SIEMENS

SINUMERIK

SINUMERIK 840D sl
Operator panel front: OP 012

Manual

Valid for:
Control system
SINUMERIK 840D sl/840DE sl

09/2016
A5E36371591B

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

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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.

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General information and networking 1

1.1 Fundamental safety instructions

1.1.1 General safety instructions

⚠ DANGER

Danger to life due to live parts and other energy sources

Death or serious injury can result when live parts are touched.

- Only work on electrical devices when you are qualified for this job.
- Always observe the country-specific safety rules.

Generally, six steps apply when establishing safety:

1. Prepare for shutdown and notify all those who will be affected by the procedure.
2. Disconnect the machine from the supply.
   - Switch off the machine.
   - Wait until the discharge time specified on the warning labels has elapsed.
   - Check that it really is in a no-voltage condition, from phase conductor to phase conductor and phase conductor to protective conductor.
   - Check whether the existing auxiliary supply circuits are de-energized.
   - Ensure that the motors cannot move.
3. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water.
4. Isolate or neutralize all hazardous energy sources by closing switches, grounding or short-circuiting or closing valves, for example.
5. Secure the energy sources against switching on again.
6. Ensure that the correct machine is completely interlocked.

After you have completed the work, restore the operational readiness in the inverse sequence.

⚠ WARNING

Danger to life through a hazardous voltage when connecting an unsuitable power supply

Touching live components can result in death or severe injury.

- 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

Danger to life when live parts are touched on damaged devices

Improper handling of devices can cause damage.

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

Danger to life through 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

Danger to life due to electric shock when not grounded

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

Danger to life due to fire spreading if housing is inadequate

Fire and smoke development can cause severe personal injury or material damage.

- Install devices without a protective housing in a metal control cabinet (or protect the device by another equivalent measure) in such a way that contact with fire is prevented.
- Ensure that smoke can only escape via controlled and monitored paths.

⚠ WARNING

Danger to life through unexpected movement of machines when using mobile wireless devices or mobile phones

Using mobile wireless devices or mobile phones with a transmit power > 1 W closer than approx. 2 m to the components may cause the devices to malfunction, influence the functional safety of machines therefore putting people at risk or causing material damage.

- Switch the wireless devices or mobile phones off in the immediate vicinity of the components.

⚠ WARNING

Danger to life due to fire if overheating occurs because of insufficient 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

Danger to life when safety functions are inactive

Safety functions that are inactive or that have not been adjusted accordingly can cause operational faults on machines that could lead to 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.

1.1.2 Handling electrostatic sensitive devices (ESD)

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

NOTICE

Damage through 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).

1.1.3 Industrial security

Note

Industrial security

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and/or networks. They are important components in a holistic industrial security concept. With this in mind, Siemens' products and solutions undergo continuous development. Siemens recommends strongly that you regularly check for product updates.

For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action (e.g. cell protection concept) and integrate each component into a holistic, state-of-the-art industrial security concept. Third-party products that may be in use should also be considered. For more information about industrial security, visit this address (http://www.siemens.com/industrialsecurity).

To stay informed about product updates as they occur, sign up for a product-specific newsletter. For more information, visit this address (http://support.automation.siemens.com).

⚠ WARNING

Danger as a result of unsafe operating states resulting from software manipulation

Software manipulation (e.g. by viruses, Trojan horses, malware, worms) can cause unsafe operating states to develop in your installation which can result in death, severe injuries and/or material damage.

- Keep the software up to date.
  You will find relevant information and newsletters at this address (http://support.automation.siemens.com).
- Incorporate the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation or machine.
  You will find further information at this address (http://www.siemens.com/industrialsecurity).
- Make sure that you include all installed products into the holistic industrial security concept.

⚠ WARNING

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

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

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

1.1.4 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

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

1.2 Application planning

1.2.1 Secondary electrical conditions

1.2.1.1 Power supply

Requirements for DC power supplies

⚠ DANGER

Danger of death caused by unsafe power supply

The DC power supply must be implemented as a circuit of Category PELV/DVC A according to EN 61800-5-1.

⚠ 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 1-1 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

1.2.1.2 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.

Additional references

EMC Design Guidelines

1.2.1.3 EMC compatibility

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.

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.

1.2.2 Ambient climatic and mechanical conditions

1.2.2.1 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 1-2 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]	
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	
Water other than rain	1 m/s and wet loading surfaces [4]	Not permissible [5]	1 m/s and wet loading surfaces [4]

Type of condition	Permissible range/class		
Height	Max. 4,000 m above sea level		
Condensation, splash water, icing, salt spray	Permissible	Not permissible [5]	Permissible [4]

[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] For storage in the transport packaging.

[5] For storage in the product packaging.

Note

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

Shipping backup batteries

Backup batteries must only be shipped in the original packaging. No special authorization is required to ship backup batteries. The lithium content is approximately 300 mg.

Note

The backup battery is classified as a hazardous substance, Class 9 in accordance with the relevant air-freight transportation regulations.

Storage of backup batteries

Always store backup batteries in a cool and dry place. The batteries have a maximum shelf life of 10 years.

Rules for handling backup batteries

⚠ WARNING

Incorrect handling of backup batteries can lead to a risk of ignition, explosion and combustion

The stipulations of DIN EN 60086-4, in particular regarding avoidance of mechanical or electrical tampering of any kind, must be complied with.

- Do not open a battery. Replace a faulty battery only with the same type.
- Obtain replacement batteries only from Siemens.
- Always try to return low batteries to the manufacturer or deliver these to a registered recycling company.

1.2.2.2 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.

Table 1-3 Ambient conditions for operation

Environmental conditions	Application areas	Remarks
Climatic environmental conditions		
Climate class	Better than class 3K3	According to EN 60721-3-3
Permissible ambient temperature when installed vertically	0 ... 45 °C (32 ... 113 °F), up to 2000 m (6562 ft) above sea level	Except PCU50.5; front-side for OP, MCP/MPP and CNC standard keyboards KB.
	0 ... 55 °C (32 ... 131 °F), up to 2000 m (6562 ft) above sea level	All, rear-side for OP, MCP/MPP and CNC standard keyboards KB.
	5 ... 55 °C (41 ... 131 °F), up to 2000 m (6562 ft) above sea level	For PCU50.5
	Above an altitude of 2000 m (6562 ft), the max. ambient temperature decreases by 7 °C (44.6 °F) for every 1000 m (3281 ft) increase in altitude	
Relative humidity (without condensation)	5% to 95% (60% when corrosive gases and/or dusts are present)	
Condensation, formation of ice	Not permissible	
Dripping water, spray, splash water, jet-water according to degree of protection	Not permissible	All components, except ...
	Permissible	For handheld units, front side of operator and machine control panels (MCP and MPP), front side of the keyboards KB 310 and KB 483C
Max. installation altitude	Up to 4000 m (13123 ft) above sea level	
Air pressure	620 hPa ... 1060 hPa	According to altitude range 0 m to 4000 m (0 ft to 13123 ft) above sea level

Environmental conditions	Application areas	Remarks
Biological, chemical and mechanical influences, pollutants		
Biological environmental conditions		Class 3B1 according to EN 60 721-3-3: Mold, mold growth, slime, rodents, termite and other animal vermin are not permissible.
Chemically active environmental conditions		Class 3C1 according to EN 60721-3-3
Mechanically active environmental conditions		Class 3S1 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
Degree of contamination		2
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.

1.2.2.3 Cooling

To calculate the heat dissipation, the total power loss P_{Vtotal} of all heat-generating components in a housing must be taken into account.

Total power loss $P_{Vtotal} = P_{V1} + P_{V2} + P_{V3} + ...$ [W]

Convection surface area A [m^2]:
The surface areas of the front and bottom sides are not included in the convection surface area calculation.

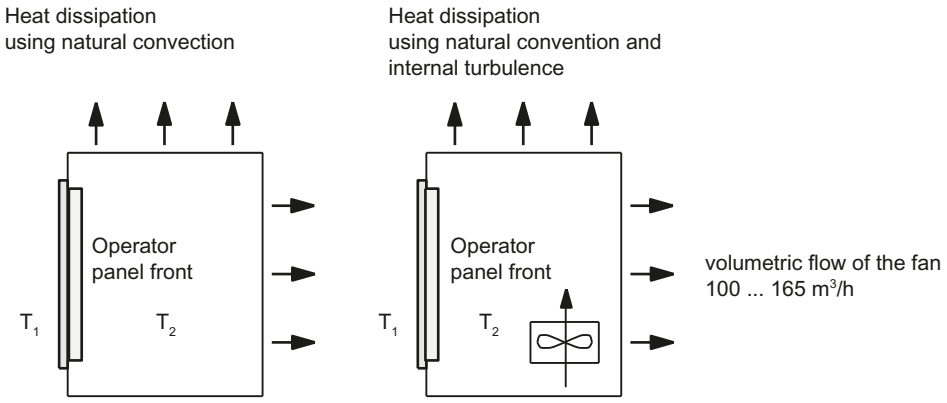
Note

A recommended value for the power loss of the operator control components is contained in the "Technical data" section of the associated component (see "Power consumption").

Means of heat dissipation

Heat dissipation can take place as follows:

- Heat dissipation by natural convection
- Heat dissipation by natural convection and internal air turbulence
- Heat dissipation by open-circuit cooling
- Heat dissipation by open-circuit ventilation



The required free convection surface A[m^2] of the
room to be converted (steel or aluminum sheeting, 1.5 mm thickness) is calculated, based on
a temperature difference $T_2 - T_1 = \Delta T \geq 10$ K, approximated from:

$$A\,[m^2] = \frac{PV_{ges}[W]}{5 * \Delta T\,[K]} \qquad A\,[m^2] = \frac{PV_{ges}[W]}{10 * \Delta T\,[K]}$$

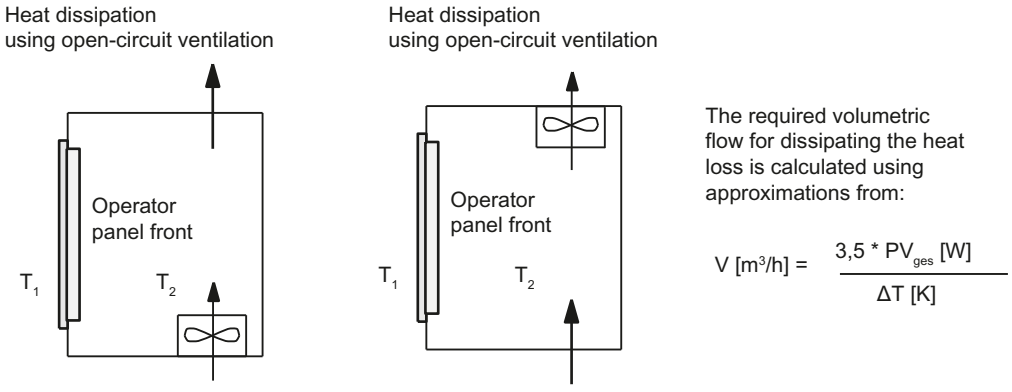


Figure 1-1 Means of heat dissipation

Fan design

- The fan must be positioned to produce an optimum heat dissipation. A clearance of 10 mm must be maintained in front of the fan.
- The inlet and outlet slots must remain free for the open-circuit ventilation.
- Air filters must be provided to maintain the permitted environmental conditions.

NOTICE
Damage to the operating components caused by temperatures that are too high or too low
Contaminated air filters impair the desired heat dissipation. For handling the air filters, pay attention to: • Proper handling • Regular replacement • Correct disposal

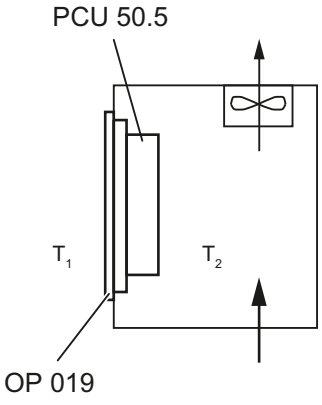
Guidelines

If the convection area A [m^2] does not suffice for the "heat dissipation using natural convection", then use:

- "Heat dissipation using natural convection and internal turbulence" for hot spots and heat concentrations in housings subject to space constraints. The total power loss P_{Ltot} for thermally critical applications can be determined as follows:
  - Current measurement for a 24 V supply voltage
  - Power loss P_{Ltot} [W] = U (24 V) * |measured value in ampères|
- Heat dissipation using open-circuit ventilation

Calculation of the volumetric flow

The power loss (thermal) dissipated by the components in an operator unit is to be dissipated using open-circuit ventilation. The volumetric flow V required for this should be calculated at a difference in temperature of $T_2 - T_1 = \Delta T \geq 10K$.



Example for heat dissipation with open-circuit ventilation:
PCU 50.5 with OP 019

Calculation of the power loss
(including internal power supply unit):

OP 019	35 W
PCU 50.5	45 W
PV_{ges} =	80 W
(max. 180 W)	

$$V = \frac{3{,}5 * PV_{ges}\,[W]}{\Delta T\,[K]} = 28\,[m^3/h]$$

External temperature $= T_1 = 45°$ C
Internal temperature $= T_2 = 55°$ C
$\Rightarrow \Delta T = 10$ K

Figure 1-2 Calculating heat dissipation for PCU 50.5 with OP 019

1.2.3 Standards and approvals

Approvals

CE approval

Figure 1-3 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)

SIBE Switzerland Certification Service

For the HT 2 and HT 8 units.

Figure 1-4 Symbol of the certifying body

HT 2

The HT 2 operator panel and the safety-relevant accessories (is identified in the "Accessories" section for the respective devices) satisfy Category 3, PL d according to EN ISO 13849-1:2008. The safety function Enabling device for special mode control and the emergency stop button satisfy the following requirements:

- Category 3, PL d according to EN ISO 13849-1:2008
- Requirements of EN 60204-1:2006, when complying with the safety instructions in the relevant chapters of this documentation

HT 8

The HT 8 operator panel and the safety-relevant accessories (is identified in the "Accessories" section for the respective devices) satisfy Category 3, PL d according to EN ISO 13849-1:2008.

The emergency stop button meets the following requirements:

- Category 3, PL d according to EN ISO 13849-1:2008
- Requirements of EN 60204-1:2006, when complying with the safety instructions in the relevant chapters of this documentation

The safety function Enabling device for special mode control satisfies the following requirements:

- Category 4, PL e according to EN ISO 13849-1:2008
- Requirements of EN 60204-1:2006, when complying with the safety instructions in the relevant chapters of this documentation

Address:

NSBIV AG, SIBE Switzerland, Brünigstrasse 18, CH-6005 Lucerne

Accreditation SCESp 0046 / Notified Body 1247

Number of the prototype test certificate: No. 1416

Risk assessment

The following standards must be used to perform the risk assessment:

- EN ISO 12100-1:2003 and EN ISO 12100-2:2003, General Design Guidelines for Machines
- EN ISO 14121-1:2007, Risk Assessment for Machinery
- EN ISO 13849-1:2008, Safety-related Parts of Machines

These considerations result in a category (B, 1, 2, 3, 4) and a performance level (PL a to e) in accordance with EN ISO 13849-1:2008 that ultimately dictate how the safety-related parts of the system to be monitored must be constructed.

The connection examples with different monitoring units in "Handheld units", Section: "HT 2", Section: "Connections" → "Connection examples for acknowledgment button and Emergency Stop button" can also be used for other operator panels and demonstrate how Category 3, PL d according to EN ISO 13849-1:2008 can be attained with the safety-related parts of the operator panels. Note that the overall concept of the installation must be designed with this in mind.

1.2.4 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.

1.3 Connecting

1.3.1 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.

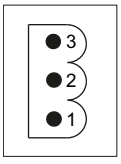
Signal type:

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

Power supply interface

Connector type:	Terminal block, 3-pin plug connector
Max. cable length:	10 m

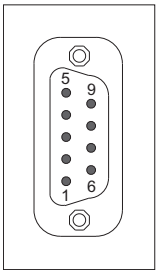
Table 1-4 Assignment of the power supply interface

	Pin	Name	Type	Meaning
	1	P24 (+)	-	24 VDC potential (20.4 to 28.8 VDC)
	2	M24 (-)	VI	Ground 24 V
	3	SHIELD (PE)		Shield potential

Serial interface COM1

9-pin sub-D connector

Table 1-5 Assignment of the serial interface COM1 (V.24/RS232)

Connector	Pin	Name	Type	Remark
	1	DCD (M5)	I	Receive signal level (carrier)
	2	RxD (D2)		Serial receive data
	3	TxD (D1)	O	Serial transmit data
	4	DTR (S1)		Data terminal ready
	5	GND (E2)	-	Ground (reference potential)
	6	DSR (M1)	I	Data Set Ready
	7	RTS (S2)	O	Request To Send
	8	CTS (M2)	I	Clear To Send
	9	RI (M3)		Incoming call

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 at maximum is permitted. It should be noted that some keyboards already have a hub.)

  NOTICE

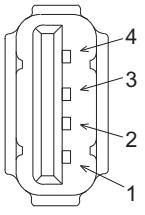
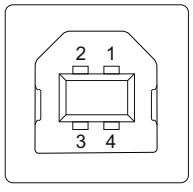
  Cables that are too long can cause the screen to freeze

  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 1-6 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:

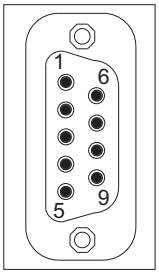
- File system: FAT16 or FAT32
- Partitioning: only in PC partition format (MBR)

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

PROFIBUS DP / MPI interface

Connector type:	9-pin sub-D socket
Max. data transmission rate:	12 Mbit/s
Max. cable length:	100 m

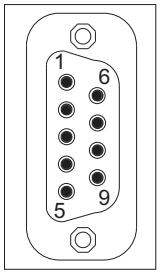
Table 1-7 Assignment of the PROFIBUS DP / MPI interface

Connector	Pin	Name	Type	Remark
	1,2	N.C.	-	Not connected
	3	LTG_B	B	Signal line B of MPI module
	4	RTS_AS	I	Control signal for receive data current. Signal 1 active if directly connected control is sending.
	5	M5EXT	V	Return line (GND) of 5 V supply. Current load from a load of 90 mA max. connected between P5EXT and M5EXT.
	6	P5EXT	V	5 V supply (current load see M5EXT)
	7	N.C.	-	Not connected
	8	LTG_A	B	Signal line A of MPI module
	9	RTS_PG	O	RTS signal of MPI module; signal is "1", when PG is sending
	Shield		-	On connector housing

PROFIBUS DP interface

Connector type:	9-pin sub-D socket
Max. data transmission rate:	12 Mbit/s
Max. cable length:	100 m

Table 1-8 Assignment of the PROFIBUS DP interface

Connector	Pin	Name	Type	Remark
	1,2	N.C.	-	Not connected
	3	RS_DP	B	RS-485 differential signal
	4	RTS_DP	O	Request To Send
	5	M5EXT	V	5 V external ground
	6	P5EXT	V	5 V external potential
	7	N.C.	-	Not connected
	8	XRS_DP	B	RS-485 differential signal
	9	N.C.	-	Not connected

Ethernet RJ45 interface

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

Table 1-9 Assignment of the Ethernet RJ45 interface 10/100 Mbit/s

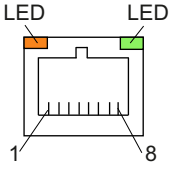
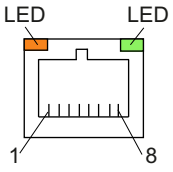
Connector	Pin	Name	Type	Remark
	1	TxD+	O	Transmit data
	2	TxD-		
	3	RxD+	I	Receive data
	4/5	GND	-	(terminated internally with 75 Ω; not required for data transmission)
	6	RD-	I	Receive data
	7/8	GND	-	(terminated internally with 75 Ω; not required for data transmission)
	Shield	-	-	On connector housing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

Table 1-10 Assignment of the Ethernet RJ45 interface 1000 Mbit/s

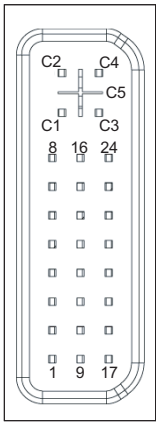
Connector	Pin	Name	Type	Remark
	1	DA+	B	Bidirectional pair A+
	2	DA-		Bidirectional pair A-
	3	DB+		Bidirectional pair B+
	4	DC+		Bidirectional pair C+
	5	DC-		Bidirectional pair C-
	6	DB-		Bidirectional pair B-
	7	DD+		Bidirectional pair D+
	8	DD-		Bidirectional pair D-
	Shield	-	-	On connector housing
	-	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!

