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Hardware and Engineering

PS 4-300

04/99 AWB 2700-1311 GB

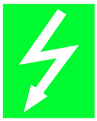
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Translators: Baker & Harrison, Terence Osborn



Caution!

Dangerous electrical voltage!

Before commencing the installation

- Disconnect the power supply of the device.
- Ensure that the device cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighbouring units that are live.
- Follow the engineering instructions (AWA) of the device concerned.
- Only suitably qualified personnel may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60 364-4-41 or HD 384.4.41 S2.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60 204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause uncontrolled operation or restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.

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About This Manual

Documentation for the PS 4-300

The documentation for the PS 4-341-MM1 compact PLC (referred to below as PS 4-300) is subdivided into four manuals with the following topics:

- Hardware and engineering
- User interface for the programming software
- Programming
- Training guide

Hardware and engineering manual
The “Hardware and engineering” manual explains how to install and configure the PLC and the settings that can be made on the PLC.

How to configure and set the PLC parameters in the topology configurator of the Sucosoft S 40 programming software is described in the “Software configuration” chapter.

The “Slave addressing” chapter defines the general syntax rules for addressing the stations in a Suconet K network.

The “Tests/commissioning/diagnostics” chapter provides an overview of the possible error and diagnostic messages and their significance.

User interface for the programming software manual
The PS 4-300 is programmed using version 3.0 or higher of the Sucosoft S 40 programming software (Windows, IEC 1131).

The user interface for the software is described in the manual AWB 2700-1305 GB and in the supplementary manual AWB 2700-1337 GB.

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Programming manual
Information on programming the PS 4-300 is contained in the “Language elements (Sucosoft S 40)” manual (AWB 2700-1306 GB).

Training guide
The Training guide AWB 27-1307 GB guide uses practical examples to illustrate the key functions of the Sucosoft S 40 software.

Symbols

The symbols in this manual have the following meaning:



Draws your attention to interesting tips and additional information.



Warning!
Warns of the possibility of damage. The product, anything in the immediate vicinity and data may be damaged.



Caution!
Warns of the possibility of severe damage. The product, anything in the immediate vicinity and data may be severely damaged or totally destroyed. There is also a risk of injury or even death.

▶ Indicates handling instructions

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1 About The PS 4-300 Compact PLC

Hardware and software requirements

To program the PS 4-300 you need:

A PC (IBM or IBM-compatible) with

Pentium processor

Windows 95, Windows 98 or Windows NT 4.0[1] operating system

16 MB RAM (32 MB recommended)

3.5” disk drive/ 1.44 MByte and CD-ROM drive

Hard disk with at least 50 MB free space; a temporary directory called C:\{_PS 4_}.TMP is created and then deleted again during installation. This requires at least 250 KB free on drive C:

Serial COM port

Parallel printer port (LPT)

VGA graphics card

ZB 4-303 KB1 programming cable (connecting cable between the PC and PS 4-300)

Features

The main features of the PS 4-300 are as follows:

24 V DC power supply

16 digital inputs 24 V DC (some are multi-function inputs for “high-speed counters”, incremental encoders and for use as alarm inputs.

14 digital outputs 24 V DC

2 analog inputs

1 analog output

1) (die Version 3.x Sucosoft version 3.x is the last version supported by Windows 3.1x

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Setup

Figure 1 contains an overview of the controls, LEDs and device connections on the PLC.

Warning!
Always ground yourself before touching the PLC to protect the components against electrostatic discharge.

Key to Figure 1:

① 24 V DC power supply
② Incremental encoder/"high-speed counter" input
③ 16 digital inputs 24 V DC
④ Plug-in screw terminal
⑤ Status LEDs for digital inputs
⑥ 2 alarm inputs
⑦ 24 V DC power supply for outputs
⑧ 14 digital outputs 24 V DC/0.5 A; short-circuit and overload-proof
⑨ Status LEDs for digital outputs
⑩ 2 analog inputs U_0, U_1 (0 to 10 V)
1 analog output U_{10} (0 to 10 V)
⑪ Suconet K interface
⑫ Setpoint potentiometers P1, P2
⑬ Switch S1 for bus terminating resistors
⑭ Programming device interface (PRG)
⑮ Memory module
⑯ Status LEDs for PLC

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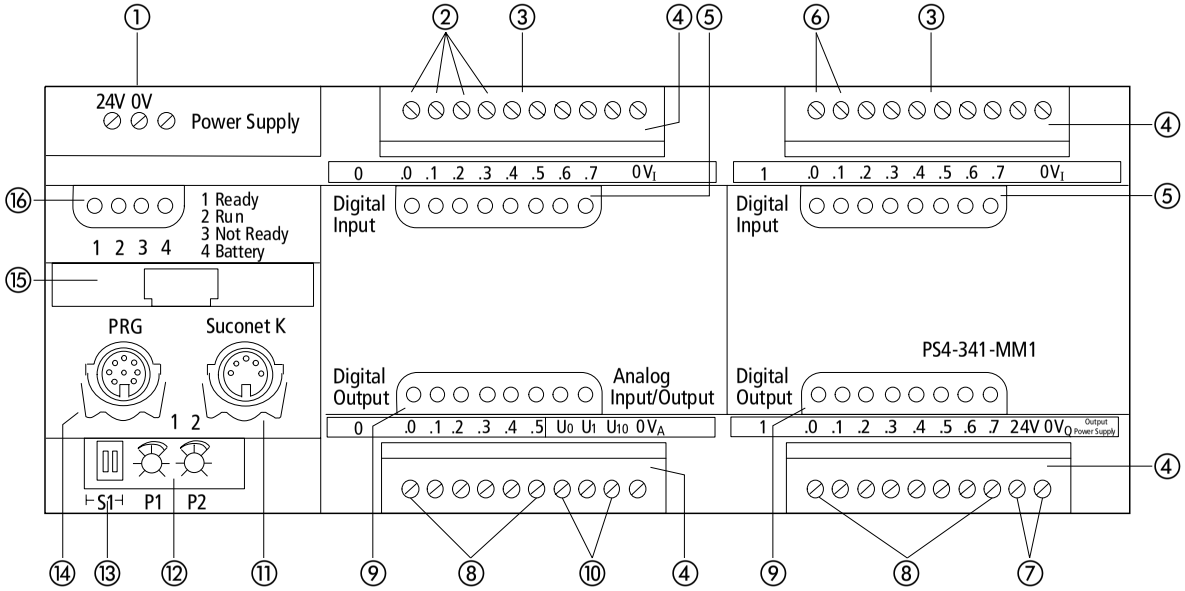


Figure 1: Setup of the PS 4-300

Features of the PS 4-300

① **Power supply unit**
The PS 4-300 is operated with a rated voltage of 24 V DC. The power supply connection is protected against polarity reversal. The 24 V connection enables the PLC to be supplied with voltages to industrial standards (IEC) and is electrically isolated from the CPU.

② **Multi-function inputs**
Inputs I0.0, I0.1, I0.2 and I0.3 are used to connect an incremental encoder. The connection assignment is shown in Figure 12. Any 24 V encoder (without antivalent signals) may be connected. The "IncEncoder"[1] function block is available for processing input signals.

Input I 0.0 ("high-speed counter") can also be used to record high-speed pulse trains. The signal level (L/H) at input I0.1 determines the counting direction. This input is supported by the "CounterAlarm"1 function block.

Inputs I0.0 to I0.3 can also be used as digital inputs.

