DCmind Soft CANopen

User Guide

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.

Revision History

Version	Date	Author	Changes
0	16/06/2015	J_BERTAUD	Initial Version
1	01/07/2015	J_BERTAUD	“PRELIMINARY” deleted

About This Manual

This manual applies to SMI21 CANopen DCmind brushless products:

- 80140301
- 80180301
- 80280301

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

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Contents

1. INTRODUCTION

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

DCmind Soft CANopen allows for:

- Detection of compatible drives connected to the software network
- Connection to one drive for configuration, tuning, testing and programming.
- Configuration and testing of different motion modes (position, velocity, torque, force, 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 or W8.
- At least 100MB of free disk space.
- USB port for controller USB connection.
- CAN port for CAN connection [optional].
- .NET framework 4.0

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.

In the menu of DCmind Soft CANopen "Help > 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.

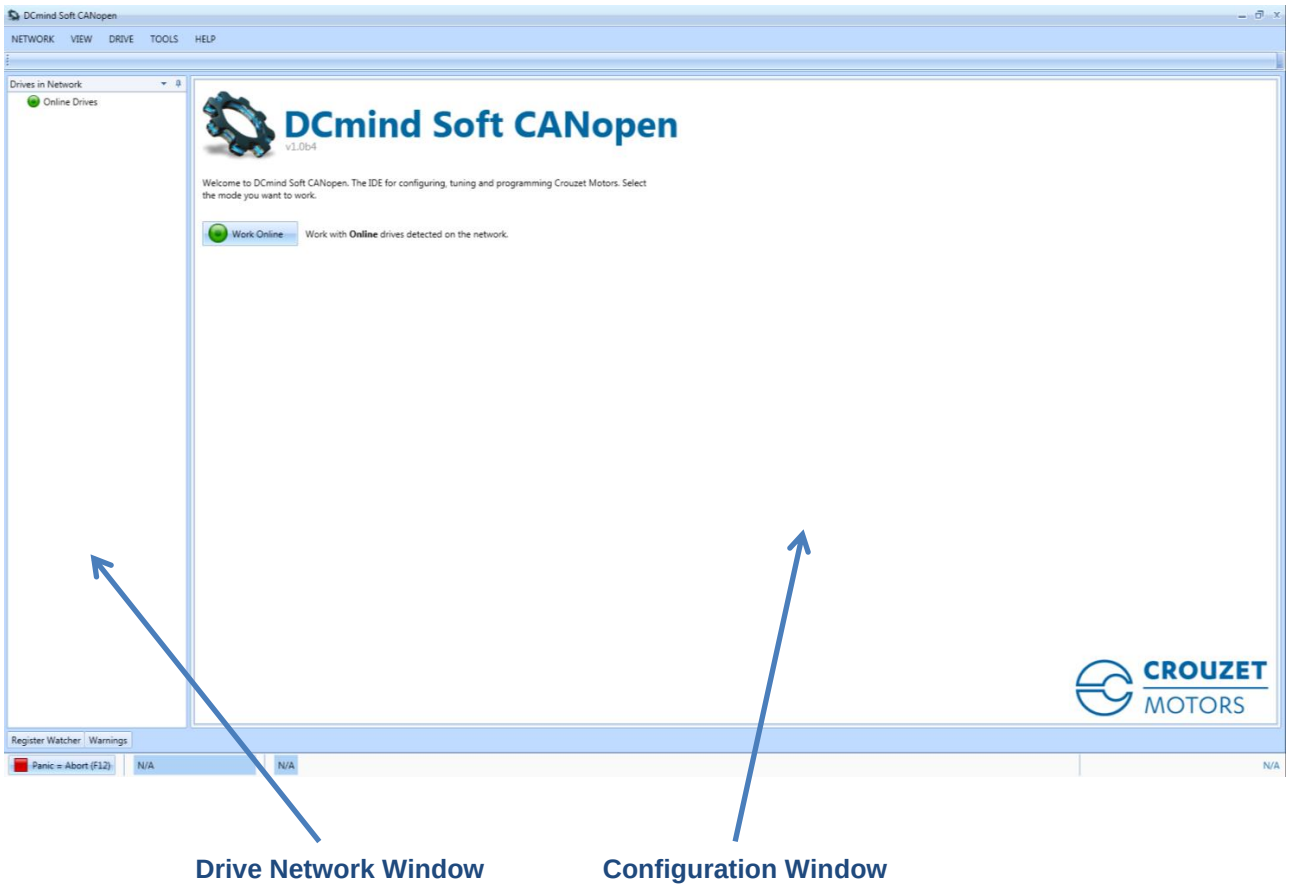
1.3. Before you begin

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

- Read the SMI21 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, you 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:

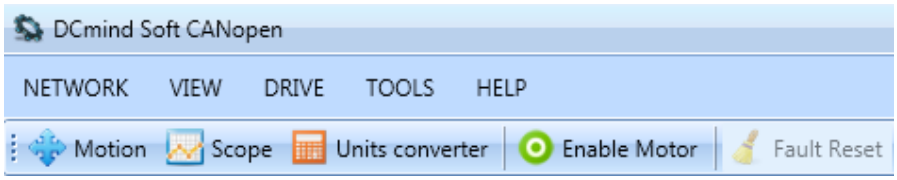
2.1.1. *Drive Network window*

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 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.

2.2. DCmind Soft CANopen toolbar and associated icons



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

Symbol	Title	Description
	Motion	Open motion test dialog
	Scope	Open scope dialog
	Units Converter	Units converter dialog
	Enable Motor	Switch ON / Operation Enable the drive
	Fault Reset	Reset actual fault and Switch ON the drive

2.3. DCmind Soft CANopen menu bar

The menu bar along the top of the DCmind Soft CANopen desktop provides access to many tools and functions. The main menu options are described in the following table:

Menu	Option → Sub-option	Description
NETWORK	Network Wizard…	Open network wizard dialog .Work in online or offline modes
VIEW	DCmind Soft CANopen windows, toolbars and status bar	
DRIVE	Upload, Download, Restore, Commit…	Options for load configuration from file, Save to file ,Commit parameters, Restore to factory...
TOOLS	Motion ,Scope, Composer, Units, Options...	Open selected DCmind Soft CANopen tool
HELP	Documentation, About DCmind Soft CANopen	Open online support documentation

2.4. DCmind Soft CANopen Status bar

The status bar on the bottom of the desktop contains information on the SMI21 CANopen drive **connection state**, **FSA current status** and **drive error codes**. It also includes a PANIC button for safety.

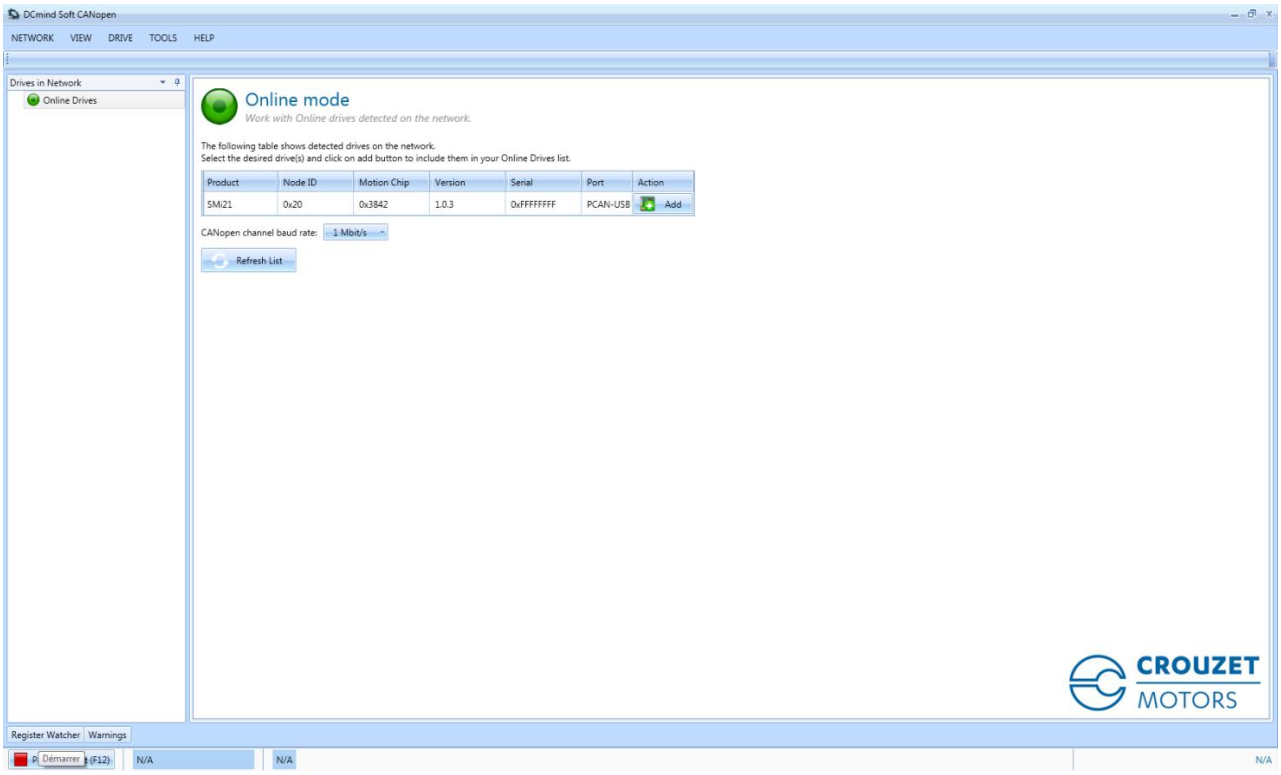
2.5. Parameters file

SMI21 CANopen drive is 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.

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 CANopen drive in DCmind Soft CANopen "Online Mode", DCmind Soft CANopen automatically 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 CANopen drive can be stored according to **CiA311 in a XML device configuration file** (.XDC).

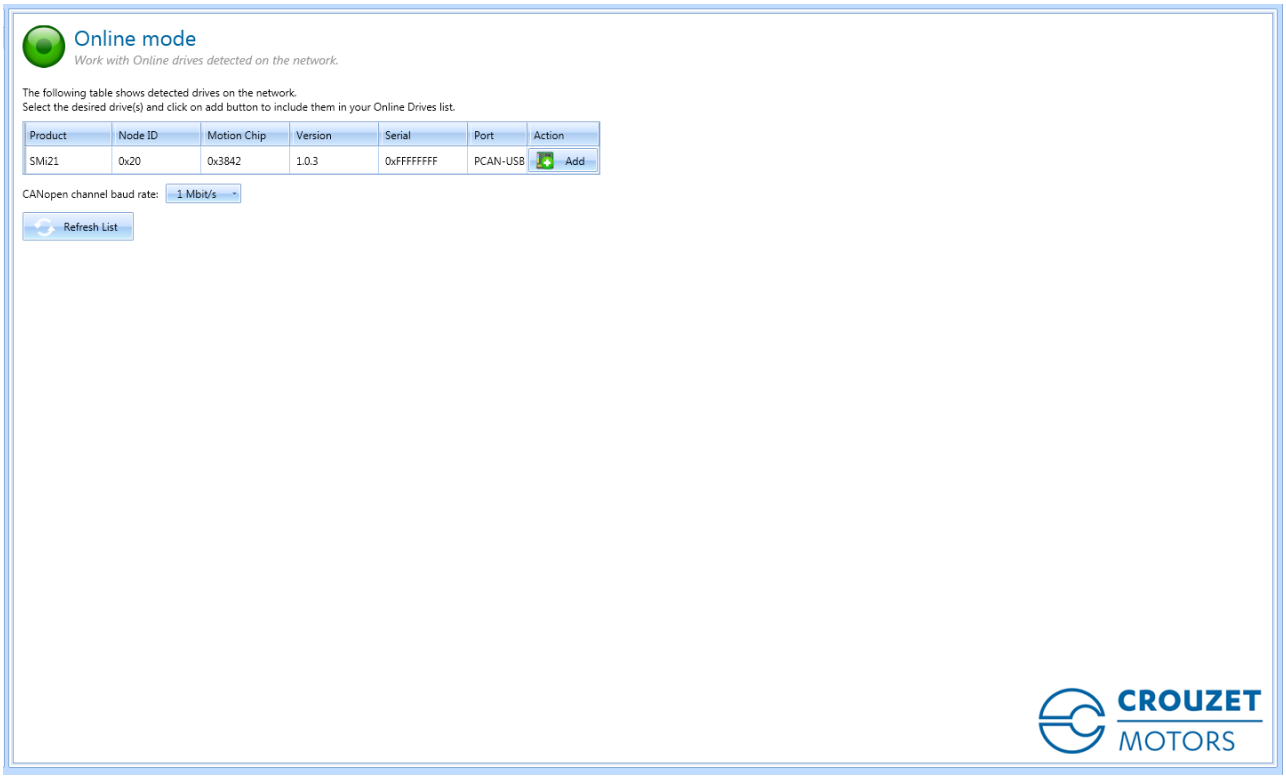
CAUTION: XDC files are the recommended format for saving SMI21 CANopen drive configurations.

