



DCmind Soft + CANopen

User Manual



Important Notes

- This manual is part of the product.
- Read and follow the instructions in this manual.
- Keep this manual in a safe place.
- Give this manual and any other documents relating to the product to anyone that uses the product.
- We reserve the right to make modifications without prior notification.





About This Manual

This manual applies to SQ57 SMI21 CANopen DCmind brushless products:

- 80140301
- 80180301
- 80280302

And to SQ75 SMI22 CANopen DCmind brushless products:

- SQ75-1: family 80350
- SQ75-2: family 80360
- SQ75-3: family 80370

Reference source for manuals The manuals can be downloaded from our website at the following address: <u>http://www.crouzet-motors.com/</u>





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1. INTRODUCTION

Use DCmind Soft + CANopen to configure and program CROUZET SMI21 or SMI22 CANopen drive.

DCmind Soft + CANopen allows for:

- Detection of compatible drives connected to the software network
- Connection to one or several drives for configuration, tuning, testing and programming.
- Configuration and testing of different motion modes (position, velocity, torque, force, homing, etc.)
- Monitor information with the digital scope

1.1. Getting Started

Minimum computer requirements to run DCmind Soft CANopen software are:

- Microsoft Windows OS version XP SP3, Vista, W7, W8 or W10.
- At least 100MB of free disk space.
- USB port for controller USB connection.
- CAN port for CAN connection [optional].
- .NET framework 4.5.2

In order to install and run the DCmind Soft + CANopen software, you must have Administrator privileges (for installation).

1.2. Communication Interfaces

DCmind Soft + CANopen supports the following communication interfaces:

- CAN Peak.
- CAN IXXAT (Not compatible with windows 10)
- CAN Kvaser.

In the menu of DCmind Soft + CANopen "About", the version of the communication libraries version are displayed.







If the version displayed is "N/A", it could be because of one of the following reasons:

- The dll library was not installed correctly, please try reinstalling DCmind Soft + CANopen.
- The dll library is being used by another program, please close the related software programs and reopen DCmind Soft + CANopen.
- The drivers are not installed in the PC, please download and install the drivers from the vendor website and then reboot the PC.

WARNING: The correct drivers must be installed in order to make DCmind Soft + CANopen work with the corresponding communication interface.

1.3. Before you begin

In order to ensure successful drive setup, you should verify that the following conditions are met:

- Read the SMI21 or SMI22 CANopen drive installation manual and the datasheet for the motor.
- Provide electrical power to the motor and connect the communication cable (USB, CAN).





2. DCMIND SOFT + CANOPEN DESKTOP

When you first start DCmind Soft + CANopen, click on "SCAN AGAIN" to see the below parts:



2.1. DCmind Soft + CANopen workspace display

The following windows provide on-going information as you work in DCmind Soft + CANopen:

2.1.1. Drive Network window

This window displays controllers on the DCmind Soft + CANopen network and its settings.

2.1.2. Configuration window

This is where the configuration of the SMI21 or SMI22 CANopen drive is edited. For example, when a settings group is selected, all the registers within that category are displayed in this area. Several configuration wizards can be accessed from this window.

2.1.3. Alerts window

This window displays a list of informations, warnings / errors from the SMI21 or SMI22 CANopen drive.

2.1.1. Drive Faults window

This window displays an history of the errors detected on the SMI21 or SMI22 CANopen drive. You can delete this history by click on the button **Clear**.





2.2. DCmind Soft + CANopen toolbar

| DCmind Programs | MOTION | L SCOPE | | S BOOTLOADER CAN | S BOOTLOADER USB | X OPTIONS | (i) ABOUT |
|-----------------|--------|---------|---------|------------------|------------------|-----------|-----------|
| E LOAD | SAVE | 1 READ | ➡ WRITE | STORE | PARAMETERS | | |

The following table describes the function of each button in the Configuration toolbar (some buttons are available only when a motor is connected and selected).

| Title | Description | | | |
|-----------------|---|--|--|--|
| DCmind Programs | Open DCmind soft Programs (V101, P101, P200, C101, conveyor belt, valves) | | | |
| MOTION | Open motion test (velocity, position and torque profile, homing) | | | |
| SCOPE | Open digital scope | | | |
| UNITS | Convert values between different units WARNING: Do not dynamically change units during SMI21 or SMI22 CANopen drive configuration and commission process because it rescales the system parameters and causes unusual motion. | | | |
| BOOTLOADER CAN | Open CAN bootloader window for firmware updating | | | |
| BOOTLOADER USB | Open USB bootloader window for firmware updating | | | |
| OPTIONS | Open options window for SMI21 or SMI22 CANopen drive general settings | | | |
| ABOUT | Open about window with the following informations: HMI version, online documentation, package libraries | | | |
| LOAD | Load values from File to Parameters list. This will load values from a previous configuration File (.xdc). The parameters are automatically downloaded to the drive WARNING: Do not load a file when the motor is in "ENABLE" mode. The motor needs to click on "DISABLE MOTOR" before the load to avoid bad behavior. | | | |
| SAVE | Users can save configurations at any time. This is very useful when a system has been completely set up and you want to store the parameters to download them to other identical systems. To save a configuration, click the SAVE button. The output format for configuration file is an XDC (XML Device Configuration file). User can find further information on that format at section Parameters file of this manual. | | | |
| READ | Read parameters from SMI21 or SMI22 CANopen drive | | | |
| WRITE | Write parameters to SMI21 or SMI22 CANopen drive | | | |
| STORE | Store SMI21 or SMI22 CANopen drive parameters to non-volatile memory (NVM) | | | |
| PARAMETERS | Show all SMI21 or SMI22 CANopen drive parameters | | | |

CAUTION: With SMI21 CANopen drive, the BOOTLOADER USB isn't available and the BOOTLOADER CAN can be used only with the baudrate 1 Mb/s.

CAUTION: With SMI22 CANopen drive, the BOOTLOADER USB or BOOTLOADER CAN button should be used with the good motor connection (CANopen or USB). When the HMI is connected to the drive only the good button is available.

WARNING: The .hex file path must not contain blank space. If an .hex file is load with a blank space in the path and the connexion is lost : physically disconnect and reconnect the USB and try again without blank space in the path.





2.3. DCmind Soft + CANopen Status bar

| EMERGENCY STOP (F12) OISABLE MOTOR | MOTOR ENABLED | N/A | Drive0 - Node 0x02 Voltage: 23.9 V Temperature: 30.5 °C | Motor Temperature |
|------------------------------------|---------------|---|--|-------------------|
| | | | | |
| EMERGENCY STOP (F12) ENABLE MOTOR | FAULT | Error code 0x3221: User under voltage detected. | Drive0 - Node 0x02 Voltage: 7.7 V Temperature: 30.5 °C | Motor Temperature |

The status bar on the bottom of the desktop contains information on the SMI21 or SMI22 CANopen drive **connection state**, **FSA current status** (motor enabled, motor disabled, fault...) and **drive error codes**. It also includes an ENABLE/DISABLE button and an EMERGENCY button for safety.

At the right of the status bar, you have the following information:

- Drive name with its Node ID
- Actual bus voltage
- Actual drive temperature
- Motor temperature information

CAUTION: With SMI21 CANopen drive, the motor temperature information isn't available





2.4. Parameters file

SMI21 and SMI22 CANopen drives are defined according to CiA311 DSP V1.0.0: CANopen XML-based device description (.XDD files).

This file contains a list of Drive's Parameters (registers), as well as its names, data type, description, and default value. Each firmware version has always associated an XDD file.

A WARNING: If you need to update your firmware version, assure that you also have the corresponding XDD file, in order to avoid possible incompatibility issues.

When connect to a SMI21 or SMI22 CANopen drive in DCmind Soft + CANopen "DETECTED DRIVES", click on "SCAN AGAIN", DCmind Soft + CANopen displays current Firmware version installed in the Drive and loads the corresponding XDD from DCmind Soft + CANopen's installation folder.



If XDD of corresponding version is not found, DCmind Soft + CANopen opens a window showing currently installed XDD files, from which the user can select which is the most appropriate. Note that DCmind Soft + CANopen must be running under administrator permission to do this action.

CAUTION: DCmind Soft + CANopen always checks XDD files into: InstallationFolder\XDD

Each single configuration of a SMI21 or SMI22 CANopen drive can be stored according to **CiA311 in a XML** device configuration file (.XDC).

CAUTION: XDC files are the recommended format for saving SMI21 or SMI22 CANopen drive configurations.

Once you are connected to the SMI21 or SMI22 CANopen drive, you can Load/Save an XDC configuration file from the top menu.





3. WELCOME SCREEN

This view lets you select which SMI21 or SMI22 CANopen drive (motor) you wish to work with. You can work with a physical drive connected to one of the ports of your PC (online) or a virtual drive (offline) to see all the features of the DCmind Soft + CANopen and create an XDC configuration file without connected motor.

3.1. Detected Drives

|) DRIVES | CANopen channel baud rate: 1 Mbit/s * | 🗘 Scan again |
|---|---------------------------------------|--------------|
| SMI22 CANOPEN Node 0x02 S/N 0xFFFFFFF v 1.2.2 USB Serial Port (COM4) | | |
| SMI22 CANOPEN Node 0x02 S/N 0xFFFFFFFF v 1.2.2 Kvaser Leaf Professional HS | | |
| VIRTUAL DRIVE Node 0x20 S/N 0x0 v 1.0 Virtual Drive | | |
| | Ð | CROUZ |

The **Drives** screen displays a list of the SMI21 or SMI22 CANopen drives that DCmind Soft + CANopen has found on your local network (CANopen or USB). You can select one of these drives from the list and click on the picture (grey line) to continue. This will connect you to the SMI21 or SMI22 CANopen drive and you will be given the option to use a wizard to setup the drive.

The following fields are available on the displayed list:

| Field | Description |
|---------|---|
| Product | Name of product: SMI21 or SMI22 CANOPEN |
| Node ID | ID used for the SMI21 or SMI22 CANopen drive |
| Version | Firmware version |
| Serial | Unique identifier for each SMI21 or SMI22 CANopen drive |
| Port | Communications port where SMI21 or SMI22 CANopen drive have been detected |

CAUTION: Click on the "Scan again" button to rescan the Network looking for available drives at any time.





3.2. Drive Overview

| | OVERVIEW | |
|---------------------|--------------------------------------|------------------------------|
| CONFIGURATION OVE | RVIEW | |
| Motor type: | Rotary Brushless AC (sinusoidal) | onfigure |
| Commutation sensor: | Digital Encoder 🖉 🖸 | ionfigure |
| Motion mode: | Profile Velocity | |
| Velocity feedback: | Estimate velocity from position sens | ionfigure |
| Position feedback: | Digital Encoder | ionfigure |
| Command source: | Network | onfigure |
| Motion limits | Protections Inputs/Outp | Additional drive information |
| COMMUNICATION PA | RAMETERS | |
| Drive name: | Drive0 - Node 0x20 Change | |
| Node ID: | 0x20 Change | |
| CANonen haud rate: | 1 Mbit/s Change | |

3.2.1. Configuration overview

Once your SMI21 or SMI22 CANopen drive is connected, the **Drive Overview** shows a summary of the drive that you are using.

You can view or configure some of the information displayed:

| Field | Description | | |
|--------------------|---|--|--|
| Motor type | Brushless AC (sinusoidal) or Brushless DC (trapezoidal) | | |
| Commutation sensor | Digital encoder or digital halls | | |
| Motion mode | Velocity, Position or Torque profile, homing | | |
| Velocity feedback | How is estimated the actual velocity | | |
| Position feedback | Digital encoder or digital halls | | |
| Command source | How is drive the motor: network (CANopen or USB), analog or PWM | | |

3.2.2. Communication parameters

After connecting to your SMI21 or SMI22 CANopen drive, the below parameters are available:

| Field | Description | Editable field |
|-------------------|---|----------------|
| Drive Name | Name assigned to the SMI21 or SMI22 CANopen drive being used | No |
| Node ID | CAN Node ID used for the SMI21 or SMI22 CANopen drive | Yes |
| CANopen baud rate | Baud rate used in CANopen communications | Yes |

The Node ID can be set by software:

| Set Drive Node ID | | | | |
|------------------------------------|--------|--|--|--|
| By Software By Hardware | | | | |
| Set new Drive Node ID: 32 🚔 (0x20) | | | | |
| ОК | Cancel | | | |

The Node ID can be set from 1 to 127, after that click on "OK" button, disconnect the drive and do an "OFF/ON" on the power supply to enable the Node ID change





The Node ID can also be set by hardware:

| lardware |
|-------------|
| 33 🚔 (0x21) |
| 1 |
| Cancel |
| |

The Node ID is increased of 1 if the selected input is at 1, the Node ID is not increased if the selected input is at 0. The selected input can be 1 to 6.

CAUTION: If the set Node-ID is 127, the Node-ID is never increased.

CAUTION: For SMI22 CANopen drive the hardware settings are available only in administrator mode

3.2.3. Additional drive information

If you click on the button "Additional drive information", the following information is available:

- Product name
- Communication port
- Recommanded XDD file
- Used XDD file
- Last loaded XDC configuration file
- Firmware version
- Supported communications
- Serial number
- Motion chip





4. MOTION SETTINGS

The Settings menu on the left allows you to configure properly several parameters for your SMI21 or SMI22 CANopen drive based on the requirements of your application. The DCmind Soft + CANopen software provides among others windows for:

- Enter motor parameters
- Configure feedback
- Assign user units of measurement
- Set system limits for temperature, current, voltage, etc.
- Set motion limits for positioning, velocity, torque / force, etc.
- Specify command source
- Adjusts servo loops



CAUTION: By default, only settings applicable to your current SMI21 or SMI22 CANopen drive operation mode, motor, feedbacks and command source will appear in this tree.

Motion settings define the system motion behavior, operation mode, control functions and motion profiler.



- **Operation mode**: There are up to eight operation modes available in SMI21 or SMI22 CANopen drive (position, velocity, homing, etc.).
- **System polarity** indicates the direction for positive movements and for negative movements. The system polarity is used in all modes. As the direction of torque, velocity and position could be changed it allows reversing the direction of a system without modifying any cabling.





4.1. Command Sources

The Command Source option allows selection between any command source supported by the SMI21 or SMI22 CANopen drive hardware and firmware.

After selecting a command source, the available settings for the chosen command will appear below in the same window.

| | SOURCE |
|-----------------|--------------|
| Command source: | Network |
| | Network |
| | Analog input |
| | PWM |
| | |

4.1.1. Network

Select this option when the SMI21 or SMI22 CANopen drive is being controlled from a PC or remote host. SMI21 or SMI22 CANopen drive can utilize register commands from a network communication (CANopen or USB) as a form of input command.

4.1.2. Analog input

Utilize one of the hardware available analog inputs as a form of input command.

Configuration allows the assignment of parameter values for the applicable Analog Input.

- Analog input used allows to specify the hardware analog input used.
- **Motion range**. This setting defines the motion range that will correspond to the analog input range. It is also possible to reverse the movement in order to make the motion values evolve towards negative values.
- **Motion offset** allows to move the Motion range up and down depending on its value. A positive offset value will move the range up, and a negative offset value will move the range down.
- Velocity deadband parameter allows defining a deadband of values when a velocity mode is used as Operation Mode. This characteristic allows reducing sensitivity at low speeds. It is expressed directly in velocity units, allowing to specify a fixed value independently of the rest of the settings.

The chart on the right represents the final motion movement depending on the analog input value. This allows an easy way to modify the parameters by seeing the effect on the final motion movement

CAUTION: The information displayed makes use of the current Operation Mode configured in the Motion setting. Depending on that, the values displayed will be relative to position, velocity, torque or force.

There is a **Quick Test (Offline)** section where the user can see a simulation of the most common values (Maximum, Medium and Minimum) of the Analog Input, to which motion values will correspond. For example, suppose that the Analog Input range is 0 - 10 V, but the signal that will be supplied has a range of 0 - 5V. Then, the range of the slider can be modified to match the real signal range and the most common values for this range will be displayed.





4.1.3. *PWM*

Choose this mode if you would like to use a PWM input as a form of input command. The PWM goes directly into MCU which calculates the appropriate command for the current, velocity or position loop.

There are two main **modes** of working with PWM command source:

- PWM & direction (Dual input mode): It uses two inputs; one to assign the direction of the movement and another to assign the duty. Applying a 0 V to Direction pin will make the system to go in negative directions.
- PWM (Single input mode): It uses one input to control the duty.

There following settings are used to adjust the desired motion based on the PWM duty:

- **Motion range**. This setting defines the motion range that will correspond to the PWM duty. It is also possible to reverse the movement in order to make the motion values evolve towards negative values.
- **Motion offset** allows to move the Motion range up and down depending on its value. A positive offset value will move the range up, and a negative offset value will move the range down.
- Velocity deadband parameter allows defining a deadband of values when a velocity mode is used as Operation Mode. This characteristic allows reducing sensitivity at low speeds. It is expressed directly in velocity units, allowing to specify a fixed value independently of the rest of the settings.

The chart on the right represents the final motion movement depending on the PWM duty. This allows an easy way to modify the parameters by seeing the effect on the final motion movement.

CAUTION: The information displayed makes use of the current Operation Mode configured in the Motion setting. Depending on that, the values displayed will be relative to position, velocity, torque or force.

There is a **Quick Test (Offline)** section where the user can see a simulation of the most common values (Maximum, Medium and Minimum) of the PWM duty, to which motion values will correspond. For example, suppose that the PWM duty used goes from 30% to 70%. Then, the range of the slider can be modified to match this range and the most common motion values will be displayed.





4.2. Limits

This screen enables you to define how your system should behave when it reaches an operational limit.

| POSITION LIMITS | | | | | |
|--------------------------------|----------------------|----------|------------------------------------|-------|---------------------------------------|
| Minimum absolute position: | -2 147 483 647 🚔 | c | -2147483647 c | 0 c | 2147483647 c |
| Maximum absolute position: | 2 147 483 647 🚔 | c | | | |
| PROFILER LIMITS | | | -5000 rpm | 0 rpm | 5000 rpm |
| Maximum profile velocity: | 5 000.00 | rpm | | | |
| Maximum motor speed | 5000 | rpm 🖌 | <u>Configure</u> | | |
| Maximum profiler acceleration: | 40 000 🚔 | rpm/s | | - | |
| Maximum profiler deceleration: | 40 000 💌 | rpm/s | 1 rpm/s | - | 100000 rpm/s |
| TORQUE LIMITS | | | | | |
| Minimum torque limit: | -6 000.48 🚔 | mNm | -17280 mNm | 0 mNm | 17280 mNm |
| Maximum torque limit: | 6 000.48 🚔 | mNm | 0 mNm | | 6000.48 mNm |
| Maximum torque @ const speed: | 2 160.00 | mNm | 1 | | · · · · · · · · · · · · · · · · · · · |
| Maximum motor torque: | 9000.72 | mNm | 6 <u>Configure</u> | | |
| QUICK STOP | | | | | |
| Quick Stop Deceleration: | 100 000.00 🚔 | rpm/s | | | |
| Quick Stop option: | Slow down on quick s | top ram | p and stay in quick stop active 🔹 | | |
| | Slow down on quick s | top ram | p and stay in quick stop active | | |
| | Slow down on phase s | hort-cir | cuit and stay in quick stop active | | |

4.2.1. Position Limits

Min/Max absolute position parameters define the absolute position limits for the target and current position. Every new target position will be checked and adjusted to the limits established by these values.

4.2.2. Profiler Limits

Max profile velocity, acceleration and **deceleration** parameters limit the profile velocity / acceleration / deceleration to an acceptable value in order to prevent the motor and the moved mechanics from being destroyed.

4.2.3. Torque Limits

Max torque parameter indicates the configured maximum permissible torque in the motor.

Max torque @ **const speed** parameter indicates the configured maximum permissible torque in the motor at constant speed (not during acceleration/deceleration paths)

Min/Max torque limit indicate the configured maximum positive and negative torque in the motor. This allows user to configure the system with an asymmetrical torque limit window.





CAUTION: Please, note that Max torque, Maximum torque limit value and Minimum torque limit value objects should not limit the peak current.

4.2.4. Quick stop

Quick stop deceleration parameter indicates the configured deceleration of the motor when we click on the "Quick stop" button, this deceleration is taken into account only if the **Quick stop option** is "Slow down on quick stop ramp and stay in quick stop active".

Quick stop option parameter indicates the configured method of quick stop, "Slow down on quick stop ramp and stay in quick stop active" use the parametrized **Quick stop deceleration**, and "Slow down on short circuit and stay in quick stop active" make a short circuit of the motor phases, with this method the deceleration depends on the load. "Slow down on short circuit and stay in quick stop active" avoid rejection during the deceleration.

CAUTION: Please, note that in V100 expert programs the Quick stop is always "Slow down on short circuit and stay in guick stop active".





4.3. Thresholds

The position, velocity and torque control functions parameters work in conjunction with position, velocity and torque loops. The position and velocity loops are powered from the output of the profiler and from the position/velocity detector or feedback output.

The output of the position/velocity loops will be input to the flux-torque or current loop.

Parameters for Position control functions sub-group are:

| | OLDS | | |
|---|---|---|--|
| POSITION THRESHOLDS If the actual position is within time, the target position is s | n the position window for a position window et as reached. | If the actual position is out error timeout time, a follow | of the following error window for a following ing error occurs. |
| Position window: | 100 🛋 c | Following error window: | 4 294 967 295 🚔 c |
| Position window time: | 10 📩 ms | Following error timeout: | 100 🚔 ms |
| Show Diagram | | Show Diagram | |

- **Position window**: this parameter indicates the configured symmetrical range of accepted position relative to the target position. If the actual value of the position encoder is within the position window, this target position shall be regarded as having been reached. As the user mostly prefers to specify the position window in his application in user-defined units, the value is transformed into increments.
- **Position window time**: this parameter indicates the configured time, during which the actual position within the position window is measured.
- **Following error window**: this parameter indicates the configured range of tolerated position values symmetrically to the position demand value.
- Following error time out: this parameter indicates the configured time for a following error condition, after that the bit 13 of the *statusword* shall be set to 1.









Parameters for Velocity control functions sub-group are:

| | OLDS | | |
|--|---|---|--|
| VELOCITY THRESHOLDS If the actual velocity is withir time, the target velocity is se | the velocity window for velocity window tt as reached. | If the actual velocity is above threshold time, the motor is the second time. | re the velocity threshold longer than velocity s considered to be moving. |
| Velocity window: | 50.00 🚔 rpm | Velocity threshold: | 50.00 🚔 rpm |
| Velocity window time: | 10 👗 ms | Velocity threshold time: | 100 🚔 ms |
| Show Diagram | | | |

- Velocity window: this parameter indicates the configured symmetrical range of accepted velocity relative to the target velocity. If the actual value of the velocity is within the velocity window, this target velocity shall be regarded as having been reached.
- Velocity window time: this parameter indicates the configured time, during which the actual velocity within the velocity window is measured.
- Velocity threshold: this parameter indicates the configured zero velocity threshold.
- Velocity threshold time: this parameter indicates the configured zero velocity threshold time.

| Velocity Window Diagram | x |
|---------------------------|-------------------------------|
| Accep | tance Velocity Range |
| | |
| Velocity Wir | ndow Velocity Window Velocity |
| Velocity NOT I Reached | elocity Reached |
| Т | Farget Velocity |

Parameters for Torque control functions sub-group are:



- **Torque window**: this parameter indicates the configured symmetrical range of accepted torque/force relative to the target torque/force. If the actual value of the torque/force is within the torque window, this target torque/force shall be regarded as having been reached.
- **Torque window time**: this parameter indicates the configured time, during which the actual torque/force within the torque/force window is measured.





4.4. Profiler

The profiler is in charge of continuously generating the position, velocity or torque references to reach the final target values according to the user specified limits.

These configuration parameters are taken into account as default values to execute a specific mode of operation or motion profile.



The available parameters are:

- Profile velocity
- Profile acceleration
- Profile deceleration
- Torque slope





4.5. Loop control

This view allows you to select the configuration for the loops in charge of regulating position, velocity and current (depending the operation mode used):

Parameters for Velocity control loop sub-group are:





Note that you can set the position loop (or alternatively the velocity loop) for velocity modes such as homing or profile velocity with a selector:



CAUTION: If your system is using a position sensor as a feedback (ex: encoder) it is highly recommended to use position loop for velocity modes.

CAUTION: If your system is going to work at low speeds in velocity modes, it is recommended to use position loop to increase accuracy.





Parameters for Position control loop sub-group are:

| | | Control | | F | |
|-----------------------|-----------------|-----------|-----------------|-------------------|----------------------|
| Digital Encoder | position actual | Loop | torque demand | Torque Control | motor voltage aemana |
| Position loop diagran | n and values | | | | |
| Proportional gain: | 68 248 | 🗧 Velocit | y FF gain: | 0 🚖 | |
| Integral gain: | 819 | Acceler | ration FF gain: | 0 | |
| | | | | | |

Parameters for *Torque control loop* sub-group are:

| Con Board Current Sensor | 25 000 mA Configure 1 000.00 mNm Configure -1 000.00 mNm Configure 0.00 mNm Configure understand torque demand limited torque Control Loop torque actual | motor voltage demand |
|-----------------------------|---|-------------------------|
| Torque loop diagram | and values | |
| Proportional gain: | 8 777 🚔 🔳 | |
| Integral gain: | 75 🚊 | |
| Constant scaling: | 6 | |
| Cutoff frequency: | 100 🕂 Hz 🔲 enable filter | |

Max current parameter indicates the maximum permissible current creating torque in the motor.





5. ACTUATOR SETTINGS

Each SMI21 or SMI22 CANopen drive requires a unique configuration with parameters that are stored in NVM on the Servo Drive.

| Ф АСТU | ATOR | | | |
|------------------|--|---|--------------------|-------------------------|
| Motor type: | Rotary Brushless AC (sinusoidal) | Ŧ | € <u>Configure</u> | O Configure Commutation |
| Brake available: | No | | | |
| Shunt available: | No | | | |
| Position sensor: | Digital Encoder | Ŧ | Configure | |
| Velocity sensor: | Estimate velocity from position sensor | Ŧ | | |

The drive supports the following motors:

- Rotary BLAC (for sinusoidal commutation)
- Rotary BLDC (for trapezoidal commutation)

The drive supports the following feedbacks:

- Digital encoder
- Digital halls

In all cases, the actual velocity is estimated from position sensor.

CAUTION: there is no brake and no shunt available on SMI21 CANopen motor





5.1. Motor

The **Motor** view is used to set up or confirm the parameters of the motor that is connected to the SMI21 or SMI22 CANopen drive.





CAUTION: Motors delivered with SMI21 or SMI22 CANopen are set at the factory with functional parameters.

Depending on the selected **Motor Type** (BLAC or BLDC), the information available for editing will change in the Motor Parameters field. Consult the motor datasheet to determine the appropriate values.

In order to help configuring the parameters, it is possible to link several parameters to calculate automatically one of them according to the following formula:

 $ContinuousCurrent = \frac{RatedTorque}{TorqueConstant}$

CAUTION: Some of the motor parameters could be used for auto-calculators of other settings so it is recommended to set them accurately.





5.1.1. Foldback

The foldback feature protects both the motor and the drive from overheating. Two current foldback algorithms run in parallel in the drive: the drive foldback algorithm and the motor foldback algorithm. Each algorithm uses different sets of parameters. Each algorithm has its own foldback current limit. The overall foldback current limit is the minimum of the two at any given moment.

CAUTION: Foldback is not the same as current limits. Instantaneous current limits for the drive are set by the Max system current in the system Limits view in DCmind Soft CANopen. The foldback algorithms may reduce the current output to the motor in spite of the current limit settings.

5.1.2. Setting up motor foldback

The parameter entries required for the drive to apply motor foldback protection properly are Cycle Time, Peak Time, Peak current of the motor and continuous current of the motor. These values are used to setup the algorithm for motor foldback.

5.1.3. Commutation

This view allows configuration of basic commutation settings. Commutation is the process of switching current in the phases in order to generate motion. The available settings will depend on the type of motor and feedback in use.

| | Ν | |
|-------------------------------------|---------------------------------|-----------|
| Commutation sensor: | Digital Encoder | Configure |
| Initial angle determination method: | Digital halls transition method | |

Commutation sensor allows selecting which sensor is used to compute the rotor position.

If the selected sensor is an incremental sensor or it is not aligned with the rotor it will not be able to give the correct value without an initial rotor determination method. The **initial angle determination method** determines which method to use in order to localize the position of the rotor.

Several methods are proposed:

- **Digital halls transition method**: This method estimates roughly the position of the rotor using Digital Hall sensors and when a Hall transition is detected the position is re-estimated precisely.
- Initial rotor position known
- Non incremental sensor used
- Forced alignment method

CAUTION: Digital halls transition method is the only one available





5.2. Feedbacks

This view allows configuration of feedback sensors used for position and velocity modes. Once the sensor is selected in the Actuator menu, the sensor item will be displayed in the settings navigation tree and from them can be properly configured.

The parameters available for each type of feedback will be dependent on the option selected.

5.2.1. Digital encoder

This view allows configuration of digital encoder parameters:

(already set in motors coming from CROUZET factory)

| | ENCODER |
|--|--|
| Encoder type: | 2 channels + index encoder (single ended) |
| Polarity: | Inverted |
| Sensor resolution: | 1 024 📩 channel lines / revolution |
| Total resolution: | 4096 counts / revolution |
| QUICK TEST If you move manually the m Actual position: | iotor you should see that actual position value changes: |
| Phasing sequence | |
| Voltage percentage : | 10 🔊 % |
| 🏏 Do the phasing | |

- Encoder type: Define whether to use a 2 or 3 channels, differential or single ended encoder.
- **Polarity**: Indicates whether to swap or not swap the channels A and B of the quadrature encoder. For a correct operation of the system the positive sense of movement based on encoder and Hall must match. There is a wizard to detect it automatically.
- Sensor Resolution: This is the value that is generally found in the *datasheet*. For rotary motor it is expressed in "channel counts / revolution".
- **Total Resolution**: It is automatically calculated from the parameter above multiplying the Sensor Resolution by 4. For rotary motors it is expressed in "counts / revolution"
- Voltage percentage: Percentage of supply voltage use for the phasing

<u>Quick test:</u> This view helps to monitor the actual position value according to actual encoder configuration and user units selected.

<u>Phasing sequence</u>: The phasing is used to configure de SMI22 drive digital encoder, in administrator mode only.

CAUTION: SMI21 or SMI22 CANopen drive uses x4 decoding with incremental encoders. So each transition in any of the two main encoder signals (A, B) will be considered to be an increment. As a 1024CPR





(Cycles Per Revolution) encoder is used, the encoder resolution will be 4096 increments per mechanical revolution.

CAUTION: there is no phasing available on SMI21 CANopen drive, and only in administrator mode for SMI22 CANopen drive.

