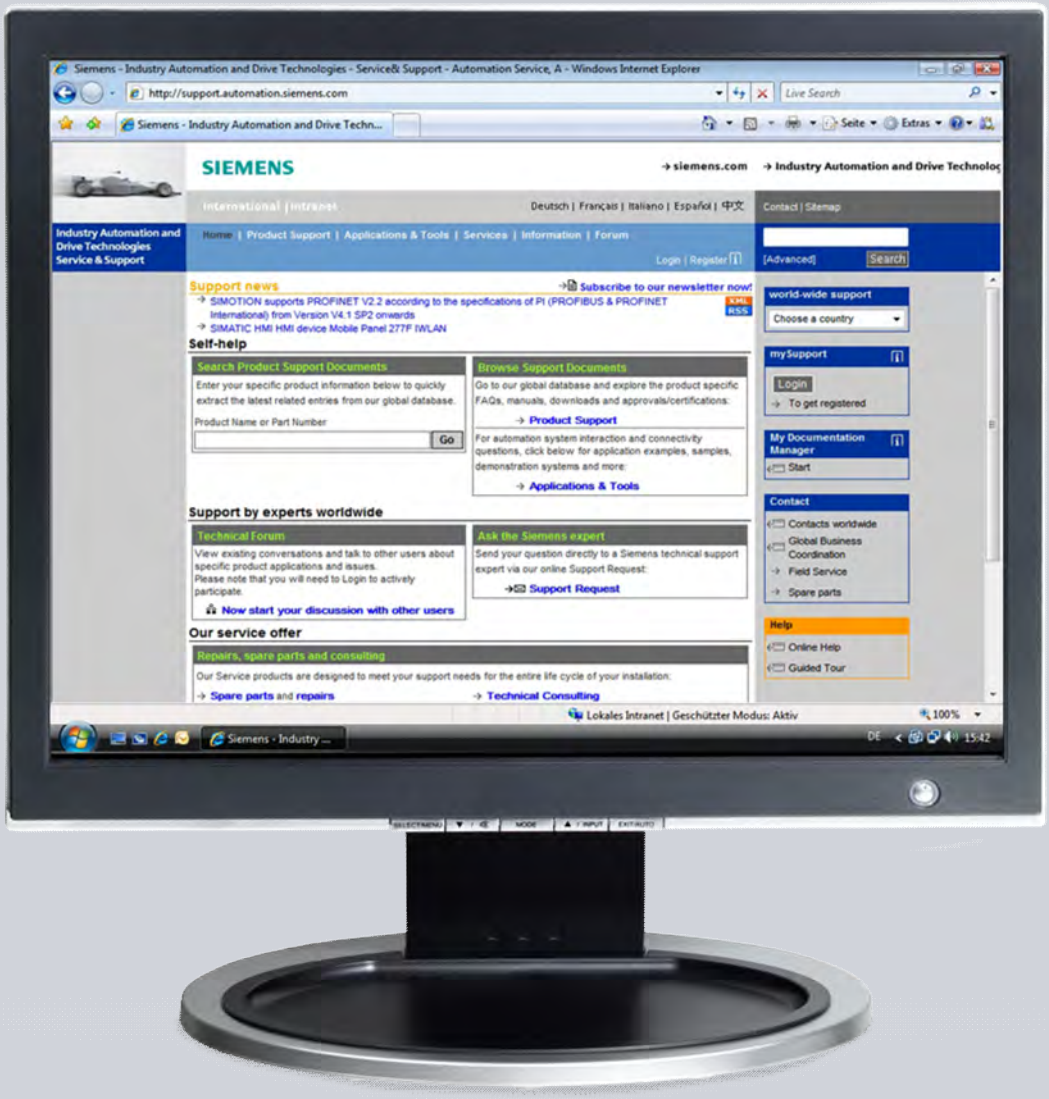
Changeover SINAMICS CU240E to CU240E-2 (as from Firmware V4.4)

SINAMICS G120

FAQ • October 2012



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The functions and solutions described in this article confine themselves to the realization of the automation task predominantly. Please take into account furthermore that corresponding protective measures have to be taken up in the context of Industrial Security when connecting your equipment to other parts of the plant, the enterprise network or the Internet. Further information can be found under the Content-ID 50203404.

