Ionization Multi Gauge Controller MG14

Operating Manual

Software version: v7.0

Rev 1.3

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CONTENTS

1. INTRODUCTION

Please read this manual carefully to ensure optimum operating conditions right from the start. This user manual handbook contains important information about functionality, installation, start-up and operation of the Vacuum Gauge controller MG14

1.1 INTENDED USE

The Ionization Multi Gauge controller MG14 is a versatile microprocessor controlled ionization gauge controller for pressure measurements in the range $2x10^{-12}$ through $1x10^{3}$ mbar. The concept and design of the controller allow for a reliable and complete integration in complex process control systems. The Multi Gauge MG14 can handle two measuring systems simultaneously. An optional different interface may be used for complete remote control of the device.

In the following, the Ionization Multi Gauge MG14 will be referred to as «MG 14».

1.2 LIABILITY AND WARRANTY

PREVAC Sp. z o.o. assumes no liability and the warranty becomes null and void if the end user or third parties

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

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

1.3 COMPATYBILITY

The MG 14 is partially compatible with its predecessor MG13. In order to operate the MG 14 in one of the MG14 modes, you have to change the configuration settings accordingly. See Chapter 4.2.4.8 - *Transmitter selection for channel 2*,

1.4 SAFETY

1.4.1 Personnel Qualifications

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

1.4.2 Illustration of Residual Dangers

This Operating Manual illustrates safety notes concerning residual dangers as follows:

⚠ DANGER

Information on preventing any kind of physical injury.

⚠ WARNING

Information on preventing extensive equipment and environmental damage.

⚠ CAUTION

Information on correct handling or use. Disregard can lead to malfunctions or equipment damage.

NOTE:

Indicates particularly important, but not safety-relevant information.

1.4.3 General Safety Instructions

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

Also observe all safety notes given in this document and forward the information to all other users of the product. In particular, pay attention to the following safety notes:

⚠ DANGER

Mains voltage.

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

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

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

⚠ WARNING

Improper use.

Improper use can damage the MG14.

Use the MG14 only as intended by the manufacturer.

⚠ WARNING

Improper installation and operation data.

Improper installation and operation data may damage the MG14.

Strictly adhere to the stipulated installation and operation data.

2 Technical Data

2.1 General Data

2.1.1 Mechanical Data

Dimensions	Width: 241,3 mm
	Height: 44 mm (1 HU)
	Depth: 337 mm
	See Fig. 2-1,
Weight	3.0 kg
Use	Desktop device
	Control panel mounted
	Rack mounted
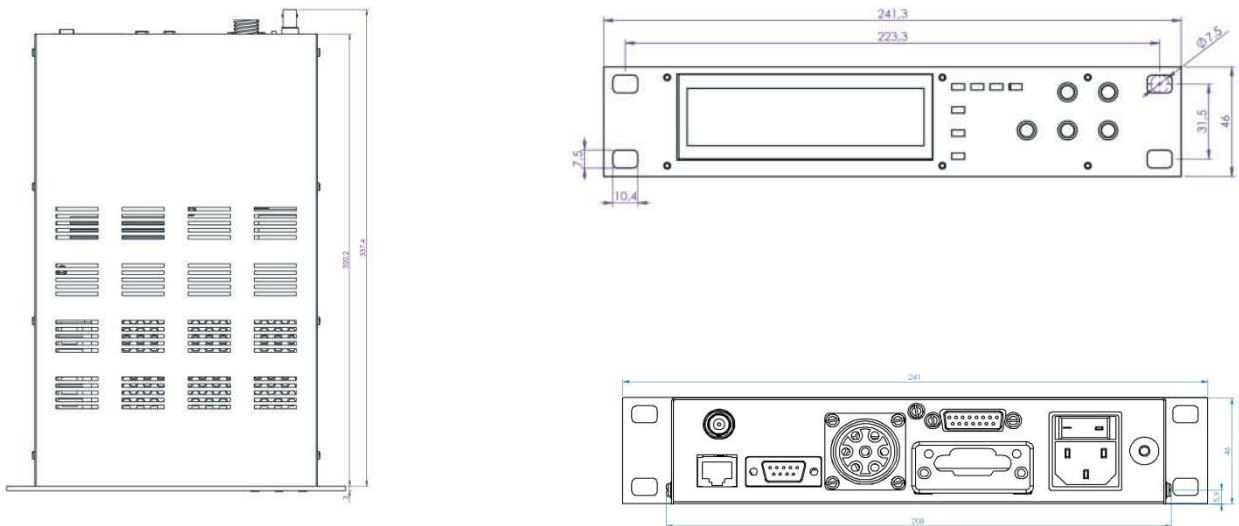
Fig. 2-1 Dimensions (in mm)

2.1.2 Ambience

Temperature Storage: -40…+70 ℃

Operation: +5…+50 ℃

Relative humidity   Max. 75 % (up to 32 ℃), decreas ing to max. 50 % (above 45 ℃)

Use Indoors only

Altitude max. 2000 m NN

Pollution degree II

Protection type IP20

2.1.3 Operation

Manually Via 5 control buttons on the front panel

Remote control Via RS232; RS485;USB;CAN-BUS, PROFI-BUS, EthernetIP – this has to be chosen with order or can be implemented any time by user – see chapter **2.4.3**.

2.1.4 Standards

Conformity with the Directive relating to electrical equipment designed for use within certain voltage limits 73/23/EWG

Conformity with the Directive relating to electromagnetic compatibility 89/336/EWG

Harmonized and international/national standards and specifications:

> EN 61010-1 (Safety requirements for electrical equipment for measurement, control and laboratory use)
>
> EN 61000-6-2 (Electromagnetic compatibility generic emission standard)
>
> EN 61000-6-3 (Electromagnetic compatibility generic immunity standard)

2.2 Mains Connection

Voltage	90 - 250 VAC
Frequency	50 - 60 Hz
Current consumption	Max. 3,5 A at 115 V
	Max. 1,75 A at 230 V
Power consumption	Max. 250 W

Overvoltage category II

Protection class 1

Connection European appliance connector IEC 320 C14

Fuse 3,5 A (in power supply)

2.3 Channels

2.3.1 Sensor Connections

Channel 1:

Sensor connections:	UTG0187SVDEU + BNC
Compatible IONIVAC sensors:	EXTRACTOR gauge IE514, IE414 B-A gauge, and any Bayard-Alpert sensor

Channel 2:

Sensor connection:	J45

Compatible sensors:

- THERMOVAC transmitters:

  TTR 90, TTR 90S, TTR 91,TTR91S

- CERAVAC transmitters:

  (CTR): Preferably CTR 90,CTR 91

- Ioni transmitters: ITR 90, ITR100

2.3.2 Sensor Supply

2.3.2.1 IONIVAC Sensors

Measuring operation:

	Universal Bayard-Alpert gauge	**IE 414** Bayard-Alpert gauge	**IE 515** Extractor gauge	Tol
Anode potential:	180V	220V	220V	± 1%
Reflector potential:	------	------	205V	± 1%
Cathode potential:	30V	80V	100V	± 1%
Emission current: (selectable)	0,1 mA	0,1 mA	1,6 mA	± 5%
	1 mA	1 mA		± 1%
	4 mA	4 mA		± 1%
	10 mA	10 mA		± 1%

Degassing:

	Universal Bayard-Alpert gauge	**IE 414** Bayard-Alpert gauge	**IE 515** Extractor gauge	Tol
Anode potential:	500V	480V	480V	± 1%
Reflector potential:	------	------	205V	± 1%
Cathode potential:	90V	20V	10V	± 1%
Emission current:	max 80 mA	max 80 mA	max 80 mA	± 5%
Power:	adjustable max 40W	adjustable max 40W	adjustable max 40W	± 1%
Degas timer:	adjustable 1-20 min	adjustable 1-20 min	adjustable 1-20 min	± 1%