③ **Digital inputs**
The PLC has 16 digital inputs. They are electrically isolated from the CPU and are designed for a rated voltage of 24 V DC. The typical input delay of 100 µs (not including the multi-function inputs) ensures short response times, e.g. for directly scanning peripheral devices or evaluating alarms. Inputs I0.0 to I0.7 and I1.0 to I1.7 can be addressed in bit, byte or word format with I/O commands.

1) These function blocks are described in chapter 6 of the manual "Language Elements for the PS 4-150/-200/-300 and PS 416" (AWB 2700-1306 GB).

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④ **Plug-in screw terminals**
An overview of the digital and analog I/O connections is given in the “Engineering” chapter.

⑤ **Status LEDs for digital inputs**
The physical and logical states of the PLC’s signal inputs and diagnostic status word are indicated by light-emitting diodes (LEDs) (See "Diagnostic status word" on page 76).

⑥ **Alarm inputs (interrupt input)**
Inputs I1.0 and I1.1 enable you to respond quickly to events regardless of the cycle time. In the Sucosoft S40 programming software, the alarm inputs are supported by the “EdgeAlarm”[1], function block. The rising or falling edge can also be used to evaluate such events

⑧ **Digital outputs**
The PS 4-300 has 14 digital outputs 24 V DC. They can withstand a load of 0.5 A and have a 100 % duty factor. They are electrically isolated from the CPU and are short-circuit and overload-proof. Up to four outputs may be connected in parallel, ideally in groups (Q0.0 to Q0.3, Q0.4 to Q0.5, Q1.0 to Q1.3 and Q1.4 to Q1.7).

The outputs can be addressed in bit, byte or word format with I/O commands. Check the composition of the groups if the outputs are connected in parallel.

1) These function blocks are described in chapter 6 of the manual “Language Elements for the PS 4-150/-200/-300 and PS 416” (AWB 2700-1306 GB).

⑨ **Status LEDs for digital outputs**
The logical states of the digital outputs are indicated by light-emitting diodes (LEDs).

⑩ **Analog inputs and outputs**
The PLC has two analog inputs U_0 and U_1. The signal range is 0 to +10 V and the resolution is 10 bits (1024 increments).

The PLC has one analog output U_{10} with a signal range of 0 to +10 V and a resolution of 12 bits (4096 increments).

The analog inputs and outputs are addressed as follows:
U_0: IAW0.0.0.4
U_1: IAW0.0.0.6
U_{10}: QAW0.0.0.0

The analog inputs and outputs are **not** electrically isolated from the CPU.

⑪ **Suconet K connector**
This interface performs the following functions:

It is the network interface for Suconet K stations, such as Suconet K master or slave PLCs or EM 4-... expansion modules.

It is used to exchange data with peripherals equipped with a serial interface (e.g. printer, terminals, etc.). This type of communication is used for process data acquisition, visualisation etc., but should not be used to exchange data for process control.

Network programming via Suconet K is described under "Programming via Suconet K" on page 72. The Suconet K connector (RS 485) is electrically isolated from the CPU.

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The Sucom A protocol enables markers and status and diagnostic bits on the PLC to be accessed directly. It provides read and write access to the marker range, whereas only read access to the status and diagnostic bits is possible.
Sucom A access can be provided via the PRG and SBI interfaces. Sucosoft S 40 contains a function block called “SUCOM-A”[1] for this purpose.

⑫ **Setpoint potentiometers**
The two setpoint potentiometers P_1 and P_2 can be set externally using a screwdriver. In other words, setpoints can be changed without the use of a programming device. The resolution is 10 bits. In the programming software, the setpoint potentiometers are addressed using the operands “IAW0.0.0.0” and “IAW0.0.0.2”.

⑬ **Switch S1 for setting the bus terminating resistors**
The bus terminating resistors at the first and last physical stations on the bus must be switched on, whereas all the other stations must be switched off (see "Setting the bus terminating resistors" on page 20).

1) These function blocks are described in chapter 6 of the manual “Language Elements for the PS 4-150/-200/-300 and PS 416” (AWB 2700-1306 GB).

⑭ **Programming device interface (PRG)**
The interface performs the following functions:

Programming the PLC via the PC

It is used to exchange data with peripherals equipped with a serial interface (e.g. printer, terminals, etc.). This type of communication is used for process data acquisition, visualisation etc., but should not be used to exchange data for process control.

Communication via the PRG interface (RS 232/485) is controlled by the “SCO”[1] function block in Sucosoft S 40. The interface is electrically isolated from the CPU.

⑮ **Memory and memory module**
The PS 4-300 has an internal battery-backed RAM which is subdivided into a user program memory and a data memory. Up to 0.5 MB is available for the user program and as the data memory. Memory allocation is dynamic. The capacity of the internal RAM **cannot** be upgraded using plug-in memory modules. The ZB 4-901-SF1 memory module acts as the backup memory.

⑯ **Status LEDs for the PLC**
The PLC’s states are indicated by four light-emitting diodes: “Ready”, “Run”, “Not Ready” and “Battery”. The meaning of these LEDs is described under "Status LEDs" on page 75.

1) These function blocks are described in chapter 6 of the manual “Language Elements for the PS 4-150/-200/-300 and PS 416” (AWB 2700-1306 GB).

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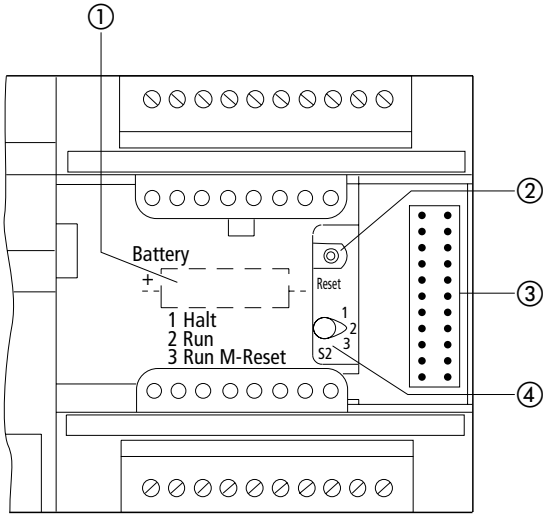


Figure 2: Controls and LEDs on the PS 4-300 (with the housing flap open)

① Back-up battery
② Reset button
③ Plug connector for local expansion modules
④ Operating mode selector switch

① Backup battery

The battery backs up the internal RAM and the real-time clock.



Warning!
The power supply must be switched on when you replace the back-up battery, otherwise programs and data will be lost.

②, ④ Operating mode selector switch/reset button

The operating mode selector switch is used to select the “Halt” (stop), “Run” and “Run M reset” operating modes. The operating states are described in detail under "Operating states of the PLC" on page 66.

③ Plug connector for the local expansion module

The plug connector acts as the interface for connecting local expansion modules (LE 4-...).

Real-time clock

The PLC is equipped with a battery-backed real-time clock which enables machines and equipment to be switched at set times. The programming software provides a function block for addressing and scanning the real-time clock. This function block can also be used to switch between summer and winter time (daylight savings time).

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2 Engineering

EMC regulations

Observe the engineering instructions in the manual "EMC Engineering Guidelines for Automation Systems" (AWB 27-1287 GB).

Connections

- **Screened data and signal cables**
  Route screened data and signal cables on the left and the right of the device along the shortest possible distance and connect the screen braid to the ground terminal using a low-impedance connections and large contact areas
  (See Figure 3, item ①).
- Connect the screen braid with the metal sleeve of the plug connector (DIN plugs) ③.
- Insulate the end of the screen braid as close as possible to the signal cable entry ②.

