



CANopen interface of the measuring amplifier GSV-8

Manual

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Version

Device firmware version for which this description is complete: 1.55 ff
EDS device description file: gsv8can5.eds
EDS Version: 3
EDS Revision: 1

General

In addition to the standard serial-over-USB, the GSV-8 CANopen offers a CANbus interface whose application layer conforms to the CANopen standard.

This is defined by the standardization agency "CAN in Automation" (CiA) in their publication DS-301. The GSV-8 CANopen corresponds to the device category of measuring devices that are described in the CiA publication DS-404 ("Device Profile Measuring Devices").

Some device settings are accessible via CANopen via the object dictionary using service data objects (SDOs). Measured values are sent by Process Data Objects (TX-PDOs).

Using the CANopen interface, write access

With the output configuration set by the manufacturer, the CANopen interface is usually switched off. This means that with one of the programs GSVmultichannel or GSV-8term etc. basic settings of the CAN interface can be made, namely the baud rate, node ID and the on / off status. These are stored in the device in a non-volatile manner. After switching on the CANopen interface or after booting, i.e. after applying the power supply with the CAN interface switched on, the GSV-8AS CANopen automatically goes into the pre-operational state (see Network management, p. 9). In this state, the object dictionary is accessible, i.e. Settings can be read and written via CAN. But measured values, i.e. TX PDOs, are not sent. In order for the GSV-8AS CANopen to do this, it must be switched to the operational state via network management (see there).

In the pre-operational and operational state, the **USB** and **serial interfaces** have **no write access**. When the CANopen interface is switched on, settings can only be changed via CAN, not via the serial interface. The stopped state is an exception: Since the object directory is not accessible in this state, settings can also be changed here via the serial or USB interface.

However, all settings can be read in any state via the serial or USB interface, and measured values are continuously transmitted via these in the default configuration.

Switching the CANopen interface on and off is only possible via the serial interface (e.g. by firmware command 140d). The Windows programs GSV8term and GSVmultichannel, which communicate with the GSV-8 via USB or serial interface, are available for convenient operation.

The prerequisite for being able to switch on the CANopen interface is the activated "Float" measured value data type. This is already set in the delivery state. The measurement data type can also be changed with the above programs via USB / serial.

Changing the CANopen settings using the Windows program GSVmultichannel (from Ver. 1-34):

1. Install the program
2. Add Channel, enter device type "GSV-8" and the COMport-No, click "Connect"
3. Menu bar -> Device -> Advanced Settings ... -> Interface tab



Calling up the menu of the CAN settings in the program GSV8terminal.exe:

1. When prompted, enter the interface number <Enter>
2. <Enter> to open the measured value display and the first main menu page
3. Press the F2 <Enter> key to open the second main menu page
4. Key c, then the respective numbers (and <Enter>) to change settings
F1 key to display the operating keys; then <Enter>: return to the display of measured values

CAN-IDs

The assignment of the CAN identifier by the device after the initial start-up takes place according to the **Predefined Connection Set**, which is described in the CANopen communication profile DS-301.

The so-called COB-ID forms the ID of the CAN frame (11 bits). It is made up of the device address (= "Node-ID", bits <6: 0>, range 0x01..0x7F) and an offset to identify the service (bits <10: 7>); with the exception of network management, for which ID 0 is reserved.

The following table shows the areas for the various services. The direction of transmission (sending / receiving) is specified from the point of view of the GSV-8 CANopen.

Service (Object type)	COB-ID (dez.)	COB-ID (hex.)	Offset (hex)
Network Management (Receive)	0	0x000	-
TxPDO No.1 (Send Ch. 1 & 2)	385 - 511	0x181 - 0x1FF	0x180
TxPDO No.2 (Send Ch. 3 & 4)	641-767	0x281 - 0x2FF	0x280
TxPDO No.3 (Send Ch. 5 & 6)	897-1023	0x381 - 0x3FF	0x380
TxPDO No.4 (Send Ch. 7 & 8)	1153-1279	0x481 - 0x4FF	0x480
SDO (Send)	1409 - 1535	0x581 - 0x5FF	0x580
SDO (Receive)	1537 - 1663	0x601 - 0x67F	0x600
Heartbeat / Boot-Message (Send)	1793 - 1919	0x701 - 0x77F	0x700

Table 1: Distribution of identifiers

Changing the Node-ID and the CAN-Bitrate

The change of the node ID and the CAN bit rate can only be done via the serial interface, e.g. by using firmware command 140. For a more comfortable setting, the Windows program GSVmultichannel or the terminal program GSV-8term.exe can also be used: Switch to the second menu page with F2 <Enter> and then press c <Enter> to view and change the CAN settings.

The following bit rates are supported by the GSV-8 CANopen:

50 kBits/s
125 kBits/s
250 kBits/s
500 kBits/s
1000 kBits/s = 1MBit/s

Connection of the CAN bus lines

The CAN bus lines are routed to two 5-pin M12 connectors connected in parallel, where pin 2 is also brought together, but which is not used. The CAN signals are assigned as follows, according to CAN-CiA303-1:

M12 Pin No.	Description
5	CAN-L
3	CAN-GND
4	CAN-H
1	Shielding = plug housing
2	Not used

Table 2: Connection of the CAN bus lines

The CAN interface is completely galvanically isolated; i.e. CAN-GND is isolated from the housing. The cable shield should be linked to the metallic union nut of the M12 connector or to pin 1.

Bus termination

The CAN bus connections are not terminated in the device. A commercially available M12 CAN bus connector with an integrated 120 Ohm terminating resistor fits into the female "Fieldbus" socket on the device. If the device is connected to the end of the CAN bus line, it should be used and the GSV-8 CANopen must then connected to the CAN bus at the male device plug.



Default settings

CAN Bit rate	500 kBits/s
Node-ID	0x40
Transmission-Type (Obj. 180n.2, n=0..3)	255
Event-Timer (Obj. 180n.5, n=0..3)	0x03E8, i.e. 1 PDO set /s (4 PDOs/s total)
Producer Heartbeat Time (Obj. 1017)	0, which means Heartbeat is switched off. The bootup frame is sent once after switching on and after a reset.
Mapping TxPDO 1	Analog input channel 1 and 2 PV
Mapping TxPDO 2	Analog input channel 3 and 4 PV
Mapping TxPDO 3	Analog input channel 5 and 6 PV
Mapping TxPDO 4	Analog input channel 7 and 8 PV

Table 3: Default settings

Network Management

The device state can be changed by Network Management messages (Stop / Pre-Operational / Operational).

Start Node

Node = Module address or 0 = all modules „Broadcast-message.“

The GSV-8 CANopen is put into the Operational State using the Start Node command. In this state, it can communicate via PDOs.

ID	DLC	B0	B1
0	2	0x01	Node-ID or 0

Stop Node

Node = module address or 0 = all modules "Broadcast-message"

The "Stop Node" command puts the GSV-8 CANopen into stop mode. In this state, communication cannot be made via SDOs nor PDOs. Instead, it can be parameterized via the serial or the USB interface.