5.2.2. Digital Halls

This view allows configuration of digital halls parameters:

(already set in motors coming from CROUZET factory)

| | IGITAL | HALLS | |
|------------------------------|---------------|-----------------|-------------------------------|
| Polarity: | Standa | rd - | 🎾 Auto identify |
| Halls step offse | et: 180° | - |] |
| QUICK TEST If you move ma | anually the m | otor you shoul | d see that actual position va |
| Actual position | | 4096 c | |
| If you move th | e motor you s | hould see all o | ombinations of HALLS happ |
| Hall 1 | Hall 2 | Hall 3 | |
| 1 | 0 | 0 | |
| 1 | 1 | 0 | |
| 0 | 1 | 0 | |
| 0 | 1 | 1 | |
| | 0 | 1 | |
| 0 | 0 | - | |

- **Polarity**: Define whether halls are active at high or low logical level.
- Hall step offset: Define the angular displacement (expressed in multiples of 60°) between the sequence of values generated by the Hall sensors and its corresponding excitation. This offset only applies when the system is using BLDC motors.

When configured for digital hall feedback, the drive will define 1 count to be equal to 1 hall state change (that is, a 4-poles motor has 12 counts per revolution)





5.3. Brake

The **Brake** view is used for configuring an external mechanical brake. If a brake is present and connected to the drive, it can automatically be controlled and activated/deactivated by the system.

First the brake must be set as available in the "ACTUATORS SETTINGS". Then the Brake appears in the menu on the left.

| DKIAF2 A 1 | | | | |
|--------------------|------------------|--|-----------------------------------|--|
| I Solution | | ATOR | | |
| Drive0 - Node 0x20 | | | | |
| ✓ of Actuator | | | 6 | |
| Motor | Motor type: | Rotary Brushless AC (sinusoidal) | Configure O Configure Commutation | |
| 🗴 Brake | Brake available: | Yes Configure | | |
| 🗅 Digital Encoder | Position sensor: | Digital Encoder | Configure | |
| 🗖 Digital Halls | Position sensor. | Digital Encoder | Conngare | |
| Motion | Velocity sensor: | Estimate velocity from position sensor | | |
| - | | | | |

Now the Brake view is accessible:

| Brake mode: | Variable voltage |] | | | |
|--|------------------|---|--|--|--|
| Delay before release brake: | 0 🚔 ms | | | | |
| Delay after enable brake: | 0 🚔 ms | | | | |
| Time at full voltage: | 0 🚔 ms | | | | |
| Voltage % rest of the time: | 100 🚔 % | | | | |
| BRAKE WILL NOT WORK: Brake digital output is not configured to any GPO | | | | | |

Brake mode allows selecting which voltage is used to supply the brake.

If the selected mode is "Constant voltage" the brake will be supply by a constant voltage and only the two first parameters will be used. If the selected mode is "Variable voltage" the brake will be supply by a PWM signal.

Delay before release brake is the delay between release the brake and activation of the power stage (in ms). This delay is designed to prevent loads from falling or coasting when the effects of gravity or other external forces are seen in the system.

Delay after enable brake is the delay between deactivation of the power stage and activation of the brake (in ms). This delay is designed to prevent loads from falling or coasting when the effects of gravity or other external forces are seen in the system.

Time at full voltage: If the Brake mode is set to voltage variable, this parameter specifies the time (in ms) for full release brake (100% duty cycle).

Voltage % rest of the time: If the Brake mode is set to voltage variable, this parameter specifies the % of duty cycle applied to the brake after full voltage time.

Brake operation is as follows:







CAUTION: Brake must be configured to the correct GPO, otherwise it would be like if there were no brake.

AUTION: Brake isn't available on SMI21 CANopen motor





6. HOMING

In positioning systems, it is usually necessary to know the absolute position of the mechanics to assure correct movements. For cost reasons, most of systems do not usually use absolute encoders which provide an absolute reference, and therefore a homing process or search for an absolute reference method is mandatory.



Parameters for homing are:

- Homing method: It indicates the used homing method.
- **Homing acceleration:** It establishes the acceleration used for all accelerations and decelerations in standard homing methods.
- Homing speeds: It indicates the speeds used to locate the switch or mechanical limit and the encoder index pulse.
- **Home offset**: It indicates the configured difference between the zero position for the application and the machine home position.
- **Homing timeout**: It indicates the maximum time allowed to complete the whole homing process. If the homing is not completed within this time, the homing process will be aborted, the statusword error bit will be raised, an emergency message will be sent and the system will execute a fault reaction.
- **Torque threshold:** It indicates the level of torque when the mechanical limit is considered to be reached

CAUTION: Some homing parameters could only be available for specific homing methods. Once homing motion has been configured, user can execute it.

CAUTION: Homings with index are not available with SMI21 CANopen drive.





7. ENABLE / DISABLE



Enable/Disable motor state is automatically controlled by the drive parameter specifies if the motor should be automatically powered on (if possible) after power-up without the needed of user intervention.

Motor Enable Input Signal indicates if a general enable signal is available (and it is connected to the GPIx). If this signal is available it will control when the power stage could be activated or deactivated. After the enable signal, the SMI21 or SMI22 CANopen drive will react to motion commands.





8. INPUTS / OUTPUTS

The SMI21 or SMI22 CANopen drive has programmable digital/analog inputs and outputs that you can use to initiate motion, control auxiliary devices, or trigger other actions. The inputs and outputs should be wired according to the instructions in the motor datasheet.

Inputs & Outputs monitor enables you to display the current value of I/O and modify the output signals.

CAUTION: Available inputs and outputs: The specific drive model purchased determines the available physical I/O and the options displayed in DCmind Soft CANopen.

8.1. Analog Inputs

All the analog input values are shown graphically and numerically (in ADC counts and mV).



CAUTION: Limits: In the semi-circle graphs, it may be observed the voltage working range.





8.2. Digital Inputs

All digital inputs appear here. Their states are shown graphically with a switch animation, with the text "On" or "Off".

| Digital Inputs | Name | Description | State | Polarity | Mode | |
|----------------|------|-------------------------|-------|---|--|--|
| | GPI1 | General Purpose Input 1 | Off | Active High Active Low | None | |
| | GPI2 | General Purpose Input 2 | Off | Active High Active Low | None Positive Switch Negative Switch Home Switch Motor Enable Fault Reset | |
| | GPI3 | General Purpose Input 3 | Off | Active High Active Low | | |
| | GPI4 | General Purpose Input 4 | Off | Active High Active Low | | |

Two parameters can be configured:

- Polarity: Indicates which signal level turns the state to "On".
 - "Active High": High value turns the state to "On".
 - "Active Low": Low value turns the state to "On".
- **Mode**: Relates the digital input to a parameter that may be used to control the motion:
 - "Positive Switch": When activated, Positive Switch signal is detected.
 - "Negative Switch": When activated, Negative Switch signal is detected.
 - "Home Switch": When activated, Home Switch signal is detected.
 - "Motor Enable": When activated, permits the motor to start moving. It has to be previously configured in Enable/Disable menu.
 - "Fault Reset": When activated, the board is unblocked after an error occurs.

CAUTION: If an entry is selected to set the Node ID by hardware, it becomes grey and can't be use in another mode.




8.3. Digital Outputs

All digital outputs appear here. As in digital inputs, their states are shown graphically with a switch animation, with the text "On" or "Off". Moreover, "auto-update" checkbox permits the state to change in real time, useful when monitoring.

| 🕑 Dig | Name | Description | State | Polarity | Mode |
|-----------|------|------------------|-------|---|------------------------------|
| ital Outp | GPO1 | Digital Output 1 | Off | Active High Active Low | None 🔹 |
| puts | GPO2 | Digital Output 2 | Off | Active High Active Low | None Brake |
| | GPO3 | Digital Output 3 | Off | Active High Active Low | Health Internal Generator |
| | GPO4 | Digital Output 4 | Off | Active High Active Low | Target Reached |

Two parameters can be configured:

- Polarity: Indicates which signal level comes from the state "On".
 - "Active High": "On" state creates a high level signal.
 "Active Low": "On" state creates a low level signal.
- Mode: Relates the digital output to a digital parameter from the drive board:
 - "Brake": Not available on SMI21 CANopen drive, available on SMI22 CANopen drive 0
 - "Health": It notifies if the drive is in Fault state or not. 0
 - "Internal Generator": Not available on SMI21 and SMI22 CANOpen drive 0
 - "Internal Limit": It is activated when an internal limit, as a switch, is reached. 0
 - "Target Reached": In motion control, this signal notifies that target value has been reached. 0

CAUTION: Brake isn't available on SMI21 CANopen motor

CAUTION: Internal Generator isn't available on SMI21 and SMI22 CANopen motor





9. PROTECTIONS

| | ONS | | | | | | | |
|--------------------------------|--------------|--------|-----------|--|--|--|--|--|
| CURRENT PROTECTIONS | | 0 mA | 120000 mA | | | | | |
| Maximum system current: | 120 000 🚔 m/ | A | | | | | | |
| Motor peak current: | 67483 m4 | 6 | | | | | | |
| Motor continuous current: | 22806 m4 | | | | | | | |
| VOLTAGE PROTECTIONS | | | | | | | | |
| Under voltage warning level: | 8.0 🛋 V | 7 V | 90 V | | | | | |
| Over voltage warning level: | 78.0 🊔 V | | | | | | | |
| TEMPERATURE PROTECTIONS | | | | | | | | |
| Under temperature fault level: | -25.0 🚔 °C | -40 °C | 110 °C | | | | | |
| Over temperature fault level: | 110.0 葦 °C | | | | | | | |
| EXTERNAL TEMPERATURE SENSOR | | | | | | | | |
| On | | | | | | | | |
| | | | | | | | | |
| Motor Temperature : 105 | ۰C | | | | | | | |

9.1. Current protections

Max current parameter indicates the maximum permissible current creating torque in the motor.

9.2. Voltage protections

9.2.1. Voltage warning level

The actual bus voltage, the over voltage warning level and the under voltage warning level can be displayed and adjusted in the Bus Voltage parameters sub-group.

CAUTION: The ABSOLUTE bus voltage limits are factory prefixed according to the hardware specifications and cannot be modified. When the actual bus voltage is out of the absolute range an Emergency message is sent and the system executes a Fault reaction.

WARNING: Setting maximum user bus voltage below the actual power supply voltage may lead to serious damage of the device. Some drives include internal shunt resistors that would be activated for a long time and cause serious overheat.





9.2.2. Shunt

While decelerating a mechanical load (abrupt motion brakes or reversals), the mechanical energy is converted into electrical energy by the motor. This energy is injected into the power supply and could lead to an increase of the supply voltage (depending on the power supply characteristics, especially its output capacitance) and then damage both the controller and the power supply.

A shunt circuit prevents the bus voltage from rising too high and therefore protects the Drive and the power supply. This shunt is automatically activated when the DC bus voltage exceeds the ballast threshold parametrized by the user.

If a shunt is available (set in the Actuators part), the Shunt menu appears on the right and the user can configure the shunt:



The external shunt will be activated when the actual bus voltage is higher than **Ballast threshold** plus **hysteresis** and will be deactivated when the actual bus voltage is lower than **Ballast threshold** minus **hysteresis**. This **hysteresis** is expressed as percentage of Ballast threshold.

The algorithm used by the shunt is the following:



CAUTION: The shunt isn't available with SMI21 CANopen motor.

 CAUTION: The voltage applied to the shunt is not modulated.
 WARNING: In case of incorrect setting of ballast activation threshold, or in case of incorrect sizing of the ballast resistor (value and power), the ballast resistor can be damaged, can burn or explode. The activation voltage threshold must be higher than the power voltage, and value/power of resistor must be in accordance with the amount of energy that the motor has to brake.





9.3. Temperature protections

The actual drive temperature, the over temperature warning/fault level and the under temperature warning/fault level can be displayed and adjusted in the Temperature parameters sub-group.

CAUTION: The ABSOLUTE temperature limits are factory prefixed according to the hardware specifications and cannot be modified. When the actual temperature is out of the absolute range an Emergency message is sent and the system executes a Fault reaction.

It's possible to activate an **external temperature sensor** which gives the **actual motor temperature**. When this temperature is over the warning level of 105°C the **motor temperature information** switch from green to red:

| Drive0 - Node 0x02 Voltage: 32.0 V Temperature: 28.2 °C Motor Tempera | ature |
|--|-------|
|--|-------|

CAUTION: The external temperature sensor isn't available with SMI21 CANopen motor.





10. PDO (PROCESS DATA OBJECT)

This page can be used to configure Process Data Objects (PDO). It is possible to configure up to 4 TPDO and 4 RPDO.

| ֥;< | Proc | ess Data Ob | jec | t (| P | DO) | | | | |
|-----------|---------------|--|------|-----|----|----------|---------------|---------------------|--------------------------|------|
| • | Configui | re the PDO used in C | ANop | oen | co | ommun | ications | | | |
| Select th | e PDO to co | nfigure: TPDO 1 - | | | | TPDO 1 (| configuratio | n | Acti | ve 🔽 |
| Type he | ere to search | | | | | Mappi | ng capac | ity: 6/8 | | |
| Index | SubIndex | Name | Size | • | | Index | SubIndex | Name | | Size |
| 0x20c2 | 0x01 | [Driver temperature] Actual temperature | 4 | _ | | 0x6041 | 0x00 | Statusw | ord | 2 |
| 0x2101 | 0x01 | [Bus voltage] DC link circuit voltage | 4 | | | 0x2101 | 0x01 | [Bus vol DC link | tage] circuit voltage | 4 |
| 0x2305 | 0x03 | [Commutation] Actual system angle | 2 | | | | | | | |
| 0x2321 | 0x02 | [Digital halls] Value | 1 | | | | | | | |
| 0x2600 | 0x01 | [Current readings] Current phase A | 2 | | | | | | | |
| 0x2600 | 0x02 | [Current readings] Current phase B | 2 | | | | | | | |
| 0x2600 | 0x03 | [Current readings] Current phase C | 2 | | | | | | | |
| 0x2601 | 0x01 | [Current d-q] Current direct | 2 | | (| COB-ID: | | | 1 | A0 |
| 0x2601 | 0x02 | [Current d-q] Current guadrature | 2 | | - | Transmis | sion type: | | Event driven | * |
| 0x2a03 | 0x01 | [Analog inputs] Analog input 1 value | 4 | | | Event m | node: | | Value change | d 🔹 |
| 0x2a03 | 0x02 | [Analog inputs] Analog input 2 value | 4 | | | Min re | fresh rate (r | ns): | 100 |) 🚖 |
| 0x2a03 | 0x03 | [Analog inputs] | 4 | - | | | | | | |

In the left part of the screen appear the **mappable objects**, and they can be dragged to the right part of the screen to map them to the current PDO.

The size is measured in bytes. A colored bar helps us to see the mapping capacity of the current PDO.

Several parameters can be configured for each PDO such as COB-ID and Transmission Type.





11. DRIVE STATUS

Drive Status allows you to view the current status of the drive internal state machine. You have access to this view by passing the mouse on the FSA current status case in the Status bar on the bottom.

| Current drive status code: 0x5627 (0101 0110 0010 0111) | | | | | | | | | |
|---|---------------------------|----------------------------|-----------------------------|---------------------------|--------------------------|--------------------------|--|--|--|
| | brake applied, if present | low-level power applied | high-level power applied | drive function enabled | configuration allowed | shunt control enabled | | | |
| NOT READY TO SWITCH ON | ~ | × | ~ | | × | | | | |
| SWITCH ON DISABLED | ~ | × | ~ | | ~ | | | | |
| READY TO SWITCH ON | ~ | × | ~ | | ~ | | | | |
| SWITCHED ON | ~ | × | ~ | | ~ | | | | |
| OPERATION ENABLED | ~ | × | × | × | | × | | | |
| QUICK STOP ACTIVE | ~ | × | × | × | | × | | | |
| FAULT REACTION ACTIVE | ~ | × | ~ | × | | × | | | |
| FAULT | × | × | ~ | | ~ | | | | |
| MOTOR ENABLED | N/A | | | | | | | | |

The system has a state machine implemented where every state determines which command are accepted or processed. For example, it is only possible to start a movement when the drive is in operation enabled state.





12.PARAMETERS

This screen displays a list of both Drive values and Application values of all the parameters that the drive supports.

A search box allows to search them by different criteria: name, index, sub-index, etc. Some of the parameters can be modified from this screen (Access type = ReadWrite or WriteOnly)

| 1 READ A | ALL. | 🛃 WRITE ALL 🛃 WRIT | TE MODIFIED | RESTOR | E DEFAULTS | |
|----------|----------|----------------------------|-------------|-------------|-------------|-------------------|
| | _Q | Search | | | | |
| ndex | SubIndex | Name | Data Type | Access Type | Drive Value | Application Value |
| - 0x1000 | 0x00 | Device Type | UInt32 | ReadOnly | 0x20192 | 0x20192 |
| — 0x1001 | 0x00 | Error Register | UInt8 | ReadOnly | 0x11 | 0x11 |
| - 0x1003 | | Pre-defined Error Field | | | | |
| - 0x1005 | 0x00 | COB-ID SYNC | UInt32 | ReadWrite | 0x80 | 0x80 |
| - 0x1006 | 0x00 | Cycle Period | UInt32 | ReadWrite | 0x0 | 0x0 |
| — 0x1007 | 0x00 | Sync Windows Length | UInt32 | ReadWrite | 0x0 | 0x0 |
| — 0x1008 | 0x00 | Device name | String | Const | emcl | emcl |
| — 0x1009 | 0x00 | Hardware version | String | Const | See PCB | See PCB |
| — 0x100a | 0x00 | Software version | String | Const | 1.1.6 | 1.1.6 |
| — 0x100c | 0x00 | Guard Time | UInt16 | ReadWrite | 0x0 | 0x0 |
| — 0x100d | 0x00 | Life Time Factor | UInt8 | ReadWrite | 0x1 | 0x1 |
| - 0x1010 | | Store Parameters | | | | |
| - 0x1011 | | Restore default parameters | | | | |
| — 0x1014 | 0x00 | COB-ID Emergency message | UInt32 | ReadWrite | 0xA0 | 0xA0 |
| — 0x1017 | 0x00 | Producer Heartbeat Time | UInt16 | ReadWrite | 0x0 | 0x0 |
| - 0x1018 | | Identity Object | | | | |
| - 0x1200 | | SSDO | | | | |
| - 0x1400 | | RPDO 1 | | | | |
| - 0x1401 | | RPDO 2 | | | | |
| - 0x1402 | | RPDO 3 | | | | |
| — 0x1403 | | RPDO 4 | | | | |
| — 0x1600 | | RPDO 1 mapping parameter | | | | |
| — 0x1601 | | RPDO 2 mapping parameter | | | | |
| — 0x1602 | | RPDO 3 mapping parameter | | | | |
| — 0x1603 | | RPDO 4 mapping parameter | | | | |
| - 0x1800 | | TPDO 1 | | | | |
| - 0x1801 | | TPDO 2 | | | | |
| — 0x1802 | | TPDO 3 | | | | |
| — 0x1803 | | TPDO 4 | | | | |
| — 0x1a00 | | TPDO 1 mapping parameter | | | | |
| — 0x1a01 | | TPDO 2 mapping parameter | | | | |
| — 0x1a02 | | TPDO 3 mapping parameter | | | | |
| — 0x1a03 | | TPDO 4 mapping parameter | | | | |
| — 0x2000 | | Uart configuration | | | | |
| - 0x2001 | | CANopen configuration | | | | |

The following options are available at the top menu:

- READ all parameters from drive: update the parameter table visualized on the screen. User-modified values will be overwritten.
- WRITE all parameters to drive: download all the application parameters to the drive, overwriting the existing ones.
- WRITE modified parameters to drive: only download the application values modified by the user.
- RESTAURE default parameters.





13.<u>MOTION</u>

DCmind Soft + CANopen includes a **Motion Test Tool** in the top toolbar to test different motion modes, to perform homing and to verify that the system has been adjusted and works properly or launch a motion profile.

After configuring a specific profile, user can execute it with the **ENABLE/DISABLE MOTOR** button and stop it at any time.

All parameters can be changed during execution and update the motion profile.

CAUTION: The following modes will only appear if the connected drive is capable of performing such movements.

13.1. Homing

See HOMING part of this document (section 6)

To do it just click on the ENABLE/DISBLE MOTOR button and wait for homing completion.

WARNING: It is necessary for a good motion performance to tune the servo loops before executing any homing method.

13.1. Open Loop

Specify target voltage (in %) to reach a target velocity without feedback.

| Homing | O Position | (2) Velocity | Torque | Rulti-Point | 🗲 Open Loop | | | | |
|---|----------------------|-----------------|--------|-------------|----------------|------------------------|---------------------|--|--|
| ● Use commutation sensor ○ Internally generate commutation angle | | | | | | | | | |
| U | NABLE MOTO |)R | ୍ 🎱 ଦ | UICK STOP | | | | | |
| Target voltage: | -100 % | -50 % ' | 0%5 | 0 % 100 % | • | 0.0 📩 % (0 V) | Set voltage to zero | | |
| Target frequency: | • | | | | • | 0 🔹 mHz | | | |
| Advanced motion control | | | | | | | | | |
| CAUTION: Open loop is available only in administrator mode | | | | | | | | | |





13.2. Profile Position

Specify velocity and acceleration to reach a given position.

| A Homing | O Position | @ Velocity | کر Torque | 📯 Multi-Point | 🗲 Open Loop | | | | |
|--------------------|----------------------|---------------|---------------|------------------|----------------|-------------------|------------|------------|-----|
| 0 | ENABLE MOTO | R | () QL | JICK STOP | Actual p | osition: | 0 c | | |
| | -21474836 | 47 c | | | | 21 | 47483647 c | | |
| Target position: | < | | | | | | | 0 🚔 | c 🔒 |
| Manual increme | ent: | 4 096 🚔 | c | — Target Pos | ition | 🕂 Target Positi | on | | |
| Turns: | | 100.00 | | O Turn | | C Turn Revers | e | | |
| Additional | l position param | eters | | | | | | | |
| PROFILER PA | ARAMETERS | | | | | | | | |
| Profile velocit | iy: | | 999.99 븣 r | pm | | | | | |
| Profile accele | ration: | | 4 000 🚔 r | pm/s | | | | | |
| Profile decele | ration: | | 4 000 🚔 r | pm/s | | | | | |
| LIMIT PARAM | METERS | | | | | | | | |
| Minimum abs | solute position: | -2 147 | 483 647 븣 c | -21474836 | 47 c | 0 c | | 2147483647 | c |
| Maximum ab: | solute position: | 2 147 | 483 647 븣 c | | | | | | |
| THRESHOLD | PARAMETERS | | | | | | | | |
| Position wind | ow: | | 100 🚔 c | | Follo | wing error window | v: | 40 960 🚔 | c |
| Position wind | low time: | | 10 🚔 n | ns | Follo | wing error timeou | ıt: | 100 🚔 | ms |
| | | | | | | | | | |

Parameters for *Profile position* are:

Advanced motion control

- Velocity: It indicates the velocity applied to the profile.
- Acceleration / Deceleration: Acc/ decel applied to the displacement.
- **Target position:** Displacement in counts or user units.

The House icon (Go Home button) allows for commanding position zero to servo drive.





13.3. Profile Velocity

Specify acceleration and deceleration to reach a target speed.

| Homing | O Position | (Contraction of the second sec | Torque | 📯 Multi-Point | ل Open Loc | γp | | | | |
|-------------------|----------------------|--|------------|------------------|---------------|---------------|--------------|-------|---------|-----|
| | NABLE MOTO | DR | 0 | UICK STOP | Actual | velocity: | | 0 rpm | | |
| Target velocity: | -5000 rp | m | | 0 rpm | | | 5000 rpm | | 0.00 | rpm |
| Manual incremen | t: | 2.93 | rpm | — Target Ve | locity | 🕂 Targ | jet Velocity | | | |
| Additional v | elocity param | eters | | | | | | | | |
| PROFILER PAR | AMETERS | | | | | | | | | |
| Profile accelerat | tion: | | 4 000 🚔 | rpm/s | | | | | | |
| Profile decelera | tion: | | 4 000 🚔 | rpm/s | | | | | | |
| LIMIT PARAMI | ETERS | | | -5 | 000 rpm | | 0 rpm | | 5000 | rpm |
| Maximum profi | le velocity: | | 5 000.00 🚖 | rpm 📑 | | | | | (| • |
| THRESHOLD P | ARAMETERS | | | | | | | | | |
| Velocity window | v: | | 49.98 韋 | rpm | Ve | locity thres | hold: | | 49.98 🚔 | rpm |
| Velocity window | v time: | | 10 韋 | ms | Ve | locity thres! | hold time: | | 100 🚔 | ms |
| Advanced m | notion control | | | | | | | | | |

Parameters for Profile Velocity are:

- Acceleration / Deceleration: Acc/ decel applied to reach target velocity.
- Target velocity: Velocity in counts/s or user units.





13.4. Profile Torque

In Torque Mode, the motor moves in one direction or another (depending on force value sign) trying to reach the torque setpoint.

| Homing Po | Sition | (2) Velocity | Torque | 📯 Multi-Point | 🗲 Open Loop | | | | |
|----------------------------------|-----------------------|-----------------|--------------|------------------|----------------|-------------|-------|------------|-----------|
| | BLE MOTOR | ۱ | UI OUI | CK STOP | Actual torque: | | 0 mNm | | |
| - Target torque: | 6000.48 mN | lm | | | | 6000.48 | mNm | 0.00 🚔 mNm | |
| Manual increment: | | 120.96 韋 | mNm | — Target tor | rque 🕂 Ta | rget torque | | | |
| Additional torque PROFILER PARAM | ue parameti IETERS | ers | 8 421.28 🚔 m | Nm/s | | | | | |
| LIMIT PARAMETE | RS | | | | | | | | |
| Negative torque lin | mit: | -1 | 6 000.48 🚔 m | -17280 r Nm | mNm | | | | 0 mNm |
| Positive torque lim | it: | | 6 000.48 📩 m | 0 mN Nm | lm | | | | 17280 mNm |
| THRESHOLD PAR | AMETERS | | | | | | | | |
| Torque window: | | | 2.16 🚔 m | Nm | | | | | |
| Torque window tim | ne: | | 1.0 🚔 m | 5 | | | | | |

Advanced motion control

Parameters for Profile force are:

- **Torque slope:** It sets how torque will increase.
- **Target torque:** Setpoint in mNm.

CAUTION: This test requires to apply some mechanical opposition to the movement. Try to hold the shaft otherwise it will rotate or move continuously. Test different values always under safety conditions using low values.

CAUTION: Notice that some configuration parameters are populated by default with the values entered under Profiler.





13.5. Multi-Point

Specify velocity and acceleration to reach several given positions (up to 15 positions).

| Homing Position | <u> </u> | s and a second s | çR ə | | | |
|---|-----------------------|--|--------------------|------------------|------------|--------------|
| | Velocity | Torque | Multi-Point | Open Loop | | |
| | | | | | [] | |
| ENABLE MOTOR | 2 | () QU | ICK STOP | Actual position: | 0 c | |
| Position | Action | | | | | |
| 0 | (+) Capture | 🕞 Dele | te | | | |
| -10000 | (+) Capture | Dele | te | | | |
| 10000 | (+) Capture | Dele | te | | | |
| -20000 | (+) Capture | Dele | te | | | |
| 20000 | (+) Capture | Dele | te | | | |
| -30000 | 🕀 Capture | Dele | te | | | |
| 30000 | (+) Capture | Dele | te | | | |
| -40000 | Capture | O Dele | te | | | |
| 40000 | Capture | O Dele | te | | | |
| -50000 | Capture | Dele | te | | | |
| 50000 | (+) Capture | Dele | te | | | |
| 0 | (+) Capture | Dele | te | | | |
| | (+) Capture | 🕞 Dele | te | | | |
| | (+) Capture | Dele | te | | | |
| | G Capture | O Dele | te | | | |
| Cause before repeating: Additional position parame PROFILER PARAMETERS Profile velocity: Profile acceleration: Profile deceleration: | 1 (| 000 x ms | pm pm/s pm/s | | | |
| | | | | | | |
| LIMIT PARAMETERS | | 3 647 📥 c | -214748364 | 17 с | 0 c | 2147483647 c |
| LIMIT PARAMETERS | -2 147 48 | | | | | |
| LIMIT PARAMETERS Minimum absolute position: Maximum absolute position: | -2 147 48 | з 647 📑 с | < ■ | | | |
| LIMIT PARAMETERS Minimum absolute position: Maximum absolute position: THRESHOLD PARAMETERS | -2 147 48 | 3 647 🌲 c | | | | • |
| LIMIT PARAMETERS Minimum absolute position: Maximum absolute position: THRESHOLD PARAMETERS Position window: | -2 147 48 2 147 48 | 3 647 😴 c | | Following err | or window: | 40 960 💌 c |

Parameters for *Profile position* are:

- Velocity: It indicates the velocity applied to the profile.
- Acceleration / Deceleration: Acc/ decel applied to the displacement.
- Target positions: Displacement in counts or user units.

You have the possibility to make periodically this sequence by check the Repeat sequence case and set the time between 2 sequences.





14. DCMIND PROGRAMS

DCmind Soft CANopen includes also a **Specific Motion Test named "DCmind Programs"** in the top toolbar to test different specific programs, to perform homing and to verify that the system has been adjusted and works properly or launch a motion profile (velocity, position and torque).



14.1. Welcome screen

14.1.1. *Toolbar*

The following table describes the function of each button in the Configuration toolbar (some buttons are available only when a motor is connected and selected).

| Title | Description |
|--------------|---|
| | Load values from File to Parameters list. This will load values from a previous |
| LOAD | configuration File (.xml). The parameters are automatically downloaded to the drive |
| SAVE | Users can save configurations at any time. This is very useful when a system has been completely set up and you want to store the parameters to download them to other identical systems. To save a configuration, click the SAVE button. The output format for configuration file is an XML. User can find further information on that format at section Parameters file of this manual. |
| MOTOR | Open a window with the following informations: motor reference, coil reference, |
| INFORMATIONS | manufacturing date, firmware, bootloader, hardware and HMI version. |
| SCOPE | Open digital scope. |
| I/O BOX | Digital Inputs / Outputs simulator. Not implemented yet. |
| HELP | Open the online documentation |





14.1.2. *Programs description*

Application programs:

- The application programs are grouped together with similar applications (valve, conveyor belt, machine, etc.).
- They enable quick start-up with completion of just a few key application values.
- Each application program is based on a preconfigured expert program. After testing the motor a few times in the application, the user can refine the motor operation by accessing all the adjustment parameters via the expert program linked to the application program and changing the pre-filled values.

Expert programs:

- The expert programs are grouped together with similar programs (P1xx, P2xx, etc position control, V1xx, V2xx velocity control, C1xx, C2xx torque control).
- These are generic programs, not specific to any application. They can be used to access all the options and settings.
- They can be used directly, without going via the "application program" step and they offer a wider choice of uses.

14.1.3. *Monitoring window*

The monitoring part of the HMI is common to all the expert and application program tabs.







14.1.4. Information bar

The monitoring information bar is common to all the expert and application program tabs.

| MOTOR DISABLED | Drive0 - Node 0x02 | Motor Temperature |
|----------------|--------------------|-------------------|
|----------------|--------------------|-------------------|

The following information is present:

- The motor status : Enable, Disable or Fault (the error code is displayed in the monitoring part)
- The node ID of the drive
- The Motor temperature information is the external temperature sensor is selected.

