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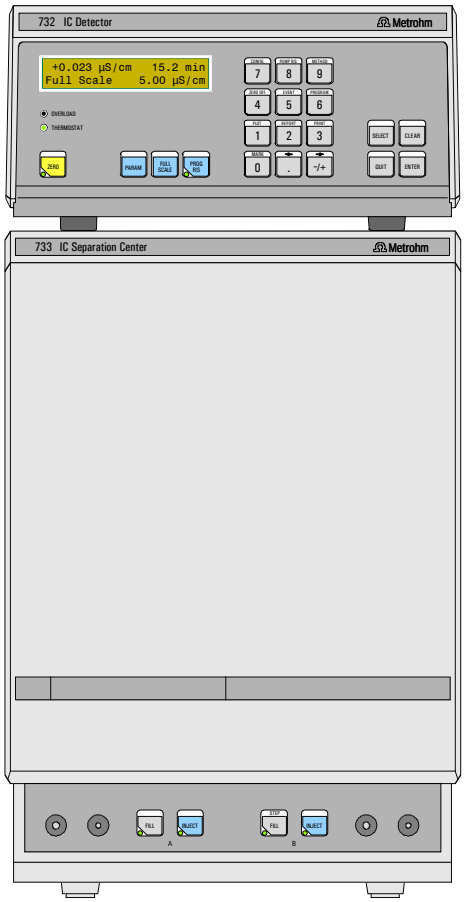
# 732 IC Detector
# 733 IC Separation Center

5.732.0012 Program




8.732.1033 Instructions for Use

1.10.1998 / dö

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# 1 Introduction

## 1.1 Instrument description

The **732 IC Detector** is a conductivity detector especially designed for ion chromatography with an extensive operating range and high sensitivity for the recording of chromatograms with and without chemical suppression. The associated thermostattable detector block is normally installed in the 733 IC Separation Center, but can also be used as a separate detector. The two following versions are available:

- **2.732.0010** IC Detector with standard detector block
- **2.732.0110** IC Detector with metal-free detector block

The 732 IC Detector is operated using the keypad with operator guidance via the two-line LCD. In addition to setting of the measurement parameters, time programs can be generated which can be used to initiate a large number of instrument functions for each of the maximum 20 program steps. Further, the same functions can be executed at a specific time with 4 programmable "events".

The 732 IC Detector is equipped with various interfaces for communication purposes. Recorders, integrators or the «IC Metrodata for Win95» chromatography data system can be connected to the analog output (1 V or 10 mV) for the plotting and evaluation of chromatograms. The two RS232 interfaces are used for the connection of a 709 IC Pump, a printer or a PC for remote control of the IC system. Finally, programmable signals at a "remote" interface can be employed to control any external devices which, in turn, can start functions at the IC system.

The **733 IC Separation Center** is a thermally and electronically isolated wet part which accommodates injectors, columns, detectors, suppressor module and pulsation dampener and is controlled by the 732 IC Detector. The following versions are available:

- **2.733.0010** IC wet part with 1 injector for a one-channel system with electronic suppression
- **2.733.0020** IC wet part with 2 injectors for a two-channel system with electronic suppression
- **2.733.0120** IC wet part with 2 injectors for a two-channel system with electronic suppression, metal-free
- **2.733.0030** IC wet part with 1 injector and 1 Metrohm Suppressor Module MSM for a one-channel system with chemical suppression
- **2.733.0130** IC wet part with 1 injector and 1 Metrohm Suppressor Module MSM for a one-channel system with chemical suppression, metal-free

The 732 IC Detector and 733 IC Separation Center are the main components of a modular **ion chromatography system** that can be expanded to meet the wishes of the individual user (*see Fig. 1*). The minimum configuration of the one-channel system also includes a 709 IC Pump, a separating column and a recorder. The two-channel system requires at least a second 732 IC Detector and a second 709 IC Pump. Printers, integrators, data recording devices, PC and autosamplers can be attached to both systems. Further, practically all HPLC peripherals and parts available on the market such as precolumns, additional separating columns, additional detectors and other injection systems can be seamlessly integrated in the system.

However, the individual IC units can also be freely combined with common HPLC instruments. This offers the possibility of expanding your system to a standalone ion chromatograph.

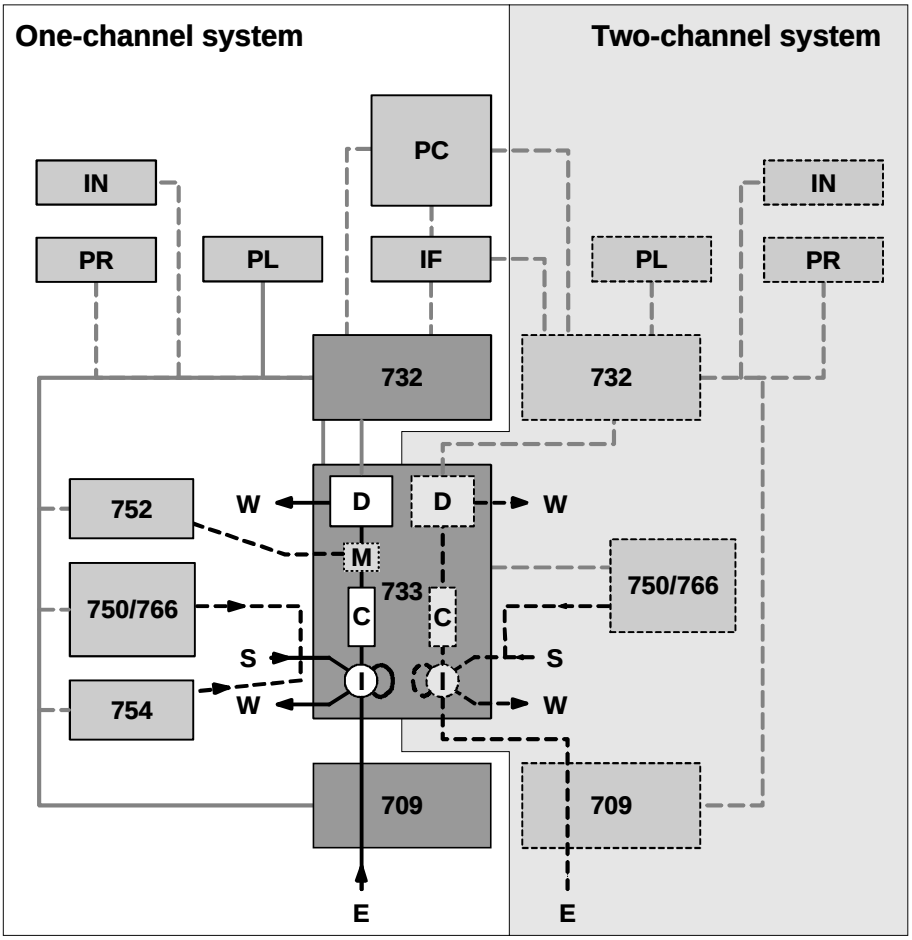



***Fig. 1: Block diagram of the ion chromatography system***

| | | | | | |
|---|---|---|---|---|---|
| **C** | **Separating column** | **M** | **Suppressor module** (one-channel system only) | **709** | **IC Pump** |
| | | | | **732** | **IC Detector** |
| **D** | **Detector** | **PC** | **PC** | **733** | **IC Separation Center** |
| **E** | **Eluent** | **PL** | **Recorder** | **750** | **Autosampler** |
| **I** | **Injector** | **PR** | **Printer** | **752** | **Pump Unit** |
| **IF** | **Interface** | **S** | **Sample** | **754** | **Dialysis Unit** |
| **IN** | **Integrator** | **W** | **Waste** | **766** | **IC Sample Processor** |

# 1.2 Parts and controls

## 1.2.1 732 IC Detector

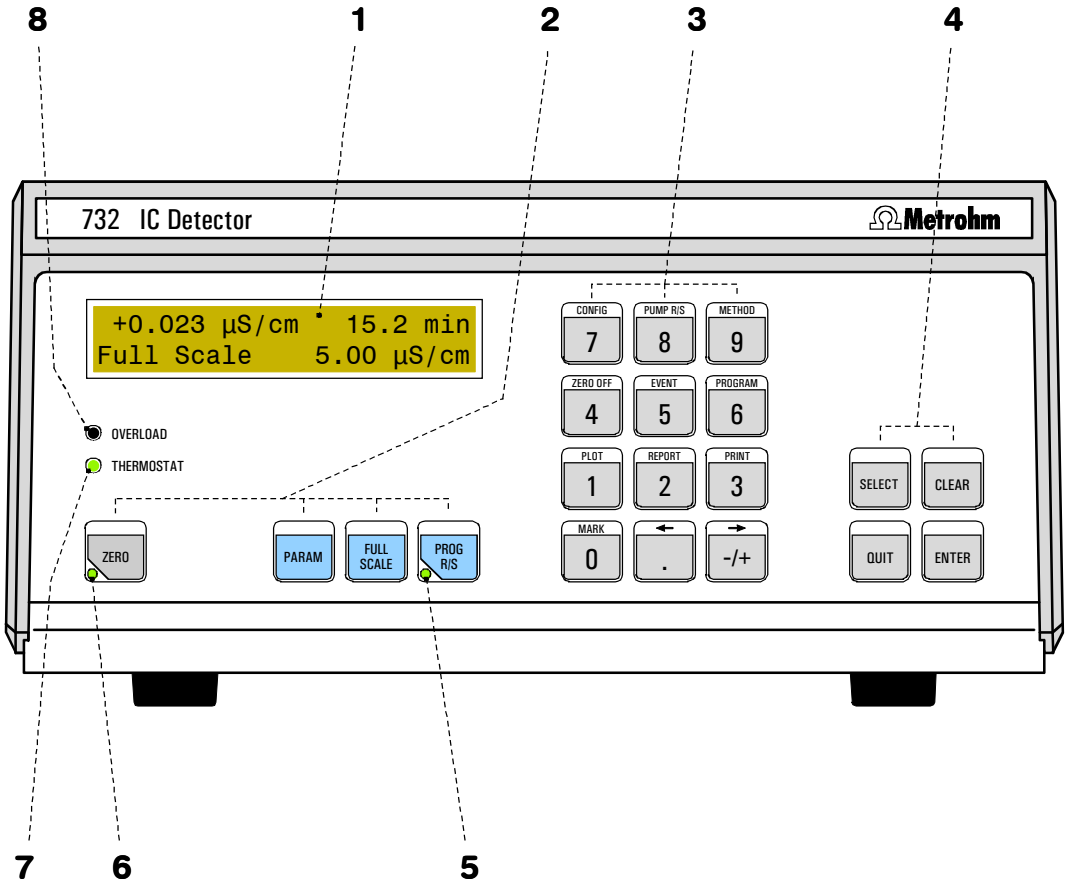



***Fig. 2: Front of the 732 IC Detector***

| | | | |
|---|---|---|---|
| **1** | **Display (LCD)**<br>comprising 2 lines each of 24 characters | **5** | **Program status display (LED)**<br>LED dark: Program inactive<br>LED lit up: Program ready<br>LED flashes: Program running |
| **2** | **Main function keys**<br>Auto-zero, Parameters, Full Scale, Program start/stop | **6** | **Auto-zero display (LED)**<br>LED dark: Auto-zero switched off<br>LED lit up: Auto-zero switched on |
| **3** | **Numeric keys**<br>Edit mode: Numeric keys<br>Basic mode: Function keys | **7** | **Thermostat display (LED)**<br>LED dark: Heating switched off<br>LED lit up: Heating switched on |
| **4** | **Auxiliary function keys**<br>Select, Clear, Quit, Enter | **8** | **Overload display (LED)**<br>LED lit up: Meas. signal >150% of full-scale range<br>LED flashes: Meas. signal >180% of full-scale range |

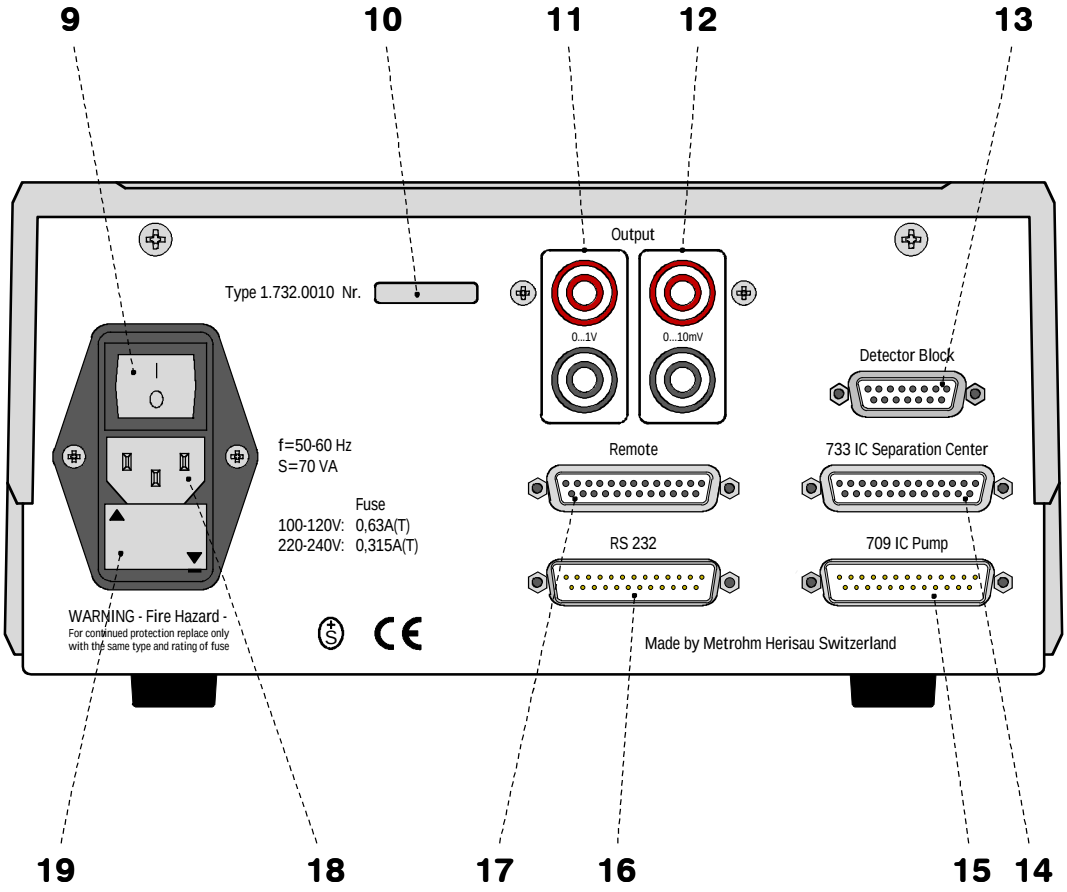



***Fig. 3: Rear of the 732 IC Detector***

| | | | |
|---|---|---|---|
| **9** | **Mains switch**<br>switch to switch instrument on and off:<br>I = ON 0 = OFF | **15** | **Connection for 709 IC Pump**<br>RS232 interface, can also be used for connection of a printer |
| **10** | **Serial number** | **16** | **RS232 interface**<br>connection of a printer, PC, etc. |
| **11** | **Analog output 0¼1 V**<br>red socket: live<br>black socket: common | **17** | **Remote interface**<br>remote I/O lines for connection of external devices |
| **12** | **Analog output 0¼10 mV**<br>red socket: live<br>black socket: common | **18** | **Mains connection plug**<br>mains connection, see *section 2.4* |
| **13** | **Connection for detector block** | **19** | **Fuse holder**<br>changing the fuses, see *section 2.4* |
| **14** | **Connection for 733 IC Separation Center** | | |

### 1.2.2 733 IC Separation Center

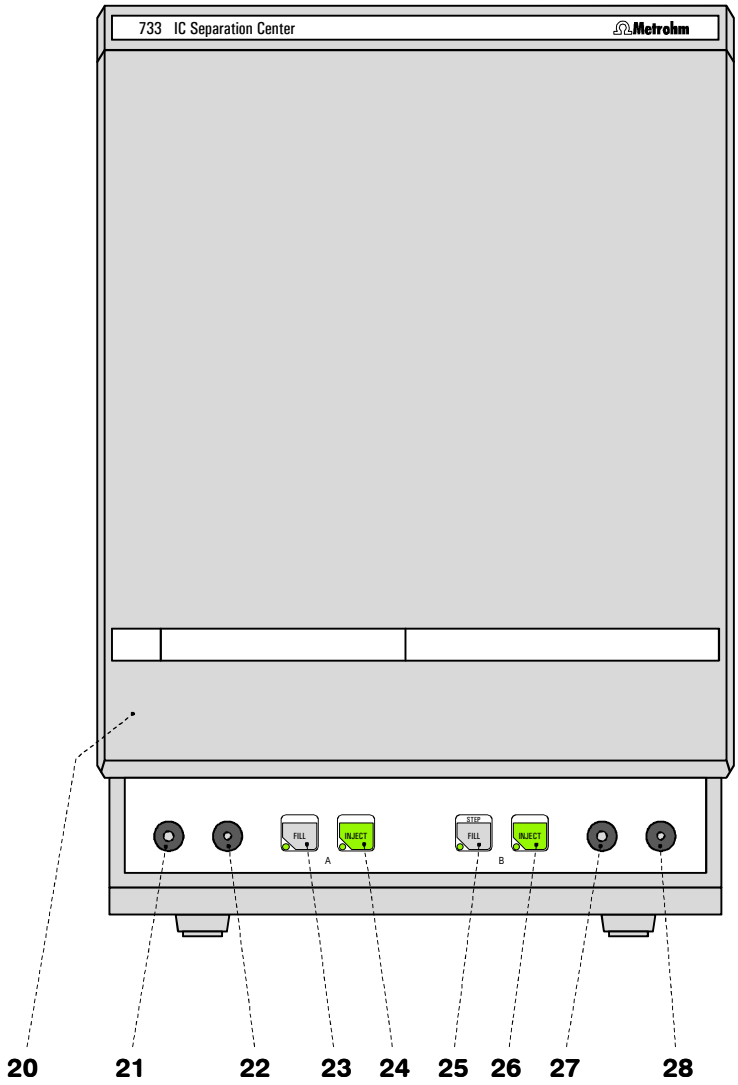



*Fig. 4: Front of the 733 IC Separation Center*

| | | | |
|---|---|---|---|
| **20** | **Door to interior** | **25** | **"FILL" key for valve B or "STEP" for suppressor module** |
| **21** | **Connection for 6.2816.020 Syringe** | **26** | **"INJECT" key for valve B** |
| **22** | **Feedthrough for aspirating tubing** | **27** | **733.0010: Feedthrough for capillary<br>733.0X20: Connection for 6.2816.020 Syringe<br>733.0X30: Feedthrough for suppressor inlet cap.** |
| **23** | **"FILL" key for valve A** | **28** | **733.0010: Feedthrough<br>733.0X20: Feedthrough for aspirating tubing<br>733.0X30: Feedthrough for suppressor inlet capillary** |
| **24** | **"INJECT" key for valve A** | | |

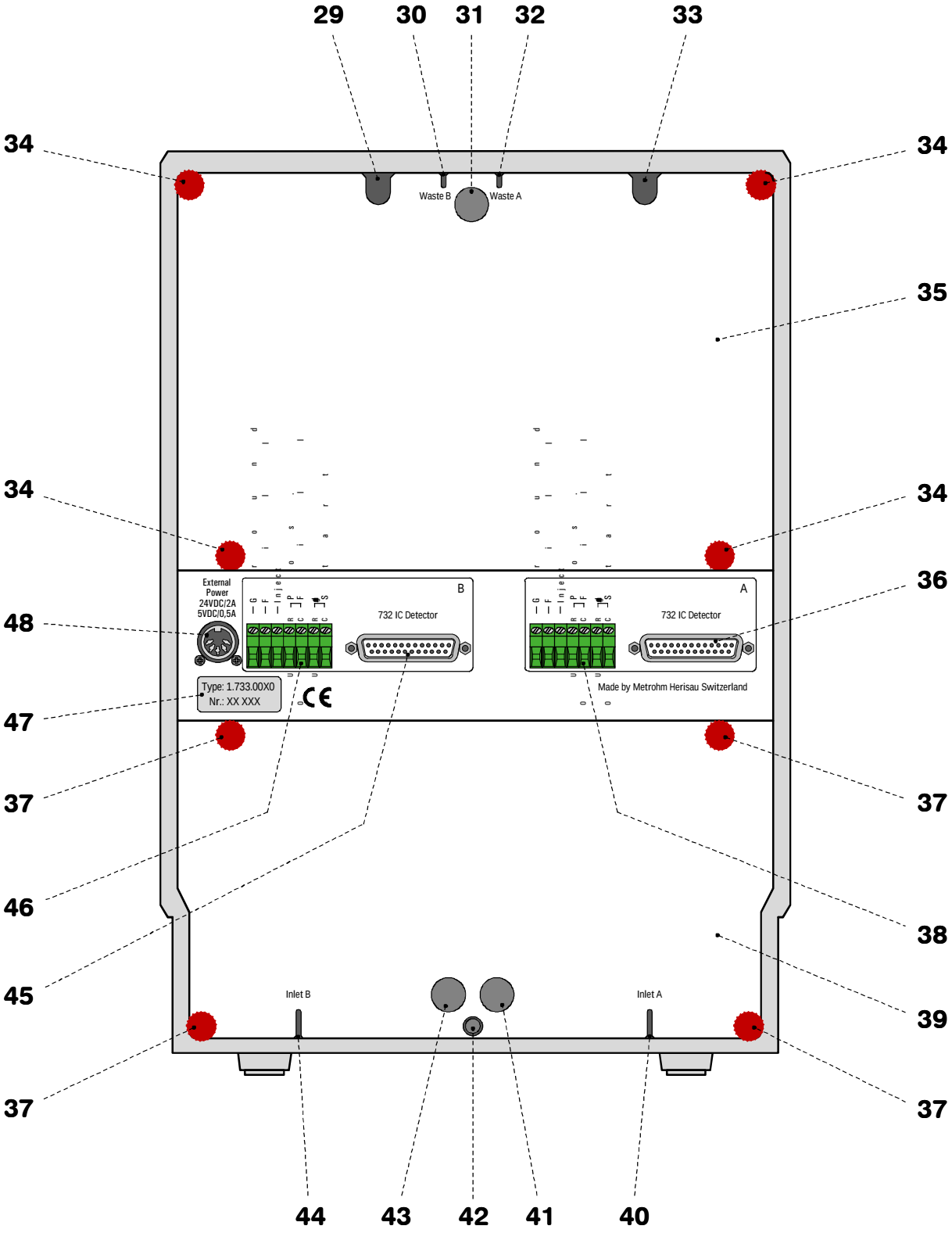



***Fig. 5:** Rear of the 733 IC Separation Center*

**29** **Opening for detector cable B**
opening for connecting cable detector block B – 732

**30** **Opening for outlet capillary B**
discharge of the eluent of column B to waste

**31** **Rear panel opening**
(closed with plastic stopper) for additional supply and discharge lines to and from the inner compartment

**32** **Opening for outlet capillary A**
discharge of the eluent of column A to waste

**33** **Opening for detector cable A**
opening for connecting cable detector block A – 732

**34** **Knurled screw**
for fastening the rear panel **35**

**35** **Detachable rear panel**
access to top part of the inner compartment

**36** **Connection for 732 IC Detector A**

**37** **Knurled screw**
for fastening rear panel **39**

**38** **Terminal block for valve A**
Ground, Fill, Inject:
inputs for control of the valve
Pos.Fill:
output signal on switching of the valve to position "FILL"
Integr.Start:
output signal on switching of the valve to position "INJECT"

**39** **Detachable rear panel**
access to bottom part of inner compartment

**40** **Opening for inlet capillary A**
supply of the eluent for column A

**41** **Rear panel opening**
(closed with plastic stopper) for additional supply and discharge lines to and from the inner compartment

**42** **Connection for drain tube**
for discharge of spilled liquid from the inner compartment

**43** **Rear panel opening**
(closed with plastic stopper) for additional supply and discharge lines to and from the inner compartment

**44** **Opening for inlet capillary B**
supply of the eluent for column B

**45** **Connection for 732 IC Detector B**

**46** **Terminal block for valve B**
Ground, Fill, Inject:
inputs for control of the valve
Pos.Fill:
output signal on switching of the valve to position "FILL"
Integr.Start:
output signal on switching of the valve to position "INJECT"

**47** **Model plate**
with serial number

**48** **Connection for external supply**
connection of power supply unit (5 V, 0.5 A / 24 V, 2 A) in operation without 732 IC Detector

# 1.3 Information on the Instructions for Use

*Please read through these Instructions for Use carefully before you put the 732 IC Detector and 733 IC Separation Center into operation. The Instructions for Use contain information and warnings which must be heeded the user to assure safe operation of the instruments.*

## 1.3.1 Organization

These **8.732.1033 Instructions for Use** for the 732 IC Detector and 733 IC Separation Center provide a comprehensive overview of the installation, startup procedure, operation, fault rectification and technical specifications of these instruments. The Instructions for Use are organized as follows:

**Section 1** **Introduction**
General description of instruments, parts and controls and safety notes

**Section 2** **Installation**
Installation of 732 IC Detector / 733 IC Separation Center, attachment of accessories and external devices

**Section 3** **Operating tutorial**
Introduction to the operation using an example

**Section 4** **Operation**
Detailed description of the operation and explanation of functions of all keys

**Section 5** **Notes – Maintenance – Faults**
Notes on ion chromatography, maintenance, fault rectification, diagnostic tests, validation

**Section 6** **Interfaces (green pages)**
Description of RS232 interfaces, remote interfaces, valve interface and analog output

**Section 7** **Appendix**
Technical data, standard equipment, options, warranty, declarations of conformity, index

To find the required information on the instruments, you will find it an advantage to use either the **Table of contents** or the **Index** at the back. The **8.732.1043 Quick Reference Guide** is suitable for use as a reference work for daily use as it explains the most important parameters and key functions.

As a supplement to the Instructions for Use, the **Metrohm Monograph 8.732.2003 "Ion chromatography"** is also supplied. This provides an introduction to the theoretical fundamentals and general information on separating columns and sample pretreatment. You will find detailed information on the separating columns available from Metrohm and on special IC applications in the relevant "**Application Bulletins"**, which are available on request free of charge from your Metrohm agency.

### 1.3.2 Notation and pictograms

The following notations and pictograms (symbols) are used in these Instructions for Use:

| | |
|---|---|
| <PARAM> | **Key** |
| "Range" | **Parameter or entry value** |
| **35** | **Part or control of 732/733** |
| **22** | **Part or control of 709** |
| >PARAM/detector<br>range: 1.00 mS/cm | **Display**<br>Text in display **1** of the 732 IC Detector |
|  | **Hazard**<br>This symbol draws attention to a possible danger to life or of injury if the associated directions are not followed correctly. |
|  | **Warning**<br>This symbol draws attention to possible damage to instruments or instrument parts if the associated directions are not followed correctly. |
|  | **Caution**<br>This symbol marks important information. First read the associated directions before you continue. |
|  | **Comment**<br>This symbol marks additional information and tips. |

# 1.4 Safety notes

## 1.4.1 Electrical safety

While electrical safety in the handling of the 732 IC Detector and 733 Separation Center is assured in the context of the specifications IEC 1010-1 (protection class 1, degree of protection IP40), the following points should be noted:

- **Mains connection**

*Setting of the **mains voltage**, checking the **mains fuse** and the **mains connection** must be effected in accordance with the instructions in section 2.4.*

- **Opening the 732 IC Detector**

*If the 732 IC Detector is connected to the power supply, the instrument must not be opened nor must parts be removed from it, otherwise there is a danger of coming into contact with components which are live. Hence, always disconnect the instrument from all voltage sources before you open it and ensure that the **mains cable is disconnected from mains connection** **18** !*

- **Opening the 733 IC Separation Center**

*Disconnect **connecting cable to the 732 IC Detector from connector** **14** before you remove the middle housing panel with connectors.*

- **Protection against static charges**

*Electronic components are sensitive to static charging and can be destroyed by discharges. Before you touch any of the components inside the 732 IC Detector or 733 IC Separation Center, you should earth yourself and any tools you are using by touching an earthed object (e.g. housing of the instrument or a radiator) to eliminate any static charges which exist.*

## 1.4.2 General precautionary rules

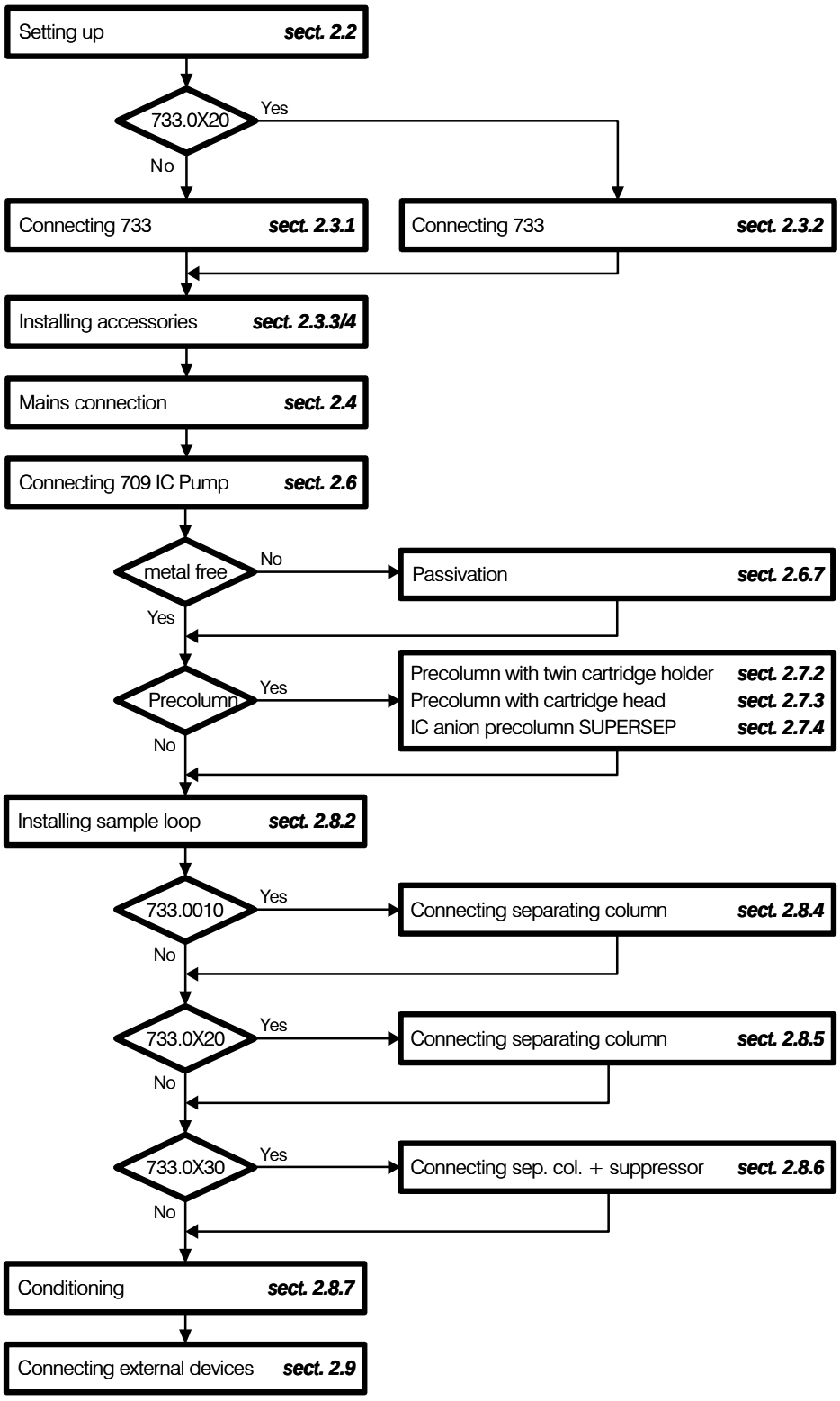
- **Handling of solvents**

*Check all lines of the IC system periodically for possible leaks. Follow the relevant instructions regarding the handling of flammable and/or toxic solvents and their disposal.*

# 2 Installation

## 2.1 Flow chart

The following flow chart provides an overview of all installation work. You will find more detailed information in the relevant sections.



# 2.2 Setting up the instruments

## 2.2.1 Packaging

The 732 IC Detector and 733 IC Separation Center are supplied together with the separately packed accessories in special packagings containing shock-absorbing foam linings designed to provide excellent protection. The actual instruments are packed in an evacuated polyethylene bag to prevent the ingress of dust. Please store all these special packagings as only they assure transport of the instruments free from damage.

## 2.2.2 Check

After receipt, immediately check whether the shipment is complete and has arrived without damage (compare with delivery note and list of accessories in *section 7.2*). In the case of transport damage, see instructions in *section 7.4.1* "Warranty".

## 2.2.3 Location

Position the instruments in the laboratory at a location convenient for operation, free from vibrations and protected against a corrosive atmosphere and contamination by chemicals. The same applies to all other components of the IC system.

*To avoid disturbing temperature influences on the insulated column compartment, the entire system including pump and eluent reservoir must be protected against direct sunlight.*

## 2.2.4 Arrangement of the instruments

In one-channel operation, the 709 IC Pump, 733 IC Separation Center and 732 IC Detector are best stacked on top of one another in this order.

In two-channel operation (2.733.0X20 IC Separation Center), the optimum arrangement (1, 2 or 3 towers) depends on the laboratory space available. However, the 709 IC Pumps should be set up at the very bottom and the 732 IC Detectors at the very top.

*To ensure that the arrangement of pumps and detectors for the two channels A and B is clearly apparent in two-channel operation, it is advantageous to mark the instruments. The 6.2248.000 Magnetic plate is enclosed with the 732 IC Detector for this purpose. It can be cut to the desired size, labeled (e.g. with "A" or "B") and affixed to the appropriate instrument.*

# 2.3 Connection of 733 IC Separation Center

## 2.3.1 2.733.0010/2.733.0X30 IC Separation Center

The instrument versions 2.733.0010 and 2.733.0030 of the IC Separation Center are operated with a 732 IC Detector whose standard equipment also includes the **1.732.0100 Detector block**. For the metal-free 2.733.0130 instrument version the **metal-free 1.732.0110 Detector block** must be used. It is best to proceed as follows when connecting the two instruments and the detector block:

### 1 Install detector block

- Unscrew the four knurled screws **34** from the top rear panel **35** of the 733 IC Separation Center and remove rear panel (see *Fig. 5*).
- Position detector block from the back in the space provided in the 733 IC Separation Center on the right and push fully to the front (see *Fig. 16*).
- Insert the cable permanently attached to the detector block in opening **33** and the outlet capillary in opening **32** "Waste A" of the rear panel **35**.
- Replace rear panel **35** and screw to the 733 IC Separation Center using the four knurled screws **34**.

### 2 Connect detector block

- Plug the gray connecting cable permanently attached to the detector block into connection **13** "Detector Block" of the 732 IC Detector and fasten to the instrument by tightening the screws in the cable connector (see *Fig. 6*).

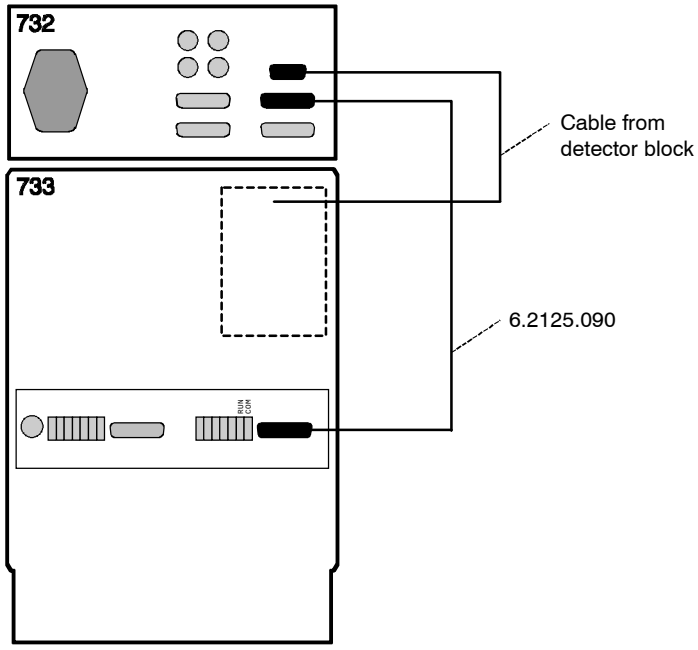



***Fig. 6: Connection 732 – 2.733.0010/2.733.0X30***

**3 Connect waste container**

- Lead the outlet capillary of the detector block to a sufficiently large waste container and fix in place.

**4 Connect 732 to 733**

- Plug one end of the 6.2125.090 Connecting cable into connection **14** "733 IC Separation Center" of the 732 IC Detector and fasten to the instrument by tightening the screws in the cable connector (see *Fig. 6*).
- Plug the other end of the 6.2125.090 Connecting cable into connection **36** "732 IC Detector" of the 733 IC Separation Center and fasten to the instrument by tightening the screws in the cable connector (see *Fig. 6*).

### 2.3.2 2.733.0X20 IC Separation Center

For operation of the 2.733.0020 or the metal-free 2.733.0120 instrument version of the 733 Separation Center, two 1.732.0100 or metal-free 1.732.0110 IC Detectors are needed. It is best to proceed as follows when connecting the instruments and the two detector blocks:

**1 Install detector blocks**

- Unscrew the four knurled screws **34** from the top rear panel **35** of the 733 IC Separation Center and remove rear panel (see *Fig. 5*).
- Position first detector block A from the back in the space provided in the 733 IC Separation Center on the right and push fully to the front (see *Fig. 16*).
- Position second detector block B from the back in the space provided in the 733 IC Separation Center on the left and push fully to the front (see *Fig. 16*).
- Insert the cable permanently attached to detector block A in opening **33** and the outlet capillary in opening **32** "Waste A" of the rear panel **35**.
- Insert the cable permanently attached to detector block B in opening **29** and the outlet capillary in opening **30** "Waste B" of the rear panel **35**.
- Replace rear panel **35** and fasten to 733 IC Separation Center with the four knurled screws **34**.

**2 Connect detector blocks**

- Plug the gray connecting cable permanently attached to detector block A into connection **13** "Detector block" of the first 732 IC Detector and fasten to the instrument by tightening the screws in the cable connector (see *Fig. 7*).
- Plug the gray connecting cable permanently attached to detector block B into connection **13** "Detector Block" of the second 732 IC Detector Block and fasten to the instrument by tightening the screws in the cable connector.

## 3 Connect waste container

- Lead the outlet capillaries of the two detector blocks to a sufficiently large waste container and fix in place.

## 4 Connect 732 to 733

- Plug one end of the 6.2125.090 Connecting cable into connection **14** "733 IC Separation Center" of the **first 732 IC Detector** and fasten to the instrument by tightening the screws in the cable connector (see *Fig. 7*).
- Plug other end of the 6.2125.090 Connecting cable into connection **36** "732 IC Detector" of the 733 IC Separation Center and fasten to the instrument by tightening the screws in the cable connector.
- Plug one end of the 6.2125.090 Connecting cable into connection **14** "733 IC Separation Center" of the **second 732 IC Detector** and fasten to the instrument by tightening the screws in the cable connector.
- Plug the other end of the 6.2125.090 Connecting cable into connection **45** "732 IC Detector" of the 733 IC Separation Center and fasten to the instrument by tightening the screws in the cable connector.

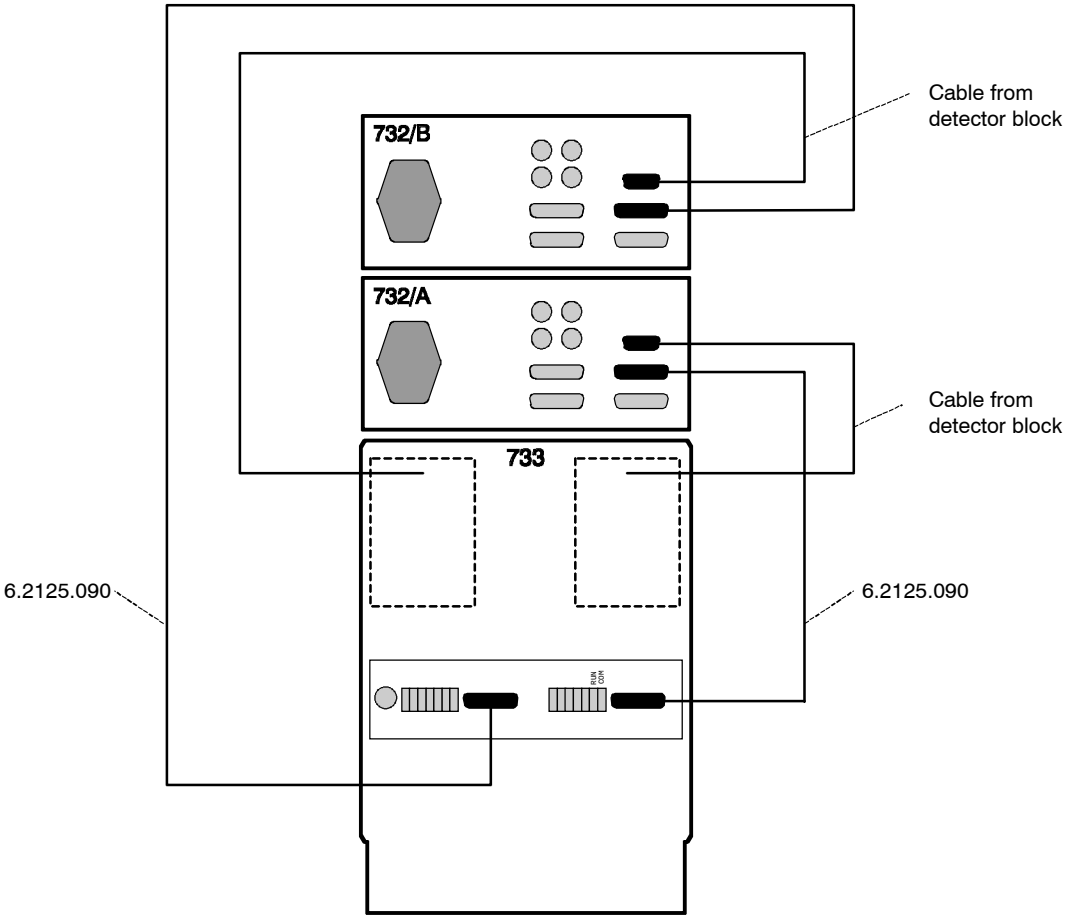



***Fig. 7: Connection 732 – 2.733.0X20***

### 2.3.3 Connection of syringe and aspirating tubing

For manual filling of the sample loops mounted on the injection valves, the 6.2816.020 Syringe and the PTFE aspirating tubing already screwed to the valve are needed. These accessories are mounted or adjusted as follows:

**1 Connect syringe**

- Push 6.2816.020 Syringe (without needle) as far as it will go into connection socket **21** (for valve A) or **27** (for valve B) (see *Fig. 4*).

**2 Adjust aspirating tubing**

- Loosen the rotary nipple screwed onto the interior side of connection **22** or **28**.
- Pull PTFE aspirating tubing **88** (see *Fig. 16* and *Fig. 17*) by hand out of connection **22** or **28** as far as desired.
- Retighten rotary nipple on the interior side of connection **22** or **28** to fix the aspirating tubing in place.

### 2.3.4 Connection of the drain tube

The 733 IC Separation Center has a connection at the rear to which a drain tube for discharged liquids can be attached. Proceed as follows:

**1 Connect drain tube**

- Mount 6.1816.00 Silicone tubing on connection nipple **42** (see *Fig. 5*).

**2 Lead drain tube to collecting vessel**

- Lead the other end of the drain tube to a suitable collecting vessel and fix in place.

### 2.3.5 Connection of the 6.5324.000 Bottle rack (option)

The optional available 6.5324.000 Bottle rack for supply vessels can be placed on top of the IC system tower. The accessories include the supply vessels for eluent (2 L), regeneration solution (1 L) and rinsing solution (1 L). For the connection of the supply capillaries leading to the 709 IC Pump and the suppressor module, see the instructions given on the enclosed leaflet.

# 2.4 Mains connection

*Follow the instructions below for connecting to the power supply. If the instrument is operated with a mains voltage set wrongly and/or wrong mains fuse, there is a danger of fire!*

## 2.4.1 Setting the mains voltage

Before switching on the 732 IC Detector for the first time, check that the mains voltage set on the instrument (see *Fig. 8*) matches the local mains voltage. If this is not the case, you must reset the mains voltage on the instrument as follows:

**1 Disconnect mains cable**

Disconnect mains cable from mains connection plug **18** of the 732 IC Detector.

**2 Remove fuse holder**

Using a screwdriver, loosen fuse holder **19** below the mains connection plug **18** and take out completely.

**3 Check and change fuse if necessary**

Carefully take the fuse installed for the desired mains voltage out of fuse holder **19** and check its specifications (the position of the fuse in the fuse holder is marked by the white arrow imprinted next to the mains voltage range):

**100…120 V** **0.63 A (slow-blow)** Metrohm No. U.600.0014

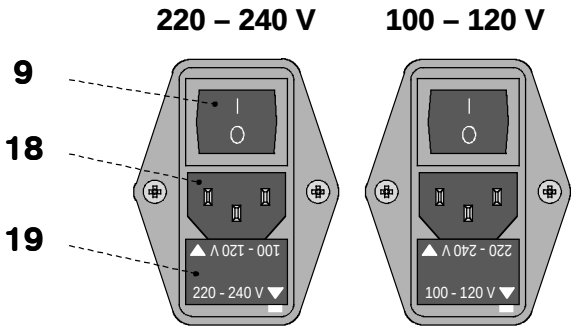
**220…240 V** **0.315 A (slow-blow)** Metrohm No. U.600.0011

**4 Insert fuse**

Change fuse if necessary and reinsert in fuse holder **19**.

**5 Install fuse holder**

Depending on the desired mains voltage, insert fuse holder **19** in the 732 IC Detector so that the corresponding mains voltage range can be read normally and the adjacent white arrow points to the white bar imprinted below the fuse holder (see *Fig. 8*).




| | |
|---|---|
| **9** | **Mains switch** |
| **18** | **Mains connection plug** |
| **19** | **Fuse holder** |

***Fig. 8: Setting the mains voltage***

## 2.4.2 Fuses

One of the two fuses 0.63 A/slow-blow for 100…120 V or 0.315 A/slow-blow for 220…240 V is installed in fuse holder **19** of the 732 IC Detector as standard.

*Ensure that the instrument is never put into operation with fuses of another type, otherwise there is danger of fire!*

For checking or changing fuses, process as described in *section 2.4.1*.

## 2.4.3 Mains cable and mains connection

### Mains cable

The instrument is supplied with one of three mains cables

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

which are three-cored and fitted with a plug with an earthing pin. If a different plug has to be fitted, the yellow/green lead (IEC standard) must be connected to protective earth (protection class 1).

*Any break in the earthing inside or outside the instrument can make it a hazard!*

### Mains connection

Plug the mains cable into mains connection plug **18** of the 732 IC Detector (see *Fig. 8*).

## 2.4.4 On/off switching of the instruments

The 732 IC Detector is switched on and off using mains switch **9**. When the instrument is switched on, display **1** lights up.

# 2.5 Capillary connections

## 2.5.1 Capillaries

Some of the connections under high pressure between the feed pump and the detector block must be set up by the user. For **metal-free systems**, the **6.1831.010 PEEK capillary** (i.d. = 0.25 mm, e.d. = 1/16", length = 3 m) must be used.

For **non metal-free systems**, the 6.1831.010 PEEK capillary can also be used in the pressure range of 0…25 MPa (0…250 bar); on the other hand, in the pressure range of 25…50 MPa (250…500 bar), which is permissible only together with the non metal-free 2.709.0010 version of the 709 IC Pump, the **6.2620.020 Steel capillary** (i.d. = 0.25 mm, e.d. = 1/16", length = 3 m) must be used.

With PEEK capillaries the connection is made preferably with the 6.2744.010 PEEK connectors, with steel capillaries, the connection is made preferably with 6.2620.000 and 6.2620.010 steel connectors (see *section 2.5.2* and *section 2.5.3*).

*Capillaries fitted with new connectors must have a perfectly flat cut surface. For PEEK capillaries it is best to use the **6.2621.080 Capillary tubing cutter**, for steel capillaries the **6.2621.040 Capillary tubing cutter** (both available as an option).*

## 2.5.2 Steel connectors

For the connection of steel capillaries, the steel connectors **6.2620.010 Ferrule** and **6.2620.000 Pressure screw** available as an option can be used. Proceed as follows:

**1 Mount connectors**

Slide a pressure screw **50** (6.2620.000) and a ferrule **49** (6.2620.010) over the end of the capillary **51** to be fastened as shown in *Fig. 9*.

**2 Insert capillary in connection**

Push capillary end into the corresponding connection as far as it will go (to avoid dead volume).

**3 Tighten compression fitting**

Tighten pressure screw **50** with the open-end spanner 1/4" (6.2621.050) supplied.

*For the connection of capillaries to the injection valves, use only the special steel connections contained in a plastic bag affixed to the valve (or as an alternative the 6.2744.010 PEEK compression fittings). If other steel connectors are used (e.g. 6.2620.000 and 6.2620.010), the valve connection may be damaged!*

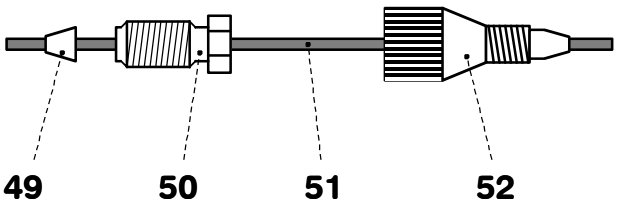



***Fig. 9: Connectors for capillaries***

| | |
|---|---|
| **49** | **Ferrule (6.2620.010)** |
| **50** | **Pressure screw (6.2620.000)** |
| **51** | **Capillary**<br>6.2620.020 Steel capillary or<br>6.1831.010 PEEK capillary |
| **52** | **Compression fitting (6.2744.010)** |

### 2.5.3 PEEK connectors

For the connection of 6.1822.010 PEEK capillaries (i.D. = 0.3 mm) or 6.1822.010 PTFE microcapillaries, the **6.2744.010 PEEK compression fittings** are used. Proceed as follows:

**1 Mount compression fitting**

Slide a compression fitting **52** (6.2744.010) over the end of the capillary **51** to be fastened as shown in *Fig. 9*.

**2 Insert capillary in connection**

Push capillary end in the corresponding connection as far as it will go (to avoid dead volume).

**3 Tighten compression fitting**

Tighten compression fitting **52** by hand (never use tools).

# 2.6 Connection of 709 IC Pump

## 2.6.1 Electrical connection

For operation of the 732 IC Detector and 733 IC Separation Center you can use any commercial HPLC pump. However, as the attainable sensitivity depends to a large extent on the quality of the pump, Metrohm advises use of the **709 IC Pump**, which has been specially developed for the demands of ion chromatography and has minimal pump pulsation and an outstanding flow constancy.

**Startup and operation of the 709 IC Pump** are described in the *709 Instructions for Use*. The eluent, which must be degassed and filtered (cf. *section 5.1.3*), is selected on the basis of the separating column installed in the 733 IC Separation Center and the current separation problem (see 8.732.2003 IC Monograph).

The **connection of the 709 IC Pump** at the connection **15** of the 732 IC Detector is shown in *Fig. 10*. For this you can use the 6.2125.060 Cable available as an option or another RS cable specified as a "null modem" cable. To ensure proper functioning of the communication between the 732 IC Detector and 709 IC Pump, the sliding switch **36** on the IC pump must be set to "RS 232" and the external control switched on with key **8** <EXT.> (see *709 Instructions for Use*).

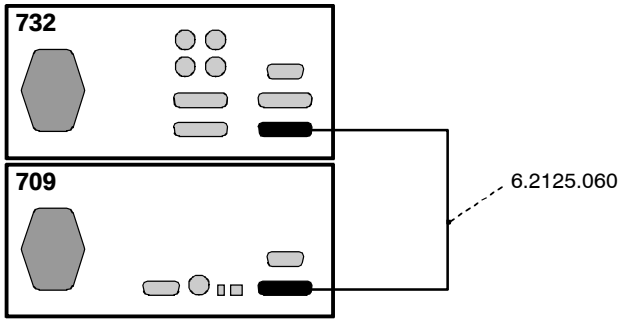



***Fig. 10: Connection of 709 IC Pump***

## 2.6.2 Pulsation dampener

To protect the column material against pressure drops caused by the injector, the use of a pulsation dampener connected between the pump and the injection valve of the 733 IC Separation Center is recommended. The optional **6.2620.150 Pulsation dampener MF** (see *section 7.3.1*) is very well suited to this purpose.

The metal-free 6.2620.150 Pulsation Dampener is supplied fully assembled and has two connections for capillaries, for which either the connectors supplied or two 6.2744.010 PEEK compression fittings can be used. The flow direction is arbitrary. The pulsation dampener is positioned in the interior of the 733 IC Separation Center on the base below the injection valve (see *Fig. 16 and Fig. 17*).

