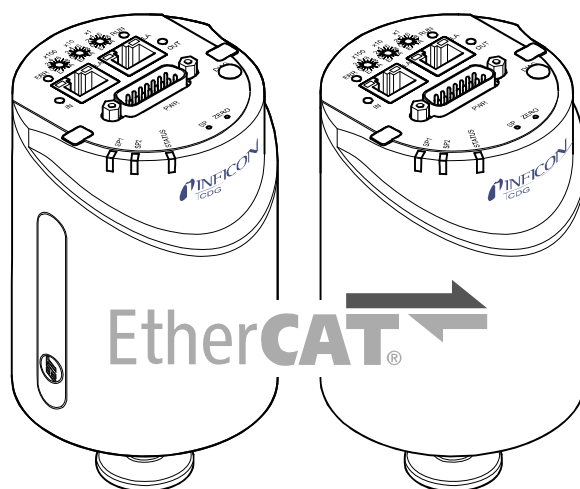


EtherCAT[®]

for Capacitance Diaphragm Gauges

CDG045D, CDG045D2, CDG100D,
CDG100D2, CDG160D, CDG200D



General Information

Caution

Caution: data transmission errors

Any attempt to simultaneously operate the gauge via the RS232C Serial Interface and EtherCAT 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 EtherCAT interface, or the diagnostic port.

Intended Use

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



For safety information, specifications and operation instructions of the vacuum gauges refer to the appropriate documents (→ [1], [2], [3]).

EtherCAT-Interface

The following description of the EtherCAT interface is compliant to the EtherCAT specification of the EtherCAT Technology Group (ETG) and to the "EtherCAT Semiconductor Device Profile".

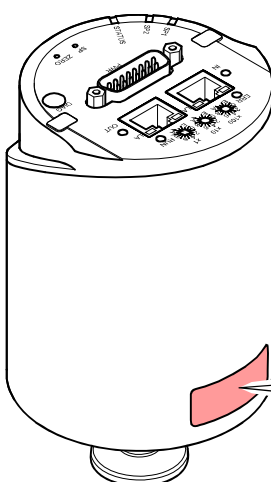
This manual describes the functionality of a EtherCAT slave and supports

- ETG.5003 Part 1: Common Device Profile (CDP) V0.9.0 (→ [12]) and
- ETG.5003 Part 2080: Specific Device Profile (SDP) Vacuum Pressure Gauge V0.4.4 (→ [13]).

We reserve the right to make technical changes without prior notice.

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.

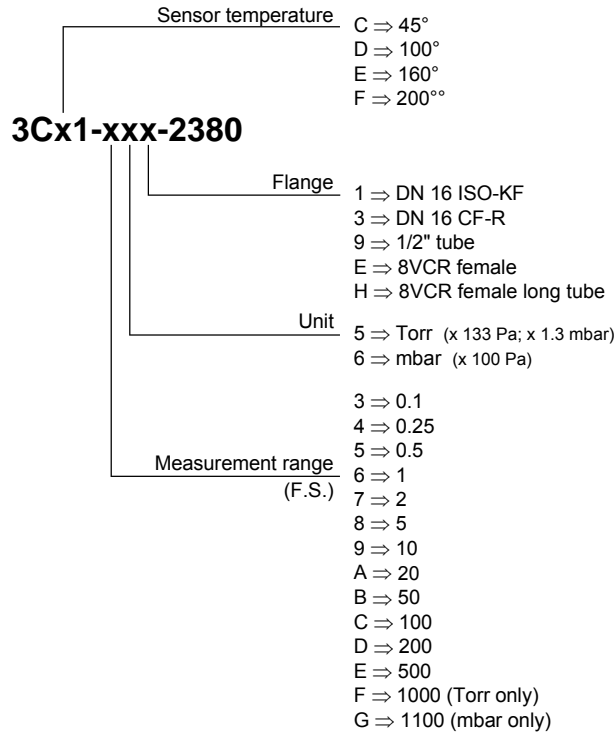


INFICON AG, LI-9496 Balzers		
Model:		
PN:	
SN:	
..... V W		

Validity

This document applies to products of the temperature controlled CDG045D, CDG045D2, CDG100D, CDG100D2, CDG160D and CDG200D series with EtherCAT interface.

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 other vacuum connections and to the other gauges by analogy.

We reserve the right to make technical changes without prior notice.

Trademark

EtherCAT® Beckhoff Automation GmbH, Deutschland

Patents



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

Contents

General Information	2
Intended Use	2
EtherCAT–Interface	2
Product Identification	2
Validity	3
Trademark	3
Patents	3
Contents	4
1 Technical Data	6
2 Interface Connection	7
3 Operation	8
3.1 Introduction	8
3.2 Front View	8
3.3 Indicators and Switches	9
3.3.1 <RUN> LED	9
3.3.2 <ERR> LED	9
3.3.3 <LA> LED (<IN> Port)	9
3.3.4 <LA> LED (<OUT> Port)	9
3.3.5 Device Address Switch	10
4 Object Structure	11
4.1 Object Dictionary structure	11
4.2 Communication Profile Objects (0x1000...0x1FFF)	12
4.3 Manufacturer-specific Profile Objects (0x2000...0x5FFF)	13
4.3.1 Manufacturer Information Common	13
4.3.2 Manufacturer Status	13
4.3.3 Manufacturer Configuration Module 1	14
4.3.4 Manufacturer Configuration Module 2	15
4.4 Input Area (0x6000...0x6FFF)	15
4.4.1 Input Common	15
4.4.2 Input Capacitance Diaphragm	15
4.4.3 Input Common	16
4.4.4 Input Piezo	16
4.4.5 Input Trip Point 1	16
4.5 Configuration Area (0x8000...0x8FFF)	17
4.5.1 Configuration Capacitance Diaphragm	17
4.5.2 Configuration Trip Point 1	17
4.5.3 Configuration Trip Point 2	19
4.6 Information Area (0x9000...0x9FFF)	20
4.6.1 Information Capacitance Diaphragm	21
4.6.2 Information Common	21
4.6.3 Information Piezo	21
4.6.4 Information Trip Point 1/2	22
4.7 Device Area (0xF000...0xAFFF)	22
4.7.1 Semiconductor Device Profile	22
4.7.2 Module Profile List	22
4.7.3 Exceptions	22
4.7.4 Active Exception Status	22
4.7.5 Active Device Warning Details	23
4.7.6 Active Device Error Details	23
4.7.7 Latched Device Warning Details	24
4.7.8 Latched Device Error Details	25
4.7.9 Device Warning Mask	25
4.7.10 Device Error Mask	25
4.7.11 Trip Point Output All	26
4.7.12 Input Latch Local Timestamp	26
4.7.13 Configure Device	26
4.7.14 Information Device	27
4.7.15 Command Zero Adjust	28
4.7.16 Full Scale Adjust	28
4.7.17 Device Reset Command	29
4.7.18 Exception Reset Command	30
4.7.19 Store Parameters Command	30

