

**KNORR-BREMSE**

---

**Service Terminal ST03A**

**General information  
and functions  
(GD19841/DCU)**



**User's Guide**

# Table of contents

1	Introduction.....	4
1.1	New Features In ST03A V3.7.....	5
1.2	ESRA and DCU Projects.....	5
1.3	Communication.....	7
1.4	Communication Devices.....	9
1.5	Device Driver Installation.....	14
1.6	System Requirements.....	15
1.7	User Interface of ST03A.....	15
1.8	Supported Languages.....	17
1.9	Hotkeys.....	17
1.10	Options.....	20
1.11	Snapshot And Data Recording.....	21
1.12	Collect ST03A Log Files.....	22
1.13	Supported File Types.....	22
1.14	Error Reporting.....	23
1.15	Glossary.....	24
1.15.1	Application.....	24
1.15.2	Board.....	24
1.15.3	Board state.....	24
1.15.4	Hotline Service Terminal.....	25
1.15.5	Node number.....	25
2	Project.....	26
2.1	Handling Project Files.....	26
2.2	Project Information.....	28
2.3	Event Comment Import.....	29
2.4	Custom Group Import.....	29
3	Services.....	31
3.1	Unit Information.....	31
3.2	I/O Channels.....	34
3.3	Process Data.....	36
3.4	System Information.....	38
3.5	Event Memory.....	39
3.6	Event History.....	43
4	Licensing.....	45
4.1	License Request.....	46
4.2	License Answer.....	48
4.3	Moving Licenses to Another PC.....	49

4.4	License types .....	50
4.5	Trouble-shooting (Licensing) .....	51
5	Measurement .....	53
5.1	Configuration .....	54
5.2	Channel .....	56
5.2.1	DGH03 properties .....	58
5.2.2	SU05A properties .....	59
5.2.3	SU06A properties .....	61
5.3	Measuring .....	66
5.3.1	Export .....	68
5.3.2	Printing .....	70
5.3.3	Note .....	75
5.4	Data Displaying .....	76
5.4.1	Plot Properties .....	76
5.4.2	Data Evaluation .....	80
5.4.3	Data Visualization .....	82
5.5	Measurement devices .....	84
5.5.1	DGH03 .....	84
5.5.2	SU05A .....	87
5.5.3	SU06A .....	89

# 1 Introduction

## **KNORR-BREMSE Service Terminal**

### ST03A — Service Terminal for Windows

ST03A (STN30440) is a railway brake and door system diagnostic and maintenance software. Supported systems are:

- ESRA brake systems of Knorr-Bremse
- Door systems of IFE (member of Knorr-Bremse Group)

The software is designed for Microsoft Windows platforms. It is able to communicate with ESRA electronics via Ethernet, RS-232 or CAN connection. ST03A connects to DCU systems using Ethernet or RS232 connection.

ST03A is a general tool so it has to be customized for a specific railway project via the project file. Knorr-Bremse always delivers the project files (\*.prj, \*.project, \*.prz, \*.eprz, \*.mpz, \*.empz) directly to the customer.

### Support ([Hotline Service Terminal](#))

Website of ST03A: <http://st03a.knorr-bremse.com/>

Hotline Service Terminal e-mail: [esraterm@knorr-bremse.com](mailto:esraterm@knorr-bremse.com)

Hotline Service Terminal phone: +36 1 289-45-00

Hotline Service Terminal fax: +36 1 289-45-04

### Content of ST03A help

For new users to Service Terminal we recommend reading the Introduction section of the help to find out how to [connect](#) to the target system, [what is a project for](#) or [how to use the GUI](#). New operators of brake and door systems may also read the Glossary to get familiar with the terms used in Service Terminal. In case any unexpected error occurs, the easiest [ways of error reporting](#) are also described.

Experienced users may find it useful to read the section [Hotkeys](#) for easier handling of the GUI.

After installing Service Terminal you will need a license to get full access rights to its functionality. The way you can get a license is described in the topic [Licensing](#). This help shows in the description of each feature which license level is needed for usage. These license levels are marked with the following labels:



The detailed functionality of Service Terminal is described in four topics.

- [Project](#): This topic contains the project-related features. A project file makes the Service Terminal able to be used with a specific ESRA/DCU system.
- [Services](#): This topic contains the description of the features not related to measurement or data logging.
- [Measurement](#): Measuring and visualizing previously measured data, printing and saving are described here.



## 1.1 New Features In ST03A V3.7

In this page you can find a list of new features of ST03A V3.7 compared to V3.5. The minimum license level needed for the service is also displayed.

Description	Reference	License ESRA	License DCU
<b>New in V3.7</b>			
Data Log via CAN connection		Operator	
Offline Data Log		Operator	
Bulk Data Log via Ethernet connection		Operator	
Project defined IP address support		Default	
HCM2 support		Default	
Extended Unit Information - Detail View		Default	
IPS measurement support		Default	
I/O Channel and Process Data custom groups	<a href="#">I/O Channel</a> <a href="#">Process Data</a> <a href="#">Custom Group Import</a>	Default	Default
<b>DCU</b>			
DCU_V3 protocol support in I/O Channels			Default
<b>New in V3.6</b>			
BSW3GEN support		Default	
RB06 support		Default	
<b>DCU</b>			
DCU_V3 protocol support in Event Memory, Event History			Default

## 1.2 ESRA and DCU Projects

ST03A supports both ESRA brake systems and IFE DCUs (Door Control Units). To access full functionality of Service Terminal with both systems you need

- A system-specific project file that defines the accessible features of the connected system.
- A [license](#) for the appropriate system type.

### Project file

Service Terminal is a general tool that needs to be customized for each connected system configuration. Some of the most important content of the project files are:

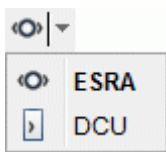
- Type of system described by the project file.
- What [boards](#)/components are in the BCU/DCU and at which address ([node number](#))?
- What inputs and outputs does each component have?

- What [application](#) should be running on each board?
- What kind of information can be retrieved from the application and how?
- Who can access any information in the application (at which license level)?

To get full access to the features depending on the project, load the project file into Service Terminal using the menu item **File / Open...**. If you find either in the menu disabled features or in the tool bar disabled buttons, this means either the project does not support the given feature or that you simply haven't loaded a project file yet.

Project files are always delivered to the customer directly by Knorr-Bremse. One project file can only be used with the BCU/DCU it is designed for. For any questions about your project file content please contact your Knorr-Bremse contact person.

## Operation mode (ESRA mode and DCU mode)



The opened project defines automatically the operating mode (ESRA/DCU). Without project the operating mode is selectable, you can choose ESRA or DCU mode from the toolbar.

The [System Mode Icon](#) in the bottom right corner of the main window shows the current mode of ST03A. When a project file is open the project file type (DCU)/(ESRA) is displayed in the title row too.

### ESRA Mode

If an ESRA project file is loaded then ESRA Mode is active.

Only the licenses of type ESRA influence the accessibility of features.

DCU related features are not accessible and a connection to a DCU is not possible.

The online help contains the description of all ESRA features and basic information about DCU mode. Full DCU help is available while ST03A is in DCU mode.

### DCU Mode

If a DCU project file is loaded then DCU Mode is active.

Only the licenses of type DCU influence the accessibility of features.

ESRA related features are not accessible and a connection to a BCU is not possible.

The online help contains the description of DCU features only. ESRA related features are available when switching back to ESRA mode.

When switching between the two modes (by opening a project file of different type than the previous) the connection to the connected system may be dropped and access rights reinitialized based on the licenses for the new system type. The content of the online help will comply with the current mode.

## Help content in ESRA mode and DCU mode

Even if the most services have the same name in both modes there are smaller differences in the usage and in the GUI in the two modes. Therefore when changing mode the help content also changes. Basic information are common but the description of services appear according to the current mode. A service not existing for a mode will not be listed in the help while that mode is active.

## 1.3 Communication

In this topic the indicators of communication between ST03A and any supported device are described. The settings of communication are discussed in the topic [Communication Settings](#). The installation of the communication devices are described in the topic [Device Driver Installation](#).

The ST03A communication indicators appear in the bottom-right corner of the main window and also in the open measurement windows. Following indicators are used:

**Communication icon**

Shows the connection state to the ESRA or DCU system.

**Interface icon**

Shows the type of connection used to connect to the ESRA or DCU system.

**System mode icon**





Shows the type connected system (ESRA or DCU).

**Measurement device icon**

Shows the connection state of the SU06A measurement device.












### Communication icons

In the lower right corner of the main window of ST03A there are two communication icons. The icon contained in the box on the right indicates the **communication state** of the ESRA or DCU unit:

	<b>Communication OK</b>	The communication connection is available but not being used.
	<b>Communicating</b>	Communication is running. The arrows indicate the direction of communication.
	<b>Collision</b>	Both direct CAN and CB12A Ethernet communication are active. Remove direct CAN connection.
	<b>No communication</b>	Communication is turned off or can not be established.

### Interface Icon

The icon contained in the box directly to the left of the communication state symbol indicates the type of **communication interface**:





	Ethernet		CANPROusb
	Ethernet over USB		Softing CAN-AC2 PCI ( <i>obsolete</i> )
	Softing CANusb ( <i>preferred</i> )		Softing CANcard2 ( <i>obsolete</i> )
	Vector CANcaseXL		Vector CANcardX ( <i>obsolete</i> )
	IXXAT CAN-to-USB compact		IXXAT CANDy ( <i>obsolete</i> )
	Serial Interface		

When the communication interface icon is double-clicked the dialog window **Options** appears, where the [communication settings](#) can be selected. This dialog window can also be opened using the **Tools / Options... / Devices** menu item.

Some communication interfaces work only with installed device driver. The drivers can be found on the ST03A CD. A description of the installation processes can be found in the topic [Device Driver Installation](#).

## System Mode Icon


Next to the interface icon (third box) the type of connected system is indicated.




	ESRA BCU connected
	DCU connected
	Cannot connect to ESRA BCU (DCU project file open)
	Cannot connect to DCU (no project file open, ESRA project file open, or required <a href="#">license</a> missing)

The two system modes support different communication devices. For further details please see the topic [Communication Settings](#).

## Measurement Device Connection Indicator Icon


### SU06A




If SU06A is properly installed (see [Device Driver Installation](#)) and connected then the SU06A connection indicator icon () will appear in the bottom of the ST03A main window.

	SU06A is connected
	SU06A is not connected
	SU06A has been manually disabled

If more instances of ST03A are running parallelly SU06A can only be connected to one instance. You can decide which instance should be connected to SU06A if you enable/disable the communication by clicking the SU06A communication indicator.

### DGH03

If DGH03 is properly installed (see [Device Driver Installation](#)) and connected then the DGH03 connection indicator icon () will appear in the bottom of the ST03A main window.

	DGH03 is connected
	DGH03 is not connected
	DGH03 has been manually disabled

If more instances of ST03A are running parallelly DGH03 can only be connected to one instance. You can decide which instance should be connected to DGH03 if you enable/disable the communication by clicking the DGH03 communication indicator.

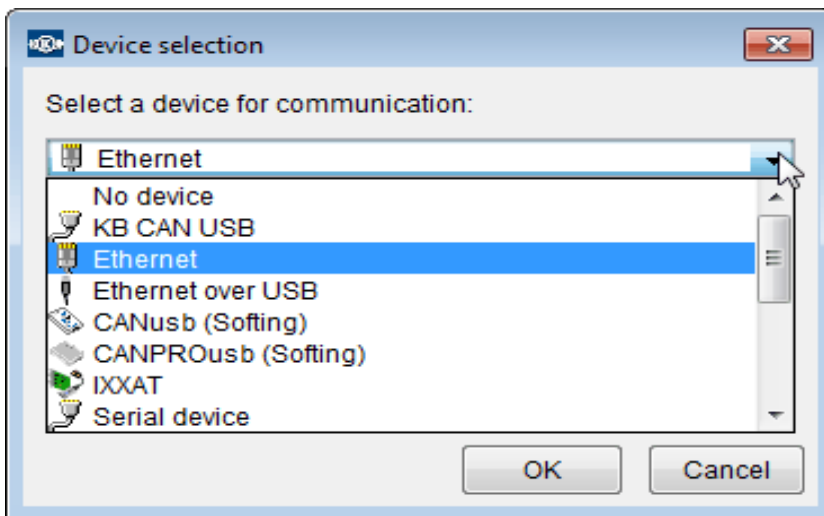


## 1.4 Communication Devices

Access:



Menu	Tools / Options...
Hotkey	ALT+T - T
Mouse	double click on communication device icon



In general there are three ways to connect ST03A to ESRA and two ways to connect to a DCU:

### Ethernet

ESRA: A board that supports Ethernet connection (e.g. CB12A) is needed. This is the most flexible way to connect to ESRA systems in an Ethernet network.

DCU: A DCU that supports Ethernet connection and a corresponding DCU-type project file that supports TCH protocol is needed.

### Serial


ESRA: A serial cable can connect the MMI of the ESRA to the PC where ST03A runs.

DCU: A DCU-type project file that supports TCH protocol is needed.

### CAN device

ESRA: A CAN device can connect a Service Board (SB) in the ESRA-System with a given port of the PC depending on the device (USB is most commonly used nowadays). CAN devices grant a faster connection to ESRA than serial connections do.

DCU: -

In this menu you can select the device you would like to use for communication. You can choose your device from the drop down. If you connect or disconnect a device and you want the list to be refreshed, please click the  (scan for device changes) button.

## Restrictions on available connection modes




The list of available connection modes depend on the active [license types](#) and the type of open project. The restrictions are listed below (license types refer to the highest available license level):

1. **Default** or **Temporary Operator** license: No Ethernet connection available.
2. DCU project file loaded: DCU can be connected by Serial (any license and any DCU project type) and Ethernet (**Operator license** or higher and only with that project type which contains DCU TCH protocol) communication.
3. DCU project file loaded, ESRA system connected: connection is disabled.
4. ESRA project file loaded, DCU system connected: connection is disabled.
5. No project file loaded: [ESRA or DCU mode](#) can be selectable without project.

If a device in the list appears in gray despite the above limitations then the driver of the device may not be installed properly (see topic [Device driver installation](#)). You will find the install package of the driver on the ST03A install CD.

## Communication devices in DCU mode

There are different protocols that can be used to connect to a DCU. The project file describes which protocols can be used to communicate with the DCU.

Category	Protocol	Connection	Comment
Ethernet	TCH	Ethernet 	Available if supported by project.
Serial	TCH	Serial / RS232 	Available if supported by project.
	<b>V1</b>	-	<b>Not yet supported by ST03A.</b>
	V3	Serial / RS232 	Available if supported by project.

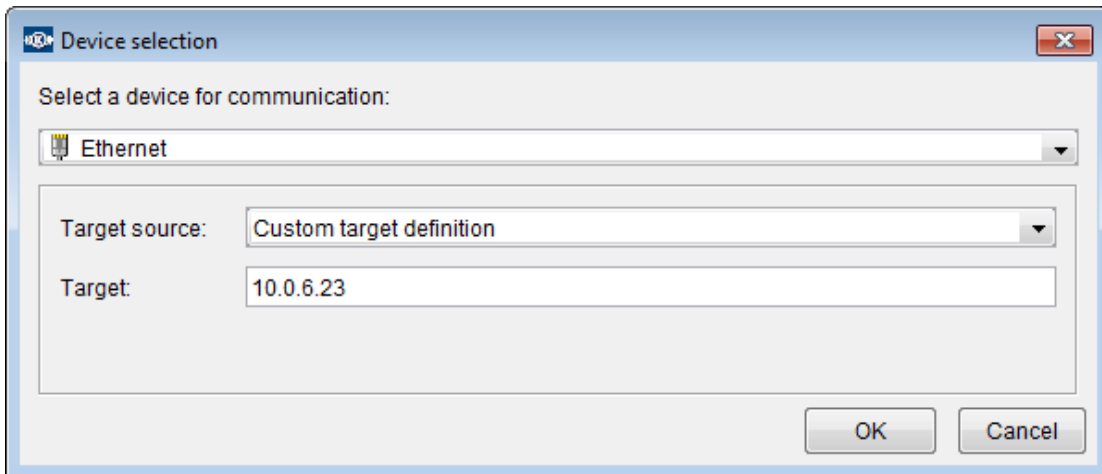
## Communication settings

Some of the communication modes can be customized. If you choose such one of these in the drop down, then the customizable settings will appear below it. These settings are the following:

### Ethernet - IP address

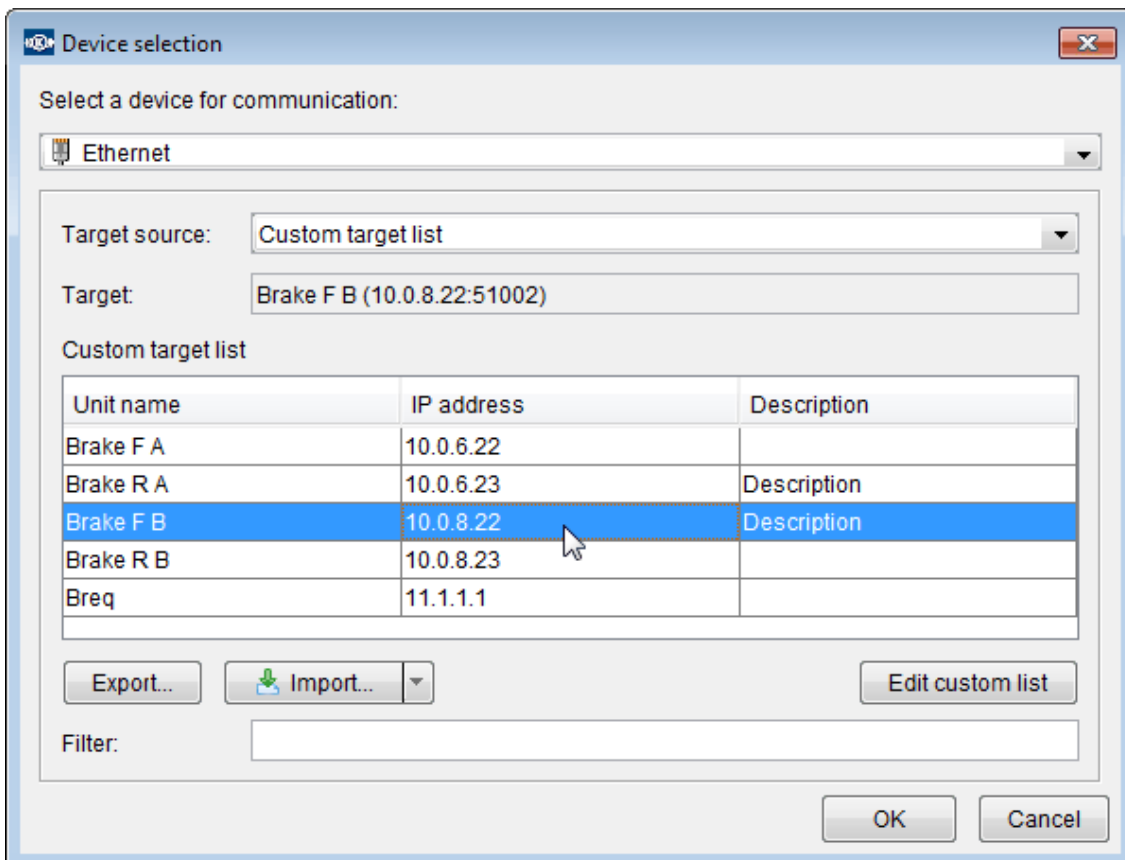
The IP address of the target can be set here. The used port is included in the project file.

### Custom target definition



The Ethernet connection can be configured by IP address or host name with an additional port definition.

### Custom target list



In this case the target to be connected can be selected from a list. The target definitions are stored in a local ST03A version independent file, which means a new ST03A will be able to use your already defined targets.

This option provides some additional functions:

**Export...**

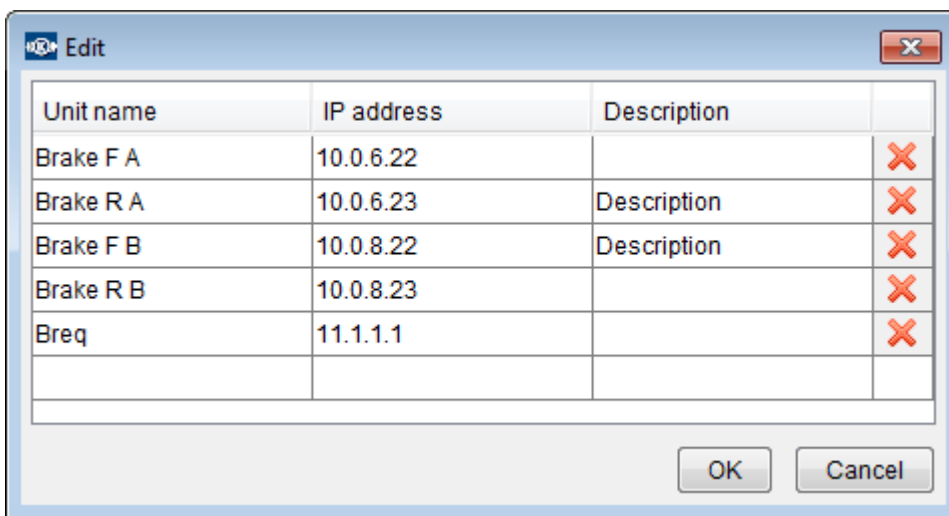
This function makes it possible to transfer or share your target definitions. It will display a Save window where you can select the target folder where the target definition file will be saved to. The result file can be imported in any ST03A version which supports this function.

**Import...**

This function provides option to import target definition from external files. It is possible to replace or extend your target definitions by the imported ones.

**Edit**

It will open a separated window where you can edit your target definitions, add a new one or delete an existing target definition.



To edit a target definition just click in a cell. Type the properties of target definition to add a new one. Use the button in the last column in the table to delete the target definition. The changes will be saved by closing the Edit window by OK. The ST03A will ask for a confirmation from the user before committing the changes in the target definition file.

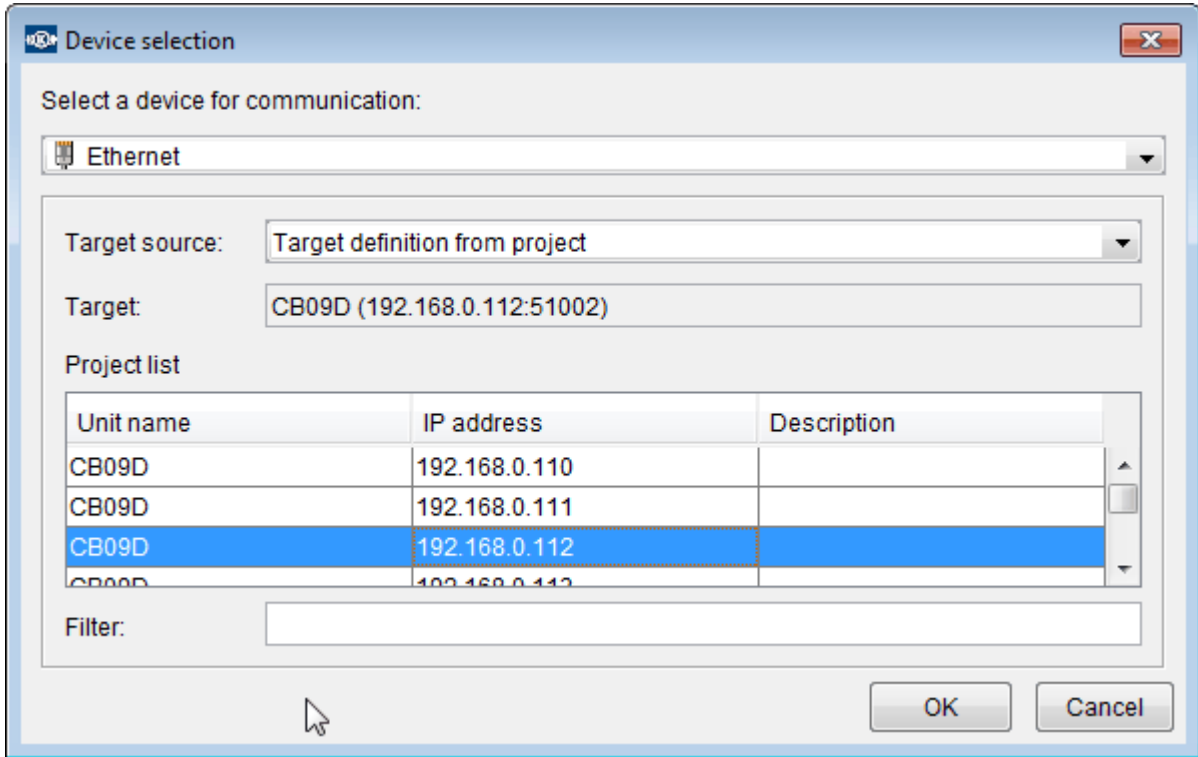
**Filter**

It filters the targets in the list according to finding the defined filter text in their any properties.

