7.1.2 Control Unit Adapter

Brief description

Using a Control Unit Adapter, a Power Module can be connected as an additional axis to an existing DC/AC group. A higher-level closed-loop control module is always required.

	
Control Unit Adapter CUA31	Control Unit Adapter CUA32

Features

Designation	Features	Order number
CUA31	- Addition of an axis	6SL3040-0PA00-0AA1
CUA32	- Addition of an axis - TTL/HTL/SSI encoder evaluation	6SL3040-0PA01-0AA0

7.2 Safety instructions for Control Units and Control Unit Adapters

⚠WARNING

Danger to life if the fundamental safety instructions and residual risks are not observed

The non-observance of the fundamental safety instructions and residual risks stated in Chapter 1 can result in accidents with severe injuries or death.

- Observe the fundamental safety instructions.
- Consider the residual risks for the risk evaluation.

⚠WARNING

Danger of fire through overheating for insufficient ventilation clearances

Insufficient ventilation clearances result in overheating with danger to persons as a result of smoke and fire. Further, increased failures can occur and the service life of units/systems shortened.

- It is essential that you maintain 50 mm ventilation clearances above and below the Control Unit and Control Unit Adapter.
- Ensure that the air openings are not blocked by connecting cables.

⚠WARNING

Danger to life due to software manipulation when using exchangeable storage media

Storing files onto exchangeable storage media amounts to an increased risk of infection, e.g. with viruses and malware. As a result of incorrect parameterization, machines can malfunction, which in turn can lead to injuries or death.

- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.

NOTICE

Memory card damage caused by electric fields or electrostatic discharge

Electrical fields or electrostatic discharge may result in the memory card being damaged.

- When removing and inserting the memory card, always observe the ESD regulations.

NOTICE

Risk of component destruction as a result of high leakage currents

The Control Unit or other PROFIBUS and/or PROFINET nodes can be destroyed, if significant leakage currents flow via the PROFIBUS or PROFINET cable.

- Use a functional equipotential bonding conductor with a cross-section of at least 25 mm² between components of a plant or system that are located at a distance from each other.

NOTICE

Device failure due to unshielded or incorrectly laid cables to the temperature sensors

Unshielded or incorrectly laid cables to the temperature sensors can cause induced voltages from the power side to the signal-processing electronics. This can cause massive interferences of all signals (error messages) through to the failure of individual components (damage of the devices).

- Use only shielded cables to the temperature sensors.
- If cables to temperature sensors are laid together with the motor cable, use twisted pairs and separately shielded cables.
- Connect the cable shield to ground potential through a large surface area.
- Recommendation: Use appropriate Motion Connect cables.

NOTICE

Damage caused by the use of incorrect DRIVE-CLiQ cables

Damage or malfunctions can occur on the devices or system when DRIVE-CLiQ cables are used that are either incorrect or have not been approved for this purpose.

- Only use suitable DRIVE-CLiQ cables that have been approved by Siemens for the particular application.

Note

Functional faults caused by dirty DRIVE-CLiQ interfaces

Malfunctions can occur in the system through the use of polluted DRIVE-CLiQ interfaces.

- Close any unused DRIVE-CLiQ interfaces with the supplied cover plates.

Note

Function equipotential bonding for distributed DRIVE-CLiQ nodes

Integrate all of the components that are connected via DRIVE-CLiQ into the function equipotential bonding concept. The connection should be preferably established by mounting on metallic bare machine and plant components that are connected with one another using an equipotential bonding conductor.
Alternatively, you can establish equipotential bonding using a conductor (min. 6 mm²), which as far as possible, is routed in parallel to the DRIVE-CLiQ cable. This involves all distributed DRIVE-CLiQ nodes, for example SMCx0.

7.3 Control Unit CU310-2 PN (PROFINET)

7.3.1 Description

The Control Unit CU310-2 PN (PROFINET) is a control module for single drives in which the open-loop and closed-loop control functions of the drive are implemented.
It controls the Power Modules in the blocksize format via the PM-IF interface and is mounted directly on the Power Module. Power Modules Chassis are controlled from the Control Unit via the DRIVE-CLiQ interface. They are mounted next to the Power Modules in the control cabinet.

The CU310-2 PN is hot-pluggable. It can be used with firmware version 4.4 or higher.

The table shows an overview of the interfaces on the CU310-2 PN.

Table 7- 1 Overview of the CU310-2 PN interfaces

Type	Quantity
Isolated digital inputs	11
Non-isolated digital inputs/outputs	8
Isolated digital output	1
Non-isolated analog input	1
DRIVE-CLiQ interface	1
PROFINET interfaces	2
Serial interface (RS232)	1
Encoder interface (HTL/TTL/SSI)	1
LAN (Ethernet)	1
Temperature sensor input	1
EP terminal	1
Measuring sockets	3

7.3.2 Interface description

7.3.2.1 Overview

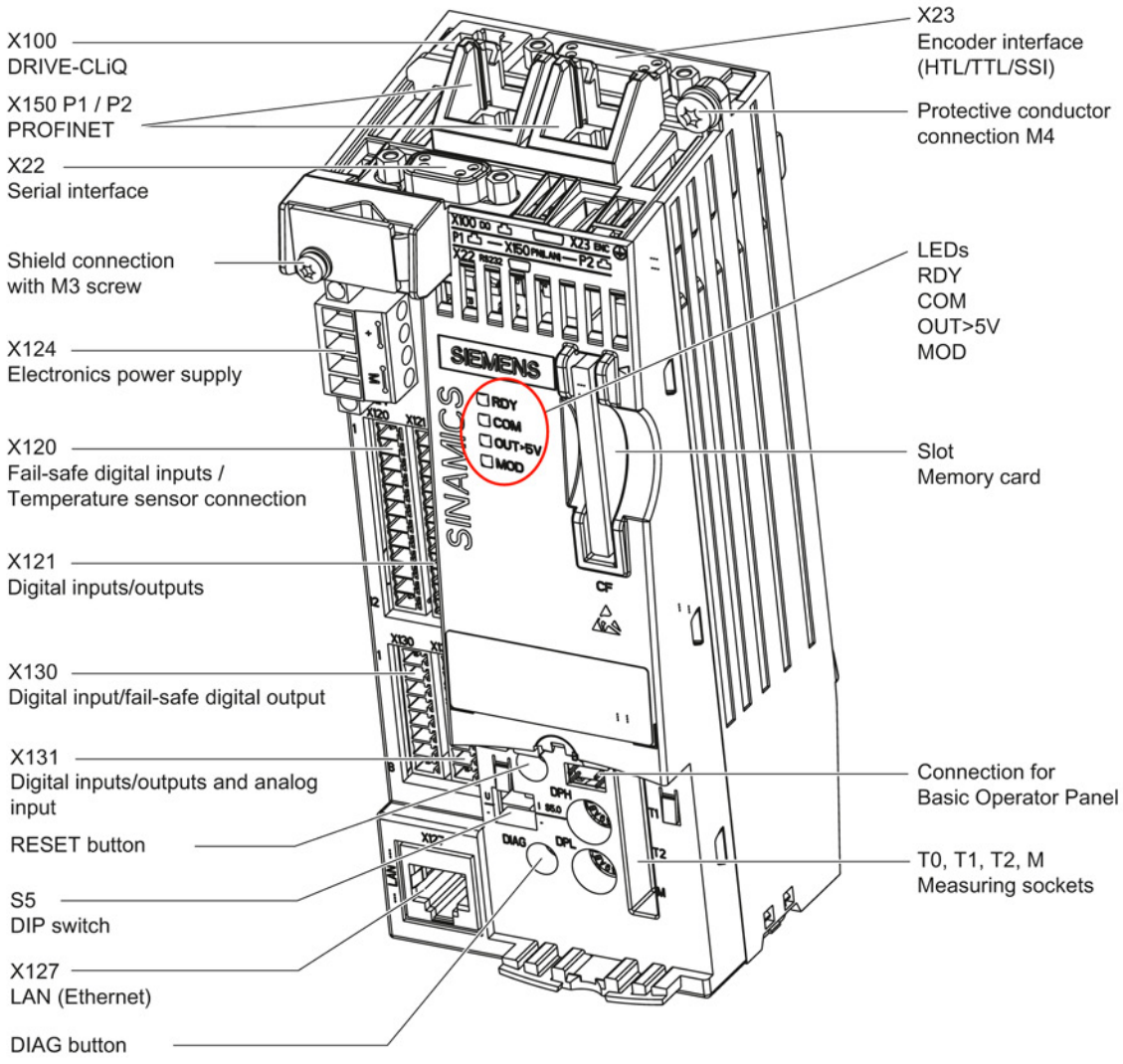


Figure 7-2 CU310-2 PN overview of interfaces

Note

The PROFIBUS address switch on the CU310-2 PN has no function.

The interface to the Power Module is located at the rear of the CU310-2 PN.

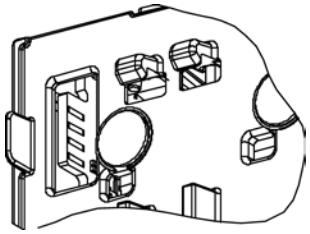
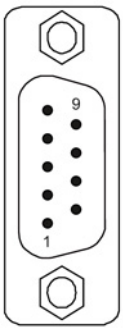


Figure 7-3 CU310-2 PN interface to the Power Module (PM-IF)

7.3.2.2 X22 serial interface (RS232)

Table 7- 2 X22 serial interface (RS232)

	Pin	Signal name	Technical data
	1	Reserved, do not use	
	2	XRXD_RS232	Receive data
	3	XTXD_RS232	Transmit data
	4	Reserved, do not use	
	5	GND	Ground
	6	Reserved, do not use	
	7	Reserved, do not use	
	8	Reserved, do not use	
	9	Reserved, do not use	
Connector type	9-pin SUB D connector		

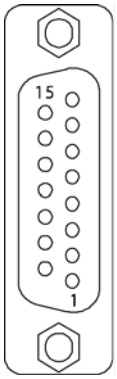
Features

The maximum data rate is:

- 120 kBaud at a load capacity of 1.0 nF
- 20 kBaud at a load capacity of 2.5 nF

7.3.2.3 X23 HTL/TTL/SSI encoder interface

Table 7- 3 X23 HTL/TTL/SSI encoder interface

	Pin	Signal name	Technical data
	1	+Temp	KTY or PTC input
	2	SSI_CLK	SSI clock, positive
	3	SSI_XCLK	SSI clock, negative
	4	P encoder 5 V / 24 V	Encoder power supply
	5	P encoder 5 V / 24 V	
	6	P_Sense	Sense input, encoder power supply
	7	GND	Ground, encoder power supply
	8	M (-Temp)	Ground for KTY or PTC
	9	M_Sense	Ground sense input
	10	RP	R track positive
	11	RN	R track negative
	12	BN	B track negative
	13	BP	B track positive
	14	AN_SSI_XDAT	A track negative / SSI data negative
	15	AP_SSI_DAT	A track positive / SSI data positive
Connector type	15-pin Sub-D socket		
Measuring current via temperature sensor connection: 2 mA			

NOTICE

Risk of motor overheating for incorrectly connected KTY temperature sensor

A KTY temperature sensor connected with incorrect polarity cannot detect if the motor overheats.

- Make sure that you connect the KTY temperature sensor with the correct polarity.

Note

There are two ways of connecting the temperature sensor:

1. via X120, terminals 1 and 2
2. via X23, pins 1 and 8

Encoders that can be connected

Note

Use of bipolar and unipolar encoders

Use bipolar encoders.

When using unipolar encoders, the unused negative track signals can either be connected or connected to ground. This results in different switching thresholds.

Table 7- 4 Specification of measuring systems that can be connected

Parameter	Designation	Threshold	Min.	Type	Max.	Unit
Permissible signal level in bipolar mode[1]; (TTL, SSI, HTL bipolar at X23)[2][3]	U_{diff}		2,0		Vcc	V
Permissible signal frequency	f_S		-		500	kHz
Required edge clearance	t_{min}		100		-	ns
Permissible zero pulse (with $T_s = 1/f_s$)	Length		¼ · T_s		¾ · T_s	
	Center of the pulse position		50	135	220	degrees
Switching threshold in the unipolar mode[1] and signals AN_SSI_XDAT, BN, RN at X23 connected to M_Encoder	$U_{(Switch)}$	High [4]	8,4	10,6	13,1	V
		Low[4]	3,5	4,8	6,3	V
Switching thresholds in the unipolar mode (see SINAMICS S120/S150 List Manual) and signals AN_SSI_XDAT, BN, RN not connected to X23	$U_{(Switch)}$	High [4]	9	11,3	13,8	V
		Low[4]	5,9	7,9	10,2	V

1) See SINAMICS S120/S150 List Manual for setting the mode

2) Other signal levels according to the RS422 specification.

3) The absolute level of the individual signals varies between 0 V and Vcc of the measuring system.

4) See SINAMICS S120/S150 List Manual for setting the threshold

Encoder cables

Encoder type	Maximum encoder cable length in m
TTL[1)]	100
HTL unipolar[2)]	100
HTL bipolar	300
SSI [3)]	up to 100 (depending on the baud rate)

1) 100 m with remote sense

2) Because the transmission technology is more robust, the bipolar connection should always be used. The unipolar connection should only be used if the encoder type does not output push-pull signals.

3) For the cable length, see the diagram "Maximum cable lengths depending on the SSI baud rate for SSI encoders"

Note

Prefabricated cable for 5 V TTL encoder

When using a 5 V TTL encoder (6FX encoder), use connection cable 6FX8002-2CR00-xxx.

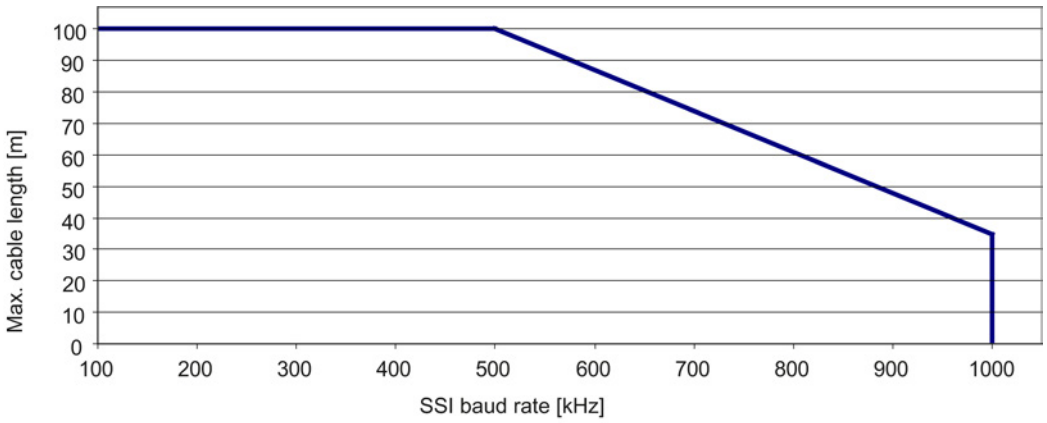
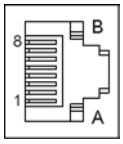


Figure 7-4 Maximum cable lengths depending on the SSI baud rate for SSI encoders

7.3.2.4 X100 DRIVE-CLiQ interface

Table 7- 5 X100 DRIVE-CLiQ interface

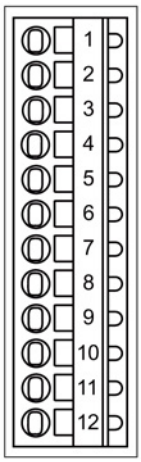
	Pin	Signal name	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	-
	5	Reserved, do not use	-
	6	RXN	Receive data -
	7	Reserved, do not use	-
	8	Reserved, do not use	-
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronic ground
Connector type	DRIVE-CLiQ socket		

The blanking cover for the DRIVE-CLiQ port is included in the scope of delivery.

