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CrossFire™ SX

CANopen Slave Developers Guide

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Contents

1. Introduction

1.1. Background

The CrossFire™ SX is a CAN bus node, and by configuring the node properties, the module can be set up to automatically send and receive I/O to and from the CAN bus network.

The CrossFire™ SX supports the CANopen protocol that is one of the leading protocols used in CAN bus networks.

This document describes how the CrossFire™ SX CANopen slave should be used. The reader is supposed to be familiar with the CANopen standard in order to fully understand the manual.

Overview:

- The CrossFire™ SX supports the CANopen protocol.
- The CrossFire™ SX is implemented in accordance with CANopen application layer and communication profile CiA 301 and Device profile for generic I/O modules CiA 401.
- The CrossFire™ SX implements all CiA 301 mandatory objects.
- The CrossFire™ SX has a default baud rate of 250 kbits/s.
- The CrossFire™ SX supports heartbeat.
- The CrossFire™ SX is an NMT slave device. It can act heartbeat consumer and producer.
- The CrossFire™ SX is a SYNC message consumer and producer.
- The CrossFire™ SX implements many CiA 301 optional objects, for details, see chapter 4.1: Communication Profile Area; Index 0x1000 to 0x13FF.

1.2. References

CAN in Automation - CANopen standard: http://www.can-cia.org

1.3. History

Rev	Date	Author	Changes
0.1	2015-11-09	Fredrik Wahlström	First draft
0.2	2015-01-07	Jochen Wendebaum	updated to fit first prototypes
0.3	2015-01-08	Carl-Magnus Moon	Updates regarding PID parameters, over current, other minor adjustments
0.4	2015-02-25	Jochen Wendebaum	Changes to the Object Dictionary: - extended object 0x1029 with additional states - clarified 0x2008 - added 0x2016-0x2030 - removed sub-indexes beyond 16 from0x6401 as they are now in the 0x2000-area
0.5	2015-04-20	Jochen Wendebaum	update of the Manufacturer Specific Entries in the OD
1.0.0.0	2016-05-24	Fredrik Wahlström	Update with changes to the Object Dictionary
1.1.0.0	2016-06-01	Carl-Magnus Moon	Corrections
1.2.0.0	2016-06-08	Carl-Magnus Moon	Updated table with emcy codes, added heartbeat consumer to overview section, Added resolution for analog inputs.
1.3.0.0	2016-09-08	Fredrik Wahlström	Updated with: - Possibility to change baudrate, default baudrate = 125k - FRAM integrity check - Port calibration: port, point1, point2, activate - Additional Internal measurements
1.3.1.0	2016-09-14	Fredrik Wahlström	Split internal voltages and temperatures into separate OD-indexes. Added LS- and HS current limit to H-Bridge.
1.4.0.0	2016-09-19	Carl-Magnus Moon	Updates regarding soft-start and detection of port errors
1.4.1.0	2016-10-03	Fredrik Wahlström	Change back default baudrate to 250k Moved some objects in OD
1.4.2.0	2016-10-21	Carl-Magnus Moon	Updates regarding temperature supervision
1.5.11.0	2017-01-23	Fredrik Wahlström	Moved and added some objects in OD
1.5.21.0	2017-02-14	Carl-Magnus Moon	Updates for slave version 1.5.21.0
1.5.22.0	2017-03-08	Mattias Lång	Update with new template
1.5.22.0B	2017-03-09	Carl-Magnus Moon	Default baud rate is set to 250kbit/s in production
1.5.22.0C	2017-06-12	Fredrik Wahlström	0x2009 Soft-start parameter A max value = 3
1.5.22.0D	2017-06-29	Fredrik Wahlström	Correction for OD index 0x1016
1.5.23.0	2017-08-09	Carl-Magnus Moon	PWM outputs now supports 2000Hz instead of 400Hz. Added 0x2032 Store PDO COB-ID. Added 0x2035 Digital feedback independent on port mode.
1.5.26.0	2020-01-14	Carl-Magnus Moon	Added input types pulse counter (8) and high resolution frequency measurement (9) Fixed error for H-bridge feedback 0x2026

2. CANopen Slave

2.1. Port Overview

The CrossFire™ SX is highly configurable. The configuration can be changed by writing to the object dictionary in the Manufacturer-Specific Profile Area (0x2000 to 0x5FFF).

2.1.1. Node Id Interface

The node id is configurable via the hardware node id pins in the connector or from software.

- The node id is set in the start-up phase and cannot be altered during runtime, (a reboot is required after the Node id is changed).
- The software node id is configurable in the object dictionary (index 0x2010).
- The software node id range is 0-127, where:
  - 0 => id is read and set from HW pins.
  - 1-127 => id is set from SW, (overrides HW pins).
- The default software node id is 0, i.e. node id is read from HW pins.

Hardware ID pins Lookup Table

CANopen node id	A3	A2	A1	A0
1	0	0	0	0
2	0	0	0	1
3	0	0	1	0
4	0	0	1	1
....				
16	1	1	1	1

- State 0 is reached by wiring corresponding id pin to GND.
- State 1 is reached by leaving corresponding id pin disconnected.
- Note, if no pins have been connected to GND the node id will be set to 16.

2.1.2. Input I/O

All of the Input I/O ports on the CrossFire™ SX are configured to “Not used” by default. They must therefore be configured in the object dictionary (index 0x2000) in order to be used.

The Input I/O ports can be configured to the following modes:

- Not used
- Analog voltage input 0-5V
- Analog voltage input 0-10V
- Analog voltage input 0-32V
- Current input 4-20mA
- Digital input
- Encoder input [1]
- Frequency input
- Pulse counter input (input 13 combined with 14, and 15 combined with 16)
- High resolution frequency input (input 11,12,13,14,15,16)

For each Input I/O port there are a bias setting available that makes it possible to activate pull up or pull down resistors. This setting can be configured in the object dictionary (index 0x2001).

2.1.3. Output I/O

All of the Output I/O ports on the CrossFire™ SX are configured to “Not used” by default. They must therefore be configured in the object dictionary (index 0x2002) in order to be used.

The Output I/O ports can be configured to the following modes:

- Not used
- PWM, (regular pulse width modulation)
- PWMi, (current controlled PWM)
- Digital output

For each Output I/O port depending on the port configuration the following additional settings are available:

- PWM
  - PWM Frequency, (object dictionary, index 0x2003).
- PWMi
  - Output Port Dither Frequency, (object dictionary, index 0x2004).
  - Output Port Dither Amplitude, (object dictionary, index 0x2005).

[1] Encoder input is available by combining two adjacent ports (port 1 combined with port 2, port 3 combined with port 4 and so on)

- Output Port PID Regulator Settings
  - P – Proportional Value, (object dictionary, index 0x2006).
  - I – Integral Value, (object dictionary, index 0x2007).
  - D – Derivative Value, (object dictionary, index 0x2008).

- Digital Output
  - Digital out with PROFET high-side switch (output 1,2,9,10)
  - The PROFET is used to be able to drive capacitive load. The PROFET must be activated by setting proper values on the A and B parameters if capacitive load will be used. If A and B=0, the normal high-side switch designed for inductive load will be used.
  - Soft start parameter A decides the time the PROFET is active. During that time, several start attempts can be done if needed.
  - Soft start parameter B decides the current limit that is used to decide if a new start attempt is needed.

- Digital out without PROFET driver (output 3,4,5,6,7,8,11,12,13,14,15,16)
  - For outputs that do not have dedicated hardware for driving capacitive load, the normal drive circuit for inductive load can be used in soft-start mode to be able to drive small capacitive loads.
  - Soft start is performed using a high frequency PWM and by automatically ramping up the duty cycle according to the formula $y = \frac{A}{1024} \cdot e^{\frac{B}{255}x}$
  - A, (object dictionary, index 0x2009).
  - B, (object dictionary, index 0x200A).

Short to ground is detected automatically by the drive circuit. This is indicated in the port status in the object dictionary. Also thermal warning, charge pump under-voltage lockout and over current are automatically detected and indicated.

Open load can be detected by the user by comparing the current feedback with the expected current.

Short to battery can be detected by the user by using the digital status signal. If the digital status is high while the output is off, there is a short to battery condition or a problem with the drive circuit.

2.1.4. H-bridge

Besides the 16 configurable outputs there are also two H-bridges. One H-bridge uses two output pins. The H-bridge is used to control a dc motor in both directions. To be able to adjust the motor speed PWM is used. In forward direction one output will be connected to VBAT and the other GND. In backward direction this will be the opposite. There is also a brake command where both outputs will be connected to GND.

The H-bridges contains a configurable low side current limit (with automatic current regulation in hardware), a configurable high side current limit and also current feedback. If the low side current limit is exceeded, current regulation is performed in hardware to reduce the current. This limit is mainly used to reduce inrush current when the motor starts. The H-bridge also contains a high side current limit. If this limit is exceeded, the motor is shut off. This limit is used to protect against short circuit between high side output and ground.

The following settings and parameters are available for the H-bridge:

H-bridge settings

Index	Description
0x200B	H-Bridge Current Limit Low Side
0x200C	H-Bridge Current Limit High Side

H-bridge control parameters

Index	Description
0x2020	H-Bridge Direction
0x2021	H-Bridge Speed

H-bridge status that can be read

Index	Description
0x2024	H-Bridge Status
0x2025	H-Bridge Current Low-Side
0x2026	H-Bridge Current High-Side

Current feedback from the H-bridge is only accurate at full speed (due to measuring is only performed in the drive phase of the PWM) so it is mainly intended to be able to see if the motor is running or not.