### 2.6.3 Filter unit PEEK

The **6.2821.100 Filter unit PEEK** (see *Fig. 11*) supplied with the 709 IC Pump is installed between the 709 IC Pump and the injection valve at the 733 IC Separation Center. This filter unit serves to avoid contamination of the piston seals of the 709 IC Pump by abrasive particles and can be used in the pressure range 0…25 MPa (0…250 bar).

The two filter units PEEK supplied with the 2.733.0X30 IC Separation Center (with suppressor) are installed between the 752 Pump Unit and the inlet capillaries for regeneration and rinsing solution. These filter units serve to protect the suppressor module from foreign particles and bacterial growth.

The 6.2821.100 Filter unit PEEK consists of the housing **54** and the two connectors **53** (with filter) and **55** (without filter) screwed into the housing **54**. For the connection of capillaries **51** PEEK compression fittings **52** (6.2744.010) must be used. New connectors **53** with filter are available as an option with the ordering number 6.2821.110 (set of 10).

*For the connection of the filter unit, please note the flow direction arrow printed on the housing.*

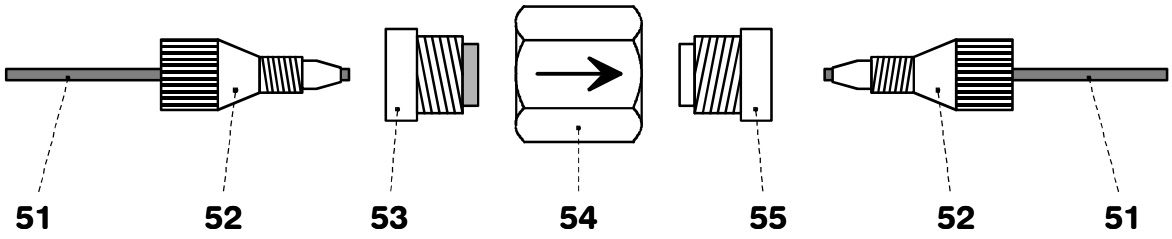



***Fig. 11: 6.2821.100 Filter unit PEEK***

| | | | |
|---|---|---|---|
| **51** | **Capillary**<br>6.1831.010 PEEK capillary | **54** | **Housing for filter unit**<br>Part of 6.2824.100 Filter unit |
| **52** | **Compression fitting (6.2744.010)** | **55** | **Connector without filter**<br>Part of 6.2824.100 Filter unit |
| **53** | **Connector with filter (6.2824.110)**<br>Part of 6.2824.100 Filter unit | | |

### 2.6.4 Filter unit Manufit

The optional **6.2821.000 Filter unit Manufit** (see *section 7.3.1*) is installed between the 709 IC Pump and the injection valve at the 733 IC Separation Center. The filter unit serves to avoid contamination of the piston seals by abrasive particles and can be used in the pressure range 0…50 MPa (0…500 bar) for non metal-free systems together with steel capillaries. It is installed as follows (see *Fig. 12*):

**1 Prepare Manufit housing**

- Insert outlet capillary **63** with steel mesh holding end **61** into Manufit housing **62**.
- Insert the 4 steel meshes **60** provided into the steel mesh holding end **61**.
- Press the PTFE gasket **59** into the steel mesh holding end **61**.

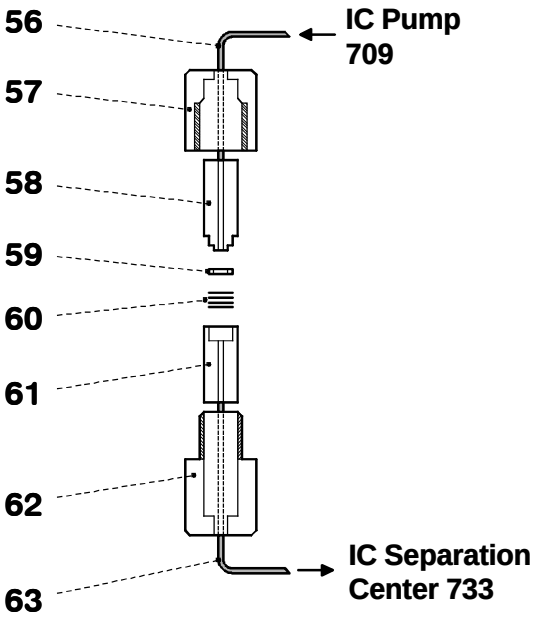
**2 Prepare Manufit pressure screw**

- Insert inlet capillary **56** with counterpart end **58** into Manufit pressure screw **57**.

**3 Assembly**

- Fit the two capillary end pieces **58** and **61** together.
- Screw Manufit pressure screw **57** and Manufit housing **62** firmly together.

*To replace contaminated steel meshes, proceed in the reverse order.*




| | |
|---|---|
| **56** | **Inlet capillary** |
| **57** | **Manufit pressure screw** |
| **58** | **Counterpart end** |
| **59** | **PTFE Gasket (6.2821.010)** |
| **60** | **Steel meshes (6.2821.020)** |
| **61** | **Steel mesh holding end** |
| **62** | **Manufit housing** |
| **63** | **Outlet capillary** |

***Fig. 12: 6.2821.000 Filter unit Manufit***

### 2.6.5 Connection to injection valve with PEEK capillaries

For metal-free systems and for non metal-free systems in the pressure range 0…25 MPa (0…250 bar) we recommend to use 6.1831.010 PEEK capillaries, a 6.2620.150 Pulsation dampener (see *section 2.6.2*) and a 6.2821.100 Filter unit PEEK (see *section 2.6.3*) to connect the 709 IC Pump and the injection valve of the 733 IC Separation Center. Proceed as follows:

*For the connection of capillaries to the injection valve, use only the 6.2744.010 PEEK compression fittings. If other steel connectors are used (e.g. 6.2620.000 and 6.2620.010), the valve connection may be damaged!*

**1 Connection to 709 IC Pump**

- Cut connection capillary **22** (6.1831.010 PEEK capillary) to the required length and equip with the necessary connectors.
- Attach one end of connection capillary **22** to connection **23** of the 709 IC Pump (see *709 Instructions for Use*).
- Attach the other end of connection capillary **22** to the connector **53** (with filter) of the filter unit **64** (see *Fig. 13*).
- Attach the PEEK capillary **65** cut to the required length and equipped with connectors to the connector **55** of the filter unit **64**.

**2 Installation of the capillary in the IC Separation Center**

- Unscrew the four knurled screws **37** of the bottom rear panel **39** of the 733 IC Separation Center and remove rear panel (see *Fig. 5*).
- Insert PEEK capillary **65** from the back into the inner compartment of the IC Separation Center.
- Install rear panel **39** so that the capillary is positioned in opening **40** „Inlet A“ or **44** „Inlet B“ and screw on with the four knurled screws **37**.

**3 Connection to injection valve**

- Connect PEEK capillary **65** to pulsation dampener **66** (see *section 2.6.2*). Using another PEEK capillary **65**, connect pulsation dampener **67** to connection "5" of injection valve **68**.

**4 Mount column connection capillary**

- Connect column connection capillary **67** (ca. 20 cm of 6.1831.010 PEEK capillary) to connection "4" of injection valve **68**.

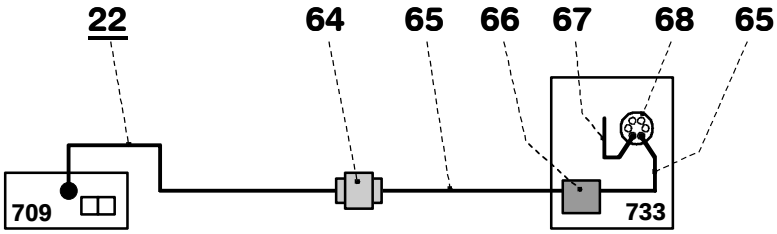



***Fig. 13: Connection to injection valve with PEEK capillaries***

| | | | |
|---|---|---|---|
| **22** | **Connection capillary**<br>6.1831.010 PEEK capillary | **66** | **Pulsation dampener (6.2620.150)** |
| **64** | **Filter unit PEEK (6.2824.100)** | **67** | **Column connection capillary**<br>6.1831.010 PEEK capillary |
| **65** | **PEEK capillary (6.1831.010)** | **68** | **Injection valve** |

## 2.6.6 Connection to injection valve with steel capillaries

For the pressure range 25…50 mPa (250…500 bar) we recommend to use 6.2620.020 Steel capillaries, a 6.2620.150 Pulsation dampener (see *section 2.6.2*) and a 6.2821.000 Filter unit Manufit (see *section 2.6.4*) to connect the 709 IC Pump and the injection valve of the 733 IC Separation Center. Proceed as follows:

*For the connection of capillaries to the injection valve, use only the special steel connectors contained in a plastic bag affixed to the valve. If other steel connectors are used (e.g. 6.2620.000 and 6.2620.010), the valve connection may be damaged!*

### 1 Connection to 709 IC Pump

- Attach inlet capillary **56** of the Manufit filter unit **69** to connection **23** of the 709 IC Pump (see *709 Instructions for Use*).
- Attach outlet capillary **63** of the filter unit Manufit **69** using coupling **70** to a steel capillary **71** cut to the required length (see *Fig. 14*).

**2 Installation of the capillary in the IC Separation Center**

- Unscrew the four knurled screws **37** of the bottom rear panel **39** of the 733 IC Separation Center and remove rear panel (see *Fig. 5*).
- Insert steel capillary **71** from the back into the inner compartment of the IC Separation Center.
- Install rear panel **39** so that the capillary is positioned in opening **40** „Inlet A“ or **44** „Inlet B“ and screw on with the four knurled screws **37**.

**3 Connection to injection valve**

- Connect steel capillary **71** to pulsation dampener **66** (see *section 2.6.2*). Using another steel capillary **71**, connect pulsation dampener **66** to connection "5" of injection valve **68**.

**4 Mount column connection capillary**

- Connect column connection capillary **67** (ca. 20 cm of 6.1831.010 PEEK capillary) to connection "4" of injection valve **68**.

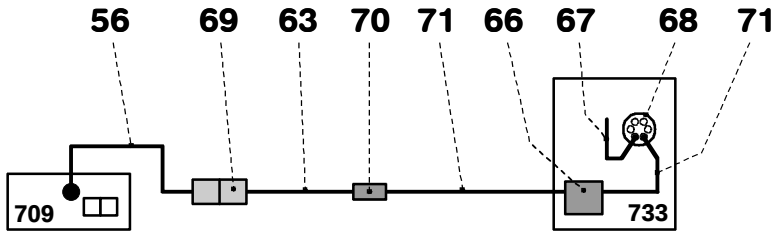



***Fig. 14: Connection to injection valve with steel capillaries***

| | | | |
|---|---|---|---|
| **56** | **Inlet capillary** of Filter unit Manufit **69** | **68** | **Injection valve** |
| **63** | **Outlet capillary** of Filter unit Manufit **69** | **69** | **Filter unit Manufit (6.2821.000)** |
| **66** | **Pulsation dampener (6.2620.150)** | **70** | **Coupling (6.2620.060)** |
| **67** | **Column connection capillary** 6.2620.020 Steel capillary | **71** | **Steel capillary (6.2620.020)** |

### 2.6.7 Passivation of the IC system

With non metal-free IC systems, the entire IC system (without precolumn, separating column and suppressor module) must be passivated with nitric acid before being put into operation for the first time. Proceed as follows:

**1 Connect detector block to injection valve**

- Connect column connection capillary **67** using a 6.2620.060 Coupling directly to inlet capillary **82** of the detector block (see *Fig. 16*).

**2 Set injection valve to "INJECT"**

- Switch on 732 IC Detector using mains switch **9**.
- Press key **24** or **26** <INJECT> on 733 IC Separation Center. The green LED in the key should light up to show that the injection valve is in the position "INJECT".

**3 Rinse with $HNO_3$**

- Immerse aspirating capillary of the 709 IC Pump in $c(HNO_3)$ = 0.2 mol/L.
- Set a flow rate of 1 mL/min on the 709 IC Pump.
- Switch on 709 IC Pump and rinse IC system for ca. 10 min. During this time, check all capillaries and their connections between the 709 IC Pump and the detector block for escaping liquid. Should liquid escape at any position, the appropriate compression fitting must be tightened more or changed.
- Switch off 709 IC Pump.

**4 Rinse with dist. $H_2O$**

- Immerse aspirating capillary of the 709 IC Pump in distilled or demineralised water.
- Switch on 709 IC Pump and rinse the IC system for ca. 10 min.
- Switch off 709 IC Pump.

**5 Rinse with eluent**

- Immerse aspirating capillary of the 709 IC Pump in the eluent which will be needed for the separating column used later.
- Switch on 709 IC Pump and rinse IC system until the absolute conductivity shown on the 732 Detector is stable.
- Switch off 709 IC Pump.

**6 Remove coupling**

- Remove 6.2620.060 Coupling between column outlet capillary **71** and inlet capillary **82** (see *Fig. 16*). The IC system is now ready for the installation of precolumns, separating columns and suppressor module.

# 2.7 Precolumns

## 2.7.1 General information on precolumns

The use of easily exchangeable precolumns protects the separating columns and prolongs their lifetime. The precolumns available from Metrohm (see *section 7.3.2*) are either real precolumns or precolumn cartridges, which are used together with the 6.2821.050 Twin cartridge holder or a 6.2821.040 Cartridge head.

*New IC precolumns are normally filled with solution and sealed at both ends. Before the precolumn is installed in the system, it must be ensured that this solution is freely miscible with the eluent used (check manufacturer's specifications).*

## 2.7.2 Precolumns with twin cartridge holder

The precolumn cartridges are installed in the 6.2821.050 Twin cartridge holder as follows (see *Fig. 15*):

### 1 Install cartridge

- Insert inlet capillary **75** with end piece for precolumn cartridge in Manufit housing **62**.
- Insert outlet capillary **72** with end piece for precolumn cartridge in Manufit pressure screw **57**.
- Remove end caps from the precolumn cartridge **74** (the steel mesh **73** and gaskets **59** are already inserted in the cartridge).
- Fit the two capillary end pieces onto the precolumn cartridge **74** (comply with the flow direction if specified on the column).
- Screw Manufit pressure screw **57** and Manufit housing **62** firmly together.

### 2 Connect precolumn

- Fit connectors to inlet capillary **75** of the assembled precolumn (see *section 2.5*).
- Connect inlet capillary **75** either using 6.2620.060 Coupling to the column connection capillary **67** mounted on the injection valve (see *section 2.6.4*) or directly to connection "4“ of injection valve A or B.
- Shorten outlet capillary **72** of the precolumn to ca. 5 cm and mount the connectors (see *section 2.5*).

### 3 Rinse the precolumn

- Place a beaker beneath outlet capillary **72**.
- Switch on 709 IC Pump, rinse precolumn for ca. 10 min with eluent and then switch off 709 IC Pump.

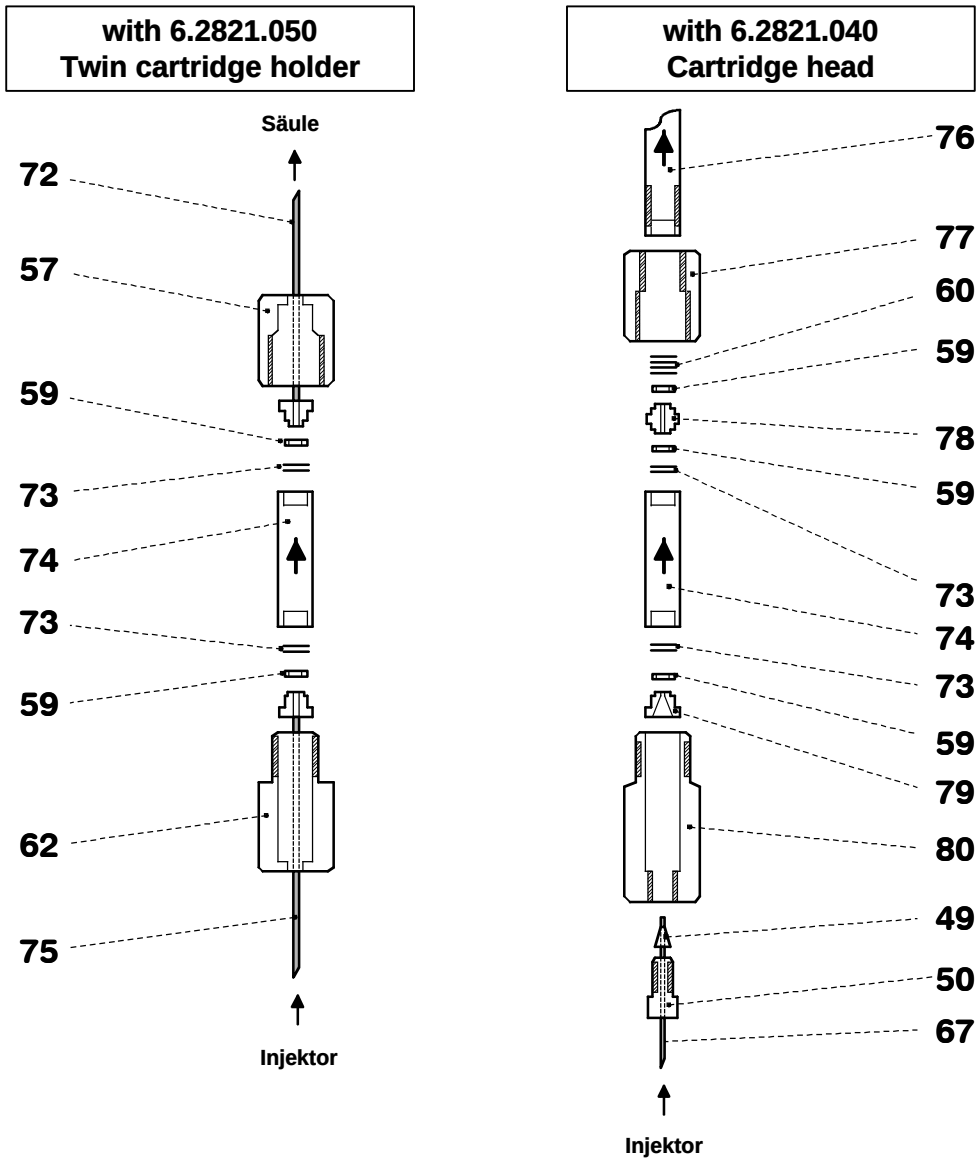



***Fig. 15: Installing precolumn cartridges***

| | | | |
|---|---|---|---|
| **49** | **Ferrule (6.2620.010)** | **73** | **2 Steel meshes (6.2821.020)** |
| **50** | **Pressure screw (6.2620.000)** | **74** | **Precolumn cartridge** |
| **57** | **Manufit pressure screw** | **75** | **Inlet capillary** |
| **59** | **PTFE gasket (6.2821.010)** | **76** | **IC separating column** |
| **60** | **4 Steel meshes (6.2821.020)** | **77** | **Manufit pressure screw** |
| **62** | **Manufit housing** | **78** | **Steel spacer (6.2821.080)** |
| **67** | **Column connection capillary of injector** | **79** | **Steel connector for ferrule** (of IC separating column) |
| **72** | **Outlet capillary** | **80** | **Manufit housing** |

### 2.7.3 Precolumns with cartridge head

The precolumn cartridges are installed in the 6.2821.040 Cartridge head as follows (see *Fig. 15*):

**1 Prepare separating column**

- Remove end caps from separating column **76**.
- Unscrew fastening screw from column inlet.
- Take steel connector **79** for ferrule out of fastening screw.

**2 Install cartridge**

- Remove end caps for precolumn cartridge **74** (the steel mesh **73** and gaskets **59** are already installed in the cartridge).
- Mount steel spacer **78** on separating column **76**.
- Mount precolumn cartridge **74** on the steel spacer (comply with flow direction if specified on the precolumn).
- Screw Manufit pressure screw **77** firmly to separating column **76**.
- Mount steel connector **79** for ferrule on the inlet side of the precolumn cartridge **74**.
- Screw on Manufit housing **80** with Manufit pressure screw **77**.

**3 Connect precolumn**

- Fit connectors to the column connection capillary **67** mounted on the injection valve (see *section 2.5*).
- Screw column connection capillary **67** to Manufit housing **80**.

### 2.7.4 IC anion precolumn SUPERSEP

The 6.1009.010 IC Anion Precolumn SUPERSEP has two connections for steel or PEEK capillaries and is installed as follows:

**1 Connect precolumn**

- Remove end caps from the precolumn.
- Fit connectors to column connection capillary **67** mounted on the injection valve (see *section 2.5*).
- Screw precolumn to column connection capillary **67.**
- Cut a piece from the 6.2620.020 Steel capillary or the 6.1831.010 PEEK capillary as short as possible and fit with connectors (see *section 2.5*).
- Fasten the prepared capillary to the other end of the precolumn.

**2 Rinse precolumn**

- Place a beaker beneath the outlet capillary of the precolumn.
- Switch on 709 IC Pump and rinse precolumn with eluent for ca. 10 min.
- Switch off IC pump.

# 2.8 Separating columns and suppressor module

## 2.8.1 General information on separating columns

*New IC separating columns are normally filled with solution and sealed at both ends. Before the column is installed in the system, it must be ensured that this solution is freely miscible with the eluent used (check manufacturer's specifications).*

The IC separating columns and precolumns currently available from Metrohm are listed in *section 7.3.2*. A test chromatogram and an information leaflet is provided with each column. You will find additional information concerning these columns in the 8.732.2003 Metrohm Monograph «Ion chromatography» and in special "Application Bulletins", which are available on request free of charge from your local Metrohm agency.

*When you install the column, always ensure that this is inserted correctly in accordance with the flow direction shown (arrow must point upwards).*

## 2.8.2 Selection of the sample loop

Selection of the sample loop depends on the separating column used. Normally, the following sample loops are used:

| | |
|---|---|
| Anion columns | 100 µL |
| Cation columns | 10 µL |
| Columns for suppressor technique | 20 µL |

Depending on the instrument version, the following sample loops are installed in the 733 IC Separation Center:

| *Version* | *Valve* | *Sample loop* | *Volume* |
|---|---|---|---|
| 2.733.0010 | A | 6.2620.120 (steel) | 100 µL |
| 2.733.0020 | A<br>B | 6.2620.120 (steel)<br>6.2620.100 (steel) | 100 µL<br>10 µL |
| 2.733.0030 | A | 6.1825.210 (PEEK) | 20 µL |
| 2.733.0120 | A<br>B | 6.1825.220 (PEEK)<br>6.1825.230 (PEEK) | 100 µL<br>10 µL |
| 2.733.0130 | A | 6.1825.210 (PEEK) | 20 µL |

If desired, the built-in sample loop can be replaced by one of the sample loops available as an option (see *section 7.3.1*).

## 2.8.3 General information on suppressor module

The **Metrohm Suppressor Module MSM** for chemical suppression installed in the 2.733.0X30 IC Separation Center comprises a total of 3 suppressor units which are in turn used for suppression, regenerated with sulfuric acid and rinsed with water. To record every new chromatogram under comparable conditions, work is normally carried out with freshly regenerated suppressor. Switching is either automatic together with the valve switching or manual.

*The suppressor units must never be regenerated with $H_2SO_4$ in the same flow direction used for the eluent. You should thus always install the inlet and outlet capillaries as described in section 2.8.6 according to the scheme shown in Fig. 18.*

For operation of the suppressor module, a **two-channel peristaltic pump** is needed which conveys the regeneration solution (normally **20 mmol/L $H_2SO_4$**) and the rinsing solution (normally **dist. $H_2O$**) to the suppressor units. We advise working with a **flow rate of 0.5 mL/min**.

*The **752 Pump Unit** is available from Metrohm as an option. Two lengths of pump tubing (6.1826.050) are enclosed with this pump (flow rate 0.5 mL/min). Startup and operation of the 752 Pump Unit is described in the Instructions for Use enclosed with the pump.*

The three inlets and outlets numbered 1...3 on the suppressor module each have 2 permanently mounted PTFE capillaries, which must be connected as described in *section 2.8.6* (see *Fig. 16 a*nd *Fig. 17*).

To avoid contamination of the suppressor module by foreign particles or bacterial growth, it is advantageous to install an **in-line filter** between the 752 Pump Unit and the suppressor module. The two **6.2821.100 Filter units PEEK** (see *section 2.6.3*) supplied with the 2.733.0X30 IC Separation Center are eminently suitable for this purpose.

*The suppressor module must never be switched in the dry state as there is a danger of blocking. Before every switching operation of the suppressor module, the three suppressor units must have been rinsed for at least ½ h with eluent, regeneration and rinsing solution.*

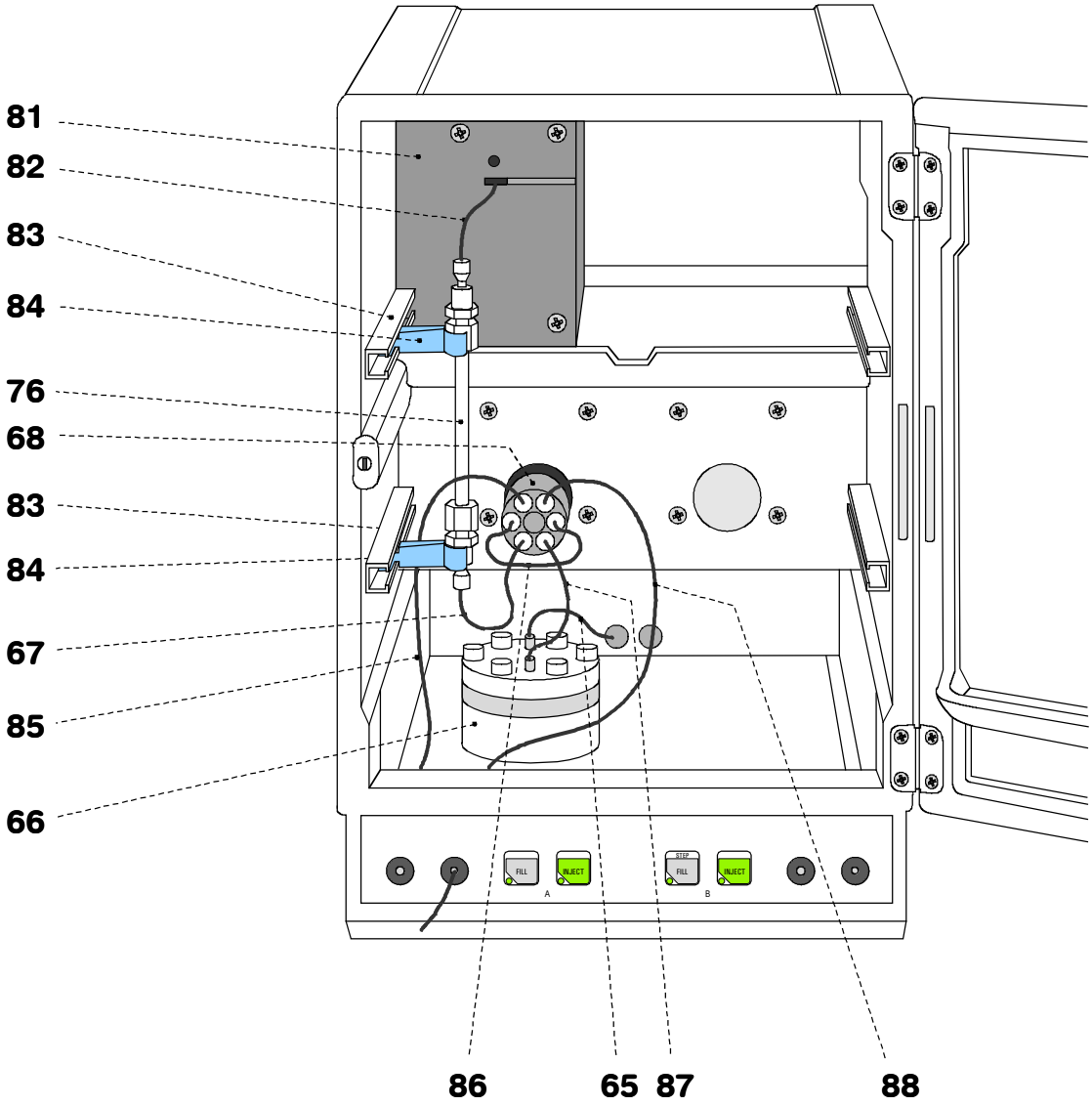



***Fig. 16: Interior of the 2.733.0010 IC Separation Center***

| | | | |
|---|---|---|---|
| **65** | **Capillary to 709 IC Pump** | **83** | **Mounting rail** |
| **66** | **Pulsation dampener (6.2620.150)** | **84** | **Column holder (6.2027.0X0)** |
| **67** | **Column connection capillary** | **85** | **Capillary for syringe**<br>PEEK capillary, fixed mounting |
| **68** | **Injection valve** | **86** | **Sample loop (6.2620.120)**<br>100 µL, fixed mounting, steel |
| **76** | **IC separating column** | **87** | **Inlet capillary for injector**<br>Steel or PEEK capillary |
| **81** | **Detector block** | **88** | **PTFE aspirating tubing**<br>fixed mounting |
| **82** | **Inlet capillary for detector block**<br>Steel capillary, fixed mounting | | |

### 2.8.4 One-channel system without suppressor module

With the one-channel system without suppressor module, the IC separating column is installed in the 2.733.0010 IC Separation Center as follows (see *Fig. 16*):

**1 Connect column to injector**

- Remove end caps from column **76**.
- *without precolumn:*
  Screw inlet end of separating column **76** (note flow direction) to column connection capillary **67** mounted on the injector.
- *with precolumn in twin cartridge holder:*
  Screw inlet end of separating column **76** (note flow direction) to outlet capillary **72** (see *Fig. 15*).
- *with precolumn in cartridge head:*
  Install separating column **76** (note flow direction) in the cartridge head (see *Fig. 15*) as described in *section 2.7.3*.

**2 Rinse column**

- Place a beaker beneath the column outlet.
- Switch on 709 IC Pump and rinse the column for ca. 10 min with eluent.
- Switch off IC Pump.

**3 Connect column to detector block**

- Screw outlet end of separating column **76** to the inlet capillary **82** permanently mounted on the detector block.

**4 Fix column**

- Insert one or two column holders **84** (6.2027.030, 6.2027.040 or 6.2027.050) in the mounting rails **83** and fasten separating column in the column holder.

### 2.8.5 Two-channel system without suppressor module

With the two-channel system without suppressor module (2.733.0X20 IC Separation Center), the first IC separating column is connected on the left side to injection valve A and detector block A as with the one-channel system (see *section 2.8.4* and *Fig. 16*). The second column is connected on the right side to injection valve B and detector block B in an analogous manner.

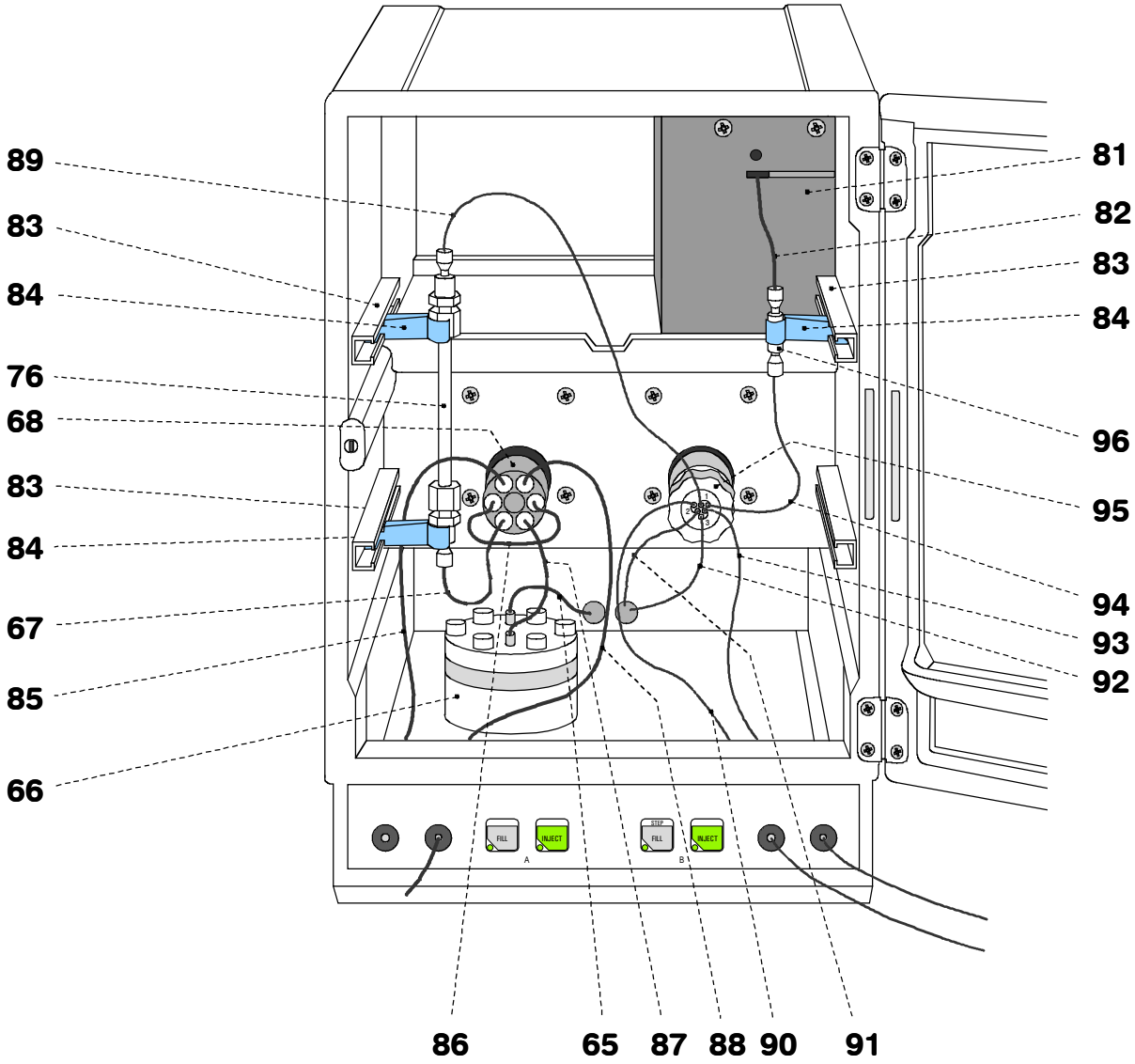



***Fig. 17: Interior of the 2.733.0X30 IC Separation Center***

| | | | |
|---|---|---|---|
| **43** | **Rear panel opening** | **83** | **Mounting rail** |
| **65** | **Capillary to 709 IC Pump** | **84** | **Column holder (6.2027.0X0)** |
| **66** | **Pulsation dampener (6.2620.150)** | **85** | **Capillary for syringe**<br>PEEK capillary, fixed mounting |
| **67** | **Column connection capillary**<br>PEEK capillary | **86** | **Sample loop (6.1825.210)**<br>20 µL, fixed mounting, PEEK |
| **68** | **Injection valve** | **87** | **Inlet capillary for injector**<br>Steel or PEEK capillary |
| **76** | **IC separating column** | **88** | **PTFE aspirating tubing**<br>fixed mounting |
| **81** | **Detector block** | **89** | **Suppressor inlet capillary for eluent** |
| **82** | **Inlet capillary for detector block** (fixed mounting) | **90** | **Suppressor inlet capillary for $H_2SO_4$** |

| | | | |
|---|---|---|---|
| **91** | **Suppressor outlet capillary for $H_2SO_4$** | **94** | **Suppressor outlet capillary for eluent** |
| **92** | **Suppressor outlet capillary for $H_2O$** | **95** | **Suppressor module** |
| **93** | **Suppressor inlet capillary for $H_2O$** | **96** | **Coupling (6.2620.060; steel) or Coupling (6.2744.040; PEEK)** |

## 2.8.6 One-channel system with suppressor module

In the case of the one-channel system with suppressor module, first the IC separating column is installed in the 2.733.0X30 IC Separation Center (see *Fig. 17*) and then the suppressor module is connected to the 752 Pump Unit needed for operation (see *Fig. 18*). Proceed as follows:

**1 Connect column to injector**

- Remove end caps from column **76**.
- *without precolumn:*
  Screw inlet end of separating column **76** (note flow direction) to column connection capillary **67** mounted on the injector.
- *with precolumn in twin cartridge holder:*
  Screw inlet end of separating column **76** (note flow direction) to outlet capillary **72** (see *Fig. 15*).
- *with precolumn in cartridge head:*
  Install separating column **76** (note flow direction) in the cartridge head as described in *section 2.7.3* (see *Fig. 15*).

**2 Rinse column**

- Place a beaker beneath the column outlet.
- Switch on 709 IC Pump and rinse column with eluent for ca. 10 min.
- Switch off IC pump.

**3 Connect column to suppressor module**

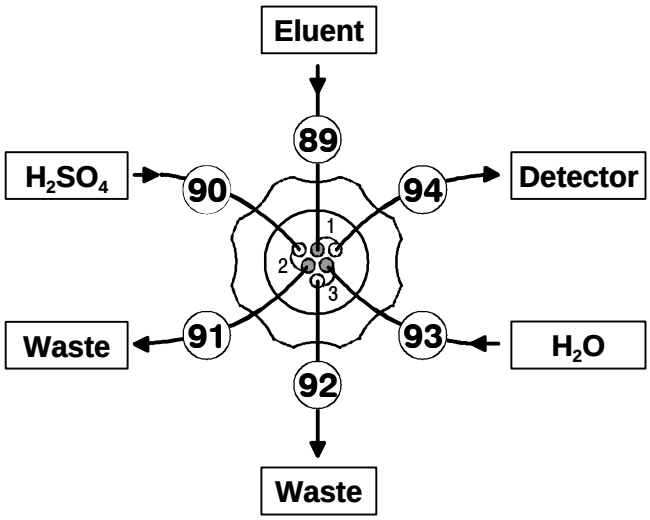
- Cut inlet capillary **89** marked with "Eluent" of suppressor module **95** to the desired length using a sharp cutting tool (e.g. razor blade).
- Screw inlet capillary **89** to outlet end of separating column **76** using a 6.2744.010 Compression fitting.

**4 Fix column**

- Insert one or two column holders **84** (6.2027.030, 6.2027.040 or 6.2027.050) in mounting rails **83** and fasten separating column in the column holder.

**5 Connect suppressor module to detector block**

- Cut outlet capillary **94** marked with "Detector" of suppressor module **95** to the desired length using a sharp cutting tool (e.g. razor blade).




| | |
|---|---|
| **89** | **Suppressor inlet capillary for eluent** |
| **90** | **Suppressor inlet capillary for $H_2SO_4$** |
| **91** | **Suppressor outlet capillary for $H_2SO_4$** |
| **92** | **Suppressor outlet capillary for $H_2O$** |
| **93** | **Suppressor inlet capillary for $H_2O$** |
| **94** | **Suppressor outlet capillary for eluent** |

***Fig. 18: Connections at suppressor module***

- Screw outlet capillary **94** to coupling **96** using a 6.2744.010 Compression fitting.
- Screw inlet capillary **82** of detector block **81** to other end of coupling **96**.

### 6 Fix connection suppressor – detector block

- Insert one of the column holders **84** (6.2027.030, 6.2027.040 or 6.2027.050) in mounting rail **83** and fasten coupling **96** in the column holder.

### 7 Prepare 752 Pump Unit

- Take two tubing cartridges out of the holder of the 752 Pump Unit.
- Lay a length of 6.1826.050 Pump tubing in each of the two tubing cartridges and reinsert these in the holder without kinking the pump tubing.
- Regulate contact pressure on pump tubing in accordance with the instructions printed on the pump.

*Pump tubing is consumable material with a lifetime which depends on the contact pressure. For this reason, raise the tubing cartridges completely by loosening the clip on the right if the pump is switched off for some considerable time (the set contact pressure remains unchanged).*

### 8 Suppressor connection 2: $H_2SO_4$

- Loosen rotary nipple screwed onto the interior side of connection **27**. Pull inlet capillary **90** marked with "$H_2SO_4$" (see *Fig. 17* and *Fig. 18*) by hand out of the opening of connection **27** as far as required. Retighten nipple on the interior side of connection **27** to fix inlet capillary **90**.

- Attach inlet capillary **90** using a 6.2744.010 Compression fitting to the connector **55** of the filter unit PEEK (see *section 2.6.3*).
- Attach a piece of the 6.1803.020 PTFE tubing (from 752 accessories) cut to the required length using a 6.2744.010 Compression fitting to the connector **53** with filter at the other end of the Filter unit PEEK.
- Attach the other end of the PTFE tubing using a 6.2744.010 Compression fitting to the 6.2744.030 Coupling (from 752 accessories) and mount it on the outlet end of the first length of pump tubing.
- Mount a 6.2744.030 Coupling to the inlet end of the first length of pump tubing. Attach a piece of the 6.1803.020 PTFE tubing (aspirating tubing, from 752 accessories) cut to the required length using a 6.2744.010 Compression fitting to the other end of this coupling.
- Immerse the other end of the aspirating tubing in a vessel containing regeneration solution (normally 20 mmol/L $H_2SO_4$) and fix in place.
- Pull outlet capillary **91** marked with "Waste" of the suppressor module through the rear panel opening **43**, lead it to a sufficiently large waste container and fix it in place.

## 9 Suppressor connection 3: $H_2O$

- Loosen rotary nipple screwed onto the interior side of connection **28**. Pull inlet capillary **93** marked with "$H_2O$" (see *Fig. 17* and *Fig. 18*) by hand out of the opening of connection **28** as far as required. Retighten nipple on the interior side of connection **28** to fix inlet capillary **93**.
- Attach inlet capillary **93** using a 6.2744.010 Compression fitting to the connector **55** of the filter unit PEEK (see *section 2.6.3*).
- Attach a piece of the 6.1803.020 PTFE tubing (from 752 accessories) cut to the required length using a 6.2744.010 Compression fitting to the connector **53** with filter at the other end of the Filter unit PEEK.
- Attach the other end of the PTFE tubing using a 6.2744.010 Compression fitting to the 6.2744.030 Coupling (from 752 accessories) and mount it on the outlet end of the second length of pump tubing.
- Mount a 6.2744.030 Coupling to the inlet end of the second length of pump tubing. Attach a piece of the 6.1803.020 PTFE tubing (aspirating tubing, from 752 accessories) cut to the required length using a 6.2744.010 Compression fitting to the other end of this coupling.
- Immerse the other end of the aspirating tubing in a vessel containing rinsing solution (normally dist. $H_2O$) and fix in place.
- Pull outlet capillary **92** marked with "Waste" of the suppressor module through the rear panel opening **43**, lead it to a sufficiently large waste container and fix it in place.

### 2.8.7 Leak testing and conditioning

Before sample solutions can be injected in the IC system, the entire system must be tested for leaks and then conditioned with eluent until the baseline is stable. Proceed as follows:

**1 Switch on 709 IC Pump**

- Immerse aspirating capillary of the 709 IC Pump in eluent.
- Set flow rate recommended on the 709 IC Pump for the separating column used (normally 0.5…2 mL/min).
- Set maximum shutoff pressure on the 709 IC Pump (normally ca. 3 MPa above the pressure observed with the column used).
- Switch on 709 IC Pump.

**2 Check for leaks**

- Check all capillaries and their connections between the 709 IC Pump and the detector block for escaping liquid. If eluent escapes anywhere, the appropriate compression fitting must be tightened further or changed.

**3 Switch on 732 IC Detector**

- Switch on 732 IC Detector with mains switch **9**.
- Set **operating temperature**: Under the <CONFIG> key, enter the desired value for the parameter "`thermostat`" (default value = 35 °C).
- Enter **cell constant**: Under the <CONFIG> key, enter the value printed on the detector block for the parameter "`cell constant`".
- Set **measuring range**: Under the <PARAM> key, set the parameter "`range`" so that the displayed absolute conductivity value of the eluent lies within the selected range (default value = 1 mS/cm).
- Set **full-scale range**: Under the <PARAM> or <FULL SCALE> key, enter the desired value for the parameter "`full scale`" (default value = range/1). To start with, it is advisable not to set too narrow a full-scale range as the conductivity of the eluent in the conditioning phase can change greatly until attainment of a stable temperature.

**4 Condition IC system**

- Rinse the IC system with eluent until the desired stability of the baseline is reached (normally 30…60 min; if the eluent is changed, the establishment of the ion exchanger equilibrium on the separating column can take longer).

**5 Condition suppressor (if present)**

- Load method "`Prep-MSM`" and start this method. The suppressor module is switched to the next position every 20 min and in this way conditioned.

# 2.9 Connection of external devices

## 2.9.1 Connection of a recorder

For the connection of a recorder the 732 IC Detector has the two analog outputs **11** (0…1 V) and **12** (0…10 mV) available (see *Fig. 3*). A diagram of the circuit of the two analogue outputs can be found in *section 6.3*. The polarity of the output signals at the analog output sockets can be switched at any time under the <PARAM> key (see *section 4.5.1*).

For the connection of recorders with banana connection sockets, the 6.2115.010 Cable available as an option can be used.

## 2.9.2 Connection of «IC Metrodata for Win95»

With «IC Metrodata for Win95» (ordering number 2.714.0310), Metrohm offers a chromatography data system for the automatic evaluation of chromatograms using a PC. It comprises a PC board and the associated integration software. You will find all relevant information about the installation of hardware and software in the *714 Instructions for Use*.

## 2.9.3 Connection of the 750 Autosampler

The 750 Autosampler available from Metrohm as an option is an automatic sampler for ion chromatography. The apparatus accommodates max. 128 samples each of 730 µL, which are automatically transferred to the sample loops attached to the injection valves of the 733 IC Separation Center. The electrical connection of the 750 Autosampler and the tubing connections for the sample feed is described in the *750 Instructions for Use*.

## 2.9.4 Connection of the 766 IC Sample Processor

The 766 IC Sample Processor available from Metrohm as an option is an automatic sampler for ion chromatography. The apparatus accommodates max. 127 samples each of 11 mL, which are automatically transferred to the sample loops attached to the injection valves of the 733 IC Separation Center. The electrical connection of the 766 IC Sample Processor and the tubing connections for the sample feed is described in the *766 Instructions for Use*.

## 2.9.5 Connection of the 791 VA Detector

The 791 VA Detector available from Metrohm as an option enables the electrochemical (amperometric) detection with carbon or metal electrodes. The accessories include a flow-through cell which can be fixed to the conductivity detector in the 733 IC Separation Center. You will find detailed information about installation and operation of the 791 VA Detector in the *791 Instructions for Use*.

## 2.9.6 Connection of a printer

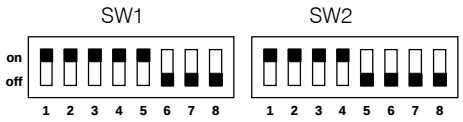
External printers are normally connected to the 732 IC Detectorr via the RS232 interfaces **16** (see *Fig. 3*). If no 709 IC Pump is connected, a printer can also be attached to connection **15** "709 IC Pump". You will find more detailed information on the RS232 interfaces in s*ection 6.1*.

*Before a printer is connected to the RS232 interfaces* **16** *or* **15***, the 732 IC Detector always be* ***switched off*** *with mains switch* **9** *!*

Printers with the following printer drivers can be connected to the two RS232 interfaces of the 732 IC Detector (see also s*ection 4.4.2*):

| | |
|---|---|
| `IBM` | IBM Proprinter and printers with IBM emulation |
| `Epson` | EPSON printers and printers with EPSON emulation |
| `Seiko` | Seiko printer DPU-411/414 |
| `Citizen` | Citizen printer IDP562 RS |
| `HP` | HP printer and printers with PCL3 emulation |

The following table provides information on a few selected printers.

| *Printer* | *Cable* | *Settings on 732 IC Detector* | *Settings on printer* |
|---|---|---|---|
| IBM Proprinter | 6.2125.050 | `>CONFIG/printer`<br>`send to: IBM`<br>`>CONFIG/RS settings`<br>`baud rate: 9600`<br>`data bit: 8`<br>`stop bit: 1`<br>`parity: none`<br>`handshake: HWs` | see printer manual |
| Epson<br>with 6-pin round connector | 6.2125.040 | `>CONFIG/printer`<br>`send to: Epson`<br>`>CONFIG/RS settings`<br>`baud rate: 9600`<br>`data bit: 8`<br>`stop bit: 1`<br>`parity none`<br>`handshake: HWs` | Settings of the DIP switches:<br>  <br> |
| Epson<br>with additional serial interface #8148 | 6.2125.050 | `>CONFIG/printer`<br>`send to: Epson`<br>`>CONFIG/RS settings`<br>`baud rate: 9600`<br>`data bit: 8`<br>`stop bit: 1`<br>`parity none`<br>`handshake: HWs` | Settings of the DIP switches on the interface:<br>  <br> |
| Epson LX-300 | 6.2125.050 | `>CONFIG/printer`<br>`send to: Epson`<br>`>CONFIG/RS settings`<br>`baud rate: 9600`<br>`data bit: 8`<br>`stop bit: 1`<br>`parity none`<br>`handshake: HWs` | see printer manual |
| Epson and Canon printers with parallel interface | 6.2125.020<br>+<br>2.145.0300<br>Serial/ parallel converter | `>CONFIG/printer`<br>`send to: Epson`<br>`>CONFIG/RS settings`<br>`baud rate: 9600`<br>`data bit: 8`<br>`stop bit: 1`<br>`parity none`<br>`handshake: HWs` | see printer manual |

| *Printer* | *Cable* | *Settings on 732 IC Detector* | *Settings on printer* |
|---|---|---|---|
| Seiko DPU-411 | 6.2125.020 | >CONFIG/printer<br>send to: Seiko<br>>CONFIG/RS settings<br>baud rate: 9600<br>data bit: 8<br>stop bit: 1<br>parity none<br>handshake: HWs | Settings of the DIP switches:<br>  <br><br>The switchable 7-bit ASCII character set of the printer will be automatically set to the national character sets in accordance with the set dialog language. |
| Seiko DPU-414 | 6.2125.130 | >CONFIG/printer<br>send to: Seiko<br>>CONFIG/RS settings<br>baud rate: 9600<br>data bit: 8<br>stop bit: 1<br>parity none<br>handshake: HWs | Settings of the DIP switches:<br>***Dip SW-1*** ***Dip SW-2*** ***Dip SW-3***<br>1 OFF ON ON<br>2 ON OFF ON<br>3 ON ON ON<br>4 OFF ON ON<br>5 ON ON OFF<br>6 OFF ON ON<br>7 ON OFF ON<br>8 ON OFF ON<br>The switchable 7-bit ASCII character set of the printer will be automatically set to the national character sets in accordance with the set dialog language. |
| Citizen IDP562-RS | 6.2125.050 | >CONFIG/printer<br>send to: Citizen<br>>CONFIG/RS settings<br>baud rate: 9600<br>data bit: 8<br>stop bit: 1<br>parity none<br>handshake: HWs | Settings of the DIP switches:<br>  <br><br>The switchable 7-bit ASCII character set of the printer can be changed to the national character sets only by setting the DIP switches 4 and 5 in the printer:<br>***4*** ***5*** ***Character set***<br>open open USA<br>closed closed Great Britain<br>closed open France<br>open closed Germany<br>Spanish does not have its own character set (it is best to select French). |
| HP Deskjet with serial interface | 6.2125.050 or adapter cable 25-pin neg./9-pin pos. (e.g. HP C2933A) | >CONFIG/printer<br>send to: HP<br>>CONFIG/RS settings<br>baud rate: 9600<br>data bit: 8<br>stop bit: 1<br>parity none<br>handshake: HWs | Settings of the DIP switches:<br>  <br> |
| HP Laserjet with serial interface | Adapter cable 25-pin neg./9-pin pos. (e.g. HP C2933A) | >CONFIG/printer<br>send to: HP<br>>CONFIG/RS settings<br>baud rate: 9600<br>data bit: 8<br>stop bit: 1<br>parity none<br>handshake: HWs | see printer manual |
| HP Deskjet/ Laserjet with parallel interface | 6.2125.020 + 2.145.0300 Serial/ parallel converter | >CONFIG/printer<br>send to: HP<br>>CONFIG/RS settings<br>baud rate: 9600<br>data bit: 8<br>stop bit: 1<br>parity none<br>handshake: HWs | see printer manual |

*If you connect other printers, ensure that these emulate a printer mode supported by the 732 IC Detector. Most printers with a serial interface are connected using the 6.2125.050 Cable. Printers with a parallel interface need a serial/parallel converter (e.g. 2.145.0300) and the 6.2125.020 Cable.*

### 2.9.7 Connection of a PC

IBM-compatible PCs are connected to the 732 IC Detector via RS232 interface **16** (see *Fig. 3*). You will find more detailed information on the RS232 interface in *section 6.1*, which also describes remote control of the 732 IC Detector via the RS interface.

*Before a PC is connected to RS232 interface* **16***, the 732 IC Detector must always be switched off using mains switch* **9** *!*

The following table provides information on the connection of PCs. It lists the required cables and details on the configuration of the 732 IC Detector 732 and PC.

| *PC* | *Cable* | *Settings on 732 Detector* | *Settings on PC* |
|---|---|---|---|
| PC with 25-pin RS232 connector | 6.2125.060 | `>CONFIG/printer send to: IBM`<br>`>CONFIG/RS settings.`<br>settings same as on PC | setting of the RS parameters dependent on control program |
| PC with 9-pin RS232 connector | 6.2125.060<br>+<br>6.2125.010 | `>CONFIG/printer send to: IBM`<br>`>CONFIG/RS settings`<br>settings same as on PC | setting of the RS parameters dependent on control program |

### 2.9.8 Connection of devices to the remote interface

Any external devices can be connected to the 25-pin remote interface **17** (see *Fig. 3*). The 732 IC Detector can be remote controlled via the 8 input lines, the 8 output lines can be used to control external devices.

