Operating Guide

VLT® Motion Control Tool MCT 10



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1 Introduction

1.1 Purpose of the Operating Guide

This guide provides basic knowledge required to use the VLT® Motion Control Tool MCT 10 with Danfoss drives. Familiarity with the following is assumed:

- MS®-Windows™ at user level.
- Setup, process knowledge, and operation of the drive.
- Use of and linkage with communication equipment.

The operating guide does not provide any detailed information regarding specific applications or possible solutions and related parameter combinations in the setup and use of a drive. Refer to the drive-related operating guide and design guide. Any update of the guide and instructions related to MCT 10 is available at https://www.danfoss.com.

Familiarity with the PC or PLC master of the system is assumed. Issues regarding hardware or software produced by other manufacturers are beyond the scope of this guide and are not the responsibility of Danfoss.

Refer to the appropriate guides for more information about master-to-master communication, or communication to a non Danfoss follower.

1.2 Document and Software Version

This manual is regularly reviewed and updated. All suggestions for improvement are welcome.

Edition	Remarks	Software version
AQ283728700891, version 13	Security Administration Tool added.	6.3X

1.3 Intended Use

The VLT® Motion Control Tool MCT 10 enables full system configuration and control. With MCT 10, it is possible to monitor the entire system more efficiently for faster diagnosis and better preventive maintenance.

Use cases of MCT 10:

- For planning a new communication network offline.
- For commissioning drives online.
- For easy replacement of drives.
- For easy expansion of networks with more drives.
- For backup of parameter settings of drives in a communication network.
- MCT 10 supports PROFIBUS DP-V1 communication via a master class 2 connection. This connection eliminates the need for an extra communication network.

The communication framework part of MCT 10 is handling the control of the fieldbuses. It provides enhanced capabilities allowing multiple concurrent fieldbus communications. Several fieldbuses can be configured and combined in the same network with MCT 10.

NOTE: If several fieldbuses are created with the same type, make sure that they are configured with different scan ranges.

1.4 Software Modules

The VLT® Motion Control Tool MCT 10 software is supplied in 2 modules:

- MCT 10 software for:
  - Setting the drive parameters.

- Copying parameter sets to and from the drive.
- Documentation/printout of setup, including diagrams.
- Servicing and fault analysis.

- APoss program for creating APoss programs.

1.5 Features of the VLT® Motion Control Tool MCT 10

- Project-oriented PC tool, 1 tool for all drive series.
- Links to all Windows™ applications possible.
- Supports Siemens CP PCMCIA- and PCI cards for PROFIBUS DP-V1 master class 2 connection.
- Supports standard interfaces: USB, RS-485, Ethernet TSC.
- Siemens PG/Field PGs already have the required hardware.
- Downwards compatibility with Dos-Dialog (*.mnu) and WinDialog (*.vlt).
- Windows™ Explorer-like interface for quick and easy start-up and navigation.

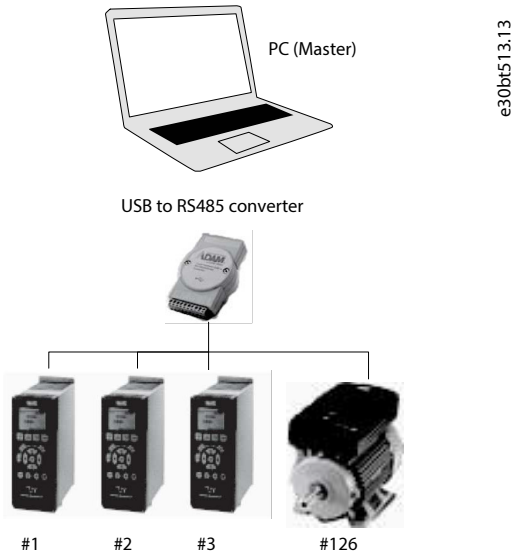

Figure 1: Connect up to 126 Nodes with a Repeater and up to 31 Nodes without a Repeater

1.6 Versions

VLT® Motion Control Tool MCT 10 is available in 2 versions. Go to https://suite.mydrive.danfoss.com/ for more information and for downloading the program.

1.7 Further Information

The following guides related to VLT® Motion Control Tool MCT 10 are available:

- VLT® PROFIBUS DP-V1 MCA 101 Installation Guide
- Drive-specific design guides

Refer to https://www.danfoss.com/en/about-danfoss/our-businesses/drives/ for more information.

It is also possible to find video training material on this site for operating the MCT 10.

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2 Safety

2.1 Safety Symbols

The following symbols are used in Danfoss documentation and products.

⚠ DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates information considered important, but not hazard-related (for example, messages relating to property damage).

	ISO warning symbol for general warnings
	ISO warning symbol for hot surfaces and burn hazard
	ISO warning symbol for high voltage and electric shock
	Symbol for indicating the required discharge time of the capacitors in the product.
	ISO action symbol for referring to the instructions

2.2 Safety Precautions

⚠ WARNING



HIGH VOLTAGE

Drives contain high voltage when connected to AC mains input, DC supply, load sharing, or permanent motors. Failure to use qualified personnel to install, start up, and maintain the drive can result in death or serious injury.

- Only qualified personnel must install, start up, and maintain the drive.
- Before performing any service or repair work, use an appropriate voltage measuring device to make sure that there is no remaining voltage on the drive.

⚠ WARNING

UNINTENDED START

When the drive is connected to AC mains, DC supply, or load sharing, the motor may start at any time. The motor may start by activation of an external switch, a fieldbus command, an input reference signal from the LCP or LOP, via remote operation using VLT® Motion Control Tool MCT 10, or after a cleared fault condition. Unintended start during programming, service, or repair work can result in death, serious injury, or property damage.

- Disconnect the drive from the mains.
- Press *[Off/Reset]* on the LCP before programming parameters.
- Ensure that the drive is fully wired and assembled when it is connected to AC mains, DC supply, or load sharing.

⚠ WARNING



DISCHARGE TIME

The drive contains DC-link capacitors, which can remain charged even when the drive is not powered. High voltage can be present even when the warning indicator lights are off.

Failure to wait the specified time after power has been removed before performing service or repair work could result in death or serious injury.

- Stop the motor.
- Disconnect AC mains, permanent magnet type motors, and remote DC-link supplies, including battery backups, UPS, and DC-link connections to other drives.
- Wait for the capacitors to discharge fully. The discharge time is specified on the drive nameplate.
- Measure the voltage level of the capacitors to verify that there is no voltage before opening the drive or performing any work on the drive.

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3 Installing and Uninstalling

3.1 Introduction to Installation

The VLT® Motion Control Tool MCT 10 software and SyncPos modules are installed via a multilingual, self-explanatory installation program.

3.2 Starting the Installation Program

1. Run MCT10_Vx.xx.msi.
2. Follow the instructions of the installation program.

When the installation process is complete, the MCT 10 Set-up Software is found on the following path:



Figure 2: Path for the MCT 10 Set-up Software

3.3 Selecting the Software Language

The Danfoss default language is English. If another language is selected, it becomes the new default.

1. Select *Options* from the main menu, then select *Select Language*.
2. Select the wanted language from the scrollbar and click *OK*.

NOTE: Changing the language affects the parameter language. If an external LCP is connected to the drive, the change of language version does not affect the language in the display.

3. Close and restart MCT 10 to activate the language setting.

3.4 Uninstalling the Software

NOTE: The following procedure is only valid for Windows™ operating systems.

1. Press *Start*.
2. Select *Settings*.
3. Select *Control Panel*.

4. Double-click *Remove/Add Programs*.
5. Select *Remove*.

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4 Communication Setup

4.1 Communication Options

Drives in the VLT® HVAC Drive FC 102, VLT® AQUA Drive FC 202, VLT® Midi Drive FC 280, and VLT® AutomationDrive FC 302 series are equipped with a USB port. Communication from a PC can be established using a standard A–B male-to-male USB cable connected to the drive. No extra hardware or bus configuration is required. If the PC is equipped with more than 1 USB port, several drives can be connected. The USB bus is automatically added to the network bus list.

Establish a hardwired connection through:

- Standard built-in RS-485, or
- USB port.

The USB interface socket allows devices to be connected and disconnected using hot swapping. When connecting a drive using USB, VLT® Motion Control Tool MCT 10 automatically adds it to the bus list.

If the Ethernet based option is mounted in the drive, for example, VLT® PROFINET MCA 120 or VLT® EtherNet/IP MCA 121, establish the connection via Ethernet based network.

If the VLT® PROFIBUS DP-V1 MCA 101 option is mounted in the drive, establish the connection via PROFIBUS master class 2 connection (MSAC 2)

NOTE: Connect soft starters either via a USB cable or via Ethernet.

NOTICE

RISK OF DAMAGE TO PC USB HOST CONTROLLER

When connecting the PC to the drive through the USB cable, there is a risk of damaging the PC USB host controller.

- Follow the recommendations for grounding described in the operating guide for the relevant drive.
- Use a USB isolator with galvanic isolation to protect the PC USB host controller from ground potential differences when connecting the PC to a drive through a USB cable.
- Do NOT use a PC power cable with a ground plug when the PC is connected to the drive through a USB cable.

Communication from a PC can be established via RS232 to RS-485 converters or via USB to RS-485 converters.

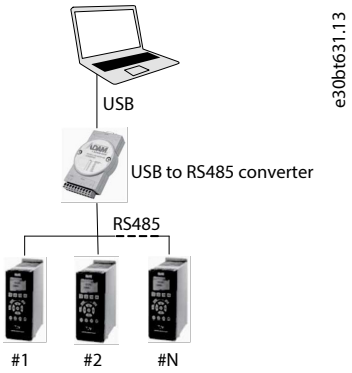

Figure 3: Communication from a PC

4.2 Manual Fieldbus Configuration

After installation, configure the non-plug-and-play networks via the fieldbus configuration dialog.

1. Start the VLT® Motion Control Tool MCT 10.
2. Select *Network*.

3. Right-click *Network* and select *Add/Remove/Configure Buses*.

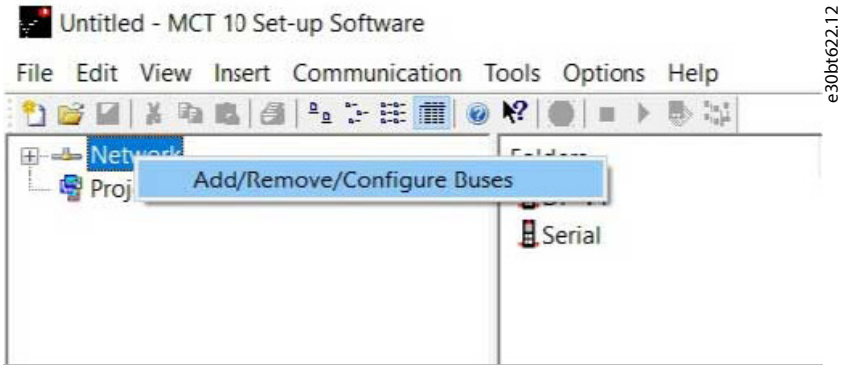

Figure 4: Refreshing the Fieldbus List

4. Add, remove, or configure the properties for the connected fieldbuses.

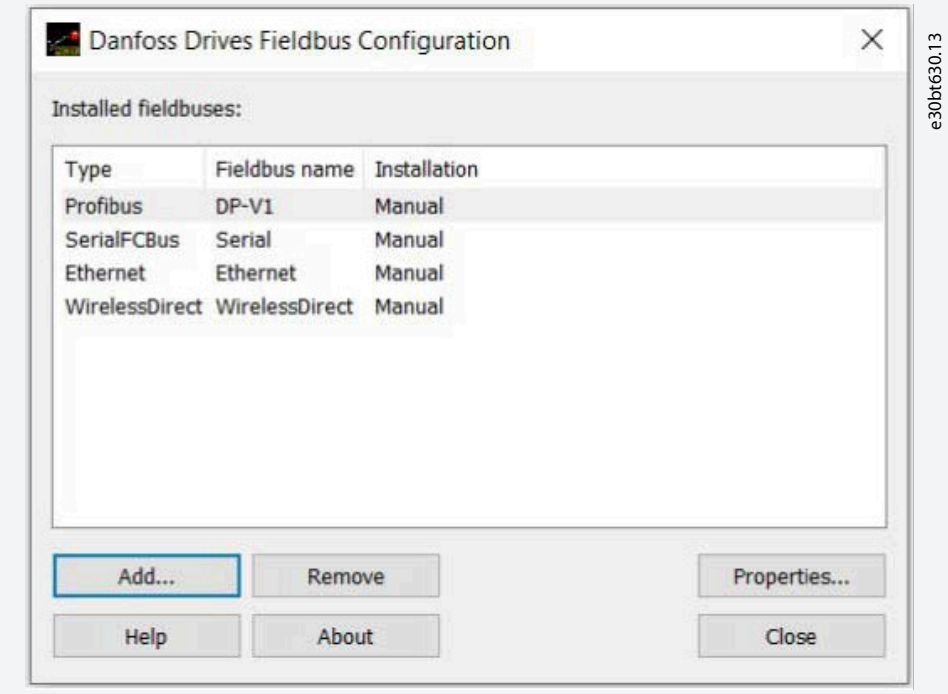

Figure 5: Fieldbus Configuration

5. Scan the network for active drives to make MCT 10 indicate available drives on the non-plug-and-play fieldbuses.

4.3 Scan

4.3.1 Automatic Scan

Only the USB fieldbus is scanned automatically when a drive is connected to the PC. For non-plug-and-play fieldbuses, scan manually for active drives.

4.3.2 Scan Range Configuration

Enter the preferred scan setting by right-clicking *on Serial bus* and then selecting *Configure Bus*.

Adding a standard bus RS-485 or PROFIBUS to the network tree configures the scan range to scan the entire address range. The Ethernet-TSC bus is added using the current IP address settings.

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The fieldbus scan range can be configured in several ways:

- Right-click the *Fieldbus* icon in the network tree and select *Configure Bus*.
- Mark the *Fieldbus* icon in the network tree and select *Configure* under *Communication* in the main menu bar.
- Open the *Fieldbus Configuration* dialog, right-click the *Network* icon, and select *Add/Remove/Configure Buses*.
- Open from the Windows™ panel.



Figure 6: Scan Network Icon

4.3.3 Scan Network

Scan a fieldbus in 3 ways:

- Right-click the *Fieldbus* icon in the network tree and select *Scan Bus* for active drives.
- Mark the *Fieldbus* icon in the network tree and select *Scan/Refresh* under *Communication* in the main menu bar.
- Mark the *Fieldbus* icon in the network tree and select the *Scan* icon on the toolbar.

The *Scanning for Drives* window appears and indicates the progress of the scan.

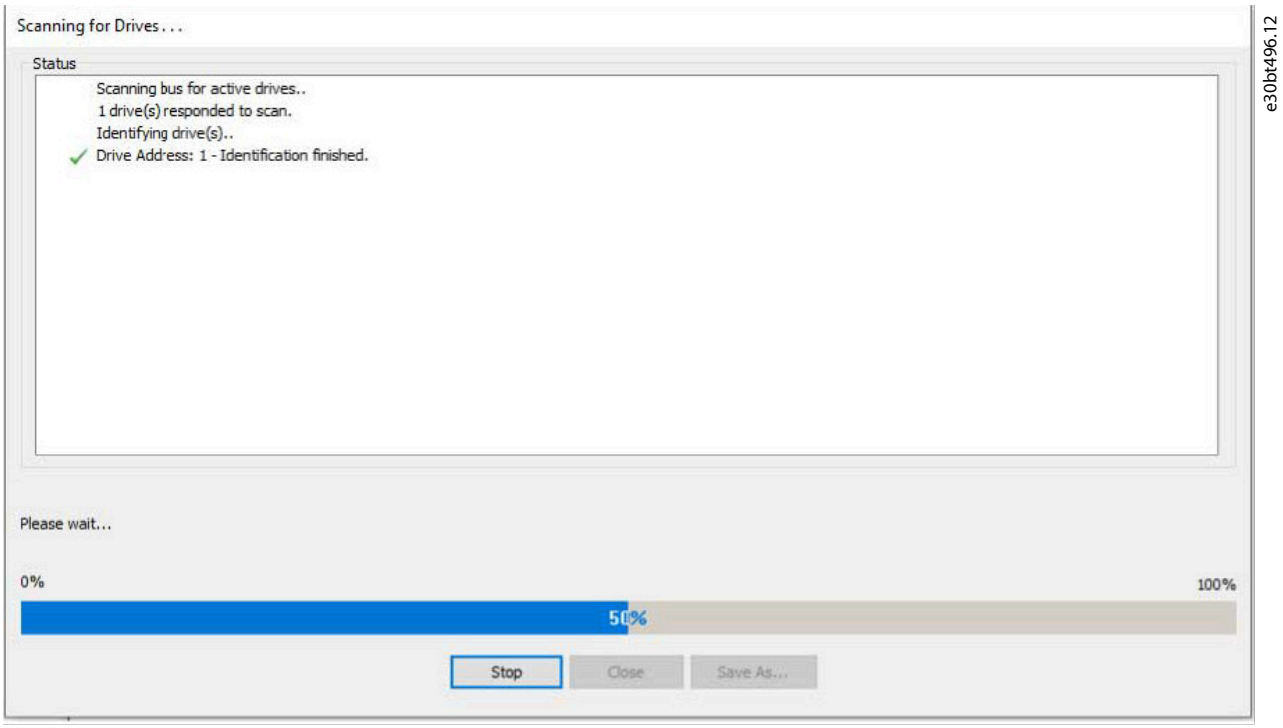

Figure 7: Progress of Network Scanning

4.4 RS-485 Communication

4.4.1 Set Up the Drive with RS-485 Data Communication

All drives can be configured to 9600 (default), 19200, 38400, 57600, or 115200 baud. The serial configuration is always configured with:

- 8 data bits.
- 1 stop bit.

- Even parity.

4.4.2 Configuring the Fieldbus

When using an RS-485 converter as the Advantech ADAM converter, VLT® Motion Control Tool MCT 10 indicates online drives available on the fieldbus after scanning.

NOTE: Protocol and advanced settings are for performance optimization and should normally not be changed.

1. Open the *Serial Fieldbus Configuration* dialog box or right-click the appropriate fieldbus.

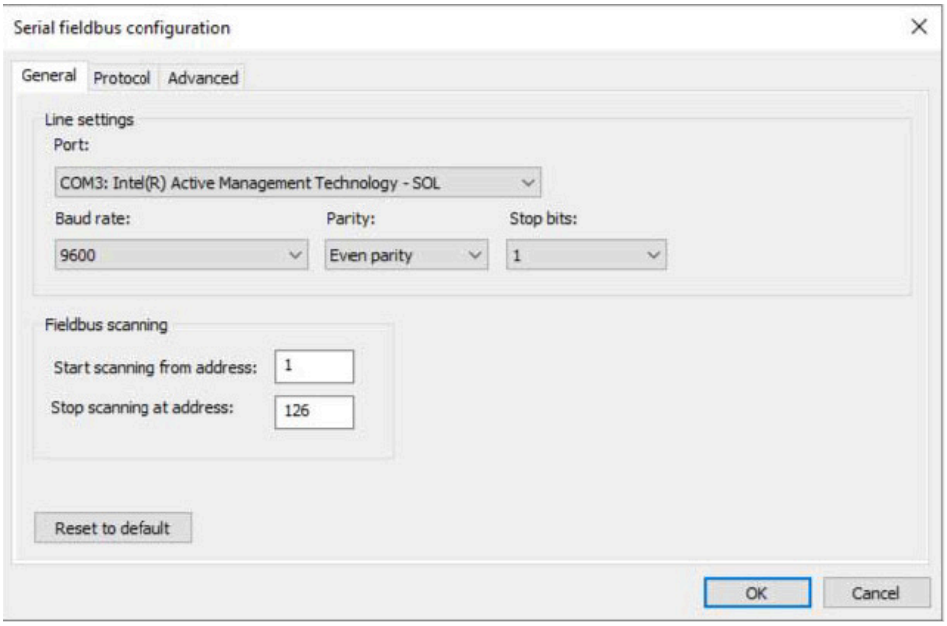

Figure 8: Serial Fieldbus Configuration

2. Set the COM port number.

   When using USB to RS-485 converters, the actual COM port number can be identified from the device manager part of the Windows™ control panel.

3. Set the baud rate, parity, and the number of stop bits (must match the settings in the drive).
4. Set the fieldbus scanning range to the available address to limit the time scanning for active drives.
5. Press *OK* to activate settings or select to restore the default settings.

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4.4.3 USB Data Communication

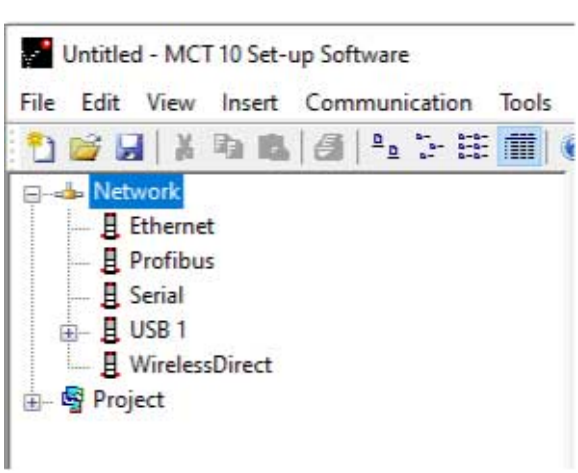

Figure 9: Network Bus List

When the USB cable is disconnected, the drive connected via the USB port is removed from the network bus list.

4.5 MCT 10 with Soft Starters

4.5.1 Setup of Soft Starter

Setting up connectivity to the VLT® Soft Starter MCD 500 and VLT® Soft Starter MCD 600 requires that the USB communication module is mounted on the soft starter. Communication from a PC can be established using a standard A–B male-to-male USB cable connected to the USB communication module. If the PC is equipped with more than 1 USB port or a USB HUB, several soft starters can be connected.

4.5.2 Serial Configuration

All soft starters can be configured to 300, 1200, 4800, 9600 (default), 19200, 38400, 57600, or 115200 baud. The serial configuration is always configured with:

- 8 data bits.
- 1 stop bit.
- No parity.

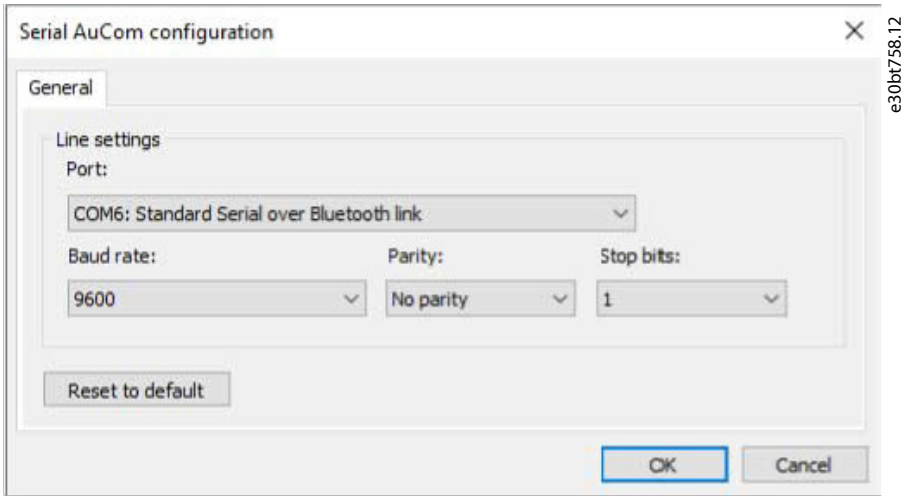

Figure 10: Serial Configuration of Soft Starters

4.5.3 Configuring the Fieldbus

1. Add and configure the fieldbus from the *Fieldbus Configuration* dialog.

   If the fieldbus is already added to the network, it can be reconfigured by right-clicking on the appropriate soft starter fieldbus.

2. Set the COM port number. The actual COM port number can be identified from the device manager part of the control panel.
3. Set the baud rate, parity, and the number of stop bits (must match the setting in the soft starter).
4. *Reset to Default* restores the general settings and fieldbus scanning to factory configuration values.

4.5.4 Using the Hilscher NetIdent Protocol

Use the tool for searching for devices and for identifying and changing IP addresses. The tool also has a filtering function.

1. Click the *Tools* menu.
2. Select *Soft Starter Discover and Configuration Tool*.

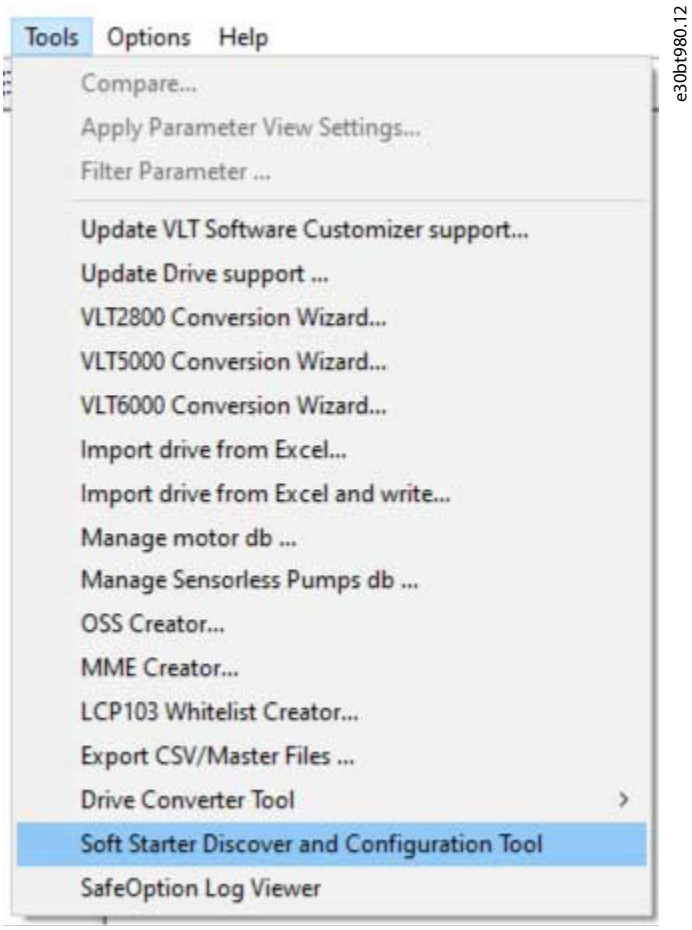

Figure 11: Selecting the Hilscher NetIdent Protocol

3. Select the soft starter for which the IP address should be configured.
4. Click *Configure*.

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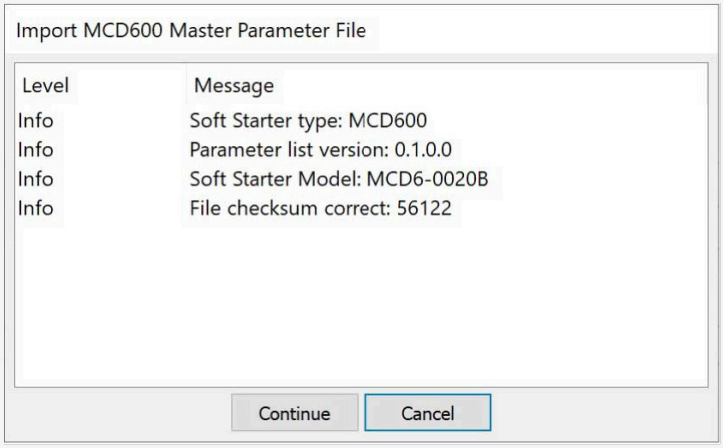
4.5.5 Importing/Exporting Parameter Files, MCD 600

With the VLT® Soft Starter MCD 600, a parameter file, (PAR file) can be exported from the soft starter to a USB stick and copied into VLT® Motion Control Tool MCT 10. After changing the file in MCT 10, the PAR file can be copied back to the USB stick and applied to the soft starter.

1. Create an MCD 600 project soft starter.
2. Right-click the project folder.
3. Select *Import Parameters*.
4. From the dialog, select the file to import.

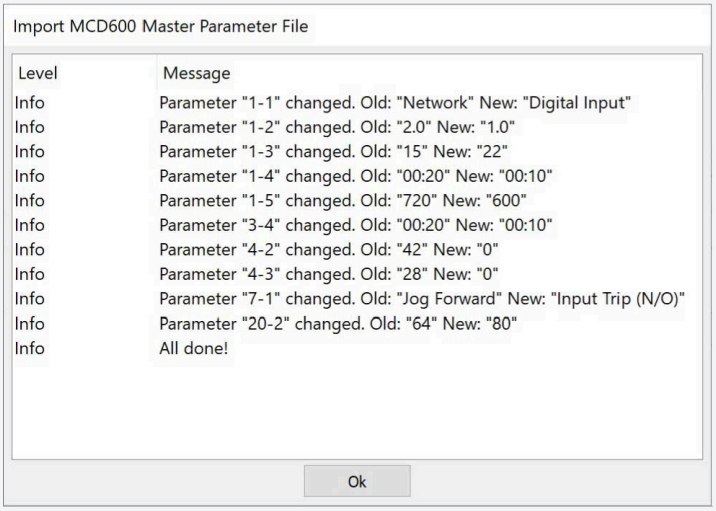
A dialog opens and shows information about the selected file.



e30bu310.12

If the soft starter differs from the project, it shows up as an error or warning in this view, depending on the difference.

5. Press *Continue* to apply the file.

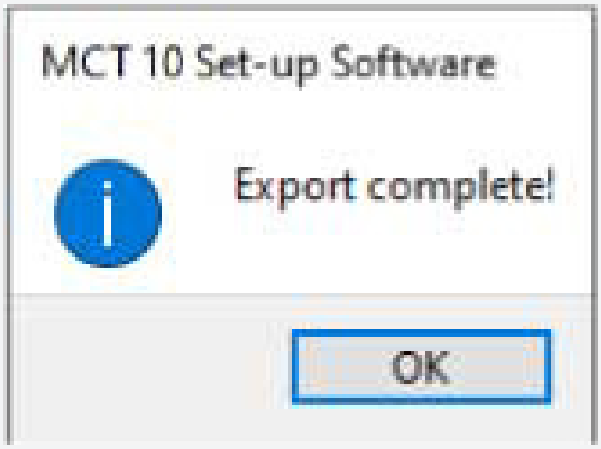


e30bu311.12

6. Click *OK* to close the window.
7. Right-click the project to export from MCT 10.
8. Select the parameters to export.

9. In the file selection dialog, select where to export the file to.

A dialog appears when the export is complete.



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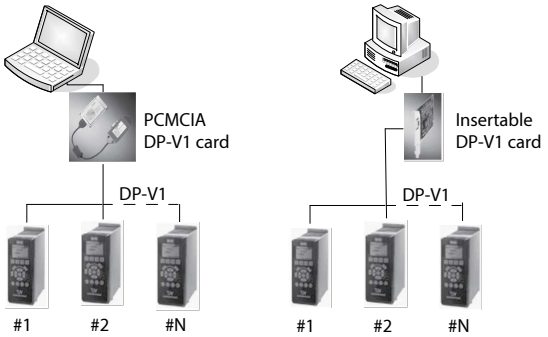
4.6 PROFIBUS DP-V1 Communication

4.6.1 Requirements

Setting up PROFIBUS DP-V1 communication requires a VLT® PROFIBUS DP-V1 MCA 101 option module. Communication from a PC using PROFIBUS DP-V1 can be established using a PROFIBUS PCMCIA card or a card installed in the PC. The PROFIBUS cable from the drive is connected to the 9-pin sub D socket connector on the card.



e30bt634.11

Figure 12: PROFIBUS DP-V1 Communication

NOTE: Connectivity via PROFIBUS DP-V1 to a VLT® AutomationDrive FC 302 using the VLT® PROFIBUS Converter MCA 114 with option firmware version 2.03 is not possible via MCT 10. Use the fieldbus or USB bus instead.

4.6.2 Configuring PROFIBUS DP-V1

When using a PROFIBUS interface card with the associated driver installed, VLT® Motion Control Tool MCT 10 indicates online drives available on the specific PROFIBUS after scanning the bus for active drives.

1. Configure the bus from the *Fieldbus Configuration* dialog or by right-clicking the appropriate PROFIBUS bus.

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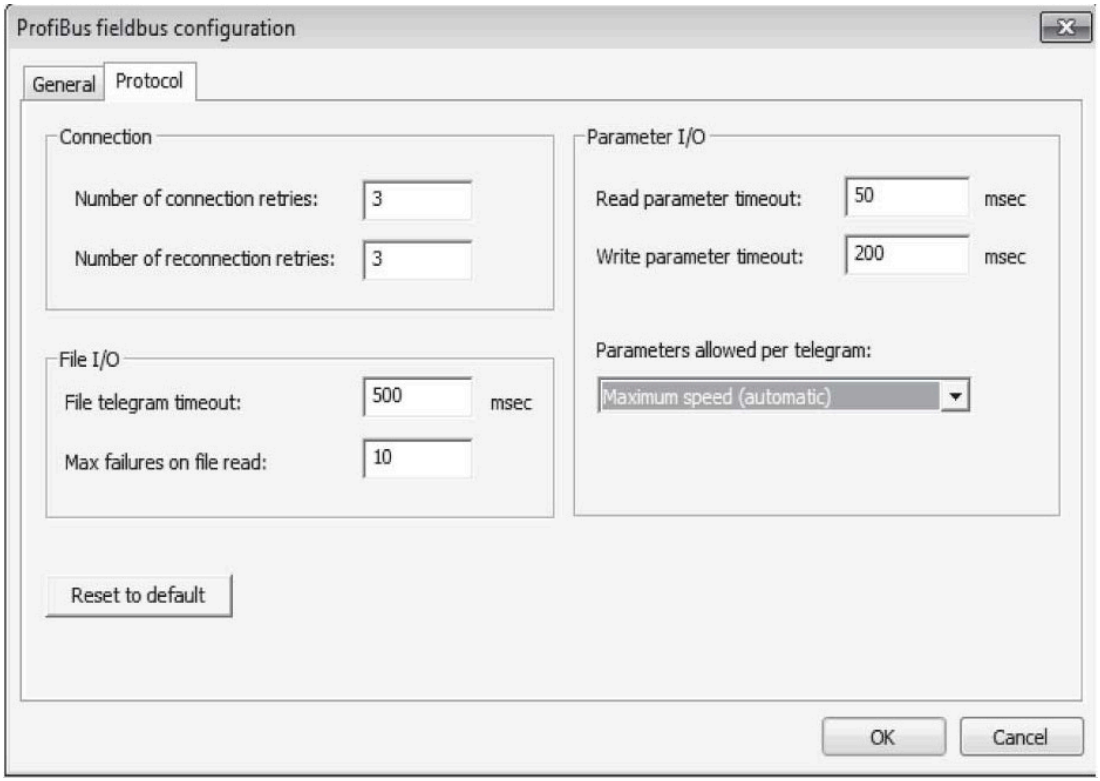

Figure 13: PROFIBUS Fieldbus Configuration

2. Set the board number.
3. Set the fieldbus scanning range to the available addresses only to limit the time used for scanning active drives.
4. Click *OK* to activate or click *Reset to default* to restore factory settings.

4.6.3 DP-V1 Connection and PG/PC Interface

The VLT® Motion Control Tool MCT 10 PROFIBUS DP-V1 fieldbus plug-in uses the Siemens SoftNet driver available from Step7, or alternatively Simatic NET, to establish connectivity via the supported master class 2 cards such as CP5511 or CP5512.

NOTE: STEP7 Lite version does not support the SoftNet driver.

4.6.4 Setting Up the PG/PC Interface

This procedure explains how to set up the PG/PC Interface from default configuration to open the PROFIBUS connection from VLT® Motion Control Tool MCT 10. Cabling and terminations must be in accordance with wiring and cabling requirements for PROFIBUS.

1. Open the PG/PC Interface.



Figure 14: Set PG/PC Interface

2. Configure *Access Point of the Application* to CP-L2_1 pointing to the master class 2 card used.
3. Set *Interface Parameter Assignment Used* corresponding to the master class 2 card used.
4. Select *Properties* to configure the station- and network parameters.
   - Station parameters:
     - Set *PG/PC is the only master on the bus* to *Active* if no PLC is active on the bus. Use the *Diagnostics* described later to select a valid PROFIBUS address.
   - Network parameters:
     - Set the *Transmission rate* to the same baud rate as the PLC if it is active.
5. Select *DP* in *Profile* and click *OK* to close the *Properties* dialog.
6. Select *Diagnostics* in the *Set PG/PC Interface* to verify network- and bus communication.

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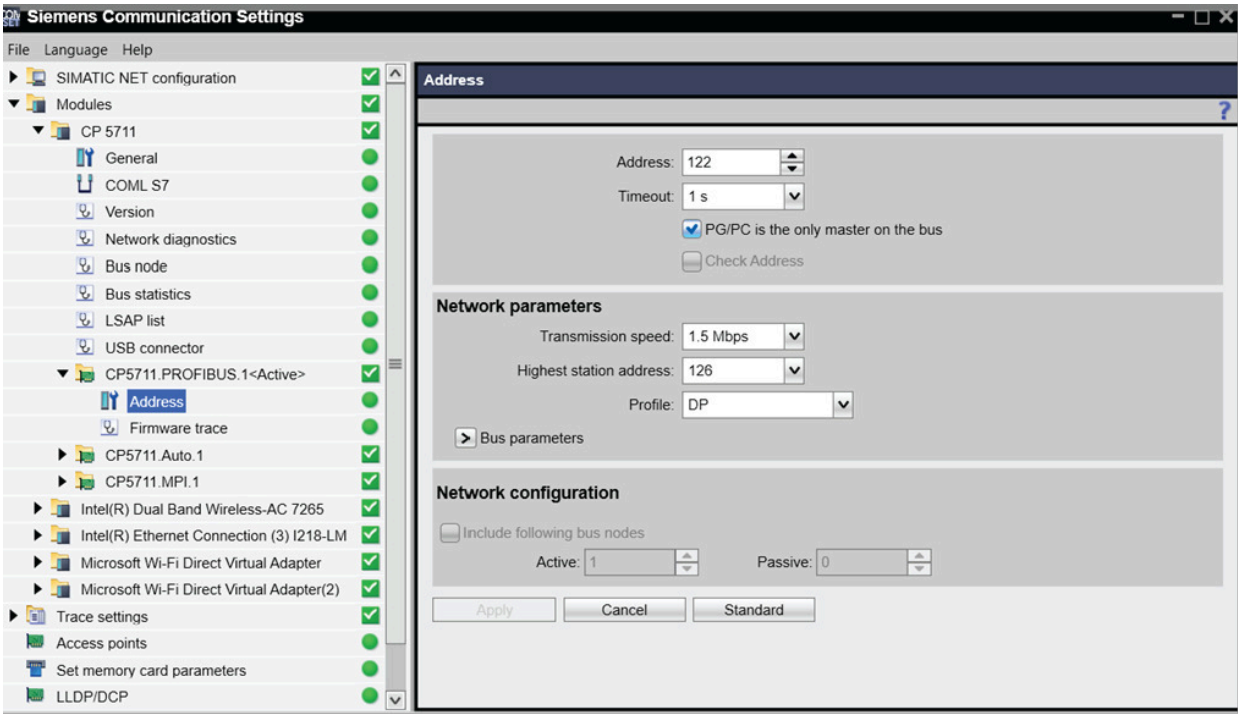
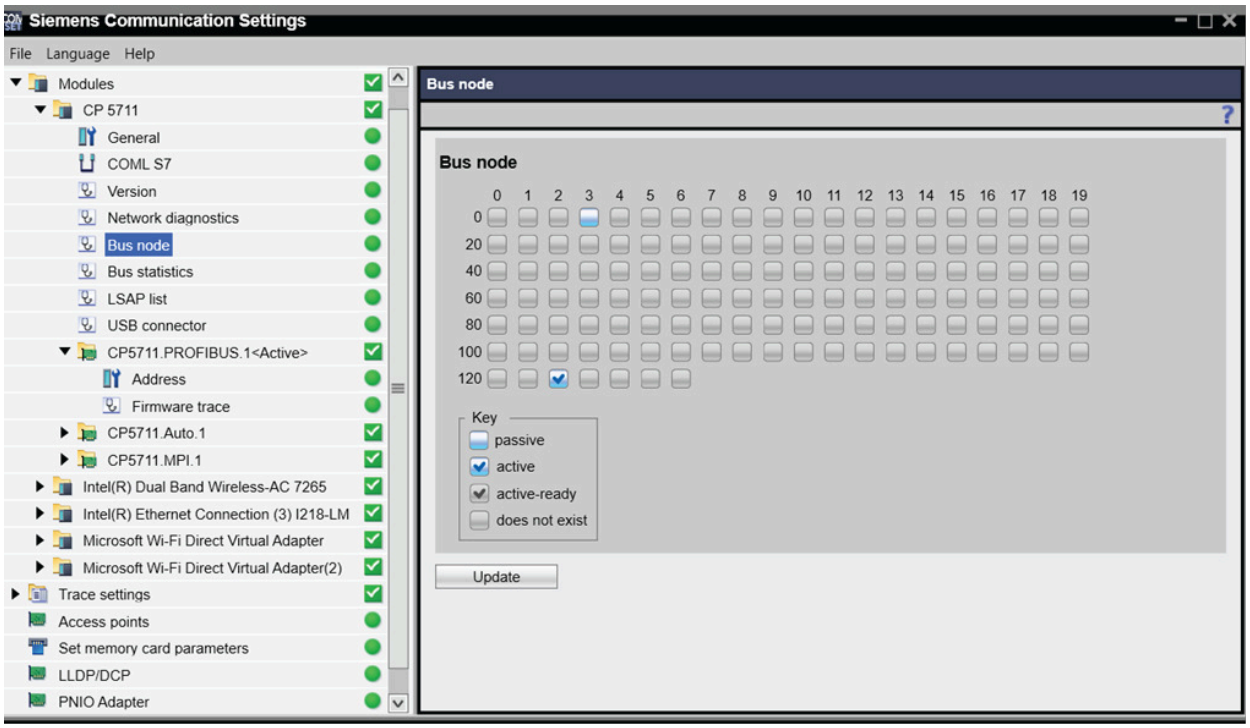


e30bt790.12

Figure 15: Properties Dialog



e30bt791.11

Figure 16: Simatic Network Diagnostics Dialog

7. Select *Test* to verify the access path and network configuration. If a sharing violation is detected, the test results in an error message. When the test result is successful, select *Read* to identify the active PROFIBUS nodes available on the network. Make sure that the address defined for the PG/PC interface does not conflict with an active node.
8. Close the PG/PC interface and start MCT 10.
9. Right-click a PROFIBUS and select *Scan* for active drives. MCT 10 identifies the same node IDs, except PLCs.

4.6.5 PROFIBUS Multitelegrams

With the *Parameters allowed per telegram* drop-down list, it is possible to configure the number of requests to be associated within a multitelegram. The standard allows up to 40 telegrams to be associated.

The following options are available:

- *Maximum speed* (default configuration). Handles the association automatically and adapts the number of telegrams for each drive according to the series. Can be used in PROFIBUS networks containing both old and new Danfoss drives.
- *Conservative*. Always associates 10 telegrams within a multitelegram. This option is useful when communicating only with old products such as the VLT® Decentral Drives FCD 300, VLT® DriveMotor FCM 300, series derived from VLT® HVAC Drive FC 102, VLT® AQUA Drive FC 202, and VLT® AutomationDrive FC 302.
- *Single request*. Only 1 request per telegram.

4.7 Ethernet-TSC Data Communication

4.7.1 Requirements for Ethernet-TSC Communication

To set up an Ethernet-TSC (transparent socket channel) communication, the VLT® EtherNet/IP MCA 121 option module is required within the drive. Communication from a PC can be established using a standard Ethernet cable connected to the drive.

4.7.2 Ethernet-TSC Configuration

An Ethernet-TSC bus is scanned using DDP (drive discovery protocol). The protocol does not require an IP port number and IP scan range. It identifies drives based on the MAC addresses.

> NOTE: When scanning through different subnets or remotely via a VPN tunnel, it is advised not to utilize the ADDP protocol but to use an IP range.

Click *Refresh* to generate a list of all active drives in the Ethernet. The list appears in the *Ethernet Fieldbus Settings* dialog when the scan is complete.

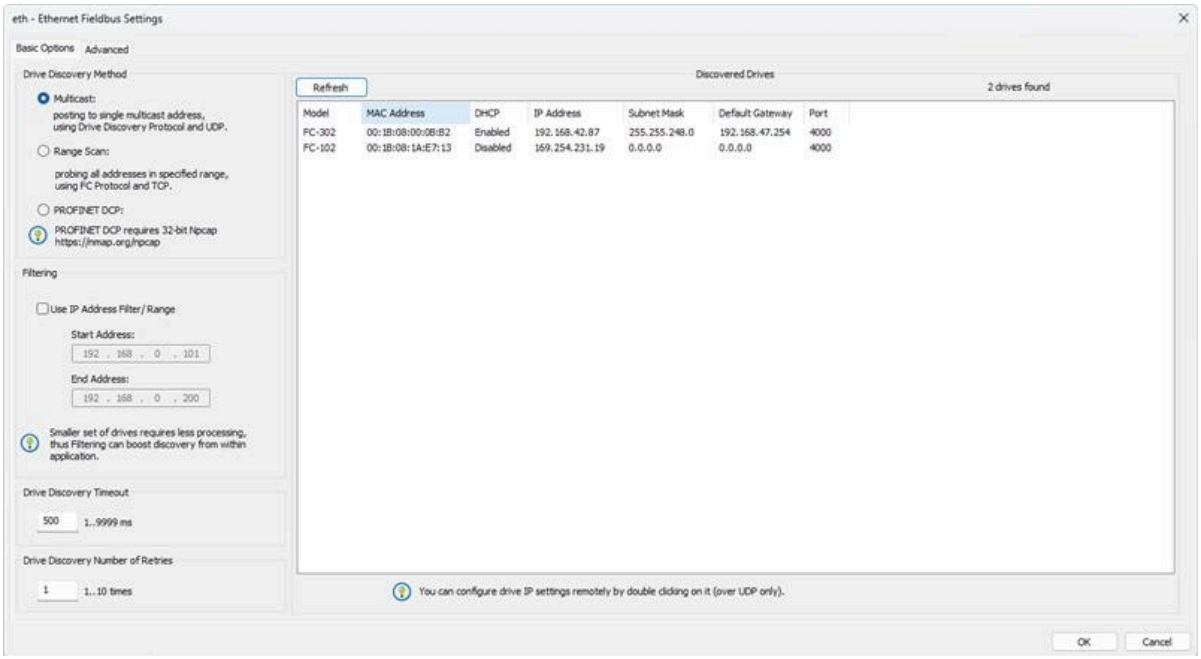


Figure 17: ADDP Configuration

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Drive types without any IP configuration use their Auto IP Class B address, which is 169.254.yy.xx, with yy.xx corresponding to the last 2 segments in the MAC address. Several uncommissioned drives without any IP configuration can be scanned on the same network.

Select a device from the *Discovered Drives* list to;

- Get more information about the device.
- Assign a static IP address, a subnet mask, or default value to the drive.
- Set up DHCP (dynamic host configuration protocol) look-up.

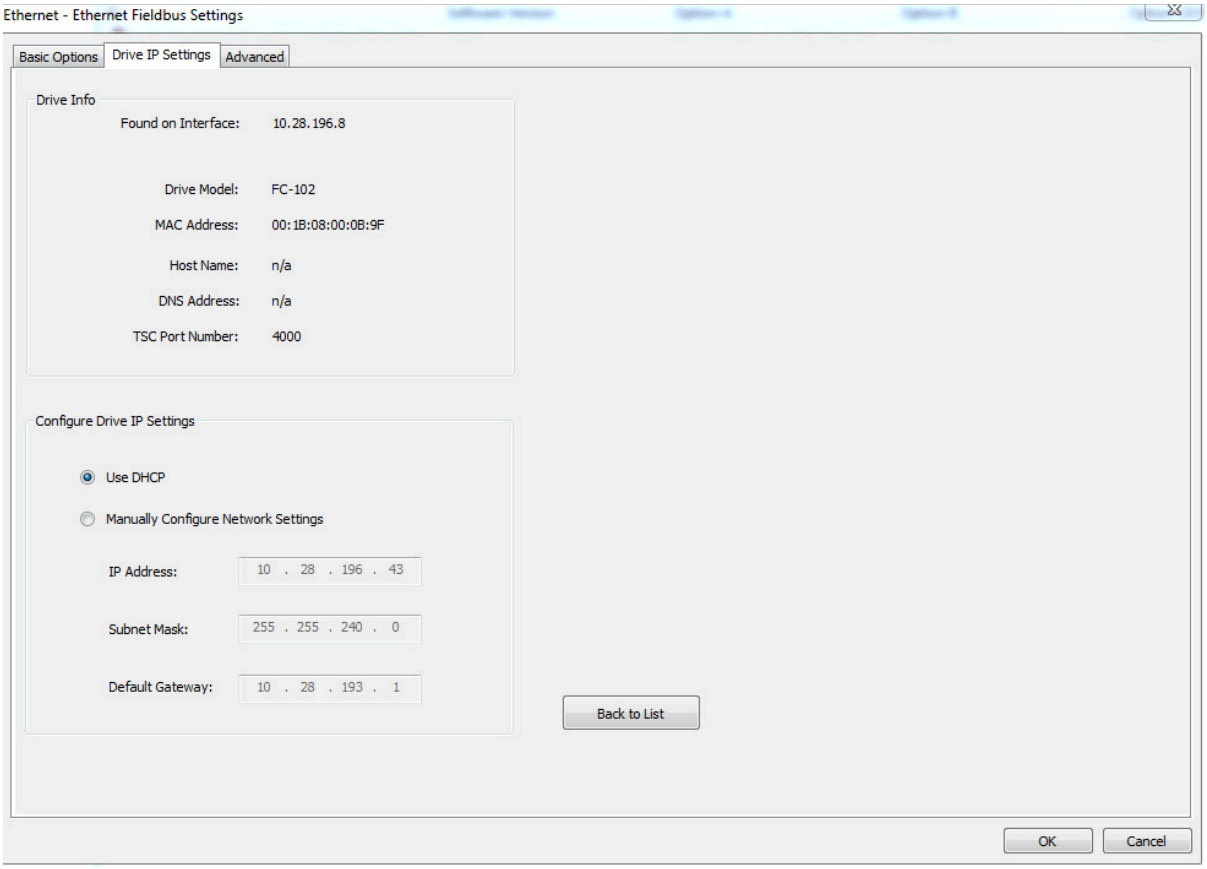

Figure 18: TSC Configure

4.7.3 PROFINET DCP Scan

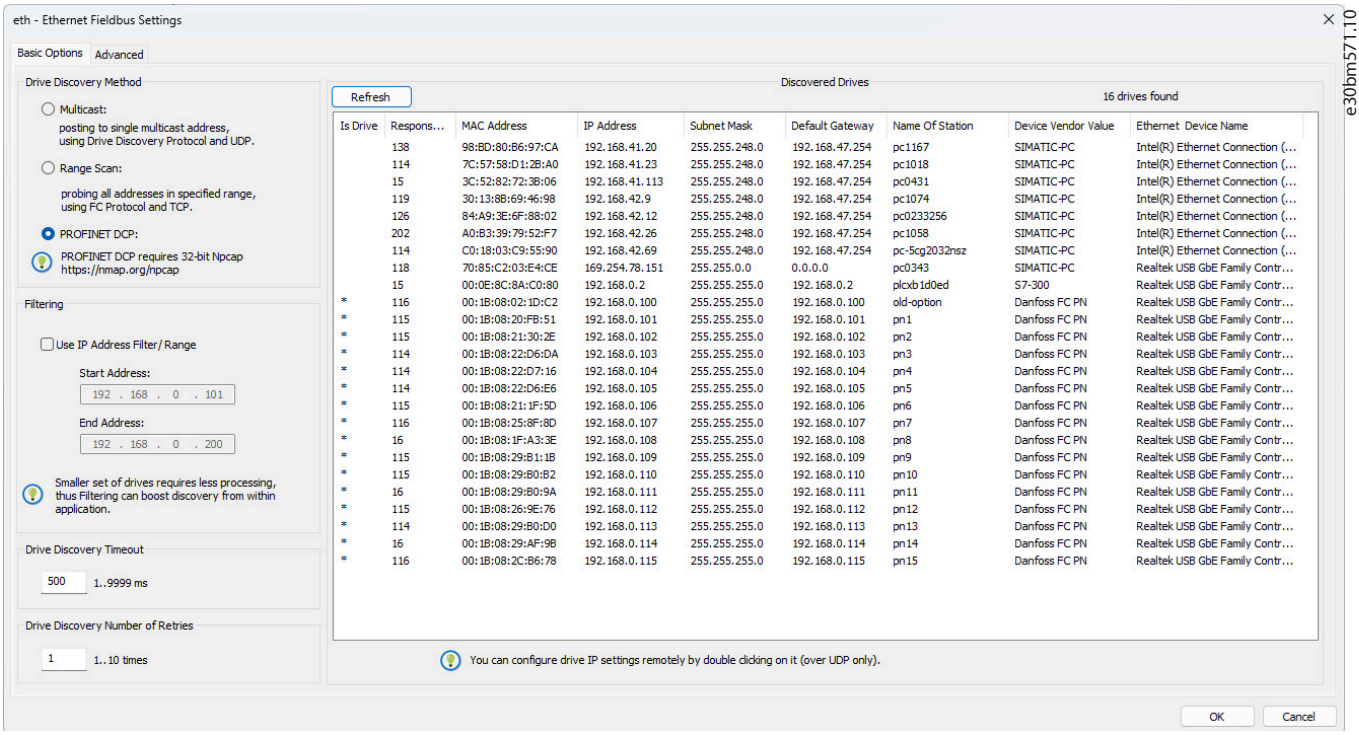

Figure 19: PROFINET DCP View

4.7.4 Scanning with IP Range

When scanning using an IP range, the Ethernet telegrams are transmitted as traditional TCP/IP packages routed out in a router, switch, or manage switch without requiring any changes. The disadvantage is an increased scanning time, and drives without IP address configured are not identified.

NOTE: Identification of drives using the VLT® EtherNet/IP MCA 121 option is possible only from option firmware version 1.03 or newer. If using options with firmware versions earlier than 1.03, configure parameter ***12-89 Transparent Socket Channel Power*** to 0 to prevent the option from failing to operate.

1. Configure the IP start address and the transparent socket channel port (parameter ***12-89 Transparent Socket Channel Port***), which is factory setting 4000 in the drive.

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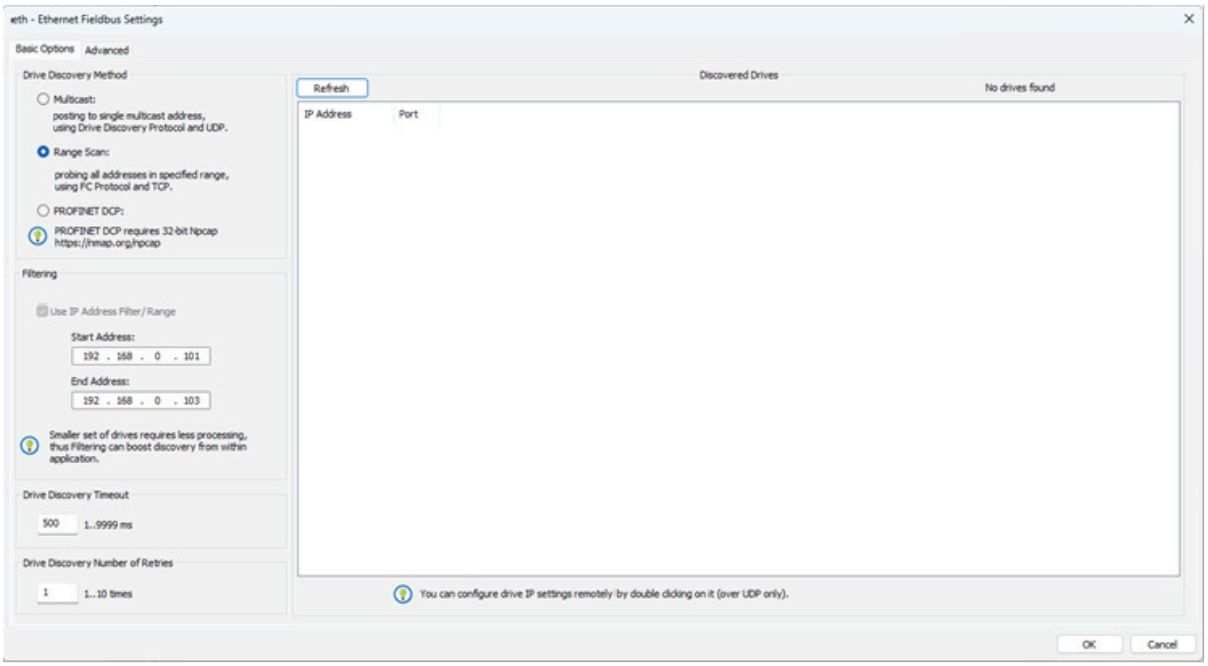

e30bt852.12

Figure 20: Scan Range

After the scan, all active drives are identified.

2. Use a corresponding drive to read or write to a single drive instead of waiting for MCT 10 to scan and identify all drives.
   a. Open the project file and create offline drives manually.
   b. Configure the connection properties.
   c. Right-click the offline drive.
   d. Read and write to the drive without scanning the bus.

4.7.5 Filtering

When using multicast, it is possible to filter a range of IP addresses.

Also, use filtering for boosting scan performance.

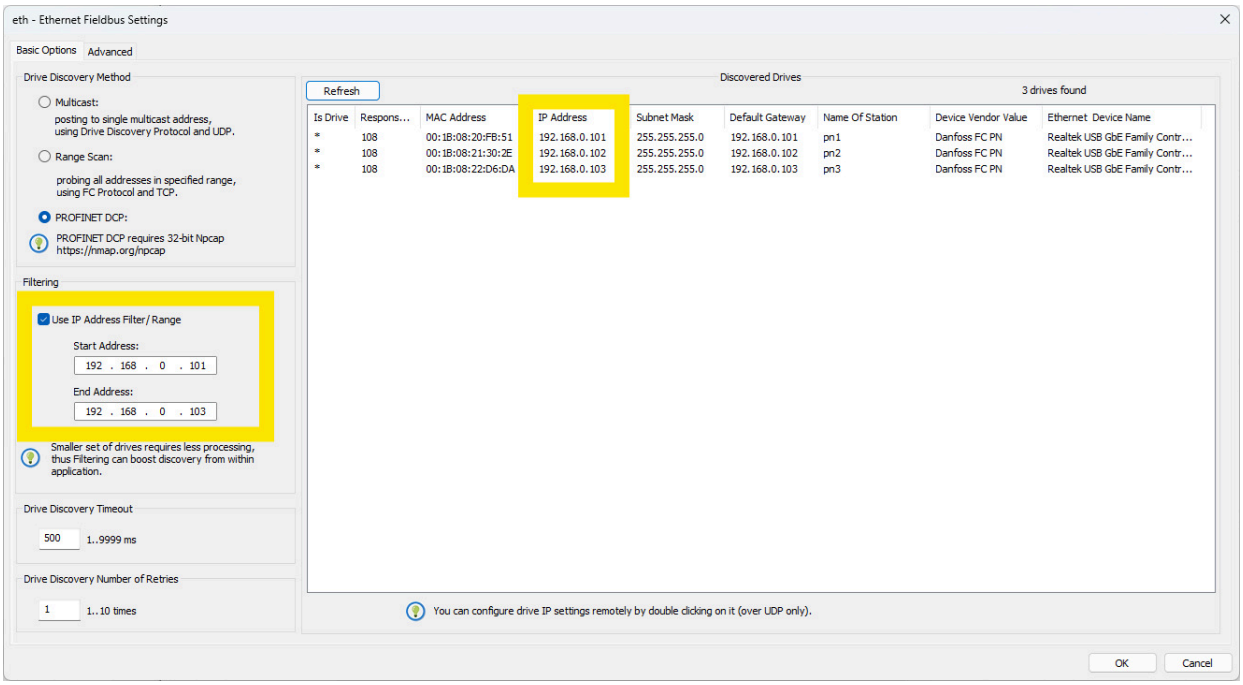

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Figure 21: Filtering

4.7.6 Wink Drive

During a commissioning process of a system containing several drives, it can be time-consuming physically to locate a drive based on the VLT® Motion Control Tool MCT 10 project. This is especially the case if the drive is not equipped with an LCP.

Through the Ethernet_TSC fieldbus, it is possible via MCT 10 to use a wink function. This function blinks with the MS, NS1, and NS2 LEDs on all Danfoss Ethernet-based fieldbus options.

On the Ethernet-based fieldbus option, the winking is recognized with all 3 LEDs blinking orange with 1-Hz interval. There is no limit to the number of drives winking and the duration of winking.

4.7.7 Start Winking

NOTE: It can take up to 30 s from starting or stopping the winking, until the option responds.

1. Right-click a drive from the Ethernet network.
2. Select *Start winking* or *Stop winking*.

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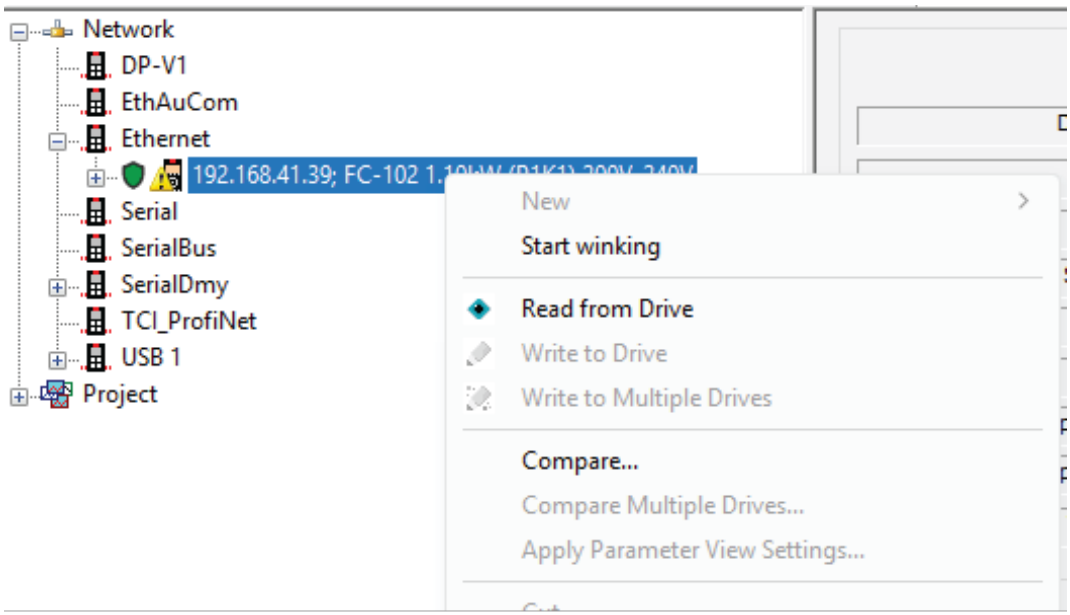


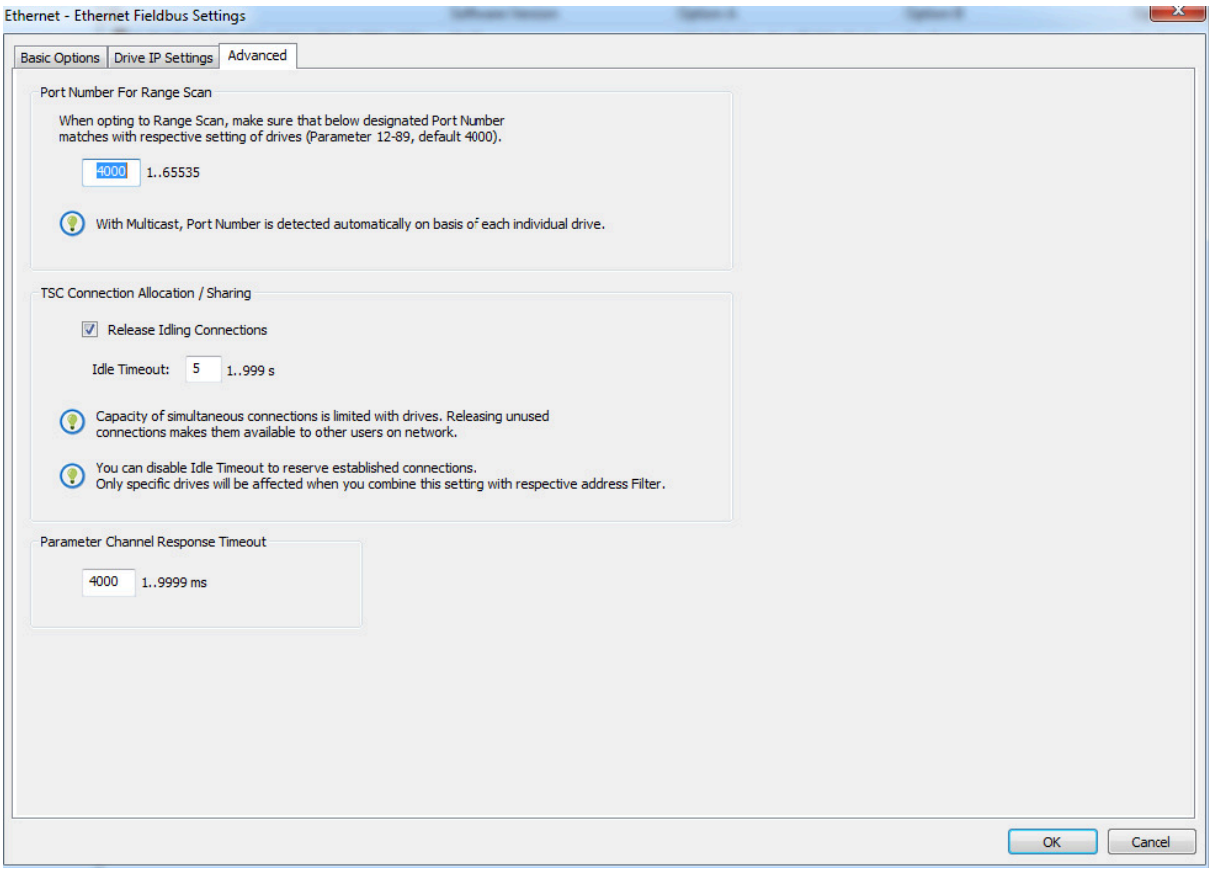
Figure 22: Start Winking

4.7.8 Advanced

Use the *Advanced* tab:

- To configure *Port Number For Range Scan*. The default value is 4000.
- To define the *TSC Connection Allocation/Sharing*.

The drive has limited simultaneous connections, and with this function it is possible to define if the connections should be released or not. If selecting *Release Idling Connections*, the VLT® Motion Control Tool MCT 10 releases unused connections and makes them available to other users in the network after idle timeout.



e30bt853.11

Figure 23: The Advanced Tab

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5 Parameter Setup

5.1 Introduction

This chapter explains how to control a drive using the VLT® Motion Control Tool MCT 10. After starting the MCT 10, the main window looks like the example shown in Figure 24.

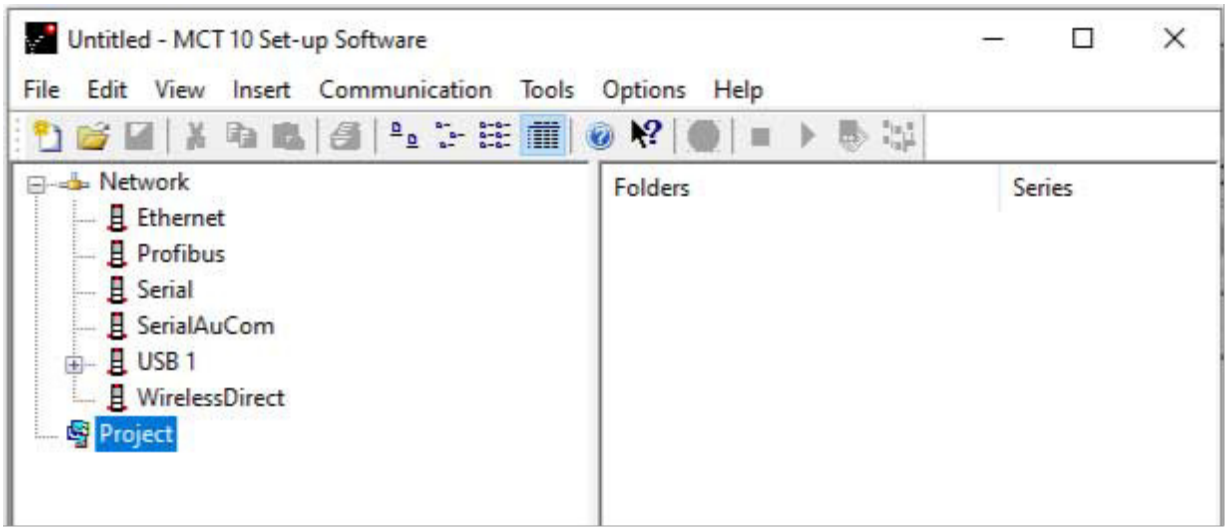


Figure 24: MCT 10 Main Window

5.2 User Interface

5.2.1 Display

The VLT® Motion Control Tool MCT 10 has 2 views:

- Left view.
- Right view.

Left view

The left view shows the network view (real, online) and the project view (simulated, offline) of the drive network.

Use the left view to:

- Add or delete folders and elements.
- Store changes into the Project folder.

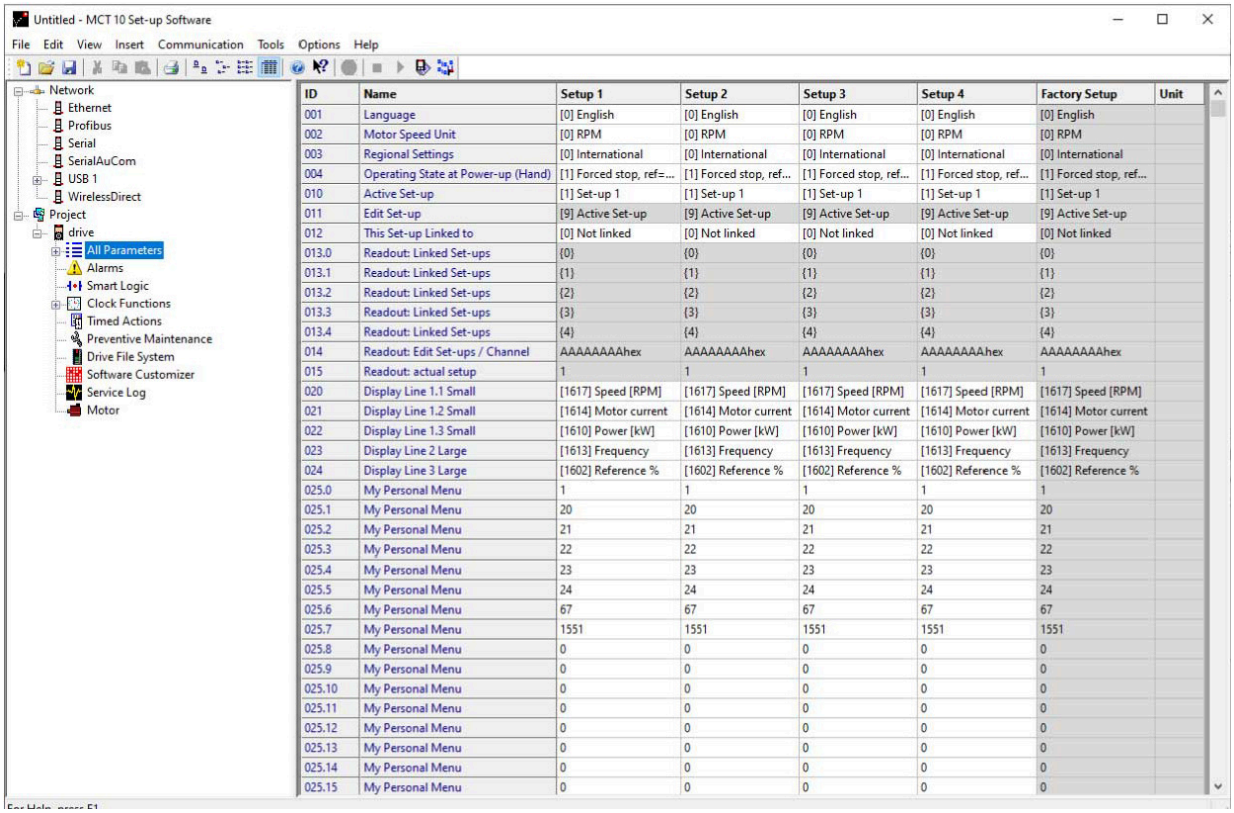
Store changes made to the real online set-up into the Project folder in the simulated, offline setup for later use.

For more information on saving data, refer to 6.12.2 Saving a Project.

The left view is organized in a tree structure and contents can be expanded or collapsed as required. Click +/- to expand/collapse the folder.

Right view

The right view shows details of the element highlighted in the left view. In the right view, the elements of the drive network can be programmed.



ID	Name	Setup 1	Setup 2	Setup 3	Setup 4	Factory Setup	Unit
001	Language	[0] English	[0] English	[0] English	[0] English	[0] English	
002	Motor Speed Unit	[0] RPM	[0] RPM	[0] RPM	[0] RPM	[0] RPM	
003	Regional Settings	[0] International	[0] International	[0] International	[0] International	[0] International	
004	Operating State at Power-up (Hand)	[1] Forced stop, ref=...	[1] Forced stop, ref...	[1] Forced stop, ref...	[1] Forced stop, ref...	[1] Forced stop, ref...	
010	Active Set-up	[1] Set-up 1	[1] Set-up 1	[1] Set-up 1	[1] Set-up 1	[1] Set-up 1	
011	Edit Set-up	[9] Active Set-up	[9] Active Set-up	[9] Active Set-up	[9] Active Set-up	[9] Active Set-up	
012	This Set-up Linked to	[0] Not linked	[0] Not linked	[0] Not linked	[0] Not linked	[0] Not linked	
013.0	Readout: Linked Set-ups	{0}	{0}	{0}	{0}	{0}	
013.1	Readout: Linked Set-ups	{1}	{1}	{1}	{1}	{1}	
013.2	Readout: Linked Set-ups	{2}	{2}	{2}	{2}	{2}	
013.3	Readout: Linked Set-ups	{3}	{3}	{3}	{3}	{3}	
013.4	Readout: Linked Set-ups	{4}	{4}	{4}	{4}	{4}	
014	Readout: Edit Set-ups / Channel	AAAAAAAAhex	AAAAAAAAhex	AAAAAAAAhex	AAAAAAAAhex	AAAAAAAAhex	
015	Readout: actual setup	1	1	1	1	1	
020	Display Line 1.1 Small	[1617] Speed [RPM]	[1617] Speed [RPM]	[1617] Speed [RPM]	[1617] Speed [RPM]	[1617] Speed [RPM]	
021	Display Line 1.2 Small	[1614] Motor current	[1614] Motor current	[1614] Motor current	[1614] Motor current	[1614] Motor current	
022	Display Line 1.3 Small	[1610] Power [kW]	[1610] Power [kW]	[1610] Power [kW]	[1610] Power [kW]	[1610] Power [kW]	
023	Display Line 2 Large	[1613] Frequency	[1613] Frequency	[1613] Frequency	[1613] Frequency	[1613] Frequency	
024	Display Line 3 Large	[1602] Reference %	[1602] Reference %	[1602] Reference %	[1602] Reference %	[1602] Reference %	
025.0	My Personal Menu	1	1	1	1	1	
025.1	My Personal Menu	20	20	20	20	20	
025.2	My Personal Menu	21	21	21	21	21	
025.3	My Personal Menu	22	22	22	22	22	
025.4	My Personal Menu	23	23	23	23	23	
025.5	My Personal Menu	24	24	24	24	24	
025.6	My Personal Menu	67	67	67	67	67	
025.7	My Personal Menu	1551	1551	1551	1551	1551	
025.8	My Personal Menu	0	0	0	0	0	
025.9	My Personal Menu	0	0	0	0	0	
025.10	My Personal Menu	0	0	0	0	0	
025.11	My Personal Menu	0	0	0	0	0	
025.12	My Personal Menu	0	0	0	0	0	
025.13	My Personal Menu	0	0	0	0	0	
025.14	My Personal Menu	0	0	0	0	0	
025.15	My Personal Menu	0	0	0	0	0	

Figure 25: Details Shown in the Right View

Toolbar

A toolbar shows icons for the most commonly used functions.



Figure 26: Toolbar

Activate the toolbar under *View* in the main menu bar, where the toolbar is tick-marked when it is active. To deactivate the toolbar, select *View⇒Toolbar*. Check that the toolbar is no longer tick-marked.

5.2.2 Network and Project Folders

The Network folder gives access to physical devices operating in the field. Use Network to configure the physical drive as with the LCP. Configuration changes made in the Network folder are therefore saved only in the physical device in the field. The Network folder contains online data.

The Project folder contains offline data.

NOTE: Changes made in the Network folder are not saved automatically to the Project folder.

Network mode - online

The Network folder contains the drives, low harmonic drives, active filters, and/or soft starters online connected to the PC. Monitor and change the parameter settings exactly as if operating on the control panel.

Data entered online is stored in the drive, low harmonic drive, active filter, or soft starter only, not on the hard disk. For information on saving data to the hard disk, refer to 6.12.2 Saving a Project.

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Project mode - offline

The Project folder contains the user-defined network of drive, low harmonic drive, active filter, and/or soft starter.

Data entered offline is stored on hard disk.

Use the Project folder to:

- Open a project file.
- Insert folders.
- Store project-related files in any format, for example, Word or PDF.

5.3 Setting Up Drives and Folders

5.3.1 Inserting a New Folder

1. Right-click the Project folder or select *Insert* in the main menu bar.
2. Select *New*.
3. Select *Folder* or *File Folder*.

5.3.2 Setting Up Drives, Active Filters, or Soft Starters

Insert the drive, the active filter, or the soft starter in a project folder as follows:

1. Right-click in the left view or click *Insert* in the main menu bar.
2. Select *New*.
3. Select the appropriate device type.

Inserting a drive opens the *New Drive* window.

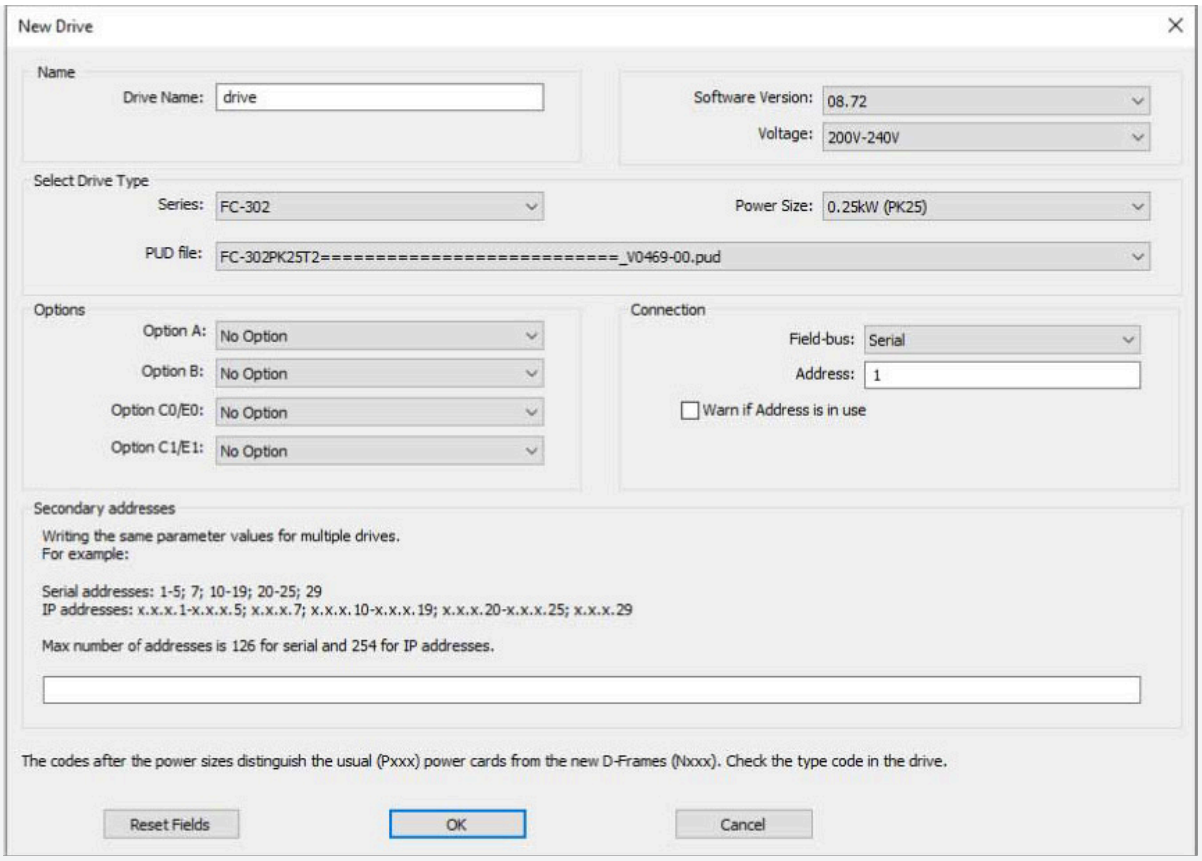

Figure 27: New Drive Window

The *New Drive* window consists of 4 sections:

Name	Enter a unique name for the drive. Any text/number combination is allowed. Also specify the software version and the voltage in this section.
Select Drive Type	Information about the drive series and power size. A PUD file (power unit data information) is also available. The default file is always preselected.
Options	Various information about the installed options.
Connection	The fieldbus used between the PC and the drive associated with the address to communicate. The specific fieldbus type is available from the drop-down menu.

It is mandatory to fill in all fields. The different selections are available from the drop-down menus. Once the new drive is added to the Project folder, the drive data is stored in the offline Project folder. To view the data, click the drive icon.

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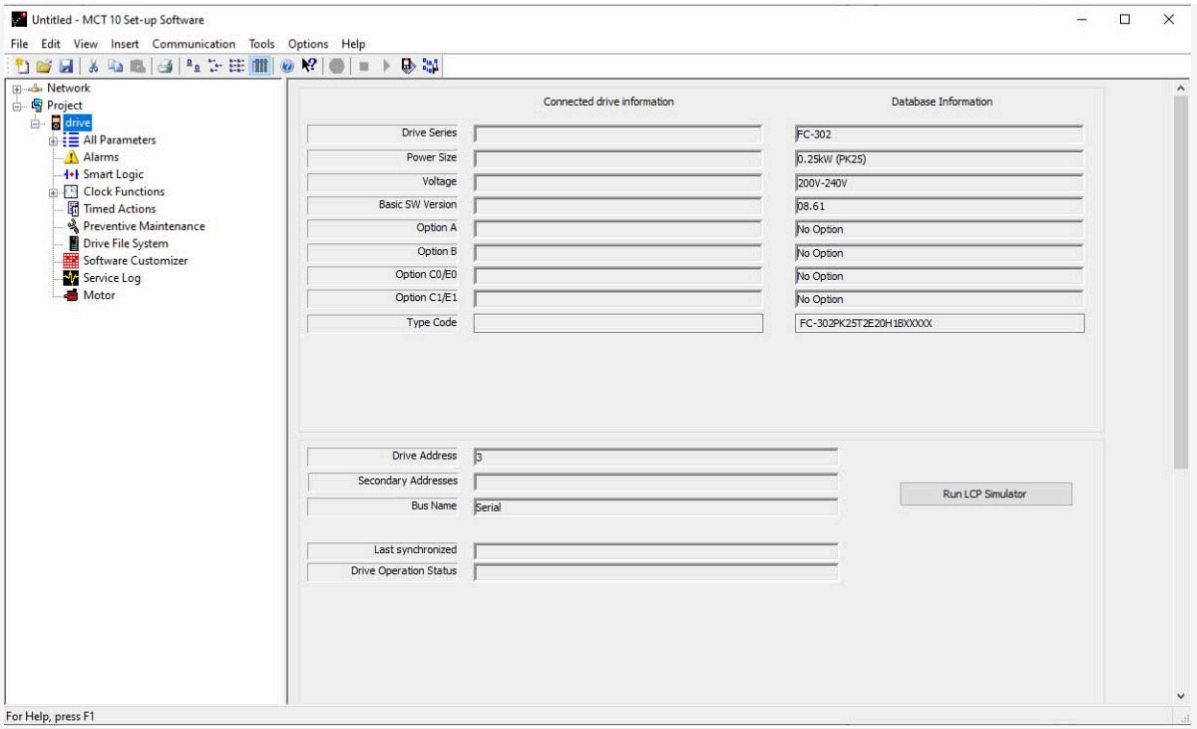

Figure 28: View the Drive Data

To change the stored drive data, right-click the specific drive icon and select *Properties*.

5.3.3 Setting Up Low Harmonic Drives

Insert a low harmonic drive in a project folder as follows:

1. Right-click the left window or select *Insert* in the main menu bar.
2. Select *New*.
3. Select *Drive*.
4. Enter all relevant data in the *New Drive* dialog and click *Make LHD*.

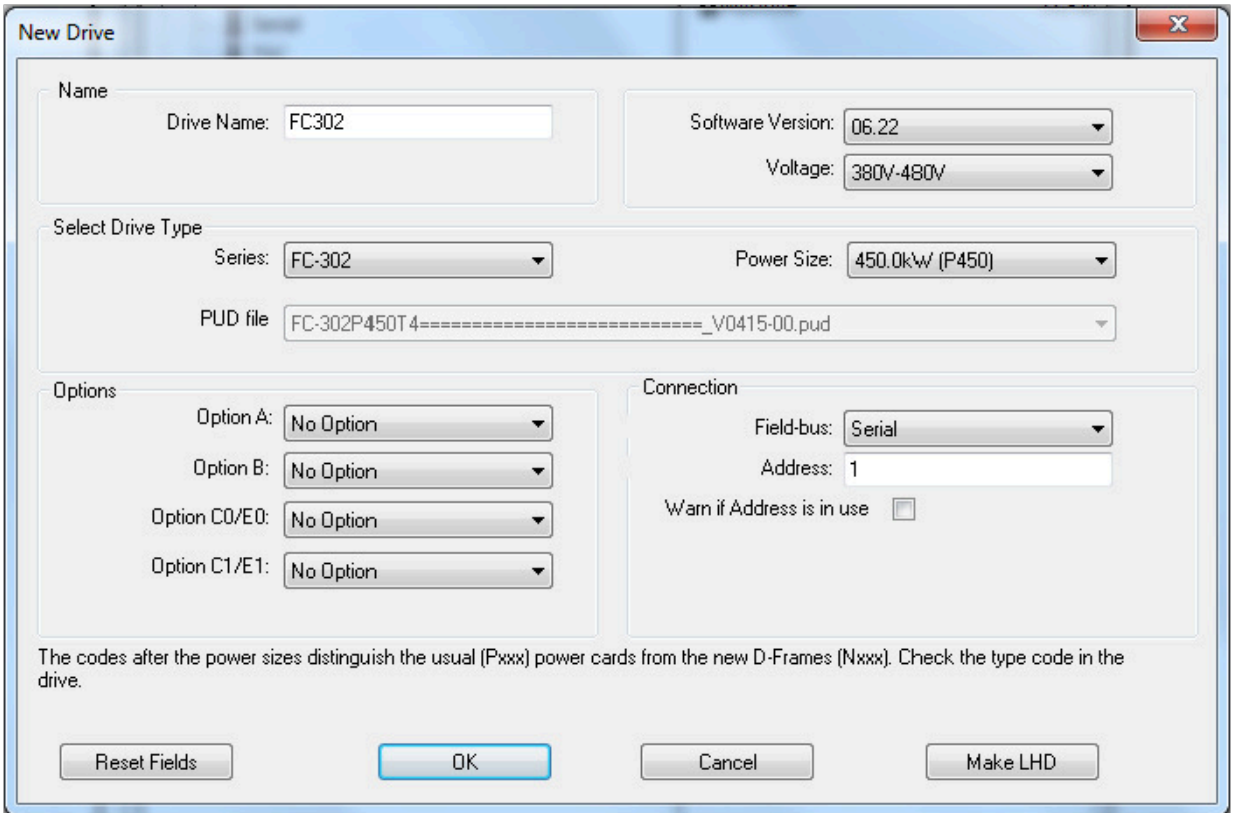

Figure 29: Entering Data for a New Low Harmonic Drive

NOTE: The *Make LHD* option is only available when the power size and voltage ranges of the drive correspond to the supported low harmonic drive.

