SIEMENS

SINUMERIK

SINUMERIK 840D sl
TCU 30.3

Manual

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Valid for: 6FC5312-0DA00-1AA1
Replaces the following products:
TCU.1: 6FC5312-0DA00-0AA0 and
6FC5312-0DA00-0AA1
TCU20.2: 6FC5312-0DA00-0AA2
TCU30.2: 6FC5312-0DA00-1AA0

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Table of contents

Fundamental safety instructions

<div style="text-align: right">1</div>

1.1   General safety instructions

> **⚠ WARNING**
>
> **Electric shock and danger to life due to other energy sources**
>
> Touching live components can result in death or severe injury.
> - Only work on electrical devices when you are qualified for this job.
> - Always observe the country-specific safety rules.
>
> Generally, the following six steps apply when establishing safety:
> 1. Prepare for disconnection. Notify all those who will be affected by the procedure.
> 2. Isolate the drive system from the power supply and take measures to prevent it being switched back on again.
> 3. Wait until the discharge time specified on the warning labels has elapsed.
> 4. Check that there is no voltage between any of the power connections, and between any of the power connections and the protective conductor connection.
> 5. Check whether the existing auxiliary supply circuits are de-energized.
> 6. Ensure that the motors cannot move.
> 7. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water. Switch the energy sources to a safe state.
> 8. Check that the correct drive system is completely locked.
>
> After you have completed the work, restore the operational readiness in the inverse sequence.

> **⚠ WARNING**
>
> **Electric shock due to connection to an unsuitable power supply**
>
> When equipment is connected to an unsuitable power supply, exposed components may carry a hazardous voltage that might result in serious injury or death.
> - Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV- (Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.

⚠ **WARNING**

Electric shock due to equipment damage

Improper handling may cause damage to equipment. For damaged devices, hazardous voltages can be present at the enclosure or at exposed components; if touched, this can result in death or severe injury.

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Do not use any damaged devices.

⚠ **WARNING**

Electric shock due to unconnected cable shields

Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.

- As a minimum, connect cable shields and the cores of cables that are not used at one end at the grounded housing potential.

⚠ **WARNING**

Electric shock if there is no ground connection

For missing or incorrectly implemented protective conductor connection for devices with protection class I, high voltages can be present at open, exposed parts, which when touched, can result in death or severe injury.

- Ground the device in compliance with the applicable regulations.

⚠ **WARNING**

Spread of fire from built-in devices

In the event of fire outbreak, the enclosures of built-in devices cannot prevent the escape of fire and smoke. This can result in serious personal injury or property damage.

- Install built-in units in a suitable metal cabinet in such a way that personnel are protected against fire and smoke, or take other appropriate measures to protect personnel.
- Ensure that smoke can only escape via controlled and monitored paths.

⚠ WARNING

Unexpected movement of machines caused by radio devices or mobile phones

When radio devices or mobile phones with a transmission power > 1 W are used in the immediate vicinity of components, they may cause the equipment to malfunction. Malfunctions may impair the functional safety of machines and can therefore put people in danger or lead to property damage.

● If you come closer than around 2 m to such components, switch off any radios or mobile phones.

● Use the "SIEMENS Industry Online Support App" only on equipment that has already been switched off.

⚠ WARNING

Fire due to inadequate ventilation clearances

Inadequate ventilation clearances can cause overheating of components with subsequent fire and smoke. This can cause severe injury or even death. This can also result in increased downtime and reduced service lives for devices/systems.

● Ensure compliance with the specified minimum clearance as ventilation clearance for the respective component.

⚠ WARNING

Unexpected movement of machines caused by inactive safety functions

Inactive or non-adapted safety functions can trigger unexpected machine movements that may result in serious injury or death.

● Observe the information in the appropriate product documentation before commissioning.

● Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components.

● Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing.

● Perform a function test.

● Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.

Note

Important safety notices for Safety Integrated functions

If you want to use Safety Integrated functions, you must observe the safety notices in the Safety Integrated manuals.

1.2 Equipment damage due to electric fields or electrostatic discharge

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.

> **NOTICE**
>
> **Equipment damage due to electric fields or electrostatic discharge**
>
> Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.
>
> - Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g conductive foam rubber of aluminum foil.
> - Only touch components, modules and devices when you are grounded by one of the following methods:
>   - Wearing an ESD wrist strap
>   - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
> - Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

1.3 Warranty and liability for application examples

The application examples are not binding and do not claim to be complete regarding configuration, equipment or any eventuality which may arise. The application examples do not represent specific customer solutions, but are only intended to provide support for typical tasks. You are responsible for the proper operation of the described products. These application examples do not relieve you of your responsibility for safe handling when using, installing, operating and maintaining the equipment.

1.4 Industrial security

Note

Industrial security

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens products and solutions only represent one component of such a concept.

The customer is responsible for preventing unauthorized access to its plants, systems, machines and networks. Systems, machines and components should only be connected to the enterprise network or the internet if and to the extent necessary and with appropriate security measures (e.g. use of firewalls and network segmentation) in place.

Additionally, Siemens' guidance on appropriate security measures should be taken into account. For more information about industrial security, please visit:

Industrial security (http://www.siemens.com/industrialsecurity).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends to apply product updates as soon as available and to always use the latest product versions. Use of product versions that are no longer supported, and failure to apply latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at:

Industrial security (http://www.siemens.com/industrialsecurity).

⚠ **WARNING**

Unsafe operating states resulting from software manipulation

Software manipulations (e.g. viruses, trojans, malware or worms) can cause unsafe operating states in your system that may lead to death, serious injury, and property damage.

- Keep the software up to date.
- Incorporate the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation or machine.
- Make sure that you include all installed products into the holistic industrial security concept.
- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.

1.5 Residual risks of power drive systems

When assessing the machine- or system-related risk in accordance with the respective local regulations (e.g., EC Machinery Directive), the machine manufacturer or system installer must take into account the following residual risks emanating from the control and drive components of a drive system:

1. Unintentional movements of driven machine or system components during commissioning, operation, maintenance, and repairs caused by, for example,

   – Hardware and/or software errors in the sensors, control system, actuators, and cables and connections

   – Response times of the control system and of the drive

   – Operation and/or environmental conditions outside the specification

   – Condensation/conductive contamination

   – Parameterization, programming, cabling, and installation errors

   – Use of wireless devices/mobile phones in the immediate vicinity of electronic components

   – External influences/damage

   – X-ray, ionizing radiation and cosmic radiation

2. Unusually high temperatures, including open flames, as well as emissions of light, noise, particles, gases, etc., can occur inside and outside the components under fault conditions caused by, for example:

   – Component failure

   – Software errors

   – Operation and/or environmental conditions outside the specification

   – External influences/damage

3. Hazardous shock voltages caused by, for example:

   – Component failure

   – Influence during electrostatic charging

   – Induction of voltages in moving motors

   – Operation and/or environmental conditions outside the specification

   – Condensation/conductive contamination

   – External influences/damage

4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc., if they are too close

5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly

6. Influence of network-connected communication systems, e.g. ripple-control transmitters or data communication via the network

For more information about the residual risks of the drive system components, see the relevant sections in the technical user documentation.

Description

2

2.1 Overview

A Thin Client Unit (TCU) allows the spatial separation between an operator panel (OP) / touch panel (TP) and the Panel Control Unit (PCU) / Numerical Control Unit (NCU). For this reason, the user interface is copied to one/several operator panel fronts, each with a TCU.

Validity

The description applies to the following TCU:

Designation	Article number
Thin Client Unit 30.3	6FC5312-0DA00-1AA1

Features

- Implementation of flat operator panels through the shallow installation depth and low power loss.

- Color depth: 32 bits

- 640 x 480 to 1280 x 1024 pixels

- Vibration-free mounting of the PCU in the control cabinet.

- Effective operation of larger machines.

- Signal transmission between PCU/NCU and operator panel via Industrial Ethernet
  The distance of the components is determined by the maximum distance between two network nodes / access points (100 m).

- The same operating screen is shown synchronously on all operator panel fronts and can be operated from all operator panel fronts.

- The operation on an operator panel front connected via TCU has the same access rights as the operation on an operator panel front connected directly to the PCU.

- The mixed operation of operator panel fronts connected via TCU and an operator panel front connected directly to the PCU is possible.

- With restrictions to the interfaces (see Section "Operating the menu for a new TCU or replacement TCU (Page 60)"), the TCU 30.3 is compatible to the previous models and therefore mixed operation is possible.

Preconditions

- NCU 7x0

- Operator panel fronts:
    - OP 010, OP 010C, OP 010S, OP 012, OP015, OP 015A, TP 015A, OP 019

Design

The TCUs are coupled via Ethernet as Thin Clients in a dedicated subnetwork (via DHCP server on the PCU/NCU) to the PCU/NCU.

Interfaces:

● 4 x USB 2.0 Hi-Speed to connect the mouse, keyboard and USB flash drive

● Ethernet 10/100/1000 Mbit/s
  The transmission rate in Ethernet system networks automatically sets itself to the maximum possible value. 1000 Mbit/s can only be achieved with NCU 7x0.3B PN and PCU 50.5 (if a PCU is required).

Note

The Ethernet interface has so-called Auto MDI-X functionality. If required, the send and receive lines of the Ethernet cable are crossed in the PHY. If, however, the partner does not have "Autocrossover", a crossover cable is required.

Information about third-party software used

This product contains open source software. License information can be obtained via the shortcut "License files" on your SINUMERIK PCU desktop, or navigate to the SINUMERIK Operate Readme OSS path "Setup/system data: System CF card/siemens/oss-license" on your SINUMERIK NCU and read the appropriate OSS file for this device.

2.2 Configurations

Configurations

The following distributed configurations are possible with a TCU 30.3:
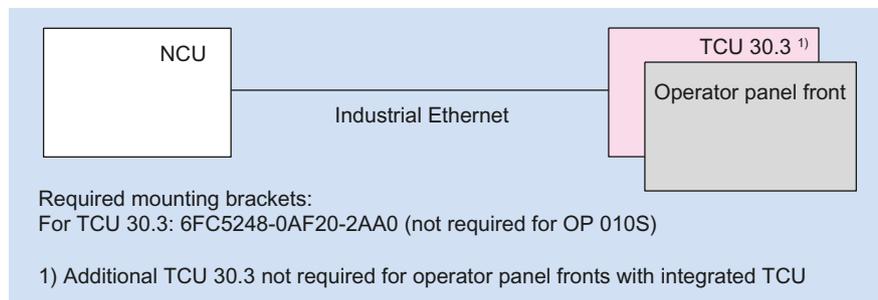
Figure 2-1   Minimum configuration with an operator panel front
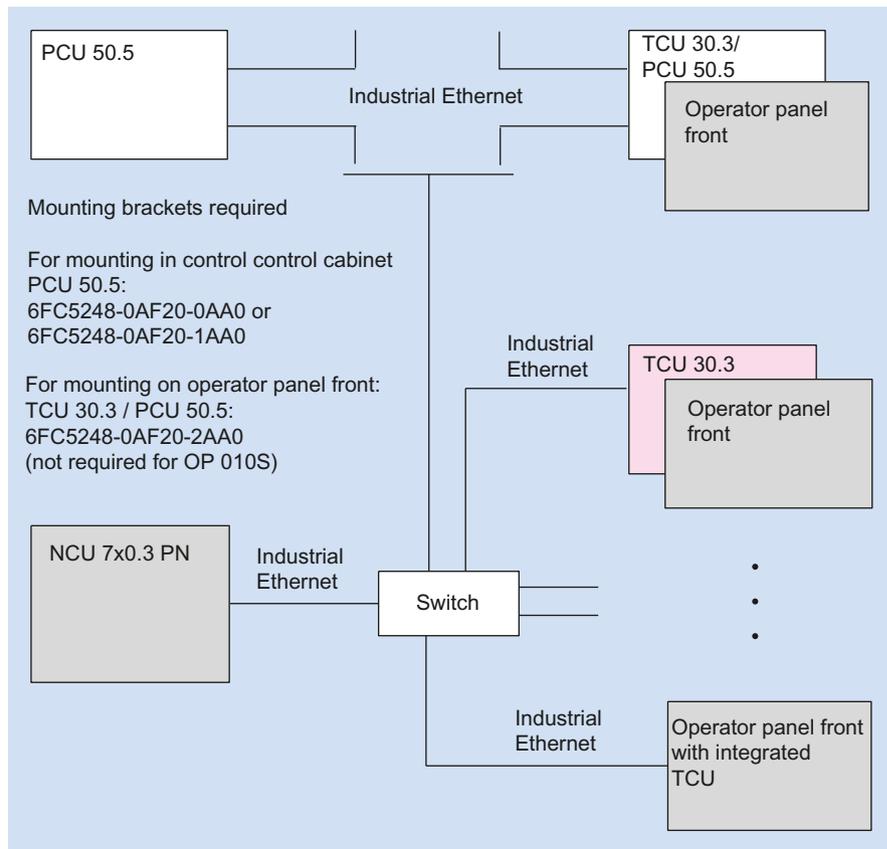
Figure 2-2   Maximum configuration, several TCUs connected to an NCU 7x0

For information about TCU commissioning, see the section titled "Networking".

2.3   Interfaces

Overview

Function	Designation	Description
Double USB interface 1 [1]	X203 / X204	2 x USB 2.0 Hi-Speed type A
Double USB interface 2 [1]	X212 / X213	2 x USB 2.0 Hi-Speed type A
Interface for direct keys	X205	2 x 10-pin plug connector
24 VDC power supply	X206	3-pin terminal block
I/O USB interface K1 [2] [3]	X207	2 x 13-pin plug connector
LVDS display interface K2 [2] [3]	X208	2 x 10-pin plug connector

Function	Designation	Description
LVDS display interface K3 [3]	X209	2 x 10-pin plug connector
Ethernet interface	X202	8-pin RJ45 socket

[1] One of the interfaces can be loaded with 500 mA, the other with 100 mA.

[2] To connect to a 10" to 15" operator panel front

[3] To connect to an OP 019 operator panel front

The following special requirements apply to the connecting cables:

- The 24 VDC cable must be approved for temperatures up to 70° C.

- Select the permitted conductor cross-section in accordance with the national regulations (NEC, VDE,...) and the "Power supply connectors for TCU30.3" table below. The line protection in accordance with the national regulations (NEC, VDE,...) must be guarantied as appropriate for the selected conductor cross-section.

- Strip the cables (7 mm) for connection to the 24 VDC connector plug.

- Flame resistance of the 24 VDC cable according to UL 2556 VW-1/ tested according to IEC 60332-1-2.

- Observe the permissible bending radii of the cables.

- Rotate the panel only in a way that does not cause pinching of the cables.

- Route all of the cables so that they do not come into contact with chafing edges.

⚠ WARNING

Warning for areas subject to NEC or CEC:

Safety notice for connectors with Ethernet marking:

A Ethernet or Ethernet segment, with all its associated interconnected equipment, shall be entirely contained within a single low-voltage power distribution and within a single building. The Ethernet is considered to be in an "environment A" according IEEE802.3 or "environment 0" according IEC TR 62102, respectively.

Never make direct electrical connection to TNV-circuits (Telephone Network) or WAN (Wide Area Network).

View
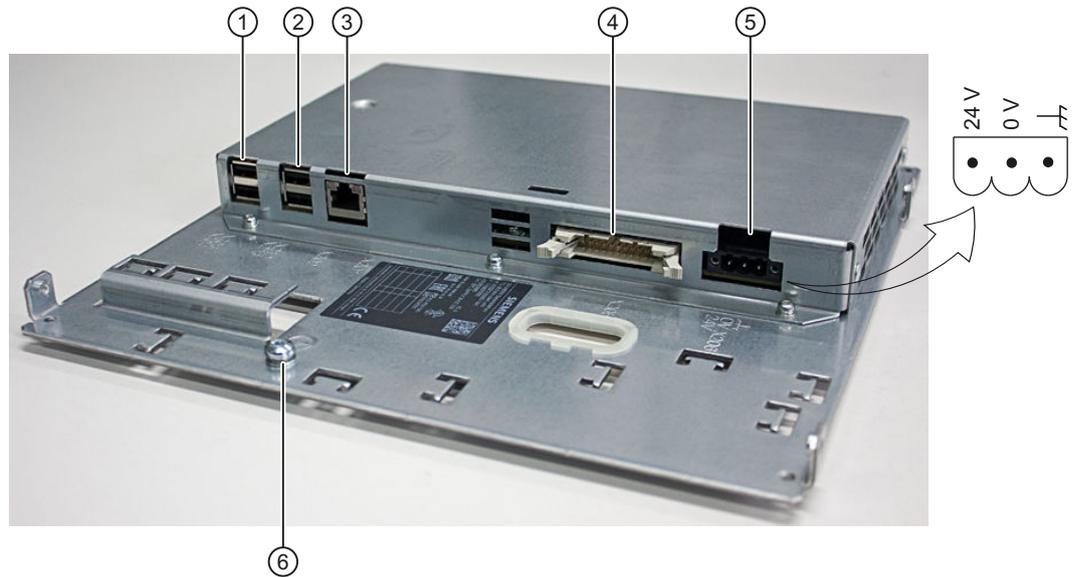
①	X203/X204	Double USB interface 1
②	X212/X213	Double USB interface 2
③	X202	Ethernet interface
④	X205	Interface for direct keys
⑤	X206	24 VDC power supply
⑥	-	Protective conductor connection

Figure 2-3   Front view of the TCU 30.3 with interfaces
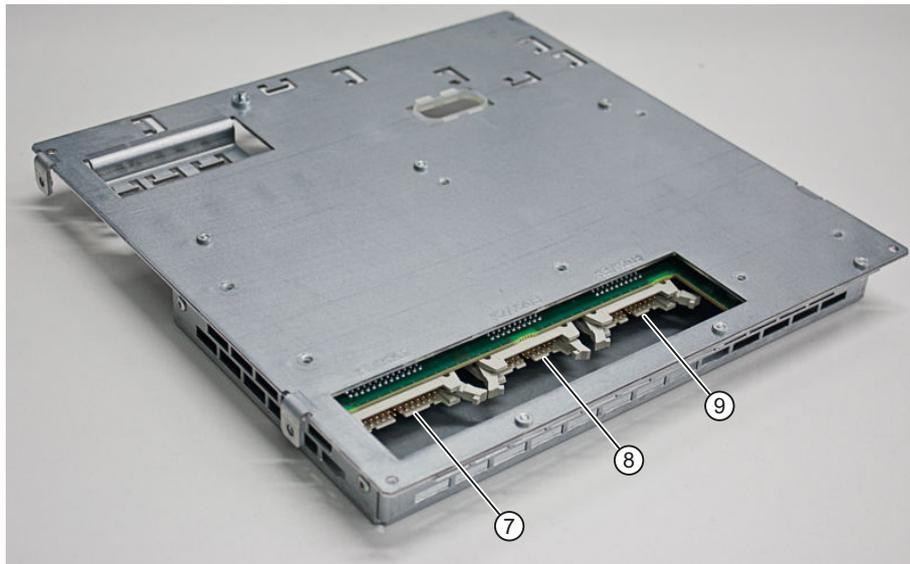
⑦	X207	I/O USB interface K1
⑧	X208	LVDS display interface K2
⑨	X209	LVDS display interface K3 (not for TCU 20.2)

Figure 2-4   Rear view of the TCU 30.3 with interfaces

The K1, K2, K3 interfaces are suitable only for connecting operator panel fronts OP 010, OP 010S, OP 010C, OP 012, OP 015, OP 015A, TP 015A and OP 019.

