

VIPA Software

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VIPA CONTROLS

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SW310S1LA_000_EtherCATManager,6,EN - © 2018

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1 General

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1.2 About this manual

Objective and contents	This manual describes the SPEED7 EtherCAT Manager of VIPA:					
	It contains a description of the structure, project implementation and usage in the Siemens SIMATIC Manager					
	The manual is targeted at users who have a background in automation technology.					
	The manual is available in electronic form as PDF file. This requires Adobe Acrobat Reader.					
	The manual consists of chapters. Every chapter provides a self-contained description of a specific topic.					
	The following guides are available in the manual:					
	 An overall table of contents at the beginning of the manual 					
	 References with pages numbers 					
Icons Headings	Important passages in the text are highlighted by following icons and headings:					
	DANGER! Immediate or likely danger. Personal injury is possible.					
	CAUTION! Damages to property is likely if these warnings are not heeded.					



Supplementary information and useful tips.

2 Installation and activation

2.1 System requirements

The minimum system requirements for installing the software package SPEED7 *EtherCAT Manager* are:

- Processor: Intel[®] Pentium[®] 4 or AMD Athlon[®] 64
- Operating system Microsoft[©] Windows[©] XP with service pack 3, Windows Vista[©] Home Premium, Business, Ultimate or Enterprise with service pack 1 (service pack 2 recommended), Windows 7[©] or Windows 8[©]
- Working memory: At least 1 GB of RAM
- Hard disc space: 1 GB (no installation at portable flash memories possible)
- Monitor and graphics card: 1024 x 768 monitor resolution (1280 x 800 recommended) with OpenGL graphics card with hardware acceleration , 16-bit colour and 256MB of VRAM
- Software
 - Siemens SIMATIC Manager V. 5.5, SP2
 - PDF reader to read the supplied PDF files

2.2 Installing the SPEED7 EtherCAT Manager

You can install the SPEED7 EtherCAT Manager with a downloaded file.

- Execute the installation program:
 - If you have downloaded the installer, double-click the downloaded file.

Follow the instructions on the screen.

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The use of the SPEED7 EtherCAT Manager requires that you agree with the license agreement. During installation, you must confirm this.

In addition to the *SPEED7 EtherCAT Manager* the following components are automatically installed, which are needed to run the software:

- Microsoft.NET Framework[©]
- WinPcap

Uninstalling the SPEED7 EtherCAT Manager

2.3 Activating the SPEED7 EtherCAT Manager

30 days trial version

After installation you can use the *SPEED7 EtherCAT Manager* fully for 30 days as a trial version. After this time the software no longer runs and must be activated.

Activation

🛷 Activation		×
	BPEED herCAT Manager	
	Licence key:	
[
[Your name:	
[Email address:	
	Activate Activate offline	

The activation happens with the following proceeding:

- **1.** Start the SPEED7 EtherCAT Manager.
 - ⇒ With each call of the *SPEED7 EtherCAT Manager* the remaining days are shown with the query if you want to activate an existing license.
- 2. To start the activation, confirm with [Yes].
 - \Rightarrow The following dialog is opened:
- **3.** Enter the serial number that you received with your order of *SPEED7 EtherCAT Manager* in the *'Licence key'* input field.
- **4.** Enter your name in the 'Your name' input field.
- **5.** If you enter your e-mail address in the *'E-mail address'* input field, you receive an e-mail confirmation regarding the product activation.

Activate licence online

Click at [Activate].

⇒ The licence is activated and the SPEED7 EtherCAT Manager is started.

Activate licence offline

If the PC, on which you would like to use the *SPEED7 EtherCAT Manager*, is not connected to the Internet, you can activate the licence offline. For this, you need to obtain an activation key via another PC that is connected to the Internet.

- 1. Click at [Activate offline].
 - \Rightarrow A dialog window with information on the subsequent steps opens.
- 2. Click at [OK] in the dialog window.
 - ⇒ The 'Save as' dialog window opens.
- **3.** Save the HTML file and transfer this file (e.g. with copy and paste) to a PC that is connected to the Internet.
- 4. Double-click at the HTML file.
 - ⇒ The HTML page is opened in the browser. The activation key is accessed by the VIPA licence server and is shown in the browser.
- **5.** Enter the activation key into the '*Activation key*' input field in the '*Product activation*' dialog window.
- **6.** Click at [Offline activation] again.
 - ⇒ The licence is activated and the SPEED7 EtherCAT Manager is started.

2.4 Uninstalling the SPEED7 EtherCAT Manager

You can uninstall the *SPEED7 EtherCAT Manager* in the control panel. A dialog is shown, where you can choose whether your stored projects remain or be deleted.

3 Deployment SPEED7 EtherCAT Manager

3.1 Overview

Properties

- Installation as TCI-Tool (Tool-Calling-Interface) within the Siemens SIMATIC Manager.
- Serves for configuration of a virtual PROFINET slave (Installation via GSDML).
- You can use multiple virtual PROFINET slaves to achieve the maximum possible number of I/O data This segmentation is automatically recognized in the SPEED7 EtherCAT Manager. A virtual PROFINET slave supports max. 1500byte I/O data.
- Synchronizes the address areas with the Siemens SIMATIC Manager.
- Saves the configuration in the Siemens SIMATIC Manager project.

The SPEED7 EtherCAT Manager has the following functions:

- Automatic configuration of a slave system
- Manual configuration of a slave system
- Diagnosis of a slave system

Starting the SPEED7The SPEED7 EtherCAT Manager can be started from the hardware configurator with
'Start Device-Tool' of the context menu of the inserted virtual PROFINET slave.EtherCAT ManagerStart Device-Tool' of the context menu of the inserted virtual PROFINET slave.

Exit the SPEED7 EtherCAT Manager

By closing the SPEED7 EtherCAT Manager with 'File \rightarrow Exit' the SPEED7 EtherCAT Manager is closed and the configuration is stored in the Siemens SIMATIC Manager. Here SDBs starting from SDB4000 are created and stored in the system data "tray".



Please consider that these SDBs can only be transferred by the Siemens SIMATIC Manager and <u>not</u> by the hardware configurator!

Overview

Work environment of the SPEED7 EtherCAT Manager

The work environment of the *SPEED7 EtherCAT Manager* is divided into the following parts:

SPEED7 EtherCAT Manager - Station		1	
File View Network Settings Help			
Configuration Mode		·	
Project Explorer	Device Editor		
▼ UIPA 315-4EC12	Master Advanced Options Di	istributed Clocks Process Image I/O Address Overview	
 Slave_001 (0001) [VIPA 053-1EC00] 			
1 001: Module 1 [021-1BD00]	General		
Slave_002 (0002) [VIPA 053-1EC00]	Unit Name	VIPA 315-4EC12	
	Cycle Time [us]	32000	
	Slaves connected to local sys	tem	
	Network Adapter	LAN-Verbindung 3 (D-Link USB2.0 Ethernet Adapter)	
0			Select
		4	
~	Slaves connected to remote s	system	
	OPG/OP Ethernet	192.168.10.124	
	 EC-Mastersystem 	192.168.1.1	
	 Custom remote system 	192.168.10.124	
	Port	6000	
_	Master-Instance		Decelect
Classic View Platent			
Short Info 🗸 👻	Messages		▼ 4
Information	Level Zeit Meldung		
Name VIPA 315-4EC12			
Description CPU 317 FE012		0	
Vendor VIPA Gm H		O	
		-	
7			0
Networks: 0 Javes: 0			Status: • JMode: CONFIG EXPERT

- 1 Main menu: Here the main functions of the *SPEED7 EtherCAT Manager* may be accessed.
- 2 Toolbar: Here you can switch between *Configuration mode* and *Diagnosis mode*.
- 3 Project Explorer: Here master and slave stations of your system are listed.
- Device editor: Property dialog of a device (parameter) respectively information area.
 Selection of the view: In the "Classic View" all the subordinate slave stations are
- 5 Selection of the view: In the "Classic View" all the subordinate slave stations are shown indented to the slave stations. In the "Flat view" all the subordinate slave stations are shown at the same level as the slave stations.
- 6 Here you can find the device information of the component, which is selected in the *Project Explorer*.
- 7 In this section you can find the number of networks and slave stations.
- 8 Here all the messages are listed. Via 'Settings → message level' you can select the type of messages to be shown.
- 9 Status area: With an online connection the 2 LEDs flash alternately in the Status area. At Mode you will find the mode (Diagnosis/Configuration).

<i>'Expert'</i> mode	By activating 'View → Expert' you can switch to the 'Expert mode'. When enabled, the properties dialogues are extended accordingly. In 'Expert mode' you will have the full scope of the SPEED7 EtherCAT Manager.

Input field - number format Some input fields have the buttons [Dec] respectively [Hex]. By selecting the appropriate button you can set the input format *decimal* respectively *hexadecimal* for the input field.

3.1.1 Main menu	
<i>'Expert'</i> mode	By activating 'View → Expert' you can switch to the 'Expert mode'. When enabled, the properties dialogs and the Main menu are extended accordingly. In 'Expert mode' you will have the full scope of the SPEED7 EtherCAT Manager.
File	 Open / Save / Save As: Open: A different EtherCAT configuration can be loaded than the current configuration in the Siemens SIMATIC Manager project. Save: Save the current EtherCAT configuration in you're the Siemens SIMATIC Manager project. There are no SDBs created! Save as: Here the EtherCAT configuration is saved in a new project (e.g. Project template). ESI manager Here ESI files may be added respectively exported. Exit The SPEED7 EtherCAT Manager is closed and the configuration is stored in the Siemens SIMATIC Manager project. Here SDBs starting from SDB4000 are created and stored in the system data "tray".
View	 Messages Here the display area 'Messages' can be enabled respectively disabled in the work environment. Information Here the display area 'Short Info' can be enabled respectively disabled in the work environment.
	 Expert mode Here the expert mode can be enabled respectively disabled. When enabled, the properties dialogs and the <i>Main menu</i> are extended accordingly. In 'Expert mode' you will have the full scope of the SPEED7 EtherCAT Manager. Refresh Here you can refresh the content of the work environment.
Network	 Scan EtherCAT network Here you can search your connected EtherCAT network for slave stations. Edit Topology Here a dialog is opened to change the current topology of your project. Export ENI File / Import slaves ENI File Here you can create an ENI file or import a slave station from an ENI file. Network mismatch analyser This function may only be called in the "Diagnosis mode". Here you can compare your configured slave stations to the connected slave stations. Different elements are represented with <i>red font</i>. Line Crossed Analyzer (active only after scan) Here wrong connected slave stations can be shown. Clear error counters Here all the listed error are deleted.

Overview > Main menu

Settings

Message level

Here you can choose, which messages should be displayed in the message area:

- All Messages
- Info&warnings&errors
- Warnings&errors
- Errors
- Project template
 - Select a configuration file as the project template from which the preconfigured slave stations are to be loaded.

Settings:

- Activate
- Ignore revision

Help

- Show user manual
 - Opens this user manual.

About ...

 Among others you get information about the version of the SPEED7 EtherCAT Manager.

ESI Manager

3.2 ESI Manager

🦪 E	ESI M	anag	er					
ESI Files								
S	Select an ESI file which should be deleted or exported or add new ESI files.							
	•	VIPA	VIPA	GmbH				
		•	Vipa	a 053-1EC00 MDP.	xml			
				Name	Description		Revision	
			١	VIPA 053-1EC00	VIPA 053-1EC00 Ethe	erCAT Fieldbus coupler (ME	DP) 0x00000013 (19)	
			1	VIPA 053-1EC00	VIPA 053-1EC00 Ethe	erCAT Fieldbus coupler (ME	OP) 0x00000012 (18)	
			۱	VIPA 053-1EC00	VIPA 053-1EC00 Ethe	erCAT Fieldbus coupler (ME	OP) 0x00000011 (17)	
	•	1	Yaska	awa Electric Corpo	ration			
		►	ESI_	SIES3_OPT_V_1_03	3_01.xml			
		►	Yasl	kawa SGDV-E1_Co	E rev5.00.xml			
		►	Yasl	kawa SGDV-E5_Co	E rev5.00.xml			
L								
							Number of ESI files: 4	
	А	dd Fi	le	Add Folde	r Delete	Export	Close	

ESI files are device description files in XML format for the respective slave stations and the peripheral modules. By including an ESI file the *SPEED7 EtherCAT Manager* gets all the information, which are required for the configuration. During the installation of the *SPEED7 EtherCAT Manager* the ESI files of the VIPA systems are pre-installed. When installing an ESI file an existing ESI file is saved and the path to the saved file appears. If an ESI file contains a slave more than once (identical revision, product and vendor ID), the slave first found is always used.

