

Operating Instructions



Application Inverter MOVIDRIVE[®] modular/system with CiA402 Device Profile

25931873/EN





Table of contents

1	Ganar	information	E						
1			. 5 5						
	1.1	Structure of the safety notes	J 5						
	1.2	1.2.1 Meaning of signal words	5						
		1.2.1 Meaning of signal words	. 5						
		1.2.2 Structure of section-related safety notes	. J 6						
	1 2	T.2.5 Structure of embedded safety holes	. U						
	1.3	Rights to claim under limited warranty	0 6						
	1.4	Content of the documentation	0						
	1.5	Other applicable documentation	6						
	1.6	Product names and trademarks	/						
		1.6.1 Trademark of Beckhoff Automation GmbH	. 7						
	1.7	Copyright notice	7						
2	Safety	otes	. 8						
	2.1	Preliminary information	8						
	2.2	Duties of the user	8						
	2.3	Target group	9						
	2.4	Designated use	. 10						
		2.4.1 Hoist applications	10						
	2.5	Functional safety technology							
	2.6	Transport							
	2.7	Installation/assembly							
		2.7.1 Restrictions of use	11						
	2.8	Electrical installation	. 12						
		2.8.1 Required preventive measure	12						
		2.8.2 Stationary application	12						
		2.8.3 Regenerative operation	12						
	2.9	Protective separation	. 12						
	2.10	Startun/operation							
		2.10.1 Energy storage unit	13						
•	0:4 40								
3		device profile	14						
	3.1		. 14						
	3.2		. 16						
	3.3	Supported operating modes	. 21						
	3.4	System units CiA402	. 22						
	3.5	Object dictionary	. 23						
4	Unit st	icture, axis system structure	24						
	4.1	Connection variants	. 24						
	4.2	Nameplates	. 25						
		4.2.1 Nameplates MOVIDRIVE [®] modular with CiA402 device profile	25						
		4.2.2 Nameplates MOVIDRIVE [®] system with CiA402 device profile	27						
	4.3	Type code	. 28						
		4.3.1 MOVIDRIVE [®] modular with CiA402 device profile	28						
		4.3.2 MOVIDRIVE [®] system with CiA402 device profile	29						

	4.4	Device s	tructure	29								
5	Installa	tion		30								
6	Startup	٥										
	6.1	General										
		6.1.1	Lifting applications	31								
		6.1.2	Connecting power	31								
		6.1.3	Connecting cables	31								
	6.2	Startup r	equirements	32								
	6.3	Validity o	of the ESI file	32								
	6.4	Startup p	procedure	33								
		6.4.1	Checklist for startup	35								
	6.5	Manufac	turer-specific operating modes	36								
		6.5.1 Rotor position identification										
		6.5.2	Motor parameter measurement.	36								
		6.5.3	Position hold control	36								
	6.6	Startup o	of an EtherCAT [®] master using the example of Beckhoff	37								
		6.6.1	Installing the ESI file.	37								
		6.6.2	Creating the I/O configuration and linking the motion axis	38								
		6.6.3	Setting the interpolation time.	45								
		6.6.4	Adjusting the PDO image	48								
		6.6.5	Settings for the "Cvclic synchronous position" (csp) operating mode	50								
		6.6.6	Settings for the "Cyclic synchronous velocity" (csv) operating mode	52								
		6.6.7	Settings for the "Profile position" (pp) operating mode	54								
		6.6.8	Settings for the "Profile velocity" (pv) operating mode	59								
		6.6.9	Using the "Homing" (hm) operating mode	62								
	6.7	Data management via File over EtherCAT [®] (FoE)										
		6.7.1 Data management via the engineering software of the EtherCAT [®] master .										
		6.7.2	Data management via the PLC program	67								
	6.8	Individual parameter access										
		6.8.1	SDO services READ and WRITE	68								
		6.8.2	Example: Reading a parameter in TwinCAT via EtherCAT [®]	69								
		6.8.3	Example: Writing a parameter in TwinCAT via EtherCAT [®]	70								
	6.9	Starting u	up FSoE of an FSoE master using the example of Beckhoff	73								
		6.9.1	Startup with MOVISAFE [®] card CSA at FSoE master	73								
7	Connec	ction to th	ne MOVISUITE [®] engineering software	79								
	7.1	Connecti (EoE/Vol	on via the TwinCAT mailbox gateway using the Ethernet over EtherCAT [®] E)	80								
		7.1.1	Setting the PLC from Beckhoff	82								
		7.1.2	Setting the EtherCAT [®] mailbox gateway in the TwinCAT system	87								
		7.1.3	Setting the engineering PC	88								
		7.1.4	Setting the engineering software	89								
		7.1.5	Connection diagnosis	90								
	7.2	Direct co	nnection via EtherCAT [®] without EtherCAT [®] master	91								
8	Append	dix		92								
	8.1	Abbrevia	tion Key	92								



1 General information

1.1 About this documentation

The current version of the documentation is the original.

This documentation is an integral part of the product. The documentation is intended for all employees who perform work on the product.

Make sure this documentation is accessible and legible. Ensure that persons responsible for the systems and their operation as well as persons who work on the product independently have read through the documentation carefully and understood it. If you are unclear about any of the information in this documentation, or if you require further information, contact SEW-EURODRIVE.

1.2 Structure of the safety notes

1.2.1 Meaning of signal words

The following table shows the grading and meaning of the signal words for safety notes.

Signal word	Meaning	Consequences if disregarded	
	Imminent hazard	Severe or fatal injuries	
	Possible dangerous situation	Severe or fatal injuries	
	Possible dangerous situation	Minor injuries	
NOTICE	Possible damage to property	Damage to the product or its envi- ronment	
INFORMATION	Useful information or tip: Simplifies handling of the product.		

1.2.2 Structure of section-related safety notes

Section-related safety notes do not apply to a specific action but to several actions pertaining to one subject. The hazard symbols used either indicate a general hazard or a specific hazard.

This is the formal structure of a safety note for a specific section:



SIGNAL WORD

Type and source of hazard.

Possible consequence(s) if disregarded.

• Measure(s) to prevent the hazard.



Meaning of the hazard symbols

The hazard symbols in the safety notes have the following meaning:

Hazard symbol	Meaning
	General hazard
	Warning of dangerous electrical voltage
	Warning about suspended load

1.2.3 Structure of embedded safety notes

Embedded safety notes are directly integrated into the instructions just before the description of the dangerous action.

This is the formal structure of an embedded safety note:

▲ SIGNAL WORD Type and source of hazard. Possible consequence(s) if disregarded. Measure(s) to prevent the hazard.

1.3 Rights to claim under limited warranty

Read the information in this documentation. This is essential for fault-free operation and fulfillment of any rights to claim under limited warranty. Read the documentation before you start working with the product.

1.4 Content of the documentation

This documentation contains additional safety-related information and conditions for operation in safety-related applications.

1.5 Other applicable documentation

- "MOVIDRIVE[®] modular application inverter" operating instructions
- "MOVIDRIVE® system application inverter" operating instructions

Observe the corresponding documentation for all further components.



1.6 **Product names and trademarks**

The brands and product names in this documentation are trademarks or registered trademarks of their respective titleholders.

1.6.1 Trademark of Beckhoff Automation GmbH

EtherCAT[®] is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.



1.7 Copyright notice

© 2019 SEW-EURODRIVE. All rights reserved. Unauthorized reproduction, modification, distribution or any other use of the whole or any part of this documentation is strictly prohibited.



7

2 Safety notes

2.1 Preliminary information

The following general safety notes serve the purpose of preventing injury to persons and damage to property. They primarily apply to the use of products described in this documentation. If you use additional components, also observe the relevant warning and safety notes.

2.2 Duties of the user

As the user, you must ensure that the basic safety notes are observed and complied with. Make sure that persons responsible for the machinery and its operation as well as persons who work on the device independently have read through the documentation carefully and understood it.

As the user, you must ensure that all of the work listed in the following is carried out only by qualified specialists:

- Setup and installation
- Installation and connection
- Startup
- Maintenance and repairs
- Shutdown
- Disassembly

Ensure that the persons who work on the product pay attention to the following regulations, conditions, documentation, and information:

- National and regional safety and accident prevention regulations
- · Warning and safety signs on the product
- All other relevant project planning documents, installation and startup instructions, and wiring diagrams
- · Do not assemble, install or operate damaged products
- All system-specific specifications and conditions

Ensure that systems in which the product is installed are equipped with additional monitoring and protection devices. Observe the applicable safety regulations and legislation governing technical work equipment and accident prevention regulations.



2.3 Target group

Specialist for me- chanical work	Any mechanical work may only be performed by adequately qualified specialists. Spe- cialists in the context of this documentation are persons familiar with the design, me- chanical installation, troubleshooting, and maintenance of the product who possess the following qualifications:
	Qualification in the mechanical area in accordance with the national regulations
	Familiarity with this documentation
Specialist for elec- trotechnical work	Any electrotechnical work may only be performed by electrically skilled persons with a suitable education. Electrically skilled persons in the context of this documentation are persons familiar with electrical installation, startup, troubleshooting, and maintenance of the product who possess the following qualifications:
	• Qualification in the electrotechnical area in accordance with the national regula- tions
	Familiarity with this documentation
Additional qualifi- cation	In addition to that, these persons must be familiar with the valid safety regulations and laws, as well as with the requirements of the standards, directives, and laws specified in this documentation. The persons must have the express authorization of the company to operate, program, parameterize, label, and ground units, systems, and circuits in accordance with the standards of safety technology.
Instructed persons	All work in the areas of transportation, storage, operation and waste disposal must be carried out by persons who are trained appropriately. The purpose of the instruction is that the persons are capable of performing the required tasks and work steps in a safe and correct manner.

2.4 Designated use

The product is intended for control cabinet installation in electrical plants or machines.

In case of installation in electrical systems or machines, startup of the product is prohibited until it is determined that the machine meets the requirements stipulated in the local laws and directives. For Europe, Machinery Directive 2006/42/EC as well as the EMC Directive 2014/30/EU apply. Observe EN 60204-1 (Safety of machinery - electrical equipment of machines). The product meets the requirements stipulated in the Low Voltage Directive 2014/35/EU.

The standards given in the declaration of conformity apply to the product.

The systems can be mobile or stationary.

The product can be used to operate the following motors in industrial and commercial systems:

- AC asynchronous motors with squirrel-cage rotor
- Permanent-field AC synchronous motors

Technical data and information on the connection conditions are provided on the nameplate and in the chapter "Technical data" in the documentation. Always comply with the data and conditions.

Unintended or improper use of the product may result in severe injury to persons and damage to property.

2.4.1 Hoist applications

To avoid danger of fatal injury due to falling hoists, observe the following points when using the product in lifting applications:

· Use mechanical protection devices.

Application in ELSM[®] control mode

When the inverter is operated in ELSM[®] control mode, using it in lifting applications is not permitted. In this control mode only applications of horizontal materials handling are permitted.



2.5 Functional safety technology

The product must not perform any safety functions without a higher-level safety system, unless explicitly allowed by the documentation.

2.6 Transport

Inspect the shipment for damage as soon as you receive the delivery. Inform the shipping company immediately about any damage. If the product is damaged, it must not be assembled, installed or started up.

Observe the following notes when transporting the device:

• Ensure that the product is not subject to mechanical impact.

If necessary, use suitable, sufficiently dimensioned handling equipment.

Observe the information on climatic conditions in the chapter "Technical data" of the documentation.

2.7 Installation/assembly

Ensure that the product is installed and cooled according to the regulations in the documentation.

Protect the product from strong mechanical strain. The product and its mounting parts must never protrude into the path of persons or vehicles. Ensure that components are not deformed and insulation spaces are not changed, particularly during transportation and handling. Electric components must not be mechanically damaged or destroyed.

Observe the notes in chapter Mechanical installation in the documentation.

2.7.1 Restrictions of use

The following applications are prohibited unless the device is explicitly designed for such use:

- Use in potentially explosive atmospheres
- Use in areas exposed to harmful oils, acids, gases, vapors, dust, and radiation
- Operation in applications with impermissibly high mechanical vibration and shock loads in excess of the regulations stipulated in EN 61800-5-1
- Use at an elevation of more than 3800 m above sea level

The product can be used at altitudes above 1000 m above sea level up to 3800 m above sea level under the following conditions:

- The reduction of the nominal output current and/or the line voltage is considered according to the data in chapter Technical data in the documentation.
- Above 2000 m above sea level, the air and creeping distances are only sufficient for overvoltage class II according to EN 60664. At altitudes above 2000 m above sea level limiting measures must be taken, which reduce the line side overvoltage from category III to category II for the entire system.
- If a protective electrical separation (in accordance with EN 61800-5-1 and EN 60204-1) is required, then implement this outside the product at altitudes of more than 2000 m above sea level.

2.8 Electrical installation

Ensure that all of the required covers are correctly attached after carrying out the electrical installation.

Make sure that preventive measures and protection devices comply with the applicable regulations (e.g. EN 60204-1 or EN 61800-5-1).

2.8.1 Required preventive measure

Make sure that the product is correctly attached to the ground connection.

2.8.2 Stationary application

Necessary preventive measure for the product is:

Type of energy transfer	Preventive measure		
Direct power supply	Ground connection		

2.8.3 Regenerative operation

The drive is operated as a generator due to the kinetic energy of the system/machine. Before opening the connection box, secure the output shaft against rotation.

2.9 Protective separation

The product meets all requirements for protective separation of power and electronics connections in accordance with EN 61800-5-1. To ensure protective separation, all connected circuits must also meet the requirements for protective separation.

2.10 Startup/operation

Observe the safety notes in the chapters Startup and Operation in this documentation.

Make sure the connection boxes are closed and screwed before connecting the supply voltage.

Depending on the degree of protection, products may have live, uninsulated, and sometimes moving or rotating parts, as well as hot surfaces during operation.

When the device is switched on, dangerous voltages are present at all power connections as well as at any connected cables and terminals. This also applies even when the product is inhibited and the motor is at standstill.

Risk of burns due to arcing: Do not disconnect power connections during operation. Do not connect power connections during operation.

If you disconnect the product from the voltage supply, do not touch any live components or power connections because capacitors might still be charged. Observe the following minimum switch-off time:

10 minutes.

Observe the corresponding information signs on the product.

The fact that the operation LED and other display elements are no longer illuminated does not indicate that the product has been disconnected from the supply system and no longer carries any voltage.

Mechanical blocking or internal protective functions of the product can cause a motor standstill. Eliminating the cause of the problem or performing a reset may result in the drive restarting automatically. If, for safety reasons, this is not permitted for the drive-controlled machine, first disconnect the product from the supply system and then start troubleshooting.

Risk of burns: The surface temperature of the product can exceed 60 °C during operation. Do not touch the product during operation. Let the product cool down before touching it.

