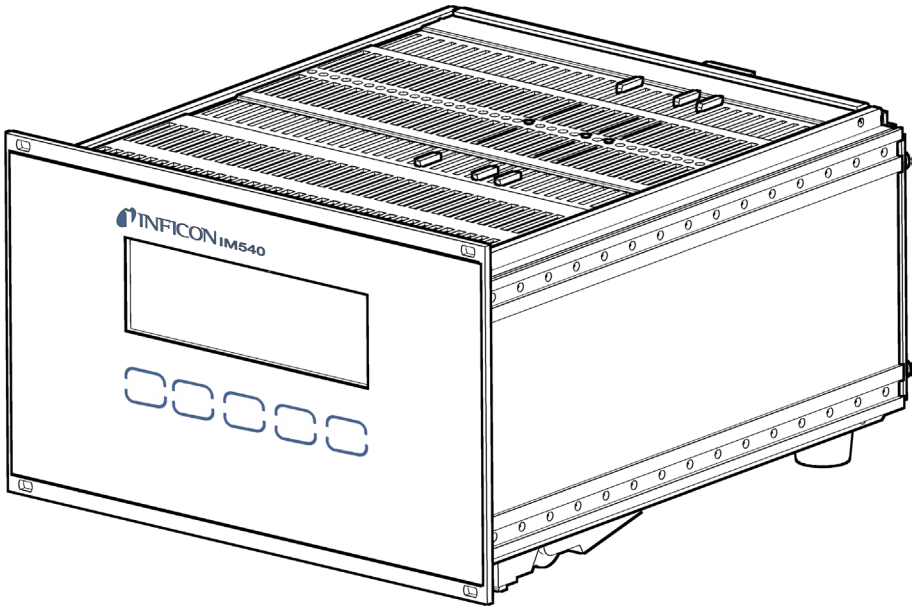


Operating Manual

Incl. EU Declaration of Conformity

IM540

Vacuum Gauge Controller

Table of Contents

For cross-references within this document, the symbol (→ 🗎 XY) is used; for cross-references to further documents listed under ‘Literature’, use is made of the symbol (→ 🕮 [Z]).

1 General

1.1 Validity

This document applies to products with part number:

399-660

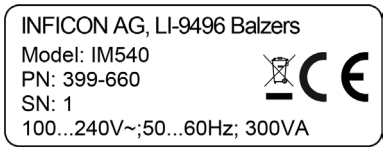
The part number (PN) can be taken from the product nameplate.

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

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 (→ «Info», 🗎 31).

We reserve the right to make technical changes without prior notice.

There is a type label attached to one side of the device. In all communication with INFICON, please state the information on the type label.



Specimen nameplate

1.2 Intended Use

The Vacuum Gauge Controller IM540 is a versatile microprocessor controlled ionization gauge controller for pressure measurements in the range 1×10^{-13} … 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 IM540 can handle four measuring systems simultaneously. An optional interface may be used for complete remote control of the device.

In the following, the Vacuum Gauge Controller IM540 will be referred to as «IM540».

1.3 Scope of Delivery

Designation	No
Vacuum Gauge Controller IM540	1
Mains cable, EUR version	1
Mains cable, US version	1
Casing feet, set	1
Collar screws	4
Plastic sleeves	4
Supplement with QR code	1

1.4 Safety

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.

Illustration of residual dangers

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

Danger

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

Warning

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

Caution

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

Indicates particularly important, but not safety-relevant information.

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.

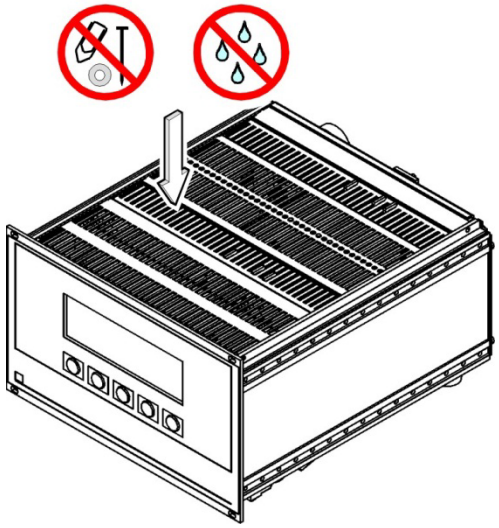
In particular, pay attention to the following safety notes:

Danger

Mains voltage

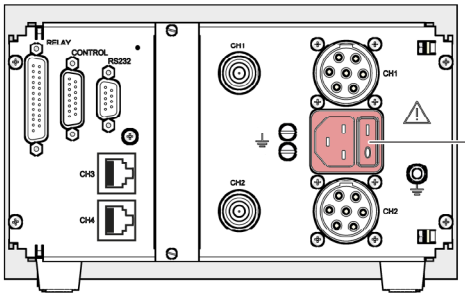
Contact with live parts is extremely hazardous when any objects are introduced or any liquids penetrate into the device.

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



Disconnecting device

The disconnecting device must be readily identifiable by and easily reached by the user.
To disconnect the unit from the mains supply, you must unplug the mains cable.



Caution

Improper use.

Improper use can damage the IM540.

Use the IM540 only as intended by the manufacturer (→ Intended Use, 🗎 5).

Caution

Improper installation and operation data.

Improper installation and operation data may damage the IM540.

Strictly adhere to the stipulated installation and operation data.

1.5 Liability and Warranty

INFICON assumes no liability and the warranty is rendered null and void if the end-user or third parties

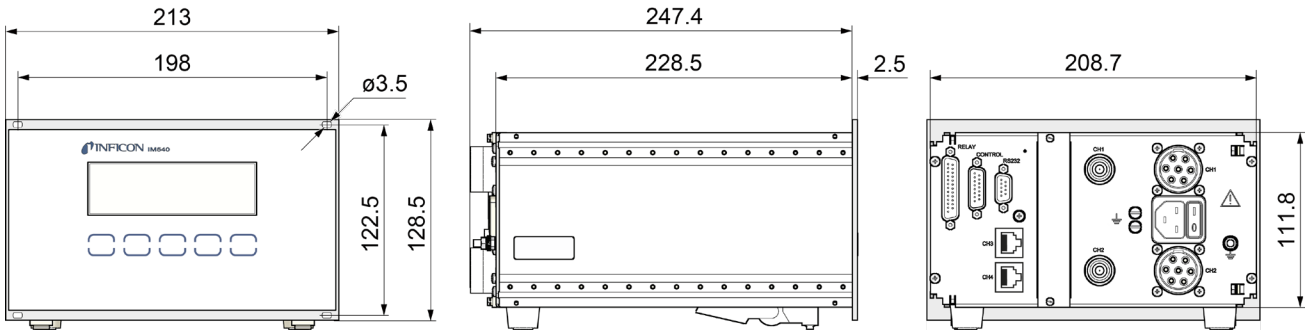
- disregard the information in this document
- use the product in a non-conforming manner
- make any kind of interventions (modifications, alterations etc.) on the product
- use the product with accessories not listed in the corresponding product documentation.

2 Technical Data

Mechanical data

Weight	approx. 3 kg
Use	desktop device, control panel mounted, rack mounted

Dimensions [mm]



Environment

Temperature	
Storage	-20 … +60°C
Operation	+5 … +40°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
Degree of protection	IP 20

Operation

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

Mains connection

Voltage	100 … 240 V (ac)
Frequency	50 … 60 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)

Channels 1 and 2

Gauge connections per channel	Metalock Bantam UTG0187SVDEU + BNC
Compatible gauges	IE414, IE514

Channels 3 and 4

Gauge connections per channel	RJ45 (FCC68)
Compatible gauges	PSG500, PSG500-S, PSG502-S, PSG510-S, PSG512-S CDG025D, CDG045D

Gauge supply

IE414, IE514

Measuring operation

	IE414	IE514
Anode potential	220 V	220 V
Reflector potential	–	205 V
Cathode potential	80 V	100 V
Emission current	0.1 mA [1]	1.6 mA
	1.0 mA [2]	
	10.0 mA [3]	

[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

	IE414	IE514
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

PSG50x, PSG51x-S CDG025D, CDG045D

Voltage	+24 V (dc) ±5%
Current	0 … 1 A per channel

Measuring ranges

Total measuring range: 1×10^{-13} … 1.3×10^{3} mbar

IE414 for pressure dependent emission current

Emission current [mA]	Pressure range [mbar]	Ion current [A]
10	10^{-11} … 10^{-8}	1.7×10^{-12} … 1.7×10^{-9}
1	10^{-8} … 10^{-5}	1.7×10^{-10} … 1.7×10^{-7}
0.1	10^{-5} … 10^{-2}	1.7×10^{-8} … 1.7×10^{-5}

IE414 for fixed emission current

Emission current [mA]	Pressure range [mbar]	Ion current [A]
10	10^{-11} … 10^{-2}	1.7×10^{-12} … 1.7×10^{-3}
1	10^{-11} … 10^{-2}	1.7×10^{-13} … 1.7×10^{-4}
0.1	10^{-11} … 10^{-2}	1.7×10^{-4} … 1.7×10^{-5}

IE514

Emission current [mA]	Pressure range [mbar]	Ionenstrom [A]
1.6	10^{-13} … 10^{-4}	1.6×10^{-15} … 1.6×10^{-6}

CDG025D, CDG045D

F.S. [Torr]	Pressure range [Torr]
0.1 (CDG045D only)	1×10^{-5} … 1×10^{-1}
1	1×10^{-4} … 1
10	1×10^{-3} … 1×10^{1}
100	1×10^{-2} … 1×10^{2}
1000	1×10^{-1} … 1×10^{3}

PSG50x, PSG51x-S

5×10^{-4} … 1×10^{3} mbar

Accuracy of measurement

Current	
Channels 1 and 2	
Relative to current reading	±2%
Absolute	±5 fA
Voltage	
Channels 3 and 4	
Relative to voltage reading	±1%
Absolute	±2 mV

Measuring speed

The measuring speed that can be achieved with IE gauges depend on the ion current to be measured and the selected resolution (details → "Current Measuring Amplifier (Amplifier)", 🗎 127).

The measuring rate of the gauges 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
Fast:	n = 5
Normal:	n = 15

Display rate, temperature drift, unit of measurement

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

Resolution of the A/D converter

CDG025D, CDG045D, PSG50x, PSG51x-S	16 Bit
IE414, IE514	≤14 Bit

Gauge identification

IE514	0 Ω (shorted) ≥4.25 V at the A/D converter
IE414	∞ Ω (interrupted) ≤0.75 V at the A/D converter
PSG50x, PSG51x-S	3.0 kΩ ± 1% 0.202 V at the A/D converter
CDG0xxD [1)]	13.2 kΩ ± 1% 0.849 V at the A/D converter

[1)] All gauges of the same type use the same identification resistor. The valid measuring range must be configured by the user (→ "Measuring Ranges", 🗎 9).

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

Relay outputs

Name	Relay
Connection	D-Sub, 25-pin, female
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 V (dc), 0.5 A

Control signals, recorder

Name	Control
Connection	D-Sub, 15-pin, 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

RS232

Name	RS232
Connection	D-Sub, 9-pin, female
Baud rate	300*), 600*), 1200*), 2400, 4800, 9600, 19200, 38400, 57600, 115200
Data	7-Bit, 8-Bit, 9-Bit
Parity	odd, even, none
Stop bits	1, 2

Interface board (option)

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 V (dc) / 50 V (ac)
Breaking capacity for current	1.5 A

Interface board with Profibus DP interface

Breaking capacity for voltage	30 V (dc) / 50 V (ac)

3 Installation

3.1 Unpacking

1. Visually inspect the transport packaging for signs of external damage.
2. Unpack the IM540 and put the packaging material aside.
3. Remove the protective film from the display.

   Keep the packaging material for later use. The IM540 must be stored and transported in the original packaging material only.

4. Examine the IM540 for completeness.
5. Visually inspect the IM540 for signs of damage.

Warning

Putting a product which is visibly damaged into operation can be extremely hazardous. If the product is visibly damaged do not put it into operation and make sure it is not inadvertently put into operation.

3.2 Mechanical Installation

The IM540 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:

Caution

Ambient temperature.

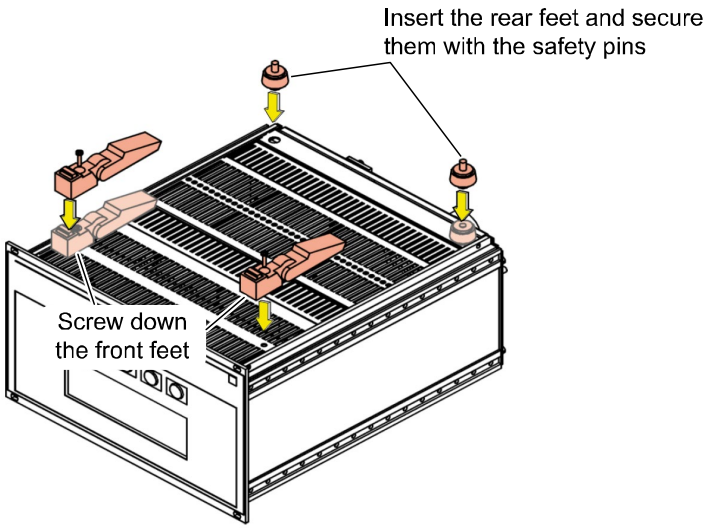
Exceeding the maximum permitted ambient temperature may damage the device. Make sure that the maximum permitted ambient temperature is not exceeded and that the air can flow freely through the louvers. Do not expose the device to direct sunlight.

3.2.1 Desk-Top Device

In order to use the IM540 as a desk-top device, proceed as follows:

1. Switch off the IM540 and disconnect it from mains power.
2. Turn the IM540 upside down as shown in step 4.
3. The holes for the legs are covered by plastic caps. Use a screw driver and remove the plastic caps.

❹ Screw the four legs on to the corners of the casing base plate.

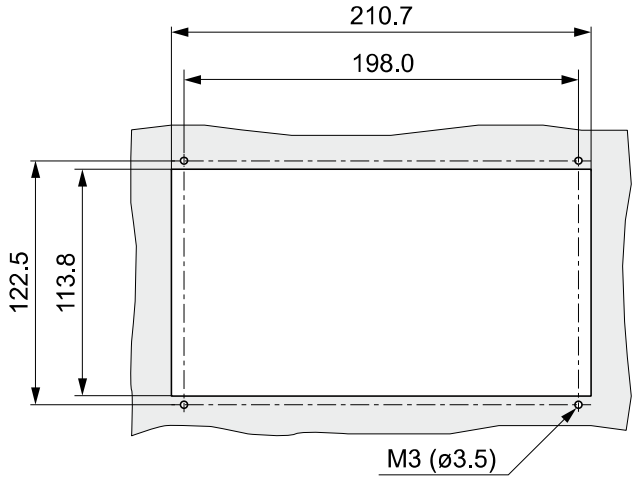


❺ If required, fold out the two front legs.

❻ Turn the IM540 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 (dimensions in [mm]):



❶ Insert the IM540 into the cutout.

❷ Fasten the device with four M3 screws

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

3.2.3 Rack Installation

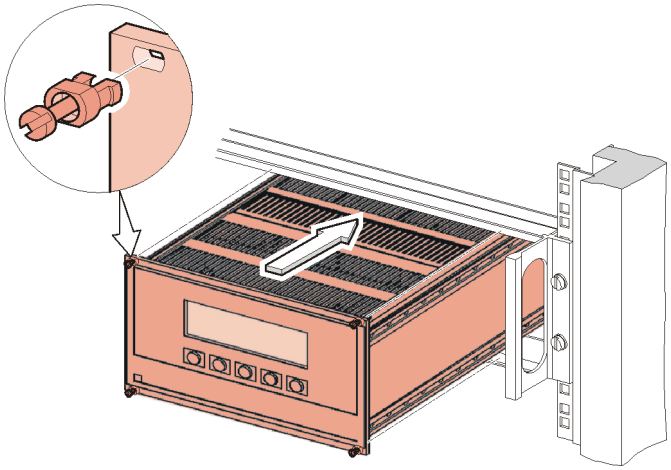
The IM540 is designed for installation into a rack chassis adapter according to DIN 41 494 (19", 3 HU). For this purpose, 4 collar screws and 4 plastic sleeves are supplied with the device.

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.



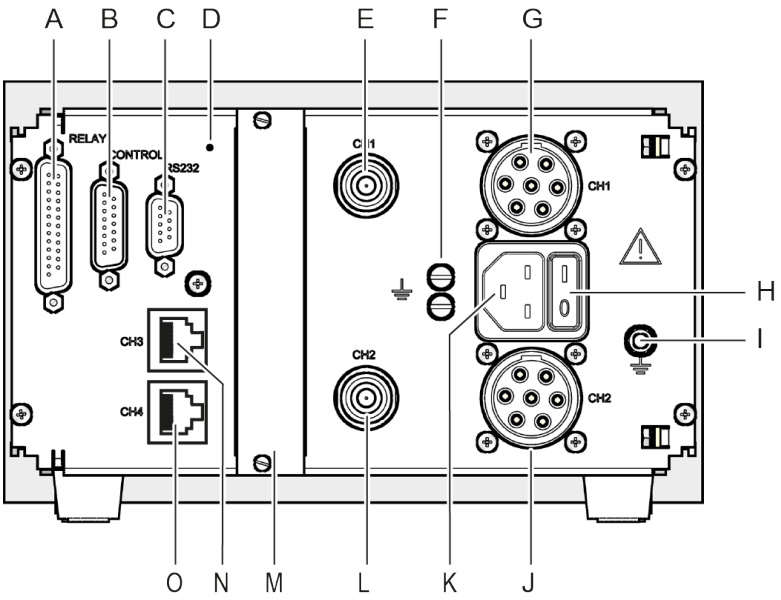
In order to reduce the strain on the front panel it is recommended to equip the rack chassis adapter with a guide rail.

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 IM540 into the rack chassis adapter.
3. Fasten the IM540 with the supplied collar screws and plastic sleeves to the rack chassis adapter.

3.3 Connecting

3.3.1 Back Side of the Device



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

Warning

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.

Warning

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.

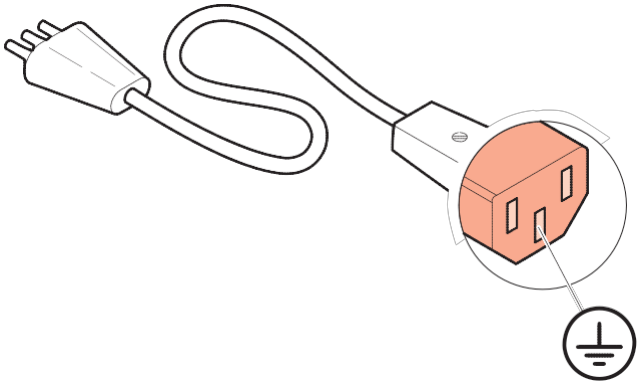
The configuration of the available connections is described in the following sections.

3.3.2 Mains Connection

The mains connection (→ pos. K, 🗎 15) 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 × 1.5 mm^2 or larger



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.

❶ Connect the European appliance connector of the mains cord with the mains connection of the device.

❷ Connect the plug of the mains cable with the wall socket.

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 (→ pos. I, 🗎 15) can be used to connect the IM540 with the protective ground of the pumping station.

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

The metal flanges of the IE414 and IE514 gauges are connected to the ground via the measuring lines inside of the IM540.

Heat sink

The heat sink is connected to the casing with two ground screws (→ pos. F, 🗎 15). Do not turn or loosen these screws

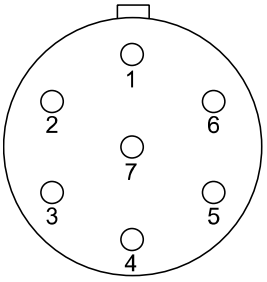
3.3.4 CH1 and CH2

The CH1 and CH2 connections are used to connect IE414/514 gauges.

Control signals

A 7-pin appliance socket (type Metalock Bantam) is available for each channel (→ pos. G and J, 🗎 15).

