Device: SOMANET Integro v17.0.3 - *Object Dictionary 5.6*

0x1000 Device type

Identifies the type of device.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Device type	0x1000:0	UDINT	32			131474		readonly (default)	

0x1001 Error register

This object shall provide error information. The CANopen device maps internal errors into this object. It is a part of an emergency object.

Structure of the error register

Bit	M/O	Meaning
0	M	Generic error
1	O	Current
2	O	Voltage
3	O	Temperature
4	O	Communication error (overrun, error state)
5	O	Device profile specific
6	O	reserved (always 0_b)
7	O	manufacturer-specific

If a specific error occurs the corresponding bit shall be set to 1_b. The generic error bit shall be supported. The other bits may be supported. The generic error shall be signaled at any error situation.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Error register	0x1001:0	USINT	8			0		readonly (default)	

0x1005 COB-ID SYNC

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
COB-ID SYNC	0x1005:0	DINT	32			128		readwrite	

0x1006 Communication cycle period

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Communication cycle period	0x1006:0	DINT	32			100		readwrite	

0x1008 Manufacturer device name

This object shall provide the name of the device as given by the manufacturer.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Manufacturer device name	0x1008:0	STRING(50)	400			0		readonly (default)	

0x100A Manufacturer software version

This object shall provide the manufacturer software version description.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Manufacturer software version	0x100A:0	STRING(50)	400			0		readonly (default)	

0x100C Guard time

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Guard time	0x100C:0	UINT	16			0		readwrite	

0x100D Life time factor

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Life time factor	0x100D:0	USINT	8			0		readwrite	

0x1010 Store parameters

Provides the ability to save to permanent storage. Write the value `0x65766173` ("evas", or "save" spelled backwards in ASCII) to start the save procedure.

> **save all parameters** - this will save the current configuration to permanent storage.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Save all parameters	0x1010:1	UDINT	32			0		readwrite	

0x1011 Restore default parameters

Provides the ability to load from permanent storage. Write the value `0x64616f6c` ("daol", or "load" spelled backwards in ASCII) to start the restore procedure.

> **0x1011:1 Restore all default parameters**: Load the configuration from the .factory_config, config.csv and .assembly_config files, in this order. These files are stored on permanent storage.
>
> **0x1011:4 Restore manufacturer default parameters**: Load the configuration from the .factory_config and .assembly_config files, in this order. These files are stored on permanent storage.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Restore all default parameters	0x1011:1	UDINT	32			0		readwrite	

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Restore communication default parameters (disabled)	0x1011:2	UDINT	32			0		readwrite	

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Restore application default parameters (disabled)	0x1011:3	UDINT	32			0		readwrite	

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Restore manufacturer default parameters	0x1011:4	UDINT	32			0		readwrite	

0x1016 Consumer heartbeat time

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Consumer heartbeat time	0x1016:1	DINT	32			100		readwrite	

0x1017 Producer heartbeat time

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Producer heartbeat time	0x1017:0	UINT	16			1000		readwrite	

0x1018 Identity object

Provides information about the device.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Vendor ID	0x1018:1	UDINT	32			8914		readonly (default)	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Product Code	0x1018:2	UDINT	32			1025		readonly (default)	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Revision number	0x1018:3	UDINT	32			285212675		readonly (default)	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Serial number	0x1018:4	UDINT	32			0		readonly (default)	

0x1019 Synchronous counter overflow value

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Synchronous counter overflow value	0x1019:0	USINT	8			100		readwrite	

0x1023 OS command

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Command	0x1023:1	ARRAY [0..7] OF BYTE	64			0		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Status	0x1023:2	USINT	8			0		readonly (default)	

0: last command completed, no errors, no reply.

1: last command completed, no errors, reply there.

2: last command completed, error, no reply.

3: last command completed, error, reply there.

100-200: indicates how much of the command has been executed (in %, 100 = 0%, 200 = 100%).

255: command is executing (if the percentage display is not supported).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Response	0x1023:3	ARRAY [0..7] OF BYTE	64			0		readonly (default)	

Byte 0: See SubIndex 2.

Byte 1: Unused.

2-n: Command specific response data.

0x1024 OS command mode

This object shall control the OS command execution in the application specific queue. This object represents the most recent command of an application program specific queue.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
OS command mode	0x1024:0	USINT	8			0		writeonly	

0x1400 Receive PDO1 parameter

Indicates the communication parameters for the RPDO 1.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
COB-ID used by PDO	0x1400:1	UDINT	32			2147484160		readwrite	

The COB-ID is stored here. For PDO mappings 1–4, the CAN-ID is fixed depending on the node-ID and only the valid bit (bit 31) can be set in the COB-ID. A COB-ID change does not take effect until the controller or communication is restarted.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Transmission type	0x1400:2	USINT	8			1		readwrite	

A number is stored in this subindex that defines the time at which the received data become valid.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Inhibit time	0x1400:3	UINT	16			0		readwrite	

This subindex contains a time lock in ms. This can be used to set a time that must elapse after the sending of a PDO before the PDO is sent another time. This time only applies for asynchronous PDOs.

0x1401 Receive PDO2 parameter

Indicates the communication parameters for the RPDO 2.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
COB-ID used by PDO	0x1401:1	UDINT	32			2147484416		readwrite	

The COB-ID is stored here. For PDO mappings 1–4, the CAN-ID is fixed depending on the node-ID and only the valid bit (bit 31) can be set in the COB-ID. A COB-ID change does not take effect until the controller or communication is restarted.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Transmission type	0x1401:2	USINT	8			1		readwrite	

A number is stored in this subindex that defines the time at which the received data become valid.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Inhibit time	0x1401:3	UINT	16			0		readwrite	

This subindex contains a time lock in ms. This can be used to set a time that must elapse after the sending of a PDO before the PDO is sent another time. This time only applies for asynchronous PDOs.

0x1402 Receive PDO3 parameter

Indicates the communication parameters for the RPDO 3.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
COB-ID used by PDO	0x1402:1	UDINT	32			2147484672		readwrite	

The COB-ID is stored here. For PDO mappings 1–4, the CAN-ID is fixed depending on the node-ID and only the valid bit (bit 31) can be set in the COB-ID. A COB-ID change does not take effect until the controller or communication is restarted.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Transmission type	0x1402:2	USINT	8			1		readwrite	

A number is stored in this subindex that defines the time at which the received data become valid.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Inhibit time	0x1402:3	UINT	16			0		readwrite	

This subindex contains a time lock in ms. This can be used to set a time that must elapse after the sending of a PDO before the PDO is sent another time. This time only applies for asynchronous PDOs.

0x1403 Receive PDO4 parameter

Indicates the communication parameters for the RPDO 4.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
COB-ID used by PDO	0x1403:1	UDINT	32			2147484928		readwrite	

The COB-ID is stored here. For PDO mappings 1–4, the CAN-ID is fixed depending on the node-ID and only the valid bit (bit 31) can be set in the COB-ID. A COB-ID change does not take effect until the controller or communication is restarted.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Transmission type	0x1403:2	USINT	8			1		readwrite	

A number is stored in this subindex that defines the time at which the received data become valid.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Inhibit time	0x1403:3	UINT	16			0		readwrite	

This subindex contains a time lock in ms. This can be used to set a time that must elapse after the sending of a PDO before the PDO is sent another time. This time only applies for asynchronous PDOs.

0x1600 Receive PDO1 mapping

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Controlword	0x1600:1	UDINT	32			1614807056		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Modes of operation	0x1600:2	UDINT	32			1616904200		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Target Torque	0x1600:3	UDINT	32			1618018320		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Target position	0x1600:4	UDINT	32			1618608160		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Target velocity	0x1600:5	UDINT	32			1627324448		readwrite	

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Torque offset	0x1600:6	UDINT	32			1622278160		readwrite	

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Tuning command	0x1600:7	UDINT	32			654376992		readwrite	

0x1601 Receive PDO2 mapping

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Physical outputs	0x1601:1	UDINT	32			1627259168		readwrite	

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Bit mask	0x1601:2	UDINT	32			1627259424		readwrite	

0x1602 Receive PDO3 mapping

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
User MOSI	0x1602:1	UDINT	32			654508064		readwrite	

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity offset	0x1602:2	UDINT	32			1622212640		readwrite	

0x1800 Transmit PDO1 parameter

Indicates the communication parameters for the TPDO 1.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
COB-ID used by PDO	0x1800:1	UDINT	32			2147484032		readwrite	

The COB-ID is stored here. For PDO mappings 1–4, the CAN-ID is fixed depending on the node-ID and only the valid bit (bit 31) can be set in the COB-ID. A COB-ID change does not take effect until the controller or communication is restarted.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Transmission type	0x1800:2	USINT	8			1		readwrite	

A number is stored in this subindex that defines the time at which the data are to be copied into the PDO message and when this is to be sent.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Inhibit time	0x1800:3	UINT	16			1000		readwrite	

This subindex contains a time lock in ms. This can be used to set a time that must elapse after the sending of a PDO before the PDO is sent another time. This time only applies for asynchronous PDOs.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
reserved	0x1800:4	USINT	8			0		readonly (default)	

This subindex has no function and exists only for compatibility reasons.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Event timer	0x1800:5	UINT	16			0		readwrite	

This time (in ms) can be used to trigger an Event which handles the copying of the data and the sending of the PDO.

0x1801 Transmit PDO2 parameter

Indicates the communication parameters for the TPDO 2.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
COB-ID used by PDO	0x1801:1	UDINT	32			2147484288		readwrite	

The COB-ID is stored here. For PDO mappings 1–4, the CAN-ID is fixed depending on the node-ID and only the valid bit (bit 31) can be set in the COB-ID. A COB-ID change does not take effect until the controller or communication is restarted.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Transmission type	0x1801:2	USINT	8			1		readwrite	

A number is stored in this subindex that defines the time at which the data are to be copied into the PDO message and when this is to be sent.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Inhibit time	0x1801:3	UINT	16			1000		readwrite	

This subindex contains a time lock in ms. This can be used to set a time that must elapse after the sending of a PDO before the PDO is sent another time. This time only applies for asynchronous PDOs.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
reserved	0x1801:4	USINT	8			0		readonly (default)	

This subindex has no function and exists only for compatibility reasons.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Event timer	0x1801:5	UINT	16			0		readwrite	

This time (in ms) can be used to trigger an Event which handles the copying of the data and the sending of the PDO.

0x1802 Transmit PDO3 parameter

Indicates the communication parameters for the TPDO 3.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
COB-ID used by PDO	0x1802:1	UDINT	32			2147484544		readwrite	

The COB-ID is stored here. For PDO mappings 1–4, the CAN-ID is fixed depending on the node-ID and only the valid bit (bit 31) can be set in the COB-ID. A COB-ID change does not take effect until the controller or communication is restarted.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Transmission type	0x1802:2	USINT	8			1		readwrite	

A number is stored in this subindex that defines the time at which the data are to be copied into the PDO message and when this is to be sent.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Inhibit time	0x1802:3	UINT	16			1000		readwrite	

This subindex contains a time lock in ms. This can be used to set a time that must elapse after the sending of a PDO before the PDO is sent another time. This time only applies for asynchronous PDOs.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
reserved	0x1802:4	USINT	8			0		readwrite	

This subindex has no function and exists only for compatibility reasons.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Event timer	0x1802:5	UINT	16			0		readwrite	

This time (in ms) can be used to trigger an Event which handles the copying of the data and the sending of the PDO.

0x1803 Transmit PDO4 parameter

Indicates the communication parameters for the TPDO 4.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
COB-ID used by PDO	0x1803:1	UDINT	32			2147484800		readwrite	

The COB-ID is stored here. For PDO mappings 1–4, the CAN-ID is fixed depending on the node-ID and only the valid bit (bit 31) can be set in the COB-ID. A COB-ID change does not take effect until the controller or communication is restarted.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Transmission type	0x1803:2	USINT	8			1		readwrite	

A number is stored in this subindex that defines the time at which the data are to be copied into the PDO message and when this is to be sent.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Inhibit time	0x1803:3	UINT	16			1000		readwrite	

This subindex contains a time lock in ms. This can be used to set a time that must elapse after the sending of a PDO before the PDO is sent another time. This time only applies for asynchronous PDOs.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
reserved	0x1803:4	USINT	8			0		readwrite	

This subindex has no function and exists only for compatibility reasons.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Event timer	0x1803:5	UINT	16			0		readwrite	

This time (in ms) can be used to trigger an Event which handles the copying of the data and the sending of the PDO.

0x1A00 Transmit PDO1 mapping

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Statusword	0x1A00:1	UDINT	32			1614872592		readwrite	

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Modes of operation display	0x1A00:2	UDINT	32			1616969736		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Position actual value	0x1A00:3	UDINT	32			1617166368		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Velocity actual value	0x1A00:4	UDINT	32			1617690656		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Torque actual value	0x1A00:5	UDINT	32			1618411536		readwrite	

0x1A01 Transmit PDO2 mapping

Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Analog input 1	0x1A01:1	UDINT	32			604045328		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Analog input 2	0x1A01:2	UDINT	32			604110864		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Analog input 3	0x1A01:3	UDINT	32			604176400		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Analog input 4	0x1A01:4	UDINT	32			604241936		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Tuning status	0x1A01:5	UDINT	32			654442528		readwrite	

0x1A02 Transmit PDO3 mapping

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Digital inputs	0x1A02:1	UDINT	32			1627193376		readwrite	

0x1A03 Transmit PDO4 mapping

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
User MISO	0x1A03:1	UDINT	32			654573600		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Timestamp	0x1A03:2	UDINT	32			552599584		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Position demand internal value	0x1A03:3	UDINT	32			1627127840		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Velocity demand value	0x1A03:4	UDINT	32			1617625120		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Torque demand	0x1A03:5	UDINT	32			1618214928		readwrite	

0x1C00 Sync manager type

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
SyncMan 0	0x1C00:1	USINT	8			1		readonly (default)	

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
SyncMan 1	0x1C00:2	USINT	8			2		readonly (default)	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
SyncMan 2	0x1C00:3	USINT	8			3		readonly (default)	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
SyncMan 3	0x1C00:4	USINT	8			4		readonly (default)	

0x1C10 SM 0 Assignment

0x1C11 SM 1 Assignment

0x1C12 SM 2 Assignment

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
SubIndex 001	0x1C12:1	UINT	16			5632		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
SubIndex 002	0x1C12:2	UINT	16			5633		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
SubIndex 003	0x1C12:3	UINT	16			5634		readwrite	

0x1C13 SM 3 Assignment

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

SubIndex 001	0x1C13:1	UINT	16			6656		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
SubIndex 002	0x1C13:2	UINT	16			6657		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
SubIndex 003	0x1C13:3	UINT	16			6658		readwrite	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
SubIndex 004	0x1C13:4	UINT	16			6659		readwrite	

0x1C32 Output SyncManager Parameter

Name	**Index:Sub**	**Type**	**Bit Size**	**Options**		**Unit**	**Access**	**PDO Mapping**
Synchronization Type	0x1C32:1	UINT	16	Free Run (not synchronized)	0		readonly (default)	

Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Cycle time	0x1C32:2	UDINT	32			500000		readonly (default)	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Shift time	0x1C32:3	UDINT	32			0		readonly (default)	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
Synchronization types supported	0x1C32:4	UINT	16			1		readonly (default)	

0x1C33 Input SyncManager Parameter

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Synchronization Type	0x1C33:1	UINT	16	Free Run (not synchronized)	0		readonly (default)	

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Cycle time	0x1C33:2	UDINT	32			500000		readonly (default)	

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Shift time	0x1C33:3	UDINT	32			0		readonly (default)	

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Synchronization types supported	0x1C33:4	UINT	16			1		readonly (default)	

0x2000 Command object (disabled)

Command object was used for storing and loading of the configuration from flash memory. This object is substituted with object 0x1010 for storing and object 0x1011 for loading of the configuration. Storing of the configuration is user triggered by entering the value "save" (LittleEndian format) in the object 0x1010, subindex 1. Loading of the configuration loads the default configuration from the flash memory. It is performed during initialization of the slave by entering the value "load" (LittleEndian format) in the object 0x1011, subindex 1.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Command object (disabled)	0x2000:0	UINT	16			0		readwrite	

0x2001 Commutation angle offset

In most of the cases, the position sensor is not physically mounted at the ideal angle on the body of the motor. As a result, an "offset" value should be added to the measured value of position sensor to give the correct (electrical) angle of rotor.

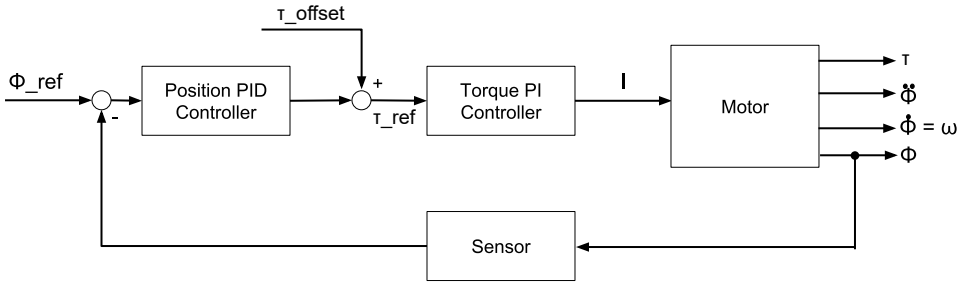
This object represents the required shift for position sensor output. Its range is between [0-4095] and corresponds to [0-360] electrical degrees inside the software.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Commutation angle offset	0x2001:0	INT	16			0		readwrite	

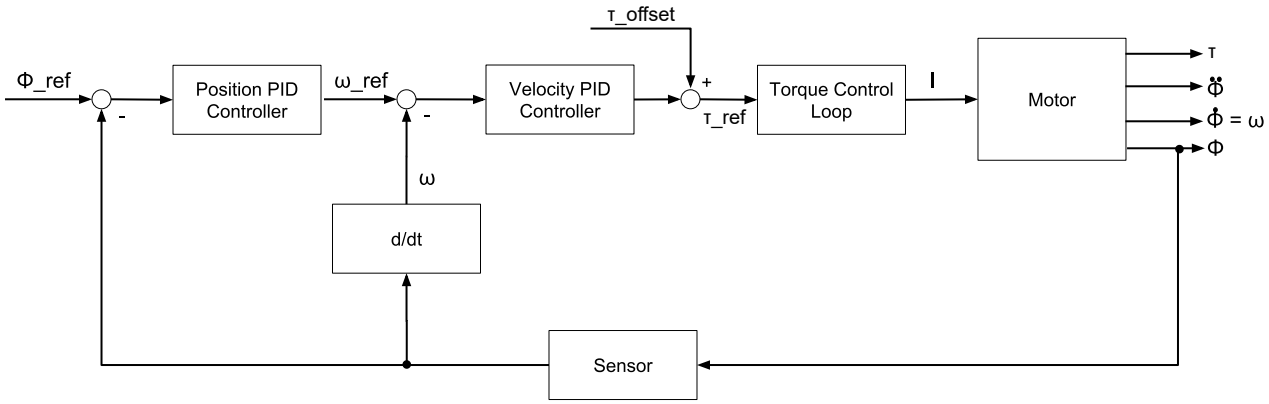
0x2002 Position control strategy

Selects the control structure used for position control:

1. Simple PID (A position PID controller directly generating the reference value for the torque controller.)



2. Cascaded PID (A position PID controller that generates the reference value for an underlying velocity controller - while that velocity controller generates the reference value for the torque controller)



Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Position control strategy	0x2002:0	UINT	16	Simple PID	1		readwrite	
				Cascaded PID	2			

0x2003 Motor specific settings

Please refer to your motor's data sheet for the specific values.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Pole pairs	0x2003:1	USINT	8			1		readwrite	

Number of magnetic pole pairs used in the motor. Please refer to your motor datasheet for this value.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Torque constant	0x2003:2	DINT	32			1	µNm/A	readwrite	

The motor's torque constant is given by the motor design it defines the torque generated per effective current(rms). The value needs to be configured in µNm/Arms

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Phase resistance	0x2003:3	DINT	32			1	µΩ	readwrite	

The resistance between motor terminal and motor neutral point. It is equal to half of "phase to phase resistance" or "line to line resistance".