ID	DLC	B0	B1
0	2	0x02	Node-ID or 0

Enter Pre-Operational

Node = module address or 0 = all modules "Broadcast-message"

The Enter Pre-Operational command puts the GSV-8 CANopen in the pre-operational state. In this state, communication can take place via SDOs, but not via PDOs. This state is entered automatically after power-up.

ID	DLC	B0	B1
0	2	0x80	Node-ID or 0

Reset Node

Node = module address or 0 = all modules „Broadcast-message“

A reset of GSV-8 CANopen is performed using the "Reset Node" command. All settings that were valid before the last power-on are restored. After reset, it is in the pre-operational state and sends the "boot-up message" once.

ID	DLC	B0	B1
0	2	0x81	Node-ID o. 0



Reset Communication Protocol

Node = module address or 0 = all modules „Broadcast-message“

The communication settings that were valid before the last power-on are restored using the "Reset Communication Protocol" command. Communication settings are those that are operated by the SDO indices 1xxxh. After reset, it is in the pre-operational state and sends the "boot-up message" once.

ID	DLC	B0	B1
0	2	0x82	Node-ID o.

Interpretation of the default TxPDOs

If the corresponding transmission conditions are met (see below), in the delivery state the GSV-8 CANopen communicates measured values by successively sending 4 Tx-PDOs, see Fig. Table 1.

After booting, the device is in the preoperational state. The "Enter Operational State NMT" must be given, so that the Tx PDOs are sent. Then - if the sending conditions are met, see below - The following PDO frames are sent, in chronological order from left to right and from top to bottom:

TxPDO No. 1 for input channels 1 and 2:

Measuring value channel 1				Measuring value channel 2			
LSbyte	Byte 2	Byte 3	MSbyte	LSbyte	Byte 2	Byte 3	MSbyte

TxPDO No. 2 for input channels 3 and 4:

Measuring value channel 3				Measuring value channel 4			
LSbyte	Byte 2	Byte 3	MSbyte	LSbyte	Byte 2	Byte 3	MSbyte

TxPDO No. 3 for input channels 5 and 6:

Measuring value channel 5				Measuring value channel 6			
LSbyte	Byte 2	Byte 3	MSbyte	LSbyte	Byte 2	Byte 3	MSbyte

TxPDO No. 4 for input channels 7 and 8:

Measuring value channel 7				Measuring value channel 8			
LSbyte	Byte 2	Byte 3	MSbyte	LSbyte	Byte 2	Byte 3	MSbyte

From firmware version 1.45, the content of the TxPDOs can be changed by using the so-called dynamic mapping, s. p.21

Transmission conditions for TxPDOs

- State = Operational AND
- PDO = valid (Object 180n.1 Data-Bit 31 =0) AND
- TxPDO-Mapping not empty (Obj. 1A0n.0 >0) AND
- Event-Timer (180n.5) expired

The numerical representation of the measured values is in 32-bit float format (according to IEEE754); with correct parameterization of the measuring amplifier, these are physically scaled measured values that do not require further conversion.

Heartbeat Protocol

The Heartbeat protocol allows other participants on the network to determine whether the module is still functional and in what state it is in.

The CAN identifier, over which the module sends a heartbeat, is set to 700h + Node ID.

The repetition time (also called Producer Heartbeat Time) is set by the SDO object with the index 1017h. A value of 0 means that no heartbeat frames are sent, s. p. 17

The heartbeat protocol transmits a byte of payload data in which the device state is encoded.

Device state on the CANopen network	Code (dec.)	Code (hex)
Bootup	0	0x00
Stopped	4	0x04
Pre-Operational	127	0x7F
Operational	5	0x05

After switching on the supply voltage or after executing the network management objects "Reset Node", the module automatically sends the so-called "boot-up message".

Example: Switching on the module with the node ID 0x40:

ID	DLC	B0
740h	1	00h



SDO-Communication

The parameters of the device and its object dictionary is accessed via a Service Data Object (SDO) channel. The GSV-8 CANopen responds to SDO requests, which can take a certain amount of time, especially for certain write requests. It is recommended to wait for the slave's (= the GSV-8-CANopen) response after a SDO requests, before sending a new requests.

It is also recommended to avoid setting communication parameters in a general manner, as they are immediately stored in the EEPROM of the device and this is specified only for a limited number of write cycles (approx. 1 million). It is recommended to read the parameters first and change them writing only if the value read differs from the desired value.

A SDO telegram has the following structure:

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
TX: NodeID+0x580 RX: NodeID+0x600	8	CMD	Index		sub-index	Data bytes			

The number of valid data bytes depends on the data type of the object. For read requests and write responses, the 4 data bytes are irrelevant and should be all =0x00. The same applies to unused bytes in the data slot if the data type is shorter than 4 bytes. Valid data bytes always start with the LSbyte in B4 of the CAN data frame.

The **Command Byte (CMD)** has the following meaning:

Function	Number of data bytes	CMD	ID Offset
Master reads from slave (RX)	irrelevant (none)	40h	600h
Slave responds to read request (TX)	1	4Fh	580h
	2	4Bh	
	3	47h	
	4	43h	
Master writes to slave (RX)	1	2Fh	600h
	2	2Bh	
	3	27h	
	4	23h	
Slave responds with OK (TX)	irrelevant (none)	60h	580h
Slave responds with error message (TX)	4	80h	580h

Indexes

The individual objects are distinguished by indexes in the object dictionary. The index is a 16-bit number whose most-significant byte (MSbyte) often represents categories or functional ranges; the upper 4 bits sometimes also data types. Within an object there are often different parameters or functionalities, which are then distinguished by the sub-index. Note:

For index and data bytes, the LSByte is transmitted first!

An example of an SDO frame can be found on p. 15

SDO Error Messages

If indexes are accessed incorrectly, you will receive an error message in response. An error message always has the following structure:

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
NodeID+0x580	8	0x80	Index		sub-index	Error Code			

The index and sub-index refers to the object to which the failed access occurred.

The error messages may contain the following content:

Error code (hex)	Importance
0504 0001	Client/server command specifier not valid or unknown.
0601 0000	Access to object not supported
0601 0001	Attempt to read a write only object.
0601 0002	Attempt to write a read only object.
0602 0000	Object does not exist in the object directory
0604 0041	Object parameter cannot be mapped to a PDO
0604 0042	Object cannot be mapped in PDO, due to length exceedance
0604 0043	Parameters incompatible with device properties
0604 0047	General internal device incompatibility
0606 0000	EEPROM (=Hardware-Memory)-error
0607 0010	Data type error: parameter length incorrect
0607 0012	Data type error: parameters too long
0607 0013	Data type error: parameters too short
0609 0011	Sub-index does not exist
0609 0030	Invalid value of the parameter (write only)
0609 0031	Value of the parameter too large (write only)



0609 0032	Value of the parameter too small (write only)
0800 0000	General error
0800 0020	Data transfer for application or storage not allowed
0800 0022	Current device state does not allow data transfer
0800 0024	No data available

Object dictionary

This chapter describes the objects implemented in the GSV-8 CANopen. For further information, refer to the CANopen communication profile DS-301 for the "Communication Objects" (indices 0x1000.. 0x1A03) and the DS-404 device profile for the Application Objects (indices 0x6114.. 0x8100).