5. Enter all active filter data in the *New Filter* dialog. Ensure that the fieldbus address used for the active filter is not used for other components.

The low harmonic drive is visible in the project as a composition of the drive and the active filter.

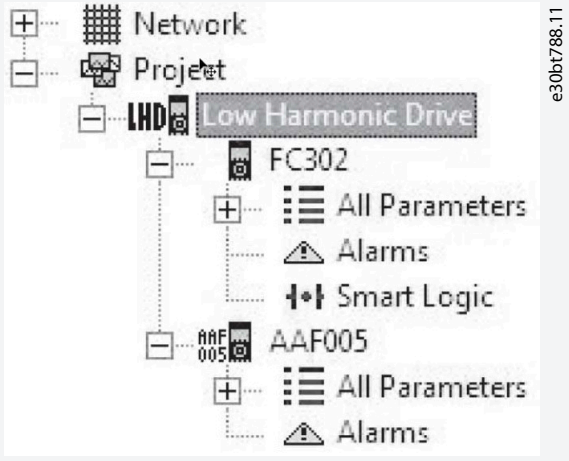

Figure 30: Low Harmonic Drive Shown in the Project Folder

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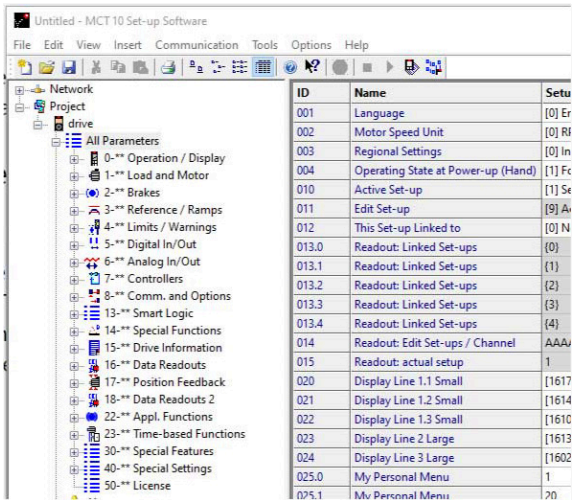
5.3.4 All Parameters Folders

A new *Drive* folder contains an *All Parameters* folder. This folder comprises a series of subfolders with generic names. There is no rename function for these folders. The generic folders within most drives consist of the following subfolders:

- Operation and display.
- Load and motor.
- References and limits.
- Inputs and outputs.
- Special functions.
- Serial communication.
- Technical functions.

The generic folders can vary according to the type of drive selected.



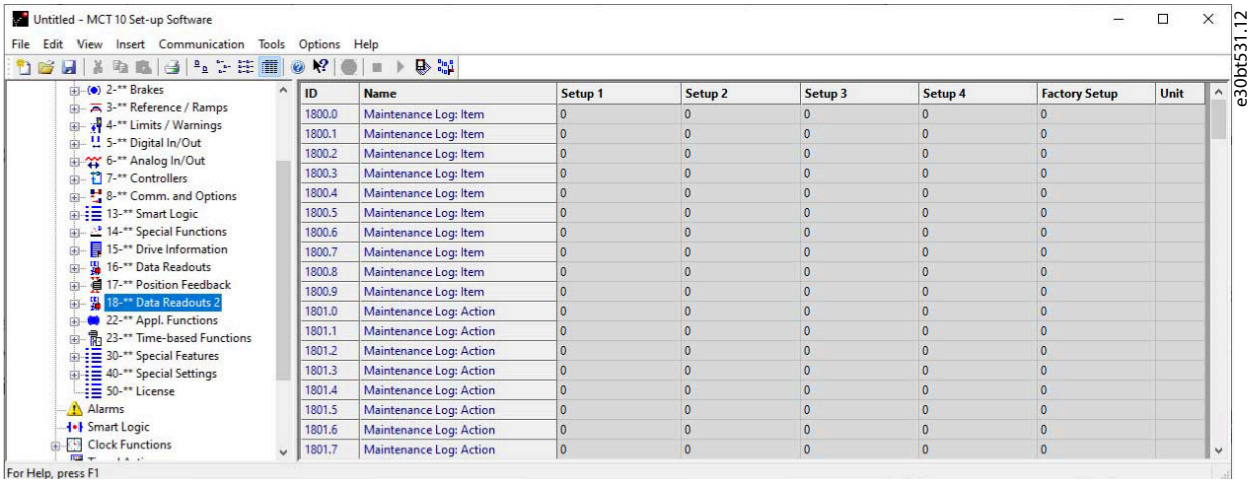
e30bt524.13

Figure 31: Subfolders in the All Parameters Folder

The generic folders comprise parameters relevant to the drive type selected.

5.3.5 Array Parameters

Parameters containing array data are shown as a matrix in the right view, where the rows of the matrix are defined as ID.1, ID.2, and so on. For example, array parameters parameter ***9-15 PCD Write Configuration*** and parameter ***9-16 PCD Read Configuration*** are shown over several entries as 915.1, 915.2, 915.3, and 916.1, 916.2, 916.3 in the right view.



e30bt531.12

Figure 32: Array Parameters

5.3.6 Sorting

The Danfoss products listed under *Network* or *Project* can be sorted according to:

- Folder name.
- Series.
- Software version.
- Address (communication address).
- Power size.
- Voltage.

Click the sorting bar and select the relevant sorting option.

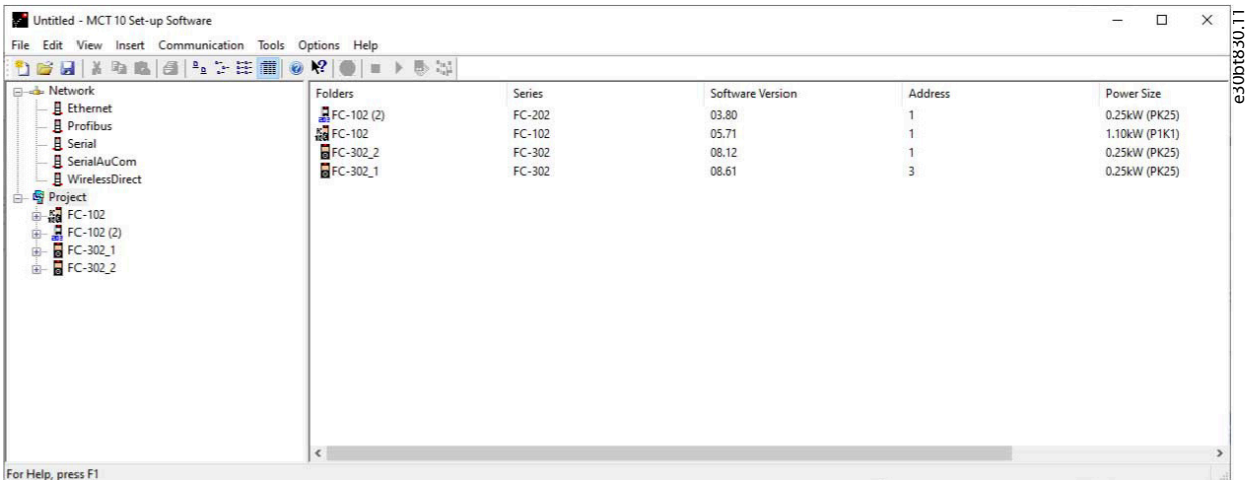


Figure 33: Sorting Options

5.4 Customizations

5.4.1 Customized Views

Select *View* in the main menu bar to see the display options. The following options are available:

- Show or hide the toolbar.
- Show or hide the status bar.
- Large icons/small icons view.
- View as list of folders and elements.
- View with details of network and project elements.

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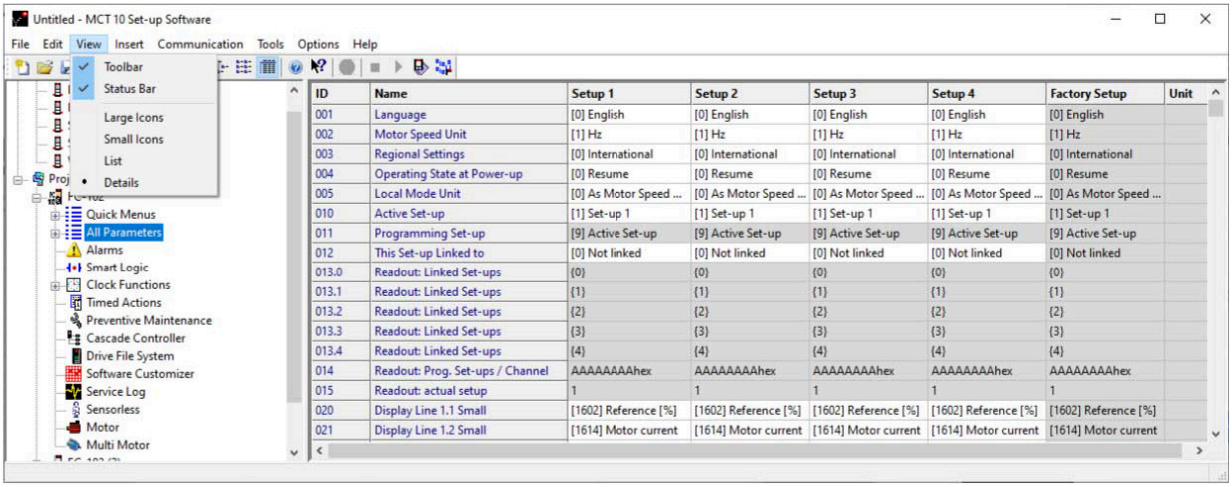


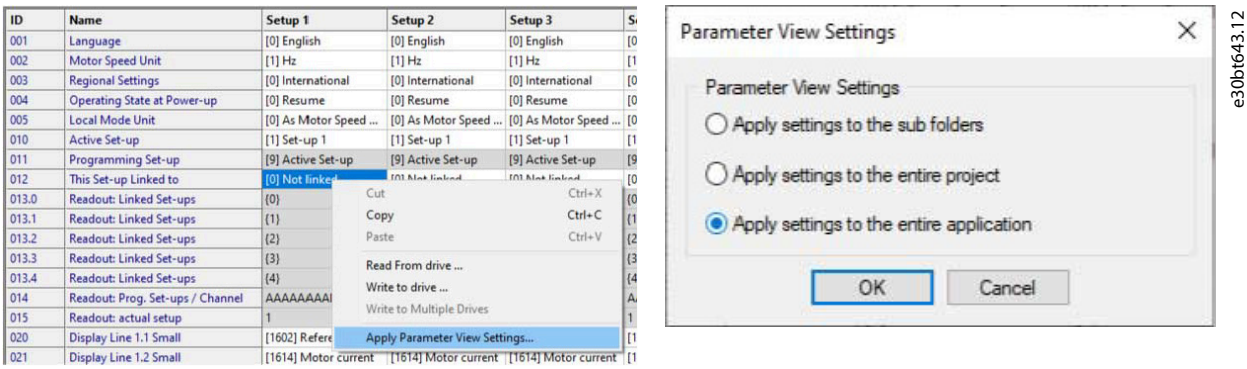
e30bt526.11

Figure 34: The View Menu

5.4.2 Customize Parameter View Settings

Apply the selected parameter view settings to subfolders, to an entire project, or to the entire application, that is, all VLT® Motion Control Tool MCT 10 folders in network or project mode.

1. Right-click the parameter cell or setup column.
2. Select *Apply Parameter View Settings*.



e30bt643.12

Figure 35: Applying Parameter View Settings

3. Select the relevant option and click *OK*.

5.4.3 Customize Background Color

To customize the background color of the views, go to *Options⇒Online Parameter Grid Settings*.

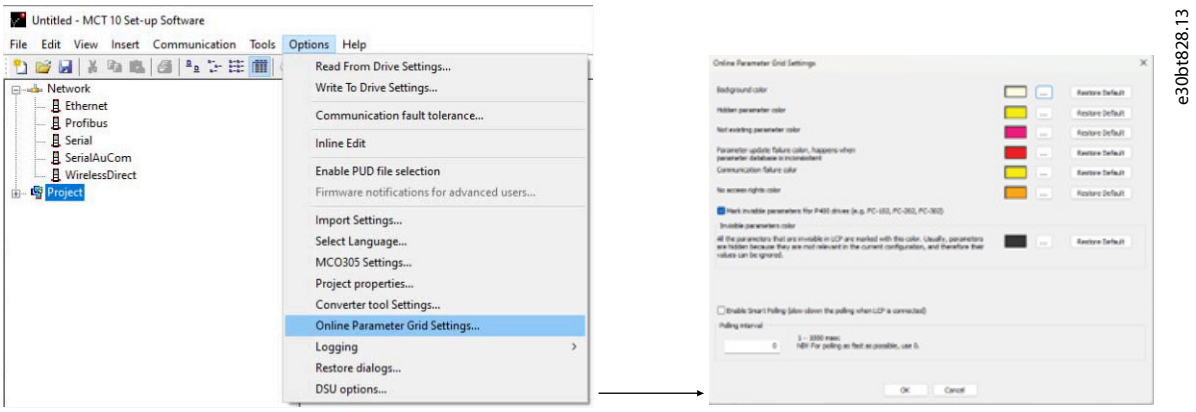


Figure 36: Customizing Background Color

1. Select *Restore Default* to restore factory default background color for online environment.
2. Click *[…]* to open a standard true color picker.
3. Select *Add to Custom Colors* for customizing colors for later usage.

5.4.4 Customize Parameter View

The parameters shown in the right view are presented in a series of columns, containing ID, parameter name, 4 setups, units, and factory setup.

Select *Parameter view⇒Set-up⇒Remove Menu*.

NOTE: Changes made to the removed setup are still stored in VLT® Motion Control Tool MCT 10 and can be shown by selecting *Customize Columns*.

1. Right-click a column.
2. Select *Customize Columns*.
3. In the left view of the *Customize Columns* dialog, select the field to be added or removed.

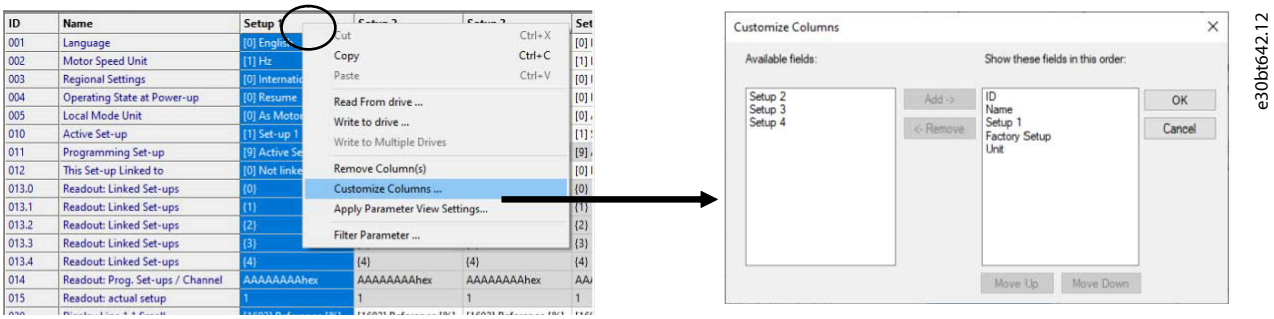


Figure 37: Customize Columns Dialog

4. Click either *Add* or *Remove*.
5. Change the order of the fields in the right view by clicking *Move Up* or *Move Down*.
6. Right-click a column and select *Apply Parameter View Settings*.

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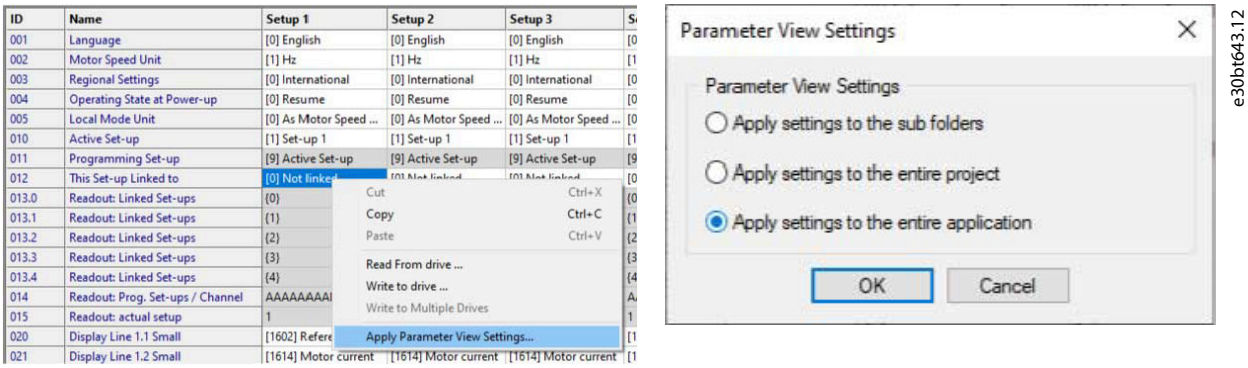


Figure 38: Apply Parameter View Settings

7. Select if the settings should apply to the subfolders, the entire project, or the entire application.

5.4.5 Filtering Parameters

Filter the parameters in the right view according to the following settings:

Table 1: Available Filter Settings

Setting	Description
Read only	Only read-only parameters are shown.
Read & Write	Only read & write parameters are shown.
Changed parameters	Only parameters that have been changed in the current session are shown.
All	All parameter groups are shown.
Group	One or more parameter groups are shown according to selection.

1. Right-click any column in the right view.
2. Select the appropriate filtering setting or the appropriate filtering group.

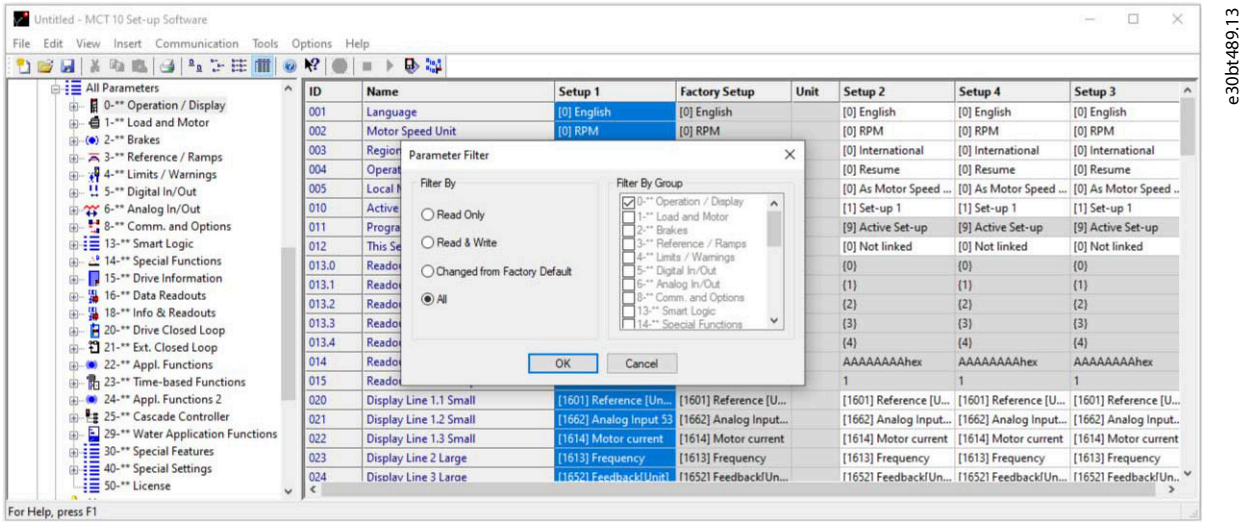
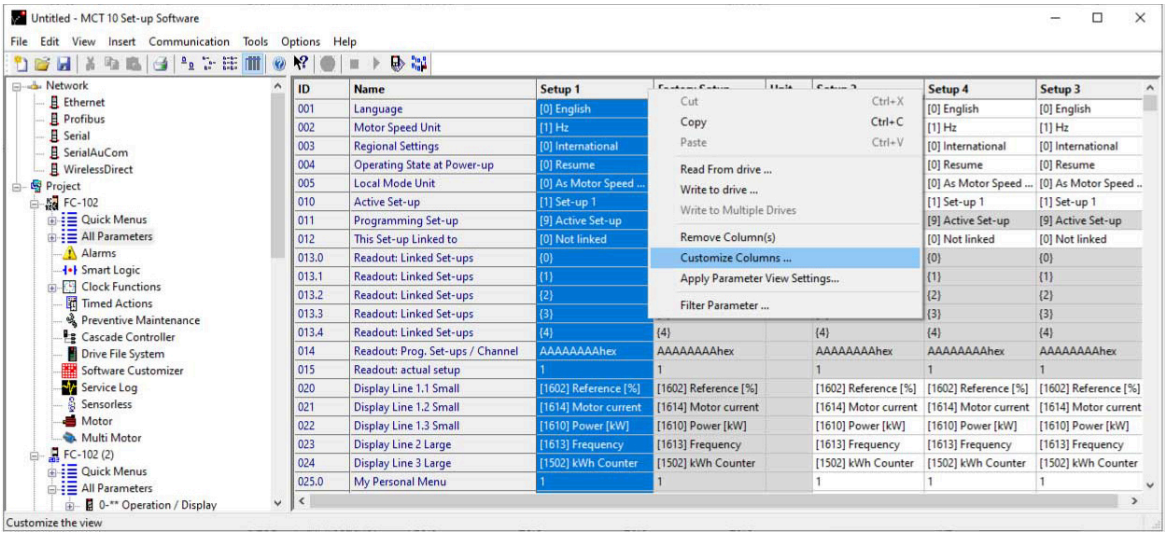


Figure 39: Filtering Columns

5.4.6 Customize Columns

1. Right-click any column.
2. Select *Customize Columns*.

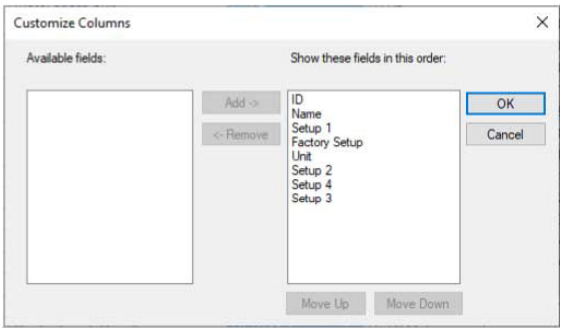


ID	Name	Setup 1	Setup 4	Setup 3
001	Language	[0] English	[0] English	[0] English
002	Motor Speed Unit	[1] Hz	[1] Hz	[1] Hz
003	Regional Settings	[0] International	[0] International	[0] International
004	Operating State at Power-up	[0] Resume	[0] Resume	[0] Resume
005	Local Mode Unit	[0] As Motor Speed ...	[0] As Motor Speed ...	[0] As Motor Speed ..
010	Active Set-up	[1] Set-up 1	[1] Set-up 1	[1] Set-up 1
011	Programming Set-up	[9] Active Set-up	[9] Active Set-up	[9] Active Set-up
012	This Set-up Linked to	[0] Not linked	[0] Not linked	[0] Not linked
013.0	Readout: Linked Set-ups	{0}	{0}	{0}
013.1	Readout: Linked Set-ups	{1}	{1}	{1}
013.2	Readout: Linked Set-ups	{2}	{2}	{2}
013.3	Readout: Linked Set-ups	{3}	{3}	{3}
013.4	Readout: Linked Set-ups	{4}	{4}	{4}
014	Readout: Prog. Set-ups / Channel	AAAAAAAAhex	AAAAAAAAhex	AAAAAAAAhex
015	Readout: actual setup	1	1	1
020	Display Line 1.1 Small	[1602] Reference [%]	[1602] Reference [%]	[1602] Reference [%]
021	Display Line 1.2 Small	[1614] Motor current	[1614] Motor current	[1614] Motor current
022	Display Line 1.3 Small	[1610] Power [kW]	[1610] Power [kW]	[1610] Power [kW]
023	Display Line 2 Large	[1613] Frequency	[1613] Frequency	[1613] Frequency
024	Display Line 3 Large	[1502] kWh Counter	[1502] kWh Counter	[1502] kWh Counter
025.0	My Personal Menu	1	1	1

e30bt529.12

Figure 40: Customize Columns Menu

3. Highlight a field to change the order.



e30bt530.12

Figure 41: Change Order of Fields

4. Select *Move Up*, *Move Down*, or *Remove*.

Removed columns are still stored in the memory and can be retrieved into the right view by highlighting the relevant field name and selecting *Add*.

5.5 Parameter Edit

The parameter structures in VLT® Motion Control Tool MCT 10 and in the drive are the same. Modify the parameter by double-clicking the relevant parameter entry. If an entry cell is shaded, the parameter is read-only and cannot be modified.

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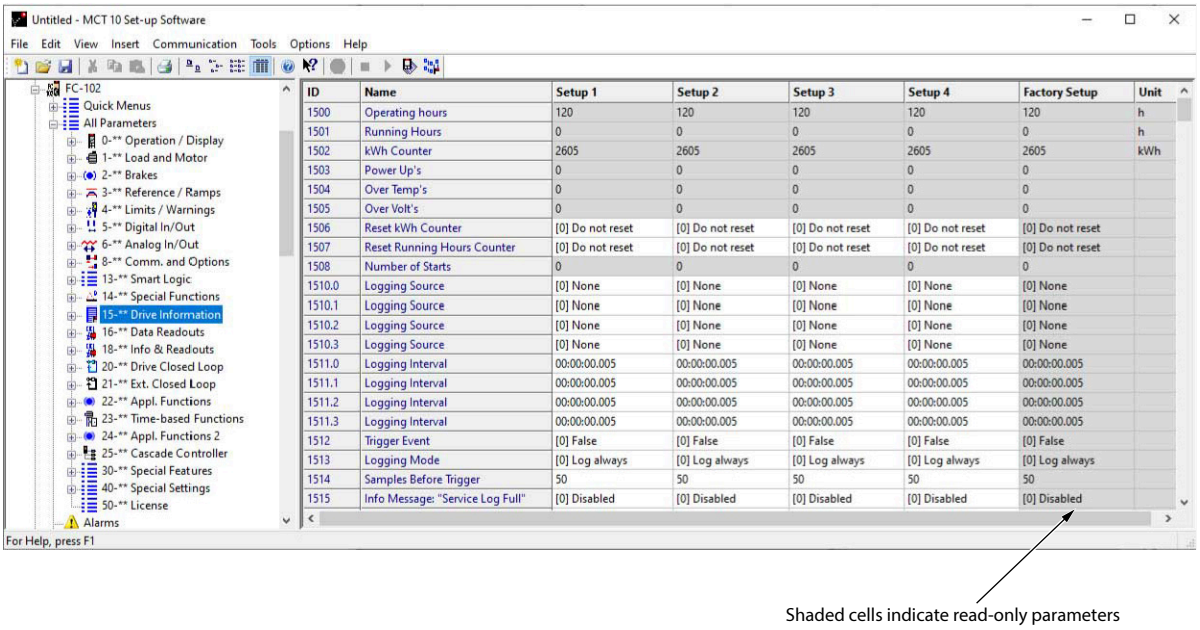


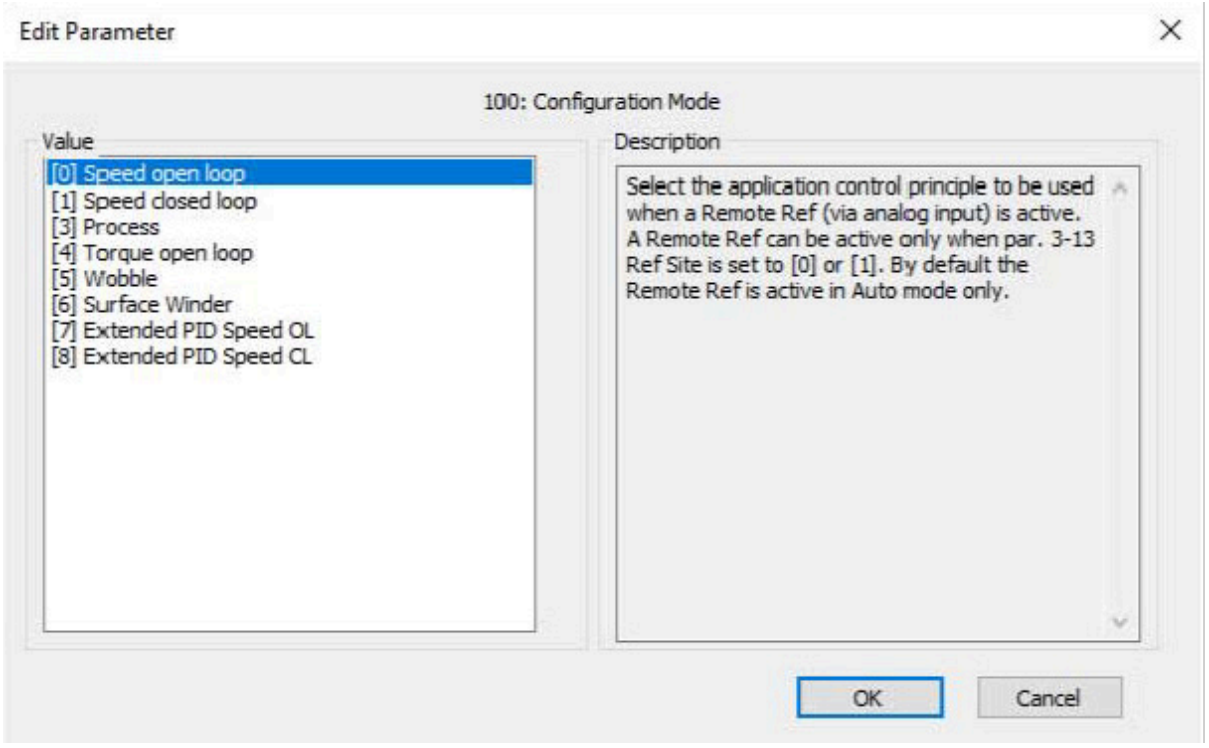
e30bt646.12

Figure 42: Editing Parameters

Change the parameter setup by manually entering new values in the cells in the right view. Alternatively, change the parameter setup by importing values from an active drive using the *Read From Drive* function.

If a parameter value is set to an illegal value, an error is shown. Parameters can be edited in 2 different modes:

- Inline.
- Dialog-based.



e30bt647.12

Figure 43: Edit Parameter View

Inline edit

In inline edit mode, the available setting options are shown without any detailed descriptions of the options. Inline edit is only recommended for experienced users.

Dialog-based edit

To have details of parameters available while editing, use dialog-based edit. The parameter details are:

- Parameter options.
- Ranges.
- Functions.

Enter dialog-based edit by deselecting inline edit.

5.6 Comparison of Parameters

Parameter settings can be compared to the parameter settings in another drive. Comparisons can be made either to another drive inside the project or to an online drive. The comparison function evaluates whether settings inside the drive have been changed, or checks if 2 or more drives have the same settings.

Procedure

1. Activate the function by highlighting the base drive for comparison and select *Compare*.

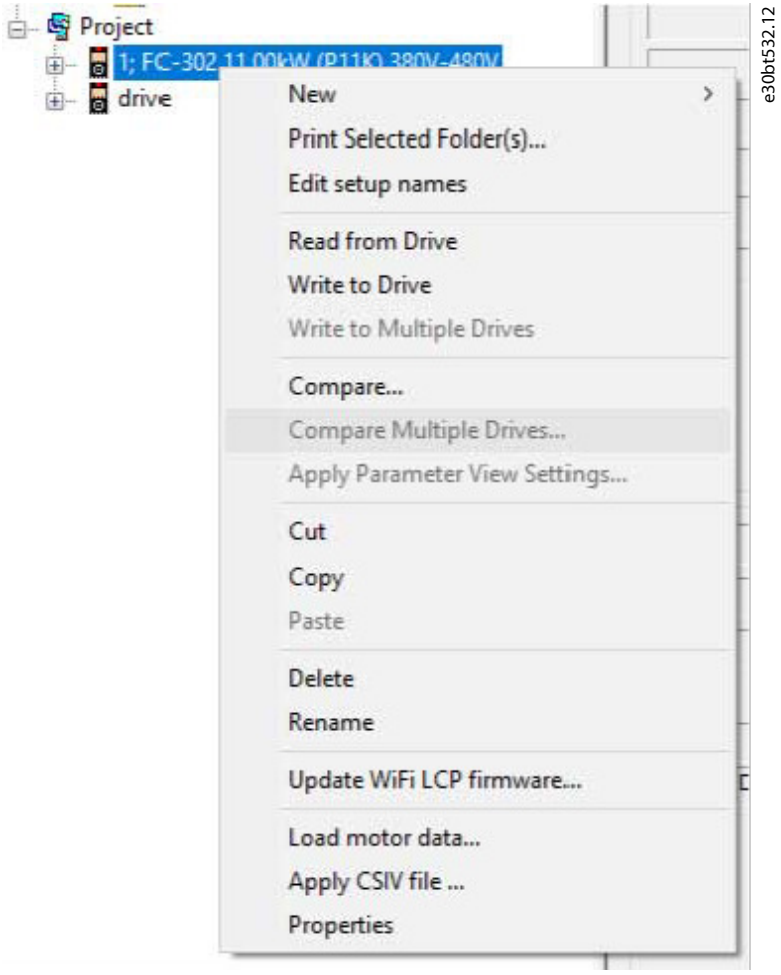


Figure 44: Comparison

2. Select the drive to compare with.

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This drive can be an online drive from the network, or it can be a drive in the offline folder (Project folder).

The result of a comparison can be stored in an ASCII text file for documentation or for subsequent import into a spreadsheet.

It is possible to compare all setups, or to compare 1 setup to another.

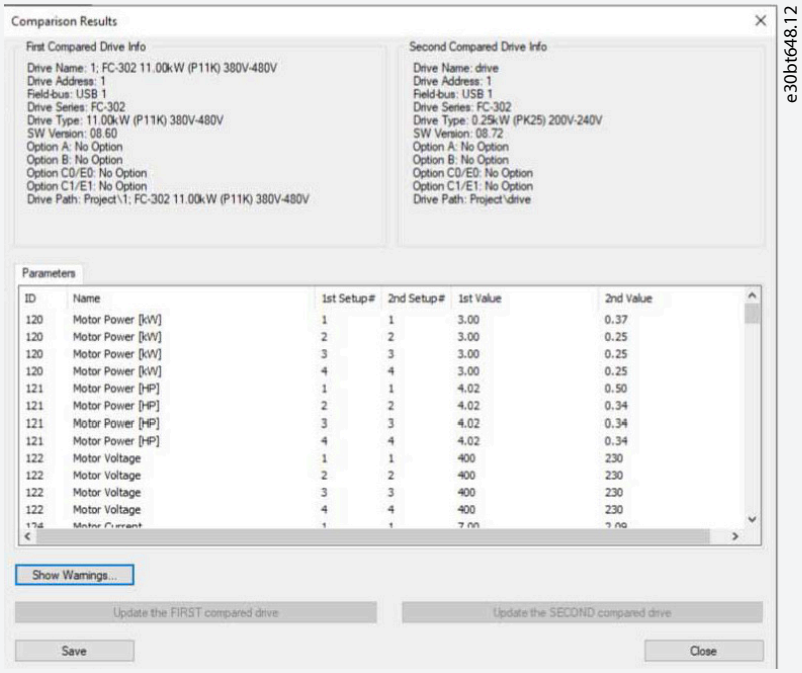
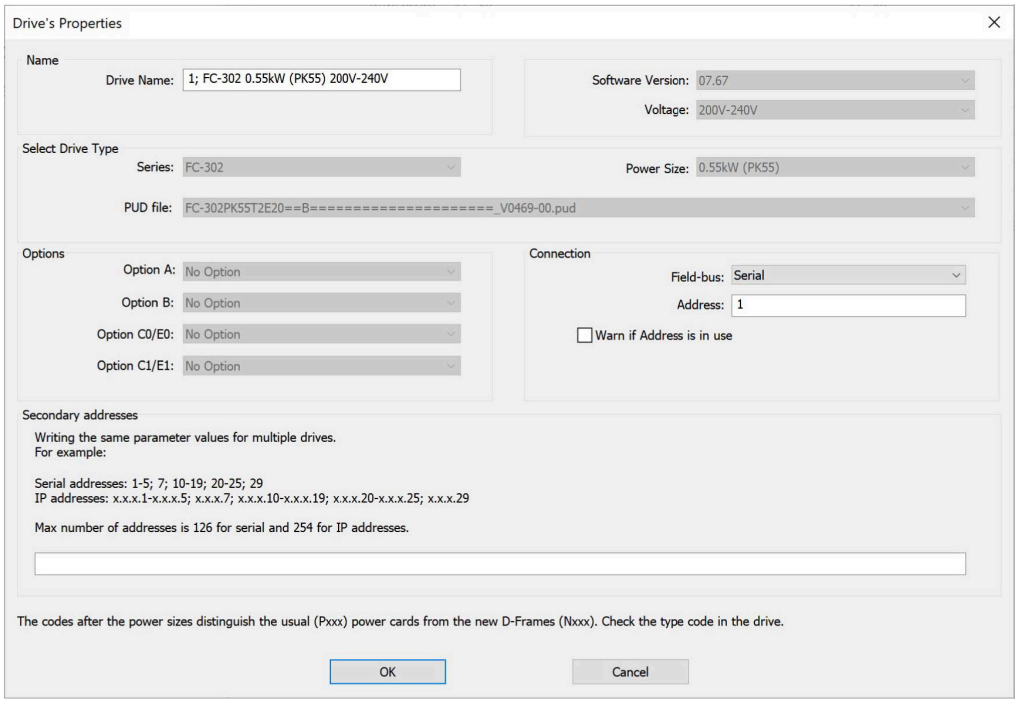


Figure 45: Comparison Result

5.7 Compare Multiple Drives

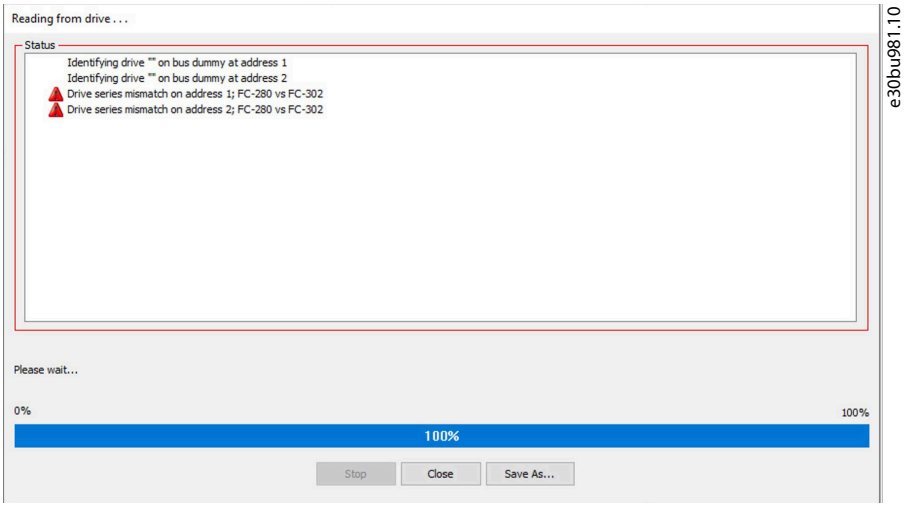
Comparing multiple drives is done via the menu. The project drive has to have the correct addresses. If necessary, the addresses can be changed in the project properties by right-clicking the project and selecting *Drive's Properties*.



e30bu980.10

Figure 46: Drive's Properties

Only drives from the same product series can be compared and written. If the series do not match, a status message is shown.



e30bu981.10

Figure 47: Drive Series Mismatch

To start the comparison, right-click the project drive and select *Compare Multiple Drives*.

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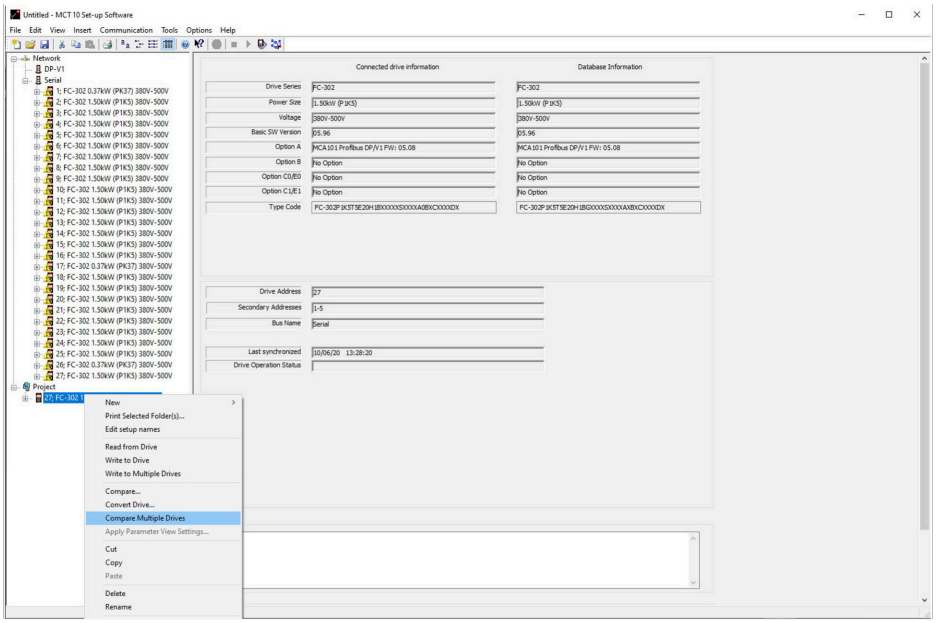

Figure 48: Selecting Compare Multiple Drives

A window appears which shows the relevant drives being read.

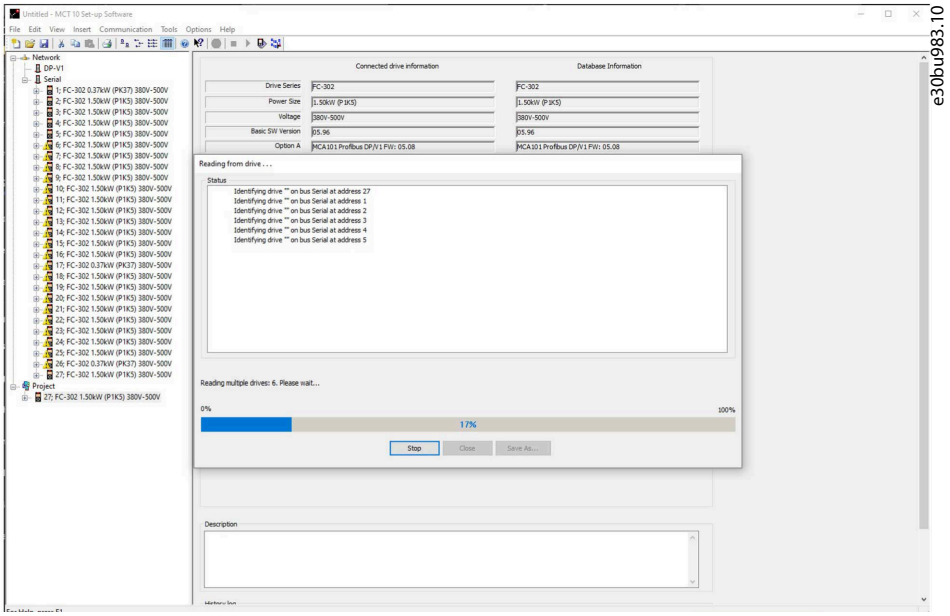

Figure 49: Drives Being Read

When the read is complete, the comparison window appears.

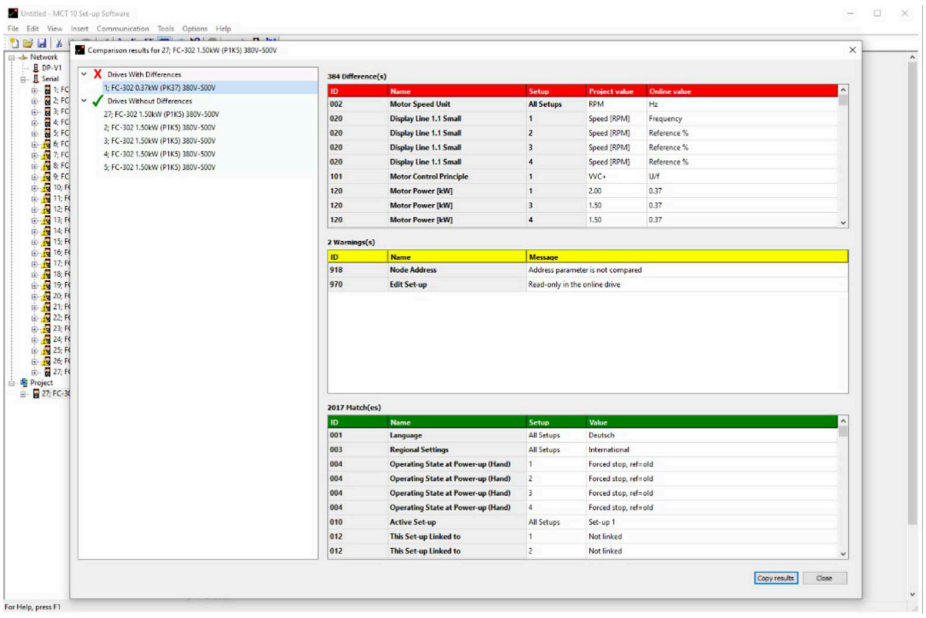

Figure 50: Comparison Window

The parameters in the red block are those which are set differently in the compared drives.

The parameters in the yellow block have not been compared.

The parameters in the green block have the same settings in the compared drives.

For common setup parameters, only setup 1 is compared. The result is shown as *All Setups*.

Exceptions

There are some parameters that, for technical reasons, are not written/compared. These parameters include some communication parameters (***8-31 Address***, ***9-18 Node Address***, and ***12-01 IP Address***). Trying to write these parameters would cause loss of communication.

Furthermore, safety parameters are not written.

5.8 View Change Log

When configuring a drive, active filter, or soft starter from the project, it is possible to view the change log containing the changes made by the user only, or the changes made including the dependent parameters.

User-defined changes can be read out by right-clicking *All Parameters* and selecting *Minimal Changeset*.

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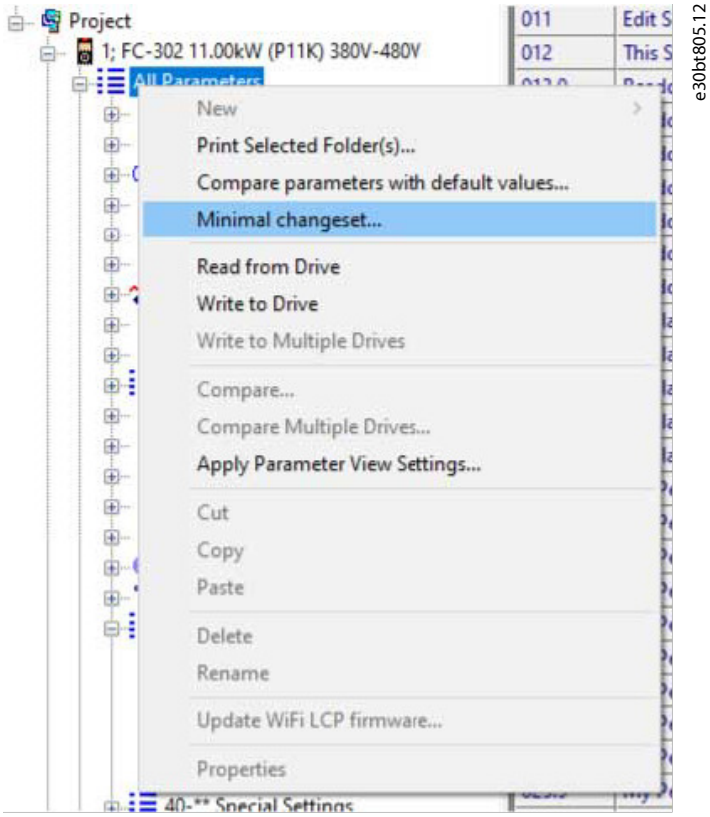

Figure 51: Minimal Changeset

Changes made including the dependent parameters can be read out by right-clicking *All Parameters* and selecting *Compare parameters with default values*.

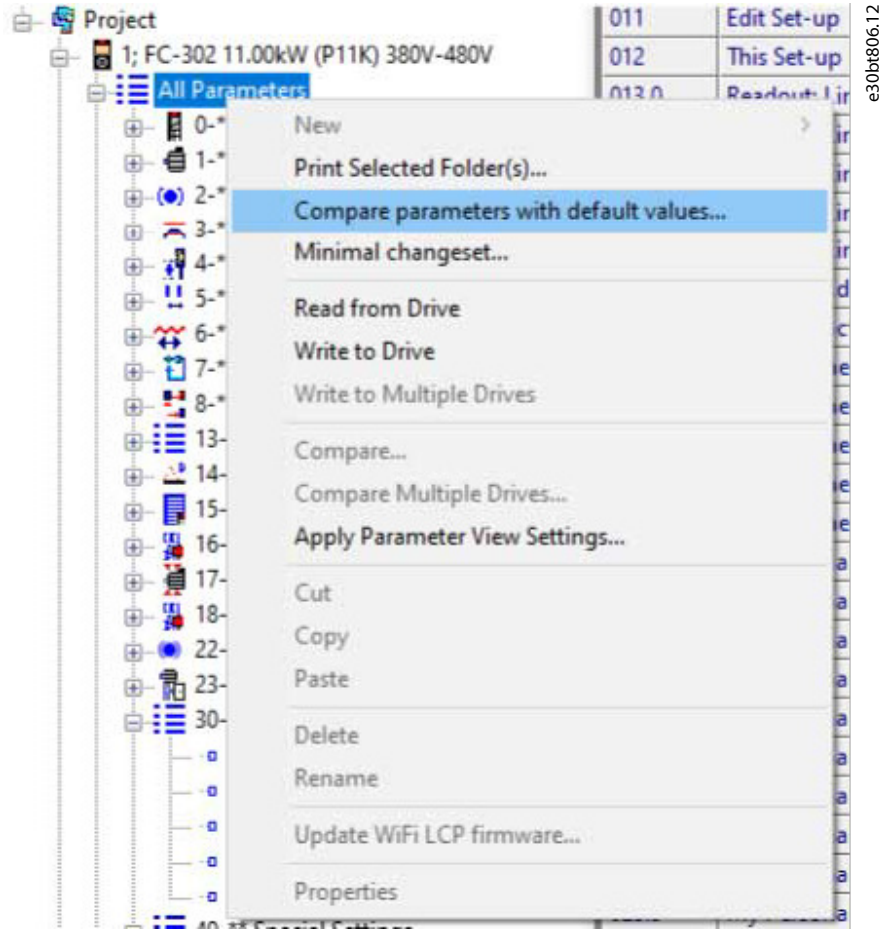

Figure 52: Compare Parameters with Default Values

5.9 Read Drive Operation Status

The drive can be in 2 different operating conditions:

- Auto On
- Off

The operation status can be monitored via the LCP or VLT® Motion Control Tool MCT 10. Use MCT 10 to monitor the actual operation status by clicking a drive in the network. Select *Refresh Status* to update the status information. Parameters can only be written to drives in operation status *Off*.

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6 Operation

6.1 Reading and Writing Parameters

Parameter settings can be read from or written to an online connected drive.

Most parameters are read/write and can thus be configured. Other parameters are read-only and cannot be configured. Use the filter function to view which parameters are read/write or read-only.

Select the values to be read/written and then select the *Read From Drive* or *Write To Drive* menu.

The following options are available:

- A single parameter in the right view.
- All parameters in the left view.
- A parameter group in the left view, for example, the Load and Motor group.

The read-from-drive and write-to-drive functions apply to the whole section.

Select *Options* in the menu bar to access a range of functions.

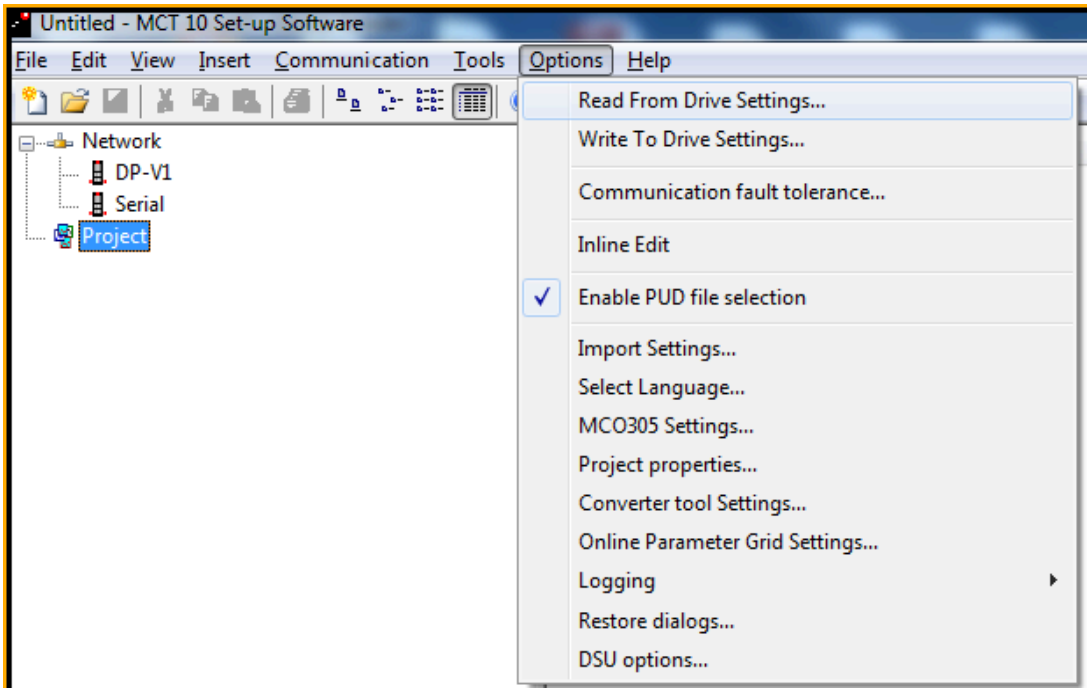

Figure 53: Select Options

6.2 Read From Drive Settings

Select the required options for reading from an active drive.

Setups

Select to read visible setups only or to read all setups.

Drive differences

If field device software and the MCT 10 software versions are not identical, specify the acceptable level of compatibility errors.

Select *Allow drive differences* to ignore all compatibility errors.

Select *Allow drive version difference* to restrict the acceptable compatibility errors to those occurring in different software versions but in the same drive series. Select *Do not allow drive differences* not to accept differences between online devices and offline devices.

Save as default settings

Activate *Read From Drive* settings for all reads from the drive.

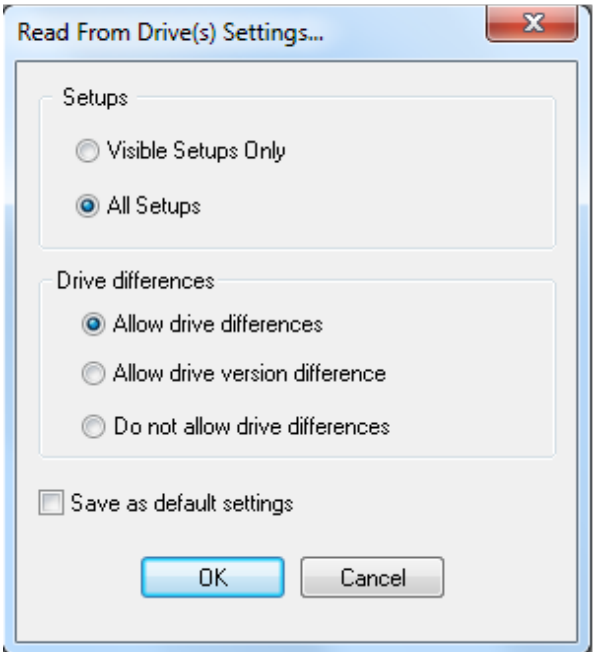

Figure 54: Read from Drive Settings

6.3 Write to Drive Settings

Select the required options for writing to an active drive, which then becomes applicable for all writing to drives.

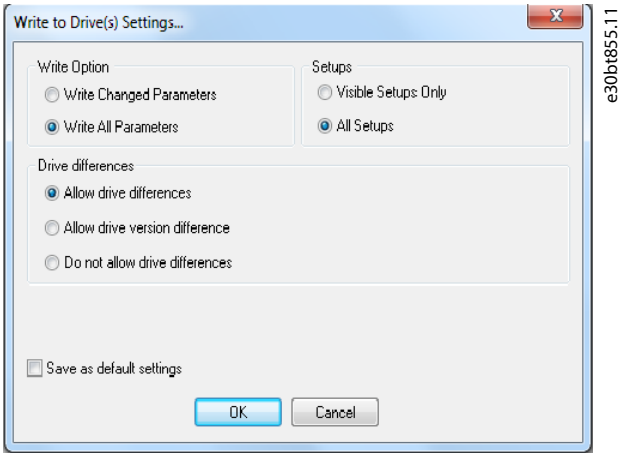

Figure 55: Write to Drive Settings

Write option

By default, *Write All Parameters* is selected. This means that all read and write parameters are written to online drives.

If selecting *Write Changed Parameters*, only the subset of parameters different from default is written. This selection improves performance.

6.4 Communication Fault Tolerance

Set an acceptable number of communication faults before disconnecting. The default number of failures is 1000.

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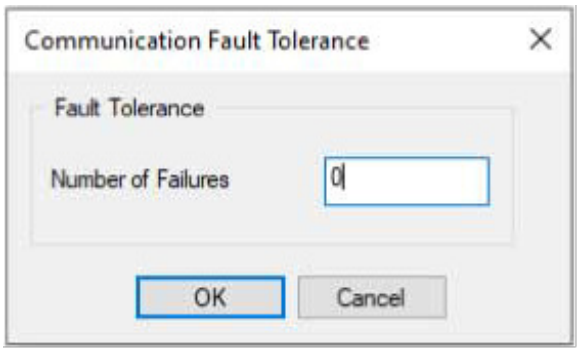

Figure 56: Fault Tolerance

6.5 Connection Properties

To read or write between online and offline drives, configure the connection properties in the offline project. If the fieldbus does not refer to an available drive in the network tree, VLT® Motion Control Tool MCT 10 is not able to identify the online drive.

Reconfigure the fieldbus by right-clicking the offline project and select *Properties⇒Connection*.

Configure the fieldbuses added to the network tree in the *Fieldbus* drop-down list.

6.6 Read From Drive

Values can be read from an active drive by right-clicking a selection and then selecting *Read from drive*.

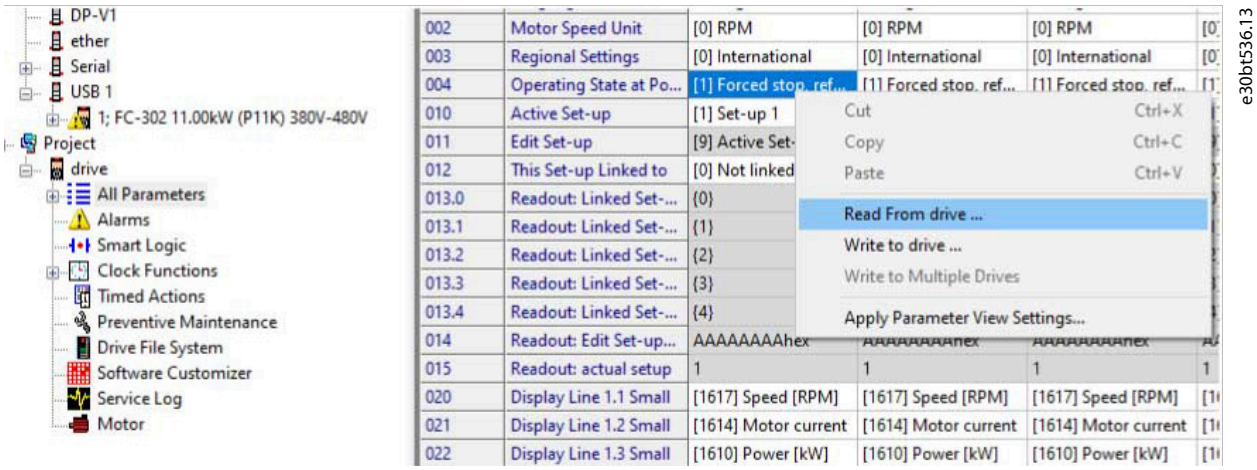

Figure 57: Read from Drive

Once *Read from drive* is selected, the software accesses the online device and shows the *Drives Check* window. This window contains a list of drives with detected compatibility issues.

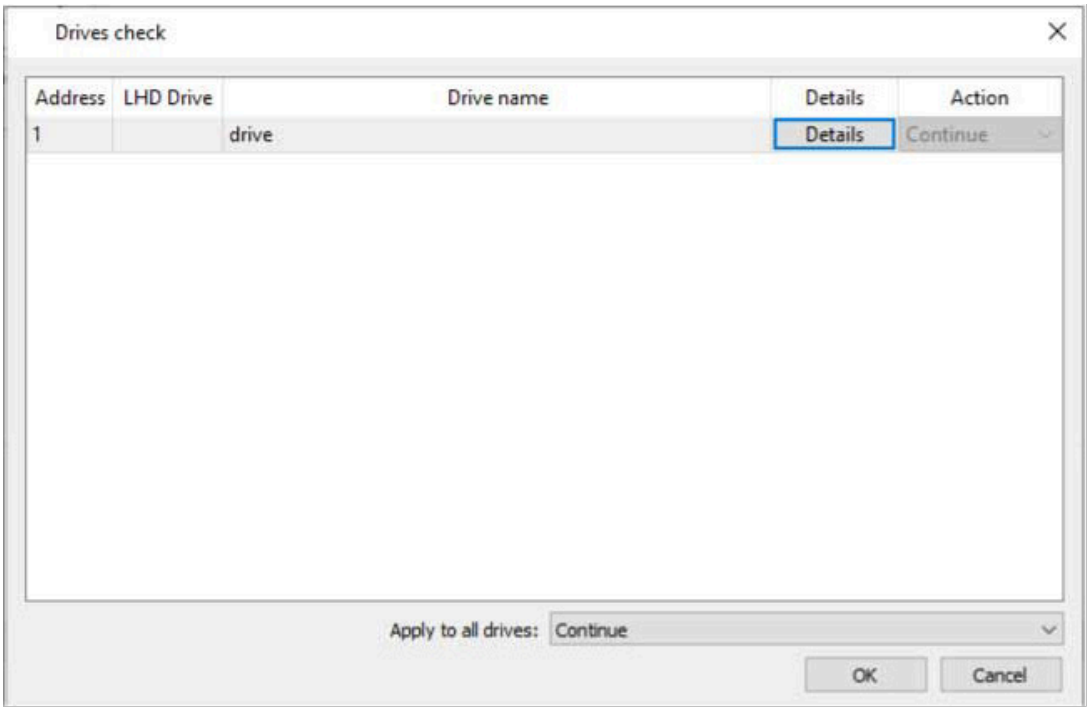

Figure 58: Drives Check Window

Select *Details* to view details on the different properties between project device (based on database information) and online device (the connected drive).

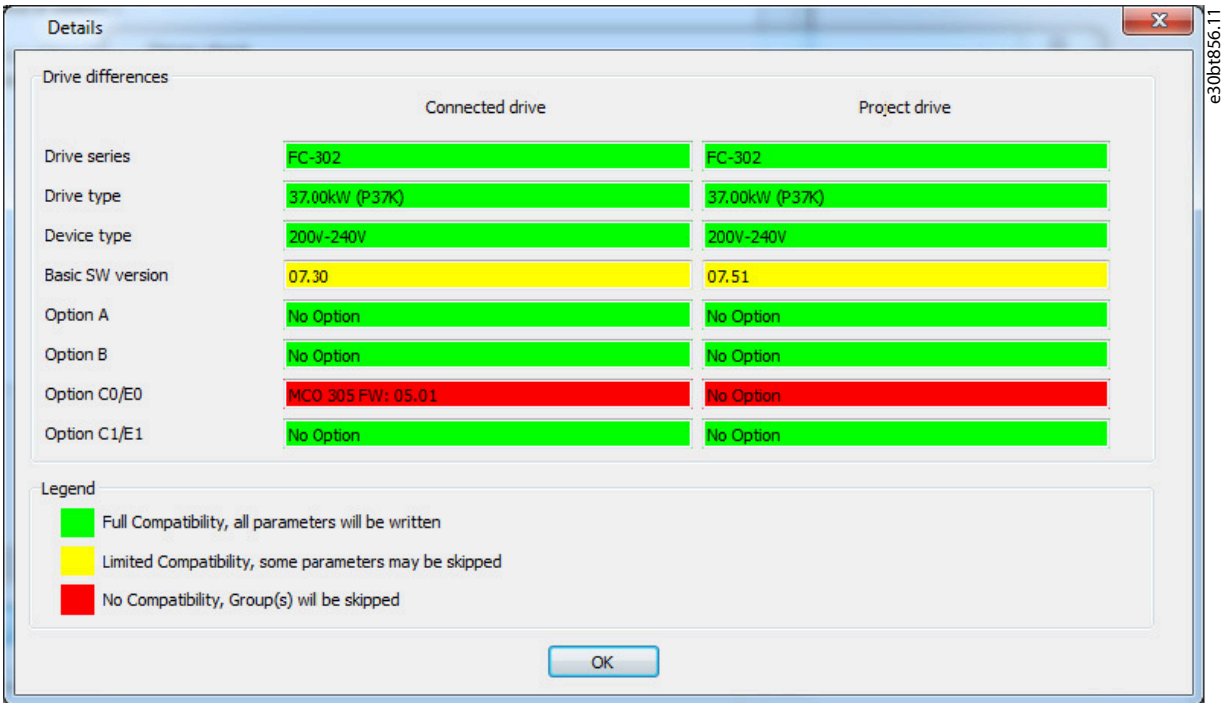

Figure 59: Details

The color codes indicate the level of compatibility between the project drive and the connected drive for each property.

To continue the reading process, define an action in the *Drives Check* dialog. The default action is *Continue*. Other available selections are:

- Skip the drive.
- None.

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- Update project and continue.

The same action can be applied to all devices at a time instead of 1 by 1.

If selecting *Skip the drive*, VLT® Motion Control Tool MCT 10 does not read that particular device, but continues reading the other devices.

Continue resumes reading. Acknowledge and accept any differences found.

Update project and continue activates the read-from-drive process, and it deletes the data in the project drive and replaces it with data from the connected drive.

NOTE: The *Update from connected* selection deletes and replaces all information stored in the project drive. To retain the information entered into the project drive, select *Continue*.

Once the read-from-drive process is completed, the display shows details of both the *Connected Drive Information* and the *Database Information*.

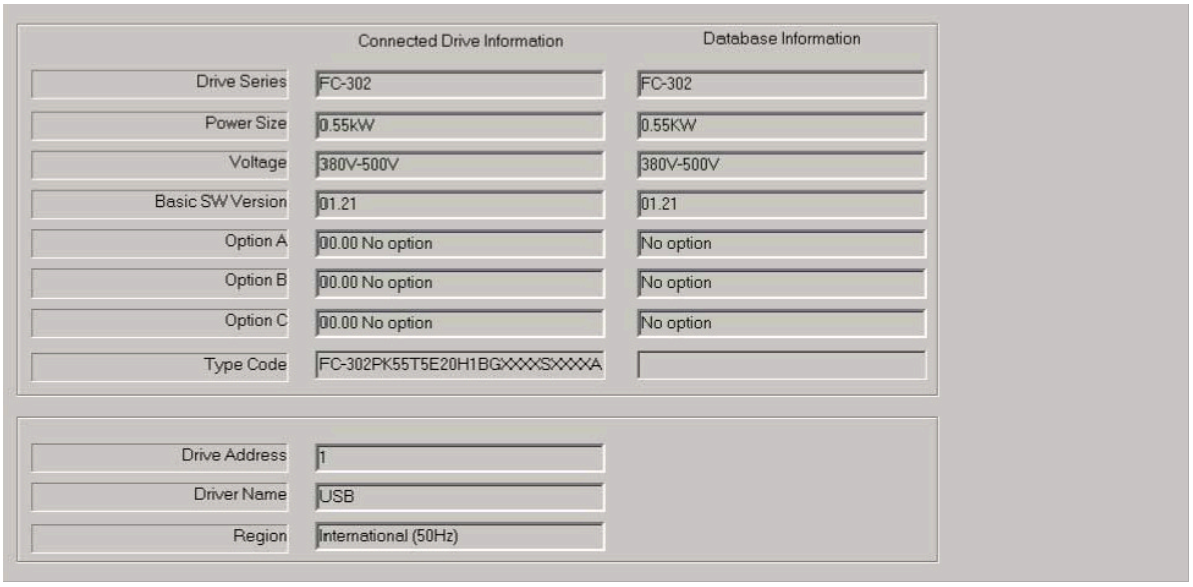


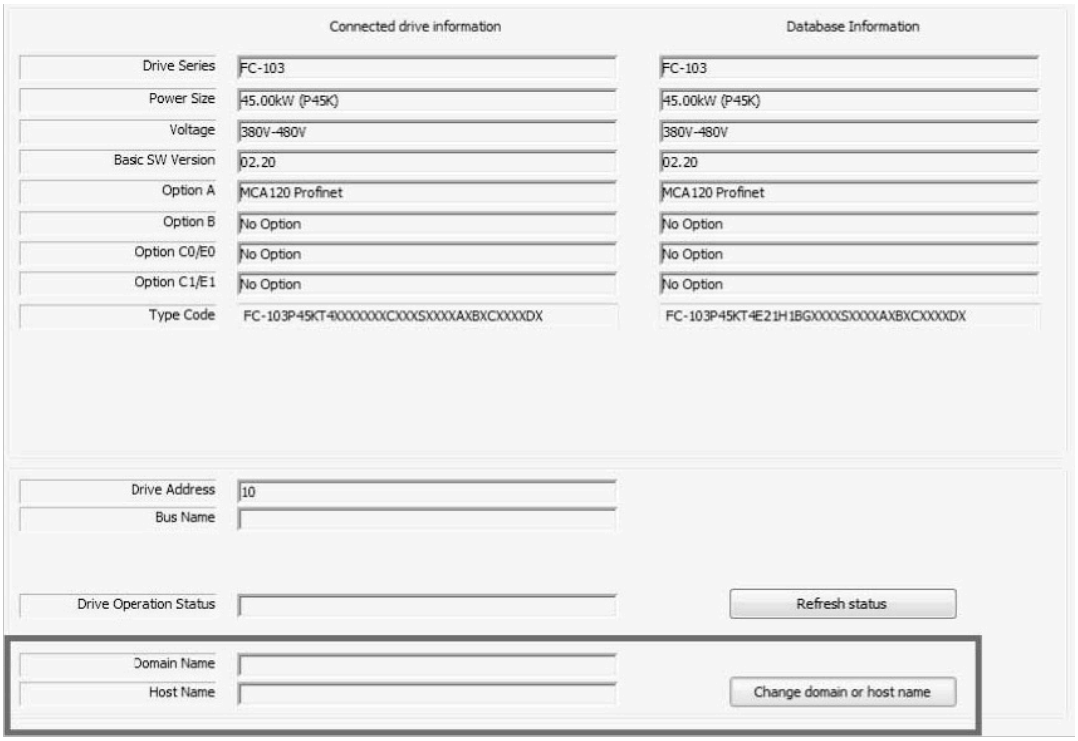
Figure 60: Read-from-drive Process Completed

6.7 Changing the PROFINET Host Name

As of VLT® Motion Control Tool MCT 10 version 4.3, the domain name and host name can be changed via the *Read-from-drive Process Completed* dialog.

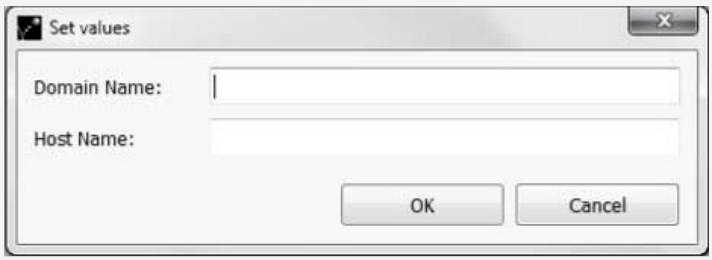
Procedure

1. Click *Change domain or host name*.



e30bu307.10

A dialog for entering the domain name and host name opens.



e30bu308.10

The values entered in the dialog are written to parameter ***12-07 Domain Name*** and parameter ***12-08 Host Name***.

6.8 Write to Drive

Procedure

1. Right-click a parameter column title in the right view or click *Communication* in the main menu bar.
2. Select *Write to drive*.

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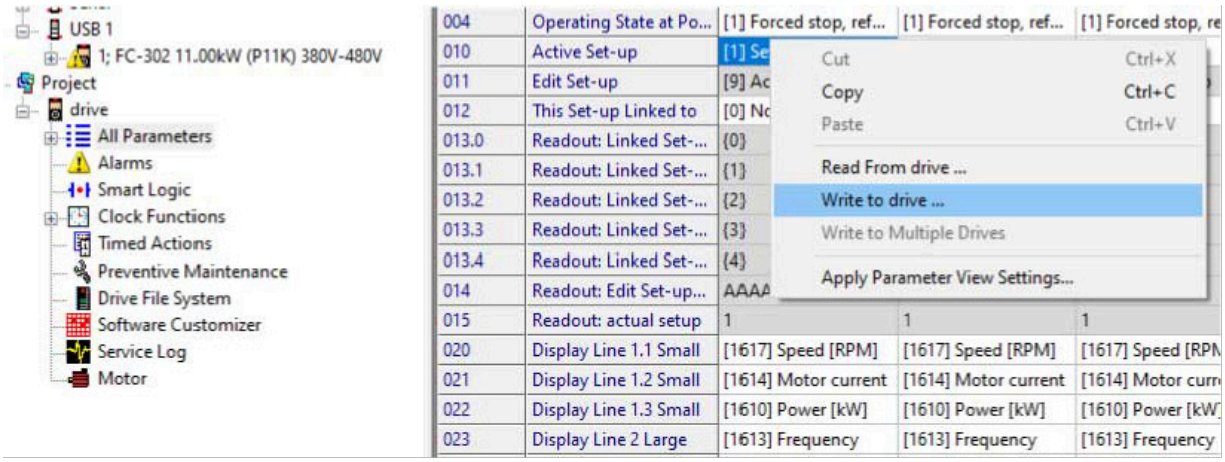
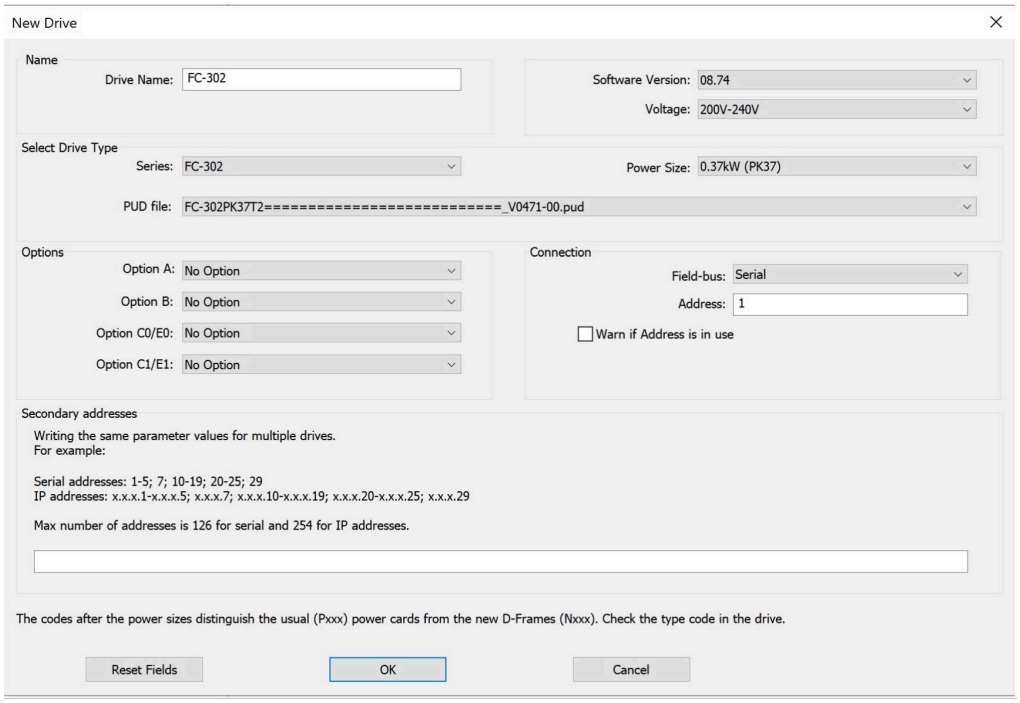


e30bt538.13

Figure 61: Write to Drive

6.9 Write to Multiple Drives

Add addresses in the *Address* field and in the *Secondary Addresses* field. *Secondary Addresses* in the right view is enabled for DP-V1, Ethernet, Serial, and Dummy.



e30bu977.10

Figure 62: New Drive Dialog

Write parameter values to the main address and to secondary addresses. If the drive is not available on the configured address, it must be skipped.

If a drive is configured with secondary addresses, the *Write to Multiple Drives* context menu is enabled on the right-view parameters, on the parameter headers context menu on the left-view group, and on the drive menu.

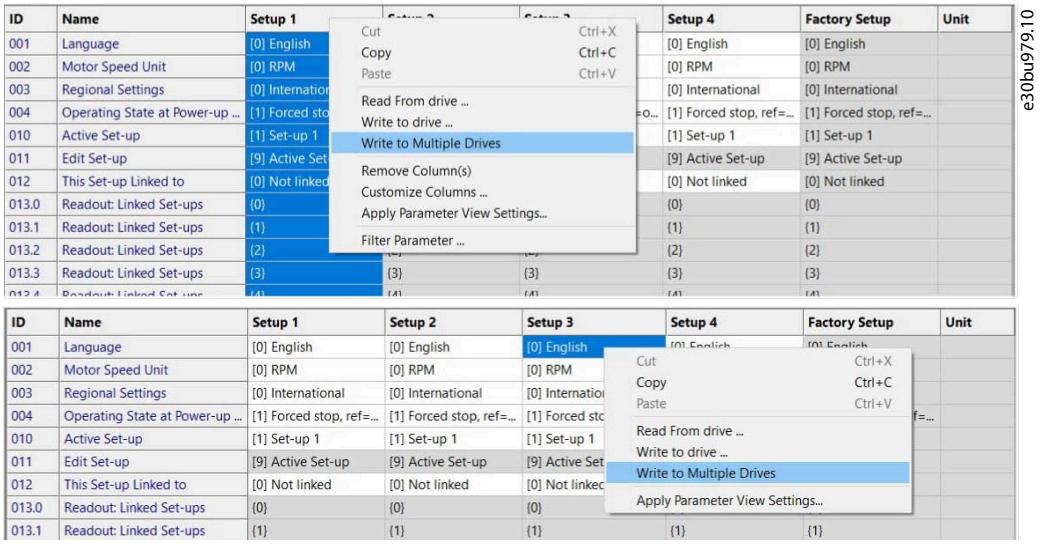


Figure 63: Examples, Write to Multiple Drives, Right-View Parameters

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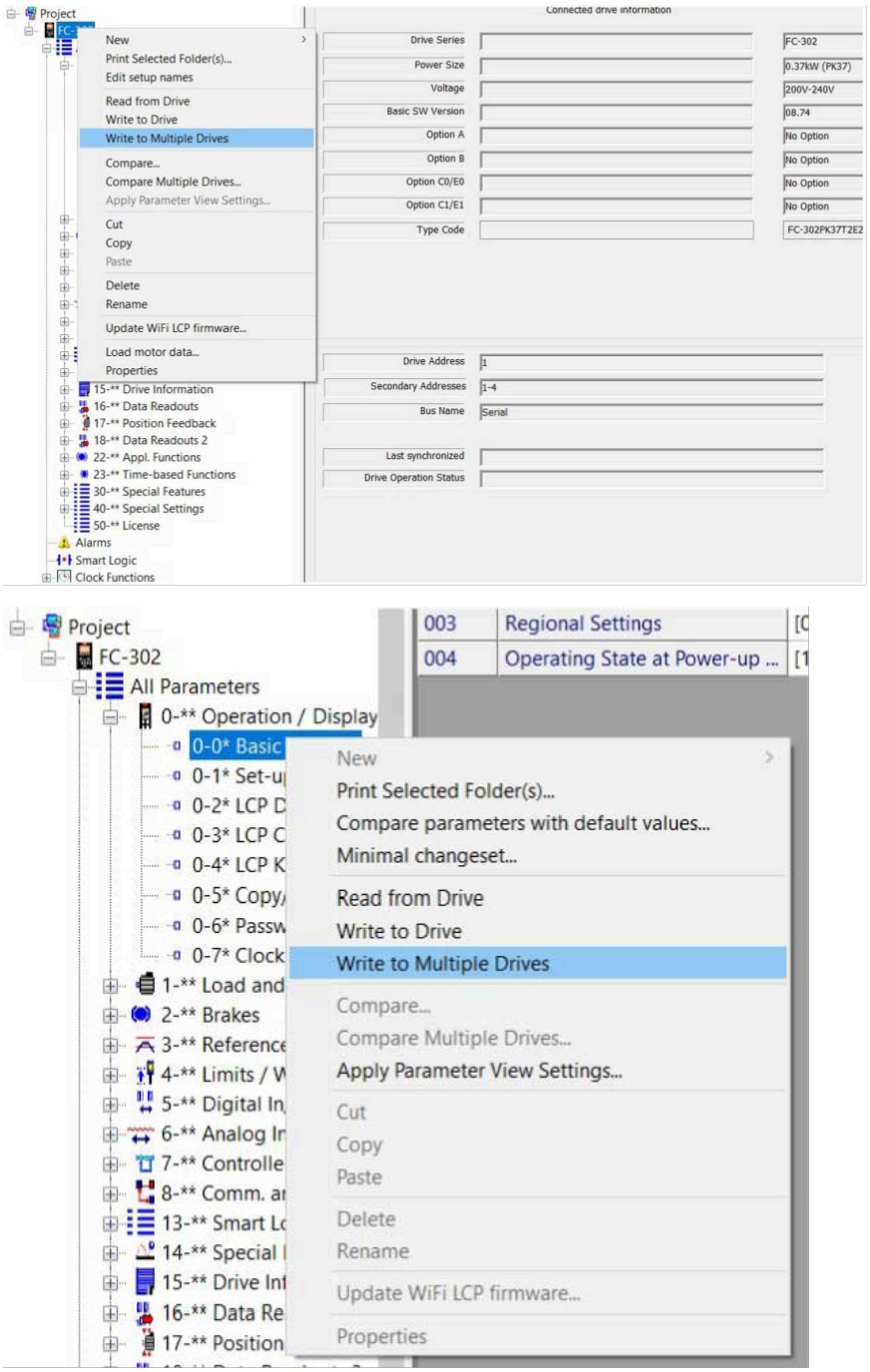


Figure 64: Examples, Write to Multiple Drives, Parameter Headers Context Menu, and Drive Menu

6.10 Polling

6.10.1 The Polling Function

When in network mode, MCT 10 automatically polls the parameters in the right view to update their status continuously to reflect live operation.

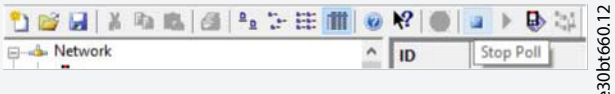
6.10.2 Stop Polling

To stop polling, for example, to freeze and analyze a particular moment:

Procedure

1. Click *Communication* in the main menu bar.
2. Select *Stop polling*.

Alternatively, click the *Stop polling* icon in the toolbar.



e30bt660.12

Figure 65: Stop Polling Icon

6.10.3 Resume Polling

Procedure

1. Click *Communication* in the main menu bar.
2. Click *Resume polling*.

Alternatively, click the *Resume polling* icon in the toolbar.



e30bt661.12

Figure 66: Resume Polling Icon

6.10.4 Using Smart Polling (Intelligent Scan Frequency)

While VLT® Motion Control Tool MCT 10 is polling the parameter grid, the LCP becomes slow. To improve LCP usability, configure MCT 10 to enable smart polling. Enabling smart polling slows down the polling when the LCP is connected.