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Phase inductance	0x2003:4	DINT	32			1	µH	readwrite	

The inductance between motor terminal and motor neutral point. It is equal to half of "phase to phase inductance" or "line to line inductance".

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Motor phases inverted	0x2003:5	BOOL	1	No	0		readwrite	
				Yes	1			

Use this parameter only when you have a negative velocity or feedback increment with the positive torque increment.

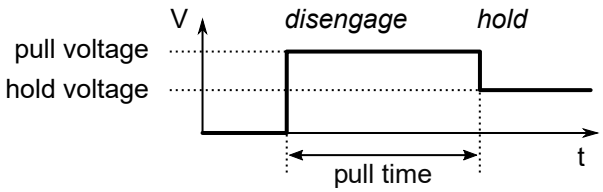
Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Difference of Ld and Lq inductance	0x2003:6	UDINT	32			0	µH	readwrite	

A difference of Ld and Lq (Ld-Lq) is required if the user enables the Maximum Torque Per Ampere (MTPA) feature to control the motor.

0x2004 Brake options

Provides options for operating a brake. A brake is spring-activated such that it engages when powered off for safety. It must be disengaged by applying current to a solenoid to be released.

A disengage Pull voltage can be applied to the solenoid to disengage the brake quickly for the duration of the Pull time. After the pull time, a holding voltage is applied to keep the pin retracted.



Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Pull voltage	0x2004:1	UDINT	32			0	mV	readwrite	

Voltage required to disengage the brake. It is ignored in manual mode.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Hold voltage	0x2004:2	UDINT	32			0	mV	readwrite	

Voltage required to hold the brake in a disengaged state. This voltage may be set lower than the "Pull voltage" to reduce losses in the brake. CAUTION! Before setting this parameter, contact your brake manufacturer to ensure reliable operation. It is ignored in manual mode.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Pull time	0x2004:3	UINT	16			0	ms	readwrite	

Time period in which `0x2004:3 Pull voltage` is applied to release the brake. It is ignored in manual mode.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Release strategy	0x2004:4	USINT	8	Manual output voltage	0		readwrite	
				Clutch-style brake control	1			
				Pin brake control	2			

Sets the method used to control the brake. The options are:

> `Manual output voltage` (0) - Manually control the brake with output voltage.
> `Clutch-style brake control` (1) - For brakes that will disengage even if a load is applied to them.
> `Pin brake control` (2) - For brakes that require extra motion handling to ensure they release.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Controller disable delay	0x2004:5	UINT	16			100	ms	readwrite	

Time from when the brake is commanded to engage, to when the controller is disabled. It is ignored in manual mode.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
DC bus voltage (deprecated)	0x2004:6	UINT	16			0	V	readonly (default)	

Deprecated. Refer to `0x6079 DC link circuit voltage` instead.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Brake status	0x2004:7	USINT	8	Not configured	0		readwrite	
				Engaged	1			
				Disengaged	2			

Reports the status of the brake. Can also control the brake in automatic mode (Pin brake or Clutch brake)*

The options for controlling or reading this value are:

`Not configured` (0) - No action will be taken for the brake
`Engaged` (1) - The brake will prevent motion (Output voltage disabled in manual mode)
`Disengaged` (2) - The brake will not prevent motion (Output voltage applied to 4th phase in manual mode)

* In Manual Mode, output voltage is controlled by bit 0 of `Digital Output Object (0x60FE)`

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Minimum displacement (pin brake)	0x2004:8	UDINT	32	0	2147483647	0	Inc	readwrite	

Minimum angle that the motor needs to turn in before it is certain that the brake pin is pulled out. The units are in commutation sensor increments.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Percentage of Rated Current (pin brake)	0x2004:9	UINT	16	0	65535	100		readwrite	

Defines the amount of current to be applied during the Pin brake release. Specify this value in percent of rated current.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Output voltage	0x2004:10	UINT	16			0	mV	readwrite	Receive PDO (Outputs)

Voltage which is applied on the 4th phase when the Release strategy is set to manual mode (0) and Physical output bit 0 as well as corresponding Bit mask in object `0x60FE` is set to 1.

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Switching frequency	0x2004:11	USINT	8	16 kHz 0 32 kHz 1 64 kHz 2		readwrite	Receive PDO (Outputs)

Select the switching frequency for the 4th phase (D).

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping
Initial movement direction (pin brake)	0x2004:12	SINT	8	Positive 1 Negative -1		readwrite	

0x2005 Homing Options

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Home Position	0x2005:1	DINT	32			0	Inc	readonly (default)	

Home Position (Encoder position at home), from which axis is referenced. The units are user-defined (increments of the position encoder by default; see `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping
Restore Home Position when loading configuration	0x2005:2	USINT	8	NO 0 YES 1		readwrite	

Value	Definition
0	**No** - Home Position will not be persistent after a power-cycle, the user would need to home again.
1	**Yes** - Home Position will be persistent after a power-cycle, the axis will be referenced with the home position saved in config.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Torque Threshold for Homing on end stop	0x2005:3	UINT	16	0		0		readwrite	

Absolute value of the torque threshold (in ‰ of rated torque) at which the controller will consider that the end stop has been met. Used for methods -1 to -4.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Offset From Endstop	0x2005:4	UINT	16			0	Inc	readwrite	

Absolute position value from Endstop where the axis needs to be homed. Used with methods -3 and -4. The units are user-defined (increments of the position encoder by default; see `0x6092 Feed constant` to change it).

0x2006 Protection

Provides user-defined values for setting protection thresholds. If the measured value of one of these parameters exceeds the threshold, the drive will issue an error and halt the drive.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Undervoltage setpoint	0x2006:1	DINT	32			0	V	readwrite	

This parameter allows to set a user-specific undervoltage limit for the DC-Link voltage of the drive (0x6079: DC link circuit voltage).

A value of 0 or a negative value disables the user-specific overvoltage protection.

Even when disabled, the drive remains protected by the manufacturer-specific undervoltage setpoint, which is always active to ensure safety.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Overvoltage setpoint	0x2006:2	DINT	32			2147483647	V	readwrite	

This parameter allows to set a user-specific overvoltage limit for the DC-Link voltage of the drive (0x6079: DC link circuit voltage).

A value of 2147483647 disables the user-specific overvoltage protection.

Even when disabled, the drive remains protected by the manufacturer-specific overvoltage setpoint, which is always active to ensure safety.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Overcurrent setpoint	0x2006:3	DINT	32			2147483647	mA	readwrite	

This parameter allows to set a user-specific overcurrent limit for the motor phases of the drive. The current value is specified as peak current, not RMS.

A value of 2147483647 disables the user-specific overcurrent protection.

Even when disabled, the drive remains protected by the manufacturer-specific overcurrent setpoint, which is always active to ensure safety.

0x2008 Cogging torque compensation

Cogging compensation is a software feature that suppresses torque ripple of electric motors to overcome vibration problems in precision applications. When cogging compensation is activated, an additional torque component is generated actively by the motor in order to compensate the cogging torque. To find the amount of compensation torque needed at each motor position, a recording procedure has to be performed before the compensation itself can be used. This object is used for reporting the state of the motor cogging data and enabling or disabling the cogging compensation feature.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
State	0x2008:1	INT	16	NO DATA	0		readonly (default)	
				IN PROGRESS	1			
				SAVING	2			
				DATA EXISTS	3			

State of the cogging compensation procedure and data.

Possible values:

`NO DATA` (0) - No cogging data has been stored. Use the Cogging Recording opmode to record new data.
`IN PROGRESS` (1) - Recording of the cogging data is in progress.
`SAVING` (2) - Recording is done and the data is being saved to memory.
`DATA EXISTS` (3) - Cogging data has been loaded from memory. Use the Enabled subfield to enable the data for cogging compensation.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Enabled	0x2008:2	INT	16	Disabled	0		readwrite	
				Enabled	1			

Enables or disables the cogging compensation feature.

0x2009 Commutation offset

Used for reporting the state of the commutation offset.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
State	0x2009:1	INT	16	OFFSET INVALID	0		readwrite	
				IN PROGRESS	1			
				OFFSET VALID	2			

This subitem shows the state of the commutation offset. A new offset can be found by entering the Commutation Offset Detection opmode.

`OFFSET INVALID` (0) - Offset detection needs to be executed before using the torque controller.
`IN PROGRESS` (1) - Commutation Sensor Offset Detection is currently in progress.
`OFFSET VALID` (2) - The offset has been found and is valid. The torque controller can now be used.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Applied percent of rated torque	0x2009:2	INT	16	0	100	100		readwrite	

Defines the percentage of rated current that is applied during the following procedures:

- Index search for relative encoders with index (Incremental encoder and SinCos encoder).
- OS Command 4: Motor phase order detection.
- OS Command 5: Commutation offset measurement.
- OS Command 7: Pole pair detection.
- OS Command 8: Phase resistance measurement.
- OS Command 9: Phase inductance measurement.
- OS Command 10: Torque constant measurement.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Measurement method	0x2009:3	SINT	8	0	2	0		readwrite	

Used method for measurement of commutation angle offset

Default value is 0. This method (method-0) does not need any tuning, it might rotate the motor up to 100% of a pole-pare range during phasing procedure.

If 1 is selected, method-1 will be executed to find the proper value of commutation angle offset. Before using method-1 the following steps should be completed:

> Proper value of "phase inverted" parameter should be updated in the software.
>
> PID parameters of phasing controller should be tuned. A well tuned phasing controller will result in no visible movement during offset detection procedure.
>
> WARNING: If not tuned, the default values of "phasing controller" do not guarantee a stable situation. Before using "offset detection method 1" tune its "phasing controller" for your mechanical load. If you want to tune "phasing controller" of "offset detection method 1" make sure that your motor can freely rotate at high speeds (recommendation: start tuning by setting kp = 1, ki = 1, and kd = 0).

If 2 is selected, method-2 will be executed to find the proper value of commutation angle offset. Regarding method 2 the following points should be considered:

> Method 2 does not need any movement on motor shaft
>
> The reliability of method 2 is a function of motor design structure. As a result, for high reliability applications it is always recommended to use method 0 or method 1.
>
> If Method 2 is selected, and commutation sensor has an index, then at startup the Drive uses method 2 to find a temporary offset. Once the index is found, this temporary offset will be replaced by the offset which is saved in object dictionary.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Phasing controller Kp	0x2009:4	REAL	32	0		0		readwrite	

Proportional constant Kp in PID phasing controller. This controller is used to hold the position during offset detection procedure.

WARNING: If not tuned, the default values of "phasing controller" do not guarantee a stable situation. Before using "offset detection method 1" tune its "phasing controller" for your mechanical load. If you want to tune "phasing controller" of "offset detection method 1" make sure that your motor can freely rotate at high speeds (recommendation: start tuning by setting kp = 1, ki = 1, and kd = 0).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Phasing controller Ki	0x2009:5	REAL	32	0		0		readwrite	

Integral constant Ki in PID phasing controller. This controller is used to hold the position during offset detection procedure.

WARNING: If not tuned, the default values of "phasing controller" do not guarantee a stable situation. Before using "offset detection method 1" tune its "phasing controller" for your mechanical load. If you want to tune "phasing controller" of "offset detection method 1" make sure that your motor can freely rotate at high speeds (recommendation: start tuning by setting kp = 1, ki = 1, and kd = 0).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Phasing controller Kd	0x2009:6	REAL	32	0		0		readwrite	

Derivative constant Kd in PID phasing controller. This controller is used to hold the position during offset detection procedure.

WARNING: If not tuned, the default values of "phasing controller" do not guarantee a stable situation. Before using "offset detection method 1" tune its "phasing controller" for your mechanical load. If you want to tune "phasing controller" of "offset detection method 1" make sure that your motor can freely rotate at high speeds (recommendation: start tuning by setting kp = 1, ki = 1, and kd = 0).

0x200A I2t and Stall protection

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Enabled	0x200A:1	USINT	8	Disabled	0		readwrite	
				Current Limit	1			
				Error Reaction	2			
				Current Limit (compatibility)	3			
				Error Reaction (compatibility)	4			

Enables and selects different modes of motor I2t protection. Options 3 and 4 are added in order to keep the compatibility with older versions of the firmware. Note that there is a change of drive's behavior for options 3 and 4, when comparing older and v5.3 version of the firmware. If a user had selected option 3 with older version of the firmware, the drive wouldn't have I2t protection enabled, while in the v5.3 I2t protection will be active. The same goes for the option 4.

Enabled Mode	Description	Reaction
[0] Motor I2T disabled	Motor I2T disabled, and will not lead to any reaction in case of winding overheat.	None
[1] Motor I2T limitation	Motor I2T will be enabled and will limit winding currents in case of motor winding overheat.	Current limit
[2] Motor I2T protection	Motor I2T will be enabled and will trigger error in case of motor winding overheat.	Error
[3] Motor I2T limitation. Added for compatibility with older versions.	The same as option 1.	Current limit
[4] Motor I2T protection. Added for compatibility with older versions.	The same as option 2.	Error

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Peak time	0x200A:2	UDINT	32		3600000	3000	ms	readwrite	

This field determines how long the motor can operate while peak rms current is flowing in its windings. This time should be determined by motor manufacturer.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Motor heat index	0x200A:3	USINT	8	200		readonly (default)

This is an index of motor's "over-heat" status. It changes between 0 and 200. At 0%, the motor is not overheated. When this value reaches 100% the motor is at its maximum allowed overheat conditions, and if motor I2t protection is enabled, the maximum rms current will be limited. This limitation will be removed when the percentage drops to 50% or less.

This object value is updated with the motor heat index only when motor i2t protection is enabled.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Protection active	0x200A:4	BOOL	1					readonly (default)	

As long as it is 0, i2t or stall protection is not enforcing any limit on maximum rms current of your motor or output current of the inverter. Once it is 1 it means that i2t algorithm is limiting the "maximum rms currents" of your motor or the output current of the drive's inverter. In case of motor overheating I2t protection limits the current to half of rated RMS value of motor phase current. To avoid overheating windings in stall conditions, if the fundamental frequency of motor phase current is less than 10 Hz, the RMS value of motor phase current will be considered as its instantanous absolute value.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Motor winding type	0x200A:5	USINT	8	Concentrated winding	0		readwrite	
				Distributed winding	1			

In a **"concentrated winding"** topology, all the turns of a given winding phase are grouped within a single stator slot.

In a **"distributed winding"** topology, the windings of all three phases (U, V, and W) are distributed across multiple stator slots.

If you are unsure about your motor winding configuration, leave this section set to **"concentrated winding"**.

By default, **concentrated winding** is selected for this object.

0x200B Max power

This object is a limit on maximum mechanical power on motor shaft. Wrong settings of "motor torque constant", "position sensor configurations" or "number of motor pole-pairs" can lead to misbehavior of power limitation

feature. By default the power of each Drive is internally limited to 110% of its Maximum Peak Output Power value. As a result, this object will only be effective if its value is less than 110% of the drive's Maximum Peak Output Power.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Max power	0x200B:0	UDINT	32	1	2147483647	2147483647	W	readwrite	

0x200C Overspeed protection limit

Unit is percentage of the Max. motor speed 0x6080. The resulting overspeed protection limit is set to Max. motor speed * (1 + Overspeed protection limit / 100). When the actual velocity exceeds the limit, drive will disable and report the error.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Overspeed protection limit	0x200C:0	USINT	8	0		20		readwrite	

0x200D System polarity

This object allows to adjust system polarity, determining the direction assigned to movement references. Motion in a given direction will be either positive or negative based on the selected value.

System polarity affects all Modes of operation, enabling to reverse the torque, velocity, and position direction without changing the hardware.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
System polarity	0x200D:0	USINT	8	Normal polarity	0		readwrite	
				Inverted polarity	1			

0x200E Logging

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

State	0x200E:1	USINT	8	Disabled 0 Enabled 1	readwrite

This object allows enabling or disabling the logging functionality of the drive.

Note: Enabling logging can lead to flash memory wear if the master continuously triggers events that are logged to the filesystem.

Even when logging is disabled, some bootloader versions might still log certain events when in BOOT or INIT.

When logging is enabled and the drive is in EtherCAT states PREOP, SAFEOP, or OP, the following events are logged:

- When the motion drive firmware boots (i.e., transition from INIT to PREOP).
- When a new error occurs (bit 3 of the Statusword). Errors are latched and logged only once until cleared using the Fault Reset bit (bit 7) of the Controlword.
- When an error is reset using the Fault Reset bit (bit 7) of the Controlword.
- When a new warning is raised (bit 7 of the Statusword). Warnings are latched for 1 second.
- When a warning is cleared (i.e., it hasn't reoccurred during the 1-second latch period).
- When the CiA402 state changes.
- When the drive is in Operation Enabled state and the operational mode is changed.
- Each time STO (Safe Torque Off) or the Safe state becomes active or inactive.
- Other rare events, such as log timestamp rollover or log file rotation (e.g., when logging_curr.log is renamed to logging_prev.log).

0x2010 Torque controller

The task of the torque controller is to make sure that the torque currently produced by the motor corresponds to the desired torque. The torque control loop is executed at a frequency of 16 kHz.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Controller Kp (disabled)	0x2010:1	REAL	32	0		1159479296		readwrite	

In the case of using predictive controllers for current loop the unit is undefined, and the default value is 2500. Moreover, Increasing this parameter directly amplifies the amplitude of applied voltages, and as a result has an effect similar to Kp in the case of using a PID controller.

Range of this torque controller gain is 0 to 100,000,000.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Controller Ki (disabled)	0x2010:2	REAL	32	0		1193033728		readwrite

The unit of this gain is 0.16 [uV/(Second * Amp_rms)]. The default value is 40000. Range of this torque controller gain is 0 to 100,000,000.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Controller Kd (disabled)	0x2010:3	REAL	32	0				readwrite	

This parameter is undefined for predictive current controller.

Range of this torque controller gain is 0 to 100,000,000.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Field weakening enabled	0x2010:4	UDINT	32	Disabled	0		readwrite	
				Enabled	1			

In many applications, it is required to extend the velocity range of an electric motor.

This parameter enables or disables “Field Weakening”, a feature that increases the speed range of a PM motor by weakening the magnetic field of the rotor linearly over the speed range.

