GEFRAN

CANopen GSH-A

Wire position transducer with tilt angle measurement

Single version
Redundant version

Cod. 80794 Edit.04/2024 - ENG

SUMMARY

1. SAFETY INSTRUCTION

Total failure or malfunction of the sensor can cause danger or injury to the operator and damage to the machinery or equipment. It is recommended that additional safety measures should be incorporated into the system.
Any alteration, reconstruction or extension of the sensor is not allowed.
Sensor must be operated only within values specified in the datasheet.
Connection to power supply must be performed in accordance with safety instructions for electrical facilities and performed only by trained staff.
Disregard of this advice can lead to malfunctions, damage to property or personal injury and releases the manufacturer from product liability.

Do not open sensor and do not remove any screws
Release of spring under tension can result in injury!

Do not snap cable
Uncontrolled cable retraction can break off cable fixing. Broken fixing and cable can result in injury. Also sensor will be damaged!

Do not travel over range
Uncontrolled cable retraction can result in injury. Also sensor will be damaged!

DANGER

Special attention during mounting and operating with the cable
Risk of injury by the cable!

Sensors without cover / housing (OEM sensors)
Risk of injury by moving parts. Mounting and operation of the sensor only with appropriate safety equipment that an injury is impossible!

Do not exceed maximum operating voltage listed in the catalog
Risk of injury. Sensor will be damaged!

Do not release the cable abruptly
Risk of injury. Sensor will be damaged!

Before connecting the sensor to the bus, the correct bitrate and the node-ID (which must be unique in the network) must be checked.

NOTICE

After power-on, the sensor will enter pre-operational state and send a boot-up message being ready for configuration by Service Data Objects. Parameters configured by the user can be stored nonvolatile by SAVE command.

On receiving “NMT-Node-Start“, the sensor transits to operational state and starts process data transmission.

When “Auto-Start“ is configured the sensor will automatically transit to operational after boot-up without a Node-Start message.

Do not damage cable!

Cable must not be oiled or lubricated!

Do not crack cable!

Cable travel should be axial to the cable outlet (no misalignment allowed!) Do not drag cable along objects!

Do not replace the drive ring

Do not remove the drive ring damper

Do not cut, joint, tear, break, bend, paint, trample on the cable

Precautions:

Do not let snap the cable

Uncontrolled retraction of cable may damage sensor. No warranty will be granted for snapped cables.

Mounting hints for unfavorable conditions

If possible, fasten cable fixing with cable in retracted position.
For example, fit a mounting loop and put it around your wrist. Do not remove the mounting loop before the cable is fastened.

Mounting

To ensure proper operation, install the sensor only as described in this manual.

2. INTRODUCTION

This document describes the mounting of the sensor and the standard CANopen implementations created. It is addressed to CANopen network system integrators and to CANopen device designers who already know the content of the standards defined by CiA (Can in Automation).
The purpose of GSH-A sensors is to transform a linear position and an angular position into an electric signal. It is composed of two parts: the first transduces the linear position and the second one transduces the angular position.

Linear motion of the measuring cable (flexible stainless steel) is converted into rotation by means of a precision cable drum. A spring motor provides torque for the cable retraction. Special design assures precise and reproducible winding of the measuring cable. Cable extraction or retraction is transformed into an electrical signal. The sensor is based on state-of-the-art contactless angle sensor (in HALL technology) implementing the functions of a CAN-BUS network slave device conforming to standard CANopen protocol proposed by CiA and described in the document entitled “CANopen Application Layer and Communication Profile DS 301 v4.2” and in other documents mentioned below. Other reference documents used are CiA DS 406 Device Profile for encoder and CiA DSP 305 Layer Setting Services and Protocol v1.1.1.

Angular position (0...360°) is determined by an inclination sensor with CANopen interface that enables angle levelling in many applications. The sensor is based on state-of-the-art MEMS capacitive technology implementing the functions of a CAN-BUS network slave device conforming to standard CANopen protocol proposed by CiA and described in the document entitled “CANopen Application Layer and Communication Profile DS 301 v4.2” and in other documents mentioned below. Other reference documents used are CiA DS 410 Device Profile for Inclinometers v3.1 (not completely implemented) and CiA DSP 305 Layer Setting Services and Protocol v1.1.1.

Definition and Shortening

CAN: Controller Area Network.
Describes a serial communication bus that implements the “physical” level 1 and the “data link” level 2 of the ISO/OSI reference model.

CAL: CAN Application Layer.
Describes implementation of the CAN in the level 7 “application” of the ISO/OSI reference model from which CANopen derives.

CMS: CAN Message Specification.
CAL service element. Defines the CAN Application Layer for the various industrial applications.

COB: Communication Object.
Unit of transport of data in a CAN network (a CAN message). A maximum of 2048 COBs may be present in a CAN network, each of which may transport from 0 to a maximum of 8 bytes.

COB-ID: COB Identifier.
Identifying element of a CAN message. The identifier determines the priority of a COB in case of multiple messages in the network.

D0 – D7: Data from 0 to 7.
Number of bytes in the data field of a CAN message.

DLC: Data Length code.
Number of data bytes transmitted in a single frame.

ISO: International Standard Organization.
International authority providing standards for various merchandise sectors.

NMT: Network Management.
CAL service element. Describes how to configure, initialize, manage errors in a CAN network.

PDO: Process Data Object.
Process data communication objects (with high priority).

RXSDO: Receive SDO.
SDO objects received from the remote device.

SDO: Service Data Object.
Service data communication objects (with low priority). The value of this data is contained in the “Objects Dictionary” of each device in the CAN network.