Power supply connector for the TCU30.3

Connection type		Strain-relief clamp connection
Connection screw		M2.5 screw with cross-slot
Operating tool		Screwdriver blade 0.6x3.5, PH0, PZ0 (DIN 5264, ISO 8764/2-PH, ISO 8764/2-PZ)
Prescribed tightening torque	Nm	0.4 ... 0.5
Conductor cross-section min./max.		
Solid	mm²	1.3 … 3.3
Finely stranded	mm²	1.3 … 3.3
With end sleeve with sleeve DIN46228/4	mm²	1.3 … 2.5
With end sleeve DIN46228/1	mm²	1.3 … 3.3
AWG cables, solid or stranded	AWG	12 … 16

Pin assignment

The pin assignments of the interfaces are described in Section "Connect" > "Pin assignment of the interfaces" (Page 25).

2.4 Rating plate
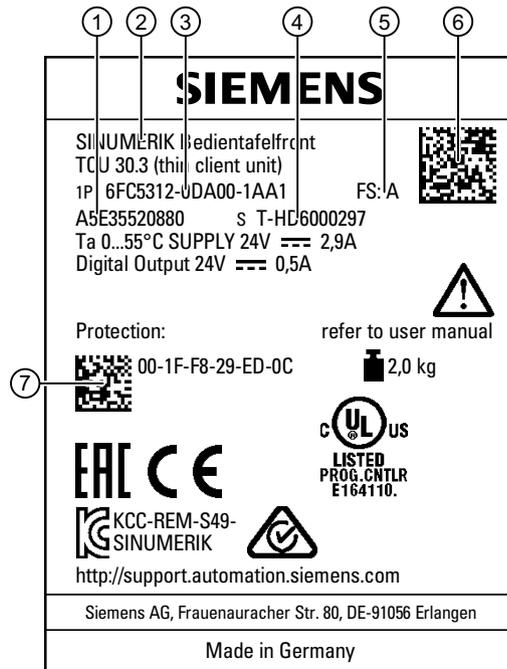
①	Material number
②	Component name
③	Article number
④	Serial number
⑤	Hardware revision level
⑥	Product code
⑦	MAC address

Figure 2-5   Example graphic of a TCU30.3 rating plate

Note

The contents of the individual rating plate fields on the front of the TCU may differ from those described in this manual (e.g. new product version, approvals and markings not yet issued).

Note

Product code scanning

The product code contains the article number of the device. Scan the product code with the aid of the Siemens Industry Online Support App to be taken directly to the Internet Webpage for the product, including all of the technical information and graphical data.

The app is available for iPhone, iPad, Android and Windows Phone.

Mounting 3

3.1 Introduction

Before assembling the two components, the interface cables of the operator panel front (IO/USB cable K1, K2 display cable and, if necessary, K3) must be inserted into the corresponding socket of the TCU (visible behind the housing cut-out).

Note

Since some of the interfaces do not have a cable strain relief for the cables to be connected, it is recommended to secure the cables to the u-shaped lugs on the supporting plate using cable ties.

⚠ **WARNING**

Electric shock in the event of an individual error when grounding is insufficient

If the panel is installed in an environment with hazardous voltages with insufficient grounding, this may cause an electric shock in the event of an individual error, which can lead to death, serious injury and property damage.

To prevent electric shocks, sufficiently ground the conductive parts of the panel according to the nationally applicable regulations. To do this, use the relevant fuse ratings of the circuits with hazardous voltages for the possible individual error scenarios as the basis for dimensioning the protective conductor connection.

⚠ **WARNING**

Parasitic voltage

If the device is installed in an environment with higher / more hazardous voltages with insufficient insulation, parasitic voltages can lead to death, serious injury and property damage.

To prevent parasitic voltages, insulate the cables corresponding to the highest voltage that will be dealt with.

The safety of a system with an integrated TCU with operator panel front is the responsibility of the system installer.

Observe all relevant information from this manual regarding the mounting of the chosen operator panel front.

The mounting at the installation site is performed in accordance with the instructions of the chosen operator panel front.

3.2 Mounting the TCU on the operator panel front with mounting bracket

This description applies to mounting a TCU on the following operator panel fronts:

OP 010, OP 010S, OP 010C, OP 012, OP 015, OP 015A, TP 015A and OP 019

Two mounting brackets (must be ordered separately) are required for mounting these operator panel fronts (see Section "Accessories (Page 83)").

1. Screw the mounting bracket ③ onto the TCU.

2. Use the two hinge catches ① to suspend the TCU mounting bracket unit (like a PCU) in the operator panel front.

3. Insert cables K1, K2 and K3 (only for OP 019).

4. Close the cabled TCU mounting bracket unit and attach it using the four knurled screws ②.

①   2 x hinge catches

②   4 x knurled screws for attaching the mounting brackets to the operator panel front

③   2 x mounting brackets

④   10 mm clearance
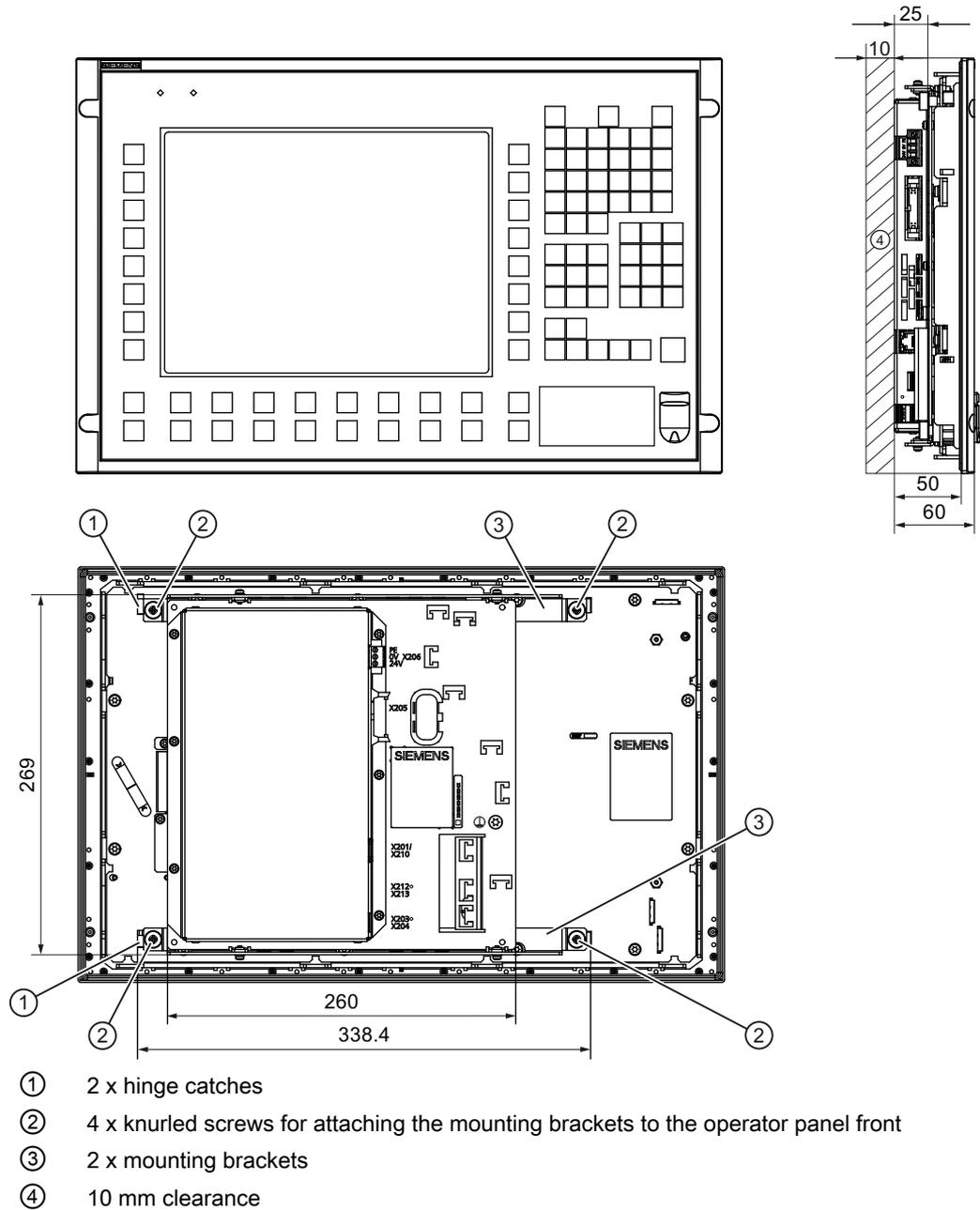
Figure 3-1   Mounted TCU (example with OP 012) in front, side and rear view

NOTICE
Impermissible mounting positions can cause malfunctions
Observe the permissible mounting position: Deviating by up to 5º from the vertical.
Only the shown mounting position is permitted.

3.3 Mounting the TCU on the operator panel front without mounting bracket

The OP 010S operator panel front and the TCU can be screwed together without any additional mounting brackets.

①   4 x M3 screws to fasten the TCU support plate to the OP 010S

②   TCU support plate

③   10 mm clearance
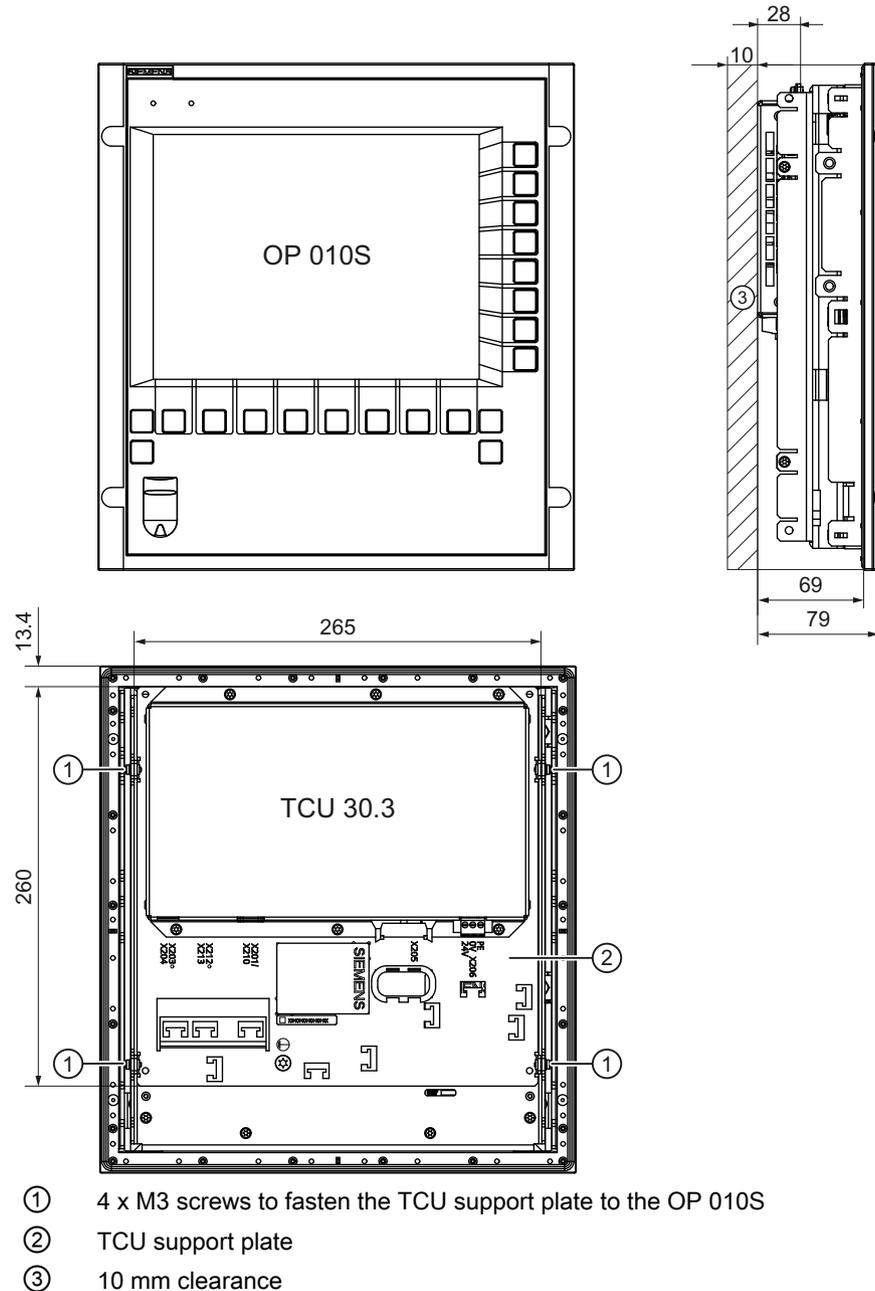
Figure 3-2   Mounted TCU with OP 010S, front, side and rear view

NOTICE
Impermissible mounting positions can cause malfunctions
Observe the permissible mounting position: Deviating by up to 5º from the vertical.

Connection 4

4.1 Pin assignment of the interfaces

The pins of the component interfaces are assigned as specified in the tables below. Any deviations are indicated at the relevant point.

Signal type	
I	Input
O	Output
B	Bidirectional (inputs/outputs)
V	Power supply
-	Ground (reference potential) or N.C. (not connected)

4.1.1 Power supply

Connector type:	Terminal block, 3-pin contact strip, screw type
Max. cable length:	10 m

Table 4-1   Assignment of the power supply interface
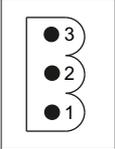
	Pin	Name	Type	Meaning
	1	P24 (+)		24 VDC potential (20.4 to 28.8 VDC)
	2	M24 (-)	V/V/-	0 V
	3	Functional earth		Connection for grounding the housing

4.1.2 USB interfaces

The USB interfaces are implemented as sockets and comply with the generally valid standard. The version information (1.1, 2.0 etc.), the maximum velocity (low speed, full speed, etc.) and the socket type (A or B) are documented in the individual sections for the associated devices.

In principle, USB interfaces have the following characteristics:

● Integrated power supply up to 500 mA for each socket.

● Maximum cable length 3 m (Length including the supply cable to the hub and the connected terminal device; only 1 hub is permitted. It should be noted that some keyboards already have a hub.)

Note

Cables that are too long can result in malfunctions or faults on the screen

Observe the following restrictions for the USB front interface for connecting operator panels to the keyboard, mouse or USB FlashDrive:

● Maximum cable length: 1.8 m

● Extension cables are not permissible

● Hot-plugging-capable devices are connected during operation and are identified automatically.

Note

Correct identification is only guaranteed for USB I/Os that comply to 100% with the USB specification.

Table 4-2   Assignment of the USB interface

Type A socket	Type B socket	Pin	Name	Type	Remark
		1	P5V_fused	V	+ 5 V (fused)
		2	Data-	B	Data -
		3	Data+		Data +
		4	GND	V	Ground (reference potential)
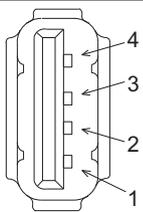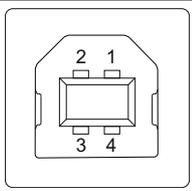
USB sticks

If you want to connect a USB stick to the USB interface, preferably use the tested SIMATIC USB stick 16 GB for this purpose (Article No.: 6ES7648-0DC60-0AA0). Alternatively, you can use a USB stick with any memory size. It must, however, meet the following minimum requirements:

● File system: FAT16 or FAT32

● Partitioning: only in PC partition format (MBR)

USB sticks that deviate from these requirements have not been tested and may not be recognized by the NCU.

4.1.3 Ethernet RJ45 interface

Connector type:	Standard RJ45 socket
Max. data transmission rate:	10/100/1000 Mbit/s
Max. cable length:	100 m

Table 4-3   Assignment of the Ethernet RJ45 interface 10/100 Mbit/s

Connector	Pin	Name	Type	Remark
	1	TxD+	O	Transmit data
	2	TxD-		
	3	RxD+	I	Receive data
	4/5	GND	-	(terminated internally with 75 Ω; not required for data transmission)
	6	RD-	I	Receive data
	7/8	GND	-	(terminated internally with 75 Ω; not required for data transmission)
	Shield	-	-	On connector housing
	-	Green LED (right)	-	Illuminated: 10 or 100 Mbit/s Off: No or faulty connection
	-	Orange LED (left)	-	Illuminated: Data exchange Off: No data exchange

Table 4-4   Assignment of the Ethernet RJ45 interface 1000 Mbit/s

Connector	Pin	Name	Type	Remark
	1	DA+	B	Bidirectional pair A+
	2	DA-		Bidirectional pair A-
	3	DB+		Bidirectional pair B+
	4	DC+		Bidirectional pair C+
	5	DC-		Bidirectional pair C-
	6	DB-		Bidirectional pair B-
	7	DD+		Bidirectional pair D+
	8	DD-		Bidirectional pair D-
	Shield	-	-	On connector housing
	-	Green LED (right)	-	Illuminated orange: 1000 Mbit/s Off: No or faulty connection
	-	Orange LED (left)	-	Illuminated: Data exchange Off: No data exchange

Note

Connection only on LAN, not on telecommunication networks!

4.1.4 LVDS display interface

LVDS display interface channel 1

Used to connect operator panel fronts with TFT displays with 640 x 480 pixels (VGA), 800 x 600 pixels (SVGA) or 1024 x 768 pixels (XGA).

Associated interface cable:	K2, max. length: 0.5 m
Connector type:	2 x 10-pin socket connector

Table 4-5   Allocation of the LVDS display interface
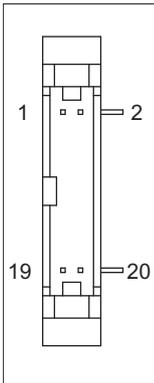
Connector	Pin	Name	Type	Meaning	
	1/2	P5V_D_fused	VO	+5 V display supply voltage (fused in PCU/ TCU)	
	3	RXIN0-			Bit 0 (-)
	4	RXIN0+	I	LVDS input signal	Bit 0 (+)
	5/6	P3V3_D_fused	VO	+3.3 V display supply voltage (fused in PCU/ TCU)	
	7	RXIN1-			Bit 1 (-)
	8	RXIN1+	I	LVDS input signal	Bit 1 (+)
	9/10	GND	-	System ground (reference potential)	
	11	RXIN2-			Bit 2 (-)
	12	RXIN2+	I	LVDS input signal	Bit 2 (+)
	13/14	GND	-	System ground (reference potential)	
	15	RXCLKIN-			(-)
	16	RXCLKIN+	O	LVDS cycle clock signal	(+)
	17/18	GND		System ground (reference potential)	
	19/20	N.C.	-	Not connected	

LVDS display interface channel 2

Used for expanding the LVDS display interface channel 1 to control TFT displays with 1280 x 1024 pixels (SXGA).