Once you are connected to the SMI21 CANopen drive, you can Load/Save an XDC configuration file from the "DRIVE" option in the main menu.

3. WELCOME SCREEN

This view lets you select which SMI21 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).

3.1. Work Online



The **Online** screen displays a list of the SMI21 CANopen drive that DCmind Soft CANopen has found on your local network. You can select one of these drives from the list and click “Add” to continue. This will connect you to the SMI21 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	Name of product
Node ID	ID used for the SMI21 CANopen drive
Motion chip	Manufacturer Motion chip used
Serial Number	Unique identifier for each SMI21 CANopen drive
Port	Communications port where SMI21 CANopen drive have been detected
Action	“Add” button to connect to the specified SMI21 CANopen drive

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

3.2. Drive Overview

3.2.1. *Drive parameters*

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

You can view or edit some of the information displayed:

Field	Description	Editable field
Drive Name	Name assigned to the SMI21 CANopen drive being used	Yes
Product Name	Commercial name of the SMI21 CANopen drive	No
Node ID	CAN Node ID used for the SMI21 CANopen drive	No
CANopen baud rate	Baud rate used in CANopen communications	Yes
Motion chip	MCU included in the SMI21 CANopen drive	Yes
Firmware version	Firmware version of the MCU	No
Serial number	Product Serial Number	No
COM port	COM port where SMI21 CANopen drive have been detected	No

3.2.2. *Drive operations*

After connecting to your SMI21 CANopen drive, the below operations and options will be displayed:

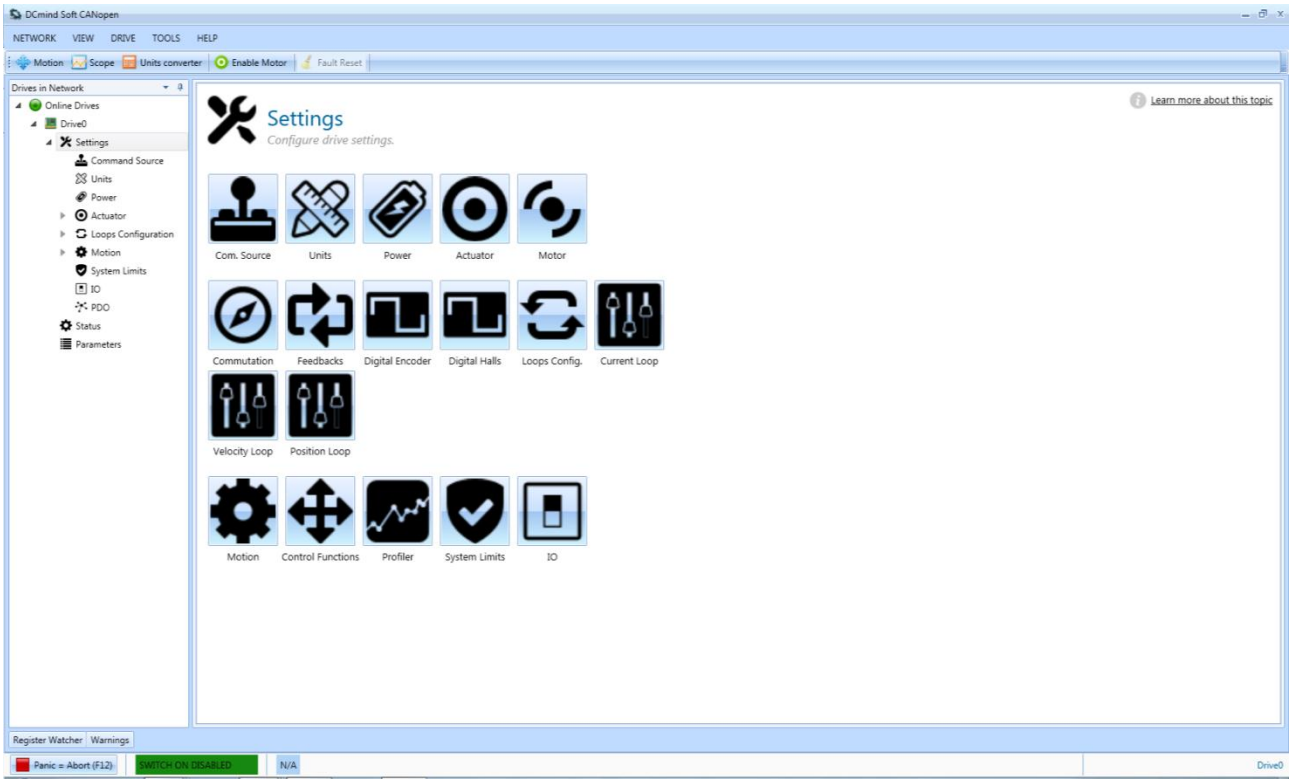
Drive operations	Description
Upload ALL from drive	Drive parameters can be uploaded from SMI21 CANopen drive at any time clicking on the Upload from Drive button.
Download ALL to drive	Current SMI21 CANopen drive configuration can be downloaded to the drive at any time by clicking on the Download to Drive button.
Download Modified	Download only modified parameters.
Commit parameters	Save actual parameters to non-volatile memory.
Restore Defaults	Restore all default Parameters to SMI21 CANopen drive.
Load from file	Load values from File to Parameters list. This will load values from a previous configuration File (.xdc).
Save to file	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 to File** 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.
Remove drive	Drives can be removed from Drive tree at any time by clicking on the Remove Drive button.

4. SETTINGS

The Settings screen allows you to configure properly several parameters for your SMI21 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

When you click on Settings in the navigation pane located to the left of the DCmind Soft CANopen screen, additional views for configuring your SMI21 CANopen drive appear.

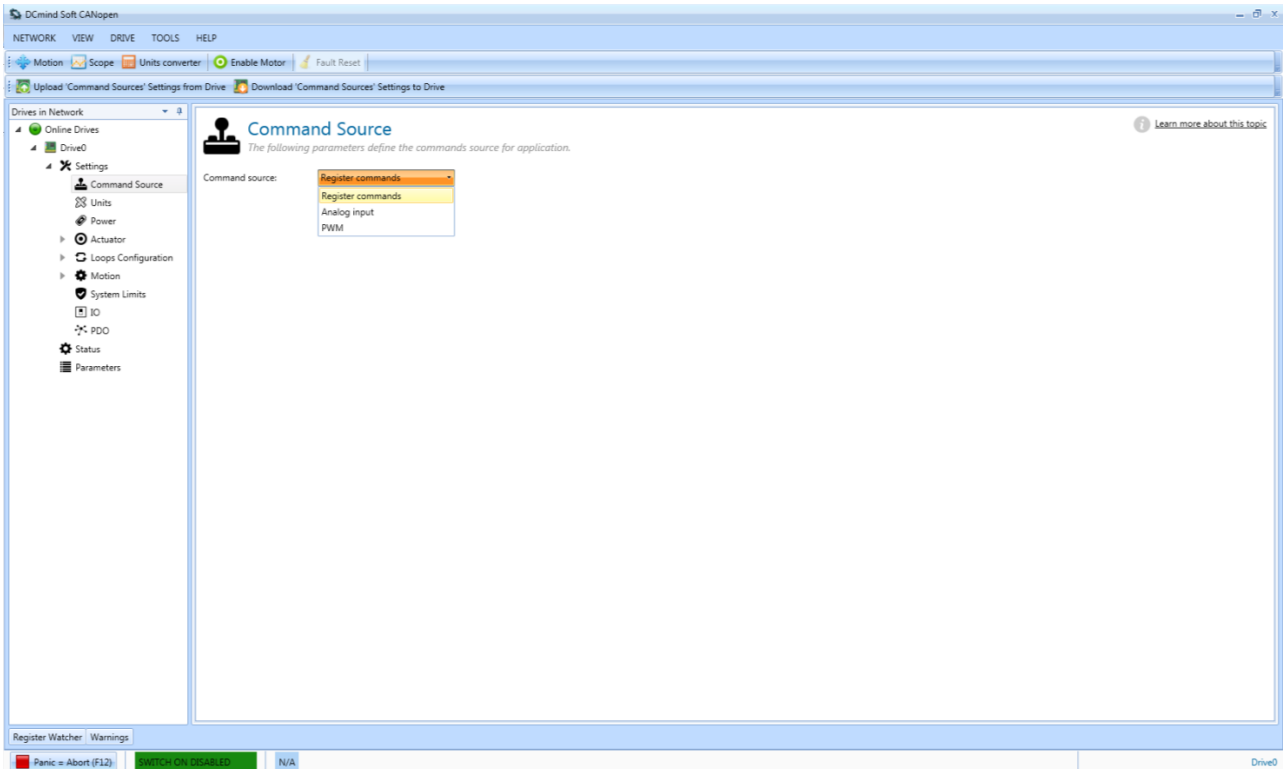


CAUTION: By default, only settings applicable to your current SMI21 CANopen drive operation mode, motor, feedbacks and command source will appear in this tree.

4.1. Command Sources

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

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



4.1.1. *Register commands*

Select this option when the SMI21 CANopen drive is being controlled from a PC or remote host. SMI21 CANopen drive can utilize register commands from a network communication 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.

