emDrive CAN introduction

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Revision History:

Version	Author	Date	Changes/Remarks
ver1.0	*Gregor Košič*	*09.03.2018*	*Initial version*

Contents

1 About user manual

The following information provide basic intordution to the CANopen treminology. Document assumes that reader have an understanding of CAN and are familiar with its use.

If the reader is new to CAN or CANopen please refer to the CiA (CAN in Automation) www.can-cia.org for further information.

2 emDrive CAN Introduction

CAN Communication interface of the emDrive motor controllers follows the CiA CANopen which is a higher layer protocol defined in the DS301 'Application Layer and Communication Profile' specification. CANopen also supports standardized profiles, which extend the functionality of a device. The controller supports CANopen standardized profile: DSP402 (V2.X) – Device Profile for Drives and Motion Control.

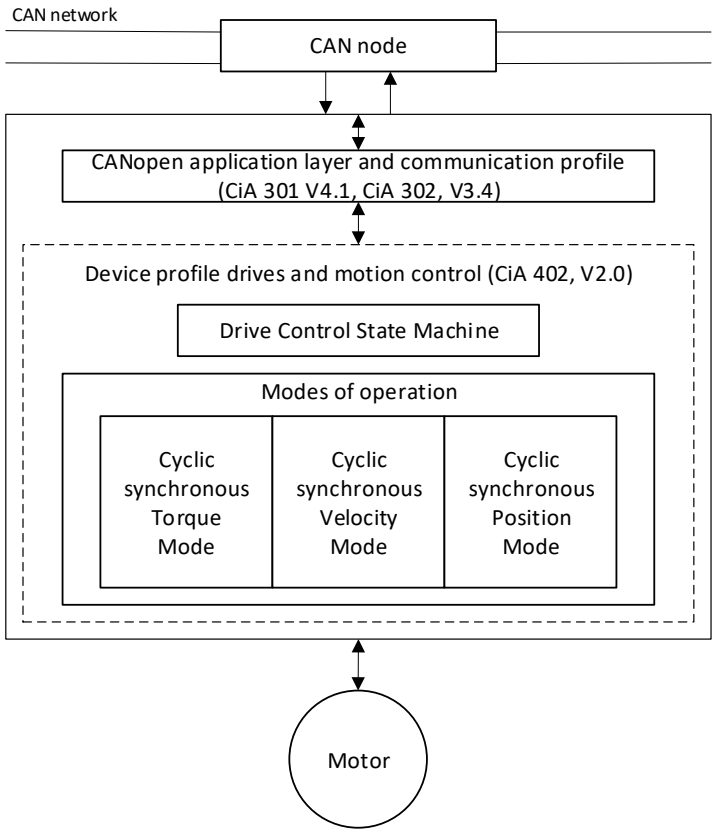

Fig. 1: Communication architesture

2.1 Physical structure of a CANopen network

The underlying CAN architecture defines the basic physical structure of the CANopen network. Therefore, a line (bus) topology is used. To avoid reflections of the signals, both ends of the network must be terminated. Maximum permissible branch line lengths for connection of the individual network nodes are to be observed.

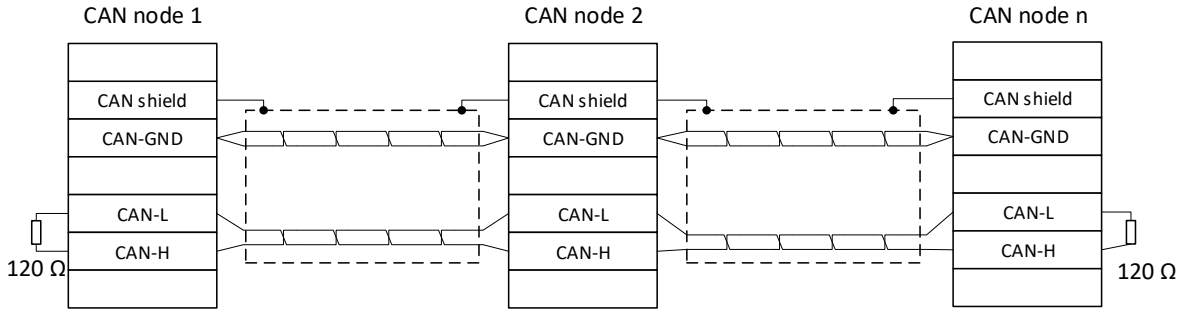

Fig. 2: CAN physical architecture example

The recommended permissible bit rates for a CANopen network are given in CiA 301: 10 kbps, 20 kbps, 50 kbps, 125 kbps, 250 kbps, 500 kbps, 800 kbps and 1000 kbps. In CiA 301 a recommendation for the configuration of the bit timing is also given.

Additionally, for CANopen, two additional conditions must be fulfilled:

- All nodes must be configured to the same bit rate and
- No node-ID may exist twice.

Unfortunately there are no mechanisms automatically ensuring these conditions. The system integrator has to check the bit rate and node-ID of every single network node when wiring a network and adjust if necessary. To set the node-ID on the controller setting these parameters is done via reserved CAN identifier by software with the aid of the so-called "LSS-service" (layer setting service) as described in CiA 305.

2.2 Object Dictionary (OD) and Electronic Data Sheet (EDS)

One of the most important properties of CANopen is a standardized device description called object dictionary. It is a table which has the same structure for all types of devices. Thus it is possible to access all important data, parameters and functions of a device using a logical addressing system (index, subindex) via the CAN bus.
There are two important text files associated with the Object Dictionary. These are:

Electronic Data sheet (EDS)
An EDS is a text file representation of the Object Dictionary structure only. It contains no data values. The EDS is used by configuration software such as »EMSISO eDrive configurator« to describe the structure of a node's Object Dictionary. An EDS for each emDrive controller model and software version, is available on the device it sell and can be also provided by EMSISO company. The EDS file format is described in the DSP306 – Electronic Data Sheet Specification.

NOTE: Each Object Distionary matches a perticular device and software version, also its structure is hardcoded into the devices software.

Device Configuration File (DCF)
This is a text file similar to an EDS except that it contains data values as well as the Object Dictionary structure. DCFs are used to:

- Download a complete pre-defined configuration to a node's Object Dictionary.
- Save the current configuration of a node's Object Dictionary for future use.

2.3 Data transfer

2.3.1 Service Data Objects (SDO)

The service data objects (SDO) bases on a client server communication and allows for direct addressing of an object using its index and subindex. It is used for configuration of a device, and upload and download of larger data blocks, but requires an additional protocol overhead.

Fig. 3 Client – Server communication

2.3.2 Process Data Object (PDO)

Process data Objects (PDO) provide an efficient transmission of data according to a producer-consumer model. The datalength is limited to eight bytes per CAN message but does not contain any protocol overhead. One PDO can contain the values of more than one entry from the object dictionary, but the contents of a PDO have to be defined during initialization.

Each device can specify up to 4 receive and 4 transmit PDOs which are used by connected nodes to exchange real time data during operations.

A PDO is driven either by remote requests, either nodes PDO are configured to be transmitted periodicaly, or when a (cyclic) synchronous transmission message (SYNC) is coming in. All nodes in the network are able to receive the message (PDO-Consumers). By filtering the COB-ID only objects of interest can be selected for further processing.

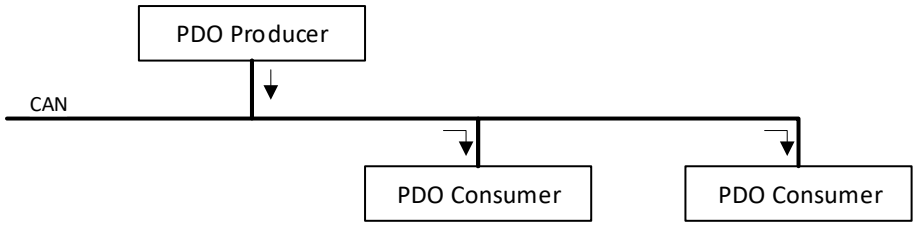

Fig. 4: PDO producer – consumer communication

2.4 Emergency Messages

As CANopen is not a hierarchical master-slave system, and node monitoring only conveys the communication state and not the actual node status, every node requires a high priority CAN identifier to indicate error situations. When device-internal failure is detected controller will transmit emergency message frames over the CANopen with highest priority. Message frame shown in **Error! Reference source not found.**. An emergency message frame will be transmitted only once per error event and consists of the *Error Code* and the actual *Error Register*.

Byte	0	1	2	3	4	5	6	7
Content	Emergency error code		Error register	Not used (always “0”)				

Table 1: Emergency message frame

emDrive can detect several variety of device error. After execution of the fault reaction, the device changes to fault state and the drive will be disabled. Error flag in Statusword will be set – bit 3. To recover from error, cause for the error must be removed and exiting error state can be made using Controlword to make transition.