Procedure

1. Click *Options* in the main menu bar.
2. Select *Online Parameter Grid Settings*.

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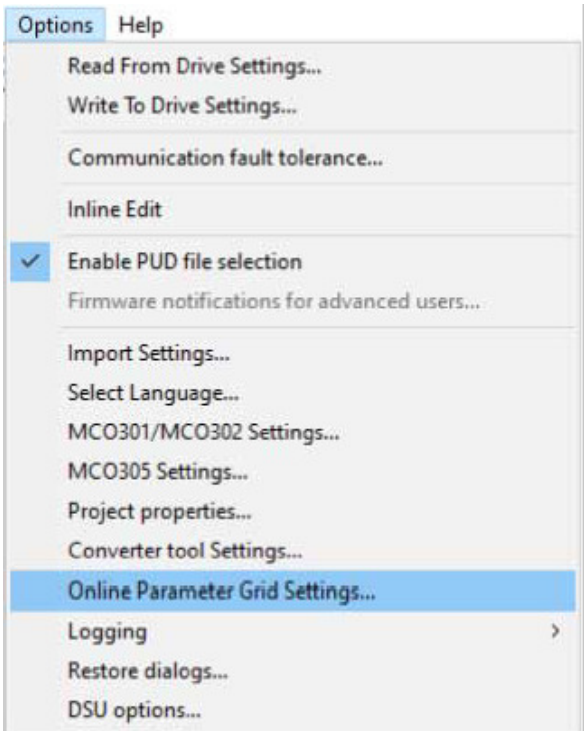

Figure 67: Selecting Online Parameter Grid Settings

3. Tick the checkbox *Enable Smart Polling (slow down the polling when the LCP is connected)*.

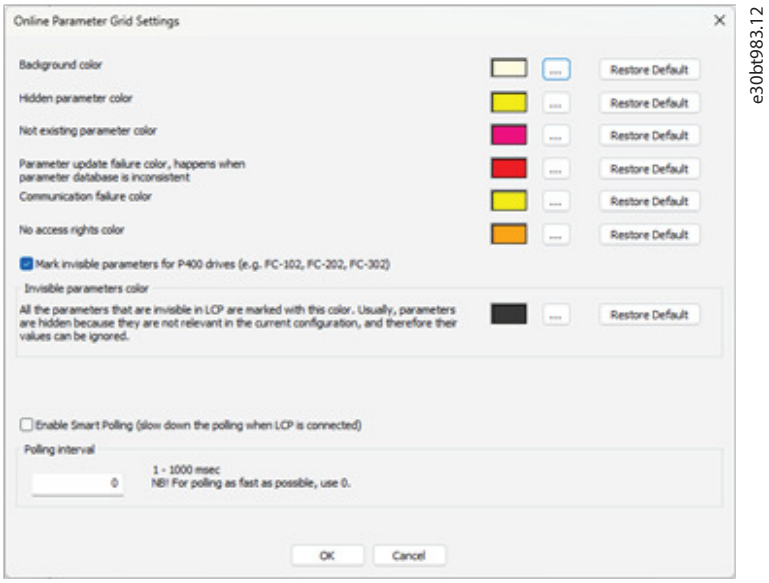

Figure 68: Ticking the Checkbox

6.11 Changing the Setup of a Field Device

Procedure

1. Open the Network folder.
2. Select the relevant device.
3. Select *Stop* on the toolbar to stop polling.
4. Change the settings in the setup columns in the right view.

The changes are implemented online in the field device, but are not recorded.

6.12 Save Changes to a Hard Disk

6.12.1 Record Online Changes

Procedure

1. Select the relevant device in the Network folder.
2. Right-click the device and select *Copy*.
3. Select the Project folder.
4. Right-click and select *Paste*.
5. Select *File* from the main menu bar.
6. Select *Save As*.
7. Save the device file into a directory in the storage location.

6.12.2 Saving a Project

Procedure

1. Click *File* in the main menu bar.
2. Select *Save*.

   Alternatively, click the *Save* icon in the toolbar.

6.12.3 Including Drive Information

It is not possible to open a project file including a firmware version not supported by VLT® Motion Control Tool MCT 10. Including the drive information in the project file makes it possible to open in other installations with MCT 10 without having the firmware installed.

By opening the project file, the drive information is updated similarly to:

- Selecting *Update Drive Support* under *Tools* in the main menu bar.
- Downloading the drive information from an online drive.

The drive information is saved in the project file.

6.12.4 Exclude Drive Information

Procedure

1. Click *Options* in the main menu bar.
2. Select *Project properties*.
3. Click *Include drive support in project*.

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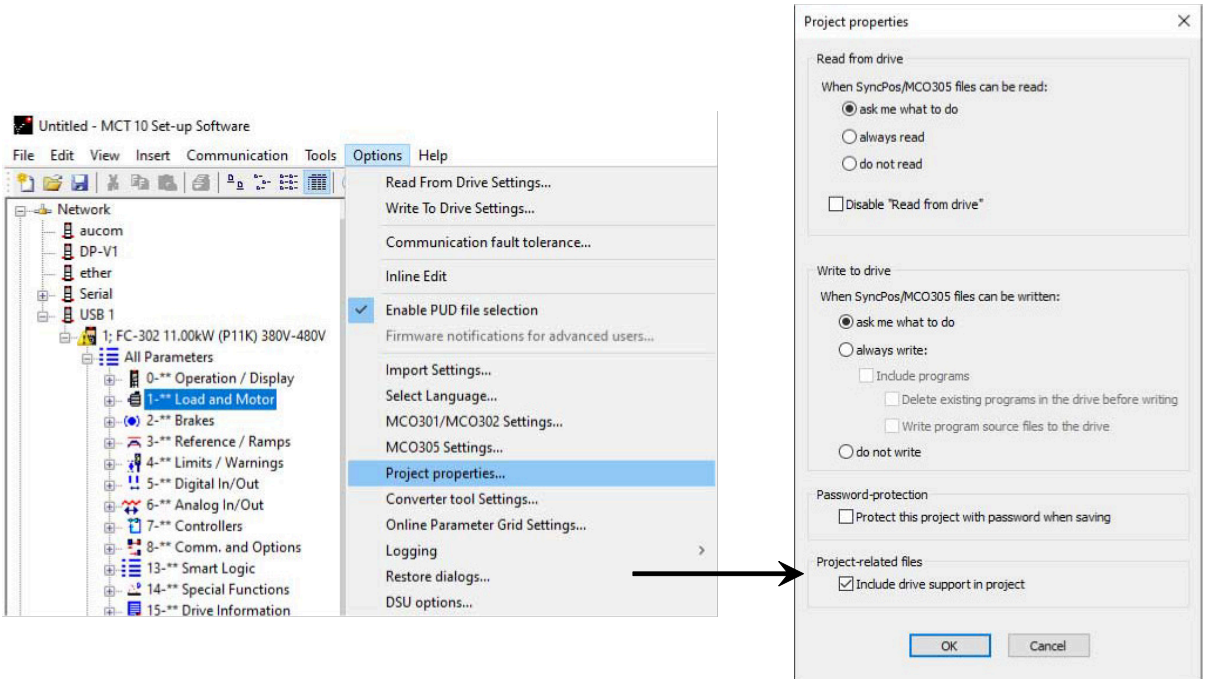


Figure 69: Save Drive Information

6.13 Import of Older Dialog Files

For users working with VLT set-up software dialog, the files generated with these software packages can be imported into the VLT® Motion Control Tool MCT 10.

Files from DOS versions and Windows versions can be imported to the MCT 10 software. Following a successful import, the MCT 10 places the imported files in an imported files folder.

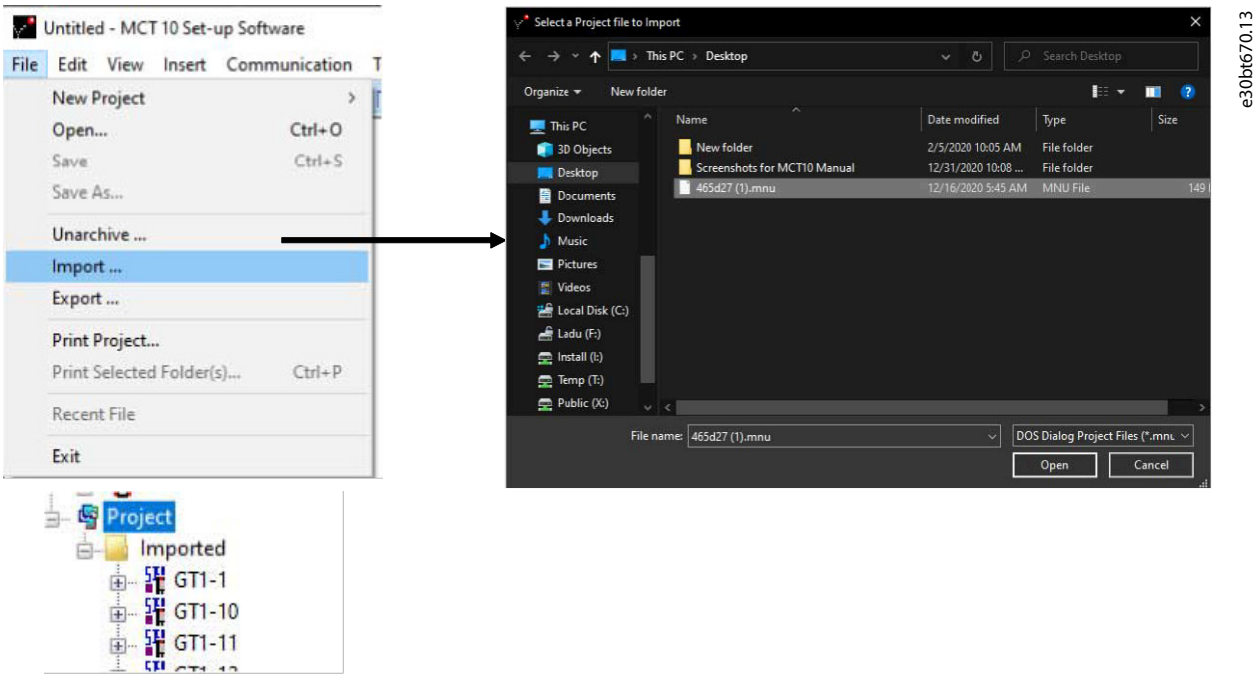


Figure 70: Import Older Dialogs

Due to limitations in some of the former PC tools, some functionalities cannot be imported, for example, functions such as showing changed values only.

6.14 Printing

There are 2 print options in VLT® Motion Control Tool MCT 10:

- Print project.
- Print selected folders.

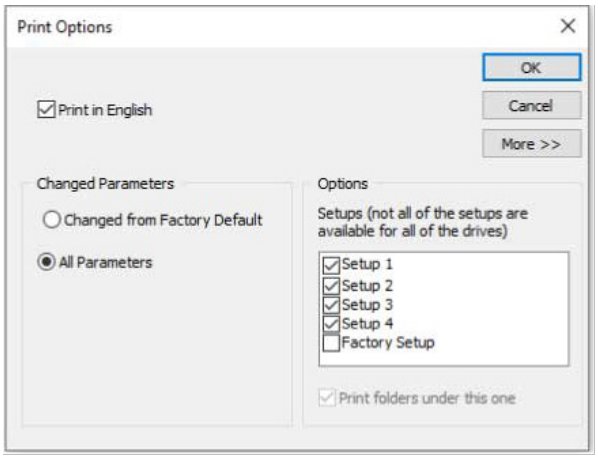
Both options are in the *File* menu in the main menu bar. Alternatively, right-click the *Project* icon and select *Print project*.

To print a folder, right-click a folder icon within the project and select *Print selected folders*.

Select *Print project* to print parameter settings for an entire project. Select *Print selected folders* to print parameter settings for part of a project.

Figure 71: Print Options

Select the wanted print language from the drop-down list.



Changed parameters

Print either parameters that have been changed from factory setting or all parameters.

Options

Select which setup to print.

More

Click *More* to be able to print selected parameter groups only.

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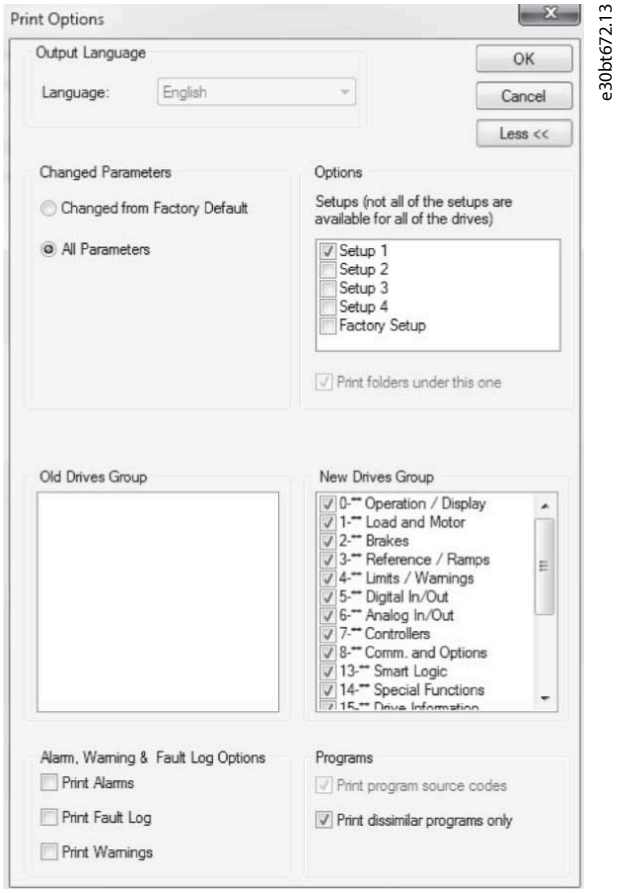
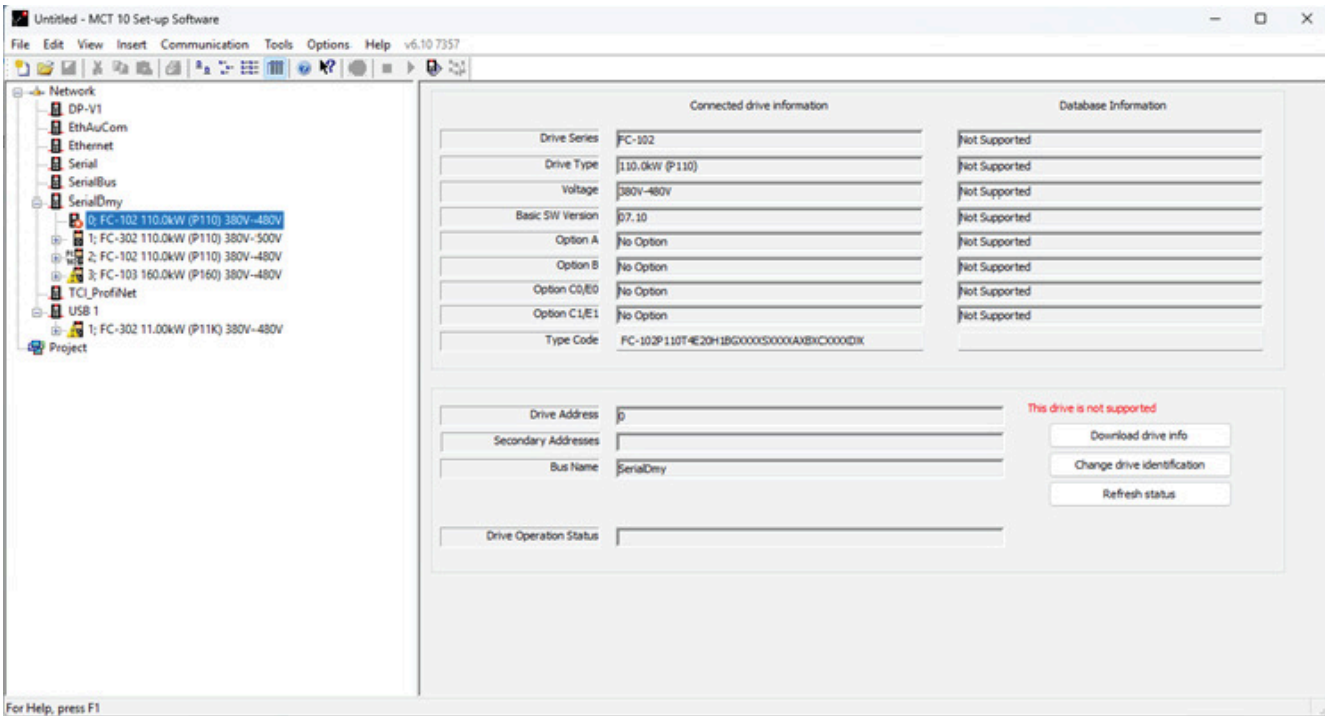


Figure 72: Example of Print Selection

6.15 Update Database Information

If the VLT® Motion Control Tool MCT 10 database information is outdated, updates are available either in https://suite.mydrive.danfoss.com or, when this is not possible, by reading from the drive itself.

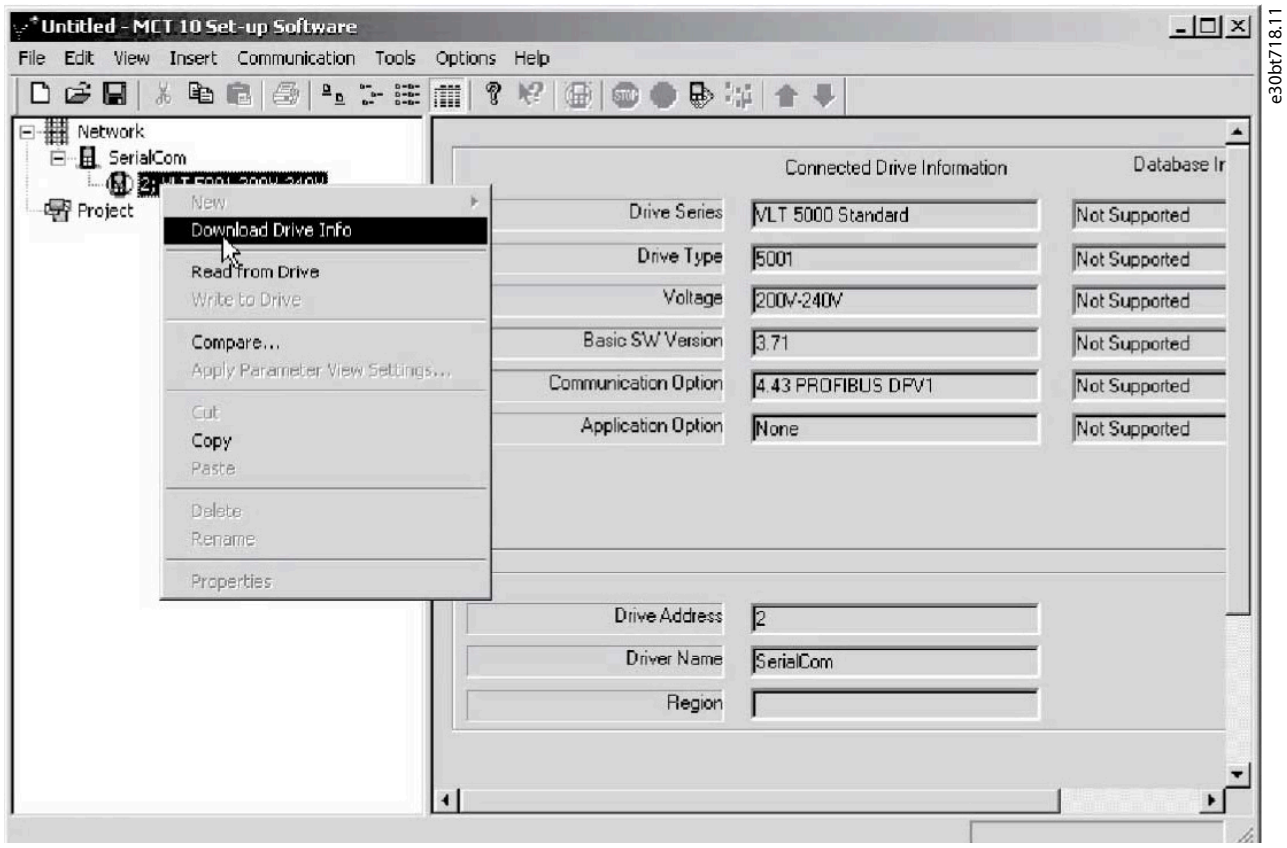
When the MCT 10 database for a drive is outdated, the drive icon is shown with a red line through it and the *Database information* fields show the message *Not supported*.



e30bm570.10

Figure 73: Drive not Supported

Update the database either by right-clicking the drive icon and selecting *Download drive info*, or by clicking *Download drive info*.



e30bt718.11

Figure 74: Database Update

To start reading from the drive, select *Yes*.

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When reading from the drive is complete, the drive icon no longer has a red line through it, and the *Database information* shows settings identical to the *Connected drive information*.

Also, the parameter settings are shown in capital letters.

6.16 Update Drives Firmware Support in MCT 10

The VLT® Motion Control Tool MCT 10 can be updated regardless of the firmware of the drive.

Download upgrades from the Danfoss website www.danfoss.com.

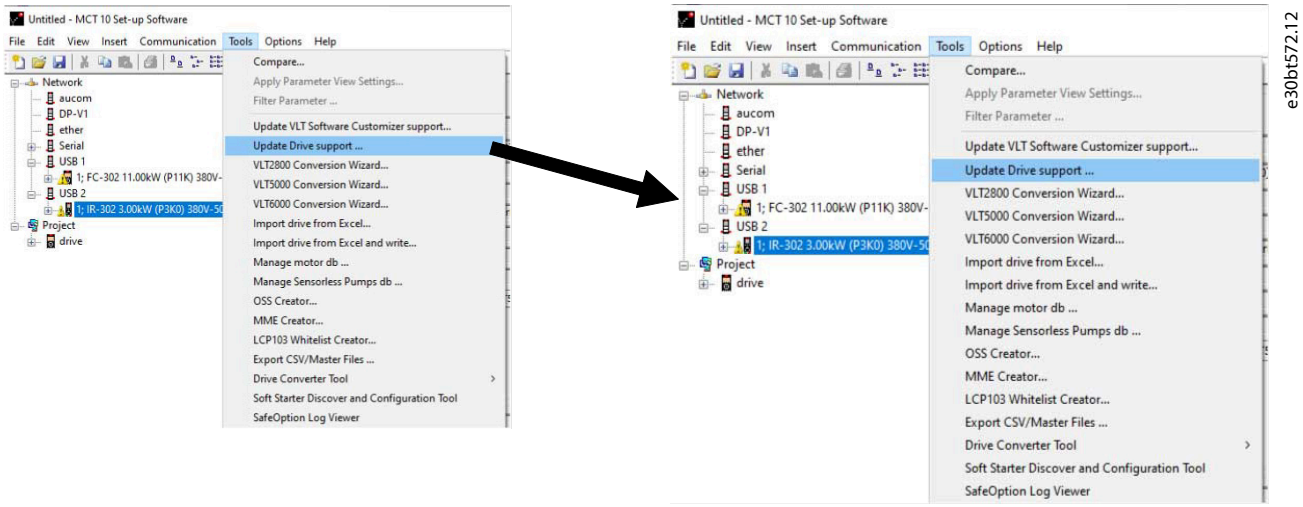

Figure 75: Update the MCT 10 Software

NOTE: The update files can be installed without administrator rights in Microsoft operating systems.

6.17 Software Compatibility

The VLT® Motion Control Tool MCT 10 project files can open legacy version project files.

For project files older than version 3.17, use a separate conversion tool for opening these files.

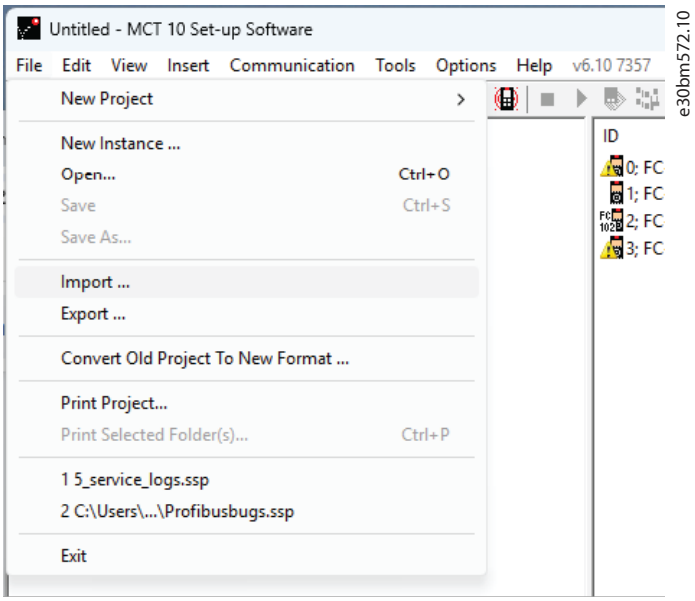

Figure 76: Select Conversion Tool

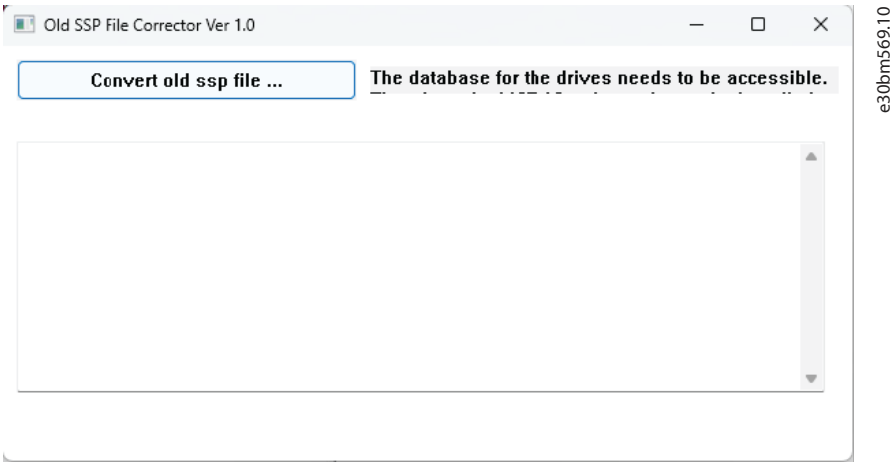

Figure 77: Convert Old Files

When MCT 10 has been updated, project files saved with a newer firmware version can be opened and used. Refer to Figure 78 for an example.

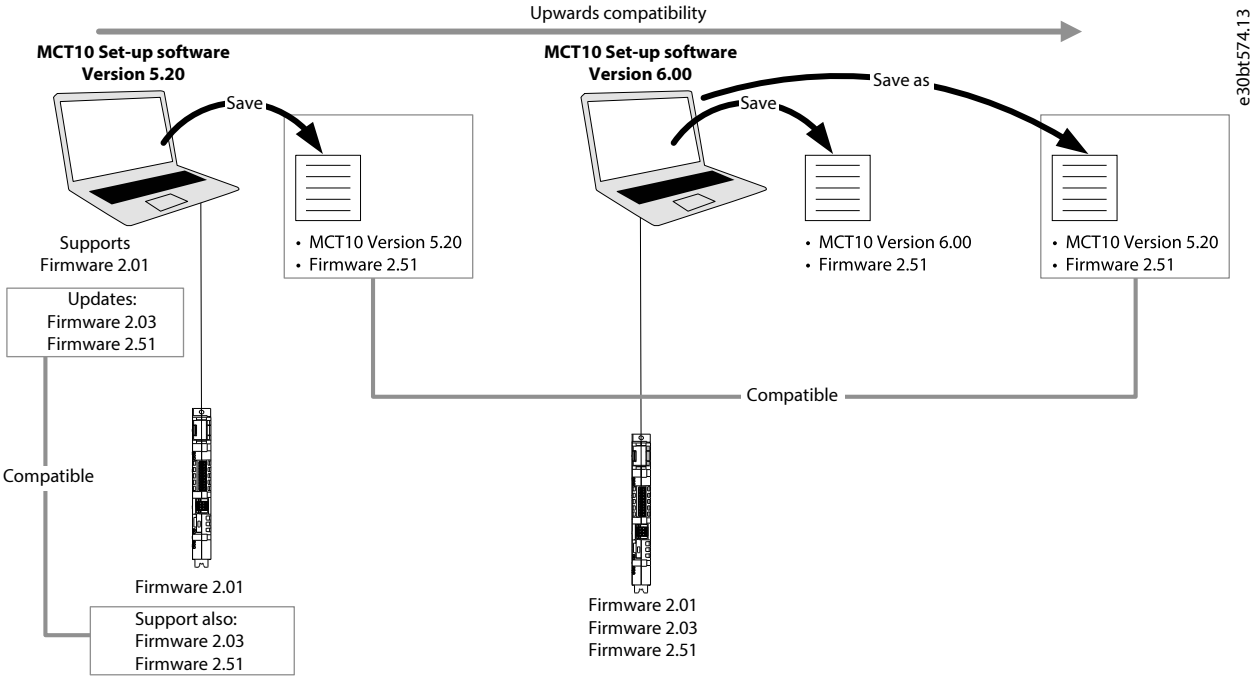

Figure 78: Use Updated MCT Software

6.18 Actual Software Version

Open the *About* box to see the actual software version of VLT® Motion Control Tool MCT 10

NOTE: System information can be copied directly to the Windows clipboard.

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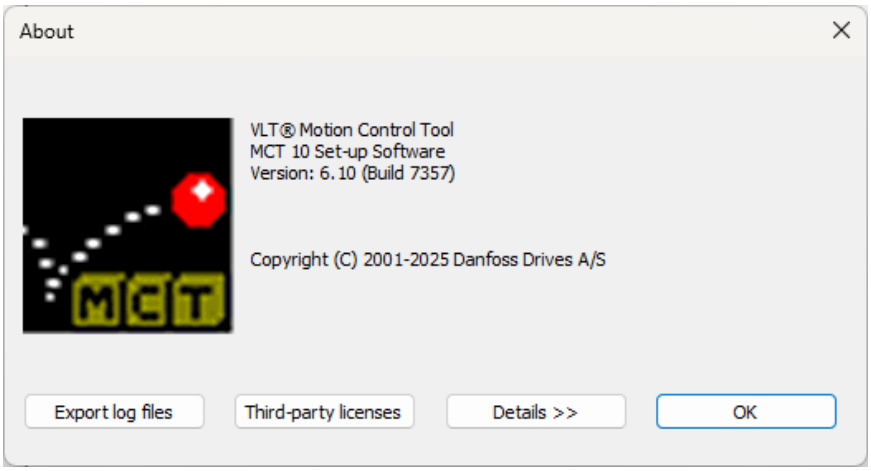

Figure 79: Copy System Information

6.19 Conversion Wizard

6.19.1 Conversion

It is required that database versions, power size, voltage range, and option configuration of the source match the destination drive. Differences can be converted using 1 of the conversion wizards available in VLT® Motion Control Tool MCT 10:

- VLT to FC series conversion.
- FC series to FC series conversion.

NOTE: If the parameter database of a source drive is different from the database on the destination drive, it cannot be written without errors signaled during write to drive.

6.19.2 VLT to FC Series

6.19.2.1 VLT to FC Series Converter Function

It is possible to convert, for example, a VLT® 5000 drive to a VLT® AutomationDrive FC 302 via the conversion matrix VLT® Motion Control Tool MCT 10.

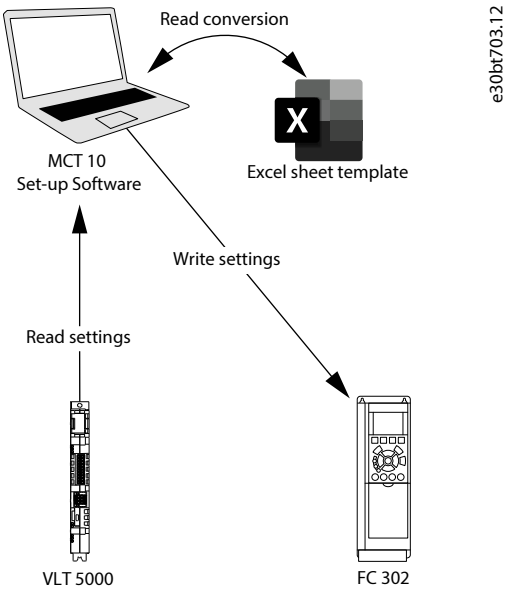

Figure 80: Conversion

6.19.2.2 Converting Multiple Drives

Procedure

1. Select the *Tools* menu and activate *Drive Conversion Wizard*.
2. In the subsequent dialogs, select the drives for conversion.

When converted, a new VLT® AutomationDrive FC 302 drive is created in the Project folder.

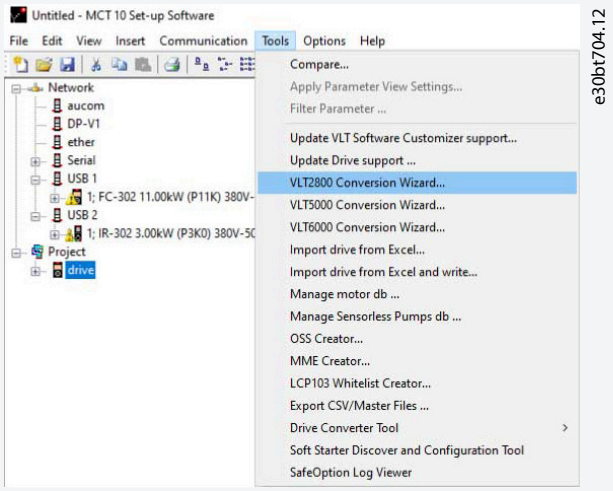

Figure 81: Conversion of Multiple Drives

6.19.2.3 Import Drive from Excel

Use this function to create a VLT® AutomationDrive project based on an Excel sheet. For example, import of VLT® 3000 settings from an Excel sheet into a new FC 302.

An example file is attached in VLT® Motion Control Tool MCT 10 (vlt3000conversion.xls). This example file can be edited and used for converting from VLT® 3000 to FC 302.

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NOTE: Detailed knowledge of Microsoft Excel formula editing is required.

6.19.3 FC Series to FC Series Conversion

1. Right-click the drive to be converted.
2. Select *Convert Drive...* from the context menu.

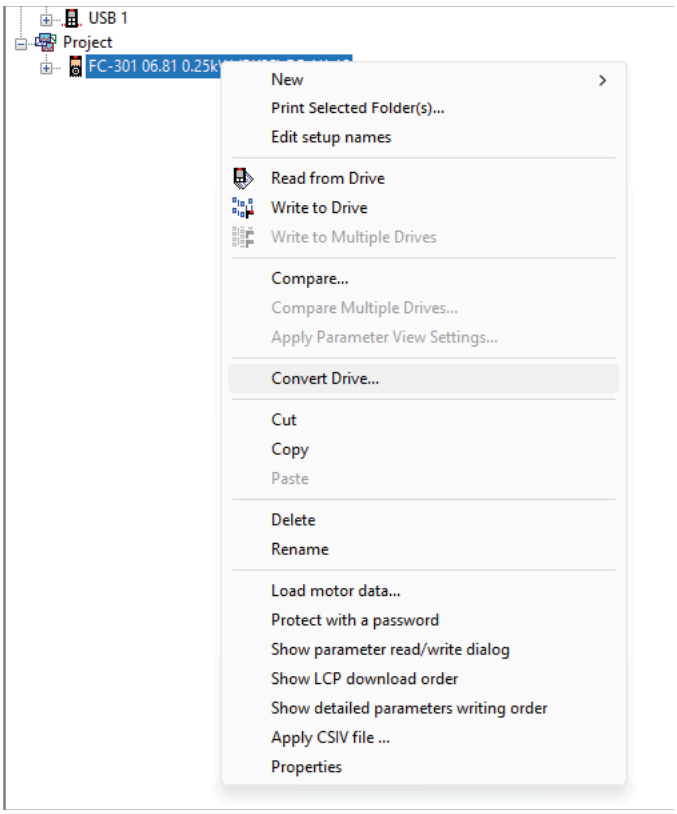
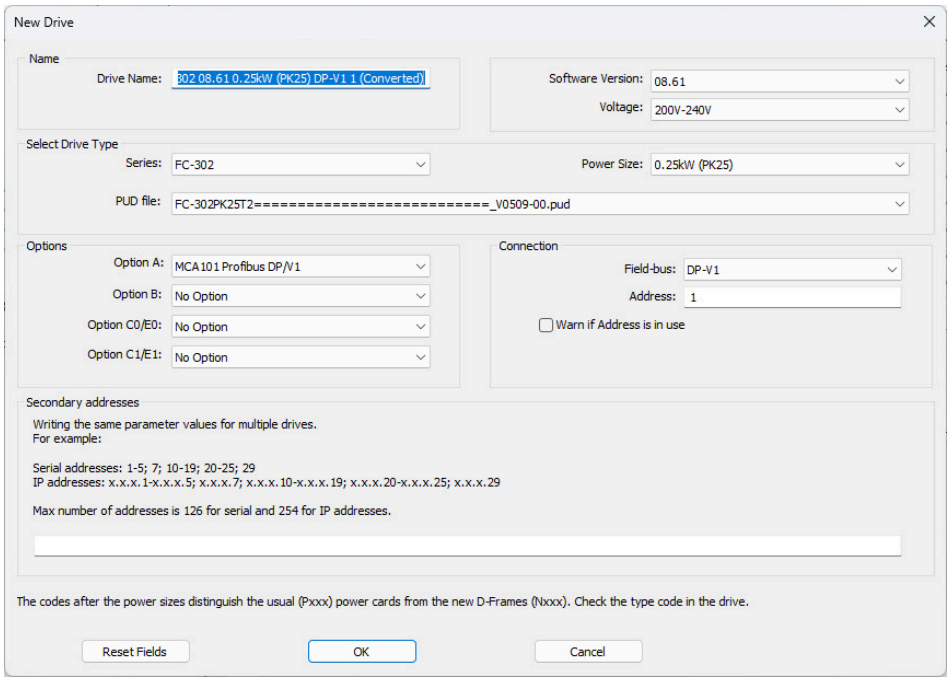


Figure 82: Convert Drive

3. Select the target drive.
4. Add a name to the drive in the field *Drive Name*.



e30bm567.10

Figure 83: Assign Name to Drive

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7 Diagnostics

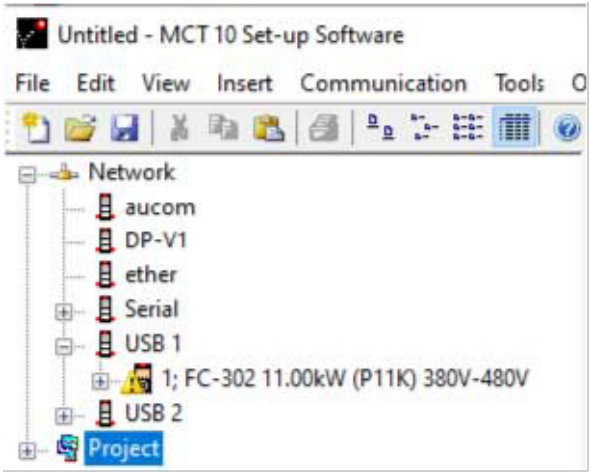
7.1 Alarm, Warning, and Fault Log Readout

Features from version 2.0 support:

- Reading out alarms, warnings, and fault logs of the online drives.
- Quick location of alarms and warnings in the connected drive system.
- Investigation of the fault log for previous trips.
- Gathering and storing events in the project file for later evaluation.
- Sending the project file to a remote specialist for further investigation.

7.2 Localization of Alarms and Warnings

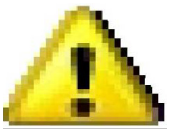
After a complete scanning of a drive network, VLT® Motion Control Tool MCT 10 indicates if the connected drives have active warnings and alarms. An exclamation mark in front of the drive icon indicates a warning or an alarm.



e30bt673.12

Figure 84: Drive with Active Alarm or Warning

Expand the drive and click the alarm/warning icon.

Name	Icon
Active alarms/warnings	 e30bt716.11
No active alarms/warning	 e30bt717.11



e30bu001.11

Figure 85: Fault Log View for Control Cards Marked MKI



e30bu002.10

Figure 86: Fault Log View for Control Cards Marked MKII

For a more detailed description of the code, refer to the operating guide for the particular drive. If the drive trips, it stores the cause for the trip in a fault log buffer. The log consists of 3 values:

- Code.
- Value.
- Time.

When MCT 10 reads the fault log, it shows the time and date when the log was read.

NOTE: The actual time when a fault occurs is not indicated.

7.3 Storing Alarms/Warnings in Project Files

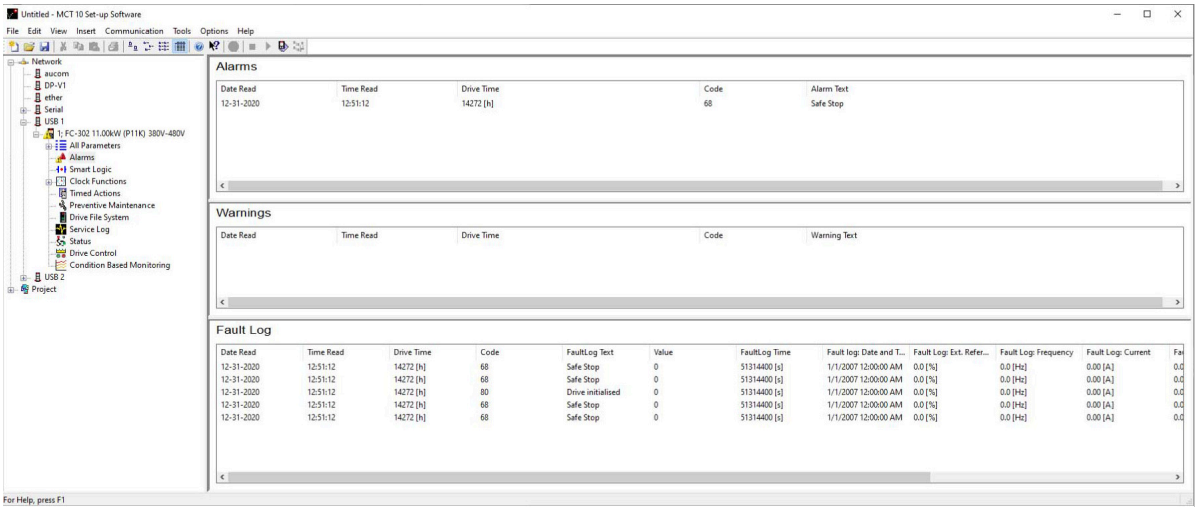
Alarms/warnings and the fault loggings are stored into the Project file. VLT® Motion Control Tool MCT 10 automatically reads alarms, warnings, and fault loggings at every read from/write to the drive.

7.4 Handling the Alarms and Warnings Loggings

VLT® Motion Control Tool MCT 10 allows more than 200 alarms and warnings for each drive in the project. The loggings can be cleared individually. This is done by entering the loggings to clear and then right-clicking. Clearing the log only clears the PC log while the information in the drive is unaffected by this handling.

NOTE: There are redundant alarm entries in the log.

MCT 10 stores active alarms and warnings in the Project file at each read/write command. No alarm is lost, but an alarm can have multiple entries in the log.



e30bt549.13

Figure 87: Loggings

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7.5 Scope

7.5.1 The Scope Function

The scope function supports monitoring and diagnosing of parameters. The function polls parameter data and dynamically shows the polled data as a curve graph.

The scope function provides 2 different channel types to sample parameters:

- PC polling channel - Channel selected when the PC SW requests the parameters from the drive. The channel does not have any time limitation, the buffer size is user-configurable and corresponds to the number of samples. Fast sampling with an accurate sampling rate cannot be obtained because the Windows operating system does not support real-time extension.
- Drive real-time channel - Only available in the FC 102, FC 202, and FC 300 series - uses an internal 16-kByte buffer in the drive. Recommended for continuously monitored applications requiring high and precise sampling rates. It is required to set up a trigger event for the drive to start filling up the buffer with samples.

7.5.2 Activating the Scope

Insert a new scope from the *Insert* menu or by right-clicking the Project folder, Drive folder, Regular folder, or Drive.

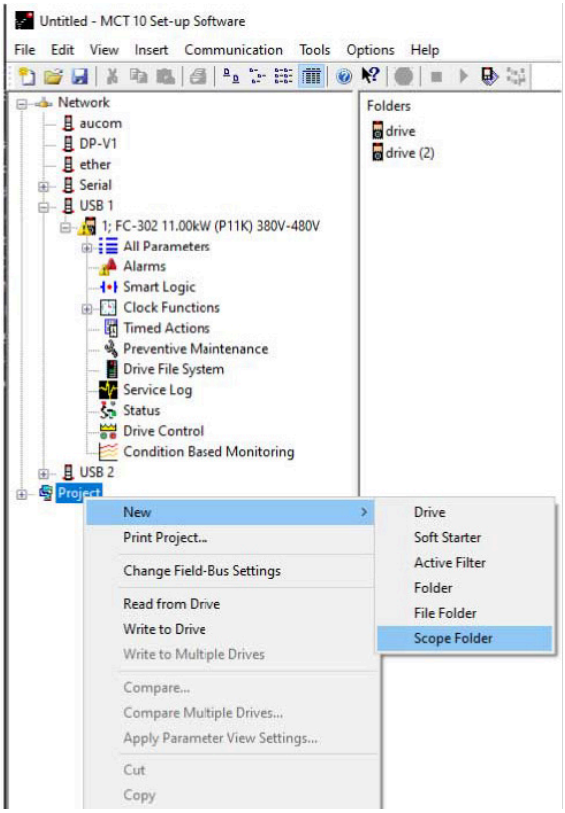
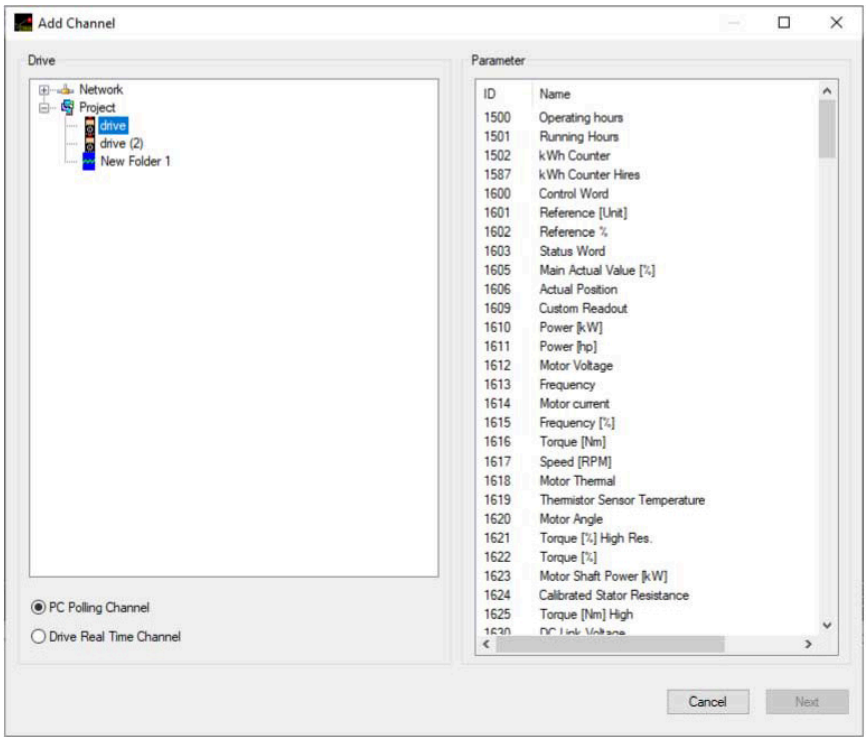


Figure 88: New Scope

Rename the Scope folder via the *Edit* menu or by right-clicking the icon and select *Rename*.

The 1st time that the Scope folder is selected, the *Add Channel* dialog pops up. From this dialog, select the drive to monitor. Then, depending on the drive series, select the type of channel to collect samples from.



e30bt793.11

Figure 89: Add Channel

Adding text notes

Insert additional text for later usage to each scope folder such as the type of drive monitored and diagnostic help text. Text notes are added by right-clicking the Scope folder and selecting *New⇒Text note*. The default text can be changed by right-clicking the text note and selecting *Rename*. Several text notes can be added to the same Scope folder.



e30bt802.12

Figure 90: Text Notes

7.5.3 Configuring the PC Polling Channel

PC polling channel is enabled by default when a drive is selected within the Network folder or Project folder. All parameters available in the list are visible by ID name and are automatically updated according to the product.

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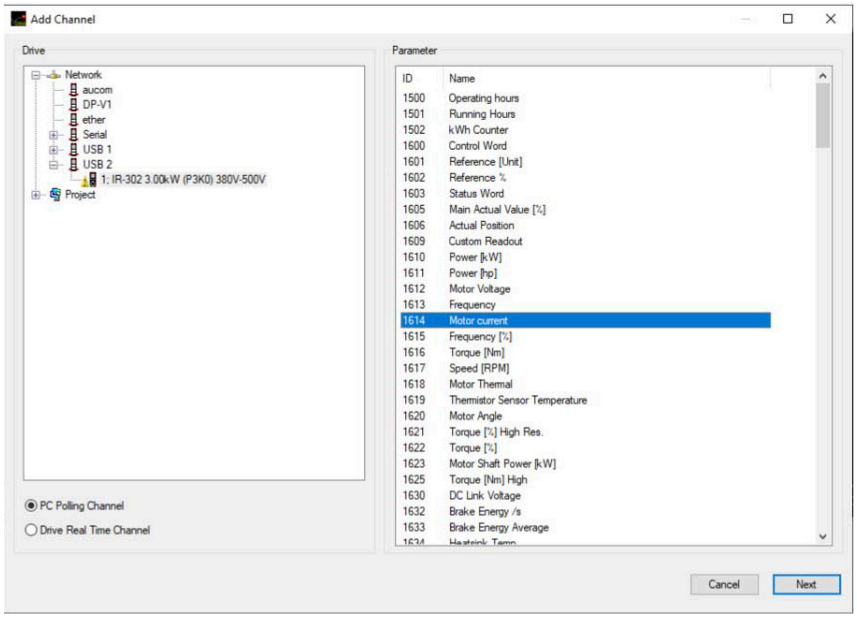


Figure 91: Parameter ID and Name

Procedure

1. Select a parameter in the parameter list and click *Next* to update the *Add Channel* dialog.
2. Configure A/div (value/division).

NOTE: VLT® Motion Control Tool MCT 10 stores the values even if they are not shown within the visible area of the curve.

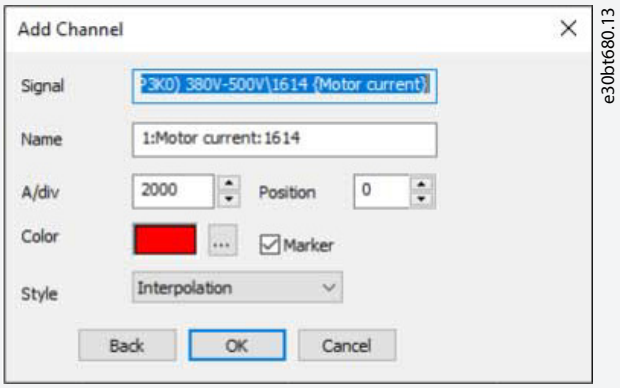
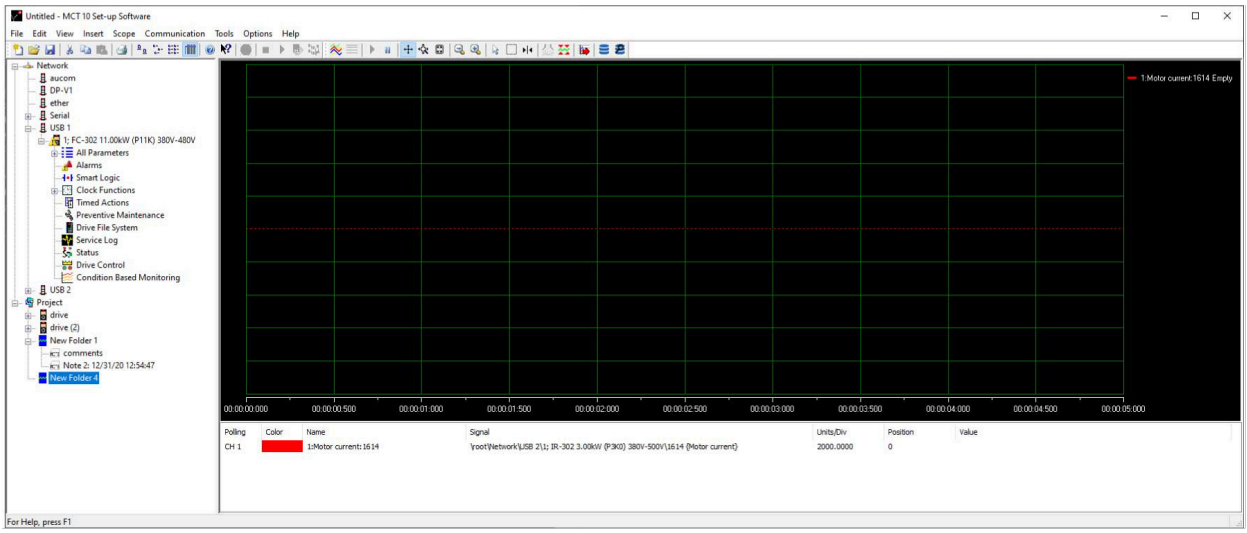


Figure 92: Storing Values

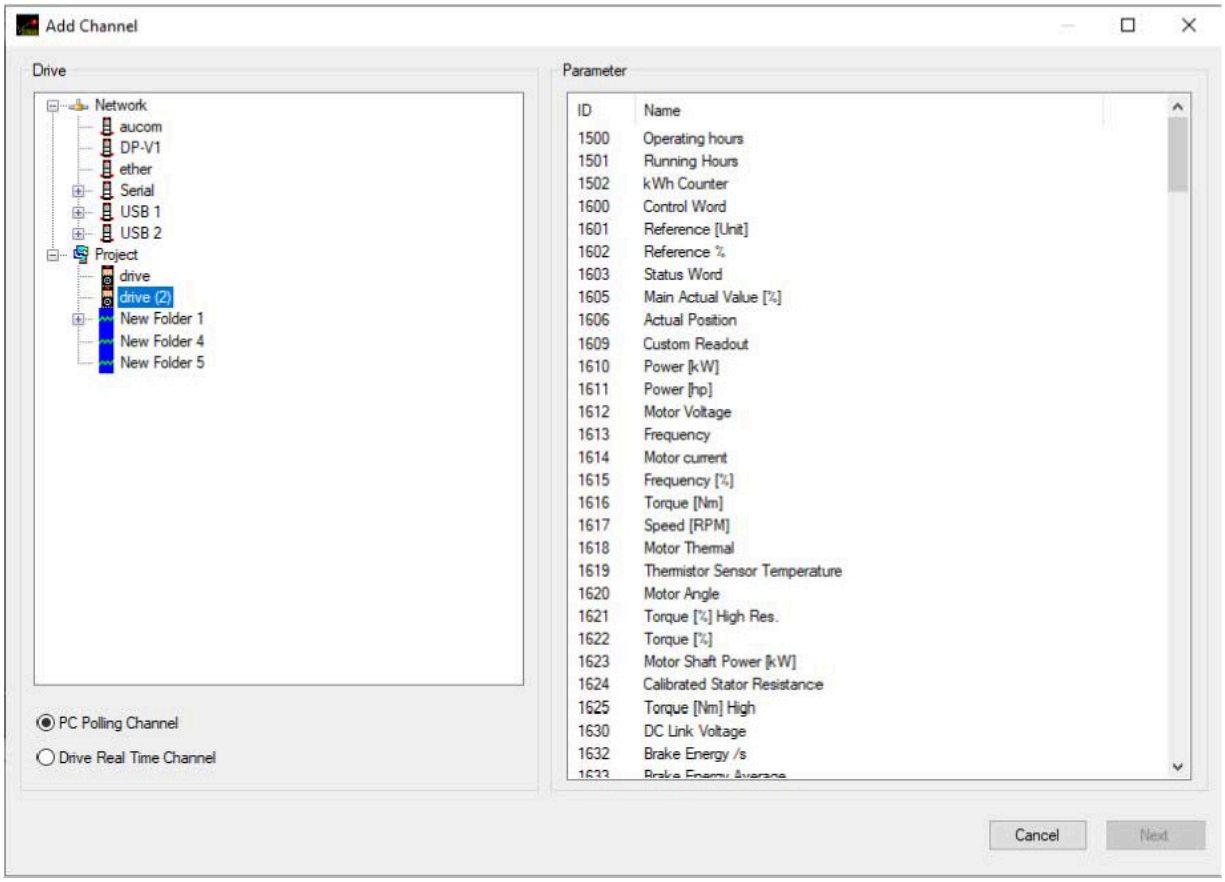
3. Define the position number (vertical zero line on the Y axis). If there are several signals on top of each other, it is useful to have them plotted apart.
4. Set color and tick *Marker* to differentiate the different curves in a black and white printout. Each curve gets a marker as box, triangle, cross, and so on.
5. Click *OK* to generate the curve graph.



e30bt503.13

Figure 93: Generate Curve Graph

6. Right-click the channel box to open the *Add Channel* dialog and add extra channels.



e30bt681.12

Figure 94: Open Add Channel Dialog

7.5.4 PC Polling Channel Properties

More settings can be configured by right-clicking the *Scope* window and selecting *Properties*. It is possible to specify:

- General parameter sample settings.
- Sample trigger settings.
- Cursor settings.

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General parameter sample settings

The *General* tab holds 4 basic settings for the *Scope Properties*:

- Seconds per division (SEC/DIV).
- Time format.
- Buffer size in samples.
- Polling rate in milliseconds.

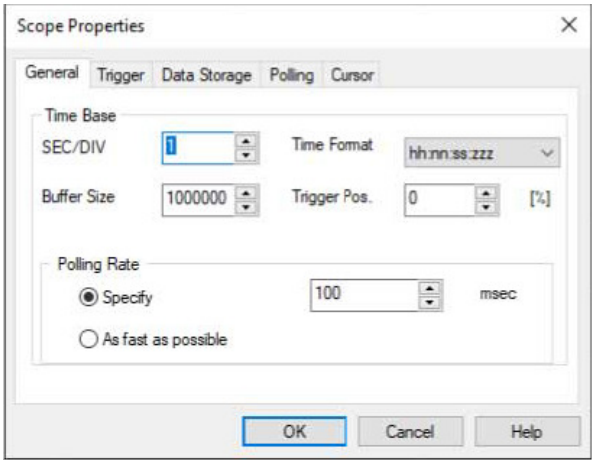


Figure 95: Basic Scope Settings

Table 2: Format and Range of the Basic Scope Settings

Description	Format	Value range
SEC/DIV	Time base on the X-axis	0.0001–1.000.000.000 s
Time format	Year, month, date, hour, seconds, and milliseconds	–
Buffer size	Number of data sets in the buffer	0–1.000.000
Polling rate	Time in milliseconds between 2 samples	–

NOTE: For systems with large inertia, a low sampling rate may be used since the value changes slowly. For systems with low inertia, a high sampling rate is needed.

NOTE: Setting *Polling Rate* to *As fast as possible* means that VLT® Motion Control Tool MCT 10 does not control the actual time between each sample. This can lead to a high jitter between 2 samples.

Trigger

The trigger function starts the sampling of values only when a certain value is reached. This reduces the need for large buffer sizes. A trigger is also a valuable tool to see if values cross borders where the drive does not store any warnings.

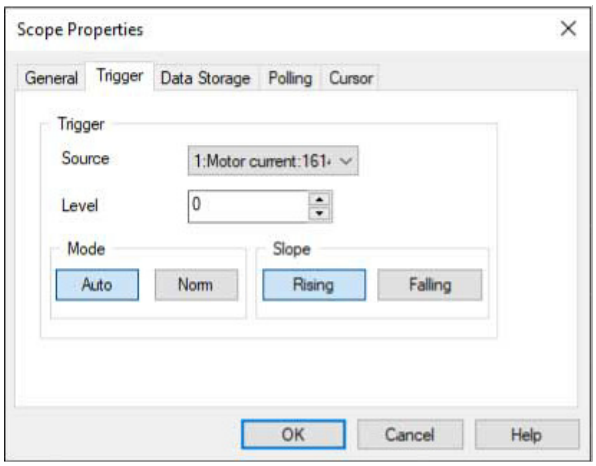


Figure 96: Trigger Functions

Table 3: Descriptions of the Trigger Functions

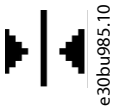
Trigger functions	Description
Source	Source channel.
Level	Level where the trigger has to be activated.
Mode	Auto starts the trigger automatically when *Resume All* is pressed. The trigger line is set to the time when *Resume* was pressed. Normal (Norm) activates the trigger when level and slope settings are fulfilled.
Slope	Sets if the value must rise (source value goes from low values to high values) or the slope must fall (source value goes from high values to low values).

Cursor

Style defines the functionality of the cursor. The style contains 5 different possibilities:

- Value XY - Shows the time and value of each signal at the cursor location.
- Value X - Shows the time only.
- Value Y - Shows the value only.
- Delta X - Shows 2 cursors, and the time between the 2 cursors is calculated.
- Delta Y - Works like Delta X, but this time the difference between the 2 levels is calculated.

The pointer position defines the default position when a cursor is inserted in Scope.

Cursor		Inserts cursor in scope

7.5.5 Reuse of PC Polling Channel Settings

Often, the same settings are used when measuring with the PC polling channel on more than 1 drive. These settings can be reused either by copying an existing scope folder or by reusing an existing one.

Reconfigure the scope folder connection properties for another drive in the network by double-clicking an added channel. In the *Reconfigure Channel* dialog, another drive on the same or a different fieldbus can be selected.

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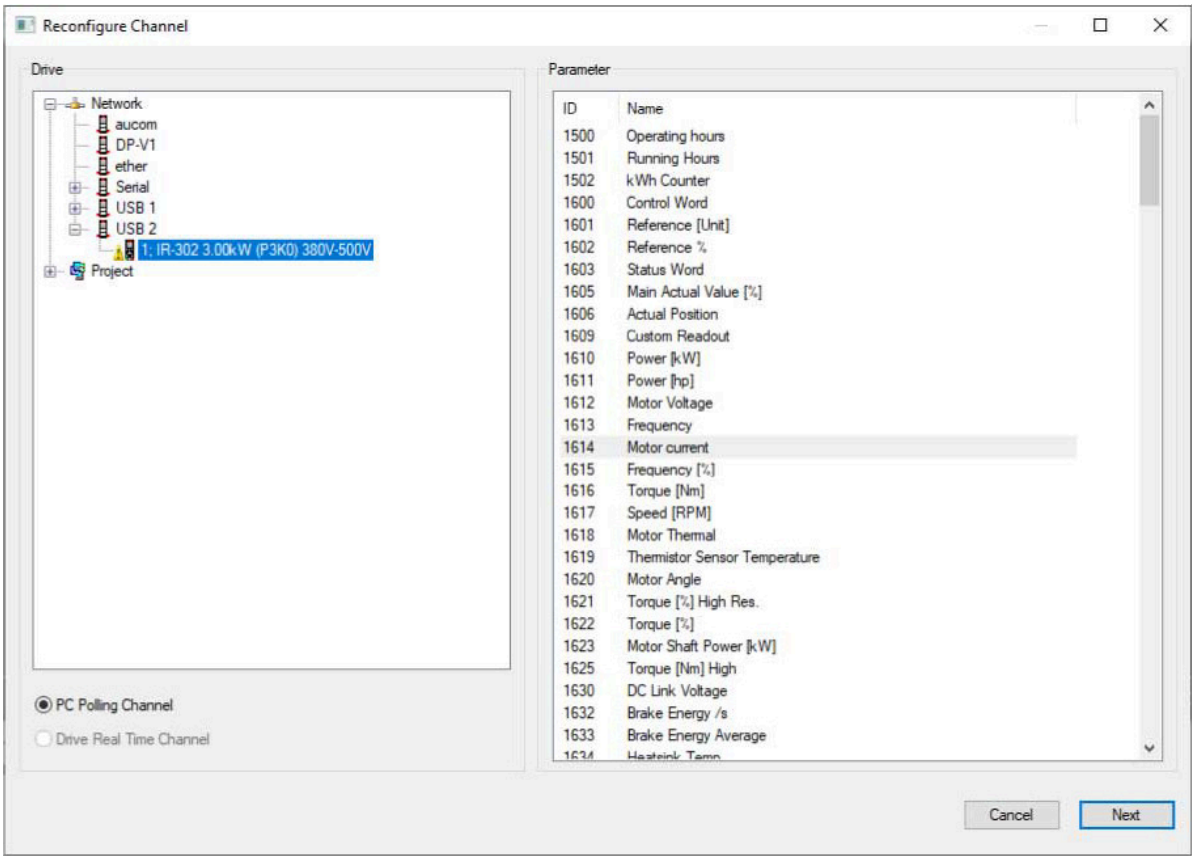

Figure 97: Reconfigure Channel

7.5.6 Configuring the Drive Real-time Channel

Drive real-time channel can be selected if the selected drive supports this functionality.

Procedure

1. Select the relevant drive.

   Drive Real-time Channel opens the *Scope Properties* dialog.

2. Configure the channels depending on what the actual drive supports.

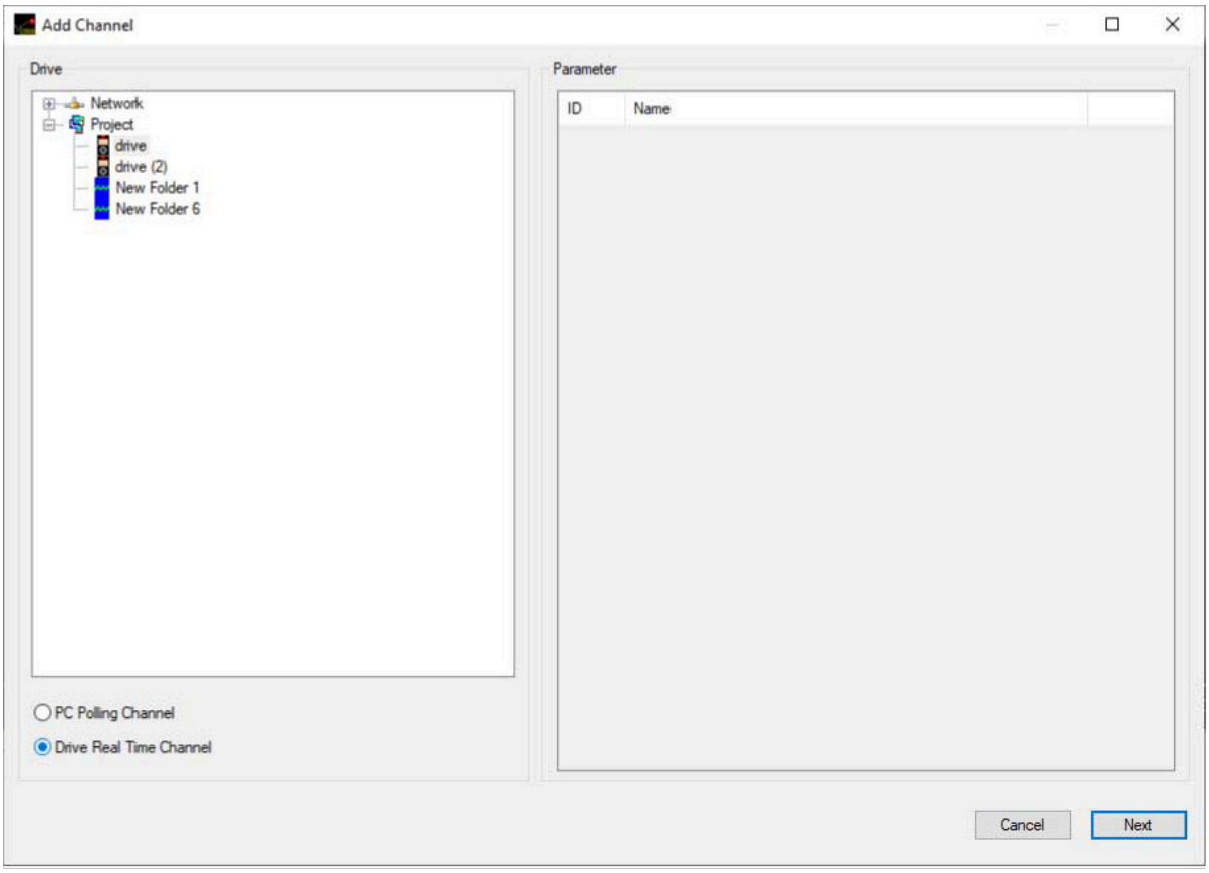

Figure 98: Select Drive Real-time Channel

All available parameters are listed by parameter name.

3. Configure the sample rate for each channel using the time format HH:MM:SS:zzz.
4. Configure the sampling mode through:
   - The trigger event.
   - Logging mode.
   - Samples before trigger options.

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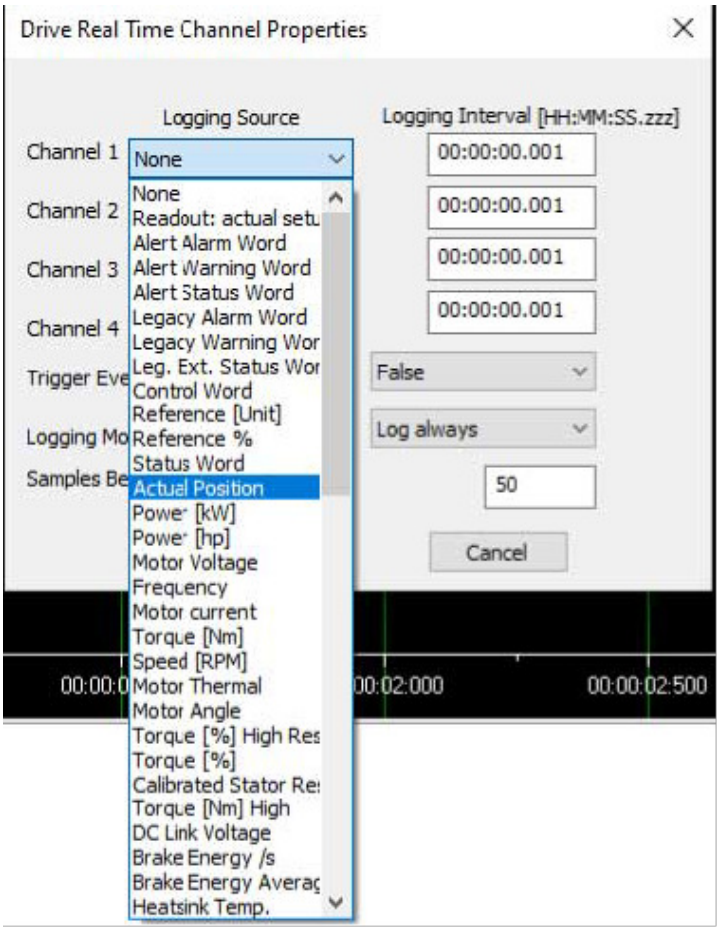

Figure 99: Configure Sampling Mode

7.5.7 Using Advanced Triggers

The following example explains the setup of a trigger, which triggers the collection of data in the drive when the motor speed exceeds a certain limit.

Set up a comparator in the smart logic control to get a trigger signal when the motor speed exceeds a certain limit:

Procedure

1. Select the smart logic group.
2. Select a comparator not in use, 1310.0, and set it up to motor speed.
3. Set *Comparator Operator* 13.11.0 greater than >.

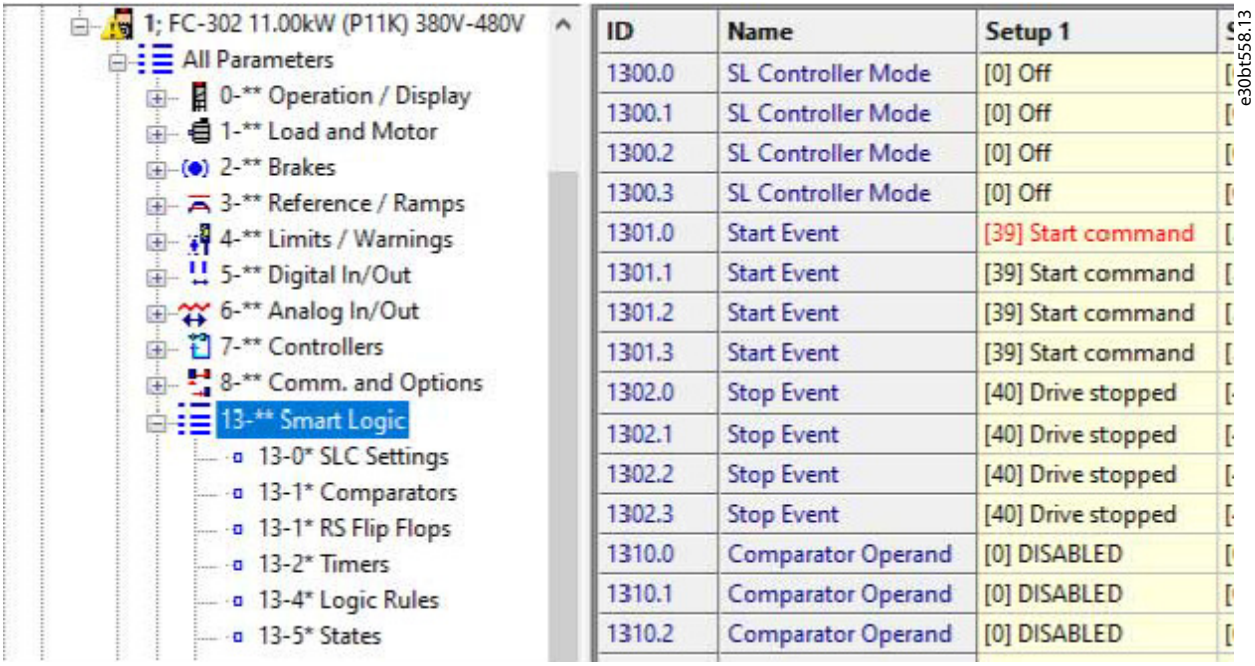

Figure 100: Smart Logic View

4. Set *Comparator Value* 1312.0 to the required value.
5. Set up the trigger event in the *Drive Real-time Channel Properties* dialog to comparator 0.
6. Set the logging mode to log once on trigger.
7. Press *OK* to enable the setup.

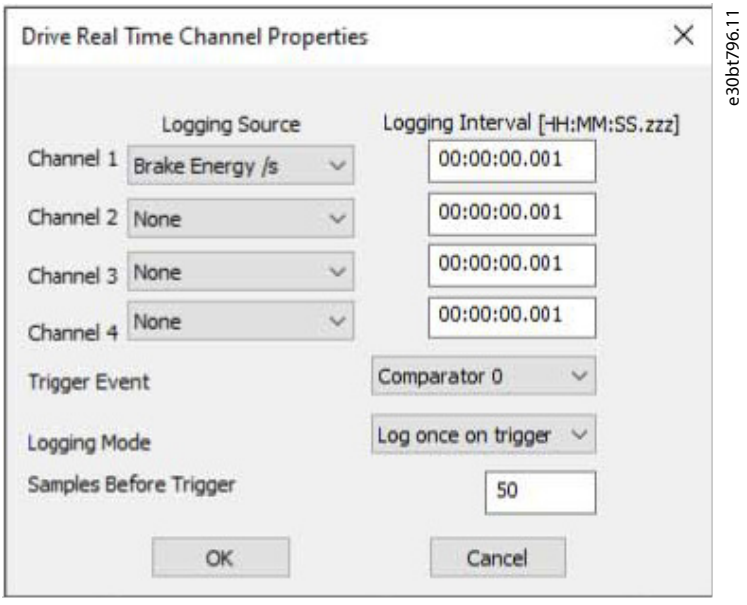

Figure 101: Trigger Event

8. Press *Start (resume) poll* to start logging.

The dialog for defining the real-time log style opens.

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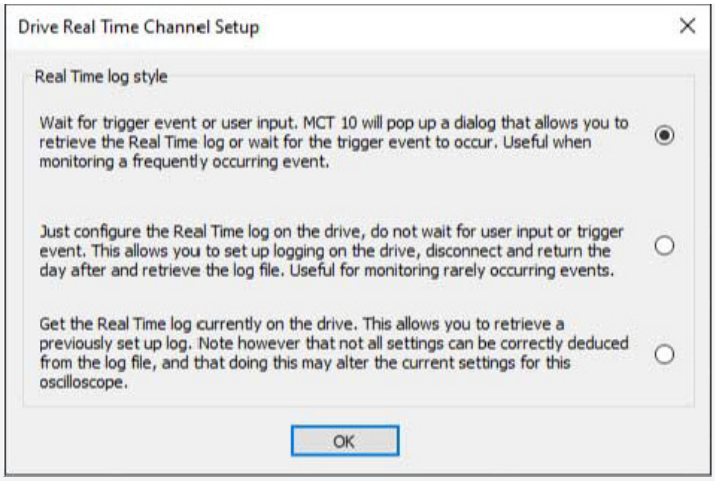


Figure 102: Real-time Log Style

7.5.8 Drive Real-time Channel Properties

More settings can be configured by right-clicking the *Scope* window and selecting *Properties*.

It is possible to reconfigure all drive real-time channel settings and also to configure:

- SEC/DIV and time format.
- Appearance settings.
- Cursor settings.

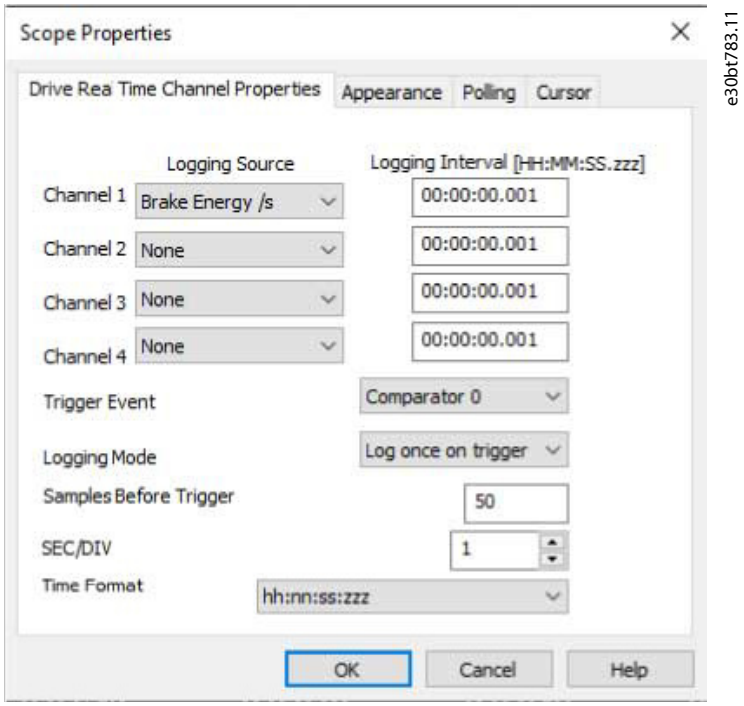


Figure 103: Reconfigure Drive Real-time Channel Settings

Besides being able to reconfigure the settings made from the *Drive Real-time Channel Properties* dialog, SEC/DIV and the time format are configurable.

SEC/DIV

The SEC/DIV and Time format functionalities are similar to the PC polling channel functionality, see 7.5.3 Configuring the PC Polling Channel.

Appearance

Each channel name can be renamed.

The Units/Div, Position, Marker, and Color functionalities are similar to the PC polling channel functionality.

Cursor

The functionality is similar to the PC polling channel functionality.

7.5.9 Communication Control

The *Scope* toolbar has 4 main buttons for communication control.

Table 4: Functions of the Control Buttons

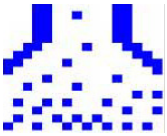
Control button		Function
Start Data Acquisition	 e30bt560.12	MCT 10 scope starts collecting the requested data from the drive network.
Stop Data Acquisition	 e30bt561.12	MCT 10 stops collecting data and there is no communication to the drive network while the scope part is active on the screen.
Resume All (Tracking)	 e30bt562.12	Activates the tracking mechanism. MCT 10 starts the readout of variables to the screen and to the buffer. Variables are checked against the trigger settings. If the buffer has been partially filled (use of the Pause All Tracking function), MCT 10 continues to fill data into the buffer.
Pause All (Tracking)	 e30bu986.10	Deactivates the tracking. The buffer remains at its current state, no new data is shown. The buffer pointer keeps its current position.

7.5.10 Additional Functionality

Select *Resume* poll to start tracking. To stop tracking, click *Stop poll* or *Pause all tracking*. The tracking continues until the buffer is filled (default 1000 samples). If the tracking stops due to a filled buffer, the buffer has to be emptied before a new track can be activated. Clear the buffer and reset the scope in 1 step by clicking the icon shown in Figure 104.

Figure 104: Clear all Buffer for the Channel

Alternatively, the buffer can be cleared individually.


e30bt469.12

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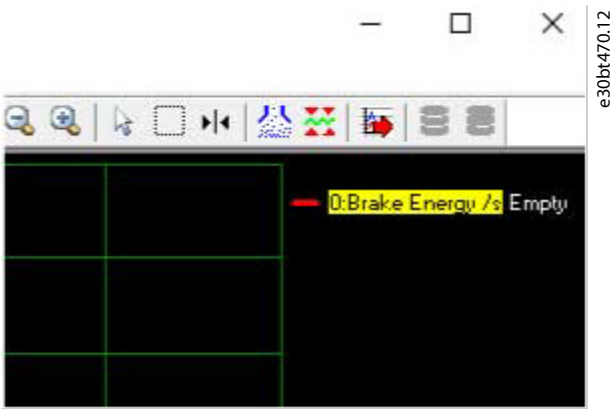
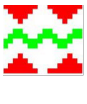


Figure 105: Individually Clearing the Buffer

Table 5: Functions of the Main Buttons

Name		Description
Reset Scope	 e30bt567.12	Clears all buffers for the channel at once. This is more convenient if many channels are activated at the same time, or if a new channel is added to an existing track. Before new values can be added to a track, all channel buffers must be emptied, since MCT 10 requires that all buffers have the same amount of data.
Export to Excel	 e30bt568.12	Enables storing scope data in a file which Microsoft Excel can open. A *Save file* dialog appears, making it possible to store the file in an appropriate location.
Scope Storage	 e30bt858.11	Enables storing scope data in a file on the hard disk. Save to the hard disk to avoid the limitation of 1 million points in the project file.
Open Scope History Viewer	 e30bt859.11	Open scope data saved on the hard disk.

7.5.11 Scope Storage

Enable scope storage or persistent data storage in *Scope Properties*. In *Scope Properties*, it is also possible to change and select where data should be saved.

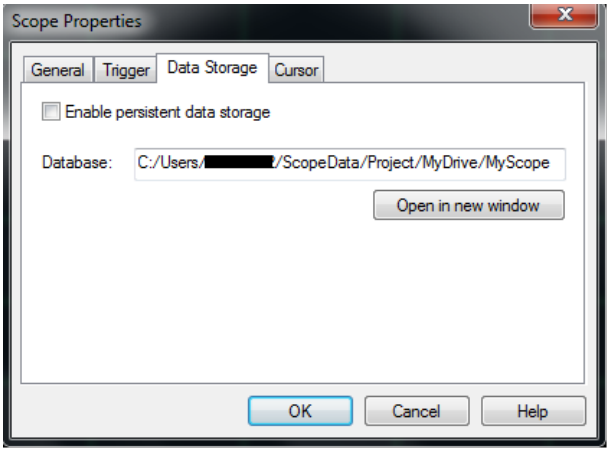


Figure 106: Scope Properties

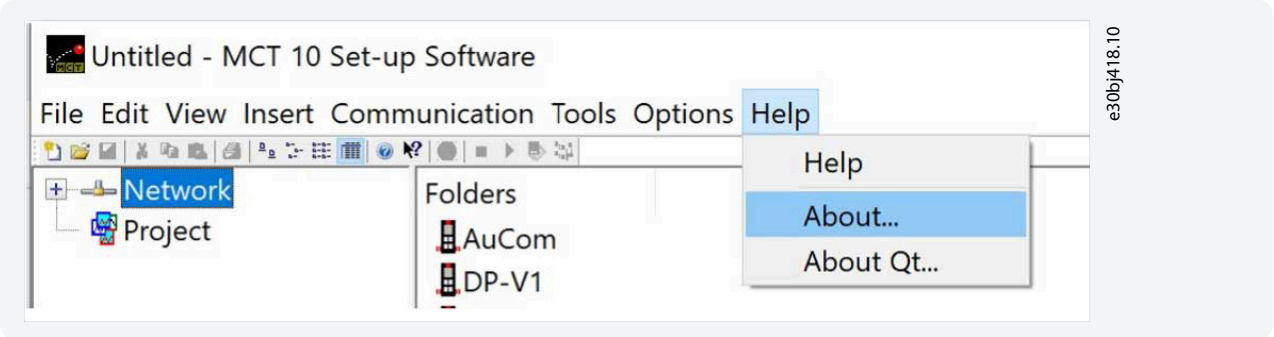
If polling data in scope when scope storage is selected, data is saved in both the project file and on the hard disk. However, the project file is limited to 1 million points. When the limit is exceeded, VLT® Motion Control Tool MCT 10 replaces the oldest point with the latest point.

7.6 Export Log Files

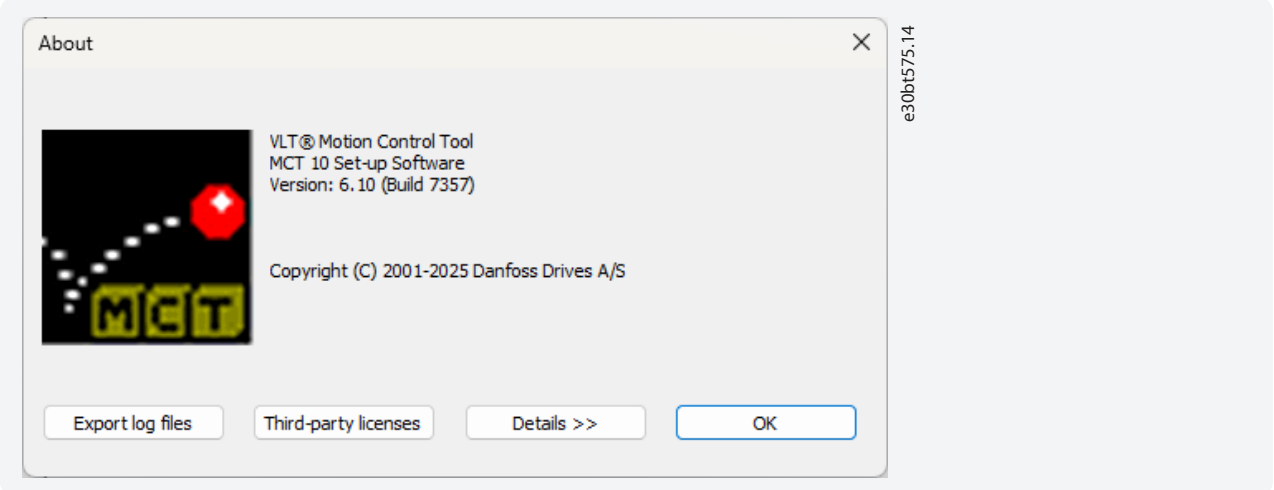
All log files can be exported to the desktop in 1 compressed .zip file.

