



Operating Guide

VLT[®] Motion Control Tools MCT 10 Set-up Software



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1 Introduction

This manual provides basic knowledge required to use the MCT 10 Set-up Software with Danfoss Drives VLT® frequency converters. Familiarity with the following is assumed:

- MS®-Windows™ at user level.
- Set-up, process knowledge, and operation of frequency converters.
- Use of and linkage with communication equipment.

The manual does not provide any detailed information regarding specific applications or possible solutions and related parameter combinations in the set-up and use of a frequency converter. Refer to the *Operating Guide* and *Design Guide* of the frequency converter. Any update of the manual and instructions related to the MCT 10 Set-up Software is available on the Danfoss Drives homepage: www.drives.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 manual and are not the responsibility of Danfoss.

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

1.1 How to Read this Document

1.1 Document and Software Version

This manual is regularly reviewed and updated. All suggestions for improvement are welcome. *Table 1.1* shows the document version and the corresponding software version.

Edition	Remarks	Software version
MG10RBxx	Upgrade to new software version.	3.26

Table 1.1 Document and Software Version

1.2 Intended Use

The MCT 10 Set-up Software enables full system configuration and control. With MCT 10 Set-up Software, it is possible to monitor the entire system more effectively for faster diagnosis and better preventive maintenance.

MCT 10 Set-up Software is designed as an interactive commissioning tool for quick and easy commissioning of the following frequency converter series:

- VLT® 2800
- VLT® 4000
- VLT® 5000
- VLT® 6000
- VLT® 8000
- VLT® HVAC Drive FC 102
- VLT® AQUA Drive FC 202
- VLT® AutomationDrive FC 302
- VLT® Decentral Drive FCD 302
- VLT® DriveMotor FCM Series

The MCT 10 Set-up Software can be used as follows:

- For planning a new communication network off-line. The MCT 10 Set-up Software contains a complete database with all Danfoss Drives products.
- For commissioning frequency converters online.
- For easy replacement of a frequency converter.
- For easy expansion of network with more frequency converters.
- For back-up of parameter settings of frequency converters in a communication network.
- The MCT 10 Set-up Software 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 Set-up Software is handling the control of the fieldbuses. It provides enhanced capabilities allowing multiple concurrent fieldbus communication. Several fieldbuses can be configured and combined in the same network within MCT 10 Set-up Software.

NOTICE

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

1.3 System Requirements

To use the MCT 10 Set-up Software, the IBM-compatible personal computer must meet the following minimum system requirements:

- A Pentium PIII 350 Mhz or compatible microprocessor.
- 1 GB of RAM recommended.
- A CD-ROM drive.
- 700 MB of available space on the hard drive.

MCT 10 Set-up Software runs on the following MS

Windows versions:

- Windows™ 7 32/64 bit editions
- Windows™ 8 32/64 bit editions
- Windows™ 10 32/64 bit editions

1.4 Software Modules

The MCT 10 Set-up Software is supplied in 2 modules:

- MCT 10 Set-up Software for:
 - Setting of the frequency converter parameters.
 - Copying of parameter sets to and from a frequency converter.
 - Documentation/printout of set-up, including diagrams.
 - Servicing and fault analysis.
- APos program for:
 - Creating APos programs.

1.4.1 Features of MCT 10 Set-up Software

- Project-oriented PC tool, 1 tool for all frequency converter series.
- Links to all Windows applications possible.
- Supports Siemens CP PCMCIA- and PCI cards, for PROFIBUS DP-V1 master class 2 connection.
- Support of standard interfaces: COMx, USB, RS232 (Flux).
- Siemens PG/Field PGs already have the necessary hardware.
- View is highly individually configurable.
- Downwards compatibility with Dos-Dialog (*.mnu) and WinDialog (*.vlt).
- Windows™ Explorer-like interface for quick and easy start-up and navigation.

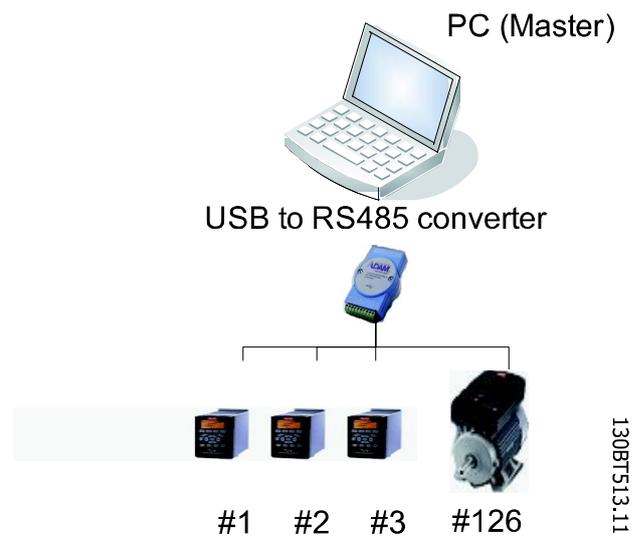


Illustration 1.1 Connect up to 126 nodes using a repeater.
Without a repeater, connect up to 31 nodes.

1.5 Versions

MCT 10 Set-up Software is available in 2 versions:

- MCT 10 Set-up Software Basic is available free of charge, downloadable from www.vlt-software.com
- MCT 10 Set-up Software Advanced can be purchased with the ordering number 130B1000.

Version supports	MCT 10 Set-up Software Advanced	MCT 10 Set-up Software Basic
Frequency converters per project	Unlimited	4
FC protocol	✓	✓
Functional safety	✓	✗
USB	✓	✓
PROFIBUS DP-V1	✓	✓
PROFIBUS DP-V1 Handling multiple Danfoss nodes concurrently	✓ (improved performance)	✗
Ethernet-TSC	✓	✓
Logging and scope function	8 channels	2 channels
Real-time logging from frequency converter	4 channels	✗
Alarm display	✓	View only
VLT® Motion Control Option MCO 305	✓	✓
Graphical smart logic control	✓	✓
VLT® 5000 to FC 302 conversion wizard	✓	✓
FC to FC conversion wizard	✓	
Import 3000.XLS to FC 302	✓	✗
Motor database	✓	✗
VLT® Extended Cascade Controller MCO 101	✓	✗
Drive file system	✓	✗

Table 1.2 Features of the Basic and Advanced Versions

1.6 Further Information

The following documents related to MCT 10 Set-up Software are available.

- *VLT® PROFIBUS DP-V1 MCA 101 Installation Guide.*
- *Design guide for the relevant frequency converters.*

Refer to drives.danfoss.com for frequently asked questions and additional information.

It is also possible to find video training material on this site for operating MCT 10 Set-up Software.

2 Safety

2.1 Safety Symbols

The following symbols are used in this guide:

⚠ WARNING

Indicates a potentially hazardous situation that could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation that could result in minor or moderate injury. It can also be used to alert against unsafe practices.

NOTICE

Indicates important information, including situations that can result in damage to equipment or property.

2.2 Safety Precautions

⚠ WARNING

HIGH VOLTAGE

Frequency converters contain high voltage when connected to AC mains input, DC supply, or load sharing. Failure to perform installation, start-up, and maintenance by qualified personnel can result in death or serious injury.

- Only qualified personnel must perform installation, start-up, and maintenance.

⚠ WARNING

UNINTENDED START

When the frequency converter is connected to AC mains, DC supply, or load sharing, the motor may start at any time. Unintended start during programming, service, or repair work can result in death, serious injury, or property damage. The motor can start via an external switch, a fieldbus command, an input reference signal from the LCP, or after a cleared fault condition.

To prevent unintended motor start:

- Disconnect the frequency converter from the mains.
- Press [Off/Reset] on the LCP before programming parameters.
- Completely wire and assemble the frequency converter, motor, and any driven equipment before connecting the frequency converter to AC mains, DC supply, or load sharing.

⚠ WARNING

DISCHARGE TIME

The frequency converter contains DC-link capacitors, which can remain charged even when the frequency converter is not powered. High voltage can be present even when the warning LED indicator lights are off. Failure to wait the specified time after power has been removed before performing service or repair work can result in death or serious injury.

- Stop the motor.
- Disconnect AC mains and remote DC-link power supplies, including battery back-ups, UPS, and DC-link connections to other frequency converters.
- Disconnect or lock PM motor.
- Wait for the capacitors to discharge fully. The minimum duration of waiting time is specified in the frequency converter *operating guide*.
- Before performing any service or repair work, use an appropriate voltage measuring device to make sure that the capacitors are fully discharged.

For further information, see drives.danfoss.com/knowledge-center/technical-documentation/

3 Installation and De-installation

3.1 Introduction

The MCT 10 Set-up Software and SyncPos modules are installed via a multilingual, self-explanatory installation program.

3.1.1 Start the Installation Program

1. Select the submenu *Run* from *File* in Windows programming control.
2. Enter: [DRIVELETTER]:\SETUP in the command line and press <Return>.
3. Follow the instructions of the installation program.

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

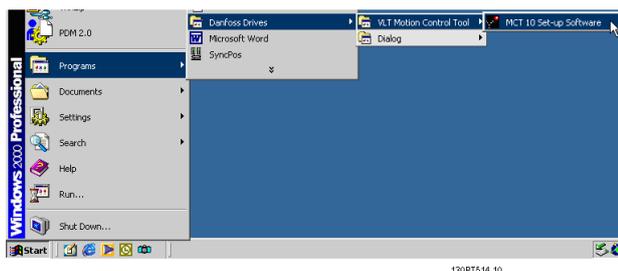


Illustration 3.1 Path for MCT 10 Set-up Software

3.1.2 MCT 10 Set-up Software Language

The default language for the MCT 10 Set-up Software is English. Change the language of operation as follows.

1. Select *Options* from the main menu, then select *Language*.
2. Select the wanted language from the scrollbar and close the window.
3. Close and restart MCT 10 Set-up Software to activate the language setting.

Change language

Select the language version during installation.

NOTICE

The selected language is the new default language.



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Illustration 3.2 Select Language

NOTICE

Change of language affects parameter language. If an external LCP display is connected to the frequency converter, the change of language version does not affect the language in the display.

3.1.3 De-installation

NOTICE

The following procedure is only valid for a Windows operating system.

1. Select *Start*.
2. Select *Settings*.
3. Select *Control Panel*.
4. Double-click *Remove/Add Programs*.
5. Select.
6. Select *Remove*.

4 Set-up of Communication

4.1 Communication Options

Danfoss frequency converters in the VLT® HVAC Drive FC 102, VLT® AQUA Drive FC 202, 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 frequency converter. No extra hardware or bus configuration is required. If the PC is equipped with more than 1 USB port, several frequency converters can be connected. The USB bus is automatically added to the network bus list.

Establish a hardwired connection through:

- Standard built-in RS485, or
- USB port.

The USB interface socket allows devices to be connected and disconnected using hot swapping. When connecting a frequency converter using USB, MCT 10 Set-up Software automatically adds on to the bus list.

If the VLT® PROFIBUS DP-V1 MCA 101 or VLT® EtherNet/IP MCA 121 option is mounted in the frequency converter, establish the connection through:

- PROFIBUS master class 2 connection (MSAC 2), or
- Ethernet-based network.

NOTICE

Soft starters can only be connected through a USB cable.

NOTICE

RISK OF DAMAGE TO PC USB HOST CONTROLLER

When connecting the PC to the frequency converter 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 frequency converter.
- Use a USB isolator with galvanic isolation to protect the PC USB host controller from ground potential differences when connecting the PC to a frequency converter through a USB cable.
- Do NOT use a PC power cable with a ground plug when the PC is connected to the frequency converter through a USB cable.

Communication from a PC can be established via RS232 to RS485 converters or via USB to RS485 converters.

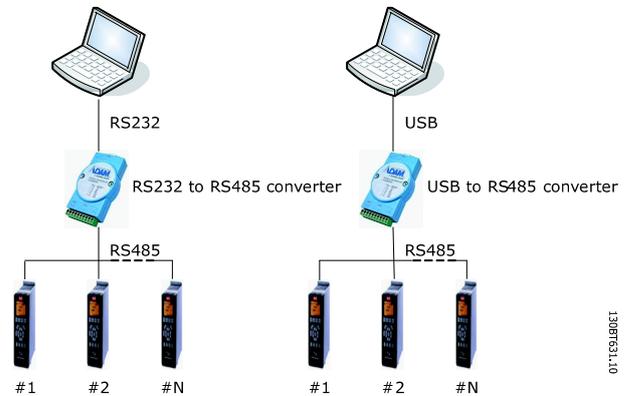


Illustration 4.1 Communication from a PC

4.2 Manual Fieldbus Configuration

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

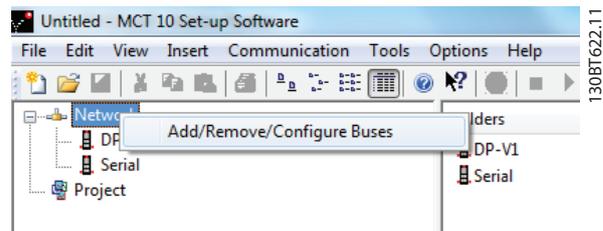


Illustration 4.2 Refresh the Fieldbus List

1. Start MCT 10 Set-up Software.
2. Select *Network*.
3. Right-click *Network* and select *Add/Remove/Configure Buses*.
4. Add, remove, or configure the properties for connected busses.
5. Scan the network for active frequency converters to make MCT 10 Set-up Software indicate available frequency converters on the non-plug-and-play fieldbuses.

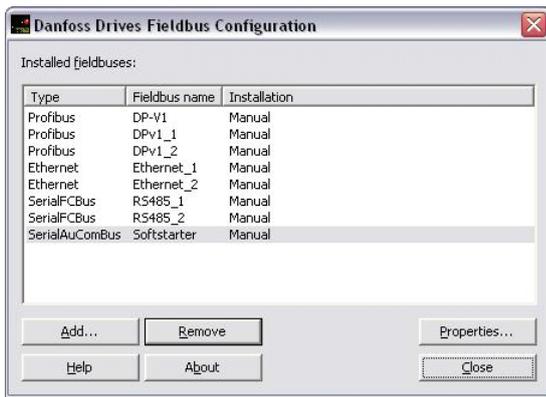


Illustration 4.3 Fieldbus Configuration

4.3 Automatic Scan

Only the USB fieldbus is automatically scanned when a frequency converter is connected to the PC. For non-plug-and-play fieldbusses, perform a manual scan for active frequency converters.

4.3.1 Scan Range Configuration

Enter the preferred scan settings by right-clicking *SerialCom* and then selecting *Configure Driver*.

Adding a standard bus RS485 or PROFIBUS to the network tree, the scan range is configured to scan the entire address range. The Ethernet-TSC bus is added using the current IP address settings.

The fieldbus scan range can be configured in more 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 on the *Network* icon and select *Add/Remove/Configure Busses*.
- Open from the Windows control panel.



Illustration 4.4 Scan Network Icon

4.3.2 Scan Network

Scan a fieldbus in 3 ways:

- Right-click on the *Fieldbus* icon in the network tree and select *Scan Bus* for active frequency converters.
- 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 pops up and indicates the progress of the scan:

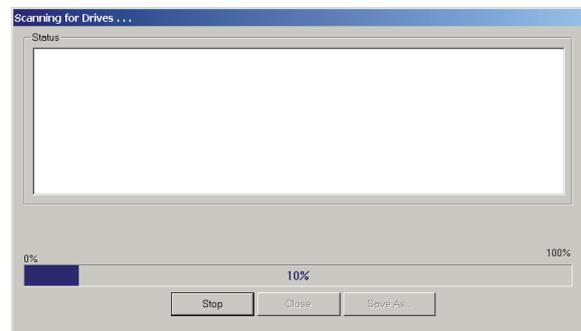


Illustration 4.5 Progress of Network Scanning

NOTICE

Using the VLT® HVAC Drive FC 102, VLT® AQUA Drive FC 202, and VLT® AutomationDrive FC 302: FC Drive MC Protocol (*parameter 8-30 Protocol [1] FC MC*) is required for correct functionality. The parameter is only available from the LCP.

4.4 Set up the Frequency Converter with RS485 Data Communication

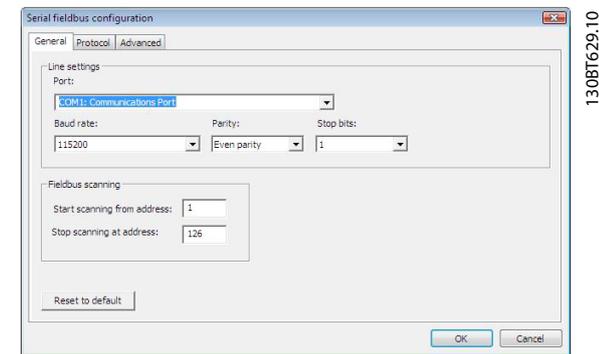
All frequency converters can be configured to 300, 1200, 4800, 9600 (default), 19200, 38400, 57600, or 115200 baud. The serial configuration is always configured with:

- 8 data bits.
- 1 stop bit.
- Even parity.

4.4.1 Fieldbus Configuration

When using an RS485 converter as the Advantech ADAM converter, MCT 10 Set-up Software indicates online frequency converters available on the fieldbus after scanning the bus.

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



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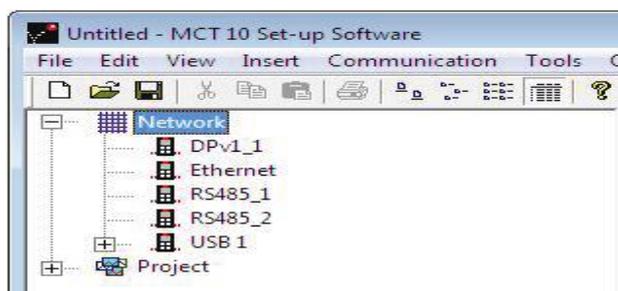
Illustration 4.6 Serial Fieldbus Configuration

2. Set the COM port number. When using USB to RS485 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 frequency converter).
4. Set the fieldbus scanning range to the available addresses to limit the time scanning for active frequency converters.
5. Press *OK* to activate settings or select to restore default settings.

NOTICE

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

4.4.2 USB Data Communication



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Illustration 4.7 Network Bus List

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

NOTICE

A USB bus has no address-setting capacity and no bus name to configure. If connecting more than 1 frequency converter through USB, the bus name is automatically incremented in the MCT 10 Set-up Software network bus list.

Connecting more than 1 frequency converter through a USB cable often causes computers installed with Windows XP to throw an exception and crash. Therefore, it is advised only to connect 1 frequency converter via USB to the PC.

4

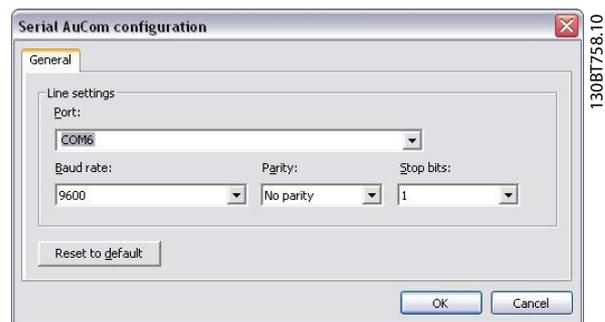
4.5 Set-up of Soft Starter

Setting up connectivity to the VLT® Soft Starter MCD 500 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.

4.5.1 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.



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Illustration 4.8 Serial Configuration of Soft Starters

1. Add and configure the bus from the *Fieldbus Configuration* dialog. If the bus 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 Windows control panel.
3. Set the baud rate, parity, and the number of stop bits (must match the settings in the soft starter).

4. *Reset to default* restores the general settings and fieldbus scanning to factory configuration values.

4.6 PROFIBUS DP-V1 Communication

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 frequency converter is connected to the 9-pin sub D socket connector on the card.

4

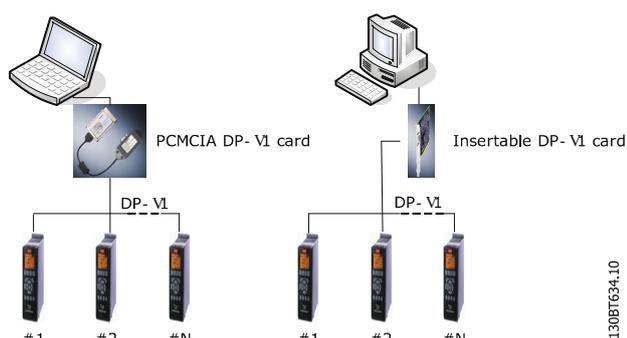


Illustration 4.9 PROFIBUS DP-V1 Communication

Consult Siemens www.siemens.com for latest supported cards for PCs.

NOTICE

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

4.6.1 PROFIBUS DP-V1 Configuration

When using a PROFIBUS interface card with the associated driver installed, MCT 10 Set-up Software indicates online frequency converters available on the specific PROFIBUS after scanning the bus for active frequency converters.

1. Configure the bus from the fieldbus configuration dialog or by right-clicking the appropriate PROFIBUS bus.
2. Set the board number.
3. Set the fieldbus scanning range to the available addresses only to limit the time used for scanning active frequency converters.
4. Press *OK* to activate or *reset* to restore factory default settings.

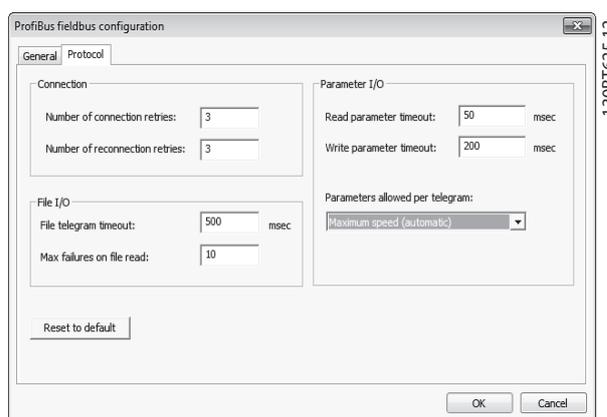


Illustration 4.10 PROFIBUS Fieldbus Configuration

4.6.2 DP-V1 Connection and PG/PC Interface

The MCT 10 Set-up Software PROFIBUS DP-V1 fieldbus plug-in utilizes 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.

NOTICE

STEP7 Lite version does not support the SoftNet driver.

The following procedure explains how to set up the PG/PC Interface from default configuration to open the PROFIBUS connection from MCT 10 Set-up Software.

It is a precondition that cabling and terminations are in accordance with wiring and cabling requirements for PROFIBUS.

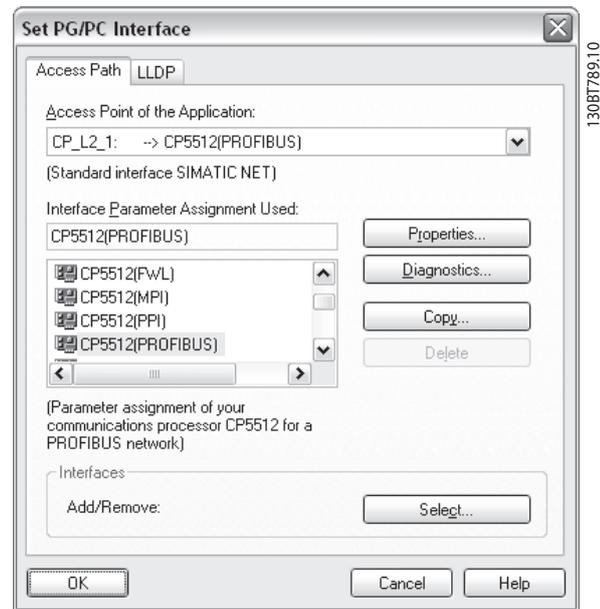


Illustration 4.11 Set PG/PC Interface

1. Open the 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.
 - 4a 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.
 - 4b Network parameters: Set the *Transmission rate* to the same baud rate as the PLC, if it is active.
5. Use *DP* as *Profile* and press *OK* to close the *Properties* dialog.
6. Select *Diagnostics* in the *Set PG/PC Interface* to verify network- and bus communication.

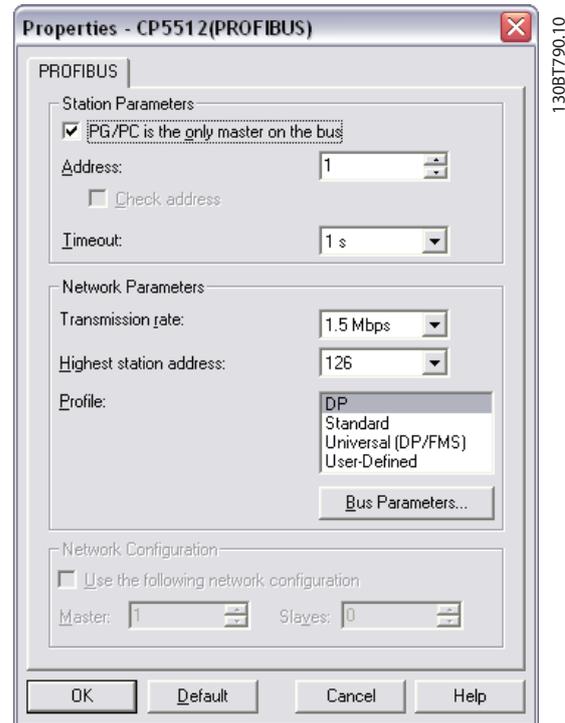


Illustration 4.12 Properties Dialog

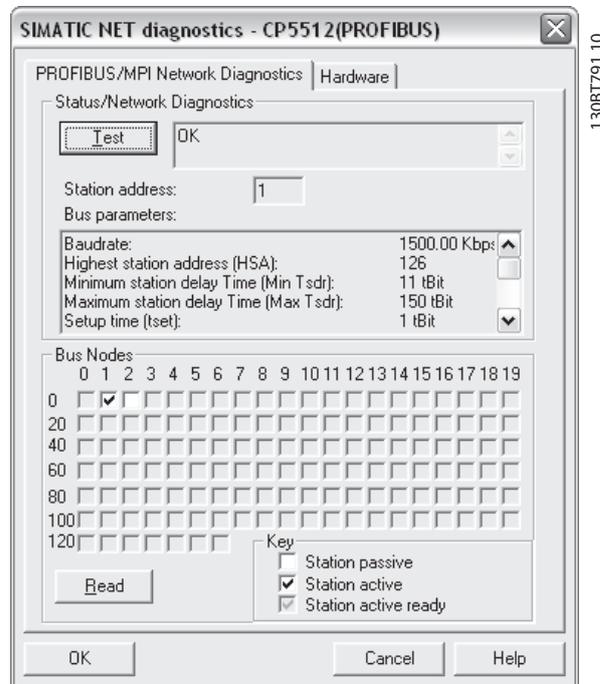


Illustration 4.13 Simatic Network Diagnostics Dialog

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 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 Set-up Software. Right-click a PROFIBUS and select *Scan* for active frequency converters. MCT 10 Set-up Software identifies the same node IDs, except PLCs.

4.6.3 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 frequency converter according to the series. Can be used in PROFIBUS networks containing both old and new Danfoss VLT® Drives products.
- *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

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

4.7.1 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 frequency converters based on the MAC address.

NOTICE

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, see *Illustration 4.14*.

Click *Refresh* to generate a list of all active frequency converters in the Ethernet. The list is shown in the *Ethernet Fieldbus Settings* dialog when the scan is completed.

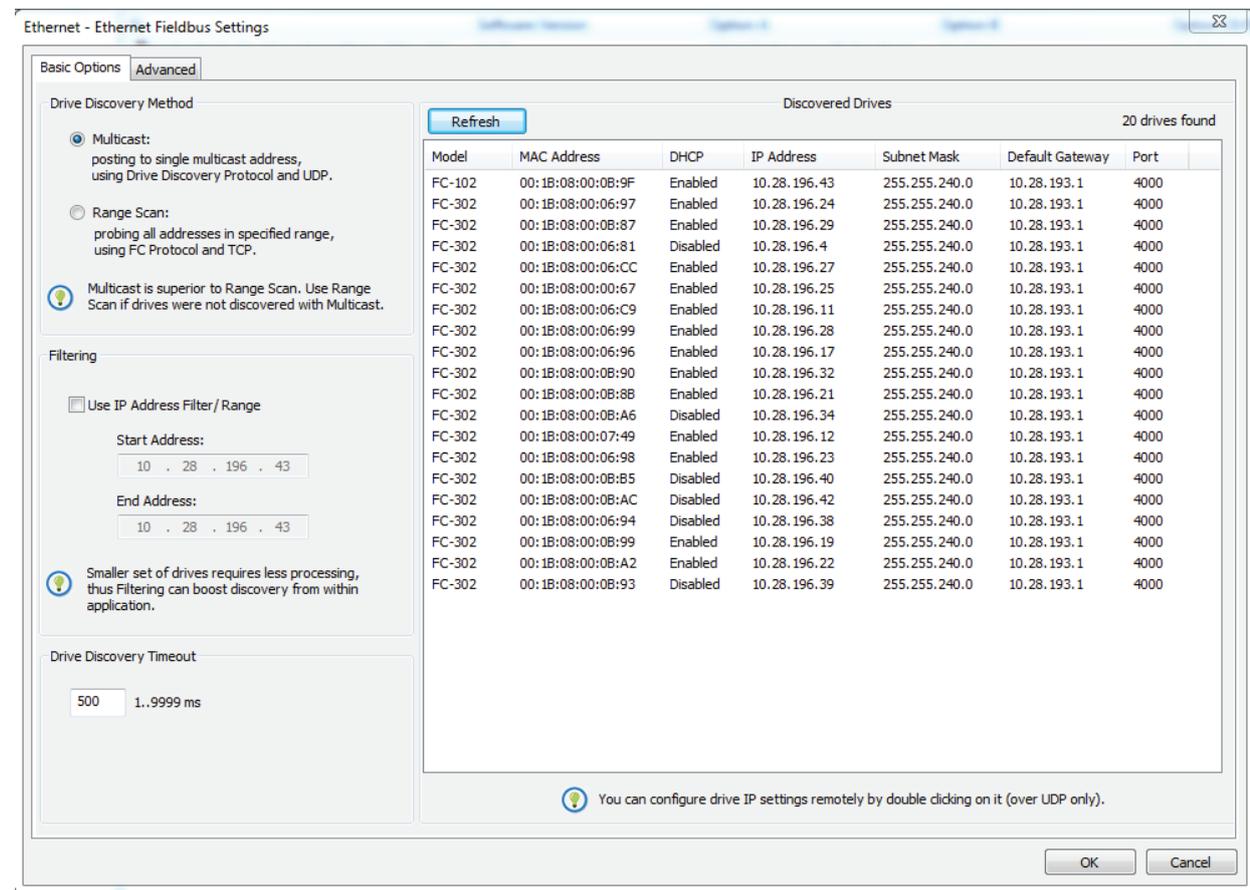
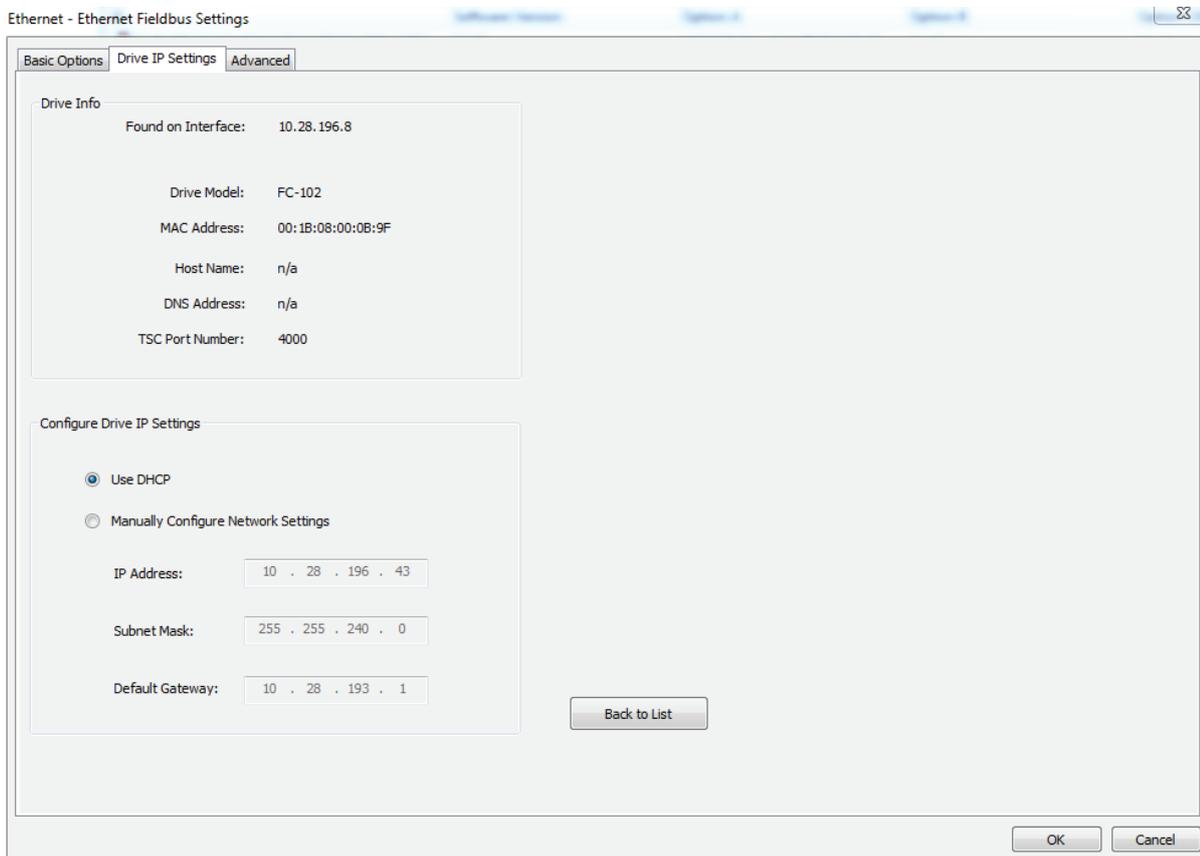


Illustration 4.14 ADDP Configuration

Frequency converter 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 frequency converters 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 frequency converter.
- Set up DHCP (dynamic host configuration protocol) look-up.



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Illustration 4.15 TSC Configure

4.7.1.1 Scan 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 frequency converters without IP address configured are not identified.

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

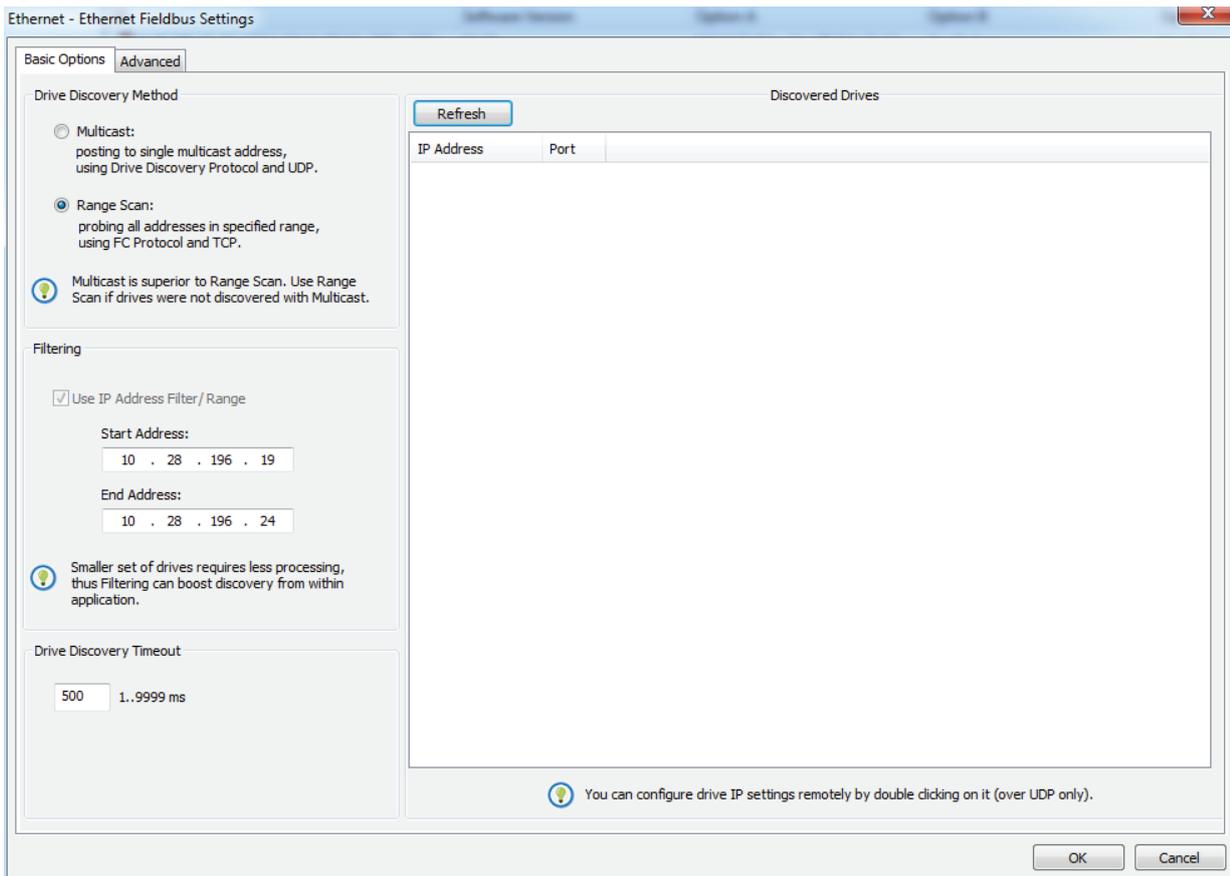


Illustration 4.16 Scan Range

After the scan, all active frequency converters are identified. Use a corresponding offline frequency converter to read or write to a single frequency converter instead of waiting for MCT 10 Set-up Software to scan and identify all frequency converters.

1. Open the project file or create the offline frequency converter manually.
2. Configure the connection properties.
3. Right-click the offline frequency converter.
4. Read and write to the frequency converter without scanning the bus.

NOTICE

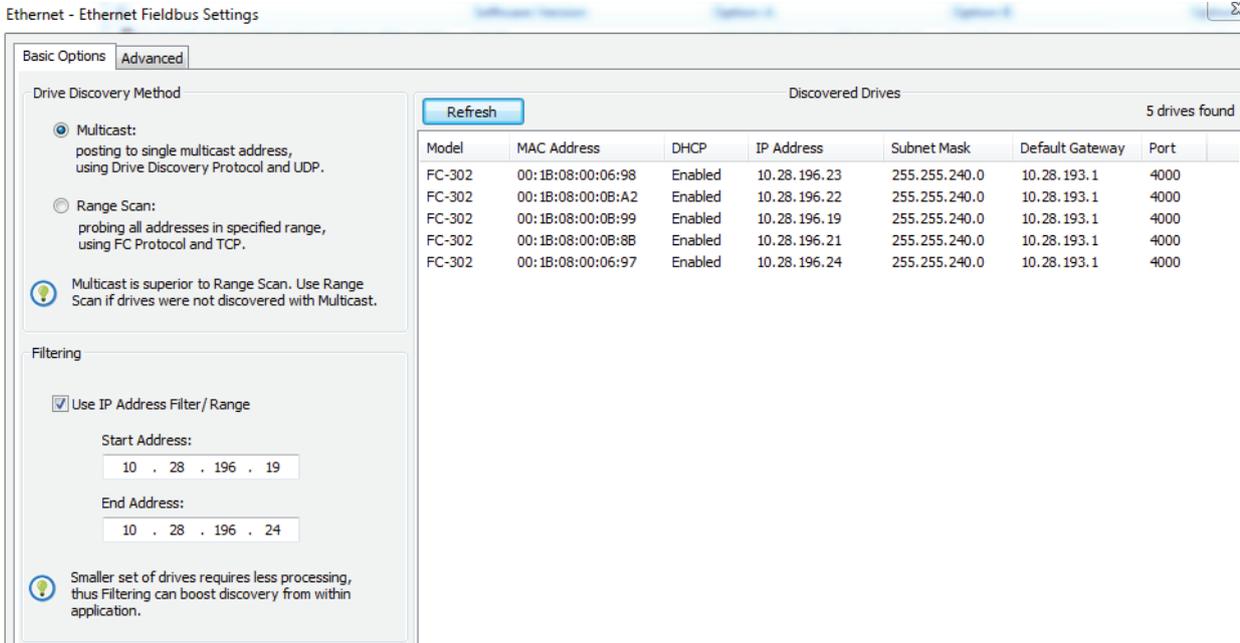
Identification of frequency converters utilizing the VLT® EtherNet/IP MCA 121 option is possible only from option firmware version 1.03 or newer. Using options with firmware versions earlier than 1.03, the *parameter 12-89 Transparent Socket Channel Port* must be configured to 0 to prevent the option from failing to operate.

4.7.1.2 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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Illustration 4.17 Filtering

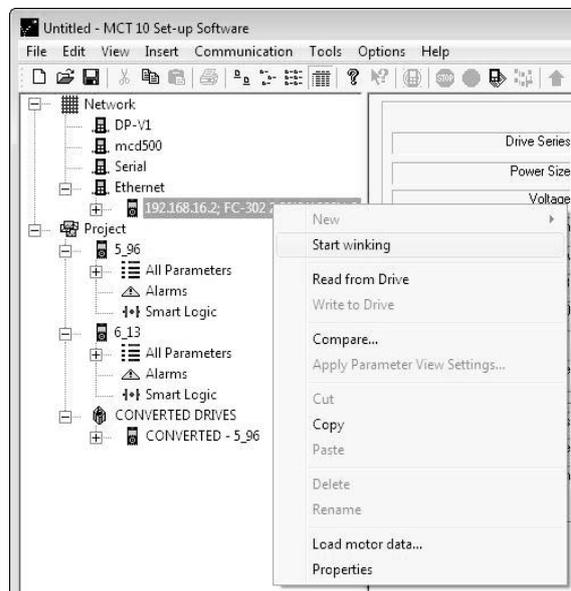
4.7.2 Wink Drive

During a commissioning process of a system containing several frequency converters, it can be time-consuming physically to locate a frequency converter based on the MCT 10 Set-up Software project. This is especially the case if they are not equipped with an LCP.