The user should set 3 parameters:

1. Field Weakening Starting Speed (Subitem 6)

2. Field Weakening Ending Speed (Subitem7)

3. Percentage of Field Weakening (f) (Subitem 5)

Note:

While the field weakening feature is enabled, it is assumed that the Drive is in its normal conditions with no fault.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Field weakening percentage	0x2010:5	UDINT	32	0	200	0		readwrite	

Percentage of Field weakening. This field can have an integer value in the range of [0-200], and determines the "RMS" value of phase currents which are (only) generated to weaken the field. For example, if set to 10, then 10% of rated current will be injected in motor phases to weaken the rotor field. WARNING: Based on motor type, values more than 25% can lead to instability of torque controller. While tuning, proceed with small steps, limited power supply voltage and limited power supply current.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Field weakening starting speed (deprecated)	0x2010:6	UDINT	32	0	50000000	0	rpm	readwrite	

Field weakening is increased linearly from 0% (at starting speed point) to its final value (at ending speed point). The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Field weakening ending speed (deprecated)	0x2010:7	UDINT	32	0	50000000	0	rpm	readwrite	

Field weakening is increased linearly from 0% (at starting speed point) to its final value (at ending speed point). The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Commutation angle measurement delay	0x2010:8	UDINT	32			0	µs	readwrite	

Time taken by the sensor in reading the position value. An offset angle corresponding to this sensor measurement delay is calculated by the firmware as shown by the equation below.

$$\text{Sensor Delay Angle Offset} = \text{Electrical Rotational Speed} \times \text{Sensor Measurement Delay}$$

This angle offset value is then added into the sampled electrical angle.

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Switching frequency	0x2010:9	USINT	8	16 kHz 0 32 kHz 1 64 kHz 2 Automatic 3		readwrite	Receive PDO (Outputs)

Select the switching frequency for the 3 motor phases (A, B, C). If the option Automatic is selected, the firmware will use an adaptive algorithm in order to determine the correct switching frequency.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Settling time	0x2010:10	UINT	16	100	10000	2000	µs	readwrite	

Settling time of current loop controllers. This value should be entered in [micro seconds]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Damping ratio	0x2010:11	UINT	16	100	10000	2000		readwrite	

Damping ratio of current loop controllers. This value should be entered in [per mill]. As an example, if a damping ratio of 1.5 is required, then this value should be set to 1500.

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping
Encoder source	0x2010:12	USINT	8	No encoder 0 Encoder 1 1 Encoder 2 2		readwrite	

Select which encoder should be used for torque control. Must be mounted to the motor shaft. Used for commutation.

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Virtual Braking Chopper Enabled	0x2010:13	USINT	8	Disabled 0 Enabled 1			readwrite	

This parameter enables the virtual braking chopper and uses the motor to burn the excess energy in the event of regeneration.

The user should set 2 parameters:

1. Voltage Level

2. Gain

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Virtual Braking Chopper Gain	0x2010:14	UDINT	32	0	40000000	0		readwrite	

The gain value determines how fast the Excess DC link energy can be burned in the motor.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Virtual Braking Chopper Voltage Level	0x2010:15	UDINT	32	0	2147483647	0	mV	readwrite	

The voltage level of the DC link above which the drive starts burning energy in the motor and tries to maintain the voltage at this level.

This voltage level must be set to greater than the normal operating voltage.

The feature will be deactivated if the voltage level is at 0.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
MTPA Enabled	0x2010:16	USINT	8	Disabled	0		readwrite	
				Enabled	1			

Enable the MTPA algorithm for torque control. The value of Ld-Lq needs to be configured for this feature to work properly.

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping
Virtual Braking Chopper Notification Level	0x2010:17	USINT	8	Disable Notification 0 Enable Warning Report 1 Enable Error Report 2		readwrite	

Enable warning or error report, when virtual braking chopper is active.

By default, warning report is enabled.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Active short circuit duration time	0x2010:18	UDINT	32	1	2500	1000	ms	readwrite	

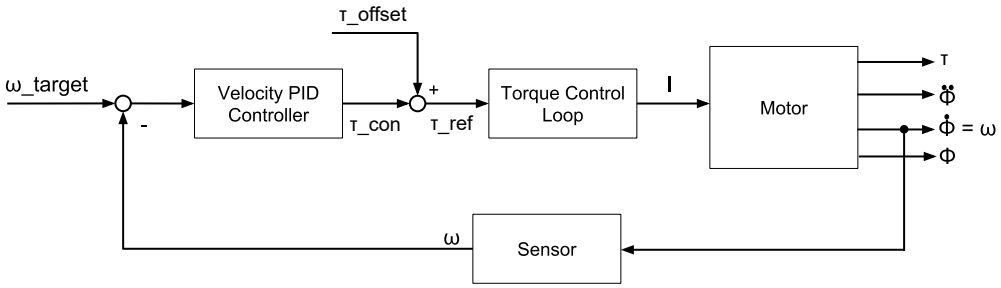
This object specifies the time frame during which the short-circuit feature remains active. If the option 'Transit into active short circuit and then into switch-on disabled' (value 9) is selected for the quick stop option code (0x605A), the control disable is performed using the active short-circuit feature and remains active until the specified duration elapses. The default value for this object is 1000 ms. After this time, brake engages.

0x2011 Velocity controller

Velocity PID Tuning (objects 2011:1...2011:4)

IMPORTANT: These values are only used in velocity control mode (not in cascaded position control)

Controller Structure



PID Parameter Range

The constants K_p, K_i, and K_d should be between 0 and 10 with the precision of 6-digit floating point. To find the proper values of PID constants of velocity controller the following steps are recommended:

Recommended Tuning Steps

- Step 1. Check if all constants K_p, K_i, and K_d are set to 0. After that activate the velocity controller. By default, the integral limit of velocity controller should be set to the maximum torque of selected motor in [mNm].
- Step 2. Set the reference velocity to 50% of rated motor velocity [rpm].
- Step 3. Increase K_p until the measured speed is around 70% of the reference speed. As a suggestion start with K_p equal to 0.1, and in each step increase K_p with a factor of 2.
- Step 4. From this step forth, step response of the system should be checked. Increase K_i step by step to increase the speed of velocity controller (as a suggestion start with K_i equal to 0.01 and in each step increase it by a factor of 2). At this point, the parameters K_p and K_i of the velocity controller are tuned. The parameter K_d of the velocity controller can be kept at its default value (0).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Controller Kp	0x2011:1	REAL	32	0	1199570688			readwrite	Receive PDO (Outputs)

The P-gain of the PID Velocity Control Loop [mNm/rpm].

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Controller Ki	0x2011:2	REAL	32	0	1199570688			readwrite	Receive PDO (Outputs)

The I-gain of the PID Velocity Control Loop [mNm/(rpm*s)]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Controller Kd	0x2011:3	REAL	32	0	1199570688			readwrite	Receive PDO (Outputs)

The D-gain of the PID Velocity Control Loop [rpm*s/inc]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Controller integral limit	0x2011:4	UDINT	32	0		0	mNm	readwrite	Receive PDO (Outputs)

Integrator limitation for anti-windup. Technique used is clamping and it prevents the integral term from accumulating above or below pre-determined bounds. Initially set to MAX (2,147,483,647 --> Integral limit DEACTIVATED), please set the maximal values for your integral limit manually.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Encoder source	0x2011:5	USINT	8	No encoder	0		readwrite	
				Encoder 1	1			
				Encoder 2	2			

Select which encoder should be used for velocity control.

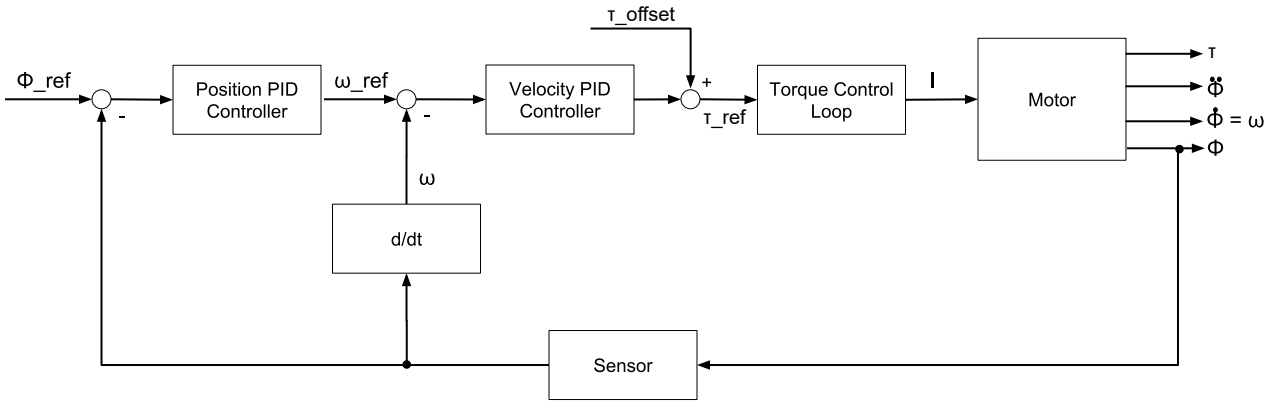
0x2012 Position controller

Parameter Tuning Guide for Position Controller with Cascaded Structure

Introduction

The cascaded control structure is the standard position control structure for SOMANET Drives. Its controller gains can be automatically set by the auto-tuning process, the results will be stored in the objects 2012:1 ... 2012:8. If auto-tuning is not applicable or manual modifications are necessary, the gains can be set manually. In the following, a procedure to do so is described. If a simple PID position controller is selected instead of the cascaded PID position controller, its gains are defined by the objects 2012:1 ... 2012:4.

Control Basics



Control Basics

Cascaded controller is usually used in PI-P form, i.e. inner loop (velocity control loop) is only using the proportional part of its PID controller and the outer loop (position controlling loop) is only using its proportional and integral part. The other form is P-PI form, i.e. inner loop is using proportional and integral part and outer loop uses only proportional part. The inner velocity control loop is responsible for calculating the torque reference. As a result the

integral limit of the velocity controller should be set to the maximum torque of your torque actuator. Moreover, the outer position control loop is responsible for controlling the reference velocity, and consequently its integral limit should be set to the maximum velocity of your system.

Tuning Concept in Brief

For tuning the cascaded structure, we should first focus on the inner (velocity) loop. As it is the inner controlling loop, it should be faster than the outer position loop. However, if all parameters of the outer position controller are set to 0, the inner loop will be disconnected from the user position commands. As a result, we can increase the K_p of both position and velocity controllers with a ratio of 10 (K_p_velocity` = 10 * K_p_position`). Once the real position started to follow the reference position, we can stop increasing the K_p_position, and only focus on increasing K_p_velocity. At this stage, we can increase (sharpen) the velocity controller as much as possible. As a rule of thumb, increase K_p_velocity until you get close to the instability margin (at this margin, you will feel a vibration effect and some acoustic noise which is caused by controller sharpness). Now, you can reduce K_p_velocity to 90% of its value to increase the stability margin, and remove vibration noise. Once the velocity controller (the inner controlling loop) is tuned, it is time to tune the position controller (the outer controlling loop). To tune the position controller loop, we should start with the P part of its PID controller. Increase K_p_position until the entire position control gets close to instability margin. At this state, you will feel a vibration (or acoustic noise) which is because of too sharpened position control. At this step, reduce K_p_position to its 90% to increase the stability margin and remove the vibration/acoustic noise. So far, the proportional parts of both inner velocity loop and outer position loop are tuned, and we can focus on integrator part of the outer position or inner velocity loop (depends on chosen structure of controller). Increasing the integrator constant will remove the steady state error, but at the same time, it adds some overshoot at step responses. As a rule of thumb, you can increase K_i step by step until the following two conditions are met at the same time:

- the steady-state error is eliminated in a short enough period of time
- the overshoot is in its acceptable range

In the following section, the explained tuning concept is divided in separate systematic steps.

Tuning Steps

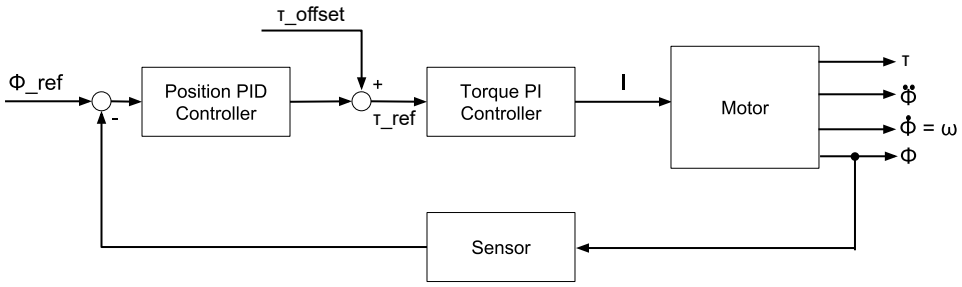
- Step 1. Set the PID constants of both controllers equal to 0. By default, the integral limit of the velocity controller should be set to motor maximum torque and the integral limit of position controller should be set to motor maximum velocity. **From this step forth, the step response of position controller should always be evaluated.**
- Step 2. In this step, the K_p constant of the velocity controller should be tuned. Increase the K_p of both position and velocity controllers with a ratio of 10 (K_p_velocity = 10 * K_p_position). Once the real position starts to follow the reference position, stop increasing the K_p_position and only focus on increasing the K_p_velocity. Increase (sharpen) the velocity controller as much as possible. As a rule of thumb, increase K_p_velocity until you get close to the instability margin (at this margin, you will feel a vibration effect and some acoustic noise which is because of controller sharpness). Now, you can reduce K_p_velocity to 90% of its value to increase the stability margin, and remove vibration noise.
- Step 3. Now that the velocity controller is tuned, it is time to tune the parameters of the PID position controller. Start with K_p_position, and increase it until you again get close to the instability margin, and then reduce K_p_position` to its 90%. So far, the proportional parts of both inner velocity loop and outer position loop are tuned.
- Step 4. In this step, increase K_i to eliminate the steady state error. As a suggestion start with K_i equal to 0.01, and in each step, increase it with a factor of 2. Increase K_i step by step until the following two conditions are met at the same time:

- the steady-state error is eliminated in a short enough period of time
- the overshoot is in its acceptable range

Parameter Tuning Guide for Position Controller with simple PID Structure (objects 2012:1...2012:4 only)

The Position Controller with Cascaded Structure is generally preferable over the simple PID controller. Apart from academic purposes, there are few reasons to use the simple PID controller.

Control Structure



Tuning Concept for Simple PID Controller

To tune the position controller loop, we should start with the P part of its PID controller. Increase K_p_position until the entire position control gets close to instability margin. At this state, you will feel a vibration (or acoustic noise) which is because of a position control that has been sharpened too much. At this step, reduce K_p_position to its 90% to increase the stability margin and remove the vibration/acoustic noise. Now increase K_i to eliminate the steady state error. As a suggestion start with K_i equal to 0.01, and in each step, increase it with a factor of 2. Increase K_i step by step until the following two conditions are met at the same time:

- the steady-state error is eliminated in a short enough period of time
- the overshoot is in its acceptable range

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Position loop Kp	0x2012:1	REAL	32	0	1199570688			readwrite	Receive PDO (Outputs)

The P-gain of the PID Position Control Loop. The value is given in [rpm/inc] for the cascaded position controller ([mNm/inc] for the simple PID position controller)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Position loop Ki	0x2012:2	REAL	32	0	1199570688			readwrite	Receive PDO (Outputs)

The I-gain of the PID Position Control Loop. The value is given in [rpm/(inc*s)] for the cascaded position controller ([mNm/(inc*s)] for the simple PID position controller)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Position loop Kd	0x2012:3	REAL	32	0	1199570688			readwrite	Receive PDO (Outputs)

The D-gain of the Position Control Loop [rpm*s/(inc)] for the cascaded position controller ([mNm*s/(inc)] for the simple PID position controller)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Position loop integral limit	0x2012:4	UDINT	32	0		0	rpm	readwrite	Receive PDO (Outputs)

Integrator limitation for anti-windup. Technique used is clamping and it prevents the integral term from accumulating above or below pre-determined bounds. Initially set to MAX (2,147,483,647 --> Integral limit DEACTIVATED), please set the maximal values for your integral limit manually. Limit should always be set in the driving shaft units, especially important, when the gear box is used in the setup. The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it). If only position controller, simple PID, is used, the unit is given in mNm.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity loop Kp	0x2012:5	REAL	32	0	1199570688			readwrite	Receive PDO (Outputs)

The P-gain of the PID Velocity Loop Controller [mNm/rpm]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity loop Ki	0x2012:6	REAL	32	0	1199570688			readwrite	Receive PDO (Outputs)

The I-gain of the PID Velocity Controller [mNm/(rpm*s)]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity loop Kd	0x2012:7	REAL	32	0	1199570688			readwrite	Receive PDO (Outputs)

The D-gain of the PID Velocity Loop Controller [mNm*s/rpm]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity loop integral limit	0x2012:8	UDINT	32	0		0	mNm	readwrite	Receive PDO (Outputs)

Integrator limitation for anti-windup. Technique used is clamping and it prevents the integral term from accumulating above or below pre-determined bounds. Initially set to MAX (2,147,483,647 --> Integral limit DEACTIVATED), please set the maximal values for your integral limit manually.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Encoder source	0x2012:9	USINT	8	No encoder	0		readwrite	
				Encoder 1	1			
				Encoder 2	2			

Select which encoder should be used for position control.

