Everest XCR - Reference manual

Everest XCR

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Disclaimer

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INGENIA
passion for motion

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2 General Information

2.1 Manual revision history

Revision	Release Date	Changes	PDF
v1	22 Apr 2020	Migration from summit series manual	

For the most up to date information use the online Reference manual.

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3 Updating Everest XCR devices

3.1 FTP mode (CANopen & EtherCAT)

FTP bootloader server is included in all Everest devices.

3.1.1 How to enter in FTP bootloader

3.1.1.1 EtherCAT devices

1. Look for the register ***0x5EDE; 0x00 - Force FTP mode*** and write a **0x424F4F54** ("BOOT" in ASCII).

   ⓘ An external tool with an EtherCAT master is required such as TwinCAT.

2. The drive will reboot and enter in FTP bootloader.

3.1.1.2 CANopen devices

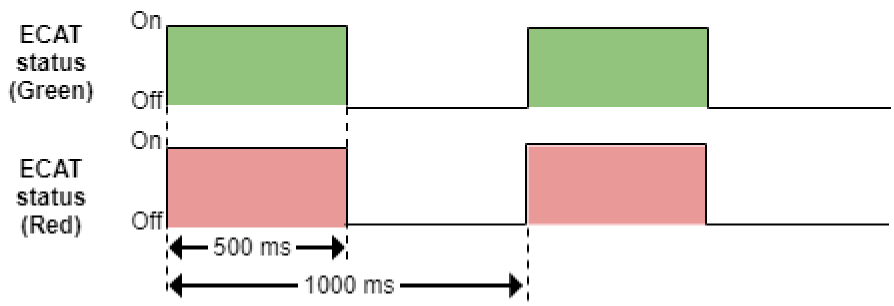
1. Write the correct password **0x424F4F54** ("BOOT" in ASCII) in CANopen dictionary register (***0x5EDE, 0x00) - Force Boot.***

   ⓘ An external tool with a CANopen master is required.

2. The drive will reboot and enter in FTP bootloader.

3.1.2 FTP bootloader LEDs

Both ECAT status LEDs (green and red) will blink at the same time at a frequency of 1 Hz once the drive enters in FTP bootloader mode.

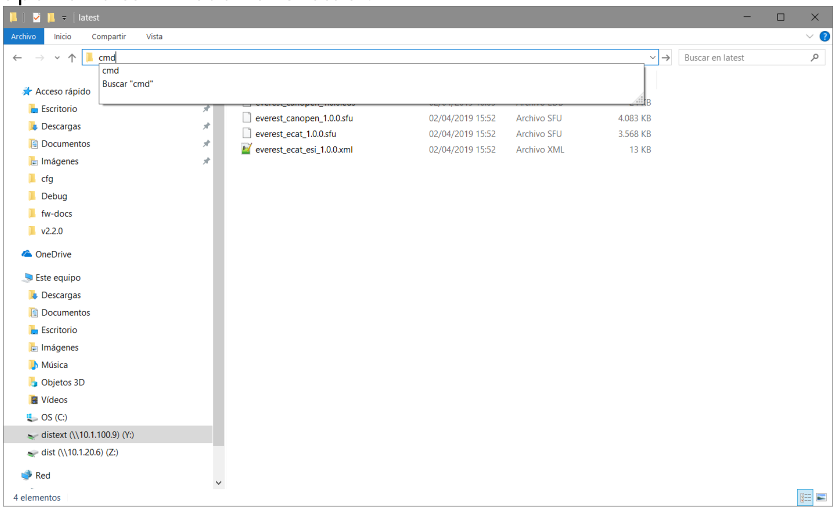


3.1.3 How to update a drive through FTP

Follow the next steps to update a summit device once in FTP bootloader.

1. Go to the folder where the .sfu file is located.

2. Open cmd terminal on this folder.

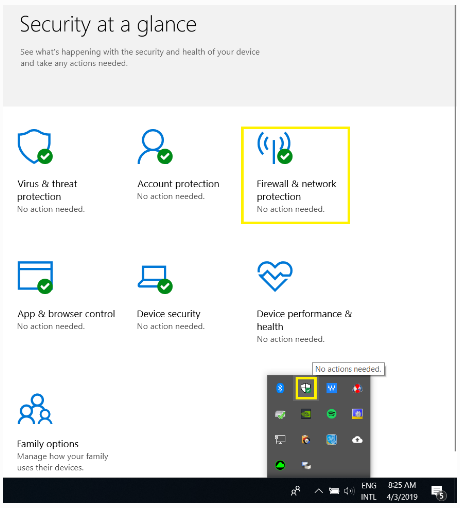


3. Make sure that the ethernet cable is connected.
4. Make sure that the ethernet network IP is 192.168.2.1 (or in the network 255.255.255.0).

> ⓘ The default IP address of a summit drive in "FTP mode" is 192.168.2.22.

5. Make sure that the firewall is not blocking the connection.

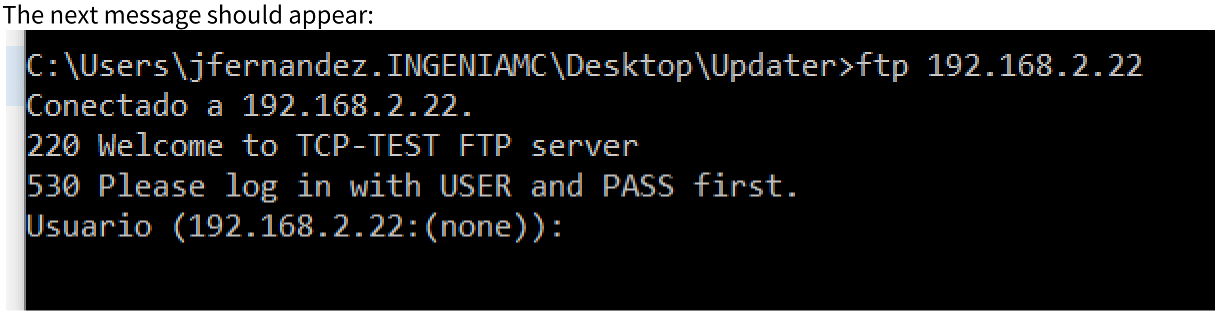
> ⓘ **Disabling firewall on windows 10**



6. Write the next command on the cmd:

```
ftp -x:512 -w:1536 192.168.2.22
```

7. The next message should appear:



```
C:\Users\jfernandez.INGENIAMC\Desktop\Updater>ftp 192.168.2.22
Conectado a 192.168.2.22.
220 Welcome to TCP-TEST FTP server
530 Please log in with USER and PASS first.
Usuario (192.168.2.22:(none)):
```

8. For .sfu files -> **User:** *Ingenia* - > **Password:** *Ingenia*
9. Next message should be seen:

```
C:\Users\jfernandez.INGENIAMC\Desktop\Updater>ftp 192.168.2.22
Conectado a 192.168.2.22.
220 Welcome to TCP-TEST FTP server
530 Please log in with USER and PASS first.
Usuario (192.168.2.22:(none)): Coco
331 Password required
Contraseña:
230 Public login successful
ftp>
```

10. Use the next command to load the file:

```
put file_name.sfu
```

11. If the transmission starts following messages will be seen:

```
200 Ok
150 Ok
```

> ⚠ If those messages don't appear, it may be needed to disable the network firewall for public networks.

12. Wait until the transmission finished appears (it can take several seconds):

```
226 File transfer completed
```

13. Board will be reset automatically, wait until the board is restarted (wait until the LED red turns off). This can take more than a minute.
14. The firmware has been updated.

3.2 FoE (File over EtherCAT)

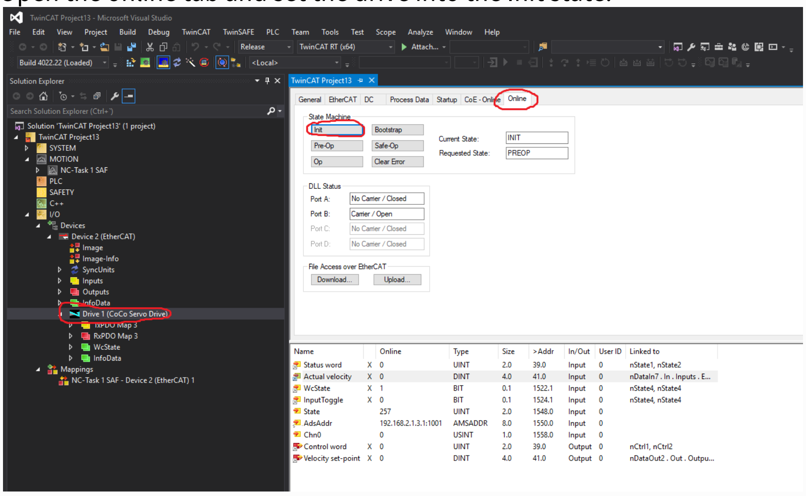
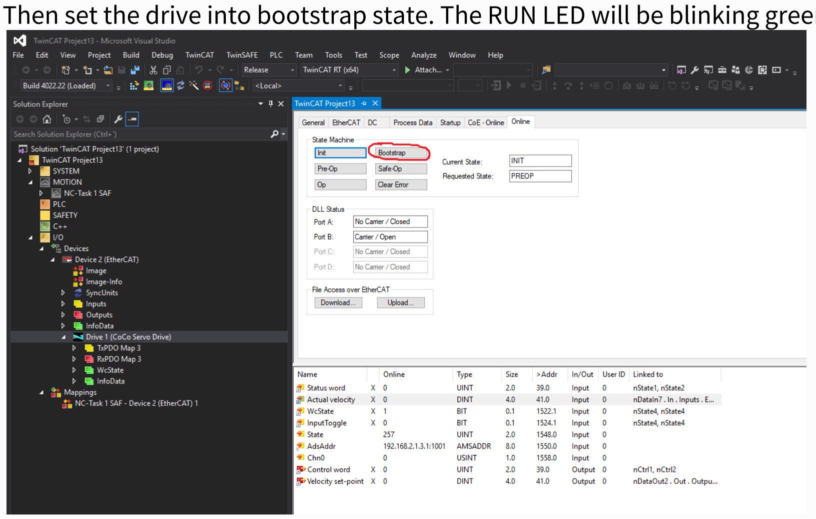
EtherCAT summit devices include the File over EtherCAT (FoE) mailbox which allows to update the firmware of summit devices.

Follow the next steps to update a summit device:

1. Open Twincat and scan the network to discover the summit device.

    > ✔ Copy the available ESI file of the downloaded firmware package into *TwinCAT\3.1\Config\Io\EtherCAT* folder before opening TwinCAT.

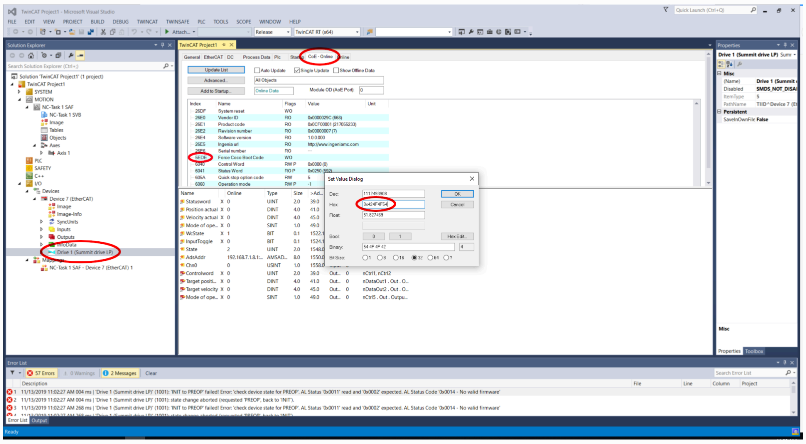
2. Entering to FoE bootloader differs between Summit devices.

    > ⓘ **Everest series**
    >
    > If using an Everest series device:
    >
    > a. Open the online tab and set the drive into the Init state.
    >
    > 
    >
    >
    > b. Then set the drive into bootstrap state. The RUN LED will be blinking green and fast.
    >
    > 
    >

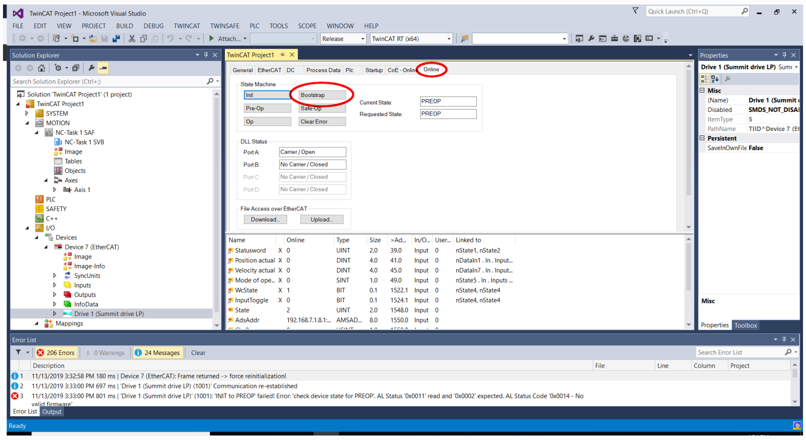
Capitan series

If using a Capitan series device:

a. Open the CoE Online tab and search for register **Force Coco Boot Code (Index 0x5EDE)** and write the boot password **0x424F4F54**.



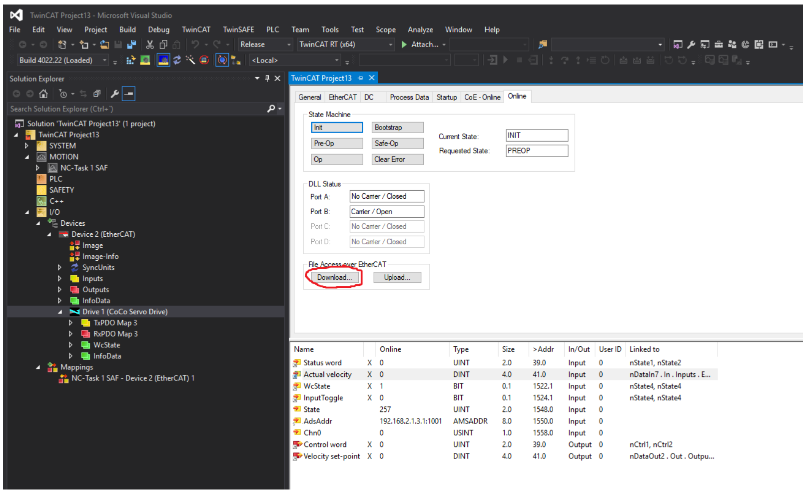
3. Move to Online tab and set the drive into bootstrap state. The drive will restart (few seconds) and the bootloader will boot up in **ERR INIT state**. A message of "no valid firmware" will be seen, this message notifies the entrance in bootloader mode.
Force a second time the **Bootstrap state.** The RUN LED will be blinking green and fast.



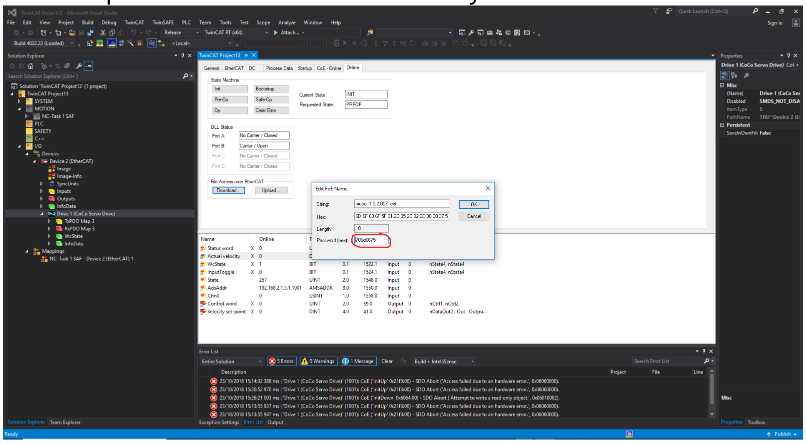
3. Now the device is in FoE bootloader mode.
Click on the *Download* button, and look for the appropriate firmware file. Click on *all files* option to be able to see the file.

firmware files

Everest series use **.sfu** firmware files. Nevertheless, Capitan series use **.lfu** firmware files, and they are not compatible.



4. Write the password **0x70636675** and finally click on *OK* button.



5. A downloading message will appear on the bottom progress bar. Wait until the message changes to ready.
6. Come back to the **INIT state**. Then the drive will finish the updating process and it will restart.
   Wait until a message of communication re-initialization appears on the TwinCAT log.

4 CANopen servo drives

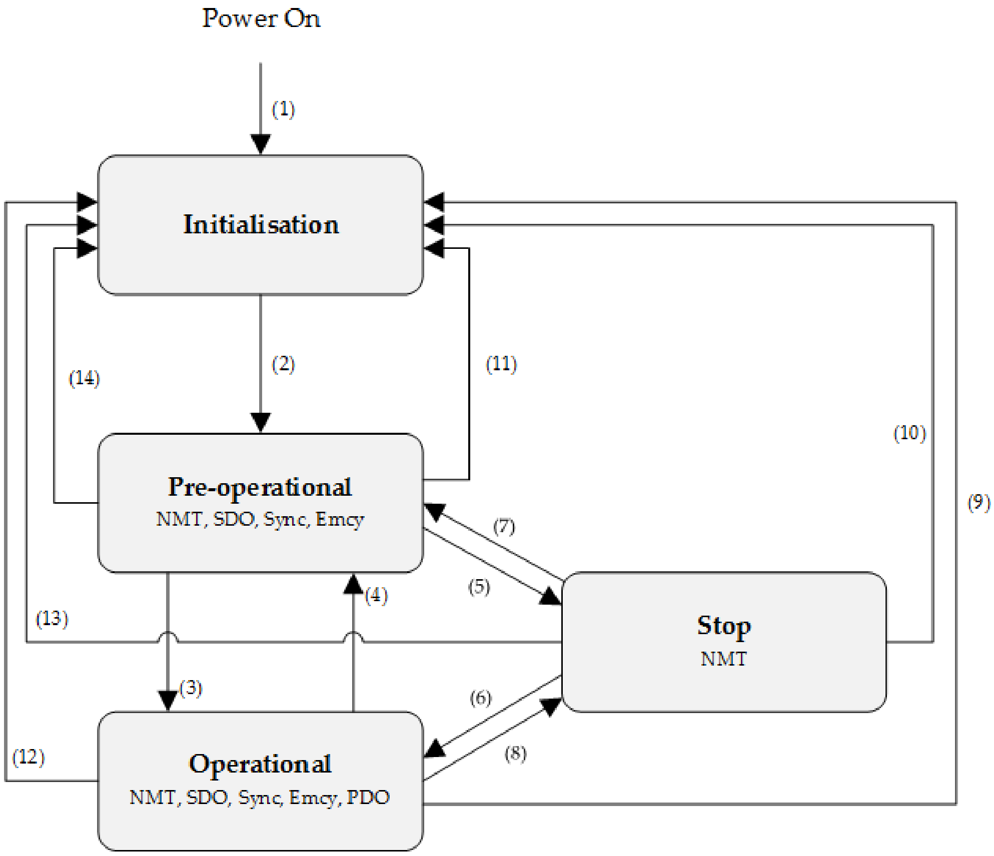
4.1 Communication objects (CiA301)

4.1.1 Network Management (NMT)

The network management (NMT) protocols provide services for network initialization, error control and device status control. NMT objects are used for executing NMT services. The NMT follows a master-slave structure and therefore requires that one CANopen device in the network fulfills the function of the NMT master. All other CANopen devices are regarded as NMT slaves. An NMT slave is uniquely identified in the network by its Node-ID, a value in the range of 1 to 127.

4.1.1.1 NMT state machine

The NMT state machine defines the communication status for CANopen devices.



Transition	Event
(1)	After power on the system goes directly to *initialization* state
(2)	Once *initialization* is completed the system enters to *Pre-operational* state
(3), (6)	Reception of *Start remote node* command
(4), (7)	Reception of *Enter pre-operational state* command
(5), (8)	Reception of *Stop remote node* command
(9), (10), (11)	Reception of *Reset node* command
(12), (13), (14)	Reception of *Reset communication* command

NMT state initialization

The initialization state could be divided into three sub-states that are executed in a sequential way: Initializing (performs the basic CANopen initialization), Reset application (in where all manufacturer-specific and standardized profile area parameters are set) and Reset communication (where the communication profile and parameters are set).
At the end of initialization state the device sends a boot-up message and goes directly to Pre-Operational state.

NMT state pre-operational

In Pre-Operational state, the communication using SDO messages is possible. PDO messages are not yet defined and therefore communication using these message is not allowed. The device will pass to Operational message after receiving a NMT start node command.
Normally the master puts a node in Pre-Operational state during the set-up and configuration of device parameters.

NMT state operational

In Operational state all kind of messages are active, even PDO messages.

NMT state stopped

When entering in Stopped state, the device is forced to stop all communications with the exception of the NMT commands. (Node Guarding & Life Guarding).

NMT states and communication object relation

Following table shows the relation between communication states and communication objects. Services on the listed communication objects may only be executed if the devices involved in the communication are in the appropriate communication states

	Pre-Operational	Operational	Stopped
NMT services	X	X	X
NMT error control	X	X	X
PDO		X	

SDO	X	X	
Sync object	X	X	
Emergency object	X	X	

4.1.1.2 NMT services

The structure of each NMT service command is as follows:

COB-ID (hex)	Number of Bytes	Data field	
		Byte 1	**Byte 2**
000	2	Command specifier	Node ID

The possible NMT services commands are the followings:

Command specifier (hex)	Command description
01	*Start remote node*
02	*Stop remote node*
80	*Enter pre-operational*
81	*Reset node*
82	*Reset communication*

Example of NMT services:

COB-ID (hex)	Number of Bytes	Data (hex)	Description
000	2	80 01	NMT Host commands node 1 into Pre-Operational state
000	2	01 01	NMT Host commands node 1 into Operational state
000	2	02 01	NMT Host commands node 1 into Stopped state
000	2	82 01	NMT Host commands a communication reset to node 1
701	1	00	Node 1 response with a boot-up message

4.1.1.3 NMT error control

Node guarding service

The NMT Master can monitor the communication status of each node using the Node Guarding protocol.
During node guarding, a controller is polled periodically and is expected to respond with its communication state within a pre-defined time frame. Note that responses indicating an acceptable state will alternate between two different values due to a toggle bit in the returned value. If there is no response, or an unacceptable state occurs, the NMT master could report an error to its host application.
The NMT master sends a node guarding request using the following a Remote Frame message:

COB-ID (hex)	Number of Bytes	RTR
700 + Node ID	0	1

The NMT slave will generate a node guarding answer using the following message:

COB-ID (hex)	Number of Bytes	RTR	Data field (Byte 1)	
			Bit 7	Bit 6 to 0
700 + Node ID	1	0	Toggle	NMT communication state

Note that the slave answers toggling a bit between consecutive responses. The value of the toggle bit of the first response after the guarding protocol becomes actives is zero.
The state of the heartbeat producer could be one of the followings:

Communication State value (hex)	State definition
00	Boot-up
04	Stopped
05	Operational
7F	Pre-operational

Example of NMT Node guarding:

COB-ID (hex)	Number of Bytes	RTR	Data field (hex)	Description
701	0	1	-	Master sends a CAN remote frame without data to node 1.
701	1	0	7F	Node 1 sends the actual NMT state (pre-operational) toggling the 7th bit.
701	0	1	-	Master sends a CAN remote frame without data to node 1.
701	1	0	FF	Node 1 sends the actual NMT state (pre-operational) toggling the 7th bit.

Life guarding service

In Life guarding protocol the NMT slave monitors the status of the NMT master. This protocol utilizes the objects Guard time (0x100C) and Life time factor (0x100D) to determine a "Lifetime" for each NMT slave (Lifetime = Guard Time * Life Time Factor). If a node does not receive a Node Guard message within its Lifetime, the node assumes communication with the host is lost sends an emergency message and performs a fault reaction. Each node may have a different Lifetime.

Example of NMT life guarding:

COB-ID (hex)	Number of Bytes	RTR	Data field (hex)	Description
701	0	1	-	Master sends a CAN remote frame without data to node 1
701	0	1	-	Master sends a CAN remote frame without data to node 1
…	…	…	…	Delay Higher than Guard Time * Life Time Factor
81	8	0	30 81 11 00 00 00 00 00	Node 1 send an EMCY indicating the lifeguard error

Note: to start the Life Guarding protocol, both Guard Time and Life Time Factor need to be different than 0, and a first CAN remote frame without data needs to be send to each node.

Heartbeat service

The heartbeat protocol defines an error control service without need for remote frame. A heartbeat producer (in this scope a controller) transmits a Heartbeat message cyclically. Transmit cycle of heartbeat message could be configured using the object *Producer heartbeat time* (0x1017). If the Heartbeat is not received by the consumer (in this scope a master) within an expected period of time (normally specified as *Consumer heartbeat time*) it could report an error to its host application. **Devices based on *summit* are only heartbeat producers.**
The heartbeat message generated by the producer will be as follows:

COB-ID (hex)	Number of Bytes	Data field (Byte 1)	
		Bit 7	Bit 6 to 0
700 + Node ID	1	Reserved	NMT communication state

The state of the heartbeat producer could be one of the followings:

Communication State value (hexadecimal)	State definition
00	Boot-up
04	Stopped
05	Operational
7F	Pre-operational

Example of NMT heartbeat:

COB-ID (hex)	Number of Bytes	Data field (hex)	Description
705	1	7F	Node 5 sends a heartbeat indicating pre-operational state.
705	1	7F	After producer heartbeat time, Node 5 sends again a heartbeat indicating pre-operational state.

Boot-up service

An NMT slave issues the Boot-up message to indicate to the NMT-Master that it has entered the state *Pre-operational* from state *Inititalising*.
Example of NMT Boot-up:

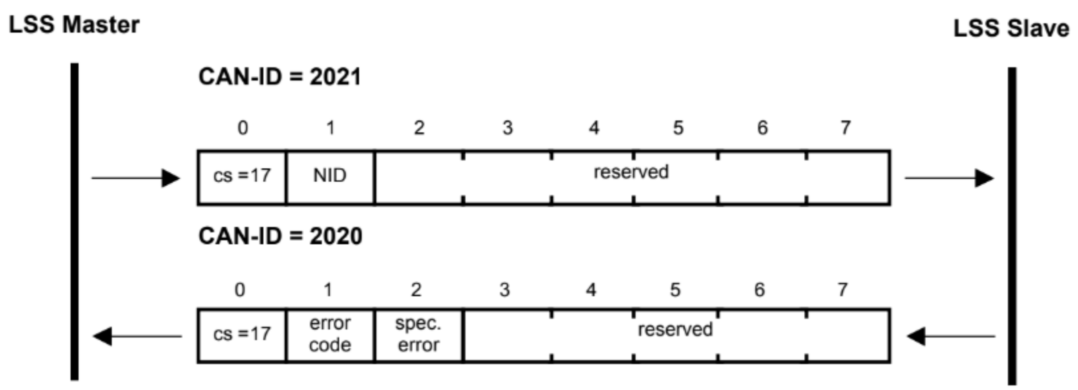
COB-ID (hex)	Number of Bytes	Data field (hex)	Description
701	1	00	Node 1 sends a boot-up NMT message

4.1.2 Layer Setting Services (LSS)

LSS service is available from the master with COB-ID 2021d (0x7E5), this service allow to identify and configure CANopen devices without knowing the Node-Id. The device will answer the master's transmissions at COB-ID 2020d (0x7E4). LSS allow to configure device Node-ID and baudrate.

4.1.2.1 Node-id modification protocol

Previous requirement is to set the desired device on the net to Selective configuration state.



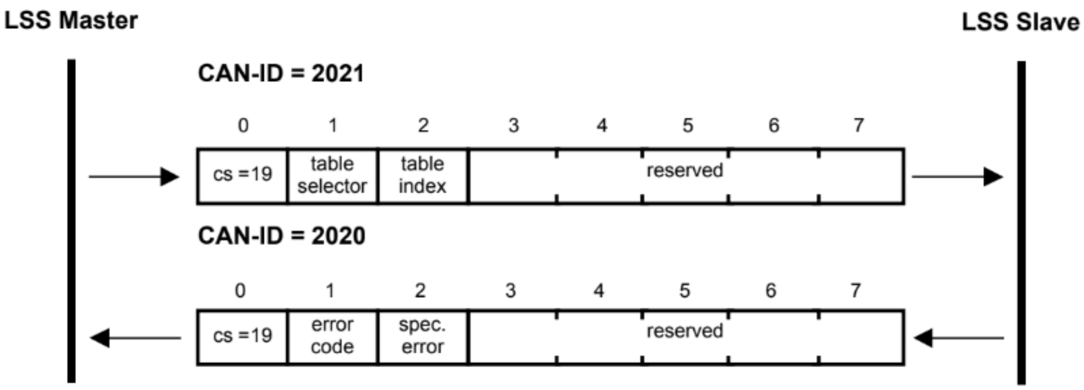
To modify the Node-ID, the master may send a message with command '17', indicating the Node-ID that the device must take.

- **NID**: Node-ID to apply to the device.
- **Error code**:
  0: Node-ID configured successfully.
  1: Node-ID out of range.
- **Specific error**: reserved for future uses.

After Node-ID is configured, it is necessary to make a communication reset of the node to apply the new Node-ID to the communication objects.

4.1.2.2 Bit-timing modification protocol

Previous requirement is to set the desired device on the net to Selective configuration state.



To modify the bit-timing, the master may send a message with command '19', indicating the new baudrate that the device must take. Bit timing must be selected by using the table + index identification.

- **Table selector:**
  0: CiA bit timing table
  1 - 255: reserved for future use
- **Table index:**
  0: 1Mbps.
  1: 800Kbps (not supported).
  2: 500Kbps.
  3: 250Kbps.
  4: 125Kbps.
  5: 50Kbps.
  6: 20Kbps.
  7: 10Kbps.
- **Error code:** reserved for future uses.
  0: Bit-timing configured successfully.
  1: Bit-timing not supported.
- **Specific error**: reserved for future uses.

After bit-timing is configured, it is necessary to send a bit-timing activation message.

4.1.2.3 Example

In this example, we will change from the initial node 15, to node 8. As it can be seen on the following image, only one device is detected, which has been connected with a PCAN driver.

```
C:\Users\elerma\apps-lss-changer>python lss_changer.py -d pcan -c PCAN_USBBUS1 -b 0

================ LssChanger ================
Can driver:      pcan
Baudrate:        1000000
============================================


=== 1 ===
Detected node: 15
Device type: 0x20192
Vendor ID: 0x29c
Product Code: 0x2c10001
Revision number: 0x03
Serial number: 0x1234
============================


Node to be configured:
1
New node id:
8
New baud rate:
0

Switching slave into CONFIGURATION state...

Stored new configuration

Reseting node. Baudrate will be applied after power cycle
Set properly the baudrate of all the nodes before power cycling the devices

Scanning network

=== 1 ===
Detected node: 8
====================
Device type: 0x20192
Vendor ID: 0x29c
Product Code: 0x2c10001
Revision number: 0x03
Serial number: 0x1234
============================


Success disconnecting network

C:\Users\elerma\apps-lss-changer>
```

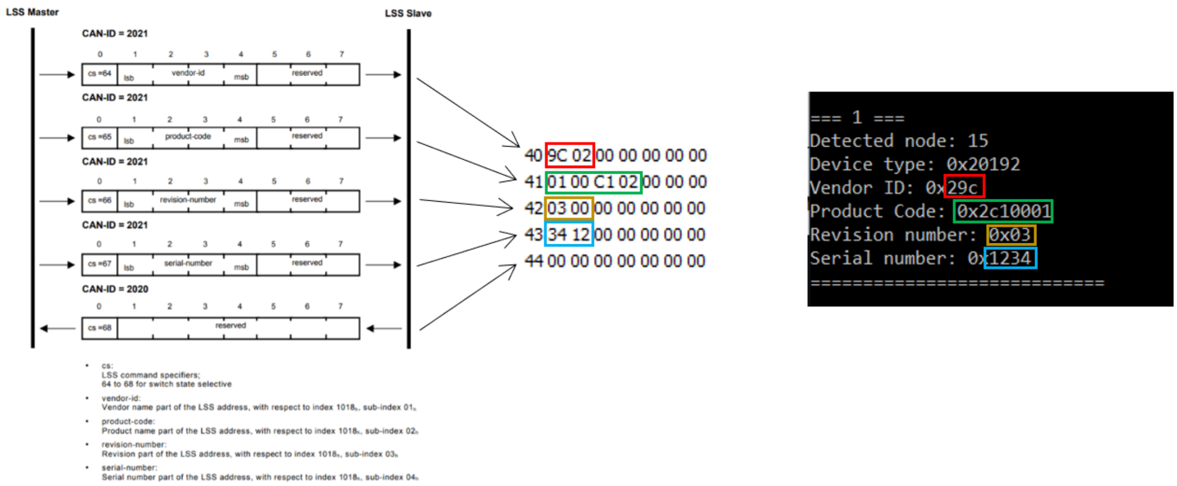
By PCAN-view software, the following sequence has been recorded when changing from one node to another. LSS messages transmitted by the LSS master device shall use the CAN-ID 2021d (0x7E5). LSS messages transmitted by the LSS slave device(s) shall use the CAN-ID 2020d (0x7E4). Comment that data is transferred in litte-endian, this means, the order of the bytes of a data are swapped.

Time	CAN-ID	Rx/Tx	Type	Length	Data	
15,4408	7E5h	Rx	Data	8	40 9C 02 00 00 00 00 00	Switch state selective protocol
15,6409	7E5h	Rx	Data	8	41 01 00 C1 02 00 00 00	
15,8411	7E5h	Rx	Data	8	42 03 00 00 00 00 00 00	
16,0416	7E5h	Rx	Data	8	43 34 12 00 00 00 00 00	
16,0424	7E4h	Rx	Data	8	44 00 00 00 00 00 00 00	
16,2442	7E5h	Rx	Data	8	13 00 00 00 00 00 00 00	Configure bit timing parameters protocol
16,2450	7E4h	Rx	Data	8	13 00 00 00 00 00 00 00	
16,3463	7E5h	Rx	Data	8	11 08 00 00 00 00 00 00	Configure node-ID protocol
16,3470	7E4h	Rx	Data	8	11 00 00 00 00 00 00 00	
16,4480	7E5h	Rx	Data	8	17 00 00 00 00 00 00 00	Store configuration protocol
16,4561	7E4h	Rx	Data	8	17 00 00 00 00 00 00 00	
16,5568	7E5h	Rx	Data	8	04 00 00 00 00 00 00 00	→ Switch state global protocol
16,5618	000h	Rx	Data	2	82 0F	
16,6423	708h	Rx	Data	1	00	

Apart from that, the last two lines corresponds to a NMT reset node and a boot-up message respectively.

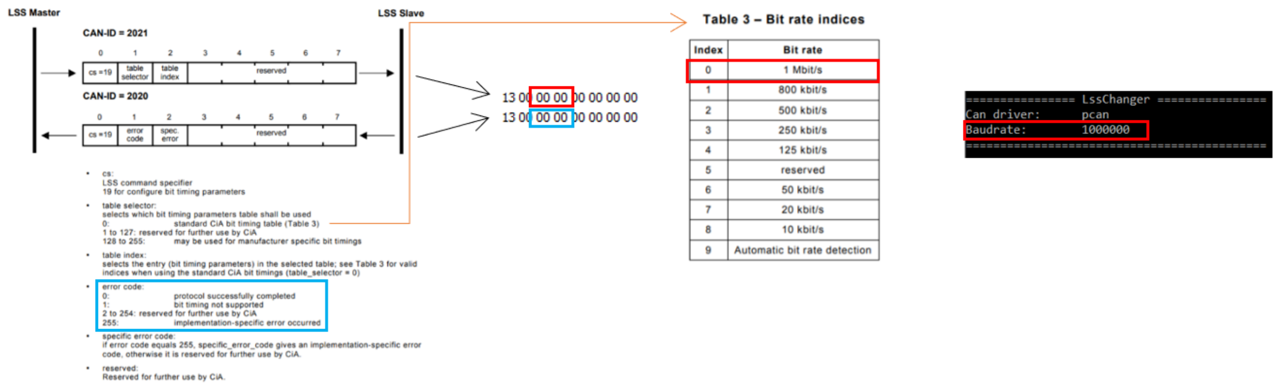
Switch state selective protocol

By the following five lines, the drive connected is analyzed. Such as, vendor ID, product code, revision number or serial number.



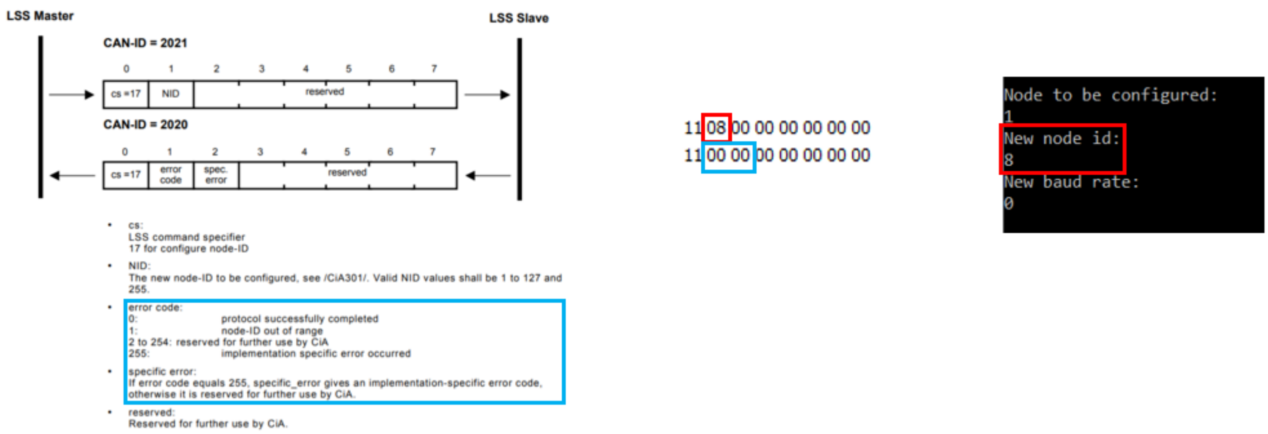
Configure bit timing parameters protocol

On the following two lines, the baudrate is configured. In this case, baudrate has not been changed, so the initial and final baudrate are the same.



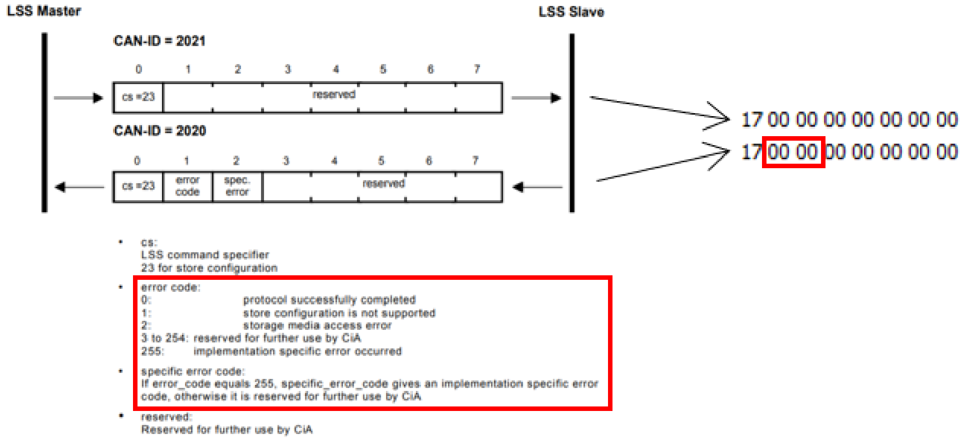
Configure node-ID protocol

The protocol defined here is used to implement the configuration of the node_ID service.



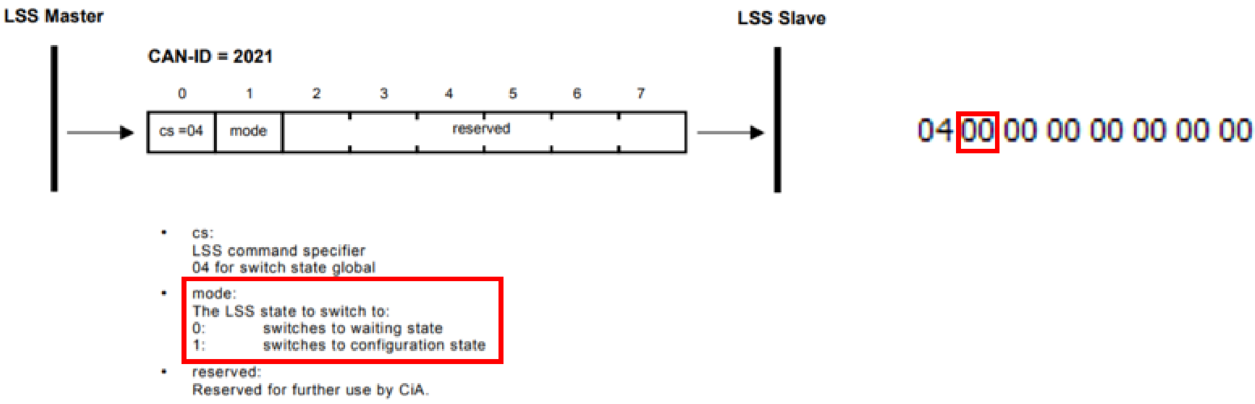
Store configuration protocol

The following two lines are the ones in charge to store the new configuration.



Switch state global protocol

Finally, state is switches to a waiting state.



4.1.3 EMCY service

The EMCY service is an asynchronous producer-consumer protocol on which the producer indicates that an error has been detected by sending an EMCY message. The consumer can easily know the error source that has been detected by the node at the error instant without polling the statusword or the error register.

Each produced EMCY message is reflected in register 0x1001. The EMCY message can both indicate that an error has been produced and also that an error condition has been removed (error code "no error"). Each error indicate the code of the error, and also the affected module.

An emergency object is sent only once per error event.

The reaction on the received EMCY messages is application-specific. By default the EMCY message CAN ID is "0x80 + Node ID". The COB-ID can be modified by means of SDO service through the register 0x1014.

The data content of the emergency message uses the following structure:

COB-ID (hex)	Byte number:	1	2	3	4	5	6	7	8
080 + Node ID		Emergency error code		Error register (Object 0x1001)	Reserved (zero values)				

Example 1

COB-ID (hex)	Number of Bytes	Data field (hex)	Description
89	8	72 73 21 00 00 00 00 00	Node 9 sends a digital encoder runaway error (0x7372) emergency message.
89	8	00 00 00 00 00 00 00 00	Node 9 indicates that the error condition has been removed.

Refer to error identification section for the error code description list.

4.1.3.1 Linking faults with EMCY service

Faults can be linked to EMCY service by means of register 0x5821. This register links a general purpose output of the motion controller to one input of the communication controller. With this link the communication controller can generate EMCY messages.

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x5821	0x00	Error notification source	UINT8	RW	No	Yes	0 to 3	0	-

Register values:

- 0: EMCY link is disabled, EMCY is only available for communication errors.
- 1: EMCY link is based in motion controller's output 1. Health function is mapped to GPO1.
- 2: EMCY link is based in motion controller's output 2. Health function is mapped to GPO2.
- 3: EMCY link is based in motion controller's output 3. Health function is mapped to GPO3.

4.1.4 Process data object (PDO)

PDOs are messages send without confirmation used for real time information transfer. PDOs are mapped to a single CAN frame and can contain multiple object dictionary entries with a maximum of 8 bytes of data. Each PDO has an identifier and is transmitted by only one node in the network, however it could be received by more than one node. PDOs must be configured previous to using them.

There are two types of PDO messages: Transmit PDO (TPDO) and Receive PDO (RPDO).

The trigger event of the PDO message could be configured using the communication parameter object and the object dictionary entries transmitted could be also defined using the PDO mapping list.

Therefore, each PDO is defined by means of:

- A PDO *communication parameter*
- A PDO *mapping object*

Ingenia motion controllers include 4 RPDO and 4 TPDO.

4.1.4.1 Transmit PDO (TPDO)

TPDOs are configured to send data from node to master after the occurrence of a trigger event or after a remote request by means of a RTR.

TPDOs have three transmission types:

- **Internal event or timer:** Message transmission is triggered when the value mapped into the PDO has changed or when the specified time (event-timer) has elapsed. PDO transmission is controlled by producer.
- **Remotely request:** Message transmission is initiated on receipt of a RTR message. PDO transmission is driven by the PDO consumer.
- **Synchronously trigger:** Message transmission is triggered by the reception of a certain number of SYNC objects (see TPDO1 definition for further information). The PDO transmission is controlled by the SYNC producer.

Example of an internal event TPDO:

COB-ID (hex)	Number of Bytes	Data field (hex)	Description
182	2	63 22	Node ID 2 sends the Transmit PDO1 with a content value of 0x2263.

4.1.4.2 Receive PDO (RPDO)

The master uses the RPDO to write data to objects in the nodes.

RPDOs have two transmission types:

- **Asynchronous:** Message content is applied upon receipt of the RPDO. The PDO reception is controlled by the PDO producer.
- **Synchronously trigger:** Message content is applied after the reception of a certain number of SYNC objects. The PDO reception is controlled by the SYNC producer.

Example of an asynchronous RPDO:

COB-ID (hex)	Number of Bytes	Data field (hex)	Description
202	2	22 12	Master sends a RPDO1 to Node 2 with a content value of 0x1222.

4.1.4.3 Mapping procedure

The steps to configure the PDO mapping are (Example for setting the RPDO 1):

1. Place the controller into NMT pre-operational.
2. Destroy the PDO writing a 1 into the *valid* bit of SubIndex 0x01 of PDO communication parameter. **(0x1400 RPDO1** - bit 31 of COB-ID used**)**
3. Unmap all registers from PDO by setting SubIndex 0x00 to zero. **(0x1600 RPDO1 mapping parameter)**.
4. Modify mapping by changing the values in the corresponding SubIndexes. **(0x1600 RPDO1 mapping parameter)**.
5. Enable mapping by setting SubIndex 0x00 to the number of mapped objects. **(0x1600 RPDO1 mapping parameter)**.
6. Create PDO by setting a 0 into the valid bit of SubIndex 0x01 of PDO communication parameter. **(0x1400 RPDO1** - bit 31 of COB-ID used**)**
7. Place the controller into NMT operational.

4.1.4.4 Storing an user-defined mapping

The drive includes 4 PDO mapping on each direction, with a pre-defined mapping configuration. These PDOs can be modified by the user (see mapping procedure) and stored in the NVM memory. The store of this configuration can be done by using register 0x1010 (store parameters).

To recover the default configuration, it can be done using register 0x1011 (Restore default parameters).

In addition, all the PDO related configuration (including mapping and COB-ID) will be recovered to their defaults if the node-ID of the device is modified (using LSS).

> If node-ID is modified, PDO configuration will be restored to defaults.

5 EtherCAT & CANopen registers

5.1 0x1000 - Device type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x1000	0x00	Device type	UINT32	RO	No	No	Data type	0x00020192	-

This object provides information about the device type. The object describes the type of the logical device and its functionality.

5.2 0x1001 - Error register

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x1001	0x00	Error register	UINT8	RO	No	No	Data type	-	-

This object provides error information. It is part of the emergency object.

5.3 0x1003 - Pre-defined error field

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x1003	0x00	Number of errors	UINT8	RW	No	No	0 to 4	0	
0x1003	0x01	Standard error field	UINT32	RO	No	No	Data type	0	-
0x1003	0x02	Standard error field	UINT32	RO	No	No	Data type	0	-
0x1003	0x03	Standard error field	UINT32	RO	No	No	Data type	0	-
0x1003	0x04	Standard error field	UINT32	RO	No	No	Data type	0	-

This object provides the errors that occurred on the drive and were signaled via the emergency object. In doing so it provides an error history.

5.4 0x1010 - Store

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x1010	0x01	Store all	UINT32	RW	No	No	Data type	-	-

This object controls the saving of parameters into the non-volatile memory.

5.5 0x1011 - Restore

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x1011	0x01	Restore all	UINT32	RW	No	No	UINT32	-	-

With this register, the default values of parameters are restored.

5.6 0x1018 - Identity Object

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x1018	0x01	Vendor ID	UINT32	RO	No	No	Data type	0x0000029C	-
0x1018	0x02	Product code	UINT32	RO	No	No	Data type	0x02C30001	-
0x1018	0x03	Revision number	UINT32	RO	No	No	Data type	-	-
0x1018	0x04	Serial number	UINT32	RO	No	No	Data type	-	-

This object provides general identification information of the drive.

5.7 0x200F - Last error

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x200F	0x00	Last error	INT32	RO	Yes	No	Data type	0	-

This register contains the code of the last detected error of the system.

5.8 0x2010 - Control word

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2010	0x00	Control word	UINT16	RW	Yes	No	Data type	0	-

This register allows operating the drive state machine and several modules.

5.9 0x2011 - Status word

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2011	0x00	Status word	UINT16	RO	Yes	No	Data type	0	-

This register allows knowing the drive status.

5.10 0x2014 - Operation mode

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2014	0x00	Operation mode	UINT16	RW	Yes	Yes	Data type	0	-

This register modifies the current operation mode.

5.11 0x2015 - Operation mode display

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2015	0x00	Operation mode display	UINT16	RO	Yes	No	Data type	0	-

This register indicates the current operation mode.

5.12 0x2018 - Voltage quadrature set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2018	0x00	Voltage quadrature set-point	FLOAT	RW	Yes	No	Data type	0.0	V

This register sets the quadrature voltage set-point when drive works in voltage mode.

5.13 0x2019 - Voltage direct set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2019	0x00	Voltage direct set-point	FLOAT	RW	Yes	No	Data type	0.0	V

This register sets the direct voltage set-point when drive works in voltage mode.

5.14 0x201A - Current quadrature set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x201A	0x00	Current quadrature set-point	FLOAT	RW	Yes	No	Data type	0.0	A

This register sets the quadrature current set-point when drive works in current mode.

5.15 0x201B - Current direct set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x201B	0x00	Current direct set-point	FLOAT	RW	Yes	No	Data type	0.0	A

This register sets the direct current set-point when drive works in current mode.

5.16 0x201C - Current A set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x201C	0x00	Current A set-point	FLOAT	RW	Yes	No	Data type	0.0	A

This register sets the A current set-point when drive works in current amplifier mode.

5.17 0x201D - Current B set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x201D	0x00	Current B set-point	FLOAT	RW	Yes	No	Data type	0.0	A

This register sets the B current set-point when drive works in current amplifier mode.

5.18 0x2020 - Position set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2020	0x00	Position set-point	INT32	RW	Yes	No	INT32	0	encoder counts

This register is used to command the target values for position input.

5.19 0x2021 - Velocity set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2021	0x00	Velocity set-point	FLOAT	RW	Yes	No	Data type	0.0	rev/s

This register is used to command the target values for velocity input. The polarity indicates the direction of rotation.

5.20 0x2024 - Positioning option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2024	0x00	Positioning option code	UINT16	RW	Yes	Yes	-	0	-

This object indicates the configured positioning behavior.

5.21 0x2025 - Profiler max. velocity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2025	0x00	Profiler max. velocity	FLOAT	RW	Yes	Yes	> 0.0	200.0	rev/s

This register configures the profiler maximum velocity.

5.22 0x2026 - Profiler max. acceleration

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2026	0x00	Profiler max. acceleration	FLOAT	RW	Yes	Yes	> 0.0	20000.0	rev / s^2

This register configures the profiler maximum acceleration.

5.23 0x2027 - Profiler max. deceleration

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2027	0x00	Profiler max. deceleration	FLOAT	RW	Yes	Yes	> 0.0	20000.0	rev / s^2

This register configures the profiler maximum deceleration.

5.24 0x2030 - Actual position

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2030	0x00	Actual position	INT32	RO	Yes	No	Data type	-	encoder counts

This object contains the actual position calculated using the position feedback.

5.25 0x2031 - Actual velocity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2031	0x00	Actual velocity	FLOAT	RO	Yes	No	Data type	-	rev/s

This register contains the velocity actual value of the actuator, calculated using the velocity feedback.

5.26 0x2033 - Auxiliar feedback value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2033	0x00	Auxiliar feedback value	INT32	RO	Yes	No	Data type	-	feedback counts

This register contains the raw of the selected auxiliar feedback sensor.

5.27 0x2038 - Current A value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2038	0x00	Current A value	FLOAT	RO	Yes	No	Data type	-	A

This register contains the instant current through phase A.

5.28 0x2039 - Current B value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2039	0x00	Current B value	FLOAT	RO	Yes	No	Data type	-	A

This register contains the instant current through phase B.

5.29 0x203A - Current C value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x203A	0x00	Current C value	FLOAT	RO	Yes	No	Data type	-	A

This register contains the instant current through phase C.

5.30 0x203B - Current quadrature value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x203B	0x00	Current quadrature value	FLOAT	RO	Yes	No	Data type	-	A

This register contains the instantaneous quadrature current value.

5.31 0x203C - Current direct value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x203C	0x00	Current direct value	FLOAT	RO	Yes	No	Data type	-	A

This register contains the instantaneous direct current value.

5.32 0x2040 - Commutation angle value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2040	0x00	Commutation angle value	FLOAT	RO	Yes	No	0.0 to 1.0	-	rev

Contains the value of the electrical angle read by the commutation feedback.

5.33 0x2041 - Reference angle

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2041	0x00	Reference angle	FLOAT	RO	Yes	No	0.0 to 1.0	0.0	rev

Contains the value of the electrical angle read by the reference feedback.

5.34 0x204A - BiSS-C slave 1 / Primary SSI - Position

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x204A	0x00	BiSS-C slave 1 / Primary SSI - Position	INT32	RO	Yes	No	Data type	0	encoder counts

This register contains the last read position value from the feedback.

5.35 0x2050 - Generator value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2050	0x00	Generator value	FLOAT	RO	Yes	No	Data type	0.0	-

Contains the value generated by the internal generator module.

5.36 0x2051 - Secondary SSI - Position

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2051	0x00	Secondary SSI - Position	INT32	RO	Yes	No	Data type	0	encoder counts

This register contains the last read position value from the feedback.

5.37 0x2060 - Bus voltage value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2060	0x00	Bus voltage value	FLOAT	RO	Yes	No	Data type	-	V

This register shows the instant bus voltage value.

5.38 0x2061 - Primary temperature value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2061	0x00	Primary temperature value	FLOAT	RO	Yes	No	Data type	-	ºC

This register shows the instant temperature value of the primary temperature sensor located into the drive power stage.

5.39 0x2063 - Motor temperature value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2063	0x00	Motor temperature value	FLOAT	RO	Yes	No	Data type	-	ºC

This register shows the instant temperature value of the motor temperature sensor.

5.40 0x2064 - Redundant temperature value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2064	0x00	Redundant temperature value	FLOAT	RO	Yes	No	Data type	-	ºC

This register shows the instant temperature value of the redundant temperature sensor located in the drive power stage.

5.41 0x2067 - Power stage temperature

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2067	0x00	Power stage temperature	FLOAT	RO	Yes	No	Data type	-	ºC

This register shows the instant temperature value of drive power stage temperature.

5.42 0x206E - Voltage direct command

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x206E	0x00	Voltage direct command	FLOAT	RW	Yes	No	Data type	0.0	V

This register contains the direct voltage command entering into the voltage chain in any mode different than voltage mode.

5.43 0x206F - Voltage quadrature command

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x206F	0x00	Voltage quadrature command	FLOAT	RW	Yes	No	Data type	0.0	V

This register contains the quadrature voltage command entering into the voltage chain in any mode different than voltage mode.

5.44 0x2070 - Voltage quadrature demand

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2070	0x00	Voltage quadrature demand	FLOAT	RW	Yes	No	Data type	-	V

This register contains the quadrature voltage demand entering into voltage chain in voltage mode.

5.45 0x2071 - Voltage direct demand

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2071	0x00	Voltage direct demand	FLOAT	RW	Yes	No	Data type	-	V

This register contains the direct voltage demand entering into the voltage chain in voltage mode.

5.46 0x2072 - Current quadrature demand

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2072	0x00	Current quadrature demand	FLOAT	RO	Yes	No	Data type	-	A

This register contains the quadrature current demand entering into current chain in current mode.

5.47 0x2073 - Current direct demand

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2073	0x00	Current direct demand	FLOAT	RO	Yes	No	Data type	-	A

This register contains the direct current demand entering the current chain in current mode.

5.48 0x2076 - Current actual value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2076	0x00	Current actual value	FLOAT	RO	Yes	No	Data type	-	A

This register contains the module of the *current quadrature value* and *current direct value*.

5.49 0x2077 - Current command value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2077	0x00	Current command value	FLOAT	RO	Yes	No	Data type	0.0	A

This register contains the module of Current quadrature / A control loop command and Current direct / B control loop command

5.50 0x2078 - Position demand

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2078	0x00	Position demand	INT32	RO	Yes	No	Data type	-	encoder counts

This object contains the input of the position control block.

5.51 0x2079 - Velocity demand

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2079	0x00	Velocity demand	FLOAT	RO	Yes	No	Data type	-	rev/s

This register shows the input of the velocity control block.

5.52 0x207B - Velocity loop input offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x207B	0x00	Velocity loop input offset	FLOAT	RW	Yes	Yes	Data type	0.0	rev/s

This register adds an offset to the filtered reference of the velocity controller.

5.53 0x207C - Current quadrature loop input offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x207C	0x00	Current quadrature loop input offset	FLOAT	RW	Yes	Yes	Data type	0.0	A

This register adds an offset to the filtered reference of the current quadrature loop controller.

5.54 0x207D - Current direct loop input offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x207D	0x00	Current direct loop input offset	FLOAT	RW	Yes	Yes	Data type	0.0	A

This register adds an offset to the filtered reference of the current direct loop controller.

5.55 0x207F - Current loop feedback bypass

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x207F	0x00	Current loop feedback bypass	UINT16	RW	No	No	0 to 1	0	-

This register allows bypassing the current feedback in the current loops, and setting the current readings to 0. This allows using the current loops in open loop.

5.56 0x2081 - Analog 1 counts

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2081	0x00	Analog 1 counts	UINT16	RO	Yes	No	Data type	-	ADC counts

This register contains the counts obtained from analog input 1. ADC resolution is 16 bits for differential signals.

5.57 0x2083 - Analog 2 counts

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2083	0x00	Analog 2 counts	UINT16	RO	Yes	No	Data type	-	ADC counts

This register contains the counts obtained from analog input 2. ADC resolution is 16 bits for differential signals.

5.58 0x2096 - Position loop control command

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2096	0x00	Position loop control command	FLOAT	RO	No	Yes	min. position to max. position (if limits active)	-	counts

This register shows the value that is commanded to the position control loop (after the effects of the position offset and reference filters).

5.59 0x2097 - Velocity loop control command

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2097	0x00	Velocity loop control command	FLOAT	RO	Yes	Yes	-max. velocity to max. velocity	-	rev/s

This register shows the value that is commanded to the velocity control loop (after the effects of the velocity offset and reference filters).

5.60 0x2098 - Current quadrature / A control loop command

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2098	0x00	Current quadrature / A control loop command	FLOAT	RO	Yes	No	Data type	-	A

This register contains the quadrature / phase A current command entering into current controller.

5.61 0x2099 - Current direct / B control loop command

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2099	0x00	Current direct/ B control loop command	FLOAT	RO	Yes	No	Data type	-	A

This register contains the direct / phase B current command entering into current controller.

5.62 0x20C1 - Interpolation data record - Position input

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x20C1	0x00	Interpolation data record - Position input	INT32	RW	Yes	No	Data type	0	counts

This register sets the position input for interpolation data record, which is the position to be stored in the buffer.

5.63 0x20C2 - Interpolation data record - Velocity input

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x20C2	0x00	Interpolation data record - Velocity input	FLOAT	RW	Yes	No	Data type	0.0	rev/s

This register sets the velocity input for interpolation data record, which is the velocity to be stored in the buffer.

5.64 0x20C3 - Interpolation data record - Time input

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x20C3	0x00	Interpolation data record - Time input	UINT16	RW	Yes	No	Data type	0	ms

This register sets the time input for interpolation data record in milliseconds.

5.65 0x20C4 - Interpolation data record integrity check

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x20C4	0x00	Interpolation data record integrity check	UINT16	RW	Yes	No	Data type	0	-

This register is used to append new PT or PVT data to the interpolated position buffer and is also used as an integrity check.

5.66 0x2100 - Rated current

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2100	0x00	Rated current	FLOAT	RW	Yes	Yes	Data type	10.0	A

This register defines the continuous current of the actuator / system

5.67 0x2101 - Peak current

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2101	0x00	Peak current	FLOAT	RW	No	Yes	Data type	16.0	A

This register defines the maximum allowed instant current during the defined *peak current time*.

5.68 0x2102 - Peak current time

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2102	0x00	Peak current time	UINT32	RW	No	Yes	Data type	1000	ms

This register defines the maximum time the drive is able to source the *peak current*.

5.69 0x2106 - Motor pole pairs

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2106	0x00	Motor pole pairs	INT16	RW	No	Yes	Data type	2	pole pairs

This register sets the number of motor pole pairs.

5.70 0x2120 - Internal shunt enable voltage

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2120	0x00	Internal shunt enable voltage	FLOAT	RW	No	Yes	Data type	60.0	V

This register sets the voltage threshold to enable the internal shunt braking resistor.

5.71 0x2121 - Internal shunt disable voltage

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2121	0x00	Internal shunt disable voltage	FLOAT	RW	No	Yes	Data type	58.0	V

This register sets the voltage threshold to disable the internal shunt braking resistor.

5.72 0x2122 - External shunt enable voltage

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2122	0x00	External shunt enable voltage	FLOAT	RW	No	Yes	Data type	60.0	V

This register sets the voltage threshold to enable the external shunt braking resistor.

5.73 0x2123 - External shunt disable voltage

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2123	0x00	External shunt disable voltage	FLOAT	RW	No	Yes	Data type	58.0	V

This register sets the voltage threshold to disable the external shunt braking resistor.

5.74 0x2124 - Brake activation voltage percentage

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2124	0x00	Brake activation voltage percentage	UINT16	RW	No	Yes	0 to 100	100	%

This parameter contains the percentage of voltage applied to release the brake.

5.75 0x2125 - Brake holding voltage percentage

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2125	0x00	Brake holding voltage percentage	UINT16	RW	No	Yes	0 to 100	100	%

This parameter contains the percentage of voltage applied to the brake.

5.76 0x2126 - Delay before release brake

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2126	0x00	Delay before release brake	UINT32	RW	No	Yes	Data type	0	ms

This parameter indicates the delay in milliseconds between activation of the power stage and disengaging the brake (brake activated state).

5.77 0x2127 - Delay after enable brake

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2127	0x00	Delay after enable brake	UINT32	RW	No	Yes	Data type	0	ms

This parameter indicates the delay in milliseconds between engaging the brake and deactivation of the power stage.

5.78 0x2128 - Activation brake time

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2128	0x00	Activation brake time	UINT32	RW	No	Yes	Data type	0	ms

This parameter indicates the time in milliseconds the voltage applied to the brake is the configured brake activation voltage percentage.

5.79 0x2129 - Brake override

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2129	0x00	Brake override	UINT16	RW	No	No	0 - 2	0	-

This register allows to override the automatic functionality of the brake.

5.80 0x214F - Commutation modulation

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x214F	0x00	Commutation modulation	UINT16	RW	No	Yes	0 - 2	0	-

This register indicates the applied modulation.

5.81 0x2150 - Commutation angle offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2150	0x00	Commutation angle offset	FLOAT	RW	No	Yes	0.0 - 1.0	0.0	rev

Defines the angle difference between the expected angle 0.0 by the drive algorithm and the angle value read from the commutation feedback at this same position.

5.82 0x2151 - Commutation feedback sensor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2151	0x00	Commutation feedback sensor	UINT16	RW	No	Yes	1 - 7	4	-

This register configures the type of feedback used for commutation.

5.83 0x2152 - Reference angle offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2152	0x00	Reference angle offset	FLOAT	RW	Yes	Yes	0.0 - 1.0	0.0	rev

This register contains the angle difference between the expected angle 0.0 by the drive algorithm and the angle value read from the reference feedback at this same position.

5.84 0x2153 - Reference feedback sensor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2153	0x00	Reference feedback sensor	UINT16	RW	No	Yes	1 - 7	4	-

This register configures the type of feedback used as reference for aligning commutation sensor.

5.85 0x2154 - Phasing mode

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2154	0x00	Phasing mode	UINT16	RW	No	Yes	0 - 2	1	-

This register configures the phasing mode used for aligning commutation feedback sensor.

5.86 0x2155 - Max. current on phasing sequence

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2155	0x00	Max. current on phasing sequence	FLOAT	RW	No	Yes	Data type	1.5	A

Maximum allowed current during a forced phasing sequence.

5.87 0x2156 - Phasing timeout

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2156	0x00	Phasing timeout	UINT16	RW	No	Yes	Data type	500	ms

This register defines the maximum time of a single step sequence for forced phasing method.

5.88 0x2157 - Phasing accuracy

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2157	0x00	Phasing accuracy	UINT16	RW	No	Yes	Data type	50	m°

This register determines the number of steps and the minimum distance the drive should detect to consider that the actuator has been moved.

5.89 0x21C8 - Profiler latching mode

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21C8	0x00	Profiler latching mode	UINT16	RW	Yes	Yes	See below	64	-

This register allows to select when the set-points are processed by the profiler (positioning start condition).

5.90 0x21DC - Velocity following error window

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21DC	0x00	Velocity following error window	FLOAT	RW	Yes	Yes	Data type	0.0	rev/s

This object indicates the maximum allowed difference between demand and actual velocity before generating an error.

5.91 0x21DD - Velocity following error timeout

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21DD	0x00	Velocity following error timeout	UINT32	RW	Yes	Yes	Data type	0	ms

This object indicates the minimum time that actual velocity must be out of velocity following error window in order to generate an error.

5.92 0x21DE - Min position range limit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21DE	0x00	Min position range limit	INT32	RW	Yes	Yes	Data type	-	encoder counts

This register sets the minimum position range limit. On reaching or exceeding these range limits, the position set-point and position actual wrap automatically to the other end of the range.

5.93 0x21DF - Max position range limit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21DF	0x00	Max position range limit	INT32	RW	Yes	Yes	Data type	-	encoder counts

This register sets the maximum position range limit. On reaching or exceeding these range limits, the position set-point and position actual wrap automatically to the other end of the range.

5.94 0x21E0 - Max. current

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21E0	0x00	Max. current	FLOAT	RW	No	Yes	Data type	24.0	A

This register sets the maximum allowed instant current.

5.95 0x21E8 - Max. velocity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21E8	0x00	Max. velocity	FLOAT	RW	No	Yes	Data type	200.0	rev/s

This register sets the maximum allowed instant velocity.

5.96 0x21EA - Min position

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21EA	0x00	Min position	INT32	RW	Yes	Yes	Data type	-	encoder counts

This object sets the user minimum allowed position.

5.97 0x21EB - Max position

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21EB	0x00	Max position	INT32	RW	Yes	Yes	Data type	-	encoder counts

This object sets the user maximum allowed position.

5.98 0x21EC - Position following error window

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21EC	0x00	Position following error window	FLOAT	RW	Yes	Yes	Data type	0.0	encoder counts

This object indicates the configured range of tolerated position values symmetrically to the position demand value.

5.99 0x21ED - Position following error timeout

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21ED	0x00	Position following error timeout	UINT32	RW	Yes	Yes	Data type	0	ms

This object indicates the minimum time that actual position must be out of position following error window in order to generate an error.

5.100 0x21EE - Following error

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21EE	0x00	Following error	FLOAT	RO	Yes	No	Data type	0.0	*

This register contains the difference between demand and actual value of active operation mode variables.

5.101 0x21EF - Interpolation time mantissa

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21EF	0x00	Interpolation time mantissa	FLOAT	RW	Yes	Yes	Data type	1.0	s

This register sets the interpolation time period between set-point values.

5.102 0x21F0 - Interpolation time exponent

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F0	0x00	Interpolation time exponent	FLOAT	RW	Yes	Yes	Data type	1.0	-

This register sets the interpolation time period between set-point values.

5.103 0x21F1 - Position window

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F1	0x00	Position window	UINT32	RW	No	Yes	Data type	1.0	counts

This register sets the window around position set-point inside which target can be considered reached.

5.104 0x21F2 - Position window time

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F2	0x00	Position window time	UINT32	RW	No	Yes	Data type	0	ms

This register sets the time that the error between Position set-point and Actual position has to be smaller than Position window before detecting a target reached.

5.105 0x21F3 - Velocity window

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F3	0x00	Velocity window	FLOAT	RW	No	Yes	Data type	1.0	rev/s

This register sets the window around velocity set-point inside which target can be considered reached.

5.106 0x21F4 - Velocity window time

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F4	0x00	Velocity window time	UINT32	RW	No	Yes	Data type	0	ms

This register sets the time that the error between Velocity set-point and Actual velocity has to be smaller than Velocity window before detecting a target reached.

5.107 0x21F5 - Quick stop deceleration

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F5	0x00	Quick stop deceleration	FLOAT	RW	No	Yes	Data type	1.0	rev / s^2

This object contains the deceleration used to slow down when quick stop state is active and quick stop option code is selected to use the quick stop ramp.

5.108 0x21F6 - Interpolation data record force clear

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F6	0x00	Interpolation data record force clear	UINT16	RW	Yes	No	Data type	0	-

This register is used to clear the buffer. Any value written to this parameter will clear the buffer.

5.109 0x21F7 - Interpolation buffer size

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F7	0x00	Interpolation buffer size	UINT16	RW	Yes	No	Data type	max buffer size	-

This register sets the buffer size. By default it takes maximum buffer size.

5.110 0x21F8 - Interpolation buffer number of elements

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F8	0x00	Interpolation buffer number of elements	UINT16	RO	Yes	No	Data type	-	-

This register shows how many elements are inside the buffer.

5.111 0x21F9 - Interpolation buffer maximum size

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F9	0x00	Interpolation buffer maximum size	UINT16	RO	Yes	No	Data type	-	-

This register shows the maximum buffer size.

5.112 0x2360 - Velocity feedback sensor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2360	0x00	Velocity feedback sensor	UINT16	RW	No	Yes	1 - 7	4	-

This register configures the type of feedback used for velocity sensing.

5.113 0x2361 - Position feedback sensor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2361	0x00	Position feedback sensor	UINT16	RW	No	Yes	1 - 7	4	-

This register configures the type of feedback used for velocity sensing.

5.114 0x2362 - Auxiliar feedback sensor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2362	0x00	Auxiliar feedback sensor	UINT16	RW	No	Yes	1 - 7	4	-

This register configures the type of feedback selected as auxiliar.

5.115 0x2364 - Position to velocity sensor ratio

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2364	0x00	Position to velocity sensor ratio	FLOAT	RW	No	Yes	Data type	1.0	[rev. at position sensor] / [rev. at velocity sensor]

This register sets the ratio between revolutions in position sensor against revolutions in velocity sensor.

5.116 0x236F - BiSS-C slave 1 / Primary SSI - Protocol

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x236F	0x00	BiSS-C slave 1 / Primary SSI - Protocol	UINT16	RW	No	Yes	0 - 1	1	-

This register indicates if the encoder protocol is SSI or BiSS-C.

5.117 0x2370 - BiSS-C slave 1 / Primary SSI - Frame size

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2370	0x00	BiSS-C slave 1 / Primary SSI - Frame size	UINT16	RW	No	Yes	10 to 64	24	bits

This register indicates the total number of bits of the frame. These include position bits, special bits, warning, error and CRC bits, etc

5.118 0x2371 - BiSS-C slave 1 / Primary SSI - Error tolerance

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2371	0x00	BiSS-C slave 1 / Primary SSI - Error tolerance	UINT16	RW	No	Yes	Data type	5	cycles

This register indicates the total number of wrong frame readings tolerated by the drive before generating a fault.

5.119 0x2372 - BiSS-C slave 1 / Primary SSI - Wait cycles

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2372	0x00	BiSS-C slave 1 / Primary SSI - Wait cycles	UINT16	RW	No	Yes	Data type	2	position control loops

This register indicates the total number of position loops will be executed before requesting a new data to the feedback.

5.120 0x2373 - BiSS-C slave 1 / Primary SSI - Polarity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2373	0x00	BiSS-C slave 1 / Primary SSI - Polarity	UINT16	RW	No	Yes	0 to 1	0	-

Indicates the direction of rotation of the encoder. 0 value applies standard polarity (read directly from the feedback) and a value different than 0 reverses the polarity.

5.121 0x2374 - BiSS-C slave 1 / Primary SSI - Frame type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2374	0x00	BiSS-C slave 1 / Primary SSI - Frame type	UINT16	RW	No	Yes	0 to 4	0	-

Indicates the format of the received frame.

5.122 0x2375 - BiSS-C slave 1 / Primary SSI - Position bits

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2375	0x00	BiSS-C slave 1 / Primary SSI - Position bits	UINT16	RW	No	Yes	10 to 32	22	bits

Indicates the number of bits used for position readings.

5.123 0x2376 - BiSS-C slave 1 / Primary SSI - Single-turn bits

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2376	0x00	BiSS-C slave 1 / Primary SSI - Single-turn bits	UINT16	RW	No	Yes	10 to 32	22	bits

Indicates the number of the position bits that represent single-turn information.

5.124 0x2377 - BiSS-C slave 1 / Primary SSI - Position start bit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2377	0x00	BiSS-C slave 1 / Primary SSI - Position start bit	UINT16	RW	No	Yes	0 to 31	0	bits

Defines how many bits the position information is displaced from the LSB in the serial absolute feedback frame.

5.125 0x2378 - Secondary SSI - Frame size

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2378	0x00	Secondary SSI - Frame size	UINT16	RW	No	Yes	10 to 32	24	bits

This register indicates the total number of bits of the frame. These include position bits, special bits, warning, error and CRC bits, etc

5.126 0x2379 - Secondary SSI - Error tolerance

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2379	0x00	Secondary SSI - Error tolerance	UINT16	RW	No	Yes	Data type	5	cycles

This register indicates the total number of wrong frame readings tolerated by the drive before generating a fault.

5.127 0x237A - Secondary SSI - Wait cycles

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x237A	0x00	Secondary SSI - Wait cycles	UINT16	RW	No	Yes	Data type	2	position control loops

This register indicates the total number of position loops will be executed before requesting a new data to the feedback.

5.128 0x237B - Secondary SSI - Polarity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x237B	0x00	Secondary SSI - Polarity	UINT16	RW	No	Yes	0 to 1	0	-

Indicates the direction of rotation of the encoder. 0 value applies standard polarity (read directly from the feedback) and a value different than 0 reverses the polarity.

5.129 0x237C - Secondary SSI - Frame type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x237C	0x00	Secondary SSI - Frame type	UINT16	RW	No	Yes	0 to 2	0	-

Indicates the format of the received frame.

5.130 0x237D - Secondary SSI - Position bits

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x237D	0x00	Secondary SSI - Position bits	UINT16	RW	No	Yes	10 to 31	22	bits

Indicates the number of bits used for position readings.

5.131 0x237E - Secondary SSI - Single-turn bits

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x237E	0x00	Secondary SSI - Single-turn bits	UINT16	RW	No	Yes	10 to 32	22	bits

Indicates the number of the position bits that represent single-turn information.

5.132 0x237F - Secondary SSI - Position start bit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x237F	0x00	Secondary SSI - Position start bit	UINT16	RW	No	Yes	0 to 31	0	bits

Defines how many bits the position information is displaced from the LSB in the serial absolute feedback frame.

5.133 0x2380 - Generator mode

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2380	0x00	Generator mode	UINT16	RW	No	Yes	0 to 2	0	-

This registers set the waveform of the internal generator module

5.134 0x2381 - Generator frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2381	0x00	Generator frequency	FLOAT	RW	No	Yes	Data type	1.0	Hz

This registers set the frequency of the waveform applied by the internal generator module.

5.135 0x2382 - Generator gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2382	0x00	Generator gain	FLOAT	RW	Yes	Yes	Data type	1.0	-

This registers set the amplitude of the waveform applied by the internal generator module.

5.136 0x2383 - Generator offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2383	0x00	Generator offset	FLOAT	RW	Yes	Yes	Data type	1.0	-

This registers set the offset amplitude of the waveform applied by the internal generator module.

5.137 0x2384 - Generator cycle number

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2384	0x00	Generator cycle number	UINT32	RW	No	Yes	Data type	0	cycles

Indicates the number of times a waveform is applied. Setting a 0 will apply the waveform continuously.

5.138 0x2385 - Generator rearm

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2385	0x00	Generator rearm	UINT16	WO	No	No	0 to 1	0	-

This register allows to start the generation of waveform during the configured waveform cycles.

5.139 0x2386 - BiSS-C slave 1 / Primary SSI - Baudrate

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2386	0x00	BiSS-C slave 1 / Primary SSI - Baudrate	UINT32	RW	No	Yes	1000 to 100000	1000	kbits/s

This register defines the frequency of the interface data transmission (frequency of clock signal).

5.140 0x2387 - Secondary SSI - Baudrate

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2387	0x00	Secondary SSI - Baudrate	UINT32	RW	No	Yes	1000 to 100000	1000	kbits/s

This register defines the frequency of the interface data transmission (frequency of clock signal).

5.141 0x2388 - Incremental encoder 1 - Resolution

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2388	0x00	Incremental encoder 1 - Resolution	UINT32	RW	No	Yes	Data type	2000	encoder counts

This register indicates the resolution of the encoder in total counts per mechanical revolution.

5.142 0x2389 - Incremental encoder 1 - Polarity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2389	0x00	Incremental encoder 1 - Polarity	UINT32	RW	No	Yes	0 to 1	0	-

Indicates the polarity of the encoder. Setting a 0 value sets standard polarity, and setting a value different from 0 sets reversed polarity.

5.143 0x238A - Incremental encoder 1 - Filter

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x238A	0x00	Incremental encoder 1 - Filter	UINT16	RW	No	Yes	0 to 10	0	-

Indicates the glitch filter levels of the incremental encoder 1. There are 10 different glitch filter levels and each level corresponds to a specific cut-off frequency. Setting this parameter to 0 will disable the glitch filter.

5.144 0x238B - Incremental encoder 1 - Value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x238B	0x00	Incremental encoder 1 - Value	INT32	RO	Yes	No	Data type	0	encoder counts

Contains the raw value in counts read from incremental encoder 1.

5.145 0x2390 - Dig. hall polarity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2390	0x00	Dig. hall polarity	UINT16	RW	No	Yes	0 to 1	0	-

Indicates the polarity (of rotation) of the digital halls readings. Setting a 0 value sets standard polarity, and setting a value different from 0 sets reversed polarity.

