

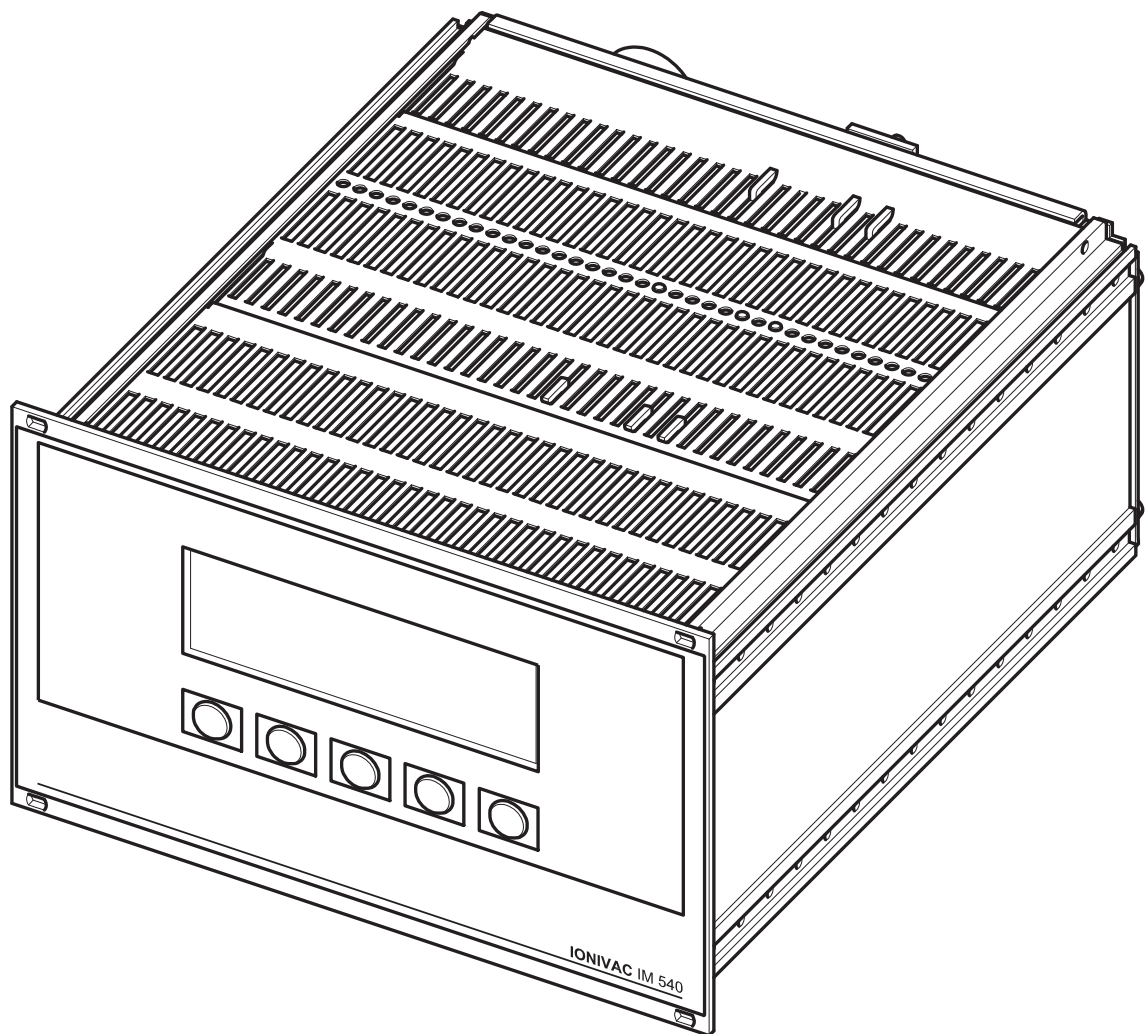
IONIVAC IM 540

Ionization Gauge Controller

Operating Manual GA09419_002_A1

Cat. number

230 100



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Contents

1 Introduction

1.1 Validity

1.1.1 Catalog Number

This document applies to the following products:

| Catalog number | Product |
|----------------|----------------|
| 230 100 | IONIVAC IM 540 |

The catalog number can be found on the type label which is attached to one side of the device.

1.1.2 Firmware Version

This Operating Manual is based on the firmware version V03.10. Previous firmware versions may not have the complete functionality described in this Operating Manual.

If the device does not work as described, please check if it is equipped with this firmware version. You can find the firmware version number of your device in the [Detail] > [Info] > [MC-Board] menu. See Section «Info», 46.

1.1.3 Type Label

There is a type label attached to one side of the device. In all communication with Oerlikon Leybold Vacuum, please state the information on the type label. For this purpose you may want to copy the information into the space provided below:

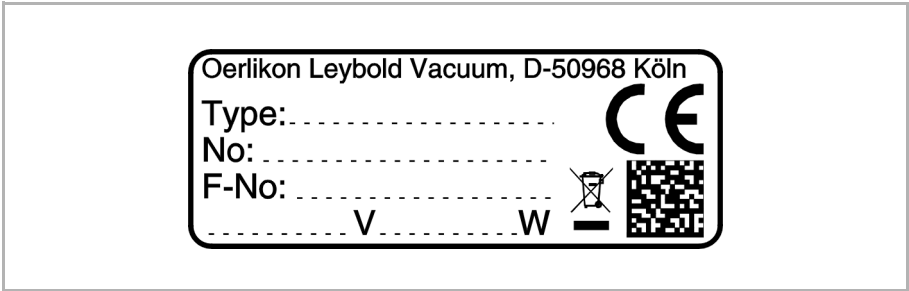


Fig. 1-1 Type label (example)

Introduction

1.2 Intended Use

The IONIVAC IM 540 is a versatile microprocessor controlled ionization gauge controller for pressure measurements in the range 1×10^{-13} through 1.1×10^3 mbar.

The concept and design of the controller allow for a reliable and complete integration in complex process control systems.

The IONIVAC IM 540 can handle four measuring systems simultaneously. An optional interface may be used for complete remote control of the device.

In the following, the IONIVAC IM 540 Ionization Gauge Controller will be referred to as «IM 540».

1.2.1 Liability and Warranty

Oerlikon Leybold Vacuum assumes no liability and the warranty becomes null and void if the end user or third parties

- Disregard the information in this document
- Use the product in a non-conforming manner
- Make any kind of alterations (modifications, repair work, etc.) to the product
- Use the product with accessories not listed in the corresponding product documentation

We reserve the right to make technical changes without prior notice. The figures are non-committal.

1.3 Compatibility

The IM 540 is compatible with its predecessor IONIVAC IM 520. Use [Parameter]>[General]>[Device] to select the IM520-Mode.

Note:

The relays inside of the IM 540 can only be used for mains power if an optional relay box is connected.

1.4 Safety

1.4.1 Personnel Qualifications

All work described in this document may only be carried out by persons who have suitable technical training and the necessary experience or who have been instructed by the end user of the product.

1.4.2 Illustration of Residual Dangers

This Operating Manual illustrates hazard alerts concerning residual dangers as follows:

Indicates an imminently hazardous situation which, if not avoided, will result in death or severe injury.

Danger



Indicates a potentially hazardous situation which, if not avoided, could result in death or severe injury.

Warning



Indicates a potentially hazardous situation which, if not avoided, could result in moderate or minor injury or in property damage.

Caution



Note:

Indicates particularly important, but not safety-relevant information.

Introduction

1.4.3 General Safety Instructions

For all work you are going to do, adhere to the applicable safety regulations.

Also observe all safety notes given in this document and forward the information to all other users of the product.

In particular, pay attention to the following safety notes:

Danger



Mains voltage.

Contact with live parts is extremely hazardous when any objects are introduced or any liquids penetrate into the device.

Make sure that no objects enter through the louvers of the device. Keep the device dry.

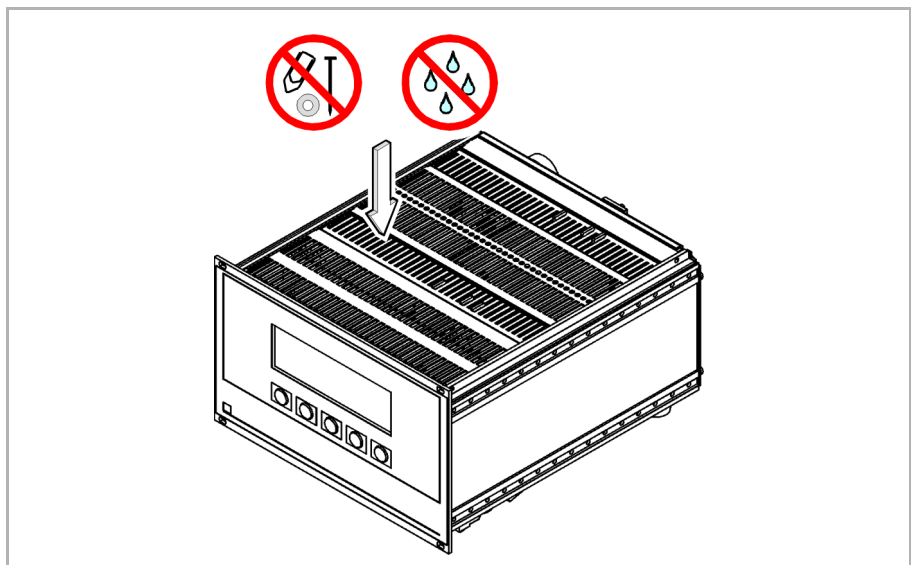


Fig. 1-2 Do not insert objects through louvers and keep device dry

Caution



Improper use.

Improper use can damage the IM 540.

Use the IM 540 only as intended by the manufacturer. See Chapter 1.2 Intended Use, 6.

Caution



Improper installation and operation data.

Improper installation and operation data may damage the IM 540.

Strictly adhere to the stipulated installation and operation data.

2 Technical Data

2.1 General Data

2.1.1 Mechanical Data

Dimensions: width: 213 mm, height: 128.5 mm (3 HE), depth: 248 mm, see Fig. 2-1, 9

Weight: Approx. 3 kg

Use: desktop device, control panel mounted, rack mounted

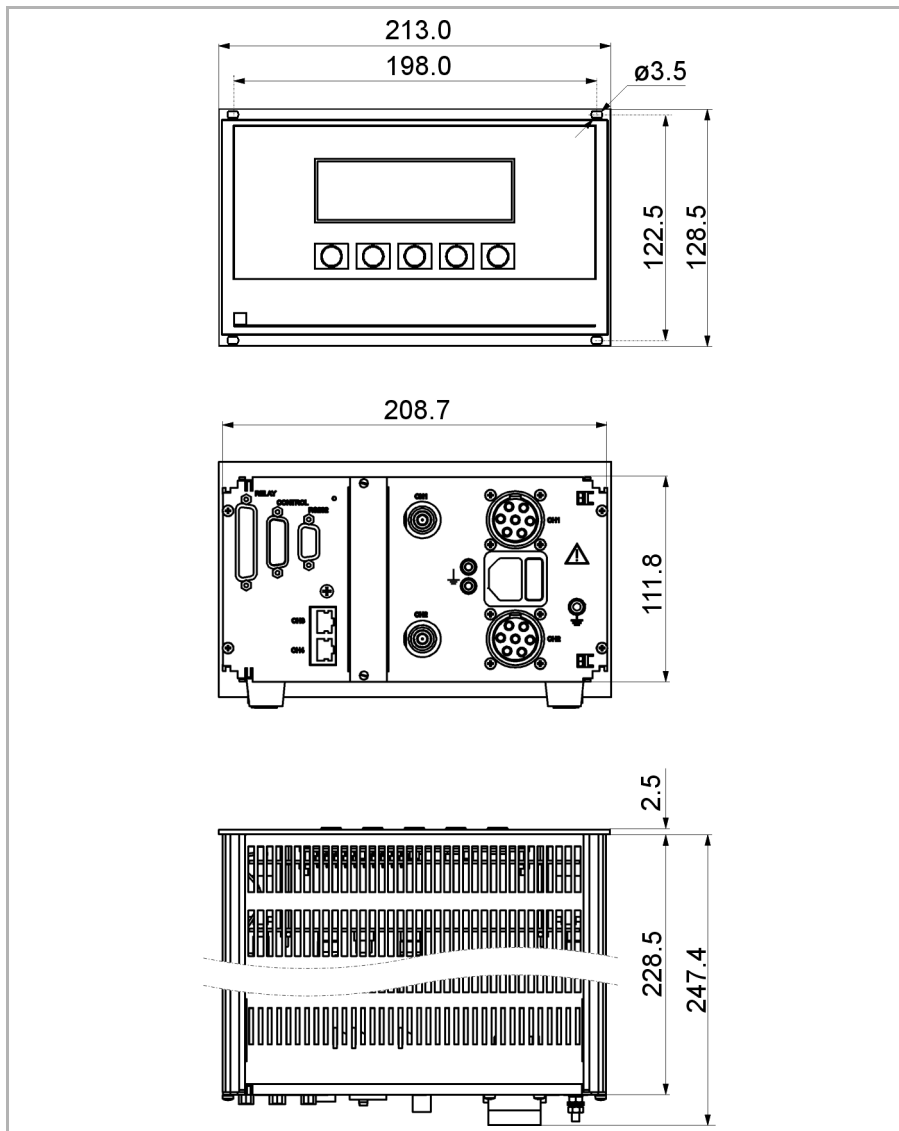


Fig. 2-1 Dimensions (in mm)

2.1.2 Environment

| | |
|--------------------|--|
| Temperature: | Storage: -20...+60 °C Operation: +5...+50 °C |
| Relative humidity: | Max. 80% (up to 30 °C), decreasing to max. 50% (above 40 °C) |
| Use: | Indoors only Altitude max. 2000 m NN |
| Pollution degree: | II |
| Protection type: | IP20 |

2.1.3 Operation

| | |
|-----------------|--|
| Manually: | Via 5 control buttons on the front panel |
| Remote control: | Via RS232 interface or via Profibus (optional) |

2.1.4 Directives

The IM 540 complies with the following EC directives:

- Directive on Low Voltage (2006/95/EC)
- Directive on Electromagnetic Compatibility (2004/108/EC)
- Directive on Restriction of the use of certain Hazardous Substances – RoHS (2011/65/EU)

2.1.5 Harmonized standards

The following harmonized standards have been applied:

- EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements
- EN 61000-6-2 Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments
- EN 61000-6-4 Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
- EN 61326-1 Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements

2.2 Mains Connection

| | |
|-----------------------|--|
| Voltage: | 90...250 VAC |
| Frequency: | 47...63 Hz |
| Current consumption: | Max. 4 A at 115 V Max. 2 A at 230 V |
| Power consumption: | Max. 300 VA |
| Overvoltage category: | II |
| Protection class: | 1 |
| Connection: | European appliance connector IEC 320 C14 |
| Fuse: | 3.15 A (in power supply) |

2.3 Channels

2.3.1 Sensor Connections

Channels 1 and 2:

| | |
|---------------------------------|--|
| Sensor connections per channel: | Metalock Bantam UTG0187SVDEU + BNC |
| Compatible sensors: | IONIVAC sensors: Bayard-Alpert sensor IE 414 Extraktor sensor IE 514 |

Channels 3 and 4:

| | |
|---------------------------------|--|
| Sensor connections per channel: | RJ45 (FCC 68) |
| Compatible sensors: | THERMOVAC transmitters: TTR 90, TTR 90S, TTR 91, TTR91S CERAVAC transmitters (CTR): Preferably CTR 90, CTR 91 |

2.3.2 Sensor Supply

2.3.2.1 IONIVAC Sensors

Measuring operation:

| | IE 414 | IE 514 |
|---------------------|---|--------|
| Anode potential | 220 V | 220 V |
| Reflector potential | - - - | 205 V |
| Cathode potential | 80 V | 100 V |
| Emission current | 0.1 mA ¹⁾ 1.0 mA ²⁾ 10.0 mA ³⁾ | 1.6 mA |

- 1) for increasing pressure in the range 9.99E-3...1E-4 mbar
for decreasing pressure in the range 9.99E-3...1E-5 mbar
2) for increasing pressure in the range 9.99E-5...1E-7 mbar
for decreasing pressure in the range 9.99E-6...1E-8 mbar
3) for increasing pressure in the range 9.99E-8...1E-11 mbar
for decreasing pressure in the range 9.99E-9...1E-11 mbar

Degassing:

| | IE 414 | IE 514 |
|---------------------|--------|--------|
| Anode potential | 480 V | 480 V |
| Reflector potential | - - - | 205 V |
| Cathode potential | 20 V | 10 V |
| Emission current | 90 mA | 45 mA |
| Power | 41 W | 21 W |

2.3.2.2 THERMOVAC and CERA-VAC Transmitters

| | |
|----------|---------------------|
| Voltage: | +24 VDC ±5% |
| Current: | 0...1 A per channel |

2.3.3 Measuring Ranges

Total measuring range:

$1 \times 10^{-13} \dots 1.3 \times 10^3$ mbar

Measuring ranges of the IONIVAC sensors

| Emission current (mA) | Pressure range (mbar) | Ion current (A) |
|-----------------------|--------------------------|--|
| 10 | $10^{-11} \dots 10^{-8}$ | $1.7 \times 10^{-12} \dots 1.7 \times 10^{-9}$ |
| 1 | $10^{-8} \dots 10^{-5}$ | $1.7 \times 10^{-10} \dots 1.7 \times 10^{-7}$ |
| 0.1 | $10^{-5} \dots 10^{-2}$ | $1.7 \times 10^{-8} \dots 1.7 \times 10^{-5}$ |

Tab. 2-1 Measuring ranges of the BAG IE 414 for pressure dependent emission current

| Emission current (mA) | Pressure range (mbar) | Ion current (A) |
|-----------------------|--------------------------|--|
| 10 | $10^{-11} \dots 10^{-2}$ | $1.7 \times 10^{-12} \dots 1.7 \times 10^{-3}$ |
| 1 | $10^{-11} \dots 10^{-2}$ | $1.7 \times 10^{-13} \dots 1.7 \times 10^{-4}$ |
| 0.1 | $10^{-11} \dots 10^{-2}$ | $1.7 \times 10^{-14} \dots 1.7 \times 10^{-5}$ |

Tab. 2-2 Measuring ranges of the BAG IE 414 for fixed emission current

| Emission current (mA) | Pressure range (mbar) | Ion current (A) |
|-----------------------|--------------------------|--|
| 1.6 | $10^{-13} \dots 10^{-4}$ | $1.6 \times 10^{-15} \dots 1.6 \times 10^{-6}$ |

Tab. 2-3 Measuring range of the Extraktor IE 514

Measuring ranges of the CERA VAC transmitters (CTR 90, CTR 91)

| CTR | Pressure range |
|------------------------|--|
| 0.1 Torr (CTR 91 only) | $1 \times 10^{-5} \dots 1 \times 10^{-1}$ Torr |
| 1 Torr | $1 \times 10^{-4} \dots 1$ Torr |
| 10 Torr | $1 \times 10^{-3} \dots 1 \times 10^1$ Torr |
| 100 Torr | $1 \times 10^{-2} \dots 1 \times 10^2$ Torr |
| 1000 Torr | $1 \times 10^{-1} \dots 1 \times 10^3$ Torr |

Measuring ranges of the THERMOVAC transmitters

$5 \times 10^{-4} \dots 1 \times 10^3$ mbar

2.3.4 Measuring Technique

Accuracy of measurement

| | |
|--------------------------------|--|
| Current: (channels 1 and 2) | Relative to current reading: $\pm 2\%$ Absolute: ± 5 fA |
| Voltage: (channels 3 and 4) | Relative to voltage reading: $\pm 1\%$ Absolute: ± 2 mV |

Measuring speed

The measuring speed that can be achieved with IONIVAC gauges depend on the ion current to be measured and the selected resolution. Details on this can be found in Chapter 8.4.4 Current Measuring Amplifier (Amplifier), 220.

The measuring rate of the transmitters is 20 s⁻¹ over the entire measuring range.

Filter time constants

The filter time constants depend on the measuring rate. The actual measurement is the average of the last n measurements. The filter settings are defined as follows:

| | |
|---------|----------|
| Slow: | $n = 50$ |
| Normal: | $n = 15$ |
| Fast: | $n = 5$ |

Display rate, temperature drift, unit of measurement

| | |
|----------------------|------------------------|
| Display rate: | 4 s ⁻¹ |
| Temperature drift: | < 0.1 % per °C |
| Unit of measurement: | mbar, Pa, Torr, Micron |

Resolution of the A/D converter

| | |
|---------------------------|---------------|
| THERMOVAC and CERAVAC: | 16 bit |
| IONIVAC: | ≤ 14 bit |

2.3.5 Sensor Identification

The following sensors are recognized automatically by means of an identification resistor:

| Sensor | ID resistor |
|-----------------------|---|
| IE 514 | 0 Ω (shorted) ≥ 4.25 V at the A/D converter |
| IE 414 | ∞ Ω (interrupted) ≤ 0.75 V at the A/D converter |
| THERMOVAC | 27.0 k Ω \pm 1% 1.640 V at the A/D converter |
| CERAVAC ¹⁾ | 13.2 k Ω \pm 1% 0.849 V at the A/D converter |

1) All transmitters of the same type use the same identification resistor. The valid measuring range must be configured by the user. See Chapter 2.3.3 Measuring Ranges, 13.

Note:

Both sensors are identified automatically by the software. If no sensor is found on channel 1 or 2, the controller assumes that a Bayard-Alpert sensor is connected to channel 1. That way the system is still operable.

2.4 Interfaces

2.4.1 Relay Outputs

| | |
|-------------------|---|
| Name: | Relay |
| Connection: | D-Sub, 25 pins, female. See Fig. 3-8, 27. |
| Number of relays: | 2, can be extended to 7 with an additional interface board |
| Response time: | Max. 50 ms, synchronous to channels 3 and 4, asynchronous to channels 1 and 2 |
| Contact type: | Change-over contact, floating |
| Load (ohmic): | Max. 50 VDC, 0.5 A |

2.4.2 Control Signals, Recorder

| | |
|-----------------------------|--|
| Name: | Control |
| Connection: | D-Sub, 15 pins, male |
| Filter time constant: | Max. 1 ms |
| Resolution A/D converter: | 16 bit |
| Resolution D/A converter: | 12 bit |
| Measuring and refresh rate: | 20 s ⁻¹ , synchronous to channels 3 and 4, asynchronous to channels 1 and 2 |
| Analog input voltage: | 0... 10 V, unipolar |
| Analog output voltage: | 0... 11 V, unipolar |
| Input impedance: | Min. 100 kΩ |
| Output impedance: | Max. 50 Ω |
| Digital inputs: | TTL compatible |

2.4.3 RS232

| | |
|---------------|--|
| Name: | RS232 |
| Connection: | D-Sub, 9 pins, female |
| Baud rate: | 300*, 600*, 1200*, 2400, 4800, 9600, 19200, 38400, 57600, 115200 * only in IM 520 Mode |
| Data: | 7 bit, 8 bit, 9 bit |
| Parity: | odd, even, none |
| Stop bits: | 1, 2 |
| Flow control: | XON/XOFF can be switched on and off * only in IM 520 Mode |

2.4.4 Interface Board (Option)

The following interface boards can be used:

■ Interface board with RS232-C interface or with RS422 interface:

| | |
|--------------------------------|-----------------|
| Number of relays: | 5 |
| Breaking capacity for power: | 45 W, 75 VA |
| Breaking capacity for voltage: | 30 VDC / 50 VAC |
| Breaking capacity for current: | 1.5 A |

■ Interface board with Profibus DP interface

| | |
|--------------------------------|-----------------|
| Breaking capacity for voltage: | 30 VDC / 50 VAC |
|--------------------------------|-----------------|

2.5 Scope of Delivery

| Designation | Number |
|---|--------|
| IONIVAC IM 540 | 1 |
| Installation manual | 1 |
| CE Declaration | 1 |
| CD-ROM | 1 |
| Mains cable, EUR version | 1 |
| Mains cable, US version | 1 |
| Casing feet, set | 1 |
| Rack mounting set (19", 3 HU), consisting of: | |
| ■ Collar screws | 4 |
| ■ Plastic sleeves | 4 |

2.6 Accessories

| Designation | Cat. no. |
|---|----------|
| Mountable measuring system IE 414 DN35 CF | 158 66 |
| Mountable measuring system IE 514 DN35 CF | 158 67 |
| Spare cathode for IE 414 | 158 63 |
| Spare cathode for IE 514 | 158 61 |
| Measuring line for IE 414/514, 5 m | 158 68 |
| Measuring line, temperature resistant 200 °C, 5 m | 158 44 |
| Extension line for IE 414/514, 20 m | 158 69 |

3 Installation

3.1 Unpacking

- 1 Visually inspect the transport packaging for signs of external damage
- 2 Unpack the IM 540 and put the packaging material aside
- 3 Remove the protective film from the display

Note:

Keep the packaging material for later use. The IM 540 must be stored and transported in the original packaging material only.

- 4 Examine the IM 540 for completeness
- 5 Visually inspect the IM 540 for signs of damage

Damaged product.

Putting a damaged product into operation can be extremely dangerous.

Never attempt to put a damaged product into operation. Secure the damaged product from unintended operation. Send a damage report to the haulage company or the insurer.

Warning



3.2 Mechanical Installation

The IM 540 can be used as follows: As a desk-top device, mounted in a control panel, or mounted in a 19" rack. In each of these cases you must pay attention to the following hazard alert:

Ambient temperature.

Exceeding the maximum permitted ambient temperature may damage the device.

Make sure that the maximum permitted ambient temperature is not exceeded and that the air can flow freely through the louvers. Do not expose the device to direct sunlight.

Caution



Installation

3.2.1 Desk-Top Device

In order to use the IM 540 as a desk-top device, proceed as follows:

- 1 Switch off the IM 540 and disconnect it from mains power
- 2 Turn the IM 540 upside down as shown in Fig. 3-1, 20
- 3 The holes for the legs are covered by plastic caps. Use a screw driver and remove the plastic caps.
- 4 Screw the four legs on to the corners of the casing base plate

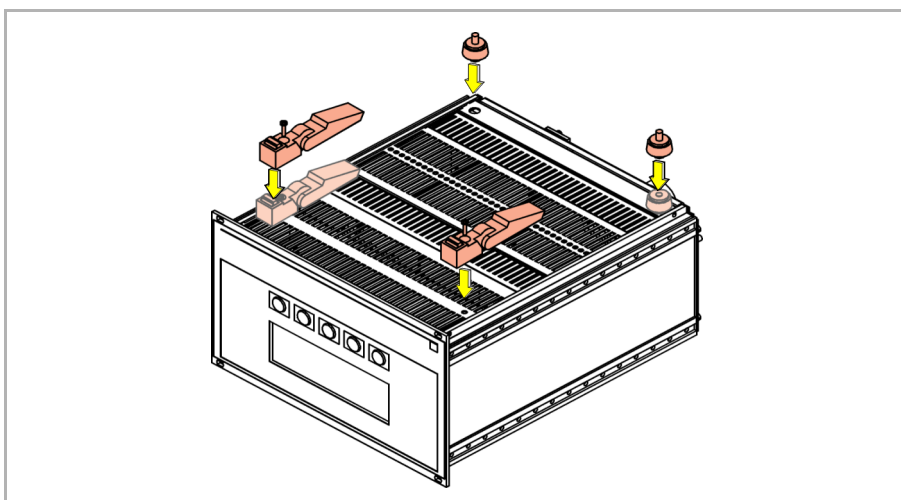


Fig. 3-1 Using the product as a desk-top device

- 5 If required, fold out the two front legs
- 6 Turn the IM 540 back to normal orientation and place it on the required location

3.2.2 Installation in a Control Panel

In order to mount the device in a control panel, the following cutout is required:

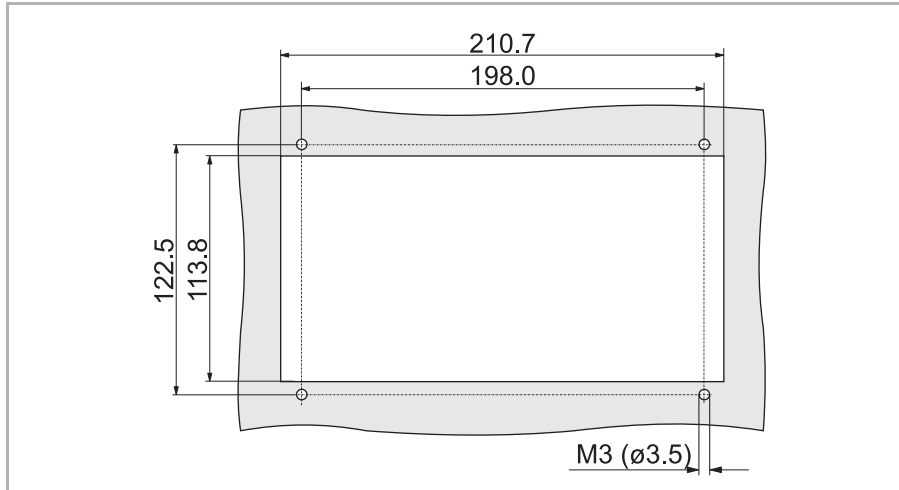


Fig. 3-2 Control panel cutout (in mm)

- 1 Insert the IM 540 into the cutout
- 2 Fasten the device with four M3 screws

Note:

In order to reduce the strain on the front panel it is recommended to support the bottom of the device.

Installation

3.2.3 Rack Installation

The IM 540 is designed for installation into a rack chassis adapter according to DIN 41 494 (19", 3 HU). For this purpose, 4 collar screws and 4 plastic sleeves are supplied with the device.

Warning



Protection class of the rack.

If the product is installed in a rack, it is likely to lower the protection class of the rack (protection from foreign bodies and water) e.g. according to the EN 60204-1 regulations for switching cabinets.

Take appropriate measures to restore the required protection class of the rack.

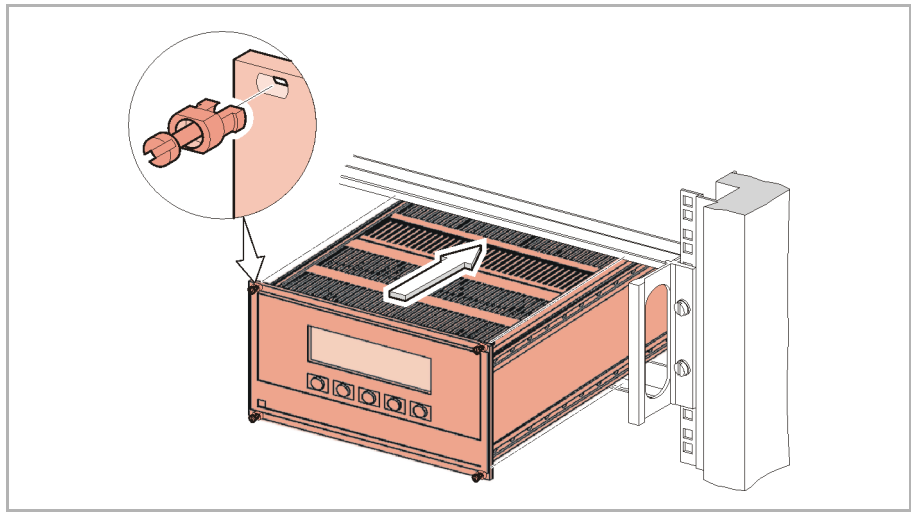


Fig. 3-3 Mounting the device in a rack

Note:

In order to reduce the strain on the front panel it is recommended to equip the rack chassis adapter with a guide rail.

Note:

For safe and easy installation of heavy rack chassis adapters, it is recommended to equip the rack frame with slide rails.

- 1 Fasten the rack chassis adapter in the rack
- 2 Insert the IM 540 into the rack chassis adapter
- 3 Fasten the IM 540 with the supplied collar screws and plastic sleeves to the rack chassis adapter

3.3 Connecting

3.3.1 Back Side of the Device

Fig. 3-4, 23 shows the back side of the IM 540.

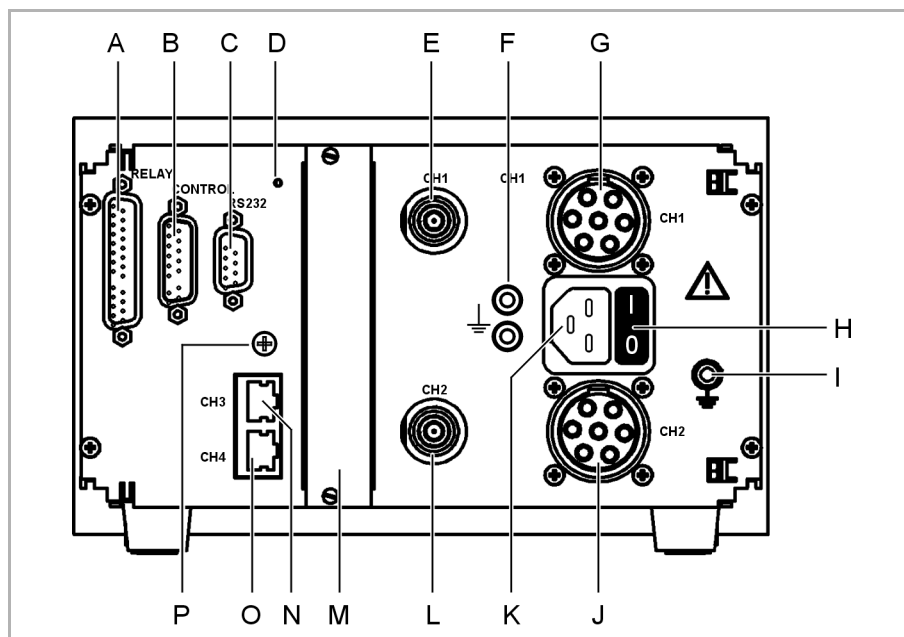


Fig. 3-4 Back side of the IM 540

- A RELAY connection
- B CONTROL connection
- C RS232 connection
- D Switch for program transfer mode
- E Connection for IONIVAC measuring signal, channel 1
- F Fastening and ground screws for heat sink
- G Connection for IONIVAC control, channel 1
- H Mains switch
- I Ground screw
- J Connection for IONIVAC control, channel 2
- K Mains connection
- L Connection for IONIVAC measuring signal, channel 2
- M Extension slot
- N Connection for transmitter, channel 3
- O Connection for transmitter, channel 4
- P Ground screw VP540

Screw for internal protective conductor.

The internal protective conductor is connected to the casing with a screw. In case of a failure, a device whose protective conductor is not connected to the casing may be lethal.

Do not turn or loosen this screw.

Ground connection of heat sink.

The heat sink is connected to the casing with two screws. In case of a failure, a device whose heat sink is not connected to the casing may be lethal.

Do not turn or loosen these screws.

Warning



Warning



Installation

The configuration of the available connections is described in the following sections.

3.3.2 Mains Connection

The mains connection (Fig. 3-4, 23, item K) is designed for a mains cable which contains a European appliance connector on the device side.

A mains cable is supplied with the device. If the plug is not compatible with your wall socket, you have to get a suitable mains cable:

- Three-conductor cable with protective ground
- Conductor cross-section $3 \times 1.5 \text{ mm}^2$ or larger

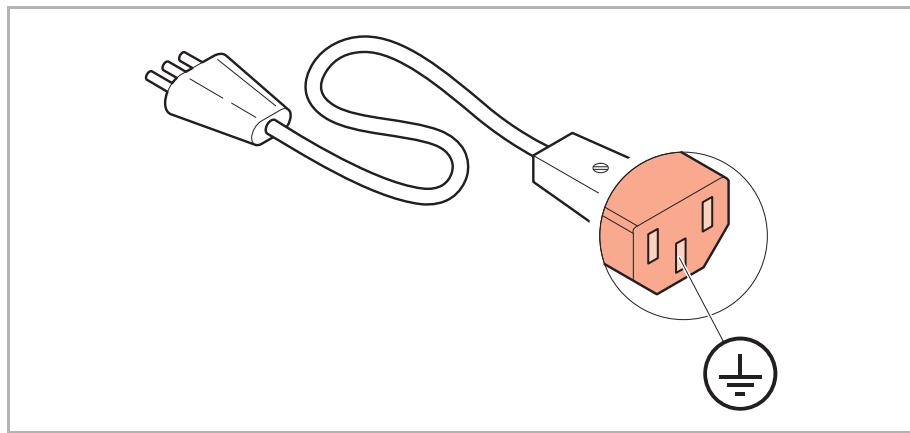


Fig. 3-5 Three-conductor cable with protective ground (example)

Danger



Mains power.

Improperly grounded devices can be extremely dangerous in the event of a fault.

Use three-wire mains or extension cables with protective ground only. Plug the mains cable into wall sockets with protective ground only.

- 1 Connect the European appliance connector of the mains cord with the mains connection of the device
- 2 Connect the plug of the mains cable with the wall socket

Note:

If the device is installed in a switching cabinet, the mains power can be supplied via a switchable central power distributor.

3.3.3 Ground

Protective conductor

The ground screws (Fig. 3-4, 23, item I) can be used to connect the IM 540 with the protective ground of the pumping station.

- 1 If required: Connect the protective ground of the pumping station with the ground screw. Use a protective conductor.

The metal flanges of the IE 414 and IE 514 sensors are connected to the ground via the measuring lines inside of the IM 540.

Heat sink

The heat sink is connected to the casing with two ground screws (Fig. 3-4, 23, item F). Do not turn or loosen these screws.

3.3.4 CH1 and CH2

The CH1 and CH2 connections are used to connect IONIVAC sensors.

Control signals

A 7-pin appliance socket (type Metalock Bantam) is available for each channel. See Fig. 3-4, 23, items G and J.

Pin assignment:

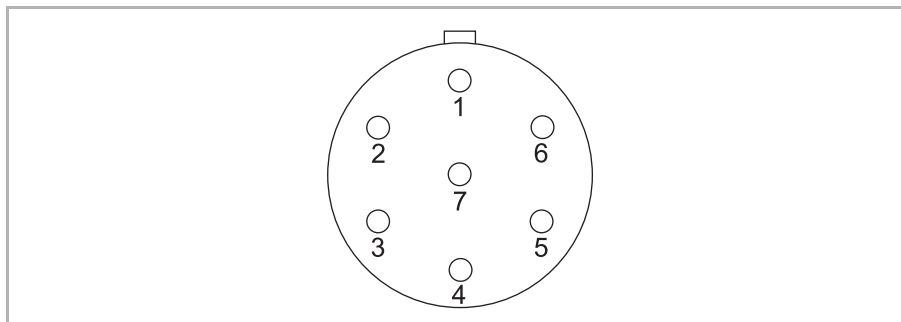


Fig. 3-6 CH1 and CH2 appliance socket (Metalock Bantam)

- | | |
|-------------------------|------------------------|
| 1 Filament | 5 ID res (short 1) |
| 2 Cathode | 6 ID res (short 2) |
| 3 Anode | 7 Protective conductor |
| 4 Reflector (Extraktor) | |

Hazardous voltage.

As soon as the emission is switched on, both appliance plugs carry hazardous levels of voltage, even if only one measuring system is connected. Touching one of these plugs may cause serious injuries.

The device must be switched off before any work is performed to the sensor or the measuring line. After switching off, wait approx. 15 seconds before starting the work.

Warning



Installation

Measuring signals

The measuring signals, i.e. the ion currents, of each sensor are transferred via a coaxial cable. See Fig. 3-4, 23, items E and L.

Pin assignment:

Inner conductor: Ion current

Outer conductor: Shielding

Danger



Hazardous voltage.

During operation of the IONIVAC sensors IE 414 and IE 514, a hazardous voltage may be present at the measuring signal connection (Fig. 3-4, 23, Pos. E und L) in case of a failure.

Mount the touch protection at the measuring signal connection. The touch protection is included in delivery of the measuring line.

3.3.5 CH3 and CH4

The CH3 and CH4 connections are used to connect the transmitters.

An 8-pin RJ45 appliance socket is available for each channel. See Fig. 3-4, 23, items N and O.

Pin assignment

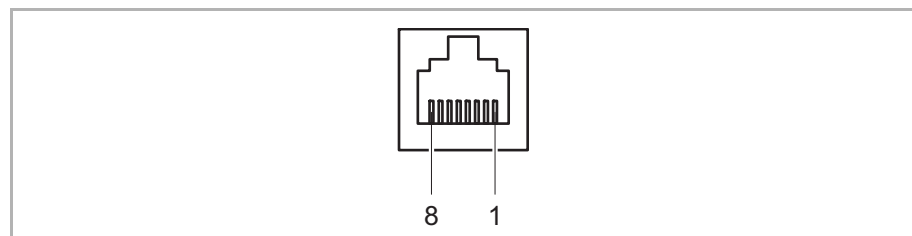


Fig. 3-7 CH3 and CH4 appliance socket (RJ45)

| | |
|------------|--------------|
| 1 +24 VDC | 5 Signal-GND |
| 2 PGND | 6 n.c. |
| 3 U_{in} | 7 n.c. |
| 4 Ident | 8 n.c. |

n.c. not connected

Caution



Improper transmitter.

Transmitters which are not designed for use with the IM 540 may damage the device.

Operate the IM 540 with proper transmitters only. See Chapter 2.3.1 Sensor Connections, 11.

Caution



Multiple connection.

Only one transmitter may be connected to each of the channels. Otherwise the connected transmitters will be damaged.

Never connect more than one transmitter per channel.

Connecting

- 1 CH3: Connect the transmitter with the CH3 connection. Use a shielded 1:1 cable.
- 2 CH4: Connect the transmitter with the CH4 connection. Use a shielded 1:1 cable.

3.3.6 RELAY

The switching functions and the error monitoring system influence the states of several relays inside of the IM 540. The RELAY connection (Fig. 3-4, 23, item A) allows to utilize the relay contacts for switching purposes. The relay contacts are potential-free (floating).

Pin assignment

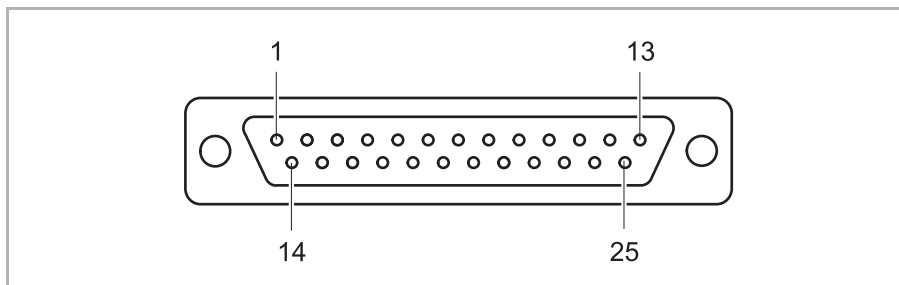


Fig. 3-8 RELAY appliance socket (D-Sub, 25-pin)

| | |
|----------------------------|---|
| 1 GND | 16 Emission off (NC) |
| 2 GND | 17 Emission common (COM) |
| 3 Channel 2 ready (NC) | 18 Emission on (NO) |
| 4 Trigger 1 off (NC) | 19 Degas off (NC) |
| 5 Trigger 1 common (COM) | 20 Degas common (COM) |
| 6 Trigger 1 on (NO) | 21 Degas on (NO) |
| 7 GND | 22 Channel 1 ready (NC) |
| 8 Trigger 2 off (NC) | 23 Channel 1 common (COM) |
| 9 Trigger 2 common (COM) | 24 Channel 1 error (NO) |
| 10 Trigger 2 on (NO) | 25 +24 VDC, 200 mA. Meets the requirements of a ground protective extra low voltage (SELV-E according to EN 61010). |
| 11 Channel 1 selected (NC) | |
| 12 Channel common (COM) | |
| 13 Channel 2 selected (NO) | |
| 14 Channel 2 error (NO) | |
| 15 Channel 2 common (COM) | |

COM common
NC normally closed
NO normally open

Note:

Pin 25 is used for supplying relays with a higher breaking capacity. The supply contact is protected at 200 mA.

Hazardous voltage.

Voltages above 60 VDC or 30 VAC pose a shock hazard.

The RELAY connection may be used for switching voltages of max. 60 VDC or 30 VAC only. These voltages must meet the requirements of a ground protective extra low voltage (SELV-E according to EN 61010).

Warning



Installation

- 1 Connect the peripheral components with the RELAY connection. Use a shielded cable.

3.3.7 CONTROL

The CONTROL connection (Fig. 3-4, 23, item B) contains the following signal pins:

- Analog inputs for remote control of the emission
- Digital inputs for switching the emission
- Linear and logarithmic recorder output

Pin assignment

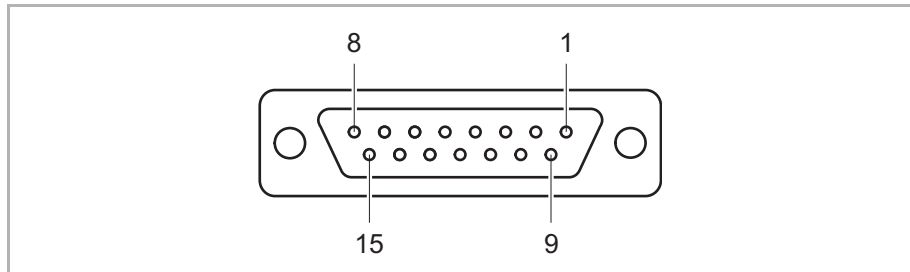


Fig. 3-9 CONTROL appliance socket (D-Sub, 15-pin)

| | |
|------------------------------|---------------------------|
| 1 Dig. Remote Channel 1 GND | 9 Dig. Remote Channel 1 |
| 2 Dig. Remote Channel 2 GND | 10 Dig. Remote Channel 2 |
| 3 GND | 11 GND |
| 4 GND | 12 Anal. Remote Channel 1 |
| 5 Anal. Remote Channel 1 GND | 13 Anal. Remote Channel 2 |
| 6 Anal. Remote Channel 2 GND | 14 Recorder 1 Output |
| 7 Recorder 1 GND | 15 Recorder 2 Output |
| 8 Recorder 2 GND | |

- 1 Connect the peripheral components with the CONTROL connection. Use a shielded cable.

3.3.8 RS232

The RS232 serial interface (Fig. 3-4, 23, item C) allows remote control of the device via a computer or a terminal. See Chapter 6 Computer Interface (IM 520 Mode), 93.