Index (Hex)	Name	Category
1000	Device Type	Communication
1001	Error register	Communication
1002	Manufacturer Status register	Application
1017	Producer Heartbeat Time	Communication
1018	Identity Object	Communication
1800	Tx PDO 1 Communication Parameter	Communication
1801	Tx PDO 2 Communication Parameter	Communication
1802	Tx PDO 3 Communication Parameter	Communication
1803	Tx PDO 4 Communication Parameter	Communication
1A00	Tx PDO 1 Mapping Parameter	Communication
1A01	Tx PDO 2 Mapping Parameter	Communication
1A02	Tx PDO 3 Mapping Parameter	Communication
1A03	Tx PDO 4 Mapping Parameter	Communication
2020	FT Sensor Information	Application, Analog Input
2021	FT Sensor No. 1 Data	Application, Analog Input
2022	FT Sensor No. 2 Data	Application, Analog Input
2023	FT Sensor No. 3 Data	Application, Analog Input
2024	FT Sensor No. 4 Data	Application, Analog Input
2025	FT Sensor No. 5 Data	Application, Analog Input
2026 ¹	FT Sensor No. 6 Data	Application, Analog Input
2027 ¹	FT Sensor No. 7 Data	Application, Analog Input

¹ Available from firmware version 1.45

2028 ¹	FT Sensor No. 8 Data	Application, Analog Input
2029 ¹	FT Sensor No. 9 Data	Application, Analog Input
202A ¹	FT Sensor No. 10 Data	Application, Analog Input
6000 ¹	DI read state 8 input lines	Application, Analog Input
6112	AI Operating Mode	Application, Analog Input
6114	AI ADC sample rate	Application, Analog Input
611C	AI TEDS control ²	Application, Analog Input
6125	AI Autozero	Application, Analog Input
6126	AI Scaling Factor	Application, Analog Input
6127	AI Scaling Offset	Application, Analog Input
6130	AI Process Value Float	Application, Analog Input
6131	AI Physical Unit PV	Application, Analog Input
6150	AI Status	Application, Analog Input
6160	AI Control byte ²	Application, Analog Input
8100	AI Field Value	Application, Analog Input

Index 1000h

DeviceType

The device profile can be queried by the object with the index 1000h.

Sub-Index	Data type	Access	Meaning	Default value
0	Unsigned32	ro	Device properties	0x800B0194 ³

The object can only be read. Only sub-index 0 is supported. Access to other sub-indices is acknowledged with an error message.

Example: Read parameter, module-ID = 0x40, Index = 1000h

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
640h	8	40h	00h	10h	00h	00h	00h	00h	00h

Table 4: SDO Request

In response, you will receive from the GSV-8 CANopen:

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
5C0h	8	42h	00h	10h	00h	94h	01h	0Bh	80h

Interpretation of the data of this object:

Byte 4 + Byte 5 = 0194h = 404d (Device Profile Number)

Byte 6 + Byte 7 <6:0> = 000Bh = 001011b (Additional Information)

The last one means following:

² Available from firmware version 1.55

³ For devices with firmware version up to and including 1.44, the read =default value is 0x800A0194



- Bit 16 =1: Digital Input function block available (see obj. 6000h, p. 33)⁴
- Bit17=1: Analog Input function block available
- Bit19=1: Analog Output function block available
- Bit31=1: PDO default mapping defined in obsolete DS404 is not used.

Index 1001h

Error Register

The object with the index 1000h can be used to query the current error state.

Sub-Index	Data type	Access	Meaning	Default value
0	Unsigned8	ro	error state	0x00

The object can only be read. Only sub-index 0 is supported. Access to other sub-indices is acknowledged with an error message.

Interpretation of the data of this object:

The data byte contains flags and currently the following are supported:

Bit 0: „Generic Error“ This flag is =1 for every error and =0 in the error-free state.

Bit 2: „Voltage Error“ This flag indicates with 1 that the bridge power of the sensor is faulty. The reason may be an error in the sensor (cable), a device defect, or a short circuit of the sensor power supply.

Index 1002h

Manufacturer Status Register

Flags of the operating status of the measurement application can be queried via the object with the index 1002h.

Sub-Index	Data type	Access	Meaning	Default value
0	Unsigned32	ro	Operating state flags	0x0005FF02

The object can only be read. Only sub-index 0 is supported. Access to other sub-indexes is acknowledged with an error message.

Interpretation of the data of this object:

The data value contains flags that are currently used as follows:

Bit-Nr.	Meaning	State changeable with Obj.
0 (LSbit)	=1: Measurement data calculation for six-axis sensor (FT sensor) active	2020.1h
1	=1: Analog input filter is set automatically based on the measurement data period	-
2	=1: Maximum and minimum value determination active	6112h
3	=1: Noisecut: below NoiseCutThreshold, measured value =0 is set	-
4	=1: If it is activated (bit 2 =1), the absolute value is used for the maximum value determination	-

4 For devices with firmware version up to and including 1.44, bit 16=0 (digital input not yet readable via CANopen)

Bit-Nr.	Meaning	State changeable with Obj.
7	=1: All write accesses to AnalogInput application blocked	-
8...15	=1: Load sensor parameterization from TEDS data when TEDS is connected. Bit 8 applies to input channel 1, bit 9 f. 2, etc. to bit 15 for input 8.	611Ch
16	=1: If valid TEDS data exists, the unit is also set if the bit corresponding to the input channel is set in <15:8>	-
17	=1: If valid TEDS data is present, the input sensitivity may also be changed if the bit corresponding to the input channel is set to <15:8>	-
18	If the corresponding bit is set in <15:8>, the analog output should also be scaled based on the TEDS data (if possible)	-
19	If the corresponding bit is set in <15:8>, the zero point should also be set based on the TEDS data (if possible)	-
22	Permanent Auto-Zero active	-

These mode flags can currently be changed by serial / USB interface only.

Index 1017h

Producer Heartbeat Time

The producer heartbeat time for the heartbeat frame is set by the object with index 1017h. The time is expressed in milliseconds. The value 0 ms turns off the heartbeat protocol. With the Heartbeat service, another node or master can monitor, whether the GSV-8 CANopen is still "alive" and in which device state it is.

Sub-Index	Data type	access	Meaning	Default value
0	unsigned16	rw	Producer Time	0x0000

The object can be read and written. Only sub-index 0 is supported. Access to other sub-indexes is acknowledged with an error message.

A write attempt is rejected if the can bus usage time would exceed 80% by this device alone. This check also considers the event timer (1800.5h) and the CAN bit rate, but no services of other devices.

The heartbeat time is one of the communication parameters and is automatically stored in a power-fail-safe manner when writing to 1017h.

Index 1018h

Identity Object

Device-specific or item-specific numbers can be queried via the object with the index 1018h.