DVI-I interface

Table 1-11 Assignment of DVI-I interface

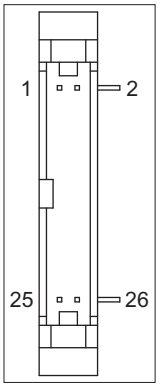
Connector	Pin	Name	Type	Remark
	S	GND	-	Ground
	S1	GND	-	Ground
	C1	R	O	Red
	C2	G		Green
	C3	B		Blue
	C4	HSYNC	O	Horizontal synchronizing pulse
	C5	GND	-	Ground
	CSA	GND	-	Ground
	1	TX2N	O	TDMS data 2-
	2	TX2P		TDMS data 2+
	3	GND	-	Ground
	4	N.C.	-	Not connected
	5	N.C.	-	Not connected
	6	DDC CLK	B	DDC clock
	7	DDC CLK		DDC data
	8	VSYNC	O	Vertical synchronizing pulse
	9	TX1N	O	TDMS data 1-
	10	TX1P		TDMS data 1+
	11	GND	-	Ground
	12	N.C.	-	Not connected
	13	N.C.	-	Not connected
	14	+ 5 V	VO	+ 5 V
	15	GND	VO	Ground
	16	MONDET	I	Hot plug detect
	17	TX0N	O	TDMS data 0-
	18	TXoP		TDMS data 0+
	19	GND	-	Ground
	20	N.C.	-	Not connected
	21	N.C.	-	Not connected
	22	GND	-	Ground
	23	TXCP	O	TDMS clock +
	24	TXCN		TDMS clock -

I/O USB interface

All signals required for connecting operator panel fronts, with the exception of the display interface, are assigned to this interface.

Associated interface cable:	K1
Connector type:	2 x 13-pin socket connector

Table 1-12 Allocation of the I/O USB interface

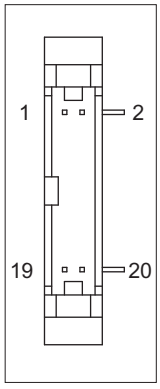
Connector	Pin	Name	Type	Meaning	
	1	GND	VO	Ground	
	2	P12C		+power supply for backlight inverter	
	3	BL_ON	O	Backlight On	
	4	P5V_fused	VO	+5 V VCC (fused in PCU/TCU)	
	5	GND	VO	Ground	
	6	P3V3_fused	VO	+3.3 V VCC (fused in PCU/TCU)	
	7 - 10	N.C.	-	Not connected	
	11	P5V_fused	VO	+5 V VCC (fused in PCU/TCU)	
	12	USB_D1M	B	USB data- Channel 1	
	13	USB_D1P		USB data+ Channel 1	
	14	GND	VO	Ground	
	15	LCD_SEL0	I	Display type select signal	1
	16	LCD_SEL1			2
	17	LCD_SEL2			3
	18	LCD_SEL3			4
	19	RESET_N		Reset signal (low active)	
	20	reserved	-	Reserved	
	21	HD_LED	O	HD LED, anode with 1 kΩ in series on the motherboard	
	22	DP_LED	O	MPI/DP LED, anode with 1 KΩ in series on the motherboard	
	23	Ethernet_LED	O	Ethernet LED, anode with 1 kΩ in series on the motherboard	
	24	TEMP_ERR	O	LED temperature sensor; anode with 1 kΩ in series on the board	
	25	RUN_R *)	O	Watchdog error LED, anode with 1 kΩ in series on the motherboard	
	26	RUN_G	O	Watchdog OK LED, anode with 1 kΩ in series on the motherboard	

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

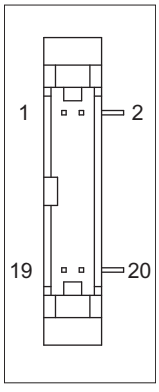
LVDS display interface channel 2

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 1-14 Allocation of the LVDS display interface

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

Rotary switch: Feed override X30

Connector designation: **X30**
Connector type: 2 x 5-pin plug connector, according to EN 60603-13 with coding
Max. cable length: 0.6 m

Table 1-15 Assignment of X30 connector (on delivery)

Pin	Name	Type	Meaning
1	N.C.	-	Not connected
2	N.C.	-	Not connected
3	M	V	Ground
4	N.C.	-	Not connected
5	P5	V	5 V supply
6	OV_VS16	I	Override rotary switch value 16
7	OV_VS8		Override rotary switch value 8
8	OV_VS4		Override rotary switch value 4
9	OV_VS2		Override rotary switch value 2
10	OV_VS1		Override rotary switch value 1

Rotary switch: Spindle override X31

Connector designation: **X31**
Connector type: 2 x 5-pin plug connector, according to EN 60603-13 with coding
Max. cable length: 0.6 m

Table 1-16 Assignment of X31 connector (on delivery)

Pin	Name	Type	Meaning
1	N.C.	-	Not connected
2	N.C.	-	Not connected
3	M	V	Ground
4	N.C.	-	Not connected
5	P5	V	5 V supply
6	OV_SP16	I	Override rotary switch value 16
7	OV_SP8		Override rotary switch value 8
8	OV_SP4		Override rotary switch value 4
9	OV_SP2		Override rotary switch value 2
10	OV_SP1		Override rotary switch value 1

Optional customer buttons IN (X51 / X52 / X55)

Only switches (passive inputs) may be connected via the X51, X52 and X55 connectors. X51 and X52 are typically used for connecting illuminated pushbuttons. The lamps in the buttons are activated via X53 and X54. X55 has no corresponding outputs.

Note

Connection miniature handheld unit

Alternatively, at the inputs X51, X52 and X55, one miniature handheld unit may be operated. For details, please refer to the corresponding section.

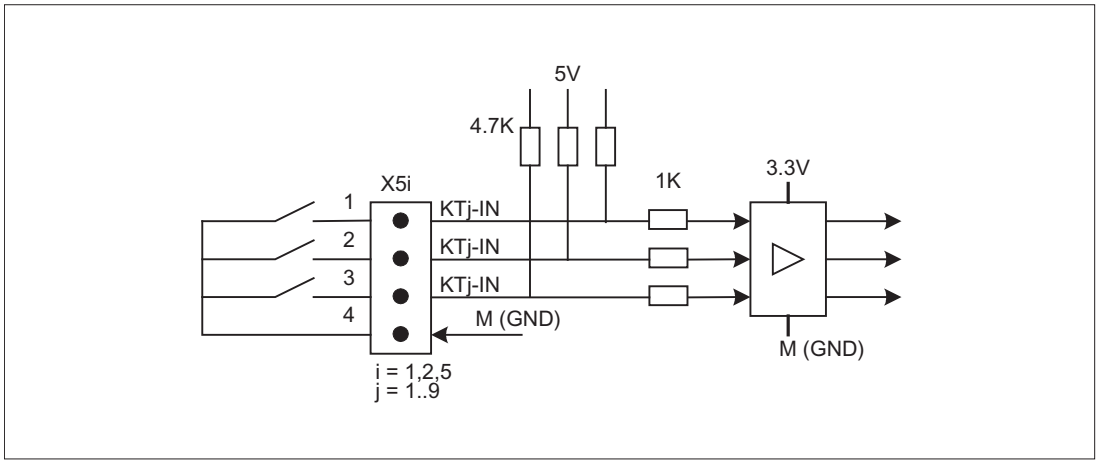


Figure 1-5 Main circuit diagram of the input circuit for X51, X52 and X55

Connector designation:	**X51 / X52 / X55**
Connector type:	4-pin plug connector
Max. cable length:	0.6 m

Table 1-17 Assignment of connector X51

Pin	Name	Type	Meaning
1	KT-IN1	I	Customer key 1
2	KT-IN2		Customer key 2
3	KT-IN3		Customer key 3
4	M	V	Ground

Table 1-18 Assignment of connector X52

Pin	Name	Type	Meaning
1	KT-IN4	I	Customer key 4
2	KT-IN5		Customer key 5
3	KT-IN6		Customer key 6
4	M	V	Ground

Table 1-19 Assignment of connector X55

Pin	Name	Type	Meaning
1	KT-IN7	I	Customer key 7
2	KT-IN8		Customer key 8
3	KT-IN9		Customer key 9
4	M	V	Ground

Optional customer buttons OUT (X53 / X54)

The short-circuit-proof outputs X53/X54 are provided to control lamps in the keys. Lamps with 24 V and 2.4 W per output are recommended.

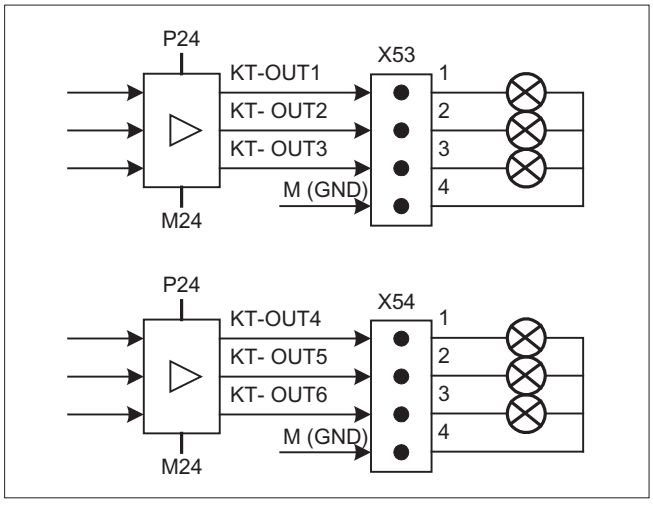


Figure 1-6 Main circuit diagram of the input circuit for X53 and X54

NOTICE
Damage to the electronics
Do not connect any relays, valves or other inductive loads.

Connector designation: **X53 / X54**
Connector type: 4-pin plug connector
Max. cable length: 0.6 m

Table 1-20 Assignment of connector X53

Pin	Name	Type	Meaning
1	KT-OUT1	O	Output 1 lamp
2	KT-OUT2		Output 2 lamp
3	KT-OUT3		Output 3 lamp
4	M	V	Ground

Table 1-21 Assignment of connector X54

Pin	Name	Type	Meaning
1	KT-OUT4	O	Output 4 lamp
2	KT-OUT5		Output 5 lamp
3	KT-OUT6		Output 6 lamp
4	M	V	Ground

Interfaces for two handwheels X60 / X 61

Interface:	Handwheel 1	Handwheel 2
Connector designation:	**X60**	**X61**
Connector type:	15-pin Sub-D socket	
Max. cable length:	25 m	

Table 1-22 Assignment of connectors X60/X61

Pin	Name	Type	Meaning
1	P5HW	V	5 V power supply
2	M	V	Ground
3	HW1_A / HW2_A	I	Handwheel pulses track A
4	HW1_XA / HW2_XA	I	Handwheel pulses track A (negated)
5	N.C.	-	Not connected
6	HW1_B / HW2_B	I	Handwheel pulses track B
7	HW1_XB / HW2_XB	I	Handwheel pulses track B (negated)
8	N.C.	-	Not connected
9	P5HW	V	5 V power supply
10	N.C.	-	Not connected
11	M	V	Ground

Pin	Name	Type	Meaning
12	N.C.	-	Not connected
13	N.C.	-	Not connected
14	N.C.	-	Not connected
15	N.C.	-	Not connected

Note

The handwheels can either be operated with TTL or differential signals.
You set the signal type using S1 (wire bridge) on the COM board.

The handwheels are supplied with 5 V ± 5% and 100 mA via the interface.

Contour and velocity specification via handwheel are not supported.

Interfaces for direct keys

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 1-7 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 1-23 Assignment of connector X11

Pin	Name	Type	Meaning
1	DT1	O	Direct key 1
...	...		...
16	DT16		Direct key 16
17	P5V	V	+ 5 V (fused)
18	P5V		+ 5 V (fused)
19	GND		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 1-24 Assignment of connector X70 (MCP, MPP, HAM) / X205 (TCU) / DTM

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

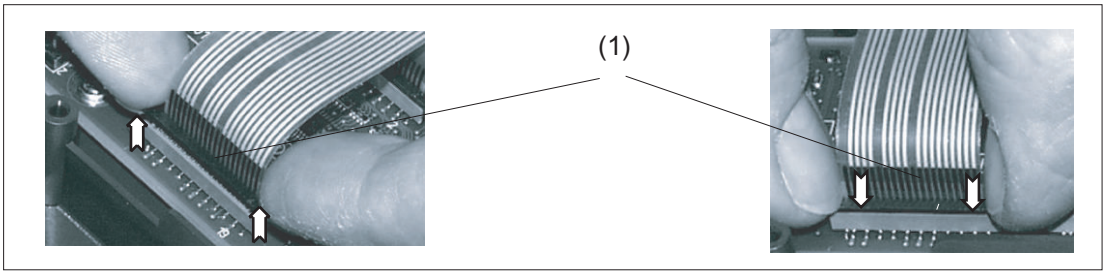
Table 1-25 Signal level

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

1.3.2 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 1-8 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).

1.4 Networking

1.4.1 System settings

1.4.1.1 Settings for SINUMERIK solution line

Range of validity

This description is valid for:

- NCU 7x0.3 PN with NCU-Basesoftware (Linux-based)
- PCU 50.5 with PCU-Basesoftware (Windows XP, Windows 7)

Introduction

This manual describes the structure and commissioning of the system network with SINUMERIK solution line control and operator components with Ethernet-based communication. The fundamentals of the system network are described first, details and special cases are described in subsequent chapters.

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 executed via the X120 Ethernet socket, for PCU it is executed 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 deviation 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 a good idea 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 length of 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.

1.4.1.2 System boot with system network

System behavior at boot

As of NCU system software V2.4 SP1 and PCU-Basesoftware V8.1, 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 all NCUs and PCUs will always receive the same IP address at each system boot.
  - If in the user's view there is a requirement that all NCUs, and possibly also the PCUs, get a defined constant IP address at each boot, for example because the IP address is entered in the respective PLC program, then 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.
- The IP addresses of TCUs and MCPs are freely assigned within the specified address band at each boot. The MCPs are identified in the PLC via 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.

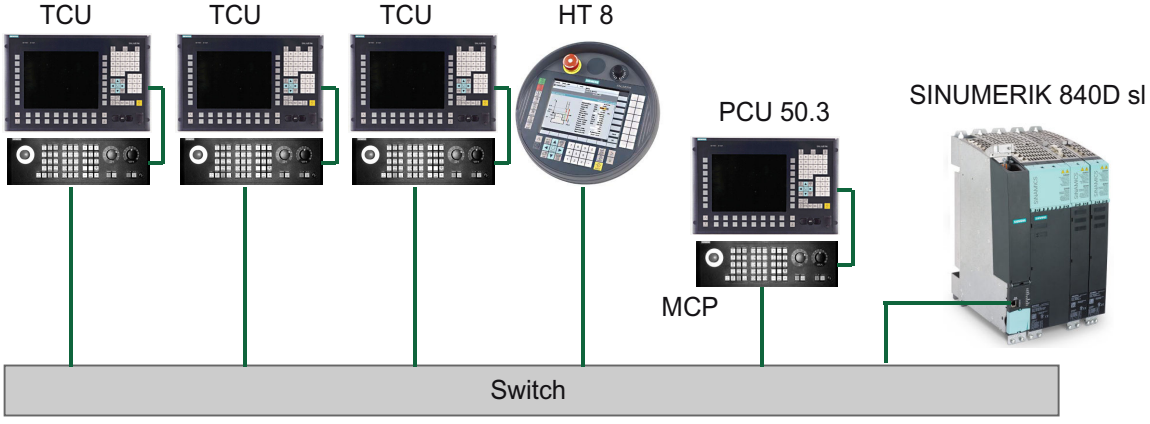
1.4.1.3 Thin Client Unit (TCU)

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 one another via a 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.

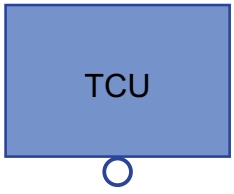
1.4.1.4 Factory default settings

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.

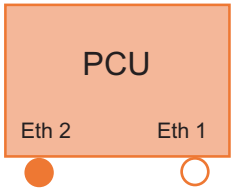


A TCU is a SINUMERIK DHCP client.
The TCU has a single Ethernet connection.

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:



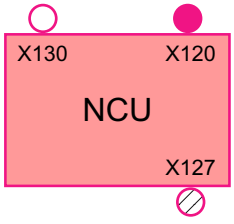
Eth 1 is pre-selected as a default DHCP client for connection to a company network.

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

1.4.2 Commissioning TCU

1.4.2.1 Using the TCU's main menu

Key assignment

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

Softkey	Key on OP	External keyboard	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

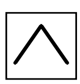
Softkey	Key on OP	External key-board	Description
---		Pos1	Moves the cursor to the top row
---	END	End	Moves the cursor to the bottom row

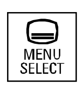
Exceptions to the above are mainly the result of input fields. Where these are present, the left/right cursor keys move the input cursor rather than performing an OK/cancel function. The Return key takes you to the next field (like the "down" key) rather than closing the entire dialog with OK. There 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 on the panel) can be used to switch between Yes/No fields.

Touch panels without any additional keys still have a special function which allows you to edit letters and numbers with HSK5/HSK6 by moving characters forwards or backwards. With a touch screen, you can activate all the softkeys and even select rows in a menu simply by touching them.