2.3.2.2 THERMOVAC, CERAVAC and IONIVAC Transmitters

Voltage +24 VDC ±5%

Current 0.1 A Thermovac, Ceravac; 1,2A IONIVAC ITR90, ITR100

2.3.3 Measuring Ranges

Total measuring range:	$2x10^{-12}$ to 1000 mbar
IONIVAC sensors:	Bayard-Alpert: $2x10^{-11}$….$1x10^{-3}$ mbar
	Extractor: $2x10^{-12}$….$1x10^{-4}$ mbar
CERAVAC transmitters CTR 90 and CTR 91:	0.1 Torr: (CTR 91 only) $1x10^{-5}$….$1x10^{-1}$ Torr
	1 Torr: $1x10^{-4}$…..1 Torr

10 Torr:	$1x10^{-3}.....1x10^{1}$ Torr
100 Torr:	$1x10^{-2}.....1x10^{2}$ Torr
1000 Torr:	$1x10^{-1}.....1x10^{3}$ Torr
THERMOVAC transmitters:	$5x10^{-4}....1x10^{3}$ mbar
IONIVAC transmitters ITR90:	$5x10^{-10} .... 5x10^{-4}$ mbar

2.3.4 Measuring Technique

Accuracy of measurement

Current: (channel 1)	- Relative to current reading: ±1%
	- Absolute: ±0.6 fA
Voltage:(channel 2)	- Relative to voltage reading: ±0.3%
	- Absolute: ±2 mV

Measuring rate

Channel 1 (B-A gauge):	2 mA.10 pA 25 s-1
	10 pA.100 fA 1.25 s-1
	< 100 fA 2.5 s-1
Channels 2 (transmitters):	Entire range 20 s-1

Display rate, temperature drift, unit of measurement

Display rate 4 s-1

Temperature drift < 0.1 % per ℃

Unit of measurement mbar, Pa, Torr, Micron

Resolution of the A/D converter

THERMOVAC, CERAVAC and IONIVAC:	24 bit
Extractor, B-A Gauge :	24 bit

2.4 Interfaces

2.4.1 Relay Outputs

Name	Relay
Connection:	D-Sub, 9 pins, female.
	See Fig. 3-8,
Number of relays:	4 NO, include one NO,NC
Response time Max.	70 ms,
Synchronous to channels:	adjustable to 1,2,3 or 4; above, bellow and hysteresis option
Load (ohmic):	Max. 50 VDC, 0.5 A

2.4.2 I/O outputs

For detailed description please refer to chapter 3.3.9

2.4.3 Communication interfaces

For network connectivity requirements Anybus CompactCom (Anybus-CC) modules has been implemented.

One of the following Anybus-CC modules can be mounted:

EtherNet/IP	- Active module with serial and parallel application interface - Complete EtherNet/IP adapter - CIP Parameter Object Support - Explicit and implicit messaging - Transformer isolated Ethernet interface 10/100 Mbit/s full duplex - TCP/IP socket interface - FTP server, E-mail and dynamic web server with SSI support - Generic EDS-file provided
Bluetooth	- Passive module with serial application interface - Physical layer converter for Bluetooth communication standard - Completely transparent interface - Bluetooth class 2 SPP compatible - Wireless range up to 30 meters
RS-232	- Passive module with serial application interface - Physical layer converter for the RS-232 communication standard - Supports baud rates up to 250 kbit/s - No configuration necessary, since the module acts only on the physical layer
RS-485	- Passive module with serial application interface - Physical layer converter for the RS-485/422 communication standard - Supports baud rates up to 10 Mbit/s - No configuration necessary, since the module acts only on the physical layer - Galvanically isolated RS-485/422 interface
USB	- Passive module with serial application interface - Physical layer converter for - USB communication standard (USB 1.1 & USB 2.0 full speed) - Supports 1 and 2 Mbit/s USB communication speed - The baud rate is set from the host computer side - Software drivers available - Galvanically isolated USB interface

3 Installation

3.1 Unpacking

1 Visually inspect the transport packaging for signs of external damage

2 Unpack the MG14 and put the packaging material aside

NOTE:

Keep the packaging material for later use. The MG14 must be stored and transported in the original packaging material only.

3 Examine the MG14 for completeness

4 Visually inspect the MG14 for signs of damage

⚠ **DANGER**

Damaged product.

Putting a damaged product into operation can be extremely dangerous.

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

3.2 Mechanical Installation

The MG14 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 safety note:

⚠ **WARNING**

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

MG14 is delivered with four stuck gummy legs – no other protection is needed. The device can be use as a desk-top like it is.

3.2.3 Rack Installation

The MG14 is designed for installation into a rack according to DIN 41 494 (19", 1 HU).

⚠ **DANGER**

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 use MG14 in the rack there is necessary to remove four stuck gummy legs. For this purpose proceed as follows:

1. Switch off the MG14 and disconnect it from mains power

2. Turn the MG14 upside down as shown in Fig. 3-1,

3. Remove (unstuck) the four stuck gummy legs

4. Turn the MG14 back to normal orientation and place it on the required location
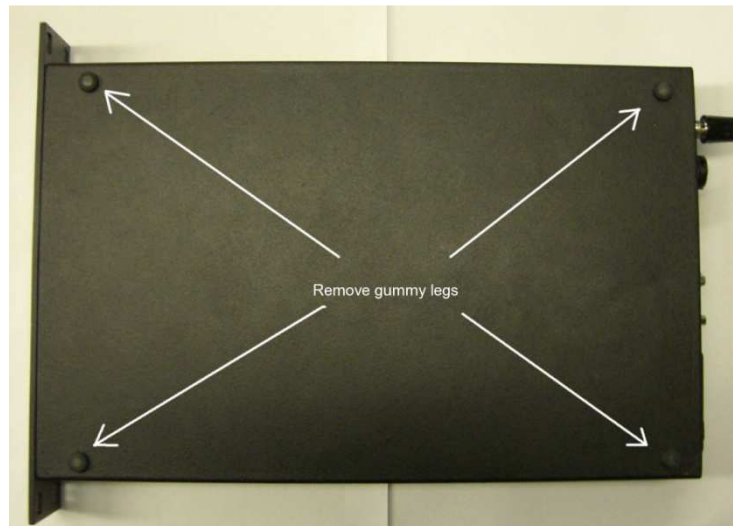

Fig. 3-1 Unstuck gummy legs from the device

NOTE:

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

1. Insert the MG14 into the rack chassis adapter

2. Fasten the MG14 with the supplied collar screws and plastic sleeves to the rack chassis adapter

3.2.4 Interface module mounting

The Anybus interfaces modules (ref. to chapter 2.4.3) can exchange any time on request For the proper installation please follow the instruction.

Turn the unit off

Before proceed with any modules, ensure that the main power is off. This prevents any electric damages in the unit

Screws fully loose

Before inserting the module, ensure that the affixing screws have been fully loosened.

NOTE:

Please carefully insert the module in – parallel to the PCB board – please refer to the Fig.3.2.
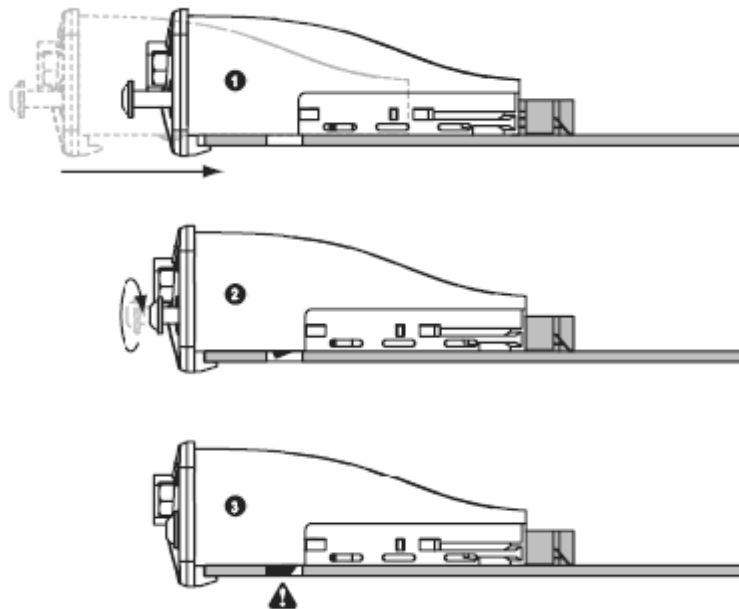
Fig. 3.2 Installation of an interface module