Pin assignment:



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

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 gauge or the measuring line. After switching off, wait approx. 15 seconds before starting the work.

Measuring signals

The measuring signals, i.e. the ion currents, of each gauge are transferred via a coaxial cable (→ pos. E and L, 🗎 15).

Pin assignment:

Inner conductor: Ion current

Outer conductor: Shielding

Danger

Hazardous voltage.

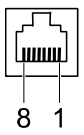
During operation of the IE414 and IE514 gauges, a hazardous voltage may be present at the measuring signal connection (→ pos. E and L, 🗎 15) in case of a failure.

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 CDG and PSG gauges.

A 8-pin RJ45 appliance socket is available for each channel (→ pos. N and O, 🗎 15).



1	+24 V(dc)	5	Signal-GND
2	PGND	6	n.c. (not connected)
3	U_in	7	n.c. (not connected)
4	Ident	8	n.c. (not connected)

Caution

Improper gauge.

Gauges which are not designed for use with the IM540 may damage the device.

Operate the IM540 with proper gauges only (→ 🗎 8).

Caution

Multiple connection.

Only one gauge may be connected to each of the channels. Otherwise the connected gauges will be damaged.

Never connect more than one gauge per channel.

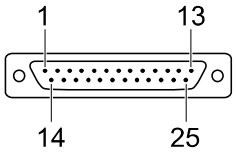
❶ CH3: Connect the gauge with the CH3 connection. Use a shielded 1:1 cable.

❷ CH4: Connect the gauge 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 IM540. The RELAY connection (→ pos. A, 🗎 15) allows to utilize the relay contacts for switching purposes. The relay contacts are potential-free (floating).

Pin assignment:



1	GND	16	Emission off (NC)
2	GND	17	Emission common (COM)
3	Channel 2 error (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 error (NC)
8	Trigger 2 off (NC)	23	Channel 1 common (COM)
9	Trigger 2 common (COM)	24	Channel 1 ready (NO)
10	Trigger 2 on (NO)	25	+24 V (dc), 200 mA Meets the requirements of a ground protective extra low voltage (PELV).
11	Channel 1 selected (NC)		
12	Channel 1 / 2 common (COM)		
13	Channel 2 selected (NO)		
14	Channel 2 ready (NO)		
15	Channel 2 common (COM)		

COM	common
NC	normally closed
NO	normally open

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

Warning

Hazardous voltage.

Voltages above 60 V (dc) or 30 V (ac) pose a shock hazard.

The RELAY connection may be used for switching voltages of max. 60 V (dc) or 30 V (ac) only. These voltages must meet the requirements of a ground protective extra low voltage (PELV).

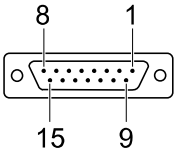
1. Connect the peripheral components with the RELAY connection. Use a shielded cable.

3.3.7 CONTROL

The CONTROL connection (→ pos. B, 🗎 15) 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:



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		

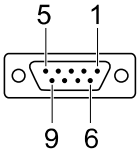
1. Connect the peripheral components with the CONTROL connection. Use a shielded cable.

3.3.8 RS232

The RS232 serial interface (→ pos. c, 🗎 15) allows remote control of the device via a computer or a terminal.

In addition, the interface may be used for firmware updates (→ "Program Transfer Mode", 🗎 121).

Pin assignment:



1	DCD, +5 V external supply, max. 300 mA	5	GND
		6	DSR
2	TxD	7	n.c. (not connected)
3	RxD	8	CTS
4	n.c. (not connected)	9	RI

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

☞ 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)

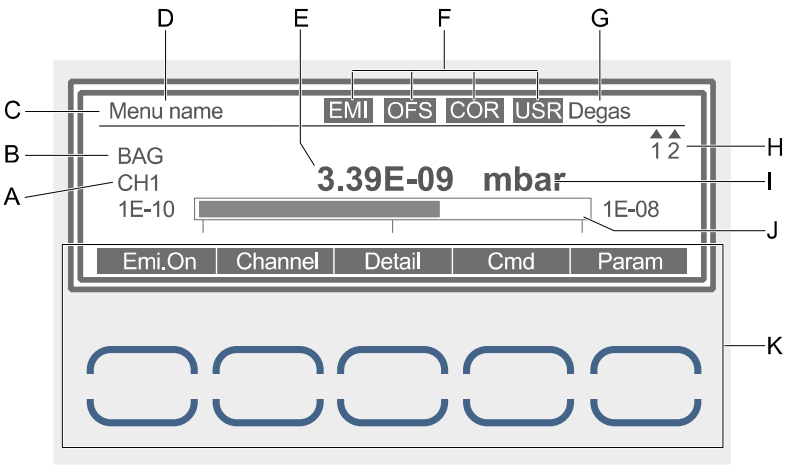
An interface board in the extension slot (→ pos. M, 🗎 15) can be used to extend the device with 5 more relays and one more interface.

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



A	Channel	G	Status display (black letters)
B	Gauge 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

Status row

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

The left part of the status row displays the menu name (pos. D) in black letters on a white background.

The right part of the status row (pos. 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 gauge is activated
3	COR	Gas type correction is programmed
4	USR	Standard parameter settings have been changed by the user

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

The right position of the status row (pos. 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 xyz	Error no. xyz has been issued • Flashing: Error has not yet been acknowledged • Static: Error has been acknowledged via the «Error» submenu (→ "Detail Groups", 🗎 31)
Test	Hardware test is being performed (→ "Test Mode", 🗎 123)
Degas	Gauge 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 (→ "Emergency-Off Action", 🗎 28)
Profi	Device is controlled via Profibus (→ "Device Control (Control)", 🗎 42)
IF540x	Device is controlled via RS232 of the optional interface board (→ "Device Control (Control)", 🗎 42)
RS232	Device is controlled via RS232 and the IM540 protocol (→ "Device Control (Control)", 🗎 42)
Remote	Device is controlled via discrete remote control inputs (→ "Device Control (Control)", 🗎 42)
(nothing)	None of the conditions mentioned above applies

Trigger relay status

The states of the two trigger relays are displayed to the right of the display (pos. 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 (→ Fig. Hysteresis, 🗎 39).

These states are only displayed if trigger relays have been selected for this (→ "Configuring Switching Functions", 🗎 39).

Measurement Display

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

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.
- Bar graph: 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 bar graph can be customized (→ "Display, Bar graph (Disp.Bar)", 🗎 46).

Important Messages

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

Display	Significance
Ov.Temp	Overtemp signal of the power supply is active, measurement cannot be performed
WaitCon	IM540 Mode, gauge control function activated, the displayed channel is waiting for release by the controlling system
CodErr	The identification resistance of a previous connected gauge cannot be detected
PowErr	Error caused by the power supply of the displayed channel

Channels

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

The following gauge types are available:

Display	Significance
EXT	Extractor IE514
BAG	Bayard Alpert IE414
CDG	Capacitance gauge: CDG025D, CDG045D
PSG	Pirani gauge: PSG50x, PSG51x-S

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

Display	Significance
BAG CH1	Channel 1 connected to a Bayard-Alpert gauge
EXT CH1	Channel 1 connected to an Extractor gauge
BAG CH2	Channel 2 connected to a Bayard-Alpert gauge
EXT CH2	Channel 2 connected to an Extractor gauge
PSG CH3	Channel 3 connected to a Pirani gauge
CDG CH3	Channel 3 connected to a capacitance gauge
PSG CH4	Channel 4 connected to a Pirani gauge
CDG CH4	Channel 4 connected to a capacitance gauge

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 gauge connected to the selected channel. Switching off the gauge 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 (→ "Emergency-Off Action", 🖹 28).

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 gauge.

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

If the displayed gauge 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.

Detail

This menu displays important parameters and error messages. In addition, you can configure the graphical display of measurements and view the related settings (→ "Detail View Mode", 🗎 31).

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 gauge. The labeling of the button changes to «Deg.Off».

Ofs.Set

his button is only visible in the Cmd menu.

It activates the offset function for the selected gauge. 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 gauge 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	Gauge parameters
Ioni Amp	Current amplifier parameters
Control	Gauge control
UserMode	User-defined settings
TestMode	Settings for hardware tests. This submenu is only available after activating the test mode (→ "Test Mode", 🗎 123).

Related configuration parameters → "Parameters", 🗎 38.

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

❶ Switch the mains switch on (→ pos. H, 🗎 15).

After switching on, the IM540 will perform the following actions:

- Self test
- Identify all gauges (→ "Gauge Identification", 🗎 10).
- Restore the previously set parameters
- Activate measurement mode
- Adapt parameters (if a gauge type has changed meanwhile)

4.2.2 Switching Off

❶ Switch the mains switch off (→ pos. H, 🗎 15)

4.2.3 Delay Time

After switching off, the IM540 requires approximately 10 seconds to initialize again.
Wait for at least 10 seconds before you switch the IM540 on again.

If the IM540 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 IM540 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 gauges. In case of an error, a status message is displayed instead (→ "Measurement Mode", 🗎 26).

Detail view mode

The detail view mode is used to display various values and error messages (if any) in a clear layout (→ "Detail View Mode", 🗎 31).

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 IM540 (→ "Parameter Mode", 🗎 38).

User mode

The user mode allows you to control and, if necessary, change these standard parameters (→ "User Parameters (UserMode)", 🗎 56).

Program transfer mode

The program transfer mode is used to transfer the latest version of the firmware to the IM540 (→ "Program Transfer Mode", 🗎 121).

Test mode

The test mode is used for service purposes. Here you can query and change device data and also perform device tests (→ "Test Mode", 🗎 123).

4.4 Measurement Mode

4.4.1 Selecting Measurement Mode

The IM540 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

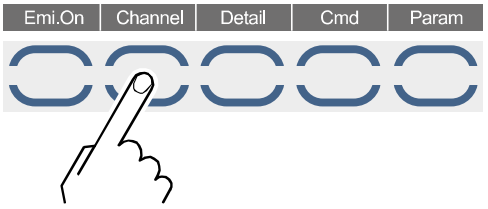
The measurement mode is the standard operating mode. It displays the pressure readings of the gauges. A status message is displayed if the pressure exceeds the permissible range.

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

4.4.3 Selecting a Channel

❶ Press the Channel button

- If the display is set to the automatic mode (→ "Sensor Activation Mode (Mode)", 🗎 55), the automatic mode will be interrupted and the active channel is displayed. The «Auto Control» signal in the status row is dark.



❷ 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 gauge. The channel number and the gauge 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.

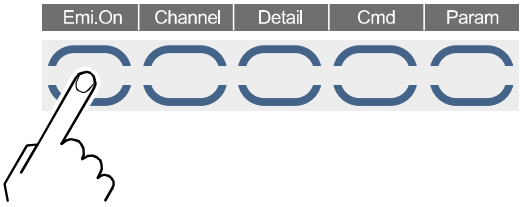
Excessive gas pressure at the measurement position can damage the gauge.

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
- Extractor: $p \leq 9.98 \times 10^{-5}$ mbar

❶ Select the required channel (→ "Selecting a Channel", 🗎 26).

❷ Press the Emi.On button.



- The gauge 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 gauge or the measuring line. After switching off, wait approx. 15 seconds before starting the work.

Danger

Hazardous voltage.

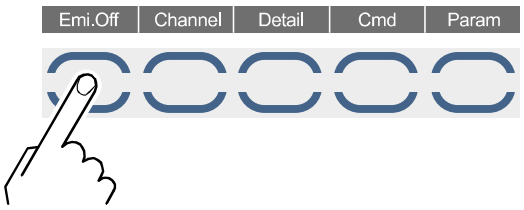
During operation of the IE414 and IE514 gauges, a hazardous voltage may be present at the measuring signal connection (→ pos. E and L, 🗎 15) in case of a failure.

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.

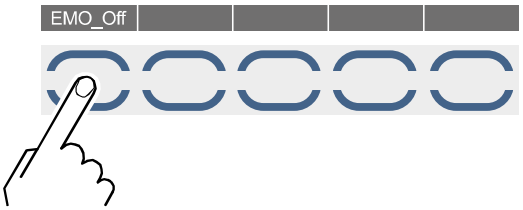
1. Select the required channel (→ " Selecting a Channel", 🗎 26).
2. Press the Emi.Off button.



- The hot ionization gauge IE414 / 514 is switched off, independent of the selected channel
- The «EMI» signal is dark
- Switching off the emission will also stop any running zero adjustment or degassing 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» (→ "Switching Emission Off", 🗎 29).



The «EMO» signal in the status row indicates this state (→ "Display", 🗎 21).

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 gauges 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 gauge.

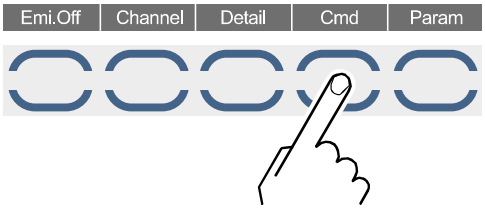
The degas function is only available for Bayard-Alpert and Extraktor gauges. It can only be activated if the emission of the gauge is already switched on and the pressure is below the following values:

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

You can switch on the degas function as follows:

1. Select the required channel (→ "Selecting a Channel", 🗎 26).

❷ Press the Cmd button.



❸ Press the Deg.On button.

- The degas function for the gauge 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:

❶ Select the required channel (→ "Selecting a Channel", 🗎 26).

❷ Press:

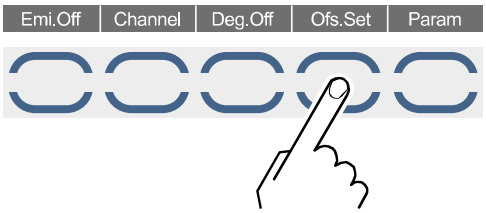
- the Emi.Off button, or
- the Cmd button and then the Deg.Off button

- The degas function for the gauge 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 gauges. The zero adjustment can only be performed if the emission is switched on.

1. Select the required channel (→ "Selecting a Channel", 🗎 26).
2. Press the Cmd button (→ fig. 🗎 29).
3. Press the Ofs.Set button.



In the case of capacitive gauges, 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 (→ Detail Groups", 🗎 31).

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 (→ "Automatic Offset (Auto_OFS)", 🗎 50).

4.4.10 Deactivating Offset

This chapter is only relevant for capacitive gauges!

1. Select the required channel (→"Selecting a Channel", 🗎 26).
2. Press the Cmd button (→ fig. 🗎 29).
3. 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

❶ Press the Detail button

The device changes to the detail view mode. Several groups are being offered for selection on the display (→ "Detail Groups", 🗎 31).

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 (→ "Displaying and Handling System Errors", 🗎 36).

Graphic

This group allows you to define and start one trend graphic per channel. Related graphic parameters → "Graphic Parameters (Detail Graphic), 🗎 58).

Pressure

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

Setpoint

Display all switching functions (→ "Switching Function Parameters (Setpoint)", 🗎 38).

Gauge

Display the following parameters of the current ionization gauge:

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.

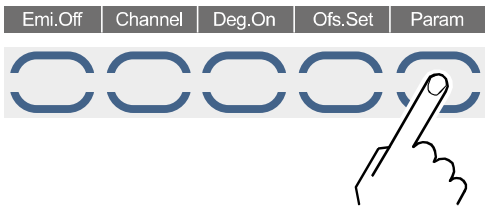
The following submenus are available:

Submenu	Display / function
Offset	Display the current offset value settings. Ranges: • CH1 and CH2: 0 … 4095 • CH3 and CH4: -3.000 V … +3.000 V (if CDG is connected) Adjustment of offset values → "Defining and Activating Offset, 🗎 29.
OPTCnt.	Operating hours of the four channels. The individual gauges are counted separately. The operating hours can be reset to zero (→ "Resetting the Operating Hours", 🗎 121).
EMOCnt.	Number of the emergency off events in channel 1 and 2. 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 (→ " Behavior of the IM540 in Case of an Error (Error), 🗎 47). The device distinguishes between the following two emergency off events: • Pre.: Pressure too high • Oth.: Other reasons The values can be reset to zero (→ Resetting the Operating Hours, 🗎 121).
Miscel.	Restart Cause for the most recent program start • «Power On» The device has been disconnected from the mains voltage and switched on again • «Watchdog» The watchdog has responded and the device has been restarted (failure, exception, …) OPTTot Display the operating hours of the entire device. This value cannot be reset. Prof.Ver Display the profibus firmware version. Only displayed if a profibus card is installed and recognized.
MC board (Micro Controller) IQ board (ion source) VP board (connection print) IV board (ion amplifier)	Display of: • Artic.No: Part number • Seria.No: Serial number • Cal-Date: Calibration date • FW-Vers: Firmware version • HW-Vers: Hardware version

4.6 Parameter Mode

4.6.1 Selecting Parameter Mode

❶ Press the Param button



The device changes to the parameter mode. Several submenus are being offered for selection on the display.

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 IM540.

The following table shows all available parameter groups and parameters.

Parameter group	Subgroup	Parameter	
Setpoint		Setpoint Channel Display Mode	Spt.Low Spt.High Trigger
General		Device	Control
	Setup	Unit Torr Set.Lock	Light Contrast Men.Time
	RS232	Com.Chan Baudrate DataBits TalkOnly	Parity Stopbits FlowCont
	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 PSG_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	→ "Test Parameters and Functions", 🗎 125		

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 (→ "Switching Function Parameters (Setpoint)", 🗎 38).

General parameters (General)

These parameters are used for general configuration of the device. The parameters affect all channels (→ "General Parameters (General), 🗎 40).

Sensor parameters (Sensor)

These parameters concern the gauge on the currently selected channel only. There is an individual set of gauge parameters for each channel (→ "Sensor Parameters (Sensor), 🗎 49).

Current amplifier parameters (Ioni Amp)

M These parameters are used for configuration of the current amplifier (→ "Current Amplifier Parameters (IoniAmp)", 🗎 54).

Sensor control (Control)

These parameters are used to configure the control inputs (→ "Sensor Control (Control), 🗎 54).

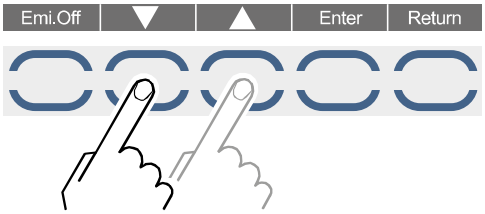
4.7 Basic Operation

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

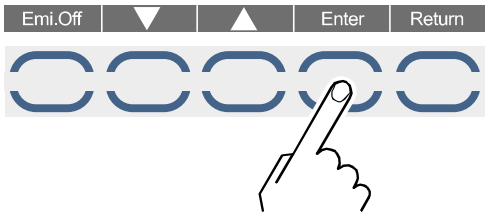
❶ Press the Param button.

❷ 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



❸ Press the Enter button.



❹ 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

❺ Press the Enter button:

- The cursor appears at the selected parameter value
- The IM540 is now in the edit mode. The Return button is replaced by the ESC button.

❻ 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.

❼ Accept the selected parameter value by pressing the Enter button:

- The parameter value is stored in the EEPROM
- The edit mode is quit

❽ 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.

❾ Return to the measurement mode (→ "Selecting Measurement Mode", 🗎 26).

4.8 Displaying and Handling System Errors

4.8.1 Displaying System Errors

The IM540 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 three-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», 🗎 147.

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.

❶ Change to the detail view mode (→ "Selecting Detail View Mode, 🗎 31).

❷ Select the Error detail group and then press the Enter button:

- The labeling of the Enter button changes to «Reset»

❸ Use the arrow buttons to select the error message you want to delete.

❹ 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
- Spt.Low
- Spt.High
- Trigger

5.1.1 Fundamental Terms

Switching functions

The IM540 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 (→ "RELAY", 🗎 18 and "Extension Slot (Option)", 🗎 20).