2.1.5. Encoder (input mode 6)

The input ports of the CrossFire™ SX can be configured to decode inputs from shaft encoders. Encoder input is available by combining two adjacent ports (port 1 combined with port 2, port 3 combined with port 4 and so on). Decoding is performed in hardware.

There are two primary signals from an encoder, called A and B. By comparing the states of these two digital signals, magnitude and direction information are extracted. This information allows the CrossFire™ SX to either add or subtract subsequent pulses to a cumulative total which represents the shaft position. Shaft Position can often be handled as a relative value but it is also possible to reset the encoder value to 0 through the OD 0x2028.

When configured as Encoder, the analog input values for both ports are combined to form the encoder value. The encoder value is 24-bit resolution.

2.1.6. Standard resolution frequency measurement (input mode 7)

Standard resolution frequency measurement works by counting the number of pulses during a 10ms period. For frequencies below 1000Hz, the time period between the last two pulses in the period are used instead. All inputs support this mode. From version 1.5.26.0 also a high resolution frequency measurement mode is supported which in most cases is recommended instead.

2.1.7. Pulse counter (input mode 8)

Pulse counter mode is supported from CODESYS RT version 1.5.26.0. Pulse counter mode is similar to encoder mode but only counts pulses on input A. Input B is used for direction. If input B is high, pulse counter is counting up. If input B is low, pulse counter is counting down.

Encoder reset is not supported in this mode. Pulse counter mode is only supported on input 13,14 and 15,16. Pulse counter is 24-bit resolution.

2.1.8. High resolution frequency measurement (input mode 9)

From version 1.5.26.0 CrossFire SX also supports up to 6 high resolution frequency measurement channels. It is only inputs 11,12,13,14,15,16, that has support for this. The high resolution frequency measurement support frequencies between 1Hz and 20kHz. High resolution frequency measurement works by measuring both time and number of pulses through the whole measurement range to get a more accurate result than the standard frequency measurement.

2.2. Storing of configuration parameters

The storing of configuration parameters to non-volatile memory is a relative slow operation. It is recommended to not switch of power during configuration. Double buffering of configuration data is used internally to avoid problems with this as far as possible.

2.3. Error behaviour

If a serious CANopen device failure is detected in NMT state Operational, the CrossFire™ SX will autonomously enter the NMT state Pre-operational. This includes:

- CAN Communication error
  - Bus-off conditions of the CAN interface
  - Life guarding event with the state ‘occurred’ and the reason 'time out'
  - Heartbeat event with state ‘occurred’ and the reason 'time out"
- Over temperature has been detected (this also shuts off outputs automatically).

2.4. Status LED indicator

LED indicator conforms to CiA 303-3 standard

Run LED – Green

CANopen mode	State	Blinking Pattern
Operational	LED ON	Constantly ON
Pre-Operational Initializing	LED Blinking	Iso-phase on and off with a frequency of approximately 2,5 Hz: (ON 200ms, OFF 200ms)
Stopped	LED Single Flash	One short flash: (ON 200ms, OFF 1000ms)

Error LED – Red

CANopen mode	State	Blinking Pattern
CAN Bus-Off	LED ON	Constantly ON
CAN Bus Warning	LED Single Flash	One short flash: (ON 200ms, OFF 1000ms)
Port Error Internal Voltage Error Over Temperature	LED Blinking	Iso-phase on and off with a frequency of approximately 2,5 Hz: (ON 200ms, OFF 200ms)

Status LED indicator in boot mode

Boot mode is activated by setting the boot pin in the connector to VBAT and restarting the unit. Boot mode is also activated when the unit is started without an application. This might happen if a failed firmware upgrade has been performed.

LED Color (Amber, Red or Green)	Blinking Pattern	Description
Green	LED ON	At start-up
Green	LED Blinking	Firmware upgrade in progress
Red	LED ON	Error during or after firmware upgrade
Green	LED ON	After successful firmware upgrade
Amber	LED ON	Incompatible or no application loaded

3. CANopen Interface

3.1. EMCY object overview

Emergency objects are triggered by the occurrence of a CANopen device internal error situation and are transmitted from an emergency producer on the CANopen device. The following error codes are supported.

Error Code	Error Register	Manufacturer specific error field	Description
0x0000	0x0		ERROR_RESET
0x8130	0x10		NODEGUARDING_ERROR
0x8140	0x10		RECOVERED_FROM_BUSOFF
0x8120	0x10		ERROR_PASSIVE_MODE
0x8210	0x10		PDO_LENGTH_ERROR
0x8220	0x10		PDO_LENGTH_EXCEEDED
0x1001	0x1		INVALID_COMMCYCLEPERIOD

The emergency object 0x8140 is only sent once during a run session even if bus off is detected and recovered several times. After a reboot, reset command or reset node command, the emergency message can be sent again.

3.2. Receive PDOs

This section describes the Receive PDO information to the CrossFire™ SX. The information received on these PDOs will directly affect the CrossFire™ SX outputs.

There are 16 output ports that all are configurable as either digital (Digital output) or analog (PWM, PWMi).

By default, all ports are configured to “Not Used”. To reconfigure the ports, index 0x2002 is used. For further information, see the description of the Object Dictionary.

By default, the PDOs of the node are mapped to the I/O following the mapping described in CiA401.

Receive PDO 1: COB ID: 200h + Node ID

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0..7 Ports 1 to 8 Digital ON/OFF [2, 3]	0..7 Ports 9 to 16 Digital ON/OFF [2, 3]	0..7 Unused	0..7 Unused	0..7 Unused	0..7 Unused	0..7 Unused	0..7 Unused

Receive PDO 2: COB ID: 300h + Node ID

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 1 Analog Output [4]		Port 2 Analog Output [4]		Port 3 Analog Output [4]		Port 4 Analog Output [4]	

Receive PDO 3: COB ID: 400h + Node ID

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 5 Analog Output [4]		Port 6 Analog Output [4]		Port 7 Analog Output [4]		Port 8 Analog Output [4]	

Receive PDO 4: COB ID: 500h + Node ID

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 9 Analog Output [4]		Port 10 Analog Output [4]		Port11 Analog Output [4]		Port12 Analog Output [4]	

Receive PDO 5: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 13 Analog Output [4]		Port 14 Analog Output [4]		Port 15 Analog Output [4]		Port 16 Analog Output [4]	

Receive PDO 6: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Output 1 … 16 retry after fault flag		0..7 Unused	0..7 Unused	0..7 Unused	0..7 Unused	0..7 Unused	0..7 Unused

Receive PDO 7: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
H-Bridge 1 Direction	H-Bridge 1 Speed		H-Bridge 2 Direction	H-Bridge 1 Speed		0..7 Unused	0..7 Unused

[2] Only bits that correspond to port configured as Digital Output will be used.
[3] There are 2 bytes for each analog Output. Valid values range is 0-1000 for PWM and 0-4000 for PWMi.
[4] Only values that correspond to port configured as PWM or PWMi will be used.

3.3. Transmit PDOs

This section describes the Transmit PDO information from the CrossFire™ SX. The information transmitted on these Transmit PDO's directly reflects the status of the CrossFire™ SX inputs.

There are 16 input ports that all are configurable as either digital (Digital input) or analog inputs (Voltage 0-5V, Voltage 0-10V, Voltage 0-32V, Current, Digital, Encoder and Frequency). Some input ports also support pulse counter mode and high resolution frequency measurement mode.

By default, all ports are configured to "Not used". To reconfigure the ports, index 0x2000 is used. For further information, see description of Object Dictionary.

The default transmission type for the Transmit PDO's is 255 (Event Triggered). This means that the Transmit PDO's will be sent only when a change occurs. Note, when reading analog inputs Event Triggered an inhibit time should be configured to prevent a heavy bus load due to intense changes from background noise. By default an inhibit time of 100 ms is used.

By default, the PDO's of the node are mapped to the I/O following the mapping described in CiA401:

Transmit PDO 1: COB ID: 180h + Node ID

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0..7 Ports 1 – 8* Digital Input	0..7 Ports 9 – 16* Digital Input	0..7 Ports 1 – 8* DO Feedback	0..7 Ports 9 – 16* DO Feedback	0..7 Unused	0..7 Unused	0..7 Unused	0..7 Unused

* Only bits that correspond to ports configured as Digital Inputs will be used.

Transmit PDO 2: COB ID: 280h + Node ID

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 1 Analog Input *		Port 2 Analog Input *		Port 3 Analog Input *		Port 4 Analog Input *	

* Value will only be valid if port is configured as an Analog Input.

Transmit PDO 3: COB ID: 380h + Node ID

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 5 Analog Input *		Port 6 Analog Input *		Port 7 Analog Input *		Port 8 Analog Input *	

* Value will only be valid if port is configured as an Analog Input.

Transmit PDO 4: COB ID: 480h + Node ID

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 9 Analog Input *		Port 10 Analog Input *		Port 11 Analog Input *		Port 12 Analog Input *	

* Value will only be valid if port is configured as an Analog Input.

Transmit PDO5: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 13 Analog Input *		Port 14 Analog Input *		Port 15 Analog Input *		Port 16 Analog Input *	

* Value will only be valid if port is configured as an Analog Input.

