



CANOpen Transducer Digital Communication

User's Manual

Firmware Version 231706B

Stellar Technology Incorporated

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CANOpen communication parameters

Baud rate: 125 (default), 250, 500 kBit/sec

Node ID: 0x01 (default)

Transmission type: 0xFE – asynchronous PDO, transmitted cyclically with the event time, measured in milliseconds

PDOs

Single TPDO with 0x180 + Node_ID + DATA

The DATA type REAL32 is represented as bit sequence of length 32. The encoding of values follows IEEE754.

It is transmitted in the following order:

| | | | | |
|--------------|---------------------------------|----------------------------------|-----------------------------------|-----------------------------------|
| Octet number | 1 | 2 | 3 | 4 |
| REAL32 | 0x00 | 0x00 | 0xC8 | 0x40 |
| | B ₇ ..B ₀ | B ₁₅ ..B ₈ | B ₂₃ ..B ₁₆ | B ₃₁ ..B ₂₄ |

Setting PDO Event Time to 0 will stop PDO transmission.

The PDO will be transmitted on SYNC object when in Operational Mode.

Setting Heartbeat Time to 0 will stop Heartbeat transmission.

SDOs

The message for the Initiate SDO Download service, with which a write access to an object dictionary entry of a CANopen node occurs at the same time, is structured as follows:

| | | | |
|---------|----------|--------------|----------------------|
| Command | OD Index | OD sub-index | Data (max. 4 bytes) |
|---------|----------|--------------|----------------------|

The SDO server responds with protocol byte 0x60:

| | | | |
|------|----------|--------------|-----------------|
| 0x60 | OD Index | OD sub-index | Empty (4 bytes) |
|------|----------|--------------|-----------------|

An SDO download to the OD entry 0x1017, with which the heartbeat interval of a heartbeat producer is to be set to 4 seconds (in ms as an UNSIGNED16 value, i.e. 0x0FA0), therefore appears as follows:

| | | | |
|------|-----------|------|---------------------|
| 0x2B | 0x17 0x10 | 0x00 | 0xA0 0x0F 0x00 0x00 |
|------|-----------|------|---------------------|

The node (SDO server) then acknowledges successful completion with the message:

| | | | |
|------|-----------|------|---------------------|
| 0x60 | 0x17 0x10 | 0x00 | 0x00 0x00 0x00 0x00 |
|------|-----------|------|---------------------|

An SDO download to the OD entry 0x2004, sub-index 0x01, with which the zero offset of 1.23 PSI is set, appears as follows:

| | | | |
|------|-----------|------|---------------------|
| 0x2B | 0x04 0x20 | 0x01 | 0xA4 0x70 0x9D 0x3F |
|------|-----------|------|---------------------|

The node (SDO server) then acknowledges successful completion with the message:

| | | | |
|------|-----------|------|---------------------|
| 0x60 | 0x04 0x20 | 0x01 | 0x00 0x00 0x00 0x00 |
|------|-----------|------|---------------------|

With the Initiate SDO Upload service, with which an object dictionary entry of a CANopen node is read out, the same division of the data field is valid, only here request and response telegrams are reversed to a certain extent. Here is the command byte of the client request 0x40:

| | | | |
|--------------|----------|--------------|-----------------|
| Command 0x40 | OD Index | OD sub-index | Empty (4 bytes) |
|--------------|----------|--------------|-----------------|

The SDO server responds with:

| | | | |
|--------------|----------|--------------|----------------|
| Command 0x40 | OD Index | OD sub-index | Data (4 bytes) |
|--------------|----------|--------------|----------------|

An SDO upload to the OD entry 0x2004, sub-index 0x01, with which the zero appears as follows:

| | | | |
|------|-----------|------|---------------------|
| 0x40 | 0x04 0x20 | 0x01 | 0x00 0x00 0x00 0x00 |
|------|-----------|------|---------------------|

The node (SDO server) then replies with offset value. In this example offset is equal to 1.23 PSI:

| | | | |
|------|-----------|------|---------------------|
| 0x60 | 0x04 0x20 | 0x01 | 0xA4 0x70 0x9D 0x3F |
|------|-----------|------|---------------------|