Note: The Export, Import and Edit function may be disabled in some project specific version according to the project requirements.

### Target definition from project

This option is available only if the opened project contains target definitions. In this case the target to be connected can be selected from a list.



## 1.5 Device Driver Installation

Most of the [communication devices](#) and the measurement instruments (SU06A and DGH03) needs to be installed separately in addition to the installation of ST03A. In this page you can find some short overview about the installation packages delivered with Service Terminal and some advice about the installation process. If a device in the device selection list appears in gray in the ST03A, the driver of the device has not been installed yet. The install package of the drivers are available on the ST03A install CD.

Access:

### Ethernet over USB, SU06A and DGH03

**Supported version**

2.12.18

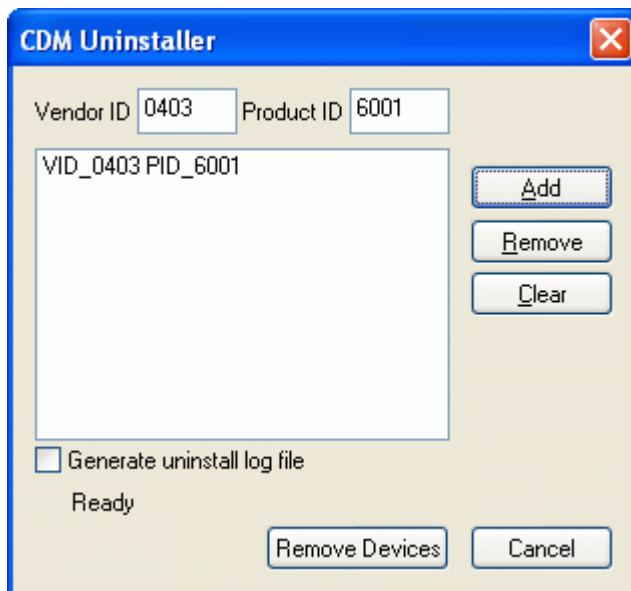
**Location on CD**

FTDI/CDM21218\_Setup.exe

Ethernet over USB (CB12) boards as well as SU06A and DGH03 measurement devices require the installation of the FTDI device driver that is available on the installation CD in the folder **FTDI**.

To install the FTDI device driver please follow these steps:

1. Uninstall all earlier installations of FTDI driver by running CDMuninstallerGUI.exe available on the install CD in the FTDI folder.  
Please click Add to add devices to the list, and click the list items to select devices to be uninstalled.  
Please click Remove Devices to uninstall the selected devices.



2. Disconnect all connected FTDI devices.
3. Close all opened instances of Service Terminal.
4. Run **CDM21218\_Setup.exe** to install the driver.
5. Plugin CB12A, DGH03 or SU06A into a free USB port of the computer.
6. Start Service Terminal and check if you can use the device connected to USB port.

## 1.6 System Requirements

ST03A performance and reliability is the best if your computer is equipped with at least the following:

### Hardware

- Computer: PC compatible
- CPU: Intel Pentium IV 2.6 GHz
- RAM: 1 GB
- Hard disk: 250 MB free space during installation (200 MB for normal operation)
- Screen resolution: 1024 X 768 with 16-bit color depth

### Supported Operating Systems

- MS Windows 7
- MS Windows 7 64 bit
- MS Windows 8.1 64 bit
- MS Windows 10 64 bit

### User right needs

Service Terminal requires different user rights in the operating system for different tasks.

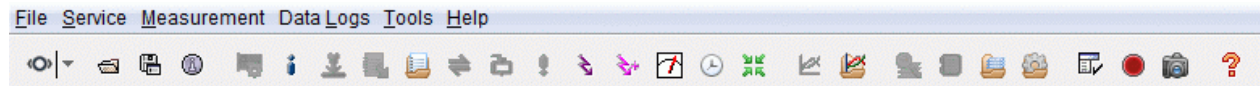
For installation you will need **Administrator** user rights. For normal operation **User** rights are needed.

If these requirements are not met then licenses can not be added and existing licenses will be displayed as **expired**.

## 1.7 User Interface of ST03A

The main elements of the ST03A user interface:

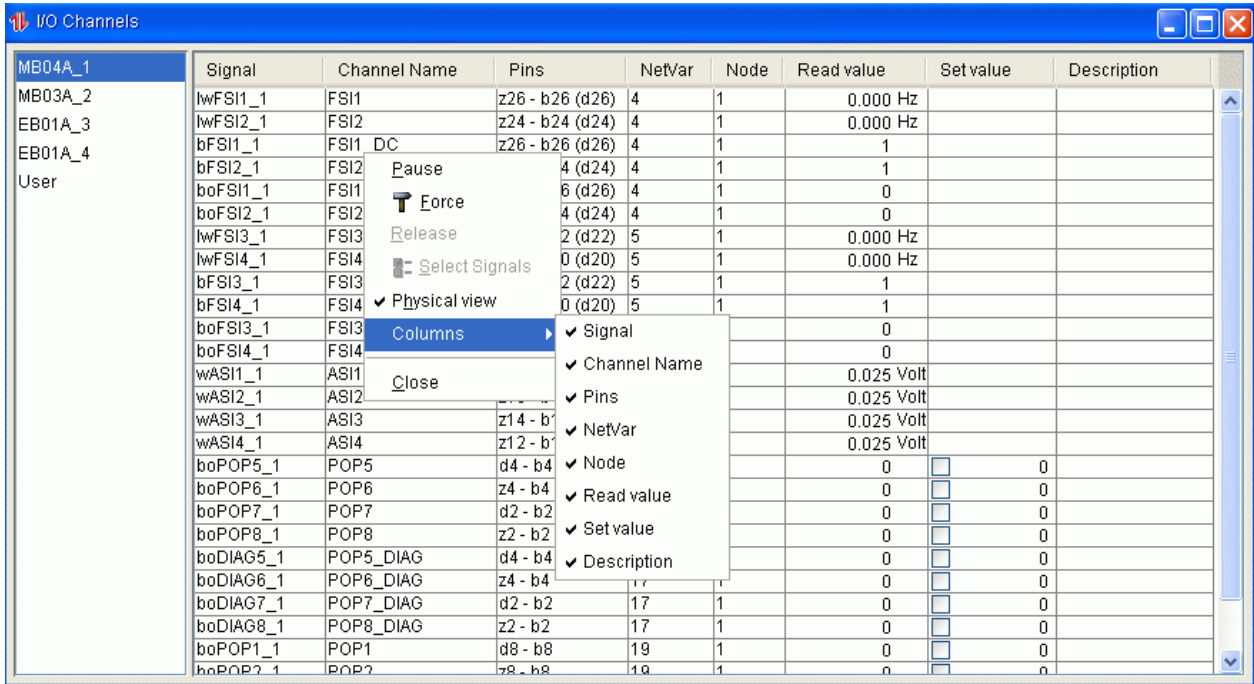
### Menu bar and toolbar



Menus and menu items can be reached by the keyboard combination **Alt + *underlined letter***. Certain menu items are also accessible via the toolbar. If a service is invoked then the appropriate menu appears in the menu bar as well as on the toolbar.

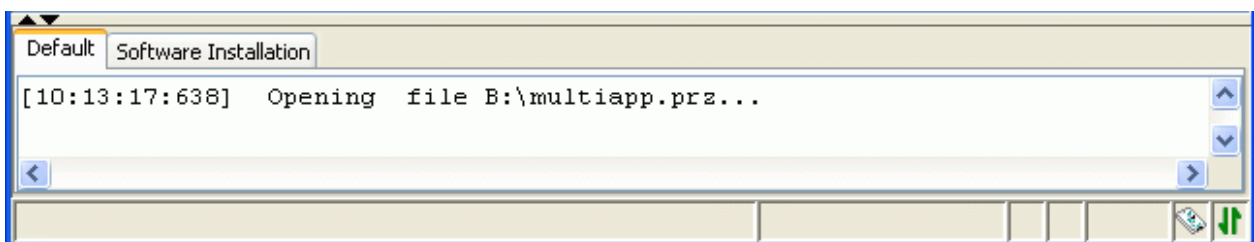
## Pop-up menus

Many of the ST03A services have context (pop-up) menus which can be activated by right clicking on the active area of the running service. The ST03A context menu options are also available from the appropriate menu item in the main menu.



## Log panel

The Log panel in the bottom of the ST03A main window is used for displaying informative messages from ST03A and its services. The tabs of the Log panel show service specific information from some of started services (there are also services which do not write messages in the Log panel). The **Default** tab contains general information and cannot be closed. The \* sign after the tab name indicates that the tab contains new unread message.



Pop-up menu of the log panel:

### Autoscroll

The automatic scrolling of messages in the log panel is turned on by default, but the user can always turn it off/on by selecting this menu item.

### Clear

Clears all messages from the actual log panel.

### Close

Closes the actual panel (the **Default** panel cannot be closed).













## 1.8 Supported Languages

You can find below a detailed list on the versions of ST03A which language is supported by which versions.

To switch between languages open the menu **Tools / Options / User Interface / Language settings**.

If you choose a language in Service Terminal and you find untranslated strings, the most likely reason for this is the following. In ST03A User Interface a part of the strings originate from the project files which can not be translated by the developers of Service Terminal. However, a translation of project file content is still possible. For further information, please contact the [Hotline Service Terminal](#).

ST03A Version									
V3.7		X	X	X	X	X	X		X
V3.6.47		X	X	X	X	X	X		X
V3.5.45		X	X	X	X	X	X		
V3.4.29		X	X	X	X	X	X		
V3.3.45		X	X	X	X	X	X		
V3.2.11		X	X	X	X	X	X		
V3.1.24		X	X	X	X	X	X		
V3.0.72		X	X	X	X	X	X		
V2.7.34 (V2.7.31)		X		X	X		X		
V2.6.14	X	X	X	X					
V2.5.19	X	X	X	X				X	
V2.4.07	X	X	X	X				X	

 Note: If your preferred language is not supported please ask your Knorr-Bremse contact person or the [Hotline Service Terminal](#) about the possibilities.

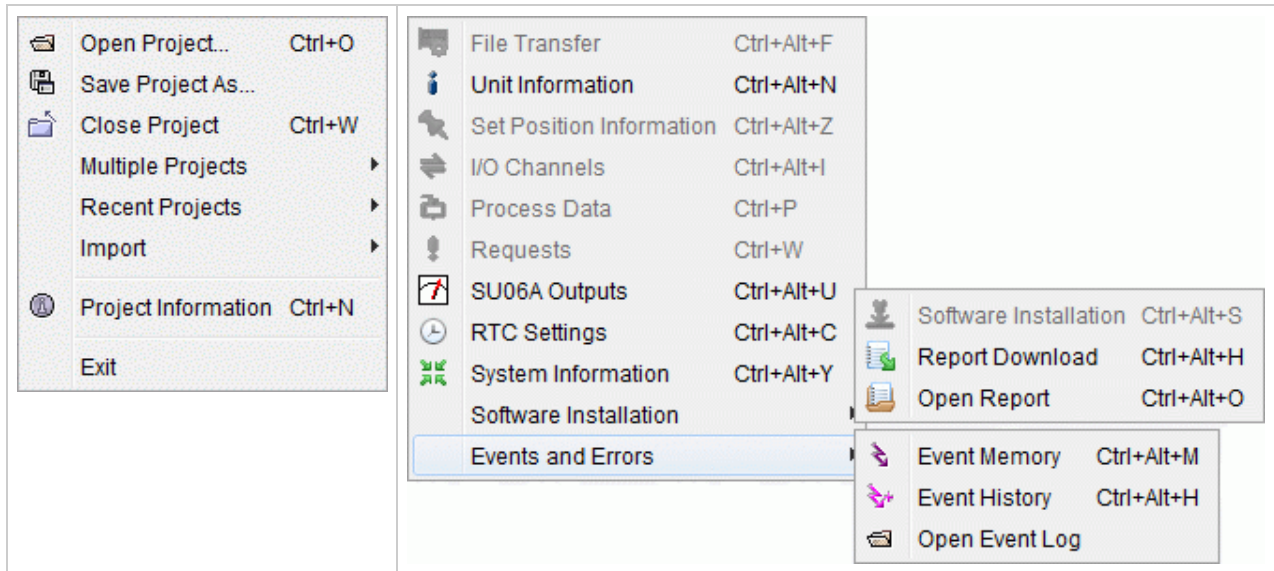
## 1.9 Hotkeys

ST03A supports the following functions through hotkeys.

ESC	Close opened menu.
Tab	Move focus between table columns or component.
Ctrl+Tab	Move focus to the first component of the next group (in a text field or in a table).
Left/Right /Up/Down	Move from element to element within units (e.g. between menus or from character to character in a text field).
Ctrl+F4	Close tabular services.
F1	Open context-oriented help topics.

## Accessing and using menus and toolbars

The menu items of **File** and **Services** menus can also be invoked with hotkeys. Features located in **File** menu can be reached using the key combination **Ctrl+....** The items of **Services** menu can be reached with the key combination **Ctrl+Alt+....**



**Note:** Some hotkeys may be unavailable on some computers because the OS has its own hotkeys that have precedence over ST03A defined hotkeys.

## Hotkeys in the Graphic Area


	Function	Available at
TAB	Moves focus to the next button/plot	Overall
SHIFT + TAB	Moves focus to the previous button/plot	
F12	Shows overview	On a plot
HOME	Fits graphic area to window	
PAGE UP	Zooms into the graphic area	
PAGE DOWN	Zooms out of the graphic area	
ARROW KEYS	Scrolls the graphic area	
ALT + ARROW KEYS	Moves time cursor	
ALT + ENTER	Opens dialog <b>Display Properties</b>	
ALT + PAGE UP	Decreases the size of/Hides a table	
ALT + PAGE DOWN	Increases the size of a table	
ALT + END	Shows or hides a table	

CTRL + ARROW KEYS	Scrolls the graphic area block by block	
CTRL + TAB	Moves focus onto plot	
CTRL + SPACE	Starts / stops measurement ▶ / ◻	
CTRL + PAGE UP	Decreases the size of a graphic area	
CTRL + PAGE DOWN	Increases the size of a graphic area	
CTRL + F	Moves time cursor to first trigger event	
CTRL + N	Moves time cursor to next trigger event	
CTRL + B	Moves time cursor to previous trigger event	
CTRL + L	Moves time cursor to last trigger event	
CTRL + SHIFT + UP ARROW	Moves/stretches selected curve up by one pixel	
CTRL + SHIFT + DOWN ARROW	Moves/stretches selected curve down by one pixel	
CTRL + SHIFT + PAGE UP	Moves/stretches selected curve up by twenty pixels	
CTRL + SHIFT + PAGE DOWN	Moves/stretches selected curve down by twenty pixels	
CTRL + SHIFT + HOME	Moves/stretches selected curve to the top of the range	
CTRL + SHIFT + END	Moves/stretches selected curve to the bottom of the range	
CTRL + SHIFT + ENTER	Moving/stretching of the selected curve is stopped	
CTRL + SHIFT + DELETE	Cancel the moving/stretching of the selected curve	
ARROW KEYS	Moves note on the diagram	On a note
DEL	Removes note from the diagram	
TAB	Moves focus to next note/table	
SHIFT + TAB	Moves focus to previous note/table	
CTRL + TAB	Removes focus from note/table	
ALT + ENTER	Opens <b>Properties</b> dialog of the note	
ARROW KEYS	Moves focus in the table	In a table
TAB	Moves focus to the first note	
CTRL + TAB	Removes focus from table/note	
SHIFT + TAB	Moves focus to the last note	
ALT + ENTER	Opens <b>Properties</b> dialog of the channel	
CTRL + SHIFT + ENTER	The curve is selected for moving and stretching	
CTRL + SHIFT + INSERT	The curve's scale is shown	

## 1.10 Options

Access:



Menu	Tools / Options...
Hotkey	CTRL + Shift + T
Mouse	

Following options can be set:

### Devices

Select device and properties as described here: [Communication devices](#).

### User interface

#### Language settings

Messages, texts labels, and help topics of ST03A are displayed in the selected language. You can change language without leaving the program. Please note that also project-specific items appear in the user interface that are not translated by default, especially table contents. Project content needs to be translated separately. If you need the project to be translated please contact your Knorr-Bremse contact person or the [Hotline Service Terminal](#).

#### Font

You can change the character size to facilitate seeing the tables of **Project Information**, **Event Memory**, **Internal Errors**, **Unit Information**, **I/O Channels** and **Process Data** services better.

#### Time format

With this option it is possible to set the time format to use when displaying time in the features **Event History**, **Measurement** and the ESRA-only features **RTC Settings** and **Data Logs**.

The two time formats supported are GMT (Greenwich Mean Time) and local time. The default is the GMT time.

#### Project information

This option enables or disables displaying of the **Project Information** window when a new project is opened. The default setting for this option is enabled (checked).

#### Measurement



**Show warning before discarding measurement data** controls whether a warning is automatically displayed when unsaved data from a previous measurement is about to be overwritten or lost. The default setting for this option is 'On'.

**Show warning if the measured file does not belong to the currently opened project** controls whether a warning is automatically displayed when the measurement and the currently opened project are mismatch. The default setting for this option is 'On'.

Three different general drawing styles of logical channels can be set: classic (by default), thick line and filled area. Changes will take effect after the restart of the measurement/DLG services.

## 1.11 Snapshot And Data Recording

Access: **Default** **Operator** **OEM**

Menu	Tools / Snapshot	Create a snapshot
Hotkey	CTRL+Q	
Mouse		
Menu	Tools / Data Recording	Start / stop data recording
Hotkey	CTRL+D	
Mouse		

These two features can be used to export data that appears in the windows of the open Service Terminal. Data is exported into CSV files. The delimiter of the values can be defined by the user (";" or ","). If it matches the list separator character of the operating system then the files can be opened and displayed with MS Excel.

### Snapshot

Snapshot creates one set of files containing data of open windows. After taking the snapshot you will be asked where to save recorded data.

### Data Recording

After starting data recording the Service Terminal saves current data in the background. Whenever some data is updated Service Terminal appends them to the recorded data. When you stop data recording you will be asked for a location where to save recorded data.

### Output files

In the file save dialog you can set the folder where to save the files. If you define a suffix, the file names will be extended by this name. The files will be collected into a folder that contains the date and time of recording. In the files, the first column shows normally the time elapsed (in milliseconds) since the start of the recording. At the end of the file you can find the time of recording.

File name	Service	Content
unit_information.csv	<a href="#">Unit Information</a>	BCU/DCU status.
project_information.csv	<a href="#">Project Information</a>	Representation of project file.
log_panel.csv	<a href="#">Log panel</a>	The tabs of the Log panel show service specific information from some of started services.
measurement.csv	<a href="#">Measurement</a>	Measured data. We recommend to use the feature <a href="#">Export</a> .
event_memory.csv	<a href="#">Event Memory</a>	Events occurring during recording.
event_history.csv	<a href="#">Event History</a>	Representation of event history contents.
signals.csv	<a href="#">I/O Channels</a> , <a href="#">Process Data</a>	Each channel is in separate columns.
triggers.csv	<a href="#">Process Data</a>	The file contains the time stamps when triggers where sent by Service Terminal to DCU. As long as the application receives these triggers periodically, the set values of Service Terminal are used in the application.

## 1.12 Collect ST03A Log Files

Access:



Menu Tools / Collect ST03A Log Files

This function saves all error and event log files into an archive ZIP file. By default, Service Terminal creates a new log file for each ST03A startup. Log files contains a list of events that are logged by the functions of Service Terminal, as well as information about functions, events, device changes, errors and more.

Log files are needed for troubleshooting and finding out where exactly the problem or the event occurred. The saved ZIP file can be sent to [Hotline Service Terminal](#) for further investigation.

## 1.13 Supported File Types

File Type	File Name	Description	Related Function
*.csv	Recorded data file	Used for data recording and can be opened with Microsoft Excel.	<a href="#">Measurement</a>
*.ehl	Event history data file	Saves the content of the event history with comments.	<a href="#">Event History</a>
*.emc	Encrypted measurement configuration file	Complete configuration of the Measurement function. Encrypted.	<a href="#">Measurement</a>
*.emd	Encrypted configuration measurement data files	Contains saved data measured with *.emc files. Encrypted	<a href="#">Measurement</a>
*.empz	Encrypted multiple project file	File type containing encrypted project data for more than one BCU/DCU.	<a href="#">Project</a>
*.eprz	Encrypted compact project file	All-in one encrypted project file. Project files of this type can be opened with ST03A Versions 3.5 and higher.	<a href="#">Project</a>
*.gtm	Generic text-based measurement file	Special CSV file format that can be imported into ST03A and displayed as measured data.	<a href="#">Measurement</a>
*.kbr	Knorr-Bremse Request file	File generated by the Service Terminal to request user privileges.	<a href="#">License Request</a>
*.kbu	Knorr-Bremse unregistration file	File generated at uninstallation of Service Terminal prove the uninstallation process. Needed when moving a license to another computer.	<a href="#">License Moving</a>
*.license	License file	Contains a license key and its activation information.	ST03A General
*.mpz	Multiple project file	File type containing project data for more than one BCU/DCU.	<a href="#">Project</a>

*.project	Project file	Saved project file in XML format. Project files of this type can be opened with ST03A Versions 2.1 and higher.	<a href="#">Project</a>
*.prz	Compact Project file	All-in one project file. Project files of this type can be opened with ST03A Versions 2.4 and higher.	<a href="#">Project</a>
*.settings	Settings file	Saved settings of the ST03A (e.g. window position, window size). If deleted then all settings are reset to the state at installation.	ST03A General
*.xmc	Measurement configuration file in XML format	Complete configuration of the Measurement function (obsolete; ST03A can only read these files; please save in *.emc file format).	<a href="#">Measurement</a>
*.xmd	Measurement data files in XML format	Contains saved measurement data (obsolete, ST03A can only read these files; please save in *.emd file format).	<a href="#">Measurement</a>
*.zip	System Information file	Contains a compilation of project dependent and independent information.	<a href="#">System Information</a>

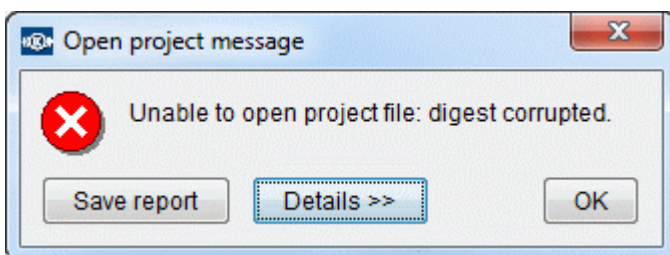
## 1.14 Error Reporting

Access:



Error reporting ZIP file can be sent to [Hotline Service Terminal](#) for further investigation. Engineers can use these logged reports to track and fix problems.

Whenever an error message occurs, the user is able to save the error and all available information about the error into a ZIP file. This contains a warning for the user or an unexpected error.



The **Save report** buttons will generate a ZIP file about the circumstances. Error report does not collect any personal data from your computer. The stack trace is available with the **Details** button.

## 1.15 Glossary

[Application](#)

[Board](#)

[Board state](#)

[Hotline Service Terminal](#)

[Node number](#)

### Abbreviations

**BCU**

Brake Control Unit

**DCU**

Door Control Unit

#### 1.15.1 Application

In case of DCU, the term application refers to the software that implements the logic of door control.

#### 1.15.2 Board

In Service Terminal used with DCU systems the term board refers to one item of door control unit.

