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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 Instructions* 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 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 300
- VLT Decentral Drive FCD 300
- 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 will eliminate the need for an extra communication network.

The communication framework part of MCT 10 Set-up Software is handling the control of the fieldbusses. It provides enhanced capabilities allowing multiple concurrent fieldbus communication. Several fieldbusses can be configured and combined in the same Network within MCT 10 Set-up Software.

NOTICE

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

1.2 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
- 256 MB of RAM (512 MB of RAM Recommended)
- a CD-ROM drive
- 200 MB of available space on the hard drive;

MCT 10 Set-up Software runs on the following MS Windows versions

- Windows™ 2000 (with service pack 3 or higher)
- Windows™ XP (Professional when using Siemens Profibus CP Cards)

- Windows™ Vista
- Windows™ 7 32/64 bit Editions

1.3 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/print-out of set-up, including diagrams
- servicing and fault analysis

APoss program for

- creating APoss programs.

1.3.1 Features of MCT 10 Set-up Software

- Project-oriented PC tool, one tool for all 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, RS 232 (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

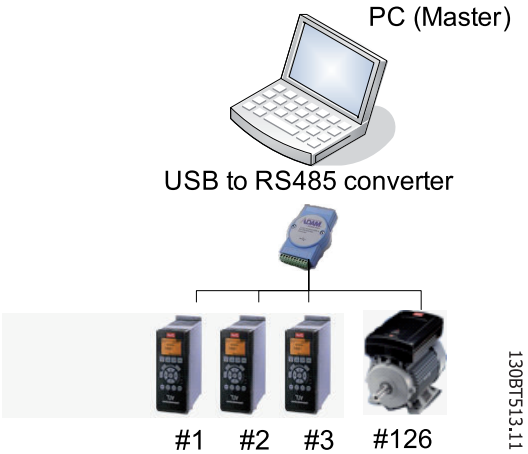

Illustration 1.1 Connect up to 126 nodes using a repeater. Without a repeater, connect up to 31 nodes.

1.4 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 under the order-number 130B1000.

Version supports	MCT 10 Set-up Software Advanced	MCT 10 Set-up Software Basic
Frequency converters per project	Unlimited	Four
FC protocol	Yes	Yes
USB	Yes	Yes
Profibus DP-V1	Yes	Yes
Profibus DP-V1 Handling Multiple Danfoss Nodes Concurrently	Yes (improved performance)	N/A
Ethernet-TSC	Yes	N/A
Logging and Scope function	8 Channels	2 Channels
Real Time Logging from Drive	4 Channels	N/A
Alarm display	Yes	View only
MCO 305	Yes	Yes
Graphical Smart Logic Contr.	Yes	Yes
VLT5000 to FC 302 Conversion Wizard	Yes	Yes
FC to FC Conversion Wizard		
Import 3000.XLS to FC 302	Yes	N/A
Motor Database	Yes	N/A
Extended Cascade Controller	Yes	No
Drive File System	Yes	N/A

Table 1.1 Features of the Basic and Advanced Versions

1.5 Further Information

The following literature related to MCT 10 Set-up Software is available.

- Profibus DP V1 Design Guide
- Design Guide for the relevant frequency converter(s)

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

2.1.1 Legal Information, Copyright and Revisions

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Danfoss reserves the right to revise, update and change this publication at any time without prior notice or specific obligation to inform former or present users of such revisions or changes.

2.2 Safety Precautions

⚠WARNING

HIGH VOLTAGE WARNING!

The voltage of the frequency converter is dangerous whenever connected to mains. Incorrect installation of the motor, frequency converter or fieldbus may cause damage to the equipment, serious personal injury or death. Consequently, the instructions in this manual, as well as national and local rules and safety regulations, must be complied with.

Safety Regulations

1. The mains supply to the frequency converter must be disconnected whenever repair work is to be carried out. Check that the mains supply has been disconnected and that the necessary time has elapsed before removing motor and mains supply plugs.
2. The [OFF] key on the LCP does not disconnect the mains supply and consequently it must not be used as a safety switch.
3. The equipment must be properly earthed, the user must be protected against supply voltage and the motor must be protected against overload in accordance with applicable national and local regulations.
4. The earth leakage current exceeds 3.5 mA.
5. Protection against motor overload is not included in the factory setting. If this function is desired, set *1-90 Motor Thermal Protection* to data value *[4] ETR trip 1* or data value *[3] ETR warning 1*.
6. Do not remove the plugs for the motor and mains supply while the frequency converter is connected to mains. Check that the mains supply has been disconnected and that the necessary time has elapsed before removing motor and mains plugs.
7. The frequency converter has more voltage sources than L1, L2 and L3, when load sharing (linking of DC intermediate circuit) or external 24 V DC are installed. Check that all voltage sources have been disconnected and that the necessary time has elapsed before commencing repair work.

⚠CAUTION

RISK OF UNINTENDED START!

This software enables remote control of a frequency converter and can start an electric motor which may drive dangerous machinery. Always observe the necessary caution when using the software and take suitable measures to prevent personal injury and damage to machinery and equipment.

Warning against unintended start

1. The motor can be stopped with digital commands, bus commands, references or a local stop, while the frequency converter is connected to mains. To ensure personal safety, these stop functions are not sufficient to avoid unintended starts. In such cases, the mains supply must be disconnected or the *Safe Torque Off* function must be activated.
2. The motor may start while setting the parameters. If this means that personal safety may be compromised (e.g. personal injury caused by contact with moving machine parts), motor starting must be prevented, for instance by use of the *Safe Torque Off* function or secure disconnection of the motor connection.
3. A motor that has been stopped with the mains supply connected, may start if faults occur in the electronics of the frequency converter, through temporary overload or if a fault in the power supply grid or motor connection is remedied. To ensure personal safety, disconnect mains supply or activate the Safe Torque Off function.

4. Control signals from, or internally within, the frequency converter may in rare cases be activated in error, be delayed or fail to occur entirely. When used in situations where safety is critical, e.g. when controlling the electromagnetic brake function of a hoist application, these control signals must not be relied on exclusively.

⚠WARNING

Touching the electrical parts may be fatal - even after the equipment has been disconnected from mains.

Also make sure that other voltage inputs have been disconnected, such as external 24 V DC, load sharing (linkage of DC intermediate circuit), as well as the motor connection for kinetic back-up.
Systems where frequency converters are installed must, if necessary, be equipped with additional monitoring and protective devices according to the valid safety regulations, e.g law on mechanical tools, regulations for the prevention of accidents etc. Modifications on the frequency converters by means of the operating software are allowed.

Hoisting applications
The frequency converter functions for controlling mechanical brakes cannot be considered as a primary safety circuit. There must always be a redundancy for controlling external brakes.

Protection Mode
Once a hardware limit on motor current or DC-link voltage is exceeded the frequency converter enters *Protection mode*. *Protection mode* means a change of the PWM modulation strategy and a low switching frequency to minimise losses. This continues 10 s after the last fault and increases the reliability and the robustness of the frequency converter while re-establishing full control of the motor.
In hoist applications, *Protection mode* is not usable because the frequency converter is usually not able to leave this mode again and therefore it extends the time before activating the brake – which is not recommendable.
Protection mode can be disabled by setting *14-26 Trip Delay at Inverter Fault* to zero which means that the frequency converter will trip immediately if one of the hardware limits is exceeded.

NOTICE

It is recommended to disable protection mode in hoisting applications (*14-26 Trip Delay at Inverter Fault* = 0)

⚠WARNING

The DC link capacitors remain charged after power has been disconnected. To avoid electrical shock hazard, disconnect the frequency converter from mains before carrying out maintenance. When using a PM-motor, make sure it is disconnected. Before doing service on the frequency converter wait at least the amount of time indicated in *Table 2.1*

Voltage [V]	Power [kW]	Waiting Time [min]
380-500	0.25-7.5	4
	11-75	15
	90-200	20
	250-800	40
525-690	37-315	20
	355-1000	30

Table 2.1 Discharge Time

For further information, see www.danfoss.com/BusinessAreas/DrivesSolutions/Documentations/Technical+Documentation.htm

3 Installation and De-installation

3

3.1 Introduction

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

3.1.1 Start the Installation Program

1. Select the sub-menu *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:

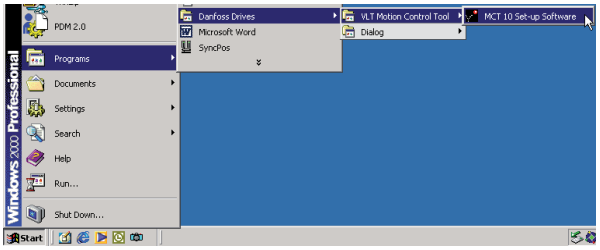

Illustration 3.1 Path for MCT 10 Set-up Software

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 desired 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 default.

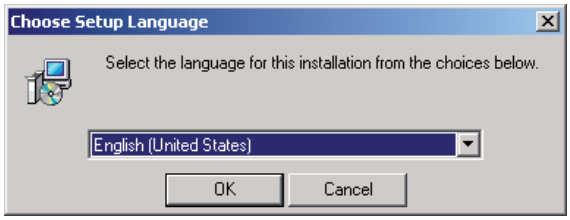

Illustration 3.2 Select Language

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 display language.

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 MCT 10 Set-up Software.
6. Select *Remove*.

4 Set-up of Communication

4.1 Communication Options

Danfoss frequency converters in the FC 100, FC 200 and FC 300 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 one 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 RS-485, or
- USB port.

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

If the Profibus DP V1 MCA 101 or Ethernet/IP MCA 121 option is mounted in the frequency converter(s), establish the connection through:

- Profibus Master Class 2 connection (MSAC 2), or
- Ethernet based network

NOTICE

The Softstarter 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 recommendations for grounding described in the Operating Instructions for the relevant frequency converter.**
- **Use a USB isolator with galvanic isolation to protect the PC USB host controller from earth ground potential differences, when connecting the PC to a frequency converter through a USB cable.**
- **Do NOT to 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 RS-232 to RS-485 converters or via USB to RS-485 converters.

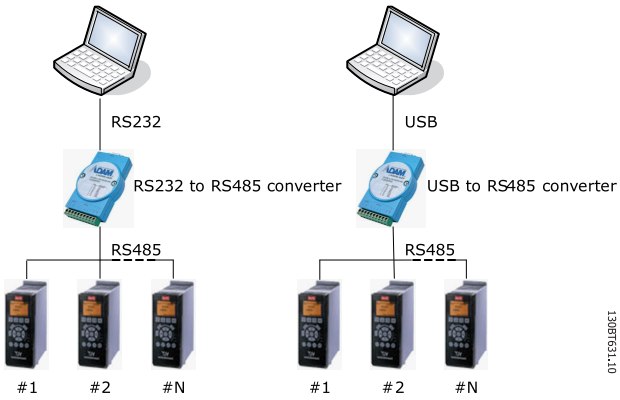

Illustration 4.1 Communication from a PC

4.2 Manual Fieldbus Configuration

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

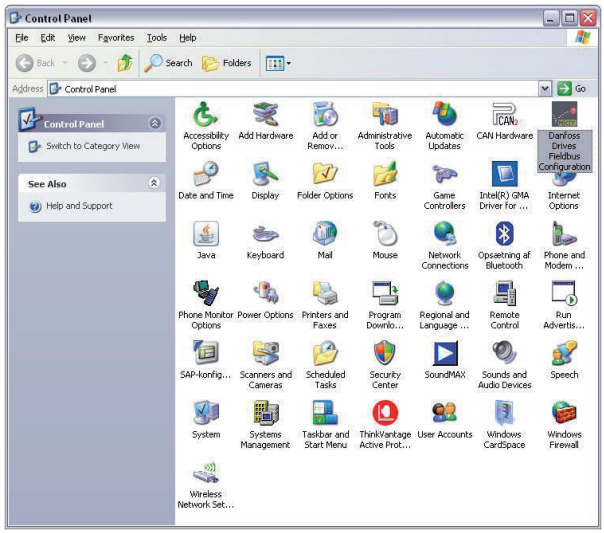

Illustration 4.2 Windows Control Panel

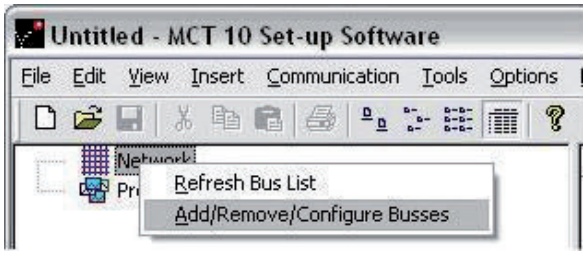

Illustration 4.3 Refresh of Fieldbus List

4

1. Open Windows control panel.
2. Select *Fieldbus configuration*.
3. Add, remove or reconfigure the non plug-and-play fieldbusses from the installed list.
4. If the installed fieldbus list is updated from the Windows Control Panel while MCT 10 Set-up Software is running, right-click *Network* to refresh the fieldbus list.
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 fieldbusses.

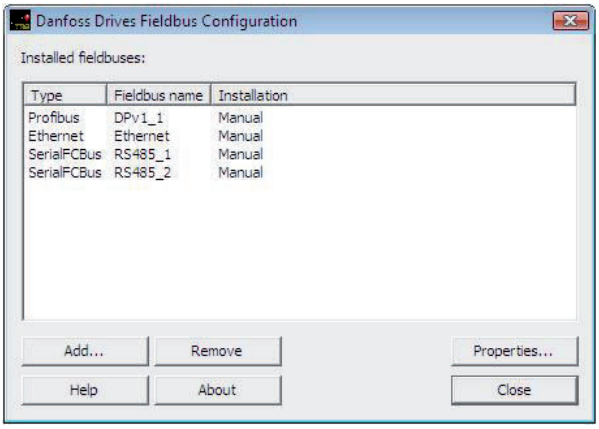

Illustration 4.4 Fieldbus Configuration

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 RS-485 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 3 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-clicking on the *Network* icon and select *Add/Remove/Configure Busses* or from the Windows Control Panel.

Illustration 4.5 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:

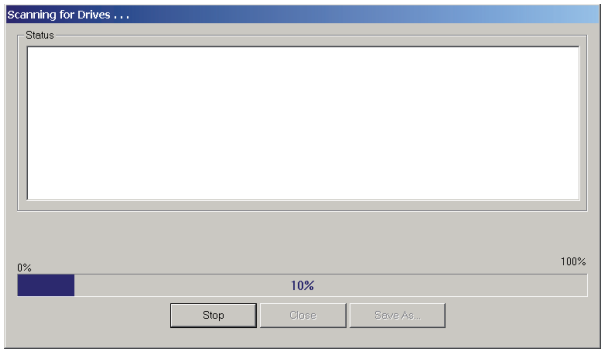

Illustration 4.6 Progress of Network Scanning

NOTICE

Using the VLT FC 100, FC 200 and FC 300 series: FC Drive MC Protocol (*8-30 "FC Drive MC*) is required for correct functionality. The parameter is only available from the LCP.

4.4 Set up the Frequency Converter with RS-485 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 and even parity.

4.4.1 Serial Bus Configuration

When using an RS-485 converter as the Advantech ADAM converter, MCT 10 Set-up Software indicates online frequency converter(s) available on the serial bus after scanning the bus.

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

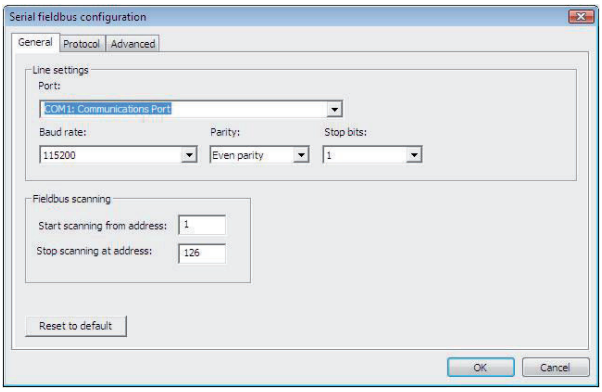

Illustration 4.7 Serial Fieldbus Configuration

2. Set the COM port number. When using USB to RS-485 converters, the actual comport 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 optimisation, and should normally not be changed.

4.4.2 USB Data Communication

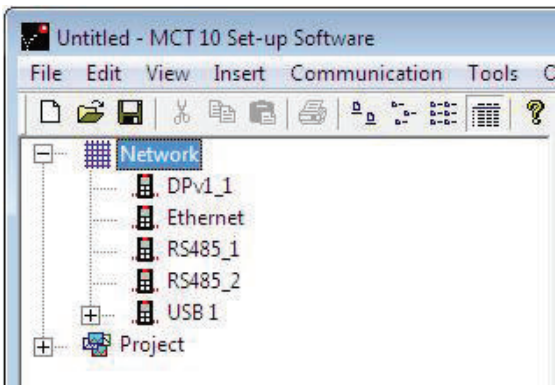

Illustration 4.8 Network Bus List

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. Connecting more than one frequency converter through USB, the bus name will be auto incremented in the MCT 10 Set-up Software Network bus list.

Connecting more than one 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 one frequency converter via USB to the PC.

4.5 Set-up of Softstarter

Setting up connectivity to the MCD 500 requires that the USB communication module is mounted on the Softstarter. 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 one USB port or a USB HUB, several Softstarters can be connected.

4

4.5.1 Serial Configuration

All Softstarters 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 and no parity.

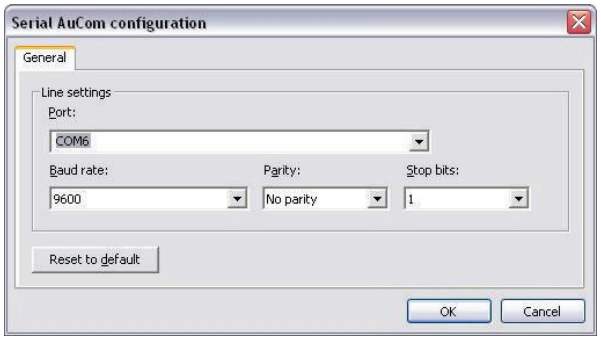

Illustration 4.9 Serial Configuration of Softstarters

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 Softstarter serial bus.
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 Softstarter).
4. *Reset to default* restores the general settings and Fieldbus scanning to factory configuration values.

4.6 Profibus DP-V1 Communication

To set up Profibus DP-V1 communication, the MCA 101 Profibus option module is required. 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 located on the card.

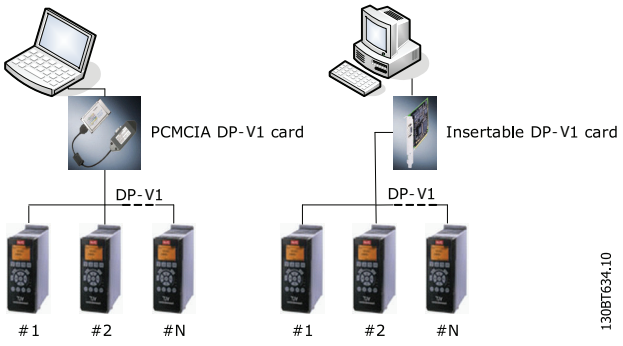

Illustration 4.10 Profibus DP-V1 Communication

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

NOTICE

Connectivity via Profibus DPv1 to a FC 302 utilizing the Profibus Converter MCA 114 with option firmware version 2.03 is not possible from MCT 10 Set-up Software. It is advised to use the serial or USB bus.

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 converter(s) 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.

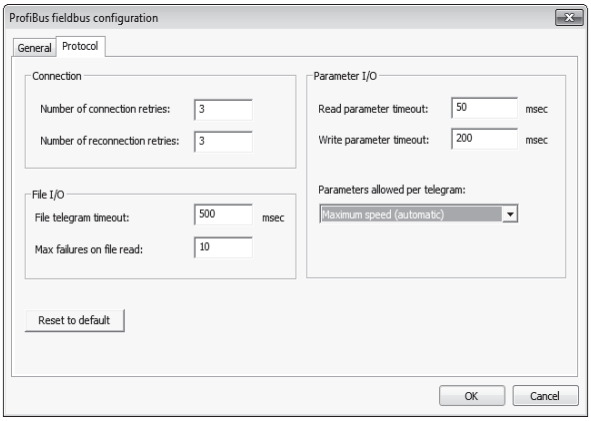

Illustration 4.11 Profibus Fieldbus Configuration

4.6.2 DP-V1 Connection and PG/PC Interface

The MCT 10 Set-up Software Profibus DP-V1 fieldbus plug-in utilises the Siemens SoftNet driver available from Step7, or alternatively Simatic NET, to establish connectivity via the supported Master Class 2 cards like e.g. 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.

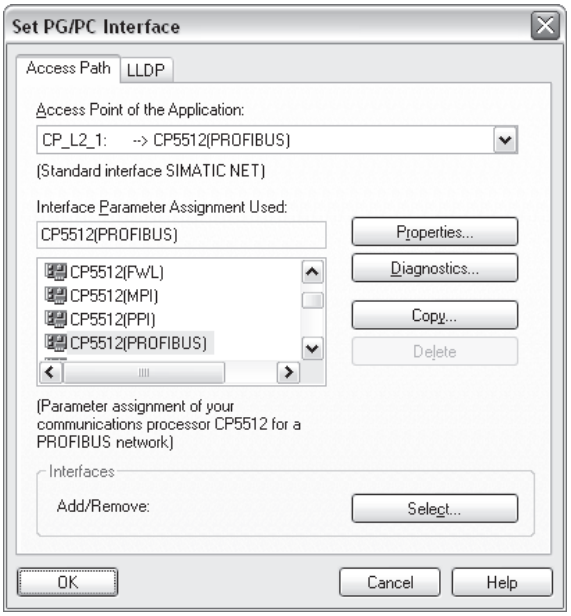

Illustration 4.12 Set PG/PC Interface

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.
   - Station Parameters: Set *PG/PC is the only master on the bus* to *Active*, if no PLC is active on the bus. Use the *Diagnostics* described later to select a valid Profibus address.
   - Network Parameters: Set the *Transmission rate* to the same baud rate as the PLC, if it is active.
5. 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.

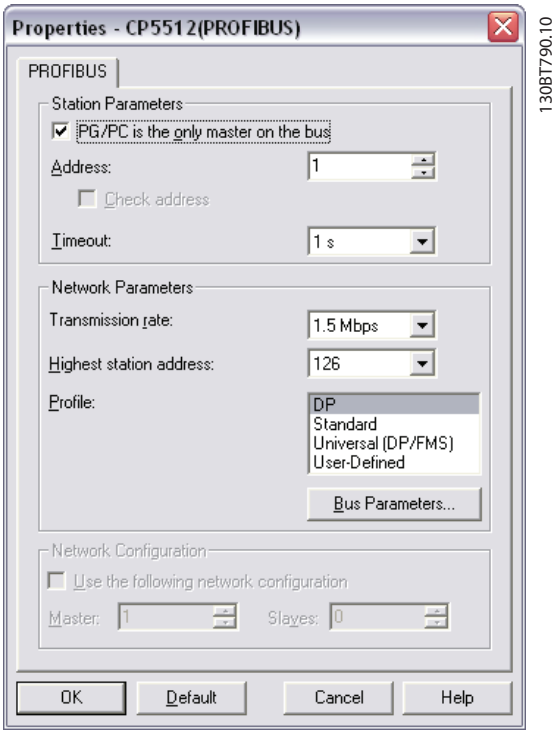

Illustration 4.13 Properties Dialog

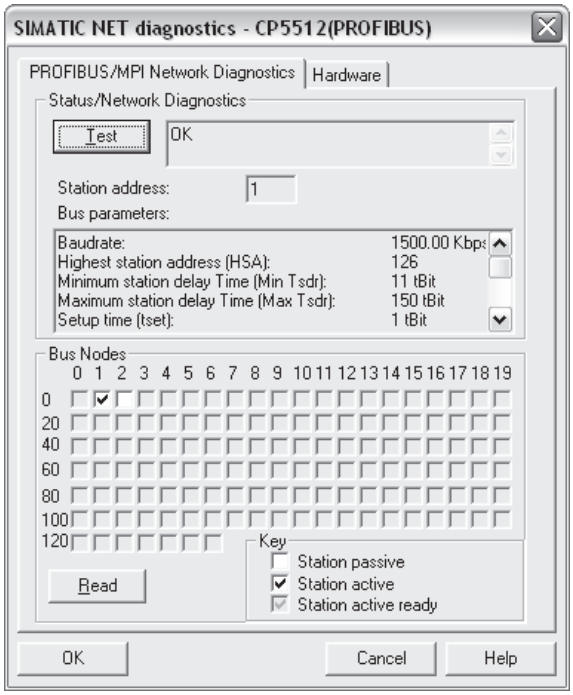

Illustration 4.14 Simatic Network Diagnostics Dialog

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 drives*. MCT 10 Set-up Software identifies the same node IDs, except PLCs.

4

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 communicating only with old products such as the FCD 300, FCM 300, FC 100, FC 200, and FC 300 all derived series.
- *Single request*. Only one request per telegram.

4.7 Ethernet-TSC Data Communication

To set up an Ethernet-TSC (Transparent Socket Channel) communication, the 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

Ethernet-TSC bus is scanned using ADDP (Advanced Digi 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 remote via a VPN tunnel, it is advised not to utlise the ADDP protocol, but to use an IP Range, see *Illustration 4.15*.

Click *Scan* to generate a list of all active frequency converters in the Ethernet. The list is shown in the *Drive Discovery and Configuration* dialog when scan is completed.

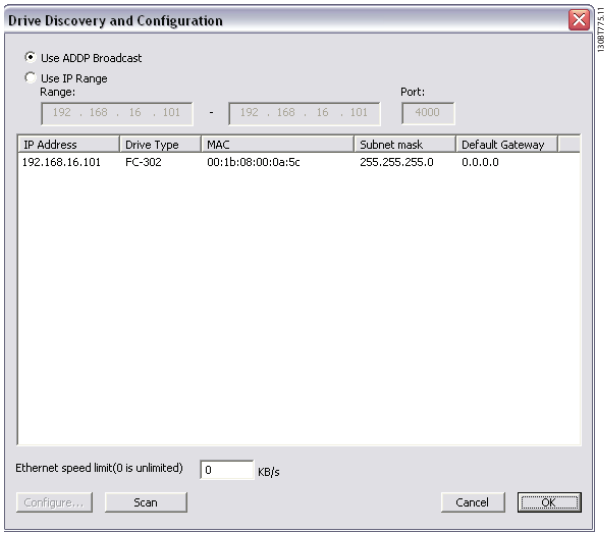

Illustration 4.15 ADDP Configuration

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 two segments in the MAC address. Several uncommissioned frequency converters without any IP configuration can be scanned on the same network. MCT 10 Set-up Software displays a warning when a frequency converter with an Auto IP address is identified prompting the user to set up the IP configuration.

Configure is used to assign the frequency converter a static *IP address*, *Subnet Mask*, *Default Gateway* or to setup using DHCP (Dynamic Host Configuration Protocol) lookup.

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 (*12-89 Transparent Socket Channel Port*), which is factory default 4000 in the frequency converter.
2. Select *Configure* to open the *Device Configuration* dialog.
3. Assign a static IP address, Subnet Mask, Default Gateway to the frequency converter to set up

using DHCP (Dynamic host Configuration Protocol) lookup.

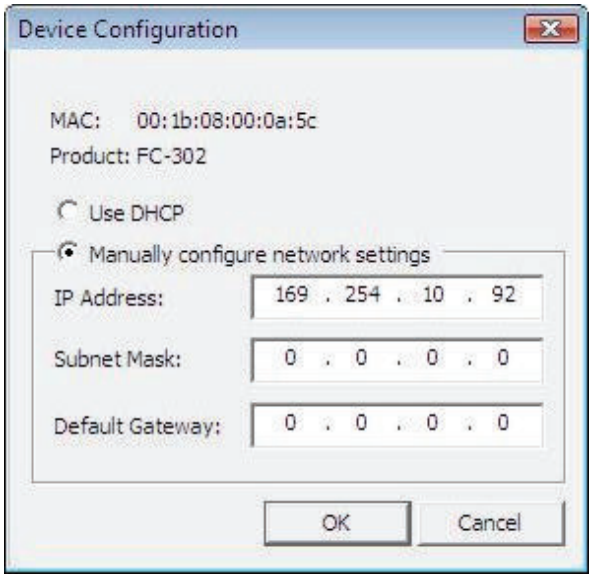

Illustration 4.16 Device Configuration

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 manually create the offline frequency converter.
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 utilising the Ethernet/IP option MCA 121 is possible only from option firmware version 1.03 or newer. Using options with firmware versions earlier than 1.03, the *12-89 Transparent Socket Channel Port* must be configured to 0 to prevent the option from failing to operate.

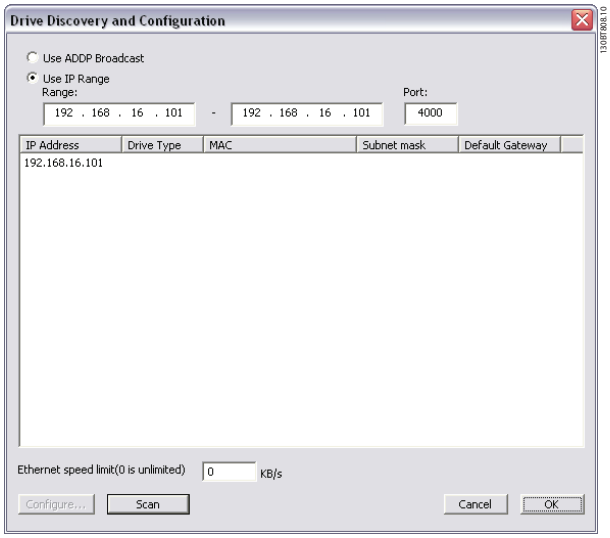

Illustration 4.17 Drive Discovery and Configuration

4.7.2 Wink Drive

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

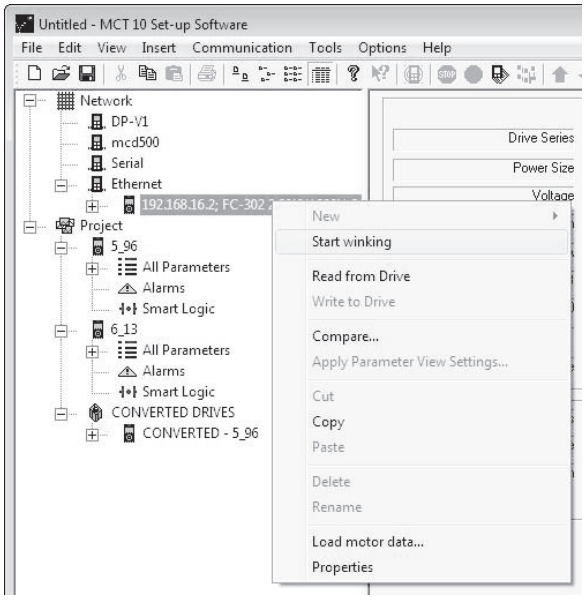

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Illustration 4.18 Start Winking

NOTICE

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

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 this:

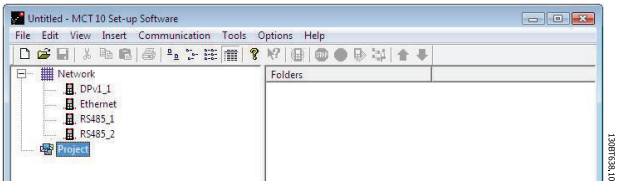

Illustration 5.1 MCT 10 Set-up Software Main Window

5.1 User Interface

5.1.1 Display

The MCT 10 Set-up Software is displayed in two parts, Left View and Right View.

Left view
The Left View shows the *Network* (real, online) and *Project* (simulated, offline) views of the frequency converter network.

Use 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 .

The Left View is organised in a tree structure and contents can be expanded or compressed as required. Click +/- , to open/close the folder.

Right view
The Right View displays details of the element highlighted in the Left View. In the Right View the elements of the frequency converter network can be programmed.

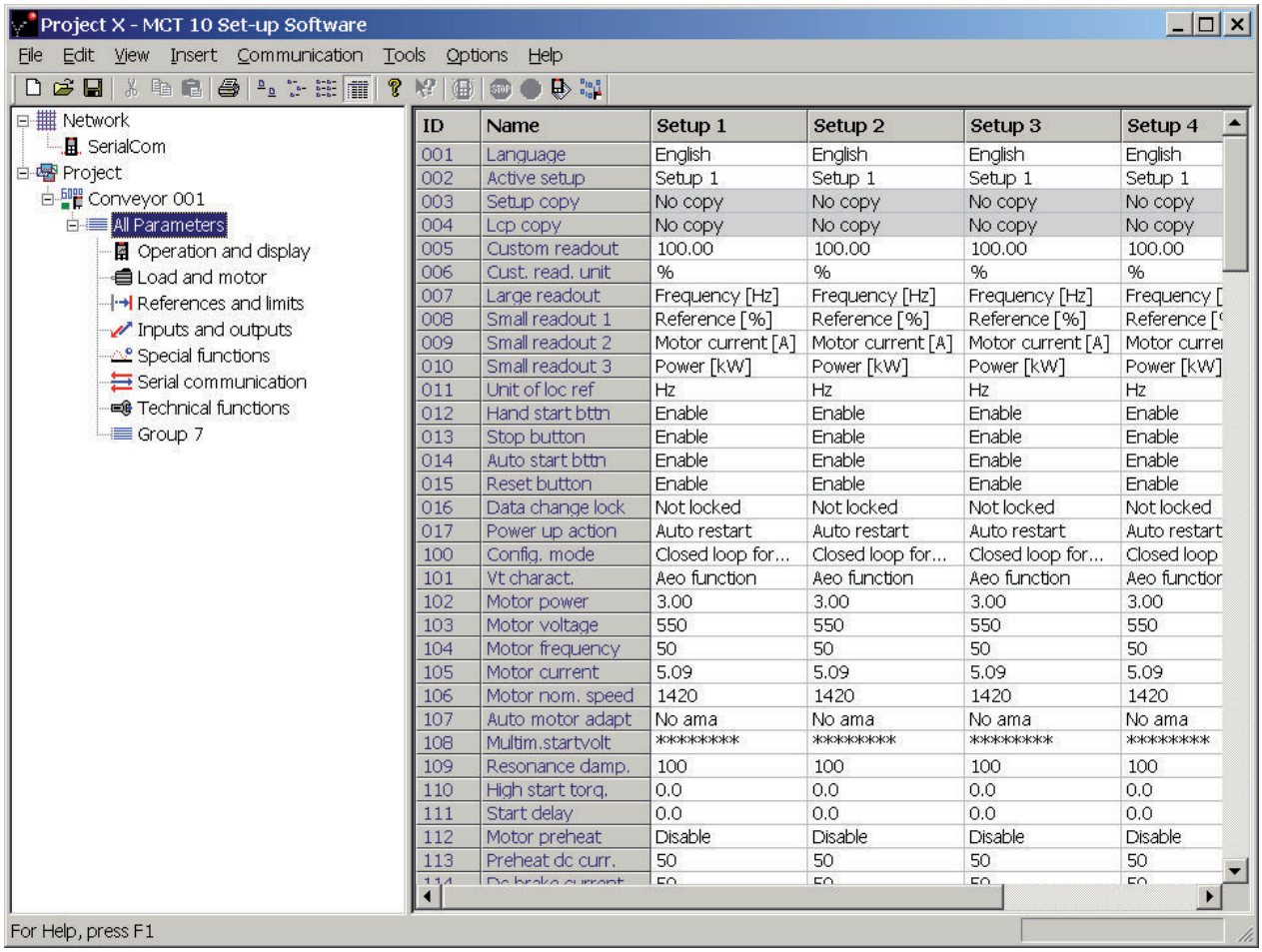

Illustration 5.2

Toolbar
A toolbar displays icons for the most commonly used functions.

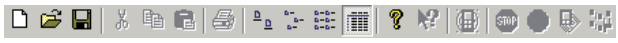
130BT712.10

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 converter(s), and Low Harmonic Drive(s), Active Filters and/or softstarters online connected to the PC. Monitor and make changes in the parameter settings exactly as if operating on the control panel.

Data entered online are stored in the frequency converter, Low Harmonic Drive, Active Filter or softstarter only, not on the hard disk. For information on saving data to the hard disk, refer to *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 softstarter.

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, e.g. Word, PDF, etc.

5.1.3 Other Folders

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

Name	Purpose	Icon
Folder	Folder Organize frequency converters and/or softstarters 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	130bb523.11
Scope folder	Analyze the behavior of one or several parameters for diagnostic purposes by visualising them as a curve.	130BT715.10

Table 5.1 Available Folder Types

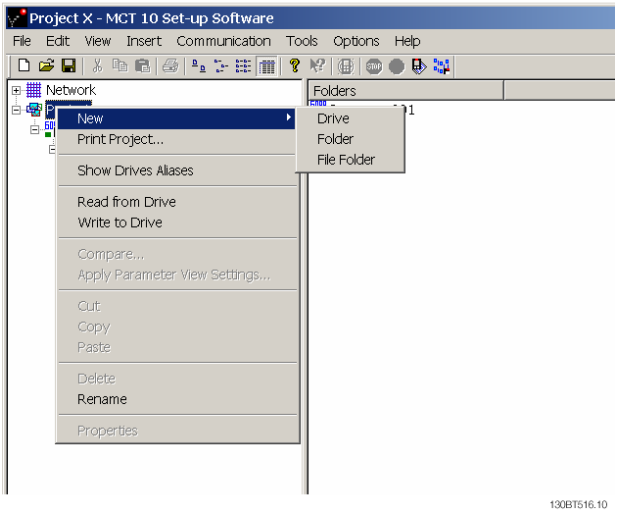

Illustration 5.4

Insert any folder type in an offline project as follows

- Right-click at the project or an existing folder and select *New Folder/New File Folder*. 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 softstarter in a project folder as follows

1. Right-click at the offline location and select the appropriate device type. Alternatively, mark the location in offline and 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 and select *New Drive*. Alternatively, mark the location in offline and select *New Drive* in the *Insert* menu.
2. Enter all relevant data in the *New Drive* dialog and select *Make LHD*.