Error Code	Name	Cause
0x1000	Generic error	Unspecific error occurred
0x2220	Overcurrent error	- short circuit in motor winding, - controller gain to high (Current control parameters, Velocity control parameters), - power stage damaged
0x3210	DC link over voltage	Power supply voltage to high
0xFF01	Phase A current measurement	Current phase A hall sensor missing or damaged
0xFF02	Phase B current measurement	Current phase B hall sensor missing or damaged

0xFF03	High side FET short circuit	- DC voltage not applied to bridge or to low - motor phases not connected to controller - damaged high side FETs
0xFF04	Low side FET short circuit	- DC voltage not applied to bridge or to low - motor phases not connected to controller - damaged low side FETs
0xFF05	Low side FET phase 1 short circuit	- motor phases not connected - damaged low side FETs on phase 1
0xFF06	Low side FET phase 2 short circuit	- motor phases not connected - damaged low side FETs on phase 2
0xFF07	Low side FET phase 3 short circuit	- motor phases not connected - damaged low side FETs on phase 3
0xFF08	High side FET phase 1 short circuit	- motor phases not connected - damaged high side FETs on phase 1
0xFF09	High side FET phase 2 short circuit	- motor phases not connected - damaged high side FETs on phase 2
0xFF0A	High side FET phase 3 short circuit	- motor phases not connected - damaged high side FETs on phase 3
0xFF0B	Motor feedback	- Wrong feedback selected (check feedback type) - Feedback damaged or not connected
0xFF0C	DC link under voltage	DC voltage not applied to bridge or to low
0xFF0D	Pulse mode finished	Pulse mode finished (It's used for fine adjustments and troubleshooting)
0xFF0E	Emergency button pressed	Emergency button pressed. (If not used pin must be connected to GND)
0xFF0F	IGBT module error	IGBT module damaged

Table 2: Error code description

2.5 Object dictionary

Index	Sub index	Object name	Datatype	Acc.	Def.	Low Limit	High Limit
0x1000	0x00	Device Type	UNSIGNED32	ro	402	0	4294967295
0x1001	0x00	Error Register	UNSIGNED8	ro	0	0	255
0x1003	0x00	Predefined Error Field Number of Errors	UNSIGNED8	rw	5	0	255
0x1003	0x01	Predefined Error Field Standard Error Field	UNSIGNED32	ro	0	0	4294967295
0x1003	0x02	Predefined Error Field Standard Error Field	UNSIGNED32	ro	0	0	4294967295
0x1003	0x03	Predefined Error Field Standard Error Field	UNSIGNED32	ro	0	0	4294967295
0x1003	0x04	Predefined Error Field Standard Error Field	UNSIGNED32	ro	0	0	4294967295
0x1003	0x05	Predefined Error Field Standard Error Field	UNSIGNED32	ro	0	0	4294967295
0x1005	0x00	COB ID SYNC	UNSIGNED32	rw	128	0	4294967295
0x1006	0x00	Communication Cycle Period	UNSIGNED32	rw	0	0	4294967295
0x1008	0x00	Manufacturer Device Name	VISIBLE_STRING	ro		0	0
0x100b	0x00	Node-ID	UNSIGNED8	rw	1	1	255
0x1010	0x00	Store Parameter Field Number of entries	UNSIGNED8	ro	4	0	255
0x1010	0x01	Store Parameter Field Save all Parameters	UNSIGNED32	rw	0	0	4294967295
0x1010	0x02	Store Parameter Field Save Communication Parameters	UNSIGNED32	rw	0	0	4294967295
0x1010	0x03	Store Parameter Field Save Application Parameters	UNSIGNED32	rw	0	0	4294967295
0x1010	0x04	Store Parameter Field Save Manufacturer Defined Parameters	UNSIGNED32	rw	0	0	4294967295
0x1011	0x00	Restore Default Parameters Number of entries	UNSIGNED8	ro	4	0	255
0x1011	0x01	Restore Default Parameters Restore all Default Parameters	UNSIGNED32	rw	0	0	4294967295
0x1011	0x02	Restore Default Parameters Restore Communication Default Parameters	UNSIGNED32	rw	0	0	4294967295
0x1011	0x03	Restore Default Parameters Restore Application Default Parameters	UNSIGNED32	rw	0	0	4294967295
0x1011	0x04	Restore Default Parameters Restore Manufacturer Defined Default Parameters	UNSIGNED32	rw	0	0	4294967295
0x1014	0x00	COB ID EMCY	UNSIGNED32	rw	0	0	4294967295
0x1015	0x00	Inhibit Time Emergency	UNSIGNED16	rw	0	0	65535
0x1016	0x00	Consumer Heartbeat Time Number of entries	UNSIGNED8	ro	1	0	127
0x1016	0x01	Consumer Heartbeat Time Consumer Heartbeat Time	UNSIGNED32	rw	0	0	4294967295

0x1017	0x00	Producer Heartbeat Time	UNSIGNED16	rw	0	0	65535
0x1018	0x00	Identity Object Number of entries	UNSIGNED8	ro	4	0	255
0x1018	0x01	Identity Object Vendor Id	UNSIGNED32	ro	793	0	4294967295
0x1018	0x02	Identity Object Product Code	UNSIGNED32	ro	150001	0	4294967295
0x1018	0x03	Identity Object Revision number	UNSIGNED32	ro	1	0	4294967295
0x1018	0x04	Identity Object Serial number	UNSIGNED32	rw	0	0	4294967295
0x1021	0x00	Store EDS	DOMAIN	ro	0	0	0
0x1029	0x00	Error behaviour Number of entries	UNSIGNED8	ro	1	0	255
0x1029	0x01	Error behaviour Communication Error	UNSIGNED8	rw	0	0	1
0x1200	0x00	Server SDO Parameter Number of entries	UNSIGNED8	ro	2	0	255
0x1200	0x01	Server SDO Parameter COB ID Client to Server	UNSIGNED32	ro	0	0	4294967295
0x1200	0x02	Server SDO Parameter COB ID Server to Client	UNSIGNED32	ro	0	0	4294967295
0x1280	0x00	Client SDO Parameter Number of entries	UNSIGNED8	ro	3	3	3
0x1280	0x01	Client SDO Parameter COB ID Client to Server	UNSIGNED32	rw	0	1	4294967295
0x1280	0x02	Client SDO Parameter COB ID Server to Client	UNSIGNED32	rw	0	1	4294967295
0x1280	0x03	Client SDO Parameter Node ID of the SDO Server	UNSIGNED8	rw	0	0	127
0x1400	0x00	Receive PDO 1 Communication Parameter Number of entries	UNSIGNED8	ro	5	2	5
0x1400	0x01	Receive PDO 1 Communication Parameter COB ID	UNSIGNED32	rw	0	0	4294967295
0x1400	0x02	Receive PDO 1 Communication Parameter Transmission Type	UNSIGNED8	rw	254	0	255
0x1400	0x03	Receive PDO 1 Communication Parameter Inhibit Time	UNSIGNED16	rw	0	0	65535
0x1400	0x04	Receive PDO 1 Communication Parameter Compatibility Entry	UNSIGNED8	rw	0	0	255
0x1400	0x05	Receive PDO 1 Communication Parameter Event Timer	UNSIGNED16	rw	0	0	65535
0x1401	0x00	Receive PDO 2 Communication Parameter Number of entries	UNSIGNED8	ro	5	2	5
0x1401	0x01	Receive PDO 2 Communication Parameter COB ID	UNSIGNED32	rw	0	0	4294967295
0x1401	0x02	Receive PDO 2 Communication Parameter Transmission Type	UNSIGNED8	rw	254	0	255

0x1401	0x03	Receive PDO 2 Communication Parameter Inhibit Time	UNSIGNED16	rw	0	0	65535
0x1401	0x04	Receive PDO 2 Communication Parameter Compatibility Entry	UNSIGNED8	rw	0	0	255
0x1401	0x05	Receive PDO 2 Communication Parameter Event Timer	UNSIGNED16	rw	0	0	65535
0x1402	0x00	Receive PDO 3 Communication Parameter Number of entries	UNSIGNED8	ro	5	2	5
0x1402	0x01	Receive PDO 3 Communication Parameter COB ID	UNSIGNED32	rw	0	0	4294967295
0x1402	0x02	Receive PDO 3 Communication Parameter Transmission Type	UNSIGNED8	rw	254	0	255
0x1402	0x03	Receive PDO 3 Communication Parameter Inhibit Time	UNSIGNED16	rw	0	0	65535
0x1402	0x04	Receive PDO 3 Communication Parameter Compatibility Entry	UNSIGNED8	rw	0	0	255
0x1402	0x05	Receive PDO 3 Communication Parameter Event Timer	UNSIGNED16	rw	0	0	65535
0x1403	0x00	Receive PDO 4 Communication Parameter Number of entries	UNSIGNED8	ro	5	2	5
0x1403	0x01	Receive PDO 4 Communication Parameter COB ID	UNSIGNED32	rw	0	0	4294967295
0x1403	0x02	Receive PDO 4 Communication Parameter Transmission Type	UNSIGNED8	rw	254	0	255
0x1403	0x03	Receive PDO 4 Communication Parameter Inhibit Time	UNSIGNED16	rw	0	0	65535
0x1403	0x04	Receive PDO 4 Communication Parameter Compatibility Entry	UNSIGNED8	rw	0	0	255
0x1403	0x05	Receive PDO 4 Communication Parameter Event Timer	UNSIGNED16	rw	0	0	65535
0x1600	0x00	Receive PDO 1 Mapping Number of entries	UNSIGNED8	rw	3	0	255
0x1600	0x01	Receive PDO 1 Mapping PDO Mapping Entry	UNSIGNED32	rw	1614807056	0	0
0x1600	0x02	Receive PDO 1 Mapping PDO Mapping Entry	UNSIGNED32	rw	1627324448	0	0
0x1600	0x03	Receive PDO 1 Mapping PDO Mapping Entry	UNSIGNED32	rw	1618018320	0	0
0x1600	0x04	Receive PDO 1 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	0