To be sure if the module is mounted correctly please have a look into the unit via the holes as shown on the photo Fig. 3.3
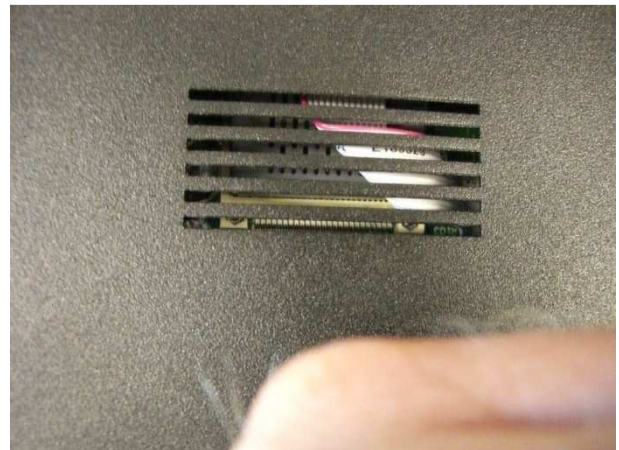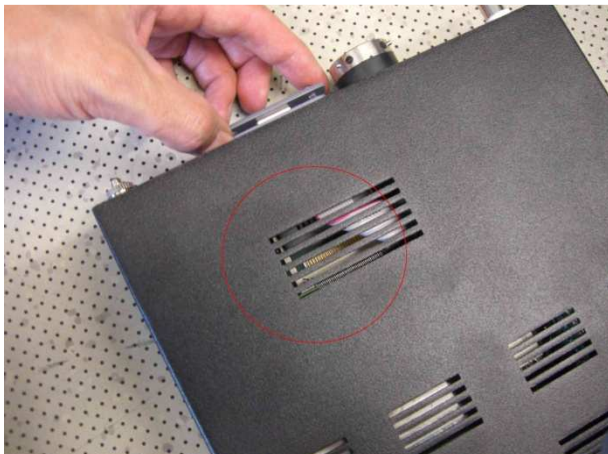

Fig. 3.3 Anybus Module mounting

1.   When inserting the module into the slot, press it with its plain side onto the MG14 board.
2.   Tighten the affixing screws until they make contact with the panel – ref..
3.   The affixing screws lock the module in place in the slot.

3.3 Connecting

3.3.1 Back Side of the Device

Fig. 3-4, shows the back side of the MG14.
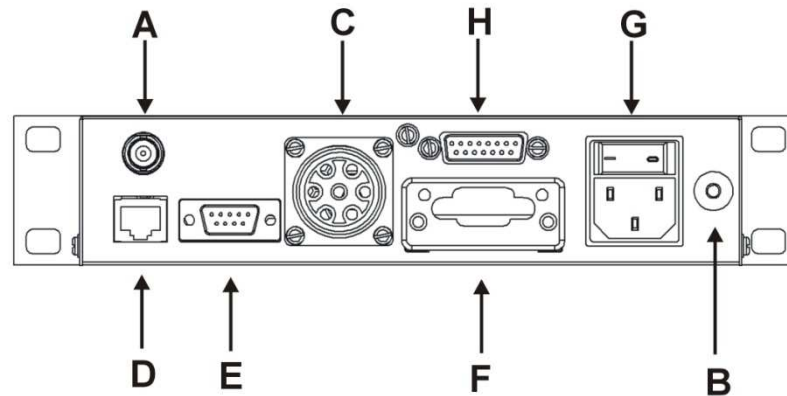
Fig. 3-4 Back side of the MG14

A	*Connection for IONIVAC measuring signal, channel 1*
B	*Ground screw*
C	*Connection for transmitter, channel 1*
D	*Connection for transmitter, channel 2*
E	*RELAY connection*
F	*AnybusCC connection module*
G	*Mains connection*
H	*I/O interface*

⚠ DANGER

Screw for internal protective conductor.

The internal protective conductor is connected to the casing with a screw.

Do not turn or loosen this screw.

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

3.3.2 Mains Connection

The mains connection (Fig. 3-4, item G) 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 3x1.5 mm^2 or larger
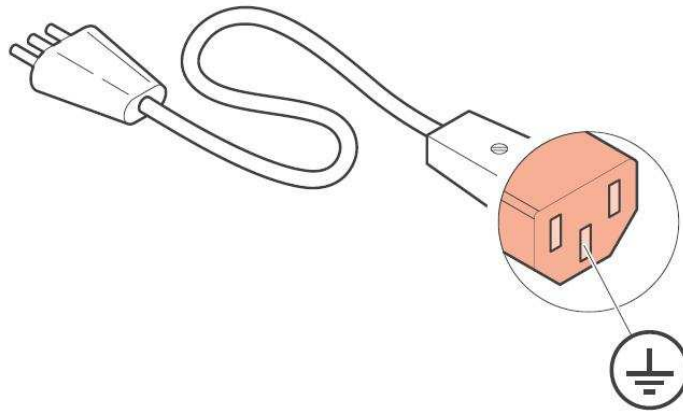
Fig. 3-5 Three-conductor cable with protective ground (example)

⚠ **DANGER**

Mains power.

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

Use three-wire mains or extension cables with protective ground only.

Plug the mains cable into wall sockets with protective ground only.

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

NOTE:

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

3.3.3 Ground

The ground screw (Fig. 3-4, item B) can be used to connect the MG14 with the protective ground of the pumping station.

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

The metal flanges of the B-A gauge sensors are connected to the ground via the measuring lines inside of the MG14.

3.3.4 Channel 1

The Channel 1 connection is used to connect B-A sensors and EXTRACTOR gauge as well.

Control signals

A 7-pin appliance socket (type Metalock Bantam) is available for channel 1. See Fig. 3-4, item C

> **Pin assignment:**
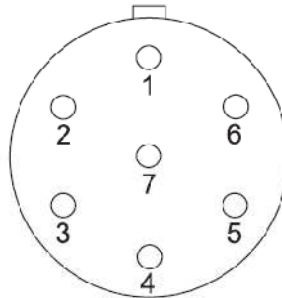
Fig. 3-6 Channel 1 appliance socket (type Metalock Bantam)

1 Filament 1	*5 Not used*
2 Filament COM	*6 Filament 2*
3 Anode	*7 Not used*
4 Reflector (Extractor)	

⚠ DANGER

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

Measuring signals

The measuring signals, i.e. the ion currents, of each sensor are transferred via a coaxial cable. See Fig. 3-4, item A

> Pin assignment:
>> Inner conductor Ion current
>> Outer conductor Shielding

3.3.5 Channel 2

The Channel 2 connection is used to connect the transmitters.

An 8-pin J-45 female appliance socket is available for each sensor. See Fig. 3-4, item D

Pin assignment
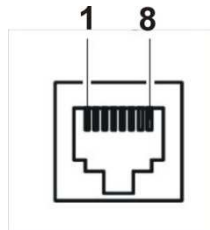
Fig. 3-7 Channel 2 appliance socket (RJ45)

1   +24VDC supply

2   Supply GND

3   Analog Input

4   n.c.

5   Analog GND

6   ITR emission OK

7   ITR Degas

8   ITR emission ON/OFF

n.c. - not connected

⚠ **CAUTION**

Improper transmitter.

Transmitters which are not designed for use with the MG14 may damage the device.
Operate the MG14 with proper transmitters only. See Chapter 2.3.1 Sensor
Connections.

⚠ **CAUTION**

Multiple connection.

Only one transmitter may be connected to each of the channels. Otherwise the
connected transmitters will be damaged.
Never connect more than one transmitter per channel.