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.

3. 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.

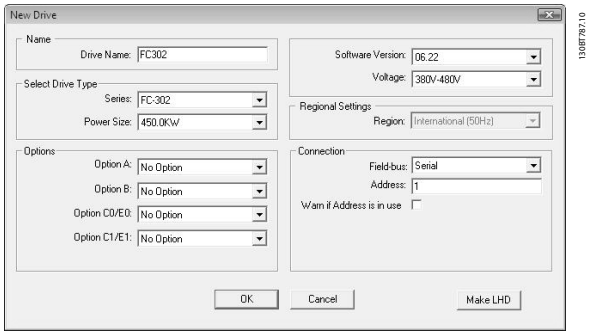

Illustration 5.5

The Low Harmonic Drive unit is visible in the Project as a composition of the frequency converter and the Active Filter.

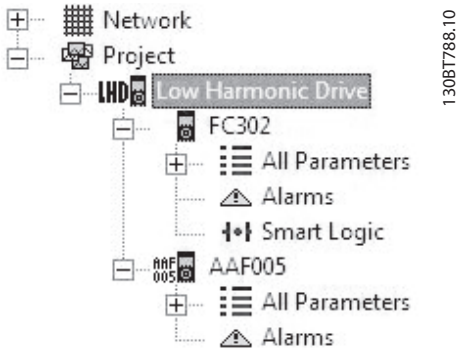

Illustration 5.6

5

Insert a new folder or file folder 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*

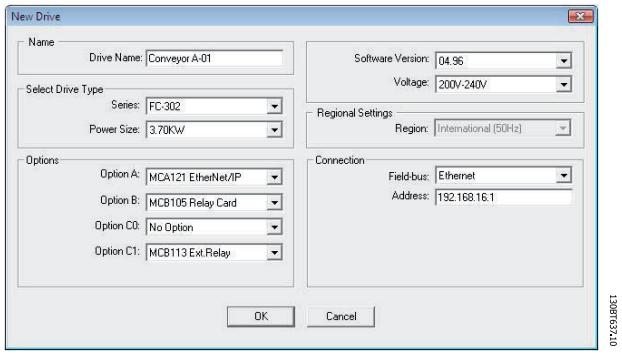

Illustration 5.7 New Drive Window

Drive refers to the type of frequency converter. Inserting a frequency converter opens the *New Drive* window, which consists of 4 main parts

- Name
- Drive identification
- Regional settings
- Connection

All parts are mandatory to fill in.

Name	Enter a unique name for the frequency converter. Any text/number combination is allowed.
Frequency converter identifi-cation	Information regarding the frequency converter series, power size, options installed, software version and voltage level. The different selections are available from the drop-down menus.
Regional settings	Configurable for International 50 Hz or North America 60 Hz settings. These settings mainly discriminate between hp, kW and voltage level.
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.

Table 5.2 Mandatory Fields in New Drive Window

Once the new frequency converter is added in the project folder, frequency converter data are stored in the offline project folder and can be viewed by clicking the frequency converter icon

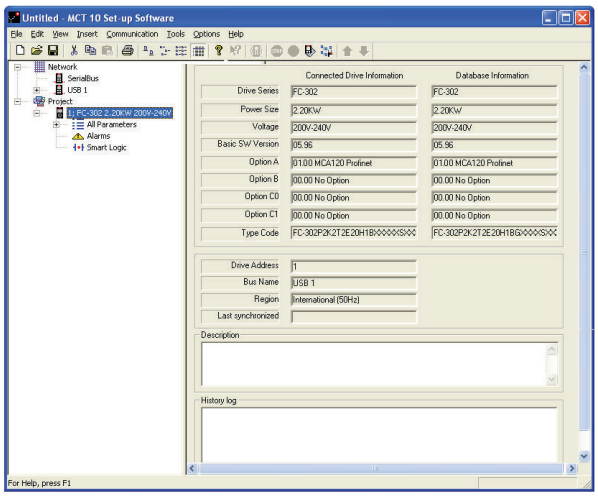

Illustration 5.8

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, which comprises a series of inner folders with generic names. There is no rename function for these folders. The generic folders within most frequency converters are as follows:

- 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.

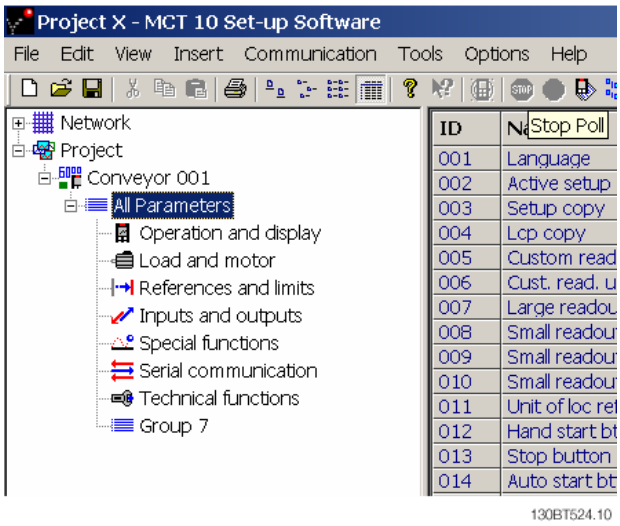

Illustration 5.9

The generic folders comprise parameters relevant to the frequency converter type selected.

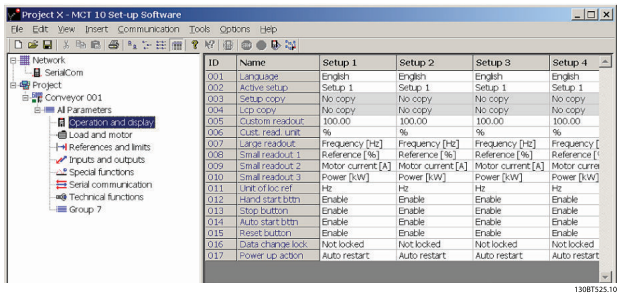

Illustration 5.10

5

5.2.2 Array Parameters

Parameters containing array data are displayed as a matrix in the *Right View*, where the rows of the matrix are identified as ID.1, ID.2, etc. For example, array parameters *9-15 PCD Write Configuration* and *9-16 PCD Read Configuration*are displayed 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*.

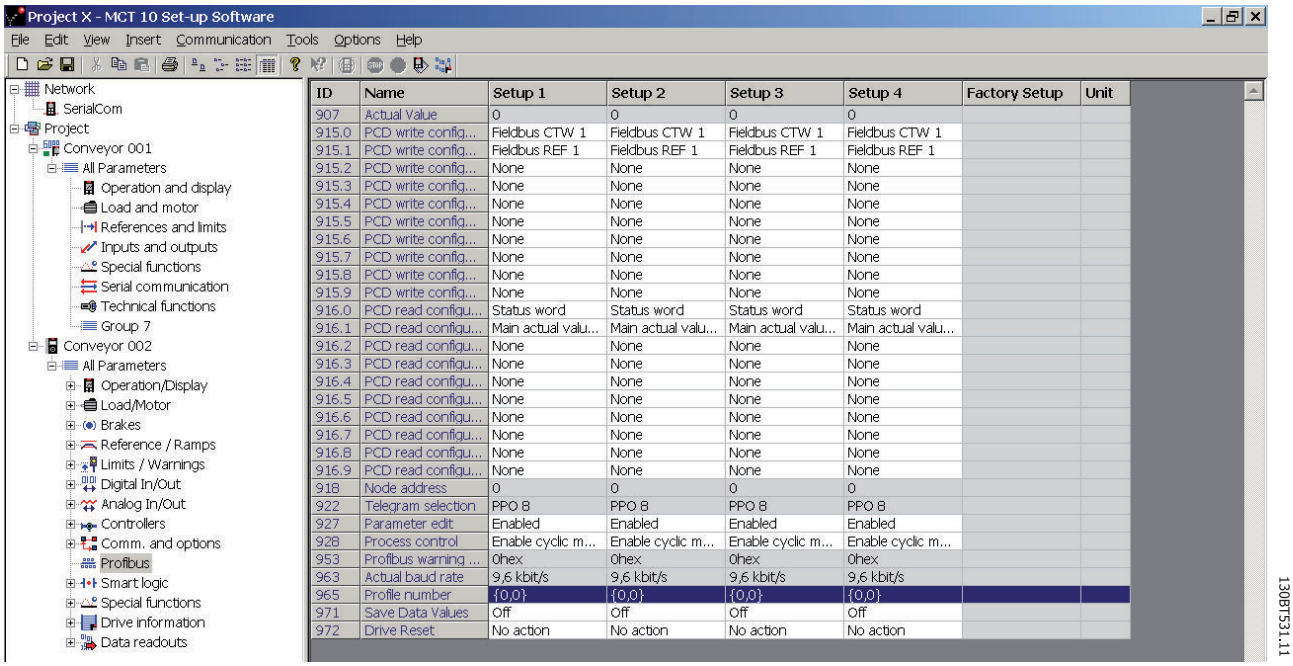

Illustration 5.11

5.2.3 Sorting

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

- Folder name
- Series
- Software Version
- Address (communication address)
- Power Size
- Voltage

5

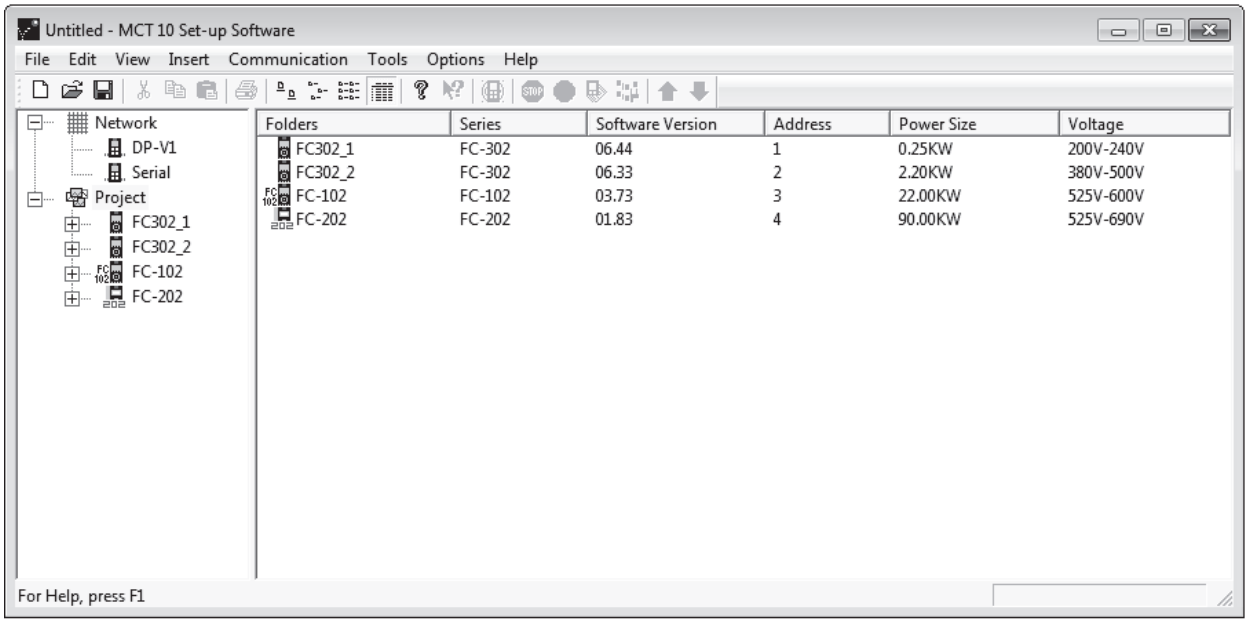

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Illustration 5.12 Sorting Options

Click the sorting bar and select the relevant sorting option.

5.3 Customised Views

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

- Display Toolbar and Status bar
- Hide Toolbar and Status bar

- *Large icons/Small icons* view
- Right View as *List* of folders and elements
- Right View with *Details* of Network and Project elements

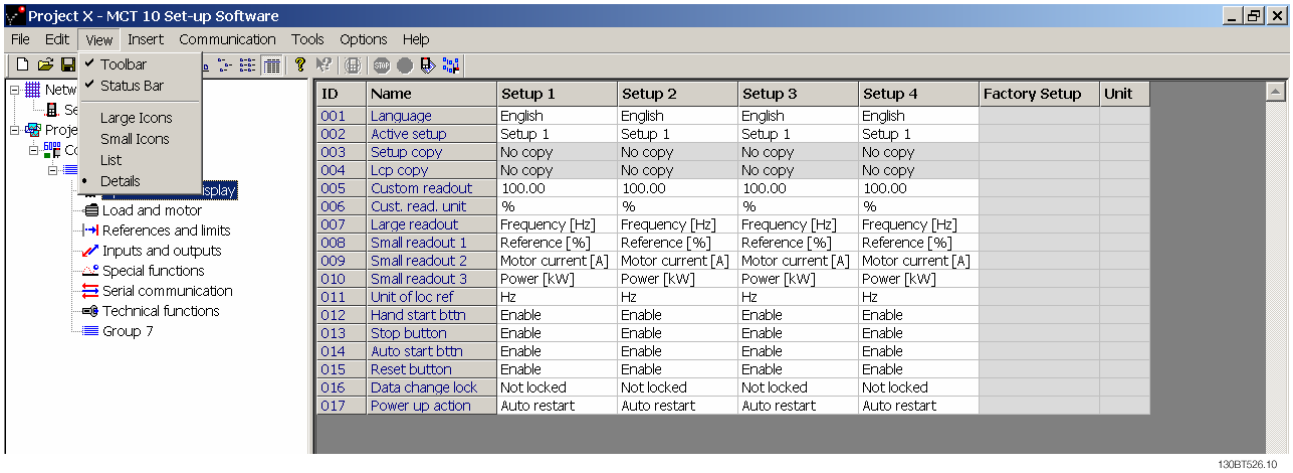


Illustration 5.13 The View Menu

Customise Parameter View Settings

Apply the selected parameter view settings to subfolders, to an entire project, or to the entire application, i.e. 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*.

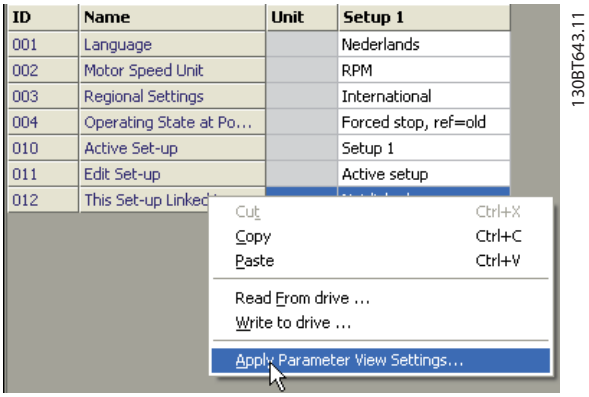


Illustration 5.14

3. Select the relevant option and click *OK*

5.3.1 Customise Background Colour

To customise the background colour of the views, go to *Options* ⇒ *Online Parameter Grid Settings*

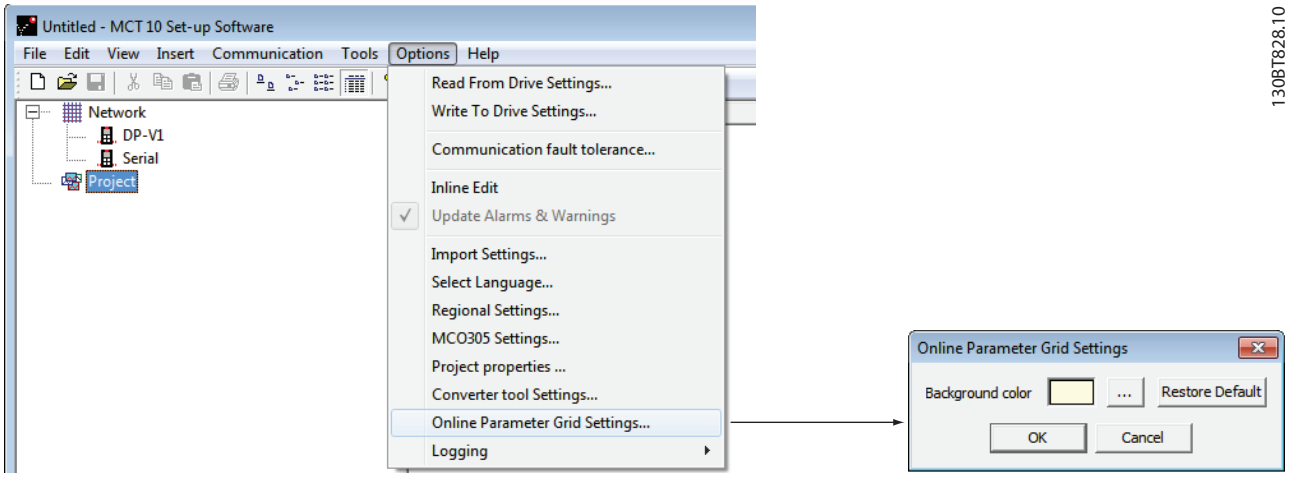


Illustration 5.15

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

5.3.2 Customise Parameter View

The parameters displayed 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 customise view.

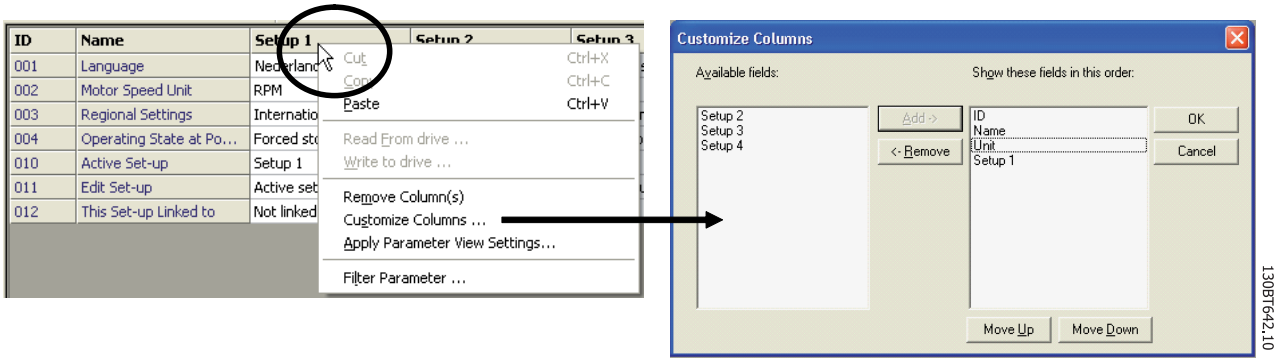


Illustration 5.16

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

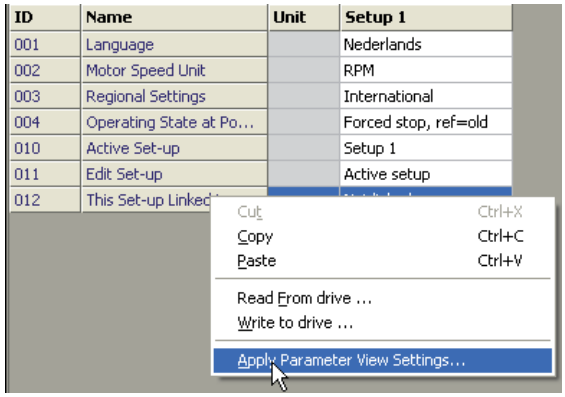


Illustration 5.17 Apply Parameter View Settings

5.3.3 Parameter Filter Options

The parameters in the Right View can be filtered.

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

Table 5.3 Available Filter Settings

1. Right-click any column in Right View.
2. Select the appropriate filtering setting or the appropriate filtering group(s).

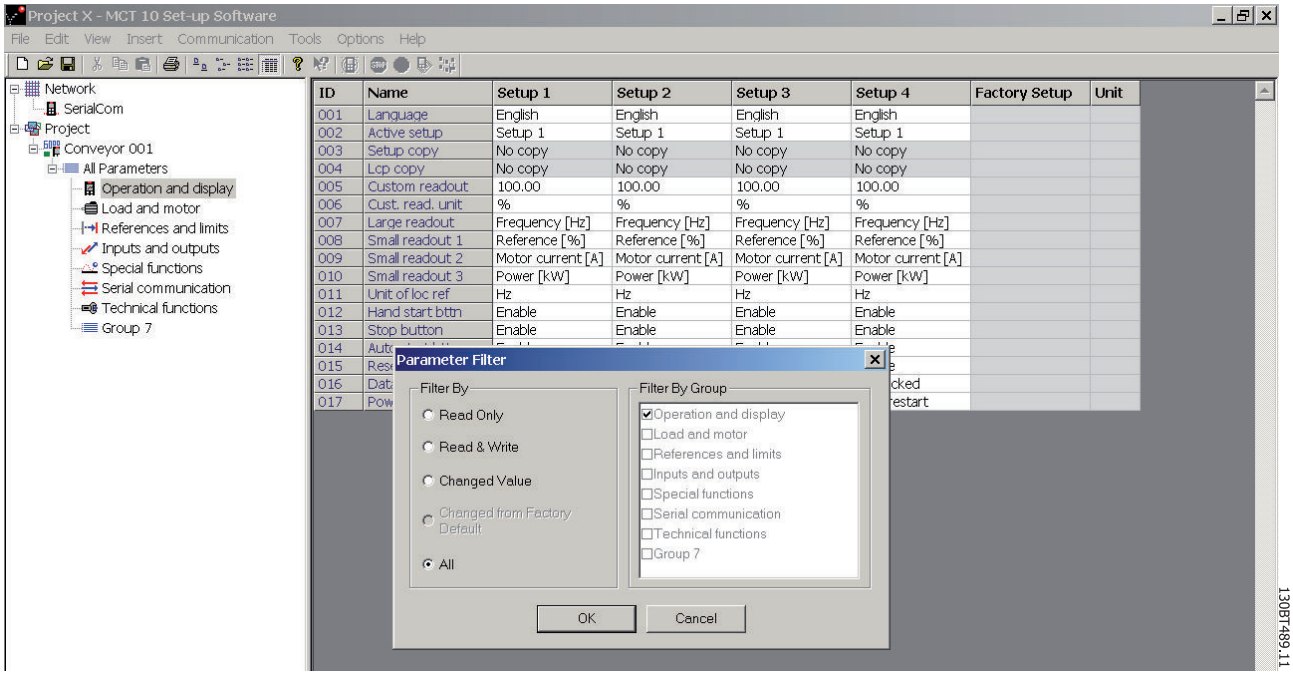
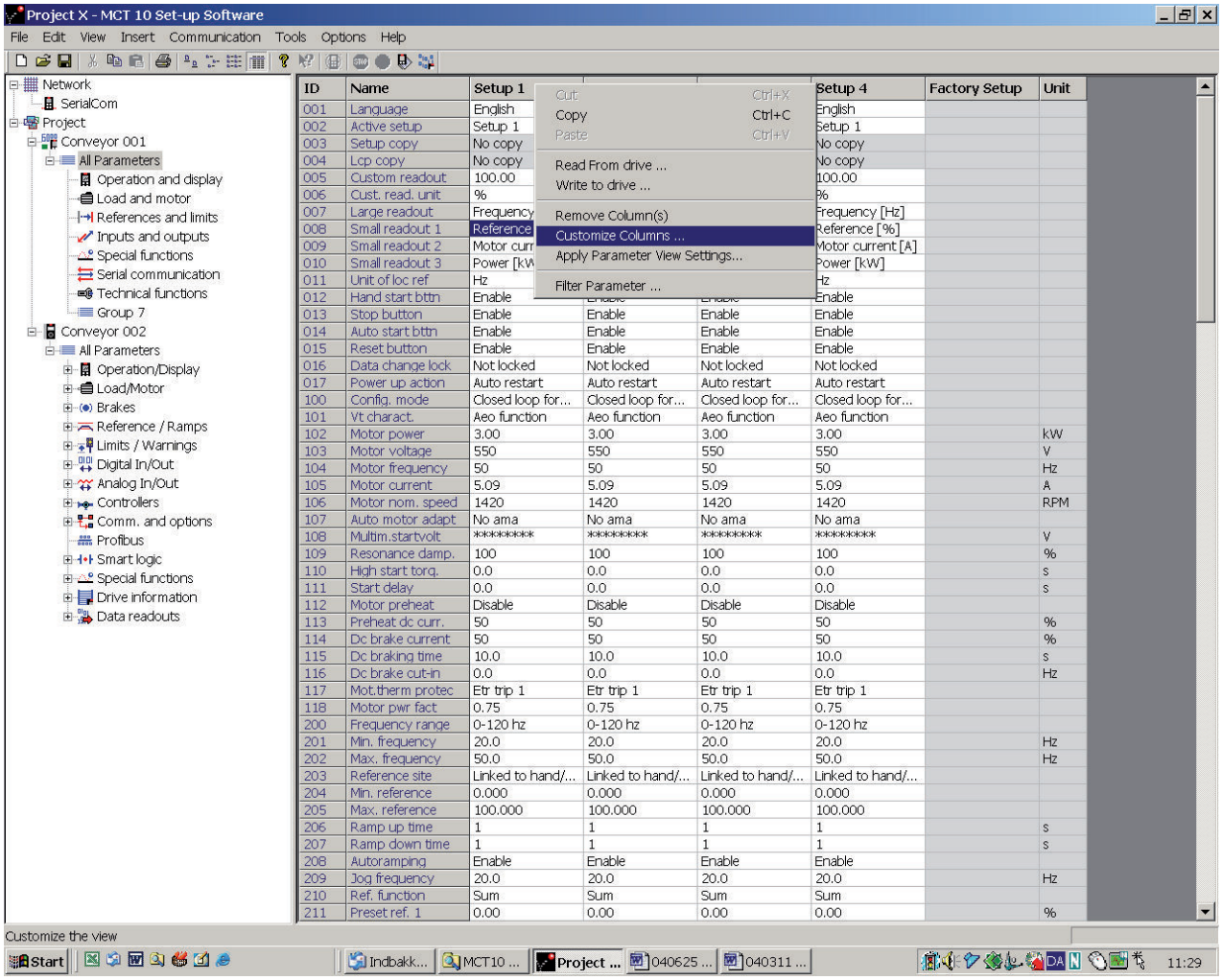


Illustration 5.18

5.3.4 Customise Columns

To rearrange the display of columns in the Right View

1. Right-click any column title.
2. Selecting *Customize Columns*.



ID	Name	Setup 1	Setup 2	Setup 3	Setup 4	Factory Setup	Unit
001	Language	English			English		
002	Active setup	Setup 1			Setup 1		
003	Setup copy	No copy			No copy		
004	Lcp copy	No copy			No copy		
005	Custom readout	100.00			100.00		
006	Cust. read. unit	%			%		
007	Large readout	Frequency			Frequency [Hz]		
008	Small readout 1	Reference			Reference [%]		
009	Small readout 2	Motor curr			Motor current [A]		
010	Small readout 3	Power [kW			Power [kW]		
011	Unit of loc ref	Hz			Hz		
012	Hand start bttn	Enable			Enable		
013	Stop button	Enable	Enable	Enable	Enable		
014	Auto start bttn	Enable	Enable	Enable	Enable		
015	Reset button	Enable	Enable	Enable	Enable		
016	Data change lock	Not locked	Not locked	Not locked	Not locked		
017	Power up action	Auto restart	Auto restart	Auto restart	Auto restart		
100	Config. mode	Closed loop for...	Closed loop for...	Closed loop for...	Closed loop for...		
101	Vt charact.	Aeo function	Aeo function	Aeo function	Aeo function		
102	Motor power	3.00	3.00	3.00	3.00		kW
103	Motor voltage	550	550	550	550		V
104	Motor frequency	50	50	50	50		Hz
105	Motor current	5.09	5.09	5.09	5.09		A
106	Motor nom. speed	1420	1420	1420	1420		RPM
107	Auto motor adapt	No ama	No ama	No ama	No ama		
108	Multim.startvolt	*********	*********	*********	*********		V
109	Resonance damp.	100	100	100	100		%
110	High start torq.	0.0	0.0	0.0	0.0		s
111	Start delay	0.0	0.0	0.0	0.0		s
112	Motor preheat	Disable	Disable	Disable	Disable		
113	Preheat dc curr.	50	50	50	50		%
114	Dc brake current	50	50	50	50		%
115	Dc braking time	10.0	10.0	10.0	10.0		s
116	Dc brake cut-in	0.0	0.0	0.0	0.0		Hz
117	Mot.therm protec	Etr trip 1	Etr trip 1	Etr trip 1	Etr trip 1		
118	Motor pwr fact	0.75	0.75	0.75	0.75		
200	Frequency range	0-120 hz	0-120 hz	0-120 hz	0-120 hz		
201	Min. frequency	20.0	20.0	20.0	20.0		Hz
202	Max. frequency	50.0	50.0	50.0	50.0		Hz
203	Reference site	Linked to hand/...	Linked to hand/...	Linked to hand/...	Linked to hand/...		
204	Min. reference	0.000	0.000	0.000	0.000		
205	Max. reference	100.000	100.000	100.000	100.000		
206	Ramp up time	1	1	1	1		s
207	Ramp down time	1	1	1	1		s
208	Autoramping	Enable	Enable	Enable	Enable		
209	Jog frequency	20.0	20.0	20.0	20.0		Hz
210	Ref. function	Sum	Sum	Sum	Sum		
211	Preset ref. 1	0.00	0.00	0.00	0.00		%

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Illustration 5.19

To change the order of fields in the display

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

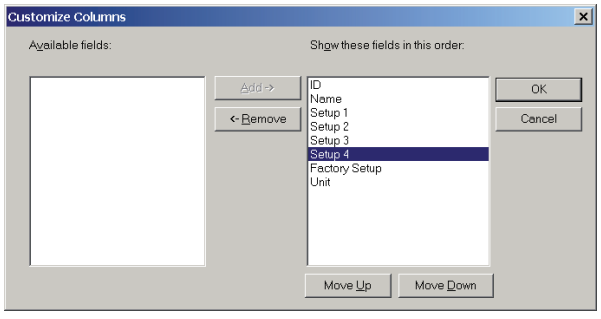

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Illustration 5.20 Change Order of Fields

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.

5

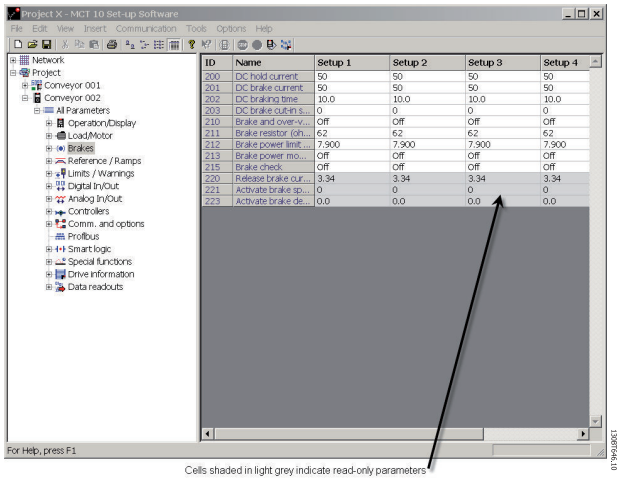

Illustration 5.21

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 displayed. Parameters can be edited in two different modes, dialog-based and inline.

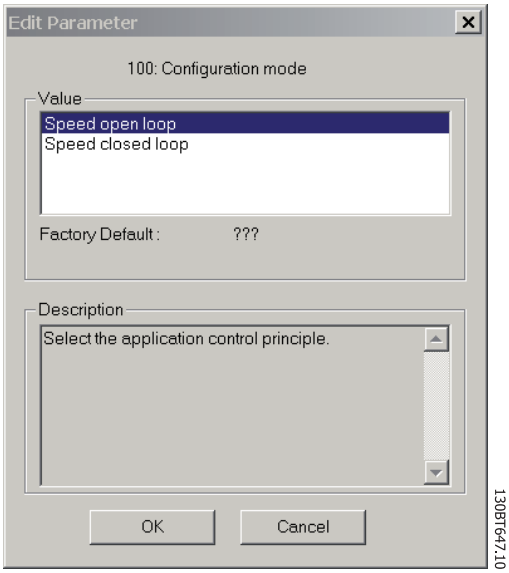

Illustration 5.22 Edit Parameter View

Inline Edit
In inline edit mode, the available setting options are displayed 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 whilst editing, use *Dialog Based Edit*. Parameter options, ranges and 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*.

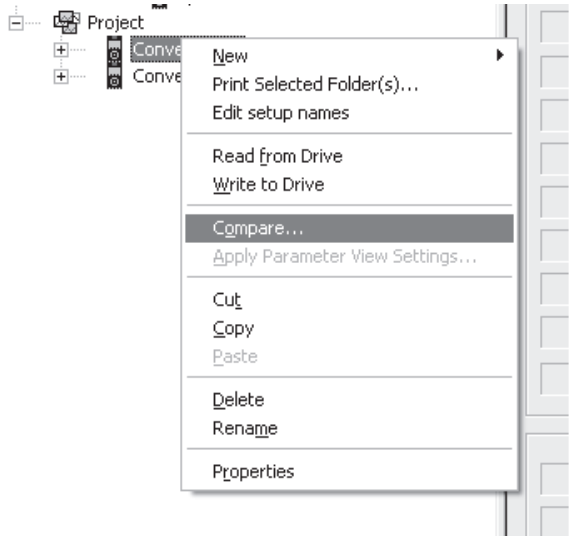

Illustration 5.23 Comparison

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 one set-up to another.

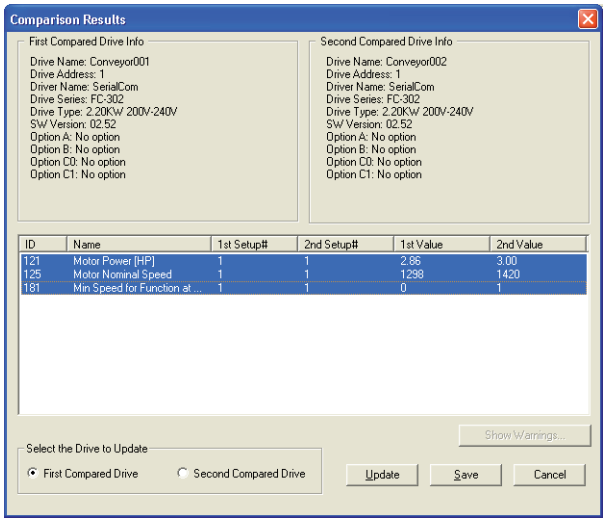

Illustration 5.24 Comparison Result

5.6 View Changelog

When configuring a frequency converter, Active Filter or Softstarter 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 dependant parameters.

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

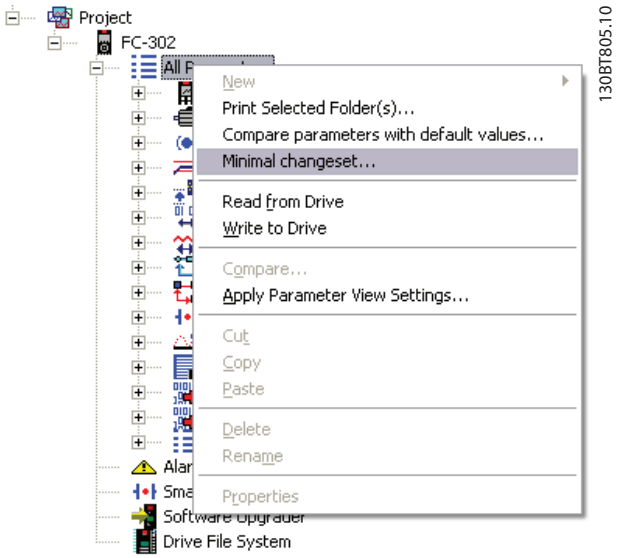

Illustration 5.25 Minimal Changeset

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

Illustration 5.26 Compare Parameters with Default Values

5.7 Read Drive Operation Status

The frequency converter can be in 2 different operations conditions *Auto On* or *Off*, which can be monitored via the LCP or MCT 10 Set-up Software. With MCT 10 Set-up Software, monitor the actual operation status by clicking on 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.

The majority of parameters are read/write, and can thus be configured. Other paramters 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 selecting the *Read From drive or Write to drive* menu.

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*, e.g. Load and Motor group

and the *Read from drive* and *Write to drive* functions applies to the whole selection.

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

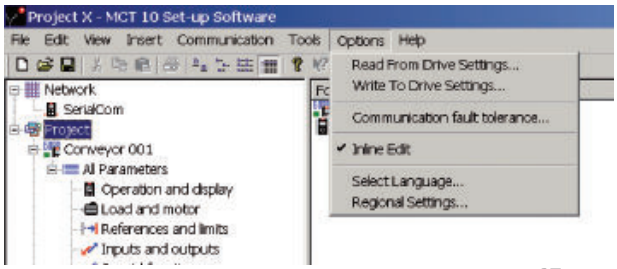

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Illustration 6.1 Select Options

6.1.1 Read From Drive Settings

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

Include factory set-up
If this option is selected, the factory set-up data (i.e. default values) are included in the data read from the frequency converter. As the factory set-up can be changed, this option is useful for checking the actual default values.