Sub-Index	Data type	Access	Meaning	Default value
0	unsigned8	ro	Highest sub-index supported	0x04



1	Unsigned32	ro	Vendor ID	0x00000270
2	Unsigned32	ro	Product code	0x00000008
3	Unsigned32	ro	Revision number (Firmware version)	-
4	Unsigned32	ro	Serial number	-

The object can only be read. Sub-indices 0 to 4 are supported. An access to other sub-indices is acknowledged with an error message.

Sub-Index 1 „Vendor ID“:

The Vendor ID is a unique vendor identifier. Each manufacturer of CANopen devices has a unique identifier, which is centrally assigned and managed by CAN in Automation. ME-Messsysteme has the Vendor ID = 270h.

Sub-Index 2 „Product Code“:

This is 8d, corresponding to GSV-8.

Sub-Index 3 „Revision number“:

The "revision number" corresponds to the firmware version and revision number. The contents of the 32-bit value must be interpreted as individual bytes with integer values.

MSB Bits <31:24>	Bits<23:16>	Bits<15:8>	LSB Bits<7:0>
Version number, „Tens“	Version number, "Ones"	00h	Revision number

In case of deep functional changes of the object directory and/or the basic communication behavior (e.g. introduction of new services), the version number is also changed, in case of changes of the application behavior only the revision number.

Sub-Index 4 „Serial number“:

The serial number is item-specific and also indicated on the nameplate of the device. It is to be interpreted as a single integer decimal number, whose lower-significant 8 decimal digits form the serial number, so its basic value range is up to 99999999d. If the number read has less than 8 digits, the higher digits shall be filled with zeros to 8 digits.

Indexes 1800h - 1803h

Tx PDO Communication Parameter

With the objects 1800h to 1803h communication parameters of the 4 Tx PDOs, which contain the measured values ("AI PV") of the 8 input channels, can be queried.

Index	Name	Default value sub-index 1
1800h	Tx PDO 1 Communication Parameter	0x400001C0
1801h	Tx PDO 2 Communication Parameter	0x400002C0
1802h	Tx PDO 3 Communication Parameter	0x400003C0
1803h	Tx PDO 4 Communication Parameter	0x400004C0

The data of the following sub-indices are the same for all of these 4 objects except for sub-index 1:

Sub-Index	Data type	Access	Meaning	Default value
0	unsigned8	ro	Highest sub-index supported	0x05
1	Unsigned32	rw ⁵	COB-ID used by PDO	s. Table above

2	Unsigned8	ro	Transmission type	0xFF
5	Unsigned16	rw	Event Timer Period	0x03E8

Sub-indexes 0 to 2 and 5 are supported. An access to other sub-indexes is acknowledged with an error message.

Interpretation of the data of these objects:

Sub-index 1 “COB-ID used by PDO”:

Bits<28:0> form the COB ID of the TX PDO service, which consists of the device address (=“NodeID”) and the offset of the service (here =180h). Bits<31:29> have the meaning:

Bit 29 = 0: The GSV-8 CANopen only supports CAN frames with 11-bit CAN ID.

Bit 30 = 1: The GSV-8 CANopen does not support RTRs.

Bit 31 = “valid”: =0: PDO is valid. When writing to Sub-index 1, only bit 31 may be changed, see “Dynamic PDO Mapping”, p. 21.

Sub-index 2 “Transmission type”:

Only 1 transmission type is supported (currently):

Value = 255d = 0xFF:

The GSV-8 CANopen sends TX PDOs if the event timer has expired and the device is in the operational state and the inhibit time has not yet expired.

Sub-index 5 “Event Timer Period”:

The Event Timer Period specifies the time period in which TX PDOs are sent. The value is expressed in increments of 1ms. A value of 0 means that this function is turned off.

It is highly **recommended** to set the internal data rate (= that of the serial interface) to a value that is selected so that the period of this data rate is less than or equal to the event timer period. This ensures that each TX-PDO frame contains a current measurement value. Because the serial data rate also corresponds to the internal refresh rate of the analog input, otherwise the same readings would be repeated in multiple TX PDOs. This setting can be made on the CAN bus with the object 6114h, see below.

Example: Event-Timer = 100d, corresponding to 100ms. The internal data rate should then be 1000/100ms = 10 readings/s or greater (10/s is the default setting).

A write attempt is rejected if the can bus usage time would exceed 80% by this device alone. This check also considers the Heartbeat TimeTimer (1017h) and the CAN bit rate. The event timer period is one of the communication parameters and is automatically stored in a power-fail-safe manner when writing to 1800.5h.

Index 1A00h

Tx PDO 1 Mapping Parameter

With the object 1A00h you can query which objects the TX-PDO No. 1 contains. Starting with firmware version 1.45, this object can also be written for dynamic mapping.

Sub-Index	Data type	Access	Meaning	Default value
0	unsigned8	rw	Number of objects mapped in TX-PDO 1	0x02
1	Unsigned32	rw	Mapping for object 1: Default: Input channel 1	0x61300120
2	Unsigned32	rw	Mapping for object 2: Default: Input channel 2	0x61300220

5 Up to and including firmware version 1.44, sub-index 1 is ro, since dyn. mapping was not supported



Sub-indices 0 to 8 are supported. An access to other sub-indexes is acknowledged with an error message.

Sub-index 0: sub-index 0 is the number of mapped objects. Value range: 0 to 8.

Sub-indices 1 to 8: mapping entries. Allowed values:

0x6000<01/02>08 Is SDO: DI read state 8 input lines

0x6130<01..0A>20 Is SDO: AI Process Value Float

0x6150<01..0A>08 Is SDO: AI Status

Index 1A01h

Tx PDO 2 Mapping Parameter

With the object 1A01h you can query which objects the TX-PDO No. 2 contains. Starting with firmware version 1.45, this object can also be written for dynamic mapping.

Sub-Index	Data type	Access	Meaning	Default value
0	unsigned8	rw	Number of objects mapped in TX-PDO 2	0x02
1	Unsigned32	rw	Mapping for object 1: Default: input channel 3	0x61300320
2	Unsigned32	rw	Mapping for object 2: Default: input channel 4	0x61300420

Sub-indices 0 to 8 are supported. An access to other sub-indexes is acknowledged with an error message.

sub-index 0: sub-index 0 is the number of mapped objects. Value range: 0 up to 8.

Sub-indices 1 up to 8: Mapping entries. Allowed values:

0x6000<01/02>08 is SDO: DI read state 8 input lines

0x6130<01..0A>20 Is SDO: AI Process Value Float

0x6150<01..0A>08 Is SDO: AI Status

Index 1A02h

Tx PDO 3 Mapping Parameter

With the object 1A00h you can query which objects the TX-PDO No. 3 contains. Starting with firmware version 1.45, this object can also be written for dynamic mapping.

Sub-Index	Data type	Access	Meaning	Default value
0	unsigned8	rw	Number of objects mapped in TX-PDO 3	0x02
1	Unsigned32	rw	Mapping for object 1: Default: input channel 5	0x61300520
2	Unsigned32	rw	Mapping for object 2: Default: input channel 6	0x61300620

Sub-indices 0 to 8 are supported. An access to other sub-indexes is acknowledged with an error message.

sub-index 0: sub-index 0 is the number of mapped objects. Value range: 0 to 8.