Appendix
A: Literature

32
32

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

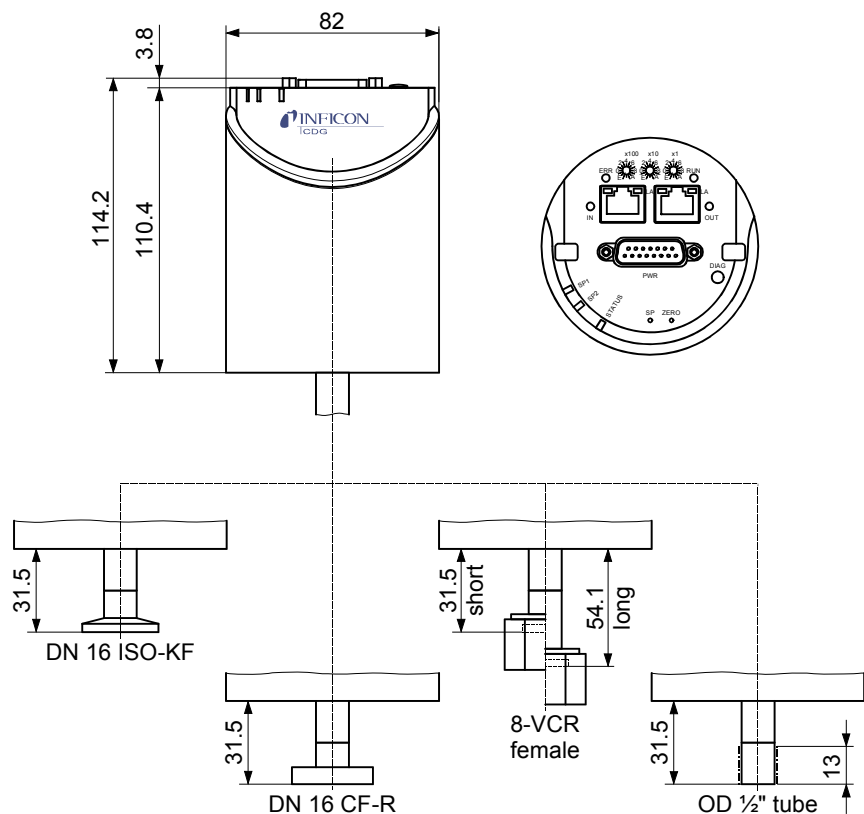


Further technical data → [1], [2], [3].

EtherCAT interface

Communication protocol	protocol specialized for EtherCAT
Communication standards	IEC 61158 -2 (Ed 4.0) IEC 61158 -3/4/5/6-12 (Ed 1.0)
Data rate	100 Mbps
Node address	Explicit Device Identification
Physical layer	100BASE-Tx (IEEE 802.3)
EtherCAT connector	2 × RJ45, 8-pin (socket) <IN>: EtherCAT input <OUT>: EtherCAT output
Cable	shielded, special Ethernet Patch Cable or Crossover Cable (CAT5e quality or higher)
Cable length	≤100 m
Process data	Fixed PDO mapping and configurable PDO mapping
Mailbox (CoE)	SDO requests, responses and information

Dimensions [mm]



2 Interface Connection

Making an EtherCAT interface cable

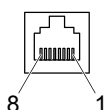
For operating the temperature controlled CDGxxxD gauge via EtherCAT, two interface cables conforming to the EtherCAT standard are required. If no such cables are available, make two according to the following indications.

Cable type

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

Procedure

1 Pin assignment:

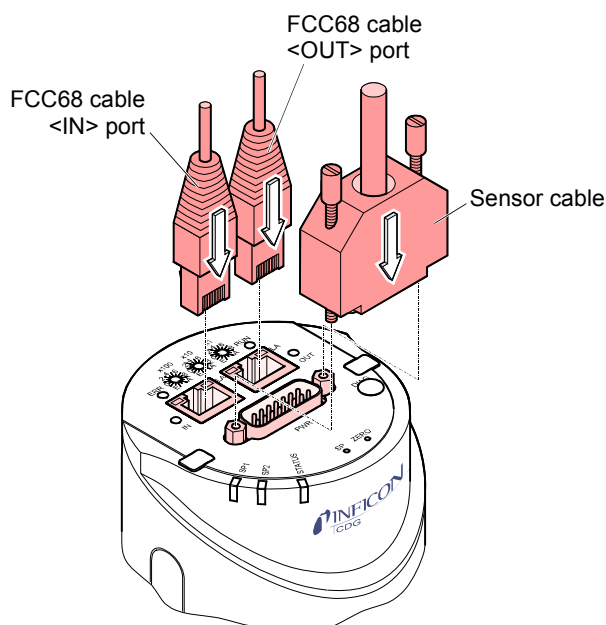


FCC68, 8-pin, male, soldering side

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], [3]).

2 Plug the EtherCAT (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 EtherCAT interface, the following and further data are exchanged in the standardized EtherCAT 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

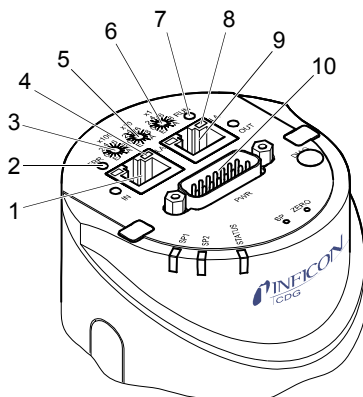


Caution: data transmission errors

Any attempt to simultaneously operate the gauge via the RS232C Serial Interface and EtherCAT 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 EtherCAT interface or the diagnostic port.

