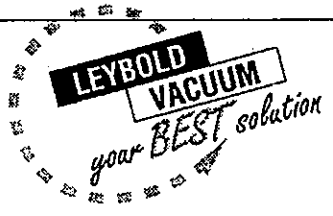
Vacuum Pumps | Instrumentation | Fittings and Valves

LEYBOLD

LEYBOLD VACUUM

GA 09.414 /3.02



Ionization Vacuum Gauge ITR 100

Cat. No
163 60; 163 66

Operating Instructions

Leybold Service
If equipment is returned to LEYBOLD VACUUM GmbH, indicate whether the equipment is free of substances damaging to health or whether it is contaminated. If it is contaminated also indicate the nature of the hazard. LEYBOLD will return any equipment without a Declaration of Contamination to the sender's address.

General Remarks
We reserve the right to alter the design or any data given in these Operating Instructions.
The illustrations are not binding.

For appliances with field bus interface profibus DP Cat. No. 163 70 and 163 72 the Operating Instructions GA 09.415 for description and operation of this interface applies as well.

Contents

1 Description

1.1 General

The ITR 100 ionization vacuum gauge is supplied ready for operation. Even so, we recommend to read these Operating Instructions with care so as to ensure optimum operating conditions right from the start.

These Operating Instructions contain important information on the functions, installation, start-up and operation of the ITR 100 ionization vacuum gauge.

Important remarks concerning operational safety and protection are emphasized as follows:

Warning Indicates procedures that must be strictly observed to prevent hazards to persons.

Caution Indicates procedures that must strictly be observed to prevent damage to, or destruction of the ITR 100 ionization gauge.

Note
Indicates special technical requirements that the user must comply with.

The references to diagrams, e.g. (3/5), consist of the Fig. No. and the Item No. in that order.

Unpack the ITR 100 ionization vacuum gauge immediately after delivery, even if it is to be installed at a later date.

Note
Retain the shipping container and the packaging materials in the event of complaints about damage.

Check that the ITR 100 ionization vacuum gauge is complete. Carefully examine the ITR 100 ionization vacuum gauge visually.

Note
In order to protect the ITR 100 against extreme electrostatic charging (ESD) during transport it is packed in electrically conductive material, which does not mean that special measures against ESD have to be taken during installation and operation.

If any damage is discovered, report it immediately to the forwarding agent and insurer. If the damaged part has to be replaced, please get in touch with the orders department.

1.1.1 Purpose

The ITR 100 - the compact total pressure vacuum gauge for the medium and high vacuum range - combines in a compact housing a hot cathode ionization gauge tube with its related operating and processing functions.

The ITR 100 is suitable for measurement tasks, including open and closed loop control, in the fine to high vacuum range.

The ITR 100 combines ruggedness with well reproducible measurements.

ITR 100 Characteristics
- Wide range Bayard-Alpert sensor covers 9 decades of pressure ($1 \cdot 10^{-10}$ and 0.1 mbar, resp. $0.75 \cdot 10^{-10}$ and $0.75 \cdot 10^{-1}$ Torr);
- Highly reproducible results through individually calibrated sensor;
- Closed sensor design which protects the sensor against mechanical damage and electromagnetic interference;
- DN 25 KF, DN 40 CF vacuum connection (alternatively);
- Automatic dual-cathode operation;
- Easily exchangeable sensor with automatic sensitivity adjustment;
- Pressure trigger relays;
- 0 to 10 V output signal; log. or linear.
- DC power supply range from 20 to 28 V;
- Rugged metal housing sealed against dust, water and electromagnetic interferences;
- Measurement operation during electron bombardment electrode system degassing;
- RS 232 C interface for measurement value acquisition and control/setting of instrument functions; (as of serial number D 97 11 00001).

1.2 Technical Data

1.2.1 ITR 100 Specifications

Response threshold	$1 \cdot 10^{-10}$ mbar or Torr $1 \cdot 10^{-8}$ Pa
Measurement range (9 decades)	$2 \cdot 10^{-10}$ to 0.1 mbar or $1.5 \cdot 10^{-10}$ to $0.75 \cdot 10^{-1}$ Torr $2 \cdot 10^{-8}$ to 10 Pa
Reproducibility (comparative standard deviation to DIN 1319-1)	± 10 % of the meas. value in the process pressure measurement range $1 \cdot 10^{-7}$ to $1 \cdot 10^{-2}$ mbar (Torr) $1 \cdot 10^{-5}$ to 1 Pa

Repeatability (refer to DIN 1319-1)
± 2 % of the measured value

Long term sensitivity drift (to DIN 16086) ± 10 %
(within 6 months for operation under clean vacuum conditions)

Sensor type: Wide range Bayard Alpert ionization vacuum gauge

Cathode: Yttrium oxide coated iridium dual cathode; capable of withstanding air inrushes, additionally protected by current limiting and overpressure emission cut-off

Degassing: Electron bombardment may be switched on at pressures $< 2 \cdot 10^{-5}$ mbar or $< 1.5 \cdot 10^{-5}$ Torr
Degas duration 3 Minutes max.
(see also Section 2.2.2: "Degassing")

Vacuum connection (alternatively) DN 25 KF, DN 40 CF
For Cat. Nos. see Section 1.2.2
(others upon request)

Measurement volume
DN 25 KF: 24 cm^3
DN 40 CF: 34 cm^3

Material in contact with the medium
stainless steel, yttrium oxide, glass, NiFe, NiCr, tungsten

Overpressure resistance: 2 bar absolute

Power supply: 20 to 28 V DC (max. ripple 2 V_{pp})

Current consumption: 0.5 A in the measurement mode
0.8 A when degassing
1.4 A while starting up (for < 1 s)

Output signal: 0 to 10 V ($R_L \geq 10$ kΩ)
selectable:
- logarithmic characteristic 1 to 10 V; 1 V per decade
or
- selection of 3 decades out of 9 (linear 0 to 10 V)
or
- all 9 decades linear
Mantissa: 0.8 to 10 V
with extra output for exponent: 1V step per decade
(see also Section 2.3.2: "Selection of the Analogue Output Characteristic")

Signal rise time: < 100 ms ($p > 1 \cdot 10^{-6}$ mbar (Torr), without emission switchover)
(for a pressure increase from 10 to 90 % of the measurement range)

Emission current
in the pressure range up to $2.5 \cdot 10^{-5}$ mbar ($1.88 \cdot 10^{-5}$ Torr): 5 mA
in the pressure range $3 \cdot 10^{-5}$ mbar ($1.88 \cdot 10^{-5}$ Torr) to $8 \cdot 10^{-5}$ mbar ($6 \cdot 10^{-5}$ Torr): 25 µA or 5 mA
depending on whether the pass through the pressure range is increasing or decreasing (hysteresis range)
in the pressure range $8 \cdot 10^{-5}$ to 0.1 mbar ($6 \cdot 10^{-5}$ to 0.075 Torr): 25 µA
(see Section 2.2.1: "Pressure Range" and Fig. 2).

Control inputs
prog. control compatible; 24 V logic; static

- Emission: ON / OFF
(automatic emission switch off at p > 0.1 mbar or 0.075 Torr; after about 200 ms)
(Levels: see Fig. 2); also directly controllable through a a THERMOVAC-Transmitter TTR 211 S- measurement signal output
Input resistance: $R_E = 22$ kΩ

- Degas: ON / OFF
(Levels: OFF: < 10 V approx.; ON: > 12 V approx.)
only at a pressure $< 2 \cdot 10^{-5}$ mbar ($< 1.5 \cdot 10^{-5}$ Torr)
after 3 minutes automatic switch off;
(see also Section 2.2.2: "Degassing")
Input resistance: $R_E = 2.6$ kΩ

- Switchover: Measurement signal (0 V)
Value for the trigger level (24 V);
unconnected = LOW = measurement signal
(Levels: Low level: < 5 V approx.; High level: > 12 V approx.)
Input resistance: $R_E = 3$ kΩ
(see also Section 2.6 "ITR 100 Signal and Power Supply Connections")

Trigger relay: 1 n.o. contact
usable from $1 \cdot 10^{-9}$ to 0.1 mbar or Torr;
Rating: 60 V DC; 0.5 A DC

Status indicator
LEDs for:

Emission ON	green
Warning status	red
Trigger status	green
Power supply	orange / yellow

RS 232 C interface
Baud rate: 9600, fixed

Data format: ASCII character set
one start bit,
seven data bits + one space bit,
one stop bit
no parity

Signal level: ± 8 V approx.

