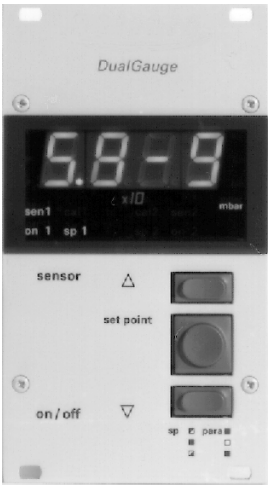
PFEIFFER VACUUM

TPG 252 A

Vacuum measurement and control unit
for Compact Gauges

DualGauge™



RS232C interface
Mnemonics

CE

Intended use

This Communication protocol contains instructions for operating the DualGauge™ (TPG 252 A) via the RS232C serial interface.

Product identification

→ 🕮 DualGauge™ BG 805 096 BE

Validity

This manual applies to products with part number

PT G28 270	(230 V~)
PT G28 272-1	(120 V~)
PT G28 273-1	(100 V~)

The part number can be taken from the nameplate.

This manual is based on firmware version

BG 509 727 -C

If your unit does not behave as described in this document, please check whether it is equipped with this firmware version (→ 🕮 DualGauge™ BG 805 096 BE).

The functions described as well as the illustrations and data contained in this manual are subject to change without notice.

Trademarks

DualGauge™ Balzers AG

Table of contents

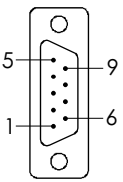
1 RS232C interface

The serial interface is used for communication between the DualGauge™ and a computer. A terminal can be connected for test purposes.

1.1 Connection diagram

Serial connector DualGauge™

RS232C,
9-pin, male



Front view of connector

Pin assignment

Pin 1: n. c.
Pin 2: RXD
Pin 3: TXD
Pin 4: DTR
Pin 5: SGND
Pin 6: not connected
Pin 7: RTS
Pin 8: CTS
Pin 9: not connected

Housing: screening

⚠ Use screened cables only (electromagnetic compatibility).

1.2 Data transmission

The data transmission is bi-directional, i.e. data and control commands can be transmitted in either direction.

Configuration of the interface → 🕮 DualGauge™ BG 805 096 BE.

1.2.1 Abbreviations and symbols used

Symbol	Meaning			
HOST	Computer or terminal			
[...]	Optional elements			
ASCII	American Standard Code for Information Interchange			
			Dec	Hex
<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

1.2.2 Flow control

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

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

1.2.3 Communication protocol

1.2.3.1 Transmission format

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

Spaces are ignored. <ETX> (CTRL C) clears the input buffer in the DualGauge™.

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

The tables on page 8 ff. are applicable to the mnemonics and parameters. The maximum number of digits, the data formats and admissible value ranges are also specified there.

1.2.3.2 Transmission protocol

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

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

1.2.3.3 Reception format

When requested with a mnemonics, the DualGauge™ 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.

1.2.3.4 Reception protocol

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

1.2.3.5 Error processing

All messages received are verified in the DualGauge™. If an error is detected, a negative acknowledgment <NAK> is output. The fault condition can subsequently be read out (→ 17).

1.2.3.6 Error recognition protocol

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

2 Mnemonics

SEN	Sensor on/off	Sensor on/off
PR1, PR2	Pressure sensor	Pressure sensor 1 or 2
PRX	Pressure sensor	Pressure of both sensors
SP1, SP2	Set point	Switching function
SPS	Set point status	Switching function status
UNI	Unit of measurement	Pressure unit
LOC	Parameter setup lock	Entry lock function
DIC	Display control	Display changeover mode
BAU	Baud rate	Baud rate
FIL	Filter time constant	Filter time constants
CAL	Calibration factor	Calibration factors
POC	PE / Ioni on control	Control of Cold Cathode / Ioni Gauge
PUC	PE underrange control	PE gauge underrange control
FSR	Full scale range	Measurement range of linear sensor
OFC	Offset correction	Offset correction
OFD	Offset display	Offset display
TID	DualGauge™ Identification	Sensor identification
SAV	Save parameters to EEPROM	Save parameters to EEPROM
ERR	Error status	Error status
RES	Reset	Reset
PNR	Program number	Program version
DIS	Display test	Display test program
RAM	RAM test	RAM test program
EPR	EPROM test	EPROM test program
EEP	EEPROM test	EEPROM test program
ADC	AD converter test	AD converter test program
IOT	I/O test	I/O test program
WDT	Watchdog control	Watchdog error behavior
RST	RS232C test	RS232C test program

