Changeover, CU240S to CU240E-2 (Firmware V4.4)

SINAMICS G120

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SIEMENS

Question

What do I have to observe if I wish to replace a member of the CU240S family (CU240S, CU240S DP, CU240S DP-F, CU240S PN or CU240S PN-F) of SINAMICS G120 by a CU240E-2 (Firmware V4.4)?

Answer

To respond to this question with the appropriate amount of detail, follow the instructions and notes listed in this document.

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1 Presentation of SINAMICS G120 CU240E-2

SINAMICS G120 CU240E-2 (Firmware V4.4) has, as successor to the CU240S (CU240S, CU240S DP and CU240S DP-F), the following new and additional properties:

Communication (see Chapter 3 for details)

- Slave-to-slave communication for direct data exchange between converters.

Safety functions (for details, refer to Chapter 7)

- The STO (Safe Torque Off) safety function is integrated in all versions as standard.
- The –F versions of the CU240E-2 (CU240E-2 –F, CU240E-2 DP-F and CU240E-2 PN-F) have the following safety functions: STO (Safe Torque Off), SS1 (Safe Stop 1), SLS (Safely Limited Speed) with up to 4 parameterizable limit values, SSM (Safe Speed Monitoring) and SDI (Safe Direction). Just as before, speed feedback using an encoder is not required for these safety functions.
- Direct control of the safety functions via onboard F-DIs or via PROFIsafe (Profibus and Profinet) from a fail-safe control system.
- Fail-safe transfer of the F-DI status via PROFIsafe for the CU240E-2 DP-F and CU240E-2 PN-F. As a consequence, the F-DI of the converter can be used as distributed I/O of an F control system.
- Maximum value of the SS1 down ramp has been increased (CU240S: max. 99s referred to 200Hz ➔ CU240E-2: max. 1000s referred to the reference speed (e.g. 1500 rpm)).

Commissioning and optimization

- Increased degree of operator friendliness using the BOP-2 operator panel.
- By using the IOP, faster local commissioning using the commissioning wizard, simpler optimization of the parameterization and fault diagnostics using plain text display.
- User-friendly, graphic commissioning using the STARTER parameterizing software, which is free-of-charge. Optimization of the parameterization using the trace function. Connections established via the USB port or via fieldbus (Profibus and Profinet).
- Optimized optional storage of the parameter assignments in an MMC / SD card so that the devices can be quickly replaced when service is required.

Same standard parameter structure as for SINAMICS S110 and S120

- One common firmware basis and standard parameterizing screen forms for all SINAMICS converters. Therefore, it is simpler to get to know a member of the SINAMICS family that has not been used up until now.

1.1 Restrictions between CU240S and CU240E-2

Unfortunately, it is still not possible to completely replace the CU240S family by the CU240E-2 family. The following overview will provide you with a first selection help as to which CU240S can be replaced with which CU240E-2 version.

	Previous concept			New concept with the CU240E-2 family		
Communication	mplemented with	Is integrated safety technology used?	Closed-loop control mode with encoder ?	Replaced by	Safety technology	Comments
No communication or RS485 / USS	CU240S	No or realized using external components	No	CU240E-2	STO	By using STO, external safety relays and contactors may be able to be eliminated
			Yes	Presently, no direct replacement possible -> Alternative, CU305		
				CU305 DP	STO / SS1 / SBC	
	CU240S DP-F or CU240S PN-F	Yes	No	CU240E-2	STO	SBC is not supported by the CU240E-2 family
				CU240E-2 -F	STO / SS1 / SLS / SDI / SSM	
			Yes	Presently, no direct replacement possible -> Alternative CU305		
				CU305 DP	With Extended Safety license STO / SS1 / SLS / SDI / SSM / SBC	
Profibus	CU240S DP	No or realized using external components	No	CU240E-2 DP	STO	By using STO, external safety relays and contactors may be able to be eliminated
			Yes	Presently, no direct replacement possible -> Alternative, CU305		
				CU305 DP	STO / SS1 / SBC	
	CU240S DP-F	Yes	No	CU240E-2 DP	STO	SBC is not supported by the CU240E-2 family
				CU240E-2 DP-F	STO / SS1 / SLS / SDI / SSM	
			Yes	Presently, no direct replacement possible -> Alternativ,e CU305		
				CU305 DP	With Extended Safety license: STO / SS1 / SLS / SDI / SSM / SBC	
Profinet	CU240S PN	No or realized using external components	No	CU240E-2 PN	STO	By using STO, external safety relays and contactors may be able to be eliminated
			Yes	Presently, no direct replacement possible -> Alternative, CU305		
				CU305 PN	STO / SS1 / SBC	
	CU240S PN-F	Yes	No	CU240E-2 PN	STO	SBC is not supported by the CU240E-2 family
				CU240E-2 PN-F	STO / SS1 / SLS / SDI / SSM	
			Yes	Presently, no direct replacement possible -> Alternative, CU305		
				CU305 PN	With Extended Safety license STO / SS1 / SLS / SDI / SSM / SBC	

With the changeover from CU240S to CU240E-2, you must observe the following restrictions:

- Digital inputs:
  - The CU240E-2 family has only 6 digital inputs, contrary to the CU240S family
- Fail-safe inputs:
  - The CU240E-2 family has no separate F-DIs, contrary to the CU240S family. The F-DIs of the CU240E-2 are formed from two standard digital inputs
- Encoder interface:
  - The CU240E-2 family has no interface for a speed controller, and as a consequence, only supports encoderless (sensorless) closed-loop

control modes (U/f, sensorless vector control (SLVC) and sensorless torque control). As an alternative, SINAMICS S110 can be used with CU305

1.2 Adaptations that must be made when making the changeover

As a result of the partially restricted functional scope, but also as a result of the expanded functionality of the CU240E-2 family with respect to the CU240S family, changes to the CU240S configuration are required. These will now be subsequently listed and explained in detail in the following chapters.

In addition, new functions will be listed in the individual chapters.

Hardware design (see Chapter 2)

- Changes to the height and depth of the CU.