Associated interface cable:	K3
Connector type:	2 x 10-pin socket connector

Table 4-6   Allocation of the LVDS display interface
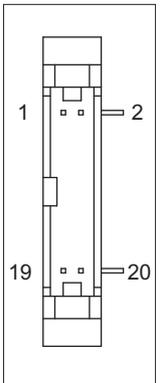
Connector	Pin	Name	Type	Meaning	
	1/2	GND	-	System ground (reference potential)	
	3	RXIN10-		LVDS input signal	Bit 0 (-)
	4	RXIN10+	I		Bit 0 (+)
	5/6	GND	-	System ground (reference potential)	
	7	RXIN1-		LVDS input signal	Bit 1 (-)
	8	RXIN1+	I		Bit 1 (+)
	9/10	GND	-	System ground (reference potential)	
	11	RXIN2-		LVDS input signal	Bit 2 (-)
	12	RXIN2+	I		Bit 2 (+)
	13/14	GND	V	Ground	
	15	RXCLKIN-		LVDS cycle clock sig-nal	(-)
	16	RXCLKIN+	O		(+)
	17	GND	V	Ground	
	18-20	P12VF	VO	+12 V fused	

4.1.5   Direct key interface

X11 on the operator panel (OP) fronts can be used to fetch the state of the direct keys. The connection of a 20-pin ribbon cable allows the direct keys to evaluate the following components:

● Direct key module (DTM)

● X70 in the machine control panels (MCP, MPP) and the handwheel connection module (HAM)

● X205 on the Thin Client Unit (TCU)

The signals are then forwarded to the control over the various communications networks. Note that DTM and HAM can be operated only with PROFIBUS DP.
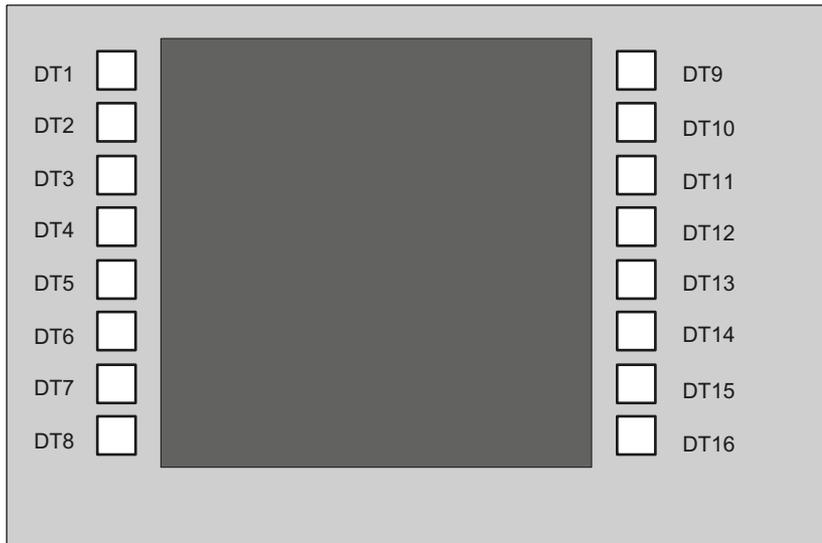
Figure 4-1   Assignment of the direct keys to the vertical softkeys of an operator panel front

16 digital inputs (5 V) can be fetched via the X11 connector.

Connector designation:	**X11**
Connector type:	20-pin plug connector
Max. cable length:	0.85 m

Table 4-7   Assignment of connector X11

Pin	Name	Type	Meaning
1	DT1		Direct key 1
...	...	O	...
16	DT16		Direct key 16
17	P5V		+ 5 V (fused)
18	P5V		+ 5 V (fused)
19	GND	V	Ground
20	GND		Ground

16 digital inputs can be polled by the X70/X205/DTM connector.

Connector designation:	**X70/X205/DTM**
Connector type:	20-pin plug connector
Max. cable length:	0.85 m

Table 4-8   Assignment of connector X70 (MCP, MPP, HAM) / X205 (TCU) / DTM

Pin	Name	Type	Meaning
1	DT1		Direct key 1
...	...	I [1]	...
16	DT16		Direct key 16
17	P5V / CON1 [2]		+ 5 V input voltage [3]
18	P5V / CON2 [2]		+ 5 V input voltage [3]
19	GND	V	Ground
20	GND		Ground

[1]   The inputs are electrically isolated for MCP / MPP / HAM and DTM.

[2]   For the TCU, it is evaluated whether the direct keys have been connected.

[3]   Power consumption: 100 mA for MCP / MPP / HAM; 500 mA for DTM

Table 4-9   Signal level

HIGH level:	5 V or open
Low level	<= 0.8 V

Networking 5

5.1 System settings

5.1.1 Thin Client Unit (TCU)

TCU overview

The Thin Client Unit (TCU) for the distributed configuration permits spatial separation of the SINUMERIK operator panel front (OP/TP) and the SINUMERIK PCU or NCU. On the SINUMERIK solution line, the TCU is used to display the user interface of the PCU 50 or the NCU.

It is possible to connect one TCU to several PCUs/NCUs. All TCUs and PCUs/NCUs that are connected to each other via a Gigabit switch form the "system network". The user interface of a PCU/NCU is copied to several OPs with one TCU each. In other words, all of the TCUs display the same screen. Operator actions can only be performed on one TCU at a time. This TCU then has user authorization. The PCU can also have its own OP connected directly to it.

The following diagram shows a **configuration example** for a distributed topology:
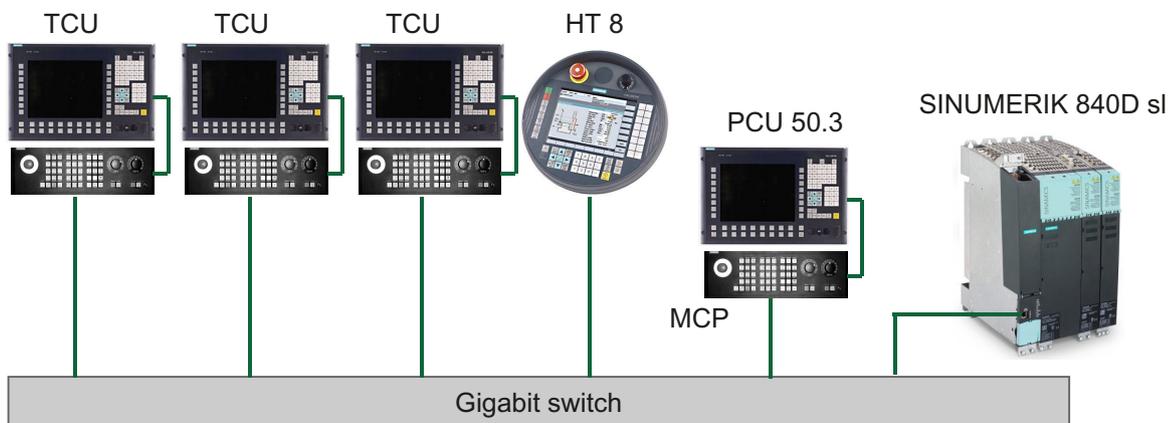
The mobile SINUMERIK HT 8 handheld terminal works on the thin client principle and combines the functions of an operator panel with a machine control panel.

The configuration and cabling of the whole plant system based on a permissible configuration is described in the chapter 'Network configurations".

Supplementary conditions

For operation of a TCU:

- In the system network, the number of **active** TCUs is limited:

    – a maximum of 2 TCUs: NCU 710.3 PN

    – a maximum of 4 TCUs: NCU 720.3 PN or NCU 730.3 PN

    – a maximum of 4 TCUs: PCU

    Any number of TCUs can be operated in the system network.

- CompactFlash Cards cannot be used on the TCU.

- A 16 bit or 32 bit depth of color setting may be selected.

- If a PC keyboard is connected to the TCU, it is not possible to ensure that all special keys, e.g., multi-media keys, will be transferred to the software of the NCU / PCU.

- Machine control panels connected via a PROFIBUS network are not supported for switchover.

- Distributed memory media that are connected to the TCU via USB can be used.

- The TOP Panels must be networked on the basis of the Gigabit standard, e.g. Gigabit switch or Ethernet cable according to CAT 6 (or higher).

5.1.2   Settings for SINUMERIK solution line

Fundamentals

The system network for SINUMERIK solution line is structured as a star topology with a central Ethernet switch, to which all Ethernet-based components of the system are connected.

For an NCU the connection is via the X120 Ethernet socket, for a PCU it is via the "Ethernet 2" connection. There is no default for all other components with two Ethernet connections. These components have an internal 2-port switch and may be used to connect an additional operator component. Thus, in this case, there can be deviations from the strict star topology.

System network

In the system network, the IP address 192.168.214.xxx with subnet mask 255.255.255.0 is pre-selected. Here there is precisely one DHCP server with DNS that can run on one NCU or one PCU. The server ensures assignment of IP addresses to the Ethernet components in the system network (DHCP clients) from a specified address band.

The following rules apply for assignment of IP addresses in the system network:

● For all NCUs and PCUs, the commissioning engineer assigns fixed IP addresses in the associated address bands, as well as appropriate computer names (host names). All other (operator) components are automatically assigned an IP address from the DHCP server. Its name is generated automatically (for MCP, MPP, HT 8), or is entered at commissioning (TCU).

● If there are multiple NCU and/or PCU in the system network the system automatically (depending on the start-up sequence) specifies the DHCP server and automatically ensures synchronization of all necessary data so that the next time the system boots any other NCU or PCU could take on the role of DHCP server. However it is better to specify a DHCP master. This is an NCU or PCU in the system network that is available at each system boot and which regularly takes over the task of the DHCP server and DNS server. Synchronization of data takes place in any event so that any other NCU or PCU can take over this task. All non-master NCU / PCU wait in the system boot an adjustable time for availability of the master.

Note

In a system network, on a boot server respectively - i.e. the NCU or PCU which accommodates the active DHCP server - a maximum of 30 operator stations may be operated simultaneously with a TCU.

A maximum of 10 operator stations with a TCU may connect up simultaneously with the same HMI application when powering up.

Connection to a company network

Each NCU can be connected via X130, and each PCU can be connected via "Ethernet 1" to the company network. The company network is used to exchange operating software with servers or to execute part-programs directly from servers in the company network. Company network and system network should always be logically and also physically separated.

Service interface X127

The service interface X127 of the NCU is used for direct connection of a PG/PC for service purposes. Here, access with STEP 7 to the PLC, and with NCU 7x0.3 PN also to PROFINET is possible.

With direct connection (peer-to-peer) of a PG/PC to X127 it is absolutely necessary that the PG is operated as a DHCP client.

5.1.3 System boot with system network

System behavior at boot

The system boot behavior is based on the following principle:

- For configuration of an NCU 7x0 with a PU 50, the default for a network configuration is as follows: The NCU keeps the default IP address 192.168.214.1 on X120, the PCU 50 keeps the default IP address 192.168.214.241 on Eth2.

- For a configuration of more than 1 NCU 7x0 without PCU, with one or several PCU 50, then a differentiation must be made between two cases:

  - At boot automatically all address conflicts and DHCP conflicts are resolved and the system is ready for operation. In this configuration, there is **no** guarantee that, on every system boot, all NCUs and PCUs will always be given the same IP address.

  - If the user requires all NCUs, and possibly also the PCUs, to have a defined constant IP address at each boot, for example, because the IP address is stated explicitly in the PLC program, the user must configure a fixed IP address for each NCU 7x0/PCU 50 in question, in the basesys.ini file.

- The user **can** specify a DHCP master in the basesys.ini file.

- Assigning names:

  - The user should assign meaningful names for all NCUs in the basesys.ini file; if not the names will be generated automatically.

  - A PCU 50 always has a computer name that can be changed as needed.

- IP addresses of the TCU und MCP are freely assigned from a prescribed address range on every system boot. The MCPs are identified in the PLC by their DIP switch setting.

Using DNS name service

Availability of the DNS (Domain Name System) name service offers the following advantages for system network administration:

- The name service enables easier configuration with names instead of IP addresses for management of operating units: All components in the system network can be addressed via a symbolic computer name. This name can to some extent be freely assigned, to some extent it is derived automatically from a DIP switch setting (MCP, MPP, EKS, HT 8, HT 2).

- A computer node in the system network (NCU, PCU, TCU, MCP, HT 8, etc.) can be addressed solely through assignment of the IP address, either via a freely selectable name or via an internally generated name in the system network, and thus becomes independent from its network address in the system network. Thus a change in the network address does not necessarily necessitate a series of additional setting changes.

- In addition, the name service is used by the system for address resolution for MCP/MPP, direct keys, and EKS when changing the user authorization.

5.1.4 Factory default settings

Meaning of the symbols:

- ○   Eth 1 as a DHCP client
- ●   Eth 2 as a DHCP server
- ■   Eth 2 with a fixed IP address

Preconfiguration of the TCU

The TCU is configured as a DHCP client and primarily accepts IP addresses from SINUMERIK components, from the DHCP server of such components that are inherent to SINUMERIK, for example, an NCU at X120 or a PCU on the system network or from a default DHCP server. The behavior of the TCU cannot be modified here.
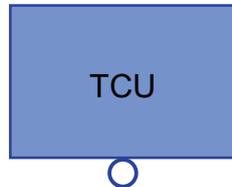
A TCU is a SINUMERIK DHCP client.

The TCU has a single Ethernet connection.

A TCU executes a boot via the network. The boot server is the computer node from which the TCU also obtains its IP address.

Pre-configuration of the PCU

A PCU has two Ethernet interfaces with default settings suitable for use with SINUMERIK solution line:
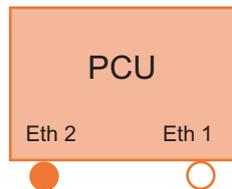
Eth 1 is pre-selected as a default DHCP client for connection to a company network.

Eth 2 is pre-selected as a SINUMERIK DHCP server for connection to a system network. On Eth 2 the fixed IP address 192.168.214.241 is pre-selected.

Preconfiguration of the NCU

On the X120, the NCU is preconfigured for the SINUMERIK DHCP protocol. The NCU is pre-selected here as a SINUMERIK DHCP server. On X120, the NCU occupies the fixed IP address 192.168.214.1 with the subnet mask 255.255.255.0 in its capacity as a DHCP server. The DHCP server of the NCU assigns IP addresses from the range 192.168.214.10 – 192.168.214.239 to the DHCP clients. The behavior of the NCU on X120 cannot be modified.

Restricting the available address band that is managed by the DHCP server of the NCU frees up IP addresses 192.168.214.2 to 192.168.214.9 as well as addresses 192.168.214.241 to 192.168.214.254 for network nodes with fixed IP addresses.
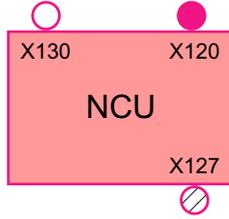
The NCU has three Ethernet connections:

- X120 to connect to the system network with an active DHCP server (Eth 0)

- X130 to connect to the company network as a default DHCP client (Eth 1)

- X127 as a service connection with an active DHCP server (Ibn 0)

On X130, the NCU is set as a default DHCP client for the address reference from a company network. The IP address received here is specified by the DHCP server from the company network.

On X127, an NCU is a standard DHCP server (in contrast to the SINUMERIK DHCP server). On X127, the NCU has the fixed IP address 192.168.215.1 with the subnet mask 255.255.255.224). The IP addresses 192.168.215.2 – 192.168.215.23 are dynamically assigned to the DHCP clients. The range 192.168.215.24 - 192.168.215.30 is reserved, and can be used by stations on the network with a fixed IP address, e.g. by a modem.

Reserved IP addresses for NCU and PCU

The following defaults apply on delivery:

- Connection to the system network with subnet mask 255.255.255.0:

IP address	Network station	Remark
192.168.214.1	NCU on X120	Default
192.168.214.2 – 9	For additional NCUs with a fixed IP address on the system network	Unassigned
192.168.214.10 – 239	For additional TCUs, subsequently for additional PCUs, NCUs, MCPs, MPPs	DHCP clients
192.168.214.240	Reserved for EKS (Electronic Key System)	Default
192.168.214.241	Fixed IP address of the PCU on Eth 2	Default
192.168.214.242 – 249	For additional PCUs with a fixed IP address	Unassigned
192.168.214.250 – 254	For PGs with a fixed IP address (service connection)	Unassigned

- Service connection with subnet mask 255.255.255.224:

IP address	Network station	Remark
192.168.215.1	NCU on X127	Default
192.168.215.2 – 23	for service purposes with PG, PC	DHCP clients
192.168.215.24 – 30	fixed IP address, for example for a modem	Unassigned

5.2 Commissioning TCU

5.2.1 Key assignment

Key assignment

Functions of the keys and softkeys in the "Operator panel service system":

Softkey	Key on OP	External key-board	Description
↓	HSK1	<F1>	Moves the cursor down a row
↑	HSK2	<F2>	Moves the cursor up a row
Page↓	HSK3	<F3>	Moves the cursor down a page
Page↑	HSK4	<F4>	Moves the cursor up a page
Char↓	HSK5	<F5>	Inserts text or digits
Char↑	HSK6	<F6>	Inserts text or digits
Cancel	VSK7	←	Cancel / Return
Ok	VSK8	→	OK / Confirm
---	NEXT WINDOW	Pos1	Moves the cursor to the top row
---	END	End	Moves the cursor to the bottom row
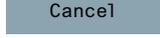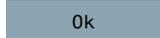
Exceptions to the above are mainly the result of input fields. Where these are present, the left/right cursor keys move the input cursor rather than performing an OK/cancel function. The Return key takes you to the next field (like the "down" key) rather than closing the entire dialog with OK. There are also Backspace (deletes character to the left) and Delete (deletes character to the right) keys for editing text and numbers. The F5, F6, Backspace, Delete, and Select keys (between the cursor keys) can be used to switch between Yes/No fields.

Note

Special function for Touch Panels without additional keys

Letters and numbers in input fields can be edited with HSK5/HSK6, which switch one character forward or backward. With a touch screen, you can activate all the softkeys and even select rows in a menu simply by touching them.

For operator panel fronts without keys, a virtual keyboard automatically appears.

5.2.2   Settings in the "TCU.ini" file

Directories

The tcu.ini file is created in the following directories:

NCU:

```
../siemens/system/etc/tcu.ini

../user/system/etc/tcu.ini

../oem/system/etc/tcu.ini
```

PCU (Windows 7):

```
C:\ProgramData\Siemens\MotionControl\siemens\System\etc\tcu.ini

C:\ProgramData\Siemens\MotionControl\user\System\etc\tcu.ini

C:\ProgramData\Siemens\MotionControl\oem\System\etc\tcu.ini
```

Note

The following entries are evaluated by SINUMERIK Operate:

- VNCServer/VetoMode
- VNCServer/AlarmBoxTimeOut
- VNCServer/FocusTimeout
- VNCServer/AdaptResolution
- VNCServer/MaxActiveTCUs
- VNCViewer/ExternalViewerSecurityPolicy

Restrictions

Restrictions for such external operator control units are:

- Neither MCP and direct keys nor an EKS system can be assigned. This also means that these devices cannot be activated to be an operator control unit in the system.