Transmit PDO6: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 1 Current Feedback		Port 2 Current Feedback		Port 3 Current Feedback		Port 4 Current Feedback	

Transmit PDO7: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 5 Current Feedback		Port 6 Current Feedback		Port 7 Current Feedback		Port 8 Current Feedback	

Transmit PDO8: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 9 Current Feedback		Port 10 Current Feedback		Port 11 Current Feedback		Port 12 Current Feedback	

Transmit PDO9: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 13 Current Feedback		Port 14 Current Feedback		Port 15 Current Feedback		Port 16 Current Feedback	

Transmit PDO10: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 1 Frequency Feedback Error! Bookmark not defined.		Port 2 Frequency Feedback Error! Bookmark not defined.		Port 3 Frequency Feedback Error! Bookmark not defined.		Port 4 Frequency Feedback Error! Bookmark not defined.	

Transmit PDO11: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 5 Frequency Feedback Error! Bookmark not defined.		Port 6 Frequency Feedback Error! Bookmark not defined.		Port 7 Frequency Feedback Error! Bookmark not defined.		Port 8 Frequency Feedback Error! Bookmark not defined.	

Transmit PDO12: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 9 Frequency Feedback Error! Bookmark not defined.		Port 10 Frequency Feedback Error! Bookmark not defined.		Port 11 Frequency Feedback Error! Bookmark not defined.		Port 12 Frequency Feedback Error! Bookmark not defined.	

Transmit PDO13: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 13 Frequency Feedback Error! Bookmark not defined.		Port 14 Frequency Feedback Error! Bookmark not defined.		Port 15 Frequency Feedback Error! Bookmark not defined.		Port 16 Frequency Feedback Error! Bookmark not defined.	

Transmit PDO14: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
VCOMP		3V0 ADC reference		2V8 threshold		6V5 Voltage	

Transmit PDO15: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 1 Duty Cycle Feedback [5]		Port 2 Duty Cycle Feedback [5]		Port 3 Duty Cycle Feedback [5]		Port 4 Duty Cycle Feedback [5]	

Transmit PDO16: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 5 Duty Cycle Feedback [5]		Port 6 Duty Cycle Feedback [5]		Port 7 Duty Cycle Feedback [5]		Port 8 Duty Cycle Feedback [5]	

Transmit PDO17: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 9 Duty Cycle Feedback [5]		Port 10 Duty Cycle Feedback [5]		Port 11 Duty Cycle Feedback [5]		Port 12 Duty Cycle Feedback [5]	

Transmit PDO18: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 13 Duty Cycle Feedback [5]		Port 14 Duty Cycle Feedback [5]		Port 15 Duty Cycle Feedback [5]		Port 16 Duty Cycle Feedback [5]	

Transmit PDO19: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 1 [6] Output status bits	Port 2 [6] Output status bits	Port 3 [6] Output status bits	Port 4 [6] Output status bits	Port 5 [6] Output status bits	Port 6 [6] Output status bits	Port 7 [6] Output status bits	Port 8 [6] Output status bits

Transmit PDO20: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 9 [6] Output status bits	Port 10 [6] Output status bits	Port 11 [6] Output status bits	Port 12 [6] Output status bits	Port 13 [6] Output status bits	Port 14 [6] Output status bits	Port 15 [6] Output status bits	Port 16 [6] Output status bits

Transmit PDO21: Default not active

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Sensor Supply 5V Feed-back		Firmware Upgrade Pin	CAN ID Pins	Unit Status		Voltage Supervision	

[5] Only when port is configured to PWM.
[7] Only when port is configured to PWMi.

4. Object Dictionary

4.1. Communication Profile Area; Index 0x1000 to 0x13FF

Index	S-Idx	Type	Default	Saved	Description
0x1000	0	u32, ro	0xF191	-	Device type: CiA401, analog in/out, digital in/out.
0x1001	0	u8, ro	0	-	Error Register: Bit coded as specified in CiA301. Error register is synchronized with the following EMCY object: • COMMUNICATION bit o INVALID_GUARDING_TIME o INVALID_HEARTBEAT_TIME o HEARTBEAT_ERROR o NODEGUARDING_ERROR o COMMUNICATION_GENERIC o RECOVERED_FROM_BUSOFF o ERROR_PASSIVE_MODE o PDO_LENGTH_ERROR o PDO_LENGTH_EXCEEDED • GENERIC o INVALID_COMMCYCLEPERIOD (Wrong bus cycle time)
0x1003	0	U8, rw	0	-	Pre-Defined Error Field: (Number of entries.)
	1	u32, ro	0	-	Latest error
	2	u32, ro	0	-	2nd last error
	3	u32, ro	0	-	3rd last error
	4	u32, ro	0	-	4th last error
	5	u32, ro	0	-	5th last error
0x1005	0	u32,rw	0x80	-	COB-ID SYNC message. Bit 31 is used to disable/enable sync producing.
0x1006	0	u32,rw	0	-	Communication cycle period. Resolution is 1 µs but the interval must be in multiples of 10ms (10000µs).
0x1008	0	string, ro	CrossFire SX		Manufacturer device name
0x100A	0	string, ro	x.x.x.x		Manufacturer software version
0x100C	0	u16, rw	0	Setting	Guard time: as specified in CiA301.
0x100D	0	u8, rw	0	Setting	Life time factor: as specified in CiA301.
0x1010	0	u8, ro	2	-	Store parameters: Highest sub-index supported
	1	u32, ro	2	-	Save all parameters
	2	u32, rw	2	Yes	Save communication parameters Valid after reboot 0 = CANopen device does not save parameters autonomously 2 = CANopen device saves parameters autonomously (Autonomous saving means that a CANopen device stores the communication parameters in a nonvolatile memory without user request.) **Note:** Autonomously saving of communication parameters is always ON, but the recall on startup can be controlled: 0=OFF => No recall of communication parameters

					2=ON => Communication parameters are recalled on startup.
0x1011	0	u8, ro	3	-	Restore default parameters: Highest sub-index supported
	1	u32, rw	0	-	Restore all default parameters by writing "load" in ASCII or 16#64616F6C. The entire object dictionary will get reset to default values. Note that a restart is needed to be able to see that the communication parameters are reset through the OD and also until they take effect. Application parameters will be reset directly in OD but will not take effect before a restart has been made. Node id and baud rate is not reset.
	2	u32, rw	0	-	Restore communication default parameters by writing "load" in ASCII or 16#64616F6C. Communication parameters in object dictionary will get reset to default values. Note that a restart is needed to be able to see that parameters are reset and also until they take effect. Node id and baud rate is not reset.
	3	u32, rw	0	-	Restore application default parameters by writing "load" in ASCII or 16#64616F6C. Application default parameters in object dictionary will get reset to default values. Note that parameter values are reset directly in OD but will take effect the next restart.
0x1014	0	u32, ro	0x80 + nodeID	No	EMCY COB ID: as specified in CiA301.
0x1016	0	u8, ro	1	-	Heartbeat: Number of entries.
	1	u32, rw	0	Setting	Consumer Heartbeat Time: Monitoring time for node xx as specified in CiA301.
0x1017	0	u16, rw	0	Setting	Producer heartbeat time: as specified in CiA301
0x1018	0	u8, ro	3	-	Identity Object: Number of entries.
	1	u32, ro	0xF2	-	Vendor ID.
	2	u32, ro	137	-	Product code.
	3	u32, ro		-	Revision number.

4.2. SDO server parameter, (Object 1200h to 127Fh)

Index	S-Idx	Type	Default	Saved	Description
0x1200	0	u8, ro	2	-	Number of entries.
	1	u32, ro	NodeId + 0x600	No	COB-ID Client->Server
	2	u32, ro	NodeId + 0x580	No	COB-ID Server->Client

4.3. RPDO communication parameter, (Object 1400h to 15FFh)

Index	S-Idx	Type	Default	Saved	Description
0x1400	0	u8, ro	2	-	Receive PDO 1: Number of entries.
	1	u32, rw	0x200 + Node ID	Setting	COB ID for receive RPDO 1.
	2	u8, rw	255	Setting	Transmission type for receive PDO 1.
0x1401	0	u8, ro	2	-	Receive PDO 2: Number of entries.
	1	u32, rw	0x300 + Node ID	Setting	COB ID for receive RPDO 2.
	2	u8, rw	255	Setting	Transmission type for receive PDO 2.
0x1402	0	u8, ro	2	-	Receive PDO 3: Number of entries.
	1	u32, rw	0x400 + Node ID	Setting	COB ID for receive RPDO 3.
	2	u8, rw	255	Setting	Transmission type for receive PDO 3.
0x1403	0	u8, ro	2	-	Receive PDO 4: Number of entries.
	1	u32, rw	0x500 + Node ID	Setting	COB ID for receive RPDO 4.
	2	u8, rw	255	Setting	Transmission type for receive PDO 4.
0x1404	0	u8, ro	2	-	Receive PDO 5: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for receive RPDO 5.
	2	u8, rw	255	Setting	Transmission type for receive PDO 5.
0x1405	0	u8, ro	2	-	Receive PDO 6: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for receive RPDO 6.
	2	u8, rw	255	Setting	Transmission type for receive PDO 6.
0x1406	0	u8, ro	2	-	Receive PDO 7: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for receive RPDO 7.
	2	u8, rw	255	Setting	Transmission type for receive PDO 7.

Note that if using automatic storage of parameters, the cob-id for PDOs will not be changed automatically when changing node id.