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Question

What do I have to observe, if I want to replace a CU240E of the SINAMICS G120 with a CU240E-2 (as from firmware V4.4)?

Answer

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

Table of content

1 Presentation of SINAMICS G120 CU240E-2

SINAMICS G120 CU240E-2 (as from firmware V4.4), as successor to the CU240E, has the following new additional properties/features:

Communication (see chapter 3 for details)

- USS / Modbus communication interface (CU240E-2 and CU240E-2-F)
- PROFIBUS communication interface (CU240E-2 DP and CU240E-2 DP-F)
- PROFINET communication interface (CU240E-2 PN and CU240E-2 PN-F)
- Slave-to-slave communication for direct data exchange between drives

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 have the following safety functions STO (Safe Torque Off), SS1 (Safe Stop 1), SLS (Safely Limited Speed), SSM (Safe Speed Monitoring) and SDI (Safe Direction). 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 “-F” version. As a consequence, the F-DIs of the drive can be used as distributed IOs of an fail-safe control system.

Commissioning and optimization

- Increased usability of the BOP-2 (Basic 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).
- Parameterization is optionally saved on 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 drives. Therefore, it is simpler to get to know a member of the SINAMICS family that has not been used up until now.

1.1 Comparison between the CU240E and the CU240E-2

Some of the most important features/properties of the CU240E when compared to the CU240E-2 family are listed below

	CU240E	CU240E-2	CU240E-2 DP	CU240E-2 F	CU240E-2 DP F
Communication	RS485 / USS	RS485 / USS / Modbus	Profibus DP with PROFIsafe	RS485 / USS / Modbus	Profibus DP with PROFIsafe
Safety	No	STO	STO	STO SS1 SLS SDI	STO SS1 SLS SDI SSM
Digital inputs	6	6 (DI3 can be used as pulse input up to 32kHz)			
Fail-safe digital inputs	0	Up to 1 (from two standard DI)		Up to 3 (each from two standard DI)	
Digital outputs	3 (relay)	3 (1 x transistor / 2 x relay), each 30V DC max. 0,5A			
Analog inputs	2 (AI0: 0/4…20mA, 0/2 ...10V and +/- 10V) (AI1: 0…20mA and 0…10V	2 (both 0/4…20mA, 0...10V and -10…+10V) the AI can be used as additional digital inputs (DI11 and 12)			
Analog outputs	2 (AO0 and 1: 0/4…20mA, AO0: 0 ...10V)	2 (both 0…10V and 0/4…20mA)			
Terminals	Spring-load. fixed	Spring-loaded, can be inserted, improved accessibility			
Motor temperature sensor	PTC and KTY	PTC, KTY and Thermoklick (bimetallic switch)			
Communication interface	RS485, not isolated	RS485, isolated	Profibus DP, isol.	RS485, isol.	Profibus DP, isol.
Communication address	Via parameter p2011	Via DIP switch or p2011	Via DIP switch or p918	Via DIP switch or p2011	Via DIP switch or p918
Memory card	No	MMC or SD card			
Parameterizing interface	RS232 via PC-converter connection kit	USB (Micro USB cable)			
Local control	BOP or IOP (via handheld)	BOP-2 or IOP			
Mechanical design	Plastic housing	Based on CU240S, rugged metal/plastic housing			
Operation with PM340 (1AC 230V)	No	Yes			

1.2 Adaptations that must be made when making the changeover

As a result of the expanded functional scope of the CU240E-2 when compared to the CU240E, the CU240E configuring must be adapted. 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)

- Changes to the terminal assignment regarding NPN / PNP logic and reference potential of the digital inputs
- Changeover, DO1 to the transistor output
- An external 24V power supply can be connected
- Analog inputs; dead zone function has been modified

Communication (see chapter 4)

- Existing programs to control a SINAMICS G120 with CU240E 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 IOP or BOP-2 (see chapter 5)

- Changes to the manual/automatic changeover
- The IOP or BOP-2 operator control elements can no longer be used as BICO source.