0x2013 Gain scheduling

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Enabled	0x2013:1	BOOL	1	Disabled	0		readwrite	
				Enabled	1			

Enables or disables the gain scheduling feature.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Threshold velocity 0	0x2013:2	UDINT	32	0		0	rpm	readwrite	

Velocity that determines the lower threshold. Underneath this value, controller gains set 0 is used. Beyond it, linear interpolation begins. The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Position loop Kp 0	0x2013:3	REAL	32	0	1199570688			readwrite	

The P-gain of the Position Control Loop of area 0 (low velocity, below threshold velocity 0) [rpm/inc]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Position loop Ki 0	0x2013:4	REAL	32	0	1199570688			readwrite	

The I-gain of the Position Control Loop of area 0 (low velocity, below threshold velocity 0) [rpm/(inc*s)]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Position loop Kd 0	0x2013:5	REAL	32	0	1199570688			readwrite	

The D-gain of the Position Control Loop of area 0 (low velocity, below threshold velocity 0) [rpm*s/inc]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Position loop integral limit 0	0x2013:6	UDINT	32	0		0	rpm	readwrite	

The integrator limit of the Position Control Loop of area 0 (low velocity, below threshold velocity 0). Technique used for preventing the windup is clamping and it prevents the integral term from accumulating above or below pre-determined bounds. Limit should always be set in the driving shaft units, especially important, when the gear box is used in the setup. The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it). If only position controller, simple PID, is used, the unit is given in mNm.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity loop Kp 0	0x2013:7	REAL	32	0	1199570688			readwrite	

The P-gain of the Velocity Control Loop of area 0 (low velocity, below threshold velocity 0) [mNm/rpm]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity loop Ki 0	0x2013:8	REAL	32	0	1199570688			readwrite	

The I-gain of the Velocity Control Loop of area 0 (low velocity, below threshold velocity 0) [mNm/(rpm*s)]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity loop Kd 0	0x2013:9	REAL	32	0	1199570688			readwrite	

The D-gain of the Velocity Control Loop of area 0 (low velocity, below threshold velocity 0) [rpm*s/inc]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity loop integral limit 0	0x2013:10	UDINT	32	0		0	mNm	readwrite	

The integrator limit of the Velocity Control Loop of area 0 (low velocity, below threshold velocity 0). Technique used for preventing the windup is clamping and it prevents the integral term from accumulating above or below pre-determined bounds.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Threshold velocity 1	0x2013:11	UDINT	32	0		0	rpm	readwrite	

Velocity that determines the upper threshold. Above this value, controller gains set 1 is used. Up to this velocity linear interpolation is performed. The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Position loop Kp 1	0x2013:12	REAL	32	0	1199570688			readwrite	

The P-gain of the Position Control Loop of area 1 (high velocity, above threshold velocity 1) [rpm/inc]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Position loop Ki 1	0x2013:13	REAL	32	0	1199570688			readwrite

The I-gain of the Position Control Loop of area 1 (high velocity, above threshold velocity 1) [rpm/(inc*s)]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Position loop Kd 1	0x2013:14	REAL	32	0	1199570688			readwrite	

The D-gain of the Position Control Loop of area 1 (high velocity, above threshold velocity 1) [rpm*s/inc]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Position loop integral limit 1	0x2013:15	UDINT	32	0		0	rpm	readwrite	

The integrator limit of the Position Control Loop of area 1 (high velocity, above threshold velocity 1). Technique used for preventing the windup is clamping and it prevents the integral term from accumulating above or below pre-determined bounds. Limit should always be set in the driving shaft units, especially important, when the gear box is used in the setup. The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it). If only position controller, simple PID, is used, the unit is given in mNm.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity loop Kp 1	0x2013:16	REAL	32	0	1199570688			readwrite	

The P-gain of the Velocity Control Loop of area 1 (high velocity, above threshold velocity 1) [mNm/rpm]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity loop Ki 1	0x2013:17	REAL	32	0	1199570688			readwrite	

The I-gain of the Velocity Control Loop of area 1 (high velocity, above threshold velocity 1) [mNm/(rpm*s)]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity loop Kd 1	0x2013:18	REAL	32	0	1199570688			readwrite	

The D-gain of the Velocity Control Loop of area 1 (high velocity, above threshold velocity 1) [rpm*s/inc]

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity loop integral limit 1	0x2013:19	UDINT	32	0		0	mNm	readwrite	

The integrator limit of the Velocity Control Loop of area 1 (high velocity, above threshold velocity 1). Technique used for preventing the windup is clamping and it prevents the integral term from accumulating above or below pre-determined bounds.

0x2014 Torque window

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Value	0x2014:1	UINT	16			65535		readwrite	

This object shall indicate the configured symmetrical range of accepted torque values relative to the target torque. If the actual torque is within the torque window, target torque shall be regarded as having been reached. The value shall be given per thousand of rated torque. If the value of the torque window is 0xFFFF, torque window monitoring will be switched off.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Time	0x2014:2	UINT	16			0	ms	readwrite	

This object shall indicate the configured time, during which the actual torque within the torque window is measured. The value shall be given in ms.

0x2015 Velocity feed forward

Velocity feed-forward takes the derivative of the target position and filters the result by using the 1st order low pass filter. The output of the filter is then multiplied by the configured gain.

The end result is added as an additional input to the velocity controller in cascaded position control mode.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Gain	0x2015:1	INT	16	0	5000	0		readwrite	

Setting the gain to 0 disables the feedforward feature. Any other value configures the end gain and enables the feature. The value is given in per-mil percent of estimated velocity.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Cutoff frequency	0x2015:2	UINT	16	5	2000	20	Hz	readwrite	

Cutoff frequency of the 1st order low pass filter that filters the calculated velocity.

0x2017 Following error option codes

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Position following error option code	0x2017:1	USINT	8	Raise Following error bit and stay in operational state	0		readwrite	
				Raise Following error bit, perform quick stop and enter a fault state	1			
				Raise Following error bit and immediately enter a fault state	2			

Configures drive's response in case of Position following error event.

Value	Definition
0	Drive will report Following error in statusword (bit 13) and stay in operational state
1	Drive will report Following error in statusword (bit 13), perform a quick stop and enter a fault state
2	Drive will report Following error in statusword (bit 13) and immediately enter a fault state

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping

Velocity following error option code	0x2017:2	USINT	8	Raise Following error bit and stay in operational state: 0 Raise Following error bit, perform quick stop and enter a fault state: 1 Raise Following error bit and immediately enter a fault state: 2		readwrite

Configures drive's response in case of Position following error event.

Value	Definition
0	Drive will report Following error in statusword (bit 13) and stay in operational state
1	Drive will report Following error in statusword (bit 13), perform a quick stop and enter a fault state
2	Drive will report Following error in statusword (bit 13) and immediately enter a fault state

0x2018 Velocity following error

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Window	0x2018:1	UINT	16			65535	rpm	readwrite	

The range of tolerated velocity values around the velocity demand value. If the velocity actual value is out of the following error window, a following error occurs. A following error may occur when a drive is blocked, an unreachable profile target is commanded, or when the controller is weakly tuned. The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it). If the value of the following error window is 0xFFFF, the following error monitoring will be switched off.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Time out	0x2018:2	UINT	16			100	ms	readwrite	

Configures the time to allow the controller to be outside the error window. After this timeout, bit 13 of the statusword will be set to 1. The units are in milliseconds.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Actual value	0x2018:3	DINT	32				rpm	readonly (default)	Transmit PDO (Inputs)

Provides the actual value of the velocity following error. . The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it).

0x2019 Total motor current

The measured total motor current in A_{rms}.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Total motor current	0x2019:0	INT	16			0		readonly (default)	Transmit PDO (Inputs)

0x2021 Velocity feedback filter

Measured velocity signal from the sensor can be filtered. There is only one type of filtering that the user can choose:
1st order low pass filter with formula G(s)=1/(1+sT), where T=1/(2*pi*f),
The filter is implemented in discrete domain using Euler's forward difference discretization method, i.e. s=1/T*(1-z^-1).

The filter is enabled by setting the filter type parameter to 1, and disabled by setting it to 0. Parameter cutoff frequency is set in [Hz].

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Type	0x2021:1	USINT	8	Disabled 0 1st order low pass 1			readwrite	

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Cutoff frequency	0x2021:2	UDINT	32	5	2000	500	Hz	readwrite	

0x2022 Position feedback filter

Measured position signal from the sensor can be filtered. There is only one type of filtering that the user can choose:
1st order low pass filter with formula G(s)=1/(1+sT), where T=1/(2*pi*f),
The filter is implemented in discrete domain using Euler's forward difference discretization method, i.e. s=1/T*(1-z^-1).

The filter is enabled by setting the filter type parameter to 1, and disabled by setting it to 0. Parameter cutoff frequency is set in [Hz].

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Type	0x2022:1	USINT	8	Disabled	0		readwrite	
				1st order low pass	1			

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Cutoff frequency	0x2022:2	UDINT	32	5	2000	1000	Hz	readwrite	

0x2023 Notch filter

Implemented as IIR 2nd order filter configured by the center frequency, the bandwidth and the notch depth. Filter is placed on the input of the torque controller so it filters the torque demand value. Frequency prewarping is applied.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping

Enabled	0x2023:1	BOOL	1	Disabled 0 Enabled 1			readwrite	

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Center frequency	0x2023:2	UINT	16	30	2000	1000	Hz	readwrite	

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Rejection band	0x2023:3	UINT	16	3	2000	10	Hz	readwrite	

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Depth	0x2023:4	UINT	16			10		readwrite	

Value of the gain at the center frequency. The unit is decibel (dB).

0x2027 Control input FIR filter

FIR filter (boxcar)
Depending on the mode of operation, this filter acts on the position or velocity demand values sent from the master. The sampling frequency is the same as the cycle time of the position controller (4 kHz). It can be used as an input profiler (or "shaper") to realize linear interpolation between successive commands (see documentation), or to limit the jerk of the profilers (see documentation). For masters operating at 1 kHz suggested filter order is 3.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Enabled	0x2027:1	BOOL	1	Disabled Enabled	0 1		readwrite	

Set to 1 to enable the control input FIR filter.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Order	0x2027:2	UINT	16	1	1023	31		readwrite	

The order of the FIR filter refers to the maximum number of delay elements used in the filter circuit. The order can be up to 1023 and is always rounded to the form of $2^N - 1$.

If the specified filter order is not already in the form of $2^N - 1$, it will be rounded up to the next valid value. For example, if an order of **512** is given, it'll round to **1023**

0x2030 Core temperature

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Measured temperature	0x2030:1	DINT	32				m°C	readonly (default)	Transmit PDO (Inputs)

Describes the temperature measured on the Core board.

0x2031 Drive temperature

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Measured temperature	0x2031:1	DINT	32				m°C	readonly (default)	Transmit PDO (Inputs)

Describes the temperature measured near the inverter.

0x2038 External scaled measurement

Feature that takes an analog input and transforms it to an output as defined by a 5th order polynomial.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Scaled measurement value	0x2038:1	REAL	32				1	readonly (default)	Transmit PDO (Inputs)

Scaled value of the selected analog input after applying the selected 5th order polynomial.

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Analog input	0x2038:2	USINT	8	Internal 0 Analog input 1 1 Analog input 2 2 Analog input 3 3 Analog input 4 4			readwrite

Select the scaled measurement source.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Resistance	0x2038:3	UDINT	32			0	Ω	readwrite	

This subindex is useful when the user wants to apply the polynomial to a resistance value (e.g. resistance-based temperature sensor). It allows to select the pull-up resistor connected to the selected analog input.

If the selected analog input doesn't have an internal pull-up resistor, this feature will assume that the user connected an external pull-up resistor of the specified value. Otherwise, the drive will use the internal pull-up resistor with the closest value to the one specified and will overwrite the subindex value with the exact value.

The user then connects the resistance they want to measure between the analog input and GND. This feature will measure the value of that resistance and input it to the polynomial.

If the user wants to apply the polynomial to the standard analog input value, a value of 0 should be selected for this subindex.

This subindex is set to 0 when a differential analog input is selected.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Constant a0	0x2038:4	REAL	32					readwrite	

Constant a0 of the polynomial (Offset)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Constant a1	0x2038:5	REAL	32					readwrite	

Constant a1 of the polynomial (1st order coefficient)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Constant a2	0x2038:6	REAL	32					readwrite	

Constant a2 of the polynomial (2nd order coefficient)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Constant a3	0x2038:7	REAL	32					readwrite	

Constant a3 of the polynomial (3rd order coefficient)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Constant a4	0x2038:8	REAL	32					readwrite	

Constant a4 of the polynomial (4th order coefficient)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Constant a5	0x2038:9	REAL	32					readwrite	

Constant a5 of the polynomial (5th order coefficient)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Cutoff frequency	0x2038:10	UINT	16	1	10000	500	Hz	readwrite	

Cutoff frequency (Hz) for the LP filter for external scaled analog measurements.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Upper error threshold	0x2038:11	REAL	32			1199570688		readwrite	

Upper error threshold for the external scaled measurements. When the scaled measurement value exceeds this threshold, a fault is generated. It is also used to generate a warning when the scaled measurement value is within 5% of the error threshold.

The default value corresponds to the equivalent int representation of the float value 65535.0

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Lower error threshold	0x2038:12	REAL	32			readwrite

Lower error threshold for the external scaled measurements. When the scaled measurement value goes lower than this threshold, a fault is generated. It is also used to generate a warning when the scaled measurement value is within 5% of the error threshold.

0x203F Error report

Provides further information about the error or warning reported by the `0x603F Error code` object.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Description	0x203F:1	STRING(8)	64			0		readonly (default)	Transmit or Receive PDO

The error report object displays information about a fault or warning that has occurred.

When a fault on the drive is reported, the drive switches into fault reaction active state, which issues a quick-stop, brings the drive to a halt, and then disables the power stage. Subsequent errors don't overwrite the existing error.

When a warning is reported, the state of the drive remains unchanged. A subsequent fault overwrites an existing warning.

0x2040 Input counter

Unsigned 32bit integer, resets after 4,294,967,295 (2^32 - 1) µs.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Input counter	0x2040:0	UDINT	32			0	Inc	readonly (default)	Transmit PDO (Inputs)

0x2041 Motor current

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Vector amplitude	0x2041:1	DINT	32		0	mA	readonly (default)	Transmit PDO (Inputs)

It represents the magnitude of the current vector in the motor control system. It is calculated as sqrt(Id^2 + Iq^2).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Phase advance angle	0x2041:2	DINT	32			0	mrad	readonly (default)	Transmit PDO (Inputs)

The angle between the Q-axis and current vector in the DQ plane. It is equal to arctan(Id / Iq).

0x2050 Joint torque controller

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Controller Kp	0x2050:1	REAL	32					readwrite	Receive PDO (Outputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Controller Ki	0x2050:2	REAL	32	0		0		readwrite	Receive PDO (Outputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Controller Kd	0x2050:3	REAL	32	0		0		readwrite	Receive PDO (Outputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Controller integral limit	0x2050:4	UDINT	32	0		0		readwrite	Receive PDO (Outputs)

0x2051 Target joint torque

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Target joint torque	0x2051:0	DINT	32			0	mNm	readwrite	Receive PDO (Outputs)

0x2052 Joint torque demand value

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Joint torque demand value	0x2052:0	DINT	32			0	mNm	readonly (default)	Transmit PDO (Inputs)

0x2053 Joint torque offset

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Joint torque offset	0x2053:0	DINT	32			0	mNm	readwrite	Receive PDO (Outputs)

0x2054 Max joint torque

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Max joint torque	0x2054:0	UDINT	32	0		0	mNm	readwrite	Receive PDO (Outputs)

0x2060 Impedance controller

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Stiffness	0x2060:1	DINT	32	0	345000	0	mNm/rad	readwrite	Receive PDO (Outputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Damping	0x2060:2	DINT	32	0	345000	0		readwrite	Receive PDO (Outputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Joint torque controller Kp	0x2060:3	REAL	32	0		0		readwrite	Receive PDO (Outputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Joint torque controller Ki	0x2060:4	REAL	32	0		0		readwrite	Receive PDO (Outputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Joint torque controller Kd	0x2060:5	REAL	32			0		readwrite	Receive PDO (Outputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Joint torque controller integral limit	0x2060:6	UDINT	32			0	mNm	readwrite	Receive PDO (Outputs)

0x20E1 High resolution data

Prototype - This object will change in future releases!

High-resolution data contains all position, velocity and phase current measurements of the last millisecond. It is updated once per millisecond with the new data.

There are four sub-objects, which, when concatenated, reflect the full chunk of data. The timestamp corresponds to the measurements marked "1". Time step between position/velocity values is the motion control loop period, time step between phase currents is the torque control loop period. The data is encoded as follows:

Bytes	Value
0-3	Timestamp (32-bit unsigned int)
4-7	Position 1 (32-bit signed int)
8-11	Position 2 (32-bit signed int)

Bytes	Value
12-15	Position 3 (32-bit signed int)
16-19	Position 4 (32-bit signed int)
20-23	Velocity 1 (32-bit signed int)
24-27	Velocity 2 (32-bit signed int)
28-31	Velocity 3 (32-bit signed int)
32-35	Velocity 4 (32-bit signed int)
36-37	Phase Current I_b 1 (16-bit signed int)
38-39	Phase Current I_c 1 (16-bit signed int)
40-41	Phase Current I_b 2 (16-bit signed int)
42-43	Phase Current I_c 2 (16-bit signed int)
...	...
96-97	Phase Current I_b 16 (16-bit signed int)
98-99	Phase Current I_c 16 (16-bit signed int)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Data 1	0x20E1:1	ARRAY [0..24] OF BYTE	200			0		readonly (default)	Transmit PDO (Inputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Data 2	0x20E1:2	ARRAY [0..24] OF BYTE	200			0		readonly (default)	Transmit PDO (Inputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Data 3	0x20E1:3	ARRAY [0..24] OF BYTE	200			0		readonly (default)	Transmit PDO (Inputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Data 4	0x20E1:4	ARRAY [0..24] OF BYTE	200			0		readonly (default)	Transmit PDO (Inputs)

0x20F0 Timestamp

Position signal measurement timestamp. Unsigned 32bit integer, resets after 42,949,672 ((2^32 - 1) / 100) µs.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Timestamp	0x20F0:0	UDINT	32	0	42949672	0	µs	readonly (default)	Transmit PDO (Inputs)

0x20F2 Assigned name

Allows a unique name to be assigned to this drive. This is only for reference; it is not used by the firmware.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Assigned name	0x20F2:0	STRING(50)	400			0		readwrite	

0x2110 Encoder 1 configuration

All configuration options for Encoder 1

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping
Sensor port	0x2110:1	USINT	8	No sensor port 0 Sensor port 1 1 Sensor port 2 2 Sensor port 3 3 Sensor port 4 4 Sensor port 5 5		readwrite	

All encoders

The sensor port on which this encoder is connected.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Type	0x2110:2	USINT	8	None	0		readwrite	
				Hall sensor	1			
				Incremental encoder	2			
				Nikon A-format	3			
				BiSS	4			
				Internal encoder	5			
				SSI	7			
				SinCos module	9			

All encoders

Select the type of encoder you want to use.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Resolution	0x2110:3	UDINT	32	1		1	Inc/Revolution	readwrite	

BiSS/SSI

Number of pulses in one revolution.

Most of BiSS/SSI encoders have a binary resolution, which means:

Resolution = 2^(subindex 12 *Singleturn bits*).

Incremental encoder

Total number of quadrature edges per revolution.

Resolution = Cycles per Revolution * 4

Hall sensor/Nikon A-Format/SinCos module

For these encoders this parameter is configured automatically.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Zero velocity threshold	0x2110:4	UDINT	32	0	1000000	4000	µs	readwrite

Incremental encoder

This parameter is only used for the velocity calculation of incremental encoders.

If no new tick is received from the encoder during the time specified in this parameter, the velocity of the encoder will be set to 0.

The value will automatically be rounded down to a multiple of 62.5 us.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Polarity	0x2110:5	BOOL	1	Normal polarity	0		readwrite	
				Inverted polarity	1			

All encoders

Invert the direction of movement of the encoder. This is the equivalent of physically flipping the encoder, so the commutation angle offset will not be valid after changing this parameter.

If you have an axis with two encoders (one for commutation and one for position and velocity), the direction of each encoder must match for control stability. This polarity parameter can be used for flipping the direction of the position or velocity encoder relative to the sensor used for commutation.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Singleturn offset	0x2110:6	UDINT	32			0	Inc	readwrite	

Absolute encoders (BiSS/SSI/Nikon A-format)

This value is subtracted from the singleturn value received from the encoder. It is the equivalent of physically moving the encoder, so the commutation angle offset will not be valid after changing this parameter. This parameter has to be lower than the resolution of the encoder.

The singleturn offset is applied after the subindex 5 *Polarity* has been applied.

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Access signal type	0x2110:7	BOOL	1	Differential RS422 0 Single-ended TTL 1			readwrite

Incremental encoder

Select if the encoder signal is differential (RS422) or single-ended (TTL).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Clock frequency	0x2110:8	UINT	16	1000	16000	1000	kHz	readwrite	

BiSS/SSI

Select the clock frequency for the BiSS MA line or the SSI clock line. Refer to your encoder's datasheet to determine the minimum and maximum allowable frequency values for your encoder.