*Before an external device is connected to the remote interface* **17,** *the 732 IC Detector must always be switched off using mains switch* **9***!*

The pin assignment of the remote interface, its functions and the electrical requirements and the conditions are described in *section 6.2*, the assignment of the remote input lines can be found in *section 4.4.1*.

# 3 Operating tutorial

*This section introduces you to the operation of the 732 IC Detector and 733 IC Separation Center by means of a brief operating tutorial which describes the basic operating steps needed for the recording of an ion chromatogram and the development of a method.*

*The determination of the anionic content of a drinking water sample with the PRP-X100 IC Anion Column using the single column technique is used an illustrative example. Please note that the steps and parameter settings described apply only to this example. If you perform a different determination, use a different separating column or other peripheral units, the procedures described in the tutorial must be modified appropriately.*

*For further explanations of the operation, please refer to section 4, which describes the functions of the individual keys and the programming in detail.*

## 3.1 Requirements

For the determination of anions in drinking water described in this tutorial, the following instruments, accessories and solutions are required:

- **2.732.0X10 IC Detector**
- **2.733.0XX0 IC Separation Center**
  without connection of the suppressor module
- **100 mL Sample loop (6.2620.120 steel or 6.1825.220 PEEK)**
  already integrated in the 2.733.0010 and
  2.733.0X20 IC Separation Center
- **2.709.0X10 IC Pump**
  In the operating tutorial, the pump is connected to the 732 IC Detector and remote controlled by this.
- **6.2125.060 Cable** (connecting cable 732 – 709)
  RS232 connecting cable for remote control of the 709 IC Pump by the 732 IC Detector.
- **6.2620.150 Pulsation dampener**
  Use of the pulsation dampener available as an option is optional, but is advisable to protect the separating column.

- **6.2821.100 Filter unit PEEK**
  Filter between 709 IC Pump and injection valve
  to avoid contamination.
- **6.1005.000 PRP-X100 IC Anion Column**
- **Eluent**
  2 mmol/L phthalic acid / 8% acetone / pH 5.0 in dist. $H_2O$
  flow: 2 mL/min
- **Standard**
  Standard solution with 5 ppm $Cl^-$ and
  10 ppm each of $NO_3^-$ and $SO_4^{2-}$ (in dist. $H_2O$)
- **2.714.0310 IC Metrodata for Win95**
  The «IC Metrodata for Win95» PC integration system, which comprises a PC board and the associated PC integration software, is used to record and evaluate chromatograms on a PC. The installation, operation and method development are not described in this brief tutorial. You will find all relevant information in the *Instructions for Use of IC Metrodata for Win95*.

  Instead of «IC Metrodata for Win95», you can also use other data recording systems, integrators, recorders or printers, but their use is also not described in this tutorial.

## 3.2 Preparations

Before you start this brief tutorial, the entire IC system must be correctly installed as described in s*ection 2.* In what follows, the most important points for the installation are described once again (for details, see the sections mentioned).

**1 Install 732 IC Detector and 733 IC Separation Center**

| | |
|---|---|
| ⇒ Setting up instruments | *section 2.2* |
| ⇒ Installing and connecting detector block | *section 2.3.1/2* |
| ⇒ Mounting syringe and aspirating tubing | *section 2.3.3* |
| ⇒ Mounting drain tube | *section 2.3.4* |
| ⇒ Power supply connection | *section 2.4* |

**2 Prepare eluent**

| | |
|---|---|
| ⇒ Preparing eluent:<br>2 mmol/L phthalic acid / 8% acetone / pH 5.0 in dist. $H_2O$<br>(pH value of solution adjusted with NaOH) | |
| ⇒ Microfiltering and degassing eluent | *section 5.1.3* |
| ⇒ Stirring eluent in supply vessel | *section 5.1.3* |

**3 Install 709 IC Pump** *(see *709 Instructions for Use*)

- ⇒ Setting up pump *section 2.1**
- ⇒ Mounting pump head *section 2.2**
- ⇒ Tubing connections *section 2.4**
- ⇒ Power supply connection *section 2.6**
- ⇒ Switching on pump *section 2.6.4**
- ⇒ Degassing pump *section 2.7**

**4 Connect 709 IC Pump**

- ⇒ Electrical connection at 732 IC Detector (requires 6.2125.060 RS Cable) *section 2.6.1*
- ⇒ Installing pulsation dampener (option) *section 2.6.2*
- ⇒ Installing filter unit PEEK *section 2.6.3*
- ⇒ Making connection to injection valve *section 2.6.5*
- ⇒ Passivating the IC system *section 2.6.7*

**5 Connect separating column**

- ⇒ Connecting PRP-X100 IC Anion Column *section 2.8*
- ⇒ Testing for leaks *section 2.8.7*
- ⇒ Conditioning *section 2.8.7*

**6 Connect external devices**

- ⇒ Connecting recorder (if used) *section 2.9.1*
- ⇒ Connecting «IC Metrodata for Win95» or other recording or evaluation system (if used) *section 2.9.2*
- ⇒ Connecting printer (if used) *section 2.9.6*

# 3.3 Putting into operation

After the complete IC system has been installed as described in *section 3.2*, it can be put into operation. In what follows, all operating steps up to the first calibration with the standard solution are described in sequence.

Please note that all displays refer to the condition in which the instrument was put into operation for the first time (initial condition). If you do not run through this tutorial until a later date, differences in regard to the dialog language and the parameter values can appear. How you return to the initial condition in such a case is described in *section 5.4.9*.

In this description of putting the instruments into operation, it is assumed that all instruments are shut down and must first be switched on. If this is not the case (e.g. if you start the operating tutorial immediately following the conditioning), you can skip steps **1** – **3**.

## 1 Switch on external devices

⇒ Switch on recorder (if used).

⇒ Switch on «IC Metrodata for Win95» and PC (if used).

⇒ Switch on other recording and evaluation system (if used).

## 2 Switch on 709 IC Pump

⇒ Switch on 709 IC Pump with mains switch **29** (see *section 2.6.4 of the 709 Instructions for Use*).

## 3 Switch on remote control for 709 IC Pump

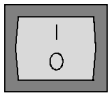
(the pump must be connected to the 732 IC Detector with a **6.2125.060 RS Cable** for this)

⇒ Set sliding switch **36** at the rear of the 709 IC Pump to "RS 232" (see *Fig. 2* of the *709 Instructions for Use*).

⇒ Press key **8** <EXT.> on the 709 IC Pump to switch on the external control (see *section 3.6* of the *709 Instructions for Use*).

When the external control is activated, LED **7** above the <EXT.> key lights up. All keys of the 709 IC Pump with the exception of the <SELECT> key are blocked, operation is now possible only via the 732 IC Detector.

## 4 Switch on 732 IC Detector

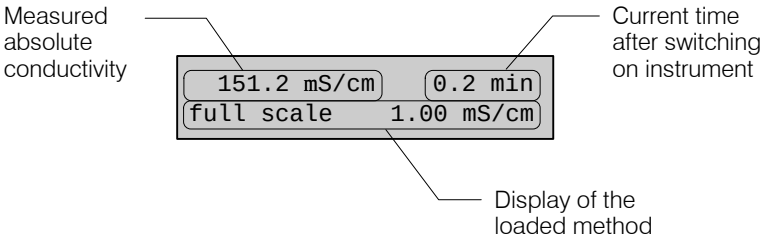


⇒ Switch on 732 IC Detector with mains switch **9** at the rear of the instrument.

```
  151.2 mS/cm    0.0 min
method           DEFAULT
```

After the instrument has been switched on, display **1** lights up and shows the status messages for the basic instrument condition.

The 732 IC Detector is now in the standby mode of conductivity measurement. The displayed values have the following meaning:




Instead of the loaded method, other status messages can be selected which are then continuously displayed in the standby mode in the bottom line of display **1**. Proceed as follows:

## 5 Select status message


⇒ Press the <SELECT> key.

```
  151.2 mS/cm    0.4 min
  1995-09-11  14:15:27
```

The bottom line of the display shows the current **date** and the current **time**. Please refer to point **6** to see how to change the date and time.


⇒ Press the <SELECT> key again.

```
  151.2 mS/cm    0.6 min
full scale    1.00 mS/cm
```

The bottom line of the display now shows the **full-scale range**.


⇒ Press the <SELECT> key again.

```
  151.2 mS/cm    0.9 min
abs.cond.    151.2 mS/cm
```

The bottom line of the display now shows the current measurement of the **absolute conductivity**, which is identical to the value already shown in the top line on the left.


⇒ Press the <SELECT> key again.

```
  151.2 mS/cm    1.2 min
pump ready
```

The bottom line of the display shows the status message for the **709 IC Pump**. If the remote operation is switched on correctly (see point **4**), the status message `"pump ready"` now appears.

If the IC Pump is operated independently, the message `"pump not responding"` appears instead.


⇒ Press the <SELECT> key again.

```
  151.2 mS/cm    0.9 min
method           DEFAULT
```

The bottom line of the display shows the status message for the loaded **method** once again. The `"DEFAULT"` method in which all parameters are set to the initial values is loaded as standard. You have now returned to the status messages displayed at the start.

The next point of the tutorial is concerned with the fundamentals of data entry using the settings of the instrument configuration required for the example.

## 6 Set configuration


⇒ Press the <CONFIG> key to open the main menu for the instrument configuration.

```
CONFIG
>CONFIG/detector
```

The name of the selected key appears in the top line of the display, the title of the submenu `"detector"`, which contains various inquiries for the conductivity detector, is shown in the bottom line.

The main menu of the <CONFIG> key contains several such submenus, which are selected by repeated pressing of this key. Each submenu has a title marked by `">"`.


⇒ Now press the <ENTER> key.

```
>CONFIG/detector
thermostat:        35 °C
```

This moves you from the title to the individual inquiries of the submenu `"detector"`; the title continues to be shown in the top line. The **operating temperature** of the conductivity cell appears in the display as the first inquiry.

Please note the character `":"` with this display. It always appears when values can not be entered using the numeric keys, but must be selected from preset values using the <SELECT> key. However, for our example the preset value of 35 °C does not have to be changed.


⇒ Confirm the set operating temperature by pressing the <ENTER> key. The displayed value will be accepted and a switch made to the next inquiry.

```
>CONFIG/detector
'zero' unit:       mS/cm
```

The next inquiry of the submenu `"detector"` appears, namely the **unit for display of the auto-zero value**.

This parameter also contains the character `":"`. The <SELECT> key can be used to select the other values `"%fs"` (% full scale) or `"mV"`. For our example, however, the preset value `"µS/cm"` need not be changed.


⇒ Confirm the set unit by pressing the <ENTER> key.

```
>CONFIG/detector
cell constant   16.7 /cm
```

The **cell constant** of the conductivity cell in the detector block appears as the next inquiry of the submenu `"detector"`. Each detector block has a characteristic cell constant which is determined in the factory and printed on the block. To ensure that the absolute conductivity is correctly displayed, this value must be entered on first time startup.

Please note that this parameter does not contain the character `":"`. This means that here values must be entered using the numeric keys. Hence press the corresponding numeric keys in the correct sequence to enter the value printed on the detector block. During the entry you can always return to the default value by pressing the <CLEAR> key and restart the entry.

```
>CONFIG/detector
cell constant   17.1 /cm
```

A cell constant of 17.1 /cm is entered here as an example.


⇒ Confirm the cell constant just entered by pressing the <ENTER> key.

```
CONFIG
>CONFIG/printer
```

As the previous inquiry was the last of the submenu `"detector"`, a switch is now made automatically to the title of the next submenu `"printer"`, which contains various inquiries concerning the printout on an external printer. As no printer is attached in our example, the next submenu can be selected directly.


⇒ To do this, press the <CONFIG> key.

```
CONFIG
>CONFIG/print meas.value
```

The title of the submenu `"print meas.value"` appears in the bottom display line. The submenu contains various inquiries for the measured value printout on an external printer, but again we are not interested in this at the present time.


⇒ Press the <CONFIG> key again.

```
CONFIG
>CONFIG/auxiliaries
```

The title of the submenu "auxiliaries" appears in the bottom line of the display. This submenu contains, among other things, the inquiries for entry of the date, time and dialog language.


⇒ Press the <ENTER> key to move to the inquiries.

```
>CONFIG/auxiliaries
run number            0
```

The display shows the selection of the run number as the first inquiry.

As we have no further interest in this here, we can proceed directly to the next inquiry.


⇒ Press the <ENTER> key.

```
>CONFIG/auxiliaries
number of cycles      1
```

This display shows the selection of the number of cycles for loop programs.

As this is yet another parameter which does not interest us at present, we can proceed to the next inquiry.


⇒ Press the <ENTER> key again.

```
>CONFIG/auxiliaries
>CONFIG/aux/event
```

The display shows the submenu for EVENT settings, which has not to be opened.


⇒ Press the <CONFIG> key.

```
>CONFIG/auxiliaries
date          1995-09-11
```

The display now shows the inquiry regarding the current **date** with the numeric data for year, month and day.

If the displayed date is the same as the current date, you need only press the <ENTER> key to confirm it.

However, if you wish to change this date, enter the new numeric values in the order year – month – day using the numeric keys, e.g. "1995-10-05" for October 5, 1995.


⇒ Confirm the inputted date by pressing the <ENTER> key.

```
>CONFIG/auxiliaries
time            16:43:27
```

The current **time** with the numeric data for hours, minutes and seconds appears in the display as the next inquiry.

If the displayed time matches the current time, you need only press the <ENTER> key to confirm this.

If you wish to change the displayed time, enter the new numeric values in the order hours – minutes – seconds using the numeric keys, e.g. `"08:32:00"`. The new time does not become active until you confirm it by pressing the <ENTER> key.


⇒ Confirm the new time by pressing the <ENTER> key.

```
>CONFIG/auxiliaries
dialog:          english
```

The display now shows the selection of the **dialog language**, which is set to `"english"`, as the next inquiry.

The character `":"` again appears with this display. This means that values must be selected from preset values using the <SELECT> key.


⇒ Press the <SELECT> key to select the next language setting.

```
>CONFIG/auxiliaries
dialog:          deutsch
```

`"deutsch"` is now selected as the dialog language.


⇒ You could confirm this language setting by pressing the <ENTER> key to immediately switch the dialog language to `"deutsch"` (or any other language you have selected), but instead:

```
>CONFIG/auxiliaries
device label
```

Use the <SELECT> key to move through the selection back to `"english"` and confirm with the <ENTER> key. The display shows the device label as the next inquiry.

However, at present we are not interested in the further inquiries of this submenu.


⇒ Press the <QUIT> key.

```
CONFIG
>CONFIG/auxiliaries
```

You now quit the inquiries and return to the title of the submenu `"auxiliaries"`.


⇒ Press the <QUIT> key again to return to the standby mode of the instrument.

```
  151.2 mS/cm    4.3 min
method           DEFAULT
```

The 732 IC Detector is now again in the standby mode and the display shows the status messages.

*Fundamentals of the instrument dialog*

***Main menu*** *Each key of the 732 IC Detector opens a main menu whose thematically arranged submenus can be selected by repeated pressing of this key. The name of the key always appears in the top line of the display.*

***Submenu*** *Each submenu has a title which is marked by ">" and appears in the bottom line of the display. <ENTER> is used to move from the title to the individual inquiries where the most important settings of the instrument can be changed. <QUIT> effects a return to the standby mode of the instrument.*

***Inquiries*** *With inquiries without ":" the valves must be entered using the numeric keys. The inputted value is accepted with <ENTER> and the next inquiry appears.*

*In the case of inquiries with ":" the admissible values must be selected using the <SELECT> key. The set value is accepted with <ENTER> and the next inquiry appears.*

*Depending on the parameter, <CLEAR> is used to reset the displayed value to the smallest possible value or the default value. The <CLEAR> key is also used to abort wrong entries.*

*<QUIT> is used to quit the inquiries and return to the title of the submenu.*

## 7 Enter parameters for the conductivity detector


⇒ Press the <PARAM> key to open the main menu for the parameter settings.

```
PARAM
>PARAM/detector
```

The title of the submenu "detector" appears that contains various inquires for the conductivity detector.


⇒ Press the <ENTER> key to move to the inquiries.

```
>PARAM/detector
range:        1.00 mS/cm
```

The first inquiry shows the **measuring range** for which 7 stages from 0…100 µS/cm to 0…10 mS/cm are available. Select the measuring range to ensure that the conductivity value of the eluent used easily lies within the selected range.


⇒ Press the <SELECT> key until the desired measuring range appears in the display.

```
>PARAM/detector
range:         200 mS/cm
```

The eluent used for the PRP-X100 Anion Column has a conductivity of ca. 150 µS/cm. A range of 200 µS/cm is thus selected as the measuring range.


⇒ Confirm the selected measuring range by pressing the <ENTER> key.

```
>PARAM/detector
full scale:    200 mS/cm
```

The next inquiry which appears concerns the **full-scale range**. The full-scale range (operating range) is used to set the desired sensitivity for the display and analog output of the measuring signal during the recording of the chromatogram. This value is set using the <FULL SCALE> key, but not until later (see s*ection 3.4*, point **2**).


⇒ Confirm the preset value corresponding to the measuring range by pressing the <ENTER> key.

```
>PARAM/detector
temp.coeff.:    2.5 %/°C
```

The next inquiry concerns the **temperature coefficient** for the automatic conversion of the conductivity from the operating temperature of the measuring cell to the reference temperature of 20° C. The preset value of `"2.5 %/°C"` applies to anions, the value applicable to cations `"1.5 %/°C"` can be selected by pressing the <SELECT> key.


⇒ Confirm the preset value for anions by pressing the <ENTER> key.

## 8 Enter parameters for analog output

```
PARAM
>PARAM/analog output
```

After the last action of point **7**, the title of the submenu `"analog output"` appears.


⇒ Press the <ENTER> key to move to the inquiries.

```
>PARAM/analog output
polarity:              +
```

The **polarity** of the analog output signal can be switched with the <SELECT> key between `"+"` and `"–"`. To ensure that a positive signal is always outputted for peaks, normally `"+"` is used for the determination of anions and `"–"` for that of cations.


⇒ Confirm the correct polarity `"+"` for our example with the <ENTER> key.

```
>PARAM/analog output
offset:           0 %fs
```

The second inquiry concerns the **offset** of the analog output signal. This offset of the zero point of the conductivity can be set to 10 % or 50 % of the full-scale range using the <SELECT> key. Such an offset of the zero point is primarily advisable when the integrator or the evaluation system do not accept any negative voltage values. As this is not the case for «IC Metrodata for Win95», the value can be left at `"0 %fs"`.


⇒ Confirm the preset value with the <ENTER> key.

```
>PARAM/analog output
damping:              off
```

The electronic **damping** of the analog output signal must normally not be switched on.


⇒ Confirm the switched-off status of the damping with the <ENTER> key.

```
PARAM
>PARAM/plot
```

The title of the submenu `"plot"` appears. This submenu contains various inquiries regarding the graphics printout on an external printer. As we shall not deal with the settings for such a printer in this brief tutorial, we can switch directly to the next inquiry.

## 9 Enter parameters for 709 IC Pump

*If you do not operate the 709 IC Pump by remote control via the 732 IC Detector, the parameters below must be entered directly on the pump (see 709 Instructions for Use).*


⇒ Press the <PARAM> key.

```
PARAM
>PARAM/709 IC Pump
```

The submenu `"709 IC Pump"` contains various inquires concerning the 709 IC Pump.


⇒ Press the <ENTER> key to move to these inquiries.

```
>PARAM/709 IC Pump
flow          0.5 mL/min
```

The first inquiry concerns the **flow** of the 709 IC Pump, which can be set to a value between 0.01 and 5.00 mL/min using the numeric keys.

```
>PARAM/709 IC Pump
flow          2.0 mL/min
```

For the PRP-X100 IC Anion Column used in the example, the recommended flow rate is 2 mL/min. Enter this value using the numeric keys.


⇒ Confirm the inputted value using the <ENTER> key.

```
>PARAM/709 IC Pump
Pmax            10.0 MPa
```

The parameter `"Pmax"` denotes the **maximum shutoff pressure** for the 709 IC Pump and is used to protect the separating column against excessive pressure. If the pressure exceeds this value, the pump is automatically shut off. Use the numeric keys to enter the desired value here. This limit value should be ca. 3 MPa above the normal operating pressure of the separating column used or correspond to the maximum admissible operating pressure of the column (1 MPa = 10 bar).

```
>PARAM/709 IC Pump
Pmax            10.0 MPa
```

The maximum admissible pressure for the PRP-X100 IC Anion Column is 34 MPa, the normal operating pressure is 2 mL/min at ca. 7 MPa. A value of 10 MPa is thus entered as the maximum shutoff pressure.


⇒ Confirm the set maximum shutoff pressure with the <ENTER> key.

```
>PARAM/709 IC Pump
Pmin            0.0 MPa
```

The parameter `"Pmin"` denotes the **minimum shutoff pressure** for the 709 IC Pump. If the pressure drops below this value for a considerable length of time (e.g. owing to leaks or if the eluent supply is interrupted), the pump is automatically switched off.

Use the numeric keys to enter here the desired value. This limit value should be sufficiently far below the normal operating pressure of the separating column used (1 MPa = 10 bar).

```
>PARAM/709 IC Pump
Pmin            1.0 MPa
```

A value of 1 MPa can be entered as the minimum shutoff pressure for the PRP-X100 IC Anion Column.


⇒ Confirm the set minimum shutoff pressure using the <ENTER> key.

```
>PARAM/709 IC Pump
flow corr.         1.00
```

The parameter `"flow corr."` denotes the **correction factor for the flow** of the 709 IC Pump. This correction factor is used to match the displayed flow to the actual flow.

If you are interested in the exact display of the flow, this correction factor must be determined by measurement of the actual flow and then entered here (see *section 3.3* of the *709 Instructions for Use*).


⇒ Confirm the inputted flow correction with the <ENTER> key. As this was the last inquiry of the last submenu of the <PARAM> key, an automatic switch is made to the standby mode.

```
  151.2 mS/cm    8.5 min
method           DEFAULT
```

The 732 IC Detector is again in the standby mode and the display shows the status messages.

## 10 Start 709 IC Pump

*If you do not operate the 709 IC Pump by remote control via the 732 IC Detector, the pump must be switched on directly using the <PUMP RS> key (see 709 Instructions for Use).*


⇒ Press the <PUMP R/S> key. The pump drive of the 709 IC Pump is started.

```
  151.2 mS/cm    8.9 min
pump running     6.9 MPa
```

After the start of the 709 IC Pump, an automatic switch is made to the status message for the pump. If this is running properly, the message "pump running" and the current measured pressure appear.

## 11 Condition IC system

⇒ Rinse IC system with eluent until the desired stability of the baseline is achieved.

To assess the baseline stability, it is advantageous if the measured conductivity is continuously recorded with a recorder or printer or (e.g. with «IC Metrodata for Win95») shown on the PC.

It normally takes 30…60 min until the IC system is ready for analysis. If the eluent is changed, the establishment of the ion exchanger equilibrium on the separating column may take longer.

```
  151.2 mS/cm   53.2 min
pump running     6.9 MPa
```

Example: With the PRP-X100 IC Anion Column a stable conductivity value of ca. 150 µS/cm is reached after around 45 min and scarcely changes after this time.

# 3.4 Calibration

After putting into operation and conditioning the IC system as described in *section 3.3*, the first calibration can now be performed. This requires a standard solution which contains the analyte substances in about the same concentration as expected in the sample.

For our example dealing with the determination of drinking water with the PRP-X100 IC Anion Column, a 100 µL sample loop is used which is filled with the following standard solution:

5 ppm $Cl^-$, 10 ppm $NO_3^-$, 10 ppm $SO_4^{2-}$
(as $Na^+$ or $K^+$ salts in dist. water)

## 1 Select status message for full-scale range


⇒ Repeatedly press the <SELECT> key until the status message for the full-scale range appears.

```
  151.2 mS/cm   54.9 min
full scale     200 mS/cm
```

The **full-scale range** currently in force appears in the bottom line of the display.

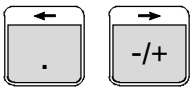
## 2 Set full-scale range


⇒ Press the <FULL SCALE> key.

```
  151.2 mS/cm   55.2 min
full scale:    200 mS/cm
```

The numeric value of the full-scale range start to flash. This indicates that the setting here must be made with the <🡐> and <🡒> keys and not as is normal with the <SELECT> key.

The **full-scale range** (operating range) is used to set the desired sensitivity for the display and the analog output of the measuring signal during the recording of the chromatogram. The range should be so selected that the largest peaks which need to be evaluated are clearly within the full-scale range.




⇒ Change the full-scale range by pressing the <🡐> key (value decremented) or the <🡒> key (value incremented) until the desired value appears in the display.

```
  151.2 mS/cm   55.8 min
full scale:   4.00 mS/cm
```

For the determination of anions in drinking water, a full-scale range of 4 µS/cm is selected.


⇒ Confirm the desired full-scale range with the <ENTER> key.

```
  151.2 mS/cm   56.1 min
full scale:   4.00 mS/cm
```

The 732 IC Detector is again in the standby mode and the display shows the status message for the full-scale range, but now the numeric value no longer flashes.

OVERLOAD

As the selected full-scale range is clearly less than the measured absolute conductivity, red overload display **8** on the 732 IC Detector now lights up.

## 3 Trigger auto-zero


⇒ Press the <ZERO> key. This starts the automatic electronic background compensation. During zeroing, the green LED in the key starts to flash.

```
 +0.000 mS/cm   56.4 min
full scale:   4.00 mS/cm
```

As soon as zeroing is at an end, the green LED in the <ZERO> key is permanently on. The top line of the display shows the **auto-zero value** in place of the absolute conductivity. In contrast to the absolute conductivity, the auto-zero value is always outputted with the sign in front of the number.

With the **auto-zero function** the current conductivity value becomes the new zero point of the selected full-scale range. Each time the <ZERO> key is pressed, the measuring signal is always reset to zero. The auto-zero function can be switched off with the <ZERO OFF> key.

## 4 Set injection valve A to "FILL"


⇒ Press the <FILL> key for injection valve A at the 733 IC Separation Center. This switches the injection valve to the "FILL" position. This position is indicated by lighting up of the green LED in the <FILL> key.

## 5 Fill sample loop

⇒ Immerse the aspirating tubing **88** attached to connection **22** in the standard solution.

⇒ Using the syringe fixed to connection **21** siphon in ca. 1 mL standard solution.

## 6 Set injection valve A to "INJECT"


⇒ Press the <INJECT> key for injection valve A on the 733 IC Separation Center and the chromatogram is started. This switches the injection valve to the "INJECT" position. The "INJECT" position is indicated by lighting up of the green LED in the <INJECT> key.

⇒ At the same time start the recorder (if used).

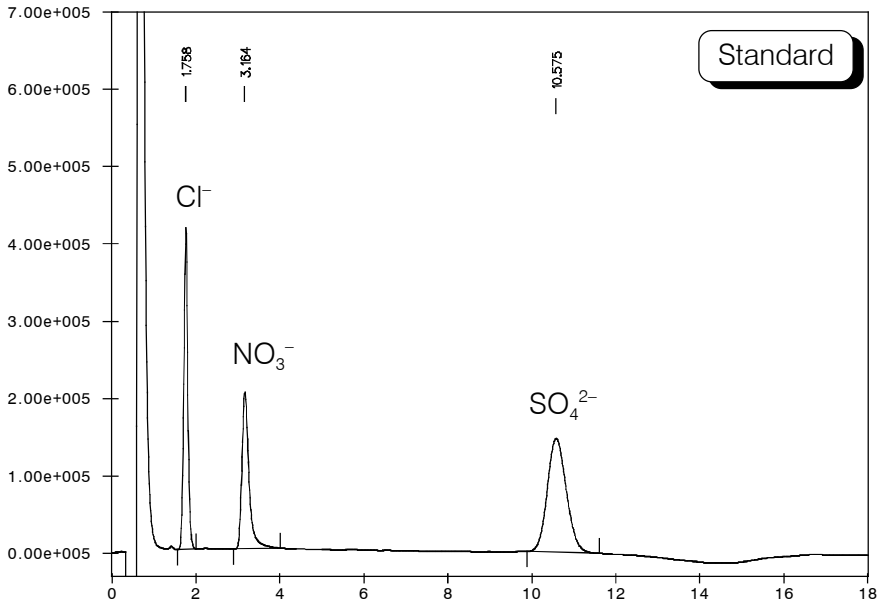
An integrator attached to the 733 IC Separation Center or a PC with evaluation software (e.g. «IC Metrodata for Win95») is started automatically when injection valve A is switched to the "INJECT" position.

```
 +0.000 mS/cm    0.0 min
full scale:   4.00 mS/cm
```

As soon as injection valve A is in the "INJECT" position, the current time is reset to `"0.0 min"`. This marks the start time of the chromatogram.

The ion chromatogram of the standard is plotted in the next 20 min or so.

*Fig. 19* shows an example of a calibration with 5 ppm $Cl^-$, 10 ppm $NO_3^-$ and 10 ppm $SO_4^{2-}$.




FULL REPORT

| Ret Time (Min) | Component Name | Concentr. ppm | Area (uV*Sec) | Height (uV) |
|---|---|---|---|---|
| 1.758 | Chloride | 5.000000 | 2791676.00 | 416181.718 |
| 3.164 | Nitrate | 10.000000 | 2405831.75 | 202204.046 |
| 10.575 | Sulphate | 10.000000 | 4652037.50 | 146991.609 |

***Fig. 19: Ion chromatogram of the calibration***

# 3.5 Sample determination

Following the calibration of the IC system as described in *section 3.4* the first sample solution can be injected.

## 1 Filter drinking water sample

⇒ Filter the drinking water sample with a 0.45 µm microfilter.

## 2 Trigger auto-zero


⇒ Press the <ZERO> key. This starts the automatic electronic background compensation. During zeroing, the green LED in the key starts to flash. As soon as zeroing is at an end, the green LED in the <ZERO> key is permanently on.

## 3 Set injection valve A to "FILL"


⇒ Press the <FILL> key for injection valve A on the 733 IC Separation Center. This switches the injection valve to the "FILL" position. This position is indicated by lighting up of the green LED in the <FILL> key.

## 4 Fill sample loop

⇒ Immerse the suction tubing **88** attached to connection **22** in the vessel containing the drinking water sample.

⇒ Use the syringe fastened to connection **21** to siphon in ca. 1 mL sample.

## 5 Set injection valve A to "INJECT"


⇒ Press the <INJECT> key for injection valve A on the 733 IC Separation Center. This switches the injection valve to the "INJECT" position and the chromatogram is started. The "INJECT" position is indicated by lighting up of the green LED in the <INJECT> key.

⇒ At the same time start the recorder (if used).

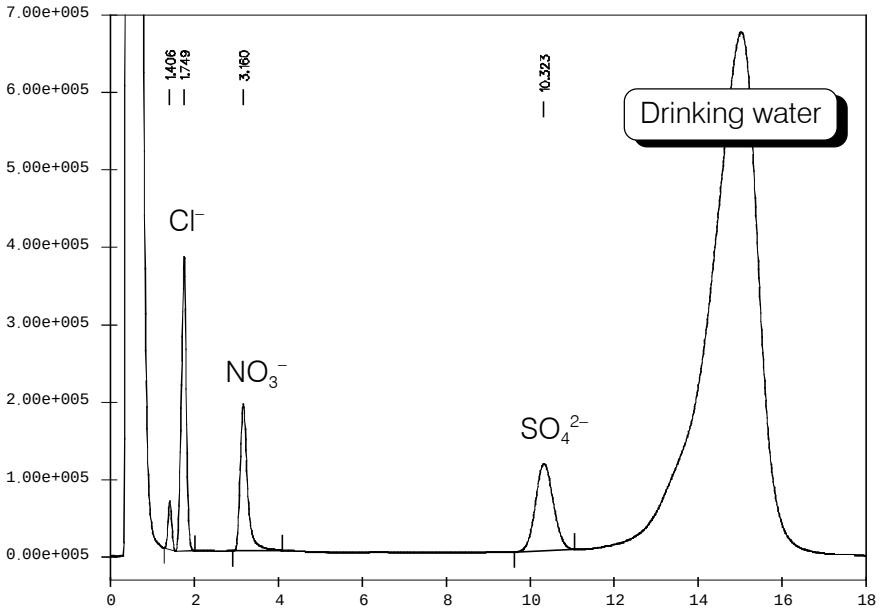
An integrator attached to the 733 IC Separation Center or a PC with evaluation software (e.g. «IC Metrodata for Win95») is started automatically when injection valve A is switched to the "INJECT" position.

```
 +0.000 mS/cm    0.0 min
full scale:   4.00 mS/cm
```

As soon as injection valve A is in the "INJECT" position, the current time is reset to `"0.0 min"`. This marks the start time of the chromatogram.

The ion chromatogram of the drinking water sample is recorded during the next 20 min or so.

*Fig. 20* shows an example of a drinking water sample.




FULL REPORT

| Ret Time (Min) | Component Name | Concentr. ppm | Area (uV*Sec) | Height (uV) |
|---|---|---|---|---|
| 1.749 | Chloride | 5.487972 | 3064128.00 | 381971.937 |
| 3.160 | Nitrate | 9.647280 | 2320973.25 | 189443.562 |
| 10.323 | Sulphate | 7.142281 | 3322615.75 | 112246.203 |

***Fig. 20: Ion chromatogram of the drinking water sample***

In comparison with the standard, in the drinking water sample the system peak which appears after the sulfate peak is very large. The next sample can be started at the earliest 18 min following injection of the previous sample.

# 3.6 Storing as a method

The parameter settings used for the drinking water determination can be stored in the 732 IC Detector as a method and hence later recalled at any time. Proceed as follows to store the inputted settings under the name "Water":


⇒ Press the <METHOD> key to open the main menu for method management.

```
METHOD
>METHOD/recall
```

The title of the submenu `"METHOD/recall"` appears. This is used to load a method already stored in the working memory. Proceed further to the next submenu.


⇒ Press the <METHOD> key again.

```
METHOD
>METHOD/store
```

The title of the submenu `"METHOD/store"` appears. This is used to store a method loaded in the working memory.


⇒ Press the <ENTER> key.

```
>METHOD/store
name:
```

The inquiry for entry of the method name which can have a length of max. 8 characters appears. The name "Water" selected for this example is entered as follows:


⇒ Press the <➔> key to start the text entry.

```
>METHOD/store
name:           ABCDEFGH
```

The first 8 letters of the alphabet `"ABCDEFGH"` appear with the first letter A flashing. The letter at the flashing position can now be selected with the <🡐> and <➔> keys.


⇒ Press the <➔> key repeatedly until the flashing letter `"W"` appears.

```
>METHOD/store
name:           WXYZ abc
```

The first letter of the name is now the desired `"W"`.


⇒ Press the <ENTER> key to confirm the first letter.

```
>METHOD/store
name:           WWXYZ ab
```

The second letter of the name starts to flash and can again be selected with the <🡐> and <➔> keys.


⇒ Press the <➔> key repeatedly until the letter `"a"` appears at the flashing position.

```
>METHOD/store
name:           Wabcdefg
```

The second letter of the name is now the desired "a".


⇒ Press the <ENTER> key to confirm the second letter.

```
>METHOD/store
name:           Waabcdef
```

The third letter of the name starts to flash and can be selected with the <🡐> and <🡒> keys.


⇒ Press the <🡒> key repeatedly until the letter "t" appears at the flashing position.

```
>METHOD/store
name:           Watuvwxy
```

The third letter of the name is now the desired "t".


⇒ Press the <ENTER> key to confirm the third letter.

```
>METHOD/store
name:           Wattuvw
```

The fourth letter of the name starts to flash can be selected with the <🡐> and <🡒> keys.


⇒ Press the <🡐> key repeatedly until the letter "e" appears at the flashing position.

```
>METHOD/store
name:           Watefghi
```

The fourth letter of the name is now the desired "e".


⇒ Press the <ENTER> key to confirm the fourth letter.

```
>METHOD/store
name:           Wateefgh
```

The fifth letter of the name starts to flash and can be selected with the <🡐> and <🡒> keys.


⇒ Press the <🡒> key repeatedly until the letter "r" appears at the flashing position.

```
>METHOD/store
name:           Waterstu
```

The fifth letter of the name is now the desired "r".


⇒ Press the <ENTER> key to confirm the fifth letter.

```
>METHOD/store
name:           Waterrst
```

The desired name "Water" has now been entered in full.


⇒ Press the <QUIT> key to end the text entry.

```
>METHOD/store
name:           Water
```

The display shows the complete method name `"Water"` for confirmation.


⇒ Press the <ENTER> key to confirm the method name. The parameters are now stored in the instrument under the name `"Water"`.

```
 +0.000 mS/cm   28.4 min
full scale:   4.00 mS/cm
```

The 732 IC Detector is now again in the standby mode and the display shows the status messages.

A method report of the method "Water" just stored can be outputted with the <REPORT> key (see *section 4.8.3*) and has the following appearance:

```
732 IC Detector          01104   732.0012
date 1995-09-18  time 11:03:47

METHOD
Method name              Water
  date:  1995-09-18  10:39:10

PARAM
>PARAM/detector
  range:             200 µS/cm
  full scale:       4.00 µS/cm
  temp.coeff.:         2.5 %/°C
>PARAM/analog output
  polarity:              +
  offset:                0 %fs
  damping:             off
>PARAM/plot
  autom.start:         off
  time interval        1.0 s
  time scale          10.0 mm/min
  time scale label:    rel
  stop time            off min
  left:              0.000 µS/cm
  right:               10 µS/cm
>PARAM/709 IC Pump
  flow                2.00 mL/min
  Pmax                10.0 MPa
  Pmin                 1.0 MPa
  flow corr.          1.00

PROGRAM
               --------------
```

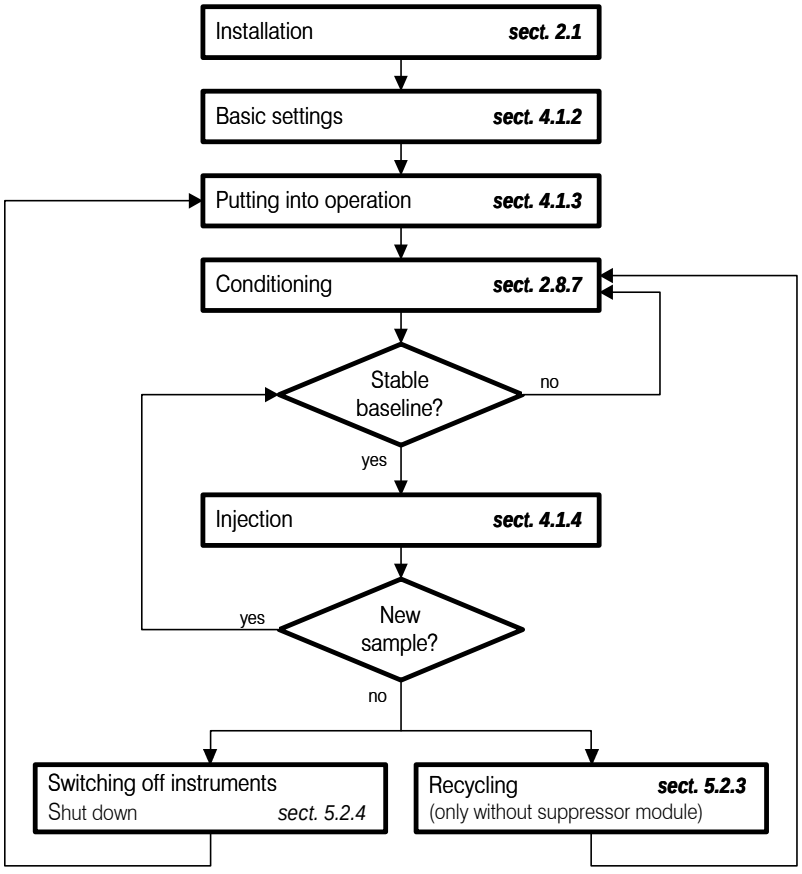
# 4 Operation

*This section provides a detailed description of the operation of the 732 IC Detector and 733 IC Separation Center using the keypad and dialog display. After an overview of the various operating sequences (section 4.1), the fundamentals of the operation are explained (section 4.2). This is followed by a detailed description of the display (section 4.3) and key functions (section 4.4 – 4.8). A few selected illustrative methods complete this section 4 (section 4.9).*

## 4.1 Operating sequences

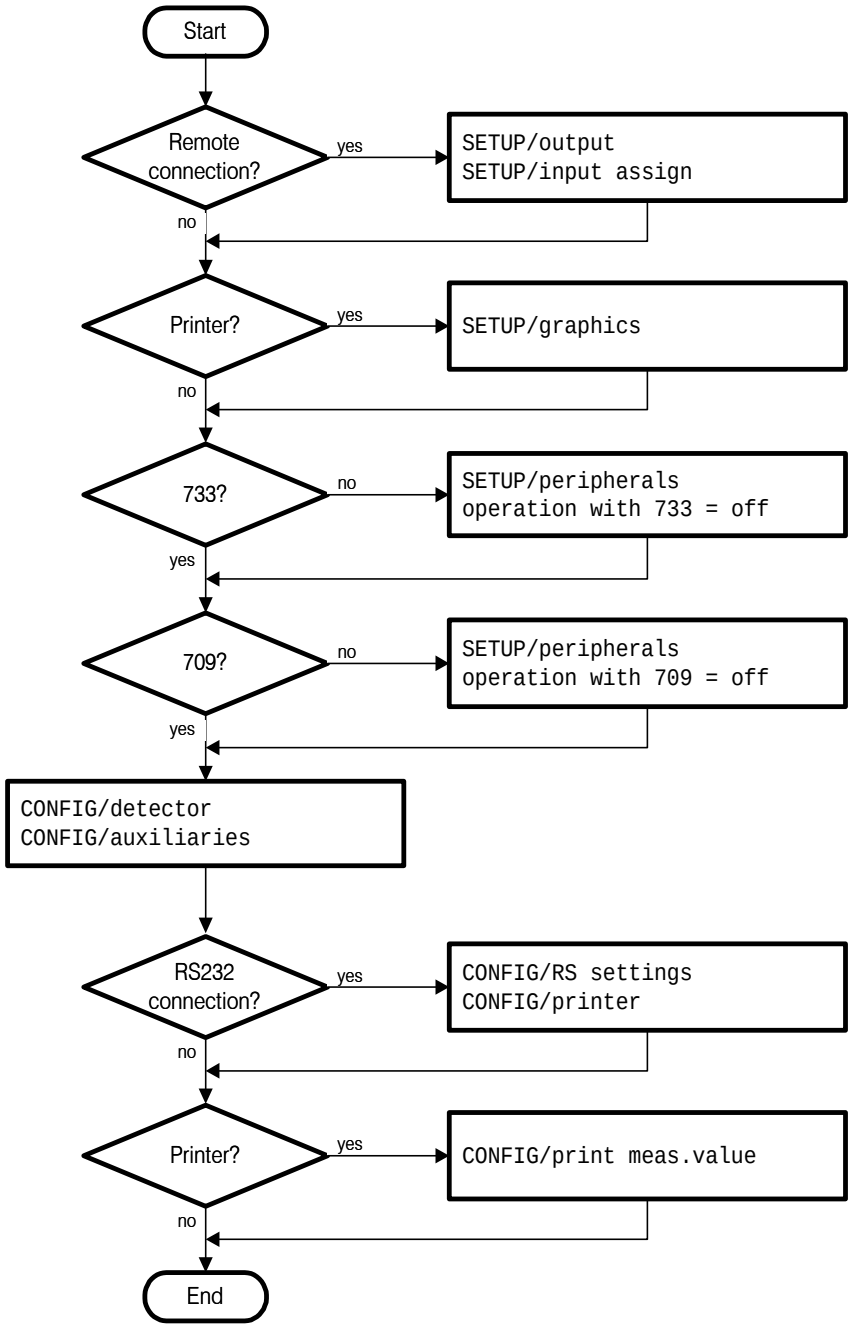
### 4.1.1 General flow chart

The following flow diagram shows the general sequence of the determination of an ion chromatogram. Additional detailed charts and in-depth information can be found in the sections mentioned.



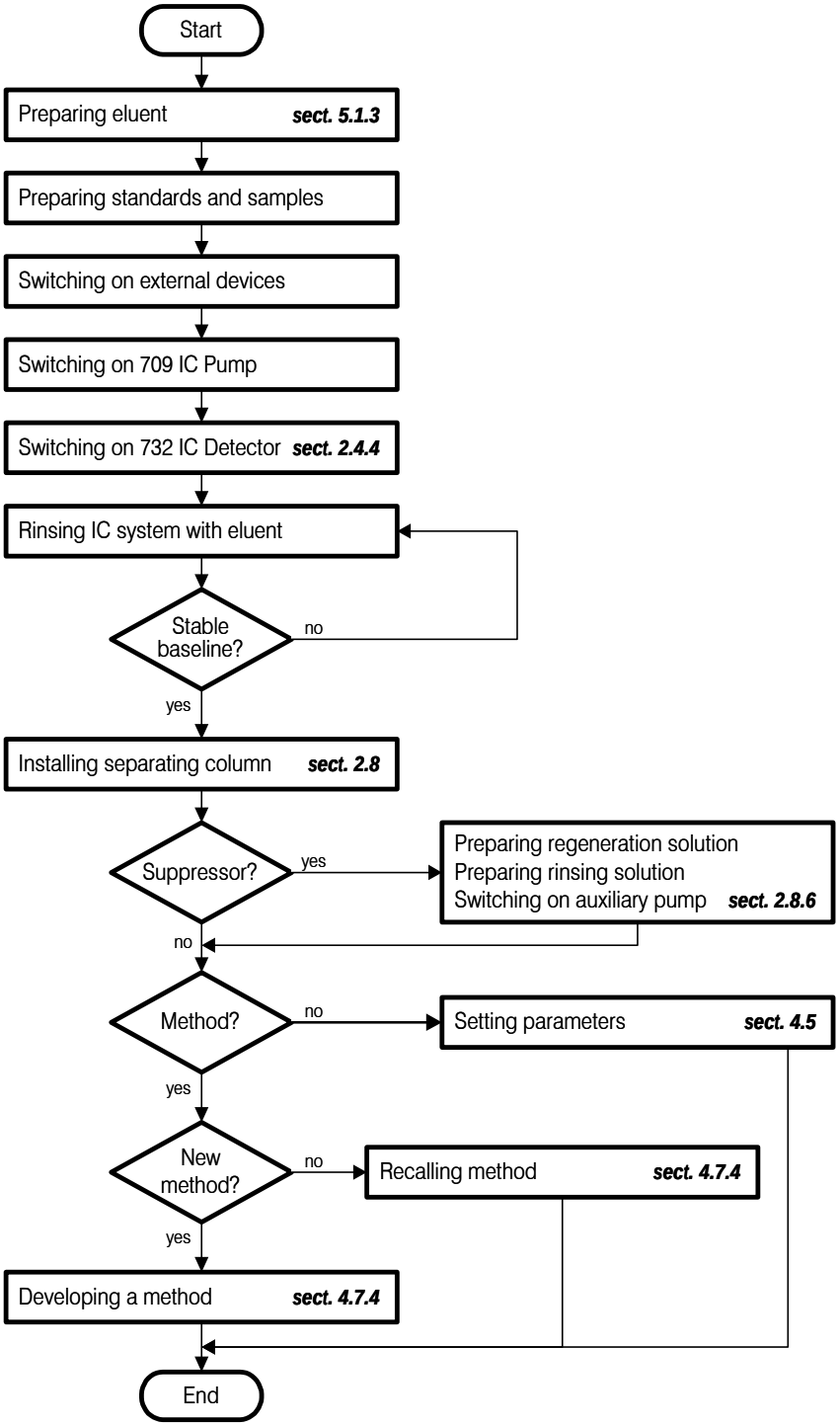
### 4.1.2 Flow chart for basic settings

The following flow diagram shows the basic SETUP and CONFIG settings which must be selected for the 732 IC Detector as a function of the attached devices. You will find detailed information in *section 4.4*.



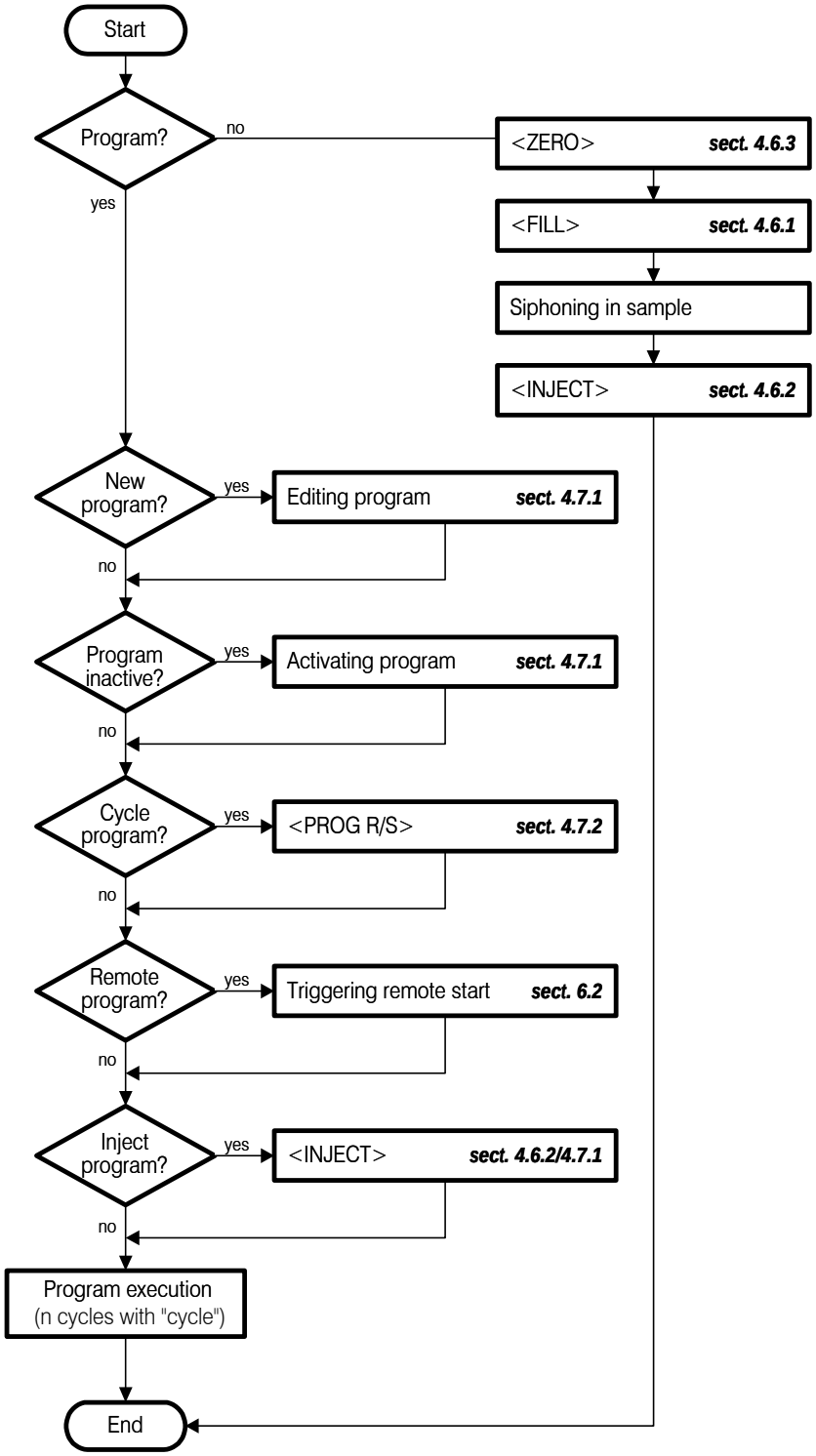
### 4.1.3 Flow chart for putting into operation

The following flow diagram shows how the IC system can be put back into operation after a separating column has been removed and all devices have been switched off (shutdown, see *section 5.2.4*). A requirement is that the installation (*section 2.1*) is complete and the basic settings (*section 4.1.2*) have been made. You will find further information in the sections mentioned.



### 4.1.4 Flow chart for injection

The following flow diagram shows how an injection is started on the IC system with and without a program. If the points <ZERO>, <FILL> and "Siphoning in sample" are not programmed or must be performed by the Autosampler, they must also be manually triggered. You will find further information in the sections mentioned.



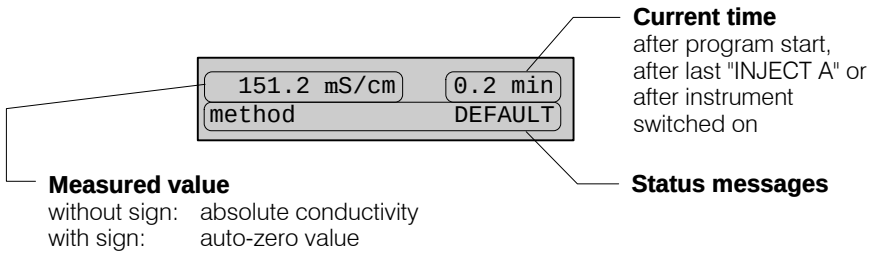
# 4.2 Fundamentals of the operation

## 4.2.1 Display

LCD **1** on the 732 IC Detector comprises two lines each of 24 characters. What appears on the display depends on whether the instrument is in the **standby mode** or the **edit mode**.