Blanking covers (50 pieces) Order number: 6SL3066-4CA00-0AA0

7.3.2.5 X120 digital inputs (fail-safe)/EP terminal/temperature sensor

Table 7- 6 X120 fail-safe digital inputs/temperature sensor input

	Terminal	Designation [1]		Technical data
	1	+ Temp [2]		Temperature sensors: KTY84-1C130/PTC Measuring current via temperature sensor connection: 2 mA
	2	- Temp [2]		
	3	DI 16	F-DI 0	Voltage: - 3 … 30 V Current consumption, typical: 6 mA at 24 VDC Input delay (typ.): [2] For "0" → "1": 50 µs For "1" → "0": 150 µs Level (incl. ripple): High signal level: 15 … 30 V Low signal level: -3 … 5 V Electrical isolation: M1: Reference potential for DO16, DI16, DI18 and DI20 DI17-/DI19-/DI21-: Reference potential for DI17/DI19/DI21
	4	DI17+ / EP +24 V3 (Enable Pulses)		
	5	DI17- / EP M3 (Enable Pulses)		
	6	DI 18	F-DI 1	
	7	DI 19+		
	8	DI 19-		
	9	DI 20	F-DI 2	
	10	DI 21+		
	11	DI 21-		
	12	M1		
Type: Spring-loaded terminal 1 (Page 437) Max. cross-section that can be connected: 1.5 mm²				

[1] DI: Digital input; DO: Digital output; F-DI: Fail-safe digital input

[2] Control of Chassis Power Modules: +Temp/-Temp deactivated, temperature input via terminal X41 of the Power Modules

[3] Pure hardware delay

The maximum cable length that can be connected is 30 m.

Fail-safe digital inputs

An F-DI consists of a digital input and a second digital input to which the cathode of the optocoupler is connected.

Temperature sensor input

NOTICE
Risk of motor overheating for incorrectly connected KTY temperature sensor A KTY temperature sensor connected with incorrect polarity cannot detect if the motor overheats. • Make sure that you connect the KTY temperature sensor with the correct polarity.

Further information regarding the temperature sensor may be found in the SINAMICS S120 Commissioning Manual, "Temperature sensors for SINAMICS components" section.

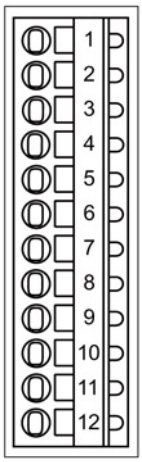
The maximum length of the temperature sensor cable is 300 m. The cables must be shielded. For cable lengths >100 m, cables with a cross-section of ≥1 mm² must be used.

EP terminal

The pulse inhibit function (EP) is only available when Integrated Basic Functions are enabled.

7.3.2.6 X121 digital inputs/outputs

Table 7- 7 X121 digital inputs and bidirectional digital inputs/outputs

	Terminal	Designation [1]	Technical data
	1	DI 0	Voltage: -3 … 30 VDC Current consumption, typical: 6 mA at 24 V Electrical isolation: via optocoupler Level (incl. ripple) High level: 15 … 30 V Low signal level: -3 … 5 V (at ≤ 2 mA) Input delay (typ.): For "0" → "1": 50 µs For "1" → "0": 150 µs protected against polarity reversal
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	M2	Reference potential for digital inputs DI 0 to DI 3
	6	GND	Ground reference for the electronics
	7	DI/DO 8	**As input:** Voltage: -3 … 30 VDC Current consumption, typical: 5 mA at 24 V Level (incl. ripple) High level: 15 … 30 V Low signal level: -3 … 5 V (at ≤ 2 mA) DI/DO 8, 9, 10, and 11 are rapid inputs [2] Input delay (typ.): For "0" → "1": 5 µs For "1" → "0": 50 µs **As output:** Voltage: 24 VDC Max. load current per output: 500 mA Output delay (typ. / max.)[3]: For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Short-circuit, ground fault, overload proof Automatic switch on again after overload trip Switching frequency: for ohmic load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	8	DI/DO 9	
	9	GND	
	10	DI/DO 10	
	11	DI/DO 11	
	12	GND	
Type: Spring-loaded terminal 1 (Page 437) Max. cross-section that can be connected: 1.5 mm^2			

[1] DI: Digital input; DI/DO: Bidirectional digital input/output

[2] The rapid inputs can be used as probe inputs or as inputs for the external zero mark

[3] Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90% V_{out}; low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

An open input is interpreted as "low".

Terminal M2 must be connected so that the digital inputs (DI0 ... DI3) can be used. This is achieved through one of the following measures:

- Provide the ground reference of the digital inputs.
- A jumper to terminal M (this removes the electrical isolation for these digital inputs).

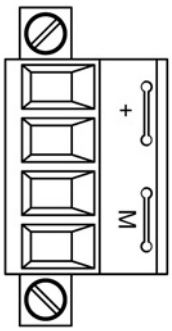
Note

A 24 V supply voltage must be connected to terminal X124 for the digital outputs to be used.

If momentary interruptions in the voltage occur in the 24 V supply, the digital outputs are deactivated until the interruption has been rectified.

7.3.2.7 X124 Electronics power supply

Table 7- 8 X124 Electronics power supply

	Terminal	Designation	Technical data
	+	Electronics power supply	Voltage: 24 VDC (20.4 ... 28.8 VDC) Current consumption: Max. 1.0 A (without DRIVE-CLiQ or digital outputs) Max. current via jumper in connector: 20 A (15 A according to UL/CSA)
	+	Electronics power supply	
	GND	Electronics ground	
	GND	Electronics ground	
Type: Screw-type terminal 2 (Page 437) Max. cross-section that can be connected: 2.5 mm^2			

The screw terminal must be tightly screwed using a flat-bladed screwdriver.

The maximum cable length that can be connected is 10 m.

If the 24 V supply is not connected, the digital outputs of the following interfaces cannot be used:

- X121 (DO8 to DO11)
- X131 (DO12 to DO 15)

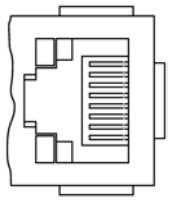
Note

The two "+" and/or "M" terminals are jumpered in the connector. This ensures that the supply voltage is looped through.

The current consumption increases by the value for the DRIVE-CLiQ participant and digital outputs.

7.3.2.8 X127 LAN (Ethernet)

Table 7- 9 X127 LAN (Ethernet)

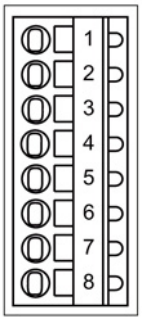
	Pin	Signal name	Technical data
	1	TXP	Ethernet transmit data +
	2	TXN	Ethernet transmit data -
	3	RXP	Ethernet receive data +
	4	Reserved, do not use	-
	5	Reserved, do not use	-
	6	RXN	Ethernet receive data -
	7	Reserved, do not use	-
	8	Reserved, do not use	-
Connector type	RJ45 socket		

Note

The Ethernet interface supports Auto MDI(X). It is therefore possible to use both crossed and uncrossed cables to connect the devices.

7.3.2.9 X130 digital input (fail safe) digital output

Table 7- 10 X130 digital input / fail-safe digital output

	Terminal	Designation [1]		Technical data
	1	DI 22+		Voltage: -3 … 30 VDC Current consumption, typical: 6 mA at 24 V Electrical isolation: via optocoupler Level (incl. ripple) High level: 15 … 30 V Low signal level: -3 … 5 V (at ≤ 2 mA) Input delay (typ.): For "0" → "1": 50 µs For "1" → "0": 150 µs protected against polarity reversal
	2	DI 22-		
	3	M2		Reference potential for digital inputs DI 0 to DI 3
	4	GND		Ground reference for the electronics
	5	M1		Reference potential for DI 16, DI 18, DI 20 and DO 16
	6	24 V1		Power supply for DO 16
	7	DO 16+	F-DO 0 [2]	Voltage: 24 VDC Max. load current per output: 500 mA Output delay (typ./max.): For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Short-circuit, ground fault, overload proof Automatic switch on again after overload trip
	8	DO 16-		
Type: Spring-loaded terminal 1 (Page 437) Max. cross-section that can be connected: 1.5 mm^2				

[1] DI: Digital input/DO: Digital output

[2] F-DO: Fail-safe digital output

The maximum cable length that can be connected is 30 m.

Fail-safe digital output

The F-DO consists of a high-side switch and a low-side switch.

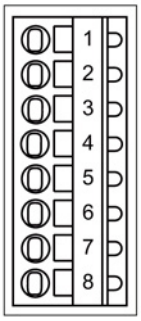
For applications without the safety function, the high-side switch may be used as an additional digital output. The low side switch is not available.

Note

If the 24 V supply is briefly interrupted, the digital output is deactivated until the interruption has been rectified.

7.3.2.10 X131 digital inputs/outputs and analog input

Table 7- 11 X131 bidirectional digital inputs/outputs and analog input

	Terminal	Designation [1]	Technical data
	1	DI/DO 12	**As input:** Voltage: -3 … 30 VDC Current consumption, typical: 5 mA at 24 V Level (incl. ripple) High level: 15 … 30 V Low signal level: -3 … 5 V (at ≤ 2 mA) DI/DO 12, 13, 14, and 15 are rapid inputs [2] Input delay (typ.): For "0" → "1": 5 µs For "1" → "0": 50 µs **As output:** Voltage: 24 VDC Max. load current per output: 500 mA Output delay (typ. / max.)[3]: For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Short-circuit, ground fault, overload proof Automatic switch on again after overload trip Switching frequency: For ohmic load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	2	DI/DO 13	
	3	GND	
	4	DI/DO 14	
	5	DI/DO 15	
	6	GND	Electronics ground
	7	AI 0+	The analog input can be switched between a current or voltage input using DIP switch S5. **Common-mode range**: ±12 V **As voltage input**: -10 … 10 V; R_i > 100 kΩ Resolution: 12-bit + sign (with respect to the maximum range that can be resolved -11 V ... 11 V) **As current input**: -20 ... 20 mA; Ri = 250 Ω Resolution: 11-bit + sign (related to -22 … 22 mA) Max. range that can be resolved: -44 … 44 mA
	8	AI 0-	
Type: Spring-loaded terminal 1 (Page 437) Max. cross-section that can be connected: 1.5 mm^2			

[1] DI/DO: bidirectional digital input/output; AI: Analog input

[2] The rapid inputs can be used as probe inputs or as inputs for the external zero mark.

[3] Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90% V_{out}; low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Permissible voltage values at the analog input

The common-mode range must not be violated in order to avoid incorrect results of the analog-digital conversion. This means that the analog differential voltage signals can have a maximum offset voltage of +/- 15 V with respect to the reference potential.

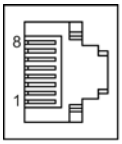
Note

A 24 V supply must be connected to terminal X124 for the digital outputs to be used.

If momentary interruptions in the voltage occur in the 24 V supply, the digital outputs are deactivated until the interruption has been rectified.

7.3.2.11 X150 P1/P2 PROFINET

Table 7- 12 X150 P1 and X150 P2 PROFINET

	Pin	Signal name	Technical data
	1	RXP	Receive data +
	2	RXN	Receive data -
	3	TXP	Transmit data +
	4	Reserved, do not use	-
	5	Reserved, do not use	-
	6	TXN	Transmit data -
	7	Reserved, do not use	-
	8	Reserved, do not use	-
Connector type:	RJ45 socket		
Data rate:	100 Mbits or 10 Mbits		

Note

The PROFINET interfaces support Auto MDI(X). It is therefore possible to use both crossed and uncrossed cables to connect the devices.

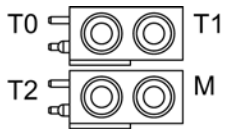
For diagnostic purposes, the two PROFINET interfaces are each equipped with a green and a yellow LED. The table shows the status information these indicate.

Table 7- 13 LED states on the X150 P1/P2 PROFINET interface

LED	Color	Status	Description
Link port	-	OFF	Missing or faulty link
	Green	Continuous light	10 or 100 Mbit link available
Activity port	-	OFF	No activity
	Yellow	Flashing	Data is being received or sent at port x

7.3.2.12 Measuring sockets

Table 7- 14 Measuring sockets T0, T1, T2

	Socket	Function	Technical data
	T0	Measuring socket 0	Voltage: 0 … V Resolution: 8 bits Load current: max. 3 mA Continued-short-circuit-proof The reference potential is terminal M
	T1	Measuring socket 1	
	T2	Measuring socket 2	
	GND	Ground	
The measuring sockets are only suitable for multiple-spring wire plugs with a diameter of 2 mm.			

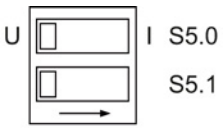
Note

Measuring sockets support commissioning and diagnosis. It must not be connected for normal operation.

7.3.2.13 S5 DIP switch

DIP switch S5 is used to switch the analog input between voltage input or current input. It is located under the blanking cover (see CU310-2 PN Interface Overview (Page 263).)

Table 7- 15 DIP switch S5 - switchover between voltage/current

	Switch	Function
	S5.0	Switchover between voltage (U) / current (I)
	S5.1	Not assigned

7.3.2.14 DIAG button

The DIAG pushbutton is reserved for service functions.

7.3.2.15 RESET button

Pressing the RESET button restarts the CU310-2 PN after expiry of a preset time. A data backup is run at the same time. This means that all the settings are retained.

7.3.2.16 Memory card

Inserting the memory card

Use only memory cards manufactured by Siemens to run the CU310-2 PN.

Insert the memory card into the CU310-2 PN so that the arrow on the card's label (on the left, next to the word Siemens) points to the arrow on the device.

Figure 7-5 CU310-2 PN Inserting the memory card

The memory card in a faulty CU310-2 PN

If you are returning a faulty CU310-2 PN to Siemens, remove the memory card and keep it in a safe place.
This ensures that all your saved data (firmware, licenses, parameters) will be available to you immediately again to commission a replacement unit.

