8270/8826
CANopen Miniature Pressure-Transmitter CMP
Version 2.0

Operating Instructions (Software)

English

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Overview

Manual

This document contains device specific information as well as additional information regarding its CANopen functionality.
Basic device features correspond to CANopen standards DS-301 V4.02 and DS-404 V1.2 (www.can-cia.org).

Description of instrument

The CMP (CANopen miniature Pressure Transmitter) is a precision pressure transducer with CANopen-interface according to CiA (CAN in Automation)-specifications DS-301/DS-404. The physical CAN-interface corresponds to DIN specification ISO 11898.
By means of a thin film-on-steel sensor pressure is measured with a resolution of 20Bit/s ($\Delta\Sigma$-converter), temperature with a resolution of 13 bit. Every 1 ms the pressure value is sampled mathematically linearized and temperature compensated. The resulting resolution is limited to 13bit (0…2000h). Two variable „Moving-Average-Filters", one for pressure (1ms...65s) and one for temperature (0.1s… 1.82h) ensure an optimum measurement filtration. The mappable measuring field values (see „Mapping Mode") are available for all data types (Float, Integer32/24/16) and for all mostly required measuring units (bar, Pa, psi, mmHg, atm, at, °C, °F, K).
The node supports all CiA baudrates from 10kbit/s…1Mbit/s and format CAN 2.0 A/B. The CCP is equipped with 4 PDO's which can be transmitted every 1ms. All Transmission Types defined in DS-301 can be used. In addition to features such as Permanent-Self-Test, Auto-Zero-Function, Auto-Start, etc. 4 switching thresholds with 8 configurable CAN-Messages are available. Communication and application parameters can be stored separately and can be reset to the initial factory configuration.

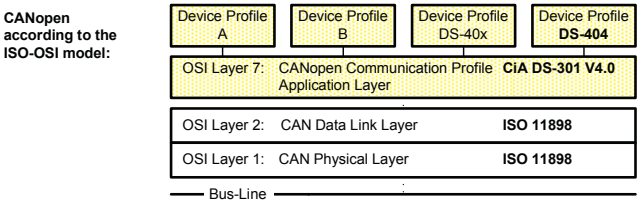
CANopen

CANopen is an open communication profile based on CAN (Controller Area Network), a bussystem developed several years ago by the company R. Bosch for data transfer in motor vehicles. CAN is internationally standardized in ISO 11898.
CANopen is a widely used CAN application layer, developed by the CiA which has meanwhile been adopted for international standardization. CANopen consists of the protocol definitions (communication profile) and of the device profiles that standardize the data contents for the various device classes.
CANopen defines a number of transmission types for the input and output data (process data objects):
– Timer driven: Telegrams are sent if a specified time period has elapsed.
– Event driven: Telegrams are sent as soon as their contents have changed (by the occurrence of an object specific event).
– Cyclic synchronous: A SYNC telegram causes the devices to measure or/and to send actual measuring data.
– Requested: A CAN data request telegram causes the device to send its measuring data.

The Trafag CANopen miniature Pressure Transmitter CMP is parameterized by means of acyclic services (service data objects).
9 transmission rates from 10kbit/s to 1Mbit/s are available for different bus lengths. The effective utilisation of the bus bandwidth allows CANopen to achieve short system reaction times at relatively low data rates.

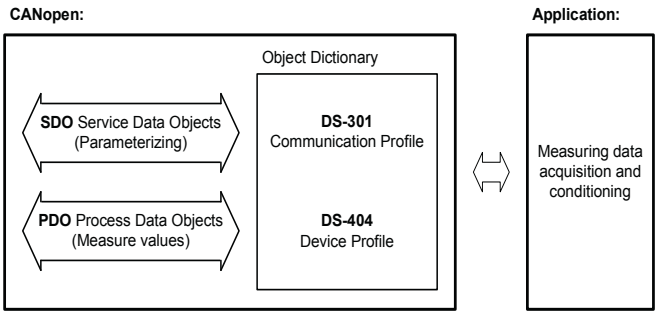
A CAN-Bus system according to the ISO-OSI model shows that CAN only defines the two lower layers (the physical and the data link layer) and CANopen defines the seventh layer (application layer). CANopen Communication- and Device Profiles were published as Profiles DS-301and DS-40x by the international CAN-organization CAN in Automation e.V. The Profile DS-301 defines the „HOW" of communication, while the „WHAT" (meaning of data) is defined by the requirements of the individual devices. Measuring and control units are based on device profile DS-404 (Measuring Devices and Closed-Loop Controllers).

The CANopen pressure sensor from Trafag has been certified by the CiA (CAN in Automation). The sensor has a comprehensive implementation of the CANopen protocol.
With the active membership of the CiA (CAN in Automation), Trafag contributes to the further development of this bus-system.



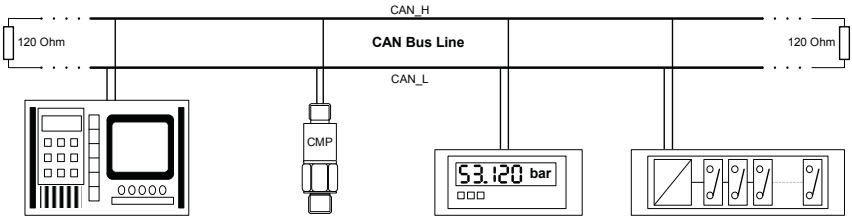
Object Dictionary, PDO und SDO

The CANopen communication profile is based on an object dictionary. The communication profile DS-301 defines two types of data objects as well as a number of special objects. The process data objects (PDO) serve the transmission of real time data and the service data objects (SDO) allow access to the object dictionary. The object dictionary contains all settings (parameters) of the unit. The parameters are read, respectively written by a multiplexor (address). The multiplexor consists of a 16-bit index and a 8 bit subindex that addresses the relevant data in the object dictionary. Special objects (DS-301) are required for synchronization (SYNC), Emergency (EMCY), as well as Nodeguarding, Heartbeat and Network Management (NMT).



Topology

CAN is based on a busline topology. CANopen logically limits the number of devices per net to 127, physically, the present driver generation permits 110 nodes in one net segment. The maximum net expansion is limited by the propagation delay of the bus medium. 1Mbit/s e.g. corresponds to a net expansion of 25m, while at 10kbit/s a net expansion of 5000m is possible.



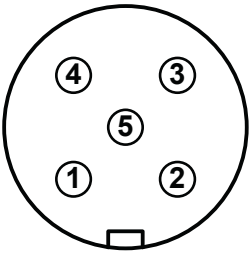
Bus access procedure

CAN operates on the basis of the Carrier-Sense-Multiple Access with Collision Avoidance (CSMA/CA) method. i.e. with regard to bus access each user is equal to the other and can access the bus as soon as the bus is free (Multi-Master-Bus Access). The exchange of information is not member related but message related. Each message is uniquely defined by a priority identifier. In order to avoid a collision (crash) when several users are transferring data simultaneously, a bit by bit bus arbitration is made over the identifier when starting data transfer. The message with the highest priority, i.e. having the lowest identifier, will be transferred first while all other messages will be transferred in accordance to their priority rating.

Configuration and parameter definition

Manufacturers of CANopen Masters supply software configuration tools for the parameter definition and configuration of the CANopen network. These tools access the object dictionary via SDO. The configuration tools receive parameter information of the device through an EDS-file (electronic data sheet) which basically contains the object dictionary listings.
For further information please contact Trafag AG (www.trafag.com).