Procedure

1. Select *Help⇒About*.



2. Click *Export log files*.



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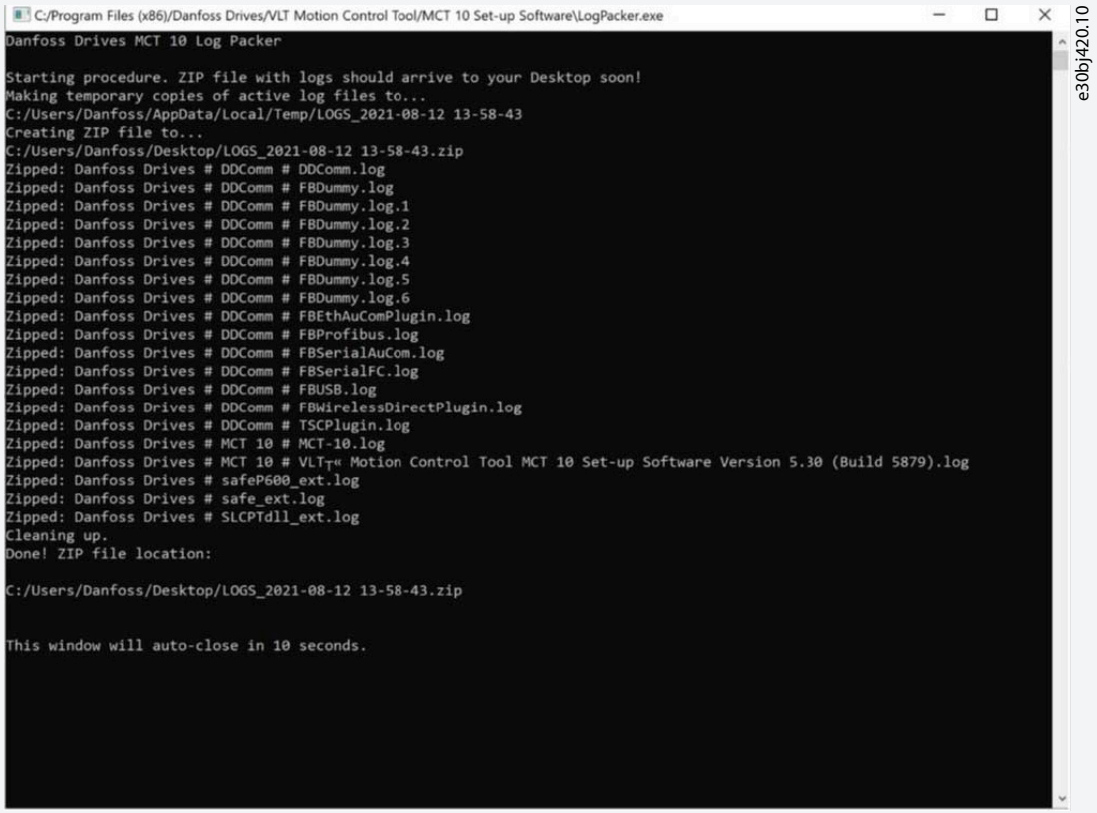
All logs are compressed into a .zip file.



8 Plug-ins

8.1 Smart Logic Controller Plug-in

From version 2.13, VLT® Motion Control Tool MCT 10 supports the smart logic controller plug-in. This feature enables quick setup of logical sequence programs.

The smart logic controller monitors a predetermined event. When the specified event occurs, it performs a predetermined act and starts monitoring the next predetermined event. The smart logic controller continues like this in up to 20 different steps until it returns to step 1 – monitoring the 1st specified event.

The smart logic controller can monitor any parameter that can be characterized as true or false. This includes digital commands and logic expressions, which allow sensor outputs to determine the operation. Temperature, pressure, flow, time, load, frequency, voltage, and other parameters combined with the operators >, <, =, AND, and OR form logic expressions that control the drive logically in any application.

The smart logic controller supports multiple controllers. The basic functionality is the same, but the appearance differs slightly due to multiple controllers being available in different tabs.

Refer to the relevant design guide for a full overview of the smart logic controller features.

8.2 Time-based Actions and Preventive Maintenance Plug-ins

8.2.1 Overview of Time-based Actions and Preventive Maintenance Plug-ins

For the VLT® HVAC Drive FC 102, VLT® AQUA Drive FC 202, and VLT® AutomationDrive FC 301/FC 302, the VLT® Motion Control Tool MCT 10 provides the following plug-ins:

- Clock features.
- Preventive maintenance.
- Time-based actions.

NOTE: Consult the product-specific design guide for detailed information about the drive.

8.2.2 Features of Time-based Actions

8.2.2.1 Clock Functions

The VLT® Motion Control Tool MCT 10 enables setup of the clock functions.

The clock functions are grouped in 2 sublevels:

- Date and time.
- Working days.

8.2.2.2 Date and Time

In the *Date and time* dialog, the following groups of settings are available:

- Display format.
- Set date and time.
- Daylight saving time.
- Enable clock fault.

Display format in LCP

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Select how date and time are presented in the LCP on the drive. In VLT® Motion Control Tool MCT 10 parameters, date and time format depends on PC regional options (date and time format).

Set date and time

Change the date and time in the drive from the PC. Normally, it should be set to use the date and time of the connected PC. When the time of the connected PC is in another time zone, it is beneficial to set the date and time manually. Date and time are changed in the VLT® Motion Control Tool MCT 10 project file or in the drive only when the *Change* checkbox is ticked.

Daylight saving time

Set the date and time for daylight saving.

Daylight saving time begins for most of the United States at 2:00 a.m. on the first Sunday of April. Time reverts to standard time at 2:00 a.m. on the last Sunday of October. In the U.S., each time zone switches at a different time. In the European Union, summer time begins and ends at 1:00 a.m. Universal Time (Greenwich Mean Time). It begins the last Sunday in March and ends the last Sunday in October. In the EU, all time zones change at the same moment.

Enable clock fault

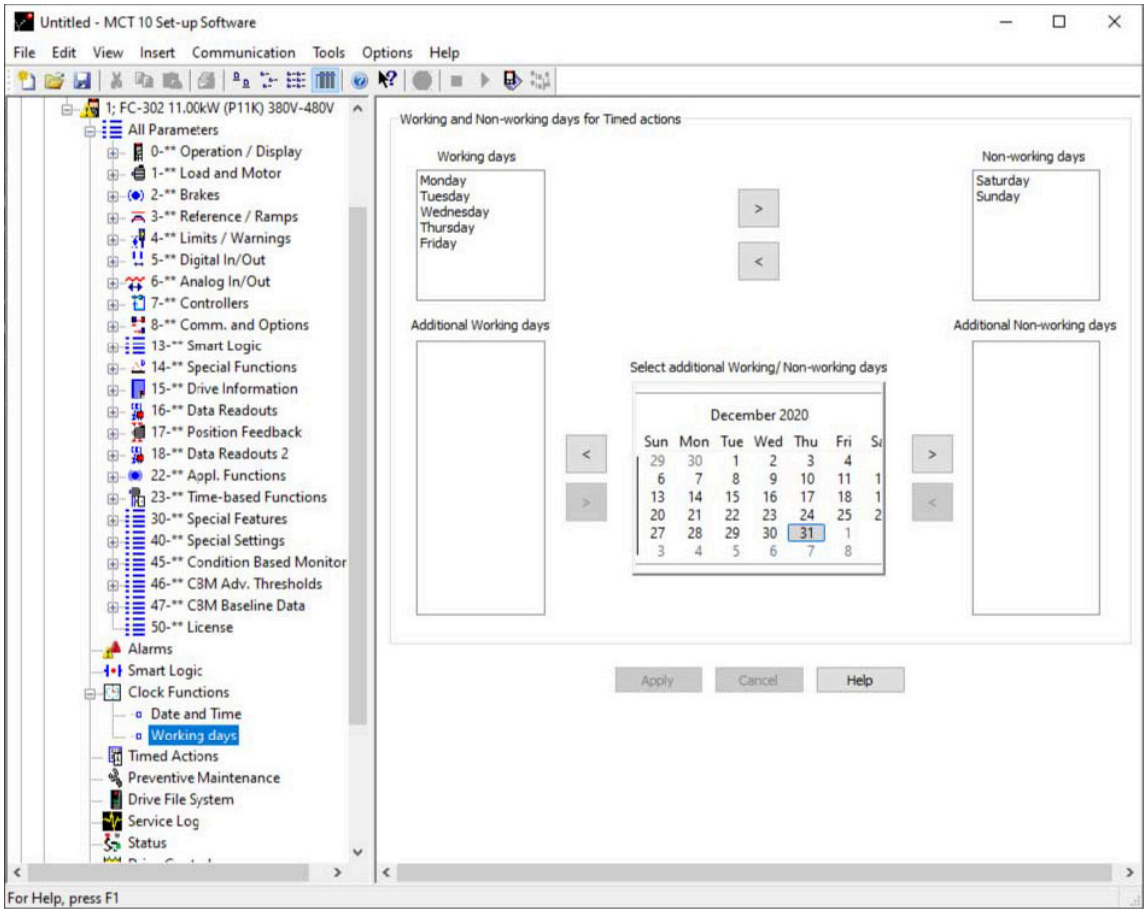
If the clock is not set up, the drive shows a specific warning. Enable or disable the clock fault function.

8.2.2.3 Defining Working Days

NOTE: Additional working days and non-working days include the year and must be updated every year.

Procedure

1. Select *First day of the week* (Monday or Sunday).
2. Select working days and non-working days.
3. Set additional working days (maximum 5).
4. Set additional non-working days (maximum 15).

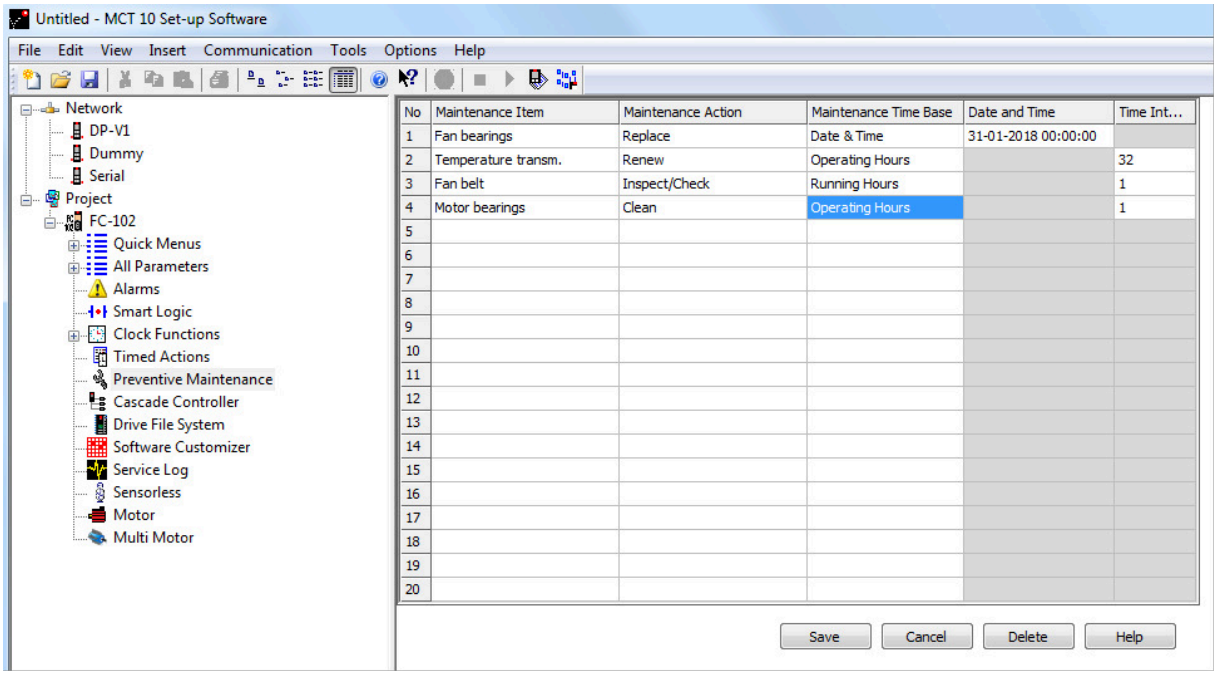


e30bt708.12

Figure 107: Define Working Days

8.2.3 Preventive Maintenance

The preventive maintenance feature supports the planning of periodic maintenance of both the drive and other technical equipment. If the defined date and time of preventive maintenance is passed, the item is marked red.



e30bt709.11

Figure 108: Preventive Maintenance

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NOTE: Program the clock parameters (parameters in the Clock functions folder) for preventive maintenance to function correctly.

Procedure

1. Double-click the cells in the right view to specify application item, action, and interval.
2. Reset Maintenance Word (in parameter ***23-15 Reset Maintenance Word***) and write to the drive.

8.2.4 Timed Actions

The time-based actions function enables automation of real-time controlled events.

Actions, which can be programmed, are the same as known from the SLC (smart logic controller), see 8.1 Smart Logic Controller Plug-in.

NOTE: The clock parameters (parameters in the Clock functions folder) must be correctly programmed for timed actions to function correctly.

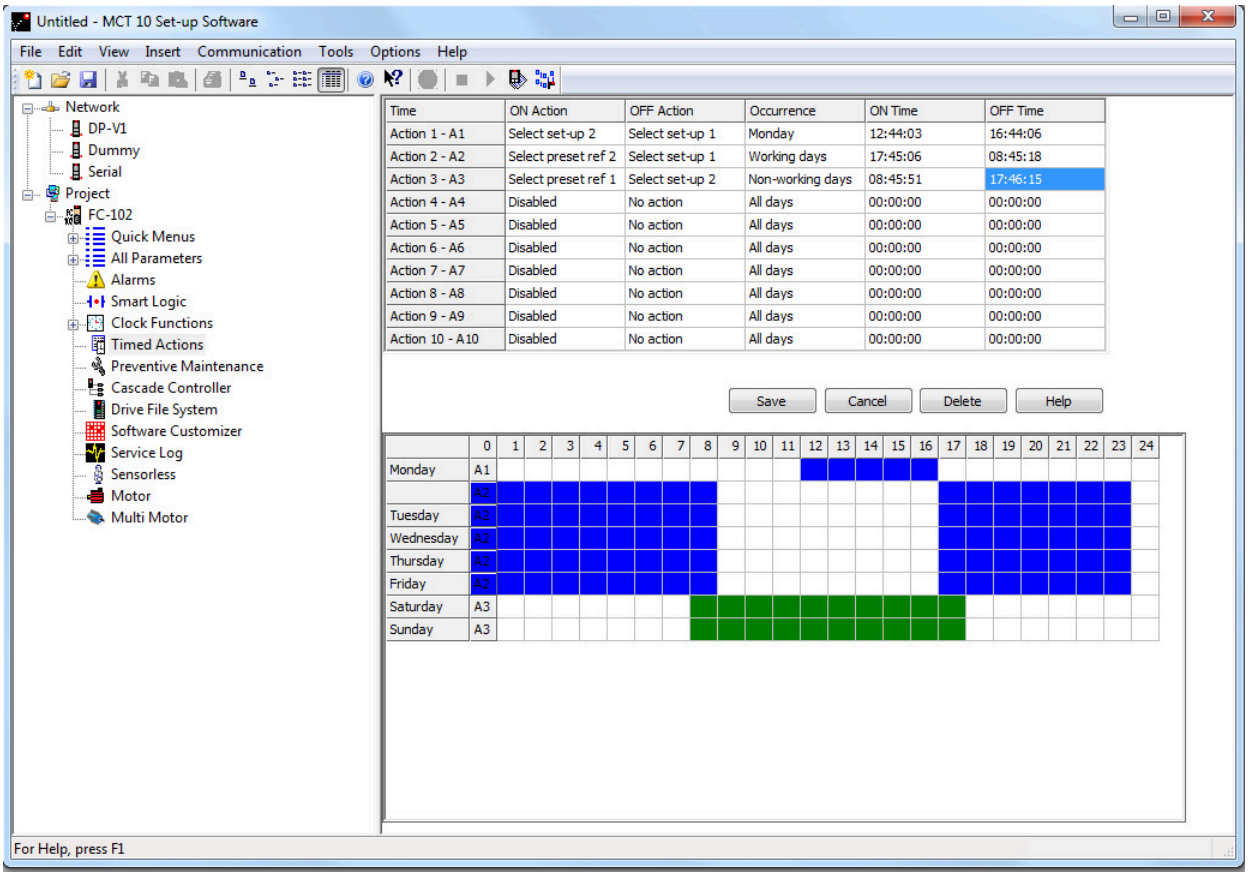


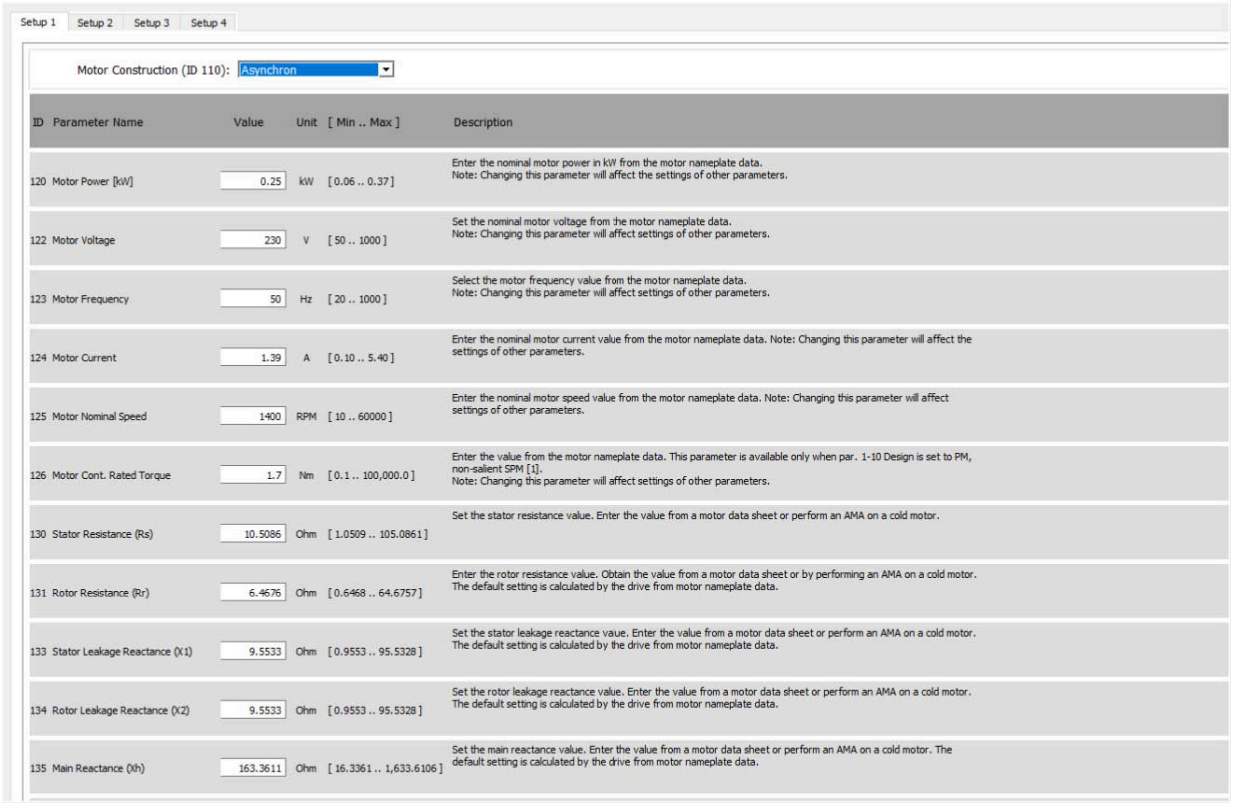
Figure 109: Time-based Actions

Procedure

1. Select *Timed Actions* in the product folder.
2. Double-click the cells in the right view to specify:
   - Action.
   - Time.
   - Recurrence.

8.3 Motor Plug-in

8.3.1 Induction Motors



e30bt992.11

Figure 110: Example of Settings for an Induction Motor

8.3.2 PM Non-salient SPM

For permanent magnet motors, calculation buttons are available. Below is an example of how to set parameter ***1-25 Motor Nominal Speed***.

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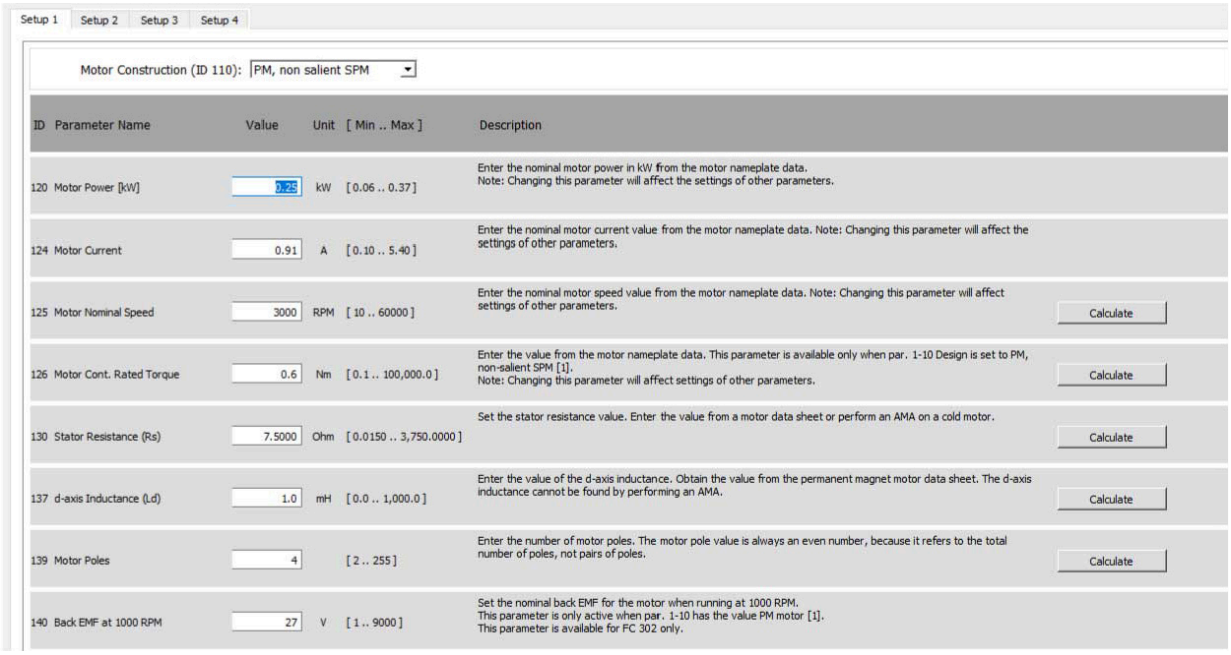
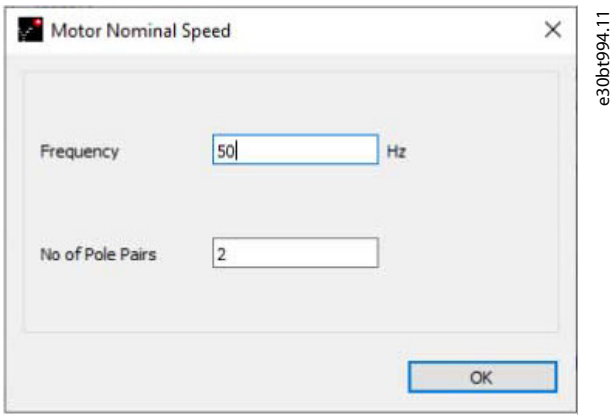


Figure 111: Example of Settings for a Non-salient SPM Motor

Procedure

1. Enter the frequency and the number of pole pairs.

Figure 112: Enter Data for Nominal Speed

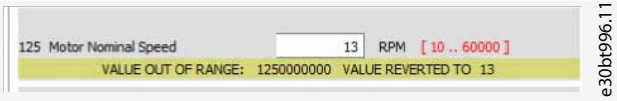


2. Click *OK* to get the value.

When the value is calculated, a notification appears. If the value is out of range, an error message appears and the value reverts to the previous value.



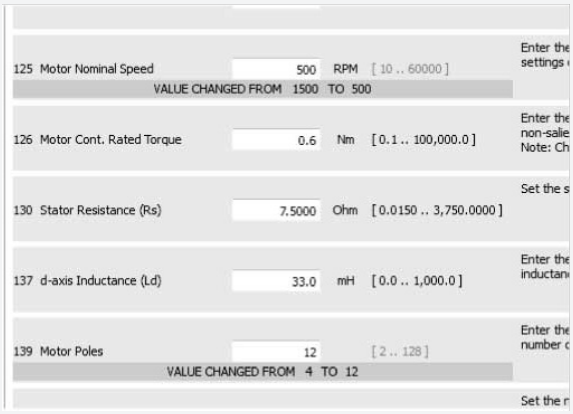
Figure 113: Notification Stating that the Value has Changed



e30bt996.11

Figure 114: Error Message when the Value is out of Range

Changing the number of pole pairs in parameter ***1-25 Motor Nominal Speed*** also changes the value of parameter ***1-39 Motor Poles***.



e30bt997.10

Figure 115: Changing Number of Pole Pairs Affects 2 Parameters

8.3.3 PM Salient IPM

Same functions and behavior as PM, non-salient SPM.

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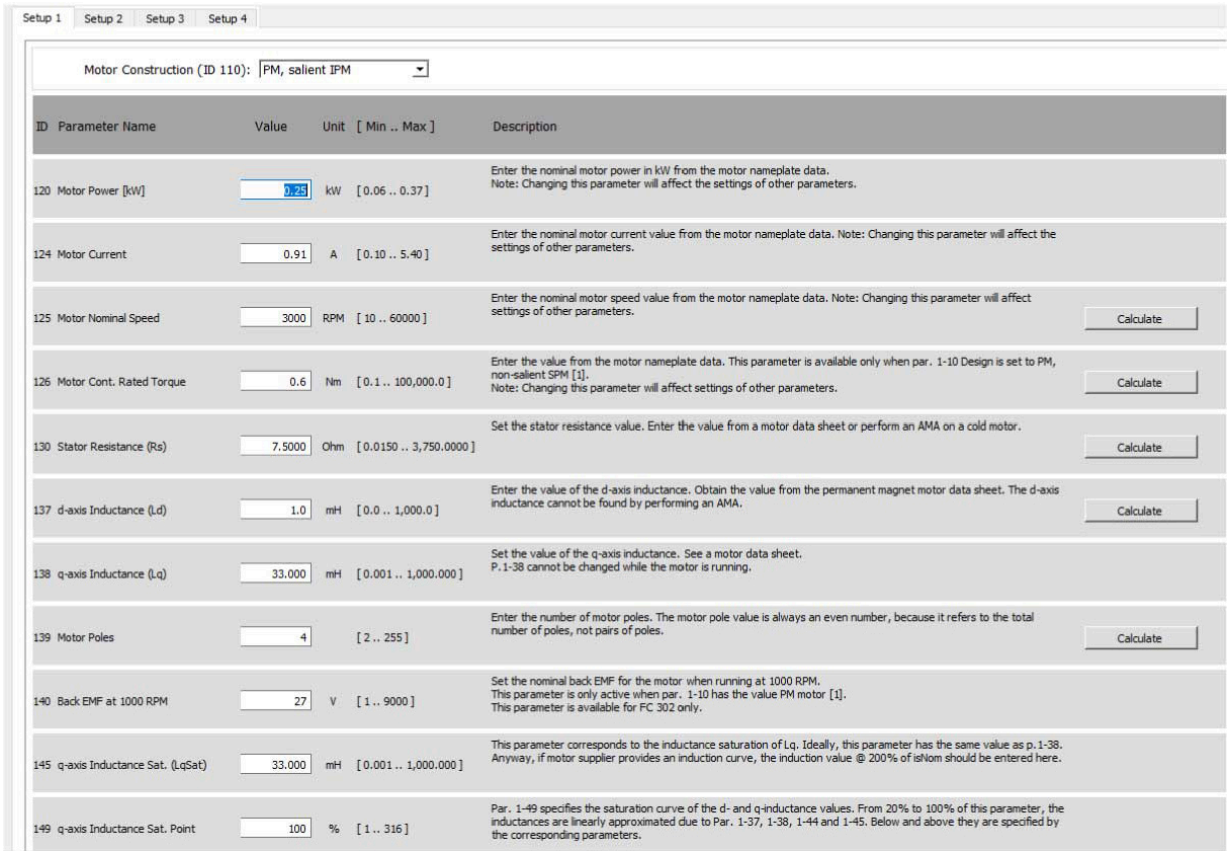
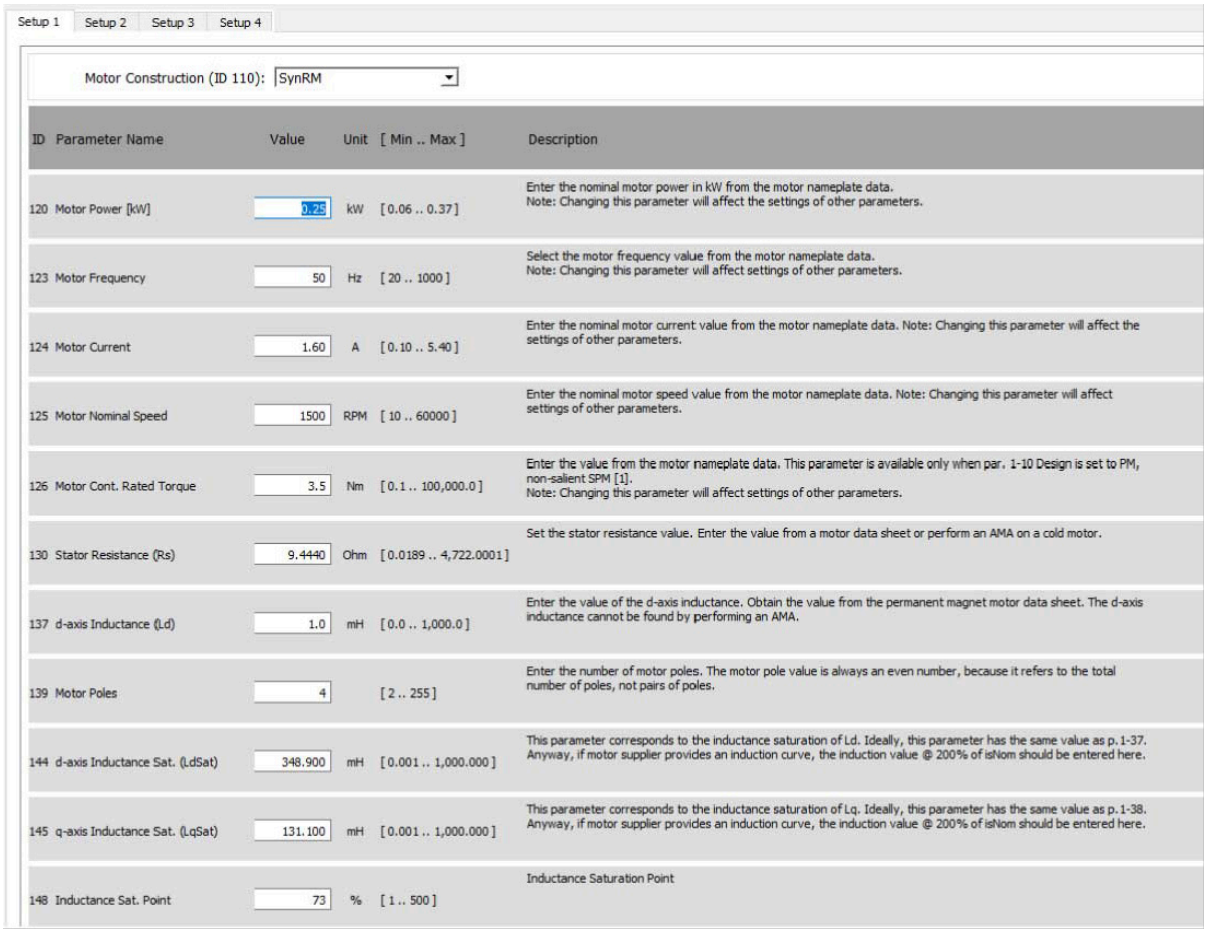


e30bt998.11

Figure 116: Examples of Settings for a Non-salient IPM Motor

8.3.4 SynRM



e30bt999.11

Figure 117: Examples of Settings for a SynRM Motor

8.4 Multi-motor Plug-in

8.4.1 Overview of Multi-motor Plug-in

In applications where 1 drive controls multiple motors/fans, a motor or motor/fan coupling failure may pass unnoticed due to missing feedback from the controlled fan. One or a few motor failures may be less critical during low or normal operating load, but it can lead to a full stop of the system in high-load situations. The multi-motor plug-in monitors and diagnoses the fan/motor state. The plug-in is limited to 8 motors of equal size and type. The multi-motor calculation tool is only for variable torque applications.

Find the multi-motor plug-in in the drive folder on the left side of the screen. Use the plug-in either online directly connected to a drive or offline for download later. Find the relevant parameters in parameter group ***24-9* Application Functions 2***.

NOTE: The multi-motor plug-in does not work on motors connected in parallel.

To get the right values, measure the current throughout the whole frequency band (from 0 Hz to maximum), also below the normal operating points.

Failures or underload of motors issue a missing motor warning. The drive continuously checks if the total motor current is below the expected value, which indicates situations where:

- One or more motors are missing/disconnected.
- One or more fans are loose.

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Overload of motors issues a locked rotor warning. The drive continuously checks if the total motor current is above the expected value, which indicates situations where:

- A rotor is locked.
- A fan touches the enclosure.

NOTE: During start-up or dynamic events like changes in speed references, the current may be below/above the current threshold. Consider and evaluate whether such situations may occur.

8.4.2 Defining a Normal Operation Curve

The plug-in provides an easy way to find the coefficients of the 3rd order polynomial by measuring currents on different frequencies.

NOTE: To avoid wrong logical minimum in the 3rd order polynomial, enter the lowest possible frequency into the tool.

NOTE: Points can be inserted at any frequency, but the defaults are recommended as the points are not saved. Only calculated coefficients are saved and used to recalculate the points on default frequencies after closing and opening the view.

Procedure

1. Measure normal operation currents on 5 different frequencies.
2. Insert the frequencies in *Normal operation currents*.

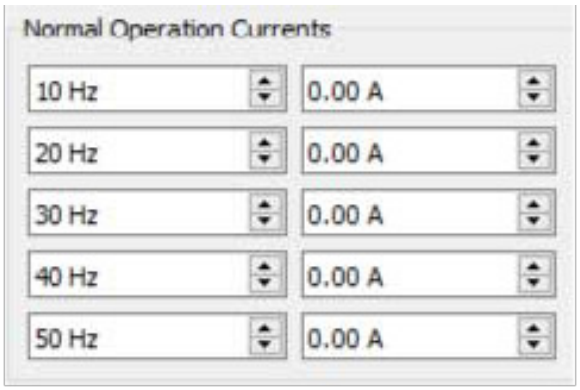


Figure 118: Normal Operation Currents

8.4.3 Threshold

Measured points show normal operation curves. Settings in *Motor Data* define the threshold of the upper and lower limits.

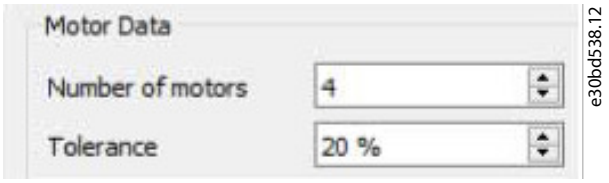


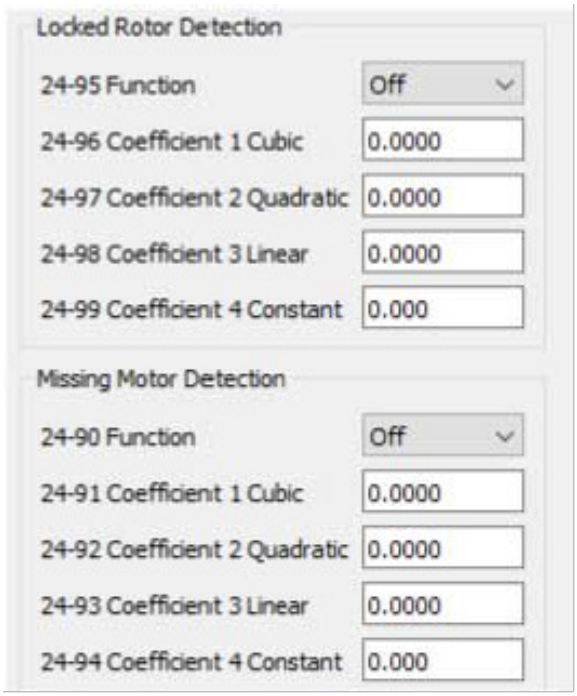
Figure 119: Threshold

- Number of motors is a convenience value to reduce the tolerance bandwidth, dividing it by the number of motors used (maximum 8 motors).
- Tolerance defines the bandwidth as a percentage of the highest measured current.

NOTE: These settings are not saved and are recalculated after closing and opening the view. If the values are different after recalculation, they still define the same tolerance. Example: 4 motors with 20% tolerance produce the same bandwidth as 2 motors with 10% tolerance.

8.4.4 Coefficients

Locked Rotor Detection and *Missing Motor Detection* show parameter values exactly as they are written to the drive. The values are synchronized automatically.



e30bd539.12

Figure 120: Locked Rotor Detection and Missing Motor Detection

NOTE: Cubic and quadratic coefficients are multiplied by 1000 to overcome precision limitation of parameters.

8.4.5 Modified Curves

Changing the frequency of a measured point moves the point along the defined curve. As the point follows the previously defined curve, the change of frequency only causes a slight change to the curve.

8.5 Cascade Controller Plug-in

8.5.1 Overview of Cascade Controller Plug-in

The cascade controller is intended for pump applications where multiple motors control a common flow, level, or pressure. By varying the speed of the motors, variable speed control is provided for the system. This maintains constant pressure while eliminating pressure surges, resulting in reduced system stress and quieter operation.

Three versions of cascade controllers are available:

- Basic cascade controller
  - Delivered as part of the software in the VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202. The 2 relays on the power card control the speed of a device connected to the drive output and on/off control devices.

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- Extended cascade controller
  - Allows more devices to be applied to the control circuitry and offers more cascade principles. It is available only in the FC 202 with a VLT® Extended Cascade Controller MCO 101 option card installed.
- Advanced cascade controller
  - Offers the cascade principles similar to extended cascade, but allows extra devices to be applied to the control circuitry. It is available only in the FC 202 by using the VLT® Advanced Cascade Controller MCO 102 option card.

The add-on option cards MCO 101 and MCO 102 can be used with the basic cascade controller (parameter group ***25- ** Cascade Controller***) and with the extended/advanced cascade controller (parameter group ***27-** Cascade CTL Option***).

The cascade controller can be configured in VLT® Motion Control Tool MCT 10 from the cascade controller plug-in. Basic mode supports the basic cascade controller, and extended mode supports the extended/advanced cascade options MCO 101/MCO 102.

The MCT 10 Cascade Controller view is divided into 4 tabs in both cascade modes:

- Preconditions.
- Setup.
- System Optimizing.
- Service.

8.5.2 Tabs in the Cascade Controller Plug-in

8.5.2.1 The Preconditions Tab

The *Preconditions* tab contains the general setup required for the cascade controller to operate in an application. It can also be used in general to set up the closed loop for other applications without the need for the cascade control. Use *Preconditions* to configure:

- General configuration.
- Setpoint and feedback.
- Digital input.

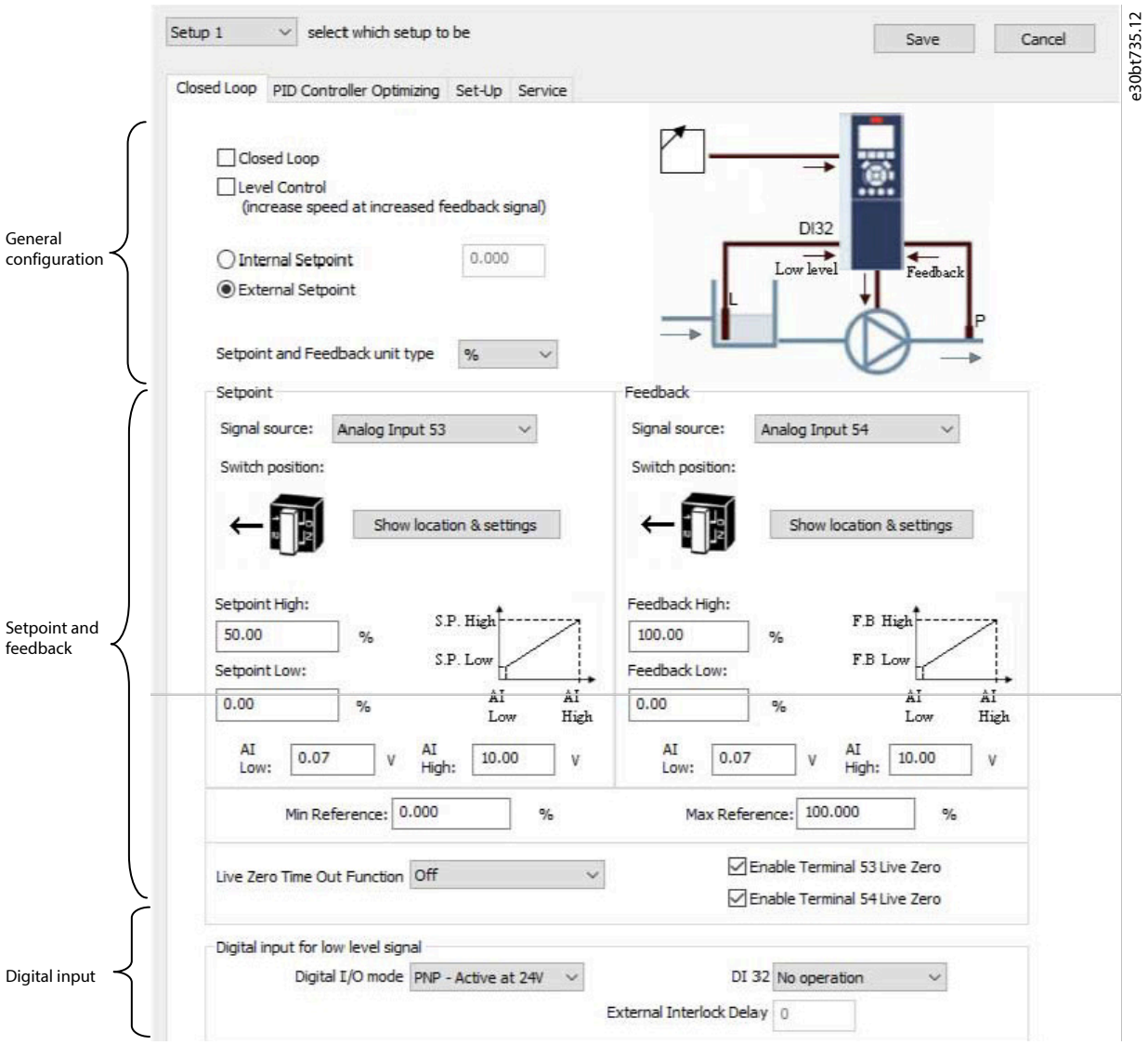

Figure 121: Preconditions

8.5.2.1.1 Areas in the Preconditions Tab

General Configuration

Closed loop is the configuration mode of the drive. Enabling or disabling the checkbox changes parameter ***1-00 Configuration Mode***.

Table 6: Closed-loop Checkbox Options

Options	**Parameter *1-00 Configuration Mode***
Enabled	***[1] Closed loop***
Disabled	***[0] Speed open loop***

Level control configures the inverse mode of the PID controller. It causes the drive output frequency to increase when the feedback is greater than the setpoint reference. If the checkbox is disabled, the PID is configured to normal control. Digital I/O mode and DI 32 are enabled.

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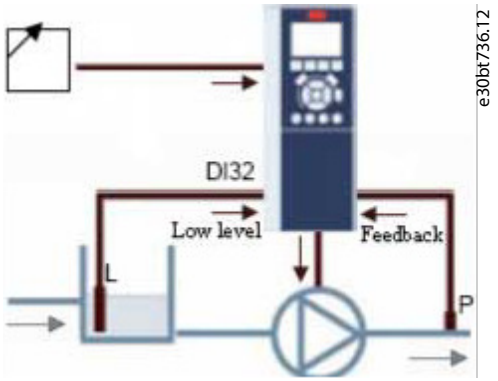


Figure 122: Level Control

Enabling the checkbox configures the PID to inverse control, and digital I/O mode and DI 32 are disabled. The drive graphic is updated to reflect the general configuration.

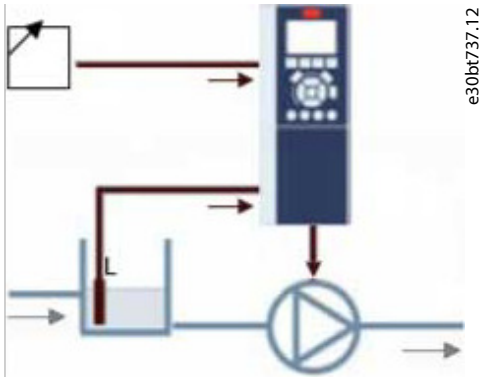


Figure 123: General Configuration

The setpoint is used in closed loop as the reference to compare the feedback values. It can be offset with the digital, analog, or bus references. Enabling the internal setpoint allows for entering a numerical value for the reference source. If the external setpoint is selected, the reference source is set to AI53. The internal setpoint settings remain in the field allowing to switch between a preset- or an external setpoint.

Setpoint and feedback unit type configures the pressure unit for the closed-loop setpoint and feedback. The pressure unit can be defined in:

- %.
- mbar.
- bar.
- Pa.
- kPa.
- m WG.
- psi.
- lb/in^2.
- in WG.
- ft WG.

General configuration affected parameters

- Parameter ***1-00 Configuration Mode***.
- Parameter ***20-81 PID Normal/Inverse Control***.

- Parameter ***3-15 Reference 1 Source***.
- Parameter ***20-12 Reference/Feedback Unit***.

Setpoint and Feedback

Configure the analog input used as setpoint and feedback. The general configuration assumes the AI 53 (analog input 53) is used for the setpoint and the AI 54 (analog input 54) is used as feedback. The signal type can only be changed from current to voltage input with the switches on the control board of the drive. Click *Show location* to see the specific location on the drive.

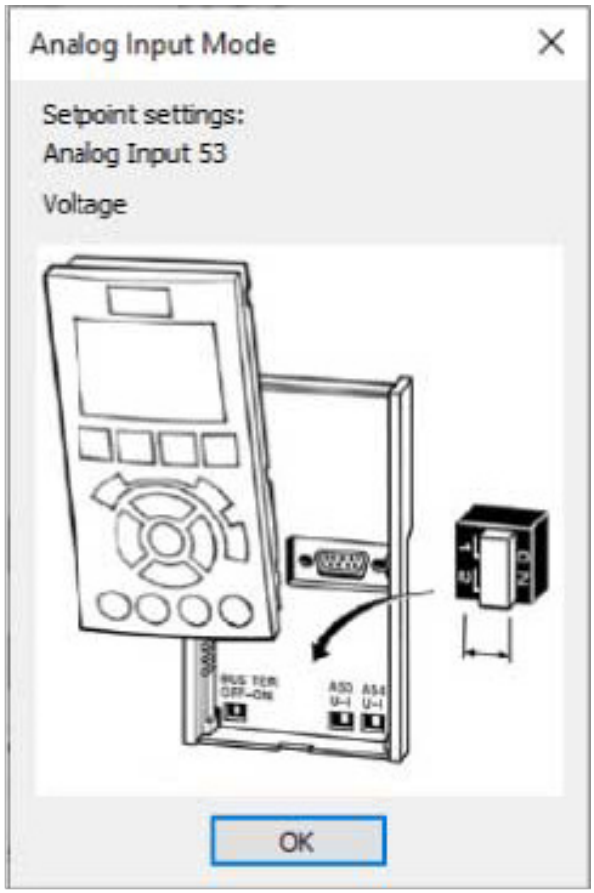
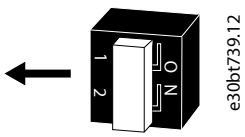
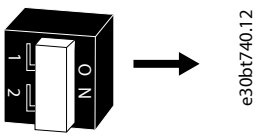


Figure 124: AI53 and AI54

Configure the signal type in accordance with the hardware switches.



Push the switch to the left to get a 0–10 V signal type.



Push the switch to the right to get a 0–20/4–20 mA signal type.

Setpoint high and *Feedback high* configure the analog input scaling value corresponding to the maximum reference feedback value. *Setpoint low* and *Feedback low* are used to configure the analog input scaling value corresponding to the minimum reference feedback value. The minimum and maximum references are the lowest and highest values obtainable by adding all references together.

To receive notification of a missing or defective transmitter, define live zero among the functions:

- Off.
- Freeze output.
- Stop.

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- Jogging.
- Maximum speed.
- Stop and trip.
- Select setup 1.
- Select setup 2.
- Select setup 3.
- Select setup 4.

The function is activated if the signal on terminal AI 53 or AI 54 is below 50% of the value defined in AI 53 low or AI 54 low. Default Live Zero Timeout time is 10 s and can be reconfigured in parameter ***6-00 Live Zero Timeout Time***.

Enable *Terminal 53 live zero* and *Terminal 54 live zero* to disable the live zero monitoring if the analog outputs are used as part of a decentral I/O system. As default, both checkboxes are enabled.

Setpoint and feedback affected parameters

- Parameter ***3-02 Minimum Reference***.
- Parameter ***3-03 Maximum Reference***.
- Parameter ***6-01 Live Zero Timeout Function***.
- Parameter ***6-10 Terminal 53 Low Voltage***.
- Parameter ***6-11 Terminal 53 High Voltage***.
- Parameter ***6-12 Terminal 53 Low Current***.
- Parameter ***6-13 Terminal 53 High Current***.
- Parameter ***6-14 Terminal 53 Low Ref./Feedb. Value***.
- Parameter ***6-15 Terminal 53 High Ref./Feedb. Value***.
- Parameter ***6-17 Terminal 53 Live Zero***.
- Parameter ***6-20 Terminal 54 Low Voltage***.
- Parameter ***6-21 Terminal 54 High Voltage.***
- Parameter ***6-22 Terminal 54 Low Current***.
- Parameter ***6-23 Terminal 54 High Current***.
- Parameter ***6-24 Terminal 54 Low Ref./Feedb. Value***.
- Parameter ***6-25 Terminal 54 High Ref./Feedb. Value***.
- Parameter ***6-27 Terminal 54 Live Zero***.

Digital Input

If a low-level signal is available, the DI32 (digital input 32) can be programmed to stop inverse or to external interlock, and an external interlock delay can be configured. The type of pulse to trigger can be configured from the digital I/O mode drop-down list.

8.5.2.2 The Set-up Tab

The *Set-up* tab contains the configuration interface for the cascade controller, parameter group ***25-** Cascade Controller***. The cascade principle can be configured to *Basic Cascade Ctrl* or *Motor Alternation Only* (VLT® AQUA Drive FC 202 only).

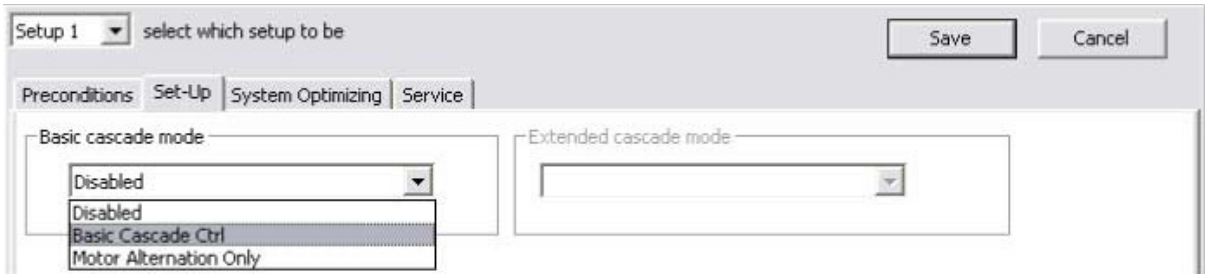

Figure 125: Configuration Interface for Parameter Group 25- Cascade Controller**

8.5.2.2.1 Cascade Principles

Basic Cascade Control

Select basic cascade control to configure:

- Motor start.
- Pump configuration.
- Staging/destaging settings.

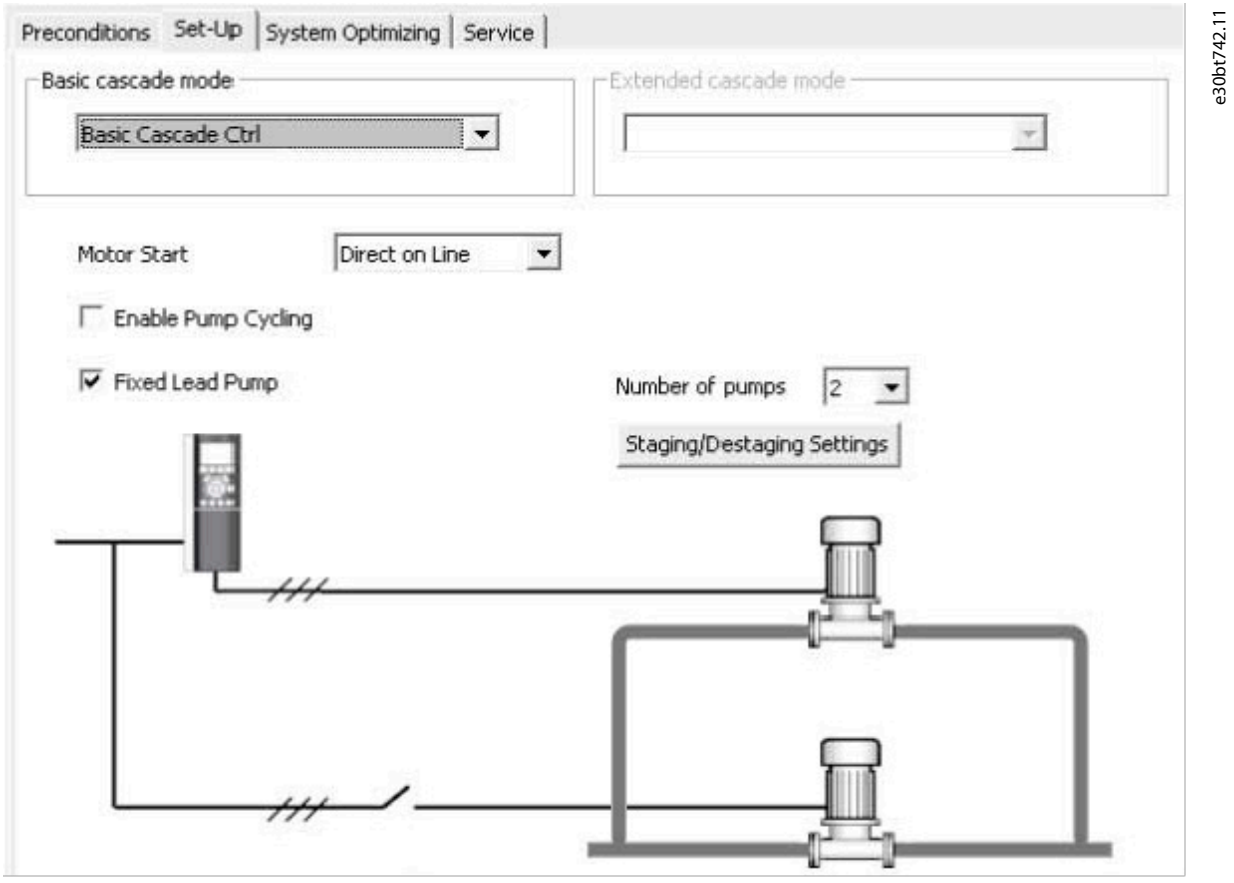

Figure 126: View of Basic Cascade Control Set-up Tab

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Table 7: View and Selection Descriptions

View	Description
Motor start	The view defines the configuration principle: • Direct on line – each lag pump is cut in directly via a contactor. • Soft starter – must be used for all fixed-speed pumps and can be used to replace traditional contactors. When using soft starters, a delay is added from the staging signal occurs until staging takes place. The delay is required due to the ramp time of the fixed speed pump.
Enable pump cycling	The view defines whether the pump cycling is enabled or not: • Disabled - lag and lead pumps are cut in to have equal hours run for each pump. • Enabled - lag pumps are cut in according to the first-in, last-out principle.
Fixed lead pump	This view defines whether a drive uses a fixed lead pump or not. The lead pumps are connected directly to the relays on the drive control card. This is shown in Figure 126. To obtain equal hours of operation within the fixed-speed pumps, the lead pump can be alternated. Timers on the relay outputs monitor the hours run of each pump. When a pump is not operating for a long time, corrosion may become an issue. When it is configured for alternating lead pump, select Alternation details to set up principles for alternation.
Lead pump alternation	This view instructs the drive to change the lead pump so all pumps run for the same period. The following options are available: • Off - no lead pump alternation occurs. • At staging - lead pump alternation occurs at pump staging. • At command - lead pump alternation occurs at explicit commands. • At staging or command - lead pump alternation occurs at pump staging and at explicit commands.
Alternation time interval	In this view, define the time period between automatic alternation of the lead pump: • 1–999.9 h - when the time expires, the lead pump alternates.
Alternation time value	This view contains the actual value of the alternation timer.
Alternation predefined time	In this view, set the time to perform an alternation. The time format depends on the settings configured in the drive.
Alternate if load <50%	In this view, define whether the lead pump must be alternated: • Enabled - pump alternation is carried out only if the capacity is equal to or below 50%.
Staging mode at alternation	In this view, configure the staging mode at alternation and determine the time of the variable-speed pump deceleration: • Quick. • Slow.
Delay before cutting in next pump	In this view, set the time between stopping the old lead pump and starting another. Range: 0.1–5.0 s.

Table 7: View and Selection Descriptions - (continued)

View	Description
Delay before cutting in on mains	Time delay before a fixed-speed pump is staged on according to the normal staging sequence. When it expires, a fixed-speed pump must be staged on according to normal staging. Range: 0.1–5.s.
Staging/destaging settings	In this view, configure when to add and remove a stage from a running application. A stage is a representation of a 100% pump.
Staging bandwidth (SBW)	In this view, define the band around the head setpoint and configure it as a percentage of the maximum reference. If the actual head exceeds the bandwidth for a specified time and the speed is at motor speed high limit, a stage is added. If the speed is at motor speed low limit, a stage is removed. Range: 1–100%.
Override bandwidth (OBW)	Preserves a stable head in the application. When quick changes in the system demands occur, the override bandwidth must add/remove a stage immediately when the actual exceeds override bandwidth. To avoid unintended staging until the head has settled after start, override bandwidth has a delay until the lead pump has reached motor nominal speed or motor speed high limit after a start command. Range: SBW to 100%.
Fixed speed pumps staging bandwidth (FSBW)	Ensures that the cascade controller continues if the drive issues an alarm. Keeping the head on the setpoint requires a frequent staging and destaging. When only fixed–speed pumps are running, a wider bandwidth (FSBW) is used instead of SBW. Range: SBW to OBW.
OBW timer	Avoids frequent staging/destaging. The OBW timer prevents staging a pump until the application pressure is stabilized. Range: 0–300 s.
SBW staging delay	Delay between the feedback signal being below the staging bandwidth and a lag pump being added. SBW destaging delay is the time between when the feedback signal is above the staging bandwidth and when a lag pump is removed. Range: 0–3000 s.
Ramp-down delay and ramp-up delay	For use with soft starters. The ramp-down delay is for setting the lead pump ramp-down delay before staging a fixed-speed pump on. Ramp-up delay is for setting the lead pump ramp-up delay before a fixed-speed pump is destaged.
Stage- and destage threshold	The percentage of maximum pump speed to stage on and to destage fixed-speed pump. The thresholds must be configured as a percentage of motor speed high limit.

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Table 7: View and Selection Descriptions - (continued)

View	Description
Destaging speed	To avoid an overshoot when adding a fixed-speed pump, the variable-speed pump ramps to motor speed low limit. When the variable pump reaches staging speed, the fixed-speed pump is staged on. To avoid an undershoot when removing a fixed-speed pump, the variable-speed pump ramps to motor speed high limit. Available options: RPM or Hz.
Enable staging function	Avoids frequent staging of fixed-speed pumps. Enabling the checkbox starts the stage function timer. Enable destage function ensures that the lowest numbers of pumps are running to save energy and to avoid dead head water circulation in the variable-speed pump. Enabling the checkbox starts the destage function timer.

Table 8: Number of Pumps Configurable from the Drop-down List

Function	Number of pumps
Fixed lead pump	2–3
Alternating lead pump	2



Figure 127: Alternation Details

If configuring the lead pump alternation *At command* or *At staging or command*, the alternation event can be configured to:

- External - Alternation takes place when a signal is applied to 1 of the digital inputs in the terminal strip.
- Alternation time interval - Alternation takes place every time the alternation time interval expires.
- Sleep mode - Alternation takes place each time the lead pump goes into sleep mode. Set the no-flow function to sleep mode or apply an external signal for this function.
- Predefined time - Alternation takes place at a defined time of the day. If *Alternation predefined time* is set, the alternation is carried out every day at the specified time.

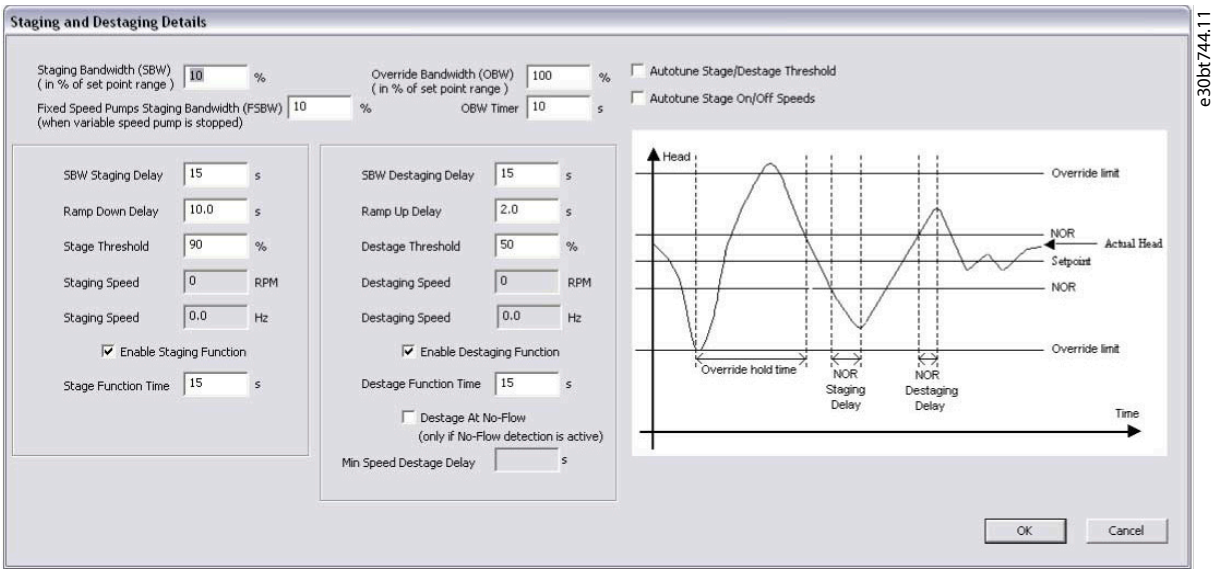

Figure 128: Staging and Destaging Details

Stage function time is the time before staging on a fixed speed if the lead pump is at maximum speed. The stage timer starts when the adjustable-speed pump is running at motor speed high limit with 1 or more constant-speed pumps stopped. When the timer expires, a fixed-speed pump is staged. The destage function time is the time before staging on a fixed speed if the lead pump is at minimum speed. It starts when the adjustable-speed pump is running at motor speed low limit with 1 or more fixed-speed pumps in operation. When the timer expires, a stage is removed avoiding dead head water circulation within the adjustable-speed pump.

If the *Destage at no-flow* checkbox is enabled, a stage is removed when there is a no-flow situation.

Motor Alternation Only

In *Motor alternation only*, 1 drive and 2 pumps are connected through contactors to both the drive and to mains. The functionality is used to allow the alternation between pumps that share a drive. The alternation takes place at an external command signal or a preprogrammed event.

8.5.2.3 The System Optimizing Tab

The *System optimizing* tab provides a simple way to start and stop the cascade controller. It allows configuration of:

- PID controller.
- Feedback low-pass filter.

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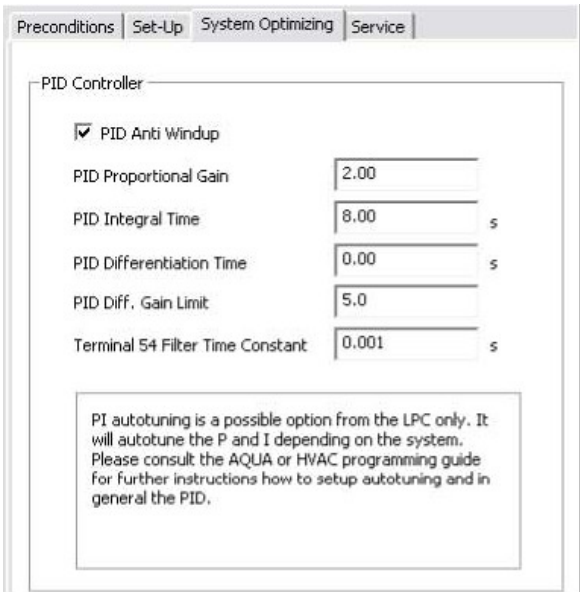

Figure 129: Start and Stop Cascade Controller

Table 9: Description of PID functions

Field	Description
PID anti-windup	Controls the integration of the PID controller. If the checkbox is enabled, the PID controller stops integrating the error between the feedback and the setpoint reference if it is not possible to adjust the output frequency of the drive to correct the error. This situation can occur when the drive has reached the minimum or maximum output frequency, or when the drive is stopped. If the checkbox is disabled, the PID controller continues integrating the error between the feedback and setpoint reference, even though the drive cannot adjust its output frequency to correct this error.
PID proportional gain	Adjusts the output of the PID controller of the drive based on the error between the feedback and the setpoint reference. A quick PID controller response is obtained using a large value. If too large, the drive output frequency may become unstable. The value is configurable from 0–10.00.
PID integral time	The duration of integrating the error between the feedback and the setpoint reference to ensure the error approaches 0. Quick speed adjustments are obtained using a short duration. At a too short value, the drive output frequency may become unstable. The time is configurable from 0.01–10000.00 s.

Table 9: Description of PID functions - (continued)

Field	Description
PID differentiation time	The time the differentiator monitors the rate of change of the feedback. If it is quickly changing, it adjusts the output of the PID controller to reduce the rate of change of the feedback. Quick PID controller responses are obtained using a long duration of time. However, at too large values, the drive output frequency may become unstable. Differential time is useful in situations where fast responses and precise speed control are required. The time is configurable from 0.00–10.00 s.
Terminal 54 Filter Time Constant	A first-order digital low-pass filter constant for suppressing electrical noise from terminal 54. A high time constant improves the dampening, but also increases the time delay through the filter. The value can only be adjusted while the drive is stopped. The time constant can be configured from 0.001–10.000 s.

8.5.2.4 The Service Tab

The *Service* tab provides a simple way to make cascade controller service.

Table 10: Service Tab Views

View	Description	Basic cascade controller	Extended cascade controller
Cascade status	–	✓	✓
Pump status	Readout of the status for each pump selected with a string, which consists of the pump number and the status of the pump. A readout with 2 pumps could be 1:D 2:O. • 1:D – Pump 1 running on drive. • 2:O – Pump 2 off.	✓	✓
Lead pump	Shows the actual lead pump in the application. When an alternation takes place, the field is updated to reflect the current lead pump.	✓	✓
Manual alternation	Select a new lead pump. The items available from the drop-down list are *Off* for the number of pumps.	✓	?
Relay status	Select relay status to update the status of the relays. The status can be • On - the relay is activated. • Off - the relay is deactivated. The values can only be updated if the drive is online.	✓	✓

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Table 10: Service Tab Views - (continued)

View	Description	Basic cascade controller	Extended cascade controller
Relay ON time	Monitors the total hours run of the connected relay. The resolution is in hours run. Reset relay counter resets all relay on-times. It is only available if the drives are connected online.	✓	?
Pump interlock	Disables a certain pump and is configurable from a checkbox at each pump.	✓	?
Pump ON time	Monitors the total hours run of the connected pump. The resolution is in hours run. *Reset* clears the hours run of a specific pump.	✓	?
Current run-time hours	Readout of the total number of hours run for each pump since last reset. The time is used to balance the hours run between pumps.	?	✓
Pump total lifetime hours	Total hours run for each connected pump.	?	✓
Manual pump control	Readout of the command parameter that allows manual control of individual pump states.	?	✓
Reset relay counter	Resets all relay on-times. Only available if the drive is online.	?	✓

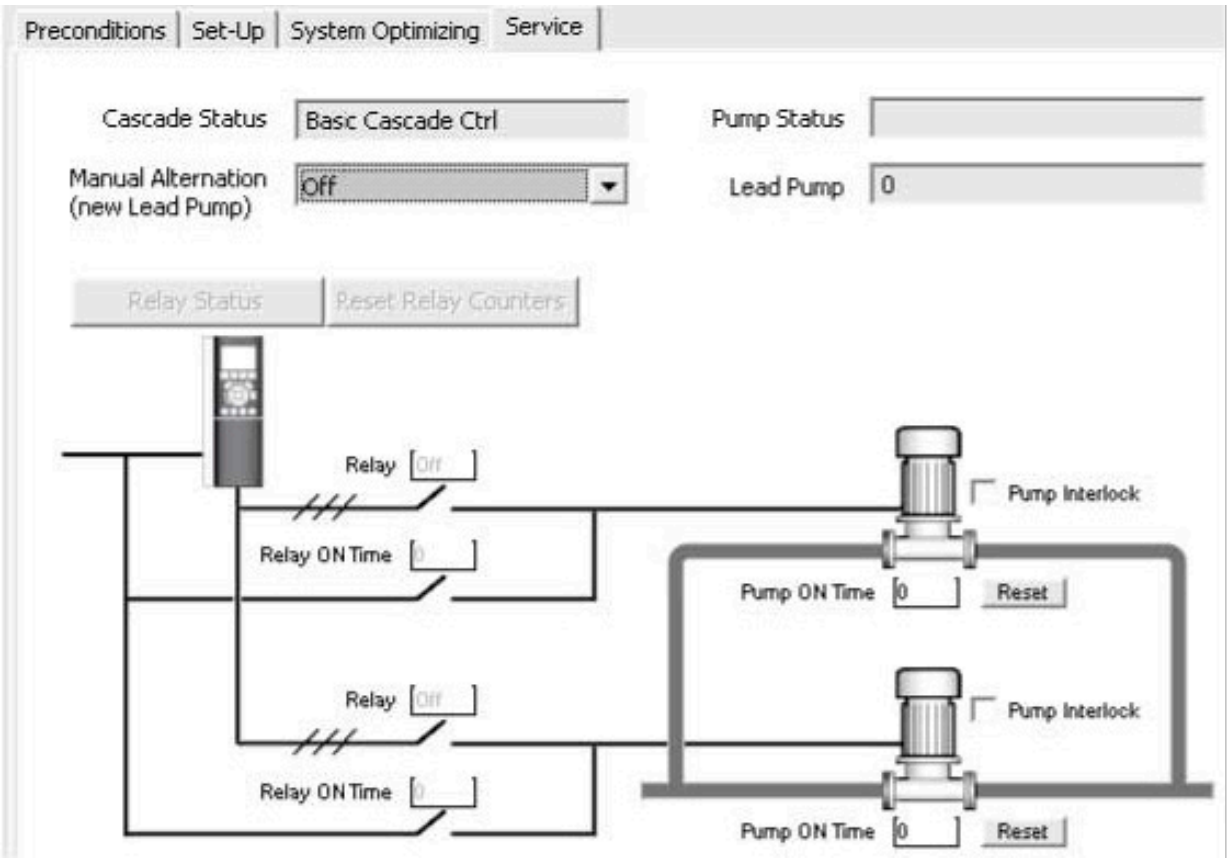

Figure 130: Service Tab Basic Cascade Controller

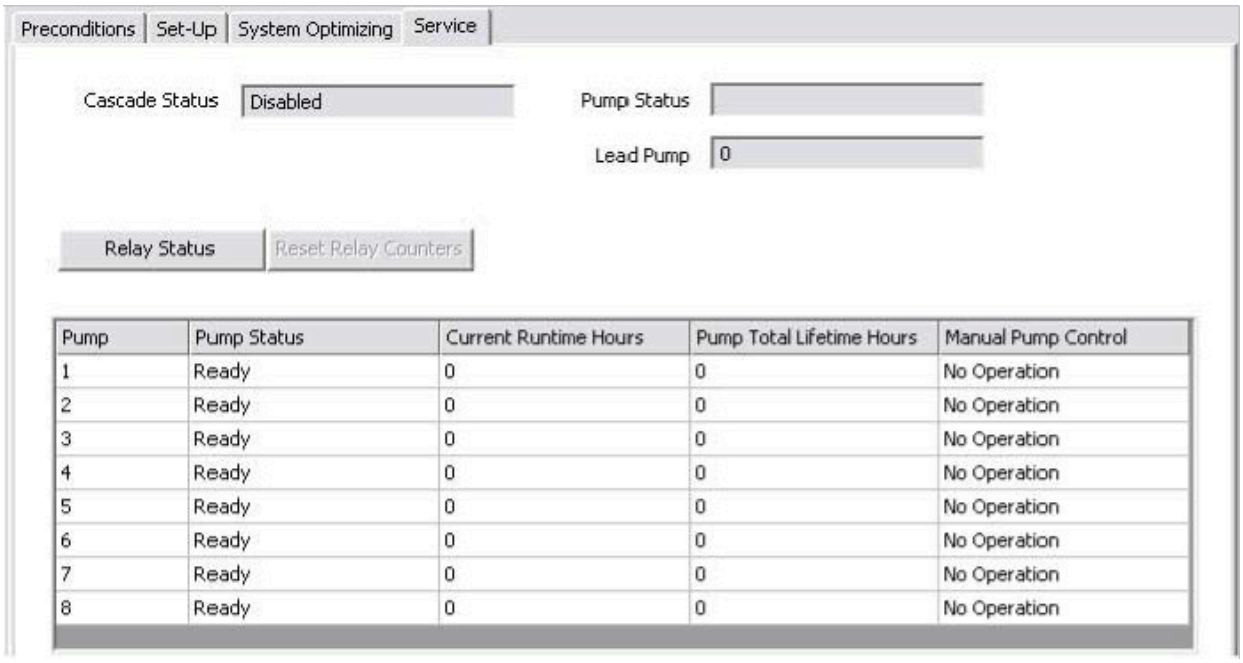

Figure 131: Service Tab Extended Cascade Controller

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Table 11: Status Descriptions

View	Status	Status description
Cascade status	Disabled	The cascade controller is disabled.
	Emergency	All pumps have been stopped by a coast/coast inverse or an external interlock command applied to the drive.
	Off	All pumps have been stopped by a stop command applied to the drive.
	In open loop	Configuration mode has been set for open loop. All fixed-speed pumps are stopped, and the variable-speed pump continues to run.
	Frozen	Staging/destaging of pumps has been locked and the reference is locked.
	Jogging	All fixed-speed pumps are stopped. When stopped, the variable-speed pump runs at jog speed.
	Running	A start command is applied to the drive and the cascade controller controls the pumps.
	Running FSBW	The drive is tripped and the cascade controller controls the fixed-speed pumps based on fixed-speed bandwidth.
	Staging	The cascade controller is staging fixed-speed pumps.
	Destaging	The cascade controller is destaging fixed-speed pumps.
	Alternating	The lead pump alternation selection is different than *Off* and an alternation sequence is taking place.
	Lead not set	No pump is available to be assigned as variable-speed pump.
Pump status	X	Disabled. The pump is interlocked either via pump interlock or signal on a digital input programmed for pump interlock in digital inputs.
	Off	Stopped by the cascade controller, but not interlocked.
	D	Running on drive, regardless of whether the variable-speed pump is connected directly or controlled via a relay in the drive.
	R	Running on mains. Fixed-speed pump running.
Relay Status[1]	On	The relay is activated.
	Off	The relay is deactivated.

Table 11: Status Descriptions - (continued)

View	Status	Status description
Manual pump control [2]	No operation	The function is disabled.
	Online	Makes the pump available to the cascade controller.
	Alternate On	Forces the selected pump to be the lead pump.
	Offline-Off	Turns off the pump and makes the pump unavailable for cascading.
	Offline-On	Turns on the pump and makes the pump available for cascading.
	Offline-Spin	Initiates a pump spin.

1) Only available in basic cascade controller.

2) Only available in extended cascade controller.

Relay status enables readout of the function and status of each relay.

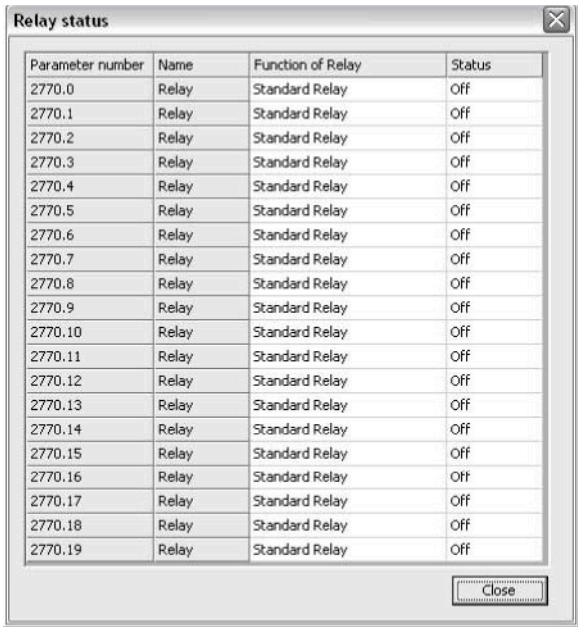

Figure 132: Relay Status

8.5.3 Extended Cascade Controller Options

8.5.3.1 Overview of Extended Cascade Controller Options

The Extended Cascade Controller offers 2 cascade modes that are not available in basic cascade control. The 2 modes are:

- Master/Follower.
- Mixed Pumps.

8.5.3.2 The Set-up Tab

Set-up is the interface for setting up the add-on cascade controller option. The *Cascade mode* drop-down list is extended with *Master/Follower* and *Mixed Pumps*.

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Figure 133: Cascade Mode Drop-down List

8.5.3.3 Master/Follower

The master/follower function allows configuring:

- Motor start.
- Pump configuration.
- Connections.
- Staging/destaging.
- Master pulse output signal.
- Spin time unused pump.
- Run-time balancing.

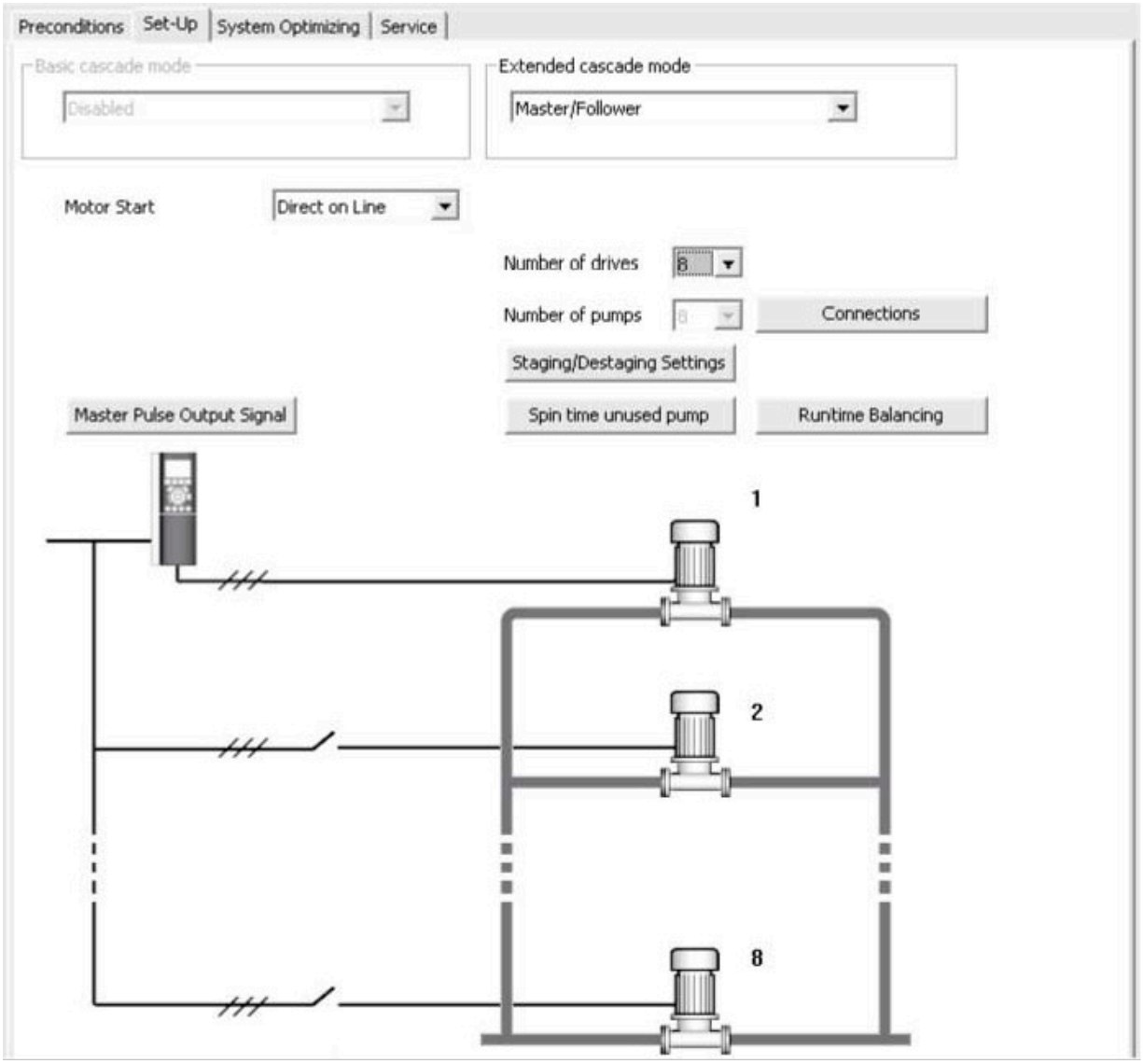

Figure 134: Master/Follower

The motor start drop-down list is similar to the configuration available in Basic Cascade Control.

A drive controls each pump, and the number of drives corresponds to the number of pumps. Staging and destaging are done based on the speed of the drive. The master drive operating in closed loop controls the constant pressure. Up to 6 pumps can be controlled with the VLT® Extended Cascade Controller MCO 101 and up to 8 pumps with the VLT® Advanced Cascade Controller MC 102.

Select *Connections* to configure the relay function for each relay in the application.

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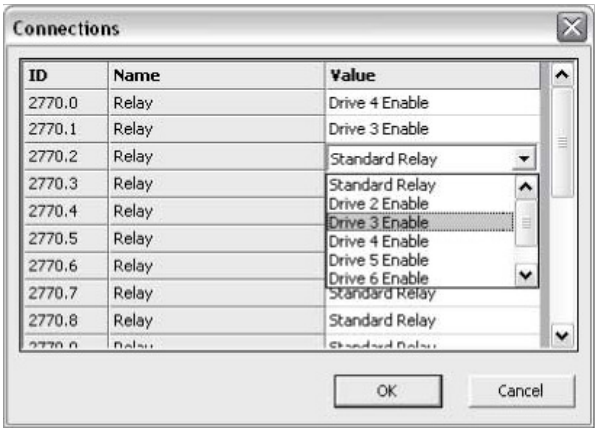

Figure 135: Configure Relay Options

NOTE: The number of available relays depends on the add-on option.

To set up the function of each relay, double-click the *Value* field and select the relay from the drop-down list. If add-on option MCO 102 is installed, the relay option VLT® Relay Card MCB 105 may also be used as an expansion.

Select *Staging/Destaging settings* to configure when to add and remove a stage from a running application. All stages are a representation of 100% pumps in *Master/Follower*.

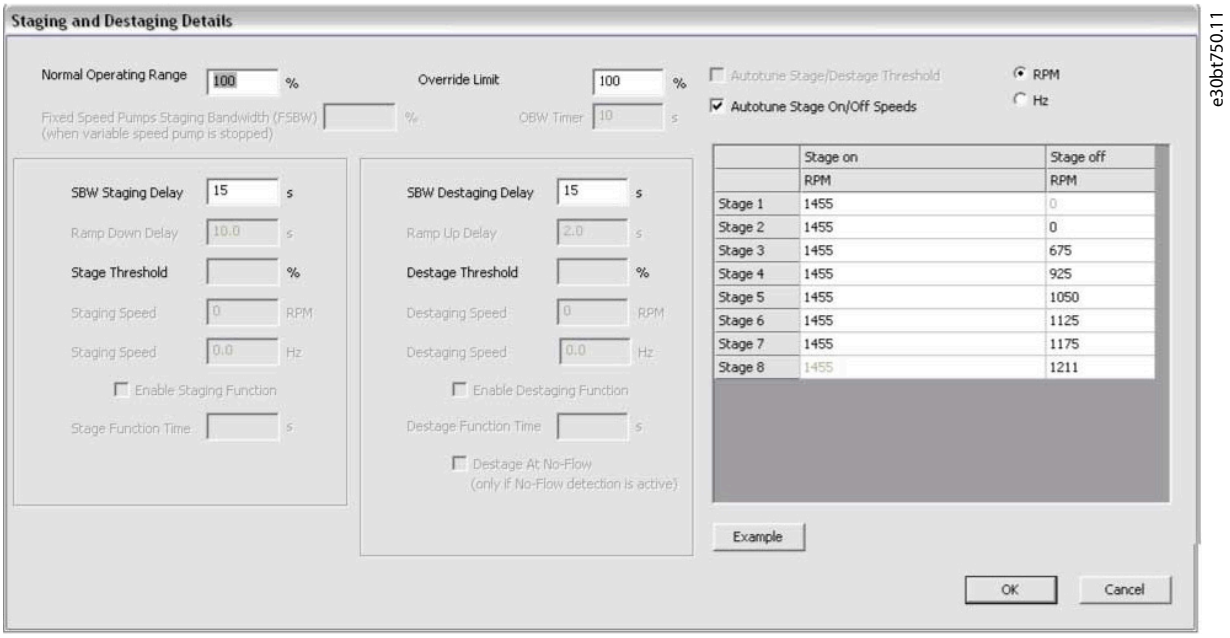

Figure 136: Staging and Destaging Details

Table 12: Staging and Destaging Description

Field	Description
Normal operating range	The allowed offset from the setpoint before a pump may be added or removed. The system must be outside of the limit for the time specified in *Staging delay*.
Override limit	The allowed offset from the setpoint before a pump is immediately added or removed.

Table 12: Staging and Destaging Description - (continued)

Field	Description
Autotune stage/destage threshold	Optimizes the threshold values during operation. The settings are updated to avoid pressure overshoots and undershoots when staging and destaging.
Autotune stage on/off speeds	Stage on and off speeds are continually autotuned during operation. Settings are optimized to ensure high performance and low energy consumption.

All supported stages On and Off settings can be configured in RPM or Hz. Select *Example* to see a configuration example of 3 pumps.