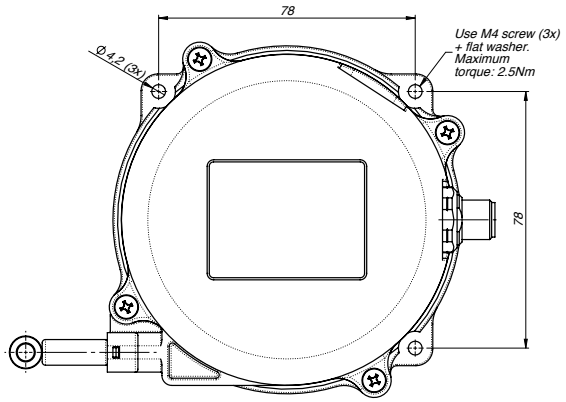
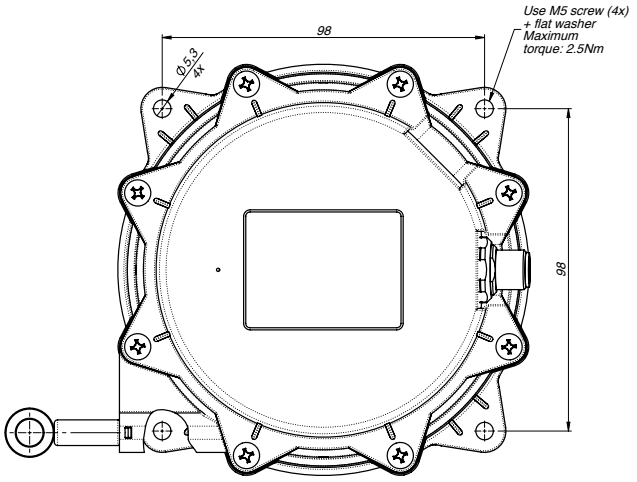
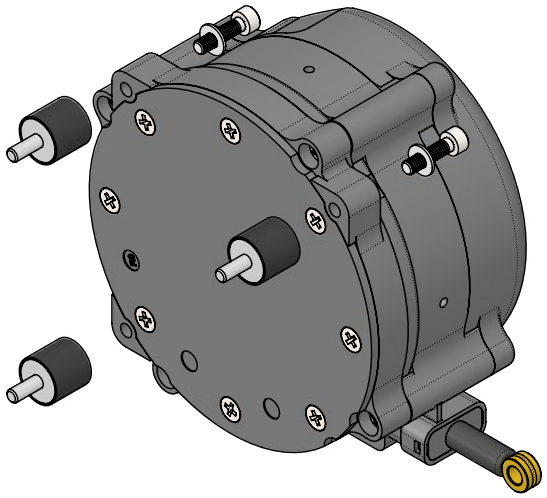
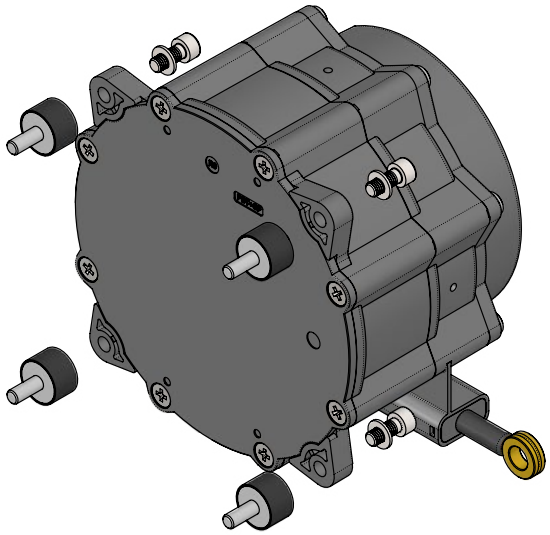
TXPDO: Transmit PDO.
PDO objects transmitted by the remote device.

TXSDO: Transmit SDO.
SDO objects transmitted by the remote device.

Note: The numbers followed by the suffix “h” or with the prefix “0x” represent a hexadecimal value, with suffix “b” a binary value, and with suffix “d” a decimal value. The value is decimal unless specified otherwise.
Note: This manual is valid for the CANopen GSH-A sensor. There are some mechanical differences based on the sensor’s stroke. When not explicitly specified, the indications in this manual are to be considered valid for all strokes available for this product.

3. MOUNTING

1. Mount the sensor at the designated place at the fixing holes with the correct screws and washers, based on the stroke of the sensor, on a flat surface:

Stroke 1800…8300 mm	Stroke 10000…12500 mm
3xM4 screws and washers (tightening torque 2.5 Nm)	4xM5 screws and washers (tightening torque 2.5 Nm)
	
To improve inclination measurement, 45 shore performance in vibration-sensitive environments, 3xM4-bobbins, Ø 14mm, H. 13mm, are recommended	To improve inclination measurement, 55 shore performance in vibration-sensitive environments, 4xM5-bobbins, Ø 16mm, H. 10mm, are recommended
	

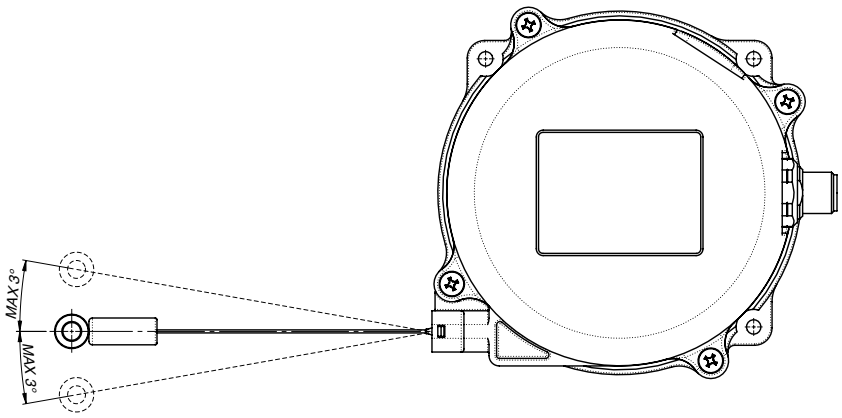
DANGER

Extract the wire and connect the wire to the measuring target only with the sensor correctly mounted