7.3.3 Connection examples

CU310-2 PN without safety function

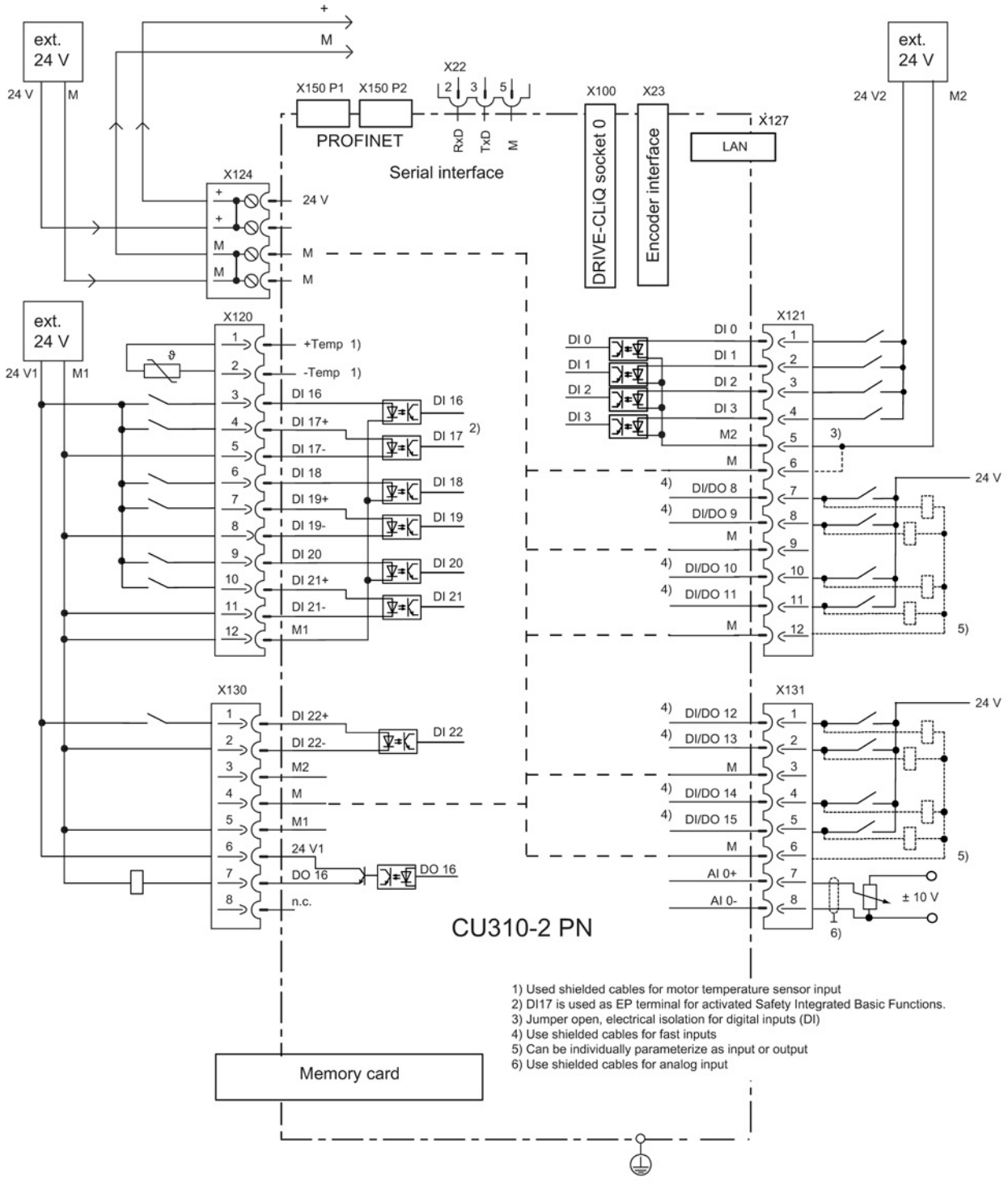


Figure 7-6 Connection example, CU310-2 PN without safety function

CU310-2 PN with safety function

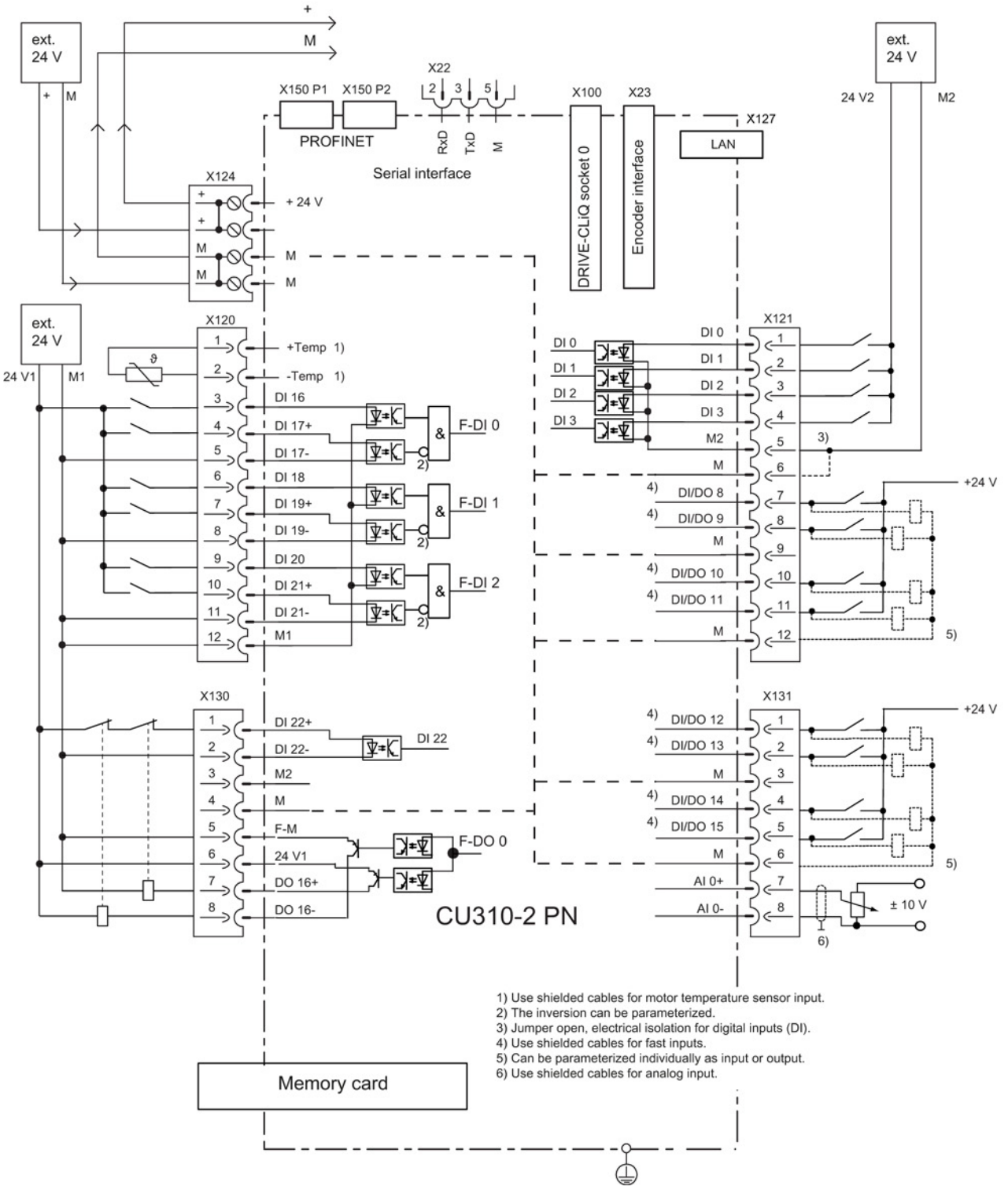


Figure 7-7 Connection example, CU310-2 PN with safety function

7.3.4 Meaning of the LEDs

7.3.4.1 Function of the LEDs

There are four LEDs on the front panel of the CU310-2 PN's housing (see CU310-2 PN Interface Overview (Page 263).)

Table 7- 16 LEDs

RDY	Ready
COM	Status of the fieldbus communication
OUT>5V	Encoder current supply > 5 V (TTL/HTL)
MOD	Operating mode (reserved)

The various LEDs are switched on and off as the control unit is powered up (depending on the phase the system is currently in). When switched on, the color of the LEDs shows the status of the corresponding power-up phase (see Behavior of the LEDs during booting (Page 284)).

In the event of a fault, power up will be ended in the corresponding phase. The LEDs that are switched on retain their color at this particular instant in time, so that the fault can be determined based on the combination of LEDs that are switched on (bright) and switched off (dark).

All the LEDs go out briefly if the CU310-2 PN has powered up without error. The system is ready for operation when the LED "RDY" is permanently green.

All the LEDs are controlled by the software loaded during operation (see Behavior of the LEDs in the operating state (Page 285).)

7.3.4.2 Behavior of the LEDs during booting

Table 7- 17 Load software

LED				State	Comment
RDY	COM	OUT>5V	MOD		
Orange	Orange	Orange	Orange	POWER ON	All LEDs light up for approx. 1 s
Red	Red	Off	Off	Hardware reset	After pressing the RESET button the LEDs light up for approx. 1 s
Red	Red	Off	Off	BIOS loaded	-
Red Flashing light 2 Hz	Red	Off	Off	BIOS error	Error occurred while loading the BIOS
Red Flashing light 2 Hz	Red Flashing light 2 Hz	Off	Off	File error	Memory card not inserted or faulty
					Software on memory card not present or corrupted

Table 7- 18 Firmware

LED				State	Comment
RDY	COM	OUT>5V	MOD		
Red	Orange	Off	Off	Firmware loading	COM-LED flashing without specific flashing frequency
Red	Off	Off	Off	Firmware loaded	-
Off	Red	Off	Off	Firmware check (no CRC error)	-
Red Flashing light 0.5 Hz	Red Flashing light 0.5 Hz	Off	Off	Firmware check (CRC error)	CRC is incorrect
Orange	Off	Off	Off	Firmware initialization	-

7.3.4.3 Behavior of the LEDs in the operating state

Table 7- 19 Description of the LEDs during operation of the CU310-2 PN

LED	Color	State	Description / cause	Remedy
RDY (READY)	-	OFF	The electronics power supply is missing or outside the permissible tolerance range.	Check the power supply
	Green	Continuous light	The unit is ready for operation. Cyclic DRIVE-CLiQ communication is in progress.	-
		Flashing light 0.5 Hz	Commissioning/reset	-
		Flashing light 2 Hz	Writing to the memory card.	-
	Red	Flashing light 2 Hz	General fault	Check parameter assignment/configuration
	Red/green	Flashing light 0.5 Hz	The control unit is ready for operation, but there are no software licenses.	Install the missing licenses.
	Orange	Flashing light 0.5 Hz	Updating the firmware of the DRIVE-CLiQ components.	-
		Flashing light 2 Hz	DRIVE-CLiQ component firmware update completed. Waiting for POWER ON of the corresponding components.	Switch on the component.
	Green/orange or red/orange	Flashing light 2 Hz	Recognition of the component via LED is activated (see SINAMICS S120/S150 List Manual.) **Note:** Both options depend on the LED status when component recognition is activated.	-
COM	-	OFF	Cyclic communication has not (yet) taken place. **Note:** PROFIdrive is ready for communication when the Control Unit is ready (see LED: RDY).	-
	Green	Continuous light	Cyclic communication is taking place.	-
		Flashing light 0.5 Hz	Full cyclic communication is not yet taking place. **Possible causes:** • The controller is not transferring any setpoints. • During isochronous operation, no GC (Global Control) or a faulty GC is transferred by the controller.	-
	Red	Flashing light 0.5 Hz	The PROFIBUS master is sending a faulty parameter assignment or the configuration file is corrupted.	Modify the configuration between master/controller and control unit.
		Flashing light 2 Hz	Cyclic bus communication has been interrupted or could not be established.	Rectify the fault in bus communication.

LED	Color	State	Description / cause	Remedy
MOD	-	OFF	-	-
OUT > 5 V	-	OFF	-	-
	Orange	Continuous light	The voltage of the electronics power supply for the measuring system is 24 V. [1]	

[1] Make sure that the encoder connected is designed for a 24 V supply. Connecting a 5 V encoder to a 24 V supply can result in destruction of the encoder electronics.

7.3.5 Dimension drawing

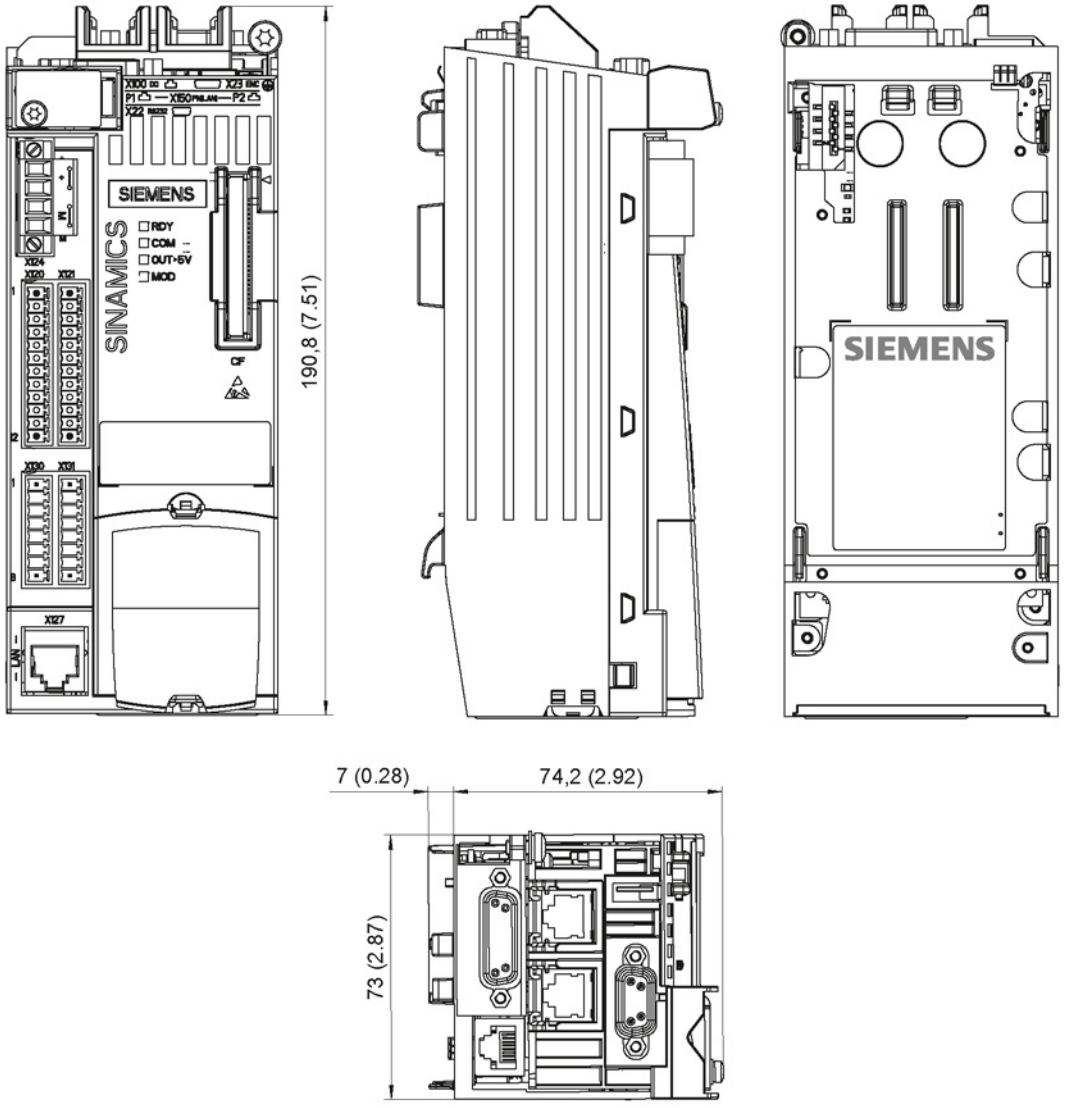


Figure 7-8 Dimension drawing, Control Unit CU310-2 PN, all data in mm (inches)

7.3.6 Technical data

Table 7- 20 Technical data for CU310-2 PN

6SL3040-1LA01-0AA0	Unit	Value
Electronics power supply		
Voltage	V_{DC}	DC 24 (20,4 … 28,8)
Current (without DRIVE-CLiQ and digital outputs)	A_{DC}	0,8
Power loss	W	< 20
Maximum DRIVE-CLiQ cable length	m	100
PE/ground connection	At the housing with M4/3 Nm screw	
Response time	The response time of digital inputs/outputs depends on the evaluation.[1)]	
Weight	kg	0,95

[1)] You will find information on this topic in the SINAMICS S120/S150 List Manual, Chapter "Function block diagrams."

