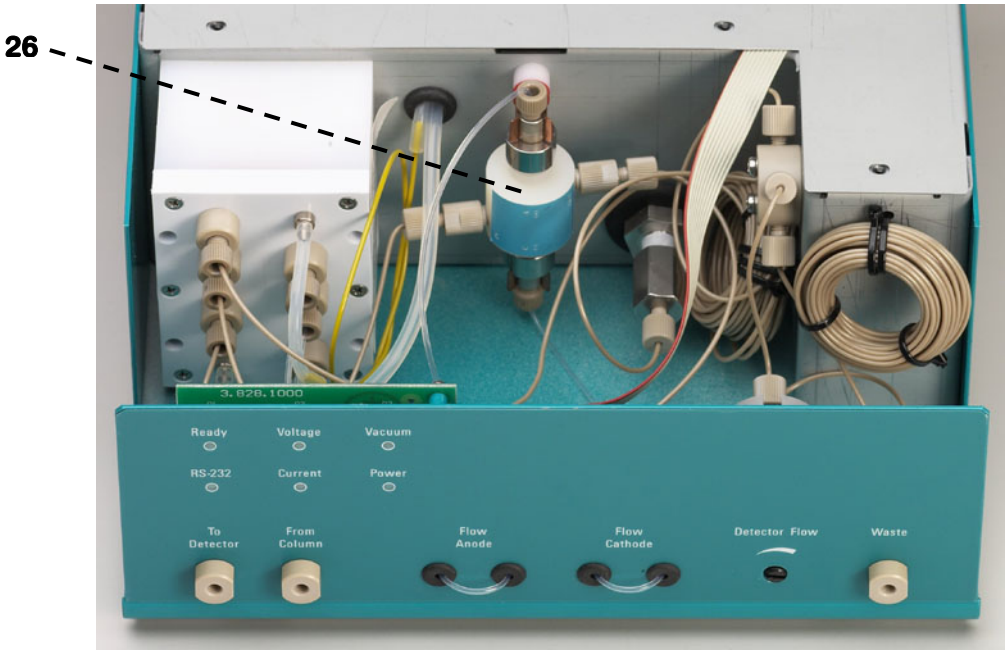



***Figure 9: Opened IC Dual Suppressor***

## 4 Replace the suppressor cell

- Reconnect the capillaries to the appropriate connections of the new **6.2838.000 Suppressor cell 26**.

  The electrode connections are kept waterproof by flat seals. Tighten them up by hand and then use the pliers to tighten them by a further 1/8 turn.

  The suppressor cell connections and capillaries are marked; the suppressor cell position and the assignment of the capillaries is shown in Figure 10.

- Press the connected-up suppressor cell back into the electrode clamp holders.

*Take care that you do not touch the suppressor cell electrodes with your bare fingers as this could cause contact problems. If you do accidentally touch the electrodes then they must be degreased with a little ethanol.*

## 5 Reassemble the instrument and connect it up

- Reattach **housing cover 25** by carrying out the steps given in item **2** in the reverse order.
- Connect the Dual Suppressor to the mains supply and switch it on. If you have removed the suppressor from your system then reinstall it as described in Section 2.

## 6 Start up the suppressor

- No further work is necessary before start-up. However, before the first measurement is made with the IC Dual Suppressor we recommend that it is allowed to run overnight to equilibrate the new cell.