0x1600	0x05	Receive PDO 1 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	0
0x1600	0x06	Receive PDO 1 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	0
0x1600	0x07	Receive PDO 1 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	0
0x1600	0x08	Receive PDO 1 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	0
0x1601	0x00	Receive PDO 2 Mapping Number of entries	UNSIGNED8	rw	1	0	255
0x1601	0x01	Receive PDO 2 Mapping PDO Mapping Entry	UNSIGNED32	rw	1618608160	0	0
0x1601	0x02	Receive PDO 2 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	0
0x1601	0x03	Receive PDO 2 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	0
0x1601	0x04	Receive PDO 2 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	0
0x1601	0x05	Receive PDO 2 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	0
0x1601	0x06	Receive PDO 2 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	0
0x1601	0x07	Receive PDO 2 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	0
0x1601	0x08	Receive PDO 2 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	0
0x1602	0x00	Receive PDO 3 Mapping Number of entries	UNSIGNED8	rw	6	0	255
0x1602	0x01	Receive PDO 3 Mapping PDO Mapping Entry	UNSIGNED32	rw	538839560	0	0
0x1602	0x02	Receive PDO 3 Mapping PDO Mapping Entry	UNSIGNED32	rw	538839816	0	0
0x1602	0x03	Receive PDO 3 Mapping PDO Mapping Entry	UNSIGNED32	rw	538840072	0	0
0x1602	0x04	Receive PDO 3 Mapping PDO Mapping Entry	UNSIGNED32	rw	538839304	0	0
0x1602	0x05	Receive PDO 3 Mapping PDO Mapping Entry	UNSIGNED32	rw	538837264	0	0
0x1602	0x06	Receive PDO 3 Mapping PDO Mapping Entry	UNSIGNED32	rw	538838544	0	0
0x1602	0x07	Receive PDO 3 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	0
0x1602	0x08	Receive PDO 3 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	0
0x1603	0x00	Receive PDO 4 Mapping Number of entries	UNSIGNED8	rw	6	0	255
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0x1603	0x03	Receive PDO 4 Mapping PDO Mapping Entry	UNSIGNED32	rw	538838032	0	0
0x1603	0x04	Receive PDO 4 Mapping PDO Mapping Entry	UNSIGNED32	rw	538838280	0	0
0x1603	0x05	Receive PDO 4 Mapping PDO Mapping Entry	UNSIGNED32	rw	538838792	0	0
0x1603	0x06	Receive PDO 4 Mapping PDO Mapping Entry	UNSIGNED32	rw	538839048	0	0
0x1603	0x07	Receive PDO 4 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	0
0x1603	0x08	Receive PDO 4 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	0

0x1800	0x00	Transmit PDO 1 Communication Parameter Number of entries	UNSIGNED8	ro	6	2	6
0x1800	0x01	Transmit PDO 1 Communication Parameter COB ID	UNSIGNED32	rw	0	1	4294967295
0x1800	0x02	Transmit PDO 1 Communication Parameter Transmission Type	UNSIGNED8	rw	1	0	255
0x1800	0x03	Transmit PDO 1 Communication Parameter Inhibit Time	UNSIGNED16	rw	0	0	65535
0x1800	0x04	Transmit PDO 1 Communication Parameter Compatibility Entry	UNSIGNED8	rw	0	0	255
0x1800	0x05	Transmit PDO 1 Communication Parameter Event Timer	UNSIGNED16	rw	0	0	65535
0x1800	0x06	Transmit PDO 1 Communication Parameter SYNC start value	UNSIGNED8	rw	0	0	255
0x1801	0x00	Transmit PDO 2 Communication Parameter Number of entries	UNSIGNED8	ro	6	2	6
0x1801	0x01	Transmit PDO 2 Communication Parameter COB ID	UNSIGNED32	rw	0	1	4294967295
0x1801	0x02	Transmit PDO 2 Communication Parameter Transmission Type	UNSIGNED8	rw	1	0	255
0x1801	0x03	Transmit PDO 2 Communication Parameter Inhibit Time	UNSIGNED16	rw	0	0	65535
0x1801	0x04	Transmit PDO 2 Communication Parameter Compatibility Entry	UNSIGNED8	rw	0	0	255
0x1801	0x05	Transmit PDO 2 Communication Parameter Event Timer	UNSIGNED16	rw	0	0	65535
0x1801	0x06	Transmit PDO 2 Communication Parameter SYNC start value	UNSIGNED8	rw	0	0	255
0x1802	0x00	Transmit PDO 3 Communication Parameter Number of entries	UNSIGNED8	ro	6	2	6
0x1802	0x01	Transmit PDO 3 Communication Parameter COB ID	UNSIGNED32	rw	0	1	4294967295
0x1802	0x02	Transmit PDO 3 Communication Parameter Transmission Type	UNSIGNED8	rw	1	0	255

0x1802	0x03	Transmit PDO 3 Communication Parameter Inhibit Time	UNSIGNED16	rw	0	0	65535
0x1802	0x04	Transmit PDO 3 Communication Parameter Compatibility Entry	UNSIGNED8	rw	0	0	255
0x1802	0x05	Transmit PDO 3 Communication Parameter Event Timer	UNSIGNED16	rw	0	0	65535
0x1802	0x06	Transmit PDO 3 Communication Parameter SYNC start value	UNSIGNED8	rw	0	0	255
0x1803	0x00	Transmit PDO 4 Communication Parameter Number of entries	UNSIGNED8	ro	6	2	6
0x1803	0x01	Transmit PDO 4 Communication Parameter COB ID	UNSIGNED32	rw	0	1	4294967295
0x1803	0x02	Transmit PDO 4 Communication Parameter Transmission Type	UNSIGNED8	rw	1	0	255
0x1803	0x03	Transmit PDO 4 Communication Parameter Inhibit Time	UNSIGNED16	rw	0	0	65535
0x1803	0x04	Transmit PDO 4 Communication Parameter Compatibility Entry	UNSIGNED8	rw	0	0	255
0x1803	0x05	Transmit PDO 4 Communication Parameter Event Timer	UNSIGNED16	rw	0	0	65535
0x1803	0x06	Transmit PDO 4 Communication Parameter SYNC start value	UNSIGNED8	rw	0	0	255
0x1a00	0x00	Transmit PDO 1 Mapping Number of entries	UNSIGNED8	rw	3	0	255
0x1a00	0x01	Transmit PDO 1 Mapping PDO Mapping Entry	UNSIGNED32	rw	1614872592	0	4294967295
0x1a00	0x02	Transmit PDO 1 Mapping PDO Mapping Entry	UNSIGNED32	rw	1617166368	0	4294967295
0x1a00	0x03	Transmit PDO 1 Mapping PDO Mapping Entry	UNSIGNED32	rw	1618411536	0	4294967295
0x1a00	0x04	Transmit PDO 1 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	4294967295
0x1a00	0x05	Transmit PDO 1 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	4294967295
0x1a00	0x06	Transmit PDO 1 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	4294967295
0x1a00	0x07	Transmit PDO 1 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	4294967295
0x1a00	0x08	Transmit PDO 1 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	4294967295
0x1a01	0x00	Transmit PDO 2 Mapping Number of entries	UNSIGNED8	rw	5	0	255
0x1a01	0x01	Transmit PDO 2 Mapping PDO Mapping Entry	UNSIGNED32	rw	539361544	0	4294967295
0x1a01	0x02	Transmit PDO 2 Mapping PDO Mapping Entry	UNSIGNED32	rw	539295752	0	4294967295