- Direct control keys cannot be triggered, i.e. the softkeys to the direct keys can be triggered in the operating software. However, the keys do not appear in the direct key image to the PLC.

- There is no configuration file config.ini, as for a TCU, i.e. the settings to be made to a TCU are not possible for such an operator control unit (power-up behavior, displacement, t:m:n); however, the displacement mechanism to the external operator control units is effective.

- An external operator control unit is never signaled as active operator station in the PLC.

Configuring the external operator control units in the tcu.ini file in section:

```
[externalTcu]

# EXTERNAL TCU IP-ADDRESSES

# List of accepted TCUs in IP-V4-format (index 1 to maximal 16)
```

```
ExternalTcuIP_1=
```

You can also set the screen resolution that you want in the tcu.ini file:

```
[VNCServer]
```

```
Resolution = ...
```

5.2.3 Displacement mechanism for TCUs

Supplementary conditions

The following supplementary conditions apply when operating the TCU:

2 active TCU connected in parallel to NCU 710.3 PN

4 active TCU connected in parallel to NCU 720.3 PN, NCU 730.3 PN

4 active TCU connected in parallel to PCU

To operate a machine with more operating stations then the maximum number the displacement mechanism ensures that **only the permitted number of TCUs are active** in shadowing grouping. The remaining TCUs are switched to a passive mode, which means they no longer represent a load relative to the resources. Thus the number of TCUs that can be connected to one HMI application is practically no longer limited, the limitation is the number of concurrently active TCUs.

Displacement rules

You configure the displacement mechanism in SINUMERIK Operate in the "Commissioning" operating area → menu forward key → "OPs" softkey for the operator panel in question.

The TCU can assume the following states:

- **The TCU is active and has user authorization:** This can be identified as the TCU shows the screen of the operating software and the screen is bright.

- **The TCU is active,** however, in the monitoring mode (i.e. it presently has no user authorization): This can be identified as the TCU shows the screen of the operating software, however, it is darkened in comparison to the TCU with user authorization.

- **The TCU is passive:** The TCU shows the selection menu of the possible connections instead of a screen of the operating software, and the softkey for selection of the last active connection of the TCU is shown in color.

When powering up, the TCU always always attempts to establish the first connection. The TCUs from a shadowing group establish their specified connection one after the other as long as the maximum number of permissible active operator units is not exceeded.

If a TCU encounters the situation that this number is already reached in its power up, then it attempts to obtain a connection via the displacement mechanism. If it can displace a formerly active operator unit then it takes on the active status itself, otherwise it transitions to passive status immediately after booting.

5.2.4 Disable switchover between TCU via PLC

Overview

The TCU switchover disable offers the option of dynamically disabling switchover from one TCU to the next when the system is running via the PLC. For the duration of the disable, a user authorization request to change user authorizations between TCUs will be ignored by the system and rejected.

The rejected user authorization request causes a message to be output in the dialog line of the HMI, in the form of a feedback message for the requester. The message disappears after five seconds.

HMI ↔ PLC data interface

The "switchover disable" function is always active and does not have to be switched on explicitly. The function is controlled by a data bit in the PLC. The HMI transfers the active OP to the PLC, thus forming the basis of the control function in the PLC.

The control bits and control information for this function are stored in the m:n data interface of the PLC. In terms of m:n, this function can be operated separately for the currently overridden HMIs in both m:n online interfaces (DB19.DBW120 ff for HMI1 and DB19.DBW130 ff for HMI2). If a system is not running an m:n, only the first m:n online interface is used for this function.

Switchover disable is controlled by a TCU_SHIFT_LOCK bit, managed by the user, on each HMI in the PLC. The bit address for the first HMI is DB19.DBB126.6 and DB19.DBB136.6 for the second HMI.

The PLC m:n online interface is expanded so that byte DB19.DBB118 is still added to the first interface and byte DB19.DBB119 to the second. These bytes acquire the index of the active TCU (of the active OP) for the appropriate HMI. The byte is called TCU_INDEX. The appropriate HMI uses the TCU index configured for the active TCU to describe the TCU_INDEX byte.

The TCU_SHIFT_LOCK bit is monitored by the appropriate HMI. A value = 1 triggers the switchover disable; switchover is enabled if the value returns to 0. The TCU_SHIFT_LOCK bit can be set, for example, to the PLC by the user pressing a key or it can be managed by the PLC user program according to its own logic. The TCU_SHIFT_LOCK bit is managed in the PLC exclusively by the user; the HMI only accesses this bit in read-only mode.

The HMI assigns the configured index of the TCU or PCU whose OP currently possesses user authorization in the shadow grouping. If no OP is active, a value of 0 is entered in TCU_INDEX.

If no TCU index is configured for the active TCU (active OP), the value 255 = undefined is presented as the TCU index. This means that the values 0 and 255 may not be configured as the TCU index.

Configuration

The TCU index and machine control panel address (MCP address) are configured on the PCU. The TCU index is set in the "OP Properties" dialog of the "System Network Center" program.

Operating principle

If the TCU_SHIFT_LOCK bit is set for switchover disable, a user authorization request is not carried out independently of the mode set on the HMI for allocation of user authorizations (veto mode), i.e., a change of user authorization is rejected.

This message appears on all OPs for approximately 5 seconds:

`"No switchover: Switchover disable set in current PLC."`

While this message is displayed, operations on the OP with the user authorization can still be carried out unaffected.

Note

The switchover disable only relates to changing the user authorization on the OPs in a shadowing grouping on a PCU.

Active switching from one OP to another PCU is not prevented.

Special features

The following special cases should be noted:

- Even if switchover disable is set, the TCU_INDEX field value may change in the PLC. This is the case if:

  - The OP in possession of the user authorization is actively switched to another PCU. Depending on whether another TCU takes on the user authorization or whether no TCU is currently active, either the index of the TCU or the PCU itself (if its directly connected OP becomes active) is entered, in exactly the same way as when there is a user authorization switchover.
    This can also be the value 255, if no TCU index is available for the OP. 0 is entered if an OP is no longer available in the shadow grouping.

  - An m:n switchover is in progress. The HMI program of the incoming PCU deactivates the HMI program which is active on it. An OP from the shadow grouping of the new (incoming) PCU must receive the user authorization. The TCU index of this OP is entered in the TCU_INDEX field.

  - A PCU is disconnected from a NCK/PLC in the context of m:n. No HMI program and, therefore, no OP with user authorization is then available on the exited NCK/PLC. This is signaled independently of a switchover disable by entering the value 0 into the TCU_INDEX field.

- If a TCU is actively switched over to another PCU, it can be deactivated there, i.e. it does not obtain the user authorization, if a switchover disable is set for the destination PCU.

- With an m:n PCU switchover – the PCU is switched to another NCK and, therefore, to another PLC – the PCU takes on the switchover disable settings of that PLC.

- The m:n interlock options on the PLC side have priority over the TCU switchover disable, so that a set TCU switchover disable cannot prevent an m:n switchover. If necessary, the m:n interference options should be synchronized here with those for the TCU in the PLC. It may, for example, be practical to set or remove the m:n displacement disable simultaneously with the TCU switchover disable.

Obtaining user authorization

On a TCU that has no user authorization, the first key that is pressed serves exclusively to request the user authorization, i.e. this key is not evaluated by the operating software.

The settings for the right to veto are stored in file tcu.ini and are only effective if the operating software is installed on the PCU. At the OP of the TCU, the operating software can be operated in exactly the same way as an OP directly connected to the PCU.

Note

These operator input sequence steps must only be carried out by qualified personnel!

5.2.5 Example: How to select the behavior of the TCUs during boot up

Example: Distributing boot support across two PCUs

To distribute boot support over two PCUs, "Boot support runtime and configuration only (TFTP/FTP)" must be selected on PCU_1 and "Boot support IP address only (DHCP)" must be selected on PCU_2.

The "No boot support" configuration must be selected on PCU_3:

Table 5-1   "TCU support" settings

TCU_1	TCU_2	TCU_3	TCU_4
192.168.214.10	192.168.214.11	192.168.214.12	192.168.214.13
VNC connections:	VNC connections:	VNC connections:	VNC connections:
192.168.214.241	192.168.214.241	192.168.214.241	192.168.214.241
192.168.214.242	192.168.214.243	192.168.214.243	192.168.214.242
192.168.214.243			
Switch to system network			

PCU_1		PCU_2		PCU_3	
192.168.214.241		192.168.214.242		192.168.214.243	
Services:		Services:		Services:	
✗ DHCP		✔ DHCP		✗ DHCP	
✔ TFTP		✗ TFTP		✗ TFTP	
✔ FTP		✗ FTP		✗ FTP	
✔ VNC		✔ VNC		✔ VNC	
Company network					

In this case, PCU_2 serves as the DHCP server which provides the IP addresses for the connected TCUs. PCU_3 is not involved in booting the TCUs, it is however displayed by the TCUs using VNC.

5.3 Network configuration

5.3.1 Permissible network topologies

Ethernet connection

A SINUMERIK 840 D sl can only be operated as a network within which the individual components communicate with one another via Ethernet connections. This network must be set up.

The individual components are factory-set so that the most frequently occurring standard configurations can be operated without changing the settings related to the network.

Division into system network and company network

On the SINUMERIK solution line, the components are generally split into a company network on the one hand and a system network on the other.

The connection to the company network provides access to the network drives, for example. On the system network, process data communication and image transmission runs from the components with operator software to the display units – the respective TCU.

This split is performed physically by means of the prescribed use of the Ethernet interfaces on the components:

● A TCU is connected exclusively to the system network.

● An NCU is always connected to the system network via X120.

● Ethernet interface Eth 2 of the PCU is preconfigured for connection to the system network; while Ethernet interface Eth 1 is used for connection to the company network.

● An NCU is connected to the company network via X130.

Meaning of the connections:

○	Eth 1 as a DHCP client
●	Eth 2 as a DHCP server
■	Eth 2 with a fixed IP address
Green connection	Uncrossed Ethernet cable
Gray connection	Crossed Ethernet cable (crossover)

5.3.2 Networks without connection to the company network

5.3.2.1 Configuration 1: NCU and TCU

Description
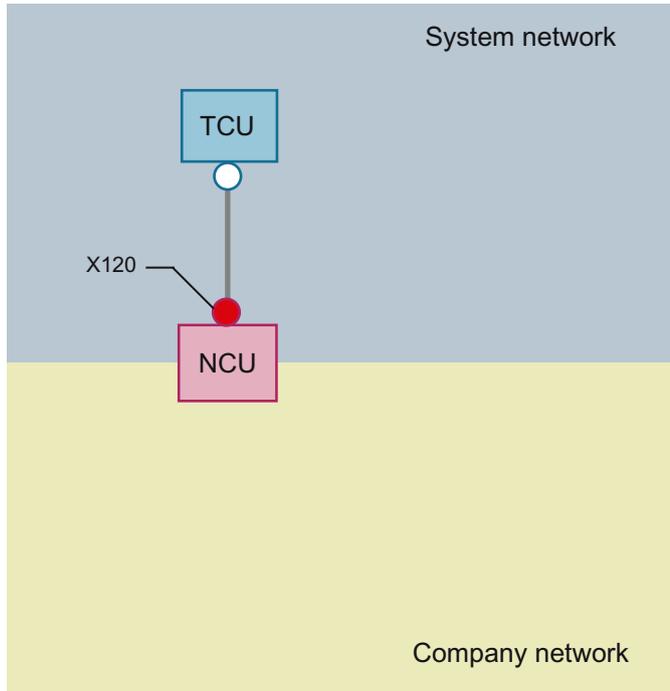
A direct Ethernet connection is used to connect a TCU to X120 of the NCU. NCU and TCU are suitably preconfigured with IP addresses.

The IP addresses are not significant for further operation.

The TCU is connected to the NCU via a **crossed** Ethernet cable.

The direct connection of the NCU via X120 to the TCU automatically forms a simple system network consisting of two computer nodes.

5.3.3 Networks with NCU connection to the company network

5.3.3.1 Configuration 2: NCU and TCU

Description
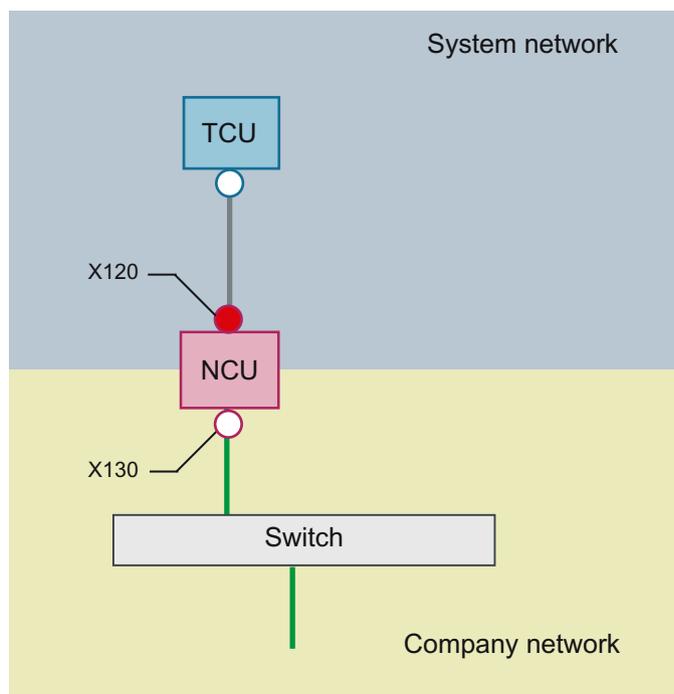
The TCU is connected to the NCU (directly) using a **crossed** Ethernet cable. On X130, the NCU is connected to a switch to the company network with a straight cable.

As in configuration 1, there is a direct Ethernet connection between a TCU and X120 of the NCU. NCU and TCU are suitably preconfigured with IP addresses. The IP addresses used here are not significant for further operation.

IP configuration: DHCP server on the company network

On X130, the NCU is set to the address reference via DHCP. If the company network has a DHCP server that provides the NCU with an IP address (IP configuration), the NCU is integrated into the company network.

Depending on the infrastructure available or the level of network administration of the company network, the following network parameters must be set for the NCU on X130:

- Computer name on the company network

- Address of a DNS server

- Address of a gateway (default router)

The IP address of the NCU to this connection is also assigned via network administration.

If the company network offers a low level of administration (in the worst case scenario the network has only one DHCP server that assigns the addresses from a predefined address range) the NCU receives an IP address that is initially unknown.

5.3.3.2 Configuration 3: PCU with TCU on NCU

Description
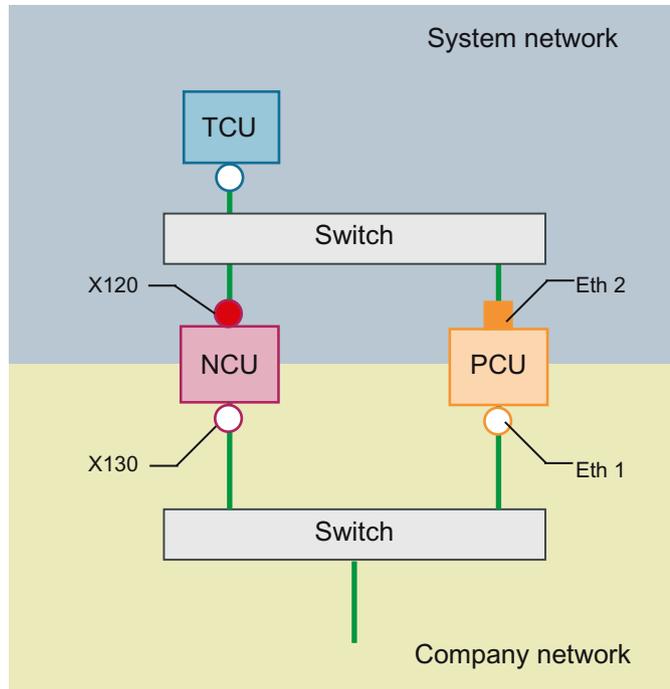
In this configuration, a switch is also required for the system network. All components are connected using straight Ethernet cables.

In terms of address allocation and the settings that need to be made, this configuration is identical to that of configuration 4. However, in this case, the DHCP server of the NCU actually supplies the TCU with an IP address and serves as a boot server for the TCU.

The observations made for configuration 3 also apply here in relation to the connection to the company network. The connection to a switch on the company network is made via a **straight** Ethernet cable.

To connect one TCU to both HMI systems you must create an additional connection to the NCU for the TCU, as described in the following chapter:

5.3.3.3 Connecting the programming device (PG) to the NCU

Description
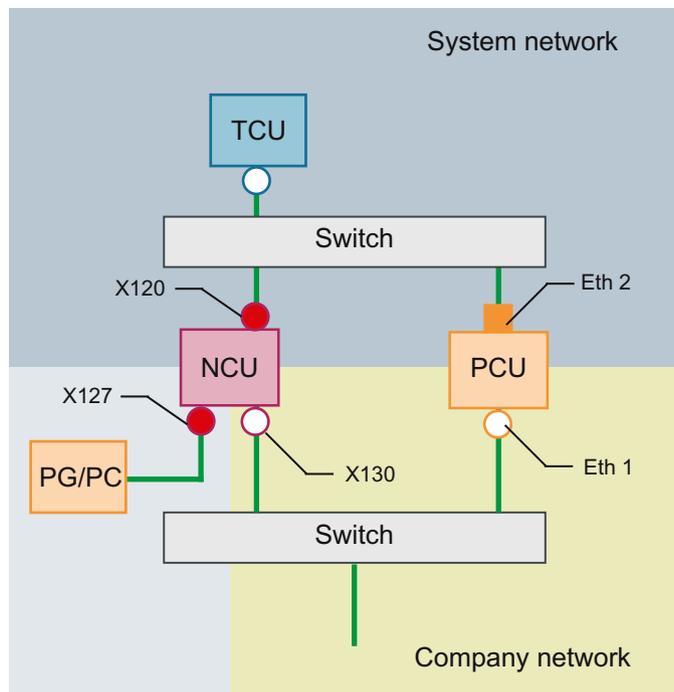
For service purposes a programming device is connected to the NCU at X127 as a standard DHCP client (automatically obtain an IP address). An NCU is a standard DHCP server on X127. On X127, the NCU occupies the fixed IP address 192.168.215.1 with the subnet mask 255.255.255.224.

At X127, IP addresses from 192.168.215.2 onwards are assigned via DHCP; e.g. to connect a programming device. This is the reason that a fixed IP address must not be set at the programming device.

5.3.4 Example: Configuring a VNC connection to a PC

Requirements

In order to use a TCU to get visual access to a computer from a SINUMERIK system via VNC, the following requirements apply:

● The boot server (active DHCP server) in the system network must be an NCU.

● This NCU must be integrated via X130 or X120, that is, into the network that contains the computer to be monitored.

● The computer to be monitored must be configured in the config.ini configuration file of the TCU according to the general configuration for a TCU in a separate host section as a switchover target for this TCU.
Where necessary, a password has to be specified in the configuration, if the VNC server requires one on the target system (see below).

● To ensure that the TCU recognizes the new switchover target, the TCU requires a restart and reboot.