CAUTION: The external temperature sensor isn't available with SMI21 CANopen motor.

14.1.5. Stop button

The stop button is common to all the expert and application program tabs.



Click on this button will:

- **Stop the motor**: motor in disable state
- Reset the actual application: no application in the drive (index 0x2C10 sub-index 0x1 set at 0)
- **Reset the restart application**: after a power on the motor will be in standby (index 0x2C10 subindex 0x3 set at 0).

WARNING: To go from DCmind programs to Motion standard profile, it's mandatory to click on the stop button (not only on the red cross), otherwise the drive can have an undesirable behavior.

WARNING: If you forgot to click on this button, you can directly change the register values (0x2C10: 0x1 = 0 and 0x2C10: 0x3 = 0).





14.2. Application Programs

14.2.1. "Valve" Group

14.2.1.1. "Valve 4 positions"

| CROUZET MOTORS | nositions | This program is dedicated to valve positioning applica The application can be made either the motor alone the ratio is adjustable (belt / pulley, gear). The user mechanical design (total stroke, reduction ratio). The positions. | tions with 4 positions. or the motor associated with a reduction system whose can set the homing phase (torque, search direction) and total stroke of the application can be divided into 1 to 4 |
|---|--|---|---|
| | Application settings Project name : P101 Number of rotation(s) to close the valve : 0.25 the turn Time to realize the total stroke (to close the valve): 1 the sec Mechanical ratio between the motor and the valve: 50.00 the valve: 10 the | Motor settings -Homing torque : 100 - mN.m Valve torque : > 10 N.m -Direction to close the valve: | Monitoring Temperature : 35.6 °C Real Speed : 0 rpm Current Position : 0 pulses Real Torque : 0 mN.m |
| Valve positions Position 1 0 * % 0 Pulse(s) Position 2 25 * % 12800 Pulse(s) Position 3 75 * % 38400 Pulse(s) Position 4 100 * % 51200 Pulse(s) | > Maximum speed: 750 rpm Inputs / Outputs configuration +5Vdc → +24 Vdc In1 Position 1 4 In2 Position 2 Positions In3 Position 3 In4 Position 4 In5 Homing In6 On / Off | Change the direction of rotation | Power Supply: 24.2 V Inputs Outputs IN1 OUT1 IN2 OUT2 IN3 OUT3 IN4 OUT4 IN5 Code Error : IN6 OUT |
| Load program Expert mode | connections Output connections | STOP | |

The "Valve 4 positions" application program invokes the P101 expert program.

The user can switch to this expert mode at any time to access all the settings by clicking the "Expert Mode" button.

The values preset in application mode will be loaded directly in expert mode.

It is then impossible to return to this application program.

The user can press the "STOP" button at any time to stop the application quickly.

To restart the motor, the program needs to be reloaded.

Once the settings are complete, press the "Load Program" button to configure the motor.

Note: Each time you power ON the power supply or a program is loaded, it is necessary to perform the homing sequence.

14.2.1.1.1. Inputs/Outputs Configuration

Inputs:

| • | IN1: If $0 \rightarrow No$ position setpoint, | if $1 \rightarrow \text{Setpoint} = "Position 1" Parameter$ |
|---|---|---|
| • | IN2: If $0 \rightarrow No$ position setpoint, | if $1 \rightarrow \text{Setpoint} = "Position 2" Parameter$ |
| • | IN3: If $0 \rightarrow No$ position setpoint, | if $1 \rightarrow \text{Setpoint} = "Position 3" Parameter$ |
| • | IN4: If $0 \rightarrow No$ position setpoint, | if $1 \rightarrow \text{Setpoint} = "Position 4" Parameter$ |
| • | IN5: If $0 \rightarrow No$ action, | if 1 \rightarrow Launch homing phase |
| • | IN6: If $0 \rightarrow \text{Stop}$, | if $1 \rightarrow Run$ |

N.B.: if more than 1 input IN1 to IN4 is activated at the same time, the motor switches to stop mode.





Outputs: Don't forget to fit the pull-down resistors on each of the outputs.

- OUT1: If $0 \rightarrow$ position setpoint not reached,
- OUT2: If $0 \rightarrow$ homing phase complete,
- OUT3: If $0 \rightarrow \text{motor stopped}$,
- OUT4: If $0 \rightarrow$ no error,

14.2.1.1.2. Application Settings

- The user can give a 4-character name in "Project name" which is stored in the motor and appears in the "Motor Information" window.
- If it has been saved on the PC by the user, this name is used by default.
- The "Number of rotation(s) to close the valve" and "Mechanical ratio between the motor and the valve" parameters are used to calculate the application total stroke in number of motor revolutions:

 $Total \ course \ [Rotation \ motor] = Nb \ of \ rotationr_{Closing \ valve} \times \eta_{Vaves \ vs \ Motor}$

 The "Time to realize the total stroke" parameter is used to calculate the motor speed of rotation during the positioning phases:

$$Motor speed [RPM] = \frac{Total \ course \ [Rotation_{motor}] \times 60}{Times_{total \ course} \ [sec]}$$

The calculated value is given for information in the grayed-out box.

• The motor speed of rotation during the mechanical stop search phase (homing) is determined as follows:

Homing speed
$$[RPM] = \frac{Motor speed [RPM]}{5}$$

14.2.1.1.3. Motor Configuration

- Used to configure the mechanical stop search phase (homing) by setting the "Homing torque" and the direction of valve closing.
- The nominal and maximum torques in the motor are determined from the "Homing torque" value as follows:

Nominal torque = Homing torque

Torque
$$Maxi = 2 \times Homing \ torque$$

• For information, the maximum torque value **seen by the valve** during operation is given in the grayed-out box.

14.2.1.1.4. Valve Positioning

- The user has the option of setting 4 position setpoints parameters as a percentage of valve opening.
- By default, position 1 corresponds to detection of the mechanical stop (valve closed). If the user wishes to
 add an offset to avoid mechanical shocks during valve closing, he should change the "Position 1"
 parameter accordingly.

• By default, position 4 corresponds to the application total stroke (valve open).

For information, all 4 positions are given in number of pulses (4096 pulses per motor revolution) in the grayed-out boxes.

if $1 \rightarrow$ position setpoint reached. if $1 \rightarrow$ homing phase in progress or not performed. if $1 \rightarrow$ motor running.

if $1 \rightarrow \text{error detected}$.









The "Valve 30 positions" application program invokes the P111 expert program.

The user can switch to this expert mode at any time to access all the settings by clicking the "Expert Mode" button.

The values preset in application mode will be loaded directly in expert mode. It is then impossible to return to this application program.

The user can press the "STOP" button at any time to stop the application quickly.

To restart the motor, the program needs to be reloaded.

Once the settings are complete, press the "Load Program" button to configure the motor.

Note: Each time you power ON the power supply or a program is loaded, it is necessary to perform the homing sequence.

14.2.1.2.1. Inputs/Outputs Configuration

Inputs:

- IN1 to IN5: 32 possible combinations:
 - $IN1 = IN2 = IN3 = IN4 = IN5 = 0 \rightarrow Stop.$
 - IN1 = 1, all 4 others = $0 \rightarrow$ Launch homing phase.
 - The other 30 combinations correspond to the 30 position setpoints.
- IN6: Not used.





Outputs: Don't forget to fit the pull-down resistors on each of the outputs.

- OUT1: If $0 \rightarrow$ position setpoint not reached,
- OUT2: If $0 \rightarrow$ homing phase complete,
- OUT3: If $0 \rightarrow \text{motor stopped}$,
- OUT4: If $0 \rightarrow$ no error,

14.2.1.2.2. Application Settings

- The user can give a 4-character name in "Project name" which is stored in the motor and appears in the "Motor Information" window.
- If it has been saved on the PC by the user, this name is used by default.
- The "Number of rotation(s) to close the valve" and "Mechanical ratio between the motor and the valve" parameters are used to calculate the application total stroke in number of motor revolutions:

 $Totale \ course \ [Rotation_{motor}] = Nb \ rotation_{closing \ valve} \times \eta_{Valve \ vs \ Motor}$

 The "Time to realize the total stroke" parameter is used to calculate the motor speed of rotation during the positioning phases:

$$Motor speed [RPM] = \frac{Totale \ course[rotation_{motor}] \times 60}{Times_{Totale \ course} \ [sec]}$$

The calculated value is given for information in the grayed-out box.

• The motor speed of rotation during the mechanical stop search phase (homing) is determined as follows:

Homing speed[RPM] =
$$\frac{Motor speed [RPM]}{5}$$

14.2.1.2.3. Motor Configuration

- Used to configure the mechanical stop search phase (homing) by setting the "Homing torque" and the direction of valve closing.
- The nominal and maximum torques in the motor should be determined from the "Homing torque" value as follows:

Nominal torque = Homing torque Maxi torque = $2 \times$ Homing torque

• For information, the maximum torque value **seen by the valve** during operation is given in the grayed-out box.

14.2.1.2.4. Position Table

- The user is not able to change the position setpoints, they will automatically be defined with between 2 and 30 equal positions, according to the defined total stroke and the "Number of positions" parameter. To change them, you need to change to "Expert Mode".
- By default, position 1 corresponds to detection of the mechanical stop (valve closed).
- By default, the last position corresponds to the application total stroke (valve open).
- For information, the position setpoints are given in number of valve rotations and number of pulses (4096 pulses per motor revolution).

- if 1 \rightarrow position setpoint reached. if 1 \rightarrow homing phase in progress or not performed.
- if $1 \rightarrow$ motor running.
- if $1 \rightarrow \text{error detected}$.





14.2.2. "Conveyor Belt" Group

14.2.2.1. "Conveyor Belt 0-10V"

| Application settings Priget name: VDI Comeyor speed mark: | Conveyor Belt 0-10V | IN1: 0V=Off, Vcc=On. IN2: 0V= Counterclockwise direction, Vcc= clockwise direction. IN3: 0V= no holding torque, Vcc= holding torque 150mNm (motor torque). IN4: 0V= running, Vcc=fast stop. IN5: 0V= acceleration 40000rpm/s, 10V= acceleration 100rpm/s. IN6: 0V=speed 0rpm, 10V= max motor speed |
|---|--|---|
| Load program Expert mode STOP | Application settings Project name : V101 Conveyor speed max : 2000 = m/s Speed ratio: 1.00 = belt travel meter(s) > Motor speed setpoint at 10V Inputs / Outputs configuration +5Vdc + +24 Vdc In 2 Direction In 3 Holding In 4 Oulck stop In 5 Accidecc 0-10V / PWM In 6 Speed 0-10V / PWM | for 1 motor revolution(s) 1200 rpm Output = + Vcc supply Output = + Vcc supply IN1 OUT1 IN2 OUT2 IN3 OUT3 IN4 OUT4 IN5 Code Error: IN6 Code Error: |
| | Load program Expert mode | STOP |

The "Conveyor Belt 0-10V" application program invokes the V101 expert program.

The user can switch to this expert mode at any time to access all the settings by clicking the "Expert Mode" button.

The values preset in application mode will be loaded directly in expert mode. It is then impossible to return to this application program.

The user can press the "STOP" button at any time to stop the application quickly. To restart the motor, the program needs to be reloaded.

Once the settings are complete, press the "Load Program" button to configure the motor.

14.2.2.1.1. Inputs/Outputs Configuration

Inputs:

- IN1: If $0 \rightarrow \text{Stop}$, if $1 \rightarrow \text{Run}$
- IN2: If $0 \rightarrow$ motor running in reverse (CCW), if $1 \rightarrow$ motor running forward (CW)
- IN3: If IN3 = 1 and IN1 = 1 and IN6 = 0, application of a 150 mNm holding torque.
- IN4: If 0 → no action, if 1 → Quick start by short-circuiting the coils. This action takes priority over the other commands.
- IN5: 0-10 V control. Sets the motor acceleration and deceleration. 40,000 rpm/sec for 0 V (maximum acceleration) and 100 rpm/sec for 10 V.
- IN6: 0-10 V control. Sets the speed setpoint. 0 V for 0 rpm and 10 V for the maximum motor speed defined by the user.





Outputs: Don't forget to fit the pull-down resistors on each of the outputs.

- OUT1: Provides information on the motor speed value in PWM. Cyclical ratio = 0% → speed = 0 rpm
 - Cyclical ratio = 100% \rightarrow speed = maximum speed.
- OUT2: Provides information on the real torque value in PWM. Cyclical ratio = 0% → torque = 0 mNm Cyclical ratio = 100% → torque = 1 Nm.
- OUT3: If $0 \rightarrow$ motor running, if $1 \rightarrow$ motor stopped.
- OUT4: If $0 \rightarrow$ error detected, if $1 \rightarrow$ no error.

14.2.2.1.2. Application Settings

- The user can give a 4-character name in "Project name" which is stored in the motor and appears in the "Motor Information" window.
- If it has been saved on the PC by the user, this name is used by default.
- The maximum motor speed corresponding to a voltage of 10 V is calculated as follows:

Setpoint motor speed_{10V}[RPM] =
$$\frac{Max \text{ speed Tapis } [m.s^{-1}] \times 60}{Speed \text{ step } [m.tr^{-1}]}$$

The calculated value is given for information in the grayed-out box.





14.2.2.2. "Conveyor Belt PWM"

| CROUZET MOTORS | This program is set: - the maximum - the ratio betw The available se Project name : V101 | dedicated to conveyor belt applications of conveyor belt speed corresponding to 100 en motor speed rotation and conveyor br titings in this program have been limited to | vith PWM setpoint inj 96 PWM setpoint elt linear speed. 5 simplify the configur Monitoring Temperature : | put for the speed. ration of the applic 35.6 | The user can ation °C |
|--------------------------|--|---|---|--|--|
| | Conveyor speed max: 20.00 mm/s Speed ratio: 1.00 mm/s → Motor speed setpoint at 100% 1200 rpm Inputs / Outputs configuration +5Vdc → +24 Vdc Int ON / OFF Speed Int ON / OFF Speed Int ON / OFF Speed Int Olding Ind Quick stop In5 Acc/decc 0-10V / PWM In6 Speed 0-10V / PWM In6 Speed 0-10V / PWM | r revolution(s) | Real Speed : Current Position : Real Torque : Power Supply : Inputs IN1 Ins IN2 Ins IN5 Ins IN6 Ins | 0 0 24.2 0UT. OUT. OUT. OUT. Code | rpm pulses mN.m V V Uutputs 1 2 2 3 3 4 4 4 5 5 1 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 |
| Load program Expert mode | | STOP | | | , |

The "Conveyor Belt PWM" application program invokes the V101 expert program.

The user can switch to this expert mode at any time to access all the settings by clicking the "Expert Mode" button.

The values preset in application mode will be loaded directly in expert mode. It is then impossible to return to this application program.

The user can press the "STOP" button at any time to stop the application quickly. To restart the motor, the program needs to be reloaded.

Once the settings are complete, press the "Load Program" button to configure the motor.

14.2.2.2.1. Inputs/Outputs Configuration

Inputs:

- IN1: If $0 \rightarrow$ Stop, if $1 \rightarrow$ Run
- IN2: If $0 \rightarrow$ motor running in reverse (CCW), if $1 \rightarrow$ motor running forward (CW)
- IN3: If IN3 = 1 and IN1 = 1 and IN6 = 0, application of a 150 mNm holding torque.
- IN4: If 0 → no action, if 1 → Quick start by short-circuiting the coils. This action takes priority over the other commands.
- IN5: PWM control. Sets the motor acceleration and deceleration. 40,000 rpm/sec for 0% PWM (maximum acceleration) and 100 rpm/sec for 100% PWM.
- IN6: PWM control. Sets the speed setpoint. 0% PWM for 0 rpm and 100% PWM for the maximum motor speed defined by the user.





Outputs: Don't forget to fit the pull-down resistors on each of the outputs.

- OUT1: Provides information on the motor speed value in PWM. Cyclical ratio = 0% → speed = 0 rpm Cyclical ratio = 100% → speed = maximum speed.
- OUT2: Provides information on the real torque value in PWM. Cyclical ratio = 0% → torque = 0 mNm Cyclical ratio = 100% → torque = 1 Nm.
- OUT3: If $0 \rightarrow$ motor running, if $1 \rightarrow$ motor stopped.
- OUT4: If $0 \rightarrow \text{error detected}$, if $1 \rightarrow \text{no error}$.

14.2.2.2.2. Application Settings

- The user can give a 4-character name in "Project name" which is stored in the motor and appears in the "Motor Information" window.
- If it has been saved on the PC by the user, this name is used by default.
- The maximum motor speed corresponding to a PWM signal with 100% cyclical ratio is calculated as follows:

Setpoint motor speed_{100% PWM}[RPM] =
$$\frac{Max \text{ speed } [m. s^{-1}] \times 60}{\text{ Speed step } [m. tr^{-1}]}$$

The calculated value is given for information in the grayed-out box.





14.2.3. "Machine" Group

14.2.3.1. "Clamp"

| Clamp | | IN1: 0V=Off, Vcc=On. IN2: 0V= Counterclockwise direction, Vcc= clockwise IN3: 0V= no holding torque, Vcc= holding torque 15 IN4: 0V= unning, Vcc=fast stop. IN5: 0V= Torque ramp 2000mN.m/s, 10V= 0mN.m/ IN6: 0V=Torque 0mN.m, 10V= max torque | : direction. OmNm (motor torque). S. | |
|--------------------------|--|---|---|---|
| | Application settings Project name : C101 Maximum clamping force: 1 * Newton(s) Ratio between clamp and motor torque: 1.00 * N/mN.m > Torque setpoint for 10V 1000 mN.m | Tightening direction | Monitoring Temperature : 35.0 Real Speed : 0 Current Position : 0 Real Torque : 0 | 5 °C rpm pulses mN.m |
| | Inputs / Outputs configuration +5Vdc → +24 Vdc In1 ON / OFF In2 Direction In3 Not used In4 Quick stop In5 Torque amp 0-10V / PWM In6 Torque 0-10V / PWM | Output = + Vcc supply (PNP open collector) ed PWM Out1 que PWM Out2 aning Out4 or Out4 or Out4 | Power Supply : 24.3 Inputs IN1 1 IN2 1 IN3 1 IN4 1 IN5 1 IN6 1 | 2 Outputs OUT1 OUT2 OUT2 OUT3 OUT3 OUT3 OUT4 OUT4 Code Error : |
| Load program Expert mode | | STOP | | |
| Input c | onnections Output connections | | | |

The "Clamp" application program invokes the C101 expert program.

The user can switch to this expert mode at any time to access all the settings by clicking the "Expert Mode" button.

The values preset in application mode will be loaded directly in expert mode.

It is then impossible to return to this application program.

The user can press the "STOP" button at any time to stop the application quickly. To restart the motor, the program needs to be reloaded.

Once the settings are complete, press the "Load Program" button to configure the motor.

14.2.3.1.1. Inputs/Outputs Configuration

Inputs:

- IN1: If $0 \rightarrow$ Stop, if $1 \rightarrow$ Run
- IN2: If $0 \rightarrow$ motor running in reverse (CCW), if $1 \rightarrow$ motor running forward (CW)
- IN3: Not used.
- IN4: If 0 → no action, if 1 → Quick start by short-circuiting the coils. This action takes priority over the other commands.
- IN5: 0-10 V control. Sets the motor torque ramp. 20,000 mNm/sec for 0 V (maximum ramp) and 100 mNm/sec for 10 V.
- IN6: 0-10 V control. Sets the torque setpoint. 0V for 0 mNm and 10V for the maximum motor torque defined by the user (value in the grayed-out box).





Outputs: Don't forget to fit the pull-down resistors on each of the outputs.

OUT1: Provides information on the motor speed value in PWM. • Cyclical

| Cyclical ratio = 0% | \rightarrow speed = 0 rpm |
|-----------------------|---------------------------------|
| Cyclical ratio = 100% | \rightarrow speed = 4000 rpm. |

- OUT2: Provides information on the real torque value in PWM. • Cyclical ratio = 0% \rightarrow torque = 0 mNm Cyclical ratio = 100% \rightarrow torque = maximum torque.

Application Settings 14.2.3.1.2.

- The user can give a 4-character name in "Project name" which is stored in the motor and appears in the • "Motor Information" window.
- If it has been saved on the PC by the user, this name is used by default. •
- The maximum motor torque corresponding to a voltage of 10 V is calculated as follows: •

$$Consigne \ Couple \ Moteur_{10V}[mNm] = \frac{Force \ Maxi \ Serrage \ [N]}{Rapport_{Pince/Moteur} \ [N/mNm]}$$

The calculated value is given for information in the grayed-out box.





14.2.3.2. "Worm Gear"

| CROUZET MOTORS ←★→ Worm Gear | This program is dedicated to positioning worm gear applications. The application can be made with either the motor alone or the motor associated with an adjustable reduction system (belt / pulley, gear). The user can set the homing phase (type of stop, search direction, offset between software zero and mechanical zero), mechanical design (total stroke, step of the screw, reduction ratio, yield) and physical limitations (linear |
|--|--|
| Mining form Application limits Switch 2 P1 P2 P3 P39 P30 Mechanical setting Application limits Maximum linear speed : 10 mm/s Total stroke length : 300 mm Maximum linear speed : 10 mm/s Mechanical setting Maximum linear speed : 10 mm/s Total stroke length : 300 mm Maximum linear speed : 10 mm/s Mechanical ratio between the motor and the screw (befulley, gearbox, included) : 20 mm/s Speed max : 2400 rpm Mechanical system efficiency : 100 mm/s Speed max : 2400 rpm Torque max : 80 mN.m Inputs / Outputs configuration Imputs / Outputs configuration Imputs / episition Torque max : 80 mN.m | Homing phase Project name : P111 - Type of stop : O Mécanique Switch - Direction of rotation (to go to the stop) : O Clockwise direction (direction 1) O Counter clockwise direction (direction 2) - Offset between position 1 and stop : 10 mm Positions Table Number of positions : 30 mm 0 1 0 0 0 0 1 1 0 0 0 10.345 0 1 1 0 0 31.034 1 1 1 0 0 1 0 651.724 0 0 1 1 0 10 20.699 1 1 0 1 0 1 0 31.034 1 1 0 1 0 1 0 32.759 1 1 0 1 1 0 13.0448 1 0 1 1 0 1 10.03.4488 1 0 1 1 1 0 124.138 |
| Load program Expert mode Input connections Output connections | STOP |

The "Worm Gear" application program invokes the P111 expert program.

The user can switch to this expert mode at any time to access all the settings by clicking the "Expert Mode" button.

The values preset in application mode will be loaded directly in expert mode.

It is then impossible to return to this application program.

The user can press the "STOP" button at any time to stop the application quickly.

To restart the motor, the program needs to be reloaded. Once the settings are complete, press the "Load Program" button to configure the motor.

Note: Each time you power ON the power supply or a program is loaded, it is necessary to perform the homing sequence.

14.2.3.2.1. Inputs/Outputs Configuration

Inputs:

- IN1 to IN5: 32 possible combinations:
 - IN1 = IN2 = IN3 = IN4 = IN5 = 0 → Stop
 - IN1 = 1, all 4 others = $0 \rightarrow$ Launch homing phase
 - The other 30 combinations correspond to the 30 position setpoints
- IN6: Switch limit input if « switch » is selected as "type of stop"

<u>Outputs</u>: Don't forget to fit the pull-down resistors on each of the outputs.

- OUT1: If 0 → position setpoint not reached,
 OUT2: If 0 → homing phase complete,
 OUT3: If 0 → motor stopped,
 OUT3: If 0 → motor stopped,
 if 1 → position setpoint reached.
 if 1 → homing phase in progress or not performed.
 if 1 → motor running.
- OUT4: If $0 \rightarrow$ no error, if $1 \rightarrow$ error detected.





14.2.3.2.2. Initialization Phase

- The user can give a 4-character name in "Project name" which is stored in the motor and appears in the "Motor Information" window.
- If it has been saved on the PC by the user, this name is used by default.
- Select the type of stop, either "Mechanical" if the stop is achieved by detection of an obstacle on the application, or "Switch" if a limit switch is used in the application.
- Define the motor direction of rotation used to reach the stop selected above (forward (CW) rotation by default).
- To protect the application and prevent the mechanical stop being reached each time it returns to position zero, a position offset (in mm) can be set between the mechanical stop and position 1 corresponding to the application reference.

14.2.3.2.3. Application Settings

To determine the maximum operating speed during the positioning phases, the user should enter the
maximum linear speed in mm/s and the "Step of the screw" and "Mechanical ratio between the motor and
the screw" adjustment parameters are used to obtain a motor speed of rotation according to the formula
below:

$$Motor speed [RPM] = \frac{Linear speed [mm/s] \times step_{Reduction} \times 60}{Step_{screw} [mm/rotation]}$$

• The motor speed of rotation during the mechanical stop search phase (homing) is determined as follows:

Homing speed
$$[RPM] = \frac{Motor speed [RPM]}{5}$$

14.2.3.2.4. Motor Configuration

• To determine the nominal torque during operation, the user should enter the maximum thrust for his application in Newtons and the "Step of the screw" and "Mechanical ratio between the motor and the screw" adjustment parameters are used to obtain a nominal motor torque using the following formula:

$$Motor torque [mN.m] = \frac{1}{2\pi} \times \frac{Pushing [N] \times Step_{screw}[mm/tour]}{Step_{Reduction}}$$

• The homing and maximum torques for detecting the mechanical stop in the motor are determined from the "Motor Torque" value defined above as follows:

Homing torque = Motor torque Maxi torque = 2 × Motor torque

14.2.3.2.5. Position Table

- The user is not able to enter the 2 to 30 position setpoints himself, they are automatically defined with between 2 and 30 equidistant positions, according to the defined total stroke "Total stroke length" and the "Number of positions" parameter.
- Position 1 corresponds to detection of the mechanical stop (as close as possible to the offset).
- The last position corresponds to the application total stroke.
- In the table, the position setpoints are given in mm.





14.2.3.3. "Worm Gear Proportional"

| CROUZET MOTORS | This program is dedicated to positioning worm gear applications. The application can be made with either the motor alone or the motor associated with an adjustable reduction system (belt / pulley, gear). The user can set the homing phase (type of stop, search direction, offset between software zero and mechanical zero), mechanical design (total stroke, step of the screw, reduction ratio, yield) and the physical limitations (linear speed and maximum thrust). |
|---|--|
| Mechanical setting Switch 2 Image: Constraint of the serve is a constraint. Imputs / Outputs configuration Imputs / Outputs configuration Imputs / Outputs configuration Imputs / Outputs configuration Imputs / Outputs configuration Imputs / Outputs configuration Imputs / Outputs configuration Imputs / Outputs configuration | Homing phase Project name : P201 • Type of stop : • • Mechanical • Switch • Direction of rotation (to go to the stop) : • • • • • • • • • • • • • • • • • • • |
| Load program Expert mode | I6: 1V = 0.469 mm 0.01V = 0.005 mm STOP |

The "Worm Gear (Proportional)" application program uses the P201 expert program.

The user can switch to this expert mode at any time to access all the settings by clicking the "Expert Mode" button.

The values preset in application mode will be loaded directly in expert mode.

It is then impossible to return to this application program.

The user can press the "STOP" button at any time to stop the application quickly.

To restart the motor, the program needs to be reloaded.

Once the settings are complete, press the "Load Program" button to configure the motor.

Note: Each time you power ON the power supply or a program is loaded, it is necessary to perform the homing sequence

14.2.3.3.1. Inputs/Outputs Configuration

Inputs:

- IN1 and IN2: 4 possible combinations:
 - $[IN1-IN2] = [00] \rightarrow Stop and error reset$
 - $[IN1-IN2] = [10] \rightarrow$ Homing phase
 - $[IN1-IN2] = [01] \rightarrow Maintain actual position$
 - [IN1-IN2] = [11] \rightarrow Go to required position
- IN3: Switch limit input if « switch » is selected as "type of stop"
- IN4: High speed (if 0) or low speed (if 1) selection
- IN5: Proportional position setting Coarse tuning
- IN6: Proportional position setting Thin tuning





Outputs: Don't forget to fit the pull-down resistors on each of the outputs.

- OUT1: Provides information on the motor speed value in PWM.
 - Cyclical ratio = 0% \rightarrow speed = 0 rpmCyclical ratio = 100% \rightarrow speed = 4000 rpm.
- OUT2: Provides information on the real torque value in PWM. Cyclical ratio = 0% \rightarrow torque = 0 mNmCyclical ratio = 100% \rightarrow torque = maximum torque.
- OUT3: If $0 \rightarrow$ motor running, if $1 \rightarrow$ motor stopped.
- OUT4: If $0 \rightarrow$ error detected, if $1 \rightarrow$ no error.

14.2.3.3.2. Initialization Phase

- The user can give a 4-character name in "Project name" which is stored in the motor and appears in the "Motor Information" window.
- If it has been saved on the PC by the user, this name is used by default. For more details, see the "Saving Parameters" paragraph.
- Select the type of stop, either "Mechanical" if the stop is achieved by detection of an obstacle on the application, or "Switch" if a limit switch is used in the application.
- Define the motor direction of rotation used to reach the stop selected above (forward (CW) rotation by default).
- To protect the application and prevent the mechanical stop being reached each time it returns to position zero, a position offset (in mm) can be set between the mechanical stop and position 1 corresponding to the application reference.

14.2.3.3.3. Application Settings

• To determine the maximum operating speed during the positioning phases, the user should enter the maximum linear speed in mm/s and the "Step of the screw" and "Mechanical ratio between the motor and the screw" adjustment parameters are used to obtain a motor speed of rotation according to the formula below:

$$Maximum speed [RPM] = \frac{Maximum linear speed [mm/s] \times step_{Reduction} \times 60}{Step_{screw} [mm/rotation]}$$

• By activating the digital input 4 (IN4 = 1), the user selects the low speed profile:

Low speed
$$[RPM] = \frac{Maximum speed [RPM]}{5}$$

• The motor speed of rotation during the mechanical stop search phase (homing) is determined as follows:

Homing speed [RPM] =
$$\frac{Maximum speed [RPM]}{5}$$

<u>NB</u>: Motor speed is restricted to max. 4000 rpm in this program. If this value is exceeded, the writing becomes red colored and the loading of the parameters becomes impossible. It is strongly advised to check motor specifications before to configuring the application.





14.2.3.3.4. Motor Configuration

To determine the maximum torque during operation, the user should enter the maximum thrust for his
application in Newtons and the "Step of the screw" and "Mechanical ratio between the motor and the
screw" and "Mechanical system efficiency" adjustment parameters are used to obtain a maximum motor
torque using the following formula:

 $Maximum \ torque \ [mN.m] = \frac{1}{2\pi} \times \frac{Pushing \ [N] \times Step_{screw}[mm/tour]}{Step_{Reduction}} \times 2$

Nominal torque =
$$\frac{Maximum torque}{2}$$

• To detect the mechanical end stop, the homing torque is automatically set to be equal to nominal torque.

<u>NB</u>: The max. torque has to don't be higher than 1000 mNm. If this value is exceeded, the writing becomes red colored and the loading of the parameters becomes impossible.

The real maximum torque value is limited per motor characteristics. It is strongly advised to check motor specifications before to configuring the application.