0x1a01	0x03	Transmit PDO 2 Mapping PDO Mapping Entry	UNSIGNED32	rw	1618542608	0	4294967295
0x1a01	0x04	Transmit PDO 2 Mapping PDO Mapping Entry	UNSIGNED32	rw	539557904	0	4294967295
0x1a01	0x05	Transmit PDO 2 Mapping PDO Mapping Entry	UNSIGNED32	rw	538574864	0	4294967295
0x1a01	0x06	Transmit PDO 2 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	4294967295
0x1a01	0x07	Transmit PDO 2 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	4294967295
0x1a01	0x08	Transmit PDO 2 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	4294967295
0x1a02	0x00	Transmit PDO 3 Mapping Number of entries	UNSIGNED8	rw	3	0	255
0x1a02	0x01	Transmit PDO 3 Mapping PDO Mapping Entry	UNSIGNED32	rw	1618477328	0	4294967295
0x1a02	0x02	Transmit PDO 3 Mapping PDO Mapping Entry	UNSIGNED32	rw	538902544	0	4294967295
0x1a02	0x03	Transmit PDO 3 Mapping PDO Mapping Entry	UNSIGNED32	rw	537853968	0	4294967295
0x1a02	0x04	Transmit PDO 3 Mapping PDO Mapping Entry	UNSIGNED32	rw	537919504	0	4294967295
0x1a02	0x05	Transmit PDO 3 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	4294967295
0x1a02	0x06	Transmit PDO 3 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	4294967295
0x1a02	0x07	Transmit PDO 3 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	4294967295
0x1a02	0x08	Transmit PDO 3 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	4294967295
0x1a03	0x00	Transmit PDO 4 Mapping Number of entries	UNSIGNED8	rw	3	0	255
0x1a03	0x01	Transmit PDO 4 Mapping PDO Mapping Entry	UNSIGNED32	rw	538641168	0	4294967295
0x1a03	0x02	Transmit PDO 4 Mapping PDO Mapping Entry	UNSIGNED32	rw	538705936	0	4294967295
0x1a03	0x03	Transmit PDO 4 Mapping PDO Mapping Entry	UNSIGNED32	rw	1617690656	0	4294967295
0x1a03	0x04	Transmit PDO 4 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	4294967295
0x1a03	0x05	Transmit PDO 4 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	4294967295
0x1a03	0x06	Transmit PDO 4 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	4294967295
0x1a03	0x07	Transmit PDO 4 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	4294967295
0x1a03	0x08	Transmit PDO 4 Mapping PDO Mapping Entry	UNSIGNED32	rw	1610547208	0	4294967295
0x1f50	0x00	Download Program Data Number of entries	UNSIGNED8	ro	2	0	255
0x1f50	0x01	Download Program Data Program data 1	DOMAIN	wo	0	0	0
0x1f50	0x02	Download Program Data Program data 2	DOMAIN	wo	0	0	0
0x1f51	0x00	Program Control Status Number of entries	UNSIGNED8	ro	2	0	255
0x1f51	0x01	Program Control Status Program Control Status 1	UNSIGNED8	rw	0	0	255
0x1f51	0x02	Program Control Status Program Control Status 2	UNSIGNED8	rw	0	0	255

0x2000	0x00	Password Number of entries	UNSIGNED8	ro	3	0	255
0x2000	0x01	Password Password	UNSIGNED32	rw	0	0	4294967295
0x2000	0x02	Password Status	UNSIGNED8	ro	0	0	255
0x2000	0x03	Password New Password	UNSIGNED32	rw	0	0	4294967295
0x2001	0x00	CAN Bitrate	UNSIGNED16	rw	500	0	65535
0x2002	0x00	RS232 baudrate	UNSIGNED16	rw	0	0	65535
0x2003	0x00	CPU Load	UNSIGNED8	ro	0	0	255
0x2004	0x00	Device ID	VISIBLE_STRING	ro		0	255
0x200c	0x00	Custom Persistent Memory 8bit Number of entries	UNSIGNED8	ro	12	0	255
0x200c	0x01	Custom Persistent Memory 8bit Custom Persistent Memory Unsigned-8 1	UNSIGNED8	rw	0	0	255
0x200c	0x02	Custom Persistent Memory 8bit Custom Persistent Memory Unsigned-8 2	UNSIGNED8	rw	0	0	255
0x200c	0x03	Custom Persistent Memory 8bit Custom Persistent Memory Signed-8 1	INTEGER8	rw	0	-128	127
0x200c	0x04	Custom Persistent Memory 8bit Custom Persistent Memory Signed-8 2	INTEGER8	rw	0	-128	127
0x200c	0x05	Custom Persistent Memory 8bit Custom Persistent Memory Unsigned-16 1	UNSIGNED16	rw	0	0	65535
0x200c	0x06	Custom Persistent Memory 8bit Custom Persistent Memory Unsigned-16 2	UNSIGNED16	rw	0	0	65535
0x200c	0x07	Custom Persistent Memory 8bit Custom Persistent Memory Signed-16 1	INTEGER16	rw	0	-32768	32767
0x200c	0x08	Custom Persistent Memory 8bit Custom Persistent Memory Signed-16 2	INTEGER16	rw	0	-32768	32767
0x200c	0x09	Custom Persistent Memory 8bit Custom Persistent Memory Unsigned-32 1	UNSIGNED32	rw	0	0	4294967295
0x200c	0x0a	Custom Persistent Memory 8bit Custom Persistent Memory Unsigned-32 2	UNSIGNED32	rw	0	0	4294967295
0x200c	0x0b	Custom Persistent Memory 8bit Custom Persistent Memory Signed-32 1	INTEGER32	rw	0	-2147483648	2147483647
0x200c	0x0c	Custom Persistent Memory 8bit Custom Persistent Memory Signed-32 2	INTEGER32	rw	0	-2147483648	2147483647

0x200f	0x00	Phase A current	INTEGER16	ro	0	-32768	32767
0x2010	0x00	Phase B current	INTEGER16	ro	0	-32768	32767
0x201a	0x00	Current demand	INTEGER16	ro	0	-32768	32767
0x201b	0x00	Torque regulator Number of entries	UNSIGNED8	ro	9	0	255
0x201b	0x01	Torque regulator Torque regulator requested	INTEGER16	ro	0	-32768	32767
0x201b	0x02	Torque regulator Torque regulator actual	INTEGER16	ro	0	-32768	32767
0x201b	0x03	Torque regulator Torque regulator out	INTEGER16	ro	0	-32768	32767
0x201b	0x04	Torque regulator Torque regulator error	INTEGER16	ro	0	-32768	32767
0x201b	0x05	Torque regulator Calculated Fly On Torque regulator-I	INTEGER16	ro	0	-32768	32767
0x201b	0x06	Torque regulator Calculated Fly On Torque regulator-P	INTEGER16	ro	0	-32768	32767
0x201b	0x07	Torque regulator Calculated Fly On Torque Integral	INTEGER32	ro	0	-2147483648	2147483647
0x201b	0x08	Torque regulator Calculated Feed FWD Const	INTEGER16	ro	0	-32768	32767
0x201b	0x09	Torque regulator Calculated Torque Feed FWD	INTEGER16	ro	0	-32768	32767
0x201c	0x00	Flux regulator Number of entries	UNSIGNED8	ro	5	0	255
0x201c	0x01	Flux regulator Flux regulator requested	INTEGER16	ro	0	-32768	32767
0x201c	0x02	Flux regulator Flux regulator actual	INTEGER16	ro	0	-32768	32767
0x201c	0x03	Flux regulator Flux regulator out	INTEGER16	ro	0	-32768	32767
0x201c	0x04	Flux regulator Flux regulator error	INTEGER16	ro	0	-32768	32767
0x201c	0x05	Flux regulator Calculated Flux Feed FWD	INTEGER16	ro	0	-32768	32767
0x201d	0x00	Motor field settings Number of entries	UNSIGNED8	ro	11	0	255
0x201d	0x01	Motor field settings PMSM Flux Mode	UNSIGNED8	rw	0	0	2
0x201d	0x02	Motor field settings PMSM Flux Manual Current	INTEGER32	rw	0	-2147483648	2147483647
0x201d	0x03	Motor field settings Flux Actual Current mA	INTEGER32	ro	0	-2147483648	2147483647
0x201d	0x04	Motor field settings Flux Actual Current	INTEGER32	ro	0	-2147483648	2147483647
0x201d	0x05	Motor field settings Flux I Increment	INTEGER32	rw	0	-2147483648	2147483647
0x201d	0x06	Motor field settings Flux pulse mode counter	UNSIGNED16	rw	0	0	65535
0x201d	0x07	Motor field settings Flux pulse mode num of pulses	UNSIGNED16	rw	0	0	65535
0x201d	0x08	Motor field settings Flux Off At Zero Torque	UNSIGNED8	rw	0	0	1
0x201d	0x09	Motor field settings Flux Max Weakening Current	INTEGER32	rw	0	-2147483648	2147483647
0x201d	0x0a	Motor field settings Motor Induction	UNSIGNED16	rw	0	0	65535