2.10.1 Energy storage unit

Products with a connected energy storage unit are not necessarily de-energized when they have been disconnected from the supply system. Usually, the energy storage unit stores sufficient energy to continue operation of the connected motors for a limited period of time. It is not sufficient to observe a minimum switch-off time.

Perform a shutdown as described in the documentation in the chapter "Service" > "Shutdown".

3 CiA402 device profile

3.1 Introduction

The CiA402 device profile for controlling inverters has established itself in plants with individual motion control functions that are calculated in the external higher-level controller.



24494793995

For control via CiA402, the MOVIDRIVE[®] modular and MOVIDRIVE[®] system application inverters can be directly connected to the higher-level controller using the integrated EtherCAT[®] interface. This means integration into the higher-level controller is particularly fast, simple, and without extensive conversion effort.

For applications with requirements on functional safety, the MOVISAFE[®] CS..A safety cards are currently being developed. They are controlled via the integrated inputs and outputs or via safe communication using Safety over EtherCAT[®] (FSoE).

CiA402 is the abbreviation for a device profile that has been defined by the organization "CAN in Automation" specifically for servo drives.



It defines the structure of the object list and the functionalities that are assigned to the individual objects. Furthermore, it defines the state machine (states, error behavior, state transitions). Additionally, it offers manufacturer-specific functions and setting options.



This profile is primarily used for startup of a motion axis on an EtherCAT[®] master and facilitates the integration of the inverter due to the standardized interface.

3.2 Object list

Index dec	Sub	Index Axis1	Index Axis2	Sub	Name	Bit coding/index default	Value	Range of values	Data type
4097	0	0x1001	0x2001	0	Error register	0: Generic error 7: Manufacturer specific			Bit field
24639	0	0x603F	0x703F	0	Error code	0x1000: CiA402 collective error	0 = No error 0x1000: Error	Min: 0 Max: 65535 Step: 1 Default: 0	Int32
24640	0	0x6040	0x7040	0	Control word	0: Switch on 1: Enable voltage 2: Quick stop 3: Enable operation 4: hm: Homing operation start 5: Operation mode specific 6: Operation mode specific 7: Fault reset 8: Halt 9: Operation mode specific 10: Reserved 11: Manufacturer specific 12: Manufacturer specific 13: Manufacturer specific 14: Manufacturer specific 15: Manufacturer specific			Bit field
24641	0	0x6041	0x7041	0	Status word	0: Ready to switch on 1: Switched on 2: Operation enabled 3: Fault reset 4: Voltage enabled 5: Quick stop 6: Switch on disabled 7: Warning 8: Manufacturer specific 9: Remote 10: pp: target reached / CSP,CSV,CST: Status toggle 11: Internal limit active 12: CSP,CSV,CST: Drive follows command value / hm: homing attained 13: hm: error 14: Manufacturer specific 15: Manufacturer specific			Bit field
24669	0	0x605D	0x705D	0	Halt option code		1: Slow down ramp	Default: 0	Enum
24672	0	0x6060	0x7060	0	Mode of opera- tion		0: No mode assigned 1: pp 3: pv 6: hm 8: csp 9: csv 10: cst -18: Rotor position iden- tification -19: Position hold con- trol -25: Motor parameter measurement	Default: 0	Enum



Ohi	iect	list
Οb	JECI	1151

3

Index dec	Sub	Index Axis1	Index Axis2	Sub	Name	Bit coding/index default	Value	Range of values	Data type
24673	0	0x6061	0x7061	0	Mode of opera- tion display		0: No mode assigned 1: pp 3: pv 6: hm 8: csp 9: csv 10: cst -1: Output stage inhibit -4: Manual mode -13: Stop at application limit -18: Rotor position iden- tification -19: Position hold con- trol -22: Output stage test -23: Brake test safety card -25: Motor parameter measurement	Default: 0	Enum
24676	0	0x6064	0x7064	0	Position actual value			Min: -2147483648 Max: 2147483647 Step: 1 Default: 0	Int32
24677	0	0x6065	0x7065	0	Following error window			Min: -1 Max: 2147483647 Step: 1 Default: -1	Int32
24678	0	0x6066	0x7066	0	Following error timeout			Min: 0 Max: 65535 Step: 1 Default: 0	Int32
24684	0	0x606C	0x706C	0	Velocity actual value			Min: -2147483648 Max: 2147483647 Step: 1 Default: 0	Int32
24689	0	0x6071	0x7071	0	Target torque			Min: -32768 Max: 32768 Step: 1 Default: 0	Int32
24695	0	0x6077	0x7077	0	Torque actual value			Min: -32768 Max: 32768 Step: 1 Default: 0	Int32
24698	0	0x607A	0x707A	0	Target position			Min: -32768 Max: 32768 Step: 1 Default: 0	Int32
24699	0	0x607B	0x707B	0	Position range limit: high sub- index support			Min: 0 Max: 2 Step: 1 Default: 2	Int32
24699	1	0x607B	0x707B	1	Position range limit: min range limit			Min: -1073741824 Max: 1073741823 Step: 1 Default: 0	Int32
24699	2	0x607B	0x707B	2	Position range limit: min range limit			Min: -1073741824 Max: 1073741823 Step: 1 Default: 0	Int32
24700	0	0x607C	0x707C	0	Home offset			Min: -2147483648 Max: 2147483647 Step: 1 Default: 0	Int32

Index dec	Sub	Index Axis1	Index Axis2	Sub	Name	Bit coding/index default	Value	Range of values	Data type
24701	0	0x607D	0x707D	0	Software pos limit: high sub- index support			Min: 0 Max: 2 Step: 1 Default: 2	Int32
24701	1	0x607D	0x707D	1	Software pos limit: min pos limit			Min: -2147483648 Max: 2147483647 Step: 1 Default: 0	Int32
24701	2	0x607D	0x707D	2	Software pos limit: max pos limit			Min: -2147483648 Max: 2147483647 Step: 1 Default: 0	Int32
24705	0	0x6081	0x7081	0	Profile velocity			Min: -2147483648 Max: 2147483647 Step: 1 Default: 0	Int32
24707	0	0x6083	0x7083	0	Profile accelera- tion			Min: -2147483648 Max: 2147483647 Step: 1 Default: 0	Int32
24708	0	0x6084	0x7084	0	Profile decelera- tion			Min: -2147483648 Max: 2147483647 Step: 1 Default: 0	Int32
24728	0	0x6098	0x7098	0	Homing method		1: Negative limit switch and index pulse 2: Positive limit switch and index pulse 10: Positive cam end and index pulse 14: Negative cam end and index pulse 17: Negative limit switch w/o index pulse 18: Positive limit switch w/o index pulse 26: Positive cam end w// o index pulse 30: Negative cam end w/o index pulse 33: Negative index pulse 37: Current position	Default: 37	UInt8
24729	0	0x6099	0x7099	0	Homing speeds: high subindex support			Min: 0 Max: 2 Step: 1 Default: 2	Int32
24729	1	0x6099	0x7099	1	Homing speeds: during search for switch			Min: 0 Max: 2147483647 Step: 1 Default: 2000000	Int32
24729	2	0x6099	0x7099	2	Homing speeds: during search for zero			Min: 0 Max: 2147483647 Step: 1 Default: 500000	Int32
24730	0	0x609A	0x709A	0	Homing acceler- ations			Min: 0 Max: 2147483647 Step: 1 Default: 300000	Int32
24752	0	0x60B0	0x70B0	0	Position offset			Min: -2147483647 Max: 2147483647 Step: 1 Default: 0	Int32
24753	0	0x60B1	0x70B1	0	Velocity offset			Min: 0 Max: 2147483647 Step: 1 Default: 0	Int32



Index dec	Sub	Index Axis1	Index Axis2	Sub	Name	Bit coding/index default	Value	Range of values	Data type
24754	0	0x60B2	0x70B2	0	Torque offset			Min: -32768 Max: 32768 Step: 1 Default: 0	Int32
24760	0	0x60B8	0x70B8	0	Touch probe function	0: Touch probe 1: enable 1: Touch probe 1: continu- ous 2: Touch probe 1: trigger source: 0=tp input1 / 1 = 3: Touch probe 1: trigger source from 0x60D0.01 4: Touch probe 1: enable positive edge 5: Touch probe 1: enable negative edge 6: Touch probe 1: user defined 0 7: Touch probe 1: user defined 1 8: Touch probe 2: enable 9: Touch probe 2: enable 9: Touch probe 2: trigger source: 0=tp input1 / 1 = 11: Touch probe 2: trigger source from 0x60D0.01 12: Touch probe 2: enable positive edge 13: Touch probe 2: enable negative edge 13: Touch probe 1: user defined 0 15: Touch probe 1: user defined 1		Default: 0	Bit field
24761	0	0x60B9	0x70B9	0	Touch probe status	0: Touch probe 1: enabled 1: Touch probe 1: positive edge position stored 2: Touch probe 1: negative edge position stored 8: Touch probe 2: enabled 9: Touch probe 2: positive edge position stored 10: Touch probe 10: negat- ive edge position stored		Default: 0	
24762	0	0x60BA	0x70BA	0	Touch probe 1: positive edge			Min: -2147483648 Max: 2147483647 Step: 1 Default: 0	Int32
24763	0	0x60BB	0x70BB	0	Touch probe 1: negative edge			Min: -2147483648 Max: 2147483647 Step: 1 Default: 0	Int32
24764		0x60BC	0x70BC	0	Touch probe 2: positive edge			Min: -2147483648 Max: 2147483647 Step: 1 Default: 0	Int32
24765		0x60BD	0x70BD	0	Touch probe 2: negative edge			Min: -2147483648 Max: 2147483647 Step: 1 Default: 0	Int32
24770	0	0x60C2	0x70C2	0	Interpolation time: high sub- index support			Min: 0 Max: 2 Step: 1 Default: 2	Int32
24770	1	0x60C2	0x70C2	1	Interpolation time: interpola- tion time period value			Min: 0 Max: 2 Step: 1 Default: 1	Int32

Index dec	Sub	Index Axis1	Index Axis2	Sub	Name	Bit coding/index default	Value	Range of values	Data type
24770	2	0x60C2	0x70C2	2	Interpolation time: Interpola- tion time index			Min: 0 Max: 2 Step: 1 Default: -3	Int32
24784	0	0x60D0	0x70D0	0	Touch probe source: high subindex sup- port			Min: 0 Max: 2 Step: 1 Default: 2	Int32
24784	1	0x60D0	0x70D0	1	Touch probe source		0: Reserved 1: Digital Input 1 2: Digital input 2 3: Digital input 3 4: Digital input 4 5: Hardware zero im- pulse	Default: 0	
24789	0	0x60D5	0x70D5	0	Touch probe 1: positive edge counter			Min: 0 Max: 65535 Step: 1 Default: 0	Uint32
24790	0	0x60D6	0x70D6	0	Touch probe 1: negative edge counter			Min: 0 Max: 65535 Step: 1 Default: 0	Uint32
24791	0	0x60D7	0x70D7	0	Touch probe 2: positive edge counter			Min: 0 Max: 65535 Step: 1 Default: 0	Uint32
24792	0	0x60D8	0x70D8	0	Touch probe 2: negative edge counter			Min: 0 Max: 65535 Step: 1 Default: 0	Uint32
24803	0	0x60E3	0x70E3	0	Supported hom- ing methods: high index sup- port			Min: 0 Max: 10 Step: 1 Default: 10	Int32
24803	1	0x60E3	0x70E3	1	Supported hom- ing methods	Index 0: Current position (37) Index 1: Negative limit switch and index pulse (1) Index 2: Positive limit switch and index pulse (2) Index 3: Positive cam end and index pulse (10) Index 4: Negative cam end and index pulse (14) Index 5: Negative limit switch w/o index pulse (17) Index 6: Positive limit switch w/o index pulse (18) Index 7: Positive cam end w/o index pulse (26) Index 8: Negative cam end w/o index pulse (30) Index 9: Negative index pulse (33	1: Negative limit switch and index pulse 2: Positive limit switch and index pulse 10: Positive cam end and index pulse 14: Negative cam end and index pulse 17: Negative limit switch w/o index pulse 18: Positive limit switch w/o index pulse 26: Positive cam end w/ o index pulse 30: Negative cam end w/o index pulse 33: Negative index pulse 37: Current position		
24818	0	0x60F2	0x70F2	0	Positioning op- tion code		0: Normal positioning 64: Only negative direc- tion 128: Only in positive dir- ection 192: Shortest way	Min: 0 Max: 10 Step: 1 Default: 0	Int32
24820	0	0x60F4	0x70F4	0	Following error actual value			Min: -2147483648 Max: 2147483647 Step: 1 Default: 0	Int32



•
_5
V

Index dec	Sub	Index Axis1	Index Axis2	Sub	Name	Bit coding/index default	Value	Range of values	Data type
24829	0	0x60FD	0x70FD	0	Digital inputs; lo- gical value	0: Negative limit switch 1: Positive limit switch 2: Home switch 3: Interlock		Default: 0	Bit field
24831	0	0x60FF	0x70FF	0	Target velocity			Min: -2147483648 Max: 2147483647 Step: 1 Default: 0	Int32
25858	0	0x6502	0x7502	0	Supported drive modes	0: Profile position mode (pp) 2: Profile velocity mode (pv) 5: Homing mode (hm) 7: Cyclic synchronous posi- tion mode (csp) 8: Cyclic synchronous velo- city mode (csv) 9: Cyclic synchronous troque mode (cst)		Default: 933	Bit field



INFORMATION

Index 24770.1 0x60C2.1 can be written to the application at startup via CoE service (SdO). In this case, the cycle time need no longer be set using the MOVISUITE[®] engineering software.

3.3 Supported operating modes

Operating mode (Mode of operation)	Abbreviation	Value	Sub value	Category	SEW-EURODRIVE device display
Profile position mode	рр	1		CiA402	24
Profile velocity mode	pv	3		CiA402	3
Homing mode	hm	6		CiA402	11
Method					
Homing on negative index pulse			1		
Homing on positive index pulse			2		
Homing on positive cam end and index pulse			10		
Homing on negative cam end and index pulse			14		
Homing on negative limit switch without index pulse			17		
Homing on positive limit switch without index pulse			18		
Homing on positive cam end without index pulse			26		
Homing on negative cam end without index pulse			30		
Homing on negative index pulse			33		
Homing on current position			0		
Cyclic synchronous position mode	csp	8		CiA402	16
Cyclic synchronous velocity mode	csv	9		CiA402	25
Cyclic synchronous torque mode	cst	10		CiA402	17
Rotor position identification	-	-18		SEW- EURODRIVE	18
Position hold control	-	-19		SEW- EURODRIVE	19
Motor parameter measurement	-	-25		SEW- EURODRIVE	25



3.4 System units CiA402

The user units (°, mm, degree...) must be set in the EtherCAT[®] master. Internally, the application inverter calculates with the following units:

Value	Unit	Scaling		
Position	inc	65536 inc/motor revolution		
Speed	inc/s	65536 inc/s		
Acceleration	inc/s ²	65536 inc/s ²		



3.5 Object dictionary

The "object dictionary" describes the values that are directly available in the engineering software of the EtherCAT[®] master for selecting the PDO image.