See also: How to calibrate a touch panel (Page 59)

"Main menu"





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

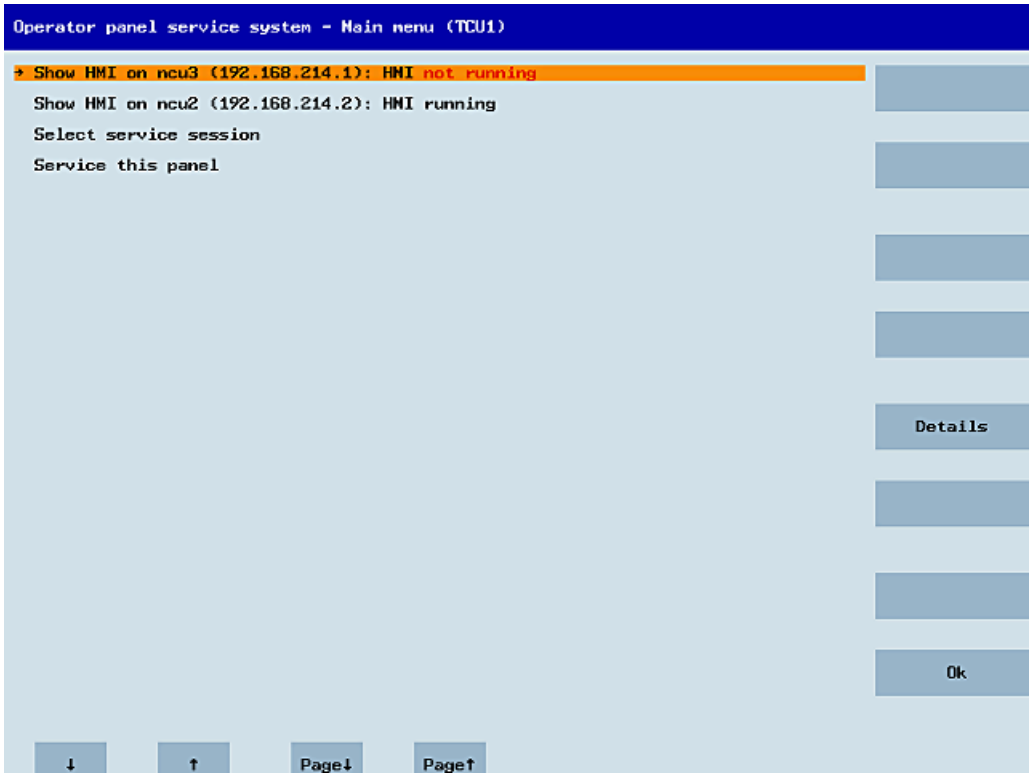


Figure 1-9 TCU menu: Main menu

The main menu contains:

- A "Main menu" title followed by the TCU name in brackets
- A central area listing the servers from config.ini. This is followed by two more fixed items, "Select service session" and "Service this panel".
  - The penultimate menu item, "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.
  - The last menu item on the main menu, "Service this panel", opens the "Service menu for operator panel" submenu.
- The right-hand side of the menu has a column containing 8 softkeys for use on a context-specific basis.
- The lower section of the menu has a row of 4 softkeys for navigating with the cursor.
- There is an error line for displaying error messages directly above the row of softkeys. Transient status messages also occasionally appear in this line.
- There is a further message line above this error line. The contents of this line can be set from the servers using HWS commands.

"Details" softkey

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

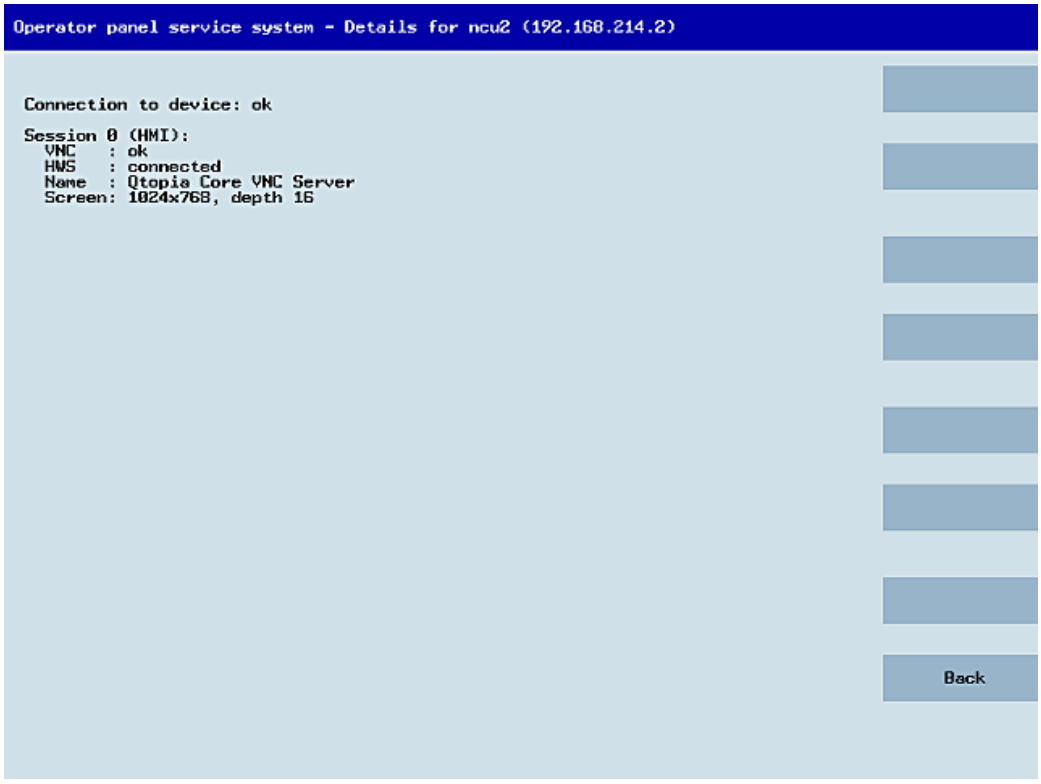


Figure 1-10 TCU menu: Connection data

1.4.2.2 Using additional TCU menus

"Service sessions" dialog

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

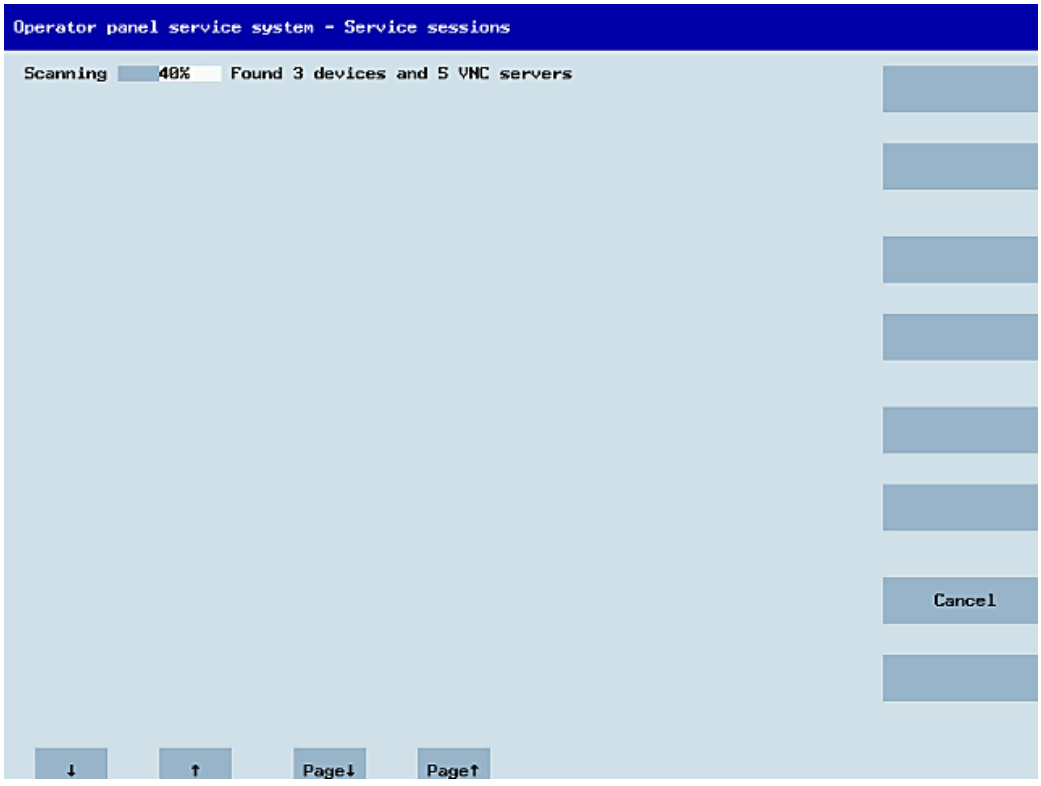


Figure 1-11 TCU menu: Scanning

After this, the following dialog appears:

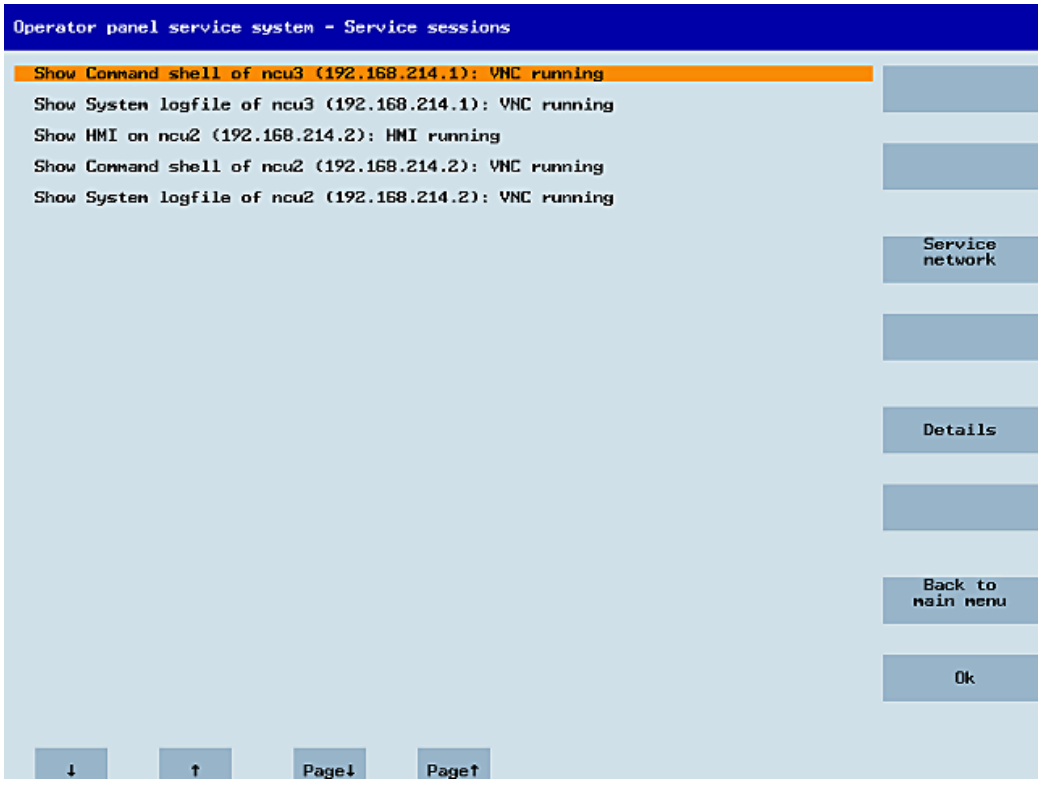


Figure 1-12 TCU menu: Active sessions

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.).

"Service menu for operator panel (TCU)" dialog

The following dialog appears when "Service this panel" is selected from the main menu:

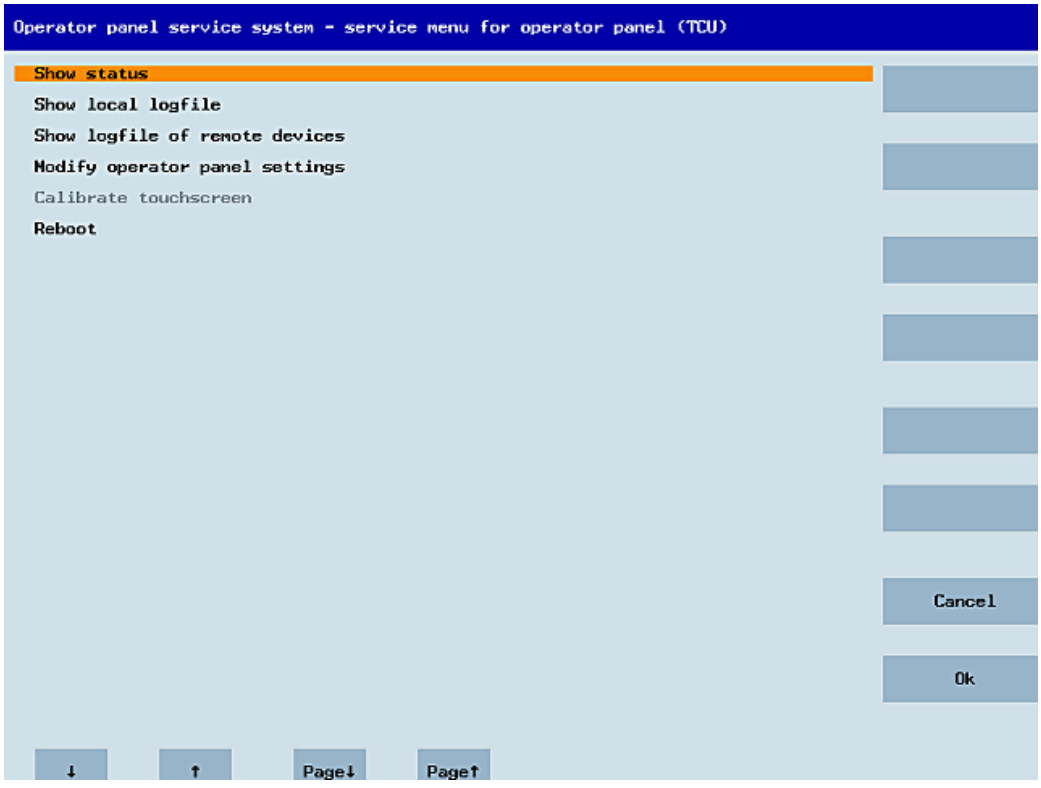


Figure 1-13 TCU menu: Service menu

The following menu items are available here:

- "Show status" displays status information including the software version, HW information, TCU network data, and the contents of the config.ini.

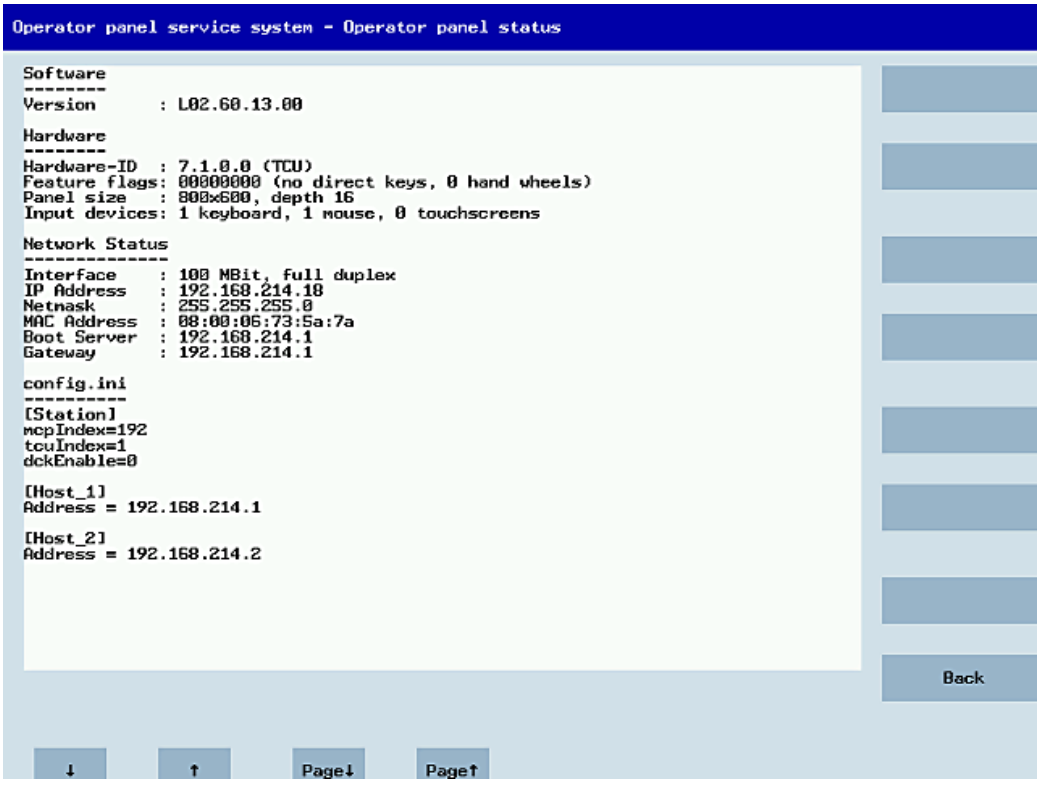


Figure 1-14 TCU menu: OP status

- "Show local logfile" displays a filtered version of the system logfile in the `/var/log/messages` directory containing local TCU messages only.
  Syslog messages received via the network are not displayed.

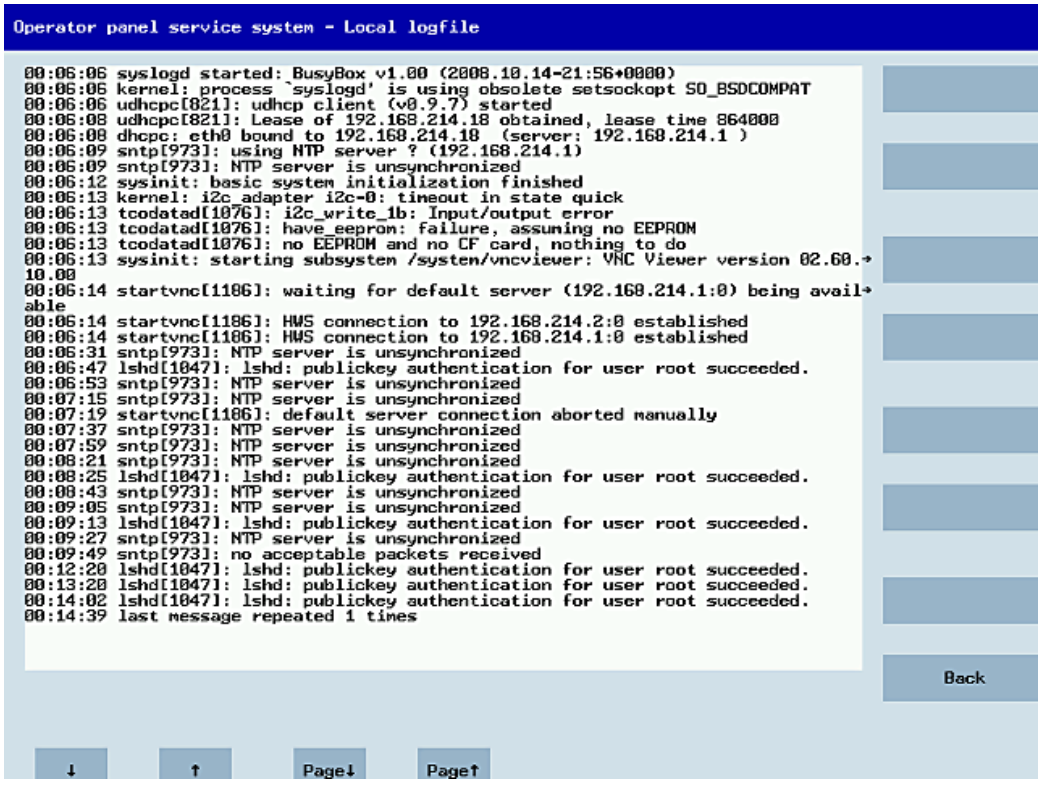


Figure 1-15 TCU menu: Local logfile

- "Show logfile of remote devices" displays the logfile 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" calls a further submenu. Please refer to the next section.
- "Calibrate touch screen" is only active if there is a touch screen. This menu item recalibrates the touch screen.
- "Reboot" restarts the TCU.

Note

Where the contents of a line exceed the space available, the remaining text runs onto the next line so that you do not have to waste time scrolling across. When this occurs, the line has a right-facing arrow at its right edge.