Threshold values

Depending on the connected gauge, 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

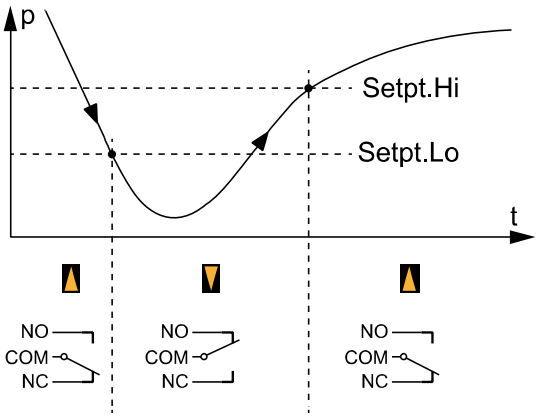
  The lower threshold value is responsible for activating the assigned switching function. The relay switches on as soon as the pressure falls below the lower threshold value. This means that the common contact of the relay is connected to the make contact.

- 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 break contact.

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.



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

❶ In the Setpoint parameter, select the relay to be configured.

❷ In the Channel parameter, select the channel to be assigned to the relay mentioned above.

❸ 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

❹ Adjust the upper and the lower threshold value of the selected relay:

- The threshold values depend on the connected gauge (→ "Threshold Values, Trigger Values, 🗎 137

❺ Enable or disable the switching function of the selected relay.

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», 🗎 137.

The hysteresis amounts to 10 % (IE414, IE514 and PSG50x, PSG51x-S) and to 1 % (capacitive gauges) 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)

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

The unit of measurement is shown on the display (→ pos. I, 🗎 21).

The pressure unit «Torr» can be locked. In this case Torr is not available for selection (→ "Torr-Lock (Torr)", 🗎 40).

Torr-Lock (Torr)

This parameter affects the general parameter Unit. If the lock is enabled, the unit of measurement «Torr» cannot be selected anymore (→ "Unit of Measurement (Unit)", 🗎 40).

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

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

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: • Channel • Trigger • Pressure unit • Offset settings • All Test mode settings The following softkeys are disabled: • 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.

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

Display Background Illumination (Light)

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

Display Contrast (Contrast)

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

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

5.2.2 Interface Parameters (RS232)

Interface (Com.Chan)

Interface to be configured.

Display	Significance
Standard	RS232 interface of the IM540 standard version
IF540x	RS232 interface of the optional interface board

Baud Rate (Baudrate)

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

Number of Data Bits (DataBits)

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

«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».

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 interface receives any character. Therefore, this setting must not be polled.

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

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.

5.2.3 Device Control (Control)

The Control parameter determines how the IM540 is operated and controlled. This parameter is only available in the standard operating mode.

Display	Significance
Manual	Operation and control via: • Buttons • CONTROL interface (Analog Remote, Digital Remote)
IF540x	Operation and control via: • 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: • Buttons • Standard RS232 interface The status row displays «RS232». The buttons (except for emergency-off) can be locked via the RS232 interface.

5.2.4 Recorder Outputs (Recorder)

The IM540 is equipped with two recorder outputs which can be configured. The recorder output voltage is kept at a constant level during the following actions.

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

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.

Measuring Channel (Source)

Measuring channel which is assigned to the selected recorder output. In addition to the measuring channels listed on 🗎 23, the following settings are available:

Display	Significance
CH1-CH4	Measuring channel 1 … 4
None	No assignment
Auto	This value is only available if the parameter «Sensor Control -Mode» has been set to «Auto» (→ "Sensor Activation Mode (Mode)", 🗎 55). In this case, the gauges and the measuring range are specified by the combination of the gauges defined in the automatic run. When switching from one gauge to the next one, the last valid value is output until valid readings are available from the new gauge.

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	The entire pressure range of the selected gauge is transformed to an output voltage of 0 … 10 V. Source: Chan 1-4 P_Low: Lower range limt of the connected gauge (not modifiable) P_High: Upper range limt of the connected gauge (not modifiable)
Expo	The exponent of the reading of the related gauge 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. Output voltage = (Reading_Exponent + 14) × 0.5 volts 1E-14 is equivalent 0 V 1E+6 is equivalent 10 V Scale: ----- P_Low: ----- P_High: -----
Auto	Outputs the mantissa of the reading of the related gauge, 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 gauge (→ "Pressure Range Limits (P_Low, P_High)", 🗎 44). Source: Chan 1-4 P_Low: Lower range limit of the connected gauge (modifiable within the range limits of the gauge) P_High: Upper range limit of the connected gauge (modifiable within the range limits of the gauge)

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 (→ "Characteristic Curves (Scale), 🗎 45). You specify the pressure range limits in the user mode (→ "Pressure Range (Mode)", 🗎 44).

The adjustable ranges for the lower and upper range limits are described in Section «Threshold Values, Trigger Values», 🗎 137.

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.

Characteristic Curves (Scale)

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

Display	Significance
lin	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. 10 volts relate to the upper limit, 0 V to the lower limit of the pressure range.
log	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. The range limits are defined by output voltages of 0 and 10 volts.

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

Display	Significance
Mode Full	The entire measuring range is mapped linearly to 0 … 10 V U out = 10.0 V × (Reading - MIN_Pressure_Sensor) / (MAX_Pressure_Sensor - MIN_Pressure_Sensor)
Mode Expo	The Lin setting has no effect U out = (Reading_Exponent + 14) × 0.5 volts
Mode Auto	The mantissa of the reading is mapped linearly U out = 10.0 V × Reading_Mantissa
Mode User	The range that has been adjusted by the user is mapped linearly to 0 … 10 V U out = 10.0 V × (Reading - MIN_Pressure_User) / (MAX_Pressure_User - MIN_Pressure_User)

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», 137.

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 IM540 display.

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

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

Explanations to MIN_Pressure_Sensor, MAX_Pressure_Sensor, MIN_Pressure_User and MAX_Pressure_User: → Note 🗎 45.

5.2.5 Display, Bar Graph (Disp.Bar)

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

Measuring channel (Channel)

Before the settings for a gauge can be configured, you have to select the channel to which the gauge is connected. This is done with the Channel parameter (→ "Measuring Channel (Cannel)", 🗎 49).

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 gauge
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 (→ "Pressure Range Limits (P_Low, P_High), 🗎 44)

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 gauge (→ "Threshold Values, Trigger Values", 🗎 137.

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.

5.2.6 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 submenu.

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 V. 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.

5.2.7 Behavior of the IM540 in Case of an Error (Error)

The behavior of the IM540 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 (→ 🗎 48).
NoReact.	Low	No reaction (no message, emission is not switched off, error relay is not activated)

Automatic Gauge Switching in Case of an Error (FailCont)

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

The originally selected parameter value is preserved after automatic gauge switching has been triggered. It will be restored after the faulty gauge has been replaced, the device reset (mains switch turned off and on), and two working gauges are found at the IM540.

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

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

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 (→ "Error Signal Relays (FailRel1, FailRel2)", 🗎 47).
Swit.Off	Emission and power supply are switched off. The error signal relay is activated. This event is considered an emergency off (→ «Info», 🗎 31).

Emi.Tol.

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

- 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», 🗎 147.

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 », 🗎 147.

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.

5.3 Gauge Parameters (Sensor)

There is an individual set of gauge parameters for each channel. The number of available parameters depends on the gauge type which is connected to the selected channel.

Gauge	Filter	Auto_OFC	Cal/Full	Fil.Pow.	Emis.Cur	Disp.Bar	Cor.Mode	Cor.Gain
IE514	✓		✓	✓		✓	✓	✓
IE414	✓		✓	✓	✓	✓	✓	✓
CDG (all)	✓	✓	✓			✓	✓	✓
PSG (all)	✓					✓	✓	✓

5.3.1 Measuring Channel (Channel)

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

Display	Significance
1−BAG	Channel 1 connected to a Bayard-Alpert gauge
1−EXT	Channel 1 connected to an Extractor gauge
2−BAG	Channel 2 connected to a Bayard-Alpert gauge
2−EXT	Channel 2 connected to an Extractor gauge
3−PSG	Channel 3 connected to a Pirani gauge
3−CDG	Channel 3 connected to a capacitive gauge
4−PSG	Channel 4 connected to a Pirani gauge
4−CDG	Channel 4 connected to a capacitive gauge

5.3.2 Measurement Filter (Filter)

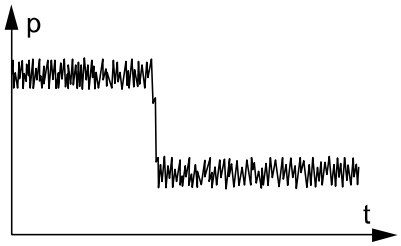
The filter improves measurements if the signal is noisy or disturbed. The filter affects the readings on the display, all interface outputs (RS232, Profibus), the recorder outputs and the switching functions. If selected, a filter is active in the entire pressure range.

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

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

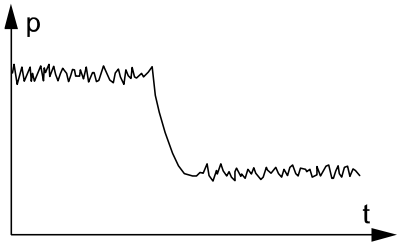
None (n = 1)
The filter is deactivated.

Fast (n = 5)
The IM540 responds quickly to signal changes. This makes it rather sensitive to signal noise.



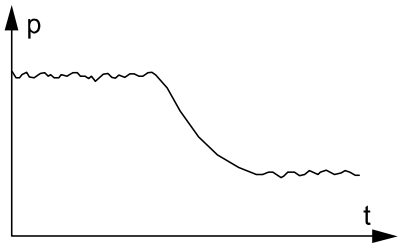
Normal (n = 15)

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



Slow (n = 50)

The IM540 responds slowly to signal changes. This makes it less sensitive to signal noise. This setting is recommended for precise comparison measurements.



5.3.3 Automatic Offset (Auto_OFS)

This menu is only offered for channel 3 and 4, and only if a capacitive gauge 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 gauge is adjusted automatically. When crossing below or above a pressure limit which is at least 2 decades below the lower measuring limit of the gauge, the offset value of the gauge is measured and stored.

If this automatic function is switched on, the manual zero adjustment cannot be performed (→ "Defining and Activating Offset", 🗎 29).

5.3.4 Sensitivity Adjustment (Cal_Full)

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

The sensitivity is adjusted via the respective gauge constant (IE414, IE514) or the measuring range (CDG). It is not possible to adjust the sensitivity for Pirani gauges

Gauge constant (IE414, IE514)

The following values can be input for the gauge constant:

Gauge	Range (mbar^{-1})	Resolution (mbar^{-1})
IE414	5.00 … 30.00	0.01
IE514	1.00 … 20.00	0.01

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

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

Measuring range (CDG)

In the case of a capacitive gauge, select its upper measuring range limit (→ "Measuring Ranges, 🗎 9.

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 gauge 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 (→ "Emi.Pow", 🗎 48).

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 gauge is connected.

Display	Significance
Auto	The emission current is switched automatically depending on the pressure range (→ "IE414, IE514", 🗎 9).
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.

Caution

Excessive emission current.

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

Only set the emission current to a fixed value if you can be sure that the gauge will operate at sufficiently low pressure levels (→ "IE414, IE514", 🗎 9).

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 gauges.

The default value is 0.00. The value can be adjusted between 1.00E-10 and 1.00E-13 mbar.

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

Gauges 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 respec- tive 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 ex- ceeds 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 (→ "User- Defined Correction Factors (Correct > Clear-All, Index, Factor, Press), 🗎 52).

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 IM540 allows you to define your own table of correction factors for each gauge. These correction factors can be used for gas type correction as well as for correction of other measuring errors.

The correction factors for a gauge 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» (→ "Automatic Gas Type Correction (Correct > Cor.Mode)", 🗎 51).

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

The user-defined correction factors are preserved even if the entire device is reset to the default parameters (→ "Starting the IM540 With Default Parameters", 🗎 122).

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:

❶ Switch the Channel parameter to the edit mode.

❷ 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

❸ Switch the Factor parameter to the edit mode.

❹ 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

❺ Switch the Pressure parameter to the edit mode.

❻ 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 gauge (→ "Measuring Ranges", 🗎 9).

❼ 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

❽ Press the Enter button.

❾ Repeat steps 3 … 8 to define more anchor points.

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

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.

Deleting Single Anchor Points

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

❶ Use the Index parameter to select the anchor point to be deleted.

❷ Switch the Factor parameter to the edit mode.

❸ 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

❹ Press the Enter button:

- The correction value is set to 1

Deleting all Anchor Points from the Table

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

❶ Switch the Channel parameter to the edit mode.

❷ Use the arrow buttons to select the channel whose table is to be deleted. Then press the Enter button.

❸ Switch the ClearAll parameter to the edit mode.

❹ Use the arrow buttons and select «Yes». Then press the Enter button:

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

Automatic Check of the Correction Table

If the device starts up or recognizes a new gauge, 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 gauge
- Correction table has been edited:
  The device checks if the table is suitable for the connected gauge. If this is not the case, an error message is output and the Cor.Mode parameter is set to «None» (→ "Automatic Gas Type Correction (Correct > Cor.Mode)", 🗎 51). Any attempt to set the Cor.Mode parameter to «User» also causes an error message.

5.4 Current Amplifier Parameters (IoniAmp)

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 IM540 always selects the best measuring range automatically. Previously, for pressures below 1E-11 mbar, 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 Gauge Control (Control)

The IM540 offers several ways of operation and remote control (→ "Device Control (Control)", 🗎 42). 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 "Channels", 🗎 23, additional values are available for the Channel parameter.

Display	Significance
Channel	The parameter "Channel" specifies the channel which is used.
Ana+Con	Logical AND operation of the Analog and Contact functions. Emission is switched on only if the prerequisites are met for both functions.
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.
Analog	Emission is switched on and off according to the voltage at the «Analog Remote» input (→ "Threshold Values (Threshold)", 🗎 46).
PSG_Only	Only the PSG mode is used (→ "PSG Mode (PSG_Ctrl", 🗎 56)

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

5.5.2 Gauge Activation Mode (Mode)

The gauges 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 Extractor gauges, 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:

- 8×10-8 mbar for the Extractor gauge (IE514)
- 8×10-3 mbar for the Bayard-Alpert gauge (IE414)

The Selfcontrol function allows you to move this pressure limit to a lower value. In this case the gauge will monitor itself, i.e. if the pressure exceeds the value P_Off, the emission will be switched off (→ "Activation and Deactivation Values (P_On, P_Off)", 🗎 56). The gauge must then be switched on manually or via the interface.

Auto

The gauge s are switched on and off automatically.

For switching the emission on, the pressure of the gauge specified under «Source» is evaluated (→ "Activation Source (Source)", 🗎 55). 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 gauge which earlier switched on the emission is switched on again (→ "Activation and Deactivation Values (P_On, P_Off)", 🗎 56).

In addition to the emission, the display is controlled as well. The displayed pressure always relates to the gauge which is currently being used for pressure measurements. Pirani and capacitive gauges, 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 gauge 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 gauge selected in «Channel».

The Source function is subject to the following restrictions:

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

Gauges on the channels 1 and 2:

- One of the gauges can be switched on via channel 3 or 4. This selection cannot be made for the other gauge 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 gauges can be switched on by the other one. However, the gauges 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.

Gauges on the channels 3 and 4:

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

Also note the rules for switching on/off in the compatibility mode (→ "Measuring Channel (General)", 🗎 54).

5.5.4 Activation and Deactivation Values (P_On, P_Off)

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

The setting ranges for the P_On and P_Off parameters are listed in Section «Pressure Range Limits», 🗎 137.

The minimum distance amounts to 10 % (IE414, IE514 and PSG50x, PSG51x-S) and to 1 % (capacitive gauges) 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 PSG Mode (PSG_Ctrl)

Display	Significance
Disable	PSG 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 PSG mode, P_On is automatically set to 5.00×10^{-3}, and P_Off to 1.00×10^{-2}.

The PSG 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 gauge 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 gauge which has been activated via PSG_Ctrl is set to «Hot» automatically. The activation mode of a capacitive gauge (if present) will then be set to «Manual» automatically (→"Gauge Activation Mode (Mode)", 🗎 55).

5.6 User Parameters (UserMode)

The IM540 is able to detect the connected gauges and interface boards and the current mains frequency automatically. It will use the optimum settings for each gauge.

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.

5.6.1 Parameters for Gauge Operation (Gauge)

Gauges are normally operated with the parameters described in Chapter "Gauges Supply", 🗎 9. The Gauge menu is used to edit these parameter settings.

Display	Significance
Channel	Gauge 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.

5.6.2 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.

5.6.3 Configuring the Device (Amplifier)

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

Display	Significance
Chan_1 Chan_2 Chan_3 Chan_4	Type of gauge connected to the related channel. Both gauges (IE414 / IE514) are identified automatically by the software. If no gauge is found on one of these channels, the controller assumes that a Bayard-Alpert gauge 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.

5.7 Graphic Parameters (Detail Graphic)

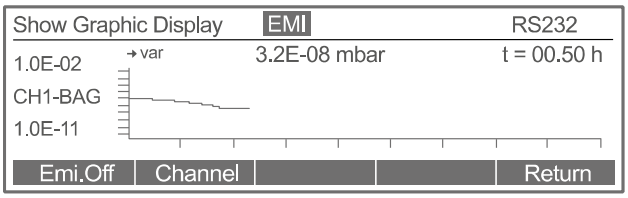
5.7.1 Parameters and Functions

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−PSG, 3−CDG 4−PSG, 4−CDG	Selection of a channel whose trend graphic is to be specified or displayed
Command	Ready	Ready for recording of a graphic
	Clear	Delete the current or the most recent recording. A running recording is stopped.
	Stop	Stops the running recording. The recording so far is still displayed.
	Start_Var	The trend graphic always covers the period specified under «Time». The graphic runs until it is stopped with «Stop».
	Start_Fix	The trend graphic runs for the time specified under «Time» and then stops automatically.
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 (→ "Trend Graphic", 🗎 59)
P_Low	See Section «Pressure Range Limits», 🗎 137	Lower pressure value for scaling the pressure axis.
P_High	See Section «Pressure Range Limits», 🗎 137	Upper pressure value for scaling the pressure axis.
Time [h]	0.05 … 99.99	Duration of the recording (in hours).

5.7.2 Trend Graphic

The Detail > Graphic > Display submenu is used to display the trend graphic of the selected channel according to the parameter settings (→ "Parameters and Functions", 58).



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).

6 Computer Interface (IM540 Mode)

6.1 Connection

The IM540 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.

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 IM540
Receiving (R)	Data transfer from the IMG540 to the Host
ASCII	American Standard Code for Information Interchange

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.

Control character	Value	Significance
<ETX>	03h	End of text. Interface reset. (Deletes the input buffer contents of the IM540, does not generate any further response).
<ENQ>	05h	Enquiry. Request to transfer the output buffer contents of the IM540.
<ACK>	06h	Acknowledge.
<LF>	0Ah	Line feed. In connection with <CR> additional end identifier.
<CR>	0Dh	Carriage return. End identifier.
<NAK>	15h	Negative Acknowledge.

6.3 Communication

6.3.1 Protocol

The following settings are used (default):

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

In GENERAL PARAMETER > RS232 > INTERFACE > STANDARD the IM540 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

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 IM540 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 acknowledgement 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 IM540 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 (→ "Mnemonics", 66).

End of message

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

6.3.2 Sending (Host → IM540) 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 IM540.

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>]
R: <ACK><CR><LF>
S: <ENQ>
R: XX <CR><LF> (XX = error code)

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:
R: <ACK><CR><LF>	R: <NAK><CR><LF>
S: <ENQ>	S: <ENQ>
R: 0<CR><LF> (Degas still off)	R: XX<CR><LF> (XX = error code)
… some time later:	
S: <ENQ>	S: <ENQ>
R: 1<CR><LF> (Degas on)	R: 00<CR><LF> (reset error code)
… 10 minutes later:	
S: <ENQ>	S: <ENQ>
R: 0<CR><LF> (Degas off)	R: 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 IM540 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 IM540 sends the positive acknowledgement <ACK><CR><LF>.

If now <ENQ> is sent the IM540 will respond with the OK error status: 00<CR><LF>. However, the command will not be executed once more.