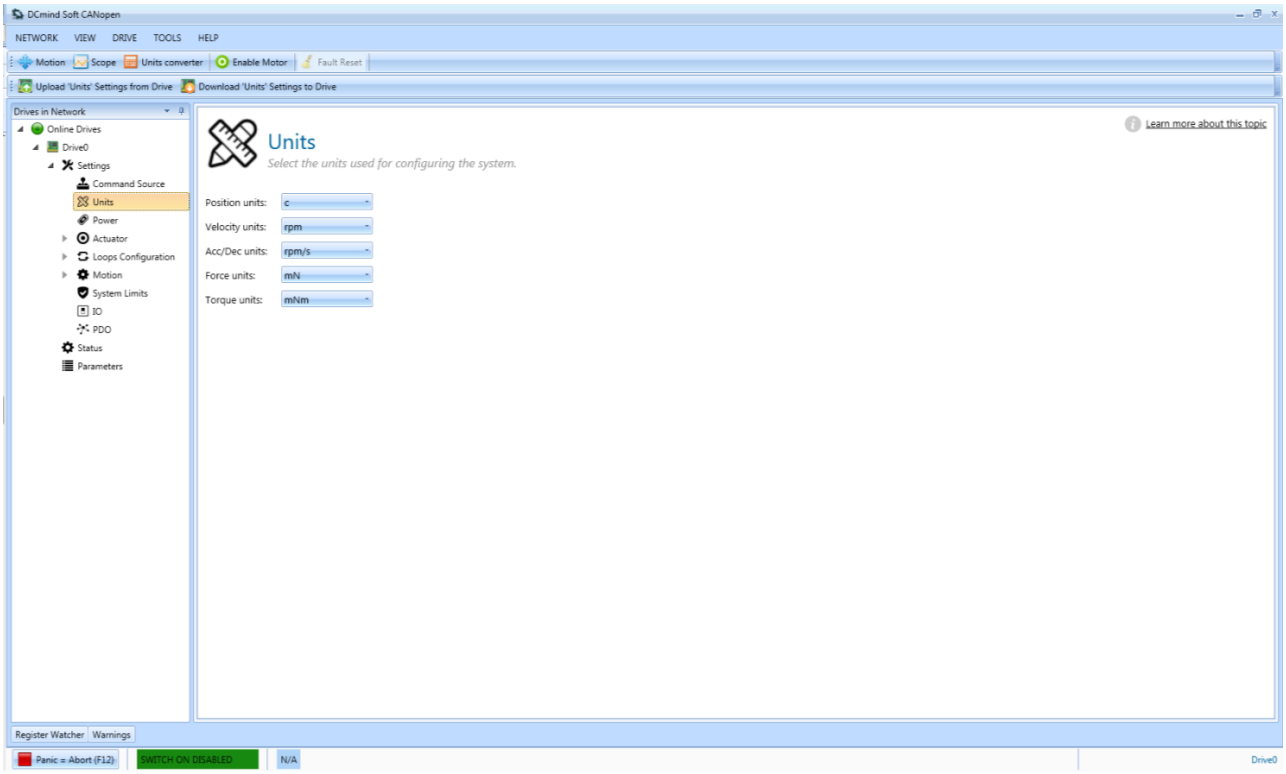
CAUTION: The information displayed makes use of the current Operation Mode configured in the Motion setting. Depending on that, the values displayed will be relative to position, velocity, torque or force.

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. **Units**

User Units allows the user to set the general units that will be used in DCmind Soft CANopen. A variety of unit types are available, and DCmind Soft CANopen also offers the option of using system counts as units. DCmind Soft CANopen supplies a calculator to help you calculate the correct values for parameters that are affected by other system settings.

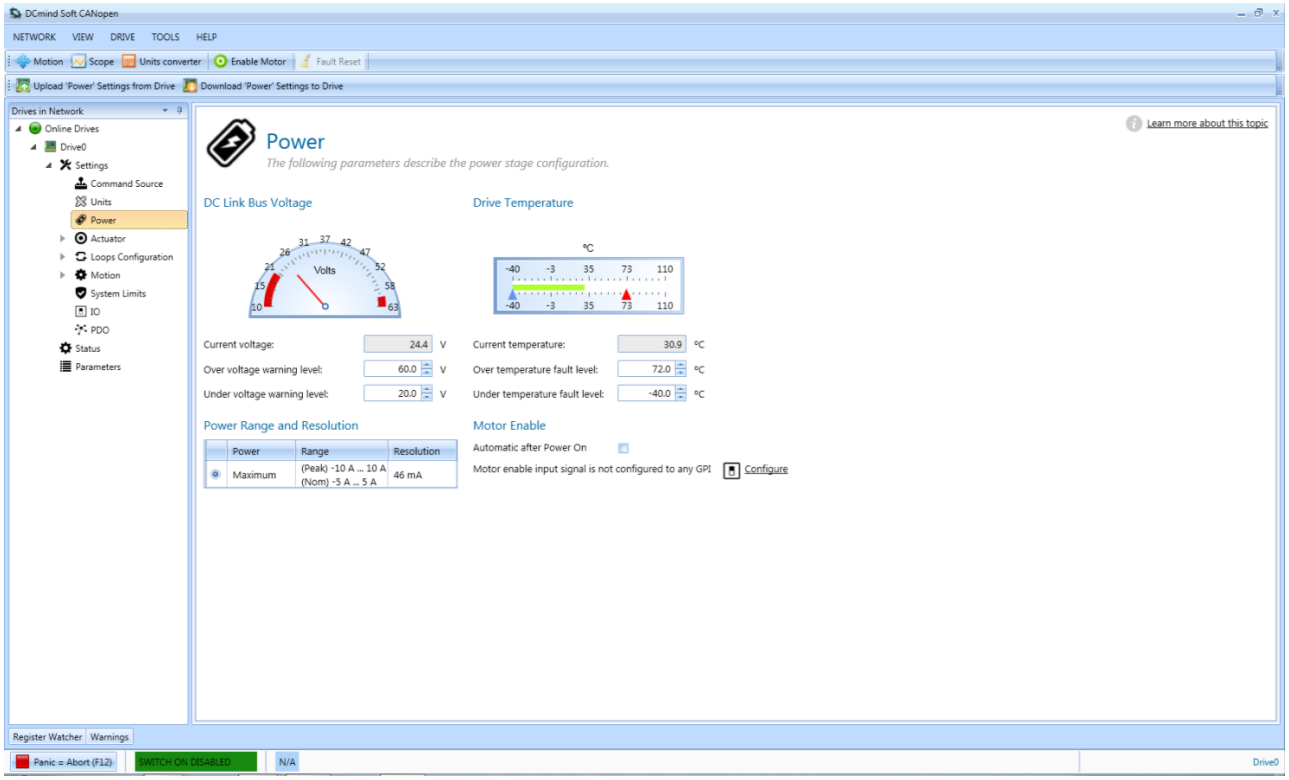
The SMI21 CANopen drive uses four primary measures of motion: position, velocity, acceleration/deceleration, force and torque. You must first choose units of measurement for each of these. The User units window allows the specification of the general units to be used throughout the application. The settings for units are automatically applied. The unit settings in the SMI21 CANopen drive will reflect last settings made in the units screen before exiting.



WARNING: Do not dynamically change units during SMI21 CANopen drive configuration and commission process because it rescales the system parameters and causes unusual motion.

4.3. Power

From the Power view, you can view and configure the SMI21 CANopen drive power settings as follows:



4.3.1. *Motor Enable*

Automatic after Power On parameter specifies if the motor should be automatically powered on (if possible) after power-up without the needed of user intervention.

Use GPDI1 as enable signal indicates if a general enable signal is available (and it is connected to the GPI1). If this signal is available it will control when the power stage could be activated or deactivated.
After the enable signal, the SMI21 CANopen drive will react to motion commands.

4.3.2. *DC Link Bus Voltage*

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.

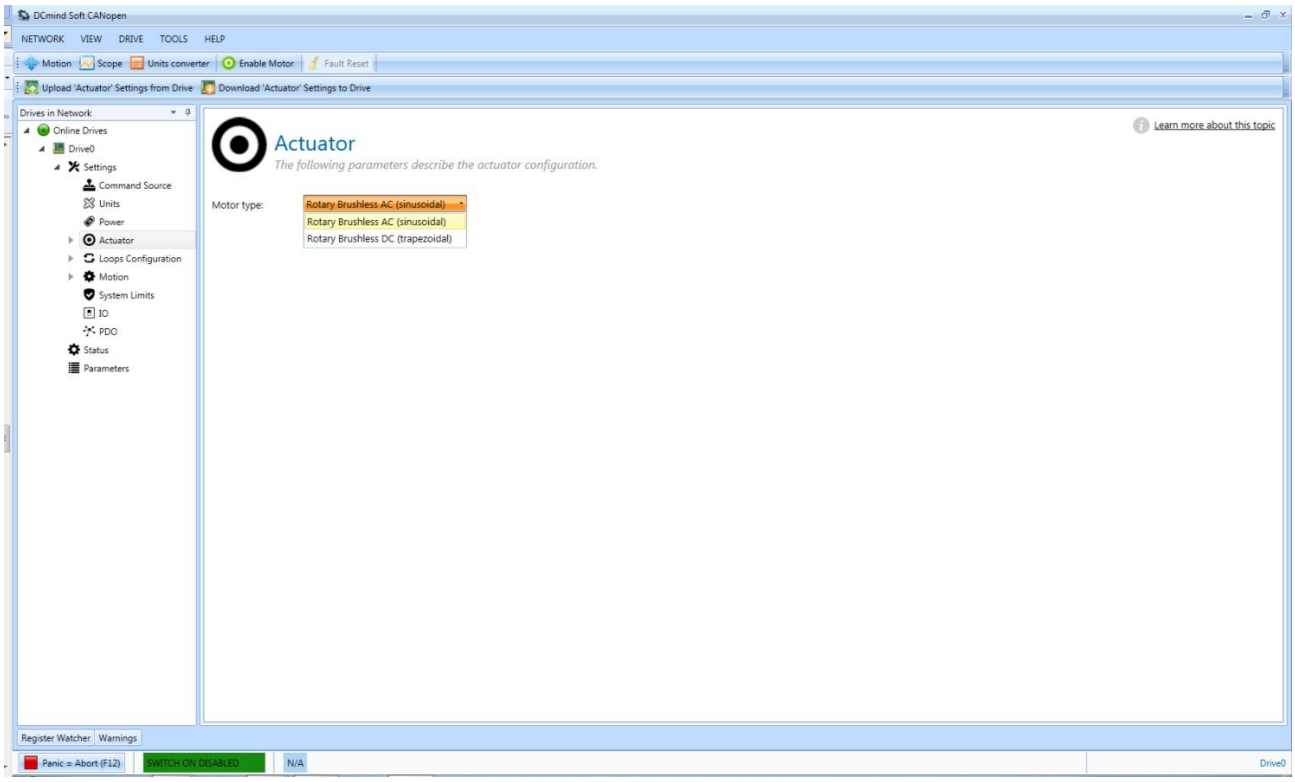
4.3.3. *Drive Temperature*

The **actual 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.