Through the Ethernet-TSC fieldbus, it is possible from MCT 10 Set-up Software using a wink function to blink with the MS, NS1, and NS2 LEDs on all Danfoss Ethernet-based fieldbus options.

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

On the Ethernet-based fieldbus option, the winking is recognized with all 3 LEDs blinking orange with 1 Hz interval. There is no limitation in the number of frequency converters winking and the duration of winking.



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Illustration 4.18 Start Winking

NOTICE

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

4.7.3 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 frequency converter 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 MCT 10 Set-up Software releases unused connections and makes them available to other users in the network after idle timeout.

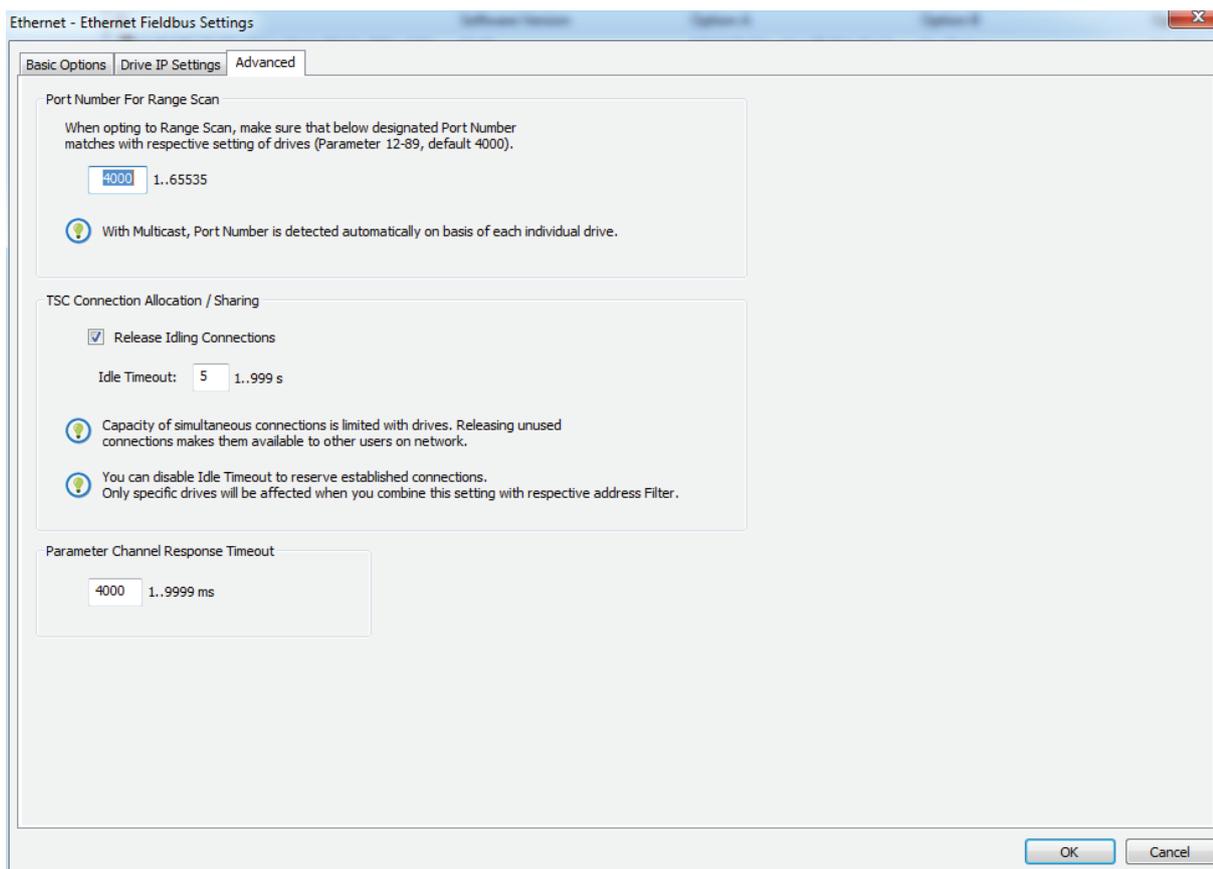


Illustration 4.19 The Advanced Tab

5 Parameter Set-up

This chapter explains how to control a frequency converter using the MCT 10 Set-up Software. After starting the MCT 10 Set-up Software, the main window looks like the example shown in *Illustration 5.1*.

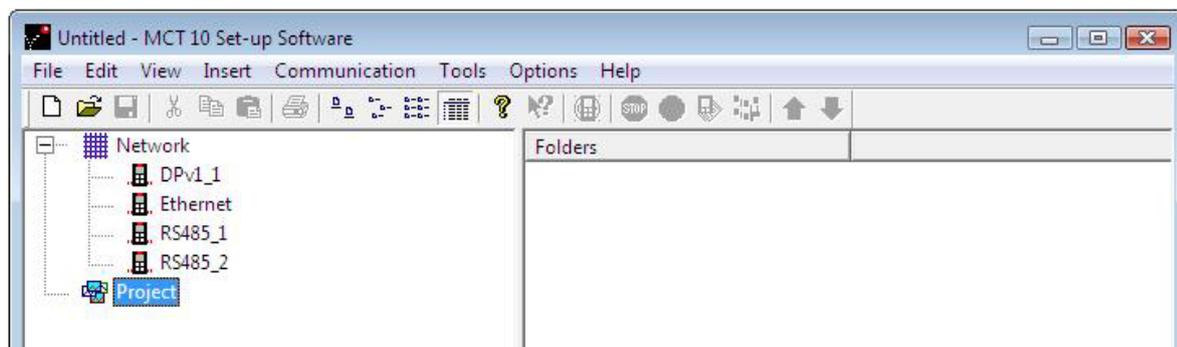


Illustration 5.1 MCT 10 Set-up Software Main Window

5.1 User Interface

5.1.1 Display

The MCT 10 Set-up Software 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 frequency converter network.

Use the left view to

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

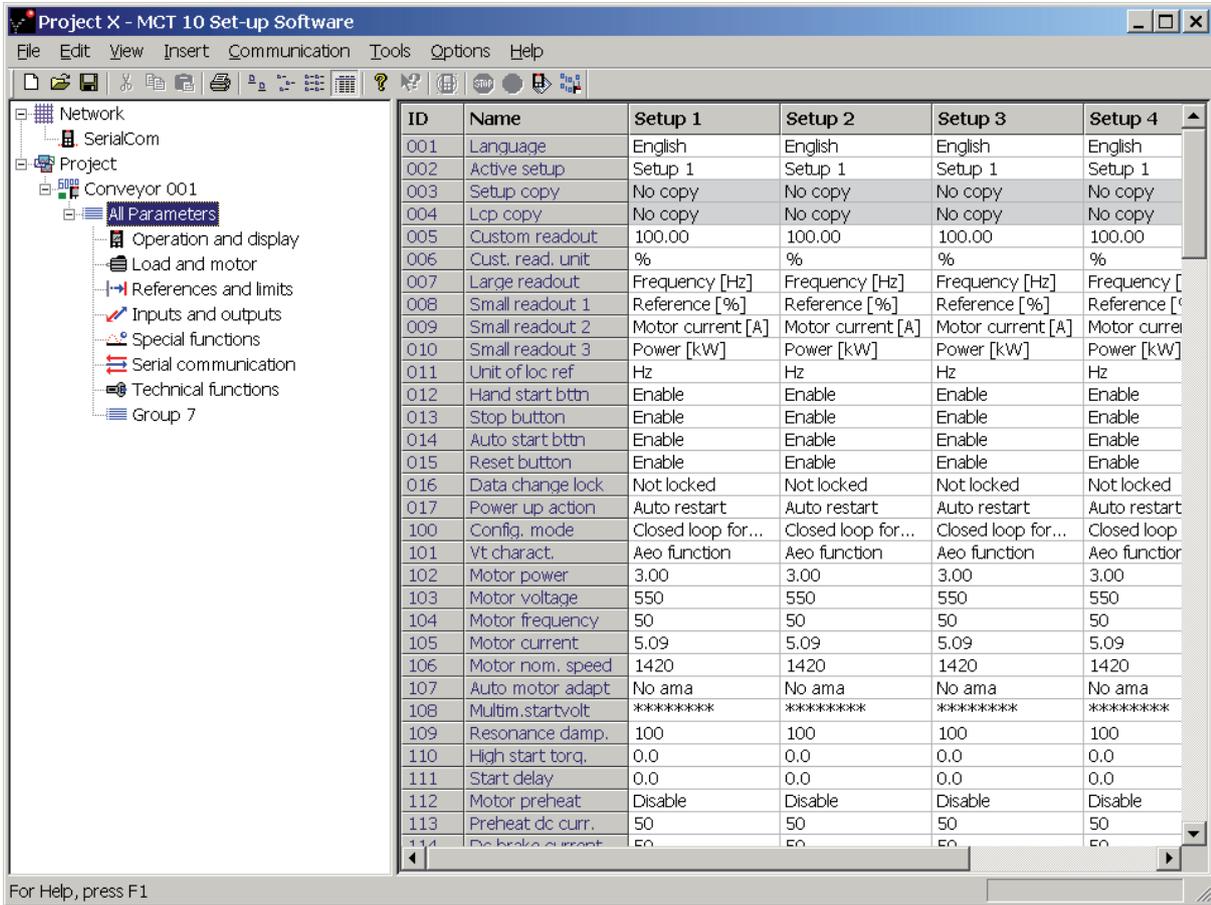
Store changes made to the real online set-up into the Project folder in the simulated, offline set-up for later use.

For more information on saving data, refer to *chapter 6.7 Save Changes to a Hard Disk*.

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

Right view

The right view, as shown in *Illustration 5.2*, shows details of the element highlighted in the left view. In the right view, the elements of the frequency converter network can be programmed.



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Illustration 5.2 Details Shown in the Right View

Toolbar

A toolbar shows icons for the most commonly used functions. See *Illustration 5.3*.



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Illustration 5.3 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.

5.1.2 Network and Project Folders

The Network folder gives access to physical devices operating in the field. Use Network to configure the physical frequency converters just 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.

NOTICE

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

Network mode - online

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

Data entered online is stored in the frequency converter, 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 *chapter 6.7 Save Changes to a Hard Disk*.

Project mode - offline

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

Data entered from offline is stored on the 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.

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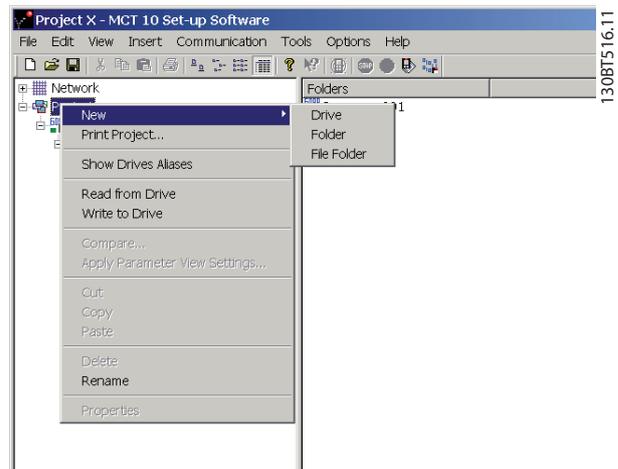


Illustration 5.4 Inserting a Folder Type

5.1.3 Other Folders

4 folder types are available for organizing a large system into several smaller systems.

Name	Purpose	Icon
Folder	Organize frequency converters and/or soft starters that are part of a machine or of a system.	 130BT713.10
File folder	Organize files belonging to a project. Any file format can be used.	 130BT714.10
Parameter folder	Store parameter settings temporarily or for documentation purposes. The folder can contain a single parameter, subgroup, parameter group, or the entire parameter database.	 130BT523.11
Scope folder	Analyze the behavior of 1 or several parameters for diagnostic purposes by visualizing them as a curve.	 130BT715.10

Table 5.1 Available Folder Types

Insert any folder type in an offline project in 1 of 2 ways:

- Right-click the project or an existing folder and select *New Folder/New File Folder*, as shown in *Illustration 5.4*.
- Alternatively, mark the project or an existing folder and select *New Folder/New File Folder* under *Insert*, in the main menu bar.

5.2 Frequency Converter Set-up

Insert a frequency converter, an active filter, or a soft starter in a project folder as follows:

1. Right-click in the offline location.
2. Select the appropriate device type.
 - 2a Alternatively, mark the location in offline.
 - 2b Select *Insert* in the main menu bar.

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

1. Right-click in the offline location.
2. Select *New drive*.
 - 2a Alternatively, mark the location in offline.
 - 2b Select *New drive* in the Insert menu.
3. Enter all relevant data in the *New drive* dialog and select *Make LHD*, as shown in *Illustration 5.5*.

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Illustration 5.5 Entering Data for a new Frequency Converter

NOTICE

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

The low harmonic drive is visible in the project as a composition of the frequency converter and the active filter, as shown in *Illustration 5.6*.

4. 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.

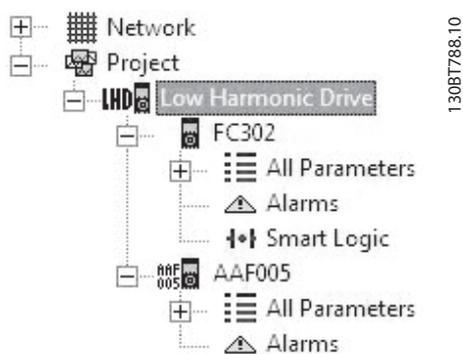


Illustration 5.6 Low Harmonic Drive Shown in the Project Folder

To insert a new folder or file folder, do as follows:

1. Right-click the project.

Alternatively,

- 1a Select *Insert* in the menu bar.
- 1b Select *New*.
- 1c Select *Drive*.
- 1d Select *Folder* or *File Folder*.

Here, the term Drive refers to the type of frequency converter. Inserting a frequency converter opens the *New drive* window, as shown in *Illustration 5.7*.

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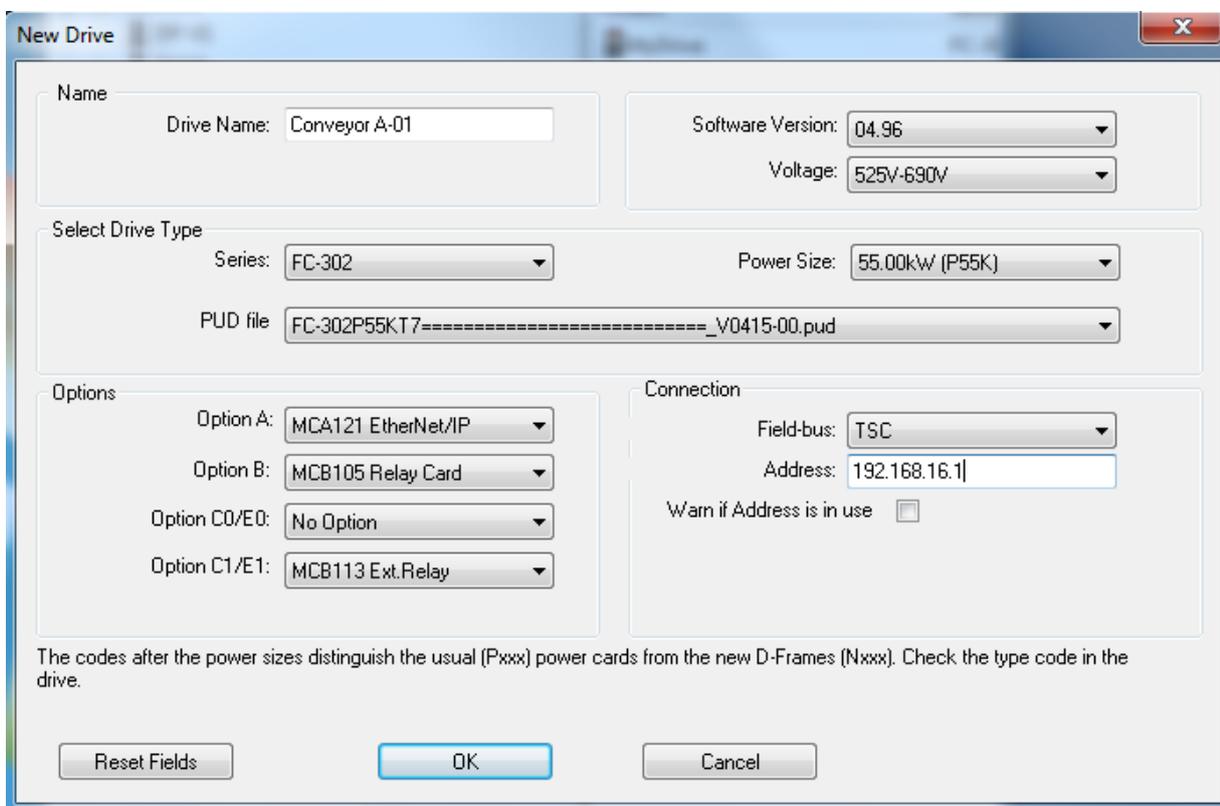


Illustration 5.7 New Drive Window

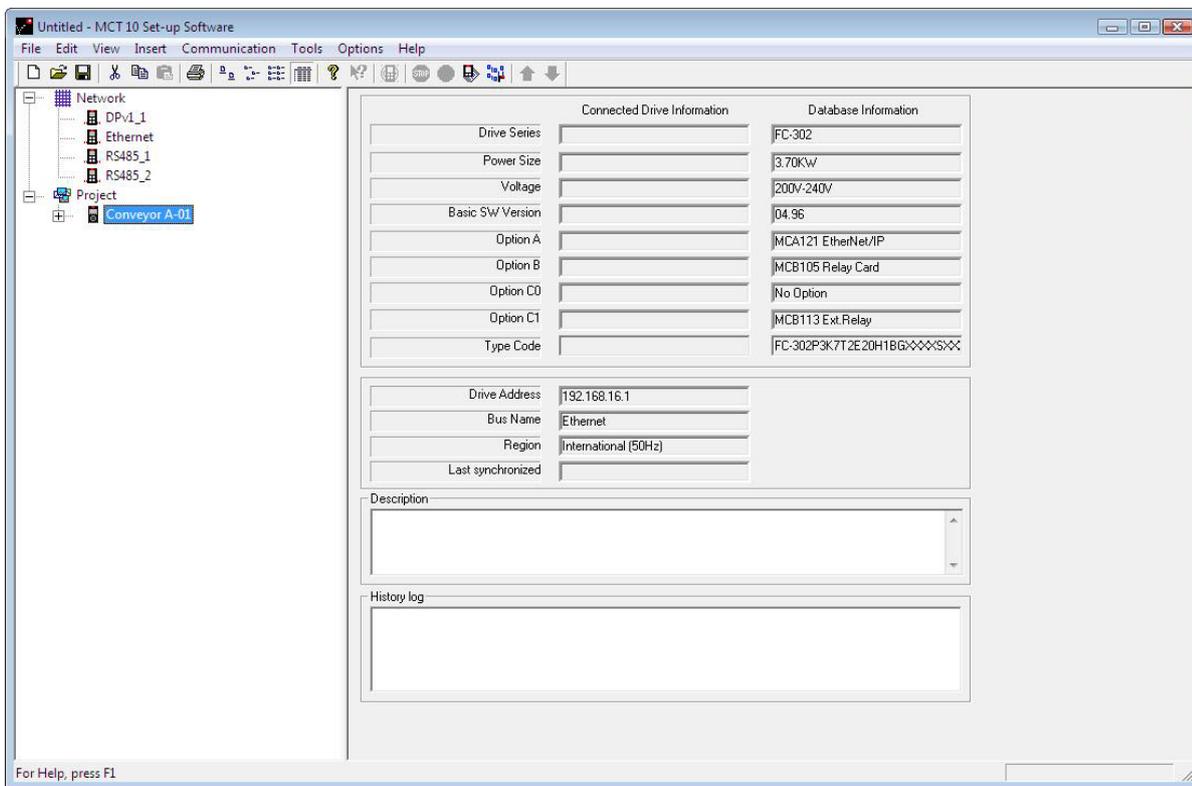
This *New drive* window consists of 4 main sections:

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

All sections are mandatory to fill in. The different selections are available from the drop-down menus.

Once the new frequency converter is added in the Project folder, the frequency converter data is stored in the offline Project folder and can be viewed by clicking the frequency converter icon. See *Illustration 5.8*.

Table 5.2 Mandatory Fields in New Drive Window



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Illustration 5.8 View the Frequency Converter Data

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

5.2.1 All Parameters Folders

A new Drive folder contains an *All parameters* folder, as shown in *Illustration 5.9*. This folder comprises a series of inner folders with generic names. There is no rename function for these folders. The generic folders within most frequency converters consist of the following folders:

- 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 frequency converter selected.

The generic folders comprise parameters relevant to the frequency converter type selected. See *Illustration 5.10*.

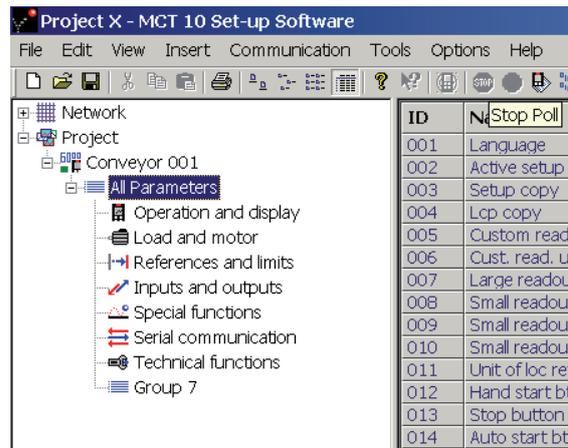


Illustration 5.9 Subfolders in the All Parameters Folder

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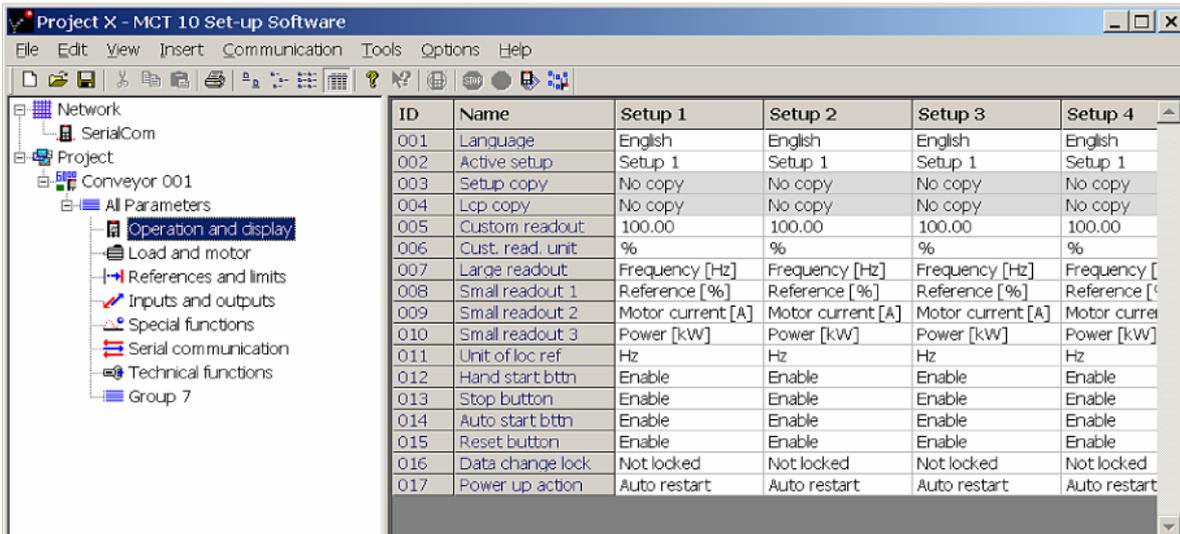


Illustration 5.10 Data Example in a Generic Folder

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5.2.2 Array Parameters

Parameters containing array data are shown as a matrix in the right view, where the rows of the matrix are identified 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, see *Illustration 5.11*.

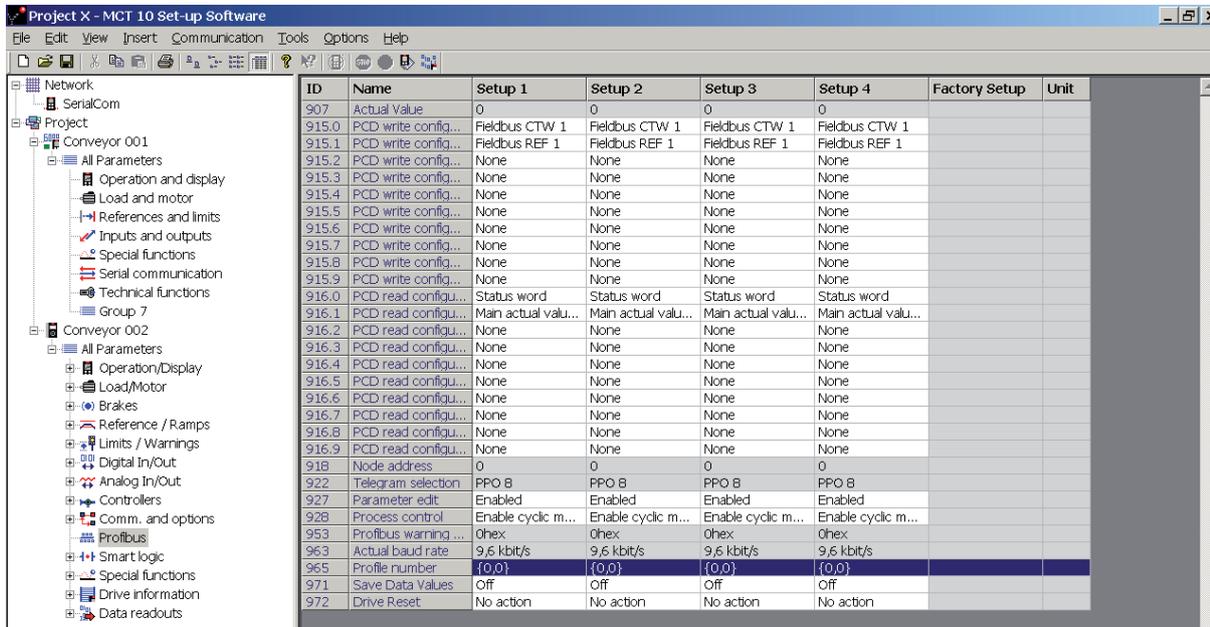


Illustration 5.11 Array Parameters

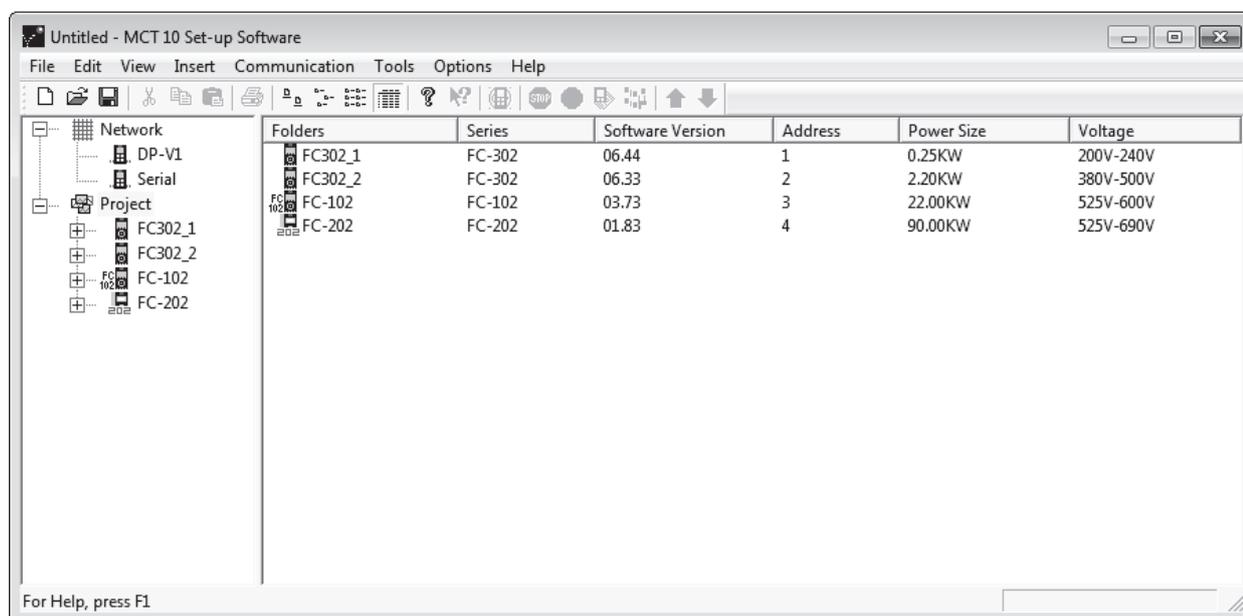
5.2.3 Sorting

The Danfoss products listed under *Network* or *Project* in *Illustration 5.12* can be sorted according to:

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

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Click the sorting bar and select the relevant sorting option.



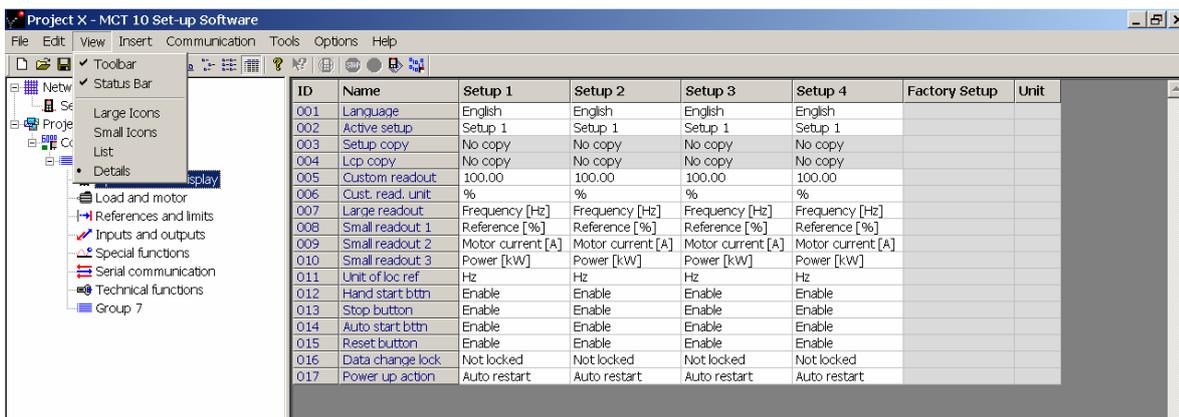
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Illustration 5.12 Sorting Options

5.3 Customized Views

Select *View* in the main menu bar to see the display options. As shown in *Illustration 5.13*, 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.



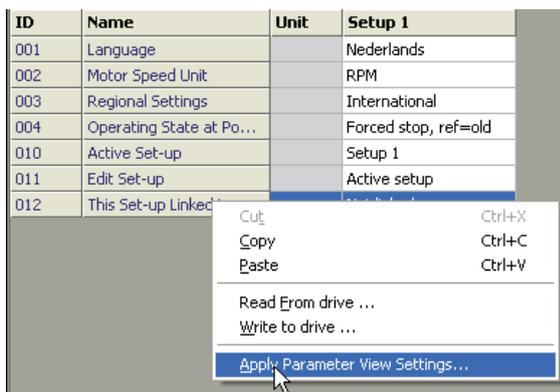
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Illustration 5.13 The View Menu

Customize parameter view settings

Apply the selected parameter view settings to subfolders, to an entire project, or to the entire application, that is all MCT 10 Set-up Software folders in network or project mode.

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



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Illustration 5.14 Applying Parameter View Settings

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

5.3.1 Customize Background Color

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

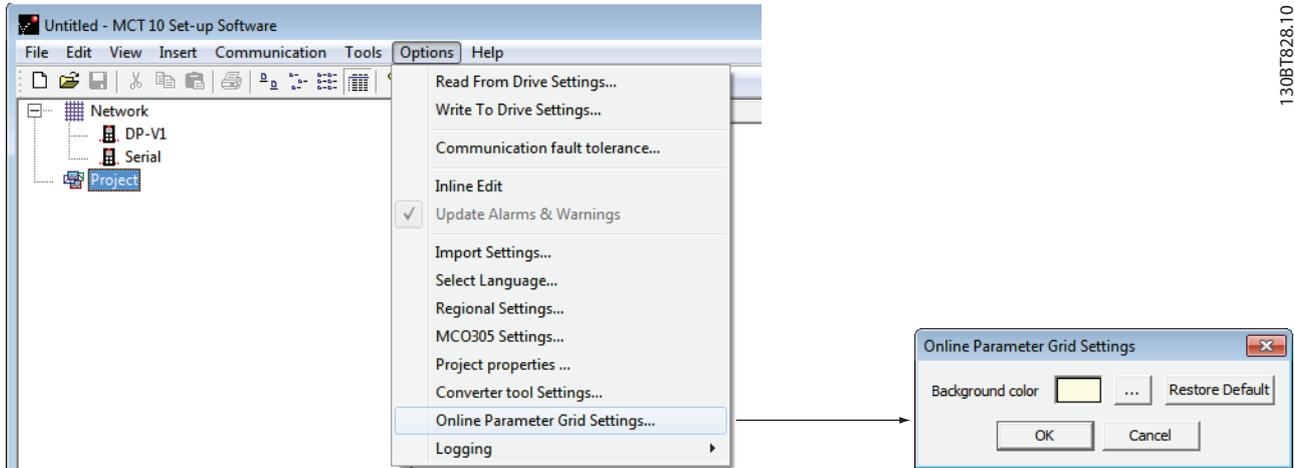


Illustration 5.15 Customizing the Background Color

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.

5.3.2 Customize Parameter View

The parameters shown in the right view are presented in a series of columns, containing ID, parameter name, 4 set-ups, units, and factory set-up.

Each set-up can be hidden by selecting *Parameter view⇒Set-up⇒Remove Menu*.

NOTICE

Changes made to the removed set-up are still stored inside the MCT 10 Set-up Software and can be shown by selecting *Customize Columns*.

Add or remove columns to customize view. See *Illustration 5.16*.

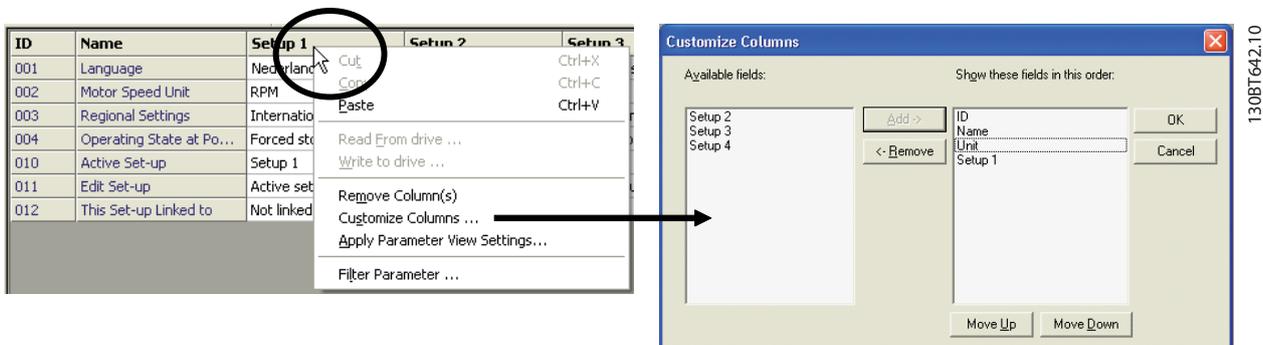


Illustration 5.16 Customize Columns Dialog

The actual view can be applied to the complete project or to the folder only.

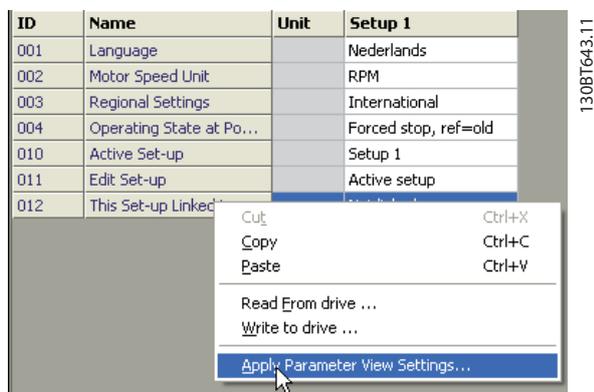


Illustration 5.17 Apply Parameter View Settings

5.3.3 Parameter Filter Options

The parameters in the right view can be filtered according to the settings shown in *Table 5.3*.

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.

Table 5.3 Available Filter Settings

To select the right-view setting:

1. Right-click any column in right view.
2. Select the appropriate filtering setting or the appropriate filtering group(s), as shown in *Illustration 5.18*.

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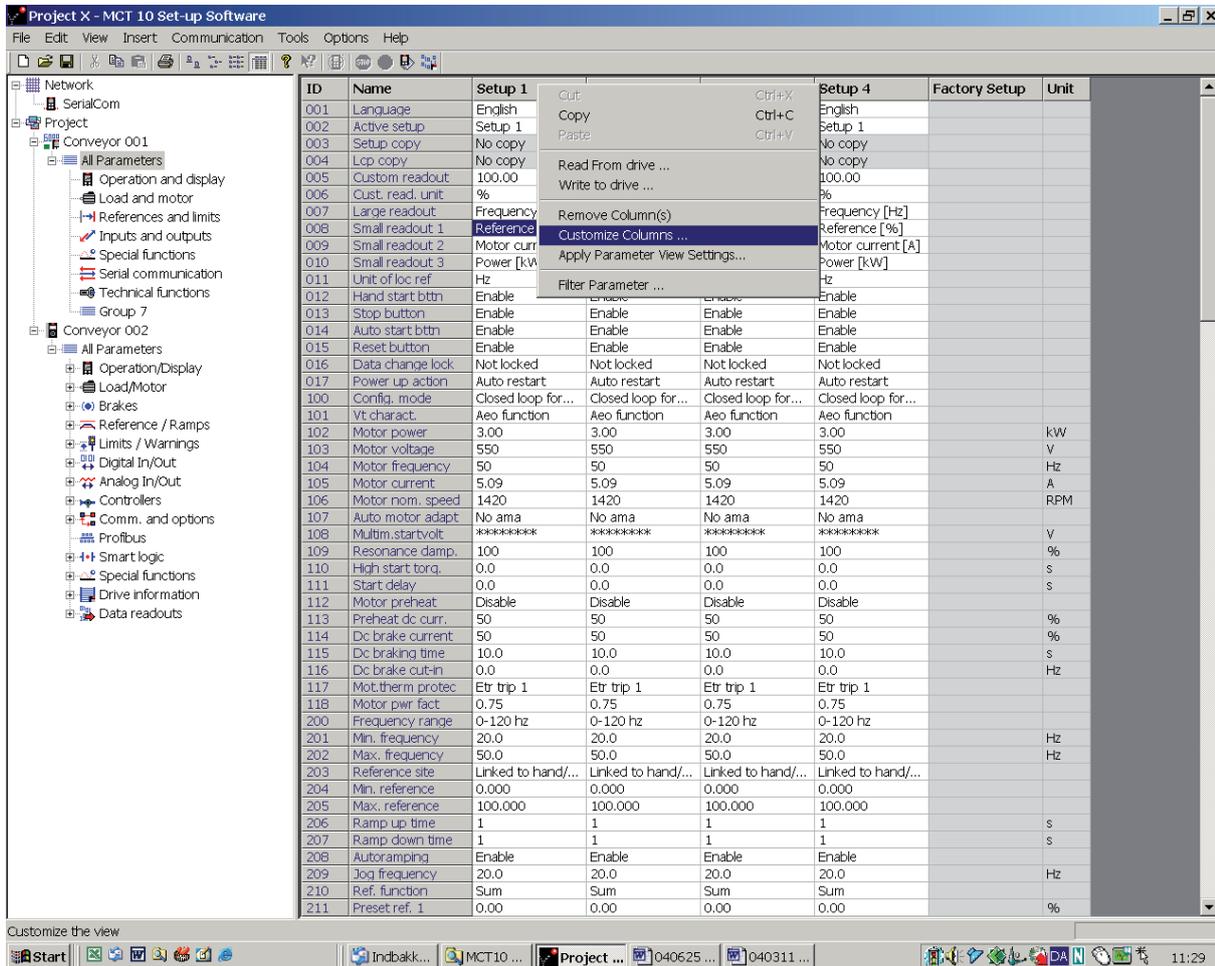
ID	Name	Setup 1	Setup 2	Setup 3	Setup 4	Factory Setup	Unit
001	Language	English	English	English	English		
002	Active setup	Setup 1	Setup 1	Setup 1	Setup 1		
003	Setup copy	No copy	No copy	No copy	No copy		
004	Lcp copy	No copy	No copy	No copy	No copy		
005	Custom readout	100.00	100.00	100.00	100.00		
006	Cust. read. unit	%	%	%	%		
007	Large readout	Frequency [Hz]	Frequency [Hz]	Frequency [Hz]	Frequency [Hz]		
008	Small readout 1	Reference [%]	Reference [%]	Reference [%]	Reference [%]		
009	Small readout 2	Motor current [A]	Motor current [A]	Motor current [A]	Motor current [A]		
010	Small readout 3	Power [kW]	Power [kW]	Power [kW]	Power [kW]		
011	Unit of loc ref	Hz	Hz	Hz	Hz		
012	Hand start btn	Enable	Enable	Enable	Enable		
013	Stop button	Enable	Enable	Enable	Enable		
014	Auto						
015	Res						
016	Dat						
017	Pow						

Illustration 5.18 Filtering Columns

5.3.4 Customize Columns

To rearrange the display of columns in the right view:

1. Right-click any column title.
2. Select *Customize columns*, as shown in *Illustration 5.19*.



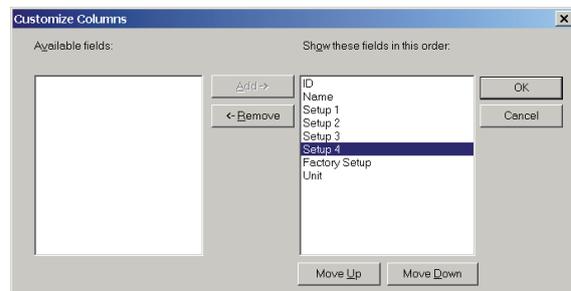
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Illustration 5.19 Customize Columns Menu

To change the order of the fields in the display:

1. Highlight a field.
2. Select *Move Up*, *Move Down*, or *Remove*.



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Illustration 5.20 Change Order of Fields

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*.

