balzers

Instruments

ARCHIV

Ion gauge control

IMG 300

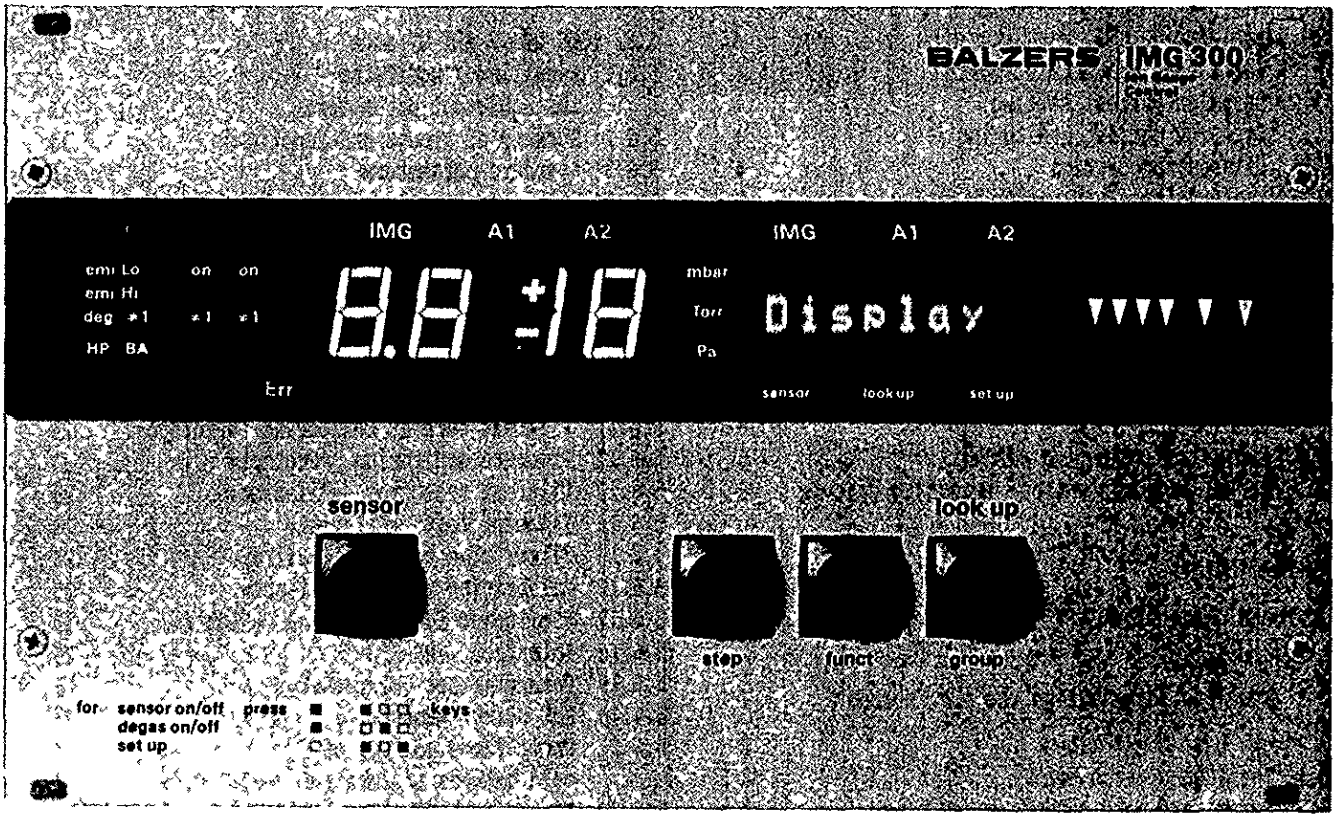


TABLE OF CONTENTS

1. IMPORTANT INFORMATION

1.1 Information marked Note, Caution and DANGER

NOTE: Draws the attention to the possibility of **measurement errors.**

CAUTION: Draws the attention to operations that could **damage the measuring equipment or peripheral devices.**

DANGER: Draws the attention to the possibility of personal injury or danger to life for the **operator or nearby persons.**

1.2 Protection against static discharges

CAUTION: Certain electronic components are highly sensitive to static discharges which means that precautions to prevent static charges must be taken. P.c. boards are to be stored in antistatic bags or containers.

BALZERS may **decline any warranty obligations** for defects caused by the violation of this recommendation.

1.3 Symbols

The following symbols are used:

Hazardous electrical voltage

Refer to the operating instructions

Protective ground (yellow/green)

1.4 Explanation of code characters

The following types of brackets are used in these instructions:

< > Designation of the operator control/component (key, potentiometer, test socket, etc.)

« » Indication, response (screen text, display data, LED, etc.)

» « Operating mode, effect (»degas«, etc.)

1.5 Validity

These operating instructions apply to ion gauge controls with serial numbers **BG 509 782 --**. You can read out the version of your equipment by following the instructions in Section 5.6.23.

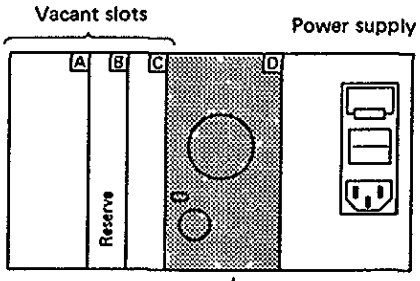
2. INTRODUCTION

2.1 Features

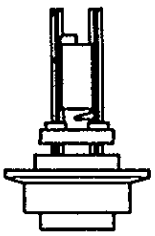
- Ionization pressure gauge for various BALZERS gauge heads.
- Additional slot either for dual Pirani, single cold cathode or combined cold cathode/Pirani measurement board.
- Two slots for interface boards.
- Continuous analog signal for each measuring circuit.
- Six programmable switching functions with two thresholds each.
- Two external control inputs for switching functions.
- Digital filtering of the measured values.
- All parameters programmable manually and via the RS-232-C interface.
- Nonvolatile parameter memory.
- IMR gauge head protection based on pressure and heating current.
- Automatic emission changeover.
- Programmable hot start.
- Two-stage code lock.
- Exchangeable p.c. boards, conversion or retrofitting capabilities.

2.2 System overview

2.2.1 Basic unit

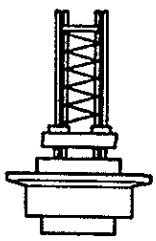


IMR - gauge heads



HP gauges:

IMR 310 (KF)
IMR 310P (KF)
IMR 312 (CF)

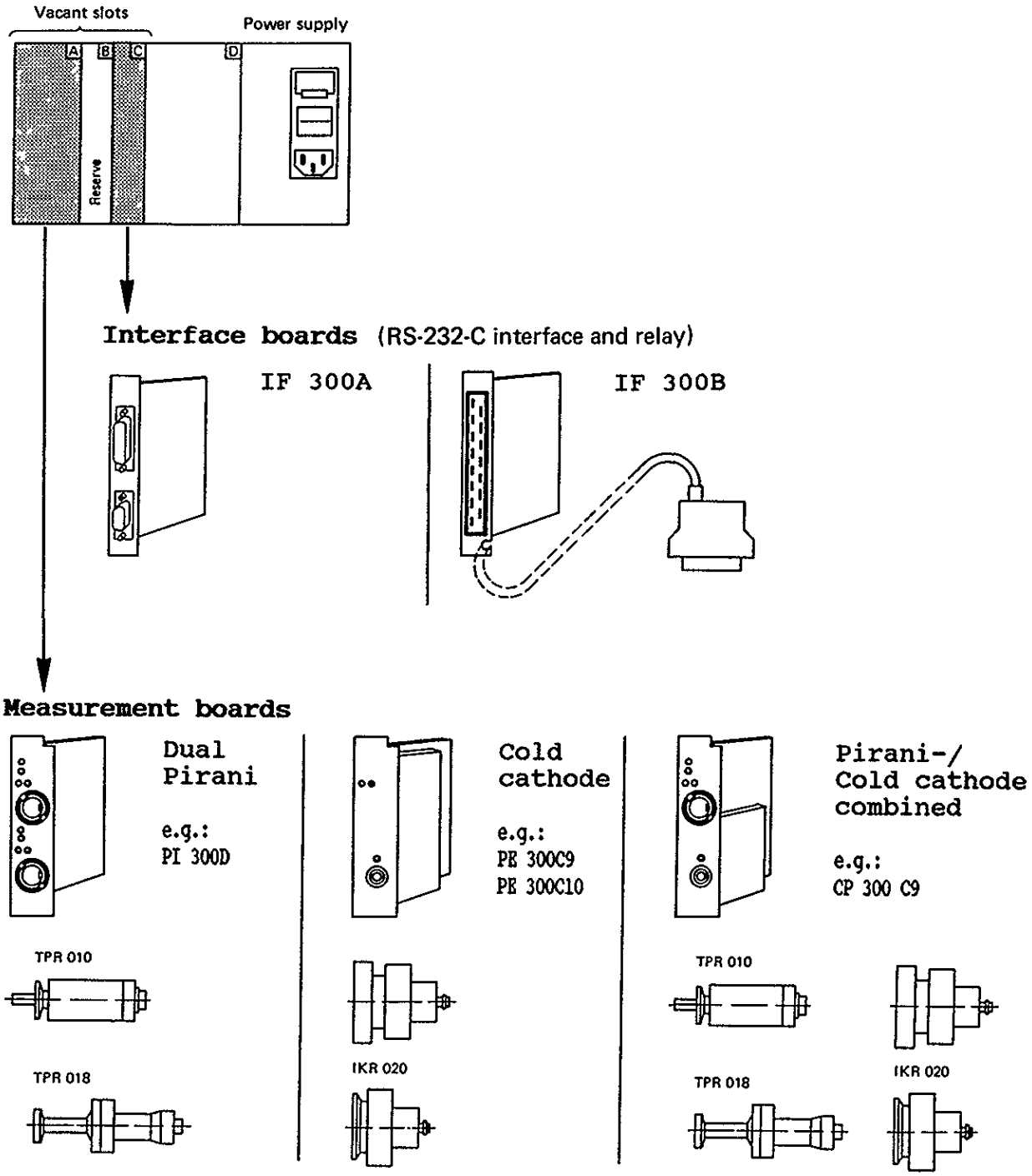


BA gauges:

IMR 320 (KF)
IMR 325 (CF)

DANGER: For correct installation of the gauge head, please refer to the instructions in Section 4.3.

2.2.2 Supplementary p.c. boards



DANGER: For correct installation of the p.c. boards please refer to the instructions in Section 4.2.

A listing of all p.c. boards suited for use with the IMG 300 can be found in Section 6.2. For detailed information to the p.c. boards refer to the separate operating instructions [3].

3. DESCRIPTION

3.1 Basic unit

3.1.1 Ionization measurement board

This measurement board which is standard equipment of the basic unit, is suited either for Bayard-Alpert or high-pressure gauge heads. It essentially consists of an emission current control circuit and a logarithmic electrometer amplifier. Two control inputs are available for external control of the measuring circuits and the switching functions. As on the other measurement boards there is also an analog signal output.

3.1.2 Emission current setting

If you select the automatic emission current setting (Emi Auto), the unit works with lower emission at high pressures and with high emission at low pressures. The changeover occurs about two decades below the upper measurement limit of the connected gauge head. The hysteresis is approx. 1/2 decade.