IO interface (see Chapter 3)

- Fewer DIs (CU240S: 9 DIs / CU240S DP-F and CU240S PN-F: 6 DIs to 6 DIs for the CU240E-2 family).
- No separate F-DIs, for the CU240E-2 family, these are formed from two standard DIs.
- No speed encoder interface.
- Changes to the terminal assignment regarding NPN/PNP logic and reference potential of the digital inputs.
- Changeover, DO1 to the transistor output.
- Analog inputs; dead zone function has been modified.

Communication (refer to Chapter 4)

- Existing programs to control a SINAMICS G120 with CU240S via a fieldbus from a PLC, in most cases can still be used for the CU240E-2. For example, if parameters are accessed via cyclic or non-cyclic communication, then the only change that is required is as a result of the modified parameter numbers.
- There are some restrictions regarding routing and teleservice functions.

Local operator control via BOP-2 or IOP (see Chapter 5)

- Changes to the manual/automatic changeover.
- The BOP / IOP operator control elements can no longer be used as BICO source.

Parameterization (refer to Chapter 6)

- It is not possible to directly migrate from CU240S projects to CU240E-2. The drive must be re-commissioned.

Safety functions (refer to Chapter 7)

- As a result of the more extensive safety functions of the CU240E-2, a direct parameter migration is not possible. The safety functions must be re-commissioned.
- It is necessary to adapt the safety program in the F-CPU, in order to use the new safety functions (4 SLS limit values, SDI and SSM).
- The CU240E-2 family does not support the SBC (Safe Brake Control) safety function.

Drive fault messages/signals (refer to Chapter 8)

- The drive fault messages/signals of the CU240E-2 have changed when compared to the CU240S. If these are to be displayed on an HMI for diagnostic purposes, then the new fault messages must be integrated into the HMI.

2 Hardware

2.1 Dimensions

Changed dimensions between the CU240S and CU240E-2

- Width:
  - No change
- Height without fieldbus connector (177 mm for CU240S, with shield connection plate, 220mm):
  - 199mm
  - with shield connection plate, 255mm
- Depth (63mm for the CU240S with/without BOP):
  - 39mm without BOP-2 / IOP
  - 50mm with BOP-2
  - 60mm with IOP

CU240S

CU240E-2

3 IO interface

3.1 Terminal assignment

The terminals of the CU240S will be compared with those of the CU240E-2 family. Changes between the CU240S and CU240E-2 have been color coded.

	CU240S		CU240E-2		
Function	**Terminal**	**Name**	**Terminal**	**Name**	**Note**
Power supply AI	1	+10V OUT	1	+10V Out	
	2	0V OUT	2	GND OUT	
Analog input AI0	3	AI0+	3	AI0+	Can also be used as additional digital input (DI11)
	4	AI0-	4	AI0-	
Digital input 0	5	DI0	5	DI0	For the CU240E-2 F and E-2 DP F, the two DIs can be re-parameterized to form F-DI0
Digital input 1	6	DI1	6	DI1	
Digital input 2	7	DI2	7	DI2	For the CU240E-2 F and E-2 DP F, the two DIs can be re-parameterized to form F-DI1
Digital input 3	8	DI3	8	DI3	
Power supply DIs	9	U24V	9	+24V Out	
Analog input AI1	10	AI1+	10	AI1+	Can also be used as additional digital input (DI12)
	11	AI1-	11	AI1-	
Analog output AO0	12	AO0+	12	AO0+	
	13	AO0-	13	GND	
Thermo sensor	14	PTC+	14	T1 Motor	Possibility of connecting PTC, KTY 84 and Thermoclick (bimetallic) sensors
	15	PTC-	15	T2 Motor	
Digital input 4	16	DI4	16	DI4	For the CU240E-2 and E-2 D the two DIs can be re-parameterized to form F-DI0 For the CU240E-2 F and E-2 DP F the two DIs can be reparameterized to form F-DI2
Digital input 5	17	DI5	17	DI5	
Relay output DO0	18	DO0 NC	18	DO0 NC	
	19	DO0 NO	19	DO0 NO	
	20	DO0 COM	20	DO0 COM	
Relay/digital output DO1	21	DO1 NO	21	DO1+	Changeover from relay to transistor output
	22	DO1 COM	22	DO1-	
Relay output DO2	23	DO2 NC	23	DO2 NC	
	24	DO2 NO	24	DO2 NO	
	25	DO2 COM	25	DO2 COM	
Analog output AO1	26	AO1+	26	AO1+	
	27	AO1-	27	GND	
Reference potential for +24V	28	U0V	28	GND	
RS485 interface			Pin 1	0V	RS485 interface for CU240E-2 and CU240E-2 F via separate connector
	29	RS485 -A	Pin 2	RS485P	
	30	RS485 -B	Pin 3	RS485N	
			Pin 4	Shield	
External 24Vpower supply of the CU, instead of supply via the PM	31	+V24 IN	31	+24V IN	
	32	0V IN	32	GND IN	
Power supply, speed encoder	33	ENC+ Supply			The CU240E-2 family has no speed encoder interface
Reference potential for DI1, 3 and 5			34	DI COM2	For NPN logic, connect both terminals with terminal 28 For PNPlogic, connect both terminals with 9
Reference potential for DI0, 2 and 6			69	DI COM1	
Digital input 6	40	DI6			Digital inputs DI6 ... DI8 are not available for the CU240E-2 family
Digital input 7	41	DI7			
Digital input 8	42	DI8			
Fail-safe digital input 0	60	FDI0A			The CU240E-2 family does not have any separate F-DIs, these are formed from standard DIs (see, for example terminals 16 and 17)
	61	FDI0B			
Fail-safe digital input 1	62	FDI1A			
	63	FDI1B			
Speed encoder interface	70	ENC AP			The CU240E-2 family has no speed encoder interface
	71	ENC AN			
	72	ENC BP			
	73	ENC BN			
	74	ENC ZP			
	75	ENC ZN			

3.2 Digital inputs

3.2.1 Changes to the number of digital inputs

Contrary to the CU240S (up to 9 DIs), the CU240E-2 family only has 6 digital inputs. However, the two analog inputs, if these are not required, can be used as two digital inputs.