3.3.6 RELAYS

The switching functions and the error monitoring system influence the states of several relays inside of the MG14. The RELAY connection (Fig. 3-4, item E) allows to utilize the relay contacts for switching purposes. The relay contacts are potential-free (floating).
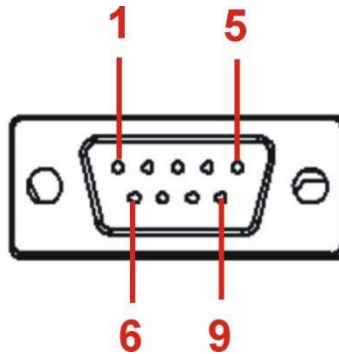
Fig. 3-8 RELAY appliance socket (D-Sub, 9-pin)

1 Trigger 1 common (COM)
2 Trigger 1 (NC)
3 Trigger 1 (NO)
4 Trigger 2 common (COM)
5 Trigger 2 (NO)
6 Trigger 3 common (COM)
7 Trigger 3 (NO)
8 Trigger 4 common (COM)
9 Trigger 4 (NO)

COM common
NC normally closed
NO normally open

3.3.8 Anybus module

User has possibilities to operate the unit via one of the "Anybus" module – for exact type please refer to the chapter: 2.4.2. For exact module description and the pin assignment please refer to the extra datasheet which is delivered together with the unit

3.3.9 I/O interface

The I/O connections contains the following signal pins:
- Digital outputs,
- Analogue outputs

Purpose of this interface is record of the measurement of the controller if needed. For channel 1 there are two analogue outputs – one is a readout direct from the preamplifier and the second one is the converted signal and filtered by the processor.

The first one solution allows for minimum response time as only is possible. However parallel with this information the amplification range information must follow. Amplification range signals (Range1,Range2 and Range3) are digital output with open collector OC type. For each amplification range analogue outputs have almost the same voltage range. More details are shown in tab bellow

Vacuum range measurement [Torr]	Output voltage U_{out} [V]:	Logical status on outputs		
		Preamplifier **Range1**	Preamplifier **Range2**	Preamplifier **Range3**
$P=U_{out}/ (4x10^5 x\ Sg\ x\ Ie)$	0,092 … 10	1	0	0
$P=U_{out}/ (4x10^8 x\ Sg\ x\ Ie)$	0,092 … 10	0	1	0
$P=U_{out}/ (4x10^9 x\ Sg\ x\ Ie)$	0,800 … 10	0	0	1
$P=U_{out}/ (4x10^{11} x\ Sg\ x\ Ie)$	0,000 … 10	0	0	0

where:

P – pressure

U_{out} *– Output voltage (proportional to the Ion current)*

S_g *– sensitivity factor for gas g*

I_e *– emission current*

Second analogue signal for channel1 is converted with the following parameters:

Resolution :   22 bits

Full voltage range: 0-10V

Measuring and refresh rate: 25 s-1

Output impedance: 150 Ohm

Pin assignment
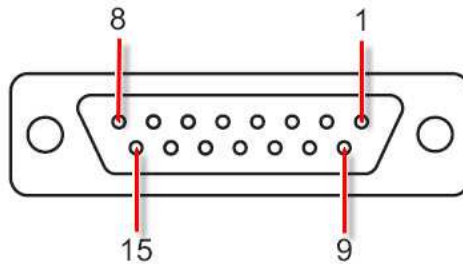
Fig. 3-10 I/O appliance socket (D-Sub, 9-pin)

1,2,3   GND
4,6   Analogue GND
5   Analogue Out for Channel 1 - linear signal direct from preamplifier
9   "Range1" digital signal – OC type
10   "Range2" digital signal – OC type

         11   "Range3" digital signal – OC type
         12   Analogue out for Channel 1 – converted linear signal
         13   Analogue out for Channel 2 – non converted – direct from the gauge
         14   Digital Out – OC type – Failure signal
         15   +24VDC; max 0,4A

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

NOTE:

All outputs are not isolated.

4 Operation

4.1 Front Panel

Fig. 4-1 shows the front panel of the MG14 .

Fig. 4-1 Front panel of the MG14 (example)

A Channel no1 row
B Channel no2 row
C LED's operation status
D Keyboard

4.1.1 Display

4.1.1.1 LED's operation status

The most important system states are always identify by LEDs - no matter which menu is selected. The upper green LED's part on the front panel displays actual setpoint status – refer to chapter 4.2.1.1. Degas and emission of Ion gauge are show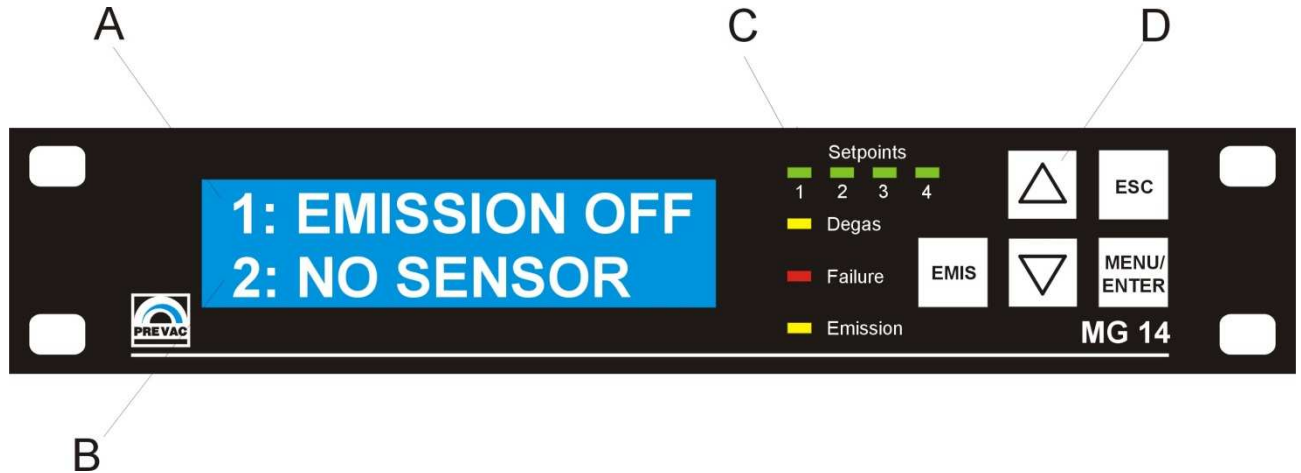n by 'Degas' and 'Emission' LED's. Any failure of operation is always signal by blinking red 'Failure' LED and additionally corresponding message to the failure is display on the LCD screen.

4.1.1.3 Measurement Display

The both channels measurement can be displayed digitally (item C) and as a bar graph for each channel separately.

Digital display: The measurement is displayed as a three-digit floating point number in scientific notation.

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.

The unit of measurement is always identical with the digital measurement display. How to change between each status see chapter 4.2.2.1.

4.1.2 Channels display

MG14 controller can be used to control two transmitters – two channels. Channel no1 is assigned to Ionization Gauge and can not be changed. For this channel only IONIVAC gauges parameters can be set – refer to chapter 4.2.4.2.

Channel 2 is an selectable input. As an standard most of OERLICON/LEYBOLD transmitters are selectable. Set correct transmitter – see chapter 4.2.4.8.

4.1.3 Control Buttons

USER INTERFACE BUTTONS:
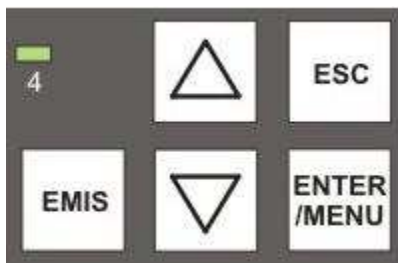
Buttons used for user interface related to the alphanumeric display

EMIS – initialization of ion gauge emission

Up, Down buttons – move between the options

ESCape button – back to previous option or cancel from the current operation

MENU/ENTER – this button has double meaning:

    a)   get into the Main Menu mode

    b)   choice acceptation if it is requested

4.2.1 Menus

To get into main menu push the **ENTER/MENU** button once. To move between each menu use narrow buttons ▲or▼. To get into deeper corresponding menu level push **ENTER/MENU** button again. Any time current operation can be canceled by pressing **ESC** button. The same user come back one menu level backward .