Function	Measurement values acquisition, status request, parameter settings
Connection plug	Sub-D socket, 15-way (Fig. 3) TxD (Transmit data) on pin 13 RxD (Receive data) on pin 14 GND signal ground on pin 5
RS 232 C cable length	max. 30 m
Operating temperature range	0 to 50 °C
Storage temperature range	- 20 °C to + 70 °C
Highest permissible degassing temperature at the flange (degassing of the vacuum chamber)	
DN 25 KF	80 °C
DN 40 CF	150 °C (horizontal installation)
Climatic rating	KWF to DIN 40040
Humidity (on 30 days per year, non-condensing)	max. 95 %
Protection	IP 54
Electrical connection	15 way sub-D connector, male
Length of the signal line (without RS 232)	100 m max.
Dimensions	See Fig. 1
Weight	
DN 25 KF	980 g
DN 40 CF	1280 g
Standard installation	sensor and electronics box as a single unit directly at the vacuum connection
Installation with special accessories	(upon request) separated sensor and electronics box linked through a 1 m long line available as a special accessory

1.2.2 ITR 100 Versions, Options and Accessories

	Cat. No.
Vacuum-connection versions	
ITR 100 with DN 25 KF	163 60
ITR 100 with DN 40 CF	163 66
ITR 100 with DN 40 CF, bakeable up to 250 °C at the flange	in preparation
Replacement sensor IE 100 with DN 25 KF	163 61
Replacement sensor IE 100 with DN 40 CF	163 67
Accessories	
Small signal connection line with 15 way Sub-D socket connector for connection to the ITR 100, 10 m length (bare wire ends on the other end of the line)	163 69
THERMOVAC-Transmitter TTR 211 S	157 30
Clamping ring DN 20 / 25 KF	183 42
Centering ring DN 25 KF	183 27
ITR 100 with Field Bus option (in preparation):	
ITR 100; DN 25 KF with ProfiBus DP	163 70
ITR 100; DN 40 CF with ProfiBus DP	163 72
In preparation	
ITR 100; DN 25 KF with DeviceNet	163 74
ITR 100; DN 40 CF with DeviceNet	163 75
On request	
ITR 100; DN 25 KF with LonWorks	163 71
ITR 100; DN 40 CF with LonWorks	163 73
Metal seals for vacuum flange	
Cu seals DN 40 CF (10 pcs.)	839 43
Al seals (Ultra sealing rings) for DN 25 KF (3 pcs.)	883 75
matching support ring	883 76
matching clamping ring	882 77

1.3 Equipment Identification

In order to identify the electronics section of the ITR 100 and the ITR 100's sensor - the IE 100 - both components are marked by an individual serial number which should be at hand when asking Leybold for advice or further information.

1.3.1 Principle of Operation

In ionization vacuum gauges, the ionization of gases within the electrode arrangement of the sensor is utilised for the measurement of the vacuum pressure. The electrode arrangement consists of two coiled hot cathodes which are operated alternatingly, a coiled anode and a ion collecting electrode.

The electrical power supply unit supplies the anode and cathode voltages required for the measurements. With the aid of an emission controller located in the power supply unit, the heater current for the cathode is controlled in such a way that the cathode emits a constant electron current (emission current).

On their way to the anode the electrons collide with the present gas molecules and ionize these. The ionized gas molecules generate a pressure dependent current at the ion collector which is then applied to a current-to-frequency converter converting the current into a frequency which depends on the measured value. Finally, the microcontroller produces from this frequency signal an internal digital value as a measure of the measured total pressure, which is then output among other signals as an analogue measurement signal spanning a range from 0 V to 10 V.

Moreover, the microcontroller takes over the task of controlling internal functions of the ITR 100 such as monitoring of the relay switching thresholds, monitoring of the emission, conversion and correction of the measurement data (automatically taking into account the sensitivity of the sensor or adaptation to the type of gas etc.).

The instrument functions including the measurement values request may be controlled and read out by the integrated RS 232 C interface or the field bus options.

1.4 Standard Specification

ITR 100, DN 25 KF or DN 40 CF

Operating Instructions	GA 09.414
Jack plug (3.5 mm)	
Nuts M 4 (4 pieces)	
Additionally for the ITR 100 with profibus-DP-interface the Operating Instructions	GA 09.415

2 Operation

2.1 Installation and Start-up

The ITR 100 is installed directly on the vacuum system. For the dimensional drawing, see Fig. 1.

For additional fastening at the housing the delivered 4 nuts M 4 can be used. In case of need the nuts are to be clipsed in the lateral housing grooves.

Basically the ITR 100 will operate in any orientation. However, it is recommended especially in the case of vacuum applications which might give rise to the production of condensate or any other deposits, to avoid a hanging orientation (i.e. with the vacuum flange at the top). If the vacuum chamber is baked out in order to attain a very low pressure, the ITR 100 must under all circumstances be installed so that the heat of the convection in the vacuum chamber can not significantly warm up the ITR 100. In this case the ambient temperature at the housing of the ITR 100 must not exceed 50 °C.

The use of a metal seal is recommended for the vacuum flange, since gasket seals (FPM) may impair the accuracy of the measurements already in the 10^{-6} mbar range and lower by giving off gas.

A DC supply voltage of about 24 V is required for the ITR 100 (see Section 2.6 "ITR 100 Signal and Power Supply Connections"). The minus connection of the power supply voltage (3/3) pin 5 is connected within the ITR 100 to the frame ground of the ITR 100 and the shield connection (3/3) pin 15. Therefore, the supply voltage must either be floating or its minus connection must be connected to ground.

It is strongly recommended to use shielded cables and connectors, and to connect the shields with care (see also Section 2.6 "ITR 100 Signal and Power Supply Connections" pin 15).

Caution

- The ITR 100 must only be connected to power supply units or measuring instruments which meet the requirements for electrically isolated small signal voltages (PELV) and VDE 0100.
- The principle of the ionization gauge requires the use of a hot cathode. For applications which involve ignitable gas mixtures, therefore, the ITR 100 must - for safety reasons - be disconnected from the power supply voltage during the presence of such ignitable gas mixtures (disconnect 24 V power supply via a switch or a relay contact in an intrinsically safe way).
- After a sudden temperature change (from cold to warm) condensation may disrupt proper operation of the gauge for a while. It is thus recommended to let the ITR 100 adapt itself for about 2 hours to the ambient temperature before starting it up.

An electronically regulated power supply unit may be used. In this case note that upon switching on the emission of the ITR 100 it will draw an increased current for a short period of time (max. 1.4 A for 1 s max.) (see also the information given in this section below and Section 2.6 "ITR 100 Signal and Power Supply Connections"). Thus a suitably rated power supply unit must be used or one where the overcurrent protection reacts slowly or which limits the current instead of shutting down at excessively high currents.

The "PWR" LED (3/1) is on continuously as long as the ITR 100 is supplied with power.

Hot cathode ionization gauges should only be started to operate at a sufficiently low pressure. It is thus neces-

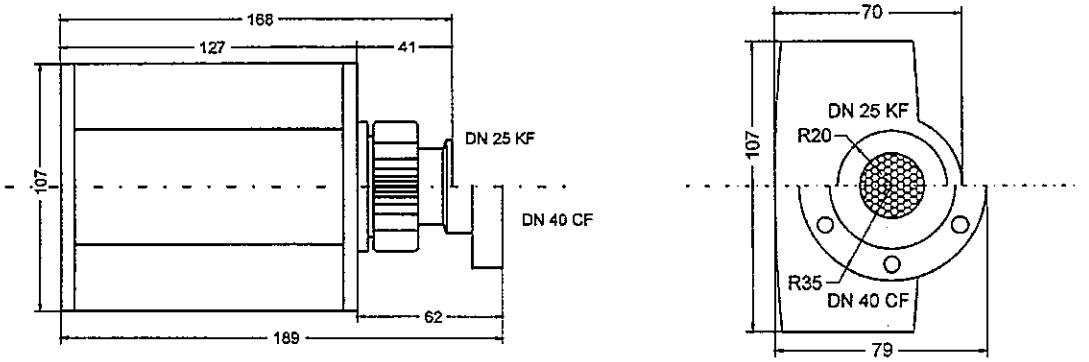


Fig. 1 Dimensional drawing

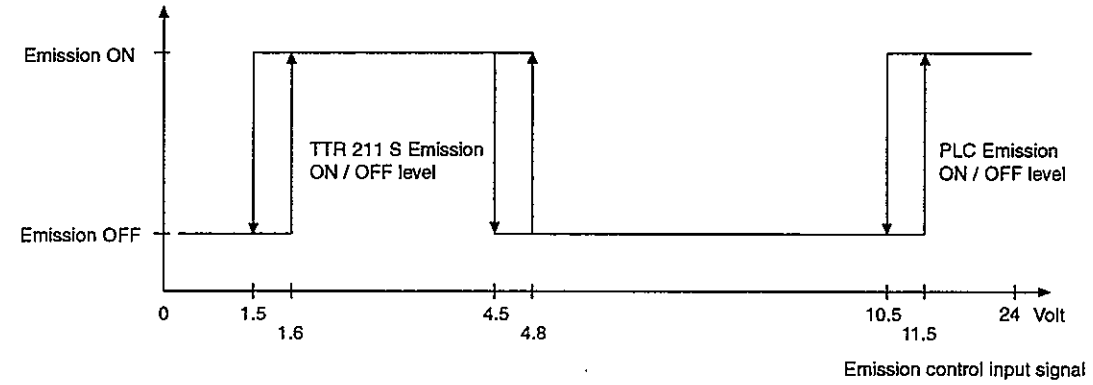


Fig. 2 Input characteristic for the emission control input, Sub-D-15 connection pin 4 (3/3)

sary to start the emission only once the upper measuring limit is decreased and to switch off the emission once the upper measuring limit has been exceeded. For example, the THERMOVAC TTR 211 S is ideal to control the emission of the ITR 100 via the emission ON / OFF input which is accessible through Sub-D-15 connector pin 4 (3/3) (see also Section 2.7 "Electrical Wiring" and Fig. 2). But it is also possible to switch on the emission of the ITR 100, by the run-up signal from the related turbomolecular pump (ready relay). The emission control can also be done via the RS 232 C interface (see Section 3).