"Modify settings for operator panel (TCU)" dialog

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

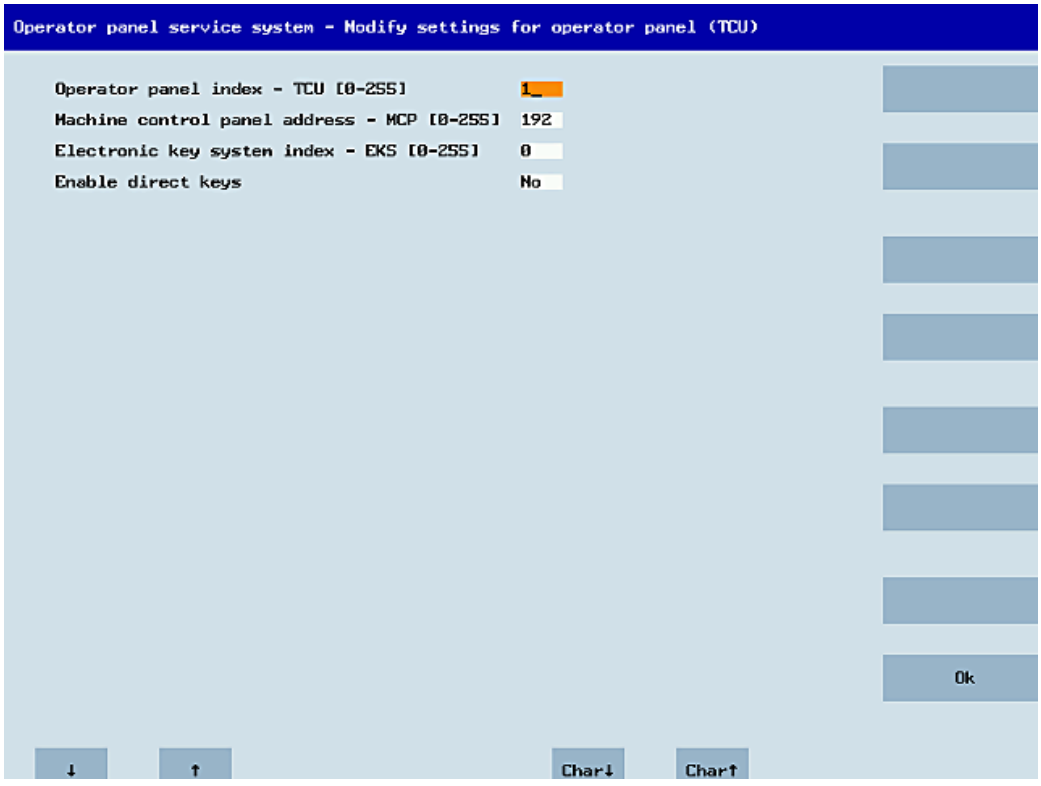


Figure 1-16 TCU menu: Settings

The central area is for setting the TCU parameters:

- "HT 8 individual mode" (yes/no)
  This is only visible with HT 8, and is used to switch between Auto Mode and Individual Mode.
  There is no need to make any settings if an HT 8 is in Auto Mode, as the name is determined automatically: ("DIP<n>") the MCP address and TCU index are determined by the DIP setting ("DIP<n>").
  It is possible, however, that another device is registered for the name selected. Such situations may only prove to be temporary, as is the case when DIP settings or two HT 8 have been confused. For this reason, this status is not reported as an error immediately, but identified as a possible problem instead ("potential name/DIP setting collision"). The text will only read ("Name/DIP settings collision") if the situation remains unchanged after some time has elapsed.
  The process itself is unaffected, as the changes only relate to how the warning or error is displayed. The explanatory text informs the user that they have probably assigned the same DIP number twice and suggests they change one of them before rebooting the HT 8.
- "Operator panel index - TCU" (0-255)"
  This specifies the TCU index. It matches the [Station] tcuIndex setting from the config.ini file.

- "Machine control panel address - MCP" (0-255)
  This specifies the address of the associated MCP. It matches the [Station] mcpIndex setting from config.ini.
- "Electronic key system index - EKS" (0-255)"
  This specifies the index of the associated EKS. It matches the [Station] eksIndex setting from config.ini.
- "Enable direct keys" (yes/no)
  This specifies whether direct keys (if present) should communicate with the PLC (yes) or be treated as ordinary keys (no).

"OK" saves any modified values to the config.ini file or to the Flashstore (HT 8 individual mode).

Parameters for the "config.ini" file

Two steps need to be performed:

1. Select "New" or "Replacement for existing panel".
2. Select what is to be replaced.

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 will appear. The accessibility of all the registered TCUs is tested in the background.

The status of this test process appears in the message line: "(0/3 panels inactive)".

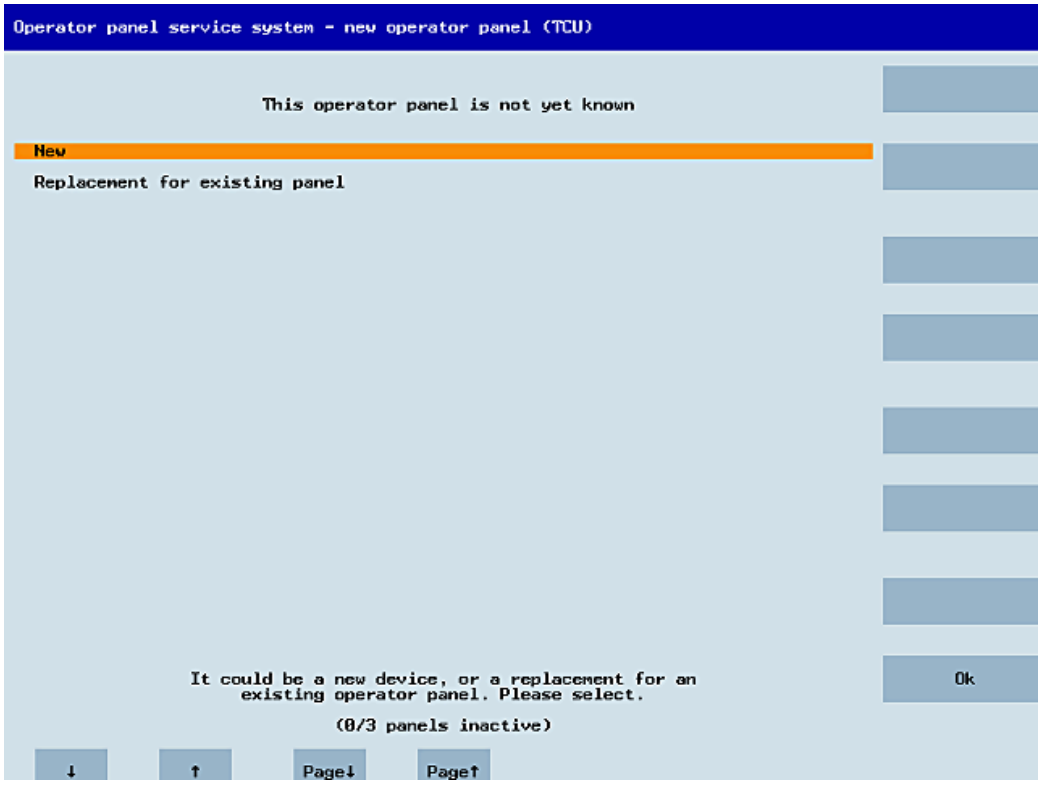


Figure 1-17 TCU menu: New TCU

If all the TCUs are active, the new one cannot be a replacement. The system will then automatically switch to the name assignment phase after a set period of time has elapsed.

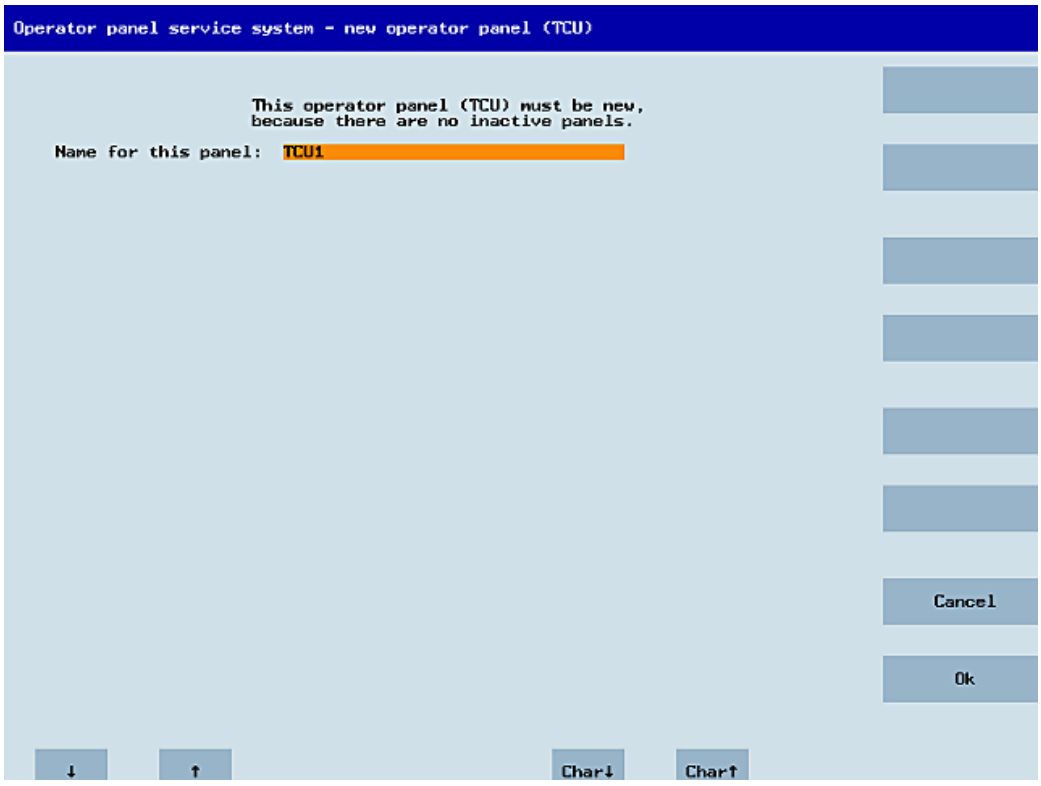


Figure 1-18 TCU menu: Name of TCU

Replacing a device

If "Replacement" is selected, all the registered TCUs will appear in a selection menu. Those which are active in the network will be 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.

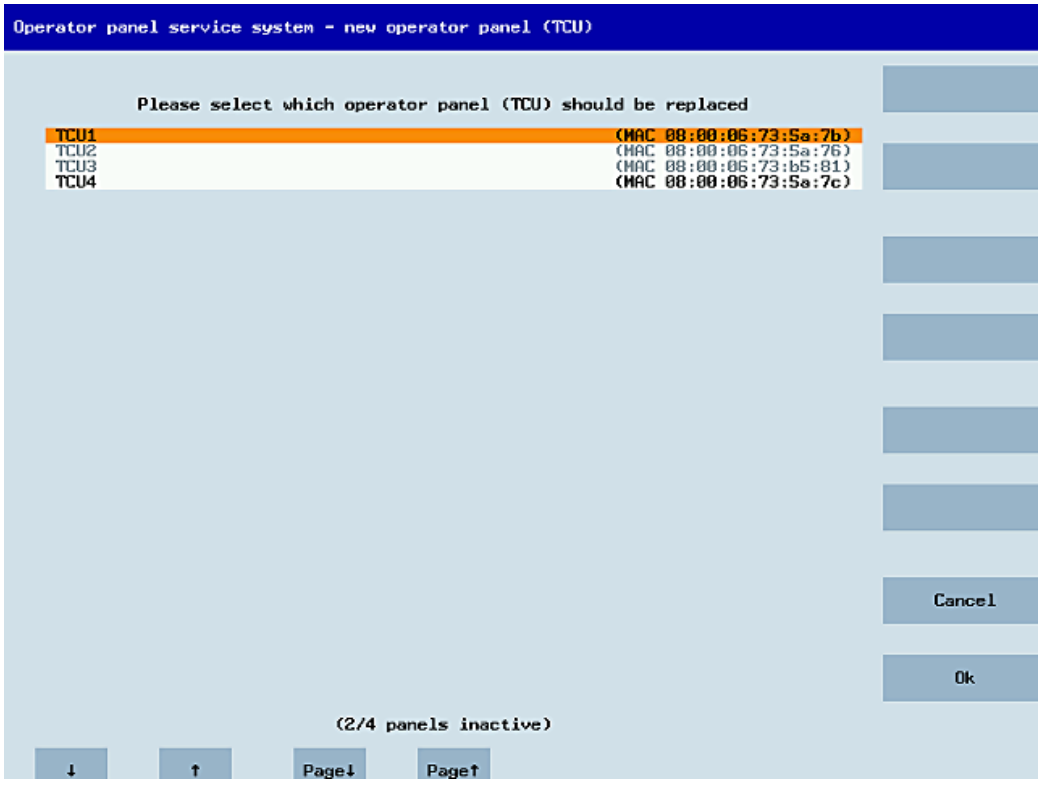


Figure 1-19 TCU menu: Spare TCU

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.

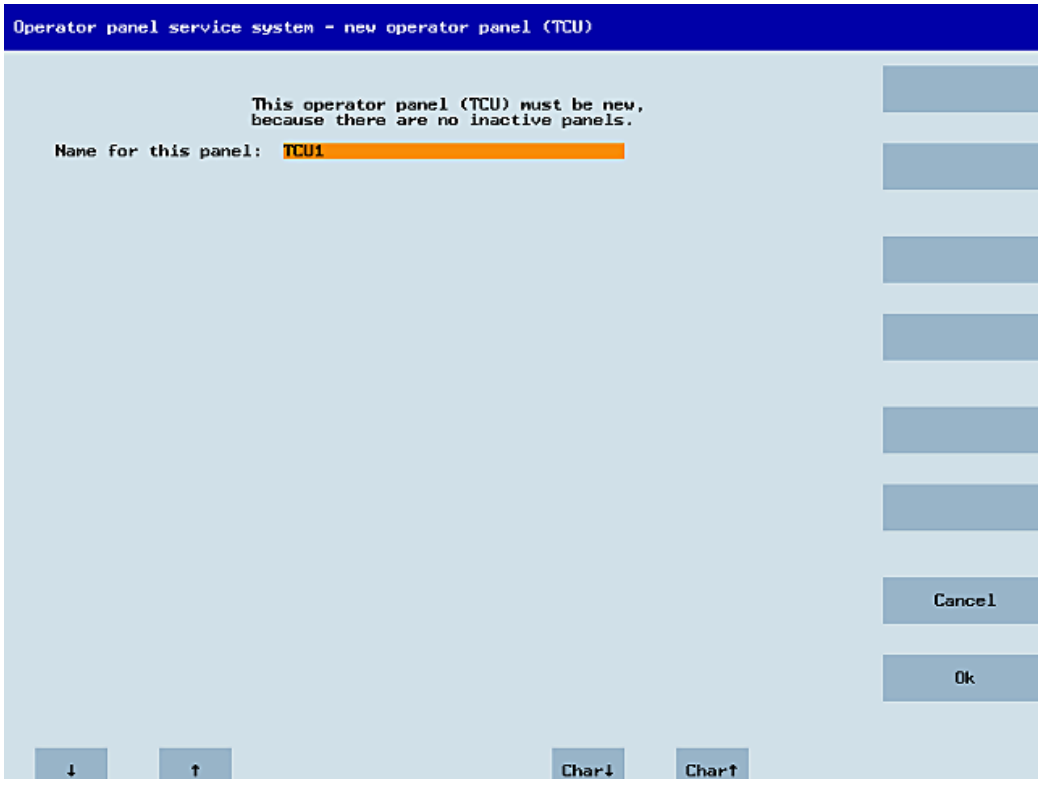


Figure 1-20 TCU menu: Name of TCU

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 will appear 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.

1.4.2.3 How to register a TCU on the system network

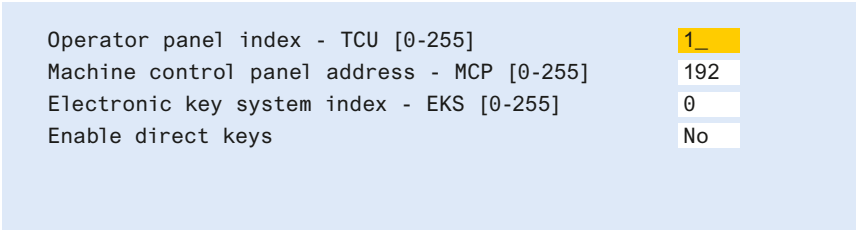
Preconditions

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 dialog "New operator panel (TCU)".
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 pre-selected for the TCU:

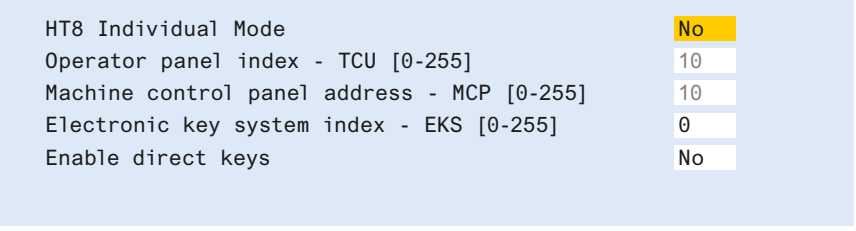


4. Restart the TCU to apply the new settings.
5. If you want to change the parameters, select "Main menu" → "Service this panel" → "Modify operator panel settings".

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:



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: Function manual basic functions, basic PLC program (P3 sl)

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.

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.

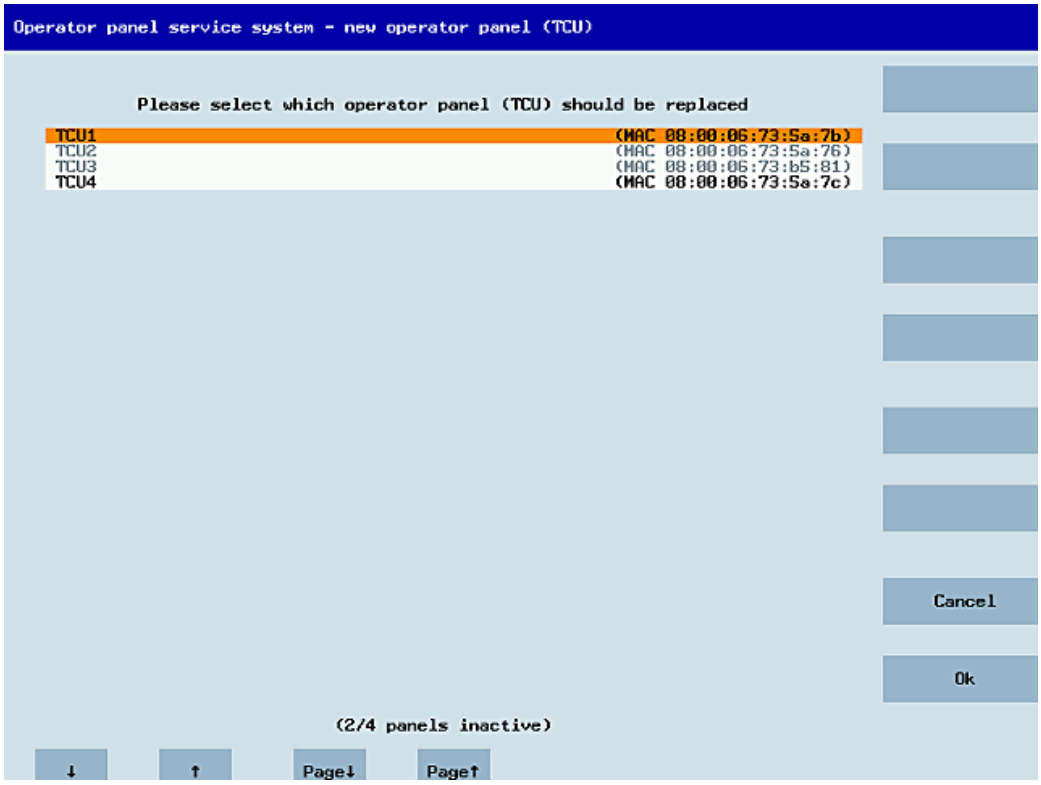


Figure 1-21 TCU menu: New operator panel (TCU)

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.