5.146 0x2391 - Dig. hall filter

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2391	0x00	Dig. hall filter	UINT16	RW	No	Yes	0 to 10	0	-

Indicates the glitch filter levels of the digital halls. There are 10 different glitch filter levels and each level corresponds to a specific cut-off frequency. Setting this parameter to 0 will disable the glitch filter.

5.147 0x2392 - Dig. hall pole pairs

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2392	0x00	Dig. hall pole pairs	UINT16	RW	No	Yes	Data type	2	pole pairs

Indicates the number of pole pairs of the digital halls.

5.148 0x2393 - Dig. hall value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2393	0x00	Dig. hall value	UINT16	RO	Yes	No	0 to 7	0	-

Contains digital input values of digital hall sensors A, B and C, where A is the least significant bit.

5.149 0x2394 - Feedback to check against Halls

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2394	0x00	Feedback to check against Halls	UINT16	RW	No	Yes	1 to 7	0	-

Indicates the feedback checked for runaway conditions against halls.

5.150 0x2395 - BiSS-C feedbacks in chain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2395	0x00	BiSS-C feedbacks in chain	UINT16	RW	No	Yes	1 to 2	1	BiSS-C feedbacks in chain

This register indicates the number of feedbacks in chain. This is used for BiSS-C devices connected in daisy chain.

5.151 0x2400 - BiSS-C slave 2 (daisy chain) - Frame size

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2400	0x00	BiSS-C slave 2 (daisy chain) - Frame size	UINT16	RW	No	Yes	10 to 64	24	bits

This register indicates the total number of bits of the frame. These include position bits, special bits, warning, error and CRC bits, etc.

5.152 0x2401 - BiSS-C slave 2 (daisy chain) - Error tolerance

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2401	0x00	BiSS-C slave 2 (daisy chain) - Error tolerance	UINT16	RW	No	Yes	Data type	5	cycles

This register indicates the total number of wrong frame readings tolerated by the drive before generating a fault.

5.153 0x2403 - BiSS-C slave 2 (daisy chain) - Polarity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2403	0x00	BiSS-C slave 2 (daisy chain) - Polarity	UINT16	RW	No	Yes	0 to 1	0	-

Indicates the direction of rotation of the encoder. 0 value applies standard polarity (read directly from the feedback) and a value different than 0 reverses the polarity.

5.154 0x2404 - BiSS-C slave 2 (daisy chain) - Frame type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2404	0x00	BiSS-C slave 2 (daisy chain) - Frame type	UINT16	RW	No	Yes	0 to 4	0	-

Indicates the format of the received frame.

5.155 0x2405 - BiSS-C slave 2 (daisy chain) - Position bits

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2405	0x00	BiSS-C slave 2 (daisy chain) - Position bits	UINT16	RW	No	Yes	10 to 32	22	bits

Indicates the number of bits used for position readings.

5.156 0x2406 - BiSS-C slave 2 (daisy chain) - Single-turn bits

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2406	0x00	BiSS-C slave 2 (daisy chain) - Single-turn bits	UINT16	RW	No	Yes	10 to 32	22	bits

Indicates the number of the position bits that represent single-turn information.

5.157 0x2407 - BiSS-C slave 2 (daisy chain) - Position start bit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2407	0x00	BiSS-C slave 2 (daisy chain) - Position start bit	UINT16	RW	No	Yes	0 to 31	0	bits

Defines how many bits the position information is displaced from the LSB in the serial absolute feedback frame.

5.158 0x2408 - BiSS-C slave 1 / Primary SSI - CRC polynomial

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2408	0x00	BiSS-C slave 1 / Primary SSI - CRC polynomial	UINT16	RO	No	No	Data type	0	-

This register indicates the CRC polynomial applied to the received frames.

5.159 0x2409 - BiSS-C slave 1 / Primary SSI - CRC number of bits

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2409	0x00	BiSS-C slave 1 / Primary SSI - CRC number of bits	UINT16	RO	No	No	Data type	0	-

This register indicates the number of bits used by the CRC algorithms.

5.160 0x240C - BiSS-C slave 1 / Primary SSI - CRC seed

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x240C	0x00	BiSS-C slave 1 / Primary SSI - CRC seed	UINT16	RO	No	No	Data type	0	-

This register indicates the seed used by the CRC algorithms.

5.161 0x2450 - Homing mode

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2450	0x00	Homing mode	UINT16	RW	No	Yes	0 to 6	0	-

This register sets the homing mode used.

5.162 0x2451 - Homing offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2451	0x00	Homing offset	INT32	RW	Yes	Yes	Data type	0	encoder counts

This object indicates the configured difference between the zero position for the application and the machine home position, as found during the homing process.

5.163 0x2452 - Homing timeout

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2452	0x00	Homing timeout	UINT32	RW	No	Yes	Data type	2000	ms

This object specifies the maximum time that a homing mode should be running, in milliseconds.

5.164 0x2453 - Homing limit search speed

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2453	0x00	Homing limit search speed	FLOAT	RW	Yes	Yes	Data type	0	rev/ s

This register sets the velocity used to look for a limit condition during a homing sequence.

5.165 0x2454 - Homing zero search speed

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2454	0x00	Homing zero search speed	FLOAT	RW	Yes	Yes	Data type	0	rev/ s

This register sets the velocity used to look for the 0 position during a homing sequence.

5.166 0x2455 - Positive homing switch

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2455	0x00	Positive homing switch	UINT16	RW	No	Yes	0 to 4	0	-

This register contains the GPI attached to a positive homing switch.

5.167 0x2456 - Negative homing switch

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2456	0x00	Negative homing switch	UINT16	RW	No	Yes	0 to 4	0	-

This register contains the GPI attached to a negative homing switch.

5.168 0x2457 - Homing index pulse source

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2457	0x00	Homing index pulse source	UINT16	RW	No	Yes	0	0	-

This register indicates which digital incremental encoder will be used to finish homing procedures based on index pulse.

5.169 0x2458 - Current loop rate

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2458	0x00	Current loop rate	UINT32	RO	No	No	Data type	20000	Hz

This register indicates the frequency at which the current control loop is running.

5.170 0x24FE - Torque constant

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x24FE	0x00	Torque constant	FLOAT	RW	No	Yes	Data type	1.0	mNm / mA

This register provides the relation between current and torque.

5.171 0x2500 - Current quadrature loop Kp

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2500	0x00	Current quadrature loop Kp	FLOAT	RW	No	Yes	Data type	1.0	V/A

This parameter allows configuring the Kp of the PI controller used for current Q regulation.

5.172 0x2501 - Current quadrature loop Ki

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2501	0x00	Current quadrature loop Ki	FLOAT	RW	No	Yes	Data type	0.8	V/A

This parameter allows configuring the Ki of the PI controller used for current Q regulation.

5.173 0x2502 - Current quadrature loop max. out

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2502	0x00	Current quadrature loop max. out	FLOAT	RW	No	Yes	Data type	24.0	V

This parameter allows configuring the Umax of the PI controller used for current Q regulation.

5.174 0x2503 - Current quadrature loop min. out

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2503	0x00	Current quadrature loop min. out	FLOAT	RW	No	Yes	Data type	-24.0	V

This parameter allows configuring the Umin of the PI controller used for current Q regulation.

5.175 0x2504 - Current quadrature loop Kr

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2504	0x00	Current quadrature loop Kr	FLOAT	RW	No	Yes	0.0 to 1.0	1.0	V

This parameter allows configuring the Kr of the PI controller used for current Q regulation.

5.176 0x2505 - Current direct loop Kp

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2505	0x00	Current direct loop Kp	FLOAT	RW	No	Yes	Data type	1.0	V/A

This parameter allows configuring the Kp of the PI controller used for current D regulation.

5.177 0x2506 - Current direct loop Ki

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2506	0x00	Current direct loop Ki	FLOAT	RW	No	Yes	Data type	0.8	V/A

This parameter allows configuring the Ki of the PI controller used for current D regulation.

5.178 0x2507 - Current direct loop max. out

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2507	0x00	Current direct loop max. out	FLOAT	RW	No	Yes	Data type	24.0	V

This parameter allows configuring the Umax of the PI controller used for current D regulation.

5.179 0x2508 - Current direct loop min. out

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2508	0x00	Current direct loop min. out	FLOAT	RW	No	Yes	Data type	-24.0	V

This parameter allows configuring the Umin of the PI controller used for current D regulation.

5.180 0x2509 - Current direct loop Kr

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2509	0x00	Current direct loop Kr	FLOAT	RW	No	Yes	0.0 to 1.0	1.0	-

This parameter allows configuring the Kr of the PI controller used for current D regulation.

5.181 0x250A - Velocity loop Kp

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x250A	0x00	Velocity loop Kp	FLOAT	RW	No	Yes	Data type	1.0	A / (rev/s)

This parameter allows configuring the Kp of the PID controller used for velocity regulation.

5.182 0x250B - Velocity loop Ki

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x250B	0x00	Velocity loop Ki	FLOAT	RW	No	Yes	Data type	1.0	-

This parameter allows configuring the Ki of the PID controller used for velocity regulation.

5.183 0x250C - Velocity loop Kd

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x250C	0x00	Velocity loop Kd	FLOAT	RW	No	Yes	Data type	1.0	-

This parameter allows configuring the Kd of the PID controller used for velocity regulation.

5.184 0x250D - Velocity loop Kd filter

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x250D	0x00	Velocity loop Kd filter	FLOAT	RW	No	Yes	Data type	1.0	Hz

This parameter allows configuring the Kd filter of the PID controller used for velocity regulation.

5.185 0x250E - Velocity loop max. output

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x250E	0x00	Velocity loop max. output	FLOAT	RW	No	Yes	Data type	1.0	A

This parameter allows configuring the Umax of the PID controller used for velocity regulation.

5.186 0x250F - Velocity loop min. output

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x250F	0x00	Velocity loop min. output	FLOAT	RW	No	Yes	Data type	-1.0	A

This parameter allows configuring the Umin of the PID controller used for velocity regulation.

5.187 0x2511 - Position loop Kp

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2511	0x00	Position loop Kp	FLOAT	RW	No	Yes	Data type	1.0	rev/s / counts

This parameter allows configuring the Kp of the PID controller used for position regulation.

5.188 0x2512 - Position loop Ki

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2512	0x00	Position loop Ki	FLOAT	RW	No	Yes	Data type	1.0	-

This parameter allows configuring the Ki of the PID controller used for position regulation.

5.189 0x2513 - Position loop Kd

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2513	0x00	Position loop Kd	FLOAT	RW	No	Yes	Data type	1.0	-

This parameter allows configuring the Kd of the PID controller used for position regulation.

5.190 0x2514 - Position loop Kd filter

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2514	0x00	Position loop Kd filter	FLOAT	RW	No	Yes	Data type	1.0	Hz

This parameter allows configuring the Kd filter of the PID controller used for position regulation.

5.191 0x2515 - Position loop max. output

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2515	0x00	Position loop max. output	FLOAT	RW	No	Yes	Data type	1.0	rev/s

This parameter allows configuring the Umax of the PID controller used for position regulation.

5.192 0x2516 - Position loop min. output

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2516	0x00	Position loop min. output	FLOAT	RW	No	Yes	Data type	1.0	rev/s

This parameter allows configuring the Umin of the PID controller used for position regulation.

5.193 0x2517 - Current loop status

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2517	0x00	Current loop status	UINT32	RO	Yes	No	Data type	-	-

This register shows the status of the current control loops.

5.194 0x2518 - Velocity loop status

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2518	0x00	Velocity loop status	UINT32	RO	Yes	No	Data type	-	-

This register shows the status of the velocity control loop.

5.195 0x2519 - Position loop status

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2519	0x00	Position loop status	UINT32	RO	Yes	No	Data type	-	-

This register shows the status of the position control loop.

5.196 0x251A - STO status

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x251A	0x00	STO status	UINT16	RO	Yes	No	0x00 - 0x1F	0	-

This register shows the status of the STO module.

5.197 0x2520 - Position & velocity loop rate

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2520	0x00	Position & velocity loop rate	UINT32	RO	Yes	No	Data type	20000	Hz

This register indicates the frequency at which the position and velocity control loops are running.

5.198 0x2522 - Control loops option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2522	0x00	Control loops option code	UINT32	RW	No	Yes	See below	0	-

This register allows configuring certain options related to the control loops.

5.199 0x2530 - Position feedback filter 1 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2530	0x00	Position feedback filter 1 type	UINT16	RW	No	Yes	0 - 7	0	-

This register contains the filter type for the position feedback filter 1.

5.200 0x2531 - Position feedback filter 1 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2531	0x00	Position feedback filter 1 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the position feedback filter 1. The meaning of filter frequency varies depending on the selected filter type.

5.201 0x2532 - Position feedback filter 1 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2532	0x00	Position feedback filter 1 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the position feedback filter 1.

5.202 0x2533 - Position feedback filter 1 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2533	0x00	Position feedback filter 1 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the position feedback filter 1.

5.203 0x2538 - Position feedback filter 2 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2538	0x00	Position feedback filter 2 type	UINT16	RW	No	Yes	0 - 7	0	-

This register contains the filter type for the position feedback filter 2.

5.204 0x2539 - Position feedback filter 2 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2539	0x00	Position feedback filter 2 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the position feedback filter 2. The meaning of filter frequency varies depending on the selected filter type.

5.205 0x253A - Position feedback filter 2 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x253A	0x00	Position feedback filter 2 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the position feedback filter 2.

5.206 0x253B - Position feedback filter 2 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x253B	0x00	Position feedback filter 2 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the position feedback filter 2.

5.207 0x2540 - Position reference filter 1 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2540	0x00	Position reference filter 1 type	UINT16	RW	No	Yes	0 - 7	0	-

This register contains the filter type for the position reference filter 1.

5.208 0x2541 - Position reference filter 1 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2541	0x00	Position reference filter 1 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the position reference filter 1. The meaning of filter frequency varies depending on the selected filter type.

5.209 0x2542 - Position reference filter 1 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2542	0x00	Position reference filter 1 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the position reference filter 1.

5.210 0x2543 - Position reference filter 1 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2543	0x00	Position reference filter 1 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the position reference filter 1.

5.211 0x2548 - Position reference filter 2 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2548	0x00	Position reference filter 2 type	UINT16	RW	No	Yes	0 - 7	0	-

This register contains the filter type for the velocity reference filter 2.

5.212 0x2549 - Position reference filter 2 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2549	0x00	Position reference filter 2 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the position reference filter 2. The meaning of filter frequency varies depending on the selected filter type.

5.213 0x254A - Position reference filter 2 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x254A	0x00	Position reference filter 2 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the position reference filter 2.

5.214 0x254B - Position reference filter 2 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x254B	0x00	Position reference filter 2 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the position reference filter 2.

5.215 0x2550 - Velocity feedback filter 1 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2550	0x00	Velocity feedback filter 1 type	UINT16	RW	No	Yes	0 - 7	0	-

This register contains the filter type for the velocity feedback filter 1.

5.216 0x2551 - Velocity feedback filter 1 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2551	0x00	Velocity feedback filter 1 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the velocity feedback filter 1. The meaning of filter frequency varies depending on the selected filter type.

5.217 0x2552 - Velocity feedback filter 1 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2552	0x00	Velocity feedback filter 1 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the velocity feedback filter 1.

5.218 0x2553 - Velocity feedback filter 1 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2553	0x00	Velocity feedback filter 1 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the velocity feedback filter 1.

5.219 0x2558 - Velocity feedback filter 2 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2558	0x00	Velocity feedback filter 2 type	UINT16	RW	No	Yes	0 - 7	0	-

This register contains the filter type for the velocity feedback filter 2.

5.220 0x2559 - Velocity feedback filter 2 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2559	0x00	Velocity feedback filter 2 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the velocity feedback filter 2. The meaning of filter frequency varies depending on the selected filter type.

5.221 0x255A - Velocity feedback filter 2 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x255A	0x00	Velocity feedback filter 2 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the velocity feedback filter 2.

5.222 0x255B - Velocity feedback filter 2 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x255B	0x00	Velocity feedback filter 2 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the velocity feedback filter 2.

5.223 0x2560 - Velocity reference filter 1 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2560	0x00	Velocity reference filter 1 type	UINT16	RW	No	Yes	0 - 7	0	-

This register contains the filter type for the velocity reference filter 1.

5.224 0x2561 - Velocity reference filter 1 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2561	0x00	Velocity reference filter 1 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the velocity reference filter 1. The meaning of filter frequency varies depending on the selected filter type.

5.225 0x2562 - Velocity reference filter 1 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2562	0x00	Velocity reference filter 1 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the velocity reference filter 1.

5.226 0x2563 - Velocity reference filter 1 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2563	0x00	Velocity reference filter 1 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the velocity reference filter 1.

5.227 0x2568 - Velocity reference filter 2 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2568	0x00	Velocity reference filter 2 type	UINT16	RW	No	Yes	0 - 7	0	-

This register contains the filter type for the velocity reference filter 2.

5.228 0x2569 - Velocity reference filter 2 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2569	0x00	Velocity reference filter 2 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the velocity reference filter 2. The meaning of filter frequency varies depending on the selected filter type.

5.229 0x256A - Velocity reference filter 2 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x256A	0x00	Velocity reference filter 2 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the velocity reference filter 2.

5.230 0x256B - Velocity reference filter 2 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x256B	0x00	Velocity reference filter 2 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the velocity reference filter 2.

5.231 0x2570 - Current feedback filter 1 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2570	0x00	Current feedback filter 1 type	UINT16	RW	No	Yes	0 - 7	0	-

This register contains the filter type for the current feedback filter 1.

5.232 0x2571 - Current feedback filter 1 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2571	0x00	Current feedback filter 1 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the current feedback filter 1. The meaning of filter frequency varies depending on the selected filter type.

5.233 0x2572 - Current feedback filter 1 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2572	0x00	Current feedback filter 1 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the current feedback filter 1.

5.234 0x2573 - Current feedback filter 1 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2573	0x00	Current feedback filter 1 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the current feedback filter 1.

5.235 0x2578 - Current feedback filter 2 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2578	0x00	Current feedback filter 2 type	UINT16	RW	No	Yes	0 - 7	0	-

This register contains the filter type for the current feedback filter 2.

5.236 0x2579 - Current feedback filter 2 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2579	0x00	Current feedback filter 2 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the current feedback filter 2. The meaning of filter frequency varies depending on the selected filter type.

5.237 0x257A - Current feedback filter 2 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x257A	0x00	Current feedback filter 2 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the current feedback filter 2.

5.238 0x257B - Current feedback filter 2 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x257B	0x00	Current feedback filter 2 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the current feedback filter 2.

5.239 0x2580 - Current reference filter 1 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2580	0x00	Current reference filter 1 type	UINT16	RW	No	Yes	0 - 7	0	-

This register contains the filter type for the current reference filter 1.

5.240 0x2581 - Current reference filter 1 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2581	0x00	Current reference filter 1 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the current reference filter 1. The meaning of filter frequency varies depending on the selected filter type.

5.241 0x2582 - Current reference filter 1 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2582	0x00	Current reference filter 1 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the current reference filter 1.

5.242 0x2583 - Current reference filter 1 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2583	0x00	Current reference filter 1 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the current reference filter 1.

5.243 0x2588 - Current reference filter 2 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2588	0x00	Current reference filter 2 type	UINT16	RW	No	Yes	0 - 7	0	-

This register contains the filter type for the current reference filter 2.

5.244 0x2589 - Current reference filter 2 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2589	0x00	Current reference filter 2 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the current reference filter 2. The meaning of filter frequency varies depending on the selected filter type.

5.245 0x258A - Current reference filter 2 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x258A	0x00	Current reference filter 2 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the current reference filter 2.

5.246 0x258B - Current reference filter 2 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x258B	0x00	Current reference filter 2 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the current reference filter 2.

5.247 0x2590 - Velocity loop Kffa

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2590	0x00	Velocity loop Kffa	FLOAT	RW	No	Yes	Data type	0.0	-

This parameter allows configuring the Kffa (feed-forward acceleration constant) of the PID controller used for velocity regulation.

5.248 0x2591 - Position loop Kffv

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2591	0x00	Position loop Kffv	FLOAT	RW	No	Yes	Data type	1.0	-

This parameter allows configuring the Kffv (feed-forward velocity constant) of the PID controller used for position regulation.

5.249 0x2592 - Position loop Kffa

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2592	0x00	Position loop Kffa	FLOAT	RW	No	Yes	Data type	1.0	rev/s / rev/s^2

This parameter allows configuring the Kffa (feed-forward acceleration constant) of the PID controller used for position regulation.

5.250 0x25FC - Map output 1

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x25FC	0x00	Map output 1	UINT16	RW	No	Yes	0 to 3	0	-

These parameters contains the attached drive event/state to the GPO 1.

5.251 0x25FD - Map output 2

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x25FD	0x00	Map output 2	UINT16	RW	No	Yes	0 to 3	0	-

These parameters contains the attached drive event/state to the GPO 2.

5.252 0x25FE - Map output 3

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x25FE	0x00	Map output 3	UINT16	RW	No	Yes	0 to 3	0	-

These parameters contains the attached drive event/state to the GPO 3.

5.253 0x25FF - Map output 4

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x25FF	0x00	Map output 4	UINT16	RW	No	Yes	0 to 3	0	-

These parameters contains the attached drive event/state to the GPO 4.

5.254 0x2600 - Digital inputs value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2600	0x00	Digital inputs value	UINT32	RO	Yes	No	Data type	0	-

The parameter provides access to the logical digital inputs state.

5.255 0x2601 - Digital outputs value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2601	0x00	Digital outputs value	UINT32	RO	Yes	No	Data type	0	-

The parameters provides the logic value of all digital outputs.

5.256 0x2602 - Digital outputs set value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2602	0x00	Digital outputs set value	UINT32	RW	Yes	No	Data type	0	-

The parameters sets the value of the digital outputs configured with standard functionality.

5.257 0x2603 - Digital outputs polarity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2603	0x00	Digital outputs polarity	UINT32	RW	No	Yes	Data type	0	-

The parameters sets the value of the digital outputs polarity.

5.258 0x2604 - Digital inputs polarity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2604	0x00	Digital inputs polarity	UINT32	RW	No	Yes	Data type	0	-

The parameters sets the value of the digital inputs polarity.

5.259 0x2608 - Positive switch limit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2608	0x00	Positive switch limit	UINT16	RW	No	Yes	0 to 4	0	-

These parameters contains the GPI attached to internal demand generator.

5.260 0x2609 - Negative switch limit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2609	0x00	Negative switch limit	UINT16	RW	No	Yes	0 to 4	0	-

These parameters contains the GPI attached to internal demand generator.

5.261 0x260A - Quick stop input

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x260A	0x00	Quick stop input	UINT16	RW	No	Yes	0 to 4	0	-

These parameters contains the GPI attached to quick stop triggered.

5.262 0x260B - Quick stop option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x260B	0x00	Quick stop option code	INT16	RW	No	Yes	Data type	5	-

This parameter indicates the reaction of the quick stop when it is called.

5.263 0x260F - User I2T error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x260F	0x00	User I2T error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an I2T detection without active current control.

5.264 0x2610 - Position feedback out of limits error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2610	0x00	Position feedback out of limits error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an position out of limits detection without active position control.

5.265 0x2611 - Velocity feedback out of limits error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2611	0x00	Velocity feedback out of limits error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an velocity out of limits detection without active velocity control.

5.266 0x2612 - Position following error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2612	0x00	Position following error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for a position following error detection.

5.267 0x2613 - Power stage user over-temperature error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2613	0x00	Power stage user over-temperature error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an user over-temperature detection.

5.268 0x2614 - Motor over-temperature error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2614	0x00	Motor over-temperature error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an motor over-temperature detection.

5.269 0x2615 - Power stage user under-temperature error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2615	0x00	Power stage user under-temperature error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an user under-temperature detection.

5.270 0x2616 - Power stage user over voltage error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2616	0x00	Power stage user over voltage error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an user over voltage detection.

5.271 0x2617 - Power stage user under voltage error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2617	0x00	Power stage user under voltage error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an user under voltage detection.

5.272 0x2618 - External fault option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2618	0x00	External fault option code	UINT16	RW	No	Yes	0 - 3	1	-

This register set the drive fault reaction for an external fault generation.

5.273 0x2619 - Halls sequence error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2619	0x00	Halls sequence error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for a hall sequence error detection.

5.274 0x261A - Incremental encoder against halls error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x261A	0x00	Incremental encoder against halls error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for a run away detection of incremental encoder against digital halls.

5.275 0x261B - Over current without current control error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x261B	0x00	Over current without current control error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an over-current detection without an active current control loop.

5.276 0x261D - Velocity following error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x261D	0x00	Velocity following error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for a velocity following error detection.

5.277 0x2621 - Halt input

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2621	0x00	Halt input	UINT16	RW	No	Yes	0 to 4	0	-

These parameters contains the GPI attached to halt trigger.

5.278 0x262F - Over-voltage sensitivity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x262F	0x00	User over voltage level	UINT16	RW	No	Yes	0 to 2	0	V

This register sets how fast an over-voltage is detected.

5.279 0x2630 - User over voltage level

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2630	0x00	User over voltage level	FLOAT	RW	No	Yes	Data type	52.0	V

This register sets the user over voltage threshold for error generation.

5.280 0x2631 - User under voltage level

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2631	0x00	User under voltage level	FLOAT	RW	No	Yes	Data type	10.0	V

This register sets the user under voltage threshold for error generation.

5.281 0x2632 - User over temperature level

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2632	0x00	User over temperature level	FLOAT	RW	No	Yes	Data type	110.0	V

This register sets the user over temperature threshold for error generation.

5.282 0x2633 - User under temperature level

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2633	0x00	User under temperature level	FLOAT	RW	No	Yes	Data type	-40.0	V

This register sets the user under temperature threshold for error generation.

5.283 0x2641 - Synchronization signal configuration

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2641	0x00	Sync. signal configuration	UINT16	RW	No	No	0 - 3	0	-

Indicates the number of synchronization signals generated by the MCBus protocol.

5.284 0x2643 - Synchronization signal frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2643	0x00	Sync. signal frequency	UINT32	RW	No	YES	Data type	1000	Hz

The frequency at which the synchronization signal is being generated. It should be an exact multiple of the PWM frequency selected.

5.285 0x2644 - Synchronization signal PLL filter cutoff frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2644	0x00	Sync. signal PLL filter cutoff frequency	UINT32	RW	No	YES	Data type	100	Hz

The cutoff frequency of the synchronization signal PLL filter.

5.286 0x2645 - Synchronization signal PLL phase

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2645	0x00	Sync. signal PLL phase	FLOAT	RW	No	YES	Data type	0.0	-

Configures phase difference between the synchronization signal and the generated PWM.

5.287 0x2646 - Synchronization signal PLL Kp

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2646	0x00	Sync. signal PLL Kp	FLOAT	RW	No	YES	Data type	0.01	-

Configures proportional constant for phase correction in PLL.

5.288 0x264D - Error total number

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x264D	0x00	Error total number	UINT16	RO	No	No	Data type	0	-

This register contains the total number of errors detected since power up.

5.289 0x264E - Error list index request

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x264E	0x00	Error list index request	UINT16	RO	No	No	0 to 32	0	-

This register indicates the position of an error inside the error queue that will be displayed in the *Error list requested code*.

5.290 0x264F - Error list requested code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x264F	0x00	Error list requested code	INT32	RO	No	No	Data type	0	-

This register contains the error code of the *Error list index request* position inside the error queue.

5.291 0x26DB - Store all

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x26DB	0x00	Store all	UINT32	RW	No	No	Data type	-	-

This register allows to store the controller parameters into the non-volatile memory.

5.292 0x26DC - Restore all

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x26DC	0x00	Restore all	UINT32	RW	No	No	Data type	-	-

This register allows to resstore the controller default parameters.

5.293 0x26E0 - Vendor ID

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x26E0	0x00	Vendor ID	UINT32	RO	No	No	Data type	0x0000029C	-

This object indentifies the vendor of the product.

5.294 0x26E1 - Product code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x26E1	0x00	Product code	UINT32	RO	No	No	Data type	0x02C30001	-

This object indentifies the product code of the drive.

5.295 0x26E2 - Revision number

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x26E2	0x00	Revision number	UINT32	RO	No	No	Data type	-	-

This object indicates the revision number of the firmware version on the drive.

5.296 0x26E4 - Software version

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x26E4	0x00	Software version	STRING	RO	No	No	-	-	-

This object indicates the firmware version on the drive.

5.297 0x26E5 - Ingenia url

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x26E5	0x00	Ingenia url	STRING	RO	No	No	-	http://www.ingeniamc.com	-

This object indicates the Ingenia website.

5.298 0x26E6 - Serial number

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x26E6	0x00	Serial number	UINT32	RO	No	No	Data type	-	-

This object indicates the unique serial number id of the device.

5.299 0x6040 - Control Word

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6040	0x00	Control Word	UINT16	RW	Yes	No	UINT16	0x0000	-

The controlword is used to:

- Check controller status.
- Check parameters related to operation modes.

5.300 0x6041 - Status Word

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6041	0x00	Status Word	UINT16	RO	Yes	No	UINT16	-	-

The statusword is used to:

- Find out the current controller status.
- Find out the operation mode status.

5.301 0x605A - Quick stop option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x605A	0x00	Quick stop option code	INT16	RW	No	Yes	INT16	6	-

5.302 0x605D - Halt option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x605D	0x00	Halt option code	INT16	RW	No	Yes	Data type	0	-

5.303 0x6060 - Operation mode

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6060	0x00	Operation mode	INT8	RW	Yes	Yes	INT8	1	-

This register modifies the current operation mode.

5.304 0x6061- Operation mode display

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6061	0x00	Operation mode display	INT8	RO	Yes	No	INT8	-	-

This object provides the actual operation mode.

5.305 0x6064 - Actual position

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6064	0x00	Actual position	INT32	RO	Yes	No	INT32	-	encoder counts

This object contains the actual position calculated using the position feedback.

5.306 0x6065 - Position following error window

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6065	0x00	Position following error window	UINT32	RW	Yes	Yes	UINT32	100	encoder counts

This object indicates the configured range of tolerated position values symmetrically to the position demand value.

5.307 0x6066 - Position following error timeout

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6066	0x00	Position following error timeout	UINT16	RW	Yes	Yes	UINT16	10	milliseconds

This object indicates the minimum time that actual position must be out of following error window in order to generate an error.

5.308 0x606C - Actual velocity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x606C	0x00	Actual velocity	INT32	RO	Yes	No	INT32	-	mrev/s

This object contains the actual velocity calculated using the velocity feedback.

5.309 0x6071 - Target torque

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6071	0x00	Target torque	INT16	RW	Yes	No	INT16	0	‰ rated torque

This object indicates the configured input value for the torque controller in profile torque mode.

5.310 0x6073 - Max. current

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6073	0x00	Max. current	UINT16	RW	Yes	Yes	UINT16	1000	‰ rated current

This object indicates the configured maximum permissible current creating torque in the motor.

5.311 0x6075 - Motor rated current

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6075	0x00	Motor rated current	UINT32	RW	Yes	Yes	UINT32	10000	mA

Defines maximum continuous current value of the actuator.

5.312 0x6077 - Torque actual value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6077	0x00	Torque actual value	INT16	RO	Yes	No	INT16	0	‰ rated torque

This object provides the actual value of the motor. It corresponds to the instantaneous torque in the motor.

5.313 0x6078 - Current actual value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6078	0x00	Current actual value	INT16	RO	Yes	No	INT16	0	‰ rated current

This object provides the actual current value of the motor. It corresponds to the instantaneous current in the motor.

5.314 0x607A - Position set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x607A	0x00	Position set-point	INT32	RW	Yes	No	INT32	0	encoder counts

This register is used to command the target values for position input.

5.315 0x607B - Position range limit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x607B	0x01	Min position range limit	INT32	RW	Yes	Yes	INT32	0	encoder counts
0x607B	0x02	Max position range limit	INT32	RW	Yes	Yes	INT32	0	encoder counts

This register indicates the max and min position range limits. On reaching or exceeding these limits, the position set-point and position actual wrap automatically to the other end of the range. This function is disabled if both subindex are set to 0.

To disable the position range limits, the min position range limit and max position range limit shall be set to 0.

5.316 0x607C - Homing offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x607C	0x00	Homing offset	INT32	RW	No	Yes	INT32	0	encoder counts

This object indicates the configured difference between the zero position for the application and the machine home position, as found during the homing process.

5.317 0x607D - Software position limit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x607D	0x01	Min position	INT32	RW	Yes	Yes	INT32	0	encoder counts

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x607D	0x02	Max position	INT32	RW	Yes	Yes	INT32	0	encoder counts

It contains two parameters, a minimum position limit and a maximum position limit. These parameters define the absolute position limits for the target and current position.

To disable the software position limits, the min position limit and max position limit shall be set to 0.

5.318 0x6081 - Profile velocity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6081	0x00	Profile velocity	UINT32	RW	Yes	Yes	UINT32	20000	mrev / s

This object indicates the configured velocity normally attained at the end of the acceleration ramp during a profiled motion. It is valid for both directions of motion.

5.319 0x6083 - Profile acceleration

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6083	0x00	Profile acceleration	UINT32	RW	Yes	Yes	UINT32	20000	mrev / s^2

This object indicates the configured acceleration used by the profiler. If this acceleration is higher than Max acceleration it will be restricted by the profiler.

5.320 0x6084 - Profile deceleration

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6084	0x00	Profile deceleration	UINT32	RW	Yes	Yes	UINT32	20000	mrev / s^2

This object indicates the configured deceleration. If this deceleration is higher than Max deceleration it will be restricted by the profiler.

5.321 0x6098 - Homing method

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6098	0x00	Homing method	INT8	RW	No	Yes	INT8	37	-

This object is used to select the homing method to be used among the homing methods supported.

5.322 0x6099 - Homing search velocities

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6099	0x01	Homing search velocity	UINT32	RW	No	Yes	UINT32	0	mrev/ s
0x6099	0x02	Homing zero velocity	UINT32	RW	No	Yes	UINT32	0	mrev/ s

Up to 2 search speeds may be used during a regular homing process: a speed to search for the switch or mechanical limit (search velocity), which may be relatively fast, and another speed to search for the actual homing point (zero velocity), which should be considerably slower.

This object only defines the magnitudes of those velocities: the direction will depend on the selected homing method.

5.323 0x60B1 - Velocity loop input offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x60B1	0x00	Velocity loop input offset	INT32	RW	Yes	No	INT32	0	mrev/s

This register adds an offset to the filtered reference of the velocity controller.

5.324 0x60B2 - Torque offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x60B2	0x00	Torque offset	INT32	RW	Yes	Yes	INT16	0	‰ rated torque

This object indicates the offset for the torque value used in all modes (Profiled velocity, profiled position, etc.).

5.325 0x60C2 - Interpolation time period

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x60C2	0x01	Interpolation time mantissa	UINT8	RW	Yes	No	UINT8	1	$10^{\text{interpolation time index}}$ sec
0x60C2	0x02	Interpolation time exponent	INT8	RW	Yes	No	-5 to 0	-3	-

This object indicates the configured interpolation cycle time.

5.326 0x60F2 - Positioning option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x60F2	0x00	Positioning option code	UINT16	RW	Yes	Yes	-	0	-

This object indicates the configured positioning behavior.

5.327 0x60F4 - Position following error

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x60F4	0x00	Position following error	INT32	RO	Yes	No	INT32	-	encoder counts

This object provides the actual value of the following error, which is the difference between the position demand and actual position (error = demand – actual).

5.328 0x60FF - Velocity set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x60FF	0x00	Velocity set-point	INT32	RW	Yes	No	INT32	0	mrev/s

This object indicates the configured target velocity and is used as input for the trajectory generator.

5.329 0x6502 - Supported drive modes

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6502	0x00	Supported drive modes	UINT32	CONST	Yes	No	UINT32	0xF03E5	-

Motion controllers can normally support more than one operation mode. This object provides information about the operation modes implemented in the device.

5.330 0x1000 - Device type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x1000	0x00	Device type	UINT32	RO	No	No	Data type	0x00020192	-

This object provides information about the device type. The object describes the type of the logical device and its functionality.

It is composed of a 16-bit field that describes the device profile or the application profile that is used and a second 16-bit field, which gives additional information about optional functionality of the logical device.

<table>
<tr><th>Bit number:</th><th>31</th><th>...</th><th>24</th><th>23</th><th>...</th><th>16</th><th>15</th><th>...</th><th>0</th></tr>
<tr><td rowspan="2"></td><td colspan="6">Additional information</td><td colspan="3" rowspan="2">Device profile number</td></tr>
<tr><td colspan="3">Mode bits</td><td colspan="3">Type</td></tr>
</table>

The value meaning is the following:

- *Device profile number*: 402 decimal (0x0192)
- *Additional information*: 02 Servo Drive

5.331 0x1001 - Error register

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x1001	0x00	Error register	UINT8	RO	No	No	Data type	-	-

This object provides error information. It is part of the emergency object.

Each bit meaning is detailed in the following table:

Bit	Meaning
0	*Generic error*
1	*Current*
2	*Voltage*
3	*Temperature*
4	*Communication*
5	*Device profile specific*
6	*Reserved (always 0)*
7	*Ingenia specific error*

5.332 0x1003 - Pre-defined error field

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x1003	0x00	Number of errors	UINT8	RW	No	No	0 to 4	0	
0x1003	0x01	Standard error field	UINT32	RO	No	No	Data type	0	-
0x1003	0x02	Standard error field	UINT32	RO	No	No	Data type	0	-
0x1003	0x03	Standard error field	UINT32	RO	No	No	Data type	0	-
0x1003	0x04	Standard error field	UINT32	RO	No	No	Data type	0	-

This object provides the errors that occurred on the drive and were signaled via the emergency object. In doing so it provides an error history.

The object entry at SubIndex 0x00 contains the number of actual errors that are recorded in the array starting at SubIndex 0x01.

Every new error will be stored at SubIndex 0x01 and older errors will be moved to the next higher sub-index.

Writing a 0 value in the subindex 0x00 will reset the errors stored.

For further information about error codes see **Error management**.

5.333 0x1010 - Store

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x1010	0x01	Store all	UINT32	RW	No	No	Data type	-	-

This object controls the saving of parameters into the non-volatile memory.

In order to avoid storage of parameters by mistake, storage is only executed when a specific signature is written to the appropriate sub-index.

The signature that must be written is "save":

MSB			LSB
e	v	a	s
0x65	0x76	0x61	0x73

5.334 0x1011 - Restore

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x1011	0x01	Restore all	UINT32	RW	No	No	UINT32	-	-

With this register, the default values of parameters are restored.

Restoring is done by declaring the stored parameters in NVM as invalid. The function does not load the default parameters immediately.
New values will be available only at next Power On.
In order to avoid the restoring of default parameters by mistake, restoring is only executed when a specific signature is written to the appropriate SubIndex.

The signature that must be written is "load":

MSB			LSB
d	a	o	l
0x64	0x61	0x6F	0x6C

5.335 0x1018 - Identity Object

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x1018	0x01	Vendor ID	UINT32	RO	No	No	Data type	0x0000029C	-
0x1018	0x02	Product code	UINT32	RO	No	No	Data type	0x02C30001	-
0x1018	0x03	Revision number	UINT32	RO	No	No	Data type	-	-
0x1018	0x04	Serial number	UINT32	RO	No	No	Data type	-	-

This object provides general identification information of the drive.

5.336 0x200F - Last error

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x200F	0x00	Last error	INT32	RO	Yes	No	Data type	0	-

This register contains the code of the last detected error of the system.

5.337 0x2010 - Control word

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2010	0x00	Control word	UINT16	RW	Yes	No	Data type	0	-

This register allows operating the drive state machine and several modules.

5.337.1 State machine dedicated bits

The binary representation of the object value and its corresponding meaning is as follows:

Bit number	15	...	8	7	6	5	4	3	2	1	0
		-		*Fault reset*	*Reserved*		*Run Set-Point Manager*	*Enable operation*	*Quick stop*	*Enable voltage*	*Switch on*

Operation commands are generated by a combination of these bits.

Command	Bit of the *control word*				
	Fault reset	**Enable operation**	**Quick stop**	**Enable voltage**	**Switch on**
Shutdown	0	X	1	1	0
Switch on	0	0	1	1	1
Switch on + enable operation	0	1	1	1	1
Disable voltage	0	x	x	0	x
Quick stop	0	x	0	1	x
Disable operation	0	0	1	1	1
Enable operation	0	1	1	1	1
Fault reset	0 to 1 (rising edge)	x	x	x	x

5.337.2 Profiler module dedicated bits

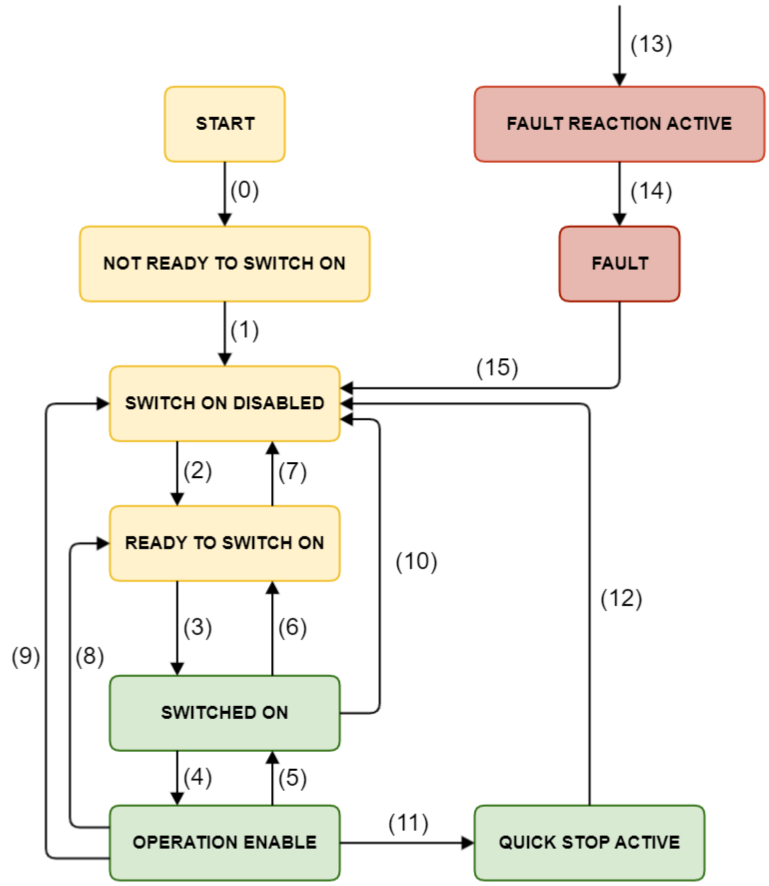
Those bits allow to operate the profiler module. The binary representation of the object value and its corresponding meaning is as follows:

Bit number	15	...	12	11	10	9	8	7	...	0
		Reserved		*Abs/Rel*	*Unused*	*New set-point*	*Halt*		-	

Halt	Description
1	*In operation enabled state, the active movement will decelerate to 0 velocity as long as the Halt option code is not set to "do nothing". New absolute set-points performed while this bit is active will be taken into account after this bit is set to 0, as long as no operation mode change has happened.*
0	*The motor can run normally. If Halt bit is set to 0 after being set to 1, a new set-point latch may be necessary.*

If no positioning is in progress, the rising edge of bit 4 will start the positioning of the axis. In case a positioning is in progress, the definitions given in the following table shall be used.

New set-point	Description
0 → 1	*Next positioning shall be started immediately interrupting the actual one.* *If Halt bit is active, this action will be taken into account once the Halt bit is released, as long as no operation mode changes happened in between.*



Note

In latest implementation, latching a new set-point modifies immediately the movement in process. The first latch after a change of mode of operation or state machine's state, takes the actual value as start-up point. Further latches begin from the latest demand values.

Bit 11 of the control word register indicates if the movement is absolute or relative:

Name	Value	Description
Abs / rel	0	*Target position is an absolute value.*
	1	*Target position is relative to previous target.*

5.337.3 Homing dedicated bits

The binary representation of the object value and its corresponding meaning is as follows:

Bit number	**15**	**...**	**10**	**9**	**8**	**7**	**...**	**0**
		Unused		*Start homing*	*Unused*		-	

If no homing is in progress, the rising edge of bit 9 will start the sequence.

Start homing	**Description**
0 → 1	*Homing sequence is started*

5.338 0x2011 - Status word

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2011	0x00	Status word	UINT16	RO	Yes	No	Data type	0	-

This register allows knowing the drive status.

The binary representation of the object value and its corresponding meaning is as follows:

Bit number	15	14	13 .. 11	10	8 .. 9	7	6	5	4	3	2	1	0
	Reserved	*Commutation feedback aligned*	*Reserved*	*Target reached*	*Reserved*	*Warning*	Switch on disabled	*Quick stop*	*Voltage enabled*	*Fault*	*Operation enabled*	*Switched on*	*Ready to switch on*

The combination of these bits determines the drive state:

Value (binary)	Status
xxxx xxxx x0xx 0000	*Not ready to switch on*
xxxx xxxx x1xx 0000	*Switch on disabled*
xxxx xxxx x01x 0001	*Ready to switch on*
xxxx xxxx x01x 0011	*Switched on*
xxxx xxxx x01x 0111	*Operation enabled*
xxxx xxxx x00x 0111	*Quick stop active*
xxxx xxxx x0xx 1111	*Fault reaction active*
xxxx xxxx x0xx 1000	*Fault*

The bit 14 is contains the information of the commutation alignment state. After power on this bit is 0 as the commutation feedback is not aligned. The first time the drive enters in operation enable state, a phasing procedure is started (forced or non-forced) and this bit is set once is finished successfully. This bit is reset every time a feedback is modified.

> ⓘ **Note**
>
> Target reached bit can be activated both using position and velocity modes. Position and velocity window and window times need to be configured to be able to use this feature.

5.338.1 Homing dedicated bits

The binary representation of the object value and its corresponding meaning is as follows:

Bit number	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**..**	**0**
	Reserved		*Homing error*	*Homing attained*	*Reserved*	*Target reached*	*Reserved*			*Drive status*		

The meaning of each bit is described below, depending on its value:

Homing error	**Homing attained**	**Target reached**	**Description**
0	0	0	*Homing procedure is in progress*
0	0	1	*Homing procedure is interrupted or not started*
0	1	0	*Homing is attained but target is not reached*
0	1	1	*Homing mode carried out successfully*
1	0	0	*Homing error occurred;* *Homing mode carried out not successfully;* *Velocity is not zero*
1	0	1	*Homing error occurred;* *Homing mode carried out not successfully;* *Velocity is zero*
1	1	x	*Reserved*

5.339 0x2014 - Operation mode

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2014	0x00	Operation mode	UINT16	RW	Yes	Yes	Data type	0	-

This register modifies the current operation mode.

This parameter is composed of a set of indicating which elements are enabled in motion:

Bit number	15	...	9	8	7	6 ... 4	3 ... 0
	Reserved			*Homing*	*PTP Buffer*	*Profiler Mode*	*Standard operation modes*

5.339.1 Standard operation modes bits

Those bits allow selecting the desired mode of operation as a base of the movement.

Value	Standard operation modes
0	*Voltage*
1	*Current amplifier*
2	*Current*
3	*Velocity mode*
4	*Position mode*

5.339.2 Profiler mode bits

The supported profiler modes are the following. These will be explained below.

Value	Profiler modes
0	*No profiler*
1	*Trapezoidal profiler*
2	*Linear interpolator*
3	*5th degree polynomial PVT*
4	*S-Curve without jerk control*

Operation modes

> ⓘ **Note**
>
> Only velocity and position modes are compatible with profiler, except with linear interpolation mode, where quadrature current is supported.

> **Note**
>
> When either the operation mode or the option bits are changed, the profiler in process is cancelled and reconfigured.

For variations of these basic modes, further options can be signaled in this register. The allowed combinations are the following.

Name	Homing bit	PTP buffer bit	Profiler mode value	Standard operation mode	Value
Profile position	0	0	1	4	0x14
Profile position S-curve	0	0	4	4	0x44
Cyclic synchronous position	0	0	2	4	0x24
Interpolated position	0	1	2	4	0xA4
Buffered PVT	0	1	3	4	0xB4
Profile velocity	0	0	1	3	0x13
Cyclic synchronous velocity	0	0	2	3	0x23
Cyclic synchronous current	0	0	2	2	0x22
Homing	1	0	1	3	0x113

5.340 0x2015 - Operation mode display

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2015	0x00	Operation mode display	UINT16	RO	Yes	No	Data type	0	-

This register indicates the current operation mode.

This parameter is composed of a set of indicating which elements are enabled in motion:

Bit number	15	...	9	8	7	6 ... 4	3 ... 0
	Reserved			*Homing Mode*	*PTP Buffer*	*Profiler Mode*	*Standard operation modes*

This register allows selecting the desired mode of operation as a base of the movement.

Value	Standard operation modes
0	*Voltage*
1	*Current amplifier*
2	*Current*
3	*Velocity mode*
4	*Position mode*

For variations of these basic modes, further options can be signaled in this register. The allowed combinations are the following.

Name	Homing bit	PTP buffer bit	Profiler mode value	Standard operation mode	Value
Profile position	0	0	1	4	0x14
Profile position S-curve	0	0	4	4	0x44
Cyclic synchronous position	0	0	2	4	0x24
Interpolated position	0	1	2	4	0xA4
Buffered PVT	0	1	3	4	0xB4
Profile velocity	0	0	1	3	0x13
Cyclic synchronous velocity	0	0	2	3	0x23
Cyclic synchronous current	0	0	2	2	0x22
Homing	1	0	1	3	0x113

5.341 0x2018 - Voltage quadrature set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2018	0x00	Voltage quadrature set-point	FLOAT	RW	Yes	No	Data type	0.0	V

This register sets the quadrature voltage set-point when drive works in voltage mode.

5.342 0x2019 - Voltage direct set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2019	0x00	Voltage direct set-point	FLOAT	RW	Yes	No	Data type	0.0	V

This register sets the direct voltage set-point when drive works in voltage mode.

5.343 0x201A - Current quadrature set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x201A	0x00	Current quadrature set-point	FLOAT	RW	Yes	No	Data type	0.0	A

This register sets the quadrature current set-point when drive works in current mode.

5.344 0x201B - Current direct set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x201B	0x00	Current direct set-point	FLOAT	RW	Yes	No	Data type	0.0	A

This register sets the direct current set-point when drive works in current mode.

5.345 0x201C - Current A set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x201C	0x00	Current A set-point	FLOAT	RW	Yes	No	Data type	0.0	A

This register sets the A current set-point when drive works in current amplifier mode.

5.346 0x201D - Current B set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x201D	0x00	Current B set-point	FLOAT	RW	Yes	No	Data type	0.0	A

This register sets the B current set-point when drive works in current amplifier mode.

5.347 0x2020 - Position set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2020	0x00	Position set-point	INT32	RW	Yes	No	INT32	0	encoder counts

This register is used to command the target values for position input.

The target position will be interpreted as absolute or relative, depending on the controlword's abs/rel flag.

5.348 0x2021 - Velocity set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2021	0x00	Velocity set-point	FLOAT	RW	Yes	No	Data type	0.0	rev/s

This register is used to command the target values for velocity input. The polarity indicates the direction of rotation.

5.349 0x2024 - Positioning option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2024	0x00	Positioning option code	UINT16	RW	Yes	Yes	-	0	-

This object indicates the configured positioning behavior.

The binary representation of the positioning option code is as follows:

Bit number:	15	14	...	12	11	...	8	7	6	5	4	3	2	1	0
	-	-			-			*Rotary axis option*		-		-		*Relative option*	

5.349.1 Relative option

It is not supported on current versions.

5.349.2 Rotary axis option

The next table defines the values for choosing between the different rotary option movements:

Name	Bit 7	Bit 6	Description
Rotary axis option	0	0	Normal positioning similar to linear axis. If reaching or exceeding the **Position range limits**, the input value wraps 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.
	0	1	Positioning only in negative direction.
	1	0	Positioning only in positive direction.
	1	1	Positioning with the shortest way to the target position. *If the difference between actual value and target position is the same in both directions, the axis moves in positive direction.

5.350 0x2025 - Profiler max. velocity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2025	0x00	Profiler max. velocity	FLOAT	RW	Yes	Yes	> 0.0	200.0	rev/s

This register configures the profiler maximum velocity.

Warning

Profiler max. velocity must have positive values, otherwise behavior will be unpredictable.

5.351 0x2026 - Profiler max. acceleration

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2026	0x00	Profiler max. acceleration	FLOAT	RW	Yes	Yes	> 0.0	20000.0	rev / s^2

This register configures the profiler maximum acceleration.

Warning

Profiler max. acceleration must have positive values, otherwise behavior will be unpredictable.

5.352 0x2027 - Profiler max. deceleration

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2027	0x00	Profiler max. deceleration	FLOAT	RW	Yes	Yes	> 0.0	20000.0	rev / s^2

This register configures the profiler maximum deceleration.

> **Warning**
>
> Profiler max. deceleration must have positive values, otherwise behavior will be unpredictable.

5.353 0x2030 - Actual position

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2030	0x00	Actual position	INT32	RO	Yes	No	Data type	-	encoder counts

This object contains the actual position calculated using the position feedback.

5.354 0x2031 - Actual velocity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2031	0x00	Actual velocity	FLOAT	RO	Yes	No	Data type	-	rev/s

This register contains the velocity actual value of the actuator, calculated using the velocity feedback.

5.355 0x2033 - Auxiliar feedback value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2033	0x00	Auxiliar feedback value	INT32	RO	Yes	No	Data type	-	feedback counts

This register contains the raw of the selected auxiliar feedback sensor.

5.356 0x2038 - Current A value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2038	0x00	Current A value	FLOAT	RO	Yes	No	Data type	-	A

This register contains the instant current through phase A.

5.357 0x2039 - Current B value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2039	0x00	Current B value	FLOAT	RO	Yes	No	Data type	-	A

This register contains the instant current through phase B.

5.358 0x203A - Current C value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x203A	0x00	Current C value	FLOAT	RO	Yes	No	Data type	-	A

This register contains the instant current through phase C.

5.359 0x203B - Current quadrature value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x203B	0x00	Current quadrature value	FLOAT	RO	Yes	No	Data type	-	A

This register contains the instantaneous quadrature current value.

5.360 0x203C - Current direct value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x203C	0x00	Current direct value	FLOAT	RO	Yes	No	Data type	-	A

This register contains the instantaneous direct current value.

5.361 0x2040 - Commutation angle value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2040	0x00	Commutation angle value	FLOAT	RO	Yes	No	0.0 to 1.0	-	rev

Contains the value of the electrical angle read by the commutation feedback.

ⓘ *Motor pole pairs* have to be properly configured to obtain good readings from this register.

5.362 0x2041 - Reference angle

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2041	0x00	Reference angle	FLOAT	RO	Yes	No	0.0 to 1.0	0.0	rev

Contains the value of the electrical angle read by the reference feedback.

Motor pole pairs have to be properly configured to obtain good readings from this register.

5.363 0x204A - BiSS-C slave 1 / Primary SSI - Position

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x204A	0x00	BiSS-C slave 1 / Primary SSI - Position	INT32	RO	Yes	No	Data type	0	encoder counts

This register contains the last read position value from the feedback.

> ⚠ This parameter doesn't include CRC neither flags information.

> ⓘ Invalid frames are dropped so all the positions on this parameter are valid for operation

5.364 0x2050 - Generator value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2050	0x00	Generator value	FLOAT	RO	Yes	No	Data type	0.0	-

Contains the value generated by the internal generator module.

5.365 0x2051 - Secondary SSI - Position

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2051	0x00	Secondary SSI - Position	INT32	RO	Yes	No	Data type	0	encoder counts

This register contains the last read position value from the feedback.

⚠ This parameter doesn't include CRC neither flags information.

ⓘ Invalid frames are dropped so all the positions on this parameter are valid for operation.

5.366 0x2060 - Bus voltage value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2060	0x00	Bus voltage value	FLOAT	RO	Yes	No	Data type	-	V

This register shows the instant bus voltage value.

5.367 0x2061 - Primary temperature value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2061	0x00	Primary temperature value	FLOAT	RO	Yes	No	Data type	-	ºC

This register shows the instant temperature value of the primary temperature sensor located into the drive power stage.

5.368 0x2063 - Motor temperature value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2063	0x00	Motor temperature value	FLOAT	RO	Yes	No	Data type	-	ºC

This register shows the instant temperature value of the motor temperature sensor.

The value depends directly on the motor temperature sensor parameters.

5.369 0x2064 - Redundant temperature value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2064	0x00	Redundant temperature value	FLOAT	RO	Yes	No	Data type	-	ºC

This register shows the instant temperature value of the redundant temperature sensor located in the drive power stage.

5.370 0x2067 - Power stage temperature

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2067	0x00	Power stage temperature	FLOAT	RO	Yes	No	Data type	-	ºC

This register shows the instant temperature value of drive power stage temperature.

The value is the maximum between the *primary* and *redundant* power stage readings.

5.371 0x206E - Voltage direct command

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x206E	0x00	Voltage direct command	FLOAT	RW	Yes	No	Data type	0.0	V

This register contains the direct voltage command entering into the voltage chain in any mode different than voltage mode.

5.372 0x206F - Voltage quadrature command

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x206F	0x00	Voltage quadrature command	FLOAT	RW	Yes	No	Data type	0.0	V

This register contains the quadrature voltage command entering into the voltage chain in any mode different than voltage mode.

5.373 0x2070 - Voltage quadrature demand

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2070	0x00	Voltage quadrature demand	FLOAT	RW	Yes	No	Data type	-	V

This register contains the quadrature voltage demand entering into voltage chain in voltage mode.

5.374 0x2071 - Voltage direct demand

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2071	0x00	Voltage direct demand	FLOAT	RW	Yes	No	Data type	-	V

This register contains the direct voltage demand entering into the voltage chain in voltage mode.

5.375 0x2072 - Current quadrature demand

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2072	0x00	Current quadrature demand	FLOAT	RO	Yes	No	Data type	-	A

This register contains the quadrature current demand entering into current chain in current mode.

5.376 0x2073 - Current direct demand

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2073	0x00	Current direct demand	FLOAT	RO	Yes	No	Data type	-	A

This register contains the direct current demand entering the current chain in current mode.

5.377 0x2076 - Current actual value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2076	0x00	Current actual value	FLOAT	RO	Yes	No	Data type	-	A

This register contains the module of the *current quadrature value* and *current direct value*.

5.378 0x2077 - Current command value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2077	0x00	Current command value	FLOAT	RO	Yes	No	Data type	0.0	A

This register contains the module of Current quadrature / A control loop command and Current direct / B control loop command

5.379 0x2078 - Position demand

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2078	0x00	Position demand	INT32	RO	Yes	No	Data type	-	encoder counts

This object contains the input of the position control block.

Its value can come directly from the network, or internally from the trajectories generated by the profilers. The source of the position demand depends on the operation mode.

5.380 0x2079 - Velocity demand

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2079	0x00	Velocity demand	FLOAT	RO	Yes	No	Data type	-	rev/s

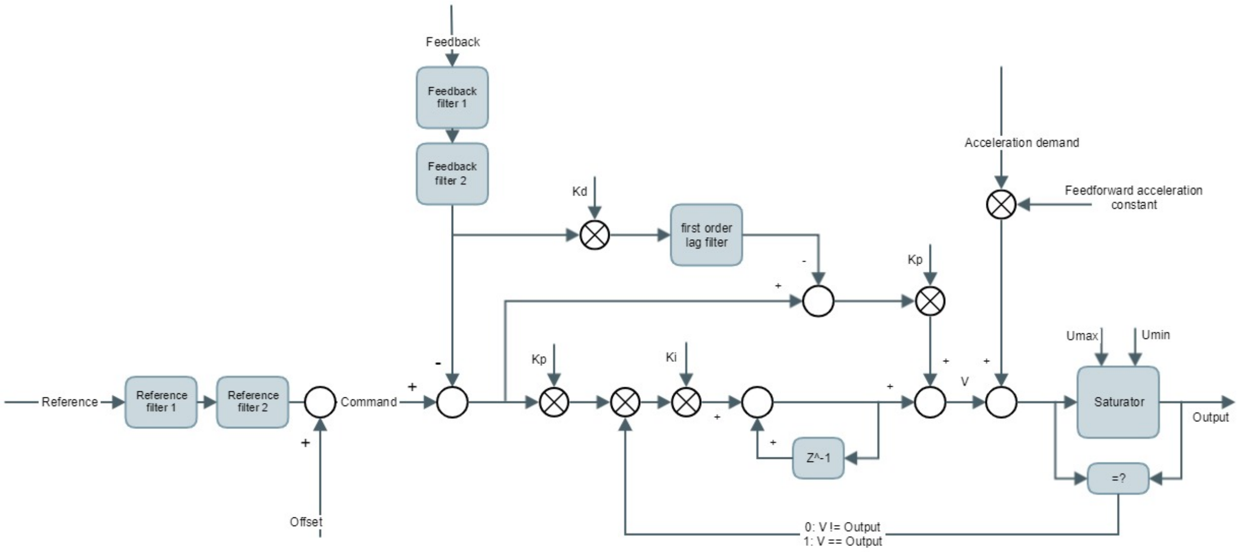
This register shows the input of the velocity control block.

This parameter shows the input of the velocity control block only when a velocity operation mode is being used. In position modes, the input of the velocity control block is retrieved from the position loop output instead. The value of the velocity demand can come directly from the network, or internally from the trajectories generated by the profilers. The source of the velocity demand depends on the operation mode.

5.381 0x207B - Velocity loop input offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x207B	0x00	Velocity loop input offset	FLOAT	RW	Yes	Yes	Data type	0.0	rev/s

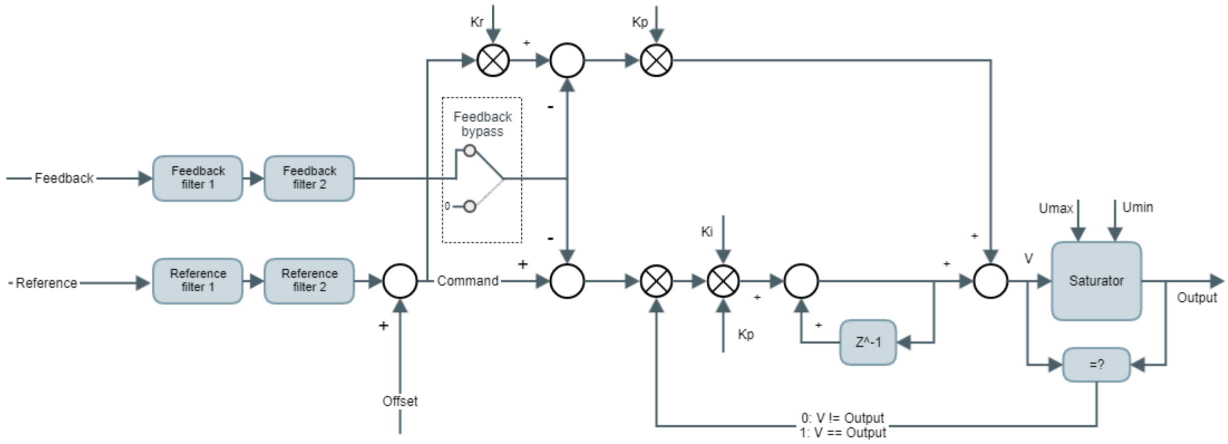
This register adds an offset to the filtered reference of the velocity controller.



5.382 0x207C - Current quadrature loop input offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x207C	0x00	Current quadrature loop input offset	FLOAT	RW	Yes	Yes	Data type	0.0	A

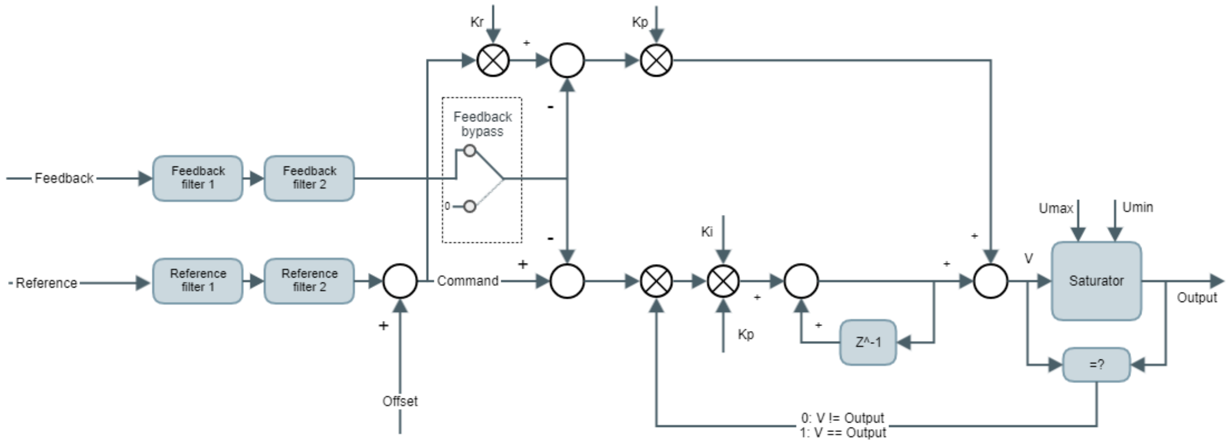
This register adds an offset to the filtered reference of the current quadrature loop controller.



5.383 0x207D - Current direct loop input offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x207D	0x00	Current direct loop input offset	FLOAT	RW	Yes	Yes	Data type	0.0	A

This register adds an offset to the filtered reference of the current direct loop controller.



Warning

When the commutation modulation type parameter is set to Brushless DC or Brushed DC, only the current quadrature control is used. However, both of the current inputs (direct and quadrature) are still used for processing some protections (I2T, derating). In this case, make sure the current direct set-point and current direct loop input offset are set to 0

5.384 0x207F - Current loop feedback bypass

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x207F	0x00	Current loop feedback bypass	UINT16	RW	No	No	0 to 1	0	-

This register allows bypassing the current feedback in the current loops, and setting the current readings to 0. This allows using the current loops in open loop.

Meaning	Value
Current feedback connected	0
Current feedback bypassed	1

5.385 0x2081 - Analog 1 counts

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2081	0x00	Analog 1 counts	UINT16	RO	Yes	No	Data type	-	ADC counts

This register contains the counts obtained from analog input 1. ADC resolution is 16 bits for differential signals.

5.386 0x2083 - Analog 2 counts

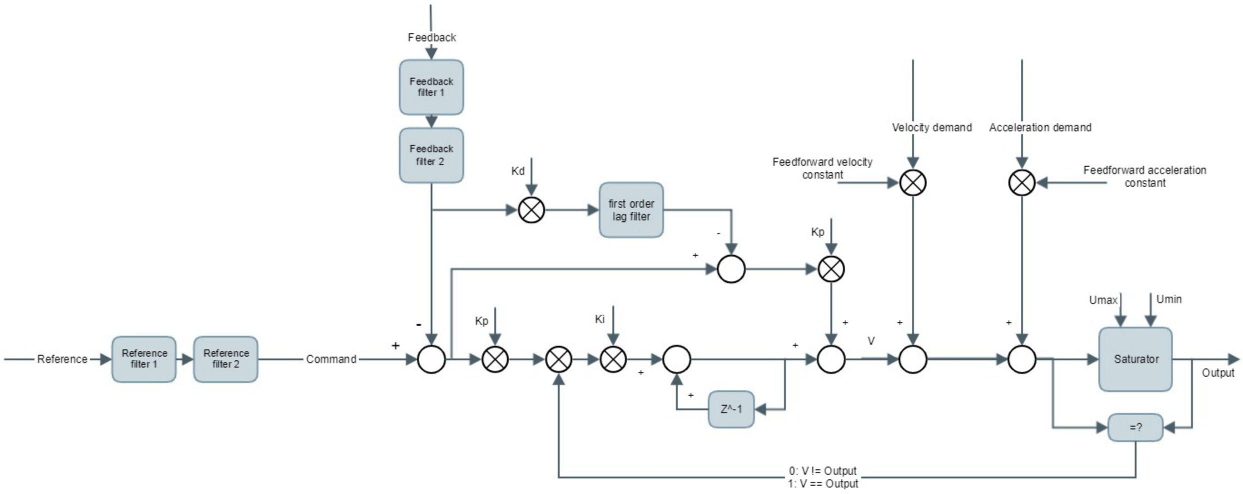
Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2083	0x00	Analog 2 counts	UINT16	RO	Yes	No	Data type	-	ADC counts

This register contains the counts obtained from analog input 2. ADC resolution is 16 bits for differential signals.

5.387 0x2096 - Position loop control command

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2096	0x00	Position loop control command	FLOAT	RO	No	Yes	min. position to max. position (if limits active)	-	counts

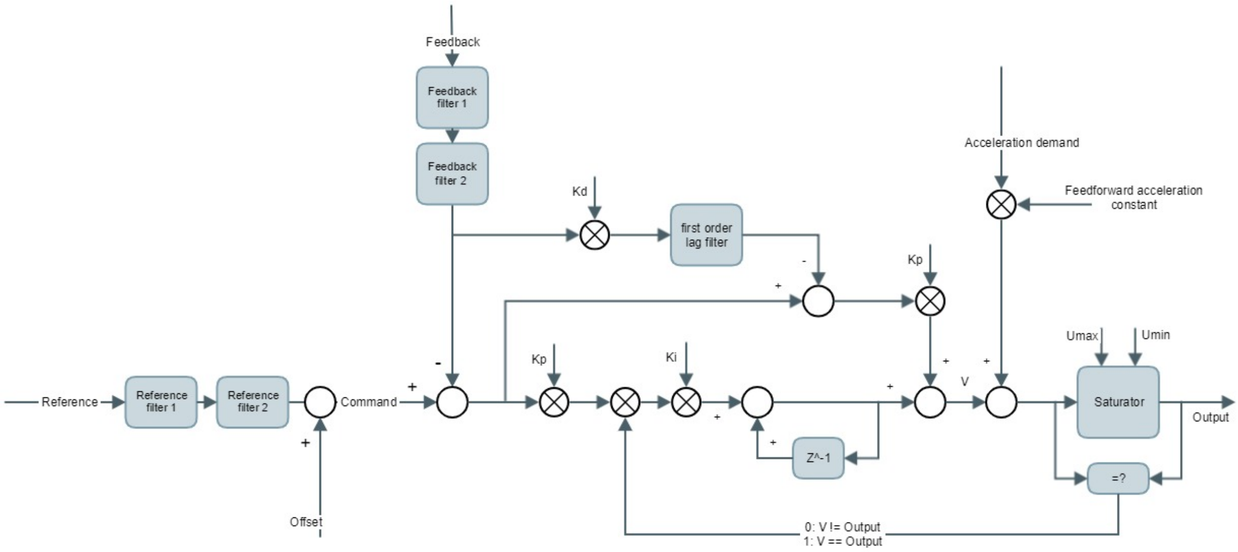
This register shows the value that is commanded to the position control loop (after the effects of the position offset and reference filters).



5.388 0x2097 - Velocity loop control command

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2097	0x00	Velocity loop control command	FLOAT	RO	Yes	Yes	-max. velocity to max. velocity	-	rev/s

This register shows the value that is commanded to the velocity control loop (after the effects of the velocity offset and reference filters).

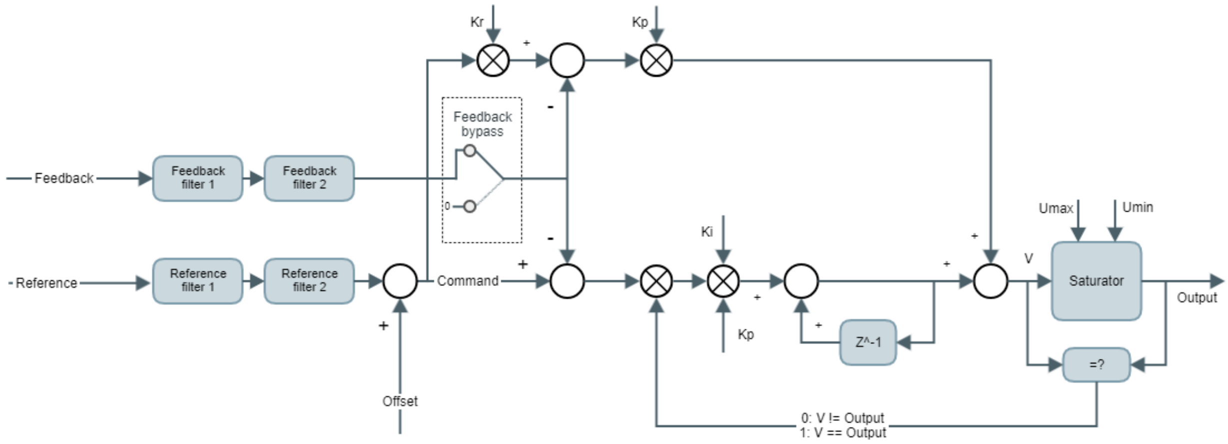


5.389 0x2098 - Current quadrature / A control loop command

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2098	0x00	Current quadrature / A control loop command	FLOAT	RO	Yes	No	Data type	-	A

This register contains the quadrature / phase A current command entering into current controller.

Command represents the value entering into the current PI controllers after filtering and offset. If current amplifier modes is selected, the register represents phase A current command whereas if another mode is selected (except voltage mode) the register represents quadrature current command.

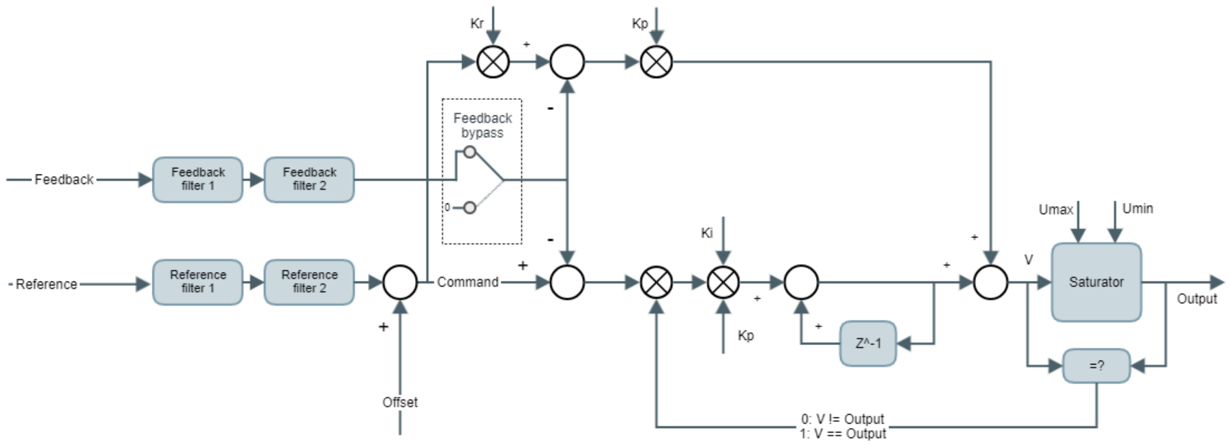


5.390 0x2099 - Current direct / B control loop command

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2099	0x00	Current direct/ B control loop command	FLOAT	RO	Yes	No	Data type	-	A

This register contains the direct / phase B current command entering into current controller.

Command represents the value entering into the current PI controllers after filtering and offset. If current amplifier mode is selected, the register represents phase B current command whereas if another mode is selected (except voltage mode) the register represents direct current command.



5.391 0x20C1 - Interpolation data record - Position input

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x20C1	0x00	Interpolation data record - Position input	INT32	RW	Yes	No	Data type	0	counts

This register sets the position input for interpolation data record, which is the position to be stored in the buffer.

5.392 0x20C2 - Interpolation data record - Velocity input

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x20C2	0x00	Interpolation data record - Velocity input	FLOAT	RW	Yes	No	Data type	0.0	rev/s

This register sets the velocity input for interpolation data record, which is the velocity to be stored in the buffer.

5.393 0x20C3 - Interpolation data record - Time input

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x20C3	0x00	Interpolation data record - Time input	UINT16	RW	Yes	No	Data type	0	ms

This register sets the time input for interpolation data record in milliseconds.

5.394 0x20C4 - Interpolation data record integrity check

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x20C4	0x00	Interpolation data record integrity check	UINT16	RW	Yes	No	Data type	0	-

This register is used to append new PT or PVT data to the interpolated position buffer and is also used as an integrity check.

Data is added to the buffer every time this parameter increases by a value of 1.

In other words, to start adding data into the interpolation data record:

1. Read this parameter.
2. Fill in the interpolation data record with the desired point.
3. Add 1 to the value read in this parameter. This process can be done with cyclic communications and the value can be added in each transmission without having to read the value again.

5.395 0x2100 - Rated current

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2100	0x00	Rated current	FLOAT	RW	Yes	Yes	Data type	10.0	A

This register defines the continuous current of the actuator / system

Rated current is referred to the total motor current →

$$motor\ current = \sqrt[2]{Iq^2 + Id^2} = max[abs(Ia), abs(Ib), abs(Ic)]$$

This register also describes the maximum continuous current of the system used by I2T algorithm for determining the maximum allowed exceed of energy.

5.396 0x2101 - Peak current

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2101	0x00	Peak current	FLOAT	RW	No	Yes	Data type	16.0	A

This register defines the maximum allowed instant current during the defined *peak current time*.

These registers allows to configure the I^2T parameters to protect the drive and/or motor in front of exceeding their thermal limit. It is a complementary protection that works together with temperature limits and current derating.

See *Drive protections*.

The main functionality of the I2T is to detect an instantaneous exceed of thermal energy on the drive. It covers the case where the temperature sensors are too slow to detect a dangerous situation.

This protection is always active. For modes of operation where current loop is not enabled, instead of limiting the current a fault is generated.

There is a maximum configurable I^2T. If a user sets an I^2T less restrictive than the allowed, the drive overwrites the user configuration with its own. The applied nominal current is the smaller between both configurations.

If maximum configurable I^2T is detected before the user I^2T levels, a fault is generated independently if the current loop is enabled or not.

Max current limit is applied to the total motor current →

$$motor\ current = \sqrt[2]{Iq^2 + Id^2} = max[abs(Ia), abs(Ib), abs(Ic)]$$

5.397 0x2102 - Peak current time

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2102	0x00	Peak current time	UINT32	RW	No	Yes	Data type	1000	ms

This register defines the maximum time the drive is able to source the *peak current*.

This register allows to configure the I^2T parameters to protect the drive and/or motor in front of exceeding their thermal limit. It is a complementary protection that works together with temperature limits and current derating.

See *Drive protections*.

The main functionality of the I2T is to detect an instantaneous exceed of thermal energy on the drive. It covers the case where the temperature sensors are too slow to detect a dangerous situation.

This protection is always active. For modes of operation where current loop is not enabled, instead of limiting the current a fault is generated.

There is a maximum configurable I^2T. If a user sets an I^2T less restrictive than the allowed, the drive overwrites the user configuration with its own. The applied nominal current is the smaller between both configurations.

If maximum configurable I^2T is detected before the user I^2T levels, a fault is generated independently if the current loop is enabled or not.