In addition, the interface may be used for firmware updates. See Chapter 8.2 Program Transfer Mode, 211.

Pin assignment

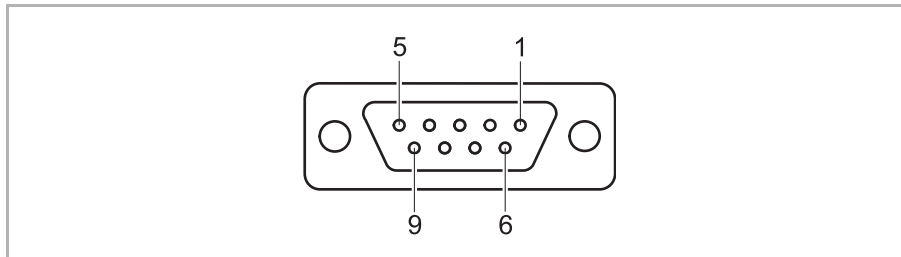


Fig. 3-10 RS232 appliance socket (D-Sub, 9-pin)

| | |
|--|--------|
| 1 DCD, +5 V external supply, max. 300 mA | 5 GND |
| 2 TxD | 6 DSR |
| 3 RxD | 7 n.c. |
| 4 n.c. | 8 CTS |
| | 9 RI |

- 1 Connect the serial interface of the computer with the RS232 connection. Use a shielded cable.

Note:

Use a serial extension cable with a 9-pin plug and a 9-pin socket. The cable must not contain any crossed wires.

3.3.9 Extension Slot (Option)

An interface board in the extension slot (Fig. 3-4, 23, item M) can be used to extend the device with 5 more relays and one more interface.

Usable interface boards

- Interface board with RS232-C interface
- Interface board with RS422 interface
- Interface board with Profibus DP interface

4 Operation

4.1 Front Panel

Fig. 4-1, 30 shows the front panel of the IM 540.

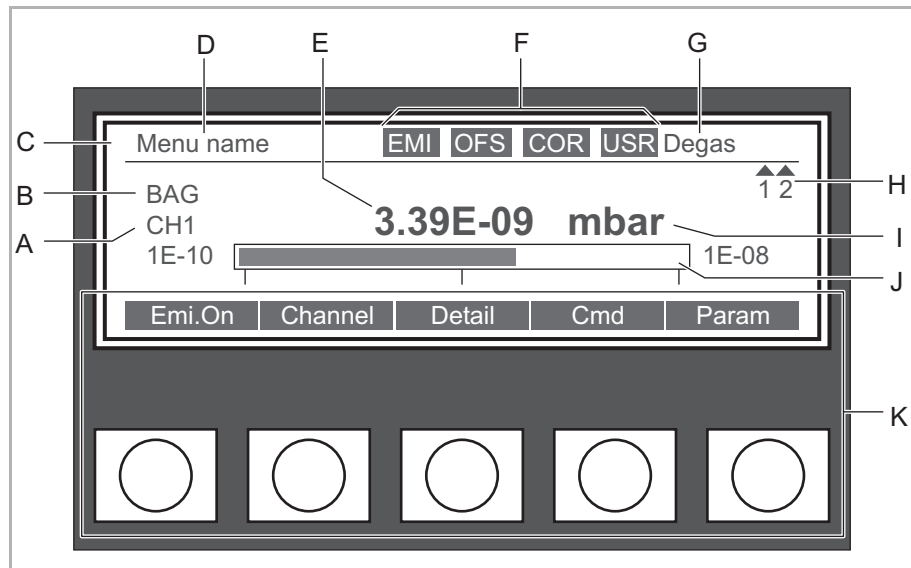


Fig. 4-1 Front panel of the IM 540 (example)

- | | |
|----------------------------------|----------------------------------|
| A Channel | G Status display (black letters) |
| B Sensor type | H Trigger relay status |
| C Status row | I Pressure unit |
| D Menu name | J Bar graph measurement display |
| E Digital measurement display | K Control buttons |
| F Status display (white letters) | |

4.1.1 Display

4.1.1.1 Status Row

The most important system states are always displayed in the top row (item C), no matter which menu is selected.

The left part of the status row displays the menu name (item D) in black letters on a white background. The right part of the status row (item F) displays the following states (from left to right) in white letters on a black background:

| Field | Display | Significance |
|-------|---------|---|
| 1 | EMI | Emission is switched on |
| 2 | OFS | Offset correction for capacitive sensor is activated |
| 3 | COR | Gas type correction is programmed |
| 4 | USR | Standard parameter settings have been changed by the user |

Tab. 4-1 Possible display fields displayed in white letters on black background

These fields remain empty if the related state does not apply.

The right position of the status row (item G) displays the following states in black letters on a white background. The priority of the display corresponds with the listed order.

| Display | Significance |
|----------|---|
| Error xy | Error no. xy has been issued <ul style="list-style-type: none"> ■ Flashing: Error has not yet been acknowledged ■ Static: Error has been acknowledged via the «Error» sub-menu. See Chapter 4.5.2 Detail Groups, 45. |
| Test | Hardware test is being performed. See Chapter 8.4 Test Mode, 213. |
| Degas | Sensor is being degassed (flashing) |
| Offset | Offset or zero values are being determined (flashing) |
| LoadCor | A charge correction is performed for the ion gauge amplifier (only in highly sensitive ranges) |
| EMO | Emergency-off button has been actuated. See Chapter 4.4.6 Emergency-Off Action, 41. |
| Profi | Device is controlled via Profibus. See Chapter 5.2.4 Device Control (Control), 65. |
| IF540x | Device is controlled via RS232 of the optional interface board. See Chapter 5.2.4 Device Control (Control), 65. |
| RS232 | Device is controlled via RS232 and the IM 540 protocol. See Chapter 5.2.4 Device Control (Control), 65. |

| Display | Significance |
|-----------|--|
| Remote | Device is controlled via discrete remote control inputs. See Chapter 5.2.4 Device Control (Control), 65. |
| IM520 | Device is controlled via RS232 and IM520 protocol. See Chapter 5.2.3 Device Mode (Device), 64. |
| (nothing) | None of the conditions mentioned above applies |

Tab. 4-2 Possible display fields in the right half of the status row

4.1.1.2 Trigger Relay Status

The states of the two trigger relays are displayed to the right of the display (item H). If the triangle above the number is illuminated, the relay is off or the pressure is above the lower threshold value. If the triangle below the number is illuminated, the relay is on or the pressure is below the upper threshold value. See Fig. 5-1, 56.

These states are only displayed if trigger relays have been selected for this. See Chapter 5.1.2 Configuring Switching Functions, 57.

4.1.1.3 Measurement Display

The current measurement is displayed digitally (item E) and as a bar graph (item J).

Note:

In sensitive measuring ranges, interference (external mechanical or electrical effects) may temporarily cause the measurement of a negative input current. In these cases, the last valid pressure value will be displayed, preceded by the less-than sign "<".

- Digital display: The measurement is displayed as a three-digit floating point number in scientific notation by default. The unit of measurement is displayed to the right: mbar, Torr, Pa, or Micron.
- Bargraph: The bar graph illustrates the increase or decrease of the measurements. The related pressure range limits can be seen at the left (lower limit) and right (upper limit) of the bar graph. Markings highlight the boundaries between decades of pressure. The unit of measurement is always identical with the digital measurement display.

The digital display and the bargraph can be customized. See Chapter 5.2.6 Display, Bargraph (Disp.Bar), 71.

4.1.1.4 Important Messages

If the measurement cannot be performed an appropriate message appears in place of the measurement display. The following messages may be displayed:

| Message | Significance |
|---------|--|
| Ov.Temp | Overtemp signal of the power supply is active, measurement cannot be performed |
| WaitPir | IM 520 Mode, Pirani Control activated, «Emission ON» has been requested, waiting for release by the Pirani sensor |
| WaitCon | IM 540-Mode, sensor control function activated, the displayed channel is waiting for release by the controlling system |
| CodErr | The identification resistance of a previous connected sensor cannot be detected |
| PowErr | Error caused by the power supply of the displayed channel |

4.1.1.5 Channels

The left side of the display shows both the channel (item A) and the sensor type (item B).

The following sensor types are available:

| Display | Significance |
|---------|---|
| EXT | Extraktor IE 514 |
| BAG | Bayard Alpert IE 414 |
| CTR | Capacitive transmitter: CTR 90, CTR 91 |
| TTR | Pirani transmitter: TTR 90, TTR 90S |

The channels 1 and 2 only accept sensors of the type BAG and EXT. Therefore the following displays are possible:

| Display | Significance |
|------------|---|
| BAG CH1 | Channel 1 connected to a Bayard-Alpert sensor |
| EXT CH1 | Channel 1 connected to an Extraktor sensor |
| BAG CH2 | Channel 2 connected to a Bayard-Alpert sensor |
| EXT CH2 | Channel 2 connected to an Extraktor sensor |

| Display | Significance |
|------------|--|
| TTR CH3 | Channel 3 connected to a Pirani sensor |
| CTR CH3 | Channel 3 connected to a capacitive sensor |
| TTR CH4 | Channel 4 connected to a Pirani sensor |
| CTR CH4 | Channel 4 connected to a capacitive sensor |

Tab. 4-3 Possible display of channels

4.1.2 Control Buttons

Emi.On, Emi.Off, EMO_Off, EMO_Res

This button is used for switching on and off the emission of the sensor connected to the selected channel. Switching off the sensor will also stop any running zero adjustment or degassing operation.

In the remote control state, this button is also used as an emergency-off button. See Chapter 4.4.6 Emergency-Off Action, 41.

The labeling of the button depends on the current state:

| Labeling | Significance |
|----------|---|
| Emi.On | Emission is switched off and can be switched on |
| - - - - | Emission is switched off and cannot be switched on |
| Emi.Off | Emission is switched on and can be switched off |
| EMO_Off | Emergency-off. Emission has been switched on via remote control or «Auto Mode». |
| EMO_Res | This will reset a previously executed EMO_Off function. Control is returned to the control unit. However, a new request for switching on is required. |

Channel

The channel button is used for selecting a measurement channel. This is necessary e.g. if you want to switch on or off a particular sensor.

If emission is switched off (Emi.Off), the following routine works in the background:

If the displayed sensor is connected to channel 1 or 2 and the ion source supply is not set to this channel, the ion source supply will be switched to this channel and as a result the sensor will be code monitored.

Detail

This menu displays important parameters and error messages. In addition, you can configure the graphical display of measurements and view the related settings. See Chapter 4.5 Detail View Mode, 45.

Cmd

The Cmd button is used to display the Deg.On and Ofs.Set buttons (depending on the configuration).

The system returns to the measurement screen by pressing a Cmd button or the Return button.

Deg.On

This button is only visible in the Cmd menu.

It activates degassing of the selected sensor. The labeling of the button changes to «Deg.Off».

Ofs.Set

This button is only visible in the Cmd menu.

It activates the offset function for the selected sensor. the labeling of the button changes to «Ofs.Res».

The offset function allows you to perform a measurement with respect to a reference pressure. This also makes the zero adjustment of the sensor unnecessary.

Param

This menu is used for configuring the device. The following submenus are available for this:

| Submenu | Configuration |
|----------|---|
| Setpoint | Switching functions |
| General | General settings, interface configuration, behavior in case of an error |
| Sensor | Sensor parameters |
| Ioni Amp | Current amplifier parameters |
| Control | Sensor control |
| UserMode | User-defined settings |
| TestMode | Settings for hardware tests. This submenu is only available after activating the test mode. See Chapter 8.4 Test Mode, 213). |

The related configuration parameters are described in Chapter 5 Parameters, 55.

If no button is pressed in one of the submenus within the «Timeout» period, the device returns to the measurement screen. Selected parameters (if any) will remain unchanged.

Arrow buttons (DOWN ▼ /UP ▲)

The arrow buttons are used for two different actions:

- Select the respective menu field for input of a parameter value
- Decrease or increase a default value. For this, the respective menu field must have been selected and then activated with the Enter key.

In the following, these buttons will be referred to as DOWN and UP, respectively.

Enter

The Enter button is used for two different actions:

- Activate the selected menu field which has been selected with the arrow buttons (edit mode)
- Accept the parameter value adjusted with the arrow buttons and exit the edit mode. The parameter value is stored in the EEPROM.

Return

This button is used to switch back to the previous level. The Return function cannot be executed in the edit mode.

ESC (Escape)

This button is only visible in the edit mode.

Pressing the ESC button will exit the edit mode. The parameter is reset to the value found when activating the edit mode.

4.2 Switching On and Off

4.2.1 Switching On

- 1 Switch the mains switch on. See Fig. 3-4, 23, item H.

After switching on, the IM 540 will perform the following actions:

- Self test
- Identify all sensors. See Chapter 2.3.5 Sensor Identification, 15).
- Restore the previously set parameters
- Activate measurement mode
- Adapt parameters (if a sensor type has changed meanwhile)

4.2.2 Switching Off

- 1 Switch the mains switch off. See Fig. 3-4, 23, item H.

4.2.3 Delay Time

Note:

After switching off, the IM 540 requires approximately 10 seconds to initialize again.

Wait for at least 10 seconds before you switch the IM 540 on again.

If the IM 540 has been installed in a control panel or a rack, it can also be switched on and off via the central power distributor.

4.3 Operating Modes

The IM 540 can be set to one of the following operating modes:

Measurement mode

The measurement mode is the standard operating mode. It displays the pressure readings of the sensors. In case of an error, a status message is displayed instead. See Chapter 4.4 Measurement Mode, [§ 39](#).

Detail view mode

The detail view mode is used to display various values and error messages (if any) in a clear layout. See Chapter 4.5 Detail View Mode, [§ 45](#).

Parameter mode

The parameter mode gives you access to various parameters. You can modify the parameter settings using the arrow buttons. This allows you to configure the IM 540. See Chapter 4.6 Parameter Mode, [§ 48](#).

User mode

The user mode allows you to control and, if necessary, change these standard parameters. See Chapter 5.7 User Parameters (UserMode), [§ 91](#).

Program transfer mode

The program transfer mode is used to transfer the latest version of the firmware to the IM 540. See Chapter 8.2 Program Transfer Mode, [§ 211](#).

Test mode

The test mode is used for service purposes. Here you can query and change device data and also perform device tests. See Chapter 8.4 Test Mode, [§ 213](#).

4.4 Measurement Mode

4.4.1 Selecting Measurement Mode

The IM 540 automatically selects the measurement mode after it has been switched on.

From any other mode, you can return to the measurement mode by pressing the Return button once or several times.

When the device is set to the parameter mode, it will automatically return to the measurement mode if no button is pressed within the «Timeout» period.

4.4.2 Description

The measurement mode is the standard operating mode. It displays the pressure readings of the sensors. A status message is displayed if the pressure exceeds the permissible range.

Channels which are not connected to a sensor are not displayed.

4.4.3 Selecting a Channel

1 Press the Channel button

If the display is set to the automatic mode (see Chapter 5.5.2 Sensor Activation Mode (Mode), 86), the automatic mode will be interrupted and the active channel is displayed. The «Auto Control» signal in the status row is dark.

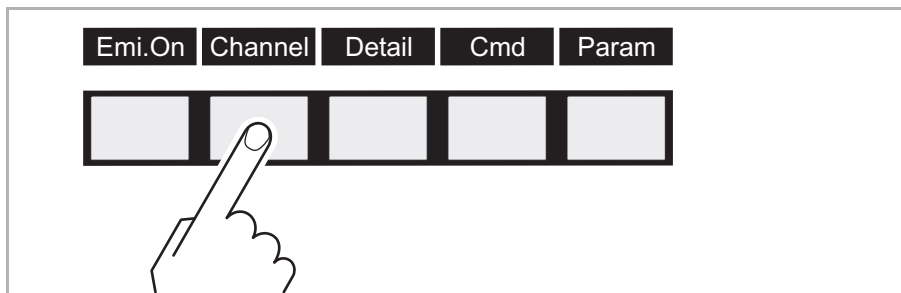


Fig. 4-2 Press the Channel button

2 Press the Channel button once or several times until the required channel is displayed

Every time the Channel button is pressed, the display changes to the next channel connected to a sensor. The channel number and the sensor type are always displayed. The automatic mode is resumed after all channels have been displayed.

4.4.4 Switching Emission On

Caution




Excessive gas pressure.

Excessive gas pressure at the measurement position can damage the sensor.

Before switching the emission on, check to make sure that the pressure at the measurement position does not exceed the following values:

- BAG: $p \leq 9.98 \times 10^{-3}$ mbar
- Extraktor: $p \leq 9.98 \times 10^{-5}$ mbar

- 1 Select the required channel. See Chapter 4.4.3 Selecting a Channel,  39.
- 2 Press the Emi.On button

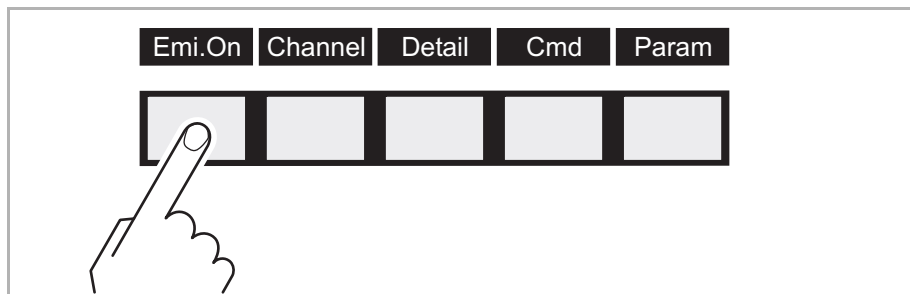


Fig. 4-3 Press the Emi.On button

- The sensor of the selected channel is switched on
- The measurement value is displayed
- The status row shows the «EMI» signal
- The button label changes to «Emi.Off»

Warning



Hazardous voltage.


As soon as the emission is switched on, both appliance plugs carry hazardous levels of voltage, even if only one measuring system is connected. Touching one of these plugs may cause serious injuries.

The device must be switched off before any work is performed to the sensor or the measuring line. After switching off, wait approx. 15 seconds before starting the work.

Danger



Hazardous voltage.

During operation of the IONIVAC sensors IE 414 and IE 514, a hazardous voltage may be present at the measuring signal connection (Fig. 3-4,  23, Pos. E und L) in case of a failure.

Mount the touch protection at the measuring signal connection. The touch protection is included in delivery of the measuring line.

4.4.5 Switching Emission Off

The emission can always be switched off manually. This is also true if the device is in the remote control state.

- 1 Select the required channel. See Chapter 4.4.3 Selecting a Channel, 39.
- 2 Press the Emi.Off button

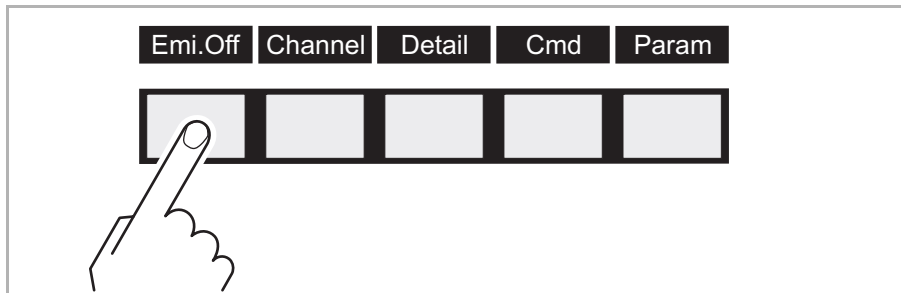


Fig. 4-4 Press the Emi.Off button

- The sensor of the selected channel is switched off
- The «EMI» signal is dark
- Switching off the emission will also stop any running zero adjustment or de-gassing operation
- The button label changes to «Emi.On»

4.4.6 Emergency-Off Action

If the device is in the remote control state, it can be switched off by pressing the EMO_Off button. The button label then changes to «EMO_Res». See Chapter 4.4.5 Switching Emission Off, 41.



Fig. 4-5 Press the EMO_Off button in the remote control state

The «EMO» signal in the status row indicates this state. See Chapter 4.1.1 Display, 31.

The emergency-off function remains active until the EMO_Res button is pressed.

Control is returned to the control unit. However, a new request for switching on is required.

4.4.7 Switching Degas Function On

Ionization sensors with a hot cathode are sensitive with regard to depositions on the electrodes. These depositions can cause signal fluctuations.

The degas function is used to bakeout and thereby clean the electrode system of the sensor.

The degas function is only available for Bayard-Alpert and Extraktor sensors. It can only be activated if the emission of the sensor is already switched on and the pressure is below the following values:

- $p < 1 \times 10^{-4}$ mbar for the Bayard-Alpert sensor
- $p < 1 \times 10^{-5}$ mbar for the Extraktor sensor

You can switch on the degas function as follows:

- 1 Select the required channel. See Chapter 4.4.3 Selecting a Channel, [Fig. 39](#).
- 2 Press the Cmd button

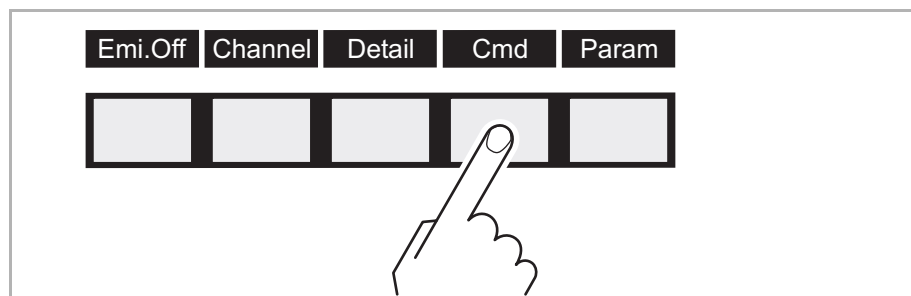


Fig. 4-6 Press the Cmd button

- 3 Press the Deg.On button

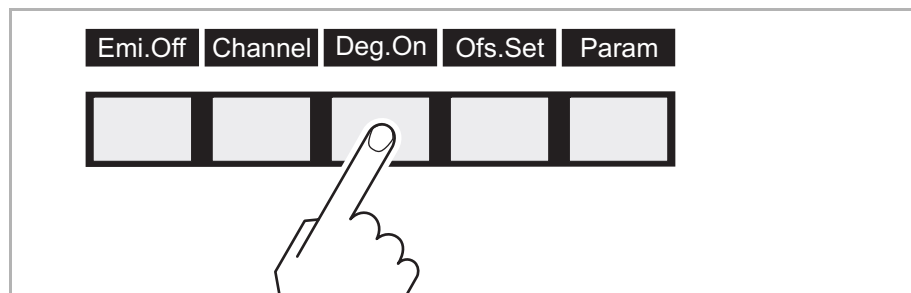


Fig. 4-7 Press the Deg.On button

- The degas function for the sensor of the selected channel is switched on
- The «Degas» signal in the status row flashes
- During degassing, there is no pressure measurement. The last valid measured value is displayed.

4.4.8 Switching Degas Function Off

The degas function is switched off automatically after 10 minutes. You may also deactivate this function manually at any time:

- 1 Select the required channel. See Chapter 4.4.3 Selecting a Channel, [Fig. 39](#).
- 2 Press:
 - the Emi.Off button, or
 - the Cmd button and then the Deg.Off button

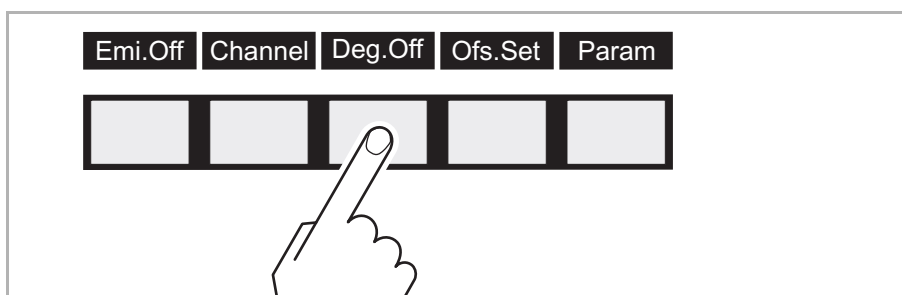


Fig. 4-8 Press the Deg.Off button

- The degas function for the sensor of the selected channel is switched off
- The «Degas» signal in the status row is dark

4.4.9 Defining and Activating Offset

The offset function is only available for ion vacuum gauges and capacitive sensors. The zero adjustment can only be performed if the emission is switched on.

- 1 Select the required channel. See Chapter 4.4.3 Selecting a Channel, [Fig. 39](#).
- 2 Press the Cmd button (Fig. 4-6, [Fig. 42](#))
- 3 Press the Ofs.Set button

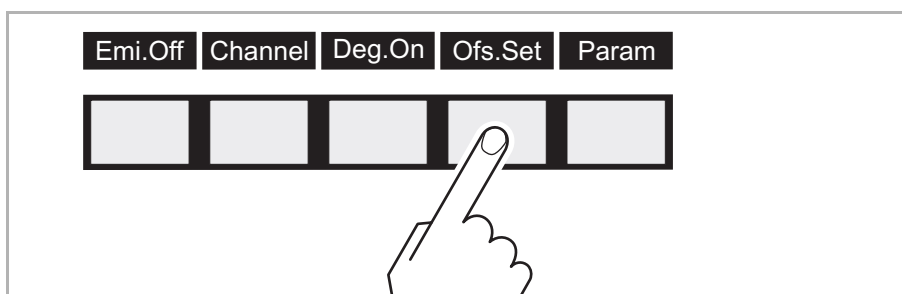


Fig. 4-9 Press the Ofs.Set button

In the case of capacitive sensors, pay attention to the following:

- When pressing the Ofs.Set button, the current pressure reading becomes the new offset value
- The stored offset value will be subtracted from all pressure readings
- The «OFS» signal in the status row is illuminated

In the case of ion vacuum gauges, an offset adjustment of the current amplifier is performed instead.

The «Offset» signal in the status row flashes as long as the zero adjustment is being performed

The current offset values can be inspected in the detail view mode. See Chapter 4.5.2 Detail Groups, 45.

Note:

The zero adjustment procedure takes a few seconds. During this period, no measurements will be read and processed.

Switching off the emission will stop the zero adjustment procedure.

The zero adjustment can also be performed automatically. See Chapter 5.3.3 Automatic Offset (Auto_OFS), 78.

4.4.10 Deactivating Offset

This chapter is only relevant for capacitive sensors!

- 1 Select the required channel. See Chapter 4.4.3 Selecting a Channel, 39.
- 2 Press the Cmd button (Fig. 4-6, 42)
- 3 Press the Ofs.Res button

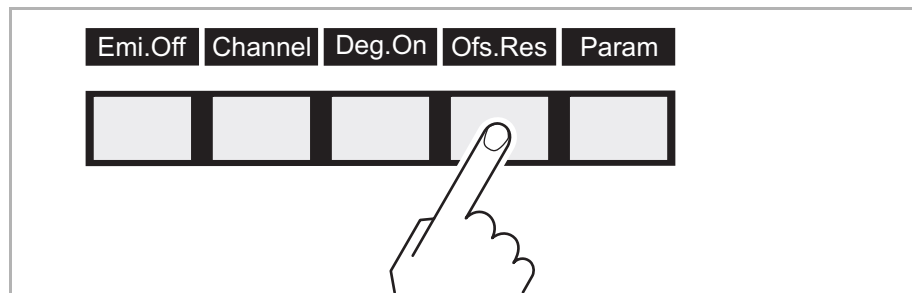


Fig. 4-10 Press the Ofs.Res button

- The offset value is reset to 0
- The «OFS» signal in the status row is dark

4.5 Detail View Mode

4.5.1 Selecting Detail View Mode

- 1 Press the Detail button

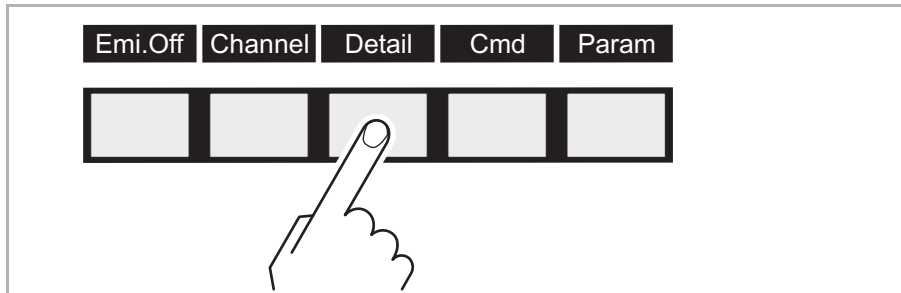


Fig. 4-11 Press the Detail button

The device changes to the detail view mode. Several groups are being offered for selection on the display. See Chapter 4.5.2 Detail Groups, 45.

You can exit the detail view mode by pressing the Return button.

4.5.2 Detail Groups

For clarity, the values displayed in the detail view mode are arranged in groups.

The following groups are available:

Error

Error messages in plain language. See Chapter 4.8 Displaying and Handling System Errors, 53.

Graphic

This group allows you to define and start one trend graphic per channel. The related graphic parameters are described in Chapter 5.6 Graphic Parameters (Detail Graphic), 89.

Pressure

Display the pressure readings for the 4 channels in the current pressure unit

Setpoint

Display all switching functions. See Chapter 5.1 Switching Function Parameters (Setpoint), 55.

Gauge

Display the following parameters of the current sensor:

| Parameter | Significance |
|-----------|------------------------|
| Anode | Anode voltage in V |
| Cathode | Cathode voltage in V |
| Reflect. | Reflector voltage in V |
| Emis. | Emission current in mA |
| U_Fila. | Filament voltage in V |
| I_Fila. | Filament current in A |
| P_Fila. | Filament power in W |

The values are only displayed if the emission is switched on.

Info

Display of offset value settings, operating hours and of print data.

The following submenus are available:

| Submenu | Display / function |
|---------|---|
| Offset | <p>Display the current offset value settings. Ranges:</p> <ul style="list-style-type: none">■ CH1 and CH2: 0...4095■ CH3 and CH4: -3.000 V...+3.000 V (if CTR is connected) <p>The adjustment of offset values is described in Chapter 4.4.9 Defining and Activating Offset, 43.</p> |
| OPTCnt. | <p>Operating hours of the four channels. The individual gauges are counted separately.</p> <p>The operating hours can be reset to zero. See Chapter 8.1.2 Resetting the Operating Hours, 210.</p> |
| EMOCnt. | <p>Number of the emergency off events in channel 1 and 2.</p> <p>An emergency-off event occurs if the emission must be switched off because the pressure is too high, a tolerance has been exceeded, or another error has occurred. See Chapter 5.2.8 Behavior of the IM 540 in Case of an Error (Error), 72.</p> <p>The device distinguishes between the following two emergency off events:</p> <ul style="list-style-type: none">■ Pre.: Pressure too high■ Oth.: Other reasons <p>The values can be reset to zero. See Chapter 8.1.2 Resetting the Operating Hours, 210.</p> |

| Submenu | Display / function |
|--------------------------------|--|
| Miscel. | <p>Restart</p> <p>Cause for the most recent program start</p> <ul style="list-style-type: none"> ■ «Power On» The device has been disconnected from the mains voltage and switched on again ■ «Watchdog» Watchdog: The watchdog has responded and the device has been restarted (failure, exception,...) <p>OPTTot</p> <p>Display the operating hours of the entire device. This value cannot be reset.</p> <p>Prof.Ver</p> <p>Display the profibus firmware version. Only displayed if a profibus card is installed and recognized.</p> |
| MC board (micro controller) | |
| IQ board (ion source) | <p>Display of:</p> <ul style="list-style-type: none"> ■ Artic.No.: Article number ■ Seria.No.: Serial number ■ Cal-Date: Calibration date ■ FW-Vers.: Firmware version ■ HW-Vers: Hardware version |
| VP board (connection print) | |
| IV board (ion amplifier) | |

4.6 Parameter Mode

4.6.1 Selecting Parameter Mode

- 1 Press the Param button

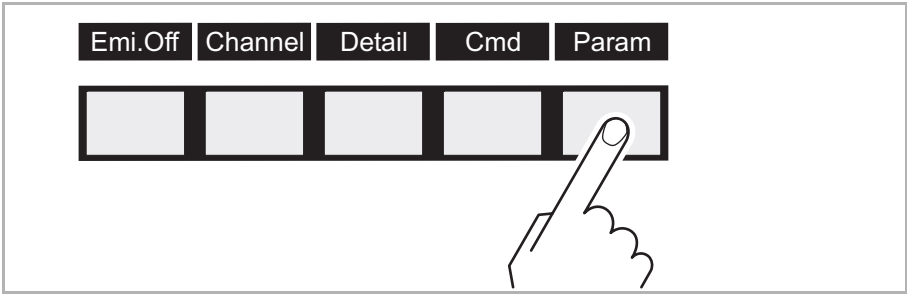


Fig. 4-12 Press the Param button

The device changes to the parameter mode. Several submenus are being offered for selection on the display. See Chapter 4.6 Parameter Mode, 48.

When the device is set to the parameter mode, it will automatically return to the measurement mode if no button is pressed within the «Timeout» period.

4.6.2 Parameter Groups

The parameter mode gives you access to various parameters. You can check the parameter settings or modify them using the arrow buttons. This allows you to configure the IM 540.

Tab. 4-4, 49 shows all available parameter groups and parameters.

| Parameter group | Subgroup | Parameter | |
|-----------------|----------|--------------|----------|
| Setpoint | | Setpoint | Spt.Low |
| | | Channel | Spt.High |
| | | Display Mode | Trigger |
| General | Setup | Device | Control |
| | | Unit | Light |
| | | Torr | Contrast |
| | RS232 | Set.Lock | Men.Time |
| | | Com.Chan | Parity |
| | | Baudrate | Stopbits |
| | | DataBits | FlowCont |
| | | TalkOnly | |

| Parameter group | Subgroup | Parameter | |
|-----------------|--|---|--------------------------------------|
| | Recorder | Channel Source Mode | P_Low P_High Scale |
| | Disp.Bar | Channel Digit Mode | P_Low P_High |
| | Threshol | U1_Low U1_High | U2_Low U2_High |
| | Error | FailRel1 FailRel2 FailCont | Emi.Warn Emi.Tol. Emi.Pow. |
| Sensor | | Channel Filter Auto_OFS Cal/Full | Fil.Pow. Emis.Cur X-Ray |
| | Correct | Channel Cor.Mode Cor.Gain | ClearAll Index Factor Press |
| Ioni Amp | | Channel Sens. | |
| Control | | General Channel Mode | Source P_On P_Off TTR_Ctrl |
| User Mode | Gauge | Channel Anode Cathode Emis.Cur | U_A_Deg. U_C_Deg. I_Degas |
| | Amplif. | Channel Range | Resolut. Time |
| | Config | Chan_1 Chan_2 Chan_3 Chan_4 | MainFreq Interf. |
| Test Mode | See Chapter 8.4.2 Test Parameters and Functions, 215. | | |

Tab. 4-4 Parameter groups and their parameters

The available parameters are subdivided into the following parameter groups:

Switching function parameters (Setpoint)

These parameters are used to assign pressure dependent switching functions to the channels. See Chapter 5.1 Switching Function Parameters (Setpoint), [§ 55](#).

General parameters (General)

These parameters are used for general configuration of the device. The parameters affect all channels. See Chapter 5.2 General Parameters (General), [§ 59](#).

Sensor parameters (Sensor)

These parameters concern the sensor on the currently selected channel only. There is an individual set of sensor parameters for each channel. See Chapter 5.3 Sensor Parameters (Sensor), [§ 76](#).

Current amplifier parameters (Ioni Amp)

These parameters are used for configuration of the current amplifier. Siehe Chapter 5.4 Current Amplifier Parameters (Ioni Amp), [§ 83](#).

Sensor control (Control)

These parameters are used to configure the control inputs. See Chapter 5.5 Sensor Control (Control), [§ 84](#).

4.7 Basic Operation

Starting at the measurement menu, you can select and modify a specific parameter as follows:

- 1 Press the Param button
- 2 Use the arrow buttons to select the required parameter group
 - Parameter groups are marked with >>>
 - The selected parameter group is displayed with white letters on a black background

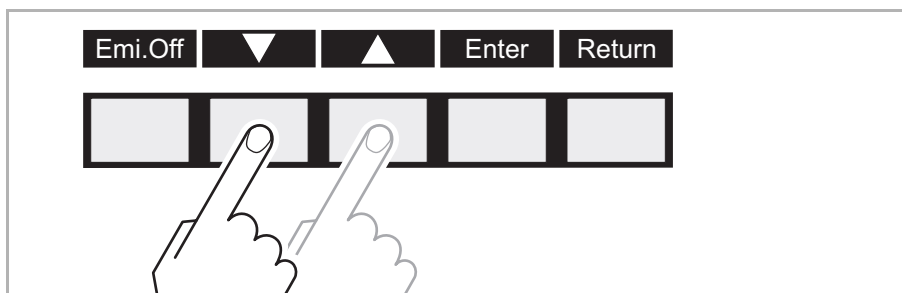


Fig. 4-13 Press the arrow buttons

- 3 Press the Enter button

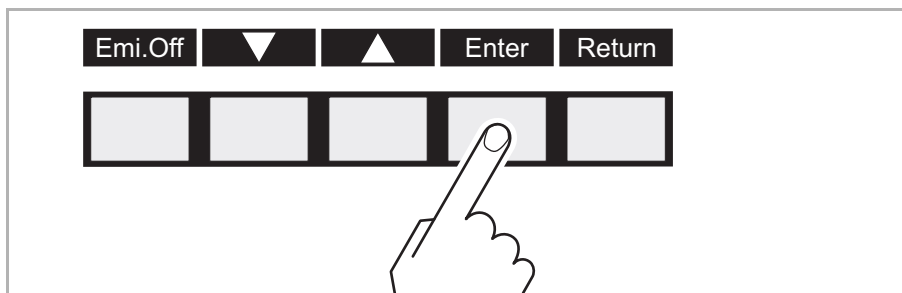



Fig. 4-14 Press the Enter button

- 4 In the parameter group, use the arrow buttons to select the required parameter
 - The selected parameter is displayed with white letters on a black background
- 5 Press the Enter button
 - The cursor appears at the selected parameter value
 - The IM 540 is now in the edit mode. The Return button is replaced by the ESC button.
- 6 Use the arrow buttons to adjust the required parameter value
 - The displayed parameter value is effective immediately
 - The selection of a parameter value can be aborted by pressing the Escape button. This will exit the edit mode and reset the parameter to the value found when activating the edit mode.
- 7 Accept the selected parameter value by pressing the Enter button
 - The parameter value is stored in the EEPROM
 - The edit mode is quit

Operation

- 8 Repeat the steps 2...7 to change further parameters. In order to change to another parameter group, press the Return button to return to the next higher level.
- 9 Return to the measurement mode. See Chapter 4.4.1 Selecting Measurement Mode,  39.

4.8 Displaying and Handling System Errors

4.8.1 Displaying System Errors

The IM 540 can store up to 20 different errors. Any error that occurs is stored in the error list, provided that it has not been stored in the list already. New errors are no longer added to the list if the list is full.

The error list is displayed in the Detail > Error menu. Selecting this menu will automatically acknowledge the current errors and the most recent error is shown in the display. The following information is displayed for errors:

| | |
|--------------|---|
| No: | Position number. The error that has occurred first (oldest error) has the position number 01 and is located at the end of the error list. |
| Code: | Error code |
| Description: | Brief description of the error in clear text |

The display shows «NoErrorsPending» if the device does not hold any pending errors.

If an error occurs, the «Error» display and the related two-digit error number in the status row start flashing. If several errors occur simultaneously, the error registered most recently is displayed in the status row.

You find a list of the error codes and the related error messages in Section «Error Messages», ■ 242.

4.8.2 Acknowledging Errors

Selection of the Detail > Error menus automatically acknowledges the error messages and the «Error xy» status stops flashing. However, the error is displayed as long as the error exists and the error message is stored in the error list.

To switch on the power supply for CH3/CH4, you have to quit the menu Detail > Error and select it again.

4.8.3 Deleting Errors from the Error List

The Detail > Error menu allows you to delete entries in the error list. When deleting an error message it is removed from the memory. If the error exists further on the error message is displayed again. The error display in the status line disappears if the error list is empty.

- 1 Change to the detail view mode. See Chapter 4.5.1 Selecting Detail View Mode, ■ 45.
- 2 Select the Error detail group and then press the Enter button
 - The labeling of the Enter button changes to «Reset»
- 3 Use the arrow buttons to select the error message you want to delete

Operation

4 Press the Reset button

- The selected error message is deleted from the list
- If the error still exists, it is immediately added to the list as a new error
- The position numbers of the error messages that have occurred after the deleted one are decreased by one
- The display shows «NoErrorsPending» if all error messages have been deleted

5 Parameters

5.1 Switching Function Parameters (Setpoint)

This parameter group allows you to configure the switching functions. The following switching function parameters are available:

- Setpoint
- Channel
- Display
- Mode
- Spt.Low
- Spt.High
- Trigger

5.1.1 Fundamental Terms

Switching functions

The IM 540 is equipped with four relays which switch in dependence of the measured pressure. These relays will be referred to as «relay 1» and «relay 2». The number of relays can be increased to 7 by upgrading the device with an interface board. These relays will be referred to as «relay 3»... «relay 7».

Each of the relays can be assigned to any of the channels. The relay contacts are potential-free and can be used for switching via the RELAY connection and the relay connections of the optional interface board. See Chapter 3.3.6 RELAY, 27 and Chapter 3.3.9 Extension Slot (Option), 29.

Threshold values

Depending on the connected sensor, each channel covers a specific pressure range. Within this pressure range, a lower and an upper threshold value are defined in order to determine the switching behavior of the respective relay.

- Lower threshold value Spt.Low
The lower threshold value is responsible for activating the assigned switching function. The relay switches on as soon as the pressure falls below the lower threshold value. This means that the common contact of the relay is connected to the make contact.
- Upper threshold value Spt.High
The upper threshold value is responsible for deactivating the assigned switching function. The relay switches off as soon as the pressure rises above the upper threshold value. This means that the common contact of the relay is connected to the make contact.

Parameters

Hysteresis

In the pressure range between the two threshold values, the previous relay state is maintained. The relay does not switch in this range, and the relay state depends on the pressure curve history. See Fig. 5-1, 56.

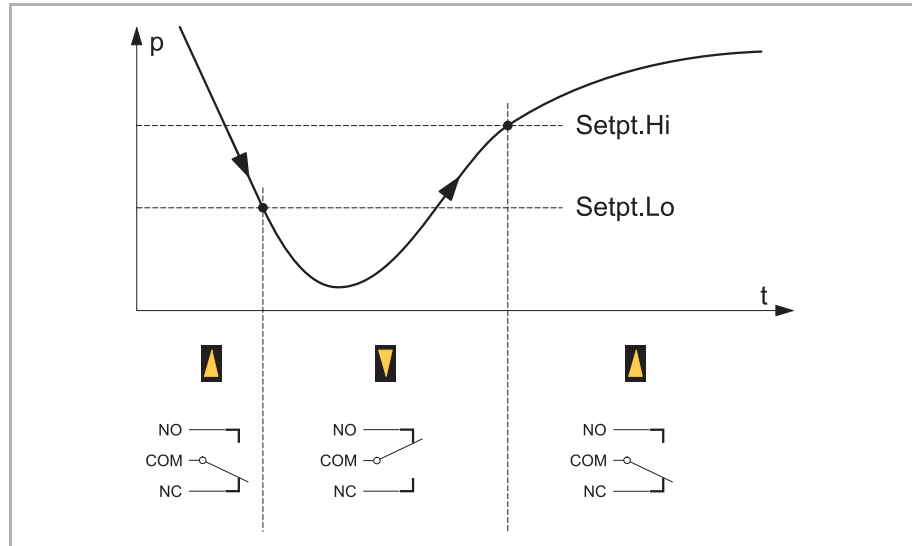


Fig. 5-1 Behavior of a switching function when the pressure changes

p Pressure
t Time
NC Normally closed contact (break contact)
NO Normally open contact (make contact)
COM Common contact

The region between the threshold values generates a hysteresis (lag) between activating and deactivating of the relay. The hysteresis prevents the switching function from rapidly switching on and off when the pressure is close to one of the threshold values.

5.1.2 Configuring Switching Functions

Prerequisite: The parameter group Setpoint is selected.

- 1 In the Setpoint parameter, select the relay to be configured
- 2 In the Channel parameter, select the channel to be assigned to the relay mentioned above
- 3 In the Display parameter, select if the status of the selected relay is to be displayed in the measuring screen
 - Only two relay states can be displayed on the measuring screen. If you set more than two relays to «yes» in the Display parameter, the two relays with the smallest numbers will be displayed. For checking purposes, these two relay states are also displayed at the bottom of the setpoint menu.
- 4 Adjust the upper and the lower threshold value of the selected relay
 - The threshold values depend on the connected sensor. See Section «Threshold Values, Trigger Values», 234.
- 5 Enable or disable the switching function of the selected relay
 - If the switching function is disabled (Trigger disable), the relay status will not be displayed even if the Display parameter is set to «yes»

The function «Mode» is only available if the Device parameter has been set to «IM520». See Chapter 5.2.3 Device Mode (Device), 64

| Value | Functionality |
|-----------|---|
| ---- | Switching functions in IM 540 mode |
| IM520_Lev | <p>Switching functions compatible with the IM 520 in the level-trigger mode.</p> <ul style="list-style-type: none"> ■ The relays 1 and 2 are addressed only ■ Both relays are independent from each other ■ The input fields Channel and Spt.High are irrelevant ■ The Display parameter is always set to «Yes» ■ The Trigger parameter is always set to «Enable» ■ The threshold value is set to Spt.Low ■ The hysteresis is set to 20 % of the decade value. As a consequence, Spt.High = 1.2×Spt.Low. ■ Only measurements from channel 1 or 2 are used as an input for the switching functions. The channel whose emission is switched on is selected automatically. |

Parameters

| Value | Functionality |
|-----------|---|
| IM520_Int | <p>Switching functions compatible with the IM 520 in the interval trigger mode:</p> <ul style="list-style-type: none">■ The relays 1 and 2 are addressed only■ Relay 1 is switched on if the pressure falls below Spt.Low of relay 1■ Relay 1 is switched off if the pressure exceeds Spt.Low of relay 2■ Spt.Low of relay 1 must be below Spt.Low of relay 2■ Relay 2 operates in the level-trigger mode (see above)■ The input fields Channel and Spt.High are irrelevant■ The Display parameter is always set to «Yes»■ The Trigger parameter is always set to «Enable»■ The hysteresis must be at least 20 % of the decade value■ Only measurements from channel 1 or 2 are used as an input for the switching functions. The channel whose emission is switched on is selected automatically. |

Tab. 5-1 Values of the switching function parameter Mode

5.1.3 Setting Range

The setting ranges for the lower and upper threshold values of a switching function are listed in Section «Threshold Values, Trigger Values», 234.