0x208EDigital inputs actual valueYes0x603FError codeYes0x6041Status wordYes0x6061Modes of operation displayYes0x6064Position actual valueYes0x606CVelocity actual valueYes0x6077Torque actual valueYes0x6088Homing methodYes0x6089Touchprobe statusYes0x6080Touchprobe 1 positive edgeYes0x608BTouchprobe 1 negative edgeYes0x608DTouchprobe 1 negative edgeYes0x608DTouchprobe 1 positive edgeYes0x608DTouchprobe 1 negative edgeYes0x608DTouchprobe 1 positive edgeYes0x608DTouchprobe 1 negative edgeYes0x608DTouchprobe 1 positive edge counterYes0x608DTouchprobe 2 negative edge counterYes0x608DTouchprobe 1 negative edge counterYes0x6006Touchprobe 1 negative edge counterYes0x6007Touchprobe 2 negative edge counterYes0x6008Touchprobe 2 negative edge counterYes0x6008Touchprobe 2 negative edge counterYes0x6008Touchprobe 2 negative edge counterYes0x6008Touchprobe 2 negative edge counterYes0x6007Touchprobe 2 negative edge counterYes0x6008Touchprobe 2 negative edge counterYes0x6008Touchprobe 2 negative edge counterYes
0x603FError codeYes0x6041Status wordYes0x6061Modes of operation displayYes0x6064Position actual valueYes0x606CVelocity actual valueYes0x6077Torque actual valueYes0x6088Homing methodYes0x6089Touchprobe statusYes0x608ATouchprobe 1 positive edgeYes0x608BTouchprobe 1 negative edgeYes0x608CTouchprobe 2 positive edgeYes0x608DTouchprobe 1 negative edgeYes0x608DTouchprobe 2 negative edgeYes0x6005Touchprobe 1 negative edge counterYes0x6006Touchprobe 2 positive edge counterYes0x6007Touchprobe 1 negative edge counterYes0x6008Touchprobe 2 positive edge counterYes0x6007Touchprobe 2 negative edge counterYes0x6008Touchprobe 2 negative edge counterYes0x6008Touchprobe 2 negative edge counterYes0x6007Touchprobe 2 negative edge counterYes0x6008Touchprobe 2 negative edge counterYes0x6008Touchprobe 2 negative edge counterYes0x6008Touchprobe 2 negative edge counterYes
0x6041Status wordYes0x6061Modes of operation displayYes0x6064Position actual valueYes0x606CVelocity actual valueYes0x6077Torque actual valueYes0x6098Homing methodYes0x6089Touchprobe statusYes0x608ATouchprobe 1 positive edgeYes0x608BTouchprobe 1 negative edgeYes0x608CTouchprobe 2 positive edgeYes0x608DTouchprobe 1 negative edgeYes0x608DTouchprobe 2 negative edgeYes0x6005Touchprobe 1 negative edge counterYes0x6006Touchprobe 2 positive edge counterYes0x6007Touchprobe 1 negative edge counterYes0x6008Touchprobe 2 positive edge counterYes0x6007Touchprobe 1 negative edge counterYes0x6008Touchprobe 2 negative edge counterYes0x6008Touchprobe 2 negative edge counterYes
0x6061Modes of operation displayYes0x6064Position actual valueYes0x606CVelocity actual valueYes0x6077Torque actual valueYes0x6098Homing methodYes0x6089Touchprobe statusYes0x608ATouchprobe 1 positive edgeYes0x608BTouchprobe 1 negative edgeYes0x608CTouchprobe 2 positive edgeYes0x608DTouchprobe 1 negative edgeYes0x608DTouchprobe 2 negative edgeYes0x6005Touchprobe 1 negative edge counterYes0x6006Touchprobe 1 positive edge counterYes0x6007Touchprobe 2 negative edge counterYes0x6008Touchprobe 1 negative edge counterYes0x6007Touchprobe 2 negative edge counterYes0x6008Touchprobe 2 negative edge counterYes0x6008Touchprobe 2 negative edge counterYes0x6008Touchprobe 2 negative edge counterYes
0x6064Position actual valueYes0x606CVelocity actual valueYes0x6077Torque actual valueYes0x6098Homing methodYes0x6089Touchprobe statusYes0x60B4Touchprobe 1 positive edgeYes0x60B5Touchprobe 1 negative edgeYes0x60BCTouchprobe 2 positive edgeYes0x60BDTouchprobe 1 negative edgeYes0x60BDTouchprobe 2 negative edgeYes0x60D5Touchprobe 1 positive edge counterYes0x60D6Touchprobe 1 negative edge counterYes0x60D6Touchprobe 1 negative edge counterYes0x60D6Touchprobe 2 negative edge counterYes0x60D7Touchprobe 2 negative edge counterYes0x60D8Touchprobe 2 negative edge counterYes0x60D8Touchprobe 2 negative edge counterYes
0x606CVelocity actual valueYes0x6077Torque actual valueYes0x6098Homing methodYes0x6089Touchprobe statusYes0x60B4Touchprobe 1 positive edgeYes0x60B5Touchprobe 1 negative edgeYes0x60B6Touchprobe 2 positive edgeYes0x60B7Touchprobe 2 negative edgeYes0x60B0Touchprobe 1 negative edgeYes0x60B1Touchprobe 2 negative edgeYes0x60D5Touchprobe 1 positive edge counterYes0x60D6Touchprobe 1 negative edge counterYes0x60D7Touchprobe 2 negative edge counterYes0x60D8Touchprobe 2 negative edge counterYes0x60D8Touchprobe 2 negative edge counterYes0x60D8Touchprobe 2 negative edge counterYes0x60D7Touchprobe 2 negative edge counterYes0x60D8Touchprobe 2 negative edge counterYes
0x6077Torque actual valueYes0x6098Homing methodYes0x6098Touchprobe statusYes0x60B9Touchprobe 1 positive edgeYes0x60BATouchprobe 1 negative edgeYes0x60BBTouchprobe 1 negative edgeYes0x60BCTouchprobe 2 positive edgeYes0x60BDTouchprobe 2 negative edgeYes0x60D5Touchprobe 1 positive edge counterYes0x60D6Touchprobe 1 negative edge counterYes0x60D7Touchprobe 2 positive edge counterYes0x60D8Touchprobe 2 negative edge counterYes
0x6098Homing methodYes0x60B9Touchprobe statusYes0x60BATouchprobe 1 positive edgeYes0x60BATouchprobe 1 negative edgeYes0x60BBTouchprobe 1 negative edgeYes0x60BCTouchprobe 2 positive edgeYes0x60BDTouchprobe 2 negative edgeYes0x60D5Touchprobe 1 positive edge counterYes0x60D6Touchprobe 1 negative edge counterYes0x60D7Touchprobe 2 negative edge counterYes0x60D8Touchprobe 2 negative edge counterYes
0x60B9Touchprobe statusYes0x60BATouchprobe 1 positive edgeYes0x60BBTouchprobe 1 negative edgeYes0x60BCTouchprobe 2 positive edgeYes0x60BDTouchprobe 2 negative edgeYes0x60D5Touchprobe 1 positive edge counterYes0x60D6Touchprobe 1 negative edge counterYes0x60D7Touchprobe 1 negative edge counterYes0x60D8Touchprobe 2 negative edge counterYes
0x60BATouchprobe 1 positive edgeYes0x60BBTouchprobe 1 negative edgeYes0x60BCTouchprobe 2 positive edgeYes0x60BDTouchprobe 2 negative edgeYes0x60D5Touchprobe 1 positive edge counterYes0x60D6Touchprobe 1 negative edge counterYes0x60D7Touchprobe 2 positive edge counterYes0x60D8Touchprobe 2 negative edge counterYes
0x60BBTouchprobe 1 negative edgeYes0x60BCTouchprobe 2 positive edgeYes0x60BDTouchprobe 2 negative edgeYes0x60D5Touchprobe 1 positive edge counterYes0x60D6Touchprobe 1 negative edge counterYes0x60D7Touchprobe 2 positive edge counterYes0x60D8Touchprobe 2 negative edge counterYes
0x60BCTouchprobe 2 positive edgeYes0x60BDTouchprobe 2 negative edgeYes0x60D5Touchprobe 1 positive edge counterYes0x60D6Touchprobe 1 negative edge counterYes0x60D7Touchprobe 2 positive edge counterYes0x60D8Touchprobe 2 negative edge counterYes
0x60BDTouchprobe 2 negative edgeYes0x60D5Touchprobe 1 positive edge counterYes0x60D6Touchprobe 1 negative edge counterYes0x60D7Touchprobe 2 positive edge counterYes0x60D8Touchprobe 2 negative edge counterYes
0x60D5Touchprobe 1 positive edge counterYes0x60D6Touchprobe 1 negative edge counterYes0x60D7Touchprobe 2 positive edge counterYes0x60D8Touchprobe 2 negative edge counterYes
0x60D6 Touchprobe 1 negative edge counter Yes 0x60D7 Touchprobe 2 positive edge counter Yes 0x60D8 Touchprobe 2 negative edge counter Yes
0x60D7 Touchprobe 2 positive edge counter Yes 0x60D8 Touchprobe 2 negative edge counter Yes
0x60D8 Touchprobe 2 negative edge counter Yes
0x60F4 Following error actual value Yes
0x6502 Supported drive modes Yes
Index Name Writable via PD
0x6040 Control word Yes
0x6060 Modes of operation Yes
0x6065 Following error window Yes
0x6066 Following error timeout Yes
0x6071 Target torque Yes
0x607A Target position Yes
0x607C Homing offset Yes
0x607D:01 Software position limit [1] Yes
0x607D:02 Software position limit [2] Yes
0x607D:02 Software position limit [2] Yes 0x6081 Profile velocity Yes
0x607D:02Software position limit [2]Yes0x6081Profile velocityYes0x6083Profile accelerationYes
0x607D:02Software position limit [2]Yes0x6081Profile velocityYes0x6083Profile accelerationYes0x6084Profile decelerationYes
0x607D:02Software position limit [2]Yes0x6081Profile velocityYes0x6083Profile accelerationYes0x6084Profile decelerationYes0x609AHoming accelerationYes
Ox607D:02Software position limit [2]YesOx6081Profile velocityYesOx6083Profile accelerationYesOx6084Profile decelerationYesOx609AHoming accelerationYesOx60B0Position offsetYes
0x607D:02Software position limit [2]Yes0x6081Profile velocityYes0x6083Profile accelerationYes0x6084Profile decelerationYes0x609AHoming accelerationYes0x60B0Position offsetYes0x60B1Velocity offsetYes
0x607D:02Software position limit [2]Yes0x6081Profile velocityYes0x6083Profile accelerationYes0x6084Profile decelerationYes0x609AHoming accelerationYes0x60B0Position offsetYes0x60B1Velocity offsetYes0x60B2Torque offsetYes
0x607D:02Software position limit [2]Yes0x6081Profile velocityYes0x6083Profile accelerationYes0x6084Profile decelerationYes0x609AHoming accelerationYes0x60B0Position offsetYes0x60B1Velocity offsetYes0x60B2Torque offsetYes0x60B8Touchprobe modeYes
0x607D:02Software position limit [2]Yes0x6081Profile velocityYes0x6083Profile accelerationYes0x6084Profile decelerationYes0x609AHoming accelerationYes0x60B0Position offsetYes0x60B1Velocity offsetYes0x60B2Torque offsetYes0x60B8Touchprobe modeYes0x60F2Position option codeYes

Inputs

Outputs



4 Unit structure, axis system structure

4.1 Connection variants

The MOVIDRIVE[®] modular and the MOVIDRIVE[®] system application inverters with firmware for the CiA402 device profile can be installed only in the following connection variant, as the MOVI-C[®] CONTROLLER currently does not support the CiA402 device profile:

• As axis system or single axis with an EtherCAT[®] master with motion functionality when using the CiA402 device profile.

The number of possible axis modules in an EtherCAT $^{\rm e}$ network depends on the EtherCAT $^{\rm e}$ master in use.



Example of an axis system:

- [1] Line voltage
- [2] EtherCAT[®] communication
- [3] EtherCAT[®] master
- [4] MOVIDRIVE[®] modular power supply module MDP90A-...
- [5] MOVIDRIVE[®] modular single-axis module MDA90A-...
- [6] MOVIDRIVE® modular double-axis module MDD90A-...
- [7] MOVIDRIVE® system MDX90A-..

NOTICE

Damage to the MOVIDRIVE[®] modular application inverter when opening the DC link (separate operation).

Separate operation of individual modules will damage the application inverter and is not permitted.

Only operate the application inverter when installed in a system as illustrated above.

For information on which cables can be used, refer to the "MOVIDRIVE" modular Application Inverters" documentation.

25931873/EN - 03/2019



4.2 **Nameplates**

The application inverters with CiA402 device profile are marked externally so that they can be distinguished from standard inverters.