Via '*File* → *ESI Manager*' the dialog window '*ESI Manager*' opens. Here you have the following possibilities:

- Add File
 - Here you can install an ESI file in the SPEED7 EtherCAT Manager.
- Add Folder
 - If you want to add more than one ESI file, you can collect them in a folder. By specifying the folder path all ESI files are installed from this folder in the SPEED7 EtherCAT Manager.
- Delete
 - Here you can delete a XML file in the SPEED7 EtherCAT Manager.
- Export
 - You can externally save a XML file outside of the SPEED7 EtherCAT Manager.
 With [Export] you can backup your ESI file before it is deleted and install it again with [Add File].
- Close
 - With [Close] the 'ESI Manager' is closed.



To reload the ESI data in your project select your slave station and execute 'Context menu \rightarrow Reload ESI data'.

Manual configuration of a slave system

3.3 Automatic configuration of a slave system

Precondition

The automatic configuration assumes that your EtherCAT system is mounted and can be reached on-line.

There are the following possibilities for on-line connection:

- Slaves connected to the local system
 - You are directly connected to a slave station via EtherCAT by means of a separate network adapter. Here the on-line connection is established by specifying the *Network Adapter*.
- Slaves connected to remote system
 - You are connected to the Ethernet PG/OP channel of your CPU and can use this to access the EtherCAT master. The on-line connection is established by specifying *IP Address*, *Port* and *Master Instance*. With VIPA *Port* 6000 and *Master Instance* 0 is to be set.

Proceeding

- 1. Depending on the SPEED7 EtherCAT Manager
- 2. Click in the 'Project Explorer' at 'EC-Mastersystem'
- 3. Set depending on the on-line access in the 'Device Editor > Master' as follows:
 - If you are directly locally connected to a slave station via EtherCAT by means of a separate network adapter, select your *Network adapter* and click at [Select].
 - If you are connected to the Ethernet PG/OP channel of you CPU, please enter IP Address, Port and Master Instance and click at [Select]. With VIPA set Port to 6000 and Master Instance to 0.
 - ⇒ The SPEED7 EtherCAT Manager uses the set connection for communication. By clicking on [Deselect] you can change the connection parameters.



When called from the Siemens SIMATIC Manager the IP address is taken once from your project. If you change the IP address you need to adjust this in the Siemens SIMATIC Manager and in the SPEED7 EtherCAT Manager.

- **4.** Click in the 'Project Explorer' at 'EC-Mastersystem' and select from the context menu 'Scan EtherCAT network'
 - ⇒ You might be asked if you want to delete the existing slaves. Confirm with [Yes].

Then the master is listed with its slaves and the associated PDO configuration in the *'Project Explorer'*, which was found by the network scan. The system can now be configured accordingly.

If there is no connection possible with the local master, the an anti virus software could block the connection. Then disabling the packet filter of the protocols of the network card in the anti virus software could help.

3.4 Manual configuration of a slave system

Precondition

With the manual configuration the system need not be built and connected online. The system can freely be configured in the *SPEED7 EtherCAT Manager*.

Configuration - EC-Mastersystem > Preparation

Proceeding

- **1.** Open if not already done the SPEED7 EtherCAT Manager.
- 2. Click at the 'Project Explorer' at 'EC-Mastersystem' and select 'Context menu → Append Slave(s)'.
 - ⇒ A dialog opens to insert slave systems
- **3.** Select the according slave from the list, enter the number of slaves and confirm with [OK].
 - \Rightarrow The corresponding slave systems are inserted and can be configured now.

3.5 Configuration - EC-Mastersystem

3.5.1 Preparation

Click in the Toolbar at [Configuration] and select *'EC-Mastersystem'* in the *'Project Explorer'*. As soon you have configured at least one slave station, the following registers are available:

- & Chapter 3.5.2 'Master' on page 16
- & Chapter 3.5.3 'Process Data Image' on page 17
- Schapter 3.5.4 'Advanced Options (Expert mode)' on page 17
- ♦ Chapter 3.5.5 'Distributed Clocks (Expert mode)' on page 20
- Schapter 3.5.6 'I/O Address Overview' on page 21

Configuration - EC-Mastersystem > Master

3.5.2 Master

Project Explorer EC-Mastersystem Slave_001 (0001)	General Unit Name Cycle Time [us]	EC-Mastersystem 32000	*		
1 001: Module 1	Slaves connected to local system	Slaves connected to local system			
1	Network Adapter	LAN-Verbindung 4 (Intel(R) PRO/1000 GT-Desktopadapter)	-		
			Select		
	Slaves connected to remote syste OP Ethernet	192.168.0.1			

laves connected to remote system						
PG/OP Ethernet	192.168.0.1					
EC-Mastersystem	192.168.0.1					
Custom remote system	192.168.0.1					
Port	6000					
Master-Instance	0 Deselect					

Here you can perform master and bus-specific settings.

- General
 - Unit Name: Name of the master
 - Cyclic time: Interval in µs, in which the process data are read and written (PDO cycle time). Here you can choose between different values.
- Slaves connected to the local system
 - You are directly connected to a slave station via EtherCAT by means of a separate network adapter. Here the on-line connection is established by specifying the *Network Adapter*.
- Slaves connected to remote system
 - You are connected to the PG/OP channel of your CPU and can use this to access the EtherCAT master. The on-line connection is established by specifying *IP Address*, *Port* and *Master Instance*.

IP Address: Enter the IP Address of the PG/OP channel of the remote CPU. Port: Port, over which the communication takes place with the remote CPU. With VIPA use Port 6000.

Master-Instance: Serves for the master instance of the remote system. With VIPA the master instance is 0.

With [Select] the *SPEED7 EtherCAT Manager* uses the set connection for communication. By clicking on [Deselect] you can change the connection parameters.



When called from the Siemens SIMATIC Manager the IP address is taken once from your project. If you change the IP address you need to adjust this in the Siemens SIMATIC Manager and in the SPEED7 EtherCAT Manager. Configuration - EC-Mastersystem > Advanced Options (Expert mode)

3.5.3 Process Data Image

P	roiect Ex	olorer	I/O a	ddresses										
EC-Mastersystem		Inpu	Input addresses				Output addre	Output addresses						
		Sta	Start address:			384 🗘 Start address: No va		No value 🌲	No value 🍦					
	 Slave_001 (0001) 001: Module 1 		Enc	End Address:			391 End Address:							
			Inp	Input addresses assigned (Byte). 9 Output addresses assigned (Byte). 1										
			No.	Bus address	Slave	Module	Slot	S7 Input address	S7 Output address	EtherCAT input address	EtherCAT output address	Туре	Order number	Со
			1	1	Slave_001			384 - 391		0 - 7		VIPA 053-1EC00	VIPA 053-1EC00	
			2	1	Slave_001	Module 1	1	392		8		021-1BF00	021-18F00	
	3	1	Slave_001	Module 2	2		384		0	022-1BF00	022-18F00			
											Refresh			

Here you have a list of S7 respectively EtherCAT addresses, which are used by the modules of all the slave stations. The 'S7 address' corresponds to the address in the address area of the CPU. By entering a new 'Start Address' you can adjust the S7 addressing of the input and output areas of the modules accordingly.



Information about the assignment of the in/output area can be found in the manual of your module.

The 'I/O Addresses EtherCAT' are only visible in 'Expert mode'! 'I/O Addresses EtherCAT' are the offset addresses, which are used within the EtherCAT process image. You cannot change the address. You can use the addresses e.g. for EtherCAT network analysis.

3.5.4 Advanced Options (Expert mode)

Designet Fuellands Master Settings	
Init Command Retries: 3	
EC-Mastersystem Properties: Name Value	
Slave_001 (0001)	
MasterStateChangeTimeout (ms) 60000	
Startup Checking	
☑ Check Vendor ID SDO Access: 0	(ms)
Check Product Code Init->Pre-Op/Init->Bootstrap: 3000	‡[ms]
Check Revision Number Pre-Op->Safe-Op/Safe-Op->Op: 10000	∉[ms]
Eack Serial Number Back to Pre-Op, Init: 5000	[ms]
Op->Safe-Op: 200	= [ms]
Identification Checking Mailbox Mode	
Check Identification Cyclic 10	[ms]
Copy Station Address -> Identification Value State Change	
Copy Identification Value -> Station Address	
Process Data Mode Overwrite Mailbox Size	[hutor]
Input Size:	[bytes]
Cupurite Watchdog	
Set Multiplier (Reg.: 0x400):	
Set PDI Watchdog (Req.: 0x410):	
Set SM Watchdog (Reg.: 0x420):	
	ly changes to all slaves

Configuration - EC-Mastersystem > Advanced Options (Expert mode)

This dialog is only visible in the '*Expert mode*'! In this dialog the parameters of the master system can be adjusted and the default settings for all the slave stations can be defined.

- Master Settings
 - Init Command Retries: Number of retries, beyond which a transmission error is returned. (default: 3)
 - MasterStateChangeTimeout: Here you can define a timeout for the state change of the master and its slave stations (default: 60000ms). If the MasterStateChangeTimeout is too short, the EtherCAT master reports the error message 0xED21.
- Slave Settings
 - In this area default parameters can be applied for all the slave stations. The settings are applied for all slave stations as default setting by clicking on [Apply changes (to all slaves)]. By selecting the slave station in the *'Project Explorer'* you always have the possibility to customize the slave parameters via the register *'Advanced Options'*.

Slave Settings

Start-up checking:

Here you can define the items, the EtherCAT master has to check during the transition '*Init* \rightarrow *Pre-Op*' (Vendor ID, Product code, Revision number).

- Revision number can be verified:
 - "==" \rightarrow High word is equal, Low word is equal
 - ">=" \rightarrow High word is equal or greater, Low word is equal or greater
 - "LW ==" \rightarrow Low word is equal
 - "LW ==, HW >=" \rightarrow Low word is equal, High word is equal or greater
 - "HW ==" \rightarrow High word is equal
 - "HW ==, LW >=" \rightarrow High word is equal, Low word is equal or greater
- Identification checking:
 - With these parameters, you determine via which HotConnect address the EtherCAT master should identify the slave station.
 - 'Check identification': When activated, the text box below shows the current Hot-Connect address, which the EtherCAT master has to use to identify the slave station.
 - For identification via the address set on the address switch of the slave station (Explicit Device ID), you have to activate 'Check identification' and enter the corresponding ESC register address for addressing via the address switch at 'Select local address'.
 - For identification via SSI (Configured Station Alias) you have to activate 'Check identification' and enter the corresponding ESC register address for SSI activation at 'Select local address'. In this case, the Configured Station Alias address must be specified via 'EEPROM' of the slave station in diagnostics mode. In addition, you must specify the Configured Station Alias address in your configuration in 'Group' by means 'Identification value'. & Chapter 3.9.4 'EEPROM (Expert mode)' on page 44 & Chapter 3.10.3 'Create Hot Connect group' on page 50



For more information about the ESC register addresses, refer to the manual for your slave station.

Process Data Mode:

Here you specify the command that should be used for process data access.

- *'LRW activate:'* With one Logical-Read-Logical-Write command inputs are read and also outputs are set. This needs 1 frame.
- *'LRW deactivate:' 'LRD/LWR:'* Read access with Logical-Read command to inputs and write access with Logical-Write command to outputs. This needs 2 frames.
- Overwrite Watchdog:

Writes the configured value in the relevant register of the slave station. Here among others you can set the time of the *'SM Watchdog'* (SyncManager-Watchdog).