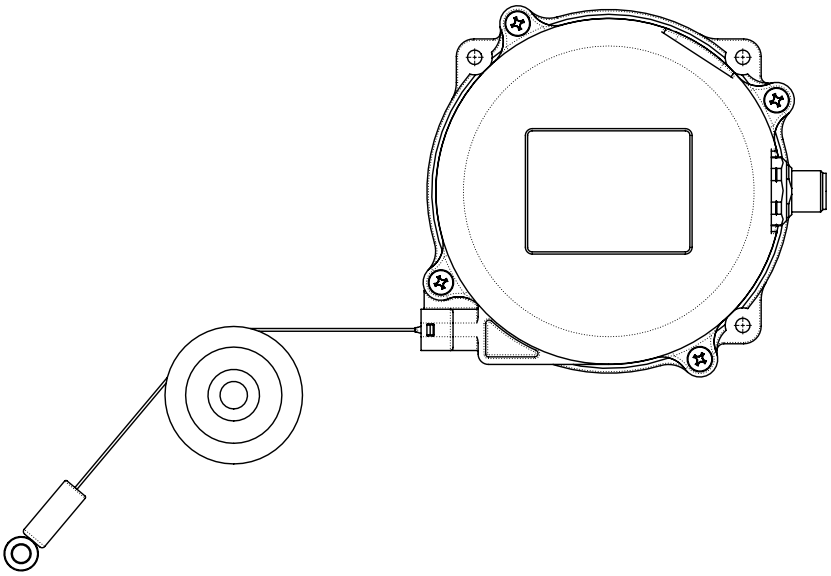
2. Secure the M12 connector with low resistance threadlocker and maximum tightening torque 0.6 Nm.
3. Connect the electronics according to the sensor type (see chapter Electrical Connections)

Additional notes:

- Do not extract the cable at angles greater than 3° compared to the exit hole



- To change the wire extraction direction, use special return pulleys

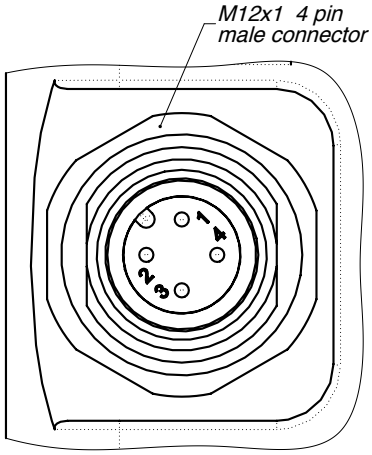


- When mounting outdoors protect the sensor and the wire from ice-formation for negative temperatures
- Prevent the deposit of fertilizers, bitumen or tar on the cable
- Do not alter the orientation of the M12 connector

4. ELECTRICAL CONNECTIONS

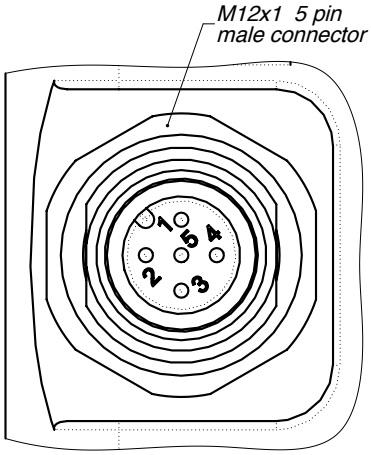
For the connections refer to following images:

SINGLE VERSION **M-1-S**
REDUNDANT VERSION **M-1-R/ M-2-R**



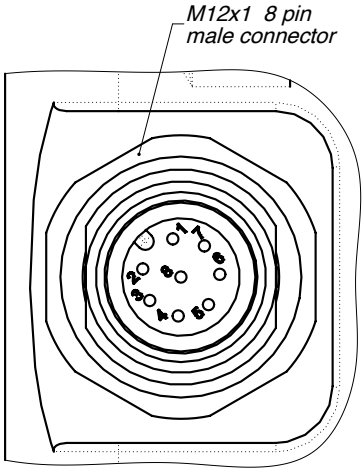
CONNECTIONS	
1	+SUPPLY
2	GROUND
3	CANH
4	CANL

SINGLE VERSION **N-1-S**
REDUNDANT VERSION **N-1-R/ N-2-R**



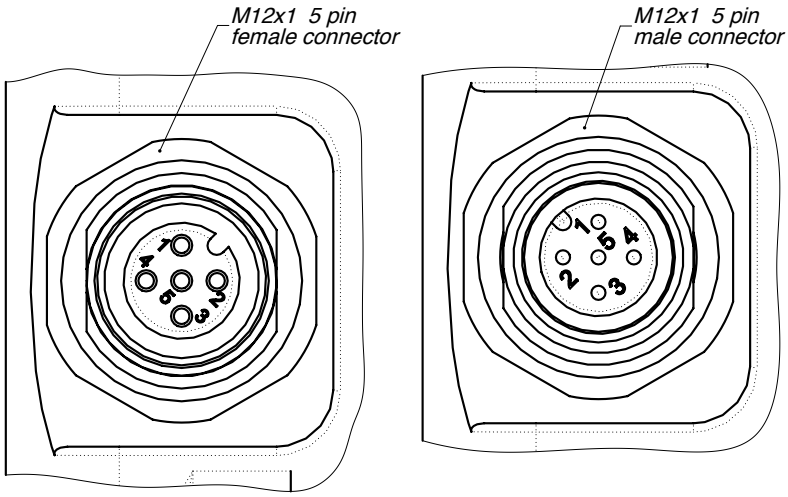
CONNECTIONS	
1	n.c.
2	+SUPPLY
3	GROUND
4	CANH
5	CANL

REDUNDANT VERSION **O-1-R**



CONNECTIONS	
1	+SUPPLY 1
2	GROUND 1
3	CANH 1
4	CANL 1
5	+SUPPLY 2
6	GROUND 2
7	CANH 2
8	CANL 2

SINGLE/REDUNDANT IN-OUT VERSION N-3-(S/R)