This standard setting is satisfactory for most applications. For special applications you can select a fixed value for one of the two emission currents (refer to Section 5.6.8).

3.1.3 Emission current monitoring

If the actual emission current deviates from the preset value by more than 15%, e.g. because the gauge head cable is too long, the error message «EmissErr» comes. At the same time the emission and the anode voltage are switched off.

3.1.4 Filament protection

During the operation the filament is protected against burn-out in two different ways (filament protection):

Filament current monitoring

The filament current I_f is monitored by the microprocessor. During degas the selected cutoff limit I_p (refer to Section 5.6.11) is automatically increased by 20% based on the higher heating current consumption.

If the monitoring circuit responds the error message «I>Ip_IMR» occurs. The emission and the anode voltage are switched off.

Pressure monitoring

If a fixed pressure limit P_p is exceeded, the emission as well as the anode voltage are switched off. The corresponding error message is «p>Pp_IMR».

3.1.5 Anode voltage monitoring

The anode voltage is monitored by an over-power protection circuit which responds in the event of short circuits and glow discharges in the gauge heads.

If the power drawn exceeds approx. 15 W, the emission as well as the anode voltage are switched off and the error message «AnodeErr» appears.

The same error messages occurs if the connection <IMR enable> (external anode voltage interlock) is open (also refer to Section 4.4.).

3.2 Supplementary p.c. boards

Refer to the relevant operating instructions [3].

3.2.1 Pirani measurement boards

Pirani measurement boards contain two independent medium vacuum measurement circuits. One gauge head connector, two trimmer potentiometers, and one analog signal output are available for each measurement circuit. The Pirani measurement circuits are always enabled when the ion gauge control is switched on. The analog signals are continually available, independently of the pressure indication.

Measurement boards for different gauge heads and line lengths are available.

3.2.2 Cold cathode measurement boards

Each cold cathode measurement board for high vacuum and ultrahigh vacuum contains one measurement circuit. An analog signal output is also available. When the gauge head is switched on, the analog signal is continually available, independently of the pressure indication.

Measurement boards for the pressure range of 10^{-10} mbar and lower feature a special electronic circuit which limits the measuring current to 100 μA. This greatly extends the life of the gauge heads.

Various measurement board versions are available that cover a wide range of measuring applications.

3.2.3 *Pirani / cold cathode measurement boards*

As the name implies, this category of boards features one Pirani and one cold cathode measurement circuit. The characteristics of these measurement circuits correspond to the measurement boards described above.

3.2.4 Interface boards

Two interface board types are available for card slot C. Both contain an RS-232-C interface and five relays with floating changeover contacts. Four of these can be assigned to any measurement circuit and be used directly for controlling the processes. The fifth relay trips in the event of a fault. The principal difference between these two types is the switching voltage of the relays and the type of interface port.

Slot B is reserved for an additional interface board which is not yet available at this time.

3.3 Measuring principles

3.3.1 Ionization measuring circuit

The quantity measured is the pressure-dependent ionization current of a hot cathode gauge head. On their trajectory to the positive electron collector, the electrons emitted by the cathode ionize the existing gas molecules. As a result, positively charged ions are created which can be measured with the aid of the ion collector. The emission current is stabilized by a control circuit which means that within the measuring range the ion current is proportional to the pressure. The measuring current is converted to a corresponding voltage by the electrometer amplifier and subsequently evaluated.

3.3.2 Pirani and cold cathode measuring circuit

Refer to the separate operating instructions [3].

4. INSTALLATION

DANGER: Whenever it is likely that the protection has been impaired, the apparatus shall be made inoperative and be secured against any unintended operati. The protection is likely to be impaired if, for example, the apparatus:
- shows visible damage,
- fails to perform the intended measurements,
- has been subjected to prolonged storage under unfavourable conditions,
- has been subjected to severe transport stresses.

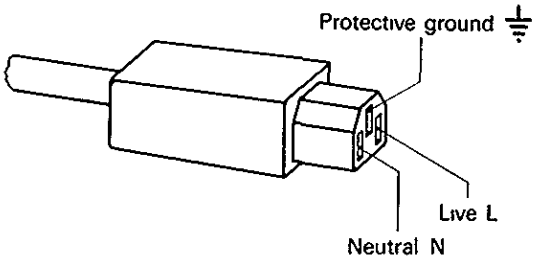
4.1 Power connection

You can connect the IMG 300 without voltage adaptation to any conventional supply system equipped with protective ground. A matching power cable is normally supplied with each unit.

DANGER: The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord without a protective conductor.

To ensure continual grounding, connect the power cable before any other cables and conversely, detach all other cables before the power cable.

If you make a power cable to suit your own requirements, you will need and EU-standard appliance connector (refer to section 10.3).



If the unit is rack mounted, the AC line voltage should be supplied via a switched power distributor.

4.2 P.c. boards

DANGER: For safety reasons, vacant slots should always be covered with dummy panels.

4.2.1 Removing / installing the p.c. boards

DANGER: Although it is of the plug-in type, the ionization measurement board is an integral part of the IMG 300. It is not permitted to operate the ion gauge control without the IM 300.

The procedure for installing / removing the supplementary plug-in boards is described in the relevant operating instructions [3].

4.3 Gauge head connections

DANGER: Additional protective measures should be implemented if certain processes in the vacuum system (e.g. flashovers) cause dangerous voltages on the gauge head terminals.

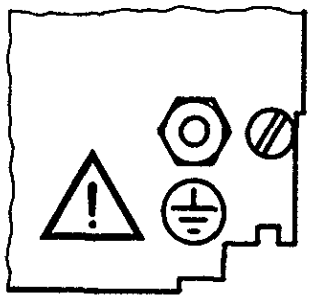
NOTE: The gauge head cables should not be run parallel to lines producing strong noise.

4.3.1 Ionization gauge head

DANGER: The IMR gauge head is to be installed in the vacuum chamber in accordance with the relevant operating instructions [4], [5].

The gauge head is linked to the <IMR> connector by means of the 7-conductor cable (with integrated coaxial cable). This connector can be interlocked.

On the bottom right at the rear panel of the IMG 300 there is a ground pin which is to be connected to ground if an IMR 310P gauge head is used.



The gauge heads of the series IMR 310 and IMR 320 are automatically recognized by the ion gauge control and the corresponding parameters are selected.

The maximum cable length of 30 m (conductor cross-section 1.5 mm²) may only be exceeded by increasing the conductor cross-section (special cable required).

4.3.2 Pirani and cold cathode gauge heads

Refer to the separate operating instructions [3].

4.4 Anode voltage interlock <IMR enable>

The ion gauge control is equipped with an anode voltage interlock.

DANGER: Install the IMR gauge head correctly so that it is safe to touch.

If in your specific application you cannot install the IMR gauge head in such a way that it is safe to touch, you must provide a floating contact on the vacuum chamber to make sure that the anode voltage is automatically switched off when the contact is opened. Depending on the system type this occurs when the vacuum chamber door is opened, the bell is lifted, etc. The contact is to be connected by means of a screened cable to the <IMR enable> terminal on the rear panel of the ion gauge control. The screening is connected to the gauge control over pin 2 and is left open on the vacuum chamber side.

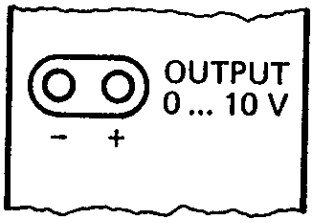
Bild
Pin assignment viewed from the connector face

In all other cases it suffices to bypass the contact with the supplied jumper. If the contact remains open, the message «AnodeErr» is displayed when the emission is switched on.

DANGER: The anode voltage interlock acts only on the IMR gauge head and not on the high voltage of any cold cathode measurement circuit.

4.5 Analog signal output <OUTPUT>

Each measurement circuit features an analog signal output. Matching connectors (diam. 2 mm) are supplied.

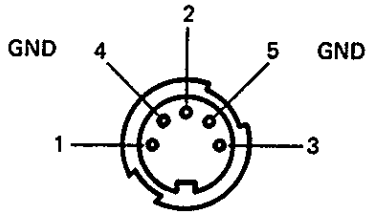


4.6 External initiation of switching function <EXT IN>

With corresponding selection of the controlling source (refer to Section 5.6.4), the switching function can be set to »on« via this socket. A TTL signal or a floating contact can be used for this purpose.

Use of a shielded cable is recommended (shielding on pin 2).

Pin assignment viewed from the connector face



1 - 4: EXT 1 IN
3 - 5: EXT 2 IN
2: Chassis

4.7 19" Rack installation

The IMG 300 can be installed in a 19" rack mount adapter according to DIN 41 494, but not in older rack frames conforming to BALZERS standard.

DANGER: If the unit is built into a rack frame the necessary protective system (protection against foreign substances and water) must be adhered to, e.g. switching boxes according to DIN VDE 0113.

CAUTION: The ambient temperature inside the rack must not exceed +50 °C.

If older units (BALZERS standard) are to be installed in the same rack frame as the IMG 300 (DIN), a special adapter is required (refer to Section 10.5).

5. OPERATION

5.1 Measuring with the IMG 300

5.1.1 Power on procedure

CAUTION: Before you switch on the equipment, check that all p.c. boards, connection cables and gauge heads are installed correctly (refer to Section 4) and that the technical parameters are satisfied (refer to Section 6).

DANGER: Any interruption of the protective conductor inside or outside the apparatus or disconnection of the protective earth terminal is likely to make the apparatus dangerous. Intentional interruption is prohibited.

The power switch is located on the back of the unit. After power has been switched on, the ion gauge control performs a self-test and reactivates the parameters which where in effect before the power was switched off. After approximately two seconds all measurement circuits with activated hot start (refer to Section 5.6.20) and all operational Pirani gauge heads are switched on. The measured value of the first measurement circuit in operation will be displayed.

After switching off wait 10 seconds before turning the unit on again (start circuit reset, defined soft-start).

Make sure that the <IMR enable> connection is closed, otherwise the emission cannot be switched on (refer to Section 4.4).

5.1.2 Dependence on gas type

The measurement indication of the ion gauge control depends on the gas type. A calibration factor of 1.00 relates to nitrogen (N_2).

For other gases please note that the calibration factors listed in Appendix B have to be taken into consideration.

5.1.3 Validity of displayed data

The measured values displayed after power provide information on the pressure in your vacuum system. Depending on the condition of the gauge heads as well as the electrical and thermal time constants, it may take a while before the reading stabilizes (given a static pressure). This is particularly important to note if you intend to use the measurement results for control functions.

5.1.4 Accuracy of the displayed data

No generally valid statement concerning the accuracy of the measured values can be made. In addition to the gas type it depends largely on the actual condition of the gauge head.