3.2 Front View



Position	Label	Function
1	IN	EtherCAT IN connector
2	ERR	Error LED
3	x100	Address Switch × 100, hexadecimal
4	LA	Link activity EtherCAT IN
5	x10	Address Switch × 10, hexadecimal
6	x1	Address Switch × 1, hexadecimal
7	RUN	EtherCAT Status LED
8	LA	Link activity EtherCAT OUT
9	OUT	EtherCAT OUT connector
10	PWR	Sensor cable connector (Power, analog I/O, RS232C I/O and Relay contacts)

3.3 Indicators and Switches

3.3.1 <RUN> LED



Displays the operating status.

Color	LED State	Description
green	off	INIT (initialization status) or no power applied to device.
	blinking (200 ms on 200 ms off)	PREOP (pre-operational status).
	single flash (200 ms on 1000 ms off)	SAFEOP (safe-operational status). Communication of cyclic data transfer running. Input values available, output values written to the device but not updated on device output.
	on	OP (operational status).

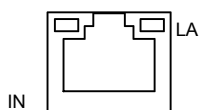
3.3.2 <ERR> LED



Displays the error content.

Color	LED State	Description
red	off	No error or no power applied to device.
	blinking (200 ms on 200 ms off)	Error occurred (see error parameter).
	single flash (200 ms on 1000 ms off)	Slave device application has changed the EtherCAT state autonomously, due to local error (see error parameter).
	double flash (200 ms on 200 ms off 200 ms on 1000 ms off)	An application watchdog timeout has occurred. Sync Manager Watchdog timeout or communication timeout occurred.
	on	A critical communication or application controller error has occurred. Application controller is not responding any more (PDI Watchdog Timeout detected by ESC)

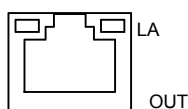
3.3.3 <LA> LED (<IN> Port)



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 not connected but no communication.

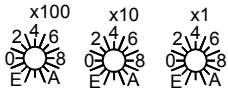
3.3.4 <LA> LED (<OUT> Port)



Displays the output status.

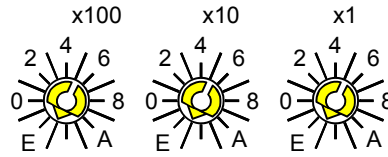
Color	LED State	Description
green	off	Port not connected or no power applied to device.
	blinking	Port connected and communication active.
	on	Port not connected but no communication.

3.3.5 Device Address Switch



During device initialization, the device address switches are read by the device firmware. This device address is supported to the master as Explicit Device Identification.

Example: Value of the Explicit Device ID = 0xDDD (dec 3549):
 $0x100 * 0xD$ (dec 3328) + $0x10 * 0xD$ (dec 208) + $0x1 * 0xD$ (dec 13)



4 Object Structure

This chapter describes the CANopen over EtherCAT (CoE) Object Dictionary.

4.1 Object Dictionary structure

The objects in the CoE Object Dictionary can be accessed with SDO services, and many of the dictionary objects can be mapped for cyclic communication in PDOs. Each object is addressed using a 16-bit index and an 8-bit subindex.

The following table presents the overall layout of the standard Object Dictionary.

Index (hex.)	Object dictionary area	
1000 – 1FFF	Communication profile area	
2000 – 5FFF	Manufacturer-specific profile area	
6000 – 6FFF	Profile Specific Area	Input area
7000 – 7FFF		Output area
8000 – 8FFF		Configuration area
9000 – 9FFF		Information area
A000 – AFFF		Diagnosis area
B000 – BFFF		Service Transfer area
C000 – EFFF		Reserved area
F000 – FFFF		Device area

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

Abbr.	Description
Access	SDO read/write access <ul style="list-style-type: none"> RO: object can only be read by the SDO service RW: object can be both read and written by the SDO service
CoE	CAN application protocol over EtherCAT
Index	Object Index (hex.) (address of an object)
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.
PDO	Process Data Object. Structure described by mapping parameters containing one or several process data entities.
PM	PDO mapping <ul style="list-style-type: none"> Rx: object can be mapped into an Rx PDO Tx : object can be mapped into a Tx PDO
RxPDO	Receive PDO. A Process Data Object received by an EtherCAT slave.
SDO	Service Data Objects. CoE asynchronous mailbox communications where all objects in the Object Dictionary can be read and written.
SI	Subindex (hex.) (sub-address of an object)
Type	Data Type <ul style="list-style-type: none"> 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)
TxPDO	Transmit PDO. A Process Data Object sent from an EtherCAT slave.

4.2 Communication Profile Objects (0x1000...0x1FFF)

The objects of the communication profile describe the basic EtherCAT properties of the CDGxxD and are common to all EtherCAT slaves using the CoE communication protocol. The objects are described in following table:

Index	SI	DataType	NV	Access	PM	Name
1000		UDINT		RO		Device Type
1008		V_STRING		RO		Manufacturer Device name
1009		V_STRING		RO		Manufacturer Hardware Version
100A		V_STRING		RO		Manufacturer Software Version
1010	0x01	UDINT		RW		Store Parameters Read: Bit 0 = 1: slave saves the backup entries when writing 0x1010:01 with 0x65766173 Bit 1-31 = 0 Write: With the value 0x65766173 the backup entries will be stored to non-volatile memory of the slave
1011	0x01	UDINT		RW		Restore Default Parameters Read: Bit 0 = 1: slave supports the restoring of backup entries with the default values when writing 0x1011:01 with 0x64616F6C Bit 1-31 = 0 Write: With the value 0x64616F6C the backup entries will be restored with the default values
1018				RO		Identity Object
	0x01	UDINT		RO		Vendor ID
	0x02	UDINT		RO		Product Code
	0x03	UDINT		RO		Revision Number
	0x04	UDINT		RO		Serial Number
10F8		ULINT		RO		Timestamp Object
1A00		PM		RW		TxPDO Transmit PDO Mapping
	0x01	BIT				Reading Valid Module1
	0x02	BIT				Ovrange Exceeded Module 1
	0x03	BIT				Underrange Exceeded Module 1
	0x04	BIT				Padding Bits 1 (5 bit)
	0x05	REAL				Sensor Value Module 1
	0x06	UDINT				Trip Point Output All Instance
1A01		PM		RW		TxPDO Transmit PDO Mapping, User Mapping