The status for the emission is indicated by the green "EMIS" LED (3/4) (LED on = emission is on).

When the highest measurable pressure for the ITR 100 ($1 \cdot 10^{-1}$ mbar or $0.75 \cdot 10^{-1}$ Torr) is exceeded and provided the emission is not switched off through the emission ON / OFF input, the ITR 100 will switch off the emission automatically after about 0.2 seconds and will output a warning message through the LED "⚠" (3/2) (see also Section 2.5 "LEDs and Status Outputs").

After the emission has been started, the ITR 100 will need some time (2 seconds max.) until it can output stable signals.

Depending on the operating mode of the activated secondary measurement signal output, the main measurement signal output which supplies a signal proportional to the pressure will deliver an output ranging from 0 Volt to 10 Volt (see also Section 2.3.2: "Selection of the Analogue Output Characteristic" and Section 2.6 "ITR 100 Signal and Power Supply Connections").

Both measurement signal outputs have been designed as differential outputs which are capable of equalising a voltage difference of +3 to -5 V between power supply ground and measurement signal ground (see also Section 2.6 "ITR 100 Signal and Power Supply Connections").

The voltage differences described here can be caused

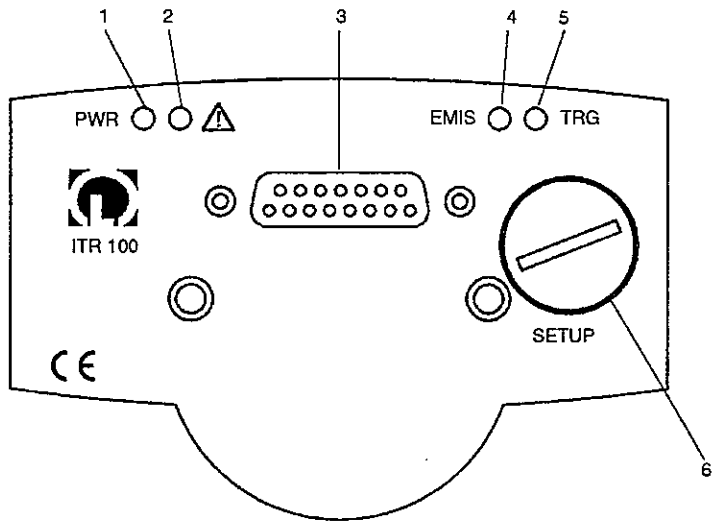


Fig. 3 Front panel

Key to Fig. 3
1 LED, 24 V supply (orange)
2 LED for different warnings (red)
3 15-way SUB-D connection
4 LED for emission ON (green)
5 LED for trigger status (green)
6 Screw-on lid for various controls (see Fig. 4)

either by a voltage drop occurring across the small signal power supply line or through equalization currents of other electrical systems. If the common mode rejection ratio of the ITR 100 ranging from +3 to -5V is not sufficient, increase the cross section of the ground conductors or electrically isolate any of the electrical systems connected to the ITR 100. This may apply to the power supply or the processing electronics for the measurement signal (A/D converter inputs of programmable controls or PCs).

Recommendation: In order to avoid the occurrence of equalization currents make sure that all ground referenced parts of the system are properly connected to ground.

The pressure measurement values may also be read out via the RS 232 C interface or the field bus interface.

2.2 Points to Observe during Measurements

2.2.1 Pressure Range

A hot cathode ionization vacuum gauge like the ITR 100 may only be sensibly employed over such a wide range of pressures when using a low emission current in the high pressure range (medium vacuum) and a high emission current in the low pressure range (high vacuum). The emission current is switched over at about $5 \cdot 10^{-5}$ mbar or about $4 \cdot 10^{-5}$ Torr (see also Section 1.2.1 "ITR 100 Specifications"). During switching over of the emission current, it is possible that the ITR will briefly (for 1 second max.) not meet its specifications (see Fig. 2).

2.2.2 Degassing

Deposits on the electrode system of the hot cathode ionization gauge may result in an unstable output.

In such a case it may be useful to start a degassing run at a pressure below $2 \cdot 10^{-5}$ mbar ($1.5 \cdot 10^{-5}$ Torr). Depending on the application, this may be done through a manually operated switch or automatically through a system controller (PLC). The ITR 100 will automatically stop the degassing process after 3 minutes, if degassing is not stopped before that.

In the ITR 100 the degassing is effected by electron bombardment to the electrode system.

For repeated degassing, the control signal must first change from ON (24 V) to OFF (0 V), in order to start the degassing process once more through ON (24 V) (see technical data in Section 1.2). It is recommended to set the degas signal to OFF again each time after a degassing period of 3 minutes has elapsed, so that a defined operating state is attained at all times.

Also during the DEGAS phase the ITR 100 will supply measured values, however, these may fall outside the normal reproducibility levels (typical range ± 30 %).

2.2.3 Dual Cathode

The cathode used in the sensing tube of the ITR 100 (IE 100) will typically operate for many thousand hours without failing. If a cathode of the ITR 100 should burn out, the second cathode is available. This cathode is selected automatically and without significant interruption of the measurement process and without impairing the process running in the vacuum. The failure of a cathode is indicated by the status LED and the warning output.

2.2.4 Exchanging the Sensor

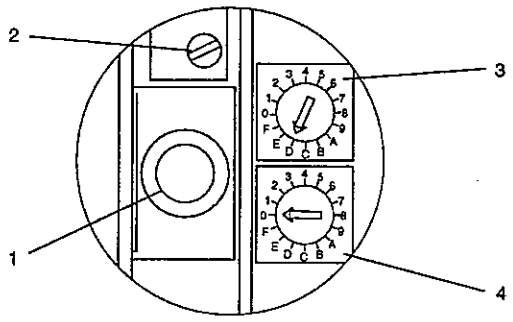
If it is required to exchange the sensing tube (IE 100) (after a failure of both cathodes, for example) all what is required is to unscrew the large collar nut in the direction of the vacuum connection and pull the IE 100 out from the electronics unit. To install the sensor, the projection on the IE 100 must be aligned with the guiding groove on the electronics unit of the ITR 100, push the IE 100 into the electronics unit and screw the collar nut back on.

Because the operating electronics of the ITR 100 automatically determine the sensitivity of the exchanged sensor, nothing else (like entering the calibration factor, for example) will be necessary for resuming the measurements besides connecting the gauge head to the vacuum system again.

2.2.5 Gas Dependence of the Pressure Readout

Basically the readout from an ionization vacuum gauge depends on the composition of the gas. The normal pressure readout will be correct for pure nitrogen (N_2) and air. In the case of other gases you will have to expect systematic deviations depending on the composition of the gas. The readout is then termed „nitrogen equivalent".

Besides the standard types of gas like nitrogen and air, correction factors for other types of gas may be selected on the ITR 100 (see also Section 2.3.3: "Selection of Type of Gas and Pressure Unit") in order to obtain also for other gases a pressure reading which is largely correct. You must note however, that the specified level of reproducibility is maintained only for constant composition of the gas.



Key to Fig. 4
1 Monitor output via a 3.5 mm jack socket for checking the trigger level and the output signal
2 Multiturn trimpot for adjustment of the trigger threshold
3 Rotary switch to select the output characteristic (log. / lin.)
4 Rotary switch to select the type of gas and the unit mbar/Torr

Fig. 4 Trigger threshold adjustment and selection of the output characteristic

2.3 Setting of Parameters

To set the trigger threshold and select the output characteristic as well as the gas type, use a coin to open the screw-on lid (3/6) (see Fig. 3).

Note
As an alternative the parameter settings may be set also via the RS 232 C- interface or the field bus option.

After the setting via interfaces the manual setting will only be effective once the switching functions have been released via the relevant interface.

2.3.1 Trigger Level

The pressure dependant trigger level for the switching relay is adjusted through a multiturn trimpot (4/2). In order to check the threshold which has been set up, a voltage (10 V max.; logarithmic relationship between voltage and value of the trigger level) which corresponds to the pressure may be taken either from the jack socket (4/1) (see also Fig. 5) or from the sub-D-15 connector (3/3). See also Section 2.6.