Parameterization (see chapter 6)

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

Safety functions (see chapter 7)

- Up until now, the CU240E had no integrated safety functions. If the safety functions of the CU240E-2 are to be used, then these must be correspondingly commissioned.

Drive fault messages/signals (see chapter 8)

- The drive fault messages/signals of the CU240E-2 have changed when compared to the CU240E. 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 dimensions

Changed dimensions between the CU240E and CU240E-2

- Width:
  - No change
- Height (195 mm for the CU240E):
  - 200mm for the CU240E-2 DP and CU240E-2 DP F
  - 215mm for the CU240E-2 / CU240E-2 F
  - 255mm with shield connection plate (all CU240E-2)
- Depth (31mm for the CU240E with/without BOP):
  - 39mm without BOP-2 / IOP
  - 50mmhe with BOP-2
  - 60mm with IOP

3 IO interface

3.1 Terminal assignment

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

	CU240E		CU240E-2		
Function	Terminal	Designation	Terminal	Designation	Note regarding CU240E-2
Power supply AI	1	+10V	1	+10V Out	
	2	0V	2	GND	
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, both DI can be reparameterized to become an 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, both DI can be reparameterized to become an 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	
Thermal sensor	14	PTC+	14	T1 Motor	PTC, KTY 84 and Thermoclick (bimetal) sensors can be connected here
	15	PTC-	15	T2 Motor	
Digital input 4	16	DI4	16	DI4	For the CU240E-2 and E-2 DP, both DI can be reparameterized to become an F-DI0
Digital input 5	17	DI5	17	DI5	For the CU240E-2 F and E-2 DP F, both DI can be reparameterized to become an F-DI2
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+	Change over 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 24V supply of the CU, instead of supply via PM			31	+24V IN	
			32	GND IN	
Reference potential for DI1, 3 and 5			34	DI COM2	For NPN logic, connect both terminals with terminal 28
Reference potential for DI0, 2 and 6			69	DI COM1	For PNP logic, connect both terminals with terminal 9

3.2 Digital inputs

3.2.1 Changed PNP / NPN logic

The PNP / NPN logic changeover of the digital inputs is, for the CU240E-2, no longer realized by parameterization (CU240E: 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 24V.

NOTE For more information refer to the List Manual (chapter 2, function diagram 2220)
http://support.automation.siemens.com/WW/view/en/49946755

3.2.2 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 (no longer available in CU240E-2). In addition, inverted signals of the digital inputs are now available.