See also

How to calibrate a touch panel (Page 59)

1.4.2.4 How to calibrate a touch panel

NOTICE
Service life of the touch screen Do not touch the operating elements of the display with pointed or hard objects. This may considerably reduce their service lives. With each HT 8-device, a Touchpen (order no. 6FC5348-0AA08-4AA0) is delivered. This should be used for calibration purposes and during operation.

Calibrate touch screen

The calibration is automatically started after switching on HT 8.

1. Follow the instructions on the screen:
2. Press the three calibration items one after the other.
   This completes the calibration.
3. Press the corresponding horizontal softkey on the touch screen to close the command shell and to re-establish the connection to the desired PCU.

Recalibrate touch screen

Procedure:

1. The key combination below can be used to initiate further TCU calibration during operation, if required: <F9> + <F10>.
   This corresponds to the key combination on an OP: Menu back key + <MENU SELECT>.
2. Select the menu item "Calibrate touch screen" to start calibration.

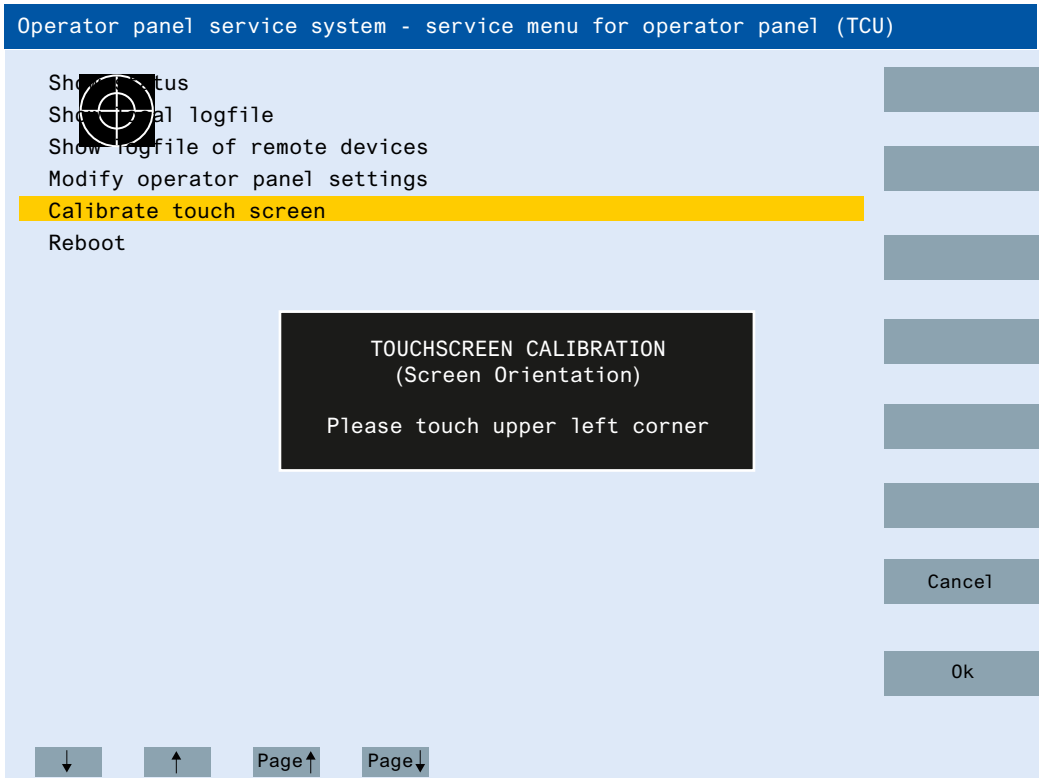


Figure 1-22 HT8 calibrating points

Note

The "Touchware" program, which is available with Windows XP, is deactivated on the TCU.

The calibration process on the HT 8 can alternatively be started with the following key combination: <Recall> + <MENU SELECT> and then the <U> key.

1.4.2.5 Connecting-up the SIMATIC Thin Client Touch Panel

Registration in the system network

The SIMATIC Thin Client Touch Panel behaves just like a TCU when connecting-up. When registering in "Operator Panel Service System" enter a name in the system network. After this, the device is available in the "Service Network Center" with the hardware ID "SIMATIC TC":

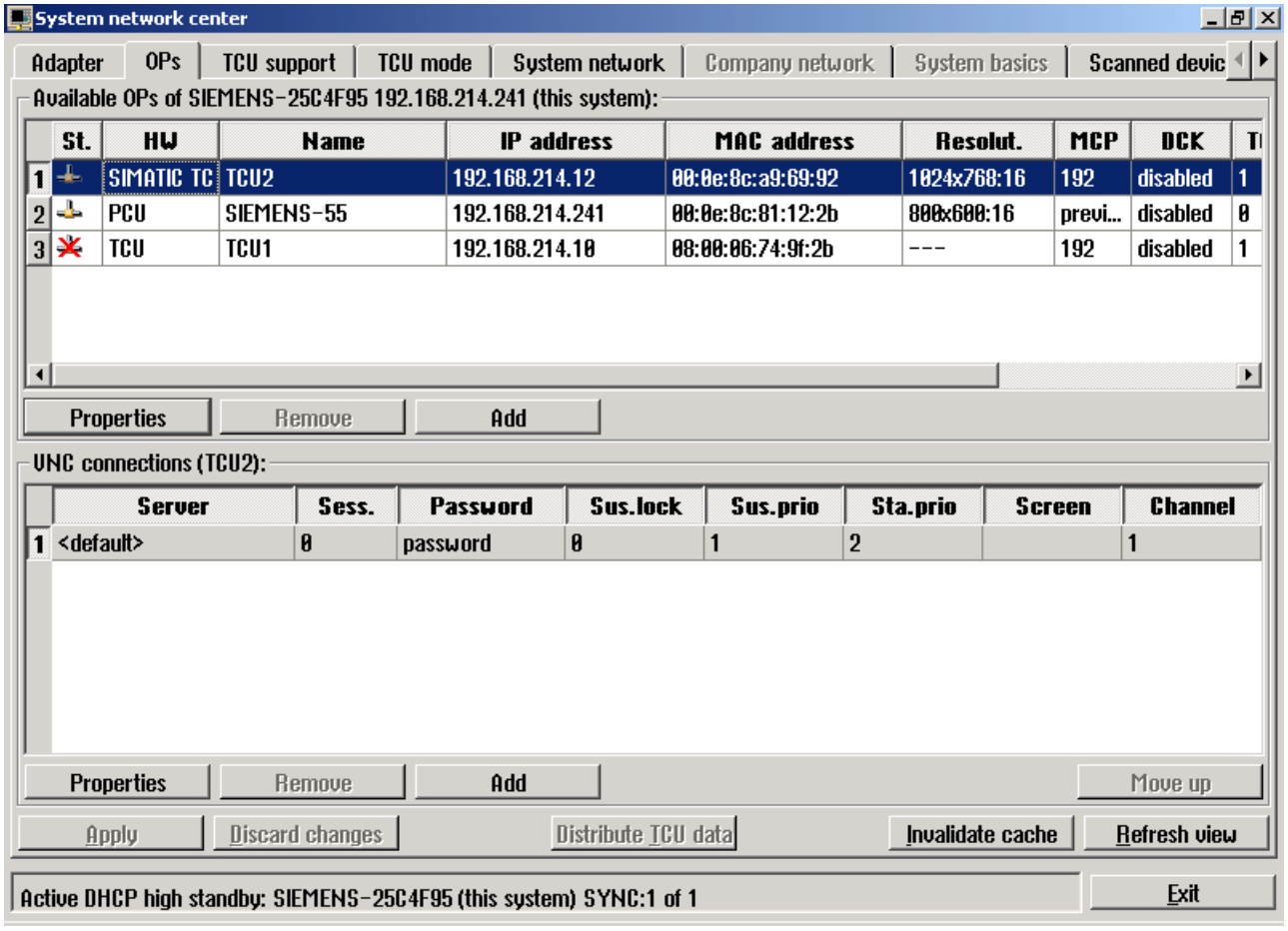


Figure 1-23 SIMATIC Thin Client

Note

The SIMATIC Thin Client Touch Panel has a USB connection at the rear, which behaves just like the USB connection X204 of a TCU.

An external keyboard is recommended for commissioning and to operate the "Operator Panel Service System".

Operating the Touch Panel

To operate the Touch Panel, use the integrated keyboard:

Figure 1-24 Virtual Keyboard

The integrated keyboard is activated using the button to the far right on the start bar.

See also

How to register a TCU on the system network (Page 55)

Using the TCU's main menu (Page 42)

Reference

SIMATIC HMI, Operating instructions: Thin Client, Thin Client PRO

1.4.2.6 This is how you configure the SIMATIC Thin Client Touch Panel

Operating the start bar

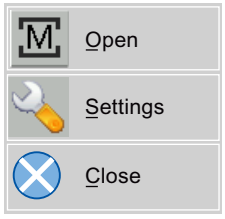
The following functions are available in the start bar of the SIMATIC Thin Client:

To select the SINUMERIK mode, press the button:

- The following buttons are important for operation as SINUMERIK operator panel:

  To configure the SIMATIC Thin Client, press the button "Settings". You therefore open the "Operator panel service system":

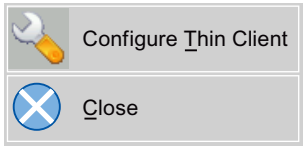
  

  To exit the SINUMERIK mode, press the button "Close".

- To make the configuration settings, press the button:

  Select "Configure Thin Client":

  To exit the SIMATIC configuration menu, press the button "Close".

- Press the button to activate the integrated keyboard:

Preconditions

To make the following settings, you must be logged on as administrator.

1. Press the "Settings" button:

2. Log on as a administrator using the specified password.

Result: As administrator you can see the complete menu of the SIMATIC Thin Client.

Note

All changes only become effective after pressing the "Enter" button on the "Virtual Keyboard" on the relevant side.

SINUMERIK mode when restarting

In order to return to the SINUMERIK mode automatically after a restart, proceed as follows:

1. In the "Applications" menu, select the "Autostart client application" tab.
2. Select the "SINUMERIK" option.

Calibrate Touch Panel

To calibrate the Touch Panel, proceed as follows:

1. In the "Device setup" menu, select the "Touch calibration" tab.
2. Follow the instructions and touch the Touch Screen at the appropriate points to calibrate.

1.4.2.7 Settings in the "config.ini" file

Boot server

The active boot server (DHCP server) is detected and displayed in the System Network Center (SNC). The boot server accesses this configuration file accordingly. Changes to the config.ini file do not become effective until the relevant TCU or PCU is next booted.

Note

If too much time (> 15 min.) elapses between commands when the user is making entries (e.g. TCU name) as part of the initial TCU log-on process, the time-out error will be suppressed. No error message will appear and the FTP connection will be reopened.

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

NCU: `/user/common/tcu/<TCU name>/common/tcu/`
PCU (Windows XP): `F:\user_base\common\tcu\<TCU name>\common\tcu\`
PCU (Windows 7): `C:\ProgramData\Siemens\MotionControl\user\common\tcu\<TCU name>\common\tcu\`

Configuration of the config.ini file

The config.ini file has the following configuration:

Parameter	Range of values	Default setting	Meaning
`[Station]`			
`tcuIndex = Number`	0 ... 255	DIP | 1	for TCU
`mcpIndex = Number`	1 ... 254	DIP | 192	for MCP via Industrial Ethernet
`eksIndex = Number`	0 ... 255	DIP | 0	for EKS
`dckEnable = 0`	0 or 1	0	for DCK
`MaxHostIndex = Number`		Number of nodes (NCU, PCU or PC) to which you can switch over.	
`[DEFAULT]`			

Parameter	Range of values	Default setting	Meaning
SessionNumber = Number			
Password = String			
SuspendLock = Number	0 or 1	0	0: No displacement disable 1: Displacement disable set
SuspendPriority = Number	1 ... 10	1	1: Lowest priority 10: Highest priority
StartupPrio = Number			Boot sequence: The lower the number the higher the priority
ScreenOnFocus = String | Number		Not relevant	
ChannelOnFocus = Number		Not relevant	
[host_1]			
Address = [hostname | IP-Adresse]			From data file structure
SessionNumber = NUMBER			
Password = STRING			
SuspendLock = NUMBER	0 or 1	0	0: No displacement disable 1: Displacement disable set
SuspendPriority = NUMBER	1 ... 10	1	1: Lowest priority 10: Highest priority
StartupActive = 0	0 or 1		Display screen after boot
StartupPrio = NUMBER	0 ... not too high		Boot sequence: The lower the number the higher the priority
ScreenOnFocus = STRING | NUMBER		Not relevant	
ChannelOnFocus = NUMBER		Not relevant	
[host_2] ...			
[host_MaxHostIndex]			
[T2M2N]			
SK1 = ch_grp x	2 x 8 characters	Empty	Softkey inscription (2 lines)
SK2 = ch_grp x	2 x 8 characters	Empty	Softkey inscription (2 lines)
SK3 = ch_grp y	2 x 8 characters	Empty	Softkey inscription (2 lines)
...			
SK32 = ch_grp z	2 x 8 characters	Empty	Softkey inscription (2 lines)
...			

Note

Connecting an MCP via PROFIBUS

If an MCP is connected via PROFIBUS, then the MCP Index = 0 should be set.

Compatibility of software versions

If a "config" file is available for the TCU, the data file structures of older versions are transferred to the config.ini file and the data file structure is then deleted.

Comment

In the config.ini file comment lines are indicated by the # character preceding a line.

1.4.2.8 Settings in the "TCU.ini" file

Directories

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

NCU:	`/siemens/system/etc/tcu.ini`
	`/user/system/etc/tcu.ini`
	`/oem/system/etc/tcu.ini`
PCU (Windows XP):	`F:\addon_base\system\etc\tcu.ini`
	`F:\user_base\system\etc\tcu.ini`
	`F:\oem_base\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

Only the following entries are evaluated by SINUMERIK Operate:

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

Structure and content

In the tcu.ini file comment lines are indicated by the # character preceding a line.

[VNCServer]

```
# VETO MODE
# VetoMode enabled:
# VNC server notifies the HMI regie before another
# panel gets the focus.
# VetoMode disabled:
# Focus timeout mode enabled (implicitly; see FOCUS TIMEOUT)
# (0=DISABLE, 1=ENABLE)
VetoMode=1

# FOCUS TIMEOUT
# Guaranteed time period (in sec) a panel can hold the
# focus at least before another panel can get the focus.
# The time period starts from the moment the panel has
# gained the focus.
FocusTimeout=10

# ALARMBOX TIMEOUT
# The time period (in sec) a messagebox is shown (i.e. is
# operable) in the case of VetoMode=1; no meaning else
AlarmBoxTimeOut=5

# RESOLUTION
0 = SYSTEM
1 = AUTO_OP_1 (default)
2 = AUTO_OP_2
3 = AUTO_MON_1
4 = AUTO_MON_2
5 = 640X480
6 = 800X600
7 = 1024X768
8 = 1280X1024

# RESOLUTION ADAPTION
# AdaptResolution enabled:
```

```
# At system runtime, the system resolution is automatically
# adapted to the resolution of that panel which
# currently owns the focus.
# AdaptResolution disabled:
# The system resolution is set at system startup phase.
# At system runtime, system resolution remains unchanged
# whichever resolution the currently focused panel owns.
# (0=DISABLE, 1=ENABLE)
AdaptResolution=1

# COLOR DEPTH
# The value the system color depth is set at system
# startup phase
# ColorDepth SYSTEM:
# System color depth remains unchanged whichever value
# the color depth is currently set to.
# COlorDepth 16_BIT
# System color depth is set to 16 bit.
# COlorDepth 32_BIT
# System color depth is set to 32 bit.
# (0=SYSTEM, 1=16_BIT, 2=32_BIT)
ColorDepth=1

# INIT TIMEOUT
# Guaranteed time period (in sec) the HMI manager waits
# for VNC server initialization.
InitTimeout=300

# PCU STARTUP TIMEOUT
# Attention: The parameter is only provided for a PCU
# configuration with local attached OP !
#
# The startup phase is completed if this timeout period
# has passed and no registration of a TCU has been car-
# ried out at this time.
```

```
PCUStartupTimeout = 90

# TCU STARTUP STEP TIME
# The startup phase starts at the first TCU registration.
# The startup phase is completed if the TCUStartupStepTime
# period has passed and no registration of another TCU has
# been carried out at this time.
TCUStartupStepTime = 30
```

[VNCViewer]

```
# EXTERNAL VIEWER MAX CONNECTIONS
# Maximum number of external Viewer Connections (1 or 2)
# ExternalViewerMaxConnections=2
ExternalViewerMaxConnections=1

# EXTERNAL VIEWER SECURITY POLICY
# The user rights, assigned to an external VNCViewer
# ExternalViewerSecurityPolicy=0 : no external viewers allowed
# ExternalViewerSecurityPolicy=1 : Guest Mode (View-Only)
# ExternalViewerSecurityPolicy=2 : Administrator Mode
# ExternalViewerSecurityPolicy=1

# EXTERNAL VIEWER MAX REFUSED REQUEST
# Number of refused external viewer requests, after which
# a timeout period is carried out for the viewer.
ExternalViewerMaxRefusedRequest=3

# EXTERNAL VIEWER CONNECTION TIMEOUT
# Timeout Period in seconds, after MaxRefusedRequest
# is reached. No viewer request is possible during the
# Timeout Period.
ExternalViewerConnectionTimeout=240

# EXTERNAL VIEWER REQUEST TIMEOUT
# The time period (in sec) the request-messagebox is shown (i.e. is
```

```
# operable)
ExternalViewerRequestTimeout=20

# EXTERNAL VIEWER REQUEST TIMEOUTMODE
# The behaviour if request-timeout elapsed
# ExternalViewerReqTimeoutMode=0 : dismiss request
# ExternalViewerReqTimeoutMode=1 : accept request
ExternalViewerReqTimeoutMode=1

# REMOTE ACCESS IP-ADDRESS
# IP-V4-format
X127RemoteAccessIP=192.168.215.29

# MODEM IP-ADDRESS
# IP-V4-format
X127ModemIP=192.168.215.30

# SERVICE HOST
# NCU with teleservice adapter on its X127 interface
# Use "Self" for your own X127 interface
# IP-V4-format or DNS-Name or Self
X127ServiceHost=Self
```

[PingService]

```
# PING SERVICE MODE
# (0=DISABLE, 1=ENABLE)
PingServiceMode=0

# PING SERVER IP-ADDRESS
# IP-V4-format
PingServerIP=

# PING SENDING DATA
PingTransmissionData=
```

```
# PING SERVER PORT-NUMBER
PingServerPort=

# PING TRANSMISSION PERIOD
# Period in minutes, in which transmission data will be sent
PingTransmissionPeriod=2

# PING TRANSMISSION INTERVAL
# Time interval in seconds between two pings
PingTransmissionInterval=5
```

[externalTcu]

```
# EXTERNAL TCU IP-ADDRESSES
# List of accepted TCUs in IP-V4-format (index 1 to maximal 16)
ExternalTcuIP_1=
```

[TCU_HWSService]

```
# TCU CONNECT TIMEOUT
# Guaranteed time period (in sec) the HMI manager waits
# for TCUs recognized as connected TCUs by the TCU_HWS
# service.
TCUConnectTimeout=30

# TCU CONNECT TIMEOUT FOR HEADLESS STARTUP
# Guaranteed time period (in sec) the HMI manager waits
# for TCUs recognized as connected TCUs by the TCU_HWS
# service, if a PCU panel doesn't exist and no TCUs are
# connected till now. This time period is effective ad-
# ditionally to the time period TCUConnectTimeout.
HeadlessTCUConnectTimeout=60
```

Prerequisite

Note

The "Operation without SINUMERIK OP" option is required when using more than 1 external VNC Viewer.