(continued)

(concluded)

Index	SI	Data Type	NV	Access	PM	Name
1A02		PM		RW		TxPDO Transmit PDO Mapping
	0x01	BIT				Reading Valid Module 2
	0x02	BIT				Overrange Exceeded Module 2
	0x03	BIT				Underrange Exceeded Module 2
	0x04	BIT				Padding Bits 1 (5 bit)
	0x05	REAL				Sensor Value Module 2
1A03		PM		RW		TxPDO Transmit PDO Mapping, User Mapping
1C00	0x01 0x02 0x03 0x04	BYTE		RW		Sync Manager Type
1C12 / 1C13	0x01 0x02 0x03 0x04	UINT		RW		Sync Manager PDO Assignment
1C32 / 1C33	0x01 - 0x20			RW		Sync Manager Parameter

4.3 Manufacturer-specific Profile Objects (0x2000...0x5FFF)

The manufacturer-specific profile objects contain the manufacturer's model number and device configuration data, status and diagnostic data. The objects are described in the following tables.

4.3.1 Manufacturer Information Common

Index	SI	Data Type	NV	Access	PM	Name
2001		V_STRING		RO		Manufacturer's Model Number
2002		V_STRING		RO		Device Configuration

4.3.2 Manufacturer Status

Index	SI	Data Type	NV	Access	PM	Name
2600	0x01	BYTE		RO		Status

Subindex 0x01

Alarm and Warning State of Module 1	
Bit 0	High Alarm Exception (0 = cleared, 1 = set)
Bit 1	Low Alarm Exception (0 = cleared, 1 = set)
Bit 2	High Warning Exception (0 = cleared, 1 = set)
Bit 3	Low Warning Exception (0 = cleared, 1 = set)
Bit 4...7	0

4.3.3 Manufacturer Configuration Module 1

Index	SI	Data Type	NV	Access	PM	Name
2800	0x01	BYTE		RW		Safe State
	0x02	REAL		RW		Safe Value
	0x03	BOOL		RW		Alarm Enable
	0x04	BOOL		RW		Warning Enable
	0x05	REAL		RW		Alarm Trip Point High
	0x06	REAL		RW		Alarm Trip Point Low
	0x07	REAL		RW		Alarm Hysteresis
	0x08	REAL		RW		Warning Trip Point High
	0x09	REAL		RW		Warning Trip Point Low
	0x0A	REAL		RW		Warning Hysteresis
	0x0B	BYTE		RW		Filter

Subindex 0x01

Specifies the behavior for the value for States other than Valid.

Safe State	
0	Zero
1	Full Scale
2	Hold last value
3	Use safe value

Subindex 0x02

Safe Value: The value to be used for Safe State = Safe Value.

Subindex 0x03

Alarm Enable: Enables the setting of the Alarm Status Bits.

Subindex 0x04

Warning Enable: Enables the setting of the Warning Status Bits.

Subindex 0x05

Alarm Trip Point High: Determines the value above which an Alarm Condition will occur.

Subindex 0x06

Alarm Trip Point Low: Determines the value below which an Alarm Condition will occur.

Subindex 0x07

Alarm Hysteresis: Determines the amount by which the value must recover to clear an Alarm Condition.

Subindex 0x08

Warning Trip Point High: Determines the value above which a Warning Condition will occur.

Subindex 0x09

Warning Trip Point Low: Determines the value below which a Warning Condition will occur.

Subindex 0x0A

Warning Hysteresis: Determines the amount by which the value must recover to clear a Warning Condition.

Subindex 0x0B

Filter	
0	Dynamic (factory default)
1	Fast
2	Slow

4.3.4 Manufacturer Configuration Module 2

Index	SI	Data Type	NV	Access	PM	Name
2801	0x01	BYTE		RW		Safe State
	0x02	REAL		RW		Safe Value

Subindex 0x01

Specifies the behavior for the Value for states other than Valid.

Safe State	
0	Zero
1	Full Scale
2	Hold last value
3	Use safe value

Subindex 0x02

Safe Value: The value to be used for Safe State = Safe Value.

4.4 Input Area (0x6000...0x6FFF)

4.4.1 Input Common

Index	SI	Data Type	NV	Access	PM	Name
6000	0x0E	BOOL		RO	tx	TxPdoState
	0x11	REAL		RO	tx	Sensor Value

Subindex 0x0E

Is set if the device is not in Safe State (value (I 0x6nn0, SI 0x11) = valid)

TxPdoState	
0	Invalid
1	Valid

Subindex 0x11

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

4.4.2 Input Capacitance Diaphragm

Index	SI	Data Type	NV	Access	PM	Name
6001	0x01	BOOL		RO	tx	Reading Valid
	0x02	BOOL		RO	tx	Overrange Exceeded
	0x03	BOOL		RO	tx	Underrange Exceeded

Subindex 0x01

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

Reading Valid	
0	Invalid
1	Valid

Subindex 0x02

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

Reading Valid	
0	No Overrange Exceeded
1	Overrange Exceeded

Subindex 0x03

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

Reading Valid	
0	No Underrange Exceeded
1	Underrange Exceeded

4.4.3 Input Common

Index	SI	DataType	NV	Access	PM	Name
6010	0x0E	BOOL		RO	tx	TxPdoState
	0x11	REAL		RO	tx	Sensor Value

Subindex 0x0E

Is set if the device is not in Safe State (value (I 0x6nn0, SI 0x11) = valid)

TxPdoState	
0	Invalid
1	Valid

Subindex 0x11

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

4.4.4 Input Piezo

Index	SI	DataType	NV	Access	PM	Name
6012	0x01	BOOL		RO	tx	Reading Valid
	0x02	BOOL		RO	tx	Ovrange Exceeded
	0x03	BOOL		RO	tx	Underrange Exceeded