0x201d	0x0b	Motor field settings Field Weakening Point	UNSIGNED8	rw	90	0	100
0x201e	0x00	BMS Data Number of entries	UNSIGNED8	ro	12	0	255
0x201e	0x01	BMS Data BMS Battery Voltage	INTEGER16	rw	0	-32768	32767
0x201e	0x02	BMS Data BMS Min Cell Voltage	INTEGER16	rw	0	-32768	32767
0x201e	0x03	BMS Data BMS Min Cell Voltage Id	UNSIGNED8	rw	0	0	255
0x201e	0x04	BMS Data BMS Max Cell Voltage	INTEGER16	rw	0	-32768	32767
0x201e	0x05	BMS Data BMS Max Cell Voltage Id	UNSIGNED8	rw	0	0	255
0x201e	0x06	BMS Data BMS Battery Current	INTEGER16	rw	0	-32768	32767
0x201e	0x07	BMS Data BMS Battery Pack Min Temperature	INTEGER8	rw	0	-128	127
0x201e	0x08	BMS Data BMS Battery Pack Max Temperature	INTEGER8	rw	0	-128	127
0x201e	0x09	BMS Data BMS SOC	UNSIGNED8	rw	0	0	255
0x201e	0x0a	BMS Data BMS State	UNSIGNED8	rw	0	0	255
0x201e	0x0b	BMS Data BMS Recup Actual Allowed	UNSIGNED8	rw	0	0	255
0x201e	0x0c	BMS Data BMS Discharge Actual Allowed	UNSIGNED8	rw	0	0	255
0x201f	0x00	Electrical angle	INTEGER16	ro	0	-32768	32767
0x2020	0x00	Consumption info Number of entries	UNSIGNED8	ro	2	0	255
0x2020	0x01	Consumption info Average consumption	INTEGER32	ro	0	-2147483648	2147483647
0x2020	0x02	Consumption info Range	UNSIGNED32	ro	0	0	4294967295
0x2021	0x00	Safety execute	UNSIGNED8	rw	0	0	2
0x2022	0x00	Hall sensor Number of entries	UNSIGNED8	ro	2	0	255
0x2022	0x01	Hall sensor Hall sensor bit pattern	UNSIGNED16	ro	0	0	65535
0x2022	0x02	Hall sensor Hall noise counter	INTEGER32	ro	0	-2147483648	2147483647
0x2023	0x00	DC current	INTEGER32	ro	0	-2147483648	2147483647
0x2024	0x00	Electric power	INTEGER32	ro	0	-2147483648	2147483647
0x2025	0x00	Motor temperature	UNSIGNED8	ro	0	0	255
0x2026	0x00	Controller temperatures Number of entries	UNSIGNED8	ro	14	0	255
0x2026	0x01	Controller temperatures Controller temperature	UNSIGNED8	ro	0	0	255
0x2026	0x02	Controller temperatures Capacitor temperature	UNSIGNED8	ro	0	0	255
0x2026	0x03	Controller temperatures IGBT PH 1 temperature	UNSIGNED16	ro	0	0	65535
0x2026	0x04	Controller temperatures IGBT PH 2 temperature	UNSIGNED16	ro	0	0	65535
0x2026	0x05	Controller temperatures IGBT PH 3 temperature	UNSIGNED16	ro	0	0	65535
0x2026	0x06	Controller temperatures I2T	UNSIGNED8	ro	0	0	255
0x2026	0x07	Controller temperatures IGBT highest die temperature	UNSIGNED8	ro	0	0	255

0x2026	0x08	Controller temperatures IGBT die LS PH 1 temperature	UNSIGNED16	ro	0	0	65535
0x2026	0x09	Controller temperatures IGBT die HS PH 1 temperature	UNSIGNED16	ro	0	0	65535
0x2026	0x0a	Controller temperatures IGBT die LS PH 2 temperature	UNSIGNED16	ro	0	0	65535
0x2026	0x0b	Controller temperatures IGBT die HS PH 2 temperature	UNSIGNED16	ro	0	0	65535
0x2026	0x0c	Controller temperatures IGBT die LS PH 3 temperature	UNSIGNED16	ro	0	0	65535
0x2026	0x0d	Controller temperatures IGBT die HS PH 3 temperature	UNSIGNED16	ro	0	0	65535
0x2026	0x0e	Controller temperatures IGBT total loss	UNSIGNED16	ro	0	0	65535
0x2027	0x00	Warnings	UNSIGNED16	ro	0	0	65535
0x2028	0x00	Motor current limit	INTEGER16	ro	0	-32768	32767
0x2029	0x00	Logic power supply voltage	INTEGER16	ro	0	-32768	32767
0x2031	0x00	Test mode command	INTEGER16	rw	0	0	10000
0x2032	0x00	Pulse mode Number of entries	UNSIGNED8	ro	2	0	255
0x2032	0x01	Pulse mode Pulse mode counter	UNSIGNED16	rw	0	0	65535
0x2032	0x02	Pulse mode Pulse mode nuber of pulses	UNSIGNED16	rw	0	0	65535
0x2033	0x00	Motor pole pairs	UNSIGNED8	rw	6	0	255
0x2034	0x00	Motor Type	UNSIGNED8	rw	0	0	1
0x2039	0x00	FOC Calculation Delay Enable	UNSIGNED8	rw	1	0	1
0x2040	0x00	Feedback config Number of entries	UNSIGNED8	ro	15	0	255
0x2040	0x01	Feedback config Feedback type	UNSIGNED8	rw	3	0	6
0x2040	0x02	Feedback config Motor phase offset	INTEGER16	rw	55	-180	180
0x2040	0x03	Feedback config Feedback direction	UNSIGNED8	rw	1	0	1
0x2040	0x04	Feedback config Test stepper frequency	INTEGER16	rw	10	0	1000
0x2040	0x05	Feedback config Hall configuration	INTEGER16	rw	0	0	1
0x2040	0x06	Feedback config Feedback resolution	UNSIGNED16	rw	4096	6	8192
0x2040	0x07	Feedback config Electrical angle filter	INTEGER16	rw	0	0	1024
0x2040	0x08	Feedback config Motor phase offset compensation	INTEGER16	rw	0	-32768	32767
0x2040	0x09	Feedback config Test stepper enable	UNSIGNED8	rw	0	0	1
0x2040	0x0a	Feedback config Auto aligning rotor position current	UNSIGNED16	rw	1000	0	2000
0x2040	0x0b	Feedback config SinCos zero voltage sin	UNSIGNED16	rw	32000	0	65535

0x2040	0x0c	Feedback config SinCos zero voltage cos	UNSIGNED16	rw	32000	0	65535
0x2040	0x0d	Feedback config Feedback Slave Mode	UNSIGNED8	rw	0	0	1
0x2040	0x0e	Feedback config El Angle Triger Out	UNSIGNED8	rw	0	0	1
0x2040	0x0f	Feedback config El Angle Triger Value	INTEGER16	rw	5250	-32768	32767
0x2049	0x00	Rotor Angle Observer Number of entries	UNSIGNED8	ro	3	0	255
0x2049	0x01	Rotor Angle Observer Rotor Angle Observer Input	INTEGER16	ro	0	-32768	32767
0x2049	0x02	Rotor Angle Observer Rotor Angle Observer Output	INTEGER16	ro	0	-32768	32767
0x2049	0x03	Rotor Angle Observer Rotor Angle Observer Error	INTEGER16	ro	0	-32768	32767
0x2050	0x00	Maximum controller current	INTEGER32	rw	250000	10000	800000
0x2051	0x00	Secondary current protection	INTEGER32	rw	300000	50000	900000
0x2052	0x00	Velocity control parameter Number of entries	UNSIGNED8	ro	4	0	255
0x2052	0x01	Velocity control parameter Maximum velocity	INTEGER32	rw	5000	1	2147483647
0x2052	0x02	Velocity control parameter Maximum velocity gain	INTEGER16	rw	10	0	100
0x2052	0x03	Velocity control parameter PMSM Back EMF Ratio	UNSIGNED16	rw	0	0	65535
0x2052	0x04	Velocity control parameter Velocity Filtering Enable	UNSIGNED8	rw	0	0	4
0x2053	0x00	DC current limit Number of entries	UNSIGNED8	ro	2	0	255
0x2053	0x01	DC current limit Maximum DC current	INTEGER32	rw	150000	1000	800000
0x2053	0x02	DC current limit Maximum DC current gain	INTEGER16	rw	10	0	100
0x2054	0x00	Overvoltage limit	INTEGER16	rw	60	0	450
0x2055	0x00	Undervoltage_limitation_ parameter Number of entries	UNSIGNED8	ro	3	0	255
0x2055	0x01	Undervoltage_limitation_ parameter Undervoltage limit	INTEGER16	rw	40	0	450
0x2055	0x02	Undervoltage_limitation_ parameter Undervoltage gain	INTEGER16	rw	20	0	100
0x2055	0x03	Undervoltage_limitation_ parameter Undervoltage min voltage	INTEGER16	rw	33	0	450
0x2057	0x00	Motor temperature config Number of entries	UNSIGNED8	ro	3	0	255
0x2057	0x01	Motor temperature config Motor temperature sensor type	UNSIGNED8	rw	2	0	10
0x2057	0x02	Motor temperature config Motor maximum temperature	UNSIGNED8	rw	100	50	150
0x2057	0x03	Motor temperature config Motor maximum temperature gain	INTEGER16	rw	10	0	100