Figure 3-1: CU240E, enabling of BICO interconnection of the DIs

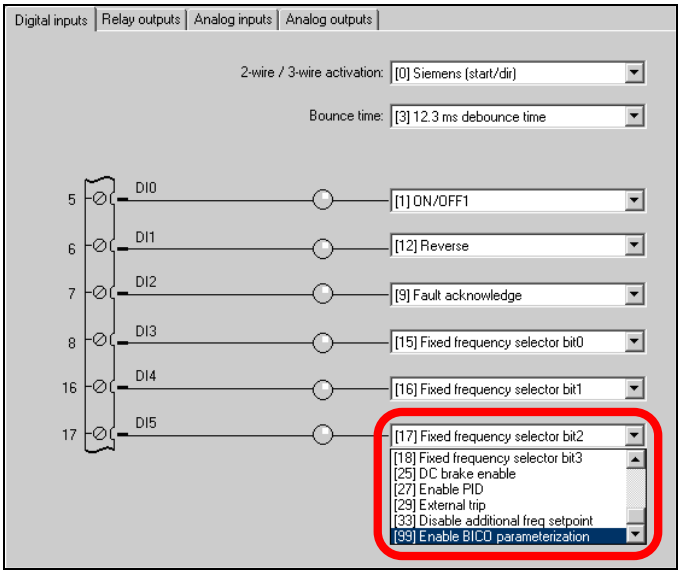


Figure 3-2: CU240E-2, direct BICO interconnection of the DIs

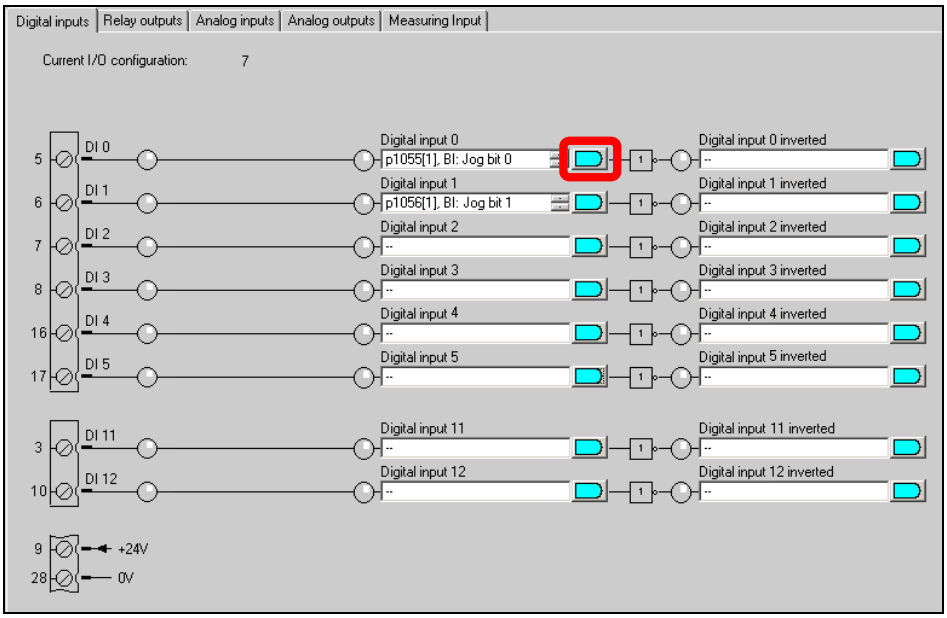
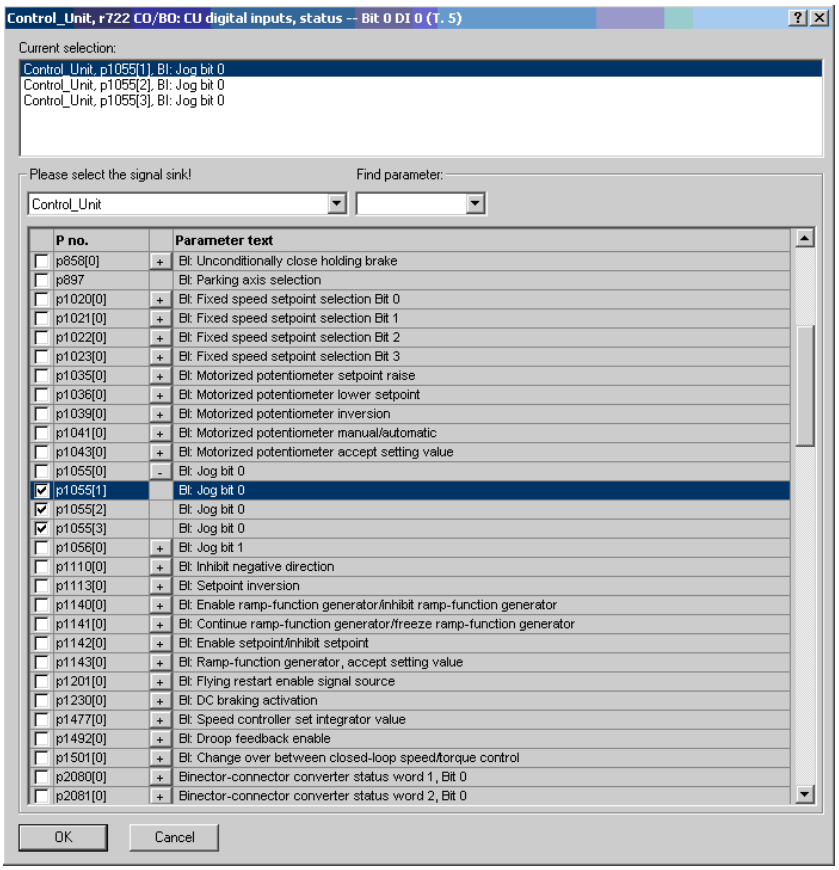