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

Compatibility errors
Specify acceptable level of compatibility errors, if field device software and MCT 10 Set-up Software versions are not identical. Select *Ignore All Errors* to ignore all compatibility errors.
Select *Ignore Drive Major Version Errors* to restrict the acceptable compatibility errors to those occurring in a major software version. Minor version differences such as v3.1 to v3.4 are ignored, but major version differences such as v3.1 to v4.1 are not accepted.

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

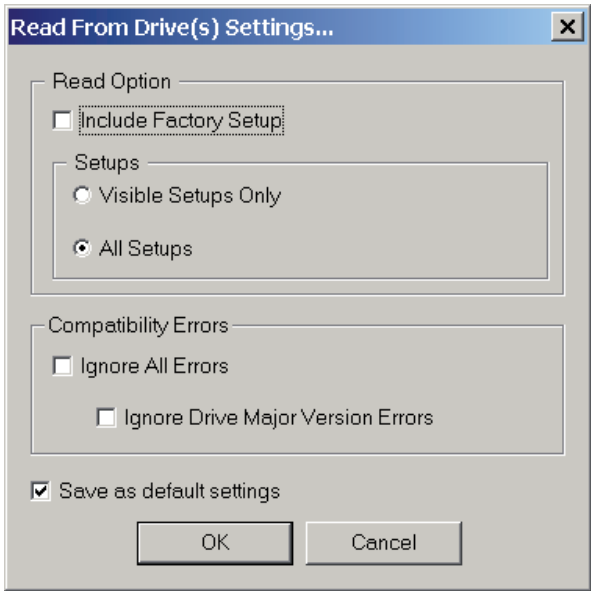

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Illustration 6.2 Save as Default Settings

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 converter(s).

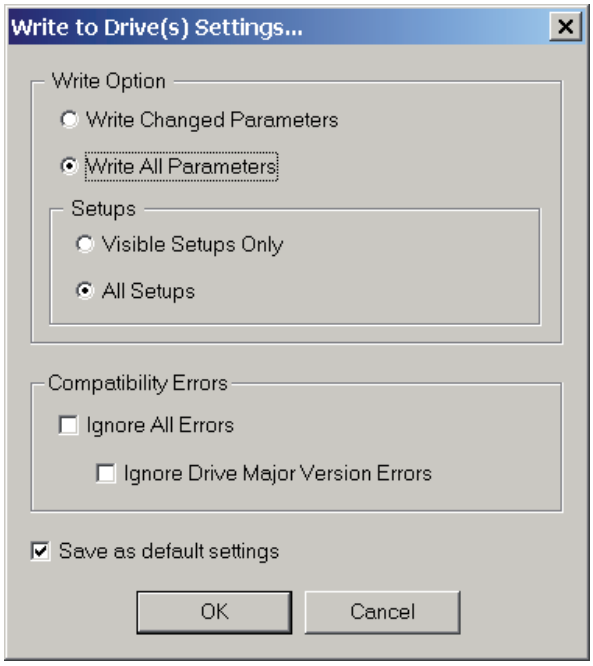

Illustration 6.3 Write all Parameters

6.1.3 Communication Fault Tolerance

Set an acceptable number of communication faults before breaking off the connection. The default Number of Failures value is 0 or 1, which in practice is usually too low a fault tolerance for smooth communications, i.e. the connection will constantly be cut off.

For normal operating conditions, set *Number of Failures* to 3 to achieve reasonably smooth communications. For operating conditions where the electrical noise level is high, or where the standard of the installation is low, set *Number of Failures* to 5.

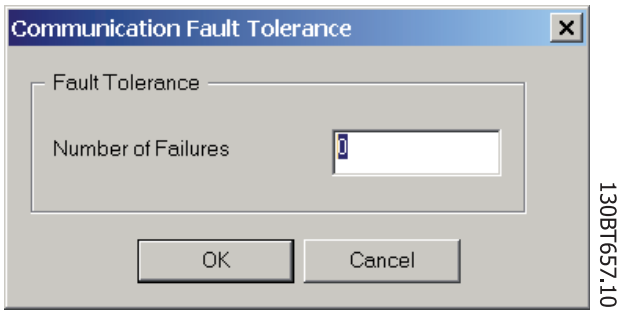

Illustration 6.4 Fault Tolerance

6.2 Connection Properties

To read or write between on- and offline frequency converter(s), 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 is not be able to identify the online frequency converter.

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

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

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*.

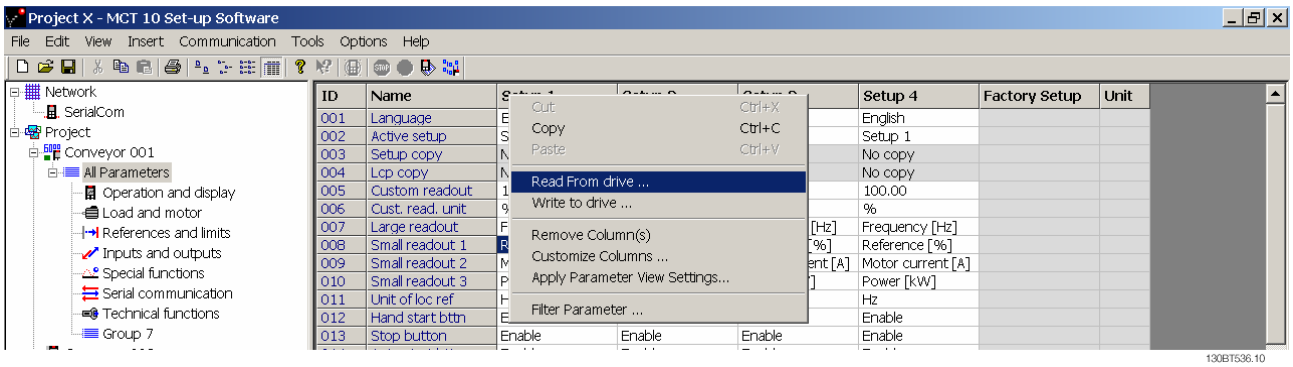

Illustration 6.5 Read from Drive

Once *Read from drive* is selected, the software accesses the online device and displays the *Drive Check* window, showing the compatibility of the properties of the offline project drive (where the properties are based on database information) with the online device, i.e. Connected Drive, as in *Illustration 6.6*:

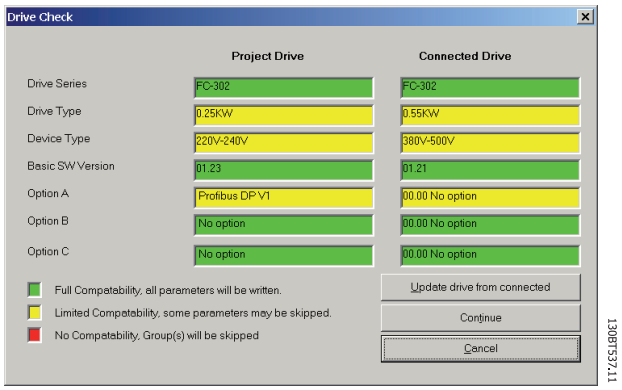

Illustration 6.6 Drive Check

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

Option	Description
Cancel	Stops the *Read From Drive*-process, for example if the level of compatibility between project drive and connected drive is unacceptably low.
Continue	Activates the *Read From Drive* process to show the properties of the connected frequency converter
Update drive from connected	Activates the *Read From Drive* process, deleting the data in the project drive and replacing it with the data from the connected drive

Table 6.1 Drive Check Options

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*.

Once the *Read From Drive* process is completed, the display shows details of both the *Connected Drive Information* and the *Database Information*.

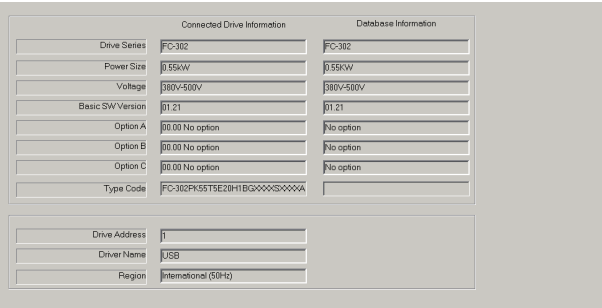

Illustration 6.7

6

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*.

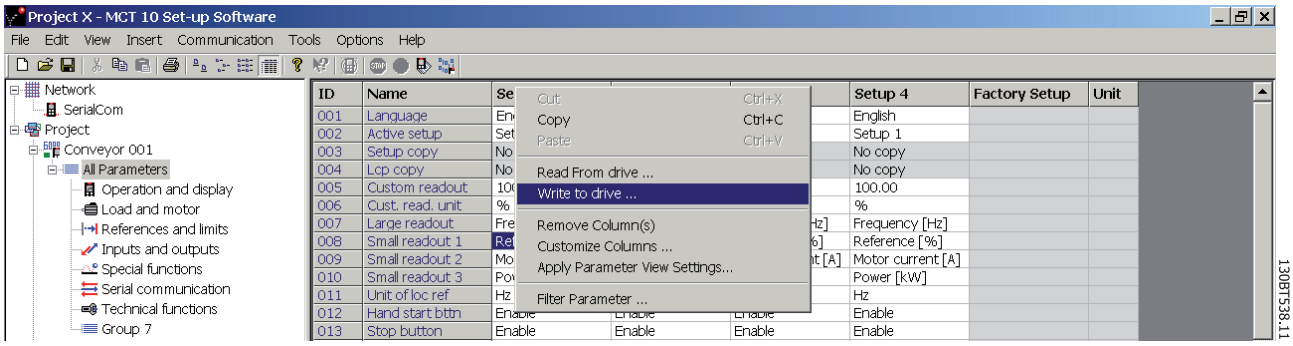

Illustration 6.8 Write to Drive

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 analyse a particular moment:

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

or

- Select *Stop Polling* from the toolbar

Illustration 6.9 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

Illustration 6.10 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 elsewhere.

6.7 Save Changes to a Hard Disk

6.7.1 Record Online Changes

To record online changes to a hard disk, select the relevant device in the *Network* folder. Right-click the device and select *Copy*.
Select the *Project* folder, right-click and select *Paste*.
Then select *File* from the main menu bar, and select *Save As*.
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. Including the frequency converter information in the project file, makes it possible to open in other MCT 10 installations 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*

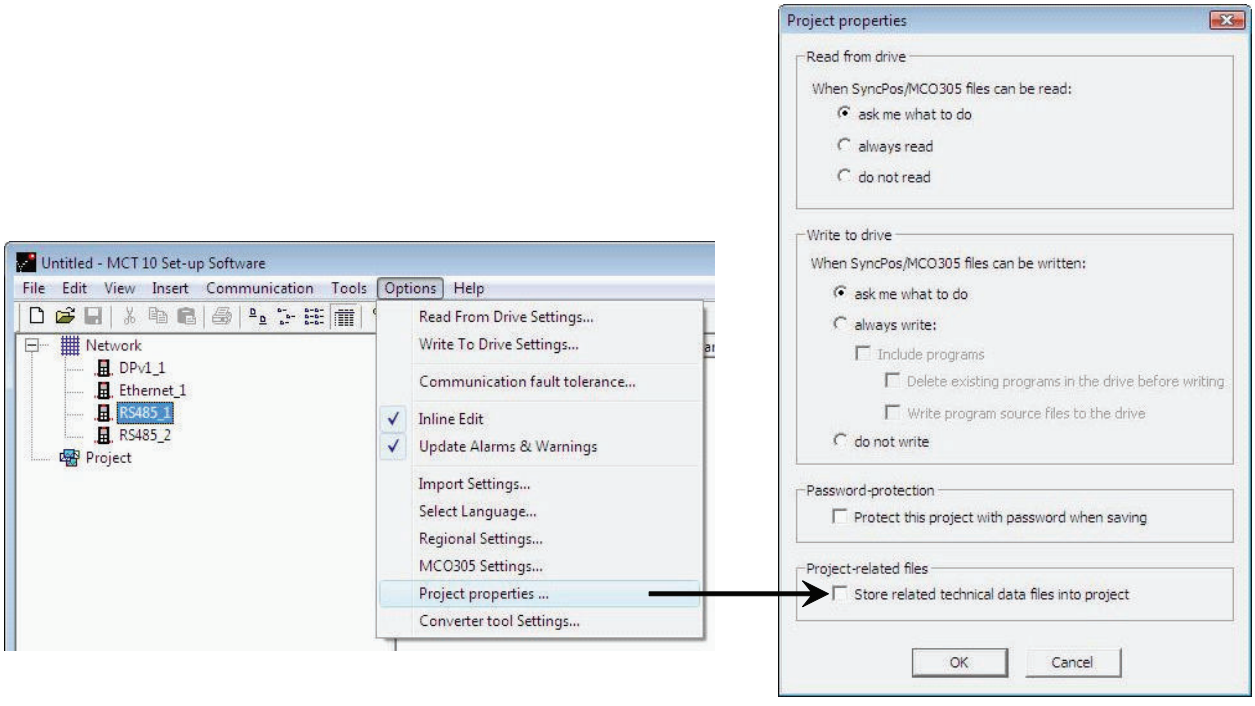

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Illustration 6.11 Save Frequency Converter Information

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 as well as 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.

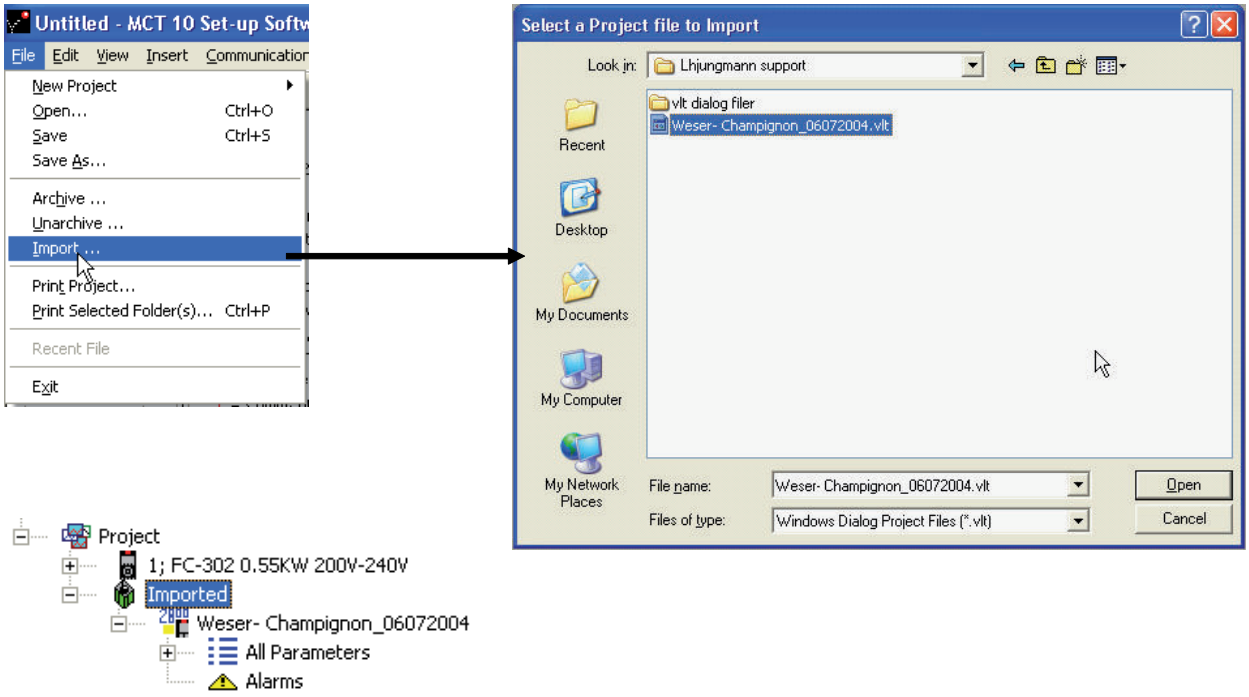

Illustration 6.12 Import Older Dialogs

Due to limitations in some of the former PC tools, some functionalities cannot be imported, e.g. 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, *Print Project* can be selected 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.

The following dialog box pops up:

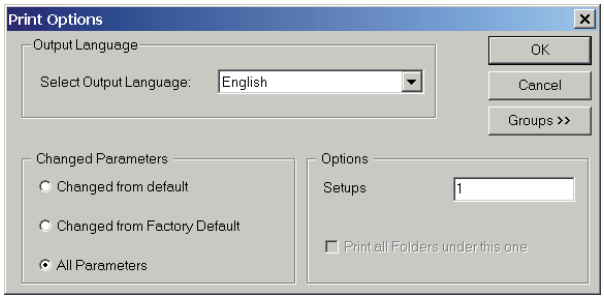

Illustration 6.13 Print Options

Select the desired print language from drop-down list.

Changed Parameters
Select this option to print all parameters, or to print changed parameters. Select between parameters

- Changed from default
- Change from factory default
- All parameters

Options
Specify which set-up to print.

Groups
Select *Groups* to print selected parameter groups only.

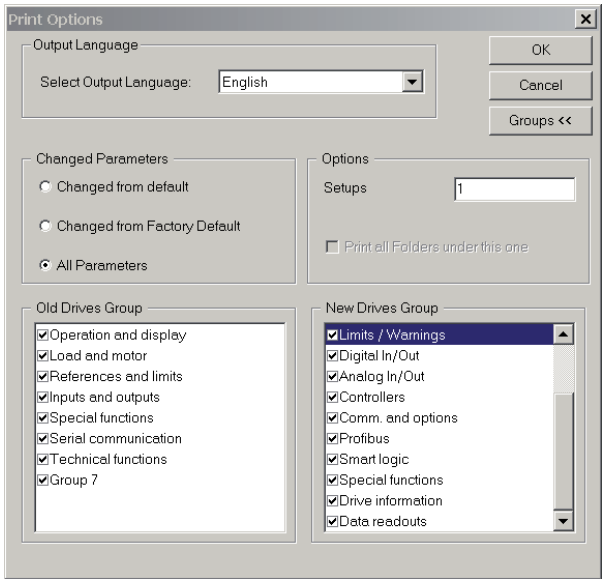

Illustration 6.14 Print Changed Parameters

1. Select the parameter groups to print.
2. Select *Groups* to return to the original unexpanded Print dialog box.
3. Select *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 displayed with a red line through it and the *Database Information* cells displays the message *Not supported*, as shown:

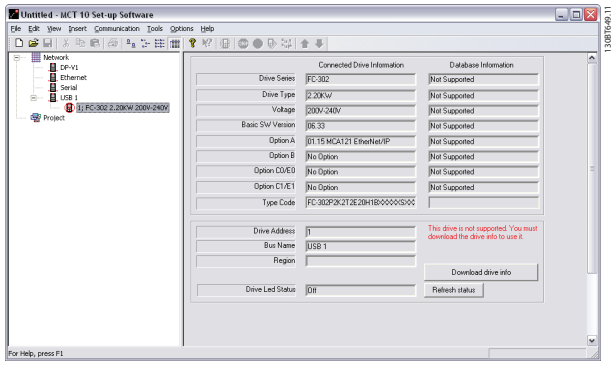

Illustration 6.15 Outdated Software Database

The database can be updated either by right-clicking the frequency converter icon and selecting *Download Drive Info*, or by clicking *Download Drive Info*.

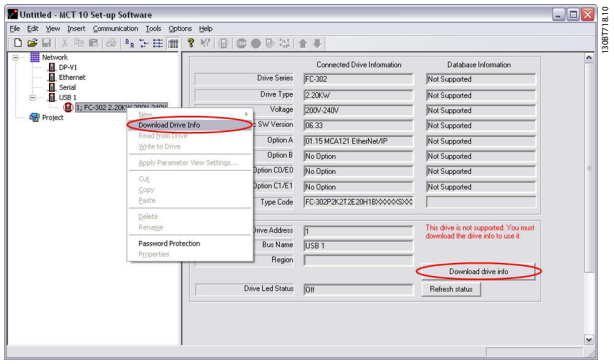

Illustration 6.16 Database Update

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 displays settings identical to the *Connected Drive Information*.

In addition, the parameter settings are displayed in capital letters.

6

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 frequency converter.

Download upgrades from the Danfoss web-site www.vlt-software.com and store on local disk drive.

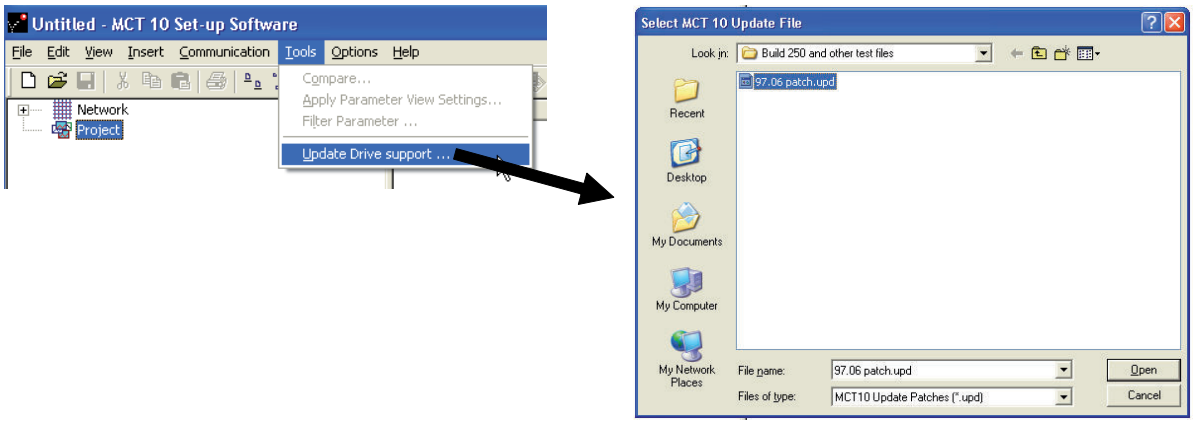

Illustration 6.17 Update MCT 10 Set-up Software

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 6.2* 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 6.2 Opening Legacy Versions

When MCT 10 Set-up Software has been updated, project-files saved as with newer version firmware can be opened and used. This scenario is shown in *Illustration 6.18*.

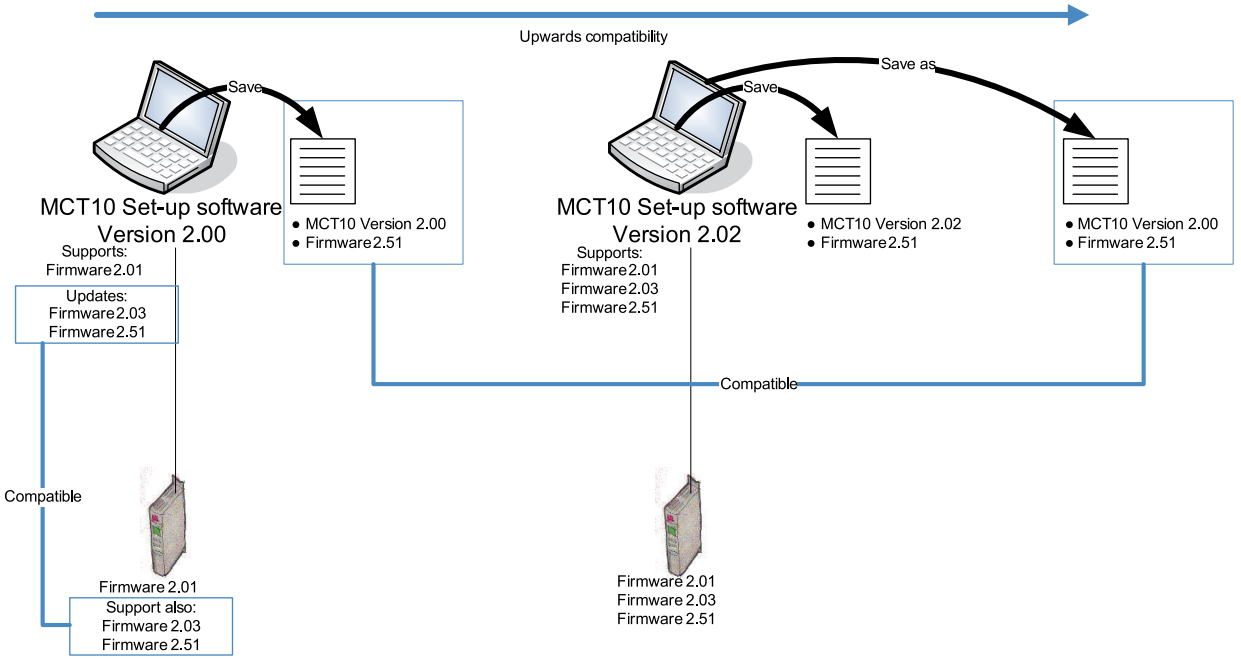

Illustration 6.18 Use updated MCT 10 Set-up Software

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 Explore 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

How to find out if MCT 10 Set-up Software has been updated

The *About* box shows the actual MCT 10 Set-up Software version.

NOTICE

System information can be copied directly to the Windows Clipboard.

130BT574.11

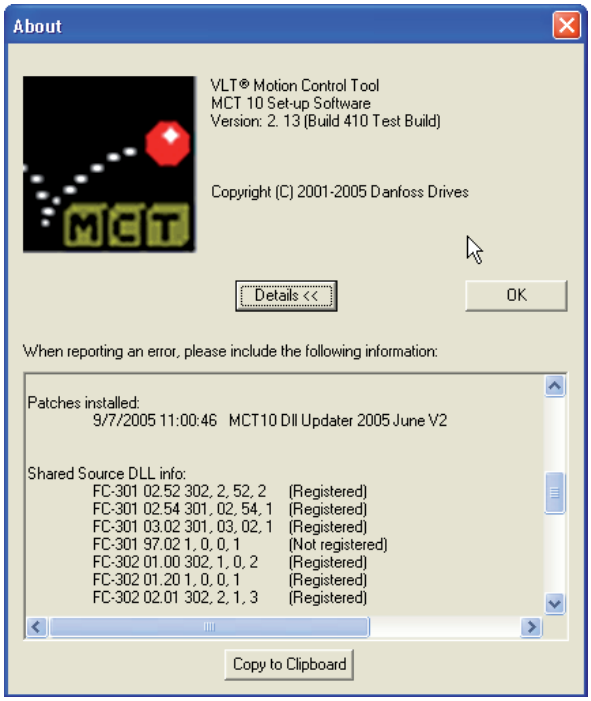

Illustration 6.19 Copy System Information

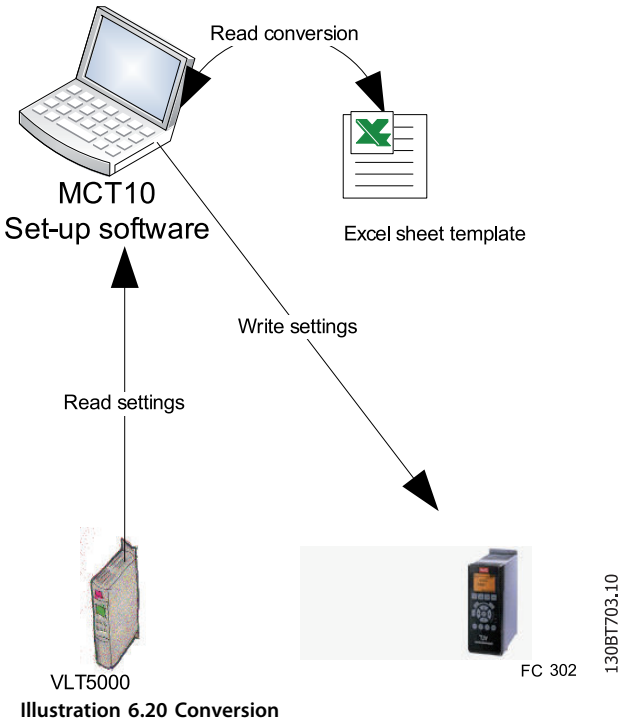

Illustration 6.20 Conversion

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 destination frequency converter. Differences can be converted using one 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 signalled during write to drive.

6.13.2 VLT to FC Series Converter Function

It is possible to convert e.g. a VLT 5000 frequency converter to an FC 302 with the conversion matrix in the MCT 10 Set-up Software.

Conversion of multiple frequency converters

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

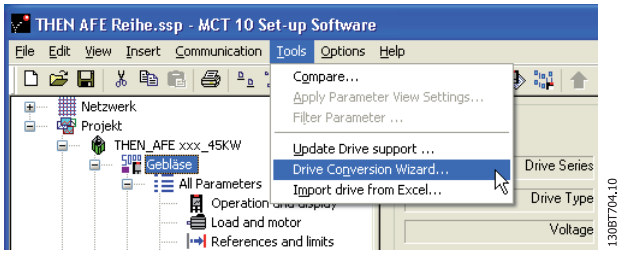

Illustration 6.21 Conversion of Multiple Frequency Converters

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 e.g. 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

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 FC 102, FC 202, FC 3xx, LD 302 and all OEM versions based on the FC xxx series. Differences can be matched by using the *Conversion Table 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 table(s) through access to the *Conversion Table Manager*. From the *Conversion Table Manager*, new conversion table(s) 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 Table Manager*. Conversion tables can be imported to the database.

MCT 10 Set-up Software is installed with user rights. Enabling the *Conversion Table Manager* is done from the checkbox in the *Converter Tools Settings* dialog.

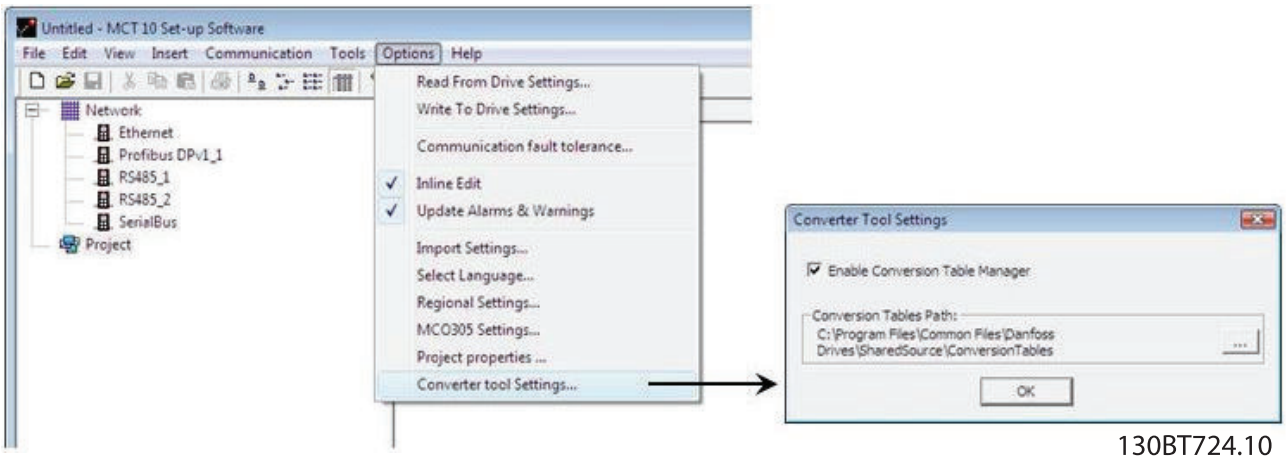

Illustration 6.22 Enabling Conversion Table Manager

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 Table Manager

Access the *Conversion Table Manager* through the MCT 10 Set-up Software tools menu.

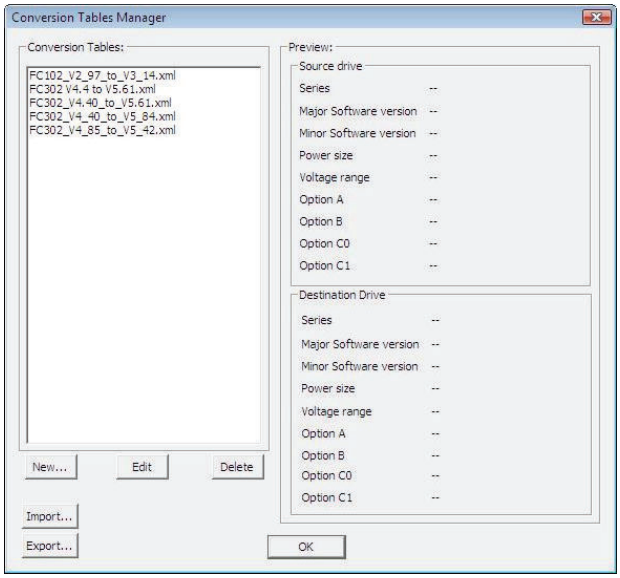

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Illustration 6.23 Conversion Table Manager

The dialog is divided in a *Conversion Table* containing the list of conversion tables in the database and a *Preview* pane. Conversion tables can be created or imported, edited, exported or deleted.

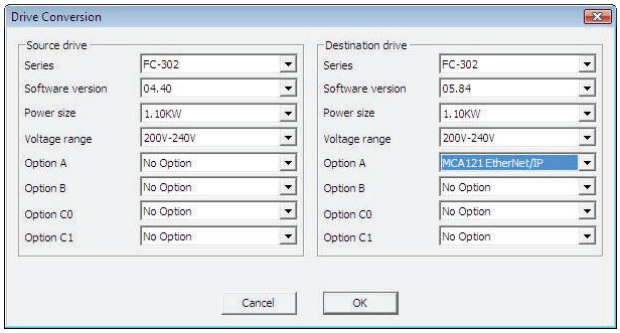
Exporting tables
Distribute to other MCT 10 Set-up Software installations by exporting the relevant tables to a *.cvt file. The *Preview* pane lists the conversion table source and destination frequency converter information. The conversion can be as follows:

- 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 Table 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.**



130BT722.10

Illustration 6.24 Drive Conversion

Editing Tables
Source and Destination frequency converter info defined, opens 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 drive 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 possbile to reedit 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 conversion process, filter the database to list alerts or applied changes only.

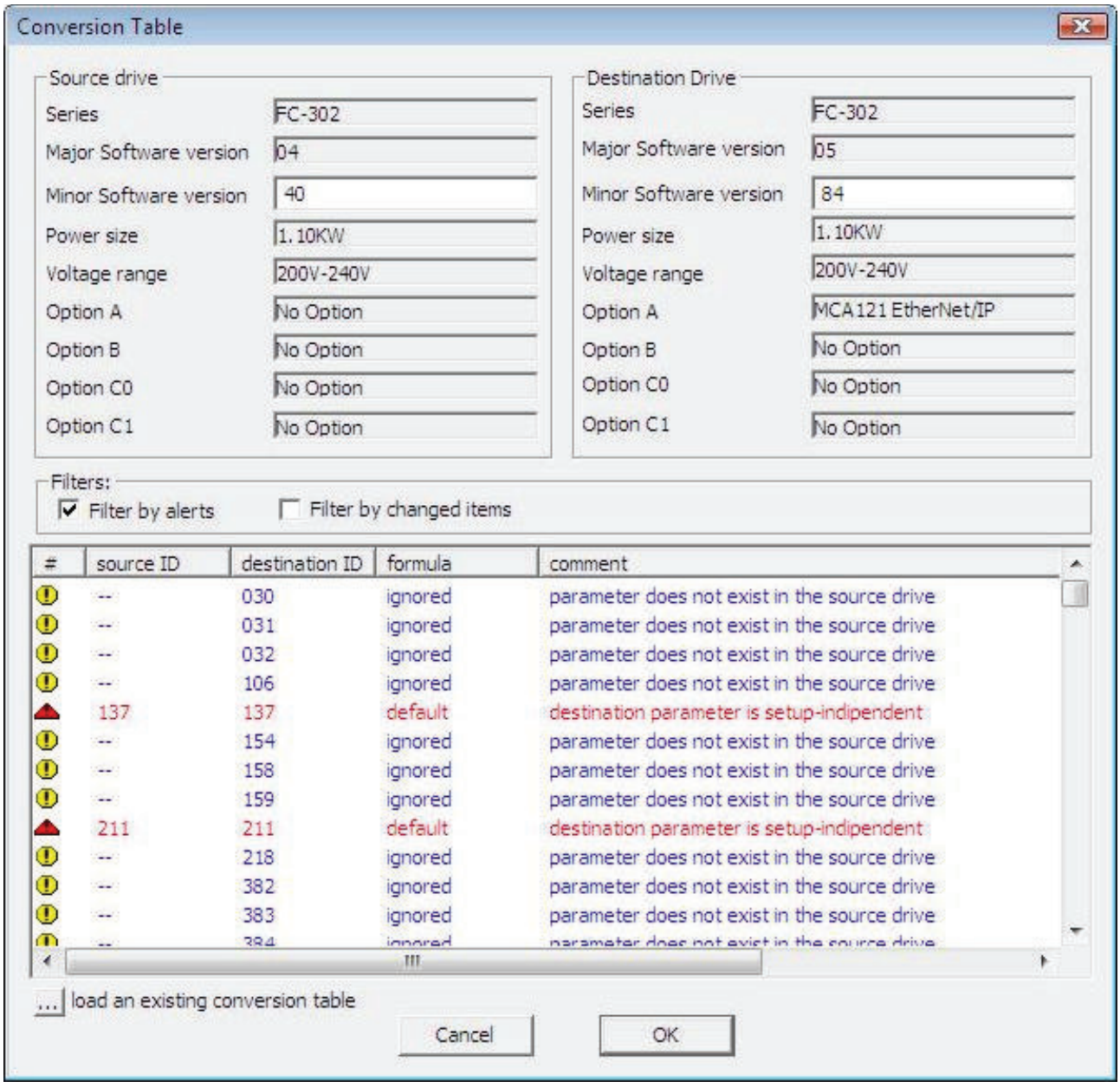
Colour Code	Description
Red	Difference between source database and frequency converter. A formula is required before changes can be applied to the frequency converter (???)
Blue	Difference between source database and frequency converter. The formula is ignored and changes can be applied to the frequency converter (???).