Connector



Male

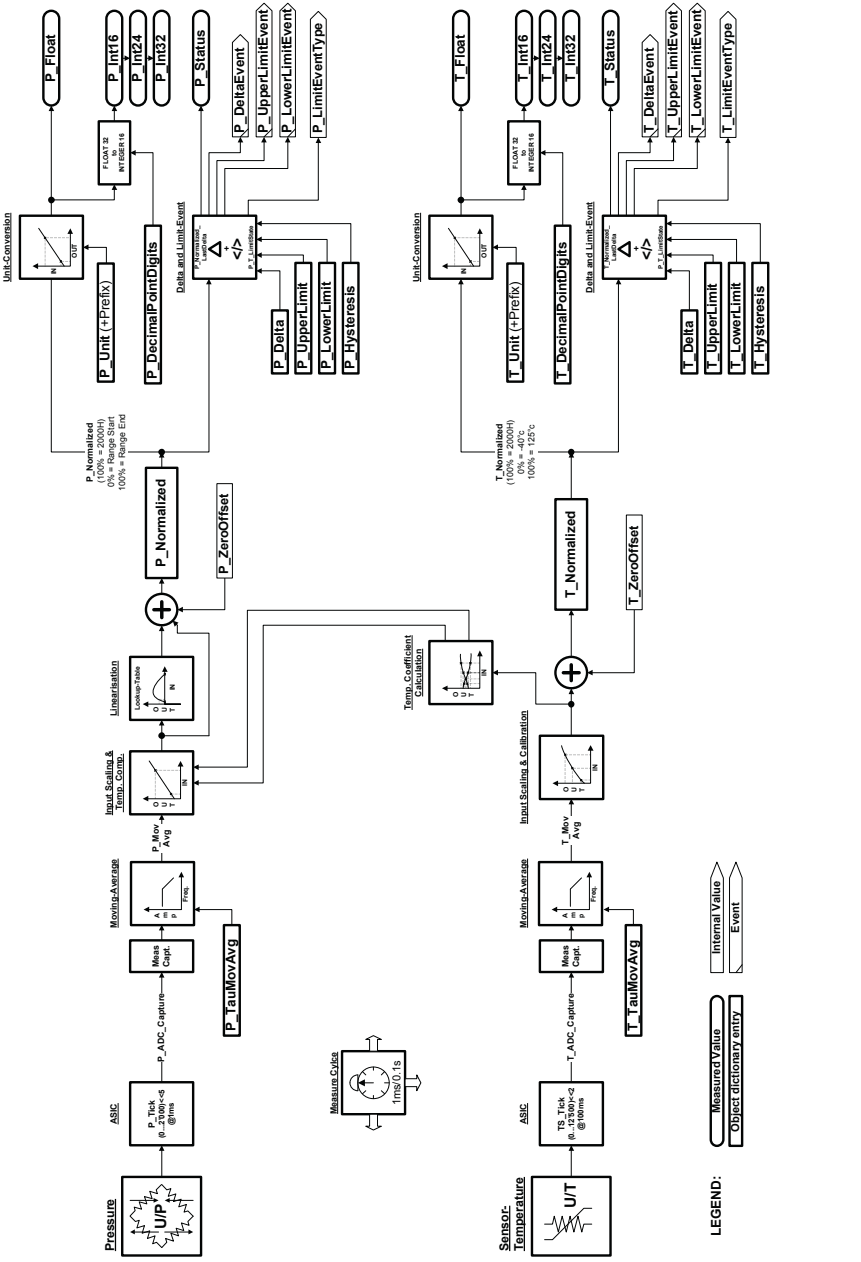
Pin	Signal	Description
1	(CAN_SHLD)	Shield / Housing
2	+24 VDC	Positiv supply / 8...32V
3	GND	Ground / 0V
4	CAN_H	CAN_H bus line (dominant high)
5	CAN_L	CAN_L bus line (dominant low)

CiA standard bit timing

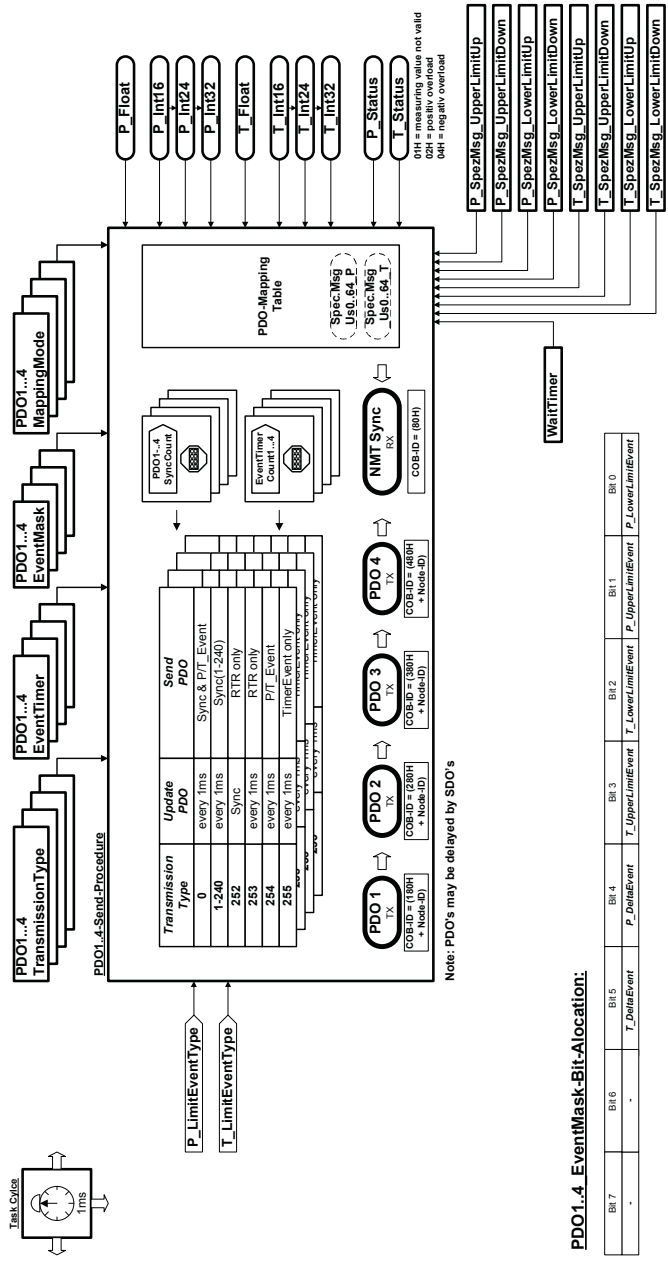
Table Index *)	Baudrate	Index 2001H Baudrate	
0h	**1 MBit/s**	1000d	03E8h
1h	**800 kBit/s**	800d	0320h
2h	**500 kBit/s**	500d	01F4h
3h	**250 kBit/s**	250d	00FAh
4h	**125 kBit/s**	125d	007Dh
5h	**100 kBit/s**	100d	0064h
6h	**50 kBit/s**	50d	0032h
7h	**20 kBit/s**	20d	0014h
8h	**10 kBit/s**	10d	000Ah
9h	**Automatic bit rate detection**	0d	0000h

*) Table Index for LSS, Table Selector = 1 (CiA standard bit timing)

Operational principle of measured value processing



Principle of PDO-Communication (TX)



PDO's (Process Data Objects)

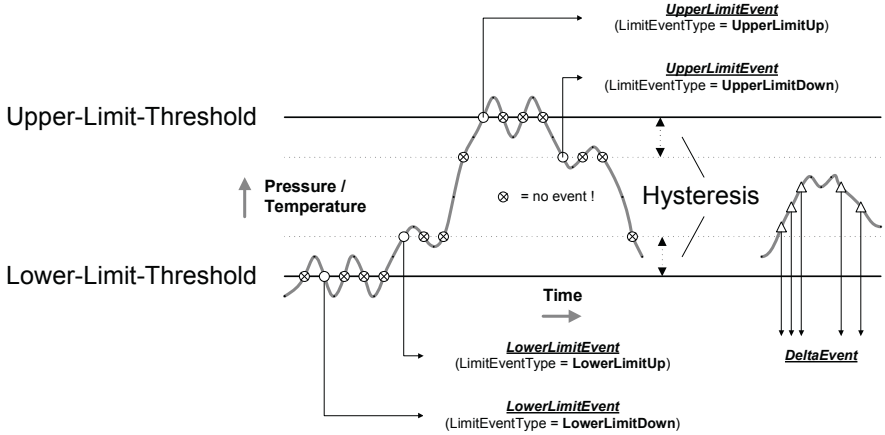
Transmission Type

The „Transmission Type" determines when a measuring value (PDO) is transmitted. „Transmission Type 254" is device specific and described here (all other „Transmission Types" are defined in communication profile DS-301):
„Transmission Type 254" transmits the corresponding PDO after a pressure or temperature event. An event is generated when pressure or temperature changes more than the preset delta-value or passes one of the two switching thresholds.
Which event results in the transmission of the PDO is defined by the „Event Mask".
If the „Event Timer" is used for cyclic transmission, a transmission only takes place in case the actual measured value passes above the upper threshold or below the lower threshold.
The adjustable hysteresis of the two thresholds always reside below the upper threshold and above the lower threshold.