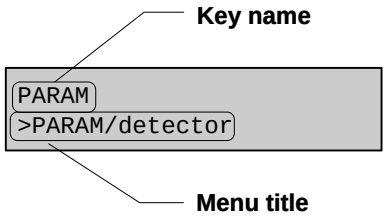
### Standby mode

After the 732 IC Detector has been switched on, the instrument is always automatically in the standby mode of conductivity measurement. The first display line shows the measured value and the current time, the second line displays status messages selectable with the <SELECT> key.

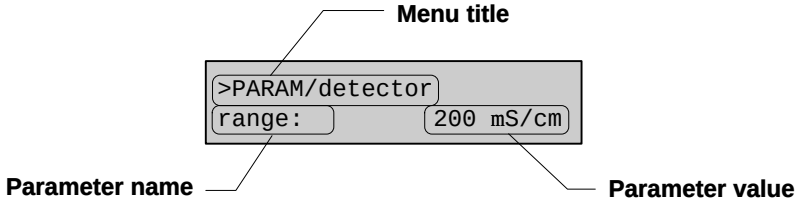



### Edit mode

Pressing the appropriate keys switches from the standby mode to the edit mode. The first line of the display then shows the name of the pressed key, the second line the title of the first submenu:

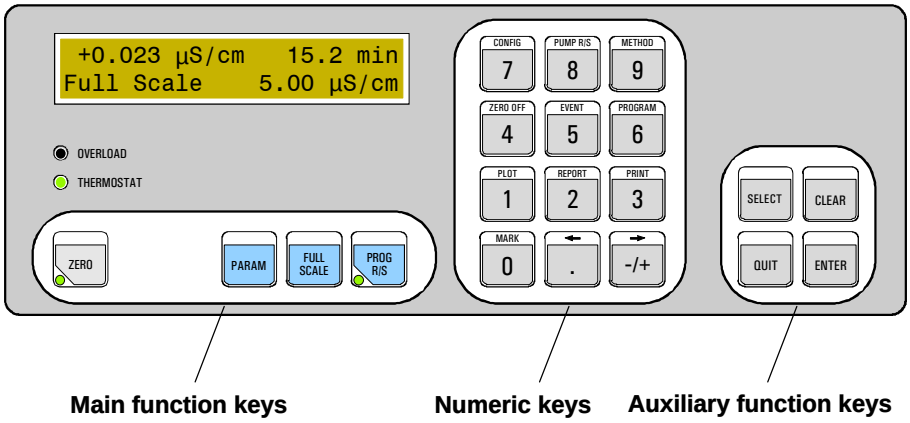



Pressing the <ENTER> key switches from the menu title to the individual inquiries. The first line shows the menu title, the second line is used as an entry line for parameters.



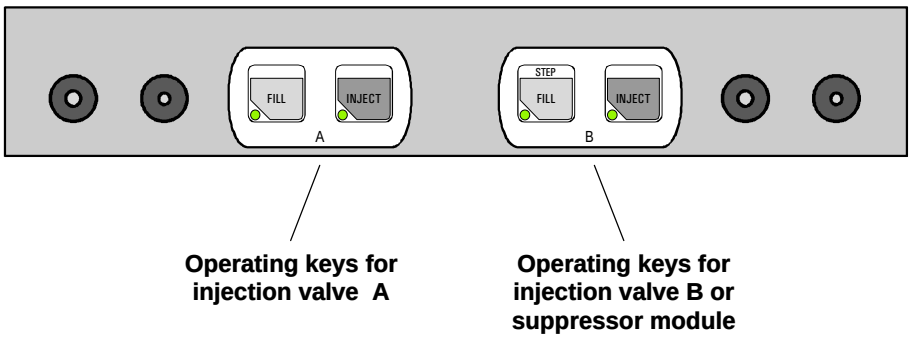
## 4.2.2 Overview of key functions

### Key field of 732 IC Detector




The key field of the 732 IC Detector contains 4 colored main function keys, 12 gray numeric keys and 4 gray auxiliary function keys. In the standby mode, the numeric keys can also be used to trigger the specified functions by means of their numbers.

### Key field of 733 Separation Center




The key field of the 733 IC Separation Center contains 4 keys for operation of the injection valves and the suppressor module.

The following table provides a brief overview of the different functions of the individual keys of the 732 IC Detector and 733 Separation Center in the standby mode and the edit mode. You will find more detailed information on the key functions in *sections 4.4¼4.8*.

## Main function keys of 732 IC Detector

| Key | Standby mode | Edit mode |
|---|---|---|
|  | **Trigger auto-zero**<br>• Automatic zeroing of the current conductivity (the green LED in the key lights up). | **Trigger auto-zero**<br>• Automatic zeroing of the current conductivity (the green LED in the key lights up). |
|  | **Open parameter menu**<br>• Opens the main menu for setting the parameters for the conductivity detector, analog output, graphics plot and 709 IC Pump.<br>• All settings which are set in the parameter menu can be stored together with the program as a method. | **Select submenu or parameters**<br>• Selection of the next submenu in the main menu.<br>• Selection of the next parameter in the submenu. |
|  | **Set full-scale range**<br>• Direct selection of the full-scale range (value flashes).<br>• Selection of the value with the <🡐> and <🡒> keys. | **Return to standby mode**<br>• Acceptance of the displayed value for the full-scale range and return to the standby mode. |
|  | **Start/stop program**<br>• *LED in key dark*: Program inactive; **No function** (program start not possible until program status = `"active"`).<br>• *LED in key lit up*: Program active; **Program start** with program type `"cycle"`.<br>• *LED in key flashes*: Program running; **Program stop** with all program types. | **No function** |

## Numeric keys of 732 IC Detector

| Key | Standby mode | Edit mode |
|---|---|---|
| CONFIG 7 | **Open configuration menu**<br>• Opens the main menu for configuration of the 732 IC Detector.<br>• The settings in the configuration menu are retained until they are changed or the working memory (RAM) is initialised. | **Numeric entry ('7')**<br>or<br>**select submenu or parameter**<br>• Selection of the next submenu in the main menu.<br>• Selection of the next parameter in the submenu. |
| PUMP R/S 8 | **Start/stop pump**<br>• On/off switching of the pump drive of the 709 IC Pump (if pump remote controlled by 732 IC Detector). | **Numeric entry ('8')** |
| METHOD 9 | **Open method menu**<br>• Opens the main menu for the recall, storage and deletion of user-defined methods. | **Numeric entry ('9')**<br>or<br>**select submenu or parameter**<br>• Selection of the next submenu in the main menu.<br>• Selection of the next parameter in the submenu. |
| ZERO OFF 4 | **Switch off auto-zero**<br>• Switches off the auto-zero function (green LED in the <ZERO> key goes out). | **Numeric entry ('4')**<br>or<br>**switch off auto-zero**<br>• Switches off the auto-zero function (green LED in the <ZERO> key goes out). |
| EVENT 5 | **Open event menu**<br>• Opens the main menu for the programming, editing and deletion of events. | **Numeric entry ('5')**<br>or<br>**select submenu or parameter**<br>• Selection of the next submenu in the main menu.<br>• Selection of the next parameter in the submenu. |
| PROGRAM 6 | **Open program menu**<br>• Opens the main menu for the development, editing and deletion of time programs.<br>• Definition of program type.<br>• Set programs active/inactive. | **Numeric entry ('6')**<br>or<br>**select submenu or parameter**<br>• Selection of the next submenu in the main menu.<br>• Selection of the next parameter in the submenu. |

| Key | Standby mode | Edit mode |
|---|---|---|
| PLOT 1 | **Start graphics plot**<br>• Output of measured value curve on an external printer (abort with <QUIT>). | **Numeric entry ('1')** |
| REPORT 2 | **Start report output**<br>• Selection of report and output on an external printer (abort with <QUIT>). | **Numeric entry ('2')**<br>or<br>**return to standby mode** |
| PRINT 3 | **Start measured value output**<br>• Output of single measured values or start of the continuous measured value output on an external printer (abort with <QUIT>). | **Numeric entry ('3')** |
| MARK 0 | **Trigger marking**<br>• Sets a marking signal of ca. 10% of the full-scale range at the analog output. | **Numeric entry ('0')** |
| ← . | **No function** | **Numeric entry ('.')**<br>or<br>**narrowing of the full-scale range** (see <FULL SCALE>)<br>or<br>**text entry**<br>• Activation of the text entry mode.<br>• Shift of the moving character string to the left (see *section. 4.2.5*). |
| → -/+ | **No function** | **Change in the sign ('–/+')**<br>or<br>**widening of the full-scale range** (see <FULL SCALE>)<br>or<br>**text entry**<br>• Activation of the text entry mode.<br>• Shift of the moving character string to the right (see *section 4.2.5*). |

## Auxiliary function keys of 732 IC Detector

| Key | Standby mode | Edit mode |
|---|---|---|
|  | **Select status message**<br>• Selection of the status messages for full-scale range, absolute conductivity, 709 IC Pump, program, method, date and time. | **Select preset parameter values**<br>• Selection from preset parameter values for parameters which are marked by a colon ":". |
|  | **No function** | **Delete parameter values**<br>• Deletion of the displayed parameter values and resetting to default values or "0". |
|  | **Acknowledge error messages**<br>• Acknowledgment of the error messages displayed on the first line.<br>or<br>**abort printing operations**<br>• Abort printing operations started with <PLOT>, <REPORT> or <PRINT>. | **Abort entry**<br>• Abort the parameter entry (parameter reset to original value).<br>• Exit from rolling inquiries and selection of the next higher menu level or the standby mode. |
|  | **No function** | **Confirmation of parameters**<br>• Confirmation of existing parameter values or those just entered.<br>• Selection of the next menu line. |

## Operating keys of 733 IC Separation Center

| Key | Injection valve | Suppressor module |
|---|---|---|
|  | **Switching to "FILL"**<br>• Switching of injection valve A to "FILL" position. | **No function** |
|  | **Switching to "INJECT"**<br>• Switching of injection valve A to "INJECT" position. | **No function** |
|  | **Switching to "FILL"**<br>• Switching of injection valve B to "FILL" position. | **Rotate suppressor module**<br>• Switch suppressor module to next position. |
|  | **Switching to "INJECT"**<br>• Switching of injection valve B to "INJECT" position. | **No function** |

### 4.2.3 Instrument dialog

The instrument dialog of the 732 IC Detector is organized in the form of so-called rolling inquiries which are arranged in menu levels in a hierarchical manner and are subject to the following rules:

#### Main menu

The main function keys as well as most numeric keys of the 732 IC Detector open a main menu whose thematically arranged submenus are selected by repeated pressing of this key. The name of the key always appears in the top line of the display.

#### Submenu

Each submenu has a title marked by ">" which appears in the bottom line of the display. <ENTER> is used to move from the title to the individual inquiries, which are used to change the most important settings of the instrument. With <QUIT> a switch is made back to the standby mode.

#### Inquiries

In inquiries without ":", the values must be entered using the numeric keys. <ENTER> is used to accept the inputted value and the next inquiry appears.

In the case of inquiries with ":", the admissible values must be selected with the <SELECT> key. <ENTER> is used to accept the set value and the next inquiry appears.

Depending on the parameter, <CLEAR> is used to reset the displayed value to the smallest possible value or the default value. The <CLEAR> key also serves to abort wrong entries.

<QUIT> is used to quit the inquiries and return to the main menu.

You will find a schematic representation of the instrument dialog in *Fig. 21*.

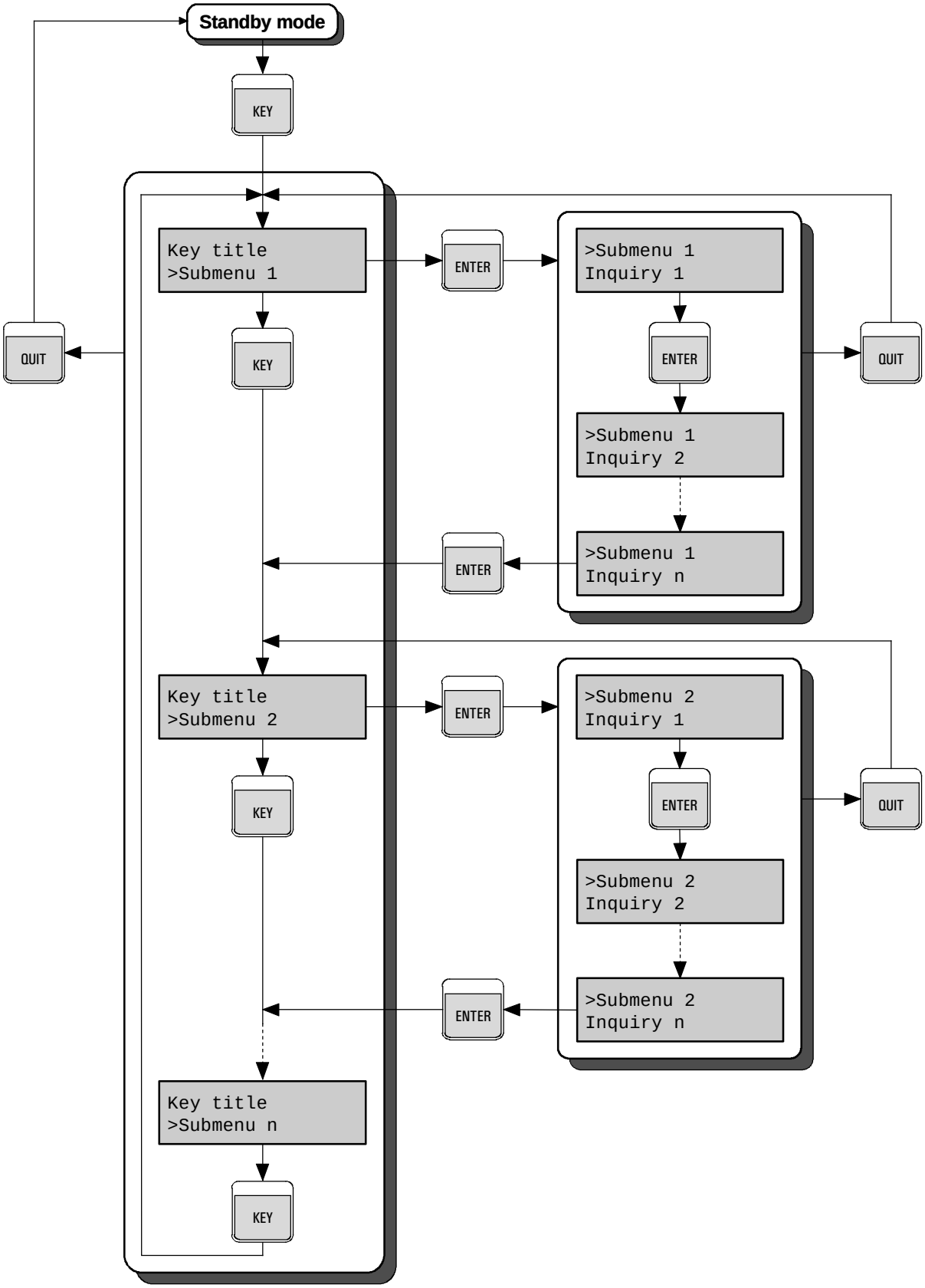



***Fig. 21: Schematic representation of the instrument dialog***

## 4.2.4 Data entry

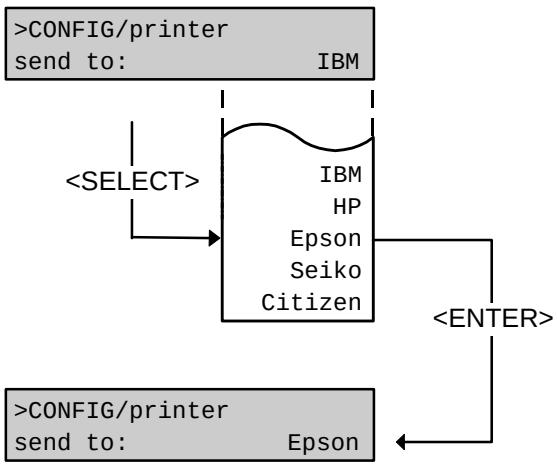
### Numeric entry


With inquiries in which the parameter title has no colon ":", the parameter values can be entered directly with the numeric keys.

### <Select> selection


With inquiries in which the parameter title has a colon ":", the <SELECT> key can be used to display a preset selection of data. This <SELECT> selection has a cyclic structure like a selector drum.

Example:




### Confirmation


Confirmation of the inputted or selected parameter value by pressing the <ENTER> key.

### Correction


Deletion of the parameter value just entered or selected and resetting to the default value or "0".


Abort of the parameter entry with <QUIT> (e.g. as a wrong value has been entered). The parameter value is reset to the original value, a beep sounds and a direct return to the submenu is effected.

## 4.2.5 Text entry

With certain inquiries which require the entry of a text, any ASCII characters can be entered to write the texts.

### Opening the text editor

The "🡐" " or "🡒" keys open the text editor.


"🡐" is used to delete an existing character string and to position the text cursor at the left edge of the entry field.


With "🡒" an existing character string is retained, the text cursor is positioned on the last character of the existing text.

After the text editor has been opened, a moving string is displayed which comprises an alphabetical list of all characters which can be entered. The character which flashes is that which is currently selected and can be changed (text cursor).

### Character selection



The "🡐" and "🡒" keys move the string of the selectable characters (uppercase and lowercase letters, numbers and special characters, arranged alphabetically) in the selected direction past the text cursor. Pressing these keys once causes a shift in the string by one position to the left or right. By pressing and holding the keys, the string can be moved rapidly.

Numbers can also be entered directly using the numeric keys.

### Confirmation of the character selection


The <ENTER> key appends the character currently at the text cursor position to the existing text line. When the entire width of the text field is full, the text entry mode is quit and the text line accepted with <ENTER>.

### Deleting characters


The <CLEAR> key is used to delete the rearmost character of the existing text line. As a result, the text cursor automatically moves one character to the left.

### Closing text entry

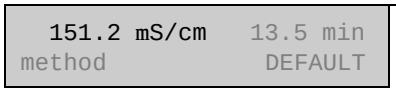

The text entry mode is exited with <QUIT>. The displayed text line can then be accepted with <ENTER> or discarded by pressing <QUIT> again.

You will find an example illustrating text entry in *section 3.6*.

# 4.3 Displays in the standby mode

## 4.3.1 Measured value and current time

In the standby mode of the conductivity measurement, the top line of the display always shows the current measured value (left) and the current time (right).




### Measured value

The following possibilities exist for the display of the measured value:

**Measured value without sign**

`151.2 µS/cm` Absolute conductivity in µS/cm or mS/cm.
This value is also shown automatically if the auto-zero value lies outside the full-scale range.

**Measured value with sign**

`+0.004 µS/cm` Auto-zero value in µS/cm (default setting)

`+0.0 %fs` Auto-zero value in %fs (% of the full-scale range, can be set under `">CONFIG/detector/'zero' unit"`)

`+0.4 mV` Auto-zero value in mV (can be set under `">CONFIG/detector/'zero' unit"`)

**No measured value**

`--------` Measured value is more than 10% outside the set measuring range.


### Current time

The following possibilities exist for the display of the current time:

**Without "INJECT A" or program start**
Current time after instrument switched on

**With "INJECT A"**
Current time after the last switching of injection valve A to "INJECT" position (does not apply to an "INJECT A" command within a program)

**With program start**
Current time from last program start

## 4.3.2 Status messages


Pressing the <SELECT> key in the standby mode selects the status messages in turn. These are shown in the bottom line of the display. Depending on the instrument status, the following messages can be displayed:

```
 +0.004 mS/cm   13.5 min
method          XXXXXXXX
```

### Status messages for a method

`method XXXXXXXX`
An unchanged method is loaded in the working memory (see *section 4.7.4*).

`method XXXXXXXX modif.`
The method loaded in the working memory has been changed (see *section 4.7.4*).

`method DEFAULT`
The default method `"DEFAULT"` is loaded in the working memory (see *section 4.7.4*).

```
 +0.004 mS/cm   13.5 min
  1995-10-12  11:24:31
```

### Display of date and time

The current date and the current time are displayed. Date and time can be changed under <CONFIG> (see *section 4.4.2*).

```
  151.2 mS/cm   13.5 min
full scale    1.00 mS/cm
```

### Display of the full-scale range

The full-scale range currently set is displayed (operating range, see *section 4.5.1*) and can be changed with the <FULL SCALE> key (see *section 4.5.2*)

```
 +0.004 mS/cm   13.5 min
abs.cond.    151.2 mS/cm
```

### Display of the absolute conductivity

The absolute conductivity currently measured is displayed. This is primarily useful when the auto-zero value is displayed as the measured value.

```
 +0.004 mS/cm   13.5 min
pump ready
```

### Status messages for 709 IC Pump

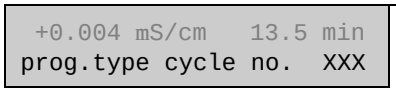
*These status messages appear only with* `"SETUP/peripherals/operation with 709 = on"`.

`pump ready`
The 709 IC Pump is switched on and ready for start with the <PUMP R/S> key (see *section 4.6.6*).

`pump running XX.X MPa`
The 709 IC Pump is running, the current pressure $P_{actual}$ is shown on the right. The pump can be stopped using the <PUMP R/S> key (see *section 4.6.6*).

`stopped: YY-MM-DD HH:MM`
The 709 IC Pump was stopped at the time indicated owing to violation of the shutoff limit `"Pmin"` or `"Pmax"`. To restart a pump stopped in this manner, the pump keys <EXT.> and <R/S> must be pressed in succession and then <EXT.> pressed again (see also *section 4.5.1*).

`pump not responding`
This message appears when
- the 709 IC Pump is not connected to the 732 IC Detector,
- the 709 IC Pump is not switched on,
- the remote control of the 709 IC Pump is not switched on.




## Status messages for program type

*These status messages appear only with* `"PROGRAM/parameters/status = active"`.

`prog.type cycle no. XXX`
Display of the program type `"cycle"` and the cycle number (see *section 4.7.1*).

`prog.type inject`
Display of the program type `"inject"` (see *section 4.7.1*).

`prog.type remote`
Display of the program type "`remote`" (see *section 4.7.1*).


## Status messages for program step

*These status messages appear only with* `"PROGRAM/parameters/status = active"`.

`next step ready`
The program is ready for a new start (see *section 4.7.1*).

`next step XXX.X min`
Display of the time when the next program step will be executed.

`next step ---`
The program has been set to `"inactive"`, a new start is not possible.

`next step ∞`
The program continues to run indefinitely (no `"end"` command available).

# 4.4 Basic settings

## 4.4.1 Setup

**Switch on +**


Under "Setup", various basic settings of the 732 IC Detector are combined which normally seldom need to be changed. They are accessible only when the <CONFIG> key is pressed at the same time as the instrument is switched on. The "SETUP" part which then appears comprises the following main menu:

| | |
|---|---|
| SETUP<br>>SETUP/output | **Setting of the remote output lines** |
| SETUP<br>>SETUP/input assign | **Assignment of the remote input lines** |
| SETUP<br>>SETUP/graphics | **Setting of general graphics parameters** |
| SETUP<br>>SETUP/peripherals | **Setting of the peripherals 733 and 709** |

Repeated pressing of the <CONFIG> key selects the submenus in turn. The individual inquiries of a submenu are accessed using the <ENTER> key and exited with the <QUIT> key. The following listings show all dialog items which appear under "SETUP". The values shown in the displays are the default values, the possible entry values or ranges are shown below the display.

>SETUP
>SETUP/output

### Setting of the remote output lines

For further details on the remote interface, see *section 6.2*.

>SETUP/output
remote 00000000

0,1

<CLEAR> sets all values to 0

### Set the remote output lines 1...8

Sets the basic setting for the remote output lines when the instrument is switched on.

Each of the remote output lines 1…8 can be set manually from left to right in turn:

0 Line off, inactive (open)

1 Line on, active (0 V)

Each time the instrument is switched on, the remote output lines are reset in accordance with the parameters entered here.

```
>SETUP
>SETUP/input assign
```

## Assignment of the remote input lines

The 732 IC Detector has 4 programmable remote input lines which can be used to trigger a total of 15 different instrument functions (for details, see *section 6.2.1*). The default assignment of the individual functions to the status of the 4 input lines 2…5 (defined by the corresponding decimal code 1…15) can be changed if need be. Several functions can thus also be assigned the same status.

```
>SETUP/input assign
PROG R/S              1
```

1...15

### Start/stop program

An active remote program is started, any programs running are stopped.

```
>SETUP/input assign
PUMP R/S              2
```

1...15

### Start/stop 709 IC Pump

Equivalent to pressing the <PUMP R/S> key.

```
>SETUP/input assign
FILL A                4
```

1...15

### Trigger "FILL" at valve A

Equivalent to pressing the <FILL A> key on the 733 IC Separation Center.

```
>SETUP/input assign
INJECT A              8
```

1...15

### Trigger "INJECT" at valve A

Equivalent to pressing the <INJECT A> key on the 733 IC Separation Center.

```
>SETUP/input assign
FILL B/STEP           3
```

1...15

### Trigger "FILL" at valve B or "STEP" on the suppressor module

Equivalent to pressing the <FILL B> key or the <STEP> key on the 733 IC Separation Center.

```
>SETUP/input assign
INJECT B             12
```

1...15

### Trigger "INJECT" at valve B

Equivalent to pressing the <INJECT B> key on the 733 IC Separation Center.

```
>SETUP/input assign
REPORT                5
```

1...15

### Report output

Equivalent to pressing the <REPORT> key.

```
>SETUP/input assign
ZERO                  6
```

1...15

### Switch on auto-zero

Equivalent to pressing the <ZERO> key.

```
>SETUP/input assign
MARK                  7
```

1...15

### Switch on marking

Equivalent to pressing the <MARK> key.

```
>SETUP/input assign
ZERO OFF              9
```

1...15

### Switch off auto-zero

Equivalent to pressing the <ZERO OFF> key.

```
>SETUP/input assign
PLOT                 10
```

1...15

### Plot output

Equivalent to pressing the <PLOT> key.

```
>SETUP/input assign
polarity             11
```

1...15

### Switch the polarity

The polarity of the signal at the analog output is switched.

```
>SETUP/input assign
SELECT               13
```

1...15

### Select

Equivalent to pressing the <SELECT> key.

```
>SETUP/input assign
QUIT                 14
```

1...15

### Quit

Equivalent to pressing the <QUIT> key.

```
>SETUP/input assign
ENTER                15
```

1...15

### Enter

Equivalent to pressing the <ENTER> key.

```
>SETUP
>SETUP/graphics
```

### General graphics parameters

General parameters for the printout of graphics plots on an external printer.

```
>SETUP/graphics
grid:                off
```

on, off

### Grid lines for graphics plot

- `on` Dotted grid lines are plotted on the graphics printout.
- `Off` No grid lines are plotted on the graphics printout.

```
>SETUP/graphics
frame:               off
```

on, off

### Frame for graphics plot

- `on` A frame is plotted on the graphics printout.
- `Off` Only the y and x axes are plotted on the graphics printout, but no frame.

```
>SETUP/graphics
width                0.8
```

0.4...1.0

### Relative width of the graphics printout

The width of the graphics printout must be matched to the attached printer.

```
>SETUP
>SETUP/peripherals
```

## Setting the peripherals

```
>SETUP/peripherals
operation with 733:   on
```

on, off

### Operation with 733 IC Separation Center

on The 732 IC Detector is operated with the 733 IC Separation Center (normal case).

Off The 732 IC Detector is operated without the 733 IC Separation Center. All parameters which affect the 733 IC Separation Center are suppressed in the dialog.

```
>SETUP/peripherals
operation with 709:   on
```

on, off

### Operation with 709 IC Pump

on The 732 IC Detector is operated with the 709 IC Pump (normal case).

off The 732 IC Detector is operated without the 709 IC Pump. All parameters which affect the 709 IC Pump are suppressed in the dialog. In this case, the RS interface "709 IC Pump" can be used for the connection of an external printer.

## 4.4.2 Configuration, <CONFIG> key


The <CONFIG> key is used for the entry of basic settings of general applicability which are also retained when the instrument is switched off. The key opens the following main menu:

| | |
|---|---|
| CONFIG<br>>CONFIG/detector | **Settings for the conductivity detector** |
| CONFIG<br>>CONFIG/printer | **Settings for external printer** |
| CONFIG<br>>CONFIG/print meas.value | **Settings for measured value printout** |
| CONFIG<br>>CONFIG/auxiliaries | **Various general instrument settings** |
| CONFIG<br>>CONFIG/RS settings | **Settings for interface "RS 232"** |
| CONFIG<br>>CONFIG/RS settings 709 | **Settings for interface "709 IC Pump" (RS232)** |
| CONFIG<br>>CONFIG/733 IC Sep.Cent. | **Settings for 733 IC Separation Center** |

Repeated pressing of the <CONFIG> key selects the submenus in turn. The individual inquiries of a submenu are accessed using the <ENTER> key and exited with the <QUIT> key. The following listings show all dialog items which appear under <CONFIG>. The values shown in the display are the default values, the possible entry values or ranges are shown below the display.

### >CONFIG >CONFIG/detector — Settings for the conductivity detector

#### >CONFIG/detector thermostat: 35 °C

25, 30, 35, 40, 45 °C, off

**Thermostatting of the conductivity detector**

Setting of the operating temperature of the conductivity cell.

At constant ambient temperature the heating built into the 732 IC Detector regulates the selected measuring cell temperature to an accuracy of ± 0.01 °C and thus establishes the precondition for highly sensitive determinations. It normally takes 30...60 min after the instrument has been switched on until this temperature stability is attained.

When the heating is switched on, the green display lamp **7** "THERMOSTAT" is on. Thermostatting of the conductivity detector is switched off by pressing the <CLEAR> key. The display shows the value `"off °C"`, at the same time the green display lamp **7** goes out.

*Thermostatting functions only if the ambient temperature is at least 5 °C lower than the operating temperature.*

```
>CONFIG/detector
'zero' unit:       mS/cm
```

µS/cm, %fs, mV

### Unit for display of the auto-zero value

The following units can be selected for the auto-zero value displayed in the instrument standby mode (see *section 4.6.3*):

- `µS/cm` Display in conductivity unit µS/cm.
- `%fs` Display in % of the full-scale range which has been set under the <PARAM> key (see *section 4.5.1*) or <FULL SCALE> key (see *section 4.5.2*).
- `mV` Display in mV.

```
>CONFIG/detector
cell constant    16.7/cm
```

13.0...21.0 /cm

### Cell constant of the conductivity cell

Setting of the cell constant of the measuring cell for correct display of the absolute conductivity.

In ion chromatography, interest is normally centered only on relative changes in the conductivity and not on the absolute value. With the cell constant of 16.7/cm set in the factory, the error in the display of the absolute conductivity is ca. ±10%.

If you wish to have a more accurate display of the absolute conductivity, the cell constant must be determined by means of a calibration solution. To do this, pump a solution of known conductivity through the IC system, observe the display of the absolute conductivity and change the cell constant until the displayed value matches the actual value.

```
>CONFIG
>CONFIG/printer
```

### Settings for external printer

```
>CONFIG/printer
id.1
```

18 ASCII characters

### Identification 1 for 1st line of print header

Freely selectable ASCII character string for the first line of the print header (text entry, *section 4.2.5*).

```
>CONFIG/printer
id.2
```

18 ASCII characters

### Identification 2 for 2nd line of print header

Freely selectable ASCII character string for the second line of the print header (text entry, see *section 4.2.5*).

```
>CONFIG/printer
print header:       once
```

once, always, off

### Printout of the print header

The print header comprises title line (with device name, serial number and program number), identification 1 and 2 as well as date and time if selected and is printed out before a measured value, report or curve plot.

- `once` Printout of the print header only once after the instrument has been switched on before each measured value, report or curve plot.
- `always` Printout of the print header before every measured value, report or curve plot.
- `off` No printout of the print header.

```
>CONFIG/printer
date&time:            on
```

on, off

### Printout of date and time in the print header

- `on` Date and time are printed out in the print header.
- `off` Date and time are not printed out in the print header.

```
>CONFIG/printer
send to:            IBM
```

IBM, Epson, Seiko, Citizen, HP

### Selection of the character set/printer type

- `IBM` Character set 437 for IBM PC or printer type IBM Proprinter
- `Epson` EPSON printers
- `Seiko` Seiko printer DPU-411/414
- `Citizen` Citizen printer IDP562 RS
- `HP` HP printers (Deskjet..., Laserjet... etc.)

You will find further details on the printer connection in *section 2.9.5.*

```
>CONFIG
>CONFIG/print meas.value
```

### Settings for measured value printout

Output of measured values via RS232 interface.

```
>CONFIG/print meas.value
print crit.:      immed.
```

immed., time, off

### Criterion for measured value printout

- `immed.` Measured value printout each time the <PRINT> is pressed.
- `time` Automatic measured value printout at selectable time intervals.
- `off` No measured value printout.

```
>CONFIG/print meas.value
time interval      1.0 s
```

0.4...99999 s

### Time interval for measured value printout

*This inquiry appears only with "print crit. = time".*

Time interval in seconds between printout of the individual measured values.

```
>CONFIG/print meas.value
stop time        off min
```

1...999 min, off

### Stop time for measured value printout

*This inquiry appears only with "print crit. = time".*

Time to stop of the measured value printout.

| | |
|---|---|
| off | No time restriction (press <CLEAR>). |

```
>CONFIG/print meas.value
date&time:           off
```

on, off

### Printout of date and time

*This inquiry appears only with "print crit. = immed." or "print crit. = time".*

| | |
|---|---|
| on | Date and time are printed out for every measured value. |
| off | Date and time are not printed out. |

```
>CONFIG
>CONFIG/auxiliaries
```

## General instrument settings

```
>CONFIG/auxiliaries
run number             0
```

0...999, off

### Run number

The run number is incremented by +1 for each new determination as follows:

| | |
|---|---|
| *without program* | Increase with every "INJECT A". |
| *with program* | Increase with every new start and with every "return" in cycle programs. |

The parameter value has the following meaning:

| | |
|---|---|
| 0...999 | Start point for numbering. |
| off | No numbering (press <CLEAR>). |

```
>CONFIG/auxiliaries
number of cycles       1
```

1...999

### Number of cycles

This parameter is identical to the parameter of the same name under the <PROGRAM> key (see *section 4.7.1*) and determines how many times cycle programs should be run. As access to the <PROGRAM> key is blocked while a program is running, the number of cycles can subsequently be changed here.

```
>CONFIG/auxiliaries
>CONFIG/aux/event
```

*Submenu*

### Settings for events

```
>CONFIG/aux/event
enabled in program:  off
```

on, off

### Perform events in a program

| | |
|---|---|
| on | Events are performed during a running program. |
| off | Events are not performed during a running program. |

```
>CONFIG/auxiliaries
date            YY-MM-DD
```

YYYY: 1995...2094;
MM: 01...12; DD: 01...31

### Date

Current date with numeric data for year (YYYY), month (MM) and day (DD).

```
>CONFIG/auxiliaries
time            HH:MM:SS
```

HH: 00...23
MM: 00...59
SS: 00...59

### Time

Current time with numeric data for hours (HH), minutes (MM) and seconds (SS). If a new time is entered, it becomes active when the <ENTER> key is pressed.

```
>CONFIG/auxiliaries
dialog:          english
```

english, deutsch,
français, español

### Dialog language

| | |
|---|---|
| english | English |
| deutsch | German |
| français | French |
| español | Spanish |

```
>CONFIG/auxiliaries
device label
```

8 ASCII characters

### Device label

Freely selectable ASCII character string for the device label (text entry, see *section 4.2.5).*

```
>CONFIG/auxiliaries
program         732.0012
```

*display only*

### Number of the program version

Display only (no entry possibility).

Please specify this number in inquiries to Metrohm.

```
>CONFIG/auxiliaries
>CONFIG/aux/beep
```

*submenu*

### Settings for the beeper

```
>CONFIG/aux/beep
status:                on
```

on, only error, off

### Status of the beeper

| | |
|---|---|
| on | Single beep on entry errors and on program return, three beeps with error messages. |
| only error | Beep (three times) only with error messages. |
| off | No beep. |

```
>CONFIG/aux/beep
repeat time          60 s
```

5...999 s, off

### Repeat time for beep

*This inquiry appears only with "*`status = on`*".*

The three beeps with error messages are repeated each time the inputted time has elapsed until the error message is confirmed with <QUIT>.

`off` No repeat (press <CLEAR>).

```
>CONFIG
>CONFIG/RS settings
```

### Settings for RS232 interface

For further details on the RS232 interface, see *section 6.1.*

```
>CONFIG/RS settings
baud rate:           9600
```

9600, 4800, 2400, 1200, 600, 300

### Data transmission rate (baud rate)

Data transmission rate in bit/s

```
>CONFIG/RS settings
data bit:               8
```

7, 8

### Data bits

```
>CONFIG/RS settings
stop bit:               1
```

1, 2

### Stop bits

```
>CONFIG/RS settings
parity:              none
```

none, odd, even

### Parity

`none` Parity is not checked.
`odd` Odd parity.
`even` Even parity.

```
>CONFIG/RS settings
handshake:            HWs
```

HWs, HWf, SWchar, SWline, none

### Handshake

`HWs` Reduced hardware handshake.
`HWf` Full hardware handshake.
`SWchar` Software handshake with character stop.
`SWline` Software handshake with line stop
`none` No handshake.

For detailed information on the handshake, see *section 6.1.8.*

```
>CONFIG/RS settings
RS control:           on
```

on, off

### Control via RS232 interface

`on` Data receipt via RS232 interface switched on.
`off` Data receipt via RS232 interface switched off (no external control via RS232 possible).

```
>CONFIG
>CONFIG/RS settings 709
```

## Settings for RS interface "709 IC Pump"

This RS232 interface is normally used for connection of the 709 IC Pump. However, it can also be used to attach an external printer if the instrument is appropriately configured in the Setup program (`"operation with 709 = off"`, see *section 4.4.1*). For detailed information on the RS232 interface, see *section 6.1*.

```
>CONFIG/RS settings 709
connected:       printer
```

printer, off

### Connection to RS interface

*This inquiry appears only with* `"operation with 709 = off"`.

- `printer` Connection of a printer (the RS232 parameters are displayed).
- `off` No device connected (no RS232 parameters appear).

```
>CONFIG/RS settings 709
baud rate:          9600
```

9600,4800,2400, 1200, 600,300

### Data transmission rate (baud rate)

*This inquiry appears only with* `"operation with 709 = on"` *or* `"operation with 709 = off"` *and* `"connected = printer"`.

Data transmission rate in bit/s

```
>CONFIG/RS settings 709
data bit:              8
```

7, 8

### Data bits

*This inquiry appears only with* `"operation with 709 = off"` *and* `"connected = printer"`.

```
>CONFIG/RS settings 709
stop bit:              1
```

1, 2

### Stop bits

*This inquiry appears only with* `"operation with 709 = off"` *and* `"connected = printer"`.

```
>CONFIG/RS settings 709
parity:             none
```

none, odd, even

### Parity

*This inquiry appears only with* `"operation with 709 = off"` *and* `"connected = printer"`.

- `none` Parity is not checked.
- `odd` Odd parity.
- `even` Even parity.

```
>CONFIG/RS settings 709
handshake:           HWs
```

HWs, HWf, SWchar, SWline, none

### Handshake

*This inquiry appears only with* `"operation with 709 = off"` *and* `"connected = printer"`.

- `HWs` Reduced hardware handshake.
- `HWf` Full hardware handshake.
- `SWchar` Software handshake with character stop.
- `SWline` Software handshake with line stop.
- `none` No handshake.

For detailed information on the handshake, see *section 6.1.8.*

>CONFIG
>CONFIG/733 IC Sep.Cent.

## Settings for 733 IC Separation Center

*This submenu appears only with* `"operation with 733 = on"`.

>CONFIG/733 IC Sep.Cent.
valve A

*display only*

## Configuration 733 IC Separation Center

Depending on the instrument configuration, the following messages appear:

| | |
|---|---|
| `valve A` | 733.0010 (1 injector). |
| `valve A + valve B` | 733.0020 (2 injectors). |
| `valve A + suppressor` | 733.0030 (1 injector + 1 suppressor module). |
| `733 not accessible` | 733 not connected or cable connection faulty. |

>CONFIG/733 IC Sep.Cent.
control: no restriction

`no restriction, 732 only`

## Valve control of the 733 IC Separation Center

| | |
|---|---|
| `no restriction` | Suppressor module and valves can be operated with the <FILL> and <INJECT> or <STEP> keys at 733 IC Separation Center and also via the 732 IC Detector. |
| `732 only` | Suppressor module and valves can be operated only via 732 IC Detector (the keys on the 733 are locked). |

>CONFIG/733 IC Sep.Cent.
>CONFIG/733/valve A

*submenu*

## Settings for injection valve A

>CONFIG/733/valve A
status fill

*display only*

## Display of the valve setting

Depending on the position of the valve, one of the following messages appears:

| | |
|---|---|
| `fill` | Filling of sample loop. |
| `inject` | Injection of loop contents. |
| `undefined` | Undefined position. |

>CONFIG/733/valve A
trigger: fill

`inject, fill`

## Switching of the valve

After confirmation with <ENTER>, the is moved to the selected position:

| | |
|---|---|
| `fill` | Filling of sample loop. |
| `inject` | Injection of loop contents. |

```
>CONFIG/733 IC Sep.Cent.
>CONFIG/733/valve B
```

*submenu*

### Settings for injection valve B

*This submenu appears only with the 733.0020 IC Separation Center with 2 injection valves.*

```
>CONFIG/733/valve B
status              fill
```

*display only*

### Display of the valve setting

Depending on the position of the valve, one of the following messages appears:

| | |
|---|---|
| `fill` | Filling of sample loop. |
| `inject` | Injection of loop contents. |
| `undefined` | Undefined position. |

```
>CONFIG/733/valve B
trigger:            fill
```

`inject, fill`

### Switching of the valve

After confirmation with <ENTER>, the valve is moved to the selected position:

| | |
|---|---|
| `fill` | Filling of sample loop. |
| `inject` | Injection of loop contents. |

```
>CONFIG/733 IC Sep.Cent.
>CONFIG/733/suppressor
```

*submenu*

### Settings for the suppressor module

*This submenu appears only with the 733.0030 IC Separation Center with suppressor module.*

```
>CONFIG/733/suppressor
auto step:          fill
```

`fill, inject, off`

### Automatic triggering of "STEP"

Switching of the suppressor module to the next position can be triggered automatically as follows:

| | |
|---|---|
| `fill` | Triggering of "STEP" after each "FILL A". |
| `inject` | Triggering of "STEP" after each "INJECT A". |
| `off` | No automatic triggering. |

```
>CONFIG/733/suppressor
status       in position
```

*display only*

### Display of the suppressor position

Depending on the position of the suppressor module, one of the following messages appears:

| | |
|---|---|
| `in position` | Suppressor module is in one of the three possible positions. |
| `undefined` | Undefined position. |

```
>CONFIG/733/suppressor
trigger:             ---
```

`---, step`

### Switching of the suppressor module

After confirmation of the entry with <ENTER>, the following action results:

| | |
|---|---|
| `---` | No action. |
| `step` | Switching of the suppressor module to the next position. |

# 4.5 Measurement parameters

## 4.5.1 <PARAM> key


The <PARAM> key combines the most important parameter settings for the 732 IC Detector. The parameter values entered here are available for the measurement immediately following their confirmation. They can be stored and recalled together with the current existing program as a method. The key opens the following main menu:

| | |
|---|---|
| PARAM<br>>PARAM/detector | **Settings for the conductivity detector** |
| PARAM<br>>PARAM/analog output | **Settings for analog output** |
| PARAM<br>>PARAM/plot | **Settings for graphics plot** |
| PARAM<br>>PARAM/709 IC Pump | **Settings for 709 IC Pump** |

Repeated pressing of the <PARAM> key selects the submenus in turn. The individual inquiries are accessed using the <ENTER> key and exited with the <QUIT> key. The following listings show all dialog items appearing under <PARAM>. The values shown in the displays are default values, possible entry values or ranges are shown below the display.

### >PARAM >PARAM/detector — Settings for the conductivity detector

```
>PARAM/detector
range:        1.00 mS/cm
```

100, 200, 500 µS/cm
1, 2, 5, 10 mS/cm

#### Measuring range

7 stages from 0…100 µS/cm to 0…10 mS/cm are available for the measuring range. Select the measuring range so that the conductivity value of the eluent used is always within the selected range.

If the measured conductivity value exceeds the upper range limit by more than 10%, "--------" appears in display **1** instead of a measured value. In such a case, set the next higher range.

The selected measuring range limits the possible settings of the full-scale range, which can be selected to be maximum 2000 times more sensitive than the measuring range.

*If the measuring range is changed, the auto-zero function is automatically switched off.*

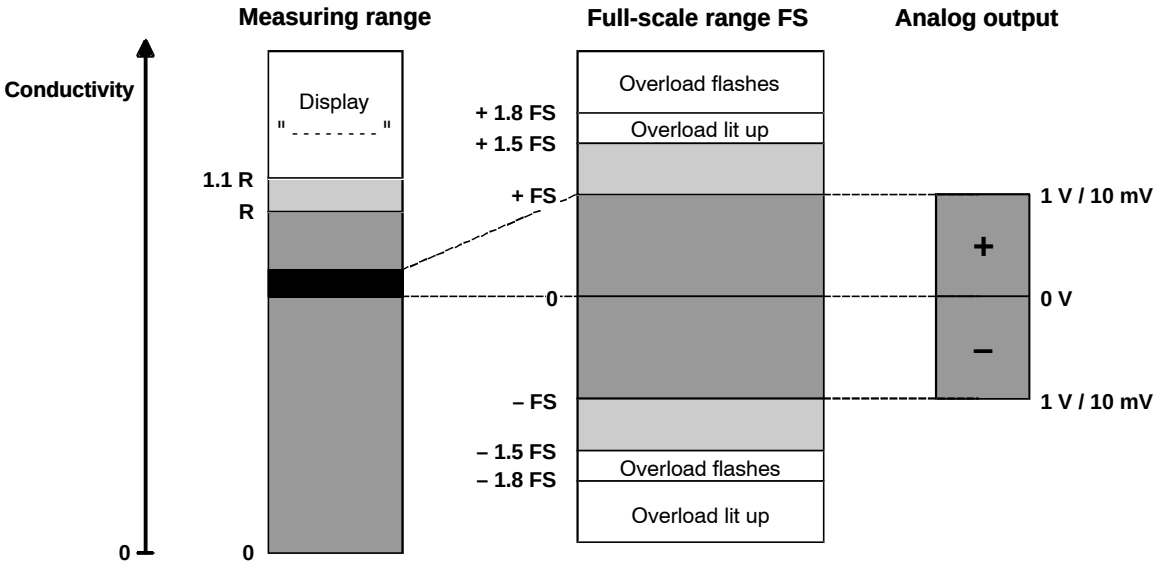
```
>PARAM/detector
full scale:   1.00 mS/cm
```

0.05 µS/cm...10 mS/cm

## Full-scale range (operating range)

The full-scale range (operating range) sets the desired sensitivity for the display and analog output of the measuring signal during the recording of a chromatogram. The following points should be noted:

- The possible values of the full-scale range which can be selected with the <SELECT> key depend on the preset measuring range `"range"`. This value can be reduced in a total of 11 stages by a factor 1 (lowest sensitivity) up to maximum a factor of 2000 (highest sensitivity).
- The full-scale range is primarily used to increase the sensitivity for the recording of the chromatogram following the electronic background compensation of the eluent sensitivity (auto-zero function, see also description in *section 4.6.3*).
- For the selected full-scale range (FS), the linearity of the conductivity measurement is assured in the range -1.5 FS...+1.5 FS. If the measured value violates these limits, overload display **8** lights up, but the measured value is still displayed. If the measured value lies outside ±1.8 FS, overload display **8** starts to flash, at the same time display **1** shows the absolute conductivity in place of the auto-zero value.
- The full-scale range determines the limits for the output of the analog signal at analog outputs **11** (0...1 V) and **12** (0...10 mV). The polarity of the output signal can be changed at any time with the parameter `"polarity"` to `"+"` (0...+FS) or `"–"` (0...–FS).



```
>PARAM/detector
temp.coeff.:    2.5 %/°C
```

1.5, 2.5 %/°C

### Temperature coefficient

The temperature coefficient is used to take into account the temperature dependence of the conductivity measurement. Two values can be selected:

- `1.5 %/°C` Temperature coefficient for cations
- `2.5 %/°C` Temperature coefficient for anions

When the thermostatting of the measuring cell is switched on (thermostat display **7** lit up), the conductivity $k_T$ measured at the set operating temperature (25...45 °C) is automatically converted to the conductivity $k_{20}$ at the reference temperature 20 °C.

```
>PARAM
>PARAM/analog output
```

### Settings for the analog output

The output signal at the two analog outputs **11** (0…1 V) and **12** (0…10 mV) is determined by the parameter `"full scale"` (see above).

```
>PARAM/analog output
polarity:             +
```

+, –

### Polarity of the output signal

Selection of whether a positive or negative full-scale range should be outputted

- `+` Positive polarity (0…+FS)
- – Negative polarity (0…–FS)

```
>PARAM/analog output
offset:           0 %fs
```

0, 10, 50 %fs

### Zero point offset

Offset of the zero point of the conductivity.

- `0 %fs` No zero point offset.
- `10 %fs` Offset by 10% of the full-scale range; at the analog output the signal –0.1 FS…+0.9 FS (+) or 0.1 FS…–0.9 FS (–) is outputted.
- `50 %fs` Offset by 50% of the full-scale range; at the analog output the signal –0.5 FS…+0.5 FS (+) or 0.5 FS…–0.5 FS (–) is outputted.

```
>PARAM/analog output
damping:            off
```

on, off

### Damping

- `on` Damping to reduce disturbing pulsations or a high noise level. Standard solutions and samples must both be recorded with damping as this can influence the peak heights.
- `off` Damping switched off (normal condition with pulsation-free and constant flow pumps).

```
>PARAM
>PARAM/plot
```

## Settings for graphics plot

These settings are effective with the graphics plot on an external printer triggered using the <PLOT> key (see *section 4.8.2*).

```
>PARAM/plot
auto start:          off
```

on, off

### Automatic start

`on` Automatic start of the graphics plot on every "INJECT A".

`off` No automatic start of the graphics plot.

```
>PARAM/plot
time interval      1.0 s
```

0.4...99999 s

### Time interval

Time interval after which a new measured value is plotted.

```
>PARAM/plot
time scale   10.0 mm/min
```

0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 60, 120 mm/min

### Time scale (paper speed)

The entry value corresponds to the paper feed of the printer in mm/min (the effective paper feed depends on the printer used).

If values other than those specified are entered, these will be automatically rounded to the next preset value.

```
>PARAM/plot
time scale label:    rel
```

rel, abs

### Labeling of the time axis

The time axis is labeled at every main division.

`abs` Labeling with absolute (current) time (e.g. `"08:34"`).

`rel` Labeling with relative time beginning with the start of the curve printout (e.g. `"2m40s"` for 2 min 40 s).

```
>PARAM/plot
stop time        off min
```

1...999 min, off

### Stop time for graphics plot

Time until graphics plot is stopped.

`off` No time limit (press <CLEAR>).

```
>PARAM/plot
left:        0.000 mS/cm
```

-2000...2000 µS/cm
-2000...2000 mS/cm
-2...2 S/cm

### Left boundary of conductivity axis

Left limit value for graphics plot of the conductivity on an external printer.

The unit (µS/cm, mS/cm, S/cm) can be selected with the <SELECT> key.

```
>PARAM/plot
right:      10.00 mS/cm
```

-2000...2000 µS/cm
-2000...2000 mS/cm
-2...2 S/cm

### Right boundary of the conductivity axis

Right limit value for graphics plot of the conductivity on an external printer.

The unit (µS/cm, mS/cm, S/cm) can be selected with the <SELECT> key.

```
>PARAM
>PARAM/709 IC Pump
```

## Settings for 709 IC Pump

*This submenu appears only with* `"SETUP/peripherals/operation with 709 = on"`.

These settings are effective only if the 709 IC Pump is connected to the 732 IC Detector and the remote control is activated with the <EXT.> key (see *section 2.6.1*).

```
>PARAM/709 IC Pump
flow          0.50 mL/min
```

0.01...5.00 mL/min

### Flow rate

Flow rate of the 709 IC Pump.

```
>PARAM/709 IC Pump
Pmax             10.0 MPa
```

0.1...50 MPa

### Maximum shutoff pressure

Maximum shutoff pressure for the automatic shutoff of the pump drive of the 709 IC Pump to protect the separating column against excessive pressure.

This limit value should be ca. 3 MPa (= 30 bar) above the normal operating pressure of the separating column used or correspond to the maximum admissible operating pressure of the separating column.

If the 709 Pump exceeds the specified limit value, the pump drive is switched off within a pump cycle and blocked, at the same time the bottom line of the display of the 732 IC Detector shows the message `"stopped: YY-MM-DD HH:MM"` with details of the time when the pump was stopped. The LED "$P_{max}$" on the 709 IC Pump flashes, the shutoff pressure can be requested under "$P_{actual}$".