3.2.2 Changes to the fail-safe inputs (F-DI)

The CU240E-2 family has, contrary to the CU240S family, no separate fail-safe digital inputs. For the CU240E-2, the F-DIs are formed from two standard DIs (see Chapter 3.1)

- CU240E-2, CU240E-2 DP and CU240E-2 PN ➔ up to 1 F-DI
- CU240E-2 –F, CU240E-2 DP-F and CU240E-2 PN-F ➔ up to 3 F-DIs

3.2.3 Transferring the status of the F-DI via PROFIsafe

New function

Using PROFIsafe, for the CU240E-2 DP-F, the status of the F-DIs can be transferred to the F-CPU in a safety-relevant fashion so that these are available as distributed F I/O. For details, refer to Chapter 7

3.2.4 Changing the reference potential and PNP / NPN logic

The reference potential terminal 69 on the CU240S was, for the CU240E-2, distributed over two terminals (terminals 69 and 34). Also refer to Chapter 3.1.

➔ Terminal 69: Reference potential for DI0, DI2 and DI4

➔ Terminal 34: Reference potential for DI1, DI3 and DI5

The PNP / NPN logic changeover of the digital inputs is, for the CU240E-2, no longer realized by parameterization (CU240S: p725) and the wiring; it is only defined using the input wiring.

➔ For an internal power supply

- For PNP logic: Connect terminals 34 and 69 with terminal 28.
- For NPN logic: Connect terminals 34 and 69 with terminal 9.

➔ For an external power supply

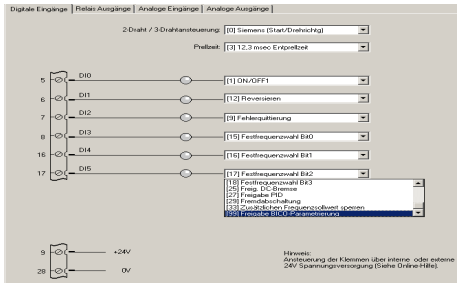
- For PNP logic: Connect terminals 34 and 69 with the system ground.
- For NPN logic: Connect terminals 34 and 69 with the system 24 V.

For more information refer to the List Manual **Link** (Chapter 2, function diagram 2220).

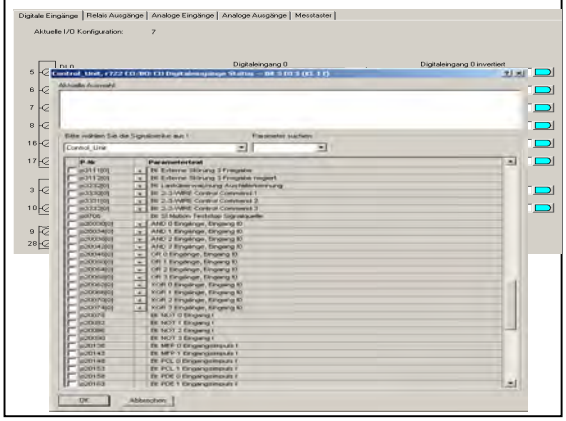
3.2.5 Changed BICO interconnection of the digital inputs

Previously, the digital inputs for BICO interconnection had to be enabled using the value 99; this is now no longer required. The interconnection can now be made directly without having to use p701…p706 or p701...p709 (no longer available in CU240E-2). In addition, inverted signals of the digital inputs are available.

CU240S



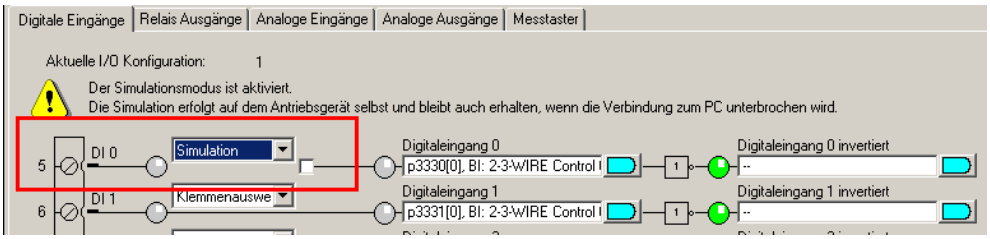
CU240E-2



3.2.6 Simulating the digital inputs

New function

The digital inputs can now be simulated for test purposes using the STARTER parameterizing software.



3.2.7 Monitoring the load/speed via a digital input

New function

Using this function, load failure can be monitored as well as a speed deviation. For details, refer to the operating instructions **Link** (Chapters 7.9.5 and 7.9.6).

3.3 Digital outputs

3.3.1 Modified parameter numbers

The parameter numbers of the DOs are shifted in the expert list by one position (for example DO0: CU240S = p731, CU240E-2 = p730).

3.3.2 Hardware change DO1

DO1 (terminal 21 / 22) was changed from being a relay output (CU240S) to a transistor output (CU240E-2).

3.4 Analog inputs

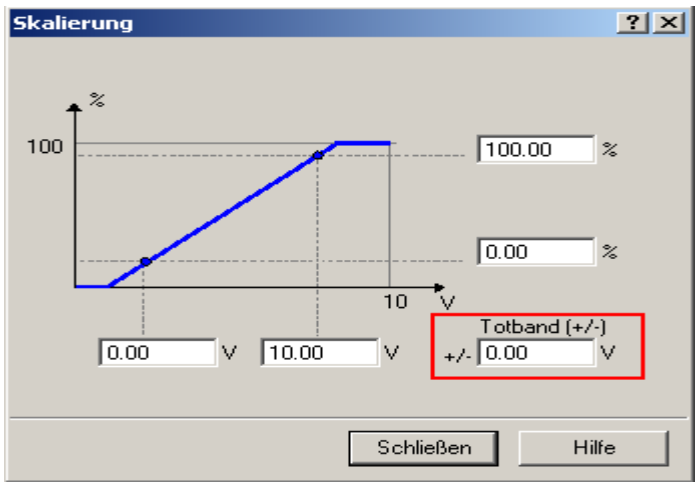
3.4.1 Modified factory setting

The factory setting was changed from 0 – 10V (CU240S) to +/- 10V (CU240E-2).