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

2.1 Measurement values

2.1.1 Gauge on/off

Transmit : SEN [,x,x] <CR>[<LF>] Sensor on/off

```
        | |
        | └── Sensor 2   x =  0 –> No change / no sensor (status)
        |                     1 –> Off
        └── Sensor 1          2 –> Automatic (status)
                              3 –> On
```

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

Receive : x,x <CR><LF>

```
| |
| └── Status Sensor 2
└── Status Sensor 1
```

2.1.2 Pressure gauge 1 or 2

Transmit : PRx <CR>[<LF>] Pressure sensor

```
   |
   └── 1  Sensor 1
       2  Sensor 2
```

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

Receive : x,x.xxxEsxx <CR><LF> (Always exponential format)

```
|   |
|   └── Measurement value [mbar]
|
└── Status   x = 0 –> Measurement data okay
                 1 –> Underrange
                 2 –> Overrange
                 3 –> Sensor Error
                 4 –> Sensor off
                 5 –> No sensor (output string: 5,2.000E-2)
                 6 –> Identification error
```

2.1.3 Pressure of both gauges

Transmit : PRX <CR> [<LF>] Pressure sensor

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

Receive : x,x.xxxEsx,y,y.yyyEsy <CR><LF> (Only exponential format available)

- x,x.xxxEsx — Measurement value sensor 2 [mbar]
- y — Status sensor 2
- x,x.xxxEsx — Measurement value sensor 1 [mbar]
- y — Status Sensor 1
  - x, y = 0 –> Measurement data okay
  - 1 –> Underrange
  - 2 –> Overrange
  - 3 –> Sensor error
  - 4 –> Sensor off
  - 5 –> No sensor (output string: 5,2.000E-2)
  - 6 –> Identification error

2.2 Switching functions

2.2.1 Threshold value setting, Allocation

Transmit : SPx [,x.xxEsx,x.xxEsx] <CR>[<LF>] Set point (always exponential format)

- x — upper threshold [mbar] (default value = 9.00E-11)
- x — lower threshold [mbar] (default value = 1.00E-11)
- x — 1 Sensor 1, 2 Sensor 2

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

Receive : x.xxEsx,x.xxEsx <CR><LF> (Always exponential format)

- x.xxEsx — upper threshold [mbar]
- x.xxEsx — lower threshold [mbar]

2.2.2 Set point status

Transmit : SPS <CR>[<LF>] Set point status

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

Receive : x,x <CR><LF>

```
| |
| └── Set point sensor 2        x = 0 –> off
|                                   1 –> on
└──── Set point sensor 1
```

2.3 Parameters

2.3.1 Measurement unit

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

```
        |
        └── Measurement unit  x = 0 –> mbar / bar   (default)
                                  1 –> Torr
                                  2 –> Pascal
```

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

Receive : x <CR><LF>

```
|
└── Measurement unit
```

2.3.2 Entry lock function

Transmit : LOC [,x] <CR>[<LF>] Parameter setup lock

```
        |
        └──  x = 0 –> off   (default)
                 1 –> on
```

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

Receive : x <CR><LF>

```
|
└── lock
```

2.3.3 Baud rate

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

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

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

Receive : x <CR><LF>

```
|
└── Baud rate
```

> **HINWEIS**
> The reply is given in the new baud rate.

2.3.4 Display control

Transmit : DIC [,x] <CR>[<LF>] Display control

```
        |
        └── Control  x =   0 –> manual   (default)
                           1 –> automatic
```

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

Receive : x <CR><LF>

```
|
└── Display control
```

2.3.5 Filter time constants

Transmit : FIL [,x,x] <CR>[<LF>] Filter time constant

```
        | |
        | └── Sensor 2   x =  0 –> fast
        |                     1 –> normal   (default)
        └──── Sensor 1        2 –> slow
```

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

Receive : x,x <CR><LF>

```
| |
| └── Filter sensor 2
|
└──── Filter sensor 1
```

2.3.6 Calibration factor

Transmit : CAL [,x.xxx,x.xxx] <CR>[<LF>] Calibration factor

```
          |     |
          |     └── Sensor 2
          |
          └──── Sensor 1
```

0.100 ... 9.999 for logarithmic sensors (default = 1.000)
0.500 ... 2.000 for linear sensors

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

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

```
    |     |
    |     └── Sensor 2
    |
    └──── Sensor 1
```