Event Mask

For the „Transmission Types 0 and 254", the „Event Mask" determines, which event triggers the transmission of PDO's. For both, pressure and temperature, the possibility exists to trigger an event by means of a preset Deltavalue or two switching thresholds (limits). The event is activated in the Parameter „Event Type" by a „1" in the corresponding bit.
Important: When changing the „Mapping Mode", the „Event Type" automatically is set to a standard value. Thereby only the „Delta Event" events are enabled, and only those where a corresponding measuring value is mapped (see „Standard Value" in PDO-Mapping-Table).

Delta- und Limit-Event-Triggering & Transmission Type 254



Mapping Mode

The Mapping Mode determines what is transmitted by a PDO. The Mapping Mode for the CMP cannot be set dynamically as defined in the communication profile DS-301. It has to be set by means of a Predefined Mapping Table. However, the Mapping settings can be read out on the basis of the DS-301. The PDO-Mapping-Table lists all possible mappable message configurations for PDO's. Mapping Modes 27…36 are special in that they assign the PDO's free definable on event dynamic CAN messages. Mapping Mode 37 comprised an additional 8bit value, which is incremented every ms.

4 CAN messages for pressure and 4 CAN messages for temperature can be defined.
The CAN messages are assigned by the events of the 2 pressure, resp. 2 temperature thresholds as follows:
- Pressure passed below or above the lower pressure threshold
- Pressure passed below or above the upper pressure threshold
- Temperature passed below or above the lower temperature threshold
- Temperature passed below or above the upper temperature threshold

Should such an event occur, the corresponding CAN message is transmitted. The contents of the CAN-messages are therefore dynamic by events.
Each of these CAN-messages is freely defined with 8 data bytes (see object dictionary). The Mapping Type entry determines the length of the CAN-message, i.e. how many of these bytes are transmitted. As defined in the Mapping Table, 0 (no data) 8, 16, 32 or 64 bites can be selected.
Mapping Modes 27…31 assign the PDO the special messages for pressure, Mapping Modes 31…36 assign the PDO the special messages for temperature.

The following 8 limit event states result (according to the free definable CAN messages):
– Value below lower pressure threshold
– Value above lower pressure threshold
– Value below upper pressure threshold
– Value above upper pressure threshold
– Value below lower temperature threshold
– Value above lower temperature threshold
– Value below upper temperature threshold
– Value above upper temperature threshold

PDO Mapping Mode 27...36

P/T_Event	P/T_LimitEventType	Sended object when "Spec.Msg_xxx_P" is mapped
P_LowerLimitEvent	LowerLimitUp	P/T_SpezMsg_LowerLimitUp
	LowerLimitDown *	P/T_SpezMsg_LowerLimitDown
P_UpperLimitEvent	UpperLimitUp *	P/T_SpezMsg_UpperLimitUp
	UpperLimitDown	P/T_SpezMsg_UpperLimitDown
T_LowerLimitEvent	LowerLimitUp	P/T_SpezMsg_LowerLimitUp
	LowerLimitDown *	P/T_SpezMsg_LowerLimitDown
T_UpperLimitEvent	UpperLimitUp *	P/T_SpezMsg_UpperLimitUp
	UpperLimitDown	P/T_SpezMsg_UpperLimitDown
P_DeltaEvent	(actual LimitEventType)	(actual Special-Message-Object)
T_DeltaEvent	(actual LimitEventType)	(actual Special-Message-Object)

* Only this events can be periodically generated by the **Timer Event** !

PDO-Mapping-Tabelle

Prepared variable mapping

PDO MappingMode	*Entry 1*	*Entry 2*	*Entry 3*	*Entry 4*	*Size [Bytes]*	*Event Mask* (standard value)
1	P_Int32	P_Status	-	-	5	00010000
2	P_Int24	P_Status	-	-	4	00010000
3	P_Int16	P_Status	-	-	3	00010000
4	P_Float	P_Status	-	-	5	00010000
5	P_Int32	-	-	-	4	00010000
6	P_Int24	-	-	-	3	00010000
7	P_Int16	-	-	-	2	00010000
8	P_Float	-	-	-	4	00010000
9	T_Int32	T_Status	-	-	5	00100000
10	T_Int24	T_Status	-	-	4	00100000
11	T_Int16	T_Status	-	-	3	00100000
12	T_Float	T_Status	-	-	5	00100000
13	T_Int32	-	-	-	4	00100000
14	T_Int24	-	-	-	3	00100000
15	T_Int16	-	-	-	2	00100000
16	T_Float	-	-	-	4	00100000
17	P_Int32	T_Int32	-	-	8	00110000
18	P_Int24	T_Int24	-	-	6	00110000
19	P_Int16	T_Int16	-	-	4	00110000
20	P_Float	T_Float	-	-	8	00110000
21	P_Int24	T_Int24	P_Status	T_Status	8	00110000
22	P_Int16	T_Int16	P_Status	T_Status	6	00110000
23	P_Int24	P_Status	T_Int24	T_Status	8	00110000
24	P_Int16	P_Status	T_Int16	T_Status	6	00110000
25	P_Float	P_Status	T_Int16	T_Status	8	00110000
26	P_Int32	P_Status	T_Int16	T_Status	8	00110000
27	Spec.Msg_Nil_P	-	-	-	0	00000011
28	Spec.Msg_Us8_P	-	-	-	1	00000011
29	Spec.Msg_Us16_P	-	-	-	2	00000011
30	Spec.Msg_Us32_P	-	-	-	4	00000011
31	Spec.Msg_Us64_P	-	-	-	8	00000011
32	Spec.Msg_Nil_T	-	-	-	0	00001100
33	Spec.Msg_Us8_T	-	-	-	1	00001100
34	Spec.Msg_Us16_T	-	-	-	2	00001100
35	Spec.Msg_Us32_T	-	-	-	4	00001100
36	Spec.Msg_Us64_T	-	-	-	8	00001100
37	P_Int16	WaitTimer	Spec.Msg_Us8_P	-	4	00010011

PDO1...4 EventMask-Bit-Alocation:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	*T_DeltaEvent*	*P_DeltaEvent*	*T_UpperLimitEvent*	*T_LowerLimitEvent*	*P_UpperLimitEvent*	*P_LowerLimitEvent*

Communication Profile Area *CAN-Open DS 301* V4.02 / [1] *DSP 302-3 V4.1* / [2] *DSP 302-2 V4.1*