A 709 IC Pump stopped in this manner is put back into operation as follows:

- Press <EXT.> key to switch off remote operation.
- Press <R/S> key to remove block. The LED "$P_{max}$" no longer flashes.
- Press <EXT.> key to switch remote operation back on.

```
>PARAM/709 IC Pump
Pmin              0.0 MPa
```

0.0...50 MPa

### Minimum shutoff pressure

Minimum shutoff pressure for the automatic shutoff of the pump drive of the 709 IC Pump to protect the IC system when leaks occur or the eluent supply is interrupted.

This limit value should be sufficiently far below the normal operating pressure of the separating column used. The entry of `"0.0"` switches the automatic shutoff off.

If the pressure value of the 709 IC Pump is below the specified limit value for a considerable length of time, the pump drive of the pump is switched off and blocked, at the same time the bottom line of the display

of the 732 IC Detector shows the message "stopped: YY-MM-DD HH:MM" with details of the time when the pump was stopped. The LED "$P_{min}$" on the 709 IC Pump flashes, the shutoff pressure can be requested under "$P_{actual}$".

A 709 IC Pump stopped in this manner is put back into operation as follows:

- Press <EXT.> key to switch off remote operation.
- Press <R/S> key to remove the block. The LED "$P_{min}$" no longer flashes.
- Press <EXT.> key to switch the remote operation back on.

```
>PARAM/709 IC Pump
flow corr.          1.00
```

0.90...1.10

### Correction factor of the flow rate

Here a correction factor for the flow rate can be entered to match the displayed flow rate with the flow rate actually measured. You will find further information in *section 3.3* of the 709 Instructions for Use.

## 4.5.2 <FULL SCALE>key


The <FULL SCALE> key can be used for direct entry of the full-scale range to avoid the circuitous route via parameter menu (see *section 4.5.1*). You will find a detailed description of the parameter "full scale" in *section 4.5.1*.

```
  XXXXX mS/cm   XXXX min
full scale:   1.00 mS/cm
```

0.05 µS/cm...10 mS/cm

### Full-scale range (operating range)

After the <FULL SCALE> key has been pressed, the bottom line of the display shows the parameter "full scale" with a flashing numeric value. In contrast to the entry under the <PARAM> key, here the parameter value is not entered using the <SELECT> key, but selected with the <🡐> and <🡒> keys. Proceed as follows:

- Press the <🡐> key to lower the full-scale range stepwise to the lowest possible value.
- Press the <🡒> key to increase the full-scale range stepwise to the highest possible value.
- Confirm the desired full-scale range with the <ENTER> or <FULL SCALE> key.

# 4.6 Triggering of functions

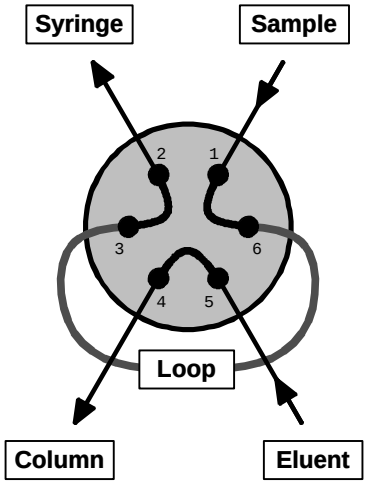
## 4.6.1 <FILL> keys

The two <FILL> keys at the 733 IC Separation Center each have the following function, which depends on the instrument version:

| | *733.0010 (1 valve)* | *733.0X20 (2 valves)* | *733.0X30 (valve+ suppr.)* |
|---|---|---|---|
|  **A** | Switching of injection valve A to "FILL" position | Switching of injection valve A to "FILL" position | Switching of injection valve A to "FILL" position |
|  **B** | No function | Switching of injection valve B to "FILL" position | Switching of suppressor module to next position ("STEP" function) |

If the injection valve is in the "FILL" position, the green LED in the key lights up. In this position the injection valve is connected as shown in the diagram opposite:

- The sample loop is filled by siphoning in the sample solution using the syringe.
- The eluent flows directly to the separating column.




The "FILL" function can be triggered at any time with the <FILL> key – also in the edit mode or when a program is running. If this is not required, the key can be locked. For this, the parameter `">CONFIG/733 IC Sep.Cent./control"` must be set to `"732 only"` under the <CONFIG> key (see *section 4.4.2*). Switching of the injection valve is then possible only using the 732 IC Detector via a programmed "FILL" command or with `">CONFIG/733 IC Sep.Cent./trigger = fill"`.

With the 733.0030 IC Separation Center, switching of the suppressor module to the next position can be triggered automatically by the switching of injection valve A to the "FILL" position. For this, the parameter `">CONFIG/733/suppressor/auto step"` must be set to `"fill"` under the <CONFIG> key (see *section 4.4.2*).

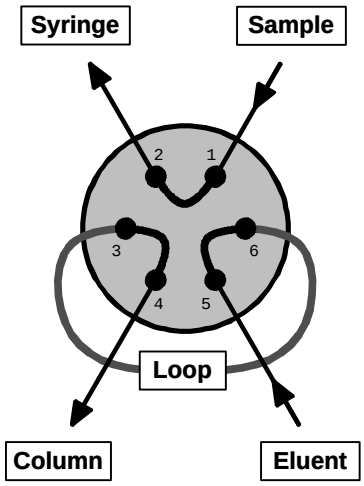
### 4.6.2 <INJECT> keys

The two <INJECT> keys at the 733 IC Separation Center have the following function, depending on the instrument version:

| | *733.0010 (1 valve)* | *733.0X20 (2 valves)* | *733.0X30 (valve+ suppr.)* |
|---|---|---|---|
|  **A** | Switching of injection valve A to "INJECT" position | Switching of injection valve A to "INJECT" position | Switching of injection valve A to "INJECT" position |
|  **B** | No function | Switching of injection valve B to "INJECT" position | No function |

If the injection valve is in the "INJECT" position, the green LED in the key lights up. In this position, the injection valve is connected as shown in the diagram opposite:

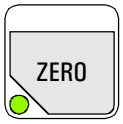
- The eluent flows via the sample loop to the separating column. This causes injection of the sample previously added to the sample loop.
- Sample inlet tubing and syringe are directly connected.



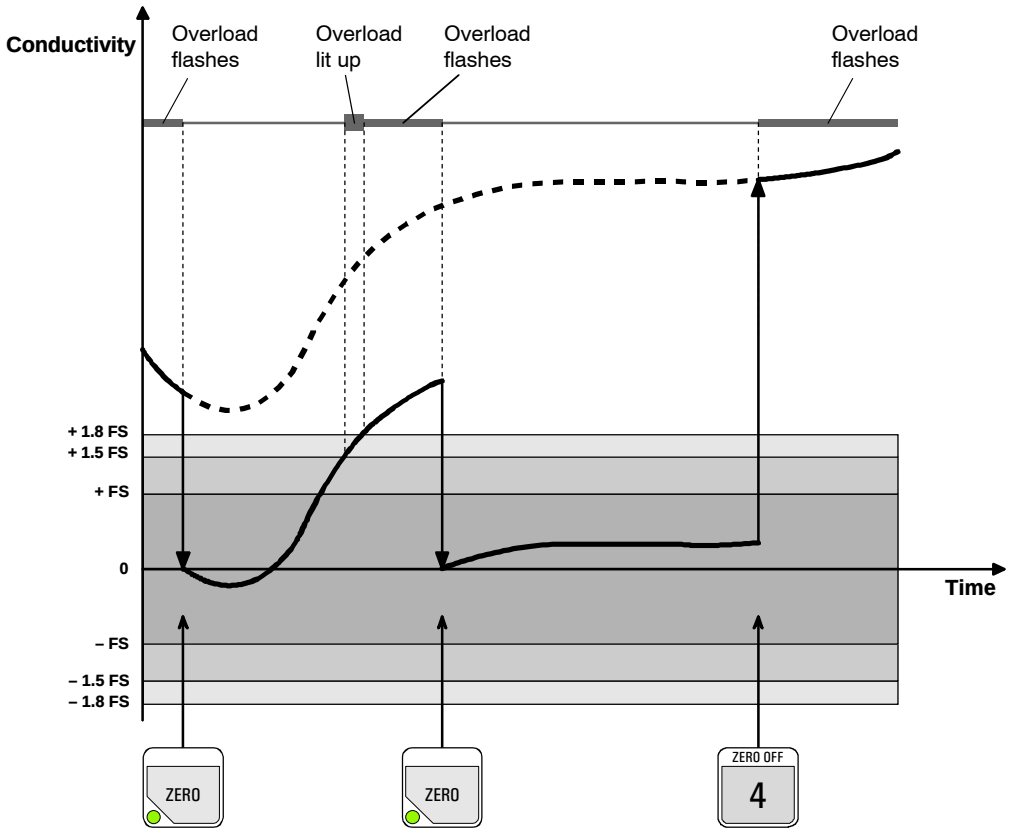

The "INJECT" function can be triggered at any time with the <INJECT> key – also in the edit mode or when a program is running. If this is not required, the key can be locked. For this, the parameter `">CONFIG/733 IC Sep.Cent./control"` must be set to `"732 only"` under the <CONFIG> key (see *section 4.4.2*). Switching of the injection valve is then possible only using the 732 IC Detector via a programmed "INJECT" command or with `">CONFIG/733 IC Sep.Cent./trigger = inject"`. Switching of injection valve A to the "INJECT" position can also be used for the automatic start of a program of the "inject" type.

With the 733.0X30 Separation Center, switching of the suppressor module to the next position can be triggered automatically by the switching of injection valve A to the "INJECT" position. For this, the parameter `">CONFIG/733/suppressor/auto step"` must be set to `"inject"` under the <CONFIG> key (see *section 4.4.2*).

### 4.6.3 <ZERO> key




The <ZERO> key is used to trigger the auto-zero function. "Auto-zero" is the name used for the automatic electronic background compensation, i.e. the current measured conductivity value is set to zero and hence lies in the middle of the selected full-scale range. The diagram below shows the operating principle of the auto-zero function. Before the auto-zero function is activated for the first time or after it has been switched off, the measuring signal lies outside the full-scale range (FS); it is automatically set to 0 µS/cm each time the <ZERO> key is pressed.




The auto-zero function can be triggered at any time using the <ZERO> key – also in the edit mode or when a program is running. Lighting up of green LED **6** in the <ZERO> key shows that the electronic background compensation is active.

*The auto-zero function works properly only when the measured value remains relatively stable (e.g. not during the appearance of the injection peak at the start of the chromatogram).*

Lighting up of the red overload display **8** shows that the measured value lies outside ±150% of the selected full-scale range. If the measured value is outside ±180% of the selected full-scale range, the overload display **8** starts to flash and the display shows the absolute conductivity (see also *section 4.5.1*).

### 4.6.4 <ZERO OFF> key


The <ZERO OFF> key is used to switch off the auto-zero function. The auto-zero function can be triggered using the <ZERO OFF> key in the standby mode or when a program is running, but not in the edit mode.

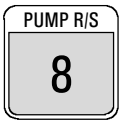
When the green LED **6** in the <ZERO> key goes out, this shows that the electronic background compensation is no longer active.

### 4.6.5 <MARK> key


The <MARK> key is used to trigger a marking signal. In addition to the measuring signal, a signal of ca. 10% of the full-scale range is outputted briefly at the analog output. This allows, e.g. the start of a chromatogram to be marked during recording on a recorder.

Marking can be triggered with the <MARK> key in the standby mode or when a program is running, but not in the edit mode.

### 4.6.6 <PUMP R/S> key




The <PUMP R/S key is used for on/off switching of the pump drive of the 709 IC Pump. A requirement for this is that the 709 IC Pump is connected to the 732 IC Detector and the remote control is switched on at the pump with the <EXT.> key (see *section 2.6.1*).

With the <PUMP R/S> key the pump drive of the 709 IC Pump can be switched on or off in the standby mode or when a program is running, but not in the edit mode. When the pump drive is switched on, the red LED above the <R/S> key on the pump lights up.

The settings of the pump parameters on the 732 IC Detector 732 are described under the <CONFIG> key in *section 4.4.2*, the pump status messages in the standby mode in *section 4.3.2*.

# 4.7 Programming

## 4.7.1 <PROGRAM> key


The <PROGRAM> key can be used to develop and edit time programs which can comprise maximum 20 program steps each with up to 14 individual program points. This allows the chronological sequence of actions at the 732 IC Detector and 733 IC Separation Center to be automated virtually at will.

The program loaded in the working memory can be stored together with the parameter values currently under the <PARAM> key as a method and recalled.

The <PROGRAM> key opens the following main menu:

| | |
|---|---|
| PROGRAM<br>>PROGRAM/parameters | **General program parameters** |
| PROGRAM<br>>PROGRAM/edit | **Edit program** |
| PROGRAM<br>>PROGRAM/delete all | **Delete all program steps** |

Repeated pressing of the <PROGRAM> key selects the submenus in turn. The individual inquiries of a submenu are accessed using the <ENTER> key and exited with the <QUIT> key. The following listings show all dialog items appearing under <PROGRAM>. The values shown in the display are default values, the possible entry values or ranges are shown below the display.

### >PROGRAM<br>>PROGRAM/parameters — General program parameters

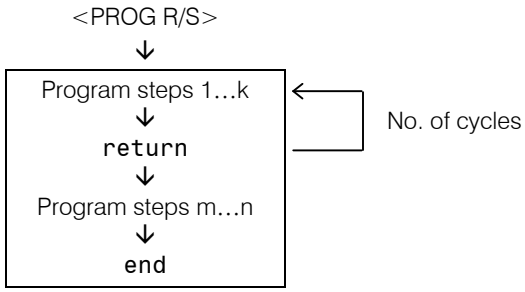
#### >PROGRAM/parameters<br>type: cycle

`cycle, remote, inject`

#### Program type

The program type is used to define the type of program start and program sequence.

`cycle` **Loop program with start via <PROG R/S>**
A loop program can be started by using the <PROG R/S> key, by external start via a remote input line (see *section 6.2.1*), or via EVENT (see *section 4.7.3*). It is automatically run several times if it includes a `"return"`. The number of repetitions is defined by the parameter `"number of cycles"`. The basic structure of a loop program has the following appearance:




`remote` **Single program with start via remote**
A remote program is started externally via a remote input line (see s*ection 6.2.1*) and executed once only.

`inject` **Single program with start via "INJECT"**
An inject program is started each time injection valve A is switched to the "INJECT" position and executed once only.

```
>PROGRAM/parameters
number of cycles      1
```

1…999

### Number of cycles

*This inquiry appears only with* `"PROGRAM/parameters/type = cycle"`.

Number of executions of loop programs.

*This parameter is identical to that of the same name in the submenu* `">CONFIG/auxiliaries"` *of the <CONFIG> key (see section 4.4.2). As access to the <PROGRAM> key is blocked while a program is running, the number of cycles can be changed only there.*

```
>PROGRAM/parameters
status:         disabled
```

`enabled, disabled, test`

### Program status

The three following program statuses are possible:

`enabled` **Program enabled**
Irrespective of the program type, a program can be started only when it is enabled. This status is shown by the lighting up of the green LED **5** in the <PROG R/S> key. If a method with program steps is loaded, the program status is automatically set to "`enabled`".

`disabled` **Program disabled**
A disabled program can not be started. In this status, the green LED **5** in the <PROG R/S> key remains off. When the instrument is switched on, the program status is always set to `"disabled"`.

`test`

### Program test

The test status is used to test a program. After the program status has been set to `"test"` and return to the standby mode, a switch is automatically made to the test mode, which runs as follows:

- The bottom line of display shows the message `"test step"` with details of the time `"X.XXX min"` when the first program step should be executed.
- Pressing the <ENTER> key executes the actions associated with the program step.
- The display shows the next program steps in turn which are triggered with <ENTER>.
- After execution of the last program step, the message `"program end"` appears and must be confirmed with <ENTER>. The instrument then returns to the standby mode and the program status is set to `"disabled"`.

```
>PROGRAM
>PROGRAM/edit
```

### Edit program

This submenu is used for the entry of new program steps or to edit existing program steps and their program points.

```
>PROGRAM/edit
time:            x.x min
```

`0.0...999.9 min`

### Edit program step

Under this inquiry new program steps can be entered or existing ones selected, changed and deleted. Each program step includes a definite time (two program steps with the same time can not be entered). A program can contain up to 20 program steps.

#### Enter new program step

A new program step can be entered when `"x.x min"` for the time appears in the display. The new time entered with the numeric keys must be confirmed with the <ENTER> key, the individual program points which should be executed at this time can then be entered.

#### Select existing program steps

Program steps already entered can be selected with the <SELECT> key. After the <ENTER> key has been pressed, the individual program points of the selected

program step can be edited.

**Change time for existing program steps**
For a program step selected with <SELECT>, a new time can be entered directly with the numeric keys and must be confirmed with <ENTER>. The individual program points of the program step can then be edited (if no change is necessary, press <QUIT>).

**Delete existing program steps**
A program step selected with <SELECT> can be deleted by pressing the two keys <CLEAR> and <ENTER> simultaneously. If you wish to delete all program steps at once, it is better to use the submenu `"PROGRAM/delete all"`.

```
>PROGRAM/edit. XXX.X min
XXXXXXXXX           ---
```

### Edit program points

After confirmation of the newly entered or selected time with <ENTER>, it is possible to edit the maximum 14 possible program points of a program step. The time of the program step then appears in the top line of the display, whereas in the bottom line the program points listed below associated with the program step can be edited in turn. For all program points, the default value `"---"` means that no action results.

```
>PROGRAM/edit. XXX.X min
flag:               ---
```

`---, return, reset, end`

### Set program flag

After setting of a program flag, no additional program points can be entered.

`return` **Return with loop programs**
Each time the `"return"` flag is reached, a return is made to the start of the program until the inputted number of cycles has been reached.

`reset` **Reset the parameters**
With this flag all parameters of the <PARAM> key are reset to the values valid before the start of the program.

`end` **Program end**
This flag is used to end a program, additional program steps are no longer executed. Programs without `"end"` are not stopped until <PROG R/S> is pressed.

```
>PROGRAM/edit. XXX.X min
FS change:          ---
```

`---, on`

### Change full-scale range

`on` The full-scale range should be changed. As the possible settings of the full-scale range depend on the measuring range, both the measuring range and the full-scale range must be reentered.

```
>PROGRAM/edit. XXX.X min
range:         100 mS/cm
```

100, 200, 500 µS/cm
1, 2, 5, 10 mS/cm

### Reset measuring range

*This inquiry appears only with* `"FS change = on"`.

The measuring range is set to the inputted value (for further details of the parameter `"range",` see *section 4.5.1*).

*If the measuring range just entered differs from the measuring range valid at the start of the program, an auto-zero function that is switched on will be switched off. If the auto-zero function should be switched on again, this can not be done in the same program step.*

```
>PROGRAM/edit. XXX.X min
full scale:    100 mS/cm
```

0.05 µS/cm...10 mS/cm

### Reset full-scale range

*This inquiry appears only with* `"FS change = on"`.

The full-scale range is set to the inputted range (for further details of the parameter `"full scale",` see *section 4.5.1*).

```
>PROGRAM/edit. XXX.X min
zero:                  ---
```

---, on, off

### Switch auto-zero on/off

*This inquiry does <u>not</u> appear with* `"FS change = on"`.

`on` Trigger the auto-zero function (equivalent to the <ZERO> key, see *section 4.6.3*).

`off` Switch off the auto-zero function (equivalent to the <ZERO OFF> key, see *section 4.6.4*).

```
>PROGRAM/edit. XXX.X min
polarity:              ---
```

---, +, –

### Reset the polarity of the output signal

`+` Output of the positive full-scale range (0…+FS; see *section 4.5.1*).

– Output of the negative full-scale range (0…–FS; see *section 4.5.1*).

```
>PROGRAM/edit. XXX.X min
mark:                  ---
```

---, on

### Trigger marking signal

`on` Output of a marking signal at the analog output (equivalent to the <MARK> key, see *section 4.6.5*).

```
>PROGRAM/edit. XXX.X min
valve A:               ---
```

---, fill, inject

### Switch injection valve A

*This inquiry appears only with* `"SETUP/peripherals/operation with 733 = on"`.

`fill` Switching of injection valve A to "FILL" position (equivalent to the <FILL> key, see *section 4.6.1*).

`inject` Switching of injection valve A to "INJECT" position (equivalent to the <INJECT> key, see *section 4.6.2*).

```
>PROGRAM/edit. XXX.X min
valve B:            ---
```

---, fill, inject

### Switch injection valve B

*This inquiry appears only with* `"SETUP/peripherals/operation with 733 = on"` *and with the 733.0020 IC Separation Center with two injection valves.*

`fill` Switching of injection valve B to "FILL" position (equivalent to the <FILL> key, see *section 4.6.1*).

`inject` Switching of injection valve B to "INJECT" position (equivalent to the <INJECT> key, see *section 4.6.2*).

```
>PROGRAM/edit. XXX.X min
suppressor:         ---
```

---, step

### Switch suppressor module

*This inquiry appears only with* `"SETUP/peripherals/operation with 733 = on"` *and with the 733.0X30 IC Separation Center with suppressor module.*

`step` Switching of the suppressor module to the next position (equivalent to the key function <STEP>, see *section 4.6.1*).

```
>PROGRAM/edit. XXX.X min
remote          ********
```

∗, 0, 1

<CLEAR> sets all values to ∗

### Set remote output lines 1...8

Sets the remote output lines 1…8 (from left to right) to the following values:

`0` Line off, inactive (open).

`1` Line on, active (0 V).

∗ Leave line in current status (entry of "∗" with numeric key <.>).

You will find further details of the remote output lines in *section 6.2*.

```
>PROGRAM/edit. XXX.X min
pump R/S:           ---
```

---, on, off

### Start/stop pump drive

*This inquiry appears only with* `"SETUP/peripherals/operation with 709 = on"`.

`on` Switch on pump drive of the 709 IC Pump (equivalent to the <PUMP R/S> key, see *section 4.6.6*).

`off` Switch off 709 IC Pump Drive (equivalent to the <PUMP R/S> key, see *section 4.6.6*).

```
>PROGRAM/edit. XXX.X min
flow:         --- mL/min
```

---, 0.01...5 mL/min

### Reset flow rate

*This inquiry appears only with* `"SETUP/peripherals/operation with 709 = on"`.

The flow rate of the 709 IC Pump is set to the inputted value (for further details of the `"flow"` parameter, see *section 4.5.1*).

```
>PROGRAM/edit. XXX.X min
Pmax:            --- MPa
```

---, 0.1...50 MPa

### Reset maximum shutoff pressure

*This inquiry appears only with* "SETUP/peripherals/operation with 709 = on".

The maximum shutoff pressure for automatic shutoff of the 709 IC Pump is set to the inputted value (for further details of the parameter "Pmax", see *section 4.5.1*).

```
>PROGRAM/edit. XXX.X min
Pmin:            --- MPa
```

---, 0.0...50 MPa

### Reset minimum shutoff pressure

*This inquiry appears only with* "SETUP/peripherals/operation with 709 = on".

The minimum shutoff pressure for the automatic shutoff of the 709 IC Pump is set to the inputted value (for further details of the parameter "Pmin", see *section 4.5.1*).

```
>PROGRAM
>PROGRAM/delete all
```

### Delete all program steps

```
>PROGRAM/delete all
delete all?
```

<ENTER>, <QUIT>

### Confirm deletion of all program steps

<ENTER> All program steps of the program will be deleted.

<QUIT> Abort of the deletion operation.

### 4.7.2 <PROG R/S> key


The <PROG R/S> key is used to start or stop the program loaded in the working memory. The status of the LED in the key indicates what it can trigger:

**LED off** **Program disabled**
No action is triggered with the <PROG R/S> key. A loop program can not be started until the parameter `"PROGRAM/parameters/status = enabled"` has been set.

**LED lit up** **Program enabled**
The <PROG R/S> key is used to start a loop program. The current time is automatically set to `"0.0 min"`.

**LED flashes** **Program running**
The <PROG R/S> key is used to stop an ongoing loop, remote or inject program.

*If a program is running, the <PARAM>, <FULL SCALE>, <METHOD> and <PROGRAM> keys are locked.*

### 4.7.3 <EVENT> key


Under the <EVENT> key maximum 4 different events, which can be triggered (once or daily) at a particular time, can be entered. These events can each comprise up to 14 individual program points.

The <EVENT> key opens the following main menu:

```
EVENT
>EVENT/new
```
**Enter new event**

```
EVENT
>EVENT/edit
```
**Edit existing event**

```
EVENT
>EVENT/delete
```
**Delete individual event**

```
EVENT
>EVENT/delete all
```
**Delete all events**

Repeated pressing of the <EVENT> key selects the submenus in turn. The individual inquiries of the submenus are accessed using the <ENTER> key and exited with the <QUIT> key. The following listings show all dialog items which appear under <EVENT>. The values shown in the displays are the default values, the possible entry values and ranges are shown below the display.

```
>EVENT
>EVENT/new
```

## Enter new event

```
>EVENT/new
format:              date
```

date, daily

### Event format

`date` The event is triggered once at a particular time.

`daily` The event is triggered daily at a particular time.

```
>EVENT/new
event:YY-MM-DD  HH:MM:SS
```

YY: 00...99 HH: 00...23
MM: 01...12 MM: 00...59
DD: 01...31 SS: 00...59

### Date and time for a new event

*This inquiry appears only with* `"format = date"`.

Entry of date and time when the event should be triggered (`YY: 00...94 = 2000...2094, 95...99 = 1995...1999`).

```
>EVENT/new
event:           HH:MM:SS
```

HH: 00...23
MM: 00...59
SS: 00...59

### Time for new event

*This inquiry appears only with* `"format = daily"`.

Entry of the time when the event should be triggered daily.

```
EVENT YY-MM-DD  HH:MM:SS
XXXXXXXXX            ---
```

### Edit program points

After confirmation of the inputted date or time with <ENTER>, it is possible to edit the maximum 14 possible program points of a new event. Date and time of the event then appear in the top line of the display, whereas in the bottom line the program points associated with the event can be edited in turn. For all program points, the default value `"---"` means that no action follows.

Except for the missing parameter `"flag"`, the program points for events are identical with the program points which can be entered under the <PROGRAM> key and are thus not described further here (see *section 4.7.1*).

In addition to this points, the following program point can be entered:

```
EVENT YY-MM-DD  HH:MM:SS
prog R/S:            ---
```

---, on, off

### Start/stop program

`on` Start of the program loaded in the working memory (corresponds to the <PROG R/S> key, see *section 4.7.2*).

`off` Stop of the program loaded in the working memory (corresponds to the <PROG R/S> key, see *section 4.7.2*).

```
>EVENT
>EVENT/edit
```

### Edit existing event

```
>EVENT/edit
event:YY-MM-DD  HH:MM:SS
```

### Select existing event

Selection of the event with the <SELECT> key.

*Date and time of an existing event can not be changed later.*

```
EVENT YY-MM-DD  HH:MM:SS
XXXXXXXXX            ---
```

### Edit program points

After confirmation of the selected date or time with <ENTER>, it is possible to edit the maximum 14 possible program points of an existing event. Date and time of the event then appear in the top line of the display, whereas in the bottom line the program points associated with the event can be edited in turn. For all program points, the default value `"---"` means that no action follows.

Except for the missing parameter `"flag"`, the program points for events are identical with the program points which can be entered under the <PROGRAM> key and are thus not described further here (see *section 4.7.1*).

In addition to this points, the program point `"prog R/S"` can be entered (see under `">EVENT/new"`).

```
>EVENT
>EVENT/delete
```

### Delete individual event

```
>EVENT/delete
event:YY-MM-DD  HH:MM:SS
```

<ENTER>, <QUIT>

### Select event for deletion

Selection of the event with the <SELECT> key.

<ENTER> The event will be deleted

<QUIT> Abort of the deletion operation.

```
>EVENT
>EVENT/delete all
```

### Delete all events

```
>EVENT/delete all
delete all?
```

<ENTER>, <QUIT>

### Confirm deletion of all events

<ENTER> All events will be deleted.

<QUIT> Abort of the deletion operation.

### 4.7.4 <METHOD> key


The <METHOD> key is used for the management of maximum 9 user-defined methods, which can be stored and recalled under freely selectable names. A method comprises the measurement parameters defined under the <PARAM> key and the program defined under the <PROGRAM> key.

The <METHOD> key opens the following main menu:

| | |
|---|---|
| METHOD<br>>METHOD/recall | **Recall method** |
| METHOD<br>>METHOD/store | **Store method** |
| METHOD<br>>METHOD/delete | **Delete method** |

Repeated pressing of the <EVENT> key selects the submenus in turn. The individual inquiries of a submenu are accessed using the <ENTER> key and exited with the <QUIT> key. The following listings show all dialog items which appear under <METHOD>. The values shown in the displays are the default values, the possible entry values and ranges are shown below the display.

| | |
|---|---|
| >METHOD<br>>METHOD/recall | **Recall existing method** |

| | |
|---|---|
| >METHOD/recall<br>name: DEFAULT | **Selection of the method** |

DEFAULT, Prep-MSM, XXXXXXXX

Use of the <SELECT> key to select the existing method which should be recalled.

| | |
|---|---|
| DEFAULT | Default method with empty program and parameters set to the default values. |
| Prep-MSM | Method for conditioning the suppressor. The suppressor module is switched to the next position every 20 min. |
| XXXXXXXX | Name of the user method stored. |

After confirmation of the name with the <ENTER> key, the method is loaded in the working memory. The parameters under the <PARAM> and <PROGRAM> keys will be overwritten.

```
>METHOD
>METHOD/store
```

## Store method

```
>METHOD/store
name:           XXXXXXXX
```

8 ASCII characters

### Enter or select method name

Entry of a new name (text entry, see *section 4.2.5*) under which the method should be stored or selection of an existing method name with the <SELECT> key.

After confirmation of the name with the <ENTER> key, the parameters loaded in the working memory under the <PARAM> and <PROGRAM> keys are stored as a method.

```
>METHOD/store
overwrite XXXXXXXX?
```

<ENTER>, <QUIT>

### Confirmation of overwriting

*This inquiry appears only if a method should be stored under a name which already exists.*

<ENTER> The method is stored under the selected name.

<QUIT> Abort of the storage operation.

```
>METHOD
>METHOD/delete
```

## Delete method

```
>METHOD/delete
name:           XXXXXXXX
```

### Selection of the method

Selection of the method which should be deleted using the <SELECT> key.

```
>METHOD/delete
delete XXXXXXXX?
```

<ENTER>, <QUIT>

### Confirmation of the deletion

<ENTER> The selected method will be deleted.

<QUIT> Abort of the deletion operation.

# 4.8 Data output

## 4.8.1 <PRINT> key


The <PRINT> key is used for the output of single measured values or to start the automatic measured value output on an external printer or PC connected to the RS232 interface. The output is triggered directly at a keystroke, no inquiries appear.

### Preparations

- For the output on an **external printer**, printer type and RS232 settings must be correctly selected under <CONFIG> (see *section 4.4.2*).
- For the output on a **PC** the character set under <CONFIG> (`"send to: IBM"`) and the RS232 settings must be correctly selected see *section 4.4.2*). For receipt of the data, a suitable program must be started on the PC (e.g. Metrodata VESUV 2.1 or terminal program in Windows accessories).

### Elements of the measured value output

Depending on the parameter settings under `">CONFIG/print meas. value"`, the measured value output can comprise the following elements:

- **Print header**
  The print header comprises a title line (device name, serial number, program number), identifications 1 and 2 (if used) as well as the date and time if desired (see *section 4.4.2*) and is outputted once, always or never before a measured value output, depending on the setting of the parameter `">CONFIG/printer/print header"`.
- **Run number**
  The run number (parameter `">CONFIG/auxiliaries/run number"`, see *section 4.4.2*) is incremented by +1 and outputted on every "INJECT A" (without program) or on every new start or `"return"` (with program).
- **Run time**
  The current time after the program start, after the last "INJECT A" or after the instrument has been switched on is outputted before the measured value.
- **Measured value**
  The measured value shown in the display is outputted:

| | |
|---|---|
| Measured value without sign | Absolute conductivity in µS/cm or mS/cm |
| Measured value with sign | Auto-zero value in µS/cm, %fs or mV |
| `"--------"` | Measured value is >10% outside the measuring range |

- **Identification** "ZEROREF"
  Reference value for the auto-zero function (measured value which is compensated).
- **Identification** "OVERLOAD"
  The measured value is 50…80% outside the selected full-scale range.
- **Identification** "BACKGROUND"
  The measured value is more than 80% outside the selected full-scale range. The absolute conductivity (background) is outputted in place of the auto-zero value.

## Output of individual measured values

- For the output of individual measured values, ">CONFIG/print meas.value = immed." must be selected (see *section 4.4.2*). Each time the <PRINT> key is pressed, a measured value will be outputted via the RS232 interface.
- Example:
  Individual measured value output with print header output (with date and time), run time, measured value

```
>CONFIG/printer
  id.1
  id.2
  print header:      always
  date&time:            on
  send to:           Seiko
>CONFIG/print meas.value
  print crit.:       immed.
  date&time:            off
```

```
732 IC Detector          01104   732.0012
date 1995-10-09  time 13:24:58

  12.3  138.9 uS/cm
               ==============

732 IC Detector          01104   732.0012
date 1995-10-09  time 13:25:37

        139.1 uS/cm            ZEROREF
  13.0   +0.0 uS/cm
               ==============
```

Print header
Date and time

Run time, measured value

Print header
Date and time

Auto-zero reference value
Run time, auto-zero value

## Automatic measured value output

- For the automatic measured value output of measured values at selectable time intervals, `">CONFIG/print meas.value/print crit. = time"` must be selected (see *section 4.4.2*). When the <PRINT> key is pressed, the measured value output defined by the parameters `"time interval"` and `"stop time"` is started via the RS232 interval. The measured value output can always be aborted with <QUIT>.
- Example:
  Automatic measured value output with single print header output (with date and time), run time, measured value

```
>CONFIG/printer
  id.1 column PRP-X100
  id.2 conditioning
  print header:        once
  date&time:             on
  send to:            Seiko
>CONFIG/print meas.value
  print crit.:         time
  time interval     600.0 s
  stop time          60 min
  date&time:            off
```

```
732 IC Detector          01104   732.0012
id.1 column PRP-X100
id.2 conditioning
date 1995-10-09  time 14:36:43

   0.0  109.6 uS/cm
  10.0  125.1 uS/cm
  20.0  133.9 uS/cm
  30.0  138.2 uS/cm
  40.0  140.6 uS/cm
  50.0  141.0 uS/cm
  60.0  141.2 uS/cm
```

Print header
Identification 1
Identification 2
Date and time

Run time, 1st meas. value
Run time, 2nd meas. value
Run time, 3rd meas. value
Run time, 4th meas. value
Run time, 5th meas. value
Run time, 6th meas. value
Run time, 7th meas. value

### 4.8.2 <PLOT> key


The <PLOT> key is used to start the graphics plot on an external printer connected to the RS232 interface. The output is started directly at a keystroke, no inquiries appear.

#### Preparations

- Under "SETUP" the general graphics parameters (frame, grid, print width) must be set to the desired values (see *section 4.4.1*).
- Under <CONFIG> printer type and RS232 settings for the output on an external printer must be correctly selected (see *section 4.4.2*).
- Under <PARAM> the parameters effective for the graphics plot must be set (see *section 4.5.1*).

#### Elements of the measured value output

Depending on the parameter settings selected under "SETUP", <CONFIG> and <PARAM>, the graphics plot can comprise the following elements:

- **Print header**
  The print header comprises title line (device name, serial number, program number), identifications 1 and 2 (if used) as well as the date and time if required (see *section 4.4.2*) and is outputted once, always or never before a graphics plot, depending on the setting of the parameter `">CONFIG/printer/print header"`.

- **Grid**
  With `"SETUP/grid = on"` grid lines are drawn in.

- **Frame**
  With `"SETUP/frame = on"` a frame is drawn in.

- **Labeling of the y axis**
  Conductivity in µS/cm, mS/cm or S/cm

- **Labeling of the x axis**
  Absolute time `"HH:MM:SS"` or relative time `"XXXmXXs"`

- **Conductivity measurement value**
  Solid line

## Example

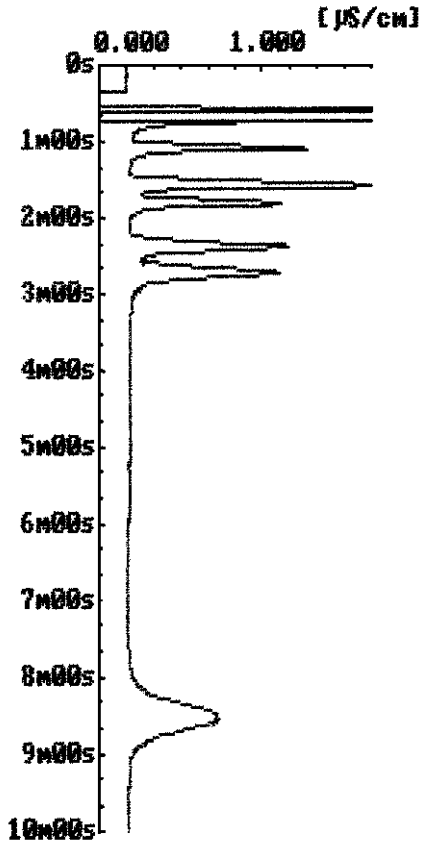
- Graphics plot of a chromatogram with the PRP-X100 IC Anion column on a Citizen printer IDP562 RS

```
>SETUP/graphics
  grid:                    off
  frame:                   off
  width                    1.0
```

```
>CONFIG/printer
  id.1 column PRP-X100
  id.2 standard
  print header:          always
  date&time:                on
  send to:              Citizen
```

```
>PARAM/printer
  auto start:                on
  time interval           1.0 s
  time scale      10.0 mm/min
  time scale label:         rel
  stop time              10 min
  left:           -0.200 µS/cm
  right:           1.800 µS/cm
```

```
732 IC Detector          01104    732.0012
id.1 column PRP-X100
id.2 standard
date 1995-10-09  time 16:03:08
```




```
==============
```

Print header
Identification 1
Identification 2
Date and time

### 4.8.3 <REPORT> key


The <REPORT> key is used for the output of reports on an external printer or PC connected to the RS232 interface.

The <REPORT> key opens the following inquiry:

```
XXXXXX mS/cm    XXXX min
report:              all
```

all, config, event, method, method list, param, program, pump

**Selection of the report**

Selection of the report which should be outputted:

| | |
|---|---|
| `all` | All reports in the order "`config, event, method, method list, pump`" |
| `config` | Configuration report (parameters of the <CONFIG> key) |
| `event` | Event report (parameters of the <EVENT> key) |
| `method` | Method report (comprises method name, parameter and program report) |
| `method list` | Method list (details of stored methods) |
| `param` | Parameter report (parameters of the <PARAM> key) |
| `program` | Program report (parameters of the <PROGRAM> key) |
| `pump` | Report of the pump parameters |

**Example of "config" report**

Configuration for 732 IC Detector with attached Seiko printer and 733.0010 IC Separation Center with 1 injection valve

```
CONFIG
>CONFIG/detector
  thermostat:              35 °C
  'zero' unit:           µS/cm
  cell constant          16.7 /cm
>CONFIG/printer
  id.1               PRP-X100
  id.2          drinking water
  print header:          once
  date&time:               on
  send to:              Seiko
>CONFIG/print meas.value
  print crit.:           time
  time interval         300.0 s
  stop time                60 min
  date&time:              off
>CONFIG/auxiliaries
  run number                0
  number of cycles          1
>CONFIG/aux/event
  enabled in program:     off
  date              1995-10-10
  time                11:38:20
  dialog:              english
  device label
  program            732.0012
```

```
>CONFIG/aux/beeper
  status:                  on
  repeat time            60 s
>CONFIG/RS settings
  baud rate:             9600
  data bit:                 8
  stop bit:                 1
  parity:                none
  handshake:              HWs
  control via RS:          on
>CONFIG/RS settings 709
  baud rate:             9600
>CONFIG/733 IC Sep.Cent.
                       valve A
  control:     no restriction
>CONFIG/733/valve A
  status               inject
  trigger:             inject
               --------------
```

## Example of "event" report

Two daily events (adjust pump flow) and a date event (switch off pump supply)

```
EVENT
daily:                07:00:00
        pump flow         2.00 mL/min
daily:                19:00:00
        pump flow         0.30 mL/min
date:       95-10-13  16:00:00
        pump                off
               --------------
```

## Example of "method" report

Method for the determination of drinking water with PRP-X100 Anion Column

```
METHOD
method name           PRP-X100
  date:  1995-10-10  15:15:41

PARAM
>PARAM/detector
  range:             200 µS/cm
  full scale:       4.00 µS/cm
  temp.coeff.:             2.5 %/°C
>PARAM/analog output
  polarity:                  +
  offset:                    0 %fs
  damping:                 off
>PARAM/plot
  auto start:              off
  time interval            1.0 s
  time scale              10.0 mm/min
  time scale label:        rel
  stop time                off min
  left:                  0.000 µS/cm
  right:                 4.000 µS/cm
>PARAM/709 IC Pump
  flow                    2.00 mL/min
  Pmax                    10.0 MPa
  Pmin                     1.0 MPa
  flow corr.              1.00

PROGRAM
  progr.typ             inject
  17.9  zero               on
  18.0  flag              end
               --------------
```

## Example of "method list" report

```
Method list
method name          'PRP-X100'
  progr.typ             inject
  date   1995-10-10  15:15:41
  number of steps            3

  free memory              8(9)
               --------------
```

## Example of "param" report

Measurement parameters for drinking water determination with PRP-X100 IC Anion Column

```
PARAM
>PARAM/detector
  range:                   200 µS/cm
  full scale:             4.00 µS/cm
  temp.coeff.:             2.5 %/°C
>PARAM/analog output
  polarity:                  +
  offset:                    0 %fs
  damping:                 off
>PARAM/plot
  auto start:              off
  time interval            1.0 s
  time scale              10.0 mm/min
  time scale label:        rel
  stop time                off min
  left:                  0.000 µS/cm
  right:                 4.000 µS/cm
>PARAM/709 IC Pump
  flow                    2.00 mL/min
  Pmax                    10.0 MPa
  Pmin                     1.0 MPa
  flow corr..             1.00
               --------------
```

## Example of "program" report

Program parameters for drinking water determination with the PRP-X100 IC Anion Column

```
PROGRAM
  progr.type:           inject
  17.9  zero:              on
  18.0  flag:             end
               --------------
```

## Example of "pump" report

Report of the parameters for the 709 IC Pump

```
PUMP
  status               running
  Pactual                  6.9 MPa
  error              no error
               --------------
```

# 4.9 Examples of methods

## 4.9.1 Cation determination with Metrosep Cation 1-2

This example shows a method for the determination of monovalent and divalent cations with the 6.1010.000 IC Cation Column Metrosep Cation 1-2, which can be used with or without an autosampler.

### General conditions

- **Separating column**: 6.1010.000 Metrosep Cation 1-2
- **Sample loop**: 10 µL
- **Eluent**: 4 mmol/L tartaric acid,
  1 mmol/L dipicolinic acid
- **Flow**: 1 mL/min
- **Eluent conductivity**: ca. 670 µS/cm
- **Full scale**: 5 µS/cm

### Configuration

```
CONFIG
>CONFIG/detector
  thermostat:              35 °C
  'zero' unit:           µS/cm
  cell constant          17.1 /cm
>CONFIG/printer
  id.1
  id.2
  print header:          once
  date&time:               on
  send to:                IBM
>CONFIG/print meas.value
  print crit.:            off
>CONFIG/auxiliaries
  run number                0
  number of cycles          1
>CONFIG/aux/event
  enabled in program:     off
  date              1995-10-16
  time                10:59:20
  dialog:              english
  device label
  program            732.0012
>CONFIG/aux/beep
  status:                  on
  repeat time              60 s
>CONFIG/RS settings.
  baud rate:             9600
  data bit:                 8
  stop bit:                 1
  parity:                none
  handshake:              HWs
  control via RS:          on
>CONFIG/RS settings 709
  baud rate:             9600
>CONFIG/733 IC Sep.Cent.
                       valve A
  control:     no restriction
>CONFIG/733/valve A
  status               inject
  trigger:             inject
               --------------
```

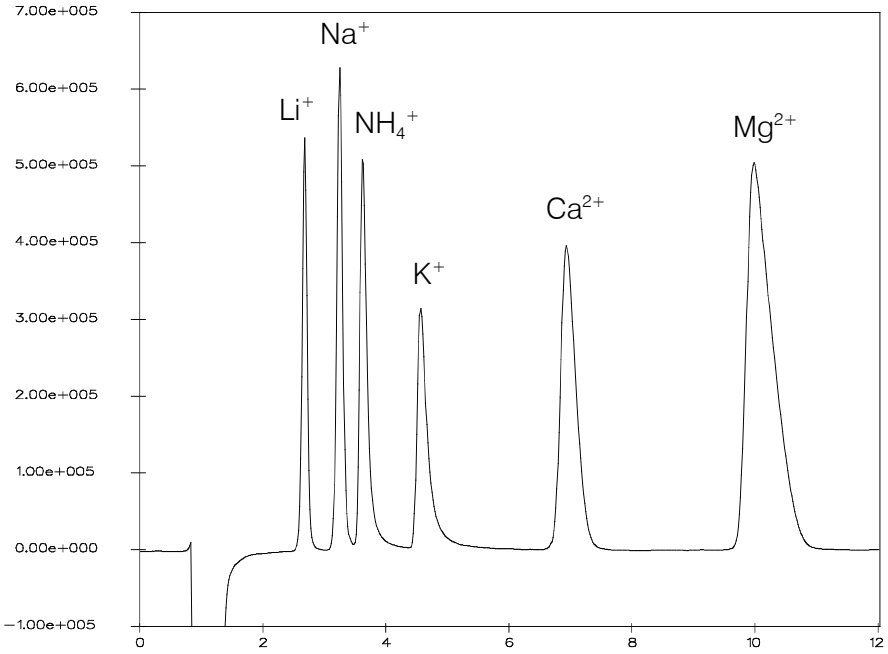
## Method

```
METHOD
method name           Cat.1-2
  date:  1995-10-16  10:57:42

PARAM
>PARAM/detector
  range:           1.00 mS/cm
  full scale:      5.00 µS/cm
  temp.coeff.:        1.5 %/°C
>PARAM/analog output
  polarity:             -
  offset:               0 %fs
  damping:            off
>PARAM/plot
  auto start:         off
  time interval       1.0 s
  time scale         10.0 mm/min
  time scale label:   rel
  stop time           off min
  left:             1.000 µS/cm
  right:           -4.000 µS/cm
>PARAM/709 IC Pump
  flow               1.00 mL/min
  Pmax               10.0 MPa
  Pmin                1.0 MPa
  flow corr.         1.00

PROGRAM
  progr.type:       inject
  11.9  zero:          on
  12.0  flag:         end
              --------------
```

Triggering of auto-zero function
Program end

The program of the type "inject" is started each time injection valve A is switched to the "INJECT" position. After 12.0 min, the IC system is ready for the next injection.

## Chromatogram for cation standard




FULL REPORT

| Ret Time (Min) | Component Name | Concentr. ppm | Area (uV*Sec) | Height (uV) |
|---|---|---|---|---|
| 2.682 | Li | 1.000000 | 3100993.50 | 537565.125 |
| 3.252 | Na | 5.000000 | 4215109.00 | 627987.062 |
| 3.624 | NH4 | 5.000000 | 4517200.50 | 508054.437 |
| 4.566 | K | 10.000000 | 4022451.00 | 313609.843 |
| 6.937 | Ca | 10.000000 | 6971803.50 | 396256.875 |
| 9.982 | Mg | 10.000000 | 15063622.0 | 501869.562 |

***Fig. 22:*** *Ion chromatogram for cation standard with Metrosep Cation 1-2*

## 4.9.2 Anion determination with Metrosep Anion Dual 2

This example shows a method for the determination of monovalent and divalent anions with the 6.1006.100 IC Anion Column Metrosep Anion Dual 2 and the Metrohm suppressor module, which can be used with or without an autosampler.

### General conditions

- **Separating column**: 6.1006.100 Metrosep Anion Dual 2
- **Sample loop**: 20 µL
- **Eluent**: 1.3 mmol/L sodium carbonate, 2.0 mmol/L sodium bicarbonate
- **Flow**: 0.8 mL/min
- **Eluent conductivity**: ca. 14 µS/cm
- **Full scale:** **50 mS/cm and 5 mS/cm**
- **Suppressor module**: Regeneration solution 20 mmol/L $H_2SO_4$, rinsing solution Milli-Q water

### Configuration

```
CONFIG
>CONFIG/detector
  thermostat:              35 °C
  'zero' unit:          µS/cm
  cell constant          17.1 /cm
>CONFIG/printer
  id.1
  id.2
  print header:          once
  date&time:               on
  send to:               IBM
>CONFIG/print meas.value
  print crit.:            off
>CONFIG/auxiliaries
  run number                0
  number of cycles          1
>CONFIG/aux/event
  enabled in program:     off
  date             1995-10-16
  time               10:59:20
  dialog:             english
  device label
  program            732.0012
>CONFIG/aux/beep
  status:                  on
  repeat time              60 s
>CONFIG/RS settings
  baud rate:             9600
  data bit:                 8
  stop bit:                 1
  parity:                none
  handshake:              HWs
  control via RS:          on
>CONFIG/RS settings 709
  baud rate:             9600
>CONFIG/733 IC Sep.Cent.
         valve A + suppressor
  control:     no restriction
>CONFIG/733/valve A
  status               inject
  trigger:             inject
>CONFIG/733/suppressor
  auto step:             fill
  status          in position
  trigger:                ---
```

## Method

```
METHOD
method name            An.Dual
  date:   1995-10-16  14:30:39

PARAM
>PARAM/detector
  range:            100 µS/cm
  full scale:     50.00 µS/cm
  temp.coeff.:        2.5 %/°C
>PARAM/analog output
  polarity:             +
  offset:               0 %fs
  damping:             off
>PARAM/Plot
  auto start:          off
  time interval        1.0 s
  time scale          10.0 mm/min
  time scale label:    rel
  stop time            off min
  left:              -5.000 µS/cm
  right:              45.00 µS/cm
>PARAM/709 IC Pump
  flow                0.80 mL/min
  Pmax                 7.0 MPa
  Pmin                 1.0 MPa
  flow corr.          1.00

PROGRAM
  progr.type:         cycle
  number of cycles        1
   9.0  range:     100 µS/cm
        full scale:5.00 µS/cm
        mark:           on
  14.7  range:     100 µS/cm
        full scale:50.0 µS/cm
        mark:           on
  19.9  zero:           on
  49.9  valve A:      fill
        remote      0*******
        pump R/S:      off
  50.0  flag:          end
             --------------
```

Switching of full-scale range to 5 µS/cm
Triggering of a marking signal
Switching of full-scale range to 50 µS/cm
Triggering of a marking signal
Triggering of the auto-zero function
Switching of valve A to "FILL"
Switching off of 752 Pump Unit
Switching off of 709 IC Pump
Program end

The program of the type "inject" is started each time injection valve A is switched to the "INJECT" position. For the determination of nitrate and phosphate, the full-scale range is briefly narrowed to 5 µS/cm and this range marked by marking signals. After 20.0 min the IC system is ready for the next injection. If there is no new program start within 50 min after the last injection, valve A is automatically switched to the "FILL" position, the 709 IC Pump and 752 Pump Unit are stopped and the program ended.

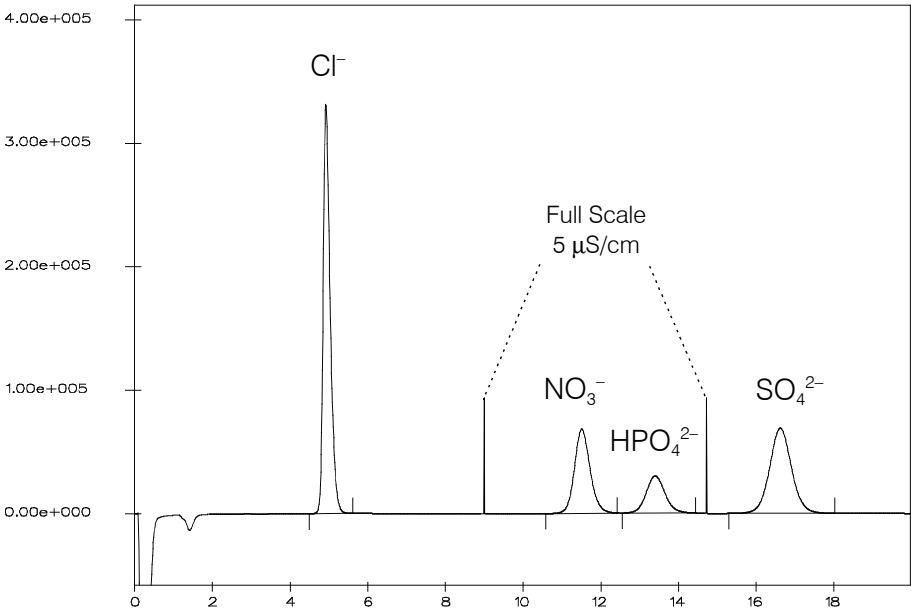
## Settings for 709 IC Pump

- **Installation**: as shown in *Fig. 10* (see *section 2.6*)
- **<EXT.> key**: Switched on (remote operation activated)

## Settings for 752 Pump Unit

- **Installation**: as described in *section 2.8.6*

## Chromatogram for anion standard




FULL REPORT

| Ret Time (Min) | Component Name | Concentr. ppm | Area (uV*Sec) | Height (uV) |
|---|---|---|---|---|
| 4.918 | Chloride | 19.661419 | 4187692.25 | 331573.781 |
| 11.505 | Nitrate | 2.010445 | 1906272.75 | 68276.7421 |
| 13.399 | Phosphate | 1.973833 | 1011560.75 | 30180.7343 |
| 16.617 | Sulphate | 19.895790 | 2717087.00 | 69003.4375 |

***Fig. 23:*** ***Ion chromatogram for anion standard with Metrosep Anion Dual 2***

# 5 Notes – Maintenance – Faults

## 5.1 Practical notes on ion chromatography

### 5.1.1 Separating columns

#### Separation efficiency

The attainable quality of analyses with the 732/733 IC system depends to a large extent on the separation efficiency of the column used. When purchasing an IC column you should ensure that the separation efficiency suffices for the analysis problems at hand. Ascertain the **characteristic data of the IC column** on the standard chromatogram enclosed with the column such as capacity factors, selectivity, plate number and resolution and check these data with your own measurements. If any difficulties arise, you should always first check the quality of the column by recording a **standard chromatogram**.