6.3.3 Sending (Host → IM540) 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 IM540 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 IM540 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

I 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:

R: <ACK><CR><LF> S: <ENQ>

R: b,±c.ccccE±cc,±d.ddddE±dd <CR><LF>

… a few minutes later, still the same state

S: <ENQ>

R: 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.

S: <ENQ>

R: <NAK> <CR><LF>

S: <ENQ>

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

S: <ENQ>

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

6.3.4 Sending (Host → IM540) 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.

6.3.5 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 IM540 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:

❶ The error is signaled by <NAK><CR><LF>.

❷ 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.

❸ In the device the error code is reset.

❹ 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.

6.3.6 Numerical Formats

In the IM540 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: ±a.aaaaE±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 IM540 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 IM540 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 reconverting 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.

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>]

R: <ACK><CR><LF>

S: <ENQ>

R: 6A<CR><LF>

6.3.7 Response Times

The following response times are given by the IM540 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 ≤ 30 ms →	R: <ACK><CR><LF>
S: <ENQ>	T ≤ 30 ms →	R: 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.

6.4 Mnemonics

6.4.1 Overview

Group Parameter Setpoints

Group Device Information

Group DETAIL - Reading Device Information

Group USER Mode

Group TEST Mode

6.4.2 Command Sequence

In general, a command sequence has the following structure:

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

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

Step 3: S: <ENQ>

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

For clarity only step 1 and 4, i.e. the Host request and the IM540 response, are shown in the following. The intermediate protocol handshake is always the same.

6.4.3 Group Error Messages

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 IM540 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>]

R: 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 (IM540 ↔ Profibus-SW)
	7	Error occurred during command execution

GDE - Global Device Error

Query the global device errors.

S: GDE<CR>[<LF>]

R: XX XX <CR><LF>

Response XX XX:

4-digit HEX number

Bit position is 0 = no error / no action
Bit position is 1 = error / action

Bit	Description	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 > Pmax (P_{max} monitoring), P > P_{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
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 IM540 power supply has caused an error or warning.	

ISE - Ioni Supply Errors

Query errors caused by the ion source power supply.

S: **ISE**<CR>[<LF>]

R: XX XX<CR><LF>

Response	Bit	Description
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	–

ISW - Ioni Supply Warnings

Query warnings caused by the ion source power supply.

S: **ISW**<CR>[<LF>]

R: XX XX <CR><LF>

Response	Bit	Description
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	–

REC - Reset Error Condition

Reset error and warning conditions.

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

R: <ACK> <CR><LF>

Parameter	Bit	Description
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 ion source power supply
	3	Reset warnings caused by the ion source 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 > Pmax or P> Puser 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.

RES - Reset

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

S: **RES**<CR>[<LF>]

R: <ACK><CR><LF>

VSE - Voltage Supply Errors

Query errors caused by the voltage supply.

S: **VSE**<CR>[<LF>]

R: XX XX <CR><LF>

Response	Bit	Description
XX XX		4-digit HEX number
		Bit position is 0 = no error OK Bit position is 1 = error occurred
	0	Plus 5 V 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	–

VSW - Voltage Supply Warnings

Query warnings caused by the voltage supply.

S: **VSW**<CR>[<LF>]

R: XX XX <CR><LF>

Response	Bit	Description
XX XX		4-digit HEX number
		Bit position is 0 = no error OK Bit position is 1 = error occurred
	0	Plus 5 V 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	–

6.4.4 Group Measurement Data Request and Control

DGS - Degas

Execute degassing or query the degassing status.
S: **DGS**[, a]<CR>[<LF>]
R: b <CR><LF>

Parameter	Value	Description
a		Switch degassing
	0	Switch off degassing
	1	Switch on degassing

Response	Description
b	Read degassing status (see above)

EMI - Emissions Control

- Set (change) the IE414/514 channel
- Switch on/off the emission
- Query currently selected channel
- Query emission status

S: **EMI**[, a,b]<CR>[<LF>]
R: c,d <CR><LF>

Parameter	Value	Description
a		Select the IE414/514 channel
	1	Select channel 1
	2	Select channel 2
b		Switch the emission
	0	Switch off the emission
	1	Switch on the emission

Response	Description
c	Read the selected channel (see above)
d	Read the emission status (see above)

OFC - Offest Correction

Reset or start the offset correction or query the offset status.

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

R: c <CR><LF>

Parameter	Value	Description
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 CDG sensor whose auto offset = OFF (command CAO).
	1	Redetermine and apply offset. Only for IE414/514 sensors or CDG sensors whose auto offset = OFF (command CAO).

Response	Value	Description
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 IE414/514 sensors.

PRS - Press Sensor

Query the status and the pressure of an addressed sensor.

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

R: XX,±b.bbbbE±bb <CR><LF>

Parameter	Description
a	Channel number 1 to 4

Response	Bit	Description
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 IE414/514 sensor is ON
	6**	Degas at the addressed IE414/514 sensor is ON
	7**	Addressed IE414/514 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 IE414/514 channels. Thus a request to channel 3 or 4 delivers 0 for those bits

PRX - Press Sensor Extended

Query the status and the pressure of all available sensors.

S: **PRX**<CR>[<LF>]

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

Response	Description
XX	States of channels 1 to 4 (→ "PRS", 🗎 77)
±a.aaaaE±aa	Measuring values at channels 1 to 4 in the current pressure unit

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 (→ "PRX", 🗎 78).

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

- the baud rate of the addressed interface is changed

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>]

R: cc.c <CR><LF>

Parameter	Value	Description
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	Description
cc.c	Setpoint of the «Talk Only» repeat rate in seconds (see above)

6.4.5 Group Display

DBR - Display Brightness

Set and query display brightness.

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

R: b <CR><LF>

Parameter	Description
a	0 - 100 (%)

Response	Description
b	0 - 100 (%)

DCO - Display Contrast

Set and query display contrast.

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

R: b <CR><LF>

Parameter	Description
a	0 - 100 (%)

Response	Description
b	0 - 100 (%)

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>]

R: b <CR><LF>

Parameter	Description
a	Channel number 1 to 4

Response	Description
b	Channel number 1 to 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>]

R: YY <CR><LF>

Parameter	Bit	Description
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	Description
YY	2-digit HEX number See write command

6.4.6 Group Parameter Setpoints

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>]

R: c<CR><LF>

Parameter	Value	Description
a	1 … 4	Channel number 1 bis 4
b	0	AUTO, Emission current not constant
	1	0.1 mA
	2	1.0 mA
	3	10 mA

Response	Value	Description
c	0 … 3	Current setpoint (see above)

CAO - CDG-Sensor Auto Offset

Set or query automatic offset correction of CDG sensors.

The addressed sensor must be a CDG system.

S: **CAO**,a[, b]<CR>[<LF>]

R: c<CR><LF>

Parameter	Value	Description
a	1 … 4	Channel number 1 bis 4
b	0	Automatic offset correction off
	1	Automatic offset correction on

Response	Value	Description
c	0/1	Current setpoint (see above)

CST - CDG Sensor Type

Set or query the CDG sensor type.

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

R: cc<CR><LF>

Parameter	Value	Description
a	3/4	Channel number 3 or 4
bb	00	CDG_0_01_MBAR sensor
	01	CDG_0_01_TORR sensor
	02	CDG_0_02_TORR sensor
	03	CDG_0_05_TORR sensor
	04	CDG_0_1_MBAR sensor
	05	CDG_0_1_TORR sensor
	06	CDG_0_25_TORR sensor
	07	CDG_0_5_TORR sensor
	08	CDG_1_MBAR sensor
	09	CDG_1_TORR sensor
	10	CDG_2_TORR sensor
	11	CDG_10_MBAR sensor
	12	CDG_10_TORR sensor
	13	CDG_100_MBAR sensor
	14	CDG_100_TORR sensor
	15	CDG_1000_MBAR sensor
	16	CDG_1100_MBAR sensor
	17	CDG_1000_TORR sensor

Response	Value	Description
cc	00 … 04	Installed CDG sensor (see above)

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 PSG_ONLY.

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

R: b <CR><LF>

Parameter	Value	Description
a	0	No automatic sensor selection
	1	Automatic sensor selection

Response	Value	Description
b	0/1	Current setpoint (see above)

FRC - Failure Relay Configuration

Configure or query the failure relays.

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

R: c <CR><LF>

Parameter	Value	Description
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	Description
c	1 … 7	Current configuration (see above)

LOC - Locking

Set or query the lockout of the control buttons.

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

R: b <CR><LF>

Parameter	Value	Description
a		Lock the keyboard
	0	OFF
	1	PARA-Lock
	2	PROFI-Lock
	3	FULL-Lock

For a description of the available settings refer to → "Setup Lock (Set.Lock)", XY.

Response	Description
b	Read the current lock setting (see above)

RSC - Recorder Scale

Set or query the scaling of a recorder output.

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

R: c <CR><LF>

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

Response		Description
c	0 … 3	Scaling setpoint (see above)

RSL - Recorder Scale Limits

Set or query the scale limits of a recorder output.

This command is allowed only 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>]

R: ±c.ccccE±cc,±d.ddddE±dd <CR><LF>

Parameter	Value	Description
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	Description
±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.

RSM - Recorder Scale Mode

Set or query the scale mode of a recorder output.

This command is allowed only if the scaling of the recorder output is not set to SCALE_EXPO.

S: **RSM**, a[,b]<CR>[<LF>]

R: c <CR><LF>

Parameter	Value	Description
a	1/2	Recorder output 1 or 2
b	0	LIN_SCALE
	1	LOG_SCALE

Response		Description
c	0/1	Scale mode setpoint (see above)

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 IM540 Mode, i.e. if it is channel based.

S: **RSO**, a[,b]<CR>[<LF>]

R: c <CR><LF>

Parameter	Value	Description
a	1/2	Recorder output 1 or 2
b	1 … 4	Channel number
	5	AUTO-Mode
	6	NONE

Response		Description
c	1 … 4	Assigned measuring channel

SAC - Sensor Amplification Correction

Set or query the sensor amplification correction.

S: **SAC**, a[,bbb]<CR>[<LF>]

R: c.cc<CR><LF>

Parameter	Value	Description
a	1 … 4	Channel number 1 to 4
b.bb	0.10 to 9.99	Correction factor

Response	Value	Description
c.cc	0 … 8	Current correction factor (see above)

SAS - Sensor Amplifier Sensitivity

Set the sensor amplification sensitivity for a channel.

S: **SAS**, a[,b]<CR>[<LF>]

R: c<CR><LF>

Parameter	Value	Description
a	1, 2	Channel number 1 or 2
b	0	Low
	1	Normal
	2	High

Response	Value	Description
c		Sensitivity (see above)

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>]

R: <AKC><CR><LF>

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 IE414/514 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>]

R: c<CR><LF>

Parameter	Value	Description
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	Description
c	0 … 4	Current setpoint (see above)

SCL - Sensor Control Limits

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.

If this parameter is changed, the emission of the IE414/514 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>]

R: ±c.ccccE±cc,±d.ddddE±dd <CR><LF>

Parameter	Value	Description
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	Description
±c.ccccE±cc	Startup value in the current pressure unit
±d.ddddE±dd	Shutdown value in the current pressure unit

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 IE414/514 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>]

R: c<CR><LF>

Parameter	Value	Description
a	1 … 4	Channel number 1 to 4
b	0	MANUAL
	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 CDG or PSG sensor

Response	Value	Description
c	0 … 3	Current setpoint (see above)

SCS - Sensor Control Setting

Set or query the basic type of sensor control.

If this parameter is changed, the emission of the IE414/514 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>]

R: b<CR><LF>

Parameter	Value	Description
a	0	Channel controlling. The sensors control each other or they are self-controlling
	1	Only PSG starting control for IE414/514 systems
	2	Control via analog inputs
	3	Control via contact inputs
	4	Control via analog and contact inputs

Response	Value	Description
b	0 … 4	Current setpoint (see above)

SCT - Sensor Control PSG

Activate or query the PSG sensor control.

This command is allowed only if the basic type of sensor control is set to PSG_ONLY, ANALOG, CONTACT or ANALOG+CONTACT and a PSG sensor is installed at the addressed channel.

If this parameter is changed, the emission of the IE414/514 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>]

R: b<CR><LF>

Parameter	Value	Description
a	0	Deactivate PSG sensor control
	1	Activate sensor control at PSG channel 3
	2	Activate sensor control at PSG channel 3

Response	Value	Description
	0 … 2	Current setpoint (see above)

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>]

R: b <CR><LF>

Parameter	Value	Description
a	0	Emission remains on
	1	Emission is switched off

Response	Value	Description
b	0/1	Current setpoint (see above)

SFP - Sensor Filament Power

Threshold values of the filament power monitoring of IE414/514 sensors.

S: **SFP**, a[,cc.c]<CR>[<LF>]

R: cc.c <CR><LF>

Parameter	Value	Description
a	1/2	Measuring channel 1 or 2
cc.c	1.0 to 15.0	Threshold values in Watt

Response	Value	Description
c	1.0 to 15.0	Current threshold value setpoints (see above)

SGC - Sensor Gas Correction

Set or query the sensor gas correction.

CDG sensors allow the values NONE or USER only.

S: **SGC**, a[,b]<CR>[<LF>]

R: c<CR><LF>

Parameter	Value	Description
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	Description
c	0 … 8	Current gas type (see above)

SMF - Sensor Measuring Filter

Set or query the sensor measuring filter.

S: **SMF**,a[, b]<CR>[<LF>]

R: c <CR><LF>

Parameter	Value	Description
a	1 … 4	Channel number 1 to 4
b	0	NONE
	1	FAST
	2	NORMAL
	3	SLOW

Response	Value	Description
c	0 … 3	Measuring filter (see above)

SPE - Setpoint Enable

- Release or lock trigger relays
- Query relay switching

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

R: YY <CR><LF>

Parameter	Bit	Description
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	Description
YY	2-digit HEX number
	Bit position is 0 = relay switching disabled Bit position is 1 = relay switching enabled
	See write command

SPS - Setpoint Status

Query setpoint status of all trigger relays.

S: SPS<CR>[<LF>]

R: XX <CR><LF>

Response	Bit	Description
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	–

SPV - Setpoint Value

Assign and set trigger point, or query trigger point.

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

R: e,±c.ccccE±cc,±d.ddddE±dd <CR><LF>

Parameter	Value	Description
a	1 … 2	Relay number
	1 … 7	Relay number, if IF540 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	Description
e	Assignment of the addressed relay number 1 … 7 to the measuring channel 1 … 4
±c.ccccE±cc	Lower threshold value in current pressure unit
±d.ddddE±dd	Upper threshold value in current pressure unit

SSV - Sensor Sensivity Value

Set or query the sensitivity of an IE414/514 sensor.

S: SSV, a[,cc.cc]<CR>[<LF>]

R: cc.cc <CR><LF>

Parameter	Value	Description
a	1/2	Measuring channel 1 or 2
cc.cc		Sensor sensitivity Range BAG: 05.00 … 30.00 Range EXT: 01.00 … 20.00

Response	Description
cc.cc	Current setpoint (see above)

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>.

This command has a long execution time.

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

Parameter	Value	Description
a	1 … 4	Channel number 1 to 4

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.

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>]

R: c.cc<CR><LF>

Parameter	Value	Description
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	Description
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.

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>.

This command has a long execution time.

S: **SUS**, a<CR>[<LF>]

Parameter	Value	Description
a	1 … 4	Channel number 1 to 4

SXR - Sensor Gas Correction

Set or query the X-ray limit for Ioni sensors.

S: **SXR**, a[, b.bbE±bb],<CR>[<LF>]

R: b.bbE±bb <CR><LF>

Parameter	Value	Description
a		Measuring channel 1 or 2
b.bbE±bb		0.00 (correction switched off) or X-ray limit

Response	Description
b.bbE±bb	Current X-ray limit

THV - Threshold Value

Set or query the threshold value of the analog input.

S: **THV**, a[,cc.cc,dd.dd]<CR>[<LF>]

R: cc.cc,dd.dd <CR><LF>

Parameter	Value	Description
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 ≥ +0.050 V

Response	Description
cc.cc	U_Low: Lower threshold value in volt
dd.dd	U_High: Upper threshold value in volt

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>]

R: b <CR><LF>

Parameter	Value	Description
a	0	Reset the Torr permission (Torr cannot be selected)
	1	Set the Torr permission (Torr can be selected)

Response		Description
b	0/1	Read the current Torr permission status (see above)

UNI - Unit

Set or query pressure unit.

S: **UNI**[, a]<CR>[<LF>]

R: b <CR><LF>

Parameter	Value	Description
a		Set the pressure unit
	0	Hectopascal (hPa)
	1	Torr
	2	Pascal
	3	Micron

The pressure unit Torr can be set only if the torr lock has been disabled.

Response	Description
b	Read the current pressure unit (see above)

WCI - Warning Condition Ionisupply

Set or query the behavior of the device in case of a warning caused by the IE414/514 supply.

S: **WCI**[, a]<CR>[<LF>]

R: b <CR><LF>

Parameter	Value	Description
a	0	No error
	1	Warning
	2	Fatal error

Response	Value	Description
b	0 … 2	Current setpoint (see above)

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>]

R: b <CR><LF>

Parameter	Value	Description
a	0	No Error
	1	Warning
	2	Fatal error

Response	Value	Description
b	0 … 2	Current setpoint (see above)

6.4.7 Group Device Information

ARN - Article Number

Query or program the article number of the IM540.

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>]

R: <String> <CR><LF>

Parameter	Description
<String>	Article number

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>]

R: IM540,Vxx.xx<CR>[<LF>]

Parameter	Description
<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 IM540 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 IM540 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 IM540 identification can be requested using the <ENQ> command.

EDA - Examine Date

Query or program the examine date of the IM540.

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>]

R: <String> <CR><LF>

Parameter	Description
<String>	Examine date in the format 2017-05-31-13-38 (example)

IEC - Ioni Emission Current

Query the current emission current at the IE414/514 channel 1 or 2.

S: **IEC**<CR>[<LF>]

R: a <CR><LF>

Response	Value	Description
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

IQM - IQ-Board-Data from MC-Board

Query the article number and the serial number of the IQ board.

S: **IQM** <CR>[<LF>]

R: <String1>,<String2> <CR><LF>

Response	Description
<String1>	Article number
<String2>	Serial number in format 106689E037 (example)

IVM - IV-Board-Data from MC-Board

Query the article number and the serial number of the IV board.

S: **IVM** <CR>[<LF>]

R: <String1>,<String2> <CR><LF>

Response	Description
<String1>	Article number
<String2>	Serial number in format 106689E037 (example)

SEN - Serial Number

Query or program the serial number of the IM540.

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>]

R: <String> <CR><LF>

Parameter	Description
<String1>	Serial number in format 106689E037 (example)

SRL - Sensor Range Limits

Query the sensor range limits.

S: **SRL**, a<CR>[<LF>]

R: b,±c.ccccE±cc,±d.ddddE±dd <CR><LF>

Parameter	Value	Description
a	1 … 4	Measuring channel 1 to 4

Response		Description
a	1 … 4	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

STI - Sensor Typ Information

Query the type of sensor connected to the addressed channel.

S: **STI**, a<CR>[<LF>]

R: bb<CR><LF>

Parameter	Value	Description
a	1 … 4	Channel number 1 to 4

Response	Value	Description
bb		Sensor connected to the addressed channel
	00	No sensor connected
	01	BAG sensor
	02	EXT sensor
	03	PSG sensor
	04	CDG_0_01_MBAR sensor
	05	CDG_0_01_TORR sensor
	06	CDG_0_02_TORR sensor
	07	CDG_0_05_TORR sensor
	08	CDG_0_10_MBAR sensor
	09	CDG_0_10_TORR sensor
	10	CDG_0_25_TORR sensor
	11	CDG_0_5_TORR sensor
	12	CDG_1_MBAR sensor
	13	CDG_1_TORR sensor
	14	CDG_2_TORR sensor
	15	CDG_10_MBAR sensor
	16	CDG_10_TORR sensor
	17	CDG_100_MBAR sensor
	18	CDG_100_TORR sensor
	19	CDG_1000_MBAR sensor
	20	CDG_1100_MBAR sensor
	21	CDG_1000_TORR sensor

VPM - VP-Board-Data from MC-Board

Query the article number and the serial number of the VP board.