Max current limit is applied to the total motor current →

$$motor\ current = \sqrt[2]{Iq^2 + Id^2} = max[abs(Ia), abs(Ib), abs(Ic)]$$

5.398 0x2106 - Motor pole pairs

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2106	0x00	Motor pole pairs	INT16	RW	No	Yes	Data type	2	pole pairs

This register sets the number of motor pole pairs.

> **Note**
>
> When modifying this parameter if digital halls are in use, review the *digital halls pole pairs* value.

5.399 0x2120 - Internal shunt enable voltage

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2120	0x00	Internal shunt enable voltage	FLOAT	RW	No	Yes	Data type	60.0	V

This register sets the voltage threshold to enable the internal shunt braking resistor.

5.400 0x2121 - Internal shunt disable voltage

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2121	0x00	Internal shunt disable voltage	FLOAT	RW	No	Yes	Data type	58.0	V

This register sets the voltage threshold to disable the internal shunt braking resistor.

5.401 0x2122 - External shunt enable voltage

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2122	0x00	External shunt enable voltage	FLOAT	RW	No	Yes	Data type	60.0	V

This register sets the voltage threshold to enable the external shunt braking resistor.

5.402 0x2123 - External shunt disable voltage

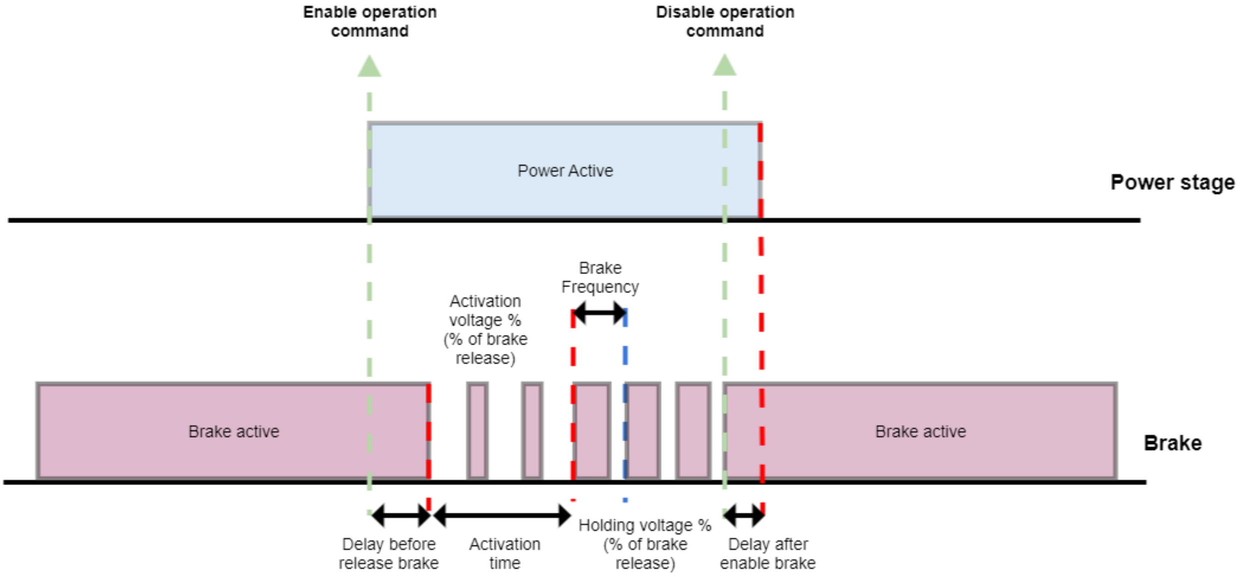
Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2123	0x00	External shunt disable voltage	FLOAT	RW	No	Yes	Data type	58.0	V

This register sets the voltage threshold to disable the external shunt braking resistor.

5.403 0x2124 - Brake activation voltage percentage

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2124	0x00	Brake activation voltage percentage	UINT16	RW	No	Yes	0 to 100	100	%

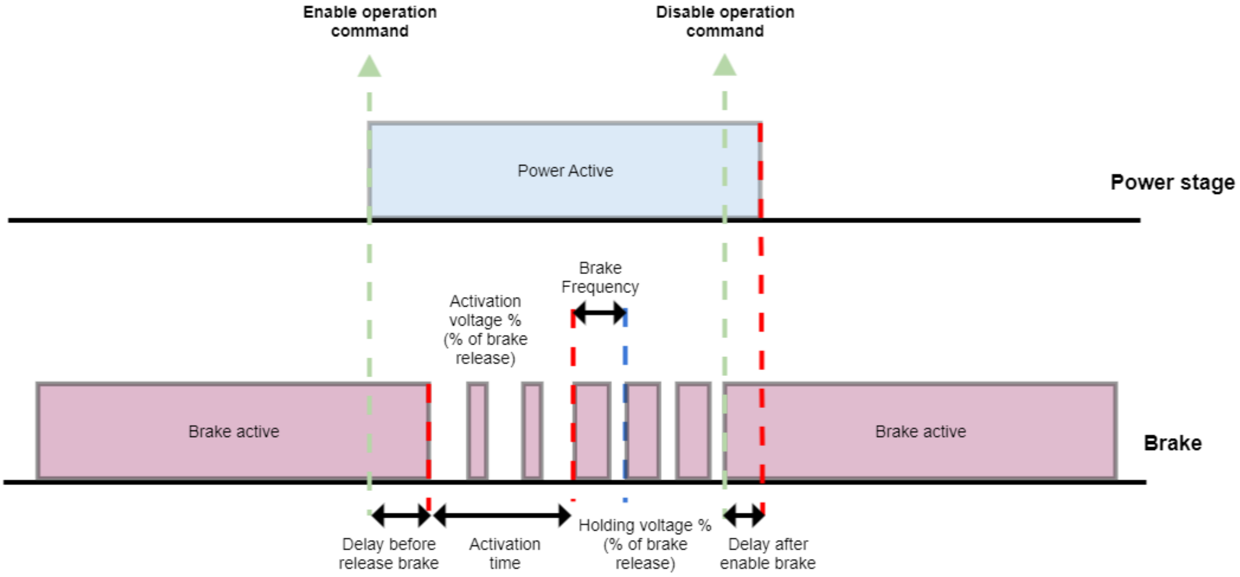
This parameter contains the percentage of voltage applied to release the brake.



5.404 0x2125 - Brake holding voltage percentage

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2125	0x00	Brake holding voltage percentage	UINT16	RW	No	Yes	0 to 100	100	%

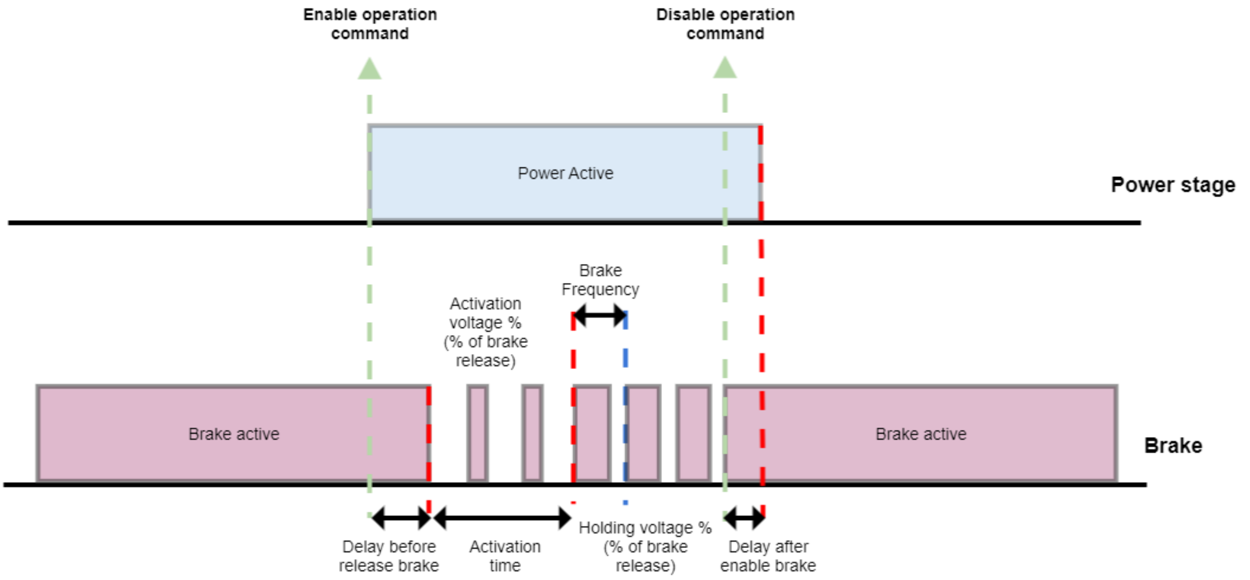
This parameter contains the percentage of voltage applied to the brake.



5.405 0x2126 - Delay before release brake

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2126	0x00	Delay before release brake	UINT32	RW	No	Yes	Data type	0	ms

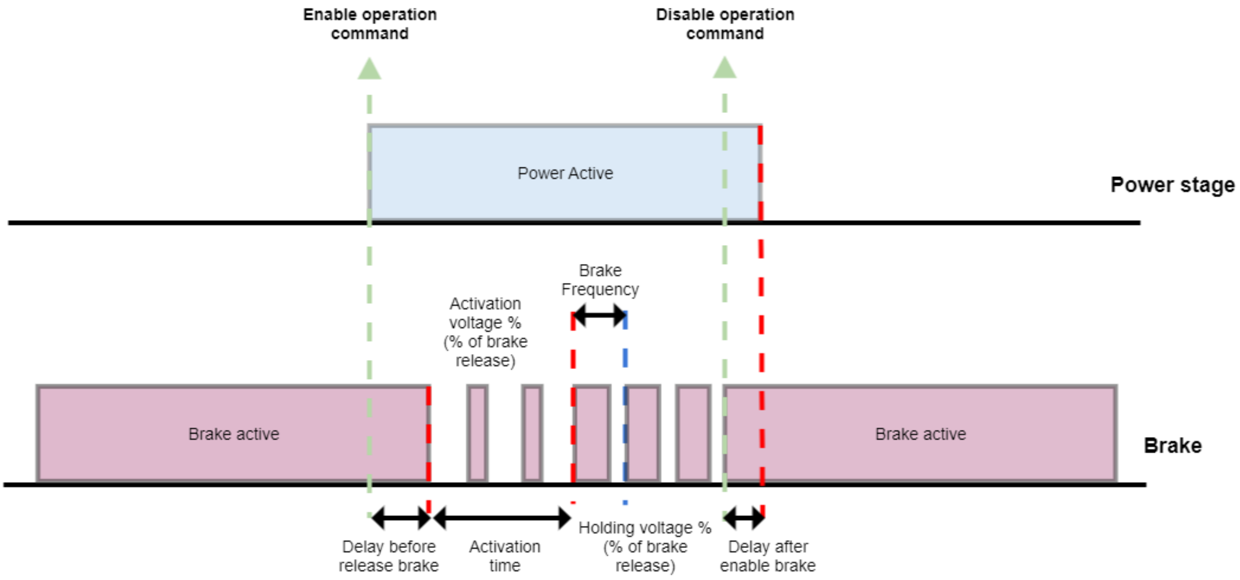
This parameter indicates the delay in milliseconds between activation of the power stage and disengaging the brake (brake activated state).



5.406 0x2127 - Delay after enable brake

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2127	0x00	Delay after enable brake	UINT32	RW	No	Yes	Data type	0	ms

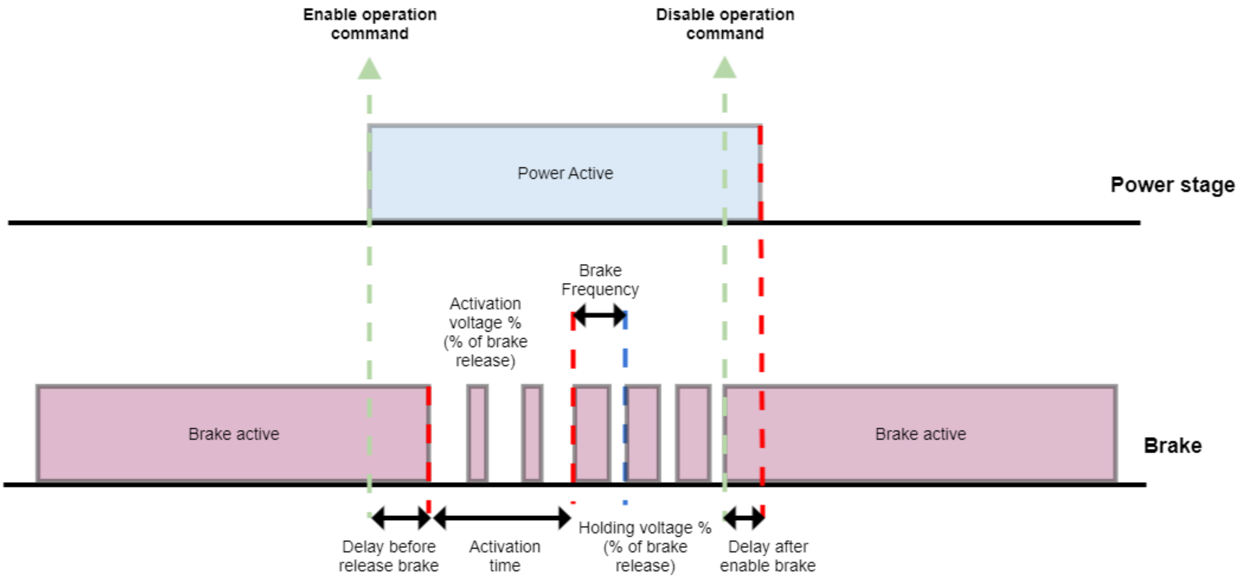
This parameter indicates the delay in milliseconds between engaging the brake and deactivation of the power stage.



5.407 0x2128 - Activation brake time

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2128	0x00	Activation brake time	UINT32	RW	No	Yes	Data type	0	ms

This parameter indicates the time in milliseconds the voltage applied to the brake is the configured brake activation voltage percentage.



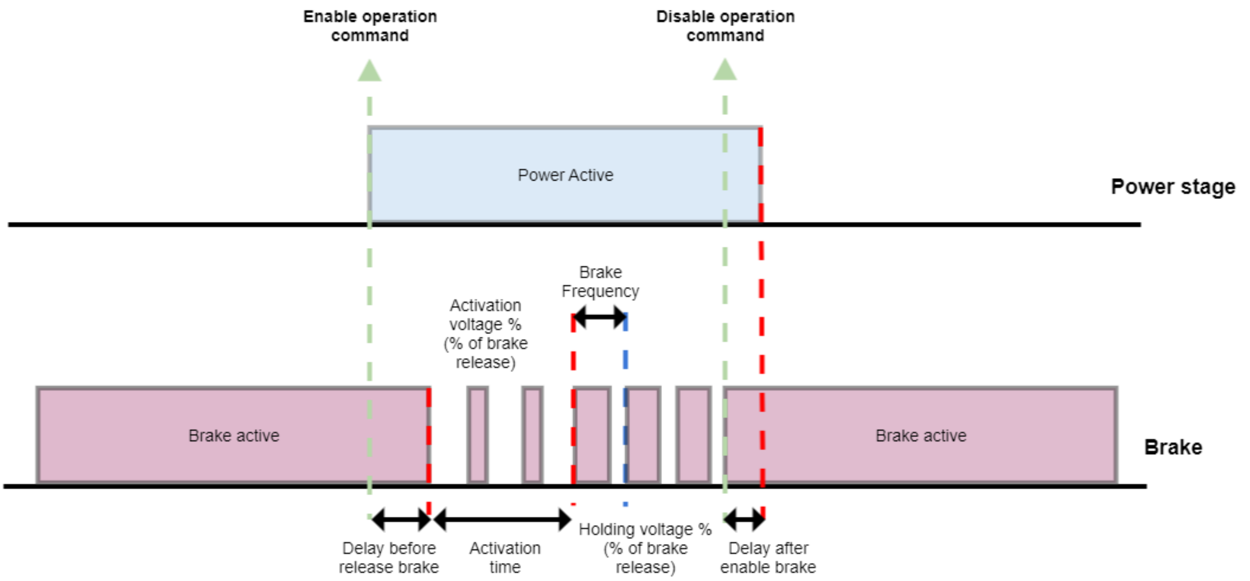
5.408 0x2129 - Brake override

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2129	0x00	Brake override	UINT16	RW	No	No	0 - 2	0	-

This register allows to override the automatic functionality of the brake.

This register can have following values:

Value	Meaning
0	*Does not override*
1	*Overrides brake and applies holding duty*
2	*Overrides and enables brake*



5.409 0x214F - Commutation modulation

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x214F	0x00	Commutation modulation	UINT16	RW	No	Yes	0 - 2	0	-

This register indicates the applied modulation.

The input values of this parameter can are described next.

Value	Description
0	*Sinusoidal modulation*
1	*Trapezoidal modulation*
2	*Single phase modulation*

Warning

Trapezoidal modulation can only be used with digital halls as commutation feedback.

5.410 0x2150 - Commutation angle offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2150	0x00	Commutation angle offset	FLOAT	RW	No	Yes	0.0 - 1.0	0.0	rev

Defines the angle difference between the expected angle 0.0 by the drive algorithm and the angle value read from the commutation feedback at this same position.

5.411 0x2151 - Commutation feedback sensor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2151	0x00	Commutation feedback sensor	UINT16	RW	No	Yes	1 - 7	4	-

This register configures the type of feedback used for commutation.

The available commutation sensors are:

Value	Meaning
1	*BiSS-C slave 1 / Primary SSI*
2	*Reserved*
3	*Internal generator*
4	*Incremental encoder 1*
5	*Digital halls*
6	*Secondary SSI*
7	*BiSS-C slave 2 (daisy chain)*

Note

Changing this parameter in operational state is not allowed.

Warning

Only 4 feedbacks can be mapped simultaneously in all of the feedback sensor parameters.

5.412 0x2152 - Reference angle offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2152	0x00	Reference angle offset	FLOAT	RW	Yes	Yes	0.0 - 1.0	0.0	rev

This register contains the angle difference between the expected angle 0.0 by the drive algorithm and the angle value read from the reference feedback at this same position.

Further information is available in *Commutation*.

5.413 0x2153 - Reference feedback sensor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2153	0x00	Reference feedback sensor	UINT16	RW	No	Yes	1 - 7	4	-

This register configures the type of feedback used as reference for aligning commutation sensor.

The available feedback sensors are:

Value	Meaning
1	*BiSS-C slave 1 / Primary SSI*
2	*Reserved*
3	*Internal generator*
4	*Incremental encoder 1*
5	*Digital halls*
6	*Secondary SSI*
7	*BiSS-C slave 2 (daisy chain)*

Note

Changing this parameter in operational state is not allowed.

Warning

Only 4 feedbacks can be mapped simultaneously in all of the feedback sensor parameters.

5.414 0x2154 - Phasing mode

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2154	0x00	Phasing mode	UINT16	RW	No	Yes	0 - 2	1	-

This register configures the phasing mode used for aligning commutation feedback sensor.

The available phasing modes are:

Value	Meaning
0	*Non - forced*
1	*Forced*
2	*Phasing disabled*

Note

Changing this parameter in the middle of a phasing process is not allowed by the drive.

5.415 0x2155 - Max. current on phasing sequence

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2155	0x00	Max. current on phasing sequence	FLOAT	RW	No	Yes	Data type	1.5	A

Maximum allowed current during a forced phasing sequence.

The current applied during any forced sequence is increased following a ramp profile.

5.416 0x2156 - Phasing timeout

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2156	0x00	Phasing timeout	UINT16	RW	No	Yes	Data type	500	ms

This register defines the maximum time of a single step sequence for forced phasing method.

This timeout is used for binary search method and expires if the displacement of the actuator is less than the expected one. If this happens, the next point is generated assuming a positive displacement.

Further information about phasing modes is available in *Commutation*.

5.417 0x2157 - Phasing accuracy

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2157	0x00	Phasing accuracy	UINT16	RW	No	Yes	Data type	50	m°

This register determines the number of steps and the minimum distance the drive should detect to consider that the actuator has been moved.

Further information about phasing modes is available in *Commutation.*

5.418 0x21C8 - Profiler latching mode

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21C8	0x00	Profiler latching mode	UINT16	RW	Yes	Yes	See below	64	-

This register allows to select when the set-points are processed by the profiler (positioning start condition).

The meaning of each bit in this parameter is described next.

Bit number	15	...	7	6	5	4	3	2	1	0
	Reserved			*Latch for position profiler*	*Latch for velocity profiler*	*Latch for current profiler*	*Reserved*	*Latch for position interpolation*	*Latch for velocity interpolation*	*Latch for current interpolation*

In operation modes using the profiler module, set-points can be latched automatically or manually, which can be selected by setting each bit with:

- **Bit set to 0:** Selected profiler mode is automatically latched by set-point change.
- **Bit set to 1:** Selected profiler mode must be manually latched by controlword.

By default this register value is 64 => 0x0040 which means that only profile position mode requires the control word latch. This configuration is the expected one for CiA402.

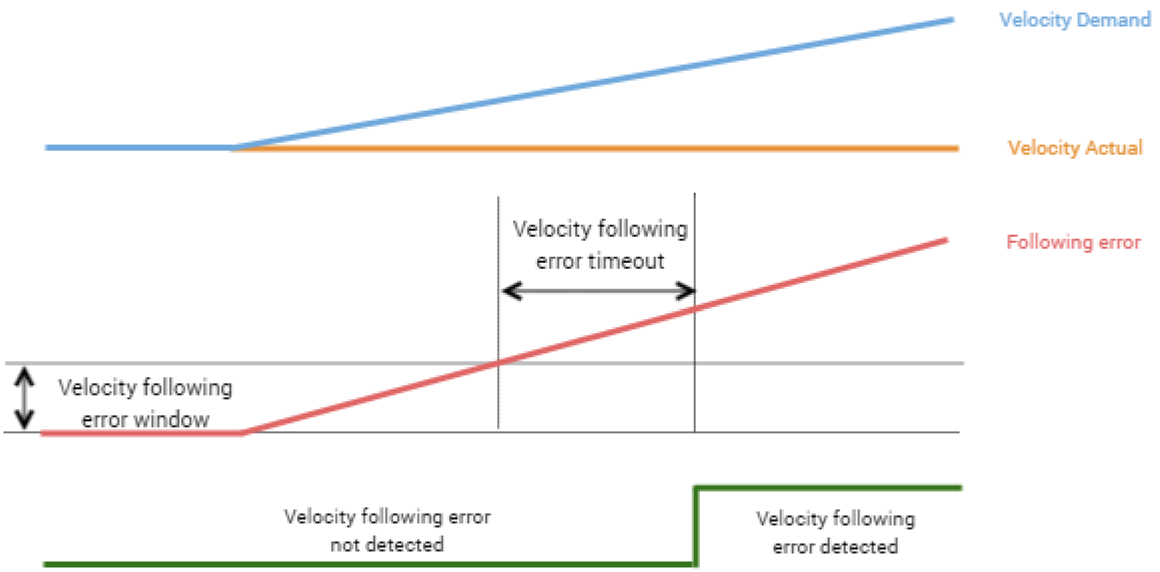
5.419 0x21DC - Velocity following error window

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21DC	0x00	Velocity following error window	FLOAT	RW	Yes	Yes	Data type	0.0	rev/s

This object indicates the maximum allowed difference between demand and actual velocity before generating an error.

If the velocity actual value is out of the velocity following error window for a velocity following error timeout time, a velocity following error occurs.

When the error condition is detected, the *Following error* bit (bit number 13) of the status word will be set. A following error may occur when a drive is blocked, when an unreachable profile velocity occurs, or when using wrong closed-loop coefficients.

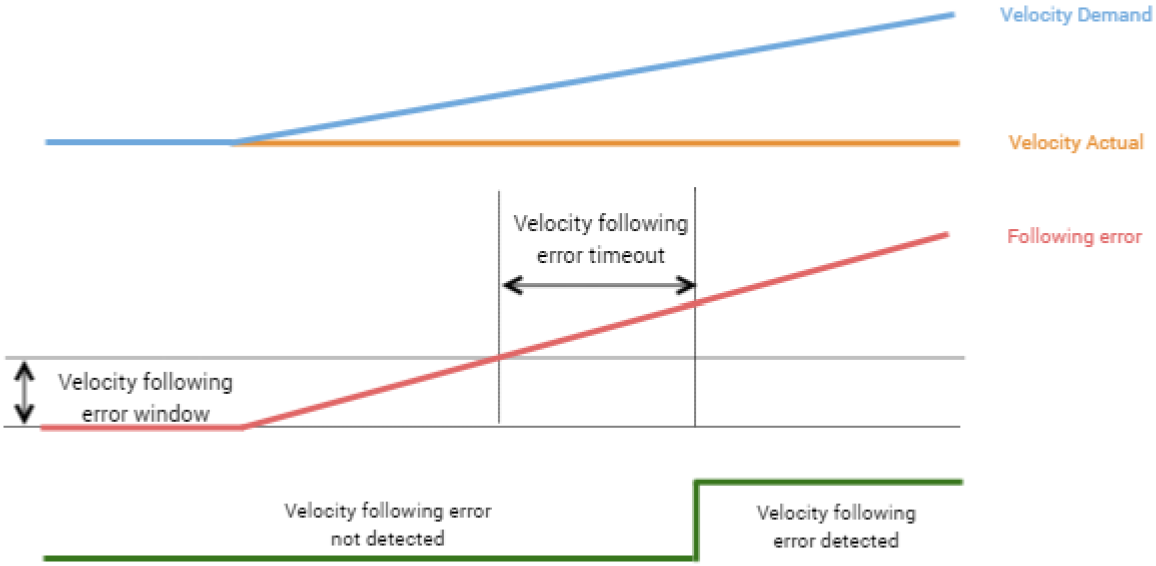


5.420 0x21DD - Velocity following error timeout

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21DD	0x00	Velocity following error timeout	UINT32	RW	Yes	Yes	Data type	0	ms

This object indicates the minimum time that actual velocity must be out of velocity following error window in order to generate an error.

When the error condition is detected, the *Following error* bit (bit number 13) of the statusword will be set.



5.421 0x21DE - Min position range limit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21DE	0x00	Min position range limit	INT32	RW	Yes	Yes	Data type	-	encoder counts

This register sets the minimum position range limit. On reaching or exceeding these range limits, the position set-point and position actual wrap automatically to the other end of the range.

This limits are disabled if both registers Min position range limit and Max position range limit are set to 0.

If software position limits and position range limits are enabled, the more restricted is applied. Software position limits are chosen in case of conflict:

5.422 0x21DF - Max position range limit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21DF	0x00	Max position range limit	INT32	RW	Yes	Yes	Data type	-	encoder counts

This register sets the maximum position range limit. On reaching or exceeding these range limits, the position set-point and position actual wrap automatically to the other end of the range.

This limits are disabled if both registers Min position range limit and Max position range limit are set to 0.

> If software position limits and position range limits are enabled, the more restricted is applied. Software position limits are chosen in case of conflict:

5.423 0x21E0 - Max. current

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21E0	0x00	Max. current	FLOAT	RW	No	Yes	Data type	24.0	A

This register sets the maximum allowed instant current.

By default, this register limits current set-points injected to the current control loops above the max current level. However if the current loop is not enabled it works as a fault: if the measured current is higher than this value the drive shut down the power stage.

> This protection is active if at least the current loop is enabled. Therefore it works for all current, velocity and position modes, but it is inactive in voltage mode.

> Max current limit is applied to the total motor current →
> $motor\ current = \sqrt[2]{Iq^2 + Id^2} = max[abs(Ia), abs(Ib), abs(Ic)]$

5.424 0x21E8 - Max. velocity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21E8	0x00	Max. velocity	FLOAT	RW	No	Yes	Data type	200.0	rev/s

This register sets the maximum allowed instant velocity.

By default, this register limits velocity set-points injected to the velocity control loops above the max velocity level. However if the velocity loop is not enabled it might work as a fault: if the measured velocity is higher than this value the drive triggers a *velocity out of limits* fault reaction.

> The limit is active if at least the velocity loop is enabled. Therefore it works for a velocity and position modes, but it is inactive in current and voltage modes.
>
> On the other hand, the fault is active if velocity loop is disabled. Therefore it is active only in current and voltage modes.

5.425 0x21EA - Min position

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21EA	0x00	Min position	INT32	RW	Yes	Yes	Data type	-	encoder counts

This object sets the user minimum allowed position.

This register limits the position values in position modes of operation. This limits are disabled if both registers Min position and Max position are set to 0.

This limits are available in all other modes of operation but instead of limiting the position, as there is not a position regulation, a fault is generated if the actuator overcomes the limit values.

If software position limits and position range limits are enabled, the more restricted is applied. Software position limits are chosen in case of conflict:

5.426 0x21EB - Max position

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21EB	0x00	Max position	INT32	RW	Yes	Yes	Data type	-	encoder counts

This object sets the user maximum allowed position.

This register limits the position values in position modes of operation. This limits are disabled if both registers Min position and Max position are set to 0.

> ⓘ This limits are available in all other modes of operation but instead of limiting the position, as there is not a position regulation, a fault is generated if the actuator overcomes the limit values.

> ⚠ If software position limits and position range limits are enabled, the more restricted is applied. Software position limits are chosen in case of conflict:

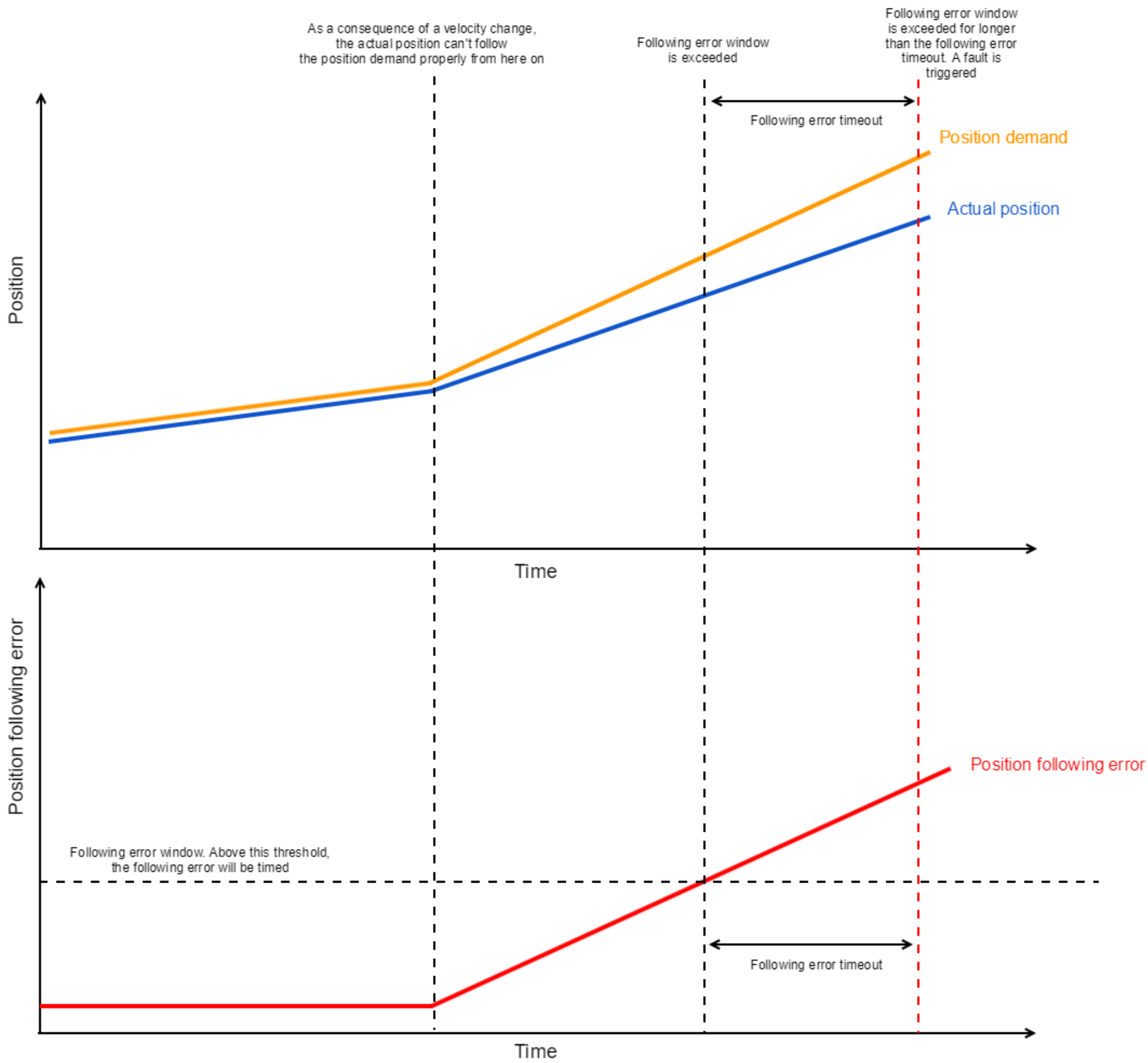
5.427 0x21EC - Position following error window

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21EC	0x00	Position following error window	FLOAT	RW	Yes	Yes	Data type	0.0	encoder counts

This object indicates the configured range of tolerated position values symmetrically to the position demand value.

If the position actual value is out of the position following error window for a position following error timeout time, a position following error occurs.

When the error condition is detected, the *Following error* bit (bit number 13) of the status word will be set. A following error may occur when a drive is blocked, when an unreachable profile velocity occurs, or when using wrong closed-loop coefficients.

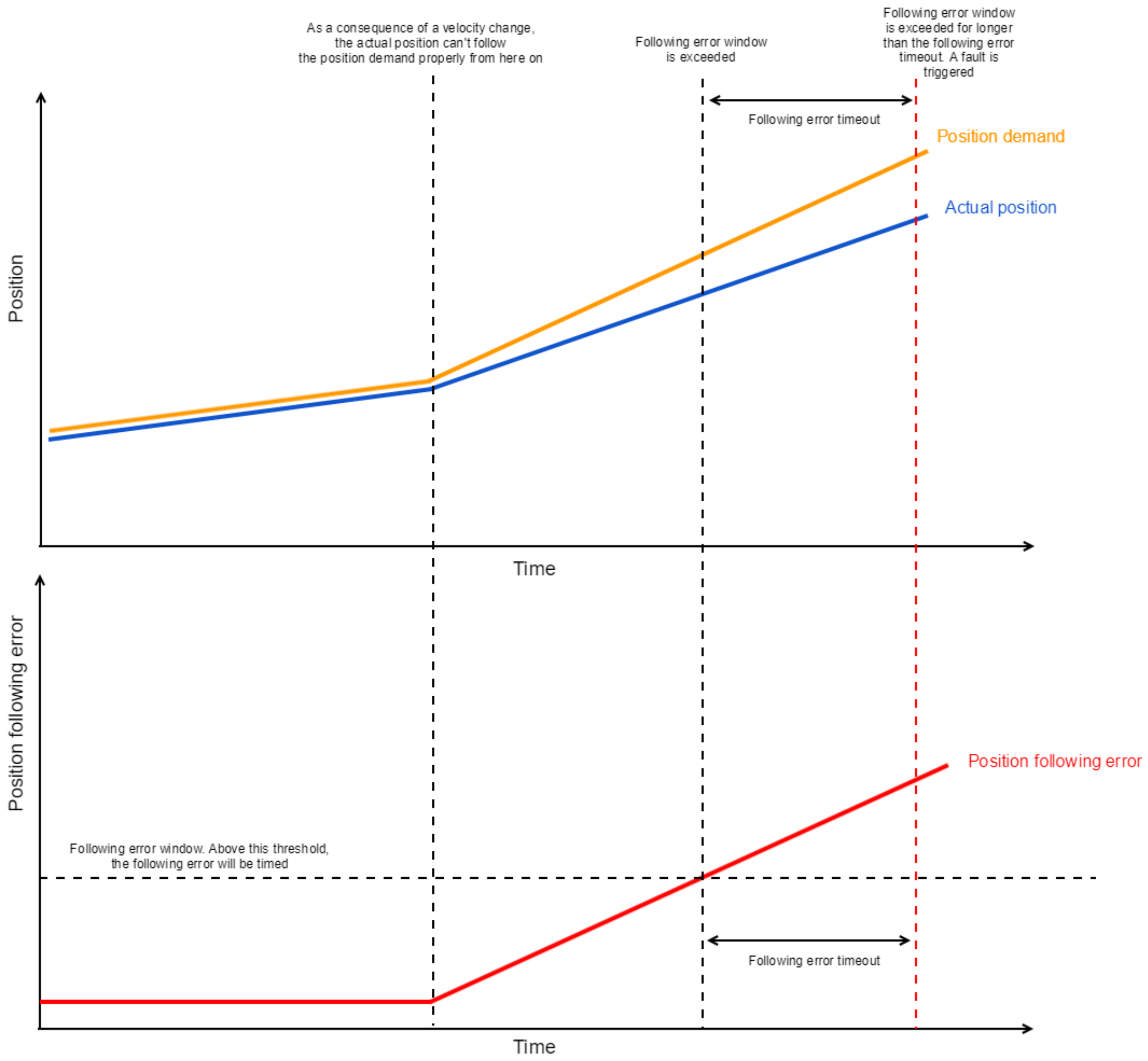


5.428 0x21ED - Position following error timeout

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21ED	0x00	Position following error timeout	UINT32	RW	Yes	Yes	Data type	0	ms

This object indicates the minimum time that actual position must be out of position following error window in order to generate an error.

When the error condition is detected, the *Following error* bit (bit number 13) of the statusword will be set.



5.429 0x21EE - Following error

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21EE	0x00	Following error	FLOAT	RO	Yes	No	Data type	0.0	*

This register contains the difference between demand and actual value of active operation mode variables.

Note

*Following error parameter contains the following error of the active operation mode. If a velocity mode is selected, the units will be rev/s, if a position mode is selected, it will represent counts.

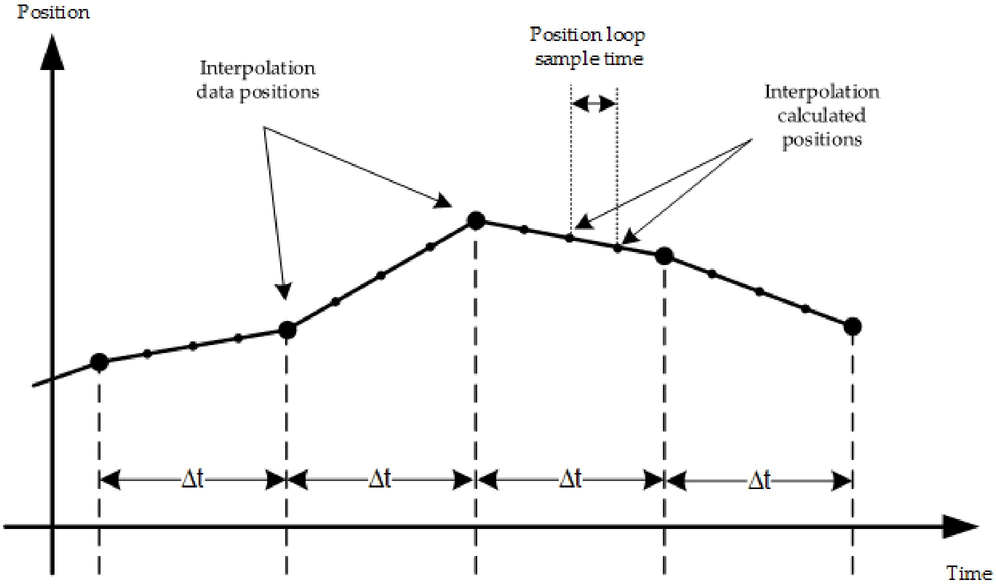
5.430 0x21EF - Interpolation time mantissa

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21EF	0x00	Interpolation time mantissa	FLOAT	RW	Yes	Yes	Data type	1.0	s

This register sets the interpolation time period between set-point values.

Interpolation time will be given by: Interpolation time mantissa * interpolation time exponent.

> **Note**
>
> If the resulting interpolation time is smaller than the update time of the system, an error will be reported.



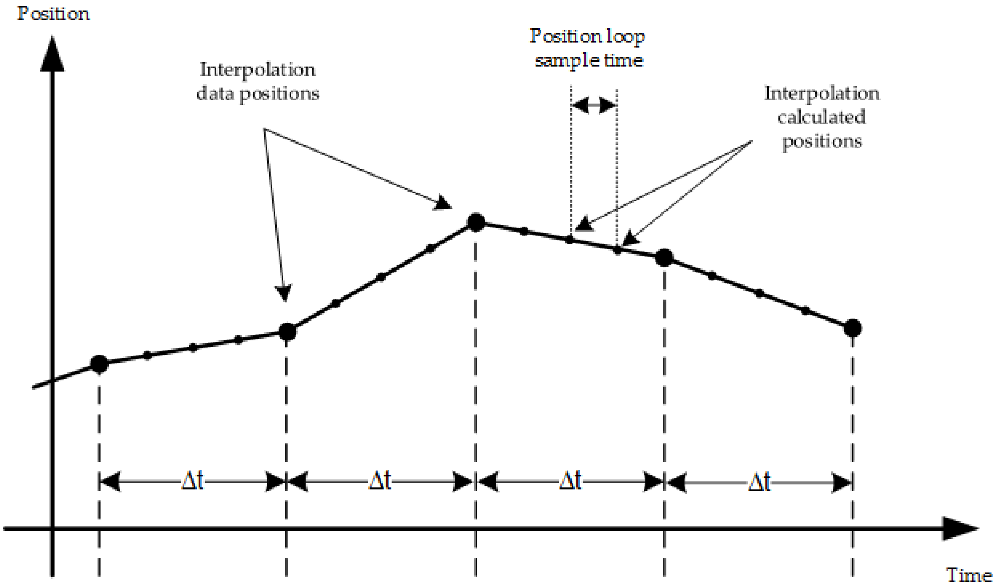
5.431 0x21F0 - Interpolation time exponent

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F0	0x00	Interpolation time exponent	FLOAT	RW	Yes	Yes	Data type	1.0	-

This register sets the interpolation time period between set-point values.

Interpolation time will be given by: Interpolation time mantissa * interpolation time exponent.

> **Note**
>
> If the resulting interpolation time is smaller than the update time of the system, an error will be reported.



5.432 0x21F1 - Position window

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F1	0x00	Position window	UINT32	RW	No	Yes	Data type	1.0	counts

This register sets the window around position set-point inside which target can be considered reached.

In position modes, the target reached bit in the status word register will be set whenever the position error is contained within the range defined in Position window for longer than the amount of time defined in Position window time.

5.433 0x21F2 - Position window time

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F2	0x00	Position window time	UINT32	RW	No	Yes	Data type	0	ms

This register sets the time that the error between Position set-point and Actual position has to be smaller than Position window before detecting a target reached.

In position modes, the target reached bit in the status word register will be set whenever the position error is contained within the range defined in Position window for longer than the amount of time defined in Position window time.

5.434 0x21F3 - Velocity window

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F3	0x00	Velocity window	FLOAT	RW	No	Yes	Data type	1.0	rev/s

This register sets the window around velocity set-point inside which target can be considered reached.

In velocity modes, the target reached bit in the status word register will be set whenever the velocity error is contained within the range defined in Velocity window for longer than the amount of time defined in Velocity window time.

5.435 0x21F4 - Velocity window time

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F4	0x00	Velocity window time	UINT32	RW	No	Yes	Data type	0	ms

This register sets the time that the error between Velocity set-point and Actual velocity has to be smaller than Velocity window before detecting a target reached.

In velocity modes, the target reached bit in the status word register will be set whenever the velocity error is contained within the range defined in Velocity window for longer than the amount of time defined in Velocity window time.

5.436 0x21F5 - Quick stop deceleration

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F5	0x00	Quick stop deceleration	FLOAT	RW	No	Yes	Data type	1.0	rev / s^2

This object contains the deceleration used to slow down when quick stop state is active and quick stop option code is selected to use the quick stop ramp.

5.437 0x21F6 - Interpolation data record force clear

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F6	0x00	Interpolation data record force clear	UINT16	RW	Yes	No	Data type	0	-

This register is used to clear the buffer. Any value written to this parameter will clear the buffer.

5.438 0x21F7 - Interpolation buffer size

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F7	0x00	Interpolation buffer size	UINT16	RW	Yes	No	Data type	max buffer size	-

This register sets the buffer size. By default it takes maximum buffer size.

5.439 0x21F8 - Interpolation buffer number of elements

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F8	0x00	Interpolation buffer number of elements	UINT16	RO	Yes	No	Data type	-	-

This register shows how many elements are inside the buffer.

5.440 0x21F9 - Interpolation buffer maximum size

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x21F9	0x00	Interpolation buffer maximum size	UINT16	RO	Yes	No	Data type	-	-

This register shows the maximum buffer size.

5.441 0x2360 - Velocity feedback sensor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2360	0x00	Velocity feedback sensor	UINT16	RW	No	Yes	1 - 7	4	-

This register configures the type of feedback used for velocity sensing.

The available velocity sensors are:

Value	Meaning
1	*BiSS-C slave 1 / Primary SSI*
2	*Reserved*
3	*Internal generator*
4	*Incremental encoder 1*
5	*Digital halls*
6	*Secondary SSI*
7	*BiSS-C slave 2 (daisy chain)*

Note

Changing this parameter in operational state is not allowed.

Warning

Only 4 feedbacks can be mapped simultaneously in all of the feedback sensor parameters.

5.442 0x2361 - Position feedback sensor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2361	0x00	Position feedback sensor	UINT16	RW	No	Yes	1 - 7	4	-

This register configures the type of feedback used for velocity sensing.

The available velocity sensors are:

Value	Meaning
1	*BiSS-C slave 1 / Primary SSI*
2	*Reserved*
3	*Internal generator*
4	*Incremental encoder 1*
5	*Digital halls*
6	*Secondary SSI*
7	*BiSS-C slave 2 (daisy chain)*

Note

Changing this parameter in operational state is not allowed.

Warning

Only 4 feedbacks can be mapped simultaneously in all of the feedback sensor parameters.

5.443 0x2362 - Auxiliar feedback sensor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2362	0x00	Auxiliar feedback sensor	UINT16	RW	No	Yes	1 - 7	4	-

This register configures the type of feedback selected as auxiliar.

The available auxiliar sensors are:

Value	Meaning
1	*BiSS-C slave 1 / Primary SSI*
2	*Reserved*
3	*Internal generator*
4	*Incremental encoder 1*
5	*Digital halls*
6	*Secondary SSI*
7	*BiSS-C slave 2 (daisy chain)*

Note

Changing this parameter in operational state is not allowed.

Warning

Only 4 feedbacks can be mapped simultaneously in all of the feedback sensor parameters.

5.444 0x2364 - Position to velocity sensor ratio

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2364	0x00	Position to velocity sensor ratio	FLOAT	RW	No	Yes	Data type	1.0	[rev. at position sensor] / [rev. at velocity sensor]

This register sets the ratio between revolutions in position sensor against revolutions in velocity sensor.

This parameter is only needed when the revolutions at the velocity sensor differ from the revolutions at the position sensor. This can happen for instance when the motor has a gear and the velocity control uses the measurements in one end (for example the motor velocity) and the position control is perfomed using the measurements at the other end (for example after the gear). In these situations this parameter is needed for the profiler to generate the trajectory taking into account the velocity limitations at the application point of the demands.

5.445 0x236F - BiSS-C slave 1 / Primary SSI - Protocol

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x236F	0x00	BiSS-C slave 1 / Primary SSI - Protocol	UINT16	RW	No	Yes	0 - 1	1	-

This register indicates if the encoder protocol is SSI or BiSS-C.

The available protocols are:

Value	Meaning
0	*BiSS-C*
1	*SSI*

5.446 0x2370 - BiSS-C slave 1 / Primary SSI - Frame size

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2370	0x00	BiSS-C slave 1 / Primary SSI - Frame size	UINT16	RW	No	Yes	10 to 64	24	bits

This register indicates the total number of bits of the frame. These include position bits, special bits, warning, error and CRC bits, etc

> ⚠ Do not include "ACK", "Start", "CDS" bits in the frame size when using BiSS-C protocol. These are managed by the drive automatically.

5.447 0x2371 - BiSS-C slave 1 / Primary SSI - Error tolerance

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2371	0x00	BiSS-C slave 1 / Primary SSI - Error tolerance	UINT16	RW	No	Yes	Data type	5	cycles

This register indicates the total number of wrong frame readings tolerated by the drive before generating a fault.

> ⚠ Setting a 0 value will ignore any error from the encoder.

5.448 0x2372 - BiSS-C slave 1 / Primary SSI - Wait cycles

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2372	0x00	BiSS-C slave 1 / Primary SSI - Wait cycles	UINT16	RW	No	Yes	Data type	2	position control loops

This register indicates the total number of position loops will be executed before requesting a new data to the feedback.

Control loops might work at higher rates than the minimum period between BiSS-C / SSI frames specified in the datasheet.

5.449 0x2373 - BiSS-C slave 1 / Primary SSI - Polarity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2373	0x00	BiSS-C slave 1 / Primary SSI - Polarity	UINT16	RW	No	Yes	0 to 1	0	-

Indicates the direction of rotation of the encoder. 0 value applies standard polarity (read directly from the feedback) and a value different than 0 reverses the polarity.

5.450 0x2374 - BiSS-C slave 1 / Primary SSI - Frame type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2374	0x00	BiSS-C slave 1 / Primary SSI - Frame type	UINT16	RW	No	Yes	0 to 4	0	-

Indicates the format of the received frame.

The available options are:

Value	Meaning
0	*Raw*
1	*Raw gray*
2	*Zettlex - SSI1*
3	*BiSS-C BP3*
4	*BiSS-C BP3 gray*

5.451 0x2375 - BiSS-C slave 1 / Primary SSI - Position bits

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2375	0x00	BiSS-C slave 1 / Primary SSI - Position bits	UINT16	RW	No	Yes	10 to 32	22	bits

Indicates the number of bits used for position readings.

5.452 0x2376 - BiSS-C slave 1 / Primary SSI - Single-turn bits

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2376	0x00	BiSS-C slave 1 / Primary SSI - Single-turn bits	UINT16	RW	No	Yes	10 to 32	22	bits

Indicates the number of the position bits that represent single-turn information.

5.453 0x2377 - BiSS-C slave 1 / Primary SSI - Position start bit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2377	0x00	BiSS-C slave 1 / Primary SSI - Position start bit	UINT16	RW	No	Yes	0 to 31	0	bits

Defines how many bits the position information is displaced from the LSB in the serial absolute feedback frame.

5.454 0x2378 - Secondary SSI - Frame size

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2378	0x00	Secondary SSI - Frame size	UINT16	RW	No	Yes	10 to 32	24	bits

This register indicates the total number of bits of the frame. These include position bits, special bits, warning, error and CRC bits, etc

5.455 0x2379 - Secondary SSI - Error tolerance

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2379	0x00	Secondary SSI - Error tolerance	UINT16	RW	No	Yes	Data type	5	cycles

This register indicates the total number of wrong frame readings tolerated by the drive before generating a fault.

> ⚠ Setting a 0 value will ignore any error from the encoder.

5.456 0x237A - Secondary SSI - Wait cycles

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x237A	0x00	Secondary SSI - Wait cycles	UINT16	RW	No	Yes	Data type	2	position control loops

This register indicates the total number of position loops will be executed before requesting a new data to the feedback.

Control loops might work at higher rates than the minimum period between SSI frames specified in the datasheet.

5.457 0x237B - Secondary SSI - Polarity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x237B	0x00	Secondary SSI - Polarity	UINT16	RW	No	Yes	0 to 1	0	-

Indicates the direction of rotation of the encoder. 0 value applies standard polarity (read directly from the feedback) and a value different than 0 reverses the polarity.

5.458 0x237C - Secondary SSI - Frame type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x237C	0x00	Secondary SSI - Frame type	UINT16	RW	No	Yes	0 to 2	0	-

Indicates the format of the received frame.

The available options are:

Value	Meaning
0	*Raw*
1	*Raw gray*
2	*Zettlex - SSI1*

5.459 0x237D - Secondary SSI - Position bits

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x237D	0x00	Secondary SSI - Position bits	UINT16	RW	No	Yes	10 to 31	22	bits

Indicates the number of bits used for position readings.

5.460 0x237E - Secondary SSI - Single-turn bits

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x237E	0x00	Secondary SSI - Single-turn bits	UINT16	RW	No	Yes	10 to 32	22	bits

Indicates the number of the position bits that represent single-turn information.

5.461 0x237F - Secondary SSI - Position start bit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x237F	0x00	Secondary SSI - Position start bit	UINT16	RW	No	Yes	0 to 31	0	bits

Defines how many bits the position information is displaced from the LSB in the serial absolute feedback frame.

5.462 0x2380 - Generator mode

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2380	0x00	Generator mode	UINT16	RW	No	Yes	0 to 2	0	-

This registers set the waveform of the internal generator module

The available waveforms are:

Value	Meaning
0	*Constant*
1	*Saw tooth*
2	*Square*

5.463 0x2381 - Generator frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2381	0x00	Generator frequency	FLOAT	RW	No	Yes	Data type	1.0	Hz

This registers set the frequency of the waveform applied by the internal generator module.

5.464 0x2382 - Generator gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2382	0x00	Generator gain	FLOAT	RW	Yes	Yes	Data type	1.0	-

This registers set the amplitude of the waveform applied by the internal generator module.

5.465 0x2383 - Generator offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2383	0x00	Generator offset	FLOAT	RW	Yes	Yes	Data type	1.0	-

This registers set the offset amplitude of the waveform applied by the internal generator module.

5.466 0x2384 - Generator cycle number

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2384	0x00	Generator cycle number	UINT32	RW	No	Yes	Data type	0	cycles

Indicates the number of times a waveform is applied. Setting a 0 will apply the waveform continuously.

> **Note**
>
> Writing to this register a value different to 0, will set the generator value to 0 until a rearm is performed.

5.467 0x2385 - Generator rearm

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2385	0x00	Generator rearm	UINT16	WO	No	No	0 to 1	0	-

This register allows to start the generation of waveform during the configured waveform cycles.

Writing a 1 triggers the start of the internal generator. Cycles are configured using *Generator cycle number* register.

5.468 0x2386 - BiSS-C slave 1 / Primary SSI - Baudrate

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2386	0x00	BiSS-C slave 1 / Primary SSI - Baudrate	UINT32	RW	No	Yes	1000 to 100000	1000	kbits/s

This register defines the frequency of the interface data transmission (frequency of clock signal).

5.469 0x2387 - Secondary SSI - Baudrate

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2387	0x00	Secondary SSI - Baudrate	UINT32	RW	No	Yes	1000 to 100000	1000	kbits/s

This register defines the frequency of the interface data transmission (frequency of clock signal).

5.470 0x2388 - Incremental encoder 1 - Resolution

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2388	0x00	Incremental encoder 1 - Resolution	UINT32	RW	No	Yes	Data type	2000	encoder counts

This register indicates the resolution of the encoder in total counts per mechanical revolution.

5.471 0x2389 - Incremental encoder 1 - Polarity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2389	0x00	Incremental encoder 1 - Polarity	UINT32	RW	No	Yes	0 to 1	0	-

Indicates the polarity of the encoder. Setting a 0 value sets standard polarity, and setting a value different from 0 sets reversed polarity.

5.472 0x238A - Incremental encoder 1 - Filter

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x238A	0x00	Incremental encoder 1 - Filter	UINT16	RW	No	Yes	0 to 10	0	-

Indicates the glitch filter levels of the incremental encoder 1. There are 10 different glitch filter levels and each level corresponds to a specific cut-off frequency. Setting this parameter to 0 will disable the glitch filter.

The different glitch filter levels can be seen in the following table:

Glitch filter levels (Register value)	Max Readable Encoder Freq (MHz)
0	100
1	33.33333333
2	16.66666667
3	8.333333333
4	4.166666667
5	2.083333333
6	1.041666667
7	0.5208333333
8	0.2604166667
9	0.1302083333
10	0.06535947712

5.473 0x238B - Incremental encoder 1 - Value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x238B	0x00	Incremental encoder 1 - Value	INT32	RO	Yes	No	Data type	0	encoder counts

Contains the raw value in counts read from incremental encoder 1.

5.474 0x2390 - Dig. hall polarity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2390	0x00	Dig. hall polarity	UINT16	RW	No	Yes	0 to 1	0	-

Indicates the polarity (of rotation) of the digital halls readings. Setting a 0 value sets standard polarity, and setting a value different from 0 sets reversed polarity.

5.475 0x2391 - Dig. hall filter

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2391	0x00	Dig. hall filter	UINT16	RW	No	Yes	0 to 10	0	-

Indicates the glitch filter levels of the digital halls. There are 10 different glitch filter levels and each level corresponds to a specific cut-off frequency. Setting this parameter to 0 will disable the glitch filter.

The different glitch filter levels can be seen in the following table:

Glitch filter levels (Register value)	Max Readable Encoder Freq (MHz)
0	100
1	33.33333333
2	16.66666667
3	8.333333333
4	4.166666667
5	2.083333333
6	1.041666667
7	0.5208333333
8	0.2604166667
9	0.1302083333
10	0.06535947712

5.476 0x2392 - Dig. hall pole pairs

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2392	0x00	Dig. hall pole pairs	UINT16	RW	No	Yes	Data type	2	pole pairs

Indicates the number of pole pairs of the digital halls.

> **Note**
>
> Generally, the pole pairs of the halls sensor are equal to the motor pole pairs.

5.477 0x2393 - Dig. hall value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2393	0x00	Dig. hall value	UINT16	RO	Yes	No	0 to 7	0	-

Contains digital input values of digital hall sensors A, B and C, where A is the least significant bit.

5.478 0x2394 - Feedback to check against Halls

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2394	0x00	Feedback to check against Halls	UINT16	RW	No	Yes	1 to 7	0	-

Indicates the feedback checked for runaway conditions against halls.

The available selected feedbacks are:

Value	Meaning
1	*BiSS-C / SSI - slave 1*
4	*Incremental encoder 1*
6	*Secondary SSI encoder*
7	*BiSS-C slave 2*

The selected feedback readings will be checked on each mechanical revolution. **If the detected feedback counts per revolution differ more than 20% of the specified feedback resolution**, an error occurs. An *error option code* is available for this error.

To detect counts per revolution of the selected feedback, an event is triggered on a specific transition of Hall A and is only triggered after as many repetitions as pair poles are specified. This event samples the readings of the feedback, and compares it to the previous event, except in the first event of all, where only the sample is taken. This first event can happen either at the start-up of the drive, or when changes of direction are detected in the halls feedback.

No more than two revolutions should occur before detecting a runaway error.

5.479 0x2395 - BiSS-C feedbacks in chain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2395	0x00	BiSS-C feedbacks in chain	UINT16	RW	No	Yes	1 to 2	1	BiSS-C feedbacks in chain

This register indicates the number of feedbacks in chain. This is used for BiSS-C devices connected in daisy chain.

5.480 0x2400 - BiSS-C slave 2 (daisy chain) - Frame size

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2400	0x00	BiSS-C slave 2 (daisy chain) - Frame size	UINT16	RW	No	Yes	10 to 64	24	bits

This register indicates the total number of bits of the frame. These include position bits, special bits, warning, error and CRC bits, etc.

⚠ Do not include "ACK", "Start", "CDS" bits in the frame size when using BiSS-C protocol. These are managed by the drive automatically.

5.481 0x2401 - BiSS-C slave 2 (daisy chain) - Error tolerance

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2401	0x00	BiSS-C slave 2 (daisy chain) - Error tolerance	UINT16	RW	No	Yes	Data type	5	cycles

This register indicates the total number of wrong frame readings tolerated by the drive before generating a fault.

> ⚠ Setting a 0 value will ignore any error from the encoder.

5.482 0x2403 - BiSS-C slave 2 (daisy chain) - Polarity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2403	0x00	BiSS-C slave 2 (daisy chain) - Polarity	UINT16	RW	No	Yes	0 to 1	0	-

Indicates the direction of rotation of the encoder. 0 value applies standard polarity (read directly from the feedback) and a value different than 0 reverses the polarity.

5.483 0x2404 - BiSS-C slave 2 (daisy chain) - Frame type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2404	0x00	BiSS-C slave 2 (daisy chain) - Frame type	UINT16	RW	No	Yes	0 to 4	0	-

Indicates the format of the received frame.

The available options are:

Value	Meaning
0	*Raw*
1	*Raw gray*
2	*Zettlex - SSI1*
3	*BiSS-C BP3*
4	*BiSS-C BP3 gray*

5.484 0x2405 - BiSS-C slave 2 (daisy chain) - Position bits

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2405	0x00	BiSS-C slave 2 (daisy chain) - Position bits	UINT16	RW	No	Yes	10 to 32	22	bits

Indicates the number of bits used for position readings.

5.485 0x2406 - BiSS-C slave 2 (daisy chain) - Single-turn bits

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2406	0x00	BiSS-C slave 2 (daisy chain) - Single-turn bits	UINT16	RW	No	Yes	10 to 32	22	bits

Indicates the number of the position bits that represent single-turn information.

5.486 0x2407 - BiSS-C slave 2 (daisy chain) - Position start bit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2407	0x00	BiSS-C slave 2 (daisy chain) - Position start bit	UINT16	RW	No	Yes	0 to 31	0	bits

Defines how many bits the position information is displaced from the LSB in the serial absolute feedback frame.

5.487 0x2408 - BiSS-C slave 1 / Primary SSI - CRC polynomial

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2408	0x00	BiSS-C slave 1 / Primary SSI - CRC polynomial	UINT16	RO	No	No	Data type	0	-

This register indicates the CRC polynomial applied to the received frames.

5.488 0x2409 - BiSS-C slave 1 / Primary SSI - CRC number of bits

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2409	0x00	BiSS-C slave 1 / Primary SSI - CRC number of bits	UINT16	RO	No	No	Data type	0	-

This register indicates the number of bits used by the CRC algorithms.

5.489 0x240C - BiSS-C slave 1 / Primary SSI - CRC seed

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x240C	0x00	BiSS-C slave 1 / Primary SSI - CRC seed	UINT16	RO	No	No	Data type	0	-

This register indicates the seed used by the CRC algorithms.

5.490 0x2450 - Homing mode

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2450	0x00	Homing mode	UINT16	RW	No	Yes	0 to 6	0	-

This register sets the homing mode used.

The homing mode allows to choose between the difference set of sequences:

Value	Description
0	*Homing on current position*
1	*Homing on the positive limit switch*
2	*Homing on the negative limit switch*
3	*Homing on positive index pulse*
4	*Homing on negative index pulse*
5	*Homing on the positive limit switch and index pulse*
6	*Homing on the negative limit switch and index pulse*

5.491 0x2451 - Homing offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2451	0x00	Homing offset	INT32	RW	Yes	Yes	Data type	0	encoder counts

This object indicates the configured difference between the zero position for the application and the machine home position, as found during the homing process.

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.

A negative value indicates opposite direction.

Example

If the desired 0 position is located 2000 counts to the positive direction when the homing is done, the homing configuration needed is:

Homing mode → X

Homing offset → 2000

Once the actuator finish the homing procedure at the homing location, the actual position value will be 2000.

5.492 0x2452 - Homing timeout

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2452	0x00	Homing timeout	UINT32	RW	No	Yes	Data type	2000	ms

This object specifies the maximum time that a homing mode should be running, in milliseconds.

If the timeout expires the movement is stopped and the error is reported through the status word register.

5.493 0x2453 - Homing limit search speed

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2453	0x00	Homing limit search speed	FLOAT	RW	Yes	Yes	Data type	0	rev/ s

This register sets the velocity used to look for a limit condition during a homing sequence.

Up to 2 search speeds may be used during a regular homing process: a speed to search for the switch or mechanical limit, which may be relatively fast, and another speed to search for the actual homing point, which should be considerably slower.

This object only defines the magnitude of the velocity: the direction will depend on the selected homing method.

Increasing homing speeds can affect the accuracy of switch/index detection, since the device reaction time is reduced.

5.494 0x2454 - Homing zero search speed

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2454	0x00	Homing zero search speed	FLOAT	RW	Yes	Yes	Data type	0	rev/ s

This register sets the velocity used to look for the 0 position during a homing sequence.

Up to 2 search speeds may be used during a regular homing process: a speed to search for the switch or mechanical limit, which may be relatively fast, and another speed to search for the actual homing point, which should be considerably slower.

This object only defines the magnitude of the velocity: the direction will depend on the selected homing method.

Increasing homing speeds can affect the accuracy of switch/index detection, since the device reaction time is reduced.

5.495 0x2455 - Positive homing switch

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2455	0x00	Positive homing switch	UINT16	RW	No	Yes	0 to 4	0	-

This register contains the GPI attached to a positive homing switch.

If the value is 0, it means that there isn't an attached GPI to the functionality, otherwise the value indicates what GPI is attached.

5.496 0x2456 - Negative homing switch

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2456	0x00	Negative homing switch	UINT16	RW	No	Yes	0 to 4	0	-

This register contains the GPI attached to a negative homing switch.

If the value is 0, it means that there isn't an attached GPI to the functionality, otherwise the value indicates what GPI is attached.

5.497 0x2457 - Homing index pulse source

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2457	0x00	Homing index pulse source	UINT16	RW	No	Yes	0	0	-

This register indicates which digital incremental encoder will be used to finish homing procedures based on index pulse.

The available index pulse sources are:

Value	Meaning
0	*Incremental encoder 1*

5.498 0x2458 - Current loop rate

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2458	0x00	Current loop rate	UINT32	RO	No	No	Data type	20000	Hz

This register indicates the frequency at which the current control loop is running.

5.499 0x24FE - Torque constant

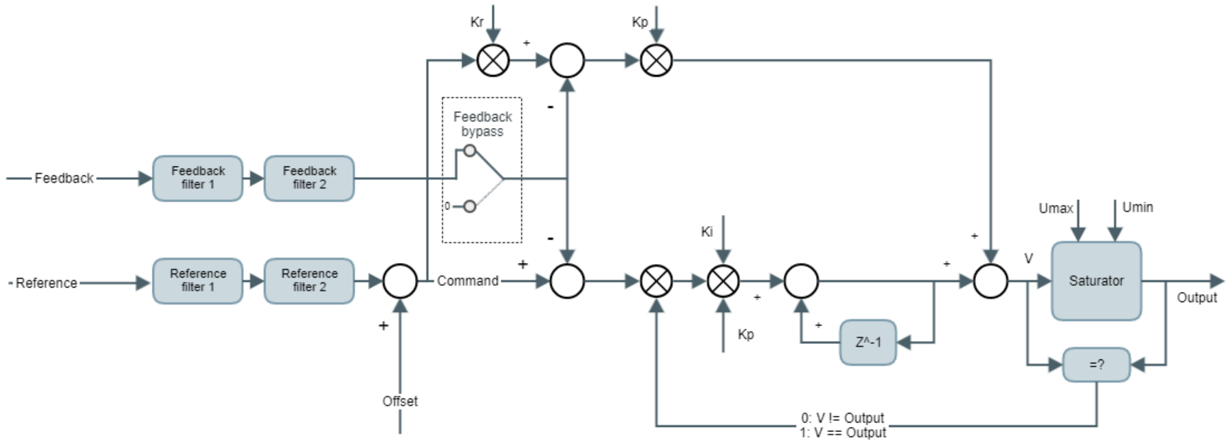
Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x24FE	0x00	Torque constant	FLOAT	RW	No	Yes	Data type	1.0	mNm / mA

This register provides the relation between current and torque.

5.500 0x2500 - Current quadrature loop Kp

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2500	0x00	Current quadrature loop Kp	FLOAT	RW	No	Yes	Data type	1.0	V/A

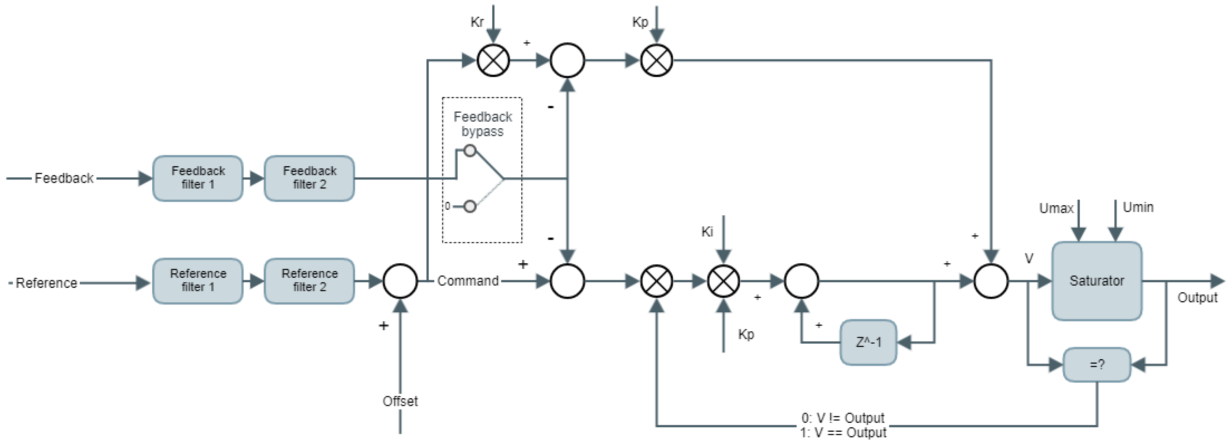
This parameter allows configuring the Kp of the PI controller used for current Q regulation.



5.501 0x2501 - Current quadrature loop Ki

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2501	0x00	Current quadrature loop Ki	FLOAT	RW	No	Yes	Data type	0.8	V/A

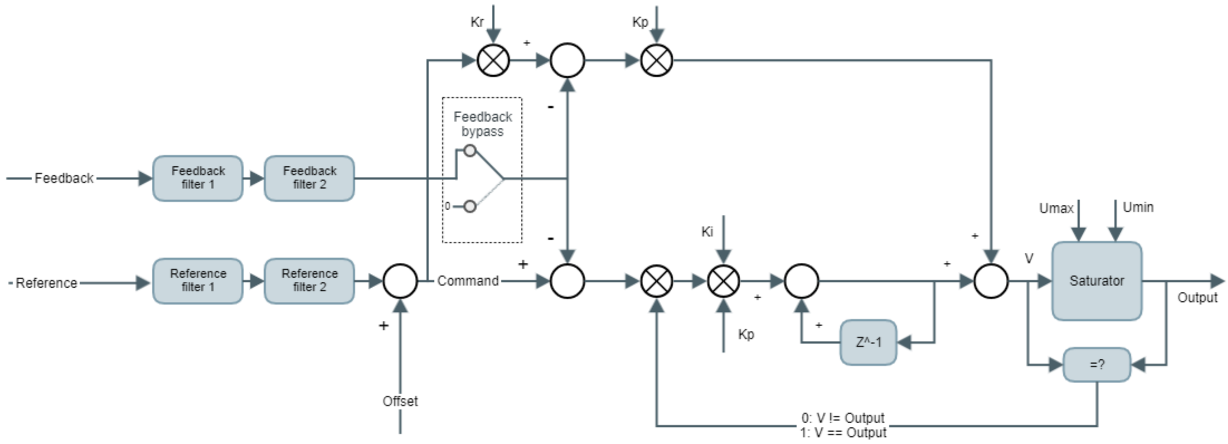
This parameter allows configuring the Ki of the PI controller used for current Q regulation.



5.502 0x2502 - Current quadrature loop max. out

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2502	0x00	Current quadrature loop max. out	FLOAT	RW	No	Yes	Data type	24.0	V

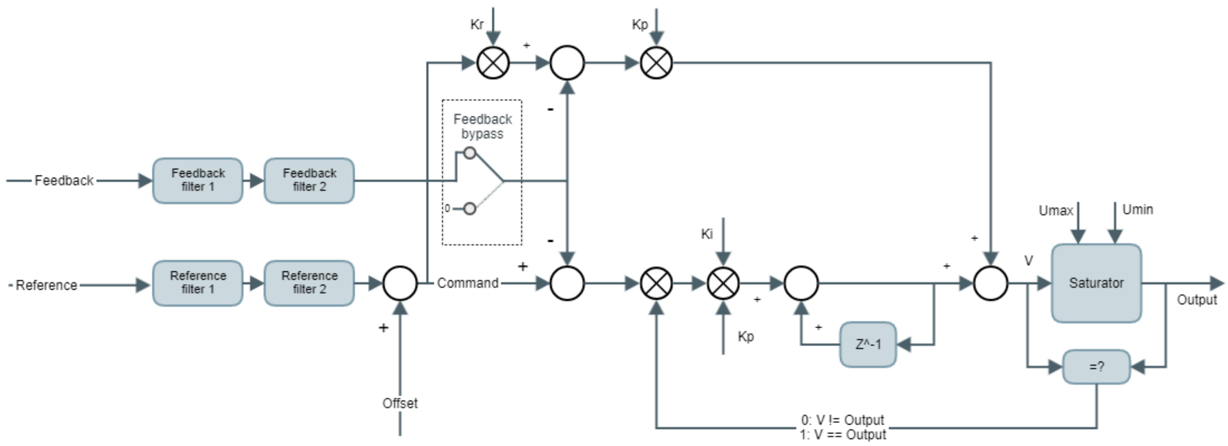
This parameter allows configuring the Umax of the PI controller used for current Q regulation.



5.503 0x2503 - Current quadrature loop min. out

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2503	0x00	Current quadrature loop min. out	FLOAT	RW	No	Yes	Data type	-24.0	V

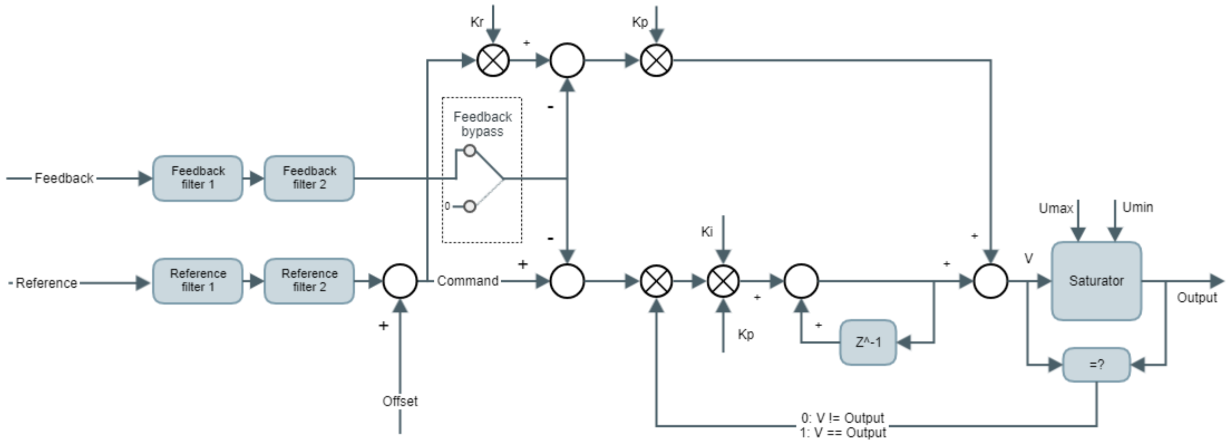
This parameter allows configuring the Umin of the PI controller used for current Q regulation.



5.504 0x2504 - Current quadrature loop Kr

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2504	0x00	Current quadrature loop Kr	FLOAT	RW	No	Yes	0.0 to 1.0	1.0	V

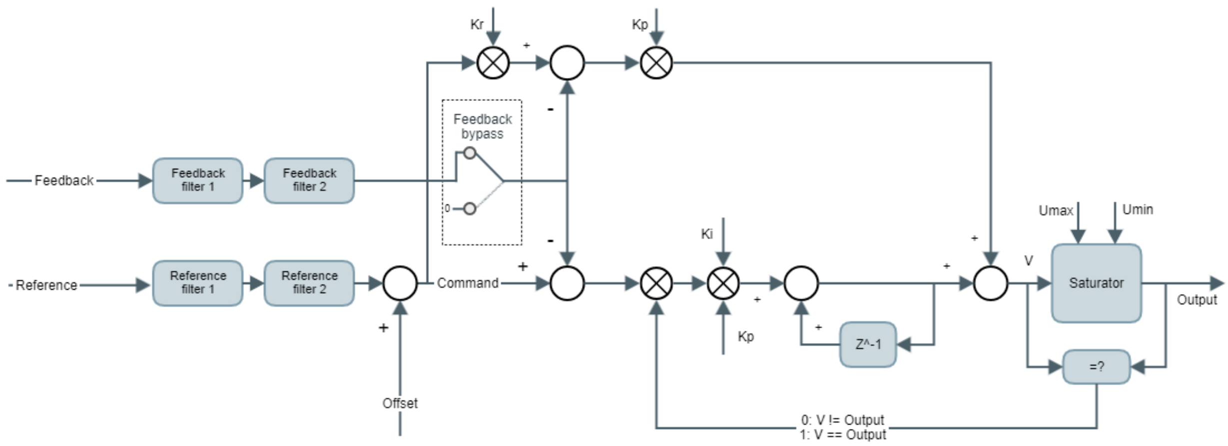
This parameter allows configuring the Kr of the PI controller used for current Q regulation.



5.505 0x2505 - Current direct loop Kp

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2505	0x00	Current direct loop Kp	FLOAT	RW	No	Yes	Data type	1.0	V/A

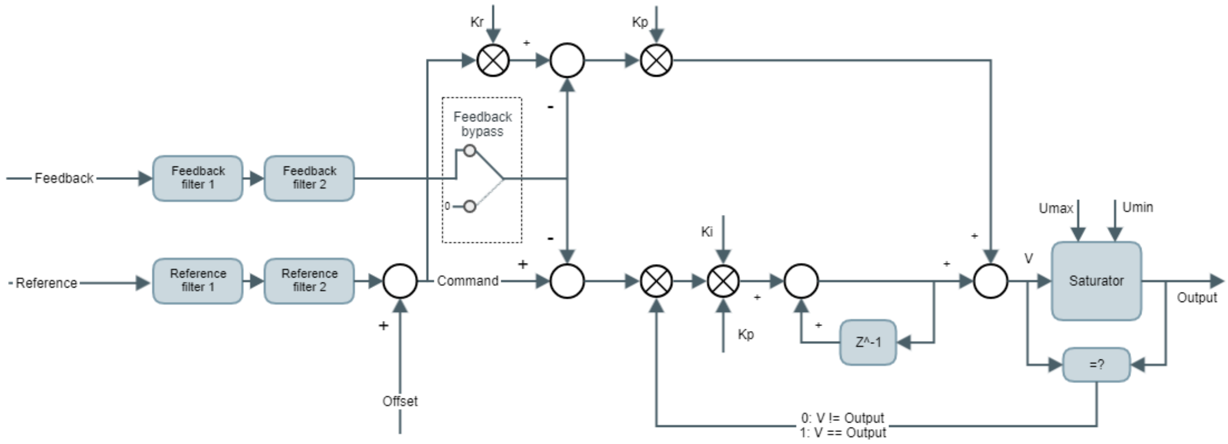
This parameter allows configuring the Kp of the PI controller used for current D regulation.