Table 6.3 Alert Colour Coding

6

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.



130BT723.10

Illustration 6.25 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.

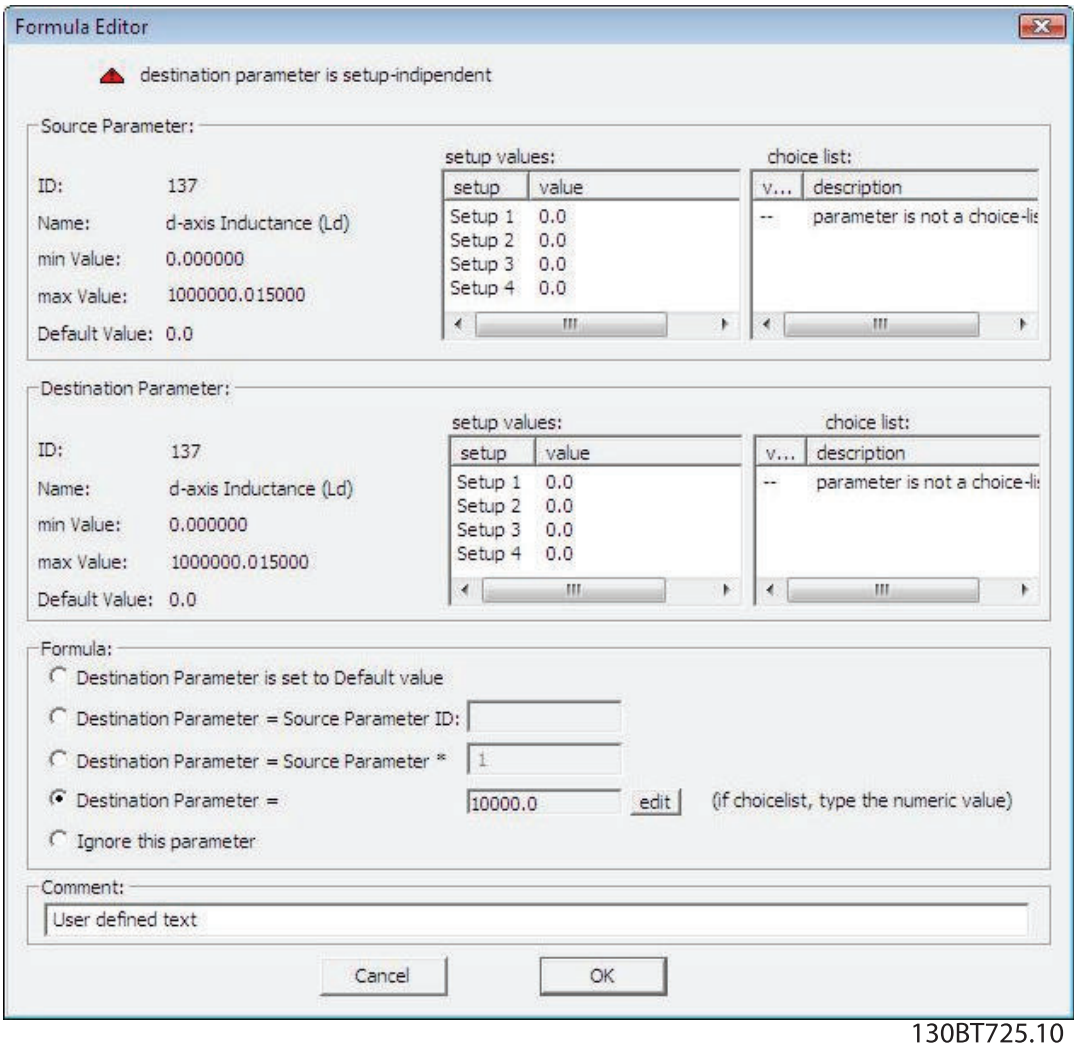


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Illustration 6.26 Formula Editor

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

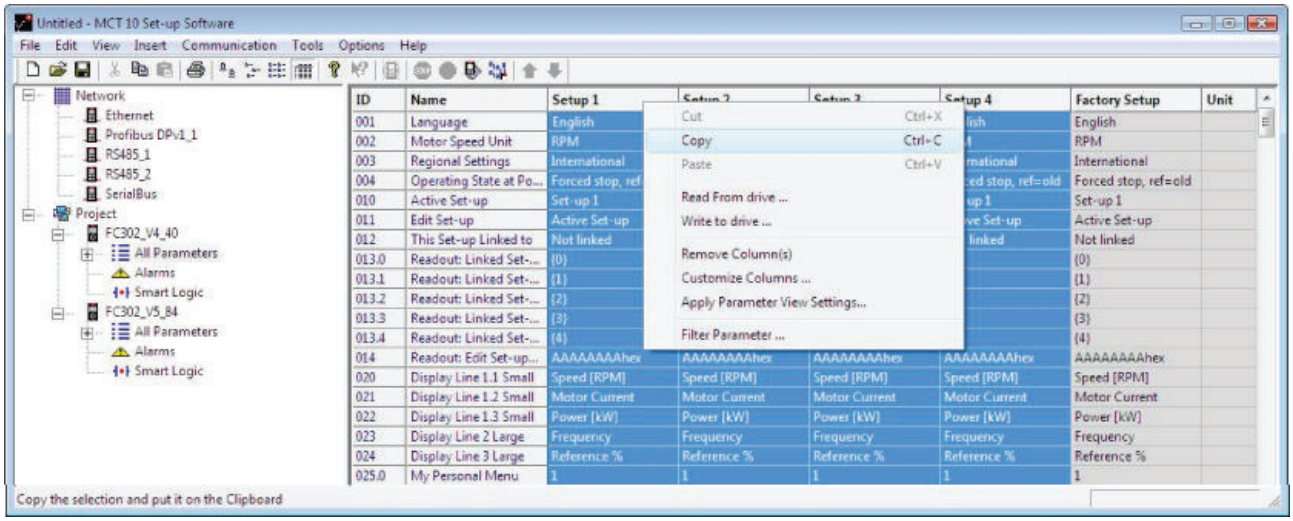
If differences are detected when writing from source to destination frequency converter, MCT 10 Set-up Software uses the frequency converter series, major software version, power size, voltage range and option configuration as search criterias. With the proper conversion table in the database, any frequency 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 criterias, MCT 10 Set-up Software uses the minor software version to find the closest match. Only one frequency converter can be written to destination transparently.

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

6.13.4.1 Convert Offline to Offline/Online to Online

Write 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.



130BT727.10

Illustration 6.27 Offline Online Conversion

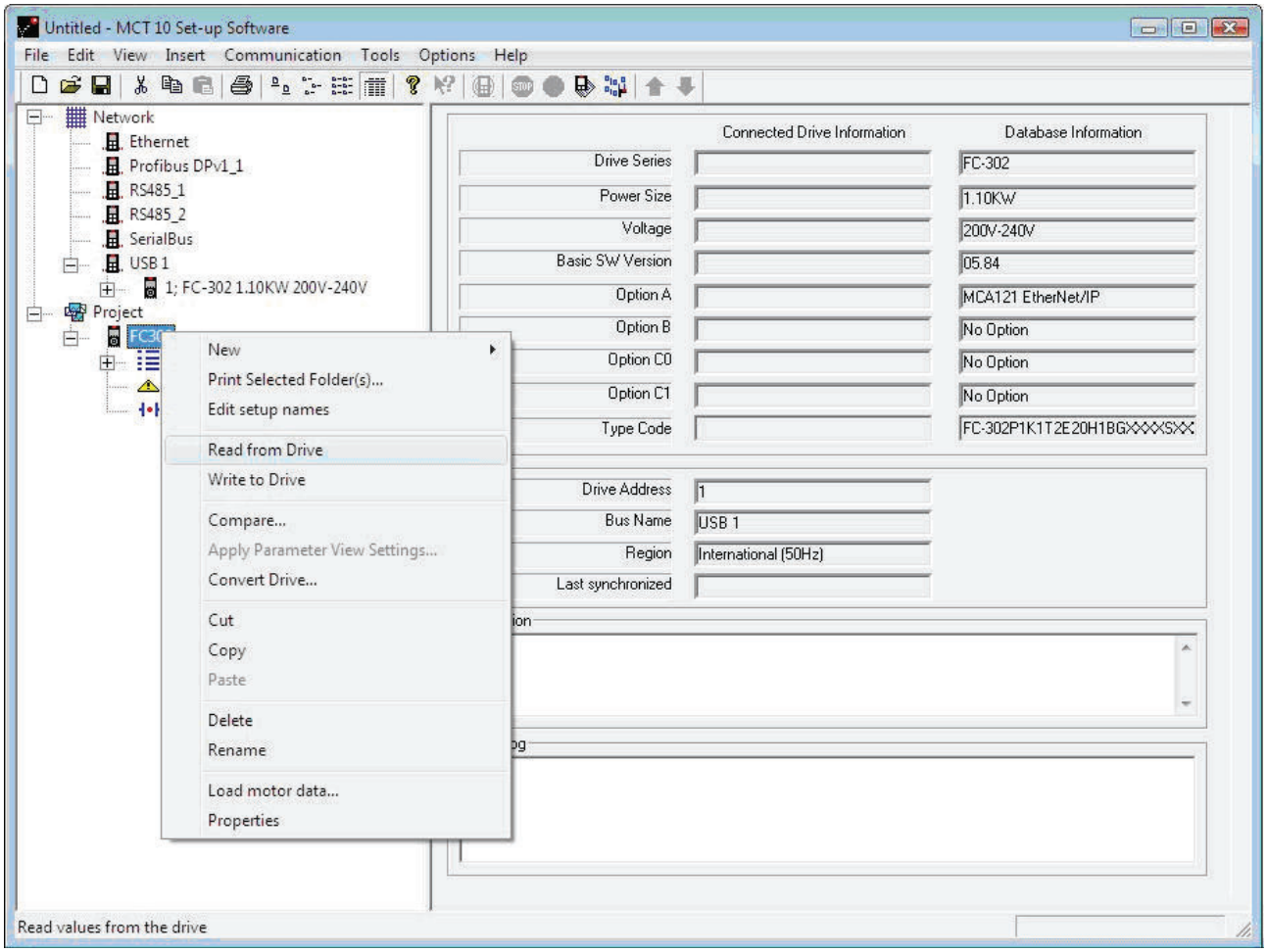
MCT 10 Set-up Software recognises any difference and automatically applies a matching conversion table, if available.

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 to read from frequency converter. MCT 10 Set-up Software recognises any difference and automatically applies a matching conversion table.



130BT729.10

Illustration 6.28 Offline Online Conversion

NOTICE

Make sure the offline frequency converter connection properties corresponds 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 supports the feature of

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

7.2 Localisation 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 drive icon.

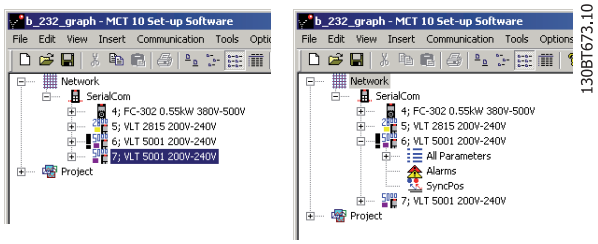


Illustration 7.1 Frequency Converter with Active Alarm or Warning

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

Name	Icon
Active alarms/ warnings	
No active alarms/ warning	

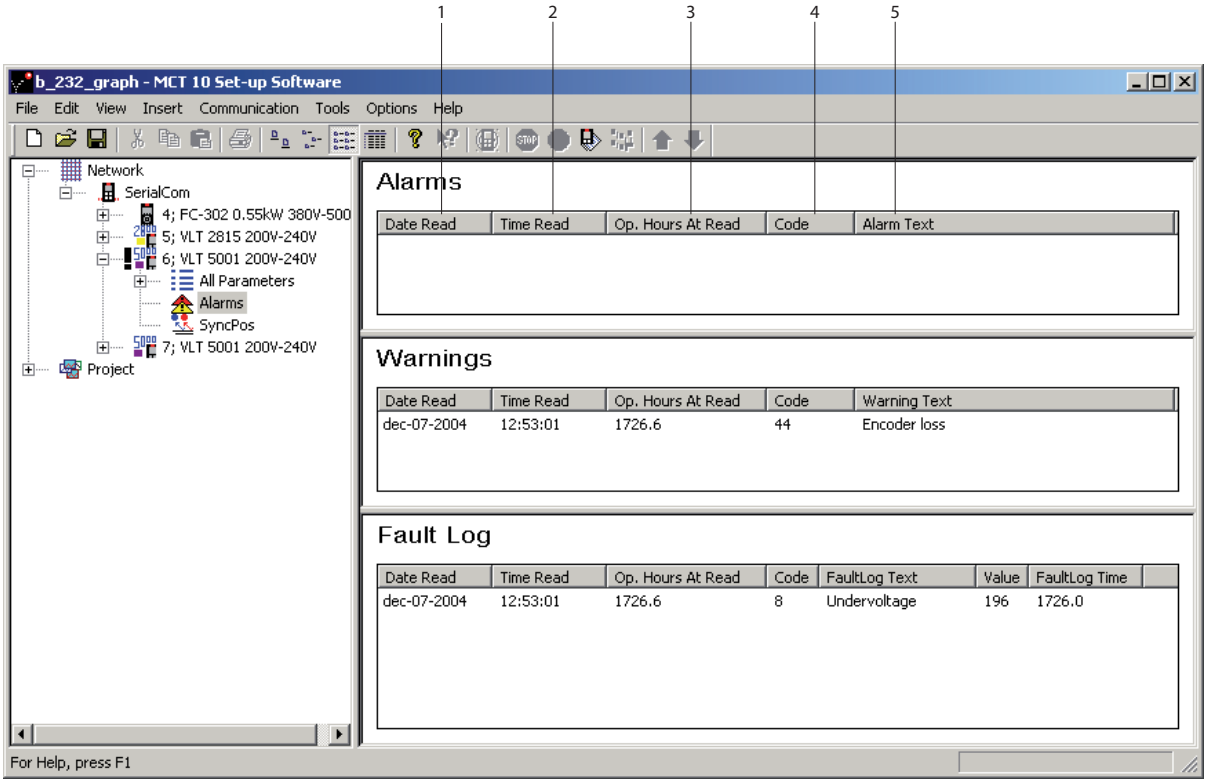


Illustration 7.2 Alarms, Warnings and Fault Log View

Item No.	Description	Item No.	Description
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 operating hours		

Table 7.1 Legend to *Illustration 7.2*

For a more detailed description of the code, refer to the *Operating Instructions* for the particular frequency converter. If the frequency converter trips, it stores the cause for the trip in a fault log buffer. The log consist of 3 values;

- code
- value
- time

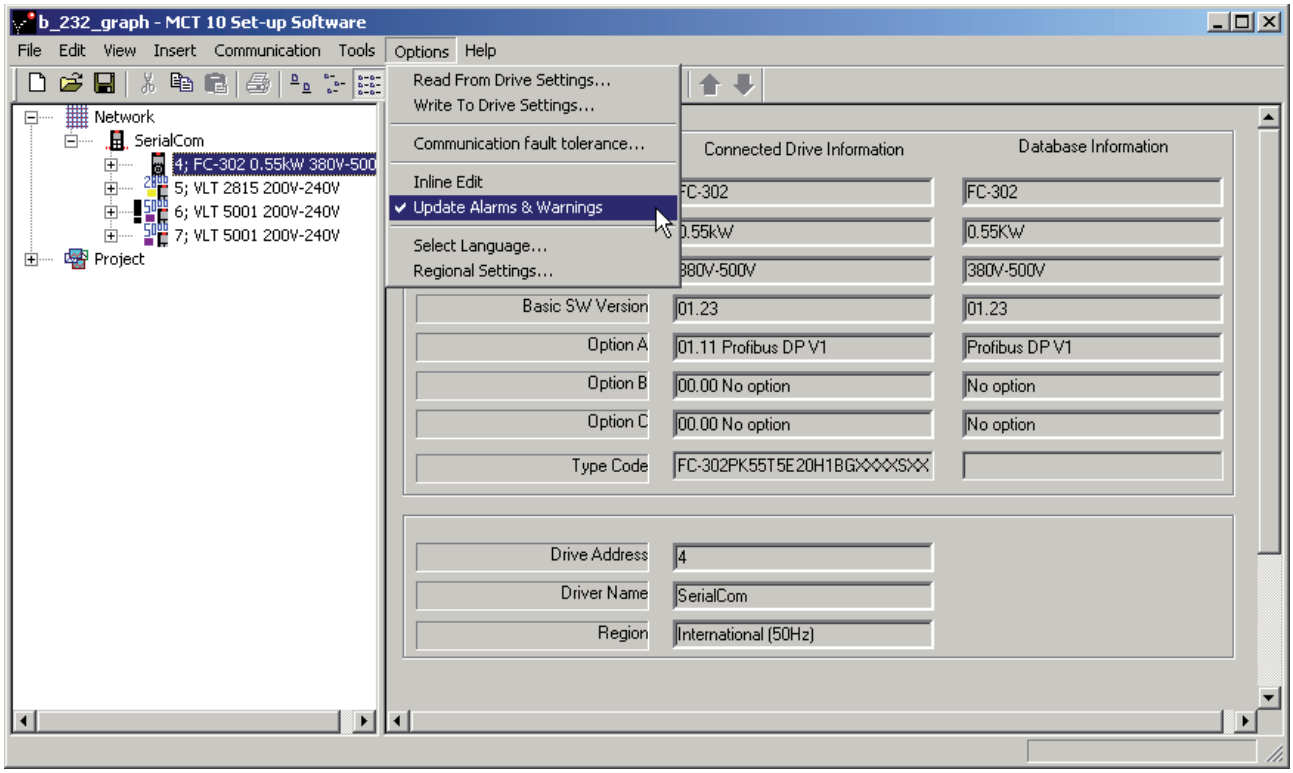
When MCT 10 Set-up Software reads the fault log, it displays the time and date when the log was read.

NOTICE

The actual time of 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*. The MCT 10 Set-up Software now automatically reads alarms, warnings and fault loggings at every read from/write to the frequency converter.

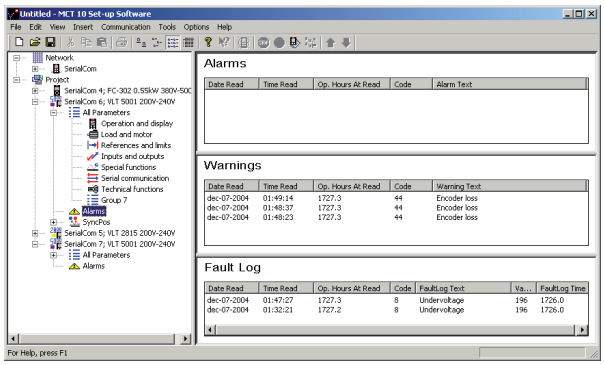


130BT548.10

Illustration 7.3 Update Alarms & Warnings

7.4 Handling the Alarms and Warning Loggings

MCT 10 Set-up Software allows for more than 200 alarms and warnings for each frequency converter in the project. The loggings can be individual cleared. This is done by entering the loggings to clear, and right-click. Clearing the log only clears the PC log, while the information in the frequency converter is unaffected by this handling.



130B7549.11

Illustration 7.4 Loggings

NOTICE

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.

7.5 Scope Function

The scope function supports monitoring and diagnosing of parameters. The function polls parameter data and dynamically displays 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*.

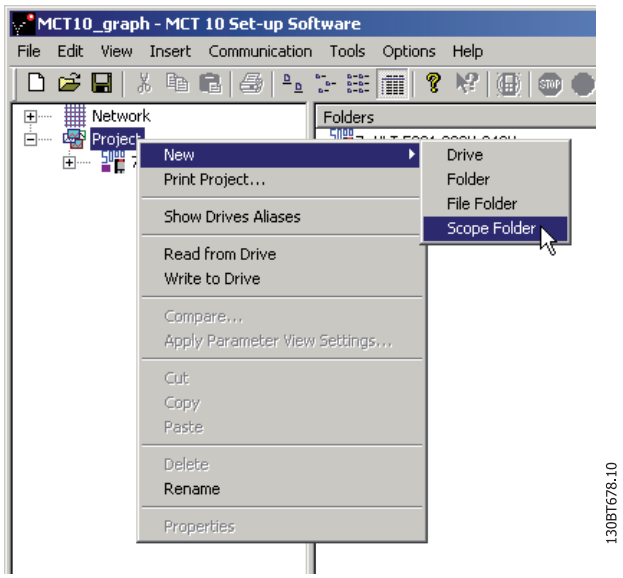


Illustration 7.5 New Scope

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.

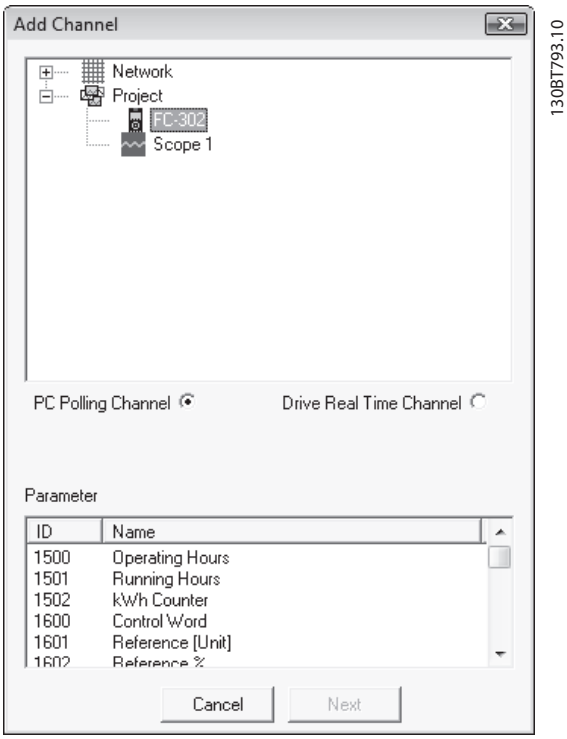


Illustration 7.6 Add Channel

Adding text notes

Insert additional text for later usage to each scope folder such as the type of frequency converter monitored, diagnostic help text, etc. 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.

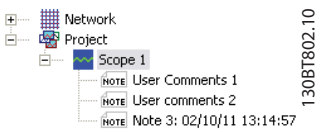


Illustration 7.7 Text Notes

7.5.2 Configure the PC Polling Channel

PC Polling Channel is default enabled when a frequency converter is selected within the Network- or Project folder. All parameters available in the list are visible by ID and Name, and are automatically updated according to the product.

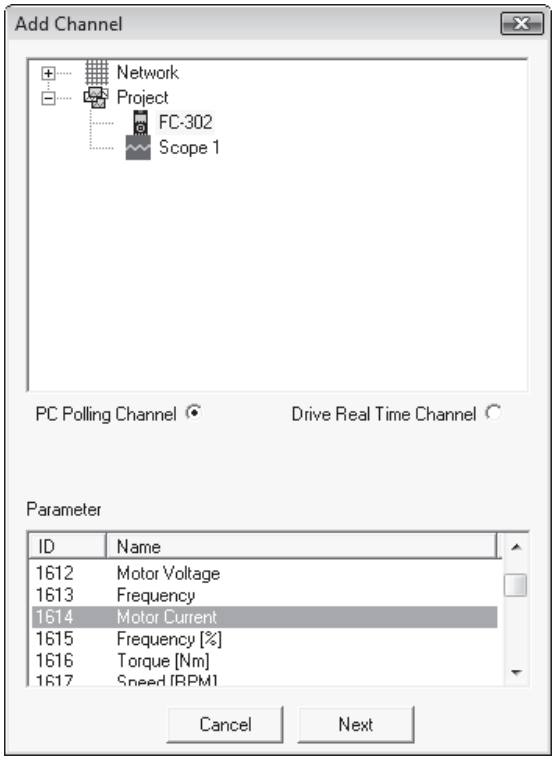


Illustration 7.8 Parameter ID and Name

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

NOTICE

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

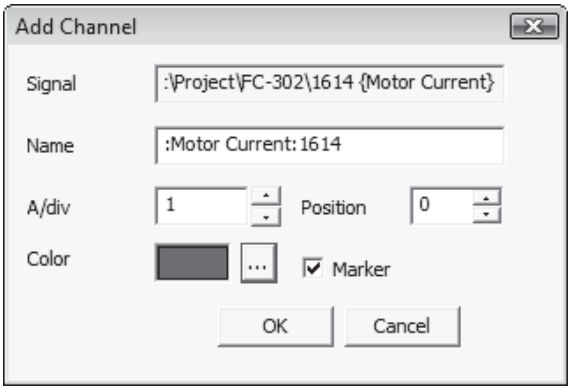


Illustration 7.9 Storring Values

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

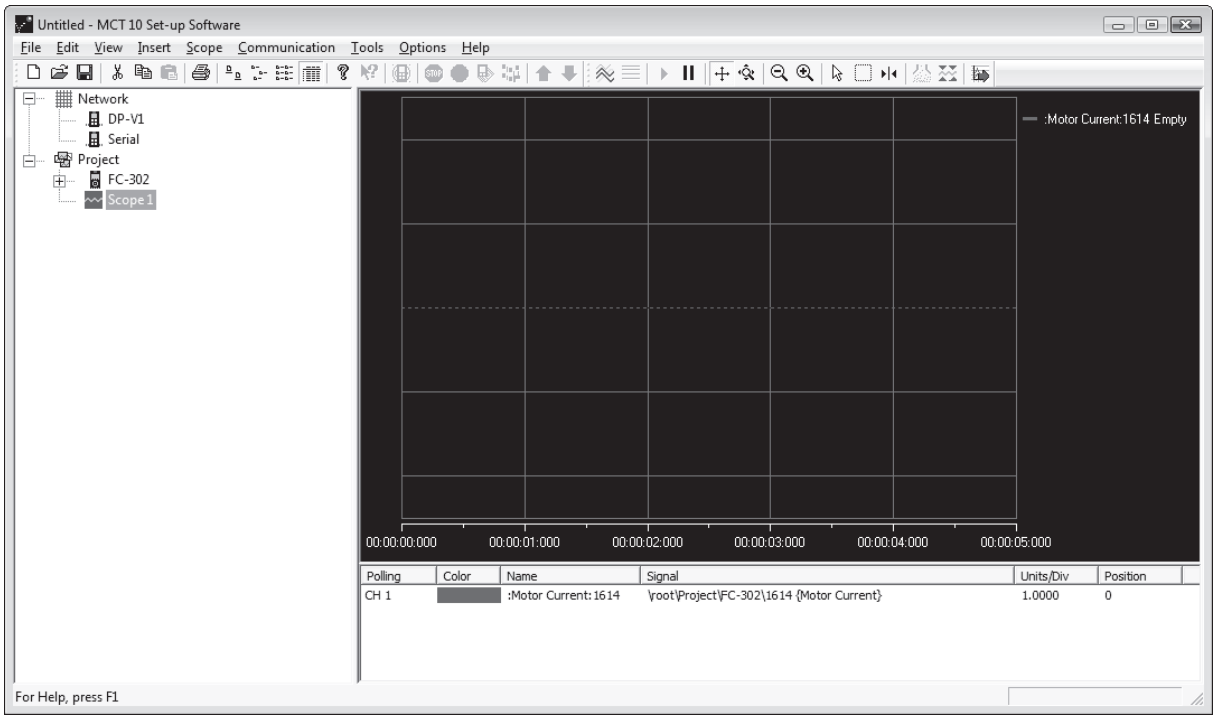


Illustration 7.10 Generate Curve Graph

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

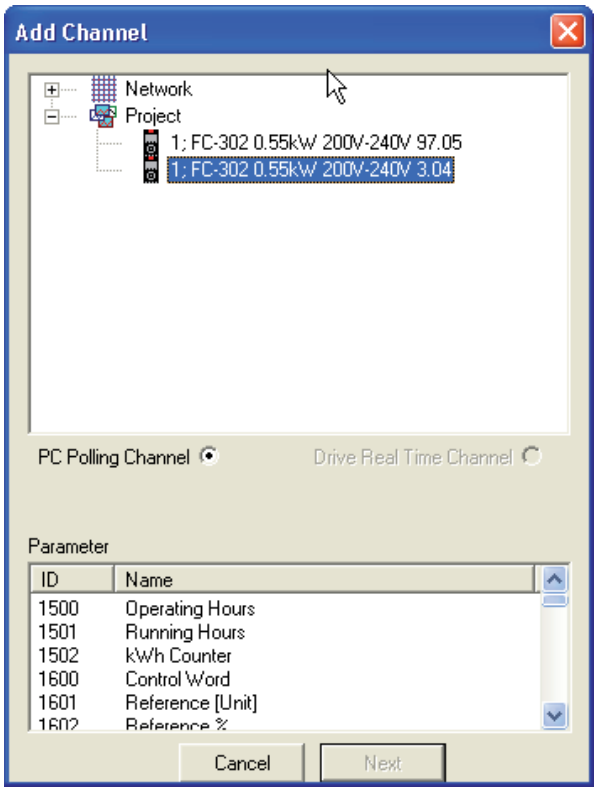


Illustration 7.11 Open Add Channel Dialog

7.5.3 PC Polling Channel Properties

Additional 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*:

1. Seconds per division (SEC/DIV)
2. Time Format
3. Buffer Size in samples
4. Polling Rate in milliseconds

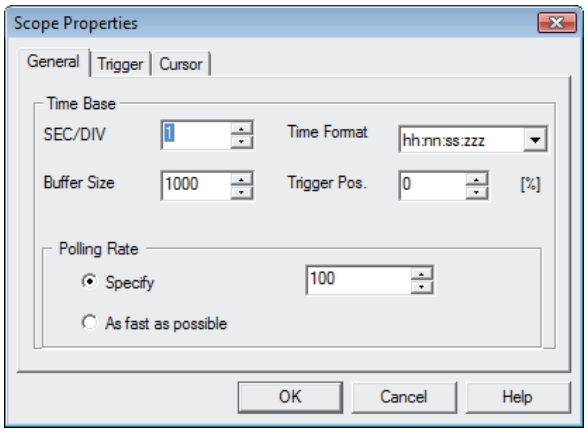


Illustration 7.12 Scope Properties - General Tab

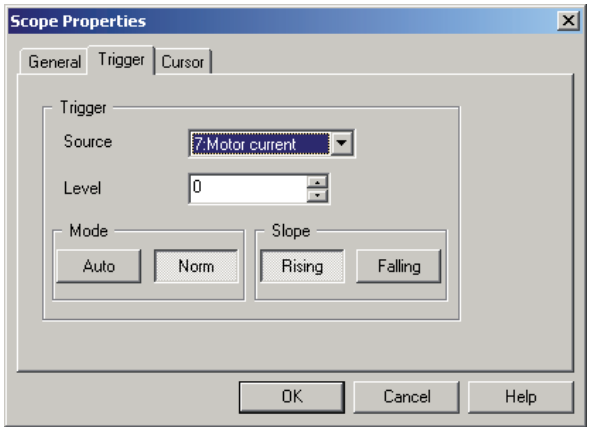


Illustration 7.13 Scope Properties - Trigger Tab

7

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

Table 7.2 Basic Scope Settings

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 two 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 border where the frequency converter does not store any warnings.

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

Table 7.3 Description of 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 two cursors, and the time between the two cursors are calculated.
- Delta Y – works like Delta X, but this time the difference between two levels is calculated.

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

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 one 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.

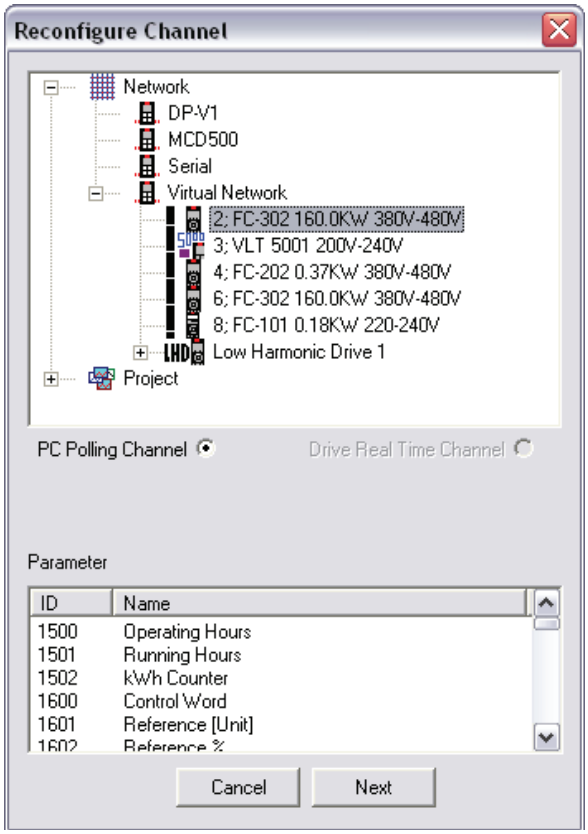


Illustration 7.14 Reconfigure Channel

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.

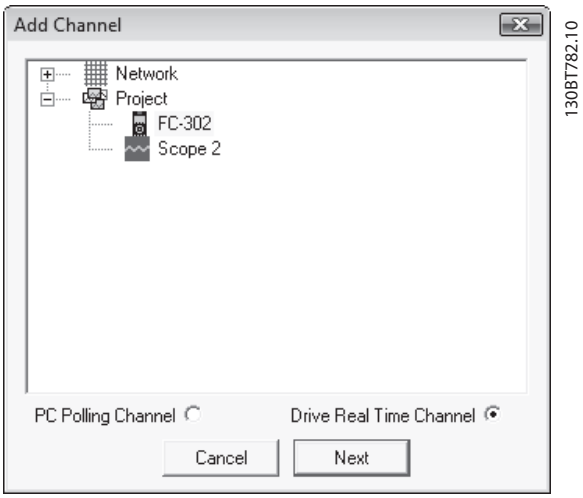


Illustration 7.15 Select Driv Real Time Channel

All available parameters are listed by parameter name.

3. Configure the sample rate for each channel using the time format HH:MM:SS:zzz.
4. Configure sampling mode through the *Trigger Event*, *Logging Mode* and *Samples Before Trigger* options.

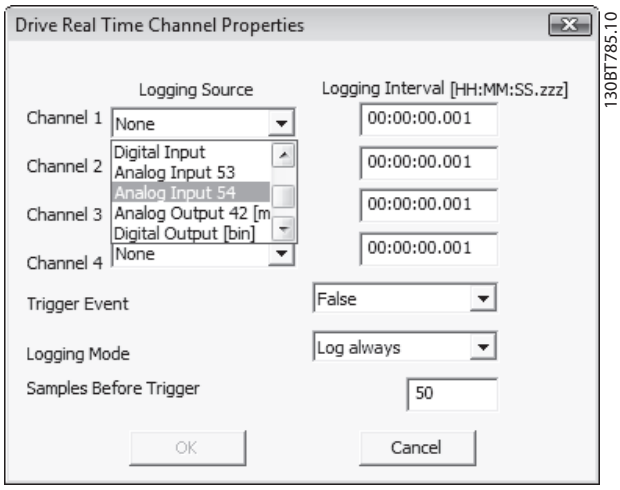


Illustration 7.16 Configure Sampling Mode

7.5.6 Using Advanced Triggers

NOTICE

The *Real Time Channel Trigger Event* utilises 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 needed 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.

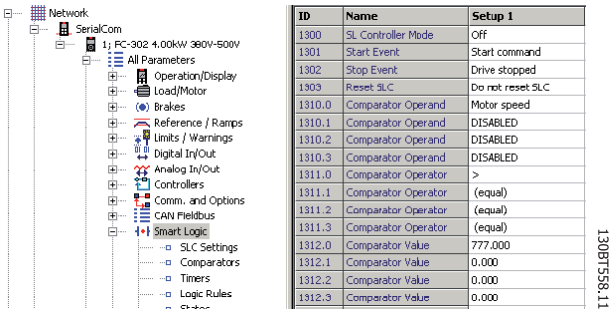


Illustration 7.17 Smart Logic View

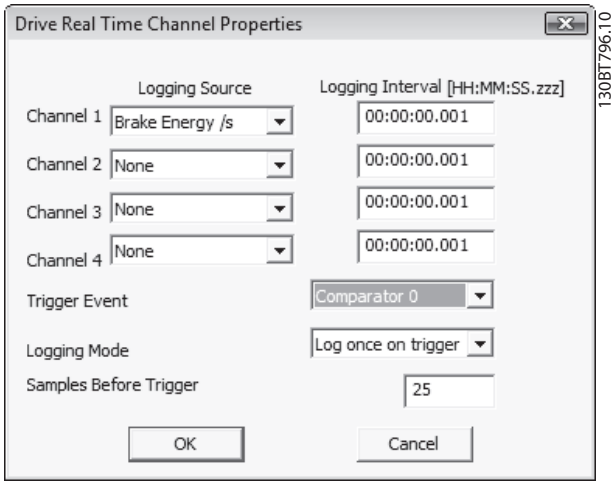


Illustration 7.18 Trigger Event

To start MCT 10 logging, press *Start (resume) Poll* which opens the dialog to define the Real Time log style.