Ramp-down delay and ramp-up delay are only configurable when motor start is configured to soft starter.

Select *Master pulse output signal* to configure terminal 27 on the master drive.

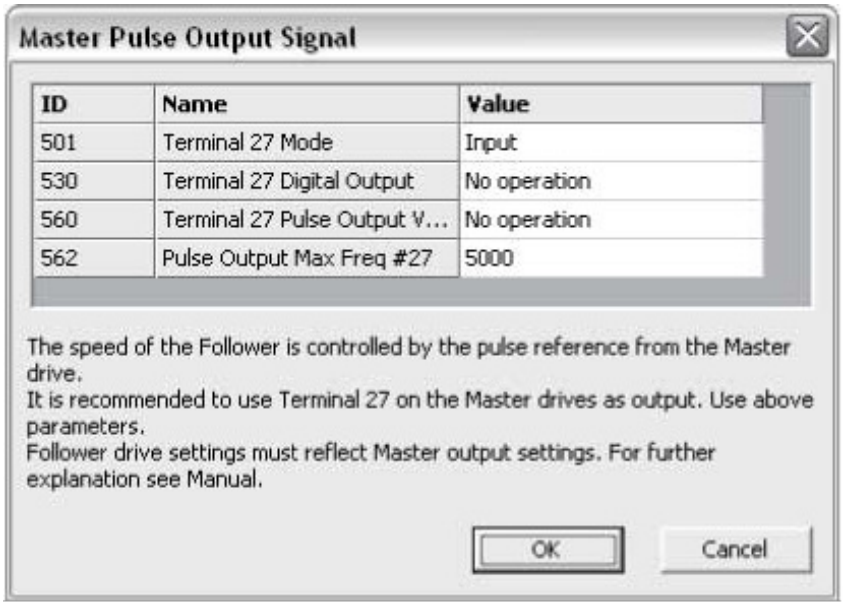

Figure 137: Master Pulse Output Signal

In some applications, not all pumps are used regularly. Select *Spin time unused pump* to configure the time a pump is allowed to idle.

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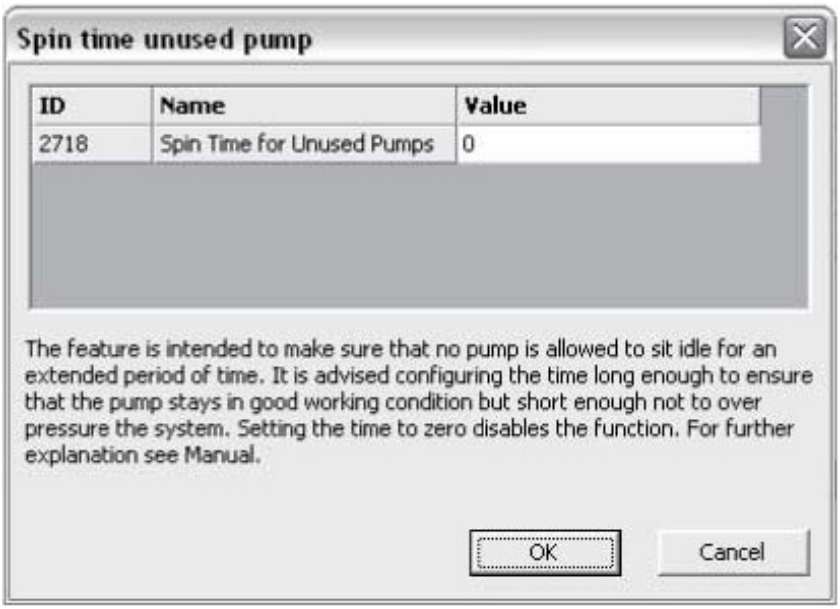

Figure 138: Spin Time Unused Pump

Select *Runtime balancing* to balance the running hours of the available pumps. Three balancing priorities are available for each pump.

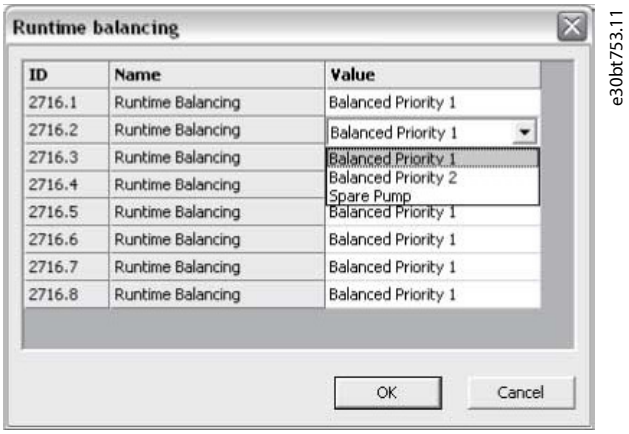

Figure 139: Balancing Running Hours

8.5.3.4 Mixed Pumps

Select *Mixed pumps* to configure:

- Motor start.
- Pump configuration.
- Pump size.
- Connections.
- Alternation details.
- Staging/destaging settings.
- Spin time unused pump.
- Runtime balancing.

The motor start drop-down list is similar to Basic Cascade Control, but with the additional possibility to configure star/delta.

Mixed Pumps Cascade Mode can be configured to:

Table 13: Mixed Pump Cascade Mode

Mode	Description
Mixed pump	A mix of variable-speed pumps connected to drives and more fixed-speed pumps.
Unequal size pump	Limited mix of fixed-speed pumps in different sizes.
Mixed pump with alternation	Alternates the drive between 2 pumps along with controlling more fixed-speed pumps.

Select *Pump size* to configure the fixed pump capacity in the application. All variable-speed pumps are read-only and 100% in capacity.

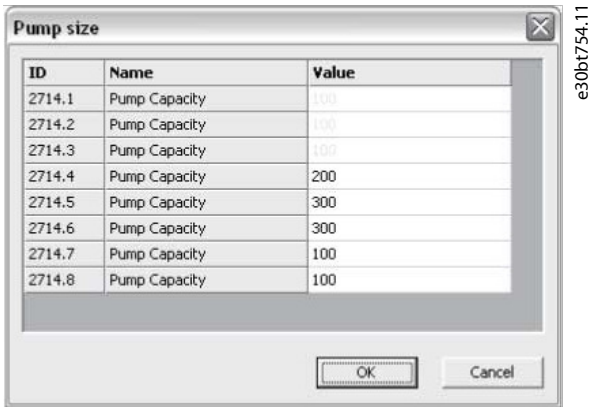

Figure 140: Configure Fixed Pump Capacity

For configuration of connection, refer to 8.5.3.3 Master/Follower. For mixed pump alternation details configuration, refer to Basic Cascade Control.

The dialog *Staging and destaging details* is similar to Basic Cascade Control with the additional option to configure minimum speed destage delay. Configure for how many seconds the lead pump must run at minimum speed while system feedback is in normal operation band. When the time has elapsed, the pump turns off to save energy.

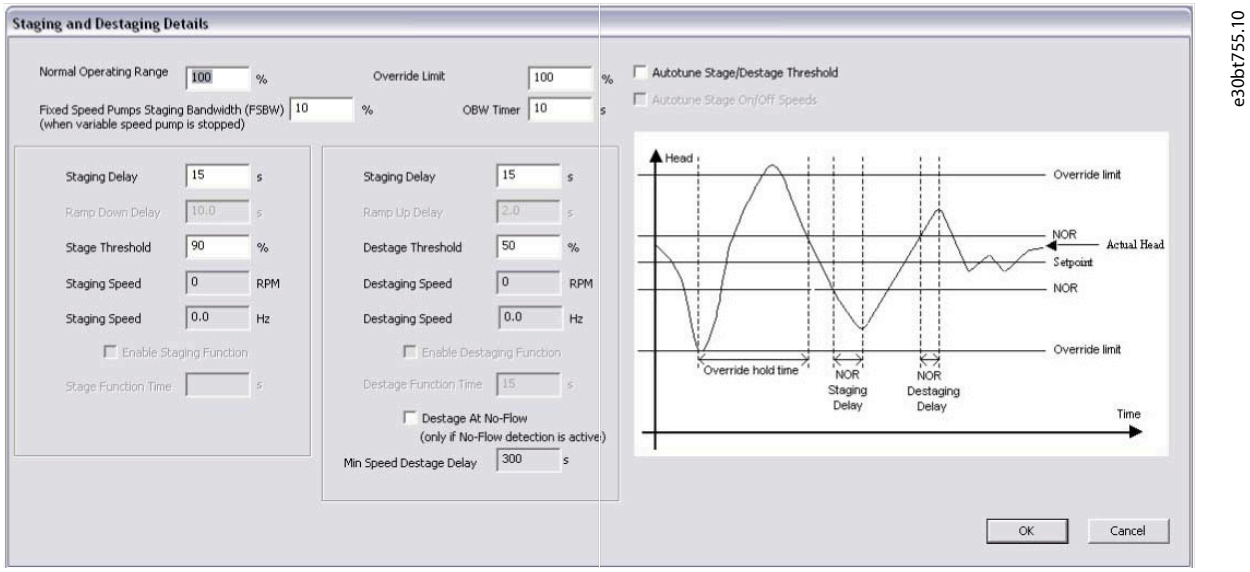

Figure 141: Staging/Destaging

Spin time unused pump and *Runtime balancing* configurations are similar to the master/follower configuration.

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8.6 Drive File Manager Plug-in

8.6.1 Customer-specific Initialization Values - CSIV

The Drive file manager provides the functionality to download files containing customer-specific initialization values (CSIV), language files, and application wizard files to the drive. CSIV files contain parameter sets that can be used to initialize the drive to reduce the time for commissioning. Files can only be flashed via the fieldbus RS-485 and USB with the drive serial address configured to 1.

Table 14: Available Features

	View drive flash file system	Down-load CSIV files	Delete CSIV files	Down-load lan-guage files	Delete language files	Download application wizard files	Delete applica-tion wiz-ard files	Splash screen
VLT® Micro Drive FC 51	–	–	–	–	–	–	–	–
VLT® HVAC Basic Drive FC 101	–	–	–	–	–	–	–	–
VLT® HVAC Drive FC 102	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VLT® AQUA Drive FC 202	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VLT® Au-tomation-Drive FC 302	Yes	Yes	Yes	Yes	Yes	Yes [1]	Yes	Yes
Derived versions of the FC Series	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VLT® Ad-vanced Filter AAF 006	Yes	Yes	Yes	Yes	Yes	–	–	–

1) Only FC 302 from firmware version 6.6x.

The functionality is available as a plug-in named Drive File System and is accessible both from the network and project nodes.

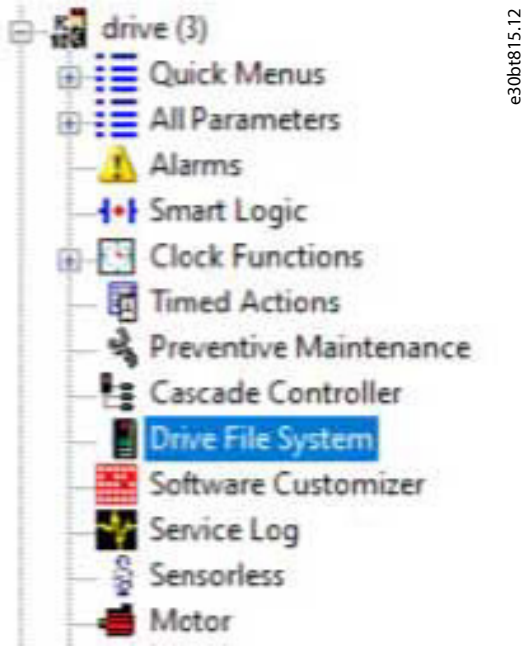

Figure 142: Drive File Manager Plug-in

From the network node, it is only possible to view the content in the Drive flash system. It requires a change of the drive serial protocol parameter ***8-30 Protocol*** to ***[1] FC MC***. CSIV and language files can only be downloaded from the project node.

8.6.2 Creating New CSIV Files

NOTE: To import existing CSIV files or language files to the list, select *Import file* from the menu.

NOTE: To export CSIV files containing initialization values to a file, select *Export file* from the menu. From the file menu, it is possible to cut, copy, paste, delete, or rename existing files from the list.

Procedure

1. Right-click the right pane of the Drive File Manager.
2. Select *New File* and *CSIV File*.

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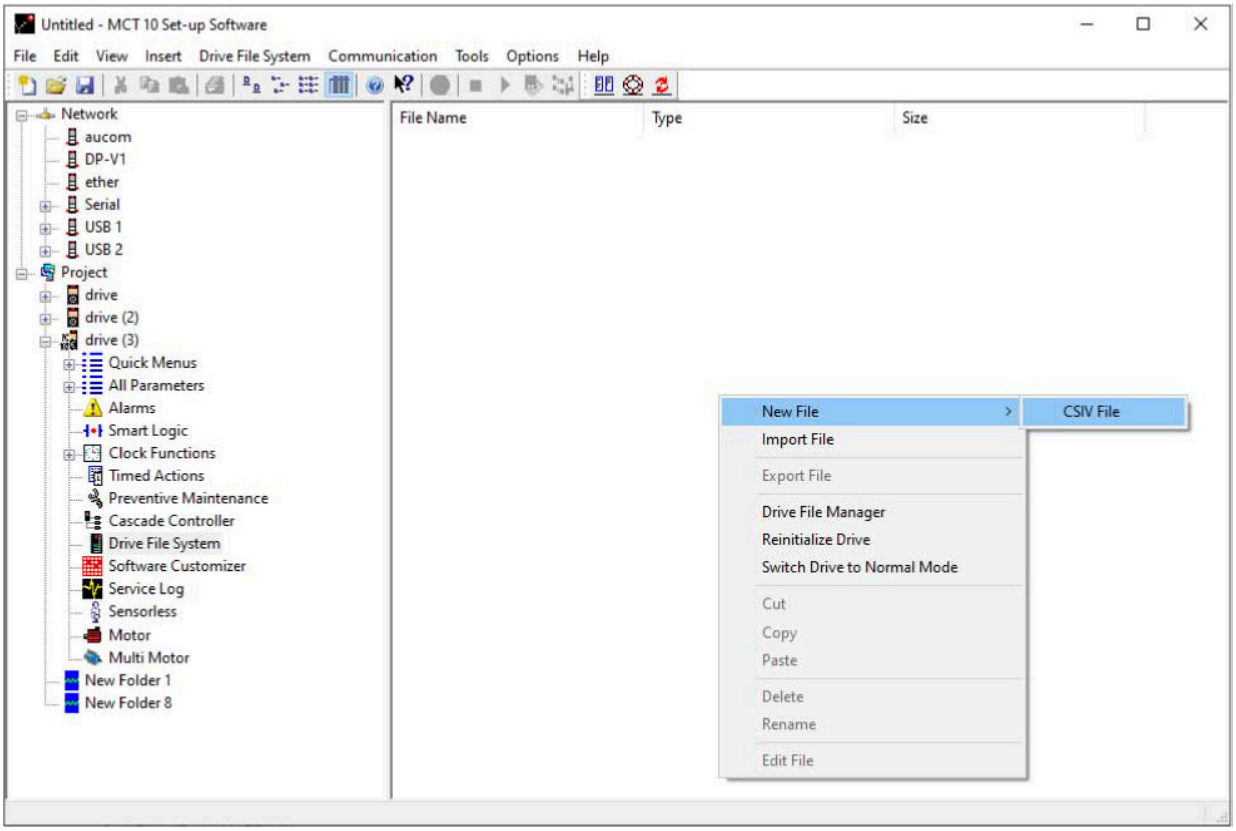


Figure 143: Create CSIV Files

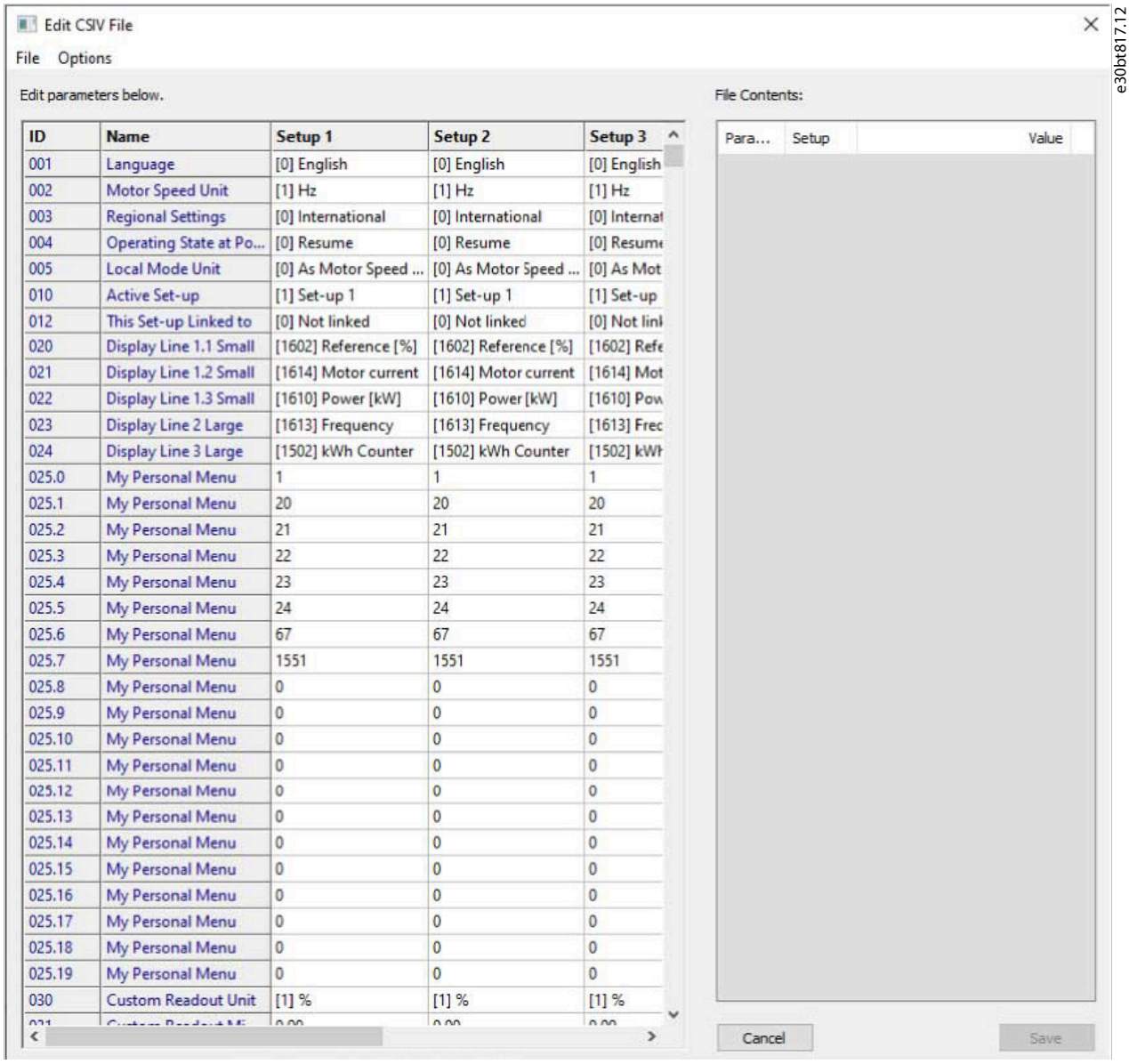
An empty CSIV file is created and listed in the right view with the default name starting from 1.

8.6.3 Configuration of CSIV Files

The CSIV file content is autogenerated based on the settings configured in the *File* menu.

- *Full change set* builds up the CSIV file content based on the user-made changes in the project including all the dependent parameters.
- *Minimal change set* builds up the CSIV file content based on user-made changes only. Selecting this option, the CSIV files are independent of the drive firmware version, except if 1 of the user-configured parameters is not available.

Use an editor to configure the CSIV file. To open the editor, double-click a file from the list or select *Edit File* from the menu.



ID	Name	Setup 1	Setup 2	Setup 3
001	Language	[0] English	[0] English	[0] English
002	Motor Speed Unit	[1] Hz	[1] Hz	[1] Hz
003	Regional Settings	[0] International	[0] International	[0] Internat
004	Operating State at Po...	[0] Resume	[0] Resume	[0] Resume
005	Local Mode Unit	[0] As Motor Speed ...	[0] As Motor Speed ...	[0] As Mot
010	Active Set-up	[1] Set-up 1	[1] Set-up 1	[1] Set-up
012	This Set-up Linked to	[0] Not linked	[0] Not linked	[0] Not link
020	Display Line 1.1 Small	[1602] Reference [%]	[1602] Reference [%]	[1602] Refe
021	Display Line 1.2 Small	[1614] Motor current	[1614] Motor current	[1614] Mot
022	Display Line 1.3 Small	[1610] Power [kW]	[1610] Power [kW]	[1610] Pow
023	Display Line 2 Large	[1613] Frequency	[1613] Frequency	[1613] Frec
024	Display Line 3 Large	[1502] kWh Counter	[1502] kWh Counter	[1502] kWh
025.0	My Personal Menu	1	1	1
025.1	My Personal Menu	20	20	20
025.2	My Personal Menu	21	21	21
025.3	My Personal Menu	22	22	22
025.4	My Personal Menu	23	23	23
025.5	My Personal Menu	24	24	24
025.6	My Personal Menu	67	67	67
025.7	My Personal Menu	1551	1551	1551
025.8	My Personal Menu	0	0	0
025.9	My Personal Menu	0	0	0
025.10	My Personal Menu	0	0	0
025.11	My Personal Menu	0	0	0
025.12	My Personal Menu	0	0	0
025.13	My Personal Menu	0	0	0
025.14	My Personal Menu	0	0	0
025.15	My Personal Menu	0	0	0
025.16	My Personal Menu	0	0	0
025.17	My Personal Menu	0	0	0
025.18	My Personal Menu	0	0	0
025.19	My Personal Menu	0	0	0
030	Custom Readout Unit	[1] %	[1] %	[1] %

Figure 144: Parameter Settings Imported from the Project and the Actual CSIV File Content

The left view contains the parameter settings imported from the project. The right view lists the actual CSIV file content.

- Edit the relevant parameter settings in the *Edit parameters below* view.
- It is possible to undo the changes made from the *Options* menu.
- *Revert parameters to project drive* settings apply to initialization values to CSIV file contents corresponding to the original project.
- *Reset to default values* resets all parameters to factory configuration and erases the CSIV file content.
- Click *Save* to save parameter settings from the file content to the CSIV file.
- Click *Cancel* to discard all changes and close the CSIV editor.

As part of the CSIV content, the drive information is also saved to the file. When opening the file in the CSIV editor, a validation is made to check for compatibility.

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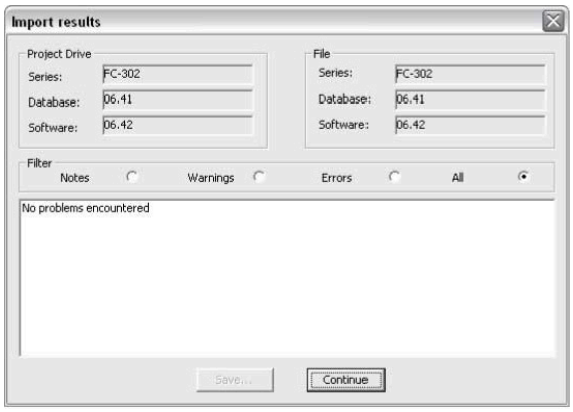

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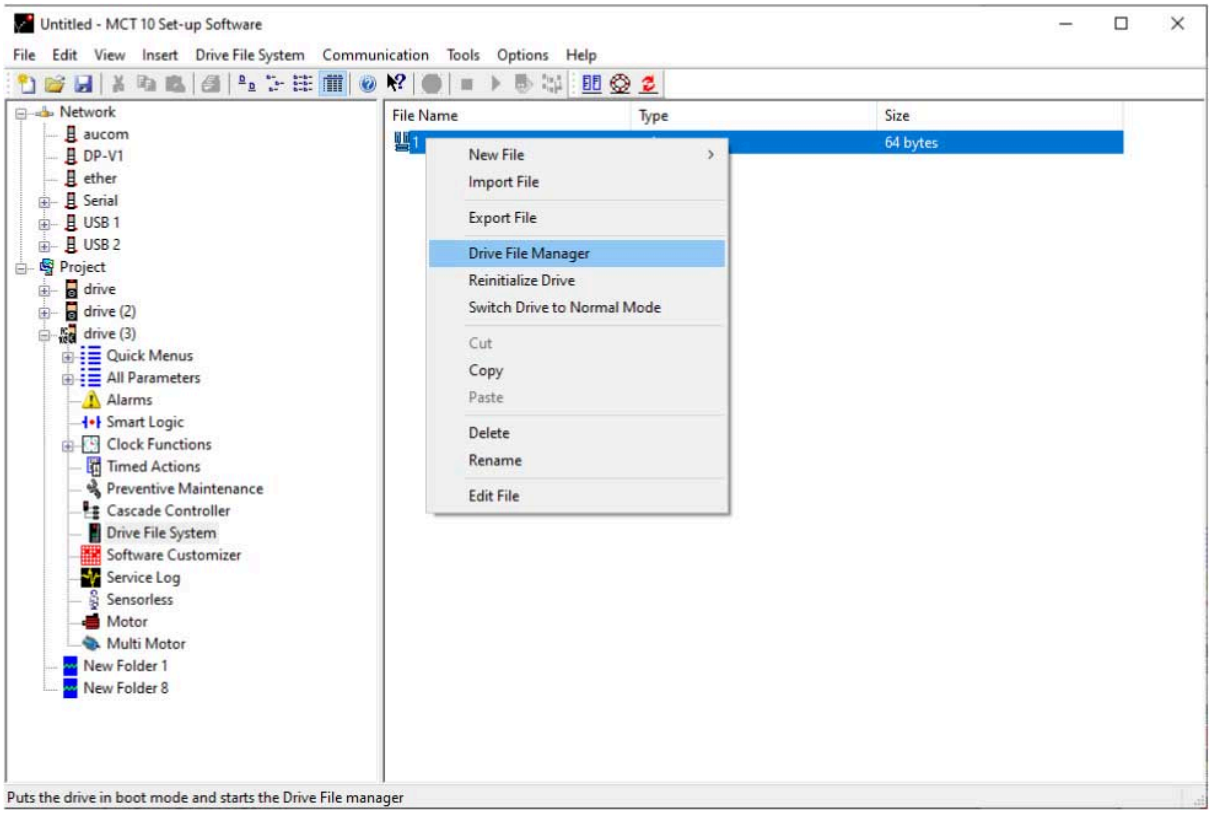
Figure 145: Validation

When parameter settings have been saved to the file, open it for validation.

8.6.4 Drive File Manager

Files can be downloaded or existing files deleted in the drive via the *Drive File Manager* available from the menu.



e30bt819.12

Figure 146: Drive File Manager

The drive is set into service mode when opening the Drive File Manager.

NOTE: If the connection is lost, or the drive is power cycled, the drive remains in service mode. It can be forced back to normal mode with the Software upgrade plug-in.



Figure 147: Service Mode

The Drive File Manager is divided into a left pane named *Project drive* and a right pane named *Connected drive*.

- *Project drive* lists the files in the project.
- *Connected drive* lists the files present in the drive flash file system.

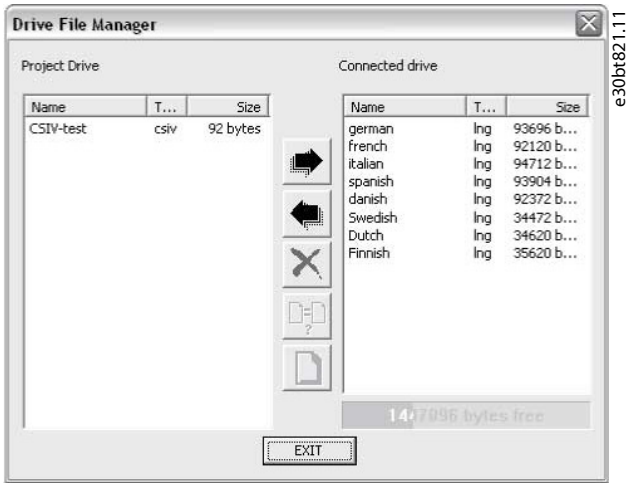


Figure 148: Present Files

There are 3 buttons in the middle of the view. The right arrow transfers the files from the project to the drive flash file system.



Figure 149: Right Arrow

The left arrow transfers the files from the drive flash file system to the project.



Figure 150: Left Arrow

The exit button closes the Drive File Manager and switches the drive back to normal mode.



Figure 151: Exit

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8.7 Functional Safety Configuration Plug-in

8.7.1 Introduction

The VLT® Safety Option MCB 15x Series is defined in the safety configuration plug-in:

- Configuration of the safety functions for safe motion shuts down the drive if an error occurs.
- Setting of:
  - Limit values.
  - Braking ramps for the safety functions.
  - Monitoring of motion sequences.

The VLT® AutomationDrive FC 301/FC 302 Operating Guide contains important safety systems information to be used to mount and set up the speed monitoring safety functions of the MCB 15x module.

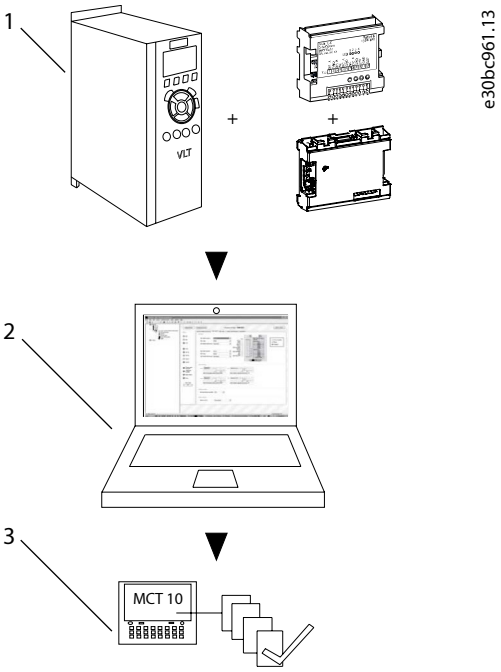

Figure 152: System Overview

8.7.2 Safe Option Compatibility

The VLT® Safety Option MCB 15x Series is supported from SW version 6.64 of VLT® AutomationDrive FC 301/FC 302. Previous versions are not supported. MCB 15x Safe Plug-in supports the following fieldbuses:

- Serial communications:
  - RS232 to RS-485
  - USB to RS-485
- USB
- PROFIBUS DP-V1

The VLT® Motion Control Tool MCT 10 safe plug-in for the VLT® Safety Option MCB 15x Series offers the following features:

- Offline project planning and preparation for safety functions.
- Commissioning of safety configurations.
- Creating backups of safety configurations.

- Safe option diagnosis.
- Monitoring the behavior and fault codes of active drives.

8.7.3 Access

8.7.3.1 Password Management

Access to the VLT® Safety Option MCB 15x Series is restricted with passwords. The password is requested at every commissioning of a new setup for the device.

8.7.3.2 Accessing the Safe Plug-in for VLT® Safety Option MCB 15x Series

Procedure

1. Expand the drive's network or project view.
2. Expand the relevant drive to show its contents.

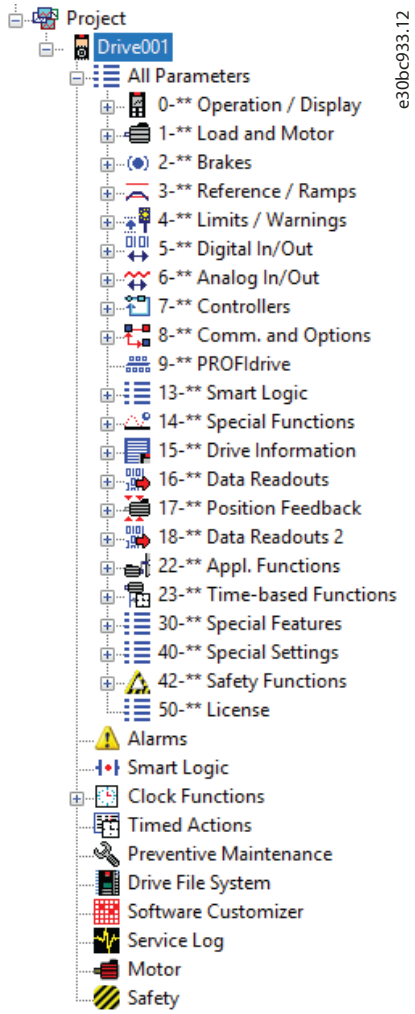

Figure 153: The Safe Plug-in for MCB 15x (Safety) shown with Functional Safety Icon in Project Tree

If there are multiple separate online or offline drives, select the relevant drive to monitor from the structure tree.

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NOTE: The parameters that can be edited using the safe plug-in for MCB 15x are also included in parameter group ***42-** Safety Functions*** in the *All Parameters* group of the structure tree. These parameters can only be edited using the safe plug-in for MCB 15x.

To review parameter group ***42-** Safety Functions*** in the *All parameters* view, expand the *All parameters* group beneath the wanted drive and select the parameter group ***42-** Safety Functions*** entity. The parameter grid is shown on the right.

8.7.4 Safe Plug-in Interface

8.7.4.1 Overview of the Safe Plug-in Interface

The layout of the plug-in is divided into separate sections that are all described in more details in this chapter.

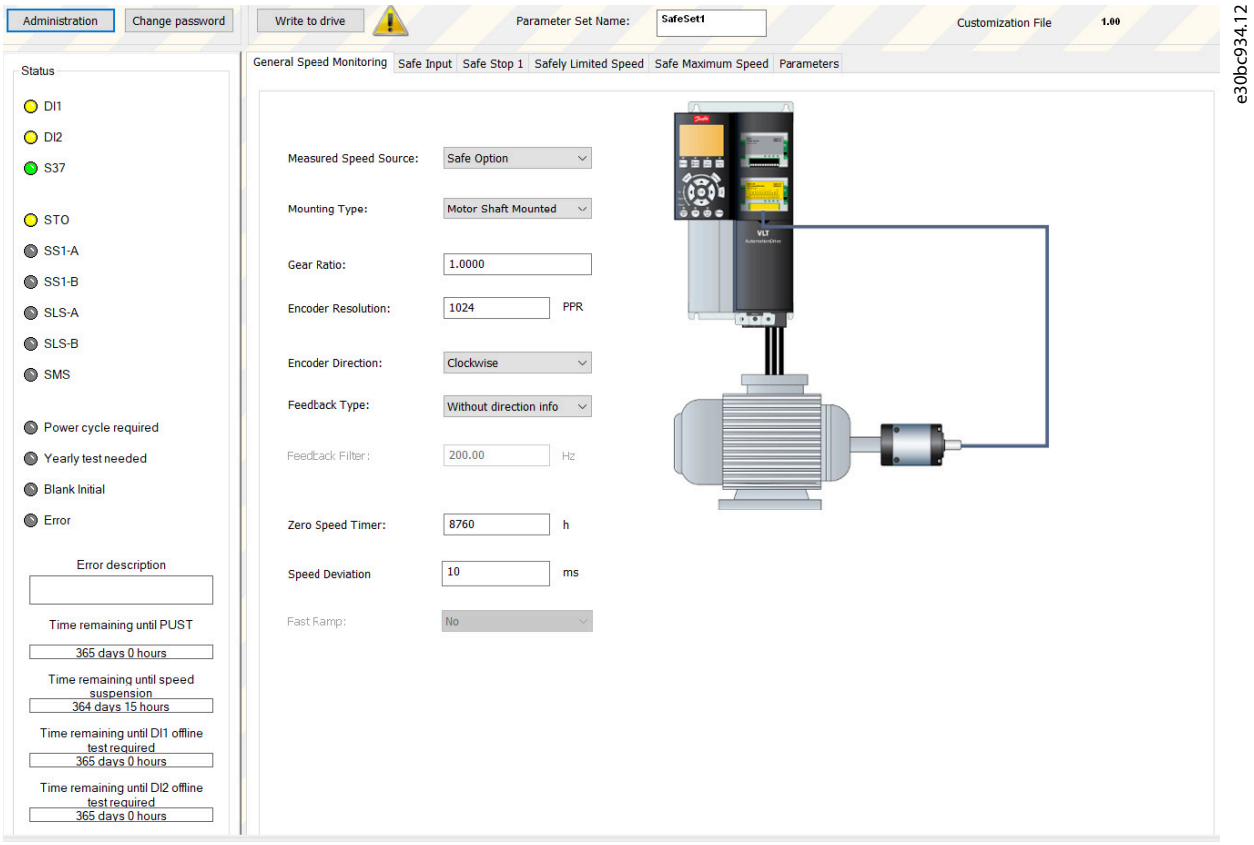


Figure 154: The Opening Tab of the Safe Plug-in for VLT® Safety Option MCB 15x Series Plug-in Interface (Operating in Offline Mode)

The safe plug-in for the MCB 15x features tooltips for all plug-in interface components. Briefly hovering the mouse cursor over any interface component reveals a tooltip detailing the current option, LED, or tab header. Refer to these tooltips for quick and easy help information.

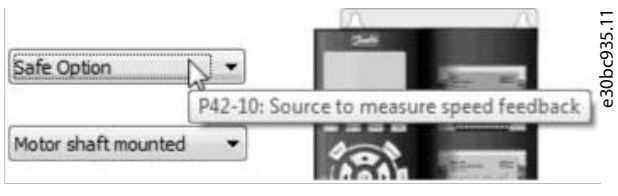


Figure 155: Tooltip Example

8.7.4.2 Areas in the Safe Plug-in Interface

8.7.4.2.1 Information and Administration Ares



e30bc936.10

Figure 156: Safe Plug-in for VLT® Safety Option MCB 15x Series Information and Administration Area

The information area at the top of the plug-in interface shows the current safe plug-in for MCB 15x profile name and notifies about pending changes.

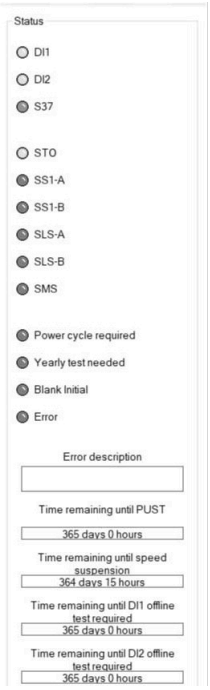
Depending on the mode, further options are available in the information area.

- Offline mode: If a drive is connected, press *Write to drive* and upload the configuration to the MCB 15x.
- Online mode: Two more selections are present in the Information area:
  - Administration
  - Change password

The *Notification* icon is shown when there are changes pending for the drive that have not yet been written to it. This icon is shown at every configuration update. The icon is removed from the view only after a successful commissioning procedure.

8.7.4.2.2 LED Status Area

The left-hand side of the safe plug-in for the VLT® Safety Option MCB 15x Series contains the *Status* pane. The *Status* pane contains informative LED status icons that help to monitor the functionality and status of the safe plug-in for MCB 15x configuration entities.



e30bc937.12

Figure 157: LED Status Area

NOTE: The LED icons are active only when the safe plug-in for MCB 15x is accessed in online network mode. When working in offline project mode, the LEDs remain inactive (gray).

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Table 15: LED Status Information

LED status	Description
Green	OK state - the option is enabled or active.
Flashing green	Pending state - the option is pending. This state applies only to DI1 and DI2 LEDs.
Yellow	Active state - the option is active.
Flashing red	Warning state - the option has encountered a warning state.
Red	Error state - the option has encountered an error.
Gray	Off state - the option is either disabled, offline, or inactive.

Table 16: LED Status Information

LED	Status
DI1	Status of digital input 1.
DI2	Status of digital input 2.
S37	Status of S37 safe output for terminal T37 on the drive.
STO	Status of Safe Torque Off.
SS1-A	Status of Safe Stop 1 A.
SS1-B	Status of Safe Stop 1 B.
SLS-A	Status of Safely Limited Speed A.
SLS-B	Status of Safely Limited Speed B.
SMS	Status of Safe Maximum Speed
Power cycle required	This LED lights up when the device requires a power cycle.
Yearly test needed	Test digital inputs once a year. A warning indicates when it is time to perform the test.
Blank initial	If the LED lights up, the MCB 15x is in a blank initial state, that is, in factory settings. When writing to the MCB 15x for the 1st time, provide a new password.
Error	The MCB 15x has detected an error. The specific fault code is shown in the fault code display below the error LED: For more information regarding fault codes, refer to 13.3.3 Warnings and Alarms.

8.7.4.2.3 Configuration Area

The configuration area contains dedicated sections/tabs for configuring the safety functions.

The sequence of tabs shows the order in which the settings should be configured.

The following sections detail the contents of the configuration tabs:

- General Speed Monitoring.
- Safe Input.
- Safe Stop 1.
- Safely Limited Speed.
- Safe Maximum Speed

The last tab, *Parameters*, contains a table layout of all configuration options, intended for advanced users.

8.7.4.3 Tabs in the Safe Plug-in Interface

8.7.4.3.1 General Speed Monitoring

The *General Speed Monitoring* tab contains primary and general information regarding the encoder/proximity switch feedback setup details.

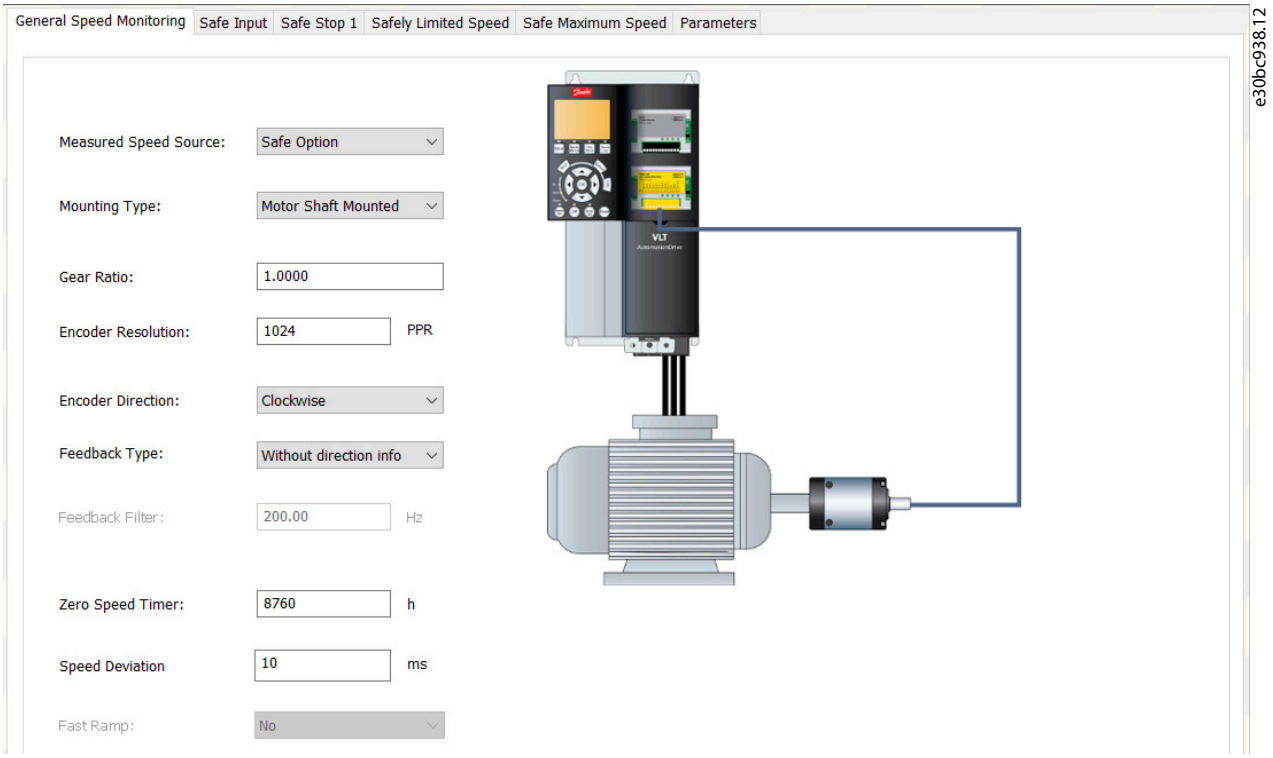

Figure 158: Speed Monitoring Configuration Tab

The left side of the tab contains the following configuration options:

Table 17: Options for General Speed Monitoring

Option	Description
Measured speed source	This option defines the measured speed feedback source. The following options are available: • Safe plug-in for VLT® Safety Option MCB 15x Series - the feedback source is the safe plug-in for MCB 15x. • None - no feedback source is used. • Factory setting: [Safe plug-in for MCB 15x].
Mounting type	This option defines where the encoder is mounted. The following options are available: • Gear mounted - the encoder reading the speed is mounted on a shaft using a gear system. • Motor shaft mounted - the encoder is mounted directly to the motor shaft. • Sensorless - the drive is mounted with the VLT® Sensorless Safety MCB 159 option. The encoder senses the motor speed via back EMF.

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Table 17: Options for General Speed Monitoring - (continued)

Option	Description
Gear ratio	This option defines the ratio between the motor shaft and the encoder speed. Range: 0.0001 and 32.0000. Factory setting: 1.0000.
VLT® Safety Option MCB 150 encoder resolution	This option defines the encoder resolution connected to the safe plug-in for MCB 15x. Range: 1 and 4096 PPR for HTL, and 1 and 1000 PPR for TTL. Factory setting: 1024 PPR.
Encoder direction	This option provides the option to change the detected encoder rotation direction without altering the wiring to the encoder itself. The following options are available: • Clockwise - that is positive feedback when the encoder rotates clockwise. • Counterclockwise - that is positive feedback when the encoder rotates counterclockwise. Factory setting: [Clockwise].
Feedback type	This option defines the feedback type. The following options are available: • With direction info - the feedback provides direction information, for example an encoder. • Without direction info - the feedback does not provide direction information (proximity switch configuration). Factory setting: [With direction info].
Feedback filter	This option defines the frequency used by the feedback filter for low-resolution encoder or proximity switch if the resolution is low. Range: 0.01–200 Hz (off). Factory setting: [200 Hz (off)].
Zero speed timer	This option allows the speed to be below 120 RPM when SLS is active before STO is engaged. Range: 0 s and 10000 s. Factory setting: [10].

8.7.4.3.2 Safe Input

The *Safe Input* tab details the input channel, settings, failure reaction, and reset functions that are mapped into the VLT® Safety Option MCB 15x Series.

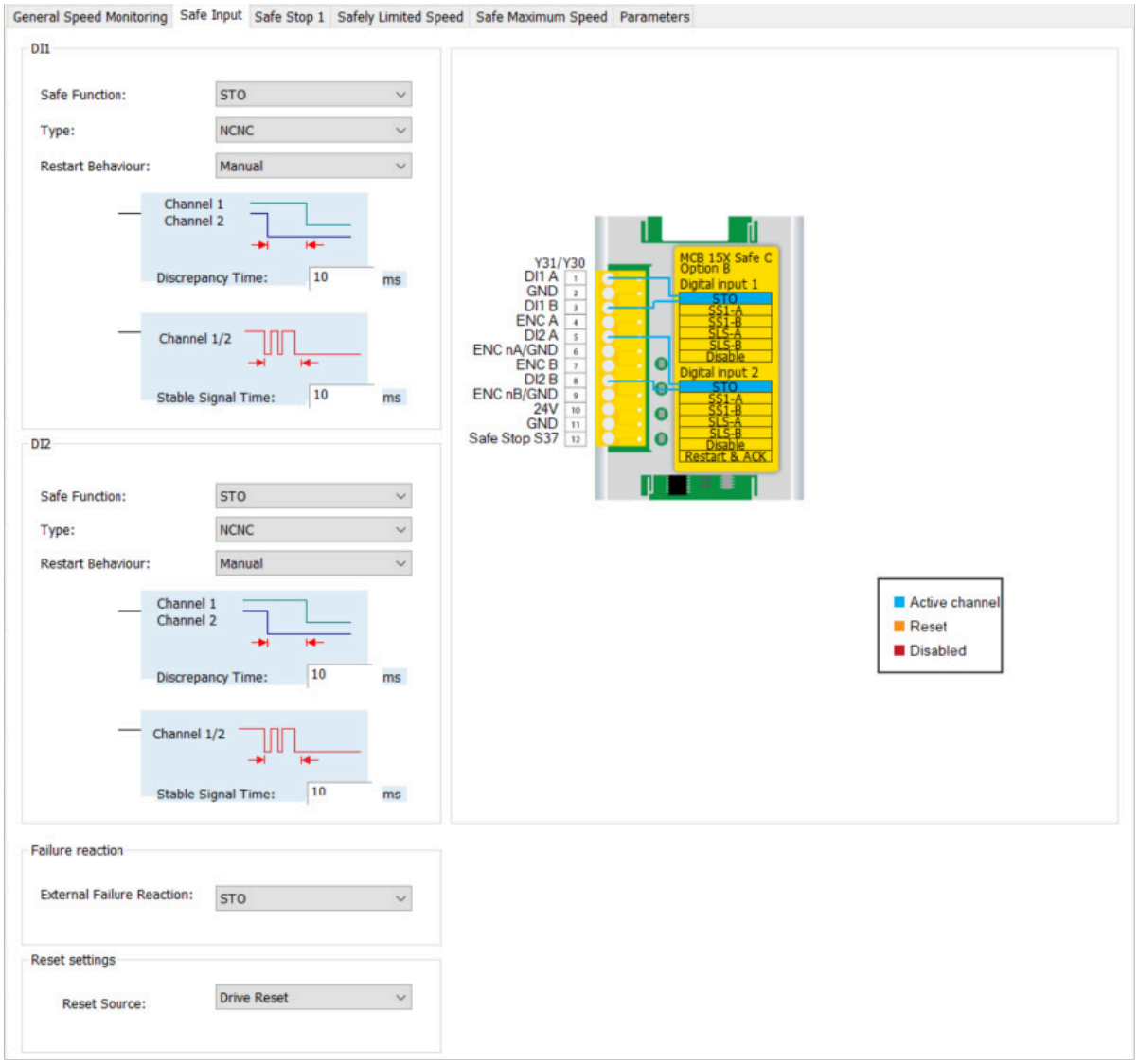

Figure 159: Safe Input Configuration Tab

The *Safe Input* tab contains several sections and configuration possibilities.

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Table 18: Options for Safe Input

Option	Description
DI1 safe function	This option defines the safe function used by DI1. The following options are available: • STO - Safe Torque Off is used as the safe functions by DI1. • SS1-A - Safe Stop 1 A is used as the safe function by DI1. • SS1-B - Safe Stop 1 B is used as the safe function by DI1. • SLS-A - Safely Limited Speed A is used as the safe function by DI1. • SLS-B - Safely Limited Speed B is used as the safe function by DI1. • Disabled - The DI1 safe function is disabled. Factory setting: STO.
DI1 type	This option defines the DI type used. The following options are available: • NCNC - NCNC type is used. • Antivalent - NO/NC (antivalent) type is used. • NC - 1 NC input type is used.
DI1 restart behavior	Restart of the MCB 15x configures the DI1 start behavior. The following options are available: • Manual - The restart is performed manually. • Automatic - The restart is performed automatically. Factory setting: Manual.
DI2	This option defines the safety function used by DI2. The following options are available: • STO - Safe Torque Off is used as the safe functions by DI2. • SS1-A - Safe Stop 1 A is used as the safe function by DI2. • SS1-B - Safe Stop 1 B is used as the safe function by DI2. • SLS-A - Safely Limited Speed A is used as the safe function by DI2. • SLS-B - Safely Limited Speed B is used as the safe function by DI2. • Disabled - The DI2 safe function is disabled. Factory setting: STO.
DI2 type	The option defines the DI2 type used. The following options are available: • NCNC - NCNC type is used. • Antivalent - NO/NC (antivalent) type is used. • NC - 1 NC input type is used.
DI2 restart behavior	This option defines the DI2 restart behavior. The following options are available: • Manual – The restart is performed manually. • Automatic – The restart is performed automatically. Factory setting: Manual.

Table 19: Options for Input Settings

Option	Description
DI1 discrepancy time	This option defines the time for the DI1 signal discrepancy. Range: 0–5000 ms. Factory setting: 10 ms.
DI1 stable signal time	This option defines the time for the DI1 signal to become stable. Range: 0–5000 ms. Factory setting: 10 ms.
DI2 discrepancy time	This option defines the time for the DI2 signal discrepancy. Range: 0–5000 ms. Factory setting: 10 ms.
DI2 stable signal time	This option defines the time for the DI2 signal to become stable. Range 0–5000 ms. Factory setting: 10 ms.

Table 20: Options for Failure Reaction

Option	Description
External failure reaction	This option defines the reaction that is executed if there is an external failure. The following options are available: • STO - STO is executed. • SS1-A - SS1-A is executed. • SS1-B - SS1-B is executed. Factory setting: STO.

Table 21: Options for Reset Settings

Option	Description
Reset source	This option defines the source for the reset signal for the safe plug-in for MCB 15x. The following options are available: • Drive Reset - The source is a drive reset. • Drive Safe Reset - The source is a safe drive reset. • Safe Option DI2_A - The source is MCB 15x DI2_A. Factory setting: Drive Reset.

8.7.4.3.3 Safe Stop 1

The *Safe Stop 1* tab allows setting specific scenarios for safe stopping of the drive using designated conditions.

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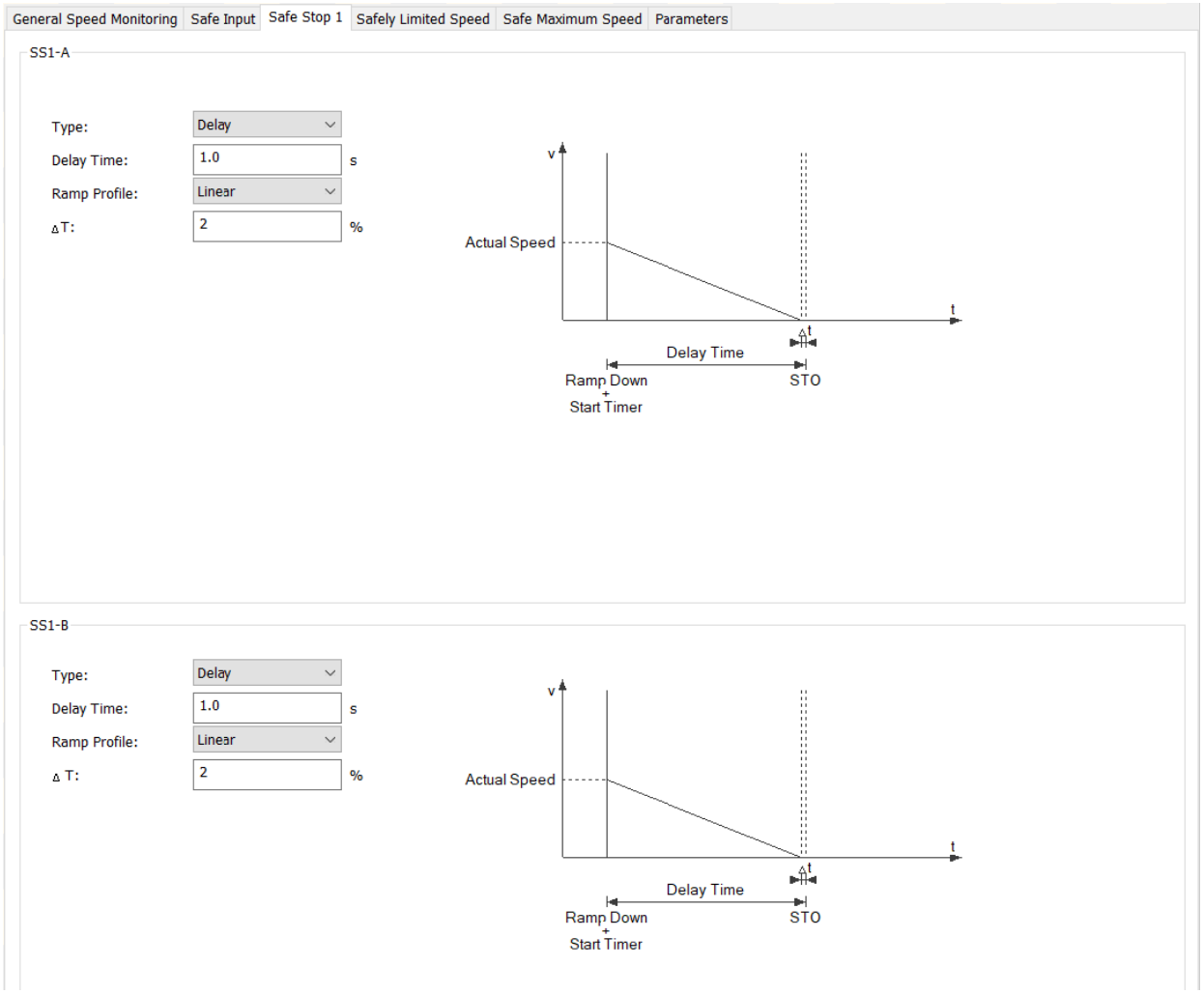

Figure 160: Safe Stop 1 Tab

The *Safe Stop 1* tab contains the following separated sections with the following configuration possibilities:

Table 22: Options for SS1-A

Option	Description	
Type	This option defines the type for the safe stopping configuration. The following options are available: • Delay - a delay is used to stop the drive safely. • Ramp - a ramp is used to stop the drive safely. Factory setting: Delay.	
Type: Delay	The following configuration options are available when the type is set to delay:	
	Delay time	This option defines the amount of time that is used by the SS1 delay function to ramp the speed down to 0 RPM. Range: 0.1–3600 s. Factory setting: 1 s.
	Ramp profile	This option defines the ramp profile setting. The following options are available: • Linear - a linear ramp is used for the delay. • S-ramp const. time - a constant time ramp is used to stop the drive safely. Factory setting: Linear.
	Delta time	This option defines the buffer time that is added to the delay time before activating STO. Range: 0–99%.
	S-ramp Ratio start	This option is configurable only when S-ramp constant time is selected as the ramp profile. This option defines the proportion of the total ramp-down time where the deceleration torque increases. The greater the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application. Range: 1–50%. Factory setting: 50%.
	S-ramp Ratio end	This option is configurable only when S-ramp constant time is selected as the ramp profile. This option defines the proportion of the total ramp-down time where the deceleration torque increases. The greater the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application. Range: 1–50%. Factory setting: 50%.

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Table 22: Options for SS1-A - (continued)

Option	Description	
Type: Ramp	The following configuration options are available when the type is set to ramp:	
	Ramping set-up	This option defines the ramping setup used. The following options are available: • Slope - a sloping ramp is used. • Time - a time ramp is used.
	Deceleration rate	This option is configurable only when slope is selected for the ramping setup. This option defines the deceleration rate for the SS1 slope-based ramp style. Range: 1–30000 RPM/s. Factory setting: 1500 RPM/s.
	Ramp time	This option is configurable only when time is selected for the ramping setup. It defines the time after which the safe plug-in for VLT® Safety Option MCB 15x Series engages the STO.
	Delta V	This option defines the tolerance between the calculated speed and the actual speed that the safe plug-in for MCB 15x allows. Range: 1–10000 RPM. Factory setting: 120 RPM.
	Zero speed	This option defines the speed at which the safe plug-in for MCB 15x engages the STO. Range: 1–600 RPM. Factory setting: 10 RPM.

Table 23: Options for SS1-B

Option	Description	
Type	This option defines the type for the safe stopping configuration. The following options are available: • Delay - a delay is used to stop the drive safely. • Ramp - a ramp is used to stop the drive safely. Factory setting: Delay.	
Type: Delay	The following configuration options are available when the type is set to delay:	
	Delay time	This option defines the amount of time that is used by the SS1 delay function to ramp the speed down to 0 RPM. Range: 0.1–3600 s. Factory setting: 1 s.
	Ramp profile	This option defines the ramp profile setting. The following options are available: • Linear - a linear ramp is used for the delay. • S-ramp const. time - a constant time ramp is used to stop the drive safely. Factory setting: Linear.
	Delta time	This option defines the buffer time that is added to the delay time before activating STO. Range: 0–99%.
	S-ramp Ratio start	This option is configurable only when S-ramp constant time is selected as the ramp profile. This option defines the proportion of the total ramp-down time where the deceleration torque increases. The greater the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application. Range: 1–50%. Factory setting: 50%.
	S-ramp Ratio end	This option is configurable only when S-ramp constant time is selected as the ramp profile. This option defines the proportion of the total ramp-down time where the deceleration torque increases. The greater the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application. Range: 1–50%. Factory setting: 50%.

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Table 23: Options for SS1-B - (continued)

Option	Description	
Type: Ramp	The following configuration options are available when the type is set to ramp:	
	Ramping set-up	This option defines the ramping setup used. The following options are available: • Slope - a sloping ramp is used. • Time - a time ramp is used.
	Deceleration rate	This option is configurable only when slope is selected for the ramping setup. This option defines the deceleration rate for the SS1 slope-based ramp style. Range: 1–30000 RPM/s. Factory setting: 1500 RPM/s.
	Ramp time	This option is configurable only when time is selected for the ramping setup. It defines the time after which the safe plug-in for VLT® Safety Option MCB 15x Series engages the STO.
	Delta V	This option defines the tolerance between the calculated speed and the actual speed that the safe plug-in for MCB 15x allows. Range: 1–10000 RPM. Factory setting: 120 RPM.
	Zero speed	This option defines the speed at which safe plug-in for MCB 15x engages the STO. Range: 1–600 RPM. Factory setting: 10 RPM.

8.7.4.3.4 Safely Limited Speed

The *Safely Limited Speed* tab allows setting specific scenarios for safely limited speeds of the drives using designated conditions.

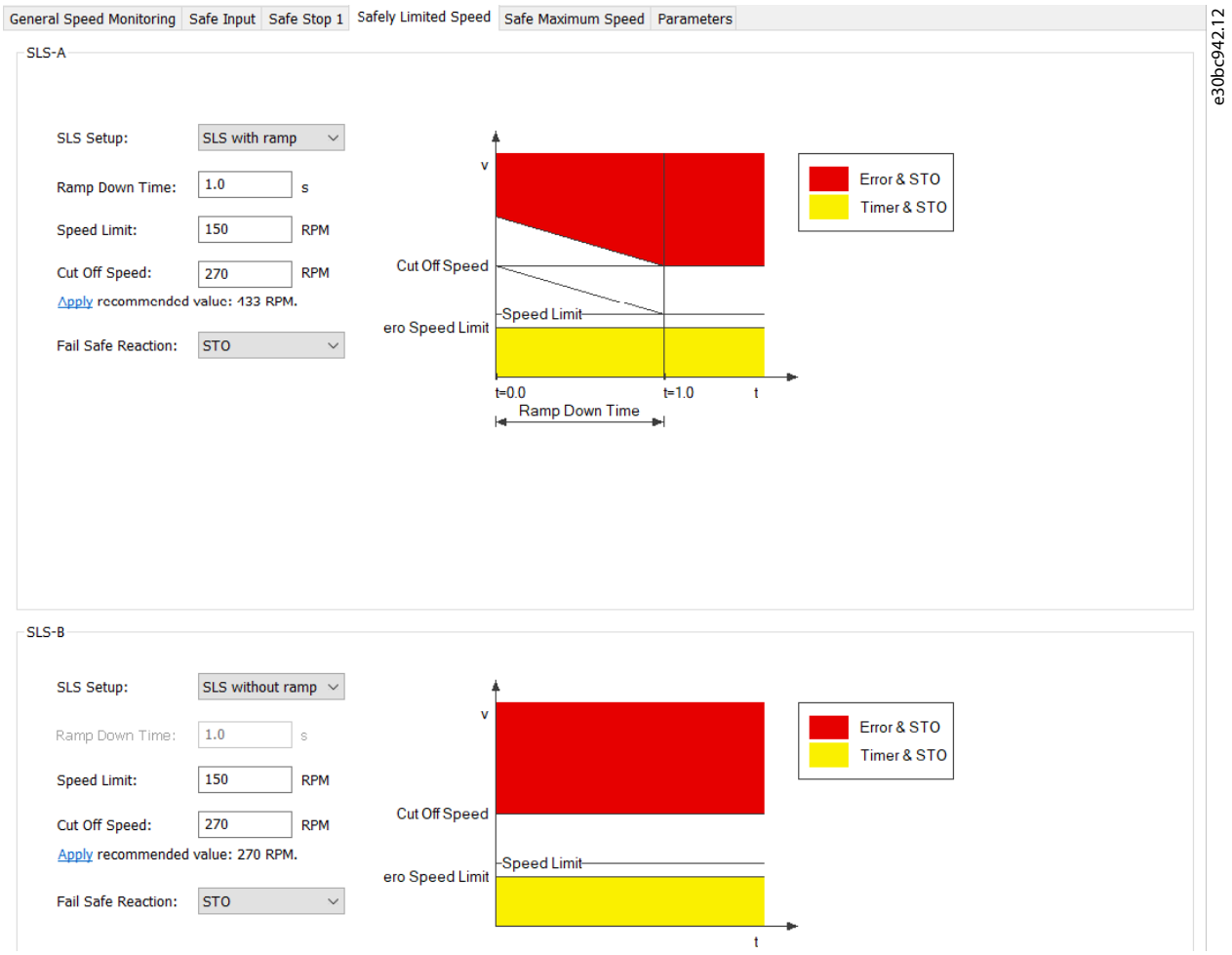

Figure 161: Safely Limited Speed Tab

The safely limited speed contains the following separated sections with the following configuration possibilities:

Table 24: Options for SLS-A

Option	Description
SLS setup	This option defines the type of the safely limited speed setup. The following options are available: • SLS without ramp. • SLS with ramp.
Ramp-down time	This option is configurable only when the SLS with ramp is selected in the SLS setup. It defines the ramp-down time for start ramp. Range: 0.1–3600 s. Factory setting: 1 s.
Cut Off Speed	This option defines the speed at which the fail-safe reaction is activated. This setting should equal the value of the speed limit parameter plus tolerance. Range: 1–10000 RPM.

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Table 24: Options for SLS-A - (continued)

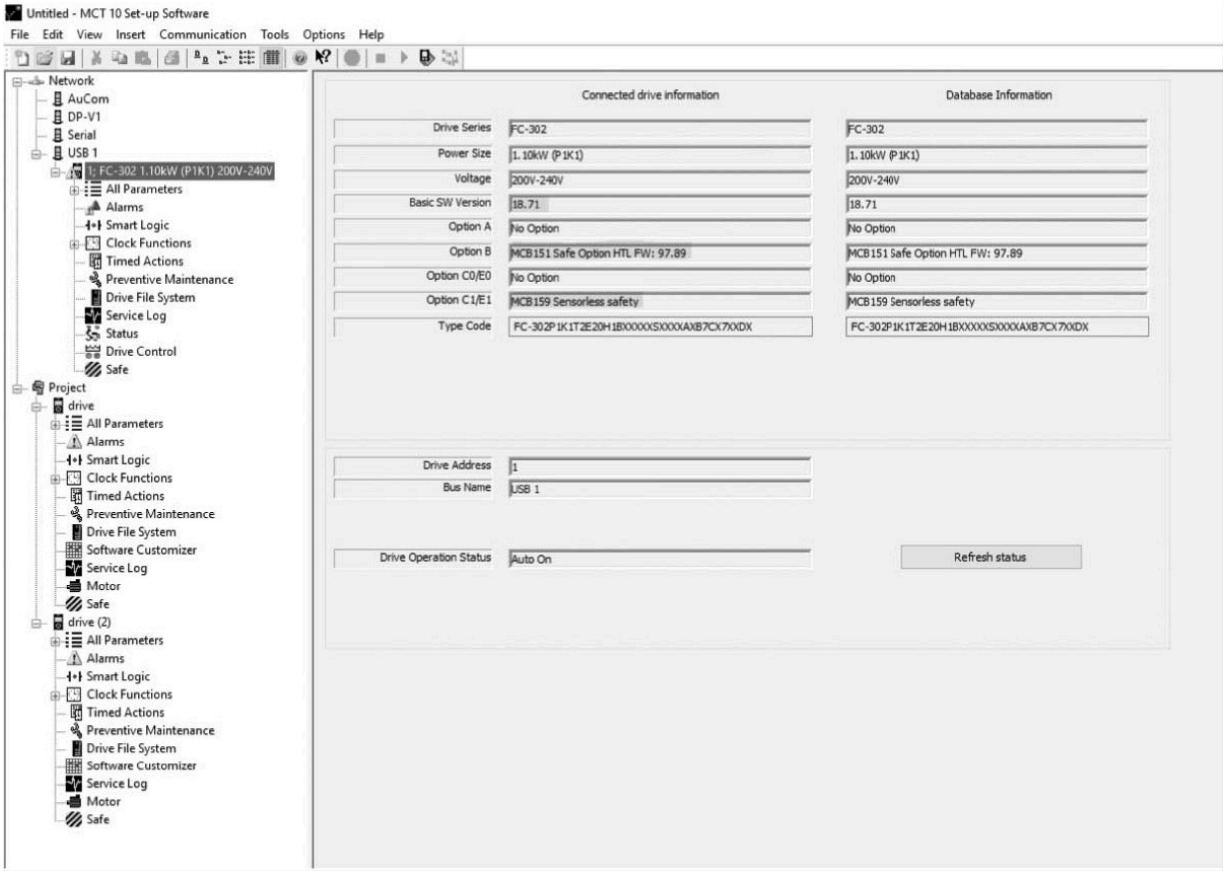
Option	Description
Speed Limit	This option defines the maximum allowed speed when the SLS function is engaged. This is a speed unit measured in RPM.
Fail Safe Reaction	This option defines the safety function that is engaged when the maximum speed is exceeded. The following options are available: • STO - Safe Torque Off is used. • SS1-A - Safe Stop 1-A is used. • SS1-B - Safe Stop 1-B is used.

Table 25: Options for SLS-B

Option	Description
SLS Setup	This option defines the type of the safely limited speed setup. The following options are available: • SLS without ramp. • SLS with ramp.
Ramp-down time	This option is configurable only when the SLS with ramp is selected in the SLS Setup. It defines the ramp-down time for start ramp. Range: 0.1–3600 s. Factory setting: 1 s.
Cut Off Speed	This option defines the speed at which the fail-safe reaction is activated. This setting should equal the value of the speed limit parameter plus tolerance. Range: 1–10000 RPM.
Speed Limit	This option defines the maximum allowed speed when the SLS function is engaged. This is a speed unit measured in RPM.
Fail Safe Reaction	This option defines the safety function that is engaged when the maximum speed is exceeded. The following options are available: • STO - Safe Torque Off is used. • SS1-A - Safe Stop 1-A is used. • SS1-B - Safe Stop 1-B is used.

8.7.4.3.5 Safe Maximum Speed - SMS

NOTE: The SMS function is only available in drives with software version 8.31 or newer.



e30bu305.10

Figure 162: Identification of Drive Software Version

If a VLT® AutomationDrive FC 302 has the VLT® Sensorless Safety MCB 159 option installed, the Safe Maximum Speed function is available. The MCB 159 offers safe-speed monitoring and prevents continuously exceeding a defined speed value.

Use the SMS function to monitor machine speed. When the maximum allowed speed is exceeded, STO is activated as fail-safe reaction. In the *Safe Maximum Speed* tab, it is possible to enable or disable the SMS function and to set the cut off speed in RPM.

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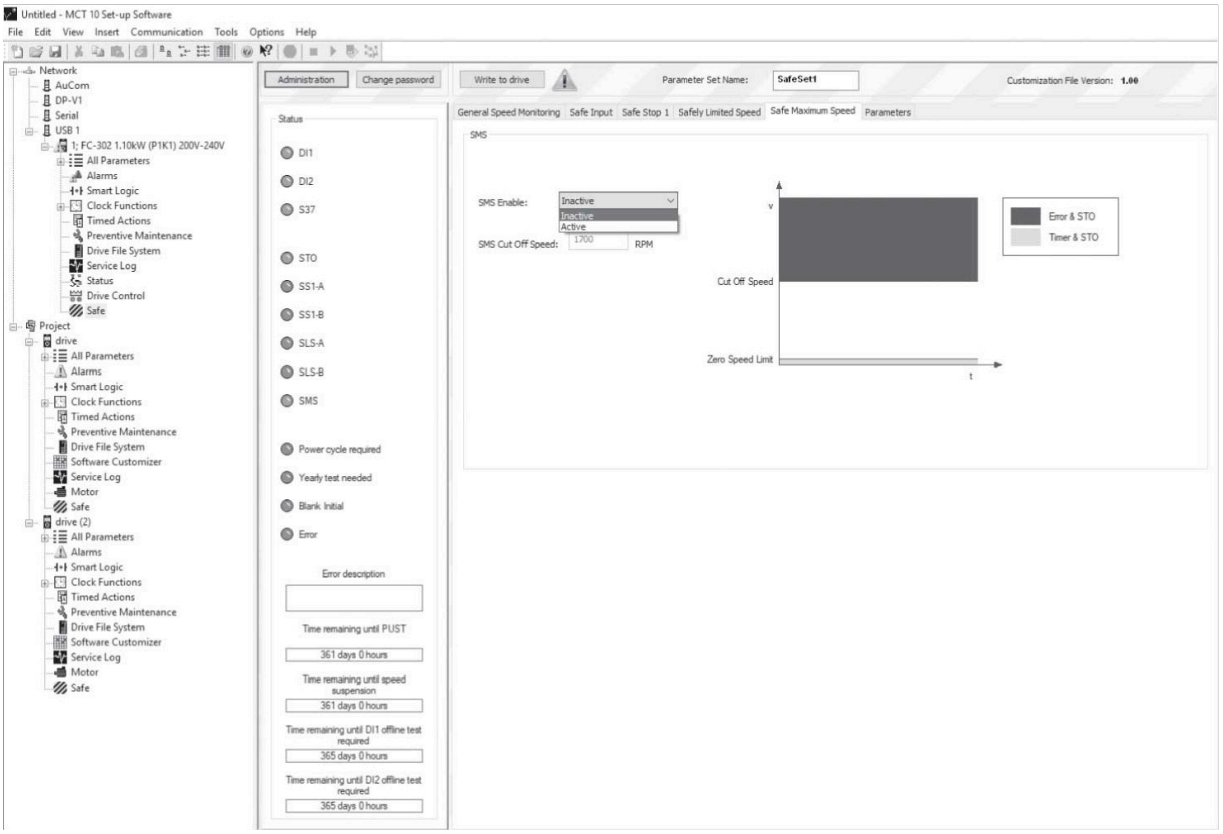

e30bu306.10

Figure 163: Safe Maximum Speed Configuration Tab

Table 26: Options for Safe Maximum Speed

Option	Description
SMS enable	The setting of this option selects whether or not the SMS function is enabled: • Inactive - the SMS function is not enabled. • Active - the SMS function is enabled.
SMS Cut off Speed	Set at which RPM the SMS function should cut off the drive.

8.7.5 Configuration

8.7.5.1 Configuration Modes

Configure the safe plug-in in online mode (PC connected to drive) or in offline mode (no PC connected to drive). In both cases, enter the required values in the configuration dialogs to configure the plug-in.

NOTE: Multiple value entry fields in the configuration tabs are accompanied by recommended value settings that appear below the text field. The recommended values are generated dynamically based on the user input of related and dependent configuration options. To apply a recommended value to a field, press the underlined *Apply* link as it appears below the wanted field.

Offline configuration

When configuring the VLT® Safety Option MCB 15x Series in an offline project mode, the configuration is stored in the project. After completing the configuration, connect to the PC and write to the drive.

NOTE: The LED status icons are not active in offline mode.

Online configuration

Changed settings within safe plug-in for MCB 15x are not applied before they are written to the device.

NOTE: If the safe plug-in for the MCB 15x interface is closed before the changes have been written to the drive, the changes are lost.

8.7.5.2 Configuring the Safe Plug-in Online

Procedure

1. Connect the safe plug-in for MCB 15x to the drive.
2. Click *Write to drive* to apply changed settings in the safe plug-in. Writing the values to the drive always updates the entire device package and not just the changed value.

8.7.5.3 Dependencies

Multiple configurable safety parameters depend on other safety parameter values. The safe plug-in for VLT® Safety Option MCB 15x Series features notification dialogs that inform about the possible consequences. It is then possible to verify the changes and either accept or discard the change.

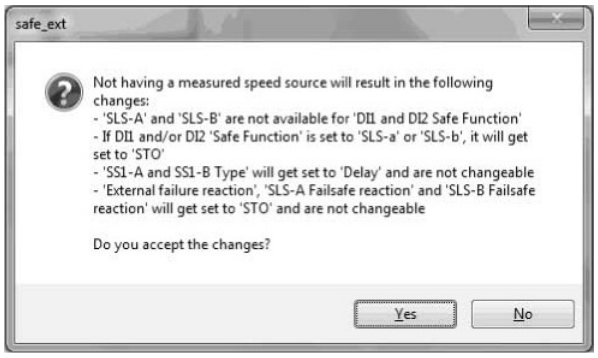

Figure 164: Dependencies Confirmation Dialog

When accepting the dependency dialog, both the change that caused the dependency dialog and all other configuration items listed in the dependency dialog are applied.

8.7.5.4 Advanced Configuration Parameters

TIP: Prepare a complete list of all configuration items and their respective values before commissioning.

In the configuration area, the parameters section is a table format value entry for all configuration settings intended for advanced users.

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ID	Name	Setup	Min. value	Max. value	Factory setup	Unit
4200	Speed Deviation Timer	10	10	5000	10	ms
4201	Fast Ramp	No			No	
4210	Measured Speed Source	Safe Option			Safe Option	
4211	Encoder Resolution	1024	1	4096	1024	
4212	Encoder Direction	Clockwise			Clockwise	
4213	Gear Ratio	1.0000	0.0001	1000.0000	1.0000	
4214	Feedback Type	Without direction info			With direction info	
4215	Feedback Filter	200.00	0.01	200.00	200.00	Hz
4216	Mounting Type	Motor Shaft Mounted			Motor Shaft Mounted	
4218	Zero Speed Timer	8760	0	10000	8760	h
4220.0	Safe Function	STO			STO	
4220.1	Safe Function	STO			STO	
4221.0	Type	NCNC			NCNC	
4221.1	Type	NCNC			NCNC	
4222.0	Discrepancy Time	10	0	5000	10	ms
4222.1	Discrepancy Time	10	0	5000	10	ms
4223.0	Stable Signal Time	10	0	5000	10	ms
4223.1	Stable Signal Time	10	0	5000	10	ms
4224.0	Restart Behaviour	Manual			Manual	
4224.1	Restart Behaviour	Manual			Manual	
4230	External Failure Reaction	STO			STO	
4231	Reset Source	Drive Reset			Drive Reset	
4233	Parameter Set Name	SafeSet1			SafeSet1	
4240.0	Type	Delay			Delay	
4240.1	Type	Delay			Delay	
4241.0	Ramp Profile	Linear			Linear	
4241.1	Ramp Profile	Linear			Linear	
4242.0	Delay Time	1.0	0.1	3600.0	1.0	s

Figure 165: Parameters Configuration Tab

8.7.6 Commissioning

8.7.6.1 Commissioning Procedure

Procedure

1. Configure a safe plug-in for VLT® Safety Option MCB 15x Series.
2. Click *Write to drive* to upload to the drive.

   The status window opens.

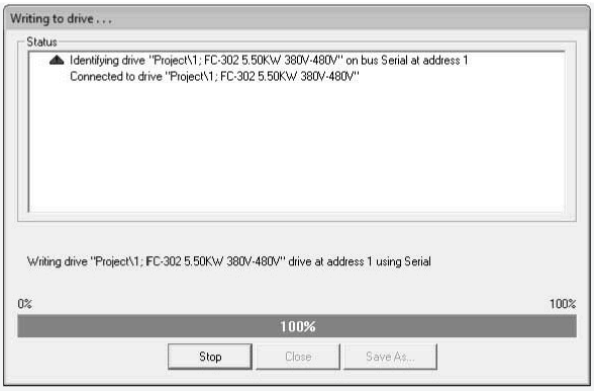

Figure 166: Writing to Drive Status Window

3. Enter the password when the *Confirm password* dialog pops up (default password: 12345678).

   For more information on changing a password, refer to 8.7.7.3 Changing the Password.



Figure 167: Password Entry Dialog

4. Press *OK* to continue OR press *Cancel* to discard the process and perform a rollback.

> NOTE: When writing to a device in blank state, the user is prompted to provide a new password for the device. Have the appropriate default password available at hand.

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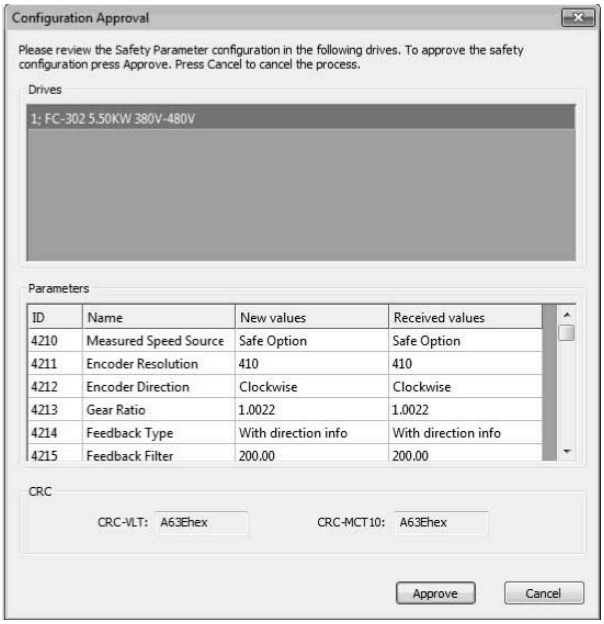
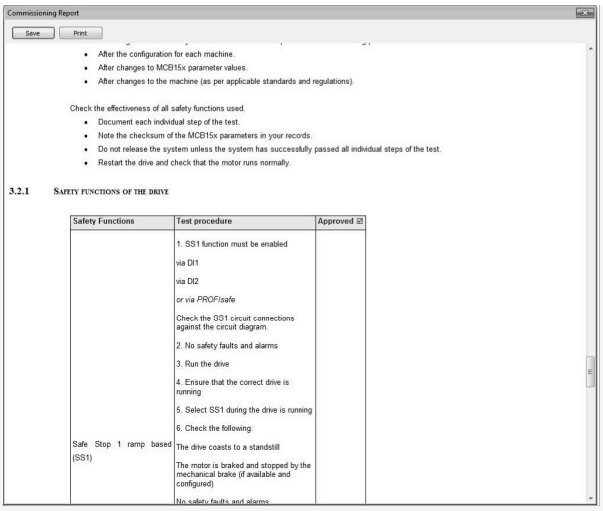


Figure 168: Configuration Approval Dialog and Summary

Drives	The top section of the summary shows all drives affected by the write procedure. If there are multiple drives, press the drive titles in the window to update parameters and CRC accordingly.	**Parameters**	This section details all the updated parameters that were written to the drive.
ID	The parameter ID written.	**Name**	The name of the parameter written.
New values	The value of the parameter that was designated to be written to the drive. This column must have the same value as *Received values*. If not, an error is shown.	**Received values**	The value that was received from the drive after the update procedure. This column must have the same value as *New values*. If not, an error is shown.
CRC	This section shows the CRC values that were generated from the application side and the drive side. These values must match. If not, an error is shown.		

5. When the configuration approval pops up, review the included summary.
6. Click *Approve* to confirm the changes and close the dialog window, OR click *Cancel* to discard the process and perform a rollback.

When the configuration is approved, the commissioning report is generated and shown.



e30bc947.11

Figure 169: Commission Report Review, Save, and Print Dialog

7. Click *Save* to save the commission report in Rich Text Format.
8. Click *Print* to print the report.
9. When the commissioning process is complete, press [*Reset*] on the drive to reboot.

8.7.6.2 Commissioning Report

During the commission process, the commission report is generated based on a fixed template within the VLT® Motion Control Tool MCT 10 application. The report contains all data written to the drive.

The report is generated during the write-to-drive procedure and the data is gathered at the moment the report is generated. This report contains the functions that must be tested, refer to the VLT® Safety Option MCB 15x Installation Guide and the VLT® Safety Option MCB 152 Installation Guide.

The contents and structure of the commissioning report are as follows:

- General introduction - general information and details about the report itself.
- Commissioning configuration - details regarding the commissioned setup and parameter configurations.
- Commissioning test - specific testing scenarios for the current setup. This section also contains CRC check procedure descriptions.

8.7.7 Operation

8.7.7.1 Using the Diagnostics Function

Procedure

1. Open the Safe Plug-in for VLT® Safety Option MCB 15x Series plug-in interface in network online mode.
2. Click *Administration* in the upper section of the interface.

The Safe Plug-in for MCB 15x Administration Window opens.

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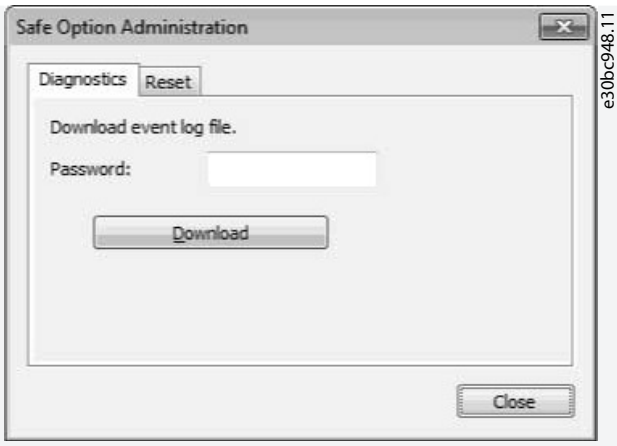

Figure 170: Safe Plug-in for MCB 15x Administration Window

3. Enter the Safe Plug-in for MCB 15x password configured for the drive.
4. Click *Download* to download the Safe Plug-in for MCB 15x event log.
5. Select a location to save the log file. The log is presented in simple text file format.

8.7.7.2 Using the Reset Function

NOTE: Resetting the device restores factory settings and erases any customized configuration on the device. To ensure rollback possibility, back up the customized configuration before resetting.

Procedure

1. Open the safe plug-in for VLT® Safety Option MCB 15x Series plug-in interface in network online mode.
2. Click *Administration* in the upper section of the interface.
3. Click the *Reset* tab header to open the *Reset*tab.

The *Reset Password* window opens.

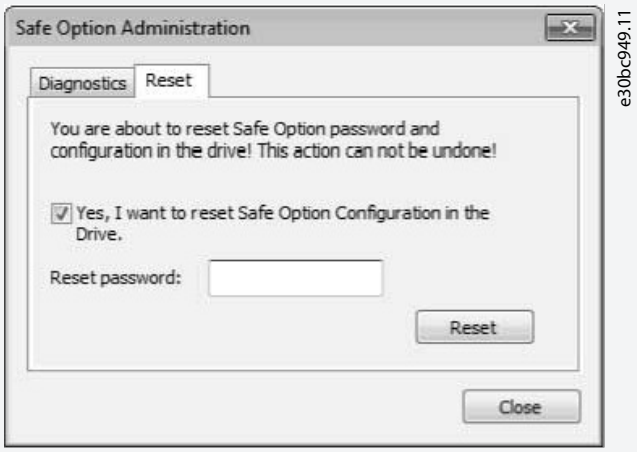

Figure 171: Reset Password Window

4. Tick *Yes, I want to reset Safe Option Configuration in the Drive* for the drive to continue.
5. Enter the master password configured for the drive to continue.
6. Click *Reset* to reset the drive password and configuration.