The drive supports only certain discrete clock frequencies. If you input a frequency outside these discrete values, the drive will set the closest possible frequency.

To calculate the actual frequency that will be used by the drive:

1. Divide 25000 by the desired clock frequency (in kHz).
2. Round the result to the nearest integer.
3. Divide 25000 by this rounded value.
4. The real frequency will be the lowest number between the value obtained in the previous step and 5000 kHz.

For example, when setting 4000 KHz the real frequency will be 4166.67 kHz.

Nikon A-format

Select the transmission speed of the encoder. The only possible values are 2500, 4000, 6670, 8000 and 16000 kbps.

See encoder datasheet for more information.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Frame size	0x2110:9	USINT	8	1		1		readwrite	

BiSS

The BiSS service expects an encoder that has the following frame structure:

- SLO line high when encoder is ready to start communicating.

- Ack bit (which can be extended to multiple bits by the encoder).

- Start bit when the encoder is ready to transmit the data.

- CDS bit for register communication.

- Payload (any data can be sent here, but the only data that can be processed is Multiturn and singleturn position).

- Error and warning bits, in this order.

- Variable length CRC.

- Timeout.

This parameter specifies the number of bits transmitted as Payload.

SSI

This parameter specifies the number of bits transmitted in one encoder frame.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Multiturn bits	0x2110:10	USINT	8			0		readwrite	

BiSS/SSI/Nikon A-format

Number of multiturn bits to read from the encoder.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Multiturn first bit position	0x2110:11	USINT	8			0		readwrite	

BiSS/SSI

Position of the first bit of multiturn position on the frame. Position 0 of the frame corresponds to the first bit transmitted within the frame size specified in subindex 9 *Frame size*.

Usually this value is 0, since multiturn is the first element on the frame.

Only relevant if subindex 10 *Multiturn bits* is bigger than 0.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Singleturn bits	0x2110:12	USINT	8	1		1		readwrite	

BiSS/SSI

Number of singleturn bits to read from the encoder.

Nikon A-format

Number of singleturn bits to read from the encoder. The only possible values are 17, 20, 22 and 24.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Singleturn first bit position	0x2110:13	USINT	8			0		readwrite	

BiSS/SSI

Position of the first bit of singleturn position on the frame. Position 0 of the frame corresponds to the first bit transmitted within the frame size specified in subindex 9 *Frame size*.

For most of the BiSS/SSI encoders, this value is equal to: subindex 10 *Multiturn bits* + subindex 11 *Multiturn first bit position*.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Timeout	0x2110:14	USINT	8			36	µs	readwrite	

BiSS/SSI

Timeout that will be sent by the drive at the end of each BiSS/SSI frame, which informs the encoder that the frame is over.

Refer to your encoder datasheet to check what is the minimum value for this parameter.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
CRC polynomial	0x2110:15	USINT	8			67		readwrite	

BiSS

Polynomial for the CRC calculation of the sensor data (SCD).

This value is obtained by writing the polynomial in binary representation.

For example: x^6 + x^3 + x^1 + x^0 is 0b1001011 = 0x4B = 75.

The default value of 67 (x^6 + x^1 + x^0 = 0b1000011 = 0x43) is the one used for most of the BiSS encoders.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Maximum tbusy	0x2110:16	USINT	8			20	µs	readwrite	

BiSS

This value defines the maximum time to wait for the Start bit once the Ack bit was already received. If the Start bit is not sent after this time, the error BisSrtBt is raised.

Check your encoder datasheet to find what's the typical or maximum value for this parameter.

It is advised to try to increase this number in case the error BisSrtBt appears, which is likely to happen because the encoder needed more time to process the data before sending the Start bit.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Status bits active value	0x2110:17	USINT	8	Status bits active low	0		readwrite	
				Status bits active high	1			

BiSS

Value of the status bits when active. The BiSS-C standard recommends that these bits are active low, so most encoders should work with the default value.

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Parity type	0x2110:18	USINT	8	No parity 0 Odd parity 1 Even parity 2			readwrite

SSI

Type of parity read from the encoder. If there is parity, it should be the last bit on the SSI frame.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
First clock delay	0x2110:19	UINT	16			0	µs	readwrite	

SSI

Delay after first clock edge. This is compatible only with some encoders (will be specified in the encoder datasheet). If your encoder supports this function, it's normally used to be able to increase the maximum allowable clock frequency.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Data ordering	0x2110:20	BOOL	1	Natural Binary Code Reflected Binary Code	0 1		readwrite	

SSI

Select if the ordering of position is done using Natural Binary Code or Reflected Binary Code (also known as Gray code).

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Endianness	0x2110:21	BOOL	1	MSB first LSB first	0 1		readwrite	

SSI

Order of the bits (Most Significant Bit or Least Significant Bit transmitted first).

Usually MSB is transmitted first.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Index availability	0x2110:22	BOOL	1	Encoder without index	0		readwrite	
				Encoder with index	1			

Incremental encoder/SinCos module

Define if the connected encoder has an index or not.

For SinCos encoders the index is often called "reference".

Incremental encoders without index are often called AB encoders, while incremental encoders with index are often called ABI encoders.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Hall sensor port	0x2110:23	USINT	8	No sensor port	0		readwrite	
				Sensor port 1	1			
				Sensor port 2	2			
				Sensor port 3	3			
				Sensor port 4	4			
				Sensor port 5	5			

Incremental encoder

This parameter is used to define to which Sensor port the Hall sensor is connected in case of using it together with an incremental encoder in order to have an approximate absolute position while the incremental encoder index is not yet found.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Sinewave cycles per revolution	0x2110:24	UINT	16	1	1		readwrite

SinCos module

Number of sinewaves cycles in one motor revolution.

This value is going to be used to calculate the singleturn resolution (subindex 3 *Resolution*).

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Sinewave resolution	0x2110:25	USINT	8	8	13	Inc	readwrite	
				16	12			
				32	11			
				64	10			
				128	9			
				256	8			
				512	7			
				1024	6			
				2048	5			
				4096	4			
				8192	3			

SinCos module

Select desired number of pulses in one sinewave.

This value is going to be used to calculate the singleturn resolution (subindex 3 *Resolution*).

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Sinusoidal output voltage	0x2110:26	USINT	8	up to 50 mVpp	15		readwrite
				up to 60 mVpp	14		
				up to 75 mVpp	13		
				up to 0.1 Vpp	12		
				up to 0.12 Vpp	11		
				up to 0.14 Vpp	10		
				up to 0.15 Vpp	9		
				up to 0.2 Vpp	8		
				up to 0.28 Vpp	7		
				up to 0.4 Vpp	6		
				up to 0.5 Vpp	5		
				up to 0.6 Vpp	4		
				up to 0.75 Vpp	3		
				up to 1 Vpp	2		
				up to 1.2 Vpp	1		
				up to 1.5 Vpp	0		

SinCos module

Differential voltage in the Sin/Cos outputs peak to peak.

It is often abbreviated as Vpp.

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Filter (disabled)	0x2110:27	USINT	8	Disabled	0		readwrite	
				Filter strength 2 (weakest)	2			
				Filter strength 3	3			
				Filter strength 4	4			
				Filter strength 5	5			
				Filter strength 6	6			
				Filter strength 7	7			
				Filter strength 8	8			
				Filter strength 9 (strongest)	9			

REM 16MT

The filter with strength F of the sensor. The estimated step response time of the filter is Ts*2^F (Ts is the sampling time, ca. 70µs).

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Sampling frequency	0x2110:28	USINT	8	16 kHz	1		readwrite	
				32 kHz	2			

BiSS/SSI/Nikon A-format/Internal encoder

Select if the encoder should be sampled at 16 or 32 kHz.

If the encoder only allows one of the sampling frequencies, the value will be reverted automatically.

0x2111 Encoder 1 feedback

Feedback of the encoder configured as Encoder 1

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Raw position	0x2111:1	UDINT	32			lnc	readonly (default)	Transmit PDO (Inputs)

Position value received by the encoder before any processing. This value is not affected by Polarity (0x2112:5), Singleturn offset (0x2112:6), Data ordering (0x2112:20) or Endianness (0x2112:21).

Absolute encoders (BiSS/SSI/Nikon A-format/REM 16MT)

It is the value read from the encoder (with or without MT depending on the encoder configuration).

Incremental encoder

It is a running counter referenced to the position that the encoder had on startup, and that wraps between 0 and the encoder resolution.

Hall sensor

Hall sensors provide 6 different hall states per electrical revolution, so in one mechanical revolution, a hall sensor provides *6 * motor_pole_pairs* hall states. This subindex shows the current hall state within one mechanical revolution.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Adjusted position	0x2111:2	DINT	32				lnc	readonly (default)	Transmit PDO (Inputs)

Encoder absolute position (referenced to the index) once Singleturn offset (0x2112:6), Polarity (0x2112:7), Data ordering (0x2112:20) and Endianness (0x2112:21) are applied. For incremental encoders, this position will be zero until the index has been found.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity	0x2111:3	DINT	32				rpm	readonly (default)	Transmit PDO (Inputs)

The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Encoder status	0x2111:4	UDINT	32					readonly (default)	

Internal encoder (Circulo)

This object provides extended information regarding the Circulo internal encoder BisErBit error.

This value is only updated once 15 ms after receiving a new BiSS error bit error (BisErBit) from the internal encoder.

Bit	Name	Description
0	-	Reserved
1	FRQ_CNV	
2	FRQ_ABZ	
3	NON_CTR	
4	MT_CTR	
5	MT_ERR	
6	EPR_ERR	
7	-	Reserved
8	STUP_ERR	
9	CFG_ERR	
10	CTR_ERR	
11	POS_ERR	
12	BAT_ERR	
13	BAT_WRN	
14	PDR	
15	PRESET	
16	AM_MIN	
17	-	Reserved
18	AN_MIN	
19	-	Reserved
20	STUP	

0x2112 Encoder 2 configuration

All configuration options for Encoder 2

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Sensor port	0x2112:1	USINT	8	No sensor port 0 Sensor port 1 1 Sensor port 2 2 Sensor port 3 3 Sensor port 4 4 Sensor port 5 5			readwrite	

All encoders

The sensor port on which this encoder is connected.

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping
Type	0x2112:2	USINT	8	None 0 Hall sensor 1 Incremental encoder 2 Nikon A-format 3 BiSS 4 Internal encoder 5 SSI 7 SinCos module 9		readwrite	

All encoders

Select the type of encoder you want to use.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Resolution	0x2112:3	UDINT	32	1		1	Inc/Revolution	readwrite	

BiSS/SSI

Number of pulses in one revolution.

Most of BiSS/SSI encoders have a binary resolution, which means:

Resolution = 2^(subindex 12 *Singleturn bits*).

Incremental encoder

Total number of quadrature edges per revolution.

Resolution = Cycles per Revolution * 4

Hall sensor/Nikon A-Format/SinCos module

For these encoders this parameter is configured automatically.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Zero velocity threshold	0x2112:4	UDINT	32	0	1000000	4000	µs	readwrite	

Incremental encoder

This parameter is only used for the velocity calculation of incremental encoders.

If no new tick is received from the encoder during the time specified in this parameter, the velocity of the encoder will be set to 0.

The value will automatically be rounded down to a multiple of 62.5 us.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Polarity	0x2112:5	BOOL	1	Normal polarity	0		readwrite	
				Inverted polarity	1			

All encoders

Invert the direction of movement of the encoder. This is the equivalent of physically flipping the encoder, so the commutation angle offset will not be valid after changing this parameter.

If you have an axis with two encoders (one for commutation and one for position and velocity), the direction of each encoder must match for control stability. This polarity parameter can be used for flipping the direction of the position or velocity encoder relative to the sensor used for commutation.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Singleturn offset	0x2112:6	UDINT	32			0	Inc	readwrite	

Absolute encoders (BiSS/SSI/Nikon A-format)

This value is subtracted from the singleturn value received from the encoder. It is the equivalent of physically moving the encoder, so the commutation angle offset will not be valid after changing this parameter. This parameter has to be lower than the resolution of the encoder.

The singleturn offset is applied after the subindex 5 *Polarity* has been applied.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Access signal type	0x2112:7	BOOL	1	Differential RS422	0		readwrite	
				Single-ended TTL	1			

Incremental encoder

Select if the encoder signal is differential (RS422) or single-ended (TTL).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Clock frequency	0x2112:8	UINT	16	1000	16000	1000	kHz	readwrite	

BiSS/SSI

Select the clock frequency for the BiSS MA line or the SSI clock line. Refer to your encoder's datasheet to determine the minimum and maximum allowable frequency values for your encoder.

The drive supports only certain discrete clock frequencies. If you input a frequency outside these discrete values, the drive will set the closest possible frequency.

To calculate the actual frequency that will be used by the drive:

1. Divide 25000 by the desired clock frequency (in kHz).
2. Round the result to the nearest integer.
3. Divide 25000 by this rounded value.
4. The real frequency will be the lowest number between the value obtained in the previous step and 5000 kHz.

For example, when setting 4000 KHz the real frequency will be 4166.67 kHz.

Nikon A-format

Select the transmission speed of the encoder. The only possible values are 2500, 4000, 6670, 8000 and 16000 kbps.

See encoder datasheet for more information.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Frame size	0x2112:9	USINT	8	1		1		readwrite	

BiSS

The BiSS service expects an encoder that has the following frame structure:

- SLO line high when encoder is ready to start communicating.

- Ack bit (which can be extended to multiple bits by the encoder).

- Start bit when the encoder is ready to transmit the data.

- CDS bit for register communication.

- Payload (any data can be sent here, but the only data that can be processed is Multiturn and singleturn position).

- Error and warning bits, in this order.

- Variable length CRC.

- Timeout.

This parameter specifies the number of bits transmitted as Payload.

SSI

This parameter specifies the number of bits transmitted in one encoder frame.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Multiturn bits	0x2112:10	USINT	8			0		readwrite	

BiSS/SSI/Nikon A-format

Number of multiturn bits to read from the encoder.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Multiturn first bit position	0x2112:11	USINT	8			0		readwrite	

BiSS/SSI

Position of the first bit of multiturn position on the frame. Position 0 of the frame corresponds to the first bit transmitted within the frame size specified in subindex 9 *Frame size*.

Usually this value is 0, since multiturn is the first element on the frame.

Only relevant if subindex 10 *Multiturn bits* is bigger than 0.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Singleturn bits	0x2112:12	USINT	8	1		1		readwrite	

BiSS/SSI

Number of singleturn bits to read from the encoder.

Nikon A-format

Number of singleturn bits to read from the encoder. The only possible values are 17, 20, 22 and 24.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Singleturn first bit position	0x2112:13	USINT	8			0		readwrite	

BiSS/SSI

Position of the first bit of singleturn position on the frame. Position 0 of the frame corresponds to the first bit transmitted within the frame size specified in subindex 9 *Frame size*.

For most of the BiSS/SSI encoders, this value is equal to: subindex 10 *Multiturn bits* + subindex 11 *Multiturn first bit position*.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Timeout	0x2112:14	USINT	8			36	µs	readwrite	

BiSS/SSI

Timeout that will be sent by the drive at the end of each BiSS/SSI frame, which informs the encoder that the frame is over.

Refer to your encoder datasheet to check what is the minimum value for this parameter.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
CRC polynomial	0x2112:15	USINT	8			67		readwrite	

BiSS

Polynomial for the CRC calculation of the sensor data (SCD).

This value is obtained by writing the polynomial in binary representation.

For example: x^6 + x^3 + x^1 + x^0 is 0b1001011 = 0x4B = 75.

The default value of 67 (x^6 + x^1 + x^0 = 0b1000011 = 0x43) is the one used for most of the BiSS encoders.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Maximum tbusy	0x2112:16	USINT	8			20	µs	readwrite	

BiSS

This value defines the maximum time to wait for the Start bit once the Ack bit was already received. If the Start bit is not sent after this time, the error BisSrtBt is raised.

Check your encoder datasheet to find what's the typical or maximum value for this parameter.

It is advised to try to increase this number in case the error BisSrtBt appears, which is likely to happen because the encoder needed more time to process the data before sending the Start bit.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Status bits active value	0x2112:17	USINT	8	Status bits active low	0		readwrite	
				Status bits active high	1			

BiSS

Value of the status bits when active. The BiSS-C standard recommends that these bits are active low, so most encoders should work with the default value.

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Parity type	0x2112:18	USINT	8	No parity Odd parity Even parity	0 1 2			readwrite

SSI

Type of parity read from the encoder. If there is parity, it should be the last bit on the SSI frame.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
First clock delay	0x2112:19	UINT	16			0	µs	readwrite	

SSI

Delay after first clock edge. This is compatible only with some encoders (will be specified in the encoder datasheet). If your encoder supports this function, it's normally used to be able to increase the maximum allowable clock frequency.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Data ordering	0x2112:20	BOOL	1	Natural Binary Code Reflected Binary Code	0 1		readwrite	

SSI

Select if the ordering of position is done using Natural Binary Code or Reflected Binary Code (also known as Gray code).

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Endianness	0x2112:21	BOOL	1	MSB first LSB first	0 1		readwrite	

SSI

Order of the bits (Most Significant Bit or Least Significant Bit transmitted first).

Usually MSB is transmitted first.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Index availability	0x2112:22	BOOL	1	Encoder without index	0		readwrite	
				Encoder with index	1			

Incremental encoder/SinCos module

Define if the connected encoder has an index or not.

For SinCos encoders the index is often called "reference".

Incremental encoders without index are often called AB encoders, while incremental encoders with index are often called ABI encoders.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Hall sensor port	0x2112:23	USINT	8	No sensor port	0		readwrite	
				Sensor port 1	1			
				Sensor port 2	2			
				Sensor port 3	3			
				Sensor port 4	4			
				Sensor port 5	5			

Incremental encoder

This parameter is used to define to which Sensor port the Hall sensor is connected in case of using it together with an incremental encoder in order to have an approximate absolute position while the incremental encoder index is not yet found.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Sinewave cycles per revolution	0x2112:24	UINT	16	1	1		readwrite

SinCos module

Number of sinewaves cycles in one motor revolution.

This value is going to be used to calculate the singleturn resolution (subindex 3 *Resolution*).

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Sinewave resolution	0x2112:25	USINT	8	8	13	Inc	readwrite	
				16	12			
				32	11			
				64	10			
				128	9			
				256	8			
				512	7			
				1024	6			
				2048	5			
				4096	4			
				8192	3			

SinCos module

Select desired number of pulses in one sinewave.

This value is going to be used to calculate the singleturn resolution (subindex 3 *Resolution*).

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Sinusoidal output voltage	0x2112:26	USINT	8	up to 50 mVpp	15		readwrite
				up to 60 mVpp	14		
				up to 75 mVpp	13		
				up to 0.1 Vpp	12		
				up to 0.12 Vpp	11		
				up to 0.14 Vpp	10		
				up to 0.15 Vpp	9		
				up to 0.2 Vpp	8		
				up to 0.28 Vpp	7		
				up to 0.4 Vpp	6		
				up to 0.5 Vpp	5		
				up to 0.6 Vpp	4		
				up to 0.75 Vpp	3		
				up to 1 Vpp	2		
				up to 1.2 Vpp	1		
				up to 1.5 Vpp	0		

SinCos module

Differential voltage in the Sin/Cos outputs peak to peak.