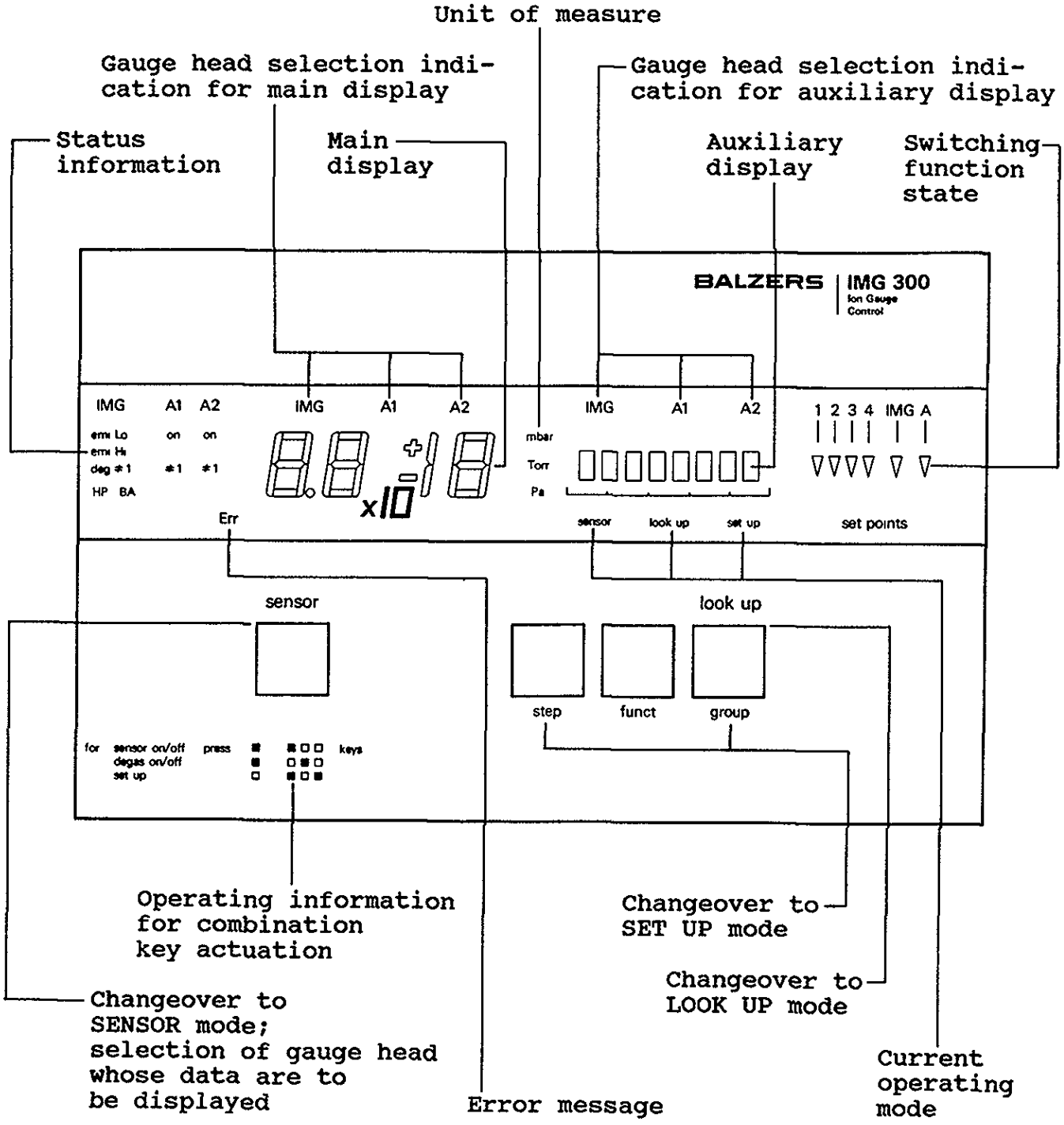
The momentary accuracy of the gauge head can only be determined by comparison with reference equipment. For reliable comparison measurements, particularly at pressures below 10^{-4} mbar, different calibration pumping stations are available.

5.1.5 Alignment

Ionization and cold cathode measurement circuits are factory-aligned and require no recalibration.

Pirani measurement circuits are also factory-aligned. For accurate measurements please refer to the separate operation instructions [3].

5.2 Front panel



5.3 Operating modes

The IMG 300 can operate in three different modes:

SENSOR mode

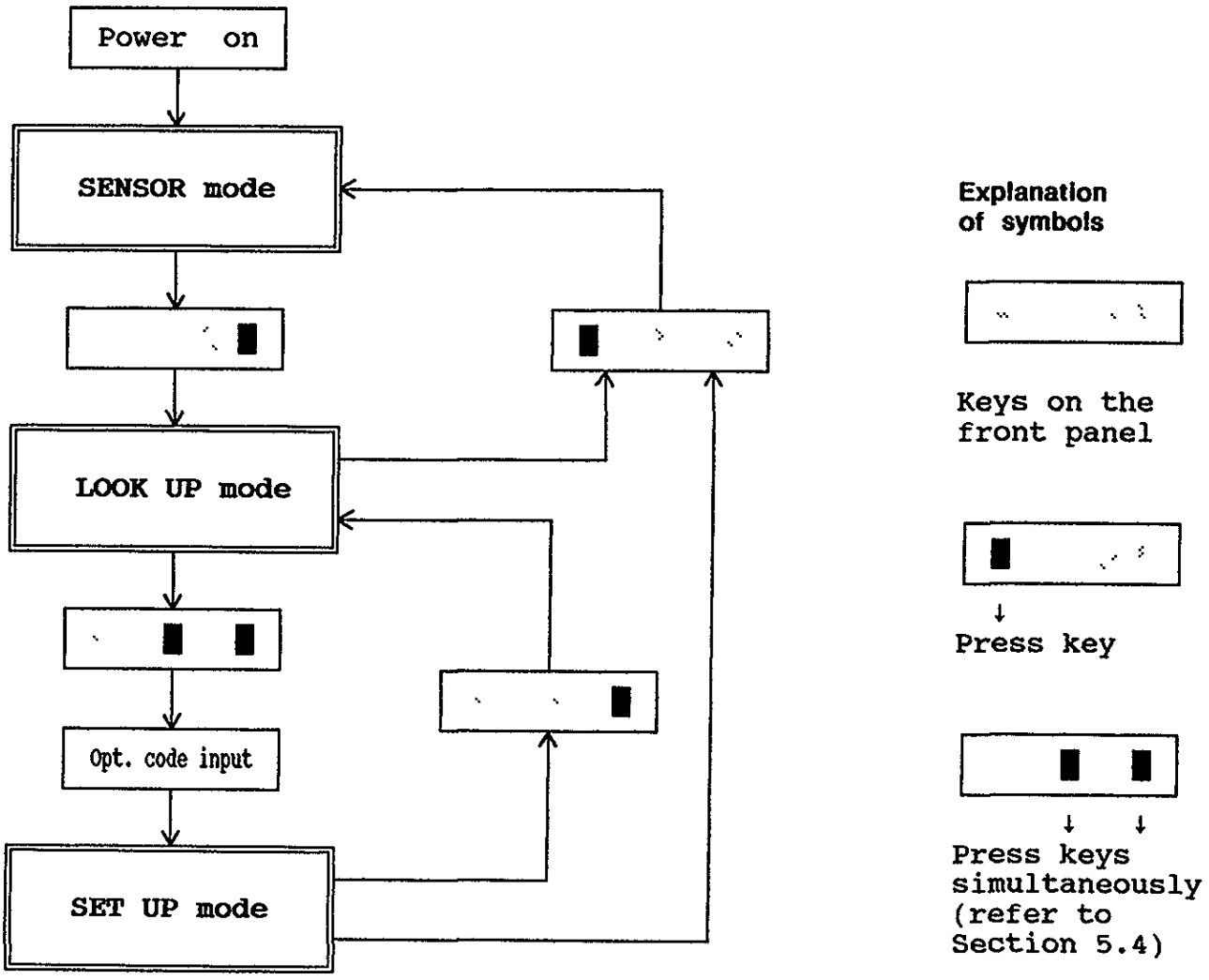
- Pressure measurement
- Select gauge head
- Switch gauge head on/off

LOOK UP mode

- Read out the equipment parameters

SET UP mode

- Modify the equipment parameters



5.4 Control key overview

SENSOR mode
(Pressure measurement)

Select gauge head

[1])

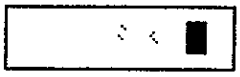
Switch selected gauge head on or off

[1])

Switch degas on or off

Display existing error messages

Delete existing error messages



Delete existing error messages

Activate LOOK UP mode

LOOK UP mode
(Parameter inquiry)

Select next group in LOOK UP mode

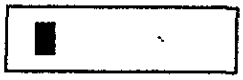
Select next function in LOOK UP mode

[1])

Switch selected gauge head on or off

[1])

Switch degas on or off



Activate SENSOR mode

[1])

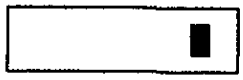
Activate SET UP mode

SET UP mode
(parameter selection)

Select next function in SET UP mode, if existing

Modify the selected parameter or start the test programs

Activate SENSOR mode

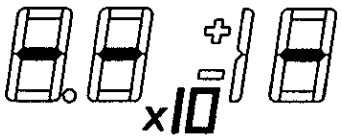
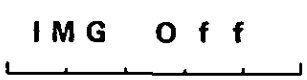


Activate LOOK UP mode

[1]) In order to void unintentional entries, certain operations require the actuation of two keys. The operating information on the front panel specifies which keys need to be pressed simultaneously. It is important, however, that <sensor> or <look up> are not pressed before the other key, otherwise the basic function will be executed.

5.5 SENSOR mode

5.5.1 Switching the gauge head on / off

	Main display	Auxiliary display
Each measurement circuit can be individually switched on or off. Manual on / off-switching has priority over the automatic control.	Measured value or e.g. 	Measured value or e.g. 
Note: Switch on the cold cathode gauge heads at pressures of $<10^{-3}$ mbar, in order to prevent excessive contamination of the gauge head.	Pirani gauge heads are not deactivated by switching them off, only their measuring results and the error message are suppressed.	
When the IMG measurement circuit is switched on, the LED «emi Lo» or «emi Hi» lights up. 	When the measurement circuit A1 is switched on, the «on» LED on the front panel is light. 	When the measurement circuit A2 is switched on, the «on» LED on the front panel is light. 

5.5.2 Out of range

	Main display	Auxiliary display
If the measured value is outside the measuring range of the board, this will be indicated if the corresponding gauge head is selected. If the ionization or cold cathode measurement circuit is controlled by another measurement circuit, the display changes over automatically.		
	Measurement over range: «**or**» and exponent which specifies the range limit	Measurement over range: «**OverRng**»
	Note: If the measurement upper range limit is exceeded, the cold cathode gauge head can become contaminated if it remains switched on.	

UnderRng

Measurement under range: «ur» and exponent which specifies the range limit

Measurement under range: «**UnderRng**»

Note: If the under range control is switched off (refer to Section 5.6.21), the system cannot distinguish between a gauge head failure, cable interruption, and under range of a cold cathode measurement circuit. «Underrange» is displayed in all cases.

5.5.3 Automatic gauge head selection

	Main display	Auxiliary display
If a measurement circuit is controlled by another measurement circuit and if either one is selected, the display automatically changes over. - If the measured value drops below the lower threshold, or - If the measured value exceeds the upper threshold	Measured value or e.g.  Automatic control: «**Au**»	Measured value or e.g. Wait A2 Automatic control: «**Wait A2** », await the fulfillment of the power on condition by the measurement circuit A2.

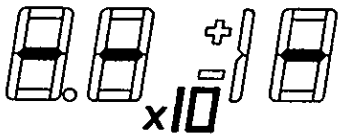
5.5.4 Self-monitoring

	Main display	Auxiliary display
If the ionization or cold cathode measurement circuit is self-monitored, it automatically switches off - If the upper threshold is exceeded. The circuit must be restarted manually.	Measured value or e.g. 	Measured value or e.g. A 1 O f f

5.5.5 Degas mode

Degassing of the ionization gauge head makes sense only at low pressures. For this reason «degas» is only allowed at pressures below a predefined threshold (refer to Section 6.2).