#### 1.15.3 Board state

Possible board states during operation:

Normal	The board is working properly.
Download	There is no application on the board or the present application is corrupted.



## 1.15.4 Hotline Service Terminal

Hotline Service Terminal provides general support for usage of ST03A.


If you have any questions, opinion, or new feature requests, please feel free to contact us.

- e-mail: [esraterm@knorr-bremse.com](mailto:esraterm@knorr-bremse.com)
- Phone: +36 1 289-45-00
- Fax: +36 1 289-45-04

Phone calls are accepted generally Monday to Friday from 9 a.m. to 5 p.m. Central European Time except Hungarian National holidays. E-mails are being answered within 72 hours, but if sent during Hungarian office hours we do our best to answer your mail ASAP. Phones are answered in English and German languages.

Hotline Service Terminal offers following services to our customers.

- Licensing of Service Terminal
- Help on usage of Service Terminal
- Handling bug reports and feature requests. In case of bug report please send also an [error reporting ZIP file](#).
- Holding Service Terminal usage trainings for internal and external users

 **Note:** Our Hotline can only give limited support to project-related problems - in these cases please contact your Knorr-Bremse contact person. However, if we can not help you, we are pleased to help you finding the right person to talk to.

## 1.15.5 Node number

The node number is the address of the boards in the connected system. In DCUs only node number 1 is used currently.

## 2 Project

For the general idea behind the project concept please see the topic [Project](#) in the section [Introduction](#).

The ways projects can be opened, closed and saved are described in the topic [Handling project files](#), where you can also find a description of Service Terminal project file types.

The service [Project Information](#) shows the content of the project file focusing on the boards in the project. You can use this feature to compare the planned situation ([Project Information](#)) with the current situation ([Unit Information](#)).

Users can update the project files with their own comments to events in the service [Event Memory](#). Event comments can also be imported from another project file. This feature is described in the topic [Event Comment Import](#).

### 2.1 Handling Project Files


To use Service Terminal with a BCU/DCU you will need to open the project assigned to the given connected system. If you add any changes or new content to the project file you may want to save the changes. If the open project file has changed, you will find a \* in the title row of the ST03A main window next to the project name.

Below you can find a description of the supported project file types

#### Opening a project

Access:




Menu	File / Open...	Opens any project of any type
Hotkey	Ctrl+O	
Mouse		
Menu	File / Recent Projects / *	Quick launcher for the last used projects
Menu	File / Multiple Projects / Open Subproject...	Open a subproject in an *.mpz, *.empz file
Auto	At program start up	Opens the last used project

#### Saving a project

Access:



Menu	File / Save As...	Saves the project - name and file type definable
Mouse		

## Multiple Projects

Access:

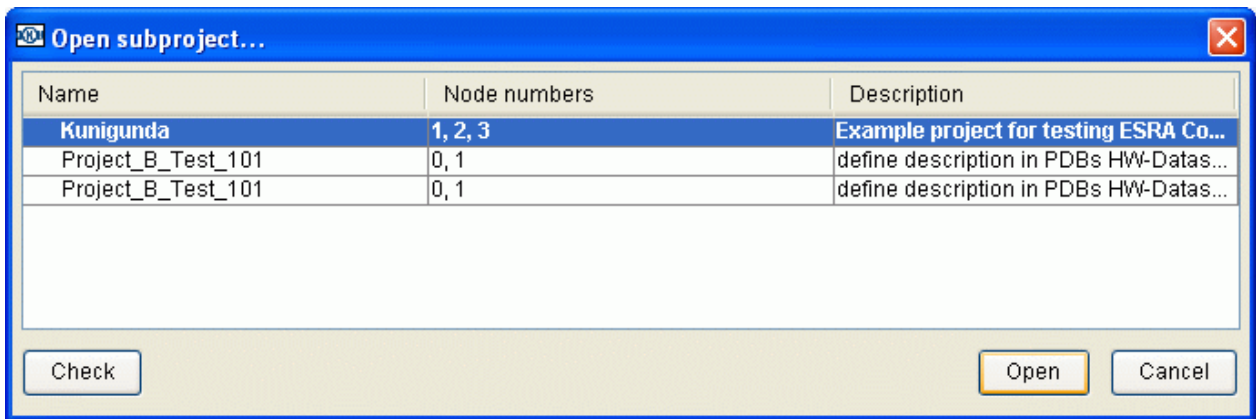


Menu	File / Multiple Projects / Open Subproject...	Open a subproject in an *.mpz, *.empz file
------	---	--

The multiple project files (.mpz) and the encrypted multiple project files (.empz) are the most convenient way to store the entire information about all projects for all control systems in the train. Multiple projects contain .prz subproject(s) and encrypted multiple projects contain .eprz subproject(s).

### Opening a subproject

All projects added to a multiple project are called subprojects. A subproject can be opened using either the **File / Multiple Projects / Open subproject...** menu option.



**Name**

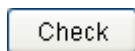
Name of the subproject.

**Node numbers**

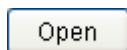
Node numbers used for the boards in the subproject. It is advisable to use at least one unique node number in each subproject to make the result of the automatic detection (  ) more determined.

**Description**

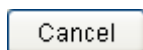
Description of the subproject.



Starts the automatic detection of the matching subproject according to the node numbers used for the boards in the connected ESRA system. The detected subproject will be marked with a green symbol preceding the name of the project. If more subprojects are marked with yellow symbol then the project can not be identified. DCU projects can not be detected since they do not differ in node numbers.



Opens the selected subproject.



Cancels the subproject opening.

## Supported Project Files

\* **.eprz: Encrypted Compact Project Files (the preferred type of project file to be used with ST03A V3.5 and later)**

These files are the encrypted type of Compact Project Files containing the same information.

\* **.prz: Compact Project Files (the preferred type of project file to be used with V3.4 and earlier versions of ST03A)**

These files are the recent type of project file format containing all relevant information for a project including the XML based project file, application software, measurement and data log configurations, project translation files, operating data descriptor file and background picture.

\* **.empz: Encrypted Multiple Projects Files**

Project file containing more \*.eprz files in one component. See details in the previous section.

\* **.mpz: Multiple Projects Files**


Project file containing more \*.prz files in one component. See details in the previous section.

\* **.project: XML Based Project Files**

These XML Based Project Files contain the same information as the \*.prj files as well as additional user defined information (e.g. user comments).

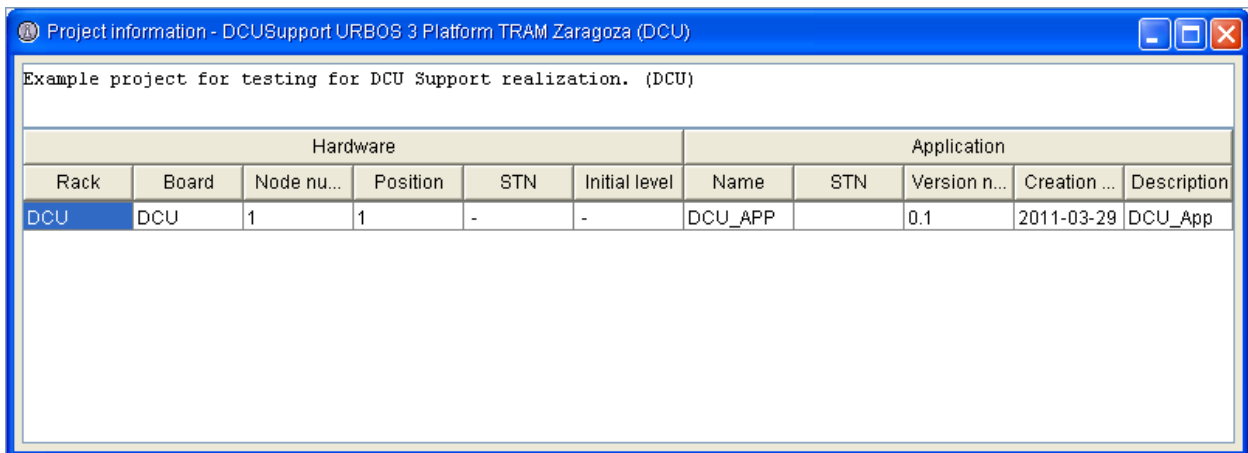
## 2.2 Project Information

Access: Default Operator OEM

Menu	File / Project Information
Mouse	

This feature displays information relevant to the boards and software configured in the current project file. By default the **Project information** window is displayed when the project file is opened, however this action can be turned on/off under the **Tools / Options...** menu item.

The state of currently connected control system is displayed with the **Service / Unit Information** menu item. Simultaneous use of **Project Information** and **Unit Information** allows the comparison of the current opened project file parameters to the parameters of the currently connected system.



## Hardware

### Rack

Name of a rack holding a set of boards.

### Board

Board name identification contained in the current project file.

### Node number

Address used during communication by the DCU.

### Initial level

Minimum hardware revision needed for running applications.

## Application

### Name, Number

Identification of the application software contained in the project file.

### Version number

The version of the application software contained in the project file.

### Creation date

Creation date of the software version contained in the project file.

### Description

Informative description of the application software contained in the project file.

## 2.3 Event Comment Import

Access:



Menu	File / Import / Event Comment Import
Hotkey	Ctrl+M

The event comments for the feature [Event Memory](#) can be imported from any PRZ, EPRZ or PROJECT project file into the currently open project file.

Steps:

1. Open a project (see: [Handling project files](#)).
2. Select **File / Import / Event Comment Import** menu item.
3. Choose a PRZ, EPRZ or PROJECT project file from which you would like to apply the event comments.

## 2.4 Custom Group Import

Access:



Menu	File / Import / Custom Group Import
------	-------------------------------------

Hotkey	Ctrl+G
--------	--------

[I/O Channel](#) and [Process Data](#) custom groups can be imported from any PRZ or EPRZ project file into the currently open project file.

Steps:

1. Open a project (see: [Handling project files](#)).
2. Select **File / Import / Custom Group Import** menu item.
3. Choose a PRZ or EPRZ project file from which you would like to apply the I/O Channel and Process Data custom groups.

### 3 Services


In this chapter you can find the description of the services of ST03A. Here you can find a list with a short description of each feature.

<a href="#">Unit Information</a>	Display current state of the connected system.
<a href="#">I/O Channel</a>	Display the I/Os of the connected system.
<a href="#">Process Data</a>	Display and set the process data in the connected system.
<a href="#">System Information</a>	Collect and export information about the connected system to *.csv files.
Events And Errors / <a href="#">Event Memory</a>	Reads out the event memory of the connected system.
Events And Errors / <a href="#">Event History</a>	Reads out the event history of the connected system.
<a href="#">Snapshot. Data Recording</a> (in the <b>Tools</b> menu)	Export data from the open windows into *.csv files.

#### 3.1 Unit Information

Access:



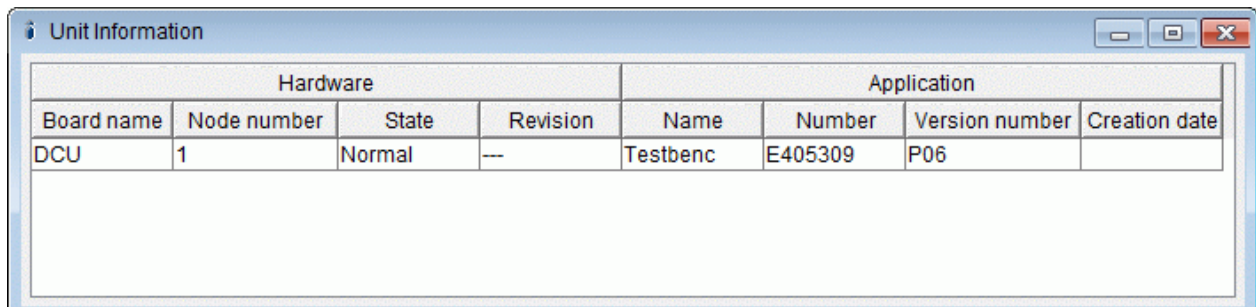
Menu	Service / Unit Information
Hotkey	CTRL+ALT+N
Mouse	

This service identifies the boards and the corresponding applications on particular node numbers in the connected system and displays the current state of boards and applications.

By means of [Project Information](#) service data defined in the loaded project can be compared with the current data of the attached control unit.

## DCU TCH protocol

The project file describes which protocols can be used to communicate with the DCU. If the opened DCU project uses the DCU TCH protocol then the Ethernet and the Serial/RS232 device can be used to communicate with the DCU. The Unit Information contains the following details with DCU TCH protocol:



Hardware				Application			
Board name	Node number	State	Revision	Name	Number	Version number	Creation date
DCU	1	Normal	---	Testbenc	E405309	P06	

### Hardware

**Board**

Name of the board.

**Node number**

Node number of the board.

**State**

Current state of the board.

**Revision**

Hardware revision number.

**Serial Number**

Serial number of the board.

### Application

**Name**

Name of the application software running on the board.

**Number**

Identification number of the DCU.

**Version number**

Version number of the application.

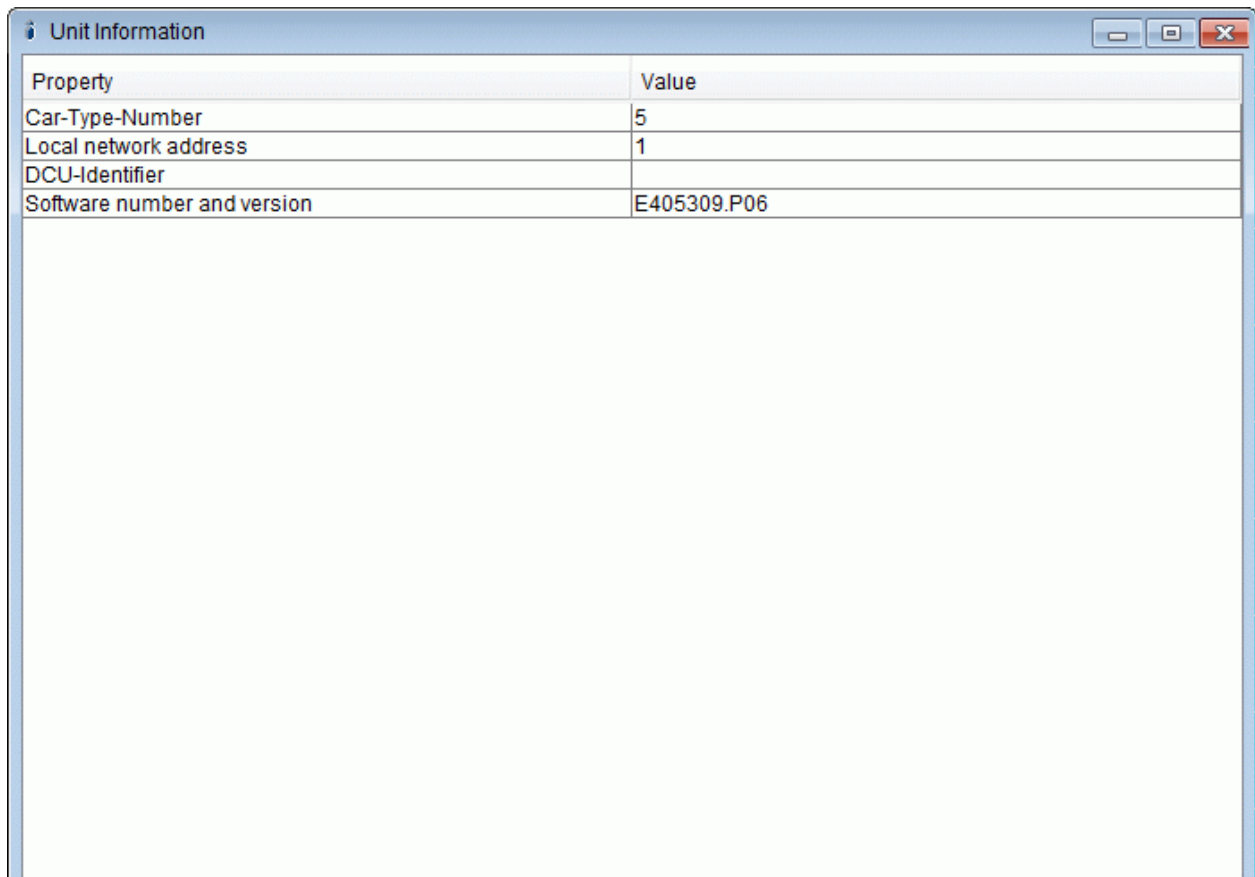
**Creation date**

Creation date of the application.



## DCU V3 protocol

If the opened DCU project uses the DCU V3 protocol then only the Serial/RS232 device can be used to communicate with the DCU. The Unit Information contains the following details with DCU V3 protocol:



Property	Value
Car-Type-Number	5
Local network address	1
DCU-Identifier	
Software number and version	E405309.P06

**Car-Type-Number**

Car type of the DCU.

**Local network address**

Network address of the DCU.

**DCU-Identifier**

Identification name of the DCU.


**Software number and version**

Software number and version number of the DCU.

### 3.2 I/O Channels

Access:



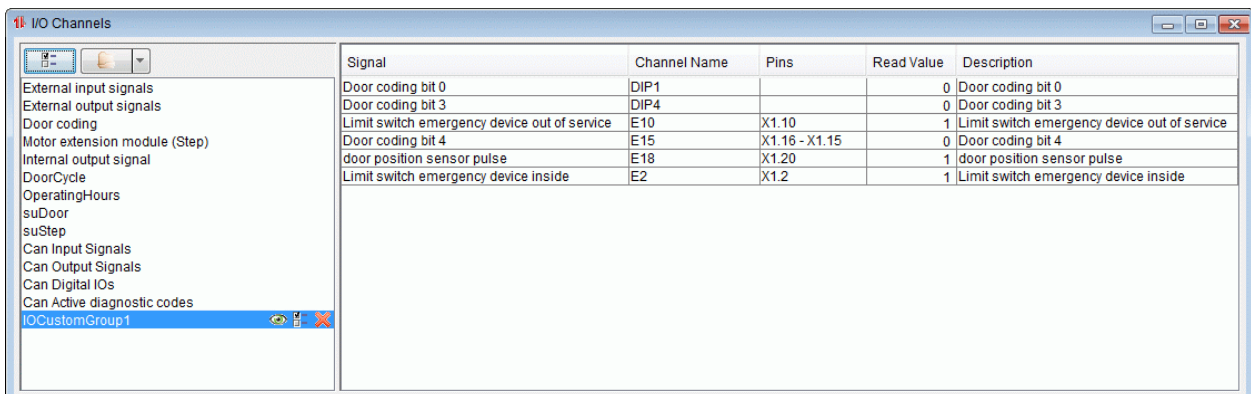
Menu	Services / I/O Channels
Hotkey	CTRL+ALT+I
Mouse	


This function allows access to the I/O signals of the DCU. The user can monitor the values of all the inputs and outputs. The display is periodically updated.

It is a fault-tolerant service which means that the ST03A will continue to read the values of channels even if there is an error channel. Channels where reading the values fails are shown with pink background.


The I/O channels are collected into groups. You can switch between groups in the left column.

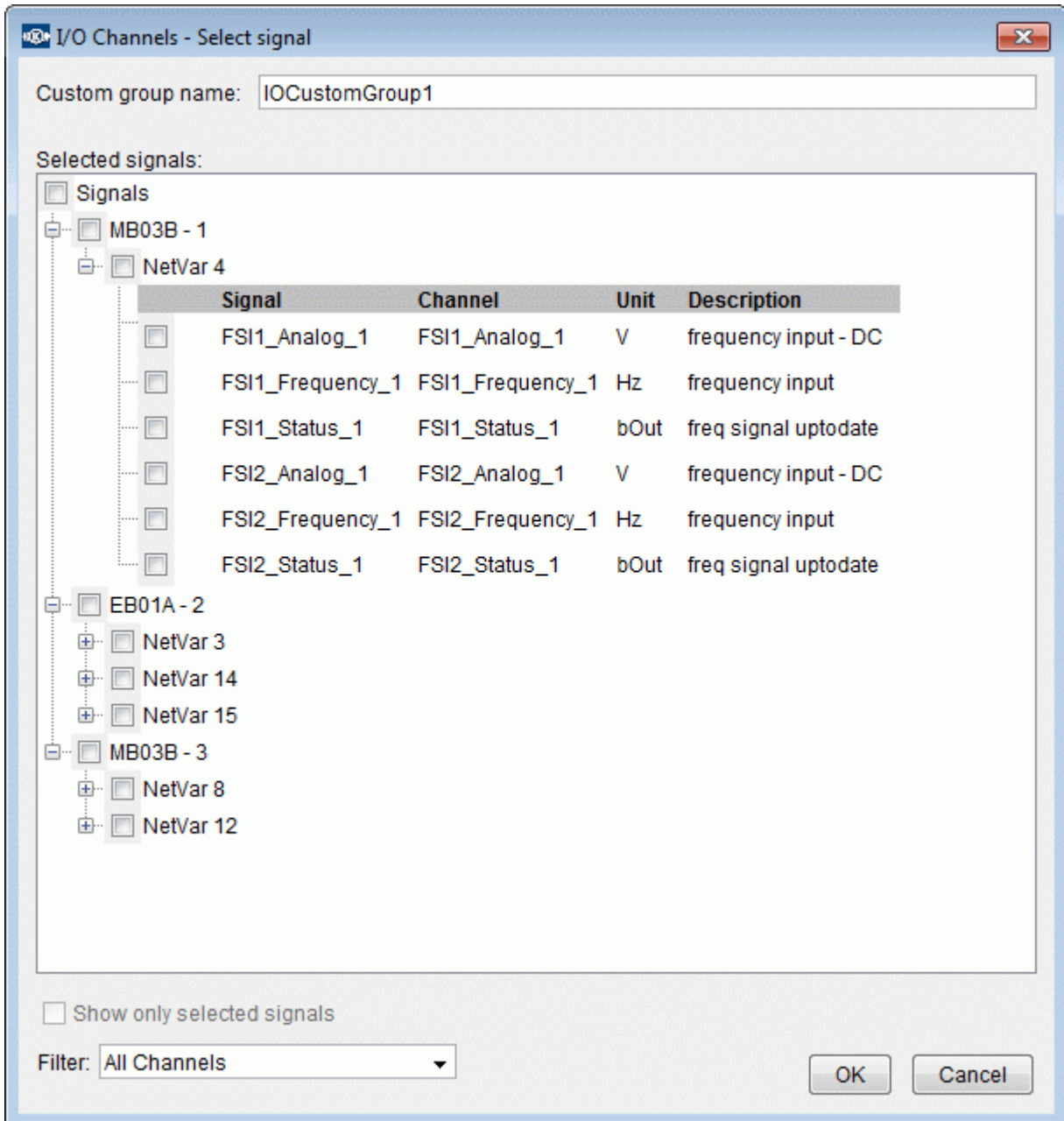
 **Note:** Access to I/O channels may also be delimited by project not only the absence of a license level.



The list in the left panel contains project defined channel groups followed - if there are any - by user defined (custom) groups. To filter the list click .

#### Custom groups

To create a custom group click . User can select a set of channels from different groups that he can see at once.



Use the following icons near the name of the group to

- hide this custom group
- modify the content of the custom group
- delete the custom group.

To preserve the custom group creation or modification the project file must be saved.

**Columns of table**

**Signal**

Name of the I/O signal defined in the application.

**Channel Name**

Standard name of the I/O channel.

**Pins**

Pin positions on the I/O connector on the board.

**Read value**

Values of input signals received by the Service Terminal. Units of measurement are added to certain signals.

**Description**

Short description of the I/O channel.

**Features**



**Changing physical/electrical view**

If **physical view** is turned on then measured values are shown in their physical meanings like speed, pressure. Otherwise, **logical view** is displayed; this is the measured signal on the sensor that is later converted to binary for transmission over CAN (e.g. frequency, voltage, current)

Also accessible from local pop-up menu or menu: *Physical view*

**Hide / unhide columns**

In the local pop-up menu *Columns* you can switch the visibility of each column on/off


**Enlarge table content**

In the menu item *Tools / Options / User Interface / Font* you can set a larger font size for this window so that values are readable even further away from the screen.