The hysteresis amounts to 10 % (IE 414, IE 514 and TTR 90) and to 1 % (capacitive sensors) of the lower threshold value at least. If there is a conflict when adjusting threshold values, the threshold value which causes the conflict will be shifted within the permitted range.

5.2 General Parameters (General)

These parameters are used for general configuration of the device. The parameters affect all channels.

5.2.1 General Settings (Setup)

5.2.1.1 Unit of Measurement (Unit)

Unit of measurement for pressure values. The unit affects displayed pressure readings, threshold values, etc.

| Display | Significance |
|---------|---------------------------|
| mbar | Pressure unit mbar or bar |
| Torr | Pressure unit Torr |
| Pascal | Pressure unit Pascal |
| Micron | Pressure unit Micron |

Tab. 5-2 Unit parameter values

The unit of measurement is shown on the display. See Fig. 4-1, 30, item F.

Note:

The pressure unit «Micron» is not available in the IM520 mode. Changing to this mode will automatically switch from «Micron» (if selected) to «mbar». See Chapter 5.2.3 Device Mode (Device), 64.

Note:

The pressure unit «Torr» can be locked. In this case Torr is not available for selection. See Chapter 5.2.1.2 Torr-Lock (Torr), 59.

5.2.1.2 Torr-Lock (Torr)

This parameter affects the general parameter Unit. If the lock is enabled, the unit of measurement «Torr» cannot be selected anymore. See Chapter 5.2.1.1 Unit of Measurement (Unit), 59.

| Display | Significance |
|---------|---|
| Yes | Unit of measurement «Torr» can be selected |
| No | Unit of measurement «Torr» cannot be selected |

Tab. 5-3 Torr parameter values

Enabling the torr lock will automatically switch from «Torr» (if selected) to «mbar».

Parameters

5.2.1.3 Setup Lock (Set.Lock)

The setup lock affects the parameter mode. If the lock is enabled, the user can inspect but not modify parameter settings.

| Display | Significance |
|---------|---|
| Off | Setup lock is disabled. Parameters can be modified. |
| Para | Setup lock is enabled. Parameters can be inspected only. All softkeys are enabled. |
| Profi | Setup lock is enabled only for the following parameters: <ul style="list-style-type: none">■ Channel■ Trigger■ Pressure unit■ Offset settings■ All Test mode settings The following softkeys are disabled: <ul style="list-style-type: none">■ The Emi.On softkey is only active as EMO button. Thus the emission cannot be switched off manually.■ The CMD softkey is disabled. Thus the DEGAS and OFFSET functions cannot be activated manually. |
| Full | Setup lock is enabled. Parameters can be inspected only. Additionally, the Emi.On and CMD softkeys are disabled. |

Tab. 5-4 Set.Lock parameter values

The Set.Lock parameter itself is not affected by the setup lock. It can always be modified.

Irrespective of the locking state all DETAIL functions are always enabled allowing to:

- view and reset error messages
- collect, save, and view data using GRAPHIC functions

5.2.1.4 Display Background Illumination (Light)

The brightness of the background illumination can be adjusted in the range 0... 100 % in 1 % steps.

5.2.1.5 Display Contrast (Contrast)

The display contrast can be adjusted in the range 30... 50 % in 1 % steps.

5.2.1.6 Menu Timeout (Men.Time)

The menu timeout determines the period of time after which the parameter menu switches back to the measurement screen if no button has been pressed.

| Display | Significance |
|--------------|--|
| off | Device does not switch back automatically |
| 10...10000 s | Period of time until switching back, adjustable in 1 second steps. |

Tab. 5-5 Men.Time parameter values

5.2.2 Interface Parameters (RS232)

5.2.2.1 Interface (Com.Chan)

Interface to be configured.

| Display | Significance |
|----------|---|
| Standard | RS232 interface of the IM 540 standard version |
| IF540x | RS232 interface of the optional interface board |

Tab. 5-6 Com.Chan parameter values

5.2.2.2 Baud Rate (Baudrate)

Transfer rate of the RS232 interface. Different baud rates can be selected:

- IM 520 mode: 10 setpoints in the range 300...115200 baud
- IM 540 mode: 7 setpoints in the range 2400...115200 baud

5.2.2.3 Number of Data Bits (DataBits)

Number of data bits used for the transmission of a character. 7, 8 or 9 bits can be selected.

5.2.2.4 «Talk Only»-Mode (TalkOnly)

The RS232 interface can be operated in a «Talk Only» mode. Different «Talk Only» repeat rates can be selected in the range 0...60 seconds. The setpoint 0 is equivalent to the entry «Disabled».

Parameters

Note:

In the following cases the «Talk Only» repeat rate is automatically reset to 0 (Disabled):

- When the baud rate for the addressed interface is changed
- When the device mode is changed from IM 540 to IM 520
- When the interface receives any character. Therefore, this setting must not be polled.

5.2.2.5 Parity Bit (Parity)

A bit which is transmitted in addition to the data bits. The parity bit is used to check the integrity of the data.

| Display | Significance |
|---------|---|
| None | The parity bit is not used |
| Odd | The parity bit is set if the number of data bits in the character is even |
| Even | The parity bit is set if the number of data bits in the character is odd |

Tab. 5-7 Parity parameter values

5.2.2.6 Stop Bit (Stopbits)

Number of bits which are transmitted in addition to the data bits. Stop bits are used to check the proper transmission of a character. A maximum of two stop bits can be set.

5.2.2.7 Flow Control (FlowCont)

The function «FlowCont» is only available in the IM 520 compatible mode.

| Display | Significance |
|------------------------|--|
| None | No flow control |
| Full | <p>Full flow control</p> <p>In the IM 520, the flow control is defined as follows:</p> <ul style="list-style-type: none"> ■ Receiving XOFF: No more data will be sent. ■ Receiving XON: The remaining data will be sent. ■ Sending XOFF: After receiving an end character ■ Sending XON: After processing a command <p>If no data exchange takes place, a XON is sent every 2 seconds if handshake is switched on.</p> |
| OnRec. (On Receive) | The device responds to XON/XOFF on receive. However, it will not send XON/XOFF. |

Tab. 5-8 FlowCont parameter values

Parameters

5.2.3 Device Mode (Device)

The IM 540 can be operated in the IM 540 standard mode as well as in the IM 520 compatibility mode. This allows replacement of an IM 520 by an IM 540 at any time and without the need for changes in the software.

| Display | Significance |
|---------|---|
| IM 540 | The IM 540 is in the standard mode. The Control parameter setting (see Chapter 5.2.4, 65) determines how the device is controlled. |
| IM 520 | <p>The IM 540 is in the IM 520 compatibility mode. The device can only be controlled remotely via the CONTROL input or the standard RS232 interface.</p> <p>The following standard values are IM520-compatible (in menu [Param]>[General]>[RS232]):</p> <ul style="list-style-type: none">■ 9600 Bd■ 8 Bit■ no parity■ 1 Stopbit,■ FlowCont: OnRec. <p>The Control parameter (see Chapter 5.2.4, 65) is no longer available.</p> <p>When selecting this mode, the following settings are made automatically:</p> <ul style="list-style-type: none">■ The functionality mode changes to «IM520_Lev». See Chapter 5.1.2 Configuring Switching Functions, 57.■ The recorder output channel is set to «IM520_Au». See Chapter 5.2.5.1 Output Channel (Channel), 66.■ The parameters for the RS232 interface are set to the IM 520 compatible default values■ The control mode is set to «Manual». See Chapter 5.2.4 Device Control (Control), 65.■ The pressure unit is set to «mbar»■ The TTR mode is set to «Disable». See Chapter 5.5.5 TTR Mode (TTR_Ctrl), 88.■ The error signal relay is assigned to channel 1. See Chapter 5.2.8.2 Error Signal Relays (FailRel1, FailRel2), 73.■ The error signal relay 2 is assigned to channel 2. See Chapter 5.2.8.2 Error Signal Relays (FailRel1, FailRel2), 73.■ The Spt.High value is set to 1.2×Spt.Low. See Chapter 5.1.2 Configuring Switching Functions, 57. |

5.2.4 Device Control (Control)

The Control parameter determines how the IM 540 is operated and controlled. This parameter is only available in the standard operating mode.

| Display | Significance |
|---------|--|
| Manual | Operation and control via: <ul style="list-style-type: none"> ■ Buttons ■ CONTROL interface (Analog Remote, Digital Remote) |
| IF540x | Operation and control via: <ul style="list-style-type: none"> ■ Buttons ■ RS232 interface of the optional interface board The status row displays «IF540x». The buttons (except for emergency-off) can be locked via RS232. |
| RS232 | Operation and control via: <ul style="list-style-type: none"> ■ Buttons ■ Standard RS232 interface The status row displays «RS232». The buttons (except for emergency-off) can be locked via the RS232 interface. |

Tab. 5-9 Control parameter values

5.2.5 Recorder Outputs (Recorder)

The IM 540 is equipped with two recorder outputs which can be configured.

The recorder output voltage is kept at a constant level during the following actions:

- Switching the measuring system
- Zero adjustment (Offset)
- Degassing (Degas)
- Switching the measuring range

5.2.5.1 Output Channel (Channel)

Recorder output to be configured. You can select between the two recorder outputs Record_1 and Record_2 or one of the following compatibility settings.

If the device mode is set to «IM 520» (see Chapter 5.2.3 Device Mode (Device), 64), the Channel parameter is set to «IM520_Au» automatically and only the two compatibility settings are available for selection.

IM520_Au

Compatibility mode for IM520 with autorange. This means:

- Only measurements from channel 1 or 2 are output. The channel whose emission is switched on is selected automatically.
- The output voltage (1.0...9.99 V) is proportional to the mantissa of the pressure
- The Record_1 output is always used as a linear output
- The Record_2 output is always used as a logarithmic output. The voltage range 0...10 V is equivalent to the pressure range 1×10^{-12} ... 1×10^{-2} mbar (1 volt per decade)
- The Channel parameter is always set to «Channel 1»
- The Source parameter is irrelevant
- The Scale parameter is always set to «lin»
- The P_Low and P_High parameters are irrelevant

IM520_Fi

Compatibility mode for IM 520 with a fixed range. This means:

- Only measurements from channel 1 or 2 are output. The channel whose emission is switched on is selected automatically.
- The upper limit of the pressure range is specified with the parameter P_High. In this case, the exponent of the parameter specifies the decade whose end value is equivalent to an output signal of 10 V.
- The output voltage is proportional to the pressure in the specified pressure range. The output voltage is limited to 10.2 V if the pressure gets higher.
- The Record_1 output is always used as a linear output
- The Record_2 output is always used as a logarithmic output. The voltage range 0...10 V is equivalent to the pressure range 1×10^{-12} ... 1×10^{-2} mbar (1 volt per decade)
- The Channel parameter is always set to «Channel 1»
- The Source parameter is irrelevant
- The Scale parameter is always set to «lin»
- The P_Low parameter is irrelevant

5.2.5.2 Measuring Channel (Source)

Measuring channel which is assigned to the selected recorder output. In addition to the measuring channels listed in Tab. 4-3, 83, the following settings are available:

| Display | Significance |
|---------|---|
| CH1-CH4 | Measuring channel 1...4 |
| None | No assignment |
| Auto | <p>This value is only available if the parameter «Sensor Control - Mode» has been set to «Auto». See Chapter 5.5.2 Sensor Activation Mode (Mode), 86. In this case, the sensors and the measuring range are specified by the combination of the sensors defined in the automatic run.</p> <p>When switching from one gauge to the next one, the last valid value is output until valid readings are available from the new gauge.</p> |

5.2.5.3 Pressure Range (Mode)

The parameter «Recorder Mode» is used to specify the pressure range used for the output. An output voltage between 10.5 and 11 volts indicates a fault.

| Display | Output |
|---------|---|
| Full | <p>The entire pressure range of the selected sensor is transformed to an output voltage of 0...10 V.</p> <p>Source: Chan 1-4</p> <p>P_Low: Lower range limit of the connected sensor (not modifiable)</p> <p>P_High: Upper range limit of the connected sensor (not modifiable)</p> |
| Expo | <p>The exponent of the reading of the related sensor is output. The mantissa is not significant. Starting at E-14, a voltage of +0.5 volts is output for each decade the reading exceeds this value.</p> <p>Output voltage = (Reading_Exponent + 14) * 0.5 volts</p> <p>1E-14 is equivalent to 0 V</p> <p>1E+6 is equivalent to 10 V</p> <p>Source: ----</p> <p>P_Low: ----</p> <p>P_High: ----</p> |

Parameters

| Display | Output |
|---------|---|
| Auto | Outputs the mantissa of the reading of the related sensor, irrespective of the measurement decade. The mantissa of the reading is equal to the output voltage 0...10 V. Source: Chan 1-4 P_Low: ----- P_High: ----- |
| User | The user can define the lower and upper pressure limits within the range limits of the assigned sensor. See Chapter 5.2.5.4 Pressure Range Limits (P_Low, P_High), 68. Source: Chan 1-4 P_Low: Lower range limit of the connected sensor (modifiable within the range limits of the sensor) P_High: Upper range limit of the connected sensor (modifiable within the range limits of the sensor) |

Tab. 5-10 Mode parameter values

5.2.5.4 Pressure Range Limits (P_Low, P_High)

The P_Low and P_High parameters are used for calculation of the output and display characteristic curve. See Chapter 5.2.5.5 Characteristic Curves (Scale), 69. The specify the pressure range limits in the user mode. See Chapter 5.2.5.3 Pressure Range (Mode), 67.

The adjustable ranges for the lower and upper range limits are described in Section «Threshold Values, Trigger Values», 234.

The distance of the range limits must amount to 10 % of the lower limit at least. If there is a conflict when adjusting range limits, the range limit which causes the conflict will be shifted within the permitted range.

5.2.5.5 Characteristic Curves (Scale)

Fundamentally, we have to distinguish between logarithmic and linear characteristic curves.

| Display | Significance |
|---------|---|
| lin | <p>A linear characteristic curve is useful if the pressure range covers only a few orders of magnitude in the measurement. In this case the recorder output voltage is proportional to the pressure value.</p> <p>10 volts relate to the upper limit, 0 V to the lower limit of the pressure range.</p> |
| log | <p>A logarithmic characteristic curve is useful if the pressure range covers several orders of magnitude in the measurement. In this case it is appropriate to take the logarithm of the pressure and then scale the result in a suitable manner.</p> <p>The range limits are defined by output voltages of 0 and 10 volts.</p> |

If the characteristic curve is set to (Scale) = Lin, the voltages for the recorder outputs are calculated as follows:

| Display | Significance |
|-----------|--|
| Mode Full | <p>The entire measuring range is mapped linearly to 0... 10 V</p> $U_{out} = 10.0 \text{ V} * (\text{Reading} - \text{MIN_Pressure_Sensor}) / (\text{MAX_Pressure_Sensor} - \text{MIN_Pressure_Sensor})$ |
| Mode Expo | <p>The Lin setting has no effect</p> $U_{out} = (\text{Reading_Exponent} + 14) * 0.5 \text{ volts}$ |
| Mode Auto | <p>The mantissa of the reading is mapped linearly</p> $U_{out} = 10.0 \text{ V} * \text{Reading_Mantissa}$ |
| Mode User | <p>The range that has been adjusted by the user is mapped linearly to 0... 10 V</p> $U_{out} = 10.0 \text{ V} * (\text{Reading} - \text{MIN_Pressure_User}) / (\text{MAX_Pressure_User} - \text{MIN_Pressure_User})$ |

Note:

MIN_Pressure_Sensor and **MAX_Pressure_Sensor** correspond to **P_Low** and **P_High** respectively and define the lower and upper range limits. See Section «Threshold Values, Trigger Values», 234.

MIN_Pressure_User and **MAX_Pressure_User** are the range limits set by the user and are also displayed as **P_Low** and **P_High** in the IM 540 display.

Parameters

If the characteristic curve is set to (Scale) = Log, the voltages for the recorder outputs are calculated as follows:

| Display | Significance |
|-----------|---|
| Mode Full | <p>The entire measuring range is mapped logarithmically to 0... 10 V</p> <p>U out = $10.0 \text{ V} * [\log(\text{Reading}) - \log(\text{MIN_Pressure_Sensor})] / [\log(\text{MAX_Pressure_Sensor}) - \log(\text{MIN_Pressure_Sensor})]$</p> <p>If (Reading < MIN_Pressure_Sensor), no calculation is performed and 0 is returned. The following rules apply:</p> <p>MIN_Pressure_Sensor ≤ Reading</p> <p>MIN_Pressure_Sensor ≤ MAX_Pressure_Sensor</p> <p>This means that the symbols for absolute values are not required in the above formula.</p> |
| Mode Expo | <p>The Log setting has no effect</p> <p>U out = (Reading_Exponent + 14) * 0.5 volts</p> |
| Mode Auto | <p>The mantissa of the reading is mapped logarithmically</p> <p>U out = 10.0 V * log(Reading_Mantissa)</p> |
| Mode User | <p>The range that has been adjusted by the user is mapped logarithmically to 0... 10 V</p> <p>U out = $10.0 \text{ V} * [\log(\text{Reading}) - \log(\text{MIN_Pressure_User})] / [\log(\text{MAX_Pressure_User}) - \log(\text{MIN_Pressure_User})]$</p> |

Note:

Explanations to MIN_Pressure_Sensor, MAX_Pressure_Sensor, MIN_Pressure_User and MAX_Pressure_User: See 69.

5.2.6 Display, Bargraph (Disp.Bar)

In this submenu you can configure the display and the bar graph.

Measuring channel (Channel)

Before the settings for a sensor can be configured, you have to select the channel to which the sensor is connected. This is done with the Channel parameter. See Tab. 5-13, 76.

Number of digits (Digit)

The display of readings can be configured to a precision of up to five digits.

| Display | Significance |
|---------|-----------------------------|
| Auto | Automatic setting |
| 1 | One digit, e.g. 2E-1 |
| 2 | Two digits, e.g. 2.5E-1 |
| 3 | Three digits, e.g. 2.47E-1 |
| 4 | Four digits, e.g. 2.473E-1 |
| 5 | Five digits, e.g. 2.4733E-1 |

Bar graph scaling (Mode)

The pressure range to be displayed by the bar graph is configured with the Mode parameter. The following values are available:

| Display | Significance |
|---------|---|
| Full | Entire pressure range of the selected sensor |
| Auto | Use the pressure decade containing the current pressure reading |
| Auto_2 | Similar to «Auto», but use a range of two decades |
| Auto_3 | Similar to «Auto», but use a range of three decades |
| User | Pressure range specified by the «P_Low» and «P_High» parameters. See Chapter 5.2.5.4 Pressure Range Limits (P_Low, P_High), 68. |

Tab. 5-11 Mode parameter values

Bar graph range limits (P_Low, P_High)

P_Low and P_High parameters specify the pressure range limits in the user mode. They depend on the respective sensor. See Section «Threshold Values, Trigger Values», 234.

Decades between P_Low and P_High are always displayed logarithmically. The length of the bar graph within the current decade is always displayed in a linear manner.

5.2.7 Threshold Values (Threshold)

The two «Analog Remote» remote control inputs of the CONTROL connection can be used to switch the emission on and off via an external voltage signal. The switching points are adjusted via the parameters of the Threshold sub-menu.

| Display | Significance |
|---------|---------------------------------------|
| U1_Low | Lower threshold voltage for channel 1 |
| U1_High | Upper threshold voltage for channel 1 |
| U2_Low | Lower threshold voltage for channel 2 |
| U2_High | Upper threshold voltage for channel 2 |


For both inputs, the emission is switched on if the input voltage is falling below the lower threshold value (pressure drop) and switched off if the input voltage is rising above the upper threshold value.

The setting range is 0.00 ... 10.00 volts. The difference between the upper and the lower threshold level must be 50 mV at least. If there is a conflict when adjusting threshold values, the threshold value which causes the conflict will be shifted within the permitted range.

5.2.8 Behavior of the IM 540 in Case of an Error (Error)

The behavior of the IM 540 in special or error situations can be configured by the user.

Fundamentally, three types of errors must be distinguished:

| Error type | Risk | Reaction |
|------------|----------|---|
| Fatal | High | Emission is switched off Error relay is activated Error message is generated |
| Warning | Moderate | Warning or error message is generated The action according to the «Emi.Warn» setting is executed. See Chapter 5.2.8.3,  74. |
| NoReact. | Low | No reaction (no message, emission is not switched off, error relay is not activated) |

5.2.8.1 Automatic Sensor Switching in Case of an Error (FailCont)

| Display | Significance |
|---------|---|
| Enable | Failure of a Bayard-Alpert or Extraktor sensor causes automatic switching to the other sensor. However, it is not possible to switch from a Bayard-Alpert sensor to an Extraktor sensor if the last valid pressure reading is $\geq 10^{-4}$ mbar. |
| Disable | No automatic switching |

The originally selected parameter value is preserved after automatic sensor switching has been triggered. It will be restored after the faulty sensor has been replaced, the device reset (mains switch turned off and on), and two working sensors are found at the IM 540.

5.2.8.2 Error Signal Relays (FailRel1, FailRel2)

The two error signal relays can be assigned to the four measurement channels as follows:

| Display | Significance |
|----------|--|
| Chan_1 | Error signal relay switches off if an error occurs in channel 1 |
| Chan_2 | Error signal relay switches off if an error occurs in channel 2 |
| Chan_3 | Error signal relay switches off if an error occurs in channel 3 |
| Chan_4 | Error signal relay switches off if an error occurs in channel 4 |
| Chan.1–4 | Error signal relay switches off if an error occurs in any of the four channels |
| Global | Error signal relay switches off if any device error occurs |
| None | Error signal relay is always switched on |

Parameters

In this case, the relay position is linked to the state of the measuring system as follows:

| Relay | Assigned measuring system |
|--------------|---------------------------|
| Switched off | Ready for operation |
| Switched on | Operational fault |

5.2.8.3 Emission and Power Supply Shutdown in Case of an Error (Emi.Warn, Emi.Tol, Emi.Pow)

Emi.Warn

If a «fatal error» occurs, the emission is switched off on principle. The response to a «warning error», however, can be configured.

| Display | Significance |
|----------|---|
| LeaveOn | Emission and power supply remain switched on. The error signal relay is not activated. Exception: The value «Global» has been assigned to the error signal relay. See Chapter 5.2.8.2 Error Signal Relays (FailRel1, FailRel2), 73 |
| Swit.Off | Emission and power supply are switched off. The error signal relay is activated. This event is considered an emergency off. See Section «Info», 46. |

Emi.Tol

The following sensor parameters are monitored constantly during operation. A reference to the related warning or error message is shown in parantheses.

- Anode voltage (U_Anode)
- Cathode voltage (U_Cathode)
- Reflector voltage (U_Reflector)
- Emission current (I_Emis)
- Filament voltage (U_Filament)
- Filament current (I_Filament)
- Filament power (P_Filament)
- Stability of the filament current regulator (P_Fil_Unstable)
- Range of the emission current regulator (Emis_Regulator_Limit)
- Stability of the emission current regulator (Emis_Regulator_Deviation)
- Power supply temperature (Power Supply Overtemp)
- Power supply temperature (IQ-Board Power Supply Temp.)
- +5V supply voltage on the MC board (MC-Board Power Supply +5V)
- +24V supply voltage on the MC board (MC-Board Power Supply +24V)
- +15V supply voltage on the MC board (MC-Board Power Supply +15V)

- -15V supply voltage on the MC board (MC-Board Power Supply -15V)

Refer to the error table in Section «Error Messages», 242.

Two tolerance ranges are defined for each parameter. No error is reported within the first tolerance range. If the value is outside of the first but still inside of the second tolerance range, one can select from the three possible types of error (Fatal, Warning, NoReact.).

If the value is outside of the second tolerance range, a «fatal error» is issued on principle.

The described monitoring functions and settings are related to the emission and may shut off the emission if necessary.

Emi.Pow

The following power supply parameters are monitored constantly during operation. A reference to the related warning or error message is shown in parentheses.

- Power supply temperature (Power Supply Overtemp)
- Power supply temperature (IQ-Board Power Supply Temp.)
- +24V supply voltage measuring channel 3 (VP-Board Power Supply +24V S3)
- +24V supply voltage measuring channel 4 (VP-Board Power Supply +24V S4)
- +24V supply voltage relay interface (VP-Board Power Supply +24V KL)
- +5V supply voltage RS232 interface (VP-Board Power Supply +5V RS)
- +5V supply voltage on the MC board (MC-Board Power Supply +5V)
- +24V supply voltage on the MC board (MC-Board Power Supply +24V)
- +15V supply voltage on the VP board (VP-Board Power Supply +15V)
- -15V supply voltage on the VP board (VP-Board Power Supply -15V)

Refer to the error table in Section «Error Messages», 242.

Two tolerance ranges are defined for each parameter. No error is reported within the first tolerance range. If the value is outside of the first but still inside of the second tolerance range, one can select from the three possible types of error (Fatal, Warning, NoReact.).

If the value is outside of the second tolerance range, a «fatal error» is issued on principle.

The described monitoring functions and settings are related to the supply voltages for the measuring channels 3 and 4 and may shut off these voltages if necessary.

Selection of the menu <Detail> <Error> will switch on the supply for the measuring channels 3 and 4 again. However, emission will not be switched on automatically if it has been interrupted before.

Parameters

5.3 Sensor Parameters (Sensor)

There is an individual set of sensor parameters for each channel.

The number of available parameters depends on the sensor type which is connected to the selected channel. See Tab. 5-12, 76.

| Sensor | Filter | Auto_OFS | Cal/Full | Fil.Pow. | Emis.Cur | Disp.Bar | Cor.Mode | Cor.Gain |
|-----------|--------|----------|----------|----------|----------|----------|----------|----------|
| IE 514 | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ |
| IE 414 | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| CTR (all) | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| TTR90 | ✓ | | | | | ✓ | ✓ | ✓ |

Tab. 5-12 Available sensor parameters

5.3.1 Measuring Channel (Channel)

Before a sensor can be configured, you have to select the channel to which the sensor is connected. This is done with the Channel parameter.

| Display | Significance |
|---------|---|
| 1-BAG | Channel 1 connected to a Bayard-Alpert sensor |
| 1-EXT | Channel 1 connected to an Extraktor sensor |
| 2-BAG | Channel 2 connected to a Bayard-Alpert sensor |
| 2-EXT | Channel 2 connected to an Extraktor sensor |
| 3-TTR | Channel 3 connected to a Pirani sensor |
| 3-CTR | Channel 3 connected to a capacitive sensor |
| 4-TTR | Channel 4 connected to a Pirani sensor |
| 4-CTR | Channel 4 connected to a capacitive sensor |

Tab. 5-13 Channel parameter values

5.3.2 Measurement Filter (Filter)

The filter improves measurements if the signal is noisy or disturbed. The filter affects the readings on the display, all interface outputs (RS232, Profibus), the recorder outputs and the switching functions. If selected, a filter is active in the entire pressure range.

The same filter settings are available for all sensors. The filter time constant, however, depends on the connected sensor.

The filter can be set to one of the following values:

None (n = 1)

The filter is deactivated.

Fast (n = 5)

The IM 540 responds quickly to signal changes. This makes it rather sensitive to signal noise.

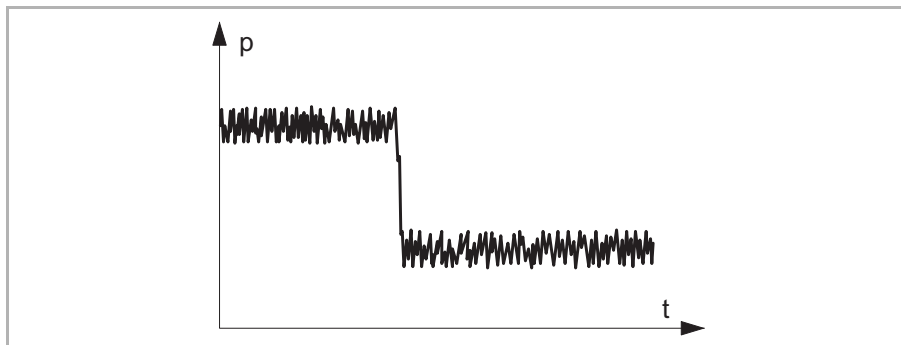


Fig. 5-2 Filter set to «Fast» (example)

Normal (n = 15)

This is the default setting. It offers a good compromise between the response time and the sensitivity to noise.

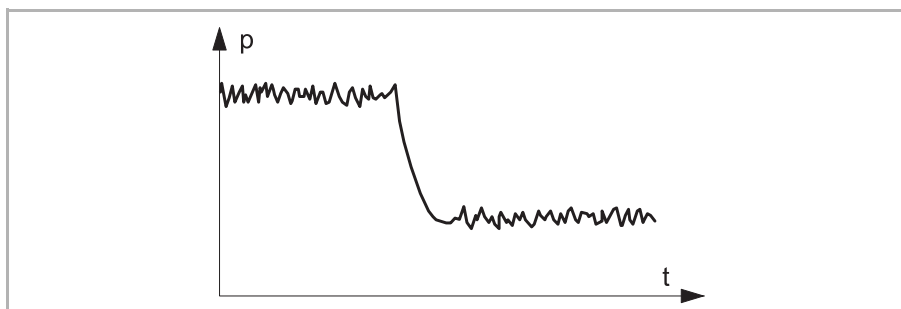


Fig. 5-3 Filter set to «Normal» (example)

Slow (n = 50)

The IM 540 responds slowly to signal changes. This makes it less sensitive to signal noise. This setting is recommended for precise comparison measurements.

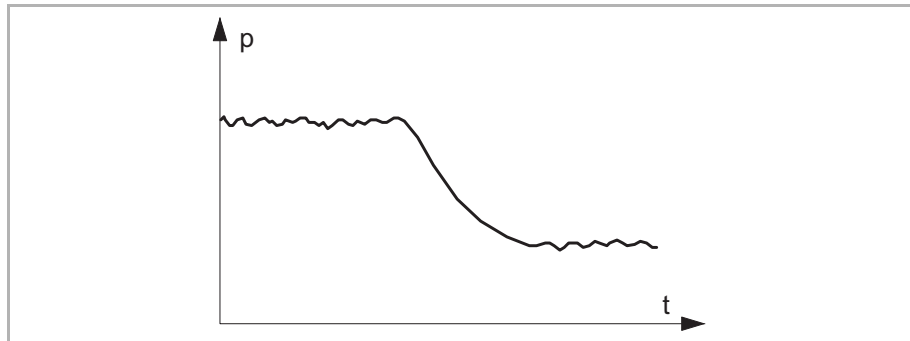


Fig. 5-4 Filter set to «Slow» (example)

5.3.3 Automatic Offset (Auto_OFS)

This menu is only offered for channel 3 and 4, and only if a capacitive sensor is connected.

| Display | Significance |
|---------|--|
| Enable | Offset control enabled. The «OFS» signal is displayed in the status row. |
| Disable | No automatic offset control |

If the offset control is enabled, the offset of the capacitive sensor is adjusted automatically. When crossing below or above a pressure limit which is at least 2 decades below the lower measuring limit of the sensor, the offset value of the sensor is measured and stored.

If this automatic function is switched on, the manual zero adjustment cannot be performed. See also Chapter 4.4.9 Defining and Activating Offset, 43.

5.3.4 Sensitivity Adjustment (Cal_Full)

In this menu you can adjust the sensitivity of the sensors.

The sensitivity is adjusted via the respective sensor constant (IE 414, IE 514) or the measuring range (CTR). It is not possible to adjust the sensitivity for Pirani sensors.

Sensor constant (IE 414, IE 514)

The following values can be input for the sensor constant:

| Sensor | Range (mbar ⁻¹) | Resolution (mbar ⁻¹) |
|--------|-----------------------------|----------------------------------|
| IE 414 | 5.00...30.00 | 0.01 |
| IE 514 | 1.00...20.00 | 0.01 |

The ion current i^+ , emission current i^- , sensor constant C and the pressure p are related with each other as follows:

$$\frac{i^+}{i^-} = C \times p$$

Measuring range (CTR)

In the case of a capacitive sensor, select its upper measuring range limit. See Chapter 2.3.3 Measuring Ranges, 13.

5.3.5 Filament Power Control (Fil.Pow)

The filament power control steps in if a pressure surge occurs or if the gauge is switched on at a gas pressure that is too high. However, the measured filament power also contains the power consumed by the sensor cable. If a long measuring cable or extension cable is used, the power loss along the cable can approach the actual filament power.

The «Fil.Pow» parameter is used to define the monitoring limits for the filament power. See Chapter 5.2.8.3 Emission and Power Supply Shutdown in Case of an Error (Emi.Warn, Emi.Tol, Emi.Pow), 74.

The setting range is between 1.0 W and 15.0 W.

5.3.6 Switching the Emission Current (Emis.Cur)

The Emission parameter is only offered for channel 1 or 2, and only if a Bayard-Alpert sensor is connected.

| Display | Significance |
|---------------------------|--|
| Auto | The emission current is switched automatically depending on the pressure range. See Chapter 2.3.2.1 IONIVAC Sensors, 12. |
| 0.1 mA 1.0 mA 10 mA | The emission current is kept at the specified value over the entire pressure range. |
| | The «USR» signal is displayed in the status row. |

Excessive emission current.

A high emission current at relatively high pressure levels can damage the sensor.

Only set the emission current to a fixed value if you can be sure that the sensor will operate at sufficiently low pressure levels. See Chapter 2.3.2.1 IONIVAC Sensors, 12.

Caution



Parameters

5.3.7 Adjusting the X-ray limit (X_Ray)

The adjusted X_Ray value is subtracted from the resulting pressure value after all other calculations have been performed.

This parameter is only available for the channels 1 and 2 (BAG and Ext sensors).

The default value is 0.00. The value can be adjusted between 1E-10 and 1E-13 mbar.

5.3.8 Automatic Gas Type Correction (Correct > Cor.Mode)

Sensors are normally calibrated for a measurement in nitrogen or in air. If pressure measurements are being performed with other gases, is necessary to correct the reading accordingly.

The Cor.Mode parameter is used to adjust the correction factor for the respective gas type. The actual pressure is obtained by multiplying the measured pressure with the correction factor.

The gas type correction becomes a function of the pressure if the pressure exceeds 0.5 mbar. This fact is taken into consideration for all gas types that can be selected.

| Display | Significance |
|--|---|
| None | No gas type correction |
| Ar, H ₂ , He, Ne, Kr, Xe, CO ₂ | Automatic gas type correction with a gas type specific correction factor. The status row displays the «COR» signal for the respective channel. |
| User | Automatic gas type correction according to correction factors input by the user. See Chapter 5.3.10 User-Defined Correction Factors (Correct > ClearAll, Index, Factor, Press), 81. |

Tab. 5-14 Cor.Mode parameter values

5.3.9 Additional Correction Factor (Correct > Cor.Gain)

In special cases, a pressure-independent additional correction of the measured pressure may be wanted. The Cor.Gain parameter can be used to define the required correction factor in the range 0.10...9.99. The actual pressure results from a multiplication of the measured pressure with the correction factor.

If a value other than 1.00 is selected, the «COR» signal is illuminated for the related channel.

The correction factor affects all values and function (display, setpoints, RS232, etc.) on principle.

5.3.10 User-Defined Correction Factors (Correct > ClearAll, Index, Factor, Press)

The IM 540 allows you to define your own table of correction factors for each sensor. These correction factors can be used for gas type correction as well as for correction of other measuring errors.

The correction factors for a sensor are based on a table of anchor points. Each anchor point consists of a pressure value (Press) and the related correction factor (Factor). Linear interpolation is used between neighboring anchor points if necessary.

The user-defined correction factors will be applied to the measurements if you set the Cor.Mode parameter to «User». See Chapter 5.3.8 Automatic Gas Type Correction (Correct > Cor.Mode), 80.

The correction factor affects all values and function (display, setpoints, RS232, etc.) on principle.

Note:

The user-defined correction factors are preserved even if the entire device is reset to the default parameters. See Chapter 8.3 Starting the IM 540 With Default Parameters, 212.

5.3.10.1 Defining Anchor Points

A maximum number of 50 anchor points can be input per table. An anchor point can be selected via its index.

Anchor points may be input in arbitrary order. Proceed as follows:

- 1 Switch the Channel parameter to the edit mode
- 2 Use the arrow buttons to select the channel for which the anchor points are to be defined. Then press the Enter button.
 - The values of the anchor point with the index number 1 are displayed
- 3 Switch the Factor parameter to the edit mode
- 4 Use the arrow buttons to select a correction factor. Then press the Enter button.
 - You can adjust the correction factors in the range 0.100...9.999
- 5 Switch the Pressure parameter to the edit mode
- 6 Use the arrow buttons to select a pressure value for the anchor point. Then press the Enter button.
 - The range of pressure values is identical with the measuring range of the connected sensor. See Chapter 2.3.3 Measuring Ranges, 13.
- 7 Press the Enter button
 - The first anchor point is defined
 - The index number is automatically increased by one
 - The parameter index is in the edit mode
- 8 Press the Enter button
- 9 Repeat steps 3...8 to define more anchor points

Note:

If two different factors are input for the same pressure value, the last input will overwrite the first one.

5.3.10.2 Locating Defined Anchor Points

The defined anchor points can be located easily by keeping an arrow button pressed and scrolling through the pressure values. Scrolling is stopped whenever an anchor point is found. In order to continue scrolling, release the arrow button and then press it again.

5.3.10.3 Deleting Single Anchor Points

If you want to delete a single anchor point, proceed as follows:

- 1 Use the Index parameter to select the anchor point to be deleted
- 2 Switch the Factor parameter to the edit mode
- 3 Press one of the arrow buttons and hold it until the input field displays «Clear»
 - «Clear» is displayed after the lower limit (0.100) or the upper limit (9.999) of the setting range has been exceeded
- 4 Press the Enter button
 - The correction value is set to 1

5.3.10.4 Deleting all Anchor Points from the Table

If you want to delete all anchor points from the table, proceed as follows:

- 1 Switch the Channel parameter to the edit mode
- 2 Use the arrow buttons to select the channel whose table is to be deleted. Then press the Enter button.
- 3 Switch the ClearAll parameter to the edit mode
- 4 Use the arrow buttons and select «Yes». Then press the Enter button.

All anchor points of the table are reset to the default values.

5.3.10.5 Automatic Check of the Correction Table

If the device starts up or recognizes a new sensor, it first checks if the correction table of the respective channel has already been edited. The result of this check determines the further settings:

- Correction table has not been edited:
The table is initialized with the default values for the recognized sensor
- Correction table has been edited:
The device checks if the table is suitable for the connected sensor. If this is not the case, an error message is output and the Cor.Mode parameter is set to «None». See Chapter 5.3.8 Automatic Gas Type Correction (Correct > Cor.Mode), 80. Any attempt to set the Cor.Mode parameter to «User» also causes an error message.

5.4 Current Amplifier Parameters (Ioni Amp)

The current measuring amplifier IV540 is capable of measuring currents in the fA range. The smallest «full range» selection is 100 fA. In this range, the IV540 is very sensitive and it will therefore react on external interference.

The device firmware in the IM 540 always selects the best measuring range automatically. Previously, for pressures below 1E-11 mbars, this was the 100 fA range exclusively.

In order to improve the stability at very low measuring currents, it is possible to restrict the measuring range to 1 pA or 10 pA by means of the «Ioni Amp» parameter.

The following values are available for the «Ioni Amp» parameter:

| Value | Display/ Selection | Significance |
|---------|-----------------------|---|
| Channel | 1 or 2 | Selection of the measuring channel |
| Sens. | Low | The smallest measuring range is 10 pA. Measurements in this range are performed with a resolution of 14 bits. |
| | Normal | The smallest measuring range is 1 pA. Measurements in this range are performed with a resolution of 12 bits. (default setting) |
| | High | The smallest measuring range is 100 fA. Measurements in this range are performed with a resolution of 8 bits. |

5.5 Sensor Control (Control)

The IM 540 offers several ways of operation and remote control. See Chapter 5.2.4 Device Control (Control), 65. The Control menu allows you to adjust the required control input configuration.

5.5.1 Measuring Channel (General)

In addition to the channels described in Chapter 4.1.1.5 Channels, 33, additional values are available for the Channel parameter to ensure compatibility with the IM 520:

| Display | Significance |
|----------|--|
| IM520_No | The IM 540 is controlled using the IM 520 mode. Equivalent to the IM 520 remote control mode with EC = 0. This setting only makes sense in combination with the TTR mode. See Chapter 5.5.5 TTR Mode (TTR_Ctrl), 88. |
| Analog | Emission is switched on and off according to the voltage at the «Analog Remote» input. Equivalent to the IM 520 remote control mode with EC = A. See Chapter 5.2.7 Threshold Values (Threshold), 72. |
| Contact | Emission is switched on if the contact of the respective «Digital Remote» input is closed. It is switched off if the contact is open. Equivalent to the IM 520 remote control mode with EC = C. |
| Ana+Con | Logical AND operation of the Analog and Contact functions. Emission is switched on only if the prerequisites are met for both functions. Equivalent to the IM 520 remote control mode with EC = b. |

Each of the channels 1 and 2 is equipped with an analog and a digital control input. The sensors connected to the channels 3 and 4 cannot be switched on or off.

The following rules apply if one of the IM 520 remote control modes (Analog, Contact or Ana+Con) is activated:

- The status row displays «Remote»
- In the Sensor Control menu, only the P_On, P_Off and TTR_Ctrl are available. See Chapter 5.5 Sensor Control (Control), 84.
- If a CTR sensor is connected to channel 3 or 4, it will be switched to «Manual». See Chapter 5.5.2 Sensor Activation Mode (Mode), 86.
- If a Pirani sensor is connected to channel 3 or 4, it will be switched to «Hot». See Chapter 5.5.2 Sensor Activation Mode (Mode), 86.
- The values of P_On and P_Off are stored in the parameter set of channel 1. For this reason, the limits of the sensor on channel 1 apply to P_On and P_Off.
- The emission can no longer be switched on via the buttons. The EMO_Off button, however, still acts as an emergency-off button. The emergency-off state can be reset via the EMO_Res button, and the remote control continues controlling the emission.

Rules for Switching On/Off in the Compatibility Mode

- The TTR mode, if activated, will set the preconditions for switching on via «Remote». This means that it signals clearance for switching on, but it does not switch on by itself.
- If two different sensors (Bayard-Alpert and Extraktor) are connected and both of them are switched on via «Remote», the Extraktor sensor will take priority over the Bayard-Alpert sensor. If the Extraktor sensor should fail, the device will automatically switch to the Bayard-Alpert sensor.
- The following rules for switching on/off apply if two identical sensors are connected:
 - Two Bayard-Alpert sensors:
The «Analog Remote Channel 2» input is disabled, i.e. «Analog Remote Channel 1» can only be used to switch on/off the sensor on channel 1
 - Two Extraktor sensors:
The «Analog Remote Channel 1» input is disabled, i.e. «Analog Remote Channel 2» can only be used to switch on/off the sensor on channel 1
- The «Digital Remote» input works normally, i.e. «Digital Remote Channel 1» will switch on/off the sensor on channel 1, and «Digital Remote Channel 2» will switch on/off the sensor on channel 2
- In case of a conflict (both channels switched on), channel 1 will gain priority
- If the sensor on channel 1 should fail, the device will automatically switch to the sensor on channel 2

5.5.2 Sensor Activation Mode (Mode)

The sensors can be switched on in different ways:

Manual

Emission is switched on and off by pressing the Emi.On and Emi.Off buttons, respectively. Except for monitoring of the upper pressure range for Bayard-Alpert and Extraktor sensors, there is no automatism for switching on and off.

This value is available for all channels.

Self (Selfcontrol)

This value is only available for the channels 1 and 2. These channels are always monitored for a maximum pressure of:

- 1×10^{-4} mbar for the Extraktor sensor
- 1×10^{-2} mbar for the Bayard-Alpert sensor

The Selfcontrol function allows you to move this pressure limit to a lower value. In this case the sensor will monitor itself, i.e. if the pressure exceeds the value P_Off, the emission will be switched off. See Chapter 5.5.4 Activation and Deactivation Values (P_On, P_Off), § 87. The sensor must then be switched on manually or via the interface.

Auto

The sensors are switched on and off automatically.

For switching the emission on, the pressure of the gauge specified under «Source» is evaluated. See Chapter 5.5.3 Activation Source (Source), § 87. If the pressure falls below the value P_On, the emission is switched on. If the pressure rises above the value P_Off, the emission is switched off again. At the same time, the sensor which earlier switched on the emission is switched on again. See Chapter 5.5.4 Activation and Deactivation Values (P_On, P_Off), § 87.

In addition to the emission, the display is controlled as well. The displayed pressure always relates to the sensor which is currently being used for pressure measurements. Pirani and capacitive sensors, which are always performing measurements, are also switched on and off with this regard.

Hot

This value is only available for the channels 3 and 4.

After the device has been switched on, the sensor is switched on and the measured pressure is displayed. However, this is only done if automatic control has not been selected. Otherwise the automatic control has priority.

The «Hot» value can only be assigned to one of the two channels. If a conflict occurs, the current input will be accepted and the other one is deleted. After switching off the emission on channel 1 or 2, the «hot channel» is displayed automatically.

5.5.3 Activation Source (Source)

The Source parameter is used to specify the channel which is used for switching on the sensor selected in «Channel».

The Source function is subject to the following restrictions:

- A sensor cannot be switched on by itself. For this reason, the respective channel is not available for selection.