4.4. RPDO mapping parameter, (Object 1600h to 17FFh)

Index	S-Idx	Type	Default	Saved	Description
0x1600	0	u8, ro	2	No	Receive PDO 1: Number of mapped application objects in PDO
	1	u32, ro	0x62000108	No	First mapped object for receive RPDO 1.
	2	u32, ro	0x62000208	No	Second mapped object for receive RPDO 1.
0x1601	0	u8, ro	4	No	Receive PDO 2: Number of mapped application objects in PDO 2.
	1	u32, ro	0x64110110	No	First mapped object for receive PDO 2.
	2	u32, ro	0x64110210	No	Second mapped object for receive PDO 2.
	3	u32, ro	0x64110310	No	Third mapped object for receive PDO 2.
	4	u32, ro	0x64110410	No	Fourth mapped object for receive PDO 2.
0x1602	0	u8, ro	4	No	Receive PDO 3: Number of mapped application objects in PDO 3.
	1	u32, ro	0x64110510	No	First mapped object for receive PDO 3.
	2	u32, ro	0x64110610	No	Second mapped object for receive PDO 3.
	3	u32, ro	0x64110710	No	Third mapped object for receive PDO 3.
	4	u32, ro	0x64110810	No	Fourth mapped object for receive PDO 3.
0x1603	0	u8, ro	4	No	Receive PDO 4: Number of mapped application objects in PDO 4.
	1	u32, ro	0x64110910	No	First mapped object for receive PDO 4.
	2	u32, ro	0x64110A10	No	Second mapped object for receive PDO 4.
	3	u32, ro	0x64110B10	No	Third mapped object for receive PDO 4.
	4	u32, ro	0x64110C10	No	Fourth mapped object for receive PDO 4.
0x1604	0	u8, ro	4	No	Receive PDO 5: Number of mapped application objects in PDO 5.
	1	u32, ro	0x 64110D10	No	First application mapped for receive PDO 5
	2	u32, ro	0x 64110E10	No	Second application mapped for receive PDO 5
	3	u32, ro	0x 64110F10	No	Third application mapped for receive PDO 5
	4	u32, ro	0x 64111010	No	Fourth application mapped for receive PDO 5
0x1605	0	u8, ro	2	No	Receive PDO 6: Number of mapped application objects in PDO 6.
	1	u32, ro	0x20120010	No	First application mapped for receive PDO 6
0x1606	0	u8, ro	4	No	Receive PDO 7: Number of mapped application objects in PDO 7.
	1	u32, ro	0x20200108	No	First application mapped for receive PDO 7
	2	u32, ro	0x20210110	No	Second application mapped for receive PDO 7
	3	u32, ro	0x20200208	No	Third application mapped for receive PDO 7
	4	u32, ro	0x20210210	No	Fourth application mapped for receive PDO 7

4.5. TPDO communication parameter, (Object 1800h to 19FFh)

Index	S-Idx	Type	Default	Saved	Description
0x1800	0	u8, ro	5	-	Transmit PDO 1: Number of entries.
	1	u32, rw	0x180 + Node ID	Setting	COB ID for transmit PDO 1.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 1.
	3	u16, rw	0	Setting	Inhibit time for transmit PDO 1.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 1.
0x1801	0	u8, ro	5	-	Transmit PDO 2: Number of entries.
	1	u32, rw	0x280 + Node ID	Setting	COB ID for transmit PDO 2.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 2.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 2.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 2.
0x1802	0	u8, ro	5	-	Transmit PDO 3: Number of entries.
	1	u32, rw	0x380 + Node ID	Setting	COB ID for transmit PDO 3
	2	u8, rw	255	Setting	Transmission type for transmit PDO 3.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 3.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 3.
0x1803	0	u8, ro	5	-	Transmit PDO 4: Number of entries.
	1	u32, rw	0x480 + Node ID	Setting	COB ID for transmit PDO 4.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 4.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 4.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 4.
0x1804	0	u8, ro	5	-	Transmit PDO 5: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for transmit PDO 5.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 5.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 5.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 5.
0x1805	0	u8, ro	5	-	Transmit PDO 6: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for transmit PDO 6.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 6.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 6.

	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 6.
0x1806	0	u8, ro	5	-	Transmit PDO 7: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for transmit PDO 7.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 7.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 7.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 7.
0x1807	0	u8, ro	5	-	Transmit PDO 8: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for transmit PDO 8.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 8.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 8.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 8.
0x1808	0	u8, ro	5	-	Transmit PDO 9: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for transmit PDO 9.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 9.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 9.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 9.
0x1809	0	u8, ro	5	-	Transmit PDO 10: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for transmit PDO 10.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 10.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 10.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 10.
0x180A	0	u8, ro	5	-	Transmit PDO 11: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for transmit PDO 11.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 11.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 11.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 11.
0x180B	0	u8, ro	5	-	Transmit PDO 12: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for transmit PDO 12.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 12.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 12.
	4	u8, rw	-	-	Not used.

	5	u16, rw	0	Setting	Event timer for transmit PDO 12.
0x180C	0	u8, ro	5	-	Transmit PDO 13: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for transmit PDO 13.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 13.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 13.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 13.
0x180D	0	u8, ro	5	-	Transmit PDO 14: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for transmit PDO 14.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 14.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 14.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 14.
0x180E	0	u8, ro	5	-	Transmit PDO 15: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for transmit PDO 15.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 15.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 15.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 15.
0x180F	0	u8, ro	5	-	Transmit PDO 16: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for transmit PDO 16.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 16.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 16.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 16.
0x1810	0	u8, ro	5	-	Transmit PDO 17: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for transmit PDO 17.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 17.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 17.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 17.
0x1811	0	u8, ro	5	-	Transmit PDO 18: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for transmit PDO 18.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 18.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 18.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 18.

0x1812	0	u8, ro	5	-	Transmit PDO 19: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for transmit PDO 19.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 19.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 19.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 19.
0x1813	0	u8, ro	5	-	Transmit PDO 20: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for transmit PDO 20.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 20.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 20.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 20.
0x1814	0	u8, ro	5	-	Transmit PDO 21: Number of entries.
	1	u32, rw	0x80000000	Setting	COB ID for transmit PDO 21.
	2	u8, rw	255	Setting	Transmission type for transmit PDO 21.
	3	u16, rw	100	Setting	Inhibit time for transmit PDO 21.
	4	u8, rw	-	-	Not used.
	5	u16, rw	0	Setting	Event timer for transmit PDO 21.

Note that if using automatic storage of parameters, the cob-id for PDOs will not be changed automatically when changing node id.

4.6. TPDO mapping parameter, (Object 1A00h to 1BFFh)

Index	S-Idx	Type	Default	Saved	Description
0x1A00	0	u8, ro	4	No	Transmit PDO 1: Number of entries
	1	u32, ro	0x60000108	No	First mapped object for transmit PDO 1.
	2	u32, ro	0x60000208	No	Second mapped object for transmit PDO1.
	3	u32, ro	0x60000308	No	Third mapped object for transmit PDO1.
	4	u32, ro	0x60000408	No	Fourth mapped object for transmit PDO1.
0x1A01	0	u8, ro	4	No	Transmit PDO 2: Number of entries
	1	u32, ro	0x64010110	No	First mapped object for transmit PDO 2.
	2	u32, ro	0x64010210	No	Second mapped object for transmit PDO2.
	3	u32, ro	0x64010310	No	Third mapped object for transmit PDO 2.
	4	u32, ro	0x64010410	No	Fourth mapped object for transmit PDO 2.
0x1A02	0	u8, ro	4	No	Transmit PDO 3: Number of entries
	1	u32, ro	0x64010510	No	First mapped object for transmit PDO 3.
	2	u32, ro	0x64010610	No	Second mapped object for transmit PDO3.
	3	u32, ro	0x64010710	No	Third mapped object for transmit PDO 3.
	4	u32, ro	0x64010810	No	Fourth mapped object for transmit PDO 3.
0x1A03	0	u8, ro	4	No	Transmit PDO 4: Number of entries
	1	u32, ro	0x64010910	No	First mapped object for transmit PDO 4.
	2	u32, ro	0x64010A10	No	Second mapped object for transmit PDO4.
	3	u32, ro	0x64010B10	No	Third mapped object for transmit PDO 4.
	4	u32, ro	0x64010C10	No	Fourth mapped object for transmit PDO 4.
0x1A04	0	u8, ro	4	No	Transmit PDO: Number of entries
	1	u32, ro	0x64010D10	No	Application object 1
	2	u32, ro	0x64010E10	No	Application object 2
	3	u32, ro	0x64010F10	No	Application object 3
	4	u32, ro	0x64011010	No	Application object 4
0x1A05	0	u8, ro	4	No	Transmit PDO: Number of entries
	1	u32, ro	0x20160110	No	Application object 1
	2	u32, ro	0x20160210	No	Application object 2
	3	u32, ro	0x20160310	No	Application object 3
	4	u32, ro	0x20160410	No	Application object 4
0x1A06	0	u8, ro	4	No	Transmit PDO: Number of entries
	1	u32, ro	0x20160510	No	Application object 1
	2	u32, ro	0x20160610	No	Application object 2
	3	u32, ro	0x20160710	No	Application object 3