3.4.2 Changed ADU dead zone (p761)

This parameter is no longer shown in the graphic display, but is still in the expert list.

CU240S



➔ The following setting should be made in order to implement a wire break monitoring function as in the CU240S:

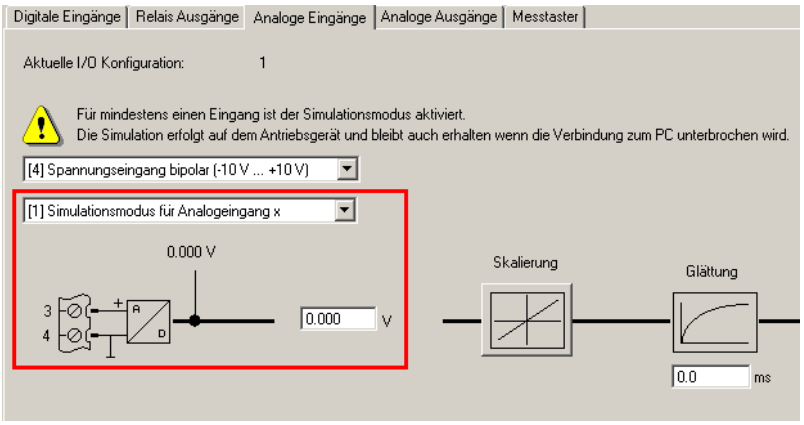
- AI0: p756[0] → 1 (for 2-10V) or 3 (for 4-20mA) and p761[0] → 0
- AI1: p756[1] → 1 (for 2-10V) or 3 (for 4-20mA) and p761[1] → 0

➔ Using this function in the CU240S, if the analog values around 0 V are suppressed, then this function can only be implemented by using FFBs (free function blocks). We are presently working on an integrated solution.

3.4.3 Simulation of the analog inputs

New function

Now, the analog inputs can be simulated for test purposes using the STARTER parameterizing software.



4 Communication

Existing programs to control a SINAMICS G120 with CU240S via a fieldbus from a PLC, in most cases can still be used for the CU240E-2. For example, if parameters are accessed via cyclic or non-cyclic communication, then the only change that is required is as a result of the modified parameter numbers.

In order to use the new or extended safety functions, the safety programs in an F-CPU must be correspondingly adapted (refer to Chapter 7)

4.1 GSD files

The new GSD files are required for the CU240E-2 family. These can be downloaded under the following **link**

4.2 Routing through a CPU

For routing beyond network limits (e.g. IE to Profibus DP), the CPU must support the routing protocol data set. In addition, just as before, DriveES Basic is required.

The following CPUs support data set routing:

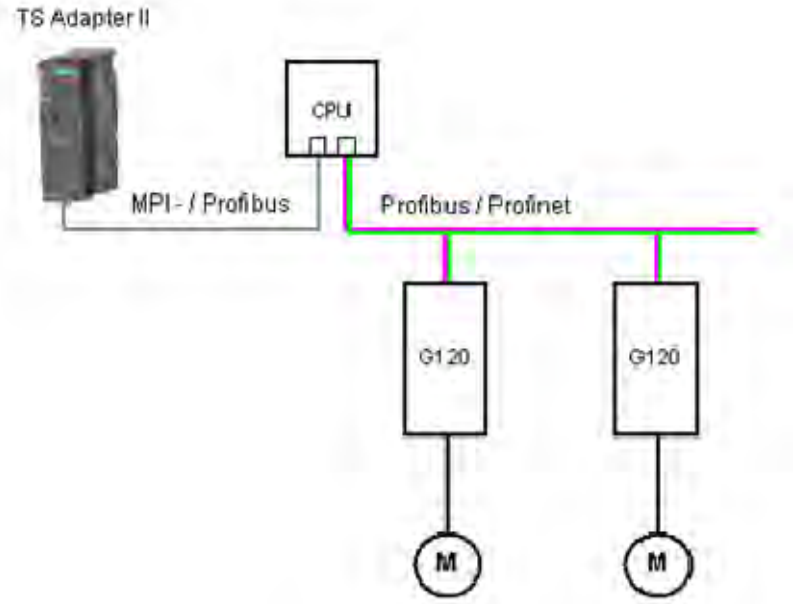
- ET200S
  - IM151-8 PN/DP CPU in conjunction with the DP master module
- SIMATIC S7-300
  - CPU313C-2 DP from version V3.3
  - CPU314C-2 DP from version V3.3
  - CPU314C-2 PN/DP from version V3.3
  - CPU315-2 DP from version V3.0
  - CPU315-2 PN/DP from version V3.1
  - CPU317-2 DP from version V3.3
  - CPU317-2 PN/DP from version V3.1
  - CPU319-3 PN/DP from version V2.7
- SIMATIC S7-400 CPUs from version V5.1
- WinAC RTX from version 2010, update 1 with CP5603, CP5613 or CP5623

Presently, the following systems do not support data set routing:

- SIMATIC S7-1200
- WinAC MP
- SIMOTION

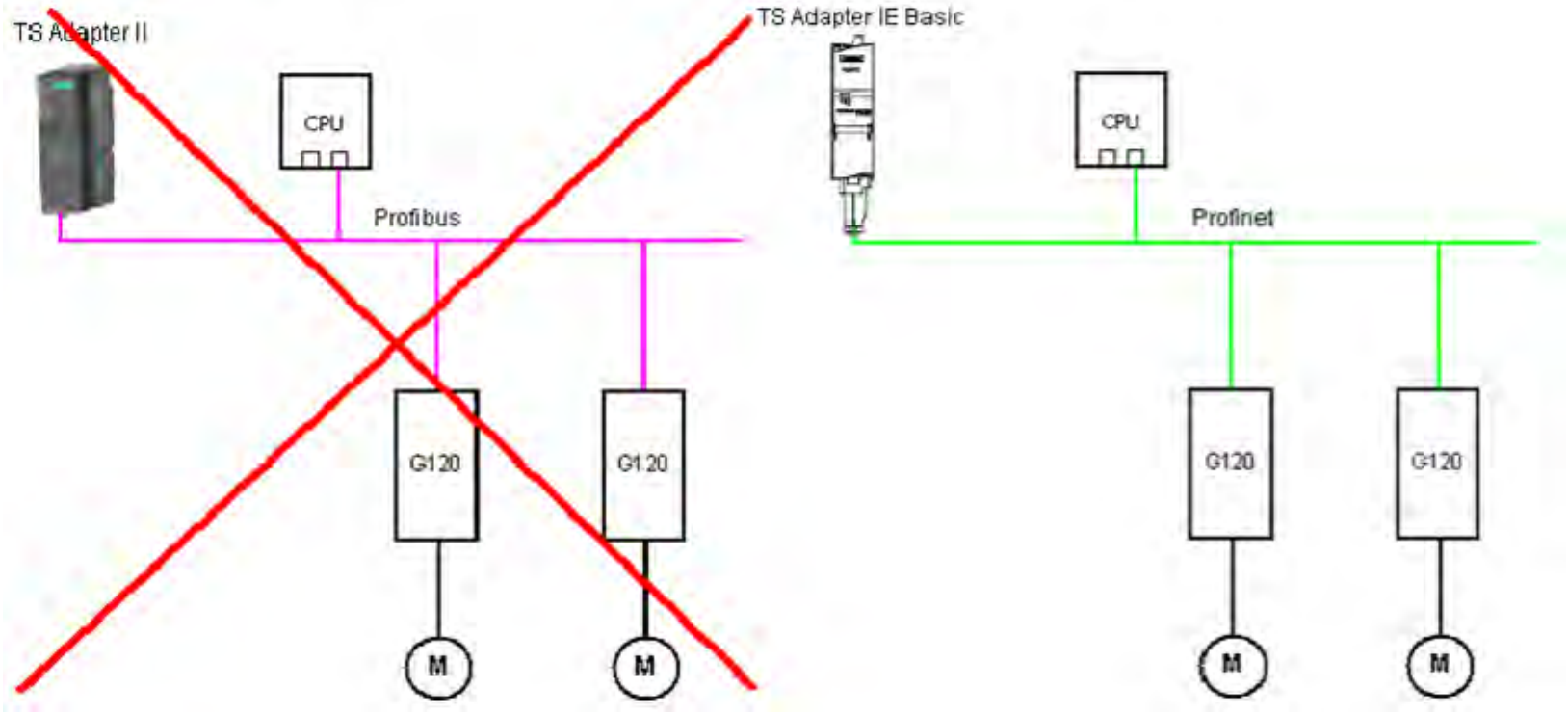
4.3 Teleservice

4.3.1 Teleservice via a CPU



A Teleservice Adapter II and a CPU, which is listed under **Routing** (Chapter 4.2) and which supports data set routing, are required.

4.3.2 Teleservice directly to the fieldbus



With this configuration, the Teleservice Adapter is directly connected to the fieldbus. This is why it is of no significance that the CPU supports data set routing.

- Presently, not possible with Profibus. Presently, the Teleservice Adapter II does not support this functionality.
- For Profinet, with a CU240E-2 PN, it is possible using the Teleservice Adapter IE Basic.

4.4 Slave-to-slave traffic

New function

With "Slave-slave communication" – also known as "Data Exchange Broadcast" – fast data exchange is possible between the converters (slaves) without the master being directly involved; for instance, to enter the actual value of one converter as setpoint for the other converter (more detailed information is provided in the Operating Instructions (Chapter 6.1.4.4) **Link**

4.5 Direct HMI connection

A direct connection between an HMI and a CU240E-2 to read out and change drive parameters without an intermediate CPU is not supported.

➔ Read-parameters from the converter via the CPU and then transfer them to the HMI.

5 Local operator control via BOP-2 or IOP

For the CU240E-2, the BOP used by the CU240S, has been replaced by the BOP-2 – its successor.

BOP

BOP-2

The IOP is also available for user-friendly commissioning supported by wizards.

IOP

5.1 Manual operation with BOP-2 / IOP

For the CU240S, manual operation has been realized by changing over the command data sets.

In the CU240E-2, the changeover to manual operation is realized using the manual button of the BOP-2 / IOP. When activating manual operation, the control authority is taken over by the BOP-2 / IOP. As a consequence, the parameterized/active command and setpoint sources are decoupled.

➔ Manual operation via the IOP/BOP-2 can be inhibited using parameter p806. This inhibit can be permanent, but can also be selected using a digital input or a fieldbus signal.

➔ Manual operation via the BOP-2 / IOP permanently active: This function is not possible. After power on, manual operation must be reactivated at the IOP / BOP-2.

5.2 Status signals of the BOP-2 / IOP operator control panels

The BOP-2 / IOP operator control panels can no longer be used as BICO sources as for the CU240S (r19).

6 Parameterization

It is not possible to directly migrate from CU240S projects to CU240E-2 as a result of the modified parameter structure.

➔ The drive must be recommissioned using BOP-2, IOP or STARTER.

6.1 Elimination of closed-control modes

As the CU240E-2 family has no speed encoder interface, only the encoderless (sensorless) closed-loop control modes are available (U/f, Sensorless Vector Control (SLVC) and encoderless closed-loop torque control) ➔ Possibly use the CU305 (SINAMICS S110)

6.2 Changed reference quantities

The reference quantities (p2000 … 2004) apply in the CU240E-2 as standard for all data sets. In addition, the reference quantities have been expanded by the reference temperature (p2006).

In the CU240E-2, the speed setpoint and actual value no longer refer to Hz but to rpm; this means that it is no longer necessary to convert the required speed into a frequency.

6.3 Fixed setpoints that can be freely used

New function

Fixed setpoints that can be freely used can be defined in p2900 / p2901 (+/- 100.00%) and p2930 (+/- 100000.00 Nm). In addition, fixed setpoints that are already defined are available in r2902 [0 … 14].