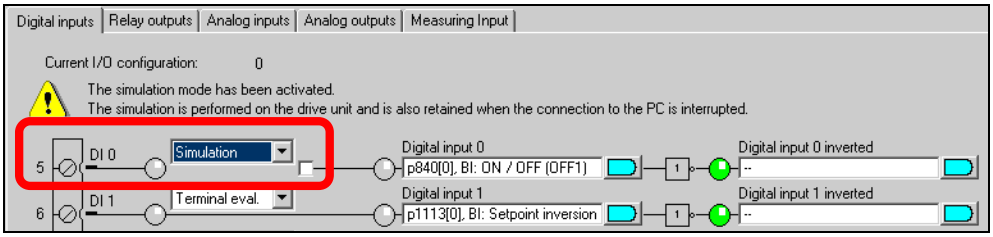
Figure 3-3: CU240E-2, direct BICO interconnection of DI0 (terminal 5)



3.2.3 Simulation of the digital inputs (NEW)

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

Figure 3-4



3.2.4 Monitoring the load / speed via a digital input (NEW)

Using this function, load failure can be monitored as well as a speed deviation.

NOTE For details, refer to the operating instructions (chapters 7.9.5 and 7.9.6)
http://support.automation.siemens.com/WW/view/en/50815575

3.2.5 Fail-safe digital inputs (F-DI, NEW)

For the safety functions of the CU240E-2, two digital inputs can now be re-parameterized to become one F-DI (fail-safe, two-channel input). The number of F-DIs varies depending on the CU (see chapter 3.1).

- CU240E-2 has just one F-DI
- CU240E-2-F has up to 3 F-DIs

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-IOs.

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:

- CU240E → p731
- CU240E-2 → p730

3.3.2 Hardware change DO1

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

3.4 Analog inputs

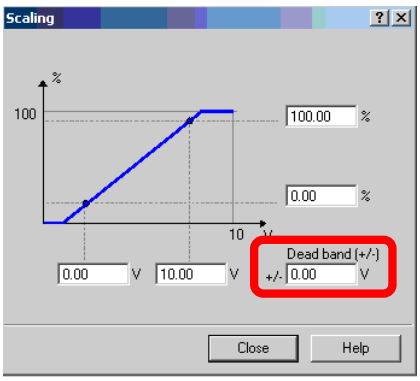
3.4.1 Modified factory setting

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

3.4.2 Changed ADU dead band (p761)

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

Figure 3-5: CU240E

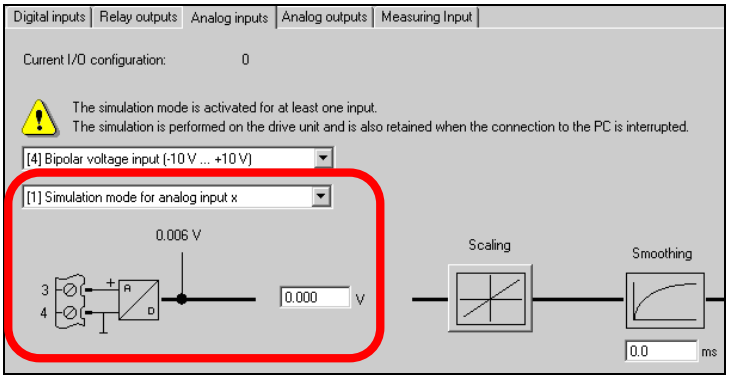


- The following setting should be made in order to implement a wire break monitoring function in the CU240E:
  - p756 → 1 (for 2-10V) or 3 (for 4-20mA) and
  - p761 → 0
- If, using this function in the CU240E, the analog values around 0V are suppressed, then this function can only be implemented by using FFBs (free function blocks). We are presently working on an integrated solution.