5.506 0x2506 - Current direct loop Ki

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2506	0x00	Current direct loop Ki	FLOAT	RW	No	Yes	Data type	0.8	V/A

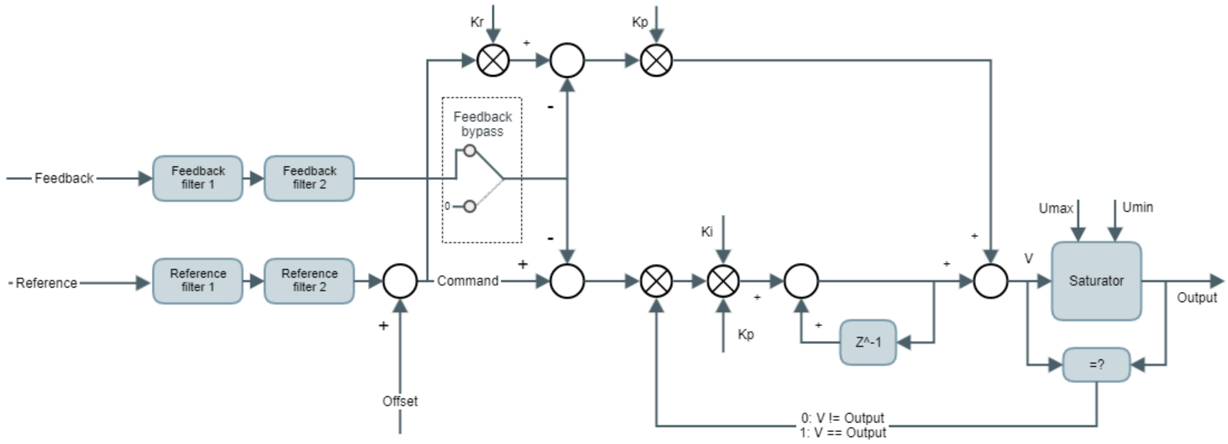
This parameter allows configuring the Ki of the PI controller used for current D regulation.



5.507 0x2507 - Current direct loop max. out

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2507	0x00	Current direct loop max. out	FLOAT	RW	No	Yes	Data type	24.0	V

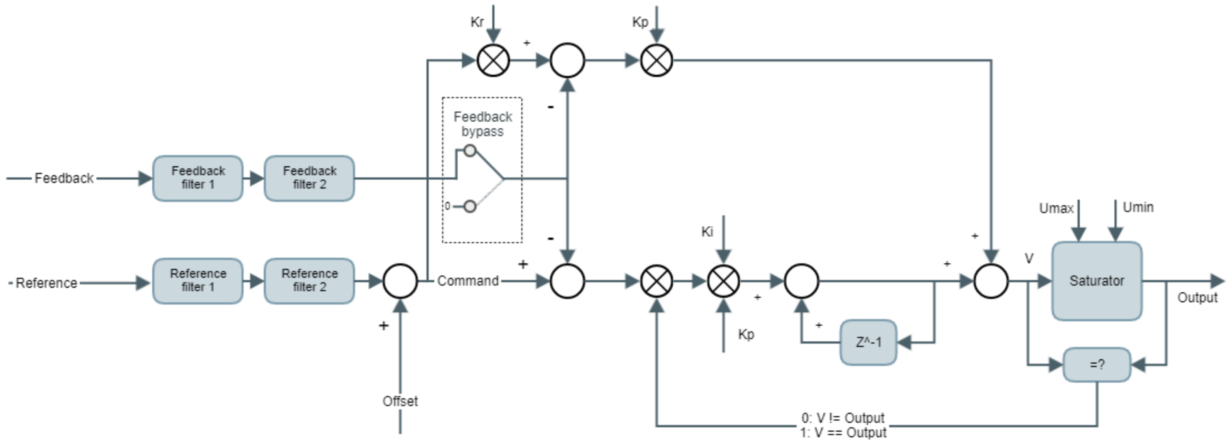
This parameter allows configuring the Umax of the PI controller used for current D regulation.



5.508 0x2508 - Current direct loop min. out

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2508	0x00	Current direct loop min. out	FLOAT	RW	No	Yes	Data type	-24.0	V

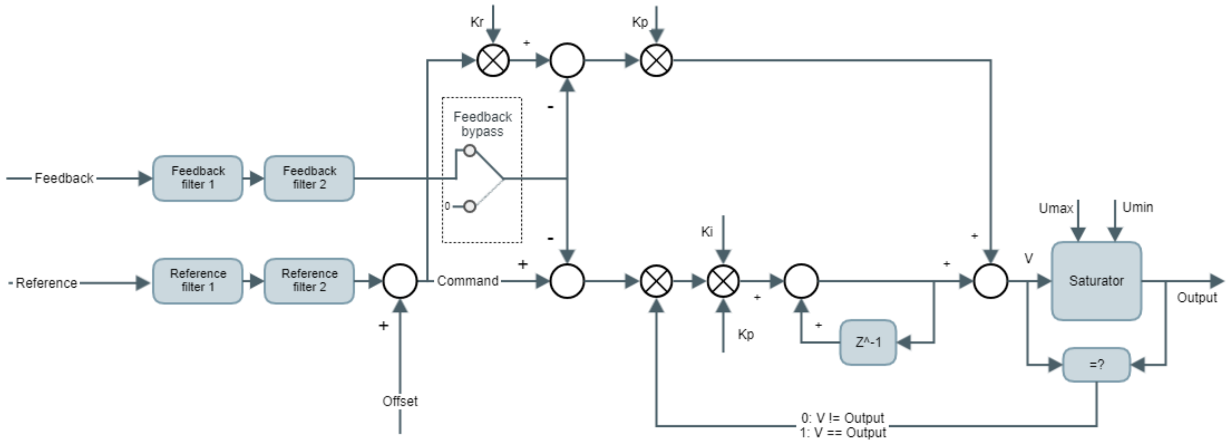
This parameter allows configuring the Umin of the PI controller used for current D regulation.



5.509 0x2509 - Current direct loop Kr

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2509	0x00	Current direct loop Kr	FLOAT	RW	No	Yes	0.0 to 1.0	1.0	-

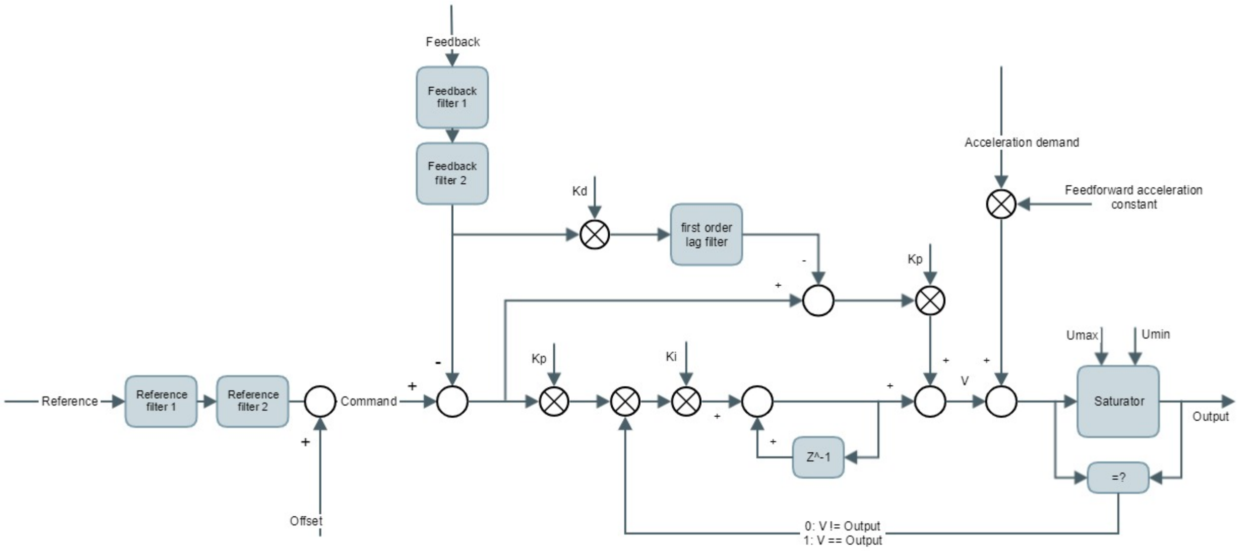
This parameter allows configuring the Kr of the PI controller used for current D regulation.



5.510 0x250A - Velocity loop Kp

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x250A	0x00	Velocity loop Kp	FLOAT	RW	No	Yes	Data type	1.0	A / (rev/s)

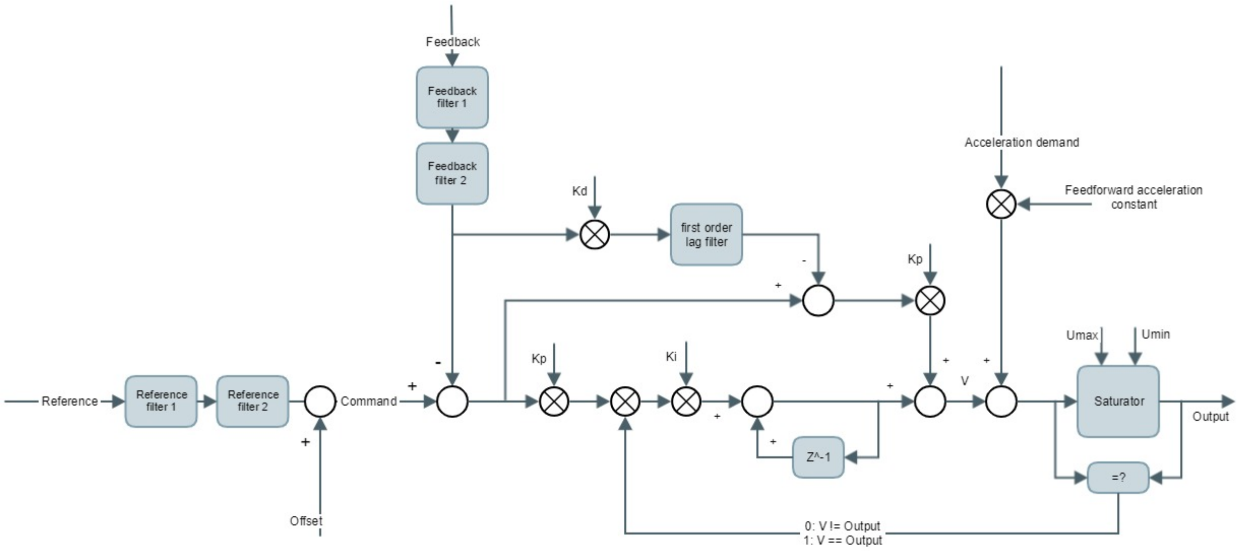
This parameter allows configuring the Kp of the PID controller used for velocity regulation.



5.511 0x250B - Velocity loop Ki

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x250B	0x00	Velocity loop Ki	FLOAT	RW	No	Yes	Data type	1.0	-

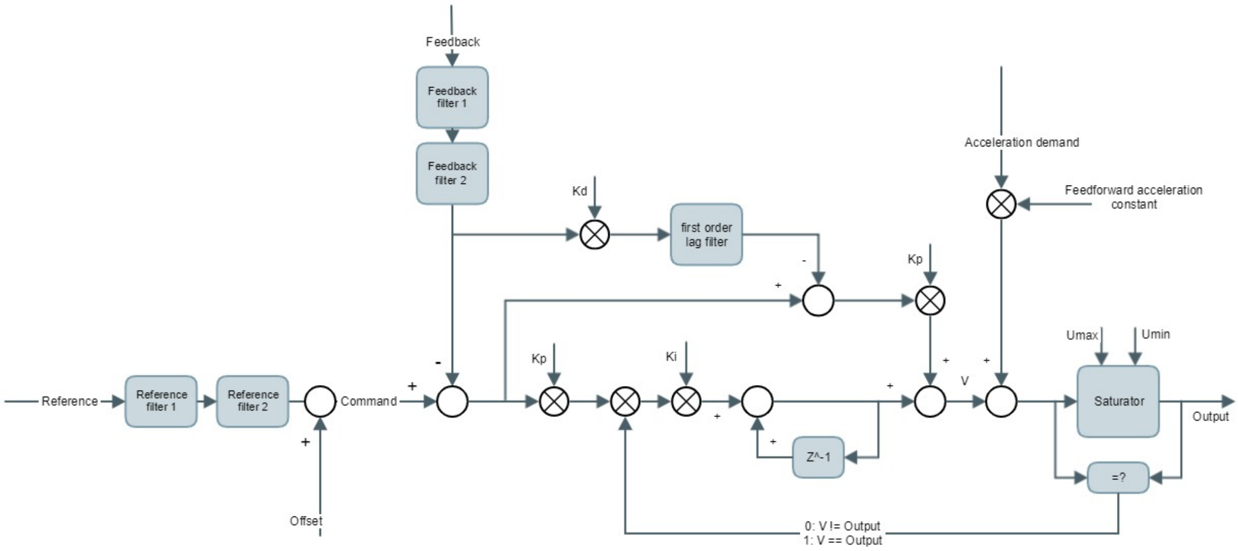
This parameter allows configuring the Ki of the PID controller used for velocity regulation.



5.512 0x250C - Velocity loop Kd

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x250C	0x00	Velocity loop Kd	FLOAT	RW	No	Yes	Data type	1.0	-

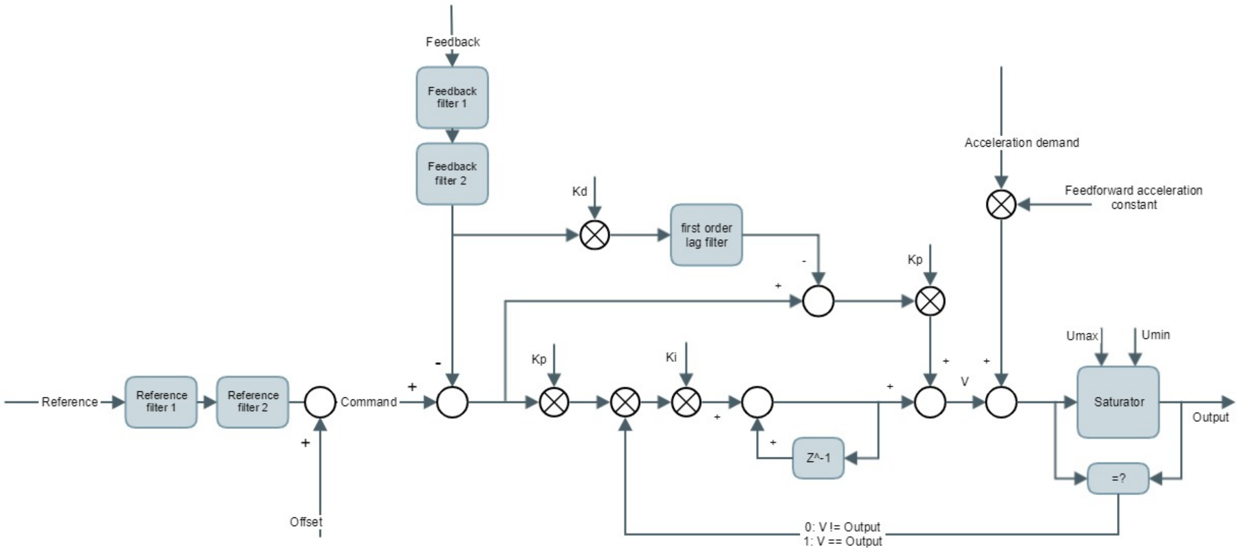
This parameter allows configuring the Kd of the PID controller used for velocity regulation.



5.513 0x250D - Velocity loop Kd filter

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x250D	0x00	Velocity loop Kd filter	FLOAT	RW	No	Yes	Data type	1.0	Hz

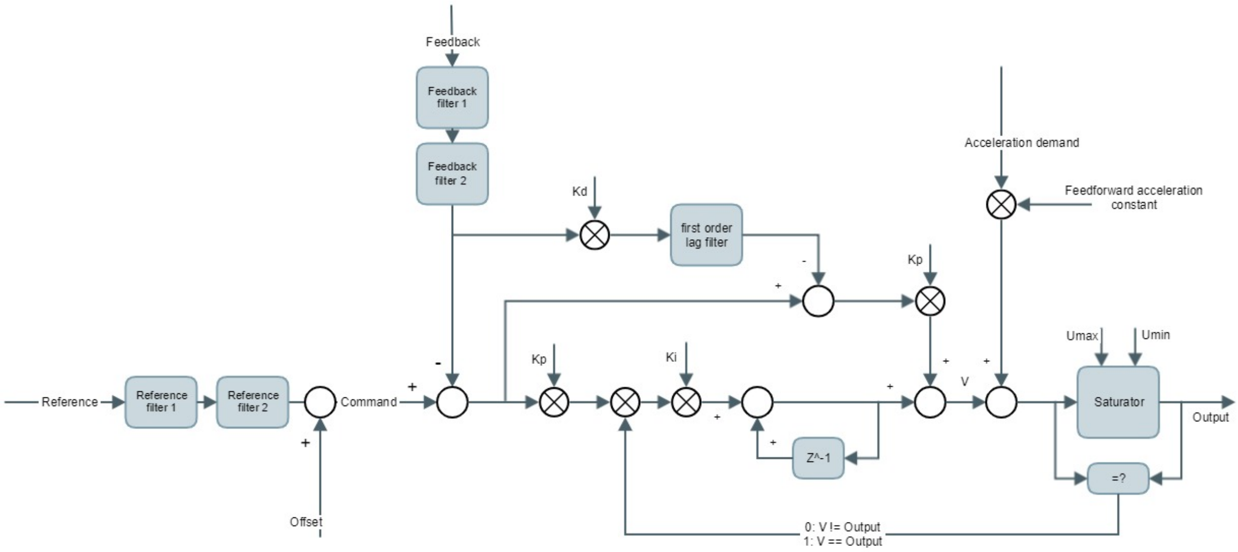
This parameter allows configuring the Kd filter of the PID controller used for velocity regulation.



5.514 0x250E - Velocity loop max. output

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x250E	0x00	Velocity loop max. output	FLOAT	RW	No	Yes	Data type	1.0	A

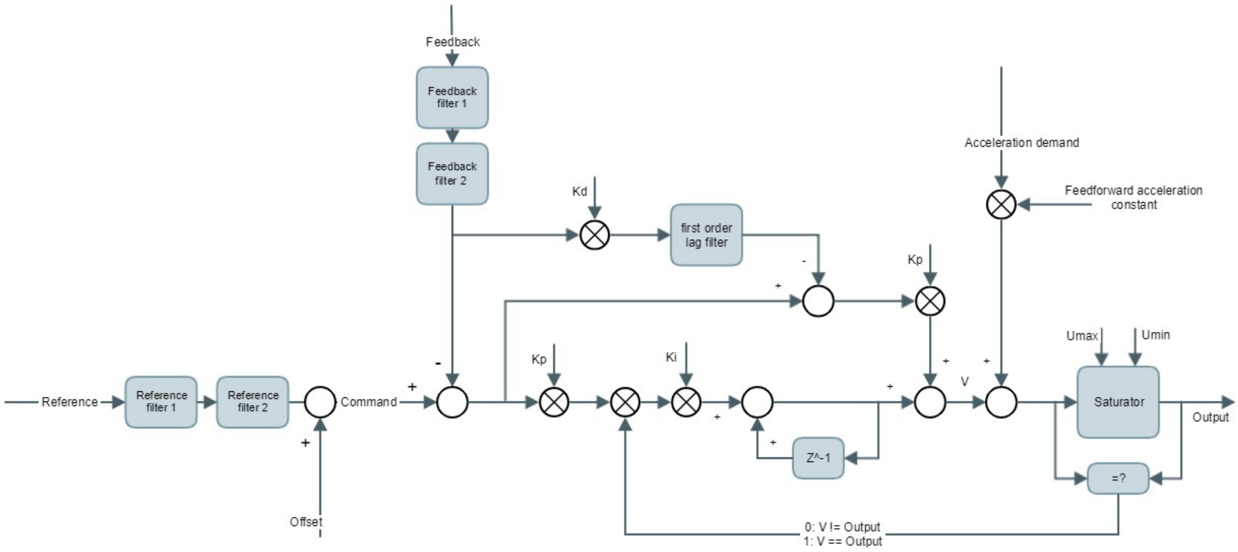
This parameter allows configuring the Umax of the PID controller used for velocity regulation.



5.515 0x250F - Velocity loop min. output

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x250F	0x00	Velocity loop min. output	FLOAT	RW	No	Yes	Data type	-1.0	A

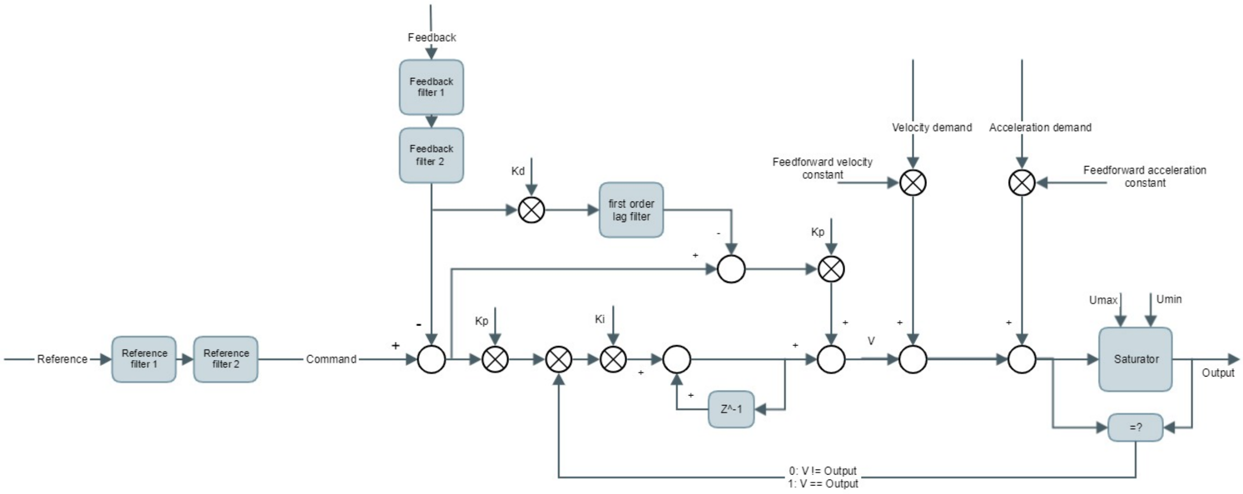
This parameter allows configuring the Umin of the PID controller used for velocity regulation.



5.516 0x2511 - Position loop Kp

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2511	0x00	Position loop Kp	FLOAT	RW	No	Yes	Data type	1.0	rev/s / counts

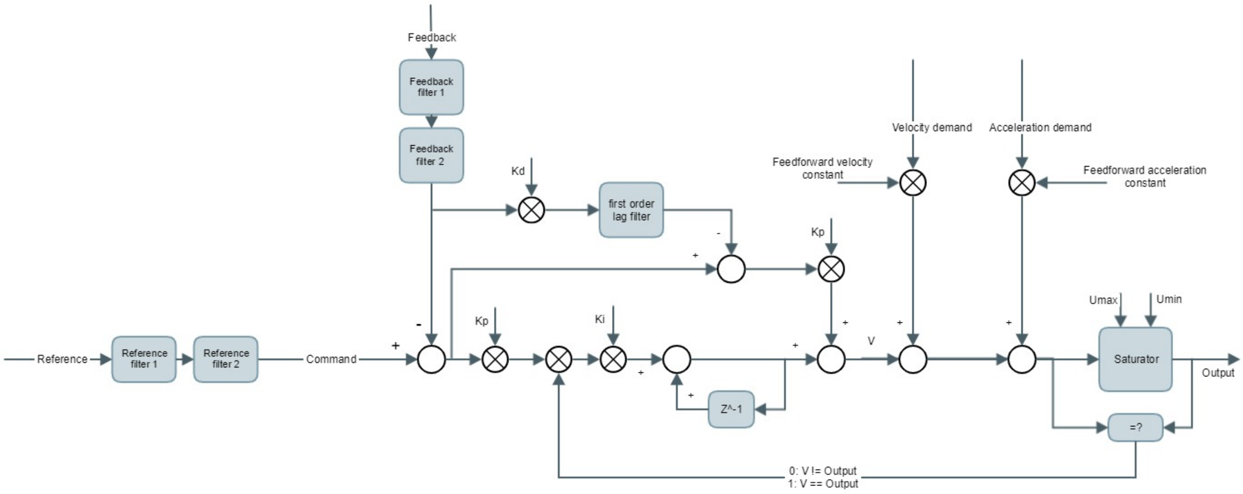
This parameter allows configuring the Kp of the PID controller used for position regulation.



5.517 0x2512 - Position loop Ki

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2512	0x00	Position loop Ki	FLOAT	RW	No	Yes	Data type	1.0	-

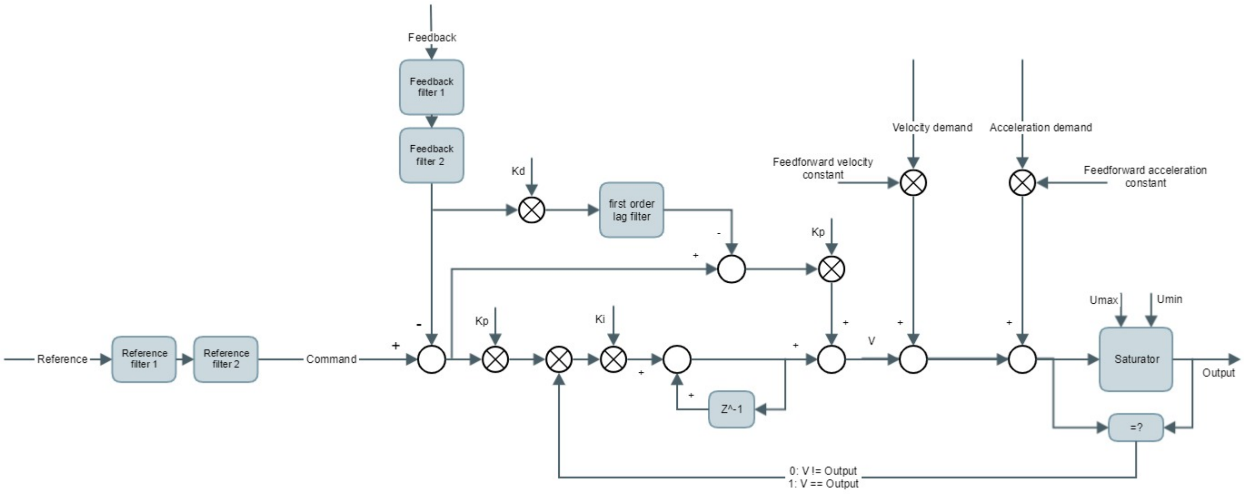
This parameter allows configuring the Ki of the PID controller used for position regulation.



5.518 0x2513 - Position loop Kd

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2513	0x00	Position loop Kd	FLOAT	RW	No	Yes	Data type	1.0	-

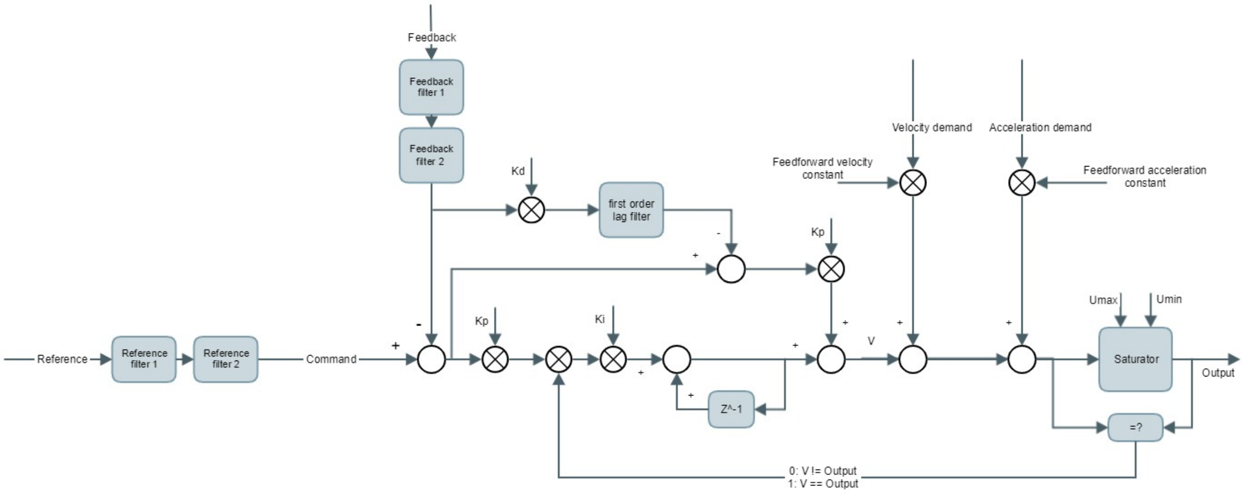
This parameter allows configuring the Kd of the PID controller used for position regulation.



5.519 0x2514 - Position loop Kd filter

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2514	0x00	Position loop Kd filter	FLOAT	RW	No	Yes	Data type	1.0	Hz

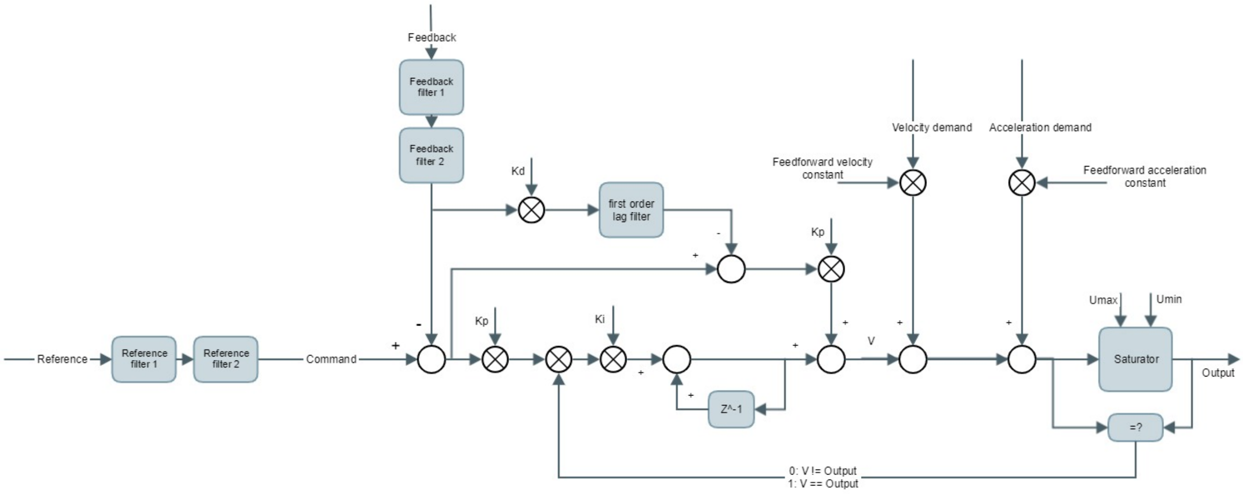
This parameter allows configuring the Kd filter of the PID controller used for position regulation.



5.520 0x2515 - Position loop max. output

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2515	0x00	Position loop max. output	FLOAT	RW	No	Yes	Data type	1.0	rev/s

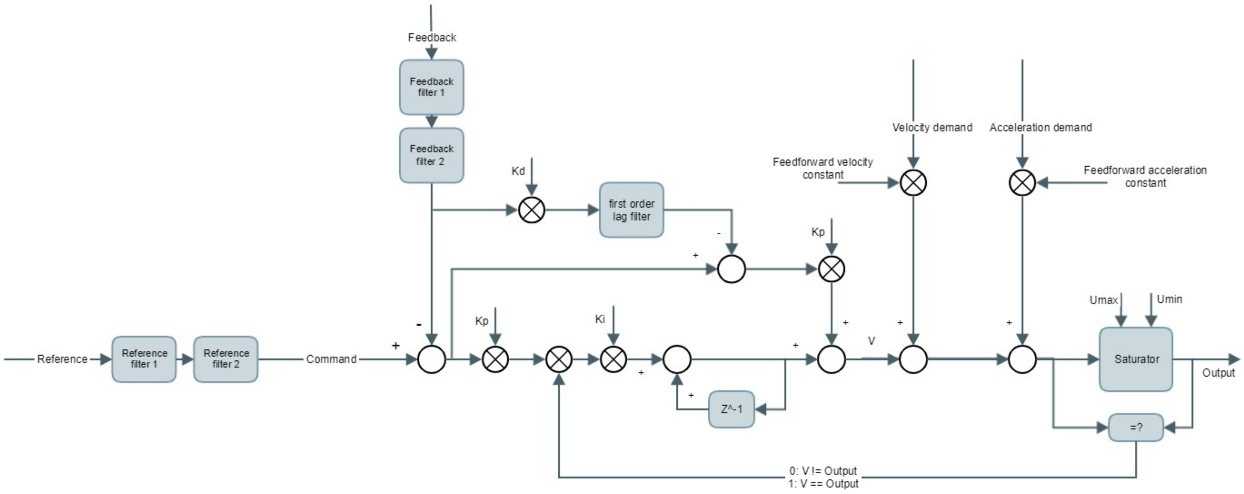
This parameter allows configuring the Umax of the PID controller used for position regulation.



5.521 0x2516 - Position loop min. output

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2516	0x00	Position loop min. output	FLOAT	RW	No	Yes	Data type	1.0	rev/s

This parameter allows configuring the Umin of the PID controller used for position regulation.



5.522 0x2517 - Current loop status

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2517	0x00	Current loop status	UINT32	RO	Yes	No	Data type	-	-

This register shows the status of the current control loops.

The meaning of each bit in this parameter is described next.

Block	Current D/B loop status										
Bits	31	30...28	27	26	25	24	23...20	19	18	17	16
Meaning	*Loop enabled*	*Reserved*	*Derating limiting latching*	*I2T limiting latching*	*Upper saturator active latching*	*Lower saturator active latching*	*Reserved*	*Derating limiting*	*I2T limiting*	*Upper saturator active*	*Lower saturator active*

Block	Current Q/A loop status										
Bits	15	14...12	11	10	9	8	7...4	3	2	1	0
Meaning	*Loop enabled*	*Reserved*	*Derating limiting latching*	*I2T limiting latching*	*Upper saturator active latching*	*Lower saturator active latching*	*Reserved*	*Derating limiting*	*I2T limiting*	*Upper saturator active*	*Lower saturator active*

Note

The latching bits of the control loops status get reset whenever the power stage transitions to "operation enabled" state or whenever a current loop PID parameter is changed.

Warning

When the *commutation modulation type* parameter is set to *Brushless DC* or *Brushed DC*, only the current quadrature path is used. In this case, the Current D/B loop status bit field must be ignored.

5.523 0x2518 - Velocity loop status

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2518	0x00	Velocity loop status	UINT32	RO	Yes	No	Data type	-	-

This register shows the status of the velocity control loop.

The meaning of each bit in this parameter is described next.

Bits	31	30...4	3	2	1	0
Meaning	*Velocity loop enabled*	*Reserved*	*Set-point limit*	*Command limit*	*Upper saturator active*	*Lower saturator active*

5.524 0x2519 - Position loop status

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2519	0x00	Position loop status	UINT32	RO	Yes	No	Data type	-	-

This register shows the status of the position control loop.

The meaning of each bit in this parameter is described next.

Bits	**31**	**30...4**	**3**	**2**	**1**	**0**
Meaning	*Position loop enabled*	*Reserved*	*Set-point limit*	*Command limit*	*Upper saturator active*	*Lower saturator active*

5.525 0x251A - STO status

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x251A	0x00	STO status	UINT16	RO	Yes	No	0x00 - 0x1F	0	-

This register shows the status of the STO module.

The meaning of each bit in this parameter is described next.

Bit number	15 ... 5	4	3	2	1	0
Meaning	*Reserved*	*STO report*	*STO abnormal fault*	*/STO supply fault*	*STO2*	*STO1*

- **STO report.** This input notifies the state of the "Safe torque off" circuit output. It is set to 1 when both STO1 and STO2 are at high level, and 0 zero in any other case.
- **STO abnormal fault.** Normally low. This input is set to high level whenever the "Safe torque off" circuit detects that STO1 and STO2 input values differs. When this situation stays for some seconds, this bit will remain active until a power-cycle is applied.
- **STO supply fault.** Normally high. If this input is set to low level it means a supply failure has happened in the "Safe torque off" circuit.
- **STO2.** Status of the Safe torque off input 2.
- **STO1.** Status of the Safe torque off input 1.

5.526 0x2520 - Position & velocity loop rate

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2520	0x00	Position & velocity loop rate	UINT32	RO	Yes	No	Data type	20000	Hz

This register indicates the frequency at which the position and velocity control loops are running.

5.527 0x2522 - Control loops option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2522	0x00	Control loops option code	UINT32	RW	No	Yes	See below	0	-

This register allows configuring certain options related to the control loops.

This parameter has the following structure

Bits	31 ... 2	1	0
Meaning	*Reserved*	*Velocity loop continuity*	*Position loop continuity*

A bit set to high ("1") means activated.

When activating a control loop of higher order that was previously inactive, the output of this higher order control loop is unknown (for example, entering a profile position mode while the drive is moving in velocity mode would enable a higher order control loop that was previously not running). Activating this loop's continuity option would prevent instantaneous undesired PID outputs. Also, changing the PID constants can cause discontinuities in the control output.

This parameter allows the user to configure whether the control integral term should be reset upon a change of operation mode or PID constants, or whether it should maintain continuity.

Warning

1. If continuity is going to be used, it is recommended to have a non-zero integral constant.
2. Do not use this feature while tuning the system since it could be misleading.

5.528 0x2530 - Position feedback filter 1 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2530	0x00	Position feedback filter 1 type	UINT16	RW	No	Yes	0 - 7	0	-

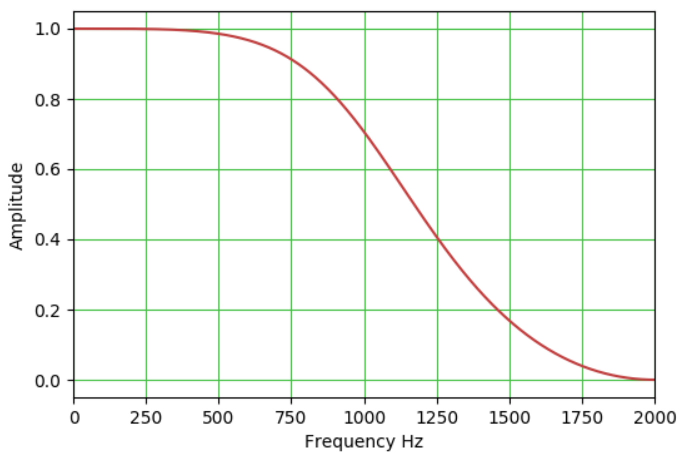
This register contains the filter type for the position feedback filter 1.

There are 7 types of filter available.

Name	Value range
Filter type	0 - No filter 1 - Low pass 2 - High pass 3 - Band pass 4 - Peak 5 - Notch 6 - Low shelf 7 - High shelf

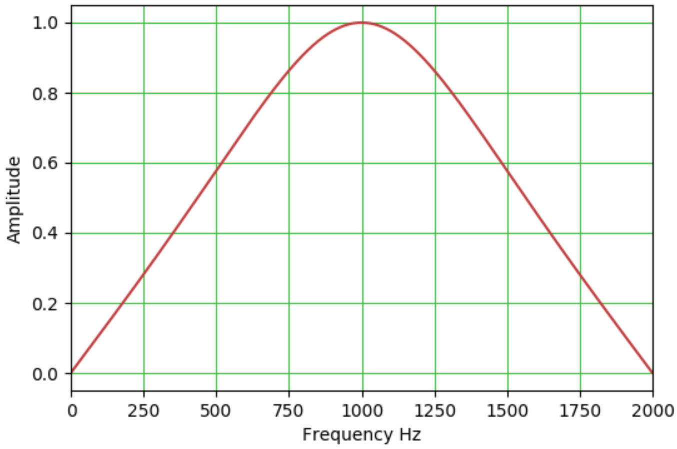
5.528.1 Low Pass Filter

Attenuates frequencies higher than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



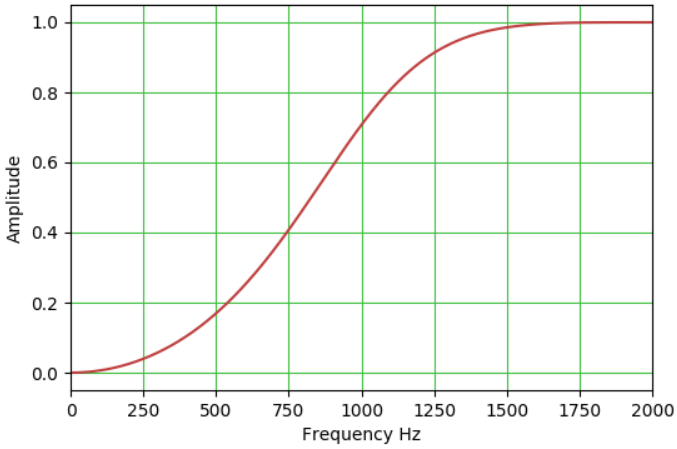
5.528.2 Band Pass Filter

Attenuates frequencies higher or lower than the center frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the center frequency is 1000 Hz



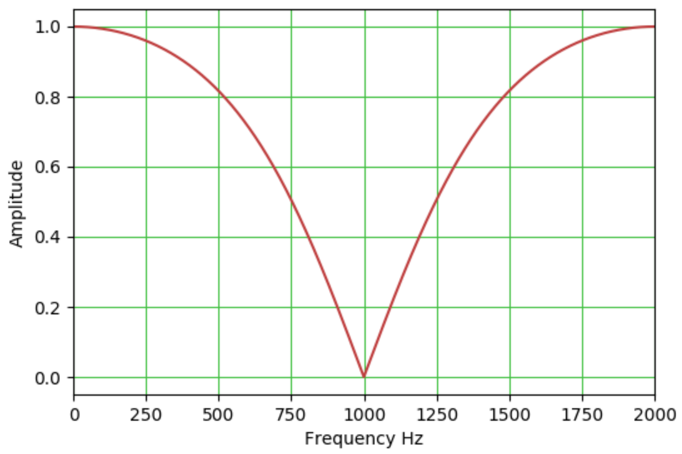
5.528.3 High Pass Filter

Attenuates frequencies lower than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



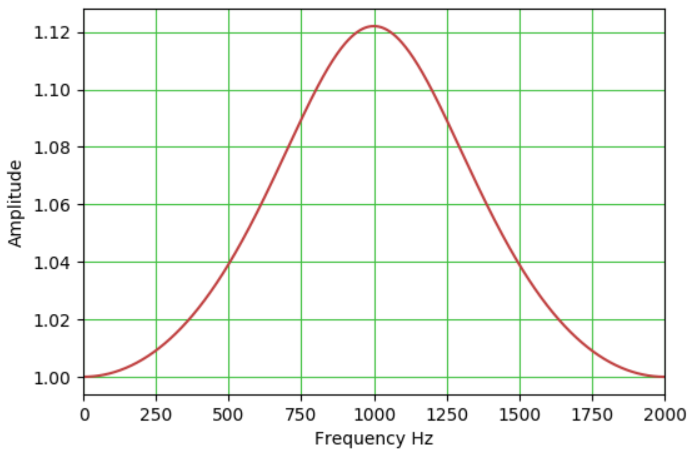
5.528.4 Notch Filter

Eliminates center frequency and attenuates its surroundings. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



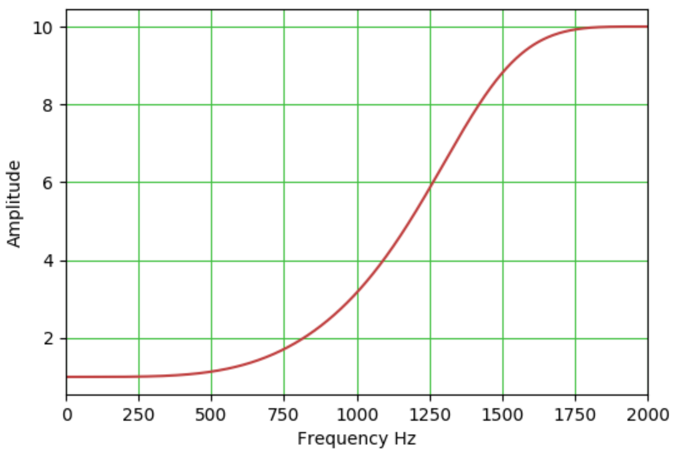
5.528.5 Peak Filter

Amplifies center frequency by a specific gain. The surrounding frequencies are also amplified. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



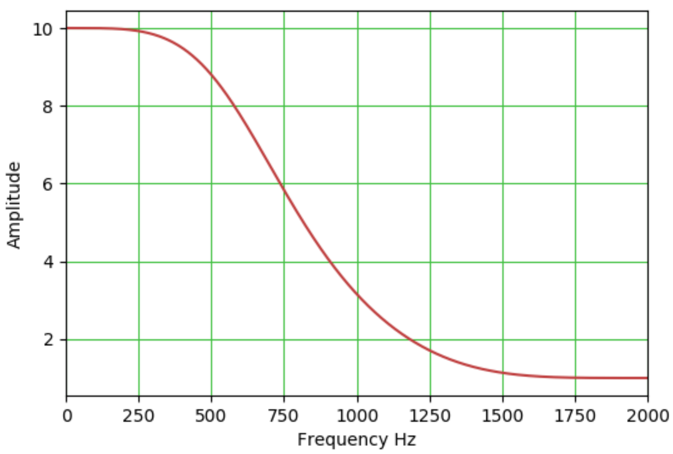
5.528.6 High Shelf Filter

Amplifies frequencies higher than the center frequency. In this example, the center frequency is 1000 Hz.



5.528.7 Low Shelf Filter

Amplifies frequencies lower than the center frequency. In this example, the center frequency is 1000 Hz.



5.529 0x2531 - Position feedback filter 1 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2531	0x00	Position feedback filter 1 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the position feedback filter 1. The meaning of filter frequency varies depending on the selected filter type.

Filter type	Frequency meaning
No filter	Nothing
Low pass filter	Cutoff frequency
High pass filter	Cutoff frequency
Band pass filter	Center frequency
Peak filter	Center frequency
Notch filter	Center frequency
Low shelf filter	Boost frequency
High shelf filter	Boost frequency

5.530 0x2532 - Position feedback filter 1 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2532	0x00	Position feedback filter 1 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the position feedback filter 1.

Filter type	Is it used?
No filter	Yes
Low pass filter	Yes
High pass filter	Yes
Band pass filter	Yes
Peak filter	Yes
Notch filter	Yes
Low shelf filter	No
High shelf filter	No

5.531 0x2533 - Position feedback filter 1 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2533	0x00	Position feedback filter 1 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the position feedback filter 1.

Filter type	Is it used?
No filter	No
Low pass filter	No
High pass filter	No
Band pass filter	No
Peak filter	Yes
Notch filter	No
Low shelf filter	Yes
High shelf filter	Yes

5.532 0x2538 - Position feedback filter 2 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2538	0x00	Position feedback filter 2 type	UINT16	RW	No	Yes	0 - 7	0	-

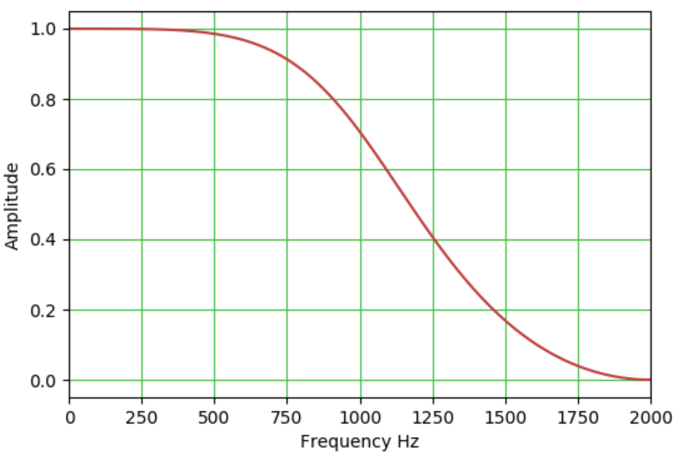
This register contains the filter type for the position feedback filter 2.

There are 7 types of filter available.

Name	Value range
Filter type	0 - No filter 1 - Low pass 2 - High pass 3 - Band pass 4 - Peak 5 - Notch 6 - Low shelf 7 - High shelf

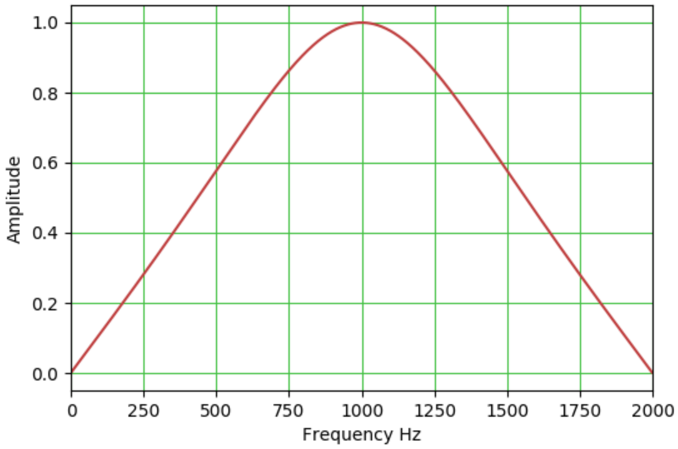
5.532.1 Low Pass Filter

Attenuates frequencies higher than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



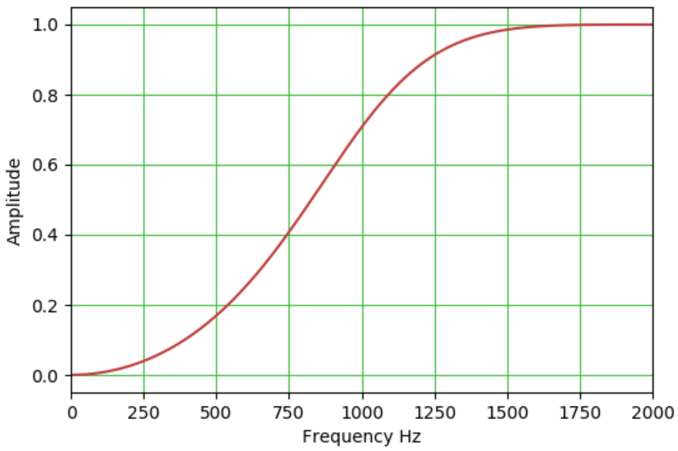
5.532.2 Band Pass Filter

Attenuates frequencies higher or lower than the center frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the center frequency is 1000 Hz



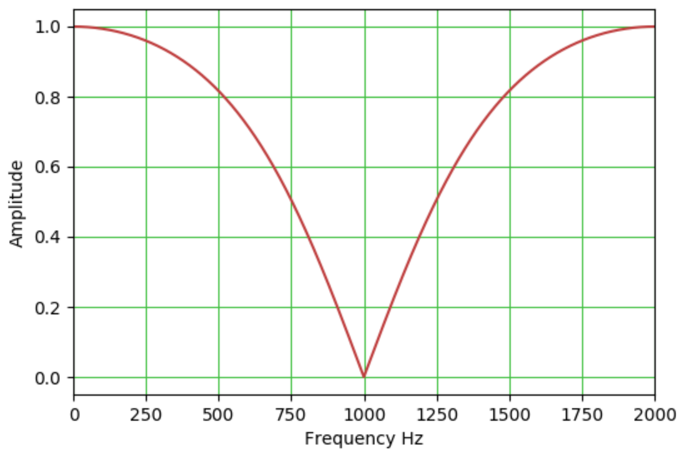
5.532.3 High Pass Filter

Attenuates frequencies lower than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



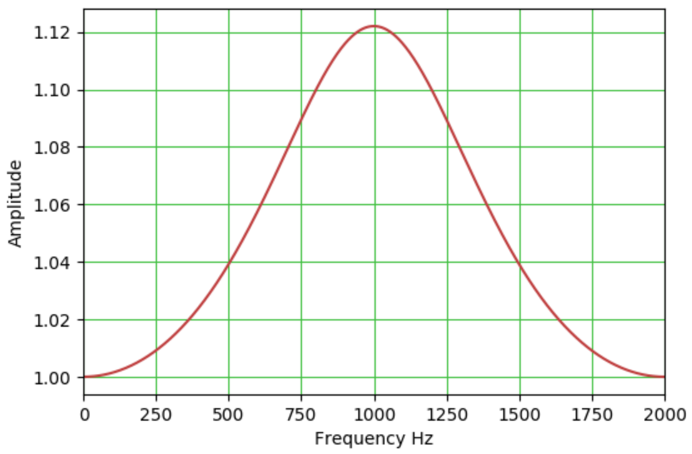
5.532.4 Notch Filter

Eliminates center frequency and attenuates its surroundings. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



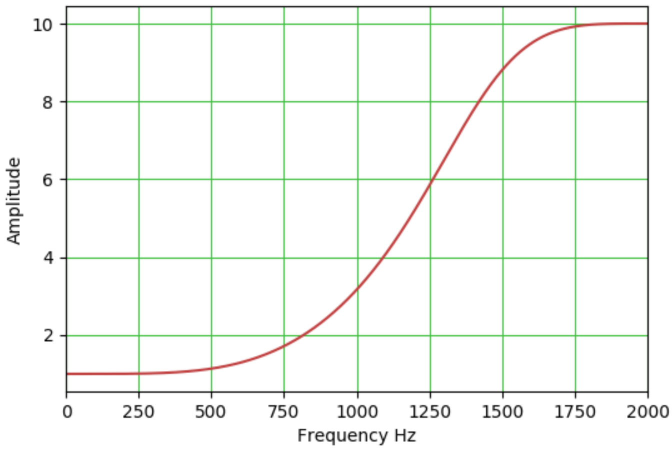
5.532.5 Peak Filter

Amplifies center frequency by a specific gain. The surrounding frequencies are also amplified. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



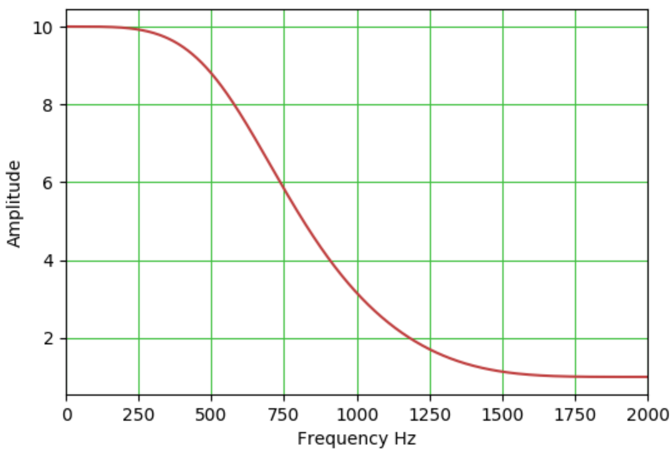
5.532.6 High Shelf Filter

Amplifies frequencies higher than the center frequency. In this example, the center frequency is 1000 Hz.



5.532.7 Low Shelf Filter

Amplifies frequencies lower than the center frequency. In this example, the center frequency is 1000 Hz.



5.533 0x2539 - Position feedback filter 2 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2539	0x00	Position feedback filter 2 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the position feedback filter 2. The meaning of filter frequency varies depending on the selected filter type.

Filter type	Frequency meaning
No filter	Nothing
Low pass filter	Cutoff frequency
High pass filter	Cutoff frequency
Band pass filter	Center frequency
Peak filter	Center frequency
Notch filter	Center frequency
Low shelf filter	Boost frequency
High shelf filter	Boost frequency

5.534 0x253A - Position feedback filter 2 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x253A	0x00	Position feedback filter 2 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the position feedback filter 2.

Filter type	Is it used?
No filter	Yes
Low pass filter	Yes
High pass filter	Yes
Band pass filter	Yes
Peak filter	Yes
Notch filter	Yes
Low shelf filter	No
High shelf filter	No

5.535 0x253B - Position feedback filter 2 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x253B	0x00	Position feedback filter 2 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the position feedback filter 2.

Filter type	Is it used?
No filter	No
Low pass filter	No
High pass filter	No
Band pass filter	No
Peak filter	Yes
Notch filter	No
Low shelf filter	Yes
High shelf filter	Yes

5.536 0x2540 - Position reference filter 1 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2540	0x00	Position reference filter 1 type	UINT16	RW	No	Yes	0 - 7	0	-

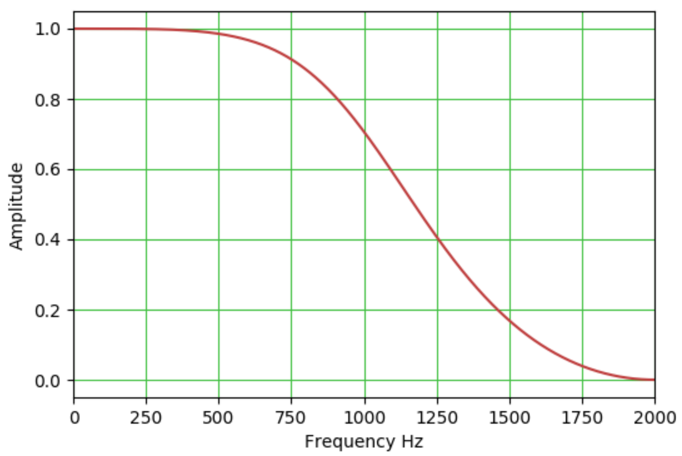
This register contains the filter type for the position reference filter 1.

There are 7 types of filter available.

Name	Value range
Filter type	0 - No filter 1 - Low pass 2 - High pass 3 - Band pass 4 - Peak 5 - Notch 6 - Low shelf 7 - High shelf

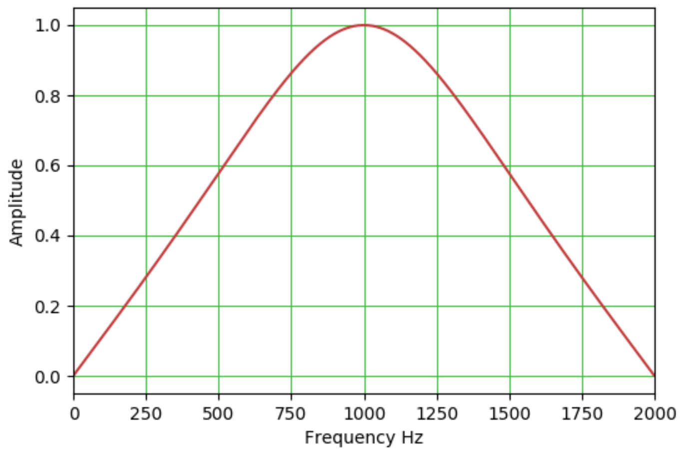
5.536.1 Low Pass Filter

Attenuates frequencies higher than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



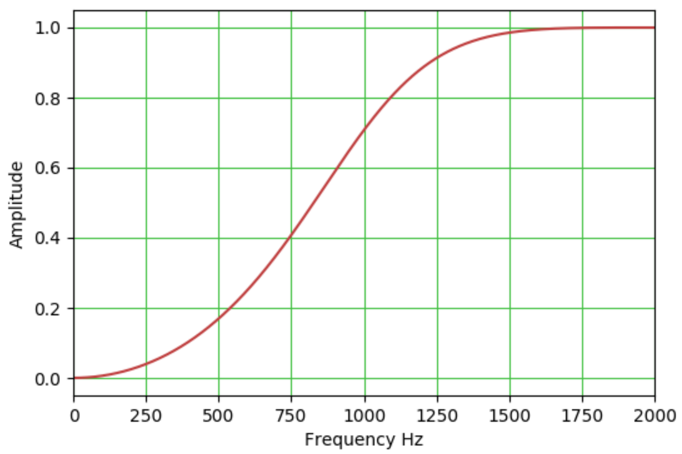
5.536.2 Band Pass Filter

Attenuates frequencies higher or lower than the center frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the center frequency is 1000 Hz



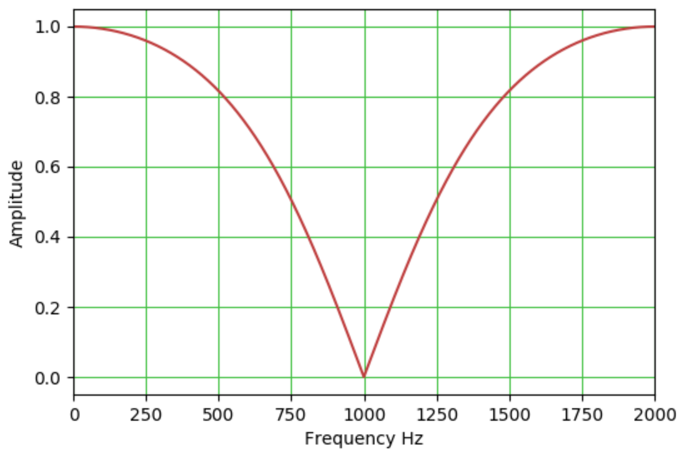
5.536.3 High Pass Filter

Attenuates frequencies lower than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



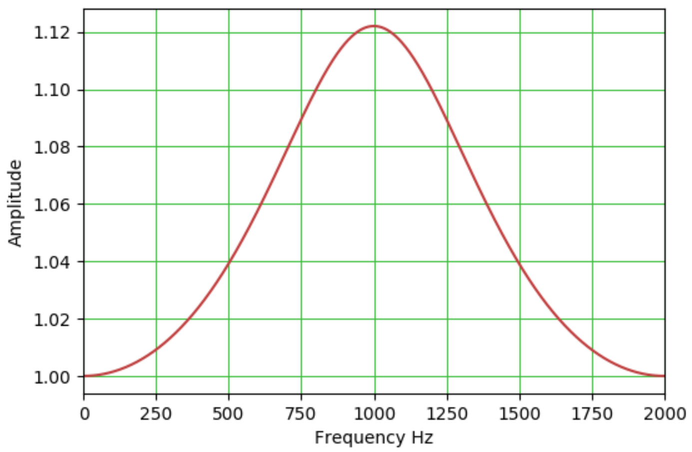
5.536.4 Notch Filter

Eliminates center frequency and attenuates its surroundings. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



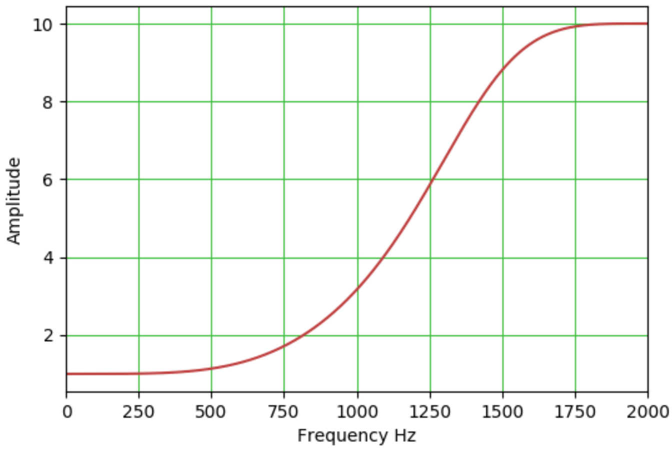
5.536.5 Peak Filter

Amplifies center frequency by a specific gain. The surrounding frequencies are also amplified. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



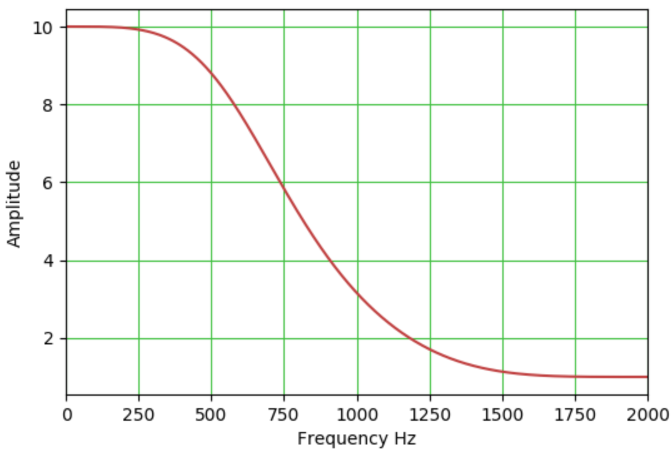
5.536.6 High Shelf Filter

Amplifies frequencies higher than the center frequency. In this example, the center frequency is 1000 Hz.



5.536.7 Low Shelf Filter

Amplifies frequencies lower than the center frequency. In this example, the center frequency is 1000 Hz.



5.537 0x2541 - Position reference filter 1 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2541	0x00	Position reference filter 1 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the position reference filter 1. The meaning of filter frequency varies depending on the selected filter type.

Filter type	Frequency meaning
No filter	Nothing
Low pass filter	Cutoff frequency
High pass filter	Cutoff frequency
Band pass filter	Center frequency
Peak filter	Center frequency
Notch filter	Center frequency
Low shelf filter	Boost frequency
High shelf filter	Boost frequency

5.538 0x2542 - Position reference filter 1 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2542	0x00	Position reference filter 1 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the position reference filter 1.

Filter type	Is it used?
No filter	Yes
Low pass filter	Yes
High pass filter	Yes
Band pass filter	Yes
Peak filter	Yes
Notch filter	Yes
Low shelf filter	No
High shelf filter	No

5.539 0x2543 - Position reference filter 1 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2543	0x00	Position reference filter 1 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the position reference filter 1.

Filter type	Is it used?
No filter	No
Low pass filter	No
High pass filter	No
Band pass filter	No
Peak filter	Yes
Notch filter	No
Low shelf filter	Yes
High shelf filter	Yes

5.540 0x2548 - Position reference filter 2 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2548	0x00	Position reference filter 2 type	UINT16	RW	No	Yes	0 - 7	0	-

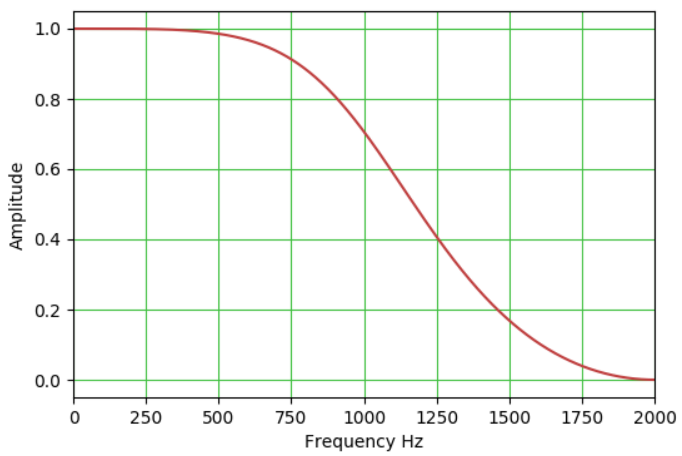
This register contains the filter type for the velocity reference filter 2.

There are 7 types of filter available.

Name	Value range
Filter type	0 - No filter 1 - Low pass 2 - High pass 3 - Band pass 4 - Peak 5 - Notch 6 - Low shelf 7 - High shelf

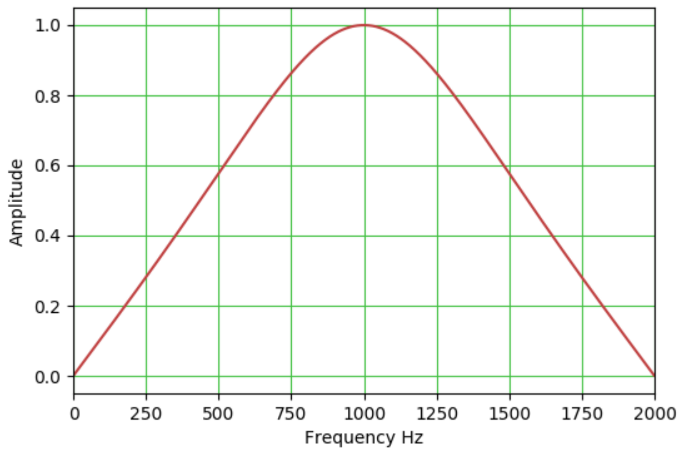
5.540.1 Low Pass Filter

Attenuates frequencies higher than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



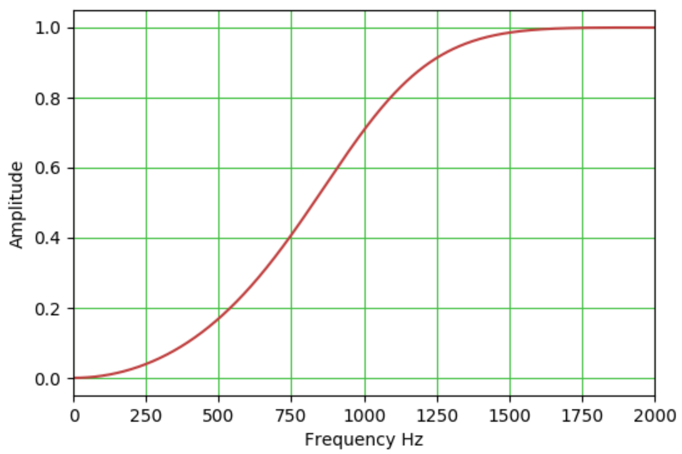
5.540.2 Band Pass Filter

Attenuates frequencies higher or lower than the center frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the center frequency is 1000 Hz



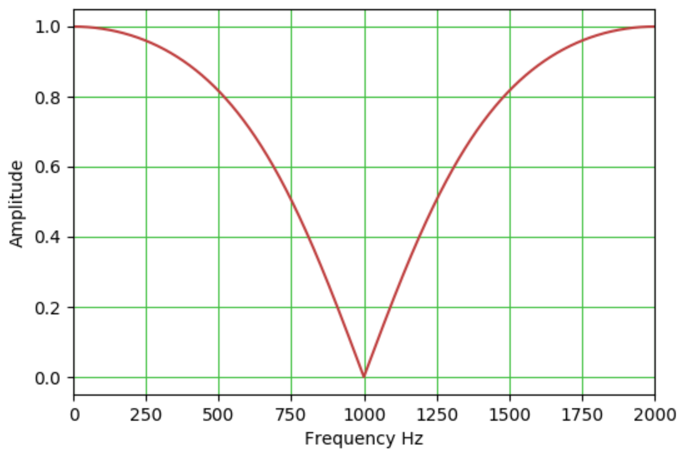
5.540.3 High Pass Filter

Attenuates frequencies lower than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



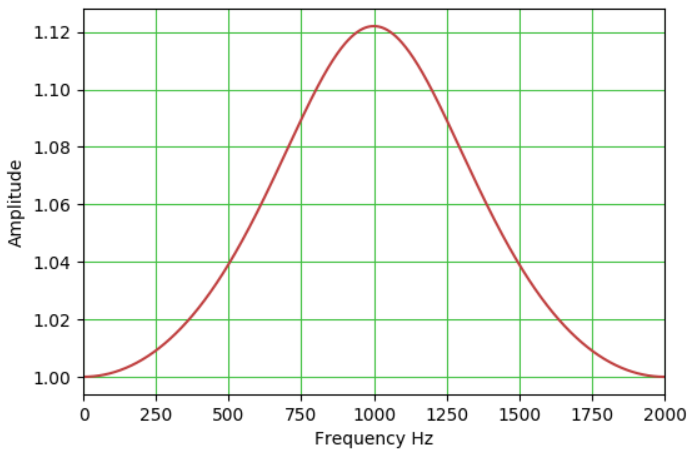
5.540.4 Notch Filter

Eliminates center frequency and attenuates its surroundings. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



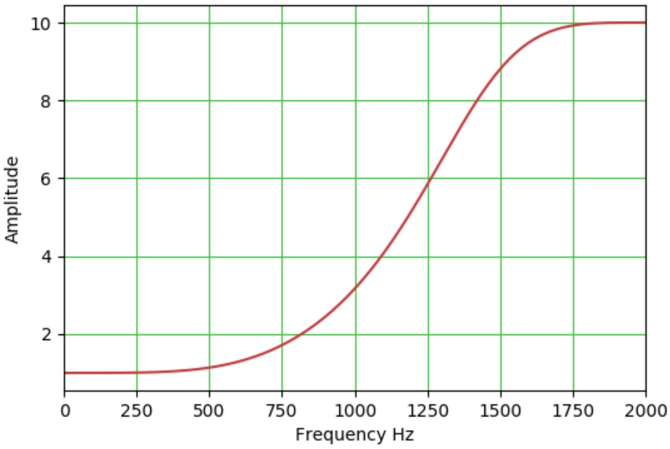
5.540.5 Peak Filter

Amplifies center frequency by a specific gain. The surrounding frequencies are also amplified. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



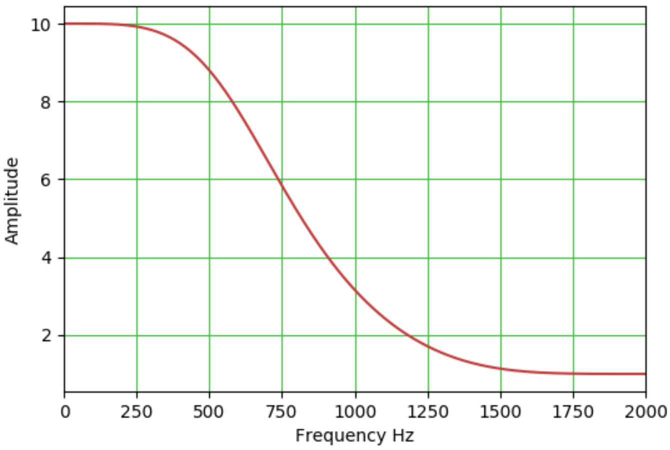
5.540.6 High Shelf Filter

Amplifies frequencies higher than the center frequency. In this example, the center frequency is 1000 Hz.



5.540.7 Low Shelf Filter

Amplifies frequencies lower than the center frequency. In this example, the center frequency is 1000 Hz.



5.541 0x2549 - Position reference filter 2 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2549	0x00	Position reference filter 2 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the position reference filter 2. The meaning of filter frequency varies depending on the selected filter type.

Filter type	Frequency meaning
No filter	Nothing
Low pass filter	Cutoff frequency
High pass filter	Cutoff frequency
Band pass filter	Center frequency
Peak filter	Center frequency
Notch filter	Center frequency
Low shelf filter	Boost frequency
High shelf filter	Boost frequency

5.542 0x254A - Position reference filter 2 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x254A	0x00	Position reference filter 2 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the position reference filter 2.

Filter type	Is it used?
No filter	Yes
Low pass filter	Yes
High pass filter	Yes
Band pass filter	Yes
Peak filter	Yes
Notch filter	Yes
Low shelf filter	No
High shelf filter	No

5.543 0x254B - Position reference filter 2 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x254B	0x00	Position reference filter 2 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the position reference filter 2.

Filter type	Is it used?
No filter	No
Low pass filter	No
High pass filter	No
Band pass filter	No
Peak filter	Yes
Notch filter	No
Low shelf filter	Yes
High shelf filter	Yes

5.544 0x2550 - Velocity feedback filter 1 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2550	0x00	Velocity feedback filter 1 type	UINT16	RW	No	Yes	0 - 7	0	-

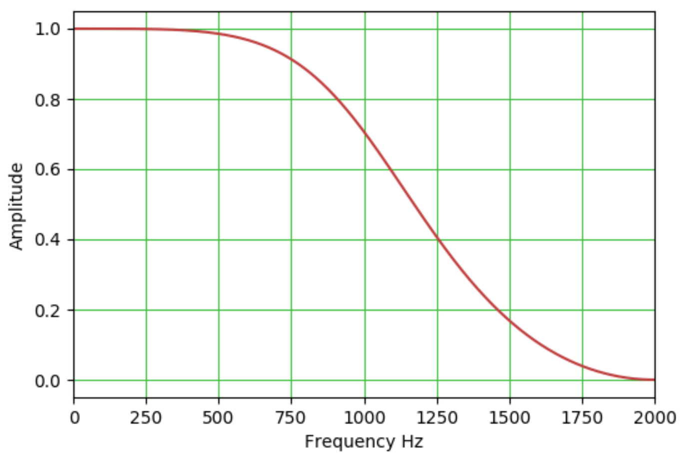
This register contains the filter type for the velocity feedback filter 1.

There are 7 types of filter available.