Fig. 4-2 shows the MENU tree of the MG14 .

Triggers
- Triggers Sets
  - T1 H x.xxe-x 1
  - T1 L x.xxe-x 1
  - T4 H x.xxe-x 1
  - T4 L x.xxe-x 1
- Triggers Logic
  - T1:   act. above/bellow
  - T2:   act. above/bellow
  - T3:   act. above/bellow
  - T4:   act. above/bellow
- Triggers active

Display Mode
- Dual Mode
- Grose Mode
  - Choose Chanel

Units
- 1: *unit sellection for chanel 1*
- 2: *unit sellection for chanel 2*

Sensor
- 1: *Gauge selection*
  - EMIS.CURR
  - SENSITI.
  - DEGAS POW.
  - CALIB.
  - FILAMENT
- 2: *Transmiter sellection*

Degas
- Degas ON/OFF
- Degas Time

Emis Control
- 1: Manual
- 1: Auto
  - *Trigger Selection*
- 2: Manual
- 2: Auto
  - *Trigger Selection*

Gas Type
- 1: *Gas correction selection for channel 1*
- 2: *Gas correction selection for channel 2*

Group Name
- 1: *Set display neme of channel 1*
- 2: *Set display neme of channel 2*

Save & Load
- Save settings
- Load setings
- Load default

Display param
- Brightness
- Contrast
- Scr.Server *ON/OFF*

Filters
- 1: *Filter selection for channel 1* (Low, Medium, High)
- 2: *Filter selection for channel 2* (Low, Medium, High)

Interface
- 1: *Anybus module selection* (EtherNet/IP,RS232/485,Bloetooth ect ...)
- 2: Parameters

Customer — *customer name*
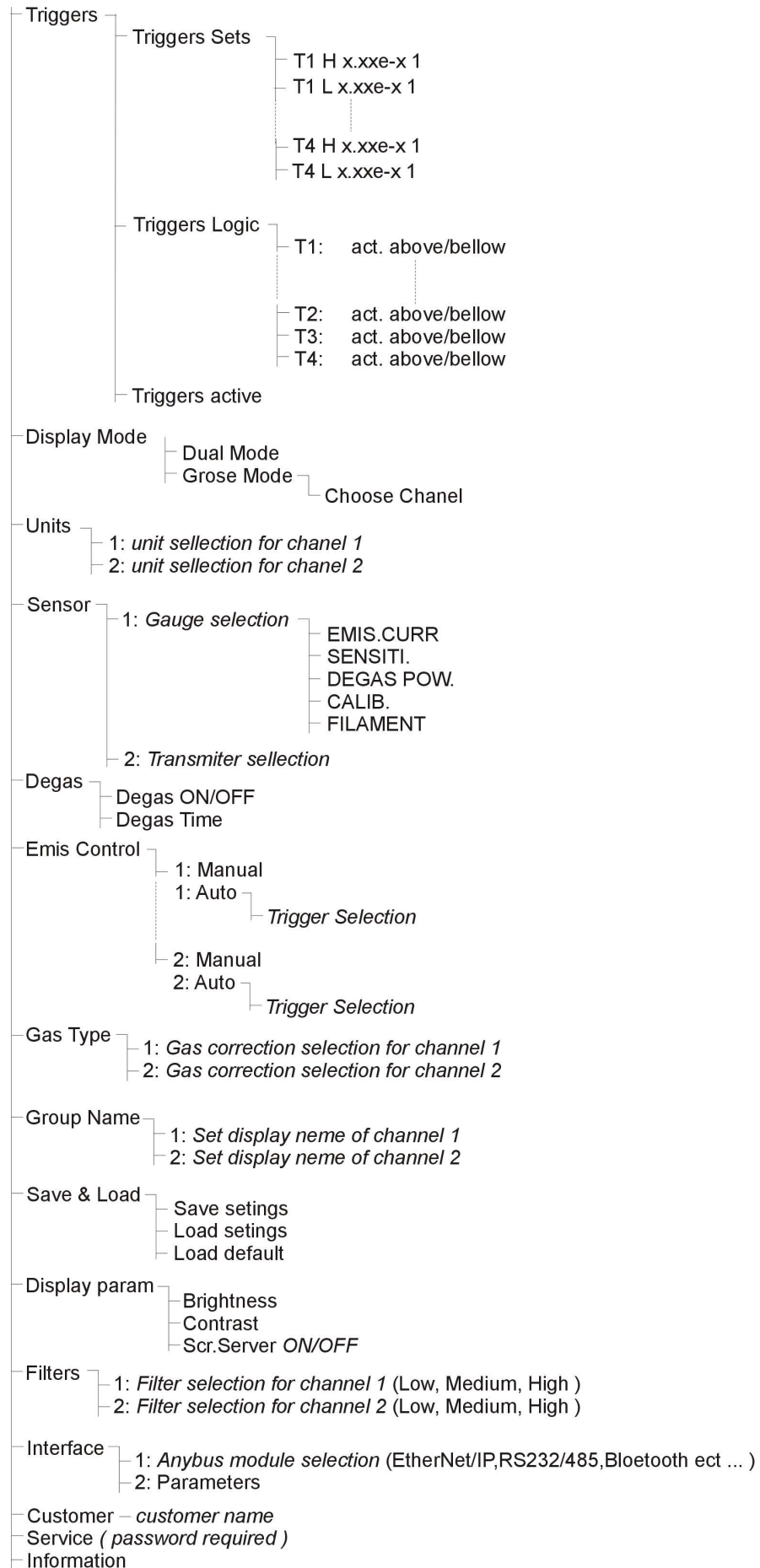Service *(password required)*
Information

Fig.4-2 MENU tree

4.2.1.1 Trigger's Menu

This parameter group allows you to configure the switching of relays functions. The MG14 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».

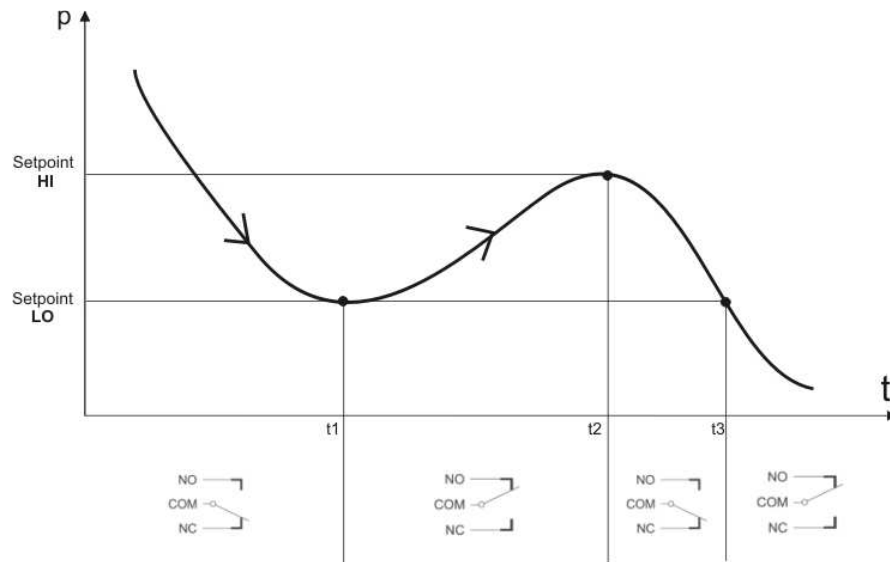Fig.4-3 shows the triggers behaviors:

Fig.4-3 Triggers behaviors

Attention: relays status is present for trigger logic with 'below' option (ref. to 4.2.1.4)

> *Relays descriptions:*
> *COM – common contact*
> *NO – Normal Open contact*
> *NC – Normal Close contact*

Refer to chapter 3.3.6. to configure connections. During the normal operation press MENU/ENTER button than press again to get into the triggers menu.