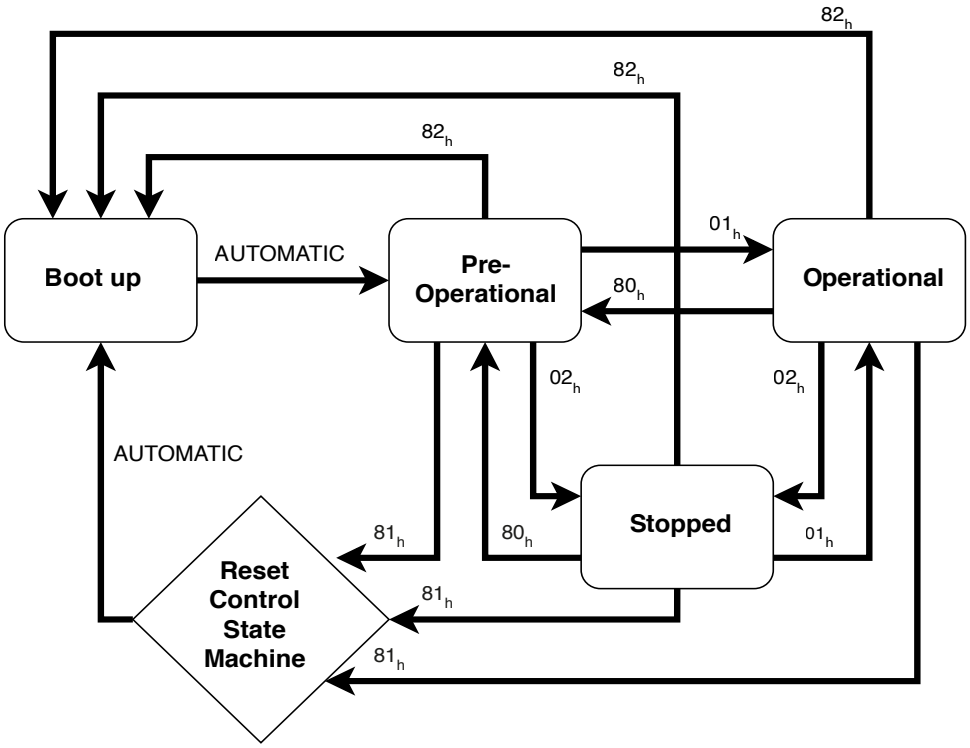
CONNECTIONS	
1	GROUND
2	+SUPPLY
3	GROUND
4	CANH
5	CANL

CONNECTIONS	
1	GROUND
2	+SUPPLY
3	GROUND
4	CANH
5	CANL

Note: please make sure that the CANbus is terminated.
The impedance measured between CAN H and CAN L must be 60 ohm that means the cable must be connected to a 120 ohm resistor on each ends of the bus line. Internally the transducer is not terminated with the resistor of 120 ohm.
Do not confuse the signal lines of the CAN bus, otherwise communication with the transducer is impossible.

5. NETWORK MANAGEMENT (NMT)

The device supports CANopen network management functionality NMT Slave (Minimum Boot Up).



Every CANopen device contains an internal Network Management server that communicates with an external NMT master. One device in a network, generally the host, may act as the NMT master.
Through NMT messages, each CANopen device's network management server controls state changes within its built-in **Communication State Machine**.
This is independent from each node's operational state machine, which is device dependent and described in **Control State Machine**.

The **"Communication State Machine"** in all CANopen devices, however, is identical as specified by the DS301. NMT messages have the highest priority. The NMT messages control the **Communication State Machine**. Each message contains 2 data bytes that identify the node's state and the node-ID.
Table 1 shows the 5 NMT messages supported, and Table 2 shows the correct message construction for sending these messages.

NMT Message	COB-ID	Byte 0	Byte 1
Start Remote Node	0	01h	Node-ID*
Stop Remote Node	0	02h	Node-ID*
Pre-operational State	0	80h	Node-ID*
Reset Node	0	81h	Node-ID*
Reset Communication	0	82h	Node-ID*

Table 1. NMT supported messages

*Node-ID = Drive address (from 01h to 7Fh), 00h for broadcast message

Arbitration Field		Data Field							
COB-ID	RTR	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
000h	0	See Table 1	Node-ID	Bytes not sent					

Table 2. NMT message construction

6. BAUD RATE

Baud rate can be configurable via SDO communication object 0x3000 (see communication examples at the end of this document).

The default Baud rate is 250 kbit/s.

Important Note:
Changing this parameter can disturb the network! Use this service only if one device is connected to the network!

7. NODE-ID

Node ID can be configurable via SDO communication object 0x3001 (see communication examples at the end of this document).

The default Node-ID can vary depending on the version, as follows:

- **Single version** **0x13 (channel 1)**

- **Redundant version** **0x13 (channel 1)**
  0x14 (channel 2)

Important Note:
Changing this parameter can disturb the network! Use this service only if one device is connected to the network!

8. PARAMETERS SETTINGS

All object dictionary parameters (objects with marking PARA) can be saved in a special section of the internal EEPROM and secured by checksum calculation. The special LSS parameters (objects with marking LSS-PARA), also part of the object dictionary, will be also saved in a special section of the internal EEPROM and secured by checksum calculation. Due to the internal architecture of the microcontroller the parameter write cycles are limited to 100,000 cycles.

9. HEARTBEAT

The heartbeat mechanism for this device is established through cyclic transmission of the heartbeat message done by the heartbeat producer. One or more devices in the network are aware of this heartbeat message. If the heartbeat cycle fails from the heartbeat producer, the local application on the heartbeat consumer will be informed about that event. The implementation of either guarding or heartbeat is mandatory.
The device supports **Heartbeat Producer** functionality.

