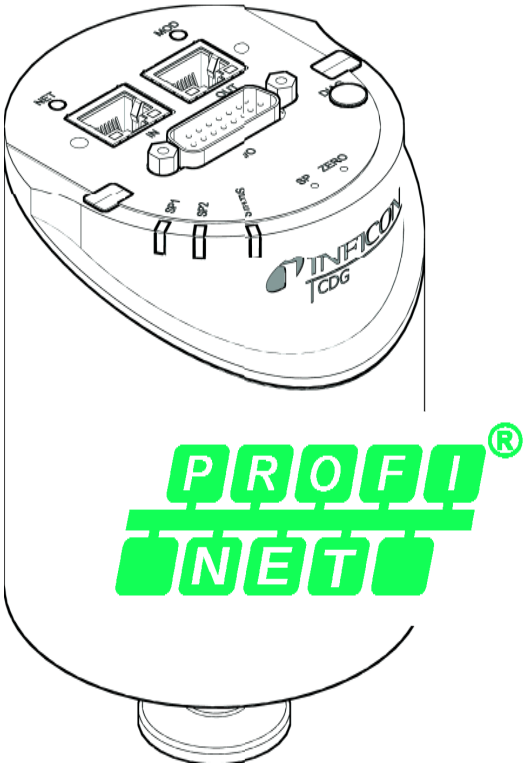
Profinet

for Capacitance Diaphragm Gauges

CDG045D
CDG100D



General Information

Caution

Data transmission errors

Any attempt to simultaneously operate the gauge via the RS232C Serial Interface and Profinet interface or the diagnostic port may result in incorrect data and data transmission errors.

Therefore, it is inadmissible to simultaneously operate the gauge via the RS232C Serial Interface and Profinet interface, or the diagnostic port.

Intended Use

This Communication Protocol contains instructions for operating Profinet interfaces (slaves) together with a master.

For safety information, specifications and operation instructions of the vacuum gauges refer to the appropriate documents:

CDG045D → 🕮 [1]
CDG100D → 🕮 [2]

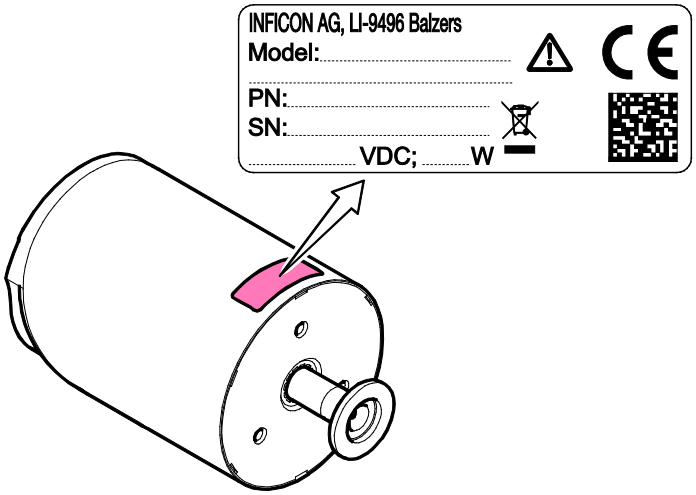
Profinet –Interface

This manual describes the functionality of a Profinet.

For operating the gauge via Profinet, prior installation of the device specific GSDML file is required on the bus master side. This file can be downloaded from our website (www.inficon.com: CDG045D, CDG100D).

Product Identification

In all communications with INFICON, please specify the information on the product nameplate. For convenient reference copy that information into the space provided below.