● The screen resolution of the computer to be monitored must be adjusted to the conditions of the TCU, since otherwise the TCU scales the image received to its possible range of representation, which would adversely affect the representation on the TCU.

Configuration
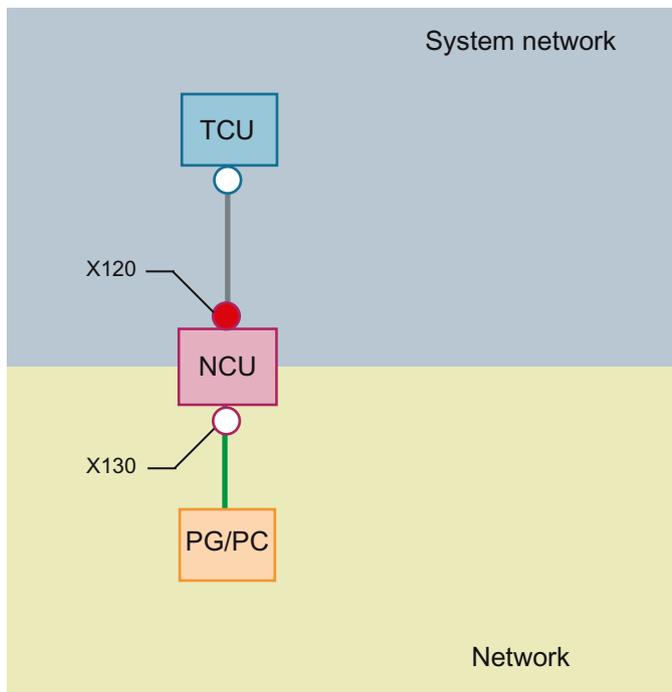
Figure 5-1   Configuration example

Configuration

The config.ini file is located in the following directory:

NCU:

`/user/common/tcu/<TCU name>/common/tcu`

PCU (Windows 7):

`C:\ProgramData\Siemens\MotionControl\user\common\tcu\<TCU name>\common\tcu`

The config.ini file must be stored on the boot server (active DHCP).

Example:

```
[Station]
maxhostindex=2               /* Number of nodes that are defined under
                                [host_1] and [host_2].
mcpIndex=192
tcuIndex=1
eksIndex=0
[host_1]
Address=192.168.214.1        /* Address of the NCU to which the
                                connection is established during booting.
[host_2]
Address=157.163.230.202      /* Address of the PC
password=123456              /* Password of the VNC server on the PC
```

Switching over between the nodes

With the menu back key + MENU SELECT, the following actions are triggered:

- In the header of the displayed window you will see the TCU name, for example TCU1.
- A selection list for connecting to the other nodes will be displayed on the TCU.

5.4 Service and diagnostics

5.4.1 Using the TCU's main menu

"Main menu"

The "Main menu (TCU1)" dialog is started with the menu back key and the <MENU SELECT> key:

```
Operator panel service system - Main menu (TCU1)                    ①

→ Show HMI on ncu3 (192.168.214.1): HMI not running
  Show HMI on ncu2 (192.168.214.2): HMI running
  Select service session
  Service this panel                                                        ③


                                                                      Details



                              ②



                                                                         Ok
                              ⑤

                              ⑥

   ↓         ↑       Page↓     Page↑        ④
```
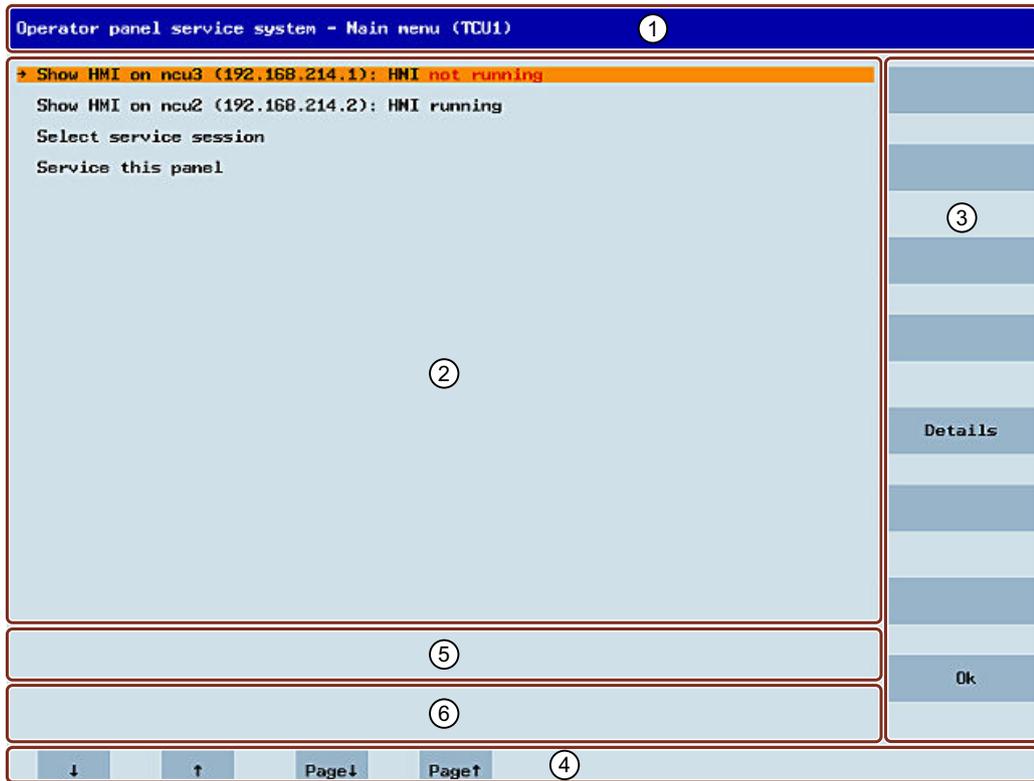
① "Main menu" title followed by the TCU name in brackets

② Central area with the list of servers and two further permanent items, "Select service session" and "Service this panel":

- "Select service session" triggers a server scan which detects all the VNC servers in the local (system) network. These are then displayed in a session menu which largely reflects the main menu.

- "Service this panel" opens the "Service menu for operator panel" submenu.

③ Eight vertical softkeys for use depending on the context.

④ Four horizontal softkeys for navigating with the cursor.

⑤ Message line whose content can be set via HWS commands from the servers

⑥ Error line in which error messages and sometimes transient status messages are output

Figure 5-2   TCU menu: Main menu

"Details" softkey

The following connection data for the selected device appears when the "Details" softkey is pressed:


```
Operator panel service system - Details for ncu2 (192.168.214.2)


Connection to device: ok

Session 0 (HMI):
    VNC   : ok
    HWS   : connected
    Name  : Qtopia Core VNC Server
    Screen: 1024x768, depth 16




                                                                    Back
```
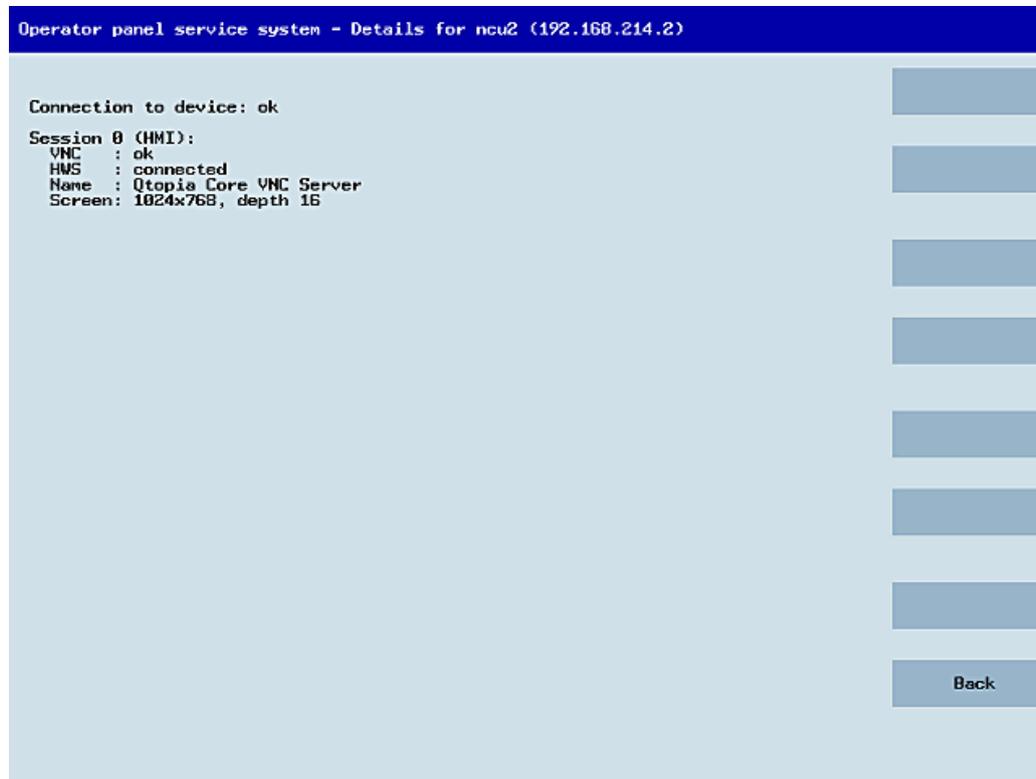
Figure 5-3   TCU menu: Connection data

5.4.2   Operating the TCU menu "Service sessions"

"Service sessions" dialog

When "Select service session" is selected from the main menu, the resulting process begins by triggering a server scan:

```
Operator panel service system - Service sessions

 Scanning  ▓  40%    Found 3 devices and 5 VNC servers
```
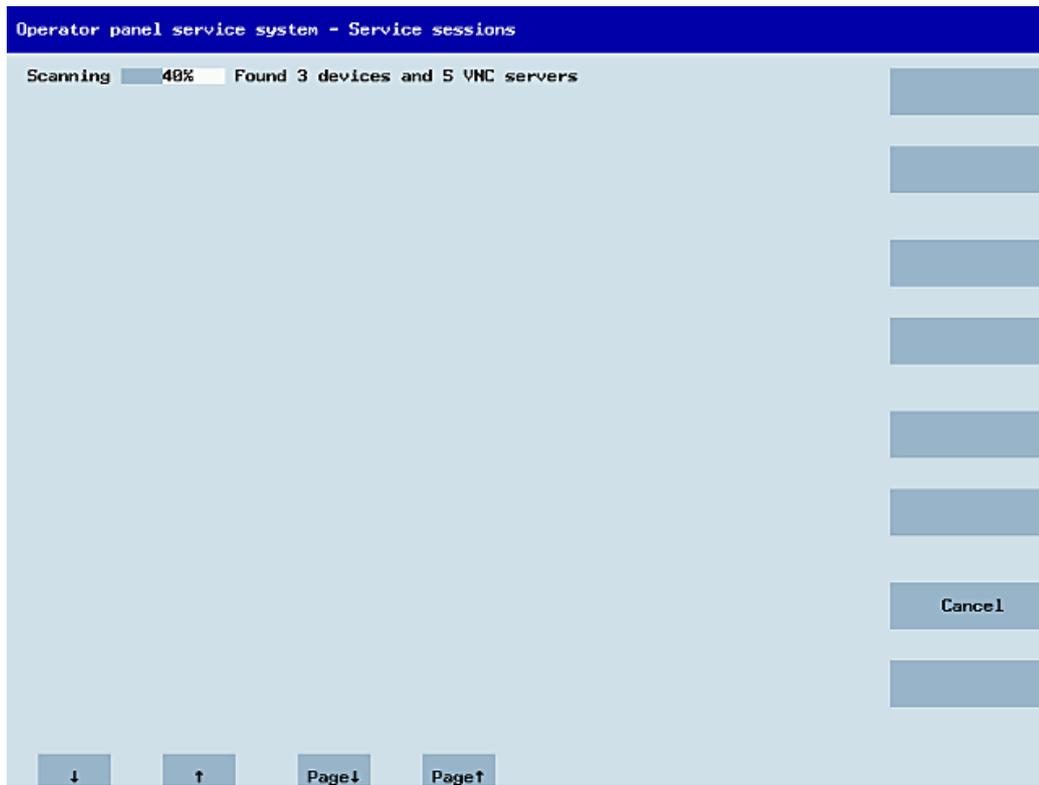
Figure 5-4   TCU menu: Scanning

After this, the following dialog appears:

```
Operator panel service system - Service sessions

  Show Command shell of ncu3 (192.168.214.1): VNC running
  Show System logfile of ncu3 (192.168.214.1): VNC running
  Show HMI on ncu2 (192.168.214.2): HMI running
  Show Command shell of ncu2 (192.168.214.2): VNC running
  Show System logfile of ncu2 (192.168.214.2): VNC running




                                                    Service
                                                    network



                                                    Details




                                                    Back to
                                                    main menu


                                                    Ok


    ↓         ↑        Page↓    Page↑
```
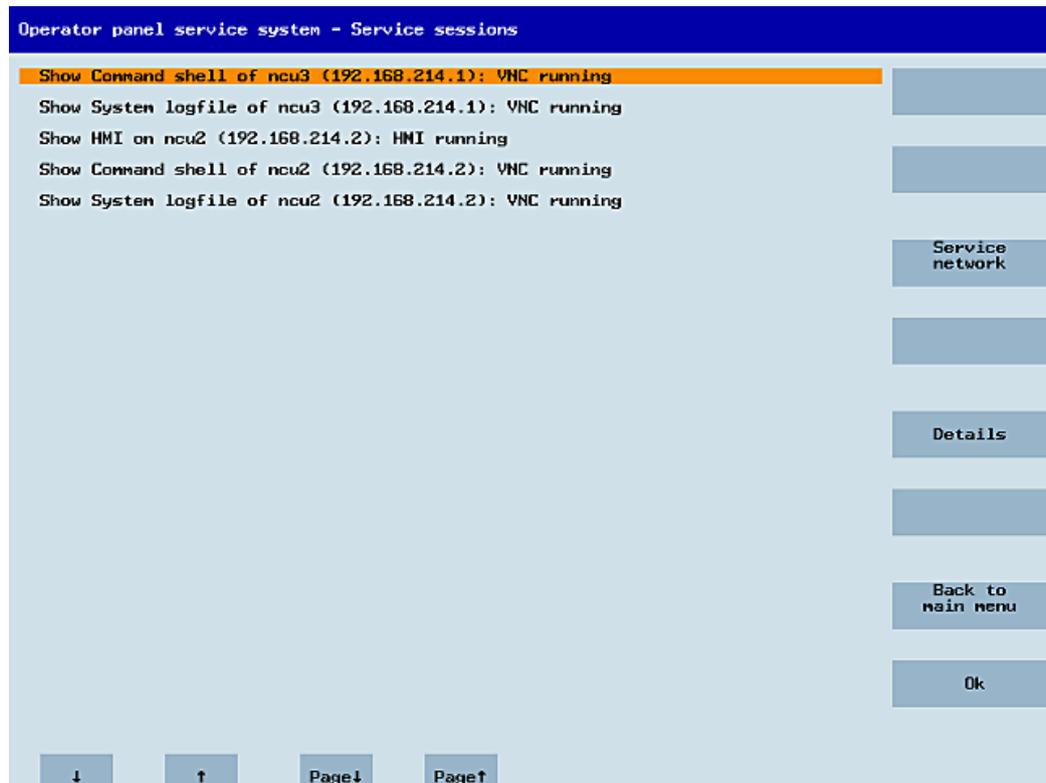
Figure 5-5   TCU menu: Active sessions

Central area with the server list:

The individual server lines contain either "Show WHAT on NAME (IP)" or the IP address only where the name is unknown.

Session number	VNC server
Session 0	HMI
Session 4	Command shell
Session 5	System logfile
Session 6	System Network Center (SNC)
...	
Session **<N>**	other server

These details are followed by a status message regarding the accessibility of the VNC server. "Connection not ok" appears if it is already impossible to access the VNC server from the IP side (if switched off, for example). If it can be accessed, a message shows whether an HMI-VNC server is also accessible ("HMI running/not running").

The VSK8, Return or right cursor keys can be used to launch a VNC viewer for the selected server.

Connection status:

Further details on the connection status can be called with the "Details" softkey. In the next dialog, "not ok" or "not running" are accompanied by an additional error message with more

precise details on the reason for the loss of function. With more favorable scenarios, the session name for the VNC server will also be specified along with its resolution.

The connection and HMI status are monitored on a regular basis in the background. This may mean that these details change spontaneously if a change is made on the relevant server (for example, it may be switched off, the HMI may become available, etc.).