Sensors on the channels 1 and 2:

- One of the sensors can be switched on via channel 3 or 4. This selection cannot be made for the other sensor because there is only one voltage supply for both channels. If a conflict occurs, the current input will be accepted and the other one is deleted.
- One of the two sensors can be switched on by the other one. However, the sensors cannot control each other mutually because only one can be switched on at a time. If a conflict occurs, the current input will be accepted and the other one is deleted.

Sensors on the channels 3 and 4:

- One of the two sensors can be switched on by the other one. However, the sensors cannot switch on each other mutually. If a conflict occurs, the current input will be accepted and the other one is deleted.
- The sensors cannot be switched via the channels 1 and 2. For this reason, only the values «Chan_3» and «Chan_4» are available for selection.

Note:

Also note the rules for switching on/off in the compatibility mode. See Chapter 5.5.1 Measuring Channel (General), 84.

5.5.4 Activation and Deactivation Values (P_On, P_Off)

If the pressure falls below the activation value P_On, the respective sensor is switched on. If the pressure rises above the deactivation value P_Off, the respective sensor is switched off.

The setting ranges for the P_On and P_Off parameters are listed in Section «Pressure Range Limits», 234.

The minimum distance amounts to 10 % (IE 414, IE 514 and TTR 90) and to 1 % (capacitive sensors) of the activation value at least. If there is a conflict when adjusting activation and deactivation values, the value which causes the conflict will be shifted within the permitted range.

5.5.5 TTR Mode (TTR_Ctrl)

The TTR_Ctrl parameter is only available if «Channel» is set to one of the four IM 520 compatibility modes.

| Display | Significance |
|---------|---|
| Disable | TTR mode disabled |
| Chan_3 | Emission can only be switched on if the pressure reading on channel 3 is below P_On. Emission will be switched off again if the pressure reading exceeds P_Off. |
| Chan_4 | Emission can only be switched on if the pressure reading on channel 4 is below P_On. Emission will be switched off again if the pressure reading exceeds P_Off. |

When activating the TTR mode, P_On is automatically set to 5.00×10^{-3} , and P_Off to 1.00×10^{-2} . These values agree with the settings of the IM 520. They can be changed in the IM 540.

The TTR mode, if activated, will set the preconditions for switching on via the buttons, RS232, Profibus or remote control. This means that it signals clearance for switching on, but it does not switch on by itself. However, the emission is switched off directly.

If the sensor connected to channel 3 or 4 fails while the emission is switched on, the emission will not be switched off.

The activation mode of a Pirani sensor which has been activated via TTR_Ctrl is set to «Hot» automatically. The activation mode of a capacitive sensor (if present) will then be set to «Manual» automatically. See Chapter 5.5.2 Sensor Activation Mode (Mode), 86.

5.6 Graphic Parameters (Detail Graphic)

5.6.1 Parameters and Functions

The Detail > Graphic menu is used to adjust parameters for the trend graphic and to start recording a graphic.

| Value | Display/ Selection | Significance |
|---------|--|--|
| Channel | 1-BAG, 1-EXT 2-BAG, 2-EXT 3-TTR, 3-CTR 4-TTR, 4-CTR | Selection of a channel whose trend graphic is to be specified or displayed |
| Command | Ready | Ready for recording of a graphic |
| | Start_Fix | The trend graphic runs for the time specified under «Time» and then stops automatically |
| | Start_Var | The trend graphic always covers the period specified under «Time». The graphic runs until it is stopped with «Stop». |
| | Stop | Stops the running recording. The recording so far is still displayed. |
| | Clear | Delete the current or the most recent recording. A running recording is stopped. |
| Status | | Current state of the trend graphic |
| | Idle | Recording of a graphic can be started |
| | Run_Var | The trend graphic has been started using the above mentioned command «Start_Var». |
| | Run_Fix | The trend graphic has been started using the above mentioned command «Start_Fix». |
| Display | >>> | Displays the running or the most recent trend graphic. See Chapter 5.6.2 Trend Graphic, 90. |
| P_Low | See Section «Pressure Range Limits», 234 | Lower pressure value for scaling the pressure axis |
| P_High | See Section «Pressure Range Limits», 234 | Upper pressure value for scaling the pressure axis |

Parameters

| Value | Display/ Selection | Significance |
|----------|-----------------------|--------------------------------------|
| Time [h] | 0.05...99.99 | Duration of the recording (in hours) |

5.6.2 Trend Graphic

The Detail > Graphic > Display submenu is used to display the trend graphic of the selected channel according to the parameter settings. See Chapter 5.6.1 Parameters and Functions, 89.

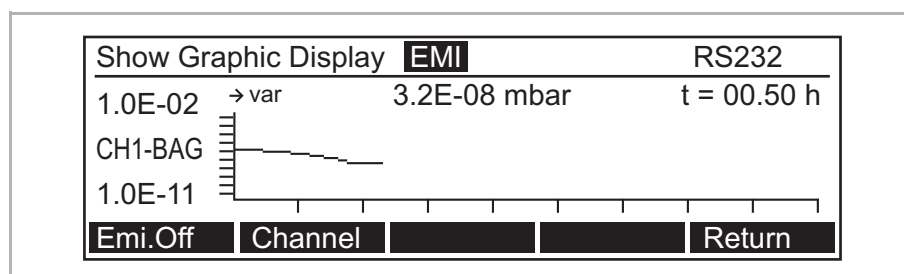


Fig. 5-5 Trend graphic (example)

The graphic is displayed in a right-angled system of coordinates.

Ordinate

The vertical axis uses a logarithmic scale and represents the pressure. The axis labeling contains the channel number with the selected vacuum gauge type and the pressure limits P_Low and P_High (example: 1.0E-02 and 1.0E-11).

The current state of the trend graphic is displayed above the ordinate:

- → fix: Recording of a graphic in the «Run_Fix» mode
- → var: Recording of a graphic in the «Run_Var» mode
- S: Recording of a graphic has been stopped, the trend graphic displays stored values

The current pressure value is displayed above the trend graphic (example: 3.2E-08).

Abscissa

The horizontal axis uses a linear scale and represents the time. The entire range is specified by the «Time» parameter. This parameter is displayed in the upper right corner of the display (example: t = 00.50 h).

5.7 User Parameters (UserMode)

The IM 540 is able to detect the connected sensors and interface boards and the current mains frequency automatically. It will use the optimum settings for each sensor.

The user mode allows you to control and, if necessary, change these standard parameters. The status row displays «USR» if any standard parameter settings have been changed.

5.7.1 Parameters for Sensor Operation (Gauge)

Sensors are normally operated with the parameters described in Chapter 2.3.2 Sensor Supply, 12. The Gauge menu is used to edit these parameter settings.

| Display | Significance |
|----------|---|
| Channel | Sensor whose parameters will be edited |
| Anode | Anode potential for measurement operation |
| Cathode | Cathode potential for measurement operation |
| Emis.Cur | Emission current for measurement operation |
| U_A_Deg. | Anode potential for degassing |
| U_C_Deg. | Cathode potential for degassing |
| I_Degas | Emission current for degassing |

A modified parameter will be adjusted automatically only after the value «Auto» has been assigned to it.

Parameters

5.7.2 Parameters For Current Amplifiers (Amplifier)

The current measuring amplifier is normally operated with the optimum parameter values. You can change these parameter values in the Amplifier menu.

| Display | Significance |
|----------|--|
| Channel | Vacuum gauge whose parameter values are to be changed |
| Range | Measuring range of the current measuring amplifier |
| Resolut. | Resolution of the measurement A list of permissible values is shown for selection |
| Time | Measuring time: Not yet implemented A list of permissible values is shown for selection |

- If the «Range» parameter is set to «Auto», «Resolut.» and «Time» are also set to «Auto» and cannot be modified anymore.
- It is always necessary to assign values to both parameters, «Resolut.» and «Time». If one of these parameters is set to «Auto», both parameters will automatically be set to «Auto».

A modified parameter will be adjusted automatically only after the value «Auto» has been assigned to it.

5.7.3 Configuring the Device (Config)

This menu allows you to check the automatic detection of the connected sensors and interface boards and of the current mains frequency. The settings can be changed if necessary. This is also possible if no sensor is connected.

| Display | Significance |
|--------------------------------------|---|
| Chan_1 Chan_2 Chan_3 Chan_4 | Type of sensor connected to the related channel. Both sensors (IE 414 / IE 514) are identified automatically by the software. If no sensor is found on one of these channels, the controller assumes that a Bayard-Alpert sensor is connected to channel 1. That way the system is still operable. |
| MainFreq | Mains frequency |
| Interf. | Type of interface board mounted in the extension slot |

A modified parameter will be adjusted automatically only after the value «Auto» has been assigned to it.

Computer Interface (IM 520 Mode)

6 Computer Interface (IM 520 Mode)

For information on the IM 520 mode refer to Chapter 5.2.3 Device Mode (Device), 64.

6.1 Connection

The IM 540 is able to communicate with a computer via a serial interface (RS232). The connection socket and the required connection cable are described in Chapter 3.3.8 RS232, 29.

6.2 Terminology

The following terms and symbolic styles will be used in the description of the computer interface:

| Term | Significance |
|---------------|--|
| Host | Computer or terminal |
| Sending (S) | Data transfer from the Host to the IM 540 |
| Receiving (R) | Data transfer from the IM 540 to the Host |
| ASCII | American Standard Code for Information Interchange |

Tab. 6-1 Terms

Square brackets [...]

Square brackets identify optional parameters. The items enclosed by the brackets may appear, but they are not essential. The brackets are not actually used in the command.

Angle brackets <...>

Abbreviations enclosed by angle brackets identify control characters. The entire expression including the brackets is replaced by a numerical value. See Tab. 6-3, 94.

Computer Interface (IM 520 Mode)

6.3 Communication

6.3.1 Protocol

In IM 520 Mode (see Chapter 5.2.3 Device Mode (Device), 64) the IM 520 protocol is used for the communication via RS232.

Messages are transferred as ASCII strings. Blanks (spaces) in the string are ignored. The information is exchanged bidirectionally, i.e. data and control commands can be exchanged in both directions.

6.3.2 Command Format

Messages of the Host are composed of mnemonics and parameters. Mnemonics are command abbreviations and always consist of three ASCII characters. See Chapter 6.4 Mnemonics (IM 520 Mode), 98.

The Host can send two types of messages: Write commands and read commands. The two types of messages are distinguished by a character which is sent right after the mnemonic. See Tab. 6-2, 94.

| Character | Significance |
|-----------|---|
| W | Write. Mnemonic is used as a write command. |
| R | Read. Mnemonic is used as a read command. |

Tab. 6-2 Characters used to specify the command type

The IM 540 does not send to the host by itself. It replies to a read command only. Automatic measurement output and interface error messages can be exempt from this rule. See Chapter 6.4.2.2 MOC (Measurement Output Control), 100 and Chapter 6.4.5.9 SIE (Send Interface Error Messages), 109.

6.3.3 End Identifier

The end of a message from the host to the device is signaled by a control character. The IM 540 expects one of the control characters listed in Tab. 6-3, 94 as an end identifier.

| End identifier | Value | Significance |
|----------------|-------|---------------------------|
| <ETX> | 03h | End of text |
| <LF> | 0Ah | Line feed |
| <CR> | 0Dh | Carriage return |
| <ETB> | 17h | End of transmission block |

Tab. 6-3 Permitted end identifiers

Note:

Use one end identifier per message only. Otherwise the next message will not work properly.

Computer Interface (IM 520 Mode)

For messages which are sent from the device to the host, you may define up to two consecutive end identifiers. See Chapter 6.4.5.5 ESO (End Sign Output), 108.

In the following, the <EOM> symbol is used to represent the end of message identifier.

Examples:

Host --> Device: <EOM> represents e.g. <ETX>

Device --> Host: <EOM> represents e.g. <CR><LF>

6.3.4 Sending (Host --> Device)

The host may send data to the device. For this, the host sends a write command to inform the device about the data type.

In a symbolic representation this process can be illustrated as follows:

S: Mnemonic W [Parameter]<EOM>

The host may query data from the device. For this, the host sends a read command to specify what kind of data are queried.

S: Mnemonic R [Parameter]<EOM>

6.3.5 Receiving (Device --> Host)

In general, the IM 540 will only send data to the host if these have been queried from it with a read command. See Chapter 6.3.4 Sending (Host --> Device), 95.

In a symbolic representation, the reply to a read command can be illustrated as follows:

E: Mnemonic [Parameter]<EOM>

In the case of interface operating errors, the IM 540 will send an error message to the host without a read command. See Chapter 6.4.5.4 ERS (Error System), 108.

Computer Interface (IM 520 Mode)

6.3.6 Examples

Adjust sensitivity of the Bayard-Alpert sensor on channel 1

S: CAL W1 17.0<CR>

Query state of the pressure-dependent shutdown system

S: APS R<CR>

E: APS 1<CR><LF>

Adjust trigger level for relay 1

S: TRG W1,6.3E-04<ETB>

Query end identifier used for output

S: ESO R<ETX>

E: ESO3,1<EOM>

Response to an interface operating error (improper end identifier)

S: EMI W1<CT>

E: ERI 5<CR><LF>

6.3.7 Measurement Output

Depending of the measuring range, the IM 540 generates a new reading every 50 ms to 1 s. The maximum output rate is therefore between 1200 min^{-1} and 60 min^{-1} .

The measurements are output in the following format:

UNIT n.nnEsmm<EOM>

| Parameter | Significance |
|-----------|---------------------------------------|
| UNIT | Pressure unit: mbar, Torr, Pa, Micron |
| n.nn | Mantissa |
| s | Sign of the exponent |
| mm | Exponent |

Each measurement is sent just once. If the MES_R command is used to query more readings than the device can deliver, an empty message is sent instead:

<Space><Space><EOM>

Computer Interface (IM 520 Mode)

Measurement output to the printer (Print Only)

In «Print Only» operation, the measurement and the current device status are sent to the printer according to the adjusted output rate. The following format is used for this:

UNIT n.nnEsmm STS [xxxxxxx] B<EOM>

See also Chapter 6.4.2.2 MOC (Measurement Output Control), 100 and Chapter 6.4.5.10 STS (Status), 110.

6.3.8 Parameter Output

Messages in response to a parameter query have a parameter dependent format. The format is described for each parameter in Chapter 6.4 Mnemonics (IM 520 Mode), 98.

In some cases, a parameter query makes internal calculations necessary. This may cause a delay of up to 50 ms between the query and the output of the parameter.

Computer Interface (IM 520 Mode)

6.4 Mnemonics (IM 520 Mode)

6.4.1 Overview

6.4.1.1 Group Measurement Data and Display

| Mnemonic | Significance | Reference |
|----------|-----------------------------|-----------|
| CAL | Calibrate the channels. | 100 |
| MOC | Measurement output control. | 100 |
| UNI | Unit of measurement. | 101 |
| ZER | Automatic zero adjustment. | 101 |

Tab. 6-4 Mnemonics (IM 520 Mode): Group Measurement Data and Display

6.4.1.2 Group Gauge Head Control

| Mnemonic | Significance | Reference |
|----------|---|-----------|
| APS | Automatic pressure dependent gauge switching. | 102 |
| DEG | Degas sensors. | 102 |
| ECO | Emission control.Emission control. | 103 |
| EMI | Switch emission on and off. | 103 |
| FCO | Fault control switching. | 103 |
| GAU | Select a sensor and query status information. | 104 |
| PCO | Pirani control. | 104 |

Tab. 6-5 Mnemonics (IM 520 Mode): Group Gauge Head Control

Computer Interface (IM 520 Mode)

6.4.1.3 Group Trigger and Analog Output Commands

| Mnemonic | Significance | Reference |
|----------|---|-----------|
| ANO | Analog output. | 105 |
| TRG | Trigger levels for switching functions. | 106 |
| TRM | Trigger mode. | 106 |

Tab. 6-6 Mnemonics (IM 520 Mode): Group Trigger and Analog Output Commands

6.4.1.4 Group Interface Commands

| Mnemonic | Significance | Reference |
|----------|----------------------------------|-----------|
| DCL | Reset the device. | 107 |
| ECH | Echo mode. | 107 |
| ERI | An interface error has occurred. | 107 |
| ERS | A device error has occurred. | 108 |
| ESO | End identifier used for output. | 108 |
| GTL | Quit remote control operation. | 109 |
| LLO | Lockout the control buttons. | 109 |
| MES | Output a measurement. | 109 |
| SIE | Send interface error messages. | 109 |
| STS | Device status. | 110 |
| SWH | Software handshake XON/XOFF. | 111 |

Tab. 6-7 Mnemonics (IM 520 Mode): Group Interface Commands

Computer Interface (IM 520 Mode)

6.4.2 Group Measurement Data and Display

6.4.2.1 CAL (Calibrate)

Calibrate the channels.

See Chapter 5.3.4 Sensitivity Adjustment (Cal_Full), 78.

S: CAL W[a mm.m]<EOM>

S: CAL R[a]<EOM>

E: CAL [a,mm.m YY]<EOM>

| Parameter | Values | Significance |
|-----------|---------------|---|
| a | 1 | System on channel 1 |
| | 2 | System on channel 2 |
| mm.m | 10.0 ... 19.6 | Sensor constant of the Bayard-Alpert sensor |
| | 03.7 ... 14.8 | Sensor constant of the Extraktor sensor |
| YY | BA | Bayard-Alpert sensor |
| | EX | Extraktor sensor |
| | -- | Sensor not connected or faulty |

6.4.2.2 MOC (Measurement Output Control)

Measurement output control.

S: MOC W[a]<EOM>

S: MOC R<EOM>

E: MOC [a]<EOM>

| Parameter | Values | Significance |
|-----------|-----------|---|
| a | 0 | Measurements are not sent automatically |
| | 1 ... 999 | Send measurements and status byte automatically with a rate of a per hour |

Computer Interface (IM 520 Mode)

6.4.2.3 UNI (Unit)

Unit of measurement.

See Chapter 5.2.1.1 Unit of Measurement (Unit), 59.

S: UNI W[a]<EOM>

S: UNI R<EOM>

E: UNI [a]<EOM>

| Parameter | Values | Significance |
|-----------|--------|-----------------|
| a | 0 | Millibar (mbar) |
| | 1 | Pascal (Pa) |
| | 2 | Torr |

6.4.2.4 ZER (Zero)

Automatic zero adjustment.

The write command is used to perform the automatic zero adjustment procedure. See Chapter 5.3.3 Automatic Offset (Auto_OFS), 78.

S: ZER W<EOM>

S: ZER R<EOM>

E: ZER [a]<EOM>

| Parameter | Values | Significance |
|-----------|--------|--|
| a | 0 | Automatic zero adjustment is not being performed |
| | 1 | Automatic zero adjustment is being performed |

Computer Interface (IM 520 Mode)

6.4.3 Group Gauge Head Control

6.4.3.1 APS (Automatic pressure dependent gauge switching)

Automatic pressure dependent gauge switching.

See Chapter 5.5.2 Sensor Activation Mode (Mode), 86.

S: APS W[a]<EOM>

S: APS R<EOM>

E: APS [a]<EOM>

| Parameter | Values | Significance |
|-----------|--------|--|
| a | 0 | Pressure dependent gauge switching off |
| | 1 | Pressure dependent gauge switching on |

6.4.3.2 DEG (Degas)

Degas sensors.

See Chapter 4.4.7 Switching Degas Function On, 42 and Chapter 4.4.8 Switching Degas Function Off, 43.

S: DEG W[a]<EOM>

S: DEG R<EOM>

E: DEG [a]<EOM>

| Parameter | Values | Significance |
|-----------|--------|---------------|
| a | 0 | Degassing off |
| | 1 | Degassing on |

Note:

The degas function switches off automatically after 10 minutes. It can be stopped manually at any time.

Computer Interface (IM 520 Mode)

6.4.3.3 ECO (Emission Control)

Emission control.

S: ECO W[a]<EOM>

S: ECO R<EOM>

E: ECO [a]<EOM>

| Parameter | Values | Emission control via: |
|-----------|--------|---------------------------|
| a | 0 | Buttons / computer |
| | 1 | Analog inputs |
| | 2 | Digital inputs |
| | 3 | Analog and digital inputs |

6.4.3.4 EMI (Emission)

Switch emission on and off.

See Chapter 4.4.4 Switching Emission On, 40 and Chapter 4.4.5 Switching Emission Off, 41.

S: EMI W[a]<EOM>

S: EMI R<EOM>

E: EMI [a]<EOM>

| Parameter | Values | Significance |
|-----------|--------|--------------|
| a | 0 | Emission off |
| | 1 | Emission on |

6.4.3.5 FCO (Fault Control Switching)

Fault control switching.

See Chapter 5.2.8 Behavior of the IM 540 in Case of an Error (Error), 72.

S: FCO W[a]<EOM>

S: FCO R<EOM>

E: FCO [a]<EOM>

| Parameter | Values | Significance |
|-----------|--------|-----------------------------|
| a | 0 | Fault control switching off |
| | 1 | Fault control switching on |

Computer Interface (IM 520 Mode)

6.4.3.6 GAU (Gauge)

Select a sensor and query status information.

S: GAU W[a]<EOM>

S: GAU R<EOM>

E: GAU [x,A,B,C,D]<EOM>

The read command always queries the status information for all channels.

| Parameter | Values | Significance |
|-----------|--------|--------------------------------------|
| a | 1 | Select sensor on channel 1 |
| | 2 | Select sensor on channel 2 |
| x | 0 | No sensor present |
| | 1 | Sensor on channel_1 active |
| | 2 | Sensor on channel_2 active |
| A, B | | Status of the sensor on channel 1, 2 |
| | 0 | Not connected |
| | 1 | Bayard-Alpert sensor |
| | 2 | Extraktor sensor |
| | 3 | System faulty |

6.4.3.7 PCO (Pirani Control)

Pirani control.

See Chapter 5.5.5 TTR Mode (TTR_Ctrl), 88.

S: PCO W[a]<EOM>

S: PCO R<EOM>

E: PCO [a]<EOM>

| Parameter | Values | Significance |
|-----------|-----------|--------------------------|
| a | 0 | THERMOVAC control off |
| | 1 | THERMOVAC control on |
| | 3 (reply) | THERMOVAC control faulty |

Computer Interface (IM 520 Mode)

6.4.4 Group Trigger and Analog Output Commands

6.4.4.1 ANO (Analog output)

Analog output.

See Chapter 5.2.5 Recorder Outputs (Recorder), 65.

S: ANO W[a]<EOM>

S: ANO R[v]<EOM>

E: ANO [x]<EOM>

| Parameter | Values | Significance |
|-----------|----------|--|
| a | 0 | Recorder output 1 with mode = IM520_Au (Chapter 5.2.5.1 Output Channel (Channel), 66) |
| | E-n | Analog output, fixed exponent n $3 \leq n \leq 12$ for mbar/Torr $1 \leq n \leq 10$ for Pa |
| v | 0 | Read settings of the analog output |
| | 1 | Read voltage of the linear analog output |
| x | 0,0 | Reply to v = 0: Autorange |
| | 0,E-n | Reply to v = 0: Fixed exponent -n |
| | 1,mm.mmV | Reply to v = 1: Voltage mm.mm in volts $00.00 \leq \text{mm.mm} \leq 10.50$ |

Computer Interface (IM 520 Mode)

6.4.4.2 TRG (Trigger)

Trigger levels for switching functions.

See Chapter 5.1 Switching Function Parameters (Setpoint), 55.

S: TRG W[a,m.mmE[snn]<EOM>

S: SWH R[a]<EOM>

E: SWH [a,m.mm]E[snn]<EOM>

| Parameter | Values | Significance |
|-----------|---------------|--|
| a | 1, 2 | Trigger levels for trigger 1 or 2 |
| m.mm | 1.00 ... 9.99 | Mantissa of the trigger level |
| s | ± | Sign for the exponent of the trigger level |
| nn | 03 ... 11 | Exponent of the trigger level for the pressure units mbar and Torr |
| | 01 ... 09 | Exponent of the trigger level for the pressure unit Pa |

6.4.4.3 TRM (Trigger Mode)

Trigger mode.

See Chapter 5.1.2 Configuring Switching Functions, 57.

S: TRM W[a]<EOM>

S: TRM R<EOM>

E: TRM [a]<EOM>

| Parameter | Values | Significance |
|-----------|--------|-------------------------|
| a | 0 | «Level Trigger» mode |
| | 1 | «Interval Trigger» mode |

Computer Interface (IM 520 Mode)

6.4.5 Group Interface Commands

6.4.5.1 DCL (Device Clear)

Reset the device.

This is a pure write command which will reset the short status of the device from an error state to the operating state.

S: DCL<EOM>

6.4.5.2 ECH (Echo Mode)

Echo mode.

S: ECH W[a]<EOM>

S: ECH R<EOM>

E: ECH [a]<EOM>

| Parameter | Values | Significance |
|-----------|--------|---------------|
| a | 0 | Echo mode off |
| | 1 | Echo mode on |

6.4.5.3 ERI (Error Interface)

An interface error has occurred.

Error messages which are caused by interface operating errors are sent to the host without a request.

E: ERI [a]<EOM>

| Parameter | Values | Significance |
|-----------|--------|--|
| a | 1 | Invalid ASCII character |
| | 2 | Input buffer full |
| | 3 | Output buffer full |
| | 4 | Command cannot be interpreted |
| | 5 | Improper end identifier. See Chapter 6.3.2 Command Format, 94. |
| | 6 | Setting is below or above permitted range |
| | 7 | Incorrect command parameters |
| | 8 | Function cannot be executed / operating error |
| | 9 | Protocol error / handshake error |

Note:

The automatic output of interface error messages can be switched off

Computer Interface (IM 520 Mode)

using the SIE command. See Chapter 6.4.5.9 SIE (Send Interface Error Messages), 109.

6.4.5.4 ERS (Error System)

A device error has occurred.

S: ERS R<EOM>

E: ERS [a]<EOM>

| Parameter | Values | Error status |
|-----------|--------|-----------------------------|
| a | 0 | No error |
| | 1 | No measuring system present |
| | 2 | Cathode voltage error |
| | 3 | Cathode disruption |
| | 4 | THERMOVAC defective |
| | 5 | Pressure too high |
| | 6 | Degassing not possible |

6.4.5.5 ESO (End Sign Output)

End identifier used for output.

S: ESO W[a,b]<EOM>

S: ESO R<EOM>

E: ESO [a,b]<EOM>

| Parameter | Values | Significance |
|-----------|--------|--------------------------------------|
| a | | First end character |
| | 1 | ETX (03h): End of text |
| | 2 | LF (0Ah): Line feed |
| | 3 | CR (0Dh): Carriage return |
| | 4 | ETB (17h): End of transmission block |
| b | | Second end character |
| | see a | see a |

When sending the data, the selected end characters are appended to the end of the character string.

Computer Interface (IM 520 Mode)

6.4.5.6 GTL (Go To Local)

Quit remote control operation.

This is a pure write command which will end remote control operation and enable operation via the buttons.

S: GTL<EOM>

6.4.5.7 LLO (Local Lockout)

Lockout the control buttons.

This is a pure write command which will lockout the command buttons. It is only used for remote control operation.

S: LLO<EOM>

Note:

The EMO_Off (emergency-off) button can still be used to switch off the emission even if the keyboard is locked.

6.4.5.8 MES (Measurement)

Output a measurement.

This is a pure read command. It queries the current measurement from the IM 540.

S: MES R<EOM>

E: MES [UNITm.mm]E[snn]<EOM>

| Parameter | Significance |
|-----------|---------------------------------------|
| UNIT | Pressure unit: mbar, Torr, Pa, Micron |
| m.mm | Mantissa |
| s | Sign of the exponent |
| nn | Exponent |

Note:

Measurements can also be output automatically. See Chapter 6.4.2.2 MOC (Measurement Output Control), 100.

6.4.5.9 SIE (Send Interface Error Messages)

Send interface error messages.

S: SIE W[a]<EOM>

S: SIE R<EOM>

E: SIE [a]<EOM>

Computer Interface (IM 520 Mode)

| Parameter | Values | Significance |
|-----------|--------|---|
| a | 0 | Do not send an error message if an interface error occurs |
| | 1 | Send an error message if an interface error occurs. See Chapter 6.4.5.3 ERI (Error Interface), 107. |

6.4.5.10 STS (Status)

Device status.

The device status can be queried from the IM 540 as a status byte.

S: STS R<EOM>

E: STS [xxxxxxxx] B<EOM>

| Parameter | Values | Significance |
|-----------|--------|--|
| x | 0 or 1 | From left to right: Status bit 8...status bit 1. See Tab. 6-8, 110 and Tab. 6-9, 111. |

Depending on the state of the leftmost bit (bit 8), the status byte has two different meanings:

Bit 8 = 0: Operating status

| Bit | Significance | Bit = 0 | Bit = 1 |
|-----|------------------------------------|---------|---------|
| 8 | Measurements possible | | |
| 7 | | | |
| 6 | | | |
| 5 | Degassing or zero point adjustment | Off | On |
| 4 | Reading available | No | Yes |
| 3 | Activated measuring system | CH1 | CH2 |
| 2 | Below threshold level 2 | No | Yes |
| 1 | Below threshold level 1 | No | Yes |

Tab. 6-8 Status byte in the operating state

Computer Interface (IM 520 Mode)

Error status: Bit 8 = 1

| Bit | Significance | Bit = 0 | Bit = 1 |
|-----|---|----------------|---------|
| 8 | No measurements possible | | |
| 7 | | | |
| 6 | | | |
| 5 | Emission off because pressure is too high | No | Yes* |
| 4 | Emission was switched off by activated THERMOVAC or remote control inputs | No | Yes* |
| 3 | THERMOVAC status | o.k. or n.c.** | Faulty* |
| 2 | Status of sensor on channel 2 | o.k. or n.c.** | Faulty* |
| 1 | Status of sensor on channel 1 | o.k. or n.c.** | Faulty* |

Tab. 6-9 Status byte in the error state

* These events are setting the STS bit 8 to 1

** n.c. = not connected

By reading the status byte, the device is reset from the error state to the operating state.

6.4.5.11 SWH (Software Handshake XON/XOFF)

Software handshake XON/XOFF.

See Chapter 5.2.2.7 Flow Control (FlowCont), 63.

S: SWH W[a]<EOM>

S: SWH R<EOM>

E: SWH [a]<EOM>

| Parameter | Values | Significance |
|-----------|--------|---|
| a | 0 | No handshake |
| | 1 | The device responds to XON/XOFF on receive. No XON/XOFF is sent. (On Receive, see Chapter 5.2.2.7 Flow Control (FlowCont), 63). |
| | 2 | Full handshake. (Full, see Chapter 5.2.2.7 Flow Control (FlowCont), 63.) |

Computer Interface (IM 540 Mode)

7 Computer Interface (IM 540 Mode)

For information on the IM 540 mode refer to Chapter 5.2.3 Device Mode (Device), 64.

7.1 Connection

The IM 540 is able to communicate with a computer via two serial interfaces (RS232C):

- Primary serial interface (RS232-1) at the casing rear side
- Secondary serial interface (RS232-0) on the IF540x interface board in the extension slot

The protocol described in this chapter is used for both serial interfaces. According to the selected control type (GENERAL PARAMETER > RS232 > DEVICE: RS232 or IF540x) the appropriate interface is addressed. The connection to the profibus is realized via the secondary serial interface RS232-0 on the IF540x interface board in the extension slot.

7.2 Terminology

The following terms and symbolic styles will be used in the description of the computer interface:

| Term | Significance |
|---------------|--|
| Host | Computer or terminal |
| Sending (S) | Data transfer from the Host to the IM 540 |
| Receiving (R) | Data transfer from the IM 540 to the Host |
| ASCII | American Standard Code for Information Interchange |

Tab. 7-1 Terms

Square brackets [...]

Square brackets identify optional parameters. The items enclosed by the brackets may appear, but they are not essential. The brackets are not actually used in the command.

Angle brackets <...>

Abbreviations enclosed by angle brackets identify control characters. The entire expression including the brackets is replaced by a numerical value. See Tab. 6-3, 94.

| Control character | Value | Significance |
|-------------------|-------|--|
| <ETX> | 03h | End of text. Interface reset. (Deletes the input buffer contents of the IM 540, does not generate any further response) |

Computer Interface (IM 540 Mode)

| Control character | Value | Significance |
|-------------------|-------|---|
| <ENQ> | 05h | Enquiry. Request to transfer the output buffer contents of the IM 540. |
| <ACK> | 06h | Acknowledge |
| <LF> | 0Ah | Line feed. In connection with <CR> additional end identifier. |
| <CR> | 0Dh | Carriage return. End identifier. |
| <NAK> | 15h | Negative Acknowledge. |

Tab. 7-2 Control characters

7.3 Communication

7.3.1 Protocol

In IM 540 Mode (see Chapter 5.2.3 Device Mode (Device), 64) the IM 540 protocol is used for the communication via RS232.

The following default settings are used for communication:

- 9600 Baud
- 8 data bits
- No parity bit
- 1 stop bit

In GENERAL PARAMETER > RS232 > INTERFACE > STANDARD the IM 540 allows the user to define separate parameter sets for the communication via the IF540x and the standard RS232 interfaces. The following parameter values can be selected:

| | |
|-----------|--|
| Baudrate: | 2400, 4800, 9600, 19200, 38400, 57200, and 115200 Baud |
| Databits: | 7, 8, 9 |
| Parity: | No, Odd, Even |
| Stopbits: | 1, 2 |

Computer Interface (IM 540 Mode)

The following rules apply for receiving and sending data:

- Data and control commands can be exchanged alternately and in both directions
- Messages are transferred as ASCII-Strings
- No hardware handshake is generated or used
- Blanks (spaces) in the string are filtered out and ignored
- Small and capital letters are allowed for receiving
- Only capital letters are used for sending
- Because only 7 bit are required for ASCII data, the eighth bit will be filtered out and ignored
- If one of the transfer errors PARITY-ERROR, FRAMING-ERROR or OVERRUN-ERROR occurs, an appropriate error message will be stored in the device error buffer. The interface itself will not react on this error.
- The receiving buffer of the IM 540 comprises 70 Byte. If this number of characters is received without end identifier, the storage of the following characters will continue at the beginning of the receiving buffer. After receiving the next end identifier or ENQ character, a negative acknowledgment NAK and the RS232 error code 0x04 (receiving buffer overflow) will be generated. The receiving buffer will be cleared and new data can be input.
- The receiving buffer of the Host must have the capacity of at least 65 Bytes

Handshake

A handshake results from the positive or negative response (ACK or NAK) to a host command or from the data transfer initialized by an ENQ request.

The response of the IM 540 to a command or request has always to be awaited prior to sending the next command of the Host.

Mnemonics

Messages of the Host are composed of mnemonics and parameters. Mnemonics are command abbreviations and always consist of three ASCII characters. See Chapter 7.4 Mnemonics (IM 540 Mode), 121.

End of message

The end of a message from the Host to the device is signaled by the control characters <CR> or <CR><LF>.

7.3.2 Sending (Host --> IM 540) a Write Command

The received message is checked according to:

- correct syntax
- the correctness and the range of all parameter values
- the permission of the command at present

Subsequently the command will be executed.

The execution of a command may also initiate a positive or negative response (e.g. correct or incorrect writing to EEPROM).

Verified messages and successful execution:

If all messages have been verified and all commands have been executed successfully the positive acknowledgment <ACK><CR><LF> is sent to the Host.

After that each <ENQ> makes the IM 540 to generate a currently valid read response to the previously received write command and send it to the Host.

Non-verified messages and/or unsuccessful execution:

If the messages have not been verified or the commands have not been executed successfully the negative acknowledgement <NAK><CR><LF> is sent to the Host.

In this case a <ENQ> is responded by sending the error code XX <CR><LF>. After that the error code is reset. Each following <ENQ> will be responded by sending the reset error code 00 <CR><LF>. This does not change until a different command will be sent to the IM 540.

Debugging

When the Host has received the negative acknowledgement <NAK><CR><LF> the reason for the error can be discovered by <ENQ> or by sending the command ERR:

S: ERR<CR>[<LF>]

E: <ACK><CR><LF>

S: <ENQ>

E: XX <CR><LF> (XX = error code)

Computer Interface (IM 540 Mode)

Example

Using the current command format the communication initiated by the DEGAS write command can be described as follows:

S: DGS,1<CR>[<LF>]

S: DGS,2 <CR>[<LF>]

Command OK:

*Parameter incorrect,
command not OK:*

E: <ACK><CR><LF>

E: <NAK><CR><LF>

S: <ENQ>

S: <ENQ>

E: 0<CR><LF>
(Degas still off)

E: XX<CR><LF>
(XX = error code)

... some time later:

S: <ENQ>

S: <ENQ>

E: 1<CR><LF>
(Degas on)

E: 00<CR><LF>
(reset error code)

... 10 minutes later:

S: <ENQ>

S: <ENQ>

E: 0<CR><LF>
(Degas off)

E: 00<CR><LF>
(reset error code)

Specific feature of commands initializing tests:

The execution of a test procedure, such as a display test or EEPROM test, can be requested by a write command. After receiving the command the IM 540 sends the positive acknowledgement <ACK><CR><LF> but the execution will not be started.

Each following <ENQ> starts the requested test. According to the test result a response will be sent, such as 1<CR><LF> if the test was executed successfully or 0<CR><LF> if the test failed.

Specific feature of non-responded commands:

The command REC (Reset Error Condition) does not deliver a return value. After receiving this command the IM 540 sends the positive acknowledgement <ACK><CR><LF>.

If now <ENQ> is sent the IM 540 will respond with the OK error status: 00<CR><LF>. However, the command will not be executed once more.

Computer Interface (IM 540 Mode)

7.3.3 Sending (Host --> IM 540) a Read Command

The received message is checked according to:

- correct syntax
- the correctness and the range of all parameter values

Verified messages:

If all messages have been verified the positive acknowledgment <ACK><CR><LF> is sent to the Host.

After that each <ENQ> makes the IM 540 to generate a currently valid read response to the previously received write command and send it to the Host.

If the permissibility of the read command changes while sending <ENQ> requests the IM 540 will send back <NAK><CR><LF> instead of data. The following <ENQ> is responded by sending the error code XX <CR><LF>. Each following <ENQ> will be responded by sending the reset error code 00 <CR><LF>.

Non-verified messages:

If the messages have not been verified the negative acknowledgement <NAK><CR><LF> is sent to the Host.

In this case a <ENQ> is responded by sending the error code XX <CR><LF>. Each following <ENQ> will be responded by sending the reset error code 00 <CR><LF>.

Example

Using the current command format the communication initiated by the «Sensor Range Limits» read command can be described as follows:

S: SRL,1<CR> [<LF>]

Command OK:

E: <ACK><CR><LF>

S: <ENQ>

E: b,±c.ccccE±cc,±d.ddddE±dd <CR><LF>

... a few minutes later, still the same state

S: <ENQ>

E: b,±c.ccccE±cc,±d.ddddE±dd <CR><LF>

... a few minutes later, sensor channel 1 has been removed via USER CONFIG, i.e. this command is no longer valid

Computer Interface (IM 540 Mode)

S: <ENQ>

E: <NAK> <CR><LF>

S: <ENQ>

E: XX<CR><LF> (XX = error code)

S: <ENQ>

E: 00<CR><LF> (reset error code)

7.3.4 Sending (Host → IM 540) an <ENQ> command

Data and states can be queried by sending the <ENQ> command. The <ENQ> command needs to be entered as the first and only character after a command that is closed by an end identifier has been sent. If an <ENQ> is detected within a command (i.e. after entering characters that have not been closed with an end identifier), the previous entry will be interpreted and consequently an error message will be posted. An <ENQ> is interpreted **instantly**.

7.3.5 Remarks on Programming Control Programs

In order to distinguish positive and negative responses to write, read, and <ENQ> commands it will suffice to investigate the first byte of the string received on the Host side. A valid ASCII character indicates a positive response while <NAK> (0x06) represents a negative one.

Especially when <ENQ> requests are sent to the IM 540 periodically, the receipt of valid data may suddenly change to the receipt of a negative acknowledgement <NAK><CR><LF>. Thus a continuous verification of the first byte of the received string is recommended:

Procedure after an error has occurred:

- 1 The error is signalled by <NAK><CR><LF>
- 2 The first <ENQ> is answered by the error code XX<CR><LF>. Alternatively, the error code can be read using the ERR<CR><LF> command.
- 3 In the device the error code is reset
- 4 Each further <ENQ> is answered by the reset error code 00<CR><LF>

All commands are checked according to their permissibility during running time. For example, no values can be assigned to a non-existing measuring or trigger channel and no parameters and values can be read out of it.

The PRX command is an exception. This command is complete only if all four channels are listed, no matter which channels are actually equipped with sensors.

7.3.6 Numerical Formats

In the IM 540 the following data are stored in exponential format:

- Pressure values
- Offset values
- Trigger values

Exponential Output Format

The output format of the above mentioned data is always the exponential format. The values are represented by a five-digit mantissa and a two-digit exponent. Both the mantissa and the exponent are signed.

Symbol: $\pm a.aaaaE\pm aa$

Example: +1.2500E-01

Exponential Input Format

The input format of the above mentioned data may be exponential format as well as fixed point format. The IM 540 will automatically convert the values into exponential format.

Capitalization

The commands from the Host may be composed of capital and small letters. The answer from the IM 540 always consists of capital letters.

Input and Output of Status Messages

Some status messages are encoded in binary. Each bit position carries information. According to the quantity of information the following numerical formats are available:

| | |
|-------------------|---------------|
| unsigned char | (8 Bit Data) |
| unsigned int | (16 Bit Data) |
| unsigned long int | (32 Bit Data) |

These numbers are represented by a hexadecimal number and will be converted into an ASCII string. As an example, the hexadecimal representation of the (unsigned char) decimal number 106 (binary number: 0110 1010) is 0x6A which will be converted into the ASCII string «6A».

Note, when reconvertig the ASCII string into a hexadecimal number, the LSB (Least Significant Bit) has to take the rightmost and the MSB (Most Significant Bit) the leftmost bit position.

Computer Interface (IM 540 Mode)

Example

The state of the 7 trigger relays should be read using the SPS (Setpoint Status) command. «1» represents «relay activated» and «0» represents «relay not activated».

| | | | | | | | | |
|----------------|---|---|---|---|---|---|---|---|
| Trigger relay: | x | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Bit position: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Status: | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 |
| Hex number: | 6 | | | | A | | | |

This results in the hex number 0x6A which means that an <ENQ> request would be answered with 6A <CR><LF>:

S: SPS<CR>[<LF>]

E: <ACK><CR><LF>

S: <ENQ>

E: 6A<CR><LF>

7.3.7 Response Times

The following response times are given by the IM 540 software architecture. However, these response times are only valid as long as the measurement screen is visible and the device is not operated manually. These conditions are guaranteed if the keyboard has been locked using the LOC command.

S: Command <CR>[<LF>] $T \leq 30 \text{ ms} \rightarrow$ E: <ACK><CR><LF>

S: <ENQ> $T \leq 30 \text{ ms} \rightarrow$ E: Data <CR><LF>

If the menu system or the graphic mode has been opened and if the device is operated manually, response times up to 500 ms are possible.