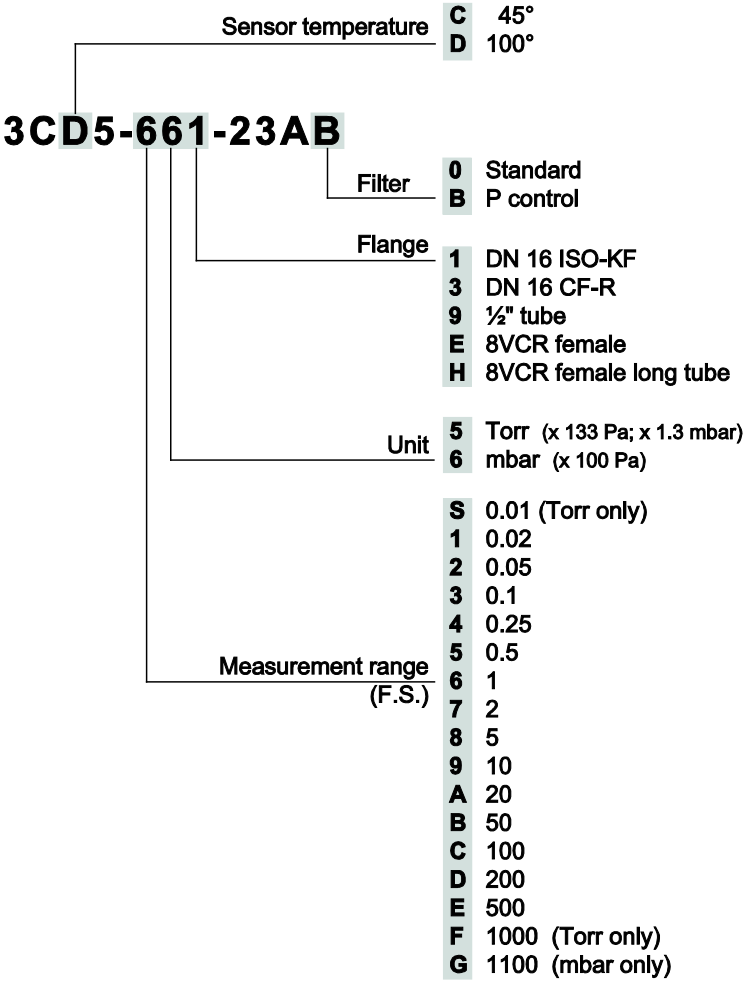


Validity

This document applies to products of the CDG045D and CDG100D series with Profinet interface.

This manual is based on firmware version 1.0.0.0.

Part numbers of standard products are indicated below. OEM products have other part numbers and different parameter settings (e.g. factory setting of setpoint) as defined in the corresponding ordering information.



The part number (PN) can be taken from the product nameplate.

If not indicated otherwise in the legends, the illustrations in this document correspond to CDG045D gauges with the DN 16 ISO-KF vacuum connection. They apply to the other gauges by analogy.

Trademarks

Profinet ® PROFIBUS Nutzerorganisation e.V. (PNO), Germany
Sky ® INFICON GmbH

Patents

EP 1070239 B1, 1040333 B1
US Patents 6528008, 6591687, 7107855, 7140085

Contents

For cross-references within this document, the symbol (→ 🗎 XY) is used, for cross-references to further documents, listed under literature, the symbol (→ 🕮 [Z]).

1 Technical Data

For further technical data refer to the appropriate documents:

CDG045D → 🕮 [1]
CDG100D → 🕮 [2]

Profinet interface

Communication protocol	protocol specialized for Profinet
Data rate	100 Mbps
Node address	Explicit Device Identification
Physical layer	100BASE-Tx (IEEE 802.3)
Profinet connector	2 × RJ45, 8-pin (socket) <IN>: Profinet input <OUT>: Profinet output
Cable	shielded, special Ethernet Patch Cable (CAT5e quality or higher)
Cable length	≤100 m
Cyclic data	IO-data
Acyclic data	configuration, responses and information

2 Interface Connection

Making a Profinet interface cable

For operating the temperature controlled CDGxxxD gauge via Profinet, two interface cables conforming to the Profinet standard are required.

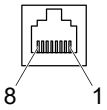
If no such cables are available, make two according to the following indications.

Cable type

Ethernet Patch Cable Cable (CAT5e quality) with FCC68 connector.