5. ACTUATORS

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

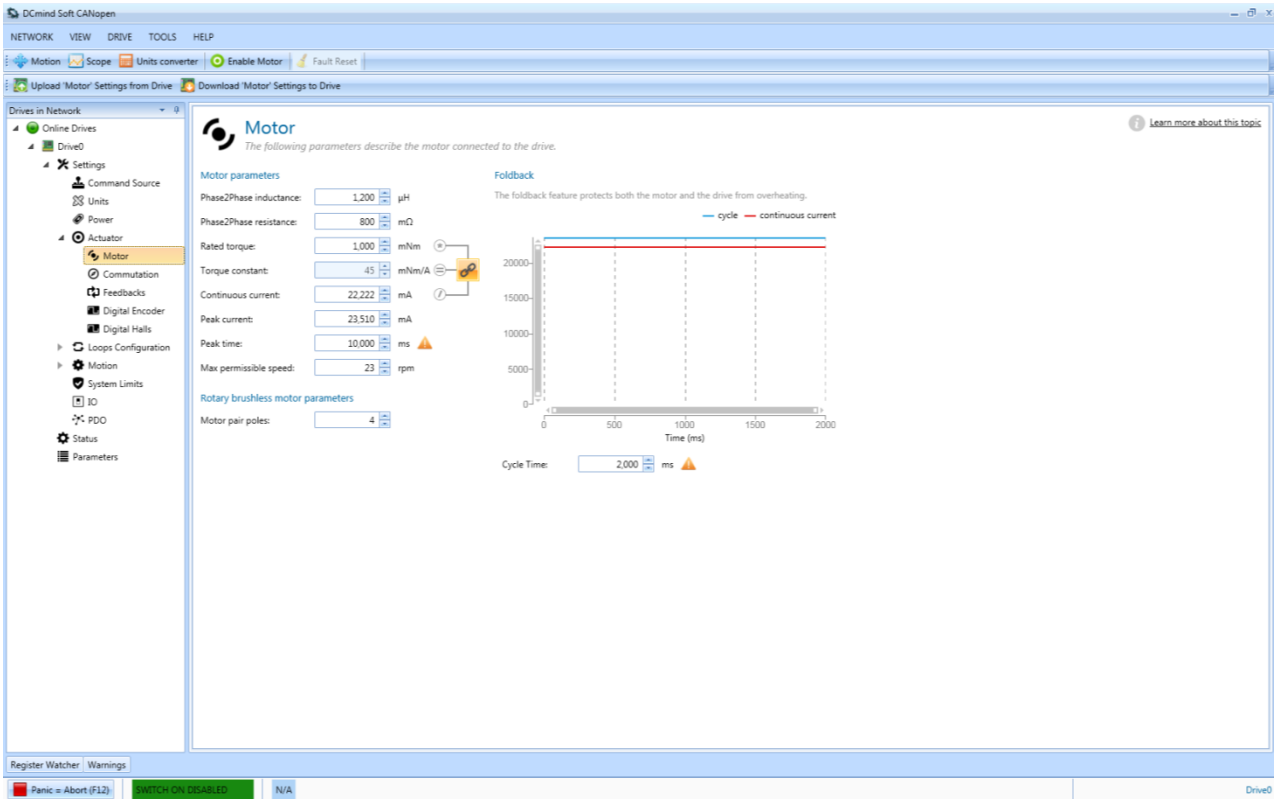


The drive supports the following motors:

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

5.1. Motor

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



CAUTION: Motors delivered with SMI21 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.

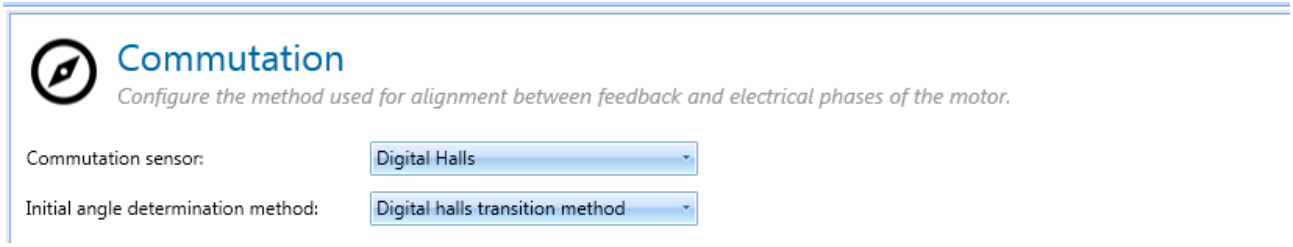
CAUTION: Foldback is not the same as current limits. Instantaneous current limits for the drive are set by the Max system current in the system Limits view in DCmind Soft CANopen. The foldback algorithms may reduce the current output to the motor in spite of the current limit settings.

5.1.2. *Setting up motor foldback*

The parameter entries required for the drive to apply motor foldback protection properly are Cycle Time, Peak 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.



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.

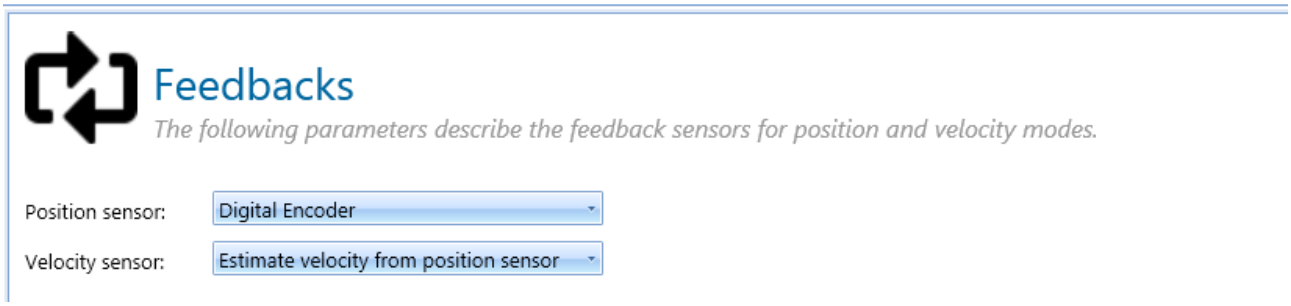
Several methods are proposed:

- **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 from the drop-down list, the sensor item will be displayed in the settings navigation tree and from them can be properly configured.

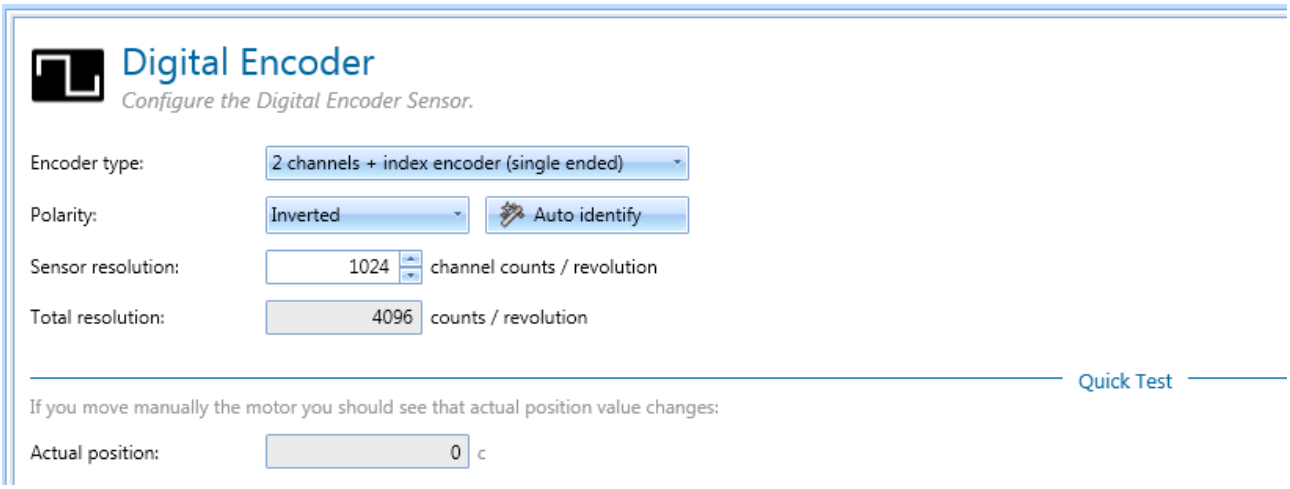


The parameters available for each type of feedback will be dependent on the option selected.

5.2.1. *Digital encoder*

This view allows configuration of digital encoder parameters:

(already set in motors coming from CROUZET factory)



- **Encoder 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"

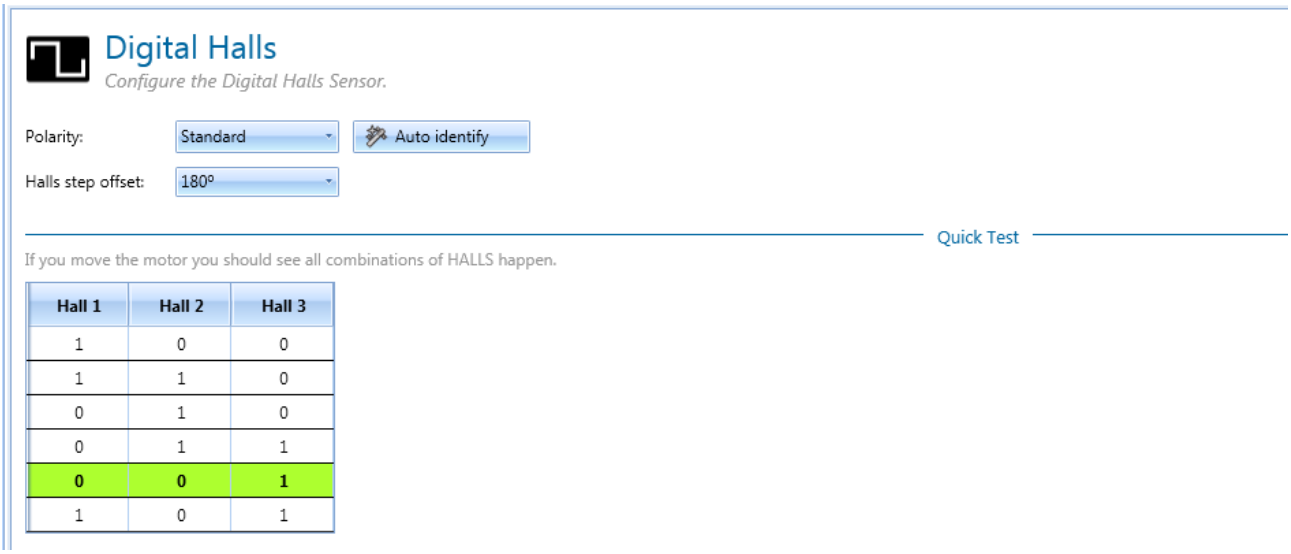
Quick test: This view helps to monitor the actual position value according to actual encoder configuration and user units selected.

CAUTION: SMI21 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.

5.2.2. *Digital Halls*

This view allows configuration of digital halls parameters:

(already set in motors coming from CROUZET factory)

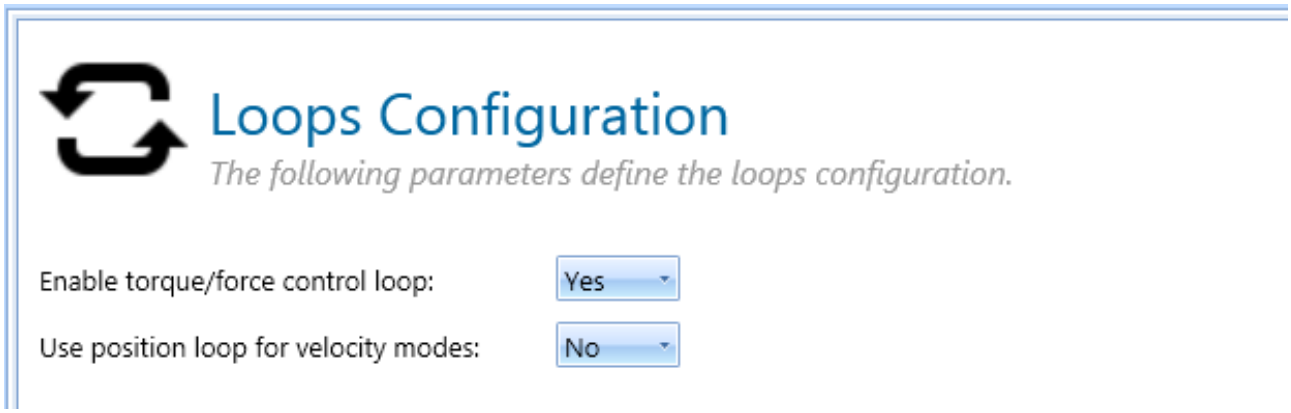


- **Polarity**: Define whether halls are active at high or low logical level.
- **Hall step offset**: Define the angular displacement (expressed in multiples of 60º) between the sequence of values generated by the Hall sensors and its corresponding excitation. This offset only applies when the system 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-pole motor has 12 counts per revolution)

5.3. Loops configuration

This view allows you to select the configuration for the loops in charge of regulating position, velocity and current.