You will find additional general tips on handling IC separating columns in the **8.732.2003 Metrohm Monograph "Ion chromatography""**, as well as detailed information on the separating columns available from Metrohm (see *section 7.3.2*) in the leaflets supplied and in the special **Application Bulletins** available free of charge from your nearest Metrohm agency.

#### Protection

To protect the column against foreign particles which could have an adverse influence on the separation efficiency, we advise you to subject both the eluents and all samples to **microfiltration** (0.45 µm filter) and to siphon the eluent through the **6.2821.090 Aspirating Filter**.

To avoid contamination by abrasive particles arising from piston seals of the 709 IC Pump, it is advantageous to install an **in-line filter** between the pump and the 733 IC Separation Center. **The 6.2821.100 Filter unit PEEK** (see *section 2.6.3*) supplied with the 709 IC Pump for operation with PEEK capillaries in the pressure range 0…25 MPa and the optional **6.2821.000 Filter unit Manufit** (see *section 2.6.4*) for operation with steel capillaries in the pressure range 0…50 MPa are eminently suitable for this purpose.

The use of readily interchangeable **precolumns** serves to protect the actual separating columns and increase their service life appreciably. The precolumns available from Metrohm (see *section 7.3.2*) are either actual precolumns or so-called precolumn cartridges which are used together with the 6.2821.050 Twin cartridge holder or the 6.2828.010 Precolumn cartridge holder (see *section 2.7*).

#### Storage

Always store the separating columns closed when not in use and filled in accordance with the manufacturer's specifications.

### Dead volume

Dead volume at the end of a column can be the cause of extreme peak broadening or splitting (appearance of double peaks). Filling the column with glass beads (∅ ≤ 100 µm) frequently improves the separation efficiency.

### Regeneration

If the separation properties of the column have deteriorated, it can be regenerated in accordance with the column manufacturer's specifications. With the separating columns available from Metrohm (see *section 7.3.2*), the instructions for regeneration can be found on the leaflet enclosed with every column.

*In the case of separating columns with carrier material based on silica,* ***only solutions with pH 2¼7*** *may be used for regeneration, otherwise the columns could be damaged.*

## 5.1.2 Pumps

### Pulsation dampener

For sensitive measurements with the 732/733 IC System, high pressure pumps as free from pulsation as possible and with a very constant capacity are required. If the pulsations that appear are too large, a pulsation dampener between the pump and the 733 IC Separation Center may possibly help. The optional **6.2620.150 Pulsation dampener MF** (see *section 7.3.1*) whose installation is described in *section 2.6.2* is eminently suitable for this purpose. A pulsation dampener also offers protection against pressure shocks on the column material caused by injection.

### Maintenance

To protect the pump against foreign particles, we advise you to subject the eluent to **microfiltration** (0.45 µm filter) and siphon the eluent through the **6.2821.090 Aspirating Filter**.

In many cases, an unstable baseline (pulsation, flow fluctuations) can be traced to contaminated valves or faulty, leaky piston seals.

**Contaminated valves** are cleaned by rinsing with water, RBS solution or organic solvents. The rinsing effect is improved by brief treatment in an ultrasonic bath. When the cleaned valves are reinstalled, you must ensure that the flow direction is correct.

The **replacement of piston seals** has to be done in accordance with the pump manufacturer's directions. The corresponding maintenance work for the 709 IC Pump is described in *section 4.2* of the *709 Instructions for Use*.

Salt crystals between the piston and the seal are the cause of abrasive particles, which can enter the eluent. These lead to contaminated valves, pressure rise and in extreme cases to scratched pistons. It is thus essential to ensure that **no precipitates** can appear (see also *section 5.1.3*).

## 5.1.3 Eluents

### Treatment

For the preparation of the eluents only chemicals of a purity degree of at least "**p.a.**" should be used. For diluting please use only **high purity water**.

Fresh eluents should always be **microfiltered** (0.45 µm filter) and **degassed** (with $N_2$, He or vacuum). For high sensitive measurements, the eluent should be continuously **stirred** with a magnetic stirrer, particularly when the recycling procedure is employed or when alkaline eluents are used. For alkaline eluents and eluents with low buffering capacity one should preferably use a **$CO_2$ absorber** (e.g. the absorber supplied with the optional 6.5324.000 Bottle rack).

The supply vessel containing the eluent must be closed as tightly as possible to avoid excessive evaporation. This is primarily important with eluents containing organic solvents (e.g. acetone), the evaporation of which can lead to drifts in the long term. If work is performed in a very sensitive range, even if one drop of condensate falls back in the eluent this can cause a noticeable change in the background conductivity.

### Influence of various parameters on anion columns

- *Concentration:* An increase in the concentration usually leads to shorter retention times and quicker separation, but also to a higher background conductivity.
- *pH:* pH alterations lead to shifts in the dissociation equilibrium and thus to changes in the retention times.
- *Organic modifiers:* Addition of an organic solvent (e.g. methanol, acetone, acetonitrile) to aqueous eluents generally accelerates lipophilic ions.

### Eluent change

When the eluent is changed, it must be ensured that **no precipitates** can be formed. Solutions used in direct succession must therefore be miscible. If the system has to be rinsed with an organic solution, several solvents with increasing or decreasing lipophilic character may possibly have to be used (e.g. water ↔ acetone ↔ chloroform).

### 5.1.4 Suppressor module

To avoid contamination of the suppressor module by foreign particles or bacterial growth, it is advantageous to install an **in-line filter** between the 752 Pump Unit and the suppressor module. The two **6.2821.100 Filter units PEEK** (see *section 2.6.3 and section 2.8.3*) supplied with the 2.733.0X30 IC Separation Center are eminently suitable for this purpose.

### 5.1.5 Connections

All connections between injector, column and detector must be as short as possible, have a low dead volume and be absolutely tight. The PEEK capillary after the detector block must be free from constriction (the measuring cell is tested to 5 MPa = 50 bar back pressure).

## 5.2 Maintenance and servicing

### 5.2.1 General information

#### Care

The 732 IC Detector and 733 IC Separation Center require proper care and attention. Excessive contamination of the instruments could possibly lead to malfunctions and a shorter service life of the inherently rugged mechanical and electronic parts.

Spilled chemicals and solvents should be wiped up immediately. It is especially important to protect the plug connections at the rear of the instrument (particular the mains plug) against contamination.

*Although constructional measures have been designed to virtually eliminate such a situation, should corrosive media penetrate the interior of the instruments the mains plug of the 732 IC Detector must be immediately disconnected to prevent extensive damage to the instrument electronics. Inform Metrohm service if your instrument(s) have been damaged in such a way.*

*The instrument must not be opened by untrained personnel. Please comply with the safety notes in section 1.4.1.*

#### Maintenance by Metrohm service

Maintenance of the 732 IC Detector and 733 IC Separation Center is best done as part of an annual service performed by specialists from the Metrohm company. If work is frequently performed with caustic and

corrosive chemicals, it may be necessary to shorten the interval between servicing.

The Metrohm service department is always willing to offer expert advice on the maintenance and servicing of all Metrohm instruments.

### 5.2.2 Passivation

Passivation of the entire IC system (without column) by rinsing with 20...50 mL 0.2 mol/L $HNO_3$ is appropriate in the following cases:

- in the installation
  (only with non metal-free IC systems, see *section 2.6.7*)
- if the separation system is changed
  (only with non metal-free IC systems, see *section 5.2.5*)
- if exceptional changes are observed in the measurement properties of the cell
  (with metal-free and non metal-free IC systems).

For passivation the separating column is removed from the 733 IC Separation Center. The two capillaries **67** and **82** (see *Fig. 16* and *Fig. 17*) are directly connected to each other using the 6.2620.060 Coupling enclosed with the accessories.

### 5.2.3 Recycling

To keep the eluent consumption between injections to a minimum when the system is at rest (e.g. overnight), the so-called recycling procedure can be used. In recycling the eluent exiting the outlet capillary of the detector block is led back directly to the eluent supply vessel. The IC system is thus quickly ready for new injections without a long conditioning period.

*The recycling procedure must **not** be used*

- *in operation with the suppressor module,*
- *with alkaline eluents,*
- *with the 6.1010.000 IC Cation column METROSEP Cation 1-2.*

### 5.2.4 Shutdown

If the 732/733 IC-System is shut down for a considerable length of time, the entire IC system (**without** column and suppressor) must be **rinsed free from salt** with methanol/water (1:4) to avoid crystallization of eluent salts with the corresponding subsequent damage.

For rinsing the separating column is removed; the two capillaries **67** and **82** (see *Fig. 16* and *Fig. 17*) are directly connected to each other with the 6.2620.060 Coupling enclosed with the accessories. Rinse with methanol/water (1:4) until the conductivity drops below 10 µS/cm.

## 5.2.5 Changing separating columns

### Identical separation system

If you wish to replace an IC separating column by a column of the same type, proceed as follows (see *Fig. 16* and *Fig. 17*):

**1 Remove old column**

- Switch off pump drive of the 709 IC Pump.
- Unscrew column from inlet capillary **82** of the detector block or from suppressor inlet capillary **89**.
- Unscrew column from column connection capillary **67** or the precolumn.

**2 Connect new column to injector**

- Remove end caps from column **76**.
- Screw inlet end of separating column **76** (note flow direction) to column connection capillary **67** or to the precolumn (see *section 2.8.4/section 2.8.6*).

**3 Rinse column**

- Place beaker beneath the column outlet.
- Switch on 709 IC Pump and rinse column with eluent for ca. 10 min, then switch off pump.

**4 Connect column to detector block**

- Screw outlet end of separating column **76** to inlet capillary **82** or suppressor inlet capillary **89**.

### Changing the separation system

If you wish to replace an IC separating column by a column of a different type, proceed as follows (see *Fig. 16* and *Fig. 17*):

**1 Remove old column**

- Switch off pump drive of 709 IC Pump.
- Unscrew column from inlet capillary **82** of the detector block or from the suppressor inlet capillary **89**.
- Unscrew column from column connection capillary **67** or the precolumn.

**2 Connect detector block to injection valve**

- Connect column connection capillary **67** using a 6.2620.060 Coupling directly to inlet capillary **82** of the detector block (see *Fig. 16*).

**3 Rinse with $HNO_3$ (passivation)**

- Rinse IC system with $c(HNO_3)$ = 0.2 mol/L (flow rate 1 mL/min) for ca. 10 min.

**4 Rinse with dist. $H_2O$**

- Rinse IC system with dist. Or demin. Water (flow rate 1 mL/min) for ca. 10 min.

**5 Rinse with eluent**

- Rinse IC system with the eluent needed for the separating column you intend to install until the absolute conductivity displayed on the 732 IC Detector is stable.

**6 Remove coupling**

- Remove 6.2620.060 Coupling between column outlet capillary **67** and inlet capillary **82** (see *Fig. 16*).

**7 Connect new column to injector**

- Remove end caps from column **76**.
- Screw inlet end of separating column **76** (note flow direction) to column connection capillary **67** or to the precolumn (see *section 2.8.4/section 2.8.6*).

**8 Rinse column**

- Place beaker beneath the column outlet.
- Switch on 709 IC Pump and rinse column with eluent for ca. 10 min, then switch off pump.

**9 Connect column to detector block**

- Screw outlet end of separating column **76** to inlet capillary **82** or suppressor inlet capillary **89**.

## 5.2.6 Regeneration of the suppressor

### Regenerating a suppressor operating at reduced capacity

If the suppressor units are exposed to certain heavy metals (e.g. iron) or organic contaminants for long periods of time, these can no longer be completely removed by the regeneration solution normally used (20 mmol/L $H_2SO_4$). This diminishes the capacity of the suppressor units, which, in milder cases, results in a reduced sensitivity to phosphates and, in severe cases, in a strong increase in the baseline. If such capacity problems occur at one or several positions, the suppressor units must be treated as follows:

**1 Disconnect suppressor from IC system**

- Disconnect suppressor from separating column and detector.

**2 Regenerate suppressor**

- Rinse each suppressor unit for about 15 min with one of the following solutions:

  **Contamination with heavy metals**
  1 mol/L $H_2SO_4$

  **Contamination with organic cationic complexing agents**
  0.1 mol/L $H_2SO_4$ / 0.1 mol/L oxalic acid / acetone 5%

  **Severe contamination with organic substances**
  0.2 mol/L $H_2SO_4$ / acetone ≥ 20%

*The 6.1826.050 pump tubing is made of PVC and must not be used for rinsing with solutions which contain acetone. In such cases, rinse with different pump tubing or a different pump.*

**3 Connect suppressor to IC system**

- Reconnect suppressor to the IC system. If capacity problems persist, replace the suppressor rotor (see *section 5.2.8*).

### Regenerating the suppressor in case of high counterpressure

If excessive counterpressure is observed in one or several suppressor units, treat the units as follows:

**1 Disconnect suppressor from IC system**

- Disconnect suppressor from separating column and detector.

**2 Regenerate suppressor**

- Connect the inlet capillary **90** marked "$H_2SO_4$" to the 709 IC Pump using the 6.2620.060 or 6.2744.040 coupling.
- Set the flow at the 709 IC Pump to 0.5 mL/min and rinse the suppressor unit with 1 mol/L $H_2SO_4$ for 5 to 10 min.
- As the pressure falls, slowly increase the flow at the 709 IC Pump to 2 mL/min. Do not exceed a maximum pressure of 2 MPa (20 bar).
- Switch suppressor to the next position using the <STEP> key.
- Connect the inlet capillary **93** marked "$H_2O$" to the 709 IC Pump using coupling 6.2620.060 or 6.2744.040.
- Set the flow at the 709 IC Pump to 0.5 mL/min and rinse the suppressor unit with distilled $H_2O$ for 5 to 10 min.
- As the pressure falls, slowly increase the flow at the 709 IC Pump to 2 mL/min. Do not exceed a maximum pressure of 2 MPa (20 bar).

**3 Connect suppressor to IC system**

- Reconnect the suppressor to the IC system and the 752 Pump Unit. If the pressure problems persist, replace the suppressor rotor (see *section 5.2.8*).

### 5.2.7 Cleaning the suppressor

It may be necessary to clean the suppressor in the following cases:

- High counterpressure on the suppressor connection tubing
- Irremediable blockage of the suppressor (the suppressor can no longer deliver solutions)
- Irremediable obstruction of the suppressor (the suppressor can no longer be switched to next position)

To clean the connection piece and the rotor, proceed as follows (see *Fig. 24*):

**1 Disconnect suppressor from IC system**

- Disconnect input lead of suppressor from the separating column and output lead to the detector.

**2 Dismantle suppressor**

- Unscrew nut **97** from suppressor holder **100**.
- Pull out connection piece **98** and suppressor rotor **99** from suppressor holder **100** (the connection piece and the rotor normally stick together).
- Loosen connection piece **98** from suppressor rotor **99**.

### 3 Clean input and output leads

- Connect each of the 6 capillary tubings attached to connection piece **98** to the pump one after another, and pump through ultrapure water.
- Check whether solution emerges from connection piece **98**. If one of the input or output leads remains blocked, replace the connection piece (order number 6.2832.010).

### 4 Clean suppressor rotor

- Clean the sealing surface of suppressor rotor **99** using a lint-free cloth and ethanol.

### 5 Insert suppressor rotor

- Insert suppressor rotor **99** in suppressor holder **100** in such a way that the tubing connections at the rear of the rotor fit in the corresponding openings inside the rotor, and that one of the three holes in the rotor can be seen from below in one of the openings of the holder.
- If the rotor has been inserted correctly, its sealing surface will be about 4 mm inside the holder. If this is not the case, bring the rotor into the correct position from below with the aid of a sharp object (e.g. a screwdriver).

### 6 Clean connection piece

- Clean the sealing surface of connection piece **98** using a lint-free cloth and ethanol.

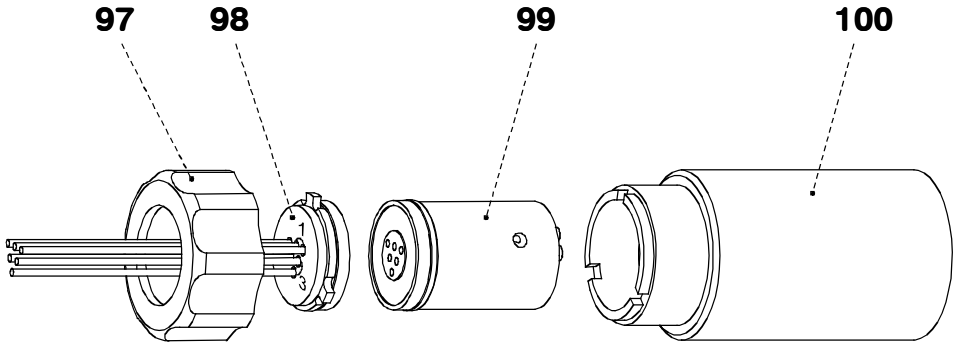



***Fig. 24: Assembling the suppressor***

| | | | |
|---|---|---|---|
| **97** | **Screw nut** | **99** | **Suppressor rotor (6.2832.000)** |
| **98** | **Connection piece (6.2832.010) with input and output leads** | **100** | **Suppressor holder** |

**7 Insert connection piece**

- Insert connection piece **98** in suppressor holder **100** in such a way that connection "1" is at the top, and that the three lugs on the connection piece fit in the corresponding openings of the holder.
- Screw nut **97** onto the thread of suppressor holder **100** manually (do not use tools).

**8 Connect and condition the suppressor**

- Reconnect the suppressor to the IC system.
- Before switching the suppressor to the next position for the first time, rinse all 3 suppressor units with solution for 5 min.

### 5.2.8 Replacing the suppressor

The suppressor in the suppressor block may have to be replaced in the following cases:

- Irremediable loss of suppressor capacity (reduced phosphate sensitivity and/or strong rise in baseline)
- Irremediable blockage of the suppressor (the suppressor can no longer deliver solutions)

Both the 6.2832.000 Suppressor rotor and the 6.2832.010 Connection piece with the input and output leads can be replaced. To replace these components proceed as follows (see *Fig. 24*):

**1 Disconnect suppressor from IC system**

- Disconnect all input and output leads of the suppressor from IC system and the pump of the 752 Pump Unit.

**2 Dismantle suppressor**

- Unscrew nut **97** from suppressor holder **100**.
- Pull out connection piece **98** and suppressor rotor **99** from suppressor holder **100** (the connection piece and the rotor normally stick together).
- Loosen connection piece **98** from suppressor rotor **99**.

**3 Clean suppressor rotor**

- Clean the sealing surface of new suppressor rotor **99** (6.2832.000) using a lint-free cloth and ethanol.

**4 Insert suppressor rotor**

- Insert new suppressor rotor **99** in suppressor holder **100** in such a way that the tubing connections at the rear of the rotor fit in the corresponding openings inside the rotor and that one of the three holes in the rotor can be seen from below in one of the openings of the holder.

- If the rotor has been inserted correctly, its sealing surface will be about 4 mm inside the holder. If this is not the case, bring the rotor into the correct position from below with the aid of a sharp object (e.g. a screwdriver).

### 5 Clean connection piece

- Clean the sealing surface of new connection piece **98** (6.2832.010) with the aid of a lint-free cloth and ethanol.

### 6 Insert connection piece

- Insert new connection piece **98** in suppressor holder **100** in such a way that connection "1" is at the top and that the three lugs on the connection piece fit in the corresponding openings of the holder.
- Screw nut **97** onto the thread of suppressor holder **100** manually (do not use tools).

### 7 Connect and condition the suppressor

- Reconnect the suppressor to the IC system.
- Before switching the suppressor to the next position for the first time, rinse all 3 suppressor units with solution for 5 min.

# 5.3 Faults and malfunctions

## 5.3.1 Error messages

If any type of malfunction occurs during operation of the 732 IC Detector, this is shown by an error message which appear in the top line of display **1** and (if switched on under <CONFIG>) by three beeps. To return to the instrument standby mode, the error messages must be confirmed with the <QUIT> key.

You will find further details of the error messages, their possible causes and the procedure for their rectification in the following table, which is arranged alphabetically. If the errors can not be rectified, please follow the procedure described in *section 5.4*.

| *Error message* | *Meaning/Causes* | *Rectification* |
|---|---|---|
| adjustment error | Instrument adjustment invalid. | Inform Metrohm service. |
| all methods faulty | The stored methods can no longer be recalled. | Re-enter methods and store. If this error occurs frequently, inform Metrohm service. |
| connect 709 IC Pump | The active program contains a command for the 709 IC Pump, which can not be addressed at present. | Check connection to 709 IC Pump, switch on pump and remote operation with <EXT.>. |
| connect 733 Sep.Center | The active program contains a command for the 733 IC Separation Center, which can not be addressed at present. | Check connection to 733 IC Separation Center. |
| DAC coarse error # | Error in internal hardware test. | Inform Metrohm service. |
| DAC fine error # | Error in internal hardware test. | Inform Metrohm service. |
| EEPROM error 233 | Error on storage of the EEPROM block "Program". | Re-enter program. |
| EEPROM error 234 | Error on storage of the EEPROM block "Parameters". | Re-enter parameters. |
| EEPROM error 235 | Error on storage of the EEPROM block "Method". | Re-enter method (program and parameters). |
| EEPROM error 236 | Error on storage of the EEPROM block "Event". | Re-enter events. |
| EEPROM error 237 | Error on storage of the EEPROM block "Config". | Re-enter configuration. |
| EEPROM error 238 | Error on storage of the EEPROM block "Device number ". | Re-enter device number. |
| EEPROM error 239 | Error on storage of the EEPROM block "Adjustment". | Inform Metrohm service. |
| EEPROM error 240 | Error on storage of the EEPROM blocks. | Re-enter all values. |
| Err1 | Program checksum wrong. | Inform Metrohm service. |
| Err3 | Instrument adjustment faulty. | <QUIT>. If new instrument adjustment necessary, inform Metrohm service. |
| Err4 | Timer interrupt for multitasking missing. | Inform Metrohm service. |

| *Error message* | *Meaning/Causes* | *Rectification* |
|---|---|---|
| `Err5` | RS232 interface at 732 IC Detector faulty. | Inform Metrohm service. |
| `Err6` | Clock faulty. | Inform Metrohm service. |
| `Err7` | LCD write/read error. | Inform Metrohm service. |
| `Err8` | AD converter faulty. | Inform Metrohm service. |
| `ErrC` | RS232 interface at 709 IC Pump faulty. | Inform Metrohm service. |
| `faulty method #` | Method # (0…9) can no longer be recalled. | Re-enter method and store. |
| `inject in inject program` | The active inject program contains an "`inject`" command. As this itself triggers the program start, the program will be executed endlessly. | Delete "`inject`" command in the program. |
| `IO error 50` | Error at input 1 or output 1. | Inform Metrohm service. |
| `IO error 51` | Error at input 2 or output 2. | Inform Metrohm service. |
| `IO error 52` | Error at input 3 or output 3. | Inform Metrohm service. |
| `IO error 53` | Error at input 4 or output 4. | Inform Metrohm service. |
| `IO error 54` | Error at input 5 or output 5. | Inform Metrohm service. |
| `IO error 55` | Error at input 6 or output 6. | Inform Metrohm service. |
| `IO error 56` | Error at input 7 or output 7. | Inform Metrohm service. |
| `IO error 57` | Error at input 8 or output 8. | Inform Metrohm service. |
| `IO error 58` | Frequency less that lower limit frequency of an RC element. | Inform Metrohm service. |
| `IO error 59` | Frequency greater that upper limit frequency of an RC element. | Inform Metrohm service. |
| `method memory full` | The memory for the user-defined methods is full. | Delete unused or seldom needed methods. |
| `missing 'end'` | An "`end`" command is missing in the active program. | Insert program step with "`Flag = end`" in the active program. Without an "`end`" command, the program continues to run indefinitely until stopped by <PROG R/S>. |
| `missing 'return'` | In the active loop program there is no "`return`" command so that the program runs only once. | Enter "`return`" command in the program. |
| `multiple 'end'` | Active program contains several "`end`" commands. | Delete superfluous "`end`" commands in the program. |
| `multiple 'return'` | Active program contains several "`return`" commands. | Delete superfluous "`return`" commands in the program. |
| `plot data overflow` | Volume of data too great for graphics plot. | <QUIT> (graphics plot aborted). |
| `program step after 'end'` | The active program contains additional program steps after an "`end`" command which can no longer be executed. | Delete program steps after "`end`" or increase time for "`end`" command. |
| `pump not responding` | No connection to 709 IC Pump or baud rate set wrongly. | Connect 709 IC Pump to 732 IC Detector, switch on pump and remote control with <EXT.> or check baud rate of 709 and 732. |
| `RAM error` | Error in RAM test. | Inform Metrohm service. |

| *Error message* | *Meaning/Causes* | *Rectification* |
|---|---|---|
| `range error #` | Error in internal hardware test. | Inform Metrohm service. |
| `RS error 36` | RS receive error; wrong parity. | <QUIT>, set same parity for both devices. |
| `RS error 37` | RS receive error; wrong stop bit. | <QUIT>, set same stop bit for both devices. |
| `RS error 38` | RS-receive error; overflow (at least 1 character could not be read). | <QUIT>, set same baud rate for both devices, restart sender. |
| `RS error 39` | RS receive error; overflow of internal receive buffer (>82 characters). | <QUIT>. |
| `RS error 40` | RS transmission error; DSR = OFF. Handshake unsatisfactory for more than 1 s. | <QUIT>, check receiver (switched on and ready?). |
| `RS error 41` | RS transmission error; DCD = ON. Handshake unsatisfactory for more than 1 s. | <QUIT>, check receiver (switched on and ready?). |
| `RS error 42` | RS transmission error; CTS = OFF. Handshake unsatisfactory for more than 1 s. | <QUIT>, check receiver (switched on and ready?). |
| `RS error 43` | RS transmission error; transmission of the IC Detector interrupted with XOFF for at least 3 s. | <QUIT> or send XON. |
| `RS error 44` | RS transmission error; the RS232 parameters for the two devices are no longer the same. | <QUIT>, reset RS232 parameters for both devices. |
| `RS error 45` | RS transmission error; the receive buffer of the IC Detector contains an incomplete string ($L_F$ missing), the transmission is thus blocked. | <QUIT> or send $L_F$. |
| `RS error 60 ... 89` | Error in RS232 test. | <QUIT>, check connection between the two RS232 interfaces. |
| `RS error XX at 709` | RS error 36…89 at the RS232 interface "709 IC Pump". | See individual RS errors. |
| `RS error XX at RS 232` | RS error 36…89 at the RS232 interface "RS 232". | See individual RS errors. |
| `sensitivity error #` | Error in internal hardware test. | Inform Metrohm service. |
| `stopped:YY-MM-DD HH:MM` | 709 IC Pump stopped at specified time owing to violation of shutoff limits. | Press the 709 IC Pump keys <EXT.>, <R/S> in succession and then <EXT.> again. |
| `store operation failed` | Storage of the method failed. | Switch instrument off/on. Store method again. If error reappears, inform Metrohm service. |
| `U cell error #` | Error in internal hardware test. | Inform Metrohm service. |

## 5.3.2 Malfunctions and their rectification

If difficulties appear with the IC system during analyses, their causes are best investigated in the order **separating column ® pump ® eluent ® 732/733 IC System**. Several of the malfunctions which may appear are listed in the following table with details of possible causes and countermeasures.

| *Malfunction* | *Cause* | *Rectification* |
|---|---|---|
| **Baseline with high noise level, pulsation** | • Contaminated pump values<br>• Faulty piston seals<br>• Quality of the pump does not suffice for the selected sensitivity | • Clean the valves (see *section 5.1.2*)<br>• Replace the piston seals (see *section 5.1.2*)<br>• Use pulsation dampener, use more powerful pump or lower the sensitivity |
| **Drift of the baseline** | • Thermal equilibrium not yet reached<br>• Leak in system<br>• Evaporation of organic solvent in eluent | • Condition system with heating switched on<br>• Check connections and make leakproof<br>• Ensure better closure of eluent supply vessel |
| **Considerable pressure drop** | • Leak in system | • Check connections and make leakproof |
| **Considerable pressure rise** | • Contamination of the filter in the 6.2821.100 Filter unit PEEK<br>• Contamination of the filter in the 6.2821.000 Filter unit Manufit<br>• Contamination of the column inlet filter<br>• Change of column packing by injection of contaminated samples | • Replace the 6.2821.110 Filter (see *section 2.6.3*)<br>• Clean or replace 6.2821.020 Steel mesh(es)<br>• Clean or replace 6.2821.020 Steel mesh(es)<br>• Regenerate the column (see *section 5.1.1*) or replace column<br>*Note:*<br>*Samples should always be microfiltered.* |
| **Chromatograms with poor resolution, change in the retention times** | • Deterioration in separation efficiency of the IC column | • Regenerate the column (see *section 5.1.1*) or replace column |
| **Extreme peak broadening, splitting (double peaks)** | • Dead volume at the column ends | • Fill column with glass beads (∅ ≤ 100 µm) or replace column |
| **No feed of regeneration or rinsing solution for suppressor** | • Contamination of the filter in the 6.2821.100 Filter unit PEEK<br>• Counterpressure too high in suppressor module | • Replace the 6.2821.110 Filter (see *section 2.6.3*)<br>• Clean or replace suppressor module (see *section 5.2.6¼5.2.8*) |

# 5.4 Diagnostic tests

## 5.4.1 General

The 732 IC Detector and 733 IC Separation Center are very precise and dependable instruments. Thanks to their rugged construction, it is highly unlikely that external mechanical or electrical influences will have any adverse effect on their functions.

Although a fault in the instruments can not be excluded with certainty, the possibility is greater that malfunctions are caused by wrong operation or handling, through improper connections and the operation with third-party devices.

Whatever the case, it is always advisable to localize the fault with the diagnostic tests, which can be performed quickly and simply. The customer need call Metrohm service only when the instrument really has a fault. Further, he can use the results of the specific diagnostic function to provide the service engineer with much more precise information.

In the case of inquiries, always quote the serial number on model plate **10** of the 732 IC Detector (see *Fig. 3*) or on model plate **47** of the 733 IC Separation Center (see *Fig. 5*), program version (see *section 4.4.2*) and if applicable the error message.

### Procedure

The diagnostic menu listed in *section 5.4.2* shows all components for which detailed instructions (diagnostic steps) are available for checking the functionality.

In the case of a possible malfunction, we advise you to perform either the corresponding diagnostic step or all diagnostic steps as a routine step on the instrument.

The reactions of the instruments to the instructions must be compared with the descriptions in the diagnostic step. If the instruments do not show the expected reaction ("No" case), the appropriate diagnostic step must be repeated to exclude operating errors. However, it is highly probable that repeated wrong reactions indicate a malfunction.

### Instruments needed:

*Necessary only if RS232 or remote should be checked:*

- **3.496.8510** Test plug (at '"Remote" socket)
- **3.496.8480** Test plug (at "RS 232" socket)

## 5.4.2 Prepare instruments

- Power off.
- Disconnect all external connections at the 732 IC Detector (except mains cable).
- Power on and immediately press and hold <9> key until

```
initialisation EEPROM?
ENTER>yes  '9'>diagnosis
```

- Press <9> key to open the following diagnostic menu:

| | | | |
|---|---|---|---|
| diagnosis >diag/EEPROM initial. | **Initialize data memory** | [1] | *sectn 5.4.9* |
| diagnosis >diag/run mode | **Parameters for sequence control of "internal test" and "external test"** | [2] | |
| diagnosis >diag/RAM test | **Check working memory (RAM)** | [3] | *sectn 5.4.3* |
| diagnosis >diag/keyboard test | **Check keypad** | [3] | *sectn 5.4.4* |
| diagnosis >diag/display test | **Check display** | [3] | *sectn 5.4.5* |
| diagnosis >diag/RS test | **Check RS232 interfaces** | [3] | *sectn 5.4.6* |
| diagnosis >diag/IO test | **Check remote interfaces** | [3] | *sectn 5.4.7* |
| diagnosis >diag/internal test | **Internal hardware test** | [3] | *sectn 5.4.8* |
| diagnosis >diag/external test | **External hardware test** | [2] | |
| diagnosis >diag/instr.adjustment | **Instrument adjustment** | [2] | |
| diagnosis >diag/instrument number | **Reading and writing the instrument number** | [2] | |
| diagnosis >diag/power on reset | **Power on reset** | [2] | |

Pressing the <9> key again selects the submenus in turn. The individual inquiries of a submenu are accessed using the <ENTER> key, exit is with the <QUIT> key.

[1] Initialization: This diagnostic step is intended for the initialization of the data memory.
[2] Care: These diagnostic steps are reserved for the service engineer and are not described.
[3] Test functions: These diagnostic steps are test functions which the customer can perform.

### 5.4.3 Checking working memory (RAM)

This diagnostic step executes a non-destructive test over the entire area of the RAM content (working memory).

- Prepare instrument for diagnostic test (see *section 5.4.2*).
- If need be, press <9> key repeatedly until

```
diagnosis
>diag/RAM test
```

- <ENTER>

If no faults are found, the display shows:

```
>diag/RAM test
RAM test ok
```

- <ENTER>

```
diagnosis
>diag/keyboard test
```

### 5.4.4 Check keypad

With this diagnostic step all keys of the keypad are checked for functionality.

- Prepare instrument for diagnostic test (see *section 5.4.2*).
- If need be, press <9> key repeatedly until

```
diagnosis
>diag/keyboard test
```

- <ENTER>

```
>diag/keyboard test
```

- Press all keys in succession and check the reaction on the display.

  *The display shows the corresponding matrix code for the pressed key. The matrix code can be seen in the key table (e.g. the following display should appear if the <CONFIG> key has been pressed).*

```
diag/keyboard test
code: 2
```

- The test is quit by pressing the <CLEAR> key twice.

```
diagnosis
>diag/display test
```

**Key table**

| Code | Key | Code | Key |
|---|---|---|---|
| 0 | <9 / METHOD> | 12 | <CLEAR> |
| 1 | <8 / PUMP R/S> | 13 | <SELECT> |
| 2 | <7 / CONFIG> | 14 | <3 / PRINT> |
| 3 | <ZERO> | 15 | <2 / REPORT> |
| 4 | <PARAM> | 16 | <1 / PLOT> |
| 5 | | 17 | |
| 6 | <6 / PROGRAM> | 18 | <ENTER> |
| 7 | <5 / EVENT> | 19 | <QUIT> |
| 8 | <4 / ZERO OFF> | 20 | <-/+ / ➔> |
| 9 | <PROG R/S> | 21 | <. / ➔> |
| 10 | <FULL SCALE> | 22 | <0 / MARK> |
| 11 | | 23 | |

## 5.4.5 Check display

This diagnostic step is used to check all light emitting diodes and the display for functionality.

- Prepare instrument for diagnostic test (see *section 5.4.2*).
- If need be, press <9> key repeatedly until

```
diagnosis
>diag/display test
```

- <ENTER>

  *After the <ENTER> key has been pressed, the program automatically runs through a test sequence for a visual check on the light emitting diodes and the display.*

  ⇒ *The light emitting diodes for OVERLOAD, THERMOSTAT, ZERO and PROG R/S are switched on for a certain time.*

  Þ *Power on test pattern (each pixel active) appears.*

  ⇒ *Both lines of the display are cleared.*

  ⇒ *Both lines of the display are written to with the characters "#", "H" and finally with "I".*

  ⇒ *Both lines are written to from right to left with the continuous moving display „0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ".*

  Þ *The light emitting diodes for OVERLOAD, THERMOSTAT, ZERO and PROG R/S flash in succession for a brief time.*

- The test sequence can be held by pressing any key (with the exception of <9>) and restarted.
- The test is quit with the <9> key.

```
diagnosis
>diag/RS test
```

### 5.4.6 Check RS232 interfaces

With this diagnostic step all outputs and inputs of the two RS232 interfaces **16** "RS 232" and **15** "709 IC Pump" can be checked for functionality.

- Prepare instrument for diagnostic test (see *section 5.4.2*).
- If need be, press <9> key repeatedly until

```
diagnosis
>diag/RS test
```

- <ENTER>

```
>diag/RS test
>diag/RS test/RS232
```

- <ENTER>

```
>diag/RS test/RS232
RS connector?
```

- Without switching off the instrument, plug the **3.496.8480** Test plug into socket "RS232".
- <ENTER>

  *The test runs automatically. If no fault is found, the following appears:*

```
>diag/RS test/RS232
RS test ok
```

- Remove test plug and <ENTER>.

```
>diag/RS test
>diag/RS test/709 Pump
```

- <ENTER>

```
>diag/RS test/709 Pump
RS connector?
```

- Without switching off the instrument, plug the **3.496.8480** Test plug into socket "709 IC Pump".
- <ENTER>

  *The test runs automatically. If no fault is found, the following appears:*

```
>diag/RS test/709 Pump
RS test ok
```

- Remove test plug and <ENTER>.

```
diagnosis
>diag/IO test
```

### 5.4.7 Check remote interfaces

This diagnostic step can be used to check all outputs and inputs of the two remote interfaces **17** "Remote" and **14** "733 IC Separation Center" for functionality.

- Prepare instrument for diagnostic test (see *section 5.4.2*).
- If need be, press <9> key repeatedly until

```
diagnosis
>diag/IO test
```

- <ENTER>

```
>diag/IO test
>diag/IO test/remote
```

- <ENTER>

```
>diag/IO test/remote
IO connector?
```

- Without switching off the instrument, plug the **3.496.8510** Test plug into socket "Remote".
- <ENTER>

  *The test runs automatically. If no fault is found, the following appears:*

```
>diag/IO test/remote
IO test ok ..
```

- Remove test plug and <ENTER>.

```
>diag/IO test
>diag/IO test/733 Sep.C.
```

- <ENTER>

```
>diag/IO test/733 Sep.C.
IO connector?
```

- Without switching off the instrument, plug **3.496.8510** Test plug into socket "733 IC Separation Center".
- <ENTER>

  *The test runs automatically. If no fault is found, the following appears:*

```
>diag/IO test/733 Sep.C.
IO test ok ..
```

- Remove test plug and <ENTER>.

```
diagnosis
>diag/internal test
```

### 5.4.8 Internal hardware test

This diagnostic step can be used to check the hardware for measured value acquisition in the 732 IC Detector for functionality. The test is divided into separate tests performed in succession. All these tests are carried out with the possibilities included in the IC Detector and are thus not dependent on working aids such as test plugs or test adapters.

- The instrument must be in operational readiness for the following tests (switched on for at least 15 min).
- Prepare instrument for diagnostic tests (see *section 5.4.2*).
- If need be, press <9> key repeatedly until

```
diagnosis
>diag/internal test
```

- <ENTER>

```
>diag/internal test
>diag/int/U cell
```

#### Check Ucell

With this diagnostic step the voltage generator (generation of the cell voltage) is checked for functionality.

- <ENTER>

*The test runs automatically and lasts ca. 3 min. During this time various measurement results appear in the display, but these should be ignored. If the test discovers results which lie outside the specified tolerance zones, the number of deviations found appears following completion of the test. If all results of the test are within the specified tolerance zones, the following appears:*

```

U cell test ok
```

- <ENTER>

```
>diag/internal test
>diag/int/range
```

#### Check range

This diagnostic step is used to test the range amplifier for functionality.

- <ENTER>

*The test runs automatically and lasts ca. ½ min. During this time various measurement results appear in the display, but these should be ignored. If the test discovers results which lie outside the specified tolerance zones, the number of deviations found appears following completion of the test. If all results of the test are within the specified tolerance zones, the following appears:*

```
range test ok
```

- <ENTER>

```
>diag/internal test
>diag/int/sensitivity
```

### Check sense

With this diagnostic step the sense amplifier is checked for functionality.

- <ENTER>

*The test runs automatically and lasts ca. 2 min. During this time various measurement results appear in the display, but these should be ignored. If the test discovers results which lie outside the specified tolerance zones, the number of deviations found appears following completion of the test. If all results of the test are within the specified tolerance zones, the following appears:*

```
sensitivity test ok
```

- <ENTER>

```
>diag/internal test
>diag/int/DAC coarse
```

### Check CompCoarse

With this diagnostic step the DA converter for the coarse adjustment is checked for functionality.

- <ENTER>

*The test runs automatically and lasts ca. ½ min. During this time various measurement results appear in the display, but these should be ignored. If the test discovers results which lie outside the specified tolerance zones, the number of deviations found appears following completion of the test. If all results of the test are within the specified tolerance zones, the following appears:*

```
DAC coarse test ok
```

- <ENTER>

```
>diag/internal test
>diag/int/DAC fine
```

### Check CompFine

With this diagnostic step the DA converter for the fine adjustment is checked for functionality.

- <ENTER>

  *The test runs automatically and lasts ca. 3 min. During this time various measurement results appear in the display, but these should be ignored. If the test discovers results which lie outside the specified tolerance zones, the number of deviations found appears following completion of the test. If all results of the test are within the specified tolerance zones, the following appears:*

  ```
  err:   0
  DAC fine test ok
  ```

- <ENTER>

  ```
  >diagnosis
  >diag/external test
  ```

## 5.4.9 Initialize data memory

This diagnostic step can be used to write default values to the instrument parameters using the keypad and thus switch the instrument to the original condition. This measure is important with the following two points:

*The setting of certain instrument parameters such as the locking of keys is possible only via RS232, i.e. with the aid of a PC. If such instrument parameters are set and no PC is available to cancel the settings, full use can not be made of the instrument.*

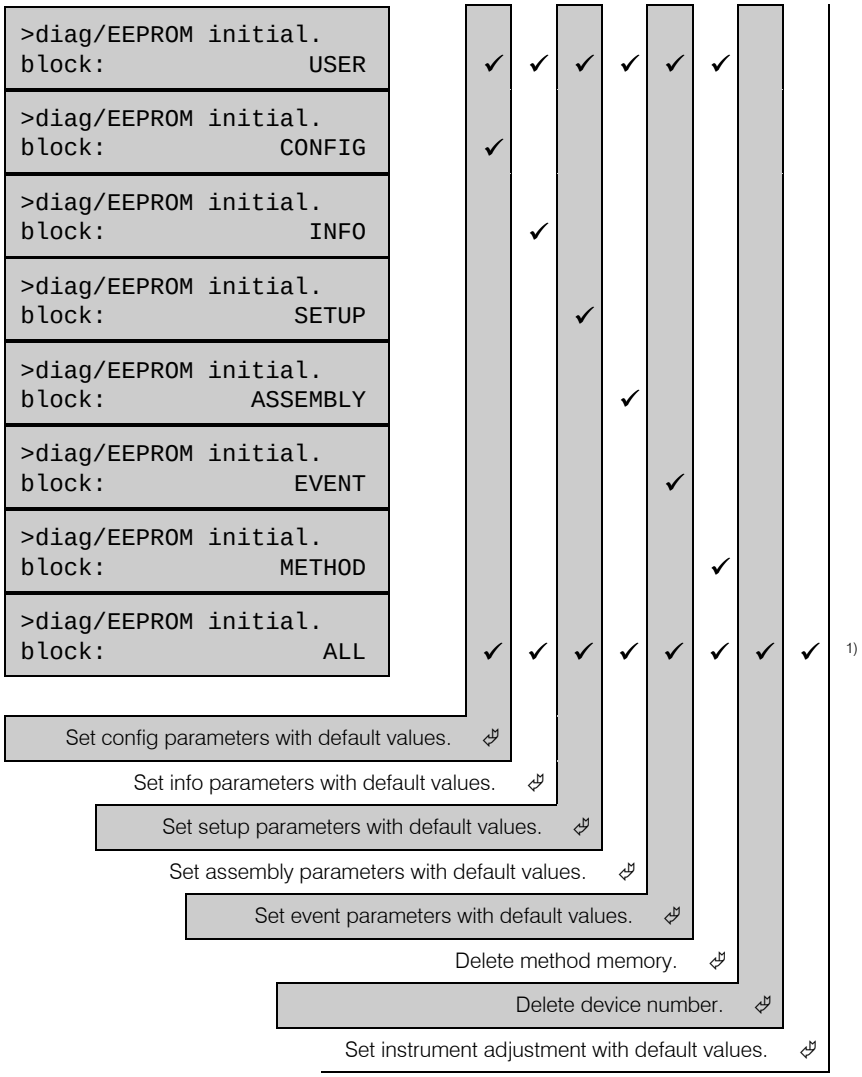
*In rare cases, it is possible that major interference signals such as line spikes and lightning can have an adverse influence on the contents of the data memory. If the contents of the data memory are undefined, this may lead to a system crash.*

With the initialization step, default values can be written into parts of the data memory (EEPROM). Although the adjustment data are retained, the initialization should be performed only if necessary as the stored user data (etc.) are deleted.

- Prepare instrument for diagnostic test (see *section 5.4.2*).
- If need be, press <9> key repeatedly until

  ```
  diagnosis
  >diag/EEPROM initial.
  ```

- Press <ENTER> key to open the following diagnostic menu:




Pressing the <SELECT> key selects the submenus in turn. The individual initialization alternatives are accessed using the <ENTER> key, exit is with the <QUIT> key.

The table shows which parts of the data memory are affected by the corresponding initialization alternatives.

- If need be, press the <SELECT> key repeatedly until the desired initialization alternative appears (such as “USER“)

```
>diag/EEPROM initial.
block:              USER
```

- <ENTER>

  *After the initialization has run automatically, the instrument quits the diagnostic menu and runs a power on reset.*

[1] Care: This initialization alternative is reserved for the service engineer!

# 5.5 Validation / GLP

The requirements of **GLP** (**G**ood **L**aboratory **P**ractice) include a periodic check of analytical measuring instruments with regard to their reproducibility and accuracy using **S**tandard **O**perating **P**rocedures, **SOP**.

The 732 IC Detector and 733 IC Separation Center as part of the complete ion chromatography system, whose most important components also include separating column, pump and evaluation system, must be incorporated in its comprehensive validation.

Testing of the electronic and mechanical function groups of Metrohm instruments can and should be performed as part of a regular service by trained personnel of the manufacturing company (see *section 5.2.1*). All Metrohm instruments are equipped with start-up-test routines which check for perfect functioning of the relevant assemblies when the instrument is switched on. If no error message is displayed, it may be assumed the instrument is operating without faults.

The Metrohm company also supplies its instruments with an integrated diagnostic program (see *section 5.4*) which, in the case of possible malfunctions or faulty behavior, allows the user to check the functioning of certain assemblies and localize the fault. Diagnostic programs can also be integrated in a validation procedure.

# 6 Interfaces

## 6.1 RS232 interfaces

The 732 IC Detector has two RS232 interfaces **15** and **16** (see *Fig. 3*) which have the same features (see *section 6.1.7 – 6.1.9*), but can be used differently.

RS232 interface **16** is reserved for the connection of a PC or a printer (see *section 2.9.4 – 2.9.5*) and allows remote operation of the 732 IC Detector 732 and 733 Separation Center 733 by an attached PC (see *section 6.1.1 – 6.1.6*).

RS232 interface **15** is normally used for the attachment of a 709 IC Pump, but a printer can also be connected in place of the pump (see *section 2.9.6*).

### 6.1.1 General rules for remote control

The 732 IC Detector is equipped with the comprehensive Metrohm remote control language, which allows full control over the instrument via an RS232 interface, i.e. the IC Detector can receive data from an external device or send data to an external device. The 732 IC Detector sends $2\times C_R$ and $L_F$ as the terminator of a requested **data block**. In contrast, $C_R$ and $L_F$ are used as the terminator of a **data line**. On receipt of data from an external device, this must always close its commands with $C_R$ and $L_F$. If more than one command is sent on a line, '**;**' must be used as a delimiter between the individual commands.

The data are grouped logically and readily understandable. For example, to select the dialog language the command

```
&Config.Aux.Dialog"english"
```

must be sent with entry of the boldface characters sufficing, in other words

```
&C.A.D"english"
```

All quantities of the 732 IC Detectors are collected in **groups**. The entries for the configuration, for example, are located in the group

```
&Config
```

The 'Config' group contains sub-groups, e.g. for setting the RS232 interface parameters

```
&Config.RSset
```

or for various settings

```
&Config.Aux
```

The data have a hierarchical structure (tree structure). The quantities which appear in this tree are called **objects** in what follows. The dialog language is that object which is called up with the command

```
&Config.Aux.Dialog
```

Once you are at the desired location in the tree, you can request the value of the object:

```
&Config.Aux.Dialog $Q      Q for query
```

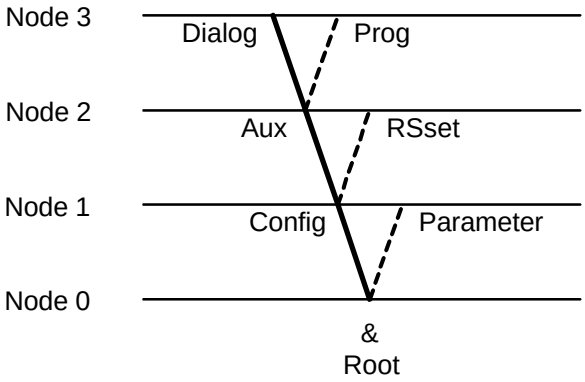
The inquiry '`$Q`' initiates the output of the value on the instrument, in other words the value output is triggered. Entries which begin with the character '`$`' always trigger something and are hence referred to as **triggers** in what follows.

However, values of objects can not only be requested, they can also be modified. Values are always inputted in inverted commas, e.g.

```
&Config.Aux.Dialog"english"
```

### 6.1.2 Call-up of objects

A section from the object tree is shown below:




The following **rules** apply to the call-up of objects:

| ***Rules*** | ***Example*** |
|---|---|
| The root of the tree is designated by '`&`'. | |
| For the call-up of an object, the nodes (levels) of the tree are marked by a point (`.`). | |
| For the call-up of the objects, as many characters as necessary to allow unambiguous allocation of the object suffice. If the call-up is not unambiguous, the first object in the series is identified. | Call up of the dialog language:<br>`&Config.Aux.Dialog`<br>or `&C.A.D` |
| Uppercase and lowercase letters can be used. | `&C.A.D` or `&c.a.d` |
| A value can be assigned to an object. Values are marked at both their beginning and end by inverted commas ("). They can contain maximum 24 ASCII characters. In the case of parameters with specified text expressions (e.g. on, off), only the English expressions may be used. Numeric values can contain up to 6 digits, a negative sign and a decimal point. Numbers with more than 6 digits are not accepted; more than 4 decimal places are rounded off. With numbers <1, leading zeros must be entered. | Entry of the dialog language:<br>`&C.A.D"english"`<br><br>Correct numeric entries:<br>`"0.1"`<br>Incorrect numeric entries:<br>`"1,5"` or `"+3"` or `".1"` |

| *Rules* | *Example* |
|---|---|
| Until a new object is called up, the old object remains in force. | Entry of a different dialog language: `"deutsch"` |
| New objects can be addressed relative to the old object:<br><br>**A leading point** leads one node **forwards** in the tree.<br><br>**More than one leading point** leads one node **backwards** in the tree. n nodes backwards require n+1 leading points. | From the root to the node `'Aux'`: `&C.A`<br><br>Forwards from the node `'Aux'` to `'Prog'`: `.P`<br><br>Jump from node `'Prog'` to the node `'Aux'` and selection of the new object `'Dialog'` at this node: `..D` |
| To return to the root, enter a leading `'&'`. | Switch from node `'Dialog'` via the root to node `'Parameter'`: `&P` |

### 6.1.3 Triggers

Triggers initiate an action at the 732 IC Detector, e.g. sequence start or data transmission. Triggers are marked by the introducer `'$'`.

The following triggers are possible:

| | | |
|---|---|---|
| `$G` | Go | Starts processes, e.g. initiation of the auto-zero function or program start |
| `$S` | Stop | Stops processes |
| `$Q` | Query | Used to request all information from the current node in the tree forwards up to and including the values |
| `$Q.P` | Path | Used to request the path from the root of the tree up to the current node |
| `$Q.H` | Highest Index | Used to request the number of daughter nodes of the current node |
| `$Q.N"i"` | Name | Used to request the name of the daughter node with index i, i = 1...n |
| `$D` | Detail-Info | Used to request detailed status information |
| `$U` | qUit | Used to terminate the data flow of the instrument, e.g. after $Q |

The triggers `'$G'` and `'$S'` are linked to particular objects, see Overview table in *section 6.1.6*.