14.2.3.3.5. Position setpoint

- The user indicates the total stroke in mm of the application: parameter « Total stroke length ». The full stroke is achieved when both setpoints (IN5 and IN6) are at 10V. To travel this distance, the settings are distributed as follows:
 - Coarse setting: Input IN5 allows to travel 63/64th of the « total stroke length »
 - Thin setting: Input IN6 allows to travel 1/64th of the « total stroke length »
- The resolution of each of the two inputs IN5 and IN6 is given as an indication in the gray boxes in the « Position table – Input 5 and input 6 scale » zone:
 - Distance equivalent to an applied voltage of 1V
 - Distance equivalent to an applied voltage of 0,01V (resolution of the system)

Example: For a «Total stroke length » = 300 mm:

 \rightarrow Input IN5 allows to travel: $Stroke_{E5} = \frac{63}{64} \times 300mm = 295,3125mm$ (for 10V applied)

Meaning 29,53125 mm for 1V Meaning 0,2953125 mm for 0,01V

 \rightarrow Input IN6 allows to travel: $Stroke_{E6} = \frac{1}{64} \times 300mm = 4,6875mm$ (for 10V applied)

Meaning 0,46875 mm for 1V Meaning 0,0046875 mm for 0,01V





14.2.4. "Dosing" Group

14.2.4.1. "Peristaltic pump"

| | This program is dedicated to dosing applications (flow - Fix quantity: 3 preset doses and 1 adjustable dose (0) - Continuous flow: 4 preset speed ranges and speed se | r or fix doses).The user can set: /10V input) et per analog 0/10V input into the selected speed range. |
|---|---|--|
| ← ♠ → Peristaltic Pump | | |
| | Application settings | Monitoring |
| | Project name : P201 | Temperature : 35.6 °C |
| | Flow : 20.00 😴 ml/rotation Mechanical Ratio : 1.00 😴 | Real Speed : 0 mm |
| | Dose setting and coding | ivea speed . 0 ipm |
| | IN 4 IN 5 Dose Time Speed Motor | Current Position : 0 pulses |
| | Dose 1 1 0 100.00 mi 60.00 s 5 rpm | Real Torque : 0 mN.m |
| | Dose I 0 1 100.00 ml 10.00 s 90 rpm | Power Supply : 24.2 V |
| | Dose 1 1 1 1000.01 ml 60.00 s 50 rpm | Inputs Outputs |
| 13 4 1 | Dose 4 (10V) 0 0 4 000.01 ml 60.00 s 200 rpm | IN1 OUT1 |
| | | |
| | Inputs / Outputs configuration | |
| | | IN3 0013 |
| | | IN4 OUT4 |
| | | IN5 Code Error : |
| Coding Speed Range | +5Vdc | IN6 |
| IN1 IN2 MinSpeec MaxSpeet MinFlow MaxFlow | Int ON / OFF Int Speed - Dosing Mode Out1 | |
| 0 0 0 3000 0 60 | In3 Direction Go Run Out2 Target Out3 | |
| 1 0 0 1000 0 20 0 1 900 2000 18 40 | Inst 4 Ranges D1, D2, D3 Error Out | |
| 1 1 1800 3000 36 60 | In Speed 10V Dosing 10V | |
| | Ť | |
| | | |
| | Input connections | |
| | | |
| | CTOD | |
| Load program Expert mode | STOP | |

The "Peristaltic pump" application program uses a preset V201 expert program.

The user can switch to this expert mode at any time to access all the settings by clicking the "Expert Mode" button.

The values preset in application mode will be loaded directly in expert mode.

It is then impossible to return to this application program.

The user can press the "STOP" button at any time to stop the application quickly.

To restart the motor, the program needs to be reloaded.

Once the settings are complete, press the "Load Program" button to configure the motor.

14.2.4.1.1. Inputs/Outputs Configuration

Inputs:

- IN1: ON/OFF $0 \rightarrow \text{Stop}$ $1 \rightarrow \text{ON}$
- IN2: Mode $0 \rightarrow \text{Dosing mode} 1 \rightarrow \text{Flow mode (speed)}$
- IN3: Direction / Go
 - In flow mode: $0 \rightarrow \text{Motor turns CCW} \quad 1 \rightarrow \text{Motor turns CW}$
 - In Dosing mode: 0 → No new dosing 1→ launches a new dose <u>Note</u>: When Dosing mode is selected, the IN3 signal has to be available during more than 15ms before to be taken in count.
- IN4 + IN 5: Coding Codes speed range or dose values depending on selected mode.
- IN6: Flow / Dose 0/10V analog input.
 - In Flow mode: Adjusts the flow value depending on the flow range selected (IN4 and I N5 coding).
 - In Dosing mode: Adjusts D4, the dose to deliver (IN4=IN5=1)

<u>Outputs</u>: Don't forget to fit the pull-down resistors on each of the outputs.





- OUT1: Mode
 - 0: Dosing mode 1: Flow mode
- OUT2: Direction of rotation 0: CCW
 - 1: CW
- OUT3: Target
 - In Dosing mode:In Flow mode:
- $0 \rightarrow$ Dose not completely delivered, $0 \rightarrow$ Motor is running
- $1 \rightarrow \text{Dose completed}$
- $1 \rightarrow$ Motor doesn't move

• OUT4: Error

 $0 \rightarrow No \text{ error detected}$ $1 \rightarrow Error detected$

14.2.4.1.2. Application configuration

- The user can give a 4-character name in "Project name" which is stored in the motor and appears in the "Motor Information" window.
- If it has been saved on the PC by the user, this name is used by default. For more details, see the "Saving Parameters" paragraph.
- « Dose », « Time » and « ratio » parameters allow to calculate the motor parameters for each dose (IN4 + IN5) the position to move, speed to deliver the dose. Calculation is as following:

 $Position \ setting \ [Pulses] = \frac{Dose \ [ml] \times 4096}{Flow \ [m.tr^{-1}]} \times Ratio$

Speed setting [RPM] = $\frac{Dose [ml]}{Flow [m. tr^{-1}]} \times \frac{60}{Time [sec]} \times Ratio$

For information, for each dose, the calculated speed is in grey boxes.

• For this program, speed ranges are fixed. You could modify them in going in "Expert mode".

| IN 4 | IN 5 | Min. motor speed (rpm) | Max. motor speed (rpm) |
|------|------|------------------------|------------------------|
| 0 | 0 | 0 | 3000 |
| 1 | 0 | 0 | 1000 |
| 0 | 1 | 900 | 2000 |
| 1 | 1 | 1800 | 3000 |





14.3. Expert Programs



14.3.1.1. "V101"



Expert program V101 is used to:

- Create speed profiles with analog or PWM control.
- Set the acceleration/deceleration phases with analog or PWM control.
- Set the nominal and maximum torque parameters for the application safety via the HMI.

14.3.1.1.1. "Inputs" tab parameters

| Input 1 - DIGITAL - ON / OFF | Input 2 - DIGITAL - Direction of Rotation |
|--|---|
| On = 1 / Off = 0 On = 0 / Off = 1 | CW = 1 / CCW = 0 CW = 0 / CCW = 1 |
| Input 3 - DIGITAL - Holding at stop | Input 4 - DIGITAL - Fast Stop |
| High state active Holding Torque : 150 nM.m Low state active | Igh state active Low state active |
| Input 5 - Proportional setpoint : Acceleration/Deceleration | Input 6 - Proportional setpoint : Speed |
| ● 0-10V ● 0-5V ● PWM ▲ 0 000 ★ rpm/s | ● 0-10V ○ 0-5V ○ PWM |
| OV | OV |

- Digital input 1: Used to set the "On/Off" input polarity.

- Digital input 2: Used to set the "Direction of rotation" input polarity.

- Digital input 3: Used to set the "Holding at stop" input polarity and set the Holding Torque value.

- Digital input 4: Used to set the "Fast stop" input polarity.

This input is used to stop the motor as quickly as possible, ignoring the setpoints applied to the other inputs.

- <u>Setpoint input 5</u>: Used to select the control type for the acceleration/deceleration setpoint and fix the maximum and minimum limits for this setpoint. An inverted scale can be used.

<u>- Setpoint input 6</u>: Used to select the control type for the speed setpoint and fix the maximum and minimum limits for this setpoint. An inverted scale can be used.





14.3.1.1.2. "Outputs" tab parameters

| 💿 Type 1 🛛 Type 2 💭 Type 3 💭 Type 4 | | | |
|---|---|---|--|
| OUTPUT 1 - PULSE : Real speed Hall Pulse Width : 500 🗮 µs | OUTPUT 1 - PWM : Real speed PWM frequency : 1000 + Hz | OUTPUT 1 - FREQUENCY : Real speed Frequency at 1000 rpm : 1000 * Hz | OUTPUT 1 - PWM : Real speed (centered on 50%) PWM frequency : 1000 + Hz |
| OUTPUT 2 - PWM : Real torque PWM frequency : 1 000 + Hz S2 torque (100% PWM) : 1 000 + mN.m | OUTPUT 2 - PWM : Real torque PWM frequency : 1 000 + S2 torque (100% PWM) : 1 000 + | OUTPUT 2 - DIGITAL : Real direction 0 : Counter Clockwise 1 : Clockwise | OUTPUT 2 - PWM : Real torque (centered on 50%) PWM frequency : 1 000 + Hz S2 torque (100% PWM) : 1 000 + mN.m |
| OUTPUT 3 - DIGITAL : Real direction 0 : Counter Clockwise 1 : Clockwise | OUTPUT 3 - DIGITAL : Motor Running 0 : Motor running 1 : Motor stopped | 0 : Motor running 1 : Motor running 1 : Motor stopped | OUTPUT 3 & 4 - DIGITAL : Motor Status 00 : Error detected 01 : Motor running |
| OUTPUT 4 - DIGITAL : Error 0 : Error detected 1 : No error | OUTPUT 4 - DIGITAL : Error 0 : Error detected 1 : No error | 0 : Error detected 1 : No error | 10 : Motor stopped and holding torque applied 11 : Motor stopped without holding |

a) Type 1

- Setting the parameter of Pulse output 1 "Real speed": A Hall pulse with configurable width (100 to 800 µs) is generated each time one of the 3 motor Hall sensors changes state.

80140_SMI21 and 80180_SMI21 motors have 12 Hall pulses per revolution (2 pairs of poles). 80280_SMI21 and all SMI22 motors have 24 Hall pulses per revolution (4 pairs of poles).

- <u>Setting the parameters of PWM output 2 "Real Torque"</u>: The parameters can be set for the signal frequency of this output and the torque value corresponding to a cyclical ratio of 100% (scaling).

| If cyclical ratio = 0% | \rightarrow Torque supplied = 0 mNm. |
|--------------------------|---|
| If cyclical ratio = 100% | \rightarrow Torque supplied = "S2 torque" |

- State of digital output 3 "Real direction": Used to find out the motor direction of rotation.

- State of digital output 4 "Error": Used to find out whether an error has been detected.

b) Type 2

- Setting the parameter of PWM output 1 "Real Speed": The parameters can be set for the signal frequency of this output (must be identical to the one for PWM output 2).

 $\begin{array}{ll} \mbox{If cyclical ratio} = 0\% & \rightarrow \mbox{Real speed} = 0 \mbox{ rpm}. \\ \mbox{If cyclical ratio} = 100\% & \rightarrow \mbox{Real speed} = \mbox{maximum speed setpoint defined in In6}. \end{array}$

- <u>Setting the parameters of PWM output 2 "Real Torque"</u>: The parameters can be set for the signal frequency of this output and the torque value corresponding to a cyclical ratio of 100% (scaling).

If cyclical ratio = 0% \rightarrow Torque supplied = 0 mNm. If cyclical ratio = 100% \rightarrow Torque supplied = "S2 torque".

- State of digital output 3 "Motor running": Used to find out whether the motor is stopped or running.

- State of digital output 4 "Error": Used to find out whether an error has been detected.

c) Type 3

- <u>Setting the parameter of frequency output 1 "Real speed"</u>: The parameters can be set for the signal frequency of this output for which the motor runs at 1000 RPM (200, 500 or 1000 Hz).

- State of digital output 2 "Real direction": Used to find out the motor direction of rotation.

- State of digital output 3 "Motor running": Used to find out whether the motor is stopped or running.

- State of digital output 4 "Error": Used to find out whether an error has been detected.





d) Type 4

- Setting the parameters of PWM output 1: "Real speed (centered on 50%)": The parameters can be set for the signal frequency of this output (must be identical to the one for PWM output 2).

| If cyclical ratio = 0% | \rightarrow Motor running forward (CW) at maximum speed setpoint defined in In6. |
|--------------------------|--|
| If cyclical ratio = 50% | \rightarrow Real speed = 0 rpm. |
| If cyclical ratio = 100% | \rightarrow Motor running in reverse (CCW) at maximum speed setpoint defined in In6. |

- <u>Setting the parameters of PWM output 2 "Real torque (centered on 50%)"</u>: The parameters can be set for the signal frequency of this output (must be identical to the one for PWM output 1) and the torque value corresponding to a cyclical ratio of 100% (scaling).

| If cyclical ratio = 0% | \rightarrow Braking torque supplied = "S2 torque". |
|--------------------------|--|
| If cyclical ratio = 50% | \rightarrow Torque supplied = 0 mNm. |
| If cyclical ratio = 100% | \rightarrow Motor torque supplied = "S2 torque". |

CAUTION: In holding torque this output will be between 0 and 50% if the motor runs in CCW, and between 50 and 100% if the motor runs in CW.

- Combinations of digital outputs 3 & 4 "Motor status": Used to find out the motor status.

14.3.1.1.3. "Settings" tab parameters

a) Torque limit parameters



<u>- Setting the various torque parameters</u>: When the application torque exceeds the torque " $C_{NOMINAL}$ " (Continuous torque), the motor can provide torque up to the value " C_{MAX} " (Peak torque) for the maximum duration " t_{MAX} " (Peak time). Thereafter, if the application torque is still higher than " $C_{NOMINAL}$ " (Continuous torque), the motor torque is limited to the value " $C_{NOMINAL}$ " (Continuous torque), until the application torque falls back below this value.

b) Threshold parameters

| Torque limit parameters | | |
|---|--------|-----|
| Threshold parameters | | |
| Velocity window: | 10 | rpm |
| Velocity window time: | 10 📮 | ms |
| Velocity threshold: | 10 📮 | rpm |
| Velocity threshold time: | 100 🚔 | ms |
| Protection parameters | | |
| PID loop parameters | | |
| Shunt configuration para | meters | |

See part "<u>4. MOTION SETTINGS / 4.3. Thresholds</u>" of this user manual.





c) Protection parameters

| Torque limit parameters | | | |
|--|--------------|--------|-----------|
| Threshold parameters | | | |
| Protection parameters CURRENT PROTECTIONS Maximum system current: | 120 000 📩 mA | 0 mA | 120000 mA |
| VOLTAGE PROTECTIONS Under voltage warning level: Over voltage warning level: | 8.0 × V | 7 V | 90 V |
| TEMPERATURE PROTECTIONS Under temperature fault level: Over temperature fault level: | -25.0 × °C | -40 °C | 110 °C |
| PID loop parameters | | | |
| Shunt configuration paramet | ers | | |

See part "<u>9. PROTECTIONS</u>" of this user manual.

If one of these protection parameters is exceeded, an error is generated, the motor is stopped and no holding torque is applied (freewheeling).

d) PID loop parameters

| Torque limit parameters | |
|--|---------|
| Threshold parameters | |
| Protection parameters | |
| PID loop parameters | |
| Velocity Proportional gain: | 600 000 |
| Velocity Integral gain: | 6 000 🚔 |
| Velocity Derivative gain: | 0 |
| Shunt configuration param | eters |

Set the PID controller factors in the speed control loop (this function is reserved for advanced users). The values given in the example below ensure correct product operation in the majority of cases.

e) Shunt configuration parameters

| Torque limit parameters | |
|--------------------------|---|
| Threshold parameters | |
| Protection parameters | |
| PID loop parameters | |
| Shunt configuration para | imeters |
| Shunt available: | No Yes Yes |
| Ballast threshold: | 78 000 🐘 mV |
| Hysteresis: | 1 *** % |

See part "<u>9. PROTECTIONS/ 9.2. Voltage protections/ 9.2.2. Shunt</u>" of this user manual.

If the ballast threshold plus hysteresis is exceeded, the shunt is activated.








Expert program V102 is used to:

- Create speed profiles with analog or PWM control.

- Set torque limiting with analog or PWM control.

14.3.1.2.1. "Inputs" tab parameters

- Digital input 1: Used to set the "On/Off" input polarity.

- Digital input 2: Used to set the "Direction of rotation" input polarity.

- Digital input 3: Used to set the "Holding at stop" input polarity and set the Holding Torque value.

- Digital input 4: Used to set the "Fast stop" input polarity.

This input is used to stop the motor as quickly as possible, ignoring the setpoints applied to the other inputs.

- Setpoint input 5: Used to select the control type for the torque limiting setpoint and fix the maximum and minimum limits for this setpoint. An inverted scale can be used.

- <u>Setpoint input 6</u>: Used to select the control type for the speed setpoint and fix the maximum and minimum limits for this setpoint. An inverted scale can be used.

14.3.1.2.2. "Outputs" tab parameters

See part "14.3.1.1. "V101" / 14.3.1.1.2 "Outputs" tab parameters" of this user manual.

14.3.1.2.3. "Settings" tab parameters

See part "<u>14.3.1.1. "V101" / 14.3.1.1.3 "Settings" tab parameters</u>" of this user manual (note that you don't have access to the "torque limit parameters", you must use the setpoint input 5 for that).





14.3.1.3. "V103"



Expert program V103 is used to:

- Create speed profiles with analog or PWM control.
- Force speed control to one of the 3 preprogrammed speeds.
- Set the acceleration/deceleration phase parameters via the HMI.

14.3.1.3.1. "Inputs" Tab Parameters

| Inputs 1, 2, 3 - DIGITAL : Choose speed setpoint | | | | | Inputs 4 5 - DIGITAL : Choose motion | | | | | | | |
|--|-------|-----|-------|------------|--------------------------------------|-------------------------------------|------------|---------|---------|--------|---------|-----------------------|
| inputs 1, 2, 5 District choose speed serpoint | | | | | | inputs 1, 5 | DIGINALIS | | - 11100 | | | |
| | | | | | | | | | | | | |
| | IN1 | IN2 | IN3 | | | | | | | IN4 | IN5 | |
| | 0 | 0 | 0 | Speed setp | oint Input (| 5 | | | | 0 | 0 | Fast stop |
| | 1 | 0 | 0 | Speed nº1 | 1 000 | rpm | | | | 1 | 0 | CCW direction |
| | 0 | 1 | 0 | Speed nº2 | 2 000 | rpm | | | | 0 | 1 | CW direction |
| | 0 | 0 | 1 | Speed nº3 | 3 000 | rpm | | | | 1 | 1 | Stop and remove error |
| | | | | | | | | | | | | |
| Input 6 - Proportional setpoint : Speed | | | | | | Acceleration | and decele | eratior | 1 | | | |
| 10V 4 000 💭 rpm | | | | | | Rate of acceleration 40 000 🚔 rpm/s | | | | | | |
| • 0-1 | .0V (| 0-! | 5V (C |) PWM | 0 0V | rpm | | | Rate of | f dece | leratio | 40 000 🛋 rpm/s |

- Combinations of digital inputs 1 to 3: Used to choose the type of speed setpoint applied at the motor input:

- If no input is active, the setpoint will be that applied to input 6.
- If one of these 3 inputs is active, the setpoint will be the priority speed associated with this input.

N.B.: If more than 1 input In1 to In3 is active, the setpoint taken into account will be that for input 6.

- Combinations of digital inputs 4 and 5: Used to choose the motion to be performed from the 4 actions indicated below.

- <u>Setpoint input 6</u>: Used to select the control type for the speed setpoint and fix the maximum and minimum limits for this setpoint. An inverted scale can be used.

- <u>Setting the acceleration and braking ramps</u>: These values are fixed via the HMI and cannot be changed by inputs while the motor is running. By default, the rates are fixed at 40,000 RPM/sec.





14.3.1.3.2. "Outputs" tab parameters

See part "14.3.1.1. "V101" / 14.3.1.1.2 "Outputs" tab parameters" of this user manual.

14.3.1.3.3. "Settings" tab parameters

See part "14.3.1.1. "V101" / 14.3.1.1.3 "Settings" tab parameters" of this user manual.





14.3.1.4. "V104"



Expert program V104 is used to:

- Create speed profiles with a choice of 8 preconfigured values.
- Set torque limiting with analog or PWM control.
- Set the acceleration/deceleration phase parameters via the HMI.

14.3.1.4.1. "Inputs" Tab Parameters

| Inputs 1, 2, 3 - DIGITAL : Choose speed setpoint | | | | Inputs 4, 5 - DIGITAL : Select motion | | | Acceleration and deceleration |
|--|-----|---|-----------------|---------------------------------------|-----------|-------------------------------------|-------------------------------------|
| | | | Input 4 Input 5 | | | | |
| IN1 | IN3 | | 0 | 0 | Fast stop | Rate of acceleration 40 000 🚔 rpm/s | |
| 0 | 0 | 0 | 0 🚔 rpm | 1 | 0 | CCW direction | |
| 1 | 0 | 0 | 500 🚔 rpm | 0 | 1 | CW direction | Rate of deceleration 40 000 📄 rpm/s |
| 0 | 1 | 0 | 1 000 🚔 rpm | 1 | 1 | Stop and remove error | |
| 1 | 1 | 0 | 1 500 🚖 rpm | Input 6 - Pr | oportio | onal setpoint : Torque Limit | |
| 0 | 0 | 1 | 2 000 🚖 rpm | | | | 10V |
| 1 | 0 | 1 | 2 500 🚖 rpm | | | | 0 🌐 mN.m |
| 0 | 1 | 1 | 3 000 章 rpm | | | ● 0-10V 🔘 0-5V 🔘 P | WM |
| 1 | 1 | 1 | 3 500 章 rpm | | | | 1 000 🦰 mN.m |
| | | | | | | | OV |

- Combinations of digital inputs 1 to 3: Used to select the type of speed setpoint applied at the motor input: 8 possible combinations:

- Combinations of digital inputs 4 and 5: Used to select the motion to be performed from the 4 actions indicated below.

- <u>Setpoint input 6</u>: Used to select the control type for the torque limiting setpoint and fix the maximum and minimum limits for this setpoint. An inverted scale can be used.

- <u>Setting the acceleration and braking ramps</u>: These values are fixed via the HMI and cannot be changed by inputs while the motor is running. By default, the rates are fixed at 40,000 RPM/sec.





14.3.1.4.2. "Outputs" tab parameters

See part "14.3.1.1. "V101" / 14.3.1.1.2 "Outputs" tab parameters" of this user manual.

14.3.1.4.3. "Settings" tab parameters

See part "<u>14.3.1.1. "V101" / 14.3.1.1.3 "Settings" tab parameters</u>" of this user manual (note that you don't have access to the "torque limit parameters", you must use the setpoint input 6 for that).





14.3.1.5. V201







V201 expert program allows to:

- Set a speed using an analog input 0/10V or 0/5V or PWM. The speed regulation is based on the "moving target" principle which allows to reach very low speed (down to 1 rpm).

- Or to set a relative position using the same analog input (0/10V or 0/5V or PWM).
- Switch between speed mode and position mode.

14.3.1.5.1. "Inputs" Tab Parameters

| Input 1 - DIGITAL - ON / OFF | Input 2 - DIGITAL - Mode | | | |
|---|--|--|--|--|
| | Speed Mode = 1 / PositionMode = 0 Speed Mode = 0 / Position Mode = 1 | | | |
| Speed Mode | Relative Position Mode | | | |
| Input 3 - DIGITAL - Direction of Rotation | Input 3 - DIGITAL | | | |
| OCW = 1 / CCW = 0 | Pulse Time Min : 15 🚔 ms | | | |
| Input 4 . 5 - TOR : Speed Range Selection | Input 4 . 5 - TOR : Position Selection | | | |
| E4 E5 Min (rpm) Max (rpm) Acceleration (rpm/s) Deceleration (rpm/s) | E4 E5 Pulses Speed (rpm) Acceleration (rpm/s) Deceleration (rpm/s) | | | |
| 0 0 1 m 1000 m 4000 m 4000 m | 1 0 1000 m 1000 m 4000 m 4000 m | | | |
| 1 0 1000 m 2000 m 4000 m 4000 m | 0 1 2 000 m 1 000 m 4 000 m 4 000 m | | | |
| 0 1 2 000 m 3 000 m 4 000 m 4 000 m | 1 1 3 000 m 1 000 m 4 000 m 4 000 m | | | |
| 1 1 3 000 <u>*</u> 3 500 <u>*</u> 4 000 <u>*</u> 4 000 <u>*</u> | 0 0 Input 6 1000 🗰 4000 🗰 4000 | | | |
| Input 6 - Proportional setpoint : Speed | Input 6 - Proportional setpoint : Position | | | |
| ● 0-10V ◎ 0-5V ◎ PWM Min (rpm) OV | ● 0-10V ◎ 0-5V ◎ PWM | | | |

- <u>Digital input 1</u>: « On/Off »: This input is to start or stop the motor. The input polarity is adjustable.
- <u>Digital input 2</u>: « Mode »: This input is to select the speed or position mode. The input polarity is adjustable.





- <u>Digital input 3 (in speed mode)</u>: « Direction »: This input is to select motor direction. The input polarity is adjustable.
- <u>Digital input 3 (in position mode)</u>: « Go »: This input gives the start to go to a new position. This input is taken in count only after that the last positioning was completed.
 The "Pulse time min." works as a filter. The « Go » signal could not be taken in count if its duration is lower than the set value.
- <u>Digital inputs 4 and 5 (in speed mode)</u>: « speed coding »: They allow to select the speed range for the IN6 input. For each range, the min and max speed, the acceleration and deceleration can be set.
- Digital inputs 4 and 5 (in position mode): "Position coding": They allow to select the relative position to reach (the step value to do). For each of the positions, the number of pulses (4096 pulses → 1 motor turn), the max speed, the acceleration and deceleration can be set. The last position is adjustable by IN6 analog input (IN4 = IN5 =0).
- <u>Analog input 6 (In speed mode)</u>: « Speed »: This input adjusts motor speed using an analog 0/10V or 0/5V or PWM signal. Speed range is given per IN4 + IN5 coding.

The setting parameter is analog or PWM signal type.

- <u>Analog input 6 (In position mode)</u>: « Step »: This input adjusts the value of the step to do (relative position) when IN4=IN5=0, using an analog 0/10V or 0/5V or PWM signal.

The setting parameters are

- Minimum of pulses (4096 pulses \rightarrow 1 motor turn)
- Maximum of pulses (4096 pulses → 1 motor turn)
 - Analog or PWM signal type.

14.3.1.5.2. "Outputs" tab parameters

| Type 11 | | | | | |
|--|--|--|--|--|--|
| OUTPUT 1 - DIGITA | L : Mode | | | | |
| 0 : Relative Posit 1: Speed Mode | 0 : Relative Positioning Mode 1: Speed Mode | | | | |
| OUTPUT 2 - DIGITA | L : Direction Of Rotation | | | | |
| 0 : Counter Cloc 1 : Clockwise | 0 : Counter Clockwise 1 : Clockwise | | | | |
| OUTPUT 3 - DIGITA | L Motor running | | | | |
| Speed Mode 0 : Motor running 1 : Motor stopped | Relative Position Mode 0 : Position Not Reached 1 : Position Reached | | | | |
| OUTPUT 4 - DIGITA | L : Error | | | | |
| 0 : No error 1 : Error detected | | | | | |

- <u>State of digital output 1:</u> "Mode": Gives mode used.
- <u>State of digital output 2:</u> "Direction" Used to find out the motor direction of rotation.
- <u>State of digital output 3 (speed mode)</u>: "Motor running": Used to find out whether the motor is stopped or running.
- <u>State of digital output 3 (position mode)</u>: "Target": Used to find out if the position is reached.
- <u>State of digital output 4:</u> "Error": Used to find out whether an error has been detected.





14.3.1.5.3. "Settings" tab parameters

See part "14.3.1.1. "V101" / 14.3.1.1.3 "Settings" tab parameters" of this user manual.

Note that there is only one additional parameter for expert program P202: "Analog input hysteresis": use this parameter when the stroke is important to minimize the oscillation of the analog target position (in pulse encoder).





14.3.2. Position group

14.3.2.1. "P101"



Expert program P101 is used to:

- Perform a homing phase to initialize the system with detection of the stroke ends.

- Perform various positionings using 4 preset position setpoints, each corresponding to one of the digital inputs "In1" to "In4".

- Set the acceleration/deceleration phases and the maximum speed that must not be exceeded between each point via the HMI.

14.3.2.1.1. "Homing" tab parameters

The homing sequence is an initialization phase that helps the motor estimate the application position reference by searching for mechanical stops. These stops can be detected in one of 2 ways:

- With 1 limit switch by retrieving information from one of the inputs.
- By detecting overtorque when the motor is at a mechanical stop.

N.B.: The default motor direction of rotation is forward (CW).

| © Start from current position 🛛 🔘 1 mechanical stop | 2 mechanical stop | |
|--|---------------------------------------|-------|
| Offset (pulses) Offset 1 0 m Offset 2 0 m Homing Speed 100 m rpm Max Homing Time 30 m seconds | | END 1 |
| Direction of rotation | <u></u> | 0 |

- <u>choose the homing method</u>: current position, with 1 or 2 mechanical stop.

- <u>Offset</u>: Set the difference in position (in pulses) between the mechanical stops and the application total stroke limits: stop 1 (END1) represents the stroke start, stop 2 (END2) represents the stroke end.

Note: Where there is only one mechanical stop, the "Offset 2" parameter is not available.





- <u>Homing speed</u>: Set the search speed for stops during the homing phase.

- <u>Homing torque</u>: Set the homing torque that allows the mechanical stop to be found by detection of overtorque.

- <u>Max Homing Time</u>: Set the maximum permitted time for the homing phase. If this value is exceeded, an error will be generated. Time limited to 300 seconds.

- Direction of rotation: Set the direction of rotation for the first stop search (END1).

<u>N.B.</u>: By default, the motor runs forward (CW).

14.3.2.1.2. "Inputs" tab parameters

| Input 1 - DIGITAL - Position 1 | Input 2 - DIGITAL - Position 2 | Inputs 1, 2, 3, 4 - DIGITAL : Select Position Setpoint | | | | |
|----------------------------------|--------------------------------|--|--|--|--|--|
| High state active | Igh state active | Position(pulses) Speed (rpm) Acceleration (rpm/s) Deceleration (rpm/s) | | | | |
| O Low state active | O Low state active | E1 1 000 🛋 1 000 🛋 40 000 🛤 40 000 🛤 | | | | |
| Input 3 - DIGITAL - Position 3 | Input 4 - DIGITAL - Position 4 | E2 2 000 🗰 1 000 🗰 40 000 🗰 40 000 | | | | |
| High state active | High state active | E3 3 000 🗰 1 000 🗮 40 000 🗰 40 000 | | | | |
| C Low state active | Constant active | E4 4 000 m 1 000 m 40 000 m 40 000 m | | | | |
| Input 5 - DIGITAL - Start Homing | | Input 6 - DIGITAL : ON / OFF | | | | |
| Start Homing= | 1 / Stop Homing=0 | ON=1 / OFF=0 | | | | |
| Start Homing= | 0 / Stop Homing=1 | ON=1 / OFF=0 | | | | |

- Digital input 1: Used to set the "Position 1" input polarity.
- Digital input 2: Used to set the "Position 2" input polarity.
- Digital input 3: Used to set the "Position 3" input polarity.
- Digital input 4: Used to set the "Position 4" input polarity.