Two parameters are available:

Enable torque/force control loop: enables or disables the current loop.

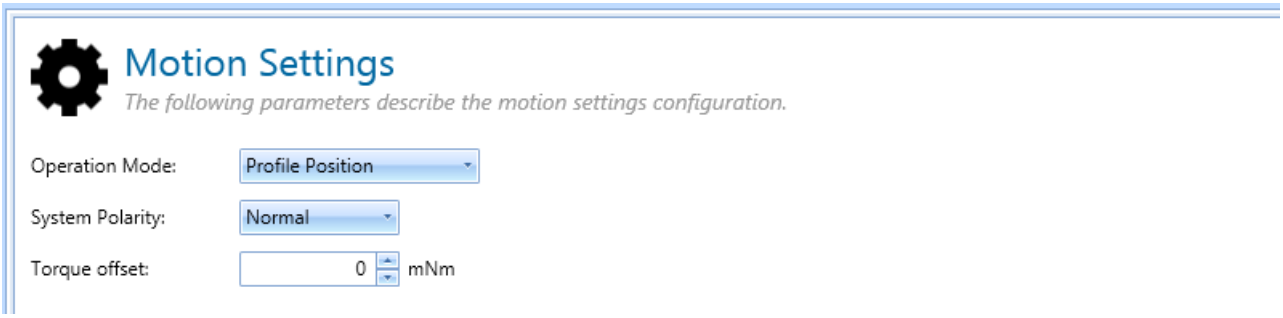
Use position loop for velocity modes: sets the position loop (or alternatively the velocity loop) for velocity modes such as homing or profile velocity.

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.

6. MOTION SETTINGS

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

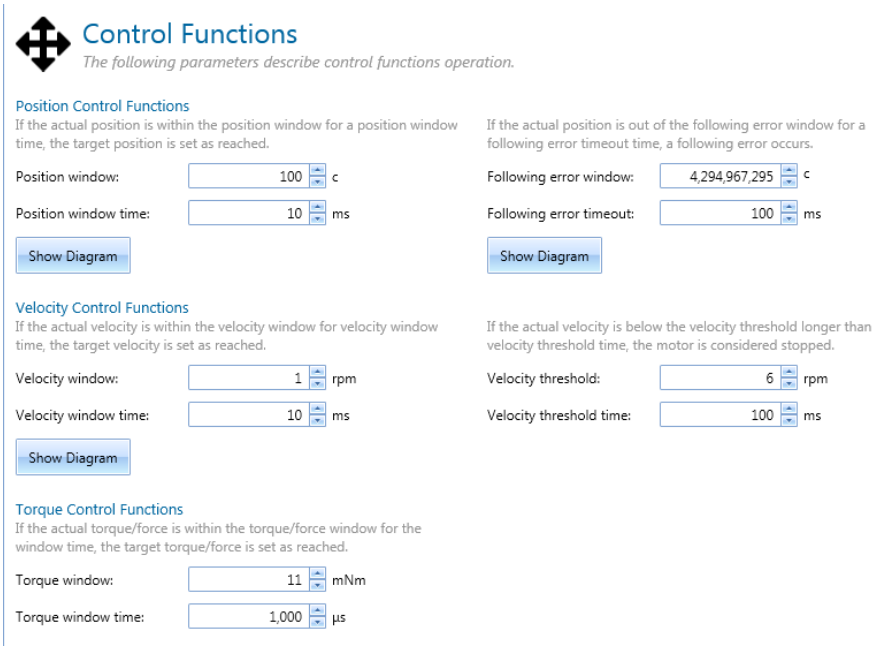


- **Operation mode**: There are up to eight operation modes available in SMI21 CANopen drive (position, velocity, homing, etc.).
- **System polarity** indicates the direction for positive movements and for negative movements. The system polarity is used in all modes. As the direction of torque, velocity and position could be changed it allows reversing the direction of a system without modifying any cabling.
- **Torque/Force offset** indicates the offset for the force/torque value. The torque/force offset is useful to compensate systems with constant loads like vertical mounted systems or springs.

6.1. Control Functions

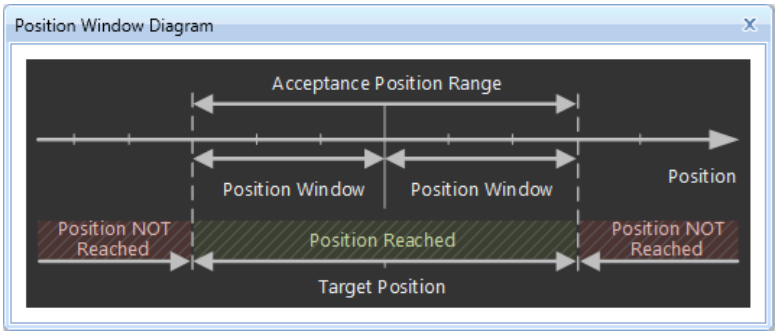
The position, velocity and torque control functions parameters work in conjunction with position, velocity and torque loops. The position and velocity loops are powered from the output of the profiler and from the position/velocity detector or feedback output.

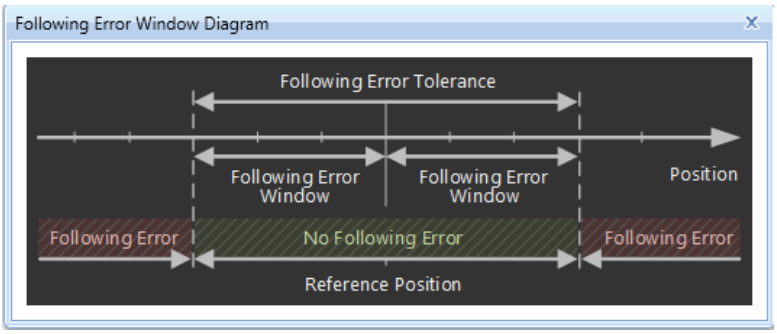
The output of the position/velocity loops will be input to the flux-torque or current loop.



Parameters for *Position control functions* sub-group are:

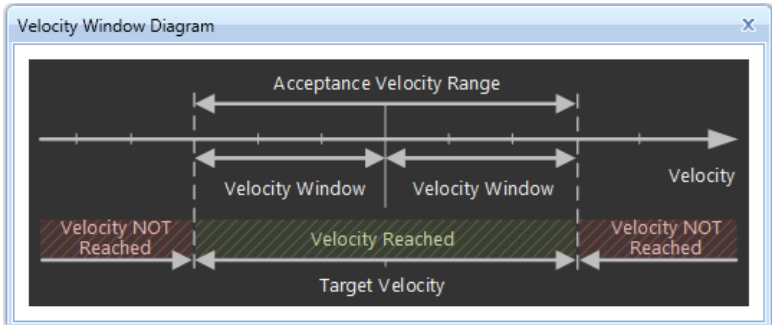
- **Position window**: this parameter indicates the configured symmetrical range of accepted position relative to the target position. If the actual value of the position encoder is within the position window, this target position shall be regarded as having been reached. As the user mostly prefers to 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:

- **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.



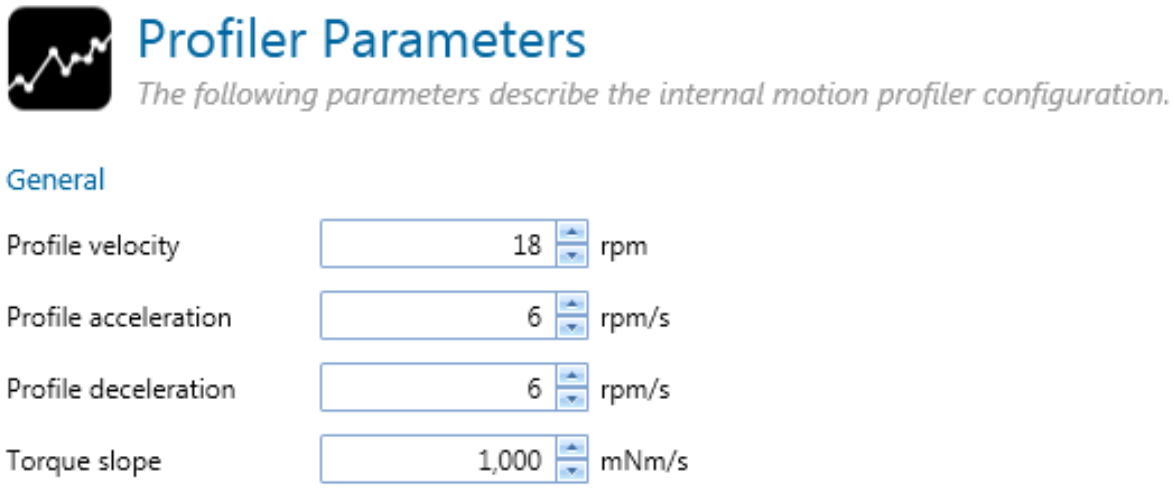
Parameters for T*orque control functions* sub-group are:

- **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.

6.2. **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.

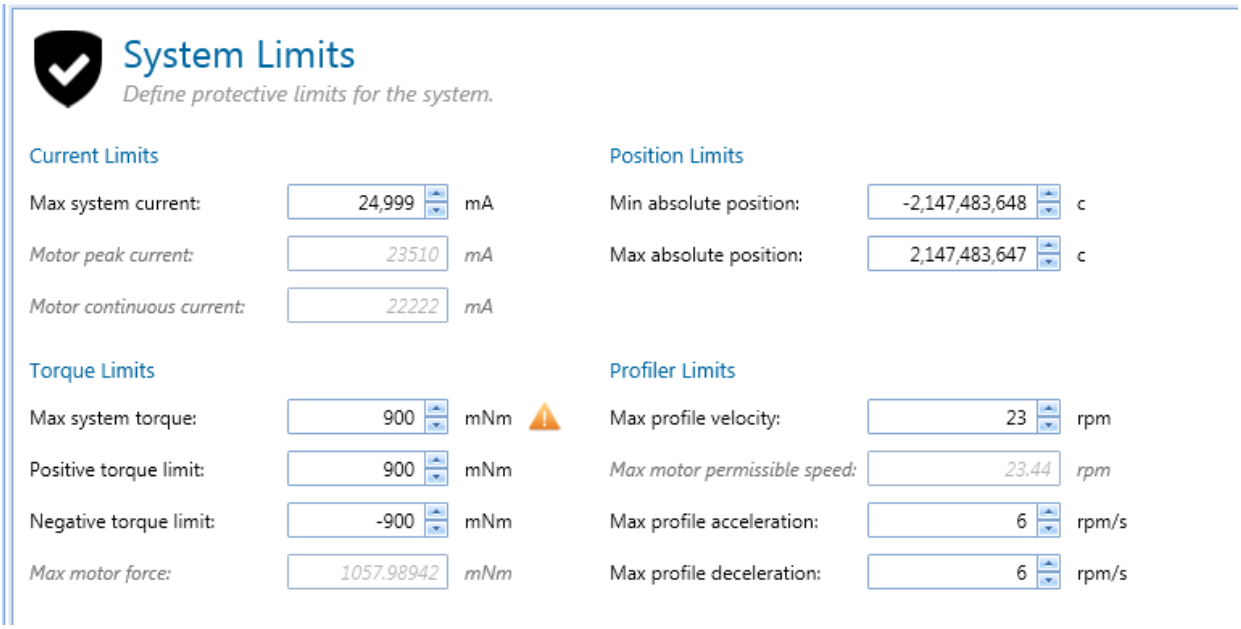


The available parameters are:

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

6.3. System limits

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



6.3.1. *Current Limits*

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

6.3.2. *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)

Positive and Negative 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 current, Max torque, Positive torque limit value and Negative torque limit value objects should not limit the peak current.