6.4 Parameterizing the command and setpoint sources

New function

In the drive, the corresponding macros can be selected via p15 (e.g. during the quick commissioning), via which the interfaces (command source, setpoint source, I/O interconnection) can be adapted to the corresponding application far faster than before. However, at the present time it is only possible to access p15 online (a change is planned in STARTER V4.3).

➔ Simplified parameterization. For details, refer to the operating instructions **Link** (Chapters 3.4.5).

6.5 Expanding the command/drive data sets

There are now up to 4 command data sets (CDS) and up to 4 drive data sets (DDS) available in the CU240E-2. Contrary to the CU240S, these must now first be enabled using parameter p170 (CDS) or p180 (DDS).

6.6 Change for the second ramp function via JOG ramp-function generator

It is no longer possible to use the JOG ramp-function generator to implement a second ramp function.

➔ However, when using the data set changeover (DDS), up to 4 different parameterizable ramp functions are now available. The data set changeover can be implemented in operation via digital inputs or via the fieldbus. For details, refer to the operating instructions **Link** (Chapter 7.11).

6.7 U/f points along a characteristic (U/f with programmable characteristic)

Contrary to the CU240S (3 voltage points and 3 frequency points along a characteristic), the CU240E-2 has 4 voltage/frequency points, which means that the characteristic can be more finely parameterized.

➔ If the additional points are not required, then set points 3 and 4 to the same value.

6.8 Speed-dependent controller adaptation

New function

The Tn and Kp components of the controller can now be adapted as a function of the speed in the CU240E-2 (refer to the list manual **Link**, function diagram 6050).

6.9 Operating hours counter

New function

The actual operating hours can be read out of p650 and a maintenance interval can be activated in p651. Alarm A1590 is activated after the time in p651 has expired.

6.10 Changes to the braking chopper

For the CU240E-2, the braking chopper is automatically activated when using a PM240. The braking resistor must be externally protected against overload.

➔ Connect the thermal sensor of the braking resistor to a DI of the converter and interconnect this input with parameter p2106 "External fault 1". As a consequence, for an overtemperature, fault F07860 "External fault 1" will be activated.

➔ In addition, the VDCmax controller must be deactivated (for vector control: p1240 → 0, for U/f: p1280 → 0).

6.11 Expansion of the motor holding brake function

The parameterization of the motor holding brake has been expanded. Various modes are now available, where the brake, as before, can be opened or closed from the process, but now also permanently or as a function of an external signal.

➔ For details refer to the operating instructions **Link** or the STARTER screen form.

➔ The CU240E-2 does not support the SBC (Safe Brake Control) safety function.

6.12 Changes to the free function blocks (FFBs)

The scope and functions of the free function blocks have been significantly expanded over the CU240S. As a consequence, it was necessary to shift the parameter numbers. Presently, the FFBs can only be interconnected via the expert list.

➔ For details refer to the list of manual **Link** (Chapter 2.12).

6.13 Changes to the phase failure monitoring

For the CU240E-2, the phase failure monitoring (CU240S, p291) is always active and cannot be deactivated.

6.14 Change, operator panel LED can be deactivated

If a fieldbus is not used, then the OP-LED (operator panel LED) can be deactivated using parameter p2030 ➔ 0. For more detailed information refer to **Link**

6.15 Wobbulation generator has been eliminated

The wobbulation generator available in the CU240S is no longer available in the CU240E-2.

6.16 Positioning down ramp has been eliminated

The positioning down ramp available in the CU240S (parameters p2480 … p2488) is no longer available in the CU240E-2.

➔ Implemented using a rapid traverse/crawl switchover based on FFBs or using a SINAMICS S110 with EPOS (basic positioner).

6.17 Memory card

Contrary to the CU240S family (only MMC), for the CU240E-2 family, MMC and SD cards can be used.

6.17.1 Transferring a project from CU240S into the CU240E-2

Projects of a CU240S on an MMC card cannot be transferred into a CU240E-2 as a result of the changed parameter structure.

➔ Clear the memory card and write the CU240E-2 project to it

6.17.2 Handling memory cards

Writing data to an MMC / SD card has been significantly simplified for the CU240E-2. Parameter changes are automatically saved to the memory card.

For details, refer to the Operating Instructions in Chapter 4.6 **Link** and FAQ **Link**

7 Safety functions

The safety functions known from the CU240S have been expanded. The following table provides an overview of the available safety functions and how they are possibly controlled.

Device family	G120			
Control Unit	CU240E-2	CU240E-2 DP CU240E-2 PN	CU240E-2 F	CU240E-2 DP-F CU240E-2 PN-F
Firmware basis	FW4.4			
Standards:				
EN 954-1	Cat. 3			
IEC 61508	SIL 2			
ISO 13849-1	Pld			
Functions:				
STO	Yes	Yes	Yes	Yes
SS1	No	No	Yes	Yes
SSM	No	No	No	Yes
SDI	No	No	Yes	Yes
SLS	No	No	Yes	Yes
Number of SLS limit values	0	0	1	4
SBC	No	No	No	No
Safety control:				
F-DI	Yes	Yes	Yes	Yes
Number of F-DI	up to 1	up to 1	up to 3	up to 3
PROFIsafe	No	Yes	No	Yes
F-DI and PROFIsafe together	No	Yes	No	Yes (only STO via F-DI)
F-DI status via PROFIsafe (telegram 900):	No	No	No	Yes

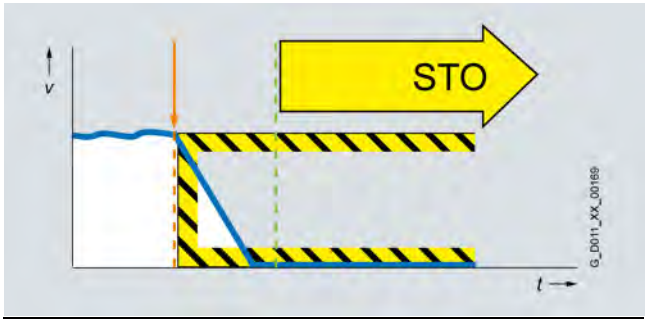
Information:

- Just as before, speed acquisition using a speed encoder is not required for these safety functions.
- STO is permissible for all applications, where Emergency Stop functionality is required.
- SS1, SLS, SSM and SDI are not permissible for loads that drive the motor or that are continuously in the regenerating mode (also referred to the function manual, Safety Integrated, Chapter 2.2 **Link**).
- The F-DIs are formed by combining 2 standard DIs through the appropriate parameter assignment (also see Chapter 3.1).