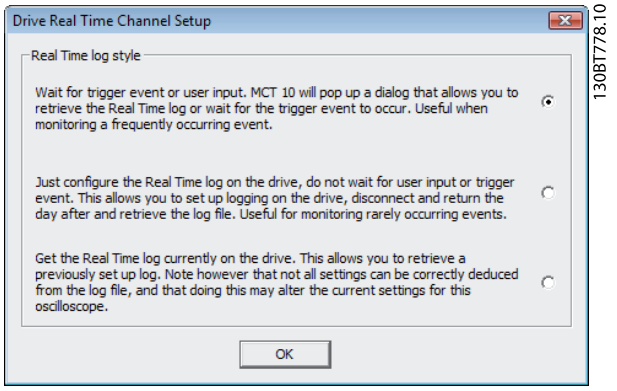


Illustration 7.19 Real Time Log Style

7.5.7 Drive Real Time Channel Properties

Additional 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 additionally to configure:

- SEC/DIV and Time Format
- Appearance settings
- Cursor settings

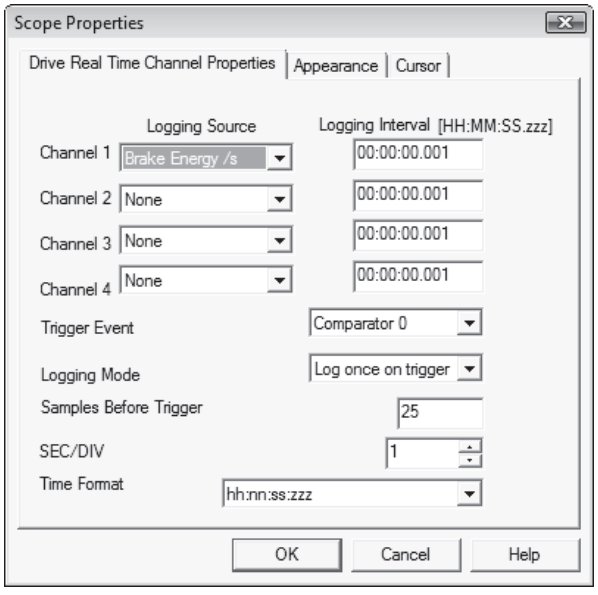


Illustration 7.20 Reconfigure Drive Real Time Channel Settings

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 *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. Buffer remains at its current state, no new data are displayed. The buffer-pointer keeps its current position.

Table 7.4

7.5.9 Additional Functionality

Select *Resume Poll* to start tracking. To stop tracking press *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 one step by clicking

Illustration 7.21 Clear all Buffer for the Channel

Alternatively, the buffer can be cleared individually.

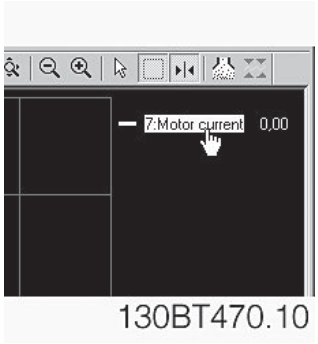
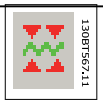
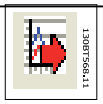


Illustration 7.22 Individually Clear the Buffer

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	Export to Excel enables storing scope data in a file which Microsoft Excel can open. A *Save file* dialog appears, making it possible to store the file in an appropriate location.	

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 pre-determined event. When the specified event occurs, it performs a pre-determined 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 characterised as “true” or “false”. This includes digital commands and logic expressions, which allows 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 controls 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 sub-levels:

- Date and Time
- Working days

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

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 MCT 10 Set-up Software project file or in the drive only when *Change* check-box is checked.

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.

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 (max 5).
4. Set additional non-working days (max 15).

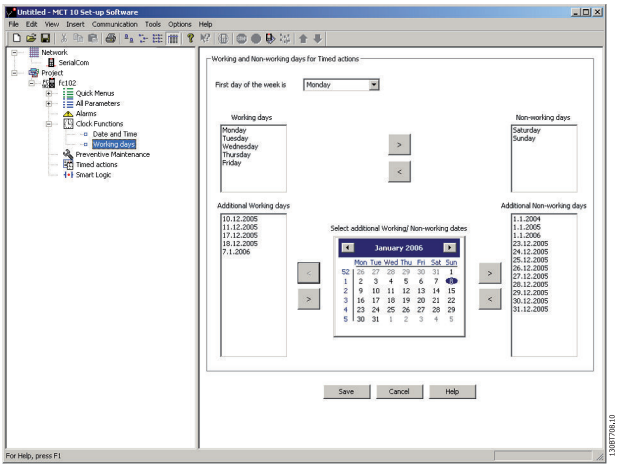


Illustration 9.1 Define Working Days

NOTICE

Additional working dates and non-working dates have 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 is passed, the item is marked red.

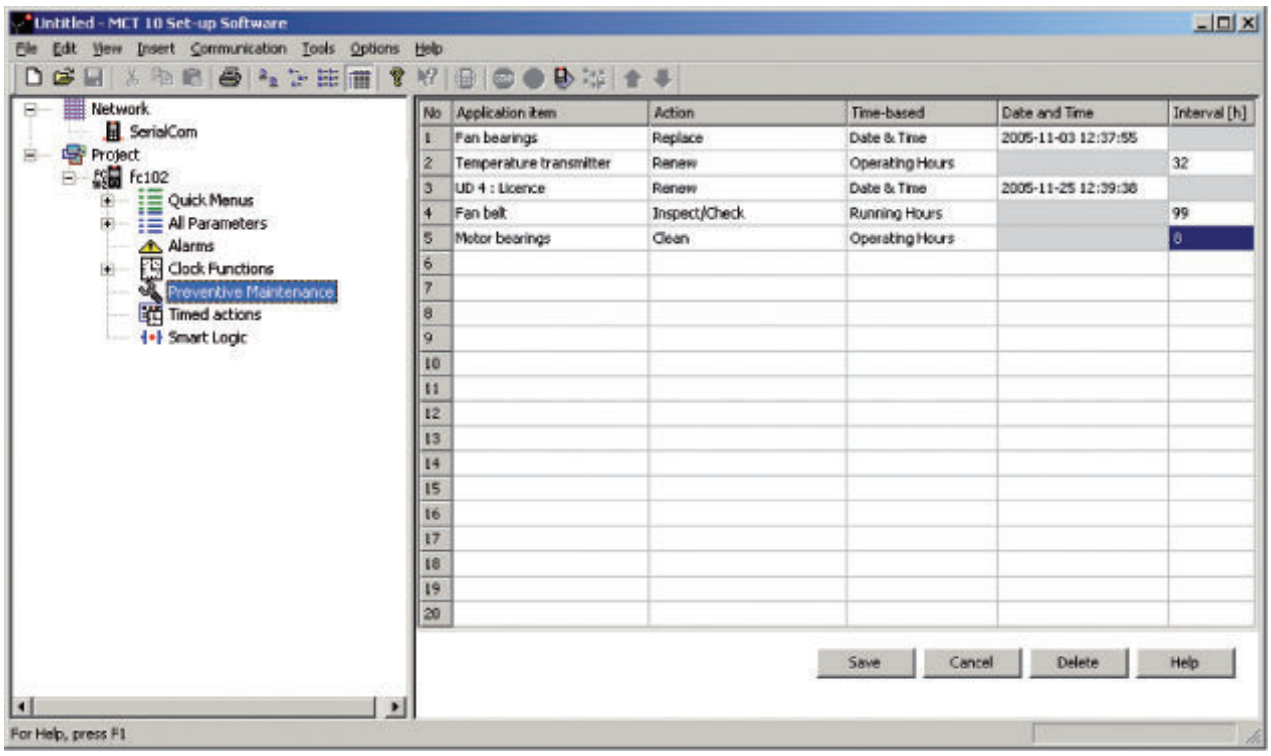


Illustration 9.2 Preventive Maintenance

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

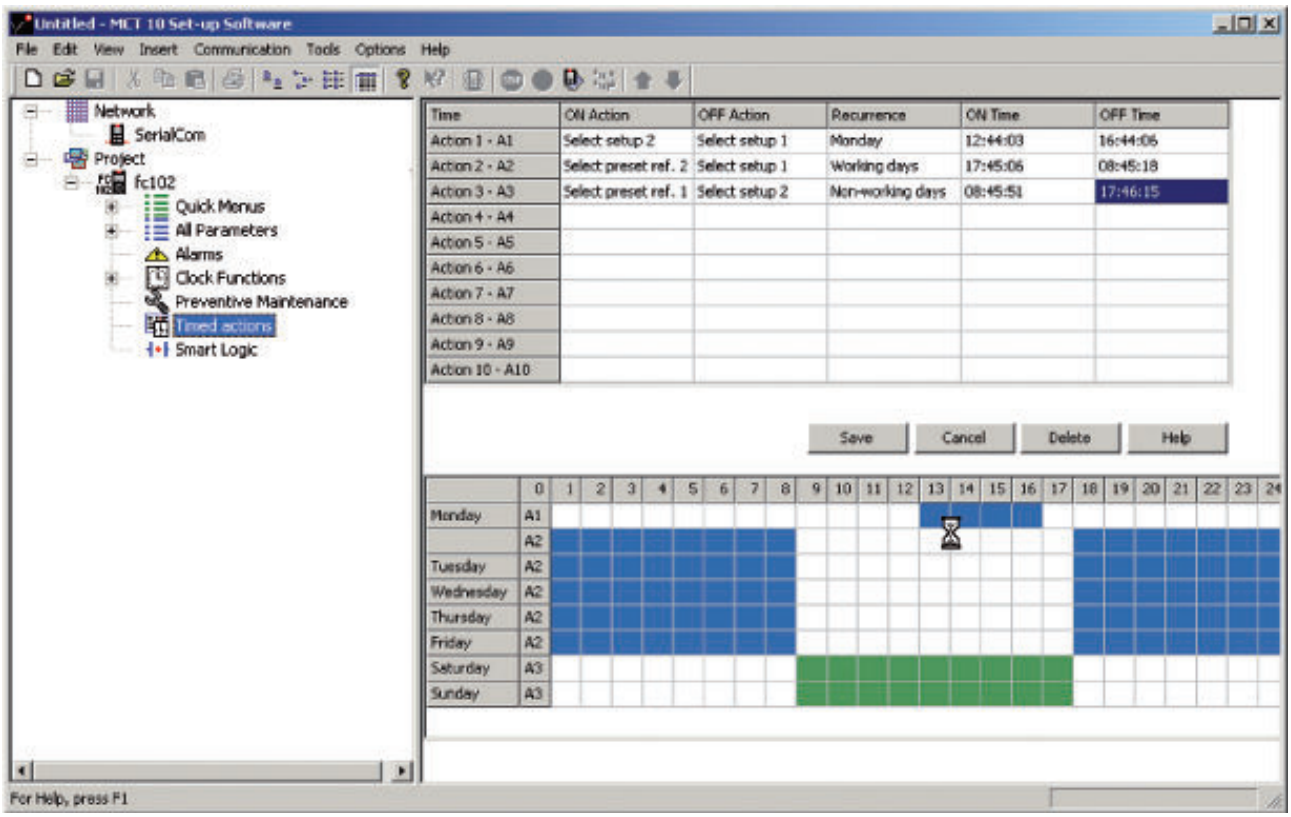


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Illustration 9.3 Time-based Actions

1. Select *Timed Actions* in the product folder.
2. Double-click the cells in the right view to specify
   - action
   - time
   - recurrency

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 *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 few motor failures may be less critical during low or normal operating load, but it can lead to a full stop of the systemin 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 the drive folder in the left side of the screen. Use the plug-in either online directly connected to a frequency converter, or offline for download at a later time. 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 Max.), also below the normal operating points.

Failures or under-load 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*.

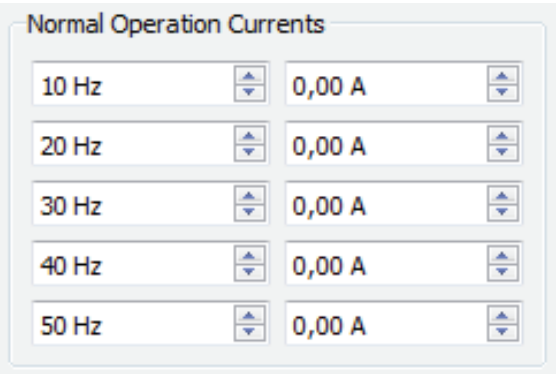

Illustration 10.1 Normal Operation Currents

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 represent normal operation curves. Settings in *Motor Data*, see *Illustration 10.2*, define the threshold of the upper and lower limits.

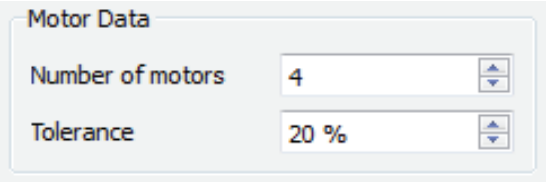

Illustration 10.2 Threshold

- *Number of motors* is a convenience value to reduce the tolerance bandwidth, dividing it by the number of motors used (max. 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*, represent parameter values exactly as they are written to drive. The values are synchronised automatically.

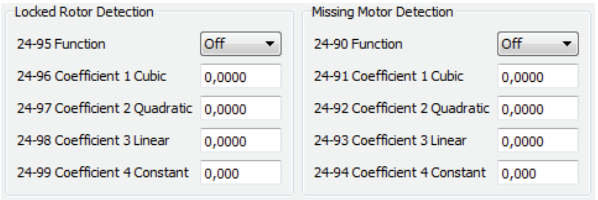

Illustration 10.3 Locked Rotor Detecttion and Missing Motor Detection

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 a part of the software in the FC 100 and 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 an MCO 101 option card installed.
- Advanced Cascade Controller offers the cascade principles similar to Extended Cascade, but allows additional devices to be applied to the control circuitry. It is available only in the FC 202 by utilising the MCO 102 option card.

The add-on option cards MCO 101 and MCO 102 can be used with the Basic Cascade Controller (parameter group *25-** Cascade Conotroller*) 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 option MCO 101/MCO 102.

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

- Preconditions
- Set-up
- System Optimising
- 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

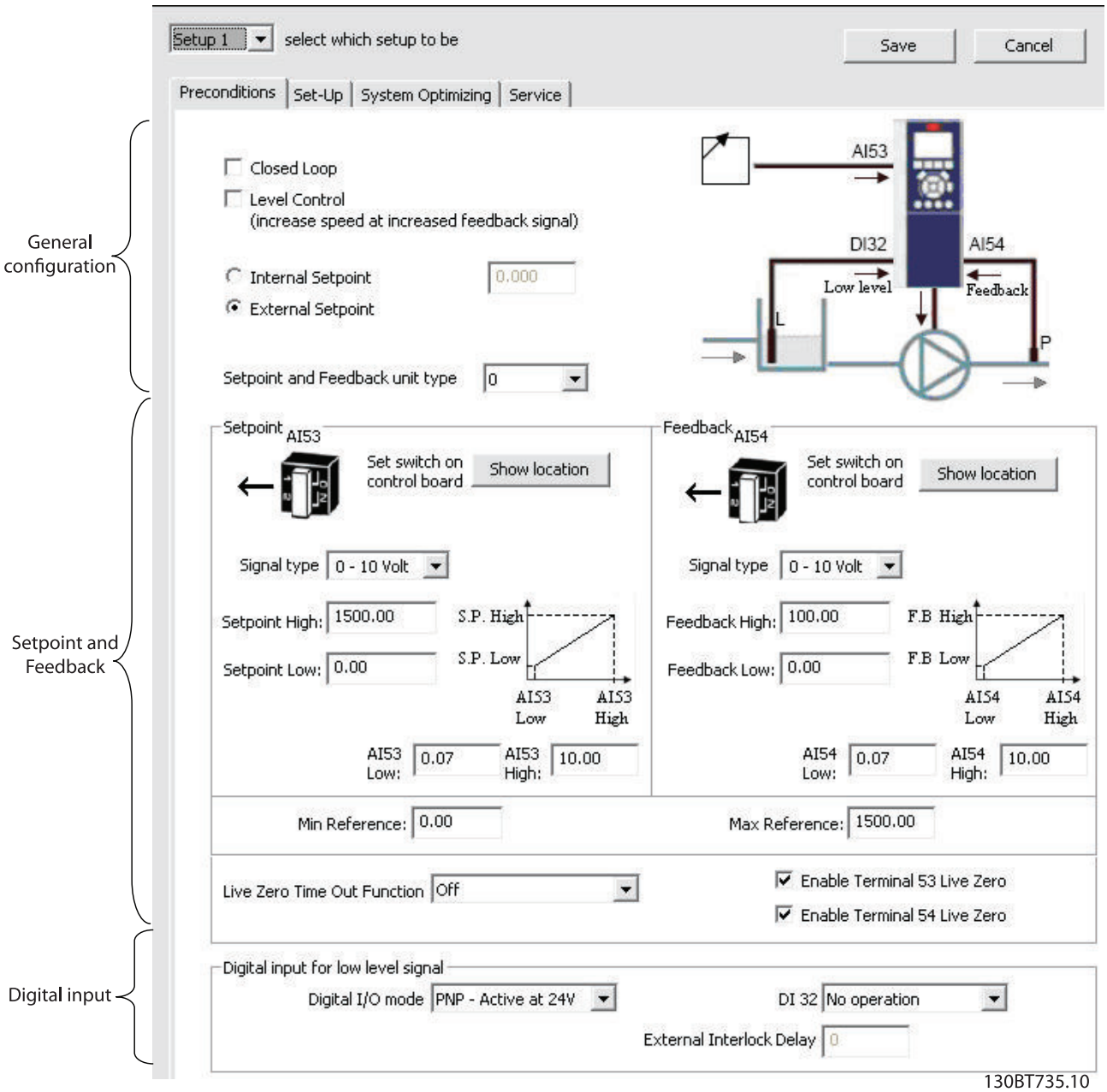

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Illustration 11.1 Preconditions

11

11.1.1 General Configuration

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

Closed Loop checkbox	1-00 Configuration Mode parameter
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 DI32 is enabled.

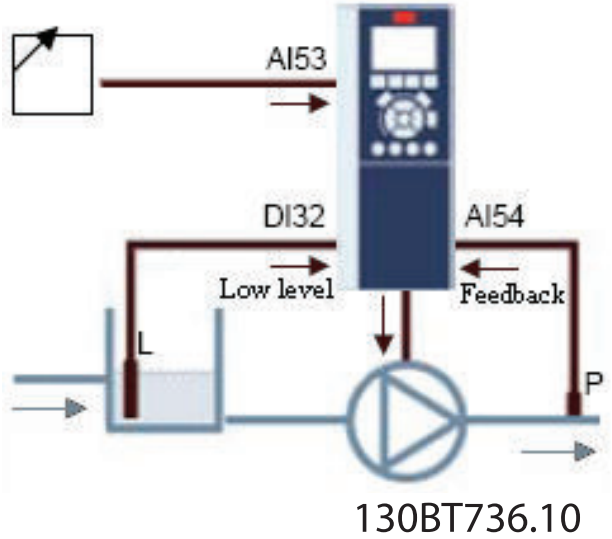

Illustration 11.2 Level Control

Enabling the checkbox configures the PID to inverse control and digital I/O mode and DI32 are disabled. The frequency converter graphic is updated to reflect the general configuration.

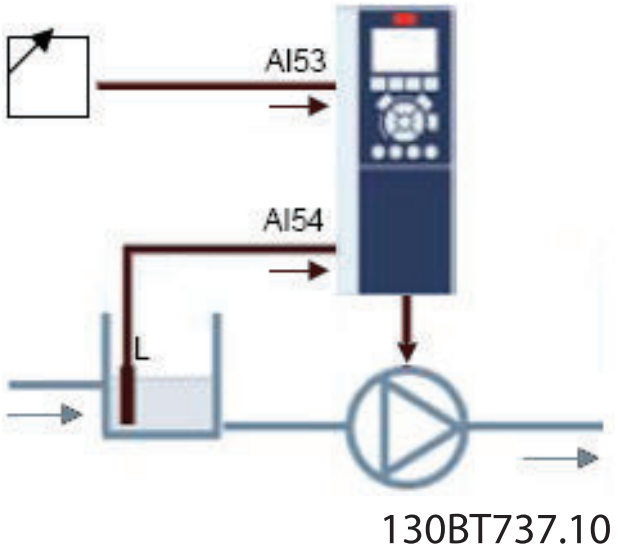

Illustration 11.3 General Configuration

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 remains 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

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

11

11.1.2 Setpoint and Feedback

Configure the analog input used as setpoint and feedback. The general configuration assumes the AI53 (Analog Input 53) is used for the Setpoint and the AI54 (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.

	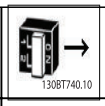
Push the switch to the left to get a 0-10 V signal type.	Push the switch to the right to get a 0-20/4-20 mA signal type.

Table 11.2 Hardware Switches

Setpoint- and Feedback High configure the analog input scaling value corresponding to the maximum reference feedback value. Setpoint- 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
- Max. speed
- Stop and trip
- Select setup 1
- Select setup 2
- Select setup 3
- Select setup 4

The function is activated, if the signal on terminal AI53 or AI54 is below 50% of the value defined in AI53 Low or AI54 Low. Default Live Zero timeout time is 10 s and can be reconfigured in *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.

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

Table 11.3 Setpoint and Feedback Affected Parameters

11.1.3 Digital Input

If a low level signal is available, the DI32 (digital input 32) can be programmed to Stop Inverse or to External Interlock, and an External Interlock delay can be configured. The type of pulse to trigger, can be configured from the Digital I/O Mode dropdown.

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* (FC 202 only).

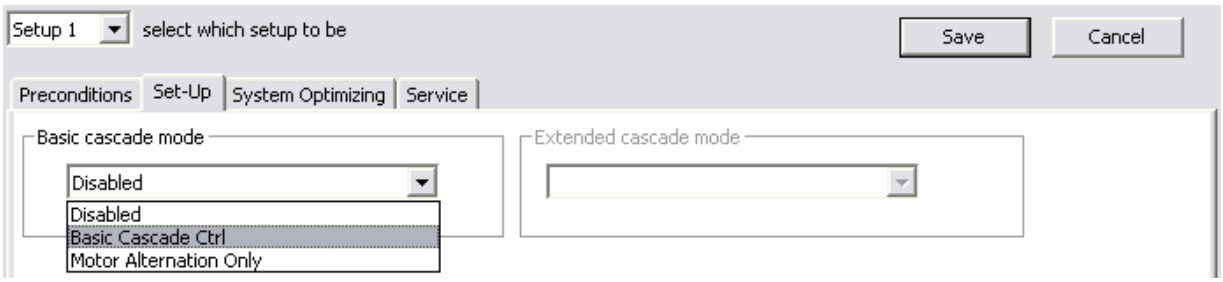

Illustration 11.5 Configuration Interface for Parameter Group 25- Cascade Controller**

11

11.2.1 Basic Cascade Control

Basic Cascade Control
Select Basic Cascade control to configure

- Motor start
- Pump configuration
- Staging/Destaging settings

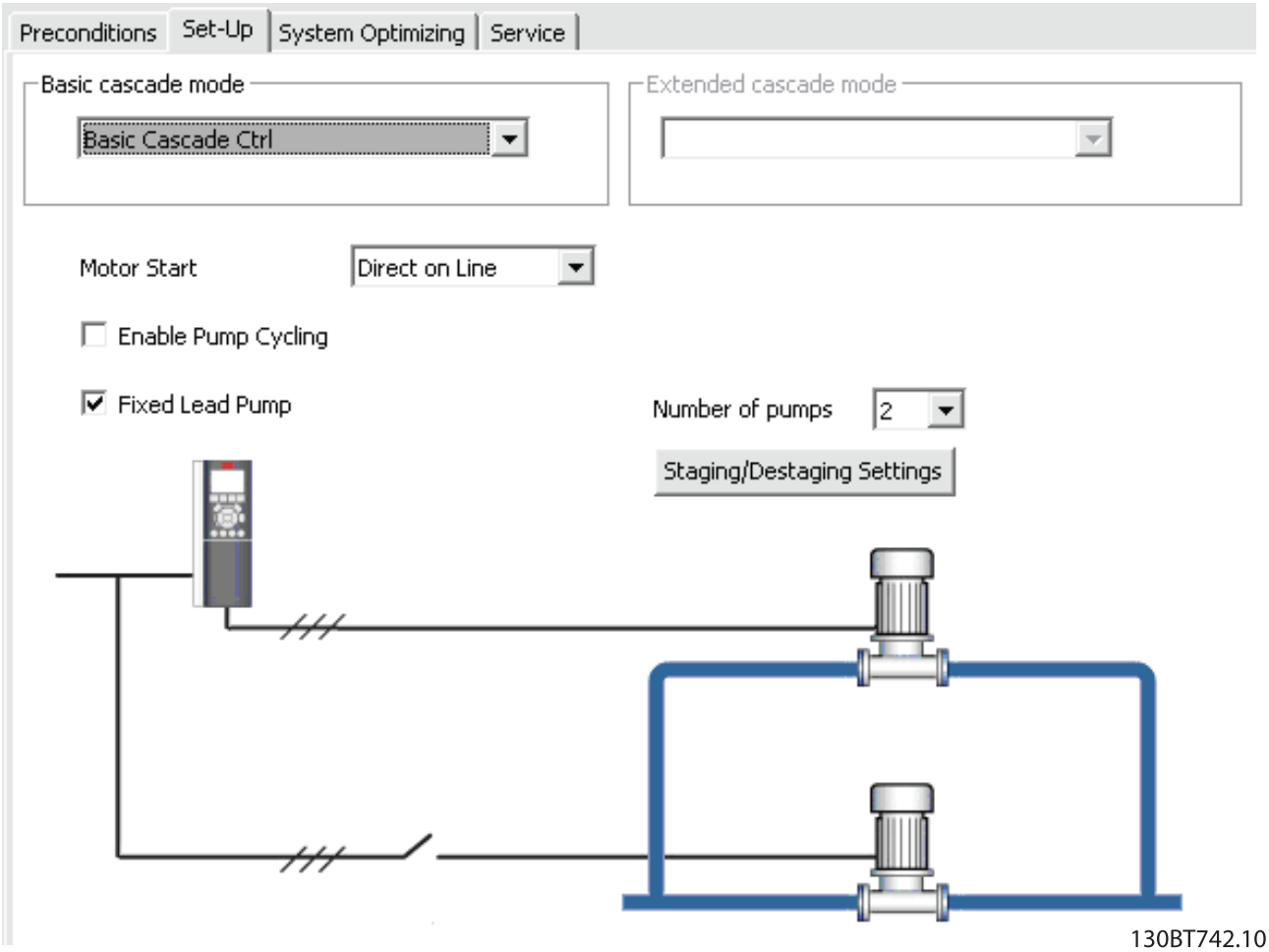

Illustration 11.6 View of Basic Cascade Control Set-up Tab

View	Description
Motor start	This view defines the configuration principle: • Direct on Line – each lag pump is cut in directly via a contactor. • Softstarter – must be used for all fixed speed pumps and can be used to replace traditional contactors. When using softstarters, 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	This view defines whether the pump cycling is enabled or not: • Disabled – lag and lead pumps will be cut in, to have equal operating hours for each pump. • Enabled – Lag pumps will be cut in according to the First in, Last out principle.

View	Description
Fixed lead pump	This view defines whether a drive uses a fixed lead pump or not. The lead pumps are connected directly to the relays on the frequency converter control card. This is illustrated in *Illustration 11.6*. To obtain equal hours of operation within the fixed speed pumps, the lead pump can be alternated. Timers on the relay outputs monitor the operating hours of each pump. When a pump is not operating over a long time, corrosion concerns may reveal. When it is configured for alternating lead pump, select *Alternation details* to set up principles for alternation.
Lead pump alternation	This view instructs the drive to change the lead pump so all pumps run for the same period of time. The following options are available: • Off – no lead pump alternation occurs. • At staging – lead pump alternation occurs at pump staging. • At command – lead pump alternation occurs at explicit commands. • At staging or command – lead pump alternation occurs at pump staging and at explicit commands.
Alternation Time Interval	In this view, define the time period between automatic alternations of the lead pump: • 1 to 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: • Enabled – pump alternation will be carried out only if the capacity is equal or below 50%.
Staging Mode at Alternation	In this view, configure the staging mode at alternation and determine the time of the variable speed pump deceleration: • Quick. • Slow.
Delay before cutting in next pump	In this view, set the time between stopping the old lead pump and starting another. Range: 0.1 s to 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 s to 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, defines the band around the head set point 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 to 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 stabilised. 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- and Up Delay	For use with Sofstarters. 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 Spee High Limit. Available options: RPM or Hz
Enable Staging Function	Avoids frequent staging of fixed speed pumps. Enabling the check box starts the stage function timer. Enable Destage Function ensures 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 11.4 View and Selection Descriptions

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

Table 11.5 Number of Pumps Configurable from the Drop-down

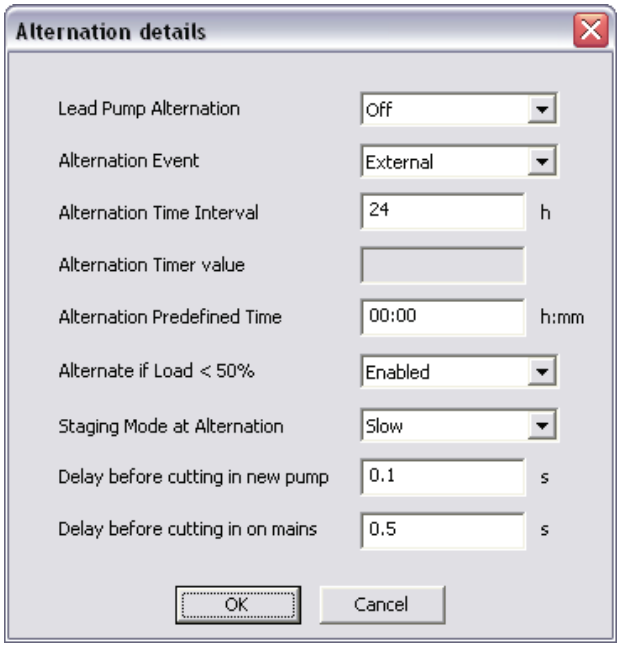

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Illustration 11.7 Alternation Details

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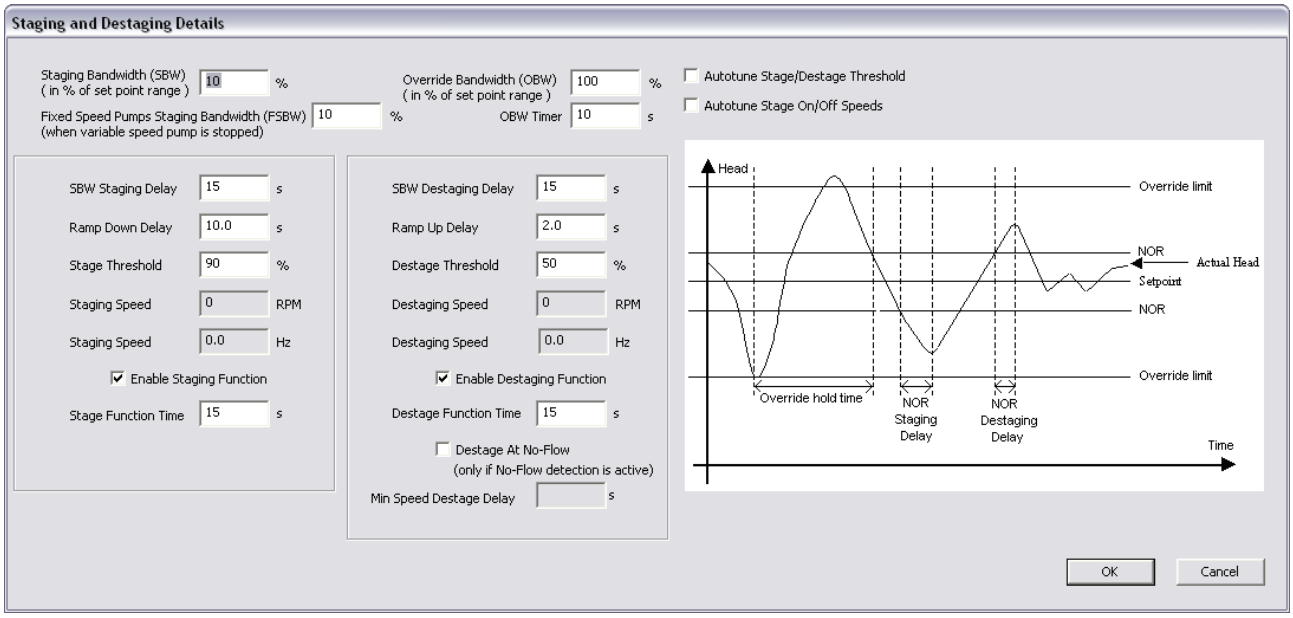
If configuring the Lead Pump Alternation *At command* or *At stating or command*, the Alternation Event can be configured to:

- **External** – Alternation takes place when a signal is applied to one of the digital inputs in the terminal strip.
- **Alternation Time Interval** – Alternation takes place every time *Alternation Time Interval* expires.
- **Sleep Mode** – Alternation takes place each time the lead pump goes into sleep mode. 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.



130BT744.10

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 one 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 one 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 *No Flow* situation.

11.2.2 Motor Alternation Only

In *Motor Alternation Only* one frequency converter and two 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 pre-programmed 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

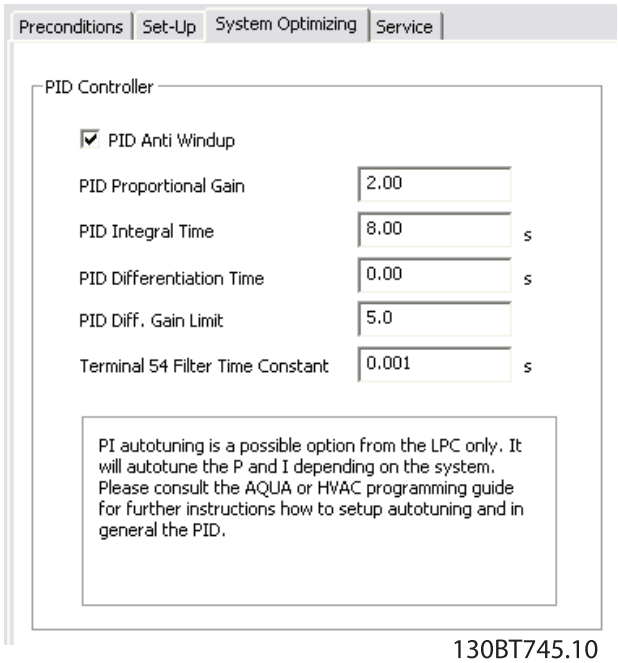


Illustration 11.9 Start and Stop Cascade Controller

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 set-point reference, if its 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 minimun 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 set-point reference, even through 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 set-point 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 to 10.00.
PID Integral Time	The duration of integrating the error between the feedback and the set-point reference, to ensure the error approaches zero. Quick speed adjustments is obtained using a short duration. A too short value. the frequency converter output frequency may become unstable. The time is configurable from 0.01 to 10000.00 s.
PID Differentiation Time	The duration the differentiator monitors the rate of change of the feedback. If its 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 large duration. However, if too large value, the frequency converter output frequency may become unstable. Differential time is useful in situations where very fast responses and precise speed control is required. The time is configurable from 0.00 to 10.00 seconds.
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 to 10.000 s.