6.3.3. *Position Limits*

Min/Max position limit 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.

6.3.4. *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.

7. INPUTS / OUTPUTS

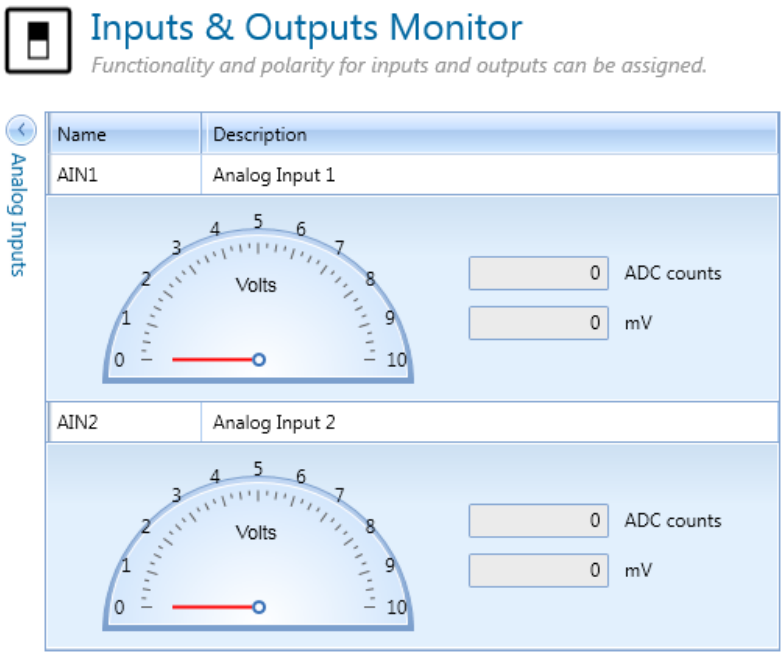
The SMI21 CANopen drive has programmable digital/analog inputs and outputs that you can use to initiate motion, control auxiliary devices, or trigger other actions. The inputs and outputs should be wired according to the instructions in the motor datasheet.

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.

7.1. Analog Inputs

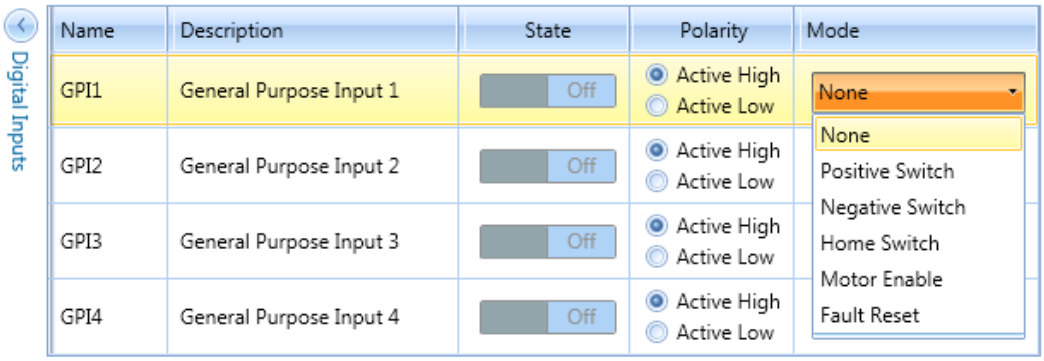
All the analog input values are shown graphically and numerically (in ADC counts and mV).



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

7.2. Digital Inputs

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



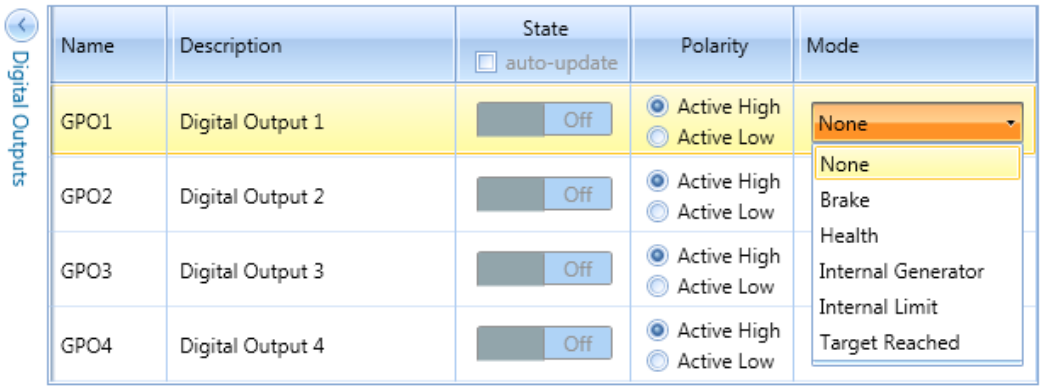
Two parameters can be configured:

- **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 Settings --> Power.
  - "Fault Reset": When activated, the board is unblocked after an error occurs.

7.3. 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.



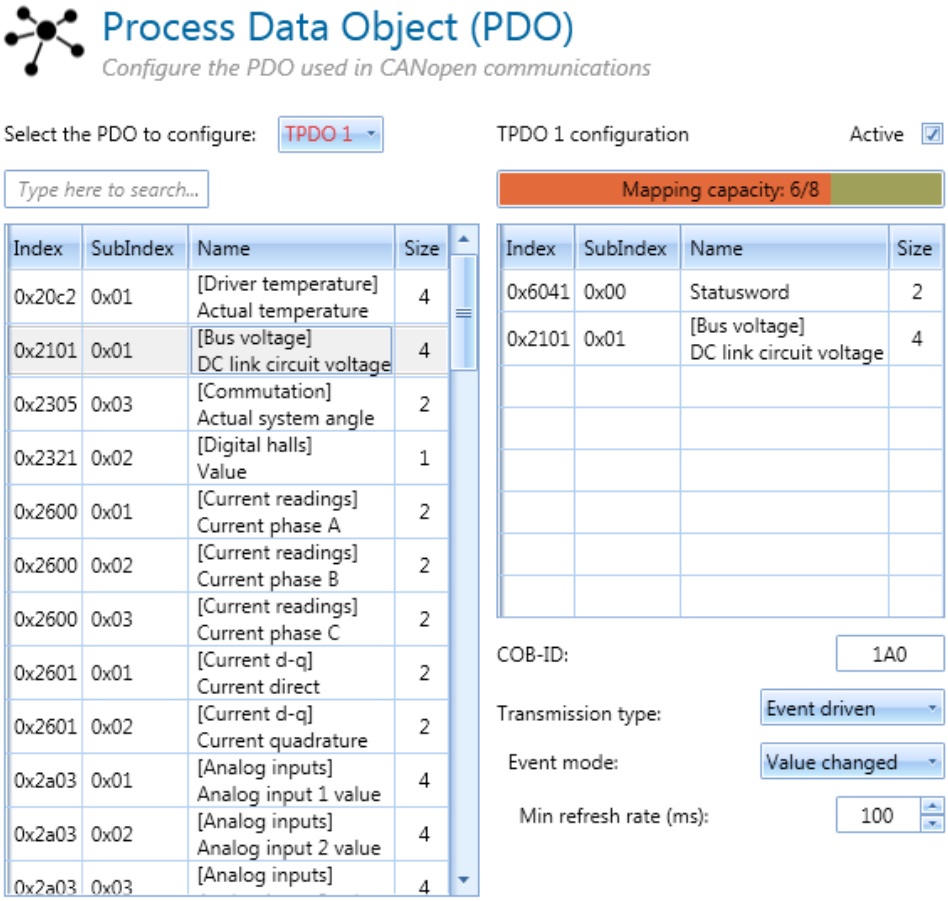
Two parameters can be configured:

- **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
  - "Health": It notifies if the drive is in Fault state or not.
  - "Internal Generator": Not available on SMI21 CANOpen drive
  - "Internal Limit": It is activated when an internal limit, as a switch, is reached.
  - "Target Reached": In motion control, this signal notifies that target value has been reached.

8. 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.



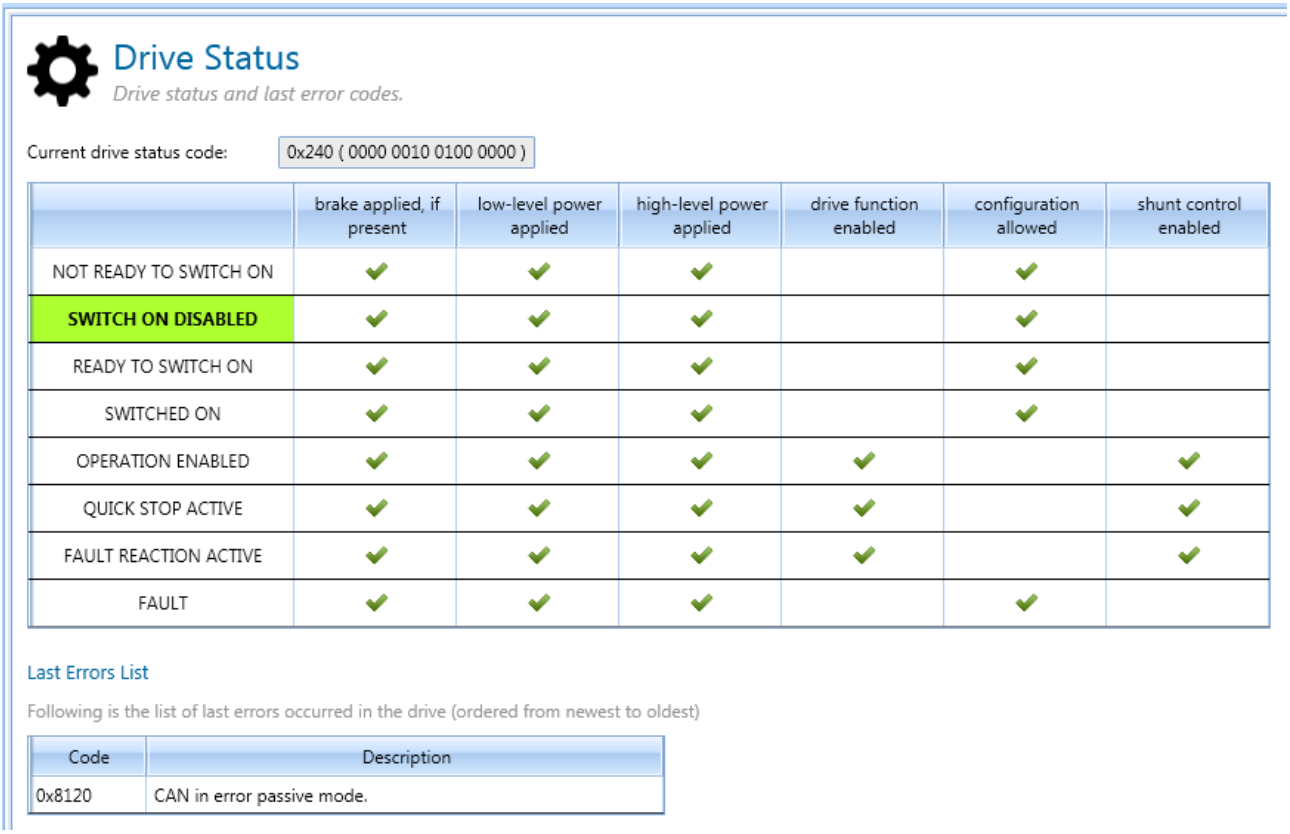
In the left part of the screen appear the **mappable objects**, and they can be dragged to the right part of the screen to map them to the current PDO.