Mandatory Objects:

0x1000 – Device Type (0x00040194)
 0x1001 – Error Register
 0x1018 – Identity Object
 Sub 1: Vendor ID (0x00000250)
 Sub 2: Product Code (0x00000000)
 Sub 3: Revision Number (0x00000000)
 Sub 4: Serial Number

Optional Objects:

0x1003 Pre-Defined Error Field
 Sub 0: Number of Errors
 Sub 1: Standard Error Field
 0x1005 COB ID SYNC
 0x1008 Device Name
 0x1009 HW Version (0001)
 0x1010 Store Parameters
 0x1011 Restore Parameters
 0x100A SW Version (0001)
 0x1014 COB ID Emergency
 0x1015 COB ID Emergency Inhibit
 0x1017 Producer Heartbeat time (1000 = 1 sec)
 0x1800 Transmit PDO Communication Parameter
 Sub 1: COB ID (0x180)
 Sub 2: Transmission Type (0xFE)
 Sub 3: Inhibit Time (100)
 Sub 5: Event Timer (1000000 = 100 sec)

Manufacturer Objects:

0x2000 Calibration Data
 Sub 1: AmbTemp
 Sub 2: AmbInc0
 Sub 3: AmbInc20
 Sub 4: AmbInc40
 Sub 5: AmbInc60
 Sub 6: AmbInc80
 Sub 7: AmbInc100
 Sub 8: AmbDec80
 Sub 9: AmbDec60
 Sub 10: AmbDec40

- Sub 11: AmbDec20
- Sub 12: AmbDec0
- Sub 13: ColdTemp
- Sub 14: Cold0
- Sub 15: Cold100
- Sub 16: HotTemp
- Sub 17: Hot0
- Sub 18: Hot100
- Sub 19: IdealHI
- Sub 20: IdealLow
- 0x2003 NULL Process Value (Pressure)
- 0x2004 Zero Offset for Process Value
 - Sub 1: Pressure
- 0x2005 Span (in %)
 - Sub 1: Pressure

Layer Setting Services (LSS)

Switch Global:

The CANopen specification DS-306: Layer Setting Services (LSS) describes how the baud rate and the Node_IDs can be set via the bus with the aid of a simple protocol.

To make contact with a device to be configured, the "Switch Mode Global" command is transmitted:

| | | |
|------|------|---------------------|
| 0x04 | 0x01 | 0x00 0x00 0x00 0x00 |
|------|------|---------------------|

This command sets the device to LSS configuration mode. This service is the only unacknowledged LSS service, to which the device will not respond. The system integrator can therefore only find out with the following command whether the device has reacted.

Node_ID is requested via the "Inquire Node-ID" service:

| | | |
|------|------|---------------------|
| 0x5E | 0x00 | 0x00 0x00 0x00 0x00 |
|------|------|---------------------|

If successful, the device responds with:

| | | |
|------|---------|---------------------|
| 0x5E | Node_ID | 0x00 0x00 0x00 0x00 |
|------|---------|---------------------|

If there is no response, then either the device does not support the LSS service or the baud rate is not correct. If, namely, the baud rate when supplied is not known, the above-mentioned communication sequence must be tested with all permissible CANopen baud rates until the device is found.

The "Configure Node-ID" service is used to configure the new Node_ID:

| | | |
|------|---------|---------------------|
| 0x11 | Node_ID | 0x00 0x00 0x00 0x00 |
|------|---------|---------------------|

The error code is included in the device response:

| | | | |
|------|------------|-----------------|----------|
| 0x11 | Error Code | Error Extension | reserved |
|------|------------|-----------------|----------|

Error code 0 means success; error code 1 means inadmissible Node_ID; the other error codes are reserved. The error extension contains vendor-specific information, but is only valid for error code 0xFF.