Subindex 0x01

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

Reading Valid	
0	Invalid
1	Valid

Subindex 0x02

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

Reading Valid	
0	No Ovrange Exceeded
1	Ovrange Exceeded

Subindex 0x03

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

Reading Valid	
0	No Underrange Exceeded
1	Underrange Exceeded

4.4.5 Input Trip Point 1

Index	SI	DataType	NV	Access	PM	Name
600E	0x01	BOOL		RO	tx	Status High Trip
	0x02	BOOL		RO	tx	Status Low Trip
600F	0x01	BOOL		RO	tx	Status High Trip
	0x02	BOOL		RO	tx	Status Low Trip

Subindex 0x01

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

Subindex 0x02

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

4.5 Configuration Area (0x8000...0x8FFF)

4.5.1 Configuration Capacitance Diaphragm

Index	SI	Data Type	NV	Access	PM	Name
8001	0x12	REAL	x	RW		Offset Customer Specific

Subindex 0x12

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 (I: 0x6000, SI: 0x11)

***) Accumulated Zero Offset (I: 0x9000, SI: 0x01)

****) Offset Customer Specified (I: 0x8001, SI: 0x12)

4.5.2 Configuration Trip Point 1

The High Trip Point is calculated by:

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

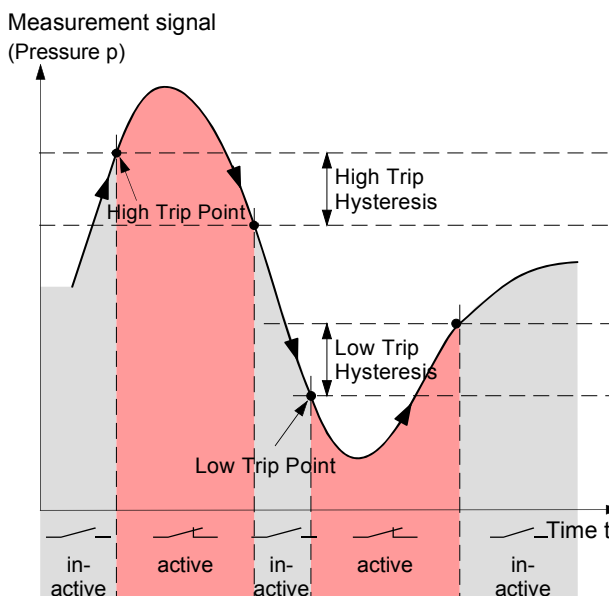
*) Value from Piezo Sensor (I: 0x6010, SI: 0x11)

***) Percentage High Trip Source (I: 0x800E/F, SI: 0x13)

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 with an abort code.

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.



Index	SI	Data Type	NV	Access	PM	Name
800E	0x01	BOOL	x	RO		High Trip Enable
	0x02	BOOL	x	RO		Low Trip Enable
	0x11	REAL	x	RO		High Trip Point Limit
	0x13	REAL	x	RW		Percentage High Trip Source
	0x14	REAL	x	RW		Low Trip Point Limit
	0x17	REAL	x	RO		High Trip Hysteresis
	0x18	REAL	x	RW		Low Trip Hysteresis
	0x1A	UDINT	x	RO		Source Index

Subindex 0x01

High Trip Point	
0	Disable
1	Enable

Subindex 0x02

Low Trip Point	
0	Disable
1	Enable

Subindex 0x11

High Trip Point Limit: High limit to trigger trip point condition if Input Value (I 0x900E, SI 0x01) is above this limit.

Subindex 0x13

Percentage of High Trip Source: Percentage of Piezo Sensor Value (I 0x6010, SI 0x11) in [%].

Subindex 0x14

Low Trip Point Limit: Low limit to trigger trip point condition if Input Value (I 0x900E, SI 0x01) is below this limit.

Subindex 0x17

High Trip Hysteresis: Hysteresis value for High Trip Point.

Subindex 0x18

Low Trip Hysteresis: Hysteresis value for Low Trip Point.

Subindex 0x1A

Object index of active source of (I 0x900E SI 0x01) Input Value.

Source Index	
Bit 16...31	Index
Bit 08...15	Subindex
Bit 00...07	Reserved

4.5.3 Configuration Trip Point 2

Calculating the High Trip Point and Low Trip Point → 4.4.7.

Index	SI	Data Type	NV	Access	PM	Name
800F	0x01	BOOL	x	RO		High Trip Enable
	0x02	BOOL	x	RO		Low Trip Enable
	0x11	REAL	x	RO		High Trip Point Limit
	0x13	REAL	x	RW		Percentage High Trip Source
	0x14	REAL	x	RW		Low Trip Point Limit
	0x17	REAL	x	RO		High Trip Hysteresis
	0x18	REAL	x	RW		Low Trip Hysteresis
	0x1A	UDINT	x	RO		Source Index

Subindex 0x01

High Trip Point	
0	Disable
1	Enable

Subindex 0x02

Low Trip Point	
0	Disable
1	Enable

Subindex 0x11

High Trip Point limit: High limit to trigger trip point condition if Input Value (I 0x900F, SI 0x01) is above this limit.

Subindex 0x13

Percentage of High Trip Source: Percentage of Piezo Sensor Value (I 0x60010, SI 0x11) in [%].

Subindex 0x14

Low Trip Point Limit: Low limit to trigger trip point condition if Input Value (I 0x900F, SI 0x01) is below this limit.

Subindex 0x17

High Trip Hysteresis: Hysteresis value for High Trip Point.

Subindex 0x18

Low Trip Hysteresis: Hysteresis value for Low Trip Point.