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.

9. DRIVE STATUS

Drive Status allows you to view the current status of the drive internal state machine.



Drive Status

Drive status and last error codes.

Current drive status code: 0x240 (0000 0010 0100 0000)

	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	✔	✔	✔		✔	

Last Errors List

Following is the list of last errors occurred in the drive (ordered from newest to oldest)

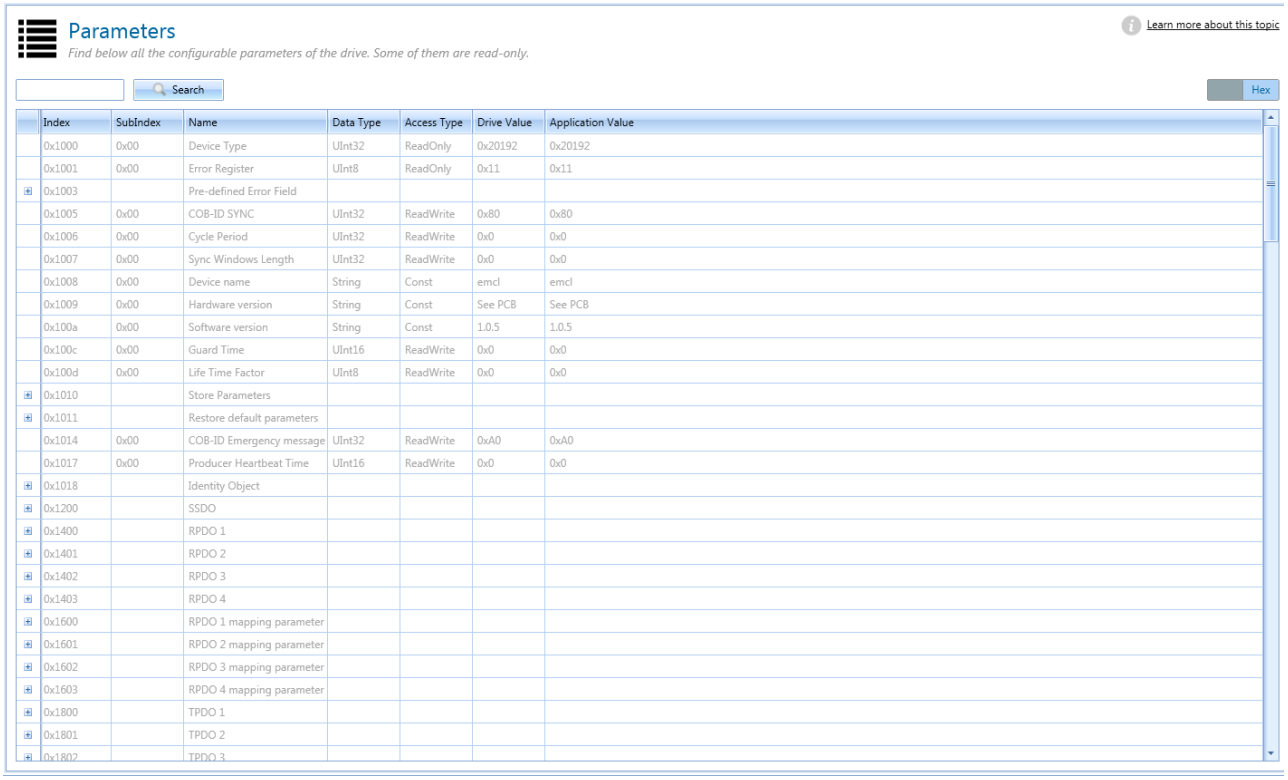
Code	Description
0x8120	CAN in error passive mode.

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.

10. DRIVE 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)



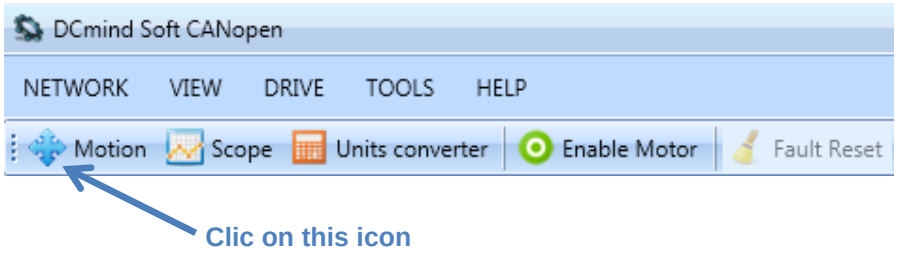
Index	SubIndex	Name	Data Type	Access Type	Drive Value	Application Value
0x1000	0x00	Device Type	UInt32	ReadOnly	0x20192	0x20192
0x1001	0x00	Error Register	UInt8	ReadOnly	0x11	0x11
0x1003		Pre-defined Error Field				
0x1005	0x00	COB-ID SYNC	UInt32	ReadWrite	0x80	0x80
0x1006	0x00	Cycle Period	UInt32	ReadWrite	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	1.0.5	1.0.5
0x100c	0x00	Guard Time	UInt16	ReadWrite	0x0	0x0
0x100d	0x00	Life Time Factor	UInt8	ReadWrite	0x0	0x0
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				

The following options are available at the top menu:

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

11. MOTION

DCmind Soft CANopen includes a **Motion Test Tool** 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.

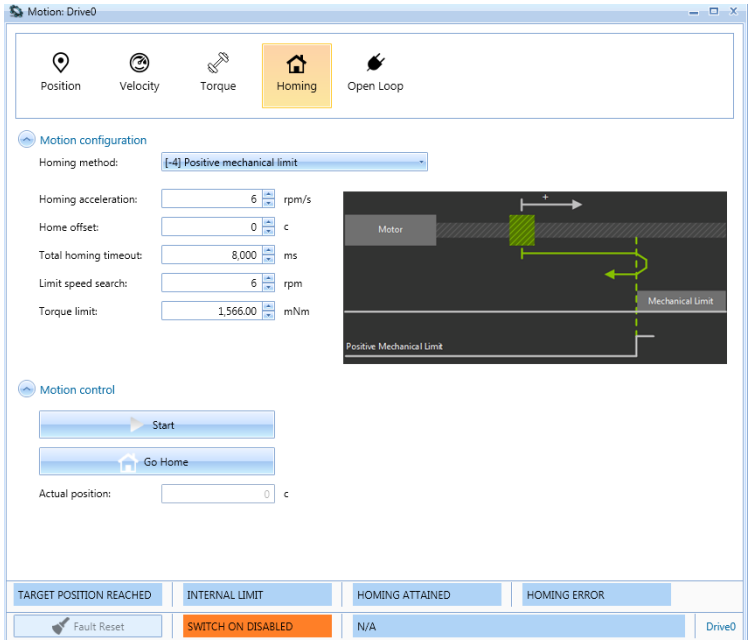


After configuring a specific profile, user can execute it with the ***Start*** button and stop it at any time. All parameters can be changed during execution and update the motion profile using the ***Update Motion Values*** button.

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

11.1. 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.
- **Total 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.

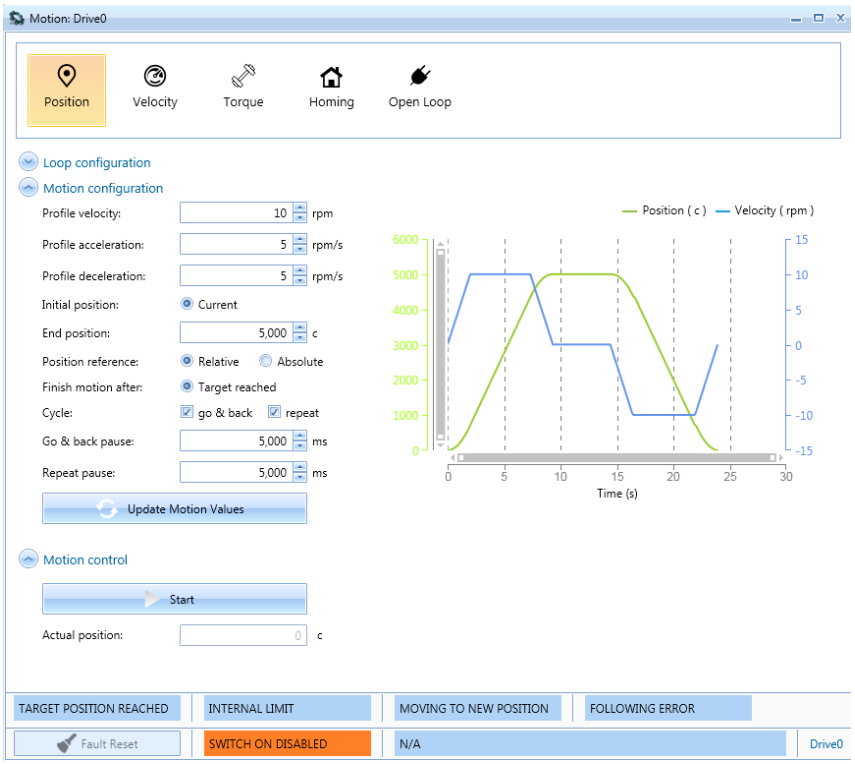
CAUTION: Some homing parameters could only be available for specific homing methods. Once homing motion has been configured, user can execute it. To do it just click on the Start button and wait for homing completion.

The **Go Home** button allows for commanding position zero to servo drive.

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

11.2. Profile Position

Specify velocity and acceleration to reach a given position.

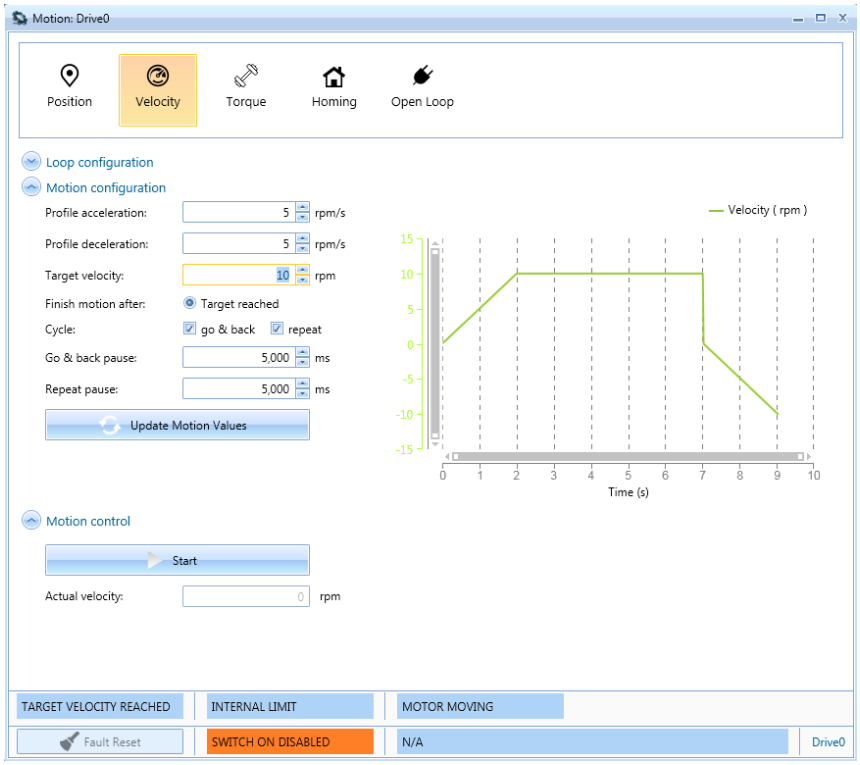


Parameters for *Profile position* are:

- **Velocity:** It indicates the velocity applied to the profile.
- **Acceleration / Deceleration:** Acc/ decel applied to the displacement.
- **Initial position:** Defines if the movement will start from current position or from a given value.
- **End position:** Displacement in counts or user units.
- **Position reference:** It defines whether the movement is relative or absolute to current position or to zero position.
- **Finish motion after:** End can be defined either by time or when target position is reached.
- **Cycle:** With *Go&back* enable, system will move to a target position and then return to initial position. With *Cyclic* enable, it will be executed all the time until pressing *Stop*.
- **Go&back pause:** Time in ms between a *Go&back* sequence
- **Repeat pause:** Time in ms between cycles

11.3. Profile Velocity

Specify acceleration and deceleration to reach a target speed.