Operator control without SINUMERIK OP

If the "Operation without SINUMERIK OP" option is set, then a list of viewers that can be assigned in tcu.ini is handled by the system just like internal viewers (=TCU); this means that these viewers have full user authorization and participate in the user rights management. Towards the outside, they behave just the same as the viewer on the SINUMERIK operator panels.

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=
```

The desired screen resolution can also be set in the file tcu.ini:

```
[VNCServer]
Resolution = ...
```

1.4.2.9 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.

Configuration

There are two new entries in the config.ini file for a TCU for the displacement mechanism:

- **SUSPENDLOCK:** controls whether the TCU can be displaced via the displacement mechanism.
  SUSPENDLOCK = 0 means that a displacement disable is not set (preset), i.e. the TCU may be displaced by any other TCU.
  SUSPENDLOCK=1 means that this TCU can never be displaced.
- **SUSPENDPRIORITY:** This entry specifies a priority for the displacement mechanism to the TCU. In a displacement process the TCUs among the active TCUs with the lowest priority that do not have a displacement disable will displaced. The priority is specified as numeric value in the range 1 - 10.
  The preset is 1 (lowest priority).

  Note

  If you set a displacement disable for a TCU then specification of a displacement priority is unnecessary because it never is used due to the displacement disable.

Displacement rules

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 a TCU boots, the TCU always attempts to establish the first connection specified in its config file. 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.

1.4.2.10 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!

1.4.2.11 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 1-26 "TCU support" settings

TCU_1 192.168.214.10	**TCU_2** 192.168.214.11	**TCU_3** 192.168.214.12	**TCU_4** 192.168.214.13
VNC connections: 192.168.214.241 192.168.214.242 192.168.214.243	**VNC connections:** 192.168.214.241 192.168.214.243	**VNC connections:** 192.168.214.241 192.168.214.243	**VNC connections:** 192.168.214.241 192.168.214.242
Switch to system network			
PCU_1 192.168.214.241	**PCU_2** 192.168.214.242	**PCU_3** 192.168.214.243	

Services: X DHCP ✓ TFTP ✓ FTP ✓ VNC	Services: ✓ DHCP X TFTP X FTP ✓ VNC	Services: X DHCP X TFTP X FTP ✓ 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.

1.4.3 Network configuration

1.4.3.1 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:

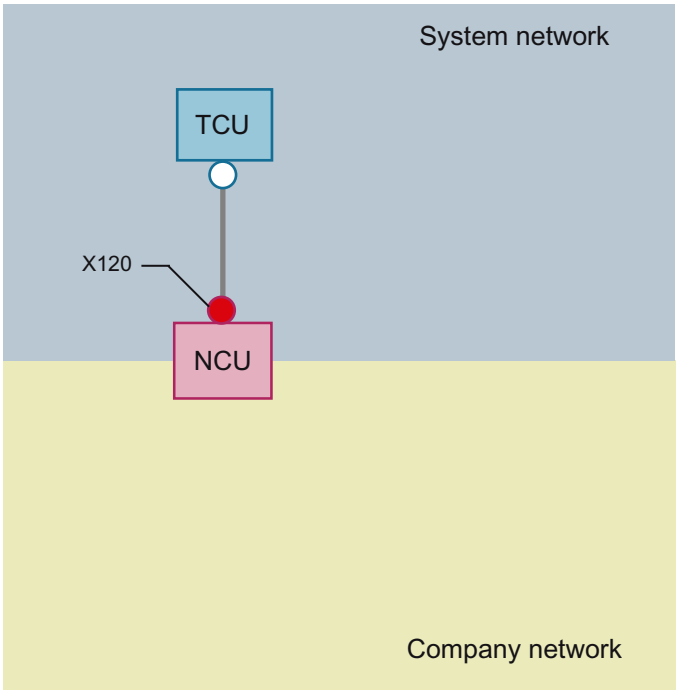
- ○ Eth 1 as a DHCP client
- • Eth 2 as a DHCP server
- ■ Eth 2 with a fixed IP address

Green connection	Uncrossed Ethernet cable
Gray connection	Crossed Ethernet cable (crossover)

1.4.3.2 Networks without connection to the company network

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.

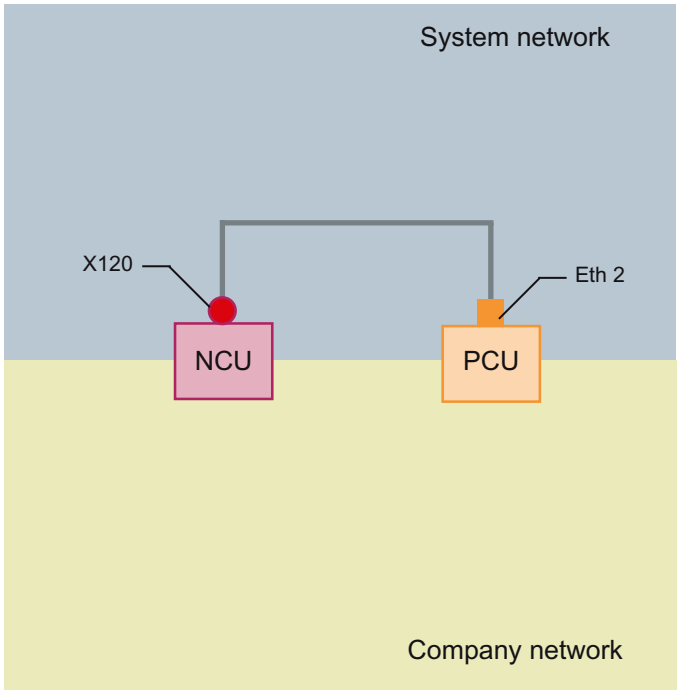
The IP addresses are not significant for further operation.

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.

Configuration 2: NCU and PCU with direct OP

Description



The NCU and PCU are connected via a **crossed** Ethernet cable.

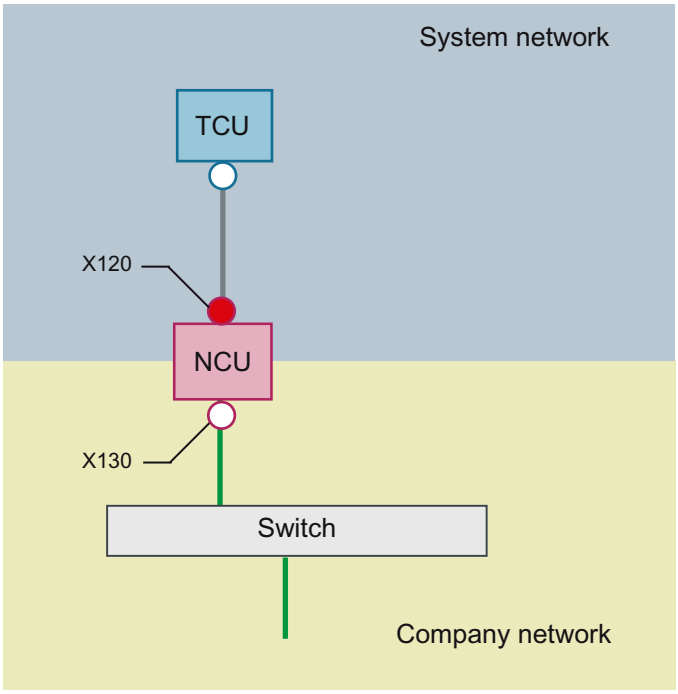
The NCU is the DHCP server with the IP address 192.168.214.1.

For this Eth 2 configuration, the PCU is assigned a fixed IP address in the range 192.168.214.241 – 192.168.214.249 with a subnet mask 255.255.255.0 .

1.4.3.3 Networks with NCU connection to the company network

Configuration 3: 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:

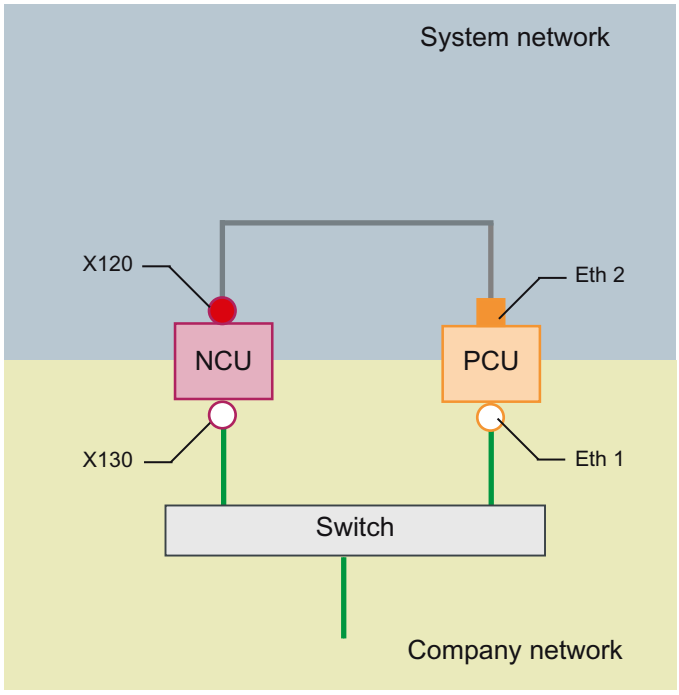
- Computer name on the company network
- Address of a DNS server
- Address of a gateway (default router)

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.

Configuration 4: NCU and PCU with direct OP

Description



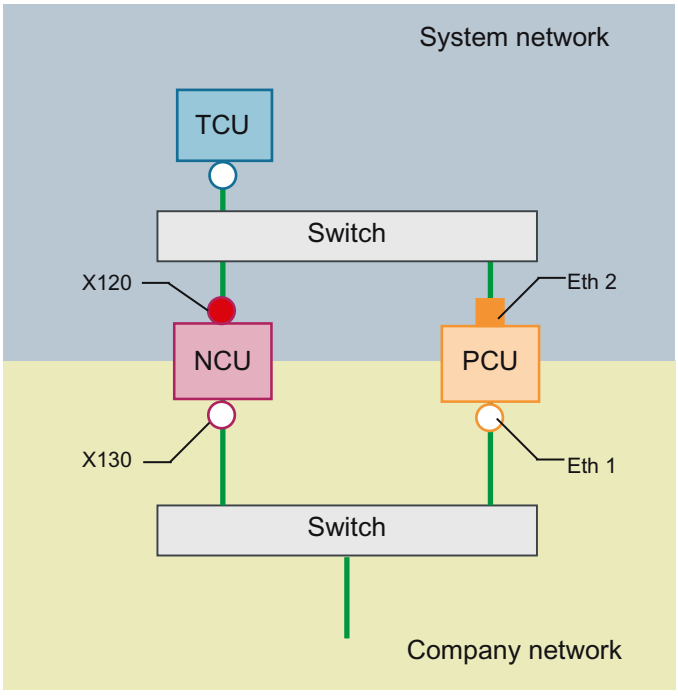
The NCU and PCU are connected via a **crossed** Ethernet cable.

On X120, the NCU occupies the fixed IP address 192.168.214.1 in its capacity as a DHCP server (not used in this configuration). For this Eth 2 configuration, the PCU is assigned a fixed IP address in the range 192.168.214.241 – 192.168.214.249 with a subnet mask 255.255.255.0 .

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 **non-crossed** Ethernet cable.

Configuration 5: 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.

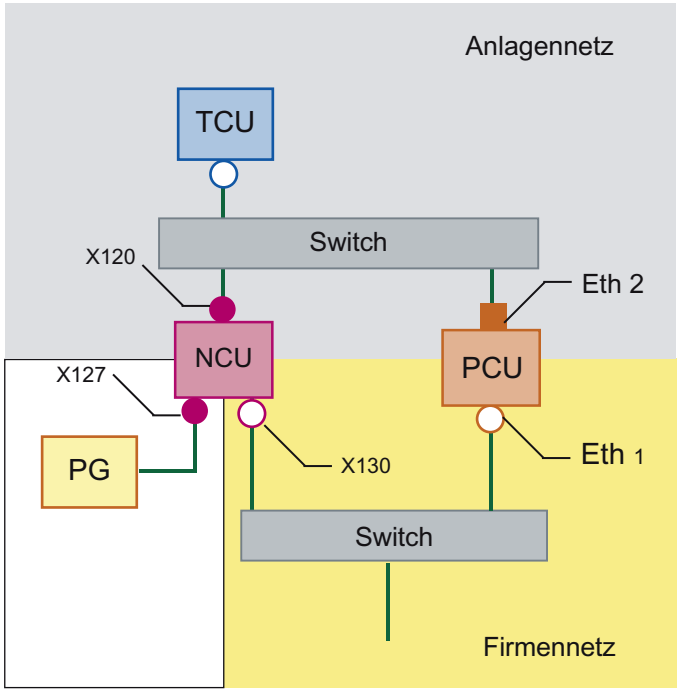
In terms of address allocation and the settings that need to be made, this configuration is identical to that of configuration 4. However, in this case, the DHCP server of the NCU actually supplies the TCU with an IP address and serves as a boot server for the TCU.

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:

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.

1.4.3.4 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 into the network to which the computer to be monitored is connected.

- 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

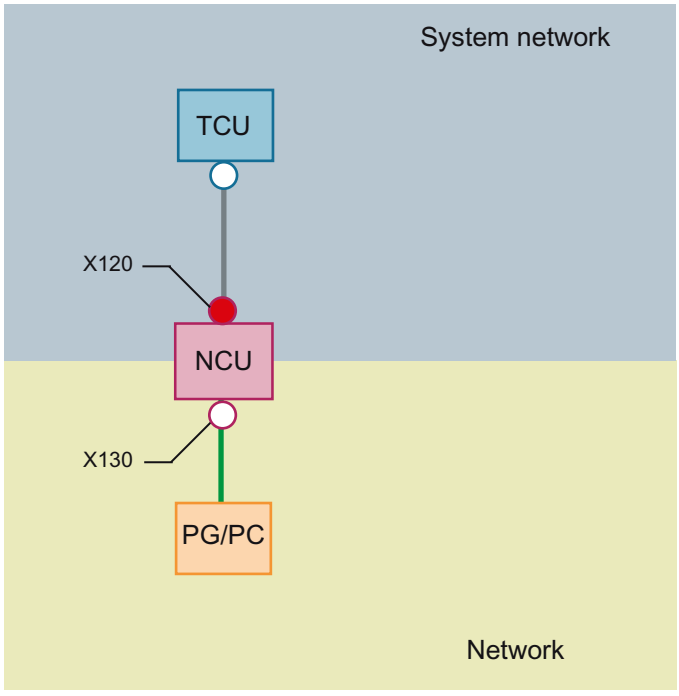


Figure 1-25 Configuration example

Configuration

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

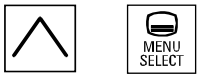
NCU:	`/user/common/tcu/<TCU name>/common/tcu`
PCU (Windows XP):	`F:\user_base\common\tcu\<TCU name>\common\tcu`
PCU (Windows 7):	`C:\ProgramData\Siemens\MotionControl\user\common\tcu\<TCU name>\common\tcu`

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" + MENU SELECT keys, 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.

See also

Settings in the "config.ini" file (Page 64)

1.4.3.5 Application example

Application

The configuration is suitable for the following application: Machine with concurrent operating option to two operator panels , a full-featured operating panel with PCU and an operator panel reduced to tool management.

Parallel operation of HMI-Advanced or SINUMERIK Operate on the PCU 50.3 and SINUMERIK Operate as component of the CNC software on the SINUMERIK 840D sl NCU:

Any OP connected to PCU 50.3 and any OP connected to the NCU can be simultaneously operated: in the example, OP 08T.

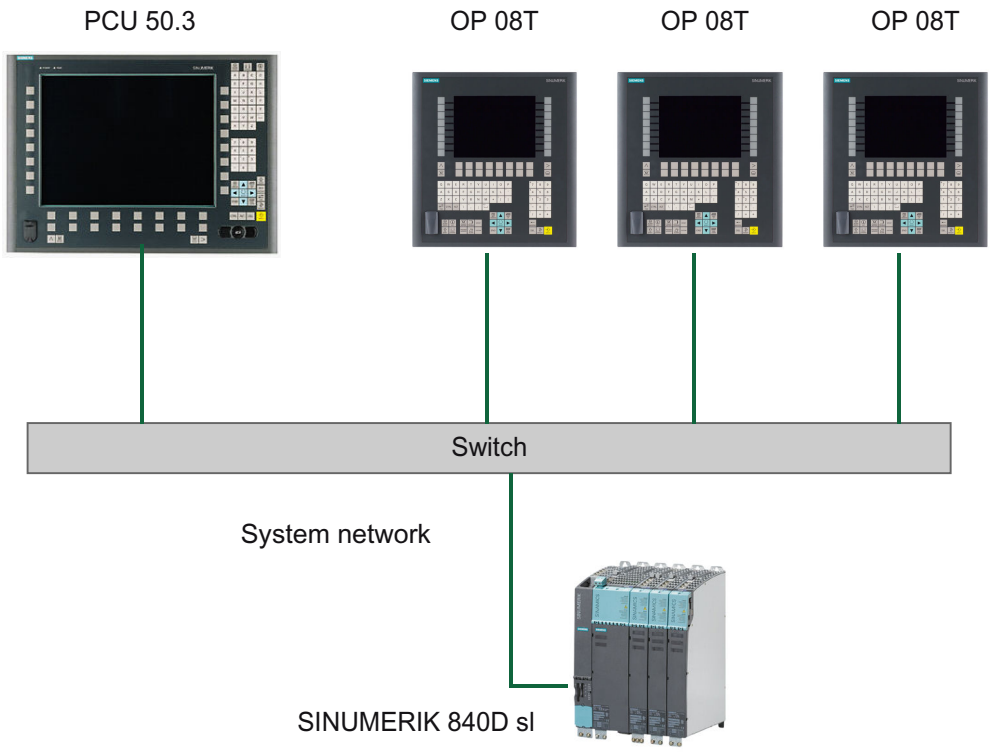


Figure 1-26 Configuration example

Proceed as follows

To configure the application example, proceed as follows:

1. PCU 50.3 with HMI Advanced
   Deactivate the DHCP server on the PCU: For this select the option "Boot support runtime and configuration only (TFTP/FTP)" on the "TCU support" tab of the "System Network Center" program.
2. SINUMERIK 840D sl from CNC software, version 2.4 and higher
   The `systemconfiguration.ini` configuration file is included on the SINUMERIK 840D sl product DVD.
3. OP 08T operator panel
   Once the installation of the OP 08T operator panel with SINUMERIK Operate has been completed, copy the `systemconfiguration.ini` file from the `/Siemens/sinumerik/hmi/appl/systemconfig/tm/` directory to the `/oem/sinumerik/hmi/cfg/` directory. After this, a system restart is necessary.

Note

Subsequent changes

Once the file has been copied, no further settings (e.g. changing language) can be implemented on the SINUMERIK Operate. If you want or need to implement changes later, the systemconfiguration.ini file can be renamed (e.g., as systemconfiguration.save). After this, a system restart is necessary. Following the restart, the full functional scope of SINUMERIK Operate is available once again.

1.4.4 Service and diagnostics

1.4.4.1 Booting of the TCU

Messages when booting

While the TCU is booting, progress is displayed after the BIOS has booted and before the operating system is loaded. 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 structure of these messages is shown below:

You can see the current boot phase in the third line. Below that you are told whether you can call up information via <F1> if a fault occurs.

Diagnostics options during booting

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

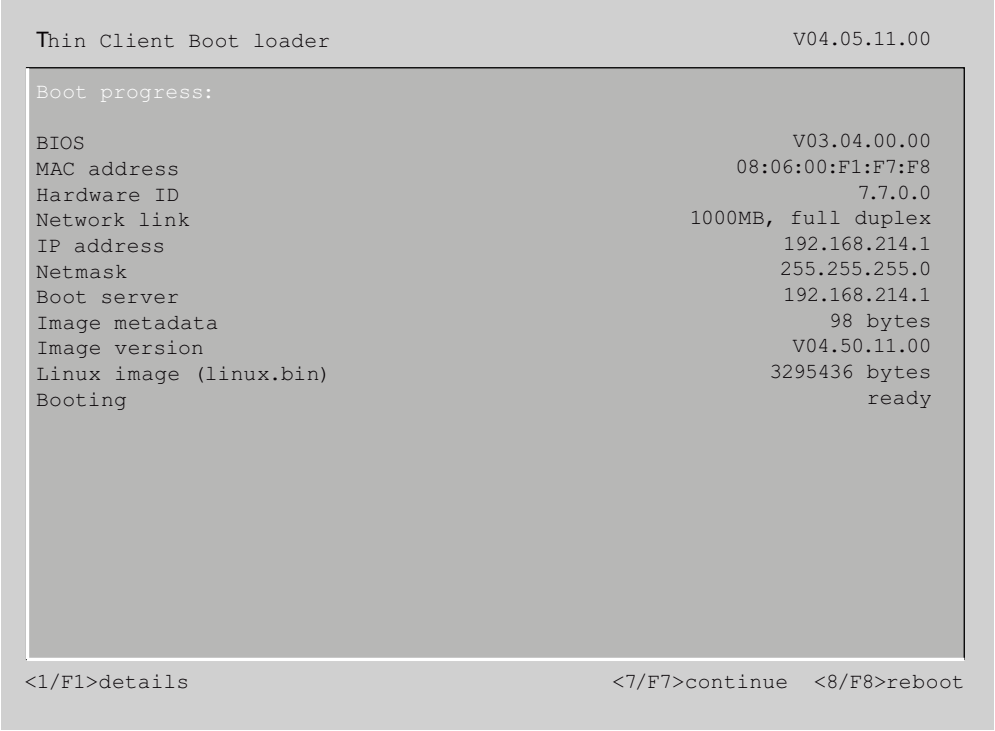
- When the <1 / F1> function is selected during booting
- When a warning message is displayed