5.4.3 Operating the TCU menu "Service menu"

"Service menu for operator panel (TCU)" dialog

The following dialog appears when "Service this panel" is selected from the main menu:
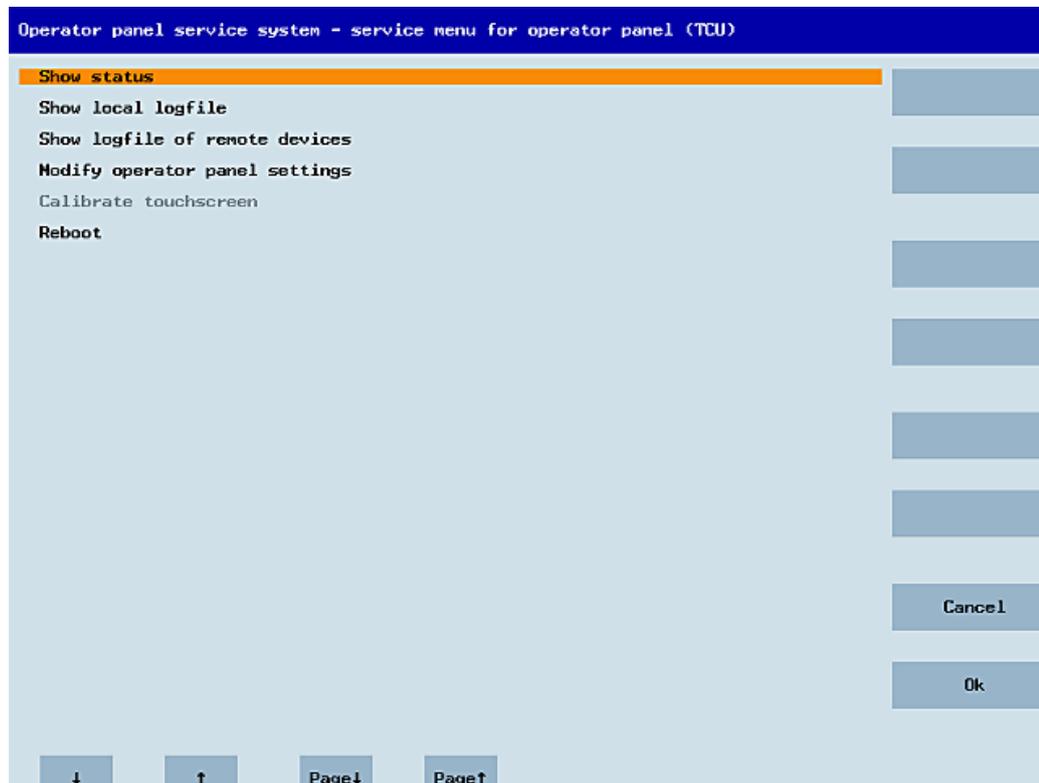
Figure 5-6   TCU menu: Service menu

The following menu items are available here:

- "Show status" shows status information, for example: Software version, hardware information, TCU network data, and their configuration:

```
Operator panel service system - Operator panel status

Software
--------
Version      : L02.60.13.00

Hardware
--------
Hardware-ID  : 7.1.0.0 (TCU)
Feature flags: 00000000 (no direct keys, 0 hand wheels)
Panel size   : 800x600, depth 16
Input devices: 1 keyboard, 1 mouse, 0 touchscreens

Network Status
--------------
Interface    : 100 MBit, full duplex
IP Address   : 192.168.214.18
Netmask      : 255.255.255.0
MAC Address  : 08:00:06:73:5a:7a
Boot Server  : 192.168.214.1
Gateway      : 192.168.214.1

config.ini
----------
[Station]
mcpIndex=192
tcuIndex=1
dckEnable=0

[Host_1]
Address = 192.168.214.1

[Host_2]
Address = 192.168.214.2
```

Back

↓   ↑   Page↓   Page↑

Figure 5-7   TCU menu: OP status

- "Show local logfile" shows a filtered version of the system log file in directory `/var/log/messages`, which contains only the messages of the local TCUs.
  Syslog messages received via the network are not displayed.

```
Operator panel service system - Local logfile

00:06:06 syslogd started: BusyBox v1.00 (2008.10.14-21:56+0000)
00:06:06 kernel: process `syslogd' is using obsolete setsockopt SO_BSDCOMPAT
00:06:06 udhcpc(821): udhcp client (v0.9.7) started
00:06:08 udhcpc(821): Lease of 192.168.214.18 obtained, lease time 864000
00:06:08 dhcpc: eth0 bound to 192.168.214.18  (server: 192.168.214.1 )
00:06:09 sntp[973]: using NTP server ? (192.168.214.1)
00:06:09 sntp[973]: NTP server is unsynchronized
00:06:12 sysinit: basic system initialization finished
00:06:13 kernel: i2c adapter i2c-0: timeout in state quick
00:06:13 tcodatad[1076]: i2c_write_1b: Input/output error
00:06:13 tcodatad[1076]: have_eeprom: failure, assuming no EEPROM
00:06:13 tcodatad[1076]: no EEPROM and no CF card, nothing to do
00:06:13 sysinit: starting subsystem /system/vncviewer: VNC Viewer version 02.60.→
10.00
00:06:14 startvnc[1186]: waiting for default server (192.168.214.1:0) being avail→
able
00:06:14 startvnc[1186]: HWS connection to 192.168.214.2:0 established
00:06:14 startvnc[1186]: HWS connection to 192.168.214.1:0 established
00:06:31 sntp[973]: NTP server is unsynchronized
00:06:47 lshd[1047]: lshd: publickey authentication for user root succeeded.
00:06:53 sntp[973]: NTP server is unsynchronized
00:07:15 sntp[973]: NTP server is unsynchronized
00:07:19 startvnc[1186]: default server connection aborted manually
00:07:37 sntp[973]: NTP server is unsynchronized
00:07:59 sntp[973]: NTP server is unsynchronized
00:08:21 sntp[973]: NTP server is unsynchronized
00:08:25 lshd[1047]: lshd: publickey authentication for user root succeeded.
00:08:43 sntp[973]: NTP server is unsynchronized
00:09:05 sntp[973]: NTP server is unsynchronized
00:09:13 lshd[1047]: lshd: publickey authentication for user root succeeded.
00:09:27 sntp[973]: NTP server is unsynchronized
00:09:49 sntp[973]: no acceptable packets received
00:12:20 lshd[1047]: lshd: publickey authentication for user root succeeded.
00:13:20 lshd[1047]: lshd: publickey authentication for user root succeeded.
00:14:02 lshd[1047]: lshd: publickey authentication for user root succeeded.
00:14:39 last message repeated 1 times

                                                            Back

  ↓          ↑        Page↓       Page↑
```

Figure 5-8   TCU menu: Local log file

- "Show logfile of remote devices" shows the log file of the other devices in the network: The syslog messages of devices in the system network which send syslog messages by broadcast, such as NCU 7x0, ...

- "Modify operator panel settings" opens another submenu, see next section.

- Calibrate touch screen" is only active if there is a touch screen. This menu item recalibrates the touch screen.

- "Reboot" initiates a restart of the TCU.

Note

Lines that are longer than space available wrap round onto the next line so that you do not have to scroll across. When this occurs, the line has a right-facing arrow at its right edge.

5.4.4 Operating the TCU menu "Modify settings"

"Modify settings for operator panel (TCU)" dialog

The following dialog appears when "Modify settings" is selected from the main menu:

```
Operator panel service system - Modify settings for operator panel (TCU)

   Operator panel index - TCU [0-255]      1_
   Machine control panel address - MCP [0-255]  192
   Electronic key system index - EKS [0-255]   0
   Enable direct keys                      No
   Virtual Keyboard                        Auto
   Software Caps-Lock                      Auto
   Emulation Type                          TCU30.1
   Screen Rotation                         normal (0°)
   Old VNC Password
   (needed to change or remove the password)
   Set VNC Password
   Repeat Password

                                                           Cancel

                                                           Ok

    ↓        ↑                    Char↓   Char↑      ←        →
```

Figure 5-9   TCU menu: Settings

In this dialog, you set the TCU parameters during first commissioning:

- "HT 8 individual mode" (yes/no)
  This is only visible with HT 8, and is used to switch between Auto Mode and Individual Mode.
  You do not have to make settings for an HT 8 in Auto Mode because the name is generated automatically: ("DIP<n>") MCP address and TCU index are derived from the DIP setting ("DIP<n>").

- "Operator panel index - TCU" (0-255)
  Defines the TCU index; see column "TCU" on the user interface.

- "Machine control panel address - MCP" (0-255)
  Specifies the address of the associated MCP; see column "MCP" on the user interface.

- "Electronic key system index - EKS" (0-255)
  Specifies the index of the associated EKS; see column "EKS" on the user interface.

- "Enable direct keys" (yes/no)
  Specifies whether direct keys are registered with the PLC (yes) or are treated as ordinary keys (no); see column "DCK" on the user interface.

- "Virtual Keyboard" (Auto/On/Off)
  Specifies whether a virtual keyboard is shown on the screen for touch screens.
  Depending on the panel features (Auto), the HMI decides whether a touch screen or keyboard is available.
  This parameter can also be set manually (On/Off).

- "Software Caps-Lock" (Auto/On/Off)
  The HMI can manage the Caps-Lock status of a keyboard in the software itself, when, for example, the key is not available. This is normally (Auto) switched on via a display machine data item. This machine data item can be overwritten individually for the TCU with the setting (On/Off).

- "Emulation Type" (TCU/TCU20.2/TCU30.3, only for modular TCU30.3)
  Specifies which TCU type is to be emulated when the TCU30.3 is operated as replacement device for an older TCU or as new device on a software version older than 4.7 SP2.

- "Screen Rotation" (0°/90°/180°/-90°/Auto)
  Specifies in which angle the screen is to be rotated in the software. This is useful when the panel is to be rotated during installation.
  For the "Auto" setting, the rotation of the display is taken from the panel.

- "Old VNC Password"
  If a password has already been set, it must be entered here so that it can be changed. If no password has been set, this field is grayed-out. The existing password can also be deleted if, after entering the old password, no new password is to be entered at "Set VNC Password" and "Repeat Password".

- "Set VNC Password"
  Assign a password which is stored in the TCU and, if required, sent to the server when the VNC connection is established.

- "Repeat Password"
  Repeat the password entered at "Set VNC Password".

The values are applied and stored with "OK". You can also make any subsequent adaptations or changes by calling up the "Commissioning" operating area → menu forward key → "OPs" softkey on the user interface.

5.4.5 Operating the menu for a new TCU or spare part TCU

Registering a new TCU

When an unknown TCU (i.e. not yet registered with the boot server) is started, a selection menu containing both the "New" and "Replacement for existing panel" items is displayed. The accessibility of all the registered TCUs is tested in the background.

The status of this test is displayed in the message line: "(0/3 panels inactive)".
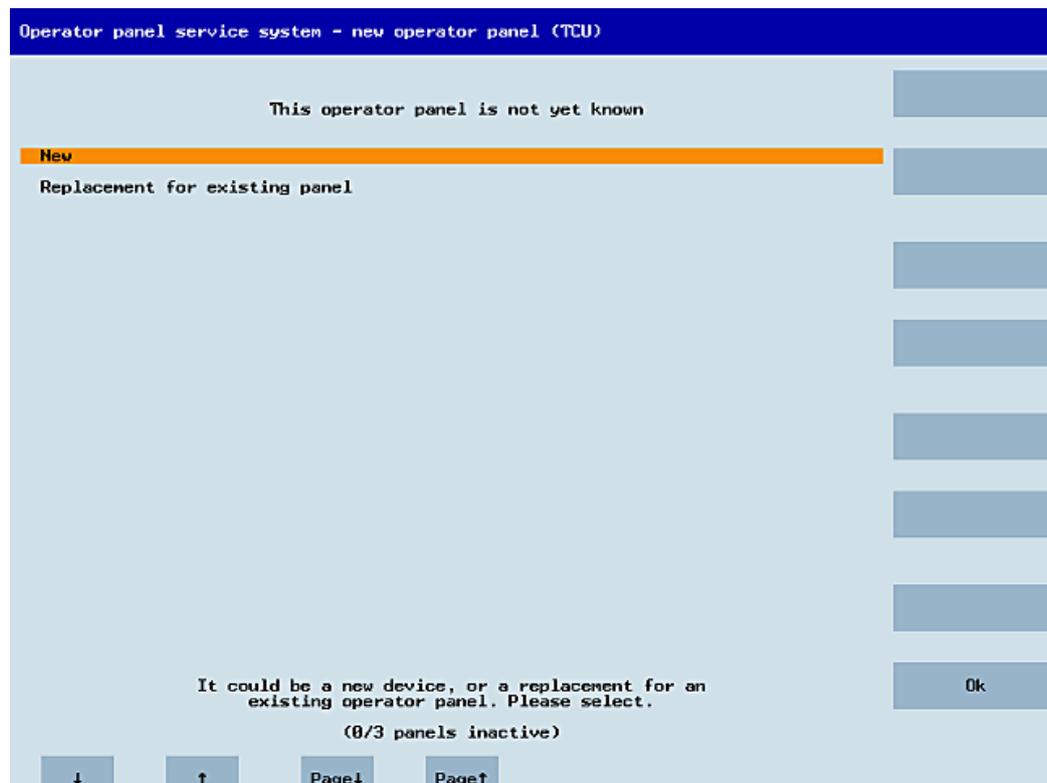
Figure 5-10   TCU menu: New TCU

If all TCUs are active, the new TCU cannot be a spare part and, after a certain time interval, the field for entering a name will automatically appear.

```
Operator panel service system - new operator panel (TCU)

                This operator panel (TCU) must be new,
                because there are no inactive panels.
        Name for this panel:  TCU1




                                                                  Cancel

                                                                    Ok


    ↓        ↑                          Char↓    Char↑
```

Figure 5-11   TCU menu: Name of TCU

If a TCU30.3 is to be operated with a software version before 4.7 SP2, the TCU is operated in compatibility mode. If required, you can view and change the emulation type in the settings.

Replacing a device

If "Replacement" is selected, all the registered TCUs will appear in a selection menu. Those which are active in the network are grayed out. (As these are functioning, there should be no question of replacing them.) The cursor automatically defaults to the first row for selection.

As the accessibility test is still running in the background, the active status of the rows may change if panels are switched on or off.

If a name is ultimately chosen, it will be applied to the new TCU along with the associated saved settings.

```
Operator panel service system - new operator panel (TCU)

        Please select which operator panel (TCU) should be replaced
   TCU1                                          (MAC 08:00:06:73:5a:7b)
   TCU2                                          (MAC 08:00:06:73:5a:76)
   TCU3                                          (MAC 08:00:06:73:b5:81)
   TCU4                                          (MAC 08:00:06:73:5a:7c)














                                                                  Cancel


                                                                    Ok


               (2/4 panels inactive)
     ↓            ↑          Page↓      Page↑
```
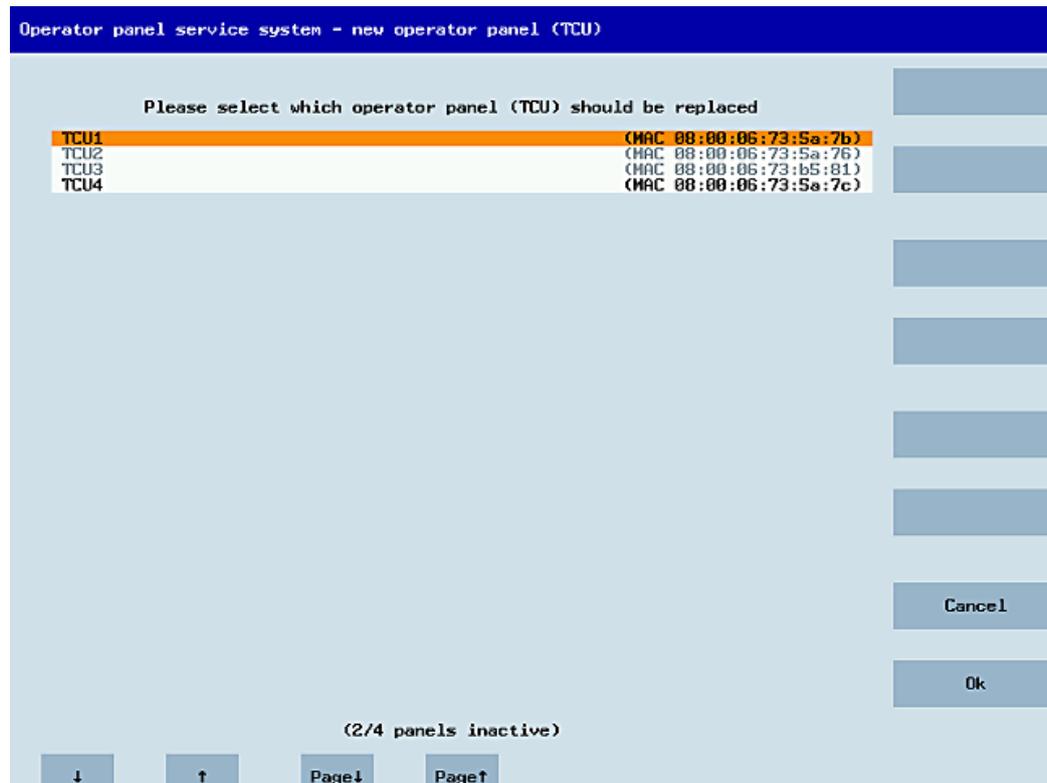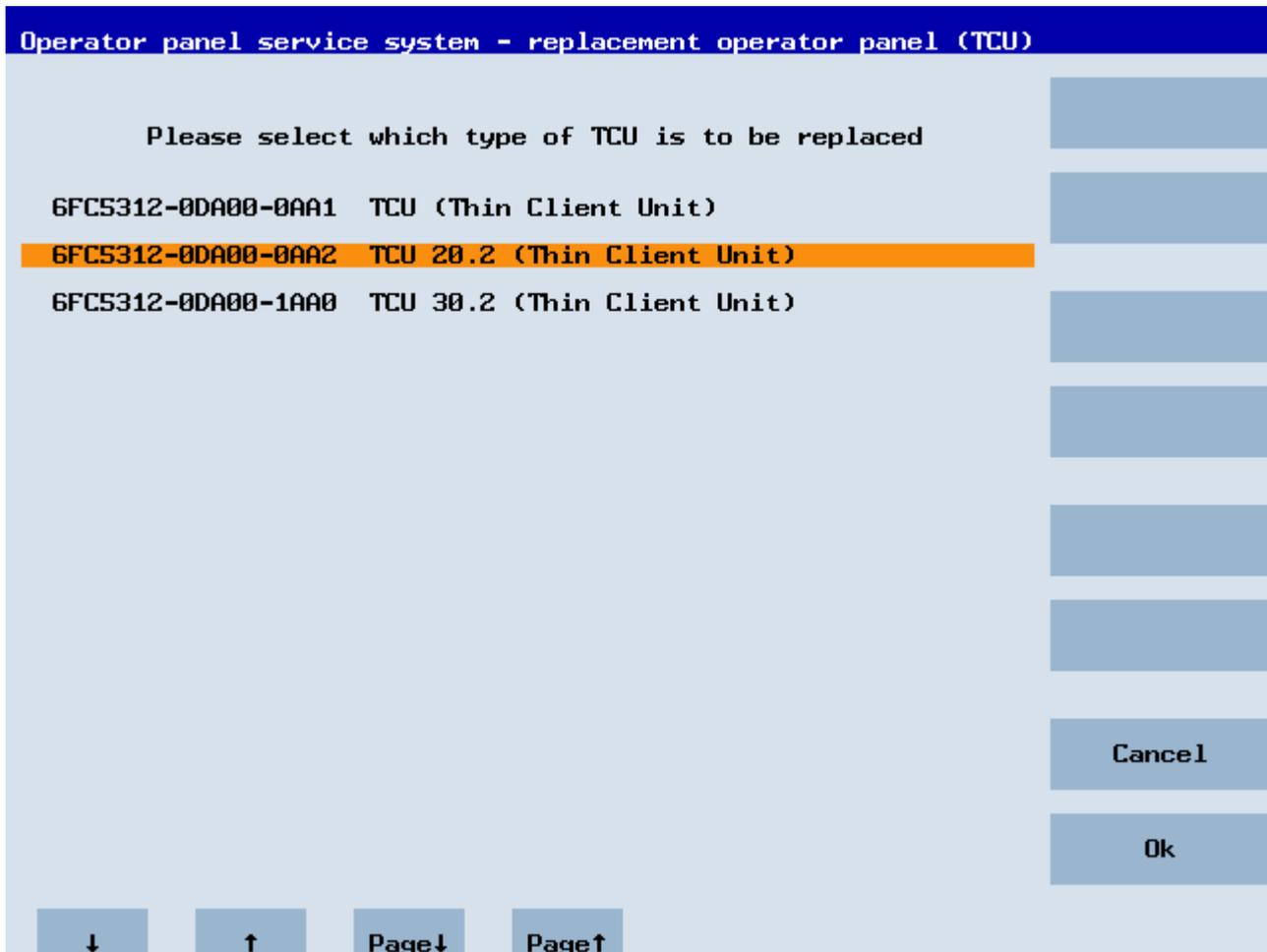
Figure 5-12   TCU menu: Replacement TCU

With the TCU30.3 and TCU30.3 legacy, after selecting the TCU to be replaced, a further dialog
to select the emulation type can be displayed in compatibility mode:

```
Operator panel service system - replacement operator panel (TCU)

        Please select which type of TCU is to be replaced

  6FC5312-0DA00-0AA1   TCU (Thin Client Unit)

  6FC5312-0DA00-0AA2   TCU 20.2 (Thin Client Unit)

  6FC5312-0DA00-1AA0   TCU 30.2 (Thin Client Unit)




                                                          Cancel


                                                            Ok


     ↓          ↑        Page↓      Page↑
```

If a static.ini of the TCU to be replaced (as of SW4.5) is found on the server, then the type of the old TCU is preselected based on the HW ID found there. If this is not the case, the TCU20.2 type is selected.