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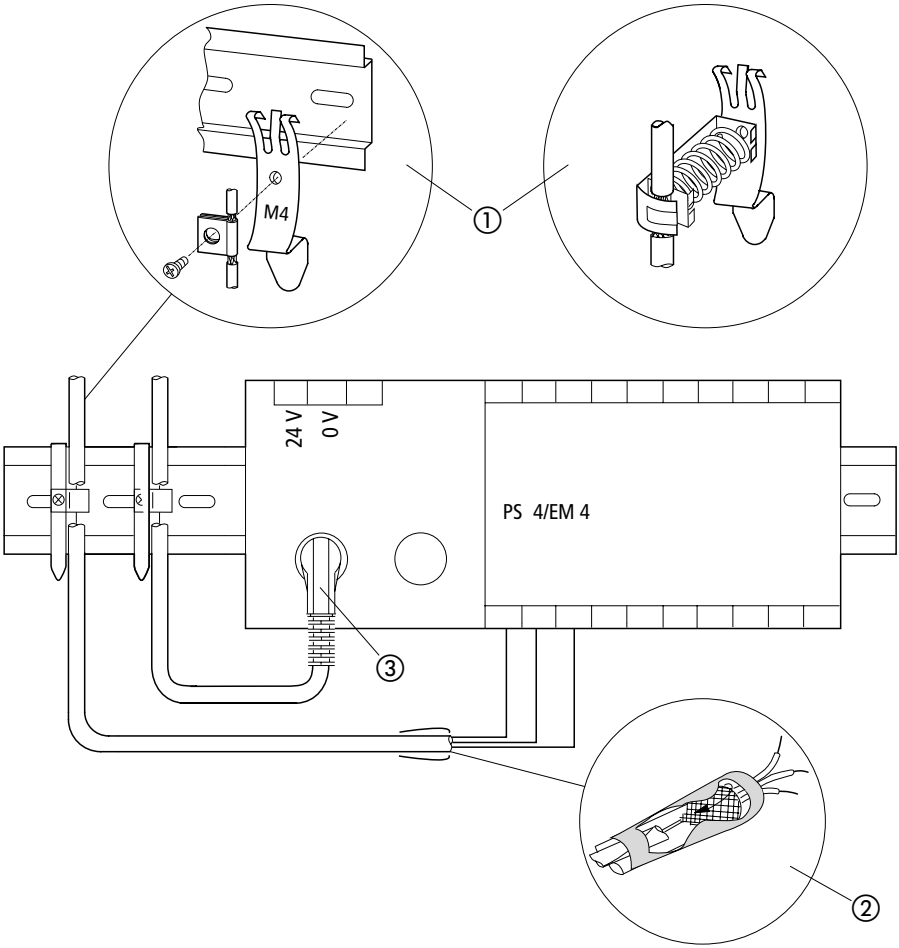


Figure 3: Grounding the screens of the cables

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Overview

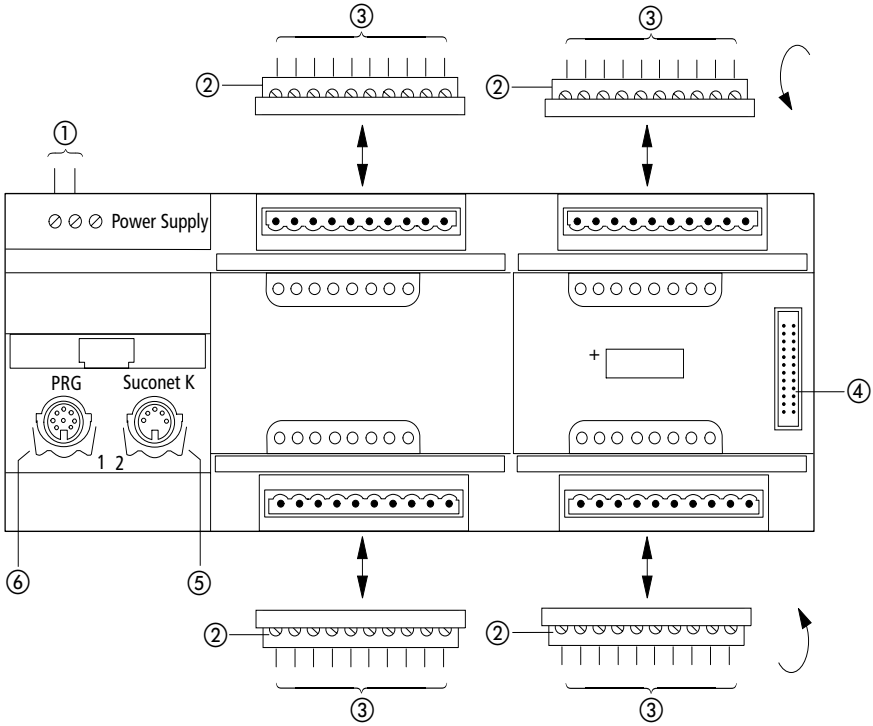


Figure 4: Overview of the connections

① Screw terminals: 24 V DC power supply
Connector cross-sections:
flexible with ferrule 0.22 to 2.5 mm² (AWG 23 ... 13)
solid 0.22 to 2.5 mm² (AWG 23 ... 13)

② Plug-in screw terminals

③ Conductor cross-sections:
flexible with ferrule 0.22 to 1.5 mm² (AWG 23 ... 16)
solid 0.22 to 2.5 mm² (AWG 23 ... 13)

④ Plug connector for local expansion modules (LE 4)

⑤ Suconet K interface (RS 485)

⑥ Programming device interface (RS 232)

Programming device interface

Pin assignment

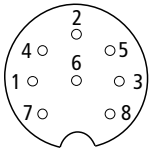


Figure 5: Pin assignment on the programming device (PRG) interface (left-hand socket, top view)

PIN 1	Not used
PIN 2	RxD
PIN 3	0 V for interface
PIN 4	Not used
PIN 5	TxD
PIN 6 – 8	Not used

Connecting the programming device (PC)

▶ Connect the PC to the PRG interface (left-hand socket) of the PS 4-300 using the ZB 4-303 KB1 programming cable:

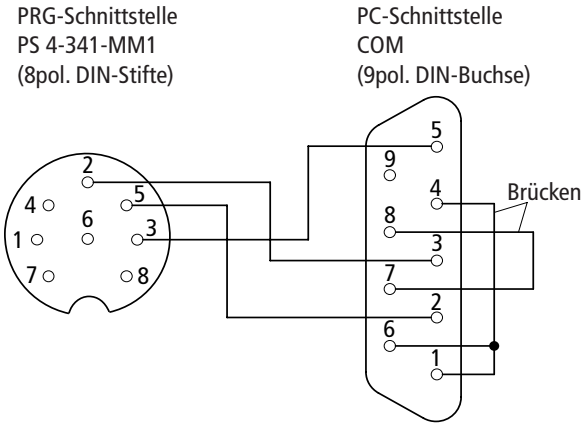


Figure 6: Pin assignment of the ZB 4-303 KB1 programming cable

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Warning!
In order to avoid potential equalisation currents between the PLC and PC, devices attached to the PRG and Suconet K sockets must have the same ground potential. The PC interface may be damaged if the potentials are different.

If identical ground potentials cannot be achieved, either connect the PC to the mains supply via an isolating transformer or use a laptop with an internal battery.