- <u>Digital Inputs 1, 2, 3, 4</u>: Set the 4 position setpoints and the speed profiles to be followed (acceleration ramp, speed step and deceleration ramp: trapezoidal profile).

- Digital input 5: Used to set the "Start Homing" input polarity.
- Digital input 6: Used to set the "On/Off" input polarity.





14.3.2.1.3. "Outputs" tab parameters

| OUTPUT 1 - DIGITAL : Target Reached Flag 0 : Position target not reached 1 : Position target reached | OUTPUT 1 - DIGITAL : Target Reached Flag 0 : Position target not reached 1 : Position target reached | OUTPUT 1 - DIGITAL : Target Reached Flag 0 : Position target not reached 1 : Position target reached | | |
|--|--|---|--|--|
| OUTPUT 2 - DIGITAL : Homing Sequence Information 0 : Homing completed 1 : Homing in progress or no homing | OUTPUT 2 - DIGITAL : Homing Sequence Information 0 : Homing in progress or no homing 1 : Homing completed | OUTPUT 2 - PWM : Real torque (centered on 50%) PWM frequency : 1 000 + Hz | | |
| OUTPUT 3 - DIGITAL : Motor Running 0 : Motor stopped 1 : Motor running | OUTPUT 3 - DIGITAL : Motor Running 0 : Motor running 1 : Motor stopped | S2 torque (100% PWM) : 1 000 MN.m OUTPUT 3 & 4 - DIGITAL : Motor status 00 : Error detected 01 : Homing in progress OR no homing 10 : Homing completed AND motor stopped 11 : Motor running * * including motor in positioning mode or motor driven by a load. | | |
| OUTPUT 4 - DIGITAL : Error 0 : No error 1 : Error detected | OUTPUT 4 - DIGITAL : Error 0 : Error detected 1 : No error | | | |
| DUTPUT 1 - DIGITAL : Target Reached Flag 0 : Position target not reached 1 : Position target reached OUTPUT 2 - PWM : Real torque (centered on 50%) PWM frequency : 1000 + Hz S2 torque (100% PWM) : 1000 + Hz S2 torque (100% PWM) : 1000 + Hz OUTPUT 3 & 4 - DIGITAL : Motor status 00 : Error detected OR motor in stop mode AND no hor 01 : Motor running ** 10 : Motor stopped AND homing completed 11 : Not used * including the state 'motor stopped before homing (position loop but no homing)' = no homing. ** including motor in positionning mode or motor driven by a load or homing in progress. | OUTPUT 1 - Pulse : Real speed Hall pulse width : 500 OUTPUT 2 - DIGITAL : Real direction 0 : Counter Clockwise 1 : Clockwise 0 : Error detected OR motor in stop mode * 01 : Not used 10 : Motor stopped AND target reached ** 11 : Motor running in OFF mode : driven by a lo in this case, the motor is free on the shaft. ** in this case the motor is free on the shaft. ** in this case the motor is free on the shaft. ** in this case the motor is free on the shaft. ** in this case the motor is always stopped : i blocked by an obstacle, position loop bef position loop after homing. *** including motor in positionning mode or | μs ad : n disabled mode, ore homing, motor driven | | |

a) Type 5

- State of digital output 1 "Target Reached Flag": Used to find out whether the position setpoint has been reached.

- <u>State of digital output 2 "Homing Sequence Information"</u>: Used to find out how the homing phase is progressing: completed, in progress or not performed.

- <u>State of digital output 3 "Motor running"</u>: Used to find out whether the motor is stopped or running.

- State of digital output 4 "Error": Used to find out whether an error has been detected.

b) Type 6

- State of digital output 1 "Target Reached Flag": Used to find out whether the position setpoint has been reached.

- <u>State of digital output 2 "Homing Sequence Information"</u>: Used to find out how the homing phase is progressing: completed, in progress or not performed.

- <u>State of digital output 3 "Motor running"</u>: Used to find out whether the motor is stopped or running.
- State of digital output 4 "Error": Used to find out whether an error has been detected.





c) Type 7

- <u>State of digital output 1 "Target Reached Flag"</u>: Used to find out whether the position setpoint has been reached.

- <u>Setting the parameters of PWM output 2 "Real torque (centered on 50%)"</u>: The parameters can be set for the signal frequency of this output and the torque value corresponding to a cyclical ratio of 100% (scaling).

| If cyclical ratio = 0% | → Braking torque supplied = "S2 torque" |
|--------------------------|--|
| If cyclical ratio = 50% | \rightarrow Torque supplied = 0 mNm. |
| If cyclical ratio = 100% | \rightarrow Motor torque supplied = "S2 torque". |

- <u>Combinations of digital outputs 3 & 4 "Motor status"</u>: Used to find out the motor status.

d) Type 8

- <u>State of digital output 1 "Target Reached Flag"</u>: Used to find out whether the position setpoint has been reached.

- <u>Setting the parameters of PWM output 2 "Real torque (centered on 50%)"</u>: The parameters can be set for the signal frequency of this output and the torque value corresponding to a cyclical ratio of 100% (scaling).

| If cyclical ratio = 0% | → Braking torque supplied = "S2 torque" |
|--------------------------|--|
| If cyclical ratio = 50% | \rightarrow Torque supplied = 0 mNm. |
| If cyclical ratio = 100% | \rightarrow Motor torque supplied = "S2 torque". |

- Combinations of digital outputs 3 & 4 "Motor status": Used to find out the motor status.

e) Type 9

- <u>Setting the parameter of Pulse output 1 "Real speed"</u>: A Hall pulse with configurable width (100 to 800 µs) is generated each time one of the 3 motor Hall sensors changes state.

80140_SMI21 and 80180_SMI21 motors have 12 Hall pulses per revolution (2 pairs of poles). 80280_SMI21 and all SMI22 motors have 24 Hall pulses per revolution (4 pairs of poles).

- <u>State of digital output 2 "Real direction"</u>: Used to find out the motor direction of rotation.

- <u>Combinations of digital outputs 3 & 4 "Motor status"</u>: Used to find out the motor status.





14.3.2.1.4. "Settings" tab parameters

a) Torque limit parameters

| Torque limit paramet | ters | | |
|----------------------|--------------|---------------|-------------|
| Continuous torque: | 2 473 🚔 mN.m | Torque (mN.m) | |
| Peak torque: | 4 859 🗮 mN.m | « CMAX » | |
| Peak time: | 2 000 🚔 ms | | |
| | | | « Cnominal» |
| | | « tuax » | Time (ms) |
| Threshold parameter | 5 | | |
| Protection parameter | rs | | |
| PID loop parameters | | | |
| Shunt configuration | parameters | | |

<u>- Setting the various torque parameters</u>: When the application torque exceeds the torque " $C_{NOMINAL}$ " (Continuous torque), the motor can provide torque up to the value " C_{MAX} " (Peak torque) for the maximum duration " t_{MAX} " (Peak time). Thereafter, if the application torque is still higher than " $C_{NOMINAL}$ " (Continuous torque), the motor torque is limited to the value " $C_{NOMINAL}$ " (Continuous torque), until the application torque falls back below this value.

b) Threshold parameters

| Torque limit parameters | | | | | |
|---|---------|--------|--|--|--|
| Threshold parameters | | | | | |
| Position window: | 100 🚔 | pulses | | | |
| Position window time: | 10 📮 | ms | | | |
| Following error window: | 4 096 🚔 | pulses | | | |
| Following error timeout: | 100 🚔 | ms | | | |
| Protection parameters | | | | | |
| PID loop parameters | | | | | |
| Shunt configuration para | meters | | | | |

See part "<u>4. MOTION SETTINGS / 4.3. Thresholds</u>" of this user manual.

c) Protection parameters

| Torque limit parameters | | | |
|--|--------------|--------|-----------|
| Threshold parameters | | | |
| Protection parameters | | | |
| CURRENT PROTECTIONS | | 0 mA | 120000 mA |
| Maximum system current: | 120 000 🚔 mA | • | _ |
| VOLTAGE PROTECTIONS | | | 60 V |
| Under voltage warning level: | 8.0 🗮 V | | 90 V |
| Over voltage warning level: | 78.0 🚔 V | | |
| TEMPERATURE PROTECTIONS | | | |
| Under temperature fault level: | -25.0 🚔 °C | -40 °C | 110 °C |
| Over temperature fault level: | 110.0 🚔 °C | | |
| PID loop parameters | | | |
| Shunt configuration parameter | ers | | |

See part "<u>9. PROTECTIONS</u>" of this user manual.

If one of these protection parameters is exceeded, an error is generated, the motor is stopped and no holding torque is applied (freewheeling).





d) PID loop parameters

| Torque limit parameters | |
|---|----------|
| Threshold parameters | |
| Protection parameters | |
| PID loop parameters | |
| Position Proportional gain: | 80 000 🚔 |
| Position Integral gain: | 500 |
| Position Derivative gain: | 409 491 |
| Shunt configuration parar | meters |
| | |

Set the PID controller factors in the position control loop (this function is reserved for advanced users). The values given in the example below ensure correct product operation in the majority of cases.

e) Shunt configuration parameters

| Torque limit parameters | |
|---------------------------|----------------|
| Threshold parameters | |
| Protection parameters | |
| PID loop parameters | |
| Shunt configuration paran | neters |
| Shunt available: | No Yes Yes |
| Ballast threshold: | 78 000 🗮 mV |
| Hysteresis: | 1 🗮 % |

See part "9. PROTECTIONS/ 9.2. Voltage protections/ 9.2.2. Shunt" of this user manual.

If the ballast threshold plus hysteresis is exceeded, the shunt is activated.





14.3.2.2. "P111"



Expert program P111 is used to:

- Perform a homing phase to initialize the system with detection of the limit switches (switch or mechanical type). A single switch type contact is managed in this program.

- Perform various positionings using 1 to 30 preset position setpoints, each corresponding to a specific combination of digital inputs "In1" to "In5".

- Set the acceleration/deceleration phases and the maximum speed that must not be exceeded between each point via the HMI.

| Start from current position O 1 mechanical stop | ○ 2 mechanical stop ○ 1 switch ○ 1 switch then 1 end ○ 1 end then 1 switch |
|--|--|
| Switch Status Igh state active Offset (pulses) Offset 1 0 The state active | |
| Homing Speed Approach Speed | Ŏ |
| Homing Torque | |
| Max Homing Time | |
| Direction of rotation Change the direction of rotation | |

14.3.2.2.1. "Homing" tab parameters

- <u>choose the homing method</u>: current position, with 1 or 2 mechanical stop, with 1 switch, with 1 mechanical stop + 1 switch.

Switch status: Set the polarity of the switch wired on digital input "In6":

- <u>Offset</u>: Set the difference in position (in pulses) between the mechanical stops and the application total stroke limits: stop 1 (END1) represents the stroke start, stop 2 (END2) represents the stroke end.

Note: Where there is only one mechanical stop, the "Offset 2" parameter is not available.

- <u>Homing speed</u>: Set the search speed for stops during the homing phase.





- Approach speed: Set the search speed for zero during the homing phase (only available with 1 switch).

- <u>Homing torque</u>: Set the homing torque that allows the mechanical stop to be found by detection of overtorque.

- <u>Max Homing Time</u>: Set the maximum permitted time for the homing phase. If this value is exceeded, an error will be generated. Time limited to 300 seconds.

- <u>Direction of rotation</u>: Set the direction of rotation for the first stop search (END1).

<u>N.B.</u>: By default, the motor runs forward (CW).

| Input 6 - DIGITAL - Switch | Position Index | IN1 | IN2 | INB | IN4 | IN5 | Position (pulses) | Speed (rpm) | Acceleration (rnm/s) | Deceleration (rom/s) | | |
|--------------------------------|----------------|-----|-----|-----|-----|-----|-------------------|---------------|--------------------------|----------------------|---|---|
| High state active | Stee | 0 | 0 | 0 | 0 | 0 | l ostaon (puises) | opees (ipiii) | l leccieradion (rpni) 5/ | beccicion (ipini) sy | | |
| | Stop | 0 | 0 | 0 | 0 | 0 | | | | | | |
| Low state active | Start Homing | 1 | 0 | 0 | 0 | 0 | | | | | | |
| | Position 1 | 1 | 1 | 0 | 0 | 0 | 1000 | 1000 | 40000 | 40000 | | |
| | Position 2 | 0 | 0 | 1 | 0 | 0 | 2000 | 1000 | 40000 | 40000 | | |
| Number of position setpoints : | Position 3 | 1 | 0 | 1 | 0 | 0 | 3000 | 1000 | 40000 | 40000 | | |
| 30 | Position 4 | 0 | 1 | 1 | 0 | 0 | 4000 | 1000 | 40000 | 40000 | | |
| | Position 5 | 1 | 1 | 1 | 0 | 0 | 5000 | 1000 | 40000 | 40000 | - | i |
| | Position 6 | 0 | 0 | 0 | 1 | 0 | 6000 | 1000 | 40000 | 40000 | | |
| | Position 7 | 1 | 0 | 0 | 1 | 0 | 7000 | 1000 | 40000 | 40000 | | |
| | Position 8 | 0 | 1 | 0 | 1 | 0 | 8000 | 1000 | 40000 | 40000 | | |
| | Position 9 | 1 | 1 | 0 | 1 | 0 | 9000 | 1000 | 40000 | 40000 | | |
| | Position 10 | 0 | 0 | 1 | 1 | 0 | 10000 | 1000 | 40000 | 40000 | | |
| | Position 11 | 1 | 0 | 1 | 1 | 0 | 11000 | 1000 | 40000 | 40000 | | |
| | Position 12 | 0 | 1 | 1 | 1 | 0 | 12000 | 1000 | 40000 | 40000 | | |
| | Position 13 | 1 | 1 | 1 | 1 | 0 | 13000 | 1000 | 40000 | 40000 | | |
| | Position 14 | 0 | 0 | 0 | 0 | 1 | 14000 | 1000 | 40000 | 40000 | | |
| | Position 15 | 1 | 0 | 0 | 0 | 1 | 15000 | 1000 | 40000 | 40000 | | |
| | Position 16 | 0 | 1 | 0 | 0 | 1 | 16000 | 1000 | 40000 | 40000 | | |
| | Position 17 | 1 | 1 | 0 | 0 | 1 | 17000 | 1000 | 40000 | 40000 | | |
| | Position 18 | 0 | 0 | 1 | 0 | 1 | 18000 | 1000 | 40000 | 40000 | • | |

14.3.2.2.2. "Inputs" tab parameters

- <u>Digital input 6</u>: Information concerning the polarity of the switch wired on digital input 6. This polarity is selected in the "Homing" tab (see above).

- Select the number of position setpoints to be preset (see table above).

14.3.2.2.3. "Outputs" tab parameters

See part "14.3.2.1. "P101" / 14.3.2.1.3 "Outputs" tab parameters" of this user manual.

14.3.2.2.4. "Settings" tab parameters

See part "14.3.2.1. "P101" / 14.3.2.1.4 "Settings" tab parameters" of this user manual.





14.3.2.3. "P201"



P201 expert program allows to:

- Perform a homing phase to initialize the system with detection of the stroke ends (mechanical stop or switch limit).

- Perform positioning in using two 0/10V analog inputs: One for coarse tuning and second for thin tuning. The total stroke (which has to be set per the user in this program) can be cut up to 65536 positions. The targeted position follows in live the 2 inputs.

- Select a speed profile (choice between 2 profiles) to go from a position to another position. A speed profile contains acceleration, deceleration and maximum allowed speed values.

14.3.2.3.1. "Homing" tab parameters

See part "<u>14.3.2.2. "P111" / 14.3.2.2.1 "Homing" tab parameters</u>" of this user manual (note that the input connected to the swtich is the input 3)

14.3.2.3.2. "Inputs" tab parameters

<u>Combinations of digital inputs 1 and 2</u>: Used to choose the motion to be performed from the 4 actions indicated below.

| Input 1 an | d 2 - Di <u>c</u> | jital: move selection |
|------------|-------------------|-------------------------------------|
| 11 | 12 | |
| 0 | 0 | Stop and error cancelation |
| 1 | 0 | Do homing phase |
| 0 | 1 | Target actual position |
| 1 | 1 | Target position from inputs 5 and 6 |





Information concerning the polarity of the switch wired on digital input 3. This polarity is selected in the "Homing" tab (see above).

| -Input 3 | - DIGITAL - Switch |
|----------|--------------------|
| ۲ | High state active |
| 0 | Low state active |

Digital input 4 - IN4: Used to select one of the two speed profile.

To go from a position to a new position, motor follows a trapezoidal trajectory. This trajectory uses the maximum speed, acceleration and deceleration which are set in the « Digital speed profile selection » zone.

| - Input 4 - Dig | ital: speed profil | e selection | |
|-----------------|--------------------|----------------------|---------------------|
| | Speed (rpm) | Acceleration (rpm/s) | Deceleration(rpm/s) |
| Profile 1: | 500 🚖 | 50 | 50 |
| Profile 2: | 2500 🚔 | 1000 | 1000 |
| | | | |

<u>NB</u>: If the user needs to change its velocity profile during a positioning phase, it is strongly recommended to use the same deceleration slope for both velocity profiles to ovoid overruns targets.

Input IN5 and IN6 setpoints: To do the position setting using the two 0-10V analog inputs.

Parameter « total stroke lenght » is the number of encoder pulses corresponding to the stroke when IN5 and IN6 are at 10V.

Parameter "resolution coefficient" allows to cut the « total stroke length » in 2,048 or 4,096 or 8,192 or 16,384 or 32,768 or 65,536 positions.

The distribution of the « Total stroke length » on the two analog setpoint inputs is carried out according to the rules below.

- On IN5: $[0 10V] \equiv [0; Stroke_{total_application} \times \frac{Coefficient_resolution 1}{Coefficient_resolution}]$ coded on 1024 points (coarse setting)
- On IN6: $[0 10V] \equiv [0; Course_{totale_application} \times \frac{1}{Coefficient_résolution}]$ coded on 1024 points (thin setting)

| Input 5 - Analogic : Position | big tuning | |
|-------------------------------|----------------|-----------------------|
| Total application stroke | 40960 🔔 pulses | 10 V -38400 pulses |
| Resolution coefficient | 16 🗸 | 0 V |





| Input 6 - Analogic : Position fine tuning | | |
|---|------|-----------|
| | 10 V | |
| | -25 | 60 pulses |
| | | |
| | | |
| | | |
| | | _ |
| | | 0 pulses |
| | 0 V | |

The motor position setpoint is the addition of position setpoint of IN5 and of position setpoint of IN6.

In above example:

- On IN5: $[0 10V] \equiv \left[0; 40960 \times \frac{16-1}{16}\right] = [0; 38400]$ coded on 1,024 points (coarse setting) On IN6: $[0 10V] \equiv \left[0; 40960 \times \frac{1}{16}\right] = [0; 2560]$ coded on 1,024 points (thin setting)

Note: The sign (-) at the 10V setpoint depends from the direction of rotation during the homing sequence.

14.3.2.3.3. "Outputs" tab parameters

See part "14.3.2.1. "P101" / 14.3.2.1.3 "Outputs" tab parameters" of this user manual.

14.3.2.3.4. "Settings" tab parameters

See part "14.3.2.1. "P101" / 14.3.2.1.4 "Settings" tab parameters" of this user manual.

Note that there is only one additional parameter for expert program P201: "Analog input hysteresis": use this parameter when the stroke is important to minimize the oscillation of the analog target position (in pulse encoder).





14.3.2.4. "P202"

| Position Position Position | time | Project name : P202 +6Vdc -+24 Vdc In1 |
|----------------------------------|--|--|
| 0/10V Main position input | 0/10V Fine position input 10 8 6 4 2 0 | Butput + vcc suppiy (PNP open collector) Target Homing (done = 0) Running Error Utz Utz Utz Utz Utz Utz Utz Utz |

P202 expert program allows to:

- Perform a homing phase to initialize the system with detection of the stroke ends (mechanical stop or switch limit).

- Define a position setpoint in using two 0/10V analog inputs: One for coarse tuning and second for thin tuning. The total stroke (which has to be set per the user in this program) can be cut up to 65536 positions.

- Memorize the new position setpoint
- Go to the new position target

- Select a speed profile (choice between 2 profiles) to go from a position to another position. A speed profile contains acceleration, deceleration and maximum allowed speed values.

14.3.2.4.1. "Homing" tab parameters

See part "14.3.2.3."P201" / 14.3.2.3.1 "Homing" tab parameters" of this user manual.

14.3.2.4.2. "Inputs" tab parameters

<u>Combinations of digital inputs 1 and 2</u>: Used to choose the motion to be performed from the 4 actions indicated below.







Information concerning the polarity of the switch wired on digital input 3. This polarity is selected in the "Homing" tab (see above).

| Input 3 - DIGITAL - Switch |
|----------------------------|
| High state active |
| Low state active |

Digital input 4 - IN4: Used to select one of the two speed profile.

To go from a position to a new position, motor follows a trapezoidal trajectory. This trajectory uses the maximum speed, acceleration and deceleration which are set in the « Digital speed profile selection » zone.

| - Input 4 - Dig | ital: speed prof | ile selection | |
|-----------------|------------------|----------------------|---------------------|
| | Speed (rpm) | Acceleration (rpm/s) | Deceleration(rpm/s) |
| Profile 1: | 500 ≑ | 50 | 50 |
| Profile 2: | 2500 ≑ | 1000 | 1000 |

<u>NB</u>: If the user needs to change its velocity profile during a positioning phase, it is strongly recommended to use the same deceleration slope for both velocity profiles to ovoid overruns targets.

Input IN5 and IN6 setpoints: To do the position setting using the two 0-10V analog inputs.

Parameter « total stroke lenght » is the number of encoder pulses corresponding to the stroke when IN5 and IN6 are at 10V.

Parameter "resolution coefficient" allows to cut the « total stroke length » in 2,048 or 4,096 or 8,192 or 16,384 or 32,768 or 65,536 positions.

The distribution of the « Total stroke length » on the two analog setpoint inputs is carried out according to the rules below.

- On IN5: $[0 10V] \equiv [0; Stroke_{total_application} \times \frac{Coefficient_resolution 1}{Coefficient_resolution}]$ coded on 1024 points (coarse setting)
- On IN6: $[0 10V] \equiv [0; Course_{totale_application} \times \frac{1}{Coefficient_résolution}]$ coded on 1024 points (thin setting)

| Input 5 - Analogic : Position | big tuning | |
|-------------------------------|----------------|-----------------------|
| Total application stroke | 40960 🔔 pulses | 10 V -38400 pulses |
| Resolution coefficient | 16 🗸 | 0 V |





| Input 6 - Analogic : Position fine tuning | | |
|---|------|--------------|
| | 10 V | |
| | | -2560 pulses |
| | _ | |
| | | |
| | | |
| | _ | |
| | | 0 pulses |
| | 0 V | |

The motor position setpoint is the addition of position setpoint of IN5 and of position setpoint of IN6.

In above example:

- On IN5: $[0 10V] \equiv \left[0; 40960 \times \frac{16-1}{16}\right] = [0; 38400]$ coded on 1,024 points (coarse setting) On IN6: $[0 10V] \equiv \left[0; 40960 \times \frac{1}{16}\right] = [0; 2560]$ coded on 1,024 points (thin setting)

Note: The sign (-) at the 10V setpoint depends from the direction of rotation during the homing sequence.

14.3.2.4.3. "Outputs" tab parameters

See part "14.3.2.1. "P101" / 14.3.2.1.3 "Outputs" tab parameters" of this user manual.

14.3.2.4.4. "Settings" tab parameters

See part "14.3.2.1. "P101" / 14.3.2.1.4 "Settings" tab parameters" of this user manual.

Note that there is only one additional parameter for expert program P202: "Analog input hysteresis": use this parameter when the stroke is important to minimize the oscillation of the analog target position (in pulse encoder).





14.3.3. Torque group

14.3.3.1. "C101"



Expert program C101 is used to:

- Create torque profiles with analog or PWM control.
- Set the torque up and down ramps with analog or PWM control.

14.3.3.1.1. "Inputs" tab parameters

| Input 1 - DIGITAL - ON / OFF | | Input 2 - DIGITAL - Direction of Rotation | |
|---|------------------|---|---------------------|
| ● On = 1 / Off = 0 | On = 0 / Off = 1 | OCW = 1 / CCW = 0 | © CW = 0 / CCW = 1 |
| Input 3 - Not used | | Input 4 - DIGITAL - Fast Stop | |
| | | High state active | C Low state active |
| Input 5 - Proportional setpoint : Torque Ramp | | Input 6 - Proportional setpoint : Torque | |
| ● 0-10V ○ 0-5V ○ PWM | 0 📩 mN.m/s | ● 0-10V ◎ 0-5V ◎ PWM | 10V 2 000 📩 mN.m |
| | 20 000 💭 mN.m/s | | 0 mN.m 0V |

- Digital input 1: Used to set the "On/Off" input polarity.
- <u>Digital input 2</u>: Used to set the "Direction of Rotation" input polarity.
- Digital input 3: Not used
- Digital input 4: Used to set the "Fast stop" input polarity.

This input is used to stop the motor as quickly as possible, ignoring the setpoints applied to the other inputs.

- <u>Setpoint input 5</u>: Used to select the control type for the torque ramp setpoint and fix the maximum and minimum limits for this setpoint. An inverted scale can be used.

- <u>Setpoint input 6</u>: Used to select the control type for the torque setpoint and fix the maximum and minimum limits for this setpoint. An inverted scale can be used.





14.3.3.1.2. "Outputs" tab parameters

| Type 2 Type 10 OUTPUT 1 - PWM : Real speed | OUTPUT 1 - PWM : Real speed (centered on 50%) |
|---|--|
| PWM frequency : 1 000 👘 Hz | PWM frequency : 1 000 + Hz |
| OUTPUT 2 - PWM : Real torque PWM frequency : 1000 + Hz S2 torque (100% PWM) : 1000 + mN.m | OUTPUT 2 - PWM : Real torque (centered on 50%) PWM frequency : 1000 + Hz S2 torque (100% PWM) : 1000 + mN.m |
| OUTPUT 3 - DIGITAL : Motor Running 0 : Motor running 1 : Motor stopped | OUTPUT 3 & 4 - DIGITAL : Motor status 00 : Error detected 01 : Motor running 10 : Motor stonget torque satopist reached and applied |
| OUTPUT 4 - DIGITAL : Error 0 : Error detected 1 : No error | 11 : Motor stopped, no torque applied |

a) Type 2

- <u>Setting the parameter of PWM output 1 "Real Speed"</u>: The parameters can be set for the signal frequency of this output (must be identical to the one for PWM output 2). If cyclical ratio = 0% \rightarrow Real speed = 0 rpm.

If cyclical ratio = 100% \rightarrow Real speed = maximum speed setpoint defined in In6.

- <u>Setting the parameters of PWM output 2 "Real Torque"</u>: The parameters can be set for the signal frequency of this output and the torque value corresponding to a cyclical ratio of 100% (scaling). If cyclical ratio = 0% \rightarrow Torque supplied = 0 mNm. If cyclical ratio = 100% \rightarrow Torque supplied = "S2 torque".

- <u>State of digital output 3 "Motor running"</u>: Used to find out whether the motor is stopped or running.

- <u>State of digital output 4 "Error"</u>: Used to find out whether an error has been detected.

b) Type 10

- <u>Setting the parameter of PWM output 1: "Real speed (centered on 50%)"</u>: The parameters can be set for the signal frequency of this output (must be identical to the one for PWM output 2).

If cyclical ratio = 0% \rightarrow Motor running forward (CW) at maximum speed setpoint defined in In6.If cyclical ratio = 50% \rightarrow Real speed = 0 rpm.If cyclical ratio = 100% \rightarrow Motor running in reverse (CCW) at maximum speed setpoint defined in In6.

- <u>Setting the parameters of PWM output 2 "Real torque (centered on 50%)"</u>: The parameters can be set for the signal frequency of this output (must be identical to the one for PWM output 1) and the torque value corresponding to a cyclical ratio of 100% (scaling).

| If cyclical ratio = 0% | \rightarrow Braking torque supplied = "S2 torque". |
|--------------------------|--|
| If cyclical ratio = 50% | \rightarrow Torque supplied = 0 mNm. |
| If cyclical ratio = 100% | \rightarrow Motor torque supplied = "S2 torque". |

- Combinations of digital outputs 3 & 4 "Motor status": Used to find out the motor status.





14.3.3.1.3. "Settings" tab parameters

a) Threshold parameters

| Threshold parameters | |
|--------------------------------|--|
| Torque window: 16 📄 mN.m | |
| Torque window time: 1 in ms | |
| Protection parameters | |
| PID loop parameters | |
| Shunt configuration parameters | |
| | |

See part "<u>4. MOTION SETTINGS / 4.3. Thresholds</u>" of this user manual.

b) Protection parameters

| Threshold parameters | | | |
|--|--------------------------|----------|-----------|
| Protection parameters CURRENT PROTECTIONS Maximum system current: | 120 000 🛤 mA | 0 mA | 120000 mA |
| VOLTAGE PROTECTIONS Under voltage warning level: Over voltage warning level: | 8.0 m V 78.0 m V | 7 V 1 | 90 V |
| TEMPERATURE PROTECTIONS Under temperature fault level: Over temperature fault level: | -25.0 💼 °C 110.0 💼 °C | -40 °C | 110 °C |
| PID loop parameters Shunt configuration parameters | | | |

See part "<u>9. PROTECTIONS</u>" of this user manual.

If one of these protection parameters is exceeded, an error is generated, the motor is stopped and no holding torque is applied (freewheeling).

c) PID loop parameters

| Threshold parameters | |
|--|---------|
| Protection parameters | |
| PID loop parameters | |
| Torque Proportional gain: | 7 168 🚔 |
| Torque Integral gain: | 72 |
| Torque Constant scaling: | 6 📄 |
| Shunt configuration param | eters |

Set the PID controller factors in the torque control loop (this function is reserved for advanced users). The values given in the example below ensure correct product operation in the majority of cases.





d) Shunt configuration parameters

| Torque limit parameters | | |
|--|-------|-------------|
| Threshold parameters | | |
| Protection parameters | | |
| PID loop parameters | | |
| Shunt configuration param | eters | |
| Shunt available: | No | O Yes |
| Ballast threshold: | | 78 000 🚔 mV |
| Hysteresis: | | 1 🔹 % |

See part "9. PROTECTIONS/ 9.2. Voltage protections/ 9.2.2. Shunt" of this user manual.

If the ballast threshold plus hysteresis is exceeded, the shunt is activated.