Computer Interface (IM 540 Mode)

7.4 Mnemonics (IM 540 Mode)

7.4.1 Overview

7.4.1.1 Group Error Messages

| Mnemonic | Significance | Reference |
|----------|--|-----------|
| ERR | Error, querying the global device error status | 128 |
| GDE | Global Device Error | 129 |
| ISE | Ioni Supply Errors | 131 |
| ISW | Ioni Supply Warnings | 132 |
| REC | Reset Error Condition | 133 |
| RES | Reset, restart the device by triggering a SW resets | 133 |
| VSE | Voltage Supply Errors, error caused by the global voltage supply | 134 |
| VSW | Voltage Supply Warnings, warning caused by the global voltage supply | 135 |

Tab. 7-3 Mnemonics (IM 540 Mode): Group Error Messages

7.4.1.2 Group Measurement Data Request and Control

| Mnemonic | Significance | Reference |
|----------|---|-----------|
| DGS | Degas, sensor command | 136 |
| EMI | Emissions Control, sensor command | 136 |
| OFC | Offset Correction of the CTR- and Ioni sensors | 137 |
| PRS | Press Sensor, sensor status and pressure request | 137 |
| PRX | Press Sensor Extended, status and pressure query to all sensors | 138 |
| TRA | Talk Only Rate | 139 |

Tab. 7-4 Mnemonics (IM 540 Mode): Group Measurement Data Request and Control

Computer Interface (IM 540 Mode)

7.4.1.3 Group Display

| Mnemonic | Significance | Reference |
|----------|---|-----------|
| DBR | Display Brightness | 140 |
| DCO | Display Contrast | 140 |
| DIC | Display Channel | 140 |
| SVI | Setpoint Visible, display trigger relay | 141 |

Tab. 7-5 Mnemonics (IM 540 Mode): Group Display

7.4.1.4 Group Parameter Setpoints

| Mnemonic | Significance | Reference |
|----------|---|-----------|
| BCC | Bayard Alpert-Sensor Constant Emission Current | 142 |
| CAO | CTR-Sensor Auto Offset, automatic offset correction for CTR's | 142 |
| CST | CTR Sensor Type | 143 |
| FCO | Failure Control. Automatic Sensor Switching in Case of an Error | 144 |
| FRC | Failure Relay Configuration | 144 |
| LOC | Locking, keyboard locking | 145 |
| RMO | Recorder Mode, analog output device mode | 145 |
| RSC | Recorder Scale, analog output scaling | 146 |
| RSF | Recorder Scale Fix, analog output fixed exponent | 146 |
| RSL | Recorder Scale Limits, analog output limits | 147 |
| RSM | Recorder Scale Mode, analog output lin. or log. scale | 148 |
| RSO | Recorder Source, analog output channel assignment | 148 |
| SAC | Sensor Amplification Correction, gain correction of measuring channel | 149 |
| SAS | Sensor Amplifier Sensitivity | 149 |
| SCA | Sensor Control Activate | 149 |
| SCC | Sensor Control Channel | 150 |
| SCL | Sensor Control Limits | 151 |
| SCM | Sensor Control Mode | 152 |

Computer Interface (IM 540 Mode)

| Mnemonic | Significance | Reference |
|----------|--|-----------|
| SCS | Sensor Control Setting, type of sensor control | 153 |
| SCT | Sensor Control TTR, set pirani control | 153 |
| SEW | Switch Emission On Warning, behavior of the emission in case of a warning | 154 |
| SFP | Max. Sensor Filament Power | 154 |
| SGC | Type of Sensor Gas Correction | 155 |
| SMF | Sensor Measuring Filter | 155 |
| SPE | Setpoint Enable, release the trigger relays | 156 |
| SPS | Setpoint Status, query trigger relay states | 157 |
| SPV | Setpoint Value, assign and set a trigger point | 157 |
| SSV | Sensor Sensivity Value | 158 |
| SUC | Sensor User-Correction Gas Clear, clear table for USER gas correction | 158 |
| SUG | Sensor User-Correction Gas, define table for USER gas correction | 159 |
| SUS | Sensor User-Correction Gas Save, saving table for USER gas correction | 160 |
| SXR | Sensor XRay, X-Ray limit | 160 |
| THV | Threshold Value, threshold values of analog outputs | 161 |
| TOP | Torr Permission, permission to set the pressure unit TORR | 162 |
| UNI | Unit, pressure unit | 162 |
| WCI | Warning Condition Ionisupply, behavior of the device when the ion source supply has caused a warning | 162 |
| WCP | Warning Condition Powersupply, behavior of the device when the power supply has caused a warning | 163 |

Tab. 7-6 Mnemonics (IM 540 Mode): Group Parameter Setpoints

Computer Interface (IM 540 Mode)

7.4.1.5 Group Device Information

| Mnemonic | Significance | Reference |
|----------|---|-----------|
| ARN | Article Number, article number of the IM 540 | 164 |
| AYT | Are You There, internal start command IM 540 <-> Profibus | 164 |
| EDA | Examine Date, examine date of the IM 540 | 165 |
| IEC | Ioni Emission Current, read the actual emission current | 165 |
| IQM | Reading IQ-Board-Data from MC-Board EEROM | 166 |
| IVM | Reading IV-Board-Data from MC-Board EEROM | 166 |
| SEN | Serial Number, serial number of the IM 540 | 166 |
| SRL | Sensor Range Limits, query the sensor range limits | 167 |
| STI | Sensor Type Information | 168 |
| VPM | Read VP-Board-Data from MC-Board EEROM | 169 |

Tab. 7-7 Mnemonics (IM 540 Mode): Group Device Information

7.4.1.6 Group DETAIL - Reading Device Information

| Mnemonic | Significance | Reference |
|----------|--------------------------------|-----------|
| GAV | Gauge Anode Voltage | 170 |
| GCV | Gauge Cathode Voltage | 170 |
| GEC | Gauge Emission Current | 170 |
| GFC | Gauge Filament Current | 171 |
| GFP | Gauge Filament Power | 171 |
| GFU | Gauge Filament Voltage | 171 |
| GRV | Gauge Reflector Voltage | 171 |
| IDO | Info Device Operation Time | 172 |
| IIA | Info IV-Board Article No. | 172 |
| IIC | Info IV-Board Calibration Date | 172 |
| IIF | Info IV-Board FW-Version | 173 |
| IIH | Info IV-Board HW-Version | 173 |

Computer Interface (IM 540 Mode)

| Mnemonic | Significance | Reference |
|----------|--------------------------------------|-----------|
| IIS | Info IV-Board Serial No. | 173 |
| IMA | Info MC-Board Article No. | 174 |
| IMC | Info MC-Board Calibration Date | 174 |
| IMF | Info MC-Board FW-Version | 174 |
| IMH | Info MC-Board HW-Version | 175 |
| IMS | Info MC-Board Serial No. | 175 |
| IQA | Info IQ-Board Article No. | 175 |
| IQC | Info IQ-Board Calibration Date | 176 |
| IQH | Info IQ-Board HW-Version | 176 |
| IQS | Info IQ-Board Serial No. | 176 |
| ISM | Info Sensor Monitoring Emergency Off | 177 |
| ISO | Info Sensor Offset | 177 |
| IST | Info Sensor Operation Time | 178 |
| IVA | Info VP-Board Article No. | 178 |
| IVC | Info VP-Board Calibration Date | 179 |
| IVH | Info VP-Board HW-Version | 179 |
| IVS | Info VP-Board Serial No. | 179 |

Tab. 7-8 Mnemonics (IM 540 Mode): Group DETAIL - Reading Device Information

Computer Interface (IM 540 Mode)

7.4.1.7 Group USER Mode

| Mnemonic | Significance | Reference |
|----------|----------------------------------|-----------|
| UAD | USER Anode Voltage Degas | 180 |
| UAM | USER Anode Voltage Measurement | 181 |
| UAR | USER Amplifier Range | 182 |
| UAS | USER Amplifier Resolution | 183 |
| UAT | USER Amplifier Time | 183 |
| UCD | USER Cathode Voltage Degas | 184 |
| UCM | USER Cathode Voltage Measurement | 184 |
| UED | USER Emis Current Degas | 185 |
| UEM | USER Emis Current Measurement | 185 |
| UID | USER Interface Board Detection | 186 |
| UMD | USER Mains Frequency Detection | 186 |
| USD | USER Sensor Detection | 187 |

Tab. 7-9 Mnemonics (IM 540 Mode): Group USER Mode

7.4.1.8 Group TEST Mode

| Mnemonic | Significance | Reference |
|----------|-------------------------------|-----------|
| ROC | ROM CRC sum | 188 |
| TAC | TEST Amplifier Mod. Capacity | 188 |
| TAD | TEST Amplifier Display | 189 |
| TAF | TEST Amplifier Mod. Frequency | 190 |
| TAH | TEST Amplifier High-Drive | 192 |
| TAI | TEST Amplifier Input | 195 |
| TAN | TEST Analog Input | 193 |
| TAO | TEST Amplifier Offset | 193 |
| TAR | TEST Amplifier Range | 194 |
| TAS | TEST Amplifier Resolution | 195 |
| TAT | TEST Amplifier Internal | 195 |
| TCA | TEST Control Anode Voltage | 196 |
| TCC | TEST Control Cathode Voltage | 196 |
| TCE | TEST Control Emission Current | 197 |
| TCF | TEST Control Frequency | 197 |

Computer Interface (IM 540 Mode)

| Mnemonic | Significance | Reference |
|----------|----------------------------------|-----------|
| TCI | TEST Control Ioni Supply Channel | 198 |
| TCO | TEST Control Emis ON | 198 |
| TCP | TEST Control PID | 199 |
| TCS | TEST Control I_Shunt | 199 |
| TDB | TEST Display Brightness | 200 |
| TDC | TEST Display Contrast | 200 |
| TDG | TEST Digital Input | 200 |
| TDI | TEST Display | 201 |
| TDP | TEST Force Default Parameter | 201 |
| TEA | TEST RAM | 201 |
| TEC | TEST Enable Calibration | 202 |
| TEF | TEST Enable Fatal Errors | 202 |
| TEI | TEST Enable IV-EEROM | 202 |
| TEM | TEST Enable MC-EEROM | 203 |
| TEO | TEST ROM | 203 |
| TEP | TEST all EEPROMS | 204 |
| TEQ | TEST Enable IQ-EEROM | 204 |
| TEV | TEST Enable VP-EEROM | 204 |
| TFR | TEST Force Reset | 204 |
| TIG | TEST I/O Gauge | 205 |
| TII | TEST IF540x Ident. | 205 |
| TIP | TEST I/O Power Supply | 206 |
| TIR | TEST IF540x Relays | 206 |
| TIS | TEST I/O Supply Ch3/4 | 207 |
| TLO | TEST RS232 Loopback | 207 |
| TPP | TEST Primary Power Supply | 208 |
| TPS | TEST Power Supply | 208 |
| TRL | TEST Relays | 209 |
| TRO | TEST Recorder Out | 209 |

Tab. 7-10 Mnemonics (IM 540 Mode): Group TEST Mode

Computer Interface (IM 540 Mode)

7.4.2 Command Sequence

In general, a command sequence has the following structure:

Step 1: S: mnemonic [,parameter]<CR>[<LF>]

Step 2: E: <ACK><CR><LF>

Step 3: S: <ENQ>

Step 4: E: response <CR><LF>

For clarity only step 1 and 4, i.e. the Host request and the IM 540 response, are shown in the following. The intermediate protocol handshake is always the same.

7.4.3 Group Error Messages

7.4.3.1 ERR (Error)

If an error is caused by a wrong command format or command syntax or if a command cannot be executed, a corresponding error code is stored in the response buffer and the IM 540 sends <NAK>. Then a following <ENQ> request from the Host is answered with the error code. The error code can also be queried using the ERR command.

S: ERR<CR>[<LF>]

E: XX <CR><LF>

| Response | Bit | Significance |
|----------|-----|---|
| XX | | 2-digit HEX number |
| | | Bit position is 0 = no error |
| | | Bit position is 1 = error occurred |
| | 0 | |
| | 1 | |
| | 2 | Receiving buffer overflow |
| | 3 | Invalid command or syntax error |
| | 4 | Parameter range error |
| | 5 | Command not feasible |
| | 6 | SW version incompatible (IM 540 <-> Profi-bus-SW) |
| | 7 | Error occurred during command execution |

Computer Interface (IM 540 Mode)

7.4.3.2 GDE (Global Device Error)

Query the global device errors.

S: GDE<CR>[<LF>]

E: XX XX <CR><LF>

Response XX XX:

4-digit HEX number

Bit position is 0 = no error / no action

Bit position is 1 = error occurred / action

| Bit | Significance | Remarks |
|-----|--|--|
| 0 | Watchdog responded since the device has been powered on. | These bits cannot be cleared |
| 1 | ROM error message during start-up | |
| 2 | RAM error message during start-up | |
| 3 | During start-up at least one of the CRC tests of the EEPROMS on the MC-VP-IV or IQ board caused an error message. | |
| 4 | At least one SPI device has caused a timeout. | |
| 5 | At least one new sensor has been detected. | After reading this bit is reset |
| 6 | Emission off because the pressure is too high. $P > P_{\max}$ (P_{\max} monitoring), $P > P_{\text{user}}$ (self control) | These bits will be reset when the emission is switched on again. Additionally, they can be reset using the REC - Bit 5 command. |
| 7 | Emission shutdown via keyboard. | |
| 8 | Overtemp. signal of the power supply is active. | This bit cannot be cleared. It depends on the state of the overtemp. signal. |
| 9 | Sensor status 1-4 has changed. | This bit is set to «1» whenever the sensor status of the channels 1-4 has changed. Thus it suffices to check this bit in order to recognize a change of the system configuration. This bit is reset by reading the global device errors using the GDE command. |

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| Bit | Significance | Remarks |
|-----|--|---|
| 10 | Sensor status channel 1 | The respective sensor status bit is set to «1» when the sensor error SENSOR_SUPPLY_ERROR or SENSOR_CODING_ERROR occurs. |
| 11 | Sensor status channel 2 | |
| 12 | Sensor status channel 3 | |
| 13 | Sensor status channel 4 | |
| 14 | The power supply has caused an error or warning. | A detailed troubleshooting can be performed using the VCE, VCW, ISE, ISW commands. |
| 15 | The ionivac power supply has caused an error or warning. | |

Computer Interface (IM 540 Mode)

7.4.3.3 ISE (Ioni Supply Errors)

Query errors caused by the ionivac power supply.

S: ISE<CR>[<LF>]

E: XX XX<CR><LF>

| Response | Bit | Significance |
|----------|-------|------------------------------------|
| XX XX | | 4-digit HEX number |
| | | Bit position is 0 = no error OK |
| | | Bit position is 1 = error occurred |
| | 0 | Anode voltage |
| | 1 | Cathode voltage |
| | 2 | Reflector voltage |
| | 3 | Anode current |
| | 4 | Filament voltage |
| | 5 | Filament current |
| | 6 | Filament power |
| | 7 | --- |
| | 8 | Cathode regulator absolute |
| | 9 | Cathode regulator deviation |
| | 10-15 | --- |

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7.4.3.4 ISW (Ioni Supply Warnings)

Query warnings caused by the ionivac power supply.

S: ISW<CR>[<LF>]

E: XX XX <CR><LF>

| Response | Bit | Significance |
|----------|-------|---|
| XX XX | | 4-digit HEX number Bit position is 0 = no error OK Bit position is 1 = error occurred |
| | 0 | Anode voltage |
| | 1 | Cathode voltage |
| | 2 | Reflector voltage |
| | 3 | Anode current |
| | 4 | Filament voltage |
| | 5 | Filament current |
| | 6 | Filament power |
| | 7 | --- |
| | 8 | Cathode regulator absolute |
| | 9 | Cathode regulator deviation |
| | 10-15 | --- |

Computer Interface (IM 540 Mode)

7.4.3.5 REC (Reset Error Condition)

Reset error and warning conditions.

S: REC, XX <CR>[<LF>]

E: <ACK> <CR><LF>

| Parameter | Bit | Significance |
|-----------|-----|---|
| XX | | 2-digit HEX number Bit position is 0 = no action Bit position is 1 = reset error |
| | 0 | Reset errors caused by the voltage supply |
| | 1 | Reset warnings caused by the voltage supply |
| | 2 | Reset errors caused by the ionivac power supply |
| | 3 | Reset warnings caused by the ionivac power supply |
| | 4 | Reset all pending SENSOR_SUPPLY_ERRORS (these are the result from errors caused by the supply units). Simultaneously, the power supplies of channels 3 and 4 are switched on. |
| | 5 | Error flag emission shutdown caused by P > P max or P > P user or reset of the Emis.On command (GDE bit 6/7) |
| | 6 | --- |
| | 7 | Reset all error signals of bit 0-5. Additionally, all error messages in the error buffer will be cleared. Once no errors are pending the message ERROR XX disappears from the display. |

7.4.3.6 RES (Reset)

Reset the device. Trigger a software reset via Watchdog-Timeout.

S: RES<CR>[<LF>]

E: <ACK><CR><LF>

Computer Interface (IM 540 Mode)

7.4.3.7 VSE (Voltage Supply Errors)

Query errors caused by the voltage supply.

S: VSE<CR>[<LF>]

E: XX XX <CR><LF>

| Response | Bit | Significance |
|----------|-----|------------------------------------|
| XX XX | | 4-digit HEX number |
| | | Bit position is 0 = no error OK |
| | | Bit position is 1 = error occurred |
| | 0 | Plus 5V analog |
| | 1 | Minus 15 V |
| | 2 | Plus 24 V |
| | 3 | Plus 15 V |
| | 4 | Plus 5 V |
| | 5 | --- |
| | 6 | --- |
| | 7 | --- |
| | 8 | Plus 24 V channel 3 |
| | 9 | Plus 24 V channel 4 |
| | | Plus 24 V KL |
| | | Plus 5 V RS232 |
| | | Plus 15 V VB-Print |
| | | Minus 15 V VB-Print |
| 14/15 | --- | |

Computer Interface (IM 540 Mode)

7.4.3.8 VSW (Voltage Supply Warnings)

Query warnings caused by the voltage supply.

S: VSW<CR>[<LF>]

E: XX XX <CR><LF>

| Response | Bit | Significance |
|----------|-----|------------------------------------|
| XX XX | | 4-digit HEX number |
| | | Bit position is 0 = no error OK |
| | | Bit position is 1 = error occurred |
| | 0 | Plus 5V analog |
| | 1 | Minus 15 V |
| | 2 | Plus 24 V |
| | 3 | Plus 15 V |
| | 4 | Plus 5 V |
| | 5 | --- |
| | 6 | --- |
| | 7 | --- |
| | 8 | Plus 24 V channel 3 |
| | 9 | Plus 24 V channel 4 |
| | | Plus 24 V KL |
| | | Plus 5 V RS232 |
| | | Plus 15 V VB-Print |
| | | Minus 15 V VB-Print |
| 14/15 | --- | |

Computer Interface (IM 540 Mode)

7.4.4 Group Measurement Data Request and Control

7.4.4.1 DGS (Degas)

Execute degassing or query the degassing status.

S: DGS[, a]<CR>[<LF>]

E: b <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|----------------------|
| a | | Switch degassing |
| | 0 | Switch off degassing |
| | 1 | Switch on degassing |

| Response | Significance |
|----------|-----------------------------------|
| b | Read degassing status (see above) |

7.4.4.2 EMI (Emissions Control)

- Set (change) the ionivac channel
- Switch on/off the emission
- Query currently selected channel
- Query emission status

S: EMI[, a,b]<CR>[<LF>]

E: c,d <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|----------------------------|
| a | | Select the ionivac channel |
| | 1 | Select channel 1 |
| | 2 | Select channel 2 |
| b | | Switch the emission |
| | 0 | Switch off the emission |
| | 1 | Switch on the emission |

| Response | Significance |
|----------|---------------------------------------|
| c | Read the selected channel (see above) |
| d | Read the emission status (see above) |

Computer Interface (IM 540 Mode)

7.4.4.3 OFC (Offset Correction)

■ Reset or start the offset correction

■ Query the offset status

S: OFC, a[,b]<CR>[<LF>]

E: c <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|---|
| a | 1...4 | Channel number 1 to 4 |
| b | | Change the offset setpoint of the addressed channel |
| | 0 | Ignore offset. Only for channel 3/4 with CTR sensor whose auto offset = OFF (command CAO). |
| | 1 | Redetermine and apply offset. Only for ionivac sensors or CTR sensors whose auto offset = OFF (command CAO). |

| Response | Value | Significance |
|----------|-------|---|
| c | | Offset setpoint of the addressed channel |
| | 0 | Ignore offset. |
| | 1 | Apply offset. For CDG sensors this might have been triggered by an automatic offset correction or by a Host request. |
| | 2 | Offset correction is running. Only for ionivac sensors. |

7.4.4.4 PRS (Press Sensor)

Query the status and the pressure of an addressed sensor.

S: PRS, a<CR>[<LF>]

E: XX,±b.bbbbE±bb <CR><LF>

| Parameter | Significance |
|-----------|-----------------------|
| a | Channel number 1 to 4 |

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| Response | Bit | Significance |
|-------------|-----|--|
| XX | | 2-digit HEX number Bit position is 0 = condition met Bit position is 1 = condition not met |
| | 0* | Measurement data OK and updated (no Degas, Ranging, etc.) |
| | 1* | Measuring range underflow |
| | 2* | Measuring range overflow |
| | 3 | No sensor connected |
| | 4 | Sensor error (CODING or SUPPLY error) is pending |
| | 5** | Emission at the addressed ionivac sensor is ON |
| | 6** | Degas at the addressed ionivac sensor is ON |
| | 7** | Addressed ionivac sensor is selected |
| ±b.bbbbE±bb | | Measuring value at the addressed channel in the current pressure unit. |

* Only one of the bit positions 0...2 can be set

**The bit positions 5...7 are useful only for ionivac channels. Thus a request to channel 3 or 4 delivers 0 for those bits

7.4.4.5 PRX (Press Sensor Extended)

Query the status and the pressure of all available sensors.

S: PRX<CR>[<LF>]

E: XX, ±a.aaaaE±aa, XX, ± a.aaaaE±aa ,XX, ± a.aaaaE±aa, XX, ± a.aaaaE±aa <CR><LF>

| Response | Significance |
|-------------|--|
| XX | States of channels 1 to 4. See PRS command, Chapter 7.4.4.4 PRS (Press Sensor), 137. |
| ±a.aaaaE±aa | Measuring values at channels 1 to 4 in the current pressure unit. |

Computer Interface (IM 540 Mode)

7.4.4.6 TRA (Talk Only Rate)

Define and query the output rate of the «Talk Only» mode.

The output string of the «Talk Only» function corresponds with that of the PRX command. See Chapter 7.4.4.5 PRX (Press Sensor Extended), 138.

Note:

The «Talk Only» rate will be reset to 0 (disabled) if:

- the baud rate of the addressed interface is changed
- the DEVICE mode is changed from IM 540 to IM 520

Note:

Once any character is received at an interface whose «Talk Only» mode is activated the «Talk Only» rate will be reset to 0 (disabled). Therefore the «Talk Only» settings should not be queried using the <ENQ> command because this would shut off the «Talk Only» mode.

S: TRA,a[, bb.b]<CR>[<LF>]

E: cc.c <CR><LF>

| Parameter | Value | Significance |
|-----------|----------|--|
| a | 0 | Standard RS232 |
| | 1 | IF540-RS232 |
| bb.b | 0 | «Talk Only» disabled |
| | 1.0-60.0 | «Talk Only» repeat rate with baud rates < 9600 baud in seconds |
| | 0.1-60.0 | «Talk Only» repeat rate with baud rates ≥ 9600 baud in seconds |
| Response | | Significance |
| cc.c | | Setpoint of the «Talk Only» repeat rate in seconds (see above) |

Computer Interface (IM 540 Mode)

7.4.5 Group Display

7.4.5.1 DBR (Display Brightness)

Set and query display brightness.

S: DBR[, a]<CR><LF>

E: b <CR><LF>

| Parameter | Significance |
|-----------|--------------|
| a | 0 - 100 (%) |

| Response | Significance |
|----------|--------------|
| b | 0 - 100 (%) |

7.4.5.2 DCO (Display Contrast)

Set and query display contrast.

S: DCO[, a]<CR><LF>

E: b <CR><LF>

| Parameter | Significance |
|-----------|--------------|
| a | 0 - 100 (%) |

| Response | Significance |
|----------|--------------|
| b | 0 - 100 (%) |

7.4.5.3 DIC (Display Channel)

- Display a measuring channel. For it the channel must be equipped with an operational sensor and the device must be in measuring mode.
- Query displayed channel

S: DIC[, a]<CR><LF>

E: b <CR><LF>

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| Parameter | Significance |
|-----------|-----------------------|
| a | Channel number 1 to 4 |

| Response | Significance |
|----------|-----------------------|
| b | Channel number 1 to 4 |

7.4.5.4 SVI (Setpoint Visible)

Display trigger relays, or query displayed trigger relays.

When using the write command only the first two bit positions which are 1 are taken into consideration.

S: SPE [,XX]<CR>[<LF>]

E: YY <CR><LF>

| Parameter | Bit | Significance |
|-----------|-----|-----------------------------------|
| XX | | 2-digit HEX number |
| | | Bit position is 0 = hide relay |
| | | Bit position is 1 = display relay |
| | 0 | Relay 1 (VB-Print) |
| | 1 | Relay 2 (VB-Print) |
| | 2 | Relay 3 (IF540 interface board) |
| | 3 | Relay 4 (IF540 interface board) |
| | 4 | Relay 5 (IF540 interface board) |
| | 5 | Relay 6 (IF540 interface board) |
| | 6 | Relay 7 (IF540 interface board) |
| | 7 | --- |

| Response | Significance |
|----------|--------------------|
| YY | 2-digit HEX number |
| | See write command. |

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7.4.6 Group Parameter Setpoints

7.4.6.1 BCC (Bayard Alpert Sensor Constant Emission Current)

Set or query the constant emission current of Bayard Alpert sensors.

The addressed sensor must be a BAG system.

S: BCC,a[, b]<CR>[<LF>]

E: c<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|-------------------------------------|
| a | 1...4 | Channel number 1 to 4 |
| b | 0 | AUTO, Emission current not constant |
| | 1 | 0.1 mA |
| | 2 | 1.0 mA |
| | 3 | 10 mA |

| Response | Value | Significance |
|----------|-------|------------------------------|
| c | 0...3 | Current setpoint (see above) |

7.4.6.2 CAO (CTR-Sensor Auto Offset)

Set or query automatic offset correction of CTR sensors.

The addressed sensor must be a CTR system.

S: COC,a[, b]<CR>[<LF>]

E: c<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|---------------------------------|
| a | 1...4 | Channel number 1 to 4 |
| b | 0 | Automatic offset correction off |
| | 1 | Automatic offset correction on |

| Response | Value | Significance |
|----------|-------|------------------------------|
| c | 0/1 | Current setpoint (see above) |

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7.4.6.3 CST (CTR Sensor Type)

Set or query the CTR sensor type.

S: CST, a[,bb]<CR>[<LF>]

E: cc<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|-----------------------|
| a | 3/4 | Channel number 3 or 4 |
| bb | 00 | CTR_0_01_MBAR sensor |
| | 01 | CTR_0_01_TORR sensor |
| | 02 | CTR_0_02_TORR sensor |
| | 03 | CTR_0_05_TORR sensor |
| | 04 | CTR_0_10_MBAR sensor |
| | 05 | CTR_0_10_TORR sensor |
| | 06 | CTR_0_25_TORR sensor |
| | 07 | CTR_0_50_TORR sensor |
| | 08 | CTR_1_MBAR sensor |
| | 09 | CTR_1_TORR sensor |
| | 10 | CTR_2_TORR sensor |
| | 11 | CTR_10_MBAR sensor |
| | 12 | CTR_10_TORR sensor |
| | 13 | CTR_100_MBAR sensor |
| | 14 | CTR_100_TORR sensor |
| | 15 | CTR_1000_MBAR sensor |
| | 16 | CTR_1100_MBAR sensor |
| | 17 | CTR_1000_TORR sensor |

| Response | Value | Significance |
|----------|---------|----------------------------------|
| cc | 00...17 | Installed CTR sensor (see above) |

Computer Interface (IM 540 Mode)

7.4.6.4 FCO (Failure Control)

Set or query the automatic sensor selection in case of an error.

This command is allowed only if the sensor control is set to TTR_ONLY.

S: FCO[, a]<CR>[<LF>]

E: b <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|-------------------------------|
| a | 0 | No automatic sensor selection |
| | 1 | Automatic sensor selection |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0/1 | Current setpoint (see above) |

7.4.6.5 FRC (Failure Relay Configuration)

Configure or query the failure relays.

S: FRC,a[, b]<CR>[<LF>]

E: c <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|-----------------------------------|
| a | 1/2 | Relay 1 or 2 |
| b | 1...4 | Assignment to a measuring channel |
| | 5 | Sum of channels 1...4 |
| | 6 | GLOBAL |
| | 7 | NONE |

| Response | Value | Significance |
|----------|-------|-----------------------------------|
| c | 1...7 | Current configuration (see above) |

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7.4.6.6 LOC (Locking)

Set or query the lockout of the control buttons.

S: LOC[, a]<CR>[<LF>]

E: b <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------------|
| a | | Lock the keyboard. |
| | 0 | OFF |
| | 1 | PARA Lock |
| | 2 | PROFI Lock |
| | 3 | FULL Lock |

For a description of the available settings refer to Chapter 5.2.1.3 Setup Lock (Set.Lock), 60.

| Response | Significance |
|----------|---|
| b | Read the current lock setting (see above) |

7.4.6.7 RMO (Recorder Mode)

Set or query the working mode of the recorder output.

S: RMO[, a]<CR>[<LF>]

E: b <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|---------------------------------|
| a | 0 | IM 540 Mode, i.e. channel based |
| | 1 | IM 520_AUTO Mode |
| | 2 | IM520_FIX Mode |

| Response | Significance |
|----------|---|
| b | 0...2 Read the current working mode (see above) |

Computer Interface (IM 540 Mode)

7.4.6.8 RSC (Recorder Scale)

Set or query the scaling of a recorder output.

This command is allowed only if the Recorder Mode is set to IM 540 Mode, i.e. if it is channel based.

S: RSC, a[,b]<CR>[<LF>]

E: c <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|------------------------|
| a | 1/2 | Recorder output 1 or 2 |
| b | 0 | SCALE_FULL |
| | 1 | SCALE_USER |
| | 2 | SCALE_AUTO |
| | 3 | SCALE_EXPO |

| Response | Significance |
|----------|---|
| c | 0...3 Scaling setpoint (see above) |

7.4.6.9 RSF (Recorder Scale Fix)

Set or query the fixed exponent of the recorder output 1.

The write command is allowed only if the Recorder Mode is set to IM 520_FIX Mode.

S: RSF, -a<CR>[<LF>]

E: -b <CR><LF>

| Parameter | Value | Significance |
|-----------|--------|-------------------------------------|
| a | 3...12 | Exponent within the range -3 to -12 |

| Response | Significance |
|----------|---|
| a | 3...12 Exponent within the range -3 to -12 |

Computer Interface (IM 540 Mode)

7.4.6.10 RSL (Recorder Scale Limits)

Set or query the scale limits of a recorder output.

This command is allowed only if the Recorder Mode is set to IM 540 Mode, i.e. if it is channel based, and if the scaling of the recorder output is not set to SCALE_USER.

The limit setpoints must not exceed the measuring limits of the selected measuring channel.

S: RSL, a[,±c.ccccE±cc,±d.ddddE±dd]<CR>[<LF>]

E: ±c.ccccE±cc,±d.ddddE±dd <CR><LF>

| Parameter | Value | Significance |
|-------------|-------|---|
| a | 1/2 | Recorder output 1 or 2 |
| ±c.ccccE±cc | | Lower pressure value of the recorder output scale in the current pressure unit. |
| ±d.ddddE±dd | | Upper pressure value of the recorder output scale in the current pressure unit. |

| Response | Significance |
|-------------|---|
| ±c.ccccE±cc | Lower pressure value of the recorder output scale in the current pressure unit. |
| ±d.ddddE±dd | Upper pressure value of the recorder output scale in the current pressure unit. |

Computer Interface (IM 540 Mode)

7.4.6.11 RSM (Recorder Scale Mode)

Set or query the scale mode of a recorder output.

This command is allowed only if the Recorder Mode is set to IM 540 Mode, i.e. if it is channel based, and if the scaling of the recorder output is not set to SCALE_EXPO.

S: RSC, a[,b]<CR>[<LF>]

E: c <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|------------------------|
| a | 1/2 | Recorder output 1 or 2 |
| b | 0 | LIN_SCALE |
| | 1 | LOG_SCALE |

| Response | Significance |
|----------|-------------------------------------|
| c | 0/1 Scale mode setpoint (see above) |

7.4.6.12 RSO (Recorder Source)

- Assign a measuring channel to a recorder output
- Query the channel assignment

This command is allowed only if the Recorder Mode is set to IM 540 Mode, i.e. if it is channel based.

The working mode IM 520_AUTO is allowed only if a sensor control has been defined.

S: RSO, a[,b]<CR>[<LF>]

E: c <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|------------------------|
| a | 1/2 | Recorder output 1 or 2 |
| b | 1...4 | Channel number |
| | 5 | AUTO Mode |
| | 6 | NONE |

| Response | Significance |
|----------|----------------------------------|
| c | 1...4 Assigned measuring channel |

7.4.6.13 SAC (Sensor Amplification Correction)

Set or query the sensor amplification correction.

S: SAC, a[,bbb]<CR>[<LF>]

E: c.cc<CR><LF>

| Parameter | Value | Significance |
|-----------|--------------|-----------------------|
| a | 1...4 | Channel number 1 to 4 |
| b.bb | 0.10 to 9.99 | Correction factor |

| Response | Value | Significance |
|----------|--------|---------------------------------------|
| c.cc | 0... 8 | Current correction factor (see above) |

7.4.6.14 SAS (Sensor Amplifier Sensitivity)

Set the sensor amplification sensitivity for a channel.

S: SAS, a[,b]<CR>[<LF>]

E: c<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|-----------------------|
| a | 1, 2 | Channel number 1 or 2 |
| b | 0 | Low |
| | 1 | Normal |
| | 2 | High |

| Response | Value | Significance |
|----------|-------|-------------------------|
| c | | Sensitivity (see above) |

7.4.6.15 SCA (Sensor Control Activate)

Reactivate the sensor control after changing the SCS, SCM, SCC, SCL, SCT parameters.

This command is allowed only if at least one of the above mentioned parameters has been changed.

S: SCA<CR>[<LF>]

E: <AKC><CR><LF>

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7.4.6.16 SCC (Sensor Control Channel)

Set or query the channel that controls a sensor whose sensor control mode is set to AUTO.

This command is allowed only if the basic type of sensor control is set to 0 (channel controlling).

If this parameter is changed, the emission of the ionivac sensors will be switched off and all running sensor control functions will be suspended (Sensor, Pirani, Contact, Analog).

If at least one of the sensor control parameters have been changed (using SCS, SCM, SCC, SCL, or SCT command) the sensor control must be reactivated using the SCA command.

S: SCC,a[, b]<CR>[<LF>]

E: c<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------------------------------|
| a | 1...4 | Sensors 1 to 4 |
| b | 0 | Is not controlled by another channel |
| | 1...4 | Controlling channel, sensors 1 to 4 |
| Response | Value | Significance |
| c | 0...4 | Current setpoint (see above) |

7.4.6.17 SCL (Sensor Control Limits)

- In IM 540 Mode (Control mode 0):
Set or query the range limits for starting up and shutting down the sensor at the controlled channel.
The sensor control mode of the addressed sensor must be set to AUTO or SELF. If the sensor control mode SELF has been selected, only the startup limit is relevant. The shutdown limit must be defined as well, but it does not take effect.
- In IM 520 Mode (Control modes 1 ... 4):
Set or query the startup and shutdown limits of the controlling TTR channel. Prior to this the TTR sensor control (channel 3 or 4) has to be activated and the channel number of the controlling TTR channel has to be defined. The limit values must not exceed the measuring range of the selected channel.

If this parameter is changed, the emission of the ionivac sensors will be switched off and all running sensor control functions will be suspended (Sensor, Pirani, Contact, Analog).

If at least one of the sensor control parameters have been changed (using SCS, SCM, SCC, SCL, or SCT command) the sensor control must be reactivated using the SCA command.

S: SCL, a[,±c.ccccE±cc,±d.ddddE±dd]<CR>[<LF>]

E: ±c.ccccE±cc,±d.ddddE±dd <CR><LF>

| Parameter | Value | Significance |
|-------------|---------|---|
| a | 1 ... 4 | Channel number 1 to 4 |
| ±c.ccccE±cc | | Startup value in the current pressure unit |
| ±d.ddddE±dd | | Shutdown value in the current pressure unit |

| Response | Significance |
|-------------|---|
| ±c.ccccE±cc | Startup value in the current pressure unit |
| ±d.ddddE±dd | Shutdown value in the current pressure unit |

Computer Interface (IM 540 Mode)

7.4.6.18 SCM (Sensor Control Mode)

Set or query the sensor control mode.

This command is allowed only if the basic type of sensor control is set to 0 (channel controlling).

If this parameter is changed, the emission of the ionivac sensors will be switched off and all running sensor control functions will be suspended (Sensor, Pirani, Contact, Analog).

If at least one of the sensor control parameters have been changed (using SCS, SCM, SCC, SCL, or SCT command) the sensor control must be reactivated using the SCA command.

S: SCM,a[, b]<CR>[<LF>]

E: c<CR><LF>

| Parameter | Value | Significance |
|-----------|---------|---|
| a | 1 ... 4 | Channel number 1 to 4 |
| b | 0 | MANAUL |
| | 1 | SELF Only applicable to BAG and EXT sensors |
| | 2 | AUTO Applicable to all sensors, however channels 3 and 4 cannot be set to AUTO simultaneously. |
| | 3 | HOT Only applicable to a CTR or TTR sensor |
| Response | Value | Significance |
| c | 0 ... 3 | Current setpoint (see above) |

7.4.6.19 SCS (Sensor Control Setting)

Set or query the basic type of sensor control.

If this parameter is changed, the emission of the ionivac sensors will be switched off and all running sensor control functions will be suspended (Sensor, Pirani, Contact, Analog).

If at least one of the sensor control parameters have been changed (using SCS, SCM, SCC, SCL, or SCT command) the sensor control must be reactivated using the SCA command.

S: SCS[, a]<CR>[<LF>]

E: b<CR><LF>

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| Parameter | Value | Significance |
|-----------|-------|--|
| a | 0 | Channel controlling. The sensors control each other or they are self-controlling. |
| | 1 | Only TTR starting control for ionivac systems |
| | 2 | Control via analog inputs |
| | 3 | Control via contact inputs |
| | 4 | Control via analog and contact inputs |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0...4 | Current setpoint (see above) |

7.4.6.20 SCT (Sensor Control TTR)

Activate or query the TTR sensor control.

This command is allowed only if the basic type of sensor control is set to TTR_ONLY, ANALOG, CONTACT or ANALOG+CONTACT and a TTR sensor is installed at the addressed channel.

If this parameter is changed, the emission of the ionivac sensors will be switched off and all running sensor control functions will be suspended (Sensor, Pirani, Contact, Analog).

If at least one of the sensor control parameters have been changed (using SCS, SCM, SCC, SCL, or SCT command) the sensor control must be reactivated using the SCA command.

S: SCT[, a]<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--|
| a | 0 | Deactivate TTR sensor control |
| | 1 | Activate sensor control at TTR channel 3 |
| | 2 | Activate sensor control at TTR channel 3 |

| Response | Value | Significance |
|----------|-------|------------------------------|
| c | 0...2 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.6.21 SEW (Switch Emission On Warning)

Set or query the behavior of the emission in case of an warning caused by the voltage monitoring.

S: SEW[, a]<CR>[<LF>]

E: b <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------------------|
| a | 0 | Emission remains on |
| | 1 | Emission is switched off |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0/1 | Current setpoint (see above) |

7.4.6.22 SFP (Sensor Filament Power)

Threshold values of the filament power monitoring of ionivac sensors.

S: SFP, a[,cc.c]<CR>[<LF>]

E: cc.c <CR><LF>

| Parameter | Value | Significance |
|-----------|----------------|--------------------------|
| a | 1/2 | Measuring channel 1 or 2 |
| cc.c | 1.0... 15.0 | Threshold values in Watt |

| Response | Value | Significance |
|----------|----------------|---|
| c | 1.0... 15.0 | Current threshold value setpoints (see above) |

Computer Interface (IM 540 Mode)

7.4.6.23 SGC (Sensor Gas Correction)

Set or query the sensor gas correction.

CTR sensors allow the values NONE or USER only.

S: SGC, a[,b]<CR>[<LF>]

E: c<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|-----------------------|
| a | 1...4 | Channel number 1 to 4 |
| b | 0 | NONE |
| | 1 | GAS_AR |
| | 2 | GAS_H2 |
| | 3 | GAS_HE |
| | 4 | GAS_NE |
| | 5 | GAS_KR |
| | 6 | GAS_XE |
| | 7 | GAS_CO2 |
| | 8 | GAS_USER |

| Response | Value | Significance |
|----------|--------|------------------------------|
| c | 0... 8 | Current gas type (see above) |

7.4.6.24 SMF (Sensor Measuring Filter)

Set or query the sensor measuring filter.

S: SMF,a[, b]<CR>[<LF>]

E: c <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|-----------------------|
| a | 1...4 | Channel number 1 to 4 |
| b | 0 | NONE |
| | 1 | FAST |
| | 2 | NORMAL |
| | 3 | SLOW |

| Response | Value | Significance |
|----------|-------|------------------------------|
| c | 0...3 | Measuring filter (see above) |

Computer Interface (IM 540 Mode)

7.4.6.25 SPE (Setpoint Enable)

■ Release or lock trigger relays

■ Query relay switching

S: SPE [,XX]<CR>[<LF>]

E: YY <CR><LF>

| Parameter | Bit | Significance |
|-----------|-----|--|
| XX | | 2-digit HEX number |
| | | Bit position is 0 = relay switching disabled |
| | | Bit position is 1 = relay switching enabled |
| | 0 | Relay 1 (VB Print) |
| | 1 | Relay 2 (VB Print) |
| | 2 | Relay 3 (IF540 interface board) |
| | 3 | Relay 4 (IF540 interface board) |
| | 4 | Relay 5 (IF540 interface board) |
| | 5 | Relay 6 (IF540 interface board) |
| | 6 | Relay 7 (IF540 interface board) |
| | 7 | --- |

| Response | Significance |
|----------|--|
| YY | 2-digit HEX number |
| | Bit position is 0 = relay switching disabled |
| | Bit position is 1 = relay switching enabled |
| | See write command. |

Computer Interface (IM 540 Mode)

7.4.6.26 SPS (Setpoint Status)

Query setpoint status of all trigger relays.

S: SPS<CR>[<LF>]

E: XX <CR><LF>

| Response | Bit | Significance |
|----------|-----|---|
| XX | | 2-digit HEX number |
| | | Bit position is 0 = relay not activated |
| | | Bit position is 1 = relay activated |
| | 0 | Relay 1 (VB Print) |
| | 1 | Relay 2 (VB Print) |
| | 2 | Relay 3 (IF540 interface board) |
| | 3 | Relay 4 (IF540 interface board) |
| | 4 | Relay 5 (IF540 interface board) |
| | 5 | Relay 6 (IF540 interface board) |
| | 6 | Relay 7 (IF540 interface board) |
| | 7 | --- |

7.4.6.27 SPV (Setpoint Value)

Assign and set trigger point, or query trigger point.

S: SPV, a[,b,±c.ccccE±cc,±d.ddddE±dd]<CR>[<LF>]

E: e,±c.ccccE±cc,±d.ddddE±dd <CR><LF>

| Parameter | Value | Significance |
|-------------|-------|---|
| a | 1...2 | Relay number |
| | 1...7 | Relay number, if IF540x interface board installed |
| b | | Assignment to measuring channels 1...4 |
| ±c.ccccE±cc | | Lower threshold value in current pressure unit |
| ±d.ddddE±dd | | Upper threshold value in current pressure unit |

| Response | Significance |
|----------|---|
| e | Assignment of the addressed relay number 1...7 to the measuring channel 1...4 |

Computer Interface (IM 540 Mode)

| Response | Significance |
|-------------|--|
| ±c.ccccE±cc | Lower threshold value in current pressure unit |
| ±d.ddddE±dd | Upper threshold value in current pressure unit |

7.4.6.28 SSV (Sensor Sensivity Value)

Set or query the sensitivity of an ionivac sensor.

S: SSV, a[,cc.cc]<CR>[<LF>]

E: cc.cc <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--|
| a | 1/2 | Measuring channel 1 or 2 |
| cc.cc | | Sensor sensitivity Range BAG: 05.00 to 30.00 Range EXT: 01.00 to 20.00 |

| Response | Value | Significance |
|----------|-------|------------------------------|
| cc.cc | | Current setpoint (see above) |

7.4.6.29 SUC (Sensor User-Correction Gas Clear)

Reset the complete pressure dependent gas correction table with max. 50 anchor points for one measuring channel.

The complete correction table will be transferred to the EEPROM. After that the execution of the command will be acknowledged with <ACK>.

Note:

This command has a long execution time.

S: SUC, a<CR>[<LF>]

| Parameter | Value | Significance |
|-----------|-------|-----------------------|
| a | 1...4 | Channel number 1 to 4 |

Computer Interface (IM 540 Mode)

7.4.6.30 SUG (Sensor User-Correction Gas)

Set or query a correction factor in a table of max. 50 anchor points. This table is used as pressure dependent correction table for one measuring channel.

Note:

After assigning all correction values to the corresponding anchor points, the complete table must be transferred to the EEPROM using the SUS command. If this transfer is neglected, the changes will get lost once the mains supply is switched off.

S: SUG, a,bb[, c.ccccE±cc,d.ddd]<CR>[<LF>]

E: c.cc<CR><LF>

| Parameter | Value | Significance |
|------------|----------------|---|
| a | 1...4 | Channel number 1 to 4 |
| bb | 01 to 50 | Table index |
| c.ccccE±cc | | Pressure value assigned to the given anchor point in the current pressure unit. This value must not exceed the measuring limits of the connected sensor. |
| d.ddd | 0.100 to 9.999 | Correction value assigned to the given anchor point. |

| Response | Value | Significance |
|------------|----------------|---|
| c.ccccE±cc | | Pressure value assigned to the given anchor point in the current pressure unit. This value must not exceed the measuring limits of the connected sensor. |
| d.ddd | 0.100 to 9.999 | Correction value assigned to the given anchor point. |

Computer Interface (IM 540 Mode)

7.4.6.31 SUS (Sensor User-Correction Gas Save)

Transfer the complete gas correction table of the addressed channel to the EEPROM. The execution of this command will be acknowledged with <ACK>.

Note:

This command has a long execution time.

S: SUS, a<CR>[<LF>]

| Parameter | Value | Significance |
|-----------|-------|-----------------------|
| a | 1...4 | Channel number 1 to 4 |

7.4.6.32 SXR (Sensor Gas Correction)

Set or query the X-ray limit for Ioni sensors.

S: SXR, a[, b.bbE±bb],<CR>[<LF>]

E: b.bbE±bb <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|---|
| a | | Measuring channel 1 or 2 |
| b.bbE±bb | | 0.00 (correction switched off) or X-ray limit |

| Response | Significance |
|----------|---------------------|
| b.bbE±bb | Current X-ray limit |

Computer Interface (IM 540 Mode)

7.4.6.33 THV (Threshold Value)

Set or query the threshold value of the analog input.

S: THV, a[,cc.cc,dd.dd]<CR>[<LF>]

E: cc.cc,dd.dd <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--|
| a | 1/2 | Analog input channel 1 or 2 |
| cc.cc | | U_Low: Lower threshold value in volt |
| dd.dd | | U_High: Upper threshold value in volt Limits: 00.00 V to 10.00 V $U_{High} - U_{Low} \geq +0.050 \text{ V}$ |

| Response | Significance |
|----------|---------------------------------------|
| cc.cc | U_Low: Lower threshold value in volt |
| dd.dd | U_High: Upper threshold value in volt |

7.4.6.34 TOP (Torr Permission)

Set or query the Torr permission.

If the current pressure unit is Torr and the permission is reset (0) the pressure unit will automatically be set to mbar (default value).

S: TOL[, a]<CR>[<LF>]

E: b <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|---|
| a | 0 | Reset the Torr permission (Torr cannot be selected) |
| | 1 | Set the Torr permission (Torr can be selected) |

| Response | Significance |
|----------|---|
| b | 0/1 Read the current Torr permission status (see above) |

Computer Interface (IM 540 Mode)

7.4.6.35 UNI (Unit)

Set or query pressure unit.

S: UNI[, a]<CR>[<LF>]

E: b <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|-----------------------|
| a | | Set the pressure unit |
| | 0 | Millibar (mbar) |
| | 1 | Torr |
| | 2 | Pascal |
| | 3 | Micron |

Note:

The pressure unit Torr can be set only if the torr lock has been disabled.

| Response | Significance |
|----------|--|
| b | Read the current pressure unit (see above) |

7.4.6.36 WCI (Warning Condition Ionisupply)

Set or query the behavior of the device in case of an warning caused by the ionivac supply.