- 'Set Multiplier': Writes the configured value to the corresponding slave register: 0x0400
- 'Set PDI Watchdog': Writes the configured value to the corresponding slave register: 0x0410
- 'Set SM Watchdog': Writes the configured value to the corresponding slave register: 0x0420



Timeouts:

'SDO Access': Internal master timeout for SDO access

'Init \rightarrow *Pre-Op'*: Internal master timeout for slave state change from *Init* to *Pre-Op 'Pre-Op* \rightarrow *Safe-Op/Safe-Op* \rightarrow *Op'*: Internal master timeout for slave state change from *Pre-Op* to *Safe-Op* and then to *Op*.

'Back to Pre-Op, Init': Internal master timeout for slave state change to Pre-Op and Init

'Op →Safe-Op': Internal master timeout for slave state change from Op to Safe-Op ⇔ Chapter 3.11 'EtherCAT State Machine' on page 52

Mailbox Mode:

The *'Mailbox'* is an a-cyclic communication channel. Here mostly *'Emergencies'* messages and *'SDOs'* are buffered. The way of accessing the just unread mailbox data can be specified here.

- 'Cyclic': Interval in ms within which the mailbox is to be read (polling mode). If you want short interrupt response times, you should select the mode 'Cyclic' and set a short time e.g. 1ms.
- 'State change': The mailbox is read only on a state bit change.
- Overwrite Mailbox Size
 - 'Output Size': Overwrites mailbox output size
 - *'Input Size'*: Overwrites mailbox input size
 - When changing the 'Process Data Mode' you have to refresh the addresses in the Register 'Process Image'.
 - If the Process Data Mode 'LRW' is used, the input and the output address of the EtherCAT process image must be identical. Here address leaks can occur between slave stations. If an EtherCAT address exceeds the maximum address area of the CPU, the current configuration gets invalid. You need to reduce the configuration or change to process data mode 'LRD/LWR'.
 - If you use long cycle times (> 100ms) you should always accordingly raise the 'SM Watchdog'. Otherwise your slave station changes after laps of 'SM Watchdog' time to Safe-Op and releases OB 86. From now on you can only manually set the slave to Op!

Configuration - EC-Mastersystem > Distributed Clocks (Expert mode)

3.5.5 Distributed Clocks (Expert mode)



Slaves with active DC

Show 64Bit System Time

This dialog is only visible in the 'Expert mode'! Here you can adjust the clock functionality accordingly. In EtherCAT "Distributed Clocks" means a logical combination of "clocks", which are located in the EtherCAT devices. With this there is the possibility to locally provide a synchronized time in each bus device. If an EtherCAT device supports the Distributed Clocks functionality, it has its own clock. After PowerON this first locally works, based on an own pulse generator. By selecting an EtherCAT slave station, which has to provide the reference time, the distributed clocks can be synchronized. This reference clock so represents the system time.

- Reference clock: Here you get information about the clock, which provides the reference time.
 - Name: Name of the reference clock. Per default this is always the 1. slave station, which supports the "Distributed Clock (DC)" functionality.
- Clock adjustment
 - Master Shift: The EtherCAT master time is synchronized by the reference clock.
 - Bus Shift: The reference clock is synchronized by the EtherCAT master time.
 - External Mode: The reference clock is controlled by an external master

- Options
 - Continuous Propagation Compensation: A command (datagram) will be inserted in the cyclic frame which allows the EtherCAT master to measure and compensate the propagation delay time by time.
 - Sync Window Monitoring: A command (datagram) will be inserted in the cyclic frame to read the ESC registers 0x092C. If this is selected the master will throw a notification about the state (*sync* respectively *out-of-sync*) of your system.
 - 64bit system time: Master supports slaves with 32bit and 64bit system time register (0x0910). If this is selected he will interpret it as 64bit system time.
- Slaves with active DC
 - Shows a list of all slave stations with active DC

3.5.6 I/O Address Overview

Proj	ect E	cplorer	I/O addres	ses					
-	U	EC-Mastersystem	Input addres	ses	Output a	Output addresses			
	Ŧ	📕 Slave_001 (0001)	Start address	12	Start addr	Start address:			
		1 001: Module 1	End Address:	Address: 19 End Address		End Address:			
			Address	Name		Data type	Comment	*	
			ED 0	d_HardwareInt	erruptC_0_1	DWORD	ED 0.0 - Slave_001 Hardware Interrupt Counter When Auto-Acknowledge is enabled it improcess alarms. Otherwise it shows only that an alarm has occurred. Write on object 0x5000:6 to reset the counter or to acknowledge the alarm respectively. [Device: Slave_001 Slot 0]		
			ED 4	d_DiagnosticIn	terrup_4_1	DWORD	ED 4.0 - Slave_001 Diagnostic Interrupt Counter When Auto-Acknowledge is enabled it ir diagnostic alarms. Otherwise it shows only that an alarm has occurred. Write on object 0x5002:6 to reset the counter or to acknowledge the alarm respectively. [Device: Slave_001 Slot 0]		

Here you have a list of addresses that are used by the I/O components of all the modules in the address area of the CPU. By entering a new *'Start address'* you can adjust the addressing of the input and output areas accordingly. You can edit *'Name'* and *'Comment'* by clicking at the corresponding entry.

With [Export] there is the possibility to save them to a SEQ file. The file can be imported as a symbol file into your project in the Siemens SIMATIC Manager.



Information about the assignment of the in/output area can be found in the manual of your module.

Configuration - slave station > Preparation

3.6 Configuration - slave station

3.6.1 Preparation

Click in the Toolbar at [Configuration] and select the Slave-Station 'Slave_...' in the 'Project Explorer'. The following registers are available now:

- \Leftrightarrow Chapter 3.6.2 'General' on page 23
- ♦ Chapter 3.6.3 'Modules' on page 24
- ♦ Chapter 3.6.4 'PDO Mapping' on page 25
- Group if a group exists for this slave station
- ♦ Chapter 3.10 'Grouping logic' on page 47
- ♦ Chapter 3.6.5 'Advanced Options (Expert mode)' on page 28
- ♦ Chapter 3.6.6 'Ethernet (EoE)' on page 31
- & Chapter 3.6.7 'Distributed Clocks (Expert mode)' on page 32 if supported
- & Chapter 3.6.8 'Init Commands (Expert mode)' on page 33
- ♦ Chapter 3.6.9 'CoE Object Dictionary (Expert mode)' on page 35
- Schapter 3.6.10 'Process Image' on page 36
- Schapter 3.6.11 'I/O Address Overview' on page 36

3.6.2 General

Project Explorer		Address Station Address	7 🛋	
-	📕 Slave_001 (0001) [VI	Information		
	î 001: Module 1	Name		Slave_007
		Description		VIPA 053-1EC00 EtherCAT Fieldbus coupler (MDP)
		Vendor		VIPA GmbH (0x0000AFFE)
		Product Code		0x0531EC00 (87157760)
		Revision Number	evision Number 0x00010001 (65537)	
		ESI File		C:\Users\Public\Documents\VIPA GmbH\SPEED7 EtherCAT Manager\EtherCAT\EsiFiles \Vipa 053-1EC00 MDP.xml
		Identification Value		Not Used
		Ports		
		Α	9	Slave_001 (0001) / Port C [X2 OUT]
		D		Not Connected

Here you can perform slave-specific settings such as assignment of name and address to a station. It is also possible to change the connection to the station.

Address

В

С

- Station Address: EtherCAT address of the slave station.

Not Connected

Not Connected

- Information
 - Name: Name of the slave station can be assigned accordingly.
 - Description: Description of the slave station.
 - Vendor: Name of the vendor.
 - Product Code: Internal product code of the slave station.
 - Revision Number: Internal revision number of the slave station.
 - ESI File: Path and name of the device file, in which the data of the slave station is stored.
 - Identification Value: Identification Value of the slave station
- Ports
 - Connected Devices: List of connected slave stations.
 - Predecessor Device: Name of the predecessor device.
 - If topology should be changed, please use the 'Edit Topology' dialog.

Configuration - slave station > Modules

3.6.3 Modules



Download Slot Configuration

Load Modules

With an E-Bus slave this dialog is hidden. & Chapter 3.10 'Grouping logic' on page 47

In this dialog you can assign modules to the appropriate slot.

Connect module to slot ("<<")

Select your module from the list on the right and add it to a selected slot *'Terminals'* in the left list by clicking [<<]. This takes place according to the following rules:

- If no modules are configured, the module is connected to the highlighted slot.
 Each additional module is inserted below.
- If modules are already exist, the module is added to the highlighted slot and the following modules are moved accordingly.
- Disconnect module from slot ("X")
 - Select from the left list the appropriate slot, which you want to disconnect from the module again and click at ["X"].



- Option field 'Download slot configuration' When enabled, an Init Command is created, which contains the slot configuration with the unique module identifier. During start-up of the slave station the slot configuration serves for comparison between configured and inserted modules. This can prevent misconfigurations.
- 'Load modules'
 With this function you can load the configuration from the EtherCAT master for the selected slave station.

Configuration - slave station > PDO Mapping

3.6.4 PDO Mapping

Project Explorer Select The Inputs
▼ J EC-Mastersystem ▼ Inputs 0x1AFF
Slave_001 (0001) [VI Name Index Bit Length
Hardware Interrupt 0xF100:01 32
Diagnostic Interrupt 0xF100:02 32
▼ 📝 Module 1 (031-1BB10).Eingänge 0x1A00
Name Index Bit Length
AI 0 0x6000:01 16
AI 1 0x6000:02 16

Add

Delete

This dialog shows a list of the assigned PDOs. With some slave stations it is possible to activate respectively de-activate certain PDO configurations.

Edit

Up

Down

Load PDO information

- Select the Inputs
 - If your slave station supports it, you can hide the corresponding input PDO from the configuration by disabling the checkbox.
- Select the Outputs
 - If your slave station supports it, you can hide the corresponding output PDO from the configuration by disabling the checkbox.
- Only 'Expert mode'
 - Add / Delete / Edit:

Used for changing the lists, if it is allowed by the ESI. First the list, which you want changed, must be selected.

Up / Down:

Moving the selected PDO in the selected list up or down.

– Load PDO information:

Here you can load PDO information directly from the slave station.

Configuration - slave station > PDO Mapping

3.6.4.1 Add or edit PDO (Expert mode)

🦪 Edit PDO			
General			Optional
Name	Module 1 (021-18D00)	Exclude:	
Index	0x1A00	Dec Hex	
Flags	Direction		
✓ Mandatory	TxPdo		
✓ Fixed Content	○ RxPdo		
Virtual PDO	Sync Manager		
	0 -		
Entries			
Name	Index	Bit Length	Comment
DI 0	0x6000:01	1	
DI 1	0x6000:02	1	
DI 2	0x6000:03	1	
DI 3	0x6000:04	1	- -
Add	Delete Edit	Up	Down
	ОК	Cancel	

PDOs can only be edited in the 'Expert mode'! Otherwise, the functions are hidden. With [Edit] the dialog 'Edit PDO' opens.

- General
 - Name: Name of the PDO
 - Index: Index of the PDO (can be entered in hexadecimal or decimal)
- Flags
 - Mandatory: If activated the PDO cannot be deleted.
 - Fixed Content: If activated the content of the PDO is write protected. to create new or to edit existing PDOs you have to disable 'Fixed Content'.
 - Virtual PDO: If activated the PDO has no entries.
- Direction
 - TxPDO: Send PDO of the slave station for input data.
 - RxPDO: Receive PDO of the slave station for output data.
- Sync Manager
 - Selected the sync manager, which should be used. The selection is only visible if more than one sync manager can be used.
- Optional
 - Exclude: Select the PDOs which cannot be activated if this PDO is activated.
- Entries
 - Here is the list of configured PDO entries shown.

Configuration - slave station > PDO Mapping

\bigcirc
1

After editing the PDOs, the addresses need to be re-calculated! For this jump to register 'Process Image' and click at [Recalculate].

3.6.4.2 Add PDO (Expert mode)

Via the following dialog the user add a PDO entry.

- General
 - Name: Name of the PDO entry
 - Comment: Comment of the PDO entry
 - Swapping: Swapping mode of the PDO entry
- Settings
 - Index: Index of the PDO entry (can be entered in hexadecimal or decimal)
 - Subindex: Subindex of the PDO entry (hexadecimal)
 - Datatype: List of available datatypes
 - Bit Length: Length of the PDO entry in bits
- CoE Object-Dictionary (loaded only if Object-Dictionary is supported by slave)

3.6.4.3 Edit PDO (Expert mode)

Via the following dialog the user adit a PDO entry.