It is often abbreviated as Vpp.

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Filter (disabled)	0x2112:27	USINT	8	Disabled Filter strength 2 (weakest) Filter strength 3 Filter strength 4 Filter strength 5 Filter strength 6 Filter strength 7 Filter strength 8 Filter strength 9 (strongest)	0 2 3 4 5 6 7 8 9			readwrite

REM 16MT

The filter with strength F of the sensor. The estimated step response time of the filter is Ts*2^F (Ts is the sampling time, ca. 70µs).

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Sampling frequency	0x2112:28	USINT	8	16 kHz 32 kHz	1 2		readwrite	

BiSS/SSI/Nikon A-format/Internal encoder

Select if the encoder should be sampled at 16 or 32 kHz.

If the encoder only allows one of the sampling frequencies, the value will be reverted automatically.

0x2113 Encoder 2 feedback

Feedback of the encoder configured as Encoder 2

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Raw position	0x2113:1	UDINT	32			lnc	readonly (default)	Transmit PDO (Inputs)

Position value received by the encoder before any processing. This value is not affected by Polarity (0x2112:5), Singleturn offset (0x2112:6), Data ordering (0x2112:20) or Endianness (0x2112:21).

Absolute encoders (BiSS/SSI/Nikon A-format/REM 16MT)

It is the value read from the encoder (with or without MT depending on the encoder configuration).

Incremental encoder

It is a running counter referenced to the position that the encoder had on startup, and that wraps between 0 and the encoder resolution.

Hall sensor

Hall sensors provide 6 different hall states per electrical revolution, so in one mechanical revolution, a hall sensor provides *6 * motor_pole_pairs* hall states. This subindex shows the current hall state within one mechanical revolution.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Adjusted position	0x2113:2	DINT	32				lnc	readonly (default)	Transmit PDO (Inputs)

Encoder absolute position (referenced to the index) once Singleturn offset (0x2112:6), Polarity (0x2112:7), Data ordering (0x2112:20) and Endianness (0x2112:21) are applied. For incremental encoders, this position will be zero until the index has been found.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity	0x2113:3	DINT	32				rpm	readonly (default)	Transmit PDO (Inputs)

The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Encoder status	0x2113:4	UDINT	32					readonly (default)	

Internal encoder (Circulo)

This object provides extended information regarding the Circulo internal encoder BisErBit error.

This value is only updated once 15 ms after receiving a new BiSS error bit error (BisErBit) from the internal encoder.

Bit	Name	Description
0	-	Reserved
1	FRQ_CNV	
2	FRQ_ABZ	
3	NON_CTR	
4	MT_CTR	
5	MT_ERR	
6	EPR_ERR	
7	-	Reserved
8	STUP_ERR	
9	CFG_ERR	
10	CTR_ERR	
11	POS_ERR	
12	BAT_ERR	
13	BAT_WRN	
14	PDR	
15	PRESET	
16	AM_MIN	
17	-	Reserved
18	AN_MIN	
19	-	Reserved
20	STUP	

0x2150 Torque sensor configuration

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Type	0x2150:1	USINT	8	No Torque Sensor	0		readwrite	
				Analog Input	1			
				VTS	2			

All torque sensors

Select the type of torque sensor

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Polarity	0x2150:2	USINT	8	Normal	0		readwrite	
				Inverted Polarity	1			

All torque sensors

Select the polarity

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Channel	0x2150:3	USINT	8	Analog Input 1	1		readwrite	
				Analog Input 2	2			
				Analog Input 3	3			
				Analog Input 4	4			

Analog Torque sensor

select the channel on which the torque sensor is connected

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Gain	0x2150:4	REAL	32			0		readwrite	

Analog torque sensor

Gain of the torque sensor

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Offset	0x2150:5	DINT	32	-2147483648	2147483647	0	mNm	readwrite	

Analog torque sensor

offset of the analog torque sensor

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Coefficient K1	0x2150:6	REAL	32			0		readwrite	

VTS

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Coefficient K2	0x2150:7	REAL	32			0		readwrite	

VTS

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Coefficient K3	0x2150:8	REAL	32			0		readwrite	

VTS

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Coefficient K4	0x2150:9	REAL	32			0		readwrite	

VTS

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Coefficient K5	0x2150:10	REAL	32			0		readwrite	

VTS

0x2151 Torque sensor value

Torque sensor value

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Torque sensor value	0x2151:0	DINT	32		0	mNm	readonly (default)	Transmit PDO (Inputs)

0x2152 Torque sensor feedback filter

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Type	0x2152:1	USINT	8	Disabled	0		readwrite	
				1st order low pass	1			

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Cutoff frequency	0x2152:2	UDINT	32	5	2000	500	Hz	readwrite	

0x2210 GPIO pin configuration

Configurable general purpose inputs and outputs with a 4 kHz update rate.

For hardware that supports it, each pin can be configured as follows:

Value	Definition
0	Disabled
2	[IN] General Purpose Input
3	[OUT] General Purpose Output
4	[IN] Home Switch Active High - Level Triggered
5	[IN] Home Switch Active Low - Level Triggered
6	[IN] Positive Limit Switch Active High - Level Triggered for Homing & Edge Triggered (Latch) for Error (PosLmAct)
7	[IN] Positive Limit Switch Active Low - Level Triggered for Homing & Edge Triggered (Latch) for Error (PosLmAct)
8	[IN] Negative Limit Switch Active High - Level Triggered for Homing & Edge Triggered (Latch) for Error (NegLmAct)
9	[IN] Negative Limit Switch Active Low - Level Triggered for Homing & Edge Triggered (Latch) for Error (NegLmAct)
10	[IN] Interlock (Disable Operation) Active Low - Level Triggered
11	[IN] Fault Reset - Edge Triggered
12	[IN] Interlock (Fault Reaction) Active Low - Level Triggered
13	[IN] Time Stamped Rising Edge - Edge Triggered
14	[OUT] Mimics Target Reached (tr) Bit of Statusword
15	[OUT] Mimics Internal Limit Active (ila) Bit of Statusword
16	[OUT] Timestamped Triggered Output

17	[OUT] Position Triggered Output (Pulse)
18	[OUT] Mimics Fault (f) Bit of Statusword
19	[OUT] Mimics Switched On (so) Bit of Statusword
20	[OUT] Mimics Ready to Switch On (rtso) Bit of Statusword
21	[OUT] Mimics Operation Enabled (oe) Bit of Statusword
22	[OUT] Mimics Voltage Enabled (ve) Bit of Statusword
23	[OUT] Mimics Switch On Disabled (sod) Bit of Statusword
24	[OUT] Mimics Quick Stop (qs) Bit of Statusword
25	[OUT] Mimics Warning (w) Bit of Statusword
26	[OUT] Configure as addressable LED (see object 0x2215)

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Digital IO 1	0x2210:1	USINT	8	Disabled 0 [IN] General Purpose 2 [OUT] General Purpose 3 [IN] Home Switch (Active High) 4 [IN] Home Switch (Active Low) 5 [IN] Limit Switch Positive (Active High) 6 [IN] Limit Switch Positive (Active Low) 7 [IN] Limit Switch Negative (Active High) 8 [IN] Limit Switch Negative (Active Low) 9 [IN] Interlock - Disable Operation (Active Low) 10 [IN] Fault Reset (Active High) 11 [IN] Interlock - Fault Reaction (Active Low) 12 [IN] Timestamped Rising Edge (Active High) 13 [OUT] Target Reached 14 [OUT] Internal limit Active 15 [OUT] Timestamped Triggered Output 16	readwrite

[OUT] Position Triggered Output (Pulse)	17
[OUT] Fault	18
[OUT] Switched On	19
[OUT] Ready to Switch On	20
[OUT] Operation Enabled	21
[OUT] Voltage Enabled	22
[OUT] Switch On Disabled	23
[OUT] Quick Stop	24
[OUT] Warning	25
[OUT] Addressable LED	26
[IN] Touch probe 1 input	27

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Digital IO 2	0x2210:2	USINT	8	Disabled 0 [IN] General Purpose 2 [OUT] General Purpose 3 [IN] Home Switch (Active High) 4 [IN] Home Switch (Active Low) 5 [IN] Limit Switch Positive (Active High) 6 [IN] Limit Switch Positive (Active Low) 7 [IN] Limit Switch Negative (Active High) 8 [IN] Limit Switch Negative (Active Low) 9 [IN] Interlock - Disable Operation (Active Low) 10 [IN] Fault Reset (Active High) 11 [IN] Interlock - Fault Reaction (Active Low) 12 [IN] Timestamped Rising Edge (Active High) 13 [OUT] Target Reached 14 [OUT] Internal limit Active 15 [OUT] Timestamped Triggered Output 16	readwrite

[OUT] Position Triggered Output (Pulse)	17
[OUT] Fault	18
[OUT] Switched On	19
[OUT] Ready to Switch On	20
[OUT] Operation Enabled	21
[OUT] Voltage Enabled	22
[OUT] Switch On Disabled	23
[OUT] Quick Stop	24
[OUT] Warning	25
[OUT] Addressable LED	26
[IN] Touch probe 1 input	27

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Digital IO 3	0x2210:3	USINT	8	Disabled 0 [IN] General Purpose 2 [OUT] General Purpose 3 [IN] Home Switch (Active High) 4 [IN] Home Switch (Active Low) 5 [IN] Limit Switch Positive (Active High) 6 [IN] Limit Switch Positive (Active Low) 7 [IN] Limit Switch Negative (Active High) 8 [IN] Limit Switch Negative (Active Low) 9 [IN] Interlock - Disable Operation (Active Low) 10 [IN] Fault Reset (Active High) 11 [IN] Interlock - Fault Reaction (Active Low) 12 [IN] Timestamped Rising Edge (Active High) 13 [OUT] Target Reached 14 [OUT] Internal limit Active 15 [OUT] Timestamped Triggered Output 16	readwrite

[OUT] Position Triggered Output (Pulse)	17
[OUT] Fault	18
[OUT] Switched On	19
[OUT] Ready to Switch On	20
[OUT] Operation Enabled	21
[OUT] Voltage Enabled	22
[OUT] Switch On Disabled	23
[OUT] Quick Stop	24
[OUT] Warning	25
[OUT] Addressable LED	26
[IN] Touch probe 1 input	27

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Digital IO 4	0x2210:4	USINT	8	Disabled 0 [IN] General Purpose 2 [OUT] General Purpose 3 [IN] Home Switch (Active High) 4 [IN] Home Switch (Active Low) 5 [IN] Limit Switch Positive (Active High) 6 [IN] Limit Switch Positive (Active Low) 7 [IN] Limit Switch Negative (Active High) 8 [IN] Limit Switch Negative (Active Low) 9 [IN] Interlock - Disable Operation (Active Low) 10 [IN] Fault Reset (Active High) 11 [IN] Interlock - Fault Reaction (Active Low) 12 [IN] Timestamped Rising Edge (Active High) 13 [OUT] Target Reached 14 [OUT] Internal limit Active 15 [OUT] Timestamped Triggered Output 16	readwrite

[OUT] Position Triggered Output (Pulse)	17
[OUT] Fault	18
[OUT] Switched On	19
[OUT] Ready to Switch On	20
[OUT] Operation Enabled	21
[OUT] Voltage Enabled	22
[OUT] Switch On Disabled	23
[OUT] Quick Stop	24
[OUT] Warning	25
[OUT] Addressable LED	26
[IN] Touch probe 1 input	27

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Digital IO 5	0x2210:5	USINT	8	Disabled 0 [IN] General Purpose 2 [OUT] General Purpose 3 [IN] Home Switch (Active High) 4 [IN] Home Switch (Active Low) 5 [IN] Limit Switch Positive (Active High) 6 [IN] Limit Switch Positive (Active Low) 7 [IN] Limit Switch Negative (Active High) 8 [IN] Limit Switch Negative (Active Low) 9 [IN] Interlock - Disable Operation (Active Low) 10 [IN] Fault Reset (Active High) 11 [IN] Interlock - Fault Reaction (Active Low) 12 [IN] Timestamped Rising Edge (Active High) 13 [OUT] Target Reached 14 [OUT] Internal limit Active 15 [OUT] Timestamped Triggered Output 16	readwrite

[OUT] Position Triggered Output (Pulse)	17
[OUT] Fault	18
[OUT] Switched On	19
[OUT] Ready to Switch On	20
[OUT] Operation Enabled	21
[OUT] Voltage Enabled	22
[OUT] Switch On Disabled	23
[OUT] Quick Stop	24
[OUT] Warning	25
[OUT] Addressable LED	26
[IN] Touch probe 1 input	27

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Digital IO 6	0x2210:6	USINT	8	Disabled 0 [IN] General Purpose 2 [OUT] General Purpose 3 [IN] Home Switch (Active High) 4 [IN] Home Switch (Active Low) 5 [IN] Limit Switch Positive (Active High) 6 [IN] Limit Switch Positive (Active Low) 7 [IN] Limit Switch Negative (Active High) 8 [IN] Limit Switch Negative (Active Low) 9 [IN] Interlock - Disable Operation (Active Low) 10 [IN] Fault Reset (Active High) 11 [IN] Interlock - Fault Reaction (Active Low) 12 [IN] Timestamped Rising Edge (Active High) 13 [OUT] Target Reached 14 [OUT] Internal limit Active 15 [OUT] Timestamped Triggered Output 16	readwrite

[OUT] Position Triggered Output (Pulse)	17
[OUT] Fault	18
[OUT] Switched On	19
[OUT] Ready to Switch On	20
[OUT] Operation Enabled	21
[OUT] Voltage Enabled	22
[OUT] Switch On Disabled	23
[OUT] Quick Stop	24
[OUT] Warning	25
[OUT] Addressable LED	26
[IN] Touch probe 1 input	27

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Digital IO 7	0x2210:7	USINT	8	Disabled	0	readwrite
				[IN] General Purpose	2	
				[OUT] General Purpose	3	
				[IN] Home Switch (Active High)	4	
				[IN] Home Switch (Active Low)	5	
				[IN] Limit Switch Positive (Active High)	6	
				[IN] Limit Switch Positive (Active Low)	7	
				[IN] Limit Switch Negative (Active High)	8	
				[IN] Limit Switch Negative (Active Low)	9	
				[IN] Interlock - Disable Operation (Active Low)	10	
				[IN] Fault Reset (Active High)	11	
				[IN] Interlock - Fault Reaction (Active Low)	12	
				[IN] Timestamped Rising Edge (Active High)	13	
				[OUT] Target Reached	14	
				[OUT] Internal limit Active	15	
				[OUT] Timestamped Triggered Output	16	

[OUT] Position Triggered Output (Pulse)	17
[OUT] Fault	18
[OUT] Switched On	19
[OUT] Ready to Switch On	20
[OUT] Operation Enabled	21
[OUT] Voltage Enabled	22
[OUT] Switch On Disabled	23
[OUT] Quick Stop	24
[OUT] Warning	25
[OUT] Addressable LED	26
[IN] Touch probe 1 input	27

0x2211 GPIO output events

Configuration to set the value in the *Digital Output* object to the corresponding GPIO when a certain event happens.

The GPIO has to be enabled in *0x2210 GPIO*.

Configurable events are:

`Timestamp triggered`: Output at a certain timestamp.

`Target reached`: Output when target is reached. This mimics bit 10 (tr) of the Statusword.

`Internal limit active`: Output when internal limit is active. This mimics bit 11 (ila) of the Statusword.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Timestamp setpoint	0x2211:1	UDINT	32		0	readwrite	Receive PDO (Outputs)

Timestamp at which the GPIO should trigger in case "Timestamp triggered" is selected. The unit is in 10 ns.

0x2212 GPIO input actions

Configure an input GPIO to perform a certain action depending on its value.

The GPIO has to be enabled in *0x2210 GPIO*.

Configurable actions are:

`Timestamped rising edge`: Report timestamp of selected GPIO last rising edge.

`Disable operation`: Clear bit 3 (eo) of controlword when the selected GPIO is high.

`Quick stop`: Clear bit 2 (qs) of controlword when the selected GPIO is high.

`Fault reset`: Set bit 7 (fr) of controlword when the selected GPIO is high.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Timestamp on rising edge	0x2212:1	UDINT	32			0		readonly (default)	Transmit PDO (Inputs)

Timestamp at which the last rising edge happened in case "Timestamped rising edge" is selected. The unit is in 10 ns.

0x2213 GPIO position trigger

Configure a GPIO to output a width-configurable pulse every time certain encoder position is reached.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Position setpoint	0x2213:1	DINT	32			0	Inc	readwrite	Receive PDO (Outputs)

Position value at which the GPIO should be triggered.

Name	Index:Sub	Type	Bit Size	Options			Unit	Access	PDO Mapping

Target encoder	0x2213:2	USINT	8	No encoder selected 0 Encoder 1 1 Encoder 2 2			readwrite	

Encoder whose position is used for this feature.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Pulse width	0x2213:3	USINT	8			0	ms	readwrite	

Width of the pulse when the GPIO is triggered.

0x2214 GPIO global options

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping
Voltage level	0x2214:1	USINT	8	3.3 volts 1 5.0 volts 2		readwrite	

Select the global voltage level of GPIO ports.

0x2215 GPIO addressable LED control

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
LED color	0x2215:1	UDINT	32	0	16777215	0		readwrite	

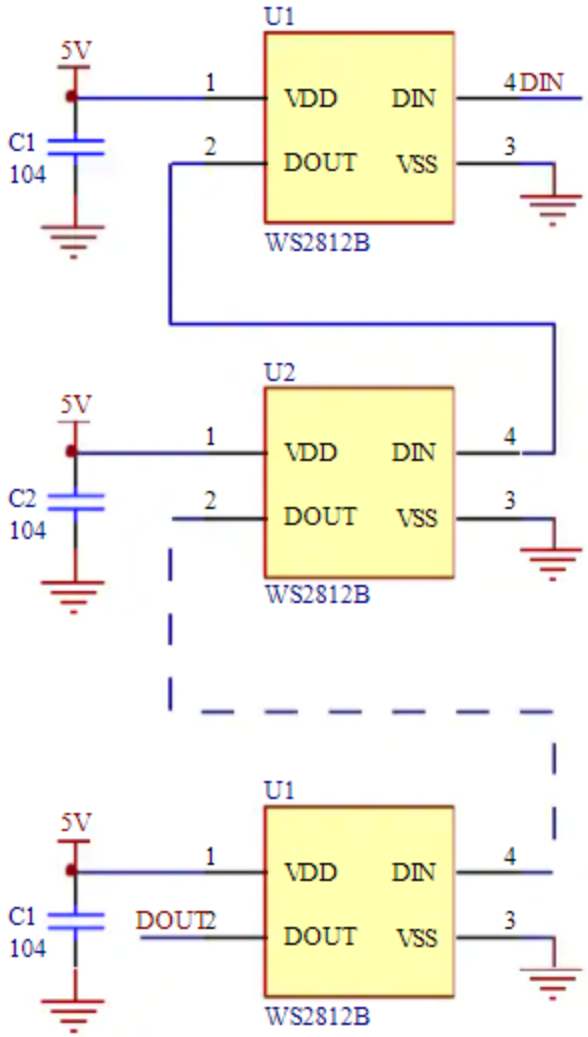
This 24-bit value holds the RGB (red, green, blue) values that will be applied to all the LEDs in the string. Each color is represented by 8 bits:

Composition of 24bit data:

G7	G6	G5	G4	G3	G2	G1	G0	R7	R6	R5	R4	R3	R2	R1	R0	B7	B6	B5	B4	B3	B2	B1	B0

Note: Follow the order of GRB to sent data and the high bit sent at first.