S: WCI[, a]<CR>[<LF>]

E: b <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------|
| a | 0 | No error |
| | 1 | Warning |
| | 2 | Fatal error |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0...2 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.6.37 WCP (Warning Condition Powersupply)

Set or query the behavior of the device in case of an warning caused by the system voltage supply.

S: WCP[, a]<CR>[<LF>]

E: b <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------|
| a | 0 | No error |
| | 1 | Warning |
| | 2 | Fatal error |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0...2 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.7 Group Device Information

7.4.7.1 ARN (Article Number)

Query or program the article number of the IM 540.

The article number is written to the EEPROM of the MC board starting at address 140H. Its maximum string length amounts to 16 characters. If the string contains less than 16 characters, it will be padded to the maximum length by appending blank characters before it is stored.

The checksum of the entire memory range 000H to 1FDH must be calculated and stored again. For this, the entire memory range must be read. This may cause a notable response time for the <ACK> of this command.

S: ARN[,<String>]<CR>[<LF>]

E: <String> <CR><LF>

| Parameter | Significance |
|-----------|---|
| <String> | Article number in the format 123-456x (example) |

7.4.7.2 AYT (Are You There)

Using this command the dialog partner can be identified and the readiness for operation can be checked.

S: AYT,<string1>,<string2><CR>[<LF>]

E: IM540,Vxx.xx<CR>[<LF>]

| Parameter | Significance |
|-----------|---|
| <string1> | Name of the dialog partner (IF540P, if profibus is used) |
| <string2> | Version number of the dialog partner in the format Vxx.xx |

Once the IM 540 is ready for operation it will respond to this command:

If a known dialog partner, such as the profibus (<string1> = IF540P) is recognized, the version number (<string2> = Vxx.xx) is compared with the minimal version number defined in the source file. If the current version is of recent date the device answers with <ACK> and the IM 540 identification can be requested using the <ENQ> command.

If this condition is not met, the device answers with <NAK>. The corresponding error code is:

40 = IM540_RS232_ERROR_SW_VERSION_INCOMPATIBLE

If the dialog partner described by <string1> is unknown the conformance with the required command syntax (AYT , ,) leads to a positive acknowledgement <ACK> and the IM 540 identification can be requested using the <ENQ> command.

Computer Interface (IM 540 Mode)

7.4.7.3 EDA (Examine Date)

Query or program the examine date of the IM 540.

The examine date is written to the EEPROM of the MC board starting at address 160H. Its maximum string length amounts to 16 characters. If the string contains less than 16 characters, it will be padded to the maximum length by appending blank characters before it is stored.

The checksum of the entire memory range 000H to 1FDH must be calculated and stored again. For this, the entire memory range must be read. This may cause a notable response time for the <ACK> of this command.

S: EDA[,<String>]<CR>[<LF>]

E: <String> <CR><LF>

| Parameter | Significance |
|-----------|--|
| <String> | Examine date in the format 2004-10-04-13-38 (example) |

7.4.7.4 IEC (Ion Emission Current)

Query the current emission current at the ionivac channel 1 or 2.

S: IEC<CR>[<LF>]

E: a <CR><LF>

| Response | Value | Significance |
|----------|-------|-----------------------|
| a | | Emission current |
| | 0 | 0,0 mA (Emission off) |
| | 1 | 0,1 mA |
| | 2 | 1 mA |
| | 3 | 1,6 mA |
| | 4 | 10 mA |
| | 5 | 45 mA |
| | 6 | 90 mA |

Computer Interface (IM 540 Mode)

7.4.7.5 IQM (IQ-Board-Data from MC-Board)

Query the article number and the serial number of the IQ board.

S: IQM <CR>[<LF>]

E: <String1>,<String2> <CR><LF>

| Response | Significance |
|-----------|--|
| <String1> | Article number in format 123-456x (example) |
| <String2> | Serial number in format 106689E037 (example) |

7.4.7.6 IVM (IV-Board-Data from MC-Board)

Query the article number and the serial number of the IV board.

S: IVM <CR>[<LF>]

E: <String1>,<String2> <CR><LF>

| Response | Significance |
|-----------|--|
| <String1> | Article number in format 123-456x (example) |
| <String2> | Serial number in format 106689E037 (example) |

7.4.7.7 SEN (Serial Number)

Query or program the serial number of the IM 540.

The serial number is written to the EEPROM of the MC board starting at address 150H. Its maximum string length amounts to 16 characters. If the string contains less than 16 characters, it will be padded to the maximum length by appending blank characters before it is stored.

The checksum of the entire memory range 000H to 1FDH must be calculated and stored again. For this, the entire memory range must be read. This may cause a notable response time for the <ACK> of this command.

S: SEN[,<String>]<CR>[<LF>]

E: <String> <CR><LF>

| Parameter | Significance |
|-----------|--|
| <String> | Serial number in the format 106689E037 (example) |

Computer Interface (IM 540 Mode)

7.4.7.8 SRL (Sensor Range Limits)

Query the sensor range limits.

S: SRL, a<CR>[<LF>]

E: b,±c.ccccE±cc,±d.ddddE±dd <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------------------|
| a | 1...4 | Measuring channel 1 to 4 |

| Response | Significance |
|-------------|---|
| a | Addressed measuring channel |
| ±c.ccccE±cc | Lower limit of the measuring range in the current pressure unit |
| ±d.ddddE±dd | Upper limit of the measuring range in the current pressure unit |

Computer Interface (IM 540 Mode)

7.4.7.9 STI (Sensor Type Information)

Query the type of sensor connected to the addressed channel.

S: STI, a<CR><LF>

E: bb<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|-----------------------|
| a | 1...4 | Channel number 1 to 4 |

| Response | Value | Significance |
|----------|-------|---|
| bb | | Sensor connected to the addressed channel |
| | 00 | No sensor connected |
| | 01 | BAG sensor |
| | 02 | EXT sensor |
| | 03 | TTR sensor |
| | 04 | CTR_0_01_MBAR sensor |
| | 05 | CTR_0_01_TORR sensor |
| | 06 | CTR_0_02_TORR sensor |
| | 07 | CTR_0_05_TORR sensor |
| | 08 | CTR_0_10_MBAR sensor |
| | 09 | CTR_0_10_TORR sensor |
| | 10 | CTR_0_25_TORR sensor |
| | 11 | CTR_0_50_TORR sensor |
| | 12 | CTR_1_MBAR sensor |
| | 13 | CTR_1_TORR sensor |
| | 14 | CTR_2_TORR sensor |
| | 15 | CTR_10_MBAR sensor |
| | 16 | CTR_10_TORR sensor |
| | 17 | CTR_100_MBAR sensor |
| | 18 | CTR_100_TORR sensor |
| | 19 | CTR_1000_MBAR sensor |
| | 20 | CTR_1100_MBAR sensor |
| | 21 | CTR_1000_TORR sensor |

Computer Interface (IM 540 Mode)

7.4.7.10 VPM (VP-Board-Data from MC-Board)

Query the article number and the serial number of the VP board.

S: VPM <CR>[<LF>]

E: <String1>,<String2> <CR><LF>

| Response | Significance |
|-----------|--|
| <String1> | Article number in format 123-456x (example) |
| <String2> | Serial number in format 106689E037 (example) |

Computer Interface (IM 540 Mode)

7.4.8 Group DETAIL - Reading Device Information

7.4.8.1 GAV (Gauge Anode Voltage)

Read the anode voltage.

If the emission is off the value 0.000 V is being output.

S: GAV<CR>[<LF>]

E: nnn. nnn <CR><LF>

| Response | Significance |
|----------|-----------------------|
| nnn.nnn | Anode voltage in Volt |

7.4.8.2 GCV (Gauge Cathode Voltage)

Read the cathode voltage.

If the emission is off the value 0.000 V is being output.

S: GCV<CR>[<LF>]

E: nn. nnn <CR><LF>

| Response | Significance |
|----------|-------------------------|
| nn.nnn | Cathode voltage in Volt |

7.4.8.3 GEC (Gauge Emission Current)

Read the emission current.

If the emission is off the value 0.000 mA is being output.

S: GEC<CR>[<LF>]

E: nn. nnn <CR><LF>

| Response | Significance |
|----------|------------------------|
| nn.nnn | Emission current in mA |

Computer Interface (IM 540 Mode)

7.4.8.4 GFC (Gauge Filament Current)

Read the filament current.

If the emission is off the value 0.000 A is being output.

S: GFC<CR>[<LF>]

E: n.nnn <CR><LF>

| Response | Significance |
|----------|-----------------------|
| n.nnn | Filament current in A |

7.4.8.5 GFP (Gauge Filament Power)

Read the filament power.

If the emission is off the value 0.000 W is being output.

S: GFP<CR>[<LF>]

E: n.nnn <CR><LF>

| Response | Significance |
|----------|---------------------|
| n.nnn | Filament power in W |

7.4.8.6 GFU (Gauge Filament Voltage)

Read the filament voltage.

If the emission is off the value 0.000 V is being output.

S: GFU<CR>[<LF>]

E: n.nnn <CR><LF>

| Response | Significance |
|----------|--------------------------|
| n.nnn | Filament voltage in Volt |

7.4.8.7 GRV (Gauge Reflector Voltage)

Read the reflector voltage.

If the emission is off the value 0.000 V is being output.

S: GRV<CR>[<LF>]

E: nnn. nnn <CR><LF>

| Response | Significance |
|----------|---------------------------|
| nnn.nnn | Reflector voltage in Volt |

Computer Interface (IM 540 Mode)

7.4.8.8 IDO (Info Device Operation Time)

Query the operation time of the IM 540.

S: IDT<CR>[<LF>]

E: a <CR><LF>

| Response | Significance |
|----------|-------------------------|
| a | Operation time in hours |

7.4.8.9 IIA (Info IV-Board Article No)

Query the article number of the IV board.

The article number of the IV board is written to the EEPROM of the IV board starting at address 100H. Its maximum string length amounts to 16 characters.

S: IIH<CR>[<LF>]

E: <String> <CR><LF>

| Response | Significance |
|----------|---|
| <String> | Article number in format 123-456x (example) |

7.4.8.10 IIC (Info IV-Board Calibration Date)

Query the calibration date of the IV board.

The calibration date of the IV board is written to the EEPROM of the IV board starting at address 120H. Its maximum string length amounts to 16 characters.

S: IIC<CR>[<LF>]

E: <String> <CR><LF>

| Response | Significance |
|----------|--|
| <String> | Calibration date in format 2004-10-04-13-38 (example) |

Computer Interface (IM 540 Mode)

7.4.8.11 IIF (Info IV-Board FW-Version)

Query the firmware version of the IV board.

The firmware version of the IV board is written to the EEPROM of the IV board starting at address 130H. Its maximum string length amounts to 16 characters.

S: IIF<CR>[<LF>]

E: <String> <CR><LF>

| Response | Significance |
|----------|---|
| <String> | Firmware version in format V03.20 (example) |

7.4.8.12 IIH (Info IV-Board HW-Version)

Query the hardware version of the IV board.

The hardware version of the IV board is written to the EEPROM of the IV board starting at address 0x1FC / 0x1FD. Format unsigned Int.

S: IMH<CR>[<LF>]

E: a <CR><LF>

| Response | Significance |
|----------|---------------------------|
| a | Hardware version (e.g. 1) |

7.4.8.13 IIS (Info IV-Board Serial No.)

Query the serial number of the IV board.

The serial number of the IV board is written to the EEPROM of the IV board starting at address 110H. Its maximum string length amounts to 16 characters.

S: IIS<CR>[<LF>]

E: <String> <CR><LF>

| Response | Significance |
|----------|--|
| <String> | Serial number in format 106689E037 (example) |

Computer Interface (IM 540 Mode)

7.4.8.14 IMA (Info MC-Board Articiel No.)

Query the article number of the MC board.

The article number of the MC board is written to the EEPROM of the MC board starting at address 100H. Its maximum string length amounts to 16 characters.

S: IMH<CR>[<LF>]

E: <String> <CR><LF>

| Response | Significance |
|----------|---|
| <String> | Article number in format 123-456x (example) |

7.4.8.15 IMC (Info MC-Board Calibration Date)

Query the calibration date of the MC board.

The calibration date of the MC board is written to the EEPROM of the MC board starting at address 120H. Its maximum string length amounts to 16 characters.

S: IMC<CR>[<LF>]

E: <String> <CR><LF>

| Response | Significance |
|----------|--|
| <String> | Calibration date in format 2004-10-04-13-38 (example) |

7.4.8.16 IMF (Info MC-Board FW-Version)

Query the firmware version of the MC board.

The firmware version of the MC board is written to the EEPROM of the MC board starting at address 130H. Its maximum string length amounts to 16 characters.

S: IMF<CR>[<LF>]

E: <String> <CR><LF>

| Response | Significance |
|----------|-----------------------------------|
| <String> | Firmware version V01.04 (example) |

Computer Interface (IM 540 Mode)

7.4.8.17 IMH (Info MC-Board HW-Version)

Query the hardware version of the MC board.

The hardware version is written to the EEPROM of the MC board starting at address 0x1FC / 0x1FD. Format unsigned Int.

S: IMH<CR>[<LF>]

E: a <CR><LF>

| Response | Significance |
|----------|---------------------------|
| a | Hardware version (e.g. 1) |

7.4.8.18 IMS (Info MC-Board Serial No.)

Query the serial number of the MC board.

The serial number of the MC board is written to the EEPROM of the MC board starting at address 110H. Its maximum string length amounts to 16 characters.

S: IMS<CR>[<LF>]

E: <String> <CR><LF>

| Response | Significance |
|----------|--|
| <String> | Serial number in format 106689E037 (example) |

7.4.8.19 IQA (Info IQ-Board Article No.)

Query the article number of the IQ board.

The article number of the IQ board is written to the EEPROM of the IQ board starting at address 100H. Its maximum string length amounts to 16 characters.

S: IQH<CR>[<LF>]

E: <String> <CR><LF>

| Response | Significance |
|----------|---|
| <String> | Article number in format 123-456x (example) |

Computer Interface (IM 540 Mode)

7.4.8.20 IQC (Info IQ-Board Calibration Date)

Query the calibration date of the IQ board.

The calibration date of the IQ board is written to the EEPROM of the IQ board starting at address 120H. Its maximum string length amounts to 16 characters.

S: IQC<CR>[<LF>]

E: <String> <CR><LF>

| Response | Significance |
|----------|--|
| <String> | Calibration date in format 2004-10-04-13-38 (example) |

7.4.8.21 IQH (Info IQ-Board HW-Version)

Query the hardware version of the IQ board.

The hardware version is written to the EEPROM of the IQ board starting at address 0x1FC / 0x1FD. Format unsigned Int.

S: IQH<CR>[<LF>]

E: a <CR><LF>

| Response | Significance |
|----------|---------------------------|
| a | Hardware version (e.g. 1) |

7.4.8.22 IQS (Info IQ-Board Serial No.)

Query the serial number of the IQ board.

The serial number of the IQ board is written to the EEPROM of the IQ board starting at address 110H. Its maximum string length amounts to 16 characters.

S: IQS<CR>[<LF>]

E: <String> <CR><LF>

| Response | Significance |
|----------|--|
| <String> | Serial number in format 106689E037 (example) |

Computer Interface (IM 540 Mode)

7.4.8.23 ISM (Info Sensor Monitoring Emergency Off)

Query the number of emergency offs at measuring channel 1 or 2.

S: ISM,a<CR>[<LF>]

E: b,c,d,e <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------------------|
| a | 1/2 | Measuring channel 1 or 2 |

| Response | Significance |
|----------|---|
| b | Number of EMOs caused by too high pressure, while a BAG system was connected to channel a |
| c | Number of EMOs not caused by too high pressure, while a BAG system was connected to channel a |
| d | Number of EMOs caused by too high pressure, while a EXT system was connected to channel a |
| e | Number of EMOs not caused by too high pressure, while a EXT system was connected to channel a |

7.4.8.24 ISO (Info Sensor Offset)

Query the current offset value of a measuring channel.

S: ISO, a<CR>[<LF>]

E: +bbbb oder ±b.bbb <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------------------|
| a | 1...4 | Measuring channel 1 to 4 |

| Response | Significance |
|----------|---|
| +bbbb | If a = measuring channel 1 or 2: current DAC value of the current amplifier. |
| ±b.bbb | If a = measuring channel 3 or 4 with CTR sensor installed: current offset value in Volt |

Computer Interface (IM 540 Mode)

7.4.8.25 IST (Info Sensor Operation Time)

Query the operation time of the sensors that are compatible to a measuring channel.

S: IST,a<CR>[<LF>]

E: b.b, c.c <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------------------|
| a | 1...4 | Measuring channel 1 to 4 |

| Response | Significance |
|----------|--|
| b.b | If a = measuring channel 1 or 2: Operation time of a BAG system at measuring channel a in hours If a = measuring channel 3 or 4: Operation time of a TTR system at measuring channel a in hours |
| c.c | If a = measuring channel 1 or 2: Operation time of a EXT system at measuring channel a in hours If a = measuring channel 3 or 4: Operation time of a CTR system at measuring channel a in hours |

7.4.8.26 IVA (Info VP-Board Article No)

Query the article number of the VP board.

The article number of the VP board is written to the EEPROM of the VP board starting at address 100H. Its maximum string length amounts to 16 characters.

S: IVH<CR>[<LF>]

E: <String> <CR><LF>

| Response | Significance |
|----------|---|
| <String> | Article number in format 123-456x (example) |

Computer Interface (IM 540 Mode)

7.4.8.27 IVC (Info VP-Board Calibration Date)

Query the calibration date of the VP board.

The calibration date of the VP board is written to the EEPROM of the VP board starting at address 120H. Its maximum string length amounts to 16 characters.

S: IVC<CR>[<LF>]

E: <String> <CR><LF>

| Response | Significance |
|----------|--|
| <String> | Calibration date in format 2004-10-04-13-38 (example) |

7.4.8.28 IVH (Info VP-Board HW-Version)

Query the hardware version of the VP board.

The hardware version is written to the EEPROM of the VP board starting at address 0x1FC / 0x1FD. Format unsigned Int.

S: IVH<CR>[<LF>]

E: a <CR><LF>

| Response | Significance |
|----------|---------------------------|
| a | Hardware version (e.g. 1) |

7.4.8.29 IVS (Info VP-Board Serial No.)

Query the serial number of the VP board.

The serial number of the VP board is written to the EEPROM of the VP board starting at address 110H. Its maximum string length amounts to 16 characters.

S: IVS<CR>[<LF>]

E: <String> <CR><LF>

| Response | Significance |
|----------|--|
| <String> | Serial number in format 106689E037 (example) |

Computer Interface (IM 540 Mode)

7.4.9 Group USER Mode

Setting range of the USER GAUGE parameters:

| Cathode potential | Anode potential | |
|-------------------|-------------------------|-------------------------------------|
| | 220V | 480V |
| 10V | 0.1mA, 1mA, 1.6mA, 10mA | 0.1mA, 1mA, 1.6mA, 10mA, 45mA, 90mA |
| 20V | 0.1mA, 1mA, 1.6mA, 10mA | 0.1mA, 1mA, 1.6mA, 10mA, 45mA, 90mA |
| 80V | 0.1mA, 1mA, 1.6mA, 10mA | 0.1mA, 1mA, 1.6mA, 10mA |
| 100V | 0.1mA, 1mA, 1.6mA, 10mA | 0.1mA, 1mA, 1.6mA, 10mA |

The values in the table above refer to the actual setpoints that may result from automatic or USER adjustment.

7.4.9.1 UAD (USER Anode Voltage Degas)

USER-Mode: set or query the anode voltage for degassing.

S: UAD,a[, b]<CR>[<LF>]

E: c<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|------------------------------|
| a | 1/2 | Channel number 1 or 2 |
| b | 0 | ANODE_AUTO |
| | 1 | ANODE_220V |
| | 2 | ANODE_480V |
| Response | Value | Significance |
| c | 0...2 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.9.2 UAM (USER Anode Voltage Measurement)

USER-Mode: set or query the operating voltage of the anode.

S: UAM,a[, b]<CR>[<LF>]

E: c<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|-----------------------|
| a | 1/2 | Channel number 1 or 2 |
| b | 0 | ANODE_AUTO |
| | 1 | ANODE_220V |
| | 2 | ANODE_480V |

| Response | Value | Significance |
|----------|-------|------------------------------|
| c | 0...2 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.9.3 UAR (USER Amplifier Range)

USER-Mode: set or query the measuring range of the current amplifier.

S: UAR,a[, b]<CR>[<LF>]

E: c<CR><LF>

| Parameter | Value | Significance |
|-----------|--------|------------------------------|
| a | 1/2 | Channel number 1 or 2 |
| b | 0 | AMPL_AUTO |
| | 1 | AMPL_100FA |
| | 2 | AMPL_1PA |
| | 3 | AMPL_10PA |
| | 4 | AMPL_100PA |
| | 5 | AMPL_1NA |
| | 6 | AMPL_10NA |
| | 7 | AMPL_100NA |
| | 8 | AMPL_1UA |
| | 9 | AMPL_10UA |
| | 10 | AMPL_100UA |
| | 11 | AMPL_2PA |
| Response | Value | Significance |
| c | 0...11 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.9.4 UAS (USER Amplifier Resolution)

USER-Mode: set or query the resolution of the current amplifier.

S: UAS,a[, b]<CR><LF>]

E: c<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|-----------------------|
| a | 1/2 | Channel number 1 or 2 |
| b | 0 | RESOLUTION_AUTO |
| | 1 | RESOLUTION_6BIT |
| | 2 | RESOLUTION_8BIT |
| | 3 | RESOLUTION_10BIT |
| | 4 | RESOLUTION_11BIT |
| | 5 | RESOLUTION_12BIT |
| | 6 | RESOLUTION_14BIT |

| Response | Value | Significance |
|----------|-------|------------------------------|
| c | 0...6 | Current setpoint (see above) |

7.4.9.5 UAT (USER Amplifier Time)

USER-Mode: set or query the measuring time of the current amplifier.

S: UAT,a[, b,ccc.cc s/ms]<CR><LF>]

E: b,ccc.cc s/ms<CR><LF>

| Parameter | Value | Significance |
|-------------|-------|---|
| a | 1/2 | Channel number 1 or 2 |
| b | 1...6 | Resolution, see UAS (USER Amplifier Resolution) |
| ccc.cc s/ms | | Measuring time in seconds or milliseconds |

| Response | Value | Significance |
|----------|-------|--------------|
| c | | TBD |

Computer Interface (IM 540 Mode)

7.4.9.6 UCD (USER Cathode Voltage Degas)

USER-Mode: set or query the cathode voltage for degassing.

S: UCD,a[, b]<CR>[<LF>]

E: c<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|------------------------------|
| a | 1/2 | Channel number 1 or 2 |
| b | 0 | CATHODE_AUTO |
| | 1 | CATHODE_10V |
| | 2 | CATHODE_20V |
| | 3 | CATHODE_80V |
| | 4 | CATHODE_100V |
| Response | Value | Significance |
| c | 0...4 | Current setpoint (see above) |

7.4.9.7 UCM (USER Cathode Voltage Measurement)

USER-Mode: set or query the operating voltage of the cathode.

S: UCM,a[, b]<CR>[<LF>]

E: c<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|------------------------------|
| a | 1/2 | Channel number 1 or 2 |
| b | 0 | CATHODE_AUTO |
| | 1 | CATHODE_10V |
| | 2 | CATHODE_20V |
| | 3 | CATHODE_80V |
| | 4 | CATHODE_100V |
| Response | Value | Significance |
| c | 0...4 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.9.8 UED (USER Emis Current Degas)

USER-Mode: set or query the emission current for degassing.

S: UED,a[, b]<CR>[<LF>]

E: c<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|-----------------------|
| a | 1/2 | Channel number 1 or 2 |
| b | 0 | EMI_AUTO |
| | 1 | EMI_0_1 MA |
| | 2 | EMI_1MA |
| | 3 | EMI_1_6MA |
| | 4 | EMI_10MA |
| | 5 | EMI_45MA |
| | 6 | EMI_90MA |

| Response | Value | Significance |
|----------|-------|------------------------------|
| c | 0...6 | Current setpoint (see above) |

7.4.9.9 UEM (USER Emis Current Measurement)

USER-Mode: set or query the operating current of the emission.

S: UEM,a[, b]<CR>[<LF>]

E: c<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|-----------------------|
| a | 1/2 | Channel number 1 or 2 |
| b | 0 | EMI_AUTO |
| | 1 | EMI_0_1 MA |
| | 2 | EMI_1MA |
| | 3 | EMI_1_6MA |
| | 4 | EMI_10MA |
| | 5 | EMI_45MA |
| | 6 | EMI_90MA |

| Response | Value | Significance |
|----------|-------|------------------------------|
| c | 0...6 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.9.10 UID (USER Interface Board Detection)

USER-Mode: set or query the IF540x interface board detection.

S: UMD[,a]<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|----------------------|
| a | 0 | IF540X_AUTO |
| | 1 | IF540X_INSTALLED |
| | 2 | IF540X_NOT_INSTALLED |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0...2 | Current setpoint (see above) |

7.4.9.11 UMD (USER Mains Frequency Detection)

USER-Mode: set or query the mains frequency detection.

S: UMD[,a]<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|------------------|
| a | 0 | MAINS_FREQU_AUTO |
| | 1 | MAINS_FREQU_50Hz |
| | 2 | MAINS_FREQU_60Hz |

| Response | Value | Significance |
|----------|-------|------------------------------|
| c | 0...2 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.9.12 USD (USER Sensor Detection)

USER-Mode: set or query the sensor detection.

Note:

If all sensors are set to NONE a BAG system is automatically assigned to channel 1. This guarantees a useful representation of the channel on the display and in the menus.

S: USD,a[, b]<CR>[<LF>]

E: c<CR><LF>

| Parameter | Value | Significance |
|-----------|-----------------------------------|------------------------------|
| a | 1...4 | Channel number 1 to 4 |
| b | in case of channel number 1 or 2: | |
| | 0 | SYSTEM_AUTO |
| | 1 | SYSTEM_BAG |
| | 2 | SYSTEM_EXT |
| | 3 | SYSTEM_NONE |
| | in case of channel number 3 or 4: | |
| | 0 | SYSTEM_AUTO |
| | 1 | SYSTEM_TTR |
| | 2 | SYSTEM_CTR |
| | 3 | SYSTEM_NONE |
| Response | Value | Significance |
| c | 0...3 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.10 Group TEST Mode

7.4.10.1 ROC (ROM CCR Sum)

Query the ROM CRC sum.

S: ROC<CR>[<LF>]

E: XXXX CR><LF>

| Response | Significance |
|----------|-------------------------------|
| XXXX | CRC sum in hexadecimal format |

7.4.10.2 TAC (TEST Amplifier Mod. Capacity)

Set or query the test setpoints of the current amplifier modulator capacity.

S: TAC [,a]<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|---------------|
| a | 0 | MOD_CAP_AUTO |
| | 1 | MOD_CAP_1_5PF |
| | 2 | MOD_CAP_100PF |
| | 3 | MOD_CAP_10NF |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0...3 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.10.3 TAD (TEST Amplifier Display)

Query the current amplifier parameters.

The output string contains 7 values separated by commas.

Note:

In contrast to the commands TAI/TAR/TAS/TAF/TAC, at the AUTO setting the respective parameter will not be output as 0 (for AUTO). The currently used setting will be output instead.

S: TAD<CR>[<LF>]

E: a, bb, c, d, e, f.ffff E-nn s, g.gggggg E-nn A<CR><LF>

| Response | Significance |
|---------------|--|
| a | 1 AMP_INPUT_NONE |
| | 2 AMP_INPUT1 |
| | 3 AMP_INPUT2 |
| | 4 AMP_INPUT1+2 |
| bb | Measuring range. See Section «TAR (TEST Amplifier Range)», 194. |
| c | Resolution |
| d | Modulator frequency. See Chapter 7.4.10.4 TAF (TEST Amplifier Mod. Frequency), 190. |
| e | Capacity. See Section «TAC (TEST Amplifier Mod. Capacity)», 188 |
| f.ffff E-nn | Measuring time in s |
| g.gggggg E-nn | Measuring current in A |

Computer Interface (IM 540 Mode)

7.4.10.4 TAF (TEST Amplifier Mod. Frequency)

Set or query the test setpoint of the current amplifier modulator frequency.

S: TAF [,a]<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|---------------------|
| a | 0 | AMP_MOD_FREQ_AUTO |
| | 1 | AMP_MOD_FREQ_40HZ |
| | 2 | AMP_MOD_FREQ_48HZ |
| | 3 | AMP_MOD_FREQ_50HZ |
| | 4 | AMP_MOD_FREQ_60HZ |
| | 5 | AMP_MOD_FREQ_64HZ |
| | 6 | AMP_MOD_FREQ_80HZ |
| | 7 | AMP_MOD_FREQ_96HZ |
| | 8 | AMP_MOD_FREQ_100HZ |
| | 9 | AMP_MOD_FREQ_120HZ |
| | 10 | AMP_MOD_FREQ_128HZ |
| | 11 | AMP_MOD_FREQ_160HZ |
| | 12 | AMP_MOD_FREQ_192HZ |
| | 13 | AMP_MOD_FREQ_200HZ |
| | 14 | AMP_MOD_FREQ_240HZ |
| | 15 | AMP_MOD_FREQ_256HZ |
| | 16 | AMP_MOD_FREQ_320HZ |
| | 17 | AMP_MOD_FREQ_384HZ |
| | 18 | AMP_MOD_FREQ_400HZ |
| | 19 | AMP_MOD_FREQ_480HZ |
| | 20 | AMP_MOD_FREQ_512HZ |
| | 21 | AMP_MOD_FREQ_640HZ |
| | 22 | AMP_MOD_FREQ_768HZ |
| | 23 | AMP_MOD_FREQ_800HZ |
| | 24 | AMP_MOD_FREQ_960HZ |
| | 25 | AMP_MOD_FREQ_1024HZ |
| | 26 | AMP_MOD_FREQ_1280HZ |
| | 27 | AMP_MOD_FREQ_1536HZ |

Computer Interface (IM 540 Mode)

| Parameter | Value | Significance |
|-----------|-------|-------------------------|
| | 28 | AMP_ MOD_FREQU_1600HZ |
| | 29 | AMP_ MOD_FREQU_1920HZ |
| | 30 | AMP_ MOD_FREQU_2048HZ |
| | 31 | AMP_ MOD_FREQU_2560HZ |
| | 32 | AMP_ MOD_FREQU_3072HZ |
| | 33 | AMP_ MOD_FREQU_3200HZ |
| | 34 | AMP_ MOD_FREQU_3840HZ |
| | 35 | AMP_ MOD_FREQU_4096HZ |
| | 36 | AMP_ MOD_FREQU_5120HZ |
| | 37 | AMP_ MOD_FREQU_6144HZ |
| | 38 | AMP_ MOD_FREQU_6400HZ |
| | 39 | AMP_ MOD_FREQU_7680HZ |
| | 40 | AMP_ MOD_FREQU_8192HZ |
| | 41 | AMP_ MOD_FREQU_10240HZ |
| | 42 | AMP_ MOD_FREQU_12288HZ |
| | 43 | AMP_ MOD_FREQU_12800HZ |
| | 44 | AMP_ MOD_FREQU_15360HZ |
| | 45 | AMP_ MOD_FREQU_17067HZ |
| | 46 | AMP_ MOD_FREQU_20480HZ |
| | 47 | AMP_ MOD_FREQU_24576HZ |
| | 48 | AMP_ MOD_FREQU_25600HZ |
| | 49 | AMP_ MOD_FREQU_30720HZ |
| | 50 | AMP_ MOD_FREQU_40960HZ |
| | 51 | AMP_ MOD_FREQU_51200HZ |
| | 52 | AMP_ MOD_FREQU_61440HZ |
| | 53 | AMP_ MOD_FREQU_68270HZ |
| | 54 | AMP_ MOD_FREQU_102400HZ |
| | 55 | AMP_ MOD_FREQU_122880HZ |

| Response | Value | Significance |
|----------|----------|------------------------------|
| b | 0 ... 16 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.10.5 TAH (TEST Amplifier High-Drive)

Set or query the test setpoint of the current amplifier High Drive Switch.

S: TAH[,a]<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|------------------------------|
| a | 0 | AUTO |
| | 1 | OFF |
| | 2 | ON |
| Response | Value | Significance |
| b | 0...2 | Current setpoint (see above) |

7.4.10.6 TAI (TEST Amplifier Input)

Set or query the test setpoint of the current amplifier input.

S: TAI [,a]<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|------------------------------|
| a | 0 | AMP_INPUT_AUTO |
| | 1 | AMP_INPUT_NONE |
| | 2 | AMP_INPUT1 |
| | 3 | AMP_INPUT2 |
| | 4 | AMP_INPUT1+2 |
| Response | Value | Significance |
| b | 0...4 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.10.7 TAN (TEST Analog Input)

Query the voltage values at the analog inputs.

S: TAI,a<CR><LF>]

E: ±b.bbbbb V <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|---------------------|
| a | 1 / 2 | Analog input 1 or 2 |

| Response | Significance |
|----------|--------------------------------|
| ±b.bbbbb | Voltage at analog input a in V |

7.4.10.8 TAO (TEST Amplifier Offset)

Set or query the test setpoint of the current amplifier offset.

The DA transducer can be set to a value in the range between 0 and 4095. As 0 represents 'AUTO-Offset' the value to be entered has to be increased by +1.

S: TAO[,a]<CR><LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-----------|--------------|
| a | 0 | AUTO-Offset |
| | 1 to 4096 | User offset |

| Response | Value | Significance |
|----------|-----------|------------------------------|
| b | 0 to 4096 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.10.9 TAR (TEST Amplifier Range)

Set or query the test setpoint of the current amplifier modulator frequency.

S: TAR [,a]<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|--------|------------------------------|
| a | 0 | RANGE_AMPL_AUTO |
| | 1 | RANGE_AMPL_100FA |
| | 2 | RANGE_AMPL_1PA |
| | 3 | RANGE_AMPL_10PA |
| | 4 | RANGE_AMPL_100PA |
| | 5 | RANGE_AMPL_1NA |
| | 6 | RANGE_AMPL_10NA |
| | 7 | RANGE_AMPL_100NA |
| | 8 | RANGE_AMPL_1UA |
| | 9 | RANGE_AMPL_10UA |
| | 10 | RANGE_AMPL_100UA |
| | 11 | RANGE_AMPL_2MA |
| Response | Value | Significance |
| b | 0...11 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.10.10 TAS (TEST Amplifier Resolution)

Set or query the test setpoint of the current amplifier resolution.

S: TAS [,a]<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|------------------|
| a | 0 | RESOLUTION_AUTO |
| | 1 | RESOLUTION_6BIT |
| | 2 | RESOLUTION_8BIT |
| | 3 | RESOLUTION_10BIT |
| | 4 | RESOLUTION_11BIT |
| | 5 | RESOLUTION_12BIT |
| | 6 | RESOLUTION_14BIT |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0...6 | Current setpoint (see above) |

7.4.10.11 TAT (TEST Amplifier Internal)

Query internal information on the current amplifier.

S: TAT<CR>[<LF>]

E: ±aaa.a C, bbbb ,cccc , d.ddd V,+e.eee V, 0, f.ffffE-nn<CR><LF>

| Parameter | Value | Significance |
|------------|-------|--|
| ±aaa.a | | Temperature in degree Celsius |
| bbbb | | Offset as DAC value |
| cccc | | New DA value with HD correction |
| +d.ddd | | Integrator voltage in V |
| +e.eee | | Calculated integrator voltage with HD correction |
| 0/1 | | Status High-Drive-Bit |
| f.ffffE-nn | | Measuring current in A |

Computer Interface (IM 540 Mode)

7.4.10.12 TCA (TEST Control Anode Voltage)

Set or query the test setpoint of the anode voltage.

S: TCA,a<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|-----------------|
| a | 0 | USER_ANODE_AUTO |
| | 1 | USER_ANODE_220V |
| | 2 | USER_ANODE_480V |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0...2 | Current setpoint (see above) |

7.4.10.13 TCC (TEST Control Cathode Voltage)

Set or query the test setpoint of the cathode voltage.

S: TCC,a<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------|
| a | 0 | CATHODE_AUTO |
| | 1 | CATHODE_10V |
| | 2 | CATHODE_20V |
| | 3 | CATHODE_80V |
| | 4 | CATHODE_100V |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0...4 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.10.14 TCE (TEST Control Emission Current)

Set or query the test setpoint of the emission current.

S: TCE,a<CR><LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------|
| a | 0 | EMI_AUTO |
| | 1 | EMI_0MA |
| | 2 | EMI_0_1 MA |
| | 3 | EMI_1MA |
| | 4 | EMI_1_6MA |
| | 5 | EMI_10MA |
| | 6 | EMI_45MA |
| | 7 | EMI_90MA |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0...7 | Current setpoint (see above) |

7.4.10.15 TCF (TEST Control Frequency)

Set or query the test setpoint of the mains frequency detection signal.

S: TCF[, a]<CR><LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------|
| a | 0 | AUTO |
| | 1 | OFF |
| | 2 | ON |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0...2 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.10.16 TCI (TEST Control Ioni Supply Channel)

Set or query the test setpoint of the ionivac supply channel.

S: TCF[, a]<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------|
| a | 0 | AUTO |
| | 1 | CH1 |
| | 2 | CH2 |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0...2 | Current setpoint (see above) |

7.4.10.17 TCO (TEST Control Emission ON)

Set or query the test setpoint for switching on the emission.

S: TCO[, a]<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------|
| a | 0 | AUTO |
| | 1 | OFF |
| | 2 | ON |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0...2 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.10.18 TCP (TEST Control PID)

Set or query the test setpoint for PDI emission current control.

S: TCP[, a]<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance | |
|-----------|-------|--------------|-------|
| a | 0 | AUTO | |
| | | PID_2 | PID_1 |
| | 1 | 0 | 0 |
| | 2 | 0 | 1 |
| | 3 | 1 | 0 |
| | 4 | 1 | 1 |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | | Current setpoint (see above) |

7.4.10.19 TCS (TEST Control I_Shunt)

Set or query the test setpoint of the emission current shunt resistance.

S: TCS[, a]<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------|
| a | 0 | AUTO |
| | 1 | OFF |
| | 2 | ON |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0...2 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.10.20 TDB (TEST Display Brightness)

Perform a display brightness test. This test will take some seconds.

After receiving and acknowledging this command the test will be performed whenever an <ENQ> request is received.

Command: S: TDB<CR>[<LF>]

Response: E: <ACK><CR><LF>

Request to execute: S: <ENQ>

Response: E: 1<CR><LF> Test finished

7.4.10.21 TDC (TEST Display Contrast)

Perform a display contrast test. This test will take some seconds.

After receiving and acknowledging this command the test will be performed whenever an <ENQ> request is received.

Command: S: TDC<CR>[<LF>]

Response: E: <ACK><CR><LF>

Request to execute: S: <ENQ>

Response: E: 1<CR><LF> Test finished

7.4.10.22 TDG (TEST Digital Input)

Query the states of the digital inputs.

S: TDG<CR>[<LF>]

E: XX <CR><LF>

| Response | Bit | Significance |
|----------|-------|---|
| XX | | 2-digit HEX number |
| | | Bitposition is 0 = logical '0' at input |
| | | Bitposition is 1 = logical '1' at input |
| | 0 | Digital input 1 |
| | 2...7 | 0 |

Computer Interface (IM 540 Mode)

7.4.10.23 TDI (TEST Display)

Perform a display test. This test will take some seconds.

After receiving and acknowledging this command the test will be performed whenever an <ENQ> request is received.

Command: S: TDI<CR>[<LF>]

Response: E: <ACK><CR><LF>

Request to execute: S: <ENQ>

Response: E: 1<CR><LF> Test finished

7.4.10.24 TDP (TEST Force Default Parameter)

Reset all parameters to default values. After this a software reset is triggered via the Watchdog. I.e. The system is restarted without Power OFF/ON.

Note:

Once this command has been executed the interface parameters are re-set and communication might be disabled. To re-enable communication it may be necessary to set those parameters again.

S: TDP<CR>[<LF>]

E: <ACK><CR><LF>

7.4.10.25 TEA (TEST RAM)

Perform a test of the internal RAM.

After receiving and acknowledging this command the test will be performed whenever an <ENQ> request is received.

Command: S: TRA<CR>[<LF>]

Response: E: <ACK><CR><LF>

Request to execute: S: <ENQ>

Response: E: 1<CR><LF> Test has been correctly executed

E: 0<CR><LF> An error occurred during test

Computer Interface (IM 540 Mode)

7.4.10.26 TEC (TEST Enable Calibration)

Allow or permit the calibration of the current amplifier and query the current setpoint.

S: TEC[,a]<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------|
| a | 0 | Disabled |
| | 1 | Enabled |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0/1 | Current setpoint (see above) |

7.4.10.27 TEF (TEST Enable Fatal Errors)

Allow or permit the generation of fatal errors and the resulting actions.

S: TEF[,a]<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------|
| a | 0 | Disabled |
| | 1 | Enabled |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0/1 | Current setpoint (see above) |

7.4.10.28 TEI (TEST Enable IV-EEROM)

For the syntax refer to the TEM command. See Chapter 7.4.10.29 TEM (TEST Enable MC-EEPROM), 203. Apply the descriptions in that chapter to the IV board.

Computer Interface (IM 540 Mode)

7.4.10.29 TEM (TEST Enable MC-EEPROM)

Allow or permit the usage of parameters stored in the EEPROM of the MC board.

If the usage is not allowed, default values will be used. Before the parameters can be used again they must be read from the appropriate EEPROM. Thus it may take some time until a positive acknowledgement <ACK> is sent back.

S: TEM[,a]<CR><LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------|
| a | 0 | Disabled |
| | 1 | Enabled |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0/1 | Current setpoint (see above) |

7.4.10.30 TEO (TEST ROM)

Perform a CRC test of the internal ROM.

After receiving and acknowledging this command the test will be performed whenever an <ENQ> request is received.

Command: S: TEO<CR><LF>]

Response: E: <ACK><CR><LF>

Request to execute: S: <ENQ>

Response: E: 1<CR><LF> Test has been correctly executed
E: 0<CR><LF> An error occurred during test

Computer Interface (IM 540 Mode)

7.4.10.31 TEP (TEST all EEPROMS)

Perform a CRC test of the EEPROMs of the MC, IQ, VP and IV boards.

After receiving and acknowledging this command the test will be performed whenever an <ENQ> request is received.

Command: S: TEP<CR>[<LF>]

Response: E: <ACK><CR><LF>

7.4.10.32 TEQ (TEST Enable IQ-EEROM)

For the syntax refer to the TEM command. See Chapter 7.4.10.29 TEM (TEST Enable MC-EEPROM), 203. Apply the descriptions in that chapter to the IQ board.

Request to
execute: S: <ENQ>

Response: E: 1<CR><LF> Test has been correctly executed

E: 0<CR><LF> An error occurred during test

7.4.10.33 TEV (TEST Enable VP-EEROM)

For the syntax refer to the TEM command. See Chapter 7.4.10.29 TEM (TEST Enable MC-EEPROM), 203. Apply the descriptions in that chapter to the VP board.

7.4.10.34 TFR (TEST Force Reset)

Trigger a software reset via watchdog, i.e. restart the device avoiding power OFF/ON.

S: TFR<CR>[<LF>]

E: <ACK><CR><LF>

Computer Interface (IM 540 Mode)

7.4.10.35 TIG (TEST I/O Gauge)

Query the power supply status of measuring channel 3 or 4.

The output string contains 3 values separated by commas.

S: TIG,a<CR>[<LF>]

E: \pm b.bbbbbb V, \pm c.ccc V, d <CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------------------|
| a | 3 / 4 | Measuring channel 3 or 4 |

| Response | Value | Significance |
|-------------|-------|--|
| \pm b.bbb | | Measuring signal of the sensor at channel a in V |
| \pm c.ccc | | Voltage at the ID resistor of channel a |
| d | | Power supply of channel a |
| | 0 | OFF |
| | 1 | ON |

7.4.10.36 TII (TEST IF540x Ident)

Query the voltage at the Ident Resistor of the IF540x interface board.

S: TII<CR>[<LF>]

E: \pm a.aaa V<CR><LF>

| Response | Significance |
|-------------|--------------|
| \pm a.aaa | Voltage in V |

Computer Interface (IM 540 Mode)

7.4.10.37 TIP (TEST I/O Power Supply)

Query the voltage values of the I/O power supply.

The output string contains 6 values separated by commas.

S: TPP<CR>[<LF>]

E: \pm a.aaa V, \pm b.bbb V, \pm c.ccc V, \pm d.ddd V, \pm e.eee V, \pm f.fff <CR><LF>

| Response | Significance |
|-------------|-------------------------------|
| \pm a.aaa | Voltage +24V supply channel 3 |
| \pm b.bbb | Voltage +24V supply channel 4 |
| \pm c.ccc | Voltage +24V supply KL1 |
| \pm d.ddd | Voltage +5V supply RS232 |
| \pm e.eee | Voltage +15V supply |
| \pm f.fff | Voltage -15V supply |

7.4.10.38 TIR (TEST IF540x Relays)

Set or query the test setpoints of the relays on the IF540x interface board.

S: TIR[,XX]<CR>[<LF>]

E: XX<CR><LF>

| Parameter | Bit | Significance |
|-----------|-------|--------------------------------|
| XX | | 2-digit HEX number |
| | | XX = 00: AUTO-Mode |
| | | Bit position is 0 = relays OFF |
| | | Bit position is 1 = relays ON |
| | 0 | RELAY 1 |
| | 1 | RELAY 2 |
| | 2 | RELAY 3 |
| | 3 | RELAY 4 |
| | 4 | RELAY 5 |
| | 5 | --- |
| | 6 | --- |
| | 7 | --- |
| Response | Bit | Significance |
| c | 0...7 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.10.39 TIS (TEST I/O Supply Ch3/4)

Set or query the test setpoint for switching on the power supply of channel 3 or 4.