COB-ID	DLC	Byte 0
700+Node-ID	01h	NMT State

Table 3. Heartbeat message

The byte associated at the NMT state is indicated in the following table.

NMT State	Byte
Start Remote Node	01h
Stop Remote Node	02h
Pre-operational State	80h
Reset Node	81h
Reset Communication	82h

Table 4. NMT State

10. SDO COMMUNICATION AND READ/WRITE COMMANDS

The device fulfils the **SDO Server** functionality.

With Service Data Object (SDO) the access to entries of a device Object Dictionary is provided. As these entries may contain data of arbitrary size and data type SDOs can be used to transfer multiple data sets from a client to a server and vice versa.

Write Access, Data Transfer from Host to Slave

Each access to the object dictionary is checked by the slave for validity. Any write access to non-existing objects, to read-only objects or with a non-corresponding data format are rejected and answered with a corresponding error message.

Structure of SDO-request by the Master:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
600+Node-ID	8	CMD	Index		Sub-Index	Data	Data	Data	Data

CMD field determines the direction of data transfer and the size of the data object:

23h Sending of 4-byte data (bytes 4...7 contain a 32-bit value)
2Bh Sending of 2-byte data (bytes 4, 5 contain a 16-bit value)
2Fh Sending of 1-byte data (byte 4 contains an 8-bit value)

Structure of SDO-answer by the Slave:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
580+Node-ID	8	RES	Index		Sub-Index	Data	Data	Data	Data

RES field determines the correct/incorrect answer of the slave:

60h Data sent successfully
80h Error

Read Access, Data Transfer from Slave to Host

Each access to the object dictionary is checked by the slave for validity. Any read access to non-existing objects or to write-only are rejected and answered with a corresponding error message.

Structure of SDO-request by the Master:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
600+Node-ID	8	CMD	Index		Sub-Index	Data	Data	Data	Data

CMD field determines the direction of data transfer for any size of the data object:

40h Read access of data (1-, 2- or 4-byte)

Structure of SDO-answer by the Slave:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
580+Node-ID	8	RES	Index		Sub-Index	Data	Data	Data	Data

RES field determines the answer of the slave:

43h Sending of 4-byte data (bytes 4...7 contain a 32-bit value)
4Bh Sending of 2-byte data (bytes 4, 5 contain a 16-bit value)
4Fh Sending of 1-byte data (byte 4 contains an 8-bit value)
80h Error

11. PDO COMMUNICATION

Transmit PDO #0 – Length and angle calculation GSH-A

The PDO transmits the measurements, in particular:

- Single version, one PDO is transmitted containing length measurement, angle measurement and alarms.
- Redundant version, one PDO is transmitted for each channel. PDO #0 contains length measurement, angle measurement and alarms of channel 1 and PDO #1 contains length measurement, angle measurement and alarms of channel 2.

The PDOs shall be transmitted cyclically, the cyclic timer has default value equal to 50ms. However, cyclic timer of PDOs is programmable through object 0x1800 sub-index 5 (and 0x1801 sub-index 5, for redundant version). Values between 4 ms and 65535 ms shall be selectable by parameter settings.
The PDO #0 (and PDO #1, for redundant version) will be transmitted by entering the “Operational” state.

Single version, structure of PDO:

Bytes 0 and 1 contain the length measurement of channel 1, unsigned integer 16-bit value with forward direction. Bytes 2 and 3 contain the angle measurement of channel 1, unsigned integer 16-bit value with forward direction.

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4, Byte 5	Byte 6	Byte 7
Position value Channel 1 LSB	Position value Channel 1 MSB	Angle value Channel 1 LSB	Angle value Channel 1 MSB	Alarms	Counter	Checksum

Table 5. Structure of PDO, single version

Redundant version, structure of PDO:

Bytes 0 and 1 contain the length measurement of channel 1, unsigned integer 16-bit value with forward direction. Bytes 2 and 3 contain the angle measurement of channel 1, unsigned integer 16-bit value with forward direction.

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4, Byte 5	Byte 6	Byte 7
Position value Channel 1 LSB	Position value Channel 1 MSB	Angle value Channel 1 LSB	Angle value Channel 1 MSB	Alarms	Counter	Checksum

Table 6. Structure of PDO channel 1 (default ID: 0x193), redundant version

Bytes 0 and 1 contain the length measurement of channel 2, unsigned integer 16-bit value with backward direction. Bytes 2 and 3 contain the angle measurement of channel 2, unsigned integer 16-bit value with backward direction.

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4, Byte 5	Byte 6	Byte 7
Position value Channel 2 LSB	Position value Channel 2 MSB	Angle value Channel 2 LSB	Angle value Channel 2 MSB	Alarms	Counter	Checksum

Table 7. Structure of PDO channel 2 (default ID: 0x194), redundant version

The measurements transmitted via PDO are described in the following figures:

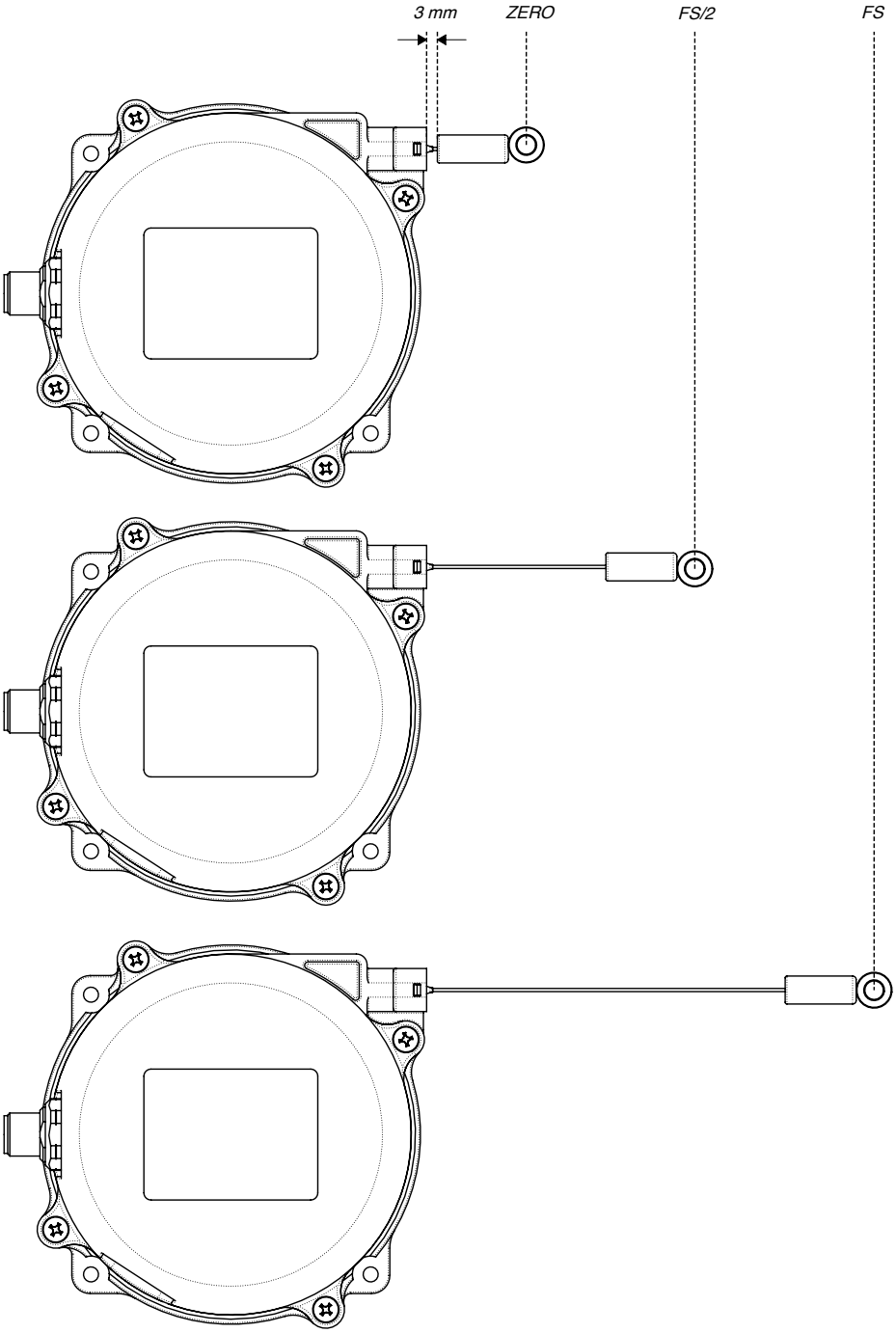
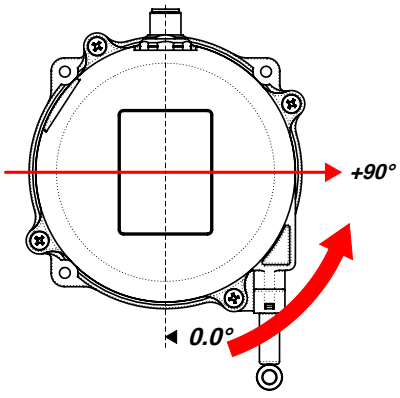
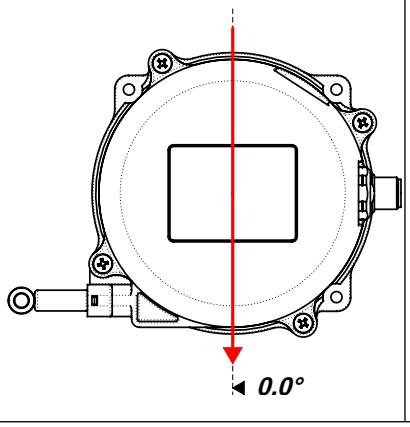
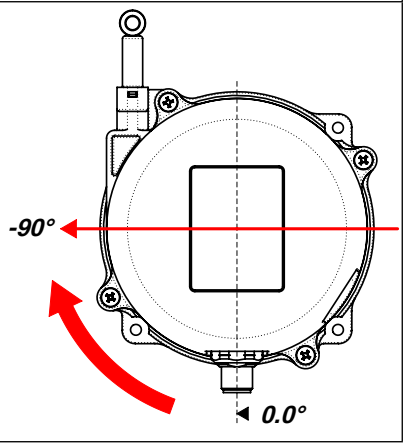


	FIGURE 1	FIGURE 2	FIGURE 3
CH1	90 deg	0 deg	270 deg
CH2	270 deg	0 deg	90 deg
			

PDO EXAMPLES (REDUNDANT VERSION)

Please, consider that a redundant GSH-A is a sensor with two independent channels, each of them producing a measurement and transmitting it through PDO communication. Channel 1 and 2 can be considered as two independent sensors, each of them with his Node-ID.
The following example of PDO mapping is reported in the case of:

- Node-ID = 13h for channel 1, 14h for channel 2
- Baud-rate = 250 kbps
- Redundant version
- Linear-encoder (CiA DS 406) setting as follow:
  1. Position Value (object 0x6004) indicates the length measurement
  2. Position Step (object 0x6005) = 1 mm (1 000 000 steps x 1 nm)
- Inclinometer (CiA DS 410) setting as follow:
  1.Resolution (object 0x6800) = 0.1 deg (100 steps x 0.001 deg)
  2.Slope long 16 (object 0x6810) indicates the slope value in degrees

• *PDO channel #1 mapping:*

ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
193h	34h	00h	22h	00h	00h	00h	04h	59h

Byte 0 (LSB) = 34h
Byte 1 (MSB) = 00h
Position channel 1: 0034h = 52d. Resolution = 1 mm. Value: 52 mm.
Byte 2 (LSB) = 22h
Byte 3 (MSB) = 00h
Angle channel 1: 0022h = 34d. Resolution = 0,1 deg. Value: 3,4 deg.

