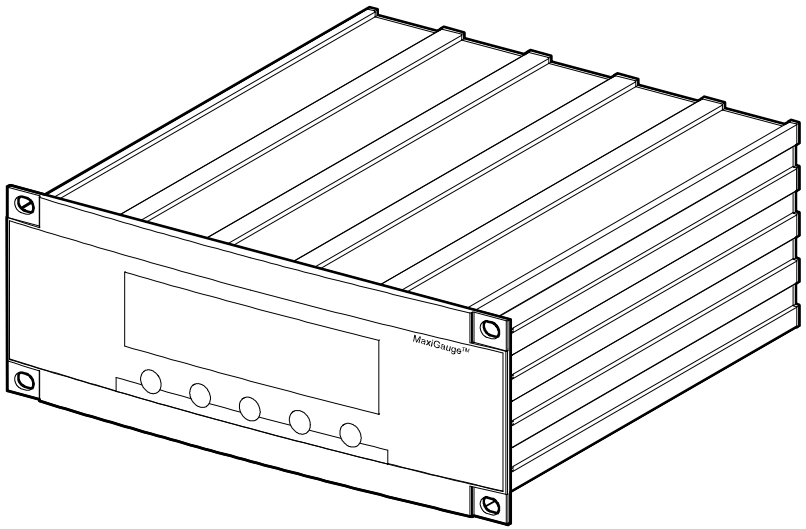
PFEIFFER VACUUM

TPG 256 A

Vacuum measurement and control unit
for Compact Gauges

MaxiGauge™



CE

Intended use

This Communication protocol contains instructions for operating the MaxiGauge™ (TPG 256 A) via the serial interfaces RS232C, RS422, RS485 (addressable, isolated), and RS422I (isolated).

Product identification

→ 🕮 MaxiGauge™ BG 805 186 BE

Validity

This manual applies to products with part number:

PT G28 760
PT G28 761

This manual is based on firmware version

BG 509 730 -F

We reserve the right to make engineering changes without notice.

Trademarks

MaxiGauge™ Balzers AG
FullRange™ Balzers AG

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For cross references to pages within this manual, the symbol (→ 🗎 XY) is used, for references to other documents, the symbol (→ 🕮 [Z]).

1 Serial interfaces

Serial interfaces are used for communication between the MaxiGauge™ and a computer (HOST). A terminal can be connected for test purposes.

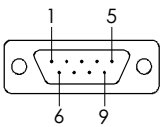
1.1 Connection diagrams

RS232C/422
Serial interface port

Pin assignment

1 Chassis
2 RXD (RS232C)
3 TXD (RS232C)
4 not connected
5 Signal ground
6 RX+ (RS422)
7 RX– (RS422)
8 TX+ (RS422)
9 TX– (RS422)

D-Sub, 9-pin, male



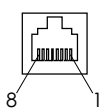
Front view

RS485/422 isol.
Serial interface port

Pin assignment

1 TX+
2 TX–
3 RX+
4 not connected
5 not connected
6 RX–
7 not connected
8 Isolation ground

RJ45, 8-pin



Front view

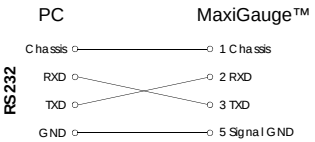
1.2 Connection cable

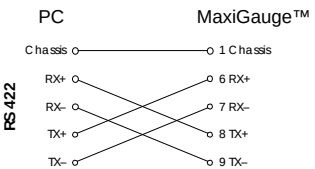
RS232C/422
Serial interface port

- Use shielded cable only

CAUTION

Only one of the two interfaces may be connected.