2.3.2 Selection of the Analogue Output Characteristic

In order to adapt the gauge to different measurement tasks, the response of the measurement output is selectable. For this, the rotary switch (4/3) must be turned to one of the positions indicated below. Take note that the changed switch position becomes only effective after having switched the supply voltage OFF and then ON again.

Logarithmic characteristic (9 decades logarithmic) switch position D (4/3) (factory default position). See also Fig. 6.

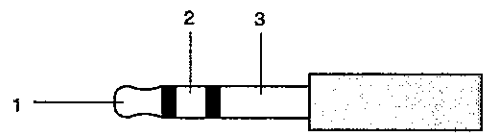
$1 \cdot 10^{-10}$ to 0.1 mbar ≙ 0 to 10 V.

$1 \cdot 10^{-10}$ to $0.75 \cdot 10^{-1}$ Torr ≙ 0 to 10 V.

$1 \cdot 10^{-8}$ to 10 Pa ≙ 0 to 10 V.

The equations for the logarithmic characteristic are:
p (mbar) = $10^{(Ua-11)}$
p (Torr) = $10^{(Ua-11)}$
p (Pa) = $10^{(Ua-9)}$

Ua : Measurement signal in Volt



Key to Fig. 5
1 Measurement signal
2 Trigger level
3 Ground

Fig. 5 Jack plug for the monitor output (included in the standard specification)

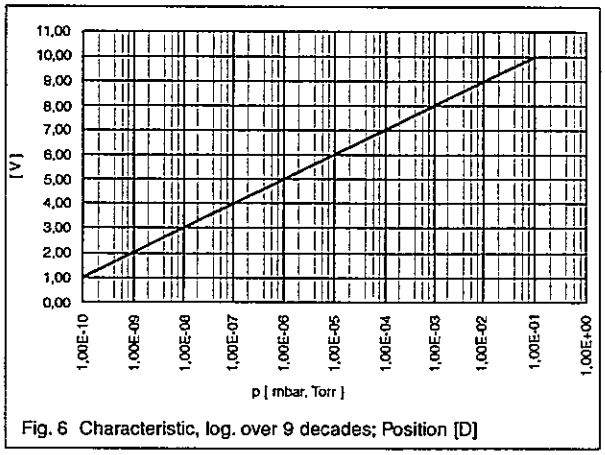


Fig. 6 Characteristic, log. over 9 decades; Position [D]

When the emission is off, the measurement signal (3/3; pin 2) indicates the presence of a fault condition within the ITR 100 or if the ITR 100 has been operating without fault the last time it was running in the measurement mode.

- If a warning or fault condition is not present the signal output will deliver a voltage level of 10.25 V.
- In the case of a warning or fault condition the signal output will deliver a voltage signal of 0.2 to 0.6 V (see also Section 2.6 "ITR 100 Signal and Power Supply Connections").

3 decades each linear (0 V to 10 V; magnification mode); selectable ranges (4/3). See also Fig. 7, 8 and Section 2.8.

Switch position	Max. pressure value
A	$1 \cdot 10^{-10}$ to $10 \cdot 10^{-10}$ mbar / Torr
9	$1 \cdot 10^{-10}$ to $10 \cdot 10^{-9}$ mbar / Torr
8	$1 \cdot 10^{-10}$ to $10 \cdot 10^{-8}$ mbar / Torr
7	$1 \cdot 10^{-9}$ to $10 \cdot 10^{-7}$ mbar / Torr
6	$1 \cdot 10^{-8}$ to $10 \cdot 10^{-6}$ mbar / Torr
5	$1 \cdot 10^{-7}$ to $10 \cdot 10^{-5}$ mbar / Torr
4	$1 \cdot 10^{-6}$ to $10 \cdot 10^{-4}$ mbar / Torr
3	$1 \cdot 10^{-5}$ to $10 \cdot 10^{-3}$ mbar / Torr
2	$1 \cdot 10^{-4}$ to $10 \cdot 10^{-2}$ mbar / $1 \cdot 10^{-4}$ to $7.5 \cdot 10^{-2}$ Torr
0, 1, B, E, F	not used

Note
For pressure values in Pascal, the pressure values in mbar must be multiplied by a factor of 100.

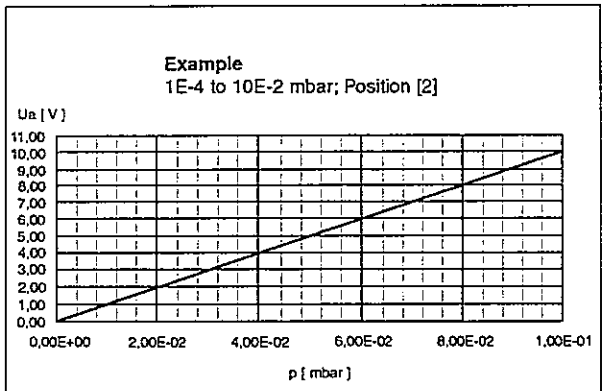


Fig. 7 Characteristic, 3 decades each, linear

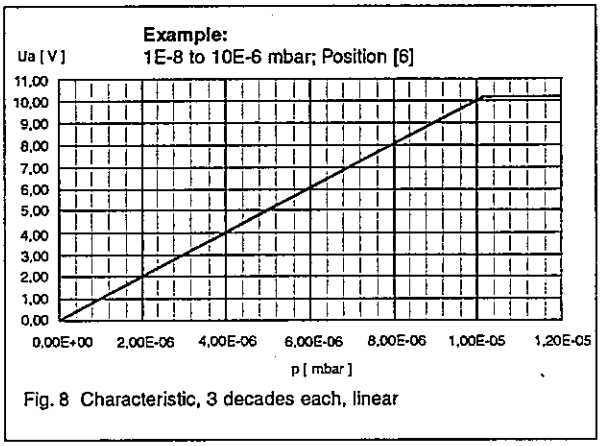


Fig. 8 Characteristic, 3 decades each, linear

When selecting the "3 decades linear" characteristic, the instrument status can **not** be indicated through the analog signal (3/3; pin 2).

9 decades linear, mantissa
Measured values output 0.8 - 10.0 V; with exponent represented by the step voltage at pin 11.
Switch position C (4/3) with extra output, exponent. See also Fig. 9.

Start pressure value		End pressure value	Step voltage output signal
$1 \cdot 10^{-10}$	to	$10 \cdot 10^{-10}$ mbar / Torr	10 V
$0.8 \cdot 10^{-9}$	to	$10 \cdot 10^{-9}$ mbar / Torr	9 V
$0.8 \cdot 10^{-8}$	to	$10 \cdot 10^{-8}$ mbar / Torr	8 V
$0.8 \cdot 10^{-7}$	to	$10 \cdot 10^{-7}$ mbar / Torr	7 V
$0.8 \cdot 10^{-6}$	to	$10 \cdot 10^{-6}$ mbar / Torr	6 V
$0.8 \cdot 10^{-5}$	to	$10 \cdot 10^{-5}$ mbar / Torr	5 V
$0.8 \cdot 10^{-4}$	to	$10 \cdot 10^{-4}$ mbar / Torr	4 V
$0.8 \cdot 10^{-3}$	to	$10 \cdot 10^{-3}$ mbar / Torr	3 V
$0.8 \cdot 10^{-2}$	to	$10 \cdot 10^{-2}$ mbar / $7.5 \cdot 10^{-2}$ Torr	2 V

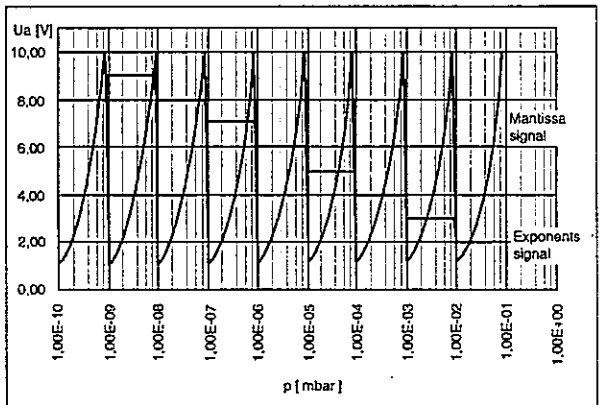


Fig. 9 Characteristic, 9 decades linear, mantissa and exponents through different outputs; Position [C]

When the emission is off, the measurement signal indicates the presence of a fault condition within the ITR 100 or if the ITR 100 has been operating without fault the last time it was running in the measurement mode.

- If a warning or fault condition is not present the signal output will deliver a voltage level of 10.25 V.
- In the case of a warning or fault condition the signal output will deliver a voltage signal of 0.2 to 0.6 V (see also Section 2.6 "ITR 100 Signal and Power Supply Connections").