5.4 Parameter Edit

The parameter structures in the MCT 10 Set-up Software and in the frequency converter are the same. Modify the parameter by double-clicking the relevant parameter entry. If an entry cell is shaded in light grey, it is read-only and cannot be modified.

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ID	Name	Setup 1	Setup 2	Setup 3	Setup 4
200	DC hold current	50	50	50	50
201	DC brake current	50	50	50	50
202	DC braking time	10.0	10.0	10.0	10.0
203	DC brake cut-in s...	0	0	0	0
210	Brake and over-v...	Off	Off	Off	Off
211	Brake resistor (oh...	62	62	62	62
212	Brake power limit ...	7.900	7.900	7.900	7.900
213	Brake power mo...	Off	Off	Off	Off
215	Brake check	Off	Off	Off	Off
220	Release brake cur...	3.34	3.34	3.34	3.34
221	Activate brake sp...	0	0	0	0
223	Activate brake de...	0,0	0,0	0,0	0,0

Cells shaded in light grey indicate read-only parameters

Illustration 5.21 Editing Parameters

Change parameter set-up by manually entering new value(s) in the cells in the right view.

Alternatively, change the parameter set-up by importing values from an active frequency converter, 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:

- Dialog-based.
- Inline.

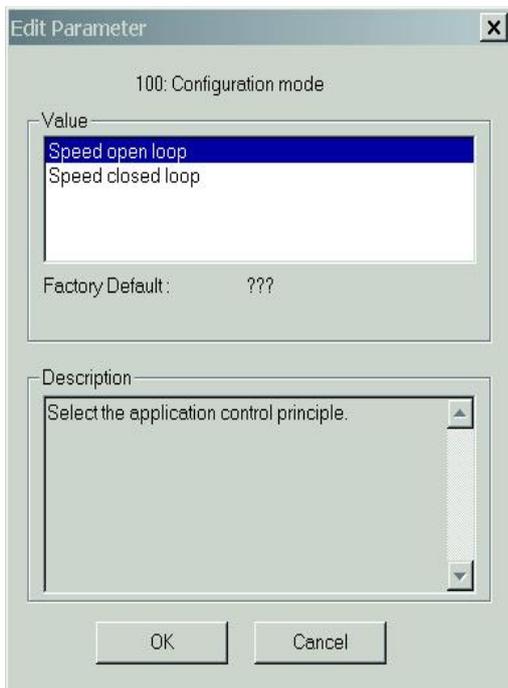


Illustration 5.22 Edit Parameter View

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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 the experienced user.

Dialog-based edit

To have details of parameters available while editing, use dialog-based edit.

Parameter details

- Parameter options.
- Ranges.
- Functions.

Enter dialog-based edit by deselecting Inline edit.

5.5 Comparison of Parameters

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

1. Activate the function by highlighting the desired frequency converter and selecting *Compare*. See *Illustration 5.23*.

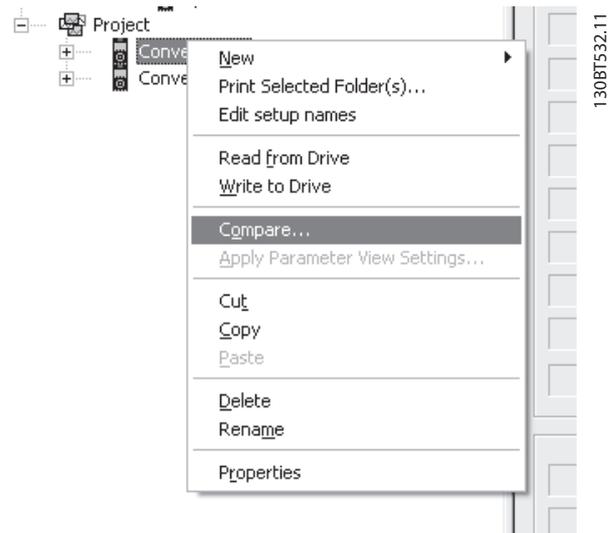


Illustration 5.23 Comparison

2. Select the frequency converter for comparison.

This can be an online frequency converter from the network, or it can be a frequency converter 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 set-ups, or to compare 1 set-up to another.

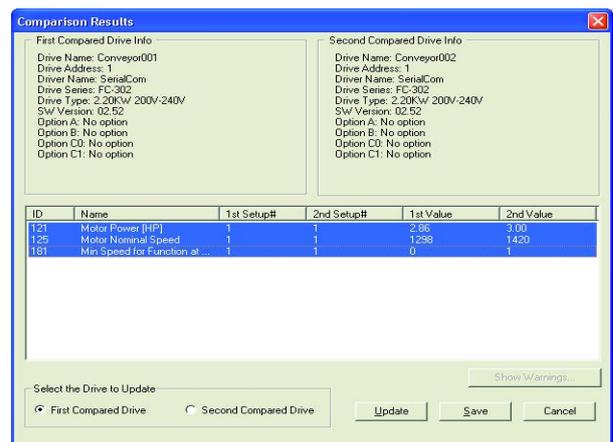


Illustration 5.24 Comparison Result

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5.6 View Change Log

When configuring a frequency converter, 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*. See *Illustration 5.25*.

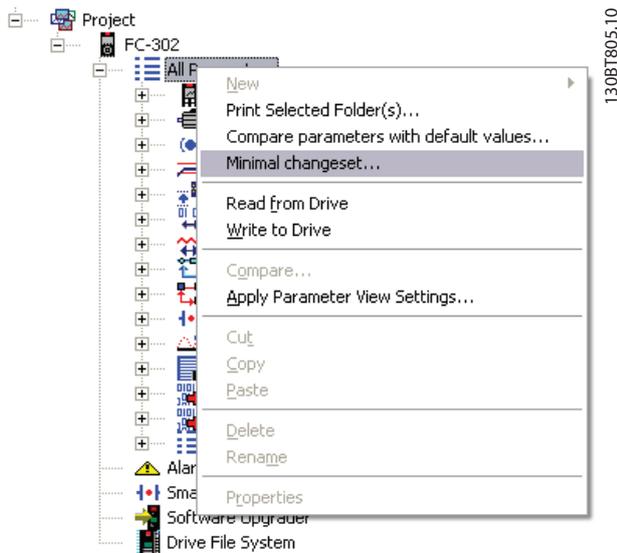


Illustration 5.25 Minimal Changeset

Changes made including the dependent parameters can be read out by right-clicking *All Parameters* and selecting *Compare parameters with default values*. See *Illustration 5.26*.

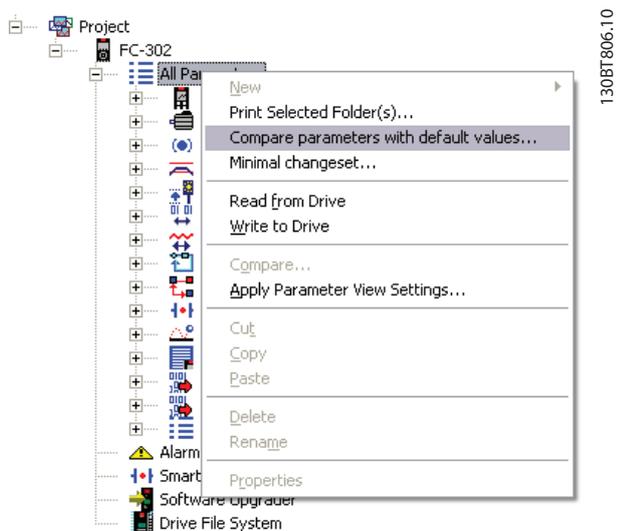


Illustration 5.26 Compare Parameters with Default Values

5.7 Read Drive Operation Status

The frequency converter can be in 2 different operation conditions: *Auto On* or *Off*. This can be monitored via the LCP or MCT 10 Set-up Software. Use MCT 10 Set-up Software to monitor the actual operation status by clicking a frequency converter located in the network. Select *Refresh status* to update the status information. Parameters can only be written to frequency converters in operation status *Off*.

6 Operation

6.1 Reading and Writing Parameters

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

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

Select the value(s) 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 group of parameters in the left view, for example the Load and motor group.

The read-from-drive and write-to-drive functions apply to the whole selection. See *Illustration 6.1*.

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

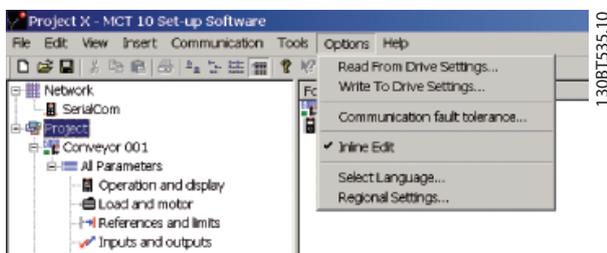


Illustration 6.1 Select Options

6.1.1 Read From Drive Settings

Select the desired options for reading from an active frequency converter.

Set-ups

Select to read visible set-ups only, or to read all set-ups.

Drive differences

Specify the acceptable level of compatibility errors, if field device software and MCT 10 Set-up Software versions are not identical. 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 version but same frequency converter

series. Select *Do not allow drive differences* to not accept differences between online devices and offline devices.

Save as default settings

Activate the *Read from Drive*-settings for all reads from frequency converter.

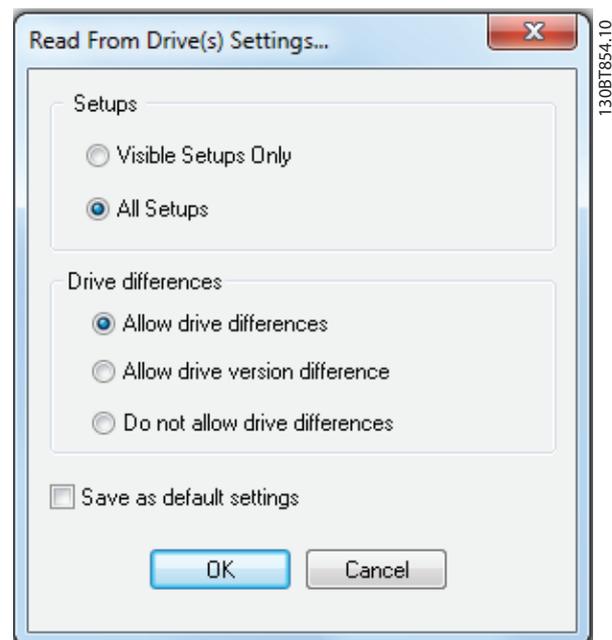


Illustration 6.2 Read from Drive Settings

6.1.2 Write to Drive Settings

Select the desired options for writing to an active frequency converter, which then becomes applicable for all writing to frequency converters. See *Illustration 6.3*.

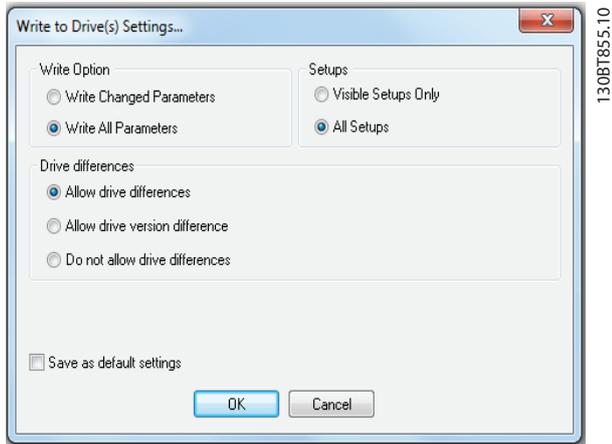


Illustration 6.3 Write to Drive Settings

Write option

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

If selecting *Write changed parameters*, only the subset of parameters different from default are written. This selection improves performance.

6.1.3 Communication Fault Tolerance

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

6.3 Read From Drive

Values can be read from an active frequency converter by right-clicking on the desired selection (in this example a parameter column title in the right view), then selecting *Read from drive*. See *Illustration 6.5*.

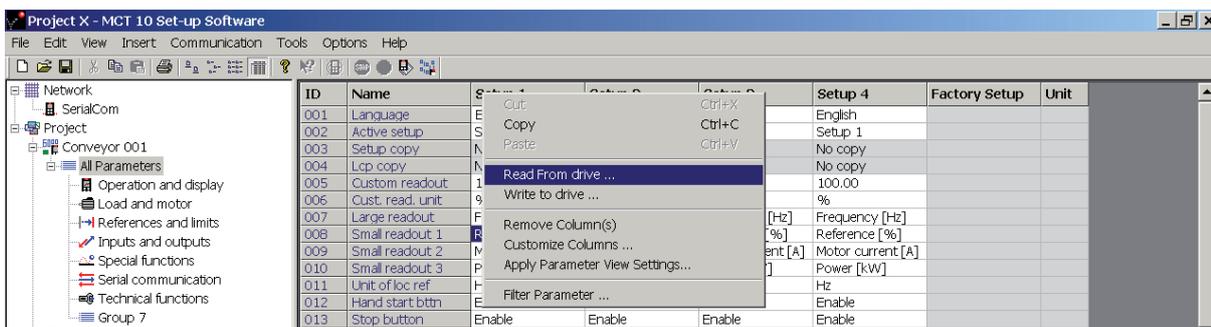


Illustration 6.5 Read from Drive

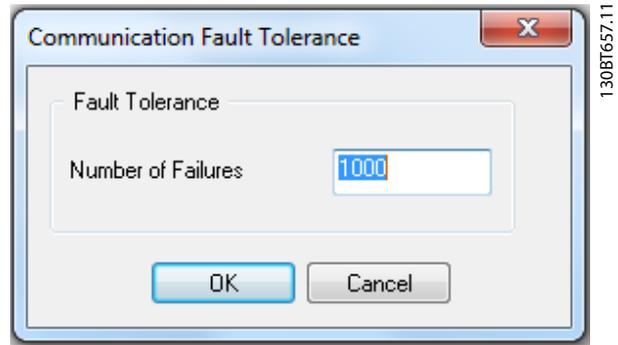


Illustration 6.4 Fault Tolerance

6.2 Connection Properties

To read or write between online and offline frequency converters, the connection properties must be configured in the offline project. If the fieldbus does not refer to an available frequency converter in the network tree, MCT 10 Set-up Software is not able to identify the online frequency converter.

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.

Once *Read from drive* is selected, the software accesses the online device and shows the *Drive Check* window, containing a list of frequency converters with detected compatibility issues. See *Illustration 6.6*.

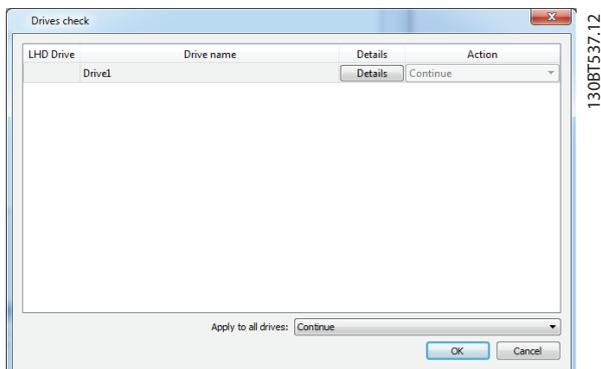


Illustration 6.6 Drive Check

Select *Details* to view details on the different properties between project device (based on database information) and online device, that is connected frequency converter, as in *Illustration 6.7*:

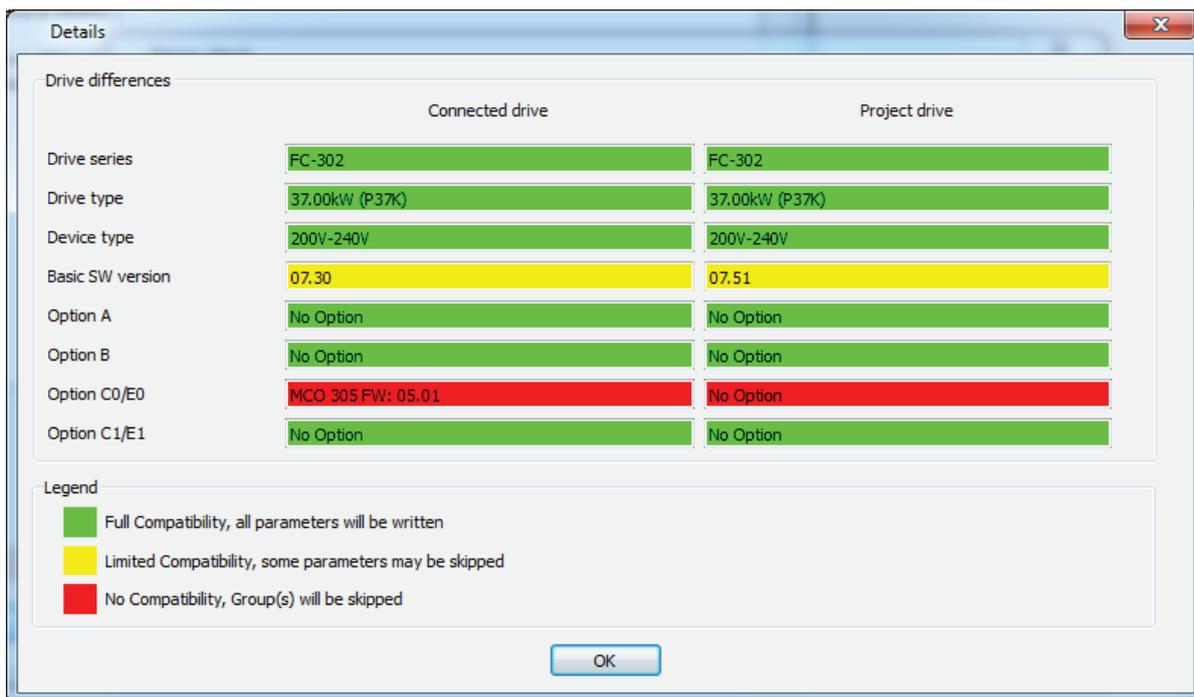


Illustration 6.7 Details

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.
- Update project and continue.

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

If selecting *Skip the drive*, MCT 10 Set-up Software does not read that particular device, but continues reading the other devices.

Continue resumes reading. The user acknowledges and accepts 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 frequency converter.

NOTICE

The *Update drive from connected* selection causes all information stored in the project drive to be deleted and replaced. To retain the information entered into the project drive, select *Continue*.

6

Once the read-from-drive process is completed, the display shows details of both the Connected drive information and the Database information. See *Illustration 6.8*.

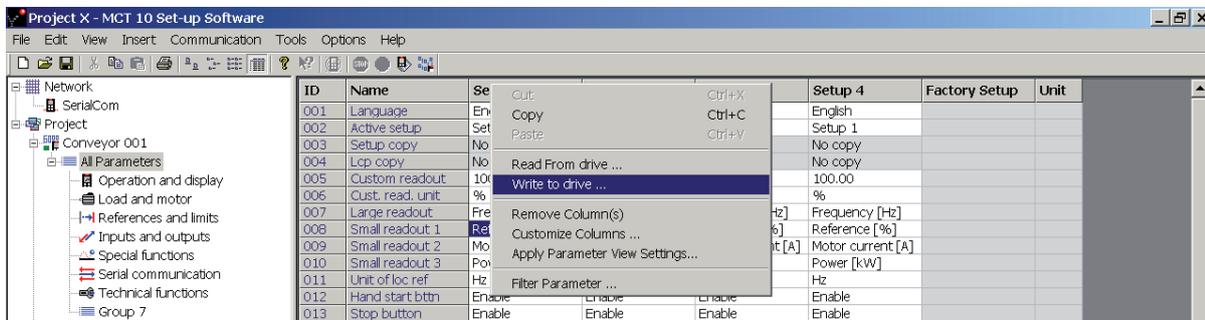
	Connected Drive Information	Database Information
Drive Series	FC-302	FC-302
Power Size	0.55kW	0.55KW
Voltage	380V-500V	380V-500V
Basic SW Version	01.21	01.21
Option A	00.00 No option	No option
Option B	00.00 No option	No option
Option C	00.00 No option	No option
Type Code	FC-302PK55T5E20H1BGXXXXXSXXXXA	
Drive Address	1	
Driver Name	USB	
Region	International (50Hz)	

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Illustration 6.8 Read-from-drive Process Completed

6.4 Write to Drive

Write values to an active frequency converter by right-clicking a parameter column title in the right view and then selecting *Write to drive*.



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Illustration 6.9 Write to Drive

Alternatively, access *Read From Drive* and *Write To Drive* by selecting *Communication* in the main menu.

6.5 Poll

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

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

- Select *Stop polling* under *Communication* in the main menu bar

or

- Select *Stop polling* from the toolbar, as shown in *Illustration 6.10*.



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Illustration 6.10 Stop Polling Icon

Resume polling in 2 ways:

- Select *Resume polling* under *Communication* in the main menu bar

or

- Select *Resume polling* from the toolbar, as shown in *Illustration 6.11*.



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Illustration 6.11 Resume Polling Icon

6.6 Changing the Set-up of a Device in the Field

To change settings for a field device, open the Network folder and select the relevant device.

Select *Stop* on the toolbar to stop polling and change the settings in the set-up columns in the right view.

NOTICE

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

6.7 Save Changes to a Hard Disk

6.7.1 Record Online Changes

To record online changes to a hard disk:

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

6.7.1.1 Save a Project

Save a project by selecting *File⇒Save* from the main menu bar. Alternatively, select the *Save* icon on the toolbar.

Include drive information

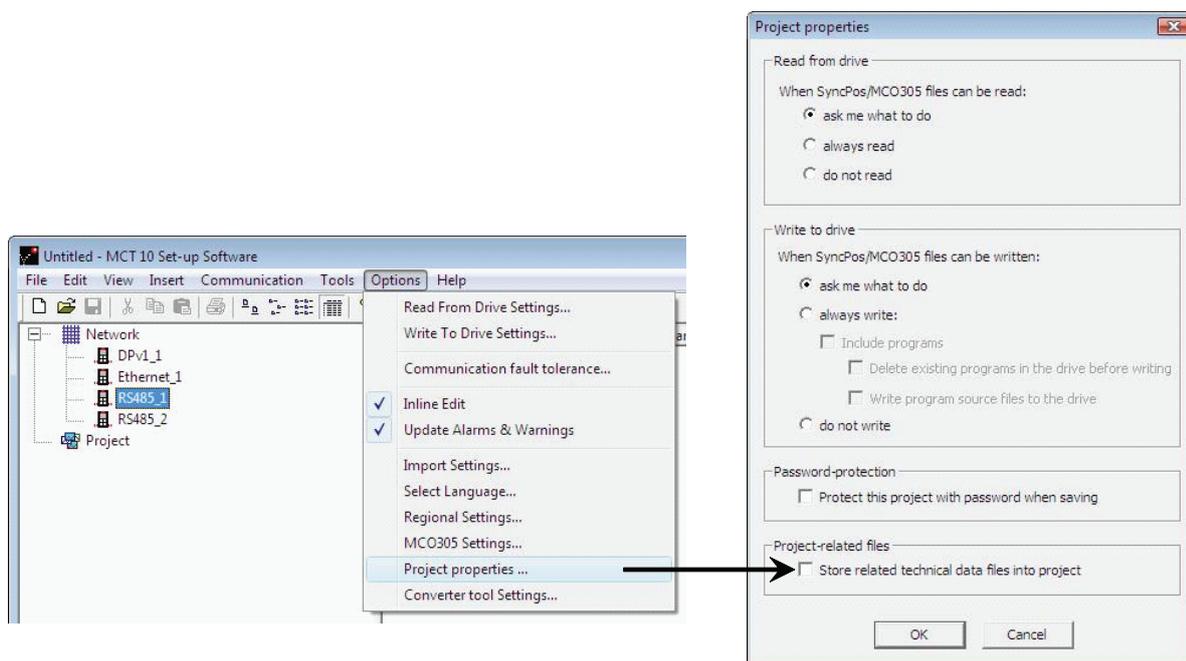
It is not possible to open a project file including a firmware version not supported by MCT 10 Set-up Software. Including the frequency converter information in the project file makes it possible to open in other installations with MCT 10 Set-up Software without having the firmware installed. Opening the project file, the frequency converter information is updated similarly to:

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

The frequency converter information is saved in the project file. To exclude the frequency converter information in the project file:

1. Select *Options*.
2. Select *Project properties*.
3. Click to enable Project-related Files. See *Illustration 6.12*.

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Illustration 6.12 Save Frequency Converter Information

6.7.2 Archive/Unarchive

Projects that include links to other documents can store the linked files.

By selecting the *Archive* function, the MCT 10 Set-up Software generates a file that contains all frequency converters and the linked files into a *.ssa File. If this file is sent to other computers, the user gets a copy of the linked files on his computer.

6.8 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 MCT 10 Set-up Software.

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

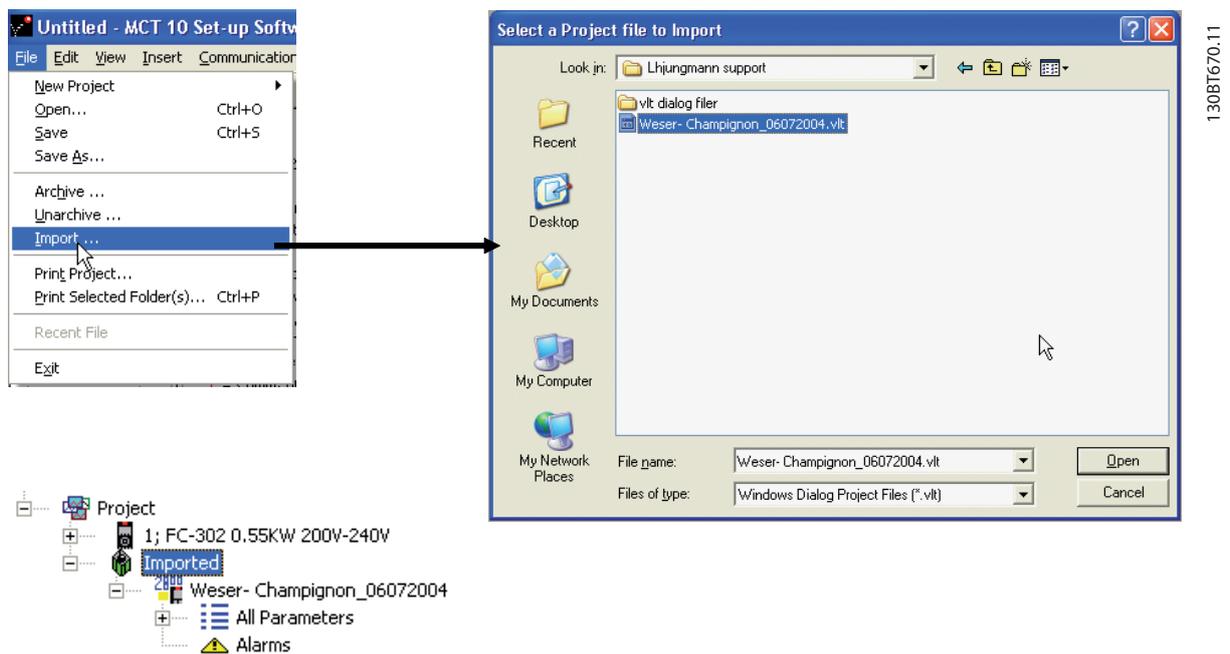


Illustration 6.13 Import Older Dialogs

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

6.9 Printing

There are 2 options for printing from MCT 10 Set-up Software:

- Print project.
- Print selected folders.

Both options are located under *File* in the main menu bar. Alternatively, select *Print project* by right-clicking the *Project* icon. Select *Print selected folders* by right-clicking the icon for a folder within the project.

Select *Print project* to print parameter settings for an entire project.

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

A dialog box, as shown in *Illustration 6.14*, pops up:

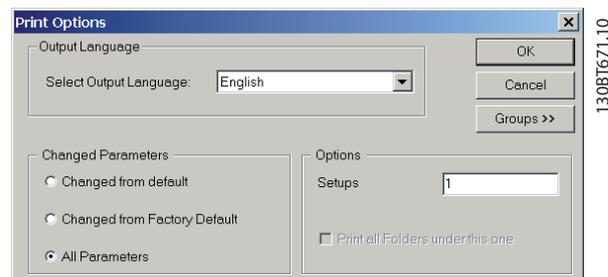


Illustration 6.14 Print Options

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

Changed parameters

Select this option to print all parameters or to print changed parameters. Select between parameters:

- Changed from default.
- Changed from factory default.
- All parameters.

Options

Specify which set-up to print.

Groups

Select *Groups* to print selected parameter groups only.

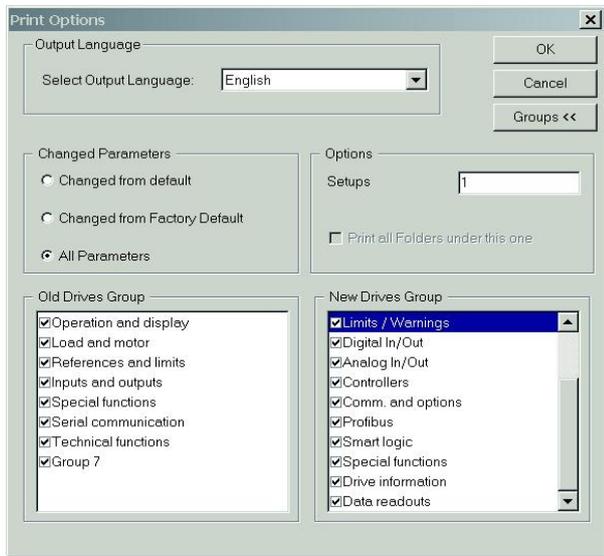


Illustration 6.15 Print Changed Parameters

1. Select the parameter groups to print.
2. Select *Groups* to return to the original unexpanded print dialog box.
3. Click *OK* to print.

6.10 Update Database Information

If the MCT 10 Set-up Software database information is outdated, updates are available either by download from Internet or, when this is not possible, by reading from the frequency converter itself.

When the MCT 10 Set-up Software database for a frequency converter is outdated, the frequency converter icon is shown with a red line through it and the *Database information* fields show settings that are identical to the *Connected drive information*, as shown in *Illustration 6.16*:

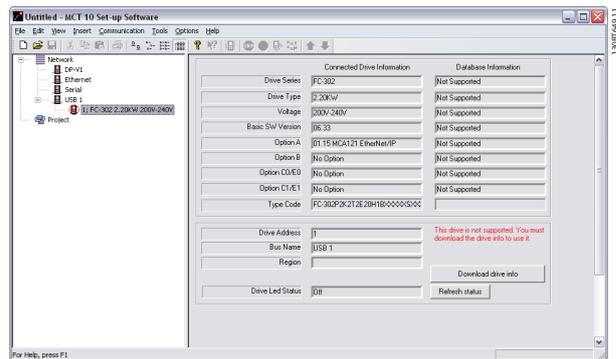


Illustration 6.16 Outdated Software Database

Update the database either by right-clicking the frequency converter icon and selecting *Download drive info*, or by clicking *Download drive info*. See *Illustration 6.17*.

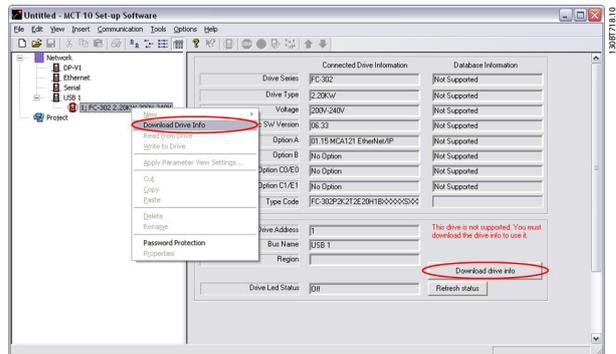


Illustration 6.17 Database Update

To commence reading from the frequency converter, select *Yes*.

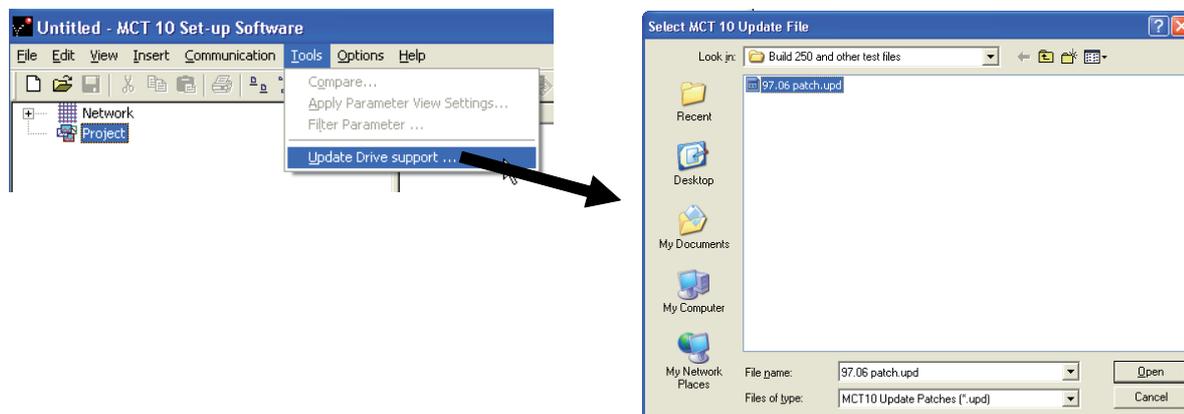
When reading from the frequency converter is complete, the frequency converter icon no longer has a red line through it, and the *Database information* in the right view shows settings that are identical to the *Connected drive information*.

Also, the parameter settings are shown in capital letters.

6.11 Update Drives Firmware Support in MCT 10 Set-up Software

MCT 10 Set-up Software can be updated regardless of the firmware version of the frequency converter.

Download upgrades from the Danfoss website www.vlt-software.com and store them on a local disk drive.



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Illustration 6.18 Update MCT 10 Set-up Software

NOTICE

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

6.12 Software Compatibility

MCT 10 Set-up Software project files can open legacy version project files. *Table 6.1* shows an example.

Software versions of MCT 10 Set-up Software and frequency converter in existing project file	Software versions of MCT 10 Set-up Software	Compatible ✓/✗
2.00 and 2.01	2.02	✓
2.02 and 2.51	2.00	✗

Table 6.1 Opening Legacy Versions

When MCT 10 Set-up Software has been updated, project-files saved with newer version firmware can be opened and used. This scenario is shown in *Illustration 6.19*.

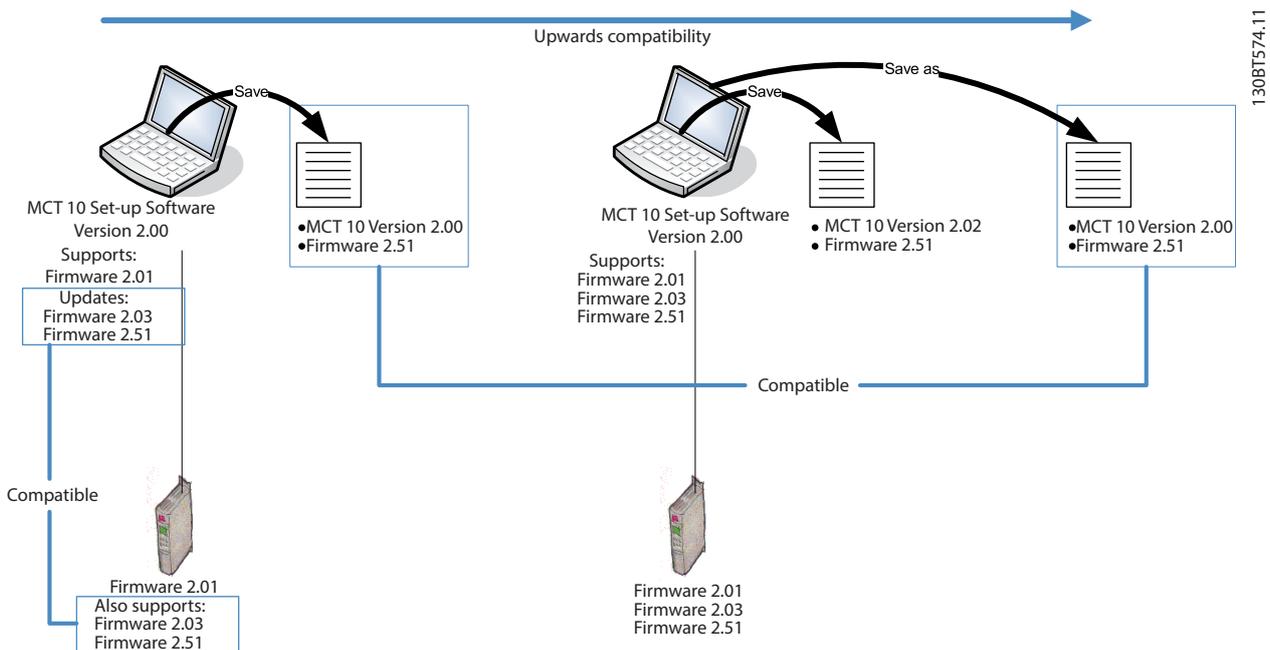


Illustration 6.19 Use Updated MCT 10 Set-up Software

To establish connectivity to a frequency converter with firmware version 1.10, it is required to modify the MCT 10 Set-up Software drive database mapping to firmware version 1.05 as reference.

- Start the MS Explorer and open the path C:\Program Files\Common Files\Danfoss Drives\SharedSource\
- Open the text file *ss_version_mapping.txt* in Notepad by right-clicking the file and selecting *Edit*.
- Change "Series="FC-202",AOC="01.10",Database="01.10" to Series="FC-202",AOC="01.10",Database="01.03"
- Save and close the file.

To find out if the MCT 10 Set-up Software has been updated, check the information in the *About* box. This box shows the actual MCT 10 Set-up Software version. See *Illustration 6.20*.

NOTICE

System information can be copied directly to the Windows clipboard.

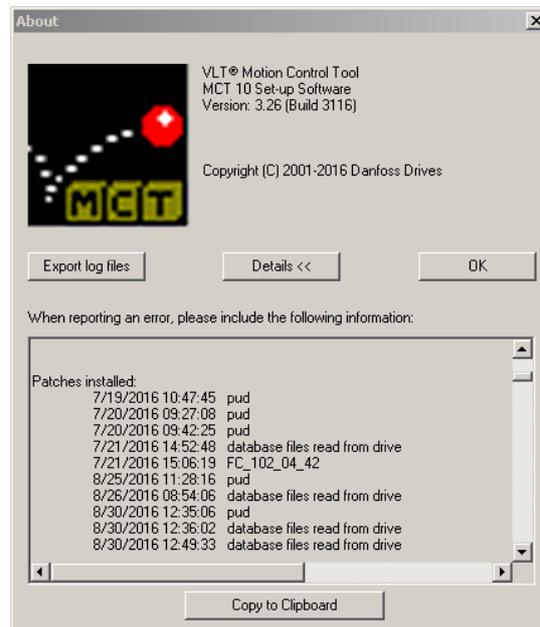


Illustration 6.20 Copy System Information

6.13 Conversion Wizard

6.13.1 Match

It is required that database versions, power size, voltage range, and option configuration of the source match the destination frequency converter. Differences can be converted using 1 of the conversion wizards available in MCT 10 Set-up Software:

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

NOTICE

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

6.13.2 VLT to FC Series Converter Function

It is possible to convert for example a VLT 5000 frequency converter to a VLT® AutomationDrive FC 302 with the conversion matrix in the MCT 10 Set-up Software.

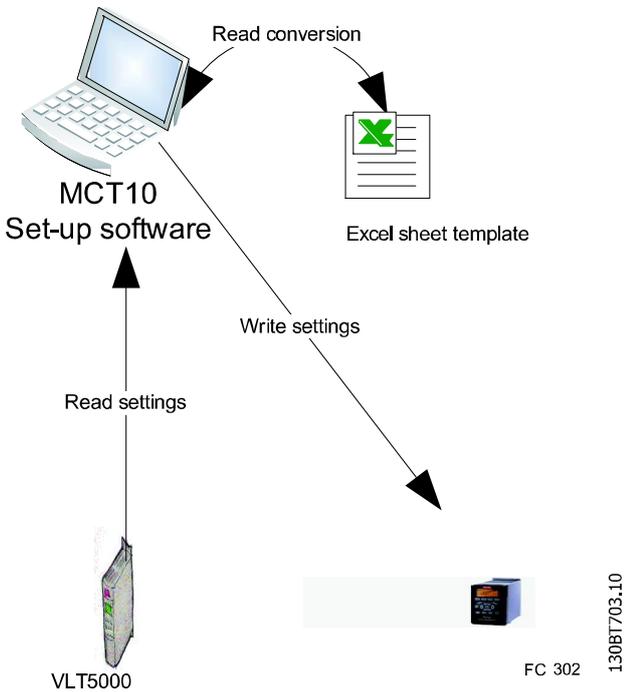


Illustration 6.21 Conversion

Conversion of multiple frequency converters

1. Select the *Tools* menu and activate *Drive Conversion Wizard*.
2. In the subsequent dialogs, select the frequency converters for conversion.
3. When converted, a new FC 302 frequency converter is created in the Project folder.