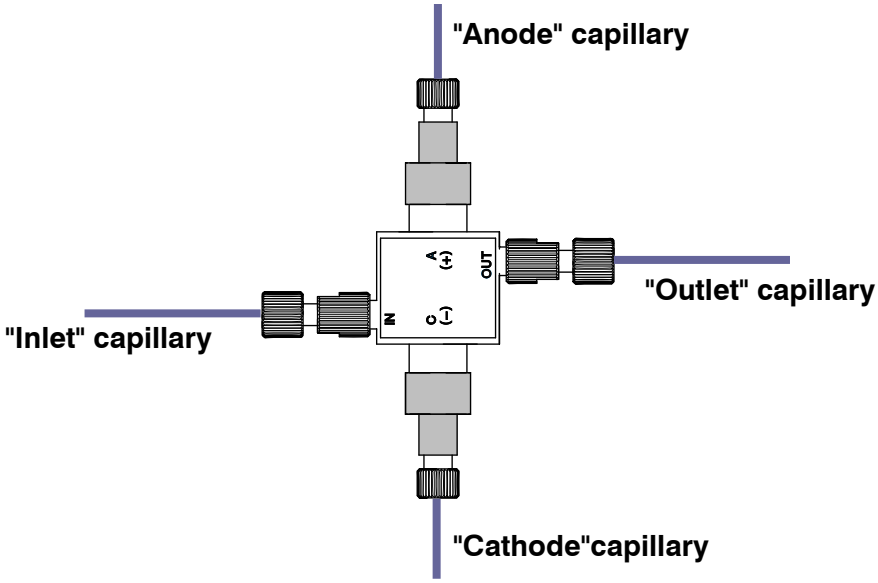



*Figure 10: Suppressor cell position, front view*

# 6 Appendix

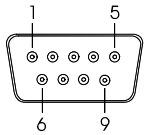
## 6.1 Technical data

### 6.1.1 Suppressor cell

| | |
|---|---|
| *Total flow rate* | 0.5...2.0 mL/min, optimal value 1.0 mL/min |
| *Flow rate ratio* | 40% ± 5% of total flow to detector |
| *Exchange capacity* | 0.05 meq/min, see Section 3.3 |
| *Eluent* | Aqueous eluents, see Section 3.2 |

### 6.1.2 RS 232 interface

*Connection* D-sub connection 9-pin (male)



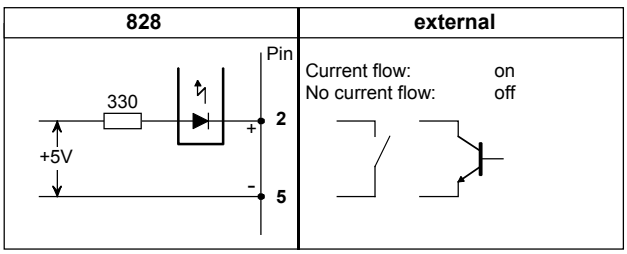

*Function* Only for service purposes

### 6.1.3 Remote interface

*Connection* DIN connection 5-pin (female)


*Purpose* Remote operation of suppressor (on/off)

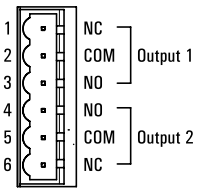
*Pin occupancy*



### 6.1.4 Fault switch, ready output

*Connection*

6-pin (male)




Ready Output

| | |
|---|---|
| NC | normally closed |
| COM | common |
| NO | normally open |

*Purpose*

Pins 1-3 and 4-6 form two independent fault switches which indicate an instrument error (an LED lights up red).

*Pin occupancy*

**Ready** status:

- Open between NC and COM
- Closed between NO and COM

**Not Ready** status:

An impulse of 1 s is outputted; during this time the pin switching is reversed.

- Closed between NC and COM
- Open between NO and COM

### 6.1.5 Mains connection

*Voltage*

100...240 V
automatic voltage adaptation in instrument
see Section 2.3.1

*Frequency*

50...60 Hz

*Power consumption*

25 W

*Fuse*

5 mm dia., 20 mm long
1.0 AT (slow blow); must only be replaced by the same type

### 6.1.6 Safety specifications

*Construction and testing*

According to EN/IEC 61010-1 / UL 3101-1, protection class 1

*Safety instructions*

The Instructions for Use contain safety information that must be observed by the user in order to ensure the safe operation of the instrument.