Suconet K connector

Pin assignment

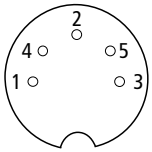


Figure 7: Pin assignment of the Suconet K connector (right-hand socket, top view)

PIN 1	RS 485 data cable, Suconet K (TB/RB)
PIN 2	Assigned internally
PIN 3	Assigned internally
PIN 4	RS 485 data cable, Suconet K (TA/RA)
PIN 5	Assigned internally

Connecting to the Suconet K field bus

▶ Use the KPG 1-PS3 bus cable to connect additional Suconet K stations (PS 4, EM 4) to the PS 4-300 compact PLC.

5-pole DIN plug (pins)		5-pole DIN plug (pins)
1	----------	1
4	----------	4

▶ Create a low-impedance connection between the screen of the Suconet K data cable and the ground terminal over the largest possible area (e.g. using a metal cable clamp) (see Figure 3).

Setting the bus terminating resistors

▶ Activate the bus terminating resistors for the physically first and last stations on the line. To do this, set both switches S1 to “ON”. Both switches must be set to the “OFF” position for all other stations.

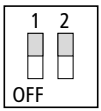


Figure 8: Bus terminating resistors active



The two S1 switches must both be set to the same position (“ON” or “OFF”) for the PLC to function correctly.

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Local expansion module

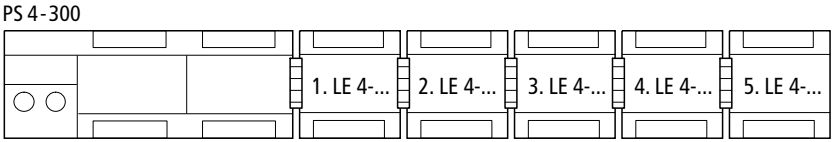
The PS 4-300 can be expanded locally. The local expansion modules (LE 4) are connected to the local bus connector of the PS 4-300 using a local bus ribbon cable. All available LE 4 types may be used, although the following restrictions should be noted:

No more than five LE 4s may be connected.

Local expansion modules with digital inputs and outputs can be used in positions 1 to 5 (1st to 5th module).

No more than two of the following LE 4s may be used on each local bus, and they must be positioned immediately after the master (1st and 2nd module):

LE 4-206-AA1/AA2
LE 4-501-BS1
LE 4-503-BS1
LE 4-505-BS1
LE 4-622-CX1
LE 4-633-CX1



Arrangement of the control cabinet

The arrangement of the components in the control cabinet has a significant influence on the way the equipment or machines work. When planning, designing and installing the equipment, ensure that the power section and control section are kept separate from one another. The power section includes:

- Contactors
- Coupling modules
- Transformers
- Frequency converters
- Power converters
- DC power supply units

To effectively eliminate electromagnetic interference, we recommend subdividing the control cabinet into sections for the different power and interference levels. Simple partitions are often sufficient to reduce interference in small control cabinets.

Ventilation

A minimum clearance of 5 cm must be allowed between other components and the ventilation slots of the housing to ensure that the PS 4-300 is adequately cooled. The values specified in the technical data (see Appendix) must be observed.

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Mounting angle

The PS 4-300 must be mounted horizontally in the control cabinet as shown in the diagram below.

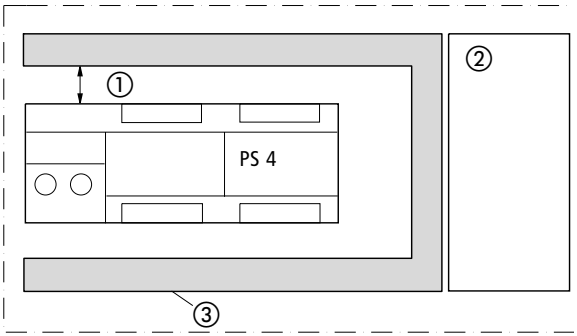


Figure 9: Horizontal installation

① At least 5 cm clearance
② Power section
③ Cable duct

The PS 4-300 must be installed horizontally if it is used with local expansion modules.

Power supply

The next few pages contain circuit diagrams of possible power supply arrangements.

Key to Figure 10:

① Main switch
② Protection for power supply units
③ Miniature circuit-breakers
④ Ground fault monitoring device
⑤ Potential equalisation rail
⑥ Reference potential for the digital inputs
⑦ Power supply for the digital outputs
⑧ Low-impedance, large contact area connection between the PS 4-300 and the ground reference potential via top-hat rail and metal mounting plate
⑨ Unassigned terminal
⑩ Input sensors
⑪ Power supply for the PS 4-300
⑫ Power supply for the digital inputs
⑬ Power supply units grounded
⑭ Power supply units ungrounded



When using an ungrounded power supply you must implement an insulation monitoring circuit (IEC 60 204, Part 1). The 24 V DC supply must be a safety extra-low voltage acc. to IEC 60 204-1 or IEC 60 364-4-41 for potentially isolated operation.

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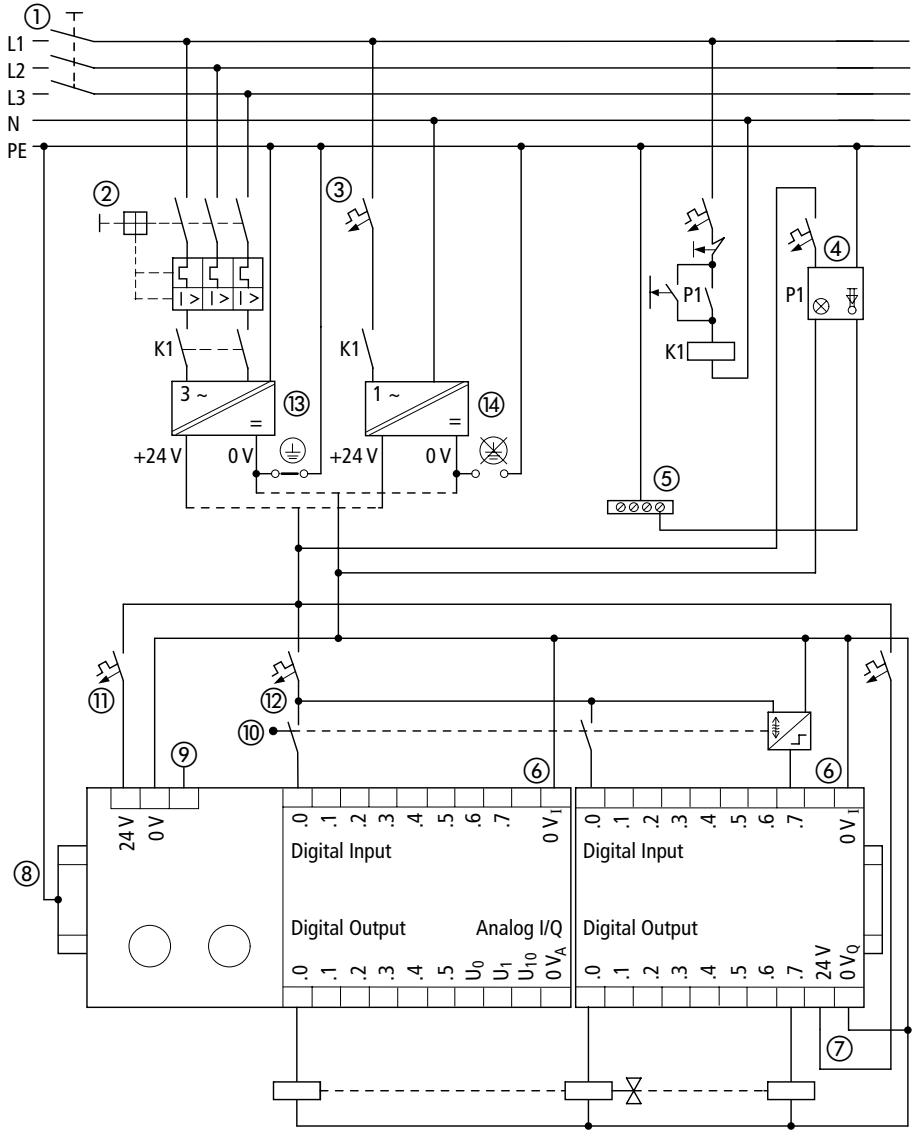


Figure 10: Common power supply wired for operation with/ without ground

Maintain a clearance of at least 30 cm between analog cables and power supply cables.