The following switching function parameters are available:
- Triggers Sets,
- Triggers Logic,
- Triggers Hysteresis

4.2.1.2 Trigger's Menu – *Triggers Sets*

In this menu you can define each setpoint as also define it's relation to the chosen channel.

Press MENU/ENTER button when 'Triggers Sets' display is active.
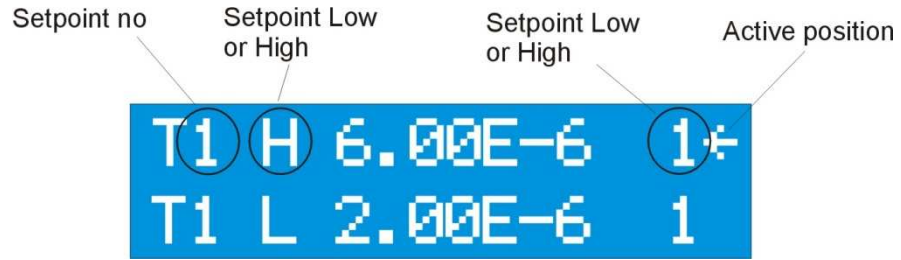
The following screen will appear:

Setpoint no   Setpoint Low   Setpoint Low   Active position
               or High   or High

Fig.4-4 Triggers menu

Using the narrow buttons ▲or▼ you can role the menu from T1 to T4. This menu presents also actual relation between channels and triggers e.g. Fig.4-4 means that trigger T1 is activate between 2….6 e-6 and is related to channel. Refer also to graph presentation on Fig. 4-3.

Pressing MENU/ENTER button on active position (left narrow) you get into the next submenu, when you define which channel actual trigger should be related to:

Fig.4-5 Triggers channel sets

To change channel use narrow buttons ▲or▼, accept the choice pressing MENU/ENTER button. Then you get into the next submenu when you can define setpoint value ('Triggers Sets' value on Fig.4-3):
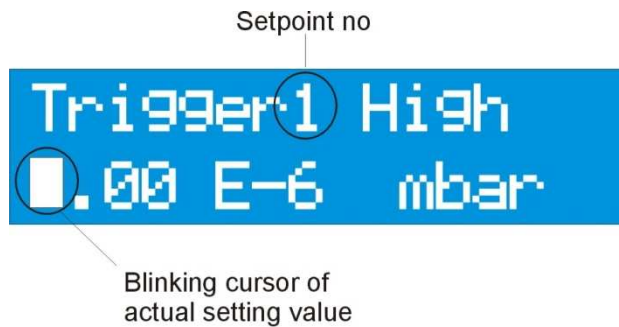
Setpoint no

Blinking cursor of
actual setting value

Fig.4-6 Triggers Setpoint HIGH menu

Using the narrow buttons ▲or▼, you can change the value which is currently display by blinking cursor. To change position press MENU/ENTER button.

4.2.1.3 Trigger's Menu - *Triggers Logic*

Triggers relays can be active bellow setting value or above. You can define this in the following submenu:

Fig.4-7 Triggers logic setting

Using the narrow buttons ▲or▼ and MENU/ENTER button you can change triggers logic. E.g. in Fig.4-7 trigger T1 is active below set value (ref. Fig.4-6), and T2 is active above set value.

4.2.1.4 Trigger's Menu - *Triggers Active*

All triggers can be activated or deactivated. When the setpoint is active works exactly according to the setpoint values and logic. Inactivation means completely switched off.

Fig.4-8 Triggers logic setting

Using the narrow buttons ▲or▼ and MENU/ENTER button you can change triggers activation. E.g. in Fig.4-8 trigger T1 is active, and T2 is inactive.

4.2.2.1 Display mode menu

During the normal operation there are to possibilities of measurement presentation: 'dual' or 'gross' mode.

Fig.4-9 Display Mode Menu

Using the narrow buttons ▲or▼ and MENU/ENTER button you can move between option and confirm current action.

4.2.2.2 Display mode menu *- Dual mode*

Choosing 'Dual mode' option by pressing MENU/ENTER button MG14 will display both of channel measurement at once as shown on figure 4-10:

Fig 4-10 Dual Mode Display

4.2.2.3 Display mode menu *- Gross* mode

Gross mode option gives additional information about the range of measuring vacuum with bar graph presentation as shown on Fig. 4-11. This opportunity is really useful for long distance waching, when digits are not big enough.
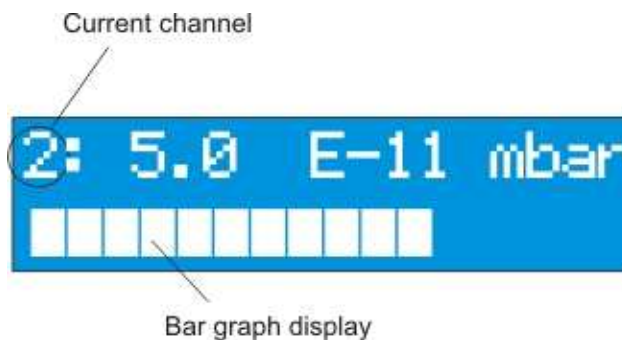

Fig 4-11 Gross Mode Display

4.2.3.1 Units menu - *UNITS*

In this menu there is possible to define unit of measurement for pressure values displayed for each channel separately. Using the narrow buttons ▲or▼ and MENU/ENTER button you can move between option and confirm current choice.

The unit affects displayed pressure readings, threshold values, etc.

There are the following units possible to choose:

      mbar – pressure unit milibar

      Pa – pressure unit Pascal

      Torr – pressure unit Torr

4.2.4.1 Sensor menu - *Sensor*

Sensor menu allows to chose type of IONI transmitter and its parameters on channel 1. Channel 2 is associated with any OERLIKON/LEYBOLD transmitter with analogue output. Gauge TTR 91 is a default one on chanell2:

Fig 4-12 Sensor menu

There is possible to choose one of 3 onivac sensors:

- Ie 514 gauge (EXTRACTOR OERLIKON/LEYBOLD)
- Ie 414 gauge (B-A OERLIKON/LEYBOLD)
- Bayard-Alpert gauge - universal

NOTE:

Emission current of Ie514 and Ie414 is limited according to the manufacturer specyfication

4.2.4.2 Gauge parameters

There is an individual set of Bayard-Albert ionization sensor. Such a possibilities makes MG14 flexible unit and can be customized to most Bayard-Alpert existing on the market.
Using the narrow buttons ▲or▼ and MENU/ENTER button you can move between the parameters and set the values.

4.2.4.3 Emission current menu – *EMIS.CURR*

The following emission current for B-A gauge can be choose:

- *0.1 ….. 1,99 mA (adjustable)*
- *2mA*
- *4 mA*
- *10 mA*

Those currents are typical for most available B-A gauges, and should be set correctly to the gauge manufacturer specification. How ever each of those parameters can be choose for any B-A gauge.
Pressure measurement is calculated to the following rule:

$$P = I_c / (S_g \times I_e)$$

where:

P – pressure

I_c – Ion current

S_g – sensitivity factor for gas g

I_e – emission current

30

It is generally agreed that I_e must be kept in the lowest practical value (certainly no more than 0.1 mA) for all work and above 10^{-3} mbar.

The following sensor parameters are monitored constantly during operation:

- *- Anode voltage*
- *- Cathode voltage*
- *- Emission current*
- *- Filament voltage*
- *- Filament current*

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.

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

Excessive emission current.

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

Only set the emission current to a fixed value if you can be sure that the sensor will operate at sufficiently low pressure levels.

4.2.4.4 Sensitivity factor menu – *SENSITI. (CALIB. for extractor IE514/515)*

Function describing relation between gas type, the geometry of the gauge and the absolute temperature is generally defined as *gauge sensitivity factor* S_g

Expression for the gauge sensitivity factor :

Sensitivity = (Ion Current) / [(Electron current) x (Pressure)]

S_g – sensitivity factor for gas correction. It can be set in the range 0,1 …. 100.