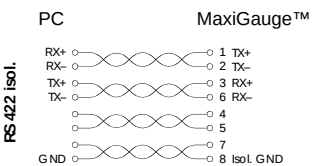


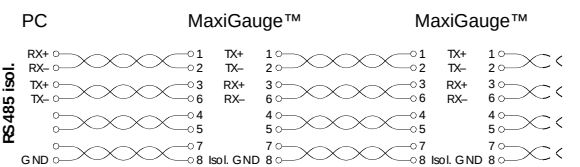
RS485/422I isol.
Serial interface port

- Use shielded RJ45 cable (STP)
- Wiring with cable pairs 1/2, 3/6, 4/5 and 7/8

CAUTION

The voltage difference between the Isol. GND and the chassis may be max. 25 V for each MaxiGauge™.





1.3 Data transmission

The data transmission is bi-directional (master-slave).

Configuration of the interface → 🕮 MaxiGauge™ BG 805 186 BE.

Data format

1 Start bit, 8 data bits, 1 stop bit, no parity bit, no hardware handshake

1.3.1 Abbreviations and symbols used

Symbol	Meaning	Dec.	Hex.
HOST	Computer or terminal		
[...]	Optional elements		
ASCII	American Standard Code for Information Interchange		
<ETX>	END OF TEXT (CTRL C) Reset the interface	3	03
<CR>	CARRIAGE RETURN Go to beginning of line	13	0D
<LF>	LINE FEED Advance by one line	10	0A
<ENQ>	ENQUIRY Request for data transmission	5	05
<ACK>	ACKNOWLEDGE Positive report signal	6	06
<NAK>	NEGATIVE ACKNOWLEDGE Negative report signal	21	15
<ESC>	ESCAPE	27	1B

1.3.2 Flow control

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

The input buffer of the HOST must have a capacity of at least 64 bytes.

1.3.3 Communication protocol

Transmission format

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

Spaces are ignored. <ETX> clears the input buffer in the MaxiGauge™.

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

> **NOTE**
>
> Do not transmit any LINE FEEDS (<LF>) via the RS485 half duplex line for fear they could cause data collisions on the bus.
>
> The RS232C, RS422, RS422I and RS485 (fullduplex) interfaces permit transmitting LINE FEEDS (<LF>). However, not transmitting them makes data transmission faster.

The tables on page 11 ff are applicable to the mnemonics and parameters. The maximum number of digits, the data formats and admissible value ranges are also specified there.

Transmission protocol

HOST	MaxiGauge™	Explanation
Mnemonics [and parameters] <CR>[<LF>]	——————>	HOST transmits message with "end of message"
<——————	<ACK><CR><LF>	MaxiGauge™ transmits positive acknowledgment of a received message

The current parameters of the function can be inquired by leaving out the [parameters].

Reception format

When requested with a mnemonics, the MaxiGauge™ transmits the measurement data or parameters as an ASCII string to the HOST.

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

If <ENQ> is received without a valid request, the error status is transmitted.

Reception protocol

HOST	MaxiGauge™	Explanation
Mnemonics [and parameters] <CR>[<LF>]	——————>	HOST transmits message with "end of message"
<——————	<ACK><CR><LF>	MaxiGauge™ transmits positive acknowledgment of a received message
<ENQ>	——————>	The HOST invites the MaxiGauge to transmit data
<——————	Measurement values or parameters <CR><LF>	MaxiGauge™ transmits data with "end of message"
<ENQ>	——————>	The HOST invites the MaxiGauge to transmit data
<——————	Measurement values or parameters <CR><LF>	MaxiGauge™ transmits data with "end of message"

Error processing

All messages received are verified in the MaxiGauge™. If an error is detected, a negative acknowledgment <NAK> is output. The fault condition can subsequently be read out (→ 🗎 25).