Avoid laying the 0 V cable for the analog signals together with the 0 V cable of the PS 4-300 and the 0 V cable for the digital inputs/outputs.

Ensure that analog actuators and encoders are electrically isolated. If potential isolation is not sufficient, the manufacturers of the analog encoder and actuator can provide suitable filters.

Key to Figure 11:

① Main switch
② Protection for power supply units
③ Miniature circuit-breakers
④ Ground fault monitoring device
⑤ Potential equalisation rail
⑥ Reference potential for the analog signals
⑦ Analog signal input from 0 to 10 V
⑧ Analog output
⑨ Low-impedance, large contact area connection between the PS 4-300 and the ground reference potential via top-hat rail and metal mounting plate
⑩ Power supply units grounded
⑪ Power supply units not grounded

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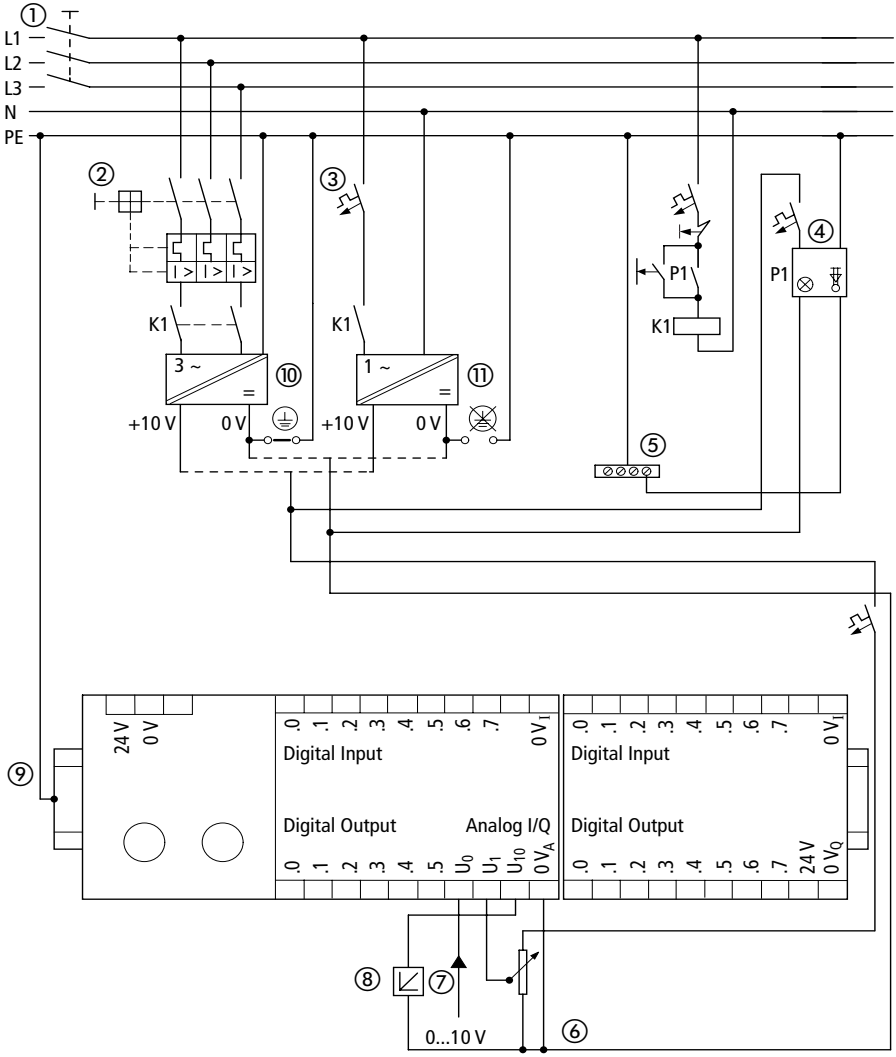


Figure 11: Power supply for the analog inputs and outputs

Connecting incremental encoders

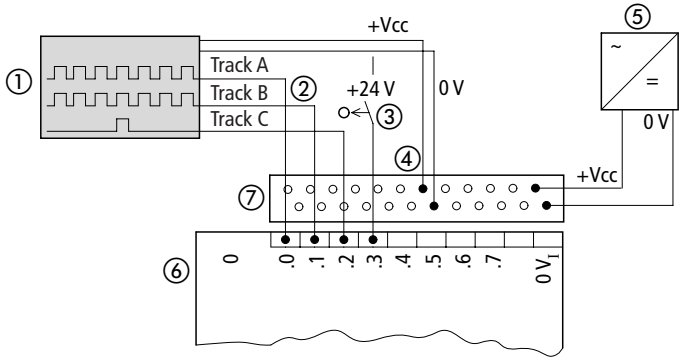


Figure 12: Connecting an incremental encoder

① Incremental encoder
② Output signals from the incremental encoder
③ Valid reference signal range
④ Power supply for the incremental encoder
⑤ Power supply unit for the incremental encoder (follow manufacturer's instructions for the incremental encoder)
⑥ Digital inputs (multi-function inputs)
⑦ ZB 4-122-KL1 twin-level terminal block

24 V incremental encoders with A, B, and C signals may be connected.

Signal B is offset 90° from signal A. This phase shift is used to determine the direction of rotation. If the rising edge of the A signal appears at the PS 4-300's signal input before the rising edge of the B signal, clockwise rotation can normally be assumed. If the rising edge of the B signal appears before that of the A signal, the direction of rotation is normally anti-clockwise.

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The C signal is the reference signal. It is used to determine the reference position for subsequent positioning tasks.

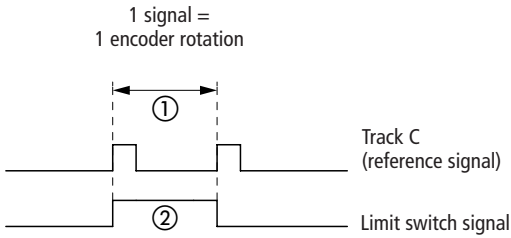


Figure 13: Reference signal

In most incremental encoders, the reference signal occurs once every turn of the encoder, although several signals will be output over the entire travelling distance ①. You should therefore determine the validity of the signal using an additional signal (limit switch signal) ②. Set up the validity range so that no other reference signal occurs within this range.

A function block (“IncEncoder”) is provided for processing the input signals of an incremental encoder. One incremental encoder may be connected to each PS 4-300..

Note!
The function block “IncEncoder” is described in the manual “Language elements for PS 4-150/-200/-300 and PS 416“ (AWB 2700-1306 GB).

Recording fast pulse trains (high-speed counter)

The PS 4-300 can be used to record pulse trains with an input frequency of up to 50 kHz.

- ▶ Apply the counting signal to input I0.0.
- ▶ Determine the counting direction via input I0.1.