	4	u32, ro	0x20160810	No	Application object 4
0x1A07	0	u8, ro	4	No	Transmit PDO: Number of entries
	1	u32, ro	0x20160910	No	Application object 1
	2	u32, ro	0x20160A10	No	Application object 2
	3	u32, ro	0x20160B10	No	Application object 3
	4	u32, ro	0x20160C10	No	Application object 4
0x1A08	0	u8, ro	4	No	Transmit PDO: Number of entries
	1	u32, ro	0x20160D10	No	Application object 1
	2	u32, ro	0x20160E10	No	Application object 2
	3	u32, ro	0x20160F10	No	Application object 3
	4	u32, ro	0x20161010	No	Application object 4
0x1A09	0	u8, ro	4	No	Transmit PDO: Number of entries
	1	u32, ro	0x20170110	No	Application object 1
	2	u32, ro	0x20170210	No	Application object 2
	3	u32, ro	0x20170310	No	Application object 3
	4	u32, ro	0x20170410	No	Application object 4
0x1A0A	0	u8, ro	4	No	Transmit PDO: Number of entries
	1	u32, ro	0x20170510	No	Application object 1
	2	u32, ro	0x20170610	No	Application object 2
	3	u32, ro	0x20170710	No	Application object 3
	4	u32, ro	0x20170810	No	Application object 4
0x1A0B	0	u8, ro	4	No	Transmit PDO: Number of entries
	1	u32, ro	0x20170910	No	Application object 1
	2	u32, ro	0x20170A10	No	Application object 2
	3	u32, ro	0x20170B10	No	Application object 3
	4	u32, ro	0x20170C10	No	Application object 4
0x1A0C	0	u8, ro	4	No	Transmit PDO: Number of entries
	1	u32, ro	0x20170D10	No	Application object 1
	2	u32, ro	0x20170E10	No	Application object 2
	3	u32, ro	0x20170F10	No	Application object 3
	4	u32, ro	0x20171010	No	Application object 4
0x1A0D	0	u8, ro	4	No	Transmit PDO: Number of entries
	1	u32, ro	0x201A0110	No	Application object 1
	2	u32, ro	0x201A0210	No	Application object 2
	3	u32, ro	0x201A0310	No	Application object 3
	4	u32, ro	0x201A0410	No	Application object 4
0x1A0E	0	u8, ro	4	No	Transmit PDO: Number of entries

	1	u32, ro	0x20180110	No	Application object 1
	2	u32, ro	0x20180210	No	Application object 2
	3	u32, ro	0x20180310	No	Application object 3
	4	u32, ro	0x20180410	No	Application object 4
0x1A0F	0	u8, ro	4	No	Transmit PDO: Number of entries
	1	u32, ro	0x20180510	No	Application object 1
	2	u32, ro	0x20180610	No	Application object 2
	3	u32, ro	0x20180710	No	Application object 3
	4	u32, ro	0x20180810	No	Application object 4
0x1A10	0	u8, ro	4	No	Transmit PDO: Number of entries
	1	u32, ro	0x20180910	No	Application object 1
	2	u32, ro	0x20180A10	No	Application object 2
	3	u32, ro	0x20180B10	No	Application object 3
	4	u32, ro	0x20180C10	No	Application object 4
0x1A11	0	u8, ro	4	No	Transmit PDO: Number of entries
	1	u32, ro	0x20180D10	No	Application object 1
	2	u32, ro	0x20180E10	No	Application object 2
	3	u32, ro	0x20180F10	No	Application object 3
	4	u32, ro	0x20181010	No	Application object 4
0x1A12	0	u8, ro	8	No	Transmit PDO: Number of entries
	1	u32, ro	0x201B0108	No	Application object 1
	2	u32, ro	0x201B0208	No	Application object 2
	3	u32, ro	0x201B0308	No	Application object 3
	4	u32, ro	0x201B0408	No	Application object 4
	5	u32, ro	0x201B0508	No	Application object 5
	6	u32, ro	0x201B0608	No	Application object 6
	7	u32, ro	0x201B0708	No	Application object 7
	8	u32, ro	0x201B0808	No	Application object 8
0x1A13	0	u8, ro	8	No	Transmit PDO: Number of entries
	1	u32, ro	0x201B0908	No	Application object 1
	2	u32, ro	0x201B0A08	No	Application object 2
	3	u32, ro	0x201B0B08	No	Application object 3
	4	u32, ro	0x201B0C08	No	Application object 4
	5	u32, ro	0x201B0D08	No	Application object 5
	6	u32, ro	0x201B0E08	No	Application object 6
	7	u32, ro	0x201B0F08	No	Application object 7
	8	u32, ro	0x201B1008	No	Application object 8

0x1A14	0	u8, ro	5	No	Transmit PDO: Number of entries
	1	u32, ro	0x201A0510	No	Application object 1
	2	u32, ro	0x20130008	No	Application object 2
	3	u32, ro	0x20150008	No	Application object 3
	4	u32, ro	0x201E0110	No	Application object 4
	5	u32, ro	0x201E0210	No	Application object 5

4.7. Manufacturer Specific Profile Area; Index 0x2000 to 0x5FFF

Index	S-Idx	Type	Default (possible)	Saved	Description
0x2000	0	u8, ro	16	-	**Input Port Configuration** (Valid after reboot). The values used have the following meaning for sub-indices 1 to 16: 0 = Port Not Used 1 = Voltage 0-5V 2 = Voltage 0-10V 3 = Voltage 0-32V 4 = Current Input (4-20mA) 5 = Digital Input 6 = Encoder Input 7 = Frequency Measurement (1-20000Hz) 8 = Pulse Counter 9 = High resolution frequency measurement (1-20000Hz)
	1	u8, rw	0 (0,1,2,3,4,5,6,7)	Yes	Port configuration for port 1:
	2	u8, rw	0 (0,1,2,3,4,5,6,7)	Yes	Port configuration for port 2:
	3	u8, rw	0 (0,1,2,3,4,5,6,7)	Yes	Port configuration for port 3:
	4	u8, rw	0 (0,1,2,3,4,5,6,7)	Yes	Port configuration for port 4:
	5	u8, rw	0 (0,1,2,3,4,5,6,7)	Yes	Port configuration for port 5:
	6	u8, rw	0 (0,1,2,3,4,5,6,7)	Yes	Port configuration for port 6:
	7	u8, rw	0 (0,1,2,3,4,5,6,7)	Yes	Port configuration for port 7:
	8	u8, rw	0 (0,1,2,3,4,5,6,7)	Yes	Port configuration for port 8:
	9	u8, rw	0 (0,1,2,3,4,5,6,7)	Yes	Port configuration for port 9:
	10	u8, rw	0 (0,1,2,3,4,5,6,7)	Yes	Port configuration for port 10:
	11	u8, rw	0 (0,1,2,3,4,5,6,7,9)	Yes	Port configuration for port 11:
	12	u8, rw	0 (0,1,2,3,4,5,6,7,9)	Yes	Port configuration for port 12:
	13	u8, rw	0 (0,1,2,3,4,5,6,7,8,9)	Yes	Port configuration for port 13:
	14	u8, rw	0 (0,1,2,3,4,5,6,7,8,9)	Yes	Port configuration for port 14:
	15	u8, rw	0 (0,1,2,3,4,5,6,7,8,9)	Yes	Port configuration for port 15:
	16	u8, rw	0 (0,1,2,3,4,5,6,7,8,9)	Yes	Port configuration for port 16:
0x2001	0	u8, ro	16	-	**Input Port Bias** (Valid after reboot). The values used have the following meaning for sub-indices 1 to 16: 0 = No bias 1 = Pull-Up 2 = Pull-Down
	1	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 1:

	2	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 2:
	3	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 3:
	4	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 4:
	5	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 5:
	6	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 6:
	7	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 7:
	8	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 8:
	9	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 9:
	10	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 10:
	11	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 11:
	12	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 12:
	13	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 13:
	14	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 14:
	15	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 15:
	16	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 16:
0x2002	0	u8, ro	16	-	**Output Port Configuration**: Number of entries. (Valid after reboot). The values used have the following meaning for sub-indices 1 to 16: 0 = Port Not Used 1 = PWM 2 = PWMi 3 = Digital
	1	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 1
	2	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 2
	3	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 3
	4	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 4
	5	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 5
	6	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 6
	7	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 7
	8	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 8
	9	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 9
	10	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 10
	11	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 11
	12	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 12
	13	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 13
	14	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 14
	15	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 15
	16	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 16
0x2003	0	u8, ro	16	-	**Output Port PWM Frequency**, Number of entries. (Valid after reboot).

					The values used have the following meaning for sub-indices 1 to 16: Value is in Hz. Valid values 50-2000Hz NOTE! For PWMi a fixed high frequency PWM is used.
	1	u16, rw	100 (50-2000)	Yes	PWM Frequency for port 1
	2	u16, rw	100 (50-2000)	Yes	PWM Frequency for port 2
	3	u16, rw	100 (50-2000)	Yes	PWM Frequency for port 3
	4	u16, rw	100 (50-2000)	Yes	PWM Frequency for port 4
	5	u16, rw	100 (50-2000)	Yes	PWM Frequency for port 5
	6	u16, rw	100 (50-2000)	Yes	PWM Frequency for port 6
	7	u16, rw	100 (50-2000)	Yes	PWM Frequency for port 7
	8	u16, rw	100 (50-2000)	Yes	PWM Frequency for port 8
	9	u16, rw	100 (50-2000)	Yes	PWM Frequency for port 9
	10	u16, rw	100 (50-2000)	Yes	PWM Frequency for port 10
	11	u16, rw	100 (50-2000)	Yes	PWM Frequency for port 11
	12	u16, rw	100 (50-2000)	Yes	PWM Frequency for port 12
	13	u16, rw	100 (50-2000)	Yes	PWM Frequency for port 13
	14	u16, rw	100 (50-2000)	Yes	PWM Frequency for port 14
	15	u16, rw	100 (50-2000)	Yes	PWM Frequency for port 15
	16	u16, rw	100 (50-2000)	Yes	PWM Frequency for port 16
0x2004	0	u8, ro	16	-	**Output Port Dither Frequency**: Number of entries. (Valid after reboot). The values used have the following meaning for sub-indices 1 to 16: Value is in Hz. Valid values 25-400Hz. NOTE! Not all values between 25-400Hz are supported. If an unsupported value is written, the closest possible value is selected automatically.
	1	u16, rw	100 (25-400)	Yes	Dither Frequency for port 1
	2	u16, rw	100 (25-400)	Yes	Dither Frequency for port 2
	3	u16, rw	100 (25-400)	Yes	Dither Frequency for port 3
	4	u16, rw	100 (25-400)	Yes	Dither Frequency for port 4
	5	u16, rw	100 (25-400)	Yes	Dither Frequency for port 5
	6	u16, rw	100 (25-400)	Yes	Dither Frequency for port 6
	7	u16, rw	100 (25-400)	Yes	Dither Frequency for port 7
	8	u16, rw	100 (25-400)	Yes	Dither Frequency for port 8
	9	u16, rw	100 (25-400)	Yes	Dither Frequency for port 9
	10	u16, rw	100 (25-400)	Yes	Dither Frequency for port 10
	11	u16, rw	100 (25-400)	Yes	Dither Frequency for port 11
	12	u16, rw	100 (25-400)	Yes	Dither Frequency for port 12
	13	u16, rw	100 (25-400)	Yes	Dither Frequency for port 13
	14	u16, rw	100 (25-400)	Yes	Dither Frequency for port 14
	15	u16, rw	100 (25-400)	Yes	Dither Frequency for port 15