S: **VPM** <CR>[<LF>]

R: <String1>,<String2> <CR><LF>

Response	Description
<String1>	Article number
	Serial number in format 106689E037 (example)

6.4.8 Group DETAIL - Reading Device Information

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>]
R: nnn.nnn <CR><LF>

Response	Description
nnn.nnn	Anode voltage in Volt

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>]
R: nn.nnn <CR><LF>

Response	Description
nnn.nnn	Cathode voltage in Volt

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>]
R: nn.nnn <CR><LF>

Response	Description
nnn.nnn	Emission current in mA

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>]
R: n.nnn <CR><LF>

Response	Description
n.nnn	Filament current in A

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>]
R: n.nnn <CR><LF>

Response	Description
n.nnn	Filament power in W

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>]

R: n.nnn <CR><LF>

Response	Description
n.nnn	Filament voltage in Volt

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>]

R: nnn.nnn <CR><LF>

Response	Description
nnn.nnn	Reflector voltage in Volt

IDO - Info Device Operation Time

Query the operation time of the IM540.

S: **IDO**<CR>[<LF>]

R: a <CR><LF>

Response	Description
a	Operation time in hours

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: **IIA**<CR>[<LF>]

R: <String> <CR><LF>

Response	Description
<String>	Article number

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>]

R: <String> <CR><LF>

Response	Description
<String>	Calibration date in format 2017-05-31-13-38 (example)

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>]

R: <String> <CR><LF>

Response	Description
<String>	Firmware version in format V03.20 (example)

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: IIH<CR>[<LF>]

R: a <CR><LF>

Response	Description
a	Hardware version (e.g. 1)

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>]

R: <String> <CR><LF>

Response	Description
<String>	Serial number in format 106689E037 (example)

IMA - Info MC-Board Articel 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: IMA<CR>[<LF>]

R: <String> <CR><LF>

Response	Description
<String>	Article number

IMC - Info MC-Board Calibrattion 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>]

R: <String> <CR><LF>

Response	Description
<String>	Calibration date in format 2017-05-31-13-38 (example)

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>]

R: <String> <CR><LF>

Response	Description
<String>	Firmware version V01.04 (example)

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>]

R: a <CR><LF>

Response	Description
a	Hardware version (e.g. 1.00)

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>]

R: <String> <CR><LF>

Response	Description
<String>	Serial number in format 106689E037 (example)

IQA - Info IQ-Board Articel 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: **IQA**<CR>[<LF>]

R: <String> <CR><LF>

Response	Description
<String>	Article number

IQC - Info IQ-Board Calibrattion 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>]

R: <String> <CR><LF>

Response	Description
<String>	Calibration date in format 2017-05-31-13-38 (example)

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>]

R: a <CR><LF>

Response	Description
a	Hardware version (e.g. 1.00)

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>]

R: <String> <CR><LF>

Response	Description
<String>	Serial number in format 106689E037 (example)

ISM - Info Sensor Monitoring Emergency Off

Query the number of emergency offs at measuring channel 1 or 2.

S: **ISM**,a<CR>[<LF>]

R: b,c,d,e <CR><LF>

Parameter	Value	Description
a	1/2	Measuring channel 1 or 2

Response	Description
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

ISO - Info Sensor Offset

Query the current offset value of a measuring channel.

S: **ISO**, a<CR>[<LF>]

R: +bbbb oder ±b.bbb <CR><LF>

Parameter	Value	Description
a	1 … 4	Measuring channel 1 to 4

Response	Description
+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 CDG sensor installed: Current offset value in Volt Volt

IST - Info Sensor Operation Time

Query the operation time of the sensors that are compatible to a measuring channel.

S: **IST**,a<CR>[<LF>]

R: b.b, c.c <CR><LF>

Parameter	Value	Description
a	1 … 4	Measuring channel 1 to 4

Response	Description
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 PSG 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 PSG system at measuring channel a in hours

IVA - Info VP-Board Articel 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: **IVA**<CR>[<LF>]

R: <String> <CR><LF>

Response	Description
<String>	Article number

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>]

R: <String> <CR><LF>

Response	Description
<String>	Calibration date in format 2017-07-31-13-38 (example)

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>]

R: a <CR><LF>

Response	Description
a	Hardware version (e.g. 1.00)

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>]

R: <String> <CR><LF>

Response	Description
<String>	Serial number in format 106689E037 (example)

6.4.9 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.

UAD - USER Anode Voltage Degas

USER-Mode: set or query the anode voltage for degassing.

S: **UAD**,a[, b]<CR>[<LF>]

R: c<CR><LF>

Parameter	Value	Description
a	1/2	Channel number 1 or 2
b	0	ANODE_AUTO
	1	ANODE_220V
	2	ANODE_480V

Response	Value	Description
c	0 … 2	Current setpoint (see above)

UAM - USER Anode Voltage Measurement

USER-Mode: set or query the operating voltage of the anode.

S: **UAM**,a[, b]<CR>[<LF>]

R: c<CR><LF>

Parameter	Value	Description
a	1/2	Channel number 1 or 2
b	0	ANODE_AUTO
	1	ANODE_220V
	2	ANODE_480V

Response	Value	Description
c	0 … 2	Current setpoint (see above)

UAR - USER Amplifier Range

USER-Mode: set or query the measuring range of the current amplifier.

S: **UAR**,a[, b]<CR>[<LF>]

R: c<CR><LF>

Parameter	Value	Description
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	Description
c	0 … 11	Current setpoint (see above)

UAS - USER Amplifier Resolution

USER-Mode: set or query the resolution of the current amplifier.

S: **UAS**,a[, b]<CR>[<LF>]

R: c<CR><LF>

Parameter	Value	Description
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	Description
c	0 … 6	Current setpoint (see above)

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>]
R: b,ccc.cc s/ms<CR><LF>

Parameter	Value	Description
a	1/2	Channel number 1 or 2
b	1 … 6	Resolution, see UAS (USER Amplifier Reso- lution)
ccc.cc s/ms		Measuring time in seconds or milliseconds

Response	Value	Description
		See above

UCD - USER Cathode Voltage Degas

USER-Mode: set or query the cathode voltage for degassing.
S: **UCD**,a[, b]<CR>[<LF>]
R: c<CR><LF>

Parameter	Value	Description
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	Description
c	0 … 4	Current setpoint (see above)

UCM - USER Cathode Voltage Measurement

USER-Mode: set or query the operating voltage of the cathode.
S: **UCM**,a[, b]<CR>[<LF>]
R: c<CR><LF>

Parameter	Value	Description
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	Description
c	0 … 4	Current setpoint (see above)

UED - USER Emis Current Degas

USER-Mode: set or query the emission current for degassing.
S: **UED**,a[, b]<CR>[<LF>]
R: c<CR><LF>

Parameter	Value	Description
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	Description
c	0 … 6	Current setpoint (see above)

UEM - USER Emis Current Measurement

USER-Mode: set or query the operating current of the emission.
S: **UEM**,a[, b]<CR>[<LF>]
R: c<CR><LF>

Parameter	Value	Description
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	Description
c	0 … 6	Current setpoint (see above)

UID - USER Interface Board Detection

USER-Mode: set or query the IF540x interface board detection.
S: **UID**[,a]<CR>[<LF>]
R: b<CR><LF>

Parameter	Value	Description
a	0	IF540X_AUTO
	1	IF540X_INSTALLED
	2	IF540X_NOT_INSTALLED

Response	Value	Description
b	0 … 2	Current setpoint (see above)

UMD - USER Mains Frequency Detection

Mode: set or query the mains frequency detection.

S: **UMD**[,a]<CR>[<LF>]

R: b<CR><LF>

Parameter	Value	Description
a	0	MAINS_FREQU_AUTO
	1	MAINS_FREQU_50Hz
	2	MAINS_FREQU_60Hz

Response	Value	Description
c	0 … 2	Current setpoint (see above)

USD - USER Sensor Detection

USER-Mode: set or query the sensor detection.

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>]

R: c<CR><LF>

Parameter	Value	Description
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
b	in case of channel number 3 or 4:	
	0	SYSTEM_AUTO
	1	SYSTEM_PSG
	2	SYSTEM_CDG
	3	SYSTEM_NONE

Response	Value	Description
c	0 … 3	Current setpoint (see above)

6.4.10 Group TEST Mode

ROC - ROM CCR Sum

Query the ROM CRC sum.

S: **ROC**<CR>[<LF>]

R: XXXX CR><LF>

Response	Description
XXXX	CRC sum in hexadecimal format

TAC - TEST Amplifier Mod. Capacity)

Set or query the test setpoints of the current amplifier modulator capacity.

S: **TAC** [,a]<CR>[<LF>]

R: b<CR><LF>

Parameter	Value	Description
a	0	MOD_CAP_AUTO
	1	MOD_CAP_1_5PF
	2	MOD_CAP_100PF
	3	MOD_CAP_10NF

Response	Value	Description
b	0 … 3	Current setpoint (see above)

TAD - TEST Amplifier Display

Query the current amplifier parameters.

The output string contains 7 values separated by commas.

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>]

R: a, bb, c, d, e, f.ffff E-nn s, g.ggggg E-nn A<CR><LF>

Response	Value	Description
a	1	AMP_INPUT_NONE
	2	AMP_INPUT1
	3	AMP_INPUT2
	4	AMP_INPUT1+2
bb		Measuring range (→ "TAR (TEST Amplifier Range)", 🗎 110)
c		Resolution
d		Modulator frequency. (→ "TAF (TEST Amplifier Mod. Frequency)", 🗎 108)
e		Capacity. (→ "TAC (TEST Amplifier Mod. Capacity)", 🗎 107.
f.ffff E-nn		Measuring time in s
g.ggggg E-nn		Measuring current in A

TAF - TEST Amplifier Mod. Frequency

Set or query the test setpoint of the current amplifier modulator frequency.

S: **TAF** [,a]<CR>[<LF>]

R: b<CR><LF>

Parameter	Value	Description
a	0	AMP_MOD_FREQ_AUTO
	1	AMP_MOD_FREQU_40HZ
	2	AMP_MOD_FREQU_48HZ
	3	AMP_MOD_FREQU_50HZ
	4	AMP_MOD_FREQU_60HZ
	5	AMP_MOD_FREQU_64HZ
	6	AMP_MOD_FREQU_80HZ
	7	AMP_MOD_FREQU_96HZ
	8	AMP_MOD_FREQU_100HZ
	9	AMP_MOD_FREQU_120HZ
	10	AMP_MOD_FREQU_128HZ
	11	AMP_MOD_FREQU_160HZ
	12	AMP_MOD_FREQU_192HZ
	13	AMP_MOD_FREQU_200HZ
	14	AMP_MOD_FREQU_240HZ
	15	AMP_MOD_FREQU_256HZ
	16	AMP_MOD_FREQU_320HZ
	17	AMP_MOD_FREQU_384HZ
	18	AMP_MOD_FREQU_400HZ
	19	AMP_MOD_FREQU_480HZ
	20	AMP_MOD_FREQU_512HZ
	21	AMP_MOD_FREQU_640HZ
	22	AMP_MOD_FREQU_768HZ
	23	AMP_MOD_FREQU_800HZ
	24	AMP_MOD_FREQU_960HZ
	25	AMP_MOD_FREQU_1024HZ
	26	AMP_MOD_FREQU_1280HZ
	27	AMP_MOD_FREQU_1536HZ
	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	Description
b	0 … 16	Current setpoint (see above)

TAH - TEST Amplifier High-Drive

Set or query the test setpoint of the current amplifier High Drive Switch.

S: **TAH**[,a]<CR>[<LF>]

R: b<CR><LF>

Parameter	Value	Description
a	0	AUTO
	1	OFF
	2	ON

Response	Value	Description
b	0 … 2	Current setpoint (see above)

TAI - TEST Amplifier Input

Set or query the test setpoint of the current amplifier input.

S: **TAI** [,a]<CR>[<LF>]

R: b<CR><LF>

Parameter	Value	Description
a	0	AMP_INPUT_AUTO
	1	AMP_INPUT_NONE
	2	AMP_INPUT1
	3	AMP_INPUT2
	4	AMP_INPUT1+2

Response	Value	Description
b	0 … 4	Current setpoint (see above)

TAN - TEST Analog Input

Query the voltage values at the analog inputs.

S: **TAN**,a<CR>[<LF>]

R: ±b.bbbbb V <CR><LF>

Parameter	Value	Description
a	1 / 2	Analog input 1 or 2

Response	Description
±b.bbbbb	Voltage at analog input a in V

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>]

R: b<CR><LF>

Parameter	Value	Description
a	0	AUTO-Offset
	1 to 4096	User offset

Response	Value	Description
b	0 to 4096	Current setpoint (see above)

TAR - TEST Amplifier Range

Set or query the test setpoint of the current amplifier modulator frequency.

S: **TAR** [,a]<CR>[<LF>]

R: b<CR><LF>

Parameter	Value	Description
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	Description
b	0 … 11	Current setpoint (see above)

TAS - (TEST Amplifier Resolution)

Set or query the test setpoint of the current amplifier resolution.

S: **TAS** [,a]<CR>[<LF>]

R: b<CR><LF>

Parameter	Value	Description
a	0	RESOLUTION_AUTO
	1	RESOLUTION_6BIT
	2	RESOLUTION_8BIT
	3	RESOLUTION_10BIT
	4	RESOLUTION_11BIT
	5	RESOLUTION_12BIT
	6	RESOLUTION_14BIT

Response	Value	Description
b	0 … 6	Current setpoint (see above)

TAT - TEST Amplifier Internal

Query internal information on the current amplifier.

S: **TAT**<CR>[<LF>]

R: ±aaa.a C, bbbb ,cccc , d.ddd V,+e.eee V, 0, f.fffffE-nn<CR><LF>

Response	Value	Description
±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 correc- tion
0/1		Status High-Drive-Bit
f.fffffE-nn		Measuring current in A

TCA - TEST Control Anode Voltage

Set or query the test setpoint of the anode voltage.

S: **TCA**,a<CR>[<LF>]

R: b<CR><LF>

Parameter	Value	Description
a	0	USER_ANODE_AUTO
	1	USER_ANODE_220V
	2	USER_ANODE_480V

Response	Value	Description
b	0 … 2	Current setpoint (see above)

TCC - TEST Control Cathode Voltage

Set or query the test setpoint of the cathode voltage.

S: **TCC**,a<CR>[<LF>]

R: b<CR><LF>

Parameter	Value	Description
a	0	CATHODE_AUTO
	1	CATHODE_10V
	2	CATHODE_20V
	3	CATHODE_80V
	4	CATHODE_100V

Response	Value	Description
b	0 … 4	Current setpoint (see above)

TCE - TEST Control Emission Current

Set or query the test setpoint of the emission current.

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

R: b<CR><LF>

Parameter	Value	Description
a	0	EMI_AUTO
	1	EMI_0MA
	2	EMI_0_1MA
	3	EMI_1MA
	4	EMI_1_6MA
	5	EMI_10MA
	6	EMI_45MA
	7	EMI_90MA

Response	Value	Description
b	0 … 7	Current setpoint (see above)

TCF - TEST Control Frequency

Set or query the test setpoint of the mains frequency detection signal.

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

R: b<CR><LF>

Parameter	Value	Description
a	0	AUTO
	1	OFF
	2	ON

Response	Value	Description
b	0 … 2	Current setpoint (see above)

TCI - TEST Control Ioni Supply Channel

Set or query the test setpoint of the inonivac supply channel.

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

R: b<CR><LF>

Parameter	Value	Description
a	0	AUTO
	1	CH1
	2	CH2

Response	Value	Description
b	0 … 2	Current setpoint (see above)

TCO - TEST Control Emission ON

Set or query the test setpoint for switching on the emission.

S: **TCO**[, a]<CR>[<LF>]

R: b<CR><LF>

Parameter	Value	Description
a	0	AUTO
	1	OFF
	2	ON

Response	Value	Description
b	0 … 2	Current setpoint (see above)

TCP - TEST Control PID

Set or query the test setpoint for PDI emission current control.

S: **TCP**[, a]<CR>[<LF>]

R: b<CR><LF>

Parameter	Value	Description	
a	0	AUTO	
		PID_2	PID_1
	1	0	0
	2	0	1
	3	1	0
	4	1	1

Response	Value	Description
b		Current setpoint (see above)

TCS - TEST Control I_Shunt

Set or query the test setpoint of the emission current shunt resistance.

S: **TCS**[, a]<CR>[<LF>]

R: b<CR><LF>

Parameter	Value	Description
a	0	AUTO
	1	OFF
	2	ON

Response	Value	Description
b	0 … 2	Current setpoint (see above)

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:	R: <ACK><CR><LF>	
Request to execute	S: <ENQ>	
Response:	R: 1<CR><LF>	Test finished

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:	R: <ACK><CR><LF>	
Request to execute:	S: <ENQ>	
Response:	R: 1<CR><LF>	Test finished

TDG - TEST Digital Input

Query the states of the digital inputs.

S: TDG<CR>[<LF>]

R: XX <CR><LF>

Response	Bit	Description
XX		2-digit HEX number
		Bit position is 0 = logical '0' at input Bit position is 1 = logical '1' at input
	0	Digital input 1
	2 … 7	0

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:	R: <ACK><CR><LF>	
Request to execute:	S: <ENQ>	
Response:	R: 1<CR><LF>	Test finished

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 re-started without Power OFF/ON.

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>]

R: <ACK><CR><LF>

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:	**TEA**<CR>[<LF>]	
Response:	R:	<ACK><CR><LF>	
Request to execute:	S:	<ENQ>	
Response:	R:	1<CR><LF>	Test has been correctly executed
	R:	0<CR><LF>	An error occurred during test

TEC - TEST Enable Calibration

Allow or permit the calibration of the current amplifier and query the current setpoint.

S: **TEC**[,a]<CR>[<LF>]

R: b<CR><LF>

Parameter	Value	Description
a	0	Disabled
	1	Enabled

Response	Value	Description
b	0/1	Current setpoint (see above)

TEF - TEST Enable Fatal Errors

Allow or permit the generation of fatal errors and the resulting actions.

S: **TEF**[,a]<CR>[<LF>]

R: b<CR><LF>

Parameter	Value	Description
a	0	Disabled
	1	Enabled

Response	Value	Description
b	0/1	Current setpoint (see above)

TEI - TEST Enable IV-EEROM

For the syntax refer to the TEM command (TEST Enable MC-EEPROM). Apply the descriptions in that chapter to the IV board

TEM - TEST Enable MC-EEROM

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>]

R: b<CR><LF>

Parameter	Value	Description
a	0	Disabled
	1	Enabled

Response	Value	Description
b	0/1	Current setpoint (see above)

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:	R: <ACK><CR><LF>	
Request to execute:	S: <ENQ>	
Response:	R: 1<CR><LF>	Test has been correctly executed
	R: 0<CR><LF>	An error occurred during test

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:	R: <ACK><CR><LF>	
Request to execute:	S: <ENQ>	
Response:	R: 1<CR><LF>	Test has been correctly executed
	R: 0<CR><LF>	At least an error occurred during test

TEQ - TEST Enable IQ-EEROM

For the syntax refer to the TEM command (→ 116). Apply the descriptions in that chapter to the IQ board.

TEV - TEST Enable VP-EEROM

For the syntax refer to the TEM command (→ 116). Apply the descriptions in that chapter to the VP board.

TFR - TEST Force Reset

Trigger a software reset via watchdog, i.e. restart the device avoiding power OFF/ON.

S: **TFR**<CR>[<LF>]

R: <ACK><CR><LF>

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>]

R: ±b.bbbbb V, ±c.ccc V, d <CR><LF>

Parameter	Value	Description
a	3 / 4	Measuring channel 3 or 4

Response	Value	Description
±b.bbb		Measuring signal of the sensor at channel a in V
±c.ccc		Voltage at the ID resistor of channel a
d		Power supply of channel a
	0	OFF
	1	ON

TII - TEST IF540x Ident

Query the voltage at the Ident Resistor of the IF540x interface board.