7. Press [*Reset*] on the drive to reboot.

8.7.7.3 Changing the Password

When working with the safe plug-in for VLT® Safety Option MCB 15x Series plug-in in network online mode, *Change password* is shown in the information area of the plug-in interface.



Figure 172: Safe Plug-in for MCB 15x Password Changing Window

Procedure

1. Click *Change password*.
2. Enter the current password into the *Current password* field.
3. Enter the new password into the *New password* field. The password length must be exactly 8 characters. The password is case sensitive.
4. Confirm the new password by entering it again into the *Confirm new password* field.
5. If necessary, select the option *Confirm to all blank initial drives* to apply the new password to all new drives in the network.
6. Click *Cancel* to discard the procedure.

8.7.8 Status Plug-in

The Status plug-in is an online plug-in that shows the digital status words, control words, and alarm words.

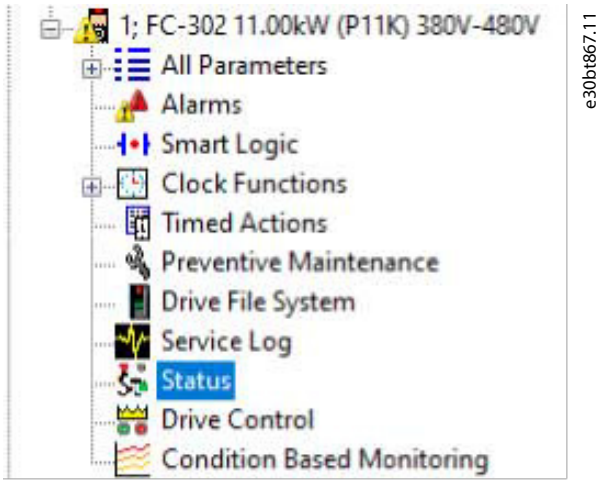

Figure 173: Selecting the Status Plug-in

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The plug-in only shows the available parameters. For each control word and status word, it shows the value in hex, reference, and control word profile. The plug-in shows all bits. Green LEDs indicate active bits (value = 1), while gray LEDs indicate inactive bits. The highlighted text shows the meaning of the bit status.

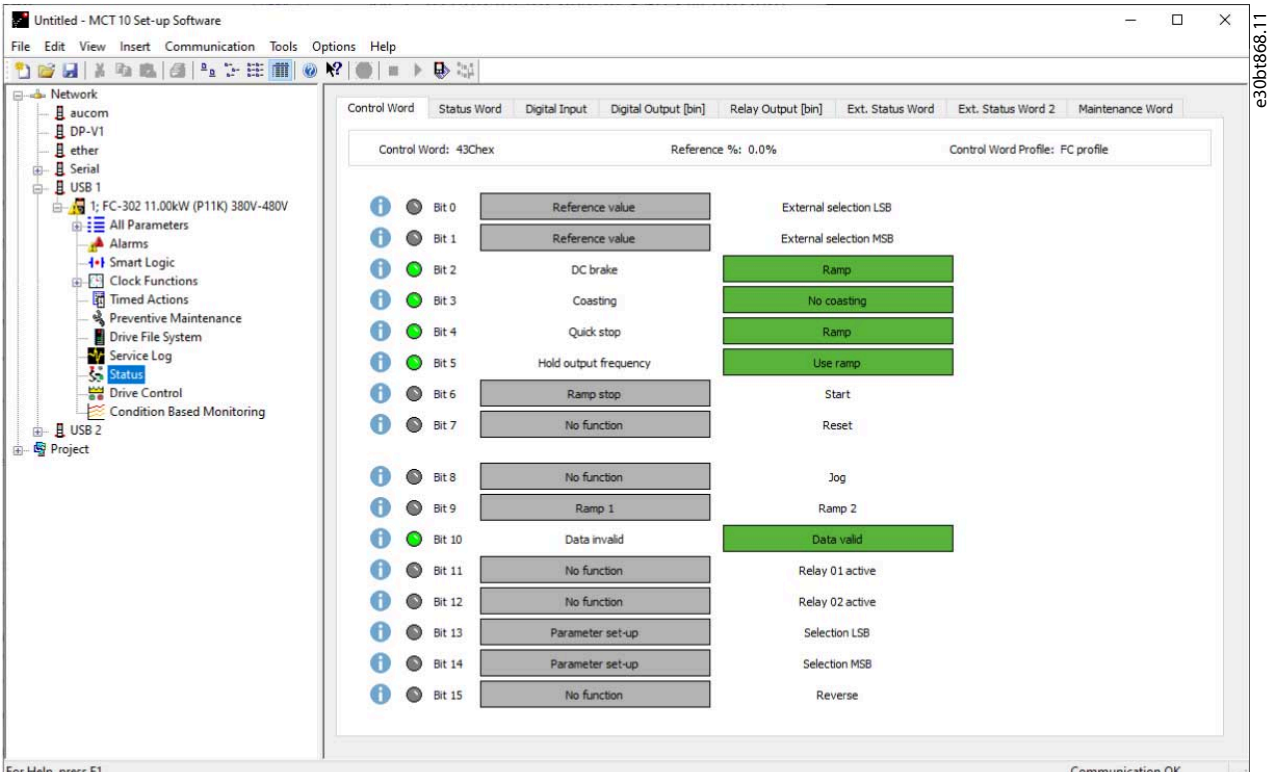

Figure 174: Example of Bit Status for Control Word

An information symbol in the left column of the screen indicates that a parameter has extra information. See Figure 174 for an example. Click the information symbol to get information about a bit.

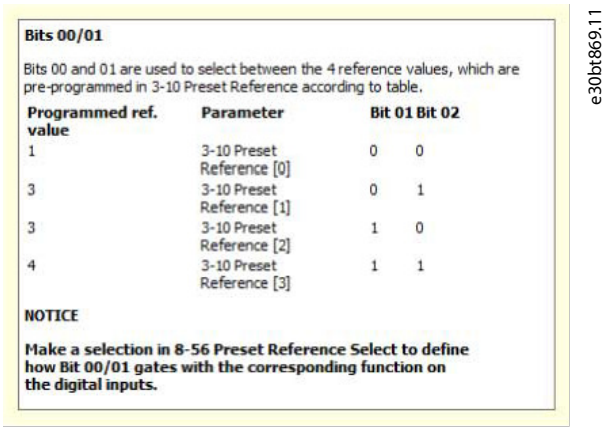

Figure 175: Example of Bit Information

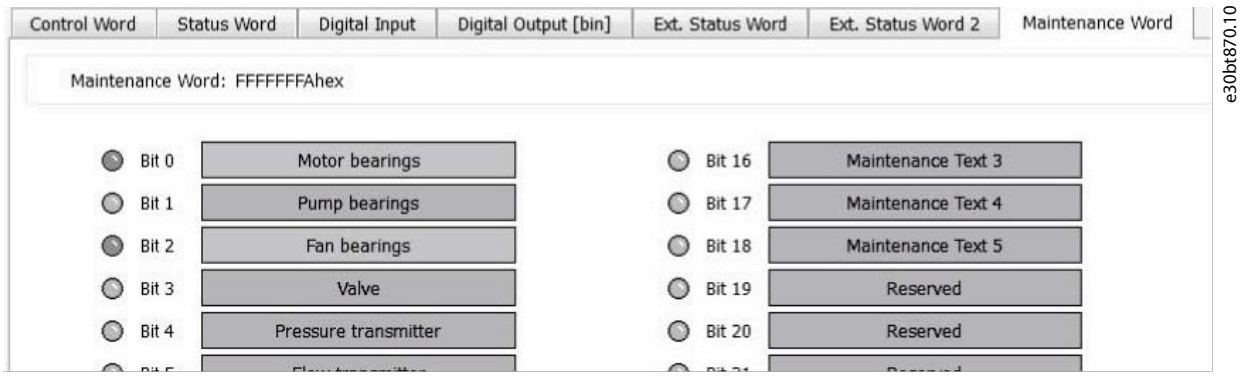

Figure 176: Example of Maintenance Word

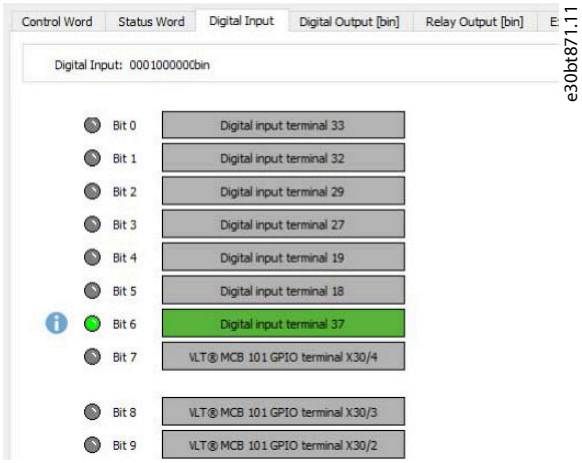

Figure 177: Example of Digital Input

NOTE: When bit 6 is active, the signal on DI 37 is inactive, meaning that there is no signal present on the input.

Status plug-in used with fieldbuses

All fieldbuses supported by VLT® Motion Control Tool MCT 10 support the Status plug-in. While the plug-in is open, MCT 10 reads the visible parameter constantly. This way, the plug-in updates automatically when values change.

Loss of communication

If communication is lost, the plug-in turns yellow and sends a notification. The latest values are kept as they were before the communication loss. When communication is recovered, the plug-in recovers automatically.

8.7.9 Drive Control Plug-in

8.7.9.1 Overview of the Drive Control Plug-in

The plug-in is supported by serial communication and USB.

For the plug-in to work, it is required to be connected to the drive that should be controlled.

To open the plug-in, select *Drive control* in the structure in the left window.

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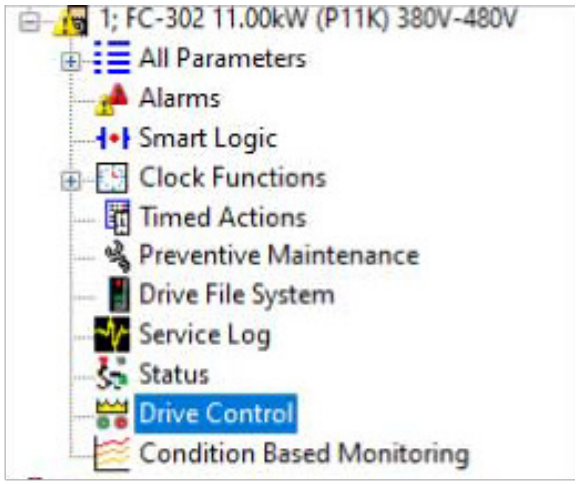

Figure 178: Drive Control in Structure

A temporary page opens for accepting risks and configuring important parameters.

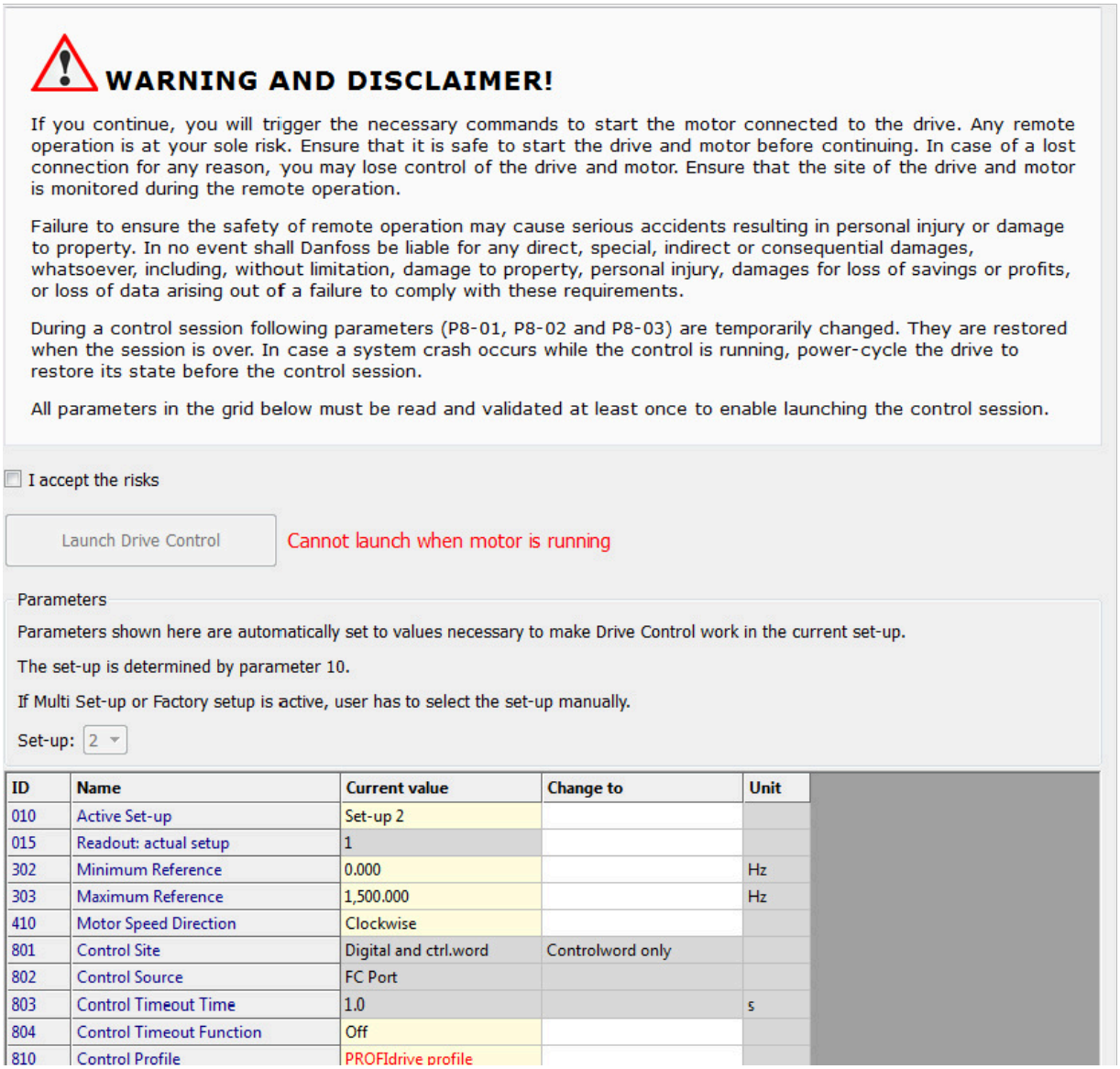

Figure 179: Risks to Accept

8.7.9.2 Launching the Drive Control Plug-in

Prerequisites:

To be able to launch the Drive Control plug-in, it is required to accept the risk.

Procedure

1. Tick *I accept the risks*.
2. Click *Launch Drive Control*.

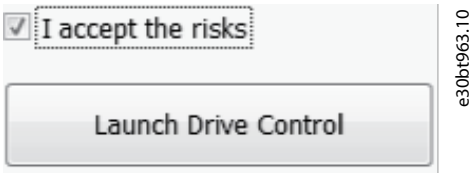

Figure 180: Launch Drive Control Button

The *Drive Control* window opens.

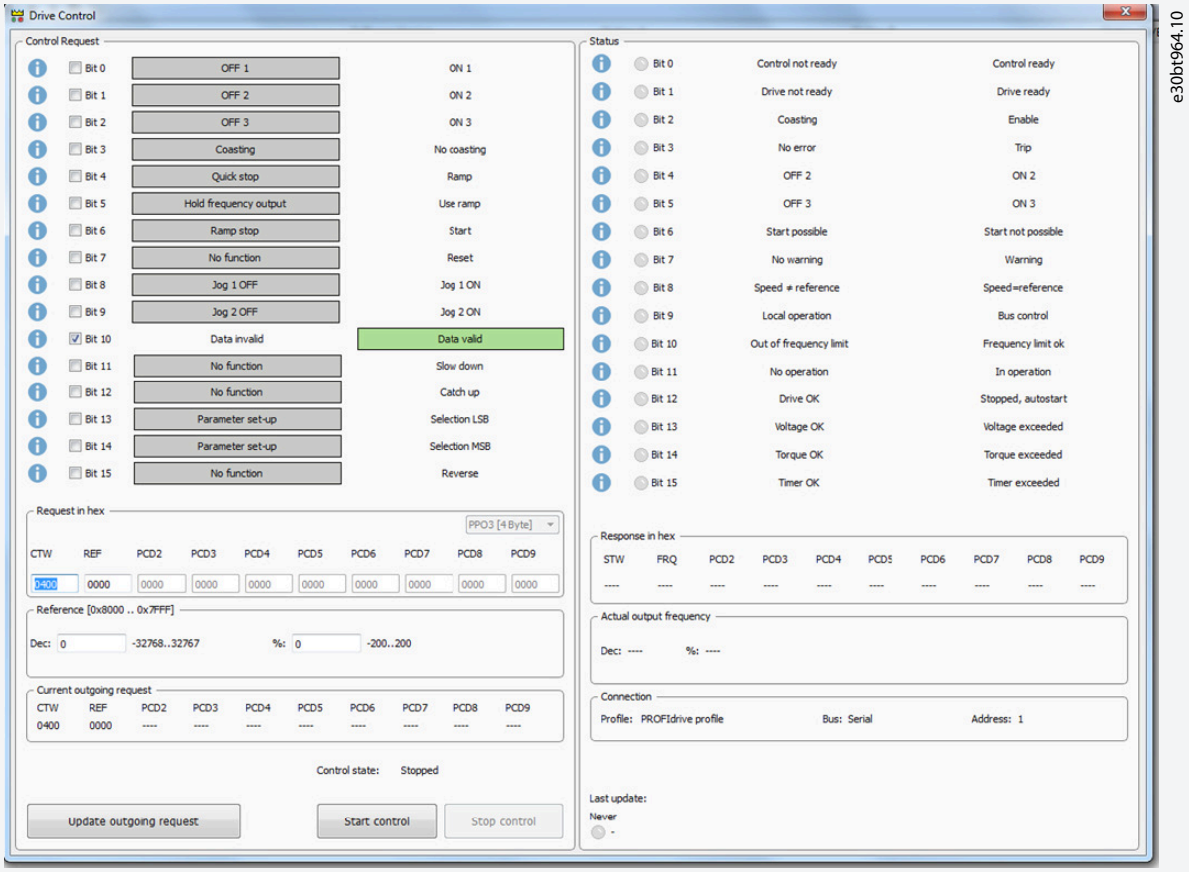

Figure 181: Drive Control Window

8.7.9.3 Setting the Control Word

At launch, the control word is set to 0400 but is not yet sent to the drive.

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Procedure

1. Set the control word in 1 of 2 ways:
   - Use the checkboxes.

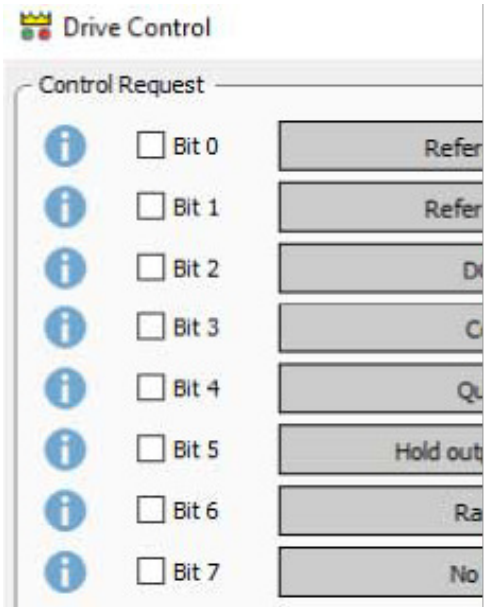

Figure 182: Checkboxes for Setting Control Word

   - Type the value directly in the *Request in Hex* field.

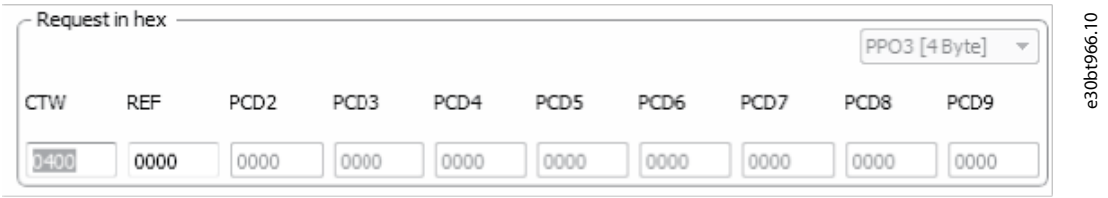

Figure 183: Type in the Value Directly

The control word is now set.

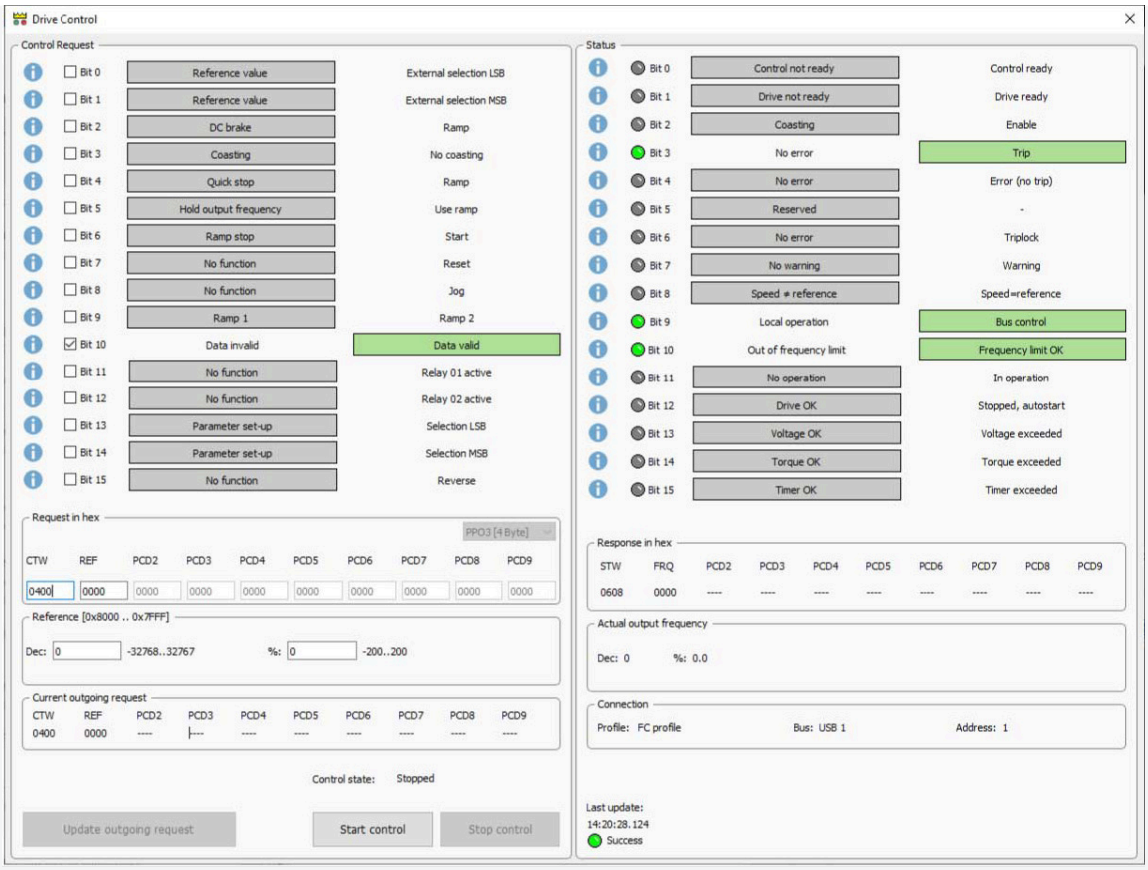

Figure 184: Control Word Set

8.7.9.4 Starting Drive Control

Prerequisites:

Set the control word before starting the drive control.

Procedure

1. Click *Start control*.

The plug-in starts sending the control word and then reads the status word.

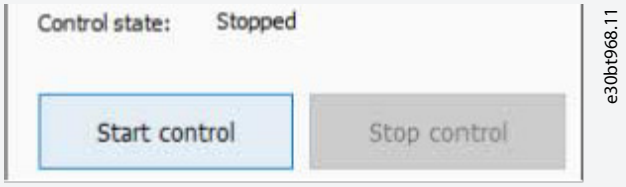

Figure 185: Start Control Button

The control word is sent cyclically until clicking *Stop control* or until communication fails. The control state bar runs while the control word is being sent.

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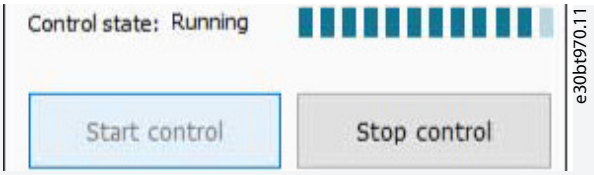

Figure 186: Control State Bar Running

After a successful reading of a status, a notification is sent.

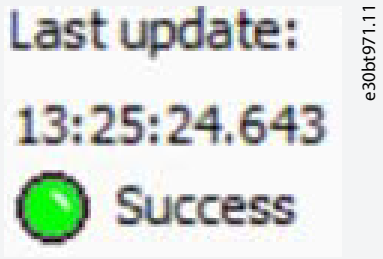

Figure 187: Last Status Read Successfully

At loss of communication, the bits of the status view turn yellow, and an error appears.



Figure 188: Loss of Communication

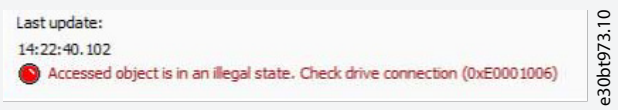

Figure 189: Error at Loss of Communication

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8.7.9.5 Changing Control Word Bits

Control word bits can be changed while the control word is being sent. While changing the control word, the values of *Request in hex* and *Current outgoing request* differ.



Figure 190: Request in Hex



Figure 191: Values of Current Outgoing Request

Procedure

1. Enter the new value of the control word.
2. Click *Update outgoing request*.



Figure 192: Update Outgoing Request Button

After clicking *Update outgoing request*, the values are the same.

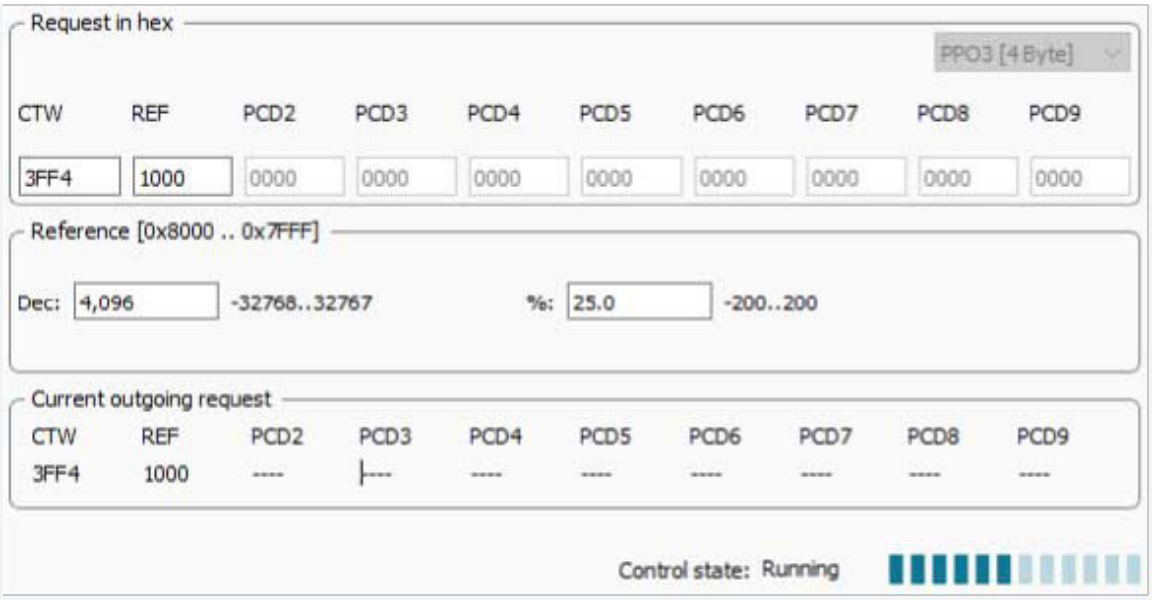

Figure 193: Values Aligned in Request in Hex and Current Outgoing Request

8.7.9.6 Changing the Reference

Procedure

1. Change the reference in 1 of 2 ways:
   - Enter the hex value directly in *Request in hex*.
   - Enter the value in either decimal or percentage.

Values out of range are shown in pink.



Figure 194: Value Out of Range

The *Update outgoing request* button is disabled until a valid value is set.

8.7.9.7 Open Drive Control Plug-in

When the Drive Control plug-in is open, the bus is locked, and it is not possible to scan or change parameter values.

It is possible to create a scope folder in a project that allows monitoring of relevant parameters while changing the control word via Drive Control.

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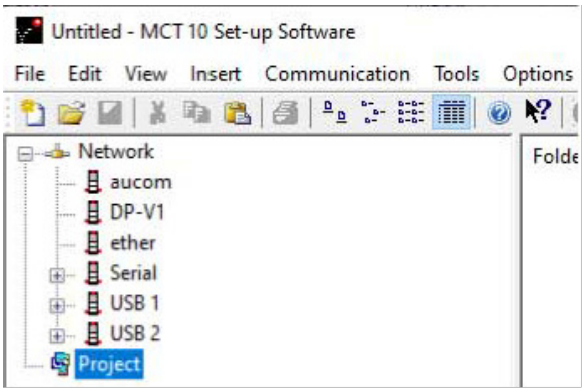

Figure 195: Create Scope Folder in Project

Once the Drive Control plug-in is closed, the control word is restored to the value it had before starting the plug-in. Also other parameters are only changed temporarily.

NOTE: Control word and other parameters used by Drive Control are written to flash instead of EEPROM. When power cycling the drive, these values are restored to the values they had before the Drive Control was started. If Drive Control of VLT® Motion Control Tool MCT 10 closes abnormally, the parameter restore process is not done. To restore the values after an abnormal shutdown, power cycle the drive.

8.7.10 Decoder Plug-in

8.7.10.1 Purpose of the Decoder Plug-in

Use the Decoder plug-in for decoding Safe Option log files. The decoded log files are shown both inline (all information shown in 1 line) and as an overview of a selected line.

8.7.10.2 Starting the Decoder Plug-in

Procedure

1. Click the *Tools* menu.
2. Select *SafeOption Log Viewer*.

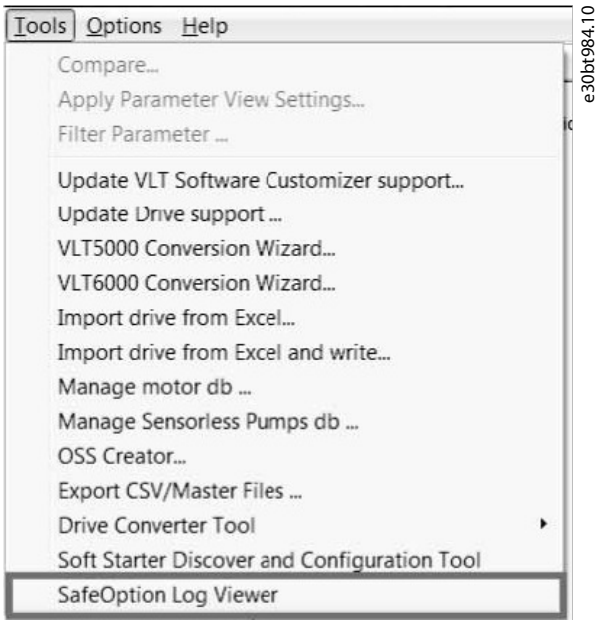

Figure 196: Selecting the Plug-in

3. Click *Browse* to select a file.

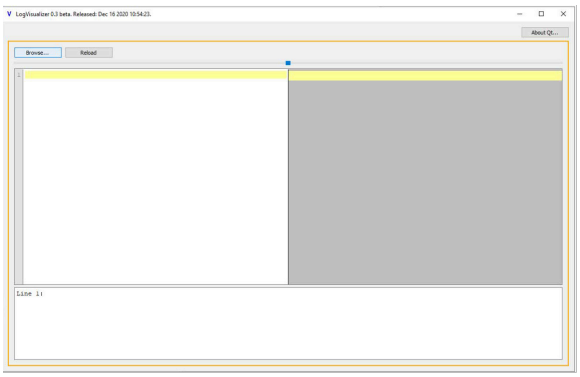

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Figure 197: View of the Log Visualizer

4. Click the arrow button to expand the log area or the explanation area.

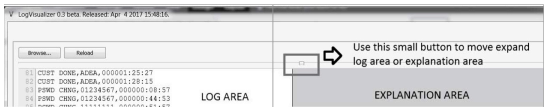

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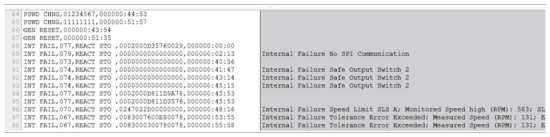
Figure 198: Expanding the Views



e30bt987.10

Figure 199: Log File Shown in Log Visualizer

Files that require decoding have a 1-line explanation in the explanation area (right window). To get a better overview of a failure description, select the failure to see an overview of the description at the bottom of the window.



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Figure 200: Failure Shown as Inline Text

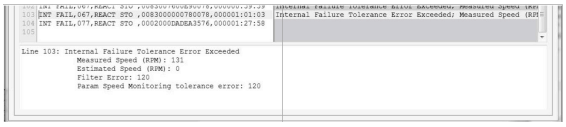

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Figure 201: Overview of Failure Description

8.7.11 Condition-based Monitoring (CBM) Plug-in

8.7.11.1 Overview of the Condition-based Monitoring Plug-in

The CBM plug-in is an online-only plug-in for intuitive and progressive setup and monitoring of the CBM parameters. For project drives, CBM parameters can be reviewed in a graphical format.

For the plug-in to function properly and for CBM parameters to be available online, a drive with CBM support and a valid CBM license must be connected. To use CBM with project drives, a drive with the same type code and a valid CBM license must have been connected previously. This allows the license information to be cached on the computer and reused for project drives.

CBM parameters can be configured using either the LCP or the CBM plug-in. However, it is not recommended to edit CBM parameters through both interfaces simultaneously, as this may result in conflicting changes.

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Once the plug-in is configured, parameter groups ***45-** Condition Based Monitoring*** to ***48-** CBM Applications*** appear in the left-hand view.

For more information about condition-based monitoring, refer to the *VLT® Condition-based Monitoring Programming Guide*.

8.7.12 Service Log

The Service Log plug-in is available offline. It enables reading from the drive in the right view of the VLT® Motion Control Tool MCT 10 screen.

Pressing *Read from drive* overwrites any log files that are already in the log.

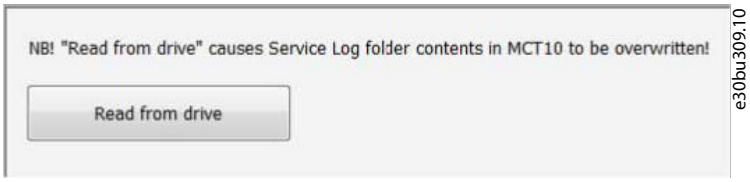

Figure 202: Read from Drive Overwrites Log Files

9 VLT® Software Customizer

9.1 Introduction

9.1.1 Overview of the VLT® Software Customizer

The VLT® Software Customizer is available from VLT® Motion Control Tool MCT 10 version 4.00. The tool enables customization of the drive by modifying or creating unique splash screens, initial values, and SmartStart wizards.

The plug-in contains 3 independent features:

- SplashScreen: Add a custom logo that is shown during initialization of the drive. The SplashScreen supports:
  - jpeg.
  - png.
  - bmp.
  - gif.
- InitialValues: Define unique parameter default values based on application needs in a customer-specific initial values (CSIV) format. Every time the drive is initialized, it starts with the custom values.
- SmartStart: Create custom SmartStart wizards that guide through predefined application steps, which simplifies the commissioning process.

Furthermore, it is possible to write to the drive and test in the simulator. The *Write to drive* function writes files that have been created or imported into VLT® Software Customizer. *Test in simulator* launches the LCP simulator for simulating a connection to a drive. In the *Settings* menu, it is possible to show or hide the disclaimer.

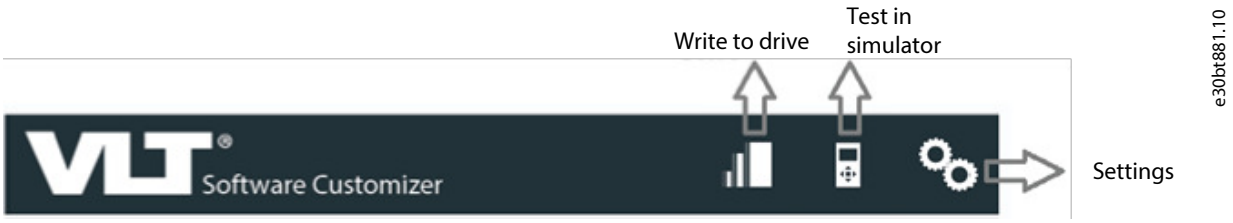

Figure 203: Tool Tips for Navigation and Support



Figure 204: A Mouse-over Highlights the Area Pointed at

When doing a mouse-over on 1 of the 3 features, the feature is highlighted, and a button is available. Click the button to open the functions currently available for the selected feature.



Figure 205: Button for Opening Available Functions

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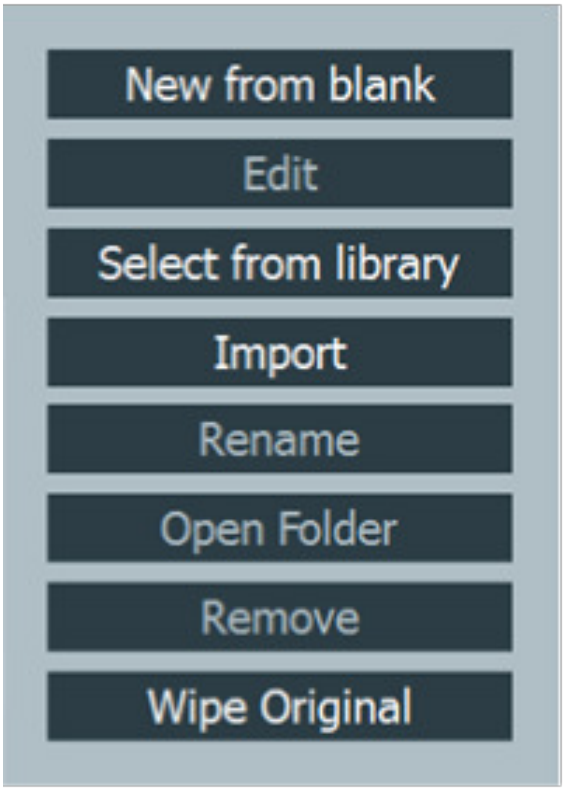

Figure 206: Example of Available Options for a Feature

9.1.2 Activation Key

The VLT® Software Customizer is an advanced tool that requires an activation key. To obtain the activation key, contact the local Danfoss representative.

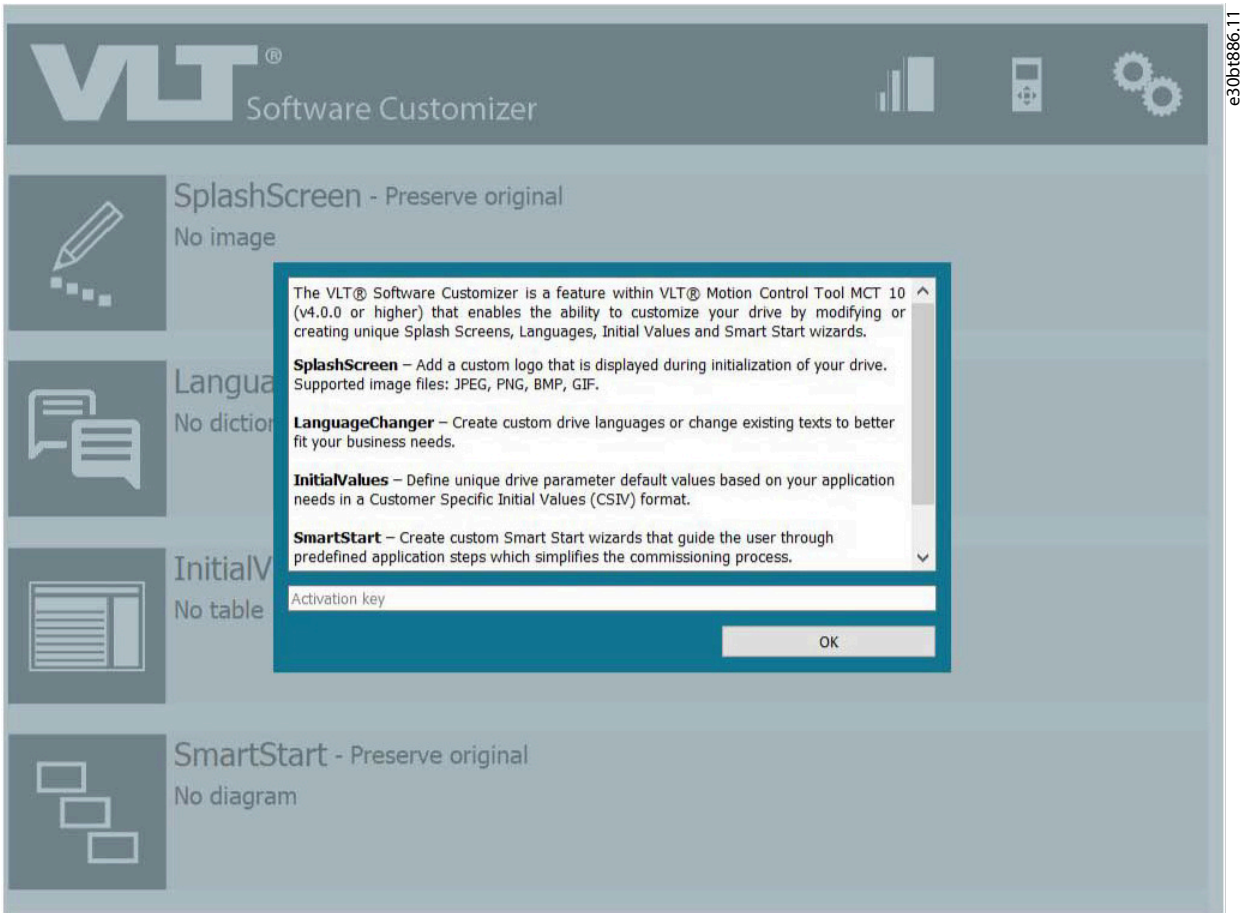

Figure 207: Dialog Box for Entering the Activation Key

9.1.3 Disclaimer

When the activation key is active, a disclaimer appears.

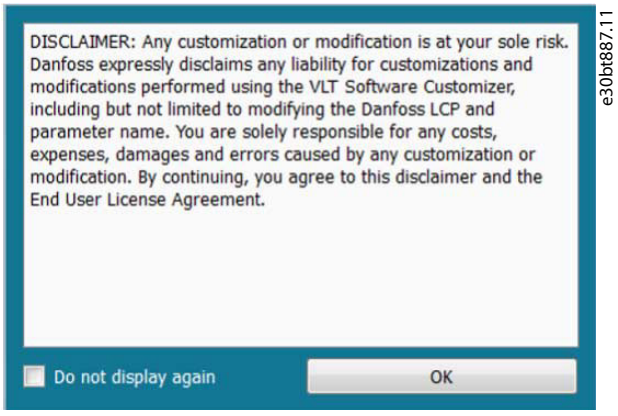

Figure 208: Disclaimer

Click *OK* to make the disclaimer disappear until the next restart of VLT® Motion Control Tool MCT 10.

To avoid seeing the disclaimer at each start-up, tick the *Do not display again*.

9.1.4 Changing the Disclaimer Settings

The settings for the disclaimer can be set at a later point.

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Procedure

1. Select *Settings* in the top menu.



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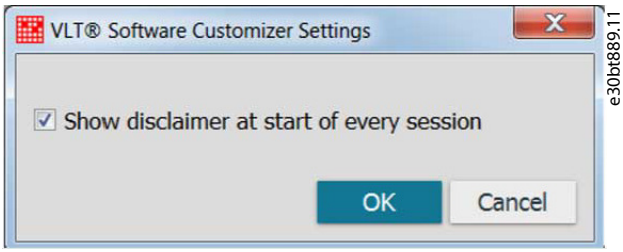
   – Tick and click *OK* to show the disclaimer at each start-up.
   – Remove the check mark and click *OK* not to show the disclaimer at each start-up.



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9.2 SplashScreen

Use the SplashScreen tool to create images to be shown on the LCP while the drive initializes.

Either create a splash screen from new, import an existing SplashScreen file, or import a picture.

9.2.1 SplashScreen Menus

9.2.1.1 New from Blank

Procedure

1. Select *New from blank* to open the editor with an empty project.

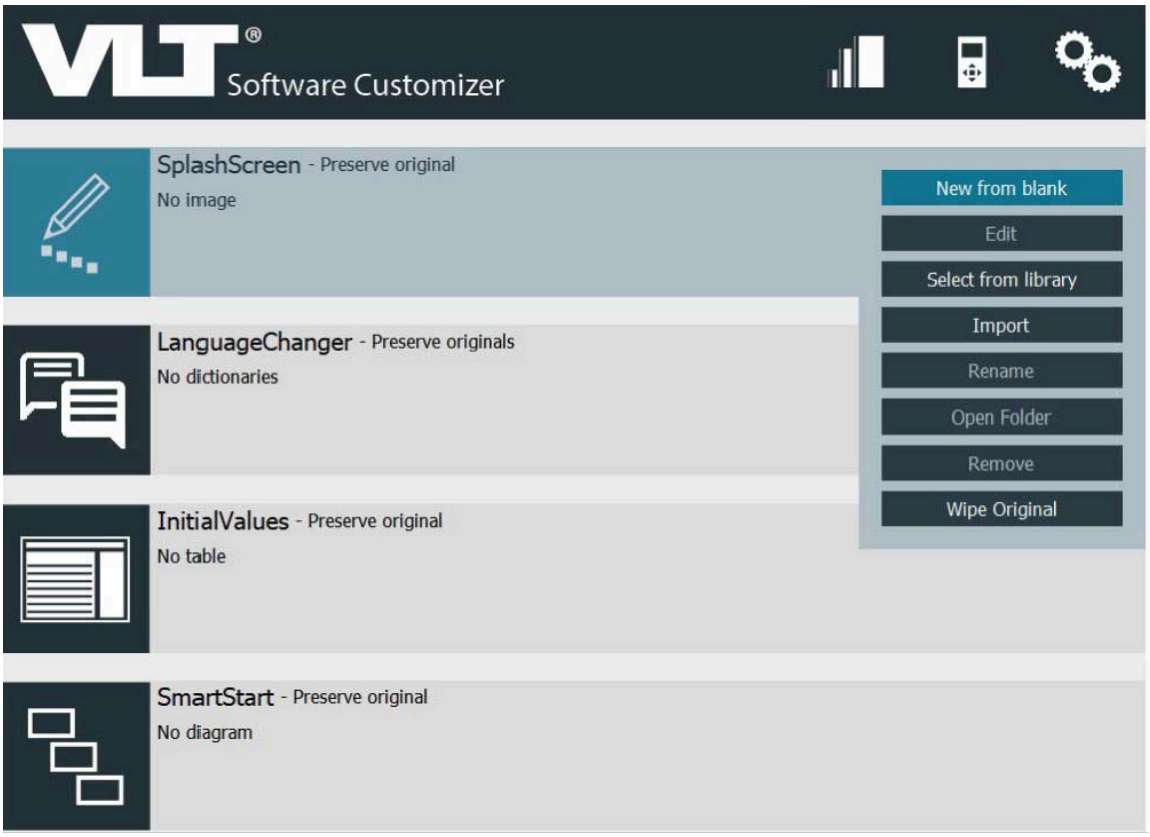

Figure 209: Selecting New From Blank

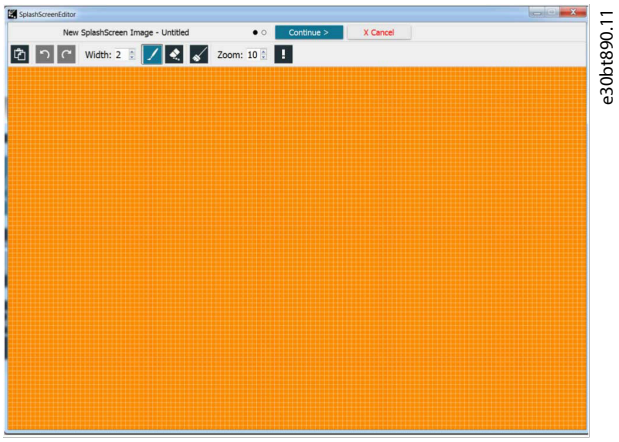

Figure 210: Empty Project in Editor

2. Use the different tools in the menu to create the drawing. *Width* increases/decreases brush line thickness, left mouse button is for freehand line, right mouse button for straight lines.

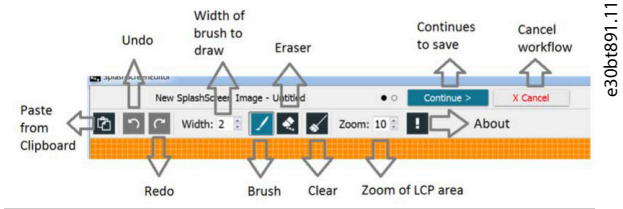

Figure 211: Drawing Tools

3. When finished, click *Continue*.
4. In the dialog box, enter a file name and click *Finish*. Clicking *Back* returns to the editor, clicking *Cancel* cancels saving of the file.

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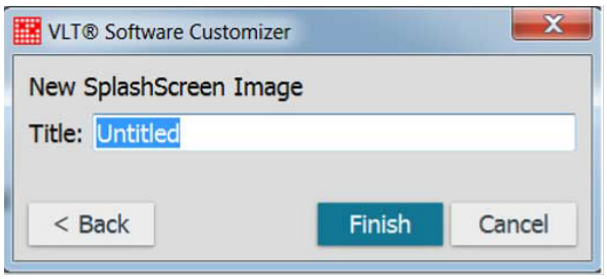

Figure 212: Dialog Box for Saving a SplashScreen Image

9.2.1.2 Select from Library

Procedure

1. Click *Select from Library* to open an already saved SplashScreen file (*.spla).

   Select from Library is also used for editing already saved SplashScreen files.

9.2.1.3 Import

Use the import function for importing pictures to the SplashScreen.

The import function allows import of:

- jpeg.
- jpg.
- bmp.
- png.
- tif.
- gif.
- spla.
- splash.

At import, the picture resizes to fit the LCP. If the entire picture is not visible, set the threshold value of the imported image.

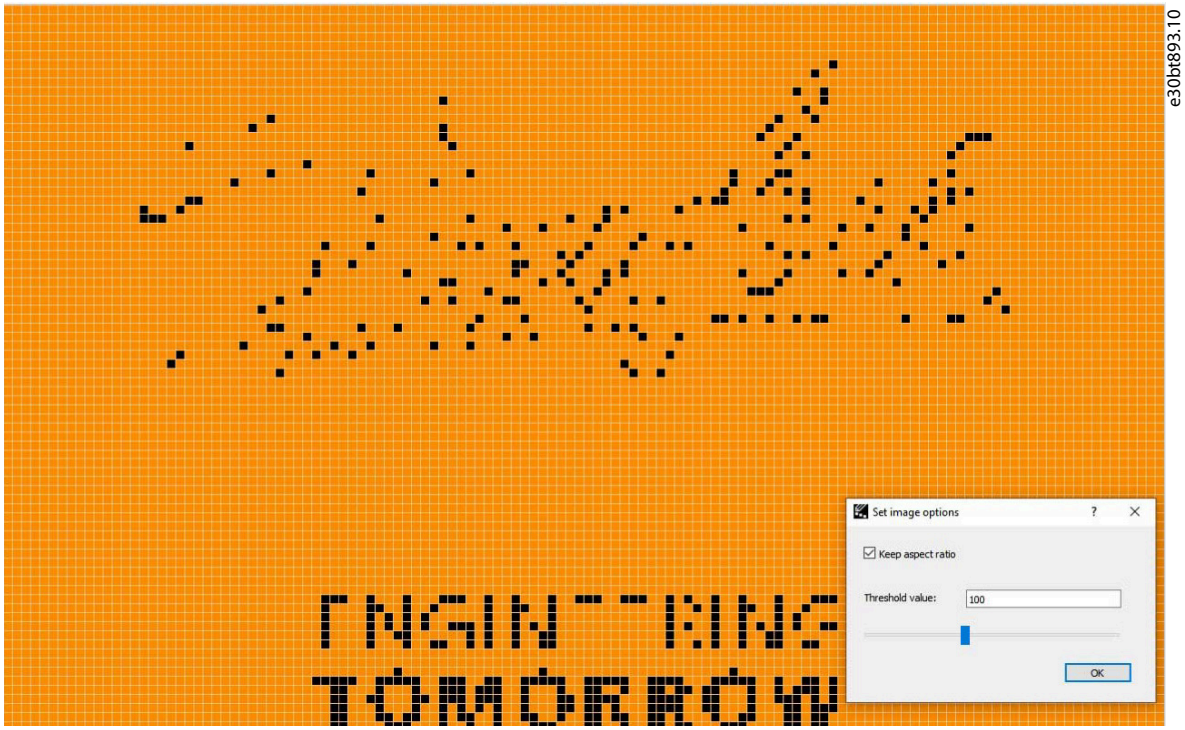

Figure 213: SplashScreen with Original Threshold Value

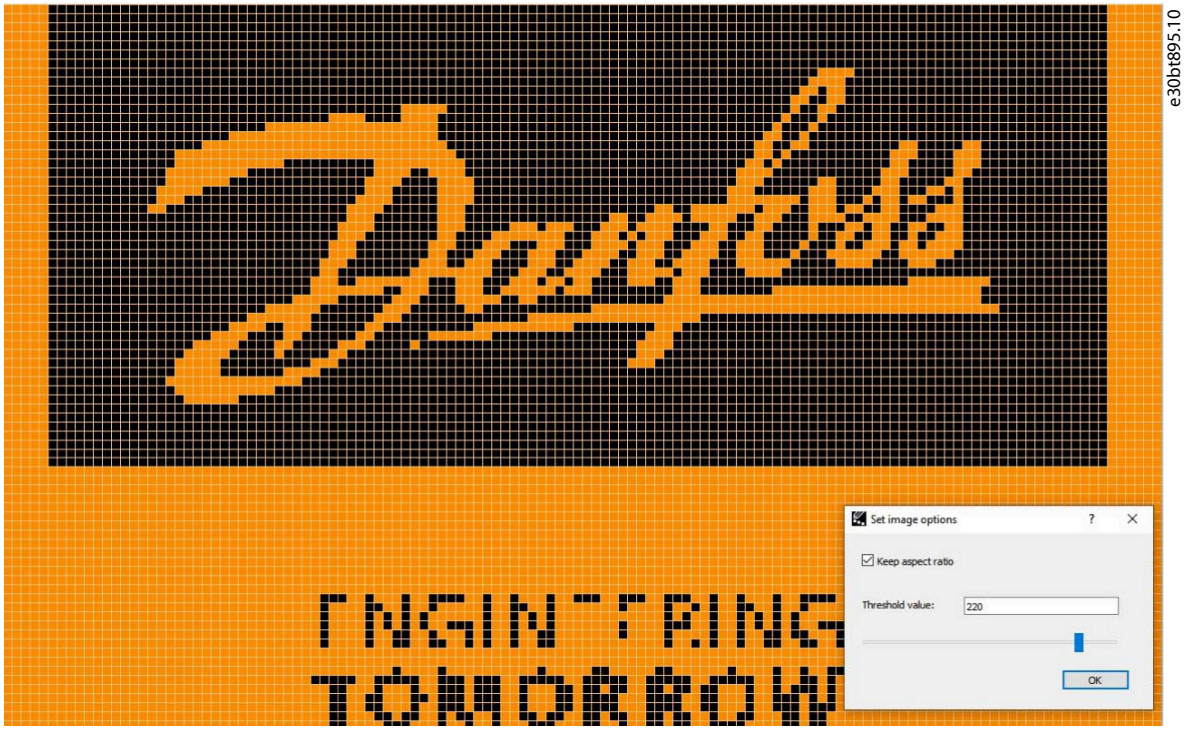

Figure 214: SplashScreen Improved with Higher Threshold Values

The quality of the picture can be improved further by using the brush.

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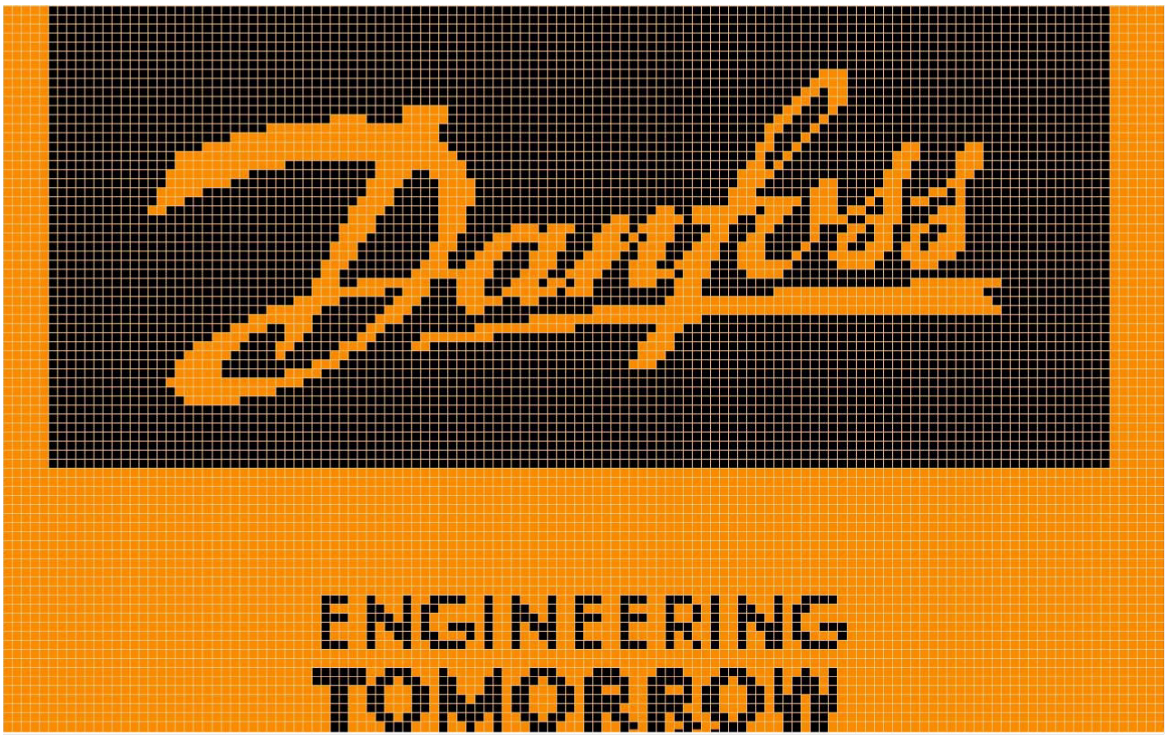

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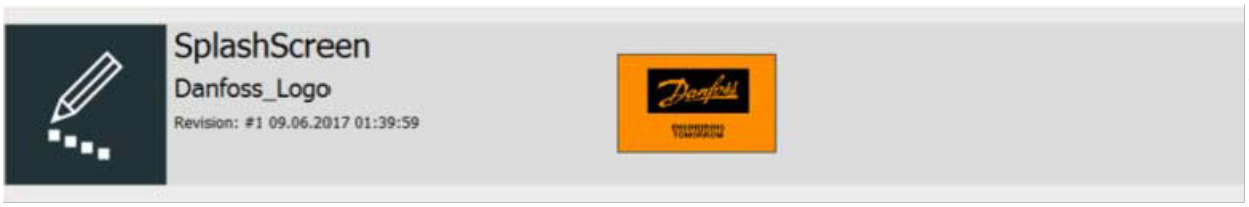
Figure 215: SplashScreen Improved with the Brush Tool

When the picture is saved, the SplashScreen is added into the VLT® Software Customizer project along with a date and time stamp. It is possible to edit and save more SplashScreen files, but only 1 appears in the project.



e30bt897.11

Figure 216: SplashScreen and Preview Added to Project

Adding a SplashScreen to the project, changes the menu to offer the functions in Figure 217.

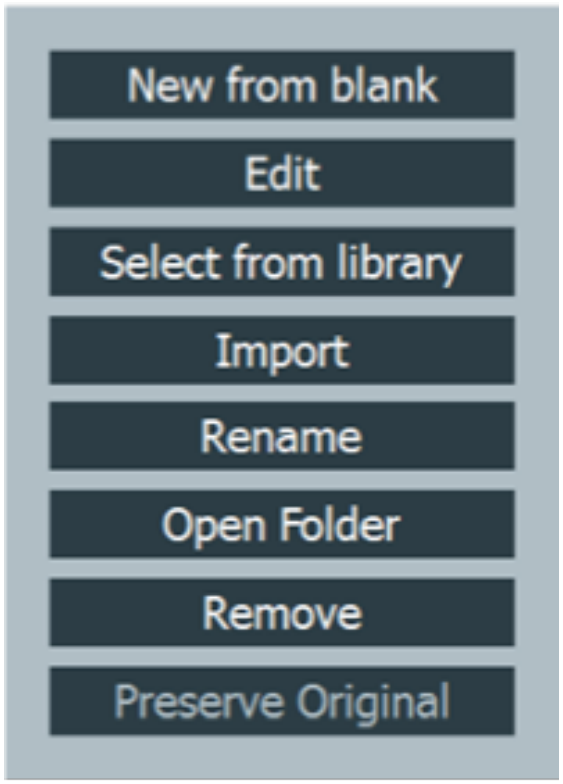


Figure 217: Functions in the SplashScreen Menu

9.3 LanguageChanger

The LanguageChanger enables editing or creating a language by translating group names, subgroup names, help texts, and parameter names.

When there is no file in the project, the menu is the same as in SplashScreen.

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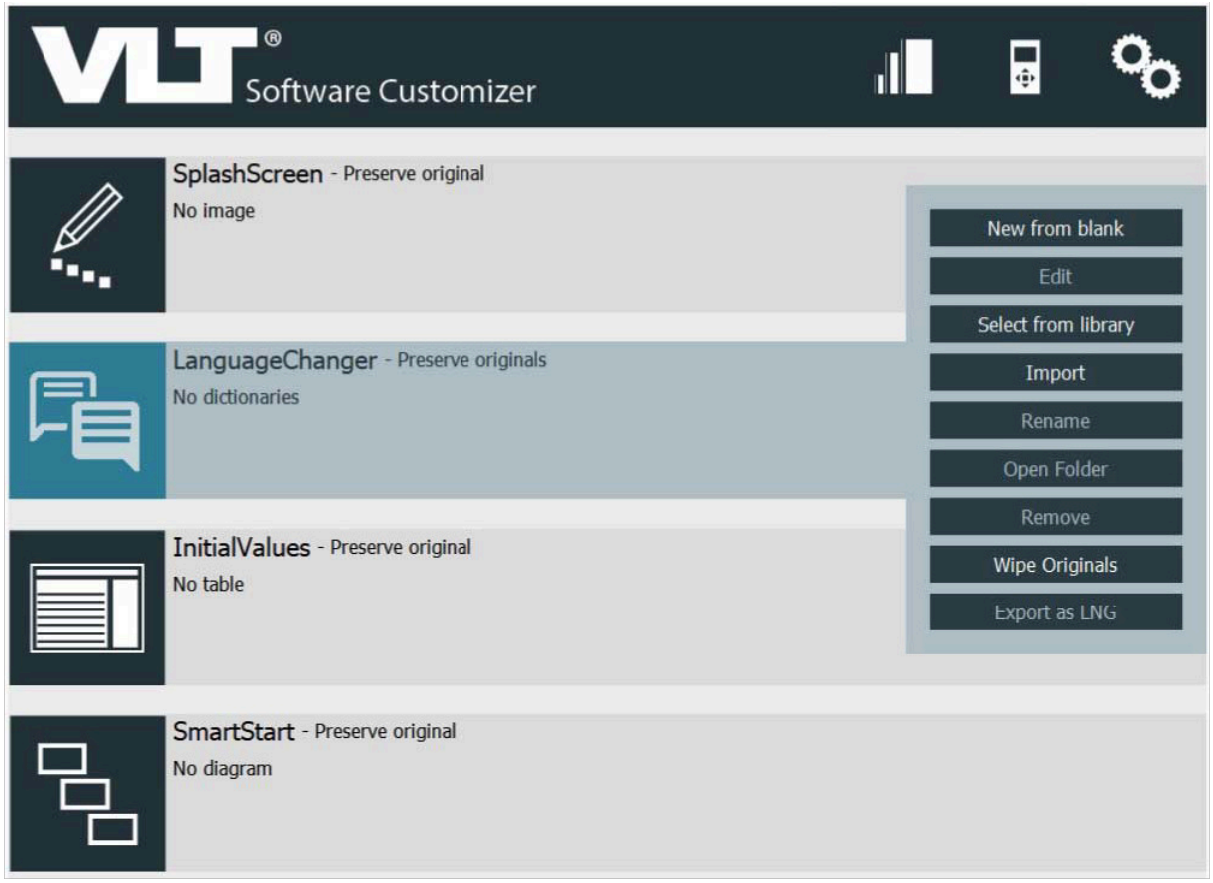

Figure 218: Overview of the LanguageChanger Menu

9.3.1 LanguageChanger Functions

9.3.1.1 New from Blank

Selecting *New from Blank* opens the editor.

The editor contains tooltips about the *Base Dictionary* and the *Base Dictionary Function*.

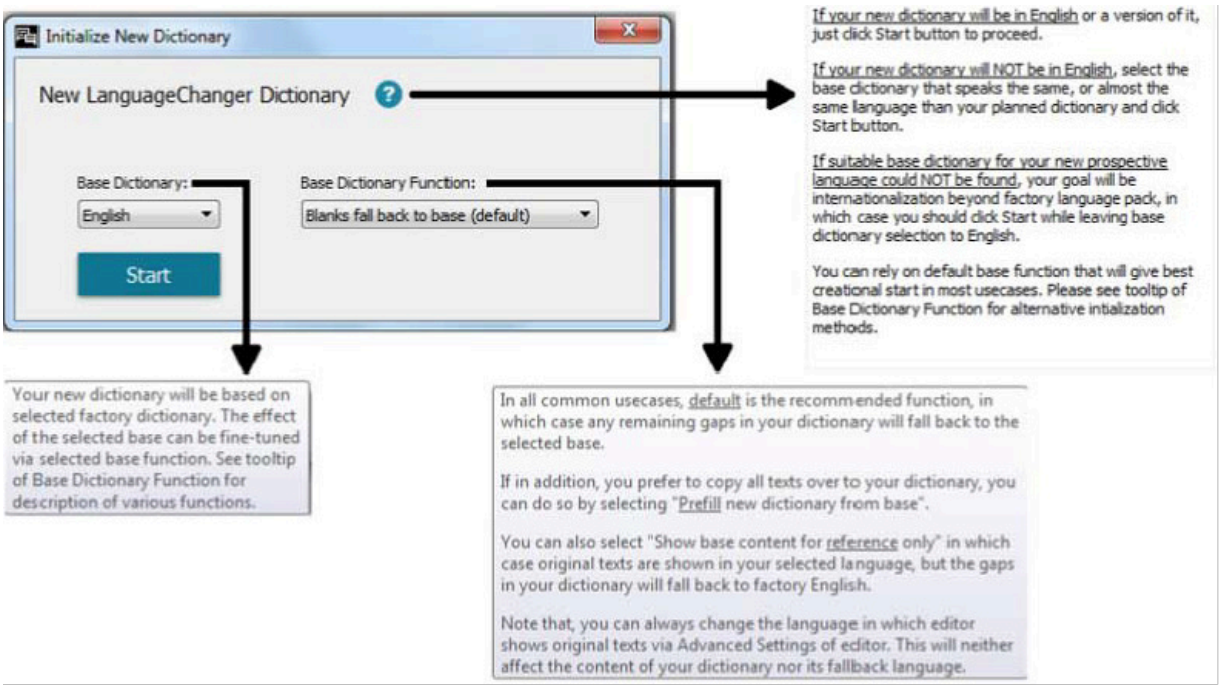

Figure 219: Tooltips in the Editor

Base Dictionary

Use the *Base Dictionary* for selecting which dictionary (LNG file) the LanguageChanger should load. For example, for translating into Spanish, select Spanish in the *Base Dictionary*. The LanguageChanger then loads parameter names, help texts, and other texts in Spanish.

Base Dictionary Function

Use the *Base Dictionary Function* for defining if the LanguageChanger should prefill the translations with texts from the *Base Dictionary*. If selecting *Blanks fall back to base*, the LanguageChanger leaves the translation field empty.



Figure 220: Example of Base Dictionary set to English



Figure 221: Example of Base Dictionary set to German

If selecting *Prefill new dictionary from base*, the LanguageChanger prefills the translation field with texts from the *Base Dictionary*.



Figure 222: Example of Prefilled Translation Field with English Base

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Figure 223: Example of Prefilled Translation Field with German Base

After selecting *Base Dictionary* and *Base Dictionary Function*, and after pressing *Start*, the LanguageChanger opens.

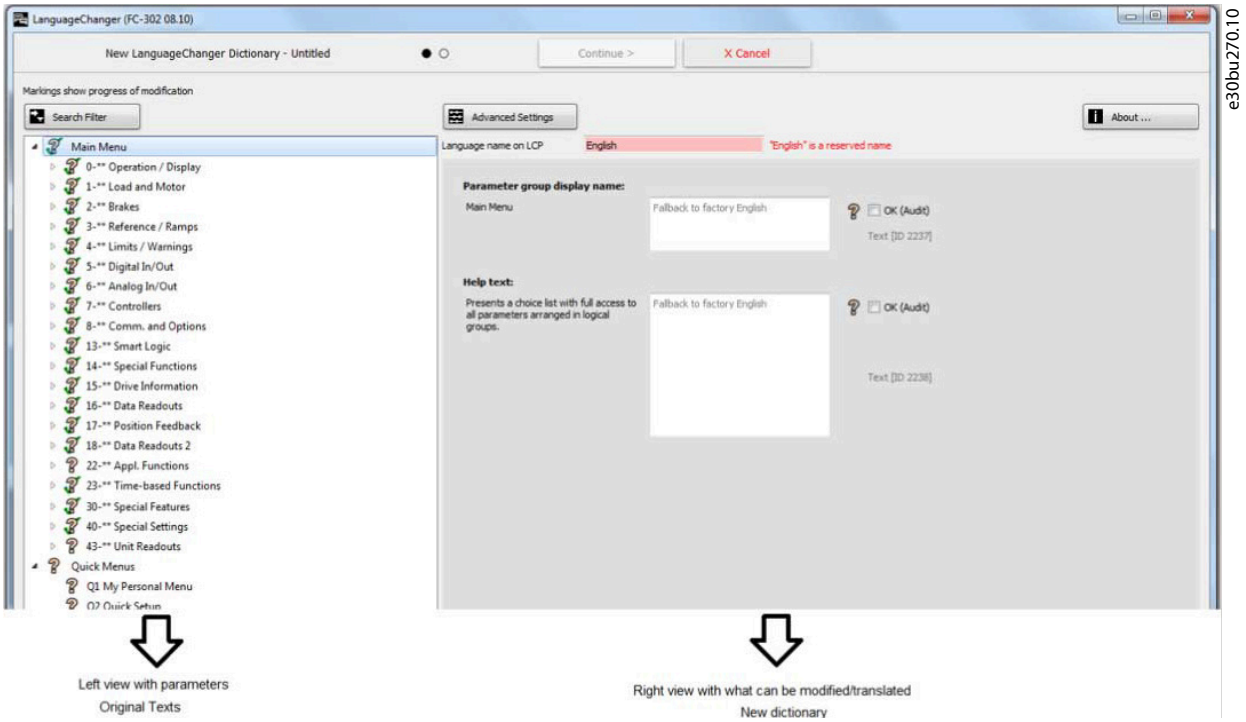

Figure 224: Overview of the LanguageChanger

NOTE: *Language name on LCP* comes from *Base Dictionary*. The name *English* is reserved for Danfoss. The name can be changed, for example to *English_Australia*. This name is then shown in the LCP.

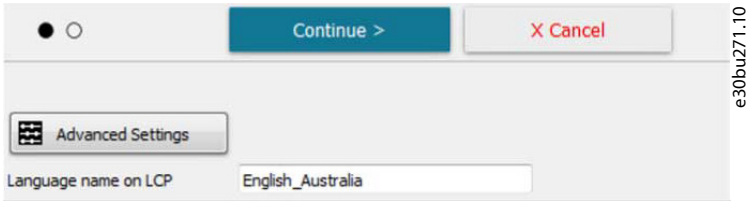

Figure 225: Language Name on LCP



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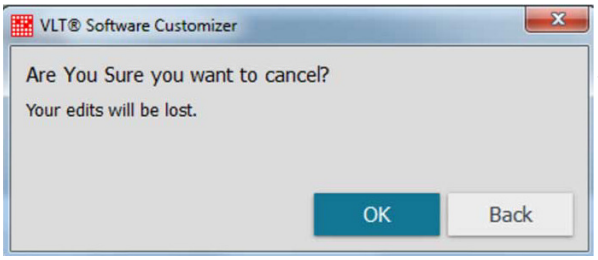
Figure 226: Language Name Shown on the LCP

Once *Language Name on LCP* is set, it is possible to start modifying and translating.

NOTE: Not all parameters can be modified/translated. Parameters shown are the ones that can be modified or translated.

If clicking *Cancel*, a dialog appears.



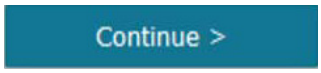
e30bu274.10

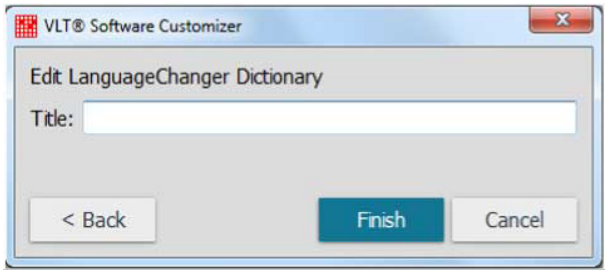
Figure 227: Cancel Dialog

Clicking *OK* closes the LanguageChanger without saving any changes.

Clicking *Back* goes back to the LanguageChanger editor.

When editing is done, press *Continue* and assign a name to the new dictionary file.





e30bu276.10

Figure 228: LanguageChanger Project Name

The name is for the specific LanguageChanger project and is shown on the dashboard.

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Figure 229: LanguageChanger Dashboard with Project Name

9.3.1.2 Search Filter

To easily find parameter names or texts to be translated, click the *Search filter* button.

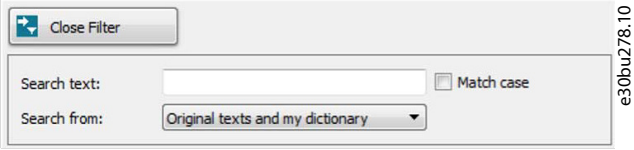

Figure 230: Search Filter

Select to search in:

- Original texts and new dictionary,
- Original texts only, or
- New dictionary only.

For example, searching for *motor power* only shows the parameters that contain *motor power* in the name or in the help text.

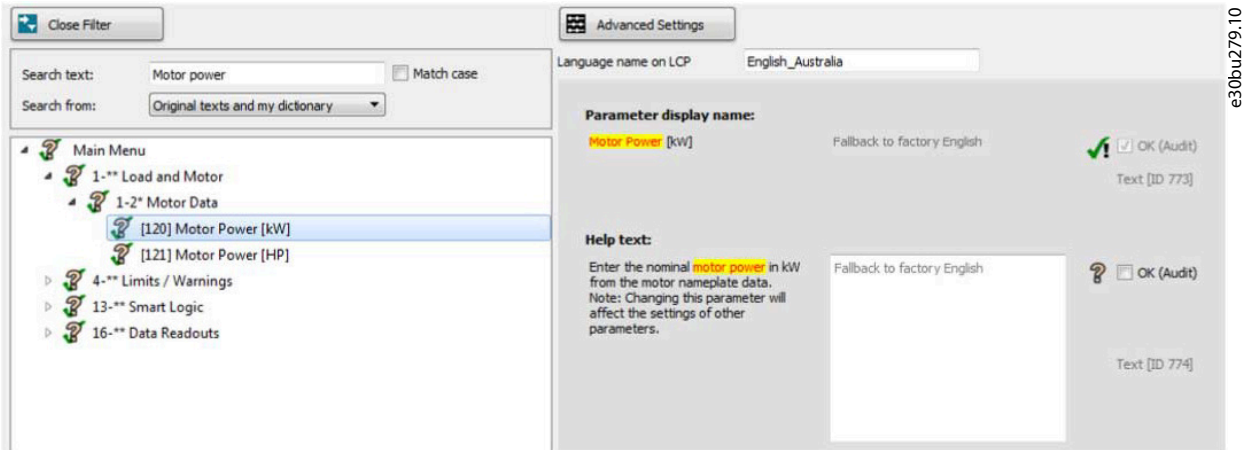

Figure 231: Search Result for Motor Power

9.3.1.3 Advanced Settings

Advanced settings contains tooltips for each possible setting and is helpful when creating a dictionary.

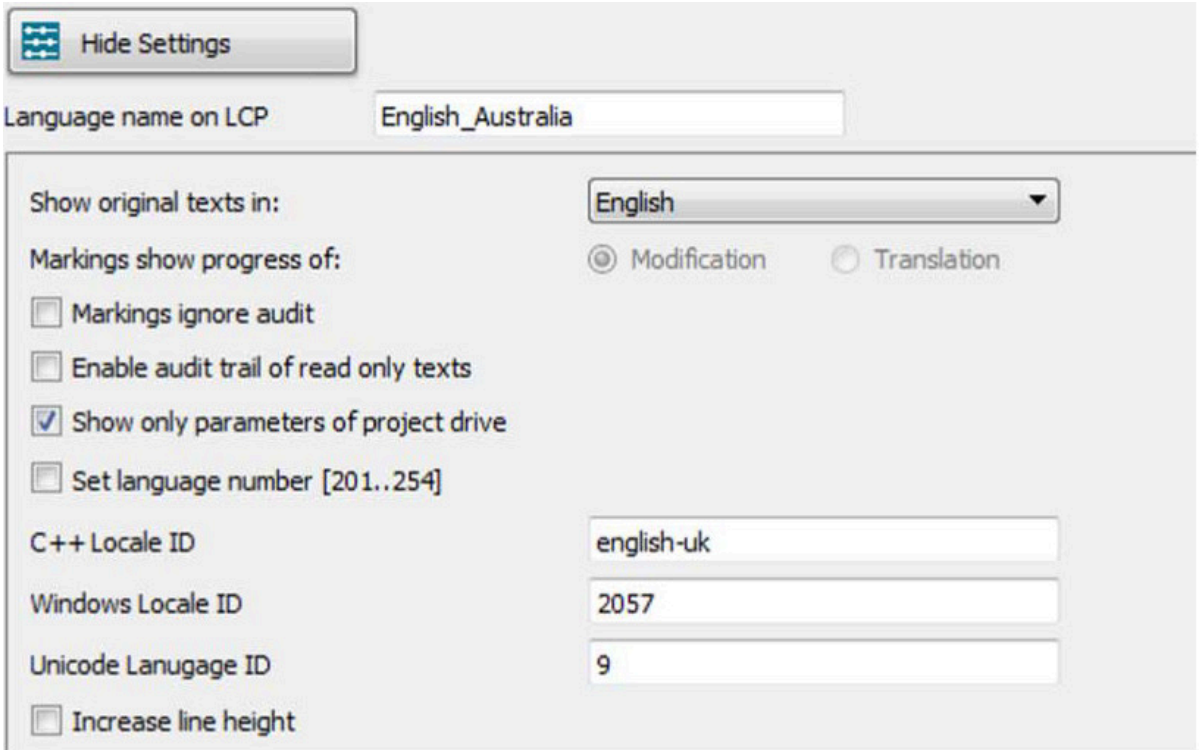

Figure 232: Overview of the Advanced Settings

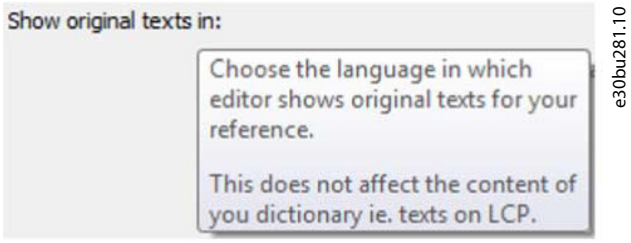

Figure 233: Tooltip Example

9.3.1.4 Audit

Clicking *Audit* accepts the original text as it is and marks it completed without modifications or translations.

9.3.1.5 Markings

To visualize the progress of translation or creation of a dictionary, LanguageChanger shows different markups.

	Text has not been modified or translated.
	Text has been modified or translated.
	Text has been accepted as is via the *Audit* function.

If *Markings ignore audit* is selected in the advanced settings, the marking only shows modified texts. All other texts are shown as



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9.4 InitialValues

Use *InitialValues* to create CSIV files. Without a CSIV file, all parameters are reset to default values during initialization of the drive. With a CSIV file, parameter values are initialized with the values defined in the CSIV file.

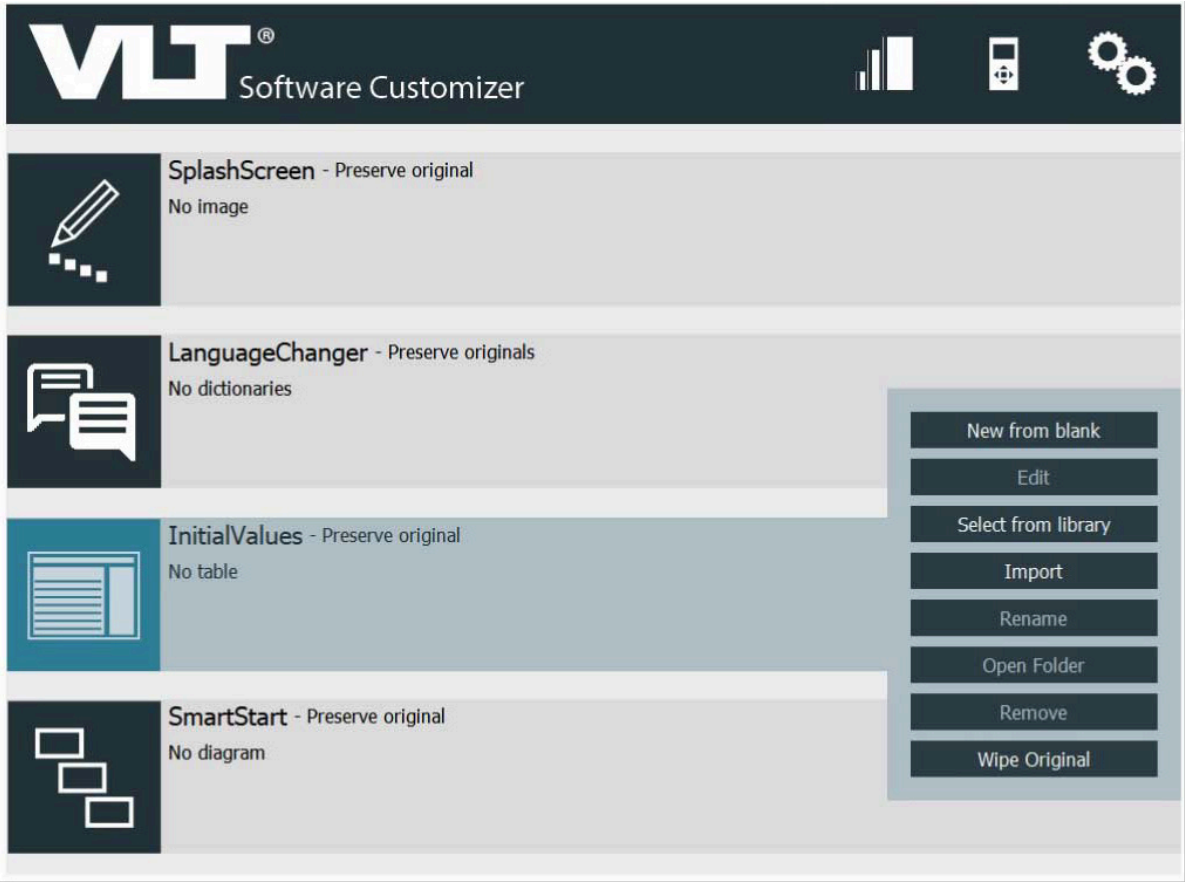

Figure 234: InitialValues Menu

9.4.1 InitialValues Functions

9.4.1.1 New from Blank

Procedure

1. Select *New from Blank* to open an empty project in the editor.

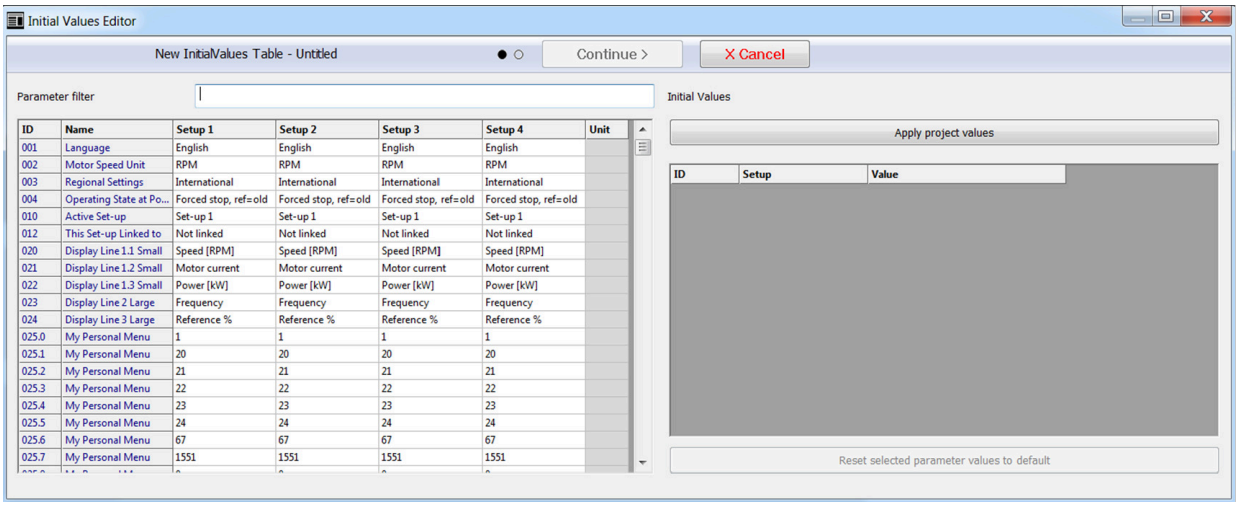

Figure 235: Example of Empty Project

2. To add parameters, double-click in a parameter and change a value. For example, add German to the CSIV.

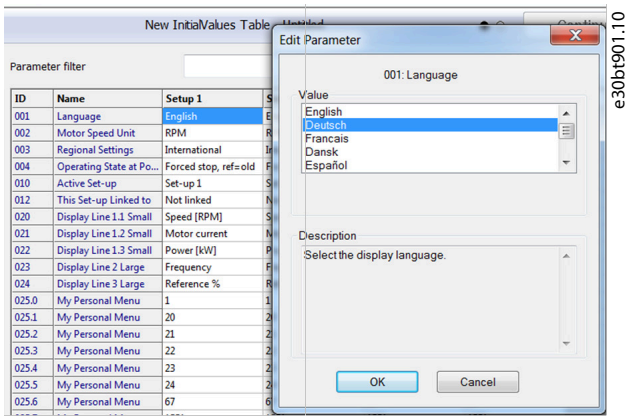

Figure 236: Setting a Value for the CSIV File

3. Click *OK* to add the value to the CSIV file.

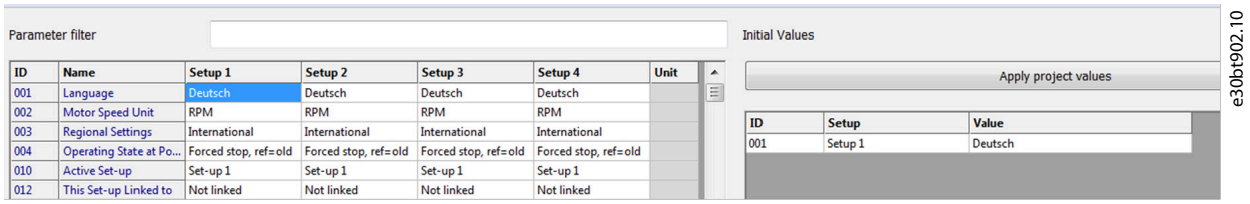

Figure 237: Value Added to CSIV File

Alternatively, use filters to easily find parameters to add to the CSIV file. Search by the parameter name or ID.