Index	Sub Ind.	Description	Index Type	Acc.	Initial Value	Annotation
1000H		**Device Type**	UNSIGNED32	ro	00020194 h	(DS 404 V1.2)
1001H		**Error Register**	UNSIGNED8	ro	00 h	ErrorRegister
1002H		**Manufacturer Status Register** (Calib. Date)	UNSIGNED32	ro	e.g. 20111221 (21. December 2011)	ManufacturerStatusRegister
1003H		**Pre-defined Error Field**				
	0H	number of errors [0..1]	UNSIGNED8	rw	-	(Generated by NodeErrorCode)
	1H	standard error field	UNSIGNED32	ro	00000000 h	LastNodeErrorCode + (NodeSubErrorCode)
1005H		**COB-ID SYNC**	UNSIGNED32	rw	80 h	SYNC_ID
1008H		**Manufacturer Device Name**	VISIBLE_STRING32	const	"CMP Pressuresensor Trafag AG"	ManufacturerDeviceName
1009H		**Manufacturer Hardware Version**	VISIBLE_STRING32	const	"8270.xx.xxxx.xx.xx,xx.xxxx.xxxx "	ManufacturerHardwareVersion
100AH		**Manufacturer Software Version**	VISIBLE_STRING32	const	"CMP V2.0 " __DATE__ " : " __TIME__	ManufacturerSoftwareVersion
100CH		**Guard Time**	UNSIGNED16	rw	0000 h (off)	GuardTime
100DH		**Life Time Factor**	UNSIGNED8	rw	00 h	LifeTimeFactor
1010H		**Store Parameters**				
	0H	largest subindex supported [3]	UNSIGNED8	ro	-	-
	1H	save all parameters	UNSIGNED32	rw	-	(Save all **Parameter**) ["evas"] [65 76 61 73]
	2H	save communication param.	UNSIGNED32	rw	-	(Save com. param. to **EEProm**) ["evas"]
	3H	save application parameters	UNSIGNED32	rw	-	(Save appl. param. to **EEProm**) ["evas"]
1011H		**Restore default Parameters**				
	0H	largest subindex supported [3]	UNSIGNED8	ro	-	-
	1H	restore all default parameters	UNSIGNED32	rw	-	(Restore all **Parameter**) ["daol"] [64 61 6F 6C]
	2H	restore communication par.	UNSIGNED32	rw	-	(Restore com. param. from **EEProm**) ["daol"]
	3H	restore application par.	UNSIGNED32	rw	-	(Restore appl. param. from **EEProm**) ["daol"]
1014H		**COB-ID EMCY**	UNSIGNED32	rw	80 h + Node_ID (on)	EMCY_ID
1017H		**Producer Heartbeat Time**	UNSIGNED16	rw	0000 h	HeartbeatTime
1018H		**Identity Object (Identity [23])**				
	0H	number of entries [4]	UNSIGNED8	ro	-	-
	1H	Vendor ID	UNSIGNED32	ro	0000'003D h	VendorID
	2H	Product Code	UNSIGNED32	ro	8270'0000 h	ProductCode ["8270.21.10"]
	3H	Revision Number	UNSIGNED32	ro	0002'0000 h	RevisionNumber
	4H	Serial Number	UNSIGNED32	ro	00000000 d	SerialNumber
1200H		**Server SDO1 Parameter (SDO Parameter [22])**				
	0H	largest sub-index supp. [2]	UNSIGNED8	ro	-	-
	1H	COB-ID Client -> Server (rx)	UNSIGNED32	ro	600h + Node_ID	(PCS_rxSDO_ID + Node_ID)
	2H	COB-ID Server -> Client (tx)	UNSIGNED32	ro	580h + Node_ID	(PCS_txSDO_ID + Node_ID)
1800H		**Transmit PDO1 Parameter (PDO CommPar [20])**				
	0H	largest sub-index supp. [5]	UNSIGNED8	ro	-	-
	1H	COB-ID used by PDO	UNSIGNED32	rw	0000'0180h + Node_ID (on)	PDO1_ID (PDO = on/off)
	2H	transmission type	UNSIGNED8	rw	255 d (timer event)	PDO1_TransmissionType
	5H	event timer	UNSIGNED16	rw	1000 d (1000ms)	PDO1_EventTimer
1801H		**Transmit PDO2 Parameter (PDO CommPar [20])**				
	0H	largest sub-index supp. [5]	UNSIGNED8	ro	-	-
	1H	COB-ID used by PDO	UNSIGNED32	rw	8000'0280h + Node_ID (off)	PDO2_ID (PDO = on/off)
	2H	transmission type	UNSIGNED8	rw	255 d (timer event)	PDO2_TransmissionType
	5H	event timer	UNSIGNED16	rw	0 d (EventTimer2 off)	PDO2_EventTimer

Index	Sub Ind.	Description	Index Type	Acc.	Initial Value	Annotation
1802H	**Transmit PDO3 Parameter (PDO CommPar [20])**					
	0H	largest sub-index supp. [5]	UNSIGNED8	ro	-	-
	1H	COB-ID used by PDO	UNSIGNED32	rw	8000'0380h + Node_ID (off)	PDO3_ID (PDO = on/off)
	2H	transmission type	UNSIGNED8	rw	255 d (timer event)	PDO3_TransmissionType
	5H	event timer	UNSIGNED16	rw	0 d (EventTimer3 off)	PDO3_EventTimer
1803H	**Transmit PDO4 Parameter (PDO CommPar [20])**					
	0H	largest sub-index supp. [5]	UNSIGNED8	ro	-	-
	1H	COB-ID used by PDO	UNSIGNED32	rw	8000'0480h + Node_ID (off)	PDO4_ID (PDO = on/off)
	2H	transmission type	UNSIGNED8	rw	255 d (timer event)	PDO4_TransmissionType
	5H	event timer	UNSIGNED16	rw	0 d (EventTimer4 off)	PDO4_EventTimer
1A00H	**Transmit PDO1 mapping (PDO Mapping [21])**					
	0H	numb. of mapped object [1..4]	UNSIGNED8	rw	-	-
	1H	PDO mapping for the 1-th obj.	UNSIGNED32	rw	91300120 h	PDO1_MappingMode
	2H	PDO mapping for the 2-th obj.	UNSIGNED32	rw	91500108 h	
	3H	PDO mapping for the 3-th obj.	UNSIGNED32	rw	-	
	4H	PDO mapping for the 4-th obj.	UNSIGNED32	rw	-	
1A01H	**Transmit PDO2 mapping (PDO Mapping [21])**					
	0H	numb. of mapped object [1..4]	UNSIGNED8	rw	-	-
	1H	PDO mapping for the 1-th obj.	UNSIGNED32	rw	91300120 h	PDO2_MappingMode
	2H	PDO mapping for the 2-th obj.	UNSIGNED32	rw	91500108 h	
	3H	PDO mapping for the 3-th obj.	UNSIGNED32	rw	-	
	4H	PDO mapping for the 4-th obj.	UNSIGNED32	rw	-	
1A02H	**Transmit PDO3 mapping (PDO Mapping [21])**					
	0H	numb. of mapped object [1..4]	UNSIGNED8	rw	-	-
	1H	PDO mapping for the 1-th obj.	UNSIGNED32	rw	91300120 h	PDO3_MappingMode
	2H	PDO mapping for the 2-th obj.	UNSIGNED32	rw	91500108 h	
	3H	PDO mapping for the 3-th obj.	UNSIGNED32	rw	-	
	4H	PDO mapping for the 4-th obj.	UNSIGNED32	rw	-	
1A03H	**Transmit PDO4 mapping (PDO Mapping [21])**					
	0H	numb. of mapped object [1..4]	UNSIGNED8	rw	-	-
	1H	PDO mapping for the 1-th obj.	UNSIGNED32	rw	91300120 h	PDO4_MappingMode
	2H	PDO mapping for the 2-th obj.	UNSIGNED32	rw	91500108 h	
	3H	PDO mapping for the 3-th obj.	UNSIGNED32	rw	-	
	4H	PDO mapping for the 4-th obj.	UNSIGNED32	rw	-	
1F50H	**Program data**[1]					
	0H	number of programs	UNSIGNED8	ro	-	-
	1H	Program number 1	DOMAIN	wo	-	Intel Hex Format
1F51H	**Program control**[1]					
	0H	number of programs	UNSIGNED8	ro	-	-
	1H	Program number 1	UNSIGNED8	rw	01h	1. Stop prog.: 0x00 (stop) -> 0x8A (exec) 2. Clear prog.: 0x80 (unlock) -> 0x03 (clear) -> 0x8A (exec)
1F56H	**Application software identification**[1]					
	0H	number of programs	UNSIGNED8	ro	-	-
	1H	Program number 1	UNSIGNED32	ro	-	CRC16 over the program data
1F57H	**Flash status identification**[1]					
	0H	number of programs	UNSIGNED8	ro	-	-
	1H	Program number 1	UNSIGNED32	ro	-	-
1F80H	**NMTStartup**[2]		UNSIGNED32	rw	0000'000C h	Normal Start: 0C h Autostart without NMT Msg. sending: 08 h Autostart with NMT Start Msg. sending (after 250ms): 02 h (see also Index 2200 h)