7.4 Control Unit CU310-2 DP (PROFIBUS)

7.4.1 Description

The CU310-2 DP Control Unit (PROFIBUS) is a control module for single-motor drives in which the open-loop and closed-loop control functions of the drive are implemented.
It controls the Power Modules in the blocksize format via the PM-IF interface. Power Modules Chassis are controlled from the Control Unit via the DRIVE-CLiQ interface.

The CU310-2 DP is hot-pluggable. It can be used with firmware version 4.4 or higher.

The table shows an overview of the interfaces on the CU310-2 DP.

Table 7- 21 Overview of interfaces on the CU310-2 DP

Type	Quantity
Isolated digital inputs	11
Non-isolated digital inputs/outputs	8
Isolated digital output	1
Non-isolated analog input	1
DRIVE-CLiQ interface	1
PROFIBUS interface	1
Serial interface (RS232)	1
Encoder interface (HTL/TTL/SSI)	1
LAN (Ethernet)	1
Temperature sensor input	1
EP terminal	1
Measuring sockets	3

7.4.2 Interface description

7.4.2.1 Overview

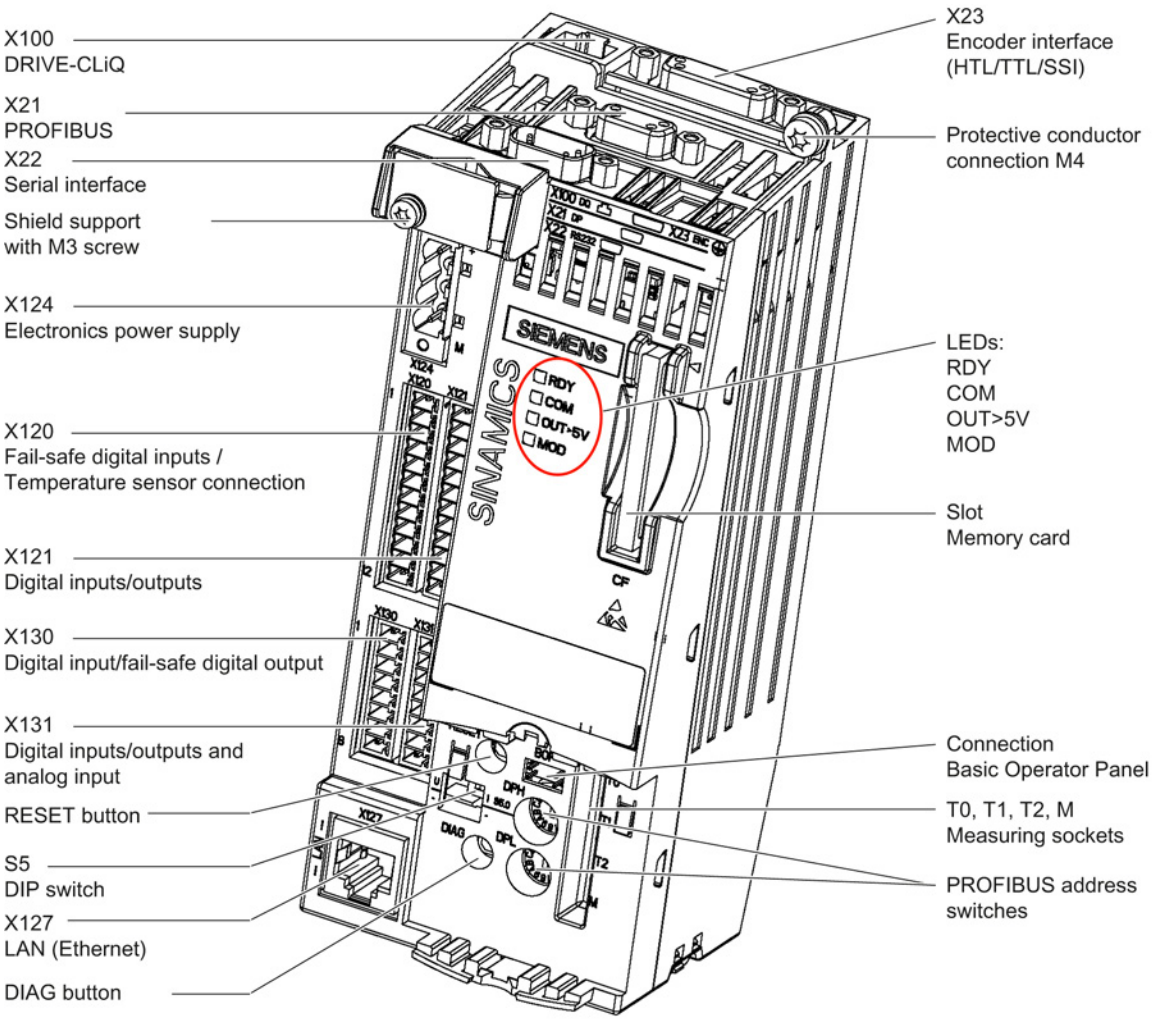


Figure 7-9 CU310-2 DP interface overview

The interface to the Power Module is located at the rear of the CU310-2 DP.

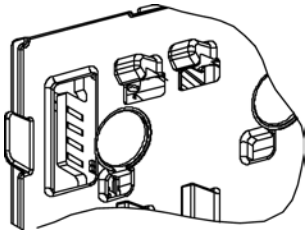
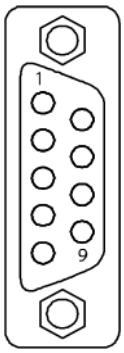


Figure 7-10 CU310-2 DP interface to the Power Module (PM-IF)

7.4.2.2 X21 PROFIBUS

The PROFIBUS interface X21 can be operated isochronously.

Table 7- 22 X21 PROFIBUS interface

	Pin	Signal name	Meaning	Range
	1	-	Not assigned	
	2	M24_SERV	Teleservice supply, ground	0 V
	3	RxD/TxD-P	Receive/transmit data P (B)	RS485
	4	CNTR-P	Control signal	TTL
	5	DGND	PROFIBUS data reference potential	
	6	VP	Supply voltage plus	5 V ± 10 %
	7	P24_SERV	Power supply for teleservice, + (24 V)	24 V (20.4 … 28.8 V)
	8	RxD/TxD-N	Receive/transmit data N (A)	RS485
	9	-	Not assigned	
Connector type	9-pin Sub-D socket			

Note

A teleservice adapter can be connected to the PROFIBUS interface X21 for remote diagnostics.
The power supply for the teleservice (terminals 2 and 7) can have a max. load of 150 mA.

PROFIBUS connector

For the first and last participants in a bus line, the terminating resistors must be switched in, otherwise, data transmission will not function correctly.

The terminating resistors are activated in the connector.

The cable shield must be connected at both ends over large-surface area contacts.

7.4.2.3 PROFIBUS address switch

The PROFIBUS address for the CU310-2 DP is set as a hexadecimal value on two rotary coding switches.
Values may be set between 0_{dec} (00_{hex}) and 127_{dec}($7F_{hex}$).
The upper rotary coding switch (H) is used to set the hexadecimal value for 16^1 and the lower rotary coding switch (L) is used to set the hexadecimal value for 16^0.

Table 7- 23 PROFIBUS address switch

Rotary coding switches	Significance	Examples		
		21_{dec}	**35_{dec}**	**126_{dec}**
		15_{hex}	**23_{hex}**	**$7E_{hex}$**
 DP H	$16^1 = 16$	1	2	7
 DP L	$16^0 = 1$	5	3	E

Setting the PROFIBUS address

The factory setting for the rotary coding switches is 0_{dec} (00_{hex}).

The PROFIBUS address is set as follows:

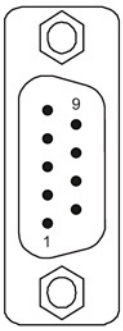
1. via a parameter (see SINAMICS S120/S150 List Manual)
   - To set the bus address for a PROFIBUS node using STARTER, first set the rotary code switches to 0_{dec} (00_{hex}) and 127_{dec} ($7F_{hex}$).
   - Then use the parameter to set the address to a value between 1 and 126.
2. via PROFIBUS address switch
   - The PROFIBUS address is set manually to a value between 1 and 126 on the two rotary coding switches. In this case the address is merely read out via the parameter.

Note

The rotary coding switches used to set the PROFIBUS address are found beneath the blanking cover (see CU310-2 DP Interface Overview (Page 289))

7.4.2.4 X22 serial interface (RS232)

Table 7- 24 X22 serial interface (RS232)

	Pin	Signal name	Technical data
	1	Reserved, do not use	
	2	XRXD_RS232	Receive data
	3	XTXD_RS232	Transmit data
	4	Reserved, do not use	
	5	GND	Ground
	6	Reserved, do not use	
	7	Reserved, do not use	
	8	Reserved, do not use	
	9	Reserved, do not use	
Connector type	9-pin SUB D connector		

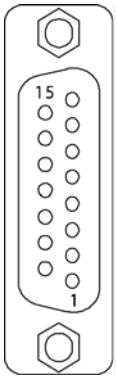
Features

The maximum data rate is:

- 120 kBaud at a load capacity of 1.0 nF
- 20 kBaud at a load capacity of 2.5 nF

7.4.2.5 X23 HTL/TTL/SSI encoder interface

Table 7- 25 X23 HTL/TTL/SSI encoder interface

	Pin	Signal name	Technical data
	1	+Temp	KTY or PTC input
	2	SSI_CLK	SSI clock, positive
	3	SSI_XCLK	SSI clock, negative
	4	P encoder 5 V / 24 V	Encoder power supply
	5	P encoder 5 V / 24 V	
	6	P_Sense	Sense input, encoder power supply
	7	GND	Ground, encoder power supply
	8	M (-Temp)	Ground for KTY or PTC
	9	M_Sense	Ground sense input
	10	RP	R track positive
	11	RN	R track negative
	12	BN	B track negative
	13	BP	B track positive
	14	AN_SSI_XDAT	A track negative / SSI data negative
	15	AP_SSI_DAT	A track positive / SSI data positive
Connector type	15-pin Sub-D socket		
Measuring current via temperature sensor connection: 2 mA			

NOTICE

Risk of motor overheating for incorrectly connected KTY temperature sensor

A KTY temperature sensor connected with incorrect polarity cannot detect if the motor overheats.

- Make sure that you connect the KTY temperature sensor with the correct polarity.

Note

There are two ways of connecting the temperature sensor:

1. via X120, terminals 1 and 2
2. via X23, pins 1 and 8

Encoders that can be connected

Note

Use of bipolar and unipolar encoders

Use bipolar encoders.

When using unipolar encoders, the unused negative track signals can either be connected or connected to ground. This results in different switching thresholds.

Table 7- 26 Specification of measuring systems that can be connected

Parameter	Designation	Threshold	Min.	Type	Max.	Unit
Permissible signal level in bipolar mode[1]; (TTL, SSI, HTL bipolar at X23)[2][3]	U_{diff}		2,0		Vcc	V
Permissible signal frequency	f_S		-		500	kHz
Required edge clearance	t_{min}		100		-	ns
Permissible zero pulse (with $T_s = 1/f_s$)	Length		¼ · T_s		¾ · T_s	
	Center of the pulse position		50	135	220	degrees
Switching threshold in the unipolar mode[1] and signals AN_SSI_XDAT, BN, RN at X23 connected to M_Encoder	$U_{(Switch)}$	High [4]	8,4	10,6	13,1	V
		Low[4]	3,5	4,8	6,3	V
Switching thresholds in the unipolar mode (see SINAMICS S120/S150 List Manual) and signals AN_SSI_XDAT, BN, RN not connected to X23	$U_{(Switch)}$	High [4]	9	11,3	13,8	V
		Low[4]	5,9	7,9	10,2	V

1) See SINAMICS S120/S150 List Manual for setting the mode

2) Other signal levels according to the RS422 specification.

3) The absolute level of the individual signals varies between 0 V and Vcc of the measuring system.

4) See SINAMICS S120/S150 List Manual for setting the threshold

Encoder cables

Encoder type	Maximum encoder cable length in m
TTL[1)]	100
HTL unipolar[2)]	100
HTL bipolar	300
SSI [3)]	up to 100 (depending on the baud rate)

1) 100 m with remote sense

2) Because the transmission technology is more robust, the bipolar connection should always be used. The unipolar connection should only be used if the encoder type does not output push-pull signals.

3) For the cable length, see the diagram "Maximum cable lengths depending on the SSI baud rate for SSI encoders"

Note

Prefabricated cable for 5 V TTL encoder

When using a 5 V TTL encoder (6FX encoder), use connection cable 6FX8002-2CR00-xxx.

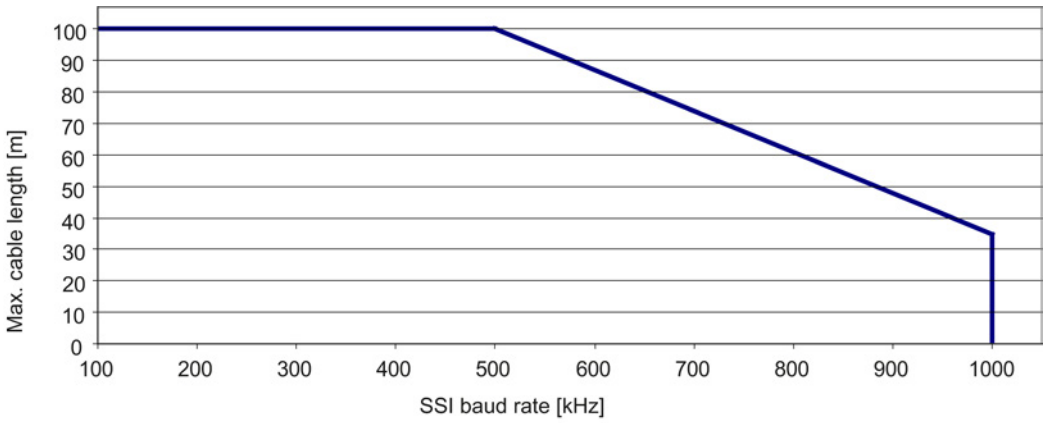
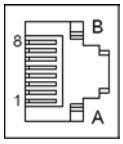


Figure 7-11 Maximum cable lengths depending on the SSI baud rate for SSI encoders

7.4.2.6 X100 DRIVE-CLiQ interface

Table 7- 27 X100 DRIVE-CLiQ interface

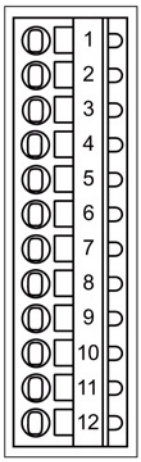
	Pin	Signal name	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	-
	5	Reserved, do not use	-
	6	RXN	Receive data -
	7	Reserved, do not use	-
	8	Reserved, do not use	-
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronic ground
Connector type	DRIVE-CLiQ socket		

The blanking cover for the DRIVE-CLiQ port is included in the scope of delivery.