The counting direction is determined as follows: if there is a high signal at input I 0.1, the count is incremented, if the signal is low, the count is decremented.

The counter status can be scanned using the operands ICW, ICD, ICPW, ICPD and then further processed in the application program.

Avoiding interference

Cabling and wiring

Cables should be divided into the following categories:

Power cables (e.g. heavy current cables or cables to current converters, contactors or solenoid valves)

Control and signal cables
(e.g. digital input cables)

Measuring and signal cables
(e.g. fieldbus cables).



Power, control and signal cables must be laid as far apart from each other as possible in order to prevent capacitive and inductive coupling. If separate cabling is not possible, then those cables that are the interference source must be screened without fail.

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In order to keep interference to a minimum ensure that the cabling inside and outside of the control cabinet is carried out correctly. Proceed as follows:

- Avoid long, parallel cable runs with cables of different power ratings next to one another.
- Separate AC cables from DC cables.

  Keep the following minimum clearances:

  At least 10 cm (approx. 4 inches) between power cables and signal cables

  At least 30 cm (approx. 12 inches) between power and data/analog cables.
- When laying cables ensure that supply and return lines of a circuit are kept together. The opposing direction of current flow makes the sum of all currents zero, so any fields that are produced are balanced out.

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① Cover
② Communication cables
③ Cable duct
④ Measuring cables, analog cables
⑤ Control cables
⑥ Power cables
⑦ Continuous partition

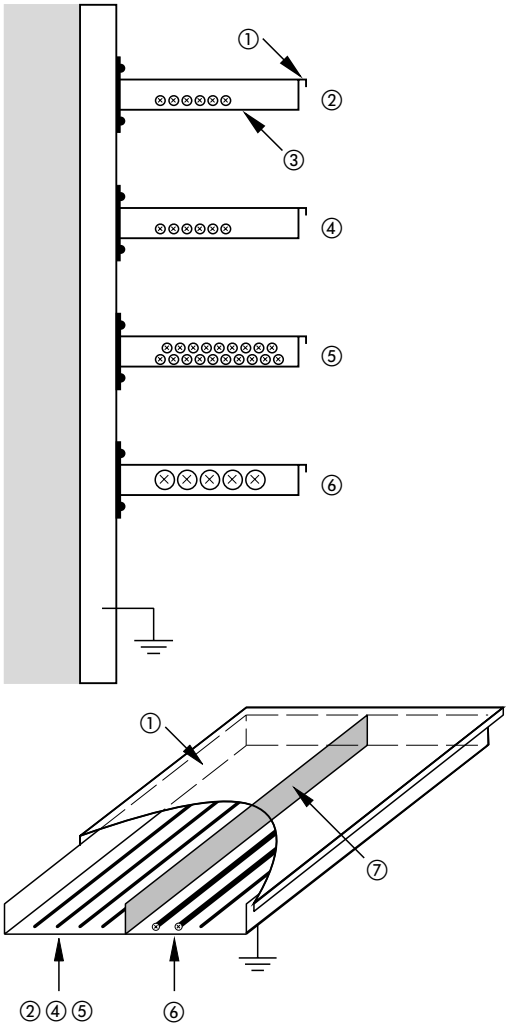


Figure 14: Using separate ducts for power and signal cables

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Suppressor circuits for interference sources

- Install all suppressor circuits as close as possible to the source of interference (contactors, relays, valves, etc).



Suppressor circuits should be provided for all switched inductances.

Screening

- Use only screened cables for the programming device interface (PRG) and Suconet K interface of the PS 4-300.

As a general rule, the lower the coupling impedance, the better the screening effect.

Lightning protection

External lightning protection

All cables which are laid between two buildings must be screened, ideally using metal conduits. Elements to protect against overvoltage, such as varistors or other types of lightning arrester, should be used for signal cables. The cables should ideally be protected at the point at which they enter the building, and certainly no later than the entry to the control cabinet.

Internal lightning protection

Internal lightning protection includes all measures that reduce the effects of the lightning current and its electrical and magnetic fields on the metal installations and electrical systems inside a building. Such measures include:

- Lightning protection equipotential bonding
- Screening
- Overvoltage protection devices.

Further information on this subject is provided in the following Moeller manuals:

- Electromagnetic compatibility (EMC) of automation systems (TB 27-001-GB)
- Electromagnetic compatibility (EMC) of machines and equipment (TB 02-022-GB)

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3 Mounting

Mounting on top-hat rail

Proceed as follows to mount the PLC on a top-hat rail:

- ▶ Place the module on the top-hat rail so that the top edge of the rail latches into the groove.
- ▶ Insert a screwdriver ① into the slot of the sliding clip and lever the clip down ②.
- ▶ Press the module onto the top-hat rail ③.
- ▶ Release the sliding clip. It will then snap into position behind the top-hat rail.
- ▶ Check that the module is seated firmly.

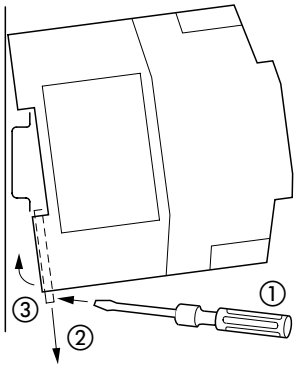


Figure 15: Mounting on a top-hat rail

Mounting on fixing feet

Proceed as follows to mount the PLC on fixing feet:

- ▶ Press the feet in so that they snap into position ①.
- ▶ Check that the PLC is seated correctly. The lug must latch in the hole ②.
- ▶ Fasten the feet to the mounting plate with M4 screws ③.
- ▶ Create a low-impedance connection between the device and the mounting plate over a large surface. When you do so, the contact springs beneath the device must touch the mounting plate.

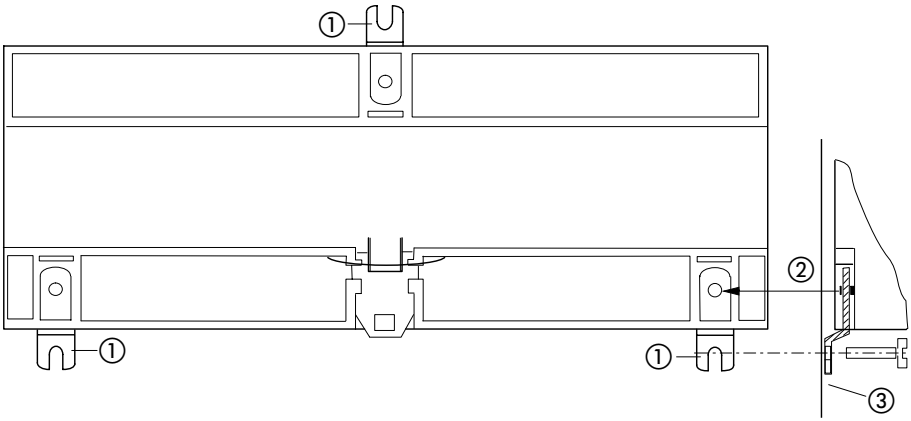


Figure 16: Mounting on fixing feet

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4 Topology Configuration

General

The Sucosoft S 40 graphical topology configurator can be used to configure your automation system. Use it to select network components, position them where you want them in the network and specify the communication conditions via dialog boxes. Typical network components include:

PS 4-... master PLC

Slaves without their own CPU. These are used in addition to the remote inputs and outputs, such as EM 4-... expansion modules, LE 4-... local expansion modules, RMQ... operating panels, MI 4-... display units, etc.

Slaves with their own CPU, such as slave PLCs.



The theoretical principles for configuring a device are described below. They are also illustrated with reference to a specific example.