**3.3 Process Data**

Access:



Menu	Service / Process Data
Hotkey	CTRL+P
Mouse	

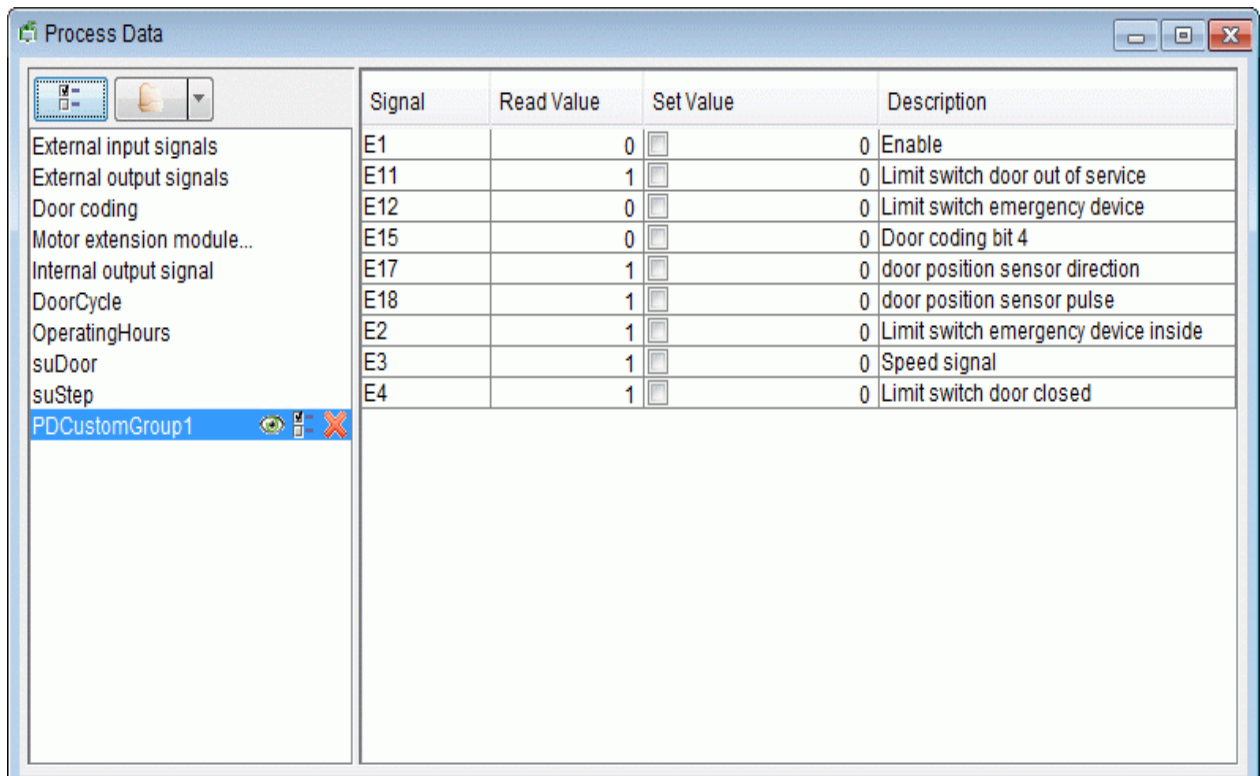
This function allows continuous observation of individual pre-selected internal system variables without using the data measurement function. Data is periodically updated.


It is a fault-tolerant service which means that the ST03A will continue to read the values of channels even if there is an error channel. Channels where reading the values fails are shown with pink background.

Process Data are collected into groups. You can switch between groups in the left column.




**Note:** Read/Write access to Process Data may also be delimited by project file content not only the absence of a license level.






The list in the left panel contains project defined channel groups followed - if there are any - by user defined (custom) groups. To filter the list click .

## Custom groups

To create a custom group click . User can select a set of channels from different groups that he can see at once.

Use the following icons near the name of the group to

-  hide this custom group
-  modify the content of the custom group
-  delete the custom group.

To preserve the custom group creation or modification the project file must be saved.

**Columns of table**



**Signal**

Variable name of the process data.

**Read value**

Data values read by ST03A from the connected system. The appropriate units of the process data are also shown.

**Set value**

Using the set value you can temporary overwrite the value of the process data in the target system. Enter a value and select the checkbox. The process data values are sent to the target system by selecting the menu item **Process Data / Force** or by pressing the  button. You can stop forcing the process data using the  button. Forcing will also stop if you switch to another process data group or if forcing has been active for 20 minutes.

**Description**


Short description of the process data.

**Features**

**Hide / unhide columns**

In the local pop-up menu *Columns* you can switch the visibility of each column on/off

**User defined channel group**

If you select the process data group *USER* and press  you can customize this group's content. A pop-up window will appear (see below) where you can select the data to be shown. If the check box *Show only selected channels* is checked, unchecked channels will be hidden.

Also accessible in the local pop-up menu *Select Signals* over the channel group *USER*.

**Enlarge table content**

In the menu item *Tools / Options / User Interface / Font* you can set a larger font size for this window so that values are readable even further away from the screen.

**3.4 System Information**

Access:




Menu	Service / System Information
Hotkey	CTRL+ALT+Y
Mouse	

This function collects information about the connected system and the current project file. The information is stored in a \*.zip file. You should use **System Information** if you detect an error during program operation and need external assistance. In this case start the **System Information** service, save the collected information in one of the existing folders, and then send the generated files to an appropriate person.


### 3.5 Event Memory

Access:



Menu	Service / Events and Errors / Event Memory
Hotkey	CTRL+ALT+M
Mouse	

With this function the current and temporary events of the boards and applications in the connected system can be displayed.

The events of the control unit are read and displayed periodically. This can be suspended by the  **Pause** command.

The user interface of Event Memory consists of three parts. The upper table summarizes the state of all event sources. The lower table lists the events that are not filtered out by the user. On the right of the window details of a selected event can be found as long as **details view** is selected.

Board	Status
DCU	Events occurred (gone)

Diagnosti...	Event name	Event stat...	Counter	Priority
0001	Internal Diag Code 001	Temporary	15	P0
0002	Internal Diag Code 002	Temporary	10	P0
0044	Internal Diag Code 044	Temporary	9	P0
0066	Internal Diag Code 226	Temporary	10	P0
0004	Internal Diag Code 004	Temporary	6	P0
0005	Internal Diag Code 005	Temporary	8	P0
0006	Internal Diag Code 006	Temporary	15	P0
0007	Internal Diag Code 007	Temporary	5	P0
0008	Internal Diag Code 008	Temporary	5	P0
0014	Internal Diag Code 014	Temporary	2	P0
0015	Internal Diag Code 015	Temporary	1	P0
0016	Internal Diag Code 016	Temporary	1	P0
0017	Internal Diag Code 017	Temporary	6	P0

Description

Instruction

Customer Comment

## Summary table content

### Board

Name of the different sources of events.

### Status

Current state of the source as listed in the table below.

Status	Definition	Comment
<b>OK</b>	The board is responding and there are no events on the board.	
<b>Events occurred (current)</b>	Some events of the source are in current state.	These events are listed in the event table.
<b>Events occurred (gone)</b>	Some events occurred, but they are not in current state anymore	These events are listed in the event table.
<b>Events filtered (current)</b>	Some events of the source are in current state. Additionally, some events are in current or temporary state but still not listed in the event table due to <b>Event Filter</b> settings.	Open the <b>Event Filter</b> and enable all events of this source to show the hidden events in the event table.
<b>Events filtered (gone)</b>	Some events occurred, but they are not in current state anymore. Additionally, some events are in temporary state but still not listed in the event table due to <b>Event Filter</b> settings.	Open the <b>Event Filter</b> and enable all events of this source to show the hidden events in the event table.
<b>Board is not responding</b>	The source did not answer the query for its events.	In some projects this is the regular behavior when in specific BCUs only a subset of the boards defined in the project should be present.
<b>Cannot read events</b>	The responsible board for sending the events of this source to ST03A is not available.	In most cases this status indicates that the extension board is found but the main board to handle its events does not respond.
<b>No events defined</b>	The board does not support the service <b>Event Memory</b> .	
<b>All events filtered, board not queried</b>	No information on the events of the source available since all events of the source are filtered out.	Open the <b>Event Filter</b> and enable at least one event of the source to start reading out the events.
<b>Loading</b>	Event states are being loaded.	Please wait while loading the events.

## Event Table content

### Diagnostic Code

Short identifier of the event.

### Event Name

Name of the event defined by the application programmer.



**Event status**

Current status of the event as listed below.

Status	Definition	Comment
<b>Current</b>	This event is active.	This event can be erased but may appear again after erasing.
Temporary	This event occurred but is not active any more.	This event can be erased.

**Counter**

Counter of the specified event. Click right mouse button and select **Read Event Counter** to activate reading out the event counter from the target.

The counter is limited to 15. This value is displayed even if the event occurred more than 15 times.

**Priority**

Priority of the event. Events of different priority levels may need different actions (defined for the project).

**Details View Content**

These information are only displayed while **Detail View** is activated.

**Description**

Description of the event in the project file.

**Instruction**

Actions to perform when the event occurs. Predefined in the project file.

**Customer Comment**

Any user defined comments. Can be edited in the **Event Filter** panel (see below).

**Available functionality**

The following functions are accessible in the **Event Memory** service:

**Show Description As Name**

If this option is checked the service will show events in human readable format. Show Description As Name can be turned on by selecting the **Event Memory / Show Description As Name** menu item.


**Read Event Counter**

If this option is checked the service will read the counter of events. Events counter can be read by selecting the **Event Memory / Read events counter** menu item.

**Detail View**

If this option is checked the service will show detailed description of an event. Detail view can be turned on by selecting the **Event Memory / Detail View** menu item.

**Pause** 

If this function is checked the service will be suspended, otherwise it will be started. Service can be started or suspended by pressing the  button or by selecting the **Event Memory / Pause** menu item.

**Clear** 

Deletes all current and temporary events of all displayed boards and applications. Events can be deleted by pressing the  button or by selecting the **Event Memory / Clear** menu item.


**Event Filter** 

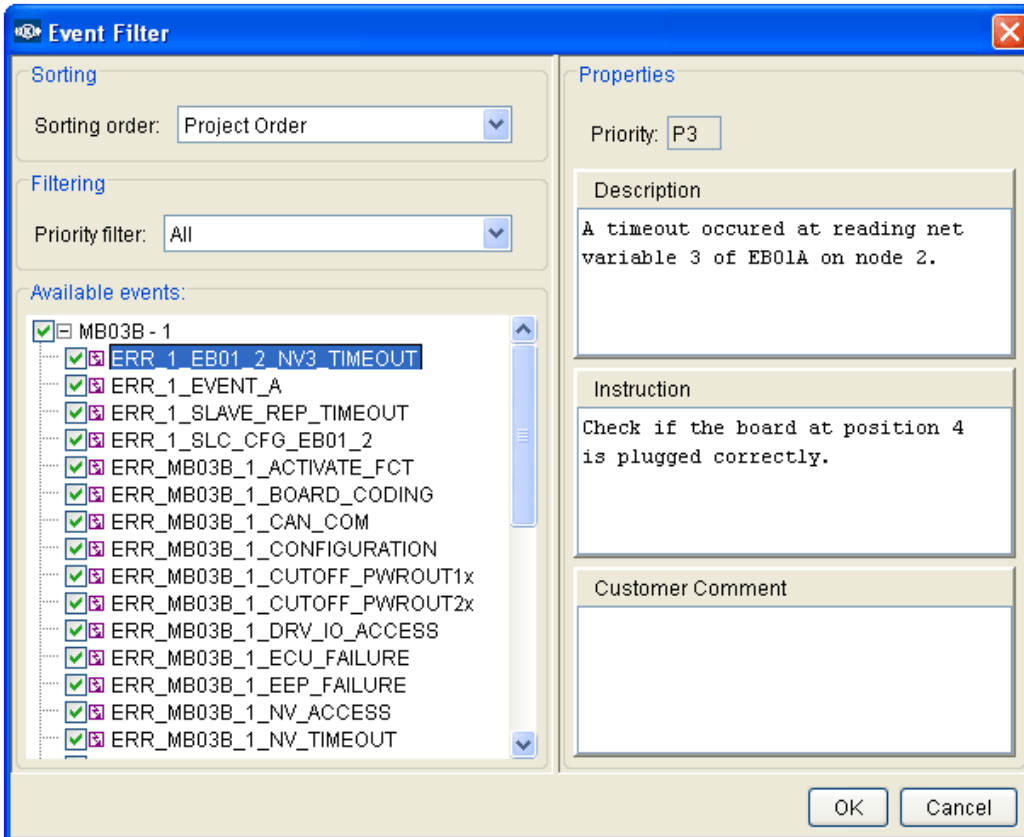
The user can see all possible events of the project grouped by boards. The user may select a subset of events, for example all events of one board.

These functions above are also available in the pop-up menu of **Event Memory** window.

## Event Filter

Access: **Operator** **OEM**

Menu if <b>Event Memory</b> window is open	Event Memory / Event Filter
Pop-up menu in <b>Event Memory</b> window	CTRL+ALT+M
Mouse in <b>Event Memory</b> window	



Using the event filter panel you can hide events from the event table to keep overview. The number of hidden channels is displayed in the title row of the Event Memory window. The boards that contain hidden channels are marked as "Filtered" in the **Event Name** column.

### Sorting order:

The events in the selection tree can be ordered within the folder of the board either by alphabetical order or the order defined in the project file.

### Priority filter:


You can select to list only the events of one priority level in the selection tree.

## Event Comments

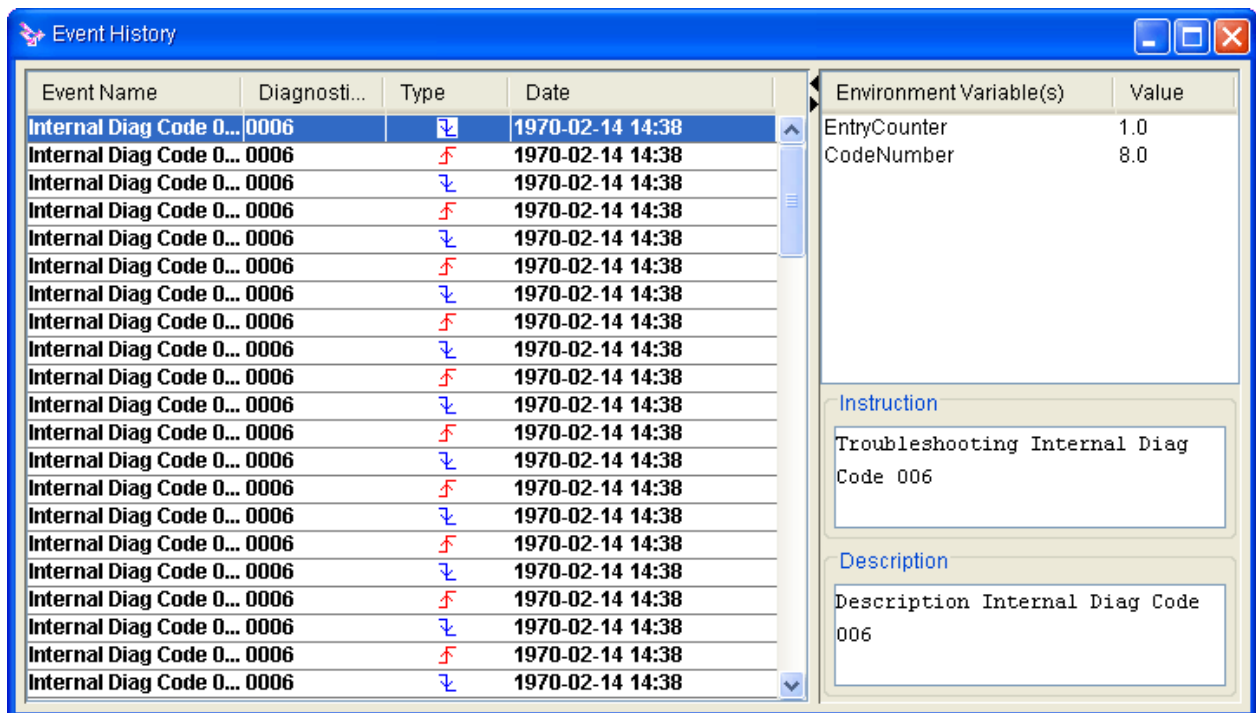
If you select an event you can see the properties of the event as contained in the project file. **Description** and **Instruction** are predefined in the project but the event comments can be edited by the user and saved into the project file (**File / Save as ...**). If you created your own comments to events and you would like to use these comments in other project files (e.g. newer version of the same project) then you can import the event comments of another project file into the currently open project using the menu feature [Event Comment Import](#).



### 3.6 Event History

Access: **Operator** **OEM**

Menu	Service / Events and Errors / Event History
Hotkey	CTRL+ALT+H
Mouse	

This function makes it possible to read, save, open and display the actual event history content. The menu item is disabled if there is no event history in the opened project.



- Event Name**  
Name of the event.
- Diagnostic Code**  
Code of the event.
- Type**  
  -  - The event is currently active.
  -  - The event is not active anymore.
- Date**  
Last time the event was read as active.



**Environment Variable(s), Value**

This table describes the state of the connected system when the event occurred; it can include values of zero or more environment variables.

The environment variable can have one of the following three types:

- State: It defines a state. E.g. the door is open.
- Bit field: In this case each bit of the variable has a separate value and a separate meaning.
- Normal: It is a number e.g. value of speed sensor.

**Description**

Description of the selected event.

**Instruction**

Advice about how to fix the error.

The events in the **Event History** window are shown normally in **black**. If an event is shown in **gray** it means that the event is marked as cleared.

The order of the events can be arranged according to name, event code, node, type, application name and time stamp.

**Event History menu**

**Erase**

Deletes the events.

**Save**

Opens the **Save** dialog window to save all events in XML Event History (\*.eh1) file format. The upper field in the dialog window is a comment field where an optional comment can be added. The comment is stored with the saved file and is displayed when browsing the Event History Log files to open. The Event History Log files can be opened through the **Services / Events / Open events log** menu item.

**Refresh**

Refreshes the content of the **Event History** window.

**Show Description As Name**

If this option is checked the service will show events in human readable format. In this case the **Description** field in the right panel will disappear.

## 4 Licensing

Service Terminal is a general tool that supports all possible ESRA services and most of the DCU services for development, maintenance and operation. Even though only a subset of features are available at once, depending on two parameters:

### Project

Only those features are active that are supported by the connected system.

The list of supported features is described in the [project file](#).

### User group

Service Terminal users belong to different groups having different tasks and different responsibilities.

Different user groups are identified by different [license levels](#).

## Getting a license

For registering your installation of ST03A you will need the ID on the label of your CD cover. You will need to fill in the license request form and either activate your license on-line or send a Knorr-Bremse license request file to the [Hotline Service Terminal](#).

Please click [here](#) to read detailed steps of getting a license.

## Activating a license key

After you have sent a license request file to [Hotline Service Terminal](#) you will receive a license key.

Please click [here](#) to find out how to activate your license key.

## Moving your Service Terminal license to another computer

As Service Terminal licenses are hardware-bound, you may only use this license with a new computer in case you prove to have uninstalled your previous Service Terminal installation.

Please click [here](#) to find out how to move your license to another computer.

## Having problems with your license?

Please check our topic [Trouble Shooting](#) for your problem, and if you haven't found the answer to your question, please feel free to contact the [Hotline Service Terminal](#).

## 4.1 License Request

There are two ways to get a license key. You can use the first solution if your computer is directly connected to the Internet.

1. Fill in the license request form (**Tools / Licensing / Request**).
2. Press **Online** to send the content of the form to the license server.
3. A dialog will appear asking if you would like to add the license key now. Click **Yes**.

You can follow the steps below in case your computer is not directly connected to the Internet or if the automatic licensing process failed due to any reason.

1. Fill in the license request form (**Tools / Licensing / Request**).
2. Press **Save**. A file dialog will appear and you can save a \*.kbr license request file on your local computer.
3. Send this saved file in an e-mail to the [Hotline Service Terminal](#).
4. You will receive your license key in e-mail within 3 days.
5. You can add your license key to your Service Terminal in the menu item **Tools / Licensing / Answer**.

**License Request** ✕

<p><b>Personal and contact information</b></p> <p>Title: <input type="text"/></p> <p>Honorific: <input type="text"/></p> <p>Given name: <input type="text"/></p> <p>Middle name: <input type="text"/></p> <p>Family name: <input type="text"/></p> <hr/> <p>E-mail: <input type="text"/></p> <p>Fax: <input type="text"/></p> <p>Phone: <input type="text"/></p>	<p><b>Address</b></p> <p>Company: <input type="text"/></p> <p>Street: <input type="text"/></p> <p>City: <input type="text"/></p> <p>State: <input type="text"/></p> <p>Country: <input type="text"/></p> <p>Zip: <input type="text"/></p> <p>ID: <input type="text"/></p>
--	---

## Content of the license request form

### Personal and contact information

Personal and contact information must be provided here.

### Address

The complete address of the user (company data) must be provided here.

### ID

The ID field must contain a valid product installation ID (serial number). Customers will not get a license without entering a valid ID.

#### Notes:

- The ID is printed on the label stuck onto the cover of the official CD. The official CD can be ordered via SAP system with the STN30440 article number.
- Only one license request per ID is approved. Please make sure you provide an ID that has not been used before.

Online

Applies for a license automatically on the Internet.



Saves the entered data in a license request file (\*.kbr). The created file should be sent to the [Hotline](#).

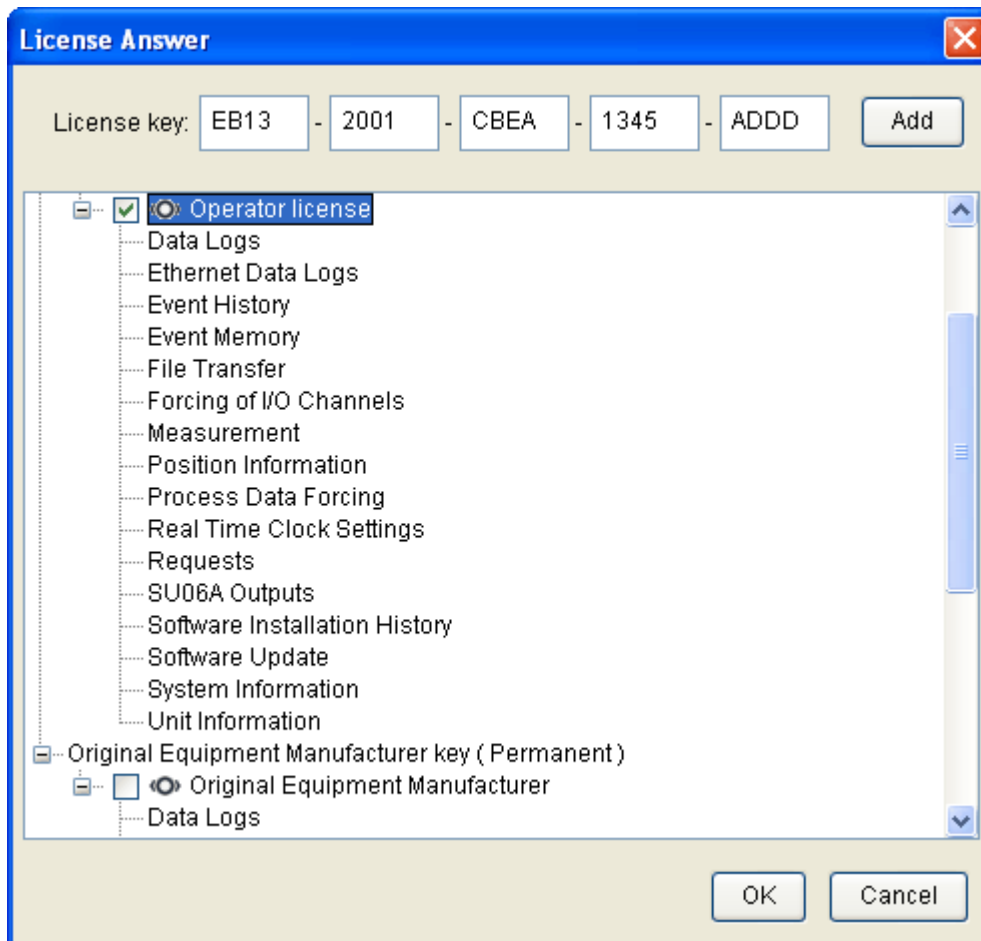
Print...