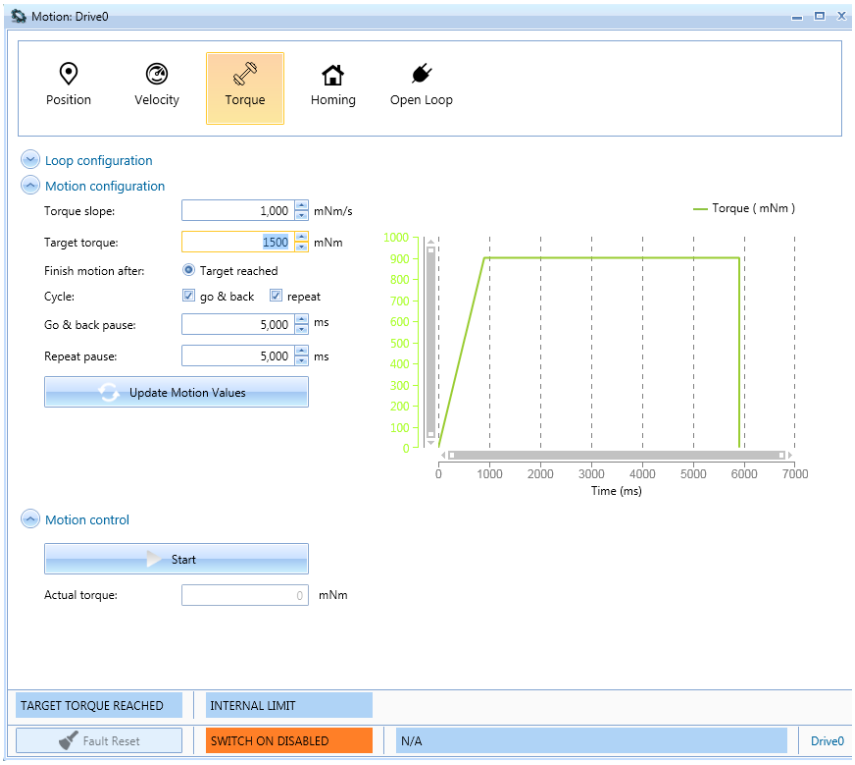


Parameters for *Profile Velocity* are:

- **Acceleration / Deceleration:** Acc/ decel applied to reach target velocity.
- **Target velocity :** Velocity in counts/s or user units.
- **Cycle:** With *Go&back* enable, system will move to a target velocity and then return to initial values. With *Cyclic* enable, it will be executed all the time until pressing *Stop.*
- **Finish motion after:** End can be defined either by time or when target velocity is reached.
- **Go&back pause:** Time in ms between a go and back sequence.
- **Repeat pause:** Time in ms between cycles.

11.4. Profile Force

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



Parameters for *Profile force* are:

- **Force slope:** It sets how force/ torque will increase.
- **Target force:** Setpoint in mNm.
- **Cycle:** With *Go&back* enable, system will move to a target torque and then return with the opposite value. With *Cyclic* enable, it will be executed all the time until pressing *Stop.*
- **Finish motion after:** End can be defined either by time or when target force is reached.
- **Go&back pause:** Time in ms between a go and back sequence.
- **Repeat pause:** Time in ms between cycles.

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.

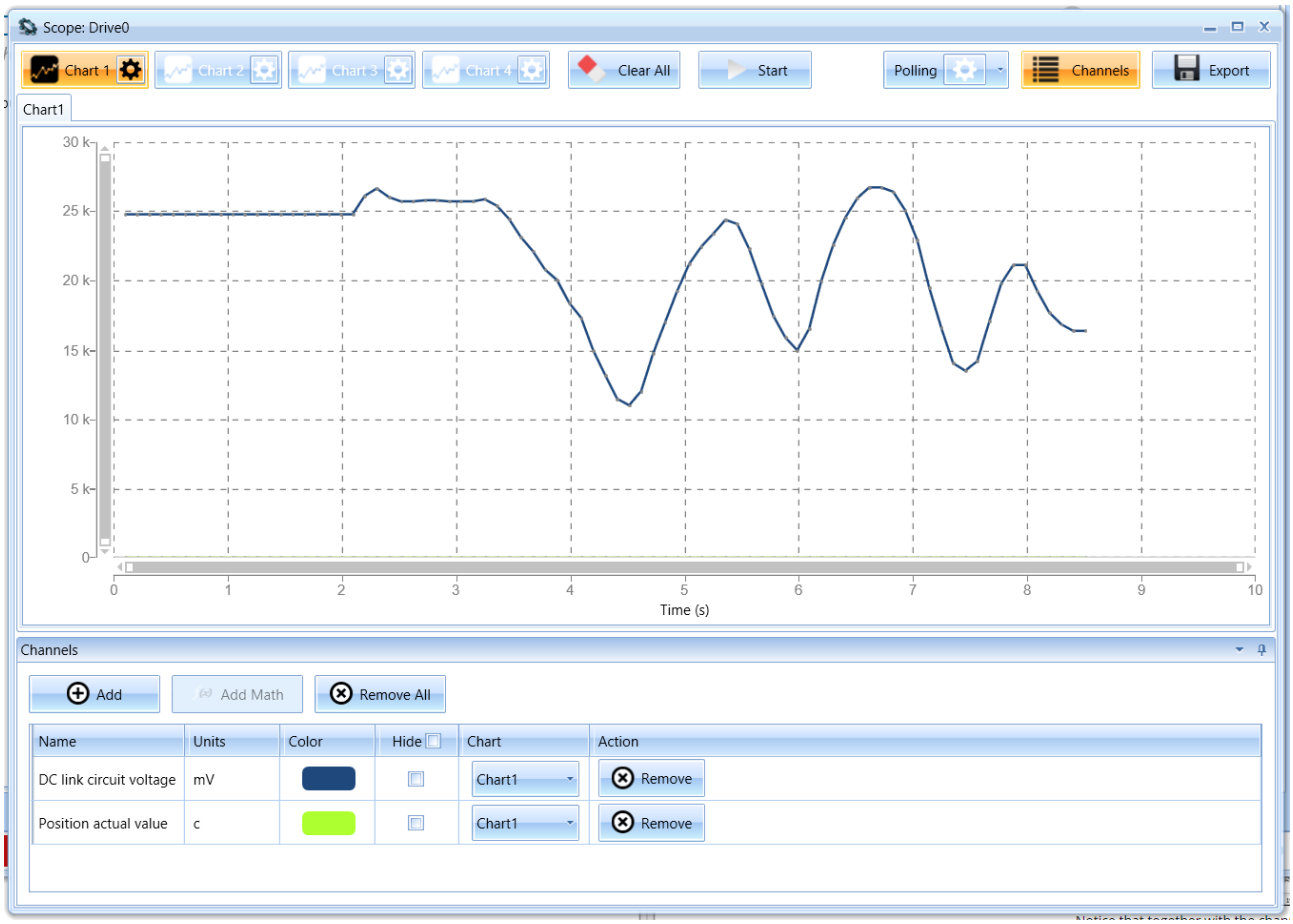
CAUTION: Notice that some configuration parameters are populated by default with the values entered under Profiler.

12. SCOPE

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 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



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

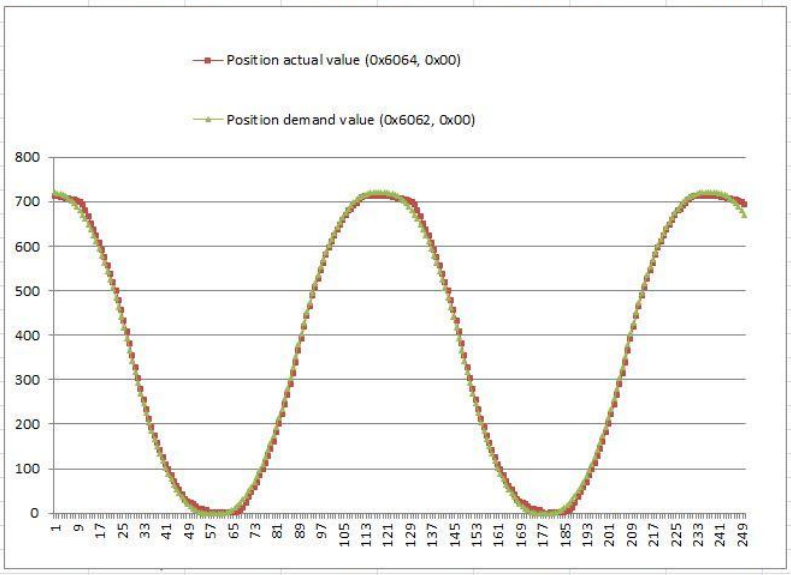
collects up to 2500 points and by default plots all the relevant motion signals (demanded and current values) which afterwards can be disabled for individual channel analysis.

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)

A	B	C	D	E	F	G	H	I	J	K	L	M
Time	Position actu	Position den	Time	Position den	Time	Velocity actu	Time	Velocity den	Time	Velocity den	Time	Torque actu
0	711,81	719,91									0	17,75
8	711,81	719,37									8	12,75
16	711,27	717,75									16	10,25
24	709,92	715,23									24	6,75
32	707,94	711,81									32	3,5
40	706,59	707,31									40	-13
48	705,87	701,91									48	-30,75
56	704,7	695,61									56	-41,5
64	703,08	688,23									64	-56,25
72	700,02	679,95									72	-64,5
80	692,82	670,77									80	-44
88	681,3	660,51									88	-35,75
96	666,18	649,35									96	-16,75
104	652,05	637,29									104	-23,5
112	638,37	624,15									112	-23,5
120	623,43	610,11									120	-18,75
128	607,86	595,17									128	-22
136	592,65	579,15									136	-32,75
144	575,1	562,23									144	-22
152	557,73	544,41									152	-25,75
160	539,01	525,51									160	-15
168	519,21	505,71									168	-22
176	499,77	485,01									176	-31,75
184	477,72	463,23									184	-21,25
192	455,85	440,55	192	-15,3	192	-456	192	-472	192	-16	192	-35,5



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 CANopen drive is compliant with the following profiles: CiA-301, CiA-303, CiA-305, CiA-306 and CiA-402.