More detailed information on the safety functions is provided in the Safety Integrated Function Manual **Link** on the following Internet page **Link**

7.1 New / extended safety functions

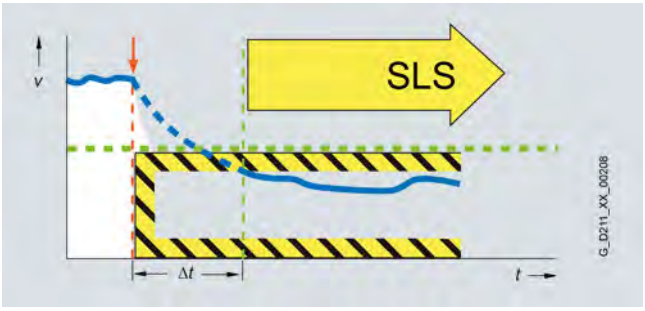
7.1.1 Extension SS1



The SS1 safety function was extended as follows when compared to the CU240S family.

- Braking the motor after activating SS1 can now be set using the following parameter assignment:
  - Braking ramp monitoring:
    - After selecting SS1, SINAMICS G120 automatically brakes along the OFF3 ramp. The deceleration is monitored using the SBR ramp (Safe Brake Ramp). STO is activated when standstill is reached
  - Acceleration monitoring:
    - After selecting SS1, SINAMICS G120 does not decelerate along the OFF3 ramp, but can be independently decelerated.
    - The speed is safely monitored to ensure that the drive does not accelerate.
    - When the "shutdown velocity/speed SS1“ is reached, or after the "SS1 delay time" has expired, then STO is activated
- The SS1 ramp time (brake ramp monitoring mode) was increased, for the CU240S (99s referred to 200Hz) in the CU240E-2 family to 1000s (referred to the reference speed, e.g.1500 rpm).
  ➔ Safely and reliably stopping high moments of inertia.
- For the CU240S family, it was possible to interrupt/cancel SS1 by withdrawing the SS1 request before reaching the SS1 standstill detection frequency. This is no longer possible for the CU240E-2 family. The SS1 request remains active until STO is internally activated.

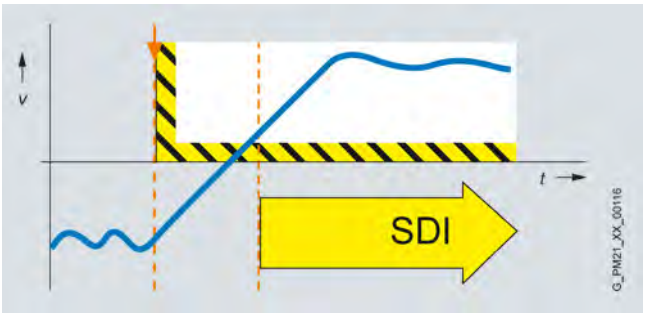
7.1.2 Extension to SLS



The SLS safety function was extended and revised as follows when compared to the CU240S family.

- The various SLS modes of the CU240S family have been integrated in the CU240E-2 family into one "mode". ➔ Simplify commissioning and the possibility of implementing new safety concepts
- With the CU240E-2 DP F and CU240E-2 PN-F for control via PROFIsafe there are now 4 SLS limit values available that can be parameterized. ➔ New safety concepts can be implemented
- When activating SLS at standstill, current must flow through the motor within 5 seconds. For the CU240S family, it is no longer necessary that a minimum speed is reached during these 5 seconds. ➔ Simplifies the control
- The behavior of the SINAMICS G120 when activating SLS (automatic or manual speed reduction) can be set using the SS1 brake ramp or acceleration monitoring.
- The response to a limit value violation when SLS is active can be selected to either be a STOP A (STO) or STOP B (SS1) (CU240S, only STO is possible) ➔ In the case of a fault, the motor can now be safely braked and no longer coasts down unbraked.

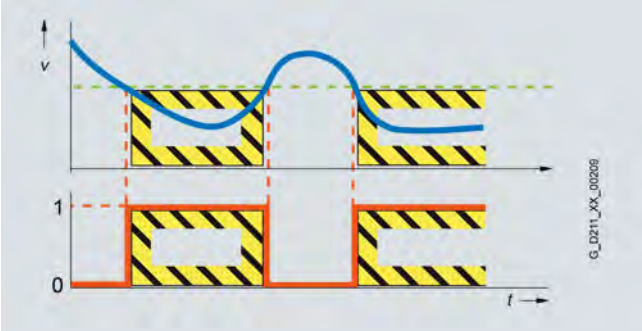
7.1.3 New safety function SDI (Safe Direction)



This safety function prevents the motor being operated in an unsafe direction of rotation. A speed encoder is not required for this safety function.

➔ New safety concepts can be implemented, for example, staying in a hazardous/dangerous area while a part of the system is being moved out of this hazardous/dangerous area or setting-up operation with a safely inhibited direction of rotation

7.1.4 New safety function SSM (Safe Speed Monitor)



A PROFIsafe signal is used to indicate that the motor speed is below a parameterized speed limit. When the speed limit is exceeded, this signal is deactivated; however, the converter does not respond to this. A speed encoder is not required for this safety function.

➔ For example, using this signal, an F-CPU can release a protective door. As long as the parameterized SSM limit speed/velocity is not exceeded, the door is released. After the door has been opened and the motor speed increases above the SSM speed limit, the F-CPU activates a safe shutdown of the SINAMICS G120 via STO or SS1.