- General
 - Name: Name of the PDO entry
 - Comment: Comment of the PDO entry
 - Swapping: Swapping mode of the PDO entry

Configuration - slave station > Advanced Options (Expert mode)

3.6.5 Advanced Options (Expert mode)

Project	t Explorer EC-Mastersystem	Startup Checking Check Vendor ID Check Product Code	Tir SD Ini	Timeouts SDO Access: 0 € [ms] Init->Pre-Op/Init->Bootstrap: 3000 € [ms]			
	Slave_001 (0001) [VI	Check Revision Number	Pre	e-Op->Safe-Op/Safe-Op->Op:	10000 🖨 [ms]		
	001: Module 1	Check Serial Number	Ba Op	Back to Pre-Op, Init: Op->Safe-Op:	5000 💌 [ms] 200 💌 [ms]		
		Identification Checking Check Identification	Ma	ailbox Mode	10 🚔 [ms]		
		0 Dec Hex Select Local Address 0x0012 Dec Hex	¢	State Change			
		Process Data Mode	Ov	verwrite Mailbox Size			
		Disable LRW		Output Size:	[bytes]		
				Input Size:	[bytes]		
		Overwrite Watchdog					
		Set Multiplier (Reg.: 0x400):					
		Set PDI Watchdog (Reg.: 0x410):					
		Set SM Watchdog (Reg.: 0x420):					

This dialog is only visible in the '*Expert mode*'! Here you can make further adjustments to the slave station.

Slave Settings

Start-up checking:

Potential Reference Clock

Distributed Clocks

Here you can define the items, the EtherCAT master has to check during the transition '*Init* \rightarrow *Pre-Op*' (Vendor ID, Product code, Revision number).

- Revision number can be verified:
 - "==" \rightarrow High word is equal, Low word is equal
 - ">=" \rightarrow High word is equal or greater, Low word is equal or greater
 - "LW ==" \rightarrow Low word is equal

"LW ==, HW >=" \rightarrow Low word is equal, High word is equal or greater

- "HW ==" \rightarrow High word is equal
- "HW ==, LW >=" \rightarrow High word is equal, Low word is equal or greater
- Identification checking:
 - With these parameters, you determine via which HotConnect address the EtherCAT master should identify the slave station.
 - 'Check identification': When activated, the text box below shows the current Hot-Connect address, which the EtherCAT master has to use to identify the slave station.
 - For identification via the address set on the address switch of the slave station (Explicit Device ID), you have to activate 'Check identification' and enter the corresponding ESC register address for addressing via the address switch at 'Select local address'.
 - For identification via SSI (Configured Station Alias) you have to activate 'Check identification' and enter the corresponding ESC register address for SSI activation at 'Select local address'. In this case, the Configured Station Alias address must be specified via 'EEPROM' of the slave station in diagnostics mode. In addition, you must specify the Configured Station Alias address in your configuration in 'Group' by means 'Identification value'. S Chapter 3.9.4 'EEPROM' (Expert mode)' on page 44 S Chapter 3.10.3 'Create Hot Connect group' on page 50

Configuration - slave station > Advanced Options (Expert mode)

For more information about the ESC register addresses, refer to the manual for your slave station.

- Process Data Mode:
 - Here you specify the command that should be used for process data access.
 - 'LRW activate:' With one Logical-Read-Logical-Write command inputs are read and also outputs are set. This needs 1 frame.
 - 'LRW deactivate:' 'LRD/LWR:' Read access with Logical-Read command to inputs and write access with Logical-Write command to outputs. This needs 2 frames.
- Overwrite Watchdog:

Writes the configured value in the relevant register of the slave station. Here among others you can set the time of the *'SM Watchdog'* (SyncManager-Watchdog).

- *'Set Multiplier'*: Writes the configured value to the corresponding slave register: 0x0400
- 'Set PDI Watchdog': Writes the configured value to the corresponding slave register: 0x0410
- 'Set SM Watchdog': Writes the configured value to the corresponding slave register: 0x0420

Please note that even if a watchdog is present, this need not be indicated in the ESI file and this is shown as inactive!

Timeouts:

'SDO Access': Internal master timeout for SDO access

'Init \rightarrow *Pre-Op'*: Internal master timeout for slave state change from *Init* to *Pre-Op 'Pre-Op* \rightarrow *Safe-Op*/*Safe-Op* \rightarrow *Op'*: Internal master timeout for slave state change from *Pre-Op* to *Safe-Op* and then to *Op*.

'Back to Pre-Op, Init': Internal master timeout for slave state change to Pre-Op and Init

'Op →Safe-Op': Internal master timeout for slave state change from Op to Safe-Op ⇔ Chapter 3.11 'EtherCAT State Machine' on page 52

Mailbox Mode:

The *'Mailbox'* is an a-cyclic communication channel. Here mostly *'Emergencies'* messages and *'SDOs'* are buffered. The way of accessing the just unread mailbox data can be specified here.

- 'Cyclic': Interval in ms within which the mailbox is to be read (polling mode). If you want short interrupt response times, you should select the mode 'Cyclic' and set a short time e.g. 1ms.
- 'State change': The mailbox is read only on a state bit change.
- Overwrite Mailbox Size
 - 'Output Size': Overwrites mailbox output size
 - *Input Size*': Overwrites mailbox input size

Configuration - slave station > Advanced Options (Expert mode)

When changing the 'Process Data Mode' you have to refresh the addresses in the Register 'Process Image'.
 If the Process Data Mode 'LRW' is used, the input and the output address of the EtherCAT process image must be identical. Here address leaks can occur between slave stations. If an EtherCAT address exceeds the maximum address area of the CPU, the current configuration gets invalid. You need to reduce the configuration or change to process data mode 'LRD/LWR'.
 If you use long cycle times (> 100ms) you should always accordingly raise the 'SM Watchdog'. Otherwise your slave station changes after laps of 'SM Watchdog' time to Safe-Op and releases OB 86. From now on you can only manually set the slave to Op!

- Distributed Clocks: 'Potential Reference Clock'
 - Every slave station can be used as a 'Potential Reference Clock' if the slave supports the DC registers. The setting is used, when you remove the slave with activated 'Potential Reference Clock' e.g. via 'Hot Connect', then the master searches for a slave station where 'Potential Reference Clock' is activated. If no slave is available, the first DC slave is used.

Configuration - slave station > Ethernet (EoE)

3.6.6 Ethernet (EoE)

Project Explorer							
*	EC-Mastersystem						
-	📗 Slave_001 (0001) [VI						
	1 001: Module 1						

Ethernet	
Virtual MAC address	02 00 00 00 00 04 📝 Auto
Time Stamp Requested Port Mode	 Switch Port IP Port
Overwrite IP Settings	
IP Address	1 . 0 . 0 . 0
Subnet Mask	1 . 0 . 0 . 0
Default Gateway	1 . 0 . 0 . 0
DNS Server	1 . 0 . 0 . 0
DNS Name	

Here you activate or change EoE (Ethernet over EtherCAT) the settings.

- Ethernet (activates EoE support)
 - Virtual MAC address: Virtual MAC address. If 'Auto' is checked, the Virtual MAC address will be generated from the Station Address, e.g. Station Address is "1010" (= 0x03F2), will generate the Virtual MAC address: "01 00 00 00 03 F2"
 - Time Stamp Requested: Slave station will response with the exact send time and the same Frame number and he should response as soon as possible.
 - Port Mode: Slave station can be run in 'Switch Port' or 'IP Port' mode.
- Override IP Settings
 - All IP settings will be overwritten from master like IP Address, Subnet Mask, Default Gateway, DNS Server and DNS Name.

Configuration - slave station > Distributed Clocks (Expert mode)

3.6.7 Distributed Clocks (Expert mode)

roject Explorer	Distributed Clock	
EC-Mastersystem Slave 001 (0001) [V]	Operation Mode	DC for synchronization
1 001: Module 1	Sync Unit Cycle (us)	1000
	Overwrite Mode	
	Sync Units	
	📝 Sync Unit 0	
	Cycle Time	
	Sync Unit C	ycle x 1 ▼ 1000 us
	O User define	d 1000
	Shift Time (us)	
	Sync Unit 1	
	Cycle Time	
	🔘 Sync Unit C	ÿcle x 1 ▼ 0 us
	Sync 0 Cycl	e x 1 💌 0 us
	🔘 User define	d
	Shift Time (us)	

This dialog is only visible in the 'Expert mode' if this is supported by your slave station! Here you can adjust the settings for *Distributed Clocks* accordingly. In EtherCAT "Distributed Clocks" (DC) means a logical combination of "clocks", which are located in the EtherCAT devices. With this there is the possibility to locally provide a synchronized time in each bus device. If an EtherCAT device supports the *Distributed Clocks* functionality, it has its own clock. After PowerON this first locally works, based on an own pulse generator. By selecting an EtherCAT slave station, which has to provide the reference time, the distributed clocks can be synchronized. This *reference clock* so represents the system time.

- Reference clock
 - Operation Mode: Here you can set the operation mode of the reference clock. More may be found in the manual of your slave station.
 - Sync Unit Cycle: Cycle time of the master. Schapter 3.5 'Configuration EC-Mastersystem' on page 15
- Sync Units
 - Sync Unit 0
 - Cycle Time: Here you can specify the cycle time in relation to the 'Master Cycle' or 'User defined'.
 - Time Shift: Specify here a time shift. This is used for fine adjustment.
 - Sync Unit 1
 - Cycle Time: Here you can specify the cycle time in relation to the *'Master Cycle'*, to the cycle of Sync Unit 0 *'Sync 0 Cycle'* or *'User defined'*.
 - Time Shift: Specify here a time shift. This is used for fine adjustment.



Due to the hardware with a local connection Distributed Clocks (connection via network adapter) is not supported!

Configuration - slave station > Init Commands (Expert mode)

3.6.8 Init Commands (Expert mode)

ect E	xplorer	Init Commands								
Ų	EC-Mastersystem	Transition	Protocol	Index	Value		Comment		Access	*
•	👖 Slave_001 (0001) [VI	Pre-Op->Safe-Op	CoE	0x3100:007	0	C	ownload to Upper lir	nit value channe	el O RW	
	1 001: Module 1	Pre-Op->Safe-Op	CoE	0x3100:003	0	D	ownload to Limit val	ue monitoring	RW	
		Edit Value								
Value:										
Edit Init Commands										
		Move Up	Move Do	wn		New	Сору	Edit	Delete	
	ect E	ect Explorer EC-Mastersystem Slave_001 (0001) [VI 1 001: Module 1	ect Explorer ↓ EC-Mastersystem ↓ Slave_001 (0001) [VI ↑ 001: Module 1 Edit Value Va Edit Init Commands Move Up	ect Explorer Init Commands ↓ EC-Mastersystem Init Commands ↓ Slave_001 (0001) [VI Pre-Op->Safe-Op CoE ↑ 001: Module 1 Pre-Op->Safe-Op CoE Edit Value Value: Value: Edit Init Commands Move Up Move Do	Image: cct Explorer Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system Image: color for the system <th>Init Commands Init Commands <t< th=""><th>Init Commands Init Commands</th><th>Init Commands Init Commands</th><th>Init Commands Init Comm</th><th>Lift Commands Init Comm</th></t<></th>	Init Commands Init Commands <t< th=""><th>Init Commands Init Commands</th><th>Init Commands Init Commands</th><th>Init Commands Init Comm</th><th>Lift Commands Init Comm</th></t<>	Init Commands Init Commands	Init Commands Init Commands	Init Commands Init Comm	Lift Commands Init Comm

This dialog is only visible in the 'Expert mode'!

-	For each parameter of a slave station or module, which differs from the standard setting you have to create an Init command!
_	If a write access to an object in the configuration mode is performed, and the written value does not reflect to the default value of the object, so this command is automatically added to the 'Init Commands'. & Chapter 3.6.9 'CoE Object Dictionary (Expert mode)' on page 35

Here you can see a list of the current configured Init Commands and if it is allowed you can also add/edit/delete the commands.