Error recognition protocol

HOST	MaxiGauge™	Explanation
Mnemonics [and parameters] <CR>[<LF>]	——————>	HOST transmits message with "end of message"
***** Transmission or programming error *****		
<——————	<NAK><CR><LF>	MaxiGauge™ transmits negative acknowledgment of a received message
Mnemonics [and parameters] <CR>[<LF>]	——————>	HOST transmits message with "end of message"
<——————	<ACK><CR><LF>	MaxiGauge™ transmits positive acknowledgment of a received message

2 Mnemonics

			→
BAU	Baud rate	Baud rate	23
CAx	Calibration factor Sensor x	Calibration factor sensor x (1 ... 6)	19
CID	Measurement point names	Measurement point names	15
DCB	Display control Bargraph	Bargraph	16
DCC	Display control Contrast	Display control contrast	16
DCD	Display control Digits	Display digits	14
DCS	Display control Screensave	Display control screensave	16
DGS	Degas	Degas	21
ERR	Error Status	Error status	25
FIL	Filter time constant	Filter time constant	19
FSR	Full scale range of linear sensors	Full scale range of linear sensors	20
LOC	Parameter setup lock	Parameter setup lock	18
NAD	Node (device) address for RS485	Node (device) address for RS485	24
OFC	Offset correction	Offset correction	20
PNR	Program number	Program number	26
PRx	Status, Pressure sensor x (1 ... 6)	Status, Pressure sensor x (1 ... 6)	14
PUC	Underrange Ctrl	Underrange control	18
RSX	Interface	Interface	22
SAV	Save default	Save default	21
SCx	Sensor control	Sensor control	13
SEN	Sensor on/off	Sensor on/off	12
SPx	Set Point Control Source for Relay x	Threshold value setting, Allocation	17
SPS	Set Point Status A,B,C,D,E,F	Set point status	17
TAI	Test program A/D Identify	Test A/D converter identification inputs	28
TAS	Test program A/D Sensor	Test A/D converter measurement value inputs	28
TDI	Display test	Display test	26
TEE	EEPROM test	EEPROM test	28
TEP	EPROM test	EPROM test	27
TID	Sensor identification	Sensor identification	29
TKB	Keyboard test	Keyboard test	27
TRA	RAM test	RAM test	27
UNI	Unit of measurement (Display)	Unit of measurement (pressure)	15
WDT	Watchdog and System Error Control	Watchdog and system error control	29

" Transmit "	"Transmit": Data transfer from HOST to MaxiGauge™
" Receive "	"Receive": Data transfer from MaxiGauge™ to HOST

2.1 Measurement values

2.1.1 Sensor on / off

Transmit: SEN [,x,x,x,x,x,x] <CR>[<LF>]

└ Sensors 1 ... 6
x = 0 –> No change
1 –> Off
2 –> On

Receive: <ACK><CR><LF>

Transmit: <ENQ>

Receive: x,x,x,x,x,x <CR><LF>

└┴┴┴┴┴ Status Sensors 1 ... 6

NOTE

Not all sensor types can be switched on and off.

2.1.2 Sensor control

Transmit: SCx [,x,x,x.xE±yy,x.xE±yy] <CR>[<LF>]

- Switching off value
- Switching on value
- Switch off the controlling source of the sensor
  x = 0 –> Sensor 1
  1 –> Sensor 2
  2 –> Sensor 3
  3 –> Sensor 4
  4 –> Sensor 5
  5 –> Sensor 6
  6 –> External control
  7 –> Manual (Default)
- Switch on the controlling source of the sensor
  x = 0 –> Sensor 1
  1 –> Sensor 2
  2 –> Sensor 3
  3 –> Sensor 4
  4 –> Sensor 5
  5 –> Sensor 6
  6 –> External control
  7 –> Manual (Default)
  8 –> Hot start
- Controlled sensor x = A –> Sensor 1
  B –> Sensor 2
  C –> Sensor 3
  D –> Sensor 4
  E –> Sensor 5
  F –> Sensor 6

NOTE

For further details → 🕮 MaxiGauge™ BG 805 186 BE

Receive: <ACK><CR><LF>

Transmit: <ENQ>

Receive: x,x,x.xxE±yy,x.xxE±yy <CR><LF>

- Switching off value
- Switching on value
- Switch off the controlling source of the gauge
- Switch on the controlling source of the gauge