Name	Value range
Filter type	0 - No filter 1 - Low pass 2 - High pass 3 - Band pass 4 - Peak 5 - Notch 6 - Low shelf 7 - High shelf

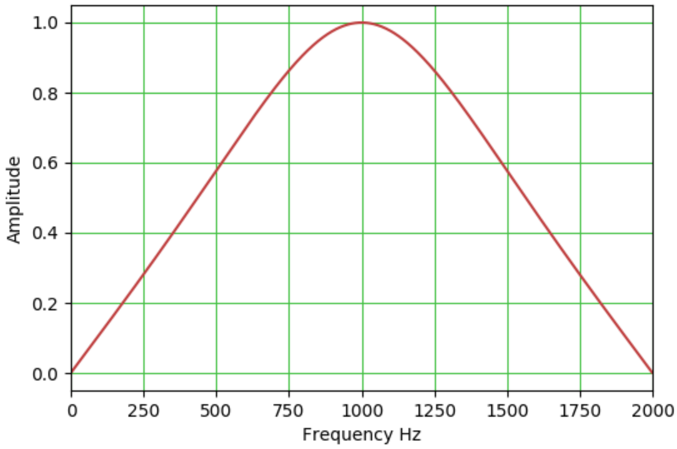
5.544.1 Low Pass Filter

Attenuates frequencies higher than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



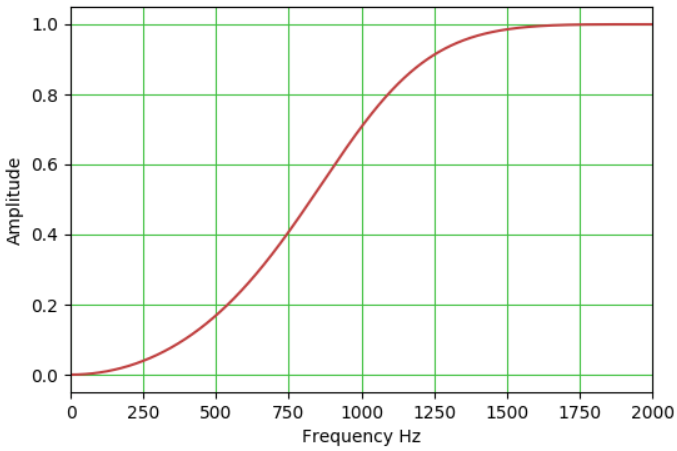
5.544.2 Band Pass Filter

Attenuates frequencies higher or lower than the center frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the center frequency is 1000 Hz



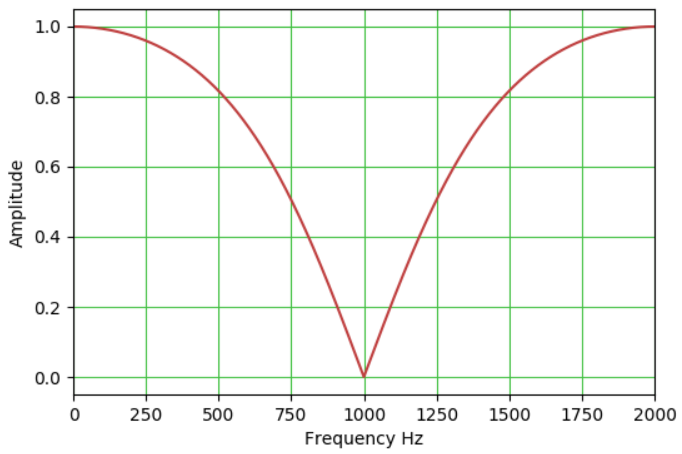
5.544.3 High Pass Filter

Attenuates frequencies lower than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



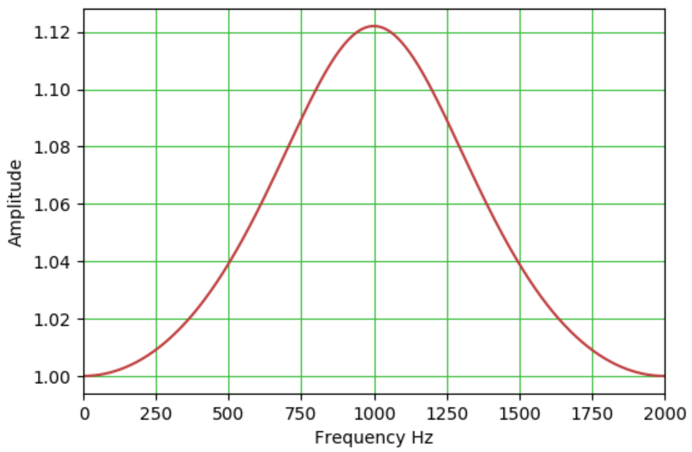
5.544.4 Notch Filter

Eliminates center frequency and attenuates its surroundings. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



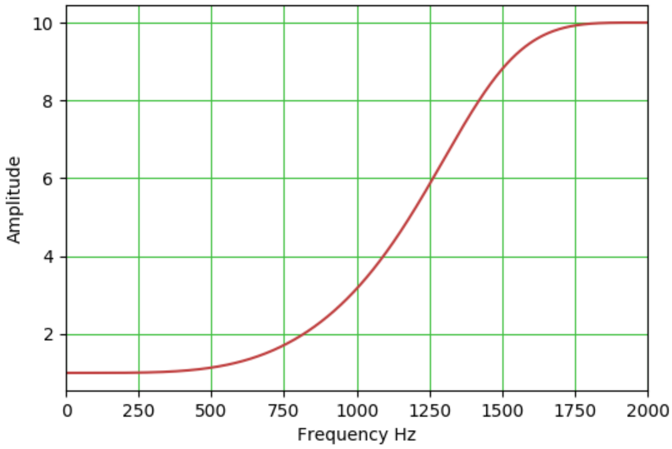
5.544.5 Peak Filter

Amplifies center frequency by a specific gain. The surrounding frequencies are also amplified. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



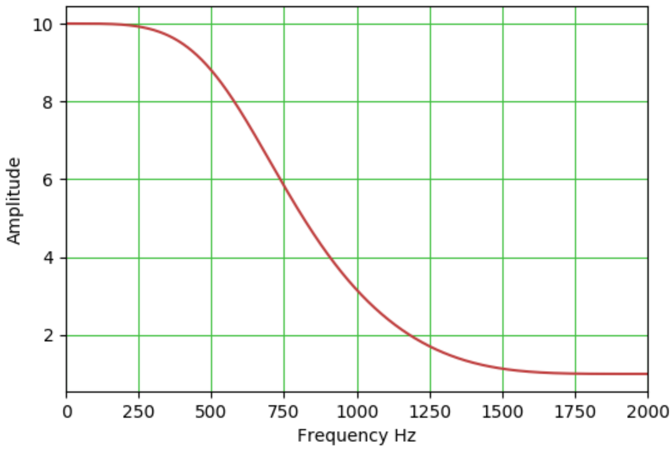
5.544.6 High Shelf Filter

Amplifies frequencies higher than the center frequency. In this example, the center frequency is 1000 Hz.



5.544.7 Low Shelf Filter

Amplifies frequencies lower than the center frequency. In this example, the center frequency is 1000 Hz.



5.545 0x2551 - Velocity feedback filter 1 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2551	0x00	Velocity feedback filter 1 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the velocity feedback filter 1. The meaning of filter frequency varies depending on the selected filter type.

Filter type	Frequency meaning
No filter	Nothing
Low pass filter	Cutoff frequency
High pass filter	Cutoff frequency
Band pass filter	Center frequency
Peak filter	Center frequency
Notch filter	Center frequency
Low shelf filter	Boost frequency
High shelf filter	Boost frequency

5.546 0x2552 - Velocity feedback filter 1 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2552	0x00	Velocity feedback filter 1 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the velocity feedback filter 1.

Filter type	Is it used?
No filter	Yes
Low pass filter	Yes
High pass filter	Yes
Band pass filter	Yes
Peak filter	Yes
Notch filter	Yes
Low shelf filter	No
High shelf filter	No

5.547 0x2553 - Velocity feedback filter 1 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2553	0x00	Velocity feedback filter 1 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the velocity feedback filter 1.

Filter type	Is it used?
No filter	No
Low pass filter	No
High pass filter	No
Band pass filter	No
Peak filter	Yes
Notch filter	No
Low shelf filter	Yes
High shelf filter	Yes

5.548 0x2558 - Velocity feedback filter 2 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2558	0x00	Velocity feedback filter 2 type	UINT16	RW	No	Yes	0 - 7	0	-

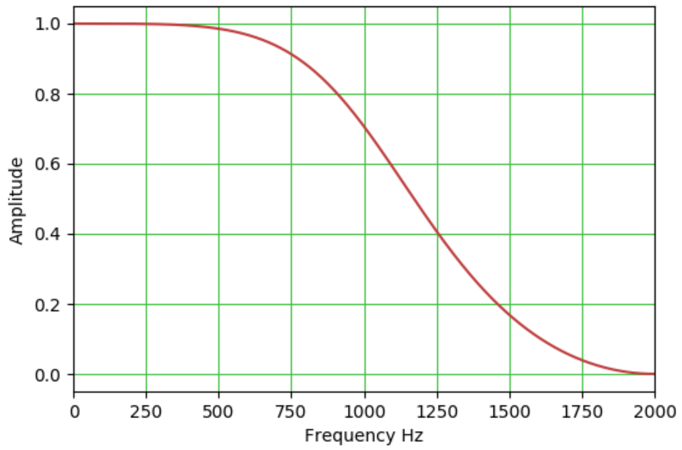
This register contains the filter type for the velocity feedback filter 2.

There are 7 types of filter available.

Name	Value range
Filter type	0 - No filter 1 - Low pass 2 - High pass 3 - Band pass 4 - Peak 5 - Notch 6 - Low shelf 7 - High shelf

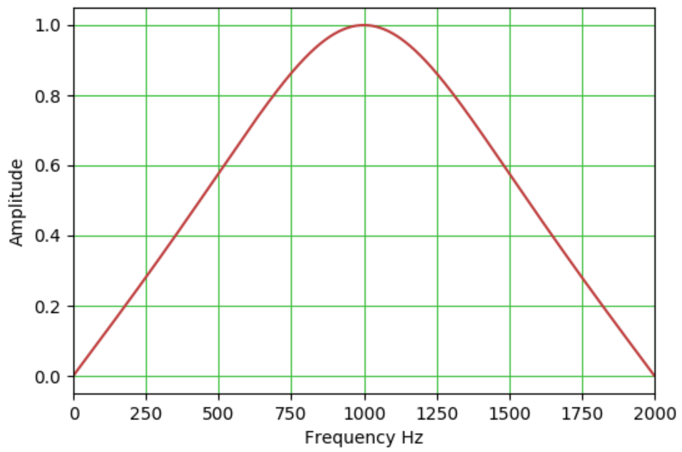
5.548.1 Low Pass Filter

Attenuates frequencies higher than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



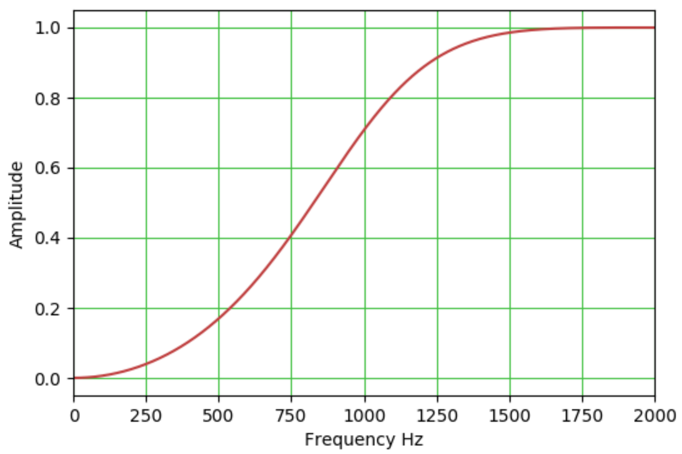
5.548.2 Band Pass Filter

Attenuates frequencies higher or lower than the center frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the center frequency is 1000 Hz



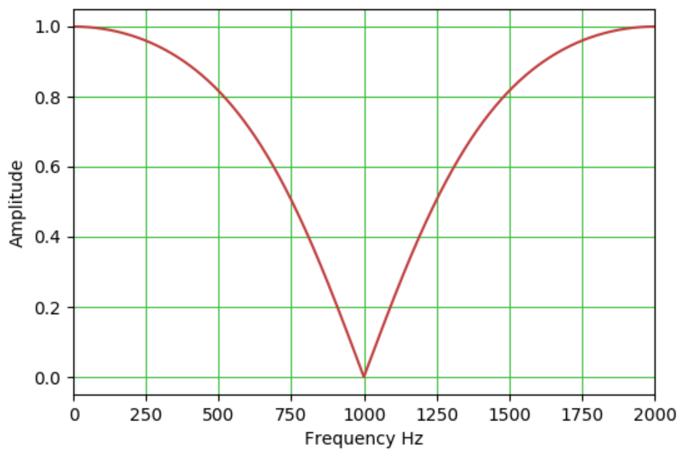
5.548.3 High Pass Filter

Attenuates frequencies lower than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



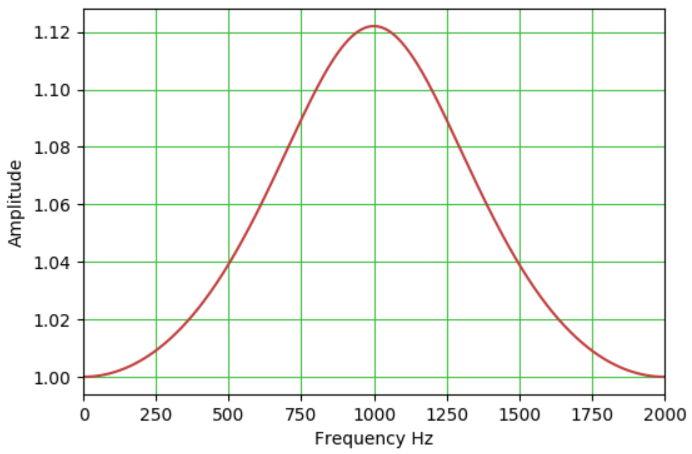
5.548.4 Notch Filter

Eliminates center frequency and attenuates its surroundings. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



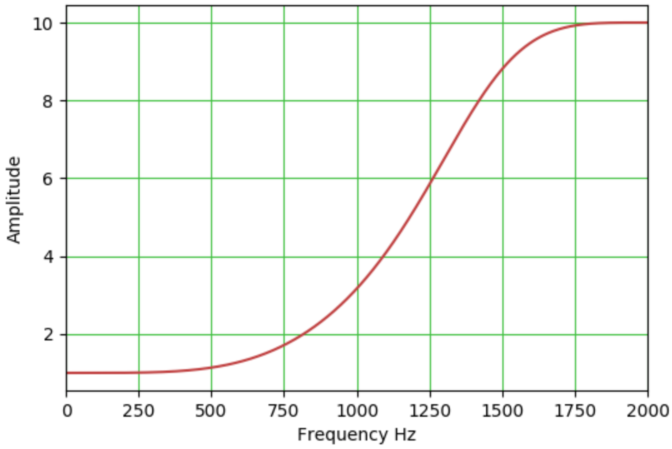
5.548.5 Peak Filter

Amplifies center frequency by a specific gain. The surrounding frequencies are also amplified. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



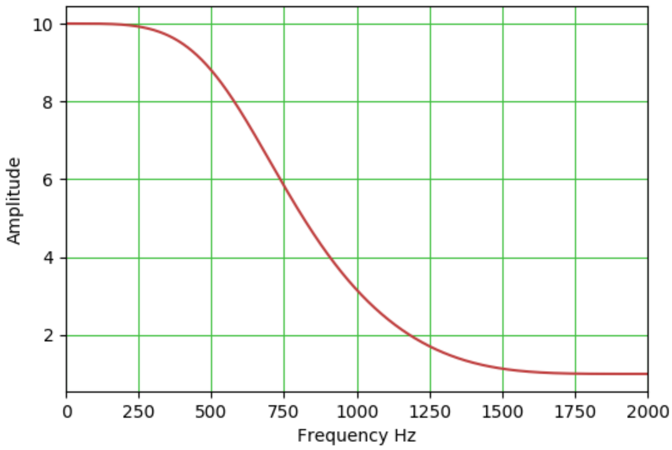
5.548.6 High Shelf Filter

Amplifies frequencies higher than the center frequency. In this example, the center frequency is 1000 Hz.



5.548.7 Low Shelf Filter

Amplifies frequencies lower than the center frequency. In this example, the center frequency is 1000 Hz.



5.549 0x2559 - Velocity feedback filter 2 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2559	0x00	Velocity feedback filter 2 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the velocity feedback filter 2. The meaning of filter frequency varies depending on the selected filter type.

Filter type	Frequency meaning
No filter	Nothing
Low pass filter	Cutoff frequency
High pass filter	Cutoff frequency
Band pass filter	Center frequency
Peak filter	Center frequency
Notch filter	Center frequency
Low shelf filter	Boost frequency
High shelf filter	Boost frequency

5.550 0x255A - Velocity feedback filter 2 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x255A	0x00	Velocity feedback filter 2 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the velocity feedback filter 2.

Filter type	Is it used?
No filter	Yes
Low pass filter	Yes
High pass filter	Yes
Band pass filter	Yes
Peak filter	Yes
Notch filter	Yes
Low shelf filter	No
High shelf filter	No

5.551 0x255B - Velocity feedback filter 2 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x255B	0x00	Velocity feedback filter 2 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the velocity feedback filter 2.

Filter type	Is it used?
No filter	No
Low pass filter	No
High pass filter	No
Band pass filter	No
Peak filter	Yes
Notch filter	No
Low shelf filter	Yes
High shelf filter	Yes

5.552 0x2560 - Velocity reference filter 1 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2560	0x00	Velocity reference filter 1 type	UINT16	RW	No	Yes	0 - 7	0	-

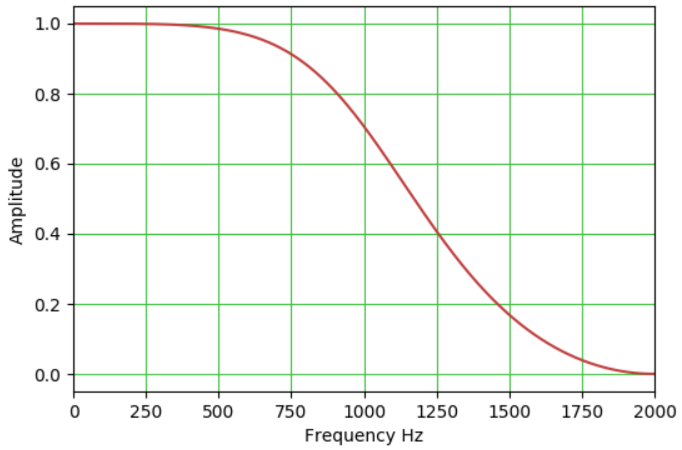
This register contains the filter type for the velocity reference filter 1.

There are 7 types of filter available.

Name	Value range
Filter type	0 - No filter 1 - Low pass 2 - High pass 3 - Band pass 4 - Peak 5 - Notch 6 - Low shelf 7 - High shelf

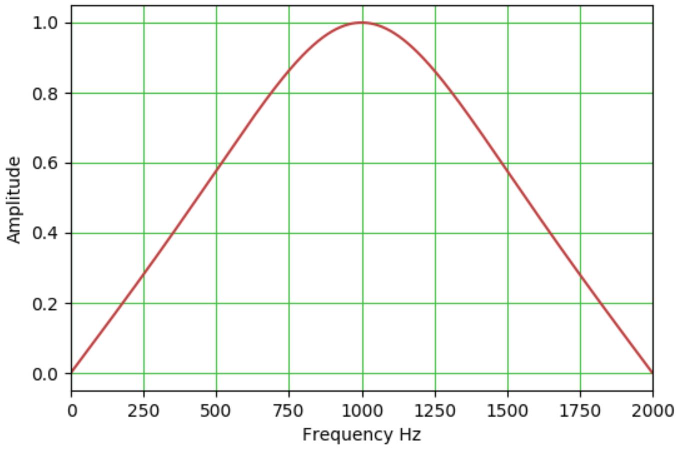
5.552.1 Low Pass Filter

Attenuates frequencies higher than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



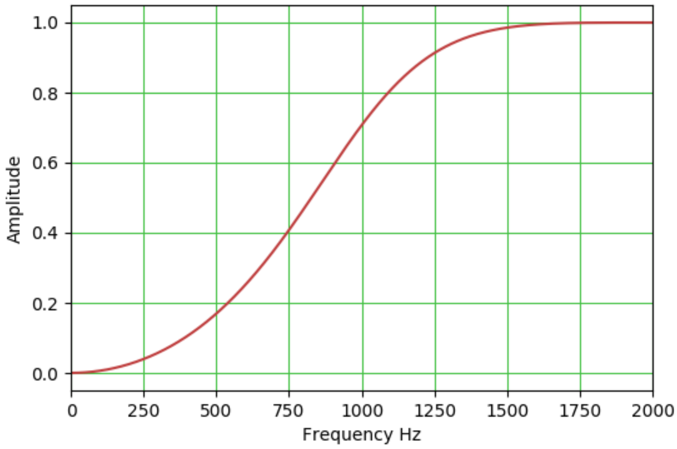
5.552.2 Band Pass Filter

Attenuates frequencies higher or lower than the center frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the center frequency is 1000 Hz



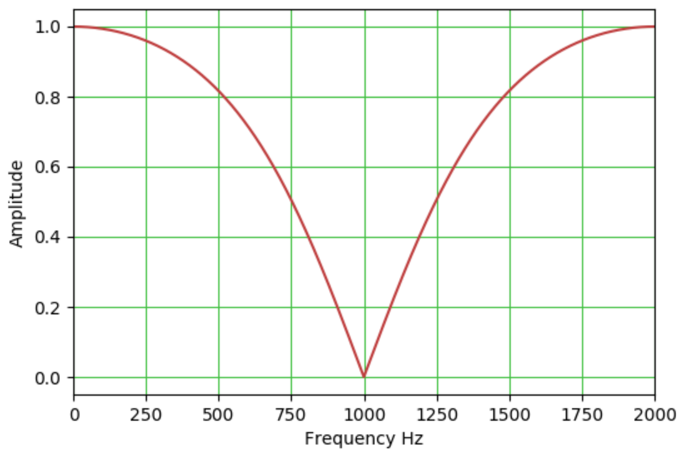
5.552.3 High Pass Filter

Attenuates frequencies lower than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



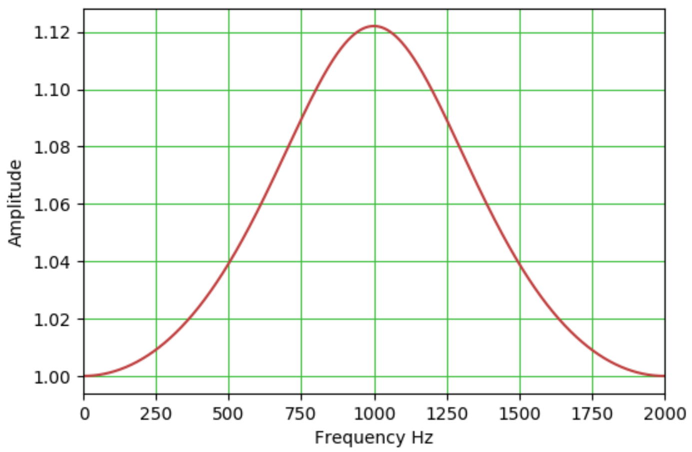
5.552.4 Notch Filter

Eliminates center frequency and attenuates its surroundings. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



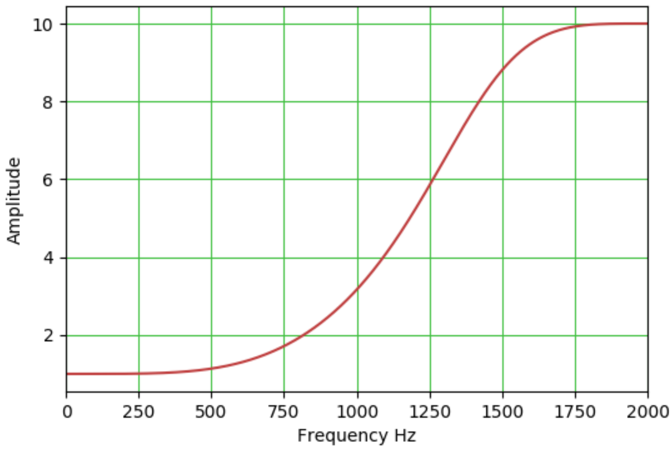
5.552.5 Peak Filter

Amplifies center frequency by a specific gain. The surrounding frequencies are also amplified. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



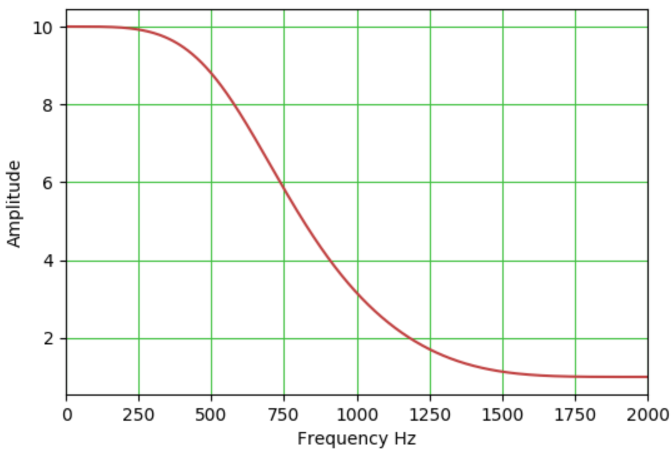
5.552.6 High Shelf Filter

Amplifies frequencies higher than the center frequency. In this example, the center frequency is 1000 Hz.



5.552.7 Low Shelf Filter

Amplifies frequencies lower than the center frequency. In this example, the center frequency is 1000 Hz.



5.553 0x2561 - Velocity reference filter 1 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2561	0x00	Velocity reference filter 1 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the velocity reference filter 1. The meaning of filter frequency varies depending on the selected filter type.

Filter type	Frequency meaning
No filter	Nothing
Low pass filter	Cutoff frequency
High pass filter	Cutoff frequency
Band pass filter	Center frequency
Peak filter	Center frequency
Notch filter	Center frequency
Low shelf filter	Boost frequency
High shelf filter	Boost frequency

5.554 0x2562 - Velocity reference filter 1 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2562	0x00	Velocity reference filter 1 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the velocity reference filter 1.

Filter type	Is it used?
No filter	Yes
Low pass filter	Yes
High pass filter	Yes
Band pass filter	Yes
Peak filter	Yes
Notch filter	Yes
Low shelf filter	No
High shelf filter	No

5.555 0x2563 - Velocity reference filter 1 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2563	0x00	Velocity reference filter 1 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the velocity reference filter 1.

Filter type	Is it used?
No filter	No
Low pass filter	No
High pass filter	No
Band pass filter	No
Peak filter	Yes
Notch filter	No
Low shelf filter	Yes
High shelf filter	Yes

5.556 0x2568 - Velocity reference filter 2 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2568	0x00	Velocity reference filter 2 type	UINT16	RW	No	Yes	0 - 7	0	-

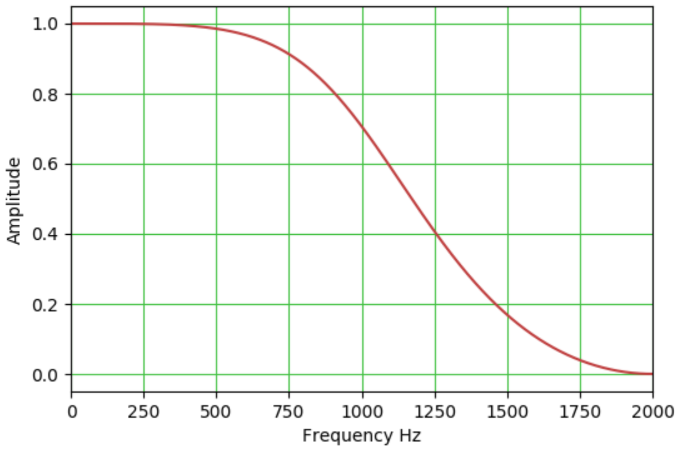
This register contains the filter type for the velocity reference filter 2.

There are 7 types of filter available.

Name	Value range
Filter type	0 - No filter 1 - Low pass 2 - High pass 3 - Band pass 4 - Peak 5 - Notch 6 - Low shelf 7 - High shelf

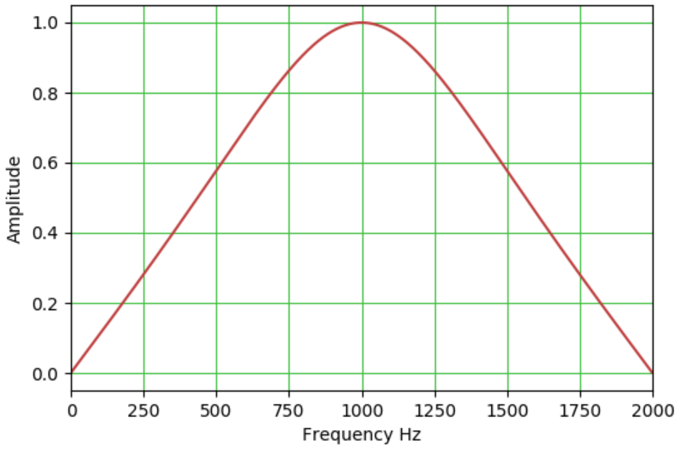
5.556.1 Low Pass Filter

Attenuates frequencies higher than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



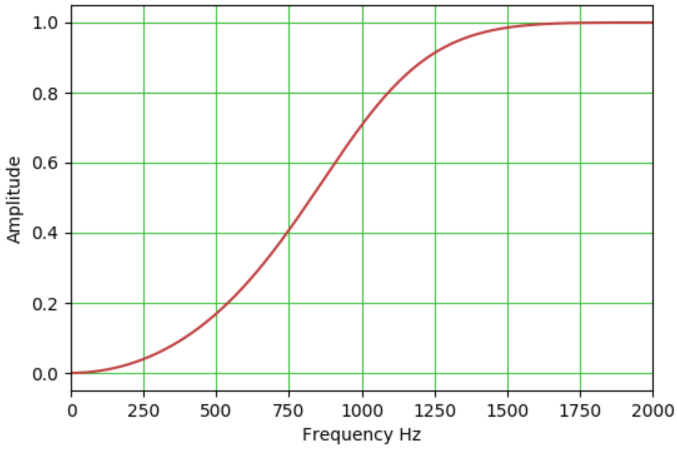
5.556.2 Band Pass Filter

Attenuates frequencies higher or lower than the center frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the center frequency is 1000 Hz



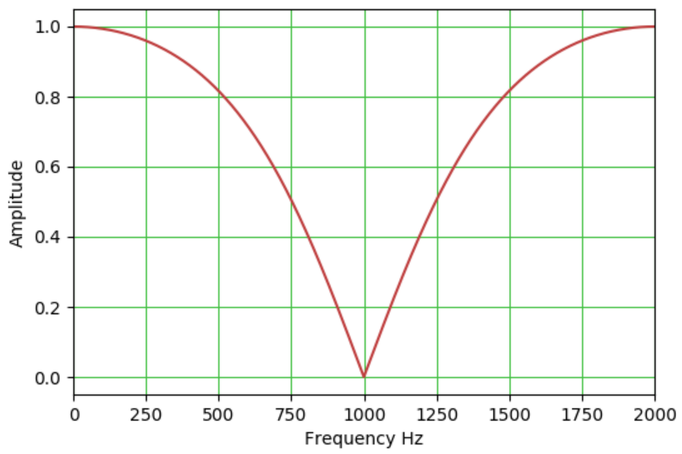
5.556.3 High Pass Filter

Attenuates frequencies lower than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



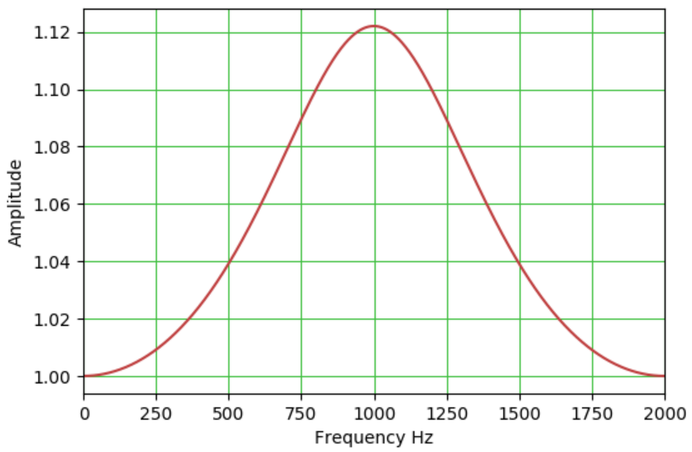
5.556.4 Notch Filter

Eliminates center frequency and attenuates its surroundings. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



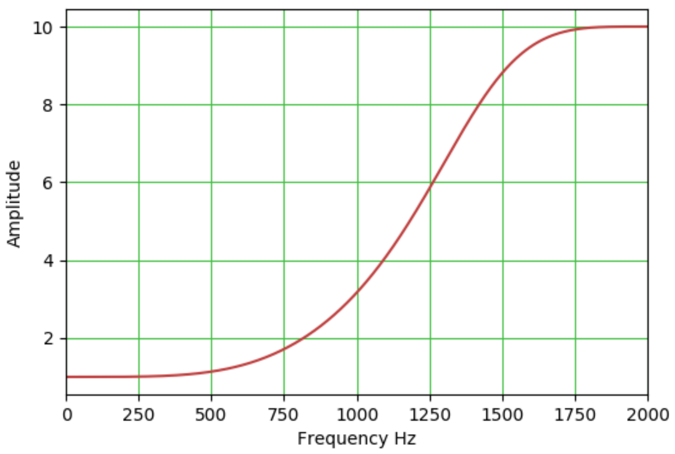
5.556.5 Peak Filter

Amplifies center frequency by a specific gain. The surrounding frequencies are also amplified. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



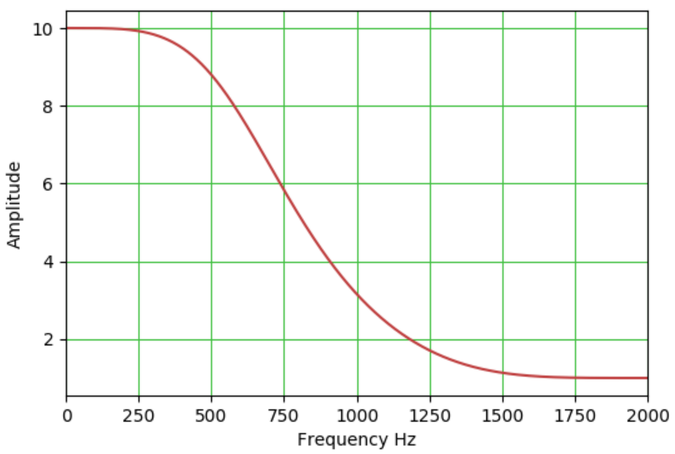
5.556.6 High Shelf Filter

Amplifies frequencies higher than the center frequency. In this example, the center frequency is 1000 Hz.



5.556.7 Low Shelf Filter

Amplifies frequencies lower than the center frequency. In this example, the center frequency is 1000 Hz.



5.557 0x2569 - Velocity reference filter 2 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2569	0x00	Velocity reference filter 2 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the velocity reference filter 2. The meaning of filter frequency varies depending on the selected filter type.

Filter type	Frequency meaning
No filter	Nothing
Low pass filter	Cutoff frequency
High pass filter	Cutoff frequency
Band pass filter	Center frequency
Peak filter	Center frequency
Notch filter	Center frequency
Low shelf filter	Boost frequency
High shelf filter	Boost frequency

5.558 0x256A - Velocity reference filter 2 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x256A	0x00	Velocity reference filter 2 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the velocity reference filter 2.

Filter type	Is it used?
No filter	Yes
Low pass filter	Yes
High pass filter	Yes
Band pass filter	Yes
Peak filter	Yes
Notch filter	Yes
Low shelf filter	No
High shelf filter	No

5.559 0x256B - Velocity reference filter 2 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x256B	0x00	Velocity reference filter 2 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the velocity reference filter 2.

Filter type	Is it used?
No filter	No
Low pass filter	No
High pass filter	No
Band pass filter	No
Peak filter	Yes
Notch filter	No
Low shelf filter	Yes
High shelf filter	Yes

5.560 0x2570 - Current feedback filter 1 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2570	0x00	Current feedback filter 1 type	UINT16	RW	No	Yes	0 - 7	0	-

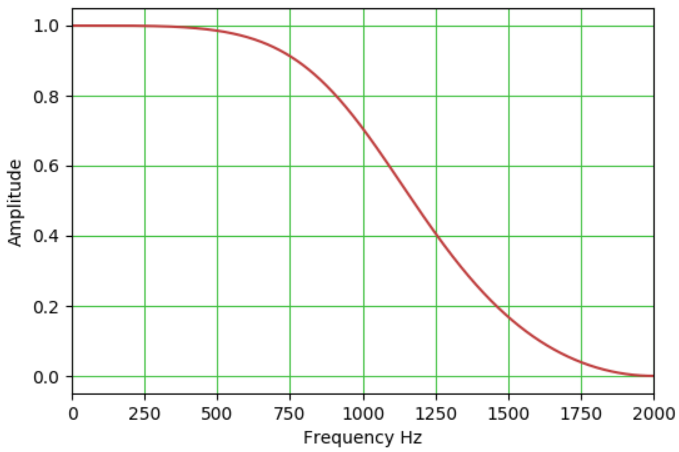
This register contains the filter type for the current feedback filter 1.

There are 7 types of filter available.

Name	Value range
Filter type	0 - No filter 1 - Low pass 2 - High pass 3 - Band pass 4 - Peak 5 - Notch 6 - Low shelf 7 - High shelf

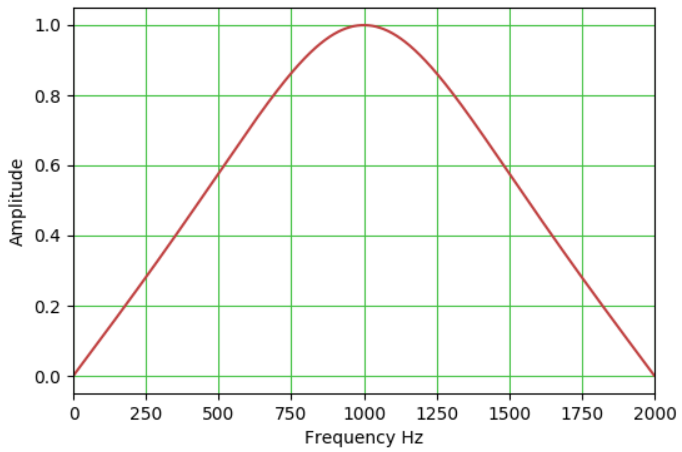
5.560.1 Low Pass Filter

Attenuates frequencies higher than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



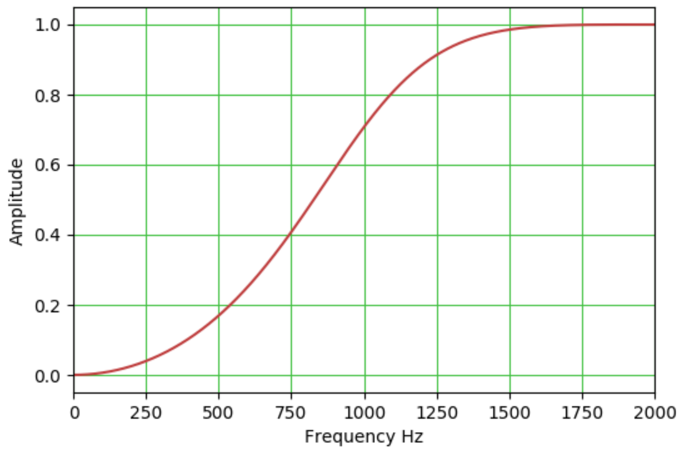
5.560.2 Band Pass Filter

Attenuates frequencies higher or lower than the center frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the center frequency is 1000 Hz



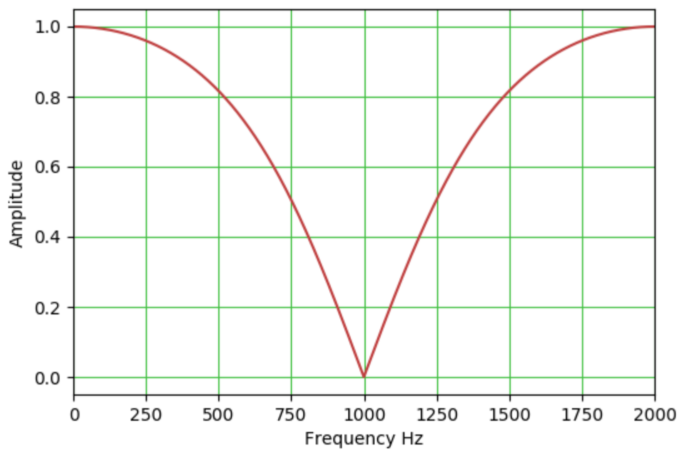
5.560.3 High Pass Filter

Attenuates frequencies lower than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



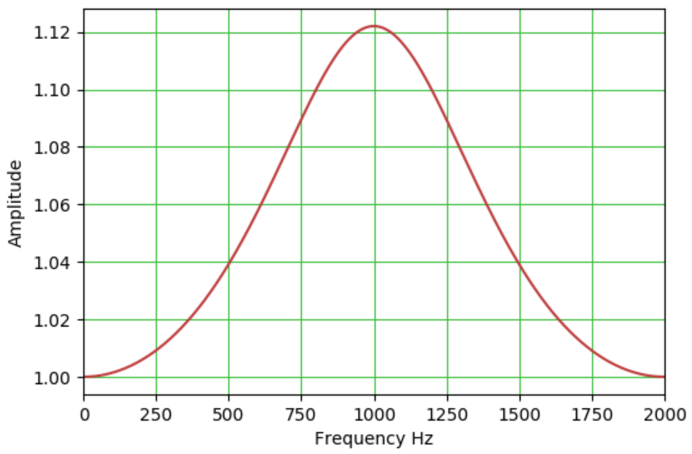
5.560.4 Notch Filter

Eliminates center frequency and attenuates its surroundings. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



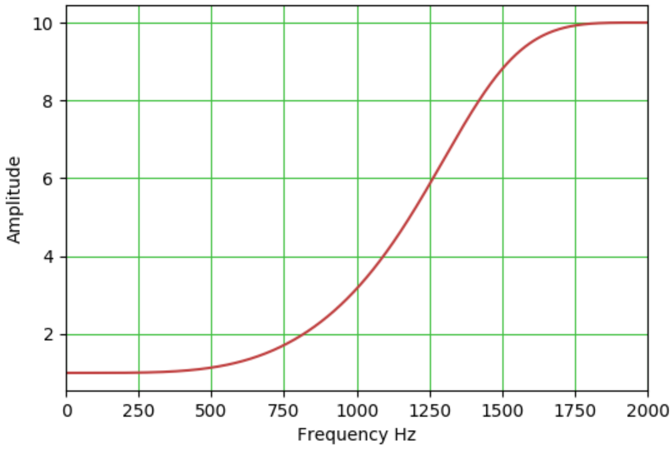
5.560.5 Peak Filter

Amplifies center frequency by a specific gain. The surrounding frequencies are also amplified. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



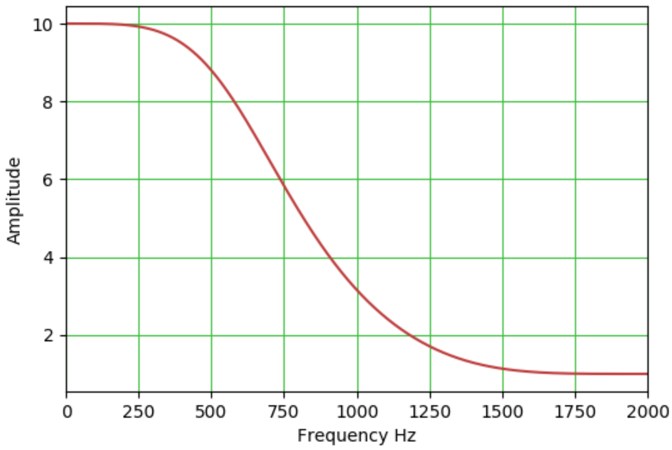
5.560.6 High Shelf Filter

Amplifies frequencies higher than the center frequency. In this example, the center frequency is 1000 Hz.



5.560.7 Low Shelf Filter

Amplifies frequencies lower than the center frequency. In this example, the center frequency is 1000 Hz.



5.561 0x2571 - Current feedback filter 1 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2571	0x00	Current feedback filter 1 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the current feedback filter 1. The meaning of filter frequency varies depending on the selected filter type.

Filter type	Frequency meaning
No filter	Nothing
Low pass filter	Cutoff frequency
High pass filter	Cutoff frequency
Band pass filter	Center frequency
Peak filter	Center frequency
Notch filter	Center frequency
Low shelf filter	Boost frequency
High shelf filter	Boost frequency

5.562 0x2572 - Current feedback filter 1 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2572	0x00	Current feedback filter 1 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the current feedback filter 1.

Filter type	Is it used?
No filter	Yes
Low pass filter	Yes
High pass filter	Yes
Band pass filter	Yes
Peak filter	Yes
Notch filter	Yes
Low shelf filter	No
High shelf filter	No

5.563 0x2573 - Current feedback filter 1 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2573	0x00	Current feedback filter 1 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the current feedback filter 1.

Filter type	Is it used?
No filter	No
Low pass filter	No
High pass filter	No
Band pass filter	No
Peak filter	Yes
Notch filter	No
Low shelf filter	Yes
High shelf filter	Yes

5.564 0x2578 - Current feedback filter 2 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2578	0x00	Current feedback filter 2 type	UINT16	RW	No	Yes	0 - 7	0	-

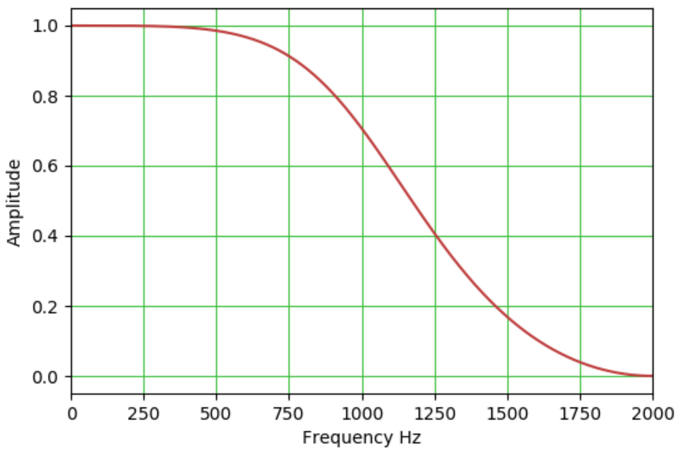
This register contains the filter type for the current feedback filter 2.

There are 7 types of filter available.

Name	Value range
Filter type	0 - No filter 1 - Low pass 2 - High pass 3 - Band pass 4 - Peak 5 - Notch 6 - Low shelf 7 - High shelf

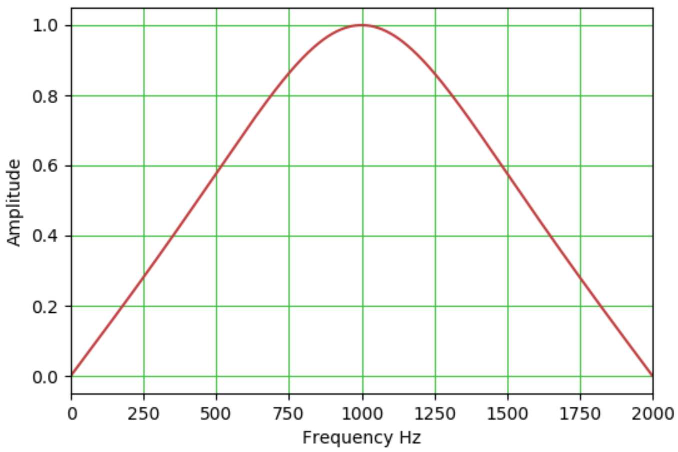
5.564.1 Low Pass Filter

Attenuates frequencies higher than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



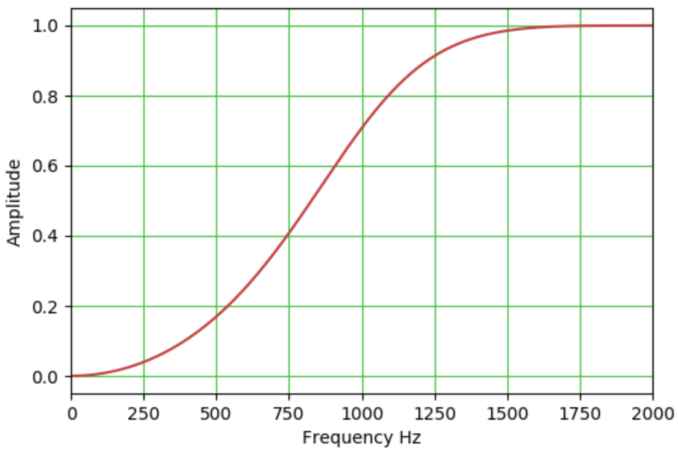
5.564.2 Band Pass Filter

Attenuates frequencies higher or lower than the center frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the center frequency is 1000 Hz



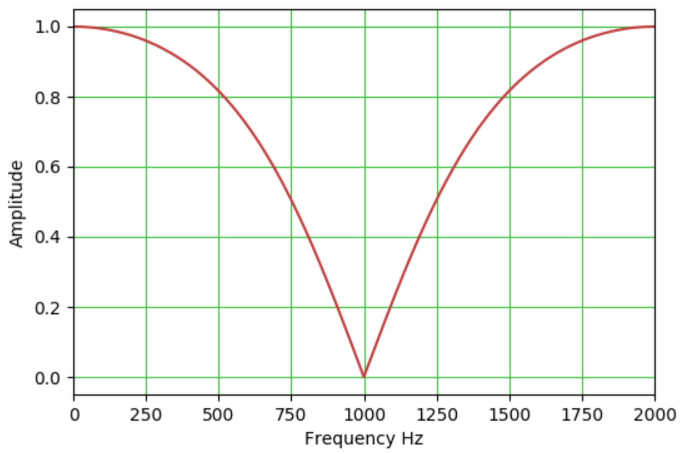
5.564.3 High Pass Filter

Attenuates frequencies lower than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



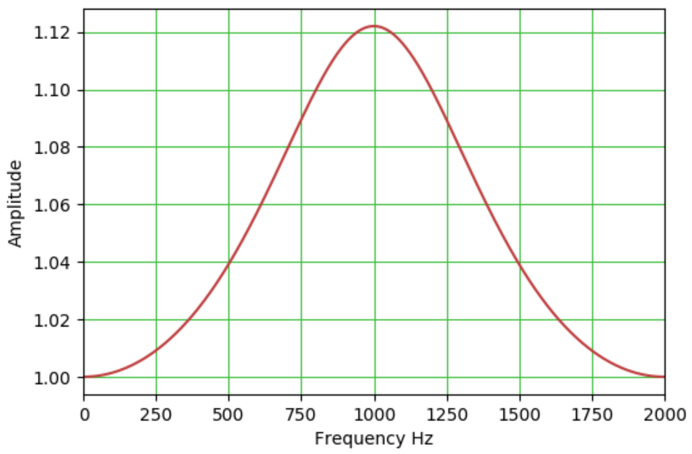
5.564.4 Notch Filter

Eliminates center frequency and attenuates its surroundings. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



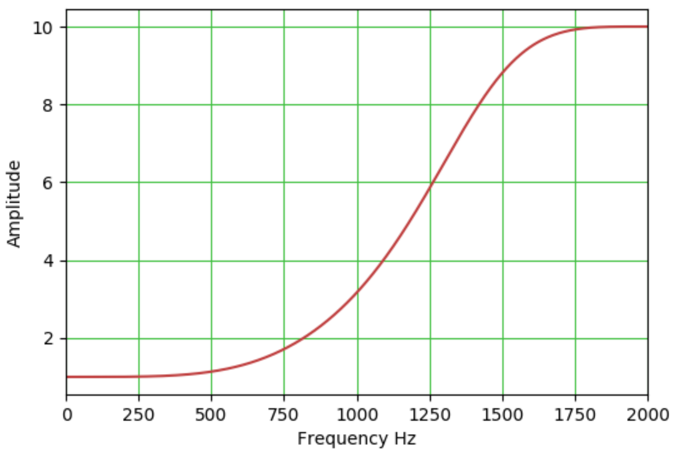
5.564.5 Peak Filter

Amplifies center frequency by a specific gain. The surrounding frequencies are also amplified. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



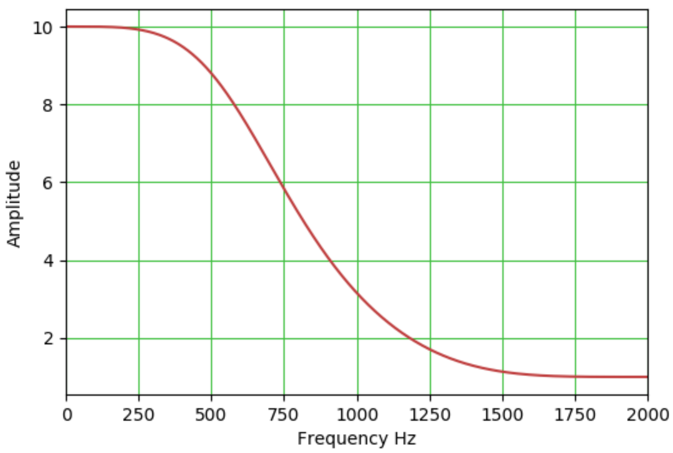
5.564.6 High Shelf Filter

Amplifies frequencies higher than the center frequency. In this example, the center frequency is 1000 Hz.



5.564.7 Low Shelf Filter

Amplifies frequencies lower than the center frequency. In this example, the center frequency is 1000 Hz.



5.565 0x2579 - Current feedback filter 2 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2579	0x00	Current feedback filter 2 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the current feedback filter 2. The meaning of filter frequency varies depending on the selected filter type.

Filter type	Frequency meaning
No filter	Nothing
Low pass filter	Cutoff frequency
High pass filter	Cutoff frequency
Band pass filter	Center frequency
Peak filter	Center frequency
Notch filter	Center frequency
Low shelf filter	Boost frequency
High shelf filter	Boost frequency

5.566 0x257A - Current feedback filter 2 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x257A	0x00	Current feedback filter 2 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the current feedback filter 2.

Filter type	Is it used?
No filter	Yes
Low pass filter	Yes
High pass filter	Yes
Band pass filter	Yes
Peak filter	Yes
Notch filter	Yes
Low shelf filter	No
High shelf filter	No

5.567 0x257B - Current feedback filter 2 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x257B	0x00	Current feedback filter 2 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the current feedback filter 2.

Filter type	Is it used?
No filter	No
Low pass filter	No
High pass filter	No
Band pass filter	No
Peak filter	Yes
Notch filter	No
Low shelf filter	Yes
High shelf filter	Yes

5.568 0x2580 - Current reference filter 1 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2580	0x00	Current reference filter 1 type	UINT16	RW	No	Yes	0 - 7	0	-

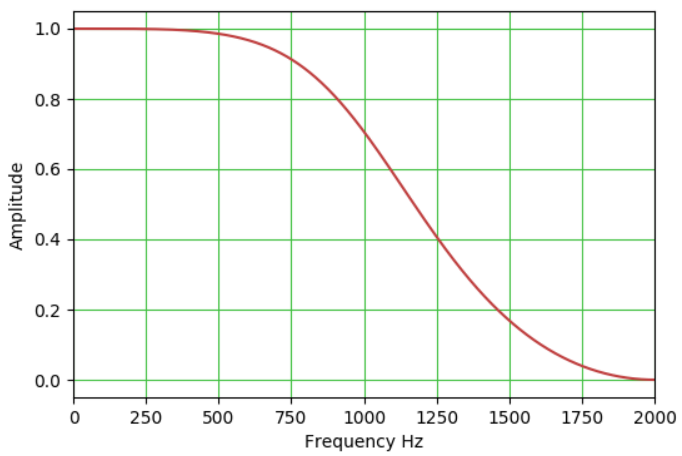
This register contains the filter type for the current reference filter 1.

There are 7 types of filter available.

Name	Value range
Filter type	0 - No filter 1 - Low pass 2 - High pass 3 - Band pass 4 - Peak 5 - Notch 6 - Low shelf 7 - High shelf

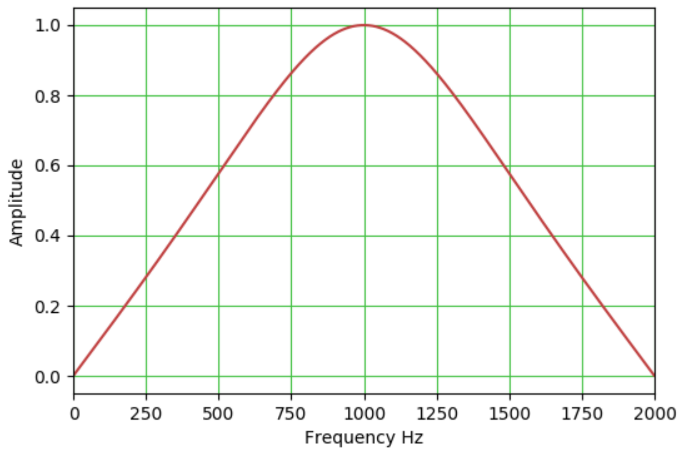
5.568.1 Low Pass Filter

Attenuates frequencies higher than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



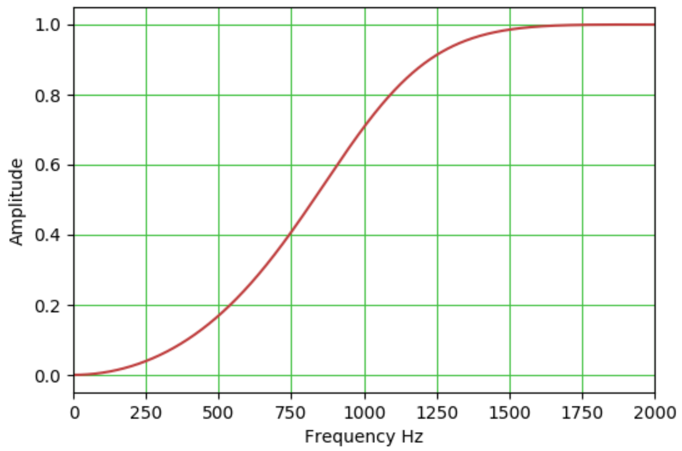
5.568.2 Band Pass Filter

Attenuates frequencies higher or lower than the center frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the center frequency is 1000 Hz



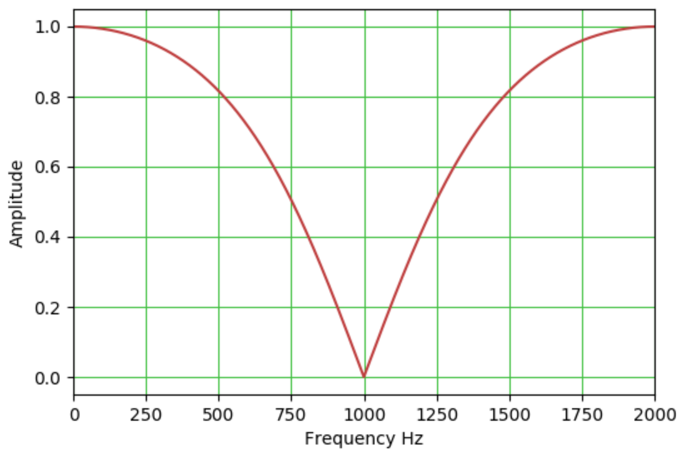
5.568.3 High Pass Filter

Attenuates frequencies lower than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



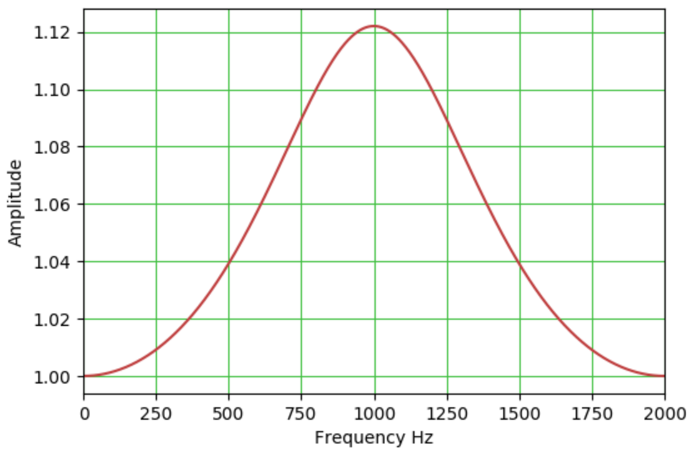
5.568.4 Notch Filter

Eliminates center frequency and attenuates its surroundings. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



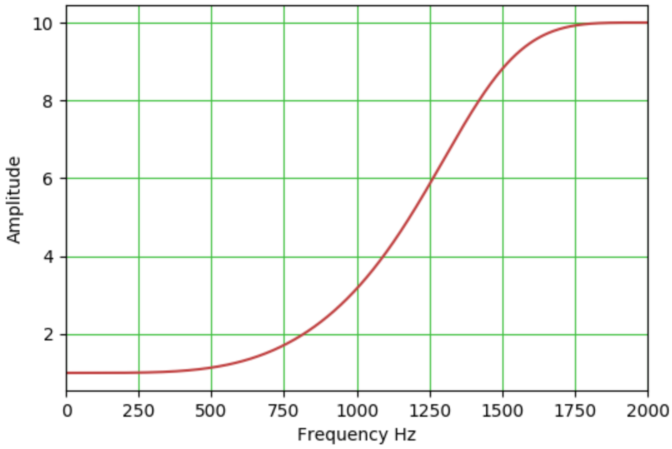
5.568.5 Peak Filter

Amplifies center frequency by a specific gain. The surrounding frequencies are also amplified. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



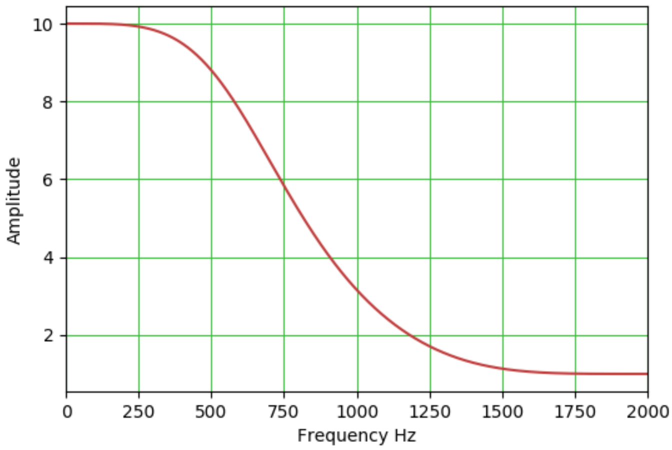
5.568.6 High Shelf Filter

Amplifies frequencies higher than the center frequency. In this example, the center frequency is 1000 Hz.



5.568.7 Low Shelf Filter

Amplifies frequencies lower than the center frequency. In this example, the center frequency is 1000 Hz.



5.569 0x2581 - Current reference filter 1 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2581	0x00	Current reference filter 1 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the current reference filter 1. The meaning of filter frequency varies depending on the selected filter type.

Filter type	Frequency meaning
No filter	Nothing
Low pass filter	Cutoff frequency
High pass filter	Cutoff frequency
Band pass filter	Center frequency
Peak filter	Center frequency
Notch filter	Center frequency
Low shelf filter	Boost frequency
High shelf filter	Boost frequency

5.570 0x2582 - Current reference filter 1 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2582	0x00	Current reference filter 1 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the current reference filter 1.

Filter type	Is it used?
No filter	Yes
Low pass filter	Yes
High pass filter	Yes
Band pass filter	Yes
Peak filter	Yes
Notch filter	Yes
Low shelf filter	No
High shelf filter	No

5.571 0x2583 - Current reference filter 1 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2583	0x00	Current reference filter 1 gain	FLOAT	RW	No	Yes	Data type	0.0	-

This register contains the filter gain for the current reference filter 1.

Filter type	Is it used?
No filter	No
Low pass filter	No
High pass filter	No
Band pass filter	No
Peak filter	Yes
Notch filter	No
Low shelf filter	Yes
High shelf filter	Yes

5.572 0x2588 - Current reference filter 2 type

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2588	0x00	Current reference filter 2 type	UINT16	RW	No	Yes	0 - 7	0	-

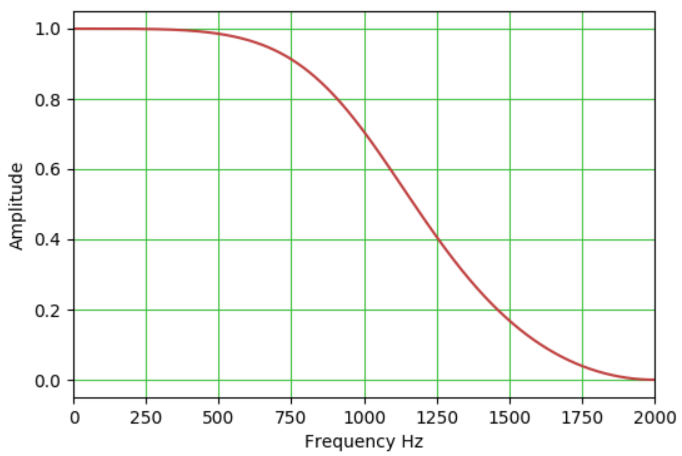
This register contains the filter type for the current reference filter 2.

There are 7 types of filter available.

Name	Value range
Filter type	0 - No filter 1 - Low pass 2 - High pass 3 - Band pass 4 - Peak 5 - Notch 6 - Low shelf 7 - High shelf

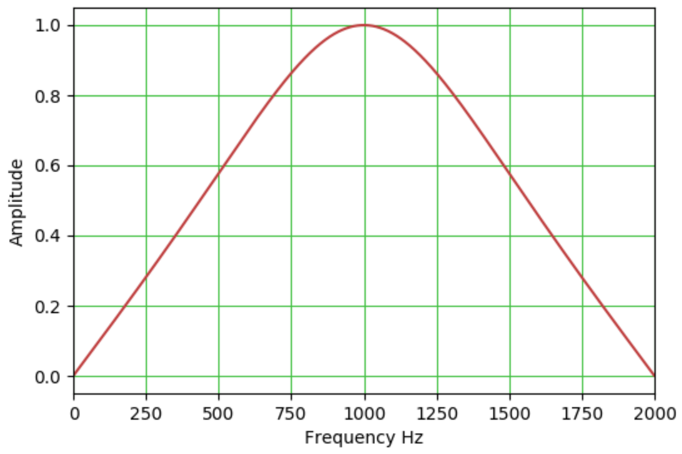
5.572.1 Low Pass Filter

Attenuates frequencies higher than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



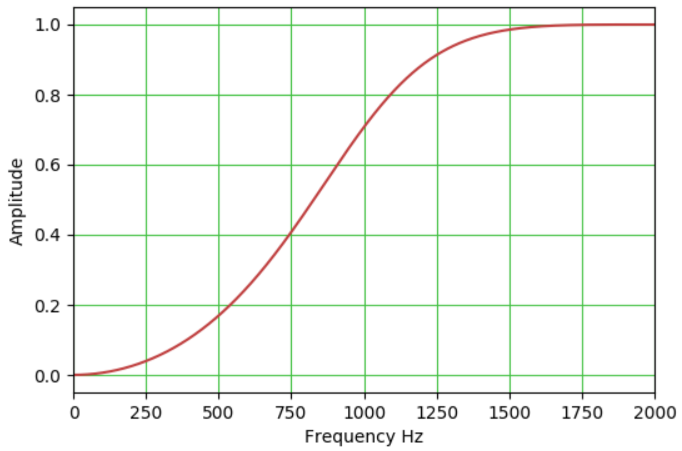
5.572.2 Band Pass Filter

Attenuates frequencies higher or lower than the center frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the center frequency is 1000 Hz



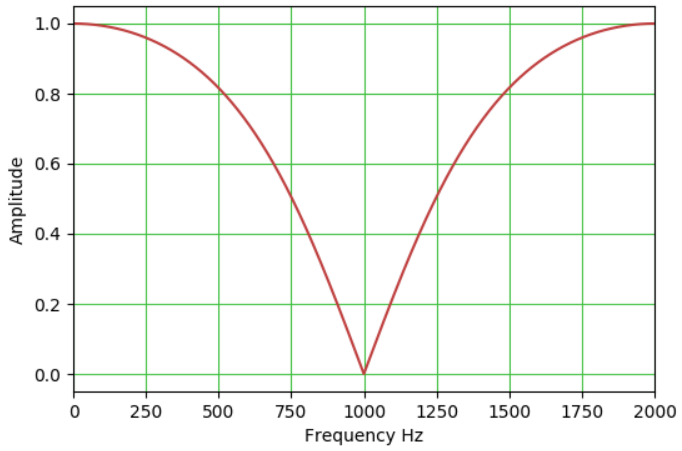
5.572.3 High Pass Filter

Attenuates frequencies lower than the cutoff frequency. The response of the filter can be dampened or made more aggressive (maybe causing resonance) by means of the quality factor. In this example, the cutoff frequency is 1000 Hz



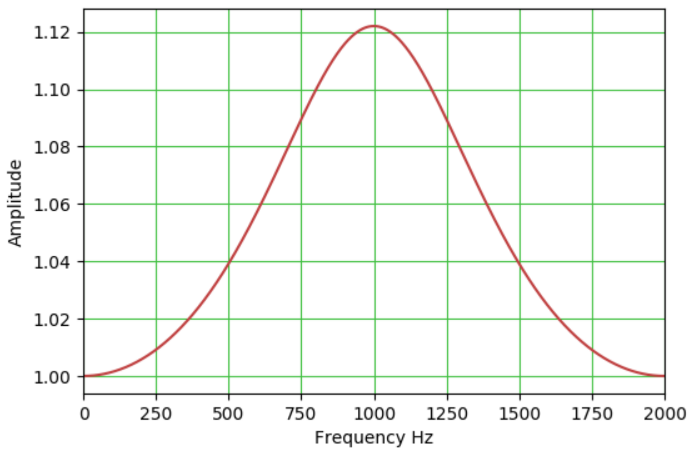
5.572.4 Notch Filter

Eliminates center frequency and attenuates its surroundings. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



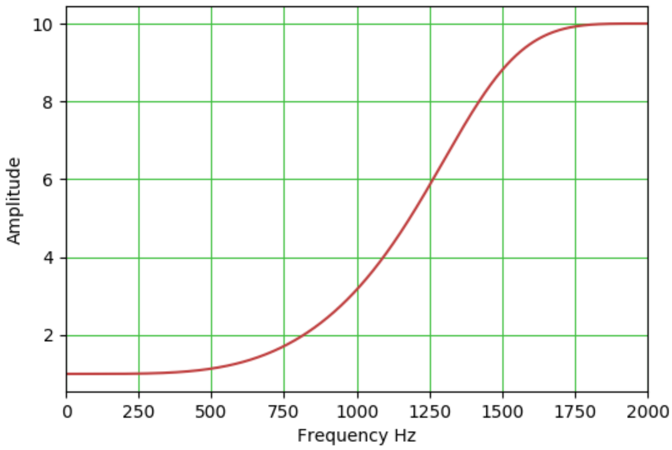
5.572.5 Peak Filter

Amplifies center frequency by a specific gain. The surrounding frequencies are also amplified. It can become sharper with a higher quality factor. In this example, the center frequency is 1000 Hz.



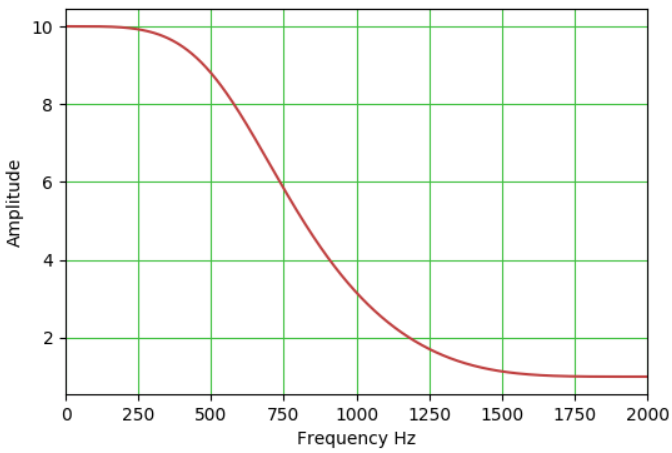
5.572.6 High Shelf Filter

Amplifies frequencies higher than the center frequency. In this example, the center frequency is 1000 Hz.



5.572.7 Low Shelf Filter

Amplifies frequencies lower than the center frequency. In this example, the center frequency is 1000 Hz.



5.573 0x2589 - Current reference filter 2 frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2589	0x00	Current reference filter 2 frequency	UINT32	RW	No	Yes	Data type	0	Hz

This register contains the filter frequency for the current reference filter 2. The meaning of filter frequency varies depending on the selected filter type.

Filter type	Frequency meaning
No filter	Nothing
Low pass filter	Cutoff frequency
High pass filter	Cutoff frequency
Band pass filter	Center frequency
Peak filter	Center frequency
Notch filter	Center frequency
Low shelf filter	Boost frequency
High shelf filter	Boost frequency

5.574 0x258A - Current reference filter 2 Q-factor

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x258A	0x00	Current reference filter 2 Q-factor	FLOAT	RW	No	Yes	Data type	0.7071	-

This register contains the filter Q-factor for the current reference filter 2.

Filter type	Is it used?
No filter	Yes
Low pass filter	Yes
High pass filter	Yes
Band pass filter	Yes
Peak filter	Yes
Notch filter	Yes
Low shelf filter	No
High shelf filter	No

5.575 0x258B - Current reference filter 2 gain

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x258B	0x00	Current reference filter 2 gain	FLOAT	RW	No	Yes	Data type	0.0	-

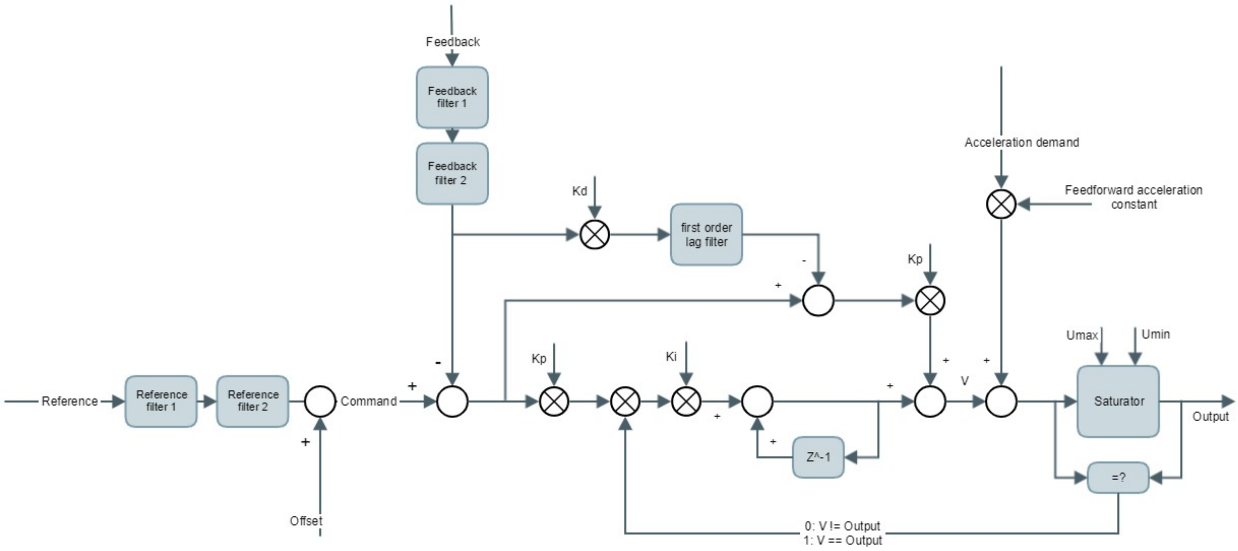
This register contains the filter gain for the current reference filter 2.

Filter type	Is it used?
No filter	No
Low pass filter	No
High pass filter	No
Band pass filter	No
Peak filter	Yes
Notch filter	No
Low shelf filter	Yes
High shelf filter	Yes

5.576 0x2590 - Velocity loop Kffa

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2590	0x00	Velocity loop Kffa	FLOAT	RW	No	Yes	Data type	0.0	-

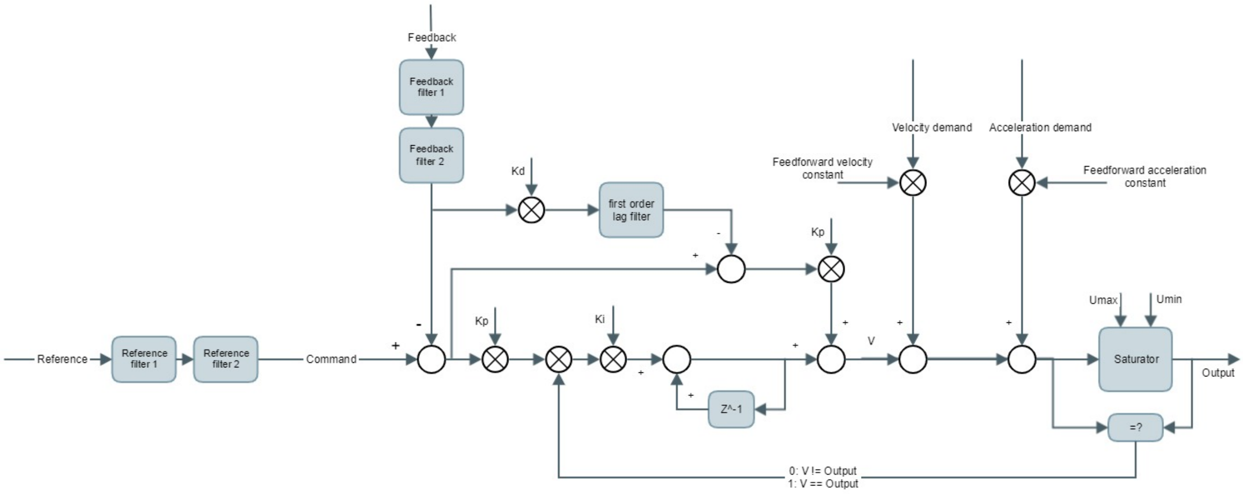
This parameter allows configuring the Kffa (feed-forward acceleration constant) of the PID controller used for velocity regulation.



5.577 0x2591 - Position loop Kffv

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2591	0x00	Position loop Kffv	FLOAT	RW	No	Yes	Data type	1.0	-

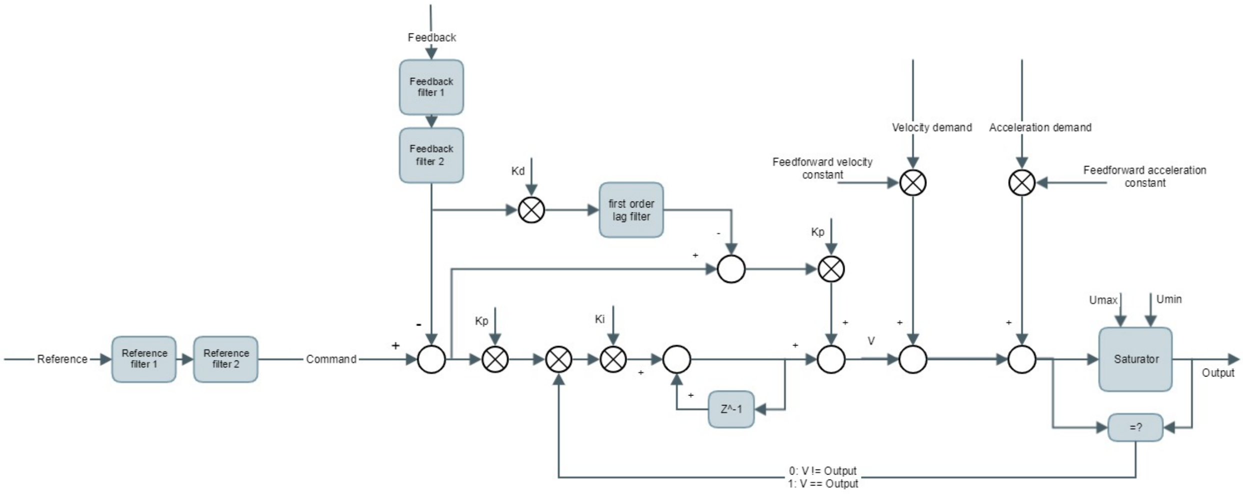
This parameter allows configuring the Kffv (feed-forward velocity constant) of the PID controller used for position regulation.