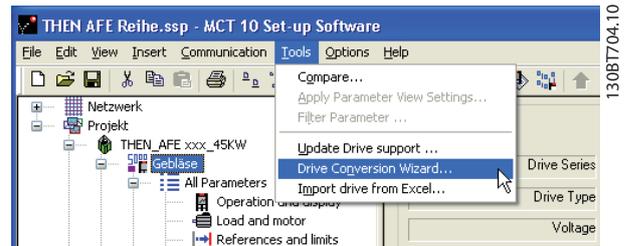


Illustration 6.22 Conversion of Multiple Frequency Converters

6.13.2.1 Import Drive from Excel

Use this function to create an FC30x frequency converter project based on an Excel sheet. Import of for example VLT 3000 settings from an Excel sheet into a new FC 302.

An example file is attached in MCT 10 Set-up Software (vlt3000conversion.xls). This example file can be edited and used for converting from VLT 3000 to FC 302.

NOTICE

Detailed knowledge of Microsoft Excel formula editing is required.

6.13.3 FC to FC Series Conversion

The converter tool can convert projects within the same frequency converter series, regardless of software versions, power size, voltage range, and option configuration. It covers VLT® HVAC Drive FC 102, VLT® AQUA Drive FC 202, VLT® AutomationDrive FC 302, VLT® Lift Drive LD 302, and all OEM versions based on the FC xxx series. Differences can be matched by using the Conversion tables manager.

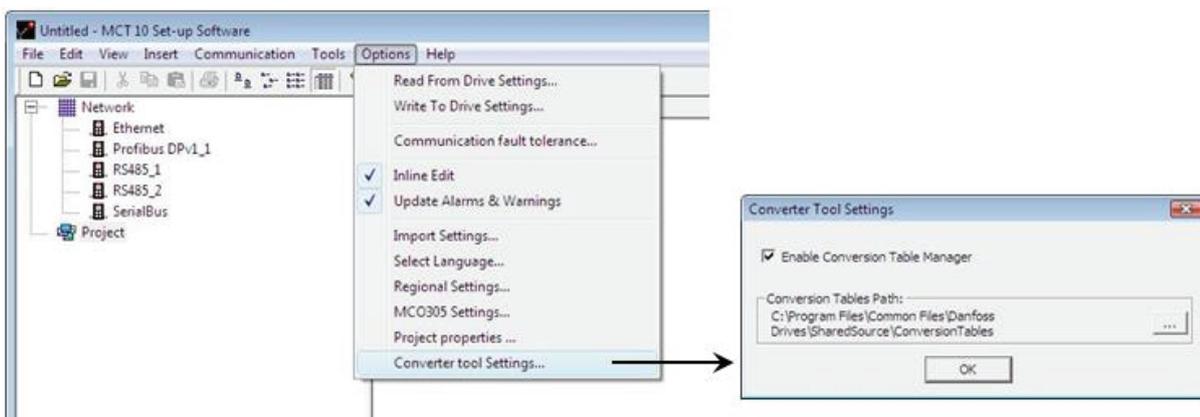
A conversion table enables conversion from:

- Online to online drive.
- Online to offline drive.
- Offline to online drive.
- Offline to offline drive.

2 user profiles are available:

- Administrator – qualifies and manages the conversion tables through access to the Conversion tables manager. From the Conversion tables manager, new conversion tables can be created and deployed to other MCT 10 Set-up Software installations.
- User – writes projects to the destination using the conversion tables transparently. The user cannot access the Conversion tables manager. Conversion tables can be imported to the database.

MCT 10 Set-up Software is installed with user rights. Enabling the Conversion tables manager is done from the checkbox in the *Converter tool settings* dialog.



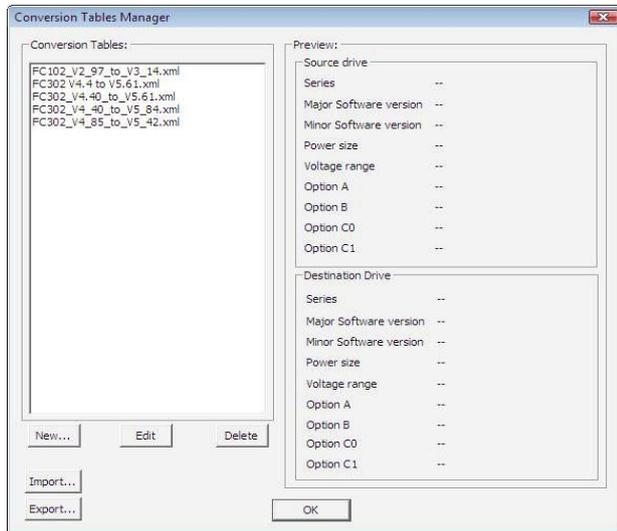
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Illustration 6.23 Enabling Conversion Table Manager

The conversion tables are stored locally on the hard disk. Using the database non-distributed, the path to the network location can be reconfigured from the *Converter tool settings* dialog.

6.13.4 Conversion Tables Manager

Access the Conversion tables manager, as shown in *Illustration 6.24*, through the MCT 10 Set-up Software tools menu.



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Illustration 6.24 Conversion Tables Manager

The dialog is divided into the following sections:

- A conversion table containing the list of conversion tables in the database.
- A preview pane.

Conversion tables can be created or imported, edited, exported, or deleted.

Exporting tables

Distribute to other MCT 10 Set-up Software installations by exporting the relevant tables to a *.cvt file. The preview pane lists the conversion table source and destination frequency converter information.

The conversion can be as follows:

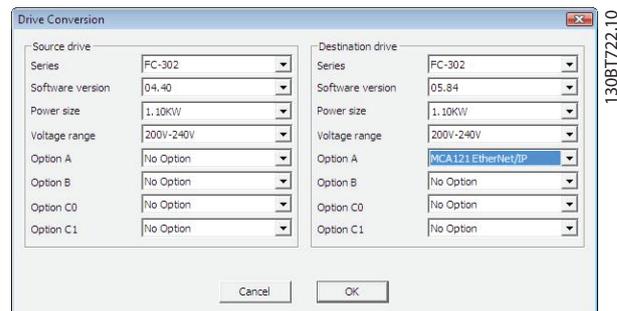
- Drive series based on the FC 102/FC 202/FC 3xx platform
- Software version (major and minor)
- Power size
- Voltage range
- Option A
- Option B
- Option C0
- Option C1

Create new conversion tables

To create a new conversion table, open the Conversion tables manager or right-click the source drive and select *Convert drive*.

NOTICE

When using the right-click option, it is only possible to configure the information of the destination frequency converter. Furthermore, *parameter group 19-** User-defined Parameters* is not converted. These settings are configured when writing from source to destination.



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Illustration 6.25 Drive Conversion

Editing tables

In the *Drive conversion* view, enter the information for source and destination frequency converters. Click *OK* to open the Conversion table editor listing the parameter database differences.

Use the Conversion table editor to create or load a conversion table. Ensure that the conversion table matches the frequency converter series, software version, power size, voltage range, and option configuration. The MCT 10 Set-up Software is not able to find and load incompatible conversion tables. After loading or creating the conversion table, it is possible to re-edit the table or to convert the source frequency converter and store the converted frequency converter in an offline folder.

Formulas

The parameter database is listed and sorted according to the parameter ID. To simplify the conversion process, filter the database to list alerts or applied changes only.

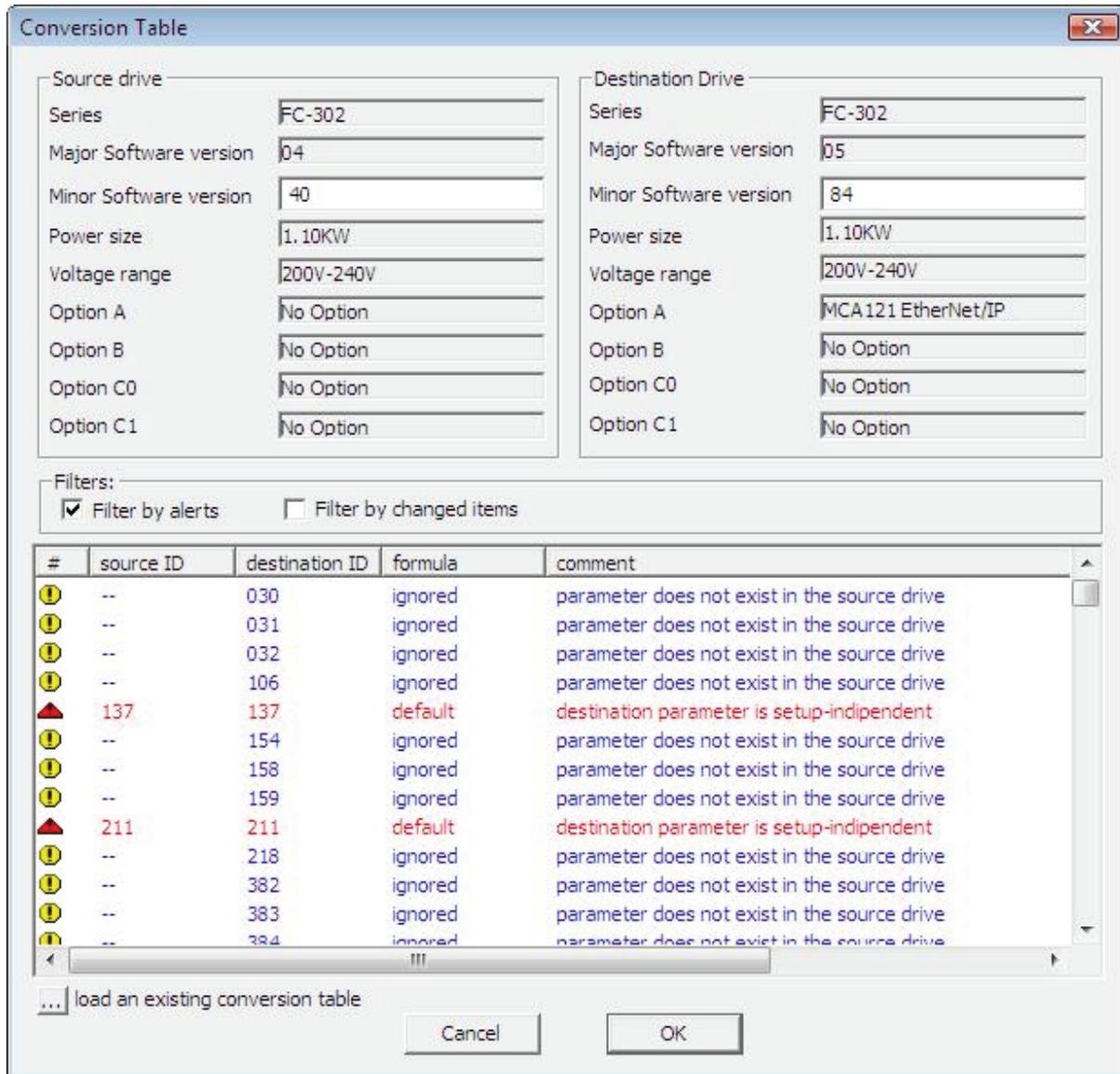
Color code	Description
Red	Difference between source database and frequency converter. A formula is required before changes can be applied to the frequency converter.
Blue	Difference between source database and frequency converter. The formula is ignored and changes can be applied to the frequency converter.

Table 6.2 Alert Color Coding

NOTICE

If a formula is applied to all alerts, the source parameter database can be converted to the destination parameter database without any further configuration.

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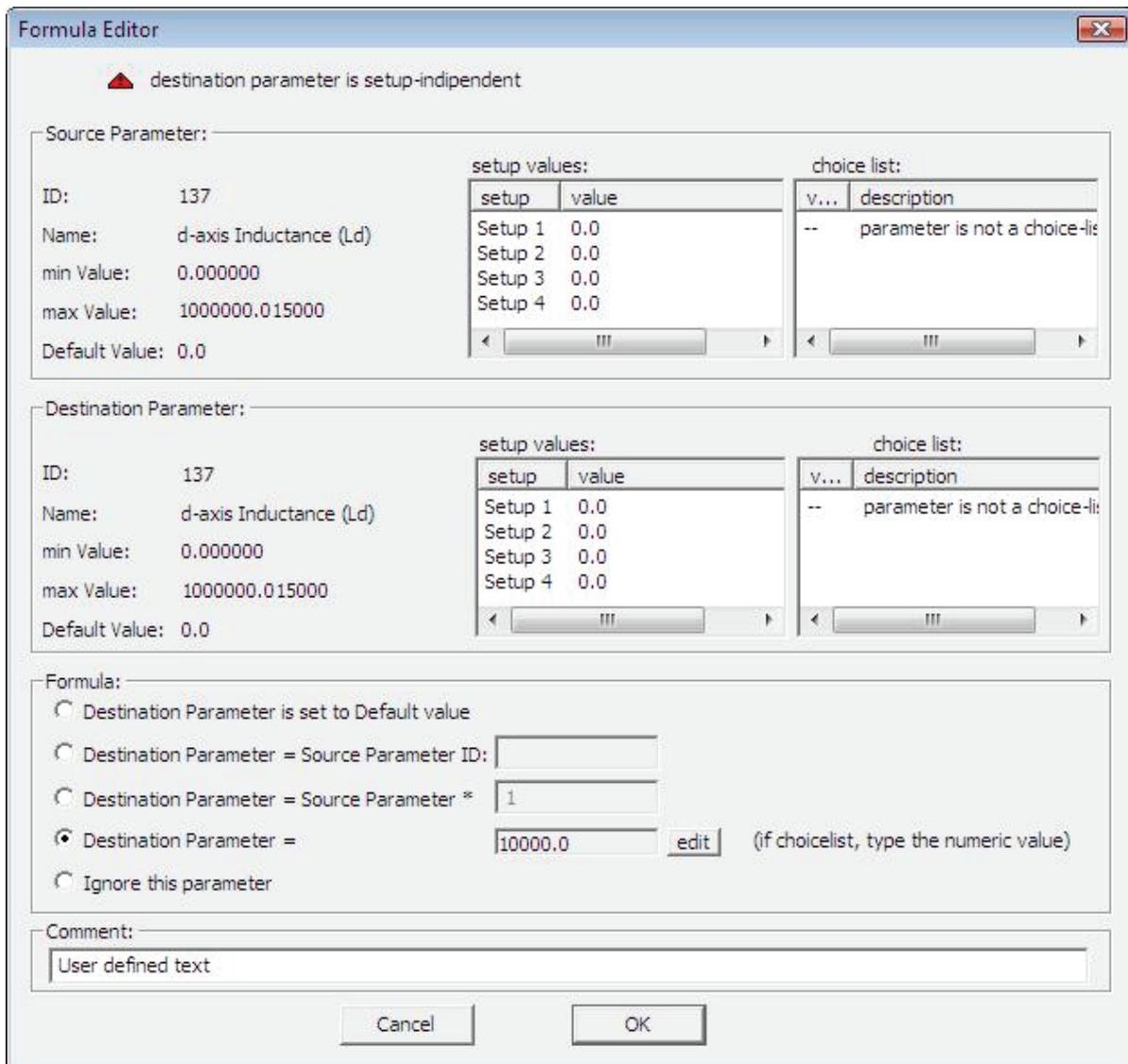
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Illustration 6.26 Conversion Table

Double-click an alert to open the *Formula Editor* dialog and specify the destination parameter mapping. The following configurations are possible:

- Destination parameter is set to default value (factory default value. Default setting for red alerts).
- Destination parameter = source parameter ID.
- Destination parameter = source parameter multiplied by a user-defined numeric value.
- Destination parameter = destination choice list or numerical value.
- Ignore this parameter. Default setting for blue alerts

Each formula applied can be associated with a comment containing a user-defined text. The comment is optional to each alert.



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Illustration 6.27 Formula Editor

When a formula is applied to all red alerts, assign a name to save the conversion table in the database.

If differences are detected when writing from source to destination frequency converter, MCT 10 Set-up Software uses the following as search criteria:

- The frequency converter series.
- Major software version.
- Power size.
- Voltage range.
- Option configuration.

With the proper conversion table in the database, any frequency converter can be written transparently to a destination even if the minor software version does not match. If several conversion tables are found matching the criteria, MCT 10 Set-

up Software uses the minor software version to find the closest match. Only 1 frequency converter can be written transparently to the destination.

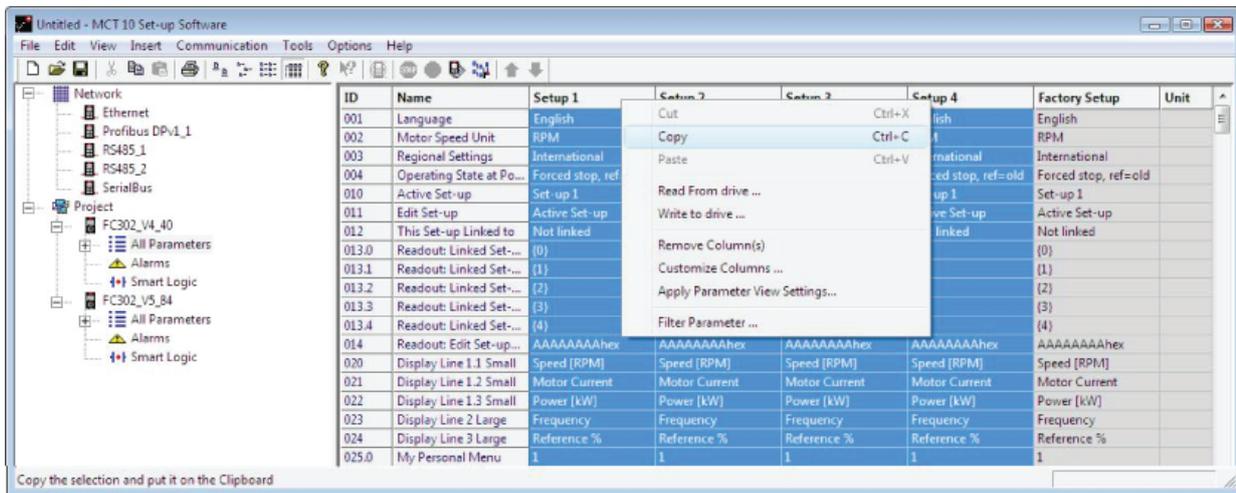
If *parameter group 19-** User-defined Parameters* is available, the settings are written transparently to the destination frequency converter.

6.13.4.1 Convert Offline to Offline/Online to Online

Writing between 2 offline or 2 online frequency converters is done as follows:

1. Mark the appropriate number of set-ups from *All Parameters*.
2. Right-click and select *Copy*.
3. Paste the parameters in the destination frequency converter folder.

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Illustration 6.28 Offline Online Conversion

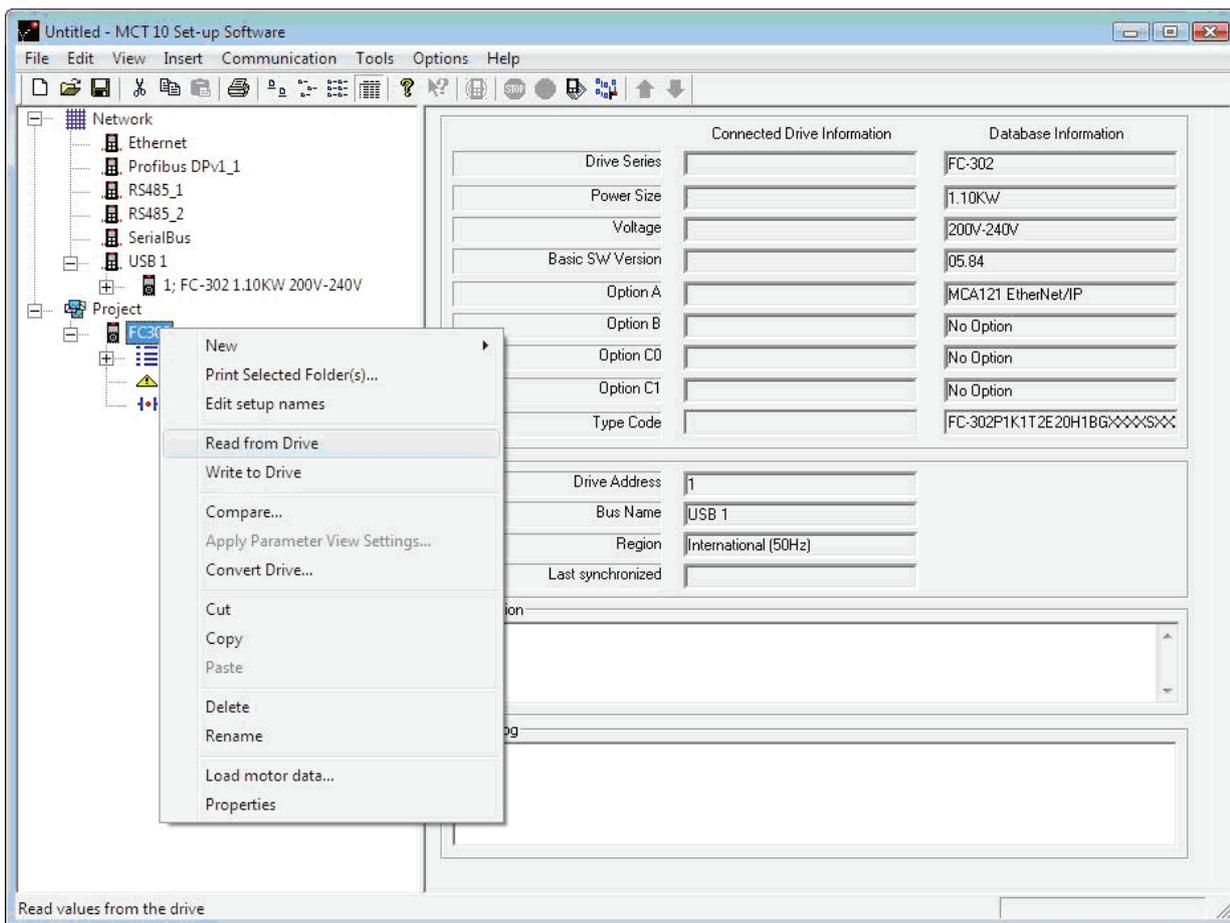
MCT 10 Set-up Software recognizes any difference and automatically applies a matching conversion table, if available.

6.13.4.2 Convert Online to Offline/Offline to Online

NOTICE

Before converting, ensure that offline and online frequency converter connection properties correspond.

Write from online to an offline frequency converter by right-clicking the offline frequency converter and selecting *Read from Drive* as shown in *Illustration 6.29*. MCT 10 Set-up Software recognizes any difference and automatically applies a matching conversion table.



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Illustration 6.29 Offline Online Conversion

NOTICE

Make sure that the offline frequency converter connection properties correspond with the online frequency converter.

7 Diagnostics

7.1 Alarm, Warning, and Fault Log Readout

Features from version 2.0, MCT 10 Set-up Software support:

- Reading out alarms, warnings, and fault logs of the online frequency converters.
- 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.

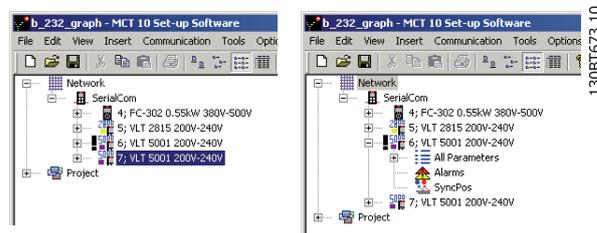


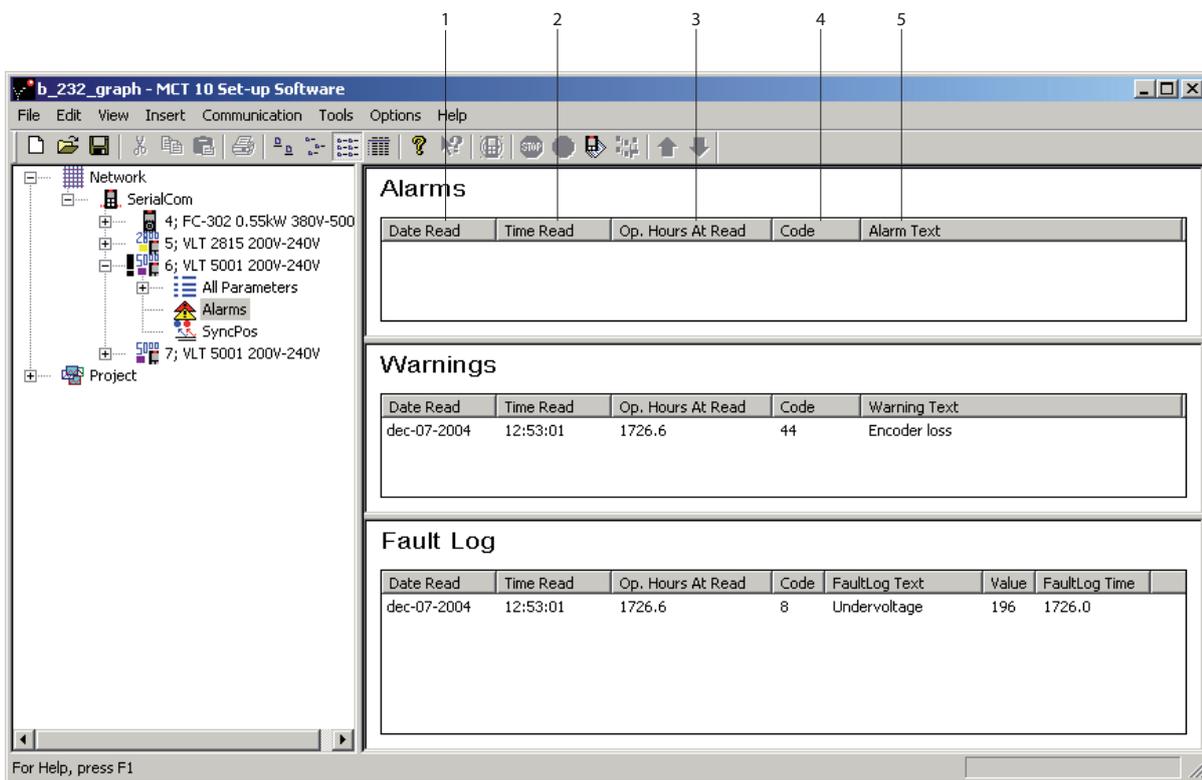
Illustration 7.1 Frequency Converter with Active Alarm or Warning

Expand the frequency converter and click the alarm/warning icon.

7.2 Localization of Alarms and Warning

After a complete scanning of a drive network, the MCT 10 Set-up Software indicates if the connected frequency converters have active warnings or alarms. Both warnings and alarms are indicated by a ! in front of the frequency converter icon.

Name	Icon
Active alarms/warnings	
No active alarms/warning	



1	The date when information was read from the frequency converter	4	Warning/alarm code
2	The time when information was read from the frequency converter	5	Name of warning/alarm
3	The number of hours run		

Illustration 7.2 Alarms, Warnings, and Fault Log View

For a more detailed description of the code, refer to the *operating guide* for the particular frequency converter. If the frequency converter 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 Set-up Software reads the fault log, it shows the time and date when the log was read.

NOTICE

The actual time when a fault occurs is not indicated.

7.3 Storing Alarms/Warnings in Project Files

Before alarms/warnings and the fault loggings are stored into the *Project File*, enable the function in MCT 10 Set-up Software. Select *Options⇒Update Alarms & Warnings*, as shown in *Illustration 7.3*. The MCT 10 Set-up Software now automatically reads alarms, warnings, and fault loggings at every read from/write to the frequency converter.

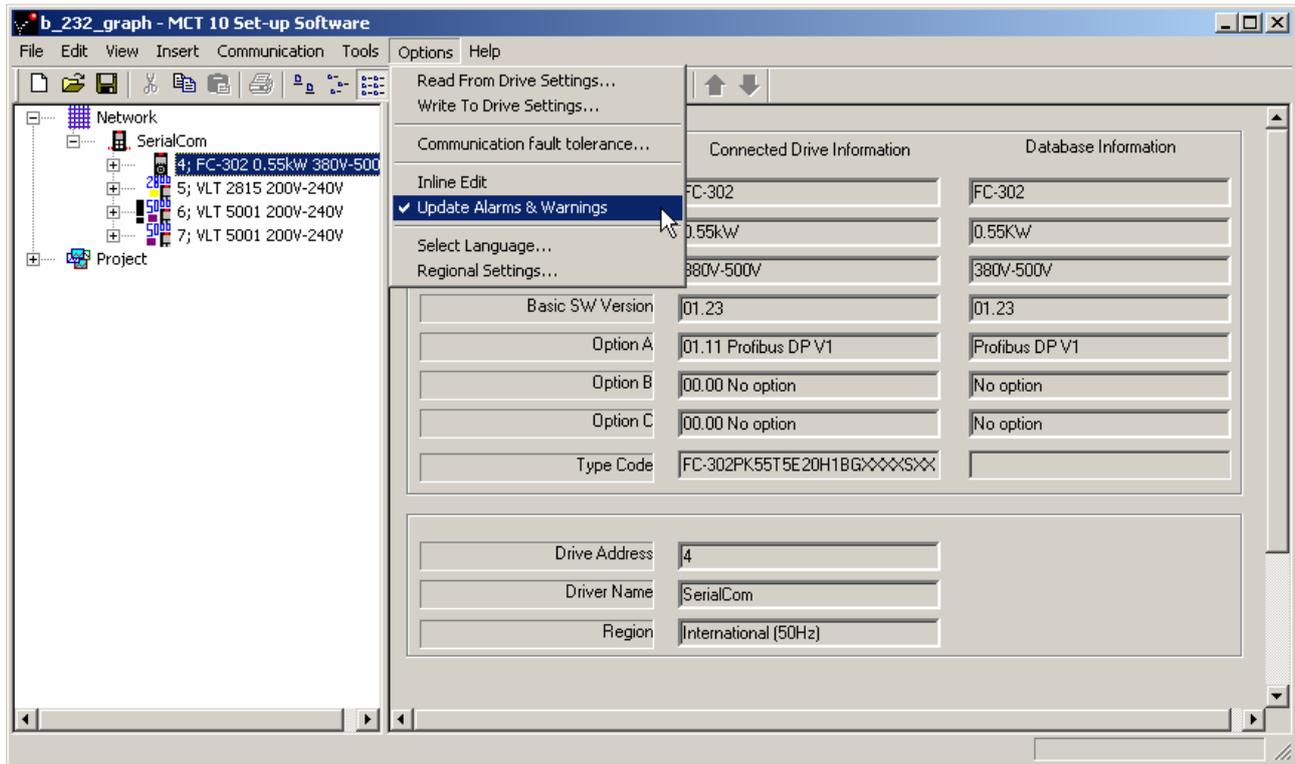


Illustration 7.3 Update Alarms & Warnings

7.4 Handling the Alarms and Warning Loggings

MCT 10 Set-up Software allows more than 200 alarms and warnings for each frequency converter in the project. The loggings can be individually cleared. 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 frequency converter is unaffected by this handling.

NOTICE

There are redundant alarm entries in log.

The MCT 10 Set-up Software 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.

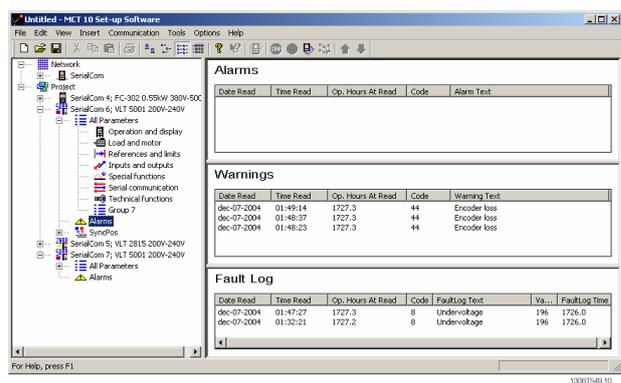


Illustration 7.4 Loggings

7.5 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 frequency converter. The channel does not have any time limitation, the buffer size is user configurable and corresponds to the number of samples. Fast sampling with 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 located in the frequency converter. Recommended for continuously monitored applications requiring high and precise sampling rates. It is required to set up a trigger event for the frequency converter to start filling up the buffer with samples.

7.5.1 Activating the Scope - MCT 10 Set-up Software

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

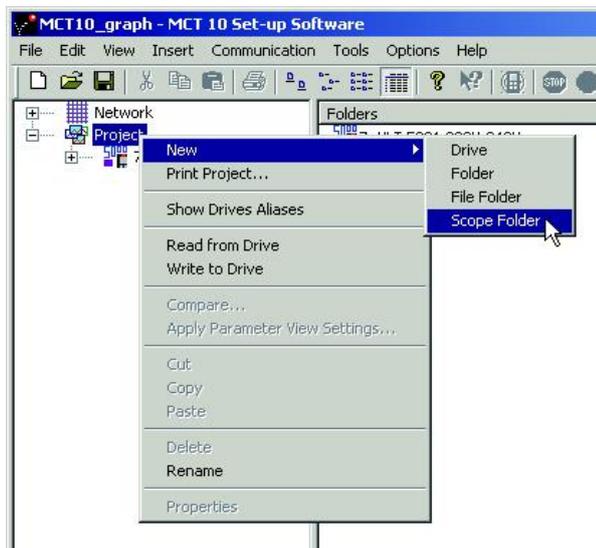


Illustration 7.5 New Scope

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

The first-time Scope folder is selected, the *Add channel* dialog pops up. From this dialog, select the frequency converter to monitor. Then, depending on the frequency converter series, select the type of channel to collect samples from.

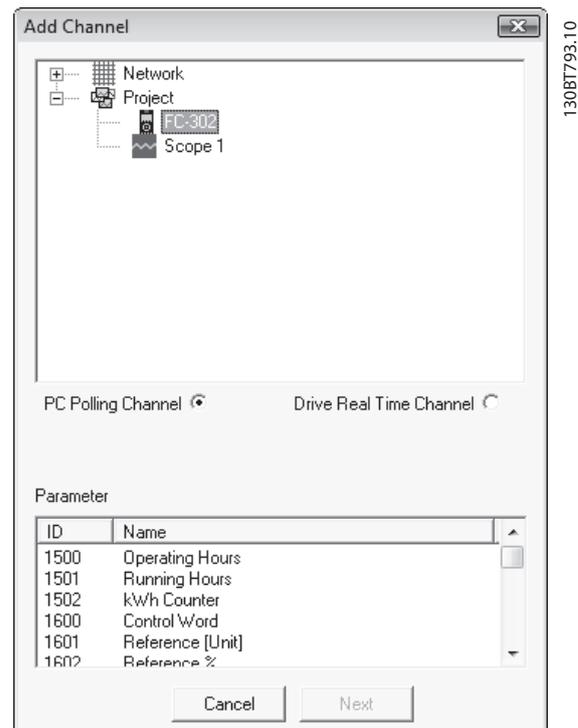


Illustration 7.6 Add Channel

Adding text notes

Insert additional text for later usage to each scope folder such as the type of frequency converter monitored, diagnostic help text, and so on. 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, as shown in *Illustration 7.7*.

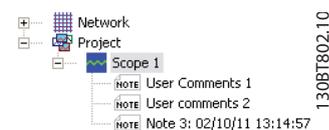
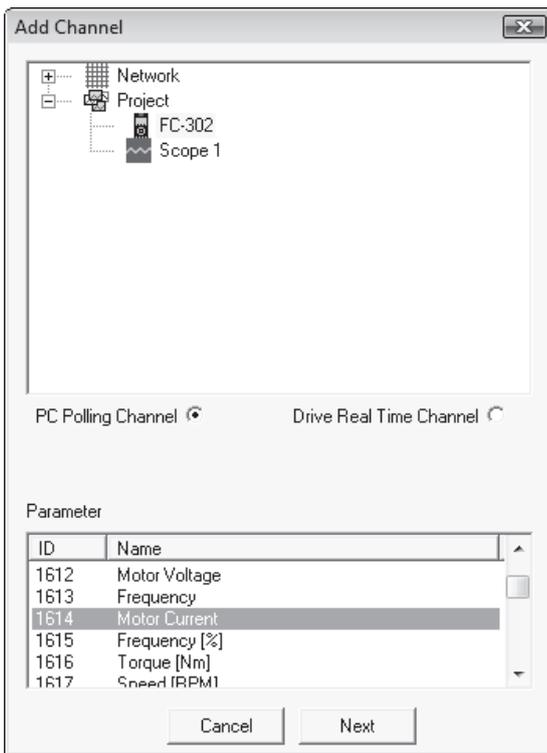


Illustration 7.7 Text Notes

7.5.2 Configure the PC Polling Channel

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

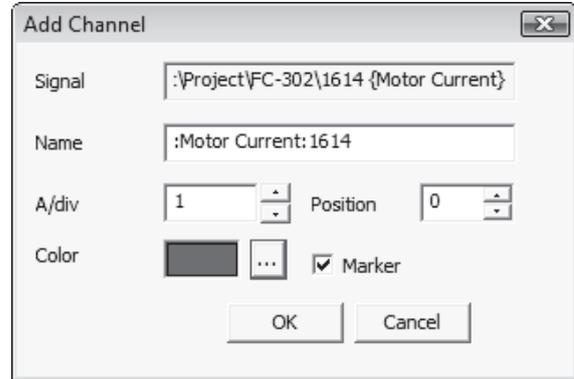
7



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NOTICE

MCT 10 Set-up Software stores the values even if they are not shown within the visible area of the curve.



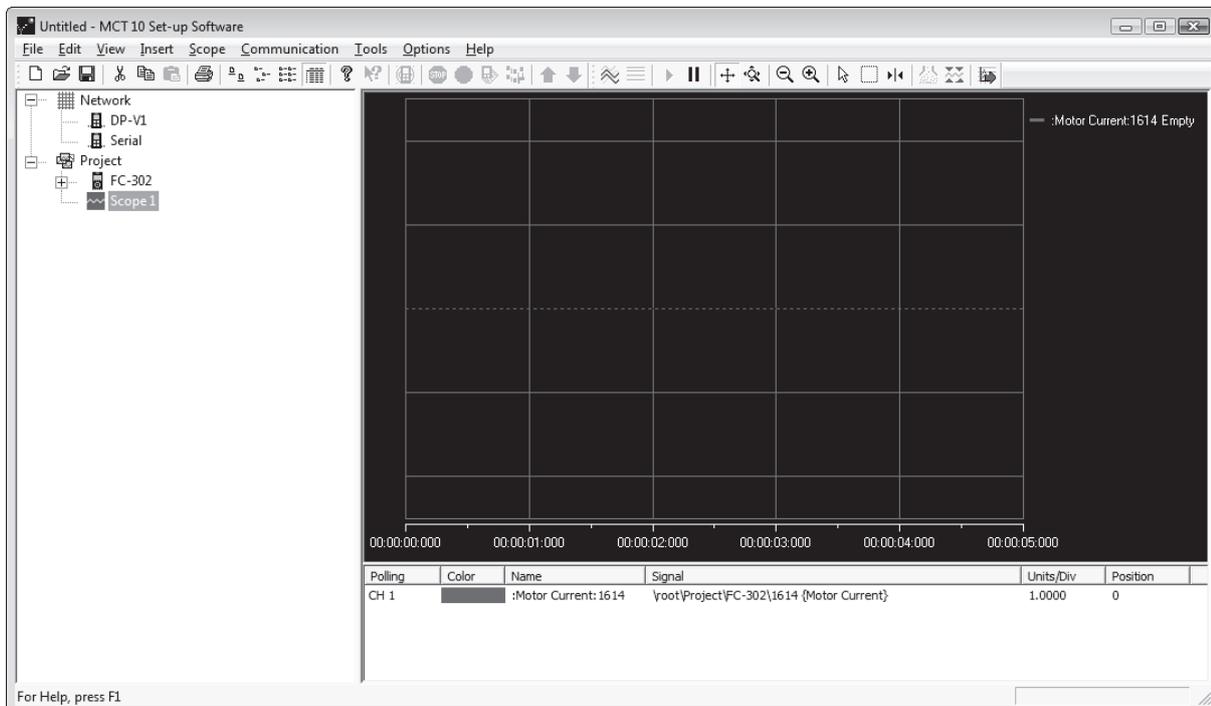
130BT680.12

Illustration 7.9 Storing Values

Illustration 7.8 Parameter ID and Name

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

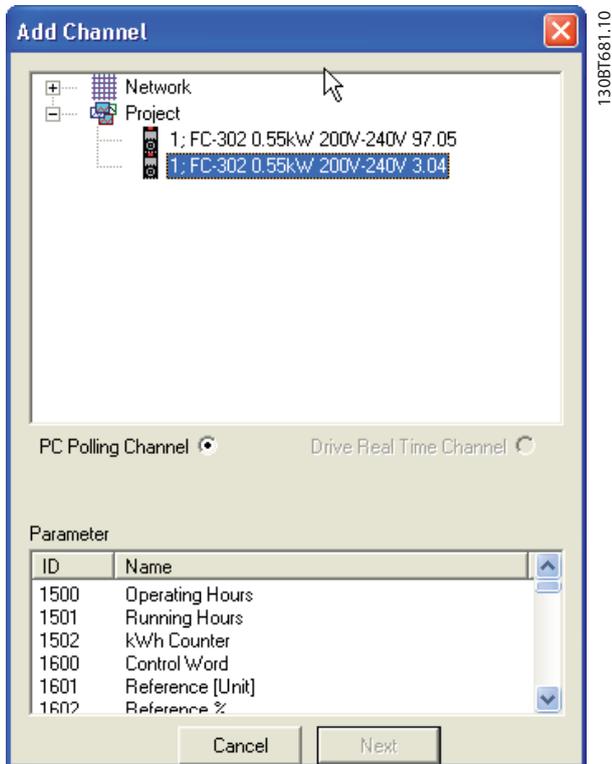
3. Define the position number (vertical zero line on the Y axis). If there are several signals on top of each other, it is useful to have them plotted apart.
4. Set color and tick *Marker* to differentiate the different curves in a black and white printout. Each curve gets a marker as box, triangle,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



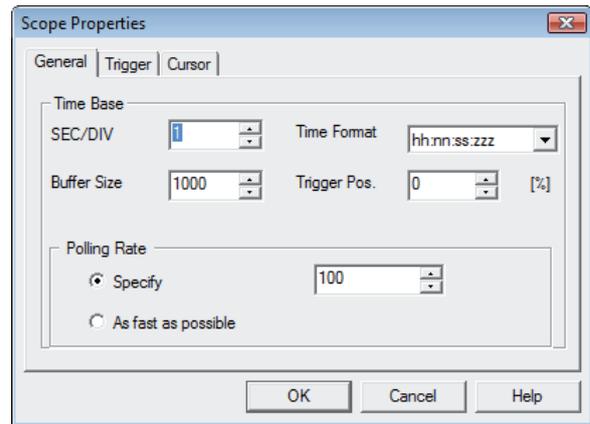
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Illustration 7.10 Generate Curve Graph

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



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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	–

Illustration 7.12 Basic Scope Settings

Illustration 7.11 Open Add Channel Dialog

7.5.3 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.