2.1.3 Status and pressure

Transmit: PRx <CR>[<LF>]
- Sensor x = 1 ... 6

Receive: <ACK><CR><LF>

Transmit: <ENQ>

Receive: x,x.xxxEsx <CR><LF>
- Measurement value (always exponential format)
- Status
  - x = 0 –> Measurement data okay
  - 1 –> Underrange
  - 2 –> Overrange
  - 3 –> Sensor error
  - 4 –> Sensor off
  - 5 –> No sensor
  - 6 –> Identification error

2.1.4 Digits

Transmit: DCD [,x] <CR>[<LF>]
- Digits x = 2 –> Display x.x (2 digits) (default)
  3 –> Display x.xx (3 digits)

Receive: <ACK><CR><LF>

Transmit: <ENQ>

Receive: x <CR><LF>
- Digits

2.1.5 Measurement point names

Transmit: CID [,xxxx,xxxx,xxxx,xxxx,xxxx,xxxx] <CR>[<LF>]

- Measurement point name 6
- Measurement point name 5
- Measurement point name 4
- Measurement point name 3
- Measurement point name 2
- Measurement point name 1

NOTE

All channel names are ASCII strings (A ... Z; 0 ... 9). Blanks (spaces) are ignored.

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: xxxx,xxxx,xxxx,xxxx,xxxx,xxxx <CR><LF>

- Measurement point names

2.2 Display

2.2.1 Unit of measurement

NOTE

The selected measurement unit has only an effect on the display, i.e. it does not affect the accuracy of the measurement.

Transmit: UNI [,x] <CR>[<LF>]

- Measurement unit x = 0 –> mbar (Default)
  1 –> Torr
  2 –> Pascal

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: x <CR><LF>

- Measurement unit

2.2.2 Bargraph

Transmit: DCB [,x] <CR>[<LF>]
└ Bargraph x = 0 –> Off (default)
1 –> Bargraph = Measurement range
2 –> Bargraph = 1 decade

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: x <CR><LF>
└ Bargraph

2.2.3 Contrast

Transmit: DCC [,xx] <CR>[<LF>]
└ Contrast x = 0 ... 20 –> Contrast dark ... light
(Default = 10 (med.))

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: xx <CR><LF>
└ Contrast

2.2.4 Screensave

Transmit: DCS [,xx] <CR>[<LF>]
└ Screensave
x = 0 –> Screensave off (default)
1 ... 99 –> Screensave after 1 ... 99 h

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: xx <CR><LF>
└ Screensave

2.3 Switching functions

2.3.1 Threshold value setting, Allocation

Transmit: SPx [,x,x.xxEsx,x.xxEsx] <CR>[<LF>]

- Upper threshold [mbar] (default = 9.00E-11)
- Lower threshold [mbar] (always exponential format) (default = 1.00E-11)
- Source x = 0 ... 5 –> sensors 1 ... 6
- Switching function (Relay) x = 1 ... 6 –> A ... F

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: x,x.xxEsx,x.xxEsx <CR><LF>

- Upper threshold
- Lower threshold
- Sensor (source)

2.3.2 Set point status

Transmit: SPS <CR>[<LF>]

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: x,x,x,x,x,x <CR><LF>

Set point A ... F x = 0 –> off
1 –> on

2.3.3 Underrange control

Transmit: PUC [,x,x,x,x,x,x] <CR>[<LF>]
└ Underrange control A ... F
x = 0 –> UR control deactivated (default)
1 –> UR control activated

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: x,x,x,x,x,x <CR><LF>
└┴┴┴┴┴┴ Underrange control

2.4 Parameters

2.4.1 Entry lock function

Transmit: LOC [,x] <CR>[<LF>]
└ Entry lock function x = 0 –> off (default)
1 –> on

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: x <CR><LF>
└ Entry lock function

2.4.2 Filter time constants

Transmit: FIL [,x,x,x,x,x,x] <CR>[<LF>]

- Filter time constant sensors1 ... 6
  - x = 0 –> fast
  - 1 –> standard (default)
  - 2 –> slow

Receive: <ACK><CR><LF>

Transmit: <ENQ>

Receive: x,x,x,x,x,x <CR><LF>

- Filter time constant

2.4.3 Calibration factor

Transmit: CAx [,x.xxx] <CR>[<LF>]