2.3.3 Selection of Type of Gas and Pressure Unit

In order to adapt the ITR 100 to different types of gas and to set it up for different pressure units, the corresponding output characteristic may be set through the rotary switch (4/4). Note that any changed settings will only come into effect after having switched the ITR 100 off and then on again.
(The factory default position is 0)

Switch position	Setting
0	mbar / N_2 (Pa / N_2)
1	mbar / Ar (Pa / Ar)
2	mbar / H_2 (Pa / H_2)
3 to 6	not used
7	mbar/variable gas correction factor to be set via RS 232 C
8	Torr / N_2
9	Torr / Ar
A	Torr / H_2
B, C, D, E, F	not used Torr / variable gas correction factor to be set via RS 232 C

2.4 Status LEDs

The ITR 100 is equipped with 4 LEDs which indicate the operating status (see Fig. 3).

Power "PWR" (3/1)

(orange) is on when the 24 V supply voltage is present and the sensor and electronics unit are linked together.

Emission "EMIS" (3/4)

(green) is on when the emission is ON and the ITR 100 is running in the measurement mode.

Warning (3/2)

(red) is on all the time or flashes at varying frequencies or with a differing mark-to-space ratio in order to indicate different warnings (f.e. cathode burnt out; critical temperature) or faults (f.e. both cathodes burnt out).

(See details in Section 2.5 "LEDs and Status Outputs").

Trigger "TRG" (3/5)

(green) is on when the measured pressure is below the trigger threshold and the trigger relay is closed.

Warning LED (3/2)	Emission status output (3/3, pin no. 1)	Warning status output (3/3, pin no. 3)	Measurement signal output at pin 2 (3/3) **for emission OFF** *	Meaning	Action, remedy
OFF	low (0 V)	high (24 V)	10.25 V	There has been no fault; (emission was switched off by the controller)	--
Slow flashing	low (0 V)	low (0 V)	0.6 V	Pressure has been too high; this led to the emission being switched off. Message is erased next time the emission is switched on	Emission ON or OFF at $p < 1 \cdot 10^{-1}$ mbar
Fast flashing	high (24 V) or low (0 V)	low (0 V)	0.6 V	Temp. warning limit (about 70 °C) has been exceeded, does not switch the emission off; temp. monitoring is continually updated	Reduce ambient temperature
Slow flashing	high (24 V) or low (0 V)	low (0 V)	0.5 V	One cathode is faulty, warning only. This will not switch the emission off	In applications where a failure is critical, exchange sensor as soon as possible
Fast flashing	high (24 V) or low (0 V)	low (0 V)	0.4 V	Sensor potential(s) out of their tolerance ranges. This will not switch the emission off, but accuray might be affected.	The ITR 100 may be operated further. In applications which require a high level of reproducibility it is recommended to check the ITR 100 and have it repaired, if required.
Pulsed flashing (LED comes on only briefly)	low (0 V)	low (0 V)	0.3 V	Both cathodes faulty, sensor faulty, electronics faulty or too high pressure led to the emission being switched off.	Exchange the sensor; Check the ITR 100 and have it repaired, if required Emission On or Off at $p < 1 \cdot 10^{-1}$ mbar
On all the time	low (0 V)	low (0 V)	0.2 V	Temperature limit for operation (about. 75 °C) exceeded or fault in the electronics of the ITR 100; The emission is switched off.	Check the ITR 100 and have it repaired, if required.

* **Caution:** The ITR 100 status information is only output through the measurement signal output (3/3) pin 2 with the emission off and the switch (4/3) settings: "C" or "D".

2.6 ITR 100 Signal and Power Supply Connections

The signal and supply voltages are submitted through a 15-way Sub-D socket (male).

Pin No.	Meaning
1	Emission status output: High level (24 V) when the emission is on. (measurement operation)
2	Measurement signal output 0 to10 V ($R_L \geq 10$ kΩ).
3	Warning status output High level (24 V) at ordinary measuring mode. Low level (0 V) in case of warnings or faults, f.e - emission failing - one cathode burnt out - electronics temperature is slightly too high
4	Emission input ON/OFF (static) Emission ON at High (24 V) Emission OFF at Low (0 V) Compatible for direct connection to the measurement signal output of the THERMOVAC transmitter TTR 211 S. See also Fig. 2 and Section 2.1 "Installation and Start-Up".
5	Supply ground (GND) for pin 8 (+24 V power supply) and all control inputs and outputs. (incl. RS 232 C)
6	Input to switch the measurement signal output pin no. 2. High level (24 V) = trigger threshold Low level (0 V or unconnected) = measurement signal Output of the trigger threshold instead of the measurement signal when applying a high level here.
7	Degassing input ON / OFF Degassing ON at High level (24 V) Degassing OFF at low level (0 V) (Degassing switches off automatically after 3 minutes - even at continuous high level).
8	+ 24 V power supply input Voltage range: 20 to 28 V (+ 2 V_{pp} ripple) Current consumption: (max.) 0.5 A during Measure, 0.8 A during Degas, 1.4 A / max. 1 s after emission on
9	Threshold relay pin 1
10	Threshold relay pin 2: normally open, activated if $p_{actual} < p_{threshold}$ (relay contact closed) Contact rating (max.) (resistive load): 0.5 A / 60 V DC
11	Step voltage signal 0 to 10 V (See also Section 2.3.2 „Selection of the Analogue Output Characteristic")
12	Reference potential for measurement signal at pin 2 and pin 11.
13	RS 232 C; RxD signal
14	RS 232 C, TxD signal
15	Chassis ground (GND), shield connection; connection for potential equalization

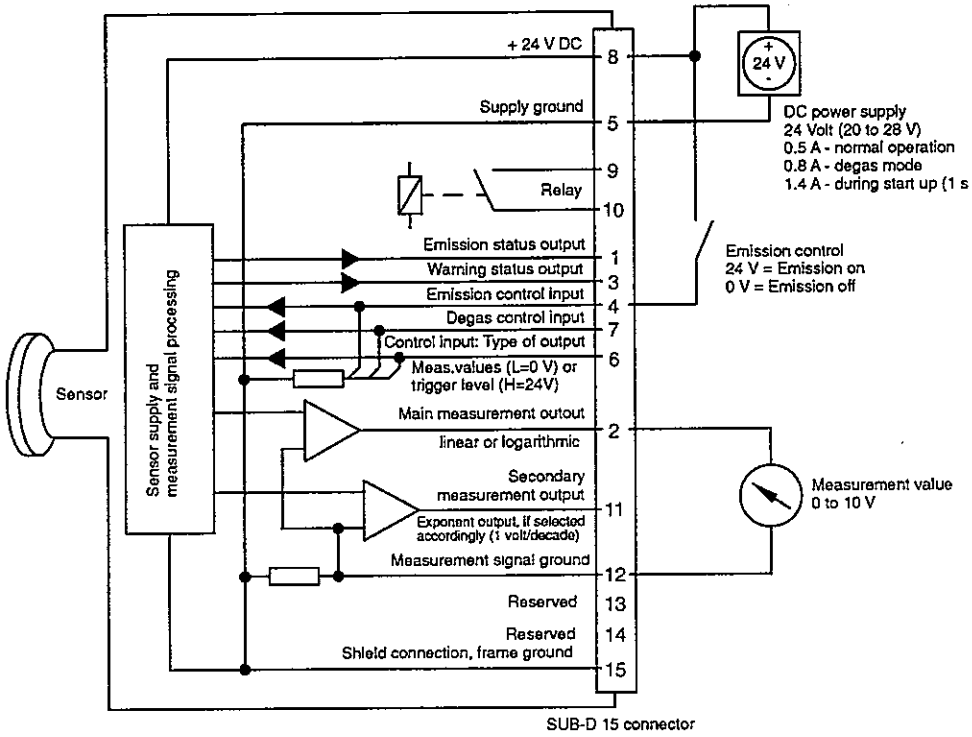
2.6.1 Recommended Cable Cross Sections for Supply Connection (Pin 8 and 5)

Cross section for 24 V-supply:

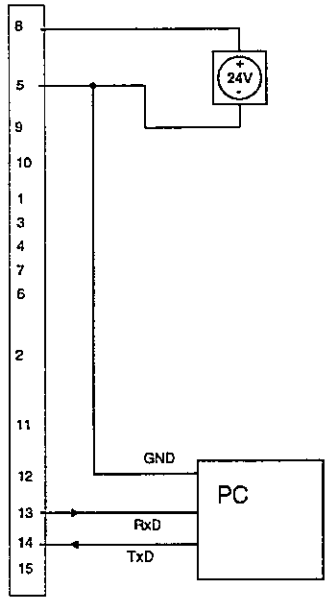
Cable length up to [m]	Cross section [mm²]
20	0.25
50	0.5
100	1.00

Note
The necessary cross section can be attained via parallel wiring of two leads for the + 24 V and the GND conductor.