Procedure

❶ Pin assignment:

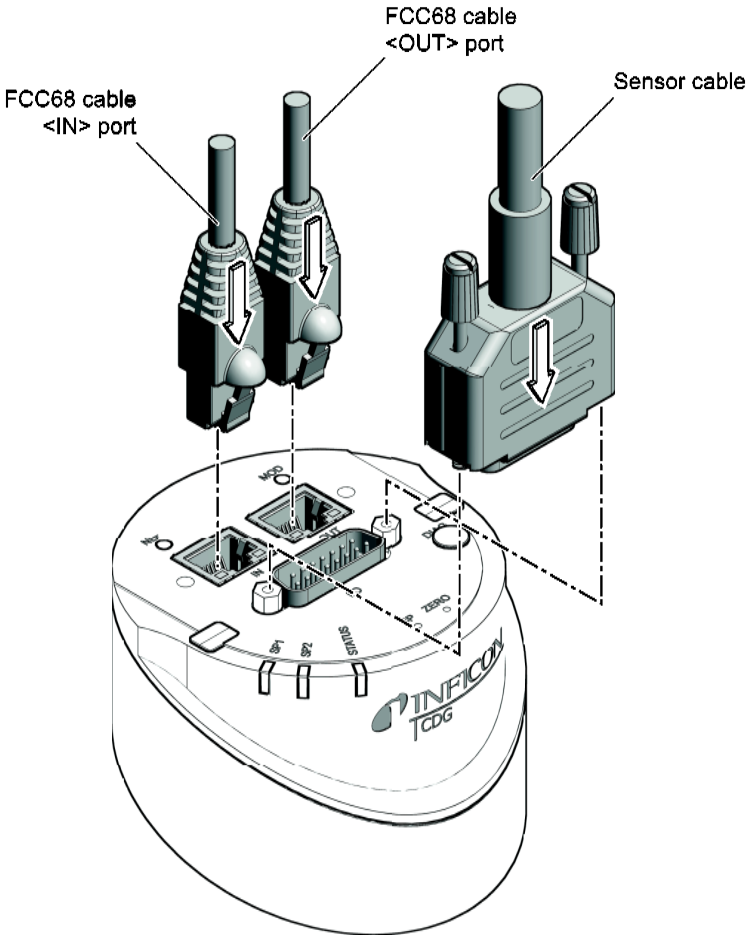


FCC68, 8-pin,
male, soldering side

Pin	Signal	Description
1	TD+	Transmission Data +
2	TD-	Transmission Data -
3	RD+	Receive Data +
4	nu	not used
5	nu	not used
6	RD-	Receive Data -
7	nu	not used
8	nu	not used

Pin assignment of the D-sub 15-pin sensor connector according to the respective operating manual (→ 🕮 [1], [2]).

❷ Plug the Profinet (and sensor) cables connector into the gauge: From the previous device the cable connected to OUT port has to be connected to the CDGxxxD <IN> port. And the cable from the CDGxxxD <OUT> port has to be connected to the next device's <IN> port.



3 Operation

3.1 Introduction

Via the Profinet interface, the following and further data are exchanged in the standardized Profinet protocol:

- Pressure reading
- Pressure unit (Torr, mbar, Pa)
- Zero adjustment
- Status and error messages
- Status of the switching functions
- Set Trip Point for switching functions

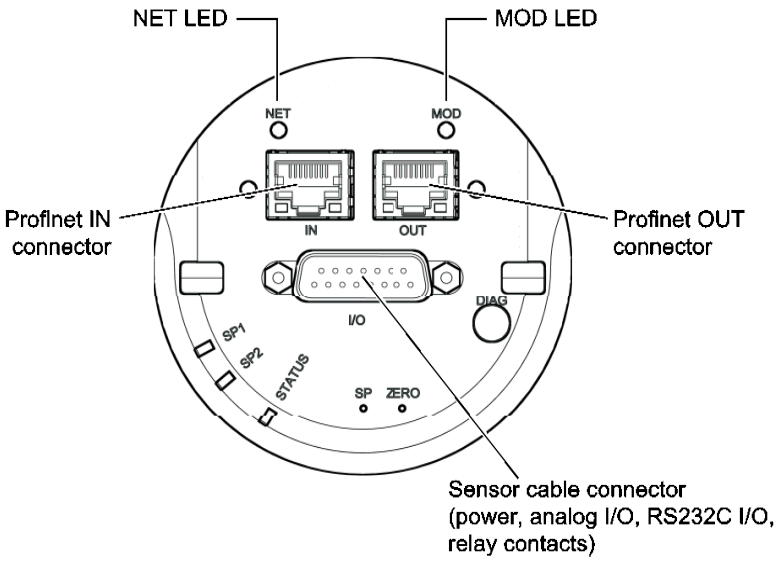
Caution

Data transmission errors

Any attempt to simultaneously operate the gauge via the RS232C Serial Interface and Profinet interface or the diagnostic port may result in incorrect data and data transmission errors.