Sensitivity factor is also called CALIBration factor in extractor gauge manufacture specification.

NOTE:

For accurate measurement please always set the correct Sensitifity/Calibration factor. This parameter is given by gauge manufacturer – in some types one for the same type and in some cases it is exact related to the serial number of the gauge

4.2.4.5 Degas power menu – *DEGAS POW.*

Degas power for channel 1 can be set from 5 to 40 W max. This value should be set correctly to the B-A gauge manufacturer specification. Power ramp is fixed and can not be changed. It is **1W/s**. In this menu degas procedure can not be activated. To activate degas mode and degas time see chapter 4.2.5.1.

4.2.4.6 Calibration parameter menu – *CALIB.*

NOTE:
Calibration parameter is used for EXTRACTOR gauge only. This value is individual for each gauge and is delivered from the supplier – OERLIKON/LEYBOLD.

Please set this parameter exact according to the gauge calibration factor. In case of missing of it, please contact with Oerlikon/Leybold directly referring to the serial number of EXTRACTOR gauge.

4.2.4.7 Filament selection menu – *FILAMENT*

Most of available B-A gauges have two filaments. In this menu this selection is possible – gauge will operate on the filament which has been set in this menu. Also degas procedure operates with this filament.

NOTE:
EXTRACTOR IE514/515 and B-A IE414/415 gauges have only one filament installed. In case of switch to the 'Fillament 2' an error will be displayed – "Cathode failure"

4.2.4.8 Transmitter selection for Channel 2

As an default channel 2 is set to TTR091 OERLIKON/LEYBOLD transmitter. Using the narrow buttons ▲or▼ and MENU/ENTER button you can choose transmitter. The following transmitter as an standard are available: TTR90, TTR91, ITR 100, ITR 090,ITR091, DI 200, DI 2000, TTR 211 S,TTR90, PTR 225.
NOTE:
There is possible any other gauge implementation with 0-10V analog output signal. If required please contact with PREVAC.

4.2.5.1 Degas menu

For each channel degas procedure can be activated (for channel 2 only for ITR100, and ITR091).
Additionally degas time can be selected. Fig. 4-13 shows degas menu:

```
1: Degas ON/OFF
2: Degas Time    ←
```

Fig. 4-13 Degas menu

4.2.5.2 Degas menu – *Degas ON/OFF*

For each channel degas procedure activation can be start independent. Using the narrow buttons
▲or▼ and MENU/ENTER button you can choose an option. Choosing Degas ON/OFF option the
following screen displays:

```
1: Degas ON
2: Degas OFF     ←
```

Fig. 4-14 Degas activation menu

Channel 2 degas activation is available only if ITR091 or ITR100 is set on this channel.
During degassing, pressure measurements cannot be performed. The measurement display shows
the "Degasing ….." command.
The degas function is switched off automatically after the time declared in next submenu – see
chapter 4.2.5.3. You may also deactivate this function manually at any time by pressing
MENU/ENTER button again.
During degassing procedure yellow LED on the front panel is illuminated too – ref. to chapter 4.1.1.1.
NOTE:
There is no possible to start degassing procedure in both channels simultaneously.
Max. degas power which can be reach during the degassing procedure is set in the other menu –
see chapter *Sensor* 4.2.4.5.
Degassing power always increase with constant ramp **1W / s**, and can not be changed.

4.2.5.3 Degas time selection menu – *Degas Time*

It is possible do set degas time for each channel separately too, as follows:

Fig. 4-15 Degas time menu

Max. degas time is 15 minutes for each channel. Using the narrow buttons ▲or▼ and MENU/ENTER button you can change the values.

4.2.6.1 Emission Control menu – *Emis.Control*

One of the advantage of MG14 is automatic emission control, it means that emission of B-A gauge on channel 1 or emission of ITR091/ITR100 on channel 2 can be activated automatically according to the interlocks. Automatic emission can be allocated to the on of four triggers, as shown on the Fig.4-16.

Fig. 4-16 Emission control menu

Explanation of Fig.4-16 is as follows: emission of B-A gauge is related to the Trigger 3 – automatic on when Trigger 3 value is reached (see chapter 4.2.1.1), and emission of channel 2 must be activate manually.

⚠️ **WARNING**

Be aware of automatic emission control. It can be the reason of filament burning out, if emission is started at high pressure with the high emission current.

4.2.7.1 Gas type correction menu – *Gas Type*

Sensors are normally calibrated for a measurement in nitrogen or in air. If pressure measurements are being performed with other gases, is necessary to correct the reading accordingly. The *Gas Type* parameter is used to adjust the correction factor for the respective gas type. The actual pressure is obtained by multiplying the measured pressure with the correction factor:

$$P = [I_c / (S_g \times I_e)], \text{ where } Sg = S_{N2} \times R_g$$

where:

P – pressure

I_c – Ion current

S_g – sensitivity factor for gas g

I_e – emission current

S_{N2} – gauge sensitivity for N_2

Rg – gas correction factor

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

The following gas type correction factors are implemented and can be choose using the narrow buttons ▲or▼ and MENU/ENTER button for each channel separately:

Gas	Rg
He	0,18
Ne	0,30
D_2	0,35
H_2	0,46
N_2	**1,00**
Air	1,00
O_2	1,01
CO	1,05
H_2O	1,12
NO	1,15
NH_3	1,23
Ar	1,29
CO_2	1,42
CH_4 (methane)	1,4
Kr	1,94
SF_6	2,2
C_2H_6 (ethane)	2,6
Xe	2,87
Hg	3,64
C_3H_8 (Propane)	4,2
DEFINE	**0…10**

Tab.1-1 Gas correction factors

Additional user can define any other gas type correction in the range 0 to 10, what makes MG more flexible and customized.

IMPORTANT !

Nominal relative sensitivity factors can not be related upon for accurate measurements since they are known to vary significantly between seemingly identical gauges and even more for different gauge types, filament materials, and operating potentials. For general vacuum use, the discrepancy in reported measurements is not greater than 10% for the common gauges, rising to a little above 20% for the less common gases, where less accurate information is available.

4.2.8.1 Setting the channel name menu – *Group Name*

For each channel individual name can be set. This name displays in any menu where corresponding channel appears.

4.2.9.1 Loading and saving parameters menu – *Save & Load*

This menu should be used when following actions are required:

Save setting – storage all individual settings which has been set in each menu

Load settings – restore parameters storage in EEPROM memory

Load default – restore original manufacturer parameters

Using the narrow buttons ▲or▼ and MENU/ENTER button you can chose an option.

IMPORTANT!

Storied values are available even after power off.

4.2.10.1 Display parameters menu – *Display param.*

LCD display is controlled by microcontroller and backlight of it as well. Because of different angle of few it is possible to set individual brightness and contrast of LCD display – Fig.4-17.

Fig. 4-17 Display menu

Using the narrow buttons ▲or▼ and MENU/ENTER button you can change the value of brightness and contrast from 0..100%.

As an additional option there another *Screen Server* menu is implemented – Fig.4-18

Fig. 4-18 Display menu – Screen Server

Activating of this option automatically starts internal time counter (15 min.) counting down. If during this period no action is taken, display brightness is switched to the minimum (5%) after 15 minutes. It stays in this condition as long as any button is pressed. Pressing any button once activating previous brightness set.

*Scr.Saver **ON*** – screen server activated

*Scr.Saver **OFF*** – screen server deactivated. LCD brightness always stays the same

IMPORTANT:

All of the sets values in '*Display Menu'* should be stored – refer to *'Save & Load'* menu (4.2.9.1). In other case after the Power Off of MG14 those value are not stored.