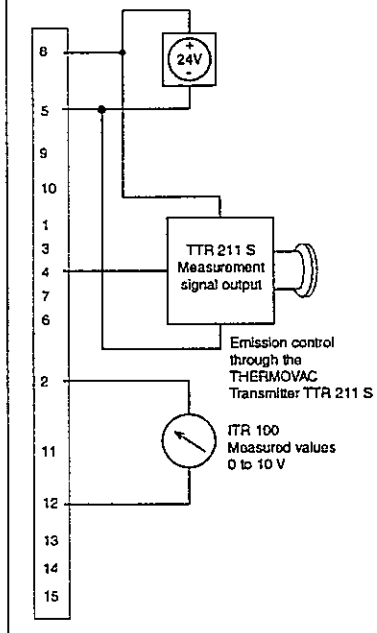
2.7 Electrical Wiring (minimum versions)



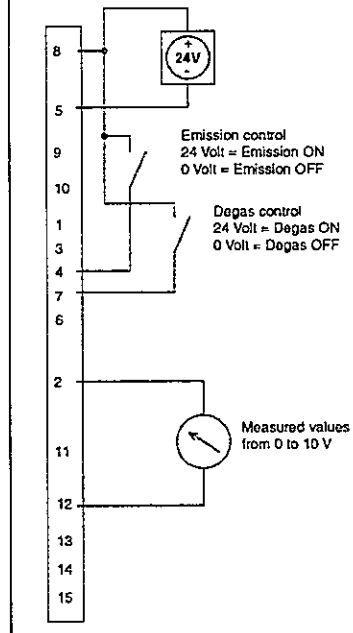
Wiring option 1: The supply voltage is always present, the emission is switched on and off through a contact or an active programmable control output (24 V level)



Wiring option 2:
Operation via RS 232 C interface



Wiring option 3:
The emission is switched on through a TTR 211 S THERMOVAC transmitter



Wiring option 4:
Standard, with degas control

2.8 ITR 100 Output Characteristics

ITR 100 output characteristics (see selector switch for the characteristics (4/3))

	Position [2]: 3 decades each linear, 1E-4 to 10E-2 mbar (0 to 10 V)	Position [6]: 3 decades each linear, 1E-8 to 10E-6 mbar (0 to 10 V)	Position [C]: 9 decades linear; mantissa-output continuous over one decade (1 V to 10 V)	Position [C]: 9 decades linear; exponent output 1 V-step per decade (2 V to 10 V)	Position [D]: logarithmic over 9 decades (1 V to 10 V)
Meas. press. [mbar]	Analog output voltage				
1.00E-10	0.00	0.00	1.00	10.00	1.00
1.20E-10	0.00	0.00	1.20	10.00	1.08
1.50E-10	0.00	0.00	1.50	10.00	1.18
2.00E-10	0.00	0.00	2.00	10.00	1.30
2.50E-10	0.00	0.00	2.50	10.00	1.40
3.00E-10	0.00	0.00	3.00	10.00	1.48
3.50E-10	0.00	0.00	3.50	10.00	1.54
4.00E-10	0.00	0.00	4.00	10.00	1.60
5.00E-10	0.00	0.00	5.00	10.00	1.70
6.00E-10	0.00	0.00	6.00	10.00	1.78
7.00E-10	0.00	0.00	7.00	10.00	1.85
8.00E-10	0.00	0.00	8.00	10.00	1.90
9.00E-10	0.00	0.00	9.00	10.00	1.95
1.00E-09	0.00	0.00	1.00	9.00	2.00
1.20E-09	0.00	0.00	1.20	9.00	2.08
1.50E-09	0.00	0.00	1.50	9.00	2.18
2.00E-09	0.00	0.00	2.00	9.00	2.30
2.50E-09	0.00	0.00	2.50	9.00	2.40
3.00E-09	0.00	0.00	3.00	9.00	2.48
3.50E-09	0.00	0.00	3.50	9.00	2.54
4.00E-09	0.00	0.00	4.00	9.00	2.60
5.00E-09	0.00	0.01	5.00	9.00	2.70
6.00E-09	0.00	0.01	6.00	9.00	2.78
7.00E-09	0.00	0.01	7.00	9.00	2.85
8.00E-09	0.00	0.01	8.00	9.00	2.90
9.00E-09	0.00	0.01	9.00	9.00	2.95
1.00E-08	0.00	0.01	1.00	8.00	3.00
1.20E-08	0.00	0.01	1.20	8.00	3.08
1.50E-08	0.00	0.02	1.50	8.00	3.18
2.00E-08	0.00	0.02	2.00	8.00	3.30
2.50E-08	0.00	0.03	2.50	8.00	3.40
3.00E-08	0.00	0.03	3.00	8.00	3.48
3.50E-08	0.00	0.04	3.50	8.00	3.54
4.00E-08	0.00	0.04	4.00	8.00	3.60
5.00E-08	0.00	0.05	5.00	8.00	3.70
6.00E-08	0.00	0.06	6.00	8.00	3.78

ITR 100 output characteristics (see selector switch for the characteristics (4/3))

	Position [2]: 3 decades each linear, 1E-4 to 10E-2 mbar (0 to 10 V)	Position [6]: 3 decades each linear, 1E-8 to 10E-6 mbar (0 to 10 V)	Position [C]: 9 decades linear; mantissa-output continuous over one decade (1 V to 10 V)	Position [C]: 9 decades linear; exponent output 1 V-step per decade (2 V to 10 V)	Position [D]: logarithmic over 9 decades (1 V to 10 V)
Meas. press. [mbar]	Analog output voltage				
7.00E-08	0.00	0.07	7.00	8.00	3.85
8.00E-08	0.00	0.08	8.00	8.00	3.90
9.00E-08	0.00	0.09	9.00	8.00	3.95
1.00E-07	0.00	0.10	1.00	7.00	4.00
1.20E-07	0.00	0.12	1.20	7.00	4.08
1.50E-07	0.00	0.15	1.50	7.00	4.18
2.00E-07	0.00	0.20	2.00	7.00	4.30
2.50E-07	0.00	0.25	2.50	7.00	4.40
3.00E-07	0.00	0.30	3.00	7.00	4.48
3.50E-07	0.00	0.35	3.50	7.00	4.54
4.00E-07	0.00	0.40	4.00	7.00	4.60
5.00E-07	0.00	0.50	5.00	7.00	4.70
6.00E-07	0.00	0.60	6.00	7.00	4.78
7.00E-07	0.00	0.70	7.00	7.00	4.85
8.00E-07	0.00	0.80	8.00	7.00	4.90
9.00E-07	0.00	0.90	9.00	7.00	4.95
1.00E-06	0.00	1.00	1.00	6.00	5.00
1.20E-06	0.00	1.20	1.20	6.00	5.08
1.50E-06	0.00	1.50	1.50	6.00	5.18
2.00E-06	0.00	2.00	2.00	6.00	5.30
2.50E-06	0.00	2.50	2.50	6.00	5.40
3.00E-06	0.00	3.00	3.00	6.00	5.48
3.50E-06	0.00	3.50	3.50	6.00	5.54
4.00E-06	0.00	4.00	4.00	6.00	5.60
5.00E-06	0.00	5.00	5.00	6.00	5.70
6.00E-06	0.00	6.00	6.00	6.00	5.78
7.00E-06	0.00	7.00	7.00	6.00	5.85
8.00E-06	0.00	8.00	8.00	6.00	5.90
9.00E-06	0.00	9.00	9.00	6.00	5.95
1.00E-05	0.00	10.00	1.00	5.00	6.00
1.20E-05	0.00	10.20	1.20	5.00	6.08
1.50E-05	0.00	10.20	1.50	5.00	6.18
2.00E-05	0.00	10.20	2.00	5.00	6.30
2.50E-05	0.00	10.20	2.50	5.00	6.40
3.00E-05	0.00	10.20	3.00	5.00	6.48
3.50E-05	0.00	10.20	3.50	5.00	6.54
4.00E-05	0.00	10.20	4.00	5.00	6.60
5.00E-05	0.01	10.20	5.00	5.00	6.70

ITR 100 output characteristics (see selector switch for the characteristics (4/3))