- When a fault occurs

Note

You can select the <1 / F1> to <F8> functions shown below using the horizontal softkeys on the OP. For example, to select <F7>, press the horizontal softkey 7.

Press the appropriate key <1> for <F1> at an HT8.

Calling up the diagnostics window with <1 / F1>



Key / text	Meaning
F1 details	Display detailed information
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 +	Display more information
F8 -	Display less information
F9 back	Return to diagnostics window

Description

2

The SINUMERIK OP 012 operator panel front and 12.1" TFT color display with a resolution of 800 x 600 pixels (SVGA) features a 59-key membrane keyboard as well as 2 x (8 + 2) horizontal and 2 x 8 vertical softkeys. The 2 x 8 vertical softkeys can be used as direct keys.

It is fixed from the rear using special clamps that are included in the delivery scope.

Validity

The description below applies to the OP 012 operator panel front.
Article number: 6FC5203-0AF02-0AA2

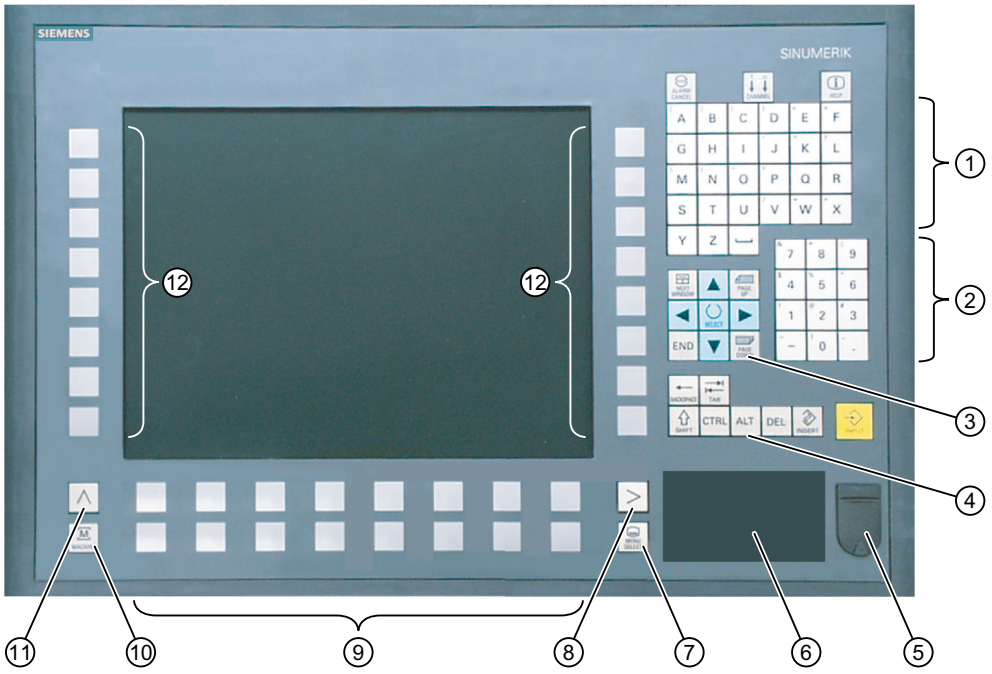
Features

- 19" mounting format, 7 HU (height units)
- Panel cutout (W x H): 450 x 290 mm
- Limited mounting depth
- 12.1" TFT flat screen (color) with SVGA resolution 800 x 600 pixels
- Membrane keyboard with alphabetic, numeric, cursor, and control keypad
- Softkeys / direct keys:
  - 2 x 8 horizontal rows of keys with softkey function
  - 2 x 8 vertical rows of keys with softkey and direct key functions
  - Direct keys connectable via direct key / handwheel connection module or MCP interface PN (optional), machine control panel, TCU or directly to the I/Os
- Shift key for switchover to the second key level (not for switching over the letters, since they are uppercase only)
- Integrated touchpad mouse
- Front USB interface
- Degree of protection IP65
- Attachment: Tension jacks at the rear
- Can be combined with PCU, TCU

Operator control and display elements

3

3.1 View



① Alphabetic key group
② Numeric key group
③ Cursor key group
④ Control key group
⑤ Front USB interface
⑥ Touchpad mouse
⑦ Menu select key
⑧ Menu forward key
⑨ Horizontal softkeys
⑩ Machine area button
⑪ Menu back key
⑫ Vertical softkeys (direct keys)

Figure 3-1 Front view of operator panel front OP 012

3.2 Keyboard

Keyboard

Several keys and keypads are installed on the operator panel front:

- The alphabetic block contains the letters A - Z and the space character.
- The numeric block contains the digits 0 - 9, and the characters "-", "/", "=", "+" and ".".
- The cursor key group is used to navigate on the screen.
- The control key group includes special functions.
- The mouse comprises a touchpad, for finger operation, as well as for cursor navigation and also for the left and right mouse buttons.
- The softkeys call up functions that are available on the screen via a menu bar.
- The "Menu back" key switches back to the higher-level horizontal menu.
- The "Menu forward" key advances in the extended horizontal softkey bar.
- The "Menu select" key calls the main menu to select the operating area.
- The "Machine area" key selects the "Machine" operating area.

Switching between upper and lower case

To toggle between upper and lower case letters, press the key combination Ctrl + Shift

Upper case is always activated as standard.

Overview of the key symbols

The key symbols used on the operator panel front are shown in the overview along with the corresponding function keys on the PC keyboard.

Key	Function corresponds to the PC key function	Key	Function corresponds to the PC key function
	Esc		End
	F11		Backspace
	F12		Tab
	Space		(only intended for internal keyboard changeover)
	Home		Ctrl key
	Page up		Alt key

Key	Function corresponds to the PC key function	Key	Function corresponds to the PC key function
PAGE DOWN	Page down	DEL	Delete
▲	Cursor up	INSERT	Insert
◀	Cursor left	INPUT	Enter
▶	Cursor right	∧	F9
▼	Cursor down	MENU SELECT	F10
SELECT	5 (in numeric key group)	A, ..., Z	<Shift> A, ..., Z
>	<Shift> F9	M MACHINE	<Shift> F10

Display

Note

Pixel error according to DIN EN ISO 9241-307, Error class II.

3.3 Screen saver

If a screen with high contrast is displayed unchanged for longer than an hour, then the screensaver must be activated in order to protect the TFT display against so-called "burning in" of the last displayed screen.

The time can be adapted individually. Further information can be found at:
Commissioning of Basic Software and Operating Software, SINUMERIK Operate (IM9)

3.4 Touchpad mouse

Operation

All of the mouse functions are based on 2-finger operation. The principle of operation of the OP 012 touchpad mouse is explained in the following table with reference to a classic 2-key mouse.

Action	Touch event	Corresponds to
Move the mouse pointer	Place your finger on the touchpad, keep it in position and then move it.	Move the mouse.
Select	Touch the touchpad once with your finger.	Click with the left mouse button
Execute	Touch the touchpad twice with your finger.	Double-click with left mouse button.
Drag, mark, move window	Touch the touchpad twice in succession, keep finger in position and then move.	Click with the left mouse button and drag the mouse.
Open the context menu	Touch the touchpad with two fingers, keep briefly in place then lift one finger.	Click with the right mouse button.

Note

The touchpad cannot be used in environments with spray water or water jets. Operating the touchpad in environments with dripping water is only possible with some restrictions.

Interfaces

4

Front

USB 1.1 Full Speed (12 Mbit/s), high power (500 mA), Type A connector for connecting an external keyboard, mouse and USB flash drive (see View (Page 91)).

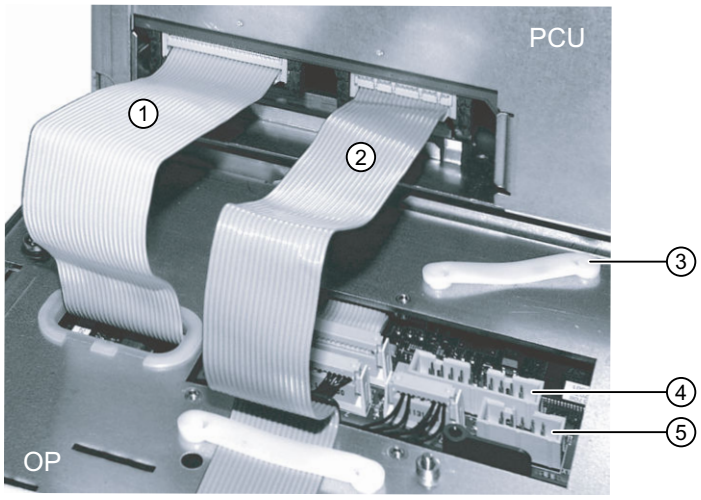
Note

Note that the electromagnetic compatibility of commercially available peripheral devices operated via the USB interface is usually rated for office use only.

For industrial use, components with a higher degree of certification are recommended.

Rear

- Two flat ribbon cables for connecting the PCU:
  - I/O USB cable K1 (ribbon cable): all signals that are used for the display interface and the connection of operator panel fronts
    (e.g. supply voltages).
  - Display cable K2
- Direct key interface X11 (under the cover plate); signals from the 16 "vertical softkey" direct keys
- Interface X12 - reserved (under the cover plate)



① I/O USB cable K1
② Display cable K2
③ Retainer for the connecting cable for the direct key module
④ Direct key interface X11
⑤ Interface X12 (reserved)

Figure 4-1 Connections on rear of housing: Connections to the PCU

Pin assignment

For more detailed information, see "General information and networking", Chapter: "Connecting".

Installation

5

5.1 Preparation for mounting

Table 5-1 Dimensions of the mounting opening

Width (mm)	Height (mm)
450	290

Thanks to the tension jacks on the OP 012, drill-holes or screw holes are not needed.

This retaining method also enables the IP65 degree of protection (but only in conjunction with a circumferential seal and when the protective USB cap is fitted).

Note

The OP 012 is supplied with what are known as "small" tension jacks. If you have the "large" tension jacks (6FC5248-0AF06-0AA0) in stock, then you can also use these.

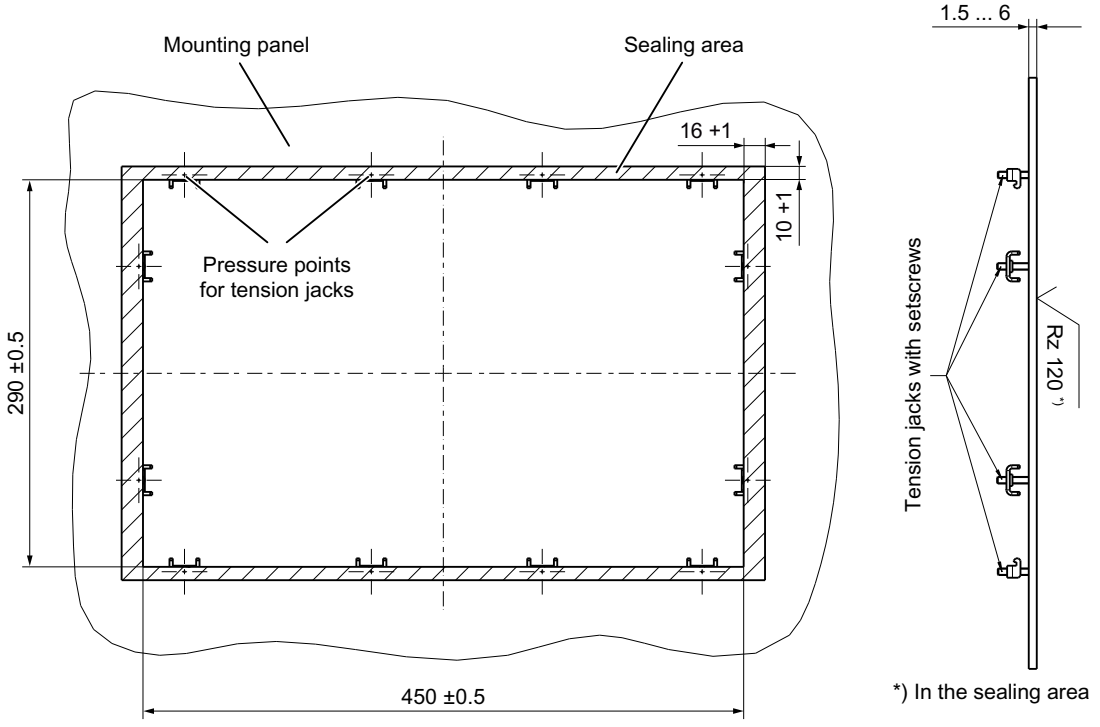


Figure 5-1 Dimension sheet for installing the OP 012 operator panel front

Table 5-2 Dimensions to be observed when installing

	Mounting depth T3 + clearance (mm)	Opening depth T5 (mm)	Protrusion P (mm)
PCU 50.5	101 + 10	377	39
TCU x0.2	50 + 10	350	-12

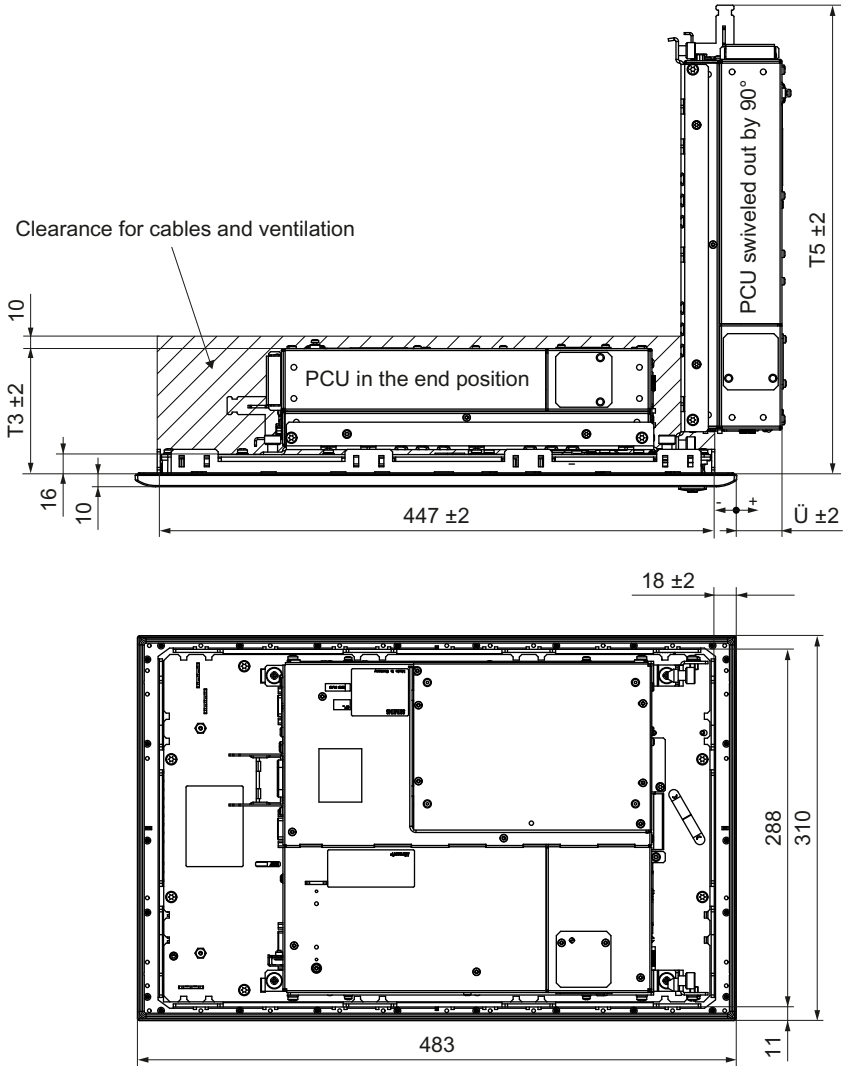


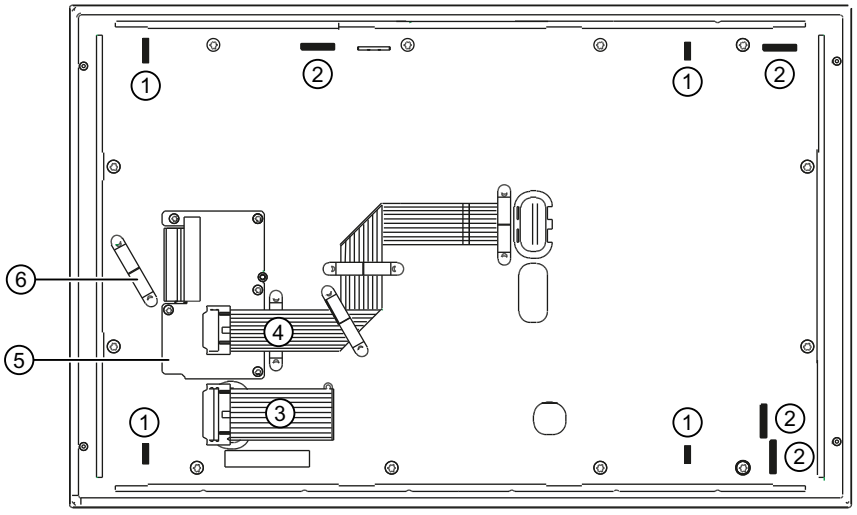
Figure 5-2 Dimension sheet for attaching the PCU to the OP 012 operator panel front

5.2 Assembling an OP 012 and a PCU

When combining an OP 012 and PCU and possibly a direct key module, it is advisable to assemble them prior to installation in an assembly panel.

Requirement

The PCU must now be bolted to the mounting brackets prior to assembly (if this has not already been done). See Section in the “PCU 50.5” manual under “Assembly" → "Assembly of PCU and operator panel front (standard mounting)"