The following TCU types can be emulated:

- TCU

- TCU 20.2

- TCU 30.2

Note, however, that if an older TCU is to be replaced by a TCU30.3, some interfaces cannot be used when the HMI version is older than V4.7. The following interfaces are affected:

TCU to be replaced	Interfaces that cannot be used
TCU	X211, X212, X213 (because they do not exist in the TCU)
TCU20.2	X211, X212 (because they do not exist in the TCU20.2)

Assigning a name

If, as described above, the system automatically follows the "New" path, an additional message will appear: "This operator panel (TCU) must be new, because there are no inactive panels." This message will not appear if "New" is selected manually.
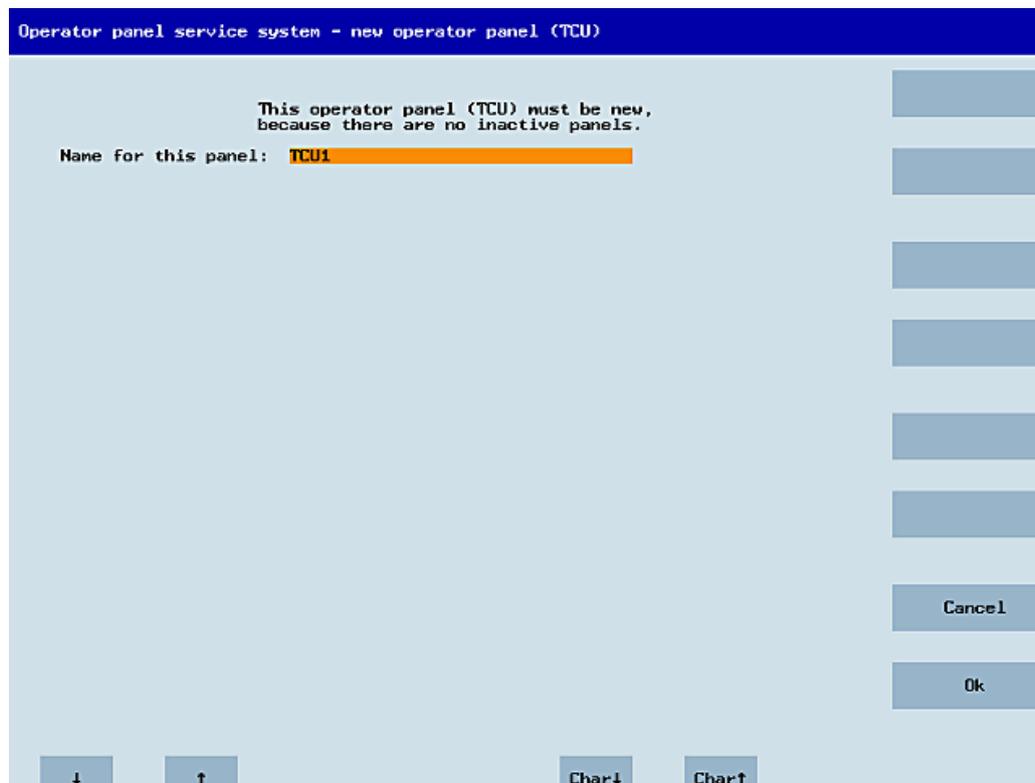

Figure 5-13   TCU menu: Name of TCU

An available TCU name is suggested in the input field, although the user is able to change this. The default name is "TCU<N>", where <N> is the lowest number yet to be used. If, however, the name is already allocated after the OK softkey has been pressed (which may happen if a number of TCUs log on at the same time) and the suggestion has not changed, a new and unused name will be specified.

If the name selected was still available, this will now be allocated, and the TCU settings can still be adapted if required. To enable any changes to be made, a new dialog appears in which all the parameters have been pre-assigned their default values. You can make any changes you like or just select "OK" to accept the existing values.

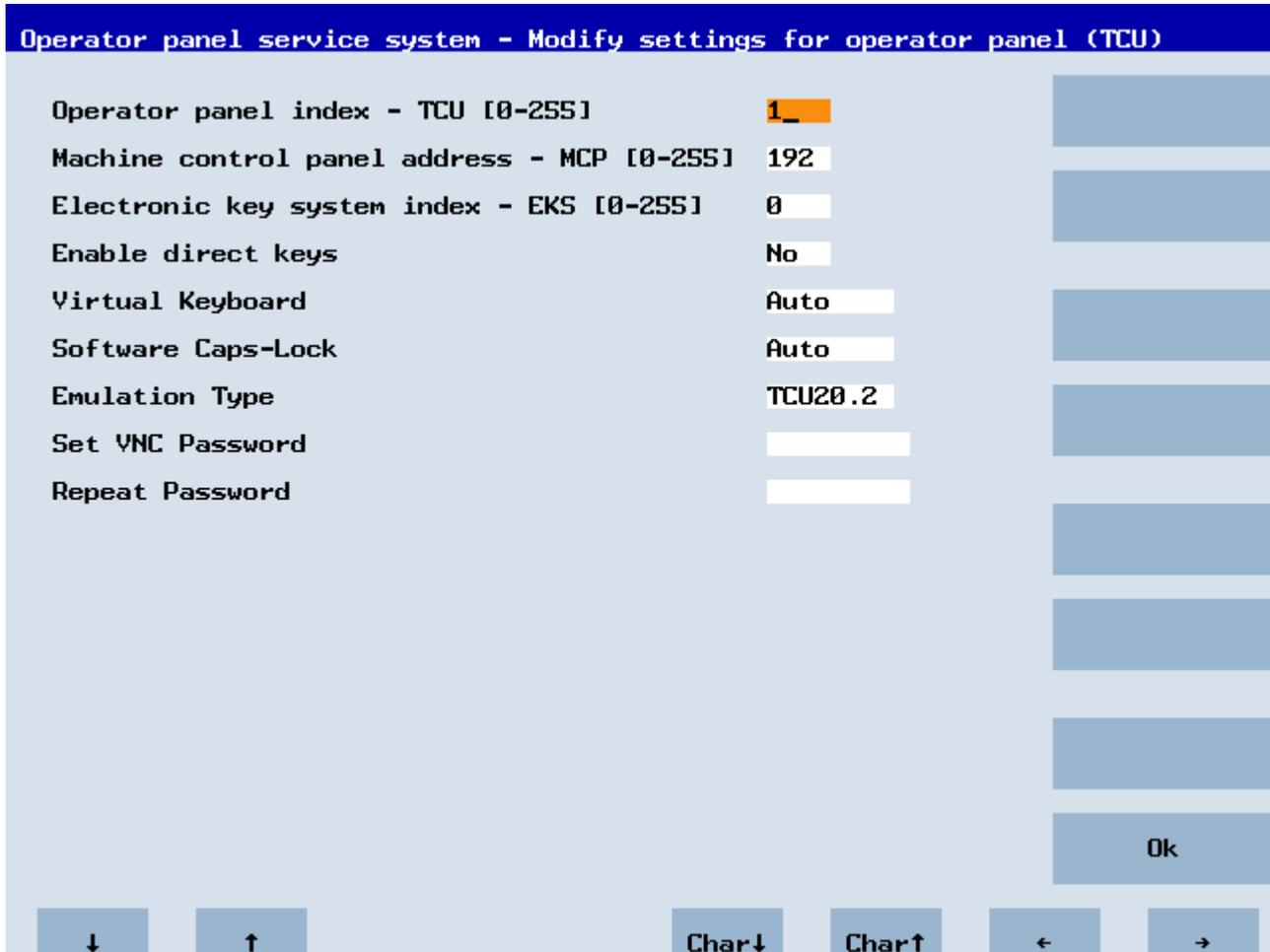## 5.4.6   How to register a TCU on the system network

Precondition

The boot server (NCU or PCU 50) defined in the system network as a DHCP master, must be switched on and be available in the network.

Sequence for a TCU

Procedure:

1. Connect TCU.
   This opens the "New operator panel (TCU)" dialog.

2. Select "New" to connect a new TCU and "OK" to confirm.

3. In the next dialog, accept the name suggested by the system or enter a name and confirm this with "OK".
   The following parameters are preselected for the TCU:

```
Operator panel service system - Modify settings for operator panel (TCU)

   Operator panel index - TCU [0-255]        1_

   Machine control panel address - MCP [0-255]  192

   Electronic key system index - EKS [0-255]    0

   Enable direct keys                        No

   Virtual Keyboard                          Auto

   Software Caps-Lock                        Auto

   Emulation Type                            TCU20.2

   Set VNC Password

   Repeat Password

                                                              Ok

    ↓        ↑               Char↓    Char↑         ←        →
```

4. Restart the TCU to apply the new settings.

5. If you want to change the parameters, select "Main menu" → "Service this panel" → "Modify operator panel settings".

Sequence for the HT 8

Procedure:

1. Connect HT 8 to a connection module and calibrate the touch screen.
   Additional softkeys are available for convenient touch panel operation:

   – "OK" has the same effect as the <INPUT> key

   – Select "DEF" to save the "Default" settings.

   – "Edit" has the same effect as the <F10> or <MENU SELECT> key.

2. Select HT 8 Individual Mode:
   According to the default setting for an HT 8, "HT 8 Individual Mode" is deselected with "No".
   This means "Auto" mode is activated for automatic detection in the system network. The
   HT 8 is automatically detected based on its name "DIP_". If "HT 8 Individual Mode" is
   activated with "Yes", the HT 8 is identified by its MAC address on the system network.

3. For an HT 8, confirm the "DIP..." name proposed by the system or adapt the name. You
   can select any other characters.
   Press the <INPUT> key to apply the following values as default settings for the HT 8:

   ```
   HT8 Individual Mode                          No
   Operator panel index - TCU [0-255]           10
   Machine control panel address - MCP [0-255]  10
   Electronic key system index - EKS [0-255]    0
   Enable direct keys                           No
   ```

   The following message will then appear: "New TCU 'DIP10' registered."

   ### Note

   The TCU index is used to evaluate the direct keys. Direct keys can only be activated by
   appropriate devices. For an HT 8 the TCU index cannot be set, but is assigned by the
   system.

Activate direct keys

The signals from pressing the direct keys are sent directly to the PLC. In the PLC, the keys
appear as 16 digital inputs.

Additional information on programming the PLC is provided in:

References: SINUMERIK Function Manual Basic Functions, PLC Basic Program (P3)

Definition: Operator panel

The term operator panel designates a unit that consists of an OP/TP, a TCU or PCU and a
machine control panel (MCP), that are connected to each other via Ethernet.

All TCUs and PCU 50 can be used along with OP/TP with "integrated TCU", e.g.: OP 08T,
OP 015T, TP 015AT.

Specifying settings without machine control panel

If a PCU or a TCU has no machine control panel (MCP), you must set one of the two following options:

- MCP address = 0 or no entry
  After the change of user authorization, there is no switchover of the machine control panel; the previously active MCP remains active.

- MCP address = 255
  If the user authorization is transferred to this PCU or TCU, the previous machine control panel is deactivated and there is no active machine control panel from this point on.

5.4.7 This is how you register a spare part TCU

Connecting a replacement TCU

Procedure:

1. Connect the new TCU.
   The following dialog lists the TCUs on the system network along with their "active" or "inactive" status.
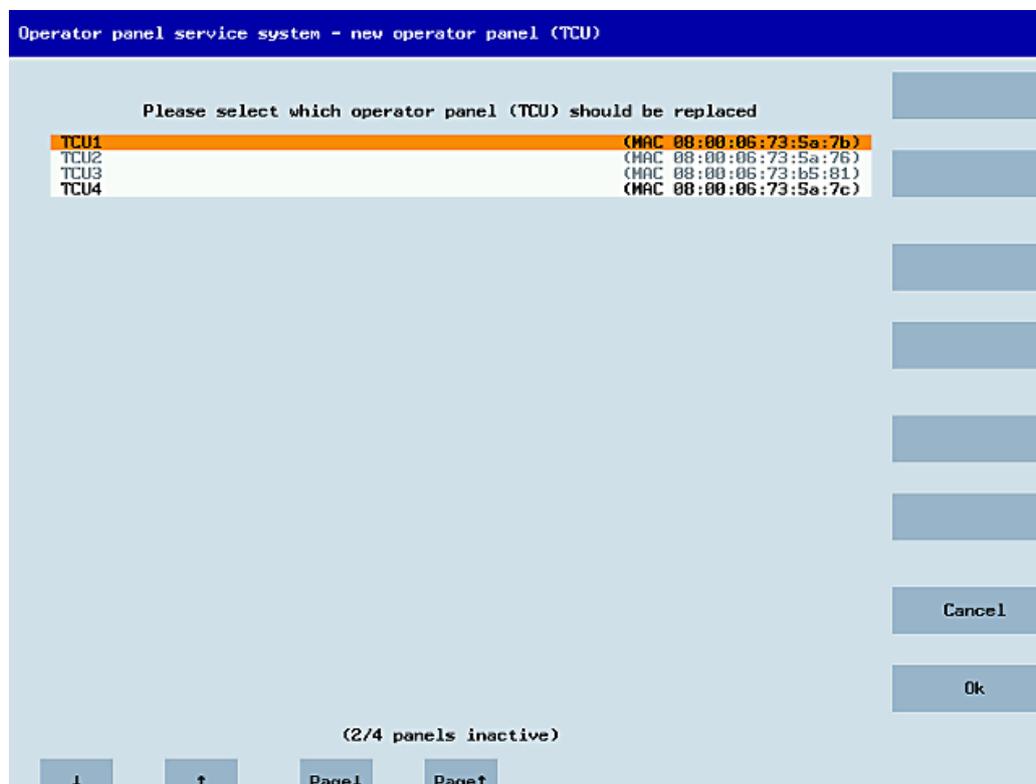

Figure 5-14   TCU menu: New operator panel (TCU)

2. Select the name previously assigned to the faulty TCU from the "New operator panel (TCU)" dialog. As a result, the new TCU is recognized on the network and acquires all of the configuration settings from the TCU that has been replaced.

5.4.8 Booting of the TCU

5.4.8.1 Messages during booting

Messages when booting

While the TCU is booting, progress is displayed after the BIOS has been loaded and before the operating system is started. In addition to messages, the current booting status is also indicated by a progress bar. While the IP address is being determined via DHCP and the TFTP is being downloaded (boot image), a progress bar indicates that booting of the TCU is not yet complete, or that a fault has occurred.

The figure below shows the structure of these messages:
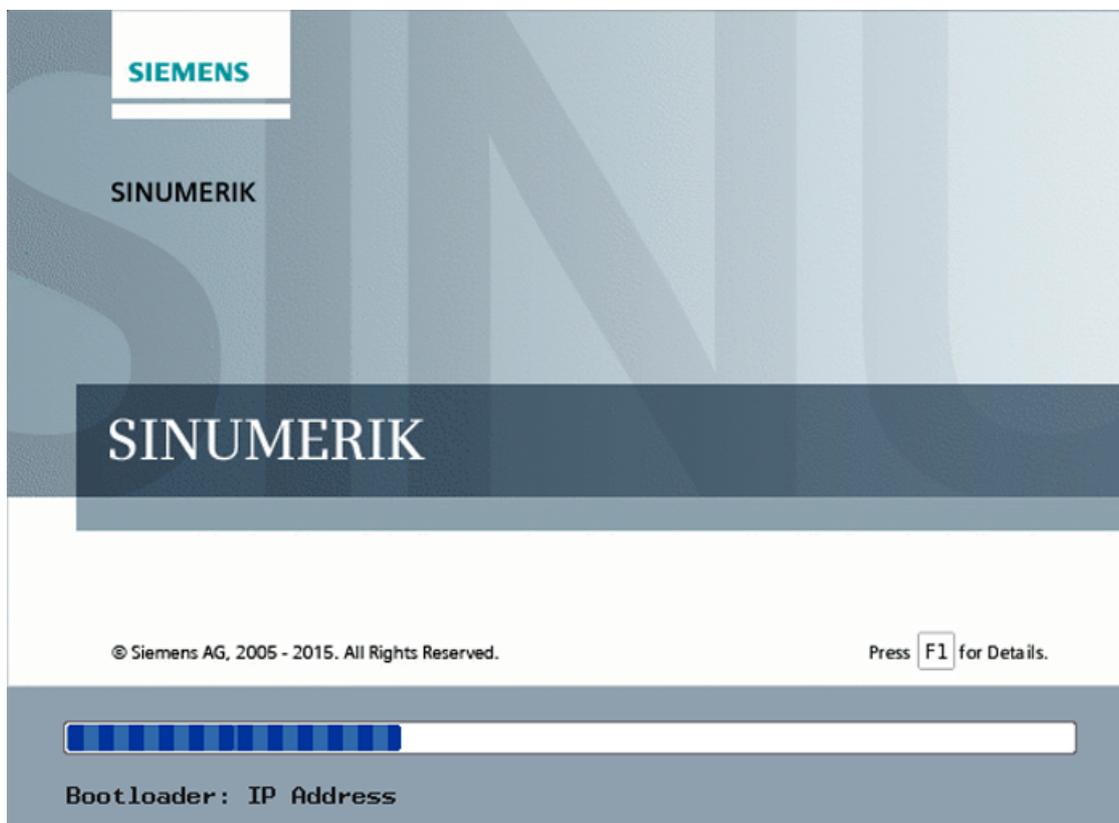
You can see the current boot phase below the progress bar. If a fault occurs, you can access further information by tapping the field designated "Press F1 for details". The "F1" symbol is touch-sensitive.

5.4.8.2 Diagnostics options during booting

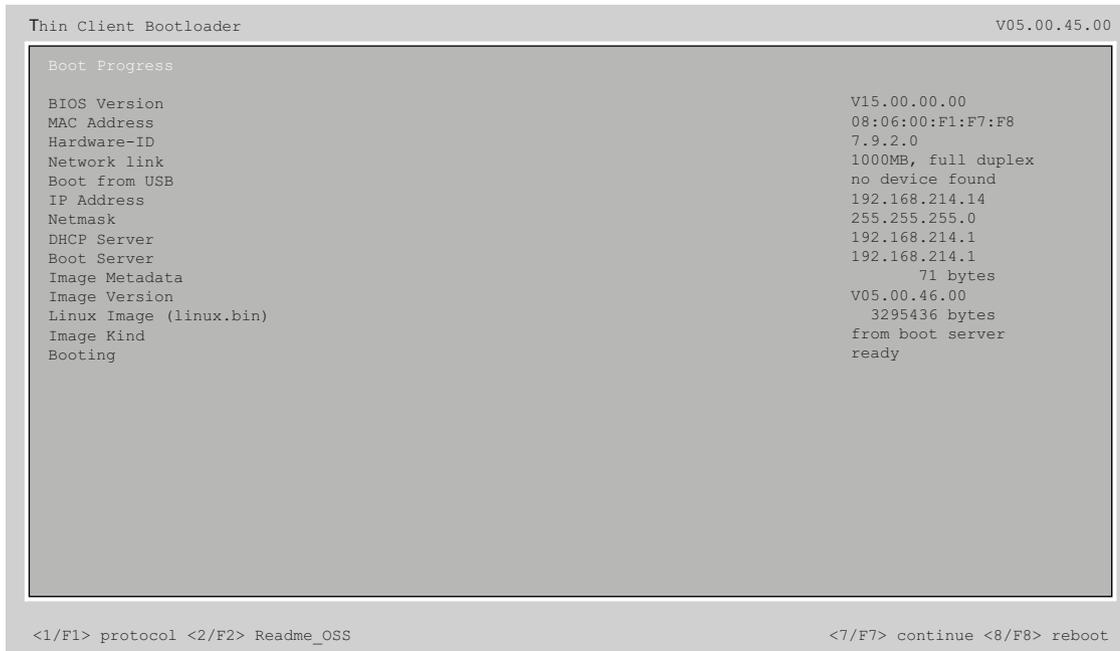### Diagnostics options during booting

In the following cases, the diagnostics window is displayed and booting of the TCU is interrupted:

- When the <1 / F1> function is selected during booting

- When a warning message is displayed

- When a fault occurs

Note

You can select functions <1 / F1> to <8 / F8> mentioned below by tapping on the Panel. Alternatively, you can do this via the corresponding function keys of a connected USB keyboard.