**(not recommended)**

Prints a copy of the registration data. (It is not recommended to use this functionality as processing the printed license requests last longer than licensing with saved \*.kbr files.)

## 4.2 License Answer

If a request is approved by Knorr-Bremse, you will receive a 20-digit-license-key, which should be activated in the **Tools / Licensing / Answer...** panel:



To activate the license key copy and paste it into the *License key* field, then click the **Add** button.

To have full access to the features of Service Terminal please do not forget to load the project file belonging to the connected ESRA system or DCU.

 **Notes:**

- If you have more than one license, you can activate/deactivate them by selecting/unselecting the appropriate check-boxes and clicking the **OK** button.
- You can always check your currently available licenses in this window.
- If you would like to see which plug-ins are available with your licenses, just click on the + sign in front of the appropriate license.



## 4.3 Moving Licenses to Another PC


Sometimes it is necessary to move a license from a computer to another one. The license revoking mechanism makes it possible to permanently remove a license from a computer and prove this to Knorr-Bremse. Afterwards [Hotline Service Terminal](#) support accepts a new registration with the same ID.

Both steps (revoking the old license key(s) and providing a new one(s)) can be done at once if you send to the Hotline Service Terminal e-mail address ([esraterm@knorr-bremse.com](mailto:esraterm@knorr-bremse.com)) both:

- the .kbu file created during the uninstallation process described below,
- the new license request file (.kbr) created on the new PC (see [License Request](#)).



To remove permanently your current licenses start the ST03A uninstaller (**Start / Programs / ST03A V(N) / Uninstall ST03A**) and check in the **Revoke license** check-box.

During the license removal ST03A generates a .kbu file that has to be sent to the Hotline Service Terminal e-mail address in order to prove the removal of the license. The .kbu file will be created into the directory which name depends on the version of ST03A and where other license files are stored. If you choose the **Revoke license**, the information about the storage directory will appear in the last panel of uninstallation process.

 **Note:** After the license has been removed from the computer it cannot be used on the same PC.

## 4.4 License types





ST03A supports two different platforms that require individual licenses:


- Door Control Units (DCU) of IFE. Marked with  in the [License Answer](#) panel.
- ESRA brake systems of Knorr-Bremse. Marked with  in the [License Answer](#) panel.

All license types listed below are available for both system types (even though the accessible features are different). Combined licenses for both systems can also be delivered.

### Available services in DCU systems

The following license types and related features are available to ST03A users in DCU systems. For the available features in ESRA mode please close the DCU project file and open this help topic again.

User Group	License Name	Available Services
<p><i>Any user</i> This license level is available immediately after installation</p>		<p><a href="#">Project Information</a>  <a href="#">Event Comment Import</a>  <a href="#">Unit Information</a>  <a href="#">I/O Channels</a> (reading)  <a href="#">Open Event Log</a>  <a href="#">Data Recording, Snapshot</a></p>
<p><i>Any user</i> This license level can be selected only during installation. Use this if you need to measure urgently before your license key arrives</p>	<p><b>TEMPORARY</b>  </p>	<p>This license level does not effect DCU-related features.</p>
<p><i>Train operator companies</i>  <i>Original Equipment Manufacturers (OEM)</i></p>	<p>  </p>	<p>Services of <b>Default</b> access rights +  <a href="#">Process Data</a> (reading + forcing)  <a href="#">System Information Export</a>  <a href="#">Event Memory</a>  <a href="#">Event History</a>  <a href="#">Measurement</a>  <a href="#">Measurement Configuration</a></p>

 **Note:** If a specific project does not support a specific feature then the menu items belonging to that feature will be disabled even if the user possesses the necessary access level. For example: the **Data Log Browser** tool-bar button will be disabled if the opened project file does not contain a data log configuration.



## 4.5 Trouble-shooting (Licensing)

Here you can find the most frequently asked questions (FAQ). If you don't find the answer to your question here please contact the [Hotline Service Terminal](#).

### Registration - License request

- ?** **How can I get a license ID?**  
 To get a license ID please contact your Knorr-Bremse contact person who will order it for you in SAP. For Original Equipment Manufacturers the order number should be STN30440/OEM-ED, and STN30440/OP-ED for Train Operator Companies. Both licenses provides access to both ESRA and DCU systems.
- ?** **How can I upgrade my Service Terminal to the newest version?**  
 If the official release date of the new version is not later then 1 year after the first registration of your ID then you can update ST03A for free. You simply download the newest version on the same computer and send a new license request file to the Hotline using the same ID.  
 If you first registered your ID more then 1 year before the official release of the new version you will need an update for your license ID that your Knorr-Bremse contact person can order for you in SAP. After the upgrade you can register the newest version of Service Terminal on the same computer where the old version was registered.
- ?** **I will get a new computer from the IT. Can I use ST03A with my old ID on the new computer?**  
 You can move your license if you follow the steps described [here](#)
- ?** **I am having Operator access rights but I need OEM. How can I get my license updated?**  
 Under special conditions your Knorr-Bremse contact person can order an upgrade for you in SAP. After the upgrade you can receive an OEM license key for your existing ST03A installation.

### Activating licenses, active licenses, license answers

- ?** **Where can I see my currently active licenses?**  
 In the menu item *Tools / Licensing / Answer* your active licenses are listed.
- ?** **How can I distinguish my ESRA licenses from my DCU licenses?**  
 The icon  indicates DCU licenses and the  mark ESRA licenses in the [license answer](#) panel.
- ?** **When adding the license key I get an error message "invalid digest".**  
 There may have been any hardware change between generation of license request file and adding the generated key.  
 Please send a new license request file to the [Hotline](#) in order to investigate the possible reasons and generate a new key.
- ?** **When activating a license I get an error message "License already added".**  
 The license has already been added or it has been [revoked](#) from the computer. If the problem can not be solved in another way you will need a new license key.
- ?** **My license key does not work on another computer.**  
 Licenses are hardware-bound so they will only work on the computer where the license request form was filled out.  
 To get a license key for your other computer please send a new license request file to the [Hotline](#) from the other machine with an unused ID



- ?** **My license key used to work on this computer but now it doesn't.**  
 A license key may not be working if any hardware has been changed on the computer.  
 Please send a new license request file to the [Hotline](#) in order to investigate the possible reasons and generate a new key.
- ?** **My license is not working - License answer window writes: "No licensing information available."**  
 The service ST03A may not be running. To correct this, please follow the steps below

  1. Open **Start** menu / **Settings** / **Control Panel** / **Administrative Tools** / **Services**
  2. Search the item **ST03A Service of Knorr-Bremse** and check if it is running.
  3. If it is not running, start it with right clicking on it and selecting "Start".
  4. If you do not find this service in the list then uninstall Service Terminal (do not check **"Revoke license"** !!!) and install it again.
- ?** **My license is not working - License answer window marks my licenses as "expired"**  
 Either your license has been [revoked](#) from the computer or you have not enough [user rights](#) to use Service Terminal.  
 Temporary licenses, after they had lost validity, are also displayed this way.

## Some features do not work...

- ?** **I can not find a service in the menu.**  
 In the menu item *Tools / Licensing / Answer* your active licenses are listed.  
 Please check which licenses are active. Please click [here](#) to find out what services should be available at your license level.  
 If you see the menu *Measurement* then you are having at least [Operator](#) rights.
- ?** **I can see a service in the menu but it is not active (gray).**  
 If you can see a menu item in the menu this means that you have the correct license type to access this menu item but your currently open project file does not support it or you may have no project file open at the moment.

## 5 Measurement

Access:



### Introduction to measurement

During measurement data is being read out cyclically from the ESRA/DCU system and from external measurement devices. Service Terminal stores the read values together with the time of reading and visualizes them in graphical plots.

The data flow during measurement consists of channels. One channel represents the values of one variable in the application or one input/output value of a measurement device including the time information belonging to each value. So each channel can be regarded as a function of time containing values of a variable and this is also the way how ST03A displays them.

The amount and size of channels that can be measured at once is limited by base software. So the user may define configurations where he can decide which variables he wants to measure at once and at what cycle time.

The output of measurement is measured data. The user may save the measured data in the own format of ST03A or export it into `csv` files that can be opened by other programs like MS-Excel. As new feature the user may also import general measured data files e.g. to use Service Terminal visualization functionality on data measured with other tools.

The plots of measured data can be individually redesigned (e.g. zooming, hiding channels, changing colors, etc.) for optimal visualization and printed out or copied into documents. You may also place notes at different locations of the plot.

### Navigation in the Measurement help topic

[Configuration](#)

Selecting channels for measurement, setting cycle times on measured boards

[Channel](#)

Description of all types of channels, configuring measurement on external measurement devices

[Measuring](#)

Step-by-step description of measurement process. Saving, exporting data, adding notes, printing, displaying measured data of DOS-Service Terminal.

[Data displaying](#)

Customization of the plots containing measured data for optimal visualization.

[Measurement Devices](#)

Detailed description of inputs and outputs of external measurement devices.

External source measured data imported into Service Terminal for further processing. Detailed description of input format.

## 5.1 Configuration



A measurement configuration file (\*.emc) includes all data settings for starting a measurement. It contains:

- A list of channels which are to be measured
- Cycle times with that a board should be measured
- Calibration information to the channels (factor, offset and unit) so that the digital data gets its real meaning
- Visualization information to the channels like color

### Opening a Configuration

Access:



Menu	Measurement / Open	Open any configuration or measured data file
Mouse		
Menu	Measurement / Last Configuration	Opens the last configuration
Mouse		
Hotkey	CTRL+ALT+L	

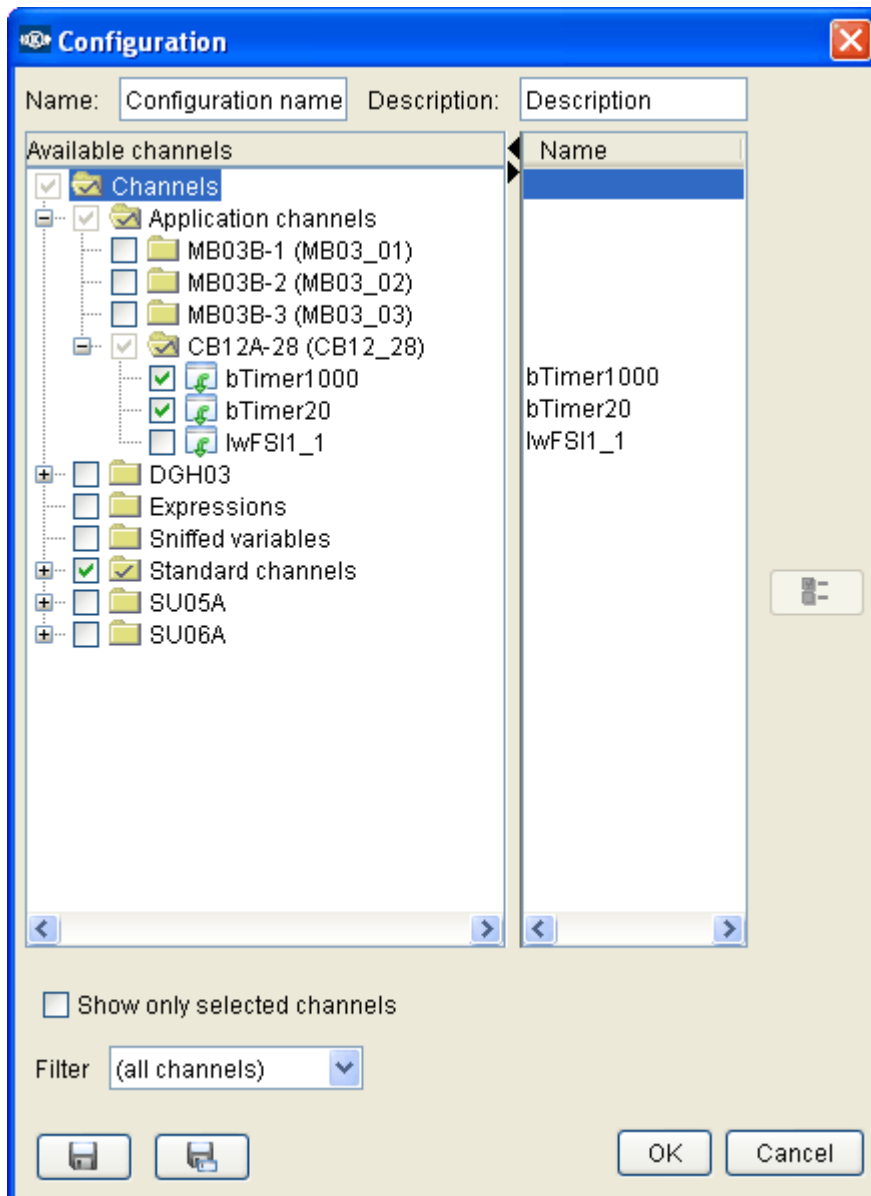
Opening a measurement configuration an empty measurement window will appear ready for starting a measurement

### Selecting Channels

Menu in measurement window	Display / Configuration
Mouse	

If you open a configuration you can change the set of channels you would like to measure in this dialog. In the right column you can find the original name of the channels while the left column shows the names that are unique identifiers in the project (so called alias names).

**Note:** There are some limitations for what channels can be selected at once and what channels can not be selected without another. For further details please check the topic [Channel](#) . There you can also find the description and properties of each channel type.





For the short list of accessible features in this dialog please see the table below.


	Feature	Description
	Show only selected channels	Check this check-box to hide channels that are not selected.
	Filter	Search a channel in the tree. Type a part of the channel name and press ENTER. <b>Logical and "&amp;" and logical or " "</b> can be used in the filtering.
	Save	Saves the configuration updating the currently open file.
	Save As	Saves the configuration using a new file name.


## Saving Configurations

Access:



Menu	Measurement / Save	Saves the current open configuration to the last location for saving.
Mouse		
Menu	Measurement / Save As...	Opens the file open dialog for saving the current configuration.
Mouse		

The  button saves the configuration to the location where the configuration was last saved. If you open a measurement configuration from the project file this button will open the **Save As...** dialog.

Using the  button you can save the configuration to a different location to your local file system in \*.emc format.

The conversion will only affect the saved file. The currently open configuration will remain the supported format of the current ST03A version.


## 5.2 Channel

Channels are storing the values of a variable / input / output etc. together with the time the value appeared. Before measurement you need to decide which channels you would like to measure. This you can do in the [Measurement Configuration Dialog](#).

In the following you can find the detailed description of each channel type.

### Expression channels

The term Expression is the short form for Mathematical expression. Expressions enable calculations on other channels' values. The result is also represented as a channel.

 **Example:** The acceleration can be calculated as the first derivative of a speed signal. A measurement may contain the expression to calculate acceleration from a speed signal. In this case only speed needs to be measured from the connected system and ST03A calculates the values for the acceleration channel.

Features of expression channels


- Expressions can be evaluated online (during measurement) and offline (on existing measured data).
- Expression channel data is also saved in measured data files.
- Expression channels depend on the channels on which they do calculations. Example for illustration: acc (acceleration, expression) depends on v\_ref (application channel measured from a board). In this case:
  1. If you select acc for measurement then v\_ref will be selected automatically.
  2. If you unselect v\_ref then acc will also be unselected automatically
- Expression channels may also include calculations on other expression values. This results in a dependency chain that is visible to the user during selecting or unselecting channels.
- Expression channels are designed by Knorr-Bremse application developers and delivered to the customers in the configuration files.



## Project And Application Folders

The project folder contains folders with the name of the applications contained by the project in the format `<Board_name>(<application_name>)`.

The application folder contains the application variables of the DCU. There are some limitations in DCU system on the amount of variables measured at the same time. The number of measured channels can not be larger than 30 and the sum of the size of all selected variables can not be larger than 120 Bytes.


 **Note:** Channels from this folder may be selected automatically when you select an expression. If you unselect a channel which has dependent expression channels then those can not be measured and will be unselected too.

## Standard Channels

The `Time` channel is used for calculations with expressions on data measured from the connected system.

## Measurement device folders

ST03A supports three different external measurement devices. You can measure variables from boards and from external measurement devices at the same time.

The elements in the folder represent the inputs and outputs of the measurement device. You can set some properties of the measurement device if you click  button or if you select *Properties* in the local pop-up menu on the folder. You can read the description of the settable properties if you click any of the following links:

- [SU05A measurement properties](#)
- [SU06A measurement properties](#)
- [DGH03 measurement properties](#)

A description of the inputs and outputs of each measurement device can be found in the topics below:

- [SU05A](#)
- [SU06A](#)
- [DGH03](#)

## Error Channels

Error channels are boolean channels that indicate the connection state to any measurement data source, e.g. one board, one measurement device. At time ranges where the error channel value is `true` the values measured from that source should not be evaluated.

Error channels can not be selected for measurement in the Configuration window, as they are being measured automatically to any source that contains channels to be measured.

To show error channels in the configuration:

1. Close Configuration window.
2. Open a new plot in measurement window (Display / New Graphic Plot).
3. In the open dialog select *boolean channels*.
4. Select the error channels appearing in the list by checking the check-boxes in the first column of the table.
5. Close open dialog.

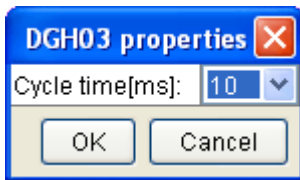
## 5.2.1 DGH03 properties

Access:



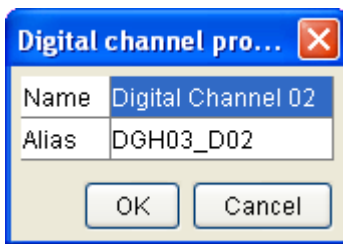
Mouse	Measurement Configuration Dialog / <i>Select folder DGH03</i> 
Hotkey	Measurement Configuration Dialog / <i>Select folder DGH03</i> / ALT+P

The possible settings for [DGH03](#):



### Cycle time

The time between two samples in milliseconds.

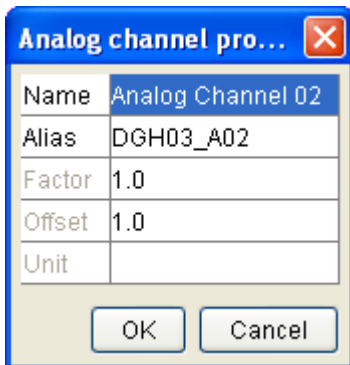


### Name

The name of the digital input channel.

### Alias

An alias is a short and unique name for a channel. In mathematical expressions the short alias has to be used.



### Name

The name of the analog input channel.

### Alias

An alias is a short and unique name for a channel. In mathematical expressions the short alias has to be used.

### Factor

Scaling factor to use when transforming values of the variable. It can be used to increase, decrease or invert the original values of the channel. This value is automatically set when the measurement starts. The parameter couldn't be set manually.

### Offset

Offset to use when transforming values of the variable. It can be used to shift the original values of the channel. This value is automatically set when the measurement starts. The parameter couldn't be set manually.


### Unit

Unit of represented value (e.g. bar, V).

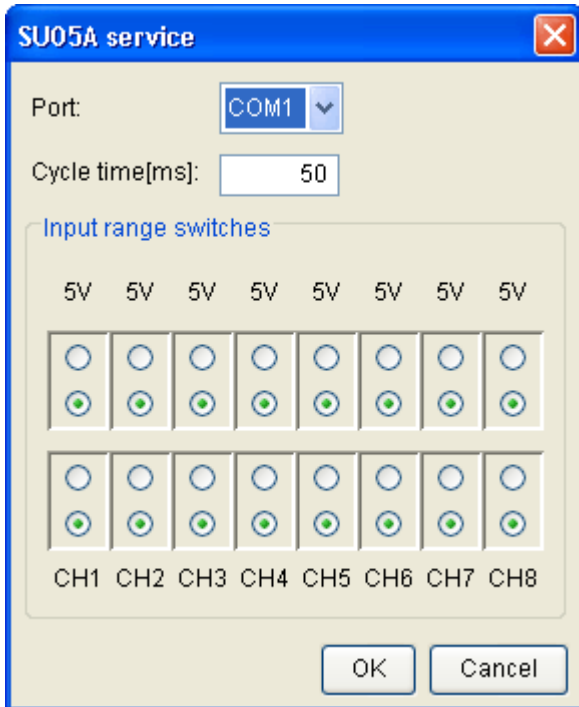
## 5.2.2 SU05A properties

Access:



Mouse	Measurement Configuration Dialog/ Select folder SU05A / 
Hotkey	Measurement Configuration Dialog/ Select folder SU05A / ALT+P

The possible settings for [SU05A](#):



**Port**

Sets the PC's serial port to which the SU05A is attached.

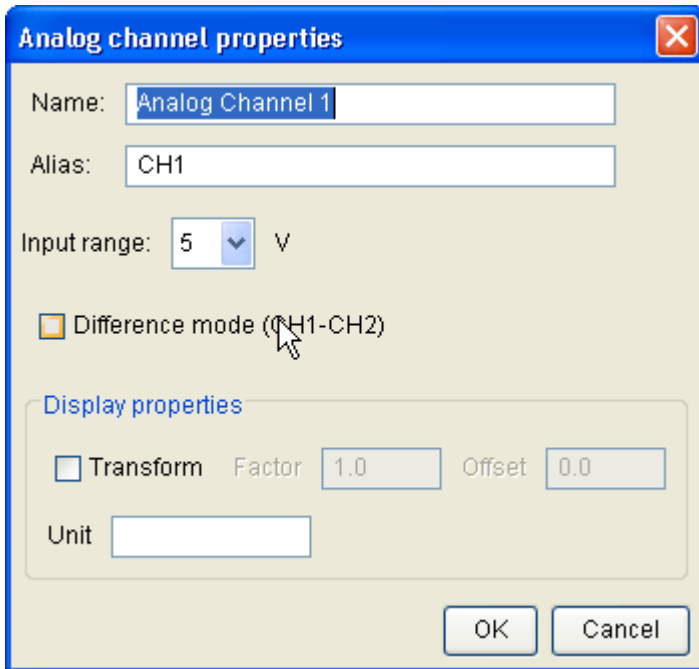
**Cycle time**

The time between two samples in milliseconds.

**Input range switches**

Selects the allowed input voltage range for each channel.

The user has the possibility to set properties for all channels of SU05A:



**Name**

The long name of the channel.

**Alias**

The short unique name of the channel.

**Input range**

Selects the allowed input voltage range.

**Differential mode**

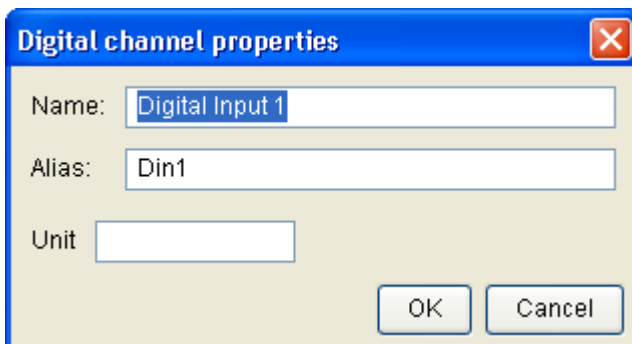
Check in this checkbox if you want to measure the difference of the channels described by the label.

**Transformation**

Measured value of the channel can be transformed by setting the transformation. The channel's value will be transformed only if the **Transformation** checkbox is checked.

**Unit**

Helps to analyze values on the graphic window or on the printed measurement.



**Name**

The long name of the channel.

**Alias**

The short unique name of the channel.

### 5.2.3 SU06A properties

Access:



Mouse	Measurement Configuration Dialog / <i>Select folder SU06A</i> /
Hotkey	Measurement Configuration Dialog / <i>Select folder SU06A</i> / ALT+P

The possible settings for the [SU06A](#):

**Cycle time**

The time between two samples in milliseconds.