Sub-indices 1 up to 8: Mapping entries. Allowed values:

0x6000<01/02>08 Is SDO: DI read state 8 input lines

0x6130<01..0A>20 Is SDO: AI Process Value Float

0x6150<01..0A>08 Is SDO: AI Status

Index 1A03h

Tx PDO 4 Mapping Parameter

With the object 1A03h you can query which objects the TX-PDO No. 4 contains. Starting with firmware version 1.45, this object can also be written for dynamic mapping.

Sub-Index	Data type	Access	Meaning	Default value
0	unsigned8	rw	Number of objects mapped in TX-PDO 4	0x02
1	Unsigned32	rw	Mapping for object 1: Default: input channel 7	0x61300720
2	Unsigned32	rw	Mapping for object 2: Default: input channel 8	0x61300820

Sub-indices 0 to 8 are supported. An access to other sub-indices is acknowledged with an error message.

sub-index 0: sub-index 0 is the number of mapped objects. Value range: 0 to 8.

Sub-indices 1 to 8: Mapping entries. Allowed values:

0x6000<01/02>08 Is SDO: DI read state 8 input lines

0x6130<01..0A>20 Is SDO: AI Process Value Float

0x6150<01..0A>08 Is SDO: AI Status

Interpretation of the data of the objects 1A00h - 1A03h:

Each of the 4 TX PDOs consists of the data of 1 to 8 objects(s); this number of objects is specified in sub-index 0. Sub-indices 1 to 8 contain the mappings in the order in which they are present in the TxPDO.

Example (default): sub-index 0: =2. At sub-index 1, the mapping represents the first object in the respective PDO, at sub-index 2 the mapping represents the second object in the PDO.

In bits<31:16> of the data entry corresponds to the index of the mapped object; in bits<15:8> is its sub-index and in bits <7:0> is the length of the value in the TX PDO in bits.

For example, 1A00.1h reads 6130.01.20, i.e. the first object in the PDO is the analog input process value of channel 1 (Obj. 6130.1h) with the length of 32 bits = 4 bytes. In total, the default mapping entries in 1A00h - 1A03h result in the following TX-PDO data frames:

B0	B1	B2	B3	B4	B5	B6	B7
Analog Input Process Value K. 1/3/5/7				Analog Input Process Value K. 2/4/6/8			
LSByte	Byte 1	Byte 2	MSByte	LSByte	Byte 1	Byte 2	MSByte

Dynamic PDO-Mapping⁶

Since the GSV-8 CANopen supports four different TxPDOs, the placeholder for n in the description must first be determined: n= TxPDO-No -1, e.g. n=0 for TxPDO 1 and up to n=3 for TxPDO 4. In order to permanently deactivate a TxPDO, steps 3 and 4 are omitted.

To change the contents of one of the 4 TxPDOs, please do the following:

1. Invalidate the PDO by first reading the object 180n.1 (index 180nh, sub-index 1), then save this value and set its bit 31 to 1 (bitwise OR with 0x80.00.00.00) and then write this value back to 180n.1.

2. Invalidate the PDO mapping by writing a zero byte (0x00) to 1A0n.0.

⁶ Possible from firmware version 1.45



3. Write the desired PDO mapping to 1A0n.1 to 1A0n.x, where x is the number of desired objects in the PDO frame. The following values are possible:

- 0x6130 0k 20: The "AI Process Value", which means a measuring value (s. p. 28), should be mapped. k is the placeholder for the sub-index of the Obj. 6130h, i.e. **the channel number**. Its value range is 1 to 10 (0x01.. 0x0A), where 1 to 8 denote the corresponding analog input channels and 9 and 10 are configured counters /counters. **Note: The counter/counter must be configured once via the serial or USB interface, otherwise the value here is constant =0**, see general user manual and "BA-GSV8-Incrementalencoder.pdf"

- 0x6150 0k 08: The "AI Status" value (s. p. 30) should be mapped. k is the placeholder for the sub-index of the Obj. 6150h, i.e. **the channel number**. The channel assignment corresponds to that of the object 6130h.

- 0x6000 0m 08: The "DI read state 8 input lines" value (s. p. 33) should be mapped. m is the placeholder for the sub-index of the Obj. 6000h. This is =1 for the digital input lines 1 to 8 and =2 for lines 9 to 16.

4. Make the PDO mapping valid again by writing the number of mapped objects in 1A0n.0.

5. Make the PDO valid again by rewriting the value originally read in step 1 of 180n.1 (the value with bit 31 =0) to 180n.1. If the mapping is error-free, it is **stored permanently** in this step so that the GSV-8 restores it the next time it is turned on.

If steps 3 and 4 have been omitted, i.e. 1A0n.0 remains =0, an "empty mapping" is saved, so that the corresponding TxPDO is permanently deactivated and is no longer sent the next time the device is switched on.

In this way, unnecessary message-frames can be avoided, so that the load on the CANbus is reduced.

SDOs (Mapping-relevant, example)

Index	Sub-index	Value
1A00 _h	00 _h	02 _h
	01 _h	6000 01 08 _h
	02 _h	6130 03 20 _h
...		
6000 _h	01 _h	0000 1111 _b
...		
6130 _h	03 _h	3F80 0000 _h

The TPDO 1 contains in this example following information:

- The first byte in the frame is the state of digital input lines 1 to 8. Lines 1 to 4 High, 5 to 8 Low.
- bytes 2 to 5 contains the measuring value of the analog input 3. This has the data type float, which means 0x3F800000 corresponds to the measuring value 1,0.