2.3.7 Gauge control

Transmit : POC [,x,x] <CR>[<LF>] PE / Ioni control

```
        | |
        | └── Sensor 2  control   x =  0 –> automatic   (default)
        |                              1 –> manual
        └──  Sensor 1                  2 –> external
```

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

Receive : x,x <CR><LF>

```
| |
| └── Gauge control sensor 2
|
└── Gauge control sensor 1
```

2.3.8 Gauge underrange control

Transmit : PUC [,x,x] <CR>[<LF>] PE underrange control

```
        | |
        | └── Sensor 2  control   x =  0 –> off   (default)
        |                              1 –> on
        └──  Sensor 1
```

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

Receive : x,x <CR><LF>

```
| |
| └── Sensor 2
|
└── Sensor 1
```

2.3.9 Measurement range linear gauge

Transmit : FSR [,x,x] <CR>[<LF>] Full scale range

```
          | |
          | └── Sensor 2  measurement range   x =  0 –> 1 mbar
          |                                        1 –> 10 mbar
          └──── Sensor 1                           2 –> 100 mbar
                                                   3 –> 1000 mbar   (default)
                                                   4 –> 2 bar
                                                   5 –> 5 bar
                                                   6 –> 10 bar
                                                   7 –> 50 bar
```

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

Receive : x,x <CR><LF>

```
          | |
          | └── Sensor 2
          |
          └──── Sensor 1
```

2.3.10 Offset correction

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

```
          | |
          | └── Sensor 2   x =  0 –> off   (default)
          |                     1 –> on
          └──── Sensor 1        2 –> auto (offset measurement)
```

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

Receive : x,x <CR><LF>

```
          | |
          | └── Sensor 2
          |
          └──── Sensor 1
```

2.3.11 Offset indication

Transmit : OFD [,x.xxxEsx,x.xxxEsx] <CR>[<LF>] Offset display

```
          |       |
          |       └── Sensor 2  (default = 0.000)
          |
          └── Sensor 1
```

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

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

```
  |       |
  |       └── Sensor 2
  |
  └── Sensor 1
```

2.4 Auxiliary functions

2.4.1 Gauge identification

Transmit : TID <CR>[<LF>] DualGauge™ identification

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

Receive : x,x <CR><LF>

```
||
|└── Identification sensor 2
|
└── Identification sensor 1
```

x = PIR (Pirani)
PE9 (Cold cathode 9)
PE11 (Cold cathode 11)
CO9 (Compact FullRange™ CC Gauge)
LIN (linear sensor)
ION (Pirani/high pressure gauge)
noSe (no sensor)
noId (no identification)

2.4.2 Saving the parameters to EEPROM

Transmit : SAV [,x] <CR>[<LF>] Save parameters to EEPROM

```
                  |
                  └── Parameter set   x =  0 –> save default parameters
                                           1 –> save user parameters
```

Receive : <ACK><CR><LF>

2.5 Error messages

2.5.1 Error status

Transmit : ERR <CR>[<LF>] Error status

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

Receive : xxxx <CR><LF>

```
          |
          └── xxxx =  0000 –> no error
                      1000 –> ERROR    (see display on front panel)
                      0100 –> NO HWR   hardware not installed
                      0010 –> PAR      inadmissible parameter
                      0001 –> SYN      syntax error
```

The error status is erased when it has been read. It is set again if the error has not been corrected or if there are any further errors.

2.5.2 Reset

Erases error messages and returns to measurement mode

Transmit : RES [,x] <CR>[<LF>] Reset
|
└── x = 1 –> Reset

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

Receive : x,x, ... <CR><LF>
|
└── List of error messages
x = 0 –> No error
1 –> Watchdog error
2 –> Task fail error
3 –> IDCX idle error
4 –> Stack overflow error
5 –> EPROM error
6 –> RAM error
7 –> EEPROM error
8 –> Key error
9 –> Sensor 1 measurement error
10 –> Sensor 2 measurement error
11 –> Sensor 1 identification error
12 –> Sensor 2 identification error

2.6 Test programs for Pfeiffer Vacuum service specialists

2.6.1 Program version

Transmit : PNR <CR> Program number

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

Receive : BGxxxxxx-x <CR><LF>
| |
| └── Index
|
└── Program version

2.6.2 Display-Test

Transmit : DIS <CR> Display test (duration 30 s)