Call diagnostics window by tapping on <1 / F1

```
Thin Client Bootloader                                          V05.00.45.00

  Boot Progress

  BIOS Version                                   V15.00.00.00
  MAC Address                                    08:06:00:F1:F7:F8
  Hardware-ID                                    7.9.2.0
  Network link                                   1000MB, full duplex
  Boot from USB                                  no device found
  IP Address                                     192.168.214.14
  Netmask                                        255.255.255.0
  DHCP Server                                    192.168.214.1
  Boot Server                                    192.168.214.1
  Image Metadata                                        71 bytes
  Image Version                                  V05.00.46.00
  Linux Image (linux.bin)                          3295436 bytes
  Image Kind                                     from boot server
  Booting                                        ready




<1/F1> protocol <2/F2> Readme_OSS              <7/F7> continue <8/F8> reboot
```

Key / text	Meaning
F1 protocol	Display detailed information
F2 Readme_OSS	Details of the Open Source licenses
F7 continue	Continue booting of the TCU
F8 reboot	Restart the TCU

Press <1 / F1> to continue

If you select function <F1> in the diagnostics window, the, detailed diagnostic information is output.

Key / text	Meaning
F1 ... F6	Navigate within the window (alternatively, the relevant keys on the OP can be used).
F7 -detail	Display less information
F8 +detail	Display more information
F9 back	Return to diagnostics window

Service and maintenance 6

Cleaning the device

The TCU is designed for low-maintenance operation.

Preparation

Note

Clean the TCU only when it is switched off.

For cleaning, use a soft cloth moistened either with water or a mild cleaning agent. Use only dish soap as cleaning agent.

Procedure

Do not spray the cleaning agent directly on the TCU, but rather on a cleaning cloth. Never use caustic solvents or abrasive cleaners.

Note

Do not clean the TCU using compressed air or steam jets because they can damage it.

Checking the device

In order to prevent foreign bodies or liquids entering the TCU, regularly check the device:

● Ensure that all the housing screws are in place and tight

● For damage to the housing

● For damage to the cable cover or cable entry

Protect the device from environmental effects

Protect the TCU against:

● Direct sunshine and heat sources

● Mechanical vibration and shock

● Dust

● Humidity

● Strong magnetic fields

Suspected malfunction

If you suspect a malfunction due to unusual feedback messages, immediately isolate the device from power and inform qualified personnel to check for proper functioning.

Signs for a suspected malfunction:

- Unusual or no functioning
- Unusual heat generation
- Smoke development

Repair

Send the TCU back to the manufacturer for repair. The TCU may be repaired only there.

Technical data

7

7.1 Technical data

Safety	
Safety class	I
Degree of protection according to EN 60529 [1]	IP00 (open equipment) [2] IP20 (mounted, end application minimum requirement)
Approvals	CE / cULus
Flame resistance	UL 94 V-1 [3]

Electrical data	
Overvoltage category	Secondary circuit supplied from primary circuits up to Cat. III, 300 VAC [4]
Power supply [5]	24 VDC (20.4 V ... 28.8 V)
Current consumption	Typically approx. 0.2 A [6] Maximum approx. 2.9 A
Power consumption, max.	10.5 W [7] / 60 W [8]

Mechanical data (without packaging)			
Dimensions	Width: 260 mm	Height: 265 mm	Depth: 34 mm
Weight	1.6 kg		
Tightening torques, max.	M3:	0.8 Nm standard	
	M4:	1.7 Nm	
	M5:	3 Nm standard	
Mechan. stability	According to UL 61010 [3]		

1) The system installer ensures the system is sealed properly according to IP20, IP classification has not been checked by UL, UL TYPE 1.

2) Open equipment according to UL 61010.

3) The customer must ensure that the product, with the rear cover to be attached by the customer, meets the requirements for flame resistance of the material according to UL 94 V-1 and the mechan. stability / fire protection requirements / touch protection according to UL 61010.

4) If power supply units with primary-side supplies up to 600 VAC (line-to-neutral voltage) have to be deployed, the transient voltages on the primary side of the power supply unit must be limited to 4000 V.

5) Connect the device only to a 24 VDC power supply that is compliant with protective extra-low voltage (PELV) requirements according to UL 61010.

6) Without connection of a panel.

7) Only TCU.

8) TCU with OP 019 and 2 x 0.5 A / 4 x 0.1 A on USB.

Note

The 24 VDC power source must be adapted to the input data of the device (see "Electrical data").

7.2 Supplementary electrical conditions

7.2.1 Power supply

Requirements for DC power supplies

⚠ WARNING
Electric shock due to connection of an unsuitable power supply
When equipment is connected to an unsuitable power supply and/or insufficiently grounded (Page 19), exposed components may carry a hazardous voltage that might result in serious injury or death. • Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage) output voltages acc. to UL 61010 for all connections and terminals of the electronics modules.

⚠ WARNING
Inadequately fused supply cables can be life-threatening
In the case of supply lines > 10 m, protectors must be installed at the device input in order to protect against lightning (surge).
The DC power supply must be connected to the ground/shield of the NC for EMC and/or functional reasons. For EMC reasons, this connection should only be made at one point. As a rule, the connection is provided as standard in the S7-300 I/Os. In exceptional circumstances when this is not the case, the ground connection should be made on the grounding rail of the NC cabinet (also refer to /EMC/EMC Installation Guide.)

Table 7-1   Requirements of the DC power supply

Rated voltage	According to EN 61131-2 Voltage range (mean value) Voltage ripple, peak/peak Powering up time when switched on	24 VDC 20.4 VDC to 28.8 VDC 5% (unsmoothed 6-pulse rectification) any
Non-periodic overvoltages	 Period of overvoltage Recover time Events per hour	≤ 35 V ≤ 500 ms ≥ 50 s ≤ 10
Transient voltage interruptions	Downtime Recovery time Events per hour	≤ 3 ms ≥ 10 s ≤ 10

7.2.2 Grounding concept

Components

The SINUMERIK 840D sl system consists of a number of individual components which have been designed so that the system complies with the appropriate EMC and safety standards. The individual system components are:

- Numerical Control Unit (NCU)
- Machine Control Panel (MCP), Machine Pushbutton Panel (MPP)
- Keyboard
- Operator panels (operator panel front + TCU/PCU)
- Distributor box and handheld unit
- S7-300 I/O with IM 153 interface module

Grounding measures

The individual modules are attached to a metal cabinet panel. Insulating paints on the mounting points (e.g. tension jacks) must be removed.

It is permissible to cluster the operator control components regarding connection/potential bonding.
Example: The control panel on the swivel arm.
It is sufficient in this instance to connect the ground connections of, for example, the PCU, TCU, and operator panel front using a cable and to route a shared grounding conductor to the central ground connection in the control cabinet.

Please note that interruption of the grounding during maintenance work is not permissible.

Additional references

EMC Design Guidelines

7.2.3 RI suppression measures

In addition to the protective grounding of system components, special precautions must be taken to guarantee safe, trouble-free operation of the system. These measures include shielded signal lines, special equipotential bonding connections, and isolation and shielding measures.

Shielded signal cables

- For safe and fault-free operation of the system, the specified cables must be used.
- For digital signal transmission, the shield must have a conductive connection at both sides of the housing.

Cable definition

Definition:

- Signal cables (example)

    – Data cables (Ethernet, PROFIBUS, sensor cables, etc.)

    – Digital I/Os

    – Cables for safety functions (emergency stop, enabling)

- Power cables (example)

    – Low-voltage supply lines (230 VAC, +24 VDC, etc.)

    – Motor cables

Rules for routing cables

In order to achieve the greatest possible EMC compatibility for the complete system (control, power unit, machine), the following EMC measures must be carefully observed:

- If necessary, signal and power cables may cross one another (if possible at an angle of 90°), but must never be laid close or parallel to one another.

- Only use cables approved by SIEMENS for the signal lines from and to the Control Unit.

- Signal cables must not be routed close to strong external magnetic fields (e.g. motors and transformers).

- If signal lines cannot be routed a sufficient distance away from other cables, they must be installed in grounded cable ducts (metal).

- The operator panel fronts, MCPs, MPPs, and full keyboards must be installed in metallically enclosed EMC-compatible housings.

Note

For further information on interference suppression measures and the connection of shielded cables, please refer to the EMC Installation Guide.

7.2.4 SINUMERIK_SouthKorea_Note

EMC limit values in South Korea

이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.
For sellers or other users, please bear in mind that this device is an A-grade electromagnetic wave device.
This device is intended to be used in areas other than at home.

The EMC limit values to be complied with for South Korea correspond to the limit values of the EMC product standard for variable-speed electric drives EN 61800-3, Category C2, or limit value class A, Group 1 according to EN 55011. By applying suitable supplementary measures, the limit values according to Category C2 or according to limit value class A, Group 1, are

maintained. Further, additional measures may be required, for instance, using an additional radio interference suppression filter (EMC filter).

The measures for EMC-compliant design of the system are described in detail in this manual respectively in the Installation Guideline EMC.

Please note that the final statement on compliance with the standard is given by the respective label attached to the individual unit.

7.3 Climatic and mechanical environmental conditions

7.3.1 Transport and storage conditions

The components of the SINUMERIK 840D sl system exceed the requirements according to EN 61800-2 with regard to shipping and storage conditions.

The following data applies under the following conditions:

- Long-term storage in the transport and product packaging:
  At weather-protected locations that have continuous contact with outside air through openings.

- Transport in the transport packaging:

  - In unventilated containers under conditions not protected from weather effects.

  - In the "cold" in accordance with outside air.

  - Air transport in the air-conditioned cargo hold.

Table 7-2   Ambient conditions during storage and transport

Type of condition	Permissible range/class	
	Transport	Storage
Classification	EN 60721-3-2	EN 60721-3-1
Climate class	2K4	1K4
Ambient temperature [1]	-40° C ... +70° C	-25° C ... +55° C
Biological environmental conditions	2B1 [2]	1B1 [2]
Chemically active environmental conditions	2C2 [3]	1C2 [3]
Mechanical environmental conditions	Class 2M3 according to EN 60721-3-2, in transport packaging [4]	Class 1M2 according to EN 60721-3-1, in product packaging [5]
Maximum permissible temperature change	Direct interaction in air/air: -40°/+30° C at 95% relative humidity	30 k/h
Relative humidity (without condensation)	5 to 95%	
Precipitation, rain	6 mm/min [2]	Not permissible

Type of condition	Permissible range/class		
Water other than rain	1 m/s and wet loading surfaces [6]	Not permissible [7]	1 m/s and wet loading surfaces [6]
Height	Max. 4,000 m above sea level		
Condensation, splash water, icing, salt spray	Permissible	Not permissible [7]	Permissible [6]

[1] Transport and storage of operator panel fronts and diskette drives: -20° C to +55° C.

[2] Mold growth, slime, rodents, termites and other animal vermin are not permissible.

[3] In marine- and weather-resistant transport packaging (container).

[4] Transport packaging is either packaging that is directly suitable for transport or secondary packaging, which together with the product packaging, satisfies the requirements for transport.

[5] Product packaging (storage packaging) is an individual packaging for storage and does not satisfy the requirements for transport. As a consequence, product packaging is therefore not suitable for shipping.

[6] For storage in the transport packaging.

[7] For storage in the product packaging.

Note

Remove the transport protective foil and packaging material before installing the components.

7.3.2 Operating conditions

The components of the SINUMERIK 840D sl system are intended for a weatherproof, fixed location. The documented
environmental conditions apply to the climate in the immediate vicinity of the units and to the entry of the cooling air. They exceed the requirements according to EN 60204-1, EN 61800-2, EN 61131-2 and IEC 62477-1.

NOTICE

Damage to components by coolants and lubricants

The SINUMERIK operator components have been designed for industrial use, particularly on machine tools and production machines. This also takes into account the use of commercially available coolants and lubricants. The use of aggressive compounds and additives can damage components and result in their failure.

Contact between the operator components and coolants and lubricants should be avoided as far as possible, as resistance to all coolants and lubricants cannot be guaranteed.

Climatic environmental conditions	
Climate class according to EN 60721-3-3	Better than class 3K3
Temperature	0 ... 55° C (without derating)

Climatic environmental conditions	
Installation altitude	Up to 1000 m without derating From 1000 m to 4000 m with linear ambient temperature de-rating, -0.5 K per 100 m
Relative humidity	5 ... 95% (no condensation)
Oil mist, salt mist, ice formation, condensation, dripping water, spraying water, splashing water and water jets	Not permitted

Biological, chemical and mechanical influences, pollutants	
Biological environmental conditions	Class 3B1 according to EN 60 721-3-3: Mold, mold growth, slime, rodents, termites and other animal vermin are not permissible.
Chemically active environmental conditions	Class 3C1 according to EN 60721-3-3
Mechanically active environmental conditions	Class 3M1 according to EN 60721-3-3: Conductive dust not permissible.
Classification of the mechanical environment	3M3 for components on the machine 3M1/3M2 for components in the control cabinet
Vibration test in operation	According to IEC 60068-2-6 test Fc (sinusoidal) ● 10…57 Hz: 0.075 mm deflection amplitude ● 57…150 Hz: 1 g acceleration amplitude ● 10 frequency cycles per axis
Shock test in operation	According to IEC 60068-2-27 test Ea (half-sine) ● 5 g peak acceleration ● 30 ms duration ● 3 shocks in all three axes in both directions
Degree of contamination	2 (only use indoors)
EMC conducted / radiation	Class C3 according to EN 61800-3

Note

The user must consider radio interference for the complete system. Particular attention should be paid to cabling. Please contact your sales representative for assistance and support.

If compliance with limit value class C2 is required, please contact your local sales representative.

7.4 Standards and approvals

Approvals

CE approval

Figure 7-1   CE marking

The operator panels and the safety-relevant accessories satisfy the requirements and protection objectives of the following EC directives. The operator panels and the safety-relevant accessories comply with the harmonized European standards (EN), promulgated in the Official Journals of the European Community:

● 2004/108/EC "Electromagnetic Compatibility" (EMC directive)

● Directive 2006/42/EC of the European Parliament and Council of May 17, 2006, on machinery, and Directive 95/16/EC (amendment)

7.5 Recycling and disposal

Products should be disposed of corresponding to the relevant national regulations.
The products described in this manual can be mostly recycled due to the fact that they contain very few damaging substances. To recycle and dispose of your old device in an environmentally friendly way, please contact an appropriate disposal company.

Spare parts / accessories

<div style="text-align: right; font-size: 3em;">8</div>

8.1 Accessories

Table 8-1   Accessories for the TCU

Component		Description	Quantity	Article number
Mounting bracket		Mounting bracket for PCU, video link receiver or TCU behind operator panel front	1 set (2 items)	6FC5248-0AF20-2AA0
Direct key cable		Ribbon cable for connection of the direct key interfaces for OP and TCU.	1	6FC5347-0AF10-0AA0
Industrial Ethernet cable	IE FC Standard Cable GP 2 x 2 (Type A)	4-core, shielded TP installation cable for connection to IE FC Outlet RJ45/ IE FC RJ45 Plug; PROFINET-compatible; with UL approval; sold by the meter (max. 1000 m; min. 20 m);	1	6XV1840-2AH10
	IE FC Trailing Cable GP 2 x 2 (Type C)	4-core, shielded TP installation cable for connection to IE FC Outlet RJ45/ IE FC RJ45 Plug 180/90 for use in trailing cables; PROFINET-compatible; without UL approval; sold by the meter (max. 1000 m; min. 20 m);	1	6XV1840-3AH10
Plug connector	IE FC RJ45 Plug 180	RJ plug connector for Industrial Ethernet with robust metal housing and integrated cutting/clamping contacts; with 180° outgoing cable	1	6GK1901-1BB10-2AA0

Spare parts for the TCU

There are no parts of this device that can be replaced by the user.

8.2 Handling membrane connectors

When replacing parts it can sometimes be necessary to disconnect membrane connectors from the boards and reconnect them again.

This should be done as follows:
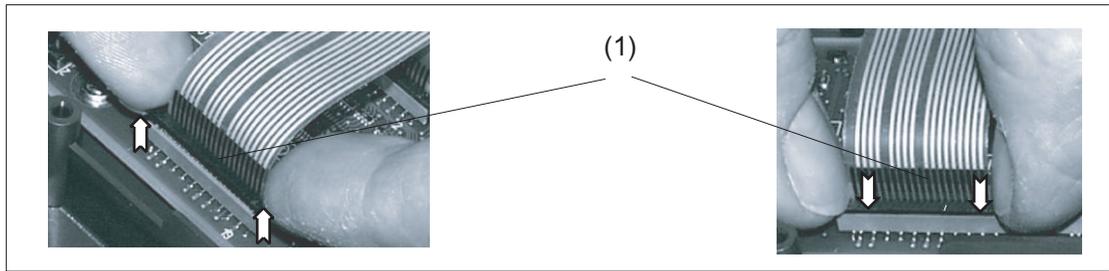
(1)   Clamping frame of socket

Figure 8-1   Removing (left) and attaching (right) a membrane connector

Unplugging the membrane connector

1. Loosen the dark clamping frame of the socket by pushing it up with your fingernails until it engages in its upper, unlocked position (Fig. left).

2. Carefully pull off the membrane connector upward.

Plugging in the membrane connector

1. With the clamping frame in the upper position, carefully plug the membrane connector into the socket.

2. Lock it in place by pushing down the clamping frame (Figure right).

Safety symbols 9

Icon	Explanation
⎓ Direct current	The equipment is only suitable for direct current. Used for marking corresponding terminals.
Protective conductor connection	For marking the connection for an external protective conductor for protecting against electrical shock in the event of an error or for a connecting terminal of the external protective conductor.
Ground	For marking the ground connection.
General warning symbol	The documentation must be consulted in any scenario where the symbol is affixed in order to find out the type of potential hazard and the actions required to avoid the risk.

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