Therefore, it is inadmissible to simultaneously operate the gauge via the RS232C Serial Interface and Profinet interface or the diagnostic port.

3.2 Front View



3.3 Indicators and Switches

3.3.1 <NET> LED

Displays the network status.

Color	LED State	Description
	off	No power No connection with IO Controller
green	1 flash	Connection with IO Controller established IO Controller in STOP state or IO data bad IRT synchronization not finished
	blinking	Used by engineering tools to identify the node on the network
	on	Connection with IO Controller established IO Controller in RUN state
red	on	Major internal error (the indication is combined with a red module status LED)
	1 flash	Station name not set
	2 flashes	IP address not set
	3 flashes	Expected Identification differs from read identification

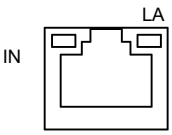
3.3.2 <MOD> LED

Displays the module status.

Color	LED State	Description
	off	No power OR Module in SETUP or NW_INIT state
green	on	Module has shifted from the NW_INIT state
	1 flash	Diagnostic event(s) present
red	on	Device in state Exception Major internal error (this indications combined with a red network status LED)
red/ green	alternating (red/green)	Firmware update. Do NOT power off the module. Turning the module off during this phase could cause permanent damage.

3.3.3 <LA> LED (<IN> Port)

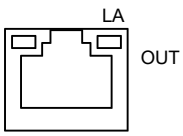
Displays the input status.



Color	LED State	Description
green	off	Port not connected or no power applied to device
	blinking	Port connected and communication active
	on	Port connected but no communication

3.3.4 <LA> LED (<OUT> Port)

Displays the output status.



Color	LED State	Description
green	off	Port not connected or no power applied to device
	blinking	Port connected and communication active
	on	Port connected but no communication

4 Object Structure

This chapter describes the acyclic parameters.

4.1 Object Dictionary structure

The parameter for the objects are in groups. They can be accessed with the acyclic read and write commands. To read this parameters the Slot has to be set to zero and the Subslot to one. The Index can be found for each individual parameter blow.
Slot = 0
Subslot = 1
Index = see individual Parameter

Explanations for the abbreviations in the columns of the tables are given below:

Abbr.	Description
Access	parameter read/write access • RO: object can only be read by the SDO service • RW: object can be both read and written by the SDO service
Index	Index for the parameter (Slot = 0, Subslot = 1)
NV	Nonvolatile; attribute value is maintained through power cycles
Object	Abstract representation of a particular component within a device, which consists of data, parameters, and methods.
Type	Data Type • BOOL, BIT = 1 bit. Boolean (0 = false, 1 = true) • USINT, BYTE = 8 bit. Unsigned Byte • UINT = 16 bit. Unsigned integer value • UDINT = 32 bit. Unsigned integer value • ULINT = 64 bit. Unsigned integer value • REAL = 32 bit. Floating point • V_STRING = 8×n bit. Visible string (1 byte for character) • BYTE_ARR(n) = Array of bytes with n bytes

4.2 Input Area (0x6000…0x6FFF)

4.2.1 Input Capacitance Diaphragm

Index	DataType	NV	Access	Name
0x0100	REAL		RO	Sensor Value
0x0101	BOOL		RO	Reading Valid
0x0102	BOOL		RO	Overrange Exceeded
0x0103	BOOL		RO	Underrange Exceeded

Index 0x0100

The corrected, converted, calibrated final analog input value of the sensor.

Index 0x0101

Indicates whether the Value parameter contains a valid value within the specified accuracy or not.

Reading Valid	
0	Invalid
1	Valid

Index 0x0102

Indicates whether the Value parameter contains a value in over range.