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.

NOTICE

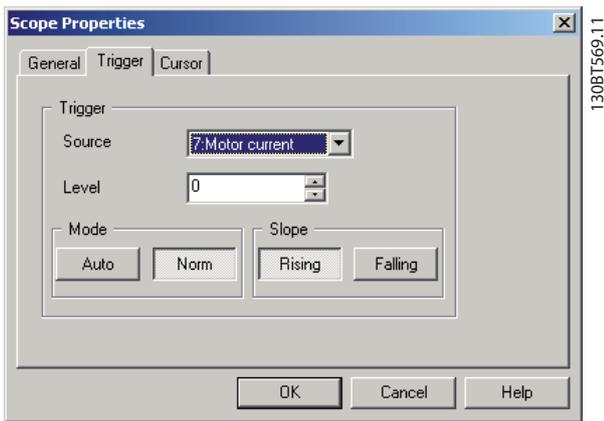
For systems with large inertia, a low sampling rate may be used since the value changes slowly. For systems with low inertia, a high sampling rate is needed.

NOTICE

Setting *Polling rate* to *As fast as possible* means that MCT 10 Set-up Software 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 frequency converter does not store any warnings.



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7.5.4 Reuse of PC Polling Channel Settings

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

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

Trigger functions	Description
Source	Source channel.
Level	Level where the trigger has to be activated.
Mode	Auto starts the trigger automatically when <i>Resume All</i> is pressed. The trigger line is set to the time when <i>Resume</i> 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).

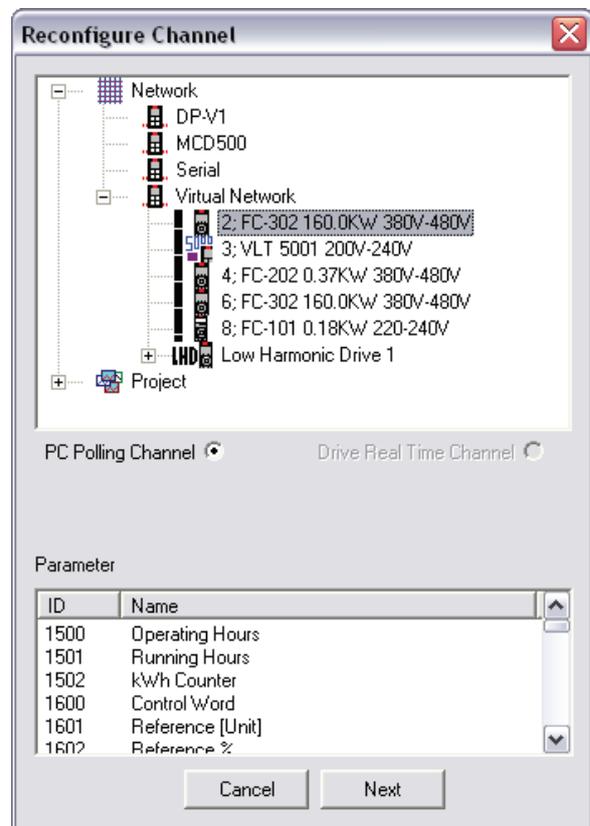
Illustration 7.13 Trigger Functions

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 alone.
- Value Y – Shows the value alone.
- 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 2 levels is calculated.

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



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Illustration 7.14 Reconfigure Channel

7.5.5 Configure the Drive Real-time Channel

Drive real-time channel can be selected if the functionality is supported in the frequency converter selected in the network.

1. Select the relevant frequency converter.
 - 1a *Drive real-time channel* opens the *Scope properties* dialog.
2. Configure the channels depending on what the actual frequency converter supports.

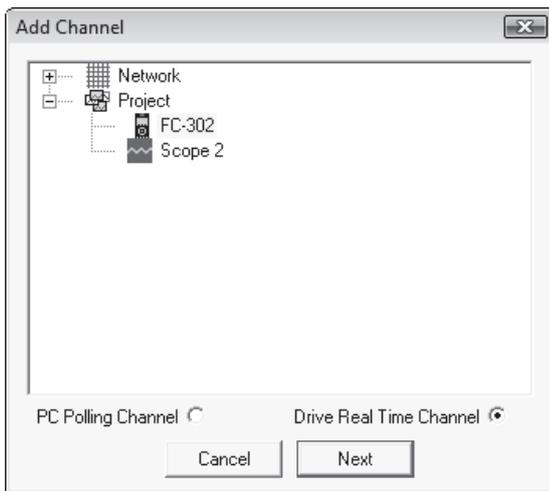


Illustration 7.15 Select Drive Real-time Channel

- 4a The trigger event.
- 4b Logging mode.
- 4c Samples before trigger options.

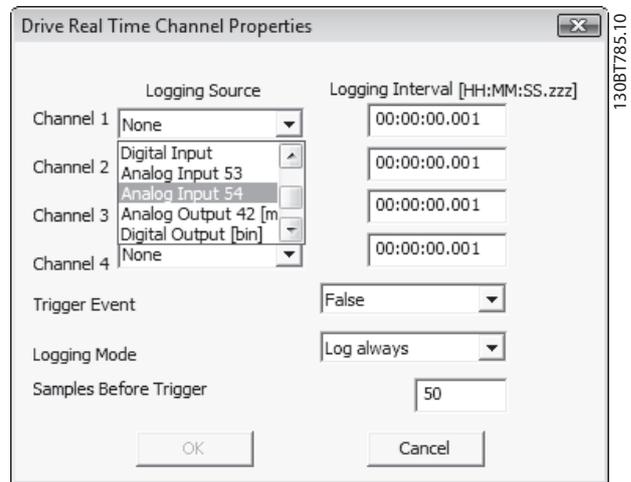


Illustration 7.16 Configure Sampling Mode

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 sampling mode through:

7.5.6 Using Advanced Triggers

NOTICE

The real-time channel trigger event utilizes the event available from the smart logic controller.

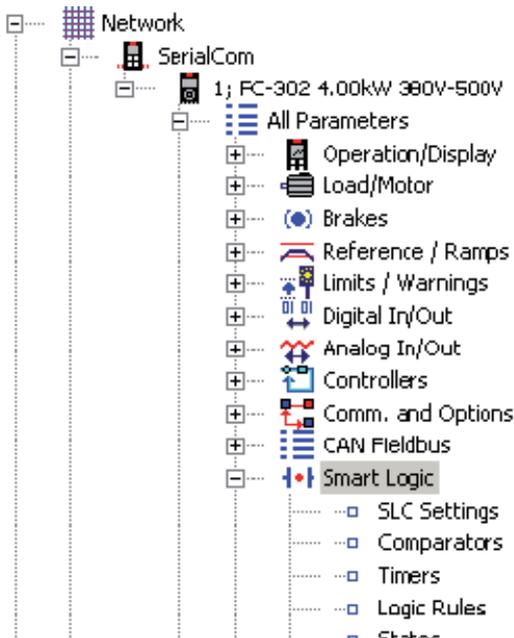
Example

The following example explains the set-up of a trigger, which triggers the collection of data in the frequency converter 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:

- 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 1311.0 to greater than >.
- 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, and set the logging mode to log once on trigger.

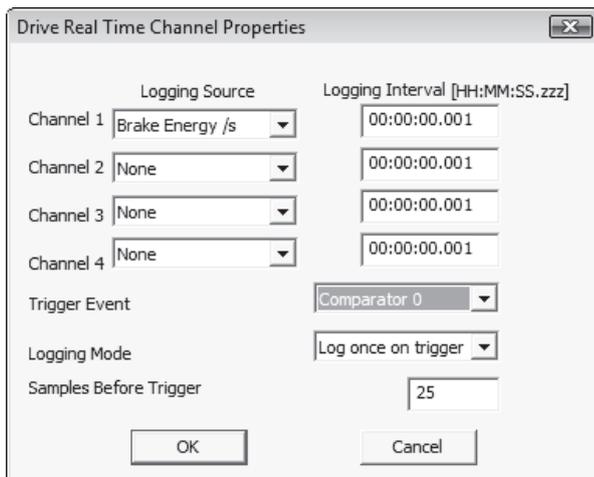
Press *OK* to enable the set-up.



ID	Name	Setup 1
1300	SL Controller Mode	Off
1301	Start Event	Start command
1302	Stop Event	Drive stopped
1303	Reset SLC	Do not reset SLC
1310.0	Comparator Operand	Motor speed
1310.1	Comparator Operand	DISABLED
1310.2	Comparator Operand	DISABLED
1310.3	Comparator Operand	DISABLED
1311.0	Comparator Operator	>
1311.1	Comparator Operator	(equal)
1311.2	Comparator Operator	(equal)
1311.3	Comparator Operator	(equal)
1312.0	Comparator Value	777.000
1312.1	Comparator Value	0.000
1312.2	Comparator Value	0.000
1312.3	Comparator Value	0.000

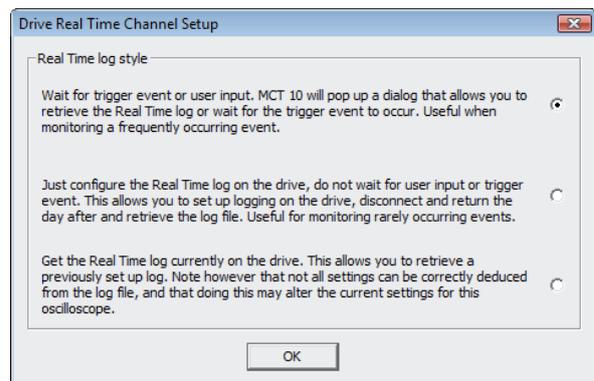
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Illustration 7.17 Smart Logic View



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Illustration 7.18 Trigger Event



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Illustration 7.19 Real-time Log Style

To start MCT 10 Set-up Software logging, press *Start* (resume) poll, which opens the dialog to define the real-time log style.

7.5.7 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.

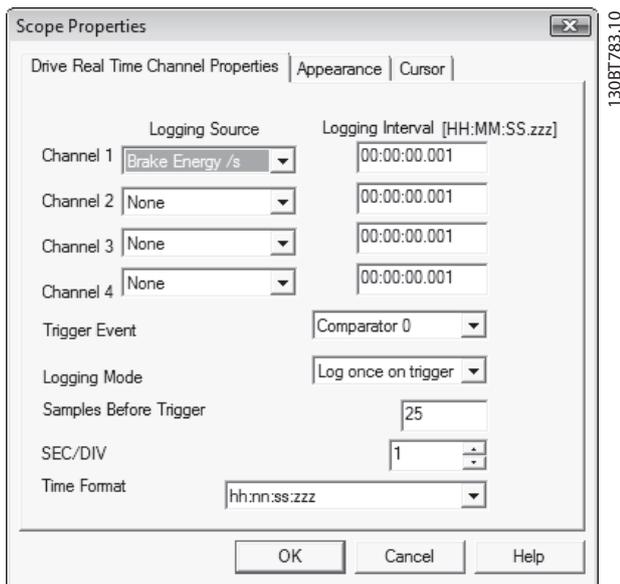


Illustration 7.20 Reconfigure Drive Real-time Channel Settings

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 *chapter 7.5.2 Configure 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.

7.5.8 Communication Control

The *Scope* toolbar has 4 main buttons to control the communication.

Control Button		Function
Start (data acquisition)		MCT 10 Set-up Software scope starts collecting the requested data from the frequency converter network.
Stop (data acquisition)		MCT 10 Set-up Software stops collecting data and there is no communication to the frequency converter network while the scope part is active on the screen.
Start (resume) all tracking		Activates the tracking mechanism. MCT 10 Set-up Software starts the readout of variables to the screen and to the buffer. Variables are checked up against the trigger settings. If the buffer has been partially filled (use of the Pause All Tracking function), MCT 10 Set-up Software continues to fill data into the buffer.
Pause all tracking		Deactivates the tracking. The buffer remains at its current state, no new data is shown. The buffer pointer keeps its current position.

Table 7.1 Functions of the Control Buttons

7.5.9 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 *Illustration 7.21*.



Illustration 7.21 Clear all Buffer for the Channel

Alternatively, the buffer can be cleared individually.

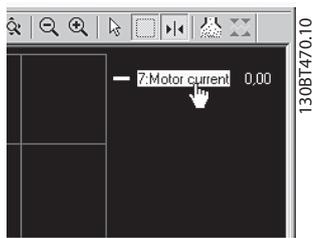


Illustration 7.22 Individually Clear the Buffer

7

Name	Description	Icon
Reset scope	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 Set-up Software requires that all buffers have the same amount of data.	
Export to Excel	Enables storing scope data in a file which Microsoft Excel can open. A <i>Save file</i> dialog appears, making it possible to store the file in an appropriate location.	
Open storage	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	Open scope data saved on the hard disk.	

7.5.10 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.

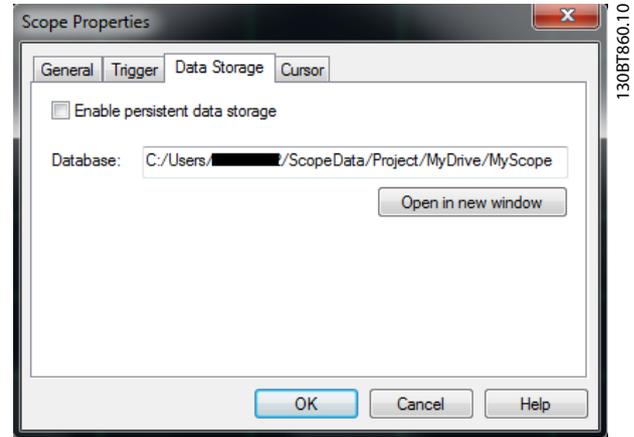


Illustration 7.23 Scope Properties

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, MCT 10 Set-up Software replaces the oldest point with the latest point.

8 Smart Logic Controller Plug-in

From version 2.13, MCT 10 Set-up Software supports the smart logic controller plug-in. This feature enables quick set-up 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 – and continues that way in up to 20 different steps until it returns to step 1 – monitoring the first specified event.

The 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 forms logic expressions that control the frequency converter logically in any application.

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

9 Time-based Actions and Preventive Maintenance Plug-ins

For the VLT® HVAC Drive FC 102, the MCT 10 Set-up Software provides the following plug-ins:

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

NOTICE

Consult the relevant *design guide* for detailed information about the frequency converters.

9.1 Clock Functions

MCT 10 Set-up Software enables set-up of the clock features.

The clock features are grouped in 2 sublevels:

- Date and time.
- Working days.

9

9.1.1 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.

9.1.2 Working Days

Define the working days for time-based actions as follows:

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).

Display format in LCP

Select how date and time are presented in the LCP on the FC 10x. In MCT 10 Set-up Software 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 FC 10x from the PC.

Normally, it should be set to use the connected PC's date and time. When the connected PC's time is in another time zone, it is beneficial to set the date and time manually.

Date and time are changed in the MCT 10 Set-up Software project file or in the drive only when the *Change checkbox* is ticked.

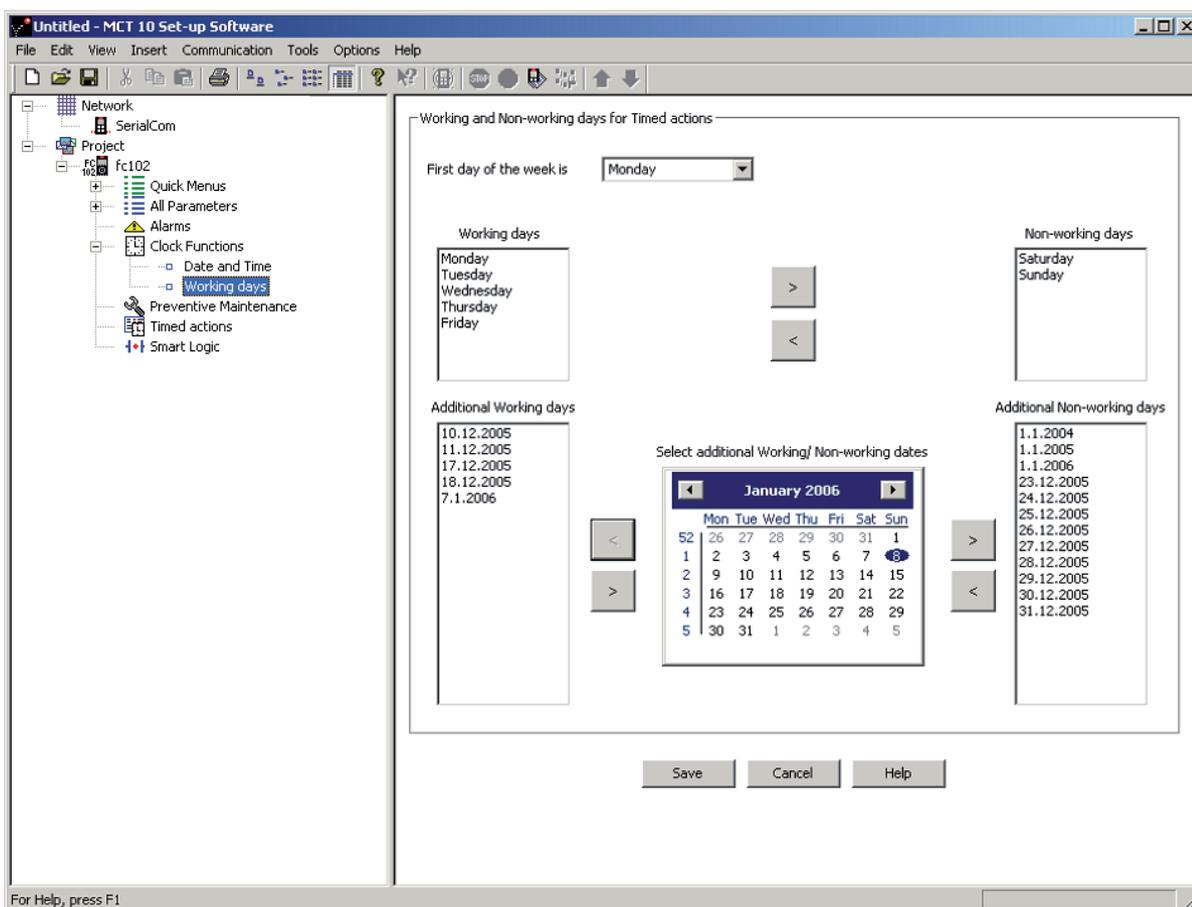
Daylight saving time

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 frequency converter shows a specific warning. Enable or disable the clock fault function.



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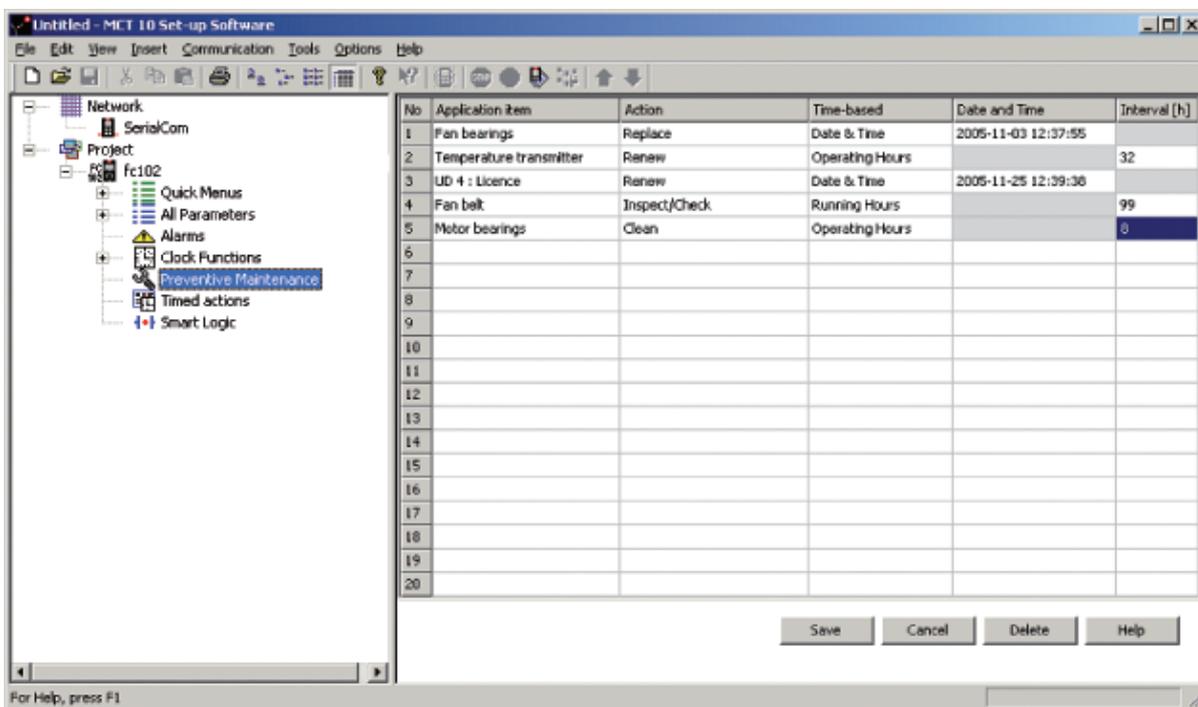
Illustration 9.1 Define Working Days

NOTICE

Additional working dates and non-working dates include the year and must be updated every year.

9.2 Preventive Maintenance

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



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Illustration 9.2 Preventive Maintenance

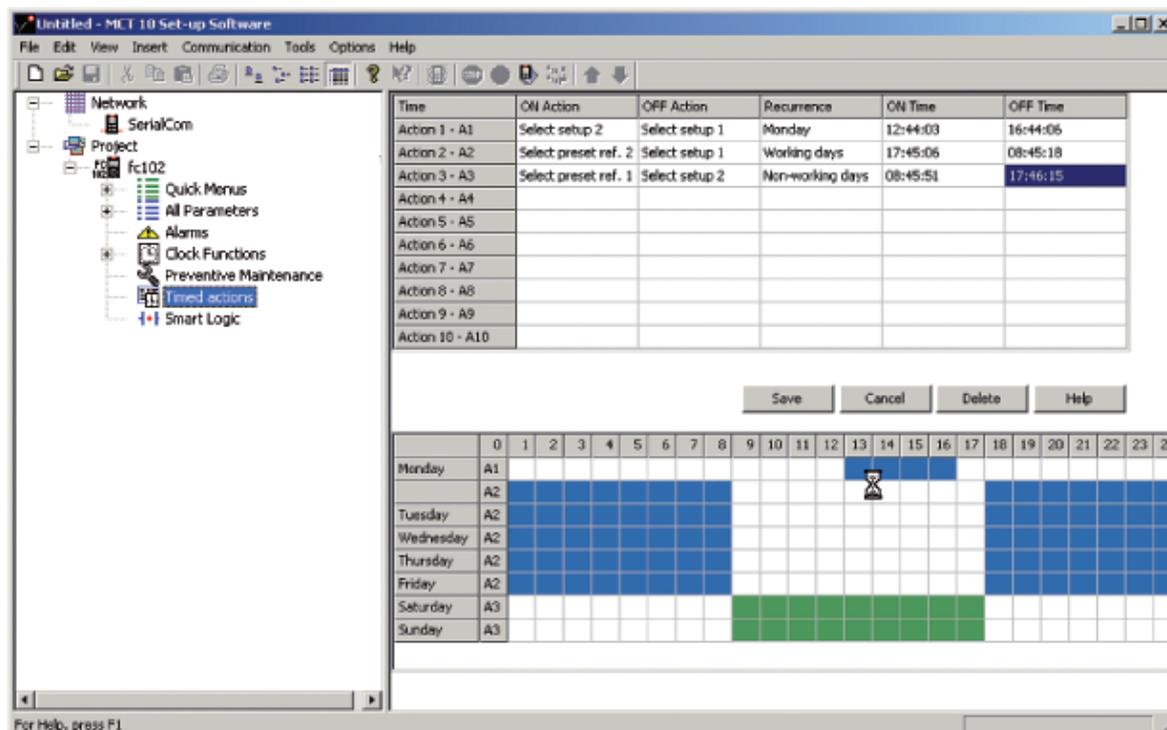
1. Double-click the cells in the right view to specify application item, action, and interval.
2. Reset Maintenance Word (*parameter 23-15 Reset Maintenance Word*) and write to drive.

NOTICE

The clock parameters (parameters in the Clock functions folder) must be programmed for preventive maintenance to function correctly.

9.3 Timed Actions

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



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Illustration 9.3 Time-based Actions

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

NOTICE

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

Actions, which can be programmed, are the same as known from the SLC (smart logic controller), see *chapter 8 Smart Logic Controller Plug-in*.

10 Multi-Motor Plug-in

10.1 Multi-Motor Plug-in

In applications where 1 frequency converter 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 frequency converter or offline for download later. Find the relevant parameters in *parameter group 24-9* Application Functions 2*.

NOTICE

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

10

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 frequency converter continuously checks if the total motor current is below expected value, which indicates situations where:

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

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

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

NOTICE

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.

10.1.1 Defining Curves and Thresholds

10.1.1.1 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.

1. Measure normal operation currents on 5 different frequencies.
2. Insert the frequencies in *Normal operation current*, see *Illustration 10.1*.

Frequency (Hz)	Current (A)
10 Hz	0,00 A
20 Hz	0,00 A
30 Hz	0,00 A
40 Hz	0,00 A
50 Hz	0,00 A

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Illustration 10.1 Normal Operation Currents

NOTICE

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

NOTICE

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.

10.1.1.2 Threshold

Measured points show normal operation curves. Settings in *Motor data*, see *Illustration 10.2*, define the threshold of the upper and lower limits.

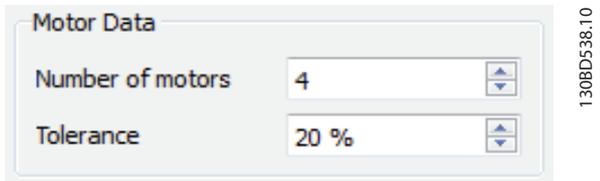


Illustration 10.2 Threshold

- 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 to the highest measured current.

NOTICE

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.

10.1.1.3 Coefficients

Locked-rotor detection and *Missing-motor detection*, see *Illustration 10.3*, show parameter values exactly as they are written to the frequency converter. The values are synchronized automatically.

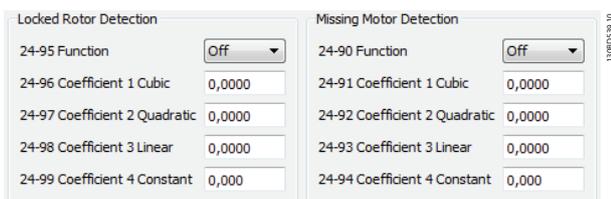


Illustration 10.3 Locked Rotor Detection and Missing Motor Detection

NOTICE

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

10.1.2 Modifying 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.

11 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.

3 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 frequency converter output and on/off control devices.
- Extended cascade controller
Allows more devices to be applied to the control circuitry and offers additional 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 utilizing the VLT® Advanced Cascade Controller MCO 102 option card.

11

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 MCT 10 Set-up Software 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.
- Set-up.
- System Optimizing.
- Service.

11.1 Preconditions

The preconditions tab contains the general set-up 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.

The screenshot shows the 'Preconditions' configuration window. It features a 'Setup 1' dropdown and 'Save'/'Cancel' buttons. The 'Preconditions' tab is active, with sub-tabs for 'Set-Up', 'System Optimizing', and 'Service'. The 'General configuration' section includes:

- Closed Loop
- Level Control (increase speed at increased feedback signal)
- Internal Setpoint (value: 0.000)
- External Setpoint
- Setpoint and Feedback unit type: 0

 The 'Setpoint and feedback' section is divided into two panels:

- Setpoint AI53:** Signal type '0 - 10 Volt', Setpoint High: 1500.00, Setpoint Low: 0.00. Includes a graph and a table:

AI53 Low:	0.07	AI53 High:	10.00
-----------	------	------------	-------
- Feedback AI54:** Signal type '0 - 10 Volt', Feedback High: 100.00, Feedback Low: 0.00. Includes a graph and a table:

AI54 Low:	0.07	AI54 High:	10.00
-----------	------	------------	-------

 Below these are 'Min Reference: 0.00' and 'Max Reference: 1500.00'. The 'Live Zero Time Out Function' is set to 'Off', with checkboxes for 'Enable Terminal 53 Live Zero' and 'Enable Terminal 54 Live Zero'. The 'Digital input for low level signal' section includes:

- Digital I/O mode: PNP - Active at 24V
- DI 32: No operation
- External Interlock Delay: 0

 A schematic diagram on the right shows a pump system with terminals AI53, DI32, AI54, and P.

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Illustration 11.1 Preconditions

11.1.1 General Configuration

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

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

Table 11.1 Closed Loop Checkbox Options

Level control configures the inverse mode of the PID controller. It causes the frequency converter 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 is enabled.

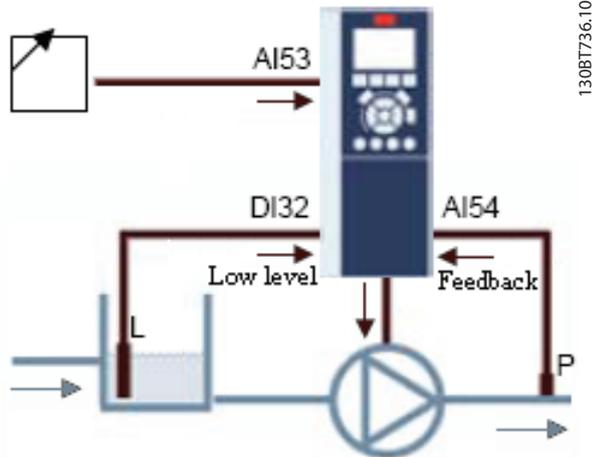


Illustration 11.2 Level Control

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

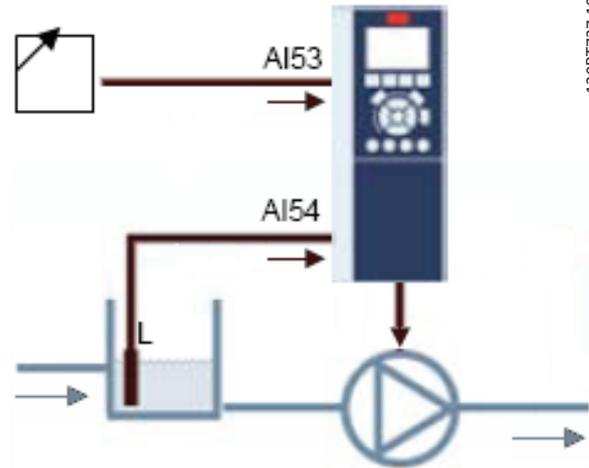


Illustration 11.3 General Configuration

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 the user 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/in².
- in WG.
- ft WG.

General configuration affected parameters

- *Parameter 1-00 Configuration Mode.*
- *Parameter 20-81 PID Normal/ Inverse Control.*
- *Parameter 3-15 Reference Resource 1.*
- *Parameter 20-12 Reference/Feedback Unit.*

11.1.2 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) used as feedback. The signal type can only be changed from current to voltage input with the switches on the control board of the frequency converter. Click *Show location* to see the specific location on the frequency converter.

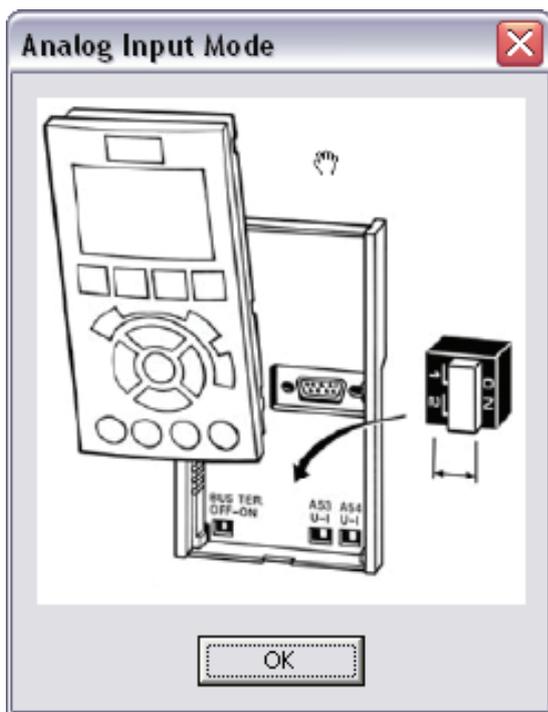


Illustration 11.4 AI53 and AI54

Configure the signal type in accordance with the hardware switches.

 <small>1308T739.10</small>	 <small>1308T740.10</small>
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.

Table 11.2 Hardware Switches

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.
- Jogging.
- Maximum speed.
- Stop and trip.
- Select set-up 1.
- Select set-up 2.
- Select set-up 3.
- Select set-up 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*

11.1.3 Digital Input

configured. The type of pulse to trigger can be configured from the digital I/O mode drop-down list.

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

11.2 Set-up

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).

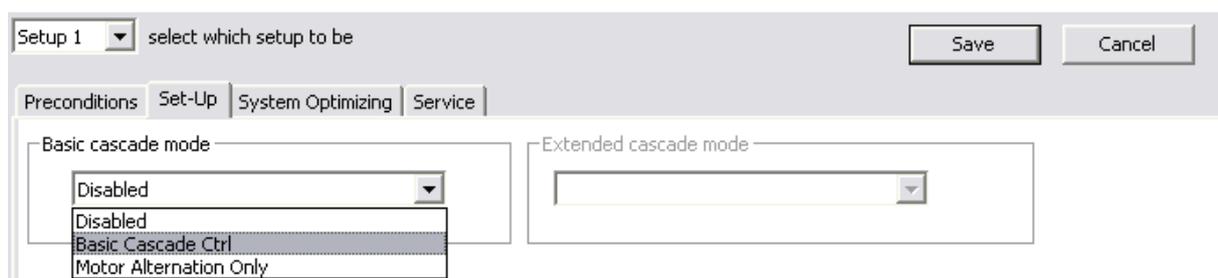
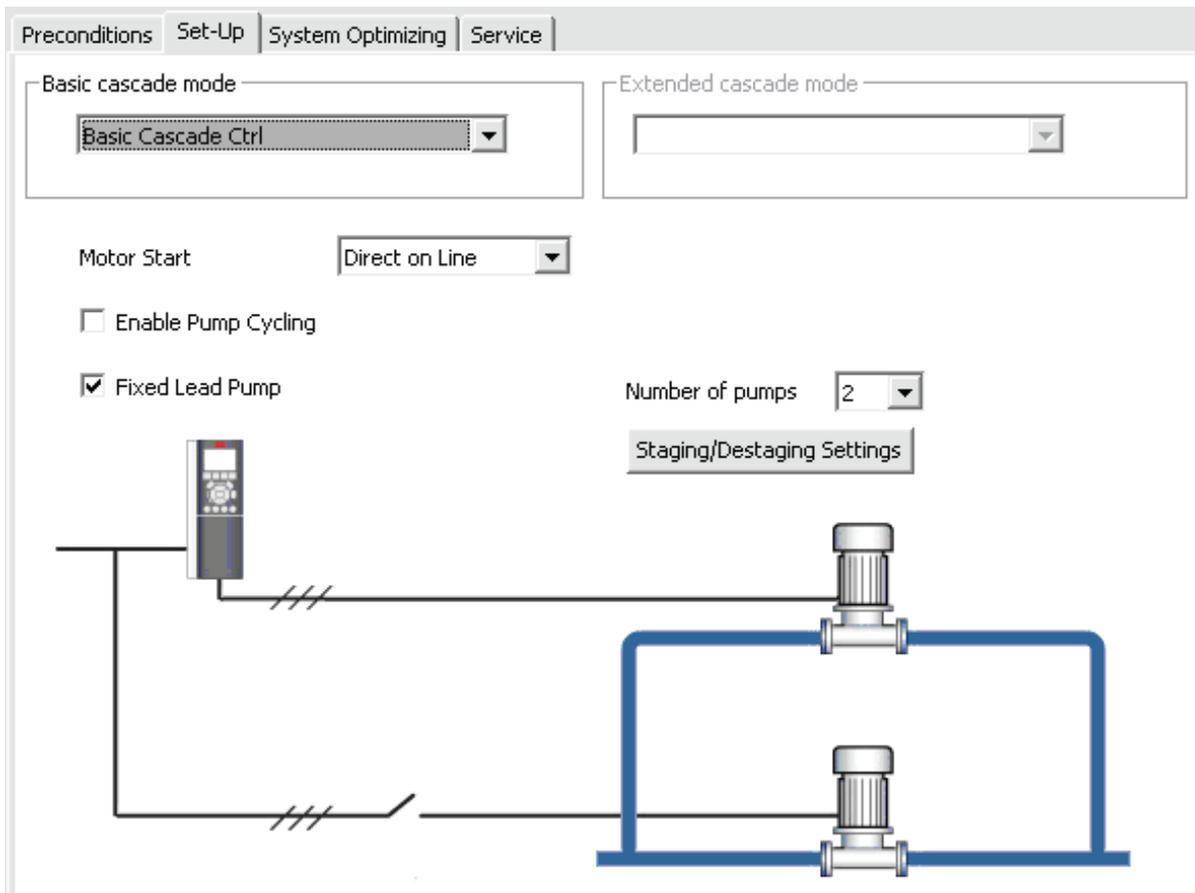


Illustration 11.5 Configuration Interface for *Parameter Group 25-** Cascade Controller*

11.2.1 Basic Cascade Control

Select basic cascade control to configure:

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



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Illustration 11.6 View of Basic Cascade Control Set-up Tab

View	Description
Motor start	<p>This view defines the configuration principle:</p> <ul style="list-style-type: none"> • 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 staging signal occurs until staging takes place. The delay is required, due to the ramp time of the fixed speed pump.

View	Description
Enable pump cycling	<p>This view defines whether the pump cycling is enabled or not:</p> <ul style="list-style-type: none"> • Disabled – lag and lead pumps are cut in to have equal operating hours for each pump. • Enabled – lag pumps are cut in according to the first-in, last-out principle.

View	Description
Fixed lead pump	This view defines whether a frequency converter uses a fixed lead pump or not. The lead pumps are connected directly to the relays on the frequency converter control card. This is shown in <i>Illustration 11.6</i> . 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 over a long time, corrosion may become an issue. When it is configured for alternating lead pump, select <i>Alternation details</i> to set up principles for alternation.
Lead pump alternation	This view instructs the frequency converter to change the lead pump so all pumps run for the same period of time. The following options are available: <ul style="list-style-type: none"> • 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 alternations of the lead pump: <ul style="list-style-type: none"> • 1–999.9 h – when the time expires, the lead pump alternates.
Alternation timer 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 setting configured in the frequency converter.
Alternate if load < 50%	In this view, define whether the lead pump must be alternated: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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.

View	Description
Delay before cutting in on mains	Time delay before a fixed speed pump is staged on according to normal staging sequence. When it expires, a fixed speed pump must be staged on according to normal staging. Range: 0.1–5.0 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 frequency converter 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.

View	Description
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.
Destaging speed	To prevent 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 prevent 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.

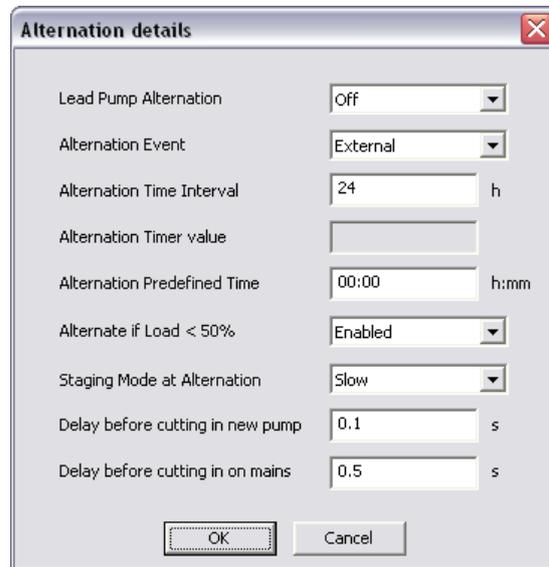
Table 11.3 View and Selection Descriptions

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. The no-flow function must be set to sleep mode or an external signal applied 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.