4.2.11.1 Interface menu – *Interface*

For network connectivity requirements Anybus CompactCom (Anybus-CC) modules has been implemented. However any module needs its own parameters senting. Software version V 6.1 (refer to chapter 4.2.14.1) supports five of anybus module:

- EtherNET/IP,
- Bluetooth,
- RS232,
- RS485,
- USB

Each module is configured in *PARAMETERS* submenu

4.2.11.2 EtherNet/IP parameters

Getting into this menu the following four parameters must be set:

IP Address   this is typical IP address which will be related to current unit

only in the network (xxx.xxx.xxx.xxx),

Subnet Mask (set subnet mask address xxx.xxx.xxx.xxx),

Gateway   (Gateway address xxx.xxx.xxx.xxx),

DHCP   enable or disable Dynamic Host Configuration Protocol

Status   (Read, Read/Write/ OFF option) – those options allow to read only,

read and write commands via the network to the unit. *OFF* option disable

the unit for the network.

4.2.11.3 Bluetooth parameters

Unit configured with Bluetooth Anybus module is able to communicate with different speeds which can be chosen in PARAMETERS submenu. Bluetooth module can communicate with the speeds: 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps.

4.2.11.4 RS232/485/USB parameters

All three communication standards requires the same software parameters. Those modules can communicate with the speeds: 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps.

8 bits of data, 1 bit stop and no parity parameters are fixed and can not be changed

For hardware connection of RS232/485 either USB Anybus module please refer to datasheet of it. It can be downloaded from the website: http://www.anybus.com/products/embeddedindex.shtml

4.2.12.1 Customer menu - *Customer*

This menu allows to enter "customer name" (up to 12 characters). This "name" is displayed later on in the network either website of the unit. It allows for the unique unit identification if more than one of units are connected to the network.

4.2.13.1 Service menu – *Service*

This menu is intended for manufacturer services only and can be activated only with the correct password.

4.2.14.1 Information menu – *Information*

In this menu information about manufacturing date and software version is displayed.

5.Maintenance and Service

5.1 Maintenance

The MG14 does not require any special maintenance work.

5.1.1 Cleaning

For cleaning the outside of the device, a slightly moistened cloth will usually do. Do not use any aggressive or abrasive cleaning agents.

 ⚠ DANGER

Mains voltage.

Components inside of the IM 540 are components to mains voltage.

Do not insert any objects through the louvers of the device. Protect the device from liquids.

Do not open the device.

6 Storage and Disposal

6.1 Packaging

Please keep the original packaging. The packaging is required for storing the MG14 and for shipping it to an PREVAC service center.

6.2 Storage

The MG14 may only be stored in a dry room. The following requirements must be met:

Ambient temperature: -20….+60 ℃

Humidity: as low as possible. Preferably in an air-tight plastic bag with
                                    a desiccant.

6.3 Disposal

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

7. APPENDINX

7.1 Trouble shuttings – error massages

L.p.	Error message	Description	Solution
1.	"NO EMISSION"	Emission is not possible	- check gauge connection, - exchange the B-A gauge cable, - exchange the B-A cable, - pressure to high, - turn emission on again
2.	"HV FAILURE"	No high voltage on gauge anode, or more than ±10V of differences from 180V (500V for degas)	- check gauge connection if there is no shortcut, - exchange the B-A gauge cable, - turn emission on again
3.	" OVERPREASURE"	Measure pressure excide critical value >1x10^{-3} mbar	- check iv there is no leak in the system, - wait till pressure reach minimum value, - turn emission on again
4.	" OVERTEMERATURE"	Temperature inside device too high (> 80 ^{o}C)	- turn emission off – let the device cool down, - check if louvers of the device are not locked, - be sure that air flow around device is proper – check inside cabinet temperature if device is mounted in the rack
5.	"CATHODE OPEN"	No current in cathode circuit	- check gauge filament if is not open, - check gauge connection, - exchange gauge cable, - turn emission on again
6.	"CATHODE SHORT"	Current in cathode circuit too high. Emission current can not be reached	- check filament if there is no connection to the ground or other pins, - check gauge cable if there no shortcuts, - exchange gauge cable, - turn emission on again
7.	"Ubias FAILURE"	Bias voltage (filament potential) different more than ± 10%	- check gauge cable if there no shortcuts, - check gauge connection, - exchange gauge cable, - turn emission on again - turn the device off, wait 10s and turn device on again
8.	"+24V FAILURE"	+24V supply voltage different more than ± 10%	- turn the device off, wait 10s and turn device on again

9.	"+5V FAILURE"	+5V supply voltage different more than ± 10%	- turn the device off, wait 10s and turn device on again
10.	"+12V FAILURE"	+12V supply voltage different more than ± 10%	- turn the device off, wait 10s and turn device on again
11.	"-12V FAILURE"	-12V supply voltage different more than ± 10%	- turn the device off, wait 10s and turn device on again

7.2 Index

8. WARRANTY CONDITIONS

Device described within this manual was manufactured with hold of appropriate carefully from value materials.
Warranty includes delivered and installed device within 1-year period, since moment of end acceptance it's functioning after install.
Device cannot be used by customer till the time of last of last acceptance after install. Every discrepancy in functioning everyone has to be noticed, and warranty period for this part will be counted since the moment of acceptance it's fully correct work. Warranty conditions are following the law regulations in country, the device is delivered to.

The company **PREVAC Sp. z o.o.** obligate to repair or replacement of whole device in cause of appearing it's damage during warranty period (described above).Warranty does not include:

a) Elements and parts that wear during normal use.

b) Elements, that were not delivered by **PREVAC**.

c) Elements damaged due to cooperation with incorrect working devices, those not delivered by **PREVAC**.

d) Damages caused by wrong use of device through user, during operating the device.

e) Damages caused by use of the device, not correct (discordant) to it's proper use.

f) Damages caused by powering the device with wrong (not allowed) voltage, that does not correspond with technical specifications of device.

g) Damages caused by influence of external factors (mechanical, chemical, electrical) other than those occur during installing the device, especially by these factors , the device was exposed to, because of user fault.

h) Damages caused by fire or other natural disasters.

At customer request, Company PREVAC can replace or repair not working parts on the spot by customer, without charging expenses to customer. With agreement of company **PREVAC**, customer can hire specialist, that can repair particular damage. For replaced or repaired part **PREVAC** gives warranty for the period from 1 year since repair that part on the spot by customer.

Company **PREVAC** obliges itself to material responsibility for defects or incorrect functioning of device, up to value, that not exceeds price (including transport) of faulty part.

Covering consigned technical information.

All technical data, like drawings, descriptions, schemes, diagrams etc. and all other data are serving only approximation functioning of machinery to the customer. They are delivered even, if they are not specified in contract. Company **PREVAC** reserves itself right to introduce technical changes in the device, that are not included in instruction, but are necessary to correct work of device.

Duty of customer is :

a) To hold in closed files all technical data and other detailed descriptions delivered by PREVAC, that are property of PREVAC company.

b) To make confidential information available, that originate from PREVAC company, only to employees, which are operating owned equipment.

Customer can not make out any technical documentations by the use of information delivered by the PREVAC company, without their knowledge and agreement.

Receiving orders

The company PREVAC receives orders and/or delivery according to import and/or export law regulations.

Damage or loss during transport

Loss or damage goods during transport will be related through customer. Customer during is obliged to check all goods delivered by the company PREVAC during acceptance of goods.

Description of delivery
Time of delivery can be reasonably expanded, if there occur any objectively obstacle, that arise in spite of plans PREVAC company, that company can not avoid. Such a reasons are epidemics, natural disasters, mobilization, war, riots, conflicts in work, serious damages, accidents, official obstacles, shortages of materials, transport difficulties.

Declaration of Conformity

We, PREVAC sp. z o.o. (Ltd.), hereby declare that the equipment mentioned below complies with the provisions of the Directive relating to electrical equipment designed for use within certain voltage limits 73/23/EEC and the Directive relating to electromagnetic compatibility 89/336/EEC.

Product

Multi gauge controller MG14

Standards

Harmonized and international/national standards and specifications:

EN 61010-1 (Safety requirements for electrical equipment for measurement, control and
laboratory use)

EN 61000-6-2 (Electromagnetic compatibility generic
emission standard)

EN 61000-6-3 (Electromagnetic compatibility generic
immunity standard)

Signatures

PREVAC sp. z o.o.

27 December 2007

Jacek Łatkowski

Electronic Products Manager