Nameplates MOVIDRIVE® modular with CiA402 device profile 4.2.1

Single-axis module

System nameplate



- [1]
- [2]

Performance data nameplate

-76646 Bruchsal lade in Germany	I = DC 2	:4A	l = Ima f = P(A	x = SM) :	AC AC 0	24. 60. 599	A A Hz	15.0HP		
eistungsdaten	T = 0+	45°C	S=	17.0	kVA				ML 0001	
erformance data	Status:	10 11 - 91 01 0	12 13 01 01	14 01	15 01	16 01	17 01	18 01		

[1] Device status



Double-axis module

System nameplate



- [1] Device status
- [2] Serial number

Performance data nameplate

DEVV	Eingang / Input	Ausgang / Output	KARA A
EURODRIVE D-76646 Bruchsal Made in Germany MOVIDRIVE modular	U = DC 560V I = DC 4A	U = 2x(3x 0VU Netz) I = 2x(AC 2A) Imax = 2x(AC 5A) f = 2x(0599Hz) P(ASM) = 2x(0.55kW / 0.74HP)	
Leistungsdaten	T = 0+45°C	S = 2x(1.4kVA) ML 0001	ׂ נ(ענ)טא
Performance data	Status: 10 11 1 01 01 0	2 13 14 15 16 17 18 1 01 01 01 01 01 01	LISTED

[1] Device status



4.2.2 Nameplates MOVIDRIVE® system with CiA402 device profile

MDX90A-0032-5E3-4-E00/CES11A/CIO21A

System nameplate

	Туре	: MI	DXS	90A	-00)32	-5E	E3-4	1-Е	00/CES	611A/	CIO21A	
JEW	SO#:)01	.12	34	567	89	0.0	001	.15	5		12353	
	Steue	rkoj	of /	Cor	ntro	U	nit						946.62
Made in Germany	Туре:	MC	X9x	A-S	00			1	22	<i>7</i> 40	i i i i i i i i i i i i i i i i i i i	1	
MOVIDRIVE system	Status	:)10	11	12	13	14	15	16	17	18			
Jmrichter	\square	01	01	01	01	01	01	01	01	01	IP 20	CE	FAL
nverter												Â	f 50 ;
/												60	

- [1] Device status
- [2] Serial number

Performance data nameplate



[1] Device status

4.3 Type code

4.3.1 MOVIDRIVE® modular with CiA402 device profile

Example: MDA90A-0080-503-X-E00							
Product family	MD	•	MD = MOVIDRIVE [®]				
Device type	Α	•	A = Single-axis module				
		•	D = Double-axis module				
		•	P = Power supply module with brake chopper				
		•	M = Master module UHX45A/MDM90A				
Series	90	•	90 = Standard design				
Version	А	•	A = Version status A				
Performance class	0080	•	MDA: Nominal output current – e.g. 0080 = 8 A				
		•	MDD: Nominal output current – e.g. $0020 = 2 \times 2 A$				
		•	MDP: Nominal power – e.g. 0100 = 10 kW				
Connection voltage	5	•	5 = AC 380 – 500 V				
EMC variants of the power section	0	•	0 = Basic interference suppression integrated				
Connection type	3	•	3 = 3-phase connection type				
Operating mode	Х	•	4 = 4-quadrant operation (with brake chopper)				
		•	X = Not relevant				
Device variant	Е	•	0 = Not relevant				
		•	S = Control MOVI-C [®] CONTROLLER				
		•	C = Power supply module with integrated braking resistor and capacitor				
		•	E = Inverter with device profile CiA402				
Designs	00	•	00 = Standard design				
		•	01 = Axis module MDA90A-0640 in size 5				
Options		•	/X = MOVIDRIVE [®] modular without card slots				
		The	e following list serves as an example:				
		•	/CES11A = Multi-encoder card				
		•	/CSA = Safety card				



Example: MDX90A-0125-5E3-X-E00								
Product family	MD	MOVIDRIVE®						
Device type	Х	X = Single-axis inverter						
Series	90	90 = Without DC 24 V switched-mode power supply						
		• 91 = With DC 24 V switched-mode power supply						
Version	А	 A = Version status of the device series 						
Performance class	0125	 0125 = Nominal output current – e.g. 0125 = 12.5 A 						
Connection voltage	5	• 2 = AC 200 – 240 V						
		• 5 = AC 380 – 500 V						
Power section design	Е	 0 = Basic interference suppression integrated 						
EMC		• E = EMC filter limit value category C2 acc. to EN 61800-3						
Connection type	3	3 = 3-phase connection type						
Operating mode	Х	 4 = 4-quadrant operation 						
		 X = Not relevant 						
Device variant	Е	 0 = Not relevant 						
		 S = MOVIDRIVE[®] system: Control via MOVI-C[®] CONTROLLER 						
		 T = MOVIDRIVE[®] technology: Control via fieldbus 						
		E = Inverter with device profile CiA402						
Designs	00	00 = Standard design						
Options		The following list serves as an example:						
		 /CES11A = Multi-encoder card 						
		 /CSA = Safety card MOVISAFE[®] CSA 						

4.3.2 MOVIDRIVE® system with CiA402 device profile

4.4 Device structure

For detailed information on the device structure and the design of the axis system, refer to the other applicable documentation:

- "MOVIDRIVE® modular application inverter" operating instructions
- "MOVIDRIVE[®] system application inverter" operating instructions

5 Installation

For information on the electrical and mechanical installation of the basic devices and cards, as well as permitted cable types, dimension sheets, terminal assignment and wiring diagrams, refer to the other applicable documentation of the inverter in use:

- "MOVIDRIVE[®] modular application inverter" operating instructions
- "MOVIDRIVE® system application inverter" operating instructions



6 Startup

6.1 General



Uncovered power connections.

Severe or fatal injuries from electric shock.

- Install the touch guards at the modules, see chapter Covers.
- Install the closing covers according to the regulations, see chapter Covers.
- Never start up the application inverter without installed closed touch guards and closing covers.

6.1.1 Lifting applications



A WARNING

Danger of fatal injury if the hoist falls.

Severe or fatal injuries.

• The application inverter is not designed for use as a safety device in lifting applications. Use monitoring systems or mechanical protection devices to ensure safety.

6.1.2 Connecting power

NOTICE

Undercutting the minimum switch-off time of the line contactor.

Irreparable damage to the application inverter or unforeseeable malfunctions.

The specified times and intervals must be observed.

- After disconnection from the supply system, observe a minimum switch-off time of 10 s.
- Do not turn the power of the supply system on or off more than once per minute.

6.1.3 Connecting cables

NOTICE

Disconnecting lines under voltage.

Irreparable damage to the application inverter or unforeseeable malfunctions.

• The following plug-in connections must always be disconnected in a de-energized state: Motor, supply system, braking resistor, brake, encoder.

6.2 Startup requirements

The following requirements apply to startup:

- You have installed the application inverter correctly, both mechanically and electrically.
- · You have configured the application inverter and connected drives correctly.
- · Safety measures prevent accidental drive startup.
- Safety measures prevent danger to persons or machines.

Required hardware components:

- PC with Ethernet interface.
- Standard Ethernet cable for connection between PC and EtherCAT[®] master Required software/configuration files:
- MOVISUITE[®] standard engineering software from SEW-EURODRIVE.
- Engineering software of the EtherCAT® master (depending on the manufacturer)
- ESI file "SEW_MOVI-C_MOVIDRIVE_CiA402.xml"
- SEW_SharedModulesDescription_CiA402_V0xxxx.xml

6.3 Validity of the ESI file

i

The ESI file (XML file) contains the device description and information that are essential for a successful startup of the application inverters on an EtherCAT[®] master.

INFORMATION

Do not edit or amend the entries in the ESI file. SEW-EURODRIVE assumes no liability for malfunctions of the inverter caused by a modified ESI file.

The following ESI file is available from SEW-EURODRIVE for connecting the drive inverters with CiA402 device profile to an EtherCAT[®] master:

- SEW_SharedModulesDescription_CiA402_Vxxxx.xml
- ESI file "SEW_MOVI-C_MOVIDRIVE_CiA402.xml"

You find the ESI file on the SEW-EURODRIVE website www.sew-eurodrive.com via the Online Support section under "Data & documents > Software".

This file is valid for the following inverters with CiA402 firmware:

- MOVIDRIVE[®] modular
- MOVIDRIVE[®] system



6.4 Startup procedure

The application inverters are taken into operation using the MOVISUITE $^{\mbox{\tiny \$}}$ engineering software from SEW-EURODRIVE.



¹⁵⁶⁴³²⁵²⁴⁹¹

The startup is functionally divided into segments. The following steps illustrate in exemplary fashion the startup procedure for an application inverter.

Drive train seg- ment	Drive train		Configuring drive trains.
Functions segment	Inputs/outputs	[<u>0000</u>] ∱	Basic device
	Setpoints	⇔10010	 Basic settings PO data
			• CiA402
	Actual values		PI data
		[11100]⊂>	• CiA402
	Drive functions		FCB01 Output stage inhibit
			FCB02 Stop default
			FCB11 Homing mode (hm)
			FCB13 Stop at application limit
			FCB14 Emergency stop
			FCB18 Rotor position identification
			FCB25 Motor measurement
	Technology functions		CiA402 Touchprobe 1
			CiA402 Touchprobe 2

	Monitoring functions	6	• • • •	Reference signals Limit values Control functions Output stage Power supply monitoring
			•	Overview of fault responses
Information on the	Device data is available via the	project no	des.	
application inverter	Device data		• • •	Device identification Main component Subcomponent Production data
	Communication		•	EtherCAT®
	Basic settings		•	Permissions Reset device parameters Active drive train Standby mode

•

Internal data backup



6.4.1 Checklist for startup

The following checklist lists the necessary steps for complete startup.

Step	Startup step	Finished
1	Install the motor	
2	Install the MOVI-C [®] component	
3	Start MOVISUITE®	
4	Start up the drive train	
5	Configure digital inputs and outputs	
6	Move the drives in manual mode	
7	Select the operating mode of the axis in the EtherCAT $^{\circ}$ master	
8	Configure the motion axis in the EtherCAT [®] master	
9	Compare/set the cycle time in the axis with the cycle time in the master	
10	Test the drives/application	

For inverters with CiA402 device profile, the assignment of the process data words that are necessary for controlling the axis is already predefined and created. You do not need to make any further settings on the process data interface of the axis in order to start up the application inverter.

6.5 Manufacturer-specific operating modes

Refer to the "Object list" (\rightarrow \blacksquare 16) chapter for the manufacturer-specific operating modes that are available.

6.5.1 Rotor position identification

Rotor position identification is primarily used if third-party synchronous motors need to be taken into operation. The position of the rotor is determined. It corresponds to FCB18.

To select rotor position identification, select -18 via the PDO "Mode of Operation".

The display reports back a value of 18.

6.5.2 Motor parameter measurement

Motor parameter measurement is primarily used for starting up AC asynchronous motors from other manufacturers. The values of the motor (inductances and resistances) are measured. They correspond to FCB 25.

To select motor parameter measurement, select -25 via the PDO "Mode of Operation".

The display reports back a value of 25.

6.5.3 Position hold control

Drive remains in position control without brake application.

To activate position hold control, you must select -19 via the PDO "Mode of Operation".

The display reports back a value of 19.


6.6 Startup of an EtherCAT[®] master using the example of Beckhoff

The following is an example of the startup using the CX2020 controller and the Twin-CAT 3 engineering software from Beckhoff. The EtherCAT[®] is connected via the EtherCAT[®] expansion EK1110 from Beckhoff.

6.6.1 Installing the ESI file

- Install the ESI file in accordance with the specifications of the TwinCAT engineering software.
- Once the file has been installed properly, the device appears next to the slave stations (under "Drives") with the designation "MOVI-C MOVIDRIVE CiA402".



6.6.2 Creating the I/O configuration and linking the motion axis

To control the application inverters, it is necessary to create the inverters in the I/O configuration of the EtherCAT[®] master.

Creating the I/O configuration by scanning the network

After the connection between engineering PC and EtherCAT[®] master has been successfully established, ensure that the EtherCAT[®] master is in "Config" state. This is indicated by the "Gear wheel" icon in the lower right-hand corner of the surface. If necessary, this state can also be established via the corresponding button in the toolbar.

You must select "Devices" to scan the network. You can activate the "Scan" operating mode via the button [Magic wand] in the toolbar.



21963232651

Now, all available interfaces of the master are displayed. If required, you can deactivate all unused interfaces.

If you confirm the "Scan for Boxes" window, it is searched for devices on the interfaces that are still activated.

If a CiA402 axis is present in the EtherCAT[®] network, the system asks if it is to be directly linked with a motion axis.

EtherCAT drive(s) added		×
Append linked axis to:	NC - Configuration CNC - Configuration	OK Cancel



Click [OK] and a motion task will be created under "Motion" in the project management. It includes a motion axis that has already been completely linked.



21963261835

As standard, the link between the I/O configuration and the motion axis looks as follows:



22819345163

If required, a module with a specific function can also be used. These can be found in the "Slots" tab. The following options are available:

- csp
- CSV
- Switching modes of operation pp/pv

As standard, the "Switching modes of operation" operating mode is selected. Here, you have the option to switch between the operating modes csp and csv because the required variables have already been linked.

Creating an offline I/O configuration

After successful installation of the ESI file, you can add the device via the menu item [Add New Item] to the I/O configuration.

olution Explorer			-	Ą
○ ○ 습 [] ○ - 司	- 4	•		
earch Solution Explorer (Ctrl+ü)			1
Solution 'DocumentationPri CommentationPri Co	tionPro oject	oject' (1 project)		
	1 <u>(Ethe</u>	rCAT)		
‡∎ Ima	g, 🙄	Add New Item	Ins	٢
🚔 Ima	9 *0	Add Existing Item	Shift+Alt+A	L
Syn 🖉 Syn	Ľ×	Remove	Del	L
 Inpo Impo <li< td=""><td>pi</td><td>Change NetId</td><td></td><td>L</td></li<>	pi	Change NetId		L
👂 🛄 Info	D	Save Device 1 (EtherCAT) As		l
🚔 Mappings		Append EtherCAT Cmd		L
		Append Dynamic Container		L
		Online Reset		L
		Change Id		L
		Change To	•	L
	ŋ	Сору	Ctrl+C	
	ж	Cut	Ctrl+X	I
	பி	Paste	Ctrl+V	L
		Paste with Links		I
		Independent Project File		l
	-	Disable		1

Search:		Name:	Drive 1	Multiple:	1	÷	OK
Туре:	Essential Second S	nation GmbH 8 Networks RIVE+DFE24 Gateway RAC+F5E248 RAC+F5E248 OT+MFE72A MOVIDRIVE	Co. KG				Cancel Port A D B (Ethernet) C
	Extended Information		Show Hidde	n Devices		ihow Su	h Groups

You can find the device under the following menu item:

21963266699

Click [OK], you will be prompted whether you want to link the inverter directly with the motion axis.

EtherCAT drive(s) added		×
Append linked axis to:	NC - Configuration CNC - Configuration	OK Cancel

21963269131

Linking an MDD double-axis module

A single-axis module is created and linked depending on the TwinCAT version used during the network scan as well as during the creation of an offline I/O configuration. This is independent of whether a single-axis module or a double-axis module is physically present. This means that only one motion axis is created and linked with the I/O configuration.

If a double-axis module is present, the second axis must be created and linked manually.