**Hardware version**

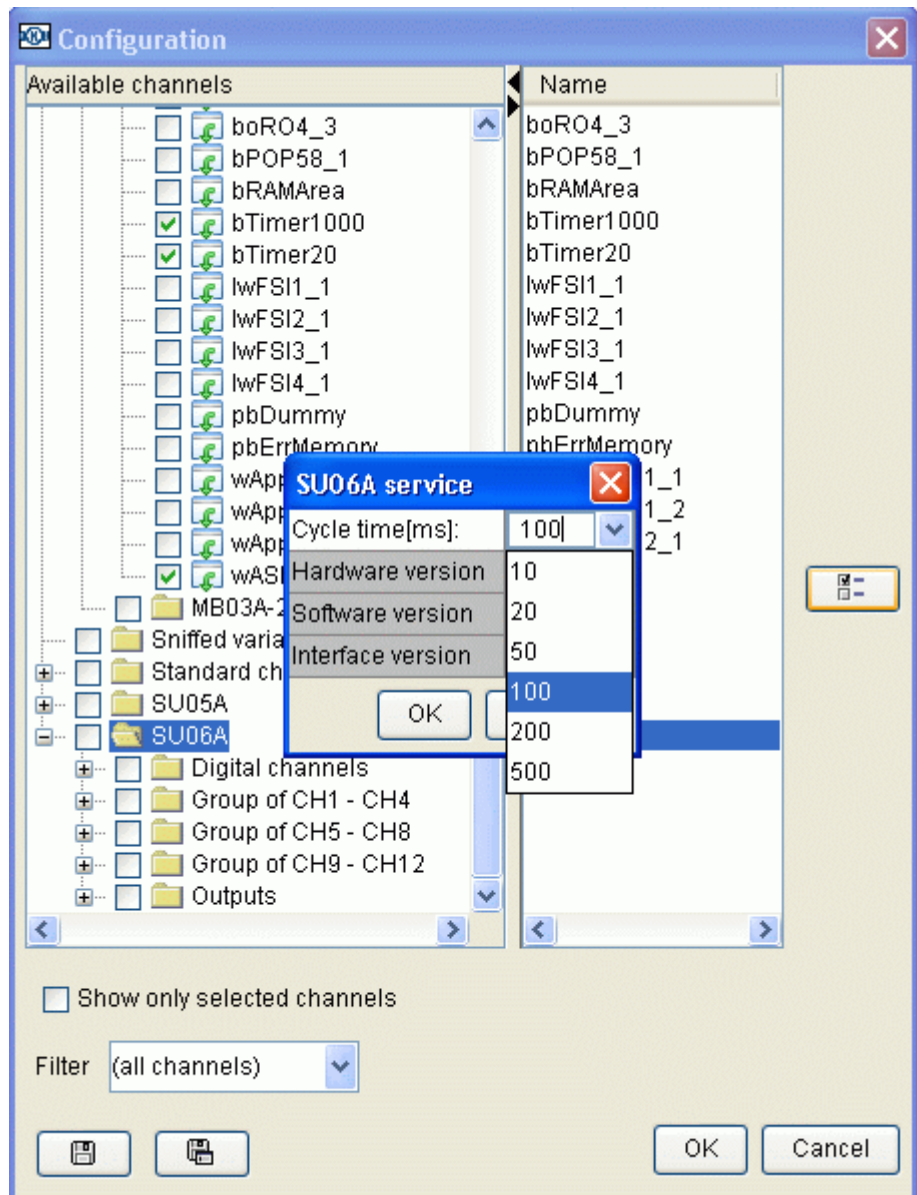
Identifies the hardware version of the connected SU06A device.

**Software version**

Version number of the embedded software running on SU06A.

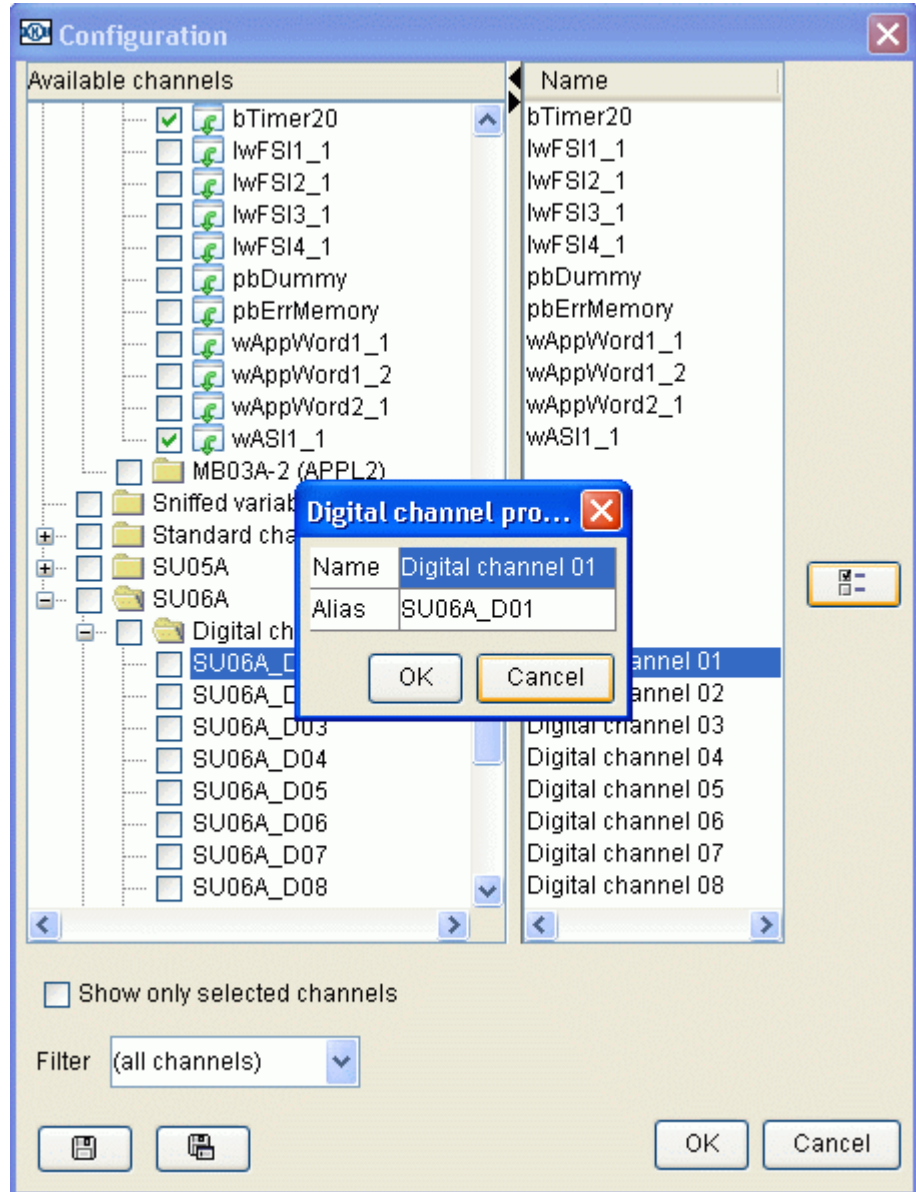
**Interface version**

Identifies the communication protocol that the ST03A must use to communicate with the connected SU06A device.



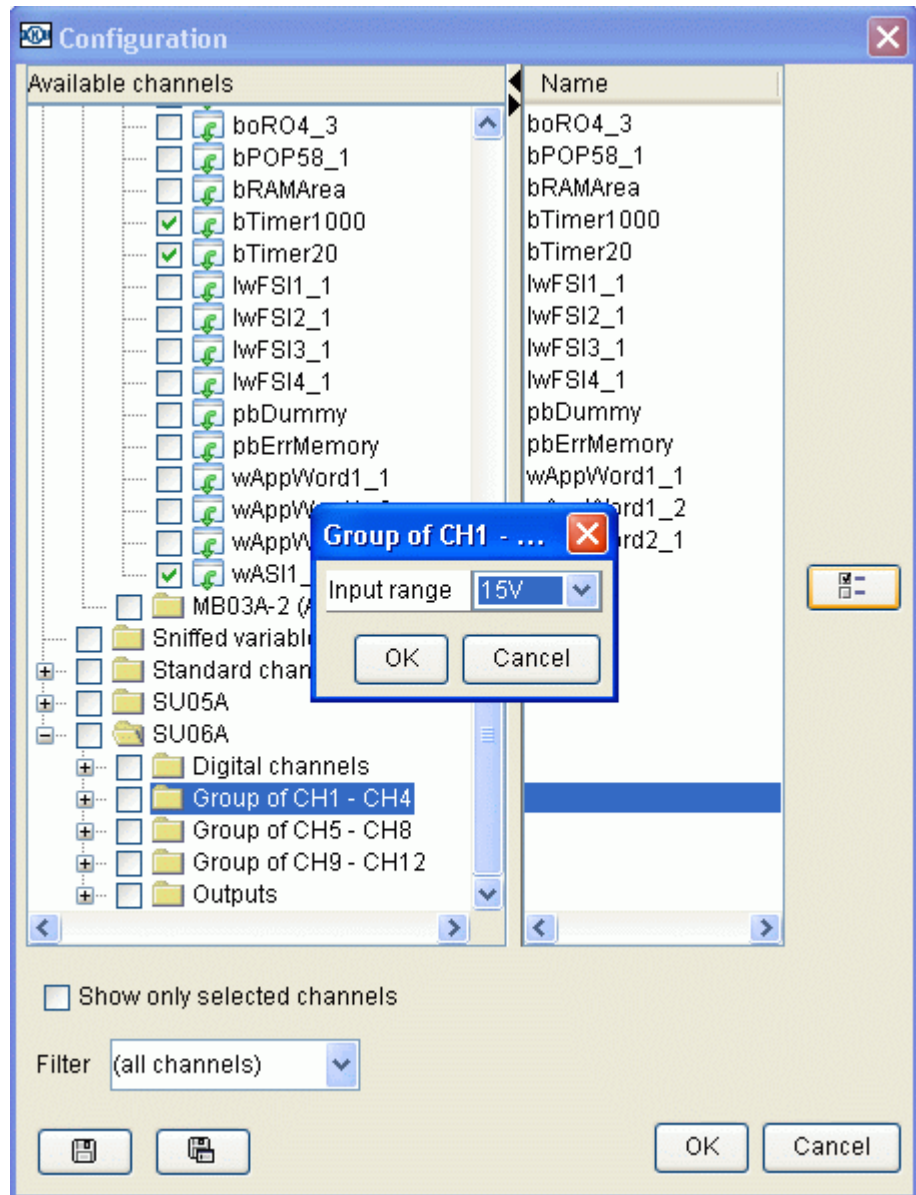
**Comparison level**

If the input voltage level is greater than the selected comparison level, the digital input value will be TRUE. Otherwise it is FALSE.



**Input range**

Selects the allowed input voltage range for each group of analog channels.





**Name**

The name of the analog input channel.

**Alias**

An alias is a short and unique name for a channel. In mathematical expressions the short alias has to be used.

**Transform**

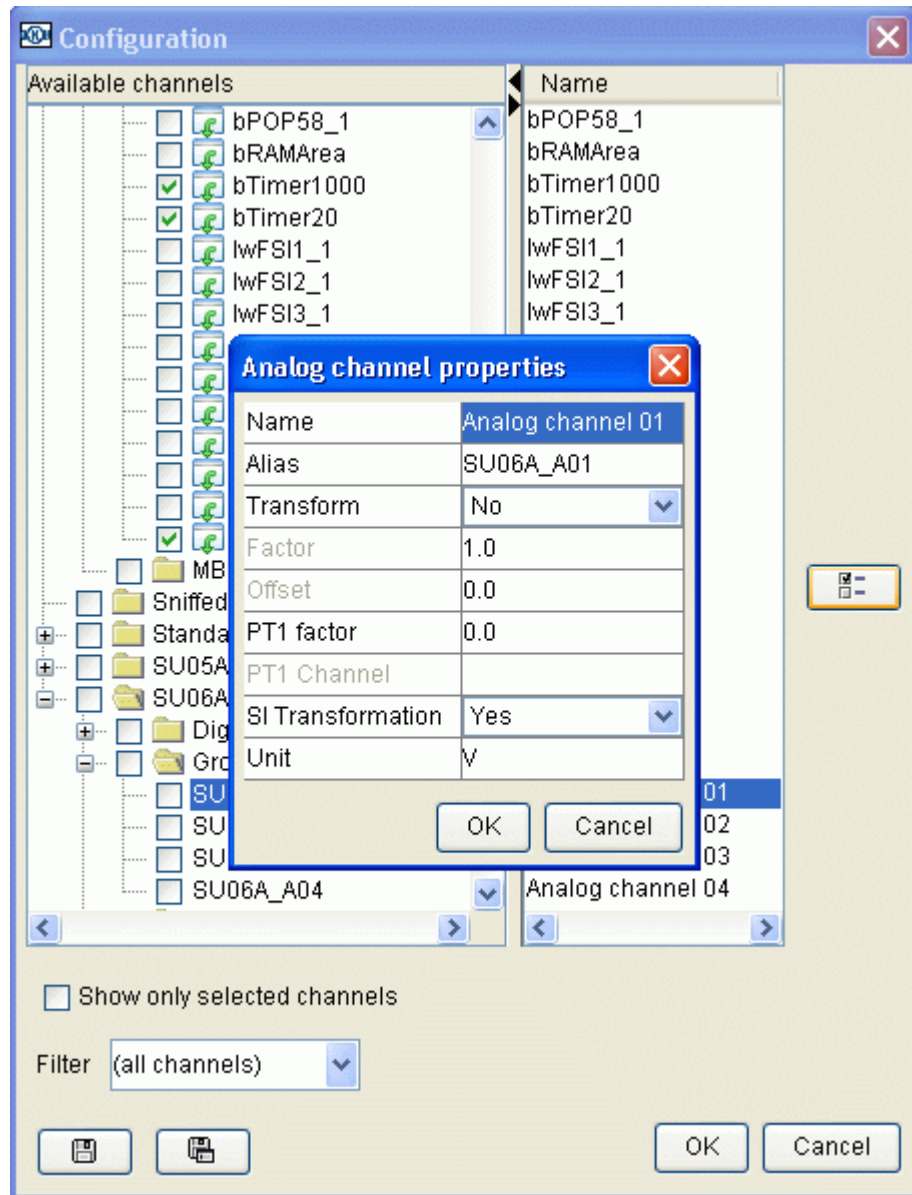
The signal can be transformed into other units. If the value of *Transform* is 'Yes' then *Factor* and *Offset* can be modified, otherwise these input fields are disabled.

**Factor**

Scaling factor to use when transforming values of the variable. It can be used to increase, decrease or invert the original values of the channel.

**Offset**

Offset to use when transforming values of the variable. It can be used to shift the original values of the channel.



**PT1 Factor**

PT1 is a linear filter function. If value set to 0.0 then no filtering is applied. The larger the factor is, the smoother the returned curve will be. Example: If the factor is 5 then each new shown value in the curve will be about the average of the last 4 or 5 measured values.

**SI Transformation**

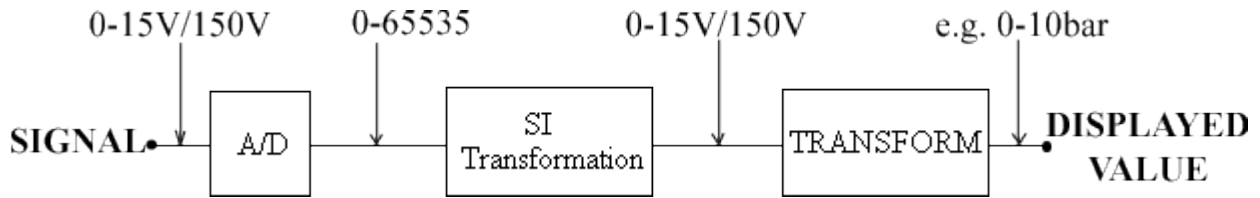
The signal can be transformed into SI.

**Unit**

Unit of represented value (e.g. bar, V).



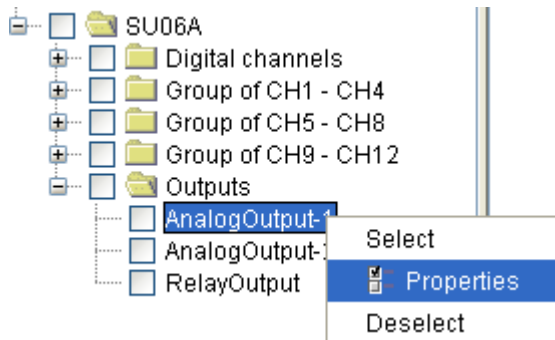
The following figure shows the process of transformations. Each transformation can be omitted.



Following options can be selected:

SI Transformation	Transform	Displayed value
No	No	0-65535
Yes	No	0-15V/150V
No	Yes	e.g. 0-10bar
Yes	Yes	e.g. 0-10bar

**Outputs:** Expression channel for controlling analog and relay outputs of SU06A.



**Expression (analog outputs)**

The given expression sets the analog output to the actual value of the expression. This value will be shown in the measurement window. The SU06A output range is 0-10 V. If the value of the expression is higher or lower than this range, the SU06A output value will be set to 10V or 0V correspondently. If the value of expression is logical, the SU06A analog output value will be set to 0V (FALSE) or 5V (TRUE).

**Expression (relay output)**

If the value of expression is logical, the SU06A relay output value will be set correspondently to FALSE or TRUE state (A or B position). By default the relay output is set to A position. If the value of expression is not logical and is lower or equal than 0, the value of SU06A relay output will be set to A position. Otherwise it will be set to B position.

## 5.3 Measuring



Access:







### Measuring summary

To perform a full measurement please follow the steps below;



#### Before measurement

1.  Open the [project file](#) that belongs to the system where you want to measure.
2.  Set the [communication device](#) in *Tools / Options* and check if the connection is established to the system (connection indicator in the bottom-right corner of the window is green).

#### Measurement



1.  Open a [configuration](#) that belongs to the opened project.
2.  Start the measurement.
3.  Stop the measurement.
4.  Save the measurement.

#### After measurement

- You may add [notes](#) to different points of the plots.
-  You may [print](#) your measurement.
-  You may [export](#) your measurement into a format legible by other programs or a format of earlier ST03A versions (e.g. V2.7.34).
- You may customize the [data displaying](#) of your measurement.


### Opening a Configuration

Access:

Menu	Measurement / Open	Opens any measurement configuration or measured data file
Mouse		
Menu	Measurement / Last Configuration	Opens the last used configuration
Mouse		
Hotkey	CTRL+ALT+L	


Since measured data files also contain the full measurement configuration, you can open any configuration file ( `.xmc`, `.emc` ) or measured data file ( `.xmd`, `.emd` ) for starting a new measurement.

## Starting Measurement




Menu	Measurement / Start
Hotkey	CTRL+R
Menu of Measurement window	Measurement / Start After Initialization
Hotkey	CTRL+I
Menu of Measurement window	Display / Start
Mouse	

The menu item **Start** starts the measurement immediately. The menu item **Start After Initialization** starts the measurement only after the communication to the boards has been initialized. For example, if the system has not been powered up the data measurement will wait until the communication with it will be established.

## Stopping Measurement

Menu	Measurement / Stop
Hotkey	CTRL+T
Menu of Measurement window	Display / Stop
Mouse	

## Saving Measured Data

Menu	Measurement / Save	Save to the last save location
Menu of Measurement window	Display / Save	
Mouse		
Menu	Measurement / Save As...	Save to a different location
Menu of Measurement window	Display / Save As...	
Mouse		
Menu	Measurement / Export...	Save the current view content Save into CSV file
Menu of Measurement window	Display / Export...	
Mouse		

You may save your measured data in the internal format of Service Terminal for later evaluations or you may [export](#) your measured data into `.csv` files which can be read by other softwares.


The internal measured data format of ST03A is the *Encrypted Measured Data* format (`*.emd`).

If you only want to save the values measured in the time range the plots currently display then please use the [export](#) feature.

### 5.3.1 Export

Access:



Menu	Measurement / Export...
Menu in Measurement window	Display / Export...
Mouse	

Using the **Export** feature of the measurement window, you can export the measured data into different file formats. You can export into comma-separated values files (\*.csv) or into ST03A files but keeping the current working copy.

For both formats you can select if you export the complete measured data or only the content of the current graphical view. All channels values will be stored that were measured in the time range that the plots display.

The properties of CSV export are discussed below the table of export formats.

#### Export file formats

In the following table the possible export file formats and contents are listed

File format	Comment
<b>ST03A formats</b>	
EMD – Measured Data, Current View (*.emd)	Channels values in displayed time range are saved.
EMC – Measurement Configuration (*.emc)	Only the configuration is saved.
<b>CSV Export</b>	
CSV – Measured Data, With Filling, Complete Measurement (*.csv)	Full measurement, no empty cells
CSV – Measured Data, With Filling, Current View (*.csv)	Displayed values, no empty cells
CSV – Measured Data, Without Filling, Complete Measurement (*.csv)	Full measurement, empty cells possible
CSV – Measured Data, Without Filling, Current View (*.csv)	Displayed values, empty cells possible

## CSV Export Properties

With the **Export** function it is possible to export data of displayed curves into a text file (.csv) that can be opened by other programs, e.g. Microsoft Excel.

The exported file contains a table of all measured data as comma separated values. The first column contains the time stamp, all other columns contain a channel each. When measured from different sources, e.g. different boards, especially at different cycle times then most of the channels will contain empty cells. This happens because at this time (represented by a row in the table) only measured data from other sources arrived, not from the source where the channel is measured from. These empty cells can be handled in two different ways:

1. The empty cells remain empty, the table only contains the measured values at that time when a value was really measured.
2. The empty cells will be filled up with the last measured value of the channel.

The tables below illustrate these two solutions. The first table contains only measured data, the second also the filled in cells (in blue).