Table 11.6 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 two pumps could be “1:D 2:O”. • **1:D** – Pump 1 Running on frequency converter. • **2:O** – Pump 2 Off.	✓	✓

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View	Description	Basic cascade controller	Extended cascade controller
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 is Off to the number of pumps.	✓	✗
Relay status	Select *Relay Status* to update the status of the relays. The status can be • On - the relay is activated • Off - the relay is deactivated The values can only be updated if the frequency converter is online.	✓	✓
Relay ON time	Monitors the total operating hours of the connected relay. The resolution is in operating hours. *Reset Relay Counter* resets all Relay On Times. It is only available, if the frequency converters is connected online.	✓	✗
Pump interlock	Disables a certain pump and is configurable from a checkbox located at each pump.	✓	✗
Pump ON Time	Monitors the total operating hours of the connected pump. The resolution is in operating hours. *Reset* clears the operating hours of a specific pump.	✓	✗
Current runtime hours	Readout of the total number of operating hours for each pump since last reset. The time is used to balance the operating hours between pumps.	✗	✓
Pump total lifetime hours	Total operating hours for each connected pump.	✗	✓
Manual pumps control	Readout of the command parameter that allows manual control of individual pump states.	✗	✓
Reset relay counter	Resets all Relay On times. Only available if the frequency converter is online.	✗	✓

Table 11.7 Service Tab Views

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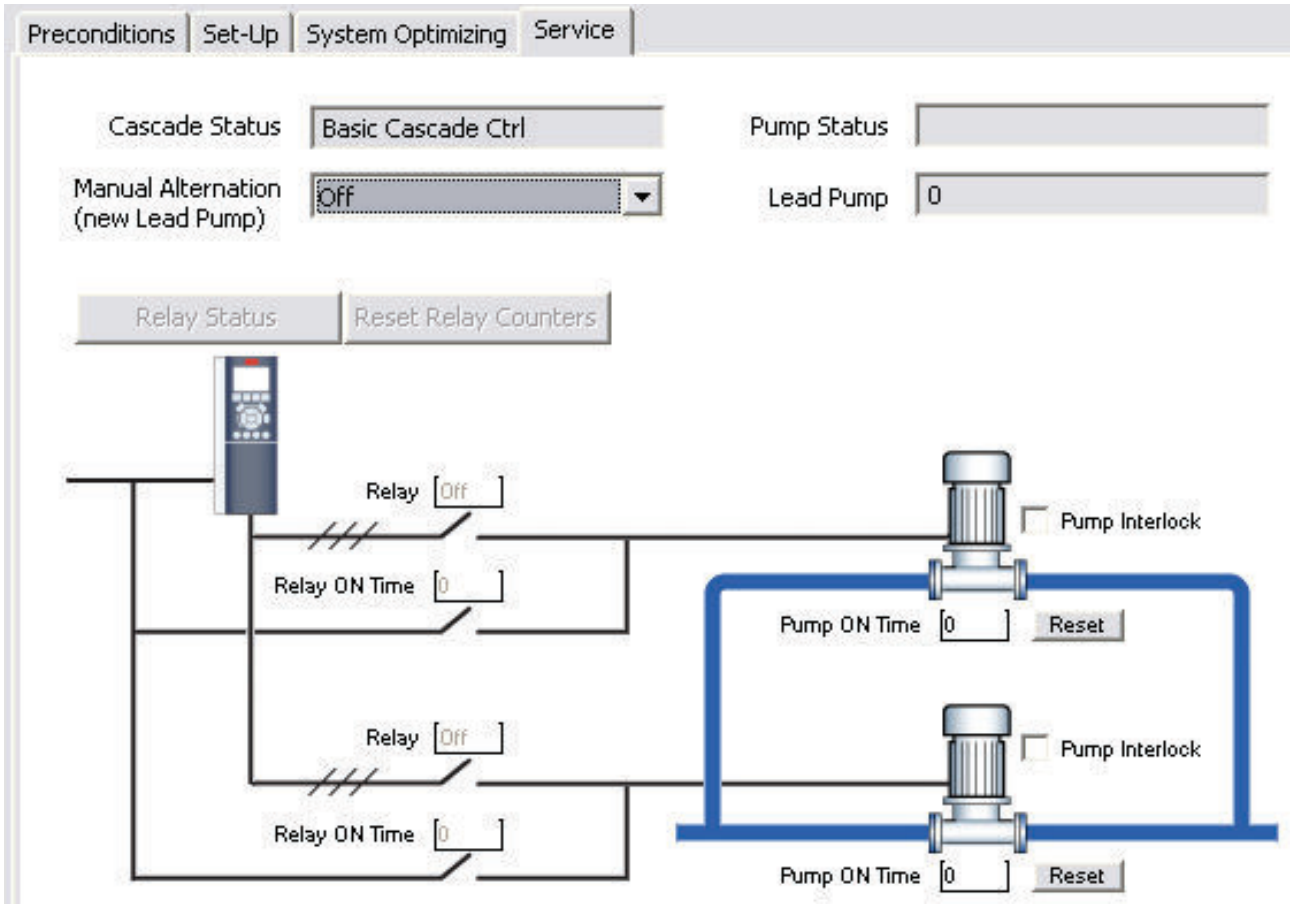

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Illustration 11.10 Service Tab Basic Cascade Controller

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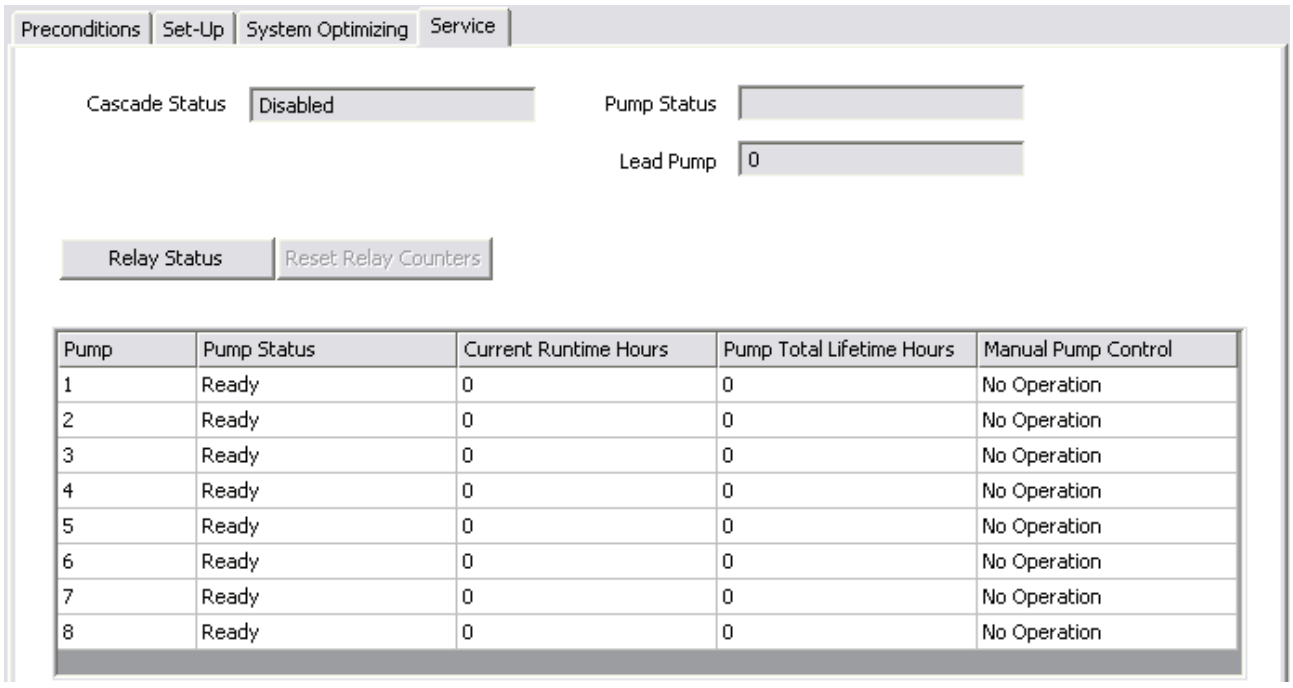

Pump	Pump Status	Current Runtime Hours	Pump Total Lifetime Hours	Manual Pump Control
1	Ready	0	0	No Operation
2	Ready	0	0	No Operation
3	Ready	0	0	No Operation
4	Ready	0	0	No Operation
5	Ready	0	0	No Operation
6	Ready	0	0	No Operation
7	Ready	0	0	No Operation
8	Ready	0	0	No Operation

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Illustration 11.11 Service Tab Extended Cascade Controller

View	Status	Status description
Cascade status	Disabled	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 is controlling the pumps
	Running FSBW	the frequency is tripped off and the Cascade Controller is controlling the fixed speed pumps based on Fixed Speed Bandwidth
	Staging	The Cascade Controller is staging fixed speed pumps
	Destaging	The Cascade Controller is destaging fixed speed pumps
	Alternating	The Lead Pump Alternation selection is different than Off and an alternation sequence is taking place
	Lead Not Set	No pump 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 of the cascade controller
	Alternate On	Forces the selected pump to be the lead pump
	Offline-Off	Turns the pump off and makes the pump unavailable for cascading
	Offline-On	Turns the pump on and makes the pump unavailable for cascading
	Offline-Spin	Initiates a pump spin

Table 11.8 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.

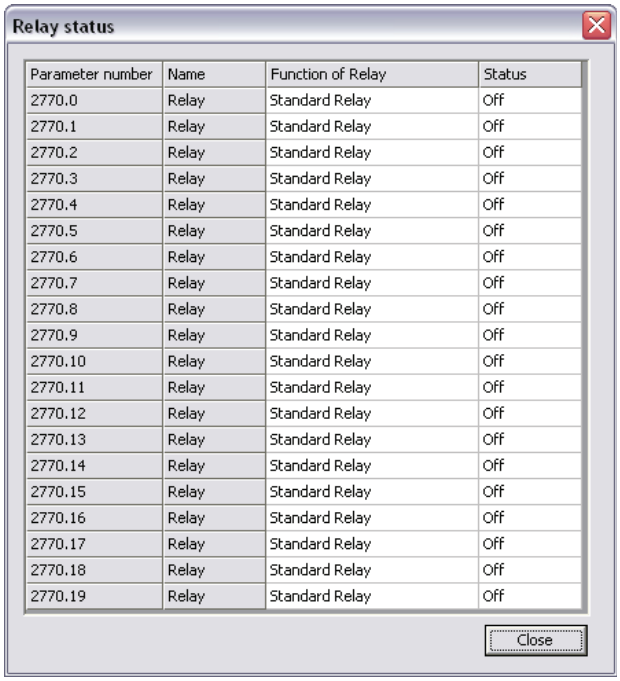

Illustration 11.12 Relay Status

11.5 Extended Cascade Controller Functions

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

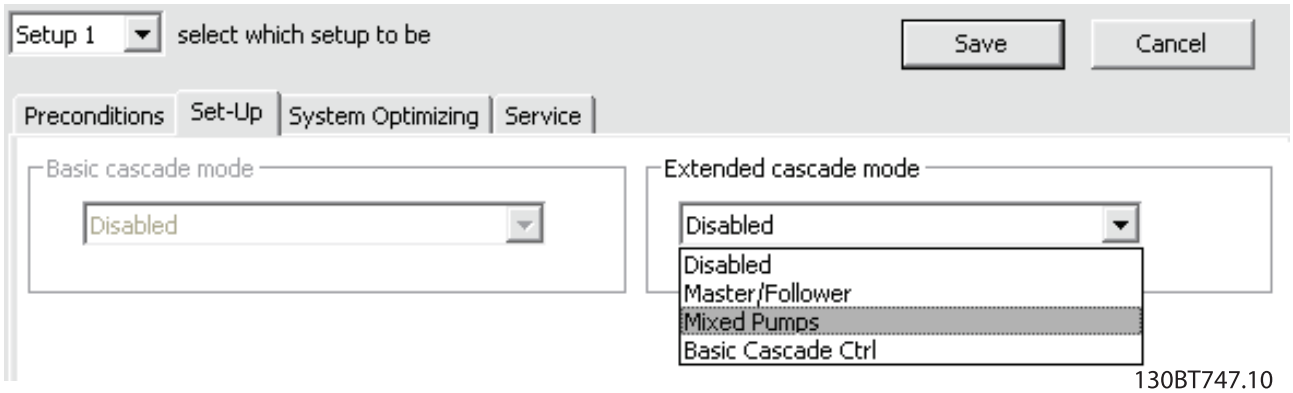

Illustration 11.13 Relay Status

11.5.1 Master/Follower

This view allows for configuring:

- Motor Start
- Pump Configuration
- Connections

- Staging/Destaging
- Master Pulse Output Signal
- Spin time unused pump
- Runtime Balancing

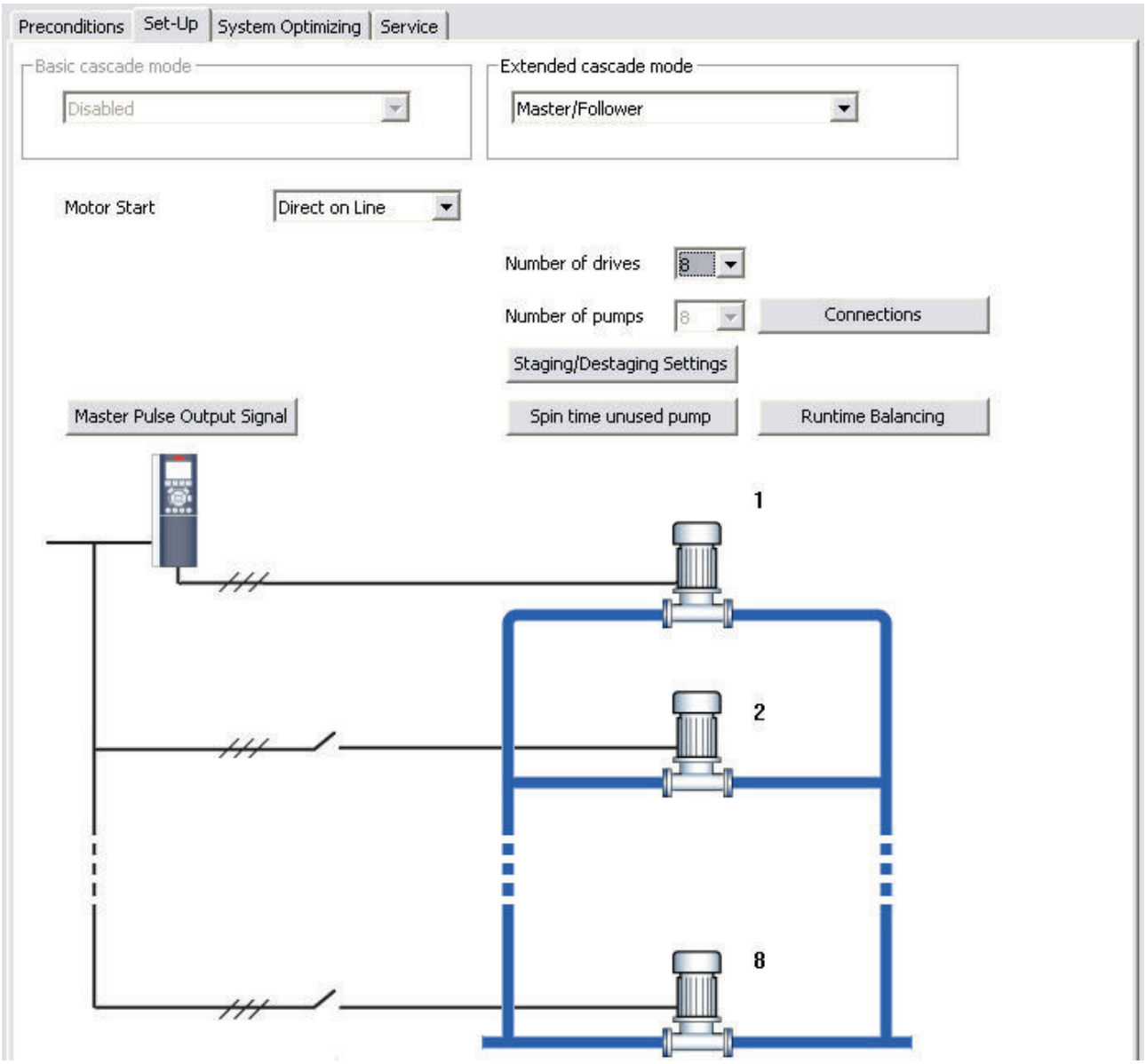

Illustration 11.14 Master/Follower

The *Motor Start* drop-down is similar the configuration available in *11.2.1 Basic Cascade Control*.

Each pump is controlled by a frequency converter and the number of frequency converters corresponds 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 MCO 101 and up to 8 with the MCO 102 add-on option.

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

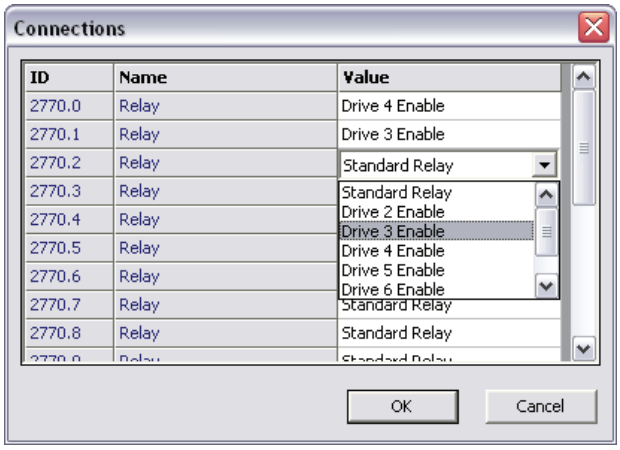

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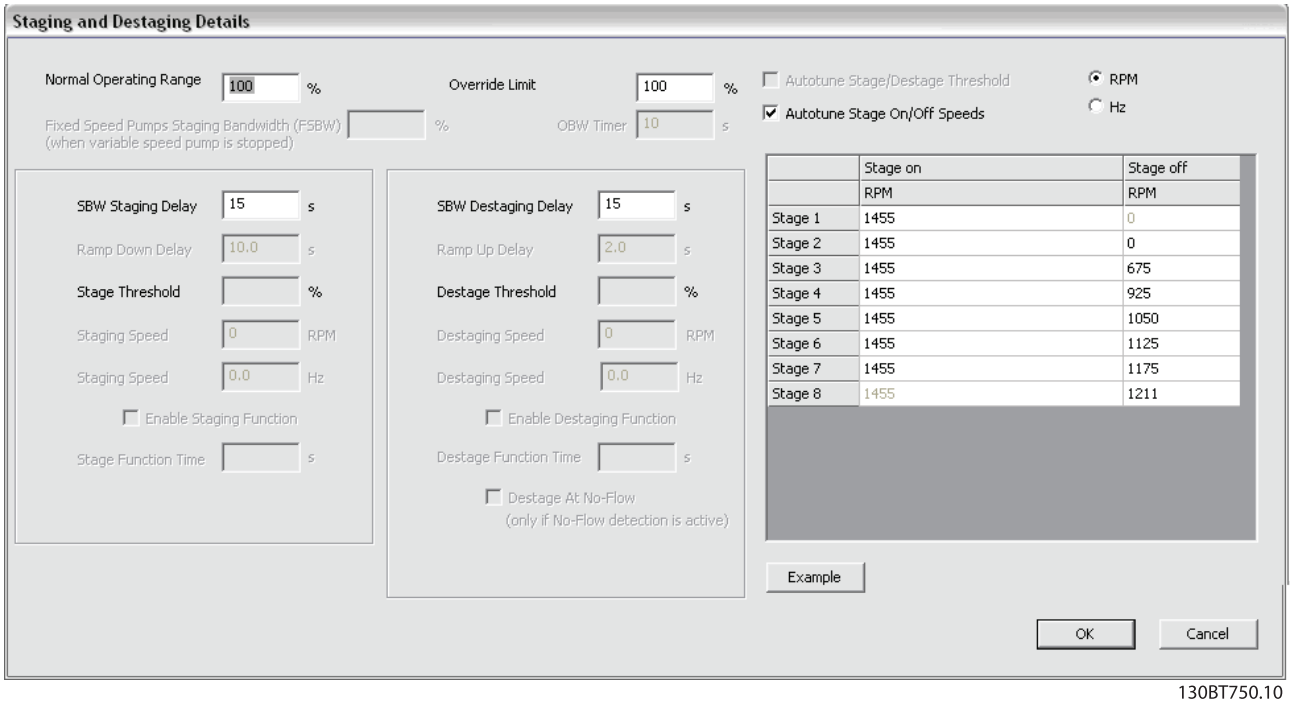
Illustration 11.15 Configure Relay Function

NOTICE

Number of available relays depends on 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 MCB 105 may also be used as an expansion.

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



130BT750.10

Illustration 11.16 Staging and Destaging Details

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Field	Description
Normal Operating Range	The allowed offset from the set-point before a pump may be added or removed. The system must be out of the limit for the time specified in *Staging Delay*.
Override Limit	The allowed offset from the set-point before a pump immediately is added or removed.
Autotune Stage/Destage Threshold	Optimises the threshold values during operation. The settings are updated to prevent pressure over and undershoots when staging and destaging.
Autotune Stage On/Off Speeds	Stage on and off speeds are continually auto tuned during operation. Sittings are optimised to ensure high performance and low energy consumption.

Table 11.9 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- and *Ramp Up Delay* are only configurable when the *Motor Start* is configured to *Softstarter*.

Select *Master Pulse Output Signal* to configure terminal 27 on the master frequency converter.

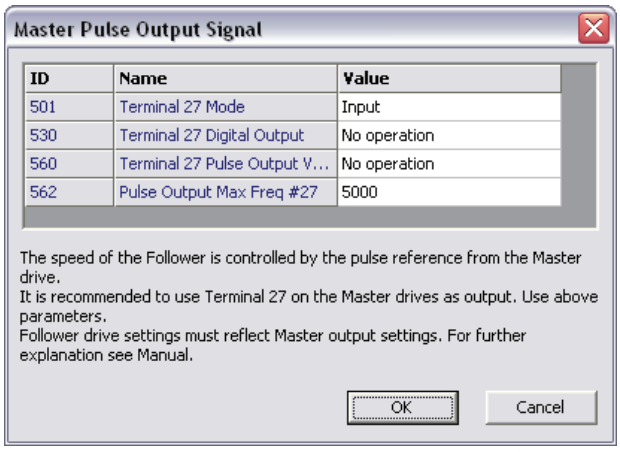

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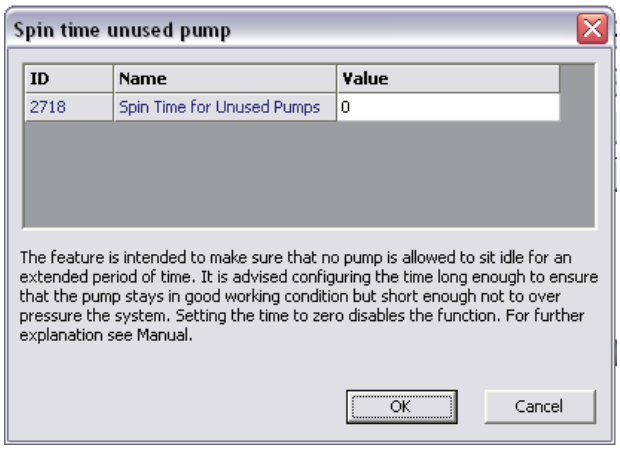
Illustration 11.17 Master Pulse Output Signal

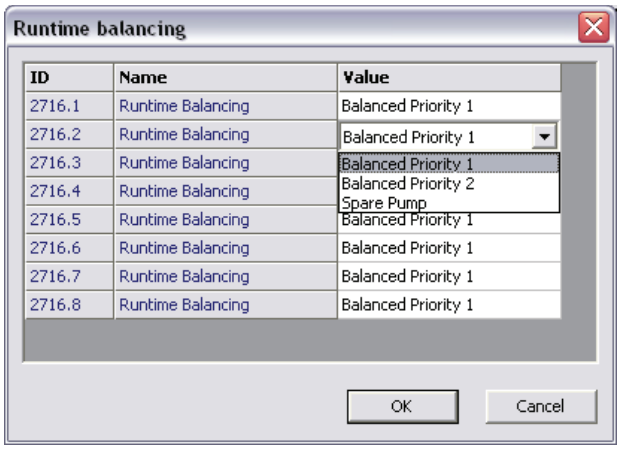
In some applications, not all pumps are used on a regularly basis. Select *Spin time unused pump* to configure the time a pump is allowed to idle.



130BT752.10

Illustration 11.18 Spin Time unused Pump

Select *Runtime balancing* to balance the running hours of the available pumps. 3 balancing priorities are available for each pump.



130BT753.10

Illustration 11.19 Balance Running Hours

11.5.2 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 *11.2.1 Basic Cascade Control*, but with the additional possibility to configure Star/Delta.

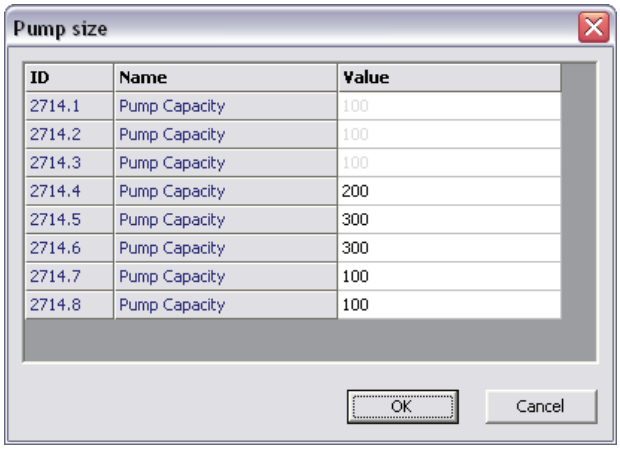
Mixed Pumps Cascade Mode can be configured to:

Mode	Description
Mixed pump	A mix of variable speed pumps connected to frequency converters as well as 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 two pumps along with controlling additional fixed speed pumps.

Table 11.10 Mixed Pump Cascade Modes

Up to 6 pumps can be controlled with MCO 101 and up to 8 with the MCO 102 add-on option.

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

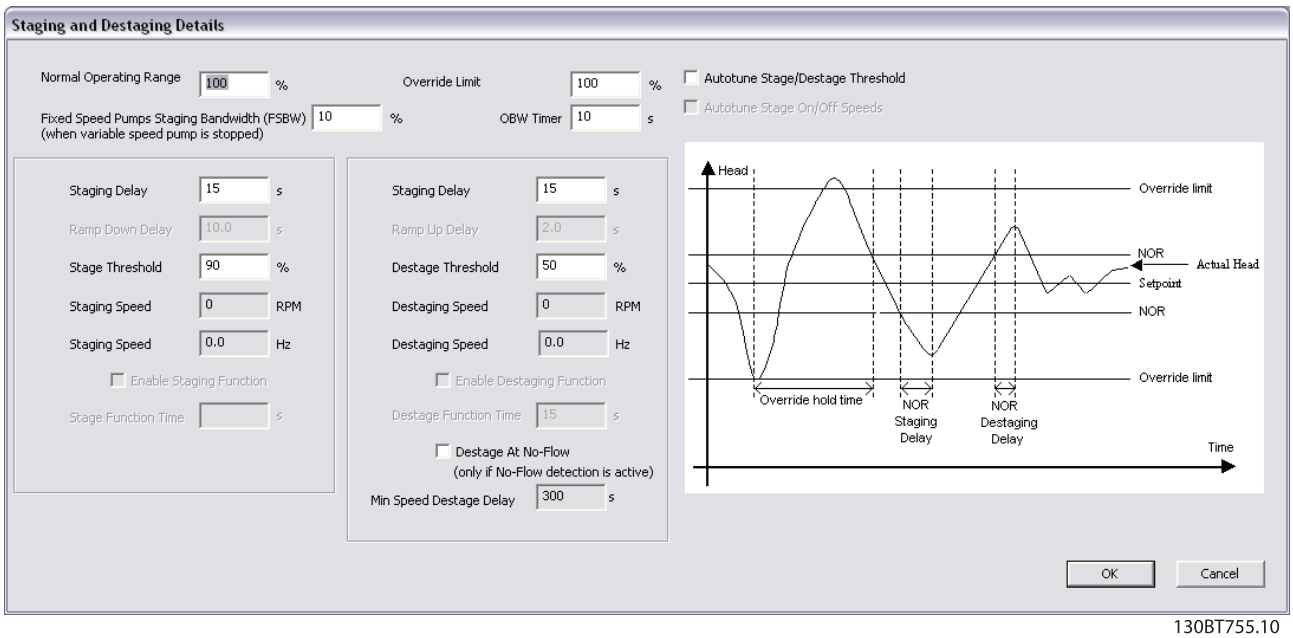


130BT754.10

Illustration 11.20 Configure Fixed Pump Capacity

For configuration of *Connection*, refer to *11.5.1 Master/Follower* configuration. For *Mixed Pumps Alternation Details* configuration, refer to*11.2.1 Basic Cascade Control*.

The dialog *Staging/Destaging settings* is similar to *11.2.1 Basic Cascade Control* with the additional option to configure *Min 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.



130BT755.10

Illustration 11.21 Staging/Destaging

Spin time unused pump and *Runtime Balancing* configuration is similar to the *Master/Follower 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 initialise the frequency converter to reduce the time for commissioning. Files can only be flashed via the serial bus RS-485 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
FC 51	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FC 101	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MCB 102	Yes	Yes	Yes	Yes	Yes	N/A	N/A
FC 202	Yes	Yes	Yes	Yes	Yes	N/A	N/A
FC 300	Yes	Yes	Yes	Yes	Yes	Yes*	Yes*
Derived versions of the FC series	Yes	Yes	Yes	Yes	Yes	N/A	N/A
AAF005	Yes	Yes	Yes	Yes	Yes	N/A	N/A

Table 12.1 Available Features

** 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.

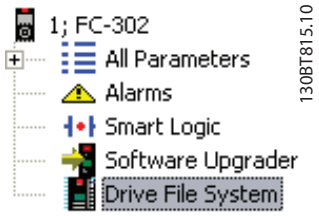


Illustration 12.1 Drive File Manager Plug-In

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 *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*. 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.

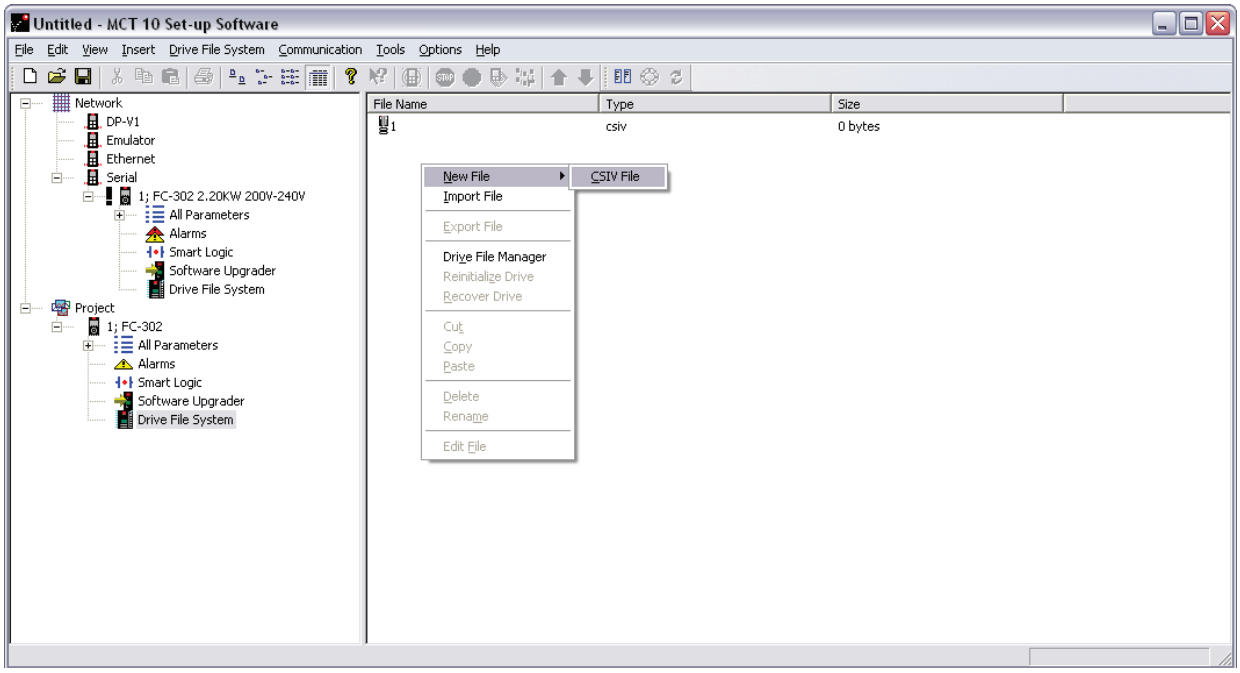


Illustration 12.2 Create CSIV Files

CSIV files containing initialisation 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 auto generated 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 dependant 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 from the frequency converter firmware version, except if one 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.

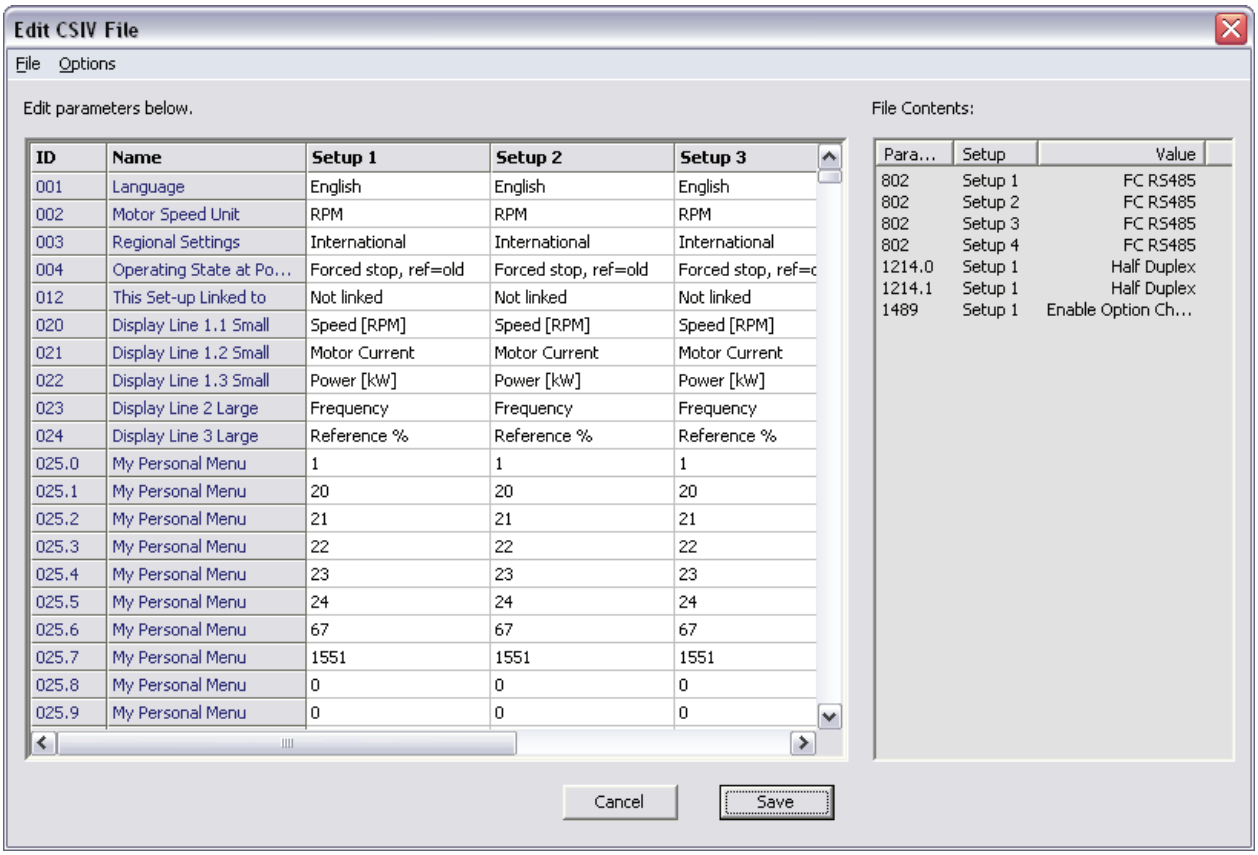

Illustration 12.3 Parameter Settings Imported from the Project and the Actual CSIV File Content

Left View contains the parameter settings imported from the project. Right View lists the actual CSIV file content.

1. 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 – applies the initialisation 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.
2. Press *Save* to save the parameter settings from the File content to the CSIV file.

   Press *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.

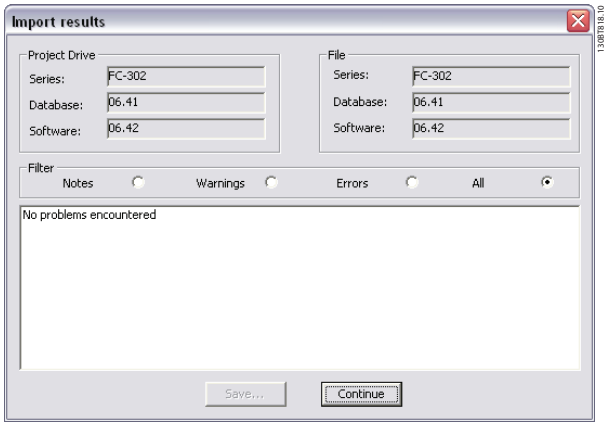

Illustration 12.4 Validation

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

12.3 Drive File Manager

Files can be downloaded or existing ones erased in the frequency converter from the *Drive File Manager* available from the menu.