5.578 0x2592 - Position loop Kffa

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2592	0x00	Position loop Kffa	FLOAT	RW	No	Yes	Data type	1.0	rev/s / rev/s^2

This parameter allows configuring the Kffa (feed-forward acceleration constant) of the PID controller used for position regulation.



5.579 0x25FC - Map output 1

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x25FC	0x00	Map output 1	UINT16	RW	No	Yes	0 to 3	0	-

These parameters contains the attached drive event/state to the GPO 1.

The events or states are always binary. It means that the output will indicate if the event or state is active on drive. The available event / states are:

Value	Event	Description
0	*No event mapping*	Standard GPO operation. Its value is modified using the parameter digital outputs value.
1	*Operation enabled event*	GPO is set to "HIGH" level when the drive reaches the operation enable state of its state machine. Otherwise is set to "LOW".
2	*External shunt*	GPO controls the external shunt braking resistor.
3	*Health signal*	GPO indicates if the drive is ready for standard operation. It is set to "LOW" if a fault is detected and it is active. It is set to "HIGH" otherwise.

5.580 0x25FD - Map output 2

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x25FD	0x00	Map output 2	UINT16	RW	No	Yes	0 to 3	0	-

These parameters contains the attached drive event/state to the GPO 2.

The events or states are always binary. It means that the output will indicate if the event or state is active on drive. The available event / states are:

Value	Event	Description
0	*No event mapping*	Standard GPO operation. Its value is modified using the parameter digital outputs value.
1	*Operation enabled event*	GPO is set to "HIGH" level when the drive reaches the operation enable state of its state machine. Otherwise is set to "LOW".
2	*External shunt*	GPO controls the external shunt braking resistor.
3	*Health signal*	GPO indicates if the drive is ready for standard operation. It is set to "LOW" if a fault is detected and it is active. It is set to "HIGH" otherwise.

5.581 0x25FE - Map output 3

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x25FE	0x00	Map output 3	UINT16	RW	No	Yes	0 to 3	0	-

These parameters contains the attached drive event/state to the GPO 3.

The events or states are always binary. It means that the output will indicate if the event or state is active on drive. The available event / states are:

Value	Event	Description
0	*No event mapping*	Standard GPO operation. Its value is modified using the parameter digital outputs value.
1	*Operation enabled event*	GPO is set to "HIGH" level when the drive reaches the operation enable state of its state machine. Otherwise is set to "LOW".
2	*External shunt*	GPO controls the external shunt braking resistor.
3	*Health signal*	GPO indicates if the drive is ready for standard operation. It is set to "LOW" if a fault is detected and it is active. It is set to "HIGH" otherwise.

5.582 0x25FF - Map output 4

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x25FF	0x00	Map output 4	UINT16	RW	No	Yes	0 to 3	0	-

These parameters contains the attached drive event/state to the GPO 4.

The events or states are always binary. It means that the output will indicate if the event or state is active on drive. The available event / states are:

Value	Event	Description
0	*No event mapping*	Standard GPO operation. Its value is modified using the parameter digital outputs value.
1	*Operation enabled event*	GPO is set to "HIGH" level when the drive reaches the operation enable state of its state machine. Otherwise is set to "LOW".
2	*External shunt*	GPO controls the external shunt braking resistor.
3	*Health signal*	GPO indicates if the drive is ready for standard operation. It is set to "LOW" if a fault is detected and it is active. It is set to "HIGH" otherwise.

5.583 0x2600 - Digital inputs value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2600	0x00	Digital inputs value	UINT32	RO	Yes	No	Data type	0	-

The parameter provides access to the logical digital inputs state.

The binary representation of the previous parameters and its corresponding meaning is as follows:

Bit number	31	...	4	3	2	1	0
Description	*GPIX*			*GPI4*	*GPI3*	*GPI2*	*GPI1*

The bits are set to high ("1") when the input is logically active.

5.584 0x2601 - Digital outputs value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2601	0x00	Digital outputs value	UINT32	RO	Yes	No	Data type	0	-

The parameters provides the logic value of all digital outputs.

The binary representation of the previous parameters and its corresponding meaning is as follows:

Bit number	31	...	4	3	2	1	0
Description	*GPOX*			*GPO4*	*GPO3*	*GPO2*	*GPO1*

A logical "1" in the output value represents that the pin is active.

5.585 0x2602 - Digital outputs set value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2602	0x00	Digital outputs set value	UINT32	RW	Yes	No	Data type	0	-

The parameters sets the value of the digital outputs configured with standard functionality.

The binary representation of the previous parameters and its corresponding meaning is as follows:

Bit number	31	...	4	3	2	1	0
Description	*GPOX*			*GPO4*	*GPO3*	*GPO2*	*GPO1*

A logical "1" in the output value represents that the pin is active.

5.586 0x2603 - Digital outputs polarity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2603	0x00	Digital outputs polarity	UINT32	RW	No	Yes	Data type	0	-

The parameters sets the value of the digital outputs polarity.

Bit number	31	...	4	3	2	1	0
Description	*GPOX*			*GPO4*	*GPO3*	*GPO2*	*GPO1*

A "0" in each GPO bit represents that the GPO has standard polarity. A "1" in each GPO bit represents that the GPO has inverted polarity.

5.587 0x2604 - Digital inputs polarity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2604	0x00	Digital inputs polarity	UINT32	RW	No	Yes	Data type	0	-

The parameters sets the value of the digital inputs polarity.

Bit number	31	...	4	3	2	1	0
Description	*GPIX*			*GPI4*	*GPI3*	*GPI2*	*GPI1*

A "0" in each GPI bit represents that the GPI has standard polarity. A "1" in each GPI bit represents that the GPI has inverted polarity.

5.588 0x2608 - Positive switch limit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2608	0x00	Positive switch limit	UINT16	RW	No	Yes	0 to 4	0	-

These parameters contains the GPI attached to internal demand generator.

If the value is 0, it means that there isn't an attached GPI to the functionality, otherwise the value indicates what GPI is attached. When a GPI is mapped to this function and its value is "1" the movements to the direction where is attached are not allowed. That means that the internal generator will force the demand that don't allow to move the motor into that direction.

Examples

If a motor is moving into the positive direction and the positive switch limit is "1":

- In any of the position modes, the drive will generate a position demand equal to the actual position, so movement is not generated (the position is held).
- In any of the velocity modes, the drive will generate a velocity demand equal to 0 (the position is held).
- In any of the current modes, the drive will generate a current demand equal to 0 (the position is not held because torque is not applied).
- In voltage mode, the drive will generate a voltage demand equal to 0 (the position is not held because torque is not applied).

5.589 0x2609 - Negative switch limit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2609	0x00	Negative switch limit	UINT16	RW	No	Yes	0 to 4	0	-

These parameters contains the GPI attached to internal demand generator.

If the value is 0, it means that there isn't an attached GPI to the functionality, otherwise the value indicates what GPI is attached. When a GPI is mapped to this function and its value is "1" the movements to the direction where is attached are not allowed. That means that the internal generator will force the demand that don't allow to move the motor into that direction.

Examples

If a motor is moving into the negative direction and the negative switch limit is "1":

- In any of the position modes, the drive will generate a position demand equal to the actual position, so movement is not generated (the position is held).
- In any of the velocity modes, the drive will generate a velocity demand equal to 0 (the position is held).
- In any of the current modes, the drive will generate a current demand equal to 0 (the position is not held because torque is not applied).
- In voltage mode, the drive will generate a voltage demand equal to 0 (the position is not held because torque is not applied).

5.590 0x260A - Quick stop input

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x260A	0x00	Quick stop input	UINT16	RW	No	Yes	0 to 4	0	-

These parameters contains the GPI attached to quick stop triggered.

If the value is 0, it means that there isn't an attached GPI to the functionality, otherwise the value indicates what GPI is attached.

When a GPI is mapped to this function and its value is "1" a quick stop transition is executed if possible.

5.591 0x260B - Quick stop option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x260B	0x00	Quick stop option code	INT16	RW	No	Yes	Data type	5	-

This parameter indicates the reaction of the quick stop when it is called.

Value	Action
0	*Disable power stage*
1	*Slow down ramp and disable*
2	*Quick stop ramp and disable*
5	*Slow down ramp*
6	*Quick stop ramp*

Note

Slow down ramp uses deceleration defined in the profiler configuration, while Quick stop ramp uses the Quick stop deceleration.

Note

When using the option codes 1 and 2, for the quick stop to disable the power stage the velocity window and window times must be correctly configured so that the drive can detect a target reached situation.

5.592 0x260F - User I2T error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x260F	0x00	User I2T error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an I2T detection without active current control.

The value of this register determines the reaction of the drive when a fault is triggered:

Option Code	Severity	Reaction
0	Fault	*Disable power stage*
1	Warning	*Do nothing*
2	Fault	*Slow down ramp*
3	Fault	*Quick stop ramp*

Note

When using slow down ramp or quick stop ramp option codes, it is important to have the velocity loop, window and feedbacks configured, since after detecting that the motor has stopped, the power stage is disabled.

Further information in *Error management*.

5.593 0x2610 - Position feedback out of limits error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2610	0x00	Position feedback out of limits error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an position out of limits detection without active position control.

The value of this register determines the reaction of the drive when a fault is triggered:

Option Code	Severity	Reaction
0	Fault	*Disable power stage*
1	Warning	*Do nothing*
2	Fault	*Slow down ramp*
3	Fault	*Quick stop ramp*

Note

When using slow down ramp or quick stop ramp option codes, it is important to have the velocity loop, window and feedbacks configured, since after detecting that the motor has stopped, the power stage is disabled.

Further information in *Error management*.

5.594 0x2611 - Velocity feedback out of limits error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2611	0x00	Velocity feedback out of limits error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an velocity out of limits detection without active velocity control.

The value of this register determines the reaction of the drive when a fault is triggered:

Option Code	Severity	Reaction
0	Fault	*Disable power stage*
1	Warning	*Do nothing*
2	Fault	*Slow down ramp*
3	Fault	*Quick stop ramp*

Note

When using slow down ramp or quick stop ramp option codes, it is important to have the velocity loop, window and feedbacks configured, since after detecting that the motor has stopped, the power stage is disabled.

Further information in *Error management*.

5.595 0x2612 - Position following error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2612	0x00	Position following error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for a position following error detection.

The value of this register determines the reaction of the drive when a fault is triggered:

Option Code	Severity	Reaction
0	Fault	*Disable power stage*
1	Warning	*Do nothing*
2	Fault	*Slow down ramp*
3	Fault	*Quick stop ramp*

Note

When using slow down ramp or quick stop ramp option codes, it is important to have the velocity loop, window and feedbacks configured, since after detecting that the motor has stopped, the power stage is disabled.

Further information in *Error management*.

5.596 0x2613 - Power stage user over-temperature error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2613	0x00	Power stage user over-temperature error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an user over-temperature detection.

The value of this register determines the reaction of the drive when a fault is triggered:

Option Code	Severity	Reaction
0	Fault	*Disable power stage*
1	Warning	*Do nothing*
2	Fault	*Slow down ramp*
3	Fault	*Quick stop ramp*

Note

When using slow down ramp or quick stop ramp option codes, it is important to have the velocity loop, window and feedbacks configured, since after detecting that the motor has stopped, the power stage is disabled.

Further information in *Error management*.

5.597 0x2614 - Motor over-temperature error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2614	0x00	Motor over-temperature error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an motor over-temperature detection.

The value of this register determines the reaction of the drive when a fault is triggered:

Option Code	Severity	Reaction
0	Fault	*Disable power stage*
1	Warning	*Do nothing*
2	Fault	*Slow down ramp*
3	Fault	*Quick stop ramp*

Note

When using slow down ramp or quick stop ramp option codes, it is important to have the velocity loop, window and feedbacks configured, since after detecting that the motor has stopped, the power stage is disabled.

Further information in *Error management*.

5.598 0x2615 - Power stage user under-temperature error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2615	0x00	Power stage user under-temperature error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an user under-temperature detection.

The value of this register determines the reaction of the drive when a fault is triggered:

Option Code	Severity	Reaction
0	Fault	*Disable power stage*
1	Warning	*Do nothing*
2	Fault	*Slow down ramp*
3	Fault	*Quick stop ramp*

Note

When using slow down ramp or quick stop ramp option codes, it is important to have the velocity loop, window and feedbacks configured, since after detecting that the motor has stopped, the power stage is disabled.

Further information in *Error management*.

5.599 0x2616 - Power stage user over voltage error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2616	0x00	Power stage user over voltage error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an user over voltage detection.

The value of this register determines the reaction of the drive when a fault is triggered:

Option Code	Severity	Reaction
0	Fault	*Disable power stage*
1	Warning	*Do nothing*
2	Fault	*Slow down ramp*
3	Fault	*Quick stop ramp*

Note

When using slow down ramp or quick stop ramp option codes, it is important to have the velocity loop, window and feedbacks configured, since after detecting that the motor has stopped, the power stage is disabled.

Further information in *Error management*.

5.600 0x2617 - Power stage user under voltage error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2617	0x00	Power stage user under voltage error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an user under voltage detection.

The value of this register determines the reaction of the drive when a fault is triggered:

Option Code	Severity	Reaction
0	Fault	*Disable power stage*
1	Warning	*Do nothing*
2	Fault	*Slow down ramp*
3	Fault	*Quick stop ramp*

Note

When using slow down ramp or quick stop ramp option codes, it is important to have the velocity loop, window and feedbacks configured, since after detecting that the motor has stopped, the power stage is disabled.

Further information in *Error management*.

5.601 0x2618 - External fault option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2618	0x00	External fault option code	UINT16	RW	No	Yes	0 - 3	1	-

This register set the drive fault reaction for an external fault generation.

The value of this register determines the reaction of the drive when a fault is triggered:

Option Code	Severity	Reaction
0	Fault	*Disable power stage*
1	Warning	*Do nothing*
2	Fault	*Slow down ramp*
3	Fault	*Quick stop ramp*

Note

When using slow down ramp or quick stop ramp option codes, it is important to have the velocity loop, window and feedbacks configured, since after detecting that the motor has stopped, the power stage is disabled.

Further information in *Error management*.

5.602 0x2619 - Halls sequence error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2619	0x00	Halls sequence error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for a hall sequence error detection.

The value of this register determines the reaction of the drive when a fault is triggered:

Option Code	Severity	Reaction
0	Fault	*Disable power stage*
1	Warning	*Do nothing*
2	Fault	*Slow down ramp*
3	Fault	*Quick stop ramp*

Note

When using slow down ramp or quick stop ramp option codes, it is important to have the velocity loop, window and feedbacks configured, since after detecting that the motor has stopped, the power stage is disabled.

Further information in *Error management*.

5.603 0x261A - Incremental encoder against halls error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x261A	0x00	Incremental encoder against halls error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for a run away detection of incremental encoder against digital halls.

The value of this register determines the reaction of the drive when a fault is triggered:

Option Code	Severity	Reaction
0	Fault	*Disable power stage*
1	Warning	*Do nothing*
2	Fault	*Slow down ramp*
3	Fault	*Quick stop ramp*

Note

When using slow down ramp or quick stop ramp option codes, it is important to have the velocity loop, window and feedbacks configured, since after detecting that the motor has stopped, the power stage is disabled.

Further information in *Error management*.

5.604 0x261B - Over current without current control error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x261B	0x00	Over current without current control error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for an over-current detection without an active current control loop.

The value of this register determines the reaction of the drive when a fault is triggered:

Option Code	Severity	Reaction
0	Fault	*Disable power stage*
1	Warning	*Do nothing*
2	Fault	*Slow down ramp*
3	Fault	*Quick stop ramp*

Note

When using slow down ramp or quick stop ramp option codes, it is important to have the velocity loop, window and feedbacks configured, since after detecting that the motor has stopped, the power stage is disabled.

Further information in *Error management*.

5.605 0x261D - Velocity following error option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x261D	0x00	Velocity following error option code	UINT16	RW	No	Yes	0 - 3	0	-

This register set the drive fault reaction for a velocity following error detection.

The value of this register determines the reaction of the drive when a fault is triggered:

Option Code	Severity	Reaction
0	Fault	*Disable power stage*
1	Warning	*Do nothing*
2	Fault	*Slow down ramp*
3	Fault	*Quick stop ramp*

Note

When using slow down ramp or quick stop ramp option codes, it is important to have the velocity loop, window and feedbacks configured, since after detecting that the motor has stopped, the power stage is disabled.

Further information in *Error management*.

5.606 0x2621 - Halt input

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2621	0x00	Halt input	UINT16	RW	No	Yes	0 to 4	0	-

These parameters contains the GPI attached to halt trigger.

If the value is 0, it means that there isn't an attached GPI to the functionality, otherwise the value indicates what GPI is attached.

When a GPI is mapped to this function and its value is "1" a halt command is executed if possible.

5.607 0x262F - Over-voltage sensitivity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x262F	0x00	User over voltage level	UINT16	RW	No	Yes	0 to 2	0	V

This register sets how fast an over-voltage is detected.

By default the over-voltage is detected as fast as the bus voltage readings overcomes the manufacturer defined over-voltage threshold. In some applications where expected fast spikes appears on bus voltage, the fault is triggered undesirably. In those cases the sensitivity of the over-voltage threshold can be decreased:

Value	Description
0	*Fast*
1	*Medium*
2	*Slow*

The detection time for each level is product dependent. However, the worst detection level (slow) is always faster than the internal drive control loops (< 20 µs approx).

5.608 0x2630 - User over voltage level

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2630	0x00	User over voltage level	FLOAT	RW	No	Yes	Data type	52.0	V

This register sets the user over voltage threshold for error generation.

The drive reaction to the detection of this threshold is user configurable by register *Power stage user over voltage error option code*.

5.609 0x2631 - User under voltage level

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2631	0x00	User under voltage level	FLOAT	RW	No	Yes	Data type	10.0	V

This register sets the user under voltage threshold for error generation.

The drive reaction to the detection of this threshold is user configurable by register *Power stage user under voltage error option code*.

5.610 0x2632 - User over temperature level

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2632	0x00	User over temperature level	FLOAT	RW	No	Yes	Data type	110.0	V

This register sets the user over temperature threshold for error generation.

The drive reaction to the detection of this threshold is user configurable by register *Power stage user over-temperature error option code*.

5.611 0x2633 - User under temperature level

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2633	0x00	User under temperature level	FLOAT	RW	No	Yes	Data type	-40.0	V

This register sets the user under temperature threshold for error generation.

The drive reaction to the detection of this threshold is user configurable by register *Power stage user under-temperature error option code*.

5.612 0x2641 - Synchronization signal configuration

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2641	0x00	Sync. signal configuration	UINT16	RW	No	No	0 - 3	0	-

Indicates the number of synchronization signals generated by the MCBus protocol.

This register allows selecting the desired synchronization signal configuration options, which are the following:

Value	Standard operation modes
0	*Disable*
1	*Only Sync 0*
2	*Only Sync 1*
3	*Sync 0 and Sync 1*

5.613 0x2643 - Synchronization signal frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2643	0x00	Sync. signal frequency	UINT32	RW	No	YES	Data type	1000	Hz

The frequency at which the synchronization signal is being generated. It should be an exact multiple of the PWM frequency selected.

5.614 0x2644 - Synchronization signal PLL filter cutoff frequency

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2644	0x00	Sync. signal PLL filter cutoff frequency	UINT32	RW	No	YES	Data type	100	Hz

The cutoff frequency of the synchronization signal PLL filter.

5.615 0x2645 - Synchronization signal PLL phase

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2645	0x00	Sync. signal PLL phase	FLOAT	RW	No	YES	Data type	0.0	-

Configures phase difference between the synchronization signal and the generated PWM.

5.616 0x2646 - Synchronization signal PLL Kp

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x2646	0x00	Sync. signal PLL Kp	FLOAT	RW	No	YES	Data type	0.01	-

Configures proportional constant for phase correction in PLL.

5.617 0x264D - Error total number

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x264D	0x00	Error total number	UINT16	RO	No	No	Data type	0	-

This register contains the total number of errors detected since power up.

5.618 0x264E - Error list index request

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x264E	0x00	Error list index request	UINT16	RO	No	No	0 to 32	0	-

This register indicates the position of an error inside the error queue that will be displayed in the *Error list requested code*.

5.619 0x264F - Error list requested code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x264F	0x00	Error list requested code	INT32	RO	No	No	Data type	0	-

This register contains the error code of the *Error list index request* position inside the error queue.

5.620 0x26DB - Store all

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x26DB	0x00	Store all	UINT32	RW	No	No	Data type	-	-

This register allows to store the controller parameters into the non-volatile memory.

In order to avoid undesired storing process, this register is protected with a password:

MSB			LSB
e	v	a	s
0x65	0x76	0x61	0x73

Only after receiving this **0x65766173** password the drive stores its parameters.

⚠ The store process might request few seconds where others registers cannot be accessed. The drive will return an error if a write attempt is detected.

5.621 0x26DC - Restore all

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x26DC	0x00	Restore all	UINT32	RW	No	No	Data type	-	-

This register allows to resstore the controller default parameters.

In order to avoid undesired access, this register is protected with a password:

MSB			LSB
d	a	o	l
0x64	0x61	0x6F	6C

Only after receiving this **0x64616F6C** password the drive restores its parameters.

⚠ Parameters are not restored immediately, a power cycle is required.

5.622 0x26E0 - Vendor ID

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x26E0	0x00	Vendor ID	UINT32	RO	No	No	Data type	0x0000029C	-

This object indentifies the vendor of the product.

5.623 0x26E1 - Product code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x26E1	0x00	Product code	UINT32	RO	No	No	Data type	0x02C30001	-

This object indentifies the product code of the drive.

5.624 0x26E2 - Revision number

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x26E2	0x00	Revision number	UINT32	RO	No	No	Data type	-	-

This object indicates the revision number of the firmware version on the drive.

5.625 0x26E4 - Software version

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x26E4	0x00	Software version	STRING	RO	No	No	-	-	-

This object indicates the firmware version on the drive.

5.626 0x26E5 - Ingenia url

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x26E5	0x00	Ingenia url	STRING	RO	No	No	-	http://www.ingeniamc.com	-

This object indicates the Ingenia website.

5.627 0x26E6 - Serial number

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x26E6	0x00	Serial number	UINT32	RO	No	No	Data type	-	-

This object indicates the unique serial number id of the device.

5.628 0x6040 - Control Word

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6040	0x00	Control Word	UINT16	RW	Yes	No	UINT16	0x0000	-

The controlword is used to:

- Check controller status.
- Check parameters related to operation modes.

Data description:

The binary representation of the object value and its corresponding meaning is as follows:

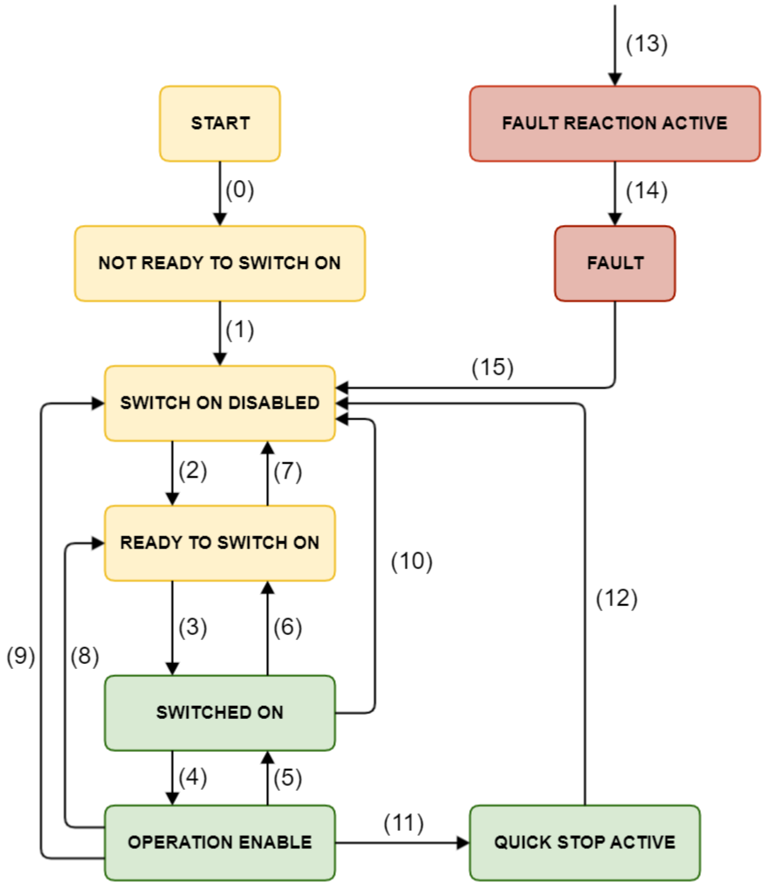
Bit number	15	...	9	8	7	6	5	4	3	2	1	0
	Reserved			*Halt*	*Fault reset*	*Mode specific*			*Enable operation*	*Quick stop*	*Enable voltage*	*Switch on*

Device control commands are generated by a combination of controlword bits.

Command patterns are shown below:

Command	Bit of the *controlword*				
	Fault reset	Enable operation	Quick stop	Enable voltage	Switch on
Shutdown	0	X	1	1	0
Switch on	0	0	1	1	1
Switch on + enable operation	0	1	1	1	1
Disable voltage	0	x	x	0	x
Quick stop	0	x	0	1	x
Disable operation	0	0	1	1	1
Enable operation	0	1	1	1	1
Fault reset	0 to 1 (rising edge)	x	x	x	x

Bits marked with an '"x" are irrelevant.



ⓘ Note that Fault reset command will be executed only in a rising edge transition.

If the halt bit is activated (writing a 1) the movement will be stopped using Quick stop deceleration. After releasing the halt bit the system will maintain the position or velocity but it will not continue the previous movement.

When working with BLAC motors with forced alignment method for initial angle determination, the alignment process will be executed when executing the Enable operation command for first time.

ⓘ Note that the Quick stop bit is activated at a low level.

Halt bit works in the following way:

Halt	Description
1	*In operation enabled state, the active movement will decelerate to 0 velocity as long as the Halt option code is not set to "do nothing". New absolute set-points performed while this bit is active will be taken into account after this bit is set to 0, as long as no operation mode change has happened.*
0	*The motor can run normally. If Halt bit is set to 0 after being set to 1, a new set-point latch may be necessary.*

5.628.1 Specific mode bits

The control word includes 3 mode-specific bits that change their meaning in function of the mode of operation.

5.628.1.1 Control word in homing mode

The binary representation of the specific control word bits and its meaning is as follows:

Bit number:	15	...	9	8	7	6	5	4	3	...	0
	-			-	-	*Reserved*		*Homing operation start*	-		

The action taken is described below, depending on the value of each bit:

Name	Value	Description
Homing operation start	0	*Do not start homing procedure*
	1	*Start or continue homing procedure*

5.628.1.2 Control word in profile position mode

The binary representation of the control word is as follows:

Bit number:	15	...	9	8	7	6	5	4	3	...	0
	-			-	-	*Abs / rel*	*Change set immediately*	*New set-point*	-		

If no positioning is in progress, the rising edge of bit 4 will start the positioning of the axis. In case a positioning is in progress, the definitions given in the following table shall be used.

Change set immediately	New set-point	Description
0	0 → 1	*Actual positioning will be completed (target reached) before the next one gets started (Set of set-points mode)*
1	0 → 1	*Next positioning shall be started immediately interrupting the actual one.*

Next table defines the values for bit 6 and 8 of the control word.

Name	Value	Description
Abs / rel	0	*Target position is an absolute value.*
	1	*Target position is a relative value.* *Relative option is configured by 0x60F2 - Positioning option code.*

5.629 0x6041 - Status Word

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6041	0x00	Status Word	UINT16	RO	Yes	No	UINT16	-	-

The statusword is used to:

- Find out the current controller status.
- Find out the operation mode status.

Data description:

The following use is given to each statusword bit:

Bit	Description
0	*Ready to switch on*
1	*Switched on*
2	*Operation enabled*
3	*Fault*
4	*Voltage enabled*
5	*Quick stop*
6	*Switch on disabled*
7	*Warning*
8	*Reserved*
9	*Remote*
10	*Target reached*
11	*Internal limit active*
12-13	*Operation mode specific*
14	*Initial angle determination process finished*
15	*Reserved*

Bits 0-3, 5 and 6 indicate the device status.

Bit 11 indicates if an internal drive limitation in motion is being applied. This limit implies that the drive is taking control of the motor in, for example, limiting movements in one direction when a switch limit is pressed. Internal limit can be activated by Stop manager, but also in Velocity mode when target velocity is out of defined limits.

Bit 14 indicates if the initial angle determination process necessary for BLAC has been completed correctly.

The connection between status and value in these bits is shown below.

Value (binary)	Status
xxxx xxxx x0xx 0000	*Not ready to switch on*
xxxx xxxx x1xx 0000	*Switch on disabled*
xxxx xxxx x01x 0001	*Ready to switch on*
xxxx xxxx x01x 0011	*Switched on*
xxxx xxxx x01x 0111	*Operation enabled*
xxxx xxxx x00x 0111	*Quick stop active*
xxxx xxxx x0xx 1111	*Fault reaction active*
xxxx xxxx x0xx 1000	*Fault*

ⓘ Note that the Quick stop bit is activated at a low level.

5.629.1 Specific mode bits

The control word includes 3 mode-specific bits that change their meaning in function of the mode of operation.

5.629.1.1 Status word in homing mode

The binary representation of the register value and its meaning is as follows:

Bit number:	15	14	13	12	11	10	9	...	0
	-		*Homing error*	*Homing attained*	-	*Target reached*	-		

The meaning of each bit is described below, depending on its value:

Homing error	Homing attained	Target reached	Description
0	0	0	*Homing procedure is in progress*
0	0	1	*Homing procedure is interrupted or not started*
0	1	0	*Homing is attained but target is not reached*
0	1	1	*Homing mode carried out successfully*
1	0	0	*Homing error occurred;* *Homing mode carried out not successfully;* *Velocity is not zero*

Homing error	Homing attained	Target reached	Description
1	0	1	*Homing error occurred; Homing mode carried out not successfully; Velocity is zero*
1	1	x	*Reserved*

5.629.1.2 Status word in cyclic synchronous torque, cyclic synchronous velocity and cyclic synchronous position modes

The binary representation of the register value and its corresponding meaning is as follows:

Bit number:	15	14	13	12	11	10	9	...	0
	-		*Following error*	*Drive follows the command value*	-	-	-		

The meaning of each bit is described below, depending on its value:

Name	Value	Description
Drive follows the command value	0	*The drive does not follow the target value*
	1	*The drive follow the target value*
Following error	0	*No following error*
	1	*Following error*

5.629.1.3 Status word in profile velocity mode

The binary representation of the register value and its corresponding meaning is as follows:

Bit number:	15	14	13	12	11	10	9	...	0
	-		-	*Speed*	-	*Target reached*	-		

The meaning of each bit is described below, depending on its value:

Name	Value	Description
Target reached	0	*Target velocity not reached*
	1	*Target velocity reached*
Speed	0	*Speed is not equal 0*
	1	*Speed is equal 0 (motor speed is considered to be zero when it is below velocity threshold value)*

5.629.1.4 Statusword in profile position mode

The binary representation of the register value and its corresponding meaning is as follows:

Bit number:	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**...**	**0**
	-		*Following error*	*Set-point ack.*	-	*Target reached*	-		

The meaning of each bit is described below, depending on its value:

Name	**Value**	**Description**
Target reached	0	*Target position not reached*
	1	*Target position reached*
Set-point acknowledge	0	*Trajectory generator has not assumed the positioning values*
	1	*Trajectory generator has assumed the positioning values*
Following error	0	*No following error*
	1	*Following error*

5.630 0x605A - Quick stop option code

This object indicates what action is performed when the quick stop function is executed.

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x605A	0x00	Quick stop option code	INT16	RW	No	Yes	INT16	6	-

Data description:
The register value has the following meaning:

Value	Quick stop option
0	*Disable power stage*
1	*Slow down ramp and disable*
2	*Quick stop ramp and disable*
5	*Slow down ramp*
6	*Quick stop ramp*

Different values than the specified are reserved and should not be used.

> **Note**
>
> Slow down ramp uses deceleration defined in the profiler configuration, while Quick stop ramp uses the Quick stop deceleration.

> **Note**
>
> When using the option codes 1 and 2, for the quick stop to disable the power stage the velocity window and window times must be correctly configured so that the drive can detect a target reached situation

5.631 0x605D - Halt option code

This object indicates what action is performed when the quick stop function is executed.

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x605D	0x00	Halt option code	INT16	RW	No	Yes	Data type	0	-

Data description

Value	Action
0	*Reserved*
1	*Slow down ramp*
2	*Quick stop ramp*

Note

Slow down ramp uses deceleration defined in the profiler configuration, while Quick stop ramp uses the Quick stop deceleration.

Warning

In order to use slow down ramp or quick stop ramp as halt bit reactions, the velocity control loop, feedback and profiler **must** be properly configured.

5.632 0x6060 - Operation mode

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6060	0x00	Operation mode	INT8	RW	Yes	Yes	INT8	1	-

This register modifies the current operation mode.

Data description:
The register value has the following meaning:

Value	Modes of operation
-4	*Current amplifier*
-3	*Cyclic sync current mode*
-2	*Current mode*
-1	*Voltage mode*
1	*Profile position mode*
3	*Profile velocity mode*
6	*Homing mode*
8	*Cyclic sync position mode*
9	*Cyclic sync velocity mode*
10	*Cyclic sync torque mode*

Different values than the specified are reserved and should not be used.

ⓘ For further information about the modes of operation, see *Operation* section.

5.633 0x6061- Operation mode display

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6061	0x00	Operation mode display	INT8	RO	Yes	No	INT8	-	-

This object provides the actual operation mode.

Data description:
The register value has the following meaning:

Value	Modes of operation
-4	*Current amplifier*
-3	*Cyclic sync current mode*
-2	*Current mode*
-1	*Voltage mode*
1	*Profile position mode*
3	*Profile velocity mode*
6	*Homing mode*
8	*Cyclic sync position mode*
9	*Cyclic sync velocity mode*
10	*Cyclic sync torque mode*

Different values than the specified are reserved and should not be used.

5.634 0x6064 - Actual position

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6064	0x00	Actual position	INT32	RO	Yes	No	INT32	-	encoder counts

This object contains the actual position calculated using the position feedback.

5.635 0x6065 - Position following error window

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6065	0x00	Position following error window	UINT32	RW	Yes	Yes	UINT32	100	encoder counts

This object indicates the configured range of tolerated position values symmetrically to the position demand value.

If the position actual value is out of the following error window for a Following error time out time, a following error occurs.

When the error condition is detected, the *Following error* bit (bit number 13) of the status word will be set. A following error may occur when a drive is blocked, when an unreachable profile velocity occurs, or when using wrong closed-loop coefficients.

Gliffy Macro Error

You do not have permission to view this diagram.

5.636 0x6066 - Position following error timeout

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6066	0x00	Position following error timeout	UINT16	RW	Yes	Yes	UINT16	10	milliseconds

This object indicates the minimum time that actual position must be out of following error window in order to generate an error.

When the error condition is detected, the *Following error* bit (bit number 13) of the statusword will be set.

Gliffy Macro Error

You do not have permission to view this diagram.

5.637 0x606C - Actual velocity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x606C	0x00	Actual velocity	INT32	RO	Yes	No	INT32	-	mrev/s

This object contains the actual velocity calculated using the velocity feedback.

5.638 0x6071 - Target torque

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6071	0x00	Target torque	INT16	RW	Yes	No	INT16	0	‰ rated torque

This object indicates the configured input value for the torque controller in profile torque mode.

5.639 0x6073 - Max. current

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6073	0x00	Max. current	UINT16	RW	Yes	Yes	UINT16	1000	‰ rated current

This object indicates the configured maximum permissible current creating torque in the motor.

5.640 0x6075 - Motor rated current

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6075	0x00	Motor rated current	UINT32	RW	Yes	Yes	UINT32	10000	mA

Defines maximum continuous current value of the actuator.

5.641 0x6077 - Torque actual value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6077	0x00	Torque actual value	INT16	RO	Yes	No	INT16	0	‰ rated torque

This object provides the actual value of the motor. It corresponds to the instantaneous torque in the motor.

> ⓘ Torque is estimated based on current readings and applying a torque constant configured by the user.

5.642 0x6078 - Current actual value

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6078	0x00	Current actual value	INT16	RO	Yes	No	INT16	0	‰ rated current

This object provides the actual current value of the motor. It corresponds to the instantaneous current in the motor.

5.643 0x607A - Position set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x607A	0x00	Position set-point	INT32	RW	Yes	No	INT32	0	encoder counts

This register is used to command the target values for position input.

The movement is performed using current movement parameters (velocity, acceleration, deceleration, profile type, etc.) when using Network as command source.

The target position will be interpreted as absolute or relative, depending on the controlword's abs/rel flag.

5.644 0x607B - Position range limit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x607B	0x01	Min position range limit	INT32	RW	Yes	Yes	INT32	0	encoder counts
0x607B	0x02	Max position range limit	INT32	RW	Yes	Yes	INT32	0	encoder counts

This register indicates the max and min position range limits. On reaching or exceeding these limits, the position set-point and position actual wrap automatically to the other end of the range. This function is disabled if both subindex are set to 0.

To disable the position range limits, the min position range limit and max position range limit shall be set to 0.

If software position limits and position range limits are enabled, the more restricted is applied. Software position limits are chosen in case of conflict:

5.645 0x607C - Homing offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x607C	0x00	Homing offset	INT32	RW	No	Yes	INT32	0	encoder counts

This object indicates the configured difference between the zero position for the application and the machine home position, as found during the homing process.

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.

A negative value indicates opposite direction

Example

If the desired 0 position is located 2000 counts to the positive direction when the homing is done, the homing configuration needed is:

Homing mode → X

Homing offset → 2000

Once the actuator finish the homing procedure at the homing location, the actual position value will be 2000.

5.646 0x607D - Software position limit

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x607D	0x01	Min position	INT32	RW	Yes	Yes	INT32	0	encoder counts
0x607D	0x02	Max position	INT32	RW	Yes	Yes	INT32	0	encoder counts

It contains two parameters, a minimum position limit and a maximum position limit. These parameters define the absolute position limits for the target and current position.

To disable the software position limits, the min position limit and max position limit shall be set to 0.

If software position limits and position range limits are enabled, the more restricted is applied. Software position limits are chosen in case of conflict:

5.647 0x6081 - Profile velocity

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6081	0x00	Profile velocity	UINT32	RW	Yes	Yes	UINT32	20000	mrev / s

This object indicates the configured velocity normally attained at the end of the acceleration ramp during a profiled motion. It is valid for both directions of motion.

If this velocity is higher than Max motor speed or than Max profile velocity it will be restricted by the profiler.

5.648 0x6083 - Profile acceleration

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6083	0x00	Profile acceleration	UINT32	RW	Yes	Yes	UINT32	20000	mrev / s^2

This object indicates the configured acceleration used by the profiler. If this acceleration is higher than Max acceleration it will be restricted by the profiler.

5.649 0x6084 - Profile deceleration

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6084	0x00	Profile deceleration	UINT32	RW	Yes	Yes	UINT32	20000	mrev / s^2

This object indicates the configured deceleration. If this deceleration is higher than Max deceleration it will be restricted by the profiler.

5.650 0x6098 - Homing method

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6098	0x00	Homing method	INT8	RW	No	Yes	INT8	37	-

This object is used to select the homing method to be used among the homing methods supported.

Data description:

Object values are interpreted as follows:

Value	Homing method
-128 to -1	*Reserved*
0	*No homing operation*
1	*Homing on the negative limit switch and index pulse*
2	*Homing on the positive limit switch and index pulse*
17	*Homing on the negative limit switch*
18	*Homing on the positive limit switch*
33	*Homing on negative index pulse*
34	*Homing on positive index pulse*
37	*Homing on current position*

Diagram interpretation

In the following figures, an encircled number indicates code selection for the homing position. Direction of movement is also indicated with an arrow. In all the diagrams, the encoder count increases as the axis is displaced to the right, in other words, the leftmost postition is the minimum position, and the rightmost position is the maximum position.

Whenever two or more movements are described, except where indicated, the first movement is always performed at the speed during search for switch , and subsequent movements are performed at the speed during search for zero.

Homing speeds

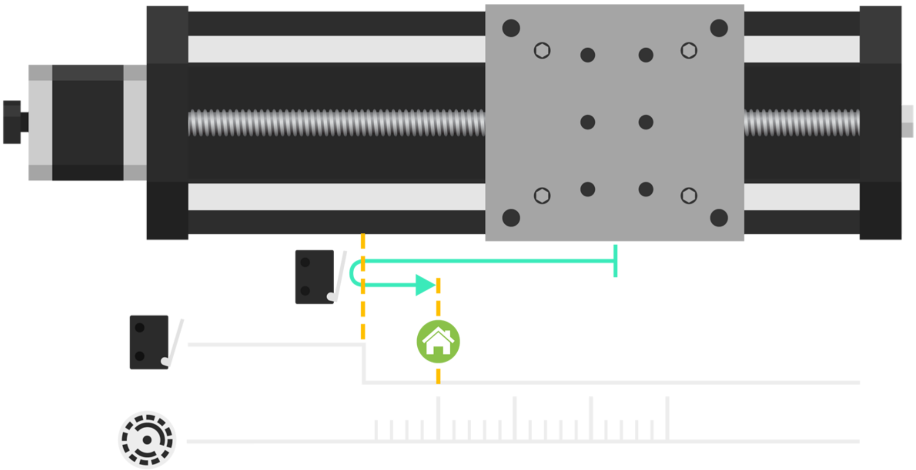
Notice that, when index pulse is not used for homing, the speed searching for zero is not used.

5.650.1 Homing on the negative limit switch and index pulse

This method starts motor movement in a negative direction until a change on the output signal of an electromecanical switch placed at the leftmost position is detected.

Afterwards, the axis is moved in a positive direction until the switch signal toggles its value again. When the switch signal has toggled, the movement continues until an index pulse is received. This is the home point.

If the whole homing process is not finished within the time specified in the timeout field of the homing extra parameters register, the homing process is aborted at this point, the statusword error bit is set, and an emergency message is sent.

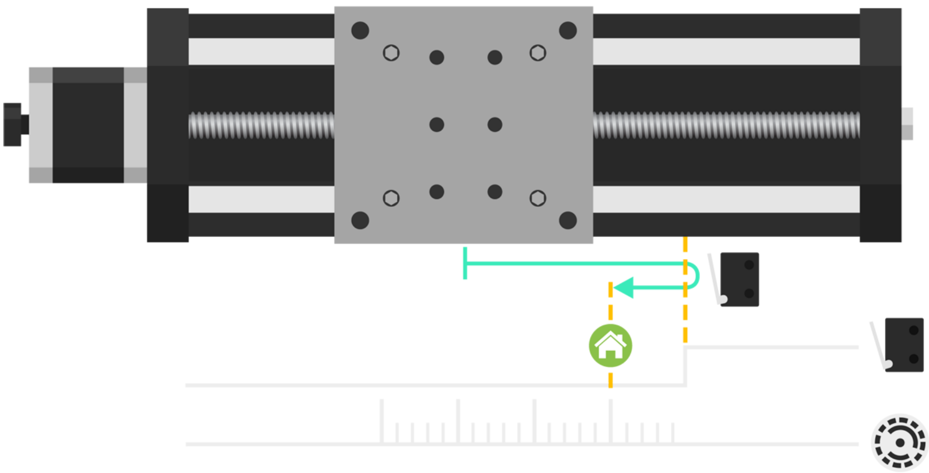


5.650.2 Homing on the positive limit switch and index pulse

This method starts motor movement in a positive direction until a change on the output signal of an electromecanical switch placed at the rightmost position is detected.

Afterwards, the axis is moved in a negative direction until the switch signal toggles its value again. When the switch signal has toggled, the movement continues until an index pulse is received. This is the home point.

If the whole homing process is not finished within the time specified in the timeout field of the homing extra parameters register, the homing process is aborted at this point, the statusword error bit is set, and an emergency message is sent.

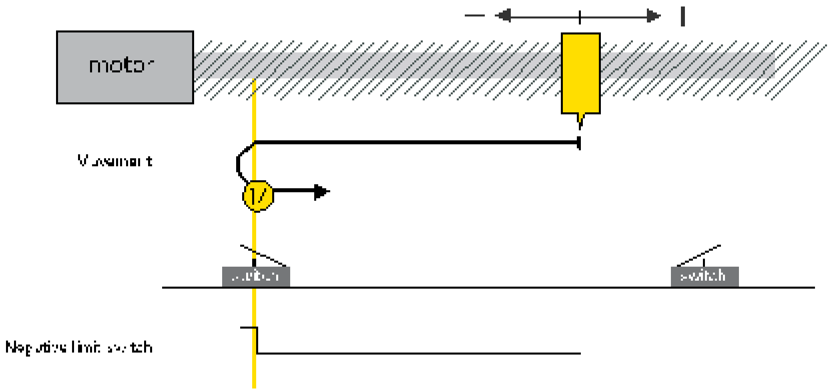


5.650.3 Homing on the negative limit switch

This method starts motor movement in a negative direction until a change on the output signal of an electromecanical switch placed ad the leftmost position is detected.

Afterwards, the axis is moved in a positive direction until the switch signal toggles its value again. This is the home point.

If the whole homing process is not finished within the time specified in the timeout field of the homing extra parameters register, the homing process is aborted at this point, the statusword error bit is set, and an emergency message is sent.

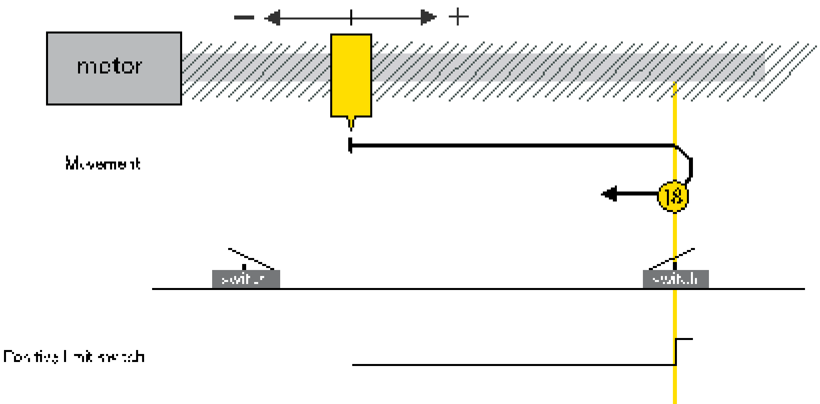


5.650.4 Homing on the positive limit switch

This method starts motor movement in a positive direction until a change on the output signal of an electromecanical switch placed ad the rightmost position is detected.

Afterwards, the axis is moved in a negative direction until the switch signal toggles its value again. This is the home point.

If the whole homing process is not finished within the time specified in the timeout field of the homing extra parameters register, the homing process is aborted at this point, the statusword error bit is set, and an emergency message is sent.



5.650.5 Homing on negative index pulse

This method starts motor movement in a negative direction until an index pulse is received. This is the home point.

If an index pulse has not been received within the time specified in the timeout field of the homing extra parameters register, the homing process is aborted at this point, the statusword error bit is set, and an emergency message is sent.

> ⓘ This movement is performed at the speed during search for zero.

5.650.6 Homing on positive index pulse

This method starts motor movement in a positive direction until an index pulse is received. This is the home point. If an index pulse has not been received within the time specified in the timeout field of the homing extra parameters register, the homing process is aborted at this point, the statusword error bit is set, and an emergency message is sent.

> ⓘ This movement is performed at the speed during search for zero.

5.650.7 Homing on current position

Home position is the current position. This is the only homing method that does not require the controller to be in operation enabled state, and no timeout is implemented.

5.651 0x6099 - Homing search velocities

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6099	0x01	Homing search velocity	UINT32	RW	No	Yes	UINT32	0	mrev/ s
0x6099	0x02	Homing zero velocity	UINT32	RW	No	Yes	UINT32	0	mrev/ s

Up to 2 search speeds may be used during a regular homing process: a speed to search for the switch or mechanical limit (search velocity), which may be relatively fast, and another speed to search for the actual homing point (zero velocity), which should be considerably slower.

This object only defines the magnitudes of those velocities: the direction will depend on the selected homing method.

Increasing homing speeds can affect the accuracy of switch/index detection, since the device reaction time is reduced.

5.652 0x60B1 - Velocity loop input offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x60B1	0x00	Velocity loop input offset	INT32	RW	Yes	No	INT32	0	mrev/s

This register adds an offset to the filtered reference of the velocity controller.

Gliffy Macro Error

You do not have permission to view this diagram.

5.653 0x60B2 - Torque offset

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x60B2	0x00	Torque offset	INT32	RW	Yes	Yes	INT16	0	‰ rated torque

This object indicates the offset for the torque value used in all modes (Profiled velocity, profiled position, etc.).

The torque offset could be useful to compensate systems with constant loads like vertical mounted systems or springs.

5.654 0x60C2 - Interpolation time period

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x60C2	0x01	Interpolation time mantissa	UINT8	RW	Yes	No	UINT8	1	$10^{\text{interpolation time index}}$ sec
0x60C2	0x02	Interpolation time exponent	INT8	RW	Yes	No	-5 to 0	-3	-

This object indicates the configured interpolation cycle time.

The interpolation time period (sub-index 01h) value is given in $10^{\text{interpolation time index}}$ seconds. The interpolation time index (sub-index 02h) is dimensionless.

5.655 0x60F2 - Positioning option code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x60F2	0x00	Positioning option code	UINT16	RW	Yes	Yes	-	0	-

This object indicates the configured positioning behavior.

The binary representation of the positioning option code is as follows:

Bit number:	**15**	**14**	**...**	**12**	**11**	**...**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	-	-			-			*Rotary axis option*		-		-		*Relative option*	

5.655.1 Relative option

It is not supported on current versions.

5.655.2 Rotary axis option

The next table defines the values for choosing between the different rotary option movements:

Name	Bit 7	Bit 6	Description
Rotary axis option	0	0	Normal positioning similar to linear axis. If reaching or exceeding the **Position range limits**, the input value wraps 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.
	0	1	Positioning only in negative direction.
	1	0	Positioning only in positive direction.
	1	1	Positioning with the shortest way to the target position. *If the difference between actual value and target position is the same in both directions, the axis moves in positive direction.

5.656 0x60F4 - Position following error

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x60F4	0x00	Position following error	INT32	RO	Yes	No	INT32	-	encoder counts

This object provides the actual value of the following error, which is the difference between the position demand and actual position (error = demand – actual).

5.657 0x60FF - Velocity set-point

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x60FF	0x00	Velocity set-point	INT32	RW	Yes	No	INT32	0	mrev/s

This object indicates the configured target velocity and is used as input for the trajectory generator.

5.658 0x6502 - Supported drive modes

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x6502	0x00	Supported drive modes	UINT32	CONST	Yes	No	UINT32	0xF03E5	-

Motion controllers can normally support more than one operation mode. This object provides information about the operation modes implemented in the device.

Data description:

The returned value has the following meaning (each bit represents an operation mode):

Bit number:	**31**	**...**	**19**	**18**	**17**	**16**	**15**	**...**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Description	*Reserved*		*ca*	*csc*	*cm*	*vm*	*Reserved*			*cst*	*csv*	*csp*	*ip*	*hm*	*Reserved*	*tq*	*pv*	*vl*	*pp*

Where:

- *pp = Profile Position mode*
- *vl = Velocity mode*
- *pv = Profile Velocity mode*
- *tq = Profile Torque mode*
- *hm = Homing mode*
- *ip = Interpolated position mode*
- *csp = Cyclic sync position mode*
- *csv = Cyclic sync velocity mode*
- *cst = Cyclic sync torque mode*
- *vm= Voltage mode*
- *cm= Current mode*
- *csc= Cyclic sync current mode*
- *ca= Current amplifier mode*

A logical '1' represents that the corresponding mode is available.

ⓘ For further information about the operation modes, see *Operation* section.

6 Configuration

If the system is already configured take a look to the *Operation* manual

6.1 Drive protections

Summit servo drives include a wide set of hardware and firmware protections that allows reaching the maximum performance with the required safety for the application and the drive itself. These protections are detailed in the product manual.

6.2 Motor and brake

Summit devices can drive a wide variety of actuators. This page describes how the motors are parameterized and how to use additional motor elements such as brake and temperature sensors.

6.3 Commutation

Setting a proper commutation method is required for BLAC / BLDC motors. Summit servo drives include different strategies to configure the commutation with the highest precision.

6.4 Feedbacks

A wide set of feedbacks is supported by Summit servo drives. The next pages describe the different options and how to configure each of them.

6.5 Inputs and outputs

Summit servo drives include a set of outputs and inputs for general purposes that might be used by the master to extend the functionalities of the application.

6.6 Shunt braking resistor

Summit series devices allow using shunt braking resistors to dissipate the regenerative energy on the DC bus.

6.7 Drive protections

Summit servo drives include a wide set of hardware and firmware protections that allows reaching the maximum performance with the required safety for the application and the drive itself. These protections are detailed in the product manual.

6.7.1 Voltage

Summit servo drives have been designed to operate in a wide range of voltages. Protections are available to protect the drive in front an undesired out of range reading:

- Fault generation (motor stopped) if and under-voltage or over-voltage is detected

  > Read the product manual for further details about the voltage input range.

- Fault generation (motor stopped) if the bus voltage is not stable and over the under-voltage level after some time once the power stage is powered.
- User-configurable under and over-voltage threshold to generate the desired fault reaction. This threshold should never overcome the product limits.

  > If the user-configuration overcomes the drive limits, then it is ignored and only the drive protection is active.

Voltage values read by the drive are available to the user to help analyze the system.

6.7.2 Current limits

Summit servo drives have current limit protections to avoid damage on the system, the actuator or the drive itself:

- **Over-current detection**. This protection generates a fault condition if the drive reads a current level above the over-current threshold.

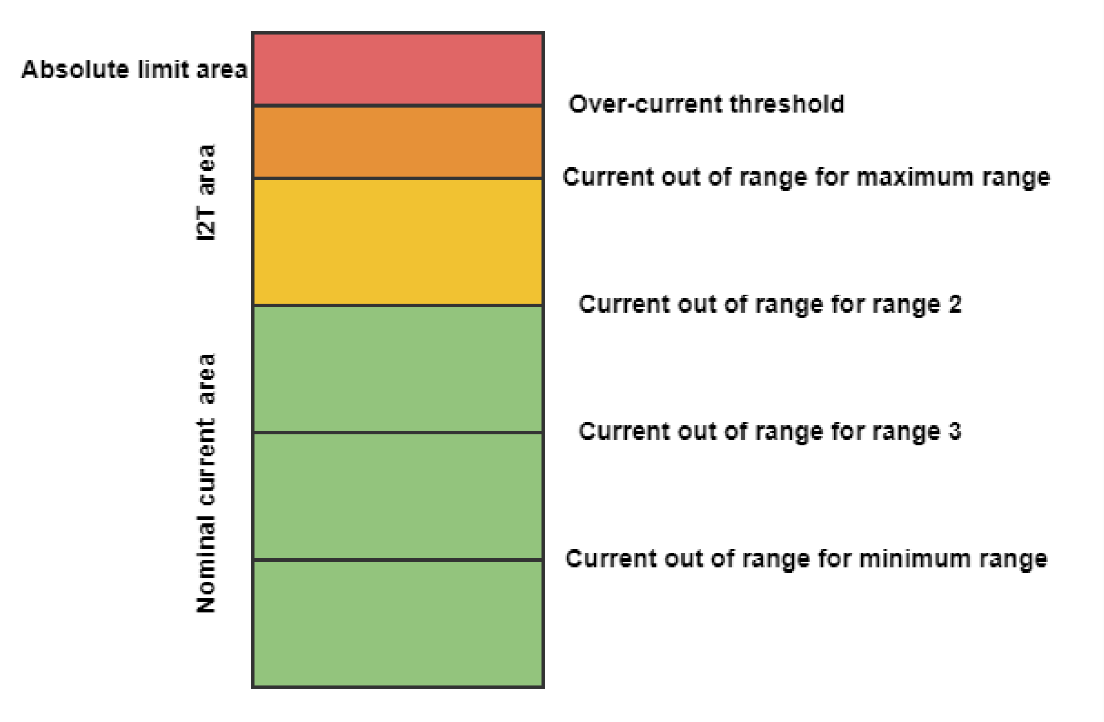
  > This protection is always enabled.

  > The over-current threshold is product dependent. The over-current threshold is checked on every drive phase.

- **Current out of range detection.** This protection generates a fault condition if the measured current is out of the measurable range.

  > This protection is enabled for some products and some firmware versions.

This protection offers additional level protection for those products that support multiple current measurement ranges. The over-current threshold is detected at the maximum drive capabilities, which doesn't offer good protection when the product is working in a smaller current range. See the next picture as an example:



If the drive works with the minimum range current, it is not able to measure if the current is in the I2T or the absolute limit area. So this protection will avoid entering this area by generated a fault if the current measurement is out of the actual range.

- **Max. current limit.** This protection limits current set-points injected to the current control loops above the max current level. Further information is available on *Current modes (CSC,C, CA)* section.

This protection is active if at least the current loop is enabled. Therefore it works for all current, velocity, and position modes, but it is inactive in voltage mode.

Max current limit is applied to the total motor current →

$$motor\ current = \sqrt[2]{Iq^2 + Id^2} = max[abs(Ia), abs(Ib), abs(Ic)]$$

- **I^2T protection.** This protection limits the current set-point to the current control loops by a thermal estimation based on current readings. The main functionality of the I2T is to detect an instantaneous exceed of thermal energy on the drive. It covers the case where the temperature sensors are too slow to detect a dangerous situation.

This protection is always active. For modes of operation where the current loop is not enabled, instead of limiting the current, a fault is generated.

6.7.2.1 Background

The instantaneous energy dissipated by a motor is proportional to the square of the current circulating through it and to the time this current lasts circulating through it. The nominal current is the current that a motor can stand in a continuous manner without exceeding its thermal limits. Therefore, any current above the nominal one creates an accumulation of thermal energy in the motor's surroundings that the cooling systems will have to dissipate. If this process of accumulating thermal energy exceeds the cooling system's ability to dissipate it, the system is bound to reach its thermal limits, and permanent damage to the motor or the surrounding element can be inflicted. The so-called *i2t* is an indirect magnitude proportional to the energy dissipated by the motor, and the *i2t* protection is a control mechanism aimed to ensure that the integral of the power dissipated by the motor in the form of thermal energy does not exceed its thermal limits.

The energy dissipated by a motor is defined as:

$$E_{system} = P \cdot t = i_A^2 \cdot R \cdot t$$

Where i_A is the current flowing through the motor and R is its resistance.

> ⓘ The current used by this algorithm is the total motor current →
> $$motor\ current = \sqrt[2]{Iq^2 + Id^2} = max[abs(Ia), abs(Ib), abs(Ic)]$$

The nominal current that can flow through the motor is determined by the power it can dissipate continuously without exceeding its thermal limits.

$$E_{system\_nom} = P \cdot t = i_{A\_nom}^2 \cdot R \cdot t$$

In a transient peak, the motor could tolerate an excess of energy with respect to the continuous limit. The excess of energy could be expressed as follows:

$$E_{trans} = i_{A\_peak}^2 \cdot R \cdot t - i_{A\_nom}^2 \cdot R \cdot t$$

Most times we do know the current rating system, the peak current and the maximum duration of the peak. Therefore, the equation could be simplified as follows:

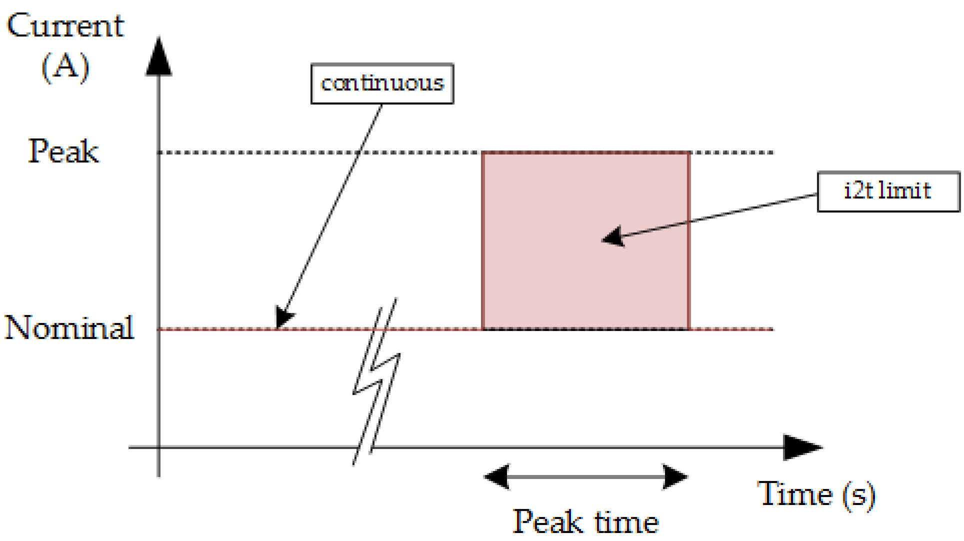
$$E_{excess} = \frac{E_{trans}}{R} = (i_{A\_peak}^2 - i_{A\_nom}^2) \cdot t$$

This excess of energy is called *I-squared-t* ($i^2 t$), and it is expressed in amper^2 per second.

$$i^2 t = (i_{A\_peak}^2 - i_{A\_nom}^2) \cdot t_{peak}$$

The following picture shows a graphical representation of the $i^2 t$ limit algorithm implemented in the controller. On the left side of the graph, the system is working with its nominal current. Under this situation, the system could be working infinitely. Once the actual current crosses the motor nominal current, the algorithm starts to integrate the excess of energy (red zone). If the excess of energy reaches the prefixed value, the current will be decreased to its nominal value, and an interrupt will be generated.

Once the system has started to limit the current, it will not allow new overcurrent peaks until the $i^2 t$ accumulated goes below half of its maximum allowed value.



There are two active I2T: User and system. The system is always active and it generates a fault if it is detected. The user is always active too but its reaction is configurable. The system values are hardcoded by the manufacturer whereas the user parameters are modificable at any time. Every time a user parameter is changed, both I2T is compared. The applied nominal current is the smaller between both.

If system I^2T is detected before the user I^2T levels, a fault is generated independently if the current loop is enabled or not.

For example, if the system is configured with the following parameters:

$$i_{A-nom} = 1A$$
$$i_{A-peak} = 2A$$
$$t_{peak} = 1s$$

The i^2t variable or energy excess will have the following value:

$$i^2t = (i^2_{A-peak} - i^2_{A-nom}) \cdot t_{peak} = 3A - s$$

It means that the system will tolerate a peak of 2 A during 1 s, but also some other combinations, like for example:

$$i_{A-nom} = 1A$$
$$i_{A-peak} = 1.5A$$
$$i^2t = (i^2_{A-peak} - i^2_{A-nom}) \cdot t_{peak} = 3A - s - t_{peak} = 2.4s$$

The system will not allow new overcurrent peaks until the energy excess goes below $\frac{i^2t}{2} = 1.5A \cdot s$

6.7.3 Temperature

Temperature is one of the key elements that must be monitored in order to reach the maximum performance of the drive safely. Summit servo drives are composed of multiple temperature sensors of two types: power stage sensors and motor sensors.

The power stage sensors are defined and parameterized by Ingenia whereas motor temperature sensor configuration is user-dependent.

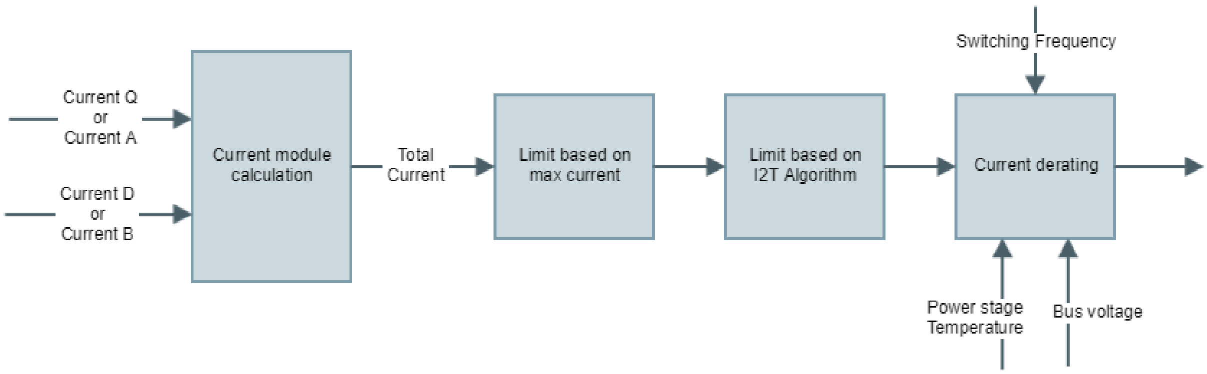
ⓘ Further information about motor temperature sensor options is available on the *Motor and brake* section.

Temperature readings of all the available sensors onboard are available for the user to monitor the state of the drive. Under and over temperature protections (both manufacturer and user limits) are based on the max. temperature measured by all the available sensors.

6.7.4 Current derating

The current limit mentioned above is only applied if the users need to decrease the maximum drive capabilities in order to avoid damage to the system and/or actuator. Otherwise, the drive current limit is based on the power stage temperature.

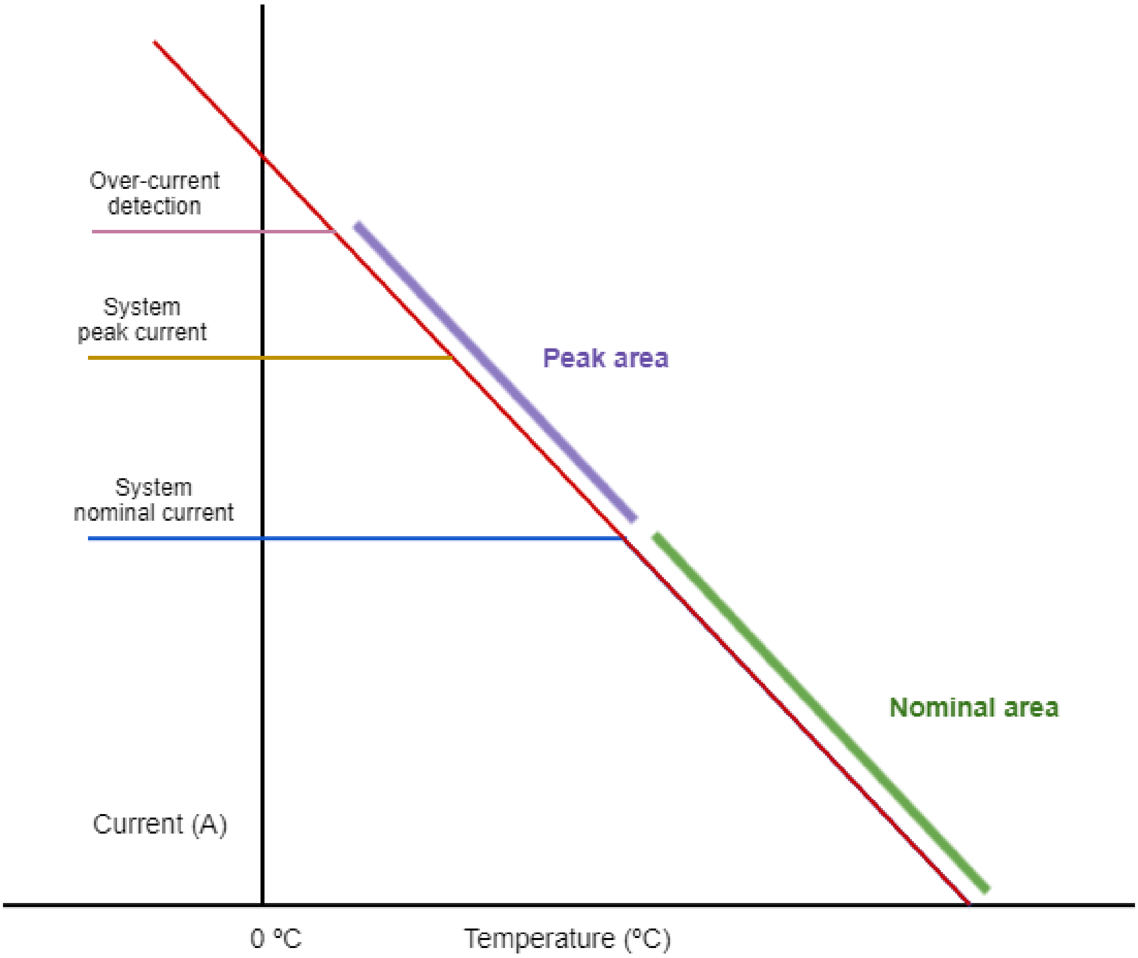
The complete current limit chain is the following one:



The derating is applied following the next equation:

$$I_{derating} = I_{Temp\ 0\ °C_x} - K_{Vbus_x} \cdot V_{Bus} - K_{derating} \cdot T_{°C}$$

K_{Vbus_x} and $I_{Temp\ 0\ °C_x}$ are dependent on the selected power stage operation frequency. $I_{Temp\ 0\ °C_x}$ is the theoretical current value supported at temperature 0.



The drive computes continuously the theoretical current derating curve point and it is compared against the output of the current limitation chain (After max current and I2T are applied). The minimum between both values is the output commanded to the current loop.

ⓘ Constants K_{Vbus_x}, $K_{derating}$ and $I_{Temp\ 0\ °C_x}$ are parameters product dependent

6.7.5 Safe torque off (STO)

The Safe Torque Off (STO) is a drive-integrated safety function that ensures no torque-generating energy can be applied to the motor. The status of this circuit can be monitored by the user via the STO status reporting parameter.

ⓘ **Info**

To activate or deactivate the STO, both inputs STO1 and STO2 need to be set to the same value. It is product dependent whether both to a low level or both to a high level will disable the power stage

6.8 Motor and brake

Summit devices can drive a wide variety of actuators. This page describes how the motors are parameterized and how to use additional motor elements such as brake and temperature sensors.

6.8.1 Commutation types

Summit servo drives support different commutation schemes. Following there is the list of possible commutation schemes:

6.8.1.1 Single-phase commutation

In this type of motors, only phases A and B are controlled. Connecting the motor to phase C will result in unpredictable behavior.

> **Warning**
>
> In this mode, the drive will use the **current quadrature command** and **voltage quadrature command** controls only. However, **current direct set-point** and **current direct loop input offset** could still affect how some protections are calculated (I2T, derating). Make sure the **current direct set-point** and **current direct loop input offset** are both set to 0. Also, the **current direct value** will always report 0.

6.8.1.2 Trapezoidal commutation

In this configuration, three phases (A, B and C) are used for control but only two of them are active at a time. Configuration parameters are not needed to start moving this kind of motors, however, a phasing procedure is required to align the commutation with the available feedback.

> **Warning**
>
> In this mode, the drive will use the **current quadrature command** and **voltage quadrature command** controls only. However, **current direct set-point** and **current direct loop input offset** could still affect how some protections are calculated (I2T, derating). Make sure the **current direct set-point** and **current direct loop input offset** are both set to 0. Also, the **current direct value** will always report 0.

> **Warning**
>
> Trapezoidal modulation can only be used with digital halls as commutation feedback

6.8.1.3 Sinusoidal modulation (SVPWM)

This modulation is based on the "Field Oriented Control" (FOC) algorithm. In this modulation scheme, the three phases A, B, and C are used for control. Configuration parameters are not needed to start moving this kind of motors, however, a phasing procedure is required to align the commutation with the available feedback.

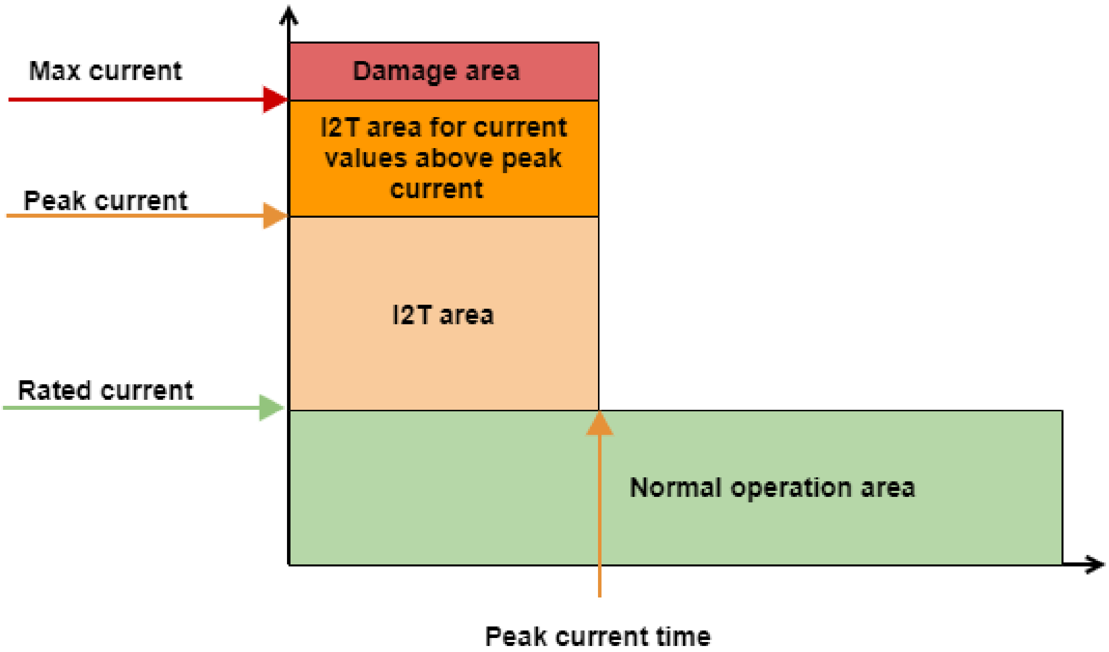
> Go to the *Operation* section for further information about how to use Summit drives

6.8.2 Motor configuration parameters

Summit servo drives require some information of the driven actuator for protection and operation purpose:

- **Motor pole pairs.** In combination with the reference and commutation feedbacks allows the drive to compute the electrical angle of the system to commutate properly.

- **Rated current.** It defines the maximum continuous current that the system is able to drive without being damaged. It is also used to compute the I2T algorithm.
- **Peak current.** Defines the maximum peak current that the system is able to drive inside a defined **window time** without being damaged. It is used as an input parameter fo the I2T algorithm.
- **Peak current time.** Defines the **window time** of the **peak current** parameter. It is used as an input parameter fo the I2T algorithm.
- **Max. current. It defines** the maximum current that the system is able to drive without being damaged. This value should be equal to or higher than the **peak current.**



> Current values that are higher than peak current but lower than max. current is allowed, however, the peak current time is automatically decreased to respect the I2T defined area. See the *Drive protections* section for further information.

> See *Operation* section to see further information about how the max current is applied to the drive loops.

- **Max. velocity.** Defines the maximum velocity of the system.

> See the *Operation* section to see further information about how the max velocity is applied to the drive loops.

> By default, this protection is always enabled. If the application works in velocity and position based modes, this protection will limit the maximum velocity. On the other hand, in all other modes where the velocity control loop is not available, the protection will stop the motor if the velocity overcomes these limits.

> The velocity out of limits protection might be disabled if the application requires it. For further information see the *Error management* section.

6.8.2.1 Motor temperature configuration

Different types of temperature sensors are supported for reading motor temperature.

The **motor temp. derating threshold** parameter indicates the threshold that the drive has to consider for generating a fault if the read temperature overcomes this value.

The **motor temp. sensor type** indicates which kind of sensor is used for motor temperature readings. The next sensor types are available:

NTC

Involved parameters:

- **Resistance.** Resistance value for 25 °C in ohms.
- **External resistance.** Resistance value in ohms connected to NTC for making the voltage divider.
- **Parameter B.** B parameter from the NTC datasheet.

PTC

Involved parameters:

- **Resistance.** Resistance value in ohms where the over-temperature must be detected.
- **External resistance.** Resistance value in ohms connected to PTC for making the voltage divider.
- **Voltage reference.** It contains the voltage applied to the voltage divider.

> This mode is not able to read temperatures in the whole range. It only detects if the over-temperature condition exists or not. The motor temperature readings return values of 50.0 °C if the over-temperature condition is not detected and 125.0 °C otherwise. **However, these values don't represent the real temperature of the motor.**

> Set motor temperature over-temperature to 100.0 °C if PTC is used as a motor temperature sensor. As said before, the temperature readings are 50.0 °C and 125.0 °C for this configuration and they don't represent the real temperature of the motor. Therefore it is required to set an over-temperature value between 50.0 and 125.0 to force an over-temperature fault reaction, even if this threshold doesn't represent the real over-temperature threshold.

> Usually, PTCs are used like an on-off switch temperature sensor. This mode allows configuring the voltage threshold that the drive expects to trigger an over-temperature fault. However, there are PTC sensors with a linear response in a wide range of temperatures. In this case, see the RTD and silicon sensor sections to see how to read the temperature in the whole range.

Linear voltage sensor

Involved parameters:

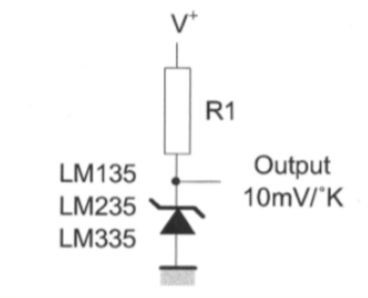
- **Gain.** The gain of the sensor, in °C / V. (From the datasheet)
- **Offset.** The offset of the sensor, in °C.
- **Voltage reference.** Voltage reference used on temperature sensor electronics (e.g pull-up voltage value).

  > Voltage reference must be set to 5 V if the voltage divider doesn't affect the sensor output.

This option takes the voltage output from the sensor and process it according to the following equation:

$$Temp = Sensor \cdot Gain + Offset$$

It doesn't take into account the voltage divider effect. This mode has been developed to read a sensor that forces the voltage output proportionally to the temperature like MCP9700 or LM135Z.



RTD

Involved parameters:

- **Temperature 0.**Temperature value at one point of the temperature sensor curves.
- **Resistance 0.** Resistance value at one point in the temperature sensor curves.
- **Temperature 1.**Temperature value at one point of the temperature sensor curves.
- **Resistance 1.** Resistance value at one point in the temperature sensor curves.
- **External resistance.** Resistance value in ohms connected to the sensor for making the voltage divider.
- **Voltage reference.** Voltage reference used on temperature sensor electronics (e.g pull-up voltage value).