0x205b	0x00	Stall config Number of entries	UNSIGNED8	ro	2	0	255
0x205b	0x01	Stall config Stall protection time	UNSIGNED8	rw	5	0	100
0x205b	0x02	Stall config Stall protection current	INTEGER16	rw	500	100	1000
0x2060	0x00	OC out config Number of entries	UNSIGNED8	ro	4	0	255
0x2060	0x01	OC out config OC_out 1 enable	UNSIGNED8	rw	1	0	2
0x2060	0x02	OC out config OC_out 2 enable	UNSIGNED8	rw	1	0	2
0x2060	0x03	OC out config OC_out 1 Value	UNSIGNED8	rw	0	0	10
0x2060	0x04	OC out config OC_out 2 Value	UNSIGNED8	rw	0	0	10
0x2061	0x00	Brake config Number of entries	UNSIGNED8	ro	3	0	255
0x2061	0x01	Brake config Brake nominal voltage	UNSIGNED8	rw	24	6	48
0x2061	0x02	Brake config Brake reduced voltage	UNSIGNED8	rw	17	6	48
0x2061	0x03	Brake config Brake Time To Reduce Voltage	INTEGER16	rw	1000	10	5000
0x2070	0x00	Analog inputs Number of entries	UNSIGNED8	ro	3	0	255
0x2070	0x01	Analog inputs Throttle voltage	INTEGER16	ro	0	-32768	32767
0x2070	0x02	Analog inputs AUX Voltage	INTEGER16	ro	0	-32768	32767
0x2070	0x03	Analog inputs Brake voltage	INTEGER16	ro	0	-32768	32767
0x2072	0x00	AD resolver Number of entries	UNSIGNED8	ro	2	0	255
0x2072	0x01	AD resolver AD resolver sin	INTEGER16	ro	0	-32768	32767
0x2072	0x02	AD resolver AD resolver cos	INTEGER16	ro	0	-32768	32767
0x2073	0x00	AD sin_cos Number of entries	UNSIGNED8	ro	2	0	255
0x2073	0x01	AD sin_cos AD Sin_Cos Sin	INTEGER16	ro	0	-32768	32767
0x2073	0x02	AD sin_cos AD Sin_Cos Cos	INTEGER16	ro	0	-32768	32767
0x2076	0x00	Digital inputs	UNSIGNED8	ro	0	0	255
0x2080	0x00	Oscilloscope settings Number of entries	UNSIGNED8	ro	20	0	255
0x2080	0x01	Oscilloscope settings Command	UNSIGNED8	rw	0	0	7
0x2080	0x02	Oscilloscope settings Memory	UNSIGNED8	rw	0	0	1
0x2080	0x03	Oscilloscope settings Sampling rate	UNSIGNED32	rw	1	1	4294967295
0x2080	0x04	Oscilloscope settings Wrap around	UNSIGNED8	rw	0	0	1
0x2080	0x05	Oscilloscope settings Trigger level	INTEGER32	rw	0	-2147483648	2147483647
0x2080	0x06	Oscilloscope settings Trigger mode	UNSIGNED8	rw	0	0	3
0x2080	0x07	Oscilloscope settings Trigger source	UNSIGNED8	rw	0	0	255
0x2080	0x08	Oscilloscope settings Pre-trigger samples requested	UNSIGNED32	rw	0	0	4294967295

0x2080	0x09	Oscilloscope settings Pre-trigger samples recorded	UNSIGNED32	ro	0	0	4294967295
0x2080	0x0a	Oscilloscope settings Post-trigger samples recorded	UNSIGNED32	ro	0	0	4294967295
0x2080	0x0b	Oscilloscope settings Status	UNSIGNED8	ro	4	0	255
0x2080	0x0c	Oscilloscope settings Record number	UNSIGNED32	rw	0	0	4294967295
0x2080	0x0d	Oscilloscope settings Record	DOMAIN	ro	0	-2147483648	2147483647
0x2080	0x0e	Oscilloscope settings Memory capacity	UNSIGNED32	ro	0	0	4294967295
0x2080	0x0f	Oscilloscope settings Trigger source Index	UNSIGNED16	rw	0	0	65535
0x2080	0x10	Oscilloscope settings Trigger source Subindex	UNSIGNED8	rw	0	0	255
0x2080	0x11	Oscilloscope settings Configuration Number	UNSIGNED8	rw	0	0	255
0x2080	0x12	Oscilloscope settings Record channel	UNSIGNED8	rw	0	0	255
0x2080	0x13	Oscilloscope settings Record step	INTEGER16	rw	0	-32768	32767
0x2080	0x14	Oscilloscope settings Number of configurations	UNSIGNED8	rw	0	0	255
0x2081	0x00	Oscilloscope channels Number of entries	UNSIGNED8	ro	5	0	255
0x2081	0x01	Oscilloscope channels Channel count	UNSIGNED8	rw	0	0	255
0x2081	0x02	Oscilloscope channels Selected channel	UNSIGNED8	rw	0	0	255
0x2081	0x03	Oscilloscope channels Channel index	UNSIGNED16	rw	0	0	65535
0x2081	0x04	Oscilloscope channels Channel subindex	UNSIGNED8	rw	0	0	255
0x2081	0x05	Oscilloscope channels Channel configuration status	UNSIGNED8	ro	0	0	255
0x2082	0x00	Frequencies Number of entries	UNSIGNED8	ro	2	0	255
0x2082	0x01	Frequencies FOC frequency	UNSIGNED16	ro	0	0	65535
0x2082	0x02	Frequencies Speed loop frequency	UNSIGNED16	ro	0	0	65535
0x2083	0x00	Oscilloscope test signals Number of entries	UNSIGNED8	ro	4	0	255
0x2083	0x01	Oscilloscope test signals Osci test signal 1	UNSIGNED8	rw	0	0	255
0x2083	0x02	Oscilloscope test signals Osci test signal 2	INTEGER8	rw	0	-128	127
0x2083	0x03	Oscilloscope test signals Osci test signal 3	UNSIGNED32	rw	0	0	4294967295
0x2083	0x04	Oscilloscope test signals Osci test signal 4	INTEGER32	rw	0	-2147483648	2147483647
0x2084	0x00	Allow PDO COB-ID change	UNSIGNED8	ro	0	0	255
0x2085	0x00	Actual FOC Angle	INTEGER16	ro	0	-32768	32767
0x2086	0x00	Velocity actual value averaged	INTEGER32	ro	0	-2147483648	2147483647
0x2087	0x00	Velocity actual value filtered	INTEGER32	ro	0	-2147483648	2147483647
0x2090	0x00	Current Flux Actual Value	INTEGER16	ro	0	-32768	32767
0x2091	0x00	Induction Motor config Number of entries	UNSIGNED8	ro	7	0	255

0x2091	0x01	Induction Motor config Induction Motor Rotor Time Constant	INTEGER32	rw	70000	100	1000000
0x2091	0x02	Induction Motor config Induction Motor Rated Velocity	INTEGER32	rw	3000	0	2147483647
0x2091	0x03	Induction Motor config Induction Motor Flux Control mode	UNSIGNED8	rw	1	0	1
0x2091	0x04	Induction Motor config Induction Motor V to Hz ratio	UNSIGNED16	rw	155	1	10000
0x2091	0x05	Induction Motor config Induction Motor Rated Flux Current	INTEGER32	rw	54000	0	500000
0x2091	0x06	Induction Motor config Induction control parameter flux set P gain	INTEGER16	rw	1000	1	32767
0x2091	0x07	Induction Motor config Induction control parameter flux set I gain	INTEGER16	rw	200	1	32767
0x2500	0x00	Gate Driver Error Number of Entries	UNSIGNED8	ro	6	0	255
0x2500	0x01	Gate Driver Error Gate Driver Error Num 1	UNSIGNED32	ro	0	0	4294967295
0x2500	0x02	Gate Driver Error Gate Driver Error Num 2	UNSIGNED32	ro	0	0	4294967295
0x2500	0x03	Gate Driver Error Gate Driver Error Num 3	UNSIGNED32	ro	0	0	4294967295
0x2500	0x04	Gate Driver Error Gate Driver Error Num 4	UNSIGNED32	ro	0	0	4294967295
0x2500	0x05	Gate Driver Error Gate Driver Error Num 5	UNSIGNED32	ro	0	0	4294967295
0x2500	0x06	Gate Driver Error Gate Driver Error Num 6	UNSIGNED32	ro	0	0	4294967295
0x3000	0x00	Select Application	UNSIGNED8	rw	0	0	255
0x3001	0x00	Application 1 - Status and settings Number of entries	UNSIGNED8	ro	17	0	255
0x3001	0x01	Application 1 - Status and settings APP 1 Control Mode	UNSIGNED8	rw	0	0	5
0x3001	0x02	Application 1 - Status and settings APP 1 Status	UNSIGNED8	ro	0	0	255
0x3001	0x03	Application 1 - Status and settings APP 1 Error Code	UNSIGNED16	ro	0	0	65535
0x3001	0x04	Application 1 - Status and settings APP 1 Number Of Contolled Drives	UNSIGNED8	rw	1	0	4
0x3001	0x05	Application 1 - Status and settings APP 1 Drive1 NodeID	UNSIGNED8	rw	1	0	255
0x3001	0x06	Application 1 - Status and settings APP 1 Drive2 NodeID	UNSIGNED8	rw	2	0	255
0x3001	0x07	Application 1 - Status and settings APP 1 Drive3 NodeID	UNSIGNED8	rw	3	0	255
0x3001	0x08	Application 1 - Status and settings APP 1 Drive4 NodeID	UNSIGNED8	rw	4	0	255
0x3001	0x09	Application 1 - Status and settings APP 1 Drive1 Dirrection Invert Enable	UNSIGNED8	rw	0	0	1