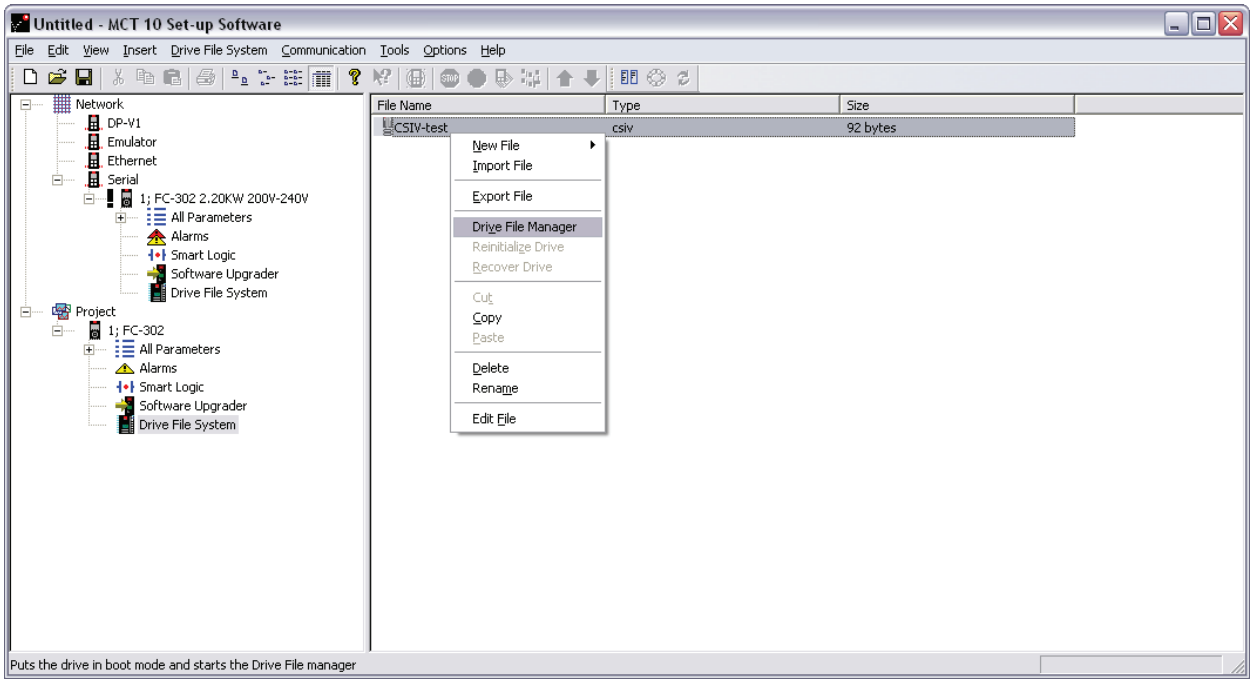

Illustration 12.5 Drive File Manager

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

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 Upgrader* plug-in.

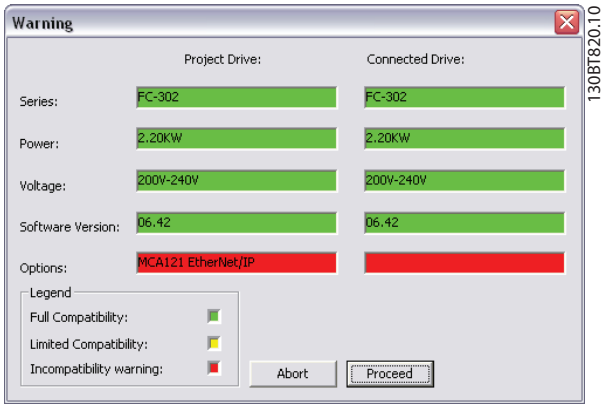

Illustration 12.6 Service Mode

The *Drive File Manager* is divided in a left pane named *Project Drive* and a right pane named *Connected Drive*.
Project Drive – lists the files in the project.
Connected Drive – lists the files present in the frequency converter flash file system.

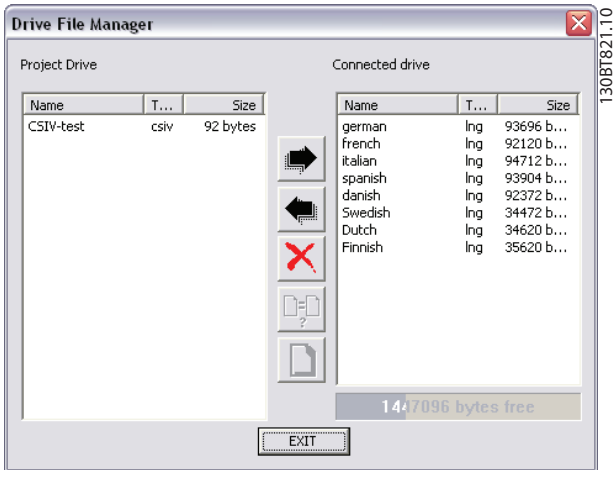

Illustration 12.7 Present Files

3 buttons are located in the middle of the view

Illustration 12.8 Right Arrow

Right arrow transfers the file(s) from the project to the frequency converter Flash File System.

Illustration 12.9 Left Arrow

Left arrow transfers the file(s) from the frequency converter Flash File System to the project.

Illustration 12.10 Exit

Exit button closes the frequency converter *File Manager* and switches the frequency converter back to normal mode.

12

13 Functional Safety Configuration Plug-in

13.1 Introduction

The MCB 15x safety functions are 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.

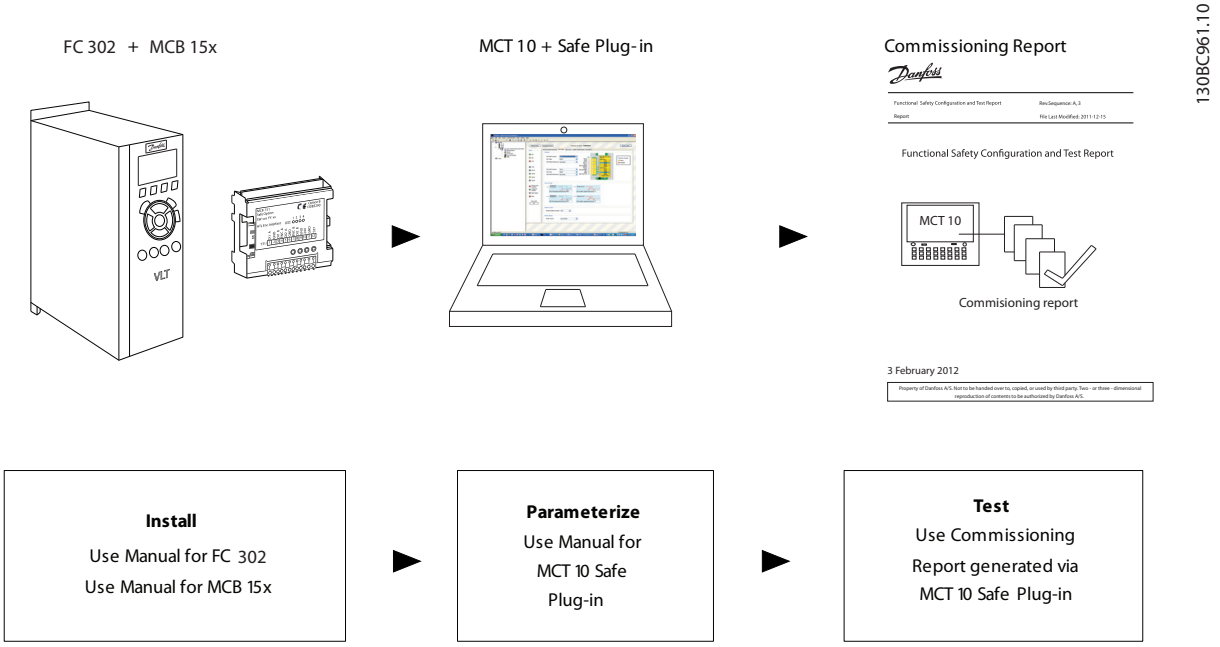

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Illustration 13.1 System Overview

Referenced literature

- VLT® AutomationDrive FC 302 Operating Instructions

13.1.1 Safe Option Compatibility

MCB 15x Safe Option 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
  - RS-232 to RS-485
  - USB to RS-485
- USB
- PROFIBUS DP.V1

The MCT 10 safe plug-in for the MCB 15x safe option offers the following features

- Offline project planning and preparation for safety functions
- Commissioning of safety configurations
- Creating backups of safety configurations
- Safe Option diagnostics
- Monitoring active frequency converters for behaviour and error codes

13.2 Access

13.2.1 Password Management

Access to the Safe Option 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 MCB 15x Safe Option

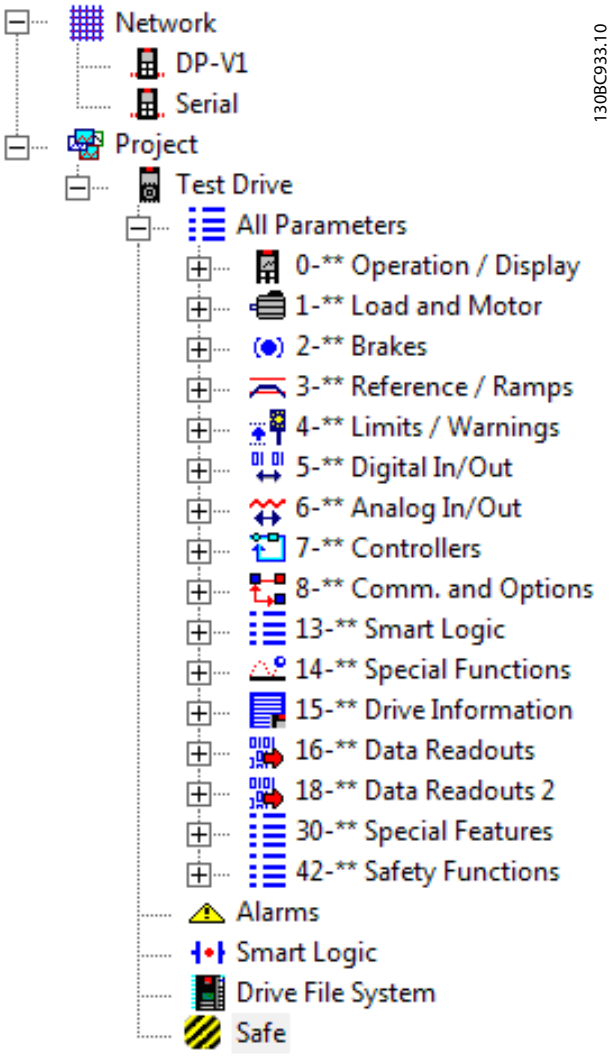

Illustration 13.2 The Safe Plug-In for MCB 15x *(Safe)* shown with Functional Safety Icon in Project Tree

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 display its contents. Press the *Safe* icon to display the Safe plug-in for MCB 15x plug-in interface in the Right View of the MCT 10 Set-up Software.

In case of multiple separate online or offline frequency converters, select the relevant frequency converter to monitor from the structure tree.

13

NOTICE

The parameters that can be edited using the Safe plug-in for MCB 15x Safe Option 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 *All Parameters* view, expand the *All Parameters* group beneath the desired frequency converter and select the *42-** Safety Functions* entity. The parameter grid is displayed on the right.

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.

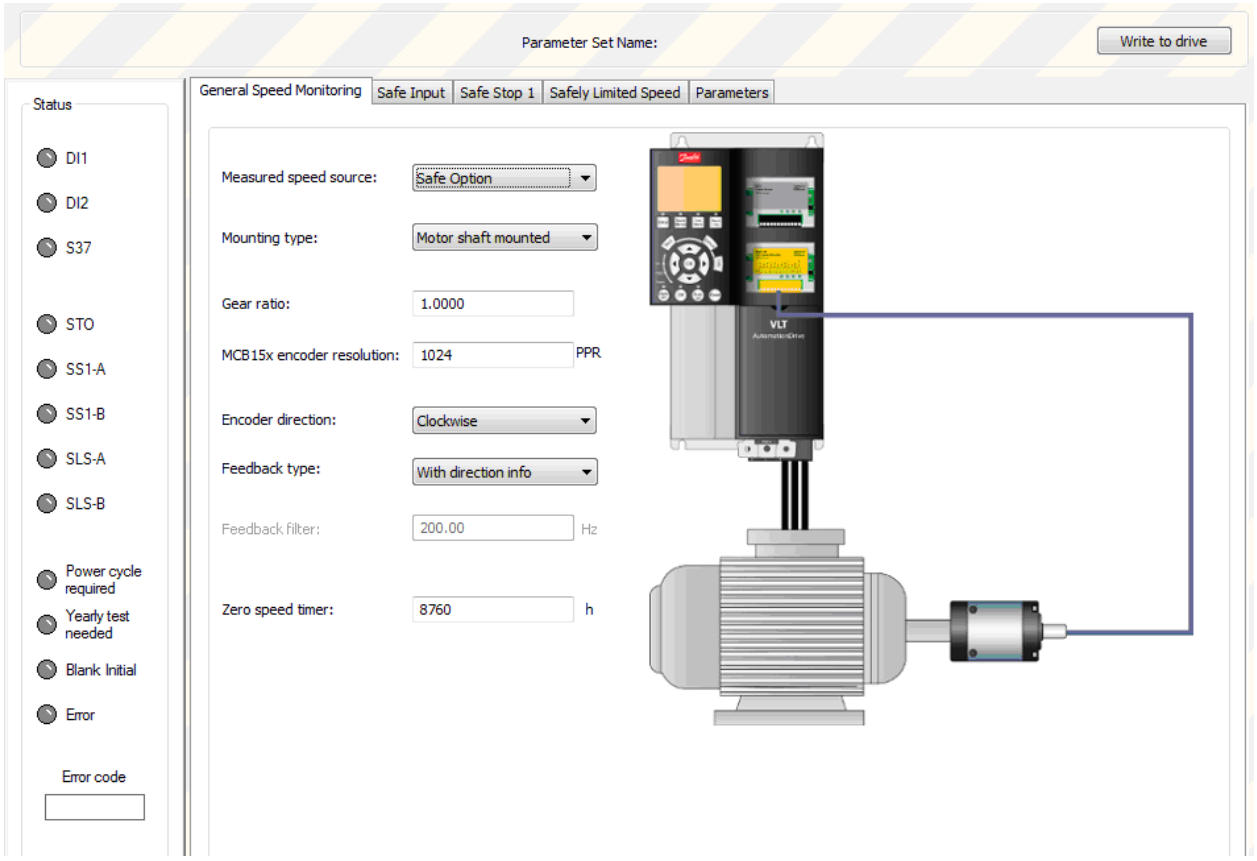

Illustration 13.3 The Opening Tab of the Safe Plug-In for MCB 15x Plug-in Interface (Operating in Offline Mode).

The Safe plug-in for MCB 15x Safe Option 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 tool tips for quick and easy help information.

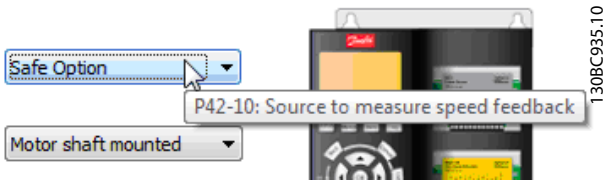

Illustration 13.4 Tool Tip Example

13.3.1 Information and Administration Area

Illustration 13.5 Safe Plug-In for MCB15x Information and Administration Area

The information area at the top of the plug-in interface displays the current Safe plug-in for MCB 15x profile name and notifies the user of pending changes.

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

- Offline mode: in case if a frequency converter is connected, press *Write to drive* and upload the configuration to the MCB 15x
- Online mode: 2 more selections are present in the *Information* area
  - Administration
  - Change password

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

13

13.3.2 LED Status Area

The left hand side of the Safe plug-in for MCB 15x Safe Option 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 Safe Option configuration entities.

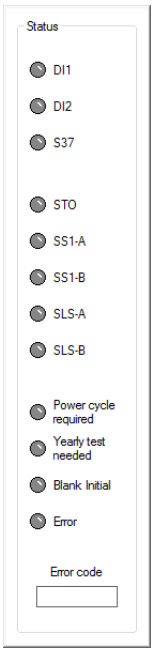

Illustration 13.6 LED Status Area

NOTICE

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

LED Status	Description
(green)	OK state – the options 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
(grey)	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 FC
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 Option is in a blank initial state, i.e. in factory settings. When writing to the Option for the first time, provide a new password
Error	The MCB 15x has detected an error. The specific error code is displayed in the error code display below the error LED. For more information regarding error codes, refer to *15.3.3 Device Error Codes*

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 represents 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

13.3.4 General Speed Monitoring

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

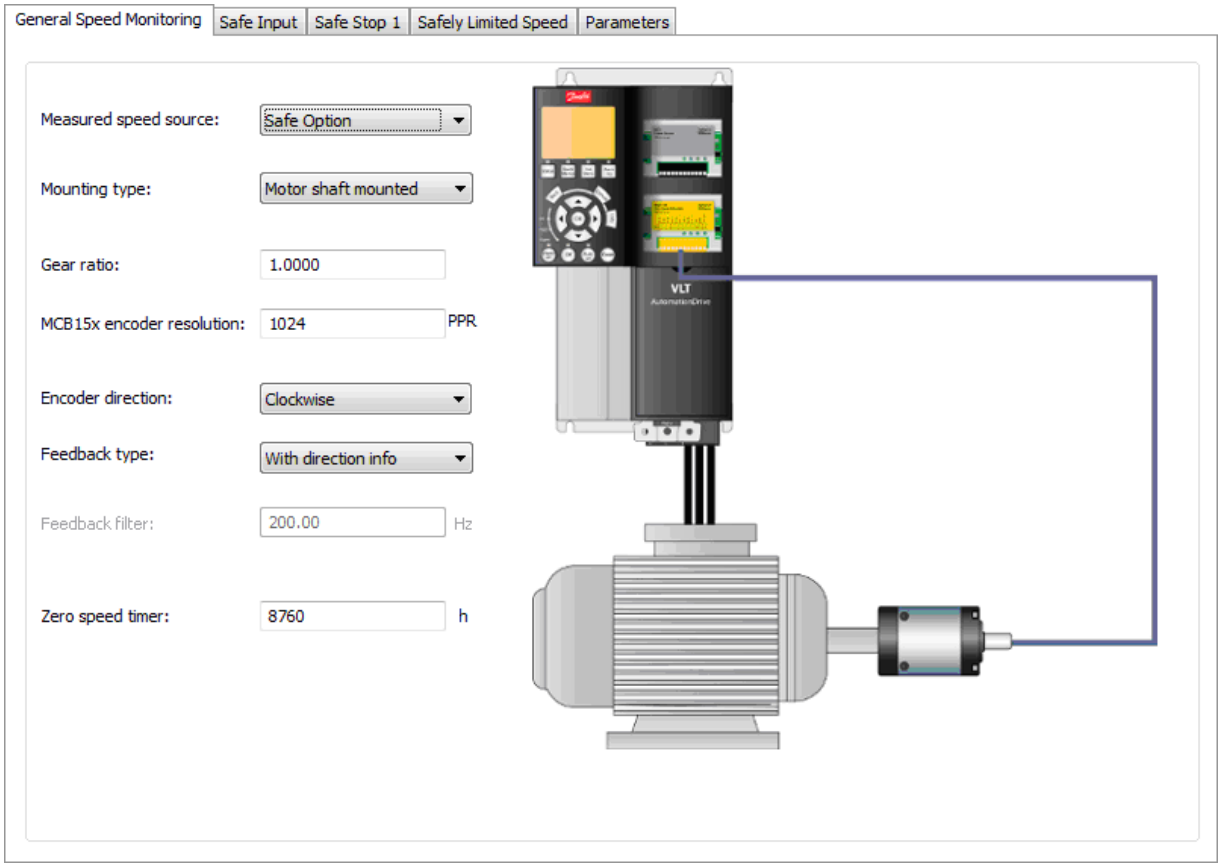

Illustration 13.7 General Speed Monitoring Configuration Tab

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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: • Safe plug-in for MCB 15x – 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: • 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
MCB150 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 10,000 PPR for TTL Factory default is 1024 PPR.

Option	Description
Encoder direction	This option provides the option to change the detected encoder rotation direction without altering the wiring to the encoder itself. The following options are available: • Clockwise – i.e. positive feedback when the encoder rotates clockwise • Counter clockwise – i.e. positive feedback when the encoder rotates counter clockwise Factory default: [Clockwise]
Feedback type	This option defines the feedback type. The following options are available: • With direction info – the feedback provides direction information, e.g. an encoder • Without direction info – the feedback does not provide direction information (proximity switch configuration) Factory default: [With direction info]
Feedback filter	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. Range : 0.01-200 Hz (off) Factory default: [200 Hz (off)]
Zero speed timer	This option allows the speed to be below 120 RPM when SLS is active before STO is engaged. Range: 0 and 10,000 s Factory default: [10].

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 Safe Option.

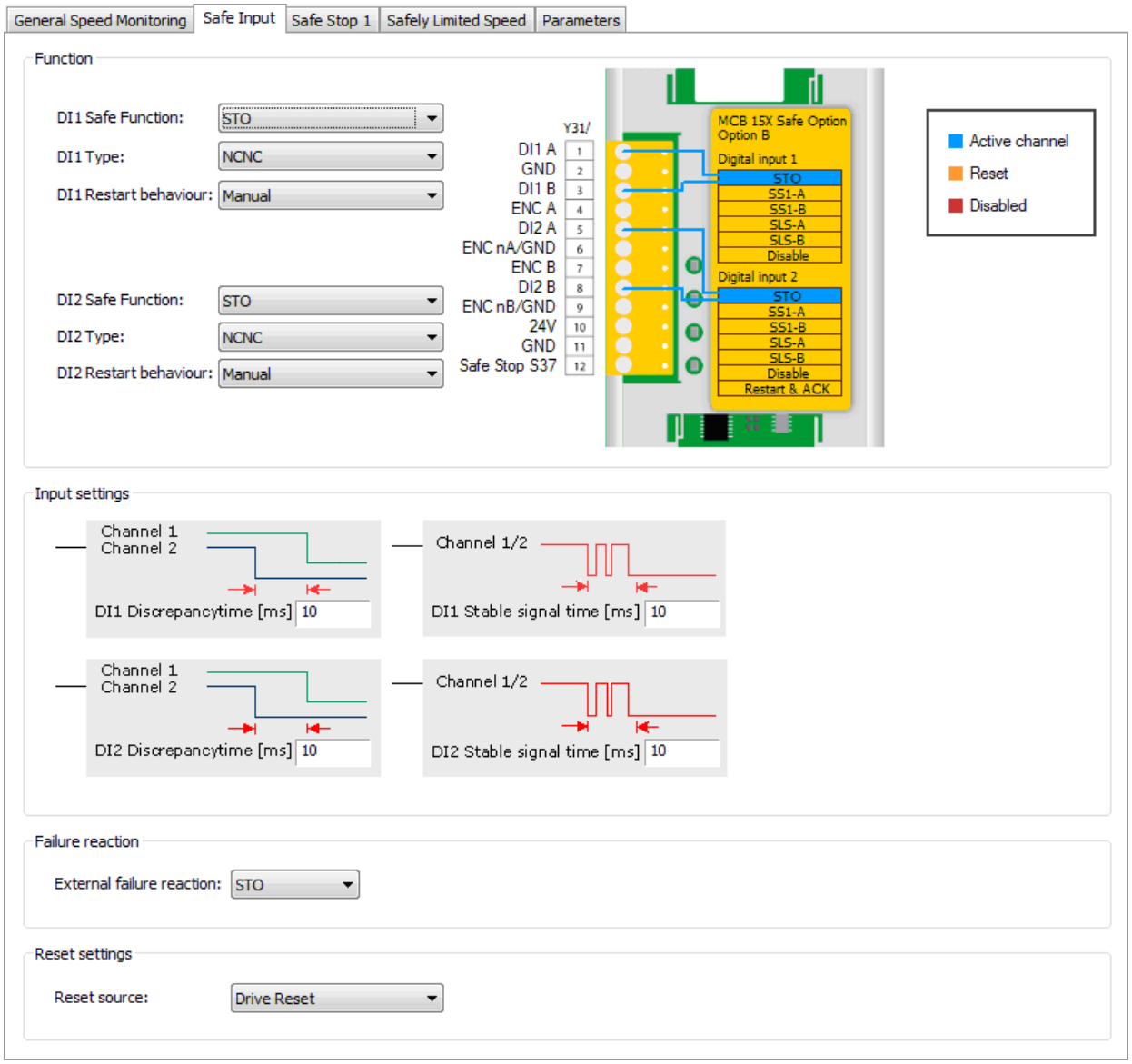

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Illustration 13.8 Safe Input Configuration Tab

The safe input tab contains the following separated sections with the following configuration possibilities:

13

Function:

Option	Description
DI1 Safe Function	This option defines the safe function used by DI1. The following options are available: • STO – safe torque off is used as the safe 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: • 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 Safe Option configured the DI1 restart behaviour. The following options are available: • 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: • 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: • NCNC – NCNC type is used • Antivalent – NO/NC (antivalent) type is used • NC – 1 NC input type is used Factory default: [NCNC]
DI2 Restart behaviour	This option defines the DI2 restart behaviour. The following options are available: • 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
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 will be executed in the case of an external failure. The following options are available: • STO – STO is executed • SS1-A – SS1-A is executed • SS1-B – SS1-B is executed Factory 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: • Drive Reset – source is a frequency converter reset • Drive Safe Reset – source is a safe drive reset • Safe Option DI2_A – source is Safe Option DI2_A Factory default: [Drive Reset]

Table 13.7 Options for Reset Settings

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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.

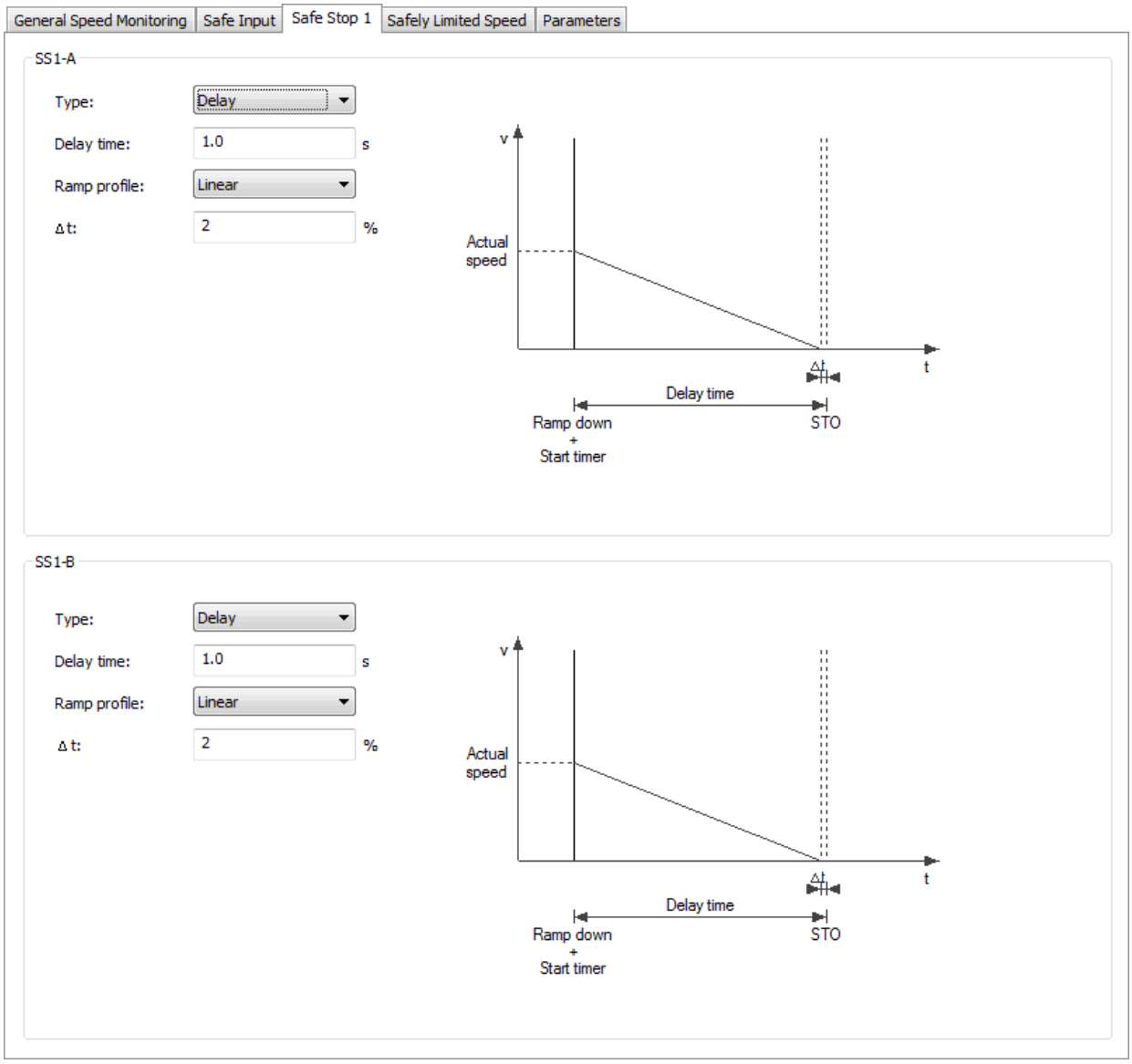


Illustration 13.9 Safe Stop 1 Configuration Tab

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

Option	Description
Type	This option defines the type of the safe stopping configuration. The following options are available: • 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]

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: • 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 Const. 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 Const. 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 setup	This option defines the ramping setup used. The following options are available: • Slope – a sloping ramp is used • Time – a time ramp is used
	Deceleration rate	This option is configurable only when Slope is selected for the Ramping set-up. This option defines the deceleration rate for the SS1 slope based ramp style. Range: 1-30.000 RPM/s Factory default: [1.500 RPM/s]
	Ramp time	This option is configurable only when Time is selected for the Ramping setup. Itdefines the time after which Safe plug-in for MCB 15x will engage the STO.
	Delta V	This option defines the tolerance between the calculated speed and the actual speed that Safe plug-in for MCB 15x allows. Range: 1-10.000 RPM Factory default: [120 RPM]
	Zero speed	This option defines the speed at which Safe plug-in for MCB 15x engages STO. Range: 1-600 RPM The factory default: [10 RPM]

Table 13.8 Options for SS1-A

13

Option	Description	
Type	This option defines the type of the safe stopping configuration. The following options are available: • 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: • 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 Const 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 Const 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 setup	This option defines the ramping setup used. The following options are available: • Slope – a sloping ramp is used • Time – a time ramp is used
	Deceleration rate	This option is configurable only when Slope is selected for the Ramping setup. This option defines the deceleration rate for the SS1 slope based ramp style. Range: 1-30.000 RPM/s Factory default: [1.500]
	Ramp time	This option is configurable only when Time is selected for the Ramping setup. It defines the time after which 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 Safe plug-in for MCB 15x allows. Range: 1-10.000 RPM Factory default: [120 RPM]
	Zero speed	This option defines the speed at which Safe plug-in for MCB 15x will engage 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.

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 setup	This option defines the type of the safe limited speed setup. The following options are available: • 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 setup. It defines the time ramp down time for start ramp. Range: 0.1-3.600 s Factory default: [1 s]

Option	Description
Cut off speed	This option defines the speed at which the Fail Safe Reaction is activated. This setting should equal the value of the Speed Limit parameter plus tolerance. Range: 1-10.000 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: • 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 setup	This option defines the type of the safe limited speed setup. The following options are available: • 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 setup. It defines the time ramp down time for start ramp. Range: 0.1-3.600 s Factory default: [1 s]
Cut off speed	This option defines the speed at which the Fail Safe Reaction is activated. This setting should equal the value of the Speed Limit parameter plus tolerance. Range: 1-10.000 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: • 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 MCB 15x Safe Option 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 Safe Option are not applied before they are written to the device.

1. Connect the Safe Plug-in for MCB 15x to the frequency converter.
2. Press *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 MCB 15x Safe Option interface is closed before the changes have been written to the frequency converter, the changes will be lost.

13.4.1 Dependencies

Multiple configurable safety parameters depend on other safety parameter values. The Safe plug-in for MCB 15x Safe Option 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.

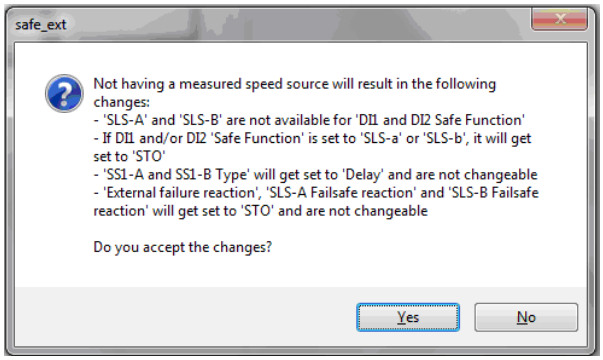


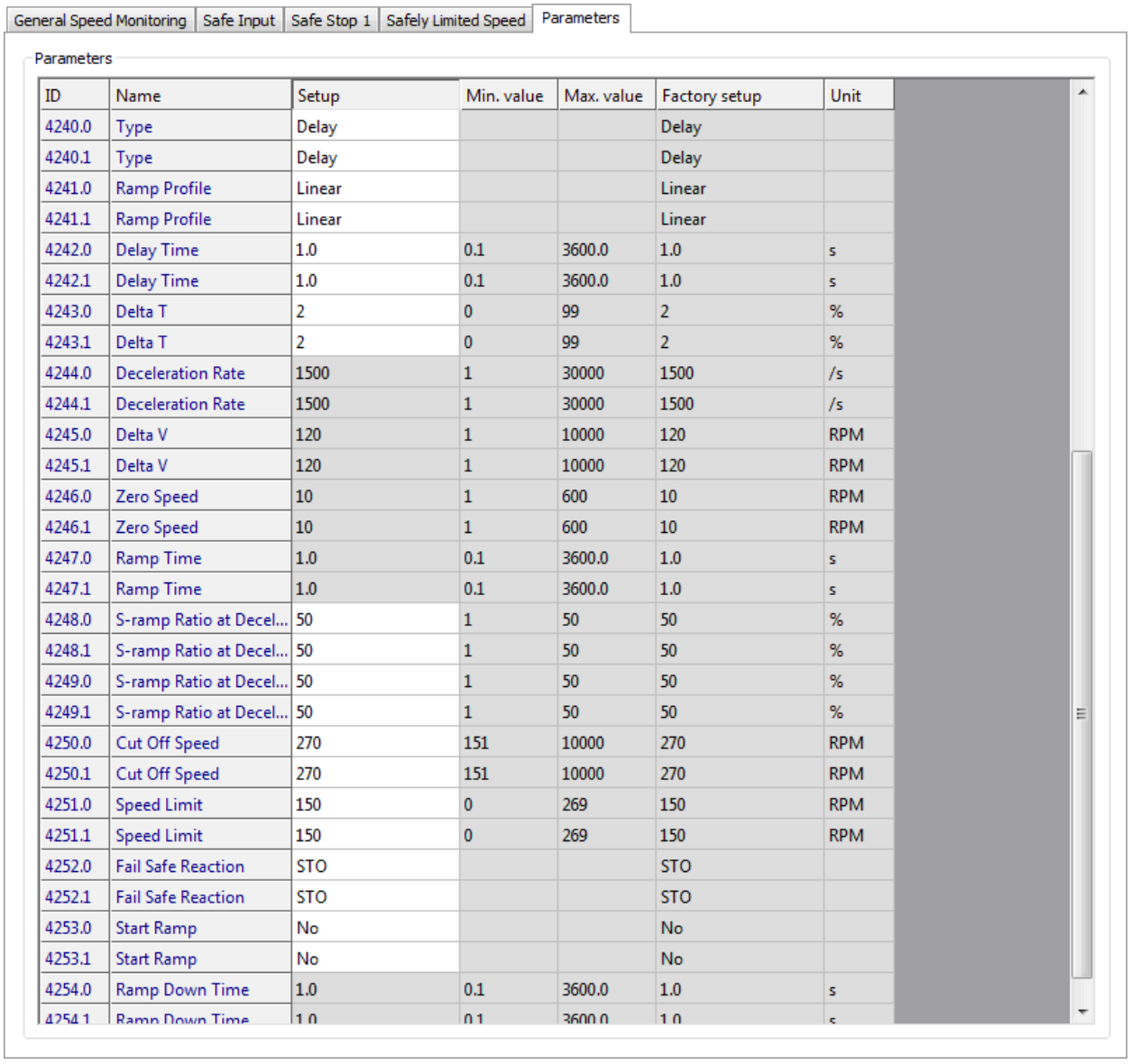
Illustration 13.11 Dependencies Confirmation Dialog

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

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.



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

Illustration 13.12 Parameters Configuration Tab

NOTICE

Prepare 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 MCB 15x.

NOTICE

Parameters ending with .0 are used for either SS1-A or SLS-A. The parameters ending with .1 are used for either SS1-b or SLS-B in the groups 42-4 and 42-5.
For group 42-2 .0, refer to DI1 and .1 to DI2.