The measurements of RTD a linearized taking two points of the resistance vs temperature curve/table from the datasheet. To obtain maximum precision for the detection of an over or under temperature condition, choose the points at the same temperature as the condition occurs. Example:

If the under-voltage must be detected at -10 °C and the over-temperature at 85 °C, the parameters should be set:

- **Temperature 0:** -10.0
- **Resistance 0:** Resistance value at -10 °C in ohms
- **Temperature 1:** 85.0
- **Resistance 1:** Resistance value at 85 °C in ohms

This sensor type mode compensates automatically the effect of the voltage divider

Silicon-based sensor

Involved parameters:

- **Temperature 0.**Temperature value at one point of the temperature sensor curves
- **Resistance 0.** Resistance value at one point of the temperature sensor curves
- **Temperature 1.**Temperature value at one point of the temperature sensor curves
- **Resistance 1.** Resistance value at one point of the temperature sensor curves
- **External resistance.** Resistance value in ohms connected to the sensor for making the voltage divider
- **Voltage reference.** Voltage reference used on temperature sensor electronics (e.g pull-up voltage value)

Silicon-based temperature sensors are configured in the same way than RTD

Switch sensor

Involved parameters:

- **Voltage reference.** Voltage reference used on temperature sensor electronics (e.g pull-up voltage value)

This mode is not able to read temperatures in the whole range. It only detects if the over-temperature condition exists or not. The motor temperature readings return values of 50.0 °C if the over-temperature condition is not detected and 125.0 °C otherwise. **However, these values don't represent the real temperature of the motor.**

None

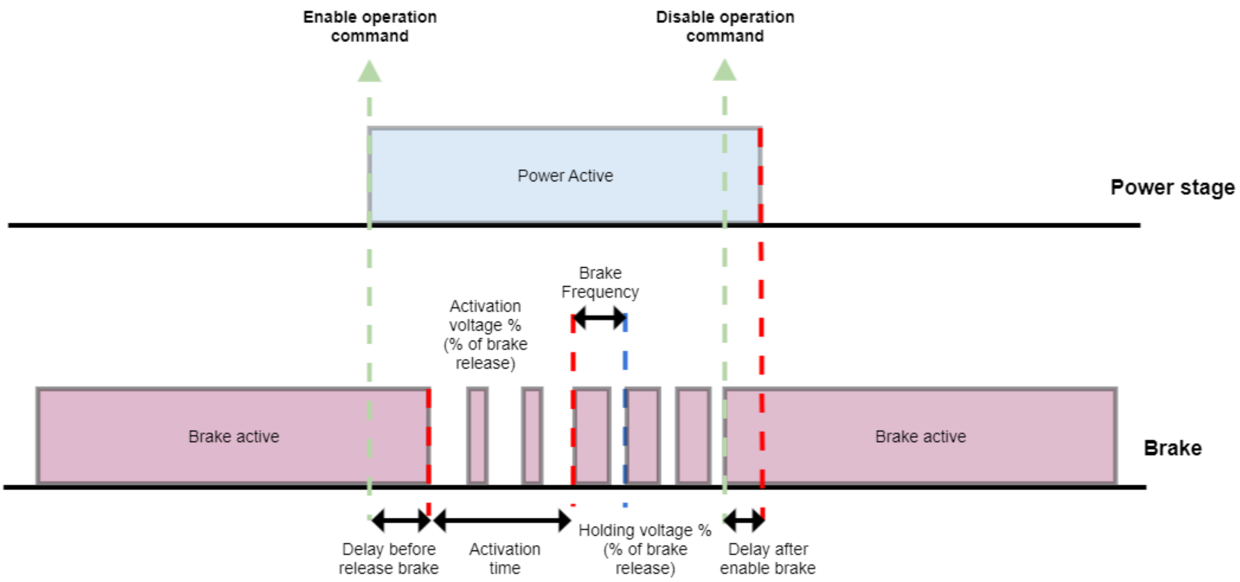
Measured temperature values are always 0.0 °C when this mode is selected.

6.8.3 Brake

Summit servo drives have a dedicated output for brake purposes. This output is automatically managed by the drive following the DS402 state machine standard. A modulation might be configured if the brake voltage is higher than the specified. The brake is modulated by a PWM signal.

Drive only releases the brake in the "*operation enable*" state.

- **Brake activation voltage percentage.** Specifies what effective voltage is applied to release the brake by means of a PWM duty
- **Brake holding voltage percentage.** Specifies what effective voltage is applied to holding released the break by means of a PWM duty.
- **Delay before release brake.** Time delay applied before releasing the brake.
  Indicates the delay in milliseconds between activation of the power stage and disengaging the brake (brake activated state).
- **Delay after enable brake.** Time delay applied after enabling the brake.
  Indicates the delay in milliseconds between engaging the brake and deactivation of the power stage.
- **Activation brake time.** Time duration in milliseconds of activation brake voltage percentage is applied.



6.8.3.1 Brake override

- Forces a state in the brake. When the override is disabled, the brake takes the value as dictated by the state machine.

6.9 Commutation

Setting a proper commutation method is required for BLAC / BLDC motors. Summit servo drives include different strategies to configure the commutation with the highest precision.

Different feedback can be used as a commutation reference. The feedback readings are converted into mechanical and electrical angle to know the position of the rotor and then apply the proper excitation to get the maximum efficiency (based on FOC algorithm).

Usually motor feedbacks are not aligned with the rotor of the motor by mechanical assembly. Therefore, before it can be used as commutation feedback, an alignment sequence is required. This pages describe all the elements that summit products include for getting this alignment.

6.9.1 Commutation feedback alignment methods

The objective of these methods is to detect the offset between the angle generation and the readings of the commutation feedback. There are three main blocks of methods:

- **Forced.** Requires to move the actuator injecting a known voltage or current. Its main use is to align incremental encoders (dig. encoder, sincos, etc) used as reference and commutation, or to align an absolute encoder.
- **Non-forced.** An absolute feedback is used as reference to measure the difference between the commutation feedback and system angle. It can be used with any feedback as commutation feedback and an absolute feedback as the reference feedback.
- **No phasing.** No phasing procedure is performed. The alignment must be previously stored in memory or introduced manually for the system to work. Its main targets are absolute encoder (halls, SSI, BiSS-C, etc) as reference and commutation feedback

  > ⓘ Before using non-forced and no phasing methods, the absolute feedback must be calibrated (aligned to rotor) using the forced method. Once it is executed, the configuration might be stored into the non-volatile memory and the forced method is not required anymore

The parameters required for aligning properly the system are:

- **Commutation feedback sensor.** Selects the type of feedback used for commutation

  > **Warning**
  >
  > Only four feedbacks can be mapped simultaneously in all of the feedback sensor parameters

- **Commutation angle offset.** Defines the angle difference between the expected angle 0.0 by the drive algorithm and the angle value read from the commutation feedback at this same position
- **Motor pole pairs.** The commutation feedback usually gives mechanical angle reference instead of the electrical angle that is the real one needed for proper commutation. This register helps to convert from mechanical to electrical angle.
- **Commutation angle value.** It contains the value of the electrical angle read by the commutation feedback once the pair poles have been applied.

6.9.1.1 Forced methods

There are different methods to align the commutation feedback. Summit product implements the next ones:

Binary search

The objective of this method is to apply the minimum possible displacement to determine the relationship between the generated angle by the FOC algorithm and the read one by the commutation feedback.

From this point, it is highly recommended to have some knowledge about Field Oriented Control algorithm. Take a look at this application note.

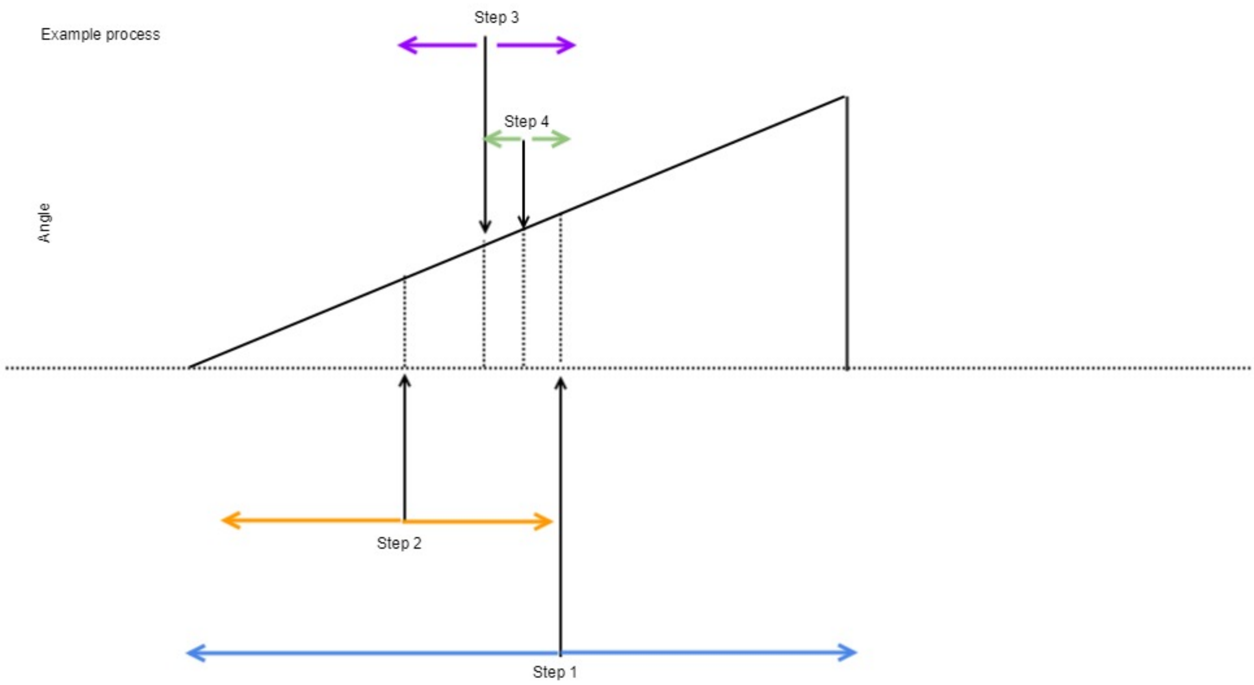
The sequence generates a set of points (angle) inside the current D-Q space. These points are generated using a binary search technique:

1. The first angle is applied to the middle of the range.

   In the angle world, if the range is 360º, the middle point is 180º

2. Then the drive reads cyclically the commutation feedback to calculate the distance between the initial angle and the current one.
3. When a minimum displacement is detected, then the next point is generated.
4. The next point is calculated as : $Next\ point = Previous\ point \cdot (1 + 0.5 \cdot (sign(displacement))$

So the algorithm detects the small movements and looks for the nearest angle to the actual position of the actuator. The next diagram shows an example of how the steps are generated



Note

The binary search phasing method modifies some of the feedbacks internally to perform the phasing. If the phasing procedure is either interrupted or finished, the feedback configuration of the user is restored.

These are the parameters required to adjust the phasing sequence to the different actuators:

- **Max. current on phasing sequence.** Forced methods use the current mode during the phasing sequence. The current is increased slowly until a movement is detected or the value of this register is reached.
- **Phasing timeout.** This timeout is used for binary search method and expires if the displacement of the actuator is less than the expected one. If this happens, the next point is generated assuming a positive displacement.

> When the last point is reached, the algorithm waits until both **Max. current on phasing sequence** and **Phasing timeout** are reached.

- **Phasing accuracy.** This register determines the number of steps and the minimum distance the drive should detect to consider that the actuator has been moved. The last step is defined as the first angle delta smaller than 3 times the phasing accuracy.

> **Example**
>
> Setting a value of 10000 mº means that the actuator must travel 10000 mº in each step and the number of steps will be 4:
>
> - Last angle delta will be smaller than $10000m^{o} \cdot 3 = 30^{o}$
>
> - First angle delta is 180 º > 30º
>
> - Second angle delta is 90 º > 30 º
>
> - Third angle delta is 45º > 30ª
>
> - Last angle delta is 22,5 º < 30 º

Therefore, this register is used to adjust the traveled distance based on the limitation of the application or the commutation feedback itself.

> **Dig. halls**
>
> In case the system includes digital halls, the minimum measurable electrical angle delta is 60 º. In this case, the user must set the phasing accuracy to a value bigger or equal than 60000 mº. The algorithm then is modified to generate two steps multiple of 60 º:
>
> - First delta is 240 º
>
> - Last delta is 120 º

6.9.1.2 Non-forced methods

This method uses an additional feedback as reference for align the commutation feedback. This reference must be previously aligned, in order to be used for this purpose, by a forced method.

> The result of the forced method is duplicated automatically into the reference feedback parameters.

Once the reference es properly configured and the desired commutation feedback, the sequence of non-forced method is:

- Wait until device enters in operation enable state
- Once in enable state, device uses reference feedback as commutation until it is updated
- The difference between the reference angle and the commutation angle is used to compute the value of the register Angle offset

> **Example**
>
> The system is composed by a BLAC motor with incremental encoder and digital halls. Incremental encoder is used as commutation feedback and digital halls as the reference. During the non-forced alignment method:
>
> - The system starts to use the digital halls for commutation until a halls transition is detected.
> - In that moment, the offset between halls and the incremental encoder is computed.
> - Finally, the device uses incremental encoder for commutation.

These are the parameters related to the reference feedback:

- **Reference offset.** Defines the angle difference between the expected angle 0.0 by the drive algorithm and the angle value read from the reference feedback at this same position.

  > It contains the same value than the register angle offset once the forced alignment method is executed.

- **Reference feedback.** Selects the type of feedback used as a reference.

  > **Warning**
  >
  > Only four feedbacks can be mapped simultaneously in all of the feedback sensor parameters

- **Reference angle. It contains** the value of the electrical angle read by the reference feedback once the pair poles have been applied.

6.10 Feedbacks configuration

6.10.1 Current feedback

Current measurements are essential for proper and efficient motor control. The drive measures the current on each phase and uses different interpretations.

6.10.1.1 Current measurements

Currents are measured using three shunt topology. Therefore **current A value**, **current B value,** and **current C value** are obtained simultaneously.

6.10.2 BiSS-C slave 1 / Primary SSI

Summit servo drives implement BiSS-C and SSI interfaces. It is able to manage both multi-turn and single-turn devices and the frame parsing is configurable allowing to support a wide range of absolute encoder devices.

6.10.3 BiSS-C

BiSS-C is a serial protocol that offers a series of advantages. These (amongst others) are:

6.10.4 BiSS-C slave 2 (daisy chain)

Summit servo drives are able to use two BiSS-C feedbacks connected in a daisy chain. This section describes how to configure the second feedback in this chainBiSS-C is a serial protocol that offers a series of advantages. These (amongst others) are:

- It has a standard protocol definition
- Contains error and warning bits and provides CRC checking

6.10.5 Incremental encoder

Summit servo drives drive are able to use up to 2 digital incremental encoder as feedback for any purpose (position, velocity, commutation, and auxiliary).The parameters required to configured each digital encoder are:

- **Resolution.** Resolution of the encoder in total counts per mechanical revolution.

  > Changing the resolution of the incremental encoder resets the position, commutation and/or reference reading values if the incremental is selected for any of these functionalities.

6.10.6 Digital halls

Summit servo drives are able to use a digital halls as feedback. It can be configured using the following parameters:

- **Dig. hall polarity.** Polarity of the digital halls. Setting a 0 value sets standard polarity, and setting a value different from 0 sets reversed polarity.
- **Dig. hall filter**: Glitch filter levels of the digital halls module. There are 10 different glitch filter levels. Each level corresponds to a specific cut-off frequency. Setting this register parameter to 0 will disable the glitch filter. The different glitch filter levels can be seen in the following table:

6.10.7 Internal generator

Summit servo drives include an internal generator that simulates feedback readings. It is useful for testing purpose or for system analysis.

> **Example**
>
> Internal generator is used as commutation feedback to force the movement of a BLAC motors to analyse the behaviour of the feedbacks in the system.

6.10.8 Secondary SSI

Additionally to the main absolute encoder channel, an additional SSI encoder is supported by Summit servo drives. This covers the cases where dual absolute is required but BiSS-C daisy chain devices are not available. A wide variety of SSI are supported by Summit servo drives. However, every feedback product has its own protocol over the SSI. Below there is an example based on a protocol of the IncOder product family.

6.10.9 Current feedback

Current measurements are essential for proper and efficient motor control. The drive measures the current on each phase and uses different interpretations.

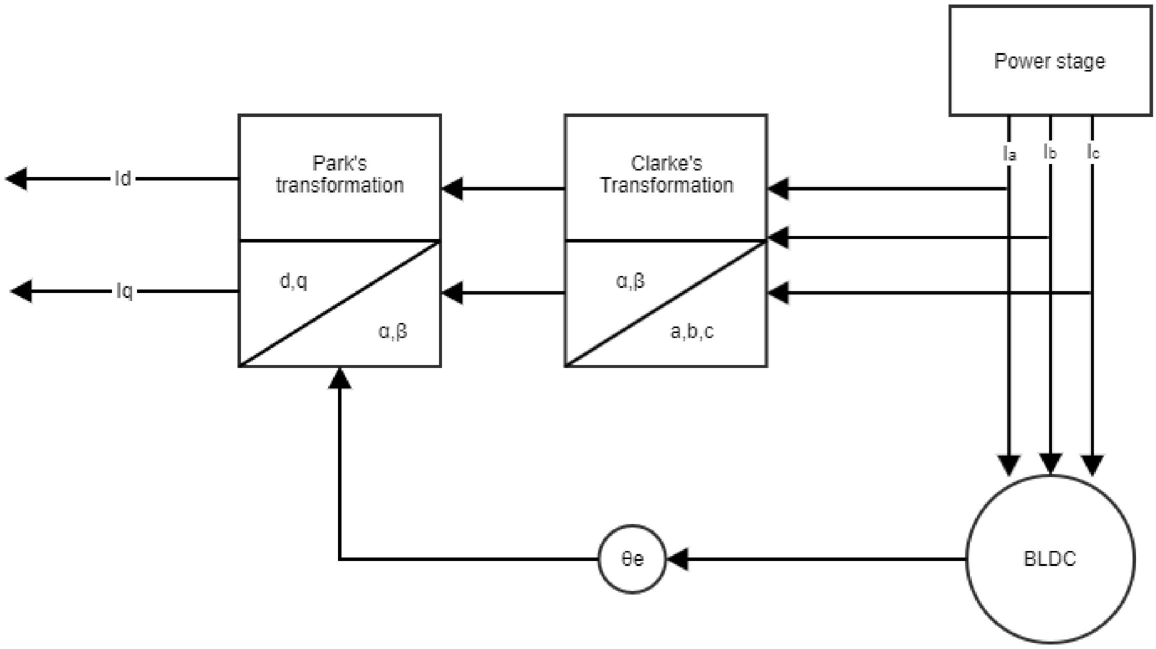
6.10.9.1 Current measurements

Currents are measured using three shunt topology. Therefore **current A value**, **current B value,** and **current C value** are obtained simultaneously.

6.10.9.2 Field oriented control (FOC)

Direct current measurements are only used for monitoring purposes. Control loops and protections use the components' **current direct value** and **current quadrature value** to reach the best performance.

These currents are obtained following the next diagram:



Clarke transformation

$$i_{\alpha\beta} = \frac{2}{3}\begin{bmatrix} \frac{1}{2} & -\frac{1}{2} & -\frac{1}{2} \\ 0 & \frac{\sqrt{3}}{2} & -\frac{\sqrt{3}}{2} \end{bmatrix} \cdot i_{ABC}$$

Park transformation

$$i_{DQ} = \begin{bmatrix} cos(\theta_e) & sin(\theta_e) \\ -sin(\theta_e) & cos(\theta_e) \end{bmatrix} \cdot i_{\alpha\beta}$$

How current control loop works is available on *Current modes (CSC, C, CA)* section

How current protections work is available on *Drive protections* section

6.10.9.3 Output current

The **current actual value** is obtained from the module of the components direct and quadrature and it represents the total amount of current driven by the drive to the actuator.

$$Total\ current = \sqrt{V_d^2 + V_q^2}$$

I2T, derating and, in general, all the current protections are based on this module. Further information on *D rive protections* section.

6.10.9.4 Current measurable range

Some products have the capability to change the measurable current range to increase the resolution for applications where the nominal current is lower than the maximum nominal current of the drive.

6.10.10 BiSS-C slave 1 / Primary SSI

Summit servo drives implement BiSS-C and SSI interfaces. It is able to manage both multi-turn and single-turn devices and the frame parsing is configurable allowing to support a wide range of absolute encoder devices.

6.10.10.1 BiSS-C

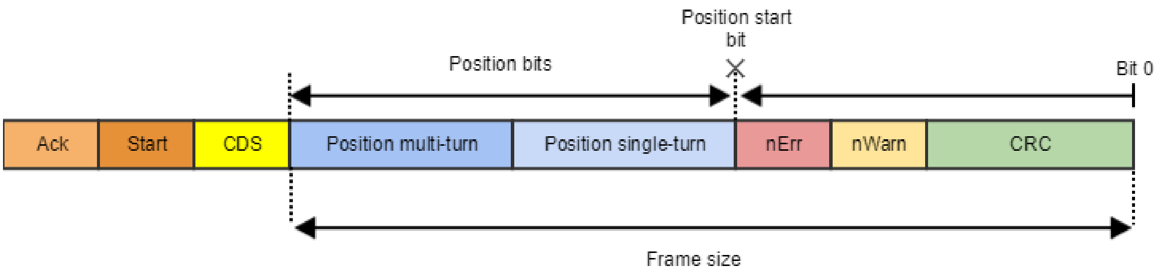
BiSS-C is a serial protocol that offers a series of advantages. These (amongst others) are:

- It has a standard protocol definition
- Contains error and warning bits and provides CRC checking
- It allows for daisy chain operation.

More information about the BiSS-C protocol can be found below:

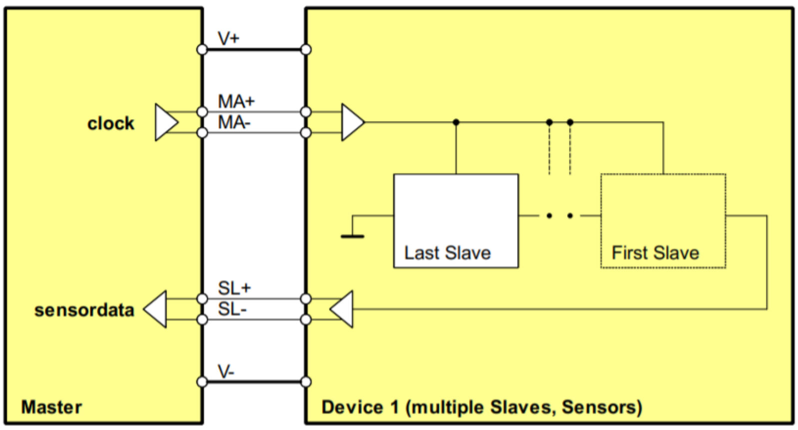
- BiSS-C protocol description
- BiSS-C BP1 profile description
- BiSS-C BP3 profile description

The standard frame described in the BiSS-C BP1 / BP3 profiles have the following structure



Where the ACK, Start, and CDS bits are automatically taken into account by the drive (when BiSS-C protocol is selected). The frame also contains active low error and warning bits, and a CRC field.

> **Note**
>
> Summit servo drives only support the unidirectional and point to point BiSS-C topology (shown below)

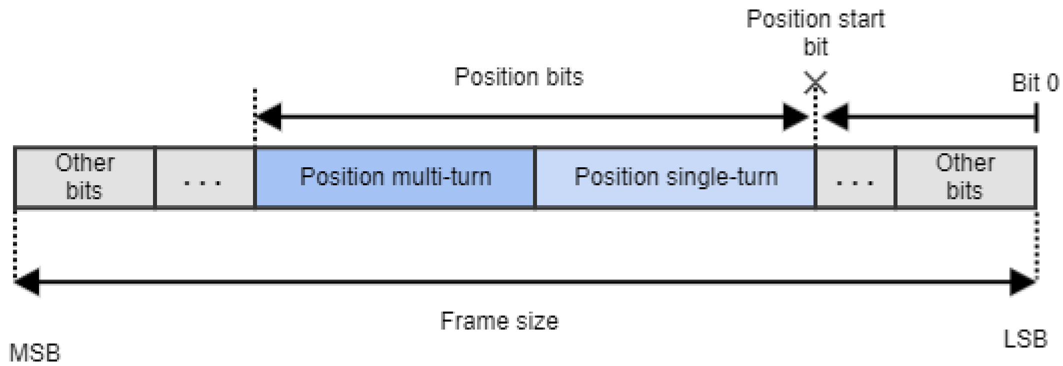


Sensor bus (1 Device / multiple Slaves) resp. point-to-point (Master / Device)

6.10.10.2 SSI

SSI is also a serial protocol but does not define a specific frame. Every feedback product has its own protocol/frame over SSI. These frames can contain manufacturer-specific special bits. Some of these frame types are supported, allowing decoding special bits in some cases. An example of a manufacturer-specific SSI frame is the "Zettlex - SSI1" frame type, which contains a "Position valid bit" that can be used to detect transmission/encoder errors

An SSI frame would have the following structure



6.10.10.3 Configuration

A set of parameters are available to the user to adapt the absolute interface to the different supported protocols:

- **Protocol.** Indicates if the encoder protocol is SSI or BiSS-C
- **Frame size.** Indicates the total number of bits of the frame. These include position bits, special bits, warning, error and CRC bits, etc.

  > ⚠ Do not include "ACK", "Start", "CDS" bits in the frame size when using BiSS-C protocol. These are managed by the drive automatically.

- **Error tolerance.** The drive is able to detect an incorrect frame (for example by reading the position valid flag of the SSI1 frame type, or by parsing the CRC and error bits in the BiSS-C frame). If an incorrect frame is detected, it is ignored and the drive keeps the last read position as the current position. However, if too many followed errors are detected, the drive generates a fault and stops the operation. **This register specifies the number of errors accepted before generating the fault.**

  > ⚠ Setting a 0 value will ignore any error from the encoder.

- **Wait cycles.** Control loops might work at high rates, and the specified minimum period between BiSS-C / SSI frames might be higher than the loop update rate. In this case, the drive must wait for some control loops before requesting new data. *This register specifies how many position loop cycles the drive will wait before requesting new encoder data.*
- **Polarity.** Indicates the direction of rotation of the encoder. 0 value applies standard polarity (read directly from the feedback) and a value different than 0 reverses the polarity.
- **Frame type.** Indicates the format of the received frame. This parameter allows parsing frames in a specific way. For example, the BiSS-C BP3 profile frame type will assume there are CRC, error and warning bits and will use them to detect errors in the frame

For unsupported frame types, use ***raw*** or ***raw gray*** modes. These modes allow reading the position from any frame type without processing special bits such as CRC or error flags.

Note

Frame type 3 implements the BiSS-C BP3 profile. By selecting this frame type, the first 8 bits will automatically be used for CRC and error checking, since a BP3 BiSS-C frame is assumed. More information about this profile can be found here

- **Position bits.** Indicates the number of bits used for position readings.
- **Single-turn bits.** Indicates the number of position bits that represent single-turn information.

  For single-turn absolute encoders, position bits = single-turn bits

- **Position start bit.** Defines how many bits the position information is displaced from the LSB in the serial absolute feedback frame.

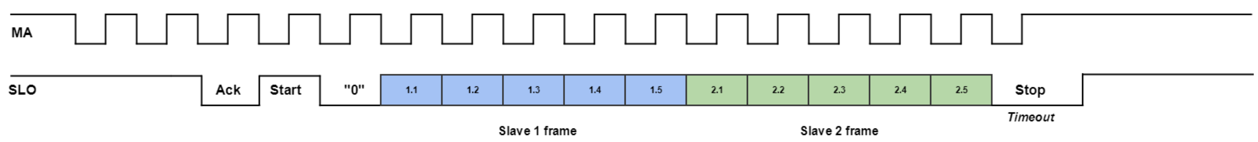
The raw position value obtained from the absolute encoder readings is available for the user removing CRC and special flags from the frame. This parameter is useful to verify the proper configuration of the encoder.

Invalid frames are dropped so all the positions on this parameter are valid for operation

6.10.10.4 BiSS-C daisy chain operation

The absolute encoder module supports up to two feedbacks in daisy chain operation when using the BiSS-C protocol. To be able to use both feedbacks (this one and *BiSS-C slave 2 (daisy chain)*) in a daisy chain, they need to be configured separately, both selected as feedback somewhere, and the **number of feedbacks in the chain** needs to be specified.

The following picture shows an example of a BiSS-C daisy chain frame.



When using the daisy chain, the drive will use a frame size that is made up of the combination of the *BiSS-C slave 1 / Primary SSI - Frame size* and *BiSS-C slave 2 (daisy chain) - Frame size*. This combination must fit the maximum frame size.

For more information, check *BiSS-C slave 2 (daisy chain)* section

6.10.11 BiSS-C slave 2 (daisy chain)

Summit servo drives are able to use two BiSS-C feedbacks connected in a daisy chain. This section describes how to configure the second feedback in this chainBiSS-C is a serial protocol that offers a series of advantages. These (amongst others) are:

- It has a standard protocol definition
- Contains error and warning bits and provides CRC checking
- It allows for daisy chain operation.

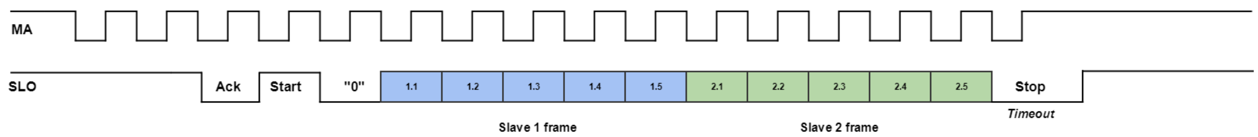
More information about the BiSS-C protocol can be found below:

BiSS-C protocol description

BiSS-C BP3 profile description

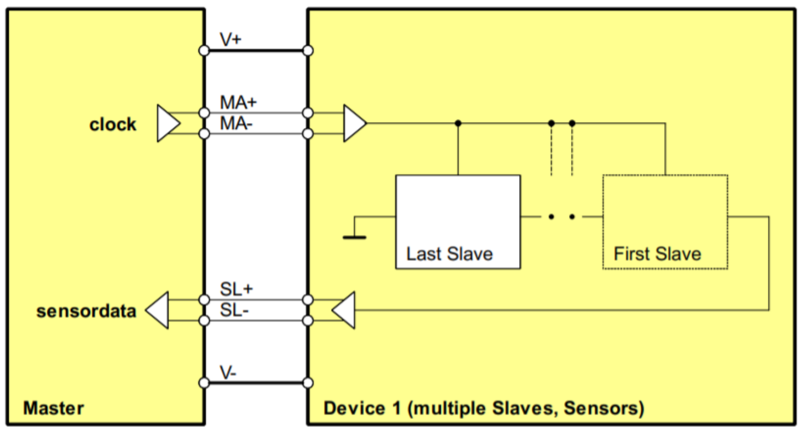
BiSS-C BP1 profile description

The following picture shows an example of a BiSS-C daisy chain frame. The example frame is divided into two segments, each containing data of each separate feedback.



ACK, Start, and CDS ("0") bits are automatically taken into account by the drive (when BiSS-C protocol is selected).

> **Note**
>
> Summit servo drives only support the BiSS-C unidirectional and point to point topology (shown below)



Sensor bus (1 Device / multiple Slaves) resp. point-to-point (Master / Device)

6.10.11.1 Daisy chain operation

Daisy chain operation is supported in BiSS-C. **The BiSS-C slave 2 encoder module is completely dependent on the** *BiSS-C slave 1 / Primary SSI encoder*. To be able to use this feedbacks in a daisy chain, both feedbacks (this one and *BiSS-C slave 1 / Primary SSI encoder*) need to be configured separately, both selected as feedback somewhere, and the **number of feedbacks in the chain** needs to be specified.

> When using daisy chain, the overall frame size is made up of the *BiSS-C slave 1 / Primary SSI encoder* frame size and the BiSS-C slave 2 frame size combined. This combination must fit the maximum frame size.

A set of parameters are available to the user to adapt the slave absolute interface to the different frame types:

- **Frame size.** Indicates the total number of bits of the frame. These include position bits, special bits, warning, error and CRC bits, etc.

  > Do not include "ACK", "Start", "CDS" bits in the frame size when using BiSS-C protocol. These are managed by the drive automatically.

- **Error tolerance.** The drive can detect errors in frames, such as the error bit and CRC in the BiSS-C protocol. If an incorrect frame is detected, it is dropped and the drive keeps the last read as current position actual. However, if too many followed errors are detected, the drive generates a fault and stops the operation. **This register specifies the number of errors accepted before generating the fault.**

  > Setting a 0 value will ignore any error from the encoder.

- **Polarity.** Indicates the direction of rotation of the encoder. 0 value applies standard polarity (read directly from the feedback) and a value different than 0 reverses the polarity.
- **Frame type.** Indicates the format of the received frame. This parameter allows parsing frames in a specific way. For example, the BiSS-C BP3 profile frame type will assume there are CRC, error and warning bits and will use them to detect errors in the frame

  > For unsupported frame types, use ***raw*** or ***raw gray*** modes. These modes allow reading the position from any frame type without processing special bits such as CRC or error flags.

  > **Note**
  >
  > Frame type 3 implements the BiSS-C BP3 profile. By selecting this frame type, the first 8 bits will automatically be used for CRC and error checking, since a BP3 BiSS-C frame is assumed. More information about this profile can be found here

- **Position bits.** Indicates the number of bits used for position readings.
- **Single-turn bits.** Indicates the number of position bits that represent single-turn information.

  > For single-turn absolute encoders, position bits = single-turn bits

- **Position start bit.** Defines how many bits the position information is displaced from the LSB in the serial absolute feedback frame.

The raw position value obtained from the absolute encoder readings is available for the user removing CRC and special flags from the frame. This parameter is useful to verify the proper configuration of the encoder.

> Invalid frames are dropped so all the positions on this parameter are valid for operation

6.10.12 Incremental encoder

Summit servo drives drive are able to use up to 2 digital incremental encoder as feedback for any purpose (position, velocity, commutation, and auxiliary).The parameters required to configured each digital encoder are:

- **Resolution.** Resolution of the encoder in total counts per mechanical revolution.

  > Changing the resolution of the incremental encoder resets the position, commutation and/or reference reading values if the incremental is selected for any of these functionalities.

- **Polarity.** Polarity of the encoder. Setting a 0 value sets standard polarity, and setting a value different from 0 sets reversed polarity.
- **Filter.** Glitch filter levels of the incremental encoder module. There are 10 different glitch filter levels. Each level corresponds to a specific cut-off frequency. Setting this parameter to 0 will disable the glitch filter. The different glitch filter levels can be seen in the following table:

Glitch filter levels (Register value)	Max Readable Encoder Freq (MHz)
0	100
1	33.33333333
2	16.66666667
3	8.333333333
4	4.166666667
5	2.083333333
6	1.041666667
7	0.5208333333
8	0.2604166667
9	0.1302083333
10	0.06535947712

Additionally to the processed values obtained from the control loops (position, velocity, or angle), the raw value of the encoder is available for the user.

6.10.13 Digital halls

Summit servo drives are able to use a digital halls as feedback. It can be configured using the following parameters:

- **Dig. hall polarity.** Polarity of the digital halls. Setting a 0 value sets standard polarity, and setting a value different from 0 sets reversed polarity.
- **Dig. hall filter**: Glitch filter levels of the digital halls module. There are 10 different glitch filter levels. Each level corresponds to a specific cut-off frequency. Setting this register parameter to 0 will disable the glitch filter. The different glitch filter levels can be seen in the following table:

Glitch filter levels (Register value)	Max Readable Encoder Freq (MHz)
0	100
1	33.33333333
2	16.66666667
3	8.333333333
4	4.166666667
5	2.083333333
6	1.041666667
7	0.5208333333
8	0.2604166667
9	0.1302083333
10	0.06535947712

- **Dig. hall pole pairs.** Pole pairs of the hall sensors.

> **Note**
>
> Generally, the pole pairs of the halls sensor are equal to the motor pole pairs

- **Dig. hall value.** Combination value of the halls signals, being A the less significant bit.

Summit servo drives include additional integrity checkings attached to digital halls that allow detecting dangerous errors during the operation of the digital halls themselves and other feedbacks

6.10.13.1 Halls combination error

This error ocurrs whenever all the signals are at high or low level. These combinations are not allowed and trigger a fault, since the feedback might be broken or disconnected and operation is not possible. This error has no option code, since it is a serious one. Instead, if needed, the Halls sensor can be removed from the feedbacks selected.

6.10.13.2 Halls sequence error

This error occurs when from one halls sector, a transition is made to a non-contiguous sector. This could happen when two halls signals change value at the same time. An error option code is available for this error.

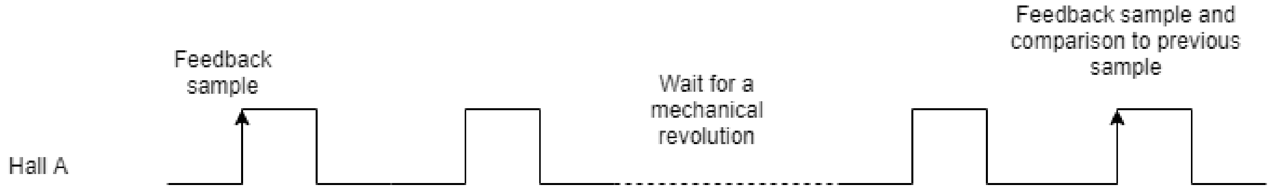
6.10.13.3 Feedback runaway checking against Halls

It is possible to check for feedback runaway conditions against halls if both are selected as feedback sensors in the drive. To do this:

1 - Select both feedbacks to be used by the drive

2 - Select the desired feedback to be checked in the **Feedback to check against Halls** parameter. The selected feedback readings will be checked on each mechanical revolution. **If the detected feedback counts per**

revolution differ more than 20% of the specified feedback resolution, an error occurs. An error option code is available for this error.



To detect counts per revolution of the selected feedback, an event is triggered on a specific transition of Hall A and is only triggered after as many repetitions as pair poles are specified. This event samples the readings of the feedback, and compares it to the previous event, except in the first event of all, where only the sample is taken. This first event can happen either at the start-up of the drive, or when changes of direction are detected in the halls feedback.

No more than two revolutions should occur before detecting a runaway error.

6.10.14 Internal generator

Summit servo drives include an internal generator that simulates feedback readings. It is useful for testing purpose or for system analysis.

> **Example**
>
> Internal generator is used as commutation feedback to force the movement of a BLAC motors to analyse the behaviour of the feedbacks in the system.

A set of parameters are available to configure the signal to be injected as feedback:

- **Mode.** Indicates the main waveform of the generator output
- **Frequency.** Sets the frequency of the generated signal in Hz.

  > **Note**
  >
  > Changing this value when the cycle number is different of 0 will set the generator value to 0. In this case, the frequency can't be changed dynamically and a rearm is required.

- **Gain and offset.** All generated waveforms are unitary internally. Gain and offset are used to scale the result to the desired magnitude:
  $Output = Gain \cdot Internal\ unitary\ value + Offset$
- **Cycle number.** Indicates the number of times a waveform is applied. Setting a 0 will apply the waveform continuously.

  > **Note**
  >
  > Writing to this register a value different to 0 will set the generator value to 0 until a rearm is performed

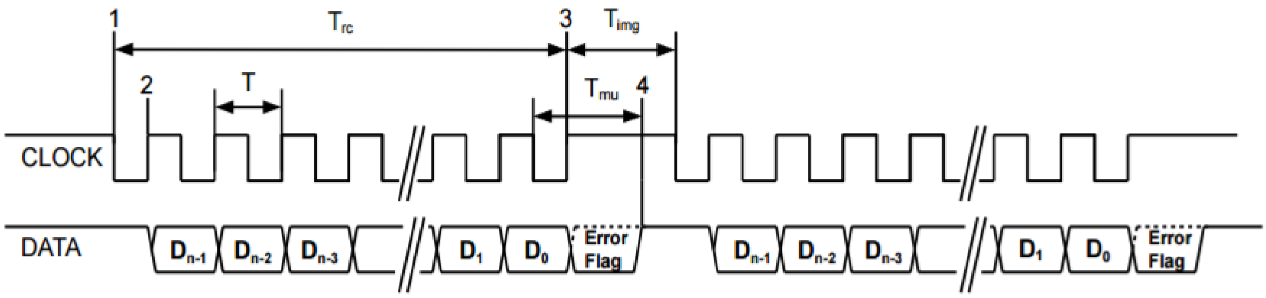
- **Rearm.** Writing a 1 triggers the generation of the waveform when certain cycles are specified. It is useful when a burst is applied.

> **Example**
>
> An application requires to simulate commutation feedback that does 10 electrical revolutions at 1 Hz every time a master requires it. The generator configuration will be:
>
> - **Mode:** 1 Sawtooth
>
> - **Frequency:** 1 Hz
>
> - **Gain:** 1.0
>
> - **Offset:** 0.0
>
> - **Cycle number:** 10
>
> Every time this sequence is required, the master will write a 1 into the rearm and should wait until the end of the sequence.

> **Important**
>
> When cycle numbers are changed, **the generator value is set to 0 regardless of the mode (even in constant mode)**. The generator value will remain 0 until a rearm is performed

6.10.15 Secondary SSI

Additionally to the main absolute encoder channel, an additional SSI encoder is supported by Summit servo drives. This covers the cases where dual absolute is required but BiSS-C daisy chain devices are not available. A wide variety of SSI are supported by Summit servo drives. However, every feedback product has its own protocol over the SSI. Below there is an example based on a protocol of the IncOder product family.



T: Clock Period (1/T = 100 kHz to 2 MHz)
Trc: Read Cycle time: This is defined as (n x T) + (0.5 x T)
Tmu: Message Update time. The time from last falling edge of clock to when new data is ready for transmission.
Tmu = 20us +/- 1 us. The DATA line will be HIGH after this time indicating a new Read Cycle can be started.
Timg: Intermessage Gap time. Must be > Tmu otherwise position data will be indeterminate.
n: The number of bits in the message (not including the Error Flag).
In idle state CLOCK and DATA are both HIGH

SSI1 (n = 24)

D23	PV	Position Valid Flag. Set to 1 when data is valid, otherwise 0 (the inverse of the ERROR FLAG).
D22	ZPD	Zero Point Default. Set to 1 when the Zero Point is at Factory Default, otherwise 0
D21-D0	PD[21:0]	Binary position data. If resolution of device is less than 22 bits, then the MSBs of this field are set to 0. The LSB of this field is in D0. When PV is 0, PD[21:0] value is not defined.

A set of parameters are available to the user to adapt the secondary SSI interface to the different supported protocols

- **Frame size.** Indicates the total number of bits of the frame, including position and any special bit.
- **Error tolerance.** The drive is able to detect an incorrect frame (for example readings the position valid flag of the SSI1). If an incorrect frame is detected, it is dropped and the drive keeps the last read as current position actual. However if too many followed errors are detected, the drive generates a fault and stops the operation. **This register specifies the number of errors accepted before generating the fault.**

  > ⚠ Setting a 0 value will ignore any error from the encoder.

- **Reading wait cycles.** Control loops might work at high rates, so the minimum period between SSI readings might be higher and the drive must wait some control loops before requesting a new data.
- **Polarity.** Indicates the direction of rotation of the SSI encoder. 0 value applies standard polarity (read directly from the feedback) and a value different than 0 reverses the polarity.
- **Frame type.** Indicates the format of the received frame.

> For unsupported frame types, use ***raw*** or ***raw gray*** modes. This modes allows to read the position from any frame type without processing special bits such as CRC or error flags.

- **Position bits.** Indicates the number of bits used for position readings.
- **Single-turn bits.** Indicates the number of the position bit used for single-turn.

  > For single-turn absolute encoders, position bits = single-turn bits

- **Position start bit.** Indicates the bit location of the first position bit inside the frame

The raw position value obtained from the absolute encoder readings is available for the user removing CRC and special flags from the frame. This parameter is useful to verify the proper configuration of the encoder.

> Invalid frames are dropped so all the positions on this parameter are valid for operation

6.11 Inputs and outputs configuration

Summit servo drives include a set of outputs and inputs for general purposes that might be used by the master to extend the functionalities of the application.

By default, all GPI and GPO are configured to work as standard GPIO. It means that the master is able to:

1. **Read** the state of the GPO & GPI
2. **Set** the state of the GPO.

Furthermore, the **polarity** of these GPI & GPO is configurable to simplify the master application.

Additionally, these GPI and GPO can be attached to special functionalities that extend the drive capabilities:

- **Positive and negative homing switches**. A GPI is able to work as a homing switch on applications where this functionality is available. How the homing process works using homing switches is described in the *Homing* section.
- **Positive and negative switch limit.** A GPI is able to work as a switch limit on applications where the movement is not infinite and delimited by sensors. When this feature is available, the drive will not allow movement in the same direction as the detected switch limit independent of the selected operation mode.

> **Examples**
>
> If a motor is moving into the positive direction and the positive switch limit is "1":
>
> - In any of the position modes, the drive will generate a position demand equal to the actual position, so movement is not generated (the position is held).
> - In any of the velocity modes, the drive will generate a velocity demand equal to 0 (the position is held)
> - In any of the current modes, the drive will generate a current demand equal to 0 (the position is not held because torque is not applied)
> - In voltage mode, the drive will generate a voltage demand equal to 0 (the position is not held because torque is not applied)

- **Quick stop input.** A GPI can trigger a quick stop request. When a GPI is mapped to this function and its value is "1" a quick stop transition is executed if possible. See the state machine details (from *Operation* section) of the drive for further information.

> **Warning**
>
> Although it is supported to map an input to different functions, pay special attention to each input mapping. Undesired behaviors could appear due to a poor configuration (i.e. entering quick stop state when enabling a homing switch or limit switch)

- **Halt input.** A GPI can trigger a Halt request. When a GPI is mapped to this function and its value is "1" a quick stop transition is executed if possible. See the control word details (from *Operation* section) of the drive for further information.
- **Operation enable indicator.** A GPO attached to this event will indicate if the drive is in operation enable state. GPO is set to "HIGH" level when the drive reaches the operation enable state of its state machine. Otherwise, it is set to "LOW".
- **Health signal.** A GPO attached to this event will indicate if the drive is outside the fault state. It is set to "LOW" if a fault is detected and it is active. It is set to "HIGH" otherwise.
- **External shunt.** A GPO attached to this functionality will be set to HIGH when the read bus voltage overcomes the **shunt enable voltage** and will be set LOW when the read bus voltage is below the **shunt disable threshold**.

> Check the *Shunt braking resistor* section for further information.

6.12 Shunt braking resistor

Summit series devices allow using shunt braking resistors to dissipate the regenerative energy on the DC bus.

The systems consist of a braking resistor, typically external to the drive, and a power transistor that is activated when the DC bus value exceeds a certain value. For some drivers the shunt transistor is internal, on others like Everest, the transistor must be added externally or on an interface board. In this case, a general-purpose output can be configured to enable the shunt braking transistor.

The shunt algorithm enables the assigned pin when the drive's bus voltage exceeds the **shunt enable voltage**. The pin stays active until the bus voltage decreases below the **shunt disable voltage**.

6.12.1 Internal shunt braking resistor configuration

The internal shunt uses hardware already implemented in the summit device. This feature might not be available on all drives, depends on the hardware.

> **Note**
>
> Internal shunt availability is product dependent

6.12.2 External shunt braking resistor configuration

The external shunt can be mapped to one or several digital outputs. Those outputs should activate the braking transistor. This can be done directly connecting the output to the transistor gate (when using low power, logic-level threshold transistors) or activating a gate driver when a high power transistor is necessary.

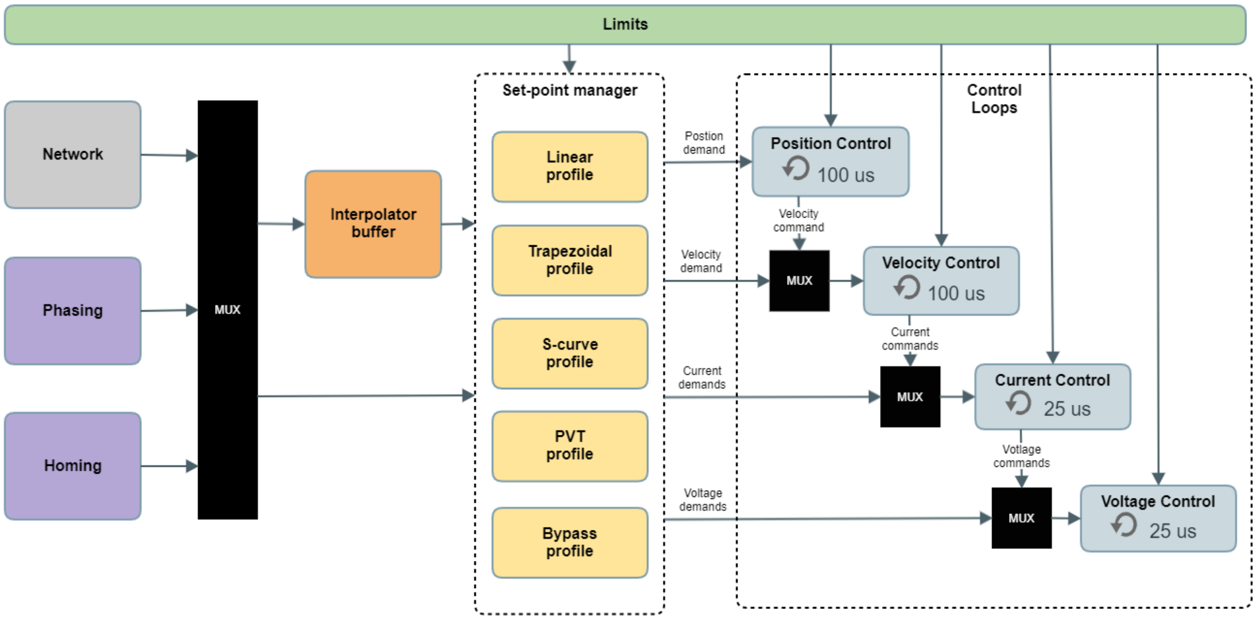
> **Note**
>
> External shunt requires general-purpose outputs to work

6.12.2.1 External shunt braking resistor output mapping

External shunt needs to be mapped to a general-purpose output in order to work. It can be mapped to several outputs simultaneously. The general-purpose output mapping parameters can be found in the *Inputs and outputs* section.

7 Operation

The following diagram shows the main Summit servo drives architecture regarding drive operation:



Network, **Phasing** and **Homing** blocks are the different sources of set-points. The **network** is always the main command source, however, when a **phasing** sequence or a **homing** is executed, the set-points from the **network** are ignored until the process finishes.

Inside the **set-point manager**, only one **profile** can be active at a time. The **set-point manager** is also responsible for delivering data from the **interpolator buffer** to the profiles.

Inside the **control loops**, all the loops are connected in cascade. So if a control block is enabled, all the other blocks to the right are active too.

> **Example**
>
> If velocity control is active, current and voltage control blocks will be active too, whereas position control may be active or not

The interconnection of the interpolator buffer, the set-point manager and control loops blocks result in a different mode of operation. These modes of operation are classified in:

- Basic modes
- Cyclic modes
- Profiler modes
- Interpolated modes

> There is an extra operation mode which includes the Homing block: **Homing mode**

> Users have complete control of the active mode of operation except when the phasing process is executed.

7.1 Basic modes

These modes are composed only by control loops (bypass profile from set-point manager):

- Position mode (P)
- Velocity mode (V)
- Current mode (C)
- Voltage mode

These modes take directly the information from the network set-point at the control loop rate.

These modes are useful for tuning purposes or in cases where the update rate of the master set-points is near to the control loops rate.

There is not an equivalent mode of operation from CiA402 / DS402 profiles for these modes.

7.2 Cyclic modes

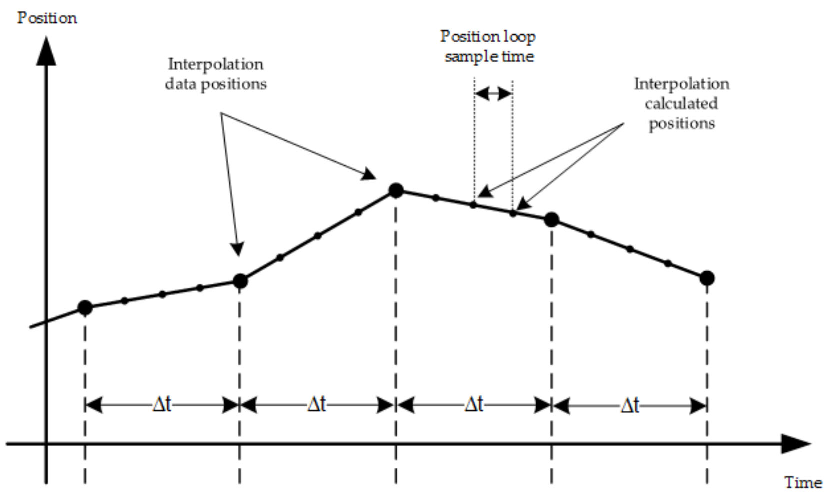
These modes are composed by control loops and the linear profile:

- Cyclic Synchronous Position (CSP) - *Compatible with CSP from CiA402 / DS402*
- Cyclic Synchronous Velocity (CSV) - *Compatible with CSV from CiA402 / DS402*
- Cyclic Synchronous Torque (CST) - *Compatible with CST from CiA402 / DS402*
- Cyclic Synchronous Current (CSC)

Cyclic Synchronous Torque

The drive does not include a torque loop. This mode works using the current control loop and estimating torque from current readings.

These modes require to know the update rate of the network set-points. This rate is compared with the internal control loops rate and the linear profile interpolates values between set-points. This allows smoother movements and relaxed timings from the master's side.



These modes are useful when the master is the one that generates the system profile, because the included by the drive does not fulfill the application requirements or because the profile involves multiple-axis that must be synchronized. Usually, a proper set-point update rate for these modes are 1 - 2 kHz.

7.3 Profiler modes

These modes are composed by control loops and trapezoidal or S-curve profiles:

- Profile Position (PP) - *Compatible with PP from CiA402 / DS402*
- S-curve Profile Position (SPP)
- Profile Velocity (PV) - *Compatible with PP from CiA402 / DS402*

These modes use a configurable trapezoidal or S-curve profiles that generate all the required demand values from a single set-point value.

> These modes are useful when the profile option inside the drive can fulfill the application requirements or/and the master capabilities do not allow generate an external profile at the required rate and determinism.

7.4 Interpolated modes

These modes are composed of control loops, all the available profiles, and the interpolator buffer:

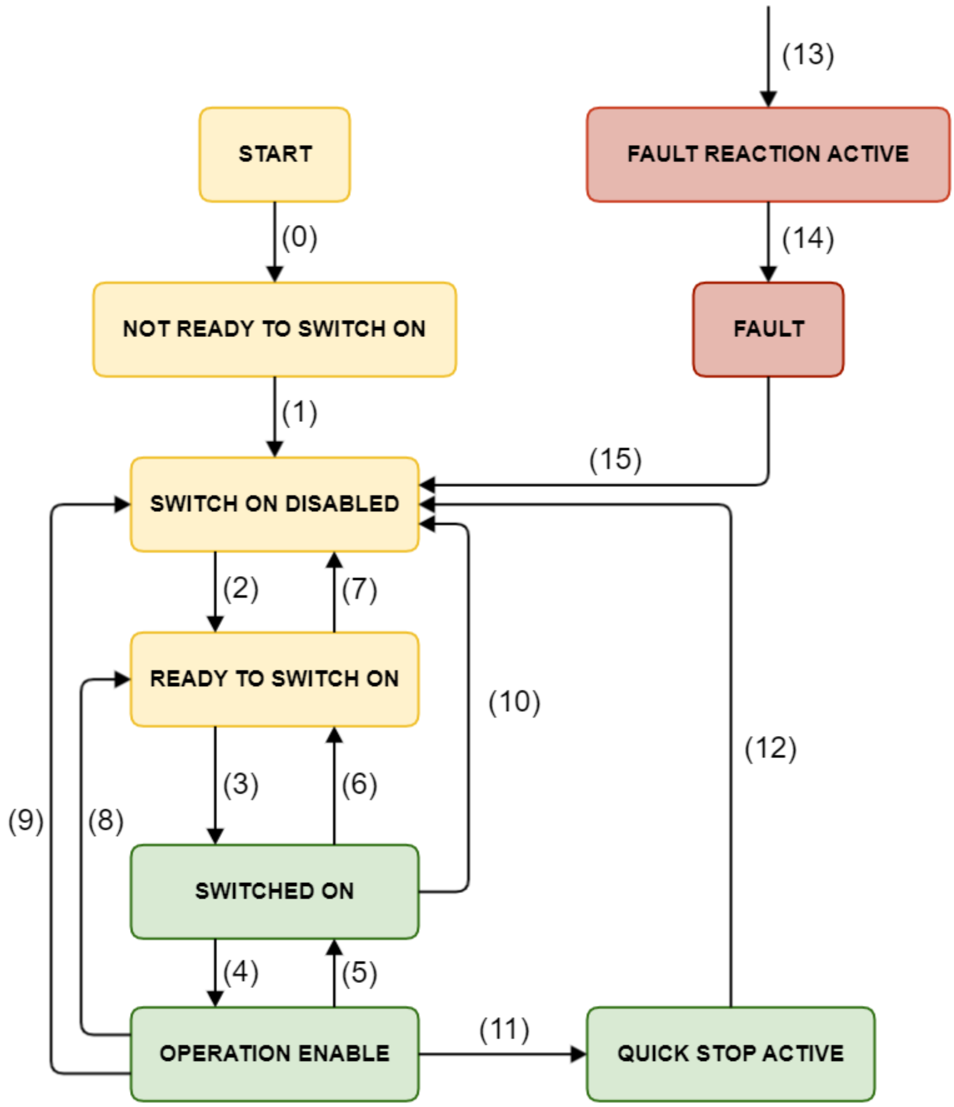
- Interpolated position mode (IP) - Uses linear profile
- Position, velocity and time (PVT) - Uses 5th-degree polynomials

These modes use the interpolator buffer to store a sequence of set-points. The drive injects these set-points into its control loops at a configurable update rate.

> These modes are useful when the profile has to be generated by the master but it is not able to transfer the set-point at a deterministic update rate. It sends bursts of set-points and gives the drive the responsibility to inject them at the proper time.

7.5 State machine

To operate with the previous modes of operation the drive implements a subsection of the CiA402 profile to standardize the drive states during configuration and operation. This state machine is composed of the next elements:



The following table indicates which functionalities can be activated in every state.

Function	Not ready to switch on	Switch on disable	Ready to switch on	Switched on	Operation enabled	Quick stop active	Fault reaction active	Fault
Brake applied	Yes	Yes	Yes	Yes	No	No	No	Yes
Drive function enabled	No	No	No	No	Yes	Yes	Yes	No
Configuration allowed	Yes	Yes	Yes	Yes	No	No	No	Yes

The controller supports the following events and actions.

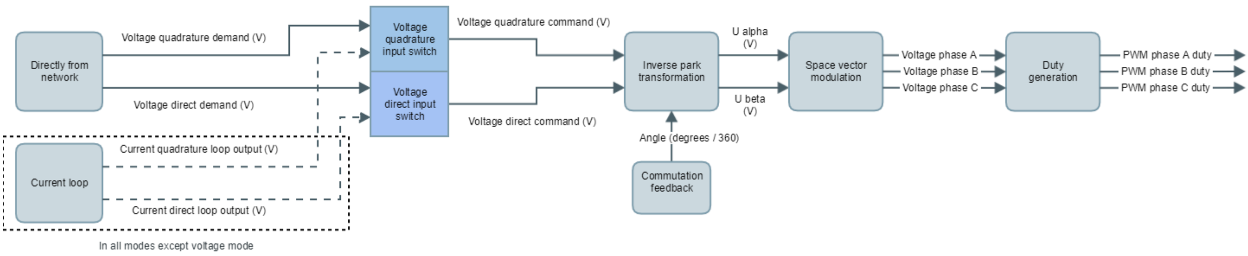
Transition	**Event**	**Action**
0	Automatic transition after power-on or reset application.	Drive device self-test and/or self initialization is performed.
1	Automatic transition after initialization.	Communications are activated. Feedback modules are reset
2	*Shutdown command* received	None.
3	*Switch on command* received	The high-level power is switched on.
4	*Enable operation command* received	The drive function is enabled, the initial angle determination process is executed and all internal set-points cleared. PI/PID controllers accumulators are reset.
5	*Disable operation command* received	The drive function is disabled.
6	*Shutdown command* received	The high-level power is switched off.
7	*Quick stop* or *disable voltage command* received	None.
8	*Shutdown command* received	The drive function is disabled, and the high-level power is switched off. Feedback modules are reset
9	*Disable voltage* command received	The drive function is disabled, and the high-level power is switched off. Feedback modules are reset
10	*Disable voltage* or *quick stop command* received	The high-level power is switched off. Feedback modules are reset
11	*Quick stop command* received	The quick stop function is started.
12	Automatic transition when the *quick stop* function is completed or *disable voltage command* is received	The drive function is disabled, and the high-level power is switched off. Feedback modules are reset
13	*Fault* signal.	The configured fault reaction function is executed.
14	Automatic transition.	The drive function is disabled, and the high-level power is switched off.
15	*Fault reset command* received	A reset of the fault condition is carried out if no fault exists currently on the drive device; after leaving the Fault state, the Fault reset bit in the control word is cleared by the control device.

When the drive function is disabled, no energy will be supplied to the motor. Target or set-point (torque, velocity, position) in that situation are not processed.

7.6 Voltage mode

This mode is used to apply a voltage directly to the actuator, without any kind of regulation. It requires a proper configuration of the commutation sensor.

The commutation sensor configuration process is described in the *Commutation* section.



If **software position limits** are enabled using this mode of operation, the drive will generate a fault if the position limits are exceeded. Set them to 0 to disable this functionality or disable the fault generation masking it.

If actuator velocity overcomes the **max. velocity** parameter using this mode of operation, the drive will generate a fault. Disable the fault generation masking it.

If current measurements surpass the **max. current** parameter using this mode of operation, the drive will generate a fault. Disable the fault generation masking it.

In this mode, this drive is still protected by the main protections such as over/under voltage, over/under temperature, short-circuits, and I2T.

7.7 Current modes (CSC, C, CA)

Summit devices implement different ways to use current loop control to adapt the needs to the application:

- **Current (C).** Current mode in q-d axis.
- **Cyclic synchronous current (CSC).** Current mode in q-d axis using an internal interpolator.
- **Current amplifier (CA).** Current mode in a-b-c axis.

7.7.1 Current (C) and Cyclic Synchronous Current (CSC) modes

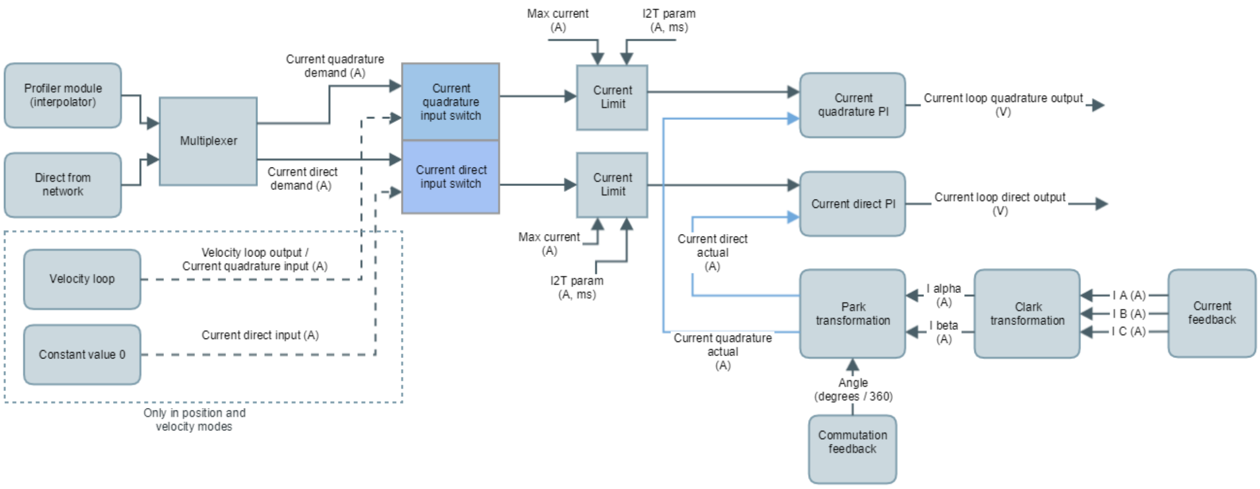
This mode is used to command the current driven through the actuator. It requires a proper configuration of the commutation sensor.

The commutation sensor configuration process is described in the *Commutation* section.

If **software position limits** are enabled using this mode of operation, the drive will generate a fault if the position limits are exceeded. Set them to 0 to disable this functionality

If actuator velocity overcomes the **max. velocity** parameter using this mode of operation, the drive will generate a fault. Disable the fault generation masking it.

7.7.1.1 Control scheme



A current limit block is available to protect the system in front of high commanded currents or the excessive amount of energy accumulated (I2T). **Max. current** and I2T parameters determine this limit an are applied to both **current quadrature demand** and **current direct demand.** The output of the PI is directly connected to the voltage demands signals of the Voltage mode.

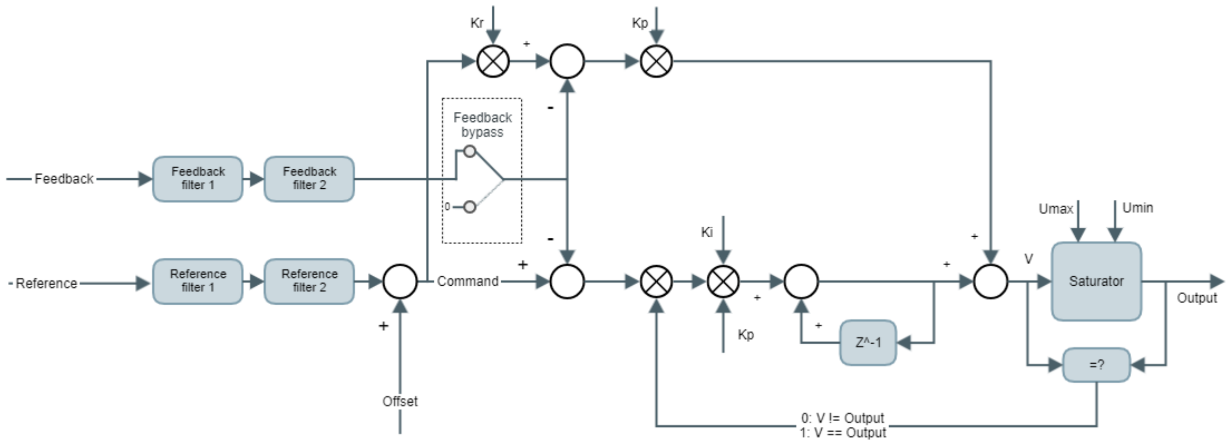
Warning

When the commutation modulation type parameter is set to Brushless DC or Brushed DC, only the current quadrature path is used. In this case, the Current direct actual value will be forced to 0, and the current direct input will have no effect.

The current feedback delivers **current A value**, **current B value,** and **current C value**. Internal FOC (Field Oriented Control) algorithm converts these inputs into the PI feedbacks **current quadrature value** and **current direct value.** How the current feedbacks is obtained is product dependent.

The current feedback chain is described in the *Feedbacks* section.

The implemented PI module follows the next block diagram:



The output of the control loop at the kth sample is:

$$V[k] = (c[k]K_r - f[k])K_p + (c[k] - f[k])K_p K_i x_1[k]) + x_2[k]$$

Where:

- V is the output before entering in the saturator
- c is the Command signal (Output of the Reference + Filters + offset)
- f is the Filtered Feedback signal (Output of the Feedback + Filters)
- **Kp** & **Ki** are the PI gains
- **Kr** is the set-point weight, used to choose between topologies PI, IP or mixed.
- x_1 is:

$$x_1[k] = \begin{cases} 1 : V[k-1] = Output[k-1] \\ 0 : V[k-1] \neq Output[k-1] \end{cases}$$

- x_2 is the integrator output in the previous sample period:

$$x_2[k] = (c[k] - f[k])K_i + x_2[k-1]$$

The input current values reference and feedback are expressed A. The output voltage value is expressed V.

The output after the saturator is limited to the values Umax and Umin, so if the V signal is outside these parameters, the output is clamped.

All current modes work with two PI in parallel and its parameters are:

- **Current direct loop Kp** & **current quadrature loop Kp**
- **Current direct loop Ki** & **current quadrature loop Ki**
- **Current direct loop Kr** & **current quadrature loop Kr**
- **Current direct loop max. out** & **current quadrature loop max. out** (Umax)
- **Current direct loop min. out** & **current quadrature loop min. out** (Umin)

All current modes involve the next signals and parameters:

- **Current direct demand** and **current quadrature demand** are the reference input of the PI (Reference signal from the diagram).
- **Current direct/B command** and **current quadrature/A command** are the command values after the filter and offset is applied (Command signal from the diagram).
- **Current direct value** and **current quadrature value** are the feedback input after the filter is applied (Filtered Feedback signal from the diagram).
- **Voltage direct command** and **Voltage quadrature command** are the output of the PI (Output signal from the diagram)

On the other hand, the implemented controller supports additional features that help during the tuning of the PI:

- **Current loop feedback bypass** allows opening the loop of the PI. The feedback path is removed from the real feedback signals and it forces a value of 0.
- **Current loop rate** contains the update rate of execution of these PIs.
- **Current loop statusword** contains information of PI functionality:
    - **Loop enabled.** This flag activates if the current loop is enabled and in use.
    - **Upper saturator active (momentary).** This flag activates when the current loop is saturating on the upper limit. The flag deactivates when the upper saturation is not happening anymore.
    - **Lower saturator active (momentary).** This flag activates when the current loop is saturating on the lower limit. The flag deactivates when the lower saturation is not happening anymore.
    - **I2T limiting (momentary).** This flag activates when the current loop command is being limited by the I2T algorithm. The flag deactivates when the command stops being limited by the I2T.
    - **Derating limiting (momentary).** This flag activates when the current loop command is being limited by the derating algorithm. The flag deactivates when the command stops being limited by the derating.
    - **Upper saturator active (latching).** This flag activates when the current loop is saturating on the upper limit and does not deactivate if the condition changes.
    - **Lower saturator active (latching).** This flag activates when the current loop is saturating on the lower limit and does not deactivate if the condition changes.
    - **I2T limiting (latching).** This flag activates when the current loop command is being limited by the I2T algorithm and does not deactivate if the condition changes.
    - **Derating limiting (latching).** This flag activates when the current loop command is being limited by the derating algorithm and does not deactivate if the condition changes.

> **Note**
>
> The latching flags of the control loops status get reset whenever the power stage transitions to "operation enabled" state or whenever a current loop PID parameter is changed.

7.7.1.2 Filters and offset

Additionally to the PI controllers, two biquad filters in cascade are available for both PI input sources: Reference and feedback. The purpose of these filters differs on every application, but basically they help to improve feedback readings or compensate undesired system dynamics. There are multiple configurations for every filter:

- Low pass filter
- High pass filter
- Band pass filter
- Peak filter
- Notch filter
- Low shelf filter
- High shelf filter

The next parameters configure every filter type

Filter type	Frequency	Q-factor	Gain (dB)
Low pass	X	X	-
High pass	X	X	-
Band pass	X	X	-
Peak	X	X	X
Notch	X	X	-
Low shelf	X	-	X
High shelf	X	-	X

The related parameters for filter configuration are:

- **Current reference filter 1 type** & **current reference filter 2 type**
- **Current reference filter 1 frequency** & **current reference filter 2 frequency**
- **Current reference filter 1 Q-factor**& **current reference filter 2 Q-factor**
- **Current reference filter 1 gain** & **current reference filter 2 gain**
- **Current feedback filter 1 type** & **current feedback filter 2 type**
- **Current feedback filter 1 frequency** & **current feedback filter 2 frequency**
- **Current feedback filter 1 Q-factor**& **current feedback filter 2 Q-factor**
- **Current feedback filter 1 gain** & **current feedback filter 2 gain**

The configured filter is applied to both components quadrature and direct at the same time.

In some applications, the PI and the filters are not enough for proper control. In these cases, there is an additional input through the reference signal to the PI (after filters are applied) that is identified as Offset in the PID diagram. The purpose of these **current quadrature loop input offset** and **current direct loop input offset** is to be used by an external master to compensate for the system dynamics based on information that cannot be read directly by the drive.

7.7.1.3 Closing upper loops on the master

In some applications, the drive is configured to work in current mode with a "simple" controller diagram whereas the position and velocity loops are implemented by an external master. For those applications where additional feedback is required to be monitored outside the drive, an **auxiliary feedback sensor** is available to map extra feedback to the drive. The readings are available on **auxiliary feedback value** in raw format (cnt). Any mappable feedback used for position and velocity can be used as an **auxiliary feedback sensor**.

7.7.1.4 Current (C) mode description

Current (C) mode uses the above control scheme, connecting the **current direct set-point** and **current quadrature set-point** inputs from the application directly to the **current direct demand** and **current quadrature demand** signals mentioned above.

Note

Set-points will begin being taken into account after transitioning to the "operation enabled" state on the drive.

7.7.1.5 Cyclic Synchronous Current (CSC) mode description

Cyclic Synchronous Current mode (CSC) uses the above control scheme as well but connects **current direct set-point** and **current quadrature set-point** inputs to the interpolator from the set-point manager. The interpolator will begin to generate **current direct demand** and **current quadrature demand** after a change in any of the previous signals.

> **Warning**
>
> It is mandatory to configure the **interpolation time mantissa** and **interpolation time exponent**. The value of these parameters will determine how the interpolation will be performed. The product of these two parameters should match the time that will take to update the current quadrature set-point. More information about the interpolator can be found in the set-point manager.

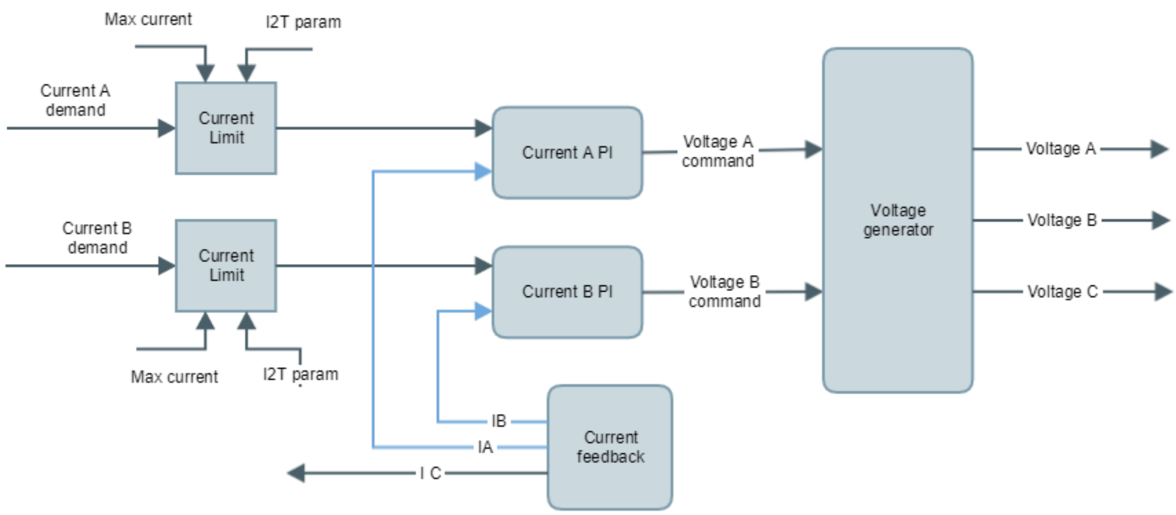
> **Note**
>
> Interpolations will begin immediately upon a change of **current quadrature set-point** or **current demand set-point**

> **Warning**
>
> When the commutation modulation type parameter is set to Brushless DC or Brushed DC, only the current quadrature control is used. However, both of the current inputs (direct and quadrature) are still used for processing some protections (I2T, derating). In this case, make sure the current direct set-point and current direct loop input offset are set to 0

7.7.2 Current Amplifier (CA) mode

This mode is used to command the current of every phase driven through the actuator.

7.7.2.1 Control scheme



> If **software position limits** are enabled using this mode of operation, the drive will generate a fault if the position limits are exceeded. Set them to 0 to disable this functionality

> If actuator velocity overcomes the **max. velocity** parameter using this mode of operation, the drive will generate a fault. Disable the fault generation masking it.

The current limit block is available to protect the system in front of high commanded currents or the excessive amount of energy accumulated (I2T). The output of the PI is directly connected to the voltage demands signals of the Voltage mode.

The implemented PI module follows exactly the same scheme as other current modes and the equations are the same. The difference is the involved signals:

- **Current A demand** and **current B demand** are the reference input of the PI (Reference signal from the diagram).
- **Current direct/B command** and **current quadrature/A command** are the command values after the filter and offset is applied (Command signal from the diagram).
- **Current A value**, **current B value** are the feedback input after the filter is applied (Filtered Feedback signal from the diagram).
- **Current C value** is indirectly used as feedback also (A, B and C current magnitudes are linked by Kirchhoff's law)
- **Voltage direct command** and **Voltage quadrature command** are the output of the PI (Output signal from the diagram)

On the other hand, the implemented PI supports additional features that help during the tuning of the PI:

- **Current loop feedback bypass** allows opening the loop of the PI. The feedback path is removed from the real feedback signals and it forces a value of 0.
- **Current loop rate** contains the update rate of execution of these PIs.
- **Current loop statusword** contains information of PI functionality:
    - **Loop enabled.** This flag activates if the current loop is enabled and in use.
    - **Upper saturator active (momentary).** This flag activates when the current loop is saturating on the upper limit. The flag deactivates when the upper saturation is not happening anymore.
    - **Lower saturator active (momentary).** This flag activates when the current loop is saturating on the lower limit. The flag deactivates when the lower saturation is not happening anymore.
    - **I2T limiting (momentary).** This flag activates when the current loop command is being limited by the I2T algorithm. The flag deactivates when the command stops being limited by the I2T.
    - **Derating limiting (momentary).** This flag activates when the current loop command is being limited by the derating algorithm. The flag deactivates when the command stops being limited by the derating.
    - **Upper saturator active (latching).** This flag activates when the current loop is saturating on the upper limit and does not deactivate if the condition changes.
    - **Lower saturator active (latching).** This flag activates when the current loop is saturating on the lower limit and does not deactivate if the condition changes.
    - **I2T limiting (latching).** This flag activates when the current loop command is being limited by the I2T algorithm and does not deactivate if the condition changes.
    - **Derating limiting (latching).** This flag activates when the current loop command is being limited by the derating algorithm and does not deactivate if the condition changes.

> **Note**
>
> The latching flags of the control loops status get reset whenever the power stage transitions to "operation enabled" state or whenever a current loop PID parameter is changed.

The input current values reference and feedback are expressed A. The output voltage value is expressed V.

The PI controllers used in this mode are exactly the same than the above ones.