Standardised Device Profile Area *CAN-Open DS 404 V1.2*

Index	Sub Ind.	Description	Index Type	Acc.	Initial Value	Annotation
7100H	**AI_Input_Field_Value**					
	0H	Number_of_entries [2]	UNSIGNED8	ro	-	-
	1H	AI_Input_Field_Value_1 **[P]**	INTEGER16	ro	*(Measured)*	P_Normalized (0000h = 0%, 2000h = 100%)
	2H	AI_Input_Field_Value_2 **[T]**	INTEGER16	ro	*(Measured)*	T_Normalized (0000h = -40°C, 2000h = 125°C)
6110H	**AI_Sensor_Type**					
	0H	Number_of_entries [2]	UNSIGNED8	ro	-	-
	1H	AI_Sensor_Type_1 **[P]**	UNSIGNED16	ro	90 d	P_SensorType
	2H	AI_Sensor_Type_2 **[T]**	UNSIGNED16	ro	100 d	T_SensorType
6/7/8/ 9148H	**AI_Sensor_Range_Start**					
	0H	Number_of_entries [2]	UNSIGNED8	ro	-	-
	1H	AI_Sen._Range_Start_1 **[P]**	Float / Integer16/24/ 32	ro	*Pressure Range Start (0)***[pa]**	P_SensorRangeStart
	2H	AI_Sen._Range_Start_2 **[T]**	Float / Integer16/24/ 32	ro	*Temperature Range Start (-40)***[c°]**	T_SensorRangeStart
6/7/8/ 9149H	**AI_Sensor_Range_End**					
	0H	Number_of_entries [2]	UNSIGNED8	ro	-	-
	1H	AI_Sen._Range_End_1 **[P]**	Float / Integer16/24/ 32	ro	*Pressure Range End (100E5)***[pa]**	P_SensorRangeEnd
	2H	AI_Sen._Range_End_2 **[T]**	Float / Integer16/24/ 32	ro	*Temperature Range End (125)***[c°]**	T_SensorRangeEnd
6125H	**AI_Autozero**					
	0H	Number_of_entries [2]	UNSIGNED8	ro	-	-
	1H	AI_Autozero_1 **[P]**	UNSIGNED32	wo	-	(Done by Subroutine when ["orez"]) [6F 62 65 7A]
	2H	AI_Autozero_2 **[T]**	UNSIGNED32	wo	-	(Done by Subroutine when ["orez"]) [6F 62 65 7A]
6126H	**AI_Scaling Factor**					
	0H	Number_of_entries [2]	UNSIGNED8	ro	-	-
	1H	AI_ScalingFactor_1 **[P]**	Float	rw	-	P_ConversionFactor
	2H	AI_ScalingFactor_2 **[T]**	Float	rw	-	T_ConversionFactor
6127H	**AI_Scaling Offset**					
	0H	Number_of_entries [2]	UNSIGNED8	ro	-	-
	1H	AI_ScalingOffset_1 **[P]**	Float	rw	-	P_ConversionOffset
	2H	AI_ScalingOffset_2 **[T]**	Float	rw	-	T_ConversionOffset
6/7/8/ 9130H	**AI_Input_Process_Value**					
	0H	Number_of_entries [2]	UNSIGNED8	ro	-	-
	1H	AI_Input_Proc._Val._1 **[P]**	Float / Integer16/24/ 32	ro	*(Measured)*	P_Float
					(Measured)	P_INT16/24/32
	2H	AI_Input_Proc._Val._2 **[T]**	Float / Integer16/24/ 32	ro	*(Measured)*	T_Float
					(Measured)	T_INT16/24/32
6131H	**AI_Physical_Unit_Process_Value**					
	0H	Number_of_entries [2]	UNSIGNED8	ro	-	-
	1H	AI_Physic_Unit_Pro..._1 **[P]**	UNSIGNED32	rw	004E0000 h (bar)	P_Unit
	2H	AI_Physic_Unit_Pro..._2 **[T]**	UNSIGNED32	rw	002D0000 h (°C)	T_Unit
6132H	**AI_Decimal_Digits_Process_Value**					
	0H	Number_of_entries [2]	UNSIGNED8	ro	-	-
	1H	AI_Dec._Digits_Pro..._1 **[P]**	UNSIGNED8	rw	*Press. Decimalpoint Digits (3)*	P_DecimalPointDigits
	2H	AI_Dec._Digits_Pro..._2 **[T]**	UNSIGNED8	rw	*Temp. Decimalpoint Digits (1)*	T_DecimalPointDigits
6/7/8/ 9133H	**AI_Interrupt_Delta_Input_Process_Value**					
	0H	Number_of_entries [2]	UNSIGNED8	ro	-	-
	1H	AI_Input_Delta_Net..._1 **[P]**	Float / Integer16/24/ 32	rw	*Pressure no Delta (0E5 pa)*	P_Delta
	2H	AI_Input_Delta_Net..._2 **[T]**	Float / Integer16/24/ 32	rw	*Temperature no Delta (0 C°)*	T_Delta

Index	Sub Ind.	Description	Index Type	Acc.	Initial Value	Annotation
6/7/8/ 9134H	**AI_Interrupt_Lower_Limit_Input_Process_Value**					
	0H	Number_of_entries [2]	UNSIGNED8	ro	-	-
	1H	AI_Lower_Limit_1 **[P]**	Float / Integer16/24/ 32	rw	*Pressure Range Start (0 pa)*	P_LowerLimit
	2H	AI_Lower_Limit_2 **[T]**	Float / Integer16/24/ 32	rw	*Temperature Range Start (-40 C°)*	T_LowerLimit
6/7/8/ 9135H	**AI_Interrupt_Upper_Limit_Input_Process_Value**					
	0H	Number_of_entries [2]	UNSIGNED8	ro	-	-
	1H	AI_Upper_Limit_1 **[P]**	Float / Integer16/24/ 32	rw	*Pressure Range End (100E5 pa)*	P_UpperLimit
	2H	AI_Upper_Limit_2 **[T]**	Float / Integer16/24/ 32	rw	*Temperature Range End (125 C°)*	T_UpperLimit
6/7/8/ 9136H	**AI_Interrupt_Limit_Hysteresis_Input_Process_Value**					
	0H	Number_of_entries [2]	UNSIGNED8	ro	-	-
	1H	AI_Hysteresis_1 **[P]**	Float / Integer16/24/ 32	rw	*Pressure no Hysteresis (0E5 pa)*	P_Hysteresis
	2H	AI_Hysteresis_2 **[T]**	Float / Integer16/24/ 32	rw	*Temperature no Hysteresis (0 C°)*	T_Hysteresis
6150H	**AI_Status**					
	0H	Number_of_entries [2]	UNSIGNED8	ro	-	-
	1H	AI_Status_1 **[P]**	UNSIGNED8	ro	00 h (valid)	P_Status
	2H	AI_Status_2 **[T]**	UNSIGNED8	ro	00 h (valid)	T_Status
61A0H	**AI_Filter_Type**					
	0H	Number_of_entries [2]	UNSIGNED8	ro	-	-
	1H	AI_Filter_Type_1 **[P]**	UNSIGNED8	ro	1 b (moving average)	P_FiterType
	2H	AI_Filter_Type_2 **[T]**	UNSIGNED8	ro	1 b (moving average)	T_FilterType
61A1H	**AI_Filter_Constant**					
	0H	Number_of_entries [2]	UNSIGNED8	ro	-	-
	1H	AI_Filter_Constant_1 **[P]**	UNSIGNED16	rw	100 d (100ms)	P_TauMovAvg
	2H	AI_Filter_Constant_2 **[T]**	UNSIGNED16	rw	10 d (10 * 0.1s = 1s)	T_TauMovAvg

Prefix supported

Mega = 06	micro = FA
Kilo = 03	milli = FD
Hecto = 02	centi = FE
Deca = 01	deci = FF

Physical Units supported

Bar = 4E	°C = 2D
Pa = 22	°F = AC
at = A1	Kelvin = 05
mWg = A2	
mHG = A3	
atm = A4	
PSI = AB	SI_none = 00

P/T_Unit

Physical units representation:

Prefix (e.g. 03h = „k“)	SI-Numerator (e.g. 22h = „Pa“)	SI-Denumerator (00h)	Reserved (00h)

MSB LSB

Initiate SDO UP/Download Data:

0	1	2	3	4	5	6	7
SDO Com-mand	LSB Index		Sub Index	LSB Data			

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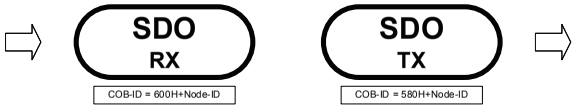
(W: 22H)