Proceed as follows:

1. Set the EtherCAT[®] master to the operating mode "Configuration".

2. Mark the required EtherCAT® slave under "I/O" and select [Slots].

General EtherCAT DC Process Data	Slots Startup				
Slot Mo	odule	ModuleIdent	Module	ModuleIdent	Description
 ⊕ Axis 1 Swi ⊕ DriveSafety Axis 1 	vitching modes of operati	0x04020001	 (€) Switching modes of operation ♥ Mode of operation - CSP (∞) Mode of operation - CSV (€) Switching modes of operation (pp + pv) 	0x04020001 0x04020002 0x04020003 0x04020004	Switching modes of operation Mode of operation - CSP Mode of operation - CSV Switching modes of operation (
Download SlotCfg (I->P)			Create project specific XML File		

24857042955

3. Mark the "Axis 2" entry. The "Switching modes of operation" entry appears on the right hand side.

General EtherCAT DC Process Data	a Slots Startup					
Slot	Module	ModuleIdent		Module	ModuleIdent	Description
 Axis 1 DriveSafety Axis 1 Axis 2 DriveSafety Axis 2 	Switching modes of operati	0x04020001	×	 Switching modes of operation Mode of operation - CSP Mode of operation - CSV Switching modes of operation (pp + pv) 	0x04020001 0x04020002 0x04020003 0x04020004	Switching modes of operation Mode of operation - CSP Mode of operation - CSV Switching modes of operation (
Download SlotCfg (I->P)				Create project specific XML File		



- 4. Mark the entry on the right hand side. In the I/O configuration, the entry looks as follows:
 - **I**/0 📲 Devices Revice 1 (EtherCAT) 🚔 Image 1mage-Info SyncUnits Þ Þ Inputs Outputs Þ 🗐 InfoData Þ Þ Term 1 (EK1200) Drive 8 (MOVI-C MOVIDRIVE CiA402) R Module 1 (Switching modes of operation) Þ Module 3 (Switching modes of operation) Þ 🖶 WcState 🗐 InfoData Þ

22820891915

5. To establish a link with a motion axis, you have to create the motion axis. Double click "Axis" and then [Add New Item]. Confirm the dialog box with [OK] to create a new motion axis.



22821141643

6. Select the previously created motion axis (here: Axis 2) and the [Settings] tab. Click [Link to I/O] to select the second axis of the EtherCAT[®] slave.





7. The newly linked axis is then displayed here:



22821150731

INFORMATION

i

Depending on the version of the TwinCAT software from Beckhoff in use, the "DriveSafety Axis 1" slot must be assigned in addition to a new "Switching Modes of Operation" slot (point 4). In this way, the link of the double-axis works without any problems.

The slot configuration looks as follows:

Slot	Module	ModuleIdent
Axis 1	Switching modes of operati	0x04020001
DriveSafety Axis 1	FSoE Safety IO 48 bit	0x04020081
Axis 2	Switching modes of operati	0x04020001
DriveSafety Axis 2		



6.6.3 Setting the interpolation time

INFORMATION



The interpolation times in the EtherCAT[®] master and in the application inverter must match, otherwise interpolation errors occur which result in loss of control performance.

Setting the interpolation time in the EtherCAT[®] master

The interpolation time in the EtherCAT[®] master is set in the motion task. For Beckhoff, this is the "NC-Task x SAF".



24868057739

For the interpolation time, refer to the [Task] tab. The default setting for the interpolation time is 2 ms.

Task Settings Online			
Name: NC-Task	1 SAF	Port:	501
Auto start		Object Id:	0x05000010
Auto Priority Manageme	nt	Options	
Priority: 4	* *	Disable	
Cycle ticks: 2	2.000 ms	Create s	ymbols
Start tick (modulo):	0	Inclu	ide external symbols
Separate input upda Pre ticks:	te 0		
Waming by exceeding		I/O at ta	sk begin
Watchdog Cycles:	0		

Setting the interpolation time in the application inverter

In the application inverter, you can adjust the interpolation time either in the MOVISUITE[®] engineering software or via the startup list of the EtherCAT[®] master.

1. Setting in the MOVISUITE[®] engineering software.

The interpolation time is set using the MOVISUITE[®] engineering software under "Functions>Setpoints>CiA402".

The "Interpolation time period value" parameter 0x60C2.1 must correspond with the set interpolation time of the motion task of the EtherCAT[®] master. In case of a change to an unequal value in the EtherCAT[®] master, you must also make this change here.

	Device properties	4.2.9 CiA402								
	🚍 Device data									
	- Communication	Basic settings	\$		Control word	Tar	rget values	1	Profile values	
	Communication	Mode of operatio	n		Function	Value Targ	get position	ſ	Profile velocity	
	Basic settings	No mode assi	igned		Switch on	0	inc		0 inc/s	
	Drive train	Quick stop option	n code		Enable voltage	Targ	get velocity	5	Profile acceleration	
		Slow down on	n quick stop ramp and transit in	nto switch on disabled 🗏	Quick stop	0	inc/s		0 inc/s^2	
	S ^{oo} Drive train DT1	Quick stop decele	eration		Enable operation	Targ	get torque	5	Profile deceleration	
	Optimization DT1	3276800 inc/s*	^2		hm: Homing operation start	0.0	0 % nominal motor tore	line	0 inc/s^2	
	turnet and the second se				Operation mode specific			1	Positioning option code	
	unctions				Operation mode specific				Normal positioning	=
	Liputs/outputs				Fault reset					
	Tan Setpoints				Halt					
le:					Reserved					
	Retual values				Manufacturer specific					
	He Drive functions				Manufacturer specific					
					Manufacturer specific					
	F Technology functions				Manufacturer specific					
	Basic settings Basic settings				Manufacturer specific					
iL,	PO data									
11	Diagnostics CiA402	Offsets	h	nterpolation time period	Following error	Position rand	qe limit Soft	tware position limit		
	4 Status	Position offset	Ir	terpolation time period value	Following error window	Min position ran	ge limit Min	position limit		
	A. Process volume	0 inc		1 ms	-1 inc	0 inc	0 ir	ĸ		
	B HOCES Values	Velocity offset	Ir	nterpolation time index	Following error timeout	Max position ran	ge limit Max	position limit		
	Fault memory	0 inc/s		-3	0.000 s	0 inc	0 ir	ĸ		
11-		Torque offset								
		0.0 % nominal n	motor torque							

9007224122681099

2. Setting using the startup list of the EtherCAT[®] master.

During the startup phase of EtherCAT[®], important parameters can be written to the application inverter via CoE (SdO) service using the startup list. Do the following to enter the interpolation time in the startup list:

- Select the [Startup] tab
- Click [New]

• The following window opens:

Edit CANopen Star	tup Entry				×
Transition □ I -> P ☑ P -> S □ S -> 0	_ S → P _ O → S	Index (hex): Sub-Index (dec):	60c2 1 Complete Act	cess	OK Cancel
Data (hexbin): Validate Mask: Comment:	00 Interpolation	time period value			Hex Edit Edit Entry
Index	Name		Flags	Value	
 ■ 1C32:0 ■ 1C33:0 ■ 208E:0 ● 607B:0 ● 607D:0 ● 6099:0 	Sync Manage Sync Manage Digital inputs t Position range Software posit Homing speed	r 2 Parameter r 3 Parameter pasic unit e limit tion limit ds	RW RW RW		
E 60C2:0 60C2:01 60C2:02 E F030:0	Interpolation ti Interpolation ti Interpolation ti Module config	ime period me period value ime index jured list	RO RW RO		

24867937675

In the [Data] edit box, you can enter the interpolation time in the unit "ms". Click [OK] to add the value to the startup list.

6.6.4 Adjusting the PDO image

Up to 8 objects with 32 bits each can be added to the PDO image of the application inverter with the CiA402 device profile. In this way, manufacturer-specific objects can be added in addition to the required objects for the respective operating modes.

Some objects are already predefined and stored in the "Object Dictionary". However, any number of indexes of the application inverter can be added. For example, this allows for monitoring values that are changing quickly. Or further process-relevant values can be written.

Do the following to add values to the PDO image:

 Scan the network or create an EtherCAT[®] slave offline so it can be found under "I/ O>Devices".



22822108299

 Double-clicking a device opens a menu window. Select the [Process data] tab. Select "Output" or "Input" depending on whether you want to add output or input objects.

ync M	Manager:			PDO List:							
SM	Size	Туре	Rags	Index	Size	Name		Rags	SM	SU	
0	1024	MbxOut		0x1A00	10.0	Inputs		М	3	0	
1	1024	MbxIn		0x1600	14.0	Outputs		М	2	0	
2	14	Outputs									
3	10	Inouts									
∢ DO A	ssignmen	t:	Þ	PDO Content	(0×1600	J):					
∢ III DO A	Assignmen	t:	Þ	PDO Content	(0x1600 Size	D): Offs	Name	т	ype	Default (hex)	
∢ DO A	ksignmen	t:	Þ	PDO Content Index 0x6060:00	(0x1600 Size 1.0	0): Offs 0.0	Name Modes of operation	T	ype INT	Default (hex)	-
∢ III	kssignmen	t:	Þ	PDO Content Index 0x6060:00 	(0x1600 Size 1.0 1.0	0): Offs 0.0 1.0	Name Modes of operation	T	ype INT	Default (hex)	
∢ III DO A	kssignmen	t	Þ	PDO Content Index 0x6060:00 0x6040:00	(0x1600 Size 1.0 1.0 2.0	0): Offs 0.0 1.0 2.0	Name Modes of operation Control word	T S	ýpe INT IINT	Default (hex)	
4 DO A	lssignmen	t:	•	PDO Content Index 0x6060:00 0x6040:00 Predefined F	(0x1600 Size 1.0 1.0 2.0	0): 0ffs 0.0 1.0 2.0 ignment: (no	Name Modes of operation Control word	T S U	iype INT IINT	Default (hex)	

22822111371

3. A menu that allows to add objects opens by right-clicking the [PDO Content] field.

Index	Size	Offs	Name		Type	Default (hex)	1
0x6061:00	1.0	0.0	Modes of a	peration display	SINT		
-	1.0	10	_				
0x6041:00	2.0		Insert		UINT		-
Predefined F	DO Assic	×	Delete				
			Edit	L			
Load PDO in	to from de	-					
Sync Unit As	signment		Move Up				
			Move Down				

22822204043

25931873/EN - 03/2019



Adding from the predefined object dictionary

The [Edit] menu item takes you to the content of the object dictionary. Depending on the selection, you can add the respective objects to "Input" or "Output".

Adding specific indexes from SEW-EURODRIVE

If you want to add any number of indexes to the PDO image, you must enter the corresponding "Index" and "Subindex". You are free to choose any name.

Value of the EtherCAT® slave	Name	Index decimal	Subindex	Bit length
DC link voltage	DC link voltage	8364	1	32
Absolute torque-generating current	OutputCurrent	8364	118	32

All process values of the inverter that are added to the PDO image must have a data length of 32 bits. It does not matter which data type is used.

6.6.5 Settings for the "Cyclic synchronous position" (csp) operating mode

After the network has been scanned or after an application inverter with CiA402 device profile has been created offline, the basic links between I/O configuration and motion axis are already created in module 1.

A successfully completed motor startup is the prerequisite for operation.



22822214027

The application inverter with CiA402 device profile operates internally with 2¹⁶ increments per revolution as reference unit according to the CiA402 specification.

User units must be realized in the higher-level controller by the user.

For this purpose, you must make the following settings at the motion axis:

- 1. Setting the unit
 - mm
 - •
 - Degree
 - s
 - ...
- 2. Setting the user units

Observe the gear unit ratio. Also observe that a motor revolution is always 2¹⁶ increments and conform to CiA402.

- 3. Setting the dynamics
 - Maximum speed
 - Ramp up/down



You must select the operating mode via the PDO "Modes of operation" in addition to enabling of the axis in order to be able to select the csp operating mode. Value "8" must be written for this purpose.

Modes of operation display	Set Value Di	alog	×
Status word Position actual value	Dec:	8	ОК
Torque actual value	Hex	0x08	Cancel
Outputs Modes of operation Sv Control word	Float		
Target position	Book	0 1	Hex Edit
Target velocity	Binanr	18	1
WeState	Unitary.		· · · ·
InfoData	Bit Size:	○1 ●8 ○16 ○32 (64 🔘 ?

The PDO "Modes of operation display" reports back a value of "8".

 Module 1 (Switching modes of oper Inputs 	Variable Rags	Online	
Modes of operation display Status word	Value:	8	
Position actual value Torque actual value Outputs Nodes of operation	Comment:	Force	Write
문 Control word 문 Target position			
Se Target velocity			

22822834571

The display of the application inverter shows a value of "16".

6.6.6 Settings for the "Cyclic synchronous velocity" (csv) operating mode

After the network has been scanned or after an application inverter with CiA402 device profile has been created offline, the basic links between I/O configuration and motion axis are already created in module 1.

A successfully completed motor startup is the prerequisite for operation.



22826019723

For this purpose, you must make the following settings at the motion axis:

- 1. Setting the unit
 - mm
 - •
 - Degree
 - s
 -
- 2. Setting the user units

Observe the gear unit ratio. Also observe that a motor revolution is always 2¹⁶ increments and conform to CiA402.

- 3. Setting the dynamics
 - Maximum speed
 - Ramp up/down

You must select the operating mode via the PDO "Modes of operation" in addition to enabling of the axis in order to be able to select the CSV operating mode. Value "9" must be written for this purpose.



22826023435

25931873/EN – 03/2019



Module 1 (Switching modes of oper Inputs	Variable Flags	Online	
* Modes of operation display	Value:	9	
 Status word Position actual value 	New Value:	Force Release	Write
Torque actual value	Comment:		
Outputs Moder of operation			
Secontrol word			
Target position			
SP Target velocity			-
Ex Target torgue			

The PDO "Modes of operation display" reports back a value of "9".

The display of the application inverter shows a value of "15".

6.6.7 Settings for the "Profile position" (pp) operating mode

After the network has been scanned or after an application inverter with CiA402 device profile has been created offline, the basic links between I/O configuration and motion axis are already created in module 1 for the csp, csv and cst operating modes.

A successfully completed motor startup is the prerequisite for operation.

The "pp" operating mode can be used in two ways:

1. Manual adjustment of the PDO interface



22826149387

The upper 2 markings display the minimum configuration for cyclic control of the application inverter via the PDO interface. You can change the profile values for speed, acceleration and deceleration during operation.

- - Drive 9 (MOVI-C MOVIDRIVE CiA402)
 - Module 1 (Switching modes of operation (pp + pv))
 - 🔺 🛄 Inputs
 - Modes of operation display
 - 👻 Status word
 - Position actual value
 - Outputs
 - Modes of operation
 - Control word
 - Target position
 - Target velocity
 - Profile velocity
 Profile acceleration
 - Profile deceleration
 - Home offset
 - WcState
 - InfoData

Þ

24857969035

The application inverter with CiA402 device profile operates internally with increments (inc.) as reference unit. During motor startup, it is not possible to define user units.

The "pp" operating mode is usually used without motion axis if the TwinCAT engineering software is used so that the possible scalings do not affect the behavior of the drive inverter. Therefore, the profile values are directly specified via the PDO interface.

Bear in mind that all values must be specified in increments. The conversion factor is always 65536 inc/motor revolution.

The unit of the speed is always inc/s.

The unit of acceleration and deceleration is always inc/s².

Example:

Setpoint speed: 1800 min ⁻¹	30 1/s	1966080 inc./s
Deceleration/acceleration: 2 s	15 1/s ²	983040 inc/s ²

A successfully completed reference travel (homing, hm) of the drive is the basis for positioning. This information is reported back by the "homing attained" bit in the status word.