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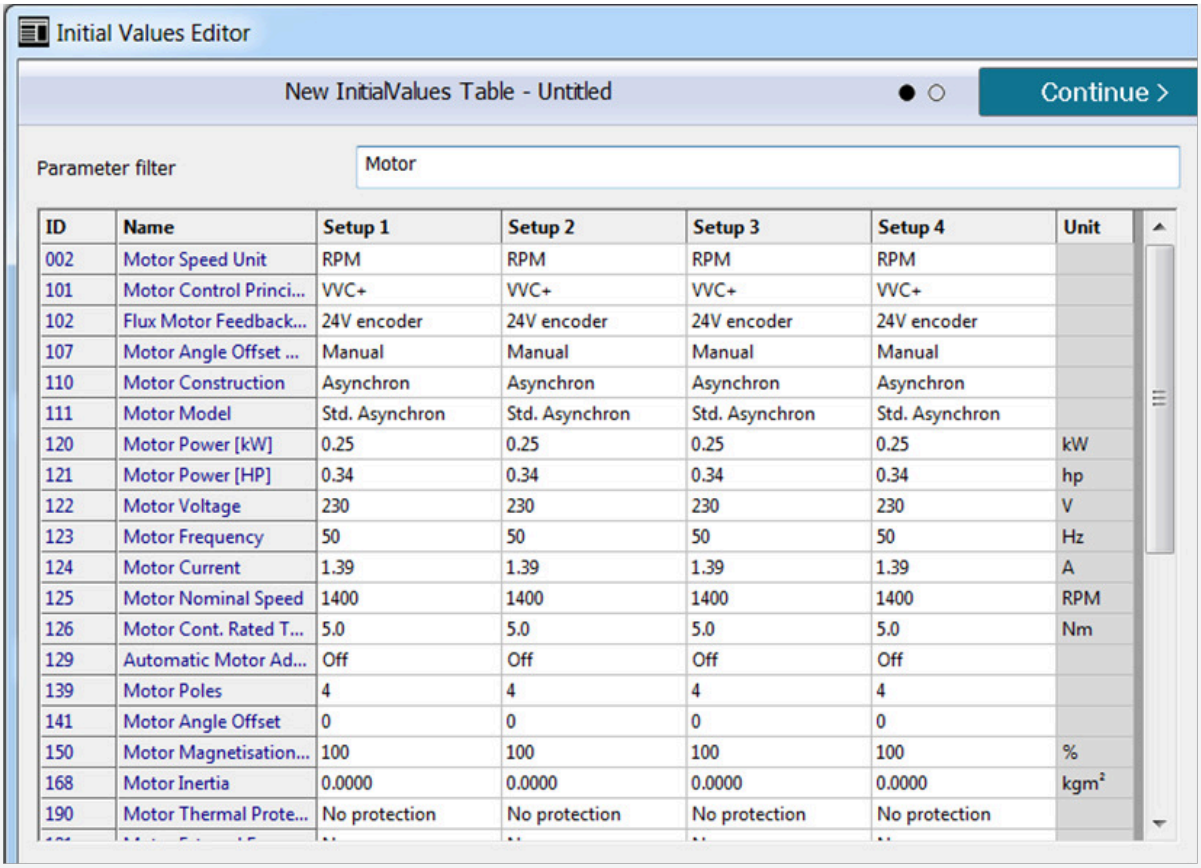


ID	Name	Setup 1	Setup 2	Setup 3	Setup 4	Unit
002	Motor Speed Unit	RPM	RPM	RPM	RPM	
101	Motor Control Princi...	VVC+	VVC+	VVC+	VVC+	
102	Flux Motor Feedback...	24V encoder	24V encoder	24V encoder	24V encoder	
107	Motor Angle Offset ...	Manual	Manual	Manual	Manual	
110	Motor Construction	Asynchron	Asynchron	Asynchron	Asynchron	
111	Motor Model	Std. Asynchron	Std. Asynchron	Std. Asynchron	Std. Asynchron	
120	Motor Power [kW]	0.25	0.25	0.25	0.25	kW
121	Motor Power [HP]	0.34	0.34	0.34	0.34	hp
122	Motor Voltage	230	230	230	230	V
123	Motor Frequency	50	50	50	50	Hz
124	Motor Current	1.39	1.39	1.39	1.39	A
125	Motor Nominal Speed	1400	1400	1400	1400	RPM
126	Motor Cont. Rated T...	5.0	5.0	5.0	5.0	Nm
129	Automatic Motor Ad...	Off	Off	Off	Off	
139	Motor Poles	4	4	4	4	
141	Motor Angle Offset	0	0	0	0	
150	Motor Magnetisation...	100	100	100	100	%
168	Motor Inertia	0.0000	0.0000	0.0000	0.0000	kgm²
190	Motor Thermal Prote...	No protection	No protection	No protection	No protection	

Figure 238: Example of Using Filters for Finding Parameters

To import a parameter available in the offline VLT® Motion Control Tool MCT 10 project, click *Apply project values*.

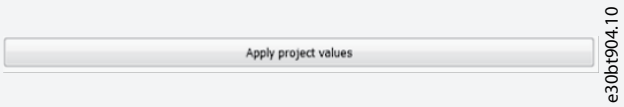


Figure 239: Apply Project Values Button

9.4.1.2 Removing Parameters

Procedure

1. Select the parameter to be removed.
2. Click *Reset selected parameter values to default*.

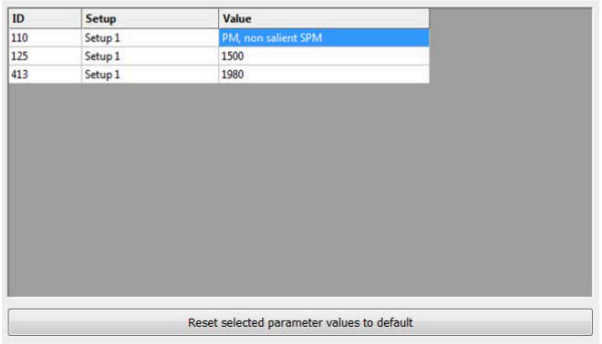


Figure 240: Removing a Parameter

NOTE: When resetting a parameter, other parameters may disappear from the CSIV file or change their values due to dependencies.

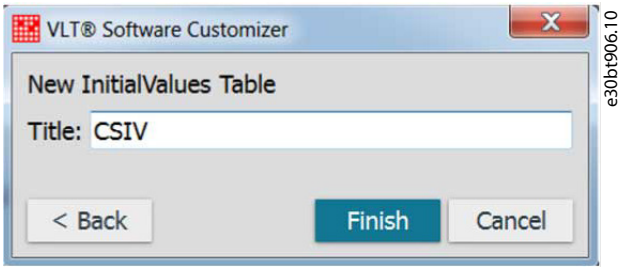
9.4.1.3 Saving the CSIV File

Prerequisites:

All values must be entered in the InitialValues editor before saving the CSIV file.

Procedure

1. Click *Continue*.
2. In the dialog box, enter a file name.



3. Click *Finish*.

Clicking *Back* returns to the editor, clicking *Cancel* cancels saving of the CSIV file.

When saving the CSIV file has completed, a preview of the file is shown in the project along with a date and time stamp.



Figure 241: Preview of CSIV File in Project

9.4.1.4 Validation of Parameters During Import

Parameters are validated during import of a CSIV file. Incompatible parameters cannot be imported and are highlighted. Incompatibilities can be caused by, for example, missing parameters or a CSIV file created for a different product series.

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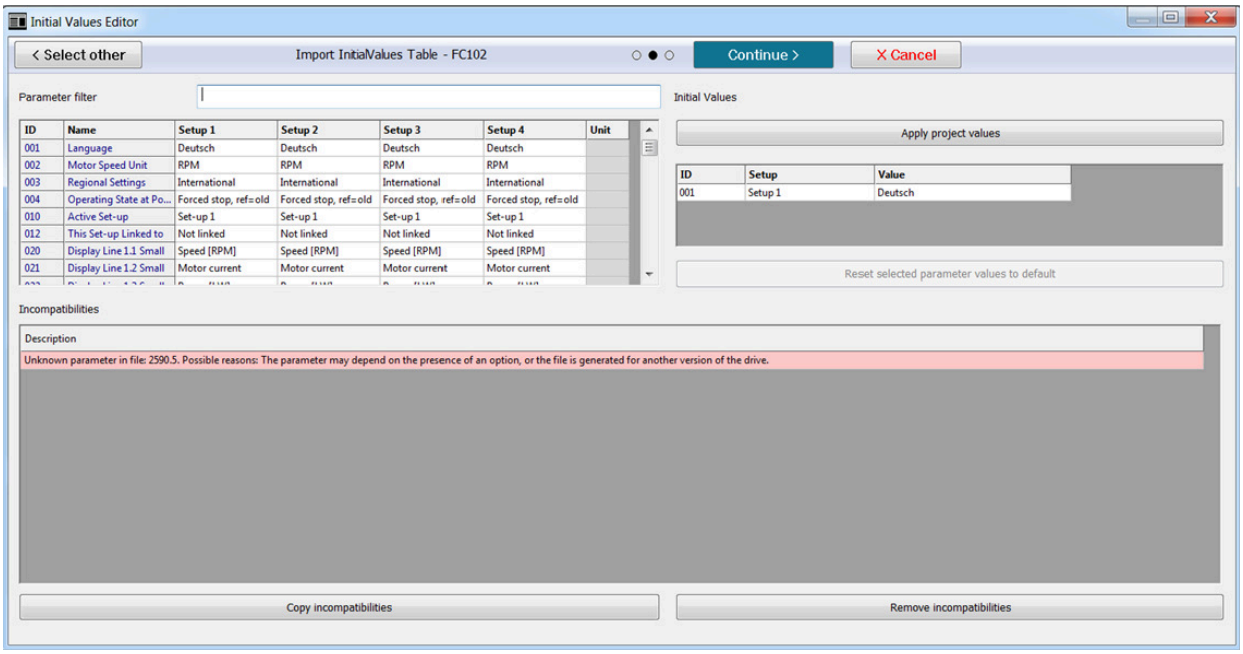

Figure 242: Example of Incompatible Parameter

To copy the shown incompatibilities into Word or Notepad, click *Copy incompatibilities*.

To remove the incompatible parameters, click *Remove incompatibilities*.

It is possible to check the content of multiple CSIV files at import. Click *Select other* in the top left corner to open a Windows folder for selecting other CSIV files.

9.5 Writing to Drive

9.5.1 Overview of the Writing to Drive Function

> IMPORTANT: *Writing to drive* puts the drive in test monitor mode. This is a special mode where it is possible to write files to flash the file system. It is important to turn off the drive.

Writing to drive writes files from the VLT® Software Customizer.

If a file is already in the drive, it is overwritten by the new file.

9.5.2 Preserve Original vs. Wipe Original

Write to drive writes all files. If a feature does not contain any files, select either to keep the original file in the drive, or to delete it (*Wipe Original*). By default, *Preserve Original* is selected. To change this setting, select it from the menu of the given feature.



Figure 243: Menu for SplashScreen

Changing from *Preserve Original* to *Wipe Original* issues a notification.

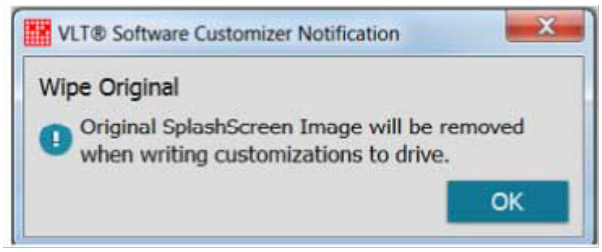

Figure 244: Notification when Changing Setting

After clicking *OK*, the new setting is shown in the project.



Figure 245: New Setting Shown in Project

The settings are individual for each feature. If a feature has a file in the project, this setting is irrelevant and therefore grayed out.

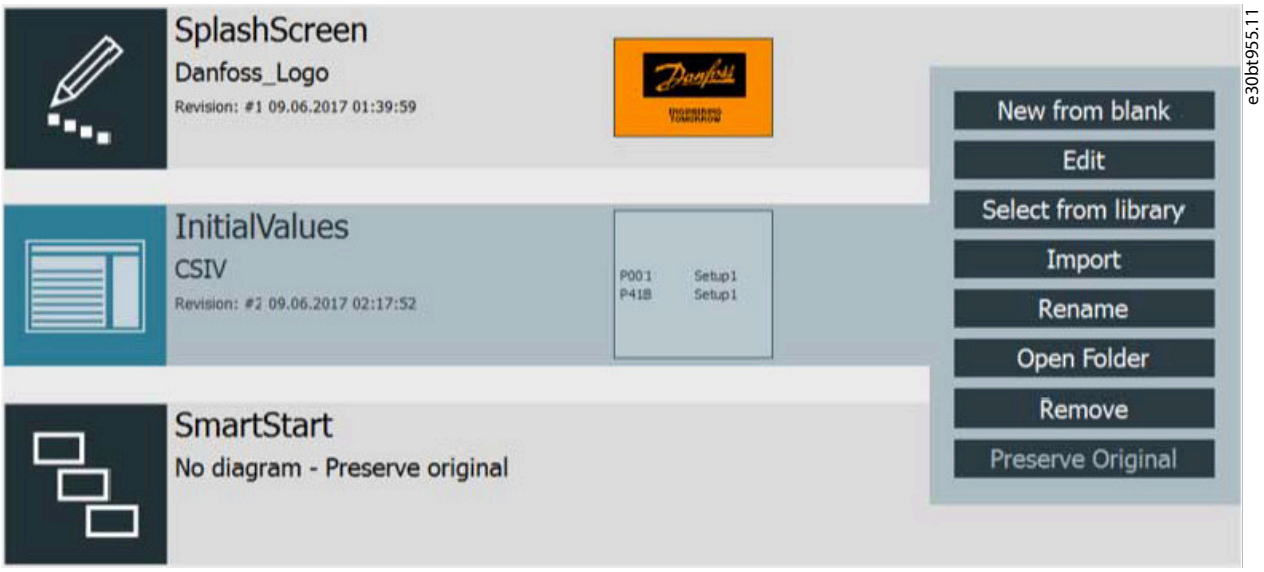

Figure 246: Example of Grayed-out Setting

NOTE: To make backup of files in the file system, use the Drive File System and the Drive File Manager.

9.5.3 Removing Files

Procedure

1. Select *Remove* from the given feature menu in the project.

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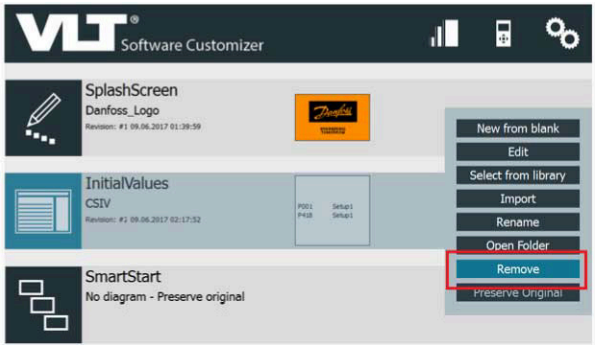

Figure 247: Removing a File

9.6 Testing in Simaltor

9.6.1 Overview of the Simulator

Use the simulator to test created files without being connected to a real drive and a real LCP. The simulator is an app that emulates LCP behavior.

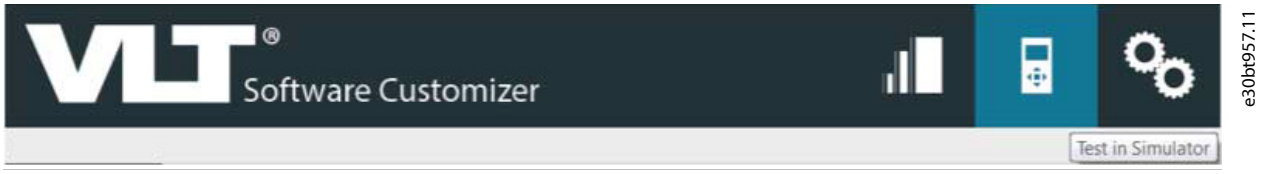

Figure 248: Select Test in Simulator in the Top Menu

Each drive series and each software version have different simulators.

If the simulator is not available when selecting *Test in Simulator*, a message is shown.



Figure 249: Warning Message - Simulator is not Installed

If the simulator is not available, contact a local Danfoss representative who can provide a zip file.

9.6.2 Installing the Simulator

Procedure

1. Save the zip file locally on a PC.
2. Open the *Tools* menu in VLT® Motion Control Tool MCT 10.
3. Select *Update VLT Software Customizer support....*

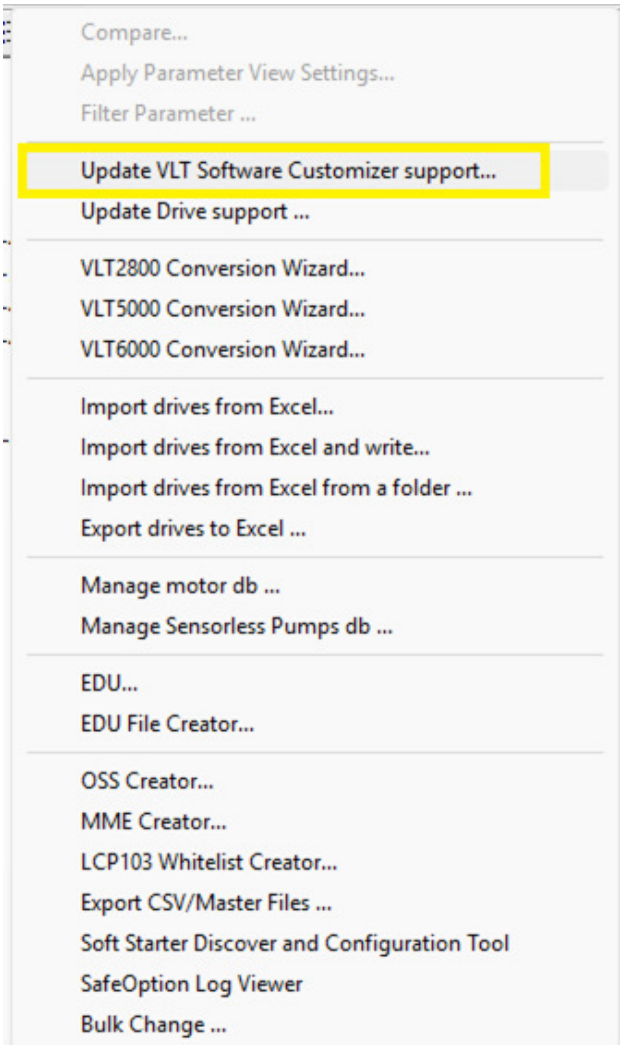

Figure 250: Selecting the Update VLT Software Customizer Support

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Figure 251: LCP Simulator

10 Tool Calling Interface (TCI)

10.1 Introduction

The TCI is an interface between the programming tool (TIA/Step 7) for the PLC and the VLT® Motion Control Tool MCT 10 and it supports fieldbus communication over network boundaries.

The TCI is available in MCT 10 from version 4.20.

When installing the MCT 10, a program interface description (PID) file is created. This file acts as an interface between the TIA portal and MCT 10. When MCT 10 is opened via the PLC, information about the drive and the parameter database is placed in a temporary parameter (TPF) file.

Benefits

- Data is inside the programming file of the PLC.
- There is no risk of selecting the wrong MCT 10 project file.
- Exact match between the controller hardware configuration and MCT 10.
- The PLC calls MCT 10.
- Reduction of faults.

10.2 Installing the GSD/GSDML File

The GSD/GSDML file is required for the TCI interface to work. Danfoss provides the file.

Procedure

1. Unzip the file.
2. Open the TIA portal.
3. Click the *Options* menu.
4. Click *Manage*.
5. Select the file and install it.

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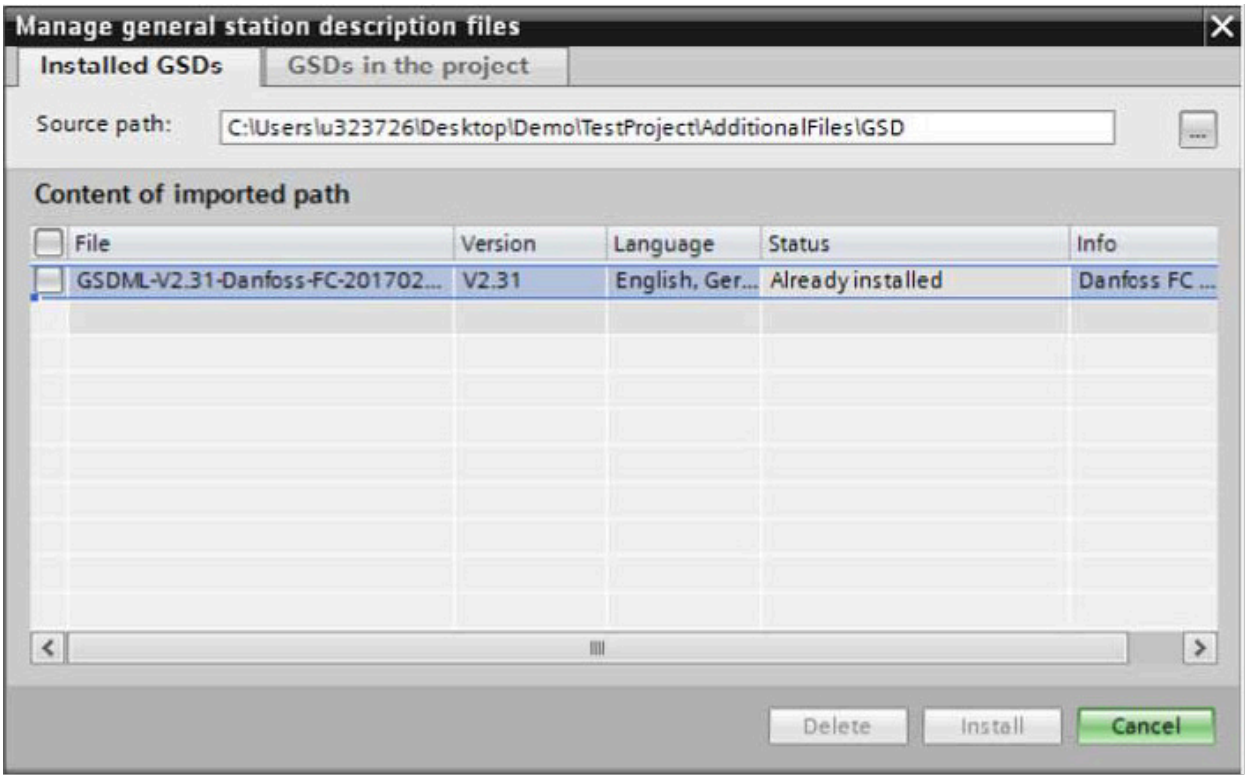

Figure 252: Installing the GSD/GSDML File

10.3 Creating a Project in TIA

Prerequisites:

The following files must be installed before creating projects:

- TIA Portal tool version 14 or higher, or Step 7 version 5.6 or higher.
- VLT® Motion Control Tool MCT 10 version 4.20 or higher.
- GSD/GSDML file provided by Danfoss.

Procedure

1. Click *Create project*.
2. Expand the project in the project tree.
3. Click *Devices & Networks*.
4. Click *Add new device*.
5. Select the PLC.

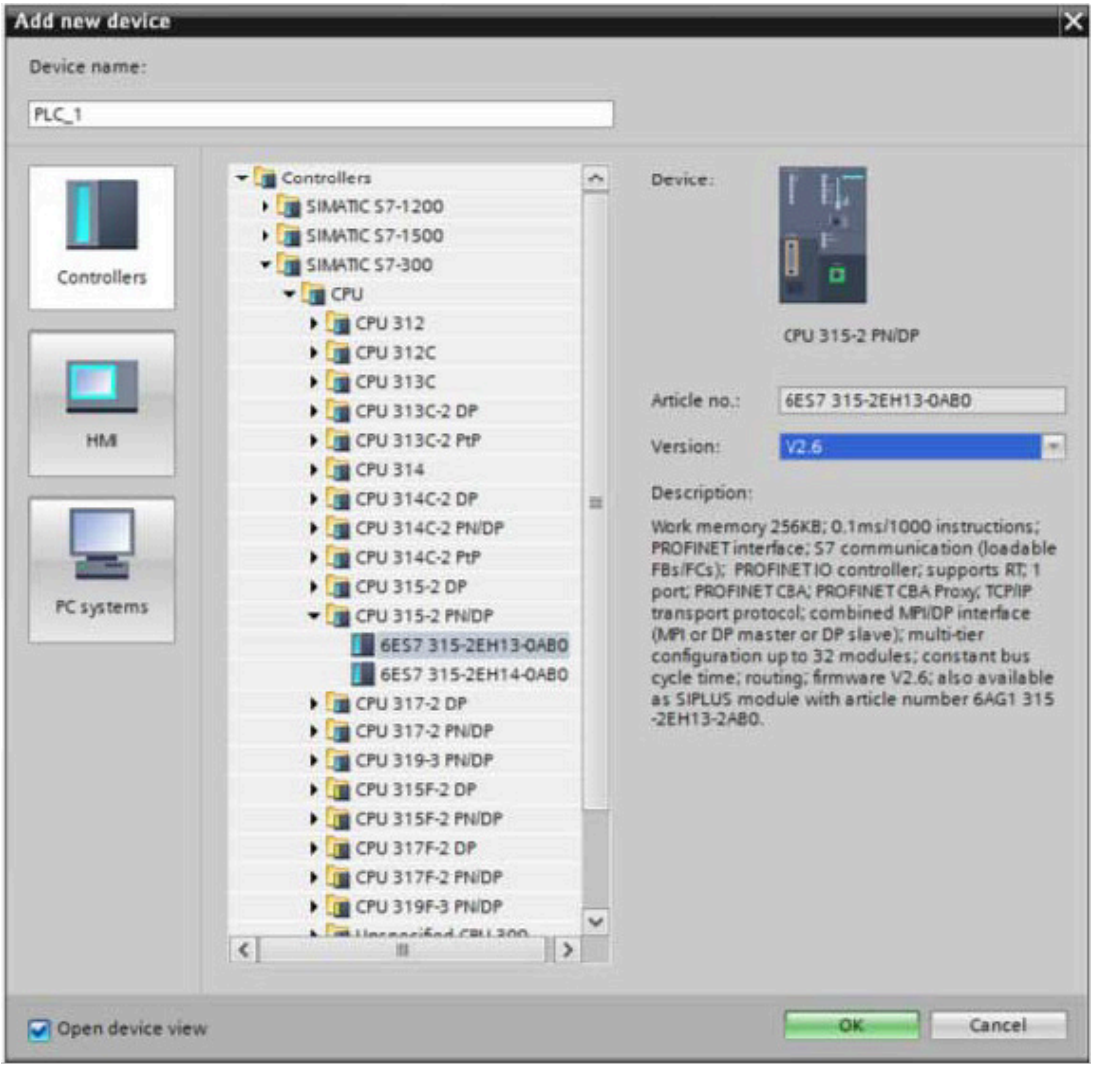

Figure 253: Add New Device

10.4 Use Cases

10.4.1 Doing the Initial Connection

Prerequisites:

Add the PLC before the initial connection can be established.

Procedure

1. Click the *Network* icon at the top left corner of the right view.
2. Enter Danfoss in the search field.

   The GSD file appears.

3. Build the drive network in the PLC via drag and drop.

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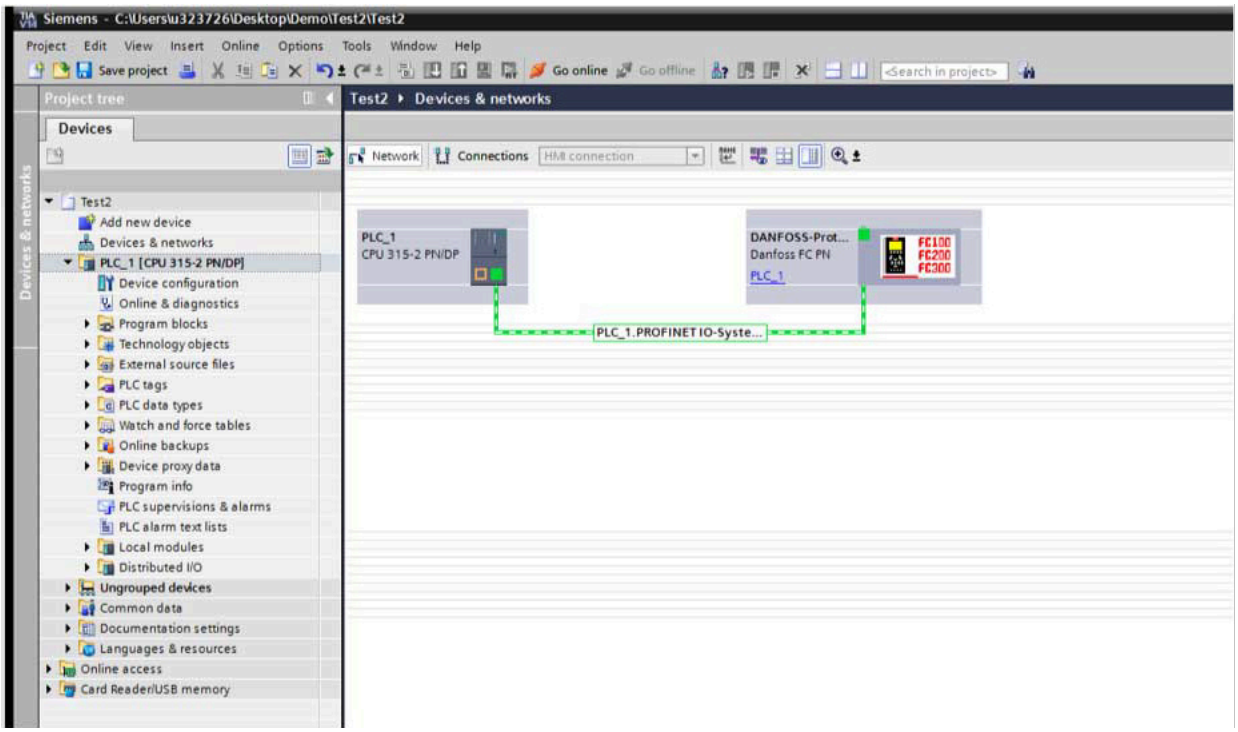

Figure 254: Initial Connection

10.4.2 Configuring the TCI

Prerequisites:

Program the PLC before starting the configuration.

Procedure

1. Right-click the drive icon and start the device tool.

   A dialog box shows for opening VLT® Motion Control Tool MCT 10.

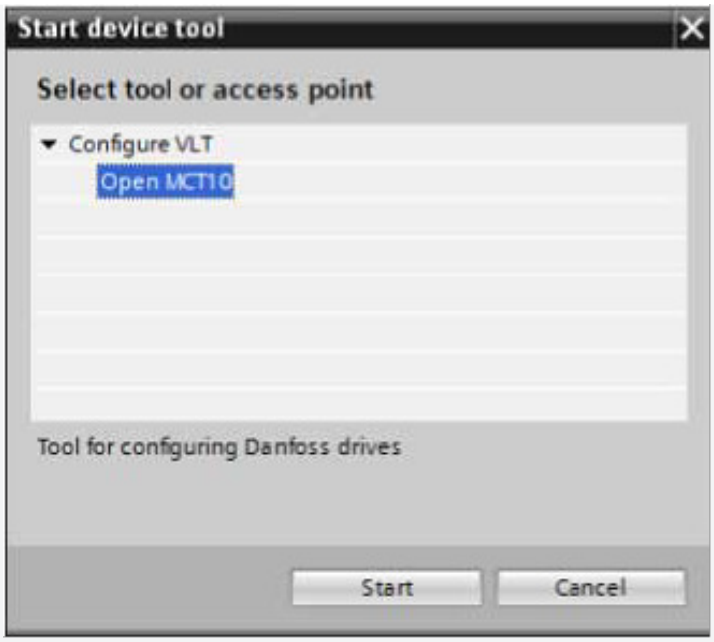

Figure 255: Start Device Tool

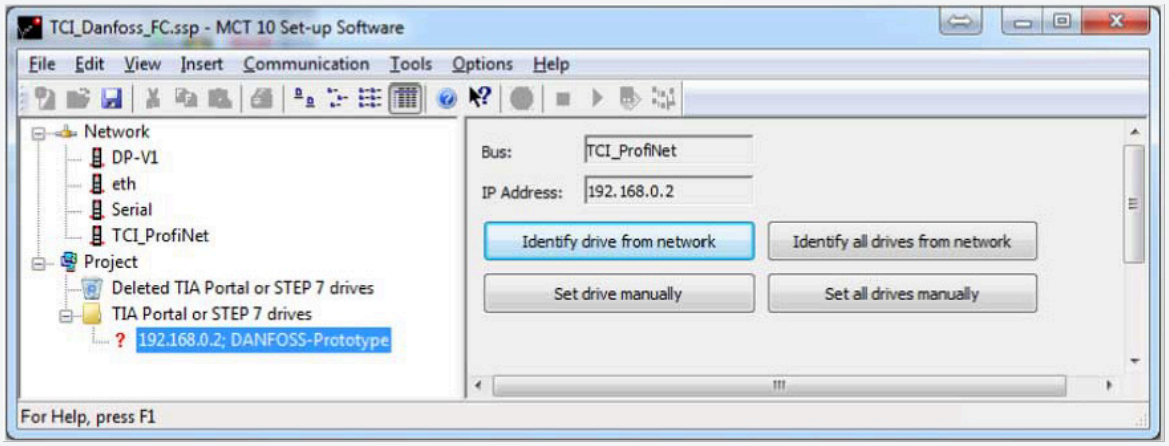

Figure 256: Configuration

2. **For online network**: Select the network, for example TCI_Profinet.

   The tool scans drives which are mapped to the TCI interface. A drive appears if it is connected to the PLC.

3. **For offline project**: Identify all drives in offline mode.

   This step is applicable for creating a project with drives that are not physically connected.

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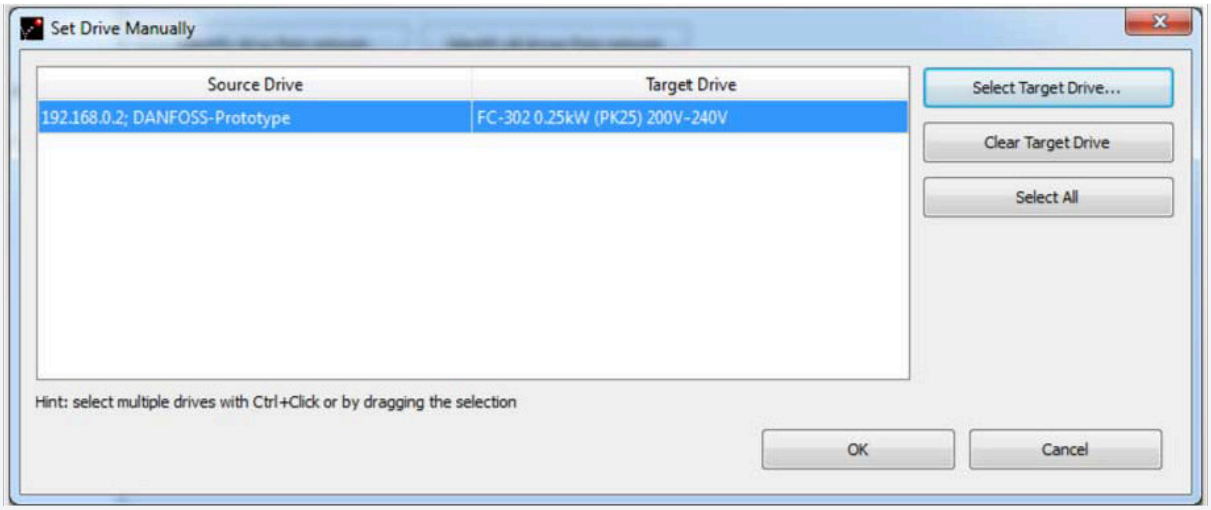

Figure 257: Set Drive Manually

Once the MCT 10 parameters are configured, and the tool is closed without saving the MCT 10 project, data goes to the TIA portal and is saved as a TIA project.

When opening the drive from TIA, MCT 10 opens with the saved data and appears in MCT 10.

11 SyncPos

11.1 SyncPos Handling

The VLT® 5000 and VLT® 5000 FLUX series have a SyncPos application option, which consists of a print card with a processor. For detailed information, refer to *Programmable SyncPos Motion Controller Operating Instructions*.

VLT® Motion Control Tool MCT 10 can directly modify, read from, and write to SyncPos files. SyncPos files are stored within the MCT 10 files and do not require separate handling.

When a VLT® 5000 has a SyncPos option installed, the MCT 10 shows 2 icons after the drive has been selected:

- An *All parameters folder* icon.
- A separate *SyncPos* icon.

*Parameter group 7-** Controllers* is incorporated under *All Parameters* and applies to SyncPos.

NOTE: VLT® Motion Control Tool MCT 10 does not fully support the SyncPos application versions 1.xx and 2.xx. The SyncPos folder is available due to the lack of functionality in these initial versions.

11.2 Programs and Configuration File

11.2.1 Introduction to the SyncPos Programs

The SyncPos program consists of 2 main parts:

- Configuration file (*.cnf).
- Program files (*.m).

A configuration file consists of a series of SyncPos parameters which can be programmed. VLT® Motion Control Tool MCT 10 allows importing, exporting, and setting up SyncPos configuration files.

11.2.2 Programs

Programs can be inserted in the VLT® Motion Control Tool MCT 10 Project folder. When a new SyncPos program is selected, an untitled program is inserted in the SyncPos folder. The program can be edited, written, and exported as in the standalone SyncPos program. If a SyncPos program exists, it can be imported into the MCT 10 project.

11.2.3 Viewing the Configuration File

Procedure

1. Select *Configuration* to view the drive configuration file in the right view of the screen.
2. To change the SyncPos settings, select the relevant drive in the right view to open a new editor (Cam Editor).

   Refer to the Programmable SyncPos Motion Controller Operating Instructions for details on using the editor.
3. Change the settings.
4. Select *Compile* (in *Settings* in the main menu) or *Exit Program* (in *File* in the main menu).
5. When selecting *Exit Program*, select *Read* or *Write*.

   The *Confirm SyncPos write* (or read) window pops up with 2 options for saving the SyncPos card.
6. Select the wanted option and select *Yes* or *No*.

   When selecting *Yes*, the information is written to the drive.

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NOTE: If *Write to Drive* is selected at the root of the drive, VLT® Motion Control Tool MCT 10 also writes the SyncPos files to the SyncPos options. This can lead to an unattended stop of the SyncPos card.

11.2.4 Importing and Exporting a Configuration File

This procedure describes how to import a configuration file to a SyncPos card. Exporting a file is done in the same way, but select *Export* instead of *Import*.

Procedure

1. Click the configuration file shown in the right view.

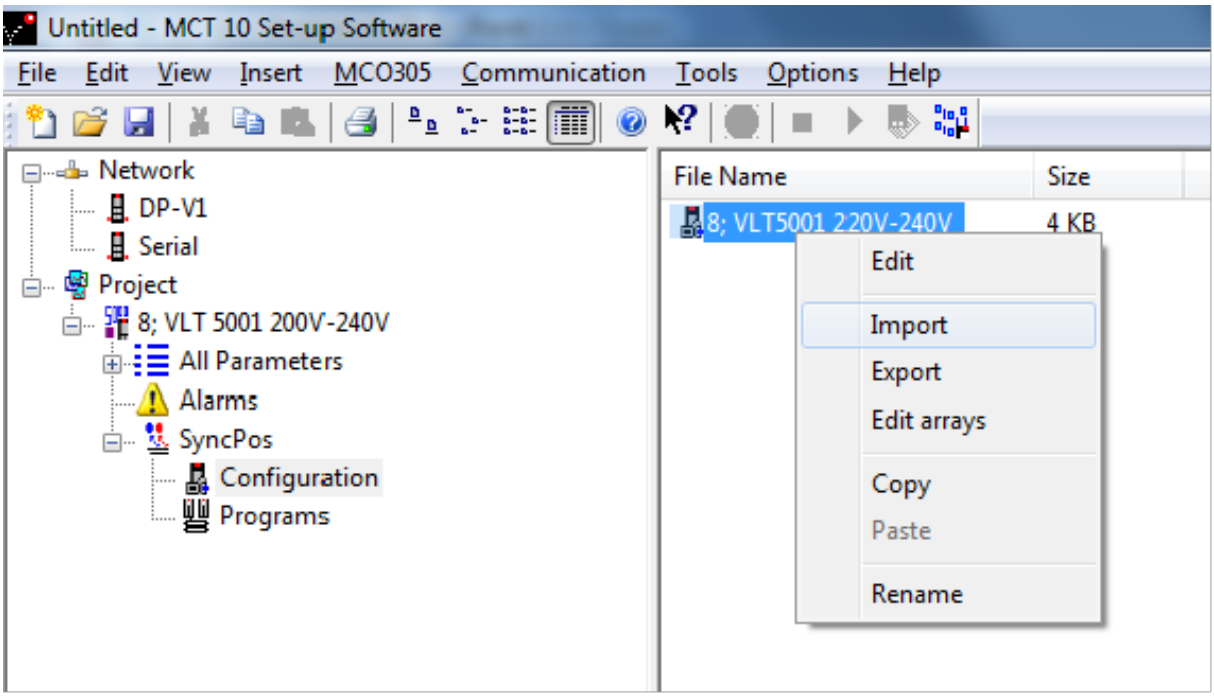

Figure 258: Import Configuration File

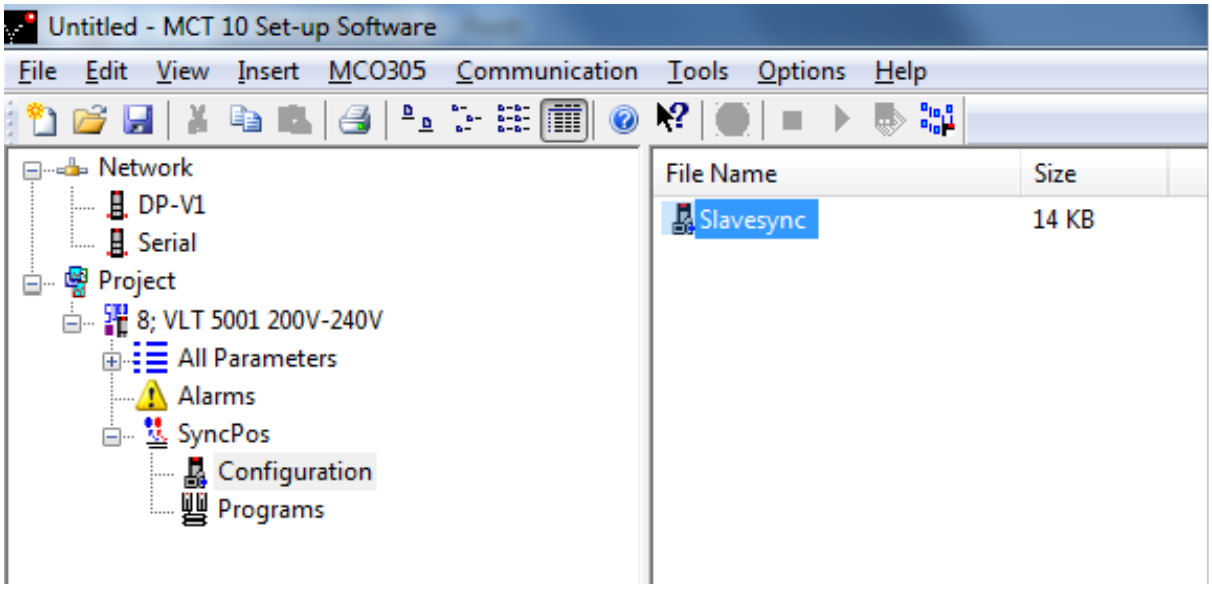

Figure 259: Import Configuration File

2. Select a configuration file for import from the computer directory.
3. Select the desired file and click *Open* to import the file to the Configuration folder.

11.2.5 Editing and Saving a Configuration File

Procedure

1. Select the configuration file to view and edit.

   The configuration editor opens.

2. Make the required changes to the configuration file.
3. Close the SyncPos application.

   The *SyncPos Application Closed* dialog appears.



Figure 260: SyncPos Application Closed

4. Select
   - *Read* to save changes to VLT® Motion Control Tool MCT 10.
   - *Write* to save changes to the drive.

   Reading or writing can take some time.

11.2.6 Importing Program Files

Procedure

1. Click a program shown in the right view.

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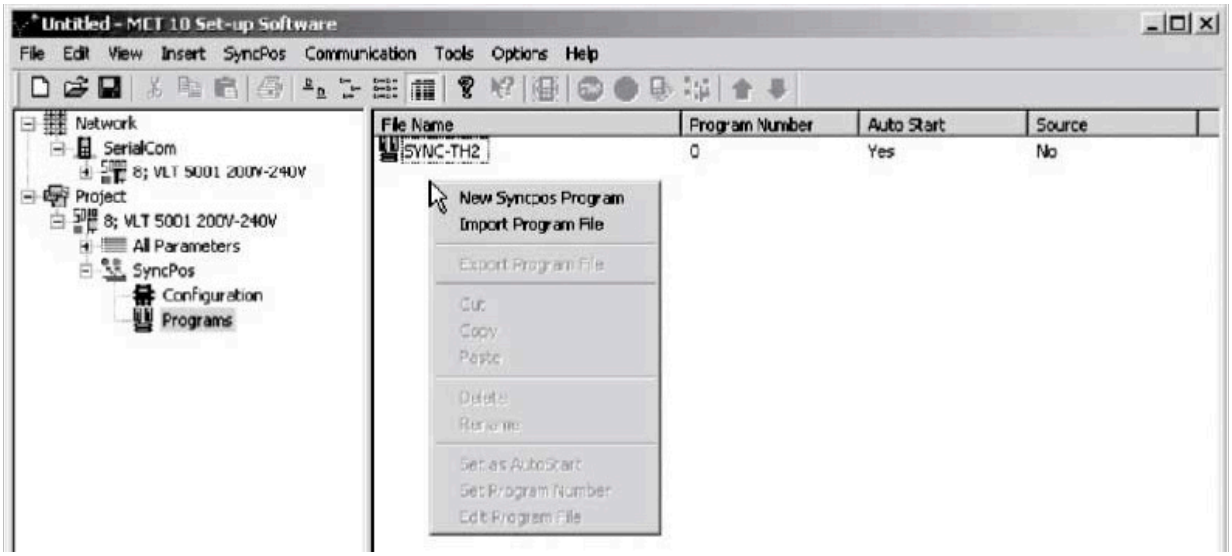

Figure 261: Import Program to SyncPos Card

2. Browse the computer to find the program to import.

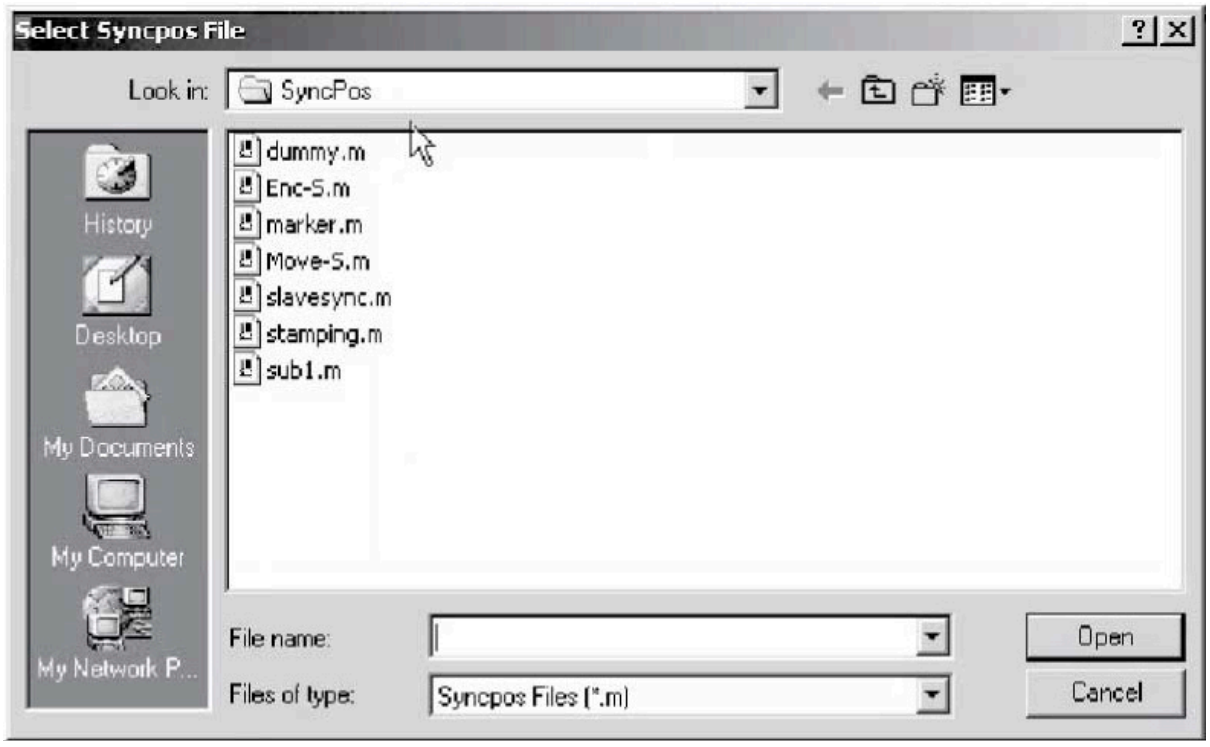

Figure 262: Browse

3. Select the wanted program.
4. Click *Open* to import the program in the Programs folder.

The import is now complete.

11.2.7 Setting a Program to Auto Start

If more than 1 program is stored in the Programs folder, it is possible to set 1 of them to start automatically when the device is turned on.

Procedure

1. Select the start-up program in the right view of the screen.
2. Right-click and select *Set As Auto Start*.

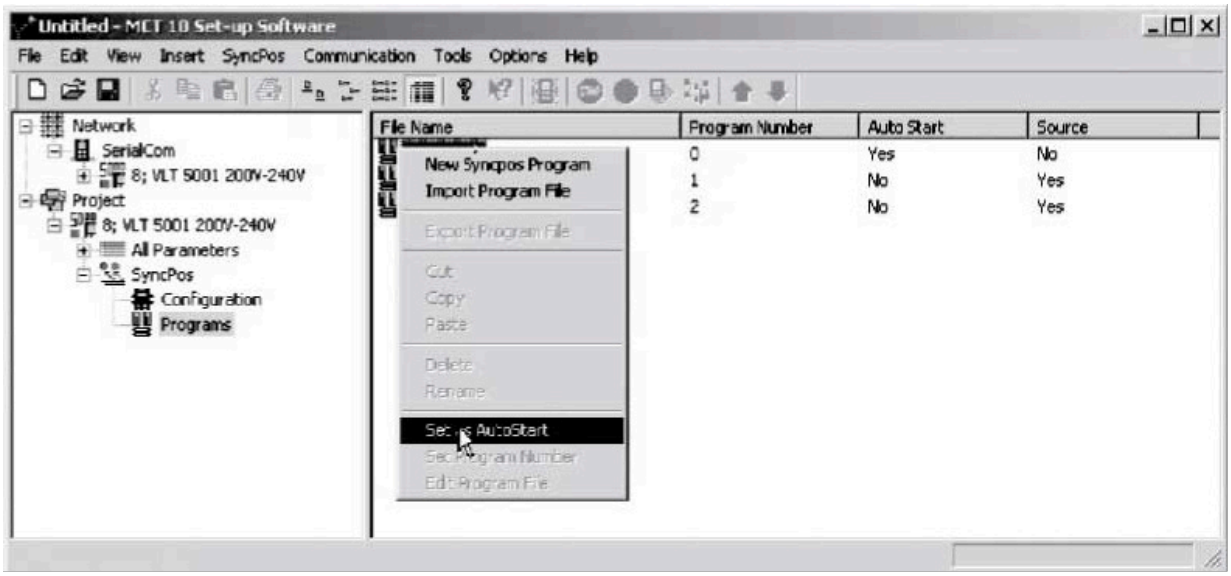

Figure 263: Auto Start

The program selected is then indicated with *Yes* in the *Auto Start* column.

11.2.8 Editing Source Code

For detailed information about the source code, refer to Programmable SyncPos Motion Controller Operating Instructions. To view or edit the source code, follow this procedure:

Procedure

1. Double-click *Program* in the right view.

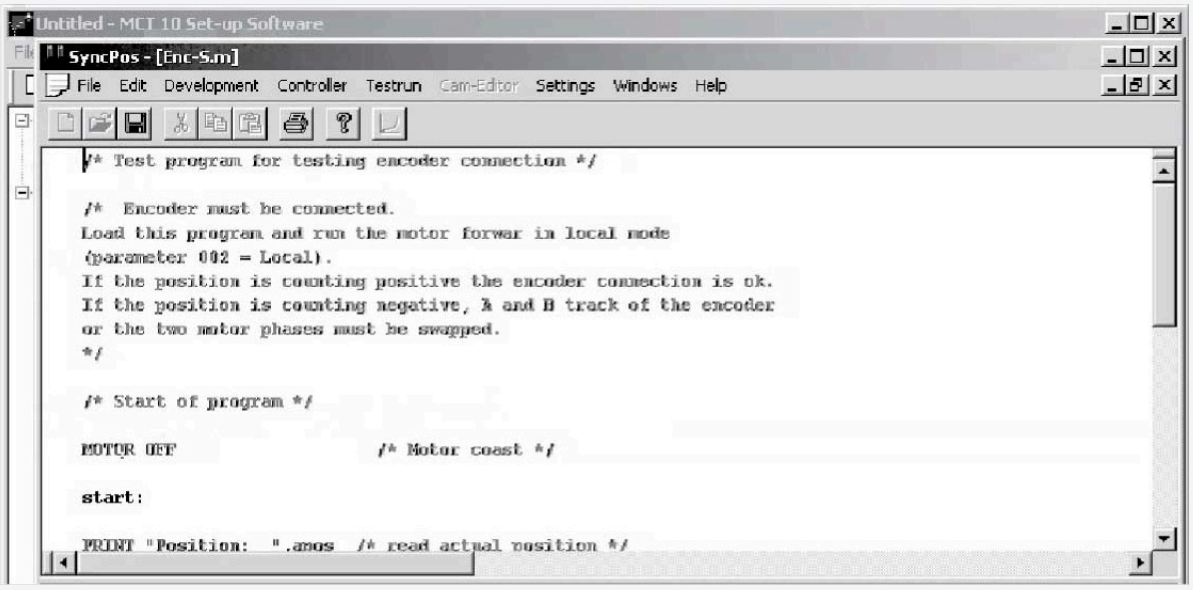

Figure 264: View/Edit Source Code

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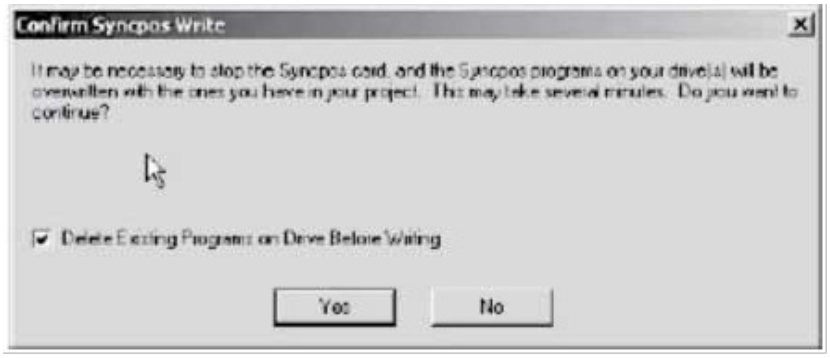
A range of editing operations are possible, described in detail in the Programmable SyncPos Motion Controller Operating Instructions.

11.2.9 Saving and Exiting Program

When editing a configuration file, a *SyncPos Application Closed* dialog box pops up. Select *Read* or *Write* according to the instructions in the box.

NOTE: If there are programs in the SyncPos card, they are deleted without further warning.



e30bt546.12

Figure 265: Confirm SyncPos Write

Procedure

1. Select *File⇒Save* in the menu bar to save the changes to the program file opened from the VLT® Motion Control Tool MCT 10 project.
2. Select *File⇒Exit program* in the menu bar to exit SyncPos.

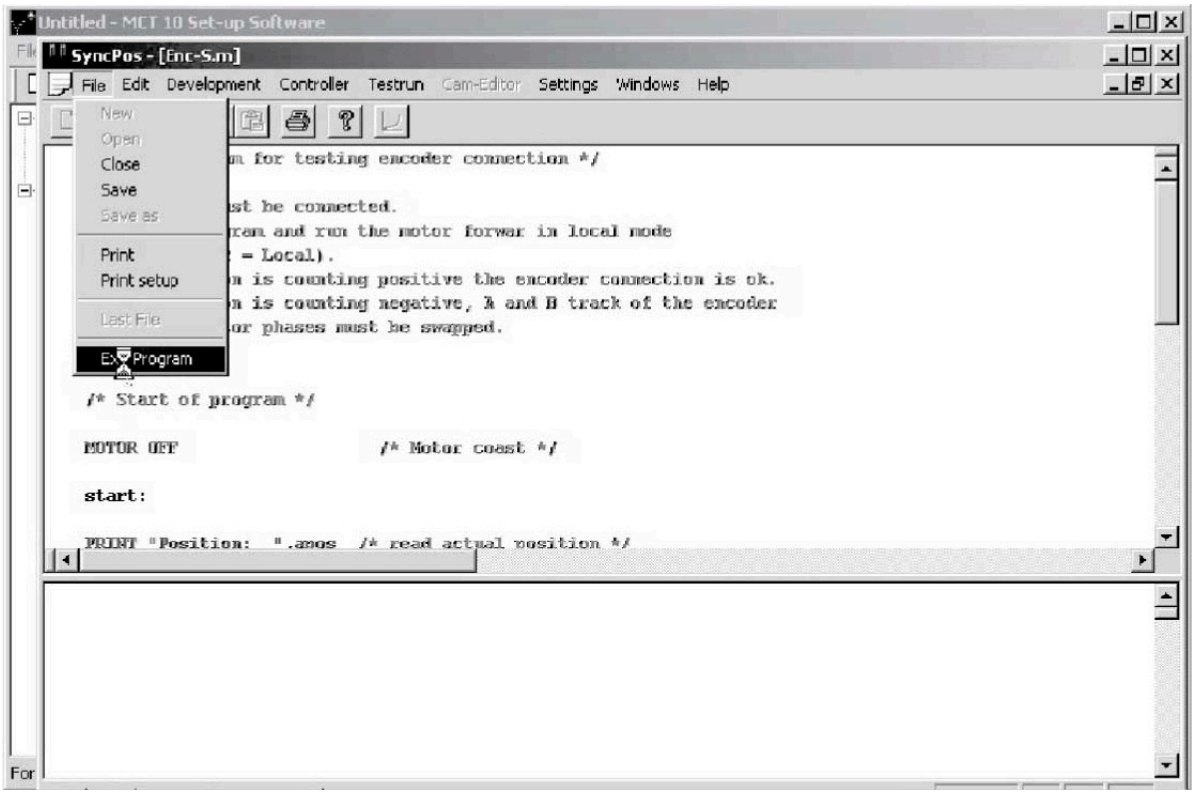


Figure 266: Exit Program

11.3 SyncPos Read from Drive

Parameters and SyncPos files can be read from a drive to a project.

Procedure

1. Right-click the root drive.
2. Select *Read from Drive*.

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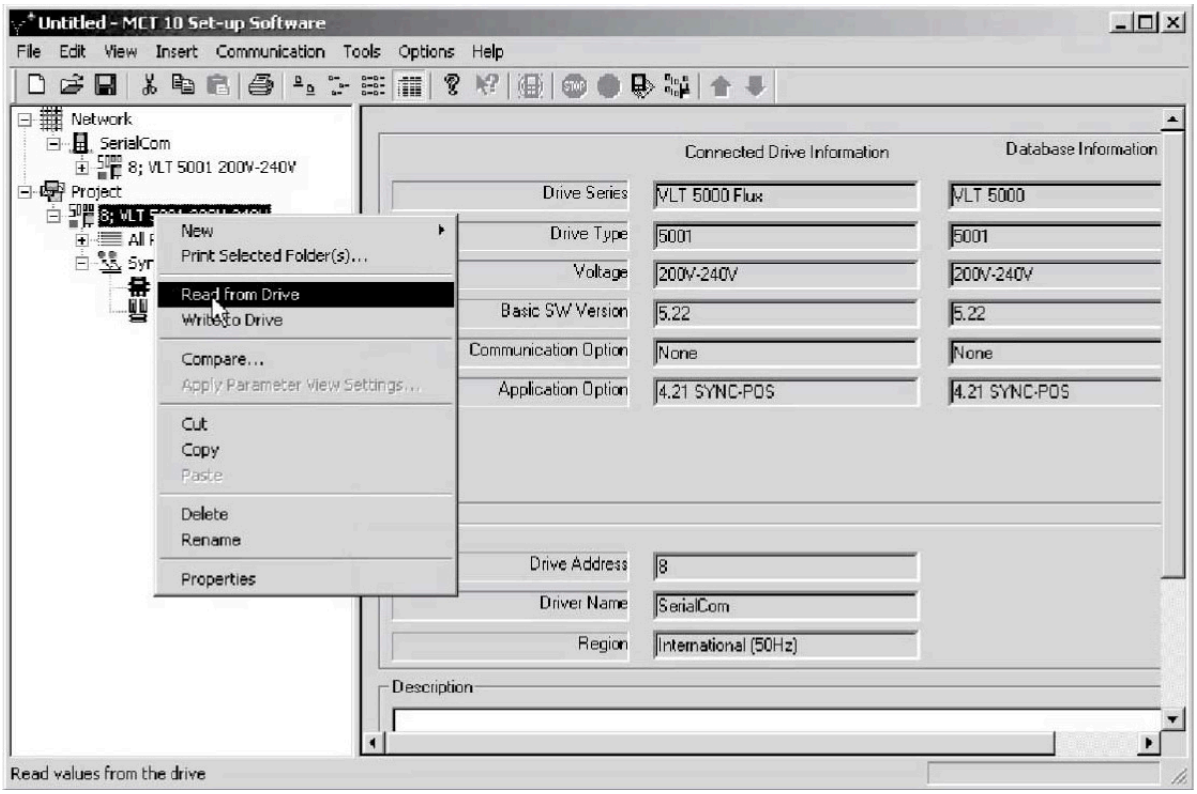
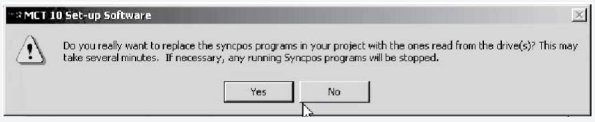


e30bt510.12

Figure 267: SyncPos Read From Drive

NOTE: Files in the project can be permanently lost as files of the same name are overwritten:



e30bt719.11

Figure 268: Files Overwritten

3. Select *Yes* to start reading and saving the configuration files and programs from the drive to the project.

11.4 SyncPos Write to Drive

All parameters and SyncPos files can be written to a drive.

Procedure

1. Right-click the root drive.
2. Select *Write to Drive*.

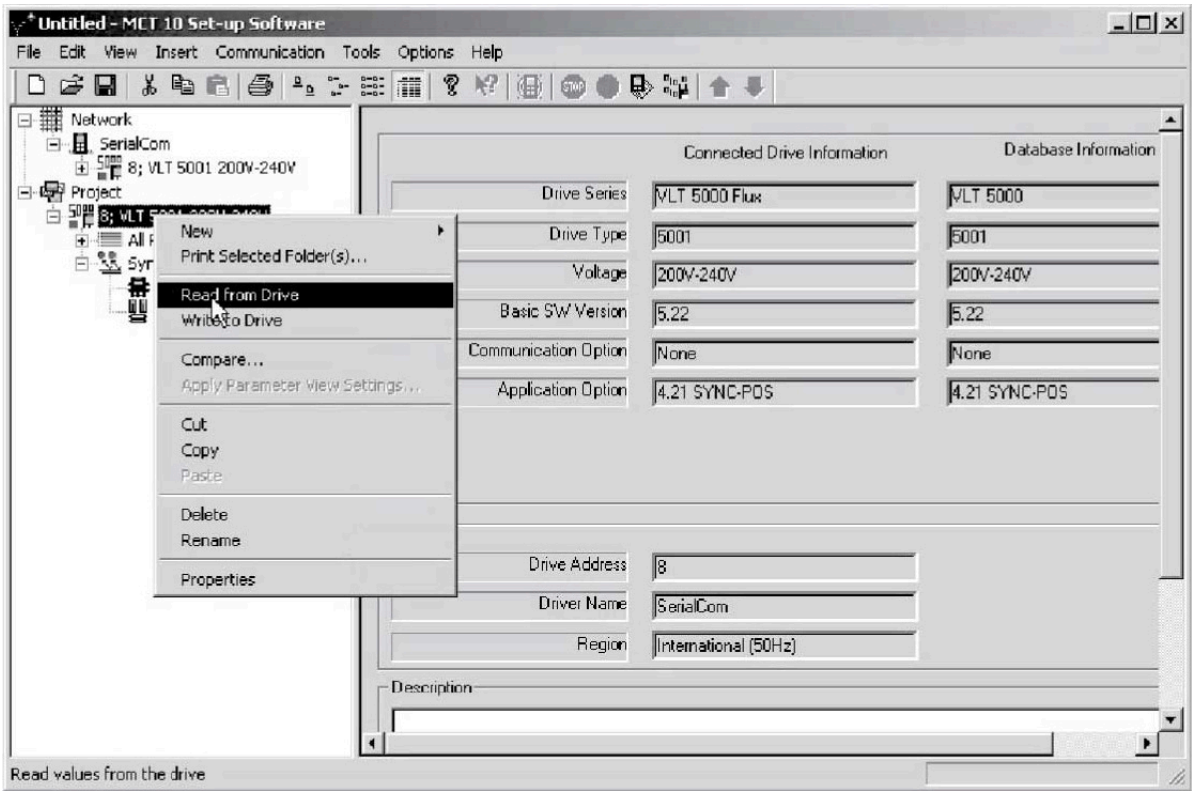


Figure 269: Write to Drive

NOTE: Use this feature with caution. If incorrectly used, files on the drive can be permanently lost. The following warning appears, explaining that files of the same name are overwritten:

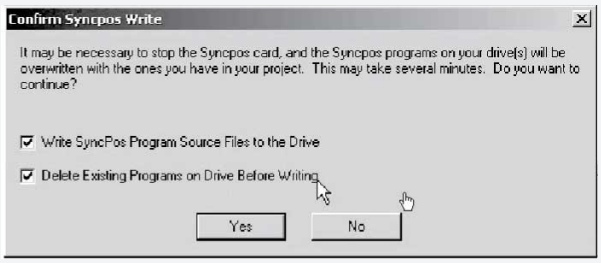


Figure 270: Warning Files Overwritten

3. Select the required settings.
4. Select *Yes* to start writing.

For the preceding settings, the existing programs are deleted. Then the SyncPos program source files are written to the drive. Once the write is complete, check the contents of the Network folder to confirm that the write to drive was successful.

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12 Security Administration Tool

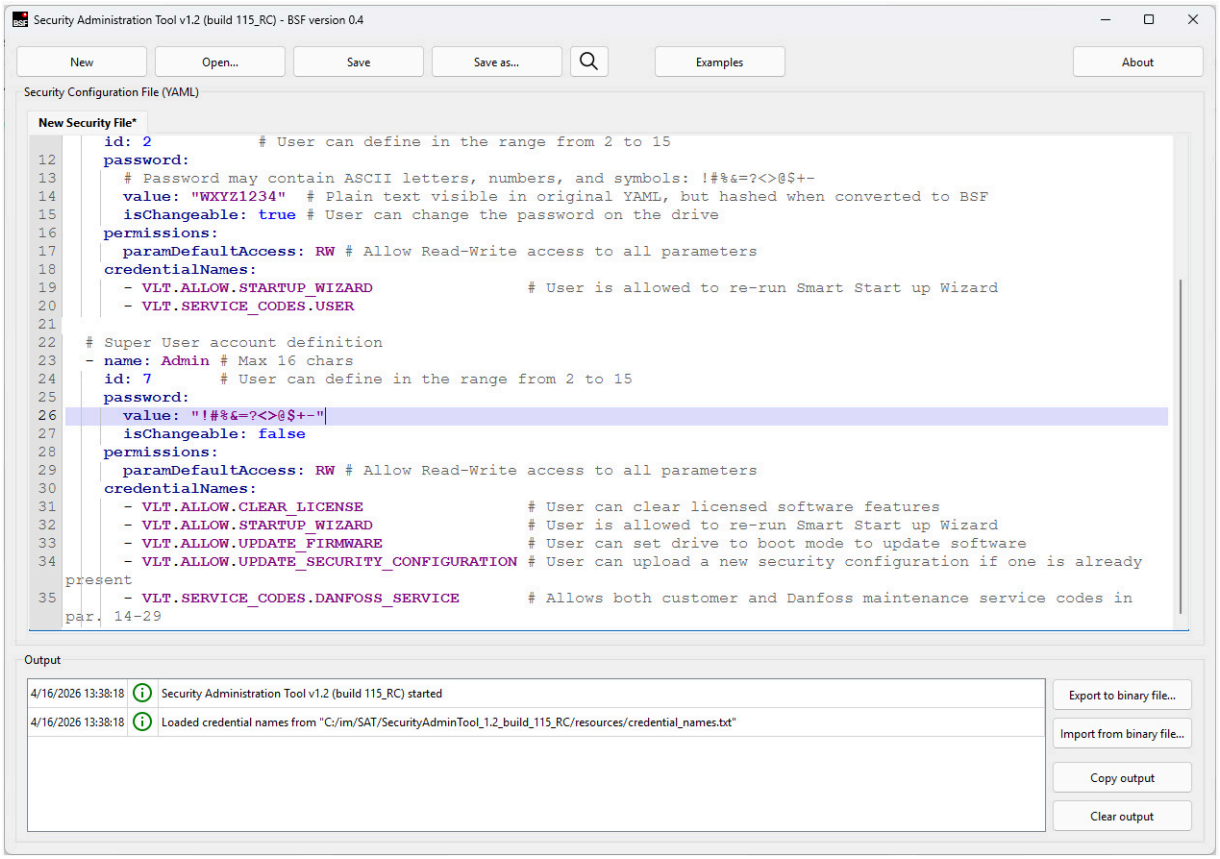
12.1 Getting Started

12.1.1 Overview of the Tool

The Security Administration Tool (SAT) is a desktop application for authoring, validating, and exporting security configuration files used by Danfoss drives. Configurations are written in YAML and exported to a binary format (.bsf) for deployment in the drive.

The tool does the following:

- Exports YAML security configurations in a syntax-highlighting editor.
- Validates account definitions, passwords, permissions, and credentials.
- Exports the validated YAML to a binary security file (.bsf).
- Opens reference example files shipped with the application.



e30bo102.10

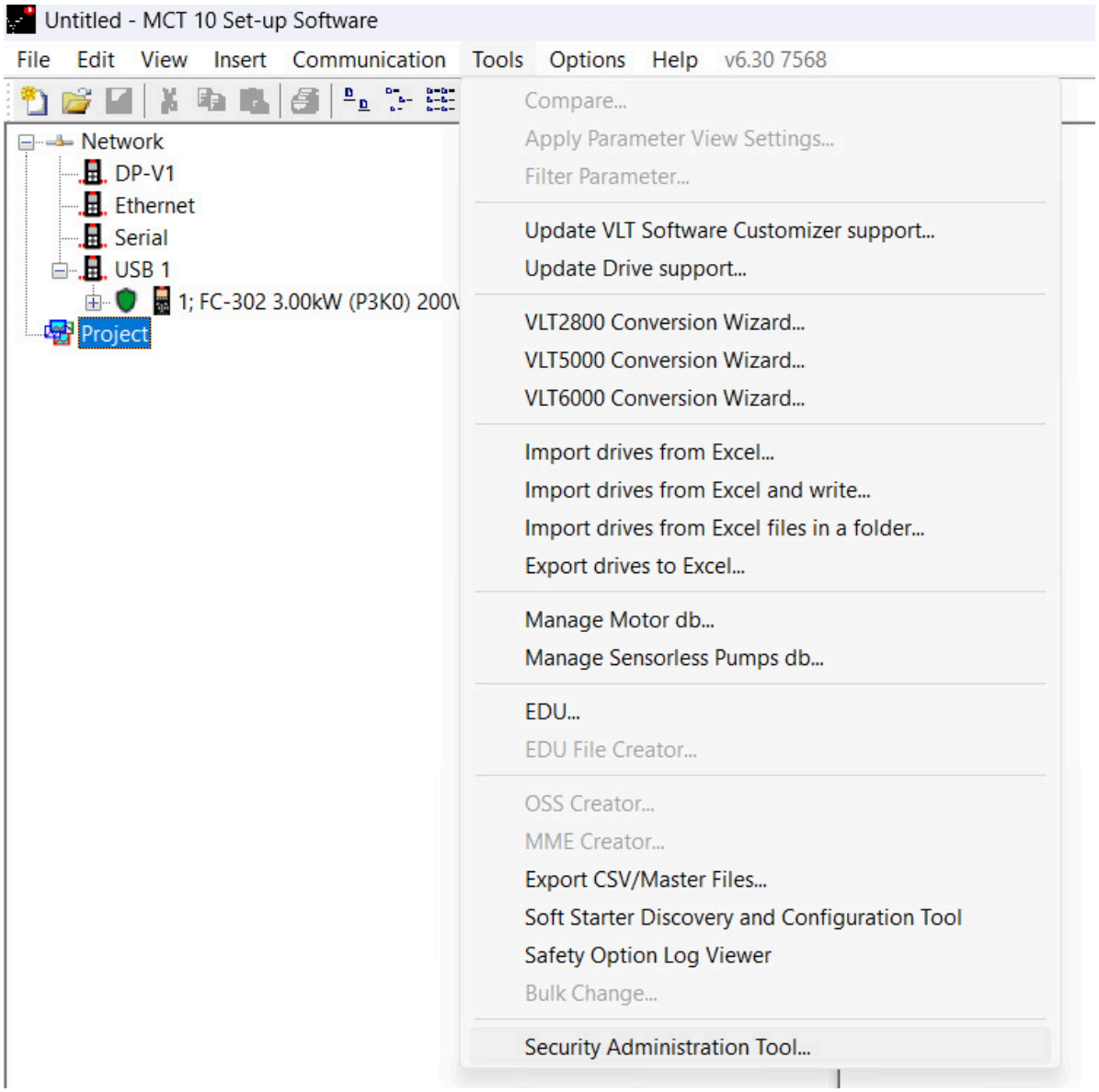
Figure 271: Main Window

NOTE: For more detailed security information, refer to Cybersecurity for Danfoss Drives User Guide.

12.1.2 Performing a Quick Start

Follow this procedure to quickly move from an empty editor to a working binary security file:

1. In the MCT 10 tool, right-click *Project* > *Security Administration Tool*.



130bo178.10

2. Press [Ctrl]+[E] to browse built-in examples.

   Alternatively, press [Ctrl]+[N] to get an empty document and then start from scratch. When starting with an empty document, steps 3 and 4 can be skipped.

3. Press [Ctrl]+[A] to copy the selected example.
4. Click the *New Security File* text panel and press [Ctrl]+[V] to paste the example in the new file.
5. Click either *Save* or *Save as...*, or press [Ctrl]+[S], to name the new file.
6. Edit the YAML directly in the editor. Syntax is highlighted during typing.
7. Save the YAML by pressing [Ctrl]+[S].
8. Press [Ctrl]+[B] to export to the binary format.

   Validation runs automatically before the .bsf file is written. Any errors are shown in the output panel.

The simplest practical configuration, named *simple_example_2* in the *Examples* browser, defines 1 unauthenticated and 2 authenticated accounts.

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```yaml
accounts:
  - name: Anonymous# Mandatory unauthenticated account common for all channels
    id: 1# Fixed
    permissions:
      paramDefaultAccess: R# R = Read-Only

# ═══════════════════════════════ END OF UNAUTHENTICATED ACCOUNTS ═══════════════════════════════

  # (Human) Operator account definition
  - name: Operator# Max 16 chars
    id: 2# User can define in the range from 2 to 15
    password:
      # Password may contain ASCII letters, numbers, and symbols: !#%&=?<>@$+-
      value: "WXYZ1234"# Plain text visible in original YAML, but hashed when converted to BSF
      isChangeable: true# User can change the password on the drive
    permissions:
      paramDefaultAccess: RW# Allow Read-Write access to all parameters
    credentialNames:
      - VLT.ALLOW.STARTUP_WIZARD# User is allowed to re-run Smart Start up Wizard
      - VLT.SERVICE_CODES.USER

  # Super User account definition
  - name: Admin# Max 16 chars
    id: 7# User can define in the range from 2 to 15
    password:
      value: "abc9112XYZ"
      isChangeable: false
    permissions:
      paramDefaultAccess: RW# Allow Read-Write access to all parameters
    credentialNames:
      - VLT.ALLOW.CLEAR_LICENSE# User can clear licensed software features
      - VLT.ALLOW.STARTUP_WIZARD# User is allowed to re-run Smart Start up Wizard
      - VLT.ALLOW.UPDATE_FIRMWARE# User can set drive to boot mode to update software
      - VLT.ALLOW.UPDATE_SECURITY_CONFIGURATION# User can upload a new security configuration if one is already present
      - VLT.SERVICE_CODES.DANFOSS_SERVICE# Allows both customer and Danfoss maintenance service codes in par. 14-29
```

e30bo122.10

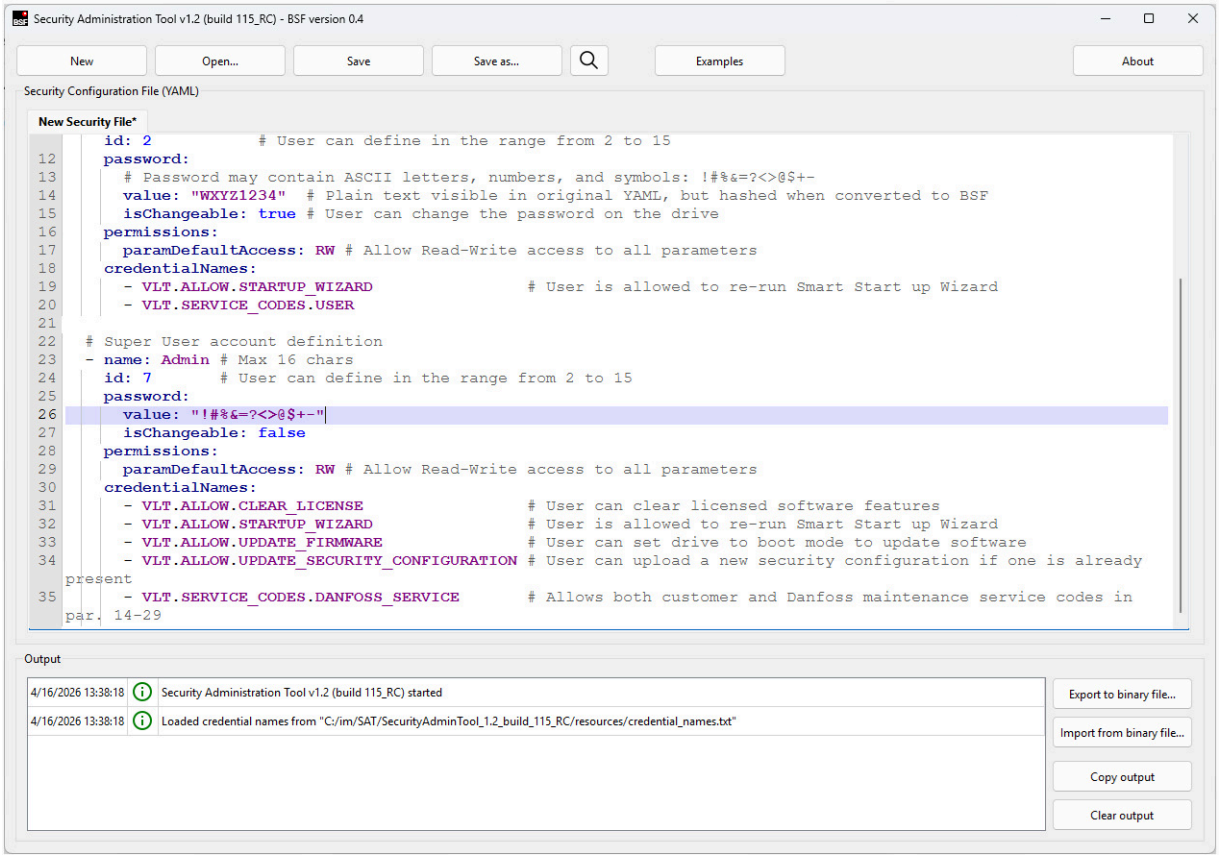
Figure 272: Example

12.2 User Interface

12.2.1 Main Window

The main window has 4 functional areas that are all visible at the same time:

- Toolbar - file and export actions (at the top)
- YAML editor - central, syntax-highlighted editing area
- Output panel - validation and export messages (at the bottom)
- Status bar - current file path and cursor position



e30bo102.10

Figure 273: Main Window

12.2.2 Toolbar Buttons



e30bo104.10

Figure 274: Toolbar as Shown in the Main Window

Table 27: Keyboard Shortcuts

Button	Shortcut	Action
New	[Ctrl]+[N]	Start a new, empty document.
Open...	[Ctrl]+[O]	Open an existing YAML file.
Save	[Ctrl]+[S]	Save the current file.
Save as...	[Ctrl]+[Shift]+[S]	Save under a different name/location.
Examples	[Ctrl]+[E]	Open the *Examples* browser dialog.
Export to binary...	[Ctrl]+[B]	Validate the YAML and write the binary .bsf file.
Copy output	[Ctrl]+[Shift]+[C]	Copy the output panel contents to the clipboard.
Clear output	[Ctrl]+[X]	Clear the output panel.
About	[F1]	Open the *About* dialog.

12.2.3 YAML Editor

The central editor is a full YAML text editor with syntax highlighting tailored to security-configuration files.

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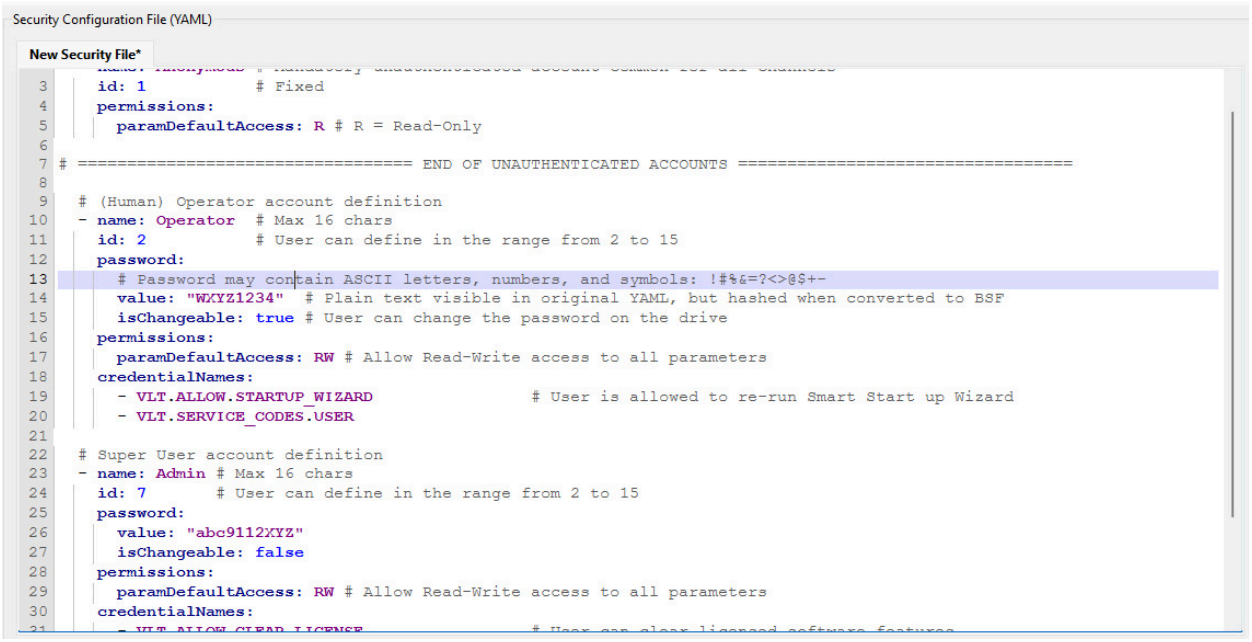


e30bo105.10

Figure 275: Overview of the Editor

Syntax colors (WYSIWYG)

The colors used by the editor are the same in all YAML examples throughout the manual.