Blanking covers (50 pieces) Order number: 6SL3066-4CA00-0AA0

7.4.2.7 X120 digital inputs (fail-safe)/EP terminal/temperature sensor

Table 7- 28 X120 fail-safe digital inputs/temperature sensor input

	Terminal	Designation 1)		Technical data
	1	+ Temp 2)		Temperature sensors: KTY84-1C130/PTC Measuring current via temperature sensor connection: 2 mA
	2	- Temp 2)		
	3	DI 16	F-DI 0	Voltage: - 3 … 30 V Current consumption, typical: 6 mA at 24 VDC Input delay (typ.): 2) For "0" → "1": 50 µs For "1" → "0": 150 µs Level (incl. ripple): High signal level: 15 … 30 V Low signal level: -3 … 5 V Electrical isolation: M1: Reference potential for DO16, DI16, DI18 and DI20 DI17-/DI19-/DI21-: Reference potential for DI17/DI19/DI21
	4	DI17+ / EP +24 V3 (Enable Pulses)		
	5	DI17- / EP M3 (Enable Pulses)		
	6	DI 18	F-DI 1	
	7	DI 19+		
	8	DI 19-		
	9	DI 20	F-DI 2	
	10	DI 21+		
	11	DI 21-		
	12	M1		
Type: Spring-loaded terminal 1 (Page 437) Max. cross-section that can be connected: 1.5 mm²				

1) DI: Digital input; DO: Digital output; F-DI: Fail-safe digital input

2) Control of Chassis Power Modules: +Temp/-Temp deactivated, temperature input via terminal X41 of the Power Modules

3) Pure hardware delay

The maximum cable length that can be connected is 30 m.

Fail-safe digital inputs

An F-DI consists of a digital input and a second digital input to which the cathode of the optocoupler is connected.

Temperature sensor input

NOTICE

Risk of motor overheating for incorrectly connected KTY temperature sensor

A KTY temperature sensor connected with incorrect polarity cannot detect if the motor overheats.

- Make sure that you connect the KTY temperature sensor with the correct polarity.

Further information regarding the temperature sensor may be found in the SINAMICS S120 Commissioning Manual, "Temperature sensors for SINAMICS components" section.

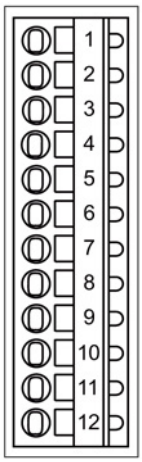
The maximum length of the temperature sensor cable is 300 m. The cables must be shielded. For cable lengths >100 m, cables with a cross-section of ≥1 mm² must be used.

EP terminal

The pulse inhibit function (EP) is only available when Integrated Basic Functions are enabled.

7.4.2.8 X121 digital inputs/outputs

Table 7- 29 X121 digital inputs and bidirectional digital inputs/outputs

	Terminal	Designation [1]	Technical data
	1	DI 0	Voltage: -3 … 30 VDC Current consumption, typical: 6 mA at 24 V Electrical isolation: via optocoupler Level (incl. ripple) High level: 15 … 30 V Low signal level: -3 … 5 V (at ≤ 2 mA) Input delay (typ.): For "0" → "1": 50 µs For "1" → "0": 150 µs protected against polarity reversal
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	M2	Reference potential for digital inputs DI 0 to DI 3
	6	GND	Ground reference for the electronics
	7	DI/DO 8	**As input:** Voltage: -3 … 30 VDC Current consumption, typical: 5 mA at 24 V Level (incl. ripple) High level: 15 … 30 V Low signal level: -3 … 5 V (at ≤ 2 mA) DI/DO 8, 9, 10, and 11 are rapid inputs [2] Input delay (typ.): For "0" → "1": 5 µs For "1" → "0": 50 µs **As output:** Voltage: 24 VDC Max. load current per output: 500 mA Output delay (typ. / max.)[3]: For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Short-circuit, ground fault, overload proof Automatic switch on again after overload trip Switching frequency: for ohmic load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	8	DI/DO 9	
	9	GND	
	10	DI/DO 10	
	11	DI/DO 11	
	12	GND	
Type: Spring-loaded terminal 1 (Page 437) Max. cross-section that can be connected: 1.5 mm^2			

[1] DI: Digital input; DI/DO: Bidirectional digital input/output

[2] The rapid inputs can be used as probe inputs or as inputs for the external zero mark

[3] Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90% V_{out}; low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

An open input is interpreted as "low".

Terminal M2 must be connected so that the digital inputs (DI0 ... DI3) can be used. This is achieved through one of the following measures:

- Provide the ground reference of the digital inputs.
- A jumper to terminal M (this removes the electrical isolation for these digital inputs).

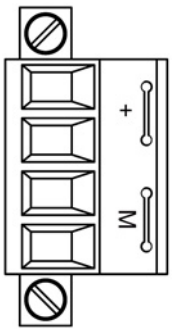
Note

A 24 V supply voltage must be connected to terminal X124 for the digital outputs to be used.

If momentary interruptions in the voltage occur in the 24 V supply, the digital outputs are deactivated until the interruption has been rectified.

7.4.2.9 X124 Electronics power supply

Table 7- 30 X124 Electronics power supply

	Terminal	Designation	Technical data
	+	Electronics power supply	Voltage: 24 VDC (20.4 ... 28.8 VDC) Current consumption: Max. 1.0 A (without DRIVE-CLiQ or digital outputs) Max. current via jumper in connector: 20 A (15 A according to UL/CSA)
	+	Electronics power supply	
	GND	Electronics ground	
	GND	Electronics ground	
Type: Screw-type terminal 2 (Page 437) Max. cross-section that can be connected: 2.5 mm^2			

The screw terminal must be tightly screwed using a flat-bladed screwdriver.

The maximum cable length that can be connected is 10 m.

If the 24 V supply is not connected, the digital outputs of the following interfaces cannot be used:

- X121 (DO8 to DO11)
- X131 (DO12 to DO 15)

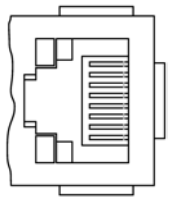
Note

The two "+" and/or "M" terminals are jumpered in the connector. This ensures that the supply voltage is looped through.

The current consumption increases by the value for the DRIVE-CLiQ participant and digital outputs.

7.4.2.10 X127 LAN (Ethernet)

Table 7- 31 X127 LAN (Ethernet)

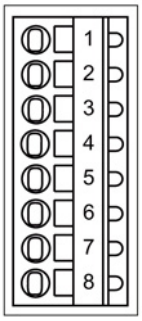
	Pin	Signal name	Technical data
	1	TXP	Ethernet transmit data +
	2	TXN	Ethernet transmit data -
	3	RXP	Ethernet receive data +
	4	Reserved, do not use	-
	5	Reserved, do not use	-
	6	RXN	Ethernet receive data -
	7	Reserved, do not use	-
	8	Reserved, do not use	-
Connector type	RJ45 socket		

Note

The Ethernet interface supports Auto MDI(X). It is therefore possible to use both crossed and uncrossed cables to connect the devices.

7.4.2.11 X130 digital input (fail safe) digital output

Table 7- 32 X130 digital input / fail-safe digital output

	Terminal	Designation [1]		Technical data
	1	DI 22+		Voltage: -3 … 30 VDC Current consumption, typical: 6 mA at 24 V Electrical isolation: via optocoupler Level (incl. ripple) High level: 15 … 30 V Low signal level: -3 … 5 V (at ≤ 2 mA) Input delay (typ.): For "0" → "1": 50 µs For "1" → "0": 150 µs protected against polarity reversal
	2	DI 22-		
	3	M2		Reference potential for digital inputs DI 0 to DI 3
	4	GND		Ground reference for the electronics
	5	M1		Reference potential for DI 16, DI 18, DI 20 and DO 16
	6	24 V1		Power supply for DO 16
	7	DO 16+	F-DO 0 [2]	Voltage: 24 VDC Max. load current per output: 500 mA Output delay (typ./max.): For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Short-circuit, ground fault, overload proof Automatic switch on again after overload trip
	8	DO 16-		
Type: Spring-loaded terminal 1 (Page 437) Max. cross-section that can be connected: 1.5 mm^2				

[1] DI: Digital input/DO: Digital output

[2] F-DO: Fail-safe digital output

The maximum cable length that can be connected is 30 m.

Fail-safe digital output

The F-DO consists of a high-side switch and a low-side switch.

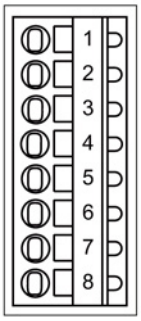
For applications without the safety function, the high-side switch may be used as an additional digital output. The low side switch is not available.

Note

If the 24 V supply is briefly interrupted, the digital output is deactivated until the interruption has been rectified.

7.4.2.12 X131 digital inputs/outputs and analog input

Table 7- 33 X131 bidirectional digital inputs/outputs and analog input

	Terminal	Designation [1]	Technical data
	1	DI/DO 12	**As input:** Voltage: -3 … 30 VDC Current consumption, typical: 5 mA at 24 V Level (incl. ripple) High level: 15 … 30 V Low signal level: -3 … 5 V (at ≤ 2 mA) DI/DO 12, 13, 14, and 15 are rapid inputs [2] Input delay (typ.): For "0" → "1": 5 µs For "1" → "0": 50 µs **As output:** Voltage: 24 VDC Max. load current per output: 500 mA Output delay (typ. / max.)[3]: For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Short-circuit, ground fault, overload proof Automatic switch on again after overload trip Switching frequency: For ohmic load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	2	DI/DO 13	
	3	GND	
	4	DI/DO 14	
	5	DI/DO 15	
	6	GND	Electronics ground
	7	AI 0+	The analog input can be switched between a current or voltage input using DIP switch S5. **Common-mode range**: ±12 V **As voltage input**: -10 … 10 V; R_i > 100 kΩ Resolution: 12-bit + sign (with respect to the maximum range that can be resolved -11 V ... 11 V) **As current input**: -20 ... 20 mA; Ri = 250 Ω Resolution: 11-bit + sign (related to -22 … 22 mA) Max. range that can be resolved: -44 … 44 mA
	8	AI 0-	
Type: Spring-loaded terminal 1 (Page 437) Max. cross-section that can be connected: 1.5 mm^2			

[1] DI/DO: bidirectional digital input/output; AI: Analog input

[2] The rapid inputs can be used as probe inputs or as inputs for the external zero mark.

[3] Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90% V_{out}; low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Permissible voltage values at the analog input

The common-mode range must not be violated in order to avoid incorrect results of the analog-digital conversion. This means that the analog differential voltage signals can have a maximum offset voltage of +/- 15 V with respect to the reference potential.

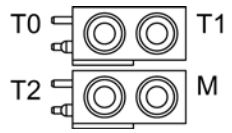
Note

A 24 V supply must be connected to terminal X124 for the digital outputs to be used.

If momentary interruptions in the voltage occur in the 24 V supply, the digital outputs are deactivated until the interruption has been rectified.

7.4.2.13 Measuring sockets

Table 7- 34 Measuring sockets T0, T1, T2

	Socket	Function	Technical data
	T0	Measuring socket 0	Voltage: 0 … V Resolution: 8 bits Load current: max. 3 mA Continued-short-circuit-proof The reference potential is terminal M
	T1	Measuring socket 1	
	T2	Measuring socket 2	
	GND	Ground	
The measuring sockets are only suitable for multiple-spring wire plugs with a diameter of 2 mm.			

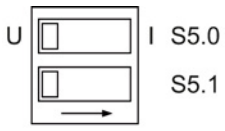
Note

Measuring sockets support commissioning and diagnosis. It must not be connected for normal operation.

7.4.2.14 S5 DIP switch

DIP switch S5 is used to switch the analog input between voltage input or current input. It is located under the blanking cover (see CU310-2 PN Interface Overview (Page 263).)

Table 7- 35 DIP switch S5 - switchover between voltage/current

	Switch	Function
	S5.0	Switchover between voltage (U) / current (I)
	S5.1	Not assigned

7.4.2.15 DIAG button

The DIAG pushbutton is reserved for service functions.

7.4.2.16 RESET button

Pressing the RESET button restarts the CU310-2 DP after expiry of a preset time. A data backup is run at the same time. This means that all the settings are retained.

7.4.2.17 Memory card

Inserting the memory card

Use only memory cards manufactured by Siemens to run the CU310-2 DP.

Insert the memory card into the CU310-2 DP so that the arrow on the card's label (on the left, next to the word Siemens) points to the arrow on the device.

Figure 7-12 CU310-2 DP Inserting the memory card

The memory card in a faulty CU310-2 DP

If you are returning a faulty CU310-2 DP to Siemens, remove the memory card and keep it in a safe place.
This ensures that all your saved data (firmware, licenses, parameters) will be available to you immediately again to commission a replacement unit.