Meas. press. [mbar]	Position [2]: 3 decades each linear, 1E-4 to 10E-2 mbar (0 to 10 V)	Position [6]: 3 decades each linear, 1E-8 to 10E-6 mbar (0 to 10 V)	Position [C]: 9 decades linear; mantissa-output continuous over one decade (1 V to 10 V)	Position [C]: 9 decades linear; exponent output 1 V-step per decade (2 V to 10 V)	Position [D]: logarithmic over 9 decades (1 V to 10 V)
	Analog output voltage				
6.00E-05	0.01	10.20	6.00	5.00	6.78
7.00E-05	0.01	10.20	7.00	5.00	6.85
8.00E-05	0.01	10.20	8.00	5.00	6.90
9.00E-05	0.01	10.20	9.00	5.00	6.95
1.00E-04	0.01	10.20	1.00	4.00	7.00
1.20E-04	0.01	10.20	1.20	4.00	7.08
1.50E-04	0.02	10.20	1.50	4.00	7.18
2.00E-04	0.02	10.20	2.00	4.00	7.30
2.50E-04	0.03	10.20	2.50	4.00	7.40
3.00E-04	0.03	10.20	3.00	4.00	7.48
3.50E-04	0.04	10.20	3.50	4.00	7.54
4.00E-04	0.04	10.20	4.00	4.00	7.60
5.00E-04	0.05	10.20	5.00	4.00	7.70
6.00E-04	0.06	10.20	6.00	4.00	7.78
7.00E-04	0.07	10.20	7.00	4.00	7.85
8.00E-04	0.08	10.20	8.00	4.00	7.90
9.00E-04	0.09	10.20	9.00	4.00	7.95
1.00E-03	0.10	10.20	1.00	3.00	8.00
1.20E-03	0.12	10.20	1.20	3.00	8.08
1.50E-03	0.15	10.20	1.50	3.00	8.18
2.00E-03	0.20	10.20	2.00	3.00	8.30
2.50E-03	0.25	10.20	2.50	3.00	8.40
3.00E-03	0.30	10.20	3.00	3.00	8.48
3.50E-03	0.35	10.20	3.50	3.00	8.54
4.00E-03	0.40	10.20	4.00	3.00	8.60
5.00E-03	0.50	10.20	5.00	3.00	8.70
6.00E-03	0.60	10.20	6.00	3.00	8.78
7.00E-03	0.70	10.20	7.00	3.00	8.85
8.00E-03	0.80	10.20	8.00	3.00	8.90
9.00E-03	0.90	10.20	9.00	3.00	8.95
1.00E-02	1.00	10.20	1.00	2.00	9.00
1.20E-02	1.20	10.20	1.20	2.00	9.08
1.50E-02	1.50	10.20	1.50	2.00	9.18
2.00E-02	2.00	10.20	2.00	2.00	9.30
2.50E-02	2.50	10.20	2.50	2.00	9.40
3.00E-02	3.00	10.20	3.00	2.00	9.48
3.50E-02	3.50	10.20	3.50	2.00	9.54
4.00E-02	4.00	10.20	4.00	2.00	9.60

ITR 100 output characteristics (see selector switch for the characteristics (4/3))

	Position [2]: 3 decades each linear, 1E-4 to 10E-2 mbar (0 to 10 V)	Position [6]: 3 decades each linear, 1E-8 to 10E-6 mbar (0 to 10 V)	Position [C]: 9 decades linear; mantissa-output continuous over one decade (1 V to 10 V)	Position [C]: 9 decades linear; exponent output 1 V-step per decade (2 V to 10 V)	Position [D]: logarithmic over 9 decades (1 V to 10 V)
Meas. press. [mbar]	Analog output voltage				
5.00E-02	5.00	10.20	5.00	2.00	9.70
6.00E-02	6.00	10.20	6.00	2.00	9.78
7.00E-02	7.00	10.20	7.00	2.00	9.85
8.00E-02	8.00	10.20	8.00	2.00	9.90
9.00E-02	9.00	10.20	9.00	2.00	9.95
1.00E-01	10.00	10.20	10.00	2.00	10.00

3 RS 232 C Interface

3.1 Description

The RS 232 C interface (as of serial number D 97 11 00001) integrated in the ITR 100 allows for the transmission of measured values, the setting of instrument parameters and the query of instrument statuses.

The RS 232 C interface requires at least 3 lines:
- Transmit line (TxD; Transmit data)
- Receive line (RxD; Receive data)
- Reference ground (GND; Signal ground)

The connections are made through a 15-way Sub-D connector (3/3).

3.2 Interface Parameters

3.2.1 Baud Rate

The baud rate is fixed to 9600 baud.

3.2.2 Data Format

The data format is fixed to:
1 start bit, 7 data bits + 1 space, 1 stop bit.

A parity bit is not generated and no parity check is run on received data.

3.2.3 End and Acknowledgement Character for Remote Operation

The character <CR> (carriage return; ASCII code 13_d) is used as the end character for remote control operation in both directions.

After the ITR 100 instrument has received a string of characters terminated by the end character <CR> it will respond by outputting the ASCII character <ACK> (acknowledge) or <NAK> (not acknowledge) depending on whether the instrument has sensed the command so that it can be carried out or not.

Having requested the measured value or read out the set parameters and operating modes, the ITR either responds with the required message or with <NAK> provided the request has been send in an incorrect way.

3.3 Initial Operation

3.3.1 Cable Link

In order to link the ITR 100 instrument to a computer or terminal, a cable link has to be provided according to Section 3.6.

The ITR 100 instrument requires at least 3 lines :

- Transmission data	TxD	Pin 14	Opposite side: Receive data
- Receive data	RxD	Pin 13	Opposite side: Transmission data
- Signal ground	GND	Pin 5	Opposite side: Signal ground

It is strongly recommended to use a screened interface cable, especially if there is the likelihood of electromagnetic interference. In this case the shield of the screened cable should only be connected on the side of the ITR 100 instrument (Pin 15).

In order to prevent disturbances caused by equalization currents, RS 232-isolation amplifiers or fiber-optical systems can be used as well which is commercially available.

3.3.2 Baud Rate and Data Format

When starting up the instrument in connection with a computer or terminal the correct baud rate and data format must be set up on the connected equipment.

3.3.3 End Character

In the remote control mode the characters <CR> (carriage return; ASCII code: 13_d) are used. The character <LF> (line feed; ASCII code: 10_d) is always ignored by the ITR 100 instrument.

With one exception each character string sent to the ITR 100 instrument must be terminated with <CR>. The only exception is the reset command which consists only of one character <ESC> (see also Section 3.3.5).

In the other direction there is no exception; all characters transmitted by the ITR 100 instrument in the remote control mode are terminated by <CR>.

In the case of a missing or incorrect end character <CR> the interface will usually not operate properly.

3.3.4 Acknowledgement Character

In the remote control mode, the ITR 100 instrument will respond to strings it receives and which has been terminated by the end sign <CR>, with one of the acknowledgement characters <ACK> or <NAK>.

<ACK> (ASCII code: 6_d) means that the received command has been detected, the parameters are acceptable and that the command which has been received can be run in the current operating mode.

<NAK> (ASCII code: 21_d) means that a variety of errors may have occurred during the transmission.
- General transmission fault, interference, wrong baud rate, wrong number of start, stop or data bits
- Wrong command or command can not be run at the moment (for example MIS instead of MES for request to send measurement data)
- Wrong direction command (R/W)
- Parameter not within the correct range, not permissible, incomplete, wrong number, not or incorrectly separated (: instead of ;)

It must always be taken in to account that the instrument will only be ready to receive and process the next command after receiving the <ACK> or <NAK> character and the reply character string or a possibly demanded reply character string.

Any characters which are sent to the instrument after the end sign and before the acknowledgement character and the reply character string will be ignored.

Example
Communication where, for example, the measurement value is read followed by setting to argon whereby one character is not transmitted correctly with subsequent correction by the control computer:

The control computer transmits „MES <CR>"
Time required for processing by the ITR 100

ITR 100 instrument transmits
„mbar: 5.615 E-05:T0<CR>"

Control computer transmits „GBS W ARGON<CR>"
Time required for processing by the ITR

ITR 100 instrument transmits „<NAK><CR>"
since the command has been incorrectly entered

Control computer transmits „GAS W ARGON<CR>"
Time required for processing by the ITR 100

ITR 100 instrument transmits „<ACK><CR>"
since the command has been incorrectly entered

Note
The time required by the ITR 100 instrument to process the interface commands may be as long as 100 ms, however, normally this time will be much shorter.

3.3.5 Reset Character

With the character <ESC> (Escape; ASCII code: 27_d) without <CR> the interface of the ITR 100 instrument may be reset to a defined state. A character string which is possibly still being processed is erased and processing of the command is terminated. After receiving the <ESC> character this is acknowledged by <ACK> <CR>, after which the interface will be ready to receive again.

3.4 Data Output and Data Formats

3.4.1 Measurement Data Output

The ITR instrument will transmit the measurement data after being requested to do so through the command „MES R"

R Read (optional)

Output in the following format, provided measurement operation is possible:

Unit:n.nnnE-mm trigger status <CR>

Meaning:

Unit	mbar, Torr, Pa	4 characters
:n.nn	Mantissa	6 characters
E-mm	Exponent always with sign	4 characters
Trigger status	T 0	Trigger not switched
Trigger status	T1	Trigger switched
<CR>	End character	1 character

Thus the entire length of a string for one set of measurement data is 17 characters.

Example mbar: 4.710 E-05:T0<CR>

Output when no measurements are possible Status format:

Unit: OFF:T0<CR>

3.4.2 Parameter Output and Response Time

The format for the response to requests for parameters is given in the list of programming commands in Section 3.5.

Parameter settings and requests for parameter and measurement data require internal processing so that response times up to 2 s max. are likely to occur.

When the ITR 100 instrument is just processing a command or transmitting a string while further characters are being transmitted to the instrument it will ignore these as invalid.