Reading Valid	
0	No Overrange Exceeded
1	Overrange Exceeded

Index 0x0103

Indicates whether the Value parameter contains a value in under range.

Reading Valid	
0	No Underrange Exceeded
1	Underrange Exceeded

4.2.2 Configuration Capacitance Diaphragm

Index	DataType	NV	Access	Name
0x0110	REAL	x	RW	Offset Customer Specific
0x0111	USINT	x	RW	Filter
0x0112	USINT	x	RW	Fieldbus Override

Index 0x0110

Customer-specified Offset which shall be added to the Value parameter of the Analog Input Sensor instance.

The Offset Customer Specified parameter is a value added from a Zero Adjust Service to the reported pressure value.

Value shall be calculated as:

$$\text{Value}^{*)} = \text{Reported pressure value} + \text{AZO}^{**)} + \text{OCS}^{***)}$$

*) Value (Index 0x0100)

) **Accumulated **Z**ero **O**ffset (Index 0x0142)

***) **O**ffset **C**ustomer **S**pecified (Index 0x0110)

Index 0x0111

Filter	
0	Dynamic (factory default)
1	Fast
2	Slow

Index 0x0112

Fieldbus Override	
0	Setpoints are active if cyclic data communication is established
1	Setpoints are always active

4.2.3 Information Common Capacitance Diaphragm

Index	DataType	NV	Access	Name
0x0142	REAL	x	RO	Accumulated Zero Offset

Index 0x0142

Accumulated Zero Offset: An amount added prior to Gain to derive Value. Result of Zero Adjust Command (accumulated value).

4.2.4 Information Capacitance Diaphragm

Index	DataType	NV	Access	Name
0x0140	UINT		RO	Sensor Warning
0x0141	UINT		RO	Sensor Error

Index 0x0140

Sensor Warnings	
Bit 0	Not at temperature
Bit 1…8	0
Bit 9	Electronics Warning
Bit 10…15	0

Index 0x0141

Sensor Errors	
Bit 0…8	0
Bit 9	Electronics Failure
Bit 10…15	0

4.2.5 Command Zero Adjust

Execution of this command will start a Zero Adjust operation.

The zeroing function is locked in order for operating errors to be prevented, therefore see the operation instructions of the vacuum gauges, refer to the appropriate documents (→ 🕮 [1], [2]).

Index	DataType	NV	Access	Name
0x0170	BYTE_ARR(6)		RW	Command
0x0171	BYTE		RO	Status
0x0172	BYTE_ARR(3)		RO	Response

Index 0x0170

Command	
Byte 0	0: Zero adjust with no offset
Byte 1	Index of the Sub Sensor Instance (always 1)
Byte 2…5	Offset value (Data format: REAL, always 0x00 0x00 0x00 0x00)

Index 0x0171

Status (supported values)	
0	Last command completed, no errors, no reply available
1	Last command completed, no errors, reply available
2	Last command completed, errors present, no reply available
3	Last command completed, errors present, reply available
255	Command is executing

Index 0x0172

Response	
Byte 0	See Index 0x0171
Byte 1	Unused
Byte 2	0: Zeroing successful 1: Zeroing failed; out-of-range 2: Zeroing failed; cumulative out-of-range 3: Zeroing failed: measurement invalid 254: No previous Zero Adjust command issued

4.2.6 Input Common

Index	DataType	NV	Access	Name
0x0200	REAL		RO	Sensor Value

Index 0x0200

The corrected, converted, calibrated final analog input value of the sensor.

4.2.7 Full Scale Adjust

Execution of this command will start a Full Scale Adjust operation.