If the attempt to degas at higher pressures, the warning «p>PDegas» is output briefly.

	Main display	Auxiliary display
During the degassing of the ionization gauge head the current degas time is shown on the auxiliary display, provided the IMG measurement circuit is selected.		t = 0 : 3 4 Degassing lasts another 34 seconds

Upon activation of «degas», gentle degassing, i.e. with 1 W, is performed during the first five seconds, before degassing with the full power of 10 W occurs. The total degas time can be selected (refer to Section 5.6.9).

Pirani and cold cathode gauge heads cannot be degassed.

5.6 LOOK UP- / SET UP mode

5.6.1 Recalling / modifying the equipment parameters

You can check the setup of your equipment by selecting the individual parameters in LOOK UP mode by means of , ▮ <group> and ▮ <funct>.

In order to modify a parameter you must first select it in LOOK UP mode before you can alter with in SET UP mode with ▮ <funct> and ▮ <step>. The parameter that can be changed flashes.

5.6.2 Summary of groups and functions

Group	Function(s)	
SETPOINT	Thresh	
DISPLAY	DispMode	
	MeasUnit	
IMRGAUGE	GaugeTyp	
	Emission	
	DegTime	
	Filament	(heating current)
	Protect	(current)
	Protect	(pressure)
	Filament	(selection)
	Filament	(test)
FILTER	IMG	
	A1	
	A2	
CALFACT	IMG	
	A1	
	A2	
IDENTIFY	Slot A	
	Slot B	
	Slot C	
	Slot D	
COMMUNIC	RS-232-C	
AUXILIAR	ParamSet	
	Hotstart	
	PE-UrCtl	
	Code	
	PRG Numb	
	Test	

Groups, functions or parameters which do not exist because of the equipment configuration will be bypassed.

5.6.3 Standard parameters

The standard parameters are summarized in the following table. In the 'user' column you can enter your own parameter set.

Parameter		Standard	User
Lower threshold	Switching function 1	$1.0 \cdot 10^{-11}$ mbar	
	Switching function 2	$1.0 \cdot 10^{-11}$ mbar	
	Switching function 3	$1.0 \cdot 10^{-11}$ mbar	
	Switching function 4	$1.0 \cdot 10^{-11}$ mbar	
	Switching function I	$1.0 \cdot 10^{+0}$ mbar	
	Switching function A	$6.0 \cdot 10^{-3}$ mbar	
Upper threshold	Switching function 1	$9.0 \cdot 10^{-11}$ mbar	
	Switching function 2	$9.0 \cdot 10^{-11}$ mbar	
	Switching function 3	$9.0 \cdot 10^{-11}$ mbar	
	Switching function 4	$9.0 \cdot 10^{-11}$ mbar	
	Switching function I	$1.5 \cdot 10^{+0}$ mbar	
	Switching function A	$8.0 \cdot 10^{-3}$ mbar	
Switching function assignment	Switching function 1	No (none)	
	Switching function 2	No (none)	
	Switching function 3	No (none)	
	Switching function 4	No (none)	
	Switching function I	No (none)	
	Switching function A	No (none)	
Display mode		Sel/Barg	
Unit of measure		mbar	
Gauge head		HP gauge	
Filament		Filam 1	
Emission	Current selection	automatic	
	Cutoff threshold	3.2 A	
Degas time		1 min	
Filter time constant	IMG measurement circuit	medium	
	Measurement circuit A1	medium	
	Measurement circuit A2	medium	
Calibration factor	IMG measurement circuit	1.00	
	Measurement circuit A1	1.00	
	Measurement circuit A2	1.00	
Baud rate		9600	
Hot start	IMG measurement circuit	No	
	Measurement circuit A1	No	
	Measurement circuit A2	No	
PE Measurement-underrange-control		No (disabled)	
Code		00 0 (unlocked)	

5.6.4 Switching functions «Thresh» (SETPOINT group)

You obtain a measurement indication across all measurement ranges if you control the ionization measurement circuit with a Pirani measurement circuit. External events can also be influenced via the relay contacts if the IF is installed.

LOOK UP mode

[1]1.0-11No

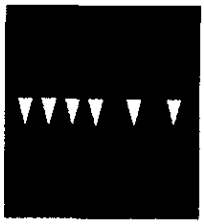
- No → Controlled switching function (assignment)
- 11 → Threshold of the switching function
- 1.0 → Controlling source (current pressure)

The function of the gauge head is not influenced.

The output of measured values on the main display is not influenced.

The switching functions are displayed cyclically.

First the lower and then the upper threshold of the switching function is displayed.



The current switching function state can be determined at any time with the aid of the LEDs (LEDs are light when switching state »on«).

SET UP mode

x1.0-11yy
:
x9.9+3yy

- yy → Threshold of the switching function

The threshold is to be entered digit by digit.

Note: The hysteresis between the upper and the lower threshold pressure is at least 10% of the lower threshold. This prevents an unsteady state. If the upper threshold is set to a value less than the lower threshold, this minimal hysteresis is taken as the default.

x
- 1 -> Switching function 1, lower threshold
- 2 -> Switching function 1, upper threshold
:
- A -> Switching function A, upper threshold

yy
- A1 --> Measurement circuit A1
- A2 --> Measurement circuit A2
- IM --> IMG measurement circuit
- Ext1 -> external control via the input <EXT 1 IN>
- Ext2 -> external control via the input <EXT 2 IN>
- No --> No assignment (switching function inactive)

Assignments are only possible to existing sources.

The upper and lower threshold cannot be assigned to different measurement circuits. The previous setting is retained.

Changes become only effective with the next change to SENSOR or LOOK UP mode.

5.6.5 Display mode «DispMode» (DISPLAY group)

LOOK UP mode	SET UP mode
Sel/Barg └→ Mode of the auxiliary display (dot matrix display) └→ Mode of the main display (7-segment display) The selected display mode has no influence on the other equipment functions. If the measured value of the same measurement circuit is displayed on the main and the auxiliary display, the one on the auxiliary display contains two places after the decimal.	IMG/Sel Sel/Barg Sel/ExpM └→ Main display: measured value of the selected sensor, Auxiliary display: 3-position measured value of the selected sensor └→ Main display: measured value of the selected sensor, Auxiliary display: bar graph representation of the mantissa └→ Main display: measured value of the IMG sensor, Auxiliary display: 2-position measured value of the selected sensor Changes become effective immediately.

5.6.6 Measurement unit «MeasUnit» (DISPLAY group)

LOOK UP mode	SET UP mode
[mbar] └→ Unit of measure of the displayed pressure mbar / Torr / Pa — The indication corresponds to the LEDs on the front panel. The pressure transmitted via the interface does not necessarily have to be expressed in the same unit of measure.	[mbar] [Torr] [Pa] └→ Unit of pressure: Pascal └→ Unit of pressure: Torr └→ Unit of pressure: mbar Changes become effective immediately. The thresholds of the switching functions are automatically adjusted.

5.6.7 IMR gauge head type «GaugeTyp» (IMRGAUGE group)

LOOK UP mode	SET UP mode
HP gauge └→ IMR gauge type HP BA — The indication corresponds to the LEDs on the front panel	No setup

5.6.8 Emission «Emission» (IMRGAUGE group)

LOOK UP mode	SET UP mode
Emi Auto └→ Emission current selection emi Lo / emi Hi When the IMG measurement circuit is switched on, the front panel display shows the actual emission.	Emi Auto Emi Low Emi High └→ High Emission └→ Low Emission └→ Automatic changeover from low to high emission and vice versa. Changes become effective immediately.

5.6.9 Degas time «DegTime» (IMRGAUGE group)

LOOK UP mode	SET UP mode
t= 1min └→ Total degas time The effective degas time is shown on the auxiliary display under »degas« when the IMG measurement is selected. When »degas« is active the corresponding front panel LED is light	t= 0min : t= 10min └→ Total degas time Changes can be made in increments of one minute. The changes become effective immediately.

5.6.10 Filament current «Filament» (IMRGAUGE group)

LOOK UP mode	SET UP mode
If=3.19A └→ Filament heating current The heating current is only displayed if the emission is switched on.	No SET UP

5.6.11 Filament current monitoring «Protect» (IMRGAUGE group)

LOOK UP mode	SET UP mode
Ip> 3.2A └→ Filament cutoff current	Ip> 3.8A : Ip> 2.0A └→ Maximum admissible current Changes can be made in increments of 0.2 A. The current value should be approx. 25-30% higher than the heating current measured in the »Emi High« position (e.g. measured heating current : If = 2.36 A Recommended threshold : Ip = 2.95 A Setting : Ip = 3.0 A). Changes become effective immediately.

5.6.12 Pressure monitoring «Protect» (IMRGAUGE group)

LOOK UP mode	SET UP mode
Ip>1.3_{10}+0 └→ Filament cutoff pressure The pressure depends on the gauge head type and is displayed in the indicated unit of measure.	No SET UP

5.6.13 Filament selection «Filament» (IMRGAUGE group)

LOOK UP mode	SET UP mode
Filam 1 └→ Filament 1 in active LOOK UP is only active if an IMR gauge containing more than one filament is connected.	Filam 1 Filam 2 └→ Filament 2 active └→ Filament 1 active SET UP is only possible if an IMR gauge head containing more than one filament is connected. For SET UP the emission must be switched off. Changes become effective immediately.

5.6.14 Filament test «Filament» (IMRGAUGE group)

The filament test can be conducted under atmospheric pressure. The gauge head does not age because no anode voltage is applied.

LOOK UP mode	SET UP mode
FilamTst └→ Test the active filament	FilamTst └→ Test start Feedback: TestOkay or: TestFail The emission must be switched off for SET UP.

5.6.15 Filter time constant «Filter» (FILTER group)

If the measurement signals are unsteady, the measured values can be filtered for stabilizing the display and for stabilizing the switching functions.

LOOK UP mode	SET UP mode
IMG Medi **A1 Medi** **A2 Medi** └→ Filter stage └→ Measurement circuit A2 └→ Measurement circuit A1 └→ IMG measurement circuit	IMG Medi IMG Slow IMG Fast └→ Fast filter stage for IMG measurement circuit └→ Slow filter stage for IMG measurement circuit └→ Medium filter stage for IMG measurement circuit Changes become effective immediately. Note: If the measurement signal fluctuates, fast filtering can cause fluttering of a switching function. The filter stages for the measurement circuits A1 and A2 are set in the same way as for the IMG filter circuit.

5.6.16 Calibration factor «CalFact» (CALFACT group)

The result of the measurements is influenced by the gas in the vacuum chamber as well as the selected measuring principle. This influence can be eliminated by means of the calibration factor (refer to Appendix B).

LOOK UP mode	SET UP mode
IMG 1.00 **A1 1.00** **A2 1.00** └→ Calibration factor └→ Measurement circuit A2 └→ Measurement circuit A1 └→ IMG measurement circuit ▪1 If the calibration factor is not 1.00, the corresponding front panel LEDs are light.	IMG 0.10 : IMG 9.99 └→ Calibration factor for IMG measurement circuit The calibration factor is entered digit by digit. Changes become only effective when the SENSOR or LOOK UP mode is activated. A calibration factor smaller than 0.10 is automatically corrected to 0.10. The calibration factors for the measurement circuits A1 and A2 are set in the same way as for the IMG measurement circuit.