- Init Commands: Init Commands come from the ESI file or are automatically generated on write access to CoE objects or can be created by the user. You either have fullaccess (RW = Read/Write) or only read access (RO = Read-only). Init commands from ESI files are automatically listed here. These cannot be changed or deleted.
- Edit Init Commands
 - New, Copy, Edit, Delete: Used for changing Init Commands.
 - Move Up, Move Down: Moving the selected Init Command up or down.

Configuration - slave station > Init Commands (Expert mode)

3.6.8.1 CoE Init Command (Expert mode)

🚽 Edit CoE Ir	nit Comm	and			🦪 Edit CoE Init Command									
General														
Index	(0x3102	Dec Hex	5	SubIndex	0x0	001	Dec	Hex					
Value	Value 0x0000001							Dec	Hex					
Comment	Comment Download to Diagnostic interrupt													
Transition ☐ Init-> ☑ Pre-O ☐ Safe-0	Transition Init->Pre-Op Pre-Op->Safe-Op Safe-Op->Op Op->Safe-Op													
Further Set	tings			Direction										
Comp	lete Acce	ss			Download									
Valida	ate value													
CoE Object-	Dictional	ry												
Inde	ex Name	2		F	Flags		Туре	Value	*					
► 0x10	C32 SM o	utput parame	ter	-	(RO RO F	RO)	USINT	-						
► 0x10	C33 SM in	put paramete	er	-	(RO RO F	RO)	USINT	-						
► 0x30	000 Coup	ler parameter		-	(RO RO F	RO)	USINT	1 (0x01)						
▼ 0x31	102 Paran	neter VIPA 03	1-1BB90	-	(RO RO F	RO)	USINT	14 (0x08	E)					
Subl	Index Na	ame		F	Flags		Туре	Value						
0x01	L Dia	agnostic inter	rupt	-	(RW RW	RW)	USINT	0 (0x0)	0)					
0x03	o wi	ire break reco	anition			RW)	LISTNE	r (0y0)	n *					
			ОК	Ca	incel									

This dialog is only visible in the '*Expert mode*'! With [New] the dialog 'Add CoE Init Command' opens. This dialog also opens to edit CoE Init Commands, which just exist.

- General
 - Index/Subindex: CoE-Index respectively Subindex of the Init Command
 - Value: Value of the Init Command, which should be written in the chose transition (only available if *'Direction'* is set to *'Download'*). If type of data is unknown, the hex format must be used. (Example: "0011 2233 ...").
 - Comment: Here you can comment your Init Command.
- Transition
 - Determines in which transition the Init Command will be executed.
- Further Settings
 - Complete Access: Determines if the complete SDO object should be written/read.
- Direction
 - Download: Writes value to slave station.
 - Upload: Reads value from slave.
- CoE Object Dictionary: Select here the value in the CoE Object Dictionary of the slave station, you want to edit.

Write

Reset

Configuration - slave station > CoE Object Dictionary (Expert mode)

3.6.9 CoE Object Dictionary (Expert mode)

Project E	xplorer	Values									
▼	EC-Mastersystem		Index	Name	Value		Туре	Flags	*		
-	📗 Slave_001 (0001) [VI		0x1000	Device Type		-	UDINT	(RO RO RO)	=		
	1 001: Module 1		0x1008	Device Name		-	STRING(17)	(RO RO RO)	1		
1			0x1009	Hardware Version		-	STRING(3)	(RO RO RO)	1		
			0x100A	Software Version		-	STRING(12)	(RO RO RO)	1		
			0x100B	System Version		-	USINT	(RO RO RO)	1		
		•	0x1018	Identity		-	USINT	(RO RO RO)	*		
		Edit Va	alue								

This dialog is only visible in the 'Expert mode'! Here you will have read and write access to the CoE Object Dictionary of the slave station. This can be changed if your slave station permits. It is indicated by the '*Flags*' of each object, if write access is permitted. Information about the structure of the Object Dictionary can be found in the manual of your slave station.

Description of the flags: "AA BB (CC DD EE)"

- AA, BB
 - Rx: Mapping as receive PDO
 - Tx: Mapping as send PDO

Value:

- --: Mapping not allowed
- CC:
 - Access rights for state PreOp (RO, WO, RW)
- DD:
 - Access rights for state SafeOp (RO, WO, RW)
- EE:
 - Access rights for state Op (RO, WO, RW)
 - & Chapter 3.11 'EtherCAT State Machine' on page 52
- Edit Value
 - Write: Changes the selected entry
 - Reset: Resets the selected entry to ESI default



Configuration - slave station > I/O Address Overview

3.6.10 Process Image

Project	t Explorer	I/O	addresses								
*	EC-Mastersystem	Inpu	t addresses				Output addresse	es			
-	📲 Slave_001 (0001) [VI	Start	address:				Start address:				
	1 001: Module 1	End	Address:				End Address:				
1		Inpu	Inputaddresses assigned (Byte).)	Outputaddresses	s assigned (Byte).	15		
		No.	Bus address	Slave	Module	Slot	S7 Input address	S7 Output address	EtherCAT input address	EtherCAT output address	Ту
		2	1	Slave_001			0 - 7		0 - 7		VI
		з	1	Slave_001	Module 1	1	8 - 11		8 - 11		VI
		I									
		Here	e you hav	e a list	of S7	resp	Dectively Eth	herCAT addre	esses, which are	e used by the	

modules of the slave system. The 'S7 address' corresponds to the address in the address area of the CPU. By entering a new 'Start address' you can adjust the S7 addressing of the input and output areas of the modules accordingly.



Information about the assignment of the in/output area can be found in the manual of your module.

The 'I/O addresses EtherCAT' are only visible in 'Expert mode'! 'I/O addresses EtherCAT' are the addresses, which are used within the EtherCAT bus. You cannot change the address. You can use the addresses e.g. for EtherCAT network analysis.

3.6.11 I/O Address Overview



I/O addres	I/O addresses									
Input addre	sses Output	addresses								
Start address	8 Start ad	dress:								
End Address	8 End Add	ress:								
Address	Name	Data type	Comment							
ED 0	d_HardwareInterruptC_0	1 DWORD	ED 0.0 - Slave_001 Hardware Interrupt Counter When Auto-Acknowledge is enabled it indical process alarms. Otherwise it shows only that an alarm has occurred. Write on object 0x5000:6 to reset the counter or to acknowledge the alarm respectively. [Device: Slave_001 Slot 0]							
ED 4	d_DiagnosticInterrup_4_1	. DWORD	ED 4.0 - Slave_001 Diagnostic Interrupt Counter When Auto-Acknowledge is enabled it indica diagnostic alarms. Otherwise it shows only that an alarm has occurred. Write on object 0x5002:6 to reset the counter or to acknowledge the alarm respectively. [Device: Slave_001 Slot 0]							

Here you have a list of addresses, which are used by the I/O components of the modules of the selected slave system in the address area of the CPU. By entering a new 'Start address' you can adjust the addressing of the input and output areas accordingly. You can edit 'Name' and 'Comment' by clicking at the corresponding entry.



Information about the assignment of the in/output area can be found in the manual of your module.

Configuration - modules > MDP Slot Properties

3.7 Configuration - modules



3.7.1 Preparation

Select in the configuration mode in the *'Project Explorer'* the module of the according slave station. The following registers are available now:

Schapter 3.7.2 'MDP Slot Properties' on page 37

Schapter 3.7.3 'Process Image' on page 38

Schapter 3.7.4 'I/O Address Overview' on page 38

3.7.2 MDP Slot Properties

^o ro	ject Ex	plorer	General	
Ŧ	Ų	EC-Mastersystem	Vendor	VIPA GmbH (0xAFFE / 45054)
	-	📕 Slave_001 (0001) [VI	ESI File of Slave	C:\Users\Public\Documents\VIPA GmbH\SPEED7 Studio\EtherCAT\EsiFiles\Vipa 053-1EC00 MDP.xml
		1 001: Module 1	Slot	
			Name	Terminals
			Number	001
			Module	
			Name	Module 1
			Description	VIPA 031-1BB10, AI 2x12Bit 020mA, potentialgetrennt
			Туре	031-1BB10
			Class	sm_ana_in
			Ident	0x04111543 (68228419)

Here you can see the MDP Slot Properties of the corresponding module. This dialog serves for information. You cannot change something.

- General
 - Vendor: Name of the vendor of the module.
 - ESI file: Path and name of the device file, in which the data of the module and the associated slave station is stored.
- Slot
 - Name: Name of the slot
 - Number: Number of the slot
- Module
 - Name: Name of the module
 - Type: Order number of the module
 - Class: Module class
 - Identificator: Identification number of the according module class.

Configuration - modules > I/O Address Overview

3.7.3 Process Image

Project Explorer								
v j	 EC-Mastersystem 							
-	📕 Slave_001 (0001) [VI							
	1 001: Module 1							

I/O a	/O addresses										
Input addresses				Output addresse	Dutput addresses						
Start address:			Start address:	Start address:							
End Address:			End Address:	ind Address:							
Inputaddresses assigned (Byte). 20				Outputaddresses assigned (Byte).							
No.	Bus address	Slave	Module	Slot	S7 Input address	S7 Output address	EtherCAT	input address	EtherCAT output address	Ту	
2	1	Slave_001	Module 1	1	8 - 11		8 - 11			VIF	

Here you have a list of S7 respectively EtherCAT addresses, which are used by the modules of all the slave stations. The 'S7 address' corresponds to the address in the address area of the CPU. By entering a new 'Start Address' you can adjust the S7 addressing of the input and output areas of the modules accordingly.



Information about the assignment of the in/output area can be found in the manual of your module.

The 'I/O Addresses EtherCAT' are only visible in 'Expert mode'! 'I/O Addresses EtherCAT' are the addresses, which are used within the EtherCAT bus. You cannot change the addresses. You can use the addresses e.g. for EtherCAT network analysis.

3.7.4 I/O Address Overview

Project Explo	orer	I/O addresses							
🔻 📗 EC	C-Mastersystem	Input addres	sses 0	utput addre	sses				
	Slave_001 (0001) [VI	Start address: 8		tart address:					
	1 001: Module 1		11 E	nd Address:					
		Address	Name	Data type	Comment				
		EW 8	w_AI_CH01_715	WORD	E 8 - AI2x12Bit 020mA, 420mA - ISO [Device: Slave_001, Slot: 1, Rack: 0]				
		EW 10	w_AI_CH02_715	WORD	E 10 - AI2x12Bit 020mA, 420mA - ISO [Device: Slave_001, Slot: 1, Rack: 0]				

Here you have a list of addresses that are used by the module in the address area of the CPU. By entering a new '*Start address*' you can adjust the addressing of the input and output areas accordingly. You can edit '*Name*' and '*Comment*' by clicking at the corresponding entry.

With [Export] there is the possibility to save them to a SEQ file. The file can be imported as a symbol file into your project in the Siemens SIMATIC Manager.



Information about the assignment of the in/output area can be found in the manual of your module.

3.8 Diagnostics - EC-Mastersystem

3.8.1 Preparation

To use the 'Diagnostics' functions, you must be connected online with your EtherCAT system.

- **1.** Click in the Toolbar at [Configuration] and select '*EC-Mastersystem*' in the '*Project Explorer*'.
- **2.** Activate in the 'Device editor' the register 'Master'.
- 3. Set depending on the on-line access in the 'Device Editor > Master' as follows:
 - If you are directly connected to a slave station via EtherCAT by means of a separate network adapter, select your *Network Adapter* and click at [Select].
 - If you are connected to the PG/OP channel of you CPU, please enter IP Address, Port and Master Instance and click at [Select]. With VIPA Port 6000 and Master Instance 0 is to be set.
 - ⇒ The SPEED7 EtherCAT Manager uses the set connection for communication. By clicking on [Deselect] you can change the connection parameters.
- **4.** Click in the Toolbar at [Diagnosis Mode].
 - An online connection to your EtherCAT system is established via the preset communication channel and the current project configuration in the 'Project Explorer'.

With an online connection the 2 LEDs flash alternately in the 'Status area'. In addition 'Modus' switches to 'Diagnosis'.