	16	u16, rw	100 (25-400)	Yes	Dither Frequency for port 16
0x2005	0	u8, ro	16	-	**Output Port Dither Amplitude**: Number of entries. (Valid after reboot). The values used have the following meaning for sub-indices 1 to 16: Valid values 0-400 which corresponds to 0-400mA Note that when using a high dither frequency, the dither will be attenuated by the inductance of the valve.
	1	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 1
	2	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 2
	3	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 3
	4	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 4
	5	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 5
	6	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 6
	7	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 7
	8	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 8
	9	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 9
	10	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 10
	11	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 11
	12	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 12
	13	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 13
	14	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 14
	15	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 15
	16	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 16
0x2006	0	u8, ro	16	-	**Output Port Current Regulator Proportional Value "P"**: Number of entries. (Valid after reboot). The values used have the following meaning for sub-indices 1 to 16: Valid values 0 - 5000 NOTE! An increased P valued gives an increased proportional gain
	1	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 1
	2	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 2
	3	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 3
	4	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 4
	5	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 5
	6	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 6
	7	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 7
	8	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 8
	9	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 9

	10	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 10
	11	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 11
	12	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 12
	13	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 13
	14	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 14
	15	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 15
	16	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 16
0x2007	0	u8, ro	16	-	**Output Port Current Regulator Integral Value "I"**: Number of entries. (Valid after reboot). The values used have the following meaning for sub-indices 1 to 16: Valid values 0-100 NOTE! An increased I value means increased integrator effect
	1	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 1
	2	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 2
	3	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 3
	4	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 4
	5	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 5
	6	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 6
	7	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 7
	8	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 8
	9	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 9
	10	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 10
	11	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 11
	12	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 12
	13	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 13
	14	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 14
	15	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 15
	16	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 16
0x2008	0	u8, ro	16	-	**Output Port Current Regulator Derivative Value "D"**: Number of entries. (Valid after reboot). Not implemented, do not use! Valid values 0
	1	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 1
	2	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 2
	3	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 3
	4	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 4
	5	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 5
	6	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 6
	7	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 7

	8	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 8
	9	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 9
	10	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 10
	11	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 11
	12	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 12
	13	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 13
	14	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 14
	15	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 15
	16	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 16
0x2009	0	u8, ro	16	-	**Digital Output Port Soft-start parameter A** Number of entries. (Valid after reboot). Soft start can be activated on digital outputs to be able to drive capacitive load. Soft start is per default off. For outputs 1,2,9,10: Decides the time the PROFET circuit is active For other outputs: Decides the A parameter used in the soft-start ramp according to formula below: $y = \frac{A}{1024} \cdot e^{\frac{B}{255}x}$ Valid values 0-3. Set to 0 to deactivate soft start. A lower value gives a slower start.
	1	u8, rw	0 (0-3)	Yes	Output Port Soft-start parameter A for port 1
	2	u8, rw	0 (0-3)	Yes	Output Port Soft-start parameter A for port 2
	3	u8, rw	0 (0-3)	Yes	Output Port Soft-start parameter A for port 3
	4	u8, rw	0 (0-3)	Yes	Output Port Soft-start parameter A for port 4
	5	u8, rw	0 (0-3)	Yes	Output Port Soft-start parameter A for port 5
	6	u8, rw	0 (0-3)	Yes	Output Port Soft-start parameter A for port 6
	7	u8, rw	0 (0-3)	Yes	Output Port Soft-start parameter A for port 7
	8	u8, rw	0 (0-3)	Yes	Output Port Soft-start parameter A for port 8
	9	u8, rw	0 (0-3)	Yes	Output Port Soft-start parameter A for port 9
	10	u8, rw	0 (0-3)	Yes	Output Port Soft-start parameter A for port 10
	11	u8, rw	0 (0-3)	Yes	Output Port Soft-start parameter A for port 11
	12	u8, rw	0 (0-3)	Yes	Output Port Soft-start parameter A for port 12
	13	u8, rw	0 (0-3)	Yes	Output Port Soft-start parameter A for port 13
	14	u8, rw	0 (0-3)	Yes	Output Port Soft-start parameter A for port 14
	15	u8, rw	0 (0-3)	Yes	Output Port Soft-start parameter A for port 15
	16	u8, rw	0 (0-3)	Yes	Output Port Soft-start parameter A for port 16
0x200A	0	u8, ro	16	-	**Digital Output Port Soft-start parameter B** Number of entries. (Valid after reboot). Soft start can be activated on digital outputs to be able to drive capacitive load. Soft start is per default off. For outputs 1,2,9,10:

					Decides the current limit that is used to decide if a new start attempt is needed For other outputs: Decides the B parameter used in the soft-start ramp according to formula below: $y = \frac{A}{1024} \cdot e^{\frac{B}{255}x}$ Valid values 0-255.
	1	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 1
	2	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 2
	3	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 3
	4	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 4
	5	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 5
	6	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 6
	7	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 7
	8	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 8
	9	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 9
	10	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 10
	11	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 11
	12	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 12
	13	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 13
	14	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 14
	15	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 15
	16	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 16
0x200B	0	u8, ro	2	-	**H-Bridge Current Limit Low Side** Number of entries. Max current in mA, (0mA - 20000mA)
	1	u16, rw	20000 (0-20000)	Yes	H-Bridge 1 - Low side Current Limit
	2	u16, rw	20000 (0-20000)	Yes	H-Bridge 2 - Low side Current Limit
0x200C	0	u8, ro	2	-	**H-Bridge Current Limit High Side** Number of entries. Max current in mA, (0mA - 25000mA)
	1	u16, rw	25000 (0-25000)	Yes	H-Bridge 1 - High side Current Limit
	2	u16, rw	25000 (0-25000)	Yes	H-Bridge 2 – High side Current Limit
0x2010	0	u8, rw	0 (0-127)	Yes	**CANopen Node ID** The default node ID is 0 => Node ID read from ID pins. (Full description, see section: ID Interface) Valid values are 0 – 127. (Valid after reboot). This value is not affected by reset command 0x1011.
0x2011	0	u8, rw	3 (0-8)	Yes	**CAN baudrate** (Valid after reboot) Possible values are: 0 = 1000 kbit/s 1 = reserved 2 = 500 kbit/s 3 = 250 kbit/s 4 = 125 kbit/s (default) 5 = 100 kbit/s

					6 = 50 kbit/s 7 = 20 kbit/s 8 = 10 kbit/s This value is not affected by reset command 0x1011.
0x2012	0	u16, rw	0 (0-65535)	No	**Retry after fault** for Outputs 1 … 16: Each output is deactivated after a detected fault. By writing a 1 to the corresponding bit in this object, the output is re-activated. When writing to this index only one retry attempt will be made (to all ports which have a 1 in the bit mask). To make a new retry, 0 must be written and then a new retry attempt can be made.
0x2013	0	u8, ro	0 (0-1)	No	**Firmware upgrade pin status** 0 when inactive, 1 when active
0x2015	0	08, ro	0		**CAN ID pin status**: see chapter 2.1.1
0x2016	0	08, ro	16		**Current Feedback** Current feedback is available in all output modes. Values are in mA.
	1	u16, ro	0	No	Current Feedback port 1.
	2	u16, ro	0	No	Current Feedback port 2.
	3	u16, ro	0	No	Current Feedback port 3.
	4	u16, ro	0	No	Current Feedback port 4.
	5	u16, ro	0	No	Current Feedback port 5.
	6	u16, ro	0	No	Current Feedback port 6.
	7	u16, ro	0	No	Current Feedback port 7.
	8	u16, ro	0	No	Current Feedback port 8.
	9	u16, ro	0	No	Current Feedback port 9.
	10	u16, ro	0	No	Current Feedback port 10
	11	u16, ro	0	No	Current Feedback port 11
	12	u16, ro	0	No	Current Feedback port 12
	13	u16, ro	0	No	Current Feedback port 13
	14	u16, ro	0	No	Current Feedback port 14
	15	u16, ro	0	No	Current Feedback port 15
	16	u16, ro	0	No	Current Feedback port 16
0x2017	0	U16, ro	0	No	Input Status Bits.
0x2018	0	u8, ro	16		**Duty Cycle Feedback** Each sub-index is only valid when the corresponding output port is configured as PWM. Values are in 0.1% steps. NOTE: For the PWM frequency and duty cycle feedback values to be reliable the time between any falling or rising edge of the PWM signal must not be shorter than 3 µs. For example at 1 kHz PWM frequency the 3 µs limit corresponds to a max duty cycle of 99.7% and a min duty cycle of 0.3%.