Therefore the PI for phase A is configured with parameters:

- **Current quadrature loop Kp**
- **Current quadrature loop Ki**
- **Current quadrature loop Kr**
- **Current quadrature loop max. out** (Umax)
- **Current quadrature loop min. out** (Umin)

And for phase B:

- **Current direct loop Kp**
- **Current direct loop Ki**
- **Current direct loop Kr**
- **Current direct loop max. out** (Umax)
- **Current direct loop min. out** (Umin)

7.8 Torque modes (CST)

7.8.1 Cyclic Synchronous Torque (CST) mode

This mode is used to command the torque that the actuator applies. It requires a proper configuration of the commutation sensor.

> The commutation sensor configuration process is described in the *Commutation* section.

> If **software position limits** are enabled using this mode of operation, the drive will generate a fault if the position limits are exceeded. Set them to 0 to disable this functionality.

> If actuator velocity overcomes the **max. velocity** parameter using this mode of operation, the drive will generate a fault. See *Error Management* section for masking it.

7.8.1.1 Control scheme

Torque estimation is based on current measurements. Therefore the control scheme is the same as the used on current modes.

A current limit block is available to protect the system in front of high commanded currents or the excessive amount of energy accumulated (I2T). The output of the PI is directly connected to the voltage demands signals of the Voltage mode.

This mode of operation connects **current direct set-point** and **current quadrature set-point** inputs to the interpolator from the set-point manager. The interpolator will begin to generate **current direct demand** and **current quadrature demand** after a change in any of the previous signals.

The Cyclic Synchronous Torque mode is obtained keeping **current direct set-point** to 0 A and using **current quadrature set-point** as a single set-point. From the user point of view the involved parameters are:

- **Torque constant** defines the relationship of the magnitude current quadrature (A) and torque (N).
- **Target torque** is linked to the **current quadrature set-point**. The units are thousands of rated torque.
- **Torque actual value** is the representation of **current quadrature value** in thousands of rated torque units.
- **Torque offset** value is linked to the **current quadrature loop input offset**. The units are thousands of rated torque.

The PI parameters involved are the same as the used in current modes based on direct and quadrature components.

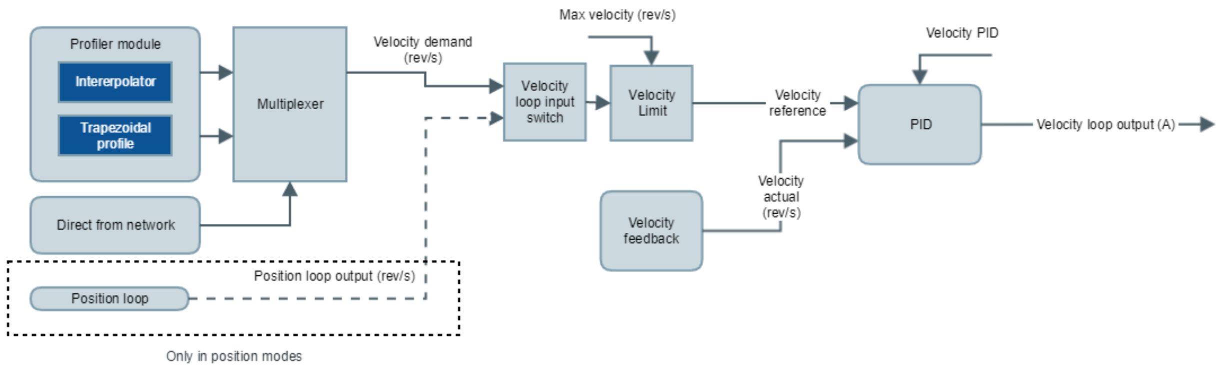
> **Warning**
>
> It is mandatory to configure the interpolation time mantissa and magnitude order for this mode to work. The value of these parameters will determine how the interpolation will be performed. The product of these two parameters should match the time that will take to update the current quadrature set-point. More information about the interpolator can be found in the *Set-point manager and interpolator buffer* section

> **Note**
>
> Interpolations will begin immediately upon a change of **Target torque**

7.9 Velocity modes (CSV, PV, V)

This mode is used to command the velocity of the actuator. It requires a proper configuration of the commutation sensor.

> The commutation sensor configuration process is described in the *Commutation* section.



> If software position limits are enabled using this mode of operation, the drive will generate a fault if the position limits are exceed. Set them to 0 to disable this functionality

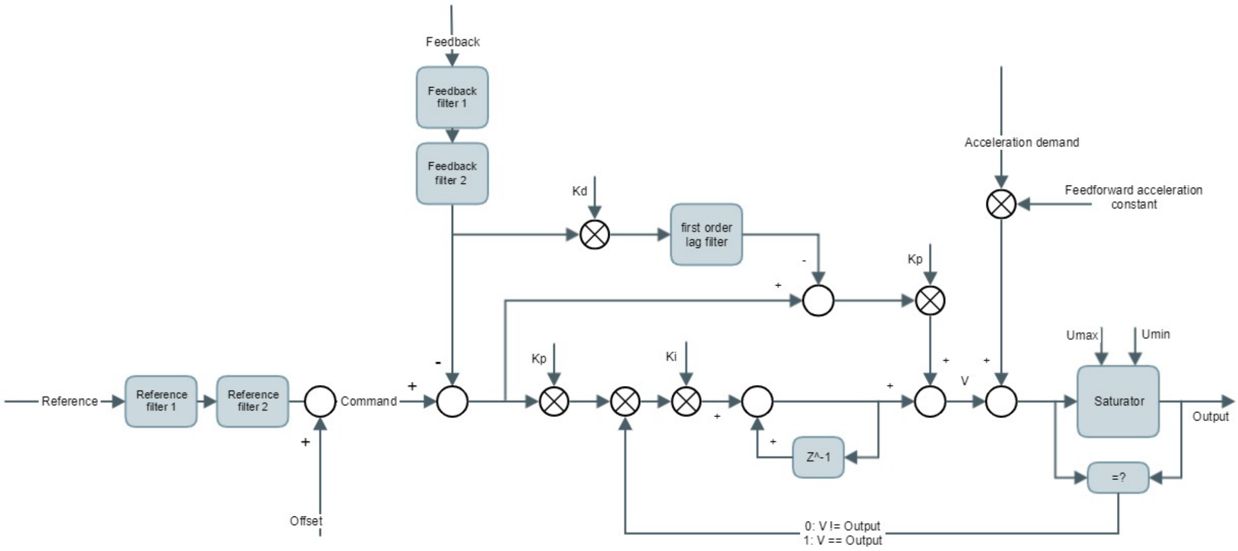
The velocity limit block is available to protect the system in front of high commanded velocities unsupported by the system. **Max. velocity** determines this limit and is applied to the **velocity demand**. The result of applying this limit is visible through **velocity loop control command**. The output of the PID is directly connected to the current Q reference signal of the current modes (CSC, C, CA). The current D reference is fixed to 0.

This mode can be sourced directly from the network or through the profiler mode. This last one allows two configurations: using interpolator (CSV) or trapezoidal profile (PV).

The velocity feedback block delivers the **actual velocity** of the system based on the **velocity feedback sensor.**

> The drive supports multiple feedback options. Take a look at the *Feedbacks* section.

The implemented PID module follows the next block diagram:



The output of the control loop at the kth sample is:

$$I[k] = x_i[k] + K_p(x_p[k] - x_d[k]) + K_{ffa}a_{demand}$$

Where:

- I is the output before entering in the saturator
- c is the Command signal (Output of the Reference + Filters + offset)
- f is the Filtered Feedback signal (Output of the Feedback + Filters)
- **Kp**, **Ki** & **Kd** are the PID gains
- **Kffa** is the feed-forward acceleration gain
- a_{demand} is the acceleration demand
- x_p is the proportional path:
  $$x_p[k] = c[k] - f[k]$$
- x_i is the integral path:
  $$x_i[k] = x_i[k-1] + (c[k] - f[k])K_pK_ix_1[k])$$
  where x_1 is:
  $$x_1[k] = \begin{cases} 1 : I[k-1] = Output[k-1] \\ 0 : I[k-1] \neq Output[k-1] \end{cases}$$
- x_d is the derivative path:
  $$x_d[k] = K_dc_1(f[k] - f[k-1]) - c_2x_d[k-1]$$
  where c_1 and c_2 are the derivative filter coefficients:
  $$c_1 = \frac{2}{T+2\tau}$$
  $$c_2 = \frac{T-2\tau}{T+2\tau}$$
  T is the sample period and τ is the reciprocal of the desired filter bandwidth in radians per second.

The input velocity values reference and feedback are expressed in mechanical revolutions per second (rev/s). The output current value is expressed in A.

The output after saturator is limited to the values Umax and Umin, so if the I signal is outside these parameters, the output is clamped.

> The output of the velocity controller is connected to the **current quadrature command** (before the filters and offset) of the current control. The **current direct command** is set to 0 A.

All velocity modes work with a PID controller and its parameters are:

- **Velocity loop Kp**
- **Velocity loop Ki**
- **Velocity loop Kd**
- **Velocity loop Kd filter**
- **Velocity loop Kffa**
- **Velocity loop max. output** (Umax)
- **Velocity loop min. output** (Umin)

All velocity modes involve the next signals and parameters.

- **Velocity demand** is the reference input of the PI (Reference signal from the diagram)
- **Velocity loop control command** is the command value after the filter, offset and limits are applied (Command signal from the diagram).
- **Actual velocity** is the feedback input after the filter is applied (Filtered Feedback signal from the diagram).

On the other hand, the implemented controller supports additional features that help during the tuning of the PID:

- **Position & velocity loop rate** contains the update rate of execution of the PID.
- **Velocity loop status** contains information about PID functionality;
    - **Loop enabled.** This flag activates if the current loop is enabled and in use.
    - **Upper saturator active (momentary).** This flag activates when the current loop is saturating on the upper limit. The flag deactivates when the upper saturation is not happening anymore.
    - **Lower saturator active.** This flag activates when the current loop is saturating on the lower limit. The flag deactivates when the lower saturation is not happening anymore.
    - **Command limit.** This flag activates when the **velocity loop control command** signal is above the **max. velocity** limit**.** The flag deactivates when the **velocity loop control command** signal is below the **max. velocity** threshold**.**
    - **Set-point limit.** This flag activates when the **velocity set-point** is above the **max. velocity limit.** Under this situation, the **velocity demand** is limited to **max. velocity.** The flag deactivates when the **velocity set-point** is below **max.velocity threshold.**
- **Control loops option code.** This parameter allows to enable or disable the continuity of the PID output. If enabled, it would prevent instantaneous undesired PID outputs. Also, changing the PID constants can cause discontinuities in the control output.

1. If continuity is going to be used, it is recommended to have a non-zero integral constant.
2. Do not use this feature while tuning the system since it could be misleading.

- **Velocity window** and **velocity window time** are used to determine when the **actual velocity** has reached the **velocity set-point**. Depending on the selected feedback, the system environment, and the drive configuration, the velocity ripple amplitude changes. These configurable parameters are used to determine what is the maximum tolerable error between the two mentioned parameters.
- **Velocity following error window** and **velocity following error timeout** are used to determine when the **actual velocity** is not following the **velocity demand** as expected, it means the error between them is too big. The response of the system if the following error is detected is configurable by the **velocity following error option code**.

7.9.1 Filters and offset

Additionally to the PID controller, two biquad filters in cascade are available for both PID input sources: Reference and feedback. The purpose of these filters differs on every application, but basically they help to improve feedback readings or compensate undesired system dynamics. There are multiple configurations for every filter:

- Low pass filter
- High pass filter
- Band pass filter
- Peak filter

- Notch filter
- Low shelf filter
- High shelf filter

The next parameters configure every filter type:

Filter type	Frequency	Q-factor	Gain (dB)
Low pass	X	X	-
High pass	X	X	-
Band pass	X	X	-
Peak	X	X	X
Notch	X	X	-
Low shelf	X	-	X
High shelf	X	-	X

The related parameters for filter configuration are:

- **Velocity reference filter 1 type** & **velocity reference filter 2 type**
- **Velocity reference filter 1 frequency** & **velocity reference filter 2 frequency**
- **Velocity reference filter 1 Q-factor**& **velocity reference filter 2 Q-factor**
- **Velocity reference filter 1 gain** & **velocity reference filter 2 gain**
- **Velocity feedback filter 1 type** & **velocity feedback filter 2 type**
- **Velocity feedback filter 1 frequency** & **velocity feedback filter 2 frequency**
- **Velocity feedback filter 1 Q-factor**& **velocity feedback filter 2 Q-factor**
- **Velocity feedback filter 1 gain** & **velocity feedback filter 2 gain**

In some applications, the PID and the filters are not enough for proper control. In these cases, there is an additional input through the reference signal to the PID (after filters are applied) that is identified as Offset in the PID diagram. The purpose of this **velocity loop input offset** is to be used by an external master to compensate for the system dynamics based on information that cannot be read directly by the drive.

7.9.2 Closing position loop on the master

In some applications, the drive is configured to work in velocity mode with a "simple" controller diagram whereas the position loop is implemented by an external master or sometimes two different feedbacks are used to measure the same parameter to add redundancy in the feedback channel. For those applications where additional feedback is required to be monitored outside the drive, an **auxiliary feedback sensor** is available to map extra feedback to the drive. The readings are available on **auxiliary feedback value** in raw format (cnt). Any mappable feedback used for position and velocity can be used as an **auxiliary feedback sensor**.

Example

A system uses a high-resolution digital incremental encoder and digital halls for work in velocity mode in a multi-turn based system. An additional external SSI encoder wants to be used by the master of the application to command different profiles based on the position, but this master does not have the required electronics to read the SSI. The drive can be configured as a bridge mapping the SSI into the **auxiliary feedback sensor.** Then it processes and returns the SSI position information directly through the network channel.

7.9.3 Velocity mode (V)

Velocity (V) mode uses the above control scheme, connecting the **velocity set-point** input from the application directly to the **Velocity demand** signal mentioned above.

> **Note**
>
> Set-points will begin being taken into account after transitioning to the "operation enabled" state on the drive.

7.9.4 Cyclic Synchronous Velocity (CSV)

Cyclic Synchronous Velocity mode (CSV) uses the above control scheme as well but connects the **velocity demand** to the linear profile of the set-point manager.

> **Note**
>
> The profile will start generating points depending on the selected **profiler latching mode**. If latching is disabled, the linear profile starts immediately upon a change of **velocity set-point**. If latching is enabled, the linear profile starts after a change of **velocity set-point** and its confirmation through lathing bit from the **control word.**

> **Warning**
>
> It is mandatory to configure the **interpolation time mantissa** and **interpolation time exponent**. The value of these parameters will determine how the linear profile will be performed. The product of these two parameters should match the time that will take to update the current quadrature set-point. More information about the linear profile can be found in the *Set-point manager and interpolator buffer* section.

7.9.5 Profile velocity (PV)

Profile velocity (PV) uses the same control scheme as CSV. The difference is that the selected profiler of the set-point manager is trapezoidal instead of linear. This profile requires additional user-configurable parameters. These are

- **Profiler max. velocity**
- **Profiler max. acceleration**
- **Profiler max. deceleration**

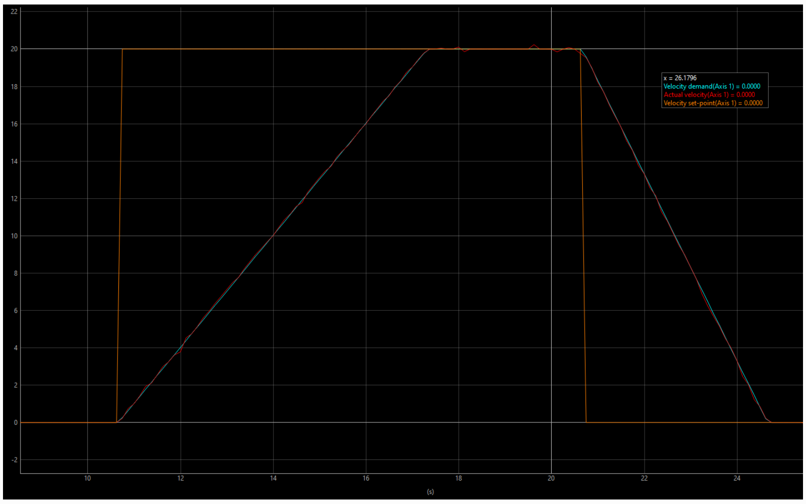
> **Note**
>
> The profile will generate new points that will begin depending on the selected **profiler latching mode**. If latching is disabled, the linear profile starts immediately upon a change of **velocity set-point**. If latching is enabled, the linear profile starts after a change of **velocity set-point** and its confirmation through latching bit from the **control word.**

The trapezoidal profile is composed of two stages in velocity mode: First, a linear acceleration/deceleration stage followed, and secondly, a constant velocity stage when either the **velocity set-point,** the **profiler max. velocity** or the **max. velocity limit** is reached.

In this mode, the profile is not time-restricted.

Example

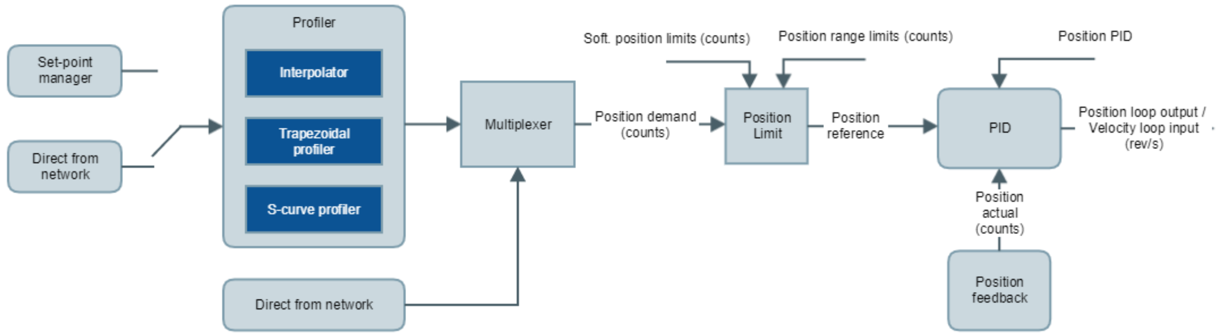
In the following picture, a trapezoidal velocity trajectory can be observed (composed of two set-point commands: 20 rev/s and 0 rev/s). Note that the acceleration and deceleration are different.



7.10 Position modes (CSP, PP, IP, P)

This mode is used to command the position of the actuator. It requires a proper configuration of the commutation sensor.

> The commutation sensor configuration process is described in the *Commutation* section.



Position limit block is available to protect the system in front of mechanical limits or other factors or to allow endless positioning in case of, for example, rotary systems. **Max position** and **min position** determine these limits and are applied to **position demand.** The output of the PID is directly connected to the velocity loop input block of the Velocity modes (CSV, PV, V).

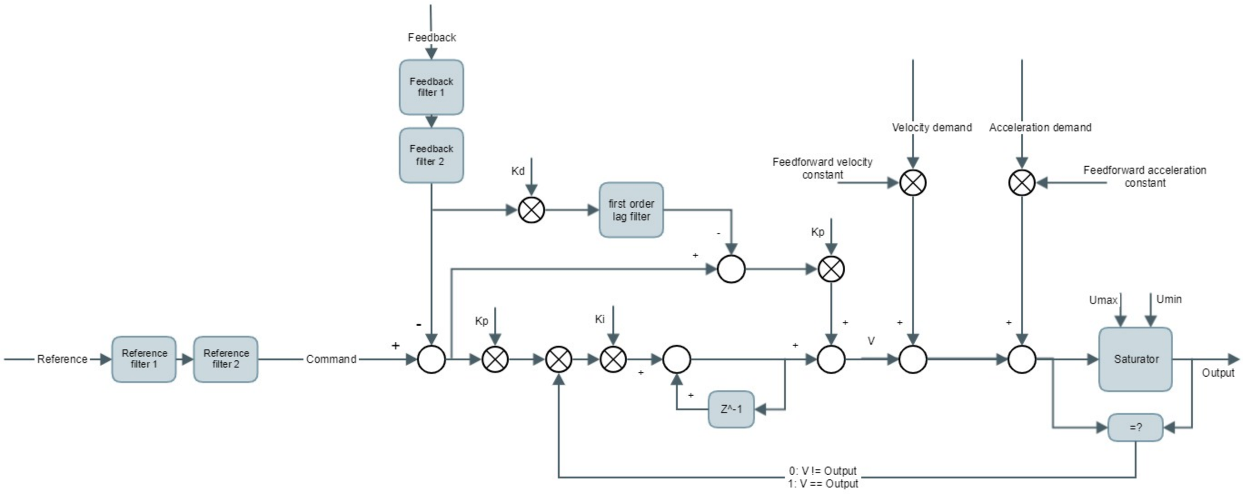
This mode can be sourced directly from the network or through the profiler mode. This last one allows multiple configurations:

- Cyclic synchronous position (CSP)
- Profile position (PP): trapezoidal and s-curves
- Interpolated position (IP): linear and 5th polynomial

The position feedback block delivers the **actual position** of the system based on the **position feedback sensor**.

> The drive supports multiple feedback options. Take a look at the *Feedbacks* section.

The implemented PID module follows the next block diagram:



The output of the control loop at the k^th sample is:

$$V[k] = x_i[k] + K_p(x_p[k] - x_d[k]) + K_{ffv}v_{demand} + K_{ffa}a_{demand}$$

Where:

- V is the output before entering in the saturator
- c is the Command signal (Output of the Reference + Filters + offset)
- f is the Filtered Feedback signal (Output of the Feedback + Filters)
- **Kp**, **Ki** & **Kd** are the PID gains
- **Kffv**, **Kffa** are the feed-forward velocity and acceleration gains, respectively
- a_{demand} is the acceleration demand
- v_{demand} is the velocity demand
- x_p is the proportional path:
  $x_p[k] = c[k] - f[k]$
- x_i is the integral path:
  $x_i[k] = x_i[k-1] + (c[k] - f[k])K_pK_ix_1[k])$
  where x_1 is:
  $x_1[k] = \begin{cases} 1 : V[k-1] = Output[k-1] \\ 0 : V[k-1] \neq Output[k-1] \end{cases}$
- x_d is the derivative path:
  $x_d[k] = K_dc_1(f[k] - f[k-1]) - c_2x_d[k-1]$
  where c_1 and c_2 are the derivative filter coefficients:
  $c_1 = \frac{2}{T+2\tau}$
  $c_2 = \frac{T-2\tau}{T+2\tau}$
  T is the sample period and τ is the reciprocal of the desired filter bandwidth in radians per second.

The input position values reference and feedback are expressed in feedback counts. The output velocity value is expressed in mechanical revolutions per second.

The output after saturator is limited to the values Umax and Umin, so if the I signal is outside these parameters, the output is clamped.

ⓘ The output of the position controller is connected to the **velocity command** (before the filters and offset) of the velocity control.

All position modes work with a PID controller and its parameters are:

- **Position loop Kp**
- **Position loop Ki**
- **Position loop Kd**
- **Position loop Kd filter**
- **Position loop Kffa**
- **Position loop Kffv**
- **Position loop max. output** (Umax)
- **Position loop min. output** (Umin)

All position modes involve the next signals and parameters.

- **Position demand** is the reference input of the PI (Reference signal from the diagram)
- **Position loop control command** is the command value after the filter and offset is applied (Command signal from the diagram).
- **Actual position** is the feedback input after the filter is applied (Filtered Feedback signal from the diagram).

On the other hand, the implemented controller supports additional features that help during the tuning of the PID:

- **Position & velocity loop rate** contains the update rate of execution of the PID.

- **Position loop status** contains information about PID functionality;
  - **Loop enabled.** This flag activates if the current loop is enabled and in use.
  - **Upper saturator active (momentary).** This flag activates when the current loop is saturating on the upper limit. The flag deactivates when the upper saturation is not happening anymore.
  - **Lower saturator active.** This flag activates when the current loop is saturating on the lower limit. The flag deactivates when the lower saturation is not happening anymore.
  - **Command limit.** This flag activates when the **position loop control command** signal is outside the **max. position** and **min. position** limits. The flag deactivates when the **position loop control command** signal is inside the position limit thresholds**.**
  - **Set-point limit.** This flag activates when the **position set-point** is outside the **max. position** and **min. position** limits. Under this situation, the **position demand** is limited to the nearest position limit. The flag deactivates when the **position set-point** is inside the position limit thresholds**.**
- **Control loops option code.** This parameter allows to enable or disable the continuity of the PID output. If enabled, it would prevent instantaneous undesired PID outputs. Also, changing the PID constants can cause discontinuities in the control output.

1. If continuity is going to be used, it is recommended to have a non-zero integral constant.
2. Do not use this feature while tuning the system since it could be misleading.

- **Position window** and **position window time** are used to determine when **position demand** has been reached by the **actual position**. Depending on the selected feedback, the system environment, and the drive configuration the velocity ripple amplitude changes. These configurable parameters are used to determine what is the maximum tolerable error between the two mentioned parameters.
- **Position following error window** and **position following error timeout** are used to determine when the **actual position** is not following the **position demand** as expected, it means the error between them is too big. The response of the system if the following error is detected is configurable by the **position following error option code**.

7.10.1 Filters and offset

Additionally to the PID controller, two biquad filters in cascade are available for both PID input sources: Reference and feedback. The purpose of these filters differs on every application, but basically they help to improve feedback readings or compensate undesired system dynamics. There are multiple configurations for every filter:

- Low pass filter
- High pass filter
- Band pass filter
- Peak filter
- Notch filter
- Low shelf filter
- High shelf filter

The next parameters configure every filter type:

Filter type	Frequency	Q-factor	Gain (dB)
Low pass	X	X	-
High pass	X	X	-
Band pass	X	X	-
Peak	X	X	X
Notch	X	X	-
Low shelf	X	-	X
High shelf	X	-	X

The related parameters for filter configuration are:

- **Position reference filter 1 type** & **position reference filter 2 type**
- **Position reference filter 1 frequency** & **position reference filter 2 frequency**

- **Position reference filter 1 Q-factor**& **position reference filter 2 Q-factor**
- **Position reference filter 1 gain** & **position reference filter 2 gain**
- **Position feedback filter 1 type** & **position feedback filter 2 type**
- **Position feedback filter 1 frequency** & **position feedback filter 2 frequency**
- **Position feedback filter 1 Q-factor**& **position feedback filter 2 Q-factor**
- **Position feedback filter 1 gain** & **position feedback filter 2 gain**

In some applications, the PID and the filters are not enough for proper control. In these cases, there is an additional input through the reference signal to the PID (after filters are applied) that is identified as Offset in the PID diagram. The purpose of this **position loop input offset** is to be used by an external master to compensate for the system dynamics based on information that cannot be read directly by the drive.

7.10.2 Additional feedback sensor

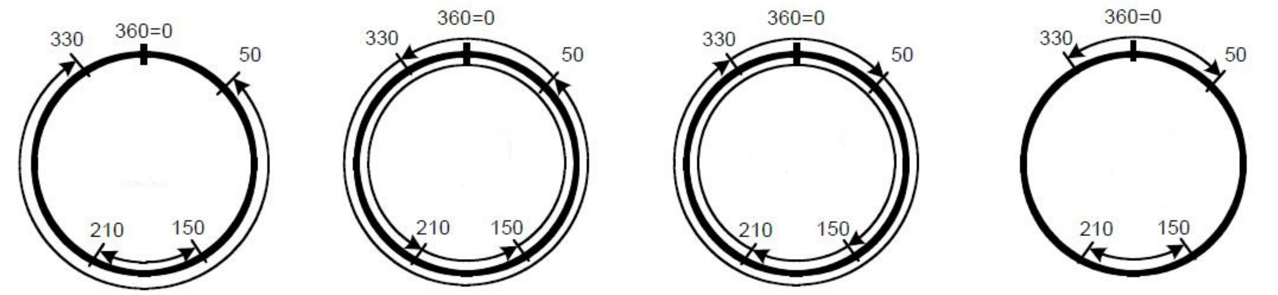
The drive allows activating additional extra feedback for monitoring or other purposes. This feedback is activated selecting it through the **auxiliary feedback sensor**. The readings are available on **auxiliary feedback value** in raw format (cnt). Any mappable feedback used for position and velocity can be used as an **auxiliary feedback sensor**.

7.10.3 Endless position applications

Applications where position control is used but the system position range is infinite (rotary systems) can be described into the drive by using the **max position range limit** and **min position range limit**. On reaching or exceeding these limits, the position set-point and position actual wrap automatically to the other end of the range. Usually, when these registers are required they define a complete system revolution.

If software position limits and position range limits are enabled, the more restricted is applied. Software position limits are chosen in case of conflict:

Following figure shows examples of the different position option movement types. In this example, the min position range limit is 0° and the max position range limit is 360°.



7.10.4 Position mode (P)

Position (P) mode uses the above control scheme, connecting the **position set-point** input from the application directly to the **position demand** signal mentioned above.

> **Note**
>
> Set-points will begin being taken into account after transitioning to the "operation enabled" state on the drive.

7.10.5 Cyclic synchronous position mode (CSP)

Cyclic Synchronous Position mode (CSP) uses the above control scheme as well but connects the **position demand** to the linear profiler of the set-point manager.

> **Note**
>
> The profile will generate depending on the selected **profiler latching mode**. If latching is disabled, the linear profile starts immediately upon a change of **position set-point**. If latching is enabled, the linear profile starts after a change of **position set-point** and its confirmation through lathing bit from **the control word.**

> **Warning**
>
> It is mandatory to configure the **interpolation time mantissa** and **interpolation time exponent**. The value of these parameters will determine how the linear profile will be performed. The product of these two parameters should match the time that will take to update the current quadrature set-point. More information about the linear profile can be found in the *Set-point manager and interpolator buffer* section.

7.10.6 Profile position (PP)

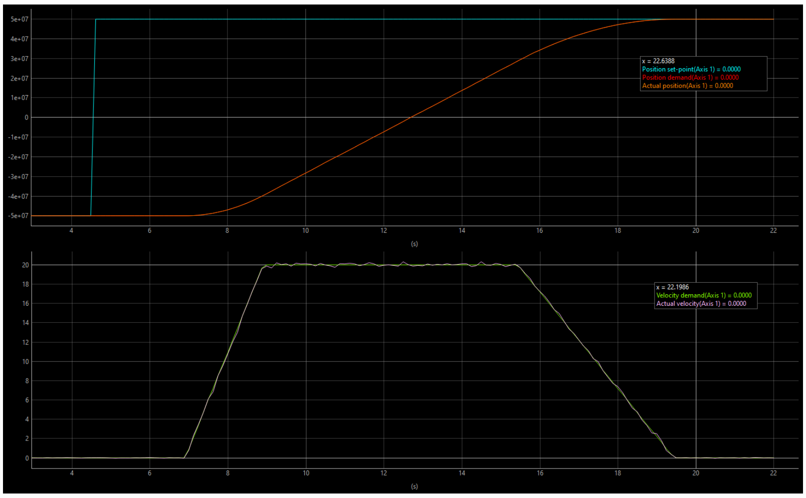
Profile position (PP) uses the same control scheme as CSP. The difference is the selected profile mode in the set-point manager. Instead of a linear profile used to interpolate position set-points, a more complex profile is generated taking into account user-configurable parameters. These parameters are:

- **Profiler max. velocity**
- **Profiler max. acceleration**
- **Profiler max. deceleration**

In this mode, a trapezoidal profiler is used. Further information about the trapezoidal profile can be found in the *Set -point manager and interpolator buffer* section.

> ⚠ This mode accepts new set-points by validating them through the control word register.

> ⓘ **Example**
>
> The following picture shows a trapezoidal velocity trajectory in a profile position (PP) movement.



7.10.7 S-curve profile position (SPP)

The S-curve profile position mode (SPP) uses the same control scheme as PP. The main difference between SPP and PP is that in PP the velocity follows a trapezoidal trajectory (acceleration, constant velocity, deceleration), whereas, in SPP, the transition points of the trapezoidal trajectory are instead linked by 5th-degree polynomials. This creates a smoother and continuous velocity trajectory, and the jerk in the system is reduced. The position trajectory also becomes smoother than in PP mode. In this mode, the set-point manager parameters required are the same as in PP. These are.

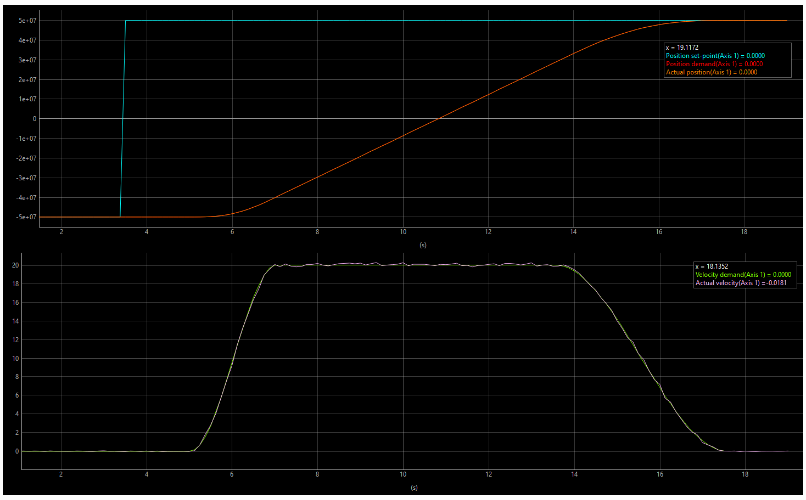
- **Profiler max. velocity**
- **Profiler max. acceleration**
- **Profiler max. deceleration**

Further information about the S-curve profile can be found in the *Set-point manager and interpolator buffer* section.

> ⚠ This mode accepts new set-points by validating them through the control word register.

Example

The following picture shows an equivalent movement of the example above, but using a S-curve velocity trajectory in a S-curve profile position (SPP) movement.



7.10.8 Interpolated position (IP)

Interpolated Position mode (IP) behaves in a similar fashion to CSP, in the way that uses a linear interpolator in the profiler module to operate. The main difference, however, is that the set-points of the interpolator are provided by the interpolation buffer.

In this mode, the interpolation buffer allows the user to append a buffer of positions in the drive that will be fed to the set-point manager at a constant rate given by the **interpolation time mantissa** and **interpolation time exponent.** More information about the interpolation buffer can be found in the *Set-point manager and interpolator buffer* section.

Warning

It is mandatory to configure the **interpolation time mantissa** and **interpolation time exponent** for this mode to work. The value of these parameters will determine how the interpolation will be performed. The product of these two parameters should match the time that will take to update the position set-point.

7.10.9 Position velocity time (PVT)

Position velocity time (PVT) behaves in a similar fashion to IP. In this mode, the *Set-point manager and interpolation buffer* allow the user to provide the drive with sets of final position, velocity, and movement duration. Interpolation time mantissa and magnitude order will not be necessary for this mode because interpolation time will be extracted from the time introduced into the buffer of the set-point manager directly. These sets of points are then fed to the set-point manager, which will use the PVT profiler to generate 5th-degree polynomial trajectories that reach each position set-point at the specified velocity in the given time duration.

Warning

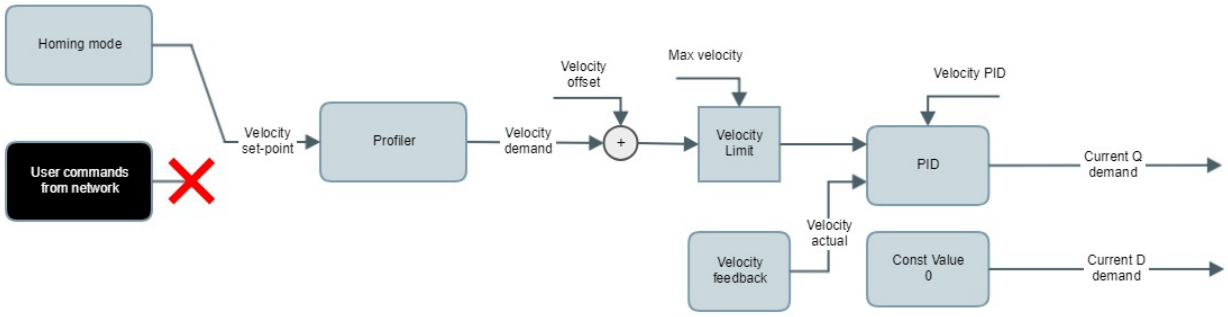
The generated PVT profile does not take into account the system limits to generate its trajectories. This means that the master should take care of ensuring that the requested trajectories can be physically performed within the average limitations of the motor.

7.11 Homing

Homing is a set of motion sequences used for locating the "home" position of the system. This method is usually needed:

- In systems using incremental position encoders. After power on, homing is used to locate the 0 (home) position.
- In systems using absolute position encoders. Usually, it is used to apply an offset to the position readings after power on to have a different 0 position than the absolute encoder one.

Homing movements are based on velocity mode with the profiler. If this mode is enabled, user commands (target velocity) are ignored.



There a several methods to be applied to find the home position. The next list are the options available on summit drives.

> ⓘ If the whole homing process is not finished within the time specified in the homing timeout register, the homing process is aborted at this point and the statusword error bit is set.

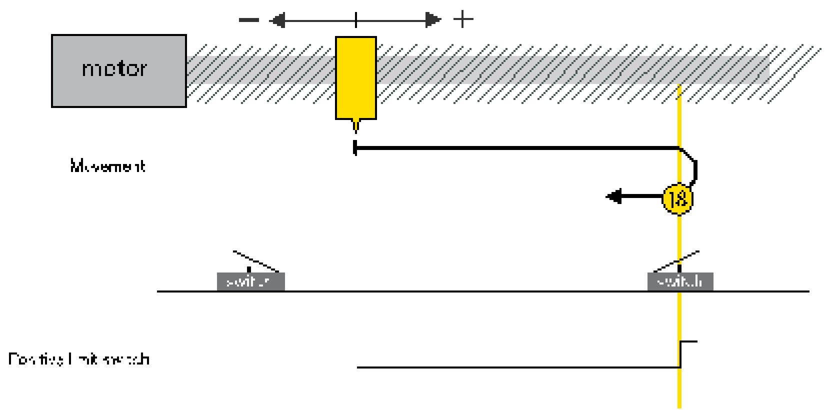
7.11.1 Homing on current position

Home position is the current position.

7.11.2 Homing on the positive limit switch

This method starts motor movement in a positive direction until a change on the output signal of an electromechanical switch placed ad the rightmost position is detected.

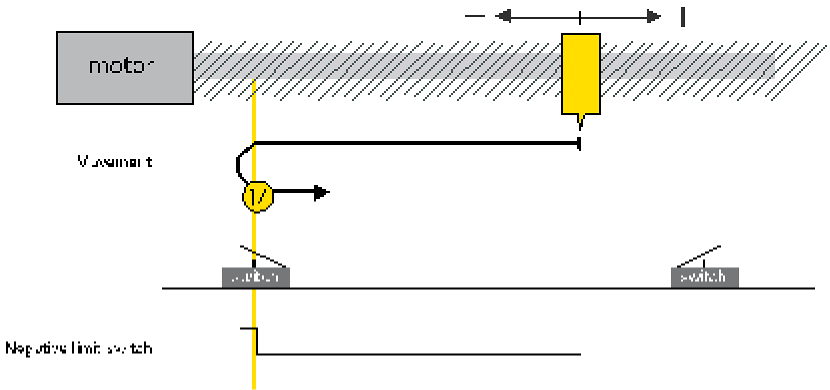
Afterwards, the axis is moved in a negative direction until the switch signal toggles its value again. This is the home point.



7.11.3 Homing on the negative limit switch

This method starts motor movement in a negative direction until a change on the output signal of an electromechanical switch placed ad the leftmost position is detected.

Afterwards, the axis is moved in a positive direction until the switch signal toggles its value again. This is the home point.



7.11.4 Homing on negative index pulse

This method starts motor movement in a negative direction until an index pulse is received. This is the home point.

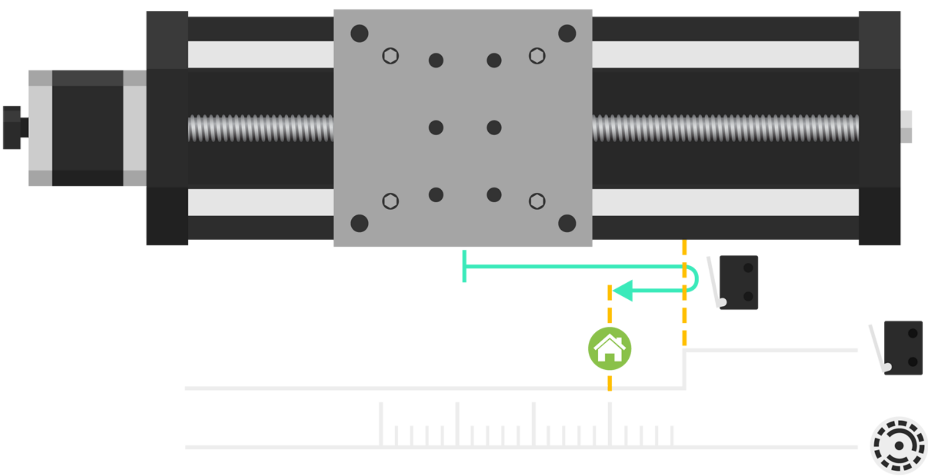
7.11.5 Homing on positive index pulse

This method starts motor movement in a positive direction until an index pulse is received. This is the home point.

7.11.6 Homing on the positive limit switch and index pulse

This method starts motor movement in a positive direction until a change on the output signal of an electromechanical switch placed at the rightmost position is detected.

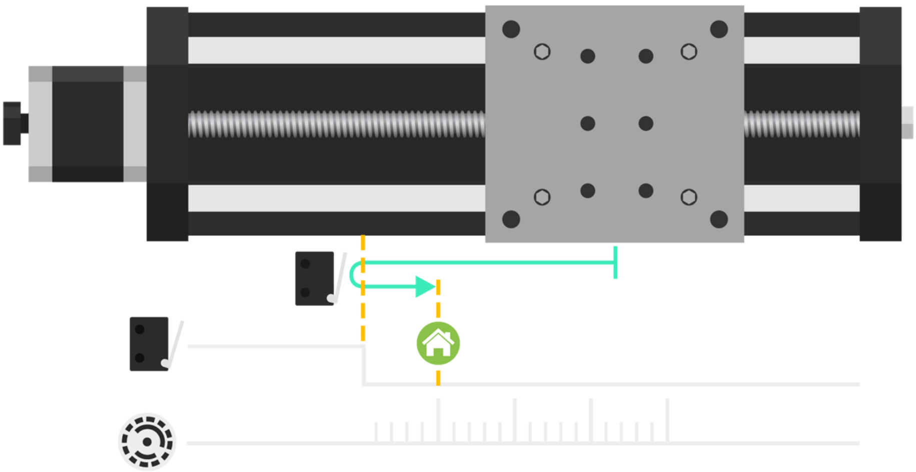
Afterwards, the axis is moved in a negative direction until the switch signal toggles its value again. When the switch signal has toggled, the movement continues until an index pulse is received. This is the home point.



7.11.7 Homing on the negative limit switch and index pulse

This method starts motor movement in a negative direction until a change on the output signal of an electromechanical switch placed at the leftmost position is detected.

Afterwards, the axis is moved in a positive direction until the switch signal toggles its value again. When the switch signal has toggled, the movement continues until an index pulse is received. This is the home point.



7.12 Set-point manager

These modules allow generating different profiles and managing burst of set-points for applications where the master cannot be fast enough and deterministic for generating its own profiles.

On one hand, the set-point manager is in charge of:

- Enabling and configuring the available profiles
- Generating a profile point on each control loop cycle

Additionally, the interpolation buffer allows storing set-points to be injected into the profiler later. When enabled, the set-point manager takes a new input from the interpolation buffer at a given rate and injects it into the active profile. The rate at which the set-points are extracted from the buffer can be determined by **interpolation time exponent** and the **interpolation time mantissa** or by the introduced duration if the PVT operation mode is selected. The profile output is directly connected to the demand of the chosen mode of operation (Position, Velocity or Current)

The profiles are not available on every selected mode of operation. For example, profiles cannot be connected to any voltage mode. Further details about what is available on each mode are:

- *Current modes (CSC, C, CA)*
- *Velocity modes (CSV, PV, V)*
- *Position modes (CSP, PP, IP, P)*

Modes using only profiles are referenced in this documentation as profile mode. Modes combining profile and the interpolation buffer are called in this documentation interpolated modes.

7.12.1 Profiles

7.12.1.1 Linear profile

This mode is time-restricted and **interpolation time exponent** and **interpolation time mantissa** are inputs of each movement. The output is a linear trajectory linking the start and endpoints. The desired interpolation time determines how far apart the start and endpoints are located and the slope of the linear trajectory.

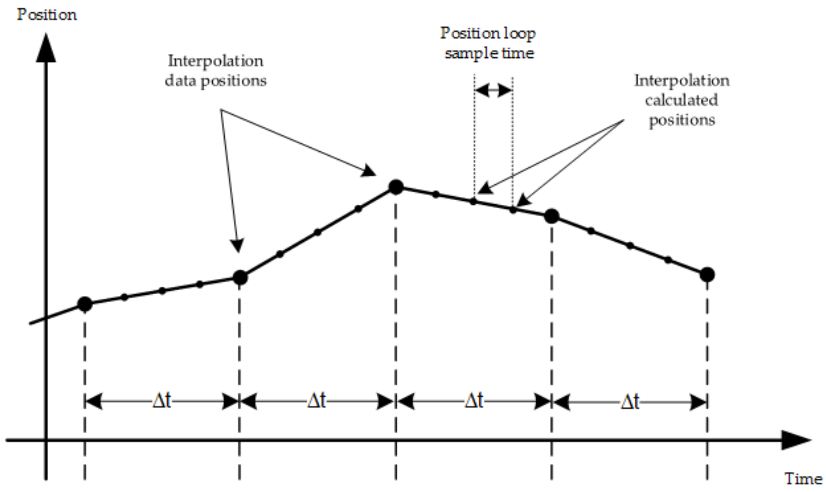
Note

The profile will start generating points depending on the selected **profiler latching mode**. If latching is disabled, the linear profile starts immediately upon a change of the **set-point**. If latching is enabled, the linear profile starts after a change of **set-point** and its confirmation through latching bit from **the control word.**

Whenever this mode is not used in combination with the interpolation buffer, the time for each movement is defined by **Interpolation time mantissa** * **interpolation time exponent**. If the interpolation buffer is used, the interpolation time may be provided by the buffer itself. See more details below.

Note

If the resulting interpolation time is smaller than the update time of the system, an error will be reported.



7.12.1.2 Trapezoidal profile

This mode follows an online trapezoidal profile with 3 stages:

- Linear acceleration stage
- Constant velocity stage
- Linear deceleration stage

In some cases, if the profile step is too small, the requested constant velocity stage is not reachable. The movement gets done in two stages:

- Linear acceleration stage
- Linear deceleration stage

This profile is defined by three parameters:

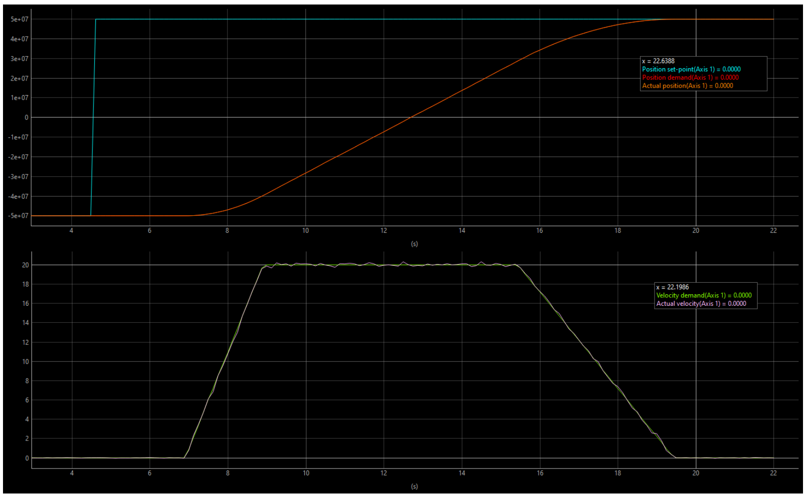
- **Profiler max. acceleration**
- **Profiler max. deceleration**
- **Profiler max. velocity** / **Velocity set-point** / **Max. velocity**

> If this profile is enabled for velocity modes, the profile is composed of 2 stages:
>
> - Linear acceleration / deceleration stage
> - Constant velocity (**velocity set-point** or **Max. velocity**)
>
> The third stage is not executed.

This profile is not time-restricted.

> **Note**
>
> The profile will start generating points depending on the selected **profiler latching mode**. If latching is disabled, the linear profile starts immediately upon a change of the **set-point**. If latching is enabled, the linear profile starts after a change of **set-point** and its confirmation through lathing bit from **the control word.**

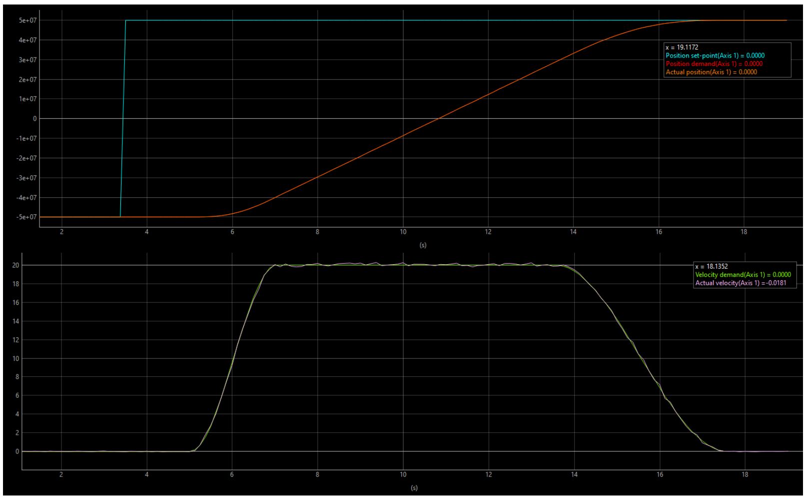
The following picture shows a trapezoidal velocity trajectory in a profile position (PP) movement.



7.12.1.3 S-curve profile

This mode internally generates an offline trapezoidal profile and joins the resulting transition points of the trapezoid with 5th-degree polynomials to soften the trajectories at each stage. These polynomials are described at the end of this document.

The following picture shows a S-curve velocity trajectory in a S-curve profile position (SPP) movement.



> **Note**
>
> Note that the resulting polynomial curves will require a higher acceleration than the trapezoidal acceleration and decelerations.

> **Note**
>
> If the time of the movement is shortened, the acceleration, velocity, and jerk may increase.

7.12.1.4 PVT profile

This mode joins a start and endpoint with a 5th-degree polynomial trajectory, and can only be used in combination with the interpolation buffer. The information to generate the profile are initial position, velocity, acceleration and time, and final position, velocity, acceleration and time. These are fed internally by the interpolation buffer once the user has introduced a list of final positions, velocities, and movement durations.

More information about these polynomials can be found at the end of this document.

> **Note**
>
> All movements in this mode assume acceleration is 0 at the beginning and end of each movement.

7.12.2 Interpolation buffer

The interpolation buffer is a buffer of set-points Depending on the operation mode active, the buffer will hold the position, velocity, and time duration set-points. In combination with the linear and 5th-degree polynomial profiles, it extends the profile generation capabilities for masters that are neither fast nor deterministic enough to generate each point of a complex profile at the right time. The idea is to fill a set of position set-points in the buffer through a network burst and then let the drive inject the stored set-points into the set-point manager, while the master computes the next set of targets and refills the interpolator buffer.

> Interpolator buffer is only available for position modes.

To use the buffer, a series of steps have to be followed. In the first place, **the drive should be in operation enable state in order to fill the buffer**. Once this state is active, the buffer can be filled by writing:

- **Interpolation data record - Position input.** (Mandatory) It contains the position to be stored in the buffer. It is required for the profiles:
  - Linear profile
  - 5th-degree polynomial profile
- **Interpolation data record - Velocity input**. (Optional) It contains the velocity to be stored in the buffer. It is required for the profiles:
  - 5th-degree polynomial profile
- **Interpolation data record - Time input**. (Optional) It contains the movement time to be stored in the buffer. It is required for the profiles:
  - 5th-degree polynomial profile
- **Interpolation data record integrity check** (Mandatory) - Used to store the previous fields into the buffer. It is required for the profiles:
  - Linear profile
  - 5th-degree polynomial profile

The steps to fill properly a point in the interpolator buffer is:

- Write the required input: (**Position input, Velocity input and/or Time input).**
- Increment the integrity check value by 1. When the drive detects an increment of 1 in the integrity check it will save whatever values are configured in the position, velocity, and time inputs.

> If the interpolator buffer is combined with the linear profile, the resulting mode of operation is called **interpolated position mode.**
>
> If interpolator buffer is combined with the 5th-degree polynomial profile, the resulting mode of operation is called **PVT**.

> **Note**
>
> If the selected operation mode is **interpolated position mode**, the **Interpolation data record - Time input** is not used and timing is replaced by the default interpolation time (given by the **interpolation time mantissa** and **interpolation time exponent**) of the drive.

To inject positions from the interpolator buffer into the profiles it is required to activate the set-point manager bit of the **control word** register. Further information is available on *Position modes (CSP, PP, IP, P)* section.

The interpolation buffer works as a FIFO (First Input First Output). That means that new set-points can be added into the buffer while the set-point manager is extracting them. For proper management of the buffer, a set of parameters are available:

- **Interpolation buffer number of elements.** Shows how many elements are inside the buffer.
- **Interpolation buffer maximum size.** Shows the maximum buffer size allowed by the drive.

On the other hand, if it is required to remove all the stored set-point from the interpolator buffer, the command **interpolation data record force clear** will clear the buffer allowing to add new set-points.

7.12.3 How 5th-degree polynomials work

5th-degree polynomials can be used to create time-dependent trajectories given some initial and final conditions. The 5th-degree polynomials are described by the following equation. This equation is used for position calculation, but its derivatives can be used for velocity, acceleration, and jerk.

$$F(t) = a0 + a1 \cdot t + a2 \cdot t^2 + a3 \cdot t^3 + a4 \cdot t^4 + a5 \cdot t^5$$

When this polynomial is going to be used to describe a position trajectory, coefficients a0 to a5 can be calculated with the following expressions:

$$a0 = q0$$

$$a1 = v0$$

$$a2 = (1/2) \cdot acc0$$

$$a3 = 1/(2 \cdot (T^3)) \cdot [20 \cdot h - (8 \cdot v1 + 12 \cdot v0) \cdot T - (3 \cdot acc0 - acc1) \cdot (T^2)]$$

$$a4 = 1/(2 \cdot (T^4)) \cdot [-30 \cdot h + (14 \cdot v1 + 16 \cdot v0) \cdot T + (3 \cdot acc0 - 2 \cdot acc1) \cdot (T^2)]$$

$$a5 = 1/(2 \cdot (T^5)) \cdot [12 \cdot h - 6(v1 + v0) \cdot T + (acc1 - acc0) \cdot (T^2)]$$

Where:

- **q0**: Initial position
- **h**: Total displacement
- **v0**: Initial velocity
- **v1**: Final velocity
- **acc0**: Initial acceleration
- **acc1**: Final acceleration
- **T**: Movement time

Note

All movements in this mode assume acceleration is 0 at the beginning and end of each movement.

Although the jerk is not controlled and can be higher or lower depending on the movement's length and maximum acceleration, the acceleration is kept continuous and gradual.

8 System diagnosis tools

A set of extra diagnosis modules have been implemented into summit devices to extend the already available tools from the field network protocols themselves(EtherCAT and CANopen). When the update rate of the field networks is not enough fast to analyze system transients, frequency identification or any other fast behavior is when these tools are useful.

The main purpose is to help the user identify and modeling the whole axis system:

- **Monitoring.** Transfer data from the drive to the master. It is used to obtain deterministic and precise information from the device measurement helping to identify the system bandwidth, transient behaviors or any other system parameters.
- **Disturbance.** Transfer data from the master to drive. It is used to inject signals into the system in a deterministic way and at the same rate as internal device control loops.

The principle of operation of monitoring and disturbance is to use the internal drive sampling rate to fill/clear an internal buffer. The content of this buffer is managed by the master using a single transmission of big frames. For this reason, these capabilities are available only through Ethernet-based communications (like EoE).

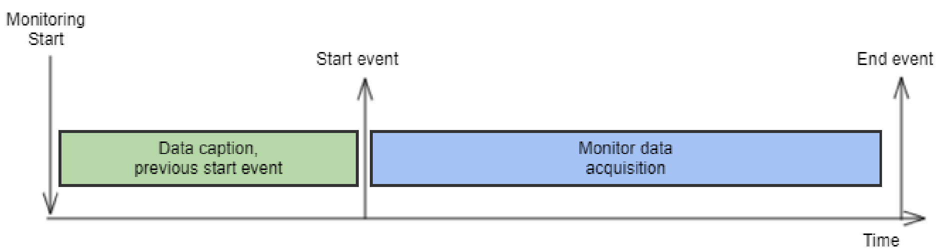
> ⓘ Whereas EtherCAT and CANopen protocols reach high update rates and deterministic transmissions with very low latency sacrificing the amount of information that can be transmitted on every packet, monitoring and disturbance sacrifice the latency and the high update rates to be able to transmit the big amount of information on every packet. This allows accumulating internal drive samples until this buffer is filled and then transmitted in a single transmission. During this transmission, the drive will keep filling the buffer for the next transmission.

8.1 Monitoring

The purpose of the monitoring is to get a short time scope with data at a high update rate.

The monitoring process is latched with a start event and it is finished when an end event is received, the output of the monitoring process is a **monitoring frame**.

The module offers the possibility of capturing data before the start event and between the start event and the end event.



8.1.1 Events

The **start and end events** are latched with a set of predefined triggers. The **triggers** are the conditions that the system diagnosis tool is looking out when this condition is accomplished, the event is latched. To set them, use the registers **monitoring end event trigger selection** and **monitoring start event trigger selection**, the currently available triggers:

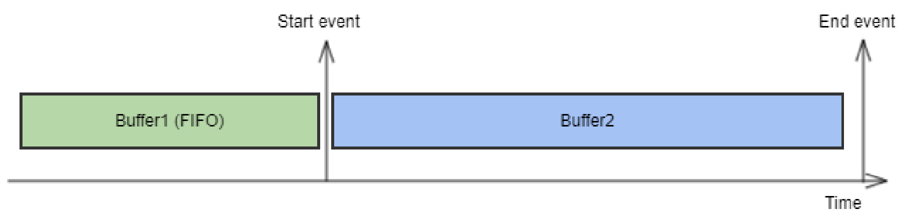
Triggers Selection	Info
Auto trigger	This condition is always accomplished
Forced trigger	External event received from communications
Rising edge	When monitored register exceeds the defined limit*
Number of samples	The number of samples stored gets the defined memory limit
Falling edge	When the monitored register exceeds the lower limit*

Limits definitions

Rising and falling limits have to be defined with the **monitoring rising edge condition** and **monitoring falling edge condition** registers.

8.1.2 Memory pools

The monitoring process uses internal memory pools to store all the captured data. The data memory buffer before the start event takes the Buffer1 name and the memory pool used between the start and end event is named Buffer2



The Buffer1 is defined as a FIFO (First In First Out), which means that if new data is received before the start event occurs, older data are removed. This method allows getting a predefined number of samples just before the start event occurs.

- **Monitoring memory buffer1 size**: number of samples to capture before the start event
- **Monitoring memory buffer2 size**: number of samples to capture after the start event and the end event

When a monitoring frame is complete it is moved to the **output user buffer**, and stored waiting for the user to read it, and the monitoring tool gets ready to latch another monitoring frame.

Memory sections

The maximum memory size in bytes is product dependent.

Memory section name	Size
Buffer1	Up to 32 Mbytes
Buffer2	Up to 32 Mbytes
Output user buffer	Up to 64 Mbytes

8.1.3 Mapping

The monitoring tool needs a predefined configuration (mapping) before starting the process, not all registers can be mapped, only the listed can be used.

Writing to **monitoring add register** adds a new mapping key, the maximum keys mapped can be 16. The mapping process can be checked with:

- **Monitoring mapped register N**: the mapping key at the position N (between 0 and 15)

- **Monitoring frame bytes**: Size in bytes of all the keys mapped

Changing the mapping (adding or removing a register), removes all stored data.

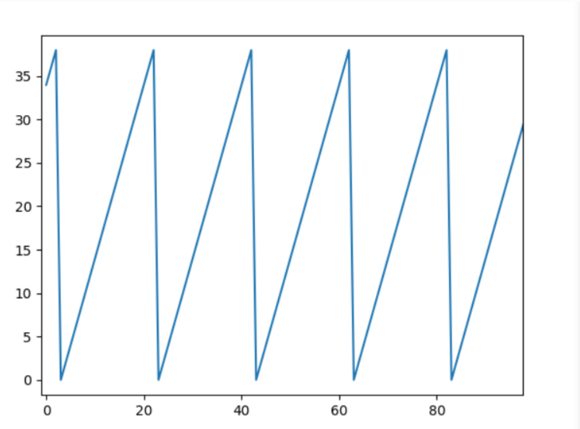
Example

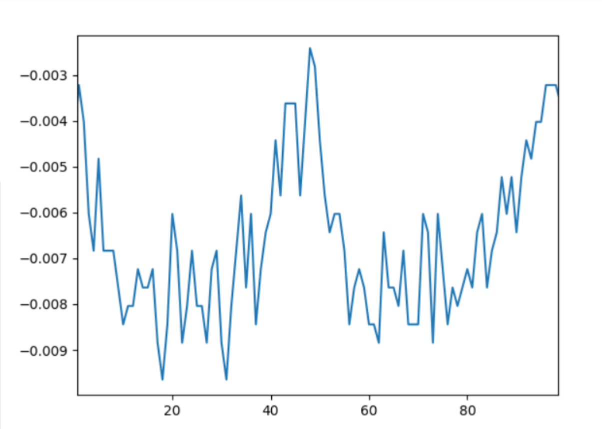
The desired capture configuration, get 100 samples of the voltage quadrature demand and current phase a:

1. Disable monitoring if enabled, monitor enable → 0
2. Mapping configuration (position demand and power stage temperature)
    a. Remove all mapped registers, monitor remove registers → 1
    b. Add registers, monitoring add register → 0x070 (voltage quadrature demand) and 0x038 (current phase a).
    c. Read monitoring frame bytes → 8 bytes, 4 bytes from position demand and 4 bytes from power stage temperature
    d. Read monitor mapped register (channel 0 and 1) → 0x078 and 0x067
3. Memory pools configuration (100 samples)
    a. Set monitoring memory buffer1 size → 50 samples
    b. Set the monitoring memory buffer2 size → 50 samples
4. Event configuration (No trigger)
    a. Start event trigger selection → 0 (No trigger)
    b. End event trigger selection → 3 (Number of samples)
5. Enable monitoring/disturbance, monitoring enable → 1

At this point the data are being captured, when the monitoring frame is completed it will be moved to the user output buffer:

1. Read monitoring current number of cycles → Check and wait to get the 100 sampling monitoring frames
2. Read monitoring data





Note

The monitoring **sampling frequency** is adjusted with the **monitoring frequency divisor**, this register is a divisor of the position and velocity loop rate, and it can be read with the **position & velocity loop rate** register.

8.1.4 Advanced events trick

The monitoring can be programmed to get multiple monitoring frames, this configuration is done with the **monitoring number of frame repetitions** register. When the monitoring process copies the data to the user output data buffer, the events are restored while this register is greater than 0.

It is easy to exceed the user output buffer capacity if the application doesn't read the monitoring blocks continuously.

Example

The drive has two-channel monitoring:

1. Channel 1: current A demand
2. Channel 2: current A value

The goal is to capture three monitoring blocks when the current A value reaches 10A (has to be surpassed three times):

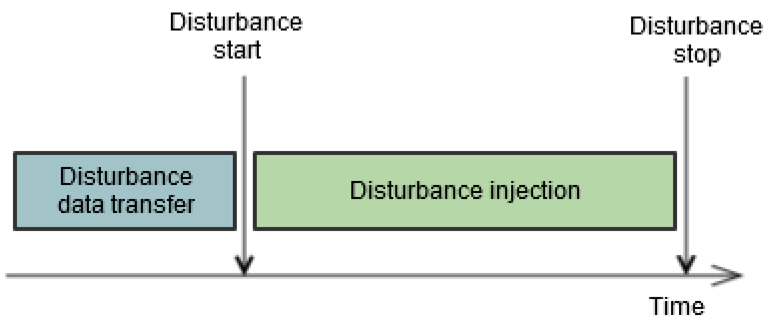
- **Monitoring start event trigger selection** → 2
- **Monitoring number of frame repetitions** → 3
- **Monitoring rising edge condition** → 10.0
- **Monitor checker** → 1 (channel index)

Note

To get an infinite number of repetitions, set the register monitor event repetitions to 0 value.

8.2 Disturbance

Disturbance uses the capabilities of the internal communication protocol and a memory pool (up to 8KB) to inject deterministic data as a command source or disturbance through the control loop offset inputs.



Disturbance has two stages:

- Disturbance configuration and data transfer: This stage configures the target registers to inject the signal and all data are sent and stored in the disturbance data manager

- Disturbance injection: In this stage disturbance is applied, data is not deleted and it is repeated periodically

8.2.1 Memory pools

The disturbance process uses an internal memory pool to store the injection signal. Data signals are constantly sent without being erased from the internal memory pool.

- **Disturbance memory size**: the size of the internal memory pool to be fulfilled with disturbance data

Memory sections

The maximum memory size in bytes

Memory section name	Size
Disturbance memory buffer	Up to 64 Mbytes

8.2.2 Mapping

The disturbance tool needs a predefined configuration (mapping) before starting the process, not all registers can be mapped, only the ones with high-speed access can be used.

Writing to **disturbance add register** adds a new mapping key, the maximum keys mapped can be up to 16. The mapping process can be checked with:

- **Disturbance frame bytes**: Size in bytes of all the keys mapped

Note

Changing the mapping (adding or removing a register), removes all stored data.

When buffer and mapping configuration steps are complete, the disturbance data can be sent to the drive:

- **Disturbance data**: when the previous registers are defined, data could be transferred using this register, it is recommended to use extended frames instead of standard frames.
- **Disturbance frequency divisor**: The injection **sampling frequency** is adjusted with the **disturbance frequency divisor**, this register is a divisor of the position and velocity loop rate, and it can be read with the **Position & velocity loop rate** register.

Example

To inject a signal of 40 samples to the current A setpoint:

1. Disable monitoring if enabled, monitor enable → 0
2. Mapping configuration (position setpoint)
    a. Remove all mapped registers, disturbance remove registers → 1
    b. Add register, disturbance add register → 0x001C, current A setpoint
    c. Read disturbance frame bytes → 4 bytes
3. Disturbance configuration (40 samples)
    a. Set disturbance memory size → 40 samples
4. Event configuration (No trigger)
    a. Start event trigger selection → 0 (No trigger)
    b. End event trigger selection → 3 (Number of samples)
5. Send disturbance data
    a. Send data to **disturbance data**
    b. Check that blocks are received by the drive, read **disturbance current number of samples** → 40
6. Enable monitoring/disturbance → 1

At this point, data are being injected at a frequency selected with **disturbance frequency divisor**.

9 Error management

Summit servo drives have been designed to contain the capability of self-test the status of its elements in order to be itself protected in front of any error inside or outside the drive. This is divided into two error types:

- **Operation errors.** During normal operation, some modules are continuously checked.
- **Configuration errors.** The access to the drive parameters is self-protected to avoid unreachable configurations.

9.1 Operation errors

Operation verification is done continuously after power on. If any error is detected, the drive goes to the called **Fault state** until the error is removed and the user reset this status through a **Fault reset** command. In the **Fault state**, all power elements are disabled and normal operation is not allowed. The next *Error identification* section describes the error codes generated.

Note

Operation errors are not logged until the drive reaches the switch-on state. More details about the drive state machine are available in the *Operation* section.

Further information about the **Fault state** is available in the *Operation* section.

Operation Errors are logged into a 32 size FIFO queue. The drive fills the queue until it is full, then the older error is overwritten by the new one. All these errors are accessible at any time. Furthermore, the last error is always monitored using a high-speed access register.

9.1.1 Error severity

Errors can have two severity levels: warning and fault. The behavior of each is different:

9.1.1.1 Warning

Warnings are considered to be non-critical errors, thus no reaction is applied. However, when an error with warning severity level happens, the warning bit of the drive's **Status Word** is set. This bit is also cleared automatically whenever the error cause is gone. Warnings are logged in the error queue unless the same error code has been logged in the previous position or unless the drive has detected a fault error.

The error ID of a warning message is equal to an error code plus the bit 0x10000000. This bit of information is used to identify if the error code has been generated as a fault or a warning.

Configuration errors are always considered a warning.

9.1.1.2 Fault

Faults are errors with higher priority than warnings, where generally the reaction is to shut down the driver's power stage for safety purposes. Only one fault can be logged in the error manager unless a new fault is generated with a more restrictive reaction. New faults can be logged as well when a fault reset is attempted, notifying the user in case some additional error is preventing the drive from exiting the fault state in the state machine.

9.1.2 Fault reaction and error masking

Some specific errors which are not excessively critical can have their reaction and severity level modified by means of user option codes. The option codes are the following:

Severity	Reaction
Fault	Disable power stage
Warning	Do nothing
Fault	Slow down ramp
Fault	Quick stop ramp

> **Note**
>
> When using a slow down ramp or quick stop ramp option codes, it is important to have the velocity loop, window and feedbacks configured since after detecting that the motor has stopped, the power stage is disabled.

9.1.3 Error identification

Error Id	Default severity and reaction	Reaction configurable	Description	Meaning
0x00000000	None	No	No error	Drive is working correctly
0x00001001	Fault - Power stage shutdown	Yes	Communications watchdog error	No valid frames have been received during the configured communications watchdog window time
0x00003280	Fault - Power stage shutdown	No	STO is enabled	STO is active and power stage is shutdown
0x00003281	Fault - Power stage shutdown	No	STO supply fault	STO supply fault. Unit could be damaged
0x00003282	Critical - Power stage shutdown	No	STO abnormal fault	STO abnormal fault. STO1 and STO2 inputs differed more than latching time
0x00002280	Fault - Power stage shutdown	No	Over-current detected (internal drive limit)	It indicates that a current value higher than the maximum absolute one allowed by the drive has been detected. There are several sources that produce this error: • Short-circuit (See product manual for further information about detectable short-circuits). • Control loops instabilities, over-shoots
0x00002282	Fault - Power stage shutdown	No	Current A sensing reached upper saturation limit	Current A ADC counts have reached upper ADC saturation limit
0x00002283	Fault - Power stage shutdown	No	Current A sensing reached lower saturation limit	Current A ADC counts have reached lower ADC saturation limit
0x00002284	Fault - Power stage shutdown	No	Current B sensing reached upper saturation limit	Current B ADC counts have reached upper ADC saturation limit
0x00002285	Fault - Power stage shutdown	No	Current B sensing reached lower saturation limit	Current B ADC counts have reached lower ADC saturation limit
0x00002286	Fault - Power stage shutdown	No	Current C sensing reached upper saturation limit	Current C ADC counts have reached upper ADC saturation limit
0x00002287	Fault - Power stage shutdown	No	Current C sensing reached lower saturation limit	Current C ADC counts have reached lower ADC saturation limit

Error Id	Default severity and reaction	Reaction configurable	Description	Meaning
0x00002288	Fault - Power stage shutdown	Yes	I2T detected	The I2T algorithm is always enabled and generates a fault if: • If the current loop is disabled when the I2T limit is overcomed. • If the current loop is enabled but the maximum allowed I2T limit is overcomed before the user I2T is detected.
0x00002289	Fault - Power stage shutdown	Yes	Over-current detected (user limit) when current control is disabled	Indicates that a current reading higher than the configured max. current has been reached.
0x0000228B	Fault - Power stage shutdown	No	Derating without current control	Indicates that driver has started derating ramp without current control
0x00003290	Fault - Power stage shutdown	No	Input stage problem	It indicates that the bus voltage is not being loaded correctly.
0x00003210	Fault - Power stage shutdown	No	Over-voltage detected (internal drive limit)	Maximum allowed voltage by the drive is overcome.
0x00003211	Fault - Power stage shutdown	No	Over-voltage detected (redundant internal drive limit)	Maximum allowed voltage by the drive is overcome.
0x00003221	Fault - Power stage shutdown	No	Under-voltage detected (internal drive limit)	Minimum allowed voltage by the drive is overcome.
0x00003231	Fault - Power stage shutdown	Yes	Over-voltage detected (user limit)	User maximum voltage limit is overcome
0x00003241	Fault - Power stage shutdown	Yes	Under-voltage detected (user limit)	User minimum voltage limit is overcome
0x00004300	Fault - Power stage shutdown	No	Over-Temperature detected (internal drive limit)	Maximum allowed drive temperature is overcome.
0x00004301	Fault - Power stage shutdown	No	Under-Temperature detected (internal drive limit)	Minimum allowed drive temperature is overcome.
0x00004303	Fault - Power stage shutdown	Yes	Over-temperature detected (user limit)	User maximum drive temperature is overcome.
0x00004304	Fault - Power stage shutdown	Yes	Under-temperature detected (user limit)	User minimum drive temperature is overcome.
0x00004400	Fault - Power stage shutdown	No	Motor Over Temperature detected	Maximum temperature allowed by the actuator is overcome
0x00004500	Fault - Power stage shutdown	No	External fault	An external element has set to "high level" the external fault input. This fault is generated by the communication core if a critical error is detected to allow stop safely the drive. Current implementation only generates this error if EtherCAT cable is disconnected during operation.
0x00007390	Fault - Power stage shutdown	No	Interpolation time is too small when PVT is enabled.	PVT movement has an interpolation time smaller than the drive loop update time.
0x00007391	Fault - Power stage shutdown	No	Profiler parameters not valid. They should all have positive values.	Profiler parameters such as Max.Velocity, Max.Acceleration or Max. Deceleration has unsupported values that can cause undesired trajectories
0x00007388	Fault - Power stage shutdown	Yes	In a velocity mode, following error overcomes the velocity following error window	The velocity demand can't be followed properly by the drive. Review controller, limits, and acceleration/velocities.
0x00007387	Fault - Power stage shutdown	Yes	In a position mode, following error overcomes the position following error window	The position demand can't be followed properly by the drive. Review controller, limits, and acceleration/velocities.

Error Id	Default severity and reaction	Reaction configurable	Description	Meaning
0x00007386	Fault - Power stage shutdown	Yes	Velocity out of limits out of velocity or position modes	It indicates that velocity readings are higher than the configured max. velocity when the velocity loop is not enabled.
0x00007385	Fault - Power stage shutdown	Yes	Position out of limits out of position modes	Indicates that position readings are out of the configured software limits when the position loop is not enabled.
0x00007382	Fault - Power stage shutdown	No	Too many incorrect CRC checks in SSI / BiSS-C readings	It indicates that the number of CRC errors detected is higher than the configured.
0x00007380	Fault - Power stage shutdown	No	Too many incorrect invalid position flags detected in SSI / BiSS - C readings	It indicates that the number of invalid frames is higher than the configured.
0x00007370	Fault - Power stage shutdown	No	Halls sequence error	Two of the 3 digital Halls signals have changed value simultaneously, leading to an unsupported sequence.
0x00007371	Fault - Power stage shutdown	No	Halls combination error	Indicates that the read halls value combination is not possible (000 or 111)
0x00007372	Fault - Power stage shutdown	No	Incremental encoder runaway error	Encoder reading over a mechanical cycle does not match with the specified encoder resolution. Review encoder resolution or encoder cabling.
0x06010000	Info - Nothing	-	Incorrect access type	Indicates that a read command has been requested to a write-only register of a write command has been requested to a read-only register
0x06020000	Info - Nothing	-	Object doesn't exist	It indicates that the requested address parameters don't exist.
0x06040041	Info - Nothing	-	Object isn't cyclic mappable as requested	This indicates that the register requested to be mapped into a cyclic frame is not cyclic.
0x06040042	Info - Nothing	-	Cyclic mapping is too large	Indicates that the requested cyclic mapping is higher than the allowed space in the cyclic buffer
0x08010000	Info - Nothing	-	Cyclic mapping key is wrong	Indicates that the requested cyclic register key doesn't exist
0x06070010	Info - Nothing	-	Mapped cyclic register size is wrong	The requested size for the mapped cyclic register differs from the expected one by the drive.
0x08010010	Info - Nothing	-	Communication state is unreachable	Transition from config to cyclic or from cyclic to config modes is unreachable in the current state.
0x08010020	Info - Nothing	-	Communication setting is not modifiable in the current state	A new mapping has been requested when the drive is in cyclic mode
0x060A0000	Info - Nothing	-	Unsupported value introduced in register	Value to be written is outside the parameter range.
0x08010030	Info - Nothing	-	Invalid command	The command requested by the master is unrecognized
0x08010040	Info - Nothing	-	CRC error	A CRC error has been detected on the previous frame
0x00007400	Info - Nothing	-	Unsupported synchronization method	The selected synchronization method doesn't exist or is not allowed in the current state
0x00007500	Info - Nothing	-	Number of active feedbacks is higher than allowed	The number of selected feedbacks to be enabled is higher than the allowed one by the drive.

9.2 Configuration errors

Configuration verification is done on every access to a drive register. Some parameters are protected to avoid unreachable (or even dangerous) configurations, for example, selecting nonexistent feedback.

Configuration error does not generate any reaction to the system operation. The next error codes help developers understand why the requested access failed:

Error Id	Description	Meaning
0x06010000	Incorrect access type	It indicates that a read command has been requested to a write-only register of a write command has been requested to a read-only register
0x06020000	Object doesn't exist	It indicates that the requested address parameters doesn't exist.
0x06040041	Object isn't cyclic mappable as requested	It indicates that the register requested to be mapped into a cyclic frame is not cyclic.
0x06040042	Cyclic mapping is too large	It indicates that the requested cyclic mapping is higher than the allowed space in the cyclic buffer
0x08010000	Cyclic mapping key is wrong	It indicates that the requested cyclic register key doesn't exist
0x06070010	Mapped cyclic register size is wrong	The requested size for the mapped cyclic register differs from the expected one by the drive.
0x08010010	Communication state is unreachable	Transition from config to cyclic or from cyclic to config modes is unreachable in the current state.
0x08010020	Communication setting is not modifiable in the current state	A new mapping has been requested when the drive is in cyclic mode
0x060A0000	Unsupported value introduced in register	Value to be written is outside the parameter range.
0x08010030	Invalid command	The command requested by the master is unrecognized
0x08010040	CRC error	A CRC error has been detected on the previous frame
0x00007400	Unsupported synchronization method	The selected synchronization method doesn't exist or is not allowed in the current state
0x00007500	Number of active feedbacks is higher than allowed	The number of selected feedbacks to be enabled is higher than the allowed one by the drive.