### Measured data *without* filling

Time stamp	Board1 Cycle time=50ms		Board2 Cycle time=20ms	
	Channel1	Channel2	Channel3	Channel4
1000	1.0	1.0	3.3	5.6
1020			3.4	5.5
1040			3.5	5.4
1050	1.1	0.8		
1060			3.4	5.3
1080			3.4	5.2
1100	1.2	0.8	3.5	5.2



### Measured data *with* filling

Time stamp	Board1 Cycle time=50ms		Board2 Cycle time=20ms	
	Channel1	Channel2	Channel3	Channel4
1000	1.0	1.0	3.3	5.6
1020	1.0	1.0	3.4	5.5
1040	1.0	1.0	3.5	5.4
1050	1.1	0.8	3.5	5.4
1060	1.1	0.8	3.4	5.3
1080	1.1	0.8	3.4	5.2
1100	1.2	0.8	3.5	5.2

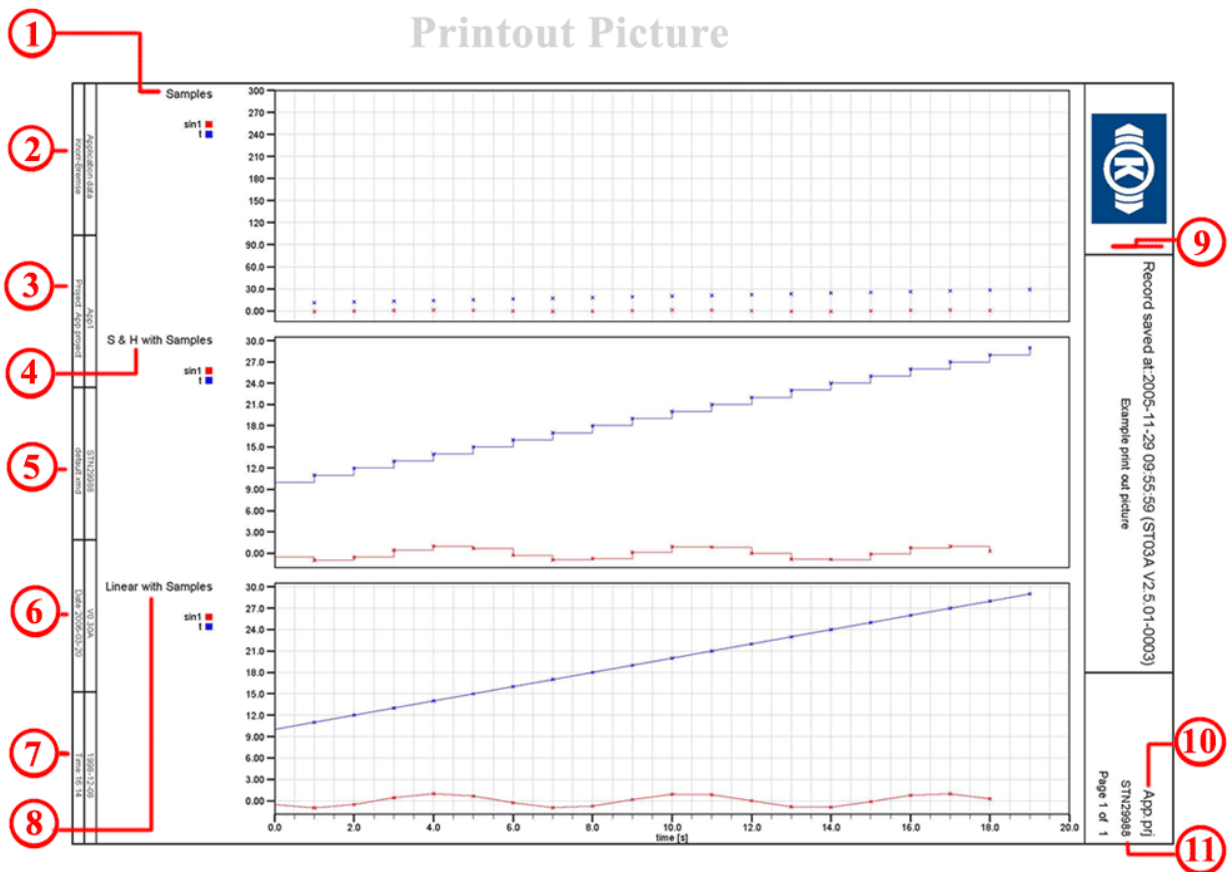
### 5.3.2 Printing

Access:



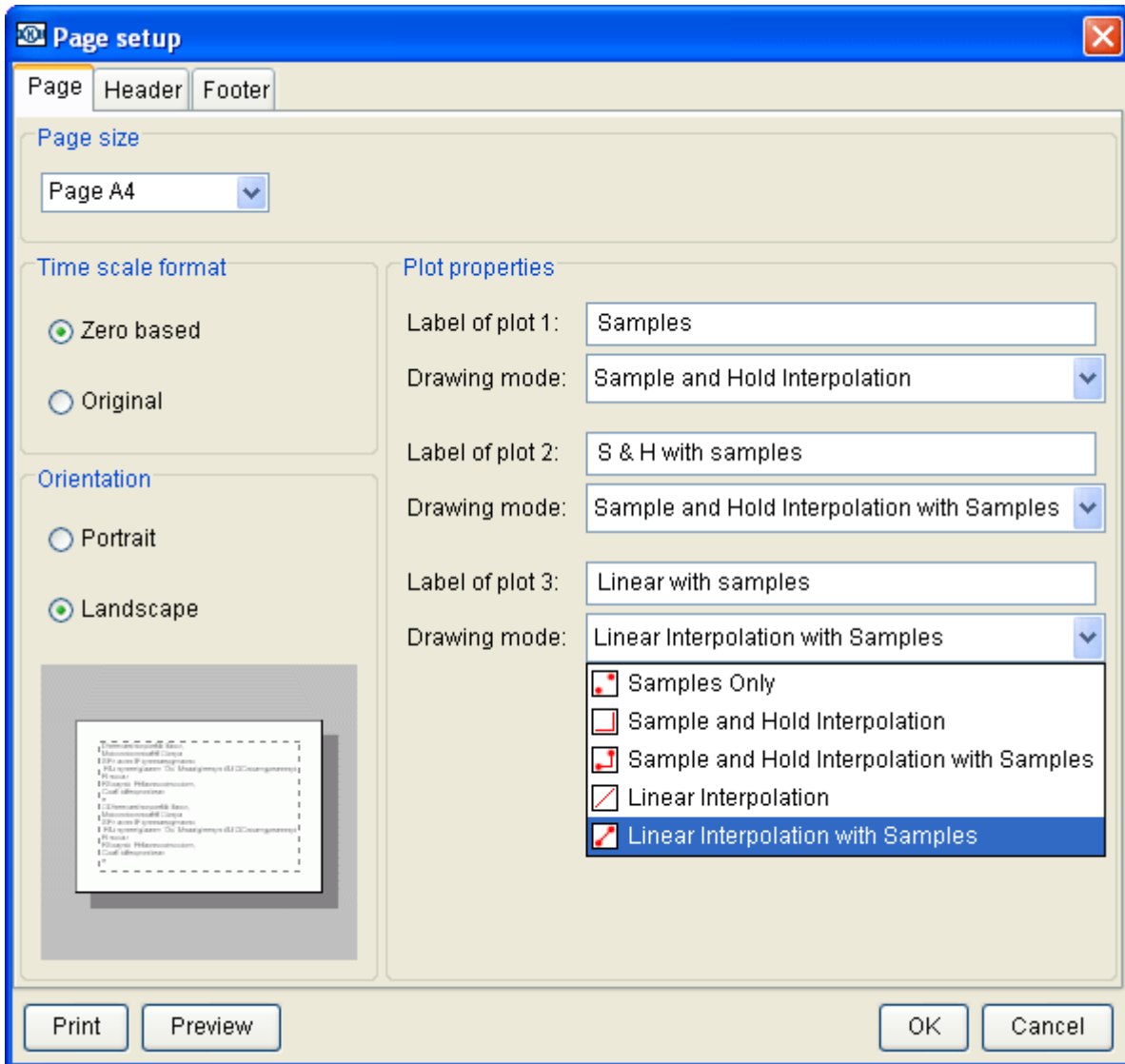
Menu in Measurement window	Display / Print	
Mouse		Print the measurement
Hotkey	CTRL+P	
Menu in Measurement window	Display / Print Preview	
Mouse		Show the preview of the printout.
Hotkey	CTRL+SHIFT+P	
Menu in Measurement window	Display / Page Setup	Setup printout properties.

The following screen shot contains an example printout. The descriptions below will refer to the places marked with red numbers.



## Settings of the printout

Customizable fields can be set in the dialog *Page Setup* as follows.



Number on the printout example	Name of field	Comment
1	Label of plot1	Drawing mode is <b>Samples Only</b>
4	Label of plot2	Drawing mode is <b>Sample and Hold Interpolation with Samples</b> and the grid is turned off.
8	Label of plot3	Drawing mode is <b>Linear Interpolation with Samples</b>

**Page size**

A4 - The printed page size is A4.

A3 - The printed page size is A3.

**Time scale format**

Zero based - Only the actually visible part of the measurement will be printed using a time scale starting from 00:00.

Original - Only the actually visible part of the measurement will be printed using the original time scale values.

**Page orientation**

Portrait - Orientation of printed page is portrait.

Landscape - Orientation of printed page is landscape.

**Drawing mode**

The user can choose 5 different connection types of measured data. If the user doesn't change the connection type than the current setting of the specified plot will be used. Settings of Drawing mode aren't preserved and the user can't see the settings of Drawing mode on the specified plot only on the printout picture.

Samples Only - only the measured data points will be drawn on the printout page.

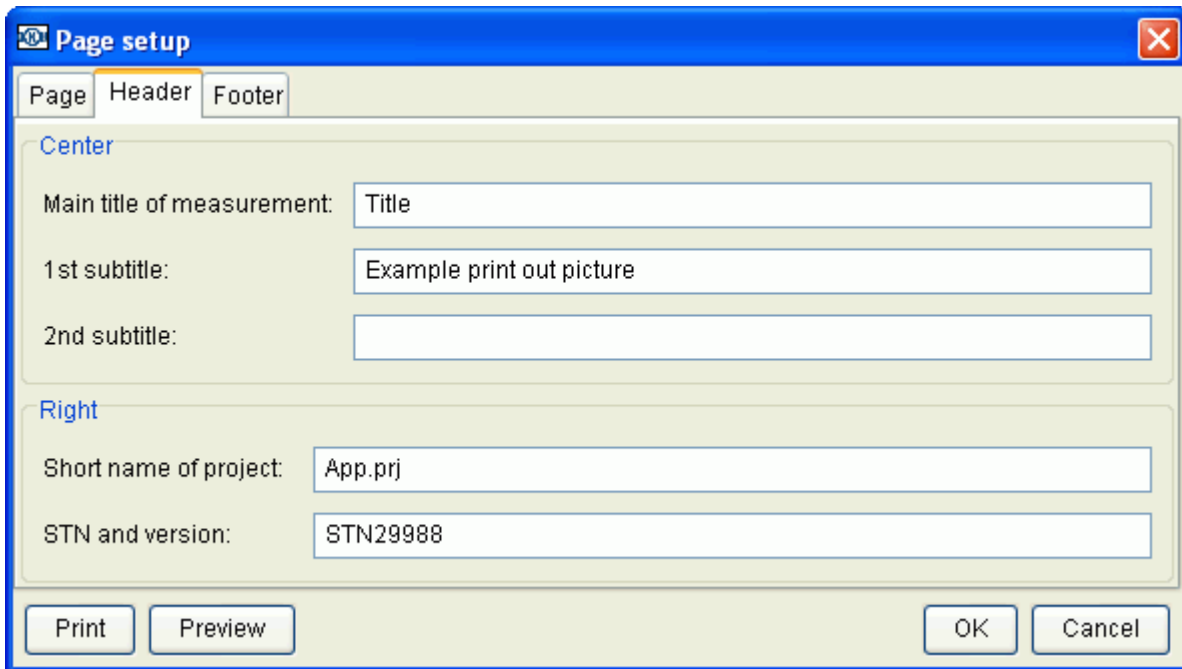
Sample and Hold Interpolation - the last measured value remains until the next measured data overrides it.

Sample and Hold Interpolation with Samples - the last measured value remains until the next measured data overrides it and the measured values are displayed as points.

Linear Interpolation - the subsequent measured values are connected with lines.

Linear Interpolation with Samples - the subsequent measured values are connected with lines and the subsequent measured values are displayed as points.





Number on the printout example	Name of field	Comment
9	Main title of measurement	The default value is the first line of comment field of the opened or saved dialog.
9	1st subtitle	The default value is the second line of comment field of opened or saved dialog.
9	2nd subtitle	The default value is the remaining lines of comment field of opened or saved dialog.
10	Short name of project	Short description of project
11	STN and version	STN number if defined in the project file.

**Page setup**

Page | Header | **Footer**

Footer

**First footer line**

1st column: Application data

2nd column: App1

3rd column: STN29988

4th column: V 0.30A

5th column: -

**Second footer line**

1st column: Engineer: Knorr-Bremse

2nd column: Project: App.project

3rd column:

4th column: Printed: 2010-05-03 12:43

5th column: Measured: 2010-05-03 12:37

Print Preview OK Cancel

Number on the printout example	Name of field	Comment
2	First footer line	1st column
3		2nd column
5		3rd column
6		4th column
7		5th column
2	Second footer line	1st column
3		2nd column
5		3rd column
6		4th column
7		5th column

**Note:** If the user added [notes](#) to the plots then the printout will consist of 2 pages, and the second page will contain a table with the description of the notes.

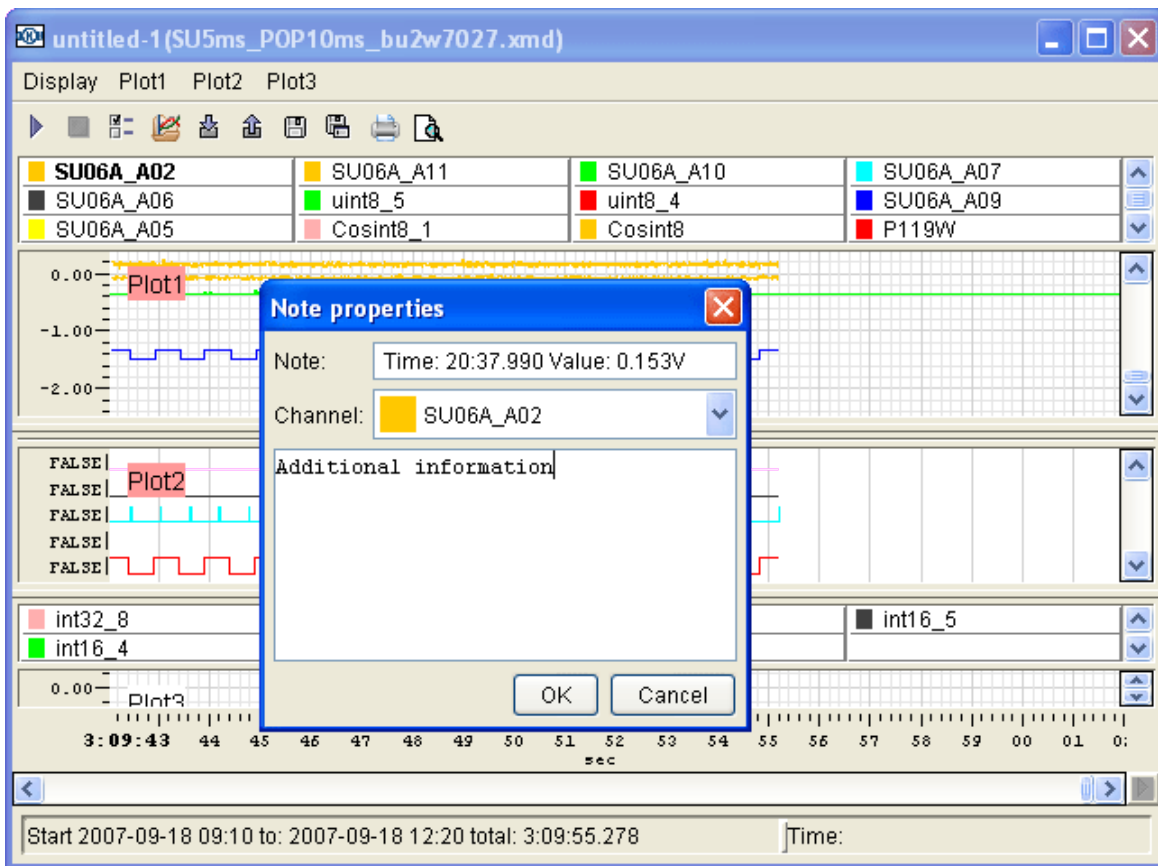
### 5.3.3 Note

Access: **Operator** **OEM**

Menu in Measurement window	Plot<N> / New Note
Pop-up menu in Measurement window	New Note

The user can add time-tagged informational notes to any displayed channel. The Plot<N> refers to the data plot to receive the note.

If you open the menu item **New Note** from the menu then the insertion point of the note will be one of the channels at the cursor position. You may select the appropriate channel in the opening dialog. If you right click with your mouse at any position in the plot then the position of the note will be at the time where the mouse showed at opening pop-up menu, on a selected channel.



**Note**

Text to be displayed in the graphics window right next to the curve.

**Channel**

Drop down box with a list of available channels. The channel selected will be the channel to receive the new note.

The text box in the **Note properties** dialog window can be used for any additional information associated with the new note. This additional information can only be viewed by activating the pop-up menu of the note and selecting the menu item **Properties**.

When you [print](#) out a measurement that contains a note then the note will be visible in the measurement in the same way as in the plot and an additional table will contain the description of the note that you edited.

## 5.4 Data Displaying

ST03A supports displaying of measured values in the graphic plots. Graphic plots are positioned on graphic windows. One window can contain 1 to 4 graphic plots and the usage of up to 4 graphic windows is supported.

ST03A has a huge variety of transformations that can be applied on the curves representing a channel each. These reorganizations of the curves (individually for each plot) enable easy evaluation of the measured values. A special kind of channel named [error channel](#) indicates eventually appearing error during communication.

In this section you can read about following topics:

### [Plot Properties](#)

Opening windows, plots, selecting channels in the plots, online and offline visualization

### [Data Visualization](#)

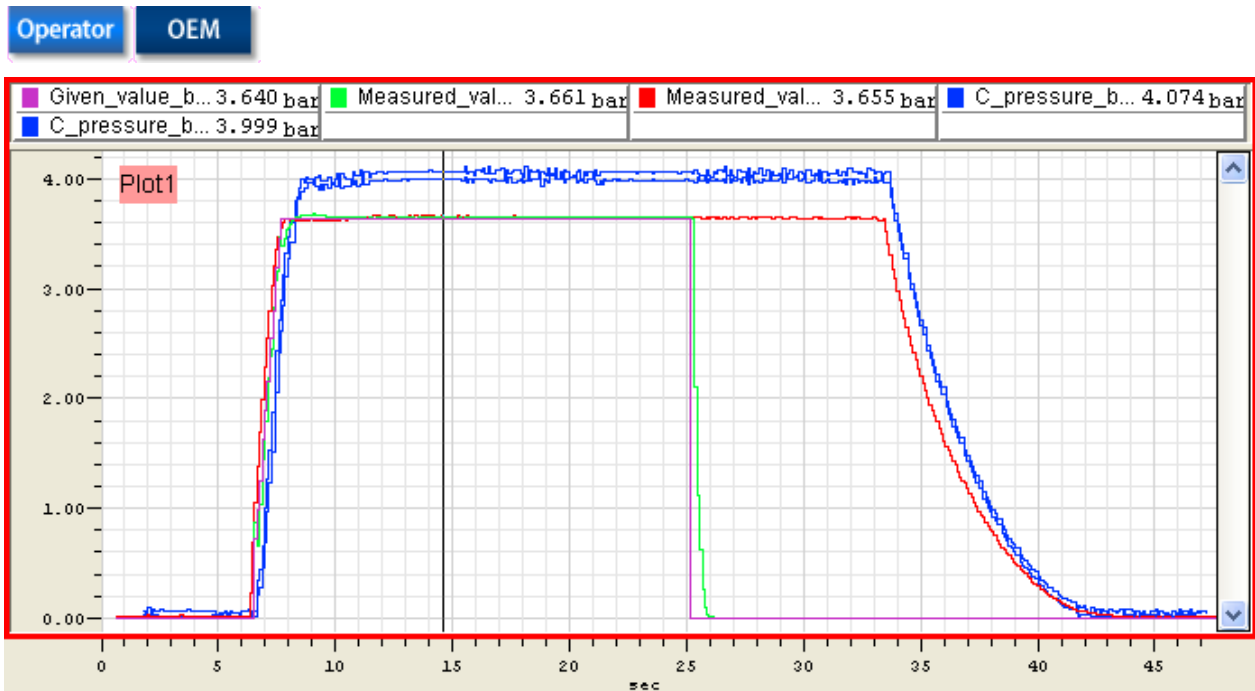
Changing view within a plot. Scrolling, Zooming and Moving curves

### [Data Evaluation](#)

Different methods of reading and calculating values of the curves.

### 5.4.1 Plot Properties

Access:



Each graphic plot contains a list of channels (top) and a graphic area. The graphic area contains the channels and the two axes. If the curves are moved so that they have different Y axes the one visible Y axis belongs to the channel that is highlighted in bold.

Graphic plots may contain channels of the same type - either analog or digital ones. A plot may contain all the measured channels or a subset of them. Plots can be configured independently from each other regarding selected channels and visualization but the data behind belongs always to the same measurement, even if the plots are in different windows.

In Service Terminal the curve drawing mode can be set individually for each plot. However, this drawing mode is only active after the measurement stopped. During measurement the most simple drawing mode (linear interpolation with sample points) is used to save resources on displaying for data calculations.

**Online drawing mode**

Drawing mode during measurement. Can not be set.

**Offline drawing mode**

Drawing mode after measurement has stopped or after opening measured data files. Can be set for each plot.

## Opening new plots and windows, closing plots

Access:

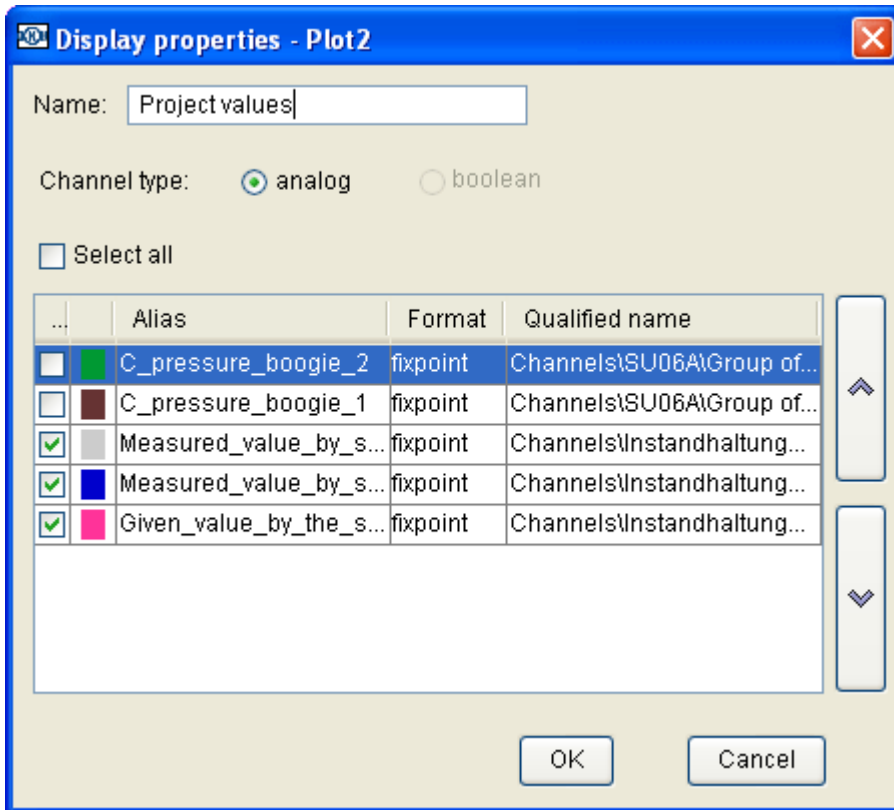
Menu in Measurement window	Display / New Graphic plot	Opens a new plot in the currently open measurement window.
Menu	Measurement / New Display	Opens a new measurement window (using the same data). The window will contain one new plot.
Menu in Measurement window	Display / Close Plot	Closes the plot. Not applicable to the last plot of the window.
Pop-up menu in Plot	Close Plot	

When opening a new plot you have to decide whether the plot should contain analog or digital (boolean) channels. According to your selection you may also select the visible channels as described below.

## Setting properties of plots, selecting channels

Access:

Menu in Measurement window	Plot<N> / Properties
Pop-up menu in Plot	Properties



Actions:

**Setting the name of the plot**

On the printouts the name will appear that you typed into the *name* field.

**Selecting / unselecting channels**

Put / remove a tick to select / unselect the channel.

**Changing color of channel**

Double click on the color label to open the color chooser dialog. Select a new color and click OK.

**Changing drawing order of the channels**

When many channels are shown on small surface then they are likely to overlap each other. To define which of the channels should be best visible move the selected channel with the arrows on the right side of the channel list up and down. The first channel in the list will be best visible, the last will be most hidden.

**Changing channel type**

Is not possible, only when opening a new plot. Close this plot and open a new one

**Setting Offline Drawing Mode of the Curves**

Access:

Menu in Measurement window	Plot<N> / Offline Drawing Modes
----------------------------	---------------------------------

The drawing modes are described in the topic [Print](#).

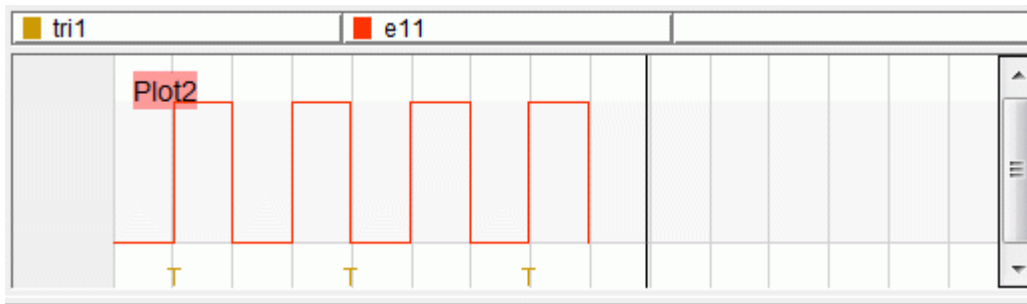
### Showing grid, hiding channel table

Menu in Measurement window	Plot<N> / Show grids	If selected then a grid is shown to help orientation in the plot.
Menu in Measurement window	Plot<N> / Show table	If selected then the table containing the channel names is shown.
Pup-up menu in Plot	Show table	You may hide it to enlarge the graphic area.