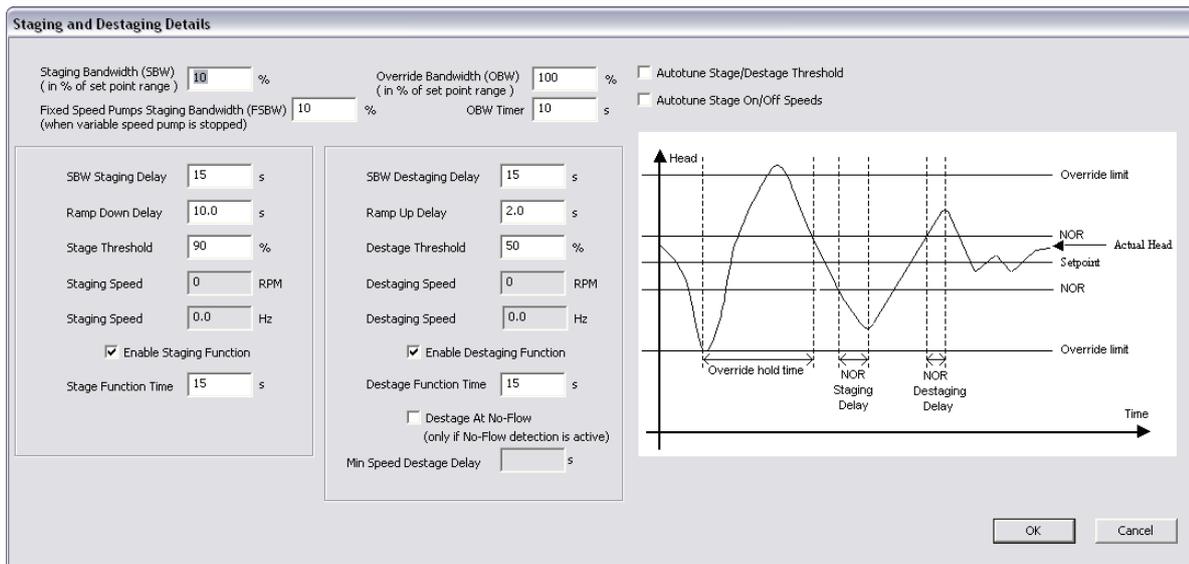
Function	Number of pumps
Fixed lead pump	2–3
Alternating lead pump	2

Table 11.4 Number of Pumps Configurable from the Drop-down List



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Illustration 11.7 Alternation Details



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Illustration 11.8 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.

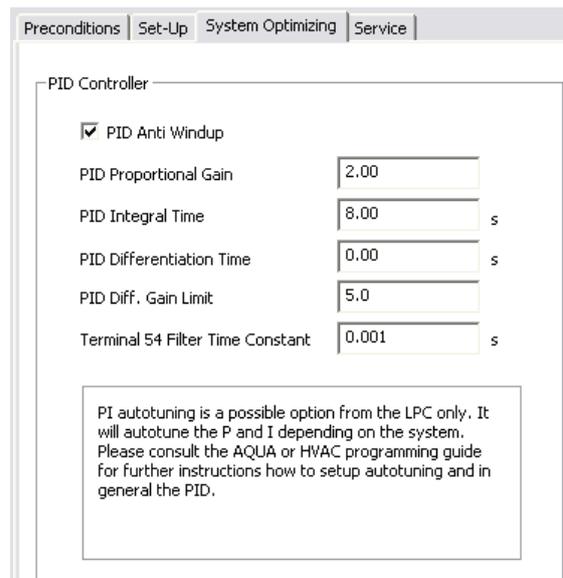
11.2.2 Motor Alternation Only

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

11.3 System Optimizing

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

- PID controller.
- Feedback low-pass filter.



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Illustration 11.9 Start and Stop Cascade Controller

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 frequency converter to correct the error. This situation can occur when the frequency converter has reached the minimum or maximum output frequency, or when the frequency converter is stopped. If the checkbox is disabled, the PID controller continues integrating the error between the feedback and setpoint reference, even though the frequency converter cannot adjust its output frequency to correct this error.
PID proportional gain	Adjusts the output of the frequency converters PID controller based on the error between the feedback and the setpoint reference. Quick PID controller response is obtained using a large value. If too large, the frequency converter 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 zero. Quick speed adjustments are obtained using a short duration. At a too short value, the frequency converter output frequency may become unstable. The time is configurable from 0.01–10000.00 s.
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 frequency converter output frequency may become unstable. Differential time is useful in situations where very 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 frequency converter is stopped. The time constant can be configured from 0.001–10.000 s.

Table 11.5 Description of PID functions

11.4 Service

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

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 current status of the pump. A readout with 2 pumps could be 1:D 2:O. <ul style="list-style-type: none"> • 1:D – Pump 1 running on frequency converter. • 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 <i>Off</i> to the number of pumps.	✓	✗
Relay status	Select relay status to update the status of the relays. The status can be <ul style="list-style-type: none"> • On - the relay is activated. • Off - the relay is deactivated. The values can only be updated if the frequency converter is online.	✓	✓
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 frequency converters are connected online.	✓	✗
Pump interlock	Disables a certain pump and is configurable from a checkbox located at each pump.	✓	✗

View	Description	Basic cascade controller	Extended cascade controller
Pump ON time	Monitors the total hours run of the connected pump. The resolution is in hours run. <i>Reset</i> clears the hours run of a specific pump.	✓	X
Current runtime 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.	X	✓
Pump total lifetime hours	Total hours run for each connected pump.	X	✓

View	Description	Basic cascade controller	Extended cascade controller
Manual pumps control	Readout of the command parameter that allows manual control of individual pump states.	X	✓
Reset relay counter	Resets all relay on-times. Only available if the frequency converter is online.	X	✓

Table 11.6 Service Tab Views

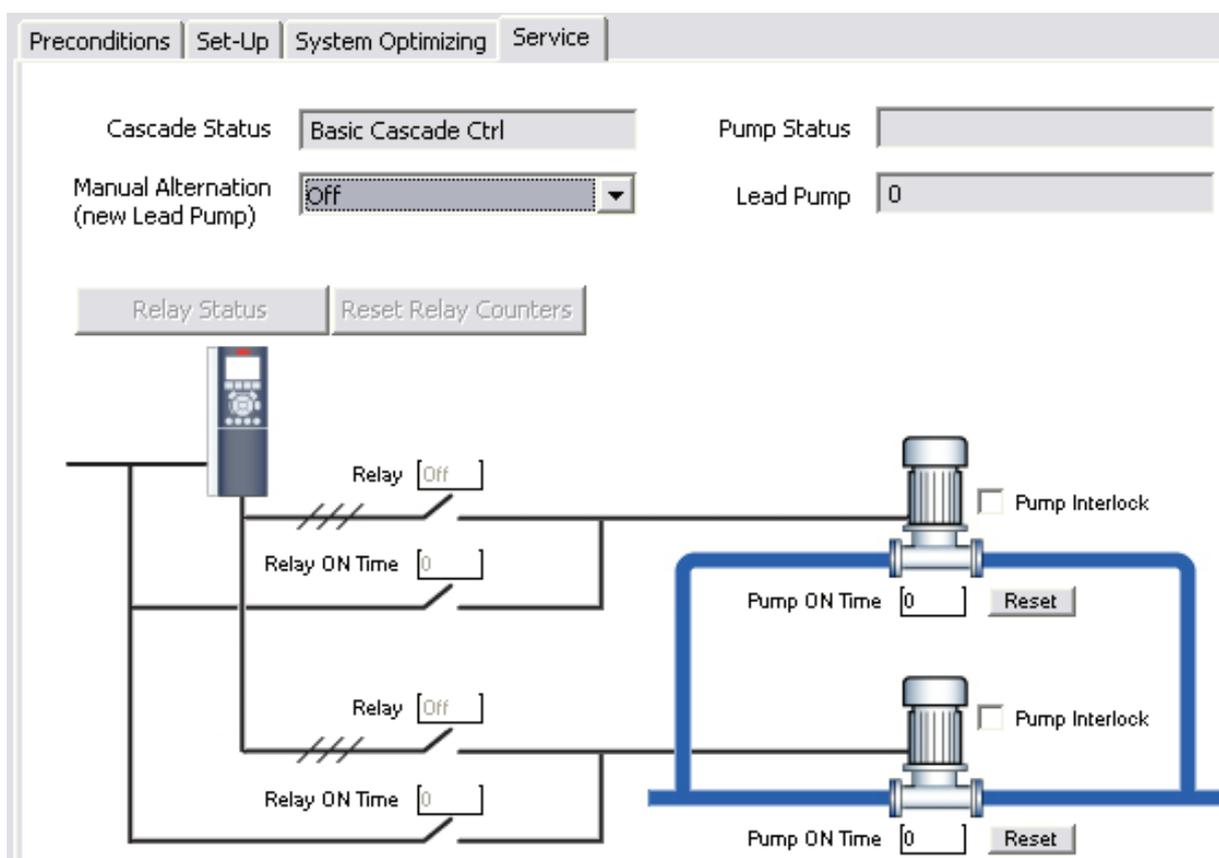


Illustration 11.10 Service Tab Basic Cascade Controller

Preconditions Set-Up System Optimizing **Service**

Cascade Status Pump Status

Lead Pump

Pump	Pump Status	Current Runtime Hours	Pump Total Lifetime Hours	Manual Pump Control
1	Ready	0	0	No Operation
2	Ready	0	0	No Operation
3	Ready	0	0	No Operation
4	Ready	0	0	No Operation
5	Ready	0	0	No Operation
6	Ready	0	0	No Operation
7	Ready	0	0	No Operation
8	Ready	0	0	No Operation

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Illustration 11.11 Service Tab Extended Cascade Controller

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 frequency converter.
	Off	All pumps have been stopped by a stop command applied to the frequency converter.
	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 frequency converter and the cascade controller controls the pumps.
	Running FSBW	The frequency 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 <i>Off</i> and an alternation sequence is taking place.
	Lead not set	No pump 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 frequency converter. Variable speed pump, regardless if connected directly or controlled via relay in the frequency converter.
	R	Running on mains. Fixed speed pump running.
Relay status ¹⁾	On	The relay is activated.
	Off	The relay is deactivated.
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 unavailable for cascading.
	Offline-Spin	Initiates a pump spin.

Table 11.7 Status Descriptions

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.

Parameter number	Name	Function of Relay	Status
2770.0	Relay	Standard Relay	Off
2770.1	Relay	Standard Relay	Off
2770.2	Relay	Standard Relay	Off
2770.3	Relay	Standard Relay	Off
2770.4	Relay	Standard Relay	Off
2770.5	Relay	Standard Relay	Off
2770.6	Relay	Standard Relay	Off
2770.7	Relay	Standard Relay	Off
2770.8	Relay	Standard Relay	Off
2770.9	Relay	Standard Relay	Off
2770.10	Relay	Standard Relay	Off
2770.11	Relay	Standard Relay	Off
2770.12	Relay	Standard Relay	Off
2770.13	Relay	Standard Relay	Off
2770.14	Relay	Standard Relay	Off
2770.15	Relay	Standard Relay	Off
2770.16	Relay	Standard Relay	Off
2770.17	Relay	Standard Relay	Off
2770.18	Relay	Standard Relay	Off
2770.19	Relay	Standard Relay	Off

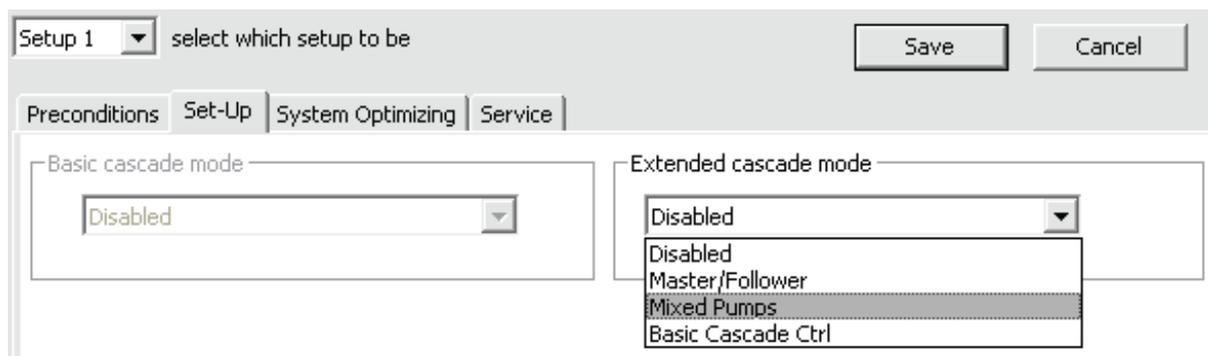
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Illustration 11.12 Relay Status

11.5 Extended Cascade Controller Functions

11.5.1 Set-up

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



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Illustration 11.13 Cascade Mode Drop-down List

11.5.2 Master/Slave

This view allows configuring:

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

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Illustration 11.14 Master/Slave

The motor start drop-down list is similar to the configuration available in *chapter 11.2.1 Basic Cascade Control*.

Each pump is controlled by a frequency converter and the number of frequency converters correspond to the number of pumps. Staging and destaging are done based on the speed of the frequency converter. The constant pressure is controlled by the master frequency converter operating in closed loop. Up to 6 pumps can be controlled with VLT® Extended Cascade Controller MCO 101 and up to 8 with the VLT® Advanced Cascade Controller MCO 102.

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

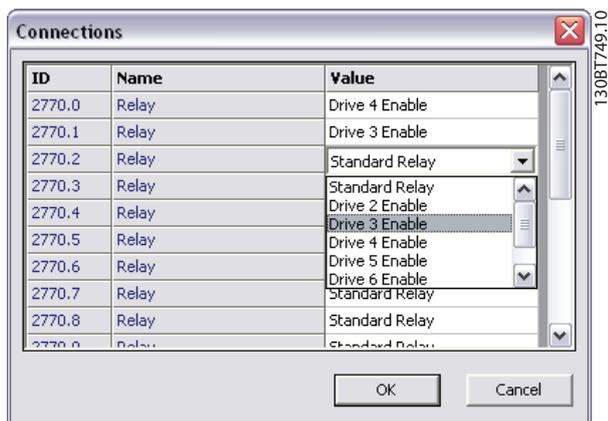


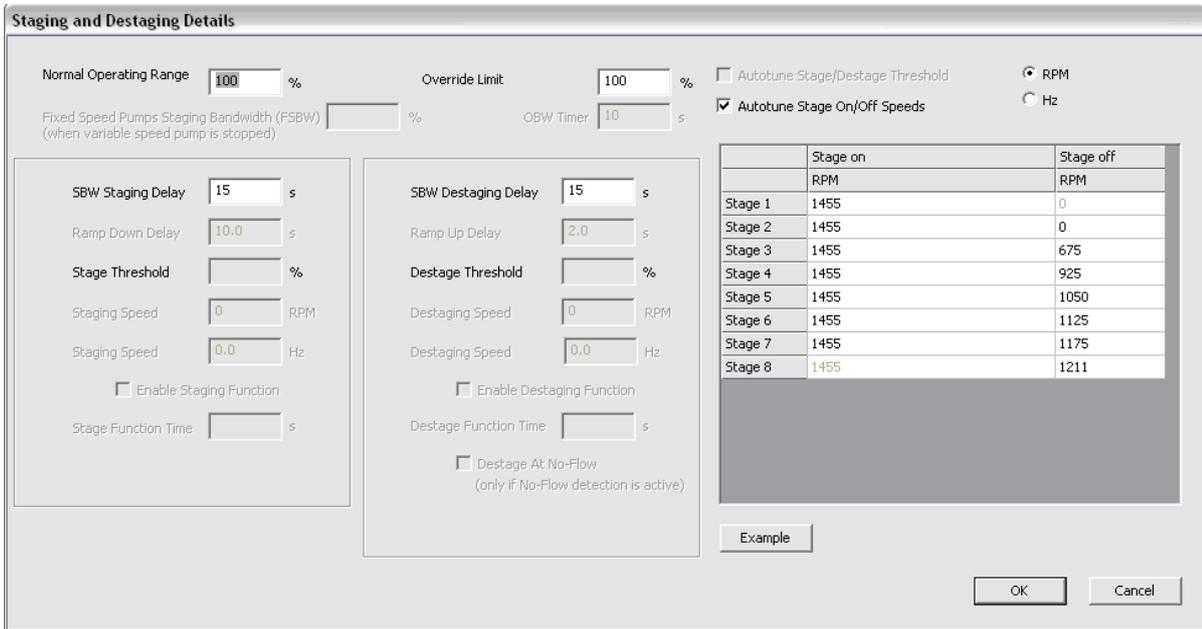
Illustration 11.15 Configure Relay Function

NOTICE

The number of available relays depend 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/Slave*.



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Illustration 11.16 Staging and Destaging Details

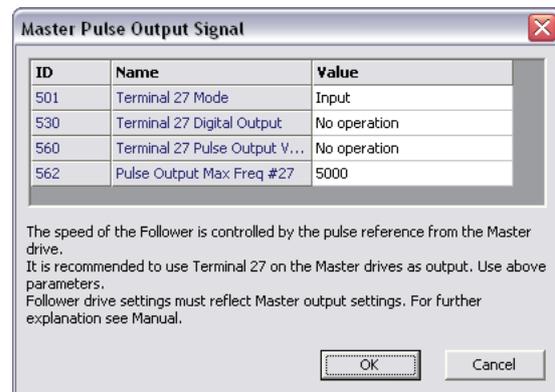
Field	Description
Normal operating range	The allowed offset from the setpoint before a pump may be added or removed. The system must be out of the limit for the time specified in <i>Staging delay</i> .
Override limit	The allowed offset from the setpoint before a pump immediately is added or removed.
Autotune stage/destage threshold	Optimizes the threshold values during operation. The settings are updated to prevent 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.

Table 11.8 Staging and Destaging Descriptions

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.

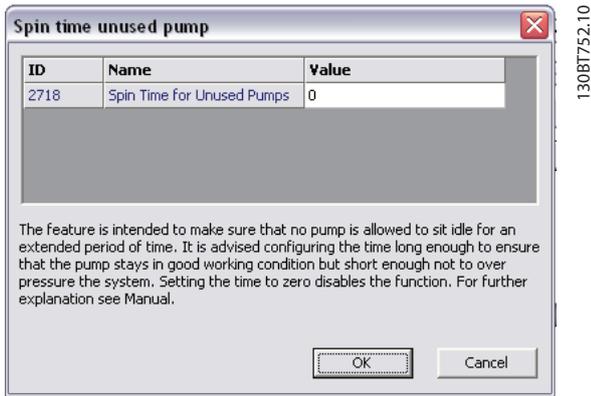
Select *Master pulse output signal* to configure terminal 27 on the master frequency converter.



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Illustration 11.17 Master Pulse Output Signal

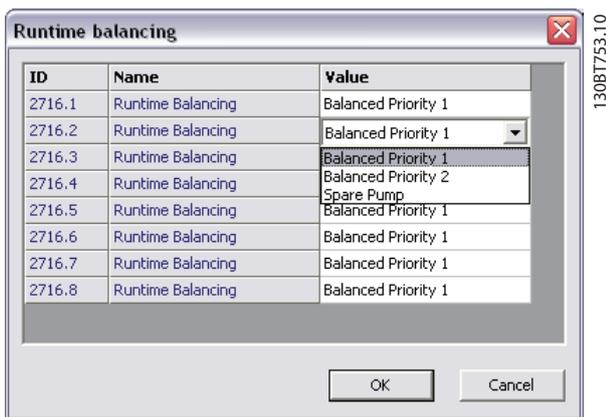
In some applications, not all pumps are used on a regular basis. Select *Spin time unused pump* to configure the time a pump is allowed to idle.



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Illustration 11.18 Spin Time Unused Pump

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



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Illustration 11.19 Balance Running Hours

11.5.3 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 *chapter 11.2.1 Basic Cascade Control*, but with the additional possibility to configure star/delta.

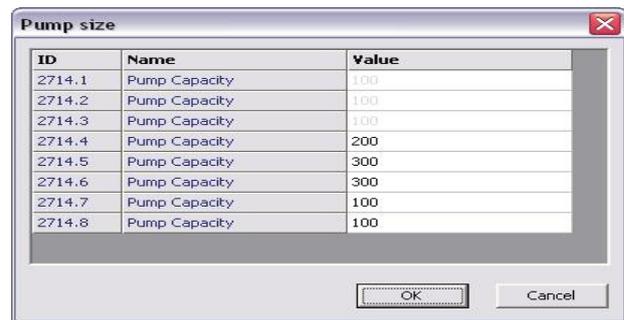
Mixed Pumps Cascade Mode can be configured to:

Mode	Description
Mixed pump	A mix of variable speed pumps connected to frequency converters and additional fixed speed pumps.
Unequal size pump	Limited mix of fixed speed pumps in different sizes.
Mixed pump with alternation	Alternates the frequency converter between 2 pumps along with controlling additional fixed speed pumps.

Table 11.9 Mixed Pump Cascade Modes

Up to 6 pumps can be controlled with VLT® Extended Cascade Controller MCO 101 and up to 8 with the VLT® Advanced Cascade Controller MCO 102.

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

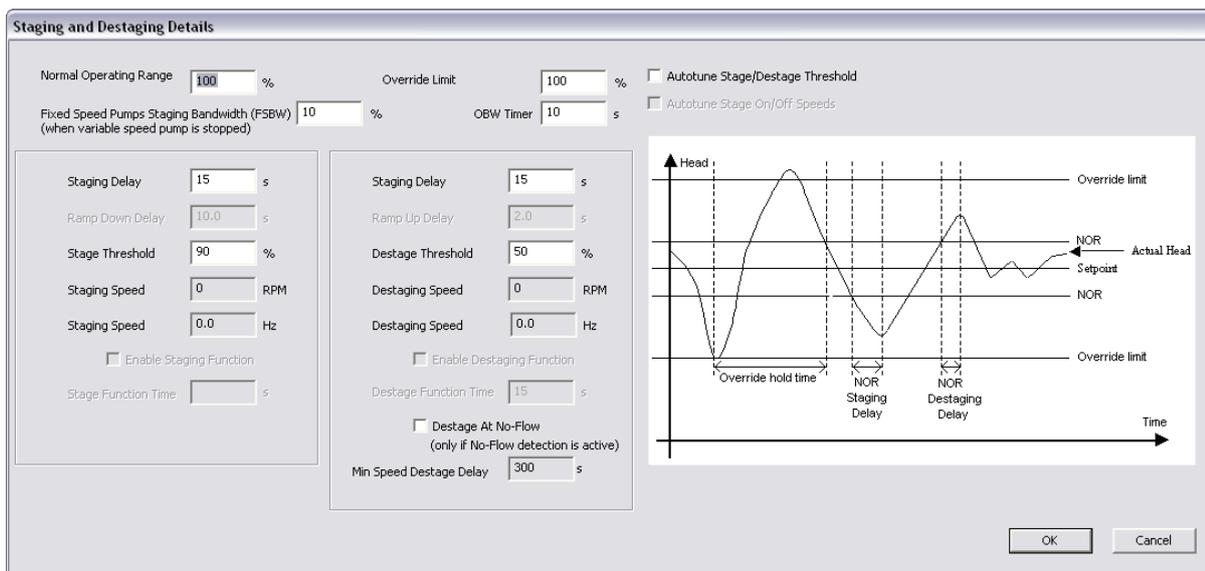


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Illustration 11.20 Configure Fixed Pump Capacity

For configuration of connection, refer to *chapter 11.5.2 Master/Slave*. For mixed pumps alternation details configuration, refer to *chapter 11.2.1 Basic Cascade Control*.

The dialog *Staging and destaging details* is similar to *chapter 11.2.1 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 operating band. When the time has elapsed, the pump turns off to save energy.



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Illustration 11.21 Staging/Destaging

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

12 Drive File Manager Plug-in

Provides the functionality to download files containing customer-specific initialization values (CSIV), language files, and application wizard files to the frequency converter. CSIV files contain parameter sets that can be used to initialize the frequency converter to reduce the time for commissioning. Files can only be flashed via the fieldbus RS485 with the frequency converter serial address configured to 1.

	View drive flash file system	Download CSIV files	Delete CSIV files	Download language files	Delete language files	Download application wizard files	Delete application wizard files
VLT® Micro Drive FC 51	N/A	N/A	N/A	N/A	N/A	N/A	N/A
VLT® HVAC Basic Drive FC 101	N/A	N/A	N/A	N/A	N/A	N/A	N/A
VLT® Encoder Input MCB 102	Yes	Yes	Yes	Yes	Yes	N/A	N/A
VLT® AQUA Drive FC 202	Yes	Yes	Yes	Yes	Yes	N/A	N/A
VLT® AutomationDrive FC 302	Yes	Yes	Yes	Yes	Yes	Yes ¹⁾	Yes ¹⁾
Derived versions of the FC series	Yes	Yes	Yes	Yes	Yes	N/A	N/A
VLT® Advanced Active Filter AAF 006	Yes	Yes	Yes	Yes	Yes	N/A	N/A

Table 12.1 Available Features

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 network and project nodes.



Illustration 12.1 Drive File Manager Plug-In

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

12.1 Creating CSIV files

New CSIV files can be created by right-clicking from the Drive file manager right pane and selecting *New File*⇒*CSIV File*, as shown in *Illustration 12.2*. An empty CSIV file is created and listed in the right view with the default name starting from 1. Additionally, existing CSIV files or language files can be imported to the list by selecting *Import file* from the menu.

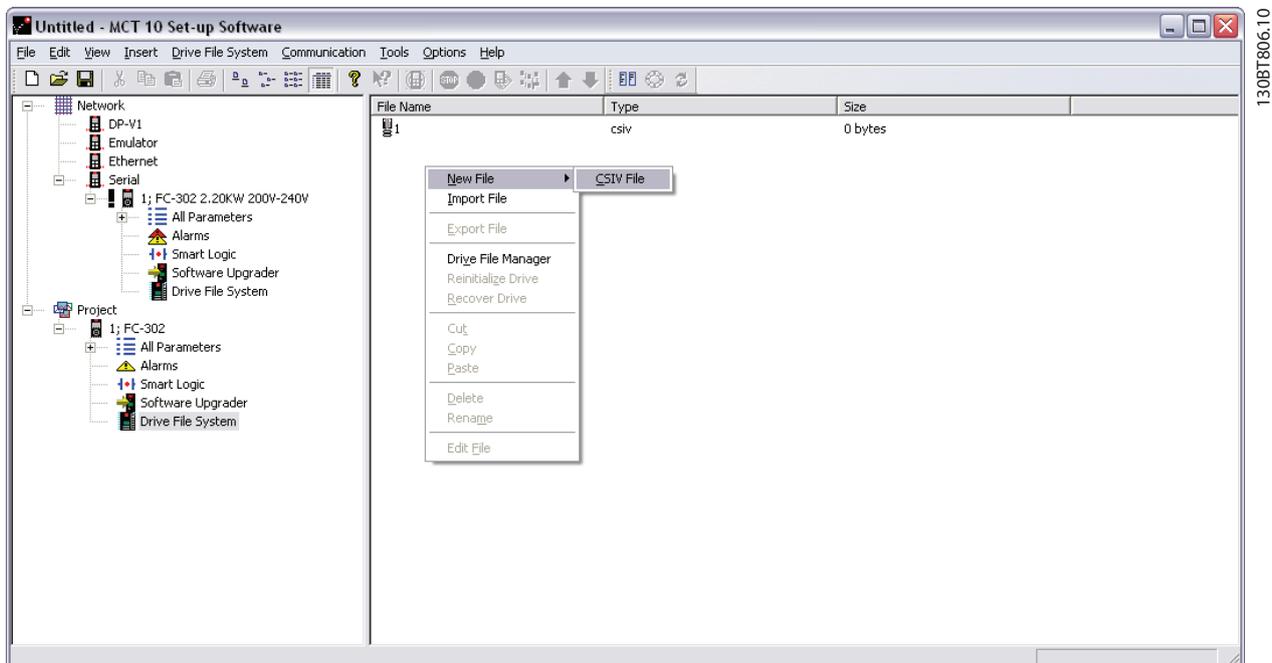


Illustration 12.2 Create CSIV Files

CSIV files containing initialization values can be exported to a file by selecting *Export File* from the menu. Traditionally, from the file menu it is possible to cut, copy, paste, delete, or rename existing files from the list.

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12.2 Configuring 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 changes made by the user in the project including all the dependent parameters.
- *Minimal change set* builds up the CSIV file content based on changes made by the user only. Selecting this option, the CSIV file is independent of the frequency converter 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.

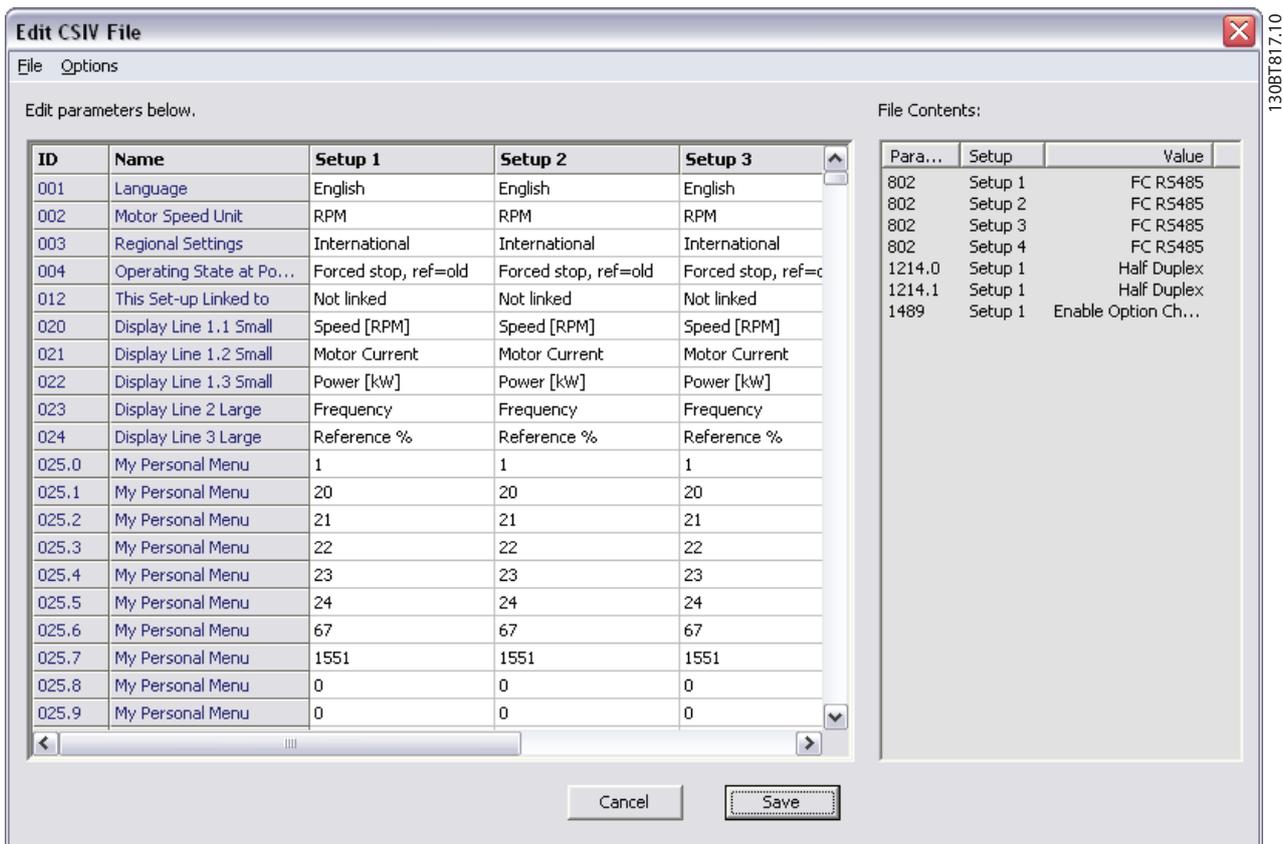


Illustration 12.3 Parameter Settings Imported from the Project and the Actual CSIV File Content

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 the 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 the 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 frequency converter information is also saved to the file. When opening the file in the CSIV editor, a validation is made to check for compatibility.

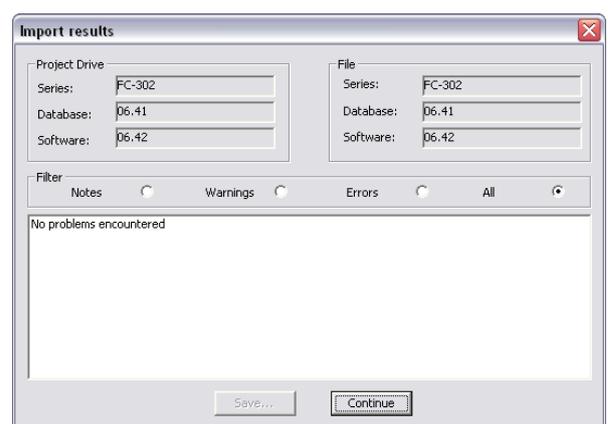


Illustration 12.4 Validation

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

12.3 Drive File Manager

Files can be downloaded or existing files erased in the frequency converter from the *Drive file manager* available from the menu. See *Illustration 12.5*.

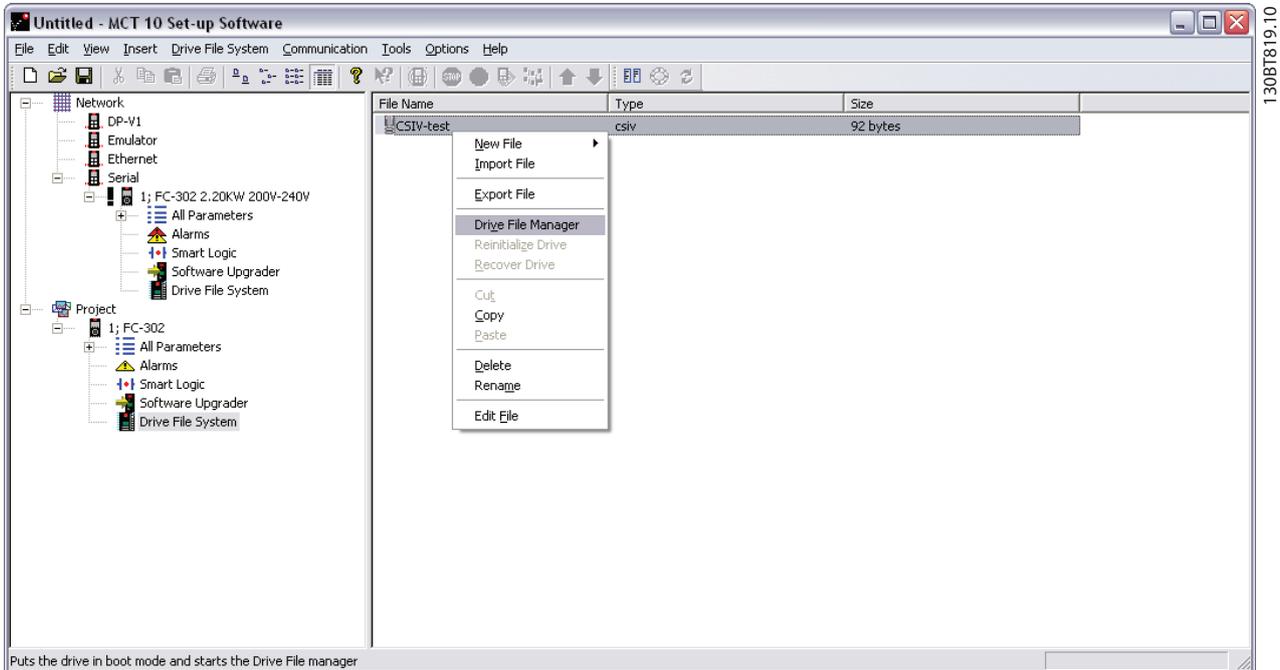


Illustration 12.5 Drive File Manager

The frequency converter is set into service mode when opening the Drive file manager.

The Drive file manager is divided in a left pane named *Project drive* and a right pane named *Connected drive*.

12

NOTICE

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

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



Illustration 12.6 Service Mode

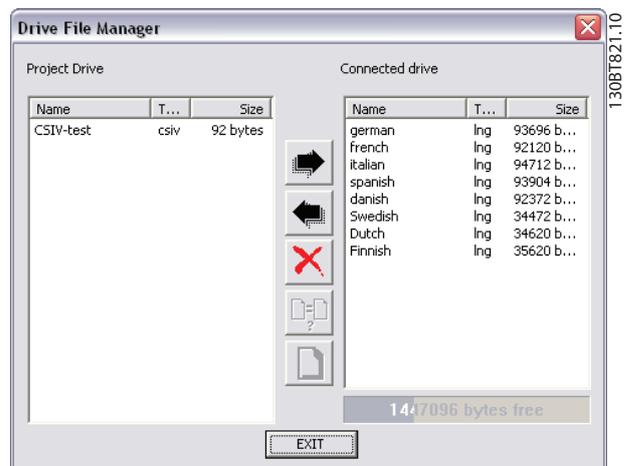


Illustration 12.7 Present Files

Three buttons are located in the middle of the view.

The right arrow transfers the file(s) from the project to the frequency converter flash file system.



Illustration 12.8 Right Arrow

The left arrow transfers the file(s) from the frequency converter flash file system to the project.



Illustration 12.9 Left Arrow

The Exit button closes the Drive file manager and switches the frequency converter back to normal mode.



Illustration 12.10 Exit

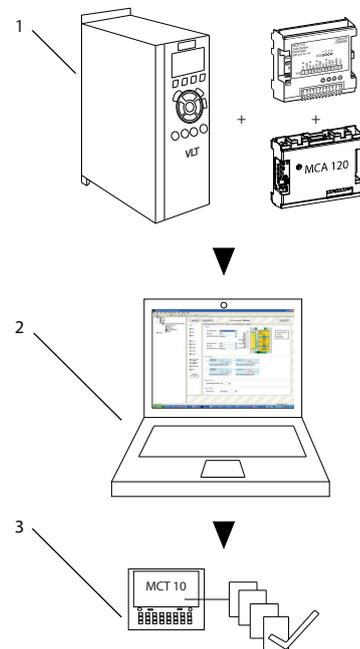
13 Functional Safety Configuration Plug-in

13.1 Introduction

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

- Configuration of the safety functions for safe motion; these shut down the frequency converter in the event of an error.
- Setting of
 - limit values.
 - braking ramps for the safety functions.
 - monitoring of motion sequences.

The manuals listed below contain important information about safety systems that must be used to mount and set up the speed monitoring safety functions of the MCB 15x module.



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Illustration 13.1 System Overview

Referenced literature

- *VLT® AutomationDrive FC 301 FC 302 Operating Guide*

13.1.1 Safe Option Compatibility

The VLT® Safety Option MCB 15x Series is supported from SW version 6.64. Previous versions are not supported. The following fieldbusses are supported by MCB 15x Safe plug-in:

- Serial communication
 - RS232 to RS485
 - USB to RS485
- USB
- PROFIBUS DPV1

The 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 back-ups of safety configurations.
- Safe option diagnostics.
- Monitoring active frequency converters for behavior and fault codes.

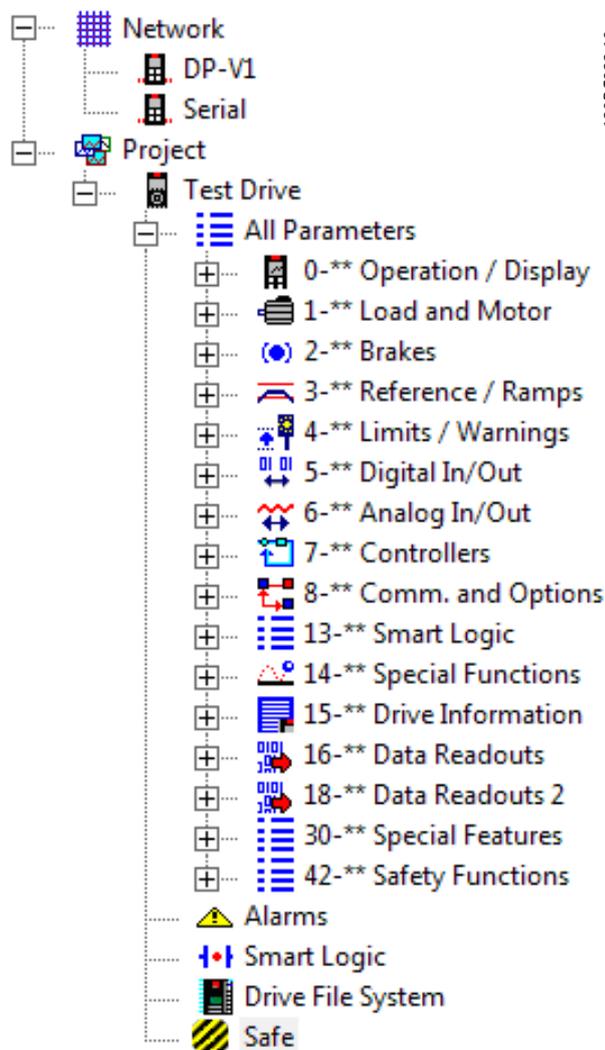
13.2 Access

13.2.1 Password Management

Access to the VLT® Safety Option MCB 15x Series is restricted with passwords. The password is requested every time the user commissions a new set-up for the device.

13.2.2 Safe Plug-In for VLT® Safety Option MCB 15x Series

To access the safe plug-in for MCB 15x for the desired frequency converter, expand the frequency converter's network or project view, then expand the relevant frequency converter to show its contents. See *Illustration 13.2*.



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Click the *Safe* icon to show the safe plug-in for MCB 15x plug-in interface in the right view of the MCT 10 Set-up Software.