Receive : <ACK><CR><LF>
Transmit : <ENQ> starts test again

Receive : <CR><LF>

2.6.3 RAM test

Transmit : RAM <CR>[<LF>] RAM test (duration 1 s)

Receive : <ACK><CR><LF>
Transmit : <ENQ> starts the test again

Receive : xxxx <CR><LF>
|
└— error status (→ 🗎 17)

2.6.4 EPROM test

Transmit : EPR <CR>[<LF>] EPROM test (duration 5 s)

Receive : <ACK><CR><LF>
Transmit : <ENQ> starts the test again

Receive : xxxx,yyyy <CR><LF>
| |
| └— Check sum (Hex)
|
└— error status (→ 🗎 17)

2.6.5 EEPROM test

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

Transmit : EEP <CR>[<LF>] EEPROM test (duration <1 s)

Receive : <ACK><CR><LF>
Transmit : <ENQ> starts the test again

Receive : xxxx <CR><LF>
|
└— error status (→ 🗎 17)

2.6.6 ADC test

Transmit : ADC <CR>[<LF>] ADC test

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

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

- 1st xxxx: Measurement value ADC channel 4 [mV]
- 2nd xxxx: Measurement value ADC channel 3 [mV]
- 3rd xxxx: Measurement value ADC channel 2 [mV]
- 4th xxxx: Measurement value ADC channel 1 [mV]

2.6.7 I/O test

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

Transmit : IOT <CR>[<LF>] I/O test (duration 5 s)

Receive : <ACK><CR><LF>
Transmit : <ENQ> starts the test again

Receive : <CR><LF>

2.6.8 Watchdog error

Transmit : WDT [,x] <CR>[<LF>] Watchdog control

- x: Parameter set x = 0 –> automatic acknowledgment (default)
  1 –> manual acknowledgment

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

Receive : x <CR><LF>

- x: Watchdog control status

2.6.9 RS232C test

Transmit : RST <CR>[<LF>] RS232C test (send back each character entered (Echo); abortion with <CTRL> C)

Receive :<ACK><CR><LF>

Example

"Transmit (T)" and "Receive (R)" refer to Host computer.

T:	TID <CR> [<LF>]	Call DualGauge™ identification
R:	<ACK> <CR> <LF>	Positive report signal
T:	<ENQ>	Enquiry
R:	PIR,LIN <CR> <LF>	Output sensor types
T:	SEN <CR> [<LF>]	Call sensor statuses
R:	<ACK> <CR> <LF>	Positive report signal
T:	<ENQ>	Enquiry
R:	3,3 <CR> <LF>	Output sensor statuses
T:	SP1 <CR> [<LF>]	Call parameters of gauge underrange control 1
R:	<ACK> <CR> <LF>	Positive report signal
T:	<ENQ>	Enquiry
R:	1.00E-9,9.00E-7 <CR> <LF>	Output threshold values
T:	SP1,6.80E-3,9.80E-3 <CR> [<LF>]	Change threshold values of gauge under-range control 1
R:	<ACK> <CR> <LF>	Positive report signal
T:	FOL,3,2 <CR> [<LF>]	Change filter (wrong input: FOL instead of FIL)
R:	<NAK> <CR> <LF>	Negative report signal (syntax error)
T:	ERR <CR> [<LF>]	Call error status
R:	0001 <CR> <LF>	Output error status
T:	FIL,3,2 <CR> [<LF>]	Change filter
R:	<ACK> <CR> <LF>	Positive report signal
T:	<ENQ>	Enquiry
R:	3,2 <CR> <LF>	Output filter setting
T:	SEN <CR> [<LF>]	Check sensor statuses
R:	<ACK> <CR> <LF>	Positive report signal
T:	<ENQ>	Enquiry
R:	3,3 <CR> <LF>	Output sensor statuses

T:	PR2 <CR> [<LF>]	Pressure measurement sensor 2
R:	<ACK> <CR> <LF>	Positive report signal
T:	<ENQ>	Enquiry
R:	0,8.340E-3 <CR> <LF>	Output pressure and status
T:	<ENQ>	Enquiry
R:	1,8.000E-4 <CR> <LF>	Output pressure and status

Pfeiffer Vacuum GmbH
Emmeliusstrasse 33
D–35614 Asslar
Deutschland
Tel +49 (0) 6441 802-0
Fax +49 (0) 6441 802-202
info@pfeiffer-vacuum.de

www.pfeiffer-vacuum.de

Original: German BG 805 098 BD (9907)