3.4.3 Simulation of the analog inputs (NEW)

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

Figure 3-6



4 Communication

Existing programs to control a SINAMICS G120 with CU240E 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.

4.1 GSD files

The new GSD files are available for the CU240E-2 family.

NOTE These can be downloaded under the following:
http://support.automation.siemens.com/WW/view/en/23450835

4.2 Dataset routing through a CPU

For routing beyond network limits (e.g. Industrial Ethernet to PROFIBUS) a network device is needed, which must support routing functionality.

In addition - just as before - “DriveES Basic” is required.

Dataset routing, which is needed for the communication between ES (engineering system) and SINAMICS G120 (new generation, “-2”), is supported by following SIMATIC CPUs:

The following CPUs support dataset 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 dataset routing:

- SIMATIC S7-1200
- WinAC MP
- SIMOTION — For SINUMERIK 840D sl: Data set routing is only possible via the X150 PROFINET interface

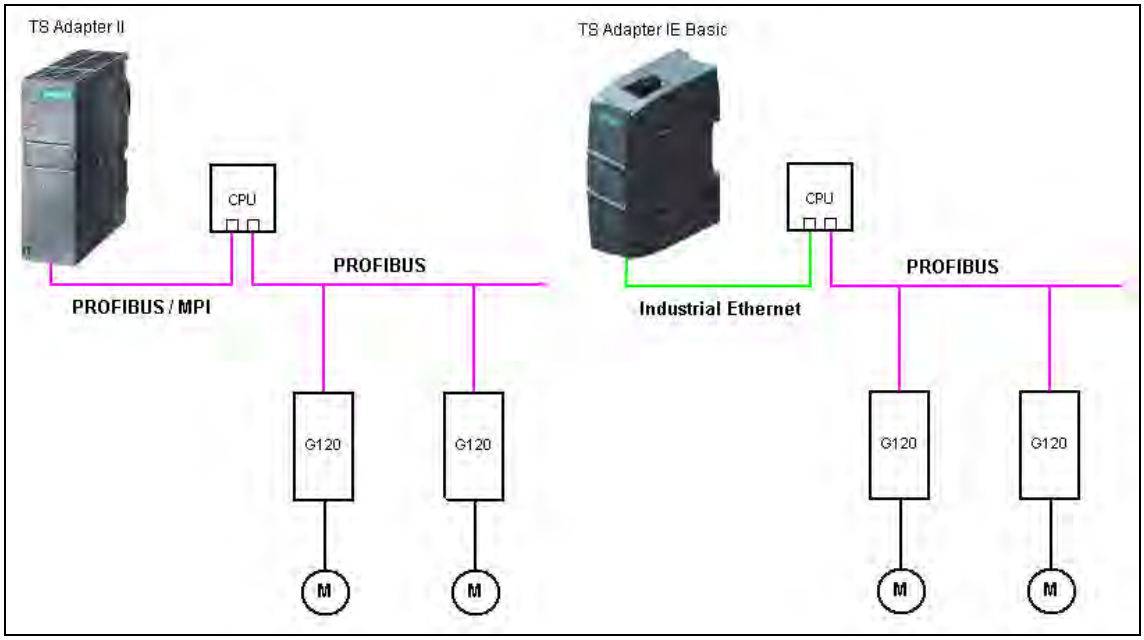
4.3 Teleservice

4.3.1 Teleservice via a CPU

A CPU is needed, which supports dataset routing (see chapter 4.2). It means the communication between TS Adapter and CPU is S7 communication, and the communication between CPU and G120 is standard dataset communication.