- 5. Click in the 'Project Explorer' at Master.
 - ⇒ The following registers are available now:
 - ♦ Chapter 3.8.2 'General' on page 39
 - Schapter 3.8.3 'CoE Object Dictionary' on page 41
 - & Chapter 3.8.4 'History (Expert mode)' on page 41

3.8.2 General

Pro	oject E	xplorer	State Machine								
-	-	EC-Mastersystem	Current State	Ор							
	+	Slave 001 (0001) [V]	Requested State	Ор							
		001: Module 1		Init	Bootstrap						
		Change State	Pre-Op	Safe-Op							
				Ор							
			Information			Frame Counter					
			Number of found slaves	2		Sent frames	20388				
			Number of slaves in configuration	2		Lost frames	0				
			Number of DC slaves	0		Cyclic frames	20306				
			DC in-sync	-		Acyclic frames	82				
		Topology Ok	Yes								
			Link Connected	Yes							
			Slaves in Master State	Yes							

Colors and states

The state of the state machine can be determined via the color according to the following specifications:

Diagnostics - EC-Mastersystem > General

Color	State of the state machine
🥥 - red	Init / Bootstrap
🔵 - blue	Pre-Op
🥥 - yellow	Safe-Op
🔵 - green	Ор

Here you will get master and bus-specific information.

- State Machine

 - Requested State: Shows the currently requested state of the master which was requested by 'Change State'.
 - Change State: Here you can change the state of the master.
- Information
 - Number of found slaves: Shows number of found slave stations at the bus.
 - Number of slaves in configuration: Shows number of configured slave stations at the bus.
 - Number of DC slaves: Shows the number of slave stations, which support distributed clocks functionality (DC).
 - DC in-sync: If distributed clocks is configured you can find here information about the synchronization status of the system.
 - Topology OK: The 'Topology' is OK ('Yes'), if the number of configured matches the number of found slave stations. Here only the mandatory slaves stations are considered.
 - Link Connected: Here you will find 'Yes', if there is a physical connection to the configured slave stations.
 - Slaves in Master State: Here you will find 'Yes', if every configured slave station is in master state.
- Frame Counter
 - Sent frames: Number of sent frames since the last power cycle.
 - Lost frames: Number of lost frames since the last power cycle.
 - Cyclic frames: Number of cyclic frames since the last power cycle.
 - Acyclic frames: Number of acyclic frames since the last power cycle.

Diagnostics - EC-Mastersystem > History (Expert mode)

Project Explorer		Values	Values								
-	- 🥥	EC-Mastersystem		Index	Name	Value	Туре	Flags	*		
	*	Slave_001 (0001) [VI		0x1000	Device type	1100 (0x44C)	UDINT	(RO RO RO)			
		001: Module 1		0x1008	Device name	EC-Master	STRING(11)	(RO RO RO)			
1				0x1009	Hardware version	V 02.06.00.07	STRING(14)	(RO RO RO)			
			0x100A	Software version	V 02.06.00.07	STRING(14)	(RO RO RO)				
		•	0x1018	Identity	4 (0x04)	USINT	(RO RO RO)				
		•	0x10F3	History	254 (0xFE)	USINT	(RO RO RO)				
				0x2000	Master State Change Command	0 (0x00)	UDINT	(RW RW RW)	1		
				0x2001	Master State Summary	67457 (0x10781)	UDINT	(RO RO RO)			
			•	0x2002	Bus Diagnosis Object	14 (0x0E)	USINT	(RO RO RO)			
			0v2005	MAC Address Object	A (0v0A)	LISTNIT	(POPOPO)	*			
			Edit Va	lue							
					Value:			W	rite		

3.8.3 CoE Object Dictionary

Here you will have read and write access to the CoE Object Dictionary of the slave station. This can be changed if your slave station permits. It is indicated by the *'Flags'* of each object, if write access is permitted. Information about the structure of the Object Dictionary can be found in the manual of your slave station.

3.8.4 History (Expert mode)

Project Explorer EC-Mastersystem Slave_001 (0001) [VI 001: Module 1	Settings Show Info Show Wa Show Erro Show Erro Current M Messages	True now Varning Messages True now Error Messages False how Emergency Messages False urrent Mode Overwrite Mode						
	Se	everity	Time	▼ ID	Acknowledged	Code	Message	^
	<u> </u>	WRN	13.01.2014 12:5	8:34 01) No	0x0000001	(0x4413) I2T Amplifier overload	
	<u> </u>	WRN	13.01.2014 12:5	8:33 00) No	0x0000001	(0x4101) Terminal-Overtemperature	
	×	ERR	13.01.2014 12:5	8:32 00	3 Yes	0x0000001	(0x8406) Undervoltage DC-Link	
		INF	13.01.2014 12:5	8:31 00	7 Yes	0x0000001	(0x0002) Communication established	~
	Change M	lessage l	Handling				Number of messages: 200)/200

Task: Kein

In this dialog box, you can access all the diagnostic messages in the master and edit them if necessary. Via *'Settings'* they may be filtered accordingly.

Execute

Diagnostics - slave station > General

3.9 Diagnostics - slave station

3.9.1 Preparation

To use the '*Diagnostics*' functions, you must be connected online with your EtherCAT system.

- **1.** Click in the Toolbar at [Configuration] and select *'EC-Mastersystem'* in the *'Project Explorer'*.
- **<u>2.</u>** Activate in the 'Device editor' the register 'Master'.
- 3. Set depending on the on-line access in the 'Device Editor > Master' as follows:
 - If you are directly connected to a slave station via EtherCAT by means of a separate network adapter, select your *Network Adapter* and click at [Select].
 - If you are connected to the PG/OP channel of you CPU, please enter IP Address, Port and Master Instance and click at [Select]. With VIPA Port 6000 and Master Instance 0 is to be set.
 - ⇒ The SPEED7 EtherCAT Manager uses the set connection for communication. By clicking on [Deselect] you can change the connection parameters.
- 4. Click in the Toolbar at [Diagnosis Mode].
 - An online connection to your EtherCAT system is established via the preset communication channel and the current project configuration in the 'Project Explorer'

With an online connection the 2 LEDs flash alternately in the 'Status area'. In addition 'Modus' switches to 'Diagnosis'.

5. Click in the 'Project Explorer' at the according slave station 'Slave_...'

The following registers are available now:

Schapter 3.9.2 'General' on page 42

- Schapter 3.9.3 'ESC Register (Expert mode)' on page 43
- Schapter 3.9.4 'EEPROM (Expert mode)' on page 44
- Schapter 3.9.5 'Extended Diagnosis (Expert mode)' on page 44
- Schapter 3.9.6 'DC Diagnosis (Expert mode)' on page 45
- Chapter 3.9.7 'CoE Object Dictionary' on page 45

3.9.2 General

Project Explorer	State Machine	
 EC-Mastersystem 	Current State	Ор
 Slave 001 (0001) [V] 	Slave_001 (0001) [VI Requested State Op	Ор
001: Module 1		Init Bootstrap
	Change State	Pre-Op Safe-Op
		Op
	Error State	
	Current	

Colors and states

The state of the state machine can be determined via the color according to the following specifications:

Diagnostics - slave station > ESC Register (Expert mode)

Color	State of the state machine
🥥 - red	Init / Bootstrap
🥥 - blue	Pre-Op
🥥 - yellow	Safe-Op
- green	Ор

State Machine

- Current State: Shows the current state of the state machine of the slave station.
 ⁽⁵⁾ Chapter 3.11 'EtherCAT State Machine' on page 52
- Requested State: Shows the requested state of the slave station.
- Change State: Here you can change the state of the state machine of the slave station.
- Error State
 - Current: Slave error which occurred during state transition.

3.9.3 ESC Register (Expert mode)



Setti	ngs									
Offset 0x			0x0000)x0000						
Ler	ngth		0x0400	0x0400						
Co	mpact									
Regi	sters									
	Index		Name	Value	Туре					
	• 0x0000		Туре	17 (0x11)	USINT					
	• 0x0001		Revision	0 (0x00)	USINT					
	• 0x0002		Build	2 (0x0002)	UINT					
	• 0x0004		FMMUs supported	8 (0x08)	USINT					
	• 0x0005		SyncManagers supported	8 (0x08)	USINT					
1	• 0x0006		RAM Size	8 (0x08)	USINT		*			
Edit	Register									
		Value:				V	Nrite			

This dialog is only visible in the '*Expert mode*'! Here you can directly access the registers of the EtherCAT ASIC. You should not make any changes here!

Smart View Hex View

Write

Diagnostics - slave station > Extended Diagnosis (Expert mode)

3.9.4 EEPROM (Expert mode)



EEPROM Values				
Index	Name	Value	Туре	*
0x0000	PDI Control	3080 (0x0C08)	UINT	
0x0001	PDI Configuration	34818 (0x8802)	UINT	
0x0002	Pulse Length of SYNC Signals	0 (0x0000)	UINT	
0x0003	Extended PDI Configuration	0 (0x0000)	UINT	
0x0004	Configured Station Alias	0 (0x0000)	UINT	
0x0005	Reserved	0 (0x0000000)	UDINT	
0x0007	Checksum	0 (0x0000)	UINT	
0x0008	Vendor ID	45054 (0x0000AFFE)	UDINT	
0x000A	Product Code	87157760 (0x0531EC00)	UDINT	*
Edit EEPROM Value				

This dialog is only visible in the 'Expert mode'! Here you can access the contents of the EEPROM of the slave station. Currently you can only change the parameter 'Configured Station Alias'. This can be used for forming groups. Schapter 3.10 'Grouping logic' on page 47



CAUTION!

Value:

Please regard that your slave station can get unusable by entering incorrect values especially in *'Hex view'*! In this case, any warranty of the vendor is excluded!

3.9.5 Extended Diagnosis (Expert mode)

roject Explorer	Common Error Counter		Clear Error Counter		
 EC-Mastersystem 	Processing Unit Error Counter	1	Clear	error counters	
 Slave_001 (0001) [VI 	PDI Error Counter	0			
001: Module 1	i bi choi counter	0			
	Port 0 (In port)		Port 1		
	Invalid Frame Counter	0	Invalid Frame Counter	0	
	RX Error Counter	0	RX Error Counter	0	
	Lost Link Counter	0	Lost Link Counter	0	
	Forwarded RX Error Counter	0	Forwarded RX Error Counter	0	
	Port 2		Port 3		
	Invalid Frame Counter	0	Invalid Frame Counter	0	
	RX Error Counter	0	RX Error Counter	0	
	Lost Link Counter	0	Lost Link Counter	0	
	Forwarded RX Error Counter	0	Forwarded RX Error Counter	0	

This dialog is only visible in the 'Expert mode'!

- Common Error Counter
 - Processing Unit Error Counter: Number of received frames by the slave station, which are no EtherCAT frames.
 - PDI Error Counter: Number of PDI access errors (Process Data Interface). These are physical errors, which were detected by the PDI at the EtherCAT bus.
 - With [Clear Error Counters] the error counters can be reset.
- Port 0...3
 - Invalid Frame Counter: Number of invalid frames from *Port* y (access at register 0x300+y*2)
 - RX Error Counter: Number of RX errors from *Port* y (access at register 0x300+y*2+8bit)
 - Lost Link Counter: Number of lost connections from *Port* y (access at register 0x310+y)
 - Forwarded RX Error Counter: Number of forwarded RX errors from *Port* y (access at register 0x380+y)

3.9.6 DC Diagnosis (Expert mode)



This dialog is only visible in the '*Expert mode*'! Here status information for the distributed clock of your slave station is shown. More may be found in the manual of the slave station.

3.9.7 CoE Object Dictionary

Project Explorer	Values	Designation from ESI	Designation from Slave Slingle C		
EC-Mastersystem	Index Name	Value	Туре	Flags	
 Slave_001 (0001) [VI 001: Module 1 	0x1000 Device Type		- UDINT	(RO RO RO)	
	0x1008 Device Name		- STRING(17)	(RO RO RO)	
	0x1009 Hardware Version		- STRING(3)	(RO RO RO)	
	0x100A Software Version		- STRING(12)	(RO RO RO)	
	0x100B System Version		- USINT	(RO RO RO)	
	Ox1018 Identity		- USINT	(RO RO RO) *	
	Edit Value				
	Value:			Write Reset	

Here you will have read and write access to the CoE Object Dictionary of the slave station. This can be changed if your slave station permits. It is indicated by the *'Flags'* of each object, if write access is permitted. Information about the structure of the Object Dictionary can be found in the manual of your slave station. Diagnostics - slave station > FoE Download/Upload

If a write access to an object in the diagnosis mode is performed, and the written value does not reflect to the default value of the object, so this command is automatically added to the 'Init commands'. & Chapter 3.6.8 'Init Commands (Expert mode)' on page 33

This dialog is only visible in the 'Expert mode':

- Designation from ESI
 - By selecting this function the designations are loaded from the ESI file. _
- Designation from slave
 - By selecting this function the designations are loaded from the slave station.
- Single Object
 - With this function you have read and write access to a single object in the object dictionary by specifying index and subindex.