0x3001	0x0a	Application 1 - Status and settings APP 1 Drive2 Dirrection Invert Enable	UNSIGNED8	rw	0	0	1
0x3001	0x0b	Application 1 - Status and settings APP 1 Drive3 Dirrection Invert Enable	UNSIGNED8	rw	0	0	1
0x3001	0x0c	Application 1 - Status and settings APP 1 Drive4 Dirrection Invert Enable	UNSIGNED8	rw	0	0	1
0x3001	0x0d	Application 1 - Status and settings APP 1 Disable PWM On Stop Enable	UNSIGNED8	rw	0	0	1
0x3001	0x0e	Application 1 - Status and settings APP 1 Disable PWM On Stop Delay	UNSIGNED8	rw	5	0	255
0x3001	0x0f	Application 1 - Status and settings APP 1 Disable PMW On Stop Velocity	UNSIGNED16	rw	5	0	65535
0x3001	0x10	Application 1 - Status and settings APP 1 Max Fw Velocity	INTEGER32	rw	6000	-2147483648	2147483647
0x3001	0x11	Application 1 - Status and settings APP 1 Max Rw Velocity	INTEGER32	rw	6000	-2147483648	2147483647
0x3003	0x00	Application 1 - I/O settings Number of entries	UNSIGNED8	ro	23	0	255
0x3003	0x01	Application 1 - I/O settings APP 1 Din1 Function	UNSIGNED8	rw	0	0	10
0x3003	0x02	Application 1 - I/O settings APP 1 Din2 Function	UNSIGNED8	rw	0	0	10
0x3003	0x03	Application 1 - I/O settings APP 1 Din3 Function	UNSIGNED8	rw	0	0	10
0x3003	0x04	Application 1 - I/O settings APP 1 Din4 Function	UNSIGNED8	rw	0	0	10
0x3003	0x05	Application 1 - I/O settings APP 1 Din5 Function	UNSIGNED8	rw	0	0	10
0x3003	0x06	Application 1 - I/O settings APP 1 Din6 Function	UNSIGNED8	rw	0	0	10
0x3003	0x07	Application 1 - I/O settings APP 1 Invert Din Polarity	UNSIGNED8	rw	0	0	1
0x3003	0x08	Application 1 - I/O settings APP 1 Dout1 Function	UNSIGNED8	rw	0	0	3
0x3003	0x09	Application 1 - I/O settings APP 1 Dout2 Function	UNSIGNED8	rw	0	0	3
0x3003	0x0a	Application 1 - I/O settings APP 1 Throttle Type	UNSIGNED8	rw	0	0	5
0x3003	0x0b	Application 1 - I/O settings APP 1 Throttle Positive Min Voltage	UNSIGNED16	rw	0	0	5000
0x3003	0x0c	Application 1 - I/O settings APP 1 Throttle Positive Max Voltage	UNSIGNED16	rw	0	0	5000
0x3003	0x0d	Application 1 - I/O settings APP 1 Throttle Negative Min Voltage	UNSIGNED16	rw	0	0	5000
0x3003	0x0e	Application 1 - I/O settings APP 1 Throttle Negative Max Voltage	UNSIGNED16	rw	0	0	5000
0x3003	0x0f	Application 1 - I/O settings APP 1 Throttle Min Out Value	INTEGER16	rw	0	-32768	32767

0x3003	0x10	Application 1 - I/O settings APP 1 Throttle Max Out Value	INTEGER16	rw	1000	-32768	32767
0x3003	0x11	Application 1 - I/O settings APP 1 Throttle Wire Brake Enable	UNSIGNED8	rw	0	0	1
0x3003	0x12	Application 1 - I/O settings APP 1 Throttle Wire Brake Min Voltage	UNSIGNED16	rw	0	0	65535
0x3003	0x13	Application 1 - I/O settings APP 1 Throttle Wire Brake Max Voltage	UNSIGNED16	rw	5000	0	65535
0x3003	0x14	Application 1 - I/O settings APP 1 Throttle Invert	UNSIGNED8	rw	0	0	1
0x3003	0x15	Application 1 - I/O settings APP 1 PWM Pulse Width	UNSIGNED16	rw	0	0	65535
0x3003	0x16	Application 1 - I/O settings APP 1 Servo PWM Valid Data Delay	UNSIGNED16	rw	40	0	65535
0x3003	0x17	Application 1 - I/O settings APP 1 Pump Control Threshold Temerature	UNSIGNED8	rw	40	0	150
0x3004	0x00	Application 1 - Velocity regulator settings Number of entries	UNSIGNED8	ro	6	0	255
0x3004	0x01	Application 1 - Velocity regulator settings APP 1 Velocity Feedback Mode	UNSIGNED8	rw	0	0	5
0x3004	0x02	Application 1 - Velocity regulator settings APP 1 Velocity Feedback Drive Number	UNSIGNED8	rw	1	0	255
0x3004	0x03	Application 1 - Velocity regulator settings APP 1 Velocity Regulator P	UNSIGNED16	rw	5000	0	65535
0x3004	0x04	Application 1 - Velocity regulator settings APP 1 Velocity Regulator I	UNSIGNED16	rw	100	0	65535
0x3004	0x05	Application 1 - Velocity regulator settings APP 1 Velocity Regulator Max Drive Current	UNSIGNED32	rw	1000	0	4294967295
0x3004	0x06	Application 1 - Velocity regulator settings APP 1 Velocity Regulator Max Regenerative Current	INTEGER32	rw	-200	-2147483648	0
0x3005	0x00	Application 1 - Brake and regeneration settings Number of entries	UNSIGNED8	ro	13	0	255
0x3005	0x01	Application 1 - Brake and regeneration settings APP 1 Brake Mode	UNSIGNED8	rw	0	0	3
0x3005	0x02	Application 1 - Brake and regeneration settings APP 1 Brake Minimum Velocity	UNSIGNED16	rw	1000	0	65535
0x3005	0x03	Application 1 - Brake and regeneration settings APP 1 Brake Digital Current	UNSIGNED16	rw	80	0	65535
0x3005	0x04	Application 1 - Brake and regeneration settings APP 1 Brake Linear Current	UNSIGNED16	rw	100	0	65535
0x3005	0x05	Application 1 - Brake and regeneration settings APP	UNSIGNED16	rw	1000	0	65535

		1 Brake Potentiometer Minimum Voltage					
0x3005	0x06	Application 1 - Brake and regeneration settings APP 1 Brake Potentiometer Maximum Voltage	UNSIGNED16	rw	4000	0	65535
0x3005	0x07	Application 1 - Brake and regeneration settings APP 1 Brake Current	INTEGER16	ro	0	-32768	32767
0x3005	0x08	Application 1 - Brake and regeneration settings APP 1 Regeneration Active	UNSIGNED8	ro	0	0	1
0x3005	0x09	Application 1 - Brake and regeneration settings APP 1 Constant Regeneration Current Enable	UNSIGNED8	rw	0	0	1
0x3005	0x0a	Application 1 - Brake and regeneration settings APP 1 Constant Regeneration Current	UNSIGNED16	rw	150	0	10000
0x3005	0x0b	Application 1 - Brake and regeneration settings APP 1 Constant Regeneration Minimum Velocity	UNSIGNED16	rw	1000	0	65535
0x3005	0x0c	Application 1 - Brake and regeneration settings APP 1 Constant Regeneration Actual Current	INTEGER16	ro	1000	-32768	32767
0x3005	0x0d	Application 1 - Brake and regeneration settings APP 1 Brake And Regeneration Zero Current Velocity	UNSIGNED16	rw	6000	0	65535
0x3006	0x00	Application 1 - Power mode - Status and settings Number of entries	UNSIGNED8	ro	4	0	255
0x3006	0x01	Application 1 - Power mode - Status and settings APP 1 Power Mode Enable	UNSIGNED8	rw	0	0	1
0x3006	0x02	Application 1 - Power mode - Status and settings APP 1 Power Mode Active	UNSIGNED8	ro	0	0	3
0x3006	0x03	Application 1 - Power mode - Status and settings APP 1 Power Mode Select Voltage 1	UNSIGNED16	rw	1000	0	5000
0x3006	0x04	Application 1 - Power mode - Status and settings APP 1 Power Mode Select Voltage 2	UNSIGNED16	rw	2000	0	5000
0x3007	0x00	Application 1 - Power mode - Normal Number of entries	UNSIGNED8	ro	8	0	255
0x3007	0x01	Application 1 - Power mode - Normal APP 1 Power Mode Normal Max Throttle Out	INTEGER16	rw	800	-32768	32767
0x3007	0x02	Application 1 - Power mode - Normal APP 1 Power Mode Normal Max Drive Current	INTEGER32	rw	800	0	10000
0x3007	0x03	Application 1 - Power mode - Normal APP 1	INTEGER32	rw	-200	-10000	0

		Power Mode Normal Max Regenerative Current					
0x3007	0x04	Application 1 - Power mode - Normal APP 1 Power Mode Normal Max Battery Current	INTEGER32	rw	150000	1000	500000
0x3007	0x05	Application 1 - Power mode - Normal APP 1 Power Mode Normal Max Linear Brake Current	INTEGER32	rw	300	0	10000
0x3007	0x06	Application 1 - Power mode - Normal APP 1 Power Mode Normal Max Digital Brake Current	INTEGER32	rw	100	0	10000
0x3007	0x07	Application 1 - Power mode - Normal APP 1 Power Mode Normal Max Velocity	INTEGER32	rw	5000	1	2147483647
0x3007	0x08	Application 1 - Power mode - Normal APP 1 Power Mode Normal Max Constant Regeneration Current	UNSIGNED16	rw	150	0	10000
0x3008	0x00	Application 1 - Power mode - Eco Number of entries	UNSIGNED8	ro	8	0	255
0x3008	0x01	Application 1 - Power mode - Eco APP 1 Power Mode Eco Max Throttle Out	INTEGER16	rw	600	-32768	32767
0x3008	0x02	Application 1 - Power mode - Eco APP 1 Power Mode Eco Max Drive Current	INTEGER32	rw	600	0	10000
0x3008	0x03	Application 1 - Power mode - Eco APP 1 Power Mode Eco Max Regenerative Current	INTEGER32	rw	-100	-10000	0
0x3008	0x04	Application 1 - Power mode - Eco APP 1 Power Mode Eco Max Battery Current	INTEGER32	rw	100000	1000	500000
0x3008	0x05	Application 1 - Power mode - Eco APP 1 Power Mode Eco Max Linear Brake Current	INTEGER32	rw	250	0	10000
0x3008	0x06	Application 1 - Power mode - Eco APP 1 Power Mode Eco Max Digital Brake Current	INTEGER32	rw	50	0	10000
0x3008	0x07	Application 1 - Power mode - Eco APP 1 Power Mode Eco Max Velocity	INTEGER32	rw	4000	1	2147483647
0x3008	0x08	Application 1 - Power mode - Eco APP 1 Power Mode Eco Max Constant Regeneration Current	UNSIGNED16	rw	100	0	10000
0x3009	0x00	Application 1 - Power mode - Sport Number of entries	UNSIGNED8	ro	8	0	255
0x3009	0x01	Application 1 - Power mode - Sport APP 1 Power	INTEGER16	rw	1000	-32768	32767