5.6.17 P.c. board identification «Slot X» (IDENTIFY group)

LOOK UP mode	SET UP mode
CP x9L └→ Detail identification └→ Type of circuit board For the decoding of circuit board types as well as detail identification refer to the separate operating instructions [3]. The identification is output for all slots according to the same principle.	No SET UP

5.6.18 Interface «RS-232-C» (COMMUNIC group)

LOOK UP mode	SET UP mode
9600Baud └→ Transmission rate LOOK UP is only active if an interface card is plugged in.	300Baud 1200Baud 2400Baud 4800Baud 9600Baud └→ Transmission rate 9600 bit/sec └→ Transmission rate 4800 bit/sec └→ Transmission rate 2400 bit/sec └→ Transmission rate 1200 bit/sec └→ Transmission rate 300 bit/sec The transmission rates of the IMG 300 and the connected computer must be identical. Changes become effective immediately.

5.6.19 Parameter set «ParamSet» (AUXILIAR group)

When the equipment is switched on, the previously active parameter set is reactivated. If the equipment is to be initialized, the default values can be activated.

LOOK UP mode	SET UP mode
DftSptNo └→ Activation status └→ Parameter set └→ Default values You cannot determine whether standard or user parameters are currently active.	DftSptxx DftParxx └→ Default values of the other parameters └→ Default values of the switching functions xx ├ No -> Do not activate default values └ Y -> Activate default values (also refer to Section 5.6.3) Caution: Activation of the default values has the following effect: - The switching functions are not assigned - The relays drop out - The communication with a computer may be disabled. Changes are only effective when the SENSOR or LOOK UP mode is activated.

5.6.20 Hot start «Hotstart» (AUXILIAR group)

By activating the hot start, a measurement circuit can be automatically reenabled after a power failure. This is particularly useful in the case of self-monitoring.

LOOK UP mode

No No No

└> Hot start measurement circuit A2

└> Hot start measurement circuit A1

└> Hot start IMG measurement circuit

SET UP mode

No No No

IM A1 A2

└> Hot start activated

└> Hot start not activated

The hot start is activated individually for each measurement circuit.

5.6.21 Under range control of cold cathode measurement «PE-UrCtl» (AUXILIAR group)

The behavior of switching functions assigned to the cold cathode measurement circuit, can be adjusted (except in the case of self-assignment).

LOOK UP mode

UrCtl No

└> The «UnderRng» is interpreted as a measured value (switching function remains »on«)

SET UP mode

UrCtl Y

UrCtl No

└> The «UnderRng» is interpreted as a measured value (switching function remains »on«)

└> «UnderRng» is interpreted as a fault (switching function changes to »off«). The switching function does not change to »on« until the measured value has remained within the measuring range of the cold cathode measurement board for at least 10 seconds.

Caution: Cold cathode measurement circuits for the range 10^{-11} sometimes requires more then 10 sec. for the transition «OverRng» -> «UnderRng».

5.6.22 Access authorization «Code» (AUXILIAR group)

As a protection against inadvertent or unauthorized manipulations on the operating states of the sensors or the parameters, the operation may be partially inhibited.

LOOK UP mode	SET UP mode
unlocked └→ Equipment not locked	Co 000xx : Co 999xx └→ Code number *The code number is entered digit by digit.* xx ├ No -> Do not store code : │ (for code 000) ├ Y -> Store code (the equipment is unlocked) : │ (for code 001 to code 998) ├ Y■ -> Store code (the SET UP mode is inhibited) ├ Y■ -> Store code (the equipment is locked) │ (except sensor changeover and LOOK UP mode)) : │ (for code 999) └ Y -> Store code (the equipment is unlocked. However it cannot be relocked (refer to Section 7.4.2)) *Changes become only effective when SENSOR or LOOK UP mode is activated.*

5.6.23 Program version «PRG Numb» (AUXILIAR group)

LOOK UP mode	SET UP mode
509782-- └→ Change index └→ Program version of the firmware Depending in the index, the program may perform additional functions. If a different program version is installed these operating instructions become invalid.	No SET UP

5.6.24 Test programs «Test» (AUXILIAR group)

LOOK UP mode

Test

└> Test programs

SET UP mode

Display
- RAM
  - EPROM
    - Keys
      - I/O
        - A/D conv.
          - RS-232-C
            - └> Interface (if configured)
          - └> A/D converter
        - └> I/Os (only if no measurement board installed)
      - └> Input keys (only if measurement board installed)
    - └> EPROM
  - └> RAM
- └> Displays

Display
- ├> Test start (Test runs continuously)
- └> Test stop

RAM
- └> Test start

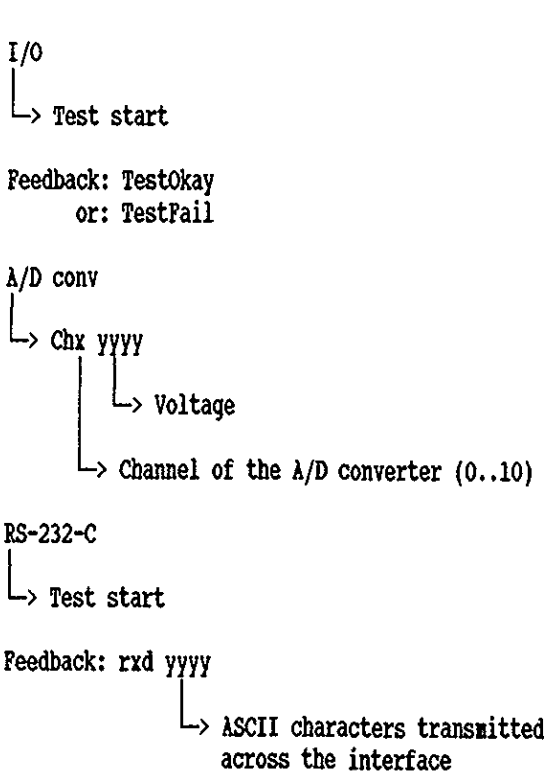
Feedback: Okayxxxx
or: Failxxxx
- └> tested RAM memory location

EPROM
- └> Test start

Feedback: Okayxxxx
or: Failxxxx
- └> Checksum

Keys
- └> Test start

Feedback: TestOkay
or: TestFail



For additional information to the test program please refer to the IMG 300 maintenance instructions.

6. TECHNICAL DATA

6.1 General

Unless specified to the contrary, the following information applies to all modules of the IMG 300.

Admissible temperature	
Storage	-40 °C ... +65 °C
Operation	+ 5 °C ... +50 °C
Relative humidity	max. 80% at temperatures up to +31 °C decreasing to 50% at +40 °C
Application	only indoors Height up to 2000 m NN

6.2 Basic unit

Measurement range [2]	
HP gauge head	1.0 mbar ... $1.0 \cdot 10^{-6}$ mbar
BA gauge head	$1.0 \cdot 10^{-2}$ mbar ... $1.0 \cdot 10^{-9}$ mbar
Suitable gauge heads	
HP gauge head	IMR 310, IMR 312, IMR 310P
BA gauge head	IMR 320, IMR 325
Gauge head factor	
HP gauge head	1.65 $mbar^{-1}$
BA gauge head	5.2 $mbar^{-1}$
Max. length of measurement line	max. 30 m (1.5 mm^2)
Operating data for IMR gauge head	
a) Measurement operation	
Emission current Auto	automatic changeover of the emission two decades before the upper range limit Low → High: < $6.3 \cdot 10^{-3}$ mbar (HP gauge heads) High → Low: > $1.6 \cdot 10^{-2}$ mbar Low → High: < $6.3 \cdot 10^{-5}$ mbar (BA gauge heads) High → Low: > $1.6 \cdot 10^{-4}$ mbar
High	50 µA (HP gauge head) 1.6 mA (BA gauge head)
Low	5 µA (HP gauge head) 160 µA (BA gauge head)
Anode voltage	+170 V
Filament potential	+ 30 V
Ion collector potential	0 V
Heating power	max. 18 W
b) Degas operation	
Emission current	20 mA
Anode voltage	+450 V
Degas time	0 ... 10 minutes, adjustable

Filament cutoff	
Strom	I > 2.0 A ... 3.8 A, adjustable
Pressure	p > 1.3 mbar (HP gauge head)
	p > $1.3 \cdot 10^{-2}$ mbar (BA gauge head)
Interlocking of degas ON	
Pressure	p ≥ $1.0 \cdot 10^{-4}$ mbar (HP gauge head)
	p ≥ $1.0 \cdot 10^{-5}$ mbar (BA gauge head)
Signal output	
Measured value, analog	0 bis +10 V
Error message (Error)	> 11.5 V
Current	max. 2 mA
Output resistance	400 Ω
Measuring rate	100 per s
Display rate	5 per s
Filter time constant	
Slow	approx. 2.7 s
Medium	approx. 320 ms
Fast	approx. 35 ms
Response time (10 → 90%)	
for sudden pressure rise	
10^{-6} → 1 mbar	< 150 ms (HP gauge head)
10^{-6} → 10^{-2} mbar	< 40 ms (HP gauge head)
10^{-9} → 10^{-2} mbar	< 150 ms (BA gauge head)
10^{-9} → 10^{-4} mbar	< 40 ms (BA gauge head)
PE under range control	
Minimum required availability of the measured value within the cold cathode measurement range	10 s
Control input <EXT IN>	TTL compatible *(pull-up resistance 4.7 kΩ to +5 V)*
Anode voltage interlock <IMR enable>	
length of line	max. 30 m (≥ 0.75 mm²)
Display	
Main display	15 mm 7-segment luminous digits 2-position mantissa, 1½-position exponent
Auxiliary display	5 mm alphanumeric display 8-digit 5x7 dot matrix
Status	30 LEDs
Error message	1 LED, red
Additional slots for	
Measurement boards	1 (slot A)
Interface boards	1 (slot C)

Available supplementary boards				
Pirani	PI 300D,	PI 300DN,	PI 300DL,	PI 300DLN
Cold cathode	PE 300C9,	PE 300C10,	PE 300T10,	PE 300T11
Combined Parani/cold cathode	CP 300C9,	CP 300C9N,	CP 300T9L,	CP 300T9LN
	CP 300C10,	CP 300C10N		
	CP 300T10,	CP 300T10N,	CP 300T10L,	CP 300T10LN
	CP 300T11,	CP 300T11N,	CP 300T11L,	CP 300T11LN
Supplementary interface boards	IF 300A,	IF 300B		

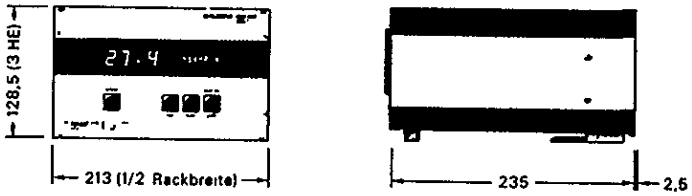
Power connection	
Voltage	100 to 240 VAC ±10% Overvoltage category II (according to EN 61010)
Frequency	50 to 60 Hz
Connected load	130 VA
Fuses F1, F2	2 0 slow, 250 V, ø5×20 mm

Equipment connection	
Gauge head <IMR>	Bicc-Vero UTGO 18-7SVDEU, 7-pin socket, integrated coaxial connector
Control input <EXT IN>	Amphenol C91E, 5-pin socket
Signal output <OUTPUT>	Laboratory connector, 2 mm

Protection	IP 30 (Protection against foreign objects > 2,5 mm no protection against water)
Safety	According to IEC 348 / DIN VDE 0411 part 1 / 10.73 DIN VDE 0411 part 1a / 2 80
EMC	Protection category I Contamination degree 2 (according to EN 61010) Emission EN 50081-2 (93) Immunity EN 50082-2 (95)

Weight	2.43 kg (without supplementary boards)

Dimensions



[2]) Measurement range N_2-equivalent

6.3 Supplementary p.c. boards

The technical data for the supplementary measurement and interface boards are contained in the separate operating instructions [3].