Dataset routing into a PROFIBUS network is supported

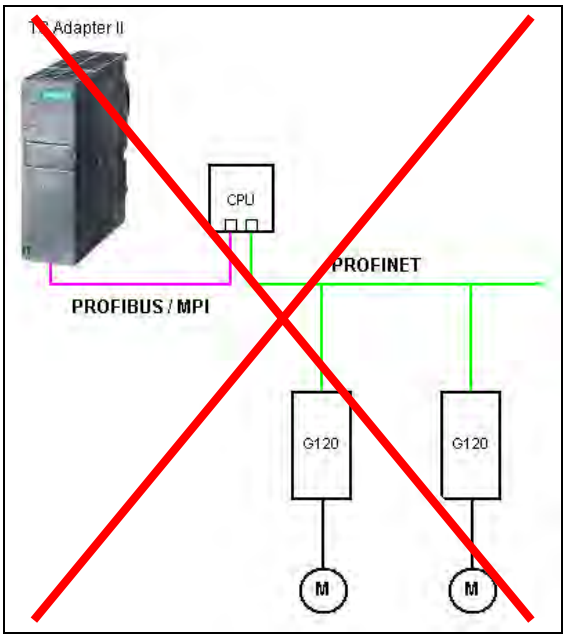
Figure 4-1



NOTE The TS Adapter and the G120 must be connected via different interfaces of the CPU.

Dataset routing into a PROFINET network is <u>not</u> supported

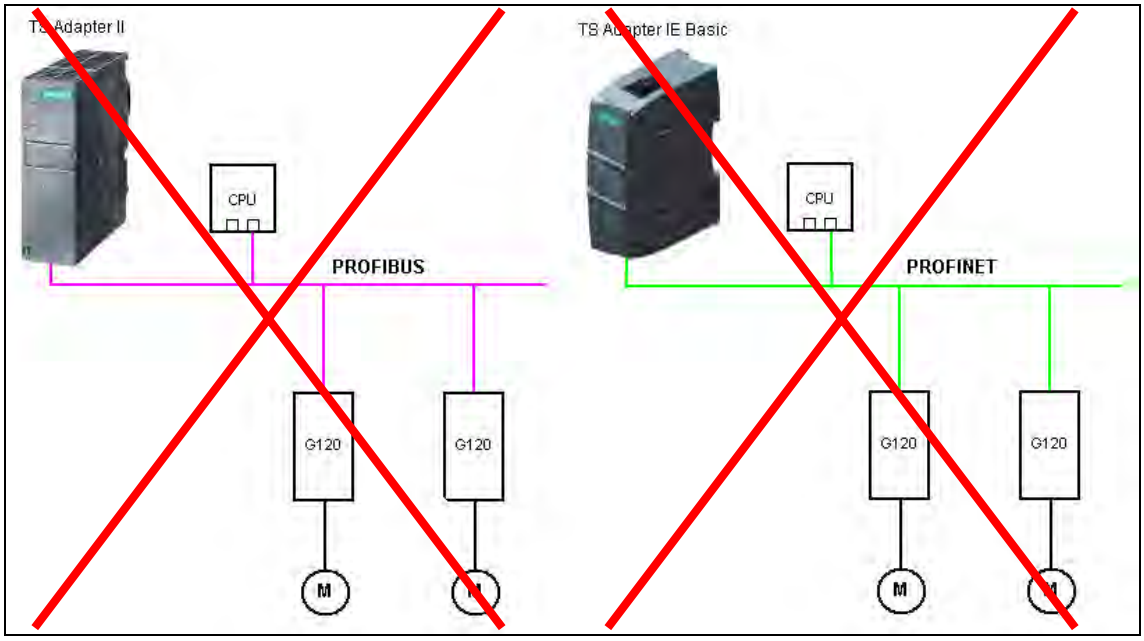
Figure 4-2



4.3.2 Teleservice directly to the fieldbus

With this configuration, the Teleservice Adapter is directly connected to the fieldbus. In this case not the CPU, but the TS Adapter must support dataset routing. Presently there is <u>no</u> TS Adapter available supporting dataset routing!

Figure 4-3



4.4 Slave-to-slave traffic (NEW)

With "Slave-slave communication" - also known as "Data Exchange Broadcast" - fast data exchange is possible between the drives (slaves) without the master being directly involved; for instance, to enter the actual value of one drive as setpoint for the other drive.

NOTE Detailed information is provided in the operating instructions (chapter 6.1.4.4)
http://support.automation.siemens.com/WW/view/en/50815575

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.

NOTE Drive parameters can be read from 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 CU240E 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 IOP or BOP-2

For the CU240E, manual operation has been realized by changing over the command datasets.