13

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 Behaviour – the behaviour for the restarting of Safe plug-in for MCB 15x, automatic or with user input.	Manual
4224.1	Restart Behaviour – the behaviour for the restarting of Safe plug-in for MCB 15x, automatic or with user input.	Manual
4230	External Failure Reaction – the safety function that is executed in case of 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 Safe plug-in for MCB 15x or within the drive itself.	Linear
4241.1	Ramp Profile – the ramp profile that is either defined by Safe plug-in for MCB 15x or within the drive itself.	Linear
4242.0	Delay Time – the amount of time used by the safe stop function to ramp the speed down to zero RPM.	1.0
4242.1	Delay Time – the amount of time used by the safe stop function to ramp the speed down to zero RPM.	1.0
4243.0	Delta T – the buffer time that is added to the delay time prior to activating STO.	2
4243.1	Delta T – the buffer time that is added to the delay time prior to 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 Safe plug-in for MCB 15x will use to engage STO.	10
4246.1	Zero Speed – the zero speed limit that Safe plug-in for MCB 15x will use to engage STO.	10
4247.0	Ramp Time – the ramp time that Safe plug-in for MCB 15x will use to engage STO.	1.0
4247.1	Ramp Time – the ramp time that Safe plug-in for MCB 15x will use 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

Parameter	Description	Factory value
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	Cut Off Speed – the speed at which the Failsafe Reaction is engaged.	
4250.1	Cut Off 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	Fail Safe Reaction – the safety function that is activated when the speed exceeds the limit set.	STO
4252.1	Fail Safe 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 MCB 15x.
2. Press *Write to drive* to upload to the frequency converter

The following status window opens:

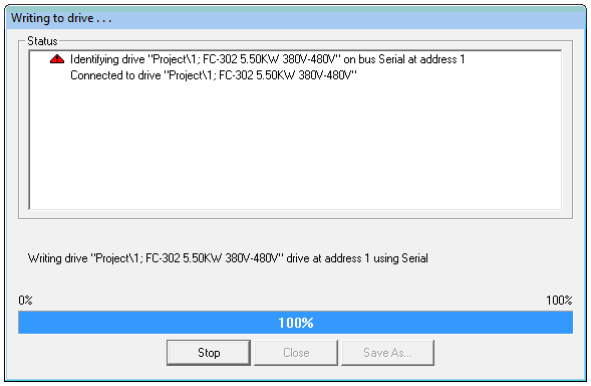


Illustration 13.13 Writing to Drive Progress Window

3. Enter the password, when the *Confirm password* dialog pops up (Default password : 12345678). For more information on changing password, refer to *13.6.3 Change Password*

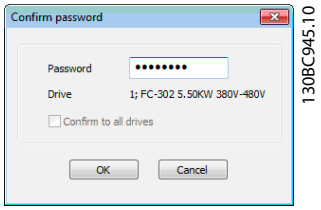


Illustration 13.14 Password Entry Dialog

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

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.

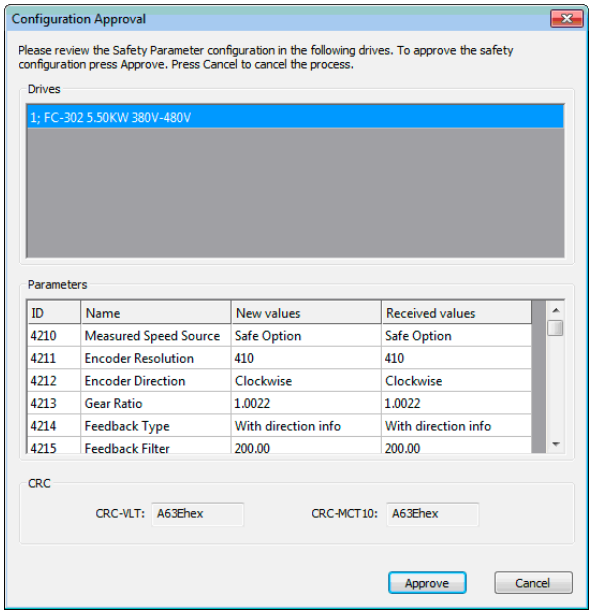


Illustration 13.15 Configuration Approval Dialog and Summary

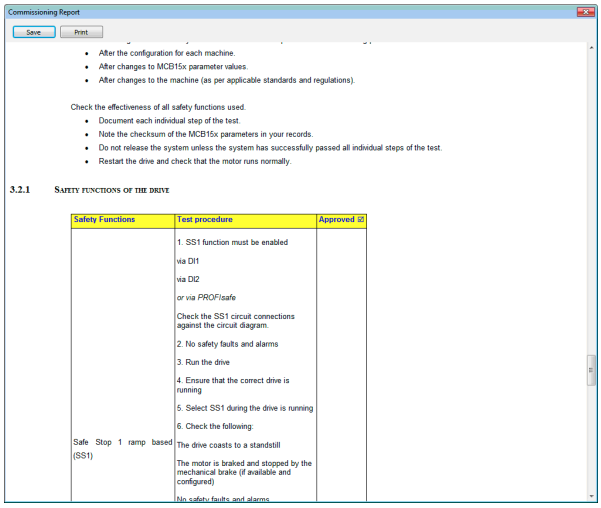
Drives	The top section of the summary displays all frequency converters affected by the write procedure. In case of multiple frequency converters, press the frequency converter titles in the window to update *Parameters* and *CRC* below accordingly.
Parameters	This section details all the updated parameters 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 *Received values*. If not, an error is displayed.
Received values	The value that was received from the frequency converter after the update procedure. This column must have the same value as *New values*. If not, an error is displayed.
CRC	This section displays the CRC values that were generated from the application side and the frequency converter side. These values must match. If not, an error is displayed.

Table 13.13 Explanations for *Illustration 13.15*

5. When the Configuration approval pops up, review the included summary.
6. 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 has been approved, the commissioning report is generated and displayed.

13



130BC947.10

Illustration 13.16 Commission Report Review, Save and Print Dialog

7. Press *Save* to save the commission report in Rich Text Format.
8. Press *Print* to print the report.
9. 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 MCT10 application. The report contains all data written to the frequency converter.

The report is generated during the *write-to-drive* procedure and the data are gathered at the moment the report is generated. This report contains the functions that need to be tested, see more details in *MCB 15x Safety Option 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

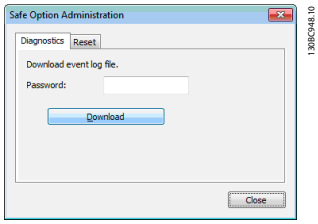
13.6 Operation

The following describes how to use the diagnosics 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 MCB 15x plug-in interface in network online mode.
2. Press *Administration* in the upper section of the interface. The following window opens:



130BC948.10

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. Press *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 MCB 15x 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:

13

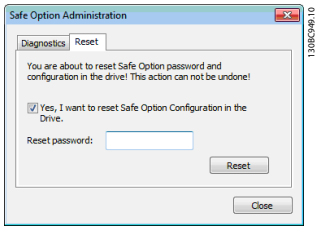


Illustration 13.18 Reset Password

4. Select the option *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 MCB 15x plug-in in network online mode, *Change password* is displayed in the information area of the plug-in interface.

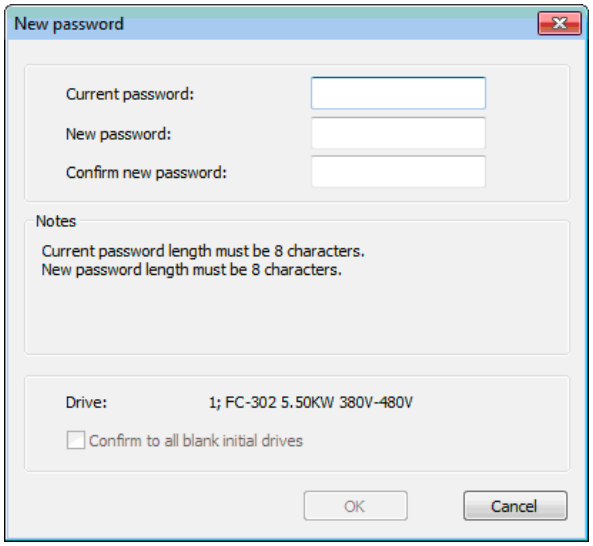


Illustration 13.19 Safe Plug-in for MCB 15x Password Changing Window

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.
4. Confirm the new desired password by entering it again into the *Confirm new password* field. The password length must be exactly 8 characters. The password is case sensitive.
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.

13

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 processor. For detailed information, refer to the separate SyncPos program manual.

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 displays 2 icons upon selection of the frequency converter: an *All Parameters* folder icon and a separate icon for the *SyncPos option*. A group 7 series of parameters is incorporated under *All Parameters*. The group 7 parameters apply 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 two main parts: Configuration file (*.cnf) and 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 stand alone SyncPos program. If a SyncPos program already 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 the separate SyncPos 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 on the configuration file displayed in the Right, 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.

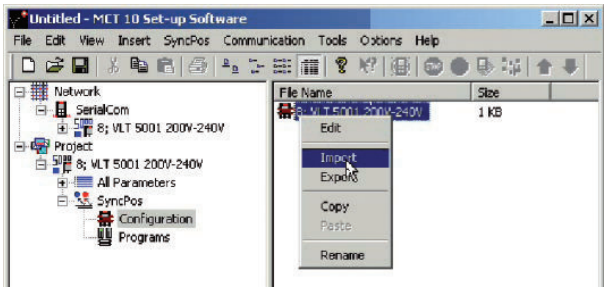


Illustration 14.1 Import Configuration File

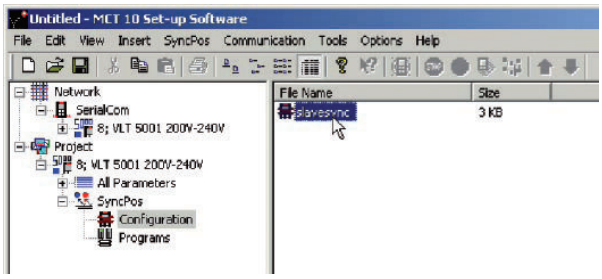


Illustration 14.2 Import Configuration File

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, whereupon the configuration editor opens.

After editing is complete, close the SyncPos application and the following window pops up:

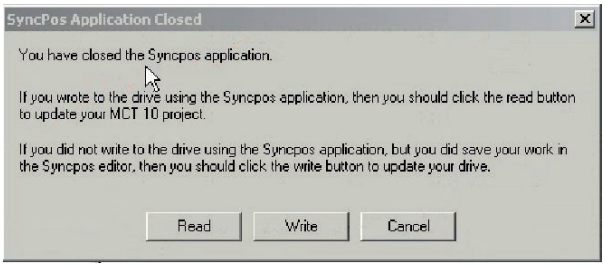


Illustration 14.3 SyncPos Application Closed

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 displayed in the Right View as shown in *Illustration 14.4*.

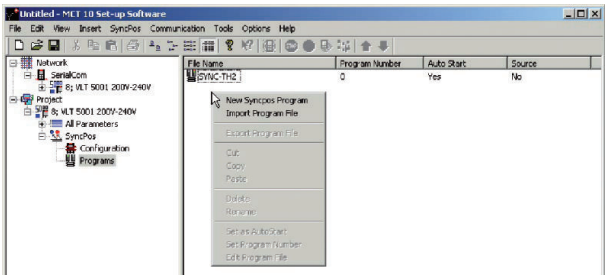


Illustration 14.4 Import Program to SyncPos Card

Browse the computer to find the desired program for import.

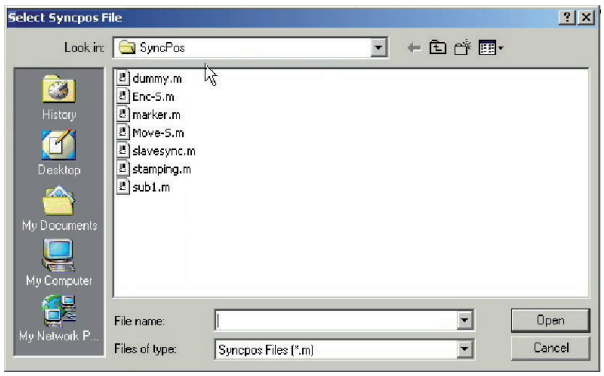


Illustration 14.5 Browse

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

14.2.6 Autostart

If more than one program is stored in the *Programs* folder, it is possible to set one 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 Autostart*. The program selected is thereafter indicated with *Yes* in the *Autostart* column.

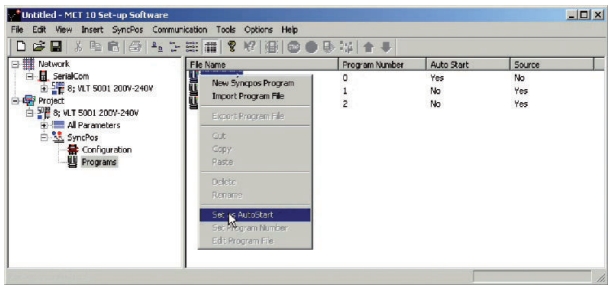


Illustration 14.6 Autostart

14.2.7 Source Code

Refer to SyncPos manual.

14

14.2.8 Edit Source Code

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

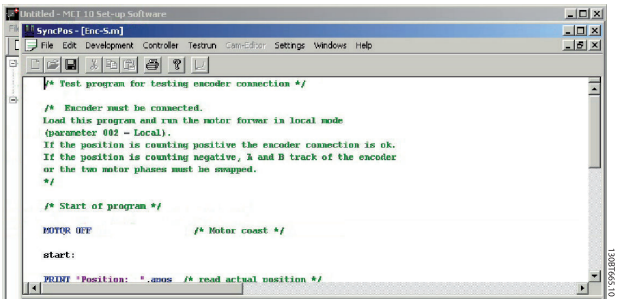


Illustration 14.7 View/Edit Source Code

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:

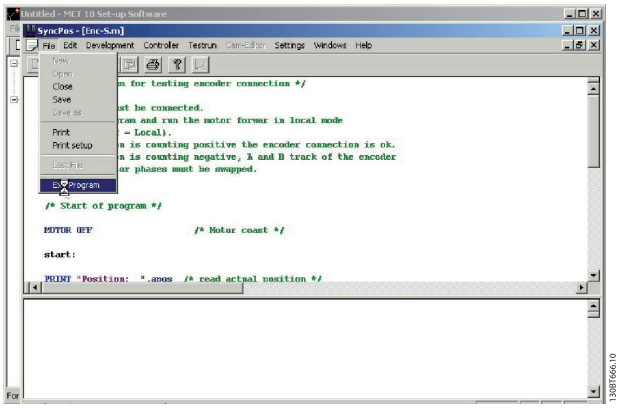


Illustration 14.8 Exit Program

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

NOTICE

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

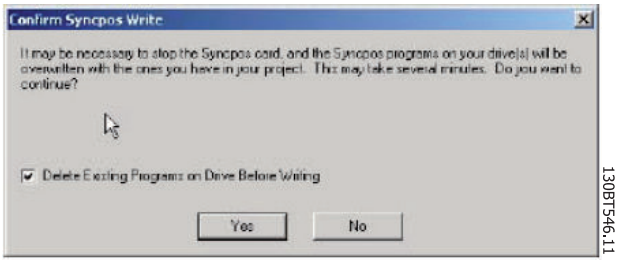


Illustration 14.9 Confirm SyncPs Write

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:

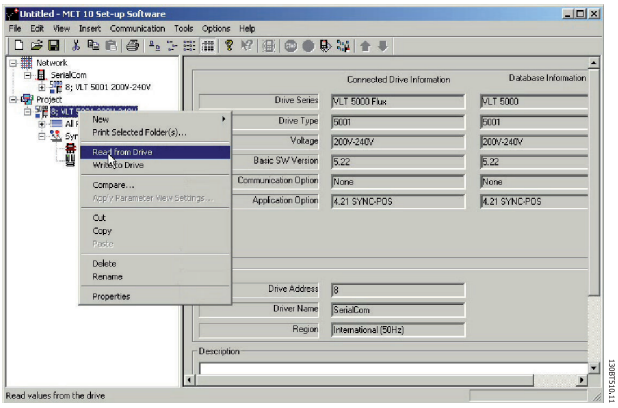


Illustration 14.10 SyncPos Read From Drive

NOTICE

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

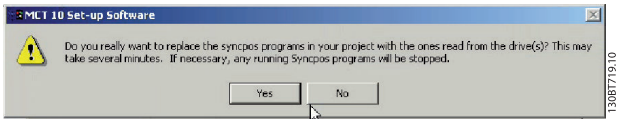


Illustration 14.11 Files Overwritten

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

14

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*:

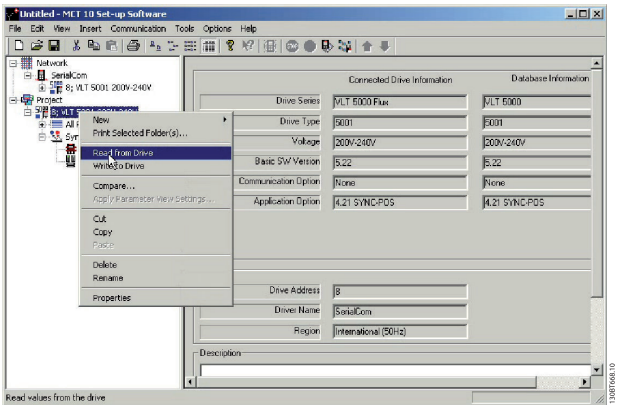


Illustration 14.12 Write to Drive

CAUTION

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 permanently overwritten:

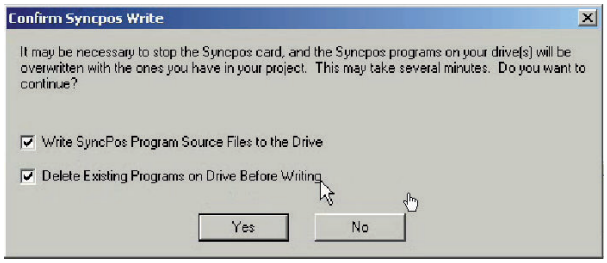


Illustration 14.13 Warning Files Overwritten

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 has a facility for saving 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:

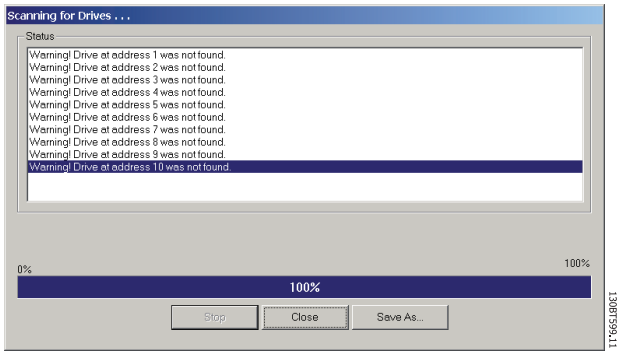


Illustration 15.1 Not detected Frequency Converters

Select *Save As* to store the error log and the following dialog appears.

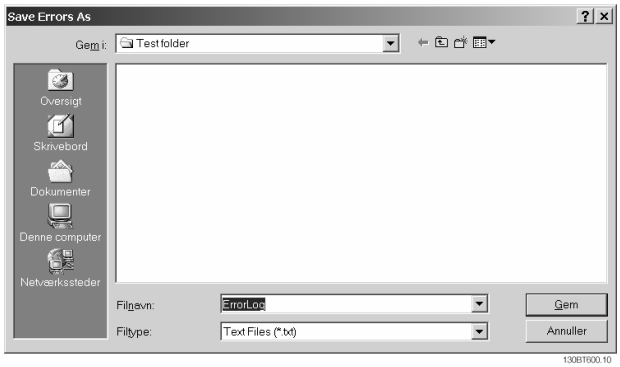


Illustration 15.2 Store Error Log

15.2 Common Problems and Solutions

15.2.1 Changes Are Not Saved to PC

Checks 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 Whilst 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 etc. Investigate whether other programs use the same COM port. If this is the case, ensure that the other PC tool does not lock or reserve the COM port.

Error message whilst storing parameter settings and reading/writing via Profibus DP-V1 using the function database readout from the frequency converter.

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15.2.3 Error Message Communication Failed

The communications error comes and goes sporadically

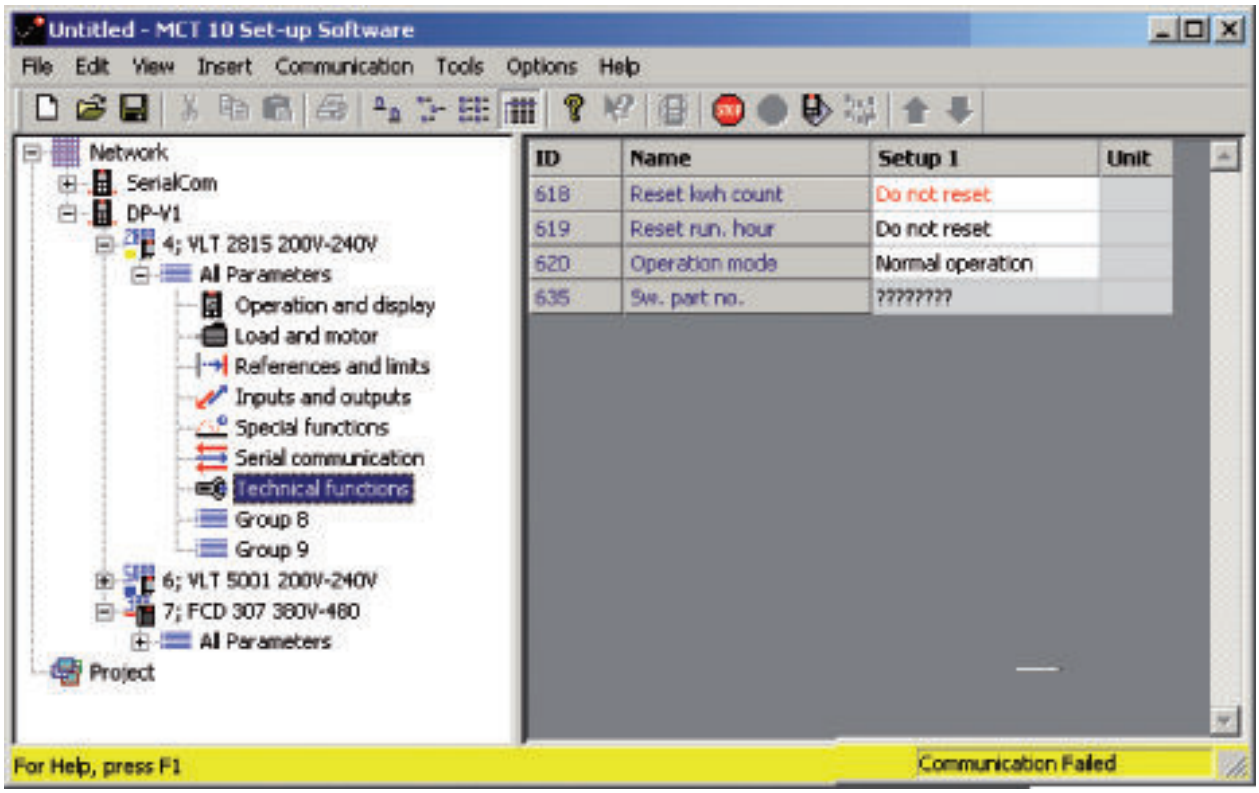
This type of communications error typically occurs when cables are inadequately screened, in which case EMC noise can affect the communications. Check that the cables are installed according to the guidelines in the *Operating Instructions* for the frequency converter.

The communications error is permanent

This type of communications error is typically due to an error in network configuration. Check that the network configuration is in accordance with the frequency converter Operating Instructions guidelines.

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

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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 communications error arises, the status bar at the bottom of the MCT 10 Set-up Software window is highlighted and displays a *Communications Failed* error message, as shown in *Illustration 15.4*

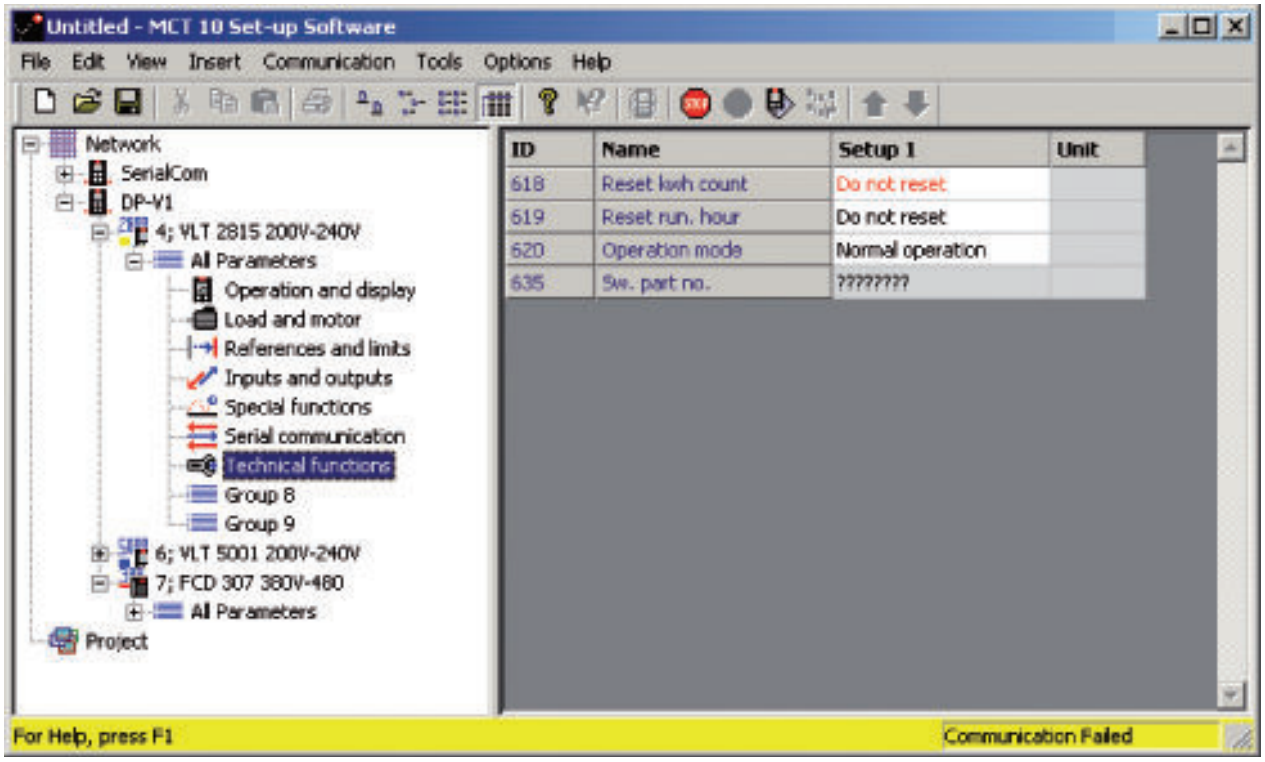

Illustration 15.4 Error Message: Communication Failed

When no communications error has occurred the same window appears as

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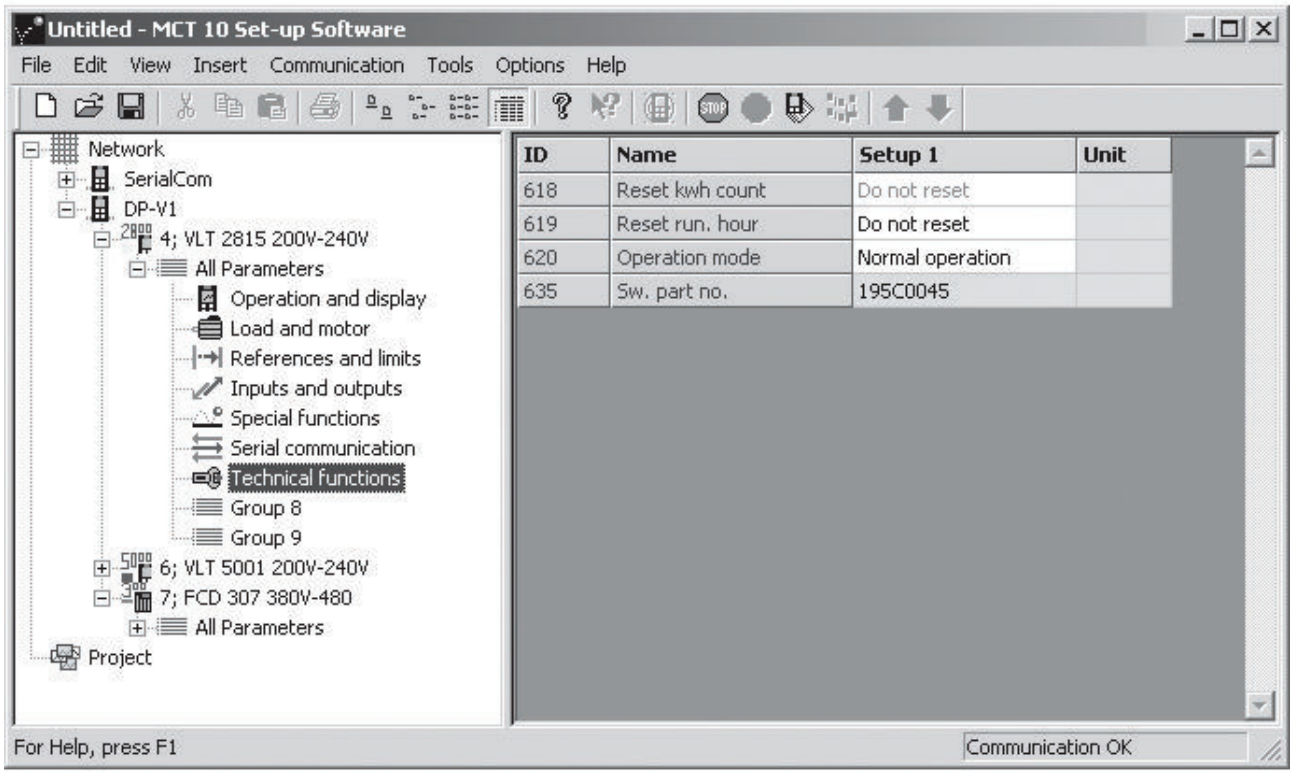

130BT603.10

Illustration 15.5 Communication OK

Communications errors typically occur due to inadequate screening of cables, i.e. cable is not installed in accordance with installation instructions.

15.2.5 Help

Select *Help* ⇒ *Help* in the main menu. A *Help* file is opened, displaying 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 known error descriptions.

15.3.1 Troubleshooting Communication Errors

During commission, the communication between MCT 10 Set-up Software and the frequency converter can fail. The user is notified of this failure via a message.

Confirm the status of the communication devices and the frequency converter as well as 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.

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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 MCB15x plugin and their respective descriptions.

Error No.	Description	Led Indications				
				LED1	LED 2	LED4
	Internal failure	**Reason**	**Action**			Green Constant
1	Diagnostic in progress					Green Constant
67	Int Fail tolerance error exceeded: Reaction STO	• Check that data for feedback (ppr., Type of feedback and gear ratio) are 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 (*42-15 Feedback Filter*). System is ramping too fast. • Feedback signals are not received at all. • No correction shielding of feedback cables.	• Make a re-customisation with correct data if needed • Set *42-12 Encoder Direction* to the opposite value. • Decrease ramping time on frequency converter • Try to run the system at e.g. 60 RPM. If error nr. 99 now occurs, this is the reason. • Improve shielding of feedback cables and motor cables.	Status of LED 1 and LED2 depends on safety function state assigned to DI1 and DI2 respectively		Red Constant
68	Int fail Speed limit SS1a Ramp: Reaction STO	• The value of Δ V is too small. For closed loop system it must often be larger than the recommended value. • Due to use of feedback filter the dynamic of the system does not match with dynamic of feedback filter (*42-15 Feedback Filter*). • Load change takes place during ramping.	• If running in closed loop, try to adjust PID setting and if needed increase SS1 ramping time. • Try to increase *42-15 Feedback Filter*, but this might cause error nr. 67 to occur. • Otherwise increase *42-45 Delta V*.			Red Constant
69	Int fail Speed limit SS1b Ramp: Reaction STO	See 68	See 68			Red Constant

Table 15.1

Error No.	Description	Led Indications				
				LED1	LED 2	LED4
	Internal failure	**Reason**	**Action**			Green Constant
70	Int fail speed limit SLSa : Reaction STO	Happens during ramping to SLS limit, see 68. Happens during speed below SLS limit: • If speed is above Cut Off speed at activation point and *42-53 Start Ramp* is set to "No", this error occurs. • Noise on the feedback signal (incl. quantisation noise) is larger that expected. • Load change takes place, do as in above point)	• Change *42-53 Start Ramp* to "Yes" and set *42-54 Ramp Down Time* accordingly. • Increase *42-50 Cut Off Speed* or decrease *42-51 Speed Limit* to get a larger tolerance	Status of LED 1 and LED2 depends on safety function state assigned to DI1 and DI2 respectively		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	• The two processos on MCB 15x have different safety states. • CPU 2 fails	• First power cycle the frequency converter or restart the MCB 15x by *42-90 Restart Safe Option*. Secondly 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

Error No.	Description	Led Indications				
				LED1	LED 2	LED4
	Internal failure	**Reason**	**Action**			Green Constant
73	Int Fail safe output switch1: Reaction STO	Diagnostic of safe output of CPU 1 fails.	• First power cycle frequency converter or restart the MCB 15x by *42-90 Restart Safe Option*. • If the problem persists, contact Danfoss			Red Constant
74	Int Fail safe output switch2: Reaction STO	Diagnostic of safe output of CPU 2 fails.	• First power cycle frequency converter or restart the option by *42-90 Restart Safe Option*. • If the problem persists, contact Danfoss			Red Constant
75	Int Fail DI2 in PUST: Reaction STO	• Safety input connected to DI2 has illegal signal level. • Sensor is broken	• Check that configuration of DI2 (*42-21 Type* sub index [1] is set correctly or the connected sensor is installed according to specification.	Status of LED 1 and LED2 depends on safety function state assigned to DI1 and DI2 respectively		Red Constant
76	Int Fail DI1 in PUST: Reaction STO	• Safety input connected to DI1 has illegal signal level. • Sensor is broken	• Check that the configuration of DI1 (*42-21 Type* sub index [1] is set correctly or the connected sensor is installed according to 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.	• First power cycle frequency converter or restart the MCB 15x by *42-90 Restart Safe Option*. • If the problem perists, contact Danfoss			Red Constant
79	Int Fail No SPI comm: Reaction STO		Contact Danfoss			Red Constant

Table 15.3

Error No.	Description	Led Indications				
				LED1	LED 2	LED4
	Internal failure	**Reason**	**Action**	Status of LED 1 and LED2 depends on safety function state assigned to DI1 and DI2 respectively		Green Constant
80	Int Fail No CAN comm: Reaction STO		Contact Danfoss			Red Constant
81	Int Fail under voltage Vuc1: Reaction STO	Voltage for CPU 1 is too low.	• First power cycle frequency converter. • If the problem persists, contact Danfoss			Red Constant
82	Int Fail overvoltage Vuc1: Reaction STO	Voltage for CPU 1 is too high.	• First power cycle 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.	• First power cycle frequency converter. • If the problem persists, contact Danfoss			Red Constant
84	Int Fail overvoltage 24v IO: Reaction STO	Voltage for terminal 12 safe output is too high.	• First power cycle 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.	• First power cycle 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.	• First power cycle frequency converter. • If the problem persists, contact Danfoss			Red Constant
87	Int Fail undervoltage int5v: Reaction STO	Voltage used for other circuits than CPU is too low.	• First power cycle frequency converter. • If the problem persists, contact Danfoss			Red Constant

Table 15.4

Error No.	Description	Led Indications				
				LED1	LED 2	LED4
	Internal failure	Reason	Action	Status of LED 1 and LED2 depends on safety function state assigned to DI1 and DI2 respectively		Green Constant
88	Int Fail overvoltage int5v: Reaction STO	Voltage used for other circuits than CPU is too high.	• First power cycle frequency converter. • If the problem persists, contact Danfoss			Red Constant
89	Int Fail Memory Fail S2: Reaction STO	• Data in EEPROM for CPU 2 is corrupted. • The Flash memory fails.	• 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	• Data in EEPROM for CPU 1 is corrupted. • The Flash memory fails.	• 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) s too low.	• First power cycle 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.	• First power cycle frequency converter. • If the problem persists, contact Danfoss			Red Constant
93	Int Fail undervoltage Vuc2 Core: Reaction STO	Voltage for CPU2 (Core) s too low.	• First power cycle frequency converter. • If the problem persists, contact Danfoss			Red Constant
94	Int Fail overvoltage Vuc2 Core: Reaction STO	Voltage for CPU2 (Core) is too high.	• First power cycle frequency converter. • If the problem persists, contact Danfoss			Red Constant

Table 15.5

Error No.	Description	Led Indications				
				LED1	LED 2	LED4
	Internal failure	**Reason**	**Action**			Green Constant
95	Int Fail undervoltage Vuc2 SDRAM: Reaction STO	Voltage for CPU2 (SDRAM) s too low.	• First power cycle 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.	• First power cycle frequency converter. • If the problem persists, contact Danfoss	Status of LED 1 and LED2 depends on safety function state assigned to DI1 and DI2 respectively		Red Constant
97	Int Fail MOC Fail S1: Reaction STO		• Contact Danfoss			Red Constant
98	Int fail invalid customer file version	Version of customisation file of MCB 15x stored in EEPROM does not match the customisation 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 to connection is done according to the specification or if the feedback source is broken.			Red
113	Ext Fail DI1 : Reaction STO	• Safety input connected to DI1 has illegal signal level. • Sensor is broken.	Check that configuration of DI1 (*42-21 Type* sub index [0] is set correctly or the connected sensor is installed according to 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)
114	Ext Fail DI2 : Reaction STO	• Safety input connected to DI2 has illegal signal level. • Sensor is broken	Check that configuration of DI2 (*42-21 Type* sub index [1] is set correctly or the connected sensor is installed according to specification	Status depends on Safety function state assigned to DI1	Red Constant	Red flashing, cycle (on 500 ms, off 500 ms)

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Error No.	Description	Led Indications				
				LED1	LED 2	LED4
178	Ext Fail DI2 :Reaction SS1a	See 114	See 114	Status depends on 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 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 parameter *42-18 Zero Speed Timer* with safe function SLS active.	Increase speed to above 120 RPM.	Status of LED 1 and LED2 depends on 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 that 1 year and a safety function that need 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					

Table 15.6

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