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Configuring stations

Which devices have to be configured?

Every line in a Suconet K network is assigned to a single master. The master is the first logical station on the line and controls all the other stations connected to that line, which are known as slaves. A separate configuration is created for each master. The configuration contains:

- All the local components of the master (basic unit and any local expansion modules)
- All slaves that are connected to the same line as the master. It is important to differentiate between slaves that have their own CPU and those that do not:

Slaves with CPU
Slaves with CPU are configured twice:

Firstly, they are slaves on the same line as the master and are therefore specified in the master's configuration. In this case, only the basic unit is specified, and not any local expansion modules that might be connected to it.

Secondly, these slaves run their own application program and thus act as masters in their own right. As masters, they have a separate configuration which describes the actual station (basic unit), all local expansion modules and any other stations that are connected to it.

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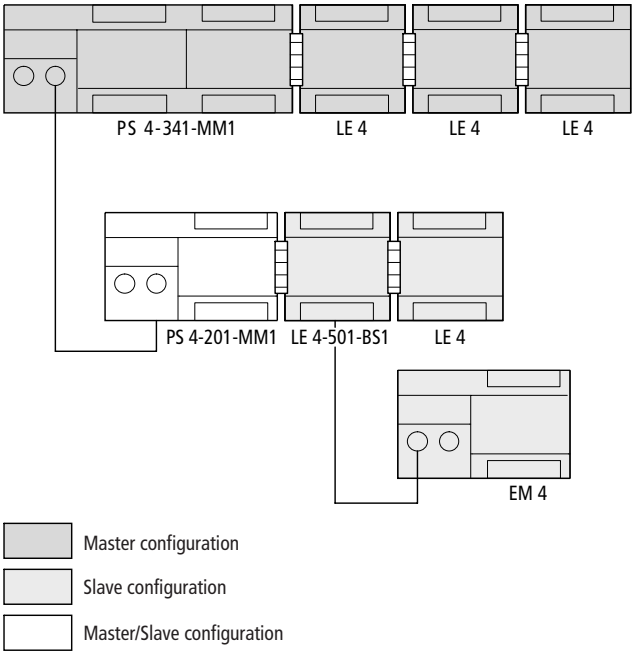


Figure 17: Double configuration of a slave with CPU

Slaves without CPU
In this case, the slave (basic unit) and all its local components are described in the master configuration.

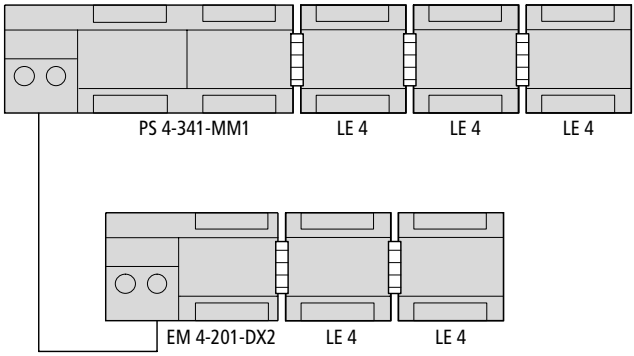


Figure 18: Configuration of a slave without CPU in the master configuration

How are the stations configured?

The topology configuration contains an address for every station. This address is determined by the station's position in the network and is made up of the line, station and module number. It is automatically allocated by the topology configurator:

Line number
Line numbers are allocated from left to right in ascending order. The first line is given number "1" and the master is always allocated line number "0".

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Station number
Station numbers are allocated from top to bottom. The master always has number “0” and the first slave has number “1”, and so on.

Module number
Module numbers are allocated from left to right in ascending order. The basic unit is always given number “0”, the first local expansion module number “1”, and so on.



In the Sucosoft S 40 topology configurator, the numbers of the components are displayed above each module. The sequence of numbers also corresponds to the first three digits of the variable address.

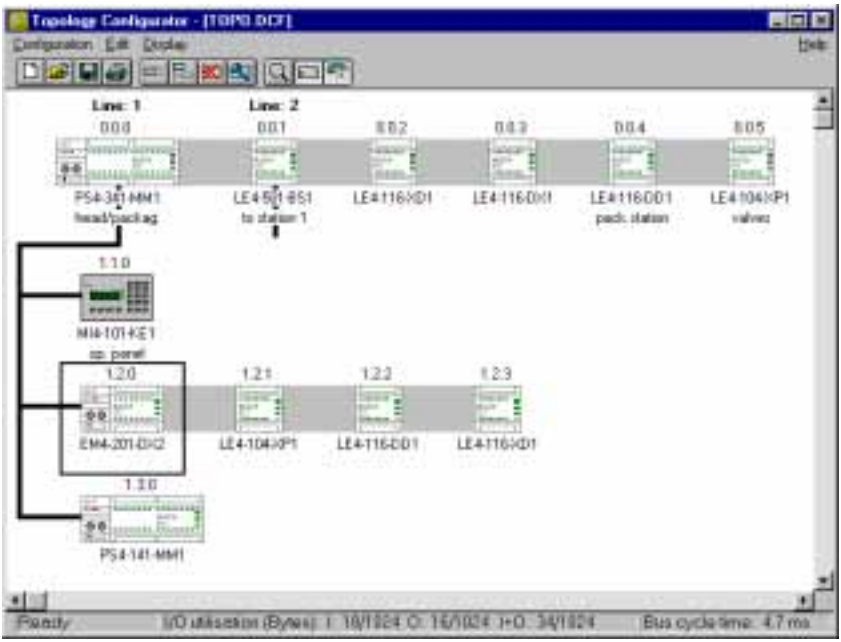


Figure 19: Station addressing in the topology configurator

Overview of the configuration data

The following table contains an overview of the configuration data for the PS 4-300. The data differs according to whether the PLC is used as a master or slave with CPU.

Table 1: Station configuration (basic unit)

	Master	Slave with CPU	
		(m)	(s)
Line	0	1	0
Station	0	1 to 30	0
Module	0	0	0

(m) = Configuration on master side
(s) = Configuration on slave side

Setting PS 4-300 parameters

The communication conditions between the individual stations are defined in the parameter dialog boxes of the Sucosoft S 40 Topology Configurator.

▶ For this open the Parameters dialog via ‹Edit → Set Parameters› in the topology configurator for PS 4-300 and set the following parameters:

General settings
(Suconet K master/slave, Transparent mode),

Analog general,

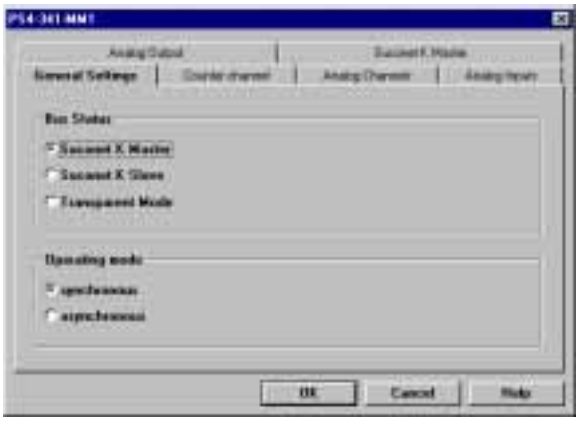
Analog inputs and

Analog output

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General settings

▶ Open ‹Edit → Parameters → General Settings›.



Bus Status:

▶ Enter whether the PLC is to run as “Suconet K master”, “Suconet K slave” or in “Transparent mode” in the appropriate dialog box (see following sections).