	1	u16, ro	0	No	Duty Cycle port 1.
	2	u16, ro	0	No	Duty Cycle port 2.
	3	u16, ro	0	No	Duty Cycle port 3.
	4	u16, ro	0	No	Duty Cycle port 4.
	5	u16, ro	0	No	Duty Cycle port 5.
	6	u16, ro	0	No	Duty Cycle port 6.
	7	u16, ro	0	No	Duty Cycle port 7.
	8	u16, ro	0	No	Duty Cycle port 8.
	9	u16, ro	0	No	Duty Cycle port 9.
	10	u16, ro	0	No	Duty Cycle port 10.
	11	u16, ro	0	No	Duty Cycle port 11.
	12	u16, ro	0	No	Duty Cycle port 12.
	13	u16, ro	0	No	Duty Cycle port 13.
	14	u16, ro	0	No	Duty Cycle port 14.
	15	u16, ro	0	No	Duty Cycle port 15.
	16	u16, ro	0	No	Duty Cycle port 16.
0x2019	0	u8, ro	16	No	**Frequency Feedback** Each sub-index is only valid when the corresponding output port is configured as PWM. Values are in Hz. *NOTE: For the PWM frequency and duty cycle feedback values to be reliable the time between any falling or rising edge of the PWM signal must not be shorter than 3 µs. For example at 1 kHz PWM frequency the 3 µs limit corresponds to a max duty cycle of 99.7% and a min duty cycle of 0.3%.*
	1	u16,ro	0	No	Frequency Feedback port 1
	2	u16,ro	0	No	Frequency Feedback port 2
	3	u16,ro	0	No	Frequency Feedback port 3
	4	u16,ro	0	No	Frequency Feedback port 4
	5	u16,ro	0	No	Frequency Feedback port 5
	6	u16,ro	0	No	Frequency Feedback port 6
	7	u16,ro	0	No	Frequency Feedback port 7
	8	u16,ro	0	No	Frequency Feedback port 8
	9	u16,ro	0	No	Frequency Feedback port 9
	10	u16,ro	0	No	Frequency Feedback port 10
	11	u16,ro	0	No	Frequency Feedback port 11
	12	u16,ro	0	No	Frequency Feedback port 12
	13	u16,ro	0	No	Frequency Feedback port 13
	14	u16,ro	0	No	Frequency Feedback port 14

	15	u16,ro	0	No	Frequency Feedback port 15
	16	u16,ro	0	No	Frequency Feedback port 16
0x201A	0	u8, ro	9	No	**Internal voltages** Values are in mV.
	1	u16, ro	0	No	VOLTAGE_VCOMP. The voltage supply for the comparators used by digital inputs.
	2	u16, ro	0	No	VOLTAGE_3V0. 3.0V reference voltage used for current regulation.
	3	u16, ro	0	No	VOLTAGE_2V8. 2.8V supply used as digital threshold level
	4	u16, ro	0	No	VOLTAGE_6V5. 6.5V supply used to power sensor supply voltage tracking regulator.
	5	u16, ro	0	No	VOLTAGE_SENSORSUPPLY5V. Sensor supply output voltage 0-42.5V range.
	6	u16, ro	0	No	VOLTAGE_UOGA. The voltage on output group A.
	7	u16, ro	0	No	VOLTAGE_UOGB. The voltage on output group B.
	8	u16, ro	0	No	VOLTAGE_5V14. 5.14V supply for TMS570 AD-converter analog rail.
	9	u16, ro	0	No	VOLTAGE_ADC_SENSOR_HIRES. Sensor supply output voltage 0-8.33V range.
0x201B	0	u8, ro	16	No	**Output Status Bits** bit 1: Short to GND bit 2: Reserved bit 3: Reserved bit 4: Thermal warning bit 5: Charge pump under-voltage lockout (UVLO) bit 6: Over current bit 7: Reserved bit 8: Reserved The status for each output can be cleared by using Object 0x2012
	1	u8, ro	0	No	Output Status Port 1
	2	u8, ro	0	No	Output Status Port 2
	3	u8, ro	0	No	Output Status Port 3
	4	u8, ro	0	No	Output Status Port 4
	5	u8, ro	0	No	Output Status Port 5
	6	u8, ro	0	No	Output Status Port 6
	7	u8, ro	0	No	Output Status Port 7
	8	u8, ro	0	No	Output Status Port 8
	9	u8, ro	0	No	Output Status Port 9
	10	u8, ro	0	No	Output Status Port 10
	11	u8, ro	0	No	Output Status Port 11
	12	u8, ro	0	No	Output Status Port 12
	13	u8, ro	0	No	Output Status Port 13
	14	u8, ro	0	No	Output Status Port 14
	15	u8, ro	0	No	Output Status Port 15
	16	u8, ro	0	No	Output Status Port 16

0x201D	0	u8, ro	4	No	**Internal temperatures.**
	1	i16,ro	0	No	TEMP Output Group A
	2	i16,ro	0	No	TEMP Output Group B
	3	i16,ro	0	No	TEMP_POWERIN
	4	i16,ro	0	No	TEMP Current Control Processor
0x201E	0	u8, ro	2	No	**Internal Supervision.**
	1	u16, ro	0	No	Unit status bits Bit 0: Over temperature has been detected and outputs has been shut off. Bit1: Error reading temp sensor 1 Bit2: Error reading temp sensor 2 Bit3: Error reading temp sensor 3 Bit4: Error reading temp sensor 4 Bit5: Error when setting input configuration. All inputs have been shut off. Bit 0 is set if over temperature has been detected. If this happens, outputs will be shut off automatically. Outputs can only be enabled again by sending the restart command (0x2027). Bit 1-4 is set if the corresponding temperature sensor cannot be read. The user must decide if it is better to continue running or shut down in this case. No automatic shutdown will be performed. Bit 5 indicates an error in the circuits controlling the inputs. If this happens all inputs are automatically switched off.
	2	u16, ro	0	No	Voltage Supervision (bit mask where each bit corresponds to error on one supervised voltage) **Bit** / **Voltage** / **Supervised** 0 / ADC_3V_AD / Yes 1 / ADC_UOGA / No 2 / ADC_VCOMP / Yes 3 / ADC_REF_TEMP / No 4 / ADC_6V5 / No 5 / ADC_UOGB / No 6 / ADC_SENSOR / No 7 / ADC_2V8_REF / Yes 8 / ADC_5V14_AD / Yes 9 / ADC_SENSOR_HIRES / Yes
0x2020	0	u8, ro	2	No	**H-Bridge Direction** 0: stop 1: forward 2: backward 3: brake
	1	u8, ro	0	No	H-Bridge 1 Direction
	2	u8, ro	0	No	H-Bridge 2 Direction
0x2021	0	u8, ro	2	No	**H-Bridge Speed** Range: 0 – 1000 (0-100% in 0.1% steps)
	1	u16, ro	0	No	H-Bridge 1 Speed
	2	u16, ro	0	No	H-Bridge 2 Speed
0x2024	0	u8, ro	2	No	**H-Bridge Status** H-bridge status is a bitmask and can therefore be a

					combination of the following: 0: no error 1: current limiting is active (motor is still running but motor current is reduced actively by the drive-circuit) 2: fault indication from drive circuit 4: over current on high side
	1	u8, ro	0	No	H-Bridge 1 Status
	2	u8, ro	0	No	H-Bridge 2 Status
0x2025	0	u8, ro	2	No	**H-Bridge Current Feedback Low-Side** Highest SubIndex
	1	u16, ro	0	No	Output Group A - H-Bridge, Low-Side Current (OGA_HB_LS)
	2	u16, ro	0	No	Output Group B - H-Bridge, Low-Side Current (OGB_HB_LS)
0x2026	0	u8, ro	2	No	**H-Bridge Current Feedback High-Side** Highest SubIndex
	1	u16, ro	0	No	Output Group A - H-Bridge, High-Side Current (OGA_HB_HS)
	2	u16, ro	0	No	Output Group B - H-Bridge, High-Side Current (OGB_HB_HS)
0x2027	0	U16, rw	0	No	**Restart** writing the value 0x1234 causes port configuration data to be updated without need for power toggle Note that node will go to pre-op and switch off outputs if this command is issued. Value needs to be reset to 0 before a new restart command can be issued.
0x2028	0	U8, rw	0	No	**Reset encoder** This is a bitmask where each bit in the mask corresponds to one pair of inputs. Setting the corresponding bit in the mask to 1 resets the encoder counter to 0. Bit 0 = input 1,2 Bit 1 = input 3,4 …
0x2030	0	u8, ro	4	No	**Software Versions**
	1	u32, ro	0	No	Boot loader version
	2	u32, ro	0	No	CODESYS Runtime version
	3	u32, ro	0	No	Current Regulator Output Group A version
	4	u32, ro	0	No	Current Regulator Output Group B version
	5	u32, ro	0	No	Application version
0x2032	0	u8, rw	0	Yes	**Store PDO COB-ID** Setting this flag to 1 means that PDO COB-ID for RPDO1-4 and TPDO1-4 is stored persistent when auto store is used. If this flag is 0, these parameters are not stored automatically, instead default id which is calculated from node-id is used.
0x2035	0	u8, ro	1	No	**Digital feedback for port 1-16. Number of entries.**
	1	u16, ro	0	No	This feedback is available independent of port mode which makes it possible to detect short to battery.