7.4.3 Connection examples

CU310-2 DP without safety function

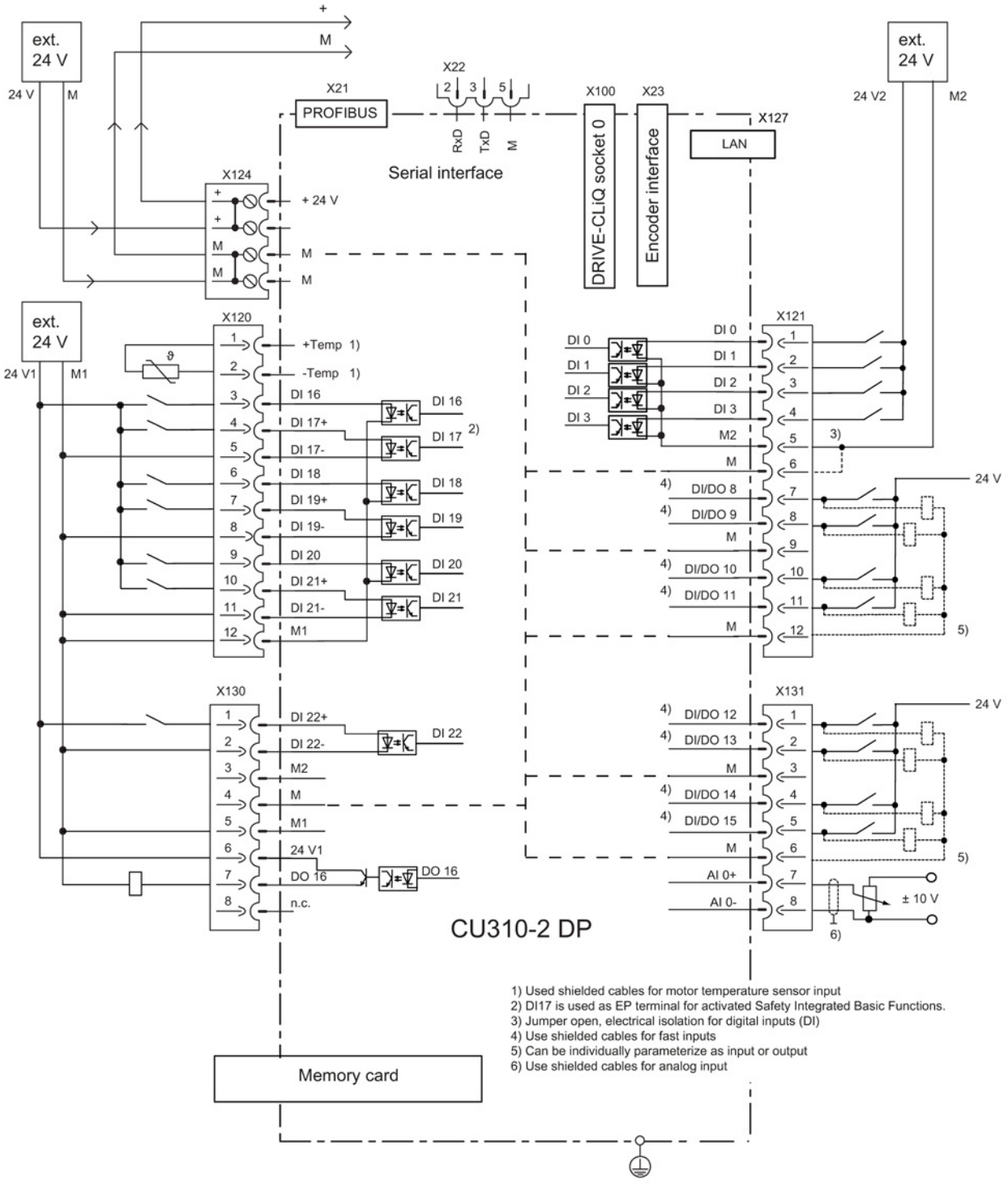


Figure 7-13 Connection example, CU310-2 DP without safety function

CU310-2 DP with safety function

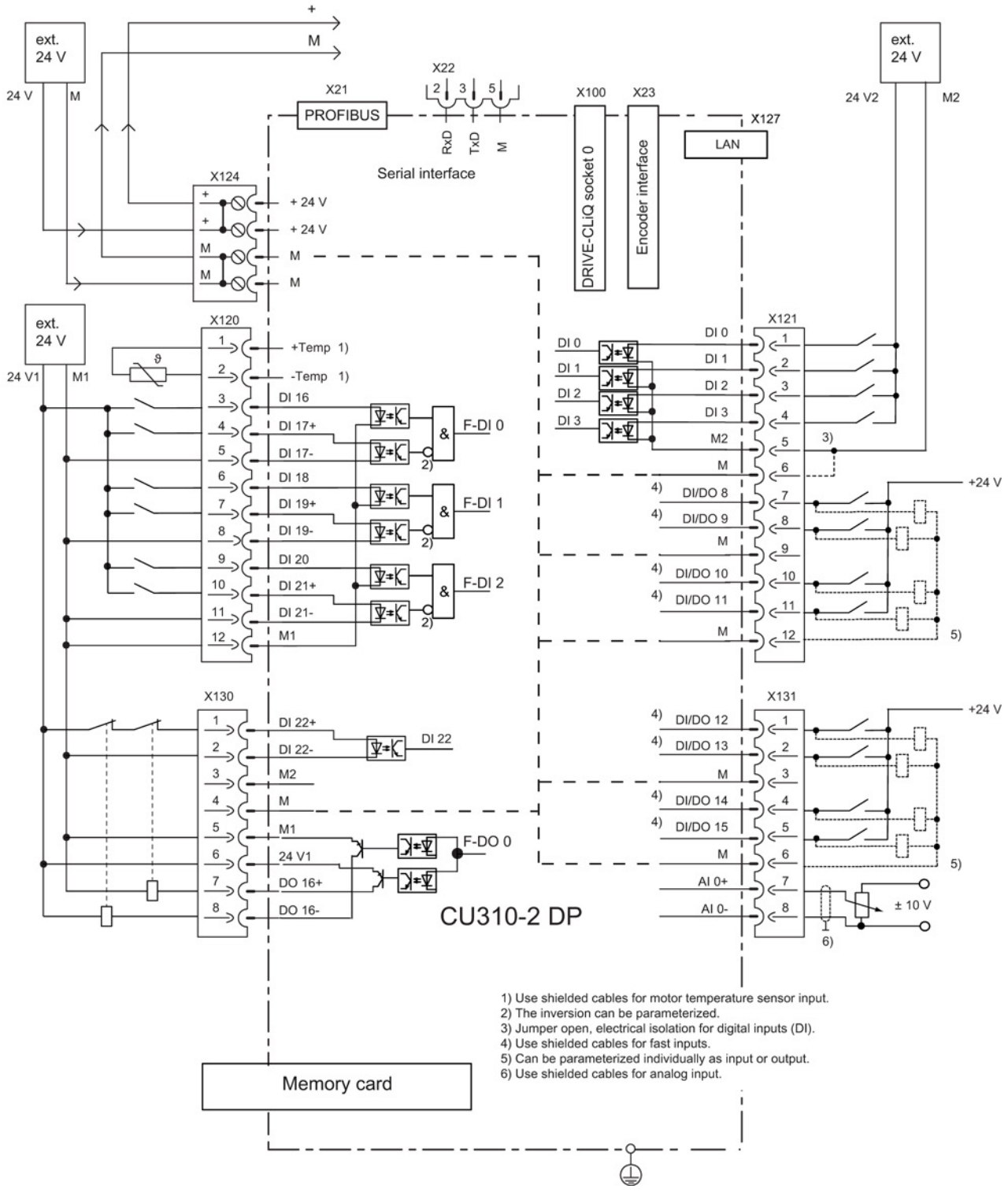


Figure 7-14 Connection example, CU310-2 DP with safety function

7.4.4 Meaning of the LEDs

7.4.4.1 Function of the LEDs

There are four LEDs on the front panel of the CU310-2 DP housing (see CU310-2 DP Interface Overview (Page 289).)

Table 7- 36 LEDs

RDY	Ready
COM	Status of the fieldbus communication
OUT>5V	Encoder current supply > 5 V (TTL/HTL)
MOD	Operating mode (reserved)

The various LEDs are switched on and off as the control unit is powered up (depending on the phase the system is currently in). When switched on, the color of the LEDs shows the status of the corresponding power-up phase (see LED display during power up (Page 311))

In the event of a fault, power up will be ended in the corresponding phase. The LEDs that are switched on retain their color at this particular instant in time, so that the fault can be determined based on the combination of LEDs that are switched on (bright) and switched off (dark).

All the LEDs go out briefly if the CU310-2 DP has powered up without error. The system is ready for operation when the LED "RDY" is permanently green.

All the LEDs are controlled by the software loaded during operation (see Behavior of the LEDs in the operating state (Page 312)).

7.4.4.2 Behavior of the LEDs during booting

Table 7- 37 Load software

LED				State	Comment
RDY	COM	OUT > 5V	MOD		
Orange	Orange	Orange	Orange	POWER ON	All LEDs light up for approx. 1 s
Red	Red	Off	Off	Hardware reset	After pressing the RESET button the LEDs light up for approx. 1 s
Red	Red	Off	Off	BIOS loaded	-
Red Flashing light 2 Hz	Red	Off	Off	BIOS error	Fault occurred while loading the BIOS
Red Flashing light 2 Hz	Red Flashing light 2 Hz	Off	Off	File error	Memory card not inserted or faulty
					Software on memory card not present or corrupted

Table 7- 38 Firmware

LED				State	Comment
RDY	COM	OUT > 5V	MOD		
Red	Orange	Off	Off	Firmware loading	COM-LED flashing without specific flashing frequency
Red	Off	Off	Off	Firmware loaded	-
Off	Red	Off	Off	Firmware check (no CRC error)	-
Red Flashing light 0.5 Hz	Red Flashing light 0.5 Hz	Off	Off	Firmware check (CRC error)	CRC is incorrect
Orange	Off	Off	Off	Firmware initialization	-

7.4.4.3 Behavior of the LEDs in the operating state

Table 7- 39 Description of the LEDs during operation of the CU310-2 DP

LED	Color	State	Description / cause	Remedy
RDY (READY)	-	OFF	The electronics power supply is missing or outside the permissible tolerance range.	Check the power supply
	Green	Continuous light	The unit is ready for operation. Cyclic DRIVE-CLiQ communication is in progress.	-
		Flashing light 0.5 Hz	Commissioning/reset	-
		Flashing light 2 Hz	Writing to the memory card.	-
	Red	Flashing light 2 Hz	General fault	Check parameter assignment/configuration
	Red/green	Flashing light 0.5 Hz	The control unit is ready for operation, but there are no software licenses.	Install the missing licenses.
	Orange	Flashing light 0.5 Hz	Updating the firmware of the DRIVE-CLiQ components.	-
		Flashing light 2 Hz	DRIVE-CLiQ component firmware update completed. Waiting for POWER ON of the corresponding components.	Switch on the component.
	Green/orange or red/orange	Flashing light 2 Hz	Recognition of the component via LED is activated (see SINAMICS S120/S150 List Manual). **Note:** Both possibilities depend on the status of the LED when activating.	-
COM	-	OFF	Cyclic communication is not (yet) running. **Note:** The PROFIdrive is ready for communication when the Control Unit is ready for operation (see LED: RDY).	-
	Green	Continuous light	Cyclic communication is taking place.	-
		Flashing light 0.5 Hz	Cyclic communication is not fully established yet. **Possible causes:** - The controller is not transmitting any setpoints. - In isochronous mode, the controller is not sending a GC (Global Control) or is sending a defective GC.	-
	Red	Flashing light 0.5 Hz	The PROFIBUS master is sending a faulty parameter assignment or the configuration file is corrupted.	Modify the configuration between master/controller and control unit.
		Flashing light 2 Hz	Cyclic bus communication has been interrupted or could not be established.	Rectify the fault in bus communication.

LED	Color	State	Description / cause	Remedy
MOD	-	OFF	-	-
OUT > 5 V	-	OFF	-	-
	Orange	Continuous light	The voltage of the electronics power supply for the measuring system is 24 V. [1)]	

[1)] Make sure that the encoder connected is designed for a 24 V supply. Connecting a 5 V encoder to a 24 V supply can result in destruction of the encoder electronics.

7.4.5 Dimension drawing

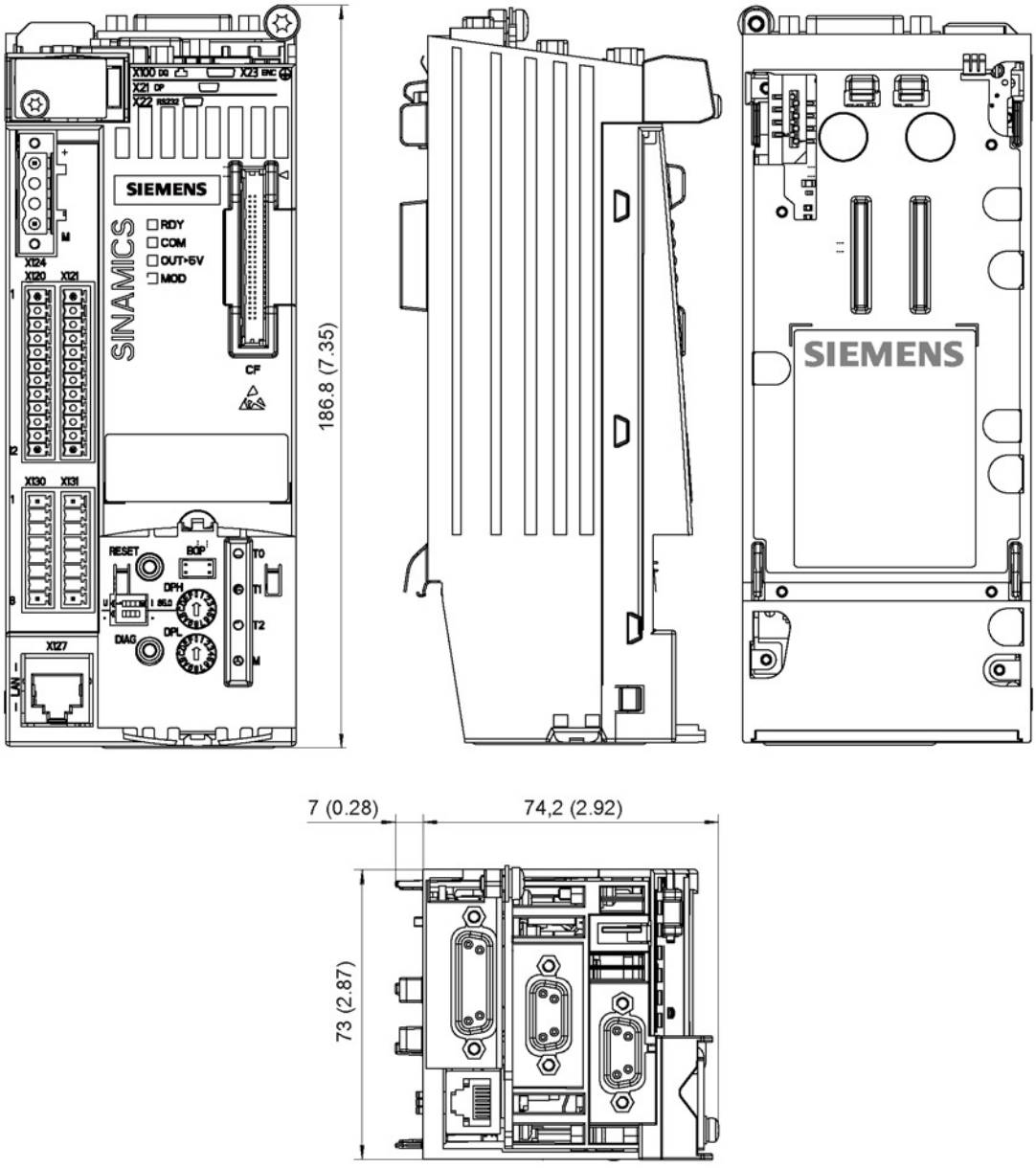


Figure 7-15 Dimension drawing, Control Unit CU310-2 DP, all data in mm (inches)

7.4.6 Technical data

Table 7- 40 Technical data of the CU310-2 DP

6SL3040-1LA00-0AA0	Unit	Value
Electronics power supply		
Voltage	V_{DC}	24 DC (20.4 ... 28.8)
Current (without DRIVE-CLiQ and digital outputs)	A_{DC}	0.8
Power loss	W	< 20
Maximum DRIVE-CLiQ cable length	m	100
PE/ground connection	At the housing with M4/3 Nm screw	
Response time	The response time of digital inputs/outputs depends on the evaluation.[1)]	
Weight	kg	0,95

[1)] You will find information on this topic in the SINAMICS S120/S150 List Manual, Chapter "Function block diagrams".