All other triggers can always be used at all locations in the data tree.

Examples:

Request of the baud rate value: `&Config.RSset.Baud $Q`

Request of all values of the node `'RSset'`: `&Config.RSset $Q`

Request of the path of the node `'RSset'`: `&Config.RSset $Q.P`

Triggering the auto-zero function: `&Zero $G`

Request of the detailed status: `$D`

### 6.1.4 Status messages

To ensure appropriate control of an external control unit is possible, it must also be possible to request status conditions which provide information on the status of the 732 IC Detector. The output of a status message is triggered by the trigger `'$D'.` Status messages comprise the global status `'$R'` and the detailed status messages listed below, which can also appear in combination, e.g. `'$R.Cond.ProgWait'`. If a fault appears, the error message is also appended to the status message, e.g. `'$R.Cond.ZeroOK;E42'`.

| | |
|---|---|
| `$R` | Ready: The 732 IC Detector is ready to measure. |
| `.Cond` | Basic status of the conductivity measurement |
| `.Zero` | Auto-zero function active, value not yet valid |
| `.ZeroOK` | Auto-zero function active, value valid |
| `.Overflow` | The measured value is 50…80% outside the full-scale range |
| `.Background` | The measured value is more than 80% outside the full-scale range |
| `.ProgWait` | Program active (can be started) |
| `.ProgGo` | Program running |
| `.ProgEnd` | Program ended |
| `.ProgTest` | Program test mode active |
| `.Input` | Change in the signal of an input line |
| `.Output` | Change in the signal of an output line |
| `.Diagnosis` | Instrument in diagnostic status |

### 6.1.5 Error messages

Error messages 'EXXX' are appended to the status message and separated from this by a ';'.

| *Error* | *Meaning* | *Exit/Corrective action* |
|---|---|---|
| E28 | Wrong object call-up. | Correct path. |
| E29 | Wrong value. | Enter correct value or new path. |
| E30 | Wrong trigger. | Enter correct trigger or new path. |
| E36 | RS232 receive error; parity. | <QUIT>, set same parity for both devices. |
| E37 | RS232 receive error; stop bit. | <QUIT>, set same stop bit for both devices. |
| E38 | RS232 receive error; overflow (at least 1 character could not be read). | <QUIT>, set same baud rate for both devices, restart sender. |
| E39 | RS232 receive error; overflow of internal receive buffer (>82 characters). | <QUIT>. |
| E40 | RS232 send error; DSR=OFF. Handshake not answered for longer than 1 s. | <QUIT>, check receiver (switched on and ready?). |
| E41 | RS232 send error; DCD=ON. Handshake not answered for longer than 1 s. | <QUIT>, check receiver (switched on and ready?). |
| E42 | RS232 send error; CTS=OFF. Handshake not answered for more than 1 s. | <QUIT>, check receiver (switched on and ready?). |
| E43 | RS232 send error; transmission of the IC Detector was interrupted with XOFF for at least 3 s. | <QUIT> or send XON. |
| E44 | RS232 send error ; the RS parameters are no longer the same for both devices. | <QUIT>, reset RS parameters for both devices. |
| E45 | RS232 send error; the receive buffer of the IC Detector contains an incomplete string ($L_F$ missing), the transmission is thus blocked. | <QUIT> or send $L_F$. |
| E50…E59 | Error in IO test. | <QUIT>, inform Metrohm Service. |
| E60…E89 | Error in RS232 test. | <QUIT>, check connection between the RS interfaces. |
| E200 | Instrument adjustment invalid. | Inform Metrohm Service. |
| E202 | Wrong entry via RS232 remote control. | Enter correct value, correct trigger or new path. |
| E240 | Error in storage of the EEPROM blocks. | <QUIT>, re-enter all values. |

### 6.1.6 Remote control commands

The remote control tree can be divided into the following main branches:

| | |
|---|---|
| **&** | **Root** |
| ├ **C**onfig | Instrument configuration |
| ├ **M**ethods | Methods |
| ├ **P**arameter | Parameters |
| ├ **Pr**ogram | Program |
| ├ **S**electEvent | Events |
| ├ **Z**ero | On/off switching of auto-zero |
| ├ **Ma**rker | Triggering marking signal |
| ├ **Pl**ot | Start/stop graphics plot |
| ├ **Pri**nt | Start/stop measured value printout |
| ├ **I**nfo | Instrument information |
| ├ **Set**up | Settings of operating mode |
| ├ **A**ssembly | Data of the assemblies |
| └ **D**iagnosis | Diagnostic tests |

The following table lists all objects of the remote control tree. For the unambiguous designation of the objects, the boldface characters suffice. The meaning of the individual object is described here only in brief, for more detailed information please refer to *section 4*. The default values of the objects are printed in boldface.

| *Object* | *Meaning* | *Entry range/Selection* |
|---|---|---|
| **&C**onfig | **Instrument configuration** | |
| ├ **. D**etector | **Conductivity detector** | |
| │ ├ **. T**hermostat | Operating temperature of conductivity cell | 25, 30, **35**, 40, 45°C, off |
| │ ├ **. Z**eroUnit | Unit for display of auto-zero value | ***µS/cm***, %fs, mV |
| │ └ **. C**ellConst | Cell constant of conductivity cell | 13.0…**16.7**…21.0 /cm |
| ├ **. P**rinter | **External printer** | |
| │ ├ **. I**d1 | 1st line of printout header | 18 ASCII characters |
| │ ├ **. Id2** | 2nd line of printout header | 18 ASCII characters |
| │ ├ **. P**rintHead | Output of printout header: once, always, never | **once**, always, off |
| │ ├ **. D**ateTime | Output of date and time in printout header | **on**, off |
| │ └ **. S**endTo | Selection of printer driver | **IBM**, Epson, Seiko, Citizen, HP |
| ├ **. PrintM**easVal | **Measured value printout** (function same as <PRINT> key) | $G, $S |
| │ ├ **. P**rintCrit | Criterion for measured value printout: immediately (single value), time (continuous output), off | **immed.**, time, off |
| │ ├ **. T**ime | Timed output of measured values | |
| │ │ ├ **. I**nterval | Time interval for output of measured values | 0.4…**1.0**…99999 s |
| │ │ └ **. S**topTime | Stop time (off = infinite) | 1…999 min, **off** |
| │ └ **. D**ateTime | Output of date and time of measured value | on, **off** |

| *Object* | *Meaning* | *Entry range/Selection* |
|---|---|---|
| **. A**ux | **General instrument settings** | |
| **. R**unNo | Run number (automatically incremented by 1 after every determination) | **0**…999, off |
| **. C**ycles | Number of cycles in loop programs | **1**…999 |
| **. CE**vent | Settings for events | |
| **. C**Eenable | Perform events during running program | on, **off** |
| **. S**et | Setting of date and time | $G, $S |
| **. D**ate | Date | YYYY–MM–DD |
| **. T**ime | Time | HH:MM:SS |
| **. D**ialog | Dialog language | **english**, deutsch, francais, español |
| **. De**vLabel | Device label | 8 ASCII characters |
| **. P**rog | Number of program version | read only |
| **. B**eeper | Beeper | |
| **. S**tatus | Status: on, error only, off | **on**, only error, off |
| **. R**epeat | Repeat time for error message | 5…**60**…999 s, off |
| **. R**Sset | **RS232 interface** | |
| **. B**aud | Baud rate in bit/s | **9600**, 4800, 2400, 1200, 600, 300 |
| **. D**ataBit | Data bits | 7, **8** |
| **. S**topBit | Stop bits | **1**, 2 |
| **. P**arity | Parity: none, odd, even | **none**, odd, even |
| **. H**andsh | Handshake: hardware simple, hardware full, software character, software line, none | **HWs**, HWf, SWchar, SWline, none |
| **. RSSet7**09 | **2nd RS232 interface "709 IC Pump"** | |
| **. S**tatus | Connection in operation without 709 IC Pump | **printer**, off |
| **. 7**09 | Connected: 709 IC Pump | |
| **. B**aud | Baud rate in bit/s | **9600**, 4800, 2400, 1200, 600, 300 |
| **. P**rinter | Connected: printer | |
| **. B**aud | Baud rate in bit/s | **9600**, 4800, 2400, 1200, 600, 300 |
| **. D**ataBit | Data bits | 7, **8** |
| **. S**topBit | Stop bits | **1**, 2 |
| **. P**arity | Parity: none, odd, even | **none**, odd, even |
| **. H**andsh | Handshake: hardware simple, hardware full, software character, software line, none | **HWs**, HWf, SWchar, SWline, none |
| **. S**epCenter | **733 IC Separation Center** | |
| **. C**onfig | Display of the configuration | read only |
| **. Cont**rol | Control: without restriction, via 732 only | **no restriction**, 732 only |
| **. A**Valve | Injection valve A | |
| **. S**tatusA | Display of valve setting: inject, fill | read only |
| **. T**riggerA | Switching the valve | inject, fill |
| **. B**Valve | Injection valve B | |
| **. S**tatusB | Display of the valve setting: inject, fill | read only |
| **. T**riggerB | Switching the valve | inject, fill |
| **. S**uppressor | Suppressor module | |
| **. A**utostep | Automatic triggering of "step" | **fill**, inject, off |
| **. S**tatus | Display of the suppressor setting: in position or undefined | read only |
| **. T**rigger | Switching the suppressor | **---**, step |

| *Object* | *Meaning* | *Entry range/Selection* |
|---|---|---|
| **&M**ethods | **Methods** | |
| . **F**reeMemory | **Free memory** (1…9) | read only |
| . **R**ecall | **Load method** | $G |
| . **N**ame | Method name | 8 ASCII characters |
| . **S**tore | **Store method** | $G |
| . **N**ame | Method name | 8 ASCII characters |
| . **D**elete | **Delete method** | $G |
| . **N**ame | Method name | 8 ASCII characters |
| . **A**llDelete | **Delete all methods** | $G |
| **&P**arameter | **Parameters** | |
| . **D**etector | **Conductivity detector** | |
| . **R**ange | Measurement range | 100, 200, 500 µS/cm, **1**, 2, 5, 10 mS/cm |
| . **F**ullScale | Full-scale range (operating range) | 0.05 µS/cm…**1**…10 mS/cm |
| . **T**empCoeff | Temperature coefficient | 1.5, **2.5** %/°C |
| . **A**nalogOut | **Analog output** | |
| . **P**olarity | Polarity | **+**, – |
| . **O**ffset | Zero point shift in % of full-scale range | **0**, 10, 50 %fs |
| . **D**amping | Damping | on, **off** |
| . **P**lotPara | **Graphics plot** | |
| . **A**utostart | Automatic start of graphics plot | on, **off** |
| . **I**nterval | Time interval for graphics plot | 0.4…**1.0**…99999 s |
| . **T**imeScale | Time scale (paper speed) | 0.1, 0.2, 0.5, 1, 2, 5, **10**, 20, 60, 120 mm/min |
| . **TL**abel | Labeling of time axis: relative, absolute | **rel**, abs |
| . **S**topTime | Stop time for graphics plot | 1…999 min, **off** |
| . **L**eft | Left boundary for conductivity axis | –2000…**0**…2000 µS/cm, –2000…0…2000 mS/cm, –2…0…2 S/cm |
| . **R**ight | Right boundary for conductivity axis | –2000…0…**10**…2000 µS/cm, –2000…0…2000 mS/cm, –2…0…2 S/cm |
| . **Pu**mp709 | **709 IC Pump** | |
| . **F**low | Flow rate | 0.01…**0.50**…5.00 mL/min |
| . **P**max | Maximum shutoff pressure | 0.1…**10.0**…50 MPa |
| . **Pmi**n | Minimum shutoff pressure | **0.0**…50 MPa |
| . **Flowc**orr | Correction factor for flow rate | 0.90…**1.00**…1.10 |
| **&Pr**ogram | **Program** | $G, $S |

| *Object* | *Meaning* | *Entry range/Selection* |
|---|---|---|
| **. P**arameter | **General program parameters** | |
| **. T**ype | Program type: cycle, remote, inject | **cycle**, remote, inject |
| **. C**ycle | Loop program | |
| **. N**o | Number of cycles | **1**…999 |
| **. S**tatus | Program status: inactive, active, test | **disabled**, enabled, test |
| **. E**dit | **Edit program** | |
| **. S**elect | Selection of program steps (max. 20) | |
| **. 1** | Program step 1 | |
| **. T**ime | Time for program step 1 | **x.x**, 0.0…999.9 min |
| **. A**ction | Actions of program step 1 | |
| **. F**lag | Program flag | **---**, return, reset, end |
| **. FS**Change | Change full-scale range | **---**, on |
| **. R**ange | Reset measurement range | **100**, 200, 500 µS/cm, 1, 2, 5, 10 mS/cm |
| **. Fu**llScale | Reset full-scale range | 0.05…**100**…999 µS/cm, 1…10 mS/cm |
| **. Z**ero | On/off switching of auto-zero | **---**, on, off |
| **. P**olarity | Change polarity | **---**, +, – |
| **. M**ark | Trigger marking signal | **---**, on |
| **. V**alveA | Switch injection valve A | **---**, fill, inject |
| **. ValveB** | Switch injection valve B | **---**, fill, inject |
| **. S**uppressor | Switch suppressor module | **---**, step |
| **. Re**mote | Set remote output lines 1…8: ✳ (leave unchanged), 0 (off, inactive, open), 1 (on, active, 0 V) | ✳, 0, 1 |
| **. Pu**mpRS | On/off switching of pump drive | **---**, on, off |
| **. Flo**w | Change flow rate | **---**, 0.01…5.00 mL/min |
| **. Pm**ax | Change maximum shutoff pressure | **---**, 0.1…50 MPa |
| **. Pmi**n | Change minimum shutoff pressure | **---**, 0.0…50 MPa |
| **. 20** | Program step 20 | |
| **. T**ime | Time for program step 20 | **x.x**, 0.0…999.9 min |
| **. A**ction | Actions of program step 20 | |
| : | *see Program step 1* | |
| **. D**eleteAll | **Delete all program steps** possible only in program status "disabled" | $G |
| **&S**electEvent | **Events** | |
| **. 1** | **Event 1** | |
| **. D**ate | Date/time or only time (daily) for event 1 | YY-MM-DD HH:MM:SS |
| **. A**ction | Actions of event 1 1 | |
| **. F**SChange | Change full-scale range | **---**, on |
| **. R**ange | Reset measurement range | **100**, 200, 500 µS/cm, 1, 2, 5, 10 mS/cm |
| **. Fu**llScale | Reset full-scale range | 0.05…**100**…999 µS/cm, 1…10 mS/cm |
| **. Z**ero | On/off switching of auto-zero | **---**, on, off |
| **. P**olarity | Change polarity | **---**, +, – |

| *Object* | *Meaning* | *Entry range/Selection* |
|---|---|---|
| **. M**ark | Trigger marking signal | **---**, on |
| **. A**Valve | Switch injection valve A | **---**, fill, inject |
| **. B**Valve | Switch injection valve B | **---**, fill, inject |
| **. S**uppressor | Advance suppressor module | **---**, step |
| **. Re**mote | Set remote output lines 1…8:<br>* (leave unchanged), 0 (off, inactive, open),<br>1 (on, active, 0 V) | ✶, 0, 1 |
| **. Pr**ogRS | Start/stop program | **---**, on, off |
| **. Pu**mpRS | On/off switching of pump drive | **---**, on, off |
| **. Fl**ow | Change flow rate | **---**, 0.01…5.00 mL/min |
| **. Pm**ax | Change maximum shutoff pressure | **---**, 0.1…50 MPa |
| **. Pmi**n | Change minimum shutoff pressure | **---**, 0.0…50 MPa |
| **. 4** | **Event 4** | |
| **. D**ate | Date/time or only time (daily) for event 4 | YY-MM-DD HH:MM:SS |
| **. A**ction | Actions of event 4 | |
| : | *see Event 1* | |
| **&Z**ero | **Start/stop of the auto-zero function** | $G, $S |
| **. R**efValue | Auto-zero ref. value (compensated conductivity) | read only |
| **&Ma**rker | **Triggering a marking signal** | $G, $S |
| **&Pl**ot | **Start/stop of the graphics plot** | $G, $S |
| **. S**tate | Status of the graphics plot: on, off | read only |
| **&Pri**nt | **Start/stop of the measured value printout** | $G, $S |
| **. S**tate | Status of the measured value printout: on, off | read only |
| **&I**nfo | **Instrument information** | |
| **. R**eport | **Send formatted reports** | $G |
| **. S**elect | Selection of the report | **all**, config, event, method, method list, param, program, pump |
| **. A**ctualInfo | **Current information** | |
| **. I**nputs | **Remote inputs** | |
| **. S**tate | Status of the input lines of the two remote interfaces "733 IC Separation Center" and "Remote" in byte form<br>(1=on, low, active; 0=off, high, inactive): | read only |

"733 IC Sep. Center " "Remote"

| n | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pin | 21 | 9 | 22 | 10 | 23 | 11 | 24 | 12 | 21 | 9 | 22 | 10 | 23 | 11 | 24 | 12 |

$$Status = \sum_{n=0}^{14} 2^n - 2^{15}$$

Example:

| 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Status $= 2^0 + 2^2 + 2^6 + 2^{12} - 2^{15} =$
$= 1 + 4 + 64 + 4096 - 32768 = -28603$

| Object | Meaning | Entry range/Selection |
|---|---|---|
| **. C**hange | Change in the status of the input lines since the last "clear", in byte form (1 = change, 0 = no change, see above) | read only |
| **. Cl**ear | Reset "change" byte to 0 | $G |
| **. O**utputs | **Remote outputs** | |
| **. S**tate | Status of the output lines of the two remote interfaces "733 IC Separation Center" and "Remote" in byte form: 1=on, low, active; 0=off, high, inactive | read only |
| **. C**hange | Change in the status of the output lines since the last "clear", in byte form (1 = change, 0 = no change, see above) | read only |
| **. Cl**ear | Reset "change" byte to 0 | $G |
| **. M**easValue | **Measured values** | |
| **. C**onductivity | Current measured value in S/cm | read only |
| **. B**ackground | Absolute conductivity in S/cm | read only |
| **. R**unTime | Run time in min | read only |
| **. P**ump709 | **709 IC Pump** | |
| **. S**tate | Status: ready, running, stopped, unknown | read only |
| **. P**actual | Current pressure in MPa | read only |
| **. E**rror | Error status: no error, stopped: YY-MM-DD XX:MM (stopped with date) | read only |
| **. Met**hod | **Method in working memory** | |
| **. N**ame | Method name | read only |
| **. S**tatus | Status: original, modified | read only |
| **. I**ndex | Method index (1…10) | read only |
| **. D**isplay | **Display** | |
| **. S**elect | Status display: full scale, absolute, prog.type, prog.step, method, date | read only |
| **. L**1 | Display in LCD line 1 | read only |
| **. L2** | Display in LCD line 2 | read only |
| **. LE**D | Status of the LED displays in byte form: 1=on, 0=off | |

"733 IC Sep. Center " "Remote"

| n | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pin | 5 | 18 | 4 | 17 | 3 | 16 | 1 | 2 | 5 | 18 | 4 | 17 | 3 | 16 | 1 | 2 |
| Output | | | | | | | 8 | 7 | 6 | | 1 | 2 | | 3 | | 4 | 5 |

$$Status = \sum_{n=0}^{14} 2^n - 2^{15}$$

Example:

| | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Status $= 2^2 + 2^8 + 2^{12} - 2^{15} =$
$= 4 + 256 + 4096 - 32768 = -28412$

| n | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| LED | OVERLOAD | THERMOSTAT | PROG R/S | ZERO |

$$Status = \sum_{n=0}^{3} 2^n$$

Example:

| | 0 | 1 | 1 | 1 |
|---|---|---|---|---|

Status $= 2^1 + 2^2 + 2^3 = 2 + 4 + 8 = 14$

| *Object* | *Meaning* | *Entry range/Selection* |
|---|---|---|
| **&Set**up | **Operating mode** | |
| **. I**dReport | **Send identification before report**<br>Elements of the message:<br>«Space (dec 32), ', report identification»<br>" 'co" config<br>" 'ev" event<br>" 'me" method<br>" 'ml" method list<br>" 'cp" parameter<br>" 'pr" program<br>" 'pu" pump<br>" 'mp" measured value output with <PRINT> | on, **off** |
| **. K**eycode | **Send key code of pressed keys**<br>Elements of the message:<br>«Space (dec 32), # or ù, two-place code»<br>0 9 (METHOD) 12 CLEAR<br>1 8 (PUMP R/S) 13 SELECT<br>2 7 (CONFIG) 14 3 (PRINT)<br>3 ZERO 15 2 (REPORT)<br>4 PARAM 16 1 (PLOT)<br>6 6 (PROGRAM) 18 ENTER<br>7 5 (EVENT) 19 QUIT<br>8 4 (ZERO OFF) 20 –/+ (→)<br>9 PROG R/S 21 . (←)<br>10 FULL SCALE 22 0 (MARK) | on, **off** |
| **. T**ree | **Definition of the response to $Q** | |
| **. S**hort | Path names are sent with just the required number of characters (boldface characters) | on, **off** |
| **. C**hangedOnly | Only path names and their values which have been edited once are sent. | on, **off** |
| **. Tra**ce | **Send path and value on changes**<br>Element of the change message:<br>«Space (dec 32), path, "value"» | on, **off** |
| **. L**ock | **Lock functions** | |
| **. K**eyboard | Lock all keys | on, **off** |
| **. C**onfig | Locking of <CONFIG> key | on, **off** |
| **. E**vent | Locking of <EVENT> key | on, **off** |
| **. F**ullScale | Locking of <FULL SCALE> key | on, **off** |
| **. M**ark | Locking of <MARK> key | on, **off** |
| **. Me**thod | Locking of <METHOD> key | on, **off** |
| **. P**aram | Locking of <PARAM> key | on, **off** |
| **. Pl**ot | Locking of <PLOT> key | on, **off** |
| **. Pr**int | Locking of <PRINT> key | on, **off** |
| **. Pro**gRS | Locking of <PROG R/S> key | on, **off** |
| **. Progra**m | Locking of <PROGRAM> key | on, **off** |
| **. Pu**mpRS | Locking of <PUMP R/S> key | on, **off** |
| **. R**eport | Locking of <REPORT> key | on, **off** |
| **. S**elect | Locking of <SELECT> key | on, **off** |
| **. Z**ero | Locking of <ZERO> key | on, **off** |
| **. Zeroo**ff | Locking of <ZERO OFF> key | on, **off** |

| *Object* | *Meaning* | *Entry range/Selection* |
|---|---|---|
| **. Methods** | Locking of functions of the <METHOD> key | |
| **. R**ecall | Locking of the "load" functions | on, **off** |
| **. S**tore | Locking of the "store" functions | on, **off** |
| **. D**elete | Locking of the "delete" functions | on, **off** |
| **. D**isplay | Locking of the LCD (measured values are no longer displayed) | on, **off** |
| **. Rem**ote | Locking of all remote lines | on, **off** |
| **. A**utoInfo | **Automatic messages on change**<br>*Note*: *While the settings of the AutoInfo branch are stored after saving with* "`&Setup.Save`"*, they are not initialised when the instrument is switched on again. They do not become active until one of the settings has been reset.* | |
| **. M**essage | Elements of the automatic message:<br>«Space (dec 32), !, instrument designation, message from sub-nodes, date (optional), time (optional)»<br>Example: « `!732B".R;.0"95-10-25 16:30:47`» | |
| **. D**ateTime | Output of date and time of appearance | on, **off** |
| **. E**rror | Message "E" on error | on, **off** |
| **. R**eady | Message "R" on attainment of basic status and on program end | on, **off** |
| **. S**topped | Message "S" on stop of a sequence | on, **off** |
| **. W**ait | Message "W" on entry into wait status | on, **off** |
| **. P**owerOn | Message "P" when instrument switched on | on, **off** |
| **. I**nputs | Message "I" on change in an input line | on, **off** |
| **. O**utputs | Message "O" on change in an output line | on, **off** |
| **. S**ave | **Saving of all parameters**<br>(without saving the parameters changed by remote control will be lost when the instrument is switched off) | $G |
| **. In**strNo | **Instrument number** | |
| **. V**alue | Serial number | 8 ASCII characters |
| **. Int**erface | **Interfaces** | |
| **. O**utputAssign | Setting of the remote output lines | |
| **. R**emOut | Basic settings for remote output lines 1…8 when instrument switched on:<br>1=on, low, active; 0=off, high, inactive | **00000000**…11111111 |
| **. I**nputAssign | Assignment of the remote input lines (details, see *section 6.2.1*) | |
| **. P**rogRS | Start/stop program (= <PROG R/S>) | **1**…15 |
| **. Pu**mpRS | Start/stop 709 IC Pump (= <PUMP R/S>) | 1…**2**…15 |
| **. F**illA | Switch injection valve A to "FILL" | 1…**4**…15 |
| **. I**njectA | Switch injection valve A to "INJECT" | 1…**8**…15 |
| **. FillB** | Switch injection valve B to "FILL" | 1…**3**…15 |
| **. InjectB** | Switch injection valve B to "INJECT" | 1…**12**…15 |
| **. R**eport | Trigger report (=<REPORT> key) | 1…**5**…15 |
| **. Z**ero | Switch on auto-zero (=<ZERO> key) | 1…**6**…15 |

| *Object* | *Meaning* | *Entry range/Selection* |
|---|---|---|
| . **M**ark | Trigger marking signal (=<MARK> key) | 1…**7**…15 |
| . **Zeroo**ff | Switch off auto-zero (=<ZERO OFF> key) | 1…**9**…15 |
| . **Pl**ot | Trigger graphics plot (=<PLOT> key) | 1…**10**…15 |
| . **Po**larity | Switch polarity at analog output | 1…**11**…15 |
| . **S**elect | Select (=<SELECT> key) | 1…**13**…15 |
| . **Q**uit | Quit (=<QUIT> key) | 1…**14**…15 |
| . **E**nter | Enter (=<ENTER> key) | 1…**15**…15 |
| . **G**raphics | General graphics parameters | |
| . **G**rid | Grid lines on graphics output | on, **off** |
| . **F**rame | Frame on graphics output | on, **off** |
| . **R**ecorder | Setting of printout | |
| . **W**idth | Relative width of printout | 0.4…**0.8**…1.0 |
| . **P**eripherals | Peripheral instruments | |
| . **W**ith733 | Operation with 733 IC Separation Center | **on**, off |
| . **With70**9 | Operation with 709 IC Pump | **on**, off |
| **&A**ssembly | **Basic elements of the assembly** | |
| . **M**eas | **Measurement** | |
| . **S**tate | On/off switching of measurement | **on**, off |
| . **O**utputs | **Remote lines** | |
| . **S**mplX | Activate (on) or deactivate (off) remote output lines | **on**, off |
| . **A**utoEOD | Automatic output of EOD on program end and "return" with loop programs | **on**, off |
| . **Se**tLines | Set remote outputs 1…16:<br>Interface "709 IC Pump": outputs 1…8<br>Interface "Remote": outputs 9…16<br>active setting of a static signal<br>inactive resetting of the static signal<br>pulse output a pulse (length ca. 150 ms)<br>off do not set line | $G |
| . **L1** | Signal of output line 1 (pin 5) | active, inactive, pulse, **off** |
| . **L2** | Signal of output line 2 (pin 18) | active, inactive, pulse, **off** |
| . **L3** | Signal of output line 3 (pin 4) | active, inactive, pulse, **off** |
| . **L4** | Signal of output line 4 (pin 17) | active, inactive, pulse, **off** |
| . **L5** | Signal of output line 5 (pin 3) | active, inactive, pulse, **off** |
| . **L6** | Signal of output line 6 (pin 16) | active, inactive, pulse, **off** |
| . **L7** | Signal of output line 7 (pin 1) | active, inactive, pulse, **off** |
| . **L8** | Signal of output line 8 (pin 2) | active, inactive, pulse, **off** |
| . **L9** | Signal of output line 9 (pin 5) | active, inactive, pulse, **off** |
| . **L10** | Signal of output line 10 (pin 18) | active, inactive, pulse, **off** |
| . **L11** | Signal of output line 11 (pin 4) | active, inactive, pulse, **off** |
| . **L12** | Signal of output line 12 (pin 17) | active, inactive, pulse, **off** |
| . **L13** | Signal of output line 13 (pin 3) | active, inactive, pulse, **off** |
| . **L14** | Signal of output line 14 (pin 16) | active, inactive, pulse, **off** |
| . **L15** | Signal of output line 15 (pin 1) | active, inactive, pulse, **off** |
| . **L16** | Signal of output line 16 (pin 2) | active, inactive, pulse, **off** |
| . **R**esetLines | Set remote outputs 1…16 to "off" | $G |

| *Object* | *Meaning* | *Entry range/Selection* |
|---|---|---|
| **&D**iagnosis | **Diagnostic tests** | |
| . **E**EPROMInit | **Initialize data memory** | $G |
| . **B**lockSelect | Selection of blocks to be initialized:<br>USER All blocks except instrument adjustment and instrument number<br>CONFIG Block &Config<br>INFO Block &Info<br>SETUP Block &Setup<br>ASSEMBLY Block &Assembly<br>EVENT Block &SelectEvent<br>METHOD Blocks &Parameter and &Program<br>ALL All blocks incl. instrument adjustment (security code necessary) | **USER**, CONFIG, INFO, SETUP, ASSEMBLY, EVENT, METHOD, ALL |
| . **R**unMode | **Parameters for sequence control** | |
| . **R**eport | Output of a diagnostic report on printer | on, **off** |
| . **S**top | Stop after error | on, **off** |
| . **R**AMTest | **Check working memory** | $G |
| . **K**eyTest | **Check keypad** | $G, $S |
| . **D**isplayTest | **Check display** | $G, $S |
| . **RS**Test | **Check RS232 interfaces**<br>(possible only with 3.496.8480 Test plug, see *section 5.4.6*) | |
| . **R**S232 | Test of "RS232" interface | $G, $S |
| . **I**CPump | Test of "709 IC Pump" interface | $G, $S |
| . **I**OTest | **Check remote interfaces**<br>(possible only with 3.496.8510 Test plug, see *section 5.4.7*) | |
| . **R**emote | Test of "Remote" interface | $G, $S |
| . **S**epCent | Test "733 IC Separation Center" interface | $G, $S |
| . **I**ntTest | **Internal hardware test** | |
| . **U**cellTest | Check voltage generator | $G, $S |
| . **R**angeTest | Check range amplifier | $G, $S |
| . **S**enseTest | Check sense amplifier | $G, $S |
| . **D**ACCoarse | Check DA converter for coarse adjustment | $G, $S |
| . **DACF**ine | Check DA converter for fine adjustment | $G, $S |
| . **E**xtTest | **External hardware test** | |
| . **L**owpassTest | Check low-pass function | $G, $S |
| . **O**ffsetTest | Check offset | $G, $S |
| . **P**olarTest | Check polarity | $G, $S |
| . **T**CoeffTest | Check temperature coefficient | $G, $S |
| . **F**reqTest | Check frequency | $G, $S |
| . **Th**ermostatTest | Check thermostat | $G, $S |

| *Object* | *Meaning* | *Entry range/Selection* |
|---|---|---|
| . **S**imulateKey | **Simulate keystroke**<br>0 9 (METHOD) 12 CLEAR<br>1 8 (PUMP R/S) 13 SELECT<br>2 7 (CONFIG) 14 3 (PRINT)<br>3 ZERO 15 2 (REPORT)<br>4 PARAM 16 1 (PLOT)<br>6 6 (PROGRAM) 18 ENTER<br>7 5 (EVENT) 19 QUIT<br>8 4 (ZERO OFF) 20 –/+ (→)<br>9 PROG R/S 21 . (←)<br>10 FULL SCALE 22 0 (MARK) | 0…22 |
| . **A**djust | **Instrument adjustment**<br>(security code necessary) | $G |
| . **Ins**trNo | **Serial number**<br>(accessible by remote control only under &Setup.InstrNo) | |
| . **P**owerOn | **Simulation "Power on "** | $G |

### 6.1.7 Data transmission protocol

The two RS232 interfaces of the 732 IC Detectors are configured as DTE (Data Terminal Equipment) with the following technical specifications:

- *Standard* — Data interface in accordance with EIA standard RS 232C (DIN 66020, page 1), transmission parameters can be set under "`>CONFIG/RS settings`", see s*ection 4.4.2*.

- *Control characters*

| | | |
|---|---|---|
| $C_R$ | DEC 13 | HEX 0D |
| $L_F$ | DEC 10 | HEX 0A |
| XON | DEC 17 | HEX 11 |
| XOFF | DEC 19 | HEX 13 |

- *Max. line length* — 80 characters + $C_R$ $L_F$

- *Mode* — Full duplex (simultaneous transmission and receiving)

  *Restriction:*
  *If data are first received by the interface, transmission is not started until the receipt is at an end.*

- *Cable* — For interconnection of the 732 IC Detector with third-party devices, only a shielded data cable may be used (e.g. Metrohm D.104.0201). The cable shield must be perfectly earthed at both devices (pay attention to current loops: always use star earthing). Use only connectors with sufficient shielding (e.g. Metrohm K.210.0001 with K.210.9004).

- *Cable length* — max. ca. 15 m

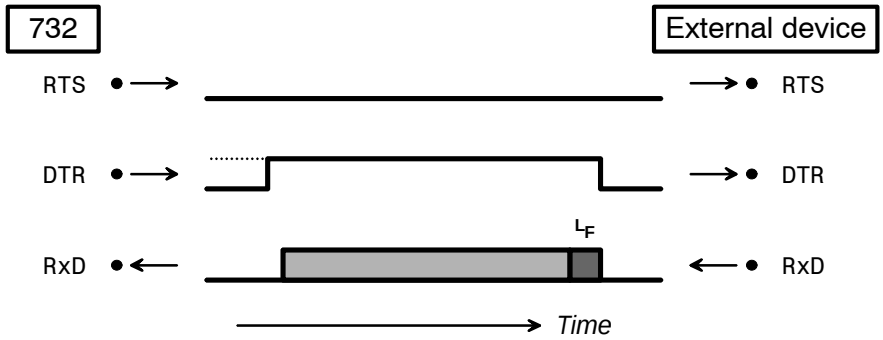
## 6.1.8 Handshake

### No handshake (none)

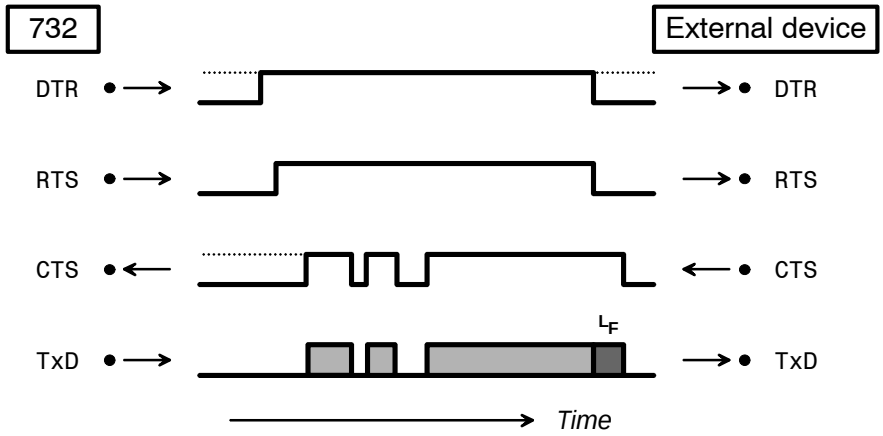
The 732 IC Detector neither checks handshake inputs (CTS, DSR, DCD) nor sets handshake outputs (DTR, RTS).

### Reduced hardware handshake (HWs)

732 IC Detector as **receiver**:




IC Detector 732 as **sender**:

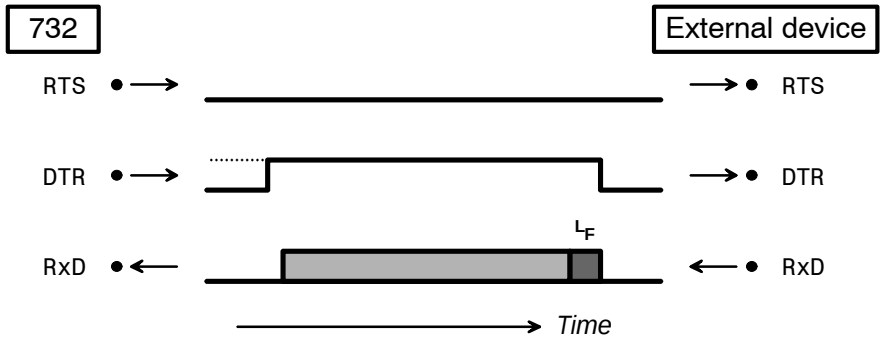



The data flow can be interrupted by deactivating the CTS line.

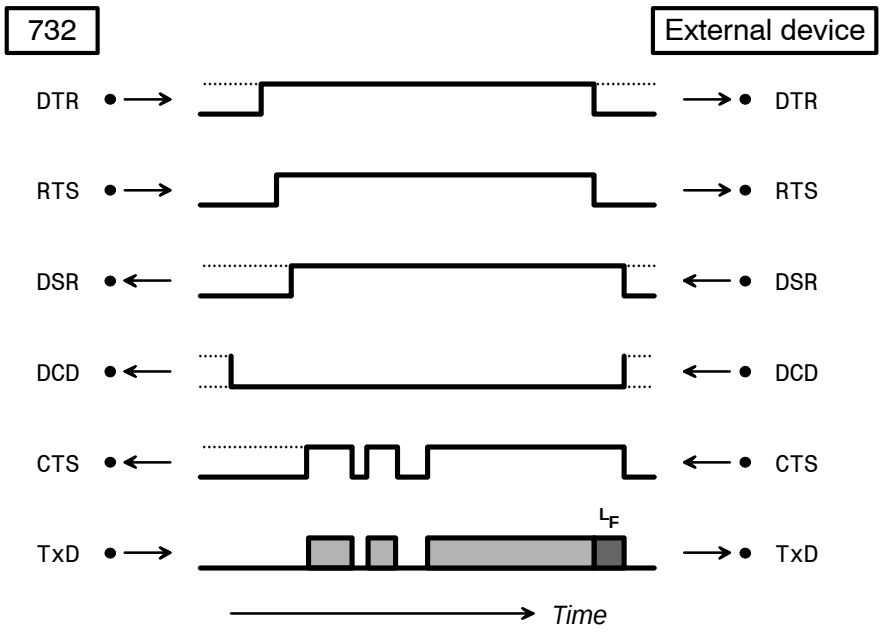
### Full hardware handshake (HWf)

All handshake inputs are checked, all handshake outputs are set.

732 IC Detector as **receiver**:



732 IC Detector as **sender**:




The data flow can be interrupted by deactivation of the CTS line.

### Software handshake with character stop (SWchar)

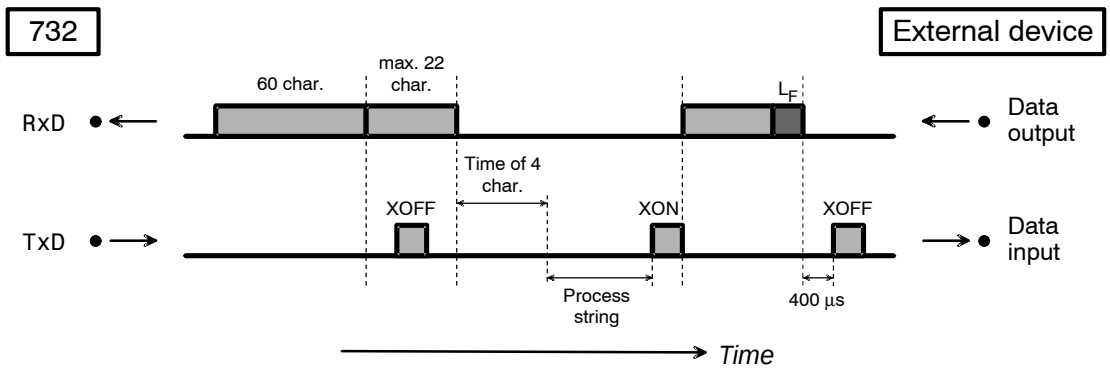
Handshake inputs (CTS, DSR, DCD) are not checked at the 732 IC Detector, handshake outputs (DTR, RTS) are set.

As soon as an $L_F$ is recognized, the 732 IC Detector sends XOFF. After this time, it can still receive 6 characters and store them temporarily.

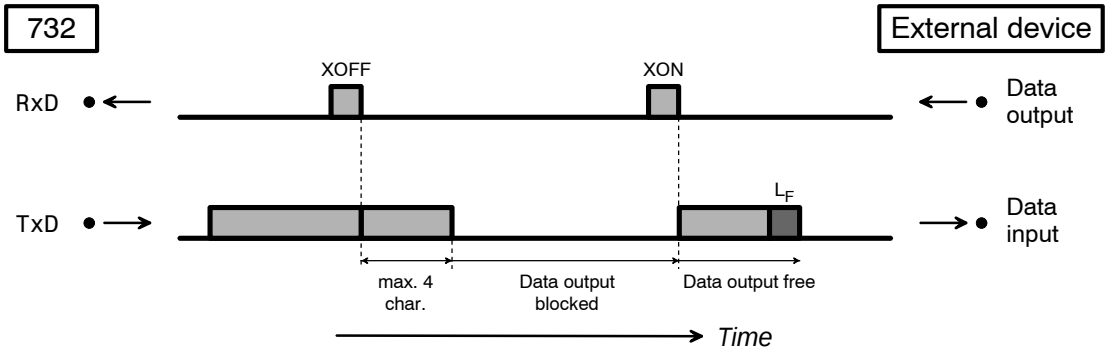
However, the 732 IC Detector also sends XOFF when its input buffer contains 60 characters. After this time, it can still receive maximum 22 characters (incl. $L_F$).

If the transmission is interrupted for the time of 4 characters after the 732 IC Detector has sent XOFF, the string previously received will be processed even if no $L_F$ has been sent.

732 IC Detector as **receiver**:



732 IC Detector as **sender**:

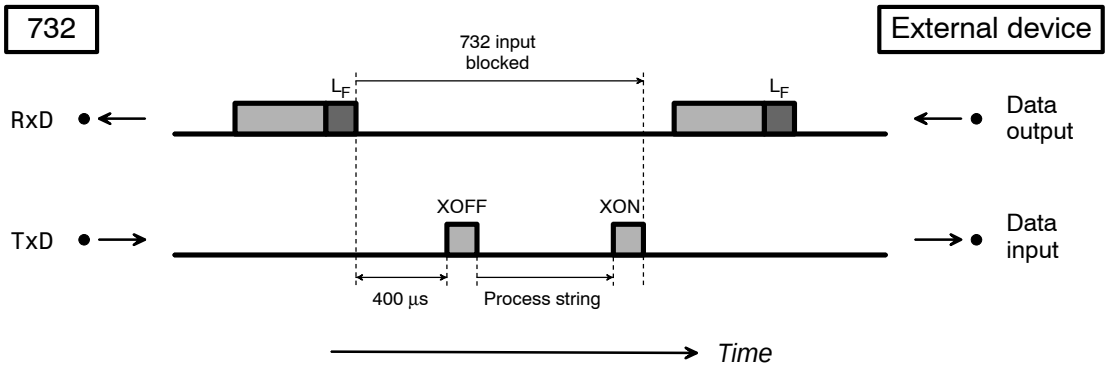



### Software handshake with line stop (SWline)

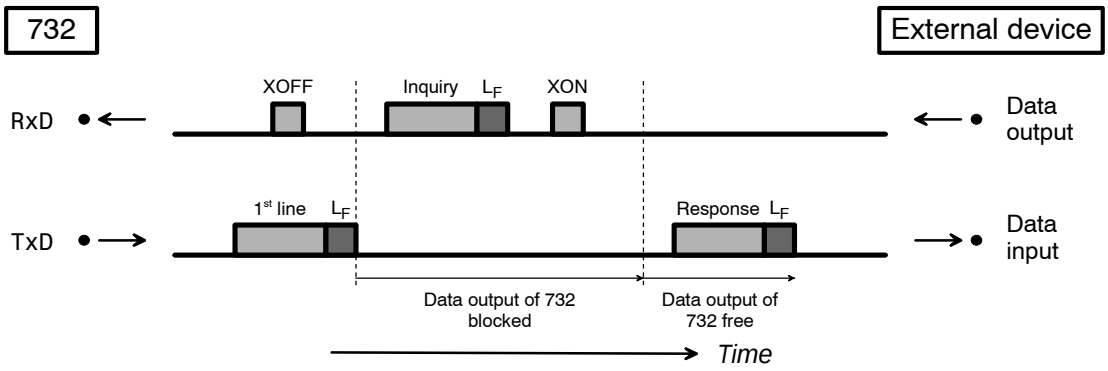
Handshake inputs (CTS, DSR, DCD) are not checked at the 732 IC Detector, handshake outputs (DTR, RTS) are set.

The 732 IC Detector has an input buffer which can accept a string of up to 80 characters + $C_R$ $L_F$. As soon as an $L_F$ is recognized, the 732 IC Detector sends XOFF. After this time, it can still receive max. 6 characters and store them temporarily. The string sent previously is now processed by the 732 IC Detector. It then sends XON and is again ready to receive.

732 IC Detector as **receiver**:

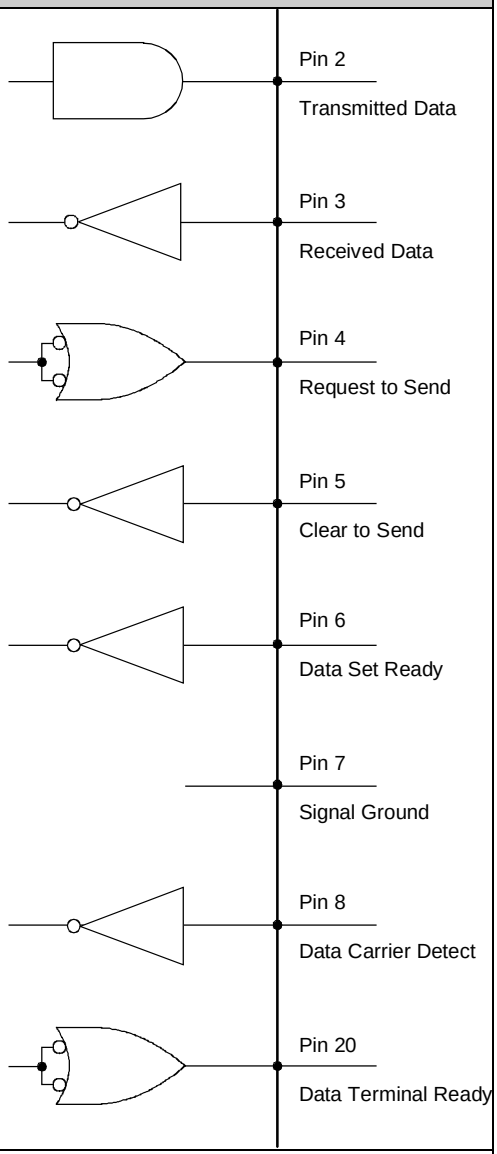
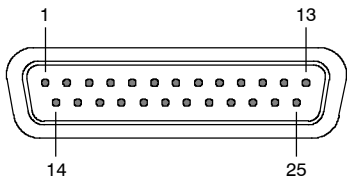



732 IC Detector as **sender**:




The transmission of the 732 IC Detector can be stopped by the external device with XOFF. After the receipt of XOFF, the IC Detector finishes transmission of the line already started. If the data output is blocked for more than 3 s by XOFF, `"RS error 43"` appears in the display.

## 6.1.9 Pin assignment

| *RS232C interface* | *external* |
|---|---|
| **Transmitted Data (TxD)**<br>If no data transmission takes place, the line is maintained in the "ON" condition. Data are sent only when CTS and DSR are in the "ON" condition and DCD is in the "OFF" condition.<br><br>**Received Data (RxD)**<br>Data are received only when DCD is "ON".<br><br>**Request to Send (RTS)**<br>ON condition: 732 IC Detector is ready to send data.<br><br>**Clear to Send (CTS)**<br>ON condition: Remote station is ready to receive data.<br><br>**Data Set Ready (DSR)**<br>ON condition: The transmission line is connected.<br><br>**Signal Ground (GND)**<br><br>**Data Carrier Detect (DCD)**<br>ON condition: The received signal level is within the tolerance range (remote station is ready to send data).<br><br>**Data Terminal Ready (DTR)**<br>ON condition: 732 IC Detector is ready to receive data. |  |
| **Protective earth**<br>Direct connection from cable connector to protective earth of the device.<br><br>**Polarity assignment of the signals**<br>• Data lines (TxD, RxD)<br>Voltage negative (<–3 V): signal status "ONE"<br>Voltage positive (>+3 V): signal status "ZERO"<br>• Control or message lines (CTS, DSR, DCD, RTS, DTR)<br>Voltage negative (<–3 V): OFF status<br>Voltage positive (>+3 V): ON status<br><br>In the transition region from +3 V to –3 V, the signal status is undefined.<br><br>**Driver 14C88** to EIA RS 232C specification<br><br>**Receiver 14C89** to EIA RS 232C specification | **Contact arrangement at the sockets "RS 232" and "709 IC Pump" (male)**<br><br>  <br><br>Connection cables to external devices must have an appropriate 25-pin connector (female). Metrohm offers connector sockets (K.210.9004) and the associated housing (K.210.0001) as an option for the preparation of such cables. |
| *No liability whatsoever will be accepted for damage arising from the improper connection of devices.* | |

### 6.1.10 RS232 error rectification

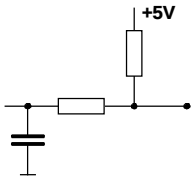
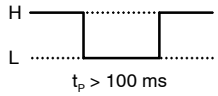
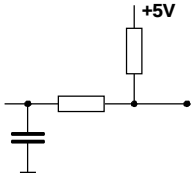
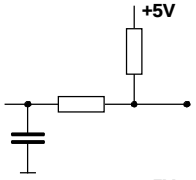
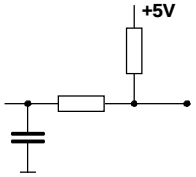
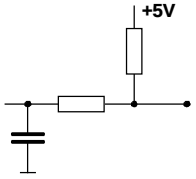
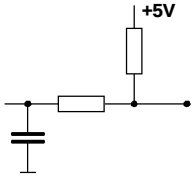
| *Problem* | *Questions for corrective action* |
|---|---|
| **No characters can be received on an attached printer.** | ⇒ Are the devices switched on and the connecting cables plugged in properly?<br>⇒ Is the printer set to ”on-line”?<br>⇒ Do the baud rate, data bits and parity for the two devices have the same setting?<br>⇒ Is the handshake set properly?<br>If everything appears ok, try to print out a report by pressing the <REPORT> key. |
| **No data transmission occurs and an error message appears in the display of the 732 IC Detector.** | Þ **RS error 36¼39**: Receive errors.<br>Do the RS232 data transmission parameters of the two devices have the same setting?<br>⇒ **RS error 40¼42**: transmission errors.<br>Is the cable used correctly wired and plugged in?<br>Is the printer switched on and set to ”on-line”?<br>⇒ **RS error 43**: Data output of the 732 IC Detector blocked for longer than 3 s by XOFF. |
| **The received characters are garbled.** | ⇒ Do the data bits and parity of the two devices have the same setting?<br>⇒ Does the baud rate of the two devices have the same setting?<br>⇒ Is the correct printer selected?<br>⇒ The data transfer has been interrupted by the hardware during a printout. Set up connections again, switch printer off then on. |
| **The graphics plot is not printed out properly. Other reports are ok.** | A handshake is necessary for the graphics plot.<br>⇒ Is your cable correctly wired? (The DTR of the printer must be wired with the CTS of the 732 IC Detectors.)<br>⇒ Set the handshake on the 732 IC Detector to `"HWs"`. The printer must be so configured that its DTR is set (usually with DIP switches). |

# 6.2 Remote interfaces

The 732 IC Detector has the two remote interfaces **14** "733 IC Separation Center" and **17** "Remote" (see *Fig. 3*) which each have 8 input and 8 output lines.