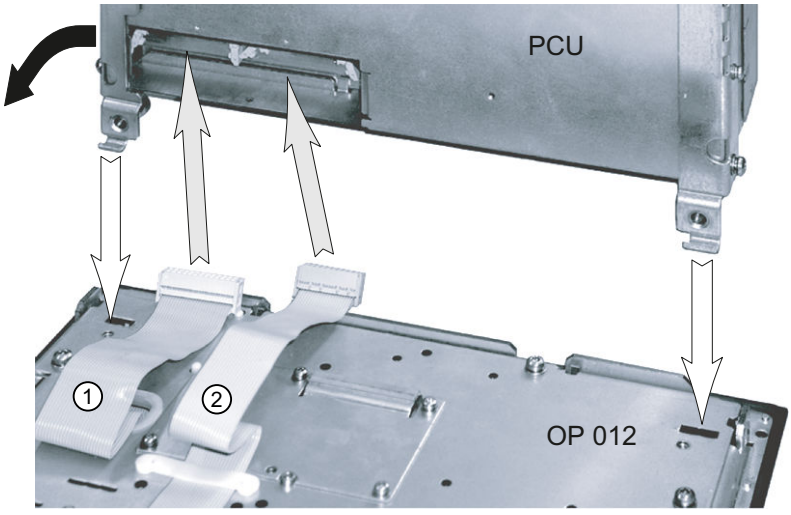


① Mounting slots for PCU lugs
② Slots for inserting softkey labeling strips
③ I/O USB cable K1
④ Display cable K2
⑤ Cover plate for keyboard controller connections
⑤ Retainers

Figure 5-3 Rear of the OP 012

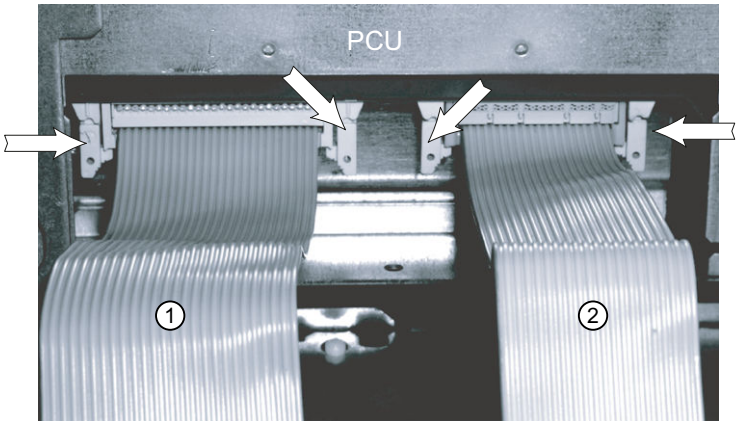
Procedure

1. Place the OP 012 face down on a flat, soft (to avoid scratches) surface.
   - Installation of the direct key module (see section in the “Direct key module" manual under "installation" → “Combination with OP 012")
   - Install or replace the softkey labeling strips (see Softkey labeling (Page 102))
2. Remove the PCU's interface cover.
3. Place the PCU with the lugs of the bolted-on mounting brackets into the mounting slots on the OP 012 as shown by the white arrows in diagram **(A)**.
   To make it easier to insert the lugs, it can be helpful to reduce the 90° angle between the PCU and OP 012 by tilting the PCU as shown by the black arrow in the picture.
4. Insert cables K1 ① and K2 ② of the OP 012 in the connector strips of the PCU [see the gray arrows in the diagram **(A)**]. Make sure that the connectors lock in audibly and that the locks [see arrows in diagram: **(B)**] are closed.
5. Swivel the PCU into its final position and secure it with knurled screws, tightening torque of 1.8 Nm [see diagram: **(C)**].



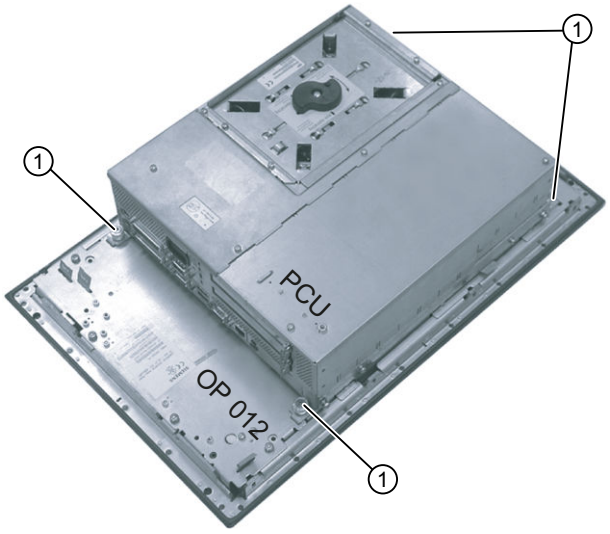
① I/O USB cable K1
② Display cable K2

Figure 5-4 (A) Assembling PCU and OP 012



① I/O / USB cable K1
② Display cable K2

Figure 5-5 (B) Correct connection of I/O-USB and display cables to the PCU



① Knurled screw

Figure 5-6 (C) OP 012 and PCU after assembly

Note

The OP 012 and TCU assembly is similar to that for a PCU.

5.3 Mounting on the mounting wall

The clearance at the rear of the PCU/TCU must be at least 10 mm to ensure sufficient ventilation (see Figure 5-2 Dimension sheet for attaching the PCU to the OP 012 operator panel front (Page 98)).

For more detailed information, please refer to the relevant PCU sections and in "General information and networking", Section: "Application planning", Section: "Climatic and mechanical environmental conditions" → "Cooling".

NOTICE
Impermissible mounting positions can cause malfunctions
Observe the permissible mounting position: Deviating by up to 5º from the vertical.
This value can be further restricted by mounted components (e.g. PCU).

Procedure

1. Insert the assembled components (operator panel front and PCU) from the front into the panel cutout (see Figure 5-1 Dimension sheet for installing the OP 012 operator panel front (Page 97)).
2. Secure the operator panel front in the panel cutout from the rear using the tension jacks by tightening the setscrews (torque 0.4 - 0.5 Nm).

See also

Preparation for mounting (Page 97)

5.4 Softkey labeling

User-specific functions can be assigned to the horizontal and vertical softkey bars. Printed labeling strips can be used to label the softkeys.

Blank labels are already installed on delivery.

DIN A4 films are available for making the strips (for the article number, see Chapter Overview (Page 105)).

Note

Use the "Arial" font to format text. This font is comparable to the "Univers S57" font, used by Siemens for the key labeling.

Procedure

1. Letter the mat side of the film using a laser printer.
2. Cut the printed labels along the preprinted lines.
3. Remove the PCU retaining screws and swing out the PCU away from the operator panel front.
4. Insert the strips into the slots provided on the rear of the operator panel front.
5. Swing the PCU back to the operator panel and secure by tightening the screws.

If the operator panel front and PCU are dismantled, omit steps 3 and 5.

Technical data

6

Safety			
Safety class	III; PELV according to EN 50178		
Degree of protection according to EN 60529	Front side IP65 Rear side IP00		
Approvals	CE / cULus		
Electrical data			
Power consumption (without load at USB interface, without direct key module)	typically approx. 5 W maximum approx. 6 W		
Mechanical data			
Dimensions	Width: 483 mm	Height: 310 mm	Depth: 30 mm
Weight	Approx. 5 kg		
Tightening torques, max.	Tension jack screws: 0.5 Nm	M3 screws: 0.8 Nm	M4 screws: 1.8 Nm
Display			
Size / resolution	12.1" TFT / 800 x 600 pixels		
Backlight-service life	typ. 50,000 h at 25º C (dependent on the temperature)		

Note

Information about the climatic and mechanical environmental conditions is contained in the associated section under:

"General notes and interconnection" → "Operational planning".

Spare parts

7

7.1 Overview

The diagram shows the OP 012 operator panel front dismantled into its individual parts.

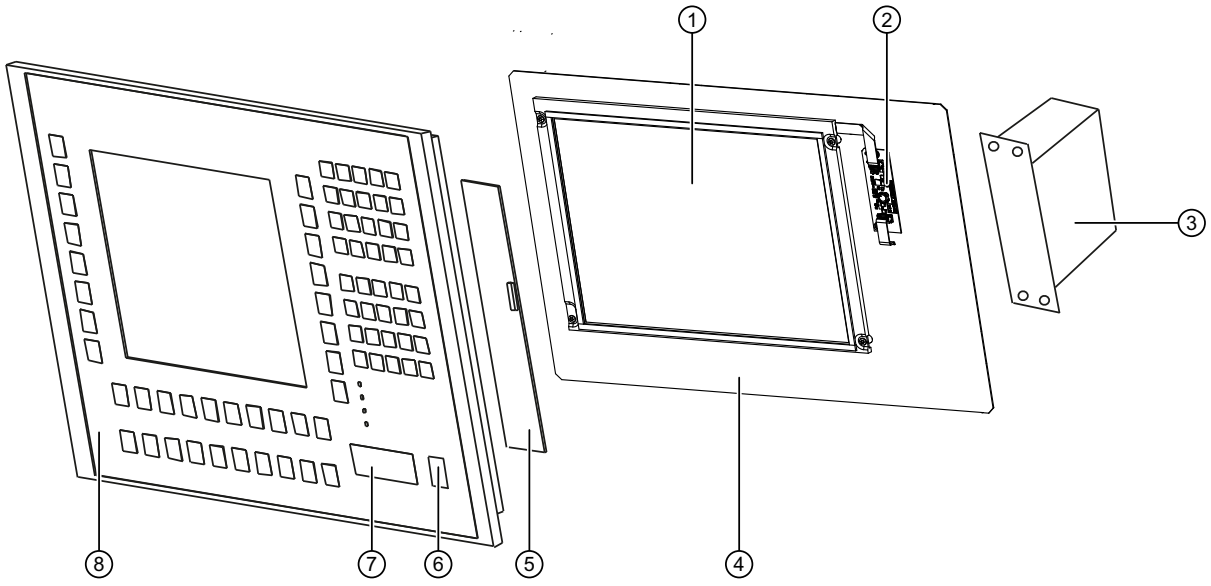


Figure 7-1 Individual parts for the OP 012 operator panel front

The components listed in the following table with an article number are available as spare parts.

①	Display		
②	LED backlight driver		
	Spare part	**Article number**	**Remark**
③	Direct key module	6FC5247-0AF11-0AA0	
④	Display support		
⑤	Keyboard controller		
⑥	Caps for the USB port	6FC5248-0AF05-0AA0	Set of 10
⑦	Touchpad mouse		
⑧	Operator panel front	6FC5248-0AF02-0AA2	with touchpad mouse, without display, without keyboard controller, without direct key module
	Slide-in strips that can be labeled	6FC5248-0AF08-0AA0	Set with 3 foils, DIN A4
	Tension jacks	6FC5248-0AF14-0AA0	Set of 9

The dimensions for creating slide-in labels from the foil for labeling the vertical softkeys can be seen in the following diagram.

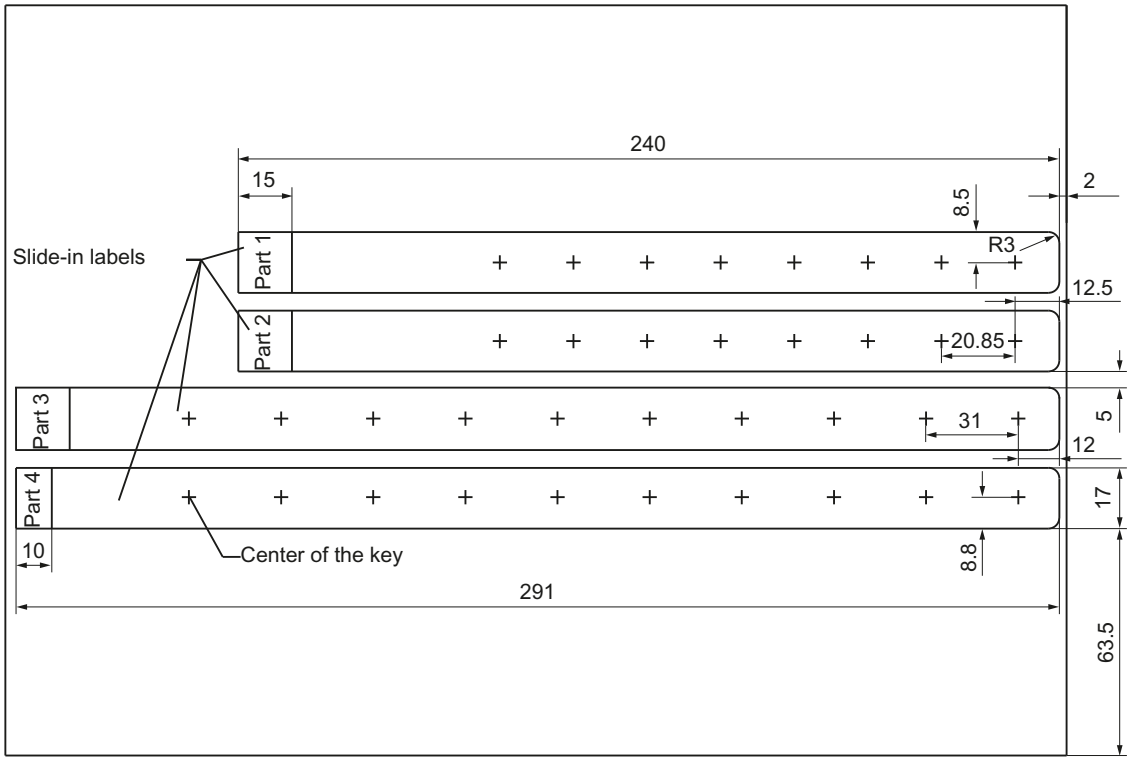


Figure 7-2 Dimensions for slide-in labels

7.2 Replacement

NOTICE
Risk of damage to sensitive components due to static electricity
Spare parts must always be replaced by properly trained personnel!

USB cap / tension jack

The replacement of the USB sealing cap and tension jacks will not be described since it is simple and self-explanatory.

Film labels

The procedure for replacement is as described in the section "Softkey labeling":

Operator panel front

When replacing the operator panel front, the previous USB interface, display and keyboard controller can continue to be used. They are therefore disassembled and reassembled after the appropriate component has been replaced.

Note

We recommend reusing the keypad controller to prevent any loss of the control parameters that have been programmed in.

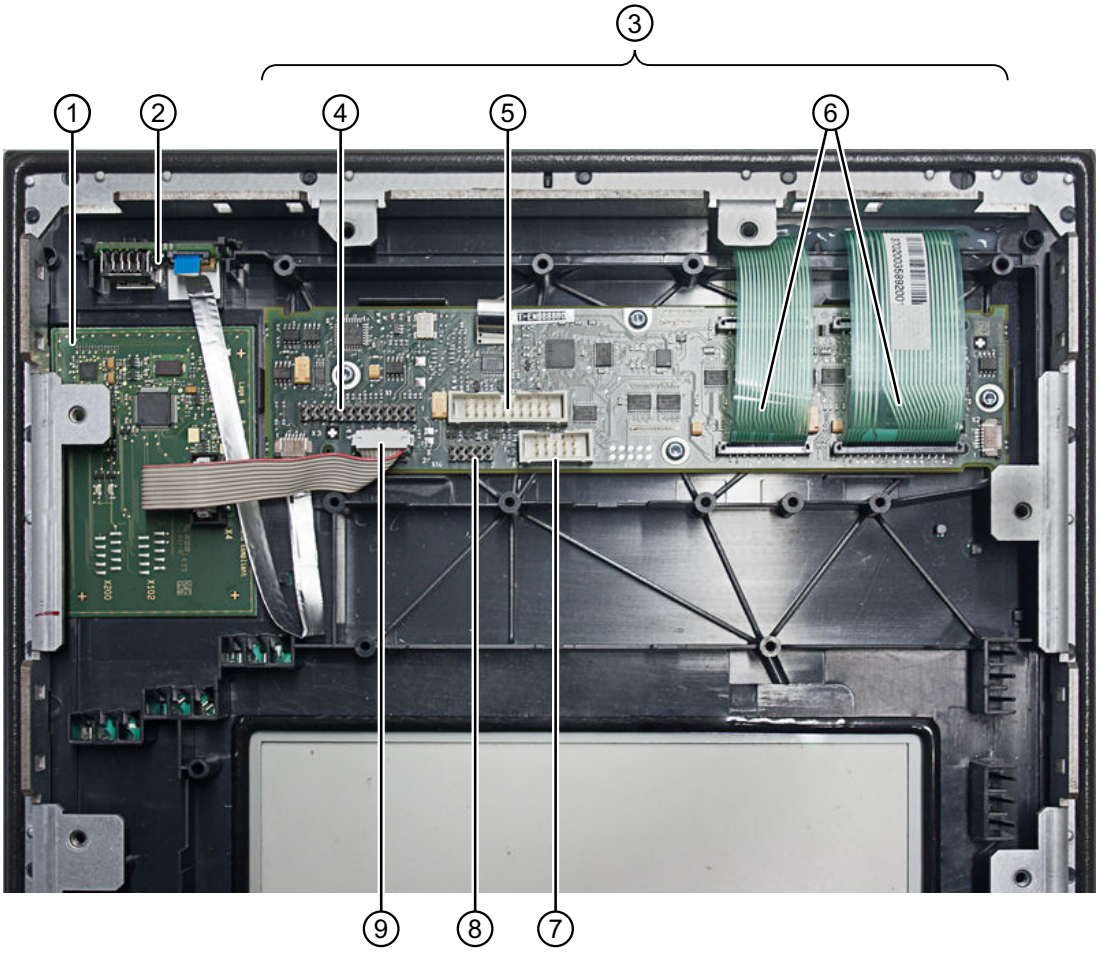
Procedure

1. Put the OP 012 face down on a flat, soft surface and loosen the 12 housing screws (see figure: "Rear of the OP 012 (Page 99)").
2. Remove the softkey labeling strips and the cover plate.
3. Remove connector X14 for the backlight ⑧ and the IO-USB cable K1 ④ from the keyboard controller ③.
4. Remove connector X4 for the touchpad mouse ⑨.
5. Lift off the display support with the display.
   The rear of the front USB interface ② becomes visible near the keyboard controller ③.
6. After bending back the two lugs, withdraw the front USB interface ②.
7. Disconnect the two membrane connectors ⑥ of the operator panel front keyboard from sockets X7 and X8 (procedure: see note).
8. Remove the fixing screws from the keyboard controller ③.
9. Lift the front USB interface ② and keyboard controller ③ off the front plate. The interconnections may remain plugged.
10. Install the components into the new operator front panel in reverse order (procedure: see note).

Note

Descriptions of how to disconnect and connect the membrane connector can be found in "General information and networking", Chapter: "Connecting", Section: "Handling membrane connectors".

When tightening the screws, observe the torques (refer to Section: "Technical data").



① Touchpad mouse
② Front USB interface
③ Keyboard controller
④ Connection X1 for IO-USB cable K1
⑤ Direct key connection X11
⑥ Membrane connectors X7 and X8 for connecting the operator panel front keyboard.
⑦ Connection X12 (reserved)
⑧ Connection X14 for backlight
⑨ Connection X4 for touchpad mouse

Figure 7-3 Replacement of operator panel front OP 012

See also

Assembling an OP 012 and a PCU (Page 98)

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