The supported LED types are SK6812, WS2811, WS2812, WS2813 and WS2815 which use an addressable LED chipset that requires a single data wire:



0x2401 Analog input 1

Analog Input value of SOMANET Drive if available.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Analog input 1	0x2401:0	UINT	16			0		readonly (default)	Transmit PDO (Inputs) [111]

0x2402 Analog input 2

Analog Input value of SOMANET Drive if available.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Analog input 2	0x2402:0	UINT	16			0		readonly (default)	Transmit PDO (Inputs)

0x2403 Analog input 3

Analog Input value of SOMANET Drive if available.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Analog input 3	0x2403:0	UINT	16			0		readonly (default)	Transmit PDO (Inputs)

0x2404 Analog input 4

Analog Input value of SOMANET Drive if available.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Analog input 4	0x2404:0	UINT	16			0		readonly (default)	Transmit PDO (Inputs)

0x2500 Cyclic control input frequency

This is the frequency at which the drive will read new control data from the master.

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Cyclic control input frequency	0x2500:0	USINT	8	4 kHz 2 2 kHz 3 1 kHz 4			readwrite	

0x2611 Safety Module input diagnostics

Safe state diagnostics - state of safety module (0 = safe state).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Input 1	0x2611:1	BOOL	1	0	1			readonly (default)	

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Input 2	0x2611:2	BOOL	1	0	1			readonly (default)	

0x2700 Firmware

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Core version	0x2700:1	STRING(50)	400			0		readonly (default)	

This object shall provide the firmware core version description.

0x2701 Tuning command

This object is used in tuning mode to specify the parameter that is configured. Altering the default values is recommended for expert users only!

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Tuning command	0x2701:0	UDINT	32			0		readwrite	Receive PDO (Outputs)

0x2702 Tuning status

For internal purposes only!

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Tuning status	0x2702:0	UDINT	32			0		readwrite	Transmit PDO (Inputs)

0x2703 User MOSI

Reserved for SDK users.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
User MOSI	0x2703:0	UDINT	32			0		readwrite	Receive PDO (Outputs)

0x2704 User MISO

Reserved for SDK users.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
User MISO	0x2704:0	UDINT	32			0		readwrite	Transmit PDO (Inputs)

0x2705 Setup wizard completed

Used in OBLAC Drives for marking the successful completion of the setup guide. Intended for internal use only.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Setup wizard completed	0x2705:0	USINT	8	0	3	0		readwrite	

0x2E00 TCP/IP Configuration

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
IP address	0x2E00:1	UDINT	32			0		readwrite	

Configuration of the IP Address of the device. If the IP is 0 then IP Address is not configured. Otherwise a valid address should be set. The Loopback device 127.0.0.1 will not work.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Network mask	0x2E00:2	UDINT	32			0		readwrite	

The device network mask. A value of 0 indicates that no mask is configured.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Gateway address	0x2E00:3	UDINT	32			0		readwrite	

Default gateway address.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Name server	0x2E00:4	UDINT	32			0		readwrite	

Primary name server address.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Name server 2	0x2E00:5	UDINT	32			0		readwrite	

Secondary name server address.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Domain name	0x2E00:6	STRING(50)	400			0		readwrite	

Default domain name. A length of 0 indicates no domain name is configured.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Host name	0x2E00:7	STRING(50)	400			0		readwrite	

Host name of the device. A value of 0 indicate no host name is configured.

0x2FFF Internal usage only

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
TCTM3	0x2FFF:1	INT	16					readonly (default)	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
TCTM4	0x2FFF:2	INT	16					readonly (default)	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
TCNM1	0x2FFF:3	INT	16					readonly (default)	
Name	**Index:Sub**	**Type**	**Bit Size**	**Min Data**	**Max Data**	**Default Data**	**Unit**	**Access**	**PDO Mapping**
BKC	0x2FFF:4	UINT	16					readonly (default)	Transmit PDO (Inputs)

0x603F Error code

Provides the error code of the last error which occurred. See object `0x203F Error report` for a more detailed description.

Error Code	Meaning
0x2220	Continuous over current (device internal)
0x2250	Short circuit (device internal)
0x2350	Load level fault (I2t, thermal state)
0x2351	Load level warning (I2t, thermal state)
0x3130	Phase failure
0x3131	Phase failure L1
0x3132	Phase failure L2
0x3133	Phase failure L3
0x3210	DC link over-voltage
0x3220	DC link under-voltage
0x3331	Field circuit interrupted
0x4210	Excess temperature device

Error Code	Meaning
0x4310	Excess temperature drive
0x5200	Control
0x5300	Operating unit
0x6010	Software reset (watchdog)
0x6320	Parameter error
0x7121	Motor blocked
0x7300	Sensor
0x7303	Resolver 1 fault
0x7304	Resolver 2 fault
0x7500	Communication
0x8611	Positioning controller (following error)
0x8612	Positioning controller (reference limit)
0xF002	Sub-synchronous run
0xFF00	Manufacturer-specific

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Error code	0x603F:0	UINT	16			0		readonly (default)	Transmit PDO (Inputs)

0x6040 Controlword

This object shall indicate the received command controlling the PDS FSA. The bits 7, 3, 2, 1, and 0 shall be supported. The other bits may be supported.

15	11	10	9	8	7	6	4	3	2	1	0
ms		r	oms	h	fr	oms		eo	qs	ev	so
MSB											LSB

LEGEND: ms = manufacturer-specific; r = reserved; oms = operation mode specific; h = halt; fr = fault reset; eo = enable operation; qs = quick stop; ev = enable voltage; so = switch on

Command	Bits of the *controlword*					Transitions
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
Shutdown	0	X	1	1	0	2, 6, 8
Switch on	0	0	1	1	1	3
Switch on + enable operation	0	1	1	1	1	3 + 4 (NOTE)

Command	Bits of the *controlword*					Transitions
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
Disable voltage	0	X	X	0	X	7, 9, 10, 12
Quick stop	0	X	0	1	X	7, 10, 11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4, 16
Fault reset	1	X	X	X	X	15
NOTE Automatic transition to Enable operation state after executing SWITCHED ON state functionality.						

Bits 9, 6, 5, and 4 of the controlword are operation mode specific. The halt function (bit 8) behavior is operation mode specific. If the bit is 1, the commanded motion shall be interrupted, the PDS shall behave as defined in the halt option code. After releasing the halt function, the commanded motion shall be continued if possible.

The bit 10 is reserved for further use; it shall be set to 0. The bits 11, 12, 13, 14, and 15 are manufacturer-specific.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Controlword	0x6040:0	UINT	16			0		readwrite	Receive PDO (Outputs)

0x6041 Statusword

This object shall provide the status of the PDS FSA. The bits 10, 9, and 6 to 0 shall be supported. The other bits may be supported.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
ms		oms		ila	tr	rm	ms	w	sod	qs	ve	f	oe	so	rtso
MSB															LSB

LEGEND: ms = manufacturer-specific; oms = operation mode specific; ila = internal limit active; tr = target reached; rm = remote; w = warning; sod = switch on disabled; qs = quick stop; ve = voltage enabled; f = fault; oe = operation enabled; so = switched on; rtso = ready to switch on

State coding

Statusword	PDS FSA state

Statusword	PDS FSA state
xxxx xxxx x0xx 0000$_b$	Not ready to switch on
xxxx xxxx x1xx 0000$_b$	Switch on disabled
xxxx xxxx x01x 0001$_b$	Ready to switch on
xxxx xxxx x01x 0011$_b$	Switched on
xxxx xxxx x01x 0111$_b$	Operation enabled
xxxx xxxx x00x 0111$_b$	Quick stop active
xxxx xxxx x0xx 1111$_b$	Fault reaction active
xxxx xxxx x0xx 1000$_b$	Fault

If bit 4 (voltage enabled) of the statusword is 1, this indicates that high voltage is applied to the PDS.

If bit 5 (quick stop) of the statusword is 0, this indicates that the PDS is reacting on a quick stop request.

If bit 7 (warning) of the statusword is 1, this indicates the presence of a warning condition. Warning is not an error or fault (examples: temperature limit exceeded, job refused). The status of the PDS FSA is not changed. The cause of the warning is given in the Error report object (203Fh).

If bit 9 (remote) of the statusword is 1, this indicates that the controlword is processed. If it is 0 (local), this indicates that the controlword is not processed. Nevertheless, the PDS may provide actual values, and the PDS may accept COB for configuration data transmission for other parameter objects.

If bit 10 (target reached) of the statusword is 1, this indicates that the PDS has reached the set-point. The set-point is operation mode specific and is defined in detail in the corresponding clauses of this part of the IEC 61800-7 series. Bit 10 is also set to 1, if the operation mode has been changed. The change of a target value by software will alter this bit. If quick stop option code is 5, 6, 7 or 8, bit 10 is set to 1, when the quick stop operation is finished and the PDS is halted. If halt occurred and the PDS has halted then bit 10 is set to 1, too.

Internal limit active (bit 11) indicates if there is an element that doesn't allow the motion to follow the target value. Several limits exist in the firmware. Max. torque (6072h) limits Torque demand (6074h), Max. motor speed (6080h) limits Velocity demand value (606Bh) and Profile velocity (6081h) in Profile position (PP) mode, Software position limit (607Dh) limits Position demand value (6062h) and position or velocity controller integral limit limits integral part of the PID controller.
Additional limit, Position range limit (607Bh), exists for Position demand value (6062h) in Profile position (PP) mode since demand value can't wrap around the range limit, when profiler is being used.

Operation mode specific bits of Statusword ("oms")

Bits	Cyclic synchronous position control	Cyclic synchronous velocity control	Cyclic synchronous torque control	Profile position mode	Profile velocity mode	Homing mode
bit 13 (0x2000)	Following error bit	not used		Following error bit	not used	Homing error bit
bit 12 (0x1000)	Target position ignored	Target velocity ignored	Target torque ignored	Set-point acknowledge bit	Speed bit	Homing attained bit

Bit 14 and bit 15 are manufacturer-specific.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Statusword	0x6041:0	UINT	16			0		readonly (default)	Transmit PDO (Inputs)

0x605A Quick stop option code

Indicates what action is performed when the quick stop function is executed. The slow down ramp is the deceleration value of the used mode of operations. The table below shows the value definitions for the function.

Note: In active short circuit mode, the user can only configure the active short circuit duration time object (0x2010:18). The active short circuit remains active until the specified duration elapses. After this period, the brake is engaged.

Warning: During an active short circuit, motor phase currents are limited to twice the motor's rated current. If this value exceeds the drive's maximum output current, the motor phase currents are limited to 90% of the drive's maximum output current.

Warning: An active short circuit may result in motor overheating.

Value	Definition
0	Disable drive function
2	Slow down on quick stop ramp and transit into switch on disabled
6	Slow down on quick stop ramp and stay in quick stop active
9	Transit into active short circuit and then into switch on disabled

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Quick stop option code	0x605A:0	INT	16	Disable Drive Function 0 Slow down on quick stop ramp and transit into switch on disabled 2 Slow down on quick stop ramp and stay in quick stop active 6 Transit into active short circuit and then into switch on disabled 9	readwrite

0x6060 Modes of operation

Use this object to request an operation mode.

NOTE This object shows only the value of the requested operation mode, the actual operation mode of the PDS is reflected in Object 0x6061:0.

Value	Definition
-6	Impedance mode
-5	Joint torque mode
-4	System identification mode (Deprecated)
-3	Open loop field mode
-2	Diagnostics mode
-1	Cogging compensation recording mode
+1	Profile position mode
+3	Profile velocity mode
+4	Torque profile mode
+6	Homing mode
+8	Cyclic sync position mode
+9	Cyclic sync velocity mode
+10	Cyclic sync torque mode

The modes can be switched dynamically while in state `Operation enabled`.

Ensure that all required PDO data is available for the mode you are switching to.

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

Modes of operation	0x6060:0	SINT	8	No mode selected: 0 Profile position mode: 1 Profile velocity mode: 3 Profile torque mode: 4 Homing mode: 6 Cyclic synchronous position mode: 8 Cyclic synchronous velocity mode: 9 Cyclic synchronous torque mode: 10 Cogging compensation recording mode: -1 Diagnostics mode: -2 Open loop field mode: -3 System identification mode (Deprecated): -4 Joint torque mode: -5 Impedance mode: -6	readwrite	Receive PDO (Outputs)

0x6061 Modes of operation display

Displays the actual operational mode.

Value	Definition
-6	Impedance mode
-5	Joint torque mode
-4	System identification mode (Deprecated)
-3	Open loop field mode
-2	Diagnostics mode
-1	Cogging compensation recording mode
0	No mode selected
+1	Profile position mode
+3	Profile velocity mode

Value	Definition
+4	Torque profile mode
+6	Homing mode
+8	Cyclic sync position mode
+9	Cyclic sync velocity mode
+10	Cyclic sync torque mode

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Modes of operation display	0x6061:0	SINT	8	No mode selected	0		readonly (default)	Transmit PDO (Inputs)
				Profile position mode	1			
				Profile velocity mode	3			
				Profile torque mode	4			
				Homing mode	6			
				Cyclic synchronous position mode	8			
				Cyclic synchronous velocity mode	9			
				Cyclic synchronous torque mode	10			
				Cogging compensation recording mode	-1			
				Diagnostics mode	-2			
				Open loop field mode	-3			
				System identification mode (Deprecated)	-4			
				Joint torque mode	-5			
				Impedance mode	-6			

0x6062 Position demand value

Provides the value of the position sent to the position controller after position limits are checked. See `0x607D Software position limit` . The units are user-defined (increments of the position encoder by default; see `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Position demand value	0x6062:0	DINT	32			0	Inc	readonly (default)	Transmit PDO (Inputs)

0x6064 Position actual value

Provides the actual value of the position encoder. The units are user-defined (increments of the position encoder by default; see `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Position actual value	0x6064:0	DINT	32			0	Inc	readonly (default)	Transmit PDO (Inputs)

0x6065 Following error window

The range of tolerated position values around the position demand value. If the position actual value is out of the following error window, a following error occurs. A following error may occur when a drive is blocked, an unreachable profile target is commanded, or when the controller is weakly tuned. The units are user-defined (increments of the position encoder by default; see `0x6092 Feed constant` to change it). If the value of the following error window is 0xFFFFFFFF, the following error monitoring will be switched off.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Following error window	0x6065:0	UDINT	32			4294967295	Inc	readwrite	Receive PDO (Outputs)

0x6066 Following error time out

Configures the time to allow the controller to be outside the error window. After this timeout, bit 13 of the statusword will be set to 1. The units are in milliseconds.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Following error time out	0x6066:0	UINT	16		100	ms	readwrite	Receive PDO (Outputs)

0x6067 Position window

Configures the size of the window by reflecting this value on either side of the target position. If the actual value of the position encoder is within this position window, the target position will be regarded as having been reached. The units are user-defined (increments of the position encoder by default; see `0x6092 Feed constant` to change it). If the value of the position window is 0xFFFFFFFF, position window monitoring will be switched off.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Position window	0x6067:0	UDINT	32			4294967295	Inc	readwrite	Receive PDO (Outputs)

0x6068 Position window time

Configures the time required for the position sensor to be within the position window before it's considered to be within the window. The units are in milliseconds.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Position window time	0x6068:0	UINT	16			0	ms	readwrite	Receive PDO (Outputs)

0x606B Velocity demand value

Provides the output value of the trajectory generator in velocity control, and the output of the position controller when using the cascaded controller. The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity demand value	0x606B:0	DINT	32			0	rpm	readonly (default)	Transmit PDO (Inputs)

0x606C Velocity actual value

Provides the actual velocity value derived either from the velocity sensor or the position sensor. The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity actual value	0x606C:0	DINT	32			0	rpm	readonly (default)	Transmit PDO (Inputs)

0x606D Velocity window

Configures the size of the window by reflecting this value on either side of the target velocity. The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it). If the value of the velocity window is 0xFFFF, velocity window monitoring will be switched off.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity window	0x606D:0	UINT	16			65535	rpm	readwrite	Receive PDO (Outputs)

0x606E Velocity window time

Configures the time the velocity controller needs to be within the velocity window to consider it having reached the target. The units are in milliseconds.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity window time	0x606E:0	UINT	16			0	ms	readwrite	Receive PDO (Outputs)

0x606F Velocity threshold

Configures the velocity that is considered zero velocity. The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity threshold	0x606F:0	UINT	16			0	rpm	readwrite	Receive PDO (Outputs)

0x6070 Velocity threshold time

Configures the time required for the actual velocity to rise above the velocity threshold before the motor is considered to be moving. The units are in milliseconds.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity threshold time	0x6070:0	UINT	16			0	ms	readwrite	Receive PDO (Outputs)

0x6071 Target Torque

Sets the desired torque for the torque controller in profile torque mode. The units are per thousand of rated torque.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Target Torque	0x6071:0	INT	16			0		readwrite	Receive PDO (Outputs)

0x6072 Max torque

The configured maximum permissible torque in the motor. The value is given in per thousandth of rated torque.

$$\text{Max Torque} = \frac{\tau_{\text{max\_Datasheet}}}{\tau_{\text{rated\_Datasheet}}} \times 1000$$

For example, if the rated torque from the datasheet is 200 Nm and maximum torque is 600 Nm,

$$\text{Max Torque} = \frac{600\ \text{Nm}}{200\ \text{Nm}} \times 1000 = 3000$$

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Max torque	0x6072:0	UINT	16	0	32767	3000		readwrite	Receive PDO (Outputs)

0x6073 Max current

Indicates the configured maximum permissible torque-creating current in the motor. The units are per thousand of rated current.

$$\text{Max Current} = \frac{I_{\text{max\_Datasheet}}}{I_{\text{rated\_Datasheet}}} \times 1000$$

For example, if the `0x6075 Motor rated current` is 2 Amps and maximum current which can be applied for short duration is 6 Amps,

$$\text{Max Current} = \frac{6\ \text{Amps}}{2\ \text{Amps}} \times 1000 = 3000$$

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Max current	0x6073:0	UINT	16	0	50000	3000		readwrite	Receive PDO (Outputs)

0x6074 Torque demand

Provides the output value of the torque trajectory generator. The units are per thousand of rated torque.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Torque demand	0x6074:0	INT	16			0		readonly (default)	Transmit PDO (Inputs)

0x6075 Motor rated current

The motor rated current is taken from the motor datasheet. It needs to be configured in rms value. In the datasheet it could be defined in other units (peak value), therefore it needs to be converted into rms value before configuration. The units are in Milliampere [mA]. All relative current data refers to this value (such as `0x6073 Max current`).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Motor rated current	0x6075:0	UDINT	32	1	1000000	1	mA	readwrite	

0x6076 Motor rated torque

Indicates the nominal torque for the motor. It is taken from the motor's specifications. All relative torque data shall refer to this value (such as `0x6072 Max torque`). For linear motors, the object name is not changed, but the motor rated force value must be entered as multiples of mN (millinewton). The value shall be given in mNm (millinewton metre).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Motor rated torque	0x6076:0	UDINT	32	1		1	mNm	readwrite

0x6077 Torque actual value

Provides the actual value of the torque, and is computed based on the currents measured in the motor. The units are per thousand of rated torque.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Torque actual value	0x6077:0	INT	16			0		readonly (default)	Transmit PDO (Inputs)

0x6079 DC link circuit voltage

Provides the bus voltage measured at the inverter. The units are in millivolts (mV).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
DC link circuit voltage	0x6079:0	UDINT	32			0	mV	readonly (default)	Transmit PDO (Inputs)

0x607A Target position

Sets the desired position for all position modes. The units are user-defined (increments of the position encoder by default; see `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Target position	0x607A:0	DINT	32			0	Inc	readwrite	Receive PDO (Outputs)

0x607B Position range limit

Reports the limits of the position sensor, and is updated when the encoder is reconfigured. On reaching or exceeding these limits, the sensor value will wrap automatically to the other end of the range. The units are user-defined (increments of the position encoder by default; see `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Min position range limit	0x607B:1	DINT	32			-2147483648	Inc	readwrite	Receive PDO (Outputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Max position range limit	0x607B:2	DINT	32			2147483647	Inc	readwrite	Receive PDO (Outputs)

0x607C Home offset

Defines the difference between the zero position for the application and the machine home position (found during homing). During homing, the machine home position is found and once the homing is completed, the zero position is offset from the home position by adding the home offset to the home position. All subsequent absolute moves are taken relative to this new zero position. The units are user-defined (increments of the position encoder by default; see `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Home offset	0x607C:0	DINT	32			0	Inc	readwrite	Receive PDO (Outputs)

0x607D Software position limit

Defines the absolute position limits for the `0x607A Target position` and the `0x6064 Position actual value`. Every new target and actual position are checked against these limits. The limit positions shall be always relative to the machine home position. Limits are disabled by setting them to default values, min. limit to -2147483648 and max. limit to 2147483647. The units are user-defined (increments of the position encoder by default; see `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Min position limit	0x607D:1	DINT	32			-2147483648	Inc	readwrite	Receive PDO (Outputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Max position limit	0x607D:2	DINT	32		2147483647	Inc	readwrite	Receive PDO (Outputs)

0x607E Polarity

Indicates if the velocity or position data are multiplied by 1 or by -1, effectively flipping the polarity of the command and feedback. The position polarity bit is used for profile position *(pp)* mode and cyclic sync position mode *(csp)*. The velocity polarity bit is used for profile velocity *(pv)* mode and cyclic sync velocity mode *(csv)*.