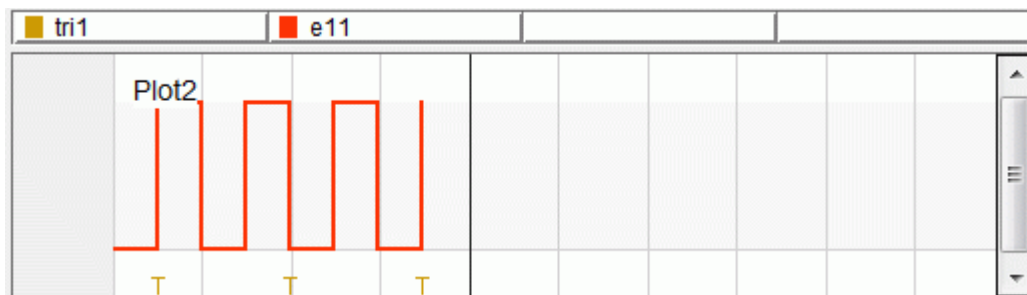
### Modify the logical measurement drawing style

The logical channels can be measured with different style: classic (by default), thick line and filled area. This can be set in the Tools/[Options](#) but changes will take effect after the restart of the measurement/DLG services.

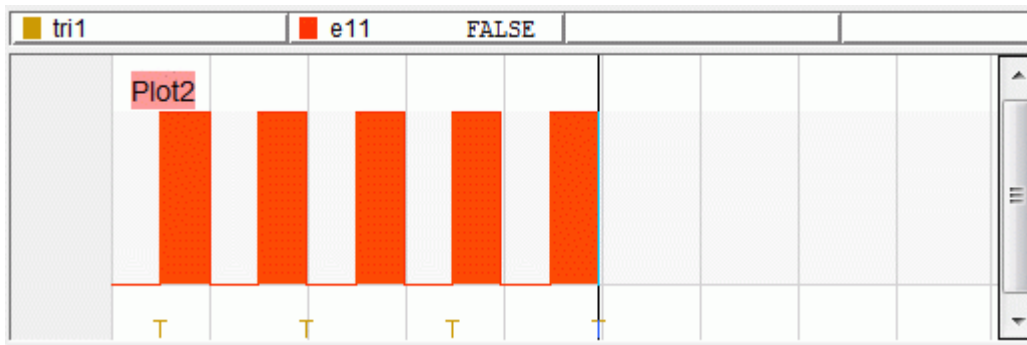
Classic:



Thick line:



Filled area:



## 5.4.2 Data Evaluation

Access:



STO3A supports different methods for data evaluation within a measurement plot:

### Single Cursor Mode

One cursor is used. The *Channel Table* contains the value of each channel at the cursor position. (This mode is active when difference mode is not turned on.)

### Difference Mode

Two cursors are used. The *Channel Table* contains the difference of the channel values measured at the two cursor positions.

## Single Cursor Mode

By default Service Terminal is in single cursor mode as far as *Difference mode* is not turned on. You can evaluate channel values while positioning the cursor to different places in the plot. The time belonging to the current cursor position is shown in the bottom right corner of the measurement window. The time cursor is common for all the plots of the window so a comparison of channels from different plots is also possible.

## Difference Mode

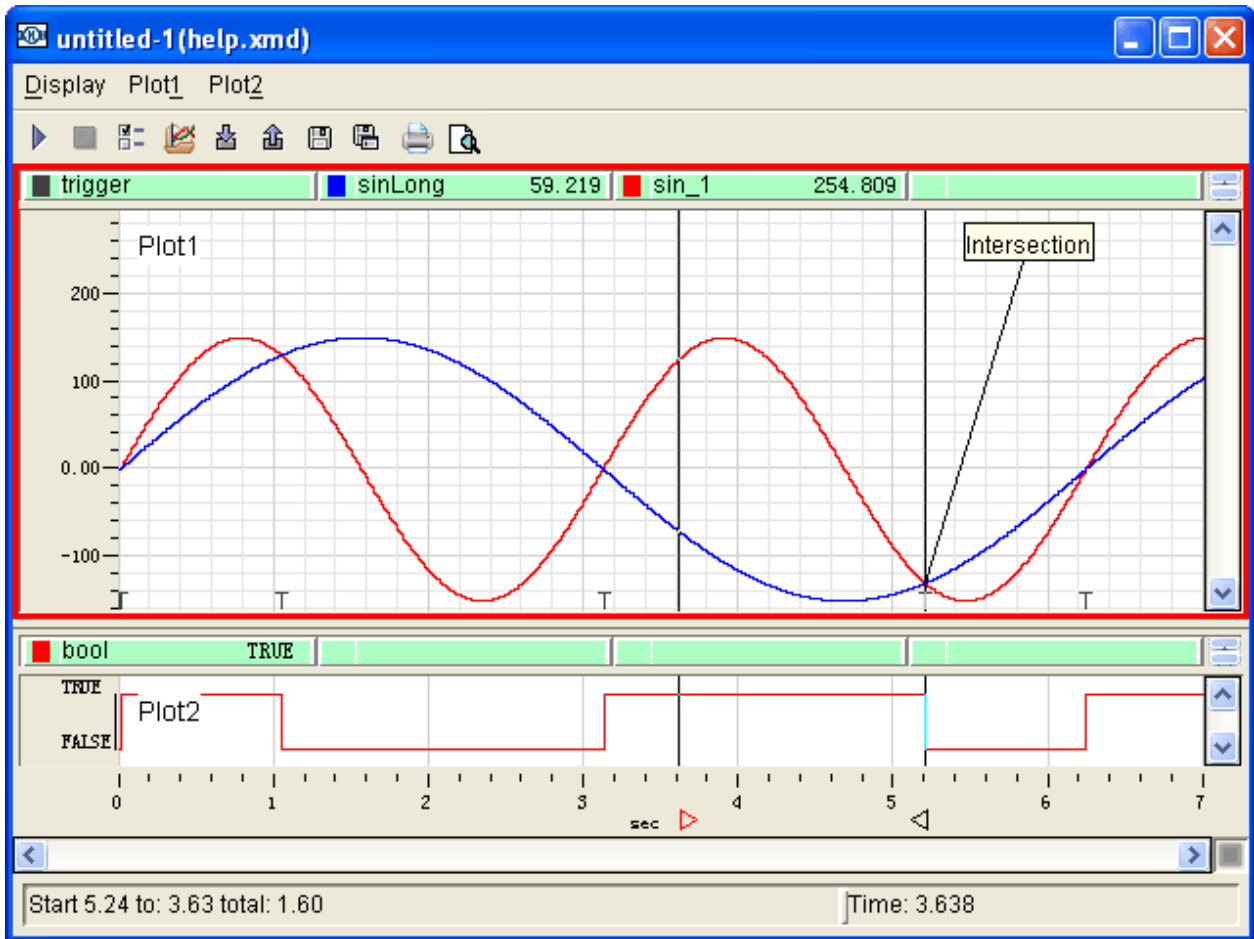
If you choose difference mode than you have two cursors that you can position in the measurement. One cursor is selected (marked with red triangle in the bottom of the window) and one not (black triangle). You can move the selected cursor by clicking at any place in a plot. You can switch between the cursors to be selected.

You can see the time difference between the two cursors in the left bottom corner of the window after *total*. The time shown by the selected cursor can be read from the bottom right corner of the window. The channel table (in difference mode it is painted in green) shows the difference of the channel values at the two cursor positions.

Access:

Menu in Measurement Window	Display / Difference mode	Start / end different mode
Hotkey in Measurement Window	CTRL+D	
Menu in Measurement Window	Display / Switch Cursor	Change active cursor
Hotkey in Measurement Window	CTRL+U	





### The Y axis in Service Terminal

In Service Terminal it is possible to move a channel within a plot. After moving, the scale on the Y axis of the moved channel will not match the scale of the other channels. The shown Y axis scale in the plot always belongs to the highlighted channel. If no channel is highlighted then the Y axes of the channels are common.

If you would like to compare the Y axis scale with a curve, please make sure that the channel you examine is the selected channel (marked with **bold**), or no channel is selected. You can select a channel by right clicking on the channel in the channel table (to open local pop-up menu) and selecting **Show Scale**.

**See also**

- Adding [notes](#) to a point of the measurement
- [Exporting](#) and [Printing](#) measured data.

### 5.4.3 Data Visualization

Access: **Operator** **OEM**

Each graphic plot can be transformed individually to enable best optimized visualization. Besides manual zooming and moving of curves automated curve-reorganization is also available (e.g. *spread curves*).

#### Zooming

Zooming can be performed by mouse or from menu. You can zoom to a given time interval.

Zooming out can be done with the **Undo** option or you may use the **Fit to window** command to make all measured data visible.

During zooming you can use the **Overview** function in order to keep orientation on the plot.

##### Zooming with mouse

Pull down left mouse button, move the mouse and release the left mouse button.

This process defines a rectangle (pull down position is one corner and release position is the opposite corner).

After releasing left mouse button the content of the rectangle will be enlarged and will fill the plot.

##### Typing in manual zoom settings (Zoom to...)

You can define the zooming by setting the range that should be visible on the time axis and the value range on the vertical axis.

Access:

- Local pop-up menu in measurement window: **Zoom to...**
- Menu in measurement window: **Plot<N> / Zoom to...**

##### Overview window

When you are zooming in the plot you may use the **Overview** function to keep your orientation on the plot.

A small window containing the full plot is shown where the currently visible (zoomed) area of the plot is marked.

Access:

- Local pop-up menu in measurement window: **Overview**
- Menu in measurement window: **Plot<N> / Overview**

##### Fit to window

After zooming you can get back to a state when all values of each channel of the plot are visible in one plot.

If you right click a channel of the *Channel table* then you can select a channel to be fitted.

In this case the full plot content will be adjusted so that the channel will fill the plot.

Access:

- Local pop-up menu in measurement plot: **Fit To Window**
- Menu in measurement window: **Plot<N> / Fit To Window**
- Local pop-up menu in channel table: **Fit Channel To Window** (The channel will be fitted)

##### Undo, Redo (zooming, scrolling)

You can undo a zooming step or redo an undone zooming. This function does not undo the command *Spread Curves*.

Access **Undo**:

- Menu in measurement window: **Display / Undo Zooming**
- Hotkey in measurement window: CTRL + Z

Access **Redo**:

- Menu in measurement window: **Display / Redo Zooming**
- Hotkey in measurement window: CTRL + Y

## Moving and stretching curves

You can move or stretch a curve along the Y axis with a mouse or apply an automatic reorganization of the curves.

When you move a curve the Y axis of the curve moves also. The left border of the plot only shows one Y axis - the axis of the channel highlighted in bold (channel table).

You can change the highlighted channel with right clicking on any channel in the channel table and selecting **Show Scale**.

### Spread curves

The command *Spread Curves* rearranges all the curves that way that the curves do not overlap each other.

Access:

- Local pop-up menu in measurement window: **Spread Curves**
- Menu in measurement window: **Plot<N> / Spread Curves**

### Move Curve (also stretching possible)

You may move and stretch one curve independently from the other the following way:

1. Select **Move Curve** in the menu.
2. Move the curve to the correct position. The mouse position shows the top of the curve
3. Click once the left mouse button
4. Now you can scale the curve while setting the place of the minimum value of the curve.
5. Click the left mouse button again to fix the curve at the position.

Access:

- Local pop-up menu in a plot: **Move curve** (The selected channel can be moved)
- Menu in measurement window: **Plot<N> / Move Curve** (Here you can choose which curve you would like to move)

### Reset Curve

Resets the curve to the state before the last moving, stretching or *Spread curves* operation.

Access:

- Local pop-up menu in a plot: **Reset Curves**
- Menu in measurement window: **Plot<N> / Reset Curves**

## 5.5 Measurement devices

Besides supporting the measurement of ESRA/DCU signals ST03A provides possibilities to measure signals of the following external measurement devices:

[SU05A](#)

[SU06A](#)

[DGH03](#)

### 5.5.1 DGH03

The Diagnostic Tool for Hydraulic Brakes (DGH03) is an auxiliary component to piloting the components of a hydraulic brake system. It also provides the opportunity to show states of signals and measured data, or forward these values to the ST03A recording and analyzing software. (see also: [DGH03 Properties](#)).

To use DGH03 needs to be installed [FTDI driver](#) separately in addition to the installation of ST03A.

Following inputs and measurement configurations are possible:

- Control of the pump motor for hydro units with AC/DC propulsion engine. Measurement with the possibility to record the motor current (for DC motors).
- Control of the pump motor for hydro units with AC propulsion engine, no measurement of voltage or current on the motor.
- Control of one or two proportional current regulating valves with current measurement between 0 and 2A and possibility of recording the measured values (Circuit1 or Circuit2 alternatively).
- Measurement, highlighting and recording of pressure sensors (4-20mA): Accumulator pressure, brake pressure (Circuit1 or Circuit2 alternatively), three extern pressure sensors, two extern load pressure sensors, and two level regulation sensors, with recording possibility.
- Force measurement with three DMS Force sensors as one sum result with recording possibility.
- Control of 4 auxiliary functions and 4 additional options with 12VDC and 24VDC valves respectively, short-circuit-proof with alarms on short-circuit, polarity reversal of the free-wheeling diode, and wire brake.
- Display of 8 digital inputs with LEDs with recording possibility.

The transport of the Data is realized via the USB port on DGH03. Beforehand selectable sample rates: 100, 10, 1 measurement/second.

For more details see the manual and other associated documents of the DGH03.

### Plug of the DGH03

#### Plug interface to the Hydro engine

All the plugs needed for the control of the hydro engine, are realized over an electric connection assembly. For measurement of force and external sensors, specific connection assemblies are installed.



**Test item Power / Signal connection plug arrangement:**  
(see the table)

2-pole deployment (f)	1	DC+	
	2	DC-	
6-pole deployment (e)	1	L1	AC motor Phase R DC motor Phase S AC motor Phase T AC motor NULL ground line
	2	L2	
	3	L3	
	4	N	
	5	PE	
	6	NC	
12-pole deployment (d)		1	GND/LED's
	DC bridge	3-5	
	AC bridge	2-4	
		6	Auxiliary release off
		7	Parking brakes released
		8	Emergency brakes released
		9	Emergency brakes engaged
		10	Parking brakes engaged
		11	Auxiliary releases engaged
		12	+24V
12-pole Deployment (c)	1	12V+	Emergency brakes / braking level 1
	2	24V+	
	3	GND	
	4	12V+	Parking brakes / braking level 2
	5	24V+	
	6	GND	
	7	12V+	Auxiliary releases / braking level 3
	8	24V+	
	9	GND	
	10	GND	Motor Power DC-
12-pole deployment (b)	1	AT1+	
	2	AT2+	



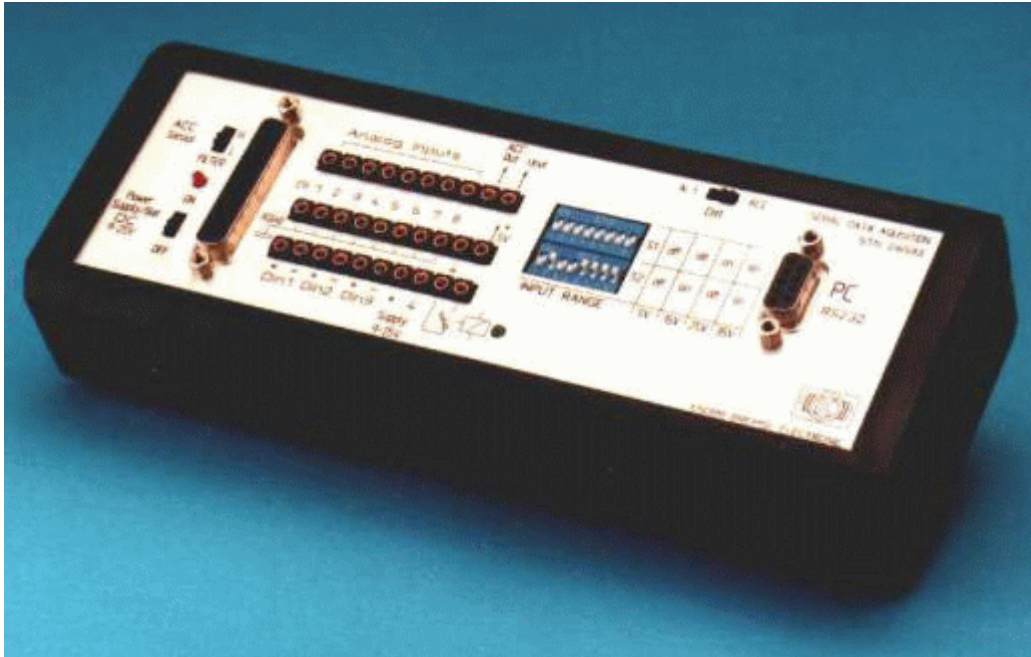
	3	AT1-	
	4	AT2-	
	5	AS1+	
	6	AS2+	
	7	AS1-	
	8	AS2-	
	A23	Motor ON/OFF externally	+24VDC applied to C10
	A24	Encoding	Bridge for internal motor control
	A25	Encoding	Bridge for internal motor control

### Connector pin assignment

25-pole deployment (a)	1	24V+
	2	Pressure sensor 1
	3	24V+
	4	Pressure sensor 2
	5	24V+
	6	Pressure sensor 3
	7	Pressure intern out
	8	Pressure intern in

## 5.5.2 SU05A

The ST03A (STN 26533) provides SU05A "Serial Data Acquisition" to measure data from the brake system via the serial interface. The measured data can be displayed in the **Measurement** function. With the SU05A, measured channels' properties and input range switches are changed in the **Configuration** panel under the folder **SU05A** (see: [SU05A Properties](#)).



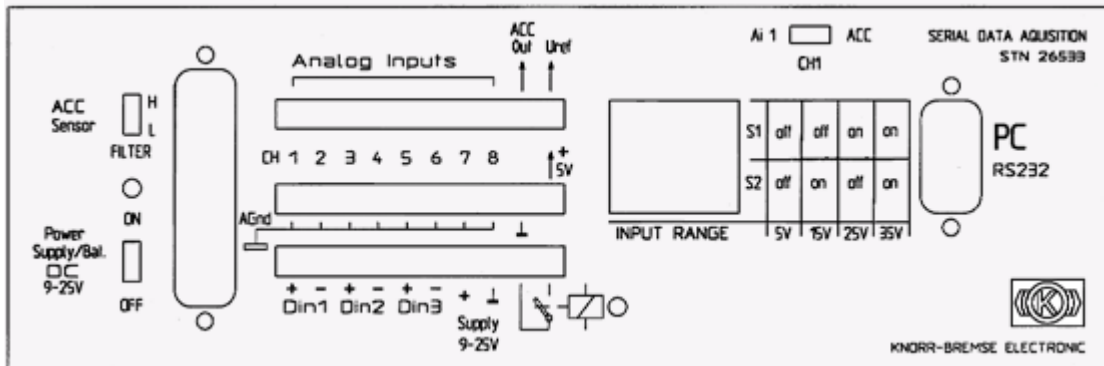
### Scope of supply:

- 1 Device "Serial Data Acquisition" with 9V battery
- 1 Disc with software MODULAB
- 1 ACC sensor
- 1 Manual
- 1 Plug power supply 220VAC/15VDC

### Supported functions of SU05A:

- 8 Analog input with common potential. Resolution 12 bit
- 3 Digital input self and PC galvanically isolated
- 1 Integrated connector for ACC Sensor

Top side of the SU05A (The position of the switches in the SU05A's switchboard should have the same as in the **Configuration** panel):



For the correct functionality, the following pin assignment is necessary between SU05A and the serial port:

SU05A			PC		
pin	SUB-D9 female	Cabling	pin	SUB-D9 male (RS 232)	comment
1	Din3	-	1	DCD	
2	n.c.	n.c	2	RXD (not used)	
3	RO	n.c	3	TXD (not used)	
4	SCLK	-	4	DTR	CH1-CH8
5	GND	-	5	GND	
6	Din1	-	6	DSR	
7	DIN	-	7	RTS	CH1-CH8
8	DOUT	-	8	CTS	CH1-CH8
9	Din2	-	9	RI	



### 5.5.3 SU06A

SU06A (STN 31977) is the replacement of the SU05A serial data acquisition unit. To use SU06A needs to be installed [FTDI driver](#) separately in addition to the installation of ST03A.

The measured data can be displayed with the [Measurement](#) function. SU06A measured channel's properties can be changed in the **Configuration** panel under the folder **SU06A** (see also: [SU06A Properties](#) and **Service / SU06A Outputs**).



Scope of supply:

- USB connection to the computer.
- 2 Plug power supply 115VAC - 230VAC/24VDC - 110VDC

Supported functions of SU06A:

- 12x16 bit analog input channels with ESRA compatible input ranges organized into 3 isolated channel groups of 4 channels.
- 8 pressure sensor inputs with power supply on LEMO connectors.
- 16 optically decoupled digital input channels with ESRA compatible selectable input ranges.
- 1 acceleration sensor input.
- 1 ms to 1s sample rates.
- 1 digital output relay (150V / 1A).
- 2 analog outputs for lever simulation (0-10V / 10mA).

## Plug of the SU06A

**Analog inputs** SUB-D25 female connector pin assignment:

pin	SUB-D25 female	connector
1	ACh1(+)	PrM1 (LEMO)
2	ACh2(+)	PrM2 (LEMO)
3	ACh3(+)	PrM3 (LEMO)
4	ACh4(+)	PrM4 (LEMO)
5	ACh5(+)	banana, PrM5 (LEMO)
6	ACh6(+)	banana, PrM6 (LEMO)
7	ACh7(+)	banana, PrM7 (LEMO)
8	ACh8(+)	banana, PrM8 (LEMO)
9	ACh9(+)	banana
10	ACh10(+)	banana
11	ACh11(+)	banana
12	ACh12(+)	banana, ACCELEROMETER
13	n.c.	n.c.
14	ACh1(-) GND1	PrM1 (LEMO)
15	ACh2(-) GND1	PrM2 (LEMO)
16	ACh3(-) GND1	PrM3 (LEMO)
17	ACh4(-) GND1	PrM4 (LEMO)
18	ACh5(-) GND2	banana, PrM5 (LEMO)
19	ACh6(-) GND2	banana, PrM6 (LEMO)
20	ACh7(-) GND2	banana, PrM7 (LEMO)
21	ACh8(-) GND2	banana, PrM8 (LEMO)
22	ACh9(-) GND3	banana
23	ACh10(-) GND3	banana
24	ACh11(-) GND3	banana
25	ACh12(-) GND3	banana, ACCELEROMETER

Pin assignment of LEMO pressure sensor input (**PrM**) connectors:

pin	description
1	signal GND(-)
2	signal input(+)
3	+24VDC supply voltage output
4	power GND

Pin assignment of LEMO acceleration sensor input (**ACCELEROMETER**) connector:

pin	description
1	+5VDC supply voltage output
2	power GND
3	signal input (2.5V +/- 2V)
4	signal GND(-)

Pin assignment of digital input connectors (**D**):

pin	SUB-D9 female				
	D1-D4 connector		D5-D8 connector	D9-D12 connector	D13-D16 connector
1	Ch1 (+)	D1 (banana)	Ch5 (+)	Ch9 (+)	Ch13 (+)
2	Ch2 (+)	D2 (banana)	Ch6 (+)	Ch10 (+)	Ch14 (+)
3	Ch3 (+)	D3 (banana)	Ch7 (+)	Ch11 (+)	Ch15 (+)
4	Ch4 (+)	D4 (banana)	Ch8 (+)	Ch12 (+)	Ch17 (+)
5	n.c.		n.c.	n.c.	n.c.
6	Ch1 (-)	D1 (banana)	Ch5 (-)	Ch9 (-)	Ch13 (-)
7	Ch2 (-)	D2 (banana)	Ch6 (-)	Ch10 (-)	Ch14(-)
8	Ch3 (-)	D3 (banana)	Ch7 (-)	Ch11 (-)	Ch15 (-)
9	Ch4 (-)	D4 (banana)	Ch8 (-)	Ch12 (-)	Ch16 (-)