- Calibration factor 0.100 ... 9.999 for logarithmic sensors (default = 1.000)
- Calibration factor 0.500 ... 2.000 for linear sensors (default = 1.000)
- Sensor x = 1 ... 6

Receive: <ACK><CR><LF>

Transmit: <ENQ>

Receive: x.xxx <CR><LF>

- Calibration factor

2.4.4 Offset correction

Transmit: OFC [,x,x,x,x,x,x] <CR>[<LF>]

└ Offset correction sensors 1 ... 6
x = 0 –> off (default)
1 –> activated
2 –> actual measurement value = offset value

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: x,x,x,x,x,x <CR><LF>

└┴┴┴┴┴┘ Offset correction

2.4.5 Measurement range

NOTE

For linear gauges, the maximum pressure should be defined (full scale value). For logarithmic gauges the measurement range is detected automatically.

Transmit: FSR [,x,x,x,x,x,x] <CR>[<LF>]

└ full scale range sensors 1 ... 6
x = 0 –> 1 mbar
1 –> 10 mbar
2 –> 100 mbar
3 –> 1000 mbar (default)
4 –> 2 bar
5 –> 5 bar
6 –> 10 bar
7 –> 50 bar
8 –> 0.1 mbar

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: x,x,x,x,x,x <CR><LF>

└┴┴┴┴┴┘ Measurement ranges

2.4.6 Degas

Transmit: DGS [,0,0,0,x,x,x] <CR>[<LF>]

- x = 0 –> Degas off
  1 –> Degas on
- Sensors 1 … 3: no degas

Receive: <ACK><CR><LF>

Transmit: <ENQ>

Receive: 0,0,0,x,x,x <CR><LF>

- Degas status

2.4.7 Default

Transmit: SAV [,1] <CR>[<LF>]

- Activate the factory setting

Receive: <ACK><CR><LF>

2.5 Interfaces

2.5.1 Interface

This functions is only useful if several interfaces are connected to the unit.

Transmit: RSX [,x] <CR>[<LF>]

└ Interface x = 0 –> RS232C (default)
1 –> RS422
2 –> RS422I isolated
3 –> RS485 isolated

> **NOTE**
>
> The RS485 interface allows to assign addresses to the connected units. The node (or device) address of each unit can be defined (→ 🕮 MaxiGauge™ BG 805 186 BE). When replacing a unit, don't forget to enter the corresponding address number (→ 🗎 24).

Receive: <ACK><CR><LF>

Transmit: <ENQ>

> **NOTE**
>
> In order not to interrupt the communication, set the HOST to the same interface as the MaxiGauge™.

Receive: x <CR><LF>

└ Interface

2.5.2 Baud rate

Transmit: BAU [,x] <CR>[<LF>]

└ Baud rate x = 0 –> 300 baud
1 –> 1200 baud
2 –> 2400 baud
3 –> 4800 baud
4 –> 9600 baud (default)
5 –> 19200 baud

NOTE

As soon as the new baud rate has been entered, the report signal is transmitted at the new baud rate.

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: x <CR><LF>

└ Baud rate

2.5.3 RS485 node address

Transmit: NAD xx <CR>[<LF>]
└ Node address of the unit
x = 00 ... 31 –> Node address 00 ... 31

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: xx <CR><LF>
└ Node address of the unit

NOTE

Do not transmit any LINE FEEDS (<LF>) via the RS485 half duplex line for fear they could cause data collisions on the bus.

The RS232C, RS422, RS422I and RS485 (fullduplex) interfaces permit transmitting LINE FEEDS (<LF>). However, not transmitting them makes data transmission faster.

Addressing the unit

Entering the corresponding node address connects the unit connects to the HOST. The other units release the bus.

Transmit: <ESC>xx
└ Node address of the unit
xx = 00 ... 31

NOTE

All node addresses have two digits (00 ... 31). The address must always be transmitted when a different unit is to be accessed.