• *PDO channel #2 mapping:*

ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
194h	26h	1Fh	E6h	0Dh	00h	00h	04h	3Ch

Byte 0 (LSB) = 26h
Byte 1 (MSB) = 1Fh
Position channel 2: 1F26h = 7974d. Resolution = 1 mm. Value: 7974 mm.
Byte 2 (LSB) = E6h
Byte 3 (MSB) = 0Dh
Angle channel 2: 0DE6h = 3558d. Resolution = 0,1 deg. Value: 355,8 deg.

12. ERROR HANDLING

Alarms

PDO has 2 bytes that indicate the alarms, if present. The bytes are mapped as in the table below.

	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
BYTE 0	-	-	Magnet field too low	Magnet field too high	-	Over extension alarm	Under extension alarm	-
BYTE 1	-	-	-	-	-	Tilt primary element alarm	Extension primary element alarm	-

Table 8. PDO mapping

13. CANopen FEATURES SUMMARY

Communication object

The parameters which are critical for communication are determined in the Communication profile. This area is common for all CANopen devices.

Index	Sub- index	Name	Type	ACCESS	DEFAULT	COMMENT
0x1000		Device Type	U32	ro	0xFFFF0196	Multiple logical device with ds406 device profile as the first logical device
0x1001		Error Register	U8	ro	0x00	Always 0
0x1005		COB-ID SYNC	U32	rw	0x00000080	
0x1008		Manufacturer Device Name	String	const	“GSHA”	Refer to GEFRAN products catalogue: GSH-A
0x1009		Manufacturer Hardware Version	String	const	“1.xx”	“Maj.MinMin”
0x100A		Manufacturer Software Version	String	const	“1.xx”	“Maj.MinMin”
0x1010	**Store Parameters**					
	0x0	Number of Entries	U8	ro	1	Number of Entries
	0x1	Save all Parameters	U32	wo		“save” (0x65766173) to store all parameters
0x1018	**Identity Object**					
	0x0	Number of Entries	U8	ro	4	Number of Entries
	0x1	Vendor ID	U32	ro	0x00000093	Refer to “Gefran Product Overview CANopen”
						Gefran Vendor ID: 0x00000093
	0x2	Product Code	U32	ro	0x00000067	Refer to “Gefran Product Overview CANopen”
	0x3	Revision Number	U32	ro	0x00000001	Revision number
	0x4	Serial Number	U32	ro	-	Serial number (Indicated on sensor label)
0x1200	**SDO Server Parameter**					
	0x0	Number of Entries	U8	ro	2	Number of Entries
	0x1	COB-ID Client to Server	U32	ro	0x600 +Node-ID	
	0x2	COB-ID Server to Client	U32	ro	0x580 +Node-ID	
0x1800	**TXPDO Communication Parameter**					
	0x0	Number of Entries	U8	ro	5	Number of Entries
	0x1	COB-ID	U32	ro	0x180 +Node-ID	
	0x2	Transmission Type	U8	ro	254	1..240: Synchronous Transmission
						254: Asynchronous transmission, transmission event is manufacturer specific, i.e. event timer
	0x3	Inhibit Time	U16	ro	0x0004	Minimum interval time for PDO
	0x4	Reserved	U8	ro	0	
	0x5	Event Timer - PARA	U16	rw	100	In the EDS file this default value must be set to 0, otherwise errors will be generated

Index	Sub- index	Name	Type	ACCESS	DEFAULT	COMMENT
0x1A00	**TXPDO Mapping Parameter**					
	0x0	Number of Entries	U8	ro	2	Number of Entries
	0x1	1st Object	U16	ro	0x60040010	PDO mapping for the 1st application object
	0x2	2st Object	U16	ro	0x68100010	PDO mapping for the 2st application object

Table 9. Communication object

Note: The access to CANopen variables can be ro (the parameter can be read only), rw (the parameter can be read and also written), wo (the parameter can be written only) or const (the parameter is always constant).

Manufacturer Specific Objects

Index	Sub- index	Name	Type	ACCESS	DEFAULT	COMMENT
0x3000		Setting of the Baud Rate	U8	rw	0x03	0 = 1000 kbps 1 = 800 kbps 2 = 500 kbps 3 = 250 kbps (default) 4 = 125 kbps 5 = 100 kbps 6 = 50 kbps 7 = 20 kbps
0x3001		Setting of the Node ID	U8	rw	0x13	The node ID used to access the sensor in the CANopen network
0x5000		Automatic NMT Start after Power On – PARA	U8	rw	1	0: not activated 1: activated (default)

Table 10. Manufacturer Specific Objects

Note: The access to CANopen variables can be ro (the parameter can be read only), rw (the parameter can be read and also written), wo (the parameter can be written only) or const (the parameter is always constant).

Profile Objects (according to CiA DS-406 and CiA DS-410)

Index	Sub- index	Name	Type	ACCESS	DEFAULT	COMMENT
0x6000		Operating Parameters – PARA	U16	ro	0x0000	
0x6004		Position Value	U32	ro	-	“Position value” defines the output position value for the communication objects 1800h
0x6005		Position step settings [nm/Step]	U32	ro	0x000F4240	Position step setting in nm 1000000 for millimeter
0x67FF		Device Type	U32	ro	0x000A0196	Multi-sensor encoder interface with DS-406 device profile
0x6800		Resolution	U16	ro	0x0064	Tilt step setting in 0.001 deg 100 for 0.1 deg;
0x6810		Slope long 16	U16	ro	-	Slope value of the longitudinal axis
0x6811		Slope long 16 operating parameters	U8	ro	0x00	
0x6FFF		Device Type	U32	ro	0x0002019A	Multi-sensor encoder interface with DS-410 device profile

Table 11. Profile Objects

Note: The access to CANopen variables can be ro (the parameter can be read only), rw (the parameter can be read and also written), wo (the parameter can be written only) or const (the parameter is always constant).