### 6.1.7 Electromagnetic compatibility (EMC)

| | |
|---|---|
| Emission | Standards fulfilled:<br>- EN/IEC 61326-1<br>- EN 55022<br>- CISPR 22 |
| Immunity | Standards fulfilled:<br>- EN/IEC 61326-1<br>- EN/IEC 61000-4-2<br>- EN/IEC 61000-4-3<br>- EN/IEC 61000-4-4<br>- EN/IEC 61000-4-5<br>- EN/IEC 61000-4-6<br>- EN/IEC 61000-4-11<br>- EN/IEC 61000-4-14<br>- Namur |

### 6.1.8 Ambient temperature

| | |
|---|---|
| *Nominal working range* | +5…+45 °C<br>(at 20…80% relative humidity) |
| *Transport* | –40…+70 °C |
| *Storage* | –20…+70 °C |

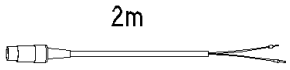
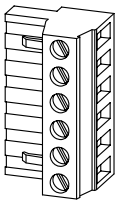
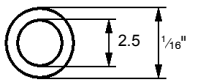
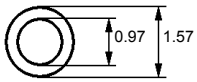
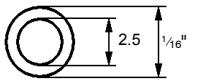
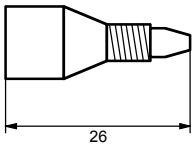
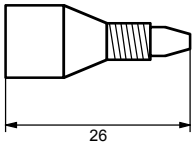
### 6.1.9 Housing

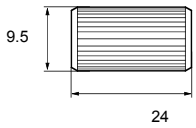
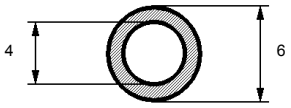
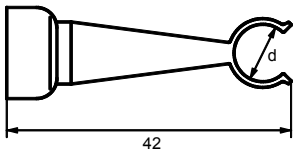
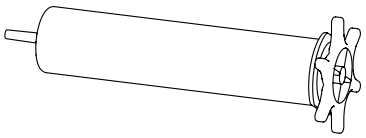
| | |
|---|---|
| *Cover material* | Rigid polyurethane foam (PUR) with flame protection to flammability class UL94VO, CFC-free |
| *Base material* | Steel, enameled |
| *Width* | 260 mm |
| *Height* | 129 mm |
| *Depth* | 366 mm |
| *Weight* | 5.6 kg (with accessories) |

# 6.2 Standard equipment

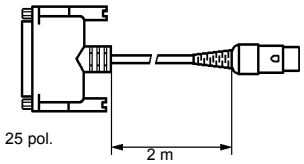
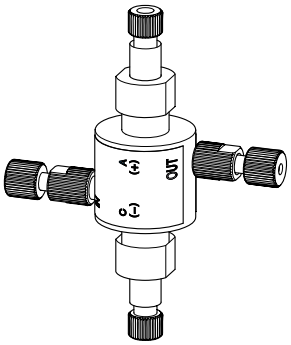
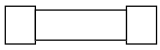
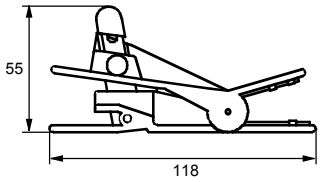
*We reserve the right to make alterations!*
*All dimensions given in mm.*

The 2.828.0010 IC Dual Suppressor includes the following accessories:

| No. | Order. no. | Description |
|---|---|---|
| 1 | 1.828.0010 | **IC Dual Suppressor** |
| 1 | 6.21220X0 | **Mains cable**<br>to customer's requirements:<br>Cable socket — Cable plug<br>Type IEC 320/C 13 — Type SEV 12 (CH…) — 6.2122.020<br>Type IEC 320/C 13 — Type CEE (7), VII (D…) — 6.2122.040<br>Type CEE (22), V — Type NEMA 5-15 (USA…) — 6.2122.070 |
| 1 | 6.2128.180 | **Remote connection cable**<br>Connection cable IC Interface 762 – 752, 753, 754, 793 or 828.<br>  |
| 1 | 6.2140.40 | **Connection block**<br>For ready output interface, 6-pin<br>  |
| 1 | 6.1831.010 | **PEEK capillary**<br>Length = 3 m<br>  |
| 1 | 6.1803.020 | **PTFE capillary tubing**<br>Length = 5 m<br>  |
| 1 | 6.1803.090 | **PTFE capillary**<br>Backpressure capillary, length = 15 m<br>  |
| 1 | 6.2744.010 | **PEEK pressure screw**<br>For connecting 1/16" capillaries, set of 5 pieces<br>  |
| 1 | 6.2744.014 | **PEEK pressure screw**<br>For connecting 1/16" capillaries, set of 2 pieces<br>  |

| | | |
|---|---|---|
| **2** | **6.2744.040** | **PEEK coupling**<br>For connecting 1⁄16" capillaries<br>  |
| **1** | **6.1816.030** | **Silicone tubing**<br>Connection tubing for $CO_2$ absorber cartridge, length = 7 cm<br>  |
| **1** | **6.2027.070** | **Column holder**<br>Holder for the $CO_2$ absorber cartridge, diameter d = 25.0 mm, 2 pieces<br>  |
| **1** | **6.2837.000** | **$CO_2$ absorber cartridge**<br>  |
| **1** | **8.828.1003** | **Instructions for Use (English)**<br>for 828 IC Dual Suppressor |

# 6.3 Optional accessories

| No. | Order. no. | Description |
|---|---|---|
| 1 | 6.2143.200 | **Remote connection cable**<br>761 Compact IC - 828, length = 2 m<br>  |
| 1 | 6.2838.000 | **IC Dual Suppressor cell**<br>  |
| 1 | U.600.0016 | **Fuse**<br>1.0 AT slow blow<br>  |
| 1 | 6.2621.080 | **Capillary cutter for plastic capillaries**<br>for 6.1831.010 PEEK capillaries and 6.1822.010 PTFE microcapillaries<br>with 5 spare cutting blades<br>  |

# 6.4 Validation / GLP

**GLP** (**G**ood **L**aboratory **P**ractice) requires, among other things, that the precision and correctness of analytical instruments is checked at regular intervals by using SOPs (**S**tandard **O**perating **P**rocedures, **SOP**). An example of such a standard operating procedure is available from Metrohm under the title **«Application Bulletin No. 277 – Validation of Metrohm Ion Chromatography Systems by using Standard Operating Procedures (SOP)»**. This SOP can be adapted for your ion chromatography system and used for its validation.

The 828 IC Dual Suppressor must be included as a part of the whole ion chromatography system, whose most important components include the pumps, separation columns, detector and evaluation system, in the all-embracing validation of the whole system.

Please contact your local Metrohm agency in order to receive support in validating your 828 IC Dual Suppressor. It can also provide you with validation documentation which will help you to carry out your installation qualification (IQ) and operational qualification (OQ).

Further information about QA, GLP and validation can also be found in the brochure «**Quality management with Metrohm**» which is also obtainable from your local Metrohm agency.

Checking the electronic and mechanical assemblies of Metrohm instruments can and should be undertaken within the framework of regular servicing by Metrohm technicians (see Section 5.2). All Metrohm instruments are equipped with start-up check routines which check that the relevant assemblies are functioning perfectly when the instrument is switched on. If no error message appears it can be assumed that the instrument is functioning properly.

The 828 IC Dual Suppressor also contains a built-in diagnosis program which allows the service technicians to check the functioning of particular assemblies should faults or malfunctions occur and to localize them.

# 6.5 Warranty and conformity

## 6.5.1 Warranty

The warranty on our products is limited to defects that are traceable to material, construction or manufacturing error which occur within 12 months from the day of delivery. In this case the defects will be rectified in our workshops free of charge. Transport costs are to be paid by the customer.