15.BOOTLOADER

15.1. Bootloader CAN

The CAN Bootloader button on the top toolbar allows you to update the firmware inside the SMI21 or SMI22 CANopen drive.

| 🗞 Bootloader - Drive0 - Node 0x20 🛛 🗕 🗆 🗙 | | |
|---|----------------------------------|--|
| Bootloa Update firmwa CANopen devi | der re of motor. ce | |
| Device: | Kvaser Leaf Professional HS | |
| Channel: | 0 ~ | |
| Baud rate: | 1 Mbps - | |
| Node ID: | 32 🔺 🔲 Use node ID | |
| File: | Browse | |
| | Update Firmware | |
| | | |
| | | |
| | | |

Select the .hex file that you want to load inside the SMI21 or SMI22 CANopen drive by click on the "Browse" button and after click on the "Update Firmware" button to launch the bootloader sequence.

When the bootloader sequence is finished, the following green message appears: "Firmware update successful".

A WARNING: Bootloader sequence is an expert procedure to update the firmware. If there is a problem during the firmware update, you can permanently lose the communication with the motor.

WARNING: During bootloader sequence (firmware update), you must never disconnect the power cable (or power supply) or the CAN communication cable before the end of the downloading, you can permanently lose the communication with the motor and be not able use to it. If it happens, send motor to Crouzet After sales department to reset completely the motor. Your parameters could not be saved, you should reset the motor after the repair. This repair is not covered by the warranty.

CAUTION: With SMI21 CANopen drive, the BOOTLOADER CAN can be used only with the baudrate 1 Mb/s.

CAUTION: The chosen baudrate in the bootloader should be the same than the one configured in the motor.





15.2. Bootloader USB

The USB Bootloader button on the top toolbar allows you to update the firmware inside the SMI22 CANopen drive.

| Bootloader USB X |
|---|
| COM Port: COM4 Refresh |
| Select the file (.hex) to download to the drive: |
| Browse |
| Update Firmware |
| |
| Select a valid file and then click on Update Firmware |

Click on Refresh and chose the COM Port of the drive.

Select the .hex file that you want to load inside the SMI22 CANopen drive by click on the "Browse" button and after click on the "Update Firmware" button to launch the bootloader sequence.

When the bootloader sequence is finished, the following green message appears: "Drive updated successfully".

WARNING: Bootloader sequence is an expert procedure to update the firmware. If there is a problem during the firmware update, you can permanently lose the communication with the motor.

WARNING: During bootloader sequence (firmware update), you must never disconnect the power cable (or power supply) or the CAN communication cable before the end of the downloading, you can permanently lose the communication with the motor and be not able to use it. If it happens, send motor to Crouzet After sales department to reset completely the motor. Your parameters could not be saved, you should reset the motor after the repair. This repair is not covered by the warranty.

WARNING: The .hex file path must not contain blank space. If an .hex file is load with a blank space in the path and the connexion is lost : physically disconnect and reconnect the USB and try again without blank space in the path.

A CAUTION: With SMI21 CANopen drive, the BOOTLOADER USB isn't available.





16.<u>SCOPE</u>

The Digital Scope allows the user to optimize system performance using data collection. It works in two different modes, collecting data continuously from the servo drive (polling) or monitoring and gathering a fixed amount of point (2500). Depending on system performance, one or another will be more appropriate and accurate to collect data.

Some features:

- Up to 4 simultaneous charts
- Collect and plot various signals including position, velocity and position error on multiple axes
- Update rates up to 50 ms in polling mode and 2500 samples in monitoring mode
- Graphically examine collected data using cursor and zooming tools
- Add math functions between channels
- Auto-scale

| Scope: Drive0 – 🗆 🗙 | | | | | | | | | |
|-------------------------|------------|----------------------|-----------|----------|--|--|--|--|--|
| Chart 1 🔅 | Chart 2 🙀 | Chart : | | Chart 4 | Clear All Start Polling 💽 - Hannels Export | | | | |
| Chart1 | | | | | | | | | |
| 30 k- | | т | | | · | | | | |
| 25 k- | | / | ~ | | | | | | |
| 20 k- | | | | | | | | | |
| 15 k- | | | | | | | | | |
| 10 k | | + | | | | | | | |
| 5 k | | | | | | | | | |
| 0 | 1 | | | | | | | | |
| 0 | 1 | 2 | 2 | 3 4 | 4 5 6 7 8 9 10 Time (s) | | | | |
| Channels | | | | | * ð | | | | |
| Add | 🧀 Add Matl | h 🛛 🐼 Re | emove All | | | | | | |
| Name | Units | Color | Hide 🗌 | Chart | Action | | | | |
| DC link circuit voltage | mV | | | Chart1 • | Remove | | | | |
| Position actual value | с | | | Chart1 - | Remove | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

Available scope modes are:

Polling Mode: In this mode, the scope collects continuous data from a set of signals previously selected; sample rate can be set up to 50 ms.

Monitoring Mode: This mode allows a more accurate data collection and analysis. After setting the recording time in ms, it will gather data using as trigger any motion start (future triggers will be available). It collects up to 2500 points and by default plots all the relevant motion signals (demanded and current values) which afterwards can be disabled for individual channel analysis.





The two modes allow to select multiple signals and assign different colors or primary/ secondary Y axis for better values visibility. Also In both modes the collected plots can be exported to a CSV file.

In polling mode only the enabled signal is exported; in monitoring mode all the signals are exported regardless of the number that are enabled:

- Position: actual value, demanded value and difference between both (following error)
- Velocity: actual value, demanded value and difference between both (following error)
- Torque: actual value, demanded value and difference between both (following error)



Notice that together with the channel description, you will find the internal register associated with this value. These registers are following the CANopen protocol structure since SMI21 and SMI22 CANopen drive is compliant with the following profiles: CiA-301, CiA-303, CiA-305, CiA-306 and CiA-402.





ANNEXE 1 – OBJECT DICTIONARY

CAUTION: The following dictionaries are both for SMI21 and SMI22 CANopen drives, some register are not present on the two drives.

CiA 301 object dictionary:

| Index (hex) | Sub-index (hex) | Description | Data type | PDO mappable | Access | NVM | Default value |
|----------------|--------------------|----------------------------------|--------------|-----------------|--------|-----|---------------|
| 1000 | 0 | Device type | UINT32 | N | RO | N | 0x00020192 |
| 1001 | 0 | Error register | UINT8 | Ν | RO | Ν | 0x00 |
| 1003 | - | Pre-defined Error Field | ARRAY | - | - | - | - |
| 1003 | 0 | Number of entries | UINT8 | Ν | RW | Ν | 0x00 |
| 1003 | 1 | Standard error field | UINT32 | Ν | RO | Ν | 0x0000000 |
| 1003 | 2 | Standard error field | UINT32 | Ν | RO | Ν | 0x0000000 |
| 1003 | 3 | Standard error field | UINT32 | Ν | RO | Ν | 0x0000000 |
| 1003 | 4 | Standard error field | UINT32 | Ν | RO | N | 0x0000000 |
| 1005 | 0 | COB-ID SYNC | UINT32 | Ν | RW | N | 0x80 |
| 1006 | 0 | Communication Cycle period | UINT32 | N | RW | N | 0x0000000 |
| 1007 | 0 | Sync window length | UINT32 | N | RW | N | 0x0000000 |
| 1008 | 0 | Device name | STR | N | CONST | N | emcl |
| 1009 | 0 | Hardware version | STR | N | CONST | N | See PCB |
| 100A | 0 | Software version | STR | N | CONST | N | 1.2.1 |
| 100C | 0 | Guard time | UINT16 | N | RW | N | 0x0000 |
| 100D | 0 | Life Time Factor | UINT8 | N | RW | N | 0x00 |
| 1010 | - | Store parameters | ARRAY | - | _ | - | - |
| 1010 | 0 | Number of entries | UINT8 | N | CONST | N | 3 |
| 1010 | 1 | Save all parameters | UINT32 | N | RW | N | 1 |
| 1010 | 2 | Save communication parameters | UINT32 | N | RW | N | 1 |
| 1010 | 3 | Save application parameters | UINT32 | N | RW | N | 1 |
| 1011 | - | Restore default parameters | ARRAY | - | _ | - | - |
| 1011 | 0 | Number of entries | UINT8 | N | CONST | N | 3 |
| 1011 | 1 | Restore all parameters | UINT32 | N | RW | N | 1 |
| 1011 | 1 | Restore communication parameters | UINT32 | N | RW | N | 1 |
| 1011 | 1 | Restore application parameters | UINT32 | N | RW | N | 1 |
| 1014 | 0 | COB-ID Emergency message | UINT32 | N | RW | Y | 0x00000A0 |
| 1017 | 0 | Producer heartbeat time | UINT16 | N | RW | Y | 0x0000 |
| 1018 | - | Identity object | RECORD | - | - | - | - |
| 1018 | 0 | Number of entries | UINT8 | N | CONST | N | 4 |
| 1018 | 1 | Vendor-ID | UINT32 | N | RO | N | 0x000003F8 |
| 1018 | 2 | Product code | UINT32 | N | RO | N | 0x00011402 |





| 1018 | 3 | Revision number | UINT32 | Ν | RO | N | 0x00000111 |
|------|---|--------------------------|--------|---|----|---|------------|
| 1018 | 4 | Serial number | UINT32 | Ν | RO | Ν | - |
| 1200 | - | SSDO | - | Ν | RO | Ν | - |
| 1400 | - | RPDO1 | - | Ν | RW | Y | - |
| 1401 | - | RPDO2 | - | Ν | RW | Y | - |
| 1402 | - | RPDO3 | - | Ν | RW | Y | - |
| 1403 | - | RPDO4 | - | Ν | RW | Y | - |
| 1600 | - | RPDO 1 mapping parameter | - | Ν | RW | Y | - |
| 1601 | - | RPDO 2 mapping parameter | - | Ν | RW | Y | - |
| 1602 | - | RPDO 3 mapping parameter | - | Ν | RW | Y | - |
| 1603 | - | RPDO 4 mapping parameter | - | Ν | RW | Y | - |
| 1800 | - | TPDO 1 | - | Ν | RW | Y | - |
| 1801 | - | TPDO 2 | - | Ν | RW | Y | - |
| 1802 | - | TPDO 3 | - | Ν | RW | Y | - |
| 1803 | - | TPDO 4 | - | Ν | RW | Y | - |
| 1A00 | - | TPDO 1 mapping parameter | - | Ν | RW | Y | - |
| 1A01 | - | TPDO 2 mapping parameter | - | Ν | RW | Y | - |
| 1A02 | - | TPDO 3 mapping parameter | | Ν | RW | Y | - |
| 1A03 | - | TPDO 4 mapping parameter | | Ν | RW | Y | - |





CiA 402 object dictionary:

| Index (hex) | Sub-index (hex) | Description | Data type | PDO mappable | Access | NVM | Default value |
|----------------|--------------------|--------------------------------|--------------|-----------------|--------|-----|---------------|
| 603F | 0 | Error code | UINT16 | Y | RO | N | 0x0000 |
| 6040 | 0 | Controlword | UINT16 | Y | RW | N | 0x0000 |
| 6041 | 0 | Statusword | UINT16 | Y | RO | N | - |
| 6060 | 0 | Modes of operation | INT8 | Y | RW | Y | 1 |
| 6061 | 0 | Modes of operation display | INT8 | Y | RO | Ν | - |
| 6062 | 0 | Position demand value | INT32 | Y | RO | Ν | - |
| 6063 | 0 | Position actual internal value | INT32 | Y | RO | N | - |
| 6064 | 0 | Position actual value | INT32 | Y | RO | Ν | - |
| 6065 | 0 | Following error window | UINT32 | Y | RW | Y | 0xFFFFFFFF |
| 6066 | 0 | Following error timeout | UINT16 | Y | RW | Y | 100 |
| 6067 | 0 | Position window | UINT32 | Y | RW | Y | 100 |
| 6068 | 0 | Position window time | UINT16 | Y | RW | Y | 10 |
| 6069 | 0 | Velocity sensor actual value | INT32 | Y | RO | N | 0 |
| 606B | 0 | Velocity demand value | INT32 | Y | RO | N | - |
| 606C | 0 | Velocity actual value | INT32 | Y | RO | N | - |
| 606D | 0 | Velocity window | UINT16 | Y | RW | Y | 1000 |
| 606E | 0 | Velocity window time | UINT16 | Y | RW | Y | 10 |
| 606F | 0 | Velocity threshold | UINT16 | Y | RW | Y | 1000 |
| 6070 | 0 | Velocity threshold time | UINT16 | Y | RW | Y | 100 |
| 6071 | 0 | Target torque | INT16 | Y | RW | N | 0 |
| 6072 | 0 | Max torque | UINT16 | Y | RW | Y | 1000 |
| 6073 | 0 | Max current | UINT16 | Y | RW | Y | 1000 |
| 6074 | 0 | Torque demand | INT16 | Y | RO | N | - |
| 6075 | 0 | Motor rated current | UINT32 | Y | RW | Y | 3000 |
| 6076 | 0 | Motor rated torque | UINT32 | Y | RW | Y | 310 |
| 6077 | 0 | Torque actual value | INT16 | Y | RO | N | - |
| 6078 | 0 | Current actual value | INT16 | Y | RO | N | - |
| 6079 | 0 | DC link circuit voltage | UINT32 | Y | RO | N | 0 |
| 607A | 0 | Target position | INT32 | Y | RW | Ν | 0 |
| 607C | 0 | Home offset | INT32 | N | RW | Y | 0 |
| 607D | - | Software position limit | ARRAY | - | - | - | - |
| 607D | 0 | Number of entries | UINT8 | Ν | CONST | Ν | 2 |
| 607D | 1 | Min position limit | INT32 | Y | RW | Y | 0x8000000 |
| 607D | 2 | Max position limit | INT32 | Y | RW | Y | 0x7FFFFFFF |
| 607E | 0 | Polarity | UINT8 | Y | RW | Y | 0 |
| 607F | 0 | Max profile velocity | UINT32 | Y | RW | Y | 200000 |
| 6080 | 0 | Max motor speed | UINT32 | Y | RW | Y | 100000 |
| 6081 | 0 | Profile velocity | UINT32 | Y | RW | Y | 100000 |
| 6083 | 0 | Profile acceleration | UINT32 | Y | RW | Y | 100000 |





| 6084 | 0 | Profile deceleration | UINT32 | Y | RW | Y | 100000 |
|------|---|---|--------|---|-------|---|----------|
| 6085 | 0 | Quick stop deceleration | UINT32 | Y | RW | Y | 200000 |
| 6086 | 0 | Motion profile type | INT16 | Y | RW | Y | 0 |
| 6087 | 0 | Torque slope | UINT32 | Y | RW | Y | 10000 |
| 6088 | 0 | Torque profile type | INT16 | Y | RW | Y | 0 |
| 608F | - | Position encoder resolution | ARRAY | - | - | - | - |
| 608F | 0 | Number of entries | UINT8 | Ν | CONST | N | 2 |
| 608F | 1 | Encoder increments | UINT32 | Y | RW | Y | 2000 |
| 608F | 2 | Motor revolutions | UINT32 | Y | RW | Y | 1 |
| 6090 | - | Velocity encoder resolution | ARRAY | - | - | - | - |
| 6090 | 0 | Number of entries | UINT8 | Ν | CONST | N | 2 |
| 6090 | 1 | Encoder increments | UINT32 | Y | RW | Y | 2000 |
| 6090 | 2 | Motor revolutions | UINT32 | Y | RW | Y | 1 |
| 6091 | - | Gear ratio | ARRAY | - | - | - | - |
| 6091 | 0 | Number of entries | UINT8 | Ν | CONST | N | 2 |
| 6091 | 1 | Motor shaft revolutions | UINT32 | Ν | RW | Y | 1 |
| 6091 | 2 | Driving shaft revolutions | UINT32 | Ν | RW | Y | 1 |
| 6092 | - | Feed constant | ARRAY | - | - | - | - |
| 6092 | 0 | Number of entries | UINT8 | N | CONST | N | 2 |
| 6092 | 1 | Feed | UINT32 | N | RW | Y | 1 |
| 6092 | 2 | Shaft revolutions | UINT32 | N | RW | Y | 1 |
| 6098 | 0 | Homing method | INT8 | N | RW | Y | 35 |
| 6099 | - | Homing speeds | ARRAY | - | - | - | - |
| 6099 | 0 | Number of entries | UINT8 | Ν | CONST | N | 2 |
| 6099 | 1 | Speed for switch search | UINT32 | Ν | RW | Y | 50000 |
| 6099 | 2 | Speed for zero search | UINT32 | Ν | RW | Y | 5000 |
| 609A | 0 | Homing acceleration | UINT32 | Ν | RW | Y | 100000 |
| 60A8 | 0 | SI unit position | UINT32 | Ν | RW | Y | 11862016 |
| 60A9 | 0 | SI unit velocity | UINT32 | Ν | RW | Y | 11862784 |
| 60AA | 0 | SI unit acceleration | UINT32 | Ν | RW | Y | 11884288 |
| 60B2 | 0 | Torque offset | INT16 | Y | RW | Y | 0 |
| 60C1 | - | Interpolation data record | ARRAY | - | - | - | - |
| 60C1 | 0 | Highest sub-index supported | UINT8 | Ν | CONST | Ν | 1 |
| 60C1 | 1 | Interpolation 1 st Set-point | INT32 | Т | RW | N | 0 |
| 60C2 | - | Interpolation time period | RECORD | - | - | - | - |
| 60C2 | 0 | Highest sub-index supported | UINT8 | Ν | CONST | Ν | 2 |
| 60C2 | 1 | Interpolation time period value | UINT8 | Ν | RW | N | 0 |
| 60C2 | 2 | Interpolation time index | INT8 | Ν | RW | N | -3 |
| 60C4 | - | Interpolation data configuration | RECORD | - | - | - | - |
| 60C4 | 0 | Highest sub-index supported | UINT8 | N | CONST | N | 6 |
| 60C4 | 1 | Maximum buffer size | UINT32 | N | RO | N | 16 |
| 60C4 | 2 | Actual buffer size | UINT32 | N | RW | N | 16 |
| 60C4 | 3 | Buffer organization | UINT8 | N | RW | N | 0 |
| 60C4 | 4 | Buffer position | UINT16 | N | RW | N | 0 |





| 60C4 | 5 | Size of data record | UINT8 | N | WO | N | - |
|------|---|--------------------------------|--------|---|-------|---|------------|
| 60C4 | 6 | Buffer clear | UINT8 | N | WO | Ν | - |
| 60C5 | 0 | Max acceleration | UINT32 | Y | RW | Y | 200000 |
| 60C6 | 0 | Max deceleration | UINT32 | Y | RW | Y | 200000 |
| 60E0 | 0 | Positive torque limit value | INT16 | Y | RW | Y | 1000 |
| 60E1 | 0 | Negative torque limit value | INT16 | Y | RW | Y | -1000 |
| 60F4 | 0 | Following error actual value | INT32 | Y | RO | N | - |
| 60FA | 0 | Control effort | INT32 | Y | RO | Ν | - |
| 60FC | 0 | Position demand internal value | INT32 | Y | RO | N | - |
| 60FD | 0 | Digital inputs | UINT32 | Y | RO | N | - |
| 60FE | - | Digital outputs | ARRAY | - | - | - | - |
| 60FE | 0 | Number of entries | UINT8 | Ν | CONST | N | 2 |
| 60FE | 1 | Physical outputs | UINT32 | N | RW | Y | 0x00000000 |
| 60FE | 2 | Bit mask | UINT32 | N | RW | Y | 0x0000000 |
| 60FF | 0 | Target velocity | INT32 | Y | RW | Y | 0 |
| 6402 | 0 | Motor type | UINT16 | Y | RW | Y | 10 |
| 6502 | 0 | Supported drive modes | UINT32 | Y | CONST | Ν | 0x300EF |
| 6505 | 0 | Http drive catalog address | STRING | N | CONST | N | - |





Manufacturer specific object dictionary:

| Index (hex) | Sub-index (hex) | Description | Data type | PDO mappable | Access | NVM | Default value |
|----------------|--------------------|-----------------------------|--------------|-----------------|--------|-----|---------------|
| 2000 | - | Uart configuration | ARRAY | - | - | - | - |
| 2000 | 0 | Number of entries | UINT8 | Ν | CONST | Ν | 5 |
| 2000 | 1 | Node ID | UINT8 | N | RW | Y | 32 |
| 2000 | 2 | Baudrate | UINT8 | N | RW | Y | 0 |
| 2000 | 3 | Daisy chain mode | UINT8 | N | RW | Y | 0 |
| 2000 | 4 | Base format | UINT8 | N | RW | Y | 0 |
| 2000 | 5 | Statusword mode | UINT8 | N | RW | Y | 1 |
| 2000 | 6 | CRC enable | UINT8 | N | RW | Y | 0 |
| 2000 | 7 | Lifeguard message | UINT8 | N | RW | Y | 0 |
| 2001 | - | CANopen configuration | ARRAY | - | - | - | - |
| 2001 | 0 | Number of entries | UINT8 | N | CONST | N | 2 |
| 2001 | 1 | Node ID | UINT8 | N | RW | N | 32 |
| 2001 | 2 | Baudrate | UINT8 | N | RW | Y | 0 |
| 200F | - | Communication password | ARRAY | - | - | - | - |
| 200F | 0 | Number of entries | UINT8 | N | CONST | N | 3 |
| 200F | 1 | All password | UINT32 | N | WO | N | 0 |
| 200F | 2 | UART password | UINT32 | N | WO | N | 0 |
| 200F | 3 | CAnopen password | UINT32 | Ν | WO | Ν | 0 |
| 20C2 | - | Driver temperature | ARRAY | - | - | - | - |
| 20C2 | 0 | Number of entries | UINT8 | Ν | CONST | N | 3 |
| 20C2 | 1 | Actual temperature | INT32 | Y | RO | Ν | - |
| 20C2 | 2 | Max user temperature | INT32 | Ν | RW | Y | 72000 |
| 20C2 | 3 | Min user temperature | INT32 | Ν | RW | Y | -20000 |
| 20C3 | - | Motor temperature | ARRAY | - | - | - | - |
| 20C3 | 0 | Number of entries | UINT8 | Ν | CONST | Ν | 3 |
| 20C3 | 1 | Max motor temperature | INT32 | TBD | RO | TDB | 125000 |
| 20C3 | 2 | Current limiting enabled | UINT8 | TBD | RO | TBD | - |
| 20C3 | 3 | Toogle current limit enable | INT32 | TBD | WO | TBD | 0 |
| 2101 | - | Bus voltage | ARRAY | - | - | - | - |
| 2101 | 0 | Number of entries | UINT8 | N | CONST | N | 3 |
| 2101 | 1 | DC link circuit voltage | UINT32 | Y | RO | N | - |
| 2101 | 2 | Max user voltage | UINT32 | N | RW | Y | 60000 |
| 2101 | 3 | Min user voltage | UINT32 | N | RW | Y | 12000 |
| 2102 | - | Homing extra parameters | RECORD | - | - | - | - |
| 2102 | 0 | Number of entries | UINT8 | N | CONST | Ν | 3 |
| 2102 | 1 | Total homing timeout | UINT16 | N | RW | Y | 8000 |
| 2102 | 2 | Torque limit | UINT16 | Ν | RW | Y | 200 |
| 2102 | 3 | Torque limit timeout | UINT32 | Ν | RW | Y | 1000 |
| 2103 | - | Shunt configuration | ARRAY | - | - | - | - |
| 2103 | 0 | Number of entries | UINT8 | N | CONST | Ν | 3 |
| 2103 | 1 | Available | UINT8 | N | RW | Y | 0 |




| 2103 | 2 | Duty used | UINT16 | Ν | RW | Y | 1024 |
|------|---|------------------------------------|--------|---|-------|---|------|
| 2103 | 3 | Hysteresis | UINT8 | Ν | RW | Y | 5 |
| 2301 | 0 | Motor pair poles | UINT8 | Ν | RW | Y | 4 |
| 2305 | - | Commutation | RECORD | - | - | - | - |
| 2305 | 0 | Number of entries | UINT8 | Ν | CONST | N | 3 |
| 2305 | 1 | Commutation sensor | UINT8 | Ν | RW | Y | 0 |
| 2305 | 2 | Initial angle determination method | UINT8 | Ν | RW | Y | 0 |
| 2305 | 3 | Actual system angle | UINT8 | Y | RO | Ν | - |
| 2306 | - | Forced alignment method | RECORD | - | - | - | - |
| 2306 | 0 | Number of entries | UINT8 | Ν | CONST | N | 3 |
| 2306 | 1 | Process time | UINT32 | Ν | RW | Y | 1000 |
| 2306 | 2 | Process current | UINT32 | Ν | RW | Y | 500 |
| 2306 | 3 | Process tolerance | UINT8 | Ν | RW | Y | 5 |
| 2307 | - | Known alignment method | RECORD | - | - | - | - |
| 2307 | 0 | Number of entries | UINT8 | Ν | CONST | N | 1 |
| 2307 | 1 | Initial rotor angle | UINT16 | Ν | RW | Y | 0 |
| 2308 | - | Non-incremental alignment | RECORD | - | - | - | - |
| 2308 | 0 | Number of entries | UINT8 | Ν | CONST | Ν | 1 |
| 2308 | 1 | Offset from phase A | UINT16 | N | RW | Y | 0 |
| 2310 | - | Feedbacks | ARRAY | - | - | - | - |
| 2310 | 0 | Number of entries | UINT8 | Ν | CONST | Ν | 3 |
| 2310 | 1 | Torque sensor | UINT8 | N | RW | Y | 0 |
| 2310 | 2 | Velocity sensor | UINT8 | Ν | RW | Y | 0 |
| 2310 | 3 | Position sensor | UINT8 | Ν | RW | Y | 0 |
| 2311 | 0 | Position encoder swap mode | UINT8 | Ν | RW | Y | 1 |
| 2312 | 0 | Position encoder type | UINT8 | Ν | RW | Y | 2 |
| 2321 | - | Digital halls | RECORD | - | - | - | - |
| 2321 | 0 | Number of entries | UINT8 | Ν | CONST | Ν | 3 |
| 2321 | 1 | Polarity | UINT8 | Ν | RW | Y | 1 |
| 2321 | 2 | Value | UINT8 | Y | RO | N | - |
| 2321 | 3 | Halls step offset | UINT8 | Ν | RW | Y | 0 |
| 2400 | 0 | System polarity | UINT8 | Ν | RW | Y | 0 |
| 2430 | 0 | Command reference source | UINT8 | Ν | RW | Y | 0 |
| 2431 | 0 | Local/remote control | UINT8 | Ν | RW | Y | 0 |
| 2433 | - | Step and direction command source | ARRAY | - | - | - | - |
| 2433 | 0 | Number of entries | UINT8 | Ν | CONST | N | 1 |
| 2433 | 1 | Step value | UINT32 | Ν | RW | Y | 1 |
| 2434 | - | Analog input command source | RECORD | - | - | - | - |
| 2434 | 0 | Number of entries | UINT8 | N | CONST | N | 3 |
| 2434 | 1 | Analog input used | UINT8 | N | RW | Y | 1 |
| 2434 | 2 | Analog input motion offset | INT32 | N | RW | Y | 0 |
| 2434 | 3 | Analog input velocity deadband | UINT32 | N | RW | Y | 0 |
| 2434 | 4 | Analog input motion range | INT32 | N | RW | Y | 1000 |
| 2435 | - | PWM cmd source | RECORD | _ | | - | - |





| 2435 | 0 | Number of entries | UINT8 | Ν | CONST | N | 1 |
|------|---|-----------------------------------|--------|---|-------|---|--------|
| 2435 | 1 | Mode | UINT8 | N | RW | Y | 0 |
| 2435 | 2 | PWM input motion offset | INT32 | Ν | RW | Y | 0 |
| 2435 | 3 | PWM input velocity deadband | UINT32 | Ν | RW | Y | 0 |
| 2435 | 4 | PWM input motion range | INT32 | Ν | RW | Y | 1000 |
| 2435 | 5 | PWM duty actual | UINT16 | Ν | RO | Ν | - |
| 2435 | 6 | PWM period actual | UINT16 | Ν | RO | N | - |
| 243A | 0 | Internal target value | INT32 | Ν | RO | Ν | - |
| 2500 | - | Position control parameter set | ARRAY | - | - | - | - |
| 2500 | 0 | Number of entries | UINT8 | Ν | CONST | N | 7 |
| 2500 | 1 | Proportional constant | UINT32 | Ν | RW | Y | 1000 |
| 2500 | 2 | Integral constant | UINT32 | Ν | RW | Y | 5 |
| 2500 | 3 | Derivative constant | UINT32 | Ν | RW | Y | 40000 |
| 2500 | 4 | Integral antiwindup constant | UINT32 | Ν | RW | Y | 0 |
| 2500 | 5 | Velocity feedforward constant | UINT32 | Ν | RW | Y | 0 |
| 2500 | 6 | Acceleration feedforward constant | UINT32 | Ν | RW | Y | 0 |
| 2500 | 7 | Integral limit | UINT32 | Ν | RW | Y | 1 |
| 2501 | - | Velocity control parameter set | ARRAY | - | - | - | - |
| 2501 | 0 | Number of entries | UINT8 | Ν | CONST | Ν | 6 |
| 2501 | 1 | Proportional constant | UINT32 | Ν | RW | Y | 4000 |
| 2501 | 2 | Integral constant | UINT32 | Ν | RW | Y | 50 |
| 2501 | 3 | Derivative constant | UINT32 | Ν | RW | Y | 0 |
| 2501 | 4 | Integral antiwindup constant | UINT32 | Ν | RW | Y | 100000 |
| 2501 | 5 | Acceleration feedforward constant | UINT32 | Ν | RW | Y | 0 |
| 2501 | 6 | Integral limit | UINT32 | Ν | RW | Y | 1 |
| 2502 | - | Flux control parameter set | ARRAY | - | - | - | - |
| 2502 | 0 | Number of entries | UINT8 | Ν | CONST | N | 2 |
| 2502 | 1 | Proportional constant | UINT16 | Ν | RW | Y | 3000 |
| 2502 | 2 | Integral constant | UINT16 | Ν | RW | Y | 300 |
| 2502 | 3 | Constant scaling | UINT8 | Ν | RW | Y | 8 |
| 2503 | - | Torque control parameter set | ARRAY | - | - | - | - |
| 2503 | 0 | Number of entries | UINT8 | Ν | CONST | Ν | 2 |
| 2503 | 1 | Proportional constant | UINT16 | Ν | RW | Y | 3000 |
| 2503 | 2 | Integral constant | UINT16 | Ν | RW | Y | 300 |
| 2503 | 3 | Constant scaling | UINT8 | Ν | RW | Y | 8 |
| 2504 | - | Torque demand low pass filter | RECORD | - | - | - | - |
| 2504 | 0 | Number of entries | UINT8 | Ν | CONST | N | 2 |
| 2504 | 1 | Filter enabled | UINT8 | N | RW | Y | 0 |
| 2504 | 2 | Cutoff frequency | UINT16 | N | RW | Y | 100 |
| 2505 | | Torque actual low pass filter | RECORD | _ | - | - | - |
| 2505 | 0 | Number of entries | UINT8 | N | CONST | N | 2 |
| 2505 | 1 | Filter enabled | UINT8 | N | RW | Y | 0 |
| 2505 | 2 | Cutoff frequency | UINT16 | N | RW | Y | 100 |
| 2506 | 0 | Max torque cte speed | UINT16 | N | RW | Y | 1000 |