If there is multiple separate online or offline frequency converters, select the relevant frequency converter to monitor from the structure tree.

NOTICE

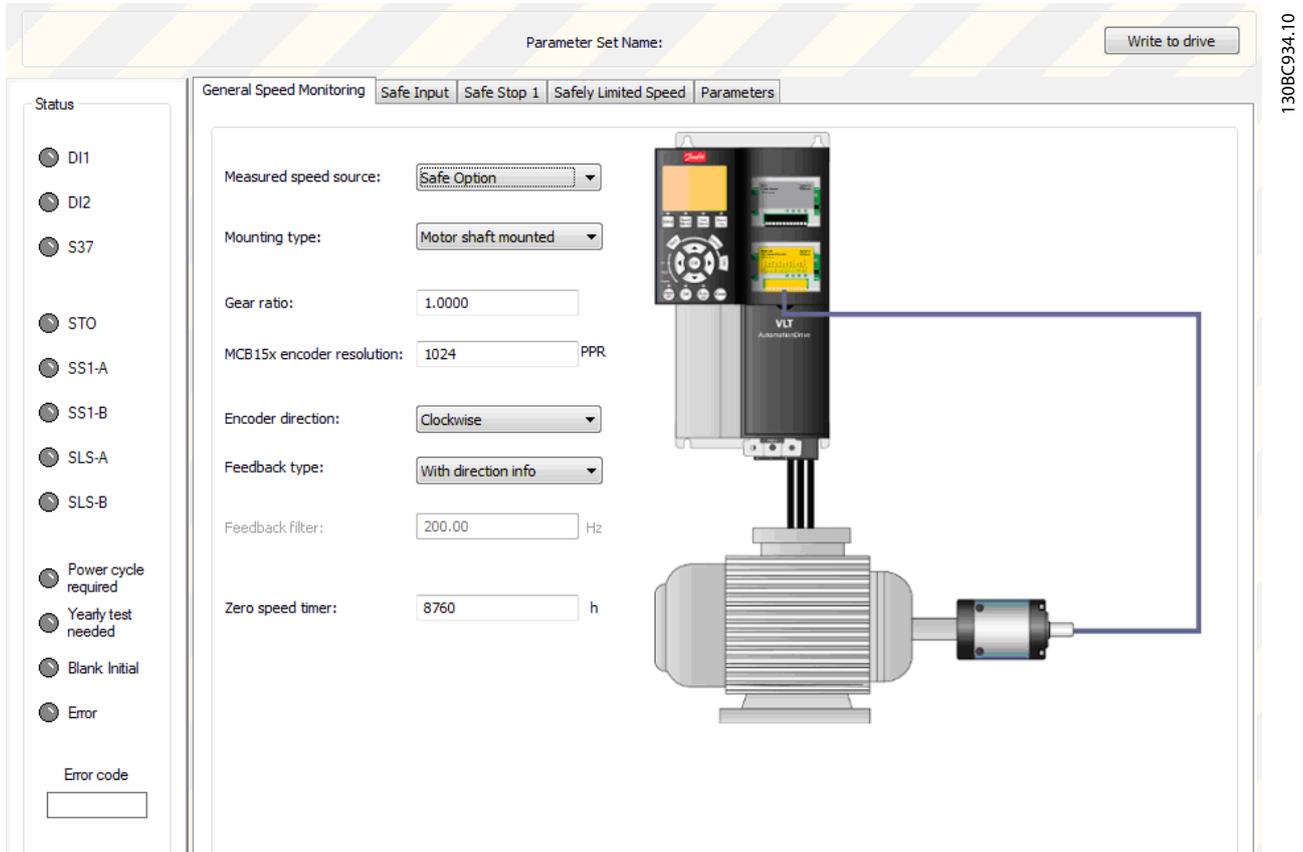
The parameters that can be edited using the safe plug-in for MCB 15x are also included in *parameter group 42-** Safety Functions* in the *All Parameters* group of the *structure tree*. These parameters can only be edited using the safe plug-in for MCB 15x.

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

Illustration 13.2 The Safe Plug-in for MCB 15x (*Safe*) shown with Functional Safety Icon in Project Tree

13.3 Safe Plug-in Interface

The layout of the plug-in is divided into separate sections that are all described in more detail below.

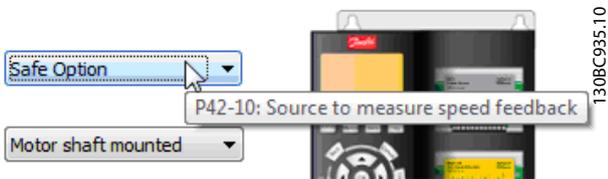


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Illustration 13.3 The Opening Tab of the Safe Plug-in for VLT® Safety Option MCB 15x Series Plug-in Interface (Operating in Offline Mode)

13

The safe plug-in for 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.



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Illustration 13.4 Tooltip Example

13.3.1 Information and Administration Area



Illustration 13.5 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 the user of pending changes.

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

- Offline mode: If a frequency converter 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 frequency converter 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.

13.3.2 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.

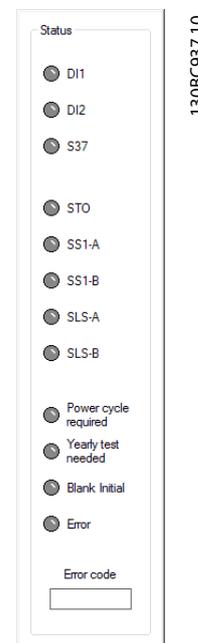


Illustration 13.6 LED Status Area

NOTICE

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).

LED status	Description
Green	OK state – the option is enabled or active.
Flashing green	Pending state – the option is pending. This 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 13.1 LED Status Information

DI1	Status of digital input 1.
DI2	Status of digital input 2.
S37	Status of S37 safe output for terminal T37 on the frequency converter.
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 safe limited speed A.
SLS-B	Status of safe limited speed B.
Power cycle required	This LED is highlighted when the device requires a power cycle.
Input offline test	Digital inputs must be tested once a year. This is indicated by a warning.
Blank initial	If the LED is highlighted, the MCB 15x is in a blank initial state, that is in factory settings. When writing to the MCB 15x for the first 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 <i>chapter 15.3.3 Device Error Codes</i> .

Table 13.2 Safe Option Status LEDs

13.3.3 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

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

13.3.4 General Speed Monitoring

The general speed monitoring tab contains primary and general information regarding the encoder/proximity switch feedback set-up details.

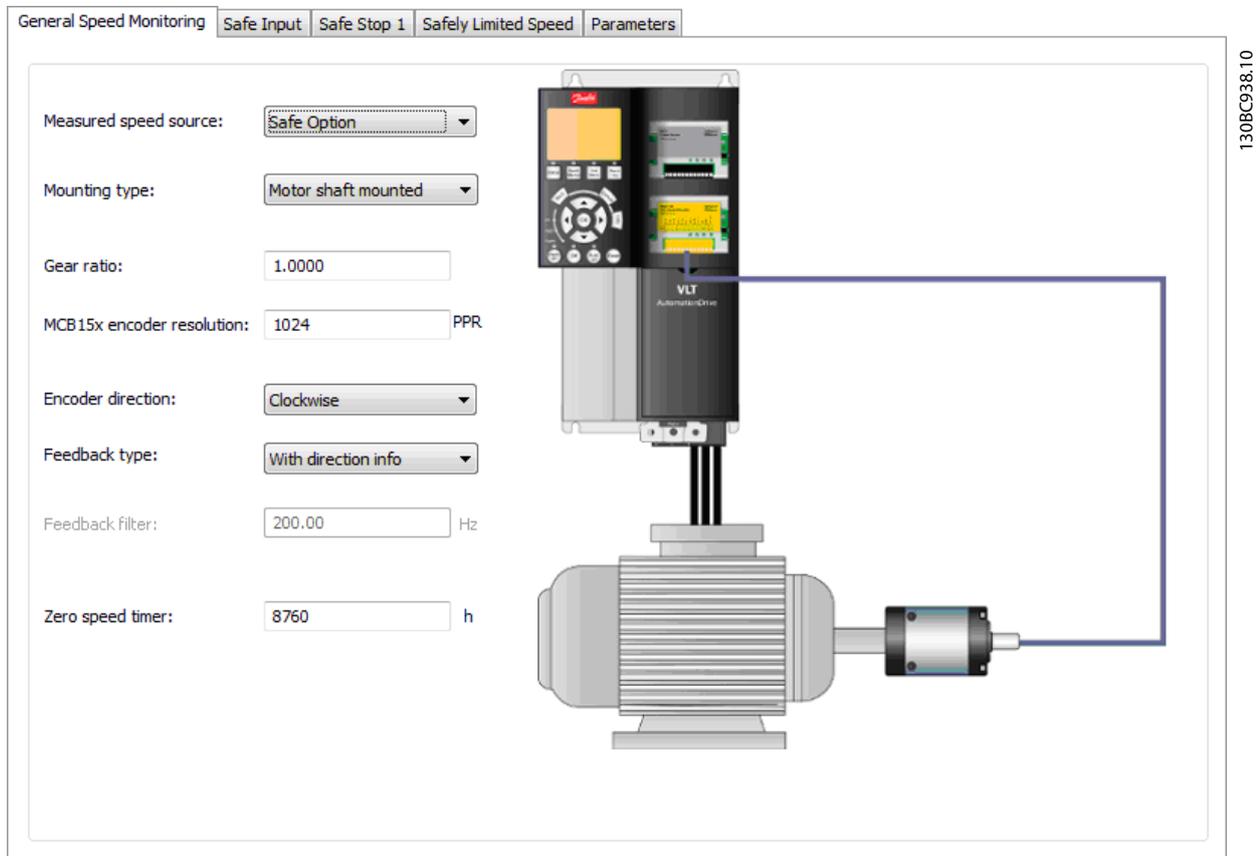


Illustration 13.7 General Speed Monitoring Configuration Tab

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

Option	Description
Measured speed source	This option defines the measured speed feedback source. The following options are available: <ul style="list-style-type: none"> • Safe plug-in for VLT® Safety Option MCB 15x Series – the feedback source is safe plug-in for MCB 15x. • None – no feedback source is used. • Factory default: [Safe plug-in for MCB 15x].
Mounting type	This option defines the frequency converter mounting type. The following options are available: <ul style="list-style-type: none"> • Gear mounted – the frequency converter is mounted using a gear system. • Motor shaft mounted – the frequency converter is mounted directly to the application.
Gear ratio	This option defines the ratio between motor shaft and the encoder speed. Range: 0.0001 and 32.0000. Factory default: 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 10000 PPR for TTL. Factory default is 1024 PPR.

Option	Description
Encoder direction	<p>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:</p> <ul style="list-style-type: none"> • Clockwise – that is positive feedback when the encoder rotates clockwise. • Counterclockwise – that is positive feedback when the encoder rotates counterclockwise. <p>Factory default: [Clockwise].</p>
Feedback type	<p>This option defines the feedback type. The following options are available:</p> <ul style="list-style-type: none"> • 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). <p>Factory default: [With direction info].</p>
Feedback filter	<p>This option defines the frequency used by the feedback filter for low-resolution encoder or proximity switch. The filter is required to reduce the quantization noise from the connected encoder or proximity switch in the case of low resolution.</p> <p>Range: 0.01–200 Hz (off).</p> <p>Factory default: [200 Hz (off)].</p>
Zero speed timer	<p>This option allows the speed to be below 120 RPM when SLS is active before STO is engaged.</p> <p>Range: 0 s and 10000 s.</p> <p>Factory default: [10].</p>

Table 13.3 Options for General Speed Monitoring

13.3.5 Safe Input

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

General Speed Monitoring | **Safe Input** | Safe Stop 1 | Safely Limited Speed | Parameters

Function

DI1 Safe Function: STO
 DI1 Type: NCNC
 DI1 Restart behaviour: Manual

DI2 Safe Function: STO
 DI2 Type: NCNC
 DI2 Restart behaviour: Manual

Y31/
 DI1 A 1
 GND 2
 DI1 B 3
 ENC A 4
 DI2 A 5
 ENC nA/GND 6
 ENC B 7
 DI2 B 8
 ENC nB/GND 9
 24V 10
 GND 11
 Safe Stop S37 12

MCB 15x Safe Option Option B

Digital input 1
 STO
 SSI-A
 SSI-B
 SLS-A
 SLS-B
 Disable

Digital input 2
 STO
 SSI-A
 SSI-B
 SLS-A
 SLS-B
 Disable
 Restart & ACK

Legend:
 Active channel (blue)
 Reset (orange)
 Disabled (red)

Input settings

Channel 1 / Channel 2
 DI1 Discrepancytime [ms] 10

Channel 1/2
 DI1 Stable signal time [ms] 10

Channel 1 / Channel 2
 DI2 Discrepancytime [ms] 10

Channel 1/2
 DI2 Stable signal time [ms] 10

Failure reaction

External failure reaction: STO

Reset settings

Reset source: Drive Reset

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Illustration 13.8 Safe Input Configuration Tab

The *Safe input* tab contains sections and configuration possibilities shown in *Table 13.4 –Table 13.7*:

Option	Description
DI1 safe function	This option defines the safe function used by DI1. The following options are available: <ul style="list-style-type: none"> • STO – Safe Torque Off is used as the safe function 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 – Safe limited speed A is used as the safe function by DI1. • SLS-B – Safe limited speed B is used as the safe function by DI1. • Disabled – The DI1 safe function is disabled. Factory default: STO.
DI1 type	This option defines the DI1 type used. The following options are available: <ul style="list-style-type: none"> • NCNC – NCNC type is used. • Antivalent – NO/NC (antivalent) type is used. • NC – 1 NC input type is used. Factory default: NCNC.
DI1 restart behavior	Restart of the MCB 15x configured the DI1 restart behavior. The following options are available: <ul style="list-style-type: none"> • Manual – The restart is performed manually. Factory default: Manual.
DI2 safe function	This option defines the safe function used by DI2. The following options are available: <ul style="list-style-type: none"> • STO – Safe Torque Off is used as the safe function 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 – Safe limited speed A is used as the safe function by DI2. • SLS-B – Safe limited speed B is used as the safe function by DI2. • Disabled – The DI2 safe function is disabled. • Restart DI1 and Failure ACK – DI1 is restarted. Factory default: STO.
DI2 type	This option defines the DI2 type used. The following options are available: <ul style="list-style-type: none"> • NCNC – NCNC type is used. • Antivalent – NO/NC (antivalent) type is used. • NC – 1 NC input type is used. Factory default: NCNC.
DI2 restart behavior	This option defines the DI2 restart behavior. The following options are available: <ul style="list-style-type: none"> • Manual – The restart is performed manually. • Automatic – The restart is performed automatically. Factory default: Manual.

Table 13.4 Options for Safe Input

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

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

Table 13.5 Options for Input Settings

Option	Description
External failure reaction	This option defines the reaction that is executed in case of an external failure. The following options are available: <ul style="list-style-type: none"> • STO – STO is executed. • SS1-A – SS1-A is executed. • SS1-B – SS1-B is executed. Factory default: STO.

Table 13.6 Options for Failure Reaction

Option	Description
Reset source	This option defines the source for the reset signal for safe plug-in for MCB 15x. The following options are available: <ul style="list-style-type: none"> • Drive Reset – The source is a frequency converter reset. • Drive Safe Reset – The source is a safe drive reset. • Safe Option DI2_A – The source is MCB 15x DI2_A. Factory default: Drive Reset.

Table 13.7 Options for Reset Settings

13.3.6 Safe Stop 1

The *Safe stop configuration* tab allows setting specific scenarios for safe stopping of the frequency converters using designated conditions.

General Speed Monitoring | Safe Input | **Safe Stop 1** | Safely Limited Speed | Parameters

SS1-A

Type: Delay

Delay time: s

Ramp profile: Linear

Δt : %

SS1-B

Type: Delay

Delay time: s

Ramp profile: Linear

Δt : %

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13

Illustration 13.9 Safe Stop 1 Configuration Tab

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

Option	Description
Type	<p>This option defines the type of the safe stopping configuration. The following options are available:</p> <ul style="list-style-type: none"> • Delay – a delay is used to safely stop the frequency converter. • Ramp – a ramp is used to safely stop the frequency converter. <p>Factory default: Delay.</p>

Option	Description
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 default: 1 s
	Ramp profile This option defines the ramp profile setting. The following options are available: <ul style="list-style-type: none"> Linear – a linear ramp is used for the delay. S-ramp const. time – a constant time ramp is used to safely stop the frequency converter. Factory default: Linear.
	Delta time This option defines 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 default: 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 decreases. 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 default: 50%.
Type: Ramp	The following configuration options are available when the type is set to ramp:
	Ramping set-up This option defines the ramping set-up used. The following options are available: <ul style="list-style-type: none"> 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 set-up. This option defines the deceleration rate for the SS1 slope-based ramp style. Range: 1–30000 RPM/s. Factory default: 1500 RPM/s.
	Ramp time This option is configurable only when time is selected for the ramping set-up. It defines the time after which 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 default: 120 RPM.
	Zero speed This option defines the speed at which safe plug-in for MCB 15x engages the STO. Range: 1–600 RPM. The factory default: 10 RPM.

Table 13.8 Options for SS1-A

Option	Description
Type	This option defines the type of the safe stopping configuration. The following options are available: <ul style="list-style-type: none"> • Delay – a delay is used to safely stop the frequency converter. • Ramp – a ramp is used to safely stop the frequency converter. Factory default: [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 default: 1 s.
	Ramp profile This option defines the ramp profile setting. The following options are available: <ul style="list-style-type: none"> • Linear – a linear ramp is used for the delay. • S-ramp const. time – a constant time ramp is used to safely stop the frequency converter. Factory default: Linear.
	Delta time This option defines 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 default: 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 decreases. 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 default: 50%.
Type: Ramp	The following configuration options are available when the type is set to ramp:
	Ramping set-up This option defines the ramping set-up used. The following options are available: <ul style="list-style-type: none"> • 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 set-up. This option defines the deceleration rate for the SS1 slope-based ramp style. Range: 1–30000 RPM/s. Factory default: 1500.
	Ramp time This option is configurable only when time is selected for the ramping set-up. It defines the time after which the safe plug-in for MCB 15x 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 default: [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 default: 10 RPM.

Table 13.9 Options for SS1-B

13.3.7 Safely Limited Speed

The *Safely limited speed configuration* tab allows setting specific scenarios for safe limited speeds of the frequency converters using designated conditions.

The screenshot displays the 'Safely Limited Speed' configuration interface. It features two tabs: 'SLS-A' and 'SLS-B'. Each tab contains configuration parameters and a corresponding speed-time graph.

SLS-A Configuration:

- SLS setup: SLS with ramp
- Ramp Down Time: 1.0 s
- Cut off speed: 270 RPM (Apply recommended value: 301 RPM)
- Speed limit: 150 RPM
- Failsafe reaction: STO

SLS-B Configuration:

- SLS setup: SLS without ramp
- Ramp Down Time: 1.0 s
- Cut off speed: 270 RPM (Apply recommended value: 270 RPM)
- Speed limit: 150 RPM
- Failsafe reaction: STO

The graphs show speed (v) on the y-axis and time (t) on the x-axis. A red shaded area represents 'Error & STO' occurring above the 'Cut Off Speed'. A yellow shaded area represents 'Timer & STO' occurring below the 'Zero speed limit'. A 'Speed limit' is indicated between the 'Cut Off Speed' and the 'Zero speed limit'. A 'Ramp Down Time' is shown as a period where the speed ramps down from the 'Cut Off Speed' to the 'Zero speed limit'.

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Illustration 13.10 Safely Limited Speed Configuration Tab

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

Option	Description
SLS set-up	This option defines the type of the safe limited speed set-up. The following options are available: <ul style="list-style-type: none"> SLS without ramp – SLS is used without a ramp. SLS with ramp – SLS is used with ramp.
Ramp-down time	This option is configurable only when the SLS with ramp is selected in SLS set-up. It defines the ramp-down time for start ramp. Range: 0.1–3600 s. Factory default: 1 s.

Option	Description
Cutoff speed	This option defines the speed at which the failsafe 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.
Failsafe reaction	This option defines the safety function that is engaged when the maximum speed is exceeded. The following options are available: <ul style="list-style-type: none"> • STO – Safe Torque Off is used. • SS1-A – Safe stop 1-A is used. • SS1-B – Safe stop 1-B is used.

Table 13.10 Options for SLS-A

Option	Description
SLS set-up	This option defines the type of the safe limited speed set-up. The following options are available: <ul style="list-style-type: none"> • SLS without ramp – SLS is used without a ramp. • SLS with ramp – SLS is used with ramp.
Ramp-down time	This option is configurable only when the SLS with ramp is selected in SLS set-up. It defines the ramp-down time for start ramp. Range: 0.1–3600 s. Factory default: 1 s.
Cutoff speed	This option defines the speed at which the failsafe 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.
Failsafe reaction	This option defines the safety function that is engaged when the maximum speed is exceeded. The following options are available: <ul style="list-style-type: none"> • STO – Safe Torque Off is used. • SS1-A – Safe stop 1-A is used. • SS1-B – Safe stop 1-B is used.

Table 13.11 Options for SLS-B

13

13.4 Configuration

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

NOTICE

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 desired 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 frequency converter.

NOTICE

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.

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

NOTICE

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

13.4.1 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 the user of the possible consequences. It is then possible to verify the changes and either accept or discard the change.

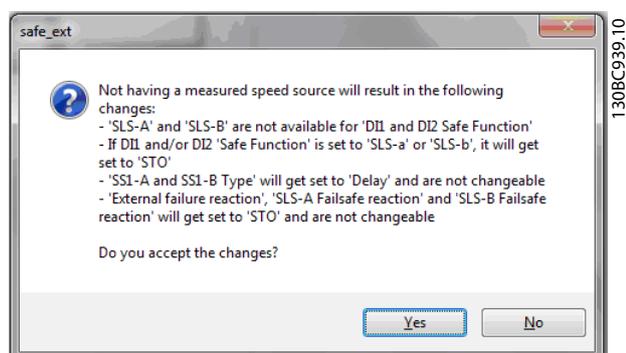


Illustration 13.11 Dependencies Confirmation Dialog

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.

13.4.2 Advanced Configuration Parameters

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

Parameters						
ID	Name	Setup	Min. value	Max. value	Factory setup	Unit
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
4242.1	Delay Time	1.0	0.1	3600.0	1.0	s
4243.0	Delta T	2	0	99	2	%
4243.1	Delta T	2	0	99	2	%
4244.0	Deceleration Rate	1500	1	30000	1500	/s
4244.1	Deceleration Rate	1500	1	30000	1500	/s
4245.0	Delta V	120	1	10000	120	RPM
4245.1	Delta V	120	1	10000	120	RPM
4246.0	Zero Speed	10	1	600	10	RPM
4246.1	Zero Speed	10	1	600	10	RPM
4247.0	Ramp Time	1.0	0.1	3600.0	1.0	s
4247.1	Ramp Time	1.0	0.1	3600.0	1.0	s
4248.0	S-ramp Ratio at Decel...	50	1	50	50	%
4248.1	S-ramp Ratio at Decel...	50	1	50	50	%
4249.0	S-ramp Ratio at Decel...	50	1	50	50	%
4249.1	S-ramp Ratio at Decel...	50	1	50	50	%
4250.0	Cut Off Speed	270	151	10000	270	RPM
4250.1	Cut Off Speed	270	151	10000	270	RPM
4251.0	Speed Limit	150	0	269	150	RPM
4251.1	Speed Limit	150	0	269	150	RPM
4252.0	Fail Safe Reaction	STO			STO	
4252.1	Fail Safe Reaction	STO			STO	
4253.0	Start Ramp	No			No	
4253.1	Start Ramp	No			No	
4254.0	Ramp Down Time	1.0	0.1	3600.0	1.0	s
4254.1	Ramp Down Time	1.0	0.1	3600.0	1.0	s

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13

Illustration 13.12 Parameters Configuration Tab

NOTICE

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

13.4.3 Parameter Lists

Table 13.12 is a complete list of all parameters available to the user for configuration via safe plug-in for VLT[®] Safety Option MCB 15x Series.

NOTICE

Parameters ending with .0 are used for either SS1-A or SLS-A. Parameters ending with .1 are used for either SS1-b or SLS-B in the *parameter groups 42-4* and 42-5**.

For *parameter group 42-2* .0*, refer to DI1 and .1 to DI2.

Parameter	Description	Factory value
4210	Measured speed source – The source of the speed feedback.	Safe option
4211	Encoder resolution – The resolution of the encoder connected to the safe plug-in for MCB 15x.	1024
4212	Encoder direction – The direction of the encoder.	Clockwise
4213	Gear ratio – The ratio between the motor speed and the encoder speed.	10.000
4214	Feedback type – The feedback type.	With direction info
4215	Feedback filter – The frequency of the feedback filter.	200.00
4218	Zero speed timer – The timer for the zero speed activation.	10
4220.0	Safe function – The safe function selected.	STO
4220.1	Safe function – The safe function selected.	STO
4221.0	Type – The type of the safe input.	NCNC
4221.1	Type – The type of the safe input.	NCNC
4222.0	Discrepancy time – The time amount allowed for discrepancy.	10
4222.1	Discrepancy time – The time amount allowed for discrepancy.	10
4223.0	Stable signal time – The time amount for a stable signal.	10
4223.1	Stable signal time – The time amount for a stable signal.	10
4224.0	Restart behavior – The restart behavior of the safe plug-in for MCB 15x, automatic or with user input.	Manual
4224.1	Restart behavior – The restart behavior of safe plug-in for MCB 15x, automatic or with user input.	Manual
4230	External failure reaction – The safety function that is executed if there is an external failure.	STO
4231	Reset source – The source for the reset signal.	Drive Reset
4233	Parameter set name – The title for the current safe plug-in for MCB 15x configuration. The maximum length of the parameter set name is 8 symbols.	–
4240.0	Type – Type of the safe stop function.	Delay
4240.1	Type – Type of the safe stop function.	Delay
4241.0	Ramp profile – The ramp profile that is either defined by the safe plug-in for MCB 15x or within the frequency converter itself.	Linear
4241.1	Ramp profile – The ramp profile that is either defined by the safe plug-in for MCB 15x or within the frequency converter itself.	Linear
4242.0	Delay time – The amount of time spent by the safe stop function to ramp the speed down to 0 RPM.	1.0
4242.1	Delay time – The amount of time spent by the safe stop function to ramp the speed down to 0 RPM.	1.0
4243.0	Delta T – The buffer time that is added to the delay time before activating STO.	2
4243.1	Delta T – The buffer time that is added to the delay time before activating STO.	2
4244.0	Deceleration rate – The deceleration rate for the safe stop slope ramp type.	1500
4244.1	Deceleration rate – The deceleration rate for the safe stop slope ramp type.	1500
4245.0	Delta V – The tolerance between the calculated and actual speeds allowed by safe plug-in for MCB 15x.	120
4245.1	Delta V – The tolerance between the calculated and actual speeds allowed by safe plug-in for MCB 15x.	120
4246.0	Zero speed – The zero speed limit that the safe plug-in for MCB 15x uses to engage STO.	10
4246.1	Zero Speed – The zero speed limit that the safe plug-in for MCB 15x uses to engage STO.	10

Parameter	Description	Factory value
4247.0	Ramp time – The ramp time that the safe plug-in for MCB 15x uses to engage STO.	1.0
4247.1	Ramp time – The ramp time that the safe plug-in for MCB 15x uses to engage STO.	1.0
4248.0	S-ramp Ratio at deceleration start – The proportion of the total ramp-down time wherein the deceleration torque increases. The greater the percentage value, the greater the jerk compensation achieved.	50
4248.1	S-ramp Ratio at deceleration start – The proportion of the total ramp-down time wherein the deceleration torque increases. The greater the percentage value, the greater the jerk compensation achieved.	50
4249.0	S-ramp Ratio at deceleration end – The proportion of the total ramp-down time wherein the deceleration torque decreases. The greater the percentage value, the greater the jerk compensation achieved.	50
4249.1	S-ramp Ratio at deceleration end – The proportion of the total ramp-down time wherein the deceleration torque decreases. The greater the percentage value, the greater the jerk compensation achieved.	50
4250.0	Cutoff speed – The speed at which the failsafe reaction is engaged.	–
4250.1	Cutoff speed – The speed at which the failsafe reaction is engaged.	–
4251.0	Speed limit – The maximum speed allowed when the safe limited-speed function is engaged.	–
4251.1	Speed limit – The maximum speed allowed when the safe limited-speed function is engaged.	–
4252.0	Failsafe reaction – The safety function that is activated when the speed exceeds the limit set.	STO
4252.1	Failsafe reaction – The safety function that is activated when the speed exceeds the limit set.	STO
4253.0	Start ramp – If the speed at the activation of safe limited speed is greater than the speed limit, the function either ramps down to the speed limit (Yes value) or activates the STO (No value.)	No
4253.1	Start ramp – If the speed at the activation of safe limited speed is greater than the speed limit, the function either ramps down to the speed limit (Yes value) or activates the STO (No value.)	No
4254.0	Ramp-down time – The ramp-down time for starting the ramp.	1.0
4254.1	Ramp-down time – The ramp-down time for starting the ramp.	1.0

Table 13.12 Parameter List

13.5 Commissioning

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

The status window shown in *Illustration 13.13* opens:

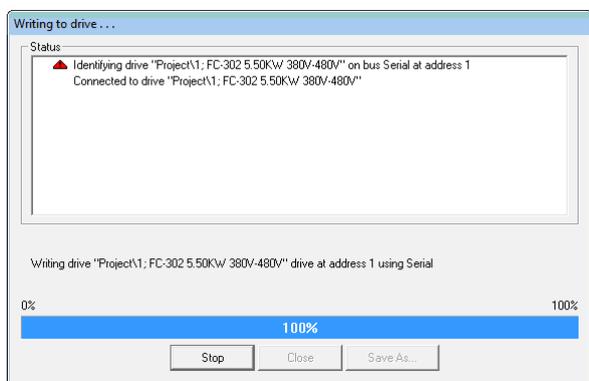


Illustration 13.13 Writing to Drive Status Window

more information on changing password, refer to *chapter 13.6.3 Change Password*.



Illustration 13.14 Password Entry Dialog

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

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

NOTICE

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.

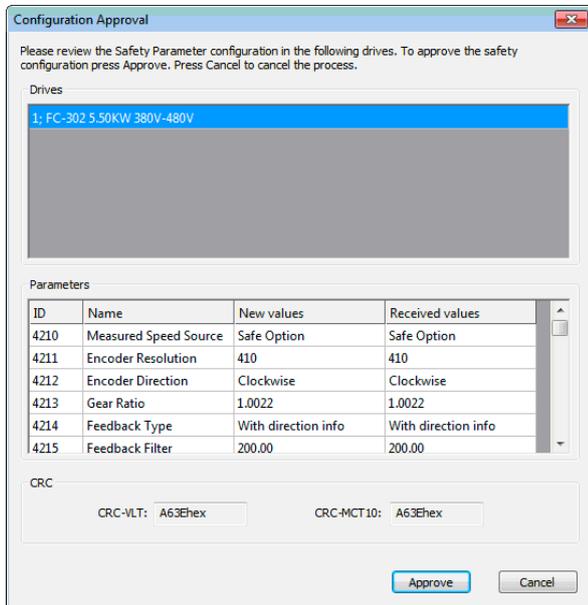


Illustration 13.15 Configuration Approval Dialog and Summary

Drives	The top section of the summary shows all frequency converters affected by the write procedure. If there are multiple frequency converters, press the frequency converter titles in the window to update parameters and CRC below accordingly.
Parameter s	This section details all the updated parameters that were written to the frequency converter.
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 frequency converter. This column must have the same value as <i>Received values</i> . If not, an error is shown.
Received values	The value that was received from the frequency converter after the update procedure. This column must have the same value as <i>New values</i> . If not, an error is shown.
CRC	This section shows the CRC values that were generated from the application side and the frequency converter side. These values must match. If not, an error is shown.

Table 13.13 Explanations for Illustration 13.15

- When the configuration approval pops up, review the included summary.
- Press *Approve* to confirm the changes and close the dialog window, OR press *Cancel* to discard the process and perform a rollback.

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

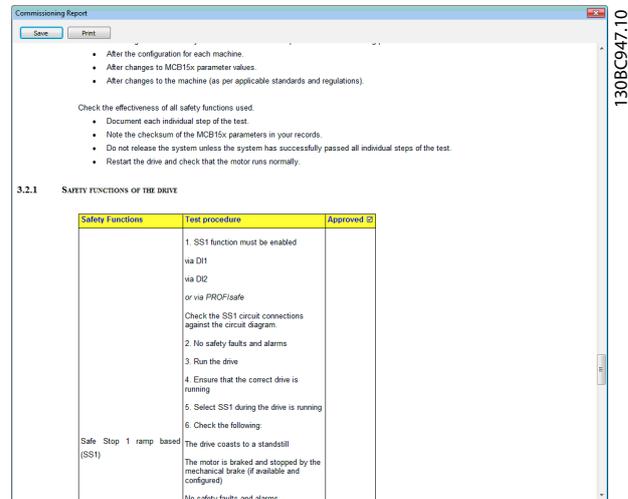


Illustration 13.16 Commission Report Review, Save, and Print Dialog

- Press *Save* to save the commission report in Rich Text Format.
- Press *Print* to print the report.
- When the commissioning process is complete, press [Reset] on the frequency converter to reboot.

13.5.1 Commission Report

During the commission process, the commission report is generated based on a fixed template within the MCT 10 application. The report contains all data written to the frequency converter.

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 need to be tested, see more details in *VLT® Safety Option MCB 150/151 Operating Instructions* and in *VLT® Safety Option MCB 152 Operating Instructions*.

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 set-up and parameter configurations.
- Commissioning test** – specific testing scenarios for the current set-up. This section also contains CRC check procedure descriptions.

13.6 Operation

The following sections describe how to use the diagnostics function, how to reset, and how to change password.

13.6.1 Diagnostics

Follow these instructions to access and use the *Diagnostics* function:

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 window shown in *Illustration 13.17* opens:

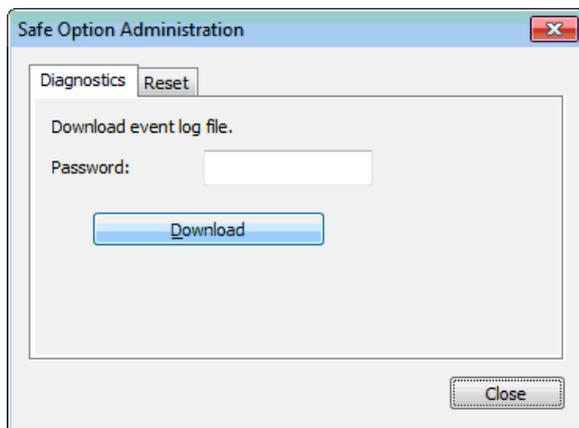


Illustration 13.17 Safe Plug-in for MCB 15x Administration Window

3. Enter the safe plug-in for MCB 15x password configured for the frequency converter.
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.

13.6.2 Reset

Follow these instructions to access and use the *Reset* function:

NOTICE

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.

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 following window opens:

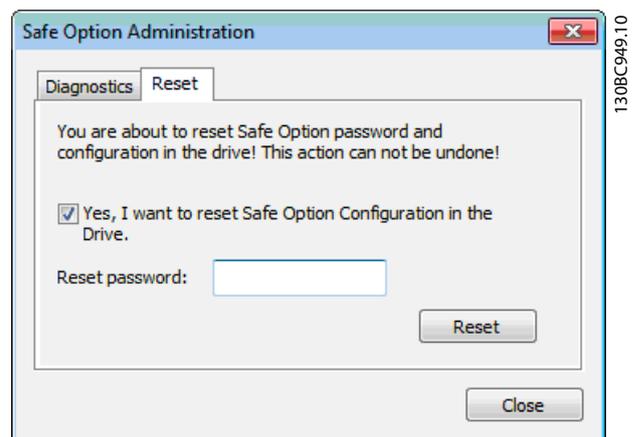


Illustration 13.18 Reset Password

4. Tick *Yes, I want to reset Safe plug-in for MCB 15x Configuration* for the frequency converter to continue.
5. Enter the master password configured for the frequency converter to continue.
6. Press *Reset* to reset the frequency converter password and configuration.
7. Press [Reset] on the frequency converter to reboot.

13.6.3 Change 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.



Illustration 13.19 Safe Plug-in for MCB 15x Password Changing Window

Follow these instructions to change the password:

1. Press *Change password*.
2. Enter the current password into the *Current password* field.
3. Enter the new desired password into the *New password* field. The password length must be exactly 8 characters. The password is case-sensitive.
4. Confirm the new desired 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. Press *Cancel* to discard the procedure.

14 SyncPos

14.1 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*.

MCT 10 Set-up Software can directly modify, read from, and write to SyncPos files. SyncPos files are stored within the MCT 10 Set-up Software files and do not require separate handling.

When a VLT 5000 has a SyncPos option installed, the MCT 10 Set-up Software shows 2 icons after the frequency converter 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.

NOTICE

MCT 10 Set-up Software 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.

14.2 Programs and Configuration File

The SyncPos program consists of 2 main parts:

- Configuration file (*.cnf).
- Program Files(s) (*.m).

A configuration file consists of a series of SyncPos parameters which can be programmed. MCT 10 Set-up Software allows importing, exporting, and setting up SyncPos configuration files.

14.2.1 Programs

Programs can be inserted in the MCT 10 Set-up Software 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 just as in the standalone SyncPos program. If a SyncPos program exists, it can be imported into the MCT 10 Set-up Software project.

14.2.2 Configuration

1. Select *Configuration* to view the available frequency converter configuration file in the right view.
2. To change the SyncPos settings, select the relevant frequency converter in the right view to open a new editor (Cam Editor). Refer to *Programmable SyncPos Motion Controller Operating Instructions* for details on using the editor.
3. Once the desired settings are made, select *Compile* (under *Settings* in the main menu) or *Exit Program* (under *File* in the main menu).
4. When selecting *Exit Program*, select *Read* or *Write*. The *Confirm SyncPos write (or read)* window pops up with 2 options for saving to the SyncPos card. Mark the desired selection and select *Yes* or *No*. When selecting *Yes*, the information is written to the frequency converter.

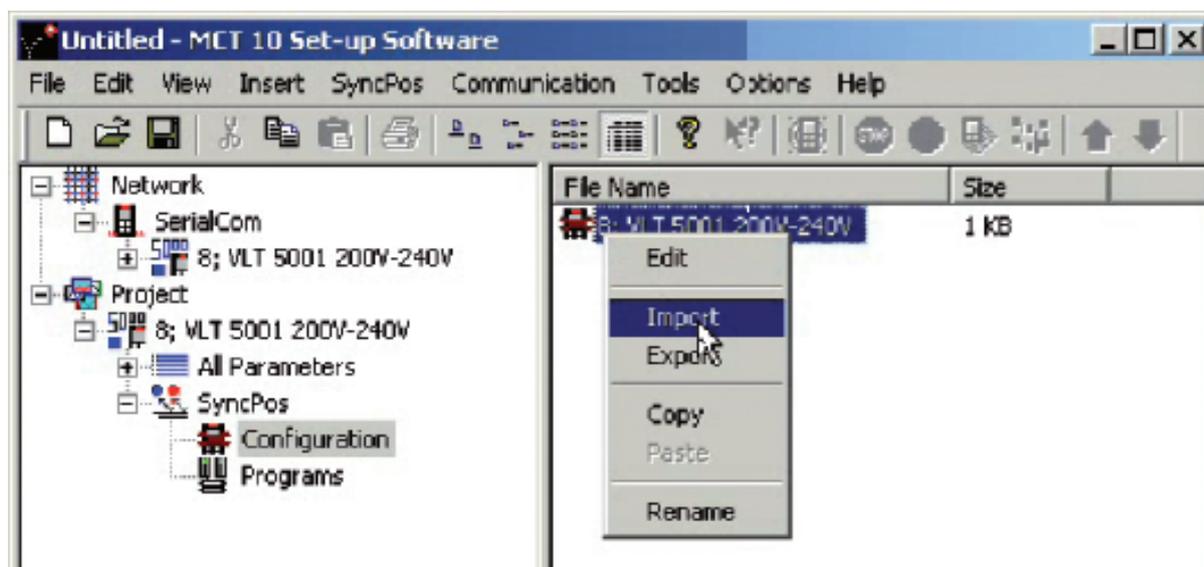
NOTICE

If *Write to Drive* is selected at the root of a frequency converter, the MCT 10 Set-up Software also writes the SyncPos files to the SyncPos options. This can lead to an unattended stop of the SyncPos card.

14.2.3 Import and Export of a Configuration File

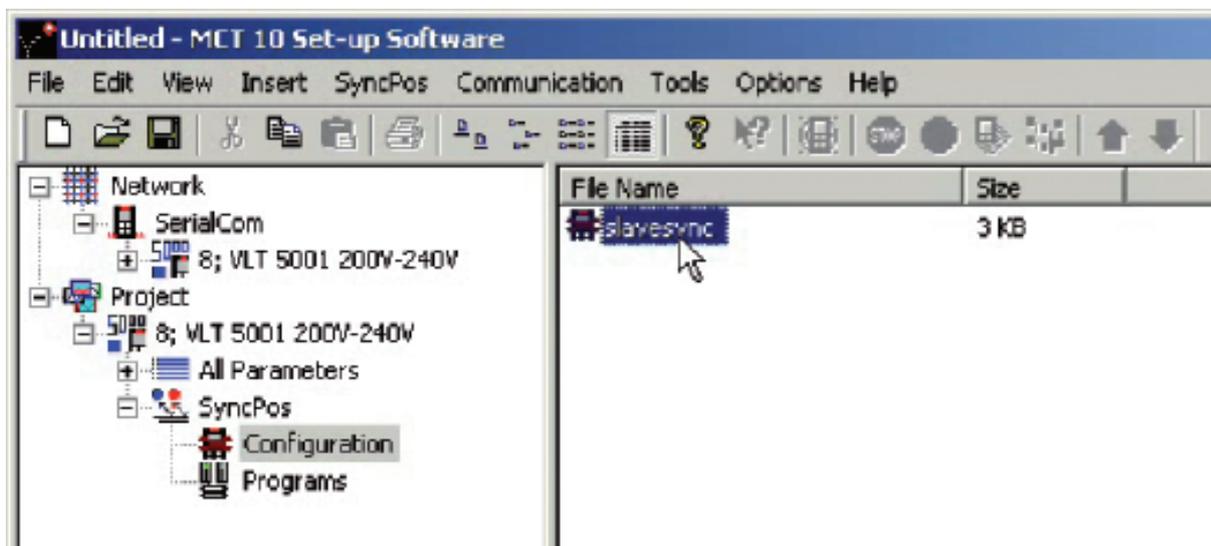
To import a configuration file saved elsewhere, for example in another project, to the SyncPos card:

1. Click the configuration file shown in the right view, see *Illustration 14.1*.
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.