Subindex 0x1A

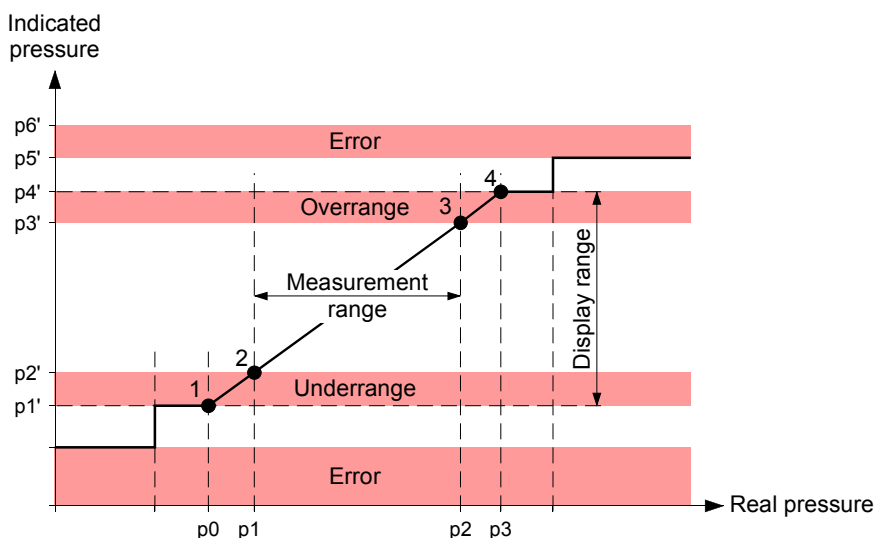
Object index of active source of (I 0x900F SI 0x01) Input Value.

Source Index	
Bit 16...31	Index
Bit 08...15	Subindex
Bit 00...07	Reserved

4.6 Information Area (0x9000...0x9FFF)

Highest / lowest measurement value

The Information Data object defines the input process data.



The "measurement range" is the range between minimum and maximum pressure, where the reading of the gauge is within the specified measurement uncertainty limits.

The "valid measurement information range" (display range) is the complete pressure range where the gauge gives an indication (measurement signal). The valid measurement information range (display range) consists of underrange, measurement range and overrange.

According to these definitions, 4 points are defined:

- 1 Lowest informational measurement value
- 2 Lowest precision measurement value
- 3 Highest precision measurement value
- 4 Highest informational measurement value

Index	SI	Data Type	NV	Access	PM	Name
9000	0x01	REAL	x	RO		Accumulated Zero Offset
	0x02	REAL	x	RO		Highest Informational Measurement Value
	0x03	REAL	x	RO		Highest Precision Measurement Value
	0x04	REAL	x	RO		Lowest Precision Measurement Value

Subindex 0x01

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

Subindex 0x02

Highest Informational Measurement Value: Highest value that the gauge can measure without a specified accuracy.

Subindex 0x03

Highest Precision Measurement Value: Highest valid value at which the gauge is specified with an accuracy value. Above that value, the parameter Reading Valid is set to invalid.

Subindex 0x04

Lowest Precision Measurement Value: Lowest valid value at which the gauge is specified with an accuracy value. Below that value, the parameter Reading Valid is set to invalid.

4.6.1 Information Capacitance Diaphragm

Index	SI	Data Type	NV	Access	PM	Name
9001	0x01	UINT		RO		Sensor Warning
	0x02	UINT		RO		Sensor Alarm

Subindex 0x01

Sensor Warnings	
Bit 0	Not at temperature
Bit 1...8	0
Bit 9	Electronics Warning
Bit 10...13	0
Bit 14	Low Warning Exception
Bit 15	High Warning Exception

Subindex 0x02

Sensor Alarms	
Bit 0...8	0
Bit 9	Electronics Failure
Bit 10...13	0
Bit 14	Low Alarm Exception
Bit 15	High Alarm Exception

4.6.2 Information Common

Index	SI	Data Type	NV	Access	PM	Name
9010	0x01	REAL	x	RO		Accumulated Zero Offset
	0x02	REAL	x	RO		Highest Informational Measurement Value
	0x03	REAL	x	RO		Highest Precision Measurement Value
	0x04	REAL	x	RO		Lowest Precision Measurement Value

Subindex 0x01

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

Subindex 0x02

Highest Informational Measurement Value: Highest value that the gauge can measure without a specified accuracy.

Subindex 0x03

Highest Precision Measurement Value: Highest valid value at which the gauge is specified with an accuracy value. Above that value, the parameter Reading Valid is set to invalid.

Subindex 0x04

Lowest Precision Measurement Value: Lowest valid value at which the gauge is specified with an accuracy value. Below that value, the parameter Reading Valid is set to invalid.

4.6.3 Information Piezo

Index	SI	Data Type	NV	Access	PM	Name
9012	0x01	UINT		RO		Sensor Warning
	0x02	UINT		RO		Sensor Alarm

Subindex 0x01

Sensor Warnings	
Bit 0...15	0

Subindex 0x02

Sensor Alarms	
Bit 0...15	0

4.6.4 Information Trip Point 1/2

Index	SI	DataType	NV	Access	PM	Name
900E	0x01	REAL		RO		Input Value Trip Point 1
900F	0x02	REAL		RO		Input Value Trip Point 2

Subindex 0x01

Input Value Trip Point 1: Trip Point Input value as referenced by Source Index (I 0x800E, SI 0x0E).

Subindex 0x02

Input Value Trip Point 2: 0 Trip Point Input value as referenced by Source Index (I 0x800F, SI 0x0E).

4.7 Device Area (0xF000...0xAFFF)

4.7.1 Semiconductor Device Profile

Index	SI	DataType	NV	Access	PM	Name
F000	0x01	UINT		RO		Index Distance
	0x02	UINT		RO		Maximum Number of Modules

Subindex 0x01

Index Distance: Index offset between PDO entries of two consecutive modules (for ETG.5003 = 0x10), e.g. 0x6000, 0x6010.

Subindex 0x02

Maximum Number of Modules: Up to 255 modules are possible. A device can support less than this. This entry describes the supported number of modules.

4.7.2 Module Profile List

Index	SI	DataType	NV	Access	PM	Name
F010	0x01	UDINT		RO		Profile Number Module 1
	0x02	UDINT		RO		Profile Number Module 2

Subindex 0x01

Each sub-index lists the profile-number of the corresponding module.

Subindex 0x02

Each sub-index lists the profile-number of the corresponding module.