For day and night operation the warranty is limited to 6 months.

Glass breakage in the case of electrodes or other parts is not covered by the warranty. Checks which are not a result of material or manufacturing faults are also charged during the warranty period. For parts from outside manufacturers, insofar as these constitute an appreciable part of our instrument, the warranty stipulations of the manufacturer in question apply.

With the regard to the guarantee of accuracy the technical specifications in the instruction manual are authoritative.

Concerning defects in materials, construction or design as well as the absence of guaranteed features the purchaser has no rights or claims except those mentioned above.

If damage of the packaging is evident on receipt of a consignment or if the goods show signs of transport damage after unpacking, the carrier must be informed immediately and a written damage report demanded. Lack of an official damage report releases Metrohm from any liability to pay compensation.

If any instruments and parts have to be returned then the original packaging should be used if at all possible. This applies above all to instruments, electrodes, buret cylinders and PTFE pistons. Before embedment in wood shavings or similar material the parts must be packed in a dustproof package (for instruments the use of a plastic bag is essential). If open assemblies are included that are sensitive to electromagnetic voltages (e.g. data interfaces, etc.) then these must be returned in the associated original protective packaging (e.g. conductive protective bag). (Exception: assemblies with a built-in voltage source belong in non-conductive protective packaging).

For damage which arises as a result of non-compliance with these instructions no warranty responsibility whatsoever will be accepted by Metrohm.

### 6.5.2 EU Declaration of Conformity

CE

## EU Declaration of Conformity

The company Metrohm AG, Herisau, Switzerland, certifies herewith, that the following instrument:

**828 IC Dual Suppressor**

meets the CE mark requirements of EU Directives 89/336/EEC and 73/23/EEC.

**Source of specifications:**

| | |
|---|---|
| EN 61326-1 | Electrical equipment for measurement, control and laboratory use – EMC requirements |
| EN 61010-1 | Safety requirements for electrical equipment for measurement, control and laboratory use |

**Description of apparatus:**

Continuous suppressor with integrated degassing unit, external controllable.

Herisau, March 20, 2002

| | |
|---|---|
| Dr. J. Frank | Ch. Buchmann |
| Development Manager | Production and Quality Assurance Manager |

### 6.5.3 Certificate of conformity and system validation

## Certificate of Conformity and System Validation

This is to certify the conformity to the standard specifications for electrical appliances and accessories, as well as to the standard specifications for security and to system validation issued by the manufacturing company.

| | |
|---|---|
| Name of commodity: | 828 IC Dual Suppressor |
| System software: | Stored in ROMs |
| Name of manufacturer: | Metrohm Ltd., Herisau, Switzerland |

This Metrohm instrument has been built and has undergone final type testing according to the standards:

*Electromagnetic compatibility: Emission*
IEC 61326-1, EN 55022, CISPR 22

*Electromagnetic compatibility: Immunity*
IEC 61326-1, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-11, IEC 61000-4-14, Namur

*Safety specifications*
IEC 61010-1, UL 3101-1

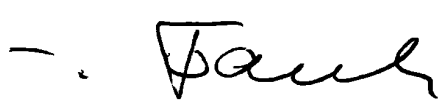
It has also been certified by the Swiss Electrotechnical Association (SEV), which is member of the International Certification Body (CB/IEC).

The technical specifications are documented in the instruction manual.

The system software, stored in Read Only Memories (ROMs) has been validated in connection with standard operating procedures in respect to functionality and performance.

Metrohm Ltd. is holder of the SQS-certificate of the quality system ISO 9001 for quality assurance in design/development, production, installation and servicing.

Herisau, March 20, 2002



| | |
|---|---|
| Dr. J. Frank | Ch. Buchmann |
| Development Manager | Production and Quality Assurance Manager |

# 6.6 Index

## P



## Q



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## S



## T



## V



## W