2.6 Error messages

2.6.1 Error status

Transmit: ERR <CR>[<LF>]

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: xxxxx,xxxxx <CR><LF>

Error status
xxxxx = 0 –> No error
1 –> Sensor 1: Measurement error
2 –> Sensor 2: Measurement error
4 –> Sensor 3: Measurement error
8 –> Sensor 4: Measurement error
16 –> Sensor 5: Measurement error
32 –> Sensor 6: Measurement error
512 –> Sensor 1: Identification error
1024 –> Sensor 2: Identification error
2048 –> Sensor 3: Identification error
4096 –> Sensor 4: Identification error
8192 –> Sensor 5: Identification error
16384 –> Sensor 6: Identification error

Error status
xxxxx = 0 –> No error
1 –> Watchdog has responded
2 –> Task fail error
4 –> IDCX idle error
8 –> Stack overflow error
16 –> EPROM error
32 –> RAM error
64 –> EEPROM error
128 –> Key error
4096 –> Syntax error
8192 –> Inadmissible parameter
16384 –> No hardware
32768 –> Fatal error

2.7 Test programs for Pfeiffer Vacuum service specialists

NOTE

Some test programs take several seconds to transmit a report signal.

Once a test program is started, the «Test» mode remains active until the unit is switched off.

2.7.1 Program version

Transmit: PNR <CR>[<LF>]

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: BGxxxxxx-x
- Index (-, A, B ... Z)
- Program version

2.7.2 Display test

Transmit: TDI <CR>[<LF>]

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: xxxxx,xxxxx <CR><LF>
- Error status → 25

2.7.3 Keyboard test

Transmit: TKB <CR>[<LF>]

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: xx <CR><LF>
└ xx = 1 –> Bit 0 = 1 Key 1 pressed
2 –> Bit 1 = 1 Key 2 pressed
4 –> Bit 2 = 1 Key 3 pressed
8 –> Bit 3 = 1 Key 4 pressed
16 –> Bit 4 = 1 Key 5 pressed
nn –> nn = Sum of the values of the pressed keys

2.7.4 RAM test

Transmit: TRA <CR>[<LF>]

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: xxxxx,xxxxx <CR><LF>
└ Error status → 25

2.7.5 EPROM test

Transmit: TEP <CR>[<LF>]

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: xxxxx,xxxxx <CR><LF>
└ Error status → 25

2.7.6 EEPROM test

CAUTION

This test should not be continually repeated (life time of the EEPROM).

Transmit: TEE <CR>[<LF>]

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: xxxxx,xxxxx <CR><LF>
└ Error status → 25

2.7.7 Test A/D converter identification inputs

Transmit: TAI <CR>[<LF>]

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: x.xxx,x.xxx,x.xxx,x.xxx,x.xxx,x.xxx<CR><LF>
└ Identification voltage sensors 1 ... 6

2.7.8 Test A/D converter measurement value inputs

Transmit: TAS <CR>[<LF>]

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: x.xxx,x.xxx,x.xxx,x.xxx,x.xxx,x.xxx<CR><LF>
└ Measurement voltage sensors 1 ... 6

2.7.9 Sensor identification

Transmit: TID <CR>[<LF>]

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: xxxxxxxxx,xxxxxxxxx, ... ,xxxxxxxxx <CR><LF>
└ Identification sensors 1 ... 6
xxxx = TPR (Pirani)
IKR9 (Cold cathode to 10^{-9} mbar)
IKR11 (Cold cathode to 10^{-11} mbar)
PKR (FullRange™ CC)
APR/CMR (Linear sensor)
IMR (Pirani / High Pressure)
PBR (FullRange™ BA)
no Sensor (No sensor)
no Ident (No identification)

2.7.10 Watchdog control

Transmit: WDT [,x] <CR>[<LF>]
└ Watchdog control
x = 0 –> automatic acknowledgment (default)
1 –> manual acknowledgment

Receive: <ACK><CR><LF>
Transmit: <ENQ>

Receive: x <CR><LF>
└ Watchdog control

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