| 2507 | - | Control loops configuration | ARRAY | - | - | - | - |
|------|---|---------------------------------|------------------|---|-------|---|----------|
| 2507 | 0 | Number of entries | UINT8 | N | CONST | N | 5 |
| 2507 | 1 | Bypass torque loop | UINT8 | Ν | RW | Y | 0 |
| 2507 | 2 | Position feedback openloop | UINT8 | Ν | RW | Y | 0 |
| 2507 | 3 | Velocity feedback openloop | UINT8 | N | RW | Y | 0 |
| 2507 | 4 | Torque feedback openloop | UINT8 | N | RW | Y | 0 |
| 2507 | 5 | Velocity mode use Position loop | UINT8 | N | RW | Y | 0 |
| 2508 | 0 | Torque window | UINT16 | N | RW | Y | 10 |
| 2509 | 0 | Torque window time | UINT16 | N | RW | Y | 10 |
| 250B | - | Spring torque compensation | ARRAY | - | - | - | - |
| 250B | 0 | Number of entries | UINT8 | N | CONST | N | 3 |
| 250B | 1 | Spring available | 0 or 1 | N | RW | Y | 0 |
| 250B | 2 | Spring torque offset | -1000 to 1000 | N | RW | Y | 0 |
| 250B | 3 | Spring aperture | UINT32 | N | RW | Y | 0 |
| 257F | 0 | Max controller output | UINT16 | N | RW | Y | 24248 |
| 2600 | - | Current readings | ARRAY | - | - | - | - |
| 2600 | 0 | Number of entries | UINT8 | N | CONST | N | 3 |
| 2600 | 1 | Current phase A | INT16 | Y | RO | N | - |
| 2600 | 2 | Current phase B | INT16 | Y | RO | N | - |
| 2600 | 3 | Current phase C | INT16 | Y | RO | N | - |
| 2601 | - | Current d-q | ARRAY | - | - | - | - |
| 2601 | 0 | Number of entries | UINT8 | N | CONST | N | 2 |
| 2601 | 1 | Current direct | INT16 | Y | RO | N | - |
| 2601 | 2 | Current quadrature | INT16 | Y | RO | N | <u> </u> |
| 2602 | - | Voltage readings | ARRAY | - | - | - | - |
| 2602 | 0 | Number of entries | UINT8 | N | CONST | N | 3 |
| 2602 | 1 | Voltage phase A | INT32 | Y | RO | N | - |
| 2602 | 2 | Voltage phase B | INT32 | Y | RO | N | - |
| 2602 | 3 | Voltage phase C | INT32 | Y | RO | N | - |
| 2603 | - | Voltage d-q | ARRAY | - | _ | - | - |
| 2603 | 0 | Number of entries | UINT8 | N | CONST | N | 2 |
| 2603 | 1 | Voltage direct | INT16 | Y | RO | N | - |
| 2603 | 2 | Voltage quadrature | INT16 | Y | RO | N | - |
| 2701 | - | Motor parameters | RECORD | - | _ | - | - |
| 2701 | 0 | Number of entries | UINT8 | N | CONST | N | 6 |
| 2701 | 1 | Resistance phase-to-phase | UINT16 | N | RW | Y | 800 |
| 2701 | 2 | Inductance phase-to-phase | UINT16 | N | RW | Y | 120 |
| 2701 | 3 | Magnetic pole pitch | UINT32 | N | RW | Y | 1 |
| 2701 | 4 | Motor backemf constant - Kv | UINT32 | N | RW | Y | 0 |
| 2701 | 5 | Stroke (um) | UINT32 | N | RW | Y | 0 |
| 2701 | 6 | Motor torque constant - Km | UINT32 | N | RW | Y | 0 |
| 2702 | | I2T parameters | RECORD | - | - | _ | <u> </u> |
| 2702 | 0 | Number of entries | UINT8 | N | CONST | N | 2 |





| 2702 | 1 | Peak current | UINT16 | N | RW | Y | 1000 |
|------|---|-------------------------------|--------|---|-------|---|--------|
| 2702 | 2 | Peak time | UINT16 | N | RW | Y | 1000 |
| 2702 | 3 | Continuous current | UINT16 | N | RW | Y | 500 |
| 2A02 | - | Digital inputs/outputs | RECORD | - | - | - | - |
| 2A02 | 0 | Number of entries | UINT8 | N | CONST | N | 1 |
| 2A02 | 1 | Input Polarity | UINT16 | N | RW | Y | 0xFFFF |
| 2A02 | 2 | Output Polarity | UINT16 | N | RW | Y | 0xFFFF |
| 2A03 | - | Analog inputs | ARRAY | - | - | - | - |
| 2A03 | 0 | Number of entries | UINT8 | N | CONST | N | 8 |
| 2A03 | 1 | Analog input 1 value | UINT32 | Ν | RO | N | - |
| 2A03 | 2 | Analog input 2 value | UINT32 | N | RO | N | - |
| 2A03 | 3 | Analog input 3 value | UINT32 | N | RO | N | - |
| 2A03 | 4 | Analog input 4 value | UINT32 | N | RO | N | - |
| 2A03 | 5 | Analog input 5 value | UINT32 | Ν | RO | N | - |
| 2A03 | 6 | Analog input 6 value | UINT32 | N | RO | N | - |
| 2A03 | 7 | Analog input 7 value | UINT32 | N | RO | N | - |
| 2A03 | 8 | Analog input 8 value | UINT32 | N | RO | N | - |
| 2A05 | - | Brake option | ARRAY | - | - | - | - |
| 2A05 | 0 | Number of entries | UINT8 | Ν | CONST | Ν | 6 |
| 2A05 | 1 | Available | UINT8 | Ν | RW | Y | 0 |
| 2A05 | 2 | Delay before release brake | UINT16 | Ν | RW | Y | 0 |
| 2A05 | 3 | Delay after enable brake | UINT16 | Ν | RW | Y | 0 |
| 2A05 | 4 | Duty cycle | UINT16 | Ν | RW | Y | 2047 |
| 2A05 | 5 | Full release brake pulse time | UINT16 | N | RW | Y | 0 |
| 2A0A | - | PWM inputs | RECORD | - | - | - | - |
| 2A0A | 0 | Number of entries | UINT8 | N | CONST | N | 5 |
| 2A0A | 1 | Max PWM frequency | UINT32 | N | CONST | N | 937500 |
| 2A0A | 2 | PWM period 1 | UINT16 | Y | RO | N | 20000 |
| 2A0A | 3 | PWM duty 1 | UINT16 | Y | RO | N | 10000 |
| 2A0A | 4 | PWM period 2 | UINT16 | Y | RO | N | 20000 |
| 2A0A | 5 | PWM duty 2 | UINT16 | Y | RO | N | 10000 |
| 2A0B | - | PWM outputs | RECORD | - | - | - | - |
| 2A0B | 0 | Number of entries | UINT8 | Ν | CONST | N | 5 |
| 2A0B | 1 | Max PWM frequency | UINT32 | Ν | CONST | N | 937500 |
| 2A0B | 2 | PWM period 1 | UINT16 | Y | RW | N | 20000 |
| 2A0B | 3 | PWM duty 1 | UINT16 | Y | RW | N | 10000 |
| 2A0B | 4 | PWM period 2 | UINT16 | Y | RW | N | 20000 |
| 2A0B | 5 | PWM duty 2 | UINT16 | Y | RW | N | 10000 |
| 2A10 | - | GPI mapping parameter | ARRAY | - | - | - | - |
| 2A10 | 0 | Number of entries | UINT8 | N | CONST | N | 10 |
| 2A10 | 1 | GPI 1 function | UINT16 | N | RW | Y | 0 |
| 2A10 | 2 | GPI 2 function | UINT16 | N | RW | Y | 0 |
| 2A10 | 3 | GPI 3 function | UINT16 | N | RW | Y | 0 |
| 2A10 | 4 | GPI 4 function | UINT16 | N | RW | Y | 0 |





| 2A10 | 5 | GPI 5 function | UINT16 | Ν | RW | Y | 0 |
|------|----|---------------------------|--------|---|-------|---|--------|
| 2A10 | 6 | GPI 6 function | UINT16 | Ν | RW | Y | 0 |
| 2A10 | 7 | GPI 7 function | UINT16 | Ν | RW | Y | 0 |
| 2A10 | 8 | GPI 8 function | UINT16 | Ν | RW | Y | 0 |
| 2A10 | 9 | HS GPI 1 function | UINT16 | Ν | RW | Y | 0 |
| 2A10 | А | HS GPI 2 function | UINT16 | Ν | RW | Y | 0 |
| 2A10 | - | GPI mapping parameter | ARRAY | - | - | - | - |
| 2A11 | 0 | Number of entries | UINT8 | Ν | CONST | Ν | 10 |
| 2A11 | 1 | GPO 1 function | UINT16 | Ν | RW | Y | 0 |
| 2A11 | 2 | GPO 2 function | UINT16 | Ν | RW | Y | 0 |
| 2A11 | 3 | GPO 3 function | UINT16 | Ν | RW | Y | 0 |
| 2A11 | 4 | GPO 4 function | UINT16 | Ν | RW | Y | 0 |
| 2A11 | 5 | GPO 5 function | UINT16 | Ν | RW | Y | 0 |
| 2A11 | 6 | GPO 6 function | UINT16 | Ν | RW | Y | 0 |
| 2A11 | 7 | GPO 7 function | UINT16 | Ν | RW | Y | 0 |
| 2A11 | 8 | GPO 8 function | UINT16 | Ν | RW | Y | 0 |
| 2A1F | - | Halls pulse parameters | RECORD | - | - | - | - |
| 2A1F | 0 | Number of entries | UINT8 | Ν | CONST | N | 2 |
| 2A1F | 1 | Max pulse frequency | UINT32 | Ν | CONST | N | 937500 |
| 2A1F | 2 | Pulse witdh | UINT16 | Ν | RW | N | 500 |
| 2C00 | - | General purpose registers | ARRAY | - | - | - | 0 |
| 2C00 | 0 | Number of entries | UINT8 | Ν | CONST | N | 150 |
| 2C00 | 1 | Accumulator | INT32 | Ν | RW | Y | 0 |
| 2C00 | 2 | W2 | INT32 | Ν | RW | Y | 0 |
| | | | INT32 | Ν | RW | Y | 0 |
| 2C00 | 96 | W150 | INT32 | Ν | RW | Y | 0 |
| 2C10 | - | Application access | RECORD | - | - | - | - |
| 2C10 | 0 | Number of entries | UINT8 | Ν | CONST | N | 2 |
| 2C10 | 1 | Application call | UINT8 | Ν | RW | Y | 0 |
| 2C10 | 2 | Run after power on | UINT8 | Ν | RW | Y | 1 |
| 2C11 | 0 | Application status | UINT16 | Ν | RO | N | 0 |
| 2C50 | - | Monitor config | RECORD | - | - | - | - |
| 2C50 | 0 | Number of entries | UINT8 | Ν | CONST | N | 2 |
| 2C50 | 1 | Sampling rate | UINT16 | Ν | RW | N | 0 |
| 2C50 | 2 | Enable mode | UINT8 | Ν | RW | N | 0 |
| 2C50 | 3 | Trigger Delay in samples | UINT32 | Ν | RW | Y | 0 |
| 2C51 | - | Monitor result | RECORD | - | - | - | - |
| 2C51 | 0 | Number of entries | UINT8 | Ν | RO | Ν | 7 |
| 2C51 | 1 | Max entry number | UINT16 | Ν | RO | N | 250 |
| 2C51 | 2 | Filled entry value | UINT8 | N | RO | N | 0 |
| 2C51 | 3 | Entry number | UINT16 | Ν | RW | Ν | 0 |
| 2C51 | 4 | Actual entry table 1 | INT32 | Ν | RO | Ν | 0 |
| 2C51 | 5 | Actual entry table 2 | INT32 | Ν | RO | Ν | 0 |
| 2C51 | 6 | Actual entry table 3 | INT32 | Ν | RO | N | 0 |





| 2C52 - Monitor mapping RECORD - - - - 2C52 0 Number of entries UINT8 N CONST N 2C52 1 Channel 1 INT32 N RW Y 0x60640020 2C53 2 Channel 1 INT32 N RW Y 0x606C0202 2C52 3 Channel 4 INT32 N RW Y 0x606C0202 2C52 4 Channel 4 INT32 N RW Y 0x606C0202 2C52 4 Channel 4 INT32 N RW Y 0x606C0202 2C52 4 Channel 4 INT32 N RW Y 0x606C0202 2C52 4 Channel 4 INT8 N RO N 2 2D00 - Open loop parameters RECORD - - - - 2D00 1 Target requency UINT8 N RO N 0 2D00 0 Motor brake enabled UINT8 N CONST N 52 2FF0 0 Number of entries UINT8 N CONST N <td< th=""><th>2C51</th><th>7</th><th>Actual entry table 4</th><th>INT32</th><th>Ν</th><th>RO</th><th>N</th><th>0</th></td<> | 2C51 | 7 | Actual entry table 4 | INT32 | Ν | RO | N | 0 |
|--|------|----------|-----------------------------------|--------|-----|-------|-----|------------|
| 2C520Number of entriesUINT8NCONSTN42C521Channel 1INT32NRWY0x606600202C522Channel 2INT32NRWY0x606C00202C524Channel 4INT32NRWY0x606C00202C524Channel 4INT32NRWY0x606C00202C524Channel 4INT32NRWY0x606C00202C524Channel 4INT32NRWY0x606E00202D000Number of entricsINT16YRWN02D001Target voltageINT16YRWN02D002Target frequencyUINT16YRWN02D000Motor brake enabledUINT8NRONSTN522FF01Current sensing resistor valueUINT8NCONSTN522FF01Current sensing resistor valueUINT16TBDROTBD1002FF02Preamplifier gainUINT16TBDROTBD102FF04Temperaure sensor availableUINT8TBDROTBD102FF05Max absolute temperature (m ² C)INT32TBDROTBD122FF06Min absolute voltage (mV)UINT32TBDROTBD122FF0< | 2C52 | - | Monitor mapping | RECORD | - | - | - | - |
| 2C52 1 Channel 1 INT32 N RW Y 0x60640020 2C52 2 Channel 3 INT32 N RW Y 0x60620020 2C53 3 Channel 4 INT32 N RW Y 0x60620020 2C52 4 Channel 4 INT32 N RW Y 0x60620020 2D00 - Open loop parameters RECORD - - - 2D00 0 Number of entries UINT8 N RO N 2 2D00 1 Target frequency UINT16 Y RW N 0 2E00 0 Motor brake enabled UINT8 N RO N 2 2E70 - Hardware configuration - - - - - 2F70 0 Number of entries UINT16 TBD RO TBD 100 2F70 2 Preamplifier gain UINT16 TBD RO TBD 10 2F70 3 VGA available UINT8 TBD RO TBD 10 2F70 5 Max absolute temperature (n°C) INT32 TBD | 2C52 | 0 | Number of entries | UINT8 | Ν | CONST | N | 4 |
| 2C52 2 Channel 2 INT32 N RW Y 0x60620020 2C52 3 Channel 3 INT32 N RW Y 0x606B0200 2C52 4 Channel 4 INT32 N RW Y 0x606B0200 2D00 - Open loop parameters RECORD - - - 2D00 0 Number of entries UINT8 N RO N 2 2D00 1 Target trequency UINT16 Y RW N 0 2D00 2 Target requency UINT16 Y RW N 0 2E70 - Hardware configuration - - - - 2E70 0 Monor brake enabled UINT8 N RO TBD 100 2F70 1 Current sensing resistor value UINT16 TBD RO TBD 100 2F70 3 VGA available UINT8 TBD RO TBD 10 2F70 4 Temperature sensor available UINT8 TBD RO TBD 10 2F70 4 Max absolute temperature (n°C) INT32 TBD <td>2C52</td> <td>1</td> <td>Channel 1</td> <td>INT32</td> <td>Ν</td> <td>RW</td> <td>Y</td> <td>0x60640020</td> | 2C52 | 1 | Channel 1 | INT32 | Ν | RW | Y | 0x60640020 |
| 2C52 3 Channel 3 INT32 N RW Y 0x606C0020 2C52 4 Channel 4 INT32 N RW Y 0x606B0020 2D00 - Open loop parameters RECORD - - - 2D00 0 Number of entrics UINT8 N RO N 2 2D00 1 Target roquexcy UINT6 Y RW N 0 2D00 2 Target frequexcy UINT6 Y RW N 0 2E00 0 Motor brake enabled UINT8 N RW N 0 2E70 - Hardware configuration - - - - - 2F70 1 Current sensing resistor value UINT16 TBD RO TBD 100 2F70 2 Preamplifter gain UINT8 TBD RO TBD 1370 2F70 3 VGA available UINT8 TBD RO TBD 16 2F70 4 Temperature sensor available UINT32 TBD RO TBD 16 2F70 5 Max absolute temperature (m*C) INT32 | 2C52 | 2 | Channel 2 | INT32 | Ν | RW | Y | 0x60620020 |
| 2C524Channel 4INT32NRWY0x606B00202D00-Open loop parametersRECORD2D000Number of entriesUINT8NRON22D001Target frequencyUINT16YRWN02D002Target frequencyUINT16YRWN02E000Motor brake enabledUINT8NRWN02E70-Hardware configuration2F701Current sensing resistor valueUINT16TBDROTBD1002F702Preamplifier gainUINT16TBDROTBD1002F703VGA availableUINT8TBDROTBD02F704Temperature sensor availableUINT8TBDROTBD12F705Max absolute temperature (m°C)INT32TBDROTBD12F707Vbus sensor availableUINT8TBDROTBD12F708Max absolute voltage (mV)UINT32TBDROTBD12F709Min absolute voltage (mV)UINT32TBDROTBD12F709Min absolute voltage (mV)UINT32TBDROTBD12F709Min absolute voltage (mV)UINT32TBDROTBD1 </td <td>2C52</td> <td>3</td> <td>Channel 3</td> <td>INT32</td> <td>N</td> <td>RW</td> <td>Y</td> <td>0x606C0020</td> | 2C52 | 3 | Channel 3 | INT32 | N | RW | Y | 0x606C0020 |
| 2D00 - Open loop parameters RECORD - - - - 2D00 0 Number of entries UINT8 N RO N 2 2D00 1 Target voltage INT16 Y RW N 0 2D00 2 Target requency UINT8 N RW N 0 2D00 0 Motor brake enabled UINT8 N RW N 0 2EF0 - Hardware configuration - - - - - - 2FF0 0 Number of entries UINT8 N RO TBD 100 2FF0 1 Current sensior available UINT8 TBD RO TBD 1370 2FF0 4 Temperature (m^C) INT32 TBD RO TBD - - 2FF0 5 Max absolute temperature (m^C) INT32 TBD RO TBD - - | 2C52 | 4 | Channel 4 | INT32 | N | RW | Y | 0x606B0020 |
| 2D000Number of entriesUINT8NRON22D001Target voltageINT16YRWN02D002Target frequencyUINT16YRWN02D000Motor brake enabledUINT8NRWN02FF0-Hardware configuration2FF00Number of entricsUINT8NCONSTN522FF01Current sensing resisror valueUINT16TBDROTBD1002FF02Preamplifier gainUINT6TBDROTBD13702FF03VGA availableUINT8TBDROTBD02FF04Temperaure sensor availableUINT8TBDROTBD-2FF05Max absolute temperature (m°C)INT32TBDROTBD-2FF06Min absolute voltage (mV)UINT32TBDROTBD-2FF07Vbus sensor availableUINT32TBDROTBD-2FF08Max absolute voltage (mV)UINT32TBDROTBD-2FF09Min absolute voltage (mV)UINT32TBDROTBD-2FF08Peak current (mA – RMS value)UINT32TBDROTBD-2FF09Min absolute voltageUINT32TBDROTBD <td>2D00</td> <td>-</td> <td>Open loop parameters</td> <td>RECORD</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> | 2D00 | - | Open loop parameters | RECORD | - | - | - | - |
| 2D001Target voltageINT16YRWN02D002Target frequencyUINT16YRWN02E000Motor brake enabledUINT8NRWN02F00-Hardware configuration2F700Number of entricsUINT8NCONSTN522F701Current sensing resisror valueUINT16TBDROTBD1002F702Preamplifier gainUINT6TBDROTBD02F703VGA availableUINT8TBDROTBD02F704Temperature sensor availableUINT8TBDROTBD-2F705Max absolute temperature (m°C)INT32TBDROTBD-2F706Min absolute temperature (m°C)INT32TBDROTBD-2F707Vbus sensor availableUINT8TBDROTBD-2F708Max absolute voltage (mV)UINT32TBDROTBD-2F709Min absolute voltage (mV)UINT32TBDROTBD-2F706Maximum quest time (10Qus)UINT32TBDROTBD-2F707Vbus sensor availableUINT32TBDROTBD-2F708Max absolute voltage (mV)UINT32TBDROTBD< | 2D00 | 0 | Number of entries | UINT8 | N | RO | N | 2 |
| 2D002Target frequencyUINT16YRWN02E000Motor brake enabledUINT8NRWN02FF0-Hardware configuration2FF00Number of entriesUINT8NCONSTN522FF01Current sensing resisor valueUINT16TBDROTBD1002FF02Preamplifier gainUINT16TBDROTBD02FF03VGA availableUINT8TBDROTBD02FF04Temperaure sensor availableUINT8TBDROTBD02FF06Min absolute temperature (m°C)INT32TBDROTBD-2FF07Vbus sensor availableUINT3TBDROTBD-2FF08Max absolute voltage (mV)UINT32TBDROTBD-2FF09Min absolute voltage (mV)UINT32TBDROTBD-2FF0ANominal current (mA - RMS value)UINT32TBDROTBD-2FF0BPeak current (mA - Peak value)UINT32TBDROTBD-2FF0CMaximum current (mA - peak value)UINT32TBDROTBD-2FF0FNVM avalableUINT8TBDROTBD2FF0FNVM avalableUINT8T | 2D00 | 1 | Target voltage | INT16 | Y | RW | N | 0 |
| 2E000Motor brake enabledUINT8NRWN02FF0-Hardware configuration2FF00Number of entriesUINT8NCONSTN522FF01Current sensing resisor valueUINT16TBDROTBD1002FF02Preamplifier gainUINT16TBDROTBD02FF03VGA availableUINT8TBDROTBD02FF05Max absolute temperature (m°C)INT32TBDROTBD-2FF06Min absolute temperature (m°C)INT32TBDROTBD-2FF07Vbus sensor availableUINT8TBDROTBD-2FF07Vbus sensor availableUINT32TBDROTBD-2FF08Max absolute voltage (mV)UINT32TBDROTBD-2FF09Min absolute voltage (mV)UINT32TBDROTBD-2FF016Max absolute voltage (mV)UINT32TBDROTBD-2FF0CMaximum current (mA - RMS value)UINT32TBDROTBD-2FF0DMaximum current (mA - peak value)UINT32TBDROTBD-2FF0FNVM avalableUINT8TBDROTBD2FF0FNVM avalable< | 2D00 | 2 | Target frequency | UINT16 | Y | RW | N | 0 |
| 2FF0 - Hardware configuration - - - - 2FF0 0 Number of entries UINT8 N CONST N 52 2FF0 1 Current sensing resisor value UINT16 TBD RO TBD 100 2FF0 2 Preamplifier gain UINT16 TBD RO TBD 0 2FF0 3 VGA available UINT8 TBD RO TBD 0 2FF0 4 Temperature sensor available UINT8 TBD RO TBD - 2FF0 6 Min absolute temperature (m°C) INT32 TBD RO TBD - 2FF0 7 Vbus sensor available UINT32 TBD RO TBD - <td>2E00</td> <td>0</td> <td>Motor brake enabled</td> <td>UINT8</td> <td>N</td> <td>RW</td> <td>N</td> <td>0</td> | 2E00 | 0 | Motor brake enabled | UINT8 | N | RW | N | 0 |
| 2FF00Number of entriesUINT8NCONSTN522FF01Current sensing resisror valueUINT16TBDROTBD1002FF02Preamplifier gainUINT16TBDROTBD13702FF03VGA availableUINT8TBDROTBD02FF04Temperaure sensor availableUINT8TBDROTBD02FF05Max absolute temperature (m°C)INT32TBDROTBD12FF06Min absolute temperature (m°C)INT32TBDROTBD12FF07Vbus sensor availableUINT8TBDROTBD12FF08Max absolute voltage (mV)UINT32TBDROTBD12FF09Min absolute voltage (mV)UINT32TBDROTBD12FF0ANominal current (mA – RMS value)UINT32TBDROTBD12FF0BPeak current (mA – RMS value)UINT32TBDROTBD12FF0CMaximum peak time (100µs)UINT32TBDROTBD12FF0DMaximum current (mA - peak value)UINT8TBDROTBD12FF0FNVM avalableUINT8TBDROTBD12FF0FNVM avalableUINT8TBDROTBD12FF010HW error availab | 2FF0 | - | Hardware configuration | - | - | - | - | - |
| 2FF01Current sensing resistor valueUINT16TBDROTBD1002FF02Preamplifier gainUINT16TBDROTBD13702FF03VGA availableUINT8TBDROTBD02FF04Temperaure sensor availableUINT8TBDROTBD02FF05Max absolute temperature (m°C)INT32TBDROTBD-2FF06Min absolute temperature (m°C)INT32TBDROTBD12FF07Vbus sensor availableUINT8TBDROTBD-2FF08Max absolute voltage (mV)UINT32TBDROTBD-2FF09Min absolute voltage (mV)UINT32TBDROTBD-2FF0ANominal current (mA - RMS value)UINT32TBDROTBD-2FF0BPeak current (mA - RMS value)UINT32TBDROTBD-2FF0CMaximum peak time (100µs)UINT32TBDROTBD-2FF0DMaximum current (mA - peak value)UINT8TBDROTBD12FF0FNVM avalableUINT8TBDROTBD12FF010HW error availableUINT8TBDROTBD02FF011Temperature sensor offset (mV)UINT32TBDROTBD12FF012 <td>2FF0</td> <td>0</td> <td>Number of entries</td> <td>UINT8</td> <td>N</td> <td>CONST</td> <td>N</td> <td>52</td> | 2FF0 | 0 | Number of entries | UINT8 | N | CONST | N | 52 |
| 2FF02Preamplifier gainUINT16TBDROTBD13702FF03VGA availableUINT8TBDROTBD02FF04Temperaure sensor availableUINT8TBDROTBD02FF05Max absolute temperature (m°C)INT32TBDROTBD-2FF06Min absolute temperature (m°C)INT32TBDROTBD-2FF07Vbus sensor availableUINT8TBDROTBD-2FF08Max absolute voltage (mV)UINT32TBDROTBD-2FF09Min absolute voltage (mV)UINT32TBDROTBD-2FF09Min absolute voltage (mV)UINT32TBDROTBD-2FF08Peak current (mA – RMS value)UINT32TBDROTBD-2FF0BPeak current (mA – RMS value)UINT32TBDROTBD-2FF0CMaximum current (mA – peak value)UINT32TBDROTBD-2FF0FNVM avalableUINT8TBDROTBD12FF0FNVM avalableUINT8TBDROTBD02FF010HW error avilableUINT8TBDROTBD02FF011Temperature sensor gain (mV/C)UINT16TBDROTBD02FF012Temperature senso | 2FF0 | 1 | Current sensing resisror value | UINT16 | TBD | RO | TBD | 100 |
| 2FF03VGA availableUINT8TBDROTBD02FF04Temperaure sensor availableUINT8TBDROTBD02FF05Max absolute temperature (m°C)INT32TBDROTBD-2FF06Min absolute temperature (m°C)INT32TBDROTBD-2FF07Vbus sensor availableUINT8TBDROTBD12FF08Max absolute voltage (mV)UINT32TBDROTBD-2FF09Min absolute voltage (mV)UINT32TBDROTBD-2FF010Maximum peak time (100µs)UINT32TBDROTBD-2FF010Maximum current (mA - peak value)UINT32TBDROTBD12FF010HW error availableUINT8TBDROTBD12FF010HW error availableUINT8TBDROTBD-2FF011Tem | 2FF0 | 2 | Preamplifier gain | UINT16 | TBD | RO | TBD | 1370 |
| 2FF04Temperaure sensor availableUINT8TBDROTBD02FF05Max absolute temperature (m°C)INT32TBDROTBD-2FF06Min absolute temperature (m°C)INT32TBDROTBD-2FF07Vbus sensor availableUINT8TBDROTBD12FF08Max absolute voltage (mV)UINT32TBDROTBD-2FF09Min absolute voltage (mV)UINT32TBDROTBD-2FF0ANominal current (mA – RMS value)UINT32TBDROTBD-2FF0BPeak current (mA – RMS value)UINT32TBDROTBD-2FF0CMaximum peak time (100µs)UINT32TBDROTBD-2FF0DMaximum current (mA - peak value)UINT32TBDROTBD-2FF0EStepper in 3phases availableUINT8TBDROTBD12FF0FNVM avalableUINT8TBDROTBD12FF010HW error avilableUINT8TBDROTBD02FF011Temperature sensor fist (mV)UINT16TBDROTBD-2FF013Vbus sensor gainUINT16TBDROTBD-2FF014Deadtime (ns)UINT16TBDROTBD02FF015PW | 2FF0 | 3 | VGA available | UINT8 | TBD | RO | TBD | 0 |
| 2FF05Max absolute temperature (m°C)INT32TBDROTBD-2FF06Min absolute temperature (m°C)INT32TBDROTBD-2FF07Vbus sensor availableUINT8TBDROTBD12FF08Max absolute voltage (mV)UINT32TBDROTBD-2FF09Min absolute voltage (mV)UINT32TBDROTBD-2FF09Min absolute voltage (mV)UINT32TBDROTBD-2FF0ANominal current (mA – RMS value)UINT32TBDROTBD-2FF0BPeak current (mA – RMS value)UINT32TBDROTBD-2FF0CMaximum peak time (100µs)UINT32TBDROTBD-2FF0DMaximum current (mA - peak value)UINT32TBDROTBD12FF0FNVM avalableUINT8TBDROTBD12FF0FNVM avalableUINT8TBDROTBD02FF010HW error avilableUINT8TBDROTBD02FF011Temperature sensor offset (mV)UINT32TBDROTBD02FF013Vbus sensor gainUINT16TBDROTBD02FF014Deadtime (ns)UINT8TBDROTBD02FF015PWM frequency scal | 2FF0 | 4 | Temperaure sensor available | UINT8 | TBD | RO | TBD | 0 |
| 2FF06Min absolute temperature (m°C)INT32TBDROTBD-2FF07Vbus sensor availableUINT8TBDROTBD12FF08Max absolute voltage (mV)UINT32TBDROTBD-2FF09Min absolute voltage (mV)UINT32TBDROTBD-2FF04Nominal current (mA - RMS value)UINT32TBDROTBD-2FF0BPeak current (mA - RMS value)UINT32TBDROTBD-2FF0CMaximum peak time (100µs)UINT32TBDROTBD-2FF0DMaximum current (mA - peak value)UINT32TBDROTBD-2FF0EStepper in 3phases availableUINT32TBDROTBD12FF0FNVM avalableUINT8TBDROTBD12FF010HW error avilableUINT8TBDROTBD02FF011Temperature sensor offset (mV)UINT32TBDROTBD02FF013Vbus sensor gainUINT16TBDROTBD-2FF014Deadtime (ns)UINT16TBDROTBD02FF015PWM frequency scale (legacy)UINT8TBDROTBD02FF016Boostrap charge time (ms)UINT16TBDROTBD-2FF018 | 2FF0 | 5 | Max absolute temperature (m°C) | INT32 | TBD | RO | TBD | - |
| 2FF07Vbus sensor availableUINT8TBDROTBDI2FF08Max absolute voltage (mV)UINT32TBDROTBD-2FF09Min absolute voltage (mV)UINT32TBDROTBD-2FF0ANominal current (mA - RMS value)UINT32TBDROTBD-2FF0BPeak current (mA - RMS value)UINT32TBDROTBD-2FF0CMaximum peak time (100µs)UINT32TBDROTBD-2FF0DMaximum current (mA - peak value)UINT32TBDROTBD-2FF0EStepper in 3phases availableUINT8TBDROTBD12FF0FNVM avalableUINT8TBDROTBD02FF010HW error avilableUINT8TBDROTBD02FF011Temperature sensor offset (mV)UINT32TBDROTBD02FF012Temperature sensor gain (mV/C)UINT16TBDROTBD02FF013Vbus sensor gainUINT16TBDROTBD02FF014Deadtime (ns)UINT16TBDROTBD02FF016Boostrap charge time (ms)UINT8TBDROTBD12FF017NTC sensor availableUINT8TBDROTBD12FF018NTC Rext | 2FF0 | 6 | Min absolute temperature (m°C) | INT32 | TBD | RO | TBD | - |
| 2FF08Max absolute voltage (mV)UINT32TBDROTBD-2FF09Min absolute voltage (mV)UINT32TBDROTBD-2FF0ANominal current (mA – RMS value)UINT32TBDROTBD-2FF0BPeak current (mA – RMS value)UINT32TBDROTBD-2FF0CMaximum current (mA – peak value)UINT32TBDROTBD-2FF0DMaximum current (mA - peak value)UINT32TBDROTBD-2FF0EStepper in 3phases availableUINT8TBDROTBD12FF0FNVM avalableUINT8TBDROTBD02FF010HW error avilableUINT8TBDROTBD02FF011Temperature sensor offset (mV)UINT32TBDROTBD02FF012Temperature sensor offset (mV/C)UINT16TBDROTBD-2FF013Vbus sensor gainUINT16TBDROTBD-2FF014Deadtime (ns)UINT16TBDROTBD02FF016Boostrap charge time (ms)UINT8TBDROTBD02FF017NTC sensor availableUINT32TBDROTBD-2FF018NTC Rext (Ohm)UINT32TBDROTBD-2FF019NT | 2FF0 | 7 | Vbus sensor available | UINT8 | TBD | RO | TBD | 1 |
| 2FF09Min absolute voltage (mV)UINT32TBDROTBD-2FF0ANominal current (mA – RMS value)UINT32TBDROTBD-2FF0BPeak current (mA – RMS value)UINT32TBDROTBD-2FF0CMaximum peak time (100µs)UINT32TBDROTBD-2FF0DMaximum current (mA - peak value)UINT32TBDROTBD-2FF0EStepper in 3phases availableUINT8TBDROTBD12FF0FNVM avalableUINT8TBDROTBD02FF010HW error avilableUINT8TBDROTBD02FF011Temperature sensor offset (mV)UINT32TBDROTBD02FF012Temperature sensor gain (mV/C)UINT16TBDROTBD-2FF013Vbus sensor gainUINT16TBDROTBD-2FF014Deadtime (ns)UINT16TBDROTBD02FF016Boostrap charge time (ms)UINT8TBDROTBD12FF017NTC sensor availableUINT8TBDROTBD-2FF018NTC Rext (Ohm)UINT32TBDROTBD-2FF014Node Ib by HWUINT32TBDROTBD-2FF016Boostrap charge time (ms | 2FF0 | 8 | Max absolute voltage (mV) | UINT32 | TBD | RO | TBD | - |
| 2FF0ANominal current (mA - RMS value)UINT32TBDROTBD-2FF0BPeak current (mA - RMS value)UINT32TBDROTBD-2FF0CMaximum peak time (100µs)UINT32TBDROTBD-2FF0DMaximum current (mA - peak value)UINT32TBDROTBD-2FF0EStepper in 3phases availableUINT8TBDROTBD12FF0FNVM avalableUINT8TBDROTBD12FF010HW error avilableUINT8TBDROTBD12FF011Temperature sensor offset (mV)UINT32TBDROTBD02FF012Temperature sensor gain (mV/C)UINT16TBDROTBD-2FF013Vbus sensor gainUINT16TBDROTBD-2FF014Deadtime (ns)UINT16TBDROTBD02FF015PWM frequency scale (legacy)UINT8TBDROTBD02FF016Boostrap charge time (ms)UINT16TBDROTBD-2FF018NTC Rext (Ohm)UINT32TBDROTBD-2FF014Dealtime (ns)UINT16TBDROTBD-2FF016Boostrap charge time (ms)UINT8TBDROTBD-2FF017NTC sensor avai | 2FF0 | 9 | Min absolute voltage (mV) | UINT32 | TBD | RO | TBD | - |
| 2FF0BPeak current (mA – RMS value)UINT32TBDROTBD-2FF0CMaximum peak time (100µs)UINT32TBDROTBD-2FF0DMaximum current (mA - peak value)UINT32TBDROTBD-2FF0EStepper in 3phases availableUINT8TBDROTBD12FF0FNVM avalableUINT8TBDROTBD02FF010HW error avilableUINT8TBDROTBD12FF011Temperature sensor offset (mV)UINT32TBDROTBD02FF012Temperature sensor gain (mV/C)UINT16TBDROTBD-2FF013Vbus sensor gainUINT16TBDROTBD-2FF014Deadtime (ns)UINT16TBDROTBD02FF016Boostrap charge time (ms)UINT8TBDROTBD12FF017NTC sensor availableUINT8TBDROTBD12FF018NTC Rext (Ohm)UINT32TBDROTBD-2FF01ANTC B25 (K)UINT16TBDROTBD-2FF01CNode ID by HWUINT8TBDROTBD02FF01DPWM frequency (Hz)UINT8TBDROTBD- | 2FF0 | А | Nominal current (mA – RMS value) | UINT32 | TBD | RO | TBD | - |
| 2FF0CMaximum peak time (100µs)UINT32TBDROTBD-2FF0DMaximum current (mA - peak value)UINT32TBDROTBD-2FF0EStepper in 3phases availableUINT8TBDROTBD12FF0FNVM avalableUINT8TBDROTBD02FF010HW error avilableUINT8TBDROTBD12FF011Temperature sensor offset (mV)UINT32TBDROTBD02FF012Temperature sensor gain (mV/C)UINT16TBDROTBD02FF013Vbus sensor gainUINT16TBDROTBD-2FF014Deadtime (ns)UINT16TBDROTBD02FF016Boostrap charge time (ms)UINT16TBDROTBD02FF017NTC sensor availableUINT8TBDROTBD-2FF018NTC Rext (Ohm)UINT16TBDROTBD-2FF01ANTC B25 (K)UINT16TBDROTBD-2FF01CNode ID by HWUINT8TBDROTBD02FF01DPWM frequency (Hz)UINT32TBDROTBD- | 2FF0 | В | Peak current (mA – RMS value) | UINT32 | TBD | RO | TBD | - |
| 2FF0DMaximum current (mA - peak value)UINT32TBDROTBD2FF0EStepper in 3phases availableUINT8TBDROTBD12FF0FNVM avalableUINT8TBDROTBD02FF010HW error avilableUINT8TBDROTBD12FF011Temperature sensor offset (mV)UINT32TBDROTBD02FF012Temperature sensor gain (mV/C)UINT16TBDROTBD02FF013Vbus sensor gainUINT16TBDROTBD-2FF014Deadtime (ns)UINT16TBDROTBD-2FF015PWM frequency scale (legacy)UINT8TBDROTBD02FF016Boostrap charge time (ms)UINT16TBDROTBD12FF017NTC sensor availableUINT32TBDROTBD-2FF018NTC Rext (Ohm)UINT32TBDROTBD-2FF01ANTC B25 (K)UINT3TBDROTBD-2FF01BResolver avilableUINT8TBDROTBD02FF01CNode ID by HWUINT8TBDROTBD02FF01DPWM frequency (Hz)UINT32TBDROTBD- | 2FF0 | С | Maximum peak time (100µs) | UINT32 | TBD | RO | TBD | - |
| 2FF0EStepper in 3phases availableUINT8TBDROTBD12FF0FNVM avalableUINT8TBDROTBD02FF010HW error avilableUINT8TBDROTBD12FF011Temperature sensor offset (mV)UINT32TBDROTBD02FF012Temperature sensor gain (mV/C)UINT16TBDROTBD02FF013Vbus sensor gainUINT16TBDROTBD-2FF014Deadtime (ns)UINT16TBDROTBD02FF016Boostrap charge time (ms)UINT8TBDROTBD02FF017NTC sensor availableUINT8TBDROTBD12FF018NTC Rext (Ohm)UINT32TBDROTBD-2FF01ANTC B25 (K)UINT16TBDROTBD-2FF01BResolver avilableUINT8TBDROTBD-2FF0118Resolver avilableUINT8TBDROTBD-2FF010PWM frequency (Hz)UINT8TBDROTBD-2FF010PWM frequency (Hz)UINT8TBDROTBD- | 2FF0 | D | Maximum current (mA - peak value) | UINT32 | TBD | RO | TBD | - |
| 2FF0FNVM avalableUINT8TBDROTBD02FF010HW error avilableUINT8TBDROTBD12FF011Temperature sensor offset (mV)UINT32TBDROTBD02FF012Temperature sensor gain (mV/C)UINT16TBDROTBD02FF013Vbus sensor gainUINT16TBDROTBD-2FF014Deadtime (ns)UINT16TBDROTBD-2FF015PWM frequency scale (legacy)UINT8TBDROTBD02FF016Boostrap charge time (ms)UINT16TBDROTBD02FF017NTC sensor availableUINT8TBDROTBD12FF018NTC Rext (Ohm)UINT32TBDROTBD-2FF01ANTC B25 (K)UINT16TBDROTBD-2FF01BResolver avilableUINT8TBDROTBD02FF01BResolver avilableUINT8TBDROTBD-2FF01CNode ID by HWUINT8TBDROTBD02FF01DPWM frequency (Hz)UINT32TBDROTBD- | 2FF0 | Е | Stepper in 3phases available | UINT8 | TBD | RO | TBD | 1 |
| 2FF010HW error avilableUINT8TBDROTBD12FF011Temperature sensor offset (mV)UINT32TBDROTBD02FF012Temperature sensor gain (mV/C)UINT16TBDROTBD02FF013Vbus sensor gainUINT16TBDROTBD-2FF014Deadtime (ns)UINT16TBDROTBD-2FF015PWM frequency scale (legacy)UINT8TBDROTBD02FF016Boostrap charge time (ms)UINT16TBDROTBD02FF017NTC sensor availableUINT8TBDROTBD12FF018NTC Rext (Ohm)UINT32TBDROTBD-2FF01ANTC B25 (K)UINT16TBDROTBD-2FF01BResolver avilableUINT8TBDROTBD-2FF01ANTC B25 (K)UINT8TBDROTBD-2FF01ANTC B25 (K)UINT8TBDROTBD02FF01CNode ID by HWUINT8TBDROTBD02FF01DPWM frequency (Hz)UINT32TBDROTBD- | 2FF0 | F | NVM avalable | UINT8 | TBD | RO | TBD | 0 |
| 2FF011Temperature sensor offset (mV)UINT32TBDROTBD02FF012Temperature sensor gain (mV/C)UINT16TBDROTBD02FF013Vbus sensor gainUINT16TBDROTBD-2FF014Deadtime (ns)UINT16TBDROTBD-2FF015PWM frequency scale (legacy)UINT8TBDROTBD02FF016Boostrap charge time (ms)UINT16TBDROTBD02FF017NTC sensor availableUINT8TBDROTBD12FF018NTC Rext (Ohm)UINT32TBDROTBD-2FF014NTC B25 (K)UINT16TBDROTBD-2FF01CNode ID by HWUINT8TBDROTBD0 | 2FF0 | 10 | HW error avilable | UINT8 | TBD | RO | TBD | 1 |
| 2FF012Temperature sensor gain (mV/C)UINT16TBDROTBD02FF013Vbus sensor gainUINT16TBDROTBD-2FF014Deadtime (ns)UINT16TBDROTBD-2FF015PWM frequency scale (legacy)UINT8TBDROTBD02FF016Boostrap charge time (ms)UINT16TBDROTBD02FF017NTC sensor availableUINT8TBDROTBD12FF018NTC Rext (Ohm)UINT16TBDROTBD-2FF014NTC B25 (K)UINT16TBDROTBD-2FF01BResolver avilableUINT8TBDROTBD-2FF01CNode ID by HWUINT8TBDROTBD02FF01DPWM frequency (Hz)UINT32TBDROTBD- | 2FF0 | 11 | Temperature sensor offset (mV) | UINT32 | TBD | RO | TBD | 0 |
| 2FF013Vbus sensor gainUINT16TBDROTBD-2FF014Deadtime (ns)UINT16TBDROTBD-2FF015PWM frequency scale (legacy)UINT8TBDROTBD02FF016Boostrap charge time (ms)UINT16TBDROTBD02FF016Boostrap charge time (ms)UINT16TBDROTBD02FF017NTC sensor availableUINT8TBDROTBD12FF018NTC Rext (Ohm)UINT16TBDROTBD-2FF019NTC R25 (Ohm)UINT32TBDROTBD-2FF01ANTC B25 (K)UINT8TBDROTBD-2FF01BResolver avilableUINT8TBDROTBD02FF01CNode ID by HWUINT8TBDROTBD02FF01DPWM frequency (Hz)UINT32TBDROTBD- | 2FF0 | 12 | Temperature sensor gain (mV/C) | UINT16 | TBD | RO | TBD | 0 |
| 2FF014Deadtime (ns)UINT16TBDROTBD2FF015PWM frequency scale (legacy)UINT8TBDROTBD02FF016Boostrap charge time (ms)UINT16TBDROTBD02FF017NTC sensor availableUINT8TBDROTBD12FF018NTC Rext (Ohm)UINT16TBDROTBD-2FF019NTC R25 (Ohm)UINT32TBDROTBD-2FF01ANTC B25 (K)UINT16TBDROTBD-2FF01BResolver avilableUINT8TBDROTBD02FF01CNode ID by HWUINT32TBDROTBD02FF01DPWM frequency (Hz)UINT32TBDROTBD- | 2FF0 | 13 | Vbus sensor gain | UINT16 | TBD | RO | TBD | - |
| 2FF015PWM frequency scale (legacy)UINT8TBDROTBD02FF016Boostrap charge time (ms)UINT16TBDROTBD02FF017NTC sensor availableUINT8TBDROTBD12FF018NTC Rext (Ohm)UINT16TBDROTBD-2FF019NTC R25 (Ohm)UINT32TBDROTBD-2FF01ANTC B25 (K)UINT16TBDROTBD-2FF01BResolver avilableUINT8TBDROTBD02FF01CNode ID by HWUINT32TBDROTBD02FF01DPWM frequency (Hz)UINT32TBDROTBD- | 2FF0 | 14 | Deadtime (ns) | UINT16 | TBD | RO | TBD | - |
| 2FF016Boostrap charge time (ms)UINT16TBDROTBD02FF017NTC sensor availableUINT8TBDROTBD12FF018NTC Rext (Ohm)UINT16TBDROTBD-2FF019NTC R25 (Ohm)UINT32TBDROTBD-2FF01ANTC B25 (K)UINT16TBDROTBD-2FF01BResolver avilableUINT8TBDROTBD02FF01CNode ID by HWUINT8TBDROTBD02FF01DPWM frequency (Hz)UINT32TBDROTBD- | 2FF0 | 15 | PWM frequency scale (legacy) | UINT8 | TBD | RO | TBD | 0 |
| 2FF017NTC sensor availableUINT8TBDROTBD12FF018NTC Rext (Ohm)UINT16TBDROTBD-2FF019NTC R25 (Ohm)UINT32TBDROTBD-2FF01ANTC B25 (K)UINT16TBDROTBD-2FF01BResolver avilableUINT8TBDROTBD02FF01CNode ID by HWUINT8TBDROTBD02FF01DPWM frequency (Hz)UINT32TBDROTBD- | 2FF0 | 16 | Boostrap charge time (ms) | UINT16 | TBD | RO | TBD | 0 |
| 2FF018NTC Rext (Ohm)UINT16TBDROTBD-2FF019NTC R25 (Ohm)UINT32TBDROTBD-2FF01ANTC B25 (K)UINT16TBDROTBD-2FF01BResolver avilableUINT8TBDROTBD02FF01CNode ID by HWUINT8TBDROTBD02FF01DPWM frequency (Hz)UINT32TBDROTBD- | 2FF0 | 17 | NTC sensor available | UINT8 | TBD | RO | TBD | 1 |
| 2FF019NTC R25 (Ohm)UINT32TBDROTBD2FF01ANTC B25 (K)UINT16TBDROTBD2FF01BResolver avilableUINT8TBDROTBD2FF01CNode ID by HWUINT8TBDROTBD2FF01DPWM frequency (Hz)UINT32TBDROTBD | 2FF0 | 18 | NTC Rext (Ohm) | UINT16 | TBD | RO | TBD | - |
| 2FF01ANTC B25 (K)UINT16TBDROTBD2FF01BResolver avilableUINT8TBDROTBD02FF01CNode ID by HWUINT8TBDROTBD02FF01DPWM frequency (Hz)UINT32TBDROTBD- | 2FF0 | 19 | NTC R25 (Ohm) | UINT32 | TBD | RO | TBD | - |
| 2FF01BResolver avilableUINT8TBDROTBD2FF01CNode ID by HWUINT8TBDROTBD02FF01DPWM frequency (Hz)UINT32TBDROTBD- | 2FF0 | 14 | NTC B25 (K) | UINT16 | TBD | RO | TBD | |
| 2FF0 1C Node ID by HW UINT8 TBD RO TBD 0 2FF0 1D PWM frequency (Hz) UINT32 TBD RO TBD - | 2FF0 | 1B | Resolver avilable | UINT8 | TBD | RO | TRD | 0 |
| 2FF0 1D PWM frequency (Hz) UINT32 TBD RO TBD - | 2FF0 | 10 | Node ID by HW | UINT8 | TBD | RO | TRD | 0 |
| | 2FF0 | 10 1D | PWM frequency (Hz) | UINT32 | TBD | RO | TRD | - |
| 2FF0 1E Available digital inputs UINT32 TBD RO TBD 63 | 2FF0 | 1E | Available digital inputs | UINT32 | TBD | RO | TRD | 63 |