You must select the operating mode via the PDO "Modes of operation" in addition to enabling of the axis in order to be able to select the "pp" operating mode.





22826157067



Drive 8 (MOVI-C MOVIDRIVE CiA402)	TwinCAT Project1
 Inodale 1 (switching modes of operation) Inputs 	Variable Rags Online
Modes of operation display Status word Status word Policity actual value Position actual value Outputs Modes of operation Grotned word	Value: 1 New Value: Force Release Write Comment:
∰ Target position ⊯ Profile velocity ⊯ Positioning option code ⊯ Profile acceleration ⊯ Profile deceleration	

22826659339

The display of the application inverter shows a value of "24".

The "target reached" bit reports back that positioning has been successfully completed.





A rising edge on bit 4 of the control word is necessary to accept a new position.

[1] Actual speed

[2] New setpoint (bit 4)

[3] Setpoint target position

[4] Setpoint acceptance (bit 12)

[5] Target position reached (bit 10)

Position option code	Value
Standard positioning	0
Only in negative direction	64
Only in positive direction	128
Shortest way	192



The positioning type that can be selected via the "position option code" is only active if bits 5 and 6 of the control word are assigned. The function assignment is shown below.

Bit 6	Bit 5	Definition
0	0	Standard positioning comparable with linear axis. If the positioning lim- its (0x607B:2, 0x607B:1) are reached, the setpoint is automatically set to the other side of the limit. Positioning can be relative or absolute. Positioning beyond the modulo value is only possible with this bit com- bination.
0	1	Positioning only in negative direction: If the setpoint position is greater than the actual position, the axis moves beyond the minimum position limit (0x607B:1) to the setpoint position.
1	0	Positioning only in positive direction: If the setpoint position is smaller than the actual position, the axis moves beyond the maximum position limit (0x607B:2) to the setpoint position.
1	1	Positioning by the shortest possible route to the setpoint position. Information: If the distance between actual position and setpoint posi- tion is 180° in a 360 degrees system, the axis moves in positive direc- tion.



6.6.8 Settings for the "Profile velocity" (pv) operating mode

After the network has been scanned or after an application inverter with CiA402 device profile has been created offline, the basic links between I/O configuration and motion axis are already created in module 1 for the csp, csv and cst operating modes.

A successfully completed motor startup is the prerequisite for operation.

You need to adjust the PDO interface to use the "pv" operating mode.

1. Manual adjustment of the PDO interface



22826149387

The upper 2 markings display the minimum configuration for cyclic control of the application inverter via the PDO interface. You can change the profile values for speed, acceleration and deceleration during operation.

The lower marking shows the values for acceleration and deceleration. Alternatively, these can be also be operated acyclically via SdO services.



- - Drive 9 (MOVI-C MOVIDRIVE CiA402)
 - Module 1 (Switching modes of operation (pp + pv))
 - 🔺 📃 Inputs

.

- 🐑 Modes of operation display
- Status word
- Position actual value
- utputs 🔤
 - Modes of operation
 - Control word
 - Target position
 - Target velocity
 - Profile velocity
 - Profile acceleration
 - Profile deceleration
 - Home offset
- WcState
 InfoData

24857969035

The application inverter with CiA402 device profile operates internally with increments (inc.) as reference unit. During motor startup, it is not possible to define user units.

The "profile velocity mode" is usually used without motion axis if the TwinCAT engineering software is used so that the possible scalings do not affect the behavior of the drive inverter. Therefore, the profile values are directly specified via the PDO interface.

Bear in mind that all values must be specified in increments. The conversion factor is always 65536 inc/motor revolution.

The unit of the speed is always inc/s.

The unit of acceleration and deceleration is always inc/s².

Example:

Setpoint speed: 1800 min ⁻¹	30 1/s	1966080 inc./s
Deceleration/acceleration: 2 s	15 1/s ²	983040 inc/s ²

You must select the operating mode via the PDO "Modes of operation" in addition to enabling of the axis in order to be able to select the "pv" operating mode.

For this purpose, enter a value of "3".





 Module 1 (Switching modes of operation) Inputs 	Variable Rags Online	
Modes of operation display Status word Velocity actual value We Outputs Wodes of operation Sochrol word Sochrol Sochro Sochro Sochro Sochro Sochrol Sochrol Soch	Value: 3 New Value: Force Release Comment:	Wite

The PDO "Modes of operation display" reports back a value of "3".

The display of the application inverter shows a value of "3".

6.6.9 Using the "Homing" (hm) operating mode

The "Homing (hm)" operating mode enables the application inverter to perform a reference travel.

Reference travel types (homing methods) that can be selected during startup either via the PDO interface, SdO parameter services or via the MOVISUITE[®] engineering software are supported, see chapter "Object dictionary" ($\rightarrow \blacksquare 23$) or "Supported operating modes" ($\rightarrow \blacksquare 21$).

If a selection is to be made via the PDO interface, you need to adjust it beforehand.



22827462411

The marked "Homing method" PDO entry is important.

INFORMATION

i

i

If the "Homing method" entry is used in the PDO interface, it must also be written with a value. If the reference travel type is selected in the MOVISUITE[®] engineering software or if it is written via a parameter access, this value will be overwritten by the value in the PDO.

A selection of the reference travel type via SdO service is performed by writing the index 24728.0 dec (0x6098/0x7098) with the corresponding value from the assignment table.

You must select the operating mode via the PDO "Modes of operation" in addition to enabling of the axis in order to be able to select the "homing" operating mode. Value "6" must be written for this purpose.

The PDO "Modes of operation display" reports back a value of "6".

The display of the application inverter shows a value of "11".

INFORMATION

If the application inverter is operated in an interpolated "Mode of operation" (csp, csv, cst), a lag error occurs in the motion axis during the reference travel with the operating mode "homing". You must reset the motion axis before you can restart the travel process (danger: Speed monitoring fault due to compensation of the lag error). The lag error does not occur with the pp and pv operating modes where the closed loop system on the application inverter is closed.

25931873/EN - 03/2019



If the "homing" operating mode and a valid method are selected, you no longer need to start the reference travel separately because the corresponding bit in the control word has already been set.

A feedback is given via the "homing attained" bit in the status word of the application inverter with CiA402 device profile.

The operating principle of the reference travel types corresponds to the reference travel types that can be selected via FCB12.

If you start a reference travel in the manual mode of MOVISUITE[®], the method that is currently parameterized will be selected.

6.7 Data management via File over EtherCAT[®] (FoE)

If you use the FoE service, it is possible to back-up the parameter set of the application inverter via the engineering software or via the control program on the EtherCAT[®] master or on the engineering PC. It is also possible to load the saved data back to the application inverter.

The following data is included in the data set:

- Motor and startup data
- Safety parameterization, if required
- Scope data, if present

This means it is possible to completely replace the device without the need for restartup.

INFORMATION

1

i

Whether or not the FoE service can be used depends on the EtherCAT[®] master. For further information, refer to the manufacturer's documentation of the EtherCAT[®] master.

The following user interfaces are defined to prepare the application inverter for the FoE service.

	MDA/MDD axis 1	MDD axis 2
All parameters	Axis1_ParametersetComplete_mcex	Axis2_ParametersetComplete_mcex
Comparable para- meter	Axis1_ParametersetRestorableOnly_mcex	Axis2_ParametersetRestorableOnly_mcex

INFORMATION

Observe the notation of the user interface.

- Observe case sensitivity
- There must not be any spaces before or after a string

These user interfaces are required for data management via the engineering software of the EtherCAT[®] master as well as for data management from the control program.



6.7.1 Data management via the engineering software of the EtherCAT[®] master

Data management via the engineering software is only possible in the "Operational" (OP) operating mode of the application inverter.

For this purpose, you must select the application inverter and then the [Online] tab.



22316480267

On this display, you find the "File Acces Over EtherCAT" category and the [Download] and [Upload] options.

The options have the following functions:

- Upload: Stores the data set of the application inverter in a file structure of the engineering system. It is irrelevant whether a separate engineering PC or the EtherCAT[®] master is used as engineering platform.
- Download: Loads an already stored data set from a file structure of the engineering platform back to the application inverter.

Uploading data

Adhere to the following sequence to upload the parameters.

- 1. Select the [Upload] option
- 2. Select a file and choose a file name

Speichero unter
G V FoE_EtherCAT
Organisieren 🔻 Neuer Ordner
Dateiname: Dataset_NC-Axis1
Dateityp: EtherCAT Firmware Files (*.efw)
·

If the data set is also used with the MOVISUITE $^{\!\!\!\!\!^{\otimes}}$ engineering software, the file extension ".mcex" must be used.

Here: Dataset_NC_Axis1.mecx



3. Confirm the transfer to the user interface with [OK]. A password is not required.

	×
Axis1_ParametersetComplete_mcex	ОК
41 78 69 73 31 5F 50 61 72 61 6D 65 74 65 72	Cancel
31	
0000000	
	Axis1_ParametersetComplete_mcex 41 78 69 73 31 5F 50 61 72 61 6D 65 74 65 72 31 00000000

22316487563

4. The file is now available under the chosen name in the defined directory structure.

→ FoE_EtherCAT		▼ 4¢	AT durchsuchen
Organisieren 👻 In Bibliothel	k aufnehmen 👻 Freigeben für 👻 Brennen	Neuer Ordner	····
	^ Name	Änderungsdatum Typ	Größe
 ➡ Bibliotheken ➡ Bilder ➡ Dokumente ➡ Musik ➡ Videos 	E Dataset_NC-Avis1	L 22.11.2017 08:47 Datei	88 KB
1 Element			

22316489995

Downloading data

For downloading data, you must adhere to the following sequence:

- 1. Select the [Download] option
- 2. Select the file system and the file
- 3. Transferring the user interface
- 4. Confirm with [OK]

6.7.2 Data management via the PLC program

A sample function block for data management from the PLC program is provided by SEW-EURODRIVE. It is available for download from the website www.sew-eurodrive.com under "Online Support>Data & documents>Software".

More information can be found in the ReadMe file of the download package on the SEW-EURODRIVE website or in the block itself.

If you use the sample function block for FoE, the file with the file extension ".mcex" is saved and therefore it can be used with the MOVISUITE[®] engineering software.



6.8 Individual parameter access

It is possible to access individual parameters of the axes. Therefore, you can read out process values or adjust parameters to the basic conditions during operation.

The parameters of the application inverter are accessed via the standard SDO READ and WRITE services in CoE (CANopen over EtherCAT[®]).

A sample function block for data management from the PLC program is provided by SEW-EURODRIVE. It is available for download from the website www.sew-eurodrive.com under "Online Support>Data & documents>Software".

More information can be found in the ReadMe file of the download package on the SEW-EURODRIVE website or in the block itself.

6.8.1 SDO services READ and WRITE

The user interface is displayed differently depending on the EtherCAT[®] master or configuration environment. However, certain sizes and information on the performance of the service are always required:

SDO-READ	Description
Slave address (16 bits)	EtherCAT [®] address of the inverter from which data is to be read
Index (16 bits)	Address in the object directory of the inverter that is to be
Subindex (8 bits)	read
SDO-WRITE	Description
Slave address (16 bits)	EtherCAT [®] address of the inverter to which data is to be written
Index (16 bits)	Address in the object directory of the inverter that is to be
Subindex (8 bits)	written
Data	Structure in which the data to be written and their length is
Dulu	Subcure in which the data to be whiten and their length is

For the SDO services READ and WRITE, other flags and parameters might be necessary:

- For activating the function
- For "In-process messages" or error messages
- For timeout monitoring

Data length

• For reporting errors during the performance

To use the non-cyclical parameter access, the manufacturer of the EtherCAT[®] master usually provides corresponding libraries and function blocks.

Depending on the EtherCAT[®] master, the following libraries are required:

Controller platform	Libraries	Function blocks
Beckhoff	Tc2_EtherCAT.lib (Standard.Lib;	Read: FB_EcCoeSdoRead
	TcBase.Lib; TcSystem.Lib,	Write: FB_EcCoeSdoWrite
	TcUtilities.Lib)	
	For more information on error nur	nbers, refer to the Beckhoff InfoSys.

25931873/EN - 03/2019



INFORMATION



With a double axis, you can access the second axis of the module via an index offset of 0x1000 (4096 dec).

6.8.2 Example: Reading a parameter in TwinCAT via EtherCAT[®]

The function SDO-READ is available for reading parameters. The index and subindex of the parameter to be read is necessary.

This information can be generated from the MOVISUITE[®] engineering software in different ways:

Tooltip of the parameter

Move the mouse cursor over the edit box or display field of the parameter. An information window with the index number opens. The subindex is separated by a period.

Actual values			Utilization	
Function	Value		Function	Value
Stator frequency	0.000 Hz		Electromechanical utilization	0.000 %
Relative apparent current	0.000 % nominal device curre	ent	Heat sink utilization	0.000 %
Relative torque-generating current	0.000 % nominal device curre	ent	Heat sink temperature	24.82 °C
Relative field-generating current	0.000 % nominal device curre	ent	Thermal current limit	435.253 %
Absolute apparent current – rms value	0.000 A		Total utilization	0.000 %
Absolute torque-generating current	0.000 A			
Absolute field-generating current	0.000 A			
DC link voltage instantaneous value	605.197 V			
Absolute setpoint voltage value - rms value	Menu	6.2.2-1.8-1		
	Index	8364.160		
	Range of values	Uint32		
	SI unit	v		
	Can be used in Scope	Yes		
	Read access	OBSERVER		
	Write access	NOBODY		
	Values	Device	Display	
	Value	605197	605.197	
	Minimum	0	0.000	
	Default	0	0.000	
	and the second se	4204067205	4204067.205	

9007221217285003

 You can search for the parameter using the MOVISUITE[®] search function. After that, the tooltip can be used.

The "FB_EcCoeSdoRead" function block can be integrated into the control program of the EtherCAT[®] master in 2 steps:

- 1. Creating an instance of the function block "FB_EcCoeSdoRead"
- 2. Assigning the inputs of the function block:
 - sNetID: Specifying the net ID of the EtherCAT[®] master.
 - nSlaveAddr: EtherCAT[®] address of the device from which data is to be read.
 - nIndex: Specifying the index of the parameter to be read. When using a doubleaxis module, the index of the second axis is assigned with an offset of 0x1000 (4096 dec).
 - nSubIndex: Subindex of the parameter to be read.

- pDstBuf: Pointer to the data range in which the read parameter is to be stored.
- cbBufLen: Maximum memory size for parameters to be read in byte. For SEW-EURODRIVE, it is always 4 bytes.
- bExecute: A positive edge starts the read process.
- tTimeout: Timeout interval of the function unit.