The valid values of this object are:

- `Position polarity flipped` (128) - multiplies the position by -1
- `Velocity polarity flipped` (64) - multiplies the velocity by -1
- `Both are flipped` (192) - both velocity and position are multiplied by -1

The polarity flag has no influence on the homing mode.

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping
Polarity	0x607E:0	USINT	8	None	0		readwrite	Receive PDO (Outputs)
				Position polarity flipped	128			
				Velocity polarity flipped	64			
				Both flipped	192			

0x6080 Max motor speed

Sets the max allowed speed for the motor in either direction. It is used to protect the motor and is taken from the motor data sheet. The value shall be given in RPM by default (see `0x60a9 SI unit velocity` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Max motor speed	0x6080:0	UDINT	32	0		1000	rpm	readwrite	Receive PDO (Outputs)

0x6081 Profile velocity

Configures the velocity target for the end of the acceleration ramp during profiled motion. The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Profile velocity	0x6081:0	UDINT	32			0	rpm	readwrite	Receive PDO (Outputs)

0x6083 Profile acceleration

Configures the acceleration used during profiled motion. The units are user-defined (RPM per second by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Profile acceleration	0x6083:0	UDINT	32			0	rpm/s	readwrite	Receive PDO (Outputs)

0x6084 Profile deceleration

Configures the deceleration used during profiled motion. The units are user-defined (RPM per second by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Profile deceleration	0x6084:0	UDINT	32			0	rpm/s	readwrite	Receive PDO (Outputs)

0x6085 Quick stop deceleration

Indicates the deceleration used to stop the motor when the quick stop function is activated. The units are user-defined (RPM per second by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Quick stop deceleration	0x6085:0	UDINT	32	1		10000	rpm/s	readwrite	Receive PDO (Outputs)

0x6086 Motion profile type

Indicates the type of motion profile used to perform profiled motion.

Value	Definition
0	Linear ramp (trapezoidal profile)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Motion profile type	0x6086:0	INT	16	-65408	0	0		readwrite	Receive PDO (Outputs)

0x6087 Torque slope

Configures the rate of change of torque. The units are in per thousand of rated torque per second.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Torque slope	0x6087:0	UDINT	32	0	100000	0		readwrite	Receive PDO (Outputs)

0x6088 Torque profile type

Indicates the type of profile used to perform a torque profile.

Value	Definition
0	Linear ramp (trapezoidal profile)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Torque profile type	0x6088:0	INT	16			0		readwrite	Receive PDO (Outputs)

0x6091 Gear ratio

Defines the ratio of motor shaft revolutions to driving shaft revolutions. The term *driving shaft* refers to the shaft where the encoder used for position control is mounted. If no position control encoder is used, it refers to the shaft where the encoder used for velocity control is mounted.

If there is only one encoder configured, or if the encoder used for position control is on the motor shaft, this parameter is not used. To scale the position between the driving shaft and the output of a gearbox, 0x6092 Feed constant should be used to create a virtual gear ratio instead.

All values for this parameter are dimensionless.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Motor revolutions	0x6091:1	UDINT	32			1		readwrite	Receive PDO (Outputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Shaft revolutions	0x6091:2	UDINT	32			1		readwrite	Receive PDO (Outputs)

0x6092 Feed constant

This object shall indicate the configured feed constant, this is the measurement distance per one revolution of the output shaft of the gearbox. The feed constant shall be calculated by the following formula:

$$\text{feed constant} = \frac{\text{feed}}{\text{driving shaft revolutions}}$$

The feed shall be given in user-defined position units, and the driving shaft revolution shall be dimensionless. If the feed is 0xFFFFFFFF, user-defined position unit is equal to position encoder ticks.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Feed	0x6092:1	UDINT	32	0		4294967295		readwrite	Receive PDO (Outputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Shaft revolutions	0x6092:2	UDINT	32	1		1		readwrite	Receive PDO (Outputs)

0x6098 Homing method

Name	Index:Sub	Type	Bit Size	Options		Unit	Access	PDO Mapping

Homing method	0x6098:0	SINT	8	[-4] Home on offset (0x2005:4) before positive endstop	-4	readwrite	Receive PDO (Outputs)
				[-3] Home on offset (0x2005:4) before negative endstop	-3		
				[-2] Home on index pulse before positive endstop	-2		
				[-1] Home on index pulse before negative endstop	-1		
				No homing method assigned	0		
				[1] Home on index pulse before negative limit switch rising edge	1		
				[2] Home on index pulse before positive limit switch rising edge	2		
				[3] Home on index pulse before positive home switch rising edge	3		
				[4] Home on index pulse after positive home switch rising edge	4		
				[5] Home on index pulse before negative home switch rising edge	5		
				[6] Home on index pulse after negative home switch rising edge	6		

[7] Home on index pulse before home switch rising edge - Positive movement direction	7
[8] Home on index pulse after home switch rising edge - Positive movement direction	8
[9] Home on index pulse before home switch falling edge - Positive movement direction	9
[10] Home on index pulse after home switch falling edge - Positive movement direction	10
[11] Home on index pulse before home switch rising edge - Negative movement direction	11
[12] Home on index pulse after home switch rising edge - Negative movement direction	12
[13] Home on index pulse before home switch falling edge - Negative movement direction	13
[14] Home on index pulse after home switch falling edge - Negative movement direction	14

[17] Home on negative limit switch rising edge (switch in inactive state)	17
[18] Home on positive limit switch rising edge (switch in inactive state)	18
[19] Home on positive home switch rising edge (switch in inactive state)	19
[20] Home on positive home switch rising edge (switch in active State)	20
[21] Home on negative home switch rising edge (switch in inactive state)	21
[22] Home on negative home switch rising edge (switch in active State)	22
[23] Home on home switch rising edge (switch in inactive state) - Positive movement direction	23
[24] Home on home switch rising edge (switch in active State)- Positive movement direction	24
[25] Home on home switch falling edge (switch in active State) - Positive movement direction	25

[26] Home on home switch falling edge (switch in inactive state) - Positive movement direction	26
[27] Home on home switch rising edge (switch in inactive state) - Negative movement direction	27
[28] Home on home switch rising edge (switch in active State) - Negative movement direction	28
[29] Home on home switch falling edge (switch in active State) - Negative movement direction	29
[30] Home on home switch falling edge (switch in inactive state) - Negative movement direction	30
[33] Home on next index pulse - Negative movement direction	33
[34] Home on next index pulse - Positive movement direction	34
[35] Home on current position (same as mode 37)	35
[37] Home on current position	37

0x6099 Homing speeds

Defines the speed at which the motor moves during homing. Two different values can be given; one is used while searching for a limit or home switch, the other is used while searching for zero position (i.e. the index pulse for QEI encoders). The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Speed during search for switch	0x6099:1	UDINT	32			0	rpm	readwrite	Receive PDO (Outputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Speed during search for zero	0x6099:2	UDINT	32			0	rpm	readwrite	Receive PDO (Outputs)

0x609A Homing acceleration

Configures the acceleration and deceleration to be used during a homing operation. The units are user-defined (RPM per second by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Homing acceleration	0x609A:0	UDINT	32			0	rpm/s	readwrite	Receive PDO (Outputs)

0x60A9 SI unit velocity

Indicates the user-defined velocity units. The prefix is used by the firmware to scale the velocity; the second byte is distance unit (0xB4), which is Revolutions if 0x6092 Feed constant is disabled, and user-defined position units when it is enabled; the third byte can define minutes (0x47) or seconds (0x03).

Below are some examples on how to set this object:

`distance unit per minute` (value 0x00B44700 or 11814656) - default.
`10E-1 distance unit per minute` (value 0xFFB44700 or 4290004736)
`10E-2 distance unit per minute` (value 0xFEB44700 or 4273227520)
`10E-3 distance unit per minute` (value 0xFDB44700 or 4256450304)
`distance unit per second` (value 0x00B40300 or 11797248)
`10E-1 distance unit per second` (value 0xFFB40300 or 4289987328)
`10E-2 distance unit per second` (value 0xFEB40300 or 4273210112)
`10E-3 distance unit per second` (value 0xFDB40300 or 4256432896)

Name	Index:Sub	Type	Bit Size	Options	Unit	Access	PDO Mapping

SI unit velocity	0x60A9:0	UDINT	32	1E12 distance unit per minute	213141248	readwrite
				1E9 distance unit per minute	162809600	
				1E6 distance unit per minute	112477952	
				1E3 distance unit per minute	62146304	
				distance unit per minute	11814656	
				1E-1 distance unit per minute	4290004736	
				1E-2 distance unit per minute	4273227520	
				1E-3 distance unit per minute	4256450304	
				1E12 distance unit per second	213123840	
				1E9 distance unit per second	162792192	

1E6 distance unit per second	112460544
1E3 distance unit per second	62128896
distance unit per second	11797248
1E-1 distance unit per second	4289987328
1E-2 distance unit per second	4273210112
1E-3 distance unit per second	4256432896

0x60B1 Velocity offset

Sets a feed-forward velocity as input to the velocity controller. The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Velocity offset	0x60B1:0	DINT	32			0	rpm	readwrite	Receive PDO (Outputs)

0x60B2 Torque offset

Sets a feed-forward torque as input to the torque controller. The units are in per thousand of rated torque.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Torque offset	0x60B2:0	INT	16			0		readwrite	Receive PDO (Outputs)

0x60B8 Touch probe function

This object shall indicate the configured function of the touch probe.

The following table specifies the value definition:

Bit	Value	Definition
0	0	Switch off touch probe 1
	1	Enable touch probe 1
1	0	Trigger first event
	1	Continuous
3, 2	0b00	Trigger with touch probe 1 input
	0b01	Trigger with zero impulse signal or position encoder (not implemented)
	0b10	Touch probe source as defined in object 0x60D0, subindex 1 (not implemented)
	0b11	Reserved
4	0	Switch off sampling at positive edge of touch probe 1
	1	Enable sampling at positive edge of touch probe 1
5	0	Switch off sampling at negative edge of touch probe 1
	1	Enable sampling at negative edge of touch probe 1
6 - 7	-	Not implemented
8	0	Switch off touch probe 2
	1	Enable touch probe 2 (not implemented)
9 - 15	-	Not implemented

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Touch probe function	0x60B8:0	UINT	16			0		readwrite	Receive PDO (Outputs)

0x60B9 Touch probe status

This object shall provide the status of the touch probe.

The following table specifies the value definition:

Bit	Value	Definition
0	0	Touch probe 1 is switched off
	1	Touch probe 1 is enabled
1	0	Touch probe 1 no positive edge value stored
	1	Touch probe 1 positive edge value stored
2	0	Touch probe 1 no negative edge value stored
	1	Touch probe 1 negative edge value stored
3 to 5	0	Reserved
6 to 15	-	Not implemented

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Touch probe status	0x60B9:0	UINT	16					readonly (default)	Transmit PDO (Inputs)

0x60BA Touch probe 1 positive edge

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Touch probe 1 positive edge	0x60BA:0	DINT	32					readonly (default)	Transmit PDO (Inputs)

0x60BB Touch probe 1 negative edge

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Touch probe 1 negative edge	0x60BB:0	DINT	32					readonly (default)	Transmit PDO (Inputs)

0x60D1 Touch probe time stamp 1 positive value

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Touch probe time stamp 1 positive value	0x60D1:0	UDINT	32					readonly (default)	Transmit PDO (Inputs)

0x60D2 Touch probe time stamp 1 negative value

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Touch probe time stamp 1 negative value	0x60D2:0	UDINT	32					readonly (default)	Transmit PDO (Inputs)

0x60F2 Positioning option code

This object shall indicate the configured positioning behaviour as described by the *profile positioning mode* or the *interpolated positioning mode*.

15	14	12	11	8	7	6	5	4	3	2	1	0
ms	reserved	ip option		reserved		rro	cio	relative option				
MSB												LSB

LEGEND ms = manufacturer-specific rro = request-response option cio = change immediately option

Currently, the code configures the positioning in the profile position mode. Only bit 0, bit 1, bits 6 and 7 are used, and they define following positioning options

The *relative option* bits shall control the behaviour of positioning tasks in detail when the *abs_rel* bit (bit 6) of the controlword is set to 1 in *pp* mode.

Bit 1	Bit 0	Definition
0	0	Positioning moves shall be performed relative to the preceding (internal absolute) target position (rsp. relative to 0 if there is no preceding target position) as described in
0	1	Positioning moves shall be performed relative to the actual position demand value (object $60FC_h$) - output of the trajectory generator
1	0	Positioning moves shall be performed relative to the position actual value (object 6064_h)
1	1	Reserved

Depending on the application, there are different rotary axis movements possible,

which are coded by bit 6 and 7.

Bit 7	Bit 6	Definition
0	0	Normal positioning similar to linear axis; If reaching or exceeding the position range limits (607Bh) the input value shall wrap automatically to the other end of the range. Positioning can be relative or absolute. Only with this bit combination, the movement greater than a modulo value is possible.
1	1	Positioning with the shortest way to the target position. NOTE: If the difference between actual value and target position in a 360° system is 180°, the axis moves in positive direction.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Positioning option code	0x60F2:0	UINT	16			0		readwrite	Transmit or Receive PDO

0x60F4 Following error actual value

Provides the actual value of the position following error. The units are user-defined (increments of the position encoder by default; see `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping

Following error actual value	0x60F4:0	DINT	32		0	Inc	readonly (default)	Transmit PDO (Inputs)

0x60FA Control effort

Provides a measure of the control effort (the output of the velocity control loop). The units are per thousand of rated torque.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Control effort	0x60FA:0	DINT	32			0		readonly (default)	Transmit PDO (Inputs)

0x60FC Position demand internal value

Provides the output of the trajectory generator in profile position mode. The units are user-defined (increments of the position encoder by default; see `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Position demand internal value	0x60FC:0	DINT	32			0	Inc	readonly (default)	Transmit PDO (Inputs)

0x60FD Digital inputs

Bit 0: Shows Negative Limit Switch Status (1 = Active, 0 = Inactive)

Bit 1: Shows Positive Limit Switch Status (1 = Active, 0 = Inactive)

Bit 2: Shows Home Switch Status (1 = Active, 0 = Inactive)

Bit 3: Shows Interlock Status (1 = Drive cannot be enabled, 0 = Drive can be enabled)

Bit 4 to 15: Reserved

The manufacturer-specific bits (16 to 31) show the state of the Drive's digital inputs.

Bit 16: Digital input 1

Bit 17: Digital input 2

:

Bit 31: Digital input 16

For example, if only Digital input 1 is high (and bits 0 to 3 are low), then object value will be 65536 (0x10000)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Digital inputs	0x60FD:0	UDINT	32			0		readonly (default)	Transmit PDO (Inputs)

0x60FE Digital outputs

The manufacturer-specific bits allow to set the state of the Drive's digital outputs.

Bit 0: Manual Brake Operation (0=Engage, 1=Disengage)

Bit 1 to 15: Reserved

Bit 16: Digital output 1

Bit 17: Digital output 2

:

Bit 31: Digital output 16

To change the state of an output, the corresponding bit in the **Bit mask** has to be set to 1.

For example, to drive Digital Output 1 only:

First enable the corresponding mask bit by writing 65536 (0x10000) in **Bit mask**

Then

Writing 65536 (0x10000) in **Physical outputs** will drive the digital output 1 High.

Writing 0 (0x0) in **Physical outputs** will drive the digital output 1 Low.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Physical outputs	0x60FE:1	UDINT	32			0		readwrite	Receive PDO (Outputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Bit mask	0x60FE:2	UDINT	32			0		readwrite	Receive PDO (Outputs)

0x60FF Target velocity

Sets the target velocity and will be used as input to the trajectory generator. The units are user-defined (RPM by default; see `0x60a9 SI unit velocity` and `0x6092 Feed constant` to change it).

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Target velocity	0x60FF:0	DINT	32			0	rpm	readwrite	Receive PDO (Outputs)

0x6502 Supported drive modes

This object indicates the supported drive modes. Each bit equal to 1 within this value indicates a mode which is supported.

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Supported drive modes	0x6502:0	UDINT	32			197549		readonly (default)	Transmit PDO (Inputs)

0x6621 Safety statusword

Status of STO and SBC. STO is the 8th bit of the first byte, SBC is the 8th bit of the second byte

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Byte 1	0x6621:1	USINT	8		1	0		readonly (default)	Transmit PDO (Inputs)

Name	Index:Sub	Type	Bit Size	Min Data	Max Data	Default Data	Unit	Access	PDO Mapping
Byte 2	0x6621:2	USINT	8		1	0		readonly (default)	Transmit PDO (Inputs)