| 2FF0 | 1F | Available digital outputs | UINT32 | TBD | RO | TBD | 15 |
|------|----|-----------------------------------|--------|-----|-------|-----|------|
| 2FF0 | 20 | Available analog inputs | UINT32 | TBD | RO | TBD | 3 |
| 2FF0 | 21 | Available analog outputs | UINT32 | TBD | RO | TBD | 0 |
| 2FF0 | 22 | Commercial product ID | UINT32 | TBD | RO | TBD | - |
| 2FF0 | 23 | Commercial Serial Number | UINT32 | TBD | RO | TBD | - |
| 2FF0 | 24 | 2 Phases Switching Scheme | UINT8 | TBD | RO | TBD | 1 |
| 2FF0 | 25 | Driver enable in UART com. | UINT8 | TBD | RO | TBD | 0 |
| 2FF0 | 26 | Available current sensors | UINT8 | TBD | RO | TBD | - |
| 2FF0 | 27 | Digitak inputs polarity mask | UINT32 | TBD | RO | TBD | 15 |
| 2FF0 | 28 | Digital output polarity mask | UINT32 | TBD | RO | TBD | 0 |
| 2FF0 | 29 | Analog reference voltage | UINT8 | TBD | RO | TBD | 1 |
| 2FF0 | 2A | Analog input 1-2 parameters | UINT16 | TBD | RO | TBD | - |
| 2FF0 | 2B | Analog input 3-4 parameters | UINT16 | TBD | RO | TBD | - |
| 2FF0 | 2C | Analog output 1-2 parameters | UINT16 | TBD | RO | TBD | - |
| 2FF0 | 2D | Macro parameters | UINT16 | TBD | RO | TBD | - |
| 2FF0 | 2E | Supported motor types | UINT16 | TBD | RO | TBD | - |
| 2FF0 | 2F | Supported communication interface | UINT16 | TBD | RO | TBD | - |
| 2FF0 | 30 | Supported feedback | UINT16 | TBD | RO | TBD | - |
| 2FF0 | 31 | PWM maximum duty cycle | UINT16 | TBD | RO | TBD | - |
| 2FF0 | 32 | Current loop frequency | UINT16 | TBD | RO | TBD | - |
| 2FF0 | 33 | Velocity/Position loop frequency | UINT16 | TBD | RO | TBD | - |
| 2FF0 | 34 | Supported command source | UINT16 | TBD | RO | TBD | - |
| 2FF1 | 0 | Ardware configuration pass | UINT16 | TBD | RW | TBD | - |
| 2FF2 | 0 | EDS version | UINT16 | Ν | CONST | Ν | - |
| 2FF3 | 0 | HW available registers | UINT16 | - | RW | - | 0x35 |
| 2FFC | - | Motor informations | - | - | - | - | - |
| 2FFC | 0 | Number of entry | UINT8 | Ν | CONST | Ν | 11 |
| 2FFC | 1 | Motor reference | UINT32 | TBD | RW | TBD | - |
| 2FFC | 2 | Coil reference | UINT32 | TBD | RW | TBD | - |
| 2FFC | 3 | Manufacturing date | UINT8 | TBD | RW | TBD | - |
| 2FFC | 4 | Firmware | UINT32 | TBD | RW | TBD | - |
| 2FFC | 5 | Firmware index ref | UINT8 | TBD | RW | TBD | - |
| 2FFC | 6 | Bootloader | UINT32 | TBD | RW | TBD | - |
| 2FFC | 7 | Bootloader index ref | UINT8 | TBD | RW | TBD | - |
| 2FFC | 8 | Hardware | UINT32 | TBD | RW | TBD | - |
| 2FFC | 9 | Hardware index ref | UINT8 | TBD | RW | TBD | - |
| 2FFC | А | Project name | INT32 | TBD | RW | TBD | - |
| 2FFC | В | Motor inforation key | INT32 | TBD | WO | TBD | - |
| 2FFD | 0 | Maximum current range | UINT8 | N | RW | Y | 0 |
| 2FFF | 0 | Reset device | UINT32 | Ν | RW | N | - |

ANNEXE 2 – LIST OF ERROR CODES





| Error code | Description |
|------------|---|
| 0x0000 | No error |
| 0x2280 | Over-current peak has been detected in phase or DC-Bus line (HW system protection). It could indicate a short circuit between phase and ground. This is a generic error without information of the phases involved in the error. |
| 0x2290 | Over-current peak has been detected in phase (FW system protection). It could indicate a short circuit between two phases or between a phase and DC-Bus input. This is a generic error without information of the phases involved in the error. |
| 0x2291 | Over-current peak has been detected in phase A (FW system protection). It could indicate a short circuit between phase A and another phase or DC-Bus input. |
| 0x2292 | Over-current peak has been detected in phase B (FW system protection). It could indicate a short circuit between phase B and another phase or DC-Bus input. |
| 0x2293 | Over-current peak has been detected in phase C (FW system protection). It could indicate a short circuit between phase C and another phase or DC-Bus input. |
| 0x22A0 | Initial current reading out of range (FW system protection). This error indicates a Hardware malfunction, please contact Crouzet or your local vendor. |
| 0x22A1 | Initial current reading of Phase A out of range (FW system protection). This error indicates a Hardware malfunction, please contact Crouzet or your local vendor. |
| 0x22A2 | Initial current reading of Phase B out of range (FW system protection). This error indicates a Hardware malfunction, please contact Couzet or your local vendor. |
| 0x22A3 | Initial current reading of Phase C out of range (FW system protection). This error indicates a Hardware malfunction, please contact Crouzet or your local vendor. |
| 0x2350 | An I ² T over-current has been detected (FW system protection). The maximum phase peak current (Overload capacity) allowed by the controller has been reached. |
| 0x2380 | Saturation of current measurement system has been detected. In system with VGA it could indicate a selected measurement range too narrow. |
| 0x2381 | Saturation of current measurement system has been detected in phase A. In system with VGA it could indicate a selected measurement range too narrow. |
| 0x2382 | Saturation of current measurement system has been detected in phase B. In system with VGA it could indicate a selected measurement range too narrow. |
| 0x2383 | Saturation of current measurement system has been detected in phase C. In system with VGA it could indicate a selected measurement range too narrow. |
| 0x3210 | System over voltage detected. Indicates that maximum absolute voltage of the controller has been exceeded. This error could be the consequence of a regenerative movement when working on power supplies with low capacitance or negative current protection. In such case use an external shunt to dissipate the excess of energy generated by the load. |
| 0x3211 | User over voltage detected. Indicates that the maximum voltage indicated by the user has been over passed. This error is only generated in systems without shunt resistor. |





| Error code | Description |
|------------|--|
| 0x3220 | System under voltage detected. Indicates that minimum absolute voltage of the controller is not reached. |
| 0x3221 | User under voltage detected. Indicates that the minimum voltage indicated by the user has not been reached. |
| 0x4300 | User temperature out of range detected. Indicates that the temperature of the controller is out of the range specified by the user. |
| 0x4310 | System over temperature detected (FW system protection). Indicates that the maximum allowed temperature of the controller has been exceeded. |
| 0x4320 | System under temperature detected (FW system protection). Indicates that the minimum allowed temperature of the controller is not reached. |
| 0x4400 | Motor temperature out of range detected. Indicates that the temperature of the motor is out of the range specified by the user. |
| 0x5210 | Internal VGA communication problem detected. This error indicates a Hardware malfunction, please contact Crouzet or your local vendor. |
| 0x5400 | Output power section problem detected (system protection). This error indicates a Hardware malfunction, please contact Crouzet or your local vendor. |
| 0x5430 | Input stage problem detected. Voltage not stable or not available (system protection). This error indicates a Hardware malfunction, please contact Crouzet or your local vendor. |
| 0x5530 | Internal NVM communication problem detected. This error indicates a Hardware malfunction, please contact Crouzet or your local vendor. |
| 0x6185 | Internal EEPROM full error. This error indicates that size of object dictionary data is higher than the space available in EEPROM. NA |
| 0x6186 | Internal EEPROM full error (Communication Dictionary). This error indicates that size of Communication object dictionary is higher than assigned space in EEPROM. NA |
| 0x6187 | Internal EEPROM full error (Manufacturer Dictionary). This error indicates that size of Manufacturer object dictionary is higher than assigned space in EEPROM. NA |
| 0x6188 | Internal EEPROM full error (Device Dictionary). This error indicates that size of Device object dictionary is higher than assigned space in EEPROM. NA |
| 0x7121 | Motor blocked. This error indicates that the motor has been blocked. Only applies to stepper with encoder position feedback. NA |
| 0x7124 | Motor not detected. This error indicates that the motor has not been detected. Only applies to stepper motors when entering in Operation Enable state. NA |
| 0x7303 | Error in resolver signals detected. This error indicates a loss or degradation of resolver signals. NA |





| Error code | Description |
|------------|---|
| 0x7306 | Differential encoder broken wire detected. Indicates that one of the differential signals of the quadrature incremental encoder, probably due to the breakage of the line. NA |
| 0x7380 | SSI encoder error. Indicates that an error occurs during the decodification of a SSI frame. Usually it means that an error flag in the SSI frame is enabled. NA |
| 0x7390 | Magnetic sensor error. Indicates that an error occurs during the decodification of the magnetic interface SPI frame. Usually it means that an error flag in the frame header is enabled, or that the read back value after a write is different than the intended value. |
| 0x8110 | CAN bus over-run. Indicates that one or more CAN message has been lost. |
| 0x8120 | CAN in error passive mode. Indicates that have been detected more than 127 reception errors, or more than 127 but less than 255 transmission errors. |
| 0x8130 | Lifeguard error. It indicates that the node has not received a Node Guard message within its Lifetime. |
| 0x8140 | Recovered from CAN bus off. Indicates that the controller has been recovered from a previous CAN bus off situation. |
| 0x8141 | CAN Bus off occurred. Indicates that has been detected more than 255 errors during transmission of messages. |
| 0x8210 | PDO not processed due to length error. This error indicates that a CAN RPDO has not been processed because the received data length does not match the expected one. |
| 0x8280 | Error decoding serial message. This error indicates that the serial message sent to the driver is incorrect. |
| 0x8613 | Homing timeout detected. Indicates that the homing has not been able to finish the process within the maximum allowed time. |
| 0xFF02 | Not allowed digital hall combination detected. Indicates that a not allowed combination of digital halls feedback has been detected (i.e all zero or all ones). |
| 0xFF03 | Not allowed sequence of digital halls has been detected. Indicates that a not allowed sequence of digital halls combination has been detected. |
| 0xFF04 | Angular error in forced alignment method is out of tolerance. Indicates that the result of forced alignment method during initial angle determination process for brushless motor has been out of specified tolerance during all retries. |
| 0xFF05 | Interpolated position mode buffer full. Indicates that the interpolation data input buffer has reached its limit. |
| 0xFF06 | Error in Analog hall signals detected. Indicates that one of the analog signals has been disconnected or it is out of allowed range. NA |





| Error code | Description |
|------------|--|
| 0xFF10 | A stand-alone divide by zero instruction detected. Indicates that a division instruction has been executed with a zero divisor. |
| 0xFF20 | RS232 reception overflow. Indicates that some of the RS232 characters have been lost. NA |
| 0xFF30 | Executing a non-existing macro or instruction address. Indicates that a macro or instruction higher than the allowed 64 has been executed. NA |
| 0xFF31 | Macro stack full. Indicates that the macro calling stack is full due to an excess of nested execution. NA |
| 0xFF33 | Detected interrupt without associated macro function. Indicates that an interrupt has been activated and generated but it does not have an associated macro function. NA |
| 0xFF34 | Saving or restoring out of learned position space. Indicates that an access to a not existing learned position table has been done. |
| 0xFF40 | EtherCAT synchronization error. Indicates that a synchronization error has occurred using EtherCAT in DC mode. NA |
| 0xFF41 | EtherCAT plugin board disconnected. Indicates that the Crouzet drive with the EtherCAT firmware has been powered up without the EtherCAT plugin board. NA |
| 0xFF50 | Incorrect object access. This error appears if the application tries to access to a nonexistent object, write in a read-only object or read a write-only object. Other incorrect access situations are signaled with this error. |
| 0xFF60 | Safe torque off activated. Indicates that the power stage has been deactivated due to the STO mechanism |