More detailed information on the safety functions is provided in the Safety Integrated Function Manual **Link** on the following Internet page **Link**

7.2 Standard STARTER parameterizing screen forms

New function

The STARTER parameterizing screen forms are now the same as the parameterizing screen forms of the SINAMICS S110 and S120.

➔ It is no longer necessary to get to know a new system when changing over to a different SINAMICS converter

7.3 Simplified parameterization

New function

Just same as for the SINAMICS S110 and S120, parameterization is performed in one channel, and only at the end of the commissioning phase, is it duplicated to the second channel by pressing a button. As a consequence, it is no longer necessary to enter safety parameters through two channels (for instance Hz and kHz). Further, it is no longer necessary to confirm the checksum.

➔ This simplifies commissioning and avoids incorrect parameter assignments

7.4 Offline safety parameterization

New function

Just the same as for the SINAMICS S110 and S120, it is now also possible to parameterize the safety functions offline.

➔ Safety parameterization can already be prepared in an office environment.

7.5 Acceptance report

New function

Using the STARTER parameterizing software, an acceptance report for the safety functions can be generated; all of the relevant parameter values are automatically entered into this report.

➔ This can be found in STARTER under the drive unit in the folder **Documentation**

7.6 Changing the reference quantity

The speed-referred safety values no longer refer to Hz, but to rpm. Further, a gear factor can now be parameterized

➔ As a consequence, it is no longer necessary to convert between the parameterization and the resulting motor speed.

7.7 Changes to the fail-safe inputs (F-DI)

The CU240E-2 family has, contrary to the CU240S family, no separate fail-safe digital inputs. For the CU240E-2, the F-DIs are formed from two standard DIs (see Chapter 3.1)

- CU240E-2, CU240E-2 DP and CU240E-2 PN ➔ up to 1 F-DI
- CU240E-2 –F, CU240E-2 DP-F and CU240E-2 PN-F ➔ up to 3 F-DIs

7.8 SBC is no longer supported

The CU240E-2 family does not support the SBC safety function. ➔ Use the CU305 (SINAMICS S110)

7.9 Group drives

The STO safety function can be used in conjunction with group drives (when more than one motor is connected and operated with one converter). The additional safety functions (SS1, SLS, SDI and SSM) have still not been released for group drives.

7.10 Changes in the PROFIsafe telegram

As a result of the more comprehensive safety functions of the CU240E-2 family, the PROFIsafe telegram has been expanded.

In order to be able to use these functions, the safety program of the F-CPU must be appropriately expanded.

7.10.1 Previous CU240S PROFIsafe telegram 30

Control word																
Byte 1								Byte 0								
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
							SLS *				**SLS ***			SS1	STO
Status word																
Byte 1								Byte 0								
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
							SLS active *				**SLS active ***			SS1 active	Power removed

* Selecting whether byte 0 / bit 4 or byte 1 / bit 0 should be used to control SLS is realized through the appropriate parameter assignment

7.10.2 New CU240E-2 PROFIsafe telegram 30

Control word																
Byte 1								Byte 0								
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
		SDI negative *	**SDI positive ***		SLS-Limit Selection * 00 = Level 1 01 = Level 2 10 = Level 3 11 = Level 4			ACK			SLS *			SS1 *	STO
Status word																
Byte 1								Byte 0								
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Status SSM *		**SDI negative active ***	**SDI positive active ***		active SLS-Limit * 00 = Level 1 active 01 = Level 2 active 10 = Level 3 active 11 = Level 4 active			Internal event			SLS active *			SS1 active *	Power removed

* Extended Safety functions (CU240E-2 –F, CU240E-2 DP-F and CU240E-2 PN-F)

Changes to the CU240S PROFIsafe telegram (control word)

- Byte 0 / bit 4 ➔ SLS is controlled exclusively using this bit
- New: Byte 0 / bit 7 ➔ acknowledgment signal for safety fault messages
- New: Byte 1 / bit 1 and 2 ➔ select SLS limit value 1..4
- New: Byte 1 / bit 4 and 4 ➔ select the corresponding safe direction of rotation

Changes to the CU240S PROFIsafe telegram (status word)

- Byte 0 / bit 4 ➔ speed under SLS limit value, exclusively using this bit
- New: Byte 0 / bit 7 ➔ fault, safety function
- New: Byte 1 / bit 1 and 2 ➔ feedback signal of active SLS limit value 1..4
- New: Byte 1 / bit 4 and 4 ➔ feedback signal of active safe direction of rotation
- New: Byte 1 / bit 7 ➔ feedback signal, SSM status

7.10.3 New CU240E-2 PROFIsafe telegram 900

Control word

Byte 1								Byte 0							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
		SDI negative *	SDI positive *		SLS-Limit Selection * 00 = Level 1 01 = Level 2 10 = Level 3 11 = Level 4			ACK			SLS *			SS1 *	STO
Byte 3								**Byte 3**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Status word

Byte 1								Byte 0							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Status SSM *		SDI negative active *	SDI positive active *		active SLS-Limit * 00 = Level 1 active 01 = Level 2 active 10 = Level 3 active 11 = Level 4 active			Internal event			SLS active *			SS1 active *	Power removed
Byte 3								**Byte 2**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
					Status FDI2 *	Status FDI1 *	Status FDI0 *								

* Extended Safety functions (CU240E-2 –F, CU240E-2 DP-F and CU240E-2 PN-F)

The PROFIsafe telegram 900 differs from the PROFIsafe telegram 30 in so much, that for this telegram, the status of the fail-safe digital inputs is also transferred (byte 3, bit 0…2)

7.11 Transferring the status of the F-DI via PROFIsafe

New function

Using PROFIsafe, for the CU240E-2 DP-F and CU240E-2 PN-F, the status of the F-DIs can be transferred to the F-CPU in a safety-relevant fashion so that these are available as distributed F I/O (see 7.9.3 telegram 900).

8 Drive fault messages

The drive fault messages/signals of the CU240E-2 have changed when compared to the CU240S. If the fault texts are to be displayed on an HMI for diagnostic purposes, then the corresponding fault texts can be downloaded under the following **Link**