4.7.3 Exceptions

4.7.4 Active Exception Status

Index	SI	DataType	NV	Access	PM	Name
F380		USINT		RO	tx	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

4.7.5 Active Device Warning Details

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

Index	SI	Data Type	NV	Access	PM	Name
F381	0x01	UDINT		RO	tx	Active Device Warning Details Device
	0x02	UDINT		RO	tx	Active Device Warning Details Module 1
	0x03	UDINT		RO	tx	Active Device Warning Details Module 2
F382	0x01	UDINT		RO	tx	Active Manufacturer Warning Details

Subindex 0x01

Active Device Warning Details(Index F381)	
Bit 0...2	0
Bit 3	EEPROM exception
Bit 4...31	0

Subindex 0x02

Active Device Warning Details Module 1 (Index F381)	
Bit 0	Not at temperature
Bit 1...8	0
Bit 9	Electronics warning
Bit 10...13	0
Bit 14	Low Warning Exception
Bit 15	High Warning Exception
Bit 16...31	0

Subindex 0x03

Active Device Warning Details Module 2 (Index F381)	
Bit 0...31	0

Subindex 0x01

Active Manufacturer Warning Details (Index F382)	
Bit 0	Internal Communication Exception (between EtherCAT-Protocol and Device-Application)
Bit 1	Atmosphere Pressure out of Range Exception (only as Warning, 0 for Error)
Bit 2...31	0

4.7.6 Active Device Error Details

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

Index	SI	Data Type	NV	Access	PM	Name
F383	0x01	UDINT		RO	tx	Active Device Error Details Device
	0x02	UDINT		RO	tx	Active Device Error Details Module 1
	0x03	UDINT		RO	tx	Active Device Error Details Module 2
F384	0x01	UDINT		RO	tx	Active Manufacturer Error Details

Subindex 0x01

Active Device Error Details (Index F383)	
Bit 0...2	0
Bit 3	EEPROM exception
Bit 4...31	0

Subindex 0x02

Active Device Error Details (Index F383)	
Bit 0...8	0
Bit 9	Electronics failure
Bit 10...13	0
Bit 14	Low Alarm Exception
Bit 15	High Alarm Exception
Bit 3...31	0 (reserved)

Subindex 0x03

Active Device Error Details (Index F383)	
Bit 0...31	0

Subindex 0x01

Active Manufacturer Error Details (Index F384)	
Bit 0	Internal Communication Exception (between EtherCAT-Protocol and Device-Application)
Bit 1	Atmosphere Pressure out of Range Exception (only as Warning, 0 for Error)
Bit 2...31	0

4.7.7 Latched Device Warning Details

Index	SI	DataType	NV	Access	PM	Name
F390		USINT		RO	tx	Latched Exceptions Status
F391	0x01	UDINT		RO	tx	Latched Device Warning Details Device
	0x02	UDINT		RO	tx	Latched Device Warning Details Module 1
	0x03	UDINT		RO	tx	Latched Device Warning Details Module 2
F392	0x01	UDINT		RO	tx	Latched Manufacturer Warning Details

Latched Exceptions Status

Latched version of 0xF380.

Subindex 0x01

Latched Device Warning Details Device: Latched version of 0xF381:01.

Subindex 0x02

Latched Device Warning Details Module 1: Latched version of 0xF381:02.

Subindex 0x03

Latched Device Warning Details Module 2: Latched version of 0xF381:03.

Subindex 0x01 (F392)

Latched Manufacturer Warning Details: Latched version of 0xF382:01.

4.7.8 Latched Device Error Details

Index	SI	Data Type	NV	Access	PM	Name
F393	0x01	UDINT		RO	tx	Latched Device Error Details Device
	0x02	UDINT		RO	tx	Latched Device Error Details Module 1
	0x03	UDINT		RO	tx	Latched Device Error Details Module 2
F394	0x01	UDINT		RO	tx	Latched Manufacturer Error Details

Subindex 0x01

Latched Device Error Details Device: Latched version of 0xF383:01.

Subindex 0x02

Latched Device Error Details Module 1: Latched version of 0xF383:02.

Subindex 0x03

Latched Device Error Details Module 2: Latched version of 0xF383:03.

Subindex 0x01 (F394)

Latched Manufacturer Error Details: Latched version of 0xF384:01.

4.7.9 Device Warning Mask

Index	SI	Data Type	NV	Access	PM	Name
F3A1	0x01	UDINT	x	RW		Device Warning Mask Device
	0x02	UDINT	x	RW		Device Warning Mask Module 1
	0x03	UDINT	x	RW		Device Warning Mask Module 2
F3A2	0x01	UDINT	x	RW		Manufacturer Warning Mask

Subindex 0x01

Device Warning Mask Device: Mask bits for 0xF381:01 and 0xF391:01.

Subindex 0x02

Device Warning Mask Module 1: Mask bits for 0xF381:02 and 0xF391:02.

Subindex 0x03

Device Warning Mask Module 2: Mask bits for 0xF381:03 and 0xF391:03.

Subindex 0x01 (F3A2)

Manufacturer Warning Mask: Mask bits for 0xF382:01 and 0xF392:01.

4.7.10 Device Error Mask

Index	SI	Data Type	NV	Access	PM	Name
F3A3	0x01	UDINT	x	RW		Device Error Mask Device
	0x02	UDINT	x	RW		Device Error Mask Module 1
	0x03	UDINT	x	RW		Device Error Mask Module 2
F3A4	0x01	UDINT	x	RW		Manufacturer Error Mask

Subindex 0x01

Device Error Mask Device: Mask bits for 0xF383:01 and 0xF393:01.

Subindex 0x02

Device Error Mask Module 1: Mask bits for 0xF383:02 and 0xF393:02.

Subindex 0x03

Device Error Mask Module 2: Mask bits for 0xF383:03 and 0xF393:03.

Subindex 0x01 (F3A4)

Manufacturer Error Mask: Mask bits for 0xF384:01 and 0xF394:01.

4.7.11 Trip Point Output All

Index	SI	DataType	NV	Access	PM	Name
F641	0x01	UDINT		RO	tx	Trip Point Output All Instance

Subindex 0x01

Status of Trip Point instances.