4.8. CrossControl Internal Specific Profile Area; Index 0x3000 ->

Internal Specific Profile Area for CrossControl specifics only to be used by CrossControl, typically production tests etc.

Index	S-Idx	Type	Default (possible)	Saved	Description
0x3000	0	u8, ro	3	No	**Production Test (only to be used by CrossControl)**
	1	u32, rw	0	No	Production Test Command
	2	u32, ro	0	No	Production Test Result
	3	u32, ro	0	No	Production Test Done
0x3001	0	u8, rw	0 (0-3)	No	**LED Override** Test of LED function LED state: 0 = Normal CAN slave node state indication 1 = green 2 = red 3 = amber
0x3002	0	08, ro	16		**Current Feedback as reported directly by the current control slave processor (Only to be used by CrossControl).** Each sub-index is only valid when the corresponding output port is configured as PWMi. Values are in mA.
	1	u16, ro	0	No	STM32 Current Feedback port 1.
	2	u16, ro	0	No	STM32 Current Feedback port 2.
	3	u16, ro	0	No	STM32 Current Feedback port 3.
	4	u16, ro	0	No	STM32 Current Feedback port 4.
	5	u16, ro	0	No	STM32 Current Feedback port 5.
	6	u16, ro	0	No	STM32 Current Feedback port 6.
	7	u16, ro	0	No	STM32 Current Feedback port 7.
	8	u16, ro	0	No	STM32 Current Feedback port 8.
	9	u16, ro	0	No	STM32 Current Feedback port 9.
	10	u16, ro	0	No	STM32 Current Feedback port 10
	11	u16, ro	0	No	STM32 Current Feedback port 11
	12	u16, ro	0	No	STM32 Current Feedback port 12
	13	u16, ro	0	No	STM32 Current Feedback port 13
	14	u16, ro	0	No	STM32 Current Feedback port 14
	15	u16, ro	0	No	STM32 Current Feedback port 15
	16	u16, ro	0	No	STM32 Current Feedback port 16
0x3003	0	u8, ro	4	No	**Calibration (only to be used by CrossControl)**
	1	U16, rw	0	No	Port
	2	u16, rw	0	No	Point1
	3	u16, rw	0	No	Point2
	4	u16, rw	0	No	Activate
0x3004	0	u8, rw	0 (0-7)	No	**Supply shut-off** bitmask bit 1: Shut off Group A bit 2: Shut off Group B

					bit 3: Shut of Sensor Supply
0x3005	0	u8, ro	2	No	**H-Bridge Current Feedback Low-Side from STM32 (only to be used by CrossControl)**
	1	u16, ro	0	No	H-Bridge 1 Current Feedback Low-Side
	2	u16, ro	0	No	H-Bridge 2 Current Feedback Low-Side
0x3006	0	u8, ro	2	No	**H-Bridge Current Feedback High-Side from STM32 (only to be used by CrossControl)**
	1	u16, ro	0	No	H-Bridge 1 Current Feedback High -Side
	2	u16, ro	0	No	H-Bridge 2 Current Feedback High -Side

4.9. Device specific entries (CiA401); Index 0x6000 to 0x9FFF

Index	S-Idx	Type	Default	Saved	Description
0x6000	0	u8, ro	4	-	Digital Inputs: Number of entries.
	1	u8, ro	0	-	Digital Input Ports 1 – 8. Bit 0 – Port 1 Bit 1 – Port 2 Bit 2 – Port 3 Bit 3 – Port 4 Bit 4 – Port 5 Bit 5 – Port 6 Bit 6 – Port 7 Bit 7 – Port 8 Each bit is only used when the corresponding port is configured as Digital Input.
	2	u8, ro	0	-	Digital Input Ports 9 – 16. Bit 0 – Port 9 Bit 1 – Port 10 Bit 2 – Port 11 Bit 3 – Port 12 Bit 4 – Port 13 Bit 5 – Port 14 Bit 6 – Port 15 Bit 7 – Port 16 Each bit is only used when the corresponding port is configured as Digital Input.
	3	u8, ro	0	-	Digital Output Feedback Ports 1 – 8. Reading a 0 means output is detected as off, 1 output is detected as on. Bit 0 – Port 1 Bit 1 – Port 2 Bit 2 – Port 3 Bit 3 – Port 4 Bit 4 – Port 5 Bit 5 – Port 6 Bit 6 – Port 7 Bit 7 – Port 8 Each bit is only used when the corresponding port is configured as digital output.
	4	u8, ro	0	-	Digital Output Feedback Ports 9 – 16. Reading a 0 means output is detected as off, 1 output is detected as on. Bit 0 – Port 9 Bit 1 – Port 10 Bit 2 – Port 11 Bit 3 – Port 12 Bit 4 – Port 13 Bit 5 – Port 14 Bit 6 – Port 15 Bit 7 – Port 16 Each bit is only used when the corresponding port is configured as digital output.
0x6200	0	u8, ro	2	-	Digital Outputs: Number of entries.
	1	u8, rw	0	No	Digital Outputs: Ports 1 – 8. Bit 0 – Port 1 Bit 1 – Port 2 Bit 2 – Port 3

					Bit 3 – Port 4 Bit 4 – Port 5 Bit 5 – Port 6 Bit 6 – Port 7 Bit 7 – Port 8 Each bit is only used when the corresponding port is configured as a Digital Output.	
	2	u8, rw	0	No	Digital Outputs: Ports 9 to 16. Bit 0 – Port 9 Bit 1 – Port 10 Bit 2 – Port 11 Bit 3 – Port 12 Bit 4 – Port 13 Bit 5 – Port 14 Bit 6 – Port 15 Bit 7 – Port 16 Each bit is only used when the corresponding port is configured as a Digital Output.	
0x6401	0	u8, ro	91	-	**Read analogue input 16-bit**, (Voltage, Current, Encoder or Frequency): Number of entries.	
	1	u16, ro	0	No	Analog Input port 1	Each sub-index is only valid when the corresponding port is configured as an Analog Input, (Voltage 0-5V, Voltage 0-10V, Voltage 0-32V, Current, Encoder, Pulse Counter or Frequency). For encoder and pulse counter inputs the value must be read as the combined value from both inputs used. The 16 least significant bits will be located in lowest port number. Most significant 8 bits will be located in highest port number. Voltage values are in mV, current in uA. Frequency is in Hz and encoder and pulse counter in steps.
	2	u16, ro	0	No	Analog Input port 2	
	3	u16, ro	0	No	Analog Input port 3	
	4	u16, ro	0	No	Analog Input port 4	
	5	u16, ro	0	No	Analog Input port 5	
	6	u16, ro	0	No	Analog Input port 6	
	7	u16, ro	0	No	Analog Input port 7	
	8	u16, ro	0	No	Analog Input port 8	
	9	u16, ro	0	No	Analog Input port 9	
	10	u16, ro	0	No	Analog Input port 10	
	11	u16, ro	0	No	Analog Input port 11	
	12	u16, ro	0	No	Analog Input port 12	
	13	u16, ro	0	No	Analog Input port 13	
	14	u16, ro	0	No	Analog Input port 14	
	15	u16, ro	0	No	Analog Input port 15	
	16	u16, ro	0	No	Analog Input port 16	
0x6411	0	u8, ro	16	-	**Write Analog Outputs 1-16.** Values are in 0.1% steps for PWM, in mA for PWMi.	
	1	u16, rw	0	No	Analog Output port 1	
	2	u16, rw	0	No	Analog Output port 2	
	3	u16, rw	0	No	Analog Output port 3	
	4	u16, rw	0	No	Analog Output port 4	
	5	u16, rw	0	No	Analog Output port 5	
	6	u16, rw	0	No	Analog Output port 6	
	7	u16, rw	0	No	Analog Output port 7	
	8	u16, rw	0	No	Analog Output port 8	
	9	u16, rw	0	No	Analog Output port 9	
	10	u16, ro	0	No	Analog Output port 10	
	11	u16, ro	0	No	Analog Output port 11	
	12	u16, ro	0	No	Analog Output port 12	
	13	u16, ro	0	No	Analog Output port 13	
	14	u16, rw	0	No	Analog Output port 14	
	15	u16, rw	0	No	Analog Output port 15	
	16	u16, rw	0	No	Analog Output port 16	

5. Limitations of the CrossFire™ SX

In the CrossFire™ SX there are some known limitation.

- No support for Dynamic PDO mapping.
- Only mandatory Emergency Messages are implemented.
- Limited use of the CANopen Error register (0x1001).
- Remote frames is not supported from the CAN driver.
- No support for CANopen Node guarding.

6. Technical support

Additional sources of information are available on the CrossControl support site:
https://crosscontrol.com/support/
You will need to register to the site in order to be able to access all available information

Contact your reseller or supplier for help with possible problems with your device. In order to get the best help, you should have access to your device and be prepared with the following information before you contact support.

- The part number and serial number of the device, which you can find on the brand label.
- Date of purchase, which can be found on the invoice.
- The conditions and circumstances under which the problem arises.
- Status indicator patterns (i.e. LED blink pattern).
- Prepare a system report on the device, using CCSettingsConsole (if possible).
- Detailed description of all external equipment connected to the unit (when relevant to the problem).

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