Manufacturer Specific Profile Area

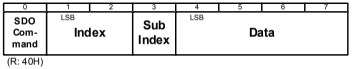
Index	Sub Ind.	Description	Index Type	Acc.	Initial Value	Annotation
2000H		**Node-ID**	UNSIGNED8	rw	1 d (Node-Id = 1)	Node_ID_New
2001H		**Baudrate**	UNSIGNED16	rw	20 d (20kbps)	Baud_New
2100H		**PDO1 Application Parameter**				
	0H	largest subindex supp. [2]	UNSIGNED8	ro	-	-
	1H	Mapping_Mode	UNSIGNED8	rw	01 h	PDO1_MappingMode
	2H	Event_Mask	UNSIGNED8	rw	(depend. on Mapping_Mode)	PDO1_EventType
2101H		**PDO2 Application Parameter**				
	0H	largest subindex supp. [2]	UNSIGNED8	ro	-	-
	1H	Mapping_Mode	UNSIGNED8	rw	01 h	PDO2_MappingMode
	2H	Event_Mask	UNSIGNED8	rw	(depend. on Mapping_Mode)	PDO2_EventType
2102H		**PDO3 Application Parameter**				
	0H	largest subindex supp. [2]	UNSIGNED8	ro	-	-
	1H	Mapping_Mode	UNSIGNED8	rw	01 h	PDO3_MappingMode
	2H	Event_Mask	UNSIGNED8	rw	(depend. on Mapping_Mode)	PDO3_EventType
2103H		**PDO4 Application Parameter**				
	0H	largest subindex supp. [2]	UNSIGNED8	ro	-	-
	1H	Mapping_Mode	UNSIGNED8	rw	01 h	PDO4_MappingMode
	2H	Event_Mask	UNSIGNED8	rw	(depend. on Mapping_Mode)	PDO4_EventType
2110H		**Aktual Special Message Value Pressure**				
	0H	largest subindex supp. [4]	UNSIGNED8	ro	-	-
	1H	S.Msg_Us8_P [Byte 0]	UNSIGNED8	ro	*(Measured)*	-
	2H	S.Msg_Us16_P [Byte 0..1]	USIGNED16	ro	*(Measured)*	-
	3H	S.Msg_Us32_P [Byte 0..3]	USIGNED32	ro	*(Measured)*	-
	4H	S.Msg_Us64_P [Byte 0..7]	USIGNED64	ro	*(Measured)*	-
2111H		**Aktual Special Message Value Temperature**				
	0H	largest subindex supp. [4]	UNSIGNED8	ro	-	-
	1H	S.Msg_Us8_T [Byte 0]	UNSIGNED8	ro	*(Measured)*	-
	2H	S.Msg_Us16_T [Byte 0..1]	UNSIGNED16	ro	*(Measured)*	-
	3H	S.Msg_Us32_T [Byte 0..3]	UNSIGNED32	ro	*(Measured)*	-
	4H	S.Msg_Us64_T [Byte 0..7]	UNSIGNED64	ro	*(Measured)*	-
2120H		**Special Message Data 1 (Spez Msg_LowerLimitDown) for Pressure**				
	0H	largest subindex supp. [2]	UNSIGNED8	ro	-	-
	1H	Special_Message [Byte 0..3]	OCTET_STRING4	rw	00 00 00 00 h	P_SpezMsg_LowerLimitDown (0..3)
	2H	Special_Message [Byte 4..7]	OCTET_STRING4	rw	00 00 00 00 h	P_SpezMsg_LowerLimitDown (4..7)
2121H		**Special Message Data 2 (Spez Msg_LowerLimitUp) for Pressure**				
	0H	largest subindex supp. [2]	UNSIGNED8	ro	-	-
	1H	Special_Message [Byte 0..3]	OCTET_STRING4	rw	00 00 00 00 h	P_SpezMsg_LowerLimitUp (0..3)
	2H	Special_Message [Byte 4..7]	OCTET_STRING4	rw	00 00 00 00 h	P_SpezMsg_LowerLimitUp (4..7)
2122H		**Special Message Data 3 (Spez Msg_UpperLimitDown) for Pressure**				
	0H	largest subindex supp. [2]	UNSIGNED8	ro	-	-
	1H	Special_Message [Byte 0..3]	OCTET_STRING4	rw	00 00 00 00 h	P_SpezMsg_UpperLimitDown (0..3)
	2H	Special_Message [Byte 4..7]	OCTET_STRING4	rw	00 00 00 00 h	P_SpezMsg_UpperLimitDown (4..7)
2123H		**Special Message Data 4 (Spez Msg_UpperLimitUp) for Pressure**				
	0H	largest subindex supp. [2]	UNSIGNED8	ro	-	-
	1H	Special_Message [Byte 0..3]	OCTET_STRING4	rw	00 00 00 00 h	P_SpezMsg_UpperLimitUp (0..3)
	2H	Special_Message [Byte 4..7]	OCTET_STRING4	rw	00 00 00 00 h	P_SpezMsg_UpperLimitUp (4..7)

Index	Sub Ind.	Description	Index Type	Acc.	Initial Value	Annotation
2124H	**Special Message Data 5 (Spez Msg_LowerLimitDown) Temperature**					
	0H	largest subindex supp. [2]	UNSIGNED8	ro	-	-
	1H	Special_Message [Byte 0..3]	OCTET_STRING4	rw	00 00 00 00 h	T_SpezMsg_LowerLimitDown (0..3)
	2H	Special_Message [Byte 4..7]	OCTET_STRING4	rw	00 00 00 00 h	T_SpezMsg_LowerLimitDown (4..7)
2125H	**Special Message Data 6 (Spez Msg_LowerLimitUp) for Temperature**					
	0H	largest subindex supp. [2]	UNSIGNED8	ro	-	-
	1H	Special_Message [Byte 0..3]	OCTET_STRING4	rw	00 00 00 00 h	T_SpezMsg_LowerLimitUp (0..3)
	2H	Special_Message [Byte 4..7]	OCTET_STRING4	rw	00 00 00 00 h	T_SpezMsg_LowerLimitUp (4..7)
2126H	**Special Message Data 7 (Spez Msg_UpperLimitDown) for Temperature**					
	0H	largest subindex supp. [2]	UNSIGNED8	ro	-	-
	1H	Special_Message [Byte 0..3]	OCTET_STRING4	rw	00 00 00 00 h	T_SpezMsg_UpperLimitDown (0..3)
	2H	Special_Message [Byte 4..7]	OCTET_STRING4	rw	00 00 00 00 h	T_SpezMsg_UpperLimitDown (4..7)
2127H	**Special Message Data 8 (Spez Msg_UpperLimitUp) for Temperature**					
	0H	largest subindex supp. [2]	UNSIGNED8	ro	-	-
	1H	Special_Message [Byte 0..3]	OCTET_STRING4	rw	00 00 00 00 h	T_SpezMsg_UpperLimitUp (0..3)
	2H	Special_Message [Byte 4..7]	OCTET_STRING4	rw	00 00 00 00 h	T_SpezMsg_UpperLimitUp (4..7)
2200H	**Start_Mode_Selection**		UNSIGNED32	rw	6D 72 6F 6E h	(Selected by Subr. when ["otua" / "mron"]) [6F 74 75 61 / 6D 72 6F 6E] (see also Index 1F80 h)

Abort Codes supported

Abort Code	Description	Abort Code	Description
0503 0000h	Toggle bit not altered	**0607 0010h**	Data type does not match, length of service parameter does not match
0504 0001h	Client/server command specifier not valid or unknown	**0607 0012h**	Data type does not match, length of service parameter too high
0504 0005h	Out of memory (Internal Buffer 32 Bytes)	**0607 0013h**	Data type does not match, length of service parameter too low
0601 0000h	Unsupported access to an object	**0609 0011h**	Sub-index does not exist
0601 0001h	Attempt to read a write only object	**0609 0030h**	Value range of parameter exeeded
0601 0002h	Attempt to write a read only object	**0609 0031h**	Value range of parameter written too high
0602 0000h	Object does not exist in the object dictionary	**0609 0032h**	Value range of parameter written too low
0604 0041h	Object can not be mapped to the PDO	**0800 0000h**	General error
0604 0042h	The number and length of the objects to be mapped would exceed PDO length	**0800 0020h**	Data cannot be transferred or stored to the application

Initiate SDO UP/Download Data:



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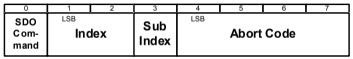
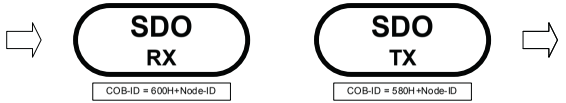
Abort SDO Transfer Data:



80H



Error Messages

Emergency Send-Procedure

Emergency Error Codes

LastNode ErrorCode	description	ErrorType	Error Register	Bit
0000h	**No Error**	-	-	-
1000h	Generic Error	generic Error	generic	0 (01h)
2000h	Current			
3000h	**Voltage**			
***3100h**	**Main Voltage**	voltage	generic & voltage	0 & 2 (05h)
4000h	**Temperature**			
***4200h**	**Device Temperature**	temperature	generic & temp.	0 & 3 (09h)
5000h	Device Hardware			
6000h	**Device Software**			
***6300h**	**Data Set**	generic Error	generic	0 (01h)

SubErrorCodes of Data Set Error	NodeSubErrorCode	
NoError	**No bit**	0x0000
EEProm_VirginByte	**bit 0**	0x0001
EEPromUserCommPage_ValidByte	**bit 1**	0x0002
EEPromUserApplPage_ValidByte	**bit 2**	0x0004
EEPromUserCommPage_Checksum	**bit 4**	0x0010
EEPromUserApplPage_Checksum	**bit 5**	0x0020
EEPromFactoryCommPage_Checksum	**bit 6**	0x0040
EEPromFactoryApplPage_Checksum	**bit 7**	0x0080
EEPromSpecialPage_Checksum	**bit 8**	0x0100
EEPromCommPage_InvalidBase	**bit 12**	0x1000
EEPromApplPage_InvalidBase	**bit 13**	0x2000

7000h	Additional Modules			
8000h	**Monitoring**			
8110h	CAN Overrun (Objects lost)	Monitoring	generic & com.	0 & 4 (11h)
8120h	CAN in Error Passive Mode	Monitoring	generic & com.	0 & 4 (11h)
***8130h**	**Life Guard Error**	Monitoring	generic & com.	0 & 4 (11h)
8140h	recovered from bus off	Monitoring	generic & com.	0 & 4 (11h)
9000h	External Error			
F000h	Additional Functions			

*** supported node error codes**

Emergency Object Data:

0	1	2	3	4	5	6	7
LastNode ErrorCode (Emerg. Error Code)		Error Reg. Err.Reg.	n.u.	NodeSubErrorCode LSB (Manufacturer specific Error Field)			

ERROR FREE
Clear '**error code**'
Send '**error recovery** '

Error indication / No Error indication

ERROR OCCURED
Set '**error code and error register**'
Send '**emmergency error code**'

Error indication

EMERGENCY

COB-ID = (80H+Node-ID)

ErrorRegister

LastNodeErrorCode

NodeSubErrorCode

Startup (Initial)

Permanent Autotest
(Hard and Softwaretest)

P_Status

T_Status

NMT (Network Management, LSS & Errorhandling)

Emergency Send Procedure

As an additional safety feature, the CMP is equipped with a „Permanent Autotest". This feature continuously checks the operating temperature of the sensor as well as the CAN-bus with Life Guard and Heartbeat. In addition the contents of the memory (EEProm) are checked at start-up. If a fault is detected while performing the Autotest, an error message will be sent. Please refer to „Emergency Send-Procedure" in this instruction manual where the cause for the message is explained. These messages conform to communication profile DS-301.
In case of a fault, the node changes to the „PRE-OPERATIONAL" state until such time that the fault is corrected and the Bus Master releases a „Start-Node-Indication". After the failure has been corrected, the node only starts automatically if „Auto-Start" is configured. If the fault cannot be corrected, the node cannot be started, not even by the Master.

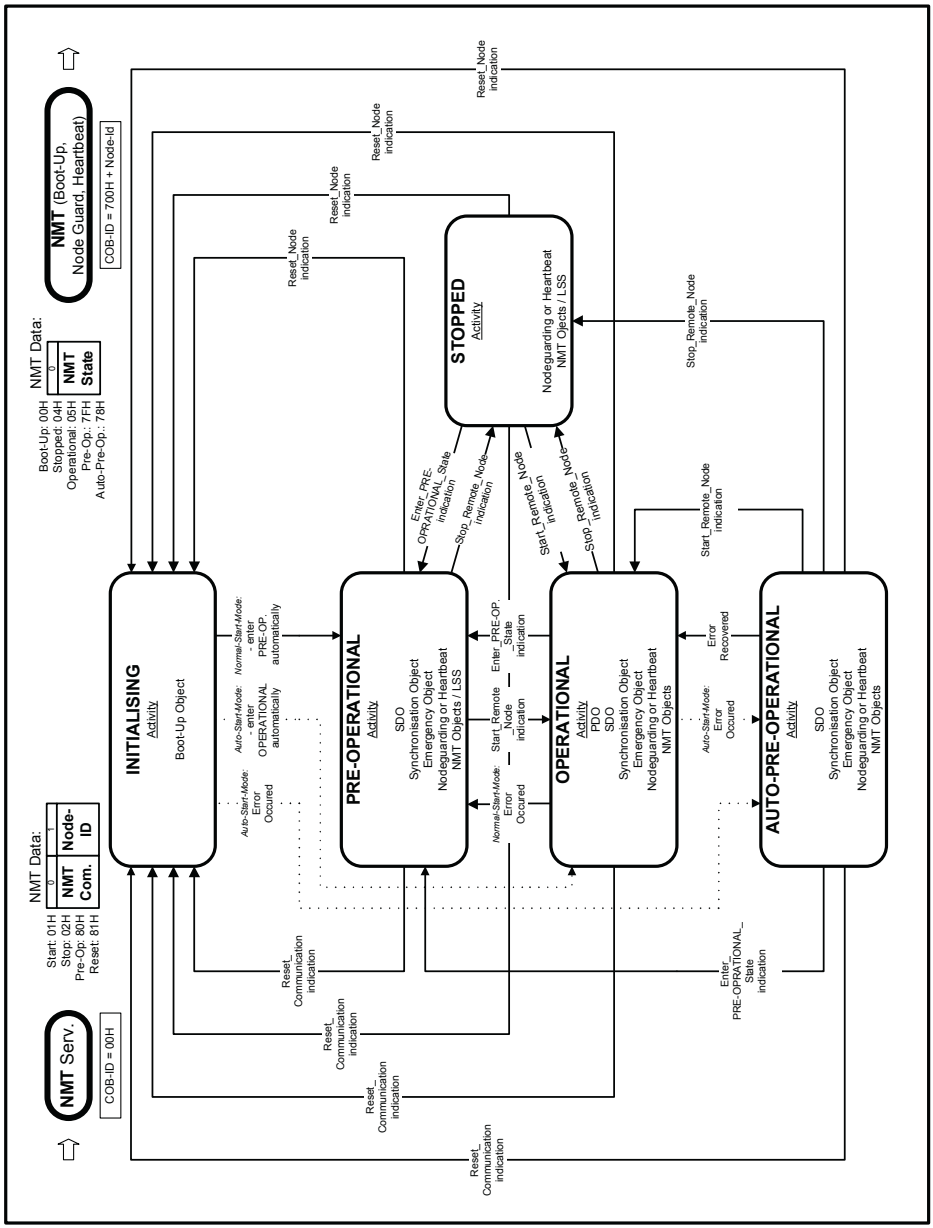
Network-Management (NMT)-State-Machine

The State Machine has been completed with an additional state (see „Modus Node State-Machine"). The standard State Machine version is defined in communication profile DS-301. The upgraded State Machine allows operation without the „Start-Node Indication" of the CANopen Master. By configuring parameter „Auto-Start „as „auto" in the object dictionary, the State Machine functions in such a way that the node after initialization is automatically „OPERATIONAL". The node, therefore, starts-up automatically. In case of a fault, the State Machine goes to „AUTO-PRE-OPERATIONAL" instead of „PRE-OPERATIONAL". Only then, after the fault has been corrected, the status „OPERATIONAL" is re-established. This feature is also available with the settings in object dictionary entry "NMTStartup". Furthermore it's possible to send a "NMT Start-Node-Indication" after 250ms of reaching the "OPERATIONAL" state (see Index 1F80h).