The output flags "bBusy" and "bError" indicate the status of the service. "nErrld" shows the error number when the "bError" flag is set if an error occurs.

The integration in TwinCAT looks as follows:

xpre	ssion		Type	Value	Prepared value	Address
6.0	fbF	B_EcCoeSdoRead	FB_EcCoeSdoRead			
4	Rea	adData	DINT	624451		
4	Dat	ta	DINT	624		
4	bex	recute	BOOL	FALSE		
8	2 (* 3 4	<pre>fbFB_EcCoeSdoRead(sNetID 192.168.20 + := '192.168.20.2.2.1', (nSlave2ddr1008 := 1008 (#EtberC2)</pre>	*AMS Net ID of the EtherC	AT master*)		
-	2 (*) 3 4 5 6 7	fbFB_ECCes3doRead (sNetIO 192:1820 b := '192.168.20.2.2.1', (nSlaveAdd(1000) := 1008, (*EtherCA nSubIndex(190) := 160, (*DC-Volt nIndex(190) := 3844, (*DC-Volt nDreFsr(122004300) := 3084, (*DC-Volt	*AMS Net ID of the Ether T Address of the CiA402 A age -> Subindex*) Voltage -> Index*) (*Pointer to the w	AT master*) xis*) ariable of t	he data*)	
	2 0 3 4 5 6 7 8 9 0	fbFE_ECCoeSdoRead(sBetID_254820 > != '192.160.20.2.2.1', (nSlaveAddr_1008 := '1000, (*EtherCA nSubIndexEmp := 160, (*CC-Volt nIndexEMP := 160, (*CC-Volt nIndexEMP := 2844, (*CC-Volt nDutBut[22284200 := ADR(ReadDate 54451, c obsutter notesting file i= 4, bExecute[7455]	*AMS Net ID of the EtherG I Address of the CiA402 A age -> Subindex*) Voltage -> Index*) (*Pointer to the v	AT master*) xis*) ariable of t	he data*)	

21962546443

After a "Rising Edge" to "bExecute", you can find the current value (here: DC link voltage) in the corresponding variable. You then have to scale the variable accordingly (in the example: 1000).

6.8.3 Example: Writing a parameter in TwinCAT via EtherCAT[®]

The SDO-WRITE function is available for writing parameters. The index and subindex of the parameter to be written is necessary.

This information can be generated from the MOVISUITE[®] engineering software in different ways:

Tooltip of the parameter

Move the mouse cursor over the edit box or display field of the parameter. An information window with the index number opens. The subindex is separated by a period.



Limits		Lin	nit values f	rom startup	
	DT1				DT1
Voltage limit	400.000 V	M	aximum speed	at motor shaft	5400 1/min
		Menu	4.6.3-2.1-1	1	Im
		Index	8357.17		
	Ran	nge of values	Int32		
		SI unit	v		
	Can be u	sed in Scope	No		
		Read access	OBSERVER		
		Write access	OPERATOR	R	
		Values	Device	Display	
		Wert	400000	400.000	
		Minimum	0	0.000	
		Default	0	0.000	
		Maximum	1000000	1000.000	

9007221217289867

• You can search for the parameter using the MOVISUITE[®] search function. After that, the tooltip can be used.

The "FB_EcCoeSdoWrite" function block can be integrated into the control program of the EtherCAT[®] master in 2 steps:

- 1. Creating an instance of the function block FB_EcCoeSdoWrite
- 2. Assigning the inputs of the function block:
 - sNetID: Specifying the net ID of the EtherCAT[®] master.
 - nSlaveAddr: EtherCAT[®] address of the device to which data is to be written.
 - nIndex: Index of the parameter to be written. When using a double-axis module, the index of the second axis is assigned with an offset of 0x1000 (4096 dec).
 - nSubIndex: Subindex of the parameter to be written.
 - pDstBuf: Pointer to the data range in which the values to be written are located.
 - cbBufLen: Length of data to be sent in bytes. For SEW-EURODRIVE, it is always 4 bytes.
 - bExecute: A positive edge starts the write process.
 - tTimeout: Timeout interval of the function unit.

The output flags "bBusy" and "bError" indicate the status of the service. "nErrId" shows the error number when the "bError" flag is set if an error occurs.

The integration in TwinCAT looks as follows:



To write the correct value, it must be scaled according to the time parameter (here: voltage limit) prior to the "Rising Edge" to "bExecute" (in the example: 1000).

pression		Type	Value	Prepared value	Address
🕴 🏟 fbFl	B_EcCoeSdoWrite	FB_EcCoeSdoWrite			
Ø Writ	teData	DINT	400000		
Ø Dat	a	DINT	400		
ø bex	ecute	BOOL	FALSE		
2 • 3 4 • 5	WriteData 40000 := Data 400 *1000; fbFB_EcCoeSdoWrite (sNetID '19218520 > := '192.168.20.2.2.1',	(*Scaling the raw (*ANS Net ID of the Ether)	data to the	actual value*)	


6.9 Starting up FSoE of an FSoE master using the example of Beckhoff

6.9.1 Startup with MOVISAFE[®] card CS..A at FSoE master

Requirements

- The higher-level F-PLC must support the iPar CRC mechanism.
- For a successful startup, you need the "Assist CS.." parameterization tool. You can open the "Assist CS.." parameterization tool directly in the MOVISUITE[®] engineering tool (from MOVISUITE[®] version 1.2 or higher; download from www.sew-eurodrive.com).
- Additional requirements for using MOVISAFE[®] CS..A with FSoE fieldbus connection via EtherCAT[®]:
 - FSoE master.
 - TwinSAFE engineering plug-in for TwinCAT.
 - Current ESI file; available for download from www.sew-eurodrive.com.

INFORMATION

To ensure proper functioning of FSoE communcation, there must not be any error pending for non-safe EtherCAT[®] communication.

Bear in mind that the option of connecting a MOVISAFE[®] card CS..A to an FSoE master depends on the manufacturer of the FSoE master.

Manufacturer	Connecting FSoE slaves of third-party manufacturers
Beckhoff	Supported
OMRON	Not supported

Settings for the MOVISAFE® card CS..A

In addition to setting the parameters for the drive safety functions, the respective safety protocol and the FSoE slave F-address must also be set.

Setting the safety protocol

i

The MOVISAFE[®] card CS..A supports several safety protocols. If you want to use FSoE, you have to make this setting during startup.





Setting the FSoE address

The FSoE slave F-slave address must be identical with the address set in the FSoE master. You can set the address in the menu shown below:

Checksum overview	4.9.15 F-communication
Basic settings	
Safe inputs	Configuration FSoE slave
Safe outputs	F-protocol type
Encoder	FSoE
F-communication	
User units	
STO/SBC	
SSx	
SOS	
SLS/SSM/SSR	
SDI/SLI	
SLA	
Function assignment	

27202715915

The FSoE slave F-address must be unequal 0.

Settings at the FSoE master

The settings to be made at an FSoE master are shown using the example of a Beckhoff controller EL9600 and the software module TwinSAFE for TwinCAT3.

Perform the following steps in the specified order:

- 1. Create the I/O configuration by scanning the network or using offline configuration.
- 2. Establish the non-safe EtherCAT[®] communication and check it.
- 3. Adjust the slot configuration of the EtherCAT[®] slave.
- 4. Create the safety project and select the target system (FSoE master).
- 5. Create the SEW alias device.
- 6. Link the FSoE slave to the safety project.
- 7. Set the FSoE slave F-address and the IPAR CRC address.
- 8. Select the safety function.



Adjusting the slot configuration of the EtherCAT[®] slave

For the following devices you have to insert the FSoE module into the second slot "DriveSafety Axis1":

- MDA90A single-axis module
- Left side of an MDD90A double-axis module
- MOVIDRIVE[®] system MDX90A

ot	Module	ModuleIdent		Module	ModuleIdent	Description	
Axis 1	Mode of operation - CSP	0x04020002	<	FSoE Safety IO 48 bit	0x04020081	FSoE Safety IO 48 bit	
😳 DriveSafety Axis 1							
🕑 Axis 2			X				
DriveSafety Axis 2							

For an MDD90A double-axis module you have to use the fourth slot "DriveSafety Axis2":

lot	Module	ModuleIdent		Module	ModuleIdent	Description	
	Mode of operation - CSP	0x04020002	<	FSoE Safety IO 48 bit	0x04020081	FSoE Safety IO 48 bit	
Drive Safety Axis 1	FSoE Safety IO 48 bit	0x04020081					
🔗 Axis 2			X				
Drive Safety Axis 2	FSoE Safety IO 48 bit	0x04020081					

With an MDD90A double-axis module, you can use either both axis halves independently of one another or both halves simultaneously with MOVISAFE[®] cards CSS..A. You have to insert FSoE modules accordingly.

Following an overview of FSoE modules you can use:

Axis type	FSoE module
-E00 axis	FSoE safety I/O 48 bit (0x04020081)

Creating the safety project and selecting the target system

To being able to establish an FSoE communication, you have to link the hardware of the FSoE master with the software. You can connect the FSoE master either via the backplane bus or via the EtherCAT[®] network.

Solution Explorer 🛛 👻 🕂 🗙	Untitled1 🕫 ×	ж.
© ⊙ 🔂 🗿 • 🗗 🖌 Search Solution Explorer (Ctrl+0) 👂 •	Target System Configuration: N/A Platform: N/A	•
Solution 'FSoE_Doku' (1 project) FSoE_Doku SVSTEM MOTION	Backup/Restore Project Settings Target System: Choose physical terminal for mapping	EL6900
P.C. SSETY SSETY SUbrited Target System b ⊒ TwinSafeGroup1 C++ b ⊒ VC	Cross load device OK Search: Devices (EtheCAT) Devices (EtheCAT) Terminal: Devices (EtheCAT) Terminal: Etherminal etablicity Etherminal etablicity Etablicity	Derice is an extend dence rot available rot available Map Project CRC 1 0 1 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 1 0 1

27202826763

The FSoE address of the master must be identical with the address of the master hardware.



Creating an alias device

You have to create an alias device to link the FSoE slave with the safety project. This alias device is the representative of the safety slot in the FSoE master created in the I/ O configuration.

The alias device is created under the "TwinSafeGroup" safety module under "Alias Devices".



27511969035

To create the alias device, right-click "Alias Device" and select "Add New Item".

da New Item - Ontitied1					×
Installed	Sort by:	Default - III IE		Search Installed Templates (Ctrl+E)	ρ.
Standard A Safety	ď.	0x00000180 - FSoE Safety IO 48 bit (FSoE Safety IO 48 bit)	Safety	Type: Safety	
 EtherCAT Beckhoff Automation GmbH Beckhoff Automation GmbH SEW-EURODRIVE 	£1	0x04020081 - FSoE Safety IO 48 bit (FSoE Safety IO 48 bit)	Safety		
KBus PROFIsafe					
Online					
		Click here to go online and find templates.			
Name: FSoE_SEW					

27202936075

Assign a name and click "Add". The alias device is now created.



Linking the FSoE slave with the safety project

The alias device must be linked with the slot of the "PhysicalDevices" in the I/O configuration to establish an FSoE communication.





Use the "Linking" tab for this purpose. This is where all configured FSoE slots are in-

27511975435

Clicking [OK] creates the linking of the alias device with the FSoE slave. If several FSoE modules are available, they will be displayed as selected.

Setting FSoE slave F-address and IPAR CRC

You can set the FSoE address under "FSoE Address". The FSoE address must correspond with the value for "Dip Switch" (8 in the example).



27202940811

If the system is in RUN mode, you can read the address set using "Assist CS..".



You can set the "iPAR CRC" under "Safety Parameters". This value must correspond with the "ParCRCBus" value of the CS.. card.

FSoE_SEW.sds* ↔ × Linking Connection Safety Parameters Process Image Index Name Value Safety Parameter >1< 4 E800.0 0x00000000 (0) E800:01 ParCrcBus Set Value Dialog X 1445962628 Dec: OK 0x562FA384 Hex: Cancel Bool: <u>0</u> 1 84 A3 2F 56 4 Binary: ◎ 1 ◎ 8 ◎ 16 ◎ 32 ◎ 64 ◎ ? Bit Size

27204385035

You can read the "ParCRCBus" value in the MOVISUITE[®] engineering software:

tion
Value
FSoE
0000008
566994884

Selecting the safety functions

You can read the assignment of FSoE data words and bit-wise assignment of the safety functions in the MOVISUITE[®] engineering software.

You have to make the linking in the safety program according to these settings.

Safety functions are always 0-active. This is why the following applies to the assignment of bits in the safety functions:

Status of monitoring	Value of process data
Monitoring active	0
Monitoring not active	1



²⁷²⁰⁴³⁸²⁶⁰³

7 Connection to the MOVISUITE[®] engineering software

There are different options to establish a connection to the MOVISUITE[®] engineering software to start up the application inverter:

- Using the mailbox gateway of the EtherCAT[®] master when using the "Ethernet over EtherCAT[®]" (EoE/VoE) function.
- Single-axis connection via the interface adapter from SEW-EURODRIVE.
- Direct connection via EtherCAT[®] without EtherCAT[®] master for scanning all devices from SEW-EURODRIVE in the network.

The following section describes these options.



7.1 Connection via the TwinCAT mailbox gateway using the Ethernet over EtherCAT[®] (EoE/VoE)

The EoE mechanism is used as the basis for engineering via the mailbox gateway. The EoE protocol is converted into a VoE protocol via the mailbox gateway. In this way it can be used as the company's own data stream protocol.

The following description refers to the connection of the MOVISUITE® engineering software to a CX2020 controller from Beckhoff and TwinCAT3.

There are 2 cases that must be observed when connecting the MOVISUITE[®] engineering software:

1. MOVISUITE[®] and EtherCAT[®] master are installed on the same device hardware.



- [3] Internal IP routing via EoE
- Mailbox gateway MBX [4]

PC

[1]

[2]

- EtherCAT® (VoE)
- 2. MOVISUITE[®] and EtherCAT[®] master have a different device hardware.



The description refers mainly to case 2. Settings that are relevant for case 1 are marked accordingly.



7.1.1 Setting the PLC from Beckhoff

It is important to establish the remote connection to the controller as administrator in order to check or change the settings.

For this reason, the network interface of the engineering PC and the engineering interface of the EtherCAT[®] master must be located in the same network area.

Example:

	IP address	Subnet mask	Standard gateway
Engineering PC	192.168.20.xx	255.255.255.0	Optional
EtherCAT [®] master	192.168.20.zz	255.255.255.0	Optional

It is important that the last octet (zz/yy) is different. You do not have to use the standard gateway.

Activating IP routing

You must open the Windows command prompt of the engineering PC and request the current settings using the "ipconfig/all" command to check whether IP routing is activated or not.