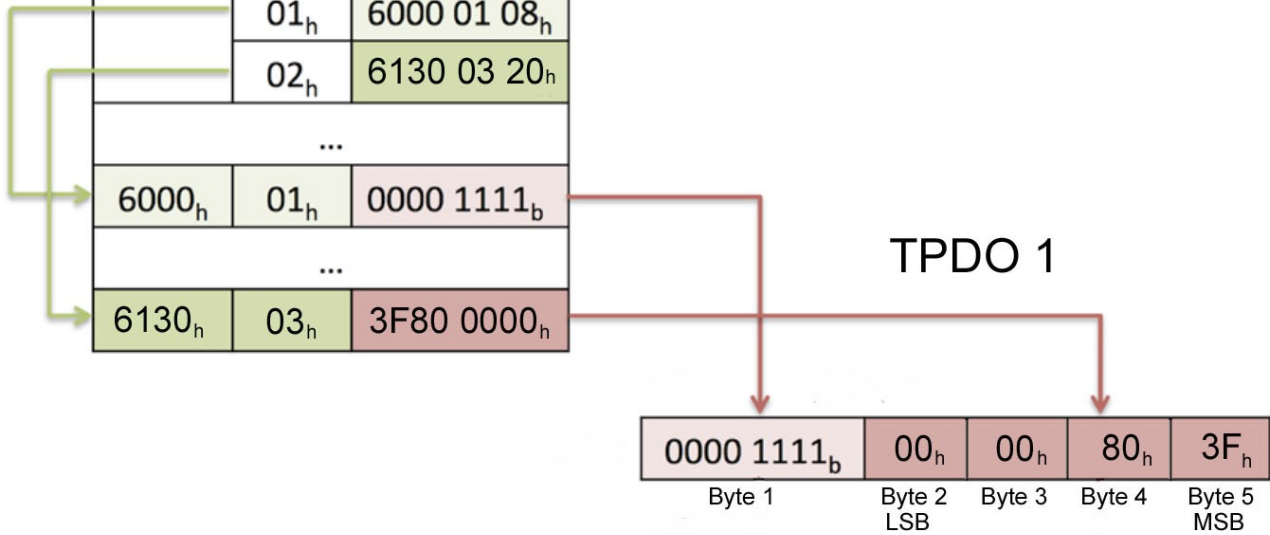


Figure 1: Examples for mapping the TxPDO 1



Application-specific objects, analog input function block

The objects in this range are sub-indexed, and sub-index 0 always reads the largest existing sub-index. Sub-indices 1 to 8 have parameters that apply to many objects for the respective analog input channels 1 to 8. Most objects also contain sub-indices 9 and 10, which are assigned to the digital counter and/or frequency measurement, as of firmware version 1.45. This function has to be activated once for use via USB or serial interface, see general user manual and "BA-GSV8-Incrementenkoder.pdf".

For some objects, the value for all input channels / sub-indexes 1 to 8 or 10 is the same. Writing to one of these sub-indices then causes changes in the values of all sub-indices 1 to 8 and 10, respectively.

Index 2020h

FT Sensor Information

Object 2020h can be used to determine the number of stored data sets for six-axis sensors (=FT sensors) and to read and set the activated array. The calculation of the physical six-axis values can also be enabled or disabled.

Sub-Index	Data type	Access	Meaning	Default value
0	unsigned8	ro	Highest sub-index supported	0x03
1	unsigned8	rw	Number of the activated FT sensor	0x00
2	unsigned8	ro	Number of saved FT data records	0x00
3	unsigned8	ro	Maximum number of FT savable records	0x0A ⁷

Sub-indices 0 to 3 are supported. An access to other sub-indexes is acknowledged with an error message.

The value range of the number of activated FT sensor at sub-index 1 is:

0 to <number of saved FT records>. A value of 0 means that the calculation of the physical six-axis values is deactivated, so that the default TxPDOs No. 1 to 3 (= Obj. 6130.1-6) display raw values, scaled in mV/V. If the value in sub-index 1 is greater than 0, the measured values mean the following:

Channel No.	TxPDO No.	Within TxPDO	Meaning	Physical unit
1	1	1. value	Force in X direction	N
2	1	2. value	Force in Y direction	N
3	2	1. value	Force in Z direction	N
4	2	2. value	Torque in X direction	Nm
5	3	1. value	Torque in Y direction	Nm
6	3	2. value	Torque in Z-direction	Nm

⁷ Up to and including firmware version 1.41 this value is 05, i.e. there are only 5 records available.

This object is Manufacturer defined, i.e. not predefined in the CANopen standard.

Indexes 2021h - 202Ah⁸

FT Sensor Data

With the objects 2021h to 2025h, the contents of the six-axis sensor data sets can be read, provided that sensor data is stored. At the time, the sensor data is stored only via the serial interface. If no sensor data is stored, the Access is canceled on sub-indexes 1 to 16 with the error message 0x08000024 "Object contains no data".

The object 2021h is assigned to the FT sensor No. 1, Obj. 2022h No. 2, etc. until 202Ah the sensor No. 10. The layout of the objects 2021h to 202Ah is identical:

Sub-Index (dec)	Data type	Access	Meaning	Physic. Unit	Default -value
0	unsigned8	ro	Highest sub-index supported	-	0x11
1	unsigned32	ro	Serial number of the FT sensor	-	-
2	Float	ro	Nominal maximum value of force in X direction (Fx max)	N	-
3	Float	ro	Nominal maximum value of force in Y direction (Fy max)	N	-
4	Float	ro	Nominal maximum value of force in Z-direction (Fz max)	N	-
5	Float	ro	Nominal maximum torque in X direction (Mx max)	Nm	-
6	Float	ro	Nominal maximum torque in Y direction (My max)	Nm	-
7	Float	ro	Nominal maximum torque in Z direction (Mz max)	Nm	-
8	Float	rw	Geometric offset in X direction	m	-
9	Float	rw	Geometric offset in Y direction	m	-
10	Float	rw	Geometric offset in Z direction	m	-
11	Float	ro	Zero signal (load-free) of component 0 (raw value)	mV/V	-
12	Float	ro	Zero signal (load-free) of component 1 (raw value)	mV/V	-
13	Float	ro	Zero signal (load-free) of component 2 (raw value)	mV/V	-
14	Float	ro	Zero signal (load-free) of component 3 (raw value)	mV/V	-
15	Float	ro	Zero signal (load-free) of component 4 (raw value)	mV/V	-
16	Float	ro	Zero signal (load-free) of component 5 (raw value)	mV/V	-
17 ⁹	unsigned32	ro	Sensor type: =0: Standard solution. =1: With "Matrix Plus" 2nd Order	-	-

Only sub-indices 0 to 17 are supported. An access to other sub-indexes is acknowledged with an error message.

These objects are "Manufacturer defined", i.e. not predefined in the CANopen standard.

⁸ Up to and including firmware version 1.41, only the objects 2021h until 2025h are available.

⁹ This sub-index is only available as of firmware version 1.42.



Index 6112h

AI Operating Mode

Object 6112h can be used to set whether the measurement data objects of all channels contain normal current measured values or maximum or minimum values.

Sub-Indices	Data type	Access	Meaning	Default value
0	unsigned8	ro	Highest sub-index supported	0x0A
1 to 10	unsigned8	rw	Measured value mode	0x01

Sub-indices 0 to 10 are supported. An access to other sub-indices is acknowledged with an error message. Writing to one of the sub-indices 1..10 causes switching of all sub-indices (=input channels).

Zeroing with Obj. 6125h causes the maximum and minimum value registers to reset.

Interpretation of the data of this object:

Value	Meaning
0x01	The measured values of all channels k (Obj. 6130.k) are normal current values
0x0A	The measured values of all channels k (Obj. 6130.k) are maximum values
0x0B	The measured values of all channels (Obj. 6130.k) are minimum values

Attempting to set a value other than one of these 3 is acknowledged with an error message.

Index 6114h

AI Sample Rate

With object 6114h, the measurement data period of the GSV-8 can be read and set. The value is expressed in microseconds. This should be less than or equal to the TX-PDO transmission period set by the event timer (Obj. 1800.5h) (see Obj. 1800h, sub-index 5), so that each TX-PDO contains a current measurement:

$$(AI_Sample_Rate_in_μs / 1000) \leq EventTimerPeriod_in_ms$$

Sub-Indexes	Data type	Access	Meaning	Default value
0	unsigned8	ro	Highest sub-index supported	0x0A
1 to 10	Unsigned32	rw	AI ADC Sample Periode in μs	0x000186A0

Sub-indices 0 to 10 are supported. An access to other sub-indices is acknowledged with an error message.