S: TII<CR>[<LF>]

R: ±a.aaa V<CR><LF>

Response	Description
±a.aaa	Voltage in V

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: TIP<CR>[<LF>]

R: ±a.aaa V, ±b.bbb V, ±c.ccc V, ±d.ddd V, ±e.eee V, ± f.fff <CR><LF>

Response	Description
±a.aaa	Voltage +24V supply channel 3
±b.bbb	Voltage +24V supply channel 4
±c.ccc	Voltage +24V supply KL1
±d.ddd	Voltage +5V supply RS232
±e.eee	Voltage +15V supply
±f.fff	Voltage -15V supply

TIR - TEST IF540x Relays

Set or query the test setpoints of the relays on the IF540x interface board.

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

R: XX<CR><LF>

Parameter	Bit	Description
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	Description
c	0 … 7	Current setpoint (see above)

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	Description
a	3 / 4	Measuring channel 3 or 4
b	0	AUTO
	1	OFF
	2	ON

Response	Value	Description
c	0 … 2	Current setpoint (see above)

TLO - TEST RS232 Loopback

Activate or deactivate the RS232-Loopback function.

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

R: b<CR><LF>

Parameter	Value	Description
a	0	Deactivate
	1	Activate

Response	Value	Description
b	0/1	Current setpoint (see above)

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>]

R: ±a.aaa V, ±b.bbb V, ±c.ccc V, ±d.ddd V, ±e.eee V<CR><LF>

Response	Description
±a.aaa	Voltage -15V supply
±b.bbb	Voltage +5V analog supply
±c.ccc	Voltage +5V supply
±d.ddd	Voltage +15V supply
±e.eee	Voltage +24V supply

TPS - TEST Power Supply

Query the power supply status.

The output string contains 8 values separated by commas.

R: TPS<CR>[<LF>]

E: a , ±bbb C ,cccc mV, dd Hz , eeee mV, ffff mV, gggg mV, hhhh mV<CR><LF>

Response	Value	Description
a		Overtemp-Signal
	0	OFF
	1	ON
±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».

TRL - TEST Relays

Set or query the test setpoints of the status relays.

S: **TRL**[,XX]<CR>[<LF>]

R: XX<CR><LF>

Parameter	Bit	Description
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	Description
c	0 … 7	Current setpoint (see above)

TRO - TEST Recorder Out

Set or query the test setpoints of the recorder outputs.

S: **TRO**, a[,b]<CR>[<LF>]

R: c <CR><LF>

Parameter	Value	Description
a	1 / 2	Recorder output 1 or 2
b	0	AUTO
	1 to 11000	Output value in mV

Response	Value	Description
c	0 to 11000	Current setpoint (see above)

7 Maintenance, Service

7.1 Maintenance

The IM540 does not require any special maintenance work.

7.1.1 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 IM540 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.

7.1.2 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 the 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

7.2 Program Transfer Mode

If your IM540 requires an updated firmware version, e.g. for using a new gauge type, please contact your local INFICON 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», 🗎 133.

7.2.1 Preparations

1. Switch the IM540 off.
2. Connect the RS232 socket (→ pos. C, 🗎 15,) with a serial interface of the PC (e.g. COM1) (→ Chapter 3.3.8 "RS232", 🗎 19).

7.2.2 Program Transfer

The firmware for the IM540 is delivered as a setup file.

1. Execute the setup file at the PC by double-clicking it with the mouse

❷ Select the serial interface of the PC which is connected to the RS232 socket of the IM540

❸ Switch the IM540 on

❹ Click the [Start] button in the setup program

- The program transfer starts automatically
- The program transfer is being displayed

❺ After the program transfer has been completed, check if errors have occurred. Repeat the transfer process if any errors have occurred.

7.2.3 Restarting

The IM540 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 IM540 (→ "Acknowledging Errors", 🗎 36 and "Deleting Errors from the Error List", 🗎 36).

The error messages 175 … 180 may also be generated. These messages are issued after a software update and can be ignored or reset (→ "Acknowledging Errors", 🗎 36 and "Deleting Errors from the Error List", 🗎 36).

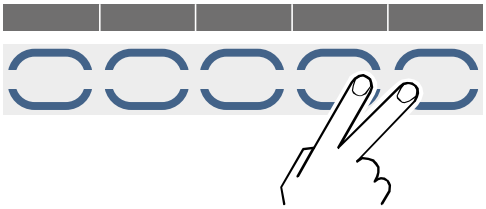
7.3 Starting the IM540 With Default Parameters

The parameters required for operation of the IM540 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 IM540 starts 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 IM540.

❶ While pressing the two rightmost control buttons, switch the IM540 on.

- A safety query appears on the display



❷ Confirm the safety query by pressing the left button

After starting the IM540 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.

7.4 Test Mode

Caution

Test mode.

All monitoring functions of the IM540 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.

7.4.1 Selecting the Test Mode

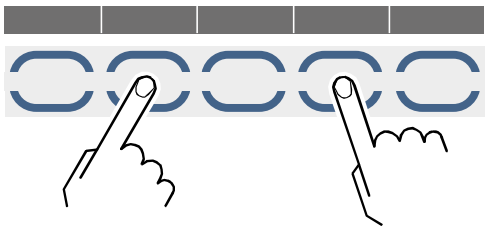
Access to the test mode requires a special restart of the device. Proceed as follows:

❶ Switch the IM540 off

❷ Wait for at least 10 seconds to make sure that the IM540 can initialize

❸ Keep the second and the fourth button pressed and switch the IM540 on

- A warning message informs you that the test mode has been enabled



❹ Confirm the warning message by pressing the leftmost button

- If you press the rightmost button instead, the IM540 will start in the measuring mode. The test mode is not available in this case.

❺ After the IM540 has started, press the Param button

❻ 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 (→ "Test Parameters and Functions", 🗎 125).

❼ Use the arrow buttons to select the required subgroup. Then press the Enter button.

- The IM540 is now in the test mode. The «Test» field in the status row is flashing.

7.4.2 Test Parameters and Functions

The test parameters and functions can be found in the subgroups of the Test Mode parameter group. The following table 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	Channel Range Resolut. Measure	Mod_Freq CycleT. Capacity
	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.
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

*) Only used for service

7.4.3 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	• 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 The offset is always adjusted when changing from disable to enable or when activating this function (→ " Automatic Offset (Auto_OFS)", 🗎 50).
Load.Cor	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. • The charge of the current measuring amplifier is adjusted automatically, if necessary • Disable: The charge of the current measuring amplifier is not adjusted automatically The charge is always corrected when changing from disable to enable or when activating this function.
Fatal Err	For certain tests it may be necessary that the device continues measuring even after a «fatal error» has occurred. • Enable: A «fatal error» will switch off the emission and, if necessary, also the supply voltages for the channels 3 and 4 • Disable: The IM540 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) EEPR_IQ (IQ540 board, power supply) EEPR_VP (VP540 board, connection board) EEPR_IV (IV540 board, current measuring ampliffier)	Calibration data in the EEPROM on the respective circuit board. • 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.

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

*) 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
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.

7.4.4 Current Measuring Amplifier (Amplifier)

The related submenus are used to adjust the parameters for the current measuring amplifier and to display all measurements.

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 Capacity
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

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», 🗎 139.

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», 🗎 138 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», 🗎 139.

How to determine the parameters for the current measuring amplifier

You can determine the parameters for the current measuring amplifier as follows:

❶ Specify a current measuring range

❷ Use the table in Section «Integrator Level Control», 🗎 139 to determine the possible modulator frequencies

❸ Specify the resolution or the measuring time:

3.1 For a given resolution: Use the table in Section «Measuring Speed», 🗎 138 to determine the resulting measuring times.

3.2 For a given measuring time: Use the table in Section «Measuring Speed», 🗎 138 to determine the resulting resolutions.

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

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

7.4.5 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.

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 emis- sion 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

Voltage (Primary Voltages)

The displayed primary voltages originate directly from the A/D converter on the CPU board.

Control (Control Bits)

Display and adjust several parameters.

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

Gauge

The following data are displayed:

- Anode: Anode potential
- Cathode: Cathode potential
- Reflect.: Reflector potential
- Emis.Cur: Emission current
- U_Filam.: Filament voltage
- I_Filam.: Filament current
- P_Filam.: Filament power

7.4.6 Inputs / Outputs

This menu displays all digital and analog inputs of the «Relay» and «Control» interfaces (→ "Relay Outputs", 🗎 10 and "Control Signals, Recorder", 🗎 11). The related outputs can be set.

Data for the channels 3 and 4 are also displayed.

Voltage (Peripheral Voltages)

The displayed peripheral voltages originate directly from the A/D converter on the VP540 circuit board.

Gauge

Display	Significance
Meas_3	Reading at the channel 3. Display range: -3 V … +13 V
Meas_4	Reading at the channel 4. Display range: -3V … +13 V
Ident_3	Reading of the ID resistor at channel 3. Display range: 0 … 5 V
Ident_4	Reading of the ID resistor at channel 4. Display range: 0 … 5 V
Supl.Ch3	Voltage supply for the gauge at channel 3 on/off
Supl.Ch4	Voltage supply for the gauge at channel 4 on/off

Control (Relais / 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
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.

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

7.4.7 IF540x

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 … 5 V

8 Storage and Disposal

8.1 Packaging

Please keep the original packaging. The packaging is required for storing the IM540 and for shipping it to INFICON service center.

8.2 Storage

The IM540 may only be stored in a dry room. The following requirements must be met:

Ambient temperature:	-20 … +40 °C
Humidity:	As low as possible. Preferably in an air-tight plastic bag with a desiccant.

8.3 Disposal

The product must be disposed of in accordance with the relevant local regulations for the environmentally safe disposal of systems and electronic components.

9 Accessories

Gauges

	Ordering No.
IE414 DN35 CF	399-661
IE514 DN35 CF	399-663

Measuring lines for IE414 / 514, 80 °C

	Ordering No.
3 m, with touch protection	399-680
5 m, with touch protection	399-681
10 m, with touch protection	399-682
50 m, with touch protection	399-685

Measuring lines for IE414 / 514, temperature resistant 200 °C

	Ordering No.
3 m, with touch protection	399-686
5 m, with touch protection	399-687
10 m, with touch protection	399-688
50 m, with touch protection	399-690

Profibus-DP interface board

	Ordering No.
IF540P	399-670

Appendix

A: Default Parameters

[Detail] > [Graphic]

Display	Default	User
Channel	1	
Command	Ready	
Status	Idle	
Display		
P_Low	→ "Threshold Values, Trigger Values", 🗎 137	
P_High		
Time [h]	1.00	

[Param] > [Setpoint]

Display	Default	User
Setpoint	Relay1	
Channel	1	
Display	Yes	
Mode	-----	
Spt.Low	→ "Threshold Values, Trigger Values", 🗎 137	
Spt.High		
Trigger	Enable	

[Param] > [General]

Display	Default	User
Device	IM540	
Control	RS232	

[Param] > [General] > [Setup]

Display	Default	User
Unit	mbar	
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	→ "Threshold Values, Trigger Values", 🗎 137	
P_High		
Scale	Log	

[Param] > [General] > [Disp.Bar]

Display	Default	User
Channel	1	
Digit	Auto	
Mode	Auto_2	
P_Low	-----	
P_High	-----	

[Param] > [General] > [Threshol]

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] > [General] > [Sensor]

Display	Default	User
Channel	1	
Filter	Normal	
Auto_OFS	-----	
Cal_Full	IE514: 6.6 $mbar^{-1}$	
	IE414: 16.6 $mbar^{-1}$	
	CDG: 1000 Torr	
Fil.Pow.	7.0 W	
Emis.Cur	Auto	
X_Ray	0.00E+00	

[Param] > [General] > [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 gauge	

[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	-----	
P_Off	-----	
PSG_Ctrl	-----	

[Param] > [UserMode] > [Gauge]

Display	Default	User
Channel	1	
Anode	Auto	
Cathode	Auto	
Emis.Cur	Auto	
U_A_Deg.	Auto	
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	
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	
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.		

B: Setting Ranges

Threshold Values, Trigger Values

Gauge	Spt.Low min. (standard for Spt.Low)	Spt.Low max.		Spt.High min.	Spt.High max. (standard for Spt.High)	
	P_On min. [mbar]	P_On max. [mbar]	Standard for P_On [mbar]	P_Off min. [mbar]	P_Off max. [mbar]	Standard for P_Off [mbar]
IE514	2.00×10^{-13}	7.20×10^{-5}	1.00×10^{-5}	2.20×10^{-13}	8.00×10^{-5}	2.00×10^{-5}
IE414	2.00×10^{-11}	7.20×10^{-3}	1.00×10^{-4}	2.20×10^{-11}	8.00×10^{-3}	2.00×10^{-4}
CDG 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}
CDG 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}
CDG 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}
CDG 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}
CDG 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}
PSG	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

Gauge	P_Low min. (standard for P_Low) [mbar]	P_Low max. [mbar]	P_High min. [mbar]	P_High max. (standard for P_High) [mbar]
IE514	1.00×10^{-13}	9.00×10^{-5}	1.10×10^{-13}	1.00×10^{-4}
IE414	1.00×10^{-11}	9.00×10^{-3}	1.10×10^{-11}	1.00×10^{-2}
CDG 0.10 Torr	1.00×10^{-5}	1.20×10^{-1}	1.50×10^{-5}	1.00×10^{0}
CDG 1 Torr	1.00×10^{-4}	1.20×10^{0}	1.50×10^{-4}	1.00×10^{1}
CDG 10 Torr	1.00×10^{-3}	1.20×10^{1}	1.50×10^{-3}	1.00×10^{2}
CDG 100 Torr	1.00×10^{-2}	1.20×10^{2}	1.50×10^{-2}	1.00×10^{3}
CDG 1000 Torr	1.00×10^{-1}	1.20×10^{3}	1.50×10^{-1}	1.00×10^{4}
PSG	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.	Resolution (s/ms/us)						Rejection
[Hz]	6 Bit	8 Bit	10 Bit	11 Bit	12 Bit	14 Bit	[Hz]
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
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

(continued)

(Table "Measuring Speed" concluded)

Mod. Freq. [Hz]	Resolution (s/ms/us) 6 Bit	8 Bit	10 Bit	11 Bit	12 Bit	14 Bit	Rejection [Hz]
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 9 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		✓	✓	✓	✓	✓					

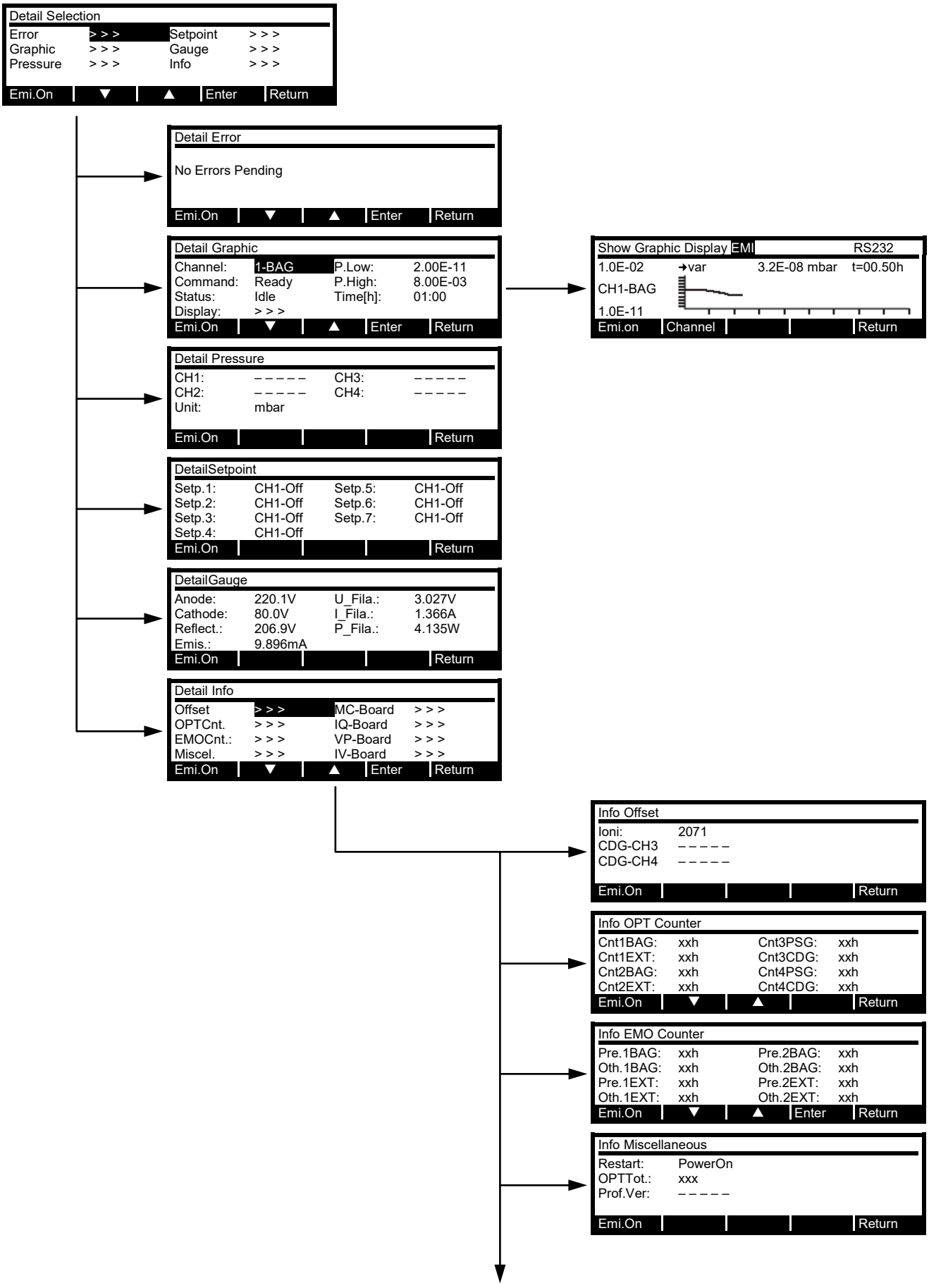
(continued)

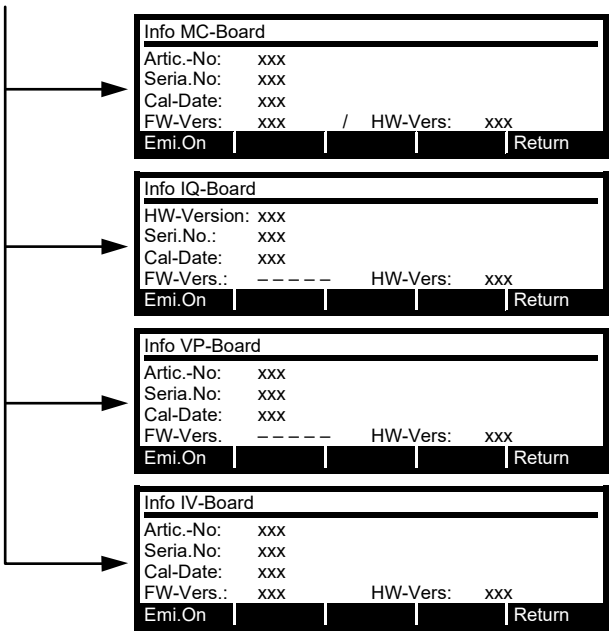
(Table "Integrator Level Control" concluded)

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
1920		✓	✓	✓	✓	✓					
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	✓	✓	✓	✓							