Trip Point Output All Instance	
Bit 0	Status High Trip (I 0x600E, SI 0x01)
Bit 1	Status Low Trip (I 0x600E S, I 0x02)
Bit 2	Status High Trip (I 0x600F, SI 0x01)
Bit 3	Status Low Trip (I 0x600F, SI 0x02)
...	...
Bit 30	Status High Trip (I 0x608F, SI 0x01)
Bit 31	Status Low Trip (I 0x608F, SI 0x02)

4.7.12 Input Latch Local Timestamp

Index	SI	DataType	NV	Access	PM	Name
F6F0	0x01	UDINT		RO	tx	Input Latch Local Timestamp. Mandatory if device has inputs (TxPDOs)
	0x02	UDINT		RO	tx	Input Latch Local Timestamp. Mandatory if device has inputs (TxPDOs)

Subindex 0x01

Local controller time corresponding to the input latch time in microseconds. It starts at zero on device power-up. Mandatory if device has inputs. If device has no inputs defined, this corresponds the time immediately prior to writing to input SM.

Subindex 0x02

Local controller time corresponding to the input latch time in microseconds. It starts at zero on device power-up. Mandatory if device has inputs. If device has no inputs defined, this corresponds the time immediately prior to writing to input SM.

4.7.13 Configure Device

Index	SI	DataType	NV	Access	PM	Name
F840	0x01	UDINT	x	RW		Data Units

Subindex 0x01

Unit of the Value of the Analog Input Sensor Instance and all related parameters.

Trip Point Output All Instance	
0x00220000	Pascal
0xFD4E0000	mbar
0x00A10000	Torr
0x00E00000	Counts (INFICON)

4.7.14 Information Device

Index	SI	Data Type	NV	Access	PM	Name
F940	0x01	UDINT		RO		Measurement Principle
	0x02	BYTE		RO		Number of Sensors
	0x04	V_STRING	x	RO		SW Version VPG PCB
F9F0		V_STRING		RO		Manufacturer Serial Number
F9F1	0x01	UDINT		RO		CDP Functional Generation Number Module 1
	0x02			RO		CDP Functional Generation Number Module 2
F9F2	0x01	UDINT		RO		SDP Functional Generation Number Module 1
	0x02	UDINT		RO		SDP Functional Generation Number Module 2
F9F3		V_STRING		RO		Vendor Name
F9F4	0x01	V_STRING		RO		Semiconductor SDP Device Name Module 1
	0x02	V_STRING		RO		Semiconductor SDP Device Name Module 2
F9F5	0x01	USINT		RW		Data stamp Module 1
	0x02	USINT		RW		Data stamp Module 2
F9F6		UDINT		RO		Time since power on
F9F7		UDINT	x	RO		Total time powered
F9F8	0x01	UDINT		RO		Firmware Update Functional Generation Number Module 1
F9F8	0x02	UDINT		RO		Firmware Update Functional Generation Number Module 2

Subindex 0x01 (F940)

Measurement principle assigned to the object instance.

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

Measurement Principle (Index F940)	
1	Capacitance Manometer
2	Piezo
3	Heat Transfer
4	Cold Cathode
5	Hot Cathode

Subindex 0x02 (F940)

Number of Sensors (Index F940): The number of sensors implemented on the device.

Subindex 0x04 (F940)

If the device consists out of several software portions this parameter should be used.

Using standard a.b.c.d format to describe a version:

SW Version VPG PCB (Index F940)	
a	Major revision
b	Minor revision
c	Development revision
d	Vendor specific
i.e. 1.0.1.2	

4.7.15 Command Zero Adjust

Execution of this command will start a Zero Adjust operation.

Index	SI	Data Type	NV	Access	PM	Name
FB40	0x01	V_STRING		RW		Command
	0x02	BYTE		RO		Status
	0x03	V_STRING		RO		Response

Subindex 0x01

If the device consists out of several software portions this parameter should be used.

Using standard a.b.c.d format to describe a version:

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

Subindex 0x02

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

Subindex 0x03

Response	
Byte 0	See Subindex 0x02
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 255: No previous Zero Adjust command issued

4.7.16 Full Scale Adjust

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

Index	SI	Data Type	NV	Access	PM	Name
FB41	0x01	V_STRING		RW		Command
	0x02	BYTE		RO		Status
	0x03	V_STRING		RO		Response

Subindex 0x01

Command	
Byte 0	0: Full Scale Adjust
Byte 1	Index of the Sub Sensor Instance (1-8)
Byte 2...5	Full Scale value (Data format: REAL, always 0)

Subindex 0x02

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

Subindex 0x03

Response	
Byte 0	See Subindex 0x02
Byte 1	Unused
Byte 2	0: Full Scale Adjust successful 1: Full Scale Adjust failed: out-of-range 255: No previous Full Scale Adjust command issued

4.7.17 Device Reset Command

Execution of this command causes the device to emulate a complete power cycle. This includes an ESC reset. An SDP may limit some behavior of the power cycle emulation, but shall not exclude the EtherCAT interface.



As consequence of an ESC 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	SI	Data Type	NV	Access	PM	Name
FBF0	0x01	V_STRING		RW		Command
	0x02	BYTE		RO		Status
	0x03	V_STRING		RO		Response

Subindex 0x01

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

Subindex 0x02

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

Subindex 0x03

Response	
Byte 0	See Subindex 0x02
Byte 1	Unused
Byte 2...n	Unused

4.7.18 Exception Reset Command

Execution of this command clears the latched exceptions.

Index	SI	DataType	NV	Access	PM	Name
FBF1	0x01	V_STRING		RW		Command
	0x02	BYTE		RO		Status
	0x03	V_STRING		RO		Response

Subindex 0x01

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

Subindex 0x02

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

Subindex 0x03

Response	
Byte 0	See Subindex 0x02
Byte 1	Unused
Byte 2...n	Unused

4.7.19 Store Parameters Command

Execution of this command will store all parameters to non-volatile memory. If a device automatically saves all non-volatile parameters at the time they are set, this command will not take any action.

Index	SI	DataType	NV	Access	PM	Name
FBF2	0x01	V_STRING		RW		Command
	0x02	BYTE		RO		Status
	0x03	V_STRING		RO		Response

Subindex 0x01

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

Command	
Byte 0	0x65
Byte 1	0x76
Byte 2	0x61
Byte 3	0x73

Subindex 0x02


















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

Subindex 0x03

Response	
Byte 0	See Subindex 0x02
Byte 1	Unused
Byte 2...n	Unused

Appendix

A: Literature

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 Operating Manual
 CDG045D
 tina51d1 (German)
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 INFICON AG, LI-9496 Balzers, Liechtenstein
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 CDG100D
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Notes

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tira68e1



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