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Illustration 14.1 Import Configuration File



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Illustration 14.2 Import Configuration File

Export of configuration files is performed in the same manner.

14.2.4 Edit and Save Configuration File

View and edit the content of the configuration file by selecting it. The configuration editor then opens.

After editing is complete, close the SyncPos application and the window shown in *Illustration 14.3* pops up:

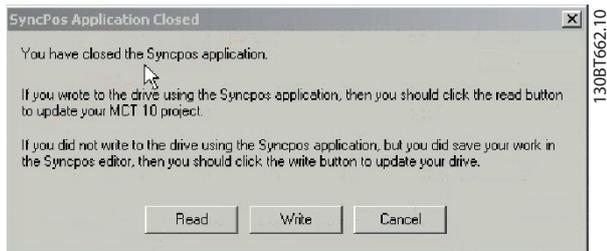


Illustration 14.3 SyncPos Application Closed

Select *Read* to save changes to the MCT 10 Set-up Software project, or *Write* to save changes to the frequency converter. Reading or writing can take some time.

14.2.5 Import and Export of Programs

To import a program to the SyncPos card, left-click on a program shown in the right view as shown in *Illustration 14.4*.

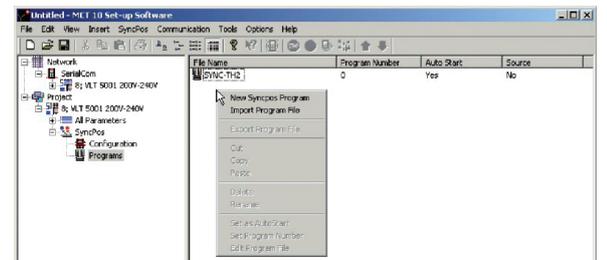


Illustration 14.4 Import Program to SyncPos Card

Browse the computer to find the desired program for import.

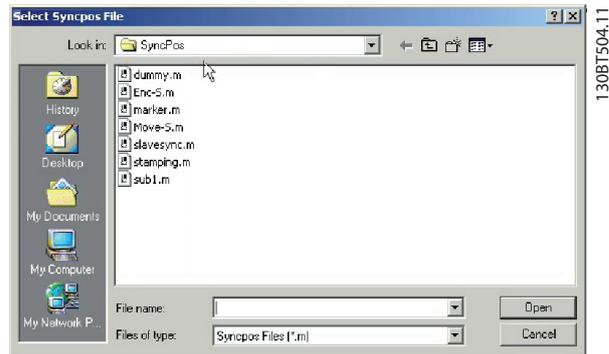


Illustration 14.5 Browse

Select the desired program, click *Open* to import program in the Programs folder. The import is now complete.

14.2.6 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.

In the right view, select the start-up program, and then right-click to select *Set As Auto Start*. The program selected is then indicated with *Yes* in the *Auto Start* column.

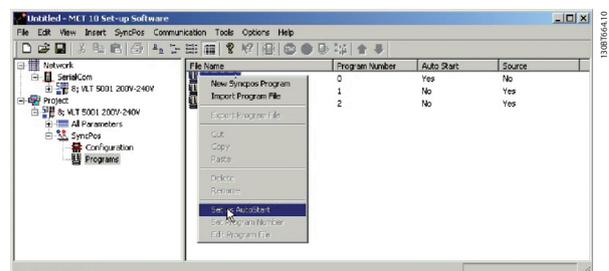


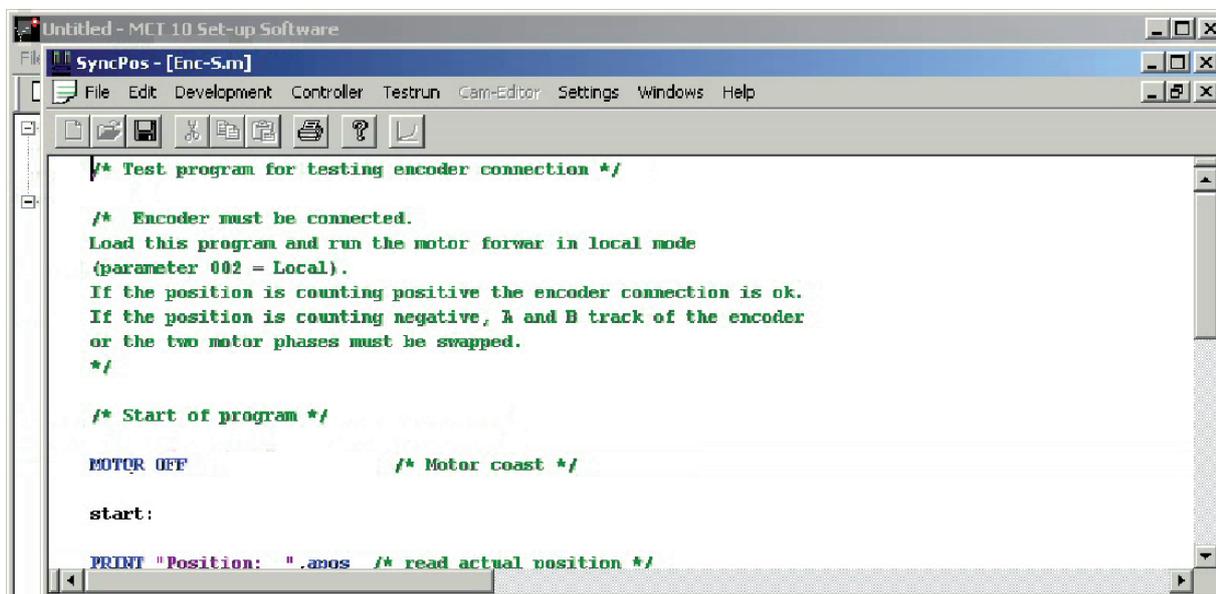
Illustration 14.6 Auto Start

14.2.7 Source Code

Refer to *Programmable SyncPos Motion Controller Operating Instructions*.

14.2.8 Edit Source Code

Double-click *Program* in the right view to view and edit the source code.



```
/* Test program for testing encoder connection */
/* Encoder must be connected.
Load this program and run the motor forward in local mode
(parameter 002 = Local).
If the position is counting positive the encoder connection is ok.
If the position is counting negative, A and B track of the encoder
or the two motor phases must be swapped.
*/
/* Start of program */
MOTOR OFF /* Motor coast */
start:
PRINT "Position: " .apos /* read actual position */
```

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Illustration 14.7 View/Edit Source Code

A range of editing operations are possible, described in detail in the SyncPos manual.

14.2.9 Save and Exit Program

Select *File⇒Save* in the menu bar to save the changes to the program file opened from the MCT 10 Set-up Software project.

To leave SyncPos, select *File⇒Exit program* in the menu bar:

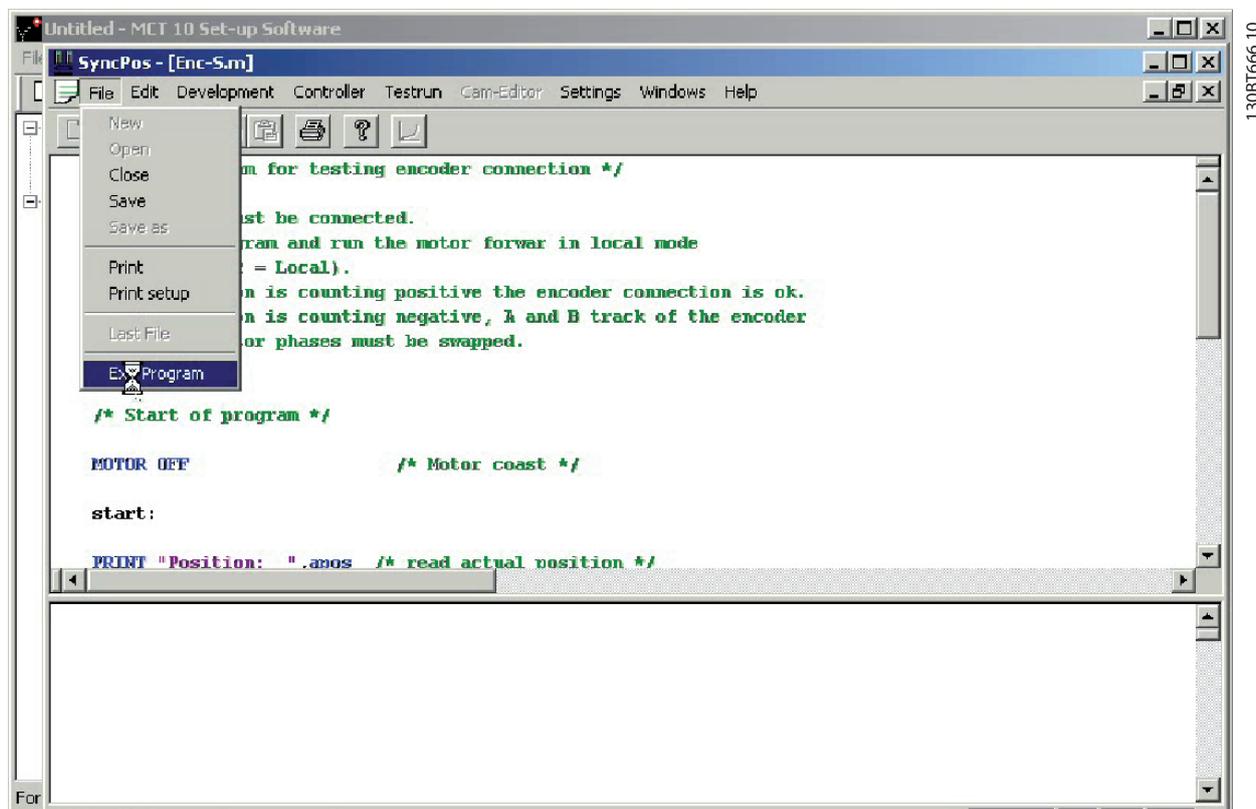


Illustration 14.8 Exit Program

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

14

NOTICE

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

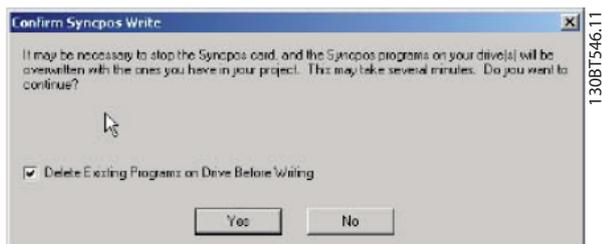
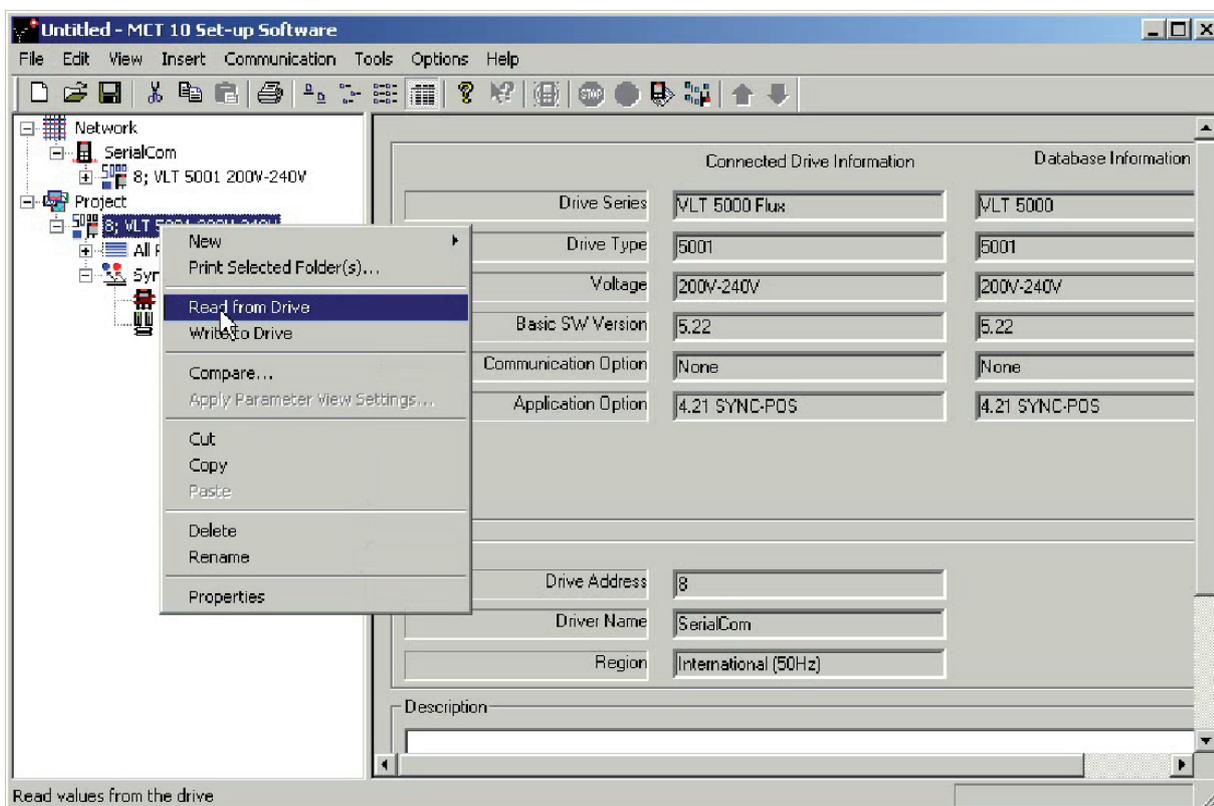


Illustration 14.9 Confirm SyncPos Write

14.3 SyncPos Read From Drive

Read all parameters and SyncPos files from a frequency converter to a project by selecting *Read from Drive*. Select the root drive and then right-click to find *Read from Drive*:

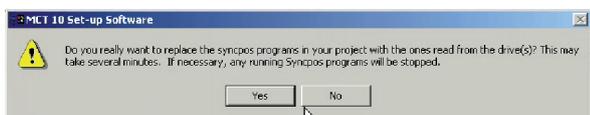


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Illustration 14.10 SyncPos Read From Drive

NOTICE

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



1308T719.10

Illustration 14.11 Files Overwritten

Select Yes to commence reading from the frequency converter and to save configuration files and programs from the frequency converter to the project.

14.4 SyncPos Write to Drive

Write all parameters and SyncPos files from a project to a frequency converter by selecting *Write to drive*. Select the root drive and then right-click to find *Write to drive*:

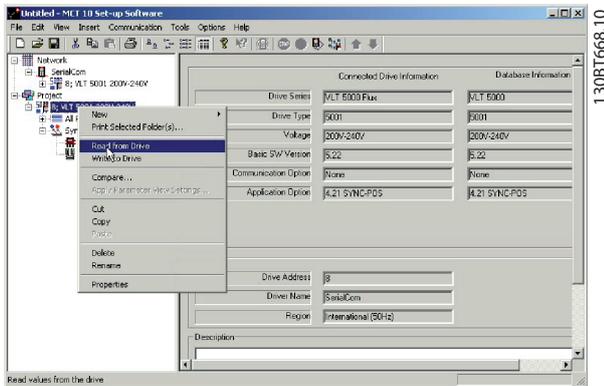


Illustration 14.12 Write to Drive

NOTICE

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



Illustration 14.13 Warning Files Overwritten

14

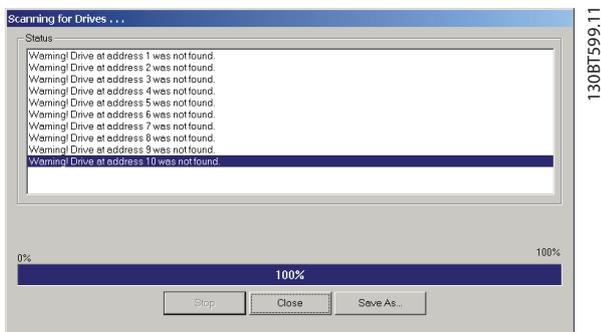
Select the required settings and select Yes to commence writing. For the above settings, the existing programs are deleted. Then the SyncPos program source files are written to the frequency converter. Once the write is complete, check the contents for the Network folder to confirm that the write to drive was successful.

15 Troubleshooting

15.1 Save Error Dialog

When an error dialog appears on the screen, MCT 10 Set-up Software can save 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.

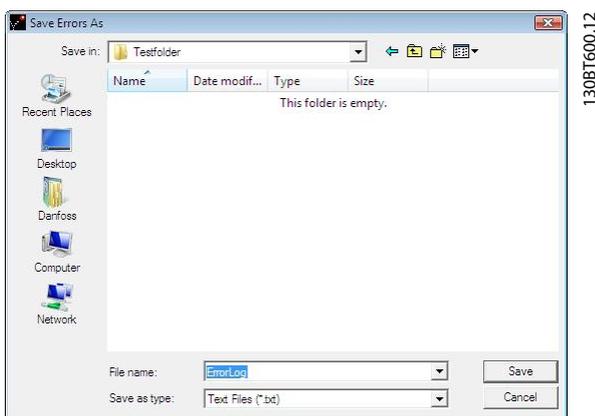
For example, when scanning the network for frequency converters, an error dialog appears showing the frequency converters not detected:



130BT599.11

Illustration 15.1 Frequency Converters Not Detected

Select *Save As* to store the error log. A dialog as shown in *Illustration 15.2* appears.



130BT600.12

Illustration 15.2 Store Error Log

15.2 Common Problems and Solutions

15.2.1 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.

15.2.2 Error Message While Installing MCT 10 Set-up Software

A message such as *MCT 10 Set-up Software SET UP SOFTWARE ERROR OPENING FC DRIVER* may occur, if there is a second 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.

15.2.3 Error Message Communication Failed

Sporadic communication errors

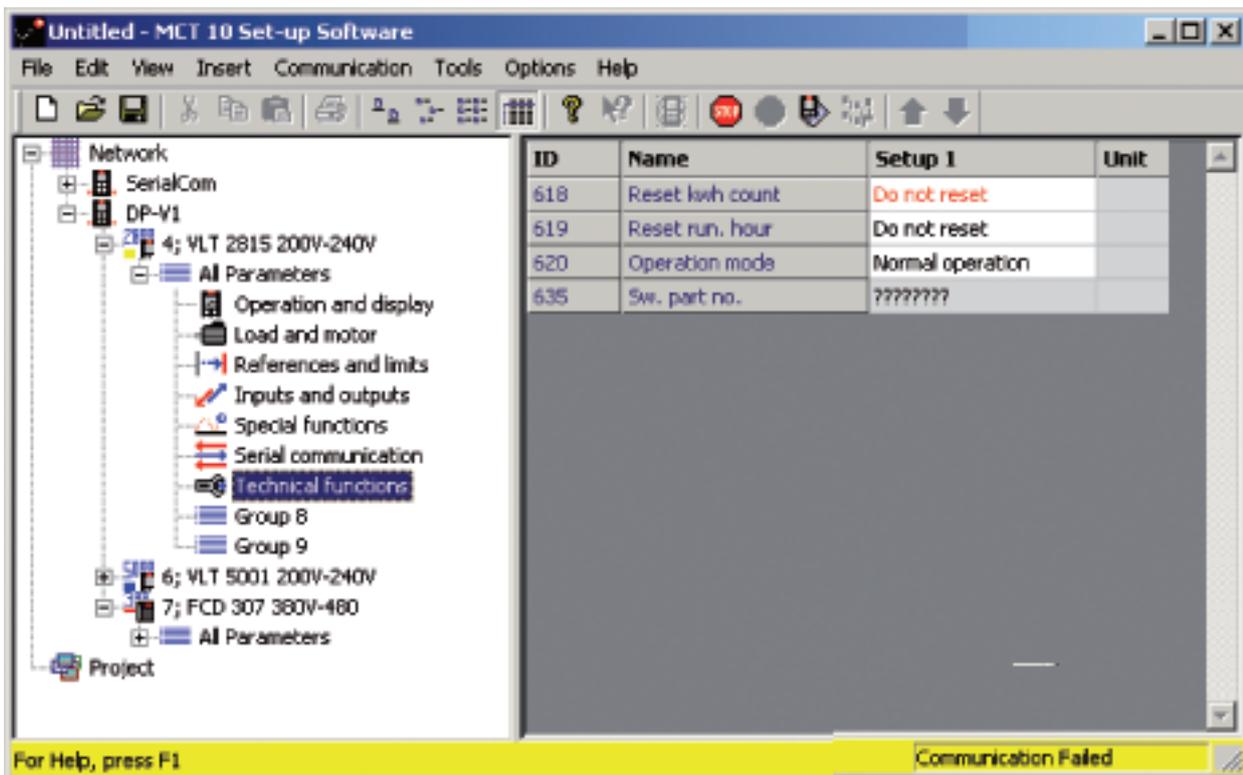
This type of communication error typically occurs when cables are inadequately shielded, in which case EMC noise can affect the communication. Check that the cables are installed according to the guidelines in the *operating guide* for the frequency converter.

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 frequency converter *operating guide*.

Communication failed

The *Communication failed* error message appears in the status bar as shown in *Illustration 15.3*.



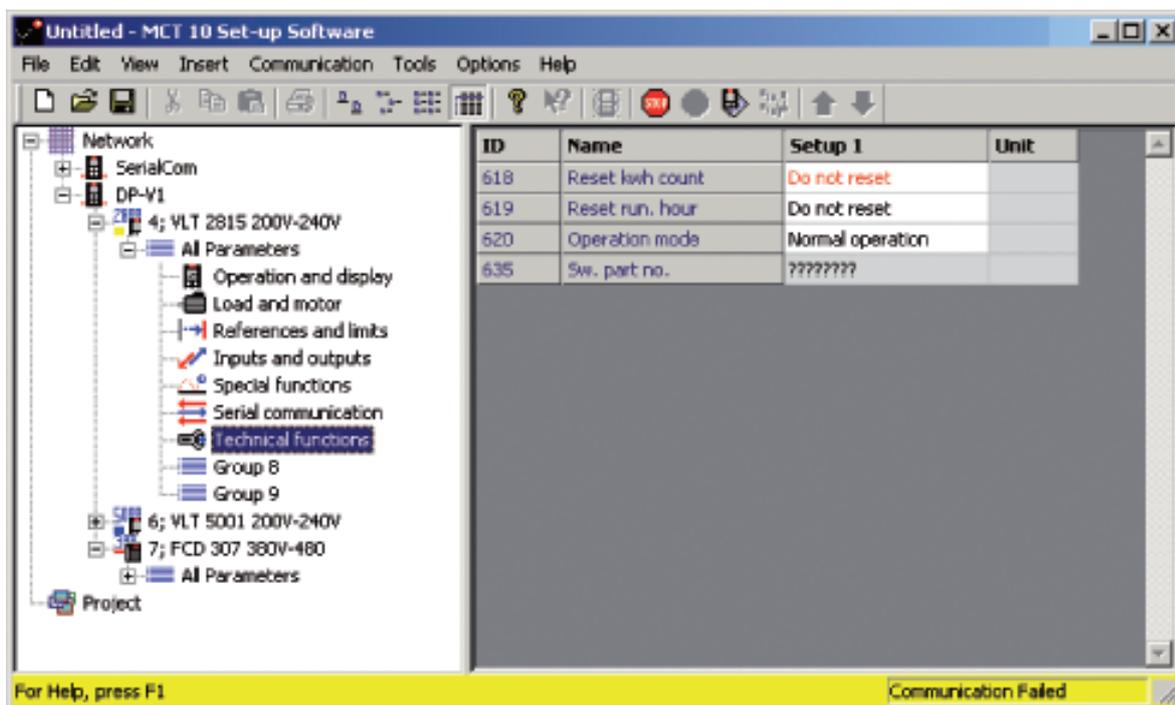
130BT601.11

Illustration 15.3 Error Message: Communication Failed

15.2.4 Communication Errors

If an erroneous/illegal action has been attempted, an error highlight appears in the status bar at the bottom of the MCT 10 Set-up Software window.

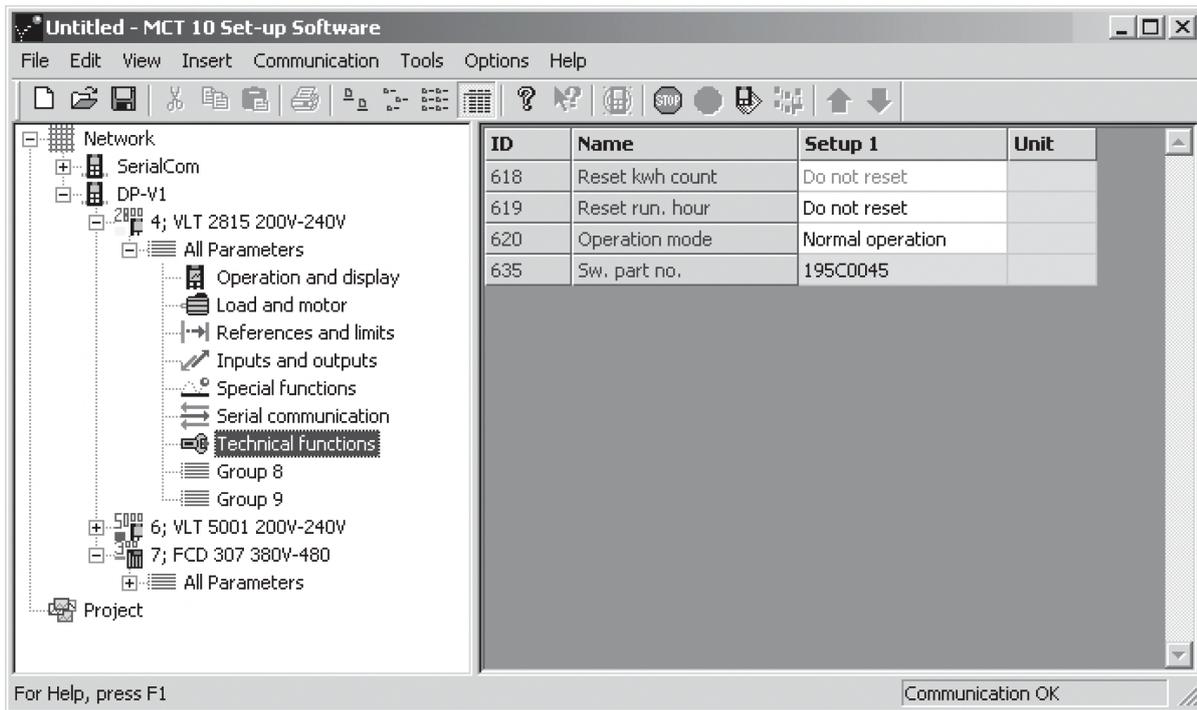
When a communication error occurs, the status bar at the bottom of the MCT 10 Set-up Software window is highlighted and shows a Communication failed- error message, as shown in *Illustration 15.4*.



1308T602.11

Illustration 15.4 Error Message: Communication Failed

When no communication error has occurred, the same window appears as:



130BT603.10

Illustration 15.5 Communication OK

Communication errors typically occur due to inadequate shielding of cables, that is the cable is not installed in accordance with the installation instructions.

15.2.5 Help

Select *Help⇒Help* in the main menu. A help file opens and shows the MCT 10 Set-up Software manual in .pdf format. Acrobat Reader software is required to open the manual. It can be downloaded free of charge at www.adobe.com.

15.3 Safe Plug-in

This section contains common troubleshooting and descriptions of known errors.

15.3.1 Troubleshooting Communication Errors

During commission, the communication between MCT 10 Set-up Software and the frequency converter can fail. In that case, the user receives an error message.

15.3.3 Device Error Codes

The following is a complete list of all error codes that can appear within the safe plug-in for VLT® Safety Option MCB 15x Series plug-in and their respective descriptions.

Confirm the status of the communication devices and the frequency converter and the status of the frequency converter to guarantee proper communication.

15.3.2 Troubleshooting CRC Errors

CRC errors can occur during the write-to-drive procedure. Should a CRC error occur, try to write to the frequency converter again.

When the CRC errors persist, verify the integrity of the devices and communication.

Error number	Description			LED 1	LED 2	LED 4
	Internal failure	Reason	Action	Status of LED 1 and LED 2 depends on safety function state assigned to DI1 and DI2 respectively.		Green constant
1	Diagnostic in progress					Green constant
67	Int fail tolerance error exceeded: Reaction STO	<ul style="list-style-type: none"> • 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 (<i>parameter 42-15 Feedback Filter</i>). System is ramping too fast. • Feedback signals are not received at all. • No correction shielding of feedback cables. 	<ul style="list-style-type: none"> • Make a recustomization with correct data if needed. • Set <i>parameter 42-12 Encoder Direction</i> to the opposite value. • Decrease ramping time on frequency converter. • Try to run the system at, for example, 60 RPM. If error number 99 now occurs, this is the reason. • Improve shielding of feedback cables and motor cables. 			Red constant
68	Int fail speed limit SS1a Ramp: Reaction STO	<ul style="list-style-type: none"> • The value of ΔV is too low. For closed-loop systems, 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 (<i>parameter 42-15 Feedback Filter</i>). • Load change takes place during ramping. 	<ul style="list-style-type: none"> • If running in closed loop, try to adjust PID setting, and if needed, increase SS1 ramping time. • Try to increase <i>parameter 42-15 Feedback Filter</i>, but this might cause error number 67 to occur. • Otherwise increase <i>parameter 42-45 Delta V</i>. 			Red constant
69	Int fail speed limit SS1b Ramp: Reaction STO	See 68.	See 68.			Red constant

Table 15.1 LED Indications

Error number	Description			LED 1	LED 2	LED 4
	Internal failure	Reason	Action	Status of LED 1 and LED 2 depends on safety function state assigned to DI1 and DI2 respectively.		Green constant
70	Int fail speed limit SLSa: Reaction STO	Happens during ramping to SLS limit, see 68. Happens during speed below SLS limit: <ul style="list-style-type: none"> If speed is above cutoff speed at activation point and <i>parameter 42-53 Start Ramp</i> is set to [0] No, this error occurs. Noise on the feedback signal (including quantization noise) is larger than expected. Load change takes place, do as in above point. 	<ul style="list-style-type: none"> Change <i>parameter 42-53 Start Ramp</i> to [1] Yes and set <i>parameter 42-54 Ramp Down Time</i> accordingly. Increase <i>parameter 42-50 Cut Off Speed</i> or decrease <i>parameter 42-51 Speed Limit</i> to get a larger tolerance 			Red constant
134	Int fail speed limit SLSa: Reaction SS1a	See 70.	See 70.			Red constant
198	Int fail speed limit SLSa: Reaction SS1b	See 70.	See 70.			Red constant
71	Int fail speed limit SLSb: Reaction STO	See 70.	See 70.			Red constant
135	Int fail speed limit SLSb: Reaction SS1a	See 70.	See 70.			Red constant
199	Int fail speed limit SLSb: Reaction SS1b	See 70.	See 70.			Red constant
72	Int fail processor failure: Reaction STO	<ul style="list-style-type: none"> The 2 processors on MCB 15x have different safety states. CPU 2 fails. 	<ul style="list-style-type: none"> First, power cycle the frequency converter or restart the MCB 15x by <i>parameter 42-90 Restart Safe Option</i>. Second, try to make a general reset of the MCB 15x with the "Administration" button (MCB 15x goes back to blank initial state). If the problem persists, contact Danfoss. 			Red constant

Table 15.2 LED Indications

Error number	Description			LED 1	LED 2	LED 4
	Internal failure	Reason	Action	<p>Status of LED 1 and LED 2 depends on safety function state assigned to DI1 and DI2 respectively.</p>		Green constant
73	Int fail-safe output switch1: Reaction STO	Diagnostic of safe output of CPU 1 fails.	<ul style="list-style-type: none"> First, power cycle the frequency converter or restart the MCB 15x by <i>parameter 42-90 Restart Safe Option</i>. If the problem persists, contact Danfoss. 			Red constant
74	Int fail-safe output switch2: Reaction STO	Diagnostic of safe output of CPU 2 fails.	<ul style="list-style-type: none"> First, power cycle the frequency converter or restart the option by <i>parameter 42-90 Restart Safe Option</i>. If the problem persists, contact Danfoss. 			Red constant
75	Int fail DI2 in PUST: Reaction STO	<ul style="list-style-type: none"> Safety input connected to DI2 has illegal signal level. Sensor is broken. 	<ul style="list-style-type: none"> Check that configuration of DI2 (<i>parameter 42-21 Type</i>) subindex [1] is set correctly or the connected sensor is installed according to specification. 			Red constant
76	Int fail DI1 in PUST: Reaction STO	<ul style="list-style-type: none"> Safety input connected to DI1 has illegal signal level. Sensor is broken. 	<ul style="list-style-type: none"> Check that the configuration of DI1 (<i>parameter 42-21 Type</i>) sub index [1] is set correctly or the connected sensor is installed according to the specification. 			Red constant
77	Int fail failsafe data CRC mismatch: Reaction STO	The CRC of the MCB 15x does not match the stored CRC value on the frequency converter.	Configure the MCB 15x with MCT 10 safe plug-in or by CRC select/LCP copy.			Red constant
78	Int fail S1S2CommChannel: Reaction STO	The communication between CPU 1 and CPU 2 fails.	<ul style="list-style-type: none"> First, power cycle the frequency converter or restart the MCB 15x by <i>parameter 42-90 Restart Safe Option</i>. If the problem persists, contact Danfoss. 			Red constant

Table 15.3 LED Indications

Error number	Description			LED 1	LED 2	LED 4
	Internal failure	Reason	Action	Status of LED 1 and LED 2 depends on safety function state assigned to DI1 and DI2, respectively.		Green constant
79	Int fail no SPI comm: Reaction STO		Contact Danfoss.			Red constant
80	Int fail no CAN comm: Reaction STO		Contact Danfoss.			Red constant
81	Int fail undervoltage Vuc1: Reaction STO	Voltage for CPU 1 is too low.	<ul style="list-style-type: none"> First, power cycle the frequency converter. If the problem persists, contact Danfoss. 			Red constant
82	Int fail overvoltage Vuc1: Reaction STO	Voltage for CPU 1 is too high.	<ul style="list-style-type: none"> First, power cycle the frequency converter. If the problem persists, contact Danfoss. 			Red constant
83	Int fail undervoltage 24 V IO: Reaction STO	Voltage for terminal 12 safe output is too low.	<ul style="list-style-type: none"> First power cycle frequency converter. If the problem persists, contact Danfoss 			Red constant
84	Int fail overvoltage 24 V IO: Reaction STO	Voltage for terminal 12 safe output is too high.	<ul style="list-style-type: none"> First, power cycle the frequency converter. If the problem persists, contact Danfoss. 			Red constant
85	Int fail undervoltage Vuc2: Reaction STO	Voltage for CPU 2 (GPIO) is too low.	<ul style="list-style-type: none"> First, power cycle the frequency converter. If the problem persists, contact Danfoss. 			Red constant
86	Int fail overvoltage Vuc2: Reaction STO	Voltage for CPU 2 (GPIO) is too high.	<ul style="list-style-type: none"> First, power cycle the frequency converter. If the problem persists, contact Danfoss. 			Red constant

Table 15.4 LED Indications

Error number	Description			LED 1	LED 2	LED 4
	Internal failure	Reason	Action	Status of LED 1 and LED 2 depends on safety function state assigned to DI1 and DI2, respectively.		Green constant
87	Int fail undervoltage int5v: Reaction STO	Voltage used for other circuits than CPU is too low.	<ul style="list-style-type: none"> First, power cycle the frequency converter. If the problem persists, contact Danfoss. 			Red constant
88	Int fail overvoltage int5v: Reaction STO	Voltage used for other circuits than CPU is too high.	<ul style="list-style-type: none"> First, power cycle the frequency converter. If the problem persists, contact Danfoss. 			Red constant
89	Int fail memory fail S2: Reaction STO	<ul style="list-style-type: none"> Data in EEPROM for CPU 2 is corrupted. The flash memory fails. 	<ul style="list-style-type: none"> Try to perform a general reset of the MCB 15x with the Administration button. If the problem persists, contact Danfoss. 			Red constant
90	Int fail memory fail S1: Reaction STO	<ul style="list-style-type: none"> Data in EEPROM for CPU 1 is corrupted. The flash memory fails. 	<ul style="list-style-type: none"> Try to perform a general reset of the MCB 15x with the Administration button. If the problem persists, contact Danfoss. 			Red constant
91	Int fail undervoltage Vuc2 PLL: Reaction STO	Voltage for CPU2 (PLL) is too low.	<ul style="list-style-type: none"> First, power cycle the frequency converter. If the problem persists, contact Danfoss. 			Red constant
92	Int fail overvoltage Vuc2 PLL: Reaction STO	Voltage for CPU2 (PLL) is too high.	<ul style="list-style-type: none"> First, power cycle the frequency converter. If the problem persists, contact Danfoss. 			Red constant
93	Int fail undervoltage Vuc2 Core: Reaction STO	Voltage for CPU2 (Core) is too low.	<ul style="list-style-type: none"> First, power cycle the frequency converter. If the problem persists, contact Danfoss. 			Red constant

Table 15.5 LED Indications

Error number	Description			LED 1	LED 2	LED 4
	Internal failure	Reason	Action	Status of LED 1 and LED 2 depends on safety function state assigned to DI1 and DI2, respectively.		Green constant
94	Int fail overvoltage Vuc2 Core: Reaction STO	Voltage for CPU2 (Core) is too high.	<ul style="list-style-type: none"> First, power cycle the frequency converter. If the problem persists, contact Danfoss. 			Red constant
95	Int fail undervoltage Vuc2 SDRAM: Reaction STO	Voltage for CPU2 (SDRAM) is too low.	<ul style="list-style-type: none"> First, power cycle the frequency converter. If the problem persists, contact Danfoss. 			Red constant
96	Int fail overvoltage Vuc2 SDRAM: Reaction STO	Voltage for CPU2 (SDRAM) is too high.	<ul style="list-style-type: none"> First, power cycle the frequency converter. If the problem persists, contact Danfoss. 			Red constant
97	Int fail MOC fail S1: Reaction STO	–	<ul style="list-style-type: none"> Contact Danfoss. 			Red constant
98	Int fail invalid customer file version	Version of customization file of MCB 15x stored in EEPROM does not match the customization file supported by the SW version of MCB 15x.	Do a new configuration with MCT 10 safe plug-in which supports the SW version of MCB 15x.			–
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
113	Ext fail DI1: Reaction STO	<ul style="list-style-type: none"> Safety input connected to DI1 has illegal signal level. Sensor is broken. 	Check that configuration of DI1 (<i>parameter 42-21 Type subindex [0]</i> is set correctly or the connected sensor is installed according to the specification.	Red constant	Status depends on safety function state assigned to DI2.	Red flashing, cycle (on 500 ms, off 500 ms).
177	Ext fail DI1: Reaction SS1a	See 113.	See 113.	Red constant		Red flashing, cycle (on 500 ms, off 500 ms).
241	Ext fail DI1: Reaction SS1b	See 113.	See 113.	Red constant		Red flashing, cycle (on 500 ms, off 500 ms).

Error number	Description			LED 1	LED 2	LED 4
114	Ext fail DI2: Reaction STO	<ul style="list-style-type: none"> Safety input connected to DI2 has illegal signal level. Sensor is broken 	Check that configuration of DI2 (<i>parameter 42-21 Type</i>) subindex [1] is set correctly or the connected sensor is installed according to the specification.	Status depends on the safety function state assigned to DI1.	Red constant	Red flashing, cycle (on 500 ms, off 500 ms).
178	Ext fail DI2: Reaction SS1a	See 114.	See 114.	Status depends on the safety function state assigned to DI1.	Red constant	Red flashing, cycle (on 500 ms, off 500 ms).
242	Ext fail DI2: Reaction SS1b	See 114.	See 114.	Status depends on the safety 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 frequency converter has been running below 120 RPM for more than the time entered in <i>parameter 42-18 Zero Speed Timer</i> with safe function SLS active.	Increase speed to above 120 RPM.	Status of LED 1 and LED 2 depends on the safety function state assigned to DI1 and DI2, respectively.		Red flashing, cycle (on 500 ms, off 500 ms).
179	Ext fail prec thresh timer elapsed: Reaction SS1a	See 115.	See 115.			Red flashing, cycle (on 500 ms, off 500 ms).
243	Ext fail prec thresh timer elapsed: Reaction SS1b	See 115.	See 115.			Red flashing, cycle (on 500 ms, off 500 ms).
116	Ext fail SF activation speed suspension: Reaction STO	The frequency converter has been running below 120 RPM for more than 1 year and a safety function that needs speed feedback is activated.	Increase speed to above 120 RPM.			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).
244	Ext fail SF activation speed suspension: Reaction SS1b	See 116.	See 116.			Red flashing, cycle (on 500 ms, off 500 ms).
252	Safe option failure					

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