```yaml
- name: Operator
  id: 12
  password:
    value: "5556777"
    isChangeable: true
  permissions:
    paramDefaultAccess: RW
    paramRanges:
      - 90 ... 199: R
      - 800 ... 899: R
    singleParams:
      - 34: R
      - 50: R
  credentialNames:
    - VLT.SERVICE_CODES.USER
```

e30bo123.10

Figure 276: Syntax Colors

Table 28: Explanation of Syntax Colors

Token	Appearance
Keys (field names)	*paramDefaultAccess:* (dark blue color)
String/identifier values	*Operator* (purple color)
Numbers	*12* (light blue color)
Comments	*# a comment* (green color)

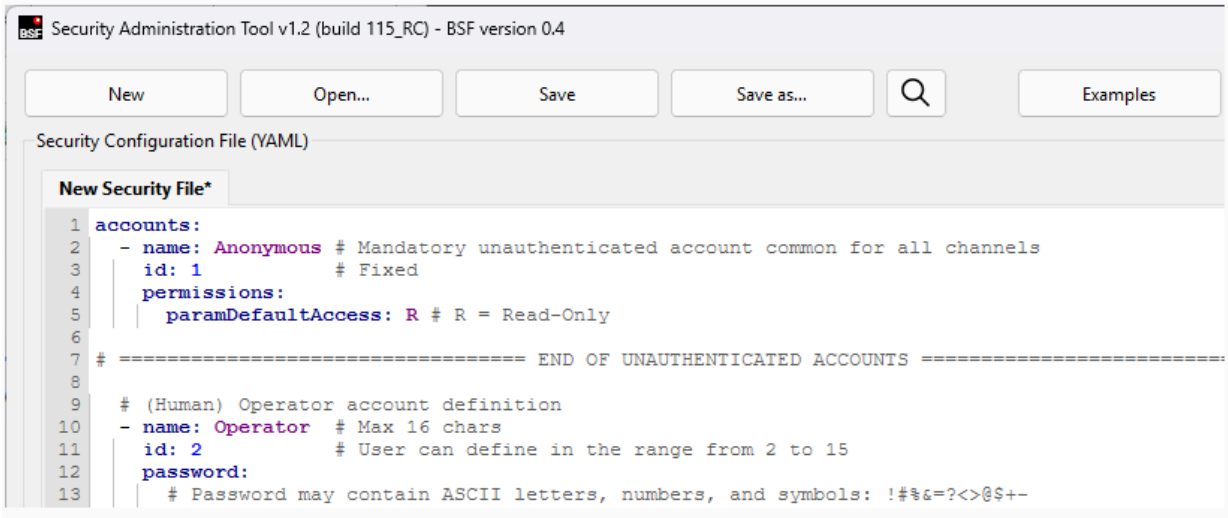
Editor features

- Line numbers in the gutter.
- Current-line highlighting.
- Automatic indentation (YAML is indentation-sensitive).
- Undo/Redo with [Ctrl]+[Z]/[Ctrl]+[Y].
- Find with [Ctrl]+[F].

12.2.4 Editor Zoom

The editor font size can be increased or decreased at any time:

- Hold [Ctrl] and scroll the mouse wheel, or
- Use [Ctrl]+[+] and [Ctrl]+[-], or
- Reset to the default with [Ctrl]+[0].



e30bo106.10

Figure 277: Smallest Zoom

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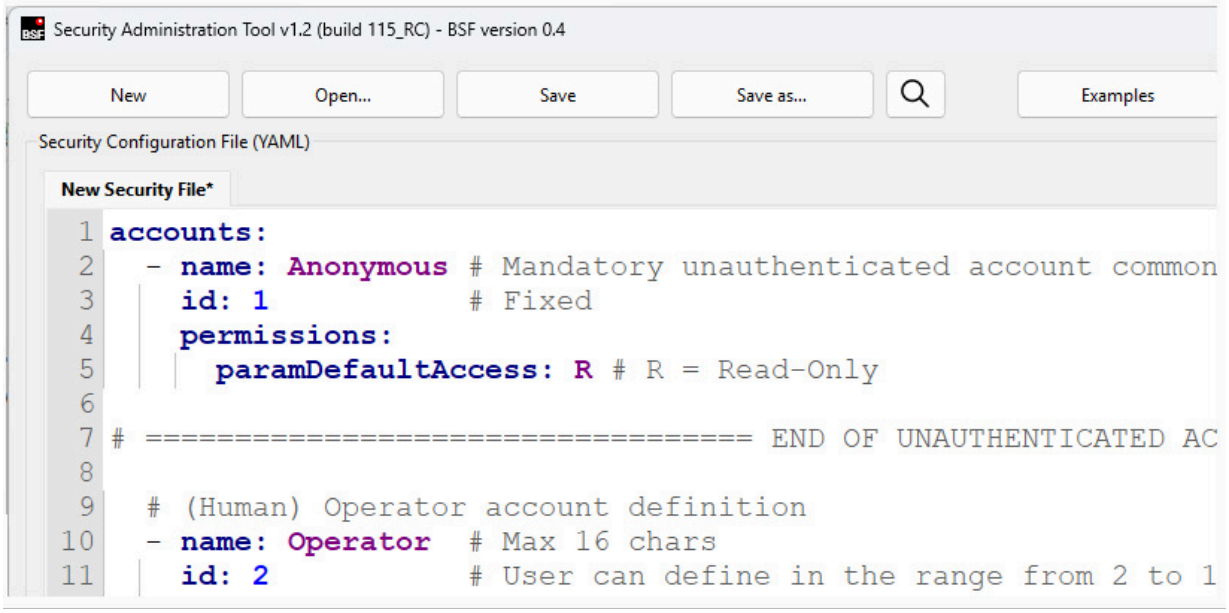


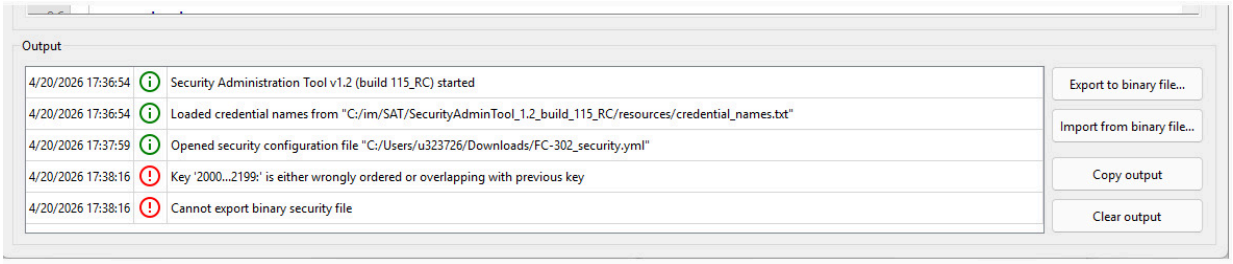
e30bo107.10

Figure 278: Comparison Zoom

12.2.5 Output Panel

The Security Administration Tool uses the output panel at the bottom of the main window to report the following:

- Validation results (success confirmation or errors with line numbers).
- Status messages when loading, saving, or exporting files.
- A dump of account/password hash information after a successful export.



e30bo108.10

Figure 279: The Output Panel

The output panel is read-only. To copy its content, press [Ctrl]+[Shift]+[C]. To clear the content, press [Ctrl]+[X].

12.2.6 About Dialog

Press [F1] or click *About* in the toolbar to see the tool version, build information, and links to the license and third-party license files.

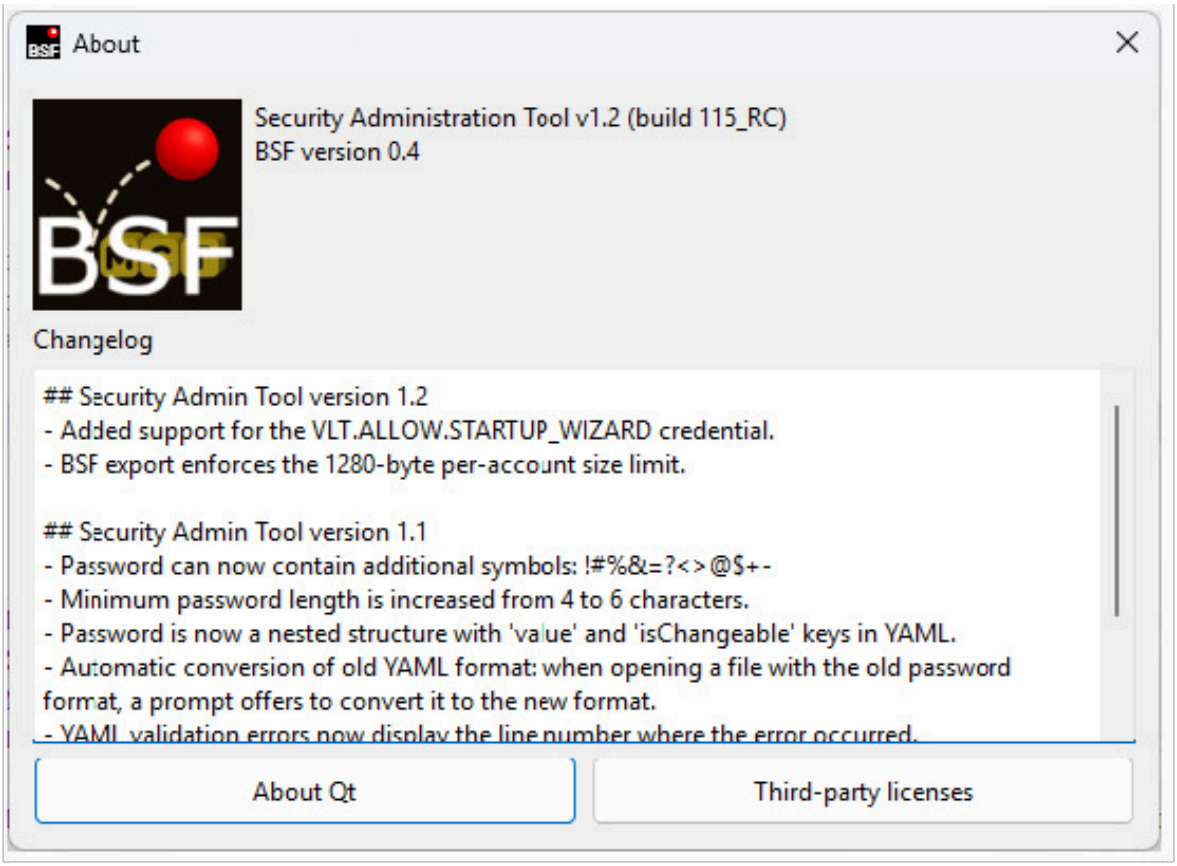


Figure 280: The About Dialog

12.3 Configuration File

12.3.1 YAML Format Overview

Keep the configuration as simple as possible:

- Instead of starting from scratch, use 1 of the included examples and adapt it.
- Only define the number of accounts needed. Extra accounts mean more password management.
- Select a *paramDefaultAccess* (R, RW, or NA) that already matches most parameters.
- If the same rule applies to several consecutive parameters, use *paramRanges* instead of long lists of *singleParams*.
- Merge adjacent ranges, for example, replace 100...199: R + 200...299: R with 100...299: R.
- If creating a new account and another account has the exact needed permissions, use *VLT.USER.COPY_ACCESSRIGHTS_FROM.<Account>* instead of duplicating the rules.
- Write as few rules as possible to reduce maintenance and risk of misconfiguration.

A security configuration is a single YAML document. It has 1 top-level key:

Table 29: Security Configuration

Field	Type	Cardinality	Description
accounts	list of Account	mandatory, 1	Add accounts defined in this configuration. The list must start with the *Anonymous* account.

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```
accounts:
  - name: Anonymous# Mandatory unauthenticated account common for all channels
    id: 1# Fixed
    permissions:
      paramDefaultAccess: R# R = Read-Only

# ================================ END OF UNAUTHENTICATED ACCOUNTS ================================

  # (Human) Operator account definition
  - name: Operator# Max 16 chars
    id: 2# User can define in the range from 2 to 15
    password:
      # Password may contain ASCII letters, numbers, and symbols: !#%&=?<>@$+-
      value: "WXYZ1234"# Plain text visible in original YAML, but hashed when converted to BSF
      isChangeable: true# User can change the password on the drive
    permissions:
      paramDefaultAccess: RW# Allow Read-Write access to all parameters
    credentialNames:
      - VLT.ALLOW.STARTUP_WIZARD# User is allowed to re-run Smart Start up Wizard
      - VLT.SERVICE_CODES.USER

  # Super User account definition
  - name: Admin# Max 16 chars
    id: 7# User can define in the range from 2 to 15
    password:
      value: "abc9112XYZ"
      isChangeable: false
    permissions:
      paramDefaultAccess: RW# Allow Read-Write access to all parameters
    credentialNames:
      - VLT.ALLOW.CLEAR_LICENSE# User can clear licensed software features
      - VLT.ALLOW.STARTUP_WIZARD# User is allowed to re-run Smart Start up Wizard
      - VLT.ALLOW.UPDATE_FIRMWARE# User can set drive to boot mode to update software
      - VLT.ALLOW.UPDATE_SECURITY_CONFIGURATION# User can upload a new security configuration if one is already present
      - VLT.SERVICE_CODES.DANFOSS_SERVICE# Allows both customer and Danfoss maintenance service codes in par. 14-29
```



Figure 281: Example of 1 Unauthenticated and 2 Authenticated Accounts

Table 30: Account, Top-level Fields

Field	Type	Cardinality	Description
name	string	mandatory, 1	Account name. Maximum 16 ASCII characters; no whitespace or control characters. Must be unique.
id	integer 1–15	mandatory, 1	Account ID. Must be unique. Id 1 is reserved for *Anonymous*.
password	Password block	conditional, 0–1	Required for authenticated accounts. Do not define any password for *Anonymous* accounts.
permissions	Permissions block	conditional, 0–1	Defines parameter access. Required unless the account uses *VLT.USER.COPY_ACCESSRIGHT_FROM.<other>*.
credentialNames	list of string	optional, 0–1	Capabilities granted to the account. See 12.3.4 Credentials.

NOTE: Comments start with # and may appear on their own line or at the end of a line. The tool ignores comments.

12.3.2 Accounts

Every account has a *name* and an *id*. The configuration must define the *Anonymous* account first; all other accounts are optional.

Reserved anonymous accounts

The tool recognizes 5 *Anonymous* account names. The name selects the channel that the account applies to. Select a unique id in the range of 1–15. The account *Anonymous* always uses id 1.

Table 31: Overview of the Reserved Anonymous Accounts

Field	Type	Cardinality	Description
Anonymous	Account	mandatory, 1	Default rules when no channel-specific anonymous account applies. Must use *id:1*.
Anonymous_RS485	Account	optional, 0–1	Applies to the FC (RS-485) port.
Anonymous_USB	Account	optional, 0–1	Applies to the USB port.
Anonymous_LCP	Account	optional, 0–1	Applies to the LCP port.
Anonymous_Eth	Account	optional, 0–1	Applies to the Transparent Socket Channel (Ethernet).

Rules:

- The Anonymous account must be the 1st account and must use *id:1*.
- Anonymous accounts must not require a password.
- Anonymous accounts must not use *VLT.USER.COPY_ACCEPTRIGHTS_FROM.**.

Example: An Anonymous account with custom per-channel overrides:

```
- name: Anonymous_RS485
  id: 2
  permissions:
    paramDefaultAccess: NA
    singleParams:
      - 2: R
```

e30bo127.10

Figure 282: Example of an Anonymous Account with Custom Per-channel Overrides

Authenticated account

Any account not being 1 of the 5 anonymous accounts is an authenticated account. All authenticated accounts must have a password. The same fields as for the Anonymous accounts apply to the authenticated accounts.

Table 32: Overview of Authenticated Accounts

Field	Type	Cardinality	Description
name	string	mandatory, 1	Maximum 16 ASCII characters; no whitespace.
id	integer 2–15	mandatory, 1	Unique within the file.
password	Password block	mandatory, 1	See 12.3.3 Passwords.
permissions	Permissions block	conditional, 0–1	Required unless *credentialNames* contains a *VLT.USER.COPY_ACCESSRIGHTS_FROM.**entry.
credentialNames	list of string	optional, 0–1	See 12.3.4 Credentials.

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```
- name: Operator
  id: 12
  password:
    value: "5556777"
    isChangeable: true
  permissions:
    paramDefaultAccess: RW
    paramRanges:
      - 90 ... 199: R
      - 800 ... 899: R
    singleParams:
      - 34: R
      - 50: R
  credentialNames:
    - VLT.SERVICE_CODES.USER
```

e30bo128.10

Figure 283: Example of an Authenticated Operator Account

Permissions block

The permission blocks define which drive parameters the account may read or write. The access level is always 1 of the following:

Table 33: Types of Access Levels

Field	Type	Cardinality	Description
NA	access level	–	No access.
R	access level	–	Read only.
RW	access level	–	Read/Write.

Table 34: Content of Permission Blocks

Field	Type	Cardinality	Description
paramDefaultAccess	NA | R | RW	mandatory, 1	Fallback access level for every parameter that is not overridden. There is no implicit default. This field must be stated.
paramRanges	list of range → access	optional, 0–1	Overrides for a range of parameter numbers. Entries use the form *<from>...<to>: <access>*.
singleParams	list of parmID → access	optional, 0–1	Overrides for individual parameter numbers. Entries use the form *<paramId>: <aacess>*.

Each *paramRanges* entry and each *singleParams* entry is a 1-line mapping. Any number of them may appear inside their list.

To write as few rules as possible, select a *paramDefaultAccess* that matches most parameters and then only add the overrides that are needed. Prefer *paramRanges* over long *singleParams* lists and merge adjacent ranges having the same access level.

```
permissions:
  paramDefaultAccess: RW
  paramRanges:
    - 90 ... 99: R
    - 4090 ... 4099: R
  singleParams:
    - 34: R
```

e30bo132.10

Figure 284: A Full Permissions Block

Copy permissions from another account

Instead of declaring a permissions block, an account can inherit the permissions of another account by listing the directive *VLT.USER.COPY_ACCESSRIGHTS_FROM.<AccountName>* in its *credentialNames*.

```
- name: BackupOperator
  id: 13
  password:
    value: "911209"
    isChangeable: true
  credentialNames:
    - VLT.SERVICE_CODES.USER
    - VLT.USER.COPY_ACCESSRIGHTS_FROM.Operator
```

e30bo130.10

Figure 285: Example of Copied Permissions

Rules for the copy directive:

- Only 1 *VLT.USER.COPY_ACCESSRIGHTS_FROM.** per account.
- The source account must exist and must define its permissions directly (no chains).
- An account that uses the directive must not define a *permissions* block.
- Anonymous accounts are not to use the directive.

Complete example

```
- name: SecurityAdmin
  id: 7
  password:
    value: "11223344"
    isChangeable: false
  credentialNames:
    - VLT.ALLOW.UPDATE_SECURITY_CONFIGURATION
    - VLT.SERVICE_CODES.USER
  permissions:
    paramDefaultAccess: R
    paramRanges:
      - 1 ... 89: RW
      - 90 ... 99: RW
      - 4090 ... 4099: RW
    singleParams:
      - 34: RW
```

e30bo131.10

Figure 286: A Single Fully Featured Authenticated Account

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12.3.3 Passwords

Table 35: Password Block for Authenticated Accounts

Field	Type	Cardinality	Description
value	string	mandatory, 1	The password has 6–16 characters. Allowed characters are: • ASCII letters • capital letters (note that the tool is case-sensitive) • digits • !#%&=?<>@$+- Stored plain text in YAML, hashed in the BSF.
isChangeable	boolean	mandatory, 1	*true:* the end user is allowed to change the password on the drive via the LCP. *false:* the password is fixed until a new configuration is deployed.

```
password:
  value: "WXYZ1234"
  isChangeable: true
```

e30bo133.10

Figure 287: Password Example

Constraints

- Length: 6–16 characters.
- Allowed characters: ASCII letters, digits, and !#%&=?<>@$+-
- Anonymous accounts are not allowed to have passwords.

NOTE: Passwords are visible in the YAML source. To keep the plaintext YAML files protected:

- Treat the YAML configuration files as sensitive material and distribute only the exported binary (.bsf) file, in which passwords are hashed.

12.3.4 Credentials

A credential is a named capability granted to an account via the *credentialNames* list. The list is optional, but when present, it contains any number of credential names. Credential names are case-sensitive.

Table 36: Overview of credentialNames

Field	Type	Cardinality	Description
credentialNames	list of string	optional, 0–1	Each entry is either 1 of the supported credentials (see Table 37) or a single *VLT.USER.COPY_ACCESSRIGHT_FROM.<Accountname>*directive.

```
credentialNames:
  - VLT.ALLOW.STARTUP_WIZARD
  - VLT.SERVICE_CODES.USER
```

e30bo134.10

Figure 288: Example

Table 37: Supported Credentials

Field	Type	Cardinality	Description
VLT.ALLOW.UPDATE_FIRMWARE	capability	0–1 per account	The account can put the drive into boot mode to update the firmware.
VLT.ALLOW.UPDATE_SECURITY_CONFIGURATION	capability	0–1 per account	The account can upload a new security configuration when 1 is already present.
VLT.ALLOW.CLEAR_LICENSE	capability	0–1 per account	The account can clear licensed software features.
VLT.ALLOW.STARTUP_WIZARD	capability	0–1 per account	The account can rerun the Smart Setup Wizard.
VLT.SERVICE_CODES.TESTING	capability	0–1 per account	Testing the service codes in parameter ***14-29 Service Code***.
VLT.SERVICE_CODES.USER	capability	0–1 per account	Customer/user service codes in parameter ***14-29 Service Code***.
VLT.SERVICE_CODES.DANFOSS_SERVICE	capability	0–1 per account	Both customer and Danfoss service codes in parameter ***14-29 Service Code***.

Copy-access-rights directive

In addition to the capability credentials, the following special directive is recognized:

Table 38: Special Credential Directive

Field	Type	Cardinality	Description
VLT.USER.COPY_ACCESSRIGHTS_FROM.<AccountName>	directive	0–1 per account	Reuse the permissions block of the named account. See 12.3.2 Accounts.

```
- name: Admin
  id: 14
  password:
    value: "100000"
    isChangeable: false
  credentialNames:
    - VLT.ALLOW.CLEAR_LICENSE
    - VLT.ALLOW.STARTUP_WIZARD
    - VLT.ALLOW.UPDATE_FIRMWARE
    - VLT.ALLOW.UPDATE_SECURITY_CONFIGURATION
    - VLT.SERVICE_CODES.DANFOSS_SERVICE
    - VLT.SERVICE_CODES.TESTING
    - VLT.SERVICE_CODES.USER
  permissions:
    paramDefaultAccess: RW
```

e30bo135.10

Figure 289: Example of Admin Account with all Capabilities

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12.4 Operations

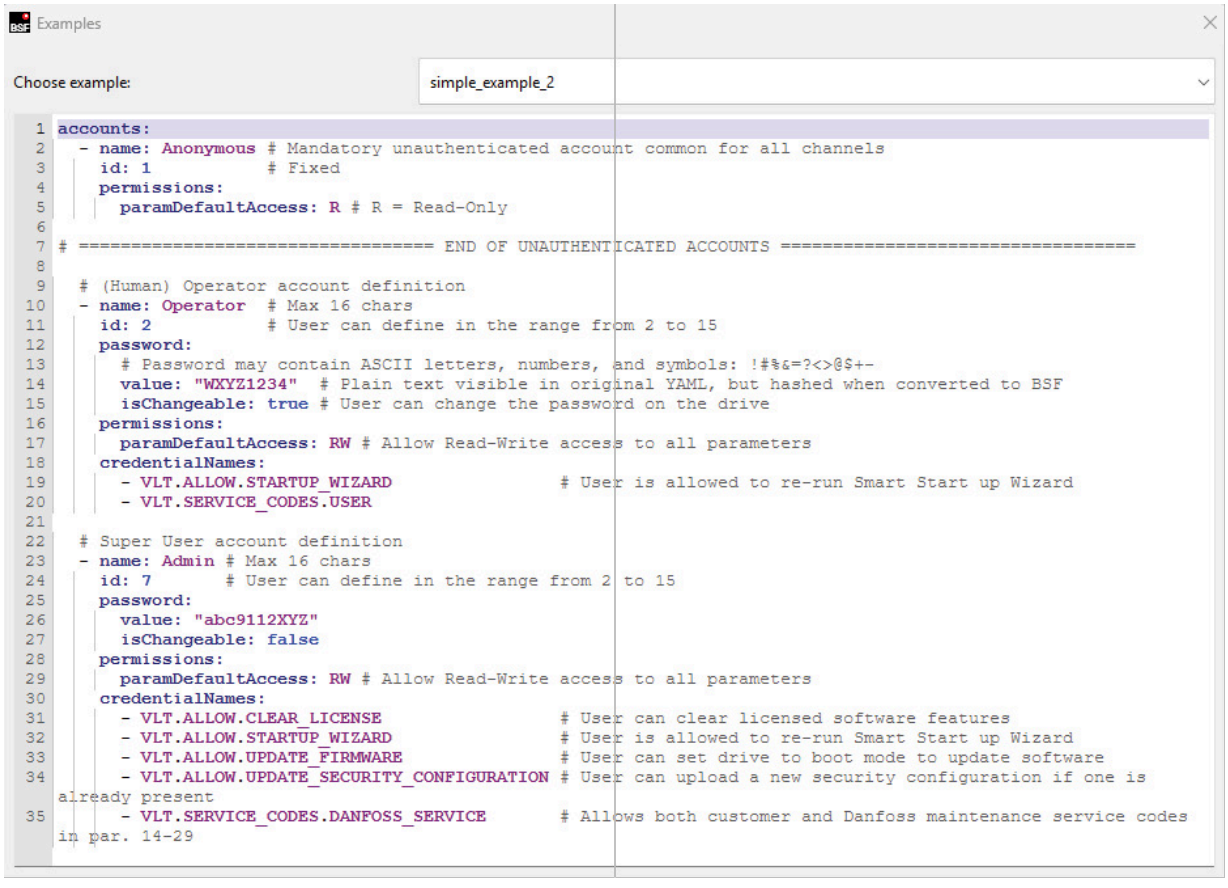
12.4.1 File Operations

New, open, save

- New ([Ctrl]+[N]): empties the editor.
- Open... ([Ctrl]+[O]): opens a YAML file from the disk.
- Save ([Ctrl]+[S]): saves the current file.
- Save as... ([Ctrl]+[Shift]+[S]): saves under a new name.

Examples browser

1. Press [Ctrl]+[E] to open the examples browser.
2. Select any entry.
3. Click *Open* to load the selected example into the editor.



e30bo110.10

Figure 290: Examples Browser

Legacy YAML conversion

Version 1.1 changed the writing of passwords in YAML. If the tool opens a file with the old password format, it prompts to convert the file to the current nested from (*password.value*/*password.isChangeable*).

12.4.2 Text Search

1. Press [Ctrl]+[F] in the editor to search the current document.

   The editor highlights the matches during typing.

2. Press [Enter] to move to the next match, or press [Esc] to close the search bar.

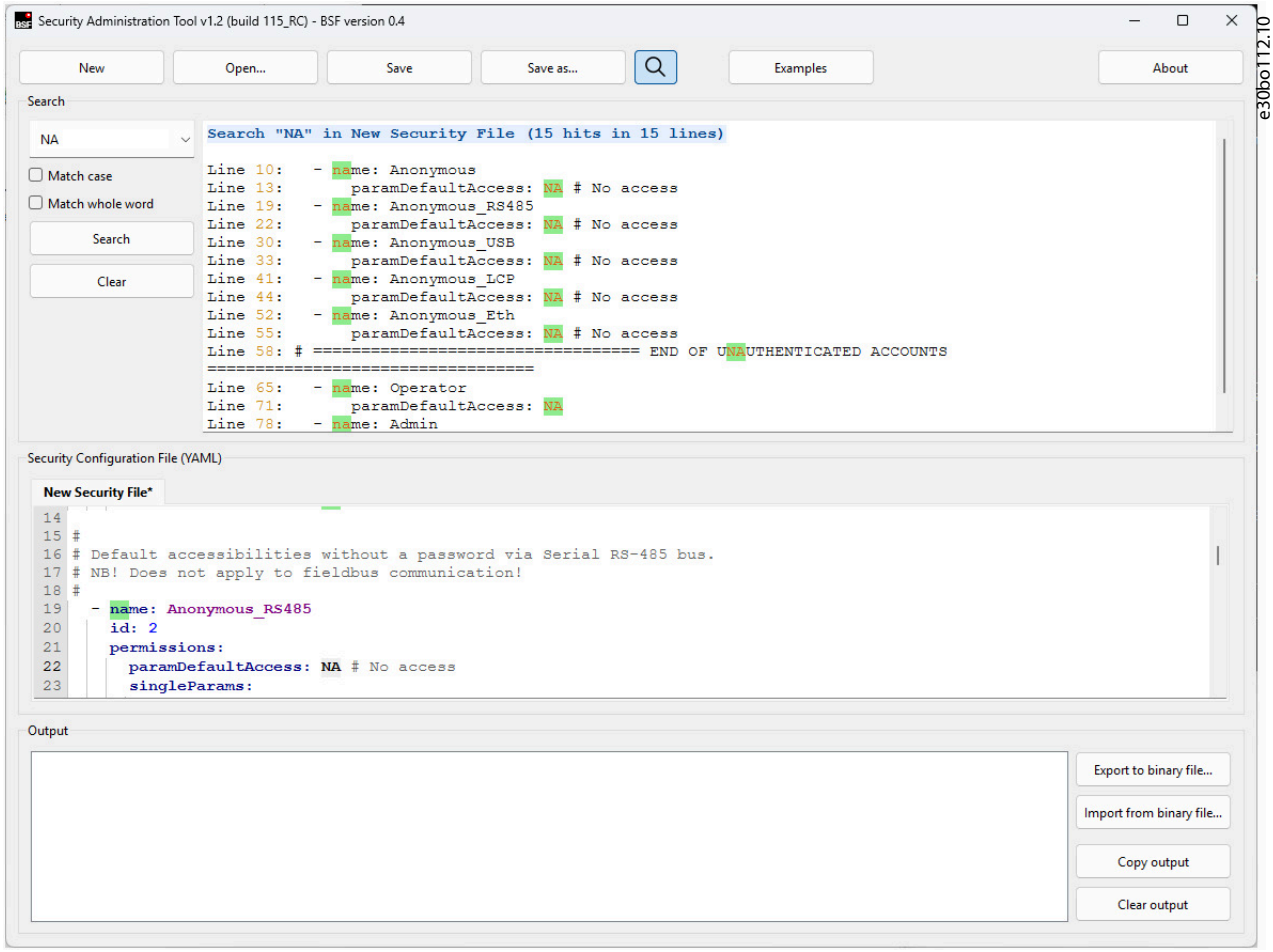


Figure 291: Search View

12.4.3 Validation

Validation runs automatically on every export to binary ([Ctrl]+[B]). Errors are printed in the output panel with the YAML line number where the problem was detected.

The following is checked during validation:

- Presence of an Anonymous account with id 1.
- Assignment of unique IDs and unique names to all accounts.
- All unique IDs are in the range of 1–15, where 1 is used for the anonymous account.
- No password is assigned to the Anonymous account.
- Passwords of 6–16 characters are assigned to all authenticated accounts.
- Access levels are either *NA*, *R*, or *RW*.
- All credential names are recognized (either 1 of the supported credentials or of the form *VLT.USER.COPY_ASSIGNMENTS_FROM.<name>*pointing to an existing account).
- Per-account data remains within the 1280-byte BSF budget.

12.4.4 Binary Format (BSF)

BSF is the binary security file consumed by the drive. It is produced from the YAML source using *Export to binary...* ([Ctrl]+[B]).

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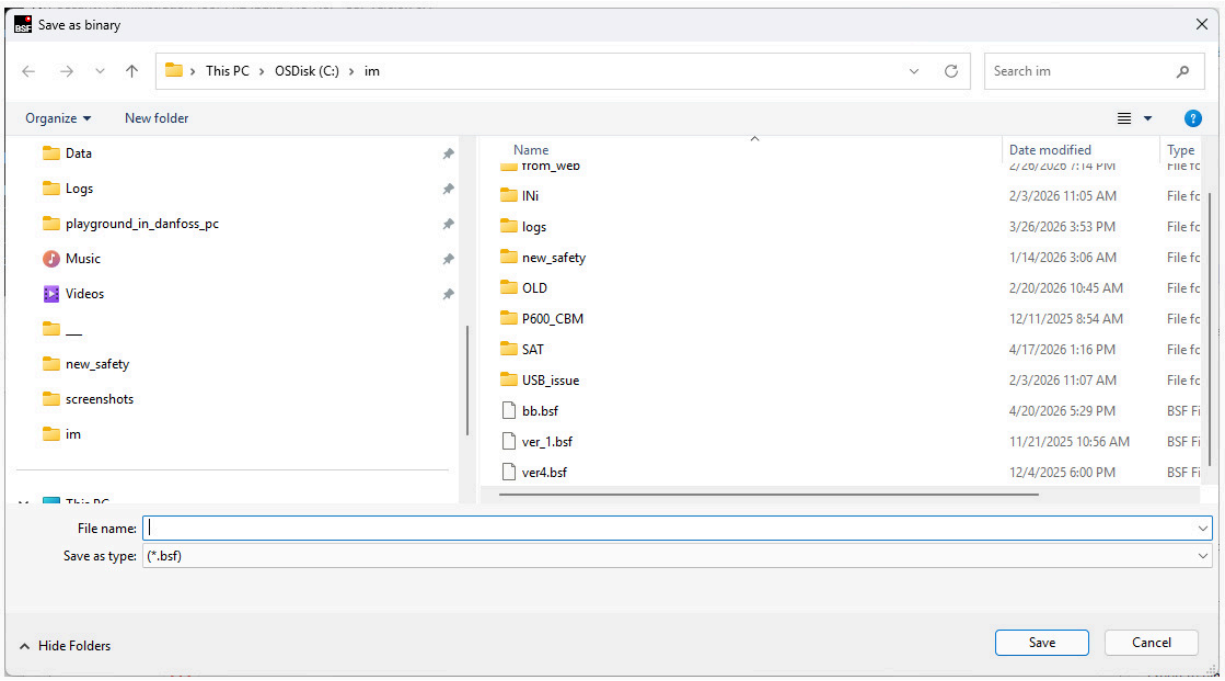


e30bo111.10

Figure 292: Save as Binary Dialog Box

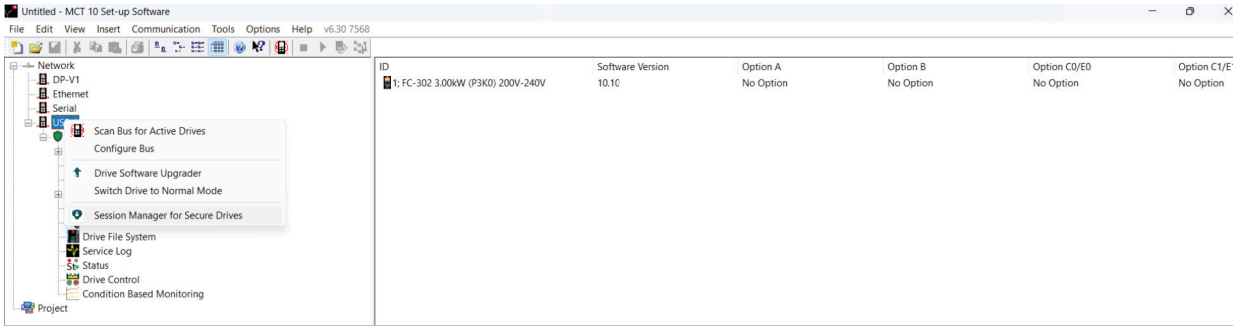
The export does the following:

- Validates the YAML (see 12.4.3 Validation).
- For each authenticated account, derives a salted HKDF-SHA256 key from the password. The plaintext password is never written to the BSF.
- Serializes account data, permissions, and credential flags into the binary layout that the drive expects.
- Enforces a per-account size limit of 1280 bytes.
- Writes a .bsf file next to the YAML (or at a selected path).

Deployment

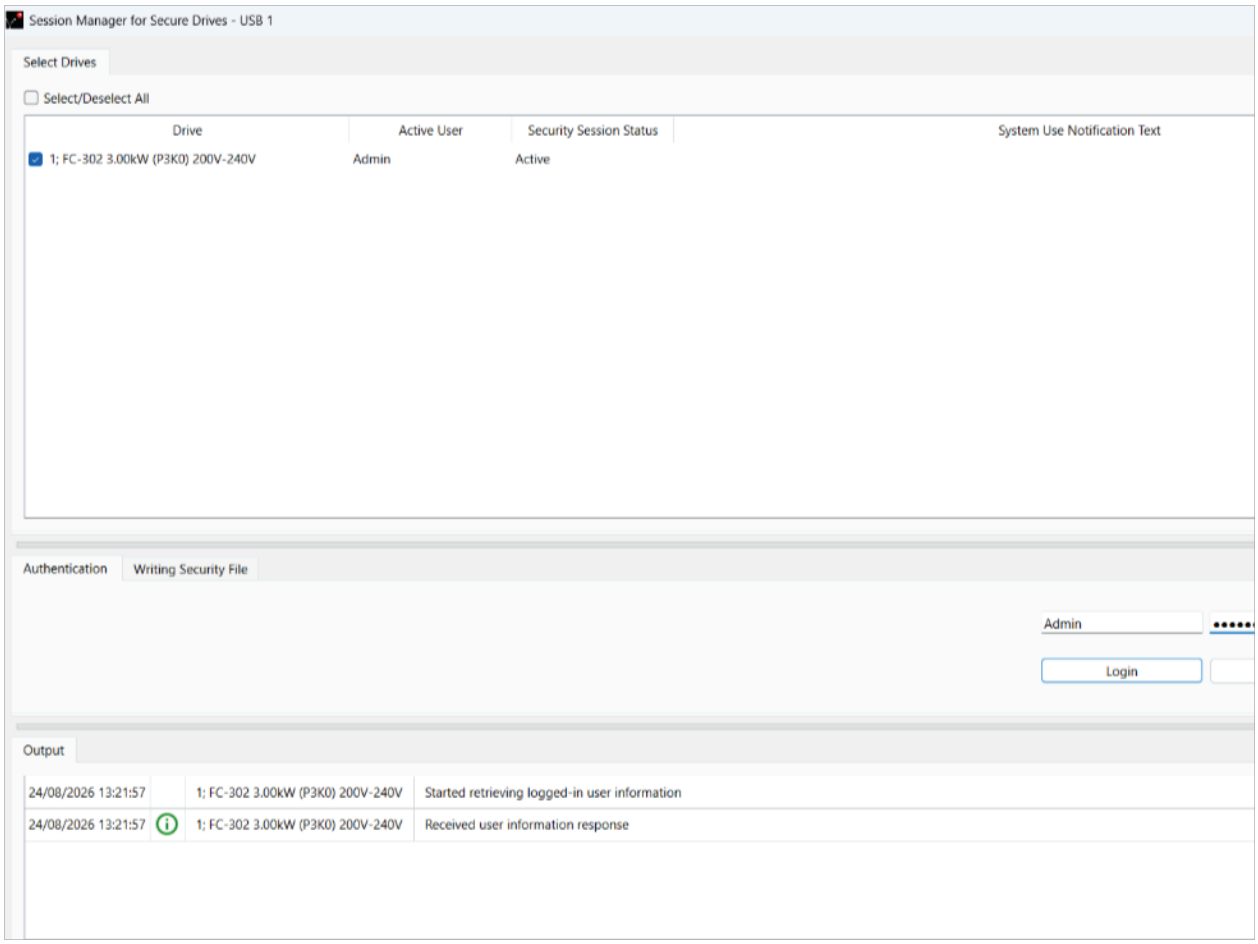
Deploy the .bsf file, not the YAML, to the drive. The YAML is the human-editable source, the .bsf is the on-device artifact.

1. Login to a secured drive via MCT 10.
2. Right-click *USB* and select *Session Manager for Secure Drives*.



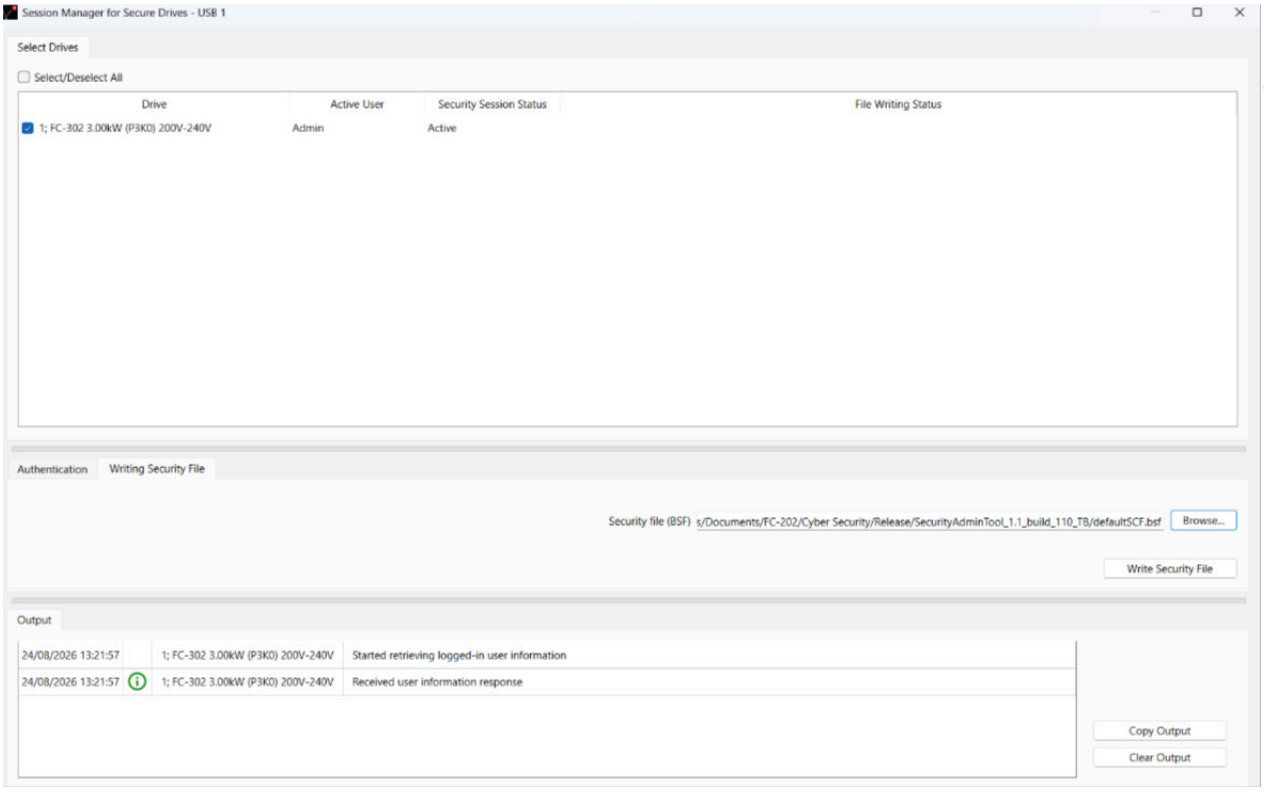
e30bo179.10

3. Enter a role and password and click *Login* (bulk login on multiple drives is possible).



e30bo180.10

4. Browse for the security file and click *Write Security File*.



e30bo181.10

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NOTE: It is possible to do a bulk update.

12.5 Reference

12.5.1 Keyboard Shortcuts

Table 39: Shortcuts

Shortcut	Action
[Ctrl]+[N]	New file.
[Ctrl]+[O]	Open file.
[Ctrl]+[S]	Save
[Ctrl]+[Shift]+[S]	Save as...
[Ctrl]+[E]	Open Examples browser.
[Ctrl]+[B]	Export to binary (BSF).
[Ctrl]+[F]	Find in editor.
[Ctrl]+[Z]	Undo
[Ctrl]+[Y]	Redo
[Ctrl]+[Shift]+[C]	Copy output panel contents.
[Ctrl]+[X]	Clear output panel.
[Ctrl]+[+]/[Ctrl]+[-]	Zoom editor in/out.
[Ctrl]+mouse wheel	Zoom editor in/out.
[Ctrl]+[0]	Reset editor zoom.
[F1]	About dialog.

12.5.2 Troubleshooting of Security Administration Tool

12.5.2.1 Introduction to Troubleshooting

Every validation error reported by the tool is listed and grouped by category. Each entry shows the exact message produced in the output panel, why it appears, and how to fix it. Placeholders such as <Name> are replaced at runtime by the offending account name or value.

12.5.2.2 Anonymous Account

Account 'Anonymous' Must Always be the First Account

The mandatory *Anonymous* account is missing or is not the 1st entry in the *accounts* list.

Troubleshooting

- Move the *Anonymous* account to the top of the list and make sure that it is defined exactly once.

Anonymous ID Must be 1

The *Anonymous* account uses an id that is different from 1.

Troubleshooting

- Set *id:1* for the *Anonymous* account (this is the only id in the file).

<Name>: Anonymous Accounts Must not have Password

An Anonymous account (*Anonymous*, *Anonymous_LCP*, *Anonymous_RS485*, *Anonymous_USB*, *Anonymous_Eth*) contains a password block.

Troubleshooting

- Remove the password block from the Anonymous account.

12.5.2.3 Account ID

Account '<Name>' ID Must be in the Range of 1 to 15, Inclusive, but it is Currently set to '<N>'

The *id* value is outside the allowed 1–15 range.

Troubleshooting

- Select an id between 1 and 15. 1 is reserved for *Anonymous*. Ids 2–15 are available for all other accounts.

<Name>: Each Account ID Must be Unique

Two or more accounts have the same ID.

Troubleshooting

- Assign a unique ID to each account.

12.5.2.4 Account Name

<Name>: Account Name Length Exceeds Allowed Length: 16

The account name exceeds 16 characters.

Troubleshooting

- Shorten the name to 16 characters or fewer.

<Name>: Account Name Must not Contain Whitespace, Control, or Non-ASCII characters

The name contains a space, tab, control character, or a character outside of plain ASCII.

Troubleshooting

- Use only ASCII letters, digits, and underscores, for example, *BackupOperator* instead of *Backup Operator*.

<Name>: Account Name Already Present

Two accounts share the same name.

Troubleshooting

- Rename 1 of the duplicate accounts.

12.5.2.5 Password

<Name>: Non-Anonymous Accounts Should Have Password

A user-defined (authenticated) account has no password block, or its *password.value* is empty.

Troubleshooting

- Add a password block with a value of 6–16 valid characters and an explicit *isChangeable* flag.

<Name>: Password Should be at Least 6 Characters Long

The password has fewer than 6 characters.

Troubleshooting

- Use a password with at least 6 characters.

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<Name>: Password Length Exceeds 16

The password has more than 16 characters.

Troubleshooting

- Trim the password to 16 characters or fewer.

<Name>: Password may Contain only ASCII Letters, Numbers, and Symbols: !#%&=?<>@$+-

The password contains a disallowed character, for example, a space, or *, ^, ~.

Troubleshooting

- Use only ASCII letters A–Z a–z, digits 0–9, and the symbols !#%&=?<>@$+-.

12.5.2.6 Permissions

<Name>: Must Define Parameter Default Access Permission

The account declares a permissions block without *paramDefaultAccess*.

Troubleshooting

- Explicitly set *paramDefaultAccess* to *NA*, *R*, or *RW*. There is no implicit default.

<Name>: Account that Copies Access Rights from Another Account Must not Define Default Param Access

The account uses *VLT.USER.COPY_ACCESSRIGHTS_FROM.<Other>* and also declares *paramDefaultAccess*.

Troubleshooting

- Remove the permissions block if the account copies its access rights from another account. *paramDefaultAccess*, *paramRanges*, and *singleParams* all come from the source account.

12.5.2.7 Credentials

<Name>: Unsupported Credential Name: '<Credential>'

The listed credential is not a supported credential and is not a valid *VLT.USER.COPY_ACCESSRIGHTS_FROM.<AccountName>*directive.

Troubleshooting

- Check for typing errors (credential names are case-sensitive) and use 1 of the names listed in *Configuration File* > *Credentials*.

12.5.2.8 Copy-Access-Rights Directive

<Anonymous…>: Anonymous Account can not Copy Access Rights from Another Account

An Anonymous account tries to copy its permissions from another account.

Troubleshooting

- Remove the *VLT.USER.COPY_ACCESSRIGHTS_FROM.**directive.

<Name>: Account cannot Copy Access Rights from Multiple Accounts

The account lists more than 1 *VLT.USER.COPY_ACCESSRIGHTS_FROM.** directive.

Troubleshooting

- Keep at most 1 copy-access-rights directive per account.

<Name>: Account that Copies Access Rights from Another Account Must not Define Permissions

The account uses *VLT.USER.COPY_ACCESSRIGHTS_FROM.** but also declares its own permissions block (any of *paramDefaultAccess*, *paramRanges*, *singleParams*).

Troubleshooting

- Delete the permissions block. The permissions of the source account are used as is.

<Name>: Account Must not Copy Access Rights from Itself

The copy-access-rights directive of the account points at its own name.

Troubleshooting

- Point the directive at a different, already-defined account.

<Name>: Account Cannot Copy Access Rights from Undefined Account '<Other>'

The referenced source account does not exist in the file.

Troubleshooting

- Define the source account first, or correct the name in the directive.

<Name>: Account Cannot Copy Access Rights from '<Other>', Chains not Supported

The source account itself copies rights from a 3rd account, that is, a chain of referrals.

Troubleshooting

- Reference a source account that defines its permissions directly, not one that re-uses the permissions of another account.

12.5.2.9 Binary Export (BSF)

Exported Account Exceeds 1280 Bytes

The BSF format reserves 1280 bytes per account. An account with a very large number of *paramRanges* or *singleParams* entries can overflow this budget.

Troubleshooting

- Reduce the number of entries, or merge adjacent ranges, for example, *-100...199: R* and *-200...299: R* with *-200...299: R*.

12.5.2.10 YAML Source Problems

Old File Opens with a Conversion Prompt

The file uses the pre-1.1 flat password format.

Troubleshooting

- Accept the prompt to rewrite it to the current nested format (*password.value*/*password.isChangeable*). The meaning of the file is preserved.

YAML Parse Errors

Messages that begin with something like *"line 12:…"* come directly from the YAML parser. Typical causes are:

- Wrong indentation: YAML is indentation-sensitive. Use spaces only.
- A missing ":" after a key.
- A duplicate key inside the same mapping, for example, 2 id entries for the same account.
- Unquoted special characters in values. Wrap the characters in double quotes.

Troubleshooting

- Jump to the line indicated in the error and correct the YAML structure.

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13 Troubleshooting

13.1 Save Error Dialog

When an error dialog appears on the screen, VLT® Motion Control Tool MCT 10 can save the error to a text file to record the error message for later reference, for example to obtain help from support. Within the error dialog window, select *Save As* to record the error message as a text file with free choice of file name and location.

For example, when scanning the network for drives, an error dialog appears, showing the drives which are not detected.

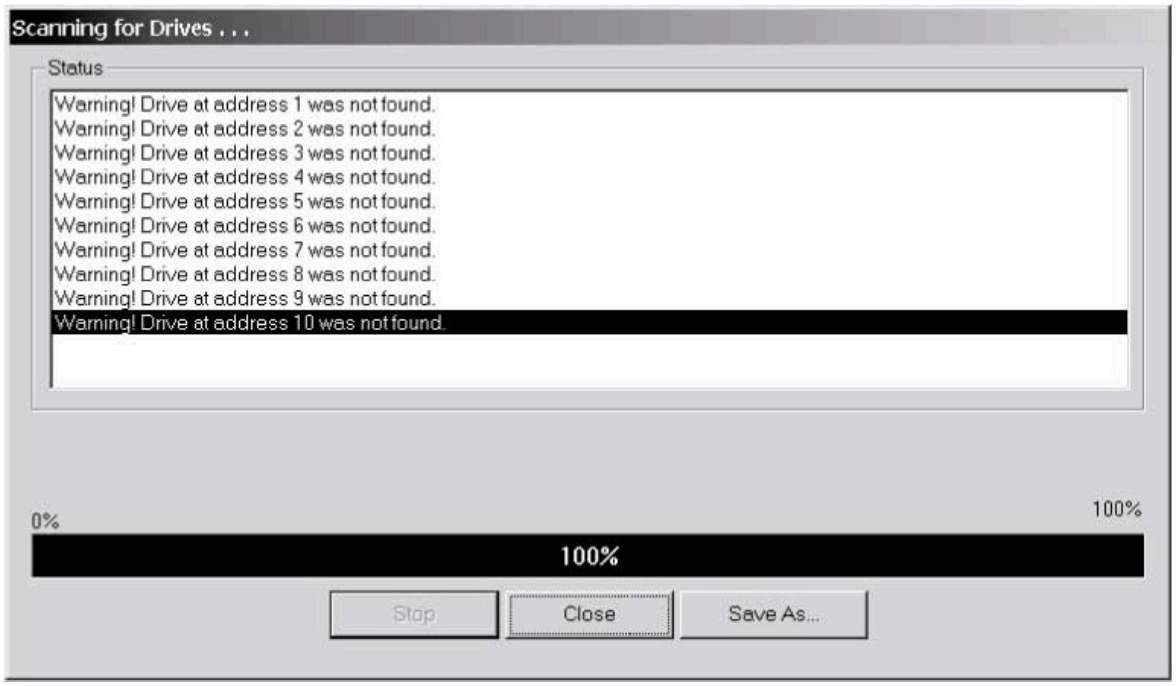

Figure 293: Drives not Detected

To store the error log, select *Save As*.

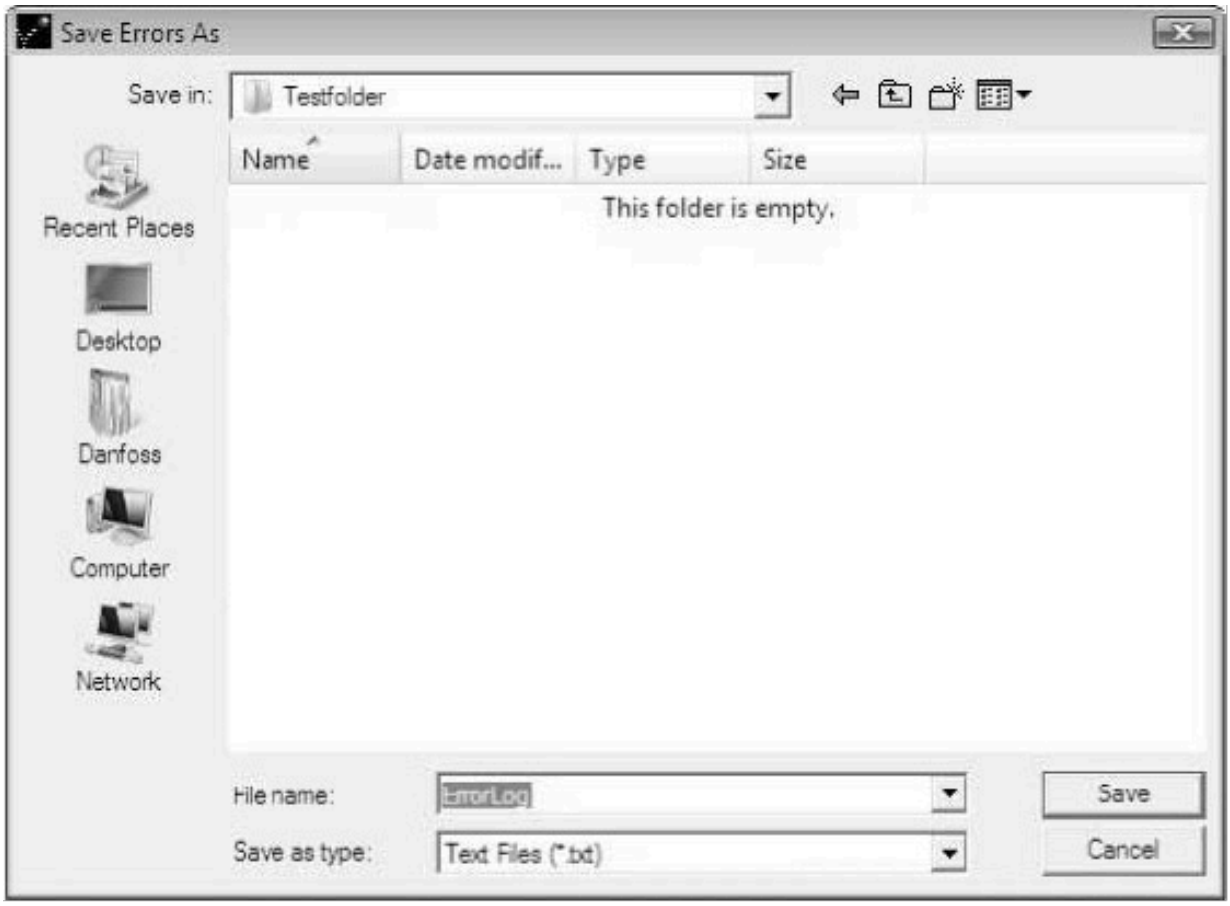

Figure 294: Store Error Log

13.2 Common Problems and Solutions

13.2.1 Changes are not Saved to PC

Check that changes made in the Network folder have been copied to the Project folder and then saved to a hard disk. Changes made in the Network folder are implemented in the field device only and are not automatically saved to a PC.

13.2.2 Error Message While Installing VLT® Motion Control Tool MCT 10

A message such as MCT 10 SET-UP SOFTWARE ERROR OPENING FC DRIVER may occur, if there is another PC program installed using the same COM port of the PC. Such a program could be a PLC programming tool, palm pilot driver, or cellular phone driver. Investigate whether other programs use the same COM port. If so, ensure that the other PC tool does not lock or reserve the COM port.

13.2.3 Error Message Communication Failed

Sporadic communication errors

This type of communication error typically occurs when cables are inadequately shielded, in which case EMC noise can affect the communication. Check that the cables are installed according to the guidelines in the *operating guide* for the drive.

The communication error is permanent

This type of communication error is typically due to an error in network configuration. Check that the network configuration is in accordance with the drive operating guide.

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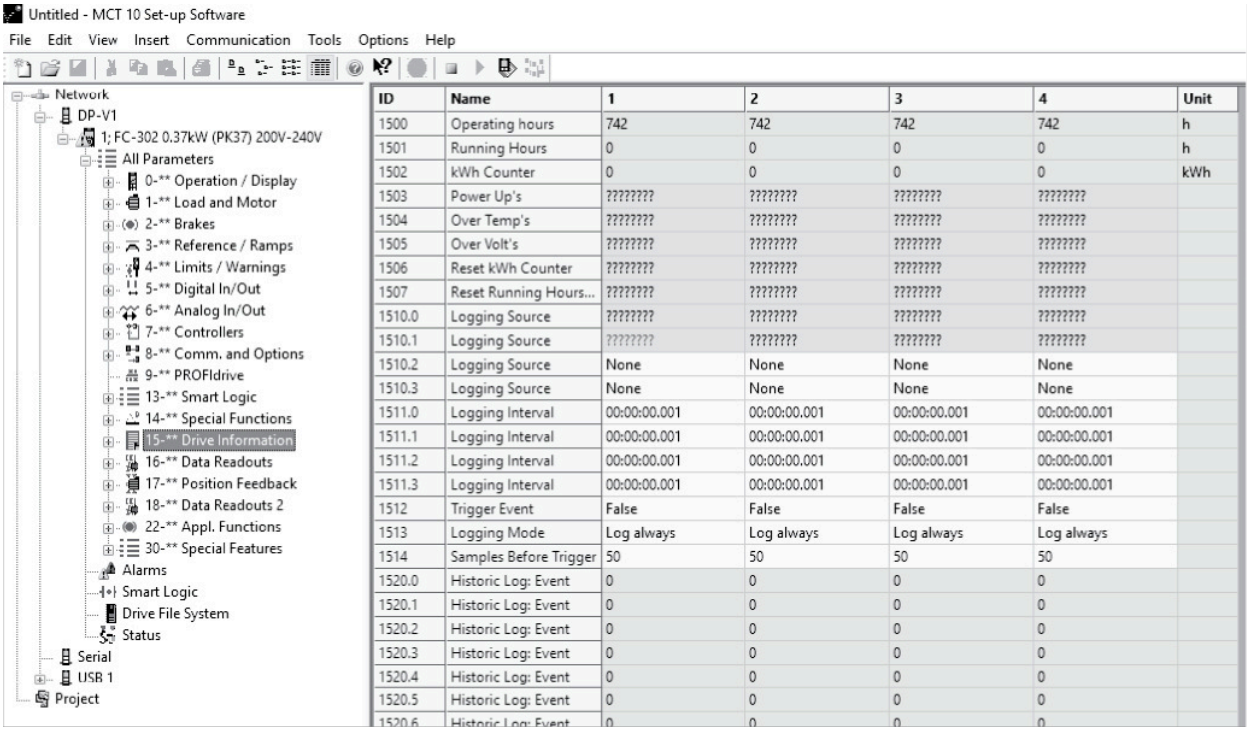
Communication failed

The *Communication failed* error message appears in the status bar.



ID	Name	1	2	3	4	Unit
1500	Operating hours	742	742	742	742	h
1501	Running Hours	0	0	0	0	h
1502	kWh Counter	0	0	0	0	kWh
1503	Power Up's	????????	????????	????????	????????	
1504	Over Temp's	????????	????????	????????	????????	
1505	Over Volt's	????????	????????	????????	????????	
1506	Reset kWh Counter	????????	????????	????????	????????	
1507	Reset Running Hours...	????????	????????	????????	????????	
1510.0	Logging Source	????????	????????	????????	????????	
1510.1	Logging Source	????????	????????	????????	????????	
1510.2	Logging Source	None	None	None	None	
1510.3	Logging Source	None	None	None	None	
1511.0	Logging Interval	00:00:00.001	00:00:00.001	00:00:00.001	00:00:00.001	
1511.1	Logging Interval	00:00:00.001	00:00:00.001	00:00:00.001	00:00:00.001	
1511.2	Logging Interval	00:00:00.001	00:00:00.001	00:00:00.001	00:00:00.001	
1511.3	Logging Interval	00:00:00.001	00:00:00.001	00:00:00.001	00:00:00.001	
1512	Trigger Event	False	False	False	False	
1513	Logging Mode	Log always	Log always	Log always	Log always	
1514	Samples Before Trigger	50	50	50	50	
1520.0	Historic Log: Event	0	0	0	0	
1520.1	Historic Log: Event	0	0	0	0	
1520.2	Historic Log: Event	0	0	0	0	
1520.3	Historic Log: Event	0	0	0	0	
1520.4	Historic Log: Event	0	0	0	0	
1520.5	Historic Log: Event	0	0	0	0	

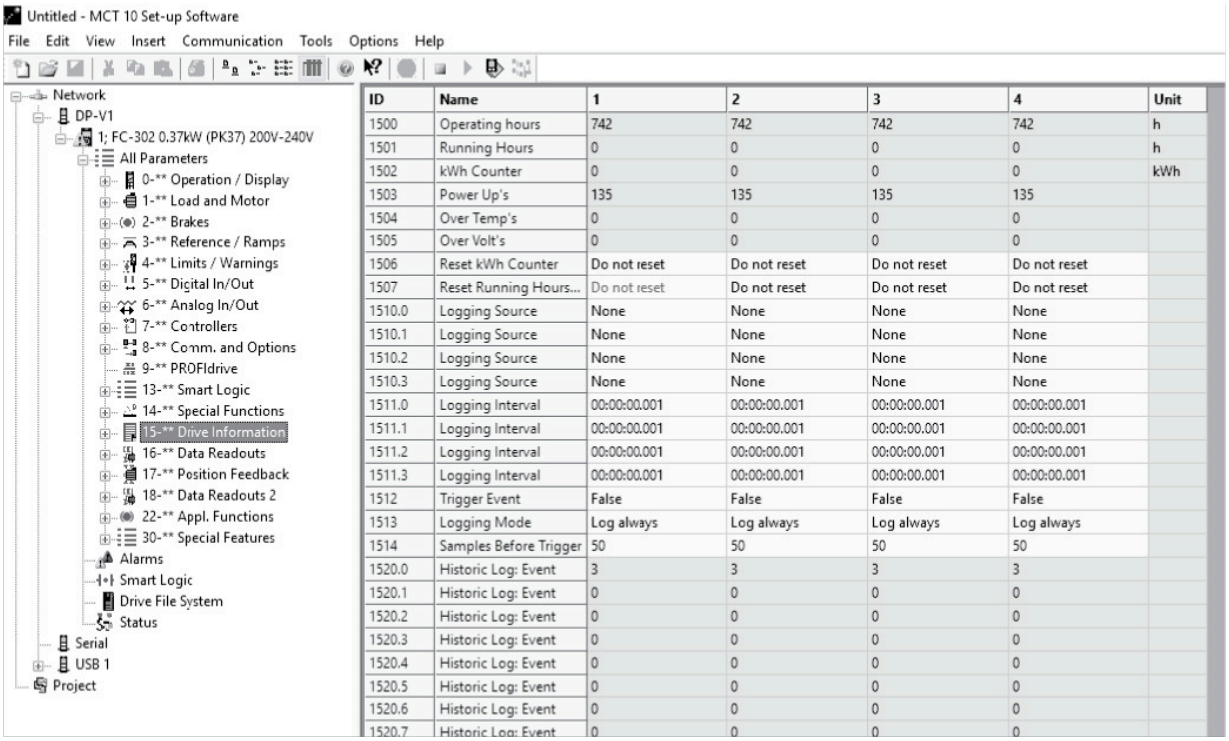
e30bt601.12

Figure 295: Error Message: Communication Failed

13.2.4 Communication Errors

If an erroneous/illegal action has been attempted, an error highlight appears in the status bar at the bottom of the VLT® Motion Control Tool MCT 10 window.

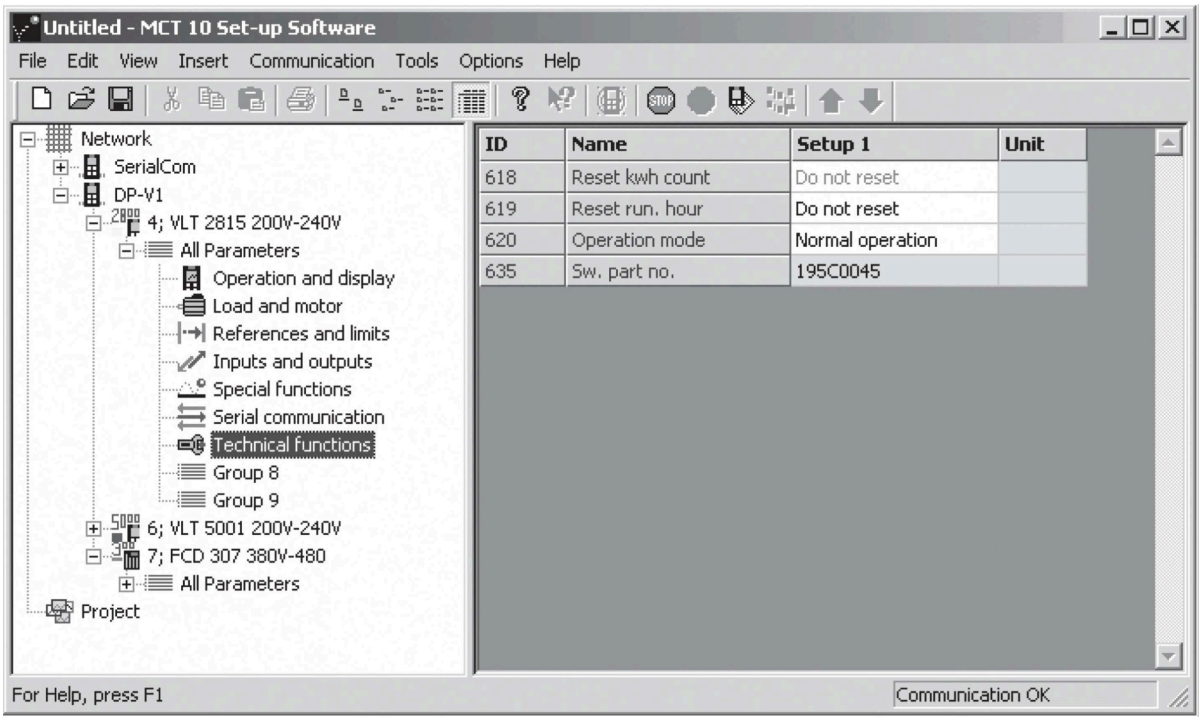
When a communication error occurs, the status bar at the bottom of the MCT 10 window is highlighted and shows a *Communication failed* error message.



e30bt602.12

Figure 296: Error Message: Communication Failed

When no communication error has occurred, the same window appears as:



e30bt603.11

Figure 297: Communication OK

Communication errors typically occur due to inadequate shielding of cables, meaning that the cable is not installed in accordance with the installation instructions.

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13.2.5 Help

Select *Help⇒Help* in the main menu. A help file opens and shows the VLT® Motion Control Tool MCT 10 guide in .pdf format. Acrobat Reader software is required to open the guide. It can be downloaded free of charge at www.adobe.com.

13.3 Safe Plug-in Troubleshooting

13.3.1 Troubleshooting Communication Errors

During commission, the communication between VLT® Motion Control Tool MCT 10 and the drive can fail. Failed communication issues an error message.

Confirm the status of the communication devices and the drive and the status of the drive to guarantee proper communication.

13.3.2 Troubleshooting CRC Errors

CRC errors can occur during the write-to-drive procedure. If a CRC error occurs, try to write to the drive again.

If the CRC errors persist, verify the integrity of the devices and communication.

13.3.3 Warnings and Alarms

NOTE: The errors are listed numerically.

Table 40: LED Indications, Errors 1–67

Error number	Description	LED indicators				
				LED1	LED2	LED4
	Internal failure	Reason	Action			
1	Diagnostic in progress			Status of LED 1 and LED2 depends on safety sub-function state assigned to DI1 and DI2.		Green constant
67	Int Fail tolerance error exceeded: Reaction STO	• Check that data for feedback (PPR, type of feedback, and gear ratio) is entered correctly. • Direction of feedback is wrong. • Due to use of feedback filter the dynamic of the system does not match with dynamic of feedback filter (parameter ***42-15 Feedback Filter***). System is ramping too fast. • Feedback signals are not received at all. • No proper shielding of feedback cables.	• Make a recustomization with correct data if needed. • Set parameter ***42-12 Encoder Direction*** to the opposite value. • Decrease the ramping time on the drive. • Try to run the system at, for example, 60 RPM. If *error 99, Int Fail Feedback error* occurs, this is the reason. • Improve shielding of feedback cables and motor cables.			Red constant

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Table 41: LED Indications, Errors 68–69

Error number	Description	LED indicators				
				LED1	LED2	LED4
	Internal failure	Reason	Action			
68	Int fail Speed limit SS1a Ramp: Reaction STO	• The value of Delta V is too small. For closed-loop system, it must often be larger than the recommended value. • Due to use of feedback filter the dynamic of the system does not match with dynamic of feedback filter (parameter ***42-15 Feedback Filter***). • Load change takes place during ramping.	• If running in closed loop, try to adjust PID setting and if needed increase SS1 ramping time. • Try to increase parameter ***42-15 Feedback Filter***, but this might cause *error 67, Int Fail tolerance error exceeded: Reaction STO* to occur. • Otherwise increase parameter ***42-45 Delta V***.	Status of LED 1 and LED2 depends on safety sub-function state assigned to DI1 and DI2.		Red constant
69	Int fail Speed limit SS1b Ramp: Reaction STO	See 68.	See 68.			Red constant

Table 42: LED Indications, Errors 70–71

Error number	Description	LED indicators				
				LED1	LED2	LED4
	Internal failure	Reason	Action			
70	Int fail speed limit SLSa: Reaction STO	Happens during ramping to SLS limit, see 68. Happens during speed below SLS limit: • If speed is above cut-off speed at activation point and parameter ***42-53 Start Ramp*** is set to ***[0] No***, this error occurs. • Noise on the feedback signal (incl. quantization noise) is larger than expected. • Load change takes place, do as in above point.	• Change parameter ***42-53 Start Ramp***to ***[1] Yes*** and set parameter ***42-54 Ramp Down Time*** accordingly. • Increase parameter ***42-50 Cut Off Speed*** or decrease parameter ***42-51 Speed Limit*** to get a larger tolerance.	Status of LED 1 and LED 2 depends on safety sub-function state assigned to DI1 and DI2.		Red constant
71	Int fail speed limit SLSb: Reaction STO	See 70.	See 70.			Red constant

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Table 43: LED Indications, Errors 72–73

Error number	Description	LED indicators				
				LED1	LED2	LED4
	Internal failure	Reason	Action			
72	Internal failure MCB 150/151		• First, power cycle the drive or restart the safety option via parameter ***42-90 Restart Safe Option***. Second, try to make a general reset of the safety option with the *Administration* button (safety option goes back to blank initial state). • If the problem persists, contact Danfoss.			Red constant
73	Internal failure MCB 150/151		• First, power cycle the drive or restart the safety option via parameter ***42-90 Restart Safe Option***. • If the problem persists, contact Danfoss.			Red constant

Table 44: LED Indications, Errors 74–75

Error number	Description	LED indicators				
				LED1	LED2	LED4
	Internal failure	Reason	Action			
74	Internal failure MCB 150/151		• First, power cycle the drive or restart the safety option via parameter ***42-90 Restart Safe Option***. • If the problem persists, contact Danfoss.	Status of LED 1 and LED 2 depends on safety sub-function state assigned to DI1 and DI2.		Red constant
75	Int Fail DI2 in PUST: Reaction STO	• Safety input connected to DI2 has illegal signal level. • Sensor is broken.	• Check that the configuration of DI2 parameter ***42-21 Type*** is set correctly or that the connected sensor is installed according to specification. • Extend discrepancy time on the safe input tab in the MCT 10 Safe Plug-in via parameter ***14-22 Operation Mode***.			Red constant

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Table 45: LED Indications, Errors 76–77

Error number	Description	LED indicators				
				LED1	LED2	LED4
	Internal failure	Reason	Action			
76	Int Fail DI1 in PUST: Reaction STO	• Safety input connected to DI1 has illegal signal level. • Sensor is broken.	• Check that the configuration of DI1 parameter ***42-21 Type***, sub-index [0], is set correctly or that the connected sensor is installed according to specification. • Extend discrepancy time on the safe input tab in the MCT 10 Safe Plug-in via parameter ***14-22 Operation Mode***.	Status of LED 1 and LED 2 depends on safety sub-function state assigned to DI1 and DI2.		Red constant
77	Int Fail failsafe data CRC mismatch: Reaction STO	The CRC of the safety option does not match the stored CRC value on the drive.	Configure the safety option with MCT 10 Safe Plug-in or by CRC select/LCP copy.			Red constant

Table 46: LED Indications, Errors 78–83

Error number	Description	LED indicators				
				LED1	LED2	LED4
	Internal failure	Reason	Action			
78	Internal failure safety option		• First, power cycle the drive or restart the safety option via parameter ***42-90 Restart Safe Option***. • If the problem persists, contact Danfoss.	Status of LED 1 and LED 2 depends on safety sub-function state assigned to DI1 and DI2.		Red constant
79	Internal failure safety option		Contact Danfoss.			Red constant
80	Internal failure safety option		Contact Danfoss.			Red constant
81	Internal failure safety option		• First, power cycle the drive. • If the problem persists, contact Danfoss.			Red constant
82	Internal failure safety option		• First, power cycle the drive. • If the problem persists, contact Danfoss.			Red constant
83	Internal failure safety option		• First, power cycle the drive. • If the problem persists, contact Danfoss.			Red constant

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Table 47: LED Indications, Errors 84–88

Error number	Description	LED indicators				
				LED1	LED2	LED4
	Internal failure	Reason	Action			
84	Internal failure safety option		• First, power cycle the drive. • If the problem persists, contact Danfoss.	Status of LED 1 and LED 2 depends on safety sub-function state assigned to DI1 and DI2.		Red constant
85	Internal failure safety option		• First, power cycle the drive. • If the problem persists, contact Danfoss.			Red constant
86	Internal failure safety option		• First, power cycle the drive. • If the problem persists, contact Danfoss.			Red constant
87	Internal failure safety option		• First, power cycle the drive. • If the problem persists, contact Danfoss.			Red constant
88	Internal failure safety option		• First, power cycle the drive. • If the problem persists, contact Danfoss.			Red constant

Table 48: LED Indications, Errors 89–92

Error number	Description	LED indicators				
				LED1	LED2	LED4
	Internal failure	Reason	Action			
89	Internal failure safety option		• Perform a general reset of the safety option with the *Administration*button. • If the problem persists, contact Danfoss.	Status of LED 1 and LED 2 depends on safety sub-function state assigned to DI1 and DI2.		Red constant
90	Internal failure safety option		• Perform a general reset of the safety option with the *Administration*button. • If the problem persists, contact Danfoss.			Red constant
91	Internal failure safety option		• Perform a general reset of the safety option with the *Administration*button. • If the problem persists, contact Danfoss.			Red constant
92	Internal failure safety option		• First, power cycle the drive. • If the problem persists, contact Danfoss.			Red constant

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Table 49: LED Indications, Errors 93–97

Error number	Description	LED indicators				
				LED1	LED2	LED4
	Internal failure	Reason	Action			
93	Internal failure safety option		• First, power cycle the drive. • If the problem persists, contact Danfoss.	Status of LED 1 and LED 2 depends on safety sub-function state assigned to DI1 and DI2.		Red constant
94	Internal failure safety option		• First, power cycle the drive. • If the problem persists, contact Danfoss.			Red constant
95	Internal failure safety option		• First, power cycle the drive. • If the problem persists, contact Danfoss.			Red constant
96	Internal failure safety option		• First, power cycle the drive. • If the problem persists, contact Danfoss.			Red constant
97	Internal failure safety option		Contact Danfoss.			Red constant

Table 50: LED Indications, Errors 98–113

Error number	Description	LED indicators				
				LED1	LED2	LED4
	Internal failure	Reason	Action			
98	Int fail invalid customer file version	Version of customization file of safety option stored in EEPROM does not match the customization file supported by the SW version of safety option.	Do a new configuration with VLT® Motion Control ToolMCT 10 Safe Plug-in, which supports the SW version of safety option.	Status of LED 1 and LED 2 depends on safety sub-function state assigned to DI1 and DI2.		
99	Int Fail Feedback error	The connected feedback source does not give any signal.	Check that the connection is done according to the specification or if the feedback source is broken.			Red
102	Int Fail Speed Limit SMS: Reaction STO	• Speed is above cut-off speed. • Noise on the feedback signal (incl. quantization noise) is larger than expected.	Check the value of parameter ***42-71 Cut Off Speed***.			Red constant
113	Ext Fail DI1: Reaction STO	• Safety input connected to DI1 has illegal signal level. • Sensor is broken.	• Check that configuration of DI1 parameter ***42-21 Type*** is set correctly or the connected sensor is installed according to the specification.	Red constant	Status depends on safety sub-function state assigned to DI2.	Red flashing, cycle (on 500 ms, off 500 ms)

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Table 51: LED Indications, Errors 114–116

Error number	Description	LED indicators				
				LED1	LED2	LED4
	Internal failure	Reason	Action			
114	Ext Fail DI2: Reaction STO	• Safety input connected to DI2 has illegal signal level. • Sensor is broken.	• Check that configuration of DI2 parameter ***42-21 Type*** is set correctly or the connected sensor is installed according to the specification. • Extend discrepancy time on safe input tab in MCT 10 Safe Plug-in parameter ***14-22 Operation Mode***.	Status depends on safety sub-function state assigned to DI1.	Red constant.	Red flashing, cycle (on 500 ms, off 500 ms)
115	Ext Fail Prec Thresh Timer Elapsed: Reaction STO	The drive has been running below 120 RPM for more than the time entered in parameter ***42-18 Zero Speed Timer*** with safe function SLS active.	Increase speed to above 120 RPM.	Status of LED 1 and LED 2 depends on safety sub-function state assigned to DI1 and DI2.		Red flashing, cycle (on 500 ms, off 500 ms)
116	Ext Fail SF activation Speed Suspension: Reaction STO	The drive has been running below 120 RPM for more that 1 year and a safety sub-function that needs speed feedback is activated.	Increase speed to above 120 RPM.			Red flashing, cycle (on 500 ms, off 500 ms)

Table 52: LED Indications, Errors 134–242

Error number	Description	LED indicators				
				LED1	LED2	LED4
	Internal failure	Reason	Action			
134	Int fail speed limit SLSa: Reaction SS1a	See 70.	See 70.	Status of LED 1 and LED 2 depends on safety sub-function state assigned to DI1 and DI2.		Red constant
135	Int fail speed limit SLSb: Reaction SS1a	See 70.	See 70.			Red constant
177	Ext Fail DI1: Reaction SS1a	See 113.	See 113.	Red constant.	Status depends on safety sub-function state assigned to DI2.	Red flashing, cycle (on 500 ms, off 500 ms)
178	Ext Fail DI2: Reaction SS1a	See 114.	See 114.	Status depends on safety sub-function state assigned to DI1.	Red constant.	Red flashing, cycle (on 500 ms, off 500 ms)
179	Ext Fail Prec Thresh Timer Elapsed: Reaction SS1a	See 115.	See 115.	Status of LED 1 and LED 2 depends on safety sub-function state assigned to DI1 and DI2.		Red flashing, cycle (on 500 ms, off 500 ms)
180	Ext Fail SF activation Speed Suspension: Reaction SS1a	See 116.	See 116.			Red flashing, cycle (on 500 ms, off 500 ms)
198	Int fail speed limit SLSa: Reaction SS1b	See 70.	See 70.			Red constant
199	Int fail speed limit SLSb: Reaction SS1b	See 70.	See 70.			Red constant
241	Ext Fail DI1: Reaction SS1b	See 113.	See 113.	Red constant.	Status depends on safety sub-function state assigned to DI2.	Red flashing, cycle (on 500 ms, off 500 ms)
242	Ext Fail DI2: Reaction SS1b	See 114.	See 114.	Status depends on safety sub-function state assigned to DI1.	Red constant.	Red flashing, cycle (on 500 ms, off 500 ms)

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Table 53: LED Indications, Errors 243–252

Error number	Description	LED indicators				
				LED1	LED2	LED4
	Internal failure	Reason	Action			
243	Ext Fail Prec Thresh Timer Elapsed: Reaction SS1b	See 115.	See 115.			Red flashing, cycle (on 500 ms, off 500 ms)
244	Ext Fail SF activation Speed Suspension: Reaction SS1b	See 116.	See 116.			Red flashing, cycle (on 500 ms, off 500 ms)
252	Internal failure safety option		Power cycle the drive. If the problem persists, contact Danfoss.			

13.3.4 Safety Option Warning

A warning message notifies that an issue exists on the safety option. It is not handled as an internal or external failure. These messages are defined to indicate that a manual user action is required.

NOTE: At any possible failure or warning indicated from the safety option, the LCP shows *warning, !Safe Option Failure [W252]* at the least.

13.3.5 Safety Option Reset Message

For some messages, the safety option requires an acknowledgment of an ongoing action or failure on the safety option. The safety option uses *Safe Option RESET* as a *Restart and Failure Acknowledgement*.

Table 54: LCP Reset Messages

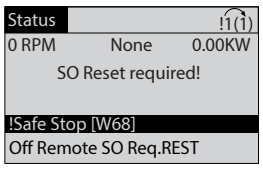
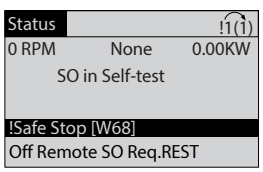
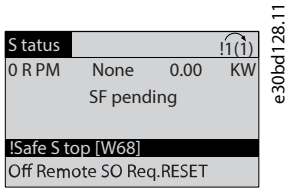
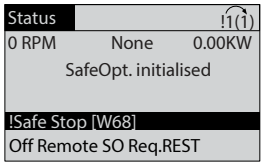
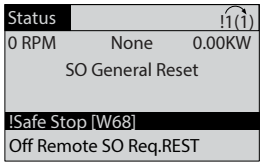
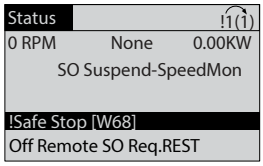
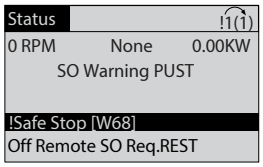
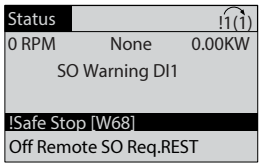
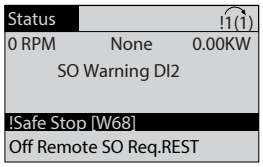
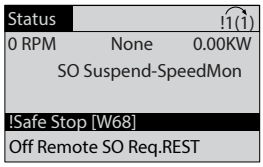
LCP message	Description
 e30bd126.11	In the following cases, the safety option requests a restart and failure acknowledgment signal: • The safety option is in safety subfunction pending-state (remark: Occurs only if the reset behavior is set/configured to *Manual*). • After a power cycle with a safety subfunction. • In PUST (power up self-test), if an external failure occurred before the power cycle. • When an external failure occurred. • When customization was aborted or completed. • At the reception of a general reset (required after blank initial state or in the customization state).
 e30bd127.11	The safety option indicates that it is in PUST State (power up self-test). • Ensure that no safe function is active after a power cycle.

Table 54: LCP Reset Messages - (continued)

LCP message	Description
 e30bd128.11	A safety subfunction is pending at the start-up, if the drive was powered down while a safety function was active. It is also pending when the drive was powered down while the safety option had detected a failure during an active safety subfunction.
 e30bd129.11	The safety option requests a Restart and Failure Acknowledge signal. This signal is always required after a PUST, and when a safety subfunction gets released and is configured to be confirmed that the motor is able to run.
 e30bd130.11	Occurs only if a general reset is performed from MCT 10. It is an indication to the user. The safety option is set to blank initial state and safe parameters are set to default.
 e30bd131.11	The zero speed timer contains the remaining time until the fail prec thresh timer elapsed after the monitoring time expires. The safety option signals Warning.
 e30bd132.11	PUST warning has occurred. Warning cause: Expiry of PUST timer. Memory test required, perform power cycle.
 e30bd133.11	DI1 offline warning has occurred. Warning cause: Expiry of offline timer for DI1.
 e30bd134.11	DI2 offline warning has occurred. Warning cause: Expiry of offline timer for DI2.
 e30bd131.11	A speed monitoring suspension warning has occurred. Warning cause: Suspension of speed monitoring for a certain duration.

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