S: TIS,a [, b]<CR>[<LF>]

E: c<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------------------|
| a | 3 / 4 | Measuring channel 3 or 4 |
| b | 0 | AUTO |
| | 1 | OFF |
| | 2 | ON |

| Response | Value | Significance |
|----------|-------|------------------------------|
| c | 0...2 | Current setpoint (see above) |

7.4.10.40 TLO (TEST RS232 Loopback)

Activate or deactivate the RS232-Loopback function.

S: TRL[,a]<CR>[<LF>]

E: b<CR><LF>

| Parameter | Value | Significance |
|-----------|-------|--------------|
| a | 0 | Deactivate |
| | 1 | Activate |

| Response | Value | Significance |
|----------|-------|------------------------------|
| b | 0/1 | Current setpoint (see above) |

Computer Interface (IM 540 Mode)

7.4.10.41 TPP (TEST Primary Power Supply)

Query the voltage values of the primary power supply.

The output string contains 5 values separated by commas.

S: TPP<CR>[<LF>]

E: $\pm a.aaa$ V, $\pm b.bbb$ V, $\pm c.ccc$ V, $\pm d.ddd$ V, $\pm e.eee$ V<CR><LF>

| Response | Significance |
|-------------|---------------------------|
| $\pm a.aaa$ | Voltage -15V supply |
| $\pm b.bbb$ | Voltage +5V analog supply |
| $\pm c.ccc$ | Voltage +5V supply |
| $\pm d.ddd$ | Voltage +15V supply |
| $\pm e.eee$ | Voltage +24V supply |

7.4.10.42 TPS (TEST Power Supply)

Query the power supply status.

The output string contains 8 values separated by commas.

S: TPP<CR>[<LF>]

E: a , $\pm bbb$ C ,cccc mV, dd Hz , eeee mV, ffff mV, gggg mV, hhhh mV<CR><LF>

| Response | Value | Bedeutung |
|-----------|-------|---|
| a | | Overtemp-Signal |
| | 0 | OFF |
| | 1 | ON |
| $\pm bbb$ | | Temperature of the heat sink IQ board in °C |
| cccc | | Voltage of the heat sink NTC in mV |
| dd | | Mains frequency 50 / 60 Hz |
| eeee | | Voltage of the emission current regulator in mV |
| ffff | | Deviation of the regulator when the emission is switched on in mV |
| gggg | | Voltage at the ID resistor channel 1 in mV |
| hhhh | | Voltage at the ID resistor channel 2 in mV |

If the temperature and the voltage of the heat sink NTC can not be measured (not configured in the hardware) the output is «---- °C» or «---- mV».

Computer Interface (IM 540 Mode)

7.4.10.43 TRL (TEST Relays)

Set or query the test setpoints of the status relays.

S: TRL[,XX]<CR>[<LF>]

E: XX<CR><LF>

| Parameter | Bit | Significance |
|-----------|-----|--------------------------------|
| XX | | 2-digit HEX number |
| | | XX = 00: AUTO-Mode |
| | | Bit position is 0 = relays OFF |
| | | Bit position is 1 = relays ON |
| | 0 | CH2_READY |
| | 1 | CH1_READY |
| | 2 | DEGAS |
| | 3 | EMIS |
| | 4 | CHAN_SEL |
| | 5 | TRG2 |
| | 6 | TRG1 |
| | 7 | --- |

| Response | Bit | Significance |
|----------|-------|------------------------------|
| c | 0...7 | Current setpoint (see above) |

7.4.10.44 TRO (TEST Recorder Out)

Set or query the test setpoints of the recorder outputs.

S: TRO, a[,b]<CR>[<LF>]

E: c <CR><LF>

| Parameter | Value | Significance |
|-----------|------------|------------------------|
| a | 1 / 2 | Recorder output 1 or 2 |
| b | 0 | AUTO |
| | 1 to 11000 | Output value in mV |

| Response | Value | Significance |
|----------|------------|------------------------------|
| c | 0 to 11000 | Current setpoint (see above) |

8 Maintenance, Service

8.1 Maintenance

The IM 540 does not require any special maintenance work.

8.1.1 Cleaning

For cleaning the outside of the device, a slightly moistened cloth will usually do. Do not use any aggressive or abrasive cleaning agents.

Danger



Mains voltage.

Components inside of the IM 540 are components to mains voltage. Touching these parts cause a lethal electric shock.

Do not insert any objects through the louvers of the device. Protect the device from liquids. Do not open the device.

8.1.2 Resetting the Operating Hours

After a vacuum gauge has been replaced by an identical vacuum gauge type, the related operating hour counter must be reset to zero.

Proceed as follows for this:

- 1 Change to se Detail > Info menu
- 2 Use the arrow buttons to select the OPTCnt submenu. Then press the Enter button.
- 3 Use the arrow buttons to select the channel with the vacuum gauge whose operating hours you want to reset to zero
- 4 Press the Enter button
 - The labelling of the Enter button changes to «Reset»
- 5 Press the Reset button
 - The operating hour counter is reset to zero

8.2 Program Transfer Mode

If your IM 540 requires an updated firmware version, e.g. for using a new sensor type, please contact your local Oerlikon Leybold Vacuum service center.

The user parameter settings are no longer available after the firmware update. They are reset to the default parameter settings. See Section «Default Parameters», 227.

8.2.1 Preparations

- 1 Switch the IM 540 off
- 2 Connect the RS232 socket (Fig. 3-4, 23, item C) with a serial interface of the PC (e.g. COM1). See Chapter 3.3.8 RS232, 29.

8.2.2 Program Transfer

The firmware for the IM 540 is delivered as a setup file.

- 1 Execute the setup file at the PC by double-clicking it with the mouse
- 2 Select the serial interface of the PC which is connected to the RS232 socket of the IM 540
- 3 Switch the IM 540 on
- 4 Click the [Start] button in the setup program
 - The program transfer starts automatically
 - The program transfer is being displayed
- 5 After the program transfer has been completed, check if errors have occurred. Repeat the transfer process if any errors have occurred.

8.2.3 Restarting

The IM 540 starts automatically after the firmware has been transferred completely. The device is ready for operation again.

Error messages issued after a software update

After performing a software update the error message 101 is generated (DIFFERENT_SW_VERSION_LOAD_DFAULT). It informs the user that all settings have be reset to the default values.

If the error message 106 is output the setup program must be ended (press [OK] or close the window). Afterwards the error message can be reset at the IM 540. See Chapter 4.8.2 Acknowledging Errors, 53 and Chapter 4.8.3 Deleting Errors from the Error List, 53.

The error messages 175... 180 may also be generated. These messages are issued after a software update and can be ignored or reset. See Chapter 4.8.2 Acknowledging Errors, 53 and Chapter 4.8.3 Deleting Errors from the Error List, 53.

8.3 Starting the IM 540 With Default Parameters

The parameters required for operation of the IM 540 are stored in an EEPROM after they have been input by the user. They are checked by a mathematical procedure (CRC-Check). If the stored data are damaged in any way IM 540 start up properly. The effected parameter values are set to the default settings. Additionally the following error message is generated.

CRC_CHECK_DEVICE_SETTINGS

The user can also reset the parameters manually when starting up the IM 540.

- 1 While pressing the two rightmost control buttons, switch the IM 540 on.
 - A safety query appears on the display

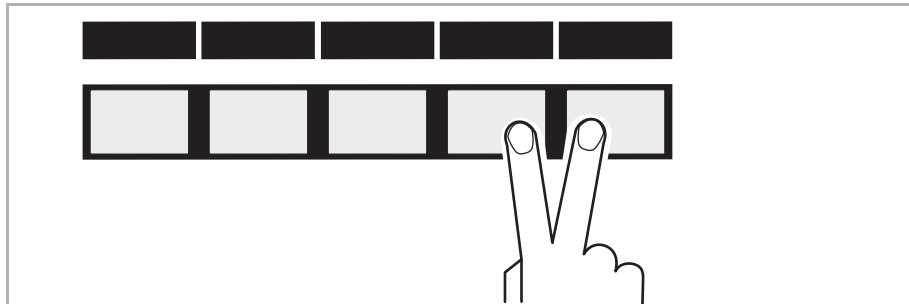


Fig. 8-1 Starting the IM 540 with default parameters

- 2 Confirm the safety query by pressing the left button

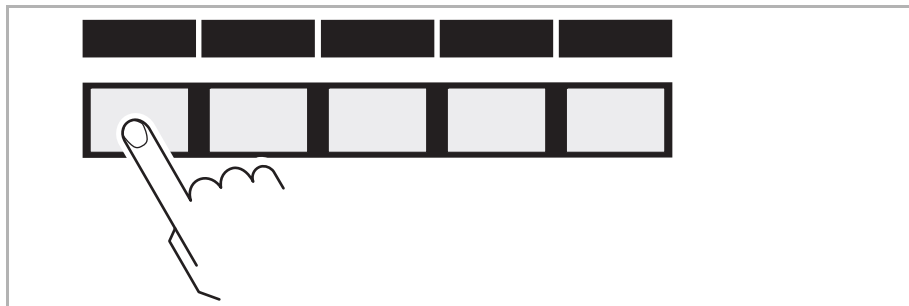


Fig. 8-2 Confirm the safety query

Note:

After starting the IM 540 with default parameters, the user parameters which have been adjusted by you are no longer available. For this reason, we recommend that you make a note of the parameters settings on a regular basis.

8.4 Test Mode

Test mode.

All monitoring functions of the IM 540 software are switched off in the test mode. Improper operation can cause damage to the device.

Only authorized personnel are allowed to select and to use the test mode.

The test mode is used for service purposes. Here you can query and change device data. All monitoring functions are switched off, so you can set any output values. In addition, you can check individual device functions with test programs.

The «Test» field in the status row flashes if the device is in the test mode.

Caution



8.4.1 Selecting the Test Mode

Access to the test mode requires a special restart of the device. Proceed as follows:

- 1 Switch the IM 540 off
- 2 Wait for at least 10 seconds to make sure that the IM 540 can initialize
- 3 Keep the second and the fourth button pressed (Fig. 8-3, 213) and switch the IM 540 on
 - A warning message informs you that the test mode has been enabled

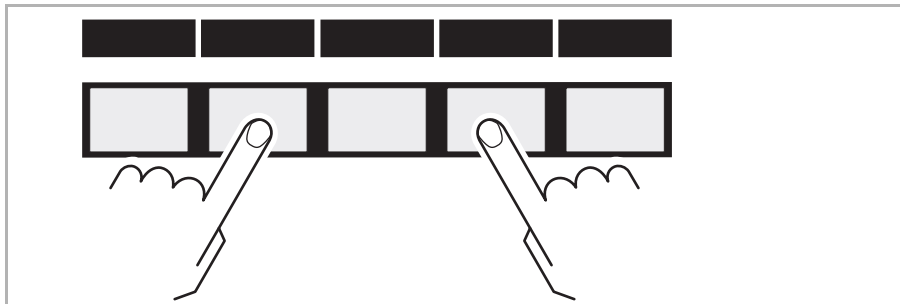


Fig. 8-3 Start the IM 540 with enabled test mode

- 4 Confirm the warning message by pressing the leftmost button (Fig. 8-4, 213)
 - If you press the rightmost button instead, the IM 540 will start in the measuring mode. The test mode is not available in this case.

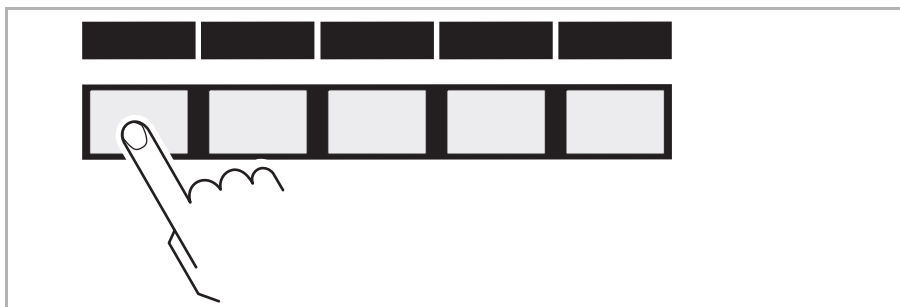



Fig. 8-4 Acknowledge the warning message

- 5 After the IM 540 has started, press the Param button

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- 6 Use the arrow buttons to select the test mode parameter group. Then press the Enter button.
 - The subgroups of the test mode parameter group are displayed. See Chapter 8.4.2 Test Parameters and Functions,  215.
- 7 Use the arrow buttons to select the required subgroup. Then press the Enter button.
 - The IM 540 is now in the test mode. The «Test» field in the status row is flashing.

8.4.2 Test Parameters and Functions

The test parameters and functions can be found in the subgroups of the Test Mode parameter group. Tab. 8-1, 216 lists all available subgroups and the related parameters and functions.

| 1. Subgroup | 2. Subgroup | Function | |
|-------------|-------------|---|--|
| CPU/Disp | Commands | Default Reset | |
| | Config. | Calibra. Load.Cor FatalErr | EEPR-MC EEPR-IQ EEPR-VP EEPR-IV |
| | Tests | RAM CRC-ROM EEPROM Display | Contrast Brightn. COM-Loop |
| Amplif. | Param. | Channel Mod.Freq Resolut. Mod.Cap | Range Offset High-Drv |
| | Display | Temp. Range Measure | Offset Integra. |
| | Intern | Temp. Offset New_DA Measure | U_Integr Calc_f High_Drv CW |
| Power | Power | Overtemp PS-Temp. NTC_Volt MainsFr | Emi.Cntr AD_Val ID_Meas1 ID_Meas2 |
| | Voltage | -15V +5VA +5V | +15V +24V |
| | Control | Cathode Emis.Cur Anode Emission | I_Shunt F_Inhib. PID_Ctrl Channel |
| | Gauge | Anode Cathode Reflect. Emis.Cur | U_Filam. I_Filam. P_Filam. |

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| 1. Subgroup | 2. Subgroup | Function | |
|-------------|-------------|--|-------------------------------|
| I/O | Voltage | +24V_3 +24V_4 +24V_KL1 | +5VRS +15V -15V |
| | Gauge | Meas_3 Meas_4 Ident_3 Ident_4 | Supl.Ch3 Supl.Ch4 |
| | Control | Rec_1 Rec_2 Analog_1 | Analog_2 Digital Relays |
| | RS232 | Receive Transmit | |
| IF540x | | Relays Receive Transmit | Ident. |
| Internal* | | OS_Overr Rec.Unex Max.Resp | CRC_ROM |

Tab. 8-1 Subgroups of the Test Mode parameter group

*) Only used for service

8.4.3 CPU / Display

The following actions can be performed in this menu:

- Enter special commands
- Start test programs
- Adjust the software configuration

Commands

| Display | Significance |
|---------|--|
| Default | All Parameters are reset to the default values and the system is restarted |
| Reset | Warm start |

Configuration

This subgroup is used to configure certain software functions:

| Display | Significance |
|----------|---|
| Calibra. | <ul style="list-style-type: none">■ Enable: The offset of the current measuring amplifier is adjusted automatically, if necessary■ Disable: The offset of the current measuring amplifier is not adjusted automatically <p>The offset is always adjusted when changing from disable to enable or when activating this function. Also see Chapter 5.3.3 Automatic Offset (Auto_OFS), 78.</p> |
| Load.Cor | <p>Switching relays and other interferences (e.g. the movement of a measuring cable) create charge injections which may drive the integrator into saturation or out of its operating range. Depending on the input current, the recovery time may be very long (> 10 minutes). The purpose of the load correction is to bring the integrator back into the rated operating range as quickly as possible.</p> <ul style="list-style-type: none">■ The charge of the current measuring amplifier is adjusted automatically, if necessary■ Disable: The charge of the current measuring amplifier is not adjusted automatically <p>The charge is always corrected when changing from disable to enable or when activating this function.</p> |

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| Display | Significance |
|---|---|
| Fatal Err | <p>For certain tests it may be necessary that the device continues measuring even after a «fatal error» has occurred.</p> <ul style="list-style-type: none"> ■ Enable: A «fatal error» will switch off the emission and, if necessary, also the supply voltages for the channels 3 and 4 ■ Disable: The IM 540 continues measuring even after a «fatal error» has occurred, i.e. the emission and the supply voltages for the channels 3 and 4 remain switched on. This is also the case if the power supply temperature is too high. |
| EEPR_MC (MC540 board, micro controller) | <p>Calibration data in the EEPROM on the respective circuit board.</p> <ul style="list-style-type: none"> ■ Enable: The parameters stored in the EEPROM are used for all related calculations ■ Disable: Instead of the parameters stored in the EEPROM, the default values are used for all calculations. However, the information (article number, serial number, etc.) is still displayed as it is stored in the EEPROM. The check sum is not checked when starting up. |
| EEPR_IQ (IQ540 board, power supply) | |
| EEPR_VP (VP540 board, connection board) | |
| EEPR_IV (IV540 board, current measuring amplifier) | |

In contrast to all other actions in the test mode, changes made to these settings do not cause the «Test» field in the status row to flash after the test mode has been left.

Tests

The following hardware tests can be started in this submenu:

| Display | Significance |
|-----------|--|
| RAM * | Test the main memory |
| CRC-ROM * | Check the check sum of the program memory |
| EEPROM * | Check the check sums of all EEPROMs |
| Display * | At first, «X»'s are written with standard font size on the entire display. After that, the display is cleared, followed by a completely dark screen. |
| Contrast | Within 5 seconds, the contrast is increased from the current setting to 100% and then from 0% to the initial setting. |
| Brightn. | Within 5 seconds, the background illumination is increased from the current setting to 100% and then from 0% to the initial setting. |
| COM-Loop | Loopback test: Every character received via the RS232 interface is sent back to the interface |

Tab. 8-2 Hardware tests

*) This test is being performed at every program start

Proceed as follows to start a test:

- 1 Select the CPU/Display > Tests menu
- 2 Use the arrow buttons to select the required test. See Tab. 8-2, 219.
- 3 Press the Enter button
- 4 Use the arrow buttons to select the «Start» function. Then press the Enter button.
 - The selected test is started. The display shows «Busy».
 - The display shows «Ready» after the test has been completed

An error message is displayed if an error has occurred during a test. The absence of an error message implies that the test has been completed successfully.

8.4.4 Current Measuring Amplifier (Amplifier)

The related submenus are used to adjust the parameters for the current measuring amplifier and to display all measurements.

8.4.4.1 Parameters

The following parameters are available to configure the current measuring amplifier:

| Display | Significance |
|----------|--|
| Channel | Select the measuring channel |
| Mod.Freq | Clock frequency of the modulator |
| Resolut. | Resolution of the measurement |
| Mod.Cap | Select the modulator capacitance |
| Range | Select the measuring range |
| Offset | Input an offset value. Range of values: 0 ... 4095 |
| High-Drv | Control bit DAC High Drv |

Integrator level control (range, modulator capacitance, modulator frequency)

The operating range of the integrator ends at 8 volts. This level must not be exceeded. For this reason, measurements may be incorrect if the modulator frequency is too low. Depending on the desired measuring range, the modulator capacitance must be selected as follows:

| Range | Modulator capacitance |
|-------|-----------------------|
| 100fA | 1.5pF |
| 1pA | 1.5pF |
| 10pA | 1.5pF |
| 100pA | 1.5pF |
| 1nA | 1.5pF |
| 10nA | 1.5pF |
| 100nA | 1.5pF |
| 1μA | 100pF |
| 10μA | 100pF |
| 100μA | 10nF |
| 2mA | 10nF |

Tab. 8-3 Modulator capacitance for various range values

The clock allows the use of various modulator frequencies. Depending on the selected range, only a subset of these fixed frequencies is useful. For an overview of these frequencies, refer to the table in Section «Integrator Level Control», 237.

Measuring rate (resolution, modulator frequency)

The measuring time, and therefore also the achieved measuring rate, depends on the selected modulator frequency and the desired resolution. The table in Section «Measuring Speed», 235 lists the measuring times.

Please note that the modulator frequency cannot be selected freely. This is because the desired measuring range must be considered. See Section «Integrator Level Control», 237.

How to determine the parameters for the current measuring amplifier

You can determine the parameters for the current measuring amplifier as follows:

- 1 Specify a current measuring range
- 2 Use the table in Section «Integrator Level Control», 237 to determine the possible modulator frequencies
- 3 Specify the resolution or the measuring time:
 - 3.1 For a given resolution: Use the table in Section «Measuring Speed», 235 to determine the resulting measuring times.
 - 3.2 For a given measuring time: Use the table in Section «Measuring Speed», 235 to determine the resulting resolutions.

8.4.4.2 Display

The following data are displayed in this menu:

| Display | Significance |
|----------|--|
| Channel | Display the measuring channel |
| Range | Display the currently selected measuring range |
| Resolut. | Display the measuring resolution |
| Measure | Display the current measuring value |
| Mod_Freq | Display the modulator frequency |
| CycleT. | Display the current measuring time |
| Capacity | Display the set integrator capacity |

8.4.4.3 Intern

The following data are displayed in this menu:

| Display | Significance |
|----------|---|
| Temp. | Display the temperature of the current amplifier assembly in °C Display range: 0.100 °C Resolution: 0.1°C |
| Offset | Display the offset value Display range: 0...4095 |
| New_DA | Display the new DA value |
| Measure | Display the current measuring value |
| U_Integr | Display the integrator voltage |
| Calc_f | Display the calculated integrator voltage with HD correction |
| High_Drv | Status High-Drive-Bit |
| CW | Display the used «Control Word» for the parameterization of the current amplifier |

8.4.5 Power Supply

This menu displays data which are related to the power supply and to the supply of the vacuum gauges. Furthermore, the power supply can be operated manually.

8.4.5.1 Power (Power Supply)

| Display | Significance |
|----------|--|
| Overtemp | Temperature in the power supply is too high |
| PS-Temp | Display the temperature of the power supply |
| NTC_Volt | Display the voltage at the NTC resistor |
| MainsFr | Display the detected mains frequency: 50 Hz or 60 Hz |
| Emi.Cntr | Output signal of the emission current regulator. Display range: 0...5 V |
| AD_Val | Indicates the stability of the output signal of the emission current regulator |
| ID_Meas1 | Reading of the ID resistor in channel 1. Display range: 0...5 V |
| ID_Meas2 | Reading of the ID resistor in channel 2. Display range: 0...5 V |

8.4.5.2 Voltage (Primary Voltages)

The displayed primary voltages originate directly from the A/D converter on the CPU board.

8.4.5.3 Control (Control Bits)

Display and adjust the control bits.

| Display | Significance |
|-----------|--|
| Cathode | Cathode potential |
| Emis.Cur | Emission current |
| Anode | Anode potential |
| Emission | Emission on, off or automatic control |
| I_Shunt | ----- |
| F_Inhib. | Switch the mains frequency measurement on or off |
| PID_Ctrl. | Control signals for emission current regulator |
| Channel | Select the measuring channel |

8.4.5.4 Gauge

The following data are displayed:

- Anode: Anode potential
- Cathode: Cathode potential
- Reflect.: Reflector potential
- Emis.Cur: Emission current
- U_Filament: Filament voltage
- I_Filament: Filament current
- P_Filament: Filament power

8.4.6 Inputs / Outputs

This menu displays all digital and analog inputs of the «Relay» and «Control» interfaces. See Chapter 2.4.1 Relay Outputs, 16 and Chapter 2.4.2 Control Signals, Recorder, 16. The related outputs can be set.

Data for the channels 3 and 4 are also displayed.

8.4.6.1 Voltage (Peripheral Voltages)

The displayed peripheral voltages originate directly from the A/D converter on the VP540 circuit board.

8.4.6.2 Gauge

| Display | Significance |
|----------|---|
| Meas_3 | Reading at the channel 3. Display range: -3V...+13V |
| Meas_4 | Reading at the channel 4. Display range: -3V...+13V |
| Ident_3 | Reading of the ID resistor at channel 3. Display range: 0...5V |
| Ident_4 | Reading of the ID resistor at channel 4. Display range: 0...5V |
| Supl.Ch3 | Voltage supply for the gauge at channel 3 on/off |
| Supl.Ch4 | Voltage supply for the gauge at channel 4 on/off |

8.4.6.3 Control (Relay / Remote / Recorder)

| Display | Significance |
|----------|---|
| Rec_1 | Recorder output 1. Setting range: 0... 11000 mV The test mode for this value is switched off if «auto» is selected. |
| Rec_2 | Recorder output 2. Setting range: 0... 11000 mV The test mode for this value is switched off if «auto» is selected. |
| Analog_1 | Input voltage at the Analog Remote Channel 1. Display range: 0... 11 V |
| Analog_2 | Input voltage at the Analog Remote Channel 2. Display range: 0... 11 V |

| Display | Significance |
|---------|--|
| Digital | Digital Remote. Binary information on the input channels «Digital Remote Channel 1» and «Digital Remote Channel 2»: ■ 0 0: Both inputs are idle ■ 1 0: Input 1 is active, input 2 is idle ■ 0 1: Input 1 is idle, input 2 is active ■ 1 1: Both inputs are active |
| Relays | Display and control of the relays. The states are displayed in binary: ■ 0000001: Channel 2 ready ■ 0000010: Channel 1 ready ■ 0000100: Degas ■ 0001000: Emission ■ 0010000: Channel ■ 0100000: Trigger 2 ■ 1000000: Trigger 1 The test mode for this value is switched off if «auto» is selected. |

8.4.6.4 RS232

This menu displays the most recently received and transmitted string of the RS232 interface.

| Display | Significance |
|----------|----------------------------------|
| Receive | Most recently received string |
| Transmit | Most recently transmitted string |

8.4.7 IF 540x

| Display | Significance |
|----------|---|
| Relays | Display and control of the five relays. The states are displayed in binary: ■ 00001: Relay 1 is switched on ■ 00010: Relay 2 is switched on ■ 00100: Relay 3 is switched on ■ 01000: Relay 4 is switched on ■ 10000: Relay 5 is switched on The test mode for this value is switched off if «auto» is selected. |
| Receive | Most recently received string of the RS232 interface |
| Transmit | Most recently transmitted string of the RS232 interface |
| Ident | ID resistor voltage, measured via the analog input on the CPU. Display range: 0...5V |

Storage and Disposal

9 Storage and Disposal

9.1 Packaging

Please keep the original packaging. The packaging is required for storing the IM 540 and for shipping it to an Oerlikon Leybold Vacuum service center.

9.2 Storage

The IM 540 may only be stored in a dry room. The following requirements must be met:

Ambient temperature: -20 ... +70 °C

Humidity: As low as possible. Preferably in an air-tight plastic bag with a desiccant.

9.3 Disposal

The product must be disposed of in accordance with the relevant local regulations for the environmentally safe disposal of systems and electronic components.

Appendix

Default Parameters

[Detail] > [Graphic]

| Display | Default | User |
|----------|---|------|
| Channel | 1 | |
| Command | Ready | |
| Status | Idle | |
| Display | | |
| P_Low | See Section «Threshold Values, Trigger Values», 234 | |
| P_High | | |
| Time [h] | 1.00 | |

[Param] > [Setpoint]

| Display | Default | User |
|----------|---|------|
| Setpoint | Relay1 | |
| Channel | 1 | |
| Display | Yes | |
| Mode | ----- | |
| Spt.Low | See Section «Threshold Values, Trigger Values», 234 | |
| Spt.High | | |
| Trigger | Enable | |

[Param] > [General]

| Display | Default | User |
|---------|---------|------|
| Device | IM540 | |
| Control | RS232 | |

[Param] > [General] > [Setup]

| Display | Default | User |
|---------|---------|------|
| Unit | mbar | |

Appendix

| Display | Default | User |
|----------|---------|------|
| Torr | Yes | |
| Set.Lock | Off | |
| Light | 80% | |
| Contrast | 40% | |
| Men.Time | Off | |

[Param] > [General] > [RS232]

| Display | Default | User |
|----------|----------|------|
| Com.Chan | Standard | |
| Baudrate | 9600 | |
| DataBits | 8 Bit | |
| TalkOnly | 1.0s | |
| Parity | No | |
| Stopbits | 1 | |
| FlowCont | ---- | |

[Param] > [General] > [Recorder]

| Display | Default | User |
|---------|----------|------|
| Channel | Record_1 | |
| Source | 1 | |
| Mode | Full | |
| P_Low | ---- | |
| P_High | ---- | |
| Scale | Log | |

[Param] > [General] > [Disp.Bar]

| Display | Default | User |
|---------|---------|------|
| Channel | 1 | |
| Digit | Auto | |
| Mode | Auto_2 | |
| P_Low | ---- | |

| Display | Default | User |
|---------|---------|------|
| P_High | ----- | |

[Param] > [General] > [Threshold]

| Display | Default | User |
|---------|---------|------|
| U1_Low | 0.10 V | |
| U1_High | 0.50 V | |
| U2_Low | 0.10 V | |
| U2_High | 0.50 V | |

[Param] > [General] > [Error]

| Display | Default | User |
|----------|---------|------|
| FailRel1 | Chan_1 | |
| FailRel2 | Chan_2 | |
| FailCont | ----- | |
| Emi.Warn | LeaveOn | |
| Emi.Tol. | Fatal | |
| Emi.Pow. | Warning | |

[Param] > [Sensor]

| Display | Default | User |
|----------|-----------------------------------|------|
| Channel | 1 | |
| Filter | Normal | |
| Auto_OFS | ----- | |
| Cal_Full | IE514: 6.6 mbar ⁻¹ | |
| | IE414: 16.6 mbar ⁻¹ | |
| | CTR: 1000 Torr | |
| Fil.Pow. | 7.0 W | |
| Emis.Cur | Auto | |
| X_Ray | 0.00E+00 | |

Appendix

[Param] > [Sensor] > [Correct]

| Display | Default | User |
|----------|---------------------------------|------|
| Channel | 1 | |
| Cor.Mode | None | |
| Cor.Gain | 1.00 | |
| ClearAll | No | |
| Index | 1 | |
| Factor | 1.000 | |
| Press | Upper range limit of the sensor | |

[Param] > [Ioni Amp]

| Display | Default | User |
|---------|---------|------|
| Channel | 1-BAG | |
| Sens. | Normal | |

[Param] > [Control]

| Display | Default | User |
|----------|--|------|
| General | Channel | |
| Channel | 1 | |
| Mode | Manual | |
| Source | ---- | |
| P_On | See Section «Pressure Range Limits», 234 | |
| P_Off | | |
| TTR_Ctrl | ---- | |

[Param] > [UserMode] > [Gauge]

| Display | Default | User |
|----------|---------|------|
| Channel | 1 | |
| Anode | Auto | |
| Cathode | Auto | |
| Emis.Cur | Auto | |
| U_A_Deg. | Auto | |

| Display | Default | User |
|----------|---------|------|
| U_C_Deg. | Auto | |
| I_Degas | Auto | |

[Param] > [UserMode] > [Amplif.]

| Display | Default | User |
|----------|---------|------|
| Channel | 1 | |
| Range | Auto | |
| Resolut. | Auto | |
| Time | Auto | |

[Param] > [UserMode] > [Config]

| Display | Default | User |
|----------|---------|------|
| Chan_1 | Auto | |
| Chan_2 | Auto | |
| Chan_3 | Auto | |
| Chan_4 | Auto | |
| MainFreq | Auto | |
| Interf. | Auto | |

[Param] > [TestMode] > [CPU/Disp] > [Commands]

| Display | Default | User |
|---------|---------|------|
| Default | Ready | |
| Reset | Ready | |

[Param] > [TestMode] > [CPU/Disp] > [Config.]

| Display | Default | User |
|-----------|---------|------|
| Calibra. | Enable | |
| Load.Cor | Enable | |
| Fatal Err | Enable | |
| EEPR-MC | Enable | |
| EEPR-IQ | Enable | |

Appendix

| Display | Default | User |
|---------|---------|------|
| EEPR-VP | Enable | |
| EEPR-IV | Enable | |

[Param] > [TestMode] > [CPU/Disp] > [Tests]

| Display | Default | User |
|----------|---------|------|
| RAM | Ready | |
| CRC-ROM | Ready | |
| EEPROM | Ready | |
| Display | Ready | |
| Contrast | Ready | |
| Brightn. | Ready | |
| COM-Loop | Disable | |

[Param] > [TestMode] > [Amplif.] > [Param.]

| Display | Default | User |
|----------|---------|------|
| Channel | Auto | |
| Mod.Freq | Auto | |
| Resolut. | Auto | |
| Mod.Cap | Auto | |
| Range | Auto | |
| Offset | Auto | |
| High-Drv | Auto | |

[Param] > [TestMode] > [Power] > [Control]

| Display | Default | User |
|----------|---------|------|
| Cathode | Auto | |
| Emis.Cur | Auto | |
| Anode | Auto | |
| Emission | Auto | |
| I_Shunt | ---- | |
| F_Inhib. | Auto | |

| Display | Default | User |
|-----------|---------|------|
| PID_Ctrl. | Auto | |
| Channel | Auto | |

[Param] > [TestMode] > [I/O] > [Gauge]

| Display | Default | User |
|----------|---------|------|
| Meas_3 | | |
| Meas_4 | | |
| Ident_3 | | |
| Ident_4 | | |
| Supl.CH3 | Auto | |
| Supl.CH4 | Auto | |

[Param] > [TestMode] > [I/O] > [Control]

| Display | Default | User |
|----------|---------|------|
| Rec_1 | Auto | |
| Rec_2 | Auto | |
| Analog_1 | | |
| Analog_2 | | |
| Digital | | |
| Relays | Auto | |

[Param] > [TestMode] > [IF540x]

| Display | Default | User |
|----------|---------|------|
| Relays | Auto | |
| Receive | | |
| Transmit | | |
| Ident. | | |

Appendix

Setting Ranges

Threshold Values, Trigger Values

| Sensor | Spt.Low min. (stan- dard for Spt.Low) | Spt.Low max. | | Spt.High min. | Spt.High max. (stan- dard for Spt.High) | |
|------------------|--|-----------------------|-----------------------|------------------------|--|-----------------------|
| | P_On min. | P_On max. | Standard for P_On | P_Off min. | P_Off max. | Standard for P_Off |
| | [mbar] | [mbar] | [mbar] | [mbar] | [mbar] | [mbar] |
| IE 514 | 2.00×10^{-13} | 7.20×10^{-5} | 1.00×10^{-5} | 2.20×10^{-13} | 8.00×10^{-5} | 2.00×10^{-5} |
| IE 414 | 2.00×10^{-11} | 7.20×10^{-3} | 1.00×10^{-4} | 2.20×10^{-11} | 8.00×10^{-3} | 2.00×10^{-4} |
| CTR 0.10 Torr | 2.00×10^{-5} | 1.24×10^{-1} | 1.00×10^{-2} | 2.02×10^{-5} | 1.25×10^{-1} | 2.00×10^{-2} |
| CTR 1 Torr | 2.00×10^{-4} | 1.24×10^0 | 1.00×10^{-1} | 2.02×10^{-4} | 1.25×10^0 | 2.00×10^{-1} |
| CTR 10 Torr | 2.00×10^{-3} | 1.24×10^1 | 1.00×10^0 | 2.02×10^{-3} | 1.25×10^1 | 2.00×10^0 |
| CTR 100 Torr | 2.00×10^{-2} | 1.24×10^2 | 1.00×10^1 | 2.02×10^{-2} | 1.25×10^2 | 2.00×10^1 |
| CTR 1000 Torr | 2.00×10^{-1} | 1.24×10^3 | 1.00×10^2 | 2.02×10^{-1} | 1.25×10^3 | 2.00×10^2 |
| TTR 90 | 1.00×10^{-3} | 4.50×10^2 | 5.00×10^{-3} | 1.10×10^{-3} | 5.00×10^2 | 1.00×10^{-2} |

Pressure Range Limits

| Sensor | P_Low min. (standard for P_Low) | P_Low max. | P_High min. | P_High max. (standard for P_High) |
|---------------|---------------------------------------|-----------------------|------------------------|---|
| | [mbar] | [mbar] | [mbar] | [mbar] |
| IE 514 | 1.00×10^{-13} | 9.00×10^{-5} | 1.10×10^{-13} | 1.00×10^{-4} |
| IE 414 | 1.00×10^{-11} | 9.00×10^{-3} | 1.10×10^{-11} | 1.00×10^{-2} |
| CTR 0.10 Torr | 1.00×10^{-5} | 1.20×10^{-1} | 1.50×10^{-5} | 1.00×10^0 |
| CTR 1 Torr | 1.00×10^{-4} | 1.20×10^0 | 1.50×10^{-4} | 1.00×10^1 |
| CTR 10 Torr | 1.00×10^{-3} | 1.20×10^1 | 1.50×10^{-3} | 1.00×10^2 |
| CTR 100 Torr | 1.00×10^{-2} | 1.20×10^2 | 1.50×10^{-2} | 1.00×10^3 |
| CTR 1000 Torr | 1.00×10^{-1} | 1.20×10^3 | 1.50×10^{-1} | 1.00×10^4 |
| TTR 90 | 1.00×10^{-4} | 1.00×10^2 | 1.10×10^{-4} | 1.00×10^3 |

Measuring Speed

The listed times are valid for normal measuring operation without transient effects and switching.

The Rejection column shows you for which mains frequency an optimum noise rejection can be achieved for the selected modulator frequency. Noise rejection only works properly if the measuring time is an integer multiple of the mains frequency period.

| Mod. freq. [Hz] | Resolution (s/ms/us) | | | | | | Reje- ction [Hz] |
|-----------------------|----------------------|-----------|-----------|---------|----------|----------|------------------------|
| | 6 Bit | 8 Bit | 10 Bit | 11 Bit | 12 Bit | 14 Bit | |
| 40 | 1.600s | 6.400s | 25.600s | 51.200s | 102.400s | 409.600s | 50,60 |
| 48 | 1.333s | 5.333s | 21.333s | 42.667s | 85.333s | 341.333s | 60 |
| 50 | 1.280s | 5.120s | 20.480s | 40.960s | 81.920s | 327.680s | 50 |
| 60 | 1.067s | 4.267s | 17.067s | 34.133s | 68.267s | 273.067s | 60 |
| 64 | 1.000s | 4.000s | 16.000s | 32.000s | 64.000s | 256.000s | 50,60 |
| 80 | 800.000ms | 3.200s | 12.800s | 25.600s | 51.200s | 204.800s | 50,60 |
| 96 | 666.667ms | 2.667s | 10.667s | 21.333s | 42.667s | 170.667s | 60 |
| 100 | 640.000ms | 2.560s | 10.240s | 20.480s | 40.960s | 163.840s | 50 |
| 120 | 533.333ms | 2.133s | 8.533s | 17.067s | 34.133s | 136.533s | 60 |
| 128 | 500.000ms | 2.000s | 8.000s | 16.000s | 32.000s | 128.000s | 50,60 |
| 160 | 400.000ms | 1.600s | 6.400s | 12.800s | 25.600s | 102.400s | 50,60 |
| 192 | 333.333ms | 1.333s | 5.333s | 10.667s | 21.333s | 85.333s | 60 |
| 200 | 320.000ms | 1.280s | 5.120s | 10.240s | 20.480s | 81.920s | 50 |
| 240 | 266.667ms | 1.067s | 4.267s | 8.533s | 17.067s | 68.267s | 60 |
| 256 | 250.000ms | 1.000s | 4.000s | 8.000s | 16.000s | 64.000s | 50,60 |
| 320 | 200.000ms | 800.000ms | 3.200s | 6.400s | 12.800s | 51.200s | 50,60 |
| 384 | 166.667ms | 666.667ms | 2.667s | 5.333s | 10.667s | 42.667s | 60 |
| 400 | 160.000ms | 640.000ms | 2.560s | 5.120s | 10.240s | 40.960s | 50 |
| 480 | 133.333ms | 533.333ms | 2.133s | 4.267s | 8.533s | 34.133s | 60 |
| 512 | 125.000ms | 500.000ms | 2.000s | 4.000s | 8.000s | 32.000s | 50,60 |
| 640 | 100.000ms | 400.000ms | 1.600s | 3.200s | 6.400s | 25.600s | 50,60 |
| 768 | 83.333ms | 333.333ms | 1.333s | 2.667s | 5.333s | 21.333s | 60 |
| 800 | 80.000ms | 320.000ms | 1.280s | 2.560s | 5.120s | 20.480s | 50 |
| 960 | 66.667ms | 266.667ms | 1.067s | 2.133s | 4.267s | 17.067s | 60 |
| 1024 | 62.500ms | 250.000ms | 1.000s | 2.000s | 4.000s | 16.000s | 50,60 |
| 1280 | 50.000ms | 200.000ms | 800.000ms | 1.600s | 3.200s | 12.800s | 50,60 |

Appendix

| Mod. freq. [Hz] | Resolution (s/ms/us) | | | | | | Reje- ction [Hz] |
|-----------------------|----------------------|-----------|-----------|-----------|-----------|-----------|------------------------|
| | 6 Bit | 8 Bit | 10 Bit | 11 Bit | 12 Bit | 14 Bit | |
| 1536 | 41.667ms | 166.667ms | 666.667ms | 1.333s | 2.667s | 10.667s | 60 |
| 1600 | 40.000ms | 160.000ms | 640.000ms | 1.280s | 2.560s | 10.240s | 50 |
| 1920 | 33.333ms | 133.333ms | 533.333ms | 1.067s | 2.133s | 8.533s | 60 |
| 2048 | 31.250ms | 125.000ms | 500.000ms | 1.000s | 2.000s | 8.000s | 50,60 |
| 2560 | 25.000ms | 100.000ms | 400.000ms | 800.000ms | 1.600s | 6.400s | 50,60 |
| 3072 | 20.833ms | 83.333ms | 333.333ms | 666.667ms | 1.333s | 5.333s | 60 |
| 3200 | 20.000ms | 80.000ms | 320.000ms | 640.000ms | 1.280s | 5.120s | 50 |
| 3840 | 16.667ms | 66.667ms | 266.667ms | 533.333ms | 1.067s | 4.267s | 60 |
| 4096 | 15.625ms | 62.500ms | 250.000ms | 500.000ms | 1.000s | 4.000s | 50,60 |
| 5120 | 12.500ms | 50.000ms | 200.000ms | 400.000ms | 800.000ms | 3.200s | 50,60 |
| 6144 | 10.417ms | 41.667ms | 166.667ms | 333.333ms | 666.667ms | 2.667s | 60 |
| 6400 | 10.000ms | 40.000ms | 160.000ms | 320.000ms | 640.000ms | 2.560s | 50 |
| 7680 | 8.333ms | 33.333ms | 133.333ms | 266.667ms | 533.333ms | 2.133s | 60 |
| 8192 | 7.813ms | 31.250ms | 125.000ms | 250.000ms | 500.000ms | 2.000s | 50,60 |
| 10240 | 6.250ms | 25.000ms | 100.000ms | 200.000ms | 400.000ms | 1.600s | 50,60 |
| 12288 | 5.208ms | 20.833ms | 83.333ms | 166.667ms | 333.333ms | 1.333s | 60 |
| 12800 | 5.000ms | 20.000ms | 80.000ms | 160.000ms | 320.000ms | 1.280s | 50 |
| 15360 | 4.167ms | 16.667ms | 66.667ms | 133.333ms | 266.667ms | 1.067s | 60 |
| 17067 | 3.750ms | 15.000ms | 59.999ms | 119.998ms | 239.995ms | 959.981ms | 50 |
| 20480 | 3.125ms | 12.500ms | 50.000ms | 100.000ms | 200.000ms | 800.000ms | 50,60 |
| 24576 | 2.604ms | 10.417ms | 41.667ms | 83.333ms | 166.667ms | 666.667ms | 60 |
| 25600 | 2.500ms | 10.000ms | 40.000ms | 80.000ms | 160.000ms | 640.000ms | 50 |
| 30720 | 2.083ms | 8.333ms | 33.333ms | 66.667ms | 133.333ms | 533.333ms | 60 |
| 40960 | 1.563ms | 6.250ms | 25.000ms | 50.000ms | 100.000ms | 400.000ms | 50,60 |
| 51200 | 1.250ms | 5.000ms | 20.000ms | 40.000ms | 80.000ms | 320.000ms | 50 |
| 61440 | 1.042ms | 4.167ms | 16.667ms | 33.333ms | 66.667ms | 266.667ms | 60 |
| 68270 | 937.454us | 3.750ms | 14.999ms | 29.999ms | 59.997ms | 239.988ms | 50 |
| 102400 | 625.000us | 2.500ms | 10.000ms | 20.000ms | 40.000ms | 160.000ms | 50 |
| 122880 | 520.833us | 2.083ms | 8.333ms | 16.667ms | 33.333ms | 133.333ms | 60 |

Integrator Level Control

The implemented clock allows the use of various modulator frequencies. All combinations of the modulator frequency and the measuring range that are marked with a ✓ symbol can be used.