Administrator: C:\Windows\system32\cmd.exe	- • ×
Microsoft Windows [Version 6.1.7601] Copyright (c) 2010 Microsoft Corporation. All rights reserved.	Â
C:\Users\Administrator>ipconfig /all	
Windows IP Configuration	E
Host Name : CX-1620B6 Prinary Dns Suffix : Node Type IP Routing Enabled : Yes	
WINS Proxy Enabled No	

21963193739

If the IP routing is not activated (standard: deactivated), the user must activate it. The way changes are made depends on the operating system.

One option is to change routing via the general services.

Enter "services.msc" in the Windows function "Run" to open the services.

🖅 Run	×
	Type the name of a program, folder, document, or Internet resource, and Windows will open it for you.
Open:	services.msc 🗸
	🐨 This task will be created with administrative privileges.
	OK Cancel Browse

- Open the "Routing and Remote Access" properties via the context menu (right mouse button).
- Set the startup type to "Manual".



🧠 Remote Packet Capture Protoco	Allows to ca		Manual
🔍 Remote Procedure Call (RPC)	The RPCSS	Started	Automatic
🧠 Remote Procedure Call (RPC) Lo	In Windows		Manual
🔍 Remote Registry	Enables rem		Manual
🤐 RIP Listener	Listens for r	Started	Automatic
🎑 Routing and Remote Access	Offers routi		Automatic
🧠 RPC Endpoint Mapper	Resolves RP	Started	Automatic
🔍 Secondary Logon	Enables star		Manual
🔍 Secure Socket Tunneling Protoc	Provides su	Started	Manual

21963198603

uting and Remote Access Properties (Local Computer)
General Log On Recovery Dependencies
Service name: RemoteAccess
Display name: Routing and Remote Access
Description: Offers routing services to businesses in local area and wide area network environments.
Path to executable: C:\Windows\System32\svchost.exe -k netsvcs
Startup type: Automatic
Automatic (Delayed Start) Automatic Manual
Service status: Stopped

Now, manually start the service. ٠

sa nemote negistry	y	criables remin		manual	LUCAL SERVICE		
🔍 RIP Listener		Listens for r	Started	Automatic	Local Service		
🔍 Routing and Re	mote Access	Offers routi					
🔍 RPC Endpoir	Start	Ives RP	Started	Automatic	Network Service	-	
🔍 Secondary L	Stop	les star		Manual	Local System		-
🔍 Secure Sock	Pause	des su	Started	Manual	Local Service		-
🔍 Security Acc	Resume	startup	Started	Automatic	Local System		
🔍 Security Cen	Destaut	NSCSV		Disabled	Local Service		
🗟 Server	Residiri	orts fil	Started	Automatic	Local System		
🗟 Shell Hardwa	All Tasks	▶ des no	Started	Automatic	Local System		
🖁 Simple TCP/		orts th	Started	Automatic	Local Service		
Smart Card	Refresh	ages ac		Manual	Local Service		
🕼 Smart Card F	Properties	vs the s		Manual	Local System		
	Help						



Setting the firewall on the engineering PC

You must activate 2 ports of the firewall on the engineering PC so that routing of the MOVISUITE $^{\mbox{\tiny \$}}$ data works.

- Port 48898 protocol TCP incoming
- Port 48899 protocol UDP incoming



21963215627

Open the "Windows Firewall" settings via the Windows control panel.



Under "Advanced settings" you can find rules for incoming and outgoing protocols.



21963220491

Activate both ports via the context menu.

P Windows Firewall with Advance	ed Security										
File Action View Help											
* + 2 m b 2 m											
P Windows Firewall with Advance	Inbound Rules										
E Inbound Rules	Name	Group	Profile	Enabled	Action	Override	Program	Local Address	Remote Address	Protocol	Local Port
Composition Security Pulses		AI	Yes	Allow	No	Any	Any	Any	TCP	4852	
Monitoring	W TwinCAT ADS (TCP)		Al	Yes	Allow	No	Any	Any	Any	TCP	48898-48899
Monitoring	TwinCAT ADS (TCP) TwinCAT ADS (UDP)		AI AI	Yes Yes	Allow Allow	No No	Any Any	Any Any	Any Any	TCP UDP	48898-48899 48898-48899

21963222923

Setting the Ethernet adapter of the EtherCAT[®] master



21963225355

If an EtherCAT[®] phase is forwarded via an EK1110 (EtherCAT[®] connection of Beckhoff), TwinCAT automatically creates a virtual Ethernet adapter in "RUN" operating mode (not visible in "Configuration" operating mode).

This is only possible if a working TwinCAT configuration is loaded. For this reason, you must assign an IP address to the virtual adapter that can be found in the subnet mask of the mailbox gateway.

Example:

- IP address mailbox gateway: 192.168.10.254
- IP address virtual Ethernet adapter: 192.168.10.1



Internet Protocol Version 4 (TCP/IPv4)	Properties ? 🗙				
General					
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.					
Obtain an IP address automatical	ly				
Output the following IP address:					
IP address:	192.168.10.1				
Subnet mask:	255 . 255 . 255 . 0				
Default gateway:	· · ·				

When using a real network adapter, you can also set the IP address in "Configuration" operating mode. You must observe the same criteria described for selecting a virtual adapter when selecting the IP.



21963230219

The Beckhoff PC is now enabled to route.



Setting the EtherCAT[®] mailbox gateway in the TwinCAT system 7.1.2

The following section describes the necessary settings in the TwinCAT system manager.

INFORMATION

Addresses with 169.x.x.x may cause problems as the address range is often used as "emergency address range" by Windows.

INFORMATION

Address ranges that are far apart may cause problems. If the last 2 octets differ from each other, it works in most cases.

Example:

- IP address TwinCAT system (engineering port): 192.168.20.2
- IP address mailbox gateway: 192.168.x.x

Setting TwinCAT in the system manager

i

i

A correct project including I/O configuration must have been created to set TwinCAT.

The project must be in "Configuration" operating mode. If the TwinCAT system is in "RUN" operating mode, you can activate the "Configuration" operating mode in the toolbar. You must activate the EoE support under "Advanced settings" in the EtherCAT[®] master.



21963235083

INFORMATION

Several EtherCAT[®] masters can be used at the same time. If the mailbox gateway is to be used with several masters, each mailbox gateway must be assigned its own address. These addresses must differ, but they must be in the same subnet.

You must now transfer the changed configuration to the EtherCAT[®] master and set the TwinCAT system to the operating mode "RUN".



i





7.1.3 Setting the engineering PC

To be able to access the application inverters with the startup software via the mailbox gateway, you must configure a static route.

You need administrator rights.

You must open the Windows command prompt to configure a static route. In this example, the following IP addresses are assigned:

- TwinCAT system: 192.168.20.2
- Mailbox gateway: 192.168.10.254

This results in the following command line:

"route -p add 192.168.10.254 MASK 255.255.255.255 192.168.20.2"

Administrator: C:\Windows\system32\cmd.exe			_ Ο Σ	3
C:\>poute -p add 192.168.10.254 MAS OK! C:\> IP Adresse Mailboxgateway	K (255.255.255.25 Subnetzmaske	5 192.168.20.2 IP Adresse Twincatsystem		< <u> </u>

21963237515

The entered route can be checked using the "route print" command.

Aktive Routen: Netzwerkmaske Gateway Schnittstelle Metrik 0.0.0.0 0.0.0.0 10.3.152.1 10.3.159.10 25 Ständige Routen: Netzwerkadresse Netzmaske Gateway Schnittstelle Metrik Ständige Routen: Netzwerkadresse Netzmaske Gatewayadresse Metzmaske 192.168.20.2	IPv4-Routentabelle				
Ständige Routen: Netzwerkadresse Netzmaske Gatewayadresse Metrik 192.168.10.254 255.255.255 192.168.20.2 1	Aktive Routen: Netzwerkziel 0.0.0.0	Netzwerkmaske 0.0.0.0	Gateway 10.3.152.1	Schnittstelle 10.3.159.10	Metrik 25
	Ständige Routen: Netzwerkadresse 192.168.10.254	Netzmaske 255.255.255.255	Gatewayadresse 192.168.20.2	Metrik 1	

21963239947

Testing the settings

If all settings have been made, you can test these using a PING to the mailbox gateway. Check again if the TwinCAT system is in "RUN" operating mode.

C:\Users\ >ping 192.168.10.254
Ping wird ausgeführt für 192.168.10.254 mit 32 Bytes Daten: Antwort von 192.168.10.254: Bytes=32 Zeit=2ms TTL=126 Antwort von 192.168.10.254: Bytes=32 Zeit=1ms TTL=126 Antwort von 192.168.10.254: Bytes=32 Zeit=1ms TTL=126 Antwort von 192.168.10.254: Bytes=32 Zeit=1ms TTL=126
Ping-Statistik für 192.168.10.254: Pakete: Gesendet = 4, Empfangen = 4, Verloren = 0
(0% Verlust), Ca. Zeitangaben in Millisek.: Minimum = 1ms, Maximum = 2ms, Mittelwert = 1ms

21963242379

If this test is negative (ping request not answered), the mailbox gateway cannot be used in the engineering software.



7.1.4 Setting the engineering software

When you create a new project, you must adjust the communication settings for using the mailbox gateway.

Depending on the used hardware and network topology, you may need to increase the timeout delay.

	≡*standard				(i) Sat	O Projecti	Contact	(B) Language) Settings	() Program information	×
New project 1											
Version EAG1 Created as 2002/07/04 FASHS AND SAME United and approximate And Same And Development and And Same And Press Same Same Same Same And Press Same Same Same And Press Same Same Same And Press Same Same Same And Press Same Same Same And Same Same Same Same Same Same Same Same	Projects Network type (thernet thercAT#/SBu/PL//S USB	Scan Q	Ethernet Scan settings Constant	0	Padowson (and a Inter non Interna (Ban-Call) 1010 III. Inter non	difres ranged) IP address I matter II matter IP address	u u g	Bari Tran 200	ic settings out m		
		_	App.	_	Cancel	_	_		_		
U								Version: Fieldte	et 🙁 Pro	jet <u>⊐</u> -U	Devices

9007221217985803

If scanning worked, it will be displayed in the network view as follows.

7.1.5 Connection diagnosis

If no connection can be established via the mailbox gateway, you must request the following points:

- Can the mailbox gateway be pinged from the engineering PC?
- Is the TwinCAT system in "RUN" operating mode?
- Are all connected axes in the "Operational" operating mode?
- Do the addresses of the network adapter correspond to the ones in the configured route?

If one of these questions is answered with "NO", there is an incorrect setting.

7.2 Direct connection via EtherCAT[®] without EtherCAT[®] master

Direct connection via the integrated EtherCAT[®] is one option to start up the complete system of application inverters without EtherCAT[®] master in advance.

	≡*standard)) Stat	O Projecti	Content	(B) Language) Settings	(i) Program information	×
New project 1										
New project a Verse Edit Control or 2020/2018 2044 AM bit sharps 2020/2018 2044 AM bit sharps 2020/2018 2044 AM bit sharps 2020/2018 AM Prove. See See M. See M. See M. Ser M. Ser M. Ser M. Ser M. Ser M. Sec	Projects Network type Dhereet USHCAT #/SBuRUS USB	Scan Q	EtherCAT®/SBusPLUS Son settings Son texeCATER/StartUS Constitutions Decadations/toxer/starter/starter Constitutions/toxer/starter/starter UAX versionArg 2 UAX versionArg 2	Basic settings Tenesal 200 m						
			Apply	Cancel						
۲							Version: Fieldtest	A Poje	< <u>□</u> -8	Devices

9007221217993099

You must use the active LAN connection of the engineering PC for this purpose.



21963254539

In the figure illustrated above the axis system consists of standard axes and one CiA402 axis.

8 Appendix

8.1 Abbreviation Key

Abbreviation	Meaning
CiA402	CiA402 is the abbreviation for a device profile that has been defined by the organ- ization "CAN in Automation" specifically for servo drives. It defines the structure of the object list and the functionalities that are assigned to the individual objects. Furthermore, it defines the state machine (states, error behavior). Additionally, it offers manufacturer-specific functions and setting options.
	In addition to the CiA402 device profile, there are profiles for sensors and control- lers (CiA404), linear and rotating encoders (CiA406), hydraulic valves and drives (CiA408) and input/output modules (CiA401).
CNC	Computerized Numerical Control
CoE	CAN open over EtherCAT [®] . This protocol is usually used for access to individual device parameters (SDO service). There is either a read or write access.
csp	Cyclic synchronous position. Synchronized position specification. The closed loop system is closed on the higher-level controller.
cst	Cyclic synchronous torque. Synchronized torque specification. The closed loop system is closed on the higher-level controller.
CSV	Cyclic synchronous velocity. Synchronized speed specification. The closed loop system is closed on the higher-level controller.
DHCP	Dynamic Host Configuration Protocol. The protocol is used to manage IP ad- dresses in a TCP/IP network and to assign them to the requesting Ethernet sta- tions. The assignment is usually performed by a DHCP-server.
EoE	Ethernet over EtherCAT [®] . Is used when the mailbox gateway is used. The data streaming protocol from SEW-EURODRIVE is tunneled from the master to the slave in a VoE protocol.
ESI	The ESI file (XML file) contains the device descriptions and information that are essential for successful startup of the application inverters on an EtherCAT [®] master.
F-PLC	Fail-safe controller. This is where both the safety program and safe communication are processed.
FoE	File over EtherCAT [®] . Used to upload and download complete parameter sets via EtherCAT [®] . This function is normally used for data management of frequency parameters.
FSoE	FailSafe over EtherCAT®
hm	"Homing" operating mode. This operating mode allows for inverter reference travel.
iPar CRC	See ParCRCBus.
NC	Numerical control. Is usually referred to as NC axis. This axis closes the closed loop system of the drive inverter in the EtherCAT [®] master and generates the setpoints of speed and position.
ParCRCBus	Checksum of the safety function on the card. Is used for comparison with the F-PLC.
рр	"Profile position" operating mode.
pv	"Profile velocity" mode.
TwinCAT	Engineering software of Beckhoff.

25931873/EN - 03/2019



Abbreviation	Meaning
VoE	Vendor specific protocol over EtherCAT [®] . This mechanism is used to tunnel manufacturer-specific protocols into the EtherCAT [®] . SEW-EURODRIVE uses this option to implement engineering via the MOVISUITE [®] engineering software.

 			 						_					_										
															i									
]]]]	1]]]	ſ]]	I]]		ſ]	
									_															
													ĺ		Ì									
 				\vdash	\vdash	\square			 								_							
									_								_							
 									_					_								\rightarrow		_
		 	 		\square				 									 			 			









SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Str. 42 76646 BRUCHSAL GERMANY Tel. +49 7251 75-0 Fax +49 7251 75-1970 sew@sew-eurodrive.com → www.sew-eurodrive.com