DANGER: Before you connect any external elements, check that they are compatible with the above technical data.

7. ERROR MESSAGES, TROUBLESHOOTING

7.1 Service and repair situations

If defects occur on the equipment or individual components which cannot be remedied based on the following troubleshooting guide, please contact the responsible service center or forward the equipment, together with a detailed description of the fault to the service center.

7.2 Warnings

Display	Cause	Remedy
Emi Off!	Degas switched on	Switch the emission on
Emi On!	Gauge type SET UP with emission switched on Filament SET UP with emission switched on Filament test with emission switched on	Switch the emission off
No Setup	SET UP selected for a function that does not permit parameter changes	---
p>PDegas	Momentary pressure higher than the limit for degas-sing the IMR gauge head	Wait until the pressure has dropped below the limit

7.3 Error messages

Display	Possible cause	Remedy
AnodeErr [4]	Contact <EMR enable> open (rear panel)	Close the contact (connector, refer to Section 4.4)
	Short circuit in the gauge head cable / in the gauge head (anode - GND or anode - filament)	Check the gauge head cable / gauge head
	Glow discharge during »degas«	Switch »degas« ON again
A1 Err [5]	TPR gauge head not connected	Connect the gauge head
	Interruption in TPR cable	Replace the cable
	TPR gauge head defective	Replace the gauge head

Display	Possible cause	Remedy
A2 Err [6]	TPR gauge head not connected	Connect the gauge head
	Interruption in TPR cable	Replace the cable
	TPR gauge head defective	Replace the gauge head
EmissErr [4]	Gauge head cable too long or cross-section to small	Use correct gauge head cable (refer to Section 6.3)
	Gauge head cable or gauge head not connected	Connect the cable or the gauge head (refer to Section 4.3.1)
	Short-circuit in the gauge head cable / gauge head (filament - GND)	Check the gauge head cable / gauge head
Fil1 Err [4]	Filament 1 defective	Switch to filament 2, if existing Replace the filament
	Gauge head cable not connected	Connect the gauge head cable
Fil2 Err [4]	Filament 2 defective	Switch to filament 1, if existing Replace the filament
	Gauge head cable not connected	Connect the gauge head cable
Idle Err [7]	Operating system over-loaded	Press <funct> key
I>Ip-IMR [4]	Current filament heating current higher than the set »protection«	Increase the limit (refer to Section 5.6.11)
	Anode interruption	Check gauge head cable / gauge head
	Short-circuit in gauge head cable / gauge head (filament - GND)	
Key Err [7]	Key pressed	Release key
	Key blocked	Exchange the basic unit

Display	Possible cause	Remedy
Prom Err [7]	PROM defective	Exchange the basic unit
p>Pp-IKR [5]	Momentary pressure exceeds limit for IKR gauge head	Wait until the pressure is below the limit
	Switching function A has switched to »off« (self-monitoring)	Manually switch on the cold cathode measurement circuit when the pressure is again below the threshold
p>Pp-IMR [4]	Momentary pressure exceeds limit for the gauge head	Wait until the pressure is below the limit
	Switching function IMG has switched to »off« (self-monitoring)	Manually switch on the ionization measurement circuit when the pressure is again below the threshold
Ram Err [7]	RAM defective	Exchange the basic unit
Ram Lost [7]	strong external interference (electromagnetic)	Press <funct> key If necessary, reenter the user parameters because the default parameters have automatically been copied.
	RAM defective	Exchange the basic unit
RS Err [7]	Transmission error	Transmit correct values
	Interface defective	Replace the interface board [3]
SlotAErr [7]	Wrong board in slot A	Insert board into the correct slot [3]
SlotBErr [7]	Wrong board in slot B	
SlotCErr [7]	Wrong board in slot C	
SlotDErr [7]	Card incorrectly identified	Exchange the basic unit
StackErr [7]	Stack overflow	Press <funct> key

Display	Possible cause	Remedy
Task Err [7]	Task failed	Press <funct> key If this error occurs frequently, replace the basic unit
Type-IMR [4]	Automatic gauge head identification supplies invalid result	Check the gauge head / gauge head cable
Wdog Err [7]	Watch dog timer - overflow due to strong external influence (electromagnetic)	Press <funct> key If this error occurs frequently, replace the basic unit

[3] **DANGER:** Please read the instructions in Section 4 before you perform any manipulations on the board.

[4] Fault in IMG measurement circuit

[5] Fault in measurement circuit A1

[6] Fault in measurement circuit A2

[7] Fatal error

7.3.1 Contact setting of the relays in the event of a fault

The relays on the IF 300A or IF 300B circuit board behave as follows when a fault occurs:

A contact 1..4 (switching function) is normally open if:

- a fault in the assigned measurement circuit
- or a fatal error exists.

Contact 5 (error status) is de-energized if:

- a fault of a measurement circuit
- or a fatal error exists.

For additional information concerning the relay contact states refer to the separate operating instructions [3].

7.4 Troubleshooting

7.4.1 Installation problems

Symptom	Possible cause	Remedy
Ion gauge control cannot be installed in the rack	Old rack system	Use rack frame according to DIN 41 494

7.4.2 Operating and alignment problems

Symptom	Possible cause	Remedy
Readout display unsteady	Filter time constant too low	Increase the filtering (refer to Section 5.6.15)
Switching functions (relays) flutter	Selected hysteresis too small	Change the thresholds (refer to Section 5.6.4) Increase the filtering (refer to Section 5.6.15)
«No board» is displayed	No circuit board installed	Install the circuit board [3])
Nonsensical reading	Loose screw on circuit board	Tighten the circuit board
	Contacts dirty or bent	Clean or carefully align the contacts [3])
Unit cannot be locked	Code 999 activated	Pull the measurement board approx. 1 cm out of the slots A and D [3]), change the code in SET UP mode, and reinstall the circuit boards [3])
Code forgotten	---	Pull the measurement board approx. 1 cm out of the slots A and D [3]), select and read out the code in LOOK UP mode, and reinstall the circuit boards [3])

[3]) **DANGER:** Please read the instructions in Section 4 before you perform any manipulations on the circuit boards!

7.4.3 Defects

Symptom	Possible cause	Remedy
No indication when the unit is switched on	No supply voltage	Check the voltage
	Fuse defective	Replace the fuse *)
Individual LED, part of the 7-segment or dot matrix display does not light up	Display / processor defective	Replace the basic unit

*) Make sure that only fuses with the required rated current and of the specified type are used for replacement (refer to Section 6.2). The use of makeshift fuses and the short-circuiting of fuse holders are prohibited.

8. MAINTENANCE

The IMG 300 requires no maintenance. Any dust however should be removed by occasional and careful blowing-out. How frequently this is necssary depends on the individual operating conditions.

Depending on the operating conditions, the contamination of the gauge heads should be checked (refer to the relevant operating instructions).

8.1 Alignment of the Pirani measurement circuit

Refer to the separate operating instructions [3].

9. RS-232-C INTERFACE

The serial interface supports the communication between the IMG and a computer. A terminal can also be connected for test purposes.

9.1 Installation and connection diagram

Refer to the separate operating instructions [3].

9.2 Data transmission

Information is exchanged bidirectionally, i.e. the data and control commands can flow in either direction.

9.2.1 Definitions

The following abbreviations and symbols are used:

Symbol	Designation			
HOST	Computer or terminal			
[...]	Non-mandatory elements			
ASCII	American Standard Code for Information Interchange			
			ASCII Dec.	Hex
<ETX>	END OF TEXT (CTRL C)	Reset of the interface	3	03
<CR>	CARRIAGE RETURN		13	0D
<LF>	LINE FEED		10	0A
<ENQ>	ENQUIRY	Request to send	5	05
<ACK>	ACKNOWLEDGE	Positive confirmation	6	06
<NAK>	NEGATIVE ACKNOWLEDGE	Negative confirmation	21	15

"Send": Transfer from HOST to IMG 300
"Receive": Transfer from IMG 300 to HOST

9.2.2 Flow control

After each ASCII string the HOST must wait for a confirmation (<ACK> or <NAK> <CR> <LF>) to ensure that the input buffer is empty.

The input buffer of the HOST must have a capacity of at least 32 bytes.

9.2.3 Communication protocol

Send format

Messages are transmitted to the IMG 300 as ASCII strings in the form of mnemonics and parameters. All mnemonics comprise three ASCII characters.

Blanks are ignored. <ETX> (CTRL C) clears the input buffer in the IMG 300.

The input is terminated by <CR> or <LF> or <CR><LF> ("end of message"), and evaluation in the IMG 300 is subsequently started.

The tables in Section 9.3.1 to 9.3.10 are applicable to the mnemonics and parameters. The maximum number of digits, the data formats and admissible value ranges are also specified there.

Send protocol

HOST	IMG 300	Explanation
Mnemonics [and parameters] <CR>[<LF>]	⟶	Receives messages with "end of message"
	⟵ <ACK><CR><LF>	Positive acknowledgment of a received message

Receive format

When requested with a mnemonic, the IMG 300 transmits the measurement data or parameters as an ASCII string to the HOST.

<ENQ> must be sent to request the transmission of an ASCII string. Additional strings, according to the last selected mnemonic, are read out by repetitive transmission of <ENQ>.

If <ENQ> is received without a valid request, the ERROR word is transmitted.

Receive protocol

HOST	IMG 300	Explanation
Mnemonics [and parameters <CR>[<LF>]	⟶	Receives messages with "end of message"
	⟵ <ACK><CR><LF>	Positive acknowledgment of a received message
<ENQ>[<CR><LF>]	⟶	Request to send data
	⟵ Measured values or parameters <CR><LF>	Transmits data with "end of message
	:	
<ENQ>[<CR><LF>]	⟶	Request to send data
	⟵ Measured values or parameters <CR><LF>	Transmits data with "end of message"
	:	

Error processing

The received strings are validated in the IMG 300. If an error is detected, a negative acknowledgment <NAK> is output. A corresponding flag is set in the ERROR word. Errors can be decoded after the ERROR word has been read.