3.5 Interface Commands

The interface commands are composed of the following sections:

- Command abbreviation — 3 characters for example MES for measurement value (compulsory entry)
- Direction character — 1 character R=Read or W=Write (can be omitted when the command only allows for writing or reading, respectively)
- Parameter value — As many characters as necessary; possibly with further separating characters

Notes

- Direction character:
  W = Writing of parameters (write)
  R = Reading of set parameters (read)
- In the case of the programming commands for the instruments of the ITR 100 spaces may be added at will or left out entirely.
- All characters are accepted both in capitals or in small initial letters.

3.5.1 Processing of Measurement Data and Read Commands

Function	String sent to the ITR 100 (example) String received from the ITR 100 (example [e])
Read measured value from the ITR 100	**MES** mbar:2.156E-05:T1 (measured value in mbar, trigger relay active) or Torr:8.375E-03:T0 (measured value in Torr, trigger relay not active)
Read voltage at the emission start/stop input of the ITR100 (may be used to detect the pressure measured by a connected TTR 211 S)	**MEST** TTR:08.45 V (the way in which the pressure value can be calculated is described in the Operating Instructions for the TTR 211S)
Enable or disable emission control through the TTR 211 S	**TTR** W ON or OFF (The TTR setting is stored in the non-volatile memory of the ITR 100 and remains active even if the supply voltage is switched off and on again, until changed once more via the RS 232 C interface)
Read the TTR 211 S emission control setting	TTR TTR ON or TTR OFF
Switch emission on (start to measure)	**EMI** W ON
Switch emission off (stop to measure)	EMI W OFF
Read emission status	EMI EMI ON or EMI OFF (The emission ON / OFF command operates in parallel to the emission controinput; i.e. the last command from the input or from the RS 232 C determines the actual emission status.)

Function	String sent to the ITR 100 (example) String received from the ITR 100 (example [e])
Start degas	**DEG** W ON
Stop degas	DEG W OFF
Read degas status	DEG DEG ON oder DEG OFF (The degas ON /OFF command operates in parallel to the degas control input)
Set trigger thresholds	**TRC** W n.nnE-nn7 n.nnE-nn (lower trigger threshold, upper trigger threshold; the reverse sequence is also accepted) (n = integer)
Read trigger thresholds	TRC mbar:2.34E-04~ 5.67E-04 (After running the TRC W ... command the trigger adjustment potentiometer (see Fig.4/2) is disabled until the next time the supply voltage is switched off and on again).
Set unit of measurement	**UNI** W mbar or Torr or Pa (or Pascal)
Read set-up unit of measurement	UNI UNI mbar or Torr or Pa
Select gas correction factor	**GAS** W N2 or Ar or H2 or var
Read selected gas correction factor	GAS GAS N2 or Ar or H2 or var (N2 = Nitrogen Ar= Argon Pa = Pascal var = variable correction factor which may be entered via the RS 232 C interface through the command GFC or GCL)
Set variable (gas) correction factor	**GFC** n.nnn (n.nnn = value within the range of 0.1 bis 9.999) (The GFC value is stored in the non-volatile memory of the ITR 100 and remainsactive even if the supply voltage is switched off and on again, if "var" has been selected for the type of gas or if the gas correction switch has been set accordingly, see also Fig. 4/4).
Read variable (gas) correction factor	GFC GFC 1.000
Set the variable (gas) correc tion factor up as the pressure reference value	**GCL** W n.nnE-nn (n.nnE-nn = current pressure reference value) (Value only permissible, if the factor between measured value from the ITR 100 and the reference pressure falls within the range from 0.1 to 9.999).
(Can not be read. Please use the GFC command instead)	(The GCL value is stored in the non-volatile memory of the ITR 100 and remains active even if the supply voltage is switched off and on again, if "var" has been selected for the type of gas or if the gas correction switch has been set accordingly, see
Select characteristic for the analogue output	**ANO** W LIN-n or LIN ALL oder LOG - LIN-n = linear characteristic over 3 decades; -n = exponent of the selected decade. - LIN ALL = linear characteristic over 9 decades - LOG = logarithmic characteristic.
Read the characteristic selected for the analogue output	ANO LIN-n or LIN ALL or LOG

Function	String sent to the ITR 100 (example) String received from the ITR 100 (example [e])	
Reading of the ITR 100 equipment status (warnings or error messages)	ERS	
	ERS O:OK	no warning, no fault
	ERS 1:electronics failure	fault in the electronics of the ITR 100 (fault in the sensor supply, for example)
	ERS 2:sensor warning	sensor warning (broken cathode, for example)
	ERS 3:electronics warning	electronics warning (temperature too high, e. g.)
	ERS 4:sensor failure	sensor failure (both cathodes broken, e. g.)
	ERS 5:pressure too high	a high pressure level has caused the emission to be switched off
	ERS 6:over temperature	the max. operating temperature has been exceeded
Reading of the RS 232 C message	ERI	
	SYNERR 0:OK	last RS 232 contained no errors
	SYNERR 1:string too long	sent string had more than 25 characters
	SYNERR 2:illegal message	illegal command
	SYNERR 3:time out	time between 2 characters exceeded 4 seconds
	SYNERR 4:bad parameter	wrong command parameter
	SYNERR 5:writing error	error while writing
	SYNERR 6:not posibl. now	Command can not be executed at this time
Read software version number and serial number of the ITR 100 electronics	VER ITR100:V.1.50:s.n.00099 V.1.50 = software version 1.50, for example s.n.00099 = serial number 99, for example	
Read model, data version and serial number of the sensor	TYP IE100KF:V1.00:s.n.00099 IE100KF = KF25 sensor V.1.50 = sensor data version 1.50, for example s.n.00099 = sensor serial number 99, for example	

3.6 Examples for the Cable Link between the Interface and and IBM®-PC

Example for a 9-way PC link

ITR 100 Signal	PIN	IBM-PC PIN	Signal	Remark for PC side
		1	DCD	
TxD	13	2	RxD	
RxD	14	3	TxD	
		4	DTR	Connect if
GND	5	5	GND	necessary
		6	DSR	
		7	RTS	
		8	CTS	
Shield	15	9	RI	

Example for a 25-way PC link

ITR 100 Signal	PIN	IBM-PC PIN	Signal	Remark for PC side
		8	DCD	
TxD	13	3	RxD	
RxD	14	2	TxD	
		20	DTR	Connect if
GND	5	7	GND	necessary
		6	DSR	
		4	RTS	
		5	CTS	
Shield	15	22	RI	

LEYBOLD

VDMA

Declaration of Contamination of Vacuum Equipment and Components

The repair and/or service of vacuum equipment and components will only be carried out if a correctly completed declaration has been submitted. Non-completion will result in delay. The manufacturer could refuse to accept any equipment without a declaration.
This declaration can only be completed and signed by authorized and qualified staff.

1. Description of Vacuum Equipment and Components

- Equipment type/model: _____
- Code No.: _____
- Serial No.: _____
- Invoice No.: _____
- Delivery date: _____

2. Reason for Return

_____
_____
_____
_____
_____
_____

3. Condition of the Vacuum Equipment and Components

- Has the equipment been used?
  yes ☐ no ☐
- What type of pump oil/liquid was used? _____
- Is the equipment free from potentially harmful substances?
  yes ☐ (go to Section 5)
  no ☐ (go to Section 4)

4. Process related Contamination of Vacuum Equipment and Components:

- toxic	yes ☐	no ☐
- corrosive	yes ☐	no ☐
- explosive*)	yes ☐	no ☐
- biological hazard*)	yes ☐	no ☐
- radioactive*)	yes ☐	no ☐
- other harmful substances	yes ☐	no ☐

*) Vacuum equipment and components which have been contaminated by biological explosive or radioactive substances, will not accepted without written evidence of decontamination!

Please list all substances, gases and by-products which may have come into contact with the equipment:

Trade name Product name Manufacturer	Chemical name (or Symbol)	Dangerous material class	Measures if spillage	First aid in case of human contact
1.				
2.				
3.				
4.				
5.				

5. Legally Binding Declaration

I hereby declare that the information supplied on this form is complete and accurate. The despatch of the contaminated vacuum equipment and components will be in accordance with the appropriate regulations covering Packaging, Transportation and Labelling of Dangerous Substances.

Name of organisation or company: _____

Address: _____ Post code: _____

Tel.: _____

Fax: _____ Telex: _____

Name: _____

Job title: _____

Date: _____ Company stamp:

Legally binding signature: _____

Copies: Page 1 (white) to manufacturer or representative - Page 2 (yellow) attach to consignment packaging securely - Page 3 (blue) copy for file of sender

Order No.: 2121

LEYBOLD VACUUM GmbH
Bonner Straße 498 (Bayenthal)
D-50968 Cologne
Phone +49 (0) 221 347-0
Fax: +49 (0) 221 347-1250

1.00.676.71 RSP 01.97
Printed in Germany on chlorine-free bleached paper