Index	DataType	NV	Access	Name
0x0273	V_STRING(6)		RW	Command
0x0274	BYTE		RO	Status
0x0275	V_STRING(3)		RO	Response

Index 0x0273

Command	
Byte 0	0: Full Scale Adjust
Byte 1	2: Index of the Sub Sensor Instance (always 2)
Byte 2…5	0: Full Scale value (Data format: REAL, always 0x00 0x00 0x00 0x00)

Index 0x0274

Status (supported values)	
0	Last command completed, no errors, no reply available
1	Last command completed, no errors, reply available
2	Last command completed, errors present, no reply available
3	Last command completed, errors present, reply available
255	Command is executing

Index 0x0275

Response	
Byte 0	See Index 0x0274
Byte 1	0: Unused
Byte 2	0: Full Scale Adjust successful 1: Full Scale Adjust failed: out-of-range 254: No previous Full Scale Adjust command issued

4.2.8 Input Trip Point 1

Index	DataType	NV	Access	Name
0x0800	BOOL		RO	Status High Trip
0x0801	BOOL		RO	Status Low Trip

Index 0x0800

Status High Trip	
0	High Trip not assert
1	High Trip assert

Index 0x0801

Status Low Trip	
0	Low Trip not assert
1	Low Trip assert

4.2.9 Configuration Trip Point

The High Trip Point is calculated by:

$$\text{High Trip Point} = \text{Value}^{*)} \times \text{Percentage}^{**)}$$

*) Value from Piezo Sensor (Index 0x0200)

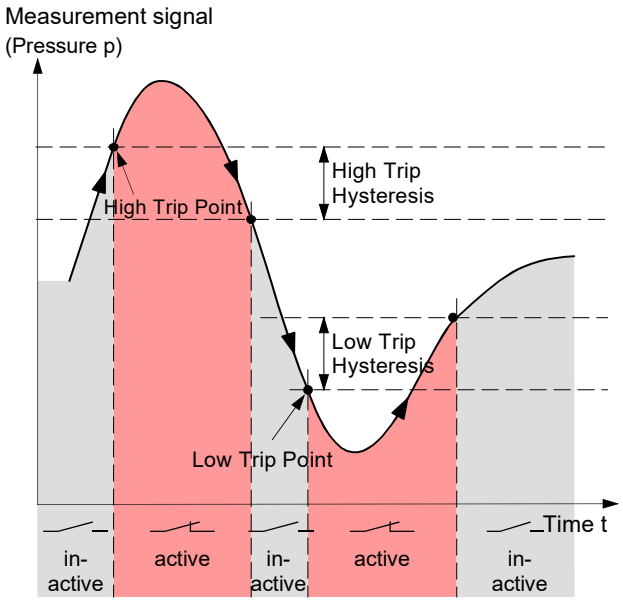
**) Percentage High Trip Source (Index 0x0828)

In this case, the High Trip Point value is automatically updated by the device itself. Any user-written value to the parameter High Trip will be refused.

Usage of High Trip Point is only recommended for measurement range 1000 Torr or 1100 mbar.

The Low Trip Point is a fixed value:

The value defined in Low Trip Point Limit is compared with the pressure value referenced by the Source Index parameter.



4.2.10 Configuration Trip Point 1

Calculating the High Trip Point and Low Trip Point → chapter 4.2.9.

Index	DataType	NV	Access	Name
0x0820	BOOL	x	RO	High Trip Enable
0x0821	BOOL	x	RO	Low Trip Enable
0x0826	REAL	x	RO	High Trip Point Limit
0x0828	REAL	x	RW	Percentage High Trip Source
0x0829	REAL	x	RW	Low Trip Point Limit
0x082C	REAL	x	RO	High Trip Hysteresis
0x082D	REAL	x	RW	Low Trip Hysteresis

Index 0x0820

High Trip Point	
0	Disable
1	Enable

Index 0x0821

Low Trip Point	
0	Disable
1	Enable

Index 0x0826

High Trip Point Limit: High limit to trigger trip point condition if pressure value of the device (Index 0x0100) is above this limit.

Index 0x0x0828

Percentage of High Trip Source: Percentage of Piezo Sensor Value (Index 0200) in [%].

Index 0x0829

Low Trip Point Limit: Low limit to trigger trip point condition if pressure value of the device is below this limit.

Index 0x082C

High Trip Hysteresis: Hysteresis value for High Trip Point.

Index 0x082D

Low Trip Hysteresis: Hysteresis value for Low Trip Point.