Error detection protocol

HOST	IMG 300	Explanation
Mnemonics [and parameters] <CR>[<LF>]	⟶ ⟶	Receives message with "end of message"
***** Transmission or programming error *****		
	⟵ <NAK><CR><LF>	Negative acknowledgment of received message
Mnemonics [and parameters] <CR>[<LF>]	⟶ ⟶	Receives message with "end of message"
	⟵ <ACK><CR><LF>	Positive acknowledgment of received message

9.3 Mnemonics

SEN	Sensor on/off	Gauge head on/off
PIM	Pressure sensor IMG	Pressure IMG measurement circuit
PA1	Pressure sensor A1	Pressure measurement circuit A1
PA2	Pressure sensor A2	Pressure measurement circuit A2
SP1	Set point 1	Switching function 1
SP2	Set point 2	Switching function 2
SP3	Set point 3	Switching function 3
SP4	Set point 4	Switching function 4
SPI	Set point IMG	Switching function IMG
SPA	Set point A1	Switching function A1
SPS	Set point status	Switching function status
DMO	Display mode	(main/auxiliary display)
UNI	Unit of measurement	(pressure)
GTY	Gauge type	(IMR)
EMO	Emission mode	
DET	Degas time	
DES	Degas status	
IFI	Filament current	
IPR	Filament current protection	
GFI	Gauge heads filament	Filament selection
FIL	Filter time constant	
CAL	Calibration factors	
ISA	Identification slot A	
ISB	Identification slot B	
ISC	Identification slot C	
ISD	Identification slot D	
PIF	Parameter for interface	
SAP	Save default parameters	
HOT	Hotstart	
PUC	PE underrange control	
COD	Code lock	Operation disabling (code)
PNR	*Program number*	*Program version*
TSP	Test programs	
ERR	Error status	

9.3.1 Measured values

Gauge head on / off

Send : **SEN** [, x, x, x] <CR> Sensor on/off

- x (3rd): IMG measurement circuit — 0 -> no change, 1 -> off, 2 -> on
- x (2nd): measurement circuit
- x (1st): measurement circuit

Receive : <ACK><CR>
Send : <ENQ>

```
Receive   :  x, x, x <CR><LF>
               |  |  |
               |  |  |__  Status IMG measurement circuit
               |  |_____  Status measurement circuit A2
               |________  Status measurement circuit A1
```

Pressure measurement

```
Send      :  Pxx <CR>   Pressure sensor
               |
               |__  IM  Pressure, IMG measurement circuit
                  A1  Pressure, measurement circuit A1
                  A2  Pressure, measurement circuit A2

Receive   :  <ACK><CR>
Send      :  <ENQ>

Receive   :  x, x.xxxEsxx <CR><LF>
               |        |
               |        |__  Measured value 1.000E-11 to 9.999E+3
               |___________  Status
                            x = 0 -> Measurement data OK
                                1 -> Underrange
                                2 -> Overrange
                                3 -> Gauge head error
                                4 -> Gauge head switched off
                                5 -> No hardware
```

9.3.2 Switching functions

Threshold setting, assignment

```
Send :  SPx [,x.xEsxx, x.xEsxx, x] <CR>  Set point
          |       |        |      |
          |       |        |      |__  Switching function assignment
          |       |        |         x = 0 -> No change
          |       |        |             1 -> Measurement circuit A1
          |       |        |             2 -> Measurement circuit A2
          |       |        |             3 -> IMG meas. circuit
          |       |        |             4 -> External 1
          |       |        |             5 -> External 2
          |       |        |             6 -> No assignment
          |       |        |
          |       |        |____  Upper threshold
          |       |             9.9E+3 ... 1.0E-11
          |       |             0 -> No change
          |       |
          |       |_____  Lower threshold
          |              9.9E+3 ... 1.0E-11
          |              0 -> No change
          |
          |__  1  Switching function 1
             2  Switching function 2
             3  Switching function 3
             4  Switching function 4
             I  Switching function IMG
             A  Switching function A1
```

```
Receive   :  <ACK><CR>
Send      :  <ENQ>
Receive   :  x.xEsxx, x.xEsxx, x <CR><LF>
                                  └── Switching function assignmen
                          └── Upper threshold
             └── Lower threshold
```

Switching function status

```
Send      :     SPS <CR>  Set point status
Receive   :  <ACK><CR>
Send      :  <ENQ>
Receive   :  x, x, x, x, x, x <CR><LF>
                                  └── Switching function A  x = 0 -> off
                                1 -> on
                          └── Switching function I
                       └── Switching function 4
                    └── Switching function 3
                 └── Switching function 2
              └── Switching function 1
```

9.3.3 Display

Display mode

```
Send      :  DMO [, x] <CR>  Display mode
                    └── Display mode  x = 0 -> No change
                                        1 -> «IMG / Sel»
                                        2 -> «Sel / Barg»
                                        3 -> «Sel / ExpM»
Receive   :  <ACK><CR>
Send      :  <ENQ>
Receive   :  x <CR><LF>
             └── Display mode
```

Unit of measure, pressure

```
Send      :  UNI [, x] <CR>  Unit of measure
                    └── Unit of measure  x = 0 -> No change
                                           1 -> «mbar»
                                           2 -> «Torr»
                                           3 -> «Pa»
Receive   :  <ACK><CR>
Send      :  <ENQ>
Receive   :  x <CR><LF>
             └── Unit of measure
```

9.3.4 IMR gauge head

Gauge head type

```
Send      :  GTY [, x] <CR>  Gauge head type
                     |
                     └──  Gauge head x =  0 -> No change
                                          1 -> IMR 320, IMR 325   (BA)
                                          2 -> IMR 310, IMR 312   (HP)
                                               IMR 310P  (HP)

Receive   :  <ACK><CR>
Send      :  <ENQ>
Receive   :  x <CR><LF>
             |
             └──  Gauge head type
```

Emission

```
Send      :  EMO [, x] <CR>  Emission mode
                     |
                     └──  Emission x =  0 -> No change
                                        1 -> Auto
                                        2 -> Low
                                        3 -> High

Receive   :  <ACK><CR>
Send      :  <ENQ>
Receive   :  x <CR><LF>
             |
             └──  Emission
```

Degas on /off, degas time

```
Send      :  DES [. x [. xx]] <CR>  Degas status
                  |     |
                  |     └──  Desired degas time
                  |          xx = 0...10 (min)
                  |
                  └──  Degas on/off   x =  0 -> No change
                                           1 -> off
                                           2 -> on

Receive   :  <ACK><CR>
Send      :  <ENQ>
Receive   :  x, xx <CR><LF>
             |  |
             |  └──  Desired degas time
             |
             └──  Degas on/off
```

Actual degas time

```
Send      :  DET <CR>  Degas time
Receive   :  <ACK><CR>
Send      :  <ENQ>
```

```
Receive   :  xxxx <CR><LF>
               └── Elapsed degas time  x = 0...600 sec (0...10 min)
```

Filament current

```
Send      :  IFI  <CR>  Filament current
Receive   :  <ACK><CR>
Send      :  <ENQ>
Receive   :  x <CR><LF>
               └── Filament current
```

Filament current protection

```
Send      :  IPR [, x] <CR>  Filament current protection
                  └── Filament        x = 0 -> 2.0A,  5 -> 3.0A
                      cutoff current      1 -> 2.2A,  6 -> 3.2A
                                          2 -> 2.4A,  7 -> 3.4A
                                          3 -> 2.6A,  8 -> 3.6A
                                          4 -> 2.8A,  9 -> 3.8A
Receive   :  <ACK><CR>
Send      :  <ENQ>
Receive   :  x <CR><LF>
               └── Filament cutoff current
```

Filament selection

```
Send      :  GFI [, x] <CR>  Gauge heads filament
                  └── Filament   x = 1 -> Filament 1
                                     2 -> Filament 2
Receive   :  <ACK><CR>
Send      :  <ENQ>
Receive   :  x <CR><LF>
               └── Filament
```

Filament test

Refer to Section 9.3.9 (Test programs)

9.3.5 Filter time constants

```
Send      :  FIL [, x, x, x] <CR>  Filter time constant
                    |  |  |
                    |  |  +--- IMG meas. circuit x = 0 -> No change
                    |  +------ Measurement circuit A2   1 -> fast (weak)
                    +--------- Measurement circuit A1    2 -> medium
                                                         3 -> slow
                                                              (strong)

Receive   :  <ACK><CR>
Send      :  <ENQ>

Receive   :  x, x, x <CR><LF>
             |  |  |
             |  |  +--- IMG measurement circuit
             |  +------ Filter, measurement circuit A2
             +--------- Filter, measurement circuit A1
```

9.3.6 Calibration factors

```
Send      :  CAL [,x.xx ,x.xx ,x.xx] <CR>  Calibration factors
                    |     |     |
                    |     |     +--- Calibr. factor IMG meas. circuit
                    |     +--------- Calibration factor meas. circuit A2
                    +--------------- Calibration factor measurement circuit A1
                                     x.xx = 0.1 ... 9.99

Receive   :  <ACK><CR>
Send      :  <ENQ>

Receive   :  x.xxx ,x.xxx ,x.xxx <CR><LF>
             |     |     |
             |     |     +--- Calibration factor IMG meas. circuit
             |     +--------- Calibration factor measurement circuit A2
             +--------------- Calibration factor measurement circuit A1
```

9.3.7 P.c. board identification

```
Send      :  ISx <CR>   Identification slot
                |
                +---  A  Identification slot A
                      B  Identification slot B
                      C  Identification slot C
                      D  Identification slot D

Receive   :  <ACK><CR>
Send      :  <ENQ>

Receive   :  x <CR><LF>
             |
             +---  Identification e.g. : NO P (no p.c.board)
                                         PI300 DL   etc.
```

9.3.8 Interface parameters

```
Send      :  PIF [, xxxx] <CR>  Parameter for interface
                    └─ Baud rate  xxxx =     0,  300, 1200,
                                          2400, 4800, 9600

Receive   :  <ACK><CR>
Send      :  <ENQ>

Receive   :  xxxx <CR><LF>
               └── Baud rate
```

9.3.9 Auxiliary functions

Parameter set (defaults)

```
Send      :  SAP [, x] <CR>  Save default parameters
                    └─ Defaultwerte  x = 0 -> No change
                                        1 -> Switching functions
                                        2 -> Other parameter
                                        3 -> All parameters

Receive   :  <ACK><CR>
Send      :  <ENQ>

Receive   :  xxxx, xxxx <CR><LF>
               │     └─ Parameter - checksum
               └── Default - checksum
```

Hot start

```
Send      :  HOT [, x, x, x] <CR>  Hot start
                  │  │  └─ IMG meas. circuit  x = 0 -> No change
                  │  └── Measurement circuit A2    1 -> off
                  └─ Measurement circuit A1        2 -> on

Receive   :  <ACK><CR>
Send      :  <ENQ>

Receive   :  x ,x ,x <CR><LF>
               │  │  └─ Status IMG measurement circuit
               │  └── Status measurement circuit A2
               └─ Status measurement circuit A1
```

PE underrange control

```
Send      :  PUC [, x] <CR>  Penning underrange control
                    └─ Control   x =  0 -> No change
                                      1 -> off
                                      2 -> on

Receive   :  <ACK><CR>
Send      :  <ENQ>
```

```
Receive   :  x <CR><LF>
             └── Underrange control
```

Code lock (Code)

```
Send      :  COD [, x, xxxx] <CR>  Code lock
                  │   └── Code key  x = 0 ... 1000
                  └── Lock     x = 0 -> No change
                                   1 -> »Setup« inhibited
                                   2 -> »Setup« and
                                        »Sensor on/off« inhibited

Receive   :  <ACK><CR>
Send      :  <ENQ>

Receive   :  x, xxxx <CR><LF>
             │   └── Code key
             └── Lock status
```