7.5 Control Unit Adapter CUA31

7.5.1 Description

The CUA31 Control Unit Adapter is used to connect a Power Module blocksize to an existing DC/AC group with a higher-level control module, e.g. a CU320-2. Since the closed-loop control is realized externally, for operation, a SINAMICS, SIMOTION, or SINUMERIK closed-loop control is always required for several axes.

The Control Unit Adapter CUA31 has the following interfaces (ports):

Table 7- 41 Interface overview of the CUA31

Type	Number
DRIVE-CLiQ interface	3
EP terminal/temperature sensor	1
Power Module Interface (PM-IF)	1
24 V electronics power supply	1

7.5.2 Interface description

7.5.2.1 Overview

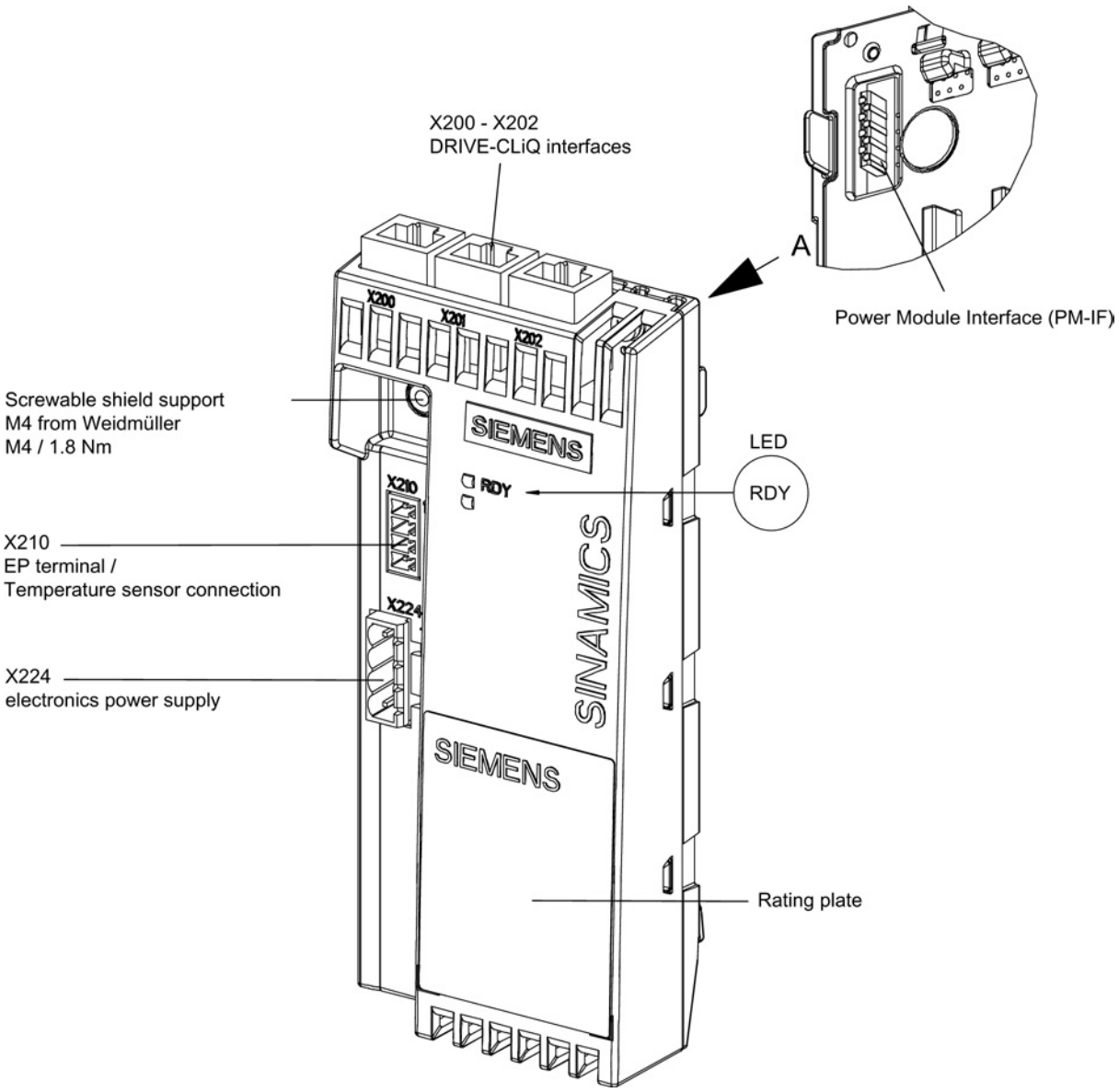
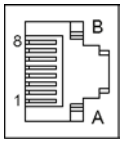


Figure 7-16 Interface overview of the CUA31

7.5.2.2 X200-X202 DRIVE-CLiQ interfaces

Table 7- 42 X200-X202 DRIVE-CLiQ interfaces

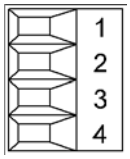
	Pin	Signal name	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronic ground
Connector type	DRIVE-CLiQ socket		

The blanking covers for the DRIVE-CLiQ interfaces are included in the scope of delivery.

Blanking plate from the Yamaichi company, order number: Y-ConAS-13

7.5.2.3 X210 EP terminal / temperature sensor

Table 7- 43 X210 EP terminal / temperature sensor input

	Terminal	Function	Technical data
	1	+ Temp [1]	Temperature sensor KTY84–1C130/PTC
	2	- Temp [1]	
	3	EP +24 V (Enable Pulses)	Supply voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA Isolated input Signal propagation delays: L → H: 100 µs H → L: 1000 µs
	4	EP M1 (Enable Pulses)	
Type: Screw-type terminal 1 (Page 437) Max. cross-section that can be connected 1.5 mm^2			

[1] Further information regarding the temperature sensor may be found in the SINAMICS S120 Commissioning Manual, Section "Temperature sensors for SINAMICS components."

Temperature sensor input

The temperature sensor is required for motors where the temperature value is not transmitted via DRIVE-CLiQ.

NOTICE

Risk of motor overheating for incorrectly connected KTY temperature sensor

A KTY temperature sensor connected with incorrect polarity cannot detect if the motor overheats.

- Make sure that you connect the KTY temperature sensor with the correct polarity.

The maximum length of the temperature sensor cable is 300 m. The cables must be shielded. For cable lengths >100 m, cables with a cross-section of ≥1 mm^2 must be used.

"Safe standstill" function

If the "Safe standstill" function is selected, a 24 V DC voltage must be connected to terminals 3 and 4. Upon removal, pulse inhibit is activated.

⚠WARNING

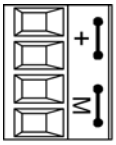
Danger to life due to electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Use temperature sensors that fully comply with the specifications of the safety isolation.
- If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), use a Sensor Module External (SME120 or SME125) or Terminal Module TM120.

7.5.2.4 X224 electronics power supply

Table 7- 44 X224 electronics power supply

	Terminal	Function	Technical data
	+	Electronics power supply	Voltage: 24 VDC (20.4 ... 28.8 VDC) Current consumption: max. 0.8 A (without DRIVE-CLiQ) Max. current via jumper in connector: 20 A (15 A according to UL/CSA)
	+	Electronics power supply	
	GND	Electronics ground	
	GND	Electronics ground	
Type: Screw-type terminal 2 (Page 437) Max. cross-section that can be connected: 2.5 mm^2			

The maximum cable length that can be connected is 10 m.

Note

The two "+" and/or "M" terminals are jumpered in the connector. This ensures that the supply voltage is looped through.

The current consumption increases by the value for the DRIVE-CLiQ node.

7.5.3 Connection example

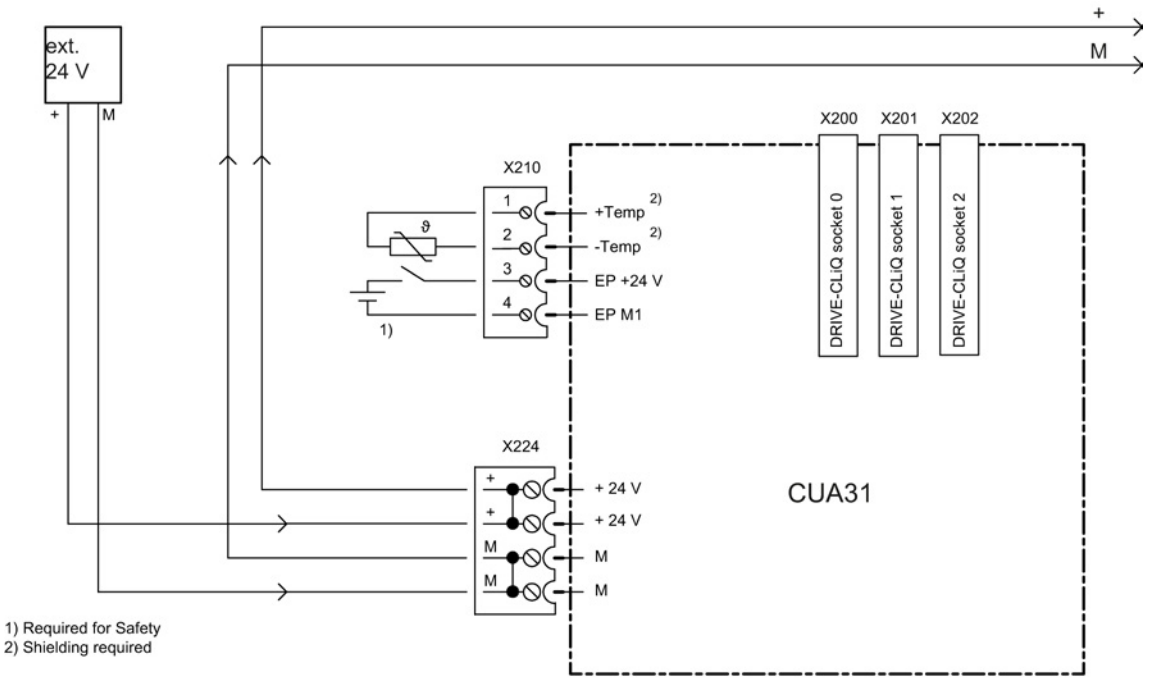


Figure 7-17 Connection example, CUA31

7.5.4 Meaning of the LEDs

Table 7- 45 Meaning of the LEDs at the Control Unit Adapter 31

LED	Color	Status	Description
RDY (READY)	Red	continuous light	At least one fault is present in this component.
	Green	continuous light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.

Cause and rectification of faults

Information about the cause and rectification of faults can be found in the SINAMICS S120 Commissioning Manual.

7.5.5 Dimension drawing

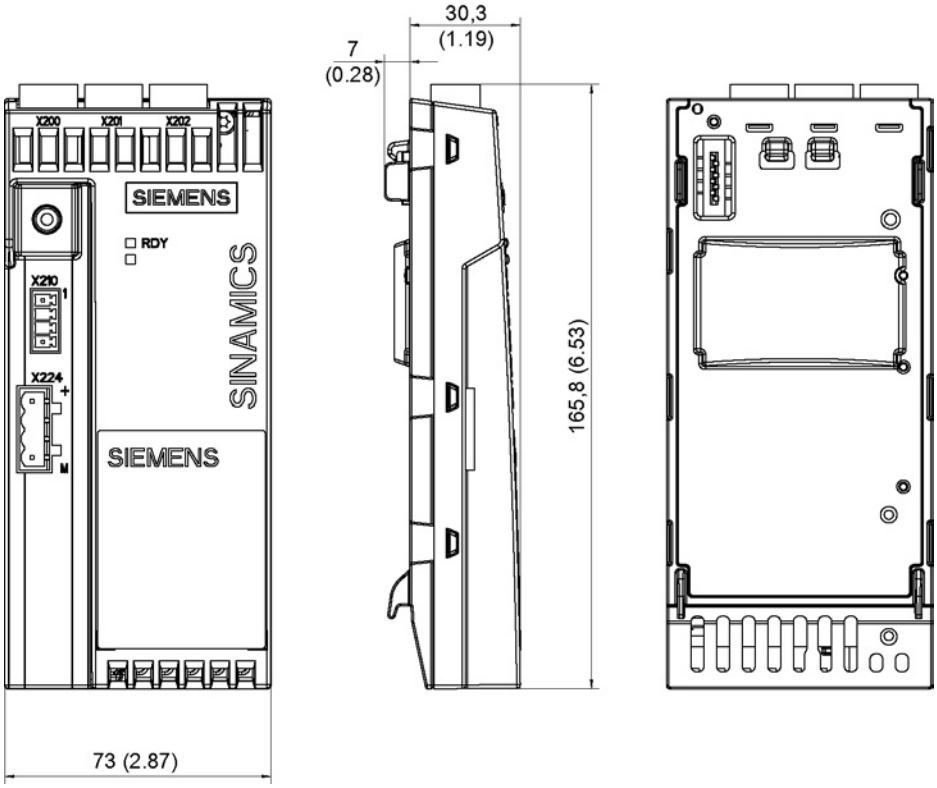


Figure 7-18 Dimension drawing of Control Unit Adapter CUA31, all data in mm and (inches)

7.5.6 Technical data

Table 7- 46 Technical data CUA31

6SL3040-0PA00-0AA0 / 6SL3040-0PA00-0AA1	Unit	Value
Electronics power supply		
Voltage	V_{DC}	24 DC (20.4 ... 28.8)
Current (without DRIVE-CLiQ)	A_{DC}	0.1
Power loss	W	2.4
Maximum DRIVE-CLiQ cable length		
CUA31 with order number 6SL3040-0PA00-0AA0	m	50
CUA31 from order number 6SL3040-0PA00-0AA1	m	100
Weight	kg	0,31

7.6 Control Unit Adapter CUA32

7.6.1 Description

The Control Unit Adapter CUA32 is used to connect a Power Module blocksize to an existing DC/AC group with a higher-level control module, e.g. a CU320-2. Since the closed-loop control is realized externally, for operation, a SINAMICS, SIMOTION, or SINUMERIK closed-loop control is always required for several axes.

The CUA32 offers additional encoder interface (HTL / TTL / SSI).