14. COMMUNICATION EXAMPLES

Example 1) How to change the Node-ID from 0x13 (19d) to 0x06 (06d)

With Service Data Object (SDO) the access to entries of a device Object Dictionary is provided. As these entries may contain data of arbitrary size and data type SDOs can be used to transfer multiple data sets from a client to a server and vice versa.

Structure of SDO-request by the Master:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
600+Node-ID	8	CMD	Index		Sub-Index	Data	Data	Data	Data

CMD field determines the direction of data transfer and the size of the data object:

23h Sending of 4-byte data (bytes 4...7 contain a 32-bit value)
2Bh Sending of 2-byte data (bytes 4, 5 contain a 16-bit value)
2Fh Sending of 1-byte data (byte 4 contains an 8-bit value)

Each access to the object dictionary is checked by the slave for validity. Any write access to non-existing objects, to read-only objects or with a non-corresponding data format are rejected and answered with a corresponding error message.

Structure of SDO-answer by the Slave:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
580+Node-ID	8	RES	Index		Sub-Index	Data	Data	Data	Data

RES field determines the correct/incorrect answer of the slave:

60h Data sent successfully
80h Error

To change the Node-ID from the standard value 13h to 06h, write the new Node-ID in the object 3001h by using the following SDO message. Then send the Save all parameters SDO and perform a sensor reset.

SDO request 1:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
613h	8	2Fh	01h	30h	00h	06h	00h	00h	00h

The answer after successful storing you will receive is:

SDO answer 1:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
593h	8	60h	01h	30h	00h	00h	00h	00h	00h

In order to save all new customized parameters, send the following SDO message. Then, turn-off and turn-on the power supply to perform the reset

SDO request 2 (SAVE):

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
613h	8	23h	10h	10h	01h	73h	61h	76h	65h

The answer after successful storing you will receive is:

SDO answer 2:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
593h	8	60h	10h	10h	01h	00h	00h	00h	00h

Example 2) How to change the PDO rate (time interval) from 100 ms (current setting) to 1000 ms

With Service Data Object (SDO) the access to entries of a device Object Dictionary is provided. As these entries may contain data of arbitrary size and data type SDOs can be used to transfer multiple data sets from a client to a server and vice versa.

Structure of SDO-request by the Master:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
600+Node-ID	8	CMD	Index		Sub-Index	Data	Data	Data	Data

CMD field determines the direction of data transfer and the size of the data object:

23h Sending of 4-byte data (bytes 4...7 contain a 32-bit value)
2Bh Sending of 2-byte data (bytes 4, 5 contain a 16-bit value)
2Fh Sending of 1-byte data (byte 4 contains an 8-bit value)

Each access to the object dictionary is checked by the slave for validity. Any write access to non-existing objects, to read-only objects or with a non-corresponding data format are rejected and answered with a corresponding error message.

Structure of SDO-answer by the Slave:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
580+Node-ID	8	RES	Index		Sub-Index	Data	Data	Data	Data

RES field determines the correct/incorrect answer of the slave:

60h Data sent successfully
80h Error

To change the PDO event timer from the standard 100ms to 1000ms, write the new event timer in the object 1800h sub-index 5 by using the following SDO message. Then send the Save all parameters SDO and perform a sensor reset.

SDO request 1:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
613h	8	2Bh	00h	18h	05h	E8h	03h	00h	00h

The answer after successful storing you will receive is:

SDO answer 1:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
593h	8	60h	00h	18h	05h	00h	00h	00h	00h

In order to save all new customized parameters, send the following SDO message. Then, turn-off and turn-on the power supply to perform the reset

SDO request 2 (SAVE):

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
613h	8	23h	10h	10h	01h	73h	61h	76h	65h

The answer after successful storing you will receive is:

SDO answer 2:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
593h	8	60h	10h	10h	01h	00h	00h	00h	00h

Example 3) How to de-activate an automatic NMT Start after Power ON (the PDO will not be send automatically after power ON)

With Service Data Object (SDO) the access to entries of a device Object Dictionary is provided. As these entries may contain data of arbitrary size and data type SDOs can be used to transfer multiple data sets from a client to a server and vice versa.

Structure of SDO-request by the Master:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
600+Node-ID	8	CMD	Index		Sub-Index	Data	Data	Data	Data

CMD field determines the direction of data transfer and the size of the data object:

23h Sending of 4-byte data (bytes 4...7 contain a 32-bit value)
2Bh Sending of 2-byte data (bytes 4, 5 contain a 16-bit value)
2Fh Sending of 1-byte data (byte 4 contains an 8-bit value)

Each access to the object dictionary is checked by the slave for validity. Any write access to non-existing objects, to read-only objects or with a non-corresponding data format are rejected and answered with a corresponding error message.

Structure of SDO-answer by the Slave:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
580+Node-ID	8	RES	Index		Sub-Index	Data	Data	Data	Data

RES field determines the correct/incorrect answer of the slave:

60h Data sent successfully
80h Error

To change the PDO event timer from the standard 100ms to 1000ms, write the new event timer in the object 5000h by using the following SDO message. Then send the Save all parameters SDO and perform a sensor reset.

SDO request 1:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
613h	8	2Fh	00h	50h	00h	00h	00h	00h	00h

The answer after successful storing you will receive is:

SDO answer 1:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
593h	8	60h	00h	50h	00h	00h	00h	00h	00h

In order to save all new customized parameters, send the following SDO message. Then, turn-off and turn-on the power supply to perform the reset

SDO request 2 (SAVE):

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
613h	8	23h	10h	10h	01h	73h	61h	76h	65h

The answer after successful storing you will receive is:

SDO answer 2:

COB-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
593h	8	60h	10h	10h	01h	00h	00h	00h	00h

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