3.9.8 FoE Download/Upload

Project Explorer C-Mastersystem Slave_001 (0001) [VI 001: Module 1	FoE Download Local Filename Slave Filename Password (hex) Timeout (s)	0x0000000 Dec H	ex 🔺
	FoE Upload Local Filename Slave Filename	Download to Sla	
	Password (hex) Timeout (s) Max File Size (kb)	0x0000000 Dec H 60 3000 Upload from Sla	ex *

- With this function you have the possibility to transfer files between PC and slave sta-tion (if this is supported by the device). If the slave station is in state Bootstrap, a firmware update of the slave station can be established via 'FoE Download'. Here you have to enter the file name without extension. & Chapter 3.12 'Firmware update -VIPA System SLIO IM 053-1EC0x' on page 53
 - Local filename: Name of the file at the PC.
 - Slave filename: Name of the file at the slave station.
 - Password: Password to access the slave station.
 - Timeout: Maximum time for data transfer.
 - Max. file size: Maximum size of the file, which is to be transferred from the slave station to the PC.

3.10 Grouping logic						
3.10.1 Overview						
Slave types	With EtherCAT, the following slave types are distinguished:					
	MII - MII corresponds to M edia Independant Interface. An MII slave has an EtherCAT interface to connect to EtherCAT for integration into a system bus (backplane bus) for connecting peripheral modules. The MII slave receives data via EtherCAT and passes them through its backplane to the according peripheral module. Conversely, it reads the input data and passes it via EtherCAT. The System SLIO 053-1EC0x e.g. is a MII-Slave.					
	E-Bus - In an E-Bus slave the EtherCAT protocol is used for communication on the backplane bus For this reason, the attached peripheral modules are also shown as a slave station in the <i>SPEED7 EtherCAT Manager</i>					
Possibilities	The EtherCAT Manager supports the following ways to group the individual slave sta- tions. Each group may consist of 1 n slave stations. Group nesting is not supported:					
	Please consider that Hot Connect groups are not possible with E-Bus slaves!					
Create Group	 Click in the Toolbar of the SPEED7 EtherCAT Manager at [Configuration]. Click in the Project Explorer at the slave station and select 'Context menu 					
	→ Create Group'.					

⇒ The dialog 'Create Group' opens. Here always the 1. slave station is selected. You can either select more slave stations or depending on the group type selection, the necessary save stations are automatically selected.

•	Slave_001 (0001)					
•	II Slave_004 (0004)				Address	
	Slave_005 (0005	2		1	Station Address	9
	Slave 006 (0006	÷	Append Slave(s)		Information	
	Slave 007 (0007	×	Remove Slave(s) Del		Name	Sime 009
	Slave 008 (0008	30	Cut Slave(s) Ctrl+X			
	Size 000 (0000	D	Copy Slave(s) Ctrl+C		Description	ELSUUI ICh. Ana. Input +/-IUV
	Since_009 (0003	ē	Paste Slave(s) Ctrl+V		Vendor	Beckhoff Automation GmbH (0x0000002)
	M 219A6_010 (0010)				Product Code	0x08B93052 (196685906)
		τ.	Diable Slave(s)		Revision Number	0x00140000 (1310720)
		^	Disable Slave(s)		FCT File	CALIFORNIA Description (Sector 1) COLED 7 Feb and AT Manager 4 Feb and AT Feb
			Reload ESI data		ESLFIIE	Crosers (Public (Documents (VIPA GmbH)SPEED7 EtherCAT Manager (EtherCAT (EsiFiles (Beckhoff ELSOXXXIII
		1	Change Slave		Identification Value	Not Used
		Ľ	Select from Project Template		Ports	
		×	Create Group		Α	Slave_008 (0008) / Port B
		×	Remove Group		D	Not Connected
		×	Detach HC Group		в	Not Connected
		×	Attach HC Group		c 🥥	Not Connected

With the 'Create Group' functionality you have two different functions:

- You can create a new group if the selected slave station is not yet part of a group.
- If the selected slave station is already part of a group, the current group is divided into two sub-groups from the selected slave station.

Grouping logic > Overview

Edit Group

After creating a group, the 'Device Editor' of the slave station is extended with the register 'Group'. Here you can adjust the group properties accordingly.

Project Explorer		Device Edi	tor						
CPU 015-CE Slave_0C O Slave_0C Slave_0C Slave_0C Slave_0C Slave_0C Slave_02 Classic View Flat	FNR00 11 (0001) 	General General MSU I Name Pinned C Input C Outpu Hot Con Identif	Group Group Dffset (I t Offset nect Gr ication	Adv pyte) (byte) Offset Value	vanced Options	Process Image 11 Group 0 Volue > 0 expect	UO Address Ovenview	0 0 0	ec Hex ec Hex ec Hex
Short Info	▲ Å	Messages							v 1
Information		Sever	ity Tin	ne	Message			_	
Name	Slave_004	ERI ERI	8 16	50:34	Invalid topology	/ from Slave 'Slave	_010' (slave connected to HC group).		
Description	EK1100 EtherCAT Coupler (2A E-Bus)								

The new group can be selected by selecting this group via '*Cut Slave*(s)' be changed.

► ▼ [Slave_001 (0001) Slave_004 (0004) Slave_005 (0005) Slave_006 (0006) Slave_006 (0006)	+	Append Slave(s)]	Address Station Address Information	9 🖣
	Slave_007 (0007)	~	Remove Slave(s) Del		Name	Slave_009
	🚦 📲 Slave_008 (0008)	7	Cut Slave(s) Ctrl+X	J	Description	EL3001 1Ch. Ana. Input +/-10V
	- Slave_009 (0009)		Copy Slave(s) Ctrl+C		Vendor	Beckhoff Automation GmbH (0x00000002)
۲	Slave_010 (0010)	D	Paste Slave(s) Ctrl+V	-	Broduct Code	0-02802052 (106695006)
		+	Enable Slave(s)		Floduct code	0x00053032 (150003500)
		×	Disable Slave(s)		Revision Number	0x00140000 (1310720)
			Reload ESI data	-	ESI File	C:\Users\Public\Documents\VIPA GmbH\SPEED7 EtherCAT Manager\EtherCAT\EsiFiles\Beckhoff EL30xxxml
		/	Change Slave		Identification Value	Not Used
		Z	Select from Project Template		Ports	
		×	Create Group	-	A	Slave_008 (0008) / Port B
		×	Remove Group		D	Not Connected
		×	Detach HC Group		в	Not Connected
		1	Attach HC Group		c	Not Connected

Detach HC Group

If you want to connect this group to an other slave station on the network, you can detach the current connection by *'Detach HC Group'*.

 Islave_001 (0001) 		Address	
 Slave_010 (0010) 		Address	
▼ ● II Slave_004.(000.4)		Station Address	4
Slav	(s)	Information	
Slav		Name	Slave_004
Slav T Cut Slave(s)	Ctrl+X	Description	EK1100 EtherCAT Coupler (2A E-Bus)
Slav Copy Slave(s	Ctri+C	Vendor	Beckhoff Automation GmbH (0x00000002)
- Slav Paste Slave(s	Ctrl+V	Product Code	0x044C2C52 (72100946)
👘 Enable Slave	:)		
🔀 Disable Slave	(s)	Revision Number	0x00120000 (1179648)
💙 Reload ESI d	ta	ESI File	C:\Users\Public\Documents\VIPA GmbH\SPEED7 EtherCAT Manager\EtherCAT\EsiFiles\Beckhoff EKxxxx.xml
/ Change Slav		Identification Value	Not Used
🥖 Select from 8	roject Template	Ports	
🦯 Create Group		A [X1 IN]	Slave_010 (0010) / Port B
🗶 Remove Gro	p	D	Not Connected
🗶 Detach HC G	oup	в	Slave_005 (0005)
🥒 Attach HC G	pup	C [X2 OUT]	Not Connected
Disable Slave Reload ESI d Change Slav Select From I Create Group Remove Gro Attach HC G	s) ta coject Template p oup oup	Revision Number ESI File Ports A [X1N] D 8 C [X2 OUT]	0.0020000 (1179-648) C:\Users\Public\Documents\VIPA GmbH\SPEED7 EtherCAT Manager\EtherCAT\EsiFiles\Beckhof Not Used Slave_010 (0010) / Port 8 Not Connected Slave_000 (0005) Not Connected

Remove Group

- ▶ To remove a group click in the SPEED7 EtherCAT Manager at a slave station and select 'Context menu → Remove Group'.
 - ⇒ The group is removed. Depending on the group, the previously grouped slave stations are reintegrated into the topology or remain at the current position.

3.10.2 Create group with pinned process data offset

Procedure



Create Group

station, at a following group or at the last slave station. The group functionality is possible with each slave type. The slave stations of this group are pinned at a fix position in the topology.

This group may start at any slave station and either end at himself, at a following slave

- 1. Click in the Toolbar of the SPEED7 EtherCAT Manager at [Configuration].
- Click in the Project Explorer at the slave station and select 'Context menu
 → Create Group'.
 - ⇒ The dialog 'Create Group' opens. Here always the 1. slave station is selected. You can either select more slave stations or depending on the group type selection, the necessary save stations are automatically selected.

► ▼ [Slave_001 (0001) Slave_004 (0004) Slave_005 (0005) Slave_005 (0006) Slave_006 (0006) Slave_007 (0007)	+ *	Append Slave(s) Remove Slave(s) Del	Address Station Address Information Name	9 B
	Slave_008 (0008	70	Cut Slave(s) Ctrl+X	Description	EL3001 1Ch. Ana. Input +/-10V
	Slave_009 (0009		Copy Slave(s) Ctrl+C	Vendor	Beckhoff Automation (mbH (0x0000002)
۲	Slave_010 (0010)	D	Paste Slave(s) Ctrl+V	Braduct Cade	0-08802052 (106685806)
		+	Enable Slave(s)	Flodder Code	000000000 (19000000)
		×	Disable Slave(s)	Revision Number	0x00140000 (1310720)
		2	Reload ESI data	ESI File	C:\Users\Public\Documents\VIPA GmbH\SPEED7 EtherCAT Manager\EtherCAT\EsiFiles\Beckhoff EL30xx.xml
		1	Change Slave	Identification Value	Not Used
		1	Select from Project Template	Ports	
		×	Create Group	A	Slave_008 (0008) / Port B
		×	Remove Group	D	Not Connected
		×	Detach HC Group	в	Not Connected
		×	Attach HC Group	c	Not Connected

Pinned group

Proj

- **1.** Choose from 'Select the slaves' the slave stations, which you want to include in the 'Pinned group'.
 - ⇒ The dialog is closed, the slave station is marked as group in the *'Project Explorer'* and a tab "Group" is created in the *'Device Editor'*.

Explorer		Group	
EC-Mastersystem	Pinned Group		
🌻 📗 Slave_001 (0001)	Input Offset (byte)	0	Dec Hex
1 001: Module 1	Output Offset (byte)	0	Dec Hex
	Hot Connect Group		
	Identification Offset	0x0012	
	Identification Value	0x0000	Dec Hex
	Fixed Position in Topology		
	Explorer EC-Mastersystem Slave_001 (0001)	Explorer EC-Mastersystem Slave_001 (0001) 1 001: Module 1 Hot Connect Group Identification Offset Identification Value Fixed Position in Topology	Explorer Group EC-Mastersystem Pinned Group Imput Offset (byte) 0 Imput Offset (byte) 0 0 0 Output Offset (byte) 0 0 0 Identification Offset 0x0012 0x0012 0x0000 Identification Value 0x0000 0x0000 0x0000

- **2.** Enable the option 'Pinned Group'.
- **3.** Enable the option *'Input Offset = Output Offset'* if the input and output addresses are identical.
 - \Rightarrow The group is now defined as *Pinned Group*.