The data period is the same for all input channels, i.e. writing to one of the sub-indices 1 to 10 causes changes in the values of all sub-indices 1 to 10.

When writing on 6114.1..8

Tips for setting the ADU period:

1. The value of the measurement data period should also not be chosen too small to ensure the best possible signal-to-noise ratio (see ba-gsv8.pdf). Ideally, the above equation applies exactly:

$$(ADU_Periode_in_us / 1000) = EventTimerPeriod_in_ms$$

1. If it is known that EM interferences are present with a certain frequency and their multiples, it is useful to select the value of the measurement data period so that it corresponds to this basic frequency of the interference, or a multiple of it. Example: If the frequency of the power grid is 50Hz, measurement data rates of 5Hz, 10Hz, 25Hz 50Hz and 100Hz are favorable, because the frequency response of the digital signal processing then has a damping maximum at 50Hz (so-called notch frequency).

Index 611Ch

AI TEDS control¹⁰

This object indicates the configured behavior on handling of connected TEDS transducer devices.

Sub-Index	Data type	Access	Meaning	Default value
0	unsigned8	ro	Highest existing sub-index	0x08
1 to 8	unsigned8	rw	TEDS handling	0x02

Sub-indices 0 to 10 are supported. An access to other sub-indexes is acknowledged with an error message.

A value of 0 means, that the content of the TEDS memory of a connected sensor is discarded and not used. A value of 2 means that the GSV-8 configures the scaling automatically, so that measured values scaled to physical quantities are transmitted in the TxPDO of the corresponding input channel, if a transducer with valid and supported TEDS content is connected.

Index 6125h

AI Autozero

With AI Autozero (Obj. 6125h), zeroing the analog input can be performed, so that the "AI Field value" (Obj. 8100h) and the "AI Process Value" (Obj. 6130h and TX-PDO) of the channel (No. = sub-index) become zero. The analog output is also affected.

Sub-Index	Data type	Access	Meaning	Value	Function (write)
0	unsigned8	ro	Highest existing sub-index	0x0A	-
1 to 10	Unsigned32	wo	Signature AI Autozero	„zero“	Zeroing input channel 1

The object can only be written. Sub-indices 0 to 10 are supported. An access to other sub-indexes is acknowledged with an error message.

To perform a zero adjust, the signature "zero" must be written to 6125.k, i.e. the byte sequence **7Ah, 65h, 72h, 6Fh**. The sub-indices 1 to 8 correspond to the channel number of the analog input, the measured value of which is to be set to zero; Sub-indices 9 and 10 are assigned to the counter/frequency measurement. However, if the measurement with

¹⁰ This object is present from firmware version 1.55



six-axis sensor is active, all input channels 1 to 6 are set to zero, as this is necessary for a correct six-axis sensor calculation. Once the zero adjustment is complete, the SDO response frame is transmitted over the CAN bus.

Index 6126h

AI Scaling factor

With object 6126h, the "UserScale" scaling factor can be read and written. This factor changes the representation and the range of the AI Process Value (Obj. 6130h and TX-PDO), the AI Field Value remains unaffected. However, when measuring with six-axis sensors is enabled, the AI Scaling factor is not used.

Sub-Index	Data type	Access	Meaning	Default value
0	unsigned8	ro	Highest existing sub-index	0x0A
1 to 10	Float	rw	AI Scaling Factor channels 1 up to 10	3.5 @1-8. else: 1

The object can be read and written. Sub-indices 0 to 10 are supported. An access to other sub-indices is acknowledged with an error message.

Index 6127h

AI Scaling Offset

With object 6127h, a summand "UserOffset" can be read or written, which is added to the measured value (AI Process value).

Sub-Index	Data type	Access	Meaning	Default value
0	unsigned8	ro	Highest existing sub-index	0x0A
1 to 10	Float	rw	AI Scaling Offset channels 1 up to 10	0.0

The object can be read and written. Sub-indices 0 to 10 are supported. An access to other sub-indices is acknowledged with an error message.

The AI Scaling Offset may also be negative, then it is subtracted from the measured value.

Index 6130h

AI Process Value Float

The Analog-Input Process Value is the measured value scaled with the AI_Scaling_Factor in 32-bit floating-point representation according to IEEE-754. No further conversion (as with 8100h) is necessary.

Sub-Index	Data type	Access	Meaning	Default value
0	unsigned8	ro	Highest existing sub-index	0x0A
1 to 10	Float	ro	AI Process Value Float channels 1 to 10	-

The object can only be read. The sub-indices 0 to 10 are supported. Access to other sub-indices is acknowledged with an error message. Sub-indices 1 to 10 can be mapped in the TxPDO. By

default, sub-indexes 1 to 8 are mapped to TxPDOs.

Index 6131h

AI Physical Unit PV

With object 6131h, a physical unit can be read or set for each input channel (=sub-index). The unit does not have an influence on other objects, i.e. after a change in the unit, the representation of the AI Process Value remains the same.

Sub-Index	Data type	Access	Meaning	Default value
0	unsigned8	ro	Highest existing sub-index	0x0A
1 to 10	Unsigned32	rw	AI Physical Unit	0xFD262600 ("mV/V")

The object can be read and written. Sub-indices 0 to 10 are supported. An access to other sub-indexes is acknowledged with an error message.

Attempting to set unsupported units (see table below) is rejected with abort code 06090030h.

The following units can be set; encodes according to CiA 303-2:

Unit	Coding (Data, hex)	Code Serial
mV/V	0xFD.26.26.00	0
kg	0x00.02.00.00	1
g	0x00.4B.00.00	2
N	0x00.21.00.00	3
cN	0xFE.21.00.00	4
V	0x00.26.00.00	5
µm/m	0xFA.01.01.00	6
(keine)	0x00.00.00.00	7
t	0x00.4C.00.00	8
kN	0x03.21.00.00	9
lb	0x00.EA.00.00	10
oz	0x00.EB.00.00	11
kp	0x00.EC.00.00	12
lbf	0x00.ED.00.00	13
pdl	0x00.EE.00.00	14
mm	0xFD.01.00.00	15
m	0x00.01.00.00	16
cNm	0xFE.56.00.00	17
Nm	0x00.56.00.00	18
°C	0x00.2D.00.00	19
°F	0x00.AC.00.00	20



Unit	Coding (Data, hex)	Code Serial
K	0x00.E8.00.00	21
oztr	0x00.E7.00.00	22
dwt	0x00.E6.00.00	23
kNm	0x03.56.00.00	24
%	0x00.E5.00.00	25
0/00	0x00.E4.00.00	26
W	0x00.24.00.00	27
kW	0x03.24.00.00	28
rpm	0x00.00.47.00	29
bar	0x00.4E.00.00	30
Pa	0x00.22.00.00	31
hPa	0x02.22.00.00	32
MPa	0x06.22.00.00	33
N/mm ²	0x06.21.58.00	34
°	0x00.41.00.00	35
Hz	0x00.20.00.00	36
m/s	0x00.01.03.00	37
km/h	0x03.01.48.00	38
m ³ /h	0x00.59.48.00	39
mA	0xFD.04.00.00	40
A	0x00.04.00.00	41
m/s ²	0x00.55.00.00	42
flbs	0x00.E3.00.00	43
ftlb	0x00.E2.00.00	44
J	0x00.23.00.00	45
kWh	0x00.E1.00.00	46
<Custom text Nr. 1>	0x00.FF.00.00	-1
<Custom text Nr. 2>	0x00.FE.00.00	-2

Bold codes are manufacturer-defined, but follow the principles described in CiA 303-2.