4.2.11 Input Trip Point 2

Index	DataType	NV	Access	Name
0x0900	BOOL		RO	Status High Trip
0x0901	BOOL		RO	Status Low Trip

Index 0x0900

Status High Trip	
0	High Trip not assert
1	High Trip assert

Index 0x0901

Status Low Trip	
0	Low Trip not assert
1	Low Trip assert

4.2.12 Configuration Trip Point 2

Calculating the High Trip Point and Low Trip Point → chapter 4.2.9.

Index	DataType	NV	Access	Name
0x0920	BOOL	x	RO	High Trip Enable
0x0921	BOOL	x	RO	Low Trip Enable
0x0926	REAL	x	RO	High Trip Point Limit
0x0928	REAL	x	RW	Percentage High Trip Source
0x0929	REAL	x	RW	Low Trip Point Limit
0x092C	REAL	x	RW	High Trip Hysteresis
0x092D	REAL	x	RW	Low Trip Hysteresis

Index 0x0920

High Trip Point	
0	Disable
1	Enable

Index 0x0921

Low Trip Point	
0	Disable
1	Enable

Index 0x0926

High Trip Point Limit: High limit to trigger trip point condition if pressure value of the device (Index 0x0100) is above this limit.

Index 0x928

Percentage of High Trip Source: Percentage of Piezo Sensor Value (Index 0200) in [%].

Index 0x929

Low Trip Point Limit: Low limit to trigger trip point condition if pressure value of the device is below this limit.

Index 0x092C

High Trip Hysteresis: Hysteresis value for High Trip Point.

Index 0x092D

Low Trip Hysteresis: Hysteresis value for Low Trip Point.

4.2.13 Exceptions

4.2.14 Active Exception Status

Index	DataType	NV	Access	Name
0x040	USINT		RO	ActiveException Status

Active Exception Status

Active Exception Status	
Bit 0	Device Warning
Bit 1	Manufacturer Warning
Bit 2	Device Error
Bit 3	Manufacturer Error
Bit 4…7	0

4.2.15 Active Device Warning Details

The "active device warning details" parameter describes the warning state of the complete device.

Index	DataType	NV	Access	Name
0x0041	UDINT		RO	Active Device Warning Details
0x0042	UDINT		RO	Active Manufacturer Warning Details

Index 0x0041

Active Device Warning Details	
Bit 0	Not at temperature
Bit 1	0
Bit 2	Electronics warning
Bit 3…31	0

Index 0x0042

Active Manufacturer Warning Details	
Bit 0	0
Bit 1	Atmosphere Pressure out of Range
Bit 2…31	0

4.2.16 Active Device Error Details

The "active device error details" parameter describes the error state of the complete device.

Index	DataType	NV	Access	Name
0x0043	UDINT		RO	Active Device Error Details
0x0044	UDINT		RO	Active Manufacturer Error Details

Index 0x0043

Active Device Error Details	
Bit 0…1	0
Bit 2	Electronics Error
Bit 3…31	0

Index 0x0044

Active Manufacturer Error Details	
Bit 0…31	0

4.2.17 Active Global Device Warning Details

The "active global device warning details" parameter describes the warning state of the complete device.

Index	DataType	NV	Access	Name
0x0045	UDINT		RO	Active Global Device Warning Details
0x0046	UDINT		RO	Active Global Manufacturer Warning Details

Index 0x0045

Active Global Device Warning Details	
Bit 0…31	0

Index 0x0046

Active Global Manufacturer Warning Details (Index F386)	
Bit 0	Internal Communication Exception (between ProfiNet-Controller and Device-Application)
Bit 1…2	0
Bit 3	EEProm CRC warning
Bit 4…31	0

4.2.18 Active Global Device Error Details

The "active global device error details" parameter describes the error state of the complete device.

Index	DataType	NV	Access	Name
0x0047	UDINT		RO	Active Global Device Error Details
0x0048	UDINT		RO	Active Global Manufacturer Error Details

Index 0x0047

Active Global Device Error Details	
Bit 0…2	0
Bit 3	EEProm Exception
Bit 4…31	0

Index 0x0048

Active Global Manufacturer Error Details	
Bit 0	Internal Communication Exception (between Profinet-Controller and Device-Application)
Bit 1…31	0

4.2.19 Trip Point Output All

Index	DataType	NV	Access	Name
0x0006	UDINT		RO	Trip Point Output All Instance

Index 0x0006

Status of Trip Point instances.