Program version

```
Send      :  PNR <CR>  Program number

Receive   :  <ACK><CR>
Send      :  <ENQ>

Receive   :  BG xxxxxx-- <CR><LF>
                    └── Program version
```

Test programs

```
Send      :  TSP [, x [,x]] <CR>  Test programs
                  │   └── A/D converter channel  x = 0 -> 10
                  └── Test program selection
                      x = 0 -> Filament
                          1 -> Display
                          2 -> RAM
                          3 -> EPROM
                          4 -> Keys
                          5 -> I/O
                          6 -> A/D converter
                          7 -> Serial interface

Receive   :  <ACK><CR>
Send      :  <ENQ>

Receive   :  xxxx [, xxxx] <CR><LF>
             │        └── Gauge head fault status
             └── Fatal error status or
                 A/D converter voltage in mV
```

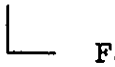
9.3.10 Error messages

Interface errors

```
Send      :  xxx <CR>
             *** Transmission or programming error ***
Receive   :  <NAK><CR>
Send      :  <ENQ>
Receive   :  x <CR><LF>
             |
             └─  Error message  x = 1 -> Syntax error
                                   2 -> Invalid parameter
                                   4 -> Hardware not installed
                                   8 -> Fatal error
```

Error status

```
Send      :  ERR <CR>  Error status
Receive   :  <ACK><CR>
Send      :  <ENQ>
Receive   :  xxxx, xxxx <CR><LF>
             |     |
             |     └──  Gauge head error
             |          x = 0 -> No error
             |              1 -> Filament protection
             |              2 -> Pressure - IMR protection
             |              4 -> Degas - protection
             |              8 -> Anode - fault
             |             16 -> Cathode - fault
             |             32 -> Emission current - fault
             |             64 -> Filament 1 defective
             |            128 -> Filament 2 defective
             |            256 -> IMR gauge head identification
             |            512 -> --- (spare)
             |           1024 -> Filament test
             |           2048 -> --- (spare)
             |           4096 -> Measurement circuit A1
             |           8192 -> Measurement circuit A2
             |          16384 -> Pressure - IKR protection
             |          32768 -> --- (spare)
             V
```



```
Fatal error
x = 0 -> No error
    1 -> RAM error
    2 -> EPROM error
    4 -> Watchdog has responded
    8 -> Task error
   16 -> Stack overflow
   32 -> IDCX system is overloaded
   64 -> NovRam data lost
  128 -> --- (spare)
  256 -> Wrong p.c. board in slot A
  512 -> Wrong p.c. board in slot B
 1024 -> Wrong p.c. board in slot C
 2048 -> Wrong p.c. board in slot D
 4096 -> Key blocked
 8192 -> Self-test auxiliary display OK
16384 -> RS-232-C interface error
```

The error word is erased as it is read out. It is automatically reset if the error persists.

9.4 Program examples

10. SPARE PARTS, ACCESSORIES

10.1 Basic unit IMG 300

	Order number
Basic unit, with processor module, operator console, power supply and ionization measurement board	BG D25 750
Apparatus fuse 2.0 A slow 250 V, diam. 5x20 mm	B 4666 442
Dummy panel for slot A	BG 546 903
Dummy panel for slot B, C	BG 546 902
Laboratory connector, gold-plated, diam. 2 mm	B 4711 152 MA
Grommet for laboratory connector, red	B 4711 152 N2
Grommet for laboratory connector, black	B 4711 152 NZ
Dust cover, support pads (pair)	BG 544 943 -T

10.2 Supplementary p.c. boards

For order numbers of the available supplementary measurement and interface boards (see Section 6.2) please refer to the separate operating instructions [3].

10.3 Power cable

			Order number
Power cable CH standard	Type 432	2.5 m	B 4564 309 YP
Power cable Schuko DIN	Type 436	2.5 m	B 4564 309 YT
Power cable USA	Type 439.1	2.5 m	B 4564 309 YW
Power cable UK, GB	Type UD 13 AI	2.5 m	B 4564 309 YZ
EU-standard apparatus connector	(for making custom power cables)		B 4707 193 AA

10.4 Gauge head cable

IMR cables

Gauge head	Cable length	Order number
IMR 310 / BG G16 000	3 m	BG 548 802 -T
IMR 312 / BG G16 500	6 m	BG 548 803 -T
IMR 310P / BG G16 001	6 m	BG 548 823 -T
	8 m	BG 548 824 -T
	10 m	BG 548 825 -T
IMR 320 / BG G16 250	3 m	BG 548 802 -T
IMR 325 / BG G17 000	6 m	BG 548 803 -T

Other lengths available on request

IMR high temperature cables up to 200 °C

Gauge head	Cable length	Order number
IMR 312 / BG G16 500	3 m	BG 548 831 -T
IMR 325 / BG G17 000	6 m	BG 548 832 -T

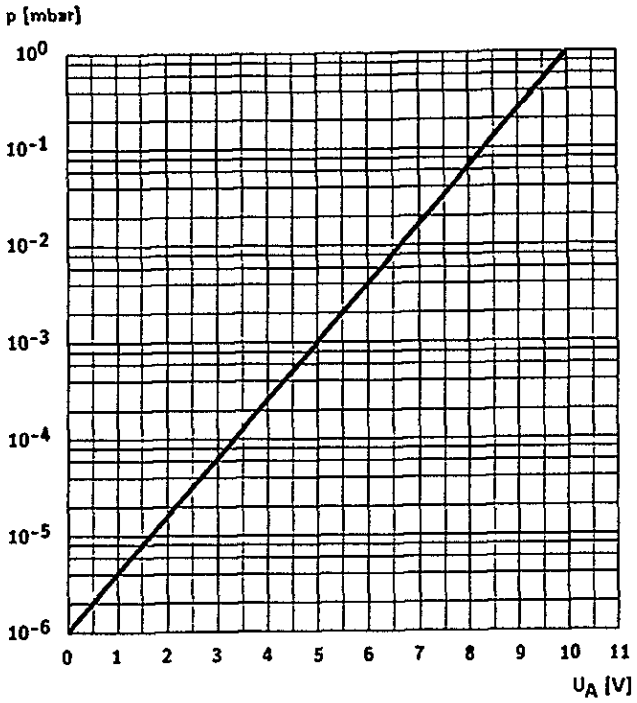
Gauge head cables for the supplementary measurement boards can be ordered according to the separate operating instructions [3].

10.5 Accessories for rack mounting

	Order number
19" rack frame DIN 41 494 (3 units high, 84 pitchs) for new submodules	BG 544 083 -T
for combination with older BALZERS equipment without "lugs", with 2 perforated rails each (hole spacing 5.08 and 17.5 mm)	BG 544 082 -T
Filler panel 1/2 rack (3 units high, 42 pitchs)	BG 544 781 -T
Filler panel 1/3 rack (3 units high, 28 pitchs)	BG 544 780 -T
Filler panel 1/6 rack (3 units high, 14 pitchs)	BG 544 779 -T

Appendix A: Characteristic curves IMR measurement circuit

A1 Characteristic curve of the IMR 310 with IM 300



The pressure is in strict logarithmic relationship to the voltage on the analog signal output. It is computed according to the following formula:

$$p = 10^{\left(\frac{U_A}{U_{A_{max}}} * \log_{10}\left(\frac{p_{max}}{p_{min}}\right) + \log_{10}(p_{min})\right)}$$

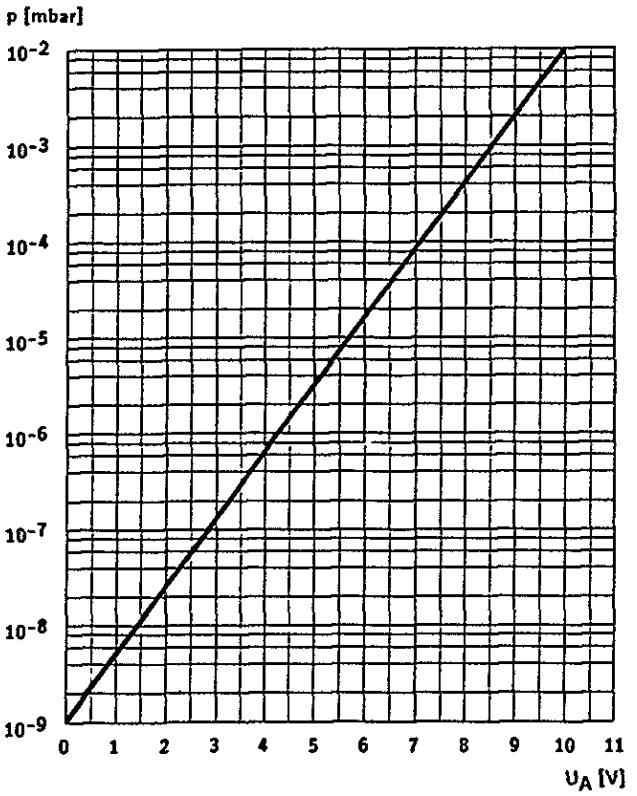
IMR 310:

p_{max} = 1 mbar p_{min} = 10^{-6} mbar $U_{A_{max}}$ = 10 V

Example:

U_A = 2.75 V => $p = 10^{\left(\frac{2.75\ V}{10\ V} * 6 - 6\right)} = 4.46 \cdot 10^{-5}$ mbar

A2 Characteristic curve of the IMR 320 with IM 300



IMR 320:

p_{max} = 10^{-2} mbar p_{min} = 10^{-9} mbar $U_{A_{max}}$ = 10 V

Example:

U_A = 5.03 V => $p = 10^{\left(\frac{5.03\ V}{10\ V} * 7 - 9\right)} = 3.32 \cdot 10^{-6}$ mbar

The output signals of the supplementary p.c. boards are described in the separate operating instructions [3].

Appendix B: Gas type dependence of the gauge head

Ionization gauge heads

Gas type		Calibration factor
Nitrogen	N_2	1.0
Air		1.0
Oxygen	O_2	1.2
Hydrogen	H_2	2.2
Helium	He	6.0
Neon	Ne	4.0
Argon	Ar	0.8
Xenon	Xe	0.36
Krypton	Kr	0.5
Carbon monoxyde	CO	0.9
Carbon dioxide	CO_2	0.7
Water vapor	H_2O	1.1
Mercury vapor	Hg	0.3
Iodine vapor	J	0.18
Methane	CH_4	0.7
Solvent vapors		0.1 - 0.2

Pirani and cold cathode gauge heads

The corresponding calibration factors can be found in the separate operating instructions [3].

Appendix C: Literature

[1] Product information IMG 300
BG 800 244 PE Edition: 9005
Balzers AG, 9496 Balzers, Principality of Liechtenstein

[2] ---

[3] Operating instructions
P.c. boards for series 300 equipment family
BG 800 342 BE 1st edition: 7. 1990
Balzers AG, 9496 Balzers, Principality of Liechtenstein

[4] Operating instructions
IMR 310, IMR 312, IMR 320, IMR 325 gauge heads
BG 800 343 BE 2nd edition: 8. 1990
Balzers AG, 9496 Balzers, Principality of Liechtenstein

[5] Operating instructions
IMR 310P gauge head
BG 800 344 BE 1st edition: 6. 1990
Balzers AG, 9496 Balzers, Principality of Liechtenstein

Keyword index

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