Index 6150h

AI Status

Object 6150h can be used to read the state of validity of the AI Input PV.

Sub-Index	Data type	Access	Meaning	Default value
0	unsigned8	ro	Highest existing sub-index	0x0A
1 to 10	Unsigned8	ro	AI Status input channels 1 up to 10	0x00

The object can only be read. Sub-indices 0 to 10 are supported. An access to other sub-indexes is acknowledged with an error message. Sub-indices 1 to 10 can be mapped in the TxPDO.

Interpretation of the data of this object:

Bits 3,4,7	Bit 6	Bit 5	Bit 2	Bit 1	Bit 0
Reserved	Object dictionary changed ¹¹	TEDS sensor present ¹¹	Negative overflow	Positive overflow	Sensor error

If bit 0 is set (sensor error), it indicates a defective sensor or a defective sensor cable or a faulty sensor connection. In this case, the AI Field and Process Value is invalid.

In the case of positive or negative overflow, the sensor amplitude is so large (or negative) that the measuring range of the sensor has been exceeded (maximum or minimum value exceedance) or that of the raw value is saturated.

Bit 5 =1 indicates that a sensor with TEDS is connected and that its data is used.

Bit 6 indicates a change in the objects 6112h to 6127h or 61A1h. The Object Dictionary may be invalid and should be read again. Bit 6 can be reset by a write access to Bit 3 of the object 6160h (AI control byte).

Index 6160h

AI control byte¹²

Writing to this object starts several control functions of the analog input as specified below.

Sub-Index	Data type	Access	Meaning	Default value
0	unsigned8	ro	Highest existing sub-index	0x0A
1 to 10	unsigned8	wo	Control flags for inputs 1 to 10	-

The object can only be written. Sub-indices 0 to 10 are supported. An access to other sub-indexes is acknowledged with an error message.

Setting the corresponding bit value to 1 starts the following operation:

Bits <7:4>	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Reset bit OD changed	Reserved	Perform Auto-Tare	Reserved

Setting Bit 1 triggers a Set Zero routine, as described in Obj. 6125h, for the input channel specified by sub index.

Setting Bit 3 clears Bit 6 of Obj. 6150h.

¹¹ Bits 5 and 6 are valid from firmware version 1.55, otherwise always =0

¹² This object is present from firmware version 1.55



Index 8100h

AI Field Value

The analog input field value is the unscaled measured value of the analog input channels 1 to 8 in raw data representation.

Sub-Index	Data type	Access	Meaning	Default value
0	unsigned8	ro	Highest existing sub-index	0x08
1 to 8	Signed24	ro	AI Field Value channels 1 bis 8	-

The object can only be read. Sub-indices 0 to 8 are supported. An access to other sub-indexes is acknowledged with an error message.

To interpret the data content:

To get scaled values, the following must be calculated:

Scaled measuring value = (AI_Field_Value * 1,05 * AI_Scaling_Factor) / 8388607

Application-specific objects, digital input function block

Starting with firmware version 1.45, the states of the digital I/O lines 1 to 16 can be read. The digital I/O lines can be configured via the USB or the serial interface (see general user manual). In the delivery state, all 16 digital lines have the type "General Purpose Input", so that they can all be used as normal digital input lines. However, reading with object 6000h is possible with any configured type, the value always reflects the current state of the line. The device-internal update rate is usually 40ms.

Index 6000h

DI read state 8 input lines

This object can be used to read the state of the digital lines.

Sub-Index	Data type	Access	Meaning	Default value
0	unsigned8	ro	Highest existing sub-index	0x02
1	unsigned8	ro	Level of Digital I/Os No. 1 to 8	-
2	unsigned8	ro	Level of Digital I/Os No. 9 to 16	-

The object can only be read. Sub-indices 0 to 2 are supported. An access to other sub-indexes is acknowledged with an error message. Sub-indices 1 to 2 can be mapped in the TxPDO.

To interpret the data content:

At sub-index 1: Bit 0 corresponds to DIO No. 1, Bit 1 to No. 2 and so forth, to Bit 7: DIO No. 8

At sub-index 2: Bit 0 corresponds to DIO No. 9, Bit 1 to No. 10 and so forth, to Bit 7: DIO No. 16



Examples for starting up by a CAN bus master

All numbers and data contents are in hexadecimal. The device has the node ID= 0x40 (default value). Otherwise, the COB ID is correspondingly different. DLC means the number of bytes in the "CAN Data" column.

Continuously sending of measuring values

Desired data rate of the TxPDOs: 10 readings*8 channels/s. It should be sent based on the event timer.

	Action	Condition for action	COB ID	CAN-Data
1	Switching on or reset	none	n.a.	n.a.
2	Bootup-Frame from GSV	Switched on or reset	740	00
3	SDO „Device-type“ read	none	640	40 00 10 00 00 00 00 00
4	GSV responds to SDO „Device-type“	Previously given read command	5C0	43 00 10 00 94 01 0A 80
5	SDO „Event timer“ (in Tx PDO 1 Communication Parameter) read	none	640	40 00 18 05 00 00 00 00
6	GSV responds to SDO „Event timer“	Previously given read command	5C0	4B 00 18 05 E8 03 00 00
7	Set the desired event timer value	0x03E8 =1000ms i.e. 1 PDO/s does not match the desired value. Therefore, set to 0x0064 = 100ms.	640	2B 00 18 05 64 00 00 00
8	GSV responds „OK“ to Write-SDO „Event timer“	Previously given write command	5C0	60 00 18 05 00 00 00 00
9	Master puts GSV to Operational State	none	000	01 40

Changelog

Version	Date	Changes
ba-gsv8CanOpen_v4.odt	04.08.16	First version
ba-gsv8CanOpen_v5a.odt	29.08.16	Formatting revised
ba-gsv8CanOpen_v5b.odt	06.02.19	TPDO mapping, DI function block, more 6-axis sensor records, etc.
ba-gsv8CanOpen_v5c_en.odt	14.10.20	Connection of the CAN bus lines: Corrected & added. Obj. 1A0n. Footer updated.
ba-gsv8CanOpen_v5d_en.odt	10.02.21	Language improved. Mistakes corrected. Updated. Obj. 611C and 6160 added.

Subject to modifications

All information herein describes our products in a general manner. They mean no assurance of properties in terms of §459 section 2 BGB (German civil code) and will not cause any liabilities.



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