		Mode Sport Max Throttle Out					
0x3009	0x02	Application 1 - Power mode - Sport APP 1 Power Mode Sport Max Drive Current	INTEGER32	rw	1000	0	10000
0x3009	0x03	Application 1 - Power mode - Sport APP 1 Power Mode Sport Max Regenerative Current	INTEGER32	rw	-300	-10000	0
0x3009	0x04	Application 1 - Power mode - Sport APP 1 Power Mode Sport Max Battery Current	INTEGER32	rw	200000	1000	500000
0x3009	0x05	Application 1 - Power mode - Sport APP 1 Power Mode Sport Max Linear Brake Current	INTEGER32	rw	350	0	10000
0x3009	0x06	Application 1 - Power mode - Sport APP 1 Power Mode Sport Max Digital Brake Current	INTEGER32	rw	150	0	10000
0x3009	0x07	Application 1 - Power mode - Sport APP 1 Power Mode Sport Max Velocity	INTEGER32	rw	6000	1	2147483647
0x3009	0x08	Application 1 - Power mode - Sport APP 1 Power Mode Sport Max Constant Regeneration Current	UNSIGNED16	rw	200	0	10000
0x300a	0x00	Application 1 - Result Number of entries	UNSIGNED8	ro	1	0	255
0x300a	0x01	Application 1 - Result APP 1 Maximum DC Current	INTEGER32	ro	0	-2147483648	2147483647
0x300b	0x00	Application 1 - Precharge Number of entries	UNSIGNED8	ro	3	0	255
0x300b	0x01	Application 1 - Precharge APP 1 Precharge Enable	UNSIGNED8	rw	0	0	1
0x300b	0x02	Application 1 - Precharge APP 1 Precharge Min Voltage	UNSIGNED16	rw	0	0	450
0x300b	0x03	Application 1 - Precharge APP 1 Precharge Max Time	UNSIGNED8	rw	0	0	255
0x5000	0x00	Development and Testing Number of entries	UNSIGNED8	ro	5	0	255
0x5000	0x01	Development and Testing Test CMD	UNSIGNED8	rw	0	0	255
0x5000	0x02	Development and Testing Test Status	UNSIGNED32	ro	0	0	4294967295
0x5000	0x03	Development and Testing Test Result 1	UNSIGNED32	ro	0	0	4294967295
0x5000	0x04	Development and Testing Test Result 2	UNSIGNED32	ro	0	0	4294967295
0x5000	0x05	Development and Testing Test Result 3	UNSIGNED32	ro	0	0	4294967295
0x5ffe	0x00	Hardware version Number of entries	UNSIGNED8	ro	1	0	255
0x5ffe	0x01	Hardware version Control board version	UNSIGNED8	ro	0	0	255
0x5fff	0x00	Dummy mapping object	UNSIGNED8	rw	0	0	0
0x6007	0x00	Abort_connection_option _code	INTEGER16	rw	3	-32768	32767

0x603f	0x00	Error_code	UNSIGNED16	ro	0	0	65535
0x6040	0x00	Controlword	UNSIGNED16	rw	0	0	65535
0x6041	0x00	Statusword	UNSIGNED16	ro	0	0	65535
0x605a	0x00	Quick_stop_option_code	INTEGER16	rw	0	-32768	32767
0x605b	0x00	Shutdown_option_code	INTEGER16	rw	0	-32768	32767
0x605c	0x00	Disable_operation_option_code	INTEGER16	rw	0	-32768	32767
0x605e	0x00	Fault_reaction_option_code	INTEGER16	rw	0	-32768	32767
0x6060	0x00	Modes_of_operation	INTEGER8	rw	0	-128	127
0x6061	0x00	Modes_of_operation_display	INTEGER8	ro	0	-128	127
0x6063	0x00	Position_actual_value_internal	INTEGER32	rw	0	-2147483648	2147483647
0x6064	0x00	Position_actual_value	INTEGER32	rw	0	-2147483648	2147483647
0x6065	0x00	Following_error_window	INTEGER16	rw	1000	1	32767
0x6067	0x00	Position_window	INTEGER16	rw	100	1	32767
0x6069	0x00	Velocity_sensor_actual_value	INTEGER32	ro	0	-2147483648	2147483647
0x606c	0x00	Velocity_actual_value	INTEGER32	ro	0	-2147483648	2147483647
0x6071	0x00	Target_torque	INTEGER16	rw	0	-32768	32767
0x6075	0x00	Motor_rated_current	INTEGER32	rw	59800	-2147483648	2147483647
0x6076	0x00	Motor_rated_torque	INTEGER32	rw	59800	-2147483648	2147483647
0x6077	0x00	Torque_actual_value	INTEGER16	ro	0	-32768	32767
0x6078	0x00	Motor Current Actual Values Number of entries	UNSIGNED8	ro	2	0	255
0x6078	0x01	Motor Current Actual Values Current Torque Actual Value	INTEGER16	ro	0	-32768	32767
0x6078	0x02	Motor Current Actual Values Current Torque Actual Value mA	INTEGER32	ro	0	-2147483648	2147483647
0x6079	0x00	DC_link_circuit_voltage	INTEGER16	ro	0	-32768	32767
0x607a	0x00	Target_position	INTEGER32	rw	0	-2147483648	2147483647
0x607e	0x00	Polarity	UNSIGNED8	rw	0	0	1
0x6093	0x00	Position_factor Position_factor_number_of_entries	UNSIGNED8	ro	2	0	255
0x6093	0x01	Position_factor Position_factor_Numerator	INTEGER32	rw	60	0	2147483647
0x6093	0x02	Position_factor Position_factor_Divisor	INTEGER32	rw	4096	0	2147483647
0x6094	0x00	Velocity_encoder_factor Velocity_encoder_factor_number_of_entries	UNSIGNED8	ro	2	0	255
0x6094	0x01	Velocity_encoder_factor Velocity_encoder_factor_Numerator	INTEGER32	rw	60	-2147483648	2147483647
0x6094	0x02	Velocity_encoder_factor Velocity_encoder_factor_Divisor	INTEGER32	rw	4096	-2147483648	2147483647
0x60f6	0x00	Current_control_parameters Number of entries	UNSIGNED8	ro	5	0	255
0x60f6	0x01	Current_control_parameters	INTEGER16	rw	1000	1	32767

		Current_control_torque_regulator_P-Gain					
0x60f6	0x02	Current_control_parameters Current_control_torque_regulator_I-Gain	INTEGER16	rw	200	1	32767
0x60f6	0x03	Current_control_parameters Current_control_flux_regulator_P-Gain	INTEGER16	rw	1000	1	32767
0x60f6	0x04	Current_control_parameters Current_control_flux_regulator_I-Gain	INTEGER16	rw	200	1	32767
0x60f6	0x05	Current_control_parameters Current_control_regulator_ramp	INTEGER16	rw	200	1	32767
0x60f9	0x00	Velocity_control_parameters Velocity_control_parameter_set_number_of_entries	UNSIGNED8	ro	2	0	255
0x60f9	0x01	Velocity_control_parameters Velocity_control_regulator_P_Gain	UNSIGNED16	rw	5000	0	65535
0x60f9	0x02	Velocity_control_parameters Velocity_control_regulator_I_Gain	UNSIGNED16	rw	100	0	65535
0x60fb	0x00	Position_control_parameters Position_control_parameter_set_number_of_entries	UNSIGNED8	ro	4	0	255
0x60fb	0x01	Position_control_parameters Position_Control_Regulator_P_Gain	INTEGER16	rw	1000	1	32767
0x60fb	0x02	Position_control_parameters Position_Control_Regulator_I_Gain	INTEGER16	rw	0	0	32767
0x60fb	0x03	Position_control_parameters Position_Control_Regulator_D_Gain	INTEGER16	rw	0	0	32767
0x60fb	0x04	Position_control_parameters Nominal_position	INTEGER32	rw	4069	0	2147483647
0x60ff	0x00	Target_velocity	INTEGER32	rw	0	-2147483648	2147483647
0x6502	0x00	Supported_drive_modes	UNSIGNED32	ro	0	0	4294967295
0x6504	0x00	Drive_manufacturer	VISIBLE_STRING	rw	EMSISO	0	0