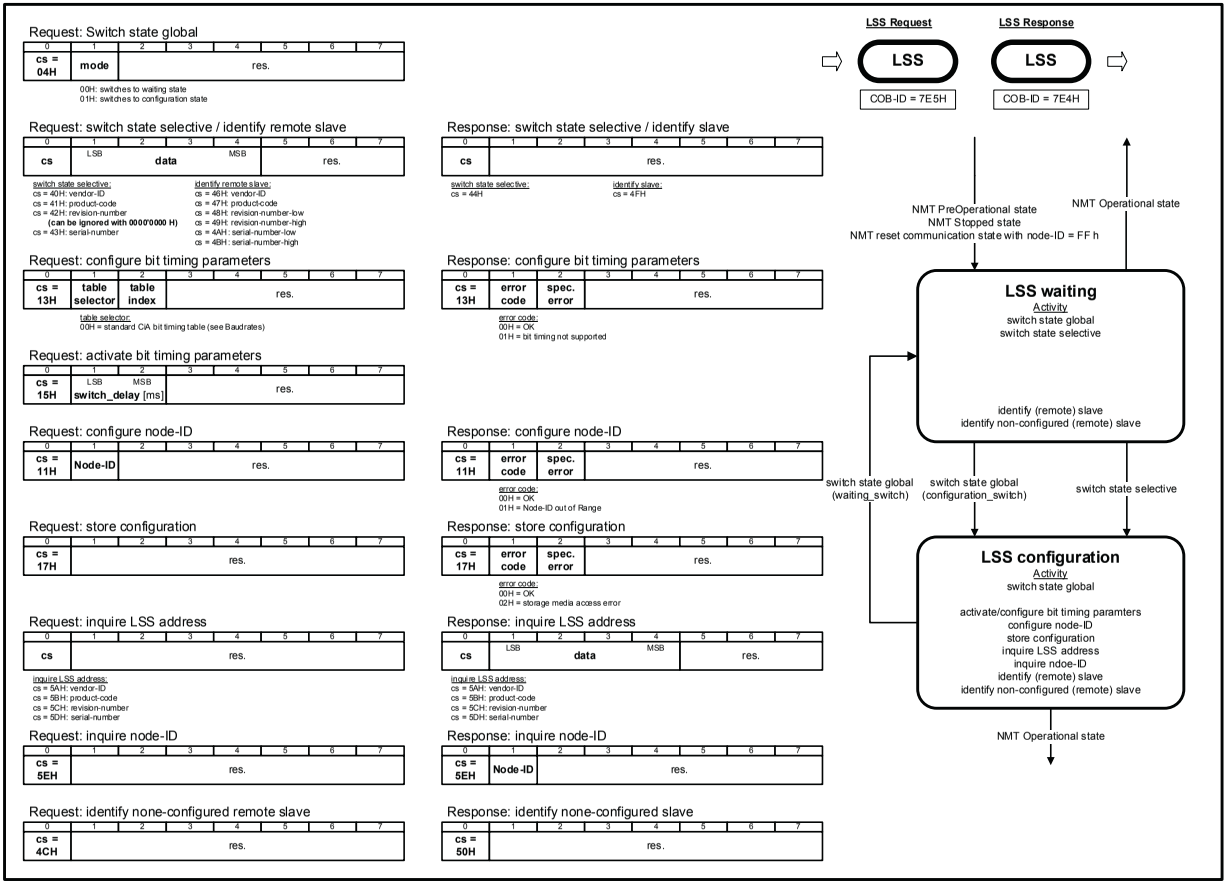
LSS

The CMP has been equiped with „Layer setting services" (LSS) according to DSP305 V2.0 with all available commands. This allows to adjust the pressure-sensor together with other devices in the network without prior configuration. As a rule the CMP will be delivered with node-id =1 and baudrate=20kbit/s. When using LSS the startup with „auto-baudrate-detection" is recommended. Therfore please specify this when ordering.
There is a as well a simplification at the comand „switch state selective". To get in the configuation mode it is not necesary to know the whole LSS number. The revision number could be ignored with 0000'000h but „Vendor ID", „Product code" and „serial-number" have to be specified. More details see „LSS State-Machine".

Network Managment (NMT) State Machine



Layer setting services and protocols (LSS) *DSP305 V2.0*



CANopen-communication Examples

Note: All numbers ar in Hex-Format, P means Pressure, T means Temperature, N means Network-Node-Address (Node-Identifier)

Start all nodes (OPERATIONAL):	COB-ID = 0	Data = 01 00
Stop all nodes (STOPPED):	COB-ID = 0	Data = 02 00
Preop. all nodes (PRE-OPERATIONAL):	COB-ID = 0	Data = 80 00
Reset all nodes (INITIALISING):	COB-ID = 0	Data = 81 00
Reset only node 10 (Reset):	COB-ID = 0	Data = 81 0A
N=1, read out P as FLOAT:	COB-ID = 601	Data = 40 30 61 01 00 00 00 00
Response of Network-Node (CMP):	COB-ID = 581	Data = 43 30 61 01 XX XX XX XX
N=1, read out T as INT_16:	COB-ID = 601	Data = 40 30 71 02 00 00 00 00
Response of Network-Node (CMP):	COB-ID = 581	Data = 4B 30 71 02 XX XX 00 00
N=10, set P-Unit to kPa:	COB-ID = 60A	Data = 22 31 61 01 00 00 22 03
Response of Network-Node (CMP):	COB-ID = 58A	Data = 60 31 61 01 00 00 00 00
N=11, set T-Decimalpoint to 2 post decimal position:	COB-ID = 60B	Data = 22 32 61 02 02 00 00 00
Response of Network-Node (CMP):	COB-ID = 58B	Data = 60 32 61 02 00 00 00 00
N=1, set P-Filter-constant to 1000ms:	COB-ID = 601	Data = 22 A1 61 01 E8 03 00 00
Response of Network-Node (CMP):	COB-ID = 581	Data = 60 A1 61 01 00 00 00 00
N=1, switch on PDO4, set COB-ID=485h:	COB-ID = 601	Data = 22 03 18 01 85 04 00 00
Response of Network-Node (CMP):	COB-ID = 581	Data = 60 03 18 01 00 00 00 00
N=1, map [P_Int32] to PDO1:	COB-ID = 601	Data = 22 00 21 01 05 00 00 00
Response of Network-Node (CMP):	COB-ID = 581	Data = 60 00 21 01 00 00 00 00
N=1, set cyclic transmit on PDO1:	COB-ID = 601	Data = 22 00 18 02 FF 00 00 00
Response of Network-Node (CMP):	COB-ID = 581	Data = 60 00 18 02 00 00 00 00
N=1, set PDO1 cycle time to 100ms:	COB-ID = 601	Data = 22 00 18 05 64 00 00 00
Response of Network-Node (CMP):	COB-ID = 581	Data = 60 00 18 05 00 00 00 00
N=1, save all settings ("save"):	COB-ID = 601	Data = 22 10 10 01 73 61 76 65
Response of Network-Node (CMP):	COB-ID = 581	Data = 60 10 10 01 00 00 00 00
N=1, restore to factory settings ("load") [1]:	COB-ID = 601	Data = 22 11 10 01 6C 6F 61 64
Response of Network-Node (CMP):	COB-ID = 581	Data = 60 11 10 01 00 00 00 00
N=1, Attempt to write a read only object:	COB-ID = 601	Data = 22 00 10 00 78 56 34 12
Response of Network-Node (CMP):	COB-ID = 581	Data = 80 00 10 00 02 00 01 06 [2]
N=1, PDO1 remote transmission request:	COB-ID = 181	RTR = 1, Data = [ ] (Datalength = 4)
Response of Network-Node (CMP):	COB-ID = 181	Data = XX XX XX XX
N=4, Error: Occur of a Nodeguard-Error:	COB-ID = 84	Data = 30 81 11 00 00 00 00 00 [3]

[1] Only after a reset the device will be start with the factory settings. If the command „save all" isn't executed, the next reset will start the device again with the previous settings.
[2] Abort Code = 0601 0002 h (Attempt to write a read only object)
[3] LastNodeErrorCode = 8130 h, ErrorRegister = 11 h, NodeSubErrorCodes = 0000 h (Monitoring, Life Guard Error)

***H73615c** Trafag AG 03/2012*