Grouping logic > Create Hot Connect group

3.10.3 Create Hot Connect group

Proceeding



Create Group

- **1.** Click in the Toolbar of the SPEED7 EtherCAT Manager at [Configuration].
- 2. Click in the *Project Explorer* at the slave station and select 'Context menu → Create Group'.
 - ⇒ The dialog 'Create Group' opens. Here always the 1. slave station is selected. You can either select more slave stations or depending on the group type selection, the necessary save stations are automatically selected.

 Slave_001 (0001) Slave_004 (0004) Slave_005 (000 Slave_005 (000 Slave_000 (000 Slave_008 (000 Slave_008 (000 Slave_000 (000 Slave_010 (0010) 		Append Slave(s) Del Remove Slave(s) Del Cut Slave(s) Ctrl-X Copy Slave(s) Ctrl-V Fashel Slave(s) Ctrl-V Fashel Slave(s) Ctrl-V Relead SI data Chappe Slave Chappe Slave Chappe Slave	Address Station Address Information Name Description Vendor Product Code Revision Number Edi File Identification Value	9 Save_009 EL3001 1Ch. Ana. Input +/-10V Beckhoff Automation GmbH (bu0000002) 0x06893053 (196685906) 0x00140000 (1310720) CUlvers/Public/Documents/VIPA GmbHiSPEED7 EtherCAT Manager/EtherCAT/EsiFiles/Beckhoff EL30xxml Not Used
	/ × × /	Select from Project Template Create Group Remove Group Detach HC Group Attach HC Group	Ports A D B C O	Slave_008 (0008) / Port 8 Not Connected Not Connected Not Connected

Project

Hot connect group

- **1.** Choose from 'Select the slaves' the slave stations, which you want to include in the 'Hot connect group'.
 - ⇒ The dialog is closed, the slave station is marked as group in the *'Project Explorer'* and a tab "Group" is created in the *'Device Editor'*.

Ехр	orer		Group	
E	C-Mastersystem	Pinned Group		
e	📕 Slave_001 (0001)	Input Offset (byte)	0	Dec Hex
	🏌 001: Module 1	Output Offset (byte)	0	Dec Hex
		Hot Connect Group		
		Identification Offset	0x0012	
		Identification Value	0x0000	Dec Hex
		Fixed Position in Topology	Value > 0 expected!	
		2. Fnable the optio	1 'Hot connect aroun'	

3. Enter an 'Identification value': This is the Station-Alias-Address, which you have to assign before to the slave station in the 'Diagnosis' Mode. Schapter 3.9.4 'EEPROM (Expert mode)' on page 44

Please regard that the slave station takes the new address after a power-cycle.

4. For a fix position of the group in the topology the option *'Pinned group'* can be enabled.

3.10.3.1 Combination possibilities

Hot Connect group with
Dynamic Position in Top-
ologyThe group must start with a MII slave. Here, all slave stations below the selected are
automatically added to the group. This group ends at himself, at a following slave station,
at a following group or at the last slave station.

Hot Connect group with Fixed Position in Topology The group is fix coupled to a predecessor slave station and its port. You always have the possibility to change the link to the previous slave station via the dialog box. If the group is removed, the slave stations remain in place.



A Hot Connect group with Fixed Position in Topology cannot be removed, if the slave stations before are a part of another Hot Connect group with Fixed Position in Topology!

Hot Connect group with Pinned or Dynamic Process Data Offset

This group does not depend on slave station or port. The group has no predecessor slave station and is moved to the end of the tree when created. When the group is removed it is searched for a suited free port starting from the end of the main tree. If there is no suited slave station available, the group will be rejected! Due to the system the group has no predecessor slave station, the connection cannot be changed via the dialog box.

EtherCAT State Machine

3.11 EtherCAT State Machine

States

In each EtherCAT communication device a *state machine* is implemented. For each state there is defined which communication service is active via EtherCAT. The state machine of the slave station is controlled by the state machine of the EtherCAT master.



Init - 01h	After power-on the EtherCAT members are in state <i>Init</i> . There is neither mailbox nor process data communication possible. The EtherCAT master initializes the SyncManager channels 0 and 1 for the mailbox communication.
Pre-Operational (Pre-Op) - 02h	The EtherCAT master initializes the SyncManager channels for process data (starting with SyncManager channel 2), the FMMU channels and the PDO mapping respectively the SyncManager PDO assignment. Further in this state the settings for process data transfer and the module-specific parameters, which deviate from the default values are transferred. During the transition from <i>Init</i> to <i>Pre-Op</i> the EtherCAT slave checks whether the mailbox was correctly initialized. In the state <i>Pre-Op</i> mailbox communication and Ethernet over EtherCAT (EoE) are possible but the process data communication is blocked.
Safe-Operational (Safe- Op) - 04h	In <i>Safe-Op</i> the input data are cyclically updated but the outputs are de-activated. With the transition from <i>Pre-Op</i> to <i>Safe-Op</i> the EtherCAT slave checks if the SyncManager channels for process data communication are correct. Before it acknowledges the state change, the EtherCAT slave copies current input data to the corresponding DP RAM areas of the EtherCAT slave controller. In the state <i>Safe-Op</i> mailbox and process data communication is possible.
Operational (Op) - 08h	In the state <i>Op</i> the input data are cyclically updated and the EtherCAT master sends output data to the EtherCAT slave. The EtherCAT slave copies the output data of the master to its outputs and return input data to the EtherCAT master. In this state process data and mailbox communication is possible.
Bootstrap - option (Boot) - 03h	In state <i>Boot</i> the firmware of an EtherCAT slave may be updated via the EtherCAT master. This state may only be reached via Init. In the state <i>Boot</i> is mailbox communication via the protocol File-Access over EtherCAT (FoE) possible. Other mailbox and process data communications are de-activated.

Firmware update - VIPA System SLIO IM 053-1EC0x

3.12 Firmware update - VIPA System SLIO IM 053-1EC0x

Current firmware at www.vipa.com

Precondition

Proceeding

The latest firmware versions are to be found in the service area at www.vipa.com. Load the Px000xxx.pkg file.

 There Ether Below the For other 1. Ope 2. Clic 3. Sele 4. Clic 5. Clic 6. Sele slav 7. Clic 8. Sele 9. Ente - Fil - Pa 	 CAUTION! When installing a new firmware you have to be extremely careful. Under certain circumstances you may destroy the slave station, for example if the voltage supply is interrupted during transfer or if the firmware file is defective. In this case, please call the VIPA Hotline! Please regard that the version of the update firmware has to be dif- ferent from the existing firmware otherwise no update is executed. is an Ethernet respectively remote connection between the PC and the VIPA CAT slave station, where a firmware update is to be established. e proceeding is shown by the example of the VIPA System SLIO slave station. devices, please follow the procedures described in the according manual. en if not already done the SPEED7 EtherCAT Manager. k in the 'Project Explorer' at 'EC-Mastersystem'. ect in 'Device Editor > Master' at 'Network Adapter' your network card and er at 'IP Address' the IP address of the PG/OP channel of the CPU and click at ect]. k in the Toolbar at [Diagnosis Mode]. An online connection to your EtherCAT system is established via the preset
 There Ether Below the For other 1. Ope 2. Clic 3. Sele ente [Sel 4. Clic 5. Clic 6. Sele slav 7. Clic esta 8. Sele 9. Ente - Fil - Pa 	is an Ethernet respectively remote connection between the PC and the VIPA CAT slave station, where a firmware update is to be established. e proceeding is shown by the example of the VIPA System SLIO slave station. devices, please follow the procedures described in the according manual. en if not already done the <i>SPEED7 EtherCAT Manager</i> . k in the <i>'Project Explorer'</i> at <i>'EC-Mastersystem'</i> . ect in <i>'Device Editor</i> > <i>Master'</i> at <i>'Network Adapter'</i> your network card and er at <i>'IP Address'</i> the IP address of the PG/OP channel of the CPU and click at ect]. k in the Toolbar at [Diagnosis Mode]. An online connection to your EtherCAT system is established via the preset
Below the For other 1. Ope 2. Clic 3. Sele (Sel 4. Clic ⇒ 5. Clic 6. Sele slav 7. Clic esta 8. Sele 9. Ente - Fil - Pa	e proceeding is shown by the example of the VIPA System SLIO slave station. devices, please follow the procedures described in the according manual. en if not already done the <i>SPEED7 EtherCAT Manager</i> . k in the <i>'Project Explorer'</i> at <i>'EC-Mastersystem'</i> . ect in <i>'Device Editor > Master'</i> at <i>'Network Adapter'</i> your network card and er at <i>'IP Address'</i> the IP address of the PG/OP channel of the CPU and click at ect]. k in the Toolbar at [Diagnosis Mode]. An online connection to your EtherCAT system is established via the preset
 Ope Clic Seld ente [Sel Clic Clic Clic Clic Clic Seld Seld Seld Seld Seld Seld Seld Fil Pa 	en if not already done the SPEED7 EtherCAT Manager. k in the 'Project Explorer' at 'EC-Mastersystem'. ect in 'Device Editor > Master' at 'Network Adapter' your network card and er at 'IP Address' the IP address of the PG/OP channel of the CPU and click at ect]. k in the Toolbar at [Diagnosis Mode]. An online connection to your EtherCAT system is established via the preset
2. Clic 3. Sela enta [Sel 4. Clic ⇒ 5. Clic 6. Sela slav 7. Clic esta 8. Sela 9. Enta - Fil - Pa	k in the <i>'Project Explorer'</i> at <i>'EC-Mastersystem'</i> . ect in <i>'Device Editor > Master'</i> at <i>'Network Adapter'</i> your network card and er at <i>'IP Address'</i> the IP address of the PG/OP channel of the CPU and click at ect]. k in the Toolbar at [Diagnosis Mode]. An online connection to your EtherCAT system is established via the preset
 Sele ente [Sel Clic Clic Clic Sele slav Clic esta Sele Sele Sele Sele Fil Pa 	ect in <i>'Device Editor > Master'</i> at <i>'Network Adapter'</i> your network card and er at <i>'IP Address'</i> the IP address of the PG/OP channel of the CPU and click at ect]. k in the Toolbar at [Diagnosis Mode]. An online connection to your EtherCAT system is established via the preset
 4. Clic ⇒ 5. Clic 6. Sele slav 7. Clic esta 8. Sele 9. Ente - Fil - Pa 	k in the Toolbar at [Diagnosis Mode]. An online connection to your EtherCAT system is established via the preset
 ⇒ 5. Clic 6. Sele 7. Clic esta 8. Sele 9. Ente - Fil - Pa 	An online connection to your EtherCAT system is established via the preset
5. Clic 6. Sele slav 7. Clic esta 8. Sele 5. Ente - Fil - Pa	communication channel and the current project configuration in the 'Project explorer'.
 Selesion Selesion Clic esta Selesion Selesion	k in the <i>'Project explorer'</i> at the master.
Clic esta Sele Ente - Fil	ect in the register <i>'General'</i> at <i>'State Machine'</i> the state <i>'Init'</i> . Wait, until all e station response the state <i>'Init'</i> .
8. Sele 9. Ente - Fil - Pa	k in the <i>'Project explorer'</i> at the slave, where the firmware update is to be ablished.
9. Ente - Fil - Pa	ect in the register 'General' at 'State Machine' the state 'Bootstrap'.
- Fil - Pa	er in the register 'FoE ' at 'FoE Download' as follows:
- Pa	ename: Px000xxx
	ssword (hex): 0x0000000
- Tir	neout (ms): 60000
- Ma	ax File Size (kb): 3000
10. Clic	k at [Download].
⇒	A dialog for file selection opens.
11. Sele	ect the file. The transfer starts with [OK].
⇔	There will be a pregress har displayed, which informs you about the transfer

Firmware update - VIPA System SLIO IM 053-1EC0x

- **12.** After successful download bring your slave in the '*Init*' state.
 - \Rightarrow With this operation the firmware file is taken.