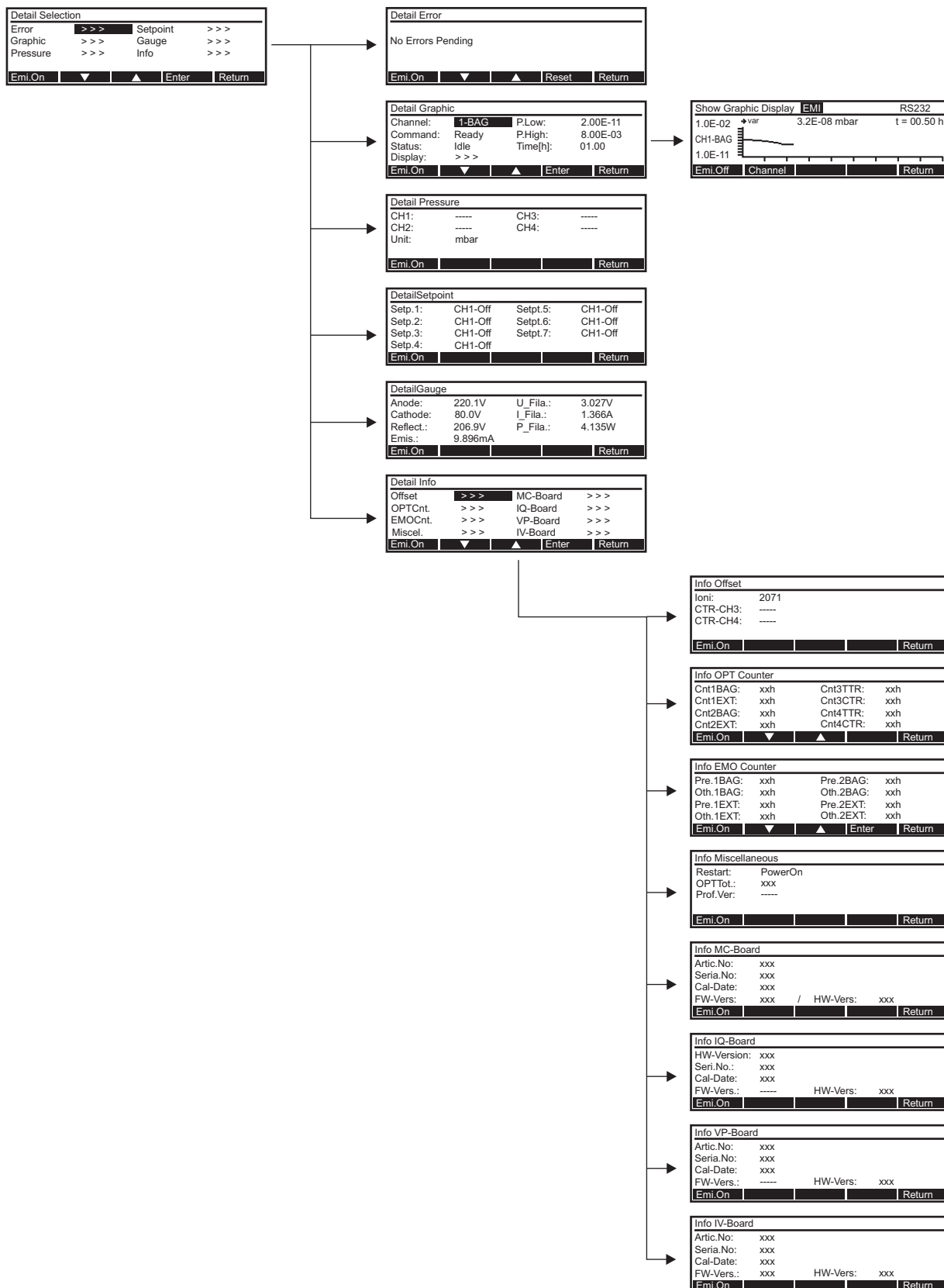
| Modulator frequency [Hz] | Measuring range | | | | | | | | | | |
|--------------------------|-----------------|------|-------|--------|------|-------|--------|------|-------|--------|------|
| | 100 fA | 1 pA | 10 pA | 100 pA | 1 nA | 10 nA | 100 nA | 1 µA | 10 µA | 100 µA | 2 mA |
| 122880 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 102400 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 68270 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 61440 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 51200 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 40960 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 30720 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 25600 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 24576 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | |
| 20480 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | |
| 17067 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | |
| 15360 | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | |
| 12800 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | |
| 12288 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | |
| 10240 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | |
| 8192 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | |
| 7680 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | |
| 6400 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | |
| 6144 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | |
| 5120 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | |
| 4096 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | |
| 3840 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | |
| 3200 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | |
| 3072 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | |
| 2560 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | |
| 2048 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| 1920 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |

Appendix

| Modulator frequency [Hz] | Measuring range | | | | | | | | | | |
|--------------------------------|-----------------|---------|----------|-----------|---------|----------|-----------|---------|----------|-----------|---------|
| | 100 fA | 1 pA | 10 pA | 100 pA | 1 nA | 10 nA | 100 nA | 1 μA | 10 μA | 100 μA | 2 mA |
| 1600 | | ✓ | ✓ | ✓ | ✓ | | | | | | |
| 1536 | | ✓ | ✓ | ✓ | ✓ | | | | | | |
| 1280 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| 1024 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| 960 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| 800 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| 768 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| 640 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| 512 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| 480 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| 400 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| 384 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| 320 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| 256 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| 240 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| 200 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| 192 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| 160 | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 128 | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 120 | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 100 | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 96 | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 80 | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 64 | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 60 | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 50 | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 48 | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 40 | ✓ | ✓ | ✓ | ✓ | | | | | | | |

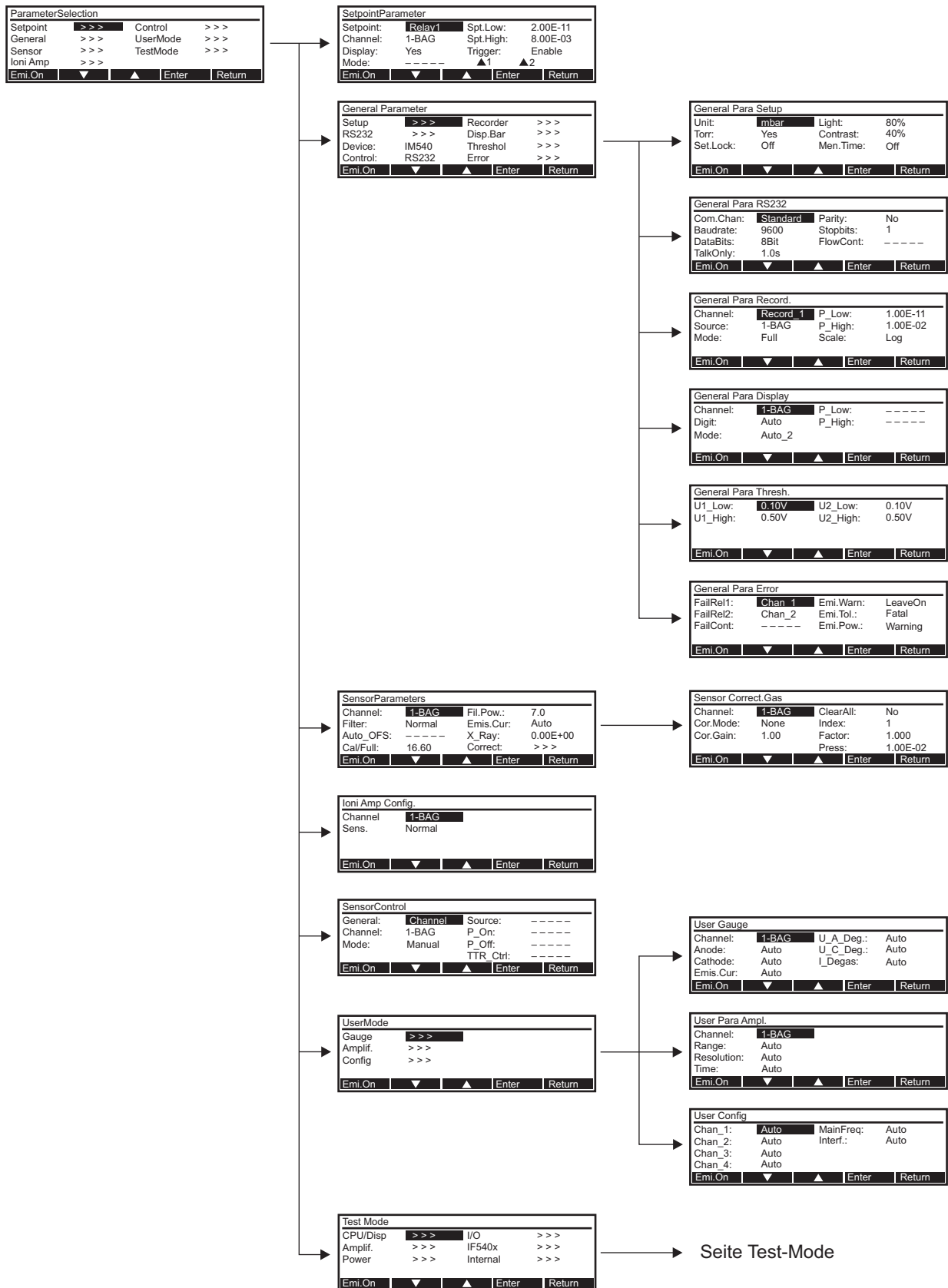
Menu Structure

Detail-Selection

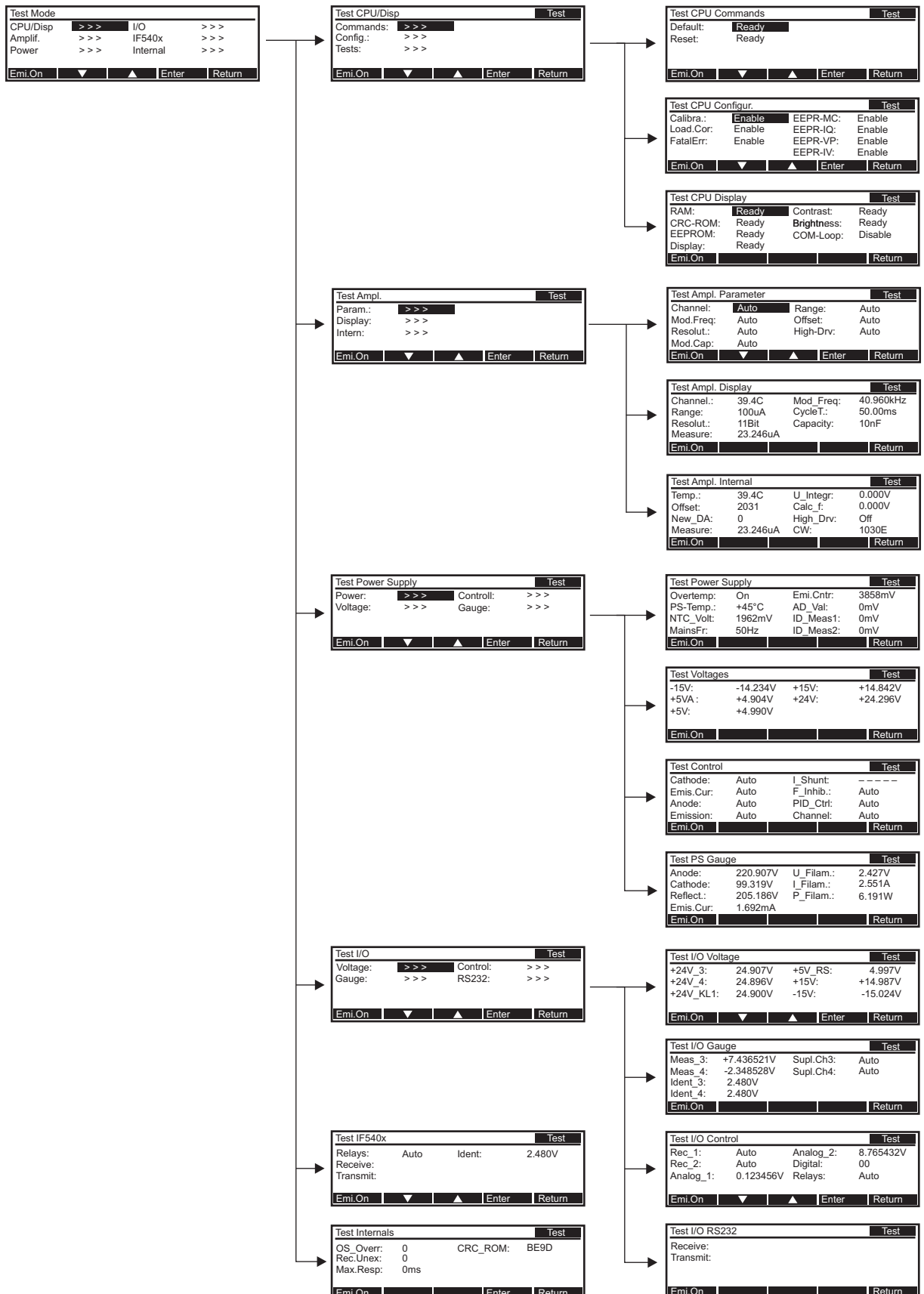


Appendix

Parameter-Selection



Test-Mode



Appendix

Error Messages

The legend for the following table can be found in Section «Legend for the Error Table», 253.

| Error no. | Error message | Error description | Reactions of the device | Possible follow-up errors | Possible cause of error | Suggestions for error correction | Useful test functions (chapter) |
|-----------|------------------------------------|--|-------------------------|---------------------------|-------------------------|----------------------------------|---------------------------------|
| 100 | No Errors Pending | No error | — | — | — | — | — |
| 101 | Different SW-Version, Load Default | Device parameters have been reset to default values after a SW update It is possible that the device shows different behavior | 5 | — | 21 | 12 | 8.4.4 |
| 102 | BAG Degas Press To High | The pressure for degassing is too high for a BAG sensor | 9 | — | 1 5 7 | 9 8 7 | 8.4.4 8.4.4 8.4.4 |
| 103 | EXT Degas Press To High | The pressure for degassing is too high for an EXT sensor | 9 | — | 1 5 7 | 9 8 7 | 8.4.4 8.4.4 8.4.4 |
| 104 | BAG Press Greater P Max. | The maximum permissible pressure for a BAG sensor has been exceeded | 23 | — | 1 5 7 | 10 8 7 | 8.4.4 8.4.4 8.4.4 |
| 105 | EXT Press Greater P Max. | The maximum permissible pressure for an EXT sensor has been exceeded | 23 | — | 1 5 7 | 10 8 7 | 8.4.4 8.4.4 8.4.4 |
| 106 | RS232 Overrun Error | An overrun error has occurred at the RS232 input | 4 | 109 | 1, 18 17 | 13 14 | 8.4.6 8.4.6 |
| 107 | RS232 Framing Error | A framing error has occurred at the RS232 input | 4 | 109 | 1, 18 17 | 13 14 | 8.4.6 8.4.6 |
| 108 | RS232 Parity Error | A parity error has occurred at the RS232 input | 4 | 109 | 1, 18 17 | 13 14 | 8.4.6 8.4.6 |
| 109 | Incompatible Profibus SW-Version | Communication trouble between IM 540 and Profibus interface IF 540 P | 11 | 106, 107, 108 | 19 20 | 16 17 | 8.4.6/8.4.7 8.4.6/8.4.7 |

| Error no. | Error message | Error description | Reactions of the device | Possible follow-up errors | Possible cause of error | Suggestions for error correction | Useful test functions (chapter) |
|-----------|-------------------------------------|---|-------------------------|-----------------------------|-------------------------|----------------------------------|---|
| 110 | Set Cor_Mode To NONE.Sensor Changed | Gas correction is reset because the sensor for the active channel has been changed | 12 | 121, 122, 123, 124 | 2 4 7 | 2 3 7 | 8.4.5/8.4.6 8.4.5/8.4.6 8.4.5/8.4.6 |
| 111 | Gas Cor_Table Mismatch To Sensor! | Gas correction for the active measuring channel was set to USER, but the related table was set to another sensor type | 1 | 121, 122, 123, 124 | 1 3 | 11 4 | 8.4.5/8.4.6 |
| 121 | Channel 1 No Coding | IM 540 does not recognize the sensor connected to channel 1 properly | 1, 13 | 141, 144, 147, 148 | 3 7 4 | 4 7 3 | 8.4.5 8.4.5 8.4.5 |
| 122 | Channel 2 No Coding | IM 540 does not recognize the sensor connected to channel 2 properly | 1, 13 | 141, 144, 147, 148 | 3 7 4 | 4 7 3 | 8.4.5 8.4.5 8.4.5 |
| 123 | Channel 3 No Coding | IM 540 does not recognize the sensor connected to channel 3 properly | 1, 13 | 129, 133 | 3 7 4 | 4 7 3 | 8.4.5 8.4.5 8.4.5 |
| 124 | Channel 4 No Coding | IM 540 does not recognize the sensor connected to channel 4 properly | 1, 13 | 130, 134 | 3 7 4 | 4 7 3 | 8.4.5 8.4.5 8.4.5 |
| 125 | Ioni Amp. Offset Failure | Offset adjustment for the measuring amplifier could not be performed successfully in the current measuring range | 14, 15 | — | 7 4 | 7 3 | 8.4.4/8.4.5 8.4.4/8.4.5 |
| 126 | Ioni Amp. Load Correction Failure | A charge correction in the current measuring range could not be performed successfully | 1, 15 | — | 7 4 10 | 7 3 21 | 8.4.3 ff 8.4.3 ff 8.4.4/8.4.5 |
| 127 | Ioni Amp. Calibration Failure | An instability has been detected for the range switching (toggling) of the measuring amplifier | 1, 15, 17 | — | 7 4 10 | 6, 7 3 21 | 8.4.3 ff 8.4.3 ff 8.4.4/8.4.5 |

Appendix

| Error no. | Error message | Error description | Reactions of the device | Possible follow-up errors | Possible cause of error | Suggestions for error correction | Useful test functions (chapter) |
|-----------|------------------------------------|--|-------------------------|---------------------------|-------------------------|----------------------------------|---------------------------------|
| 128 | Ioni Amp. Negative Input Current | A negative input current has been detected at the measuring amplifier input for several measurement cycles | 1, 15 | — | 7 | 6, 7 | 8.4.4/8.4.5 |
| | | | | | 4 | 3 | 8.4.4/8.4.5 |
| | | | | | 10 | 21 | 8.4.4/8.4.5 |
| 129 | VP-Board Power Supply +24VS3 Warn. | +24 V supply for channel 3 on the VP board deviates from the setpoint | 18, 15 | 133 | 7 | 7 | 8.4.5/8.4.6 |
| | | | | | 3 | 4 | 8.4.5/8.4.6 |
| | | | | | 4 | 3 | 8.4.5/8.4.6 |
| | | | | | 13 | 21 | 8.4.5/8.4.6 |
| 130 | VP-Board Power Supply +24VS4 Warn. | +24 V supply for channel 4 on the VP board deviates from the setpoint | 19, 15 | 134 | 7 | 7 | 8.4.5/8.4.6 |
| | | | | | 3 | 4 | 8.4.5/8.4.6 |
| | | | | | 4 | 3 | 8.4.5/8.4.6 |
| | | | | | 13 | 21 | 8.4.5/8.4.6 |
| 131 | VP-Board Power Supply +24VKL Warn. | +24 V supply for external relays at the «Relay» plug deviates from the setpoint | 1, 15 | 135 | 15 | 15 | 8.4.5/8.4.6 |
| | | | | | 12 | 21 | 8.4.5/8.4.6 |
| | | | | | 13 | 21 | 8.4.5/8.4.6 |
| | | | | | | | |
| 132 | VP-Board Power Supply +5V RS Warn. | +5 V supply for the RS232 interface on the VP board differs from the setpoint | 1, 15 | 136 | 16 | 15 | 8.4.5/8.4.6 |
| | | | | | 12 | 21 | 8.4.5/8.4.6 |
| | | | | | 13 | 21 | 8.4.5/8.4.6 |
| 133 | VP-Board Power Supply +24VS3 Error | +24 V supply for channel 3 on the VP board is missing or shows an unacceptable deviation from the setpoint | 20, 16 | 129 | 7 | 7 | 8.4.5/8.4.6 |
| | | | | | 3 | 4 | 8.4.5/8.4.6 |
| | | | | | 4 | 3 | 8.4.5/8.4.6 |
| | | | | | 13 | 21 | 8.4.5/8.4.6 |
| 134 | VP-Board Power Supply +24VS4 Error | +24 V supply for channel 4 on the VP board is missing or shows an unacceptable deviation from the setpoint | 21, 16 | 130 | 7 | 7 | 8.4.5/8.4.6 |
| | | | | | 3 | 4 | 8.4.5/8.4.6 |
| | | | | | 4 | 3 | 8.4.5/8.4.6 |
| | | | | | 13 | 21 | 8.4.5/8.4.6 |
| | | | | | 12 | 21 | 8.4.5/8.4.6 |

| Error no. | Error message | Error description | Reactions of the device | Possible follow-up errors | Possible cause of error | Suggestions for error correction | Useful test functions (chapter) |
|-----------|------------------------------------|--|-------------------------|---------------------------|-------------------------|----------------------------------|---------------------------------|
| 135 | VP-Board Power Supply +24VKL Error | +24 V supply for external relays at the «Relay» plug is missing or shows an unacceptable deviation from the setpoint | 1, 16 | 131 | 15 | 15 | 8.4.5/8.4.6 |
| | | | | | 12 | 21 | 8.4.5/8.4.6 |
| | | | | | 13 | 21 | 8.4.5/8.4.6 |
| 136 | VP-Board Power Supply +5V RS Error | +5 V supply for the RS232 interface on the VP board is missing or shows an unacceptable deviation from the setpoint | 1, 16 | 132 | 16 | 15 | 8.4.5/8.4.6 |
| | | | | | 12 | 21 | 8.4.5/8.4.6 |
| | | | | | 13 | 21 | 8.4.5/8.4.6 |
| 137 | Ioni Supply U_Anode Warning | Anode voltage supply on the IQ board shows an unacceptable deviation from the setpoint | 22, 15 | 143 | 7 | 7 | 8.4.5 |
| | | | | | 3 | 4 | 8.4.5 |
| | | | | | 4 | 3 | 8.4.5 |
| | | | | | 12 | 21 | 8.4.5 |
| 138 | Ioni Supply U_Cathode Warning | Cathode voltage supply on the IQ board deviates from the setpoint | 22, 15 | 144 | 7 | 7 | 8.4.5 |
| | | | | | 3 | 4 | 8.4.5 |
| | | | | | 4 | 3 | 8.4.5 |
| | | | | | 12 | 21 | 8.4.5 |
| 139 | Ioni Supply I_Emis Warning | Emission current of active sensor deviates from the permissible setpoint | 22, 15 | 145 | 7 | 7 | 8.4.5 |
| | | | | | 4 | 3 | 8.4.5 |
| | | | | | 3 | 4 | 8.4.5 |
| | | | | | 12 | 21 | 8.4.5 |
| 140 | Ioni Supply U_Filament Warning | Filament voltage (heating voltage) of active sensor deviates from the permissible setpoint | 22, 15 | 146 | 7 | 7 | 8.4.5 |
| | | | | | 4 | 3 | 8.4.5 |
| | | | | | 3 | 4 | 8.4.5 |
| | | | | | 12 | 21 | 8.4.5 |
| 141 | Ioni Supply I_Filament Warning | Filament current (heating current) of active sensor deviates from the permissible setpoint | 22, 15 | 121, | 7 | 7 | 8.4.5 |
| | | | | 122, | 4 | 3 | 8.4.5 |
| | | | | 144, | 3 | 4 | 8.4.5 |
| | | | | 145, | 12 | 21 | 8.4.5 |
| 142 | Ioni Supply U_Reflector Warning | Reflector voltage supply on the IQ board deviates from the setpoint | 22, 15 | 149 | 7 | 7 | 8.4.5 |
| | | | | | 4 | 3 | 8.4.5 |
| | | | | | 3 | 4 | 8.4.5 |
| | | | | | 12 | 21 | 8.4.5 |

Appendix

| Error no. | Error message | Error description | Reactions of the device | Possible follow-up errors | Possible cause of error | Suggestions for error correction | Useful test functions (chapter) |
|-----------|-------------------------------|---|-------------------------|---------------------------|-------------------------|----------------------------------|---------------------------------|
| 143 | Ioni Supply U_Anode Error | Anode voltage supply on the IQ board is missing or shows an unacceptable deviation from the setpoint | 23, 16 | 144, 149 | 7 | 7 | 8.4.5 |
| | | | | | 4 | 3 | 8.4.5 |
| | | | | | 3 | 4 | 8.4.5 |
| | | | | | 12 | 21 | 8.4.5 |
| 144 | Ioni Supply U_Cathode Error | Cathode voltage supply on the IQ board is missing or shows an unacceptable deviation from the setpoint | 23, 16 | 121, 143, 145, 149 | 7 | 7 | 8.4.5 |
| | | | | | 4 | 3 | 8.4.5 |
| | | | | | 3 | 4 | 8.4.5 |
| | | | | | 12 | 21 | 8.4.5 |
| 145 | Ioni Supply I_Emis Error | Emission current of active sensor is missing or shows an unacceptable deviation from the setpoint | 23, 16 | 139 | 7 | 7 | 8.4.5 |
| | | | | | 4 | 3 | 8.4.5 |
| | | | | | 3 | 4 | 8.4.5 |
| | | | | | 12 | 21 | 8.4.5 |
| 146 | Ioni Supply U_Filament Error | Filament voltage (heating voltage) of active sensor is missing or shows an unacceptable deviation from the setpoint | 23, 16 | 144 | 7 | 7 | 8.4.5 |
| | | | | | 4 | 3 | 8.4.5 |
| | | | | | 3 | 4 | 8.4.5 |
| | | | | | 12 | 21 | 8.4.5 |
| 147 | Ioni Supply I_Filament Error | Filament current (heating current) of active sensor is missing or shows an unacceptable deviation from the setpoint | 23, 16 | 121, 141 | 7 | 7 | 8.4.5 |
| | | | | | 4 | 3 | 8.4.5 |
| | | | | | 3 | 4 | 8.4.5 |
| | | | | | 12 | 21 | 8.4.5 |
| 148 | Ioni Supply P_Filament Error | Filament power (heating power) of active sensor is missing or shows an unacceptable deviation from the setpoint | 23, 16 | 121 | 5 | 8, 19 | 8.4.5 |
| | | | | | 6 | 5, 19 | 8.4.5 |
| | | | | | 7 | 7 | 8.4.5 |
| | | | | | 3 | 4 | 8.4.5 |
| | | | | | 4 | 3 | 8.4.5 |
| | | | | | 12 | 21 | 8.4.5 |
| 149 | Ioni Supply U_Reflector Error | Reflector voltage supply on the IQ board is missing or shows an unacceptable deviation from the setpoint | 23, 16 | 142, 143, 144 | 7 | 7 | 8.4.5 |
| | | | | | 3 | 4 | 8.4.5 |
| | | | | | 4 | 3 | 8.4.5 |
| | | | | | 12 | 21 | 8.4.5 |

| Error no. | Error message | Error description | Reactions of the device | Possible follow-up errors | Possible cause of error | Suggestions for error correction | Useful test functions (chapter) |
|-----------|------------------------------------|---|-------------------------|---------------------------|-------------------------|----------------------------------|---------------------------------|
| 150 | Ioni Supply P_Fil Unstable Error | Filament current regulator is oscillating, works unstable, or is faulty | 23, 16 | — | 7 | 7 | 8.4.5 |
| | | | | | 3 | 4 | 8.4.5 |
| | | | | | 4 | 3 | 8.4.5 |
| | | | | | 12 | 21 | 8.4.5 |
| 151 | Emis Regulator Limit Warning | Emission regulator works at the limit of its dynamic range | 22, 15 | 152 | 7 | 7 | 8.4.5 |
| | | | | | 3 | 4 | 8.4.5 |
| | | | | | 4 | 3 | 8.4.5 |
| | | | | | 12 | 21 | 8.4.5 |
| 152 | Emis Regulator Limit Error | Operating range of emission regulator has been exceeded or emission regulator is faulty | 23, 16 | 151 | 7 | 7 | 8.4.5 |
| | | | | | 3 | 4 | 8.4.5 |
| | | | | | 4 | 3 | 8.4.5 |
| | | | | | 12 | 21 | 8.4.5 |
| 153 | Emis Regulator Deviation Warning | Stability of emission control is impaired | 22, 15 | 154 | 7 | 7 | 8.4.5 |
| | | | | | 3 | 4 | 8.4.5 |
| | | | | | 4 | 3 | 8.4.5 |
| | | | | | 12 | 21 | 8.4.5 |
| 154 | Emis Regulator Deviation Error | Emission regulator is oscillating, works unstable, or is faulty | 23, 16 | 153 | 7 | 7 | 8.4.5 |
| | | | | | 3 | 4 | 8.4.5 |
| | | | | | 4 | 3 | 8.4.5 |
| | | | | | 12 | 21 | 8.4.5 |
| 161 | MC Board EEPROM Operation Timeout | Communication error between the processor and the EEPROM on the MC board | 1, 4 | — | 9 | 21 | 8.4.3 |
| 162 | Ioni Amp. EEPROM Operation Timeout | Communication error between the processor and the EEPROM of the measuring amplifier on the IV board | 1, 4 | — | 10 | 21 | 8.4.3 |
| 163 | IQ Board EEPROM Operation Timeout | Communication error between the processor and the EEPROM on the IQ board | 1, 4 | — | 12 | 21 | 8.4.3 |
| 164 | VP Board EEPROM Operation Timeout | Communication error between the processor and the EEPROM on the VP board | 1, 4 | — | 13 | 21 | 8.4.3 |

Appendix

| Error no. | Error message | Error description | Reactions of the device | Possible follow-up errors | Possible cause of error | Suggestions for error correction | Useful test functions (chapter) |
|-----------|-----------------------------------|--|-------------------------|---------------------------|-------------------------|----------------------------------|---------------------------------|
| 165 | IF Board EEPROM Operation Timeout | Communication error between the processor and the EEPROM on the IF board | 1, 4 | — | 14 | 21 | 8.4.3 |
| 166 | MC Board Kontrast Device Timeout | Communication error between the processor and the EEPROM on the CS board | 1, 4 | — | 23 | 21 | 8.4.3 |
| 167 | MC Board AD Device Timeout | Communication error between the processor and the AD converter on the MC board | 1, 4 | — | 9 | 21 | 8.4.3 |
| 168 | VP Board AD4MUX Device Timeout | Communication error between the processor and the 4-channel MUX/AD converter on the VP board | 1, 4 | — | 13 | 21 | 8.4.3 |
| 169 | VP Board AD8MUX Device Timeout | Communication error between the processor and the 8-channel MUX/AD converter on the VP board | 1, 4 | — | 13 | 21 | 8.4.3 |
| 170 | VP Board DA Device Timeout | Communication error between the processor and the DA converter on the VP board | 1, 4 | — | 13 | 21 | 8.4.3 |
| 171 | Ioni Amp. Command Device Timeout | Communication error between the processor and the control circuit of the measuring amplifier on the IV board | 1, 4 | — | 10 | 21 | 8.4.3 |
| 172 | Ioni Amp. AD Device Timeout | Communication error between the processor and the AD converter of the measuring amplifier on the IV board | 1, 4 | — | 10 | 21 | 8.4.3 |

| Error no. | Error message | Error description | Reactions of the device | Possible follow-up errors | Possible cause of error | Suggestions for error correction | Useful test functions (chapter) |
|-----------|----------------------------------|---|-------------------------|---------------------------|-------------------------|----------------------------------|---------------------------------|
| 173 | Ioni Amp. DA Device Timeout | Communication error between the processor and the DA converter of the measuring amplifier on the IV board | 1, 4 | — | 10 | 21 | 8.4.3 |
| 174 | Ioni Amp. Temp. Device Timeout | Communication error between the processor and the temperature sensor of the measuring amplifier on the IV board | 1, 4 | — | 10 | 21 | 8.4.3 |
| 175 | CRC Check Device Settings | Data consistency problem in EEPROM of the MC board | 24 | — | 9 | 21 | 8.4.3 |
| 176 | CRC Check Device OPT Counter | Data consistency problem in EEPROM of the MC board | 7 | — | 9 | 21 | 8.4.3 |
| 177 | CRC Check Gas-cor.Data Channel 1 | Data consistency problem in EEPROM of the MC board | 8 | — | 9 | 21 | 8.4.3 |
| 178 | CRC Check Gas-cor.Data Channel 2 | Data consistency problem in EEPROM of the MC board | 8 | — | 9 | 21 | 8.4.3 |
| 179 | CRC Check Gas-cor.Data Channel 3 | Data consistency problem in EEPROM of the MC board | 8 | — | 9 | 21 | 8.4.3 |
| 180 | CRC Check Gas-cor.Data Channel 4 | Data consistency problem in EEPROM of the MC board | 8 | — | 9 | 21 | 8.4.3 |
| 181 | Default MC Board HW Data | Default values have been loaded as a result of error no. 185 | 1 | — | 8 | 1 | — |
| 182 | Default VP Board HW Data | Default values have been loaded as a result of error no. 186 | 1 | — | 8 | 1 | — |
| 183 | Default IQ Board HW Data | Default values have been loaded as a result of error no. 187 | 1 | — | 8 | 1 | — |

Appendix

| Error no. | Error message | Error description | Reactions of the device | Possible follow-up errors | Possible cause of error | Suggestions for error correction | Useful test functions (chapter) |
|-----------|-------------------------------------|---|-------------------------|---------------------------|-------------------------|----------------------------------|---------------------------------|
| 184 | Default Ioni Amp. Board HW Data | Default values have been loaded as a result of error no. 188 | 1 | — | 8 | 1 | — |
| 185 | CRC Check MC Board HW Data | Data consistency problem in EEPROM of the MC board | 6 | 181 | 9 | 21 | 8.4.3 |
| 186 | CRC Check VP Board HW Data | Data consistency problem in EEPROM of the VP board | 6 | 182 | 13 | 21 | 8.4.3 |
| 187 | CRC Check IQ Board HW Data | Data consistency problem in EEPROM of the IQ board | 6 | 183 | 12 | 21 | 8.4.3 |
| 188 | CRC Check Ioni Amp. Board HW Data | Data consistency problem in EEPROM of the measuring amplifier on the IV board | 6 | 184 | 10 | 21 | 8.4.3 |
| 189 | RAM Test Failure ! -> Service | An error occurred when testing the dynamic processor RAM | 1 | — | 9 | 21 | 8.4.3 |
| 190 | CRC ROM Test Failure ! -> Service | An error occurred when testing the processor program memory (ROM) | 1 | — | 9 | 21 | 8.4.3 |
| 191 | Power Supply Overtemp | Temperature sensor on the IQ print signals overheating | 20, 21, 23, 10 | 192, 193 | 24, 12 | 18, 21 | 8.4.5/8.4.6 8.4.5/8.4.6 |
| 192 | IQ-Board Power Supply Temp. Warning | Temperature sensor on the IQ print signals overheating | 18, 19, 15 | 191, 193 | 24, 12 | 18, 21 | 8.4.5 8.4.5 |
| 193 | IQ-Board Power Supply Temp. Error | Temperature sensor on the IQ print signals overheating | 20, 21, 16 | 191, 192 | 24, 12 | 18, 21 | 8.4.5 8.4.5 |
| 194 | No Mains Frequency Signal | Mains frequency signal of IQ board is missing | 28 | — | 12 | 20 | 8.4.5 |
| 195 | MC-Board Power Supply -15V Warning | -15 V supply on the MC board deviates from the setpoint | 22, 15 | 199 | 12, 9 | 21, 21 | 8.4.5 8.4.5 |

| Error no. | Error message | Error description | Reactions of the device | Possible follow-up errors | Possible cause of error | Suggestions for error correction | Useful test functions (chapter) |
|-----------|------------------------------------|--|-------------------------|---------------------------|-------------------------|----------------------------------|---------------------------------|
| 196 | MC-Board Power Supply +5V Warning | Die +5 V supply on the MC board deviates from the setpoint | 18, 19, 22, 15 | 200 | 12 | 21 | 8.4.5 |
| | | | | | 9 | 21 | 8.4.5 |
| 197 | MC-Board Power Supply +15V Warning | Die +15 V supply on the MC board deviates from the setpoint | 22, 15 | 201 | 12 | 21 | 8.4.5 |
| | | | | | 9 | 21 | 8.4.5 |
| 198 | MC-Board Power Supply +24V Warning | +24 V supply on the MC board deviates from the setpoint | 18, 19, 15 | 202 | 12 | 21 | 8.4.5 |
| | | | | | 9 | 21 | 8.4.5 |
| 199 | MC-Board Power Supply -15V Error | -15 V supply on the MC board is missing or shows an unacceptable deviation from the setpoint | 23, 16 | 195 | 12 | 21 | 8.4.5 |
| | | | | | 9 | 21 | 8.4.5 |
| 200 | MC-Board Power Supply +5V Error | +5 V supply on the MC board is missing or shows an unacceptable deviation from the setpoint | 20, 21, 16 | 196 | 12 | 21 | 8.4.5 |
| | | | | | 9 | 21 | 8.4.5 |
| 201 | MC-Board Power Supply +15V Error | +15 V supply on the MC board is missing or shows an unacceptable deviation from the setpoint | 23, 16 | 197 | 12 | 21 | 8.4.5 |
| | | | | | 9 | 21 | 8.4.5 |
| 202 | MC-Board Power Supply +24V Error | +24 V supply on the MC board is missing or shows an unacceptable deviation from the setpoint | 20, 21, 23, 16 | 198 | 12 | 21 | 8.4.5 |
| | | | | | 9 | 21 | 8.4.5 |
| 203 | VP-Board Power Supply +15V Warn. | +15 V supply on the VP board deviates from the setpoint | 18, 19, 15 | 205 | 12 | 21 | 8.4.5 |
| | | | | | 13 | 21 | 8.4.5 |
| 204 | VP-Board Power Supply -15V Warn. | -15 V supply on the VP board deviates from the setpoint | 18, 19, 15 | 206 | 12 | 21 | 8.4.5 |
| | | | | | 13 | 21 | 8.4.5 |
| 205 | VP-Board Power Supply +15V Error | +15 V supply on the VP board is missing or shows an unacceptable deviation from the setpoint | 20, 21, 16 | 203 | 12 | 21 | 8.4.5 |
| | | | | | 13 | 21 | 8.4.5 |

Appendix

| Error no. | Error message | Error description | Reactions of the device | Possible follow-up errors | Possible cause of error | Suggestions for error correction | Useful test functions (chapter) |
|-----------|----------------------------------|--|-------------------------|---------------------------|-------------------------|----------------------------------|---------------------------------|
| 206 | VP-Board Power Supply -15V Error | -15 V supply on the VP board is missing or shows an unacceptable deviation from the setpoint | 20, 21, 16 | 204 | 12 | 21 | 8.4.5 |
| | | | | | 13 | 21 | 8.4.5 |
| 221 | SPI Communication Overrun Error | An overrun error has occurred during internal communication via SPI | 1, 4, 16 | — | 22 | 21 | 8.4.2 |
| 222 | No Dynamic RAM Available | The dynamic RAM required for running the program is not sufficient | 1, 4, 16 | — | 22 | 21 | 8.4.3 |
| 223 | EEPROM Address Mismatch | Invalid address when saving data in the internal EEPROM of the MC board | 1, 4, 16 | — | 22 | 21 | 8.4.2/8.4.3 |

Legend for the Error Table

Reactions of the device in case of an error

| Code | Meaning |
|------|---|
| 1 | Note (The text of the error message is just a note) |
| 2 | Certain functions cannot be executed |
| 3 | An action could not be executed |
| 4 | Data loss possible, proper functioning of the device is no longer guaranteed |
| 5 | General device parameters (except for operating hours counters) are reset to default values |
| 6 | The device parameters of the related board are reset to the default values |
| 7 | The operating hours counters are reset |
| 8 | The gas correction table of the respective channel is reset to the default values |
| 9 | Degassing is not possible |
| 10 | Measuring operation is not possible |
| 11 | Profibus operation is not possible |
| 12 | The gas correction is reset to the value NONE |
| 13 | The measurement cannot be started on this channel |
| 14 | The old offset value (or default value) will be used further on |
| 15 | It is possible that the device specifications are not met anymore |
| 16 | The device specifications are not met anymore |
| 17 | The offset adjustment of at least one measuring range is probably wrong |
| 18 | Depending on the configuration (see Chapter 5.2.8, 72), the +24 V voltage for channel 3 is switched off |
| 19 | Depending on the configuration (see Chapter 5.2.8, 72), the +24 V voltage for channel 4 is switched off |
| 20 | The +24 V voltage for channel 3 is switched off |
| 21 | The +24 V voltage for channel 4 is switched off |
| 22 | Depending on the configuration (see Chapter 5.2.8, 72), the emission is switched off |
| 23 | The emission is switched off |
| 24 | The default values for the device parameters are loaded |

| Code | Meaning |
|------|---|
| 25 | The correction table of the respective channel is reset to the default values |
| 26 | The device parameters of the respective board are reset to the default values |
| 27 | The device parameters of the measuring amplifier (IV board) are reset to the default values |
| 28 | The device expects a mains frequency of 50 Hz |

Possible follow-up errors

| Range | Meaning |
|-------------|---|
| 101 ... 250 | Depending on the configuration of the device (see Chapter 5.2.8, 72), the cause of the error and the previous history, further error messages may be triggered. The most frequent follow-up errors are listed in this column. |

Possible cause of the error

In some cases, the error table lists several possible causes for an error. In this case, this column and the following two columns contain several entries (sorted with regard to decreasing likelihood).


| Code | Meaning |
|------|---|
| 1 | Operating or adjustment error |
| 2 | Sensor change during operation |
| 3 | Wrong sensor connected |
| 4 | Faulty sensor connected |
| 5 | Unacceptable pressure rise in the vacuum system |
| 6 | Sensor cable too long (resistance too high) |

| Code | Meaning |
|------|--|
| 7 | <p>Sensor connection problem:</p> <p>There are many possible causes for such an error. Here are a few examples:</p> <ul style="list-style-type: none"> ■ Improper installation (cable routing, grounding, etc.) ■ Sensor cable too long ■ Sensor cable damaged ■ Plug problems ■ Leakage currents (humidity, contamination) ■ Contact resistance ■ Magnetic fields ■ Pressure in the vacuum system is too high ■ Abnormal ambience conditions ■ Mechanical vibrations (cable and sensor) <p>Because of the extremely small measuring currents, some of these causes have a stronger effect in the lower pressure ranges.</p> |
| 8 | Result of the described error |
| 9 | Hardware error in the MC board |
| 10 | Hardware error in the IV board |
| 11 | Reserved, this error code is not used |
| 12 | Hardware error in the IQ board |
| 13 | Hardware error in the VP board |
| 14 | Hardware error in the IF board |
| 15 | The maximum permissible load for the +24 V power supply for external relays at the «Relay» plug is exceeded. See Chapter 2 Technical Data, 9. |
| 16 | The maximum permissible load for the +5 V power supply for the RS232 interface is exceeded. See Chapter 2 Technical Data, 9. |
| 17 | Disturbances in the RS232 cable, caused by electric or magnetic interference or by faulty/improper wiring |
| 18 | RS232 configuration of the IM 540 is not compatible with the one of the connected device |
| 19 | Wrong firmware installed in the IF 540 P board. See GA IF 540 P. |
| 20 | IF 540 P board is not installed correctly. See GA IF 540 P. |
| 21 | A SW update has been performed |
| 22 | General IM 540 software error |
| 23 | Hardware error in the display module (CS board) |

| Code | Meaning |
|------|---|
| 24 | Thermal problem (e.g. louvers obstructed or ambient temperature too high). See Chapter 2 Technical Data, 9. |

Suggestions for error correction

| Code | Meaning |
|------|---|
| 1 | Delete the error message |
| 2 | Restart the device |
| 3 | Replace the sensor and restart |
| 4 | Connect the correct sensor and restart |
| 5 | Use a suitable sensor cable and restart |
| 6 | Select a less sensitive current amplification program |
| 7 | Correcting a sensor connection problem: Read the respective entries in Section «Possible cause of the error», 254 and perform suitable corrective actions. Then restart the device. |
| 8 | Find the cause for the pressure rise and correct the pressure problem |
| 9 | Avoid the degas command if the pressure is too high |
| 10 | Observe the permissible measuring range for the connected sensor |
| 11 | Select a valid gas type table, create or assign a suitable gas type table, or select a suitable sensor |
| 12 | Enter the device parameters again |
| 13 | Check the RS232 parameter settings of the IM 540 and the connected device (PC, control, etc.). Correct the settings if necessary. |
| 14 | Check the interface cable and plug-in connections. Replace the parts if necessary. |
| 15 | Check the correct use of the connection, pay attention to the maximum load. See Chapter 2 Technical Data, 9. |
| 16 | Replace the firmware EEPROM on the IF 540 P Profibus board with the latest version. See GA IF 540 P. |
| 17 | Pay attention to correct installation of the IF 540 P Profibus board. See GA IF 540 P. |
| 18 | Make sure that air can circulate freely through the device, adhere to the ambient temperature range (see Chapter 2 Technical Data, 9), wait for the cooldown time |

| Code | Meaning |
|------|---|
| 19 | Adjust the «Filament power» parameter. See Chapter 5.3.5,  79. |
| 20 | Manually configure the mains frequency in the USER mode |
| 21 | Write down the current device parameters (if still possible) and send the device back the the service center |

Useful test functions

| Chapter | Meaning |
|---------|--|
| 8.4.x | <p>Test program recommendation:</p> <p>The IM 540 provides a number of useful test functions which make troubleshooting easier.</p> <p>Pay attention to the required safety measures when using the test mode.</p> |

Literature

- [1] Operating Manual
THERMOVAC-Transmitter TTR 90
GA 09.220
Oerlikon Leybold Vacuum GmbH, D-50968 Köln
- [2] Operating Manual
THERMOVAC-Transmitter TTR 90S
GA 09.220
Oerlikon Leybold Vacuum GmbH, D-50968 Köln
- [3] Operating Manual
CERAVAC-Transmitter CTR 90
GA 09.040
Oerlikon Leybold Vacuum GmbH, D-50968 Köln
- [4] Operating Manual
CERAVAC-Transmitter CTR 91
GA 09.040
Oerlikon Leybold Vacuum GmbH, D-50968 Köln
- [5] Operating Manual
IONIVAC-Sensors IE 414, IE 514
300265097_002_A0
Oerlikon Leybold Vacuum GmbH, D-50968 Köln
- [6] Operating Manual
Profibus-DP Interface Board
SB 09.419/1.02
Oerlikon Leybold Vacuum GmbH, D-50968 Köln

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EC Declaration of Conformity

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herewith declares that the products specified and listed below which we have placed on the market, comply with the applicable EC Council Directives. This declaration becomes invalid if modifications are made to the product without agreement of Oerlikon Leybold Vacuum GmbH. Compliance with the EMC Directives requires that the components are installed within a system or machine in a manner adapted to EMC requirements.

Product designation: Ionisation Gauge Controller

Type designation: IONIVAC IM 540

Catalogue No.: 230100

The product complies to the following European Council Directive:

- Directive on Low Voltage (2006/95/EC)
- Directive on Electromagnetic Compatibility (2004/108/EC)
- Directive on Restriction of the use of certain Hazardous Substances – RoHS (2011/65/EU)

The following harmonised standard has been applied:

- EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements
- EN 61000-6-2 Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
- EN 61000-6-4 Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
- EN 61326-1 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

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