In the CU240E-2, switchover to manual operation is realized using the manual button of the IOP/BOP-2. When activating manual operation, the control authority is taken over by the IOP/BOP-2, the parameterized/active command and setpoint sources are therefore 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 IOP/BOP-2 permanently active:
  This function is not possible. After line supply on, manual operation must be reactivated at the IOP/BOP-2.

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

The IOP/BOP-2 operator control panels can no longer be used as BICO sources as for the CU240E (r19).

6 Parameterization

It is not possible to directly migrate from CU240E 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 Changed reference quantities

The reference quantities (p2000..2004) apply in the CU240E-2 as standard for all datasets. 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.

6.2 Fixed setpoints that can be freely used (NEW)

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].

6.3 Parameterizing the command and setpoint sources (NEW)

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, IO interconnection) can be adapted to the corresponding application far faster than before. However, depending on the STARTER version it is only possible to access p15 online.

NOTE Details, refer to the operating instructions (chapters 3.4.5)
http://support.automation.siemens.com/WW/view/en/50815575

6.4 Expanding the command / drive datasets

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

6.5 Speed-dependent controller adaptation (NEW)

The Tn and Kp components of the controller can now be adapted as a function of the speed in the CU240E-2.

NOTE Refer to the parameter manual (function diagram 6050)
http://support.automation.siemens.com/WW/view/en/49946755

6.6 Changed second ramp function

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

NOTE However, when using the dataset changeover (DDS), up to 4 different parameterizable ramp functions are now available. The dataset changeover can be implemented in operation via digital inputs or via the fieldbus (for details, refer to the operating instructions, chapter 7.11).
http://support.automation.siemens.com/WW/view/en/50815575

6.7 U/f characteristic (U/f with programmable characteristic)

Contrary to the CU240E (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.

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

6.8 Operating hours counter (NEW)

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.

6.9 Changes to the braking chopper

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

- Connect the thermal sensor of the braking resistor to a DI of the drive and parameterize this input with the function "[29] External fault".
- In addition, the VDCmax controller must be deactivated (for vector control: p1240 = 0, for U/f: p1280 = 0).

6.10 BF-LED can be deactivated

If a fieldbus is not used, then the BF-LED (bus failure LED) can be deactivated using parameter p2030 = 0.

NOTE For more detailed information see
http://support.automation.siemens.com/WW/view/en/35230900

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.

NOTE For details refer to the operating instructions or the STARTER screen form
http://support.automation.siemens.com/WW/view/en/50815575

NOTE 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 CU240E. As a consequence, it was necessary to shift the parameter numbers. Presently, the FFBs can only be interconnected via the expert list.

NOTE For details refer to the list of manual (chapter 2.12)
http://support.automation.siemens.com/WW/view/en/49946755

6.13 Changes to the phase failure monitoring

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

6.14 Wobbulation generator has been eliminated

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

6.15 Positioning down ramp has been eliminated

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

NOTE Alternative the implementation using a rapid traverse / crawl switchover based on FFBs or using a SINAMICS S110 with EPOS (basic positioner) is possible.

7 Safety functions

Contrary to the CU240E, the CU240E-2 has integrated safety functions. The following table provides an overview of the available safety functions and how they are controlled.

Drive family	SINAMICS G120			
Control Unit	CU240E-2	CU240E-2 DP	CU240E-2 F	CU240E-2 DP-F
Firmware basis	as from V4.4			
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
Controlling the safety functions:				
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

NOTE

- Speed sensing using an encoder is not required for the 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 – and loads that are permanently in the generator mode.
- The F-DIs are formed by combining 2 standard DIs by making the appropriate parameter assignment.

NOTE

More detailed information on the safety functions is provided in the Safety Integrated Function Manual; Entry-ID: 50736819

or under following link: https://www.automation.siemens.com/mcms/safety-integrated/en/machine-safety/drive-technology/safety-functions/Pages/Default.aspx

8 Drive fault messages

The drive fault messages/signals of the CU240E-2 have changed when compared to the CU240E.

NOTE 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: http://support.automation.siemens.com/WW/view/en/47520881