The baud rate is configured with the "Configure Bit Timing Parameters" service:

| | | | |
|------|------------------|-------------|---------------------|
| 0x13 | Bit timing table | Table entry | 0x00 0x00 0x00 0x00 |
|------|------------------|-------------|---------------------|

The standardized CANopen baud rates are listed in the following table:

| Baudrate table 0x00 | |
|---------------------|-------------------|
| Table index | Baudrate |
| 0 | 1000 kBit/s |
| 1 | 800 kBit/s |
| 2 | 500 kBit/s |
| 3 | 250 kBit/s |
| 4 | 125 kBit/s |
| 5 | reserved |
| 6 | 50 kBit/s |
| 7 | 20 kBit/s |
| 8 | 10 kBit/s |

The current implementation of CANOpen by STI supports only 500, 250 and 125 kBit/s baud rates.

Now that the Node_ID and baud rate are configured, these settings should be saved with the "Store Configuration" service:

| | |
|------|----------|
| 0x17 | reserved |
|------|----------|

The device acknowledges:

| | | | |
|------|------------|-----------------|----------|
| 0x17 | Error Code | Error Extension | reserved |
|------|------------|-----------------|----------|

Error code 0 means success; error code 1 means that the device does not support saving; error code 2 means that there is a problem with access to the storage medium; the other error codes are reserved. The error extension contains vendor-specific information, but is only valid for error code 0xFF.

Finally, the device is switched back from configuration mode to normal mode via "Switch Mode Global":

| | | |
|------|------|---------------------|
| 0x04 | 0x00 | 0x00 0x00 0x00 0x00 |
|------|------|---------------------|

Switch Selective:

An LSS Slave is identified by an LSS Address. An LSS Address consists of a Vendor ID, a Product Code, a Revision Number and a Serial Number. The Vendor

ID and Product Code are numerical numbers. The Revision Number contains the major and minor revision as numerical number. The Serial Number is coded as a numerical number too. They adhere to the following syntax:

<LSS-ADDRESS> = <Vendor ID><Product Code><Revision Number><Serial Number>

Vendor ID = 0x00000250 (STI)

Product Code = 0x00000000

Revision Number = 0x00000000

Serial Number = UNSIGNEDINT32

A Vendor ID is assigned to module suppliers by CiA. A Product Code, Revision Number and a Serial Number are assigned by the module supplier. For LSS Addresses the following conditions must be met:

- The LSS Address is identical to the CANopen identity object.
- The LSS Address of a LSS Slave can be inquired.
- There exists no other LSS Slave in the world with the same LSS Address

To select a device using LSS Switch Selective the following sequence of commands must be executed:

| | | |
|------|-----------------|----------------|
| 0x40 | Vendor_ID | 0x00 0x00 0x00 |
| 0x41 | Product Code | 0x00 0x00 0x00 |
| 0x42 | Revision Number | 0x00 0x00 0x00 |
| 0x43 | Serial Number | 0x00 0x00 0x00 |

If there is matching device on the network, it will go into Configuration mode and reply with:

| | | |
|------|---------------------|---------------------|
| 0x44 | 0x00 0x00 0x00 0x00 | 0x00 0x00 0x00 0x00 |
|------|---------------------|---------------------|

Below you will find an example of CAN frames to be send for an STI CANOpen transducer with SN 123456.

| | | |
|------|---------------------|----------------|
| 0x40 | 0x50 0x02 0x00 0x00 | 0x00 0x00 0x00 |
| 0x41 | 0x00 0x00 0x00 0x00 | 0x00 0x00 0x00 |
| 0x42 | 0x00 0x00 0x00 0x00 | 0x00 0x00 0x00 |
| 0x43 | 0x40 0xE2 0x01 0x00 | 0x00 0x00 0x00 |

Saving Parameters:

In order for all the changes to be stored in non-volatile memory, the word “save” must be written to the OD entry 0x1010, sub-index 0x01 – Store parameters.

| | | | |
|------|-----------|------|---------------------|
| 0x2B | 0x10 0x10 | 0x01 | 0x65 0x76 0x61 0x73 |
|------|-----------|------|---------------------|

The node (SDO server) then acknowledges successful completion with the message:

| | | | |
|------|-----------|------|---------------------|
| 0x60 | 0x10 0x10 | 0x01 | 0x00 0x00 0x00 0x00 |
|------|-----------|------|---------------------|

After being switched physically off and on again, the device now works with the new settings.