The Control Unit Adapter CUA32 has the following interfaces (ports):

Table 7- 47 Interface overview of the CUA32

Type	Number
DRIVE-CLiQ interface	3
EP terminal/temperature sensor	1
Power Module Interface (PM-IF)	1
24 V electronics power supply	1
Encoder interface (HTL/TTL/SSI(1))	1

1 Only SSI encoders without incremental tracks can be operated on the CUA32.

7.6.2 Interface description

7.6.2.1 Overview

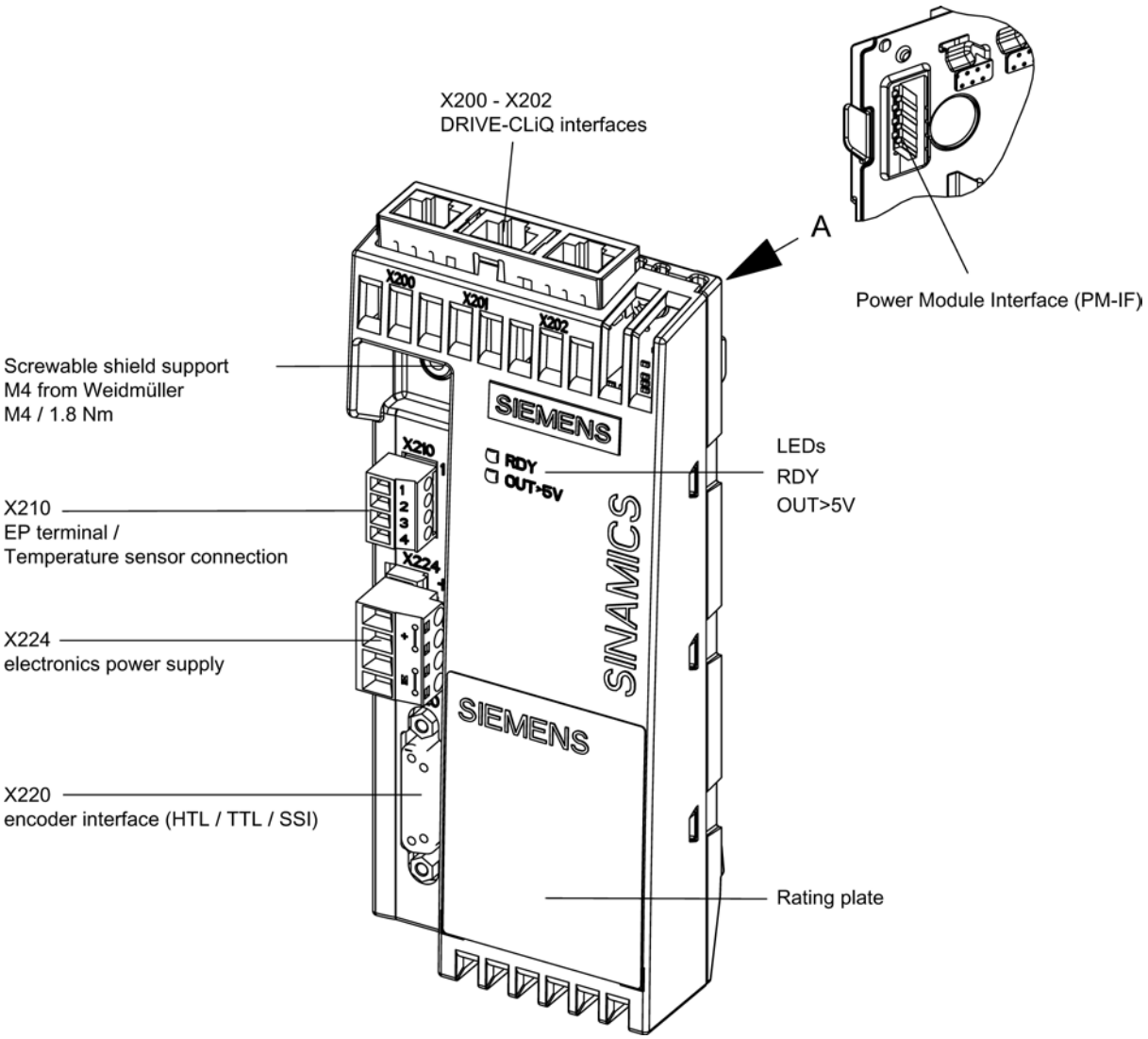
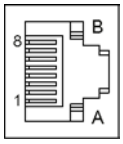


Figure 7-19 Interface overview CUA32

7.6.2.2 X200-X202 DRIVE-CLiQ interfaces

Table 7- 48 X200-X202 DRIVE-CLiQ interfaces

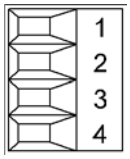
	Pin	Signal name	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronic ground
Connector type	DRIVE-CLiQ socket		

The blanking covers for the DRIVE-CLiQ interfaces are included in the scope of delivery.

Blanking covers (50 pieces) Order number: 6SL3066-4CA00-0AA0

7.6.2.3 X210 EP terminal / temperature sensor

Table 7- 49 X210 EP terminal / temperature sensor input

	Terminal	Function	Technical data
	1	+ Temp [1]	Temperature sensor KTY84–1C130/PTC
	2	- Temp [1]	
	3	EP +24 V (Enable Pulses)	Supply voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA Isolated input Signal propagation delays: L → H: 100 µs H → L: 1000 µs
	4	EP M1 (Enable Pulses)	
Type: Screw-type terminal 1 (Page 437) Max. cross-section that can be connected 1.5 mm²			

[1] Further information regarding the temperature sensor may be found in the SINAMICS S120 Commissioning Manual, Section "Temperature sensors for SINAMICS components."

Temperature sensor input

The temperature sensor is required for motors where the temperature value is not transmitted via DRIVE-CLiQ.

NOTICE

Risk of motor overheating for incorrectly connected KTY temperature sensor

A KTY temperature sensor connected with incorrect polarity cannot detect if the motor overheats.

- Make sure that you connect the KTY temperature sensor with the correct polarity.

The maximum length of the temperature sensor cable is 300 m. The cables must be shielded. For cable lengths >100 m, cables with a cross-section of ≥1 mm² must be used.

"Safe standstill" function

If the "Safe standstill" function is selected, a 24 V DC voltage must be connected to terminals 3 and 4. Upon removal, pulse inhibit is activated.

⚠ WARNING

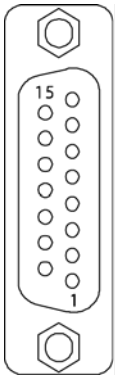
Danger to life due to electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Use temperature sensors that fully comply with the specifications of the safety isolation.
- If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), use a Sensor Module External (SME120 or SME125) or Terminal Module TM120.

7.6.2.4 X220 HTL/TTL/SSI encoder interface

Table 7- 50 X220 HTL/TTL/SSI encoder interface

	Pin	Signal name	Technical data
	1	+Temp	KTY or PTC input
	2	SSI_CLK	SSI clock, positive
	3	SSI_XCLK	SSI clock, negative
	4	P encoder 5 V / 24 V	Encoder power supply
	5	P encoder 5 V / 24 V	Encoder power supply
	6	P sense	Sense input encoder power supply
	7	M encoder (M)	Ground, encoder power supply
	8	-Temp	Ground for KTY or PTC
	9	M sense	Ground sense input
	10	RP	R track positive
	11	RN	R track negative
	12	BN	B track negative
	13	BP	B track positive
	14	AN_SSI_XDAT	A track negative / SSI data negative
	15	AP_SSI_DAT	A track positive / SSI data positive
Connector type	15-pin sub D connector		

NOTICE

Risk of motor overheating for incorrectly connected KTY temperature sensor

A KTY temperature sensor connected with incorrect polarity cannot detect if the motor overheats.

- Make sure that you connect the KTY temperature sensor with the correct polarity.

Table 7- 51 Specification of measuring systems that can be connected

Parameter	Designation	Threshold	Min.	Type	Max.	Unit
High signal level (TTL bipolar at X220)	U_{Hdiff}		2		5	V
Low signal level (TTL bipolar at X220)	U_{Ldiff}		-5		-2	V
High signal level (HTL unipolar)	U_H	High	17		V_{CC}	V
		Low	10		V_{CC}	V
Low signal level (HTL unipolar)	U_L	High	0		7	V
		Low	0		2	V
High signal level (HTL bipolar)	U_{Hdiff}		3		V_{CC}	V
Low signal level (HTL bipolar)	U_{Ldiff}		$-V_{CC}$		-3	V
High signal level (SSI bipolar at X220)	U_{Hdiff}		2		5	V
Low signal level (SSI bipolar at X220)	U_{Ldiff}		-5		-2	V
Signal frequency	f_S		-		500	kHz
Edge clearance	t_{min}		100		-	ns
Zero pulse (with $T_s = 1/f_s$)	Length		¼ · T_s		¾ · T_s	
	Center of the pulse position		50	135	220	degrees

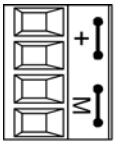
Note

We recommend that bipolar encoders are used.

When uni-polar encoders are used, the 15-pin sub D connector should be opened and the unused inverse signals (AN Pin14, BN Pin12 and RN Pin11) connected to ground (Pin7).

7.6.2.5 X224 electronics power supply

Table 7- 52 X224 electronics power supply

	Terminal	Function	Technical data
	+	Electronics power supply	Voltage: 24 VDC (20.4 ... 28.8 VDC) Current consumption: max. 0.8 A (without DRIVE-CLiQ and encoder) Max. current via jumper in connector: 20 A (15 A according to UL/CSA)
	+	Electronics power supply	
	GND	Electronics ground	
	GND	Electronics ground	
Type: Screw-type terminal 2 (Page 437) Max. cross-section that can be connected: 2.5 mm²			

The maximum cable length that can be connected is 10 m.

Note

The two "+" and/or "M" terminals are jumpered in the connector. This ensures that the supply voltage is looped through.

The current consumption increases by the value for the DRIVE-CLiQ node and the encoder.

7.6.3 Connection example

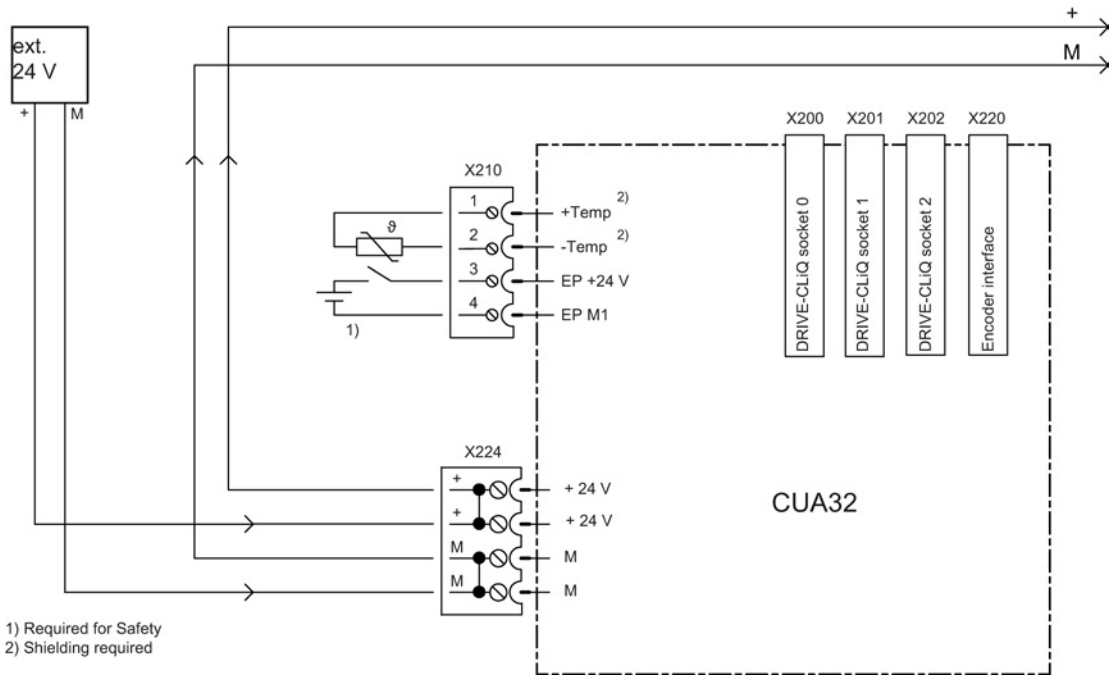


Figure 7-20 Connection example for CUA32

7.6.4 Meaning of the LEDs

Table 7- 53 Meaning of the LEDs on the Control Unit Adapter CUA32

LED	Color	Status	Description
RDY (READY)	Red	continuous light	At least one fault is present in this component.
	Green	continuous light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
OUT > 5V	-	Off	Electronics power supply is missing or outside permissible tolerance range. Power supply: ≤5 V.
	Orange	continuous light	Electronics power supply for measuring system available. Power supply: >5 V. **Caution** You must ensure that the connected encoder can be operated with a 24 V power supply. If an encoder that is designed for a 5 V power supply is operated with a 24 V power supply, this can destroy the encoder electronics.

Cause and rectification of faults

Information about the cause and rectification of faults can be found in the SINAMICS S120 Commissioning Manual.

7.6.5 Dimension drawing

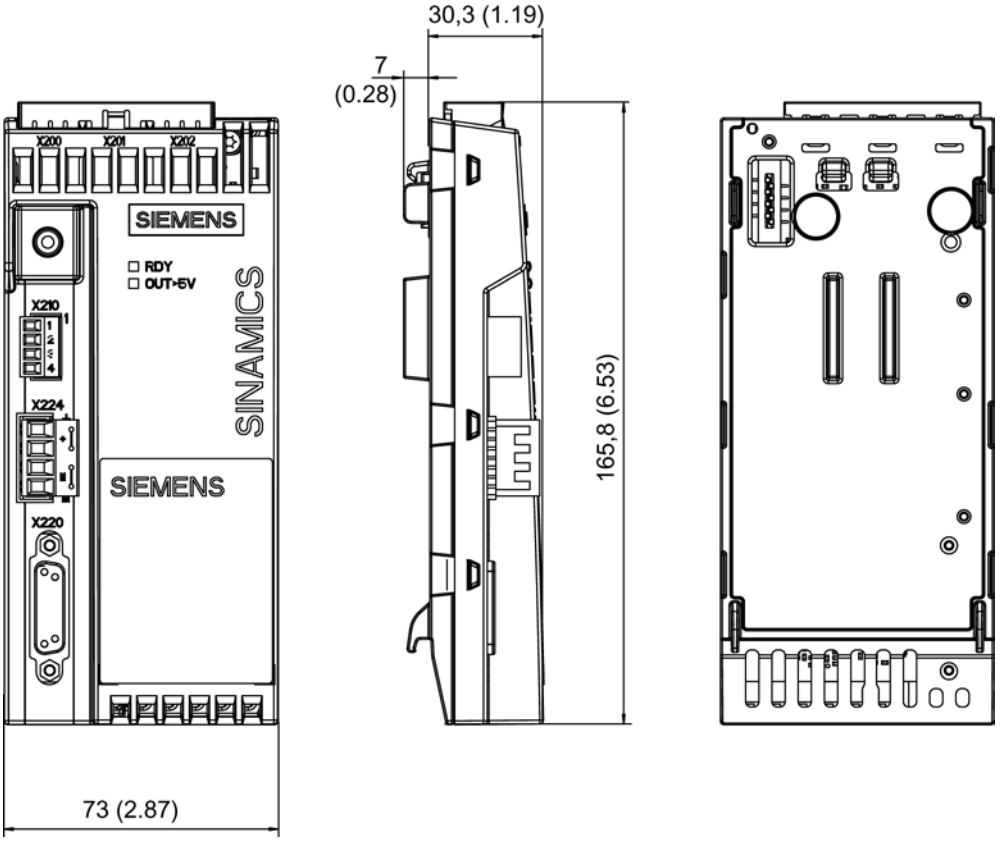


Figure 7-21 Dimension drawing of Control Unit Adapter CUA32, all data in mm and (inches)

7.6.6 Technical data

Table 7- 54 Technical data CUA32

6SL3040-0PA01-0AA0	Unit	Value
Electronics power supply		
Voltage	V_{DC}	24 DC (20.4 ... 28.8)
Current (without DRIVE-CLiQ and encoder)	A_{DC}	0.11
Maximum current consumption of encoder	mA	400
Power loss	W	2.6
Maximum DRIVE-CLiQ cable length	m	100
Weight	kg	0,32