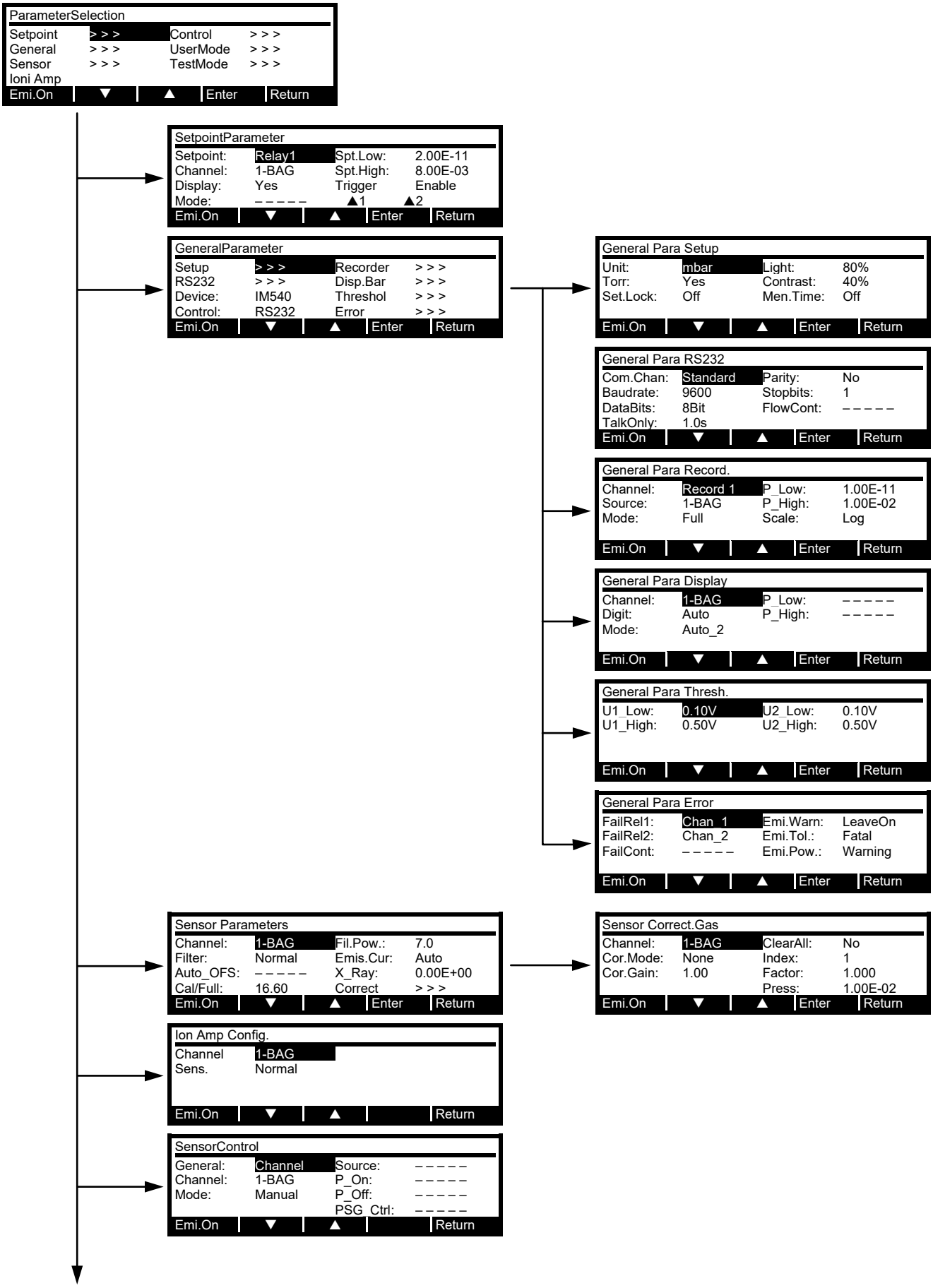
C: Menu Structure

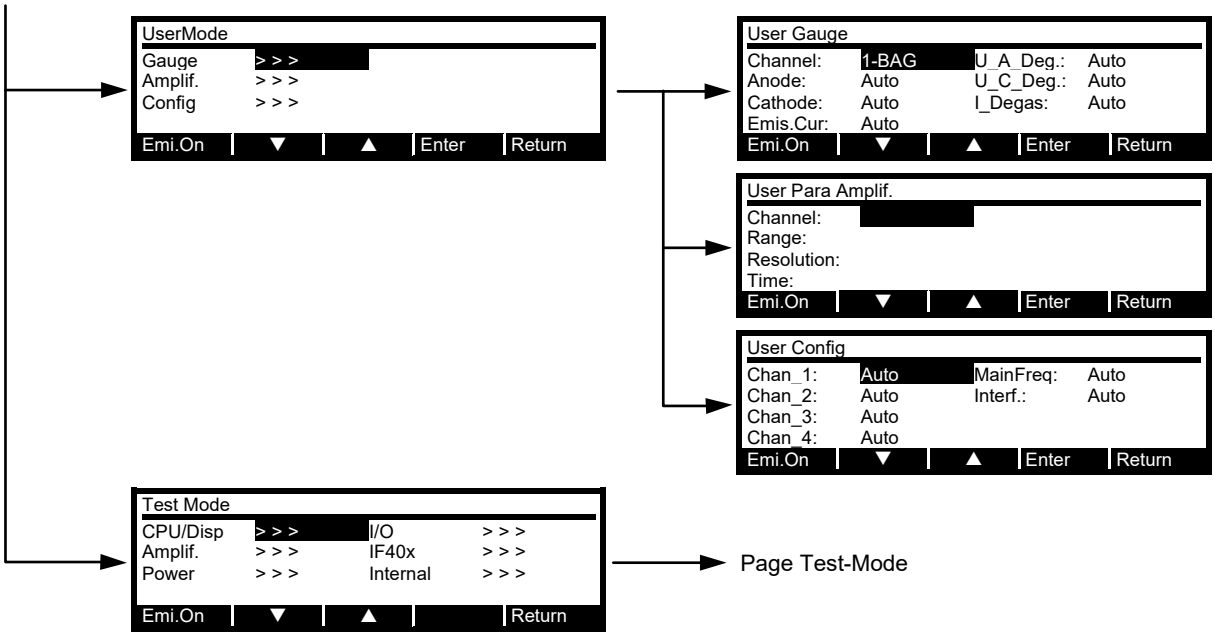
Detail-Selection



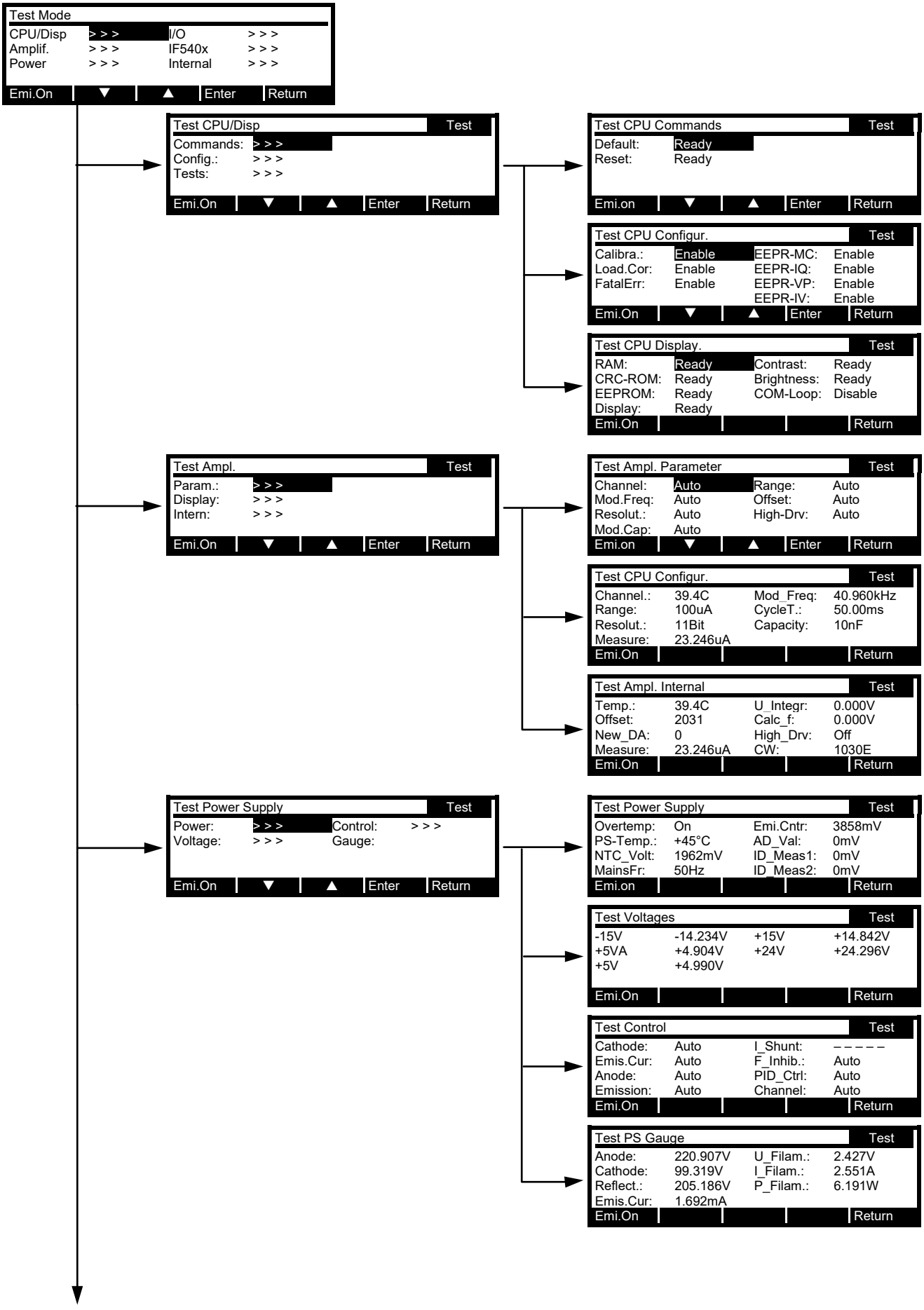

Info MC-Board
Artic.-No: xxx
Seria.No: xxx
Cal-Date: xxx
FW-Vers: xxx / HW-Vers: xxx
Emi.On
Return
Info IQ-Board
HW-Version: xxx
Seri.No.: xxx
Cal-Date: xxx
FW-Vers.: – – – – – HW-Vers: xxx
Emi.On
Return
Info VP-Board
Artic.-No: xxx
Seria.No: xxx
Cal-Date: xxx
FW-Vers. – – – – – HW-Vers: xxx
Emi.On
Return
Info IV-Board
Artic.-No: xxx
Seria.No: xxx
Cal-Date: xxx
FW-Vers.: xxx HW-Vers: xxx
Emi.On
Return

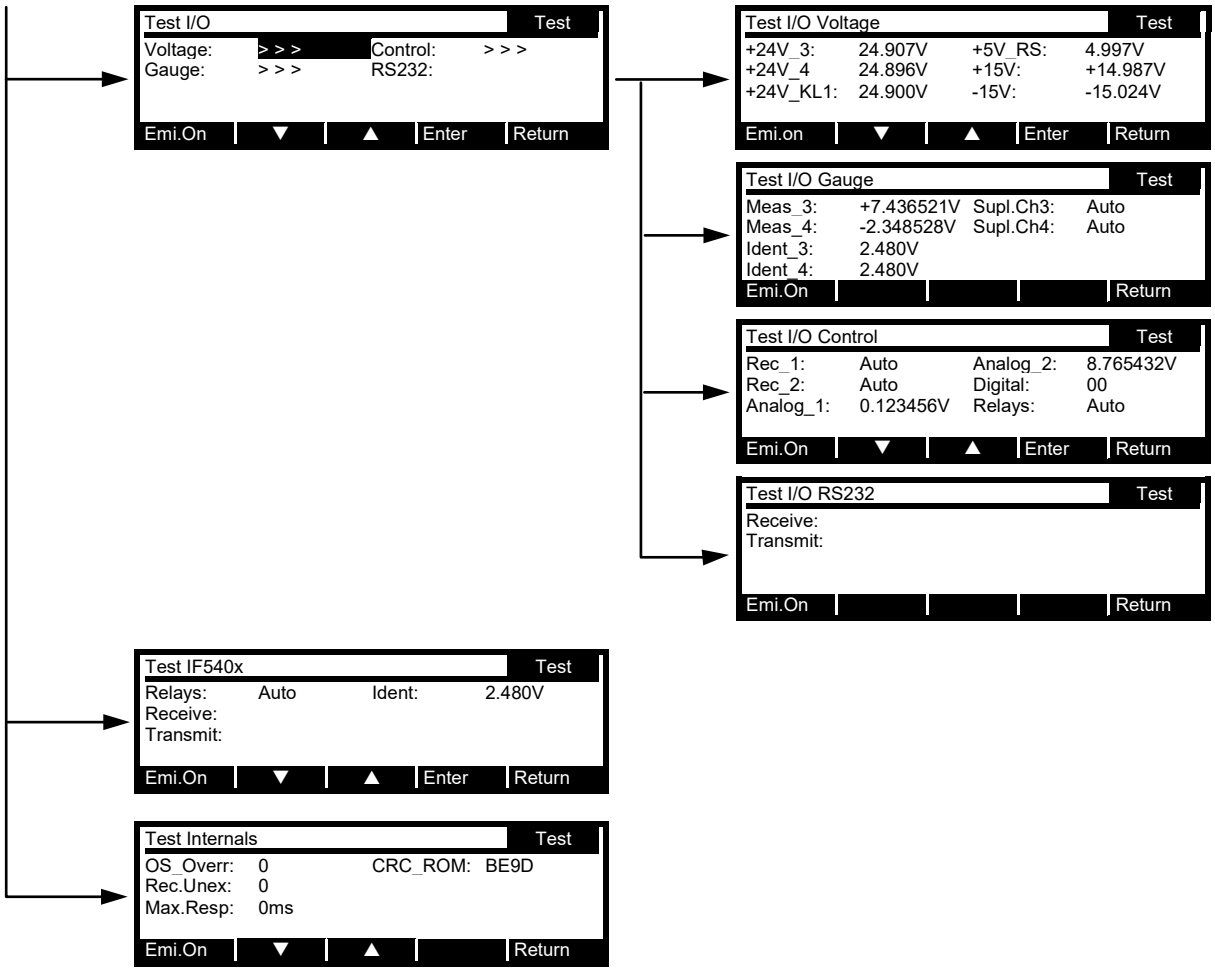
Parameter-Selection




UserMode
Gauge > > >
Amplif. > > >
Config > > >
Emi.On ▼ ▲ Enter Return
User Gauge
Channel: 1-BAG U_A_Deg.: Auto
Anode: Auto U_C_Deg.: Auto
Cathode: Auto I_Degas: Auto
Emis.Cur: Auto
Emi.On ▼ ▲ Enter Return
User Para Amplif.
Channel:
Range:
Resolution:
Time:
Emi.On ▼ ▲ Enter Return
User Config
Chan_1: Auto MainFreq: Auto
Chan_2: Auto Interf.: Auto
Chan_3: Auto
Chan_4: Auto
Emi.On ▼ ▲ Enter Return
Test Mode
CPU/Disp > > > I/O > > >
Amplif. > > > IF40x > > >
Power > > > Internal > > >
Emi.On ▼ ▲ Return
Page Test-Mode

Test-Mode


Test Mode
CPU/Disp > > >
Amplif. > > >
Power > > >
I/O > > >
IF540x > > >
Internal > > >
Emi.On ▼ ▲ Enter Return
Test CPU/Disp Test
Commands: > > >
Config.: > > >
Tests: > > >
Emi.On ▼ ▲ Enter Return
Test CPU Commands Test
Default: Ready
Reset: Ready
Emi.on ▼ ▲ Enter Return
Test CPU Configur. Test
Calibra.: Enable
Load.Cor: Enable
FatalErr: Enable
EEPR-MC: Enable
EEPR-IQ: Enable
EEPR-VP: Enable
EEPR-IV: Enable
Emi.On ▼ ▲ Enter Return
Test CPU Display. Test
RAM: Ready
CRC-ROM: Ready
EEPROM: Ready
Display: Ready
Contrast: Ready
Brightness: Ready
COM-Loop: Disable
Emi.On Return
Test Ampl. Test
Param.: > > >
Display: > > >
Intern: > > >
Emi.On ▼ ▲ Enter Return
Test Ampl. Parameter Test
Channel: Auto
Mod.Freq: Auto
Resolut.: Auto
Mod.Cap: Auto
Range: Auto
Offset: Auto
High-Drv: Auto
Emi.on ▼ ▲ Enter Return
Test CPU Configur. Test
Channel.: 39.4C
Range: 100uA
Resolut.: 11Bit
Measure: 23.246uA
Mod_Freq: 40.960kHz
CycleT.: 50.00ms
Capacity: 10nF
Emi.On Return
Test Ampl. Internal Test
Temp.: 39.4C
Offset: 2031
New_DA: 0
Measure: 23.246uA
U_Integr: 0.000V
Calc_f: 0.000V
High_Drv: Off
CW: 1030E
Emi.On Return
Test Power Supply Test
Power: > > >
Voltage: > > >
Control: > > >
Gauge:
Emi.On ▼ ▲ Enter Return
Test Power Supply Test
Overtemp: On
PS-Temp.: +45°C
NTC_Volt: 1962mV
MainsFr: 50Hz
Emi.Cntr: 3858mV
AD_Val: 0mV
ID_Meas1: 0mV
ID_Meas2: 0mV
Emi.on Return
Test Voltages Test
-15V -14.234V
+5VA +4.904V
+5V +4.990V
+15V +14.842V
+24V +24.296V
Emi.On Return
Test Control Test
Cathode: Auto
Emis.Cur: Auto
Anode: Auto
Emission: Auto
I_Shunt: – – – – –
F_Inhib.: Auto
PID_Ctrl: Auto
Channel: Auto
Emi.On Return
Test PS Gauge Test
Anode: 220.907V
Cathode: 99.319V
Reflect.: 205.186V
Emis.Cur: 1.692mA
U_Filam.: 2.427V
I_Filam.: 2.551A
P_Filam.: 6.191W
Emi.On Return


Test I/O
Test
Voltage: > > >
Control: > > >
Gauge: > > >
RS232:
Emi.On
▼
▲
Enter
Return
Test I/O Voltage
Test
+24V_3: 24.907V
+5V_RS: 4.997V
+24V_4 24.896V
+15V: +14.987V
+24V_KL1: 24.900V
-15V: -15.024V
Emi.on
▼
▲
Enter
Return
Test I/O Gauge
Test
Meas_3: +7.436521V
Supl.Ch3: Auto
Meas_4: -2.348528V
Supl.Ch4: Auto
Ident_3: 2.480V
Ident_4: 2.480V
Emi.On
Return
Test I/O Control
Test
Rec_1: Auto
Analog_2: 8.765432V
Rec_2: Auto
Digital: 00
Analog_1: 0.123456V
Relays: Auto
Emi.On
▼
▲
Enter
Return
Test I/O RS232
Test
Receive:
Transmit:
Emi.On
Return
Test IF540x
Test
Relays: Auto
Ident: 2.480V
Receive:
Transmit:
Emi.On
▼
▲
Enter
Return
Test Internals
Test
OS_Overr: 0
CRC_ROM: BE9D
Rec.Unex: 0
Max.Resp: 0ms
Emi.On
▼
▲
Return

D: Error Messages

The legend for the following table can be found in Section «Legend for the Error Table», 154.