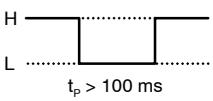
## 6.2.1 "Remote" interface

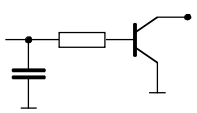
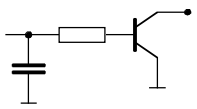
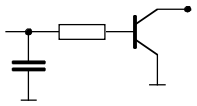
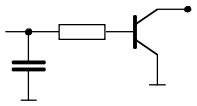
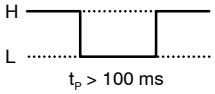
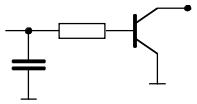
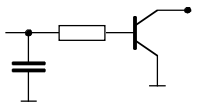
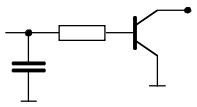
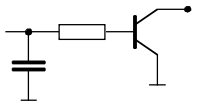
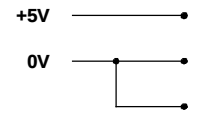
The remote interface **17** "Remote" is used for the connection of any type of external device (see s*ection 2.9.8*) and has the following pin assignment:

| *732 IC Detector* | *Pin* | *Function* |
|---|---|---|
| **Inputs** | | |
|  | 21 | **Print**<br>**Triggering the print command**<br>Equivalent to pressing the <PRINT> key (see s*ection 4.8.1*).<br>  <br> |
|  | 9 | $2^0$ |
|  | 22 | $2^1$ |
|  | 10 | $2^2$ |
|  | 23 | $2^3$ |
|  | 11<br>24<br>12 | **not assigned** |

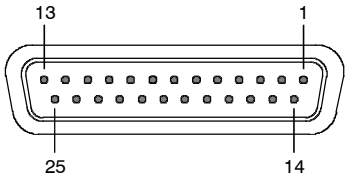
**Triggering of functions (remote control)**
Assignment of the input lines see *section 4.4.1*

| *Input* | | | | *Decimal* | *Function* |
|---|---|---|---|---|---|
| *23* | *10* | *22* | *9* | *code* | *(default settings)* |
| H | H | H | H | 0 | Inactive |
| H | H | H | L | 1 | PROG R/S |
| H | H | L | H | 2 | PUMP R/S |
| H | H | L | L | 3 | FILL B/STEP |
| H | L | H | H | 4 | FILL A |
| H | L | H | L | 5 | REPORT |
| H | L | L | H | 6 | ZERO |
| H | L | L | L | 7 | MARK |
| L | H | H | H | 8 | INJECT A |
| L | H | H | L | 9 | ZERO OFF |
| L | H | L | H | 10 | PLOT |
| L | H | L | L | 11 | Switch polarity |
| L | L | H | H | 12 | INJECT B |
| L | L | H | L | 13 | SELECT |
| L | L | L | H | 14 | QUIT |
| L | L | L | L | 15 | ENTER |



| 732 IC Detector Pin | Function |
|---|---|
| **Outputs** | |
|  5 | **Ready**<br>L = ready (program inactive or not started)<br>H = not ready (program running)<br>$V_{CEO}$ = 40 V<br>IC = 20 mA |
|  18 | **Remote 1**<br>Programmable remote output line 1<br>(command "remote" in program or event)<br>$V_{CEO}$ = 40 V<br>IC = 20 mA |
|  4 | **Remote 2**<br>Programmable remote output line 2<br>(command "remote" in program or event)<br>$V_{CEO}$ = 40 V<br>IC = 20 mA |
|  17 | **Advance pulse (EOD)**<br>The EOD signal is outputted in the following cases:<br>• without program: on every "INJECT A"<br>• with program: each time a program is ended and on every return to the loop start with loop programs<br>  |
|  3 | **Remote 3**<br>Programmable remote output line 3<br>(command "remote" in program or event)<br>$V_{CEO}$ = 40 V<br>IC = 20 mA |
|  16 | **Error**<br>L = instrument error (as long as it exists)<br>H = instrument ok<br>$V_{CEO}$ = 40 V<br>IC = 20 mA |
|  1 | **Remote 4**<br>Programmable remote output line 4<br>(command "remote" in program or event)<br>$V_{CEO}$ = 40 V<br>IC = 20 mA |
|  2 | **Remote 5**<br>Programmable remote output line 5<br>(command "remote" in program or event)<br>$V_{CEO}$ = 40 V<br>IC = 20 mA |
| **Voltages** | |
|  15<br>14<br>25 | 5 V: inactive High (H)<br>0 V: active Low (L)<br>I ≤ 40 mA<br>$R_i$ ≅ 12 Ω |

**Contact arrangement at socket "Remote" (female)**

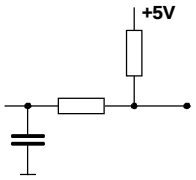
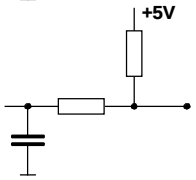
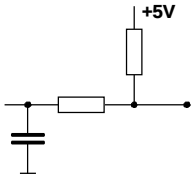
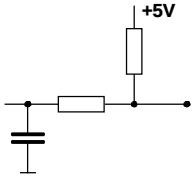
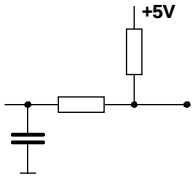
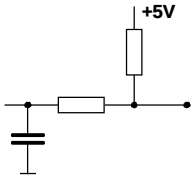
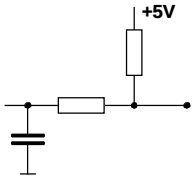
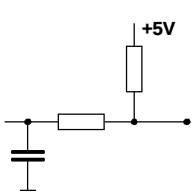


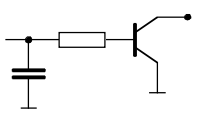
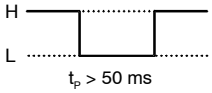
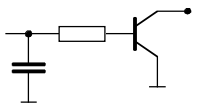
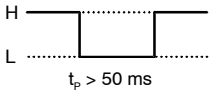
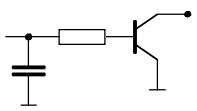
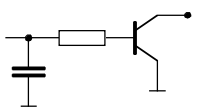
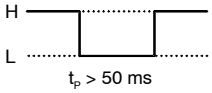
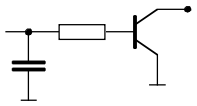
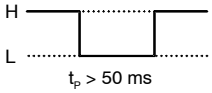
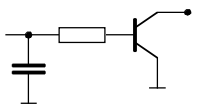
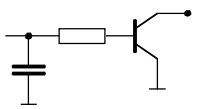
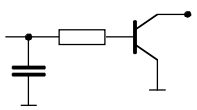
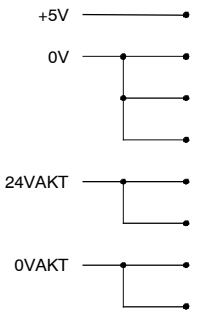

Connecting cables to external devices must have an appropriate 25-pin connector (male). Metrohm offers connector sockets (K.210.9060) and the associated housing (K.210.0002) as an option for the preparation of such cables.

*No liability whatsoever will be accepted for damage arising from the improper connection of devices.*

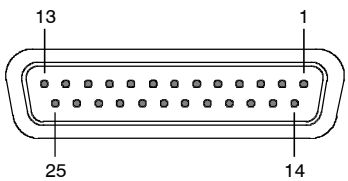
## 6.2.2 "733 IC Separation Center" interface

The “733 IC Separation Center” is normally attached to remote interface **14** "733 IC Separation Center" (see s*ection 2.3*). If the 732 IC Detector is operated without the 733 IC Separation Center, this remote interface can also be used for the connection of external devices. The remote interface "733 IC Separation Center" has the following pin assignment:

| *732 IC Detector* *Pin* | *Function* |
|---|---|
| **Inputs** | |
|  | **Position "FILL" at injection valve A**<br>L = Valve A in position "FILL"<br>H = Valve A not in position "FILL" |
|  | **Position "INJECT" at injection valve A**<br>L = Valve A in position "INJECT"<br>H = Valve A not in position "INJECT" |
|  | **Position "FILL" at injection valve B or "in position" at suppressor**<br>L = Valve B in position "FILL" or suppressor set to "in position"<br>H = Valve B not in position "FILL" or suppressor not set to "in position" |
|  | **Position "INJECT" at injection valve B**<br>L = Valve B in position "INJECT"<br>H = Valve B not in position "INJECT" |
|  | **Configuration of the 733 IC Separation Center**<br>**$2^0$**<br>**$2^1$**<br>*Input 11 23* / *Decimal code* / *Status*:<br>H H 0 undefined<br>H L 1 valve A<br>L H 2 valve A + suppressor<br>L L 3 valve A + valve B |
|  | |
|  | **Connection 733 IC Separation Center**<br>L = 733 IC Separation Center connected<br>H = 733 IC Separation Center not accessible |
|  | **not assigned** |

| 732 IC Detector Pin | Function |
|---|---|
| **Outputs** | |
|  5 | **Valve A ® "FILL"**<br>Valve A is switched to position "FILL".<br>  |
|  18 | **Valve A ® "INJECT"**<br>Valve A is switched to position "INJECT".<br>  |
|  4 | **Lock 733 keypad**<br>L = <FILL> and <INJECT> keys are locked<br>H = <FILL> and <INJECT> are not locked<br>$V_{CEO}$ = 40 V<br>IC = 20 mA |
|  17 | **Valve B ® "FILL" or suppressor ® "STEP"**<br>Valve B is switched to position "FILL" or suppressor module is switched to next position.<br>  |
|  3 | **Valve B ® "INJECT"**<br>Valve B is switched to position "INJECT".<br>  |
|  2 | **Remote 6**<br>Programmable remote output line 6<br>(command "remote" in program or event)<br>$V_{CEO}$ = 40 V<br>IC = 20 mA |
|  1 | **Remote 7**<br>Programmable remote output line 7<br>(command "remote" in program or event)<br>$V_{CEO}$ = 40 V<br>IC = 20 mA |
|  16 | **Remote 8**<br>Programmable remote output line 8<br>(command "remote" in program or event)<br>$V_{CEO}$ = 40 V<br>IC = 20 mA |
| **Voltages** | |
|  | 5 V: inactive High (H) I ≤ 40 mA<br>0 V: active Low (L) $R_i$ ≅ 12 Ω |

**Contact arrangement at socket "733 IC Separation Center" (female)**

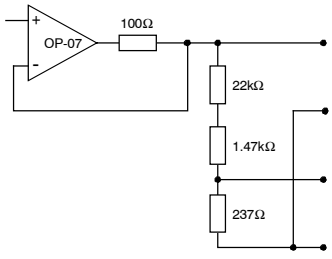



Connecting cables to external devices must have an appropriate 25-pin connector (male). Metrohm offers connector sockets (K.210.9060) and the associated housing (K.210.0002) as an option for the preparation of such cables.

*No liability whatsoever will be accepted for damage arising from the improper connection of devices.*

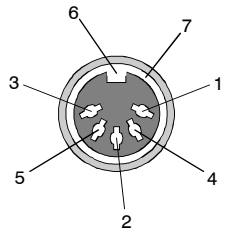
# 6.3 Analog output

For the attachment of recorders or integration systems, the 732 IC Detector offers the two analog outputs **11** (0…1 V) and **12** (0…10 mV) (see *section 3*). The attachment of these instruments is described in detail in *section 2.9*. The polarity of the output signal at the analog output sockets can always be switched under the <PARAM> key (see *section 4.5.1*). The circuit of the two analog outputs has the following appearance:

| *732 IC Detector* | *Connection* | *Function* |
|---|---|---|
|  | **1 V** (red)<br>**0 V** (black)<br>**10 mV** (red)<br>**0 V** (black) | **Analog output 0…1 V**<br>**Analog output 0…10 mV** |

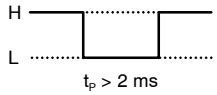
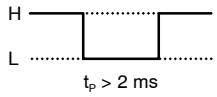
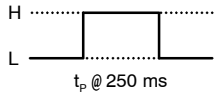
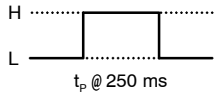
# 6.4 External power supply for 733 IC Separation Center

If the 733 IC Separation Center is operated without the 732 IC Detector, an external power supply must be attached to connection **48** "External Power". Power supply and connecting cable must comply with the following conditions:

| *"External Power" socket* | *Function* | |
|---|---|---|
|  | 1 +5 V DC / 0.5 A<br>2 not assigned<br>3 +24 V DC / 2 A<br>4 0 V (digital) *<br>5 0 V (analog) *<br>6 Ground<br>7 Ground | * Pin 4 and pin 5 must be connected in the vicinity of the power source ("zero point of star") |

# 6.5 Valve interfaces

The two valve interfaces **38** and **46** of the 733 IC Separation Center can be used for the attachment of external devices (e.g. 750 Autosampler, «IC Metrodata for Win95») which can be employed to control the injection valves or the suppressor module (see *section 2.3*). The two valve interfaces for the injection valves A and B (or the suppressor module) are identical and have the following connections

| *733 IC Sep. Center Connection* | *Function* |
|---|---|
| **Inputs** | |
| 0V — **Ground** | **Ground** |
| +5V, 10kΩ — **Fill** | **Valve ® "FILL"**<br>Valve is switched to the position "FILL"<br>(or suppressor module is switched further)<br>  |
| +5V, 10kΩ — **Inject** | **Valve ® "INJECT"**<br>Valve is switched to the position "INJECT"<br>  |
| **Outputs** | |
| **COM**, **RUN** | **Position "Fill"**<br>A pulse is outputted when the valve is switched to the position "FILL".<br>  |
| **COM**, **RUN** | **Integrator Start**<br>A pulse is outputted when the valve is switched to the position "INJECT".<br>  |
| *No liability whatsoever will be accepted for damage arising from the improper connection of devices.* | |

# 7 Appendix

## 7.1 Technical data

### 7.1.1 732 IC Detector

#### Conductivity measurement

| | |
|---|---|
| *Measurement ranges* | 100, 200, 500, 1000, 2000, 5000, 10 000 µS/cm |
| *Full scale* | 0.05…10 000 µS/cm |
| *Temperature correction* | Automatic correction of the measured conductivity to reference temperature 20°C with the adjustable temperature coefficients (1.5 %/°C or 2.5 %/°C) |
| *Accuracy, absolute value* | < 4 % of full-scale value for all ranges under the following reference conditions: Adjustment with reference resistance to 1.000 V (range 1 mS/cm, cell constant 16.7 /cm, temp. coeff. 2.5 %/°C, frequency 5 kHz, room temperature) to accuracy < ± 2 mV, measurement accuracy < 0.5 % after 30 min warm-up time |
| *Linearity* | Up to ± 150 % of each full-scale range Deviations < 0.5 % of full-scale range |
| *Temperature dependence* | Typically 25 ppm/°C |
| *Dependence of cell const..* | < ± 1 % over entire adjustment range |
| *Drift (electronic)* | < 0.0013 % of selected measurement range /h/°C |
| *Noise (electronic)* | Typically < 0.0003 % of selected meas. range |
| *Damping* | 2-stage damping (Bessel 4th order)<br>"damping = off" 0.25 s (10…90 %)<br>"damping = on" 2.00 s (10…90 %) |

#### Auto-zero

| | |
|---|---|
| *Function* | Automatic zero setting (electronic background compensation) over entire selectable measurement range |
| *Initiation* | Manually or externally (RS232, remote) |
| *Maximum error* | ± 0.6 % of full-scale range |
| *Linear range* | ± 150 % of full-scale range |

#### Marker

| | |
|---|---|
| *Signal* | Ca. 10 % of full-scale range |
| *Initiation* | Manual or externally (RS232, remote) |

## Conductivity detector

*Construction*
Thermostatted conductivity detector with 2 ring-shaped steel electrodes

*Measurement principle*
Alternating current measurement with following cell supply:

| Meas. Range | Amplitude | Frequency |
|---|---|---|
| 100 µS/cm | 1 V peak | 714 Hz |
| 200 µS/cm | 1 V peak | 5000 Hz |
| 500 µS/cm | 1 V peak | 5000 Hz |
| 1 mS/cm | 1 V peak | 5000 Hz |
| 2 mS/cm | 0.5 V peak | 5000 Hz |
| 5 mS/cm | 0.2 V peak | 5000 Hz |
| 10 mS/cm | 0.1 V peak | 5000 Hz |

*Cell volume*
1.5 µL

*Cell constant*
16.7 /cm; adjustable 13.0…21.0 /cm

*Maximum back pressure for measuring cell*
5.0 MPa (50 bar)

*Thermostatting*
Connectable dynamic control to adjustable operating temperature, indicated by LED

*Operating temperature*
Adjustable in steps of 5°C from 25…45°C

*Max. temperature deviation*
± 1.5°C

*Temperature stability*
≤ 0.01°C at constant ambient temperature

## Parts and controls

*Display*
LCD, 2 lines, each of 24 characters (character height 5 mm)

*Indicators*
LED for auto-zero display
LED for display of program status
LED for overload display
LED for display of block heating

*Keypad*
Chemically resistant membrane keypad made of polyester with function and numeric keys

*Mains switch*
At rear of instrument

## Mains connection

*Voltage*
115 V: 100...120 V ± 10 %
230 V: 220...240 V ± 10 %
Switching with mains voltage selector in fuse holder (see s*ection 2.4.1*)

*Frequency*
50...60 Hz

*Power consumption*
70 VA

*Fuse*
5 mm Ø, 20 mm length
100…120 V: 0.63 A (slow-blow)
220…240 V: 0.315 A (slow-blow)

## Interfaces

| | |
|---|---|
| *RS232 interfaces* | Specifications, see ***section 6.1*** |
| *Remote interfaces* | Specifications, see ***section 6.2*** |
| *Analog output* | Specifications, see ***section 6.3*** |

## Safety specifications

| | |
|---|---|
| *Construction/testing* | According to IEC 1010 / EN 61010 / UL 3101-1, protection class 1, degree of protection IP40 |
| *Safety directions* | The Instructions for Use include information and warnings which must be heeded by the user to assure safe operation of the instrument. |

## Electromagnetic compatibility (EMC)

| | |
|---|---|
| *Emitted interference* | Standards met:<br>EN 55011 (class B), EN 55022 (class B), EN 50081-1/2 |
| *Immunity to interference* | Standards met:<br>IEC801-2/IEC1000-4-2 (class 4), IEC801-3/ IEC1000-4-3 (class 3), IEC801-4/IEC1000-4-4 (class 4), IEC801-5/IEC1000-4-5 (class 2/3), IEC801-6/IEC1000-4-6 (class 3), EN50082-2, EN61000-3-2/3/IEC1000-3-2/3, EN50093/ IEC1000-4-11 |

## Ambient temperature

| | |
|---|---|
| *Nominal operating range* | +5…+45°C<br>(at 20…80 % atmospheric humidity) |
| *Storage, transport* | –20…+70°C |

## Diagnostic tests

| | |
|---|---|
| *Self-diagnostic test* | Automatic self-diagnosis when instrument switched on |
| *User diagnostic test* | Built-in diagnostic program (see ***section 5.4***) |

## Housing

| | |
|---|---|
| *Material of cover* | Polyurethane rigid foam (PUR) with fire protection for fire class UL94VO, FCH-free |
| *Material of base* | Steel, enameled |
| *Width* | 255 mm |
| *Height* | 130 mm |
| *Depth* | 343 mm |
| *Weight* | 8.2 kg (with detector block, without accessories) |

## 7.1.2 733 IC Separation Center

### Parts and controls

| | |
|---|---|
| *Keypad* | Chemically resistant membrane keypad made of polyester with function keys |
| *Indicators* | LEDs for display of valve position |

### Power supply

| | |
|---|---|
| *Internal* | Internal supply of 732 IC Detector via connecting cable |
| *External* | External supply via DIN connector:<br>5 V / 0.5 A<br>24 V / 2 A (transient, 200…300 ms) |

### Interfaces

| | |
|---|---|
| *Valve interfaces* | Specifications, see *section 6.5* |

### Safety specifications

| | |
|---|---|
| *Construction/testing* | According to IEC 1010 / EN 61010 / UL 3101-1, protection class 1, degree of protection IP40 |
| *Safety notes* | The Instructions for Use include information and warnings which must be heeded by the user to assure safe operation of the instrument. |

### Electromagnetic compatibility (EMC)

| | |
|---|---|
| *Emitted interference* | Standards met:<br>EN 55011 (class B), EN 55022 (class B), EN 50081-1/2 |
| *Immunity to interference* | Standards met:<br>IEC801-2/IEC1000-4-2 (class 4), IEC801-3/ IEC1000-4-3 (class 3), IEC801-4/IEC1000-4-4 (class 4), IEC801-5/IEC1000-4-5 (class 2/3), IEC801-6/IEC1000-4-6 (class 3), EN50082-2 |

### Ambient temperature

| | |
|---|---|
| *Nominal operating range* | +5…+45°C (at 20…80 % atmospheric humidity) |
| *Storage, transport* | –20…+70°C |

### Housing

| | |
|---|---|
| *Material* | Polyurethane rigid foam (PUR) with fire protection for fire class UL94VO, FCH-free |
| *Width* | 255 mm |
| *Height* | 385 mm |
| *Depth* | 343 mm |
| *Weight* | 6.4 kg (without accessories) |

# 7.2 Standard equipment

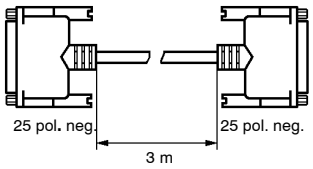
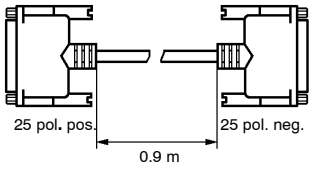
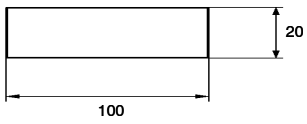
*Subject to changes !*
*All dimensions are given in mm.*

## 7.2.1 732 IC Detector

The 732 IC Detector is available in two versions:

- **2.732.0010** IC Detector with standard detector block
- **2.732.0110** IC Detector with metal-free detector block

These instruments include the following parts:

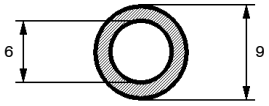
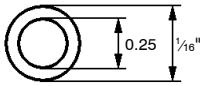
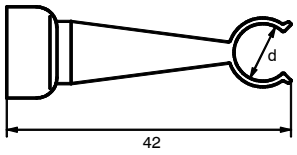
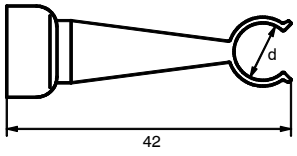
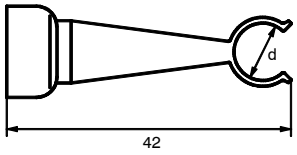
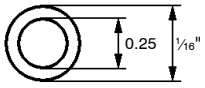
| Quant. | | Order No. | Description |
|---|---|---|---|
| 2.732.0010 | 2.732.0110 | | |
| 1 | - | 1.732.0100 | **Detector block**<br>with permanently attached connecting cable to 732 IC Detector |
| - | 1 | 1.732.0110 | **Detector block, metal-free**<br>with permanently attached connecting cable to 732 IC Detector |
| 1 | 1 | 6.2125.060 | **Connecting cable**<br>Connecting cable 732 IC Detector (RS232) – PC<br>  |
| 1 | 1 | 6.2125.090 | **Connecting cable**<br>Connecting cable 732 IC Detector – 733 IC Separation Center<br>  |
| 1 | 1 | 6.2248.000 | **Magnetic plate**<br>for identification of the 732 IC Detector<br>  |
| 1 | 1 | 6.2122.0X0 | **Mains cable**<br>to customer's specifications:<br>Cable socket — Cable connector<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 | 1 | 8.732.1033 | **Instructions for Use (English)**<br>for 732 IC Detector and 733 IC Separation Center |
| 1 | 1 | 8.732.1043 | **Quick reference guide (English)**<br>for 732 IC Detector and 733 IC Separation Center |

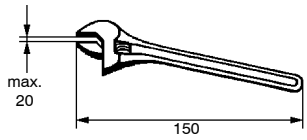
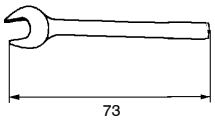
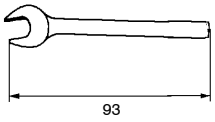
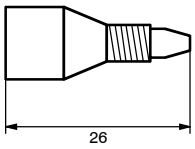
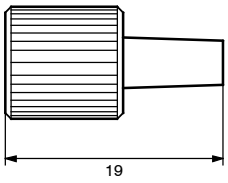
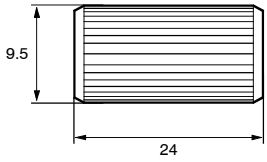
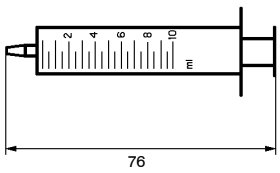
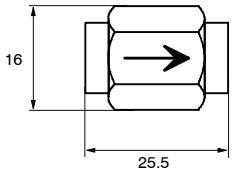
## 7.2.2 733 IC Separation Center

The 733 IC Separation Center is available in the following versions:

- **2.733.0010** Instrument with 1 injection valve
- **2.733.0020** Instrument with 2 injection valves
- **2.733.0120** Instrument with 2 injection valves, metal-free
- **2.733.0030** Instrument with 1 injection valve and 1 suppressor module
- **2.733.0130** Instrument with 1 inj. valve and 1 suppr. module, metal-free

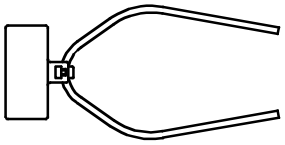
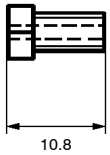
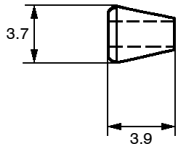
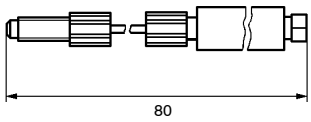
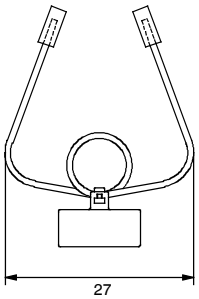
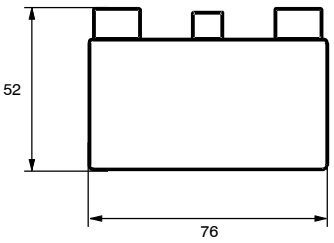
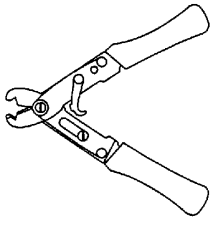
These instruments contain the following parts:

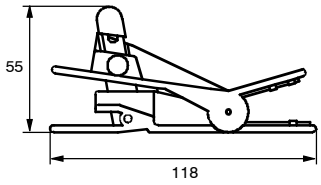
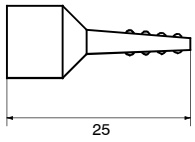
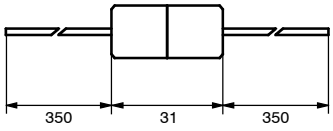
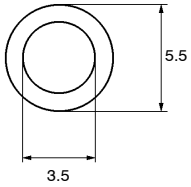
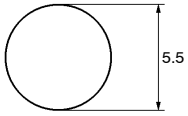
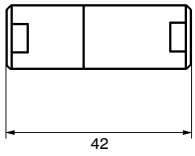
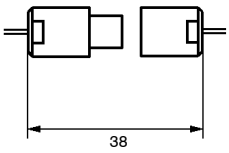
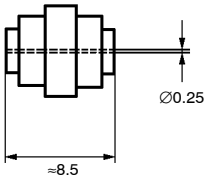
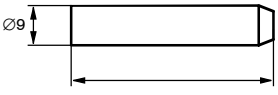
| Quant. | | | | | Order No. | Description |
|---|---|---|---|---|---|---|
| 2.733.0010 | 2.733.0020 | 2.733.0120 | 2.733.0030 | 2.733.0130 | | |
| 1 | 1 | 1 | 1 | 1 | 6.1816.000 | **Silicone tubing**<br>Drain tube for inner compartment, length = 0.5 m  |
| 1 | 1 | 1 | 1 | 1 | 6.1831.010 | **PEEK capillary**<br>Length = 3 m  |
| 1 | 2 | 2 | 1 | 1 | 6.2027.030 | **Column holder**<br>Diameter d = 8.5 mm  |
| 1 | 2 | 2 | 1 | 1 | 6.2027.040 | **Column holder**<br>Diameter d = 11.3 mm  |
| 1 | 2 | 2 | 1 | 1 | 6.2027.050 | **Column holder**<br>Diameter d = 15.0 mm  |
| 1 | 1 | - | 1 | - | 6.2620.020 | **Steel capillary**<br>Length = 3 m  |
| 2 | 4 | - | 2 | - | 6.2620.060 | **Coupling 1/16" – 1/16"**<br>for connection of 1/16" steel or PEEK capillaries;<br>incl. two 6.2620.000 Compression screws and two 6.2620.010 Ferrules  |

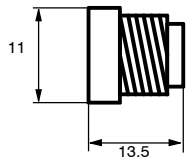
| Quant. | | | | | Order No. | Description |
|---|---|---|---|---|---|---|
| 2.733.0010 | 2.733.0020 | 2.733.0120 | 2.733.0030 | 2.733.0130 | | |
| 1 | 1 | - | 1 | - | 6.2621.000 | **Adjustable spanner**   |
| 1 | 1 | - | 1 | - | 6.2621.050 | **Open-end spanner 1/4"**   |
| 1 | 1 | - | 1 | - | 6.2621.060 | **Open-end spanner 5/16"**   |
| 1 | 2 | 2 | 2 | 2 | 6.2744.010 | **PEEK compression fitting**<br>For the connection of 6.1831.010 PEEK capillaries or 6.1822.010 PTFE microcapillaries, set of 5   |
| 1 | 2 | 2 | 1 | 1 | 6.2744.020 | **Coupling 1/16" – Luer**<br>Coupling for connection of a 6.1803.000 PTFE capillary to connection **21** or **27** of the 733 IC Separation Center when a 750 Autosampler or a 766 IC Sample Processor is used   |
| - | - | 4 | - | 2 | 6.2744.040 | **PEEK coupling**<br>for the connection of 1/16" capillaries   |
| 1 | 2 | 2 | 1 | 1 | 6.2816.020 | **Syringe**<br>made of PP, volume = 10 mL; for manual filling of the sample loop   |
| - | - | - | 2 | 2 | 6.2821.100 | **Filter unit PEEK 2 mm**<br>To avoid contamination of the suppressor module.<br><br>Spare part: 6.2821.110 Filter   |

# 7.3 Optional accessories

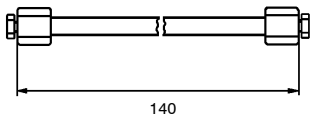
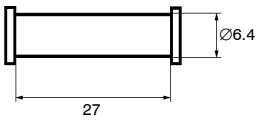
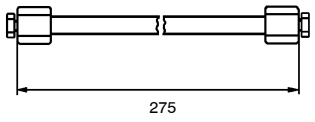
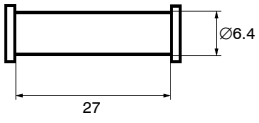
## 7.3.1 Accessories for 733 IC Separation Center

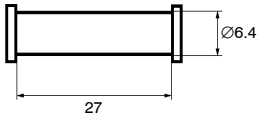
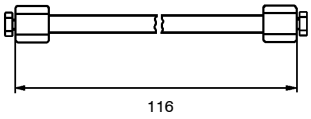
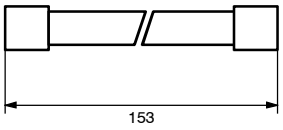
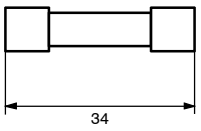
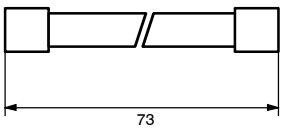
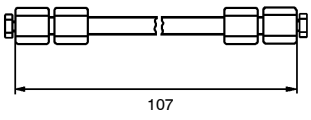
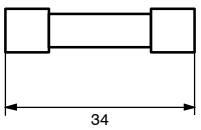
| Order No. | Description |
|---|---|
| 6.1825.XXX | **Sample loop, made of PEEK**<br>For injection valve; incl. 2 PEEK compression fittings 6.2744.010<br>6.1825.230: Volume = 10 µL<br>6.1825.210: Volume = 20 µL<br>6.1825.220: Volume = 100 µL<br>  |
| 6.2620.000 | **Pressure screw, made of steel**<br>For connection of 6.2620.020 Steel capillaries, set of 5.<br>  |
| 6.2620.010 | **Ferrule, made of steel**<br>For connection of 6.2620.020 Steel capillaries, set of 5.<br>  |
| 6.2620.040 | **Coupling 1/16" – 1/4"**<br>Connector for plastic separating columns with ¼"-28 thread.<br>  |
| 6.2620.XXX | **Sample loop, made of steel**<br>For injection valve.<br>6.2620.100: Volume = 10 µL<br>6.2620.110: Volume = 20 µL<br>6.2620.120: Volume = 100 µL<br>  |
| 6.2620.150 | **Pulsation dampener MF**<br>Metal-free pulsation dampener to reduce pulsations and prolong the life of separating columns.<br>  |
| 6.2621.040 | **Capillary tubing cutter for steel capillaries**<br>  |

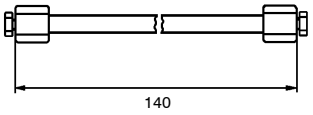
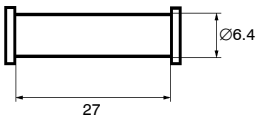
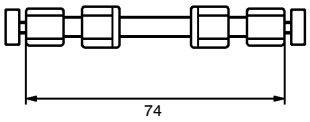
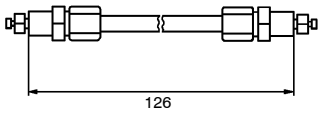
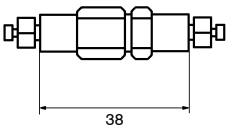
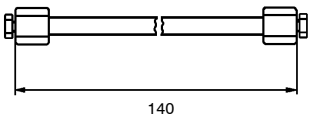
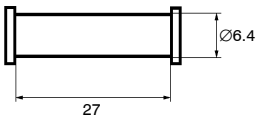
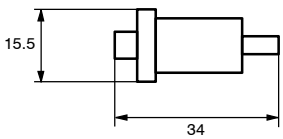
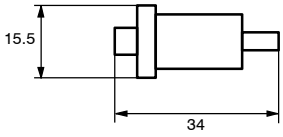
| Order No. | Description |
|---|---|
| 6.2621.080 | **Capillary tubing cutter for plastic capillaries**<br>For 6.1831.010 PEEK capillaries and 6.1822.010 PTFE microcapillaries<br>incl. 5 additional blades<br>  |
| 6.2744.030 | **PEEK Coupling**<br>Connection between 6.2744.010 PEEK compression fitting and 6.1826.0X0 Pump tubing; set of 4<br>  |
| 6.2821.000 | **Filter unit Manufit**<br>To avoid contamination through abrasive particles from piston seals.<br>For the pressure range 25…50 MPa with steel capillaries.<br>  |
| 6.2821.010 | **PTFE gasket**<br>Spare part for 6.2821.000 Filter unit Manufit and 6.1005.000, 6.1005.030, 6.1007.000 and 6.1010.000 IC Separating Columns; set of 4.<br>  |
| 6.2821.020 | **Steel mesh**<br>Spare part for 6.2821.000 Filter unit Manufit and 6.1005.000, 6.1005.030, 6.1007.000 and 6.1010.000 IC Separating Columns; set of 4.<br>  |
| 6.2821.040 | **Cartridge head**<br>To hold precolumn cartridges; mounted directly on the separating column.<br>  |
| 6.2821.050 | **Twin cartridge holder**<br>To hold precolumn cartridges; installed in the inlet capillary of the separating column.<br>  |
| 6.2821.080 | **Steel spacer**<br>Spare part for 6.2821.040 Cartridge head.<br>  |
| 6.2821.090 | **Aspirating filter PE 20 µm**<br>For 6.1834.000 Aspirating tubing (supplied with the 709 IC Pump); set of 5.<br>  |

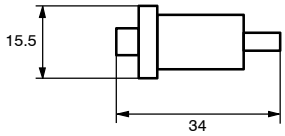
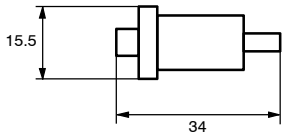
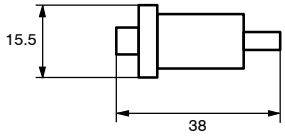
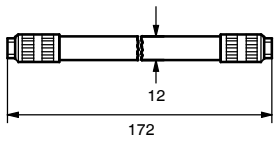
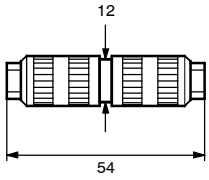
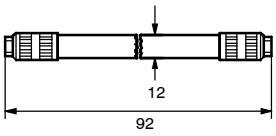
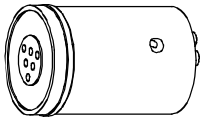
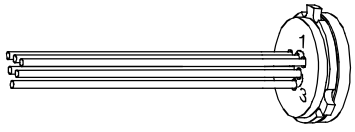
| Order No. | Description |
|---|---|
| **6.2821.110** | **Filter for Filter unit PEEK 2 mm**<br>Spare part for 6.2821.100 Filter unit PEEK.<br>Set of 10.<br>  |
| **6.5324.000** | **Bottle rack**<br>For holding 3 supply bottles with eluent, regeneration solution and rinsing solution, incl. accessories (bottles, siphon, etc.) |

## 7.3.2 Separating columns and precolumns

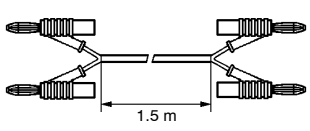
| Order No. | Description |
|---|---|
| **6.1005.000** | **IC anion column PRP-X100 (125 mm)**<br>For the determination of anions without chemical suppression.<br>Column dimensions: 125 × 4.0 mm<br>Precolumn: 6.1005.020<br>  |
| **6.1005.010** | **IC anion column PRP-X100 (250 mm)**<br>For the determination of anions without chemical suppression.<br>Column dimensions: 250 × 4.0 mm<br>Precolumn: 6.1005.020<br>  |
| **6.1005.020** | **IC precolumn cartridge PRP-X100**<br>To prolong the service life of 6.1005.000 and 6.1005.010 IC anion columns PRP-X100.<br>Column dimensions: 20 × 4.0 mm<br>Installation using 6.2821.040 Cartridge head or 6.2821.050 Twin cartridge holder.<br>  |
| **6.1005.030** | **IC exclusion column PRP-X300**<br>For the determination of organic acids without chemical suppression.<br>Column dimensions: 250 × 4.0 mm<br>Precolumn: 6.1005.040<br>  |
| **6.1005.040** | **IC precolumn cartridge PRP-X300**<br>To prolong the service life of the 6.1005.030 IC exclusion column PRP-X300.<br>Column dimensions: 20 × 4.0 mm<br>Installation using 6.2821.040 Cartridge head or 6.2821.050 Twin cartridge holder.<br>  |

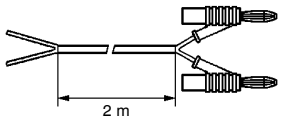
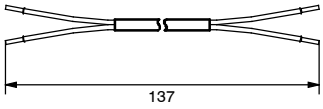
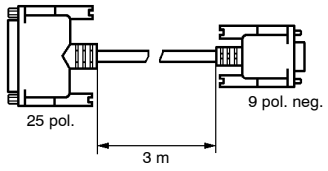
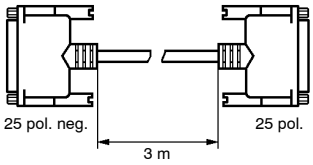
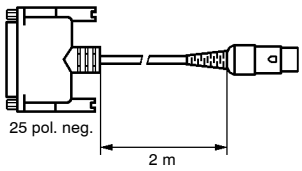
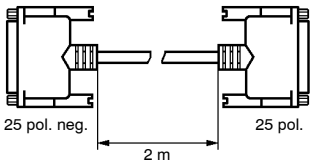
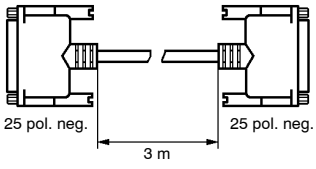
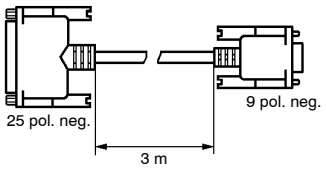
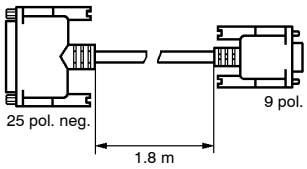
| Order No. | Description |
|---|---|
| **6.1005.050** | **IC precolumn cartridge PRP-1**<br>To prolong the service life of the 6.1009.000 IC anion column SUPERSEP and the 6.1006.100 IC anion column METROSEP Anion Dual 2.<br>Column dimensions: 20 × 4.0 mm<br>Installation using 6.2821.040 Cartridge head or 6.2821.050 Twin cartridge holder.<br>  |
| **6.1005.100** | **IC anion column Star-Ion A300**<br>For the determination of anions with chemical suppression.<br>Column dimensions: 100 × 4.6 mm<br>  |
| **6.1005.200** | **IC anion column Organic Acids**<br>For the determination of organic acids.<br>Column dimensions: 250 × 7.5 mm<br>  |
| **6.1006.020** | **IC column cartridge METROSEP Anion Dual 1**<br>For the determination of anions with and without chemical suppression.<br>Column dimensions: 150 × 3.0 mm<br>Installation using 6.2828.000 Glass cartridge holder.<br>  |
| **6.1006.030** | **IC precolumn cartridge METROSEP Anion Dual 1**<br>Set of 3<br>To prolong the service life of the 6.1006.020 IC column cartridge METROSEP Anion Dual 1.<br>Column dimensions: 30 × 3.0 mm<br>Installation using 6.2828.010 Precolumn cartridge holder.<br>  |
| **6.1006.040** | **IC precolumn cartridge METROSEP Anion Dual 1**<br>Set of 3<br>To prolong the service life of the 6.1006.020 IC column cartridge METROSEP Anion Dual 1.<br>Column dimensions: 70 × 3.0 mm<br>Installation using 6.2828.020 Glass cartridge holder.<br>  |
| **6.1006.100** | **IC anion column METROSEP Anion Dual 2**<br>For the determination of anions with and without chemical suppression.<br>Column dimensions: 75 × 4.6 mm<br>Precolumn: 6.1005.050 (installation with 6.2821.050 Twin cartridge holder)<br>  |
| **6.1006.200** | **Preconcentration cartridge METROSEP Anion**<br>For anion preconcentration.<br>Column dimensions: 30 × 3.0 mm<br>Installation using 6.2828.010 Precolumn cartridge holder.<br>  |

| Order No. | Description |
|---|---|
| **6.1007.000** | **IC cation column Nucleosil 5SA**<br>For the determination of divalent cations without chemical suppression.<br>Column dimensions: 125 × 4.0 mm<br>Precolumn: 6.1007.010<br>  |
| **6.1007.010** | **IC precolumn cartridge Nucleosil 5SA**<br>To prolong the service life of the 6.1007.000 IC cation column Nucleosil 5SA.<br>Column dimensions: 20 × 4.0 mm<br>Installation using 6.2821.040 Cartridge head or 6.2821.050 Twin cartridge holder.<br>  |
| **6.1008.010** | **IC cation column Hyperrez Monovalent**<br>For the determination of monovalent cations without chemical suppression.<br>Column dimensions: 50 × 4.6 mm<br>  |
| **6.1009.000** | **IC anion column SUPERSEP**<br>For the determination of anions without chemical suppression.<br>Column dimensions: 100 × 4.6 mm<br>Precolumns: 6.1009.010 IC anion column SUPERSEP or 6.1005.010 IC precolumn cartridge<br>  |
| **6.1009.010** | **IC anion precolumn SUPERSEP**<br>To prolong the service life of the 6.1009.000 IC anion column SUPERSEP.<br>  |
| **6.1010.000** | **IC cation column METROSEP Cation 1-2**<br>For the determination of monovalent and divalent cations without chemical suppression.<br>Column dimensions: 125 × 4.0 mm<br>Precolumn: 6.1010.010<br>  |
| **6.1010.010** | **IC precolumn cartridge METROSEP Cation 1-2**<br>To prolong the service life of the 6.1010.000 IC cation column METROSEP Cation 1-2.<br>Column dimensions: 20 × 4.0 mm<br>Installation using 6.2821.040 Cartridge head or 6.2821.050 Twin cartridge holder.<br>  |
| **6.1012.X00** | **Sample pretreatment cartridge IC-RP**<br>For non-polar solid phase extraction. Removes organic substances; for the enrichment of heavy metals.<br>With Luer connection.<br>6.1012.000: set of 50<br>6.1012.100: set of 10<br>  |
| **6.1012.X10** | **Sample pretreatment cartridge IC-H**<br>Cation exchanger in $H^+$ form. Removes interfering cations, $CO_3^{2-}$, $HCO_3^-$ or for alkaline samples.<br>With Luer connection.<br>6.1012.010: set of 50<br>6.1012.110: set of 10<br>  |

| Order No. | Description |
|---|---|
| 6.1012.X20 | **Sample pretreatment cartridge IC-Ag**<br>Cation exchanger in $Ag^+$ form. Removes halides.<br>With Luer connection.<br>6.1012.020: set of 50<br>6.1012.120: set of 10<br>  |
| 6.1012.X30 | **Sample pretreatment cartridge IC-OH**<br>Cation exchanger in $OH^-$ form. For highly acidic samples.<br>With Luer connection.<br>6.1012.030: set of 50<br>6.1012.130: set of 10<br>  |
| 6.1012.200 | **Sample pretreatment cartridge Chromafix C18**<br>Removes organic substances (not suitable for fluoride determinations).<br>With Luer connection.<br>6.1012.200: set of 50<br>  |
| 6.2828.000 | **Glass cartridge holder**<br>To hold the 6.1006.0020 Column cartridge METROSEP Anion Dual 1.<br>  |
| 6.2828.010 | **Precolumn cartridge holder**<br>To hold the 6.1006.0030 Precolumn cartridge METROSEP Anion Dual 1.<br>  |
| 6.2828.020 | **Glass cartridge holder**<br>To hold the 6.1006.0040 Column cartridge METROSEP Anion Dual 1.<br>  |
| 6.2832.000 | **Suppressor rotor**<br>Replacement cartridge for Metrohm suppressor module<br>  |
| 6.2832.010 | **Connection piece for suppressor rotor**<br>with input and output leads<br>  |

## 7.3.3 Additional devices and cables

| *Order No.* | *Description* |
|---|---|
| **2.145.0300** | **Serial/parallel converter**<br>For the connection of printers with a parallel interface to the RS232 interface of 732 IC Detector |
| **2.709.0X10** | **709 IC Pump**<br>Serial, high-performance dual piston pump with minimal residual pulsation and outstanding flow constancy; incl. accessories.<br>Versions: 2.709.0010 Standard version<br>2.709.0110 Metal-free version |
| **2.714.0310** | **IC Metrodata for Win95**<br>Chromatography data system comprising a PC board and evaluation software, for the automatic evaluation of chromatograms with a PC.<br>Versions: 2.714.0310 For 1 chromatography system with 2 channels<br>2.714.0320 For 2 chromatography systems each with 2 channels |
| **2.750.0010** | **750 Autosampler**<br>Sampler for the automation of sample injection. Capacity: 128 sample vessels each with an effective volume of ca. 700 µL; incl. accessories.<br>Accessories: 6.2413.000 Glass Sample Vessels, set of 1000<br>6.2743.000 PP Sample Vessels, set of 1000<br>6.2743.010 Polyethylene Stoppers, transparent, set of 1000<br>6.2743.020 Polyethylene Stoppers, red, set of 1000<br>6.2743.030 Filter Stoppers, set of 100 |
| **2.752.0010** | **752 Pump Unit**<br>Dual-channel peristaltic pump for the regeneration and rinsing solutions for the suppressor module; incl. 2 lengths of 6.1826.050 Pump tubing. |
| **2.754.0010** | **754 Dialysis Unit**<br>Instrument for automatic sample dialysis for sample pretreatment, incl. dialysis cell and dual-channel peristaltic pump. |
| **2.766.0010** | **766 IC Sample Processor**<br>Sampler for the automation of sample injection. Capacity: 127 sample vessels each with an effective volume of ca. 11 mL; incl. accessories.<br>Accessories: 6.2743.050 PP Sample vessels, set of 2000<br>6.2743.060 Polyethylene stoppers, transparent, set of 1000 |
| **2.791.0020** | **791 VA Detector**<br>Current measuring instrument for electrochemical detection; complete with detection cell and accessories (without working electrode).<br>Working electrodes: 6.0807.000 Mini carbon paste electrode<br>6.0807.010 Mini glassy carbon electrode<br>6.1204.100 Ultra Trace graphite tip *<br>6.1204.120 Platinum tip *<br>6.1204.130 Silver tip *<br>6.1204.140 Gold tip * (* 6.2103.110 Contact pin needed) |
| **6.2115.010** | **Cable**<br>Connecting cable 732 IC Detector (analog output) – recorder<br>  |

| Order No. | Description |
|---|---|
| **6.2115.060** | **Cable**<br>Connecting cable 732 IC Detector (analog output) – integrator or data acquisition system (analog cable)<br>  |
| **6.2115.070** | **Cable**<br>Connecting cable between 733 IC Separation Center and integrator or data acquisition system (start cable)<br>  |
| **6.2125.010** | **Cable**<br>Connecting cable 732 IC Detector (RS232 interface) – PC<br>Adapter cable 25-pin to 9-pin.<br>  |
| **6.2125.020** | **Cable**<br>Connecting cable 732 IC Detector (RS232 interface) – Seiko printer DPU-411<br>Can also be used as an RS232 extension cable.<br>  |
| **6.2125.040** | **Cable**<br>Connecting cable 732 IC Detector (RS232 interface) – Epson printer with 9-pin circular connector<br>  |
| **6.2125.050** | **Cable**<br>Connecting cable 732 IC Detector (RS232 interface) – printer (IBM Proprinter, Citizen IDP562-RS, Epson with serial interface, Epson LX-300, HP Deskjet/Laserjet with serial interface, etc.)<br>  |
| **6.2125.060** | **Cable**<br>Connecting cable 732 IC Detector (RS232 interface) – PC or 709 IC Pump<br>  |
| **6.2125.110** | **Cable**<br>Connecting cable 732 IC Detector (RS232 interface) – PC<br>  |
| **6.2125.130** | **Cable**<br>Connecting cable 732 IC Detector (RS232 interface) – Seiko printer DPU-414<br>Adapter cable 25-pin to 9-pin.<br>  |

# 7.4 Warranty and conformity

## 7.4.1 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 of outside manufacture 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 material, construction or design as well as the absence of guaranteed features, the orderer 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, the original packaging should be used if at all possible. This applies above all to instruments, electrodes, burette cylinders and PTFE pistons. Before embedment in wood shavings or similar material, the parts must be packed in a dust-proof package (for instruments, use of a plastic bag is imperative). If open assemblies are enclosed in the scope of delivery that are sensitive to electromagnetic voltages (e.g. data interfaces etc.) these must be returned in the associated original protective packaging (e.g. conductive protective bag). (Exception: assemblies with built-in voltage source belong in a 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.

### 7.4.2 EU Declaration of conformity

CE

## EU Declaration of Conformity

The METROHM AG company, Herisau, Switzerland hereby certifies, that the instrument:

**732 IC Detector**

meets the requirements of EC Directives 89/336/EWG and 73/23/EWG.

**Source of the specifications:**

| | |
|---|---|
| EN 50081-1/2 | Electromagnetic compatibility, basic specification Emitted Interference |
| EN 50082-2 | Electromagnetic compatibility, basic specification Interference Immunity |
| EN 61010 | Safety requirements for electrical laboratory measurement and control equipment |

**Description of the instrument:**

Thermostatted conductivity detector for ion chromatographic analyses with electronic or chemical suppression.

Herisau, September 30, 1995

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

CE

# EU Declaration of Conformity

The METROHM AG company, Herisau, Switzerland hereby certifies, that the instrument:

## 733 IC Separation Center

meets the requirements of EC Directives 89/336/EWG and 73/23/EWG.

**Source of the specifications:**

| | |
|---|---|
| EN 50081-1/2 | Electromagnetic compatibility, basic specification Emitted Interference |
| EN 50082-2 | Electromagnetic compatibility, basic specification Interference Immunity |

**Description of the instrument:**

Thermally and electronically isolated wet part for ion chromatography.

Herisau, September 30, 1995

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

### 7.4.3 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: | 732 IC Detector | |
| System software: | Stored in ROMs | |
| Name of manufacturer: | Metrohm Ltd., Herisau, Switzerland | |
| Principal technical information: | Voltages: | 100…120, 220…240 V |
| | Frequency: | 50…60 Hz |

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

IEC801-2/IEC1000-4-2 (class 4), IEC801-3/ IEC1000-4-3 (class 3), IEC801-4/IEC1000-4-4 (class 4), IEC801-5/IEC1000-4-5 (class 2/3), IEC801-6/IEC1000-4-6 (class 3), EN50082-2, EN61000-3-2/3/IEC1000-3-2/3, EN50093/IEC1000-4-11, EN55011 (class B), EN55022 (class B), EN50081-1/2 — *Electromagnetic compatibility*

IEC1010, EN61010, UL3101-1 — *Security specifications*

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. The features of the system software are documented in the instruction manual.

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, September 30, 1995

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

## 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: | 733 IC Separation Center | |
| Name of manufacturer: | Metrohm Ltd., Herisau, Switzerland | |
| Principal technical information: | Voltages: | 5 V DC, 24 V DC |

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

IEC801-2/IEC1000-4-2 (class 4), IEC801-3/ IEC1000-4-3 (class 3), IEC801-4/IEC1000-4-4 (class 4), IEC801-5/IEC1000-4-5 (class 2/3), IEC801-6/IEC1000-4-6 (class 3), EN50082-2, EN55011 (class B), EN55022 (class B), EN50081-1/2 — *Electromagnetic compatibility*

IEC1010, EN61010, UL3101-1 — *Security specifications*

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.

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, September 30, 1995

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

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