Trip Point Output All Instance	
Bit 0	Status High Trip (0x0800)
Bit 1	Status Low Trip (0x0801)
Bit 2	Status High Trip (0x0900)
Bit 3	Status Low Trip (0x0901)
Bit 4…31	0

4.2.20 Configure Device

Index	DataType	NV	Access	Name
0x0021	UINT	x	RW	Data Units Enum

Index 0x0021

Data Unit for Input Sensor as Enum to have a list of possible values.

Data Units	
0x01	Pascal
0x04	mbar
0x05	Torr

4.2.21 Information Device

Index	DataType	NV	Access	Name
0x0049	UDINT		RO	Measurement Principle
0x004A	BYTE		RO	Number of Sensors
0x004C	V_STRING	x	RO	SW Version VPG PCB
0x004D	UINT		RO	Total time powered
0x007C	UDINT		RO	Serial number

Index 0x0049

Measurement principle assigned to the object instance.

The most significant nibble of the parameter represents the sensor type of the first sensor module; the second most significant nibble of the parameter represents the sensor type of the second sensor module, and so forth.

Measurement Principle	
1	Capacitance Manometer
2	Piezo
3	Heat Transfer
4	Cold Cathode
5	Hot Cathode

Index 0x004A

Number of sensors for pressure measurement (always 2).

Index 0x004D

Time the device is powered on in hours.

4.2.22 Device Reset Command

Execution of this command causes the device to emulate a complete power cycle.

As consequence of an reset all following devices are disconnected from the network.

There are two versions of this command:

- Standard reset (as described above)
- Factory reset (as described above, but additionally, all parameters are restored to as-shipped defaults).

Index	DataType	NV	Access	Name
0x0082	BYTE_ARR(6)		RW	Command
0x0083	BYTE		RO	Status
0x0084	BYTE_ARR(2)		RO	Response

Index 0x0082

A device reset is initiated when the following byte sequence is sent.

Command	
Byte 0	0x74
Byte 1	0x65
Byte 2	0x73
Byte 3	0x65
Byte 4	0x72
Byte 5	0x00 = Standard reset, 0x66 = Factory Reset

Index 0x0083

Status (supported values)	
0	Reserved
1	Reserved
2	Last command completed, error, no response
3	Reserved
255	Command is executing

Index 0x0084

Response	
Byte 0	See Index 0x0083
Byte 1	0: not used

4.2.23 Cyclic Data

Telegram 1

Data	DataType
Combination Gauge Active Value	REAL
Combination Gauge Active Sensor Number	UINT
Active Exception Status	USINT
Trip Point Output All Instance	UDINT

Telegram 2

Data	DataType
Combination Gauge Active Value	REAL
Active Exception Status	USINT

Telegram 3

Data	DataType
Combination Gauge Active Value	REAL
Active Exception Status	USINT
Trip Point Output All Instance	UDINT

Telegram 4

Data	DataType
Combination Gauge Active Value	REAL

Telegram 5

Data	DataType
Active Exception Status	USINT

A: Literature

📖 [1] www.inficon.com
Operating Manual
Sky CDG045D
tina51d1 (German)
tina51e1 (English)
INFICON AG, LI–9496 Balzers, Liechtenstein

📖 [2] www.inficon.com
Operating Manual
Sky CDG100D
tina52d1 (German)
tina52e1 (English)
INFICON AG, LI–9496 Balzers, Liechtenstein

📖 [3] www.profibus.com
Profibus user organization

📖 [4] IEC 61158-x-12 (all parts for type 12): Industrial communication networks – Fieldbus specifications

📖 [5] IEC 61784-2: Industrial communication networks – Profiles – Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3

📖 [6] SEMI E54 / Draft 5102A: SPECIFICATION FOR SENSOR/ACTUATOR NETWORK SPECIFIC DEVICE MODEL FOR VACUUM PRESSURE GAUGES

📖 [7] SEMI E52: Practice for referencing gases, gas mixtures and vaporizable materials used in digital mass flow controllers

Notes

Original: English
tirb62e1

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