Error no.	Error message	Error description	Reaction of the device	Possible follow-up errors	Possible cause of error	Suggestion 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	7.4.4
102	BAG Degas Press To High	The pressure for degassing is too high for a BAG gauge	9	—	1 5 7	9 8 7	7.4.4 7.4.4 7.4.4
103	EXT Degas Press To High	The pressure for degassing is too high for an EXT gauge	9	—	1 5 7	9 8 7	7.4.4 7.4.4 7.4.4
104	BAG Press Greater P Max.	The maximum permissible pressure for a BAG gauge has been exceeded	23	—	1 5 7	10 8 7	7.4.4 7.4.4 7.4.4
105	EXT Press Greater P Max.	The maximum permissible pressure for an EXT gauge has been exceeded	23	—	1 5 7	10 8 7	7.4.4 7.4.4 7.4.4
106	RS232 Overrun Error	An overrun error has occurred at the RS232 input	4	109	1, 18 17	13 14	7.4.6 7.4.6
107	RS232 Framing Error	A framing error has occurred at the RS232 input	4	109	1, 18 17	13 14	7.4.6 7.4.6
108	RS232 Parity Error	A parity error has occurred at the RS232 input	4	109	1, 18 17	13 14	7.4.6 7.4.6
109	Incompatible Profibus SW-Version	Communication trouble between IM540 and Profibus interface IF 540 P	11	106, 107, 108	19 20	16 17	7.4.6/7.4.7 7.4.6/7.4.7
110	Set Cor_Mode To NONE.Sensor Changed	Gas correction is reset because the gauge for the active channel has been changed	12	121, 122, 123, 124	2 4 7	2 3 7	7.4.5/7.4.6 7.4.5/7.4.6 7.4.5/7.4.6
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 gauge type	1	121, 122, 123, 124	1 3	11 4	7.4.5/7.4.6
121	Channel 1 No Coding	IM540 does not recognize the gauge connected to channel 1 properly	1, 13	141, 144, 147, 148	3 7 4	4 7 3	7.4.5 7.4.5 7.4.5
122	Channel 2 No Coding	IM540 does not recognize the gauge connected to channel 2 properly	1, 13	141, 144, 147, 148	3 7 4	4 7 3	7.4.5 7.4.5 7.4.5
123	Channel 3 No Coding	IM540 does not recognize the gauge connected to channel 3 properly	1, 13	129, 133	3 7 4	4 7 3	7.4.5 7.4.5 7.4.5

(continued)

(Table "Error Messages" continued)

Error no.	Error message	Error description	Reaction of the device	Possible follow-up errors	Possible cause of error	Suggestion for error correction	Useful test functions (chapter)
124	Channel 4 No Coding	IM540 does not recognize the gauge connected to channel 4 properly	1, 13	130, 134	3	4	7.4.5
					7	7	7.4.5
					4	3	7.4.5
125	Ioni Amp. Offset Failure	Offset adjustment for the measuring amplifier could not be performed successfully in the current measuring range	14, 15	—	7	7	7.4.4/7.4.5
					4	3	7.4.4/7.4.5
126	Ioni Amp. Load Correction Failure	A charge correction in the current measuring range could not be performed successfully	1, 15	—	7	7	7.4.3 ff
					4	3	7.4.3 ff
					10	21	7.4.4/7.4.5
127	Ioni Amp. Calibration Failure	An instability has been detected for the range switching (toggling) of the measuring amplifier	1, 15, 17	—	7	6, 7	7.4.3 ff
					4	3	7.4.3 ff
					10	21	7.4.4/7.4.5
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	7.4.4/7.4.5
					4	3	7.4.4/7.4.5
					10	21	7.4.4/7.4.5
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	7.4.5/7.4.6
					3	4	7.4.5/7.4.6
					4	3	7.4.5/7.4.6
					13	21	7.4.5/7.4.6
					12	21	7.4.5/7.4.6
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	7.4.5/7.4.6
					3	4	7.4.5/7.4.6
					4	3	7.4.5/7.4.6
					13	21	7.4.5/7.4.6
					12	21	7.4.5/7.4.6
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	7.4.5/7.4.6
					12	21	7.4.5/7.4.6
					13	21	7.4.5/7.4.6
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	7.4.5/7.4.6
					12	21	7.4.5/7.4.6
					13	21	7.4.5/7.4.6
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	7.4.5/7.4.6
					3	4	7.4.5/7.4.6
					4	3	7.4.5/7.4.6
					13	21	7.4.5/7.4.6
					12	21	7.4.5/7.4.6
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	7.4.5/7.4.6
					3	4	7.4.5/7.4.6
					4	3	7.4.5/7.4.6
					13	21	7.4.5/7.4.6
					12	21	7.4.5/7.4.6

(continued)

(Table "Error Messages" continued)

Error no.	Error message	Error description	Reaction of the device	Possible follow-up errors	Possible cause of error	Suggestion 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	7.4.5/7.4.6
					12	21	7.4.5/7.4.6
					13	21	7.4.5/7.4.6
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	7.4.5/7.4.6
					12	21	7.4.5/7.4.6
					13	21	7.4.5/7.4.6
137	Ioni Supply U_Anode Warning	Anode voltage supply on the IQ board shows an unacceptable deviation from the setpoint		143	7	7	7.4.5
					3	4	7.4.5
					4	3	7.4.5
					12	21	7.4.5
138	Ioni Supply U_Cathode Warning	Cathode voltage supply on the IQ board deviates from the setpoint	22, 15	144	7	7	7.4.5
					3	4	7.4.5
					4	3	7.4.5
					12	21	7.4.5
139	Ioni Supply I_Emis Warning	Emission current of active gauge deviates from the permissible setpoint	22, 15	145	7	7	7.4.5
					4	3	7.4.5
					3	4	7.4.5
					12	21	7.4.5
140	Ioni Supply U_Filament Warning	Filament voltage (heating voltage) of active gauge deviates from the permissible setpoint	22, 15	146	7	7	7.4.5
					4	3	7.4.5
					3	4	7.4.5
					12	21	7.4.5
141	Ioni Supply I_Filament Warning	Filament current (heating current) of active gauge deviates from the permissible setpoint	22, 15	121, 122, 144, 145, 147	7	7	7.4.5
					4	3	7.4.5
					3	4	7.4.5
					12	21	7.4.5
142	Ioni Supply U_Reflector Warning	Reflector voltage supply on the IQ board deviates from the setpoint	22, 15	149	7	7	7.4.5
					4	3	7.4.5
					3	4	7.4.5
					12	21	7.4.5
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	7.4.5
					4	3	7.4.5
					3	4	7.4.5
					12	21	7.4.5
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	7.4.5
					4	3	7.4.5
					3	4	7.4.5
					12	21	7.4.5
145	Ioni Supply I_Emis Error	Emission current of active gauge is missing or shows an unacceptable deviation from the setpoint	23, 16	139	7	7	7.4.5
					4	3	7.4.5
					3	4	7.4.5
					12	21	7.4.5

(continued)

(Table "Error Messages" continued)

Error no.	Error message	Error description	Reaction of the device	Possible follow-up errors	Possible cause of error	Suggestion for error correction	Useful test functions (chapter)
146	Ioni Supply U_Filament Error	Filament voltage (heating voltage) of active gauge is missing or shows an unacceptable deviation from the setpoint	23, 16	144	7	7	7.4.5
					4	3	7.4.5
					3	4	7.4.5
					12	21	7.4.5
147	Ioni Supply I_Filament Error	Filament current (heating current) of active gauge is missing or shows an unacceptable deviation from the setpoint	23, 16	121, 141	7	7	7.4.5
					4	3	7.4.5
					3	4	7.4.5
					12	21	7.4.5
148	Ioni Supply P_Filament Error	Filament power (heating power) of active gauge is missing or shows an unacceptable deviation from the setpoint	23, 16	121	5	8, 19	7.4.5
					6	5, 19	7.4.5
					7	7	7.4.5
					3	4	7.4.5
					4	3	7.4.5
					12	21	7.4.5
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	7.4.5
					3	4	7.4.5
					4	3	7.4.5
					12	21	7.4.5
150	Ioni Supply P_Fil Unstable Error	Filament current regulator is oscillating, works unstable, or is faulty	23, 16	–	7	7	7.4.5
					3	4	7.4.5
					4	3	7.4.5
					12	21	7.4.5
151	Emis Regulator Limit Warning	Emission regulator works at the limit of its dynamic range	22, 15	152	7	7	7.4.5
					3	4	7.4.5
					4	3	7.4.5
					12	21	7.4.5
152	Emis Regulator Limit Error	Operating range of emission regulator has been exceeded or emission regulator is faulty	23, 16	152	7	7	7.4.5
					3	4	7.4.5
					4	3	7.4.5
					12	21	7.4.5
153	Emis Regulator Deviation Warning	Stability of emission control is impaired	22, 15	154	7	7	7.4.5
					3	4	7.4.5
					4	3	7.4.5
					12	21	7.4.5
154	Emis Regulator Deviation Error	Emission regulator is oscillating, works unstable, or is faulty	23, 16	153	7	7	7.4.5
					3	4	7.4.5
					4	3	7.4.5
					12	21	7.4.5
161	MC Board EEPROM Operation Timeout	Communication error between the processor and the EEPROM on the MC board	1, 4	–	9	21	7.4.3
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	7.4.3

(continued)

(Table "Error Messages" continued)

Error no.	Error message	Error description	Reaction of the device	Possible follow-up errors	Possible cause of error	Suggestion for error correction	Useful test functions (chapter)
163	IQ Board EEPROM Operation Timeout	Communication error between the processor and the EEPROM on the IQ board	1, 4	—	12	21	7.4.3
164	VP Board EEPROM Operation Timeout	Communication error between the processor and the EEPROM on the VP board	1, 4	—	13	21	7.4.3
165	IF Board EEPROM Operation Timeout	Communication error between the processor and the EEPROM on the IF board	1, 4	—	14	21	7.4.3
166	MC Board Kontrast Device Timeout	Communication error between the processor and the EEPROM on the CS board	1, 4	—	23	21	7.4.3
167	MC Board AD Device Timeout	Communication error between the processor and the AD converter on the MC board	1, 4	—	9	21	7.4.3
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	7.4.3
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	7.4.3
170	VP Board DA Device Timeout	Communication error between the processor and the DA converter on the VP board	1, 4	—	13	21	7.4.3
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	7.4.3
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	7.4.3
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	7.4.3
174	Ioni Amp. Temp. Device Timeout	Communication error between the processor and the temperature gauge of the measuring amplifier on the IV board	1, 4	—	10	21	7.4.3
175	CRC Check Device Settings	Data consistency problem in EEPROM of the MC board	24	—	9	21	7.4.3
176	CRC Check Device OPT Counter	Data consistency problem in EEPROM of the MC board	7	—	9	21	7.4.3
177	CRC Check Gas cor.Data Channel 1	Data consistency problem in EEPROM of the MC board	8	—	9	21	7.4.3
178	CRC Check Gas cor.Data Channel 2	Data consistency problem in EEPROM of the MC board	8	—	9	21	7.4.3
179	CRC Check Gas cor.Data Channel 3	Data consistency problem in EEPROM of the MC board	8	—	9	21	7.4.3

(continued)

(Table "Error Messages" continued)

Error no.	Error message	Error description	Reaction of the device	Possible follow-up errors	Possible cause of error	Suggestion for error correction	Useful test functions (chapter)
180	CRC Check Gas cor.Data Channel 4	Data consistency problem in EEPROM of the MC board	8	—	9	21	7.4.3
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	—
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	7.4.3
186	CRC Check VP Board HW Data	Data consistency problem in EEPROM of the VP board	6	182	13	21	7.4.3
187	CRC Check IQ Board HW Data	Data consistency problem in EEPROM of the IQ board	6	183	12	21	7.4.3
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	7.4.3
189	RAM Test Failure ! → Service	An error occurred when testing the dynamic processor RAM	1	—	9	21	7.4.3
190	CRC ROM Test Failure ! → Service	An error occurred when testing the processor program memory (ROM)	1	—	9	21	7.4.3
191	Power Supply Overtemp	Temperature gauge on the IQ print signals overheating	20, 21, 23, 10	192, 193	24 12	18 21	7.4.5/7.4.6 7.4.5/7.4.6
192	IQ-Board Power Supply Temp. Warning	Temperature gauge on the IQ print signals overheating	18, 19, 15	191, 193	24 12	18 21	7.4.5 7.4.5
193	IQ-Board Power Supply Temp. Error	Temperature gauge on the IQ print signals overheating	20, 21, 16	191, 192	24 12	18 21	7.4.5 7.4.5
194	No Mains Frequency Signal	Mains frequency signal of IQ board is missing	28	—	12	20	7.4.5
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	7.4.5 7.4.5
196	MC-Board Power Supply +5V Warning	+5 V supply on the MC board deviates from the setpoint	18, 19, 22, 15	200	12 9	21 21	7.4.5 7.4.5
197	MC-Board Power Supply +15V Warning	+15 V supply on the MC board deviates from the setpoint	22, 15	201	12 9	21 21	7.4.5 7.4.5
198	MC-Board Power Supply +24V Warning	+24 V supply on the MC board deviates from the setpoint	18, 19, 15	202	12 9	21 21	7.4.5 7.4.5
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 9	21 21	7.4.5 7.4.5

(continued)

(Table "Error Messages" continued)

Error no.	Error message	Error description	Reaction of the device	Possible follow-up errors	Possible cause of error	Suggestion for error correction	Useful test functions (chapter)
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 9	21 21	7.4.5 7.4.5
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 9	21 21	7.4.5 7.4.5
202	MC-Board Power Supply +24V Error	+24 V supply on the MC board is missing or shows an unacceptable deviation from the setpoint	21, 21, 23, 16	198	12 9	21 21	7.4.5 7.4.5
203	VP-Board Power Supply +15V Warning	+15 V supply on the VP board deviates from the setpoint	18, 19, 15	205	12 13	21 21	7.4.5 7.4.5
204	VP-Board Power Supply −15V Warning	−15 V supply on the VP board deviates from the setpoint	18, 19, 15	206	12 13	21 21	7.4.5 7.4.5
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 13	21 21	7.4.5 7.4.5
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 13	21 21	7.4.5 7.4.5
221	SPI Communication Overrun Error	An overrun error has occurred during internal communication via SPI	1, 4, 16	—	22	21	7.4.2
222	No Dynamic RAM Available	The dynamic RAM required for running the program is not sufficient	1, 4, 16	—	22	21	7.4.3
223	EEPROM Address Mismatch	Invalid address when saving data in the internal EEPROM of the MC board	1, 4, 16	—	22	21	7.4.2/7.4.3

(continued)

E: 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 (→ 5.2.7, 🗎 47) the +24 V voltage for channel 3 is switched off
19	Depending on the configuration (→ 5.2.7, 🗎 47), 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 (→ 5.2.7, 🗎 47), the emission is switched off
23	The emission is switched off
24	The default values for the device parameters are loaded
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 (→ 5.2.7, 🗎 47), 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	Gauge change during operation
3	Wrong gauge connected
4	Faulty gauge connected
5	Unacceptable pressure rise in the vacuum system
6	Gauge cable too long (resistance too high)
7	Gauge connection problem There are many possible causes for such an error. Here are a few examples: • Improper installation (cable routing, grounding, etc.) • Gauge cable too long • Gauge 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 gauge) Because of the extremely small measuring currents, some of these causes have a stronger effect in the lower pressure ranges.
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 (→ "Technical Data", 🗎 8).
16	The maximum permissible load for the +5 V power supply for the RS232 interface is exceeded (→ "Technical Data", 🗎 8).
17	Disturbances in the RS232 cable, caused by electric or magnetic interference or by faulty/improper wiring
18	RS232 configuration of the IM540 is not compatible with the one of the connected device
19	Wrong firmware installed in the IF540P board (→ 🕮 [4]).
20	IF540P board is not installed correctly (→ 🕮 [4]).
21	A SW update has been performed
22	General IM540 software error
23	Hardware error in the display module (CS board)
24	Thermal problem (e.g. louvers obstructed or ambient temperature too high) (→ "Technical Data", 🗎 8).

Suggestions for error correction

Code	Meaning
1	Delete the error message
2	Restart the device
3	Replace the gauge and restart
4	Connect the correct gauge and restart
5	Use a suitable gauge cable and restart
6	Select a less sensitive current amplification program
7	Correcting a gauge connection problem: Read the respective entries in Section "Possible cause of the error", 🗎 155), 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 gauge
11	Select a valid gas type table, create or assign a suitable gas type table, or select a suitable gauge
12	Enter the device parameters again
13	Check the RS232 parameter settings of the IM540 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 (→ "Technical Data", 🗎 8).
16	Replace the firmware EEPROM on the IF540P Profibus board with the latest version (→ 🕮 [4]).
17	Pay attention to correct installation of the IF540P Profibus board (→ 🕮 [4]).
18	Make sure that air can circulate freely through the device, adhere to the ambient temperature range (→ "Technical Data", 🗎 8). Wait for the cool-down time.
19	Adjust the «Filament power» parameter (→ 5.3.5, 🗎 50).
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 to the service center

Useful test functions

Chapter	Meaning
7.4.x	Test program recommendation: The IM540 provides a number of useful test functions which make troubleshooting easier. Pay attention to the required safety measures when using the test mode.

F: Literature

📖 [1] www.inficon.com
Operating Manual
Pirani Standard Gauge PSG500, PSG500-S, PSG502--S, PSG510-S, PSG512-S
tina44e1
INFICON AG, LI–9496 Balzers, Liechtenstein

📖 [2] www.inficon.com
Operating Manual
Capacitance Diaphragm Gauge CDG025D, CDG025D-S
tina49e1
INFICON AG, LI–9496 Balzers, Liechtenstein

📖 [3] www.inficon.com
Operating Manual
Integration Sensors IE414, IE514
tinb19e1
INFICON AG, LI–9496 Balzers, Liechtenstein

📖 [4] www.inficon.com
Communication Protocol
IF540P Profibus-DP Interface Board
tirb18e1
INFICON AG, LI–9496 Balzers, Liechtenstein

EU Declaration of Conformity

CE

Manufacturer: INFICON AG, Alte Landstraße 6, LI-9496 Balzers

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Product: IM540
(operation with IE414, IE514)

The product of the declaration described above is in conformity with following Union harmonization legislation:

- 2014/35/EU, OJ L 96/357 29.3.2014
  (LV Directive; Directive relating to electrical equipment designed for use within certain voltage limits)
- 2014/30/EU, OJ L 96/79, 29.3.2014
  (EMC Directive; Directive relating to electromagnetic compatibility)
- 2011/65/EU, OJ L 174/88, 1.7.2011
  (RoHS Directive; Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment)

Harmonized and international/national standards and specifications:

- EN 61000-6-2:2005
  (EMC: generic immunity standard for industrial enviroments)
- EN 61000-6-4:2007 + A1:2011
  (EMC: generic emission standard for industrial enviroments)
- EN 61010-1:2010 + A1:2019 + A1:2019/AC:2019
  (Safety requirements for electrical equipment for measurement, control and laboratory use)
- EN 61326-1:2013; Group 1, Class A
  (EMC requirements for electrical equipment for measurement, control and laboratory use)
- EN IEC 63000:2018
  (RoHS: technical documentation)

Signed for and on behalf of: INFICON AG, Alte Landstraße 6, LI-9496 Balzers

Balzers, 2025-03-31

William Opie
Managing Director

Balzers, 2025-03-31

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UKCA Declaration of Conformity

Manufacturer: INFICON AG, Alte Landstraße 6, LI-9496 Balzers

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Product: IM540
(operation with IE414, IE514)

The product of the declaration described above is in conformity with the relevant UK Statutory Instruments:

- S.I. 2016/1101, 11.2016
  (The electrical equipment (safety) regulations 2016)
- S.I. 2016/1091, 11.2016
  (The electromagnetic compatibility regulations 2016)
- S.I. 2012/3032, 12.2012
  (The restriction of the use of certain hazardous substances in electrical and electronic equipment regulations 2012)

Harmonized and international/national standards and specifications:

- EN 61000-6-2:2005
  (EMC: generic immunity standard for industrial enviroments)
- EN 61000-6-4:2007 + A1:2011
  (EMC: generic emission standard for industrial enviroments)
- EN 61010-1:2010 + A1:2019 + A1:2019/AC:2019
  (Safety requirements for electrical equipment for measurement, control and laboratory use)
- EN 61326-1:2013; Group 1, Class A
  (EMC requirements for electrical equipment for measurement, control and laboratory use)
- EN IEC 63000:2018
  (RoHS: technical documentation)

Signed for and on behalf of: INFICON AG, Alte Landstraße 6, LI-9496 Balzers

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