Operating Mode:

▶ Set whether data exchange is to be carried out via the Suconet K interface synchronously or asynchronously to the user program cycle.

Suconet K master

▶ Click the Suconet K Master tab.

Requirements: Master must be selected as Bus Status in the General Settings dialog box. The following dialog box will appear:



Enter here the transmission speed of the data exchange via Suconet K:

187.5 kBaud:

▶ Select 187.5 kBaud as the data transfer rate if Suconet K1 stations are also connected to the Suconet K line.

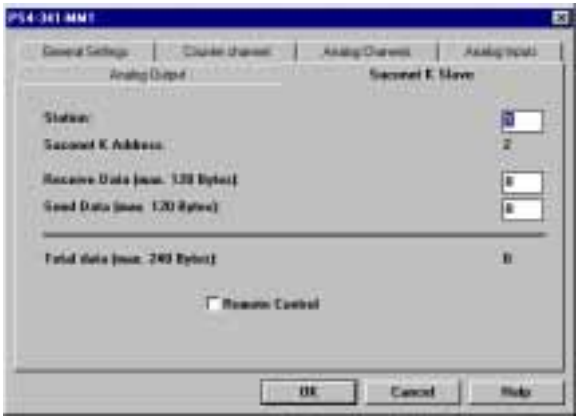
375 kBaud:

▶ Select 375 kBaud as the data transfer rate if only Suconet K stations are connected to the Suconet K line.

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Suconet K slave

▶ Click the Suconet K Slave tab.
Requirements: Slave must be selected as Bus Status in the General Settings dialog box. The following dialog box will appear:



Enter the following in this dialog box:

Station Number:
The station number is the ID number of the station on the Suconet K line. The station number for a master is alwas “0”. The station number for a slaves starts from “1” in ascending order. Enter the number required. This will be displayed in the configuration of the relevant master.

Suconet K Address:
This shows the internal Suconet K address. This entry cannot be manipulated. The Suconet K address is always “1” higher than the station number.

Receive data:
Number of data bytes that the slave is to receive from the master. The number of receive data bytes must match the set number of send data bytes from the master.

Send data:
Number of data bytes that the slave is to send to the master. The number of send data bytes must match the set number of receive data bytes of the master.



Receive/send data bytes are always defined from the point of view of the device for which the configuration is created. The number of possible send/receive data bytes have the following limits:

Send/Receive data	Bytes
Max. number of send data bytes (Output) per station	120
Max. number of receive data bytes (Input) per station	120
Max. total number of send / receive data bytes (Output/Input)	784

Remote Control:
Check the box if the slave is to switch between “Halt” or “Run” simultaneously with the master.

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Transparent mode

▶ Click the Transparent Mode tab.

Requirements: Transparent mode must be selected as Bus Status in the General Settings dialog box. The following dialog box will appear:



Baud Rate:
The baud rate defines the maximum data transmission speed of the stations. Select the highest possible baud rate for the stations connected.

Parity:
This parameter defines whether a CRC check is to be carried out with even or odd parity or not at all.

Stop bit:
The Stop bit is not a bit in the real sense of the word. It defines the time interval between characters. Refer to the relevant manual of the connected device for the correct setting.



Transparent mode is supported in the user program via the “SCO” function block (see the manual “Language Elements for PS 4-150/-200/-300 and PS 416“, AWB 2700-1306 GB).

Set counter channel parameters

▶ Open the dialog box ‹Edit → Set Parameters → Counter Channel›.



Not Used:
Select this setting if the digital inputs are not to be used as a “High-speed counter” neither as an “Incremental encoder”. This setting is the default setting.

Up/down counter (“CounterAlarm” function block): If you wish to use the digital inputs I0.0/I0.1 as up/down counters you can specify a start value. The value range of 0 to 4 294 967 295 is available. The default setting is 0.

Analog general

▶ Open the dialog box ‹Edit → Set Parameters → Analog General›.



The analog inputs (%IAW0.0.0.4 and %IAW0.0.0.6) and the analog output (%QAW0.0.0.0) are read and written at the start and end of the user program cycle. The analog inputs and the output can also be addressed via direct peripheral access (%IPAW and %QPAW) by the user program.

Averaging:
The averaging function is only available for the analog inputs “2”“ and “3”. No averaging is available here for the input channels “0” and “1” of the integrated setpoint potentiomenters of the PS 4-300 and the analog output.

If Averaging has been activated, the mean analog value of the most recent measured values will be formed. The number of values from which the average is taken and the relevant scanning interval can be set.

When this function is started, the first measured value of the channel is taken as the mean value. Averaging is then started from this point on, thus providing values before the scan time for the set number of values for averaging has elapsed.

If Averaging has been activated, the analog inputs %IAW and %IPAW are always mean values. Actual analog values are only read if Averaging has been deactivated.

Scan interval: Constant time frame in which the PS 4-300 reads new measured values for analog channels 0 to 3. Values from 10 to 50000 ms are permissible.

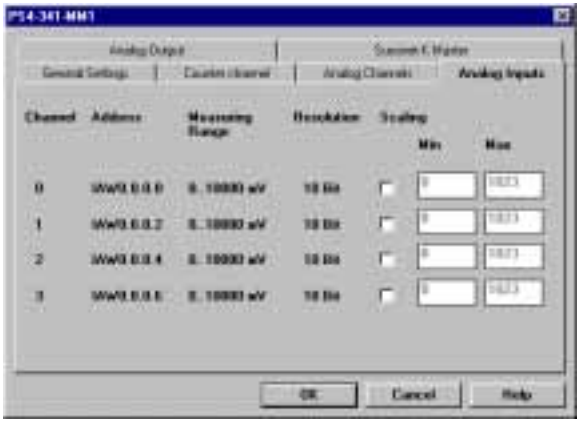
Number of values: Number of the most recent values taken for averaging. Values 2, 4, 8, 16 are permissible.

Averaging over: Time in which averaging takes place. The product of Scan interval × No. of values.

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Setting analog input parameters

▶ Open the dialog box ‹Edit → Set Parameters → Analog Inputs›.



Channel:
Number of the analog channel.

Address:
Operand address of the input channel for addressing from the user program.

If you which to address values directly via peripheral access from the user program, declare the input variables with %IPAW.

Measuring range:
Value range of physical measured values provided by the input channel.

Resolution:
Bit resolution of the measured value recorded.

Scaling:
Value range of the input operand in which the physical measuring values are converted with a linear function.

Scaling can be activated for every channel separately. Values between –32768 and +32767 are permissible for Min and Max. Min must always be less than Max.

When scaling is deactivated, the scaling range corresponds to the 12-bit resolution: 0 to 1023.

Setting analog output parameters

▶ Open the dialog box ‹Edit → Parameters → Analog Output›.



Channel:
Number of the output channel.

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Address:
Operand address of the output channel for addressing from the user program. If you wish to address the values directly from the user program via a peripheral access, declare the output variables with %QPAW in the program.

Resolution:
Bit width in which the physical measuring range is represented internally.

Scaling:
Value range of the output operand in which the values are converted linearly to physical measuring values. When Scaling is activated, values between - 32768 and +32767 are permissible for Min and Max. Min must always be less than Max.

When Scaling is deactivated the scaling range is 0 to 4095.

Configuration example

The example contains device configurations for master and slaves with their own CPU. This units are highlighted in the figure.



Remember that slaves with a CPU must be configured twice. Once for the master and once for the slave.

Legend for Figure 20

Master: Device A
Slaves with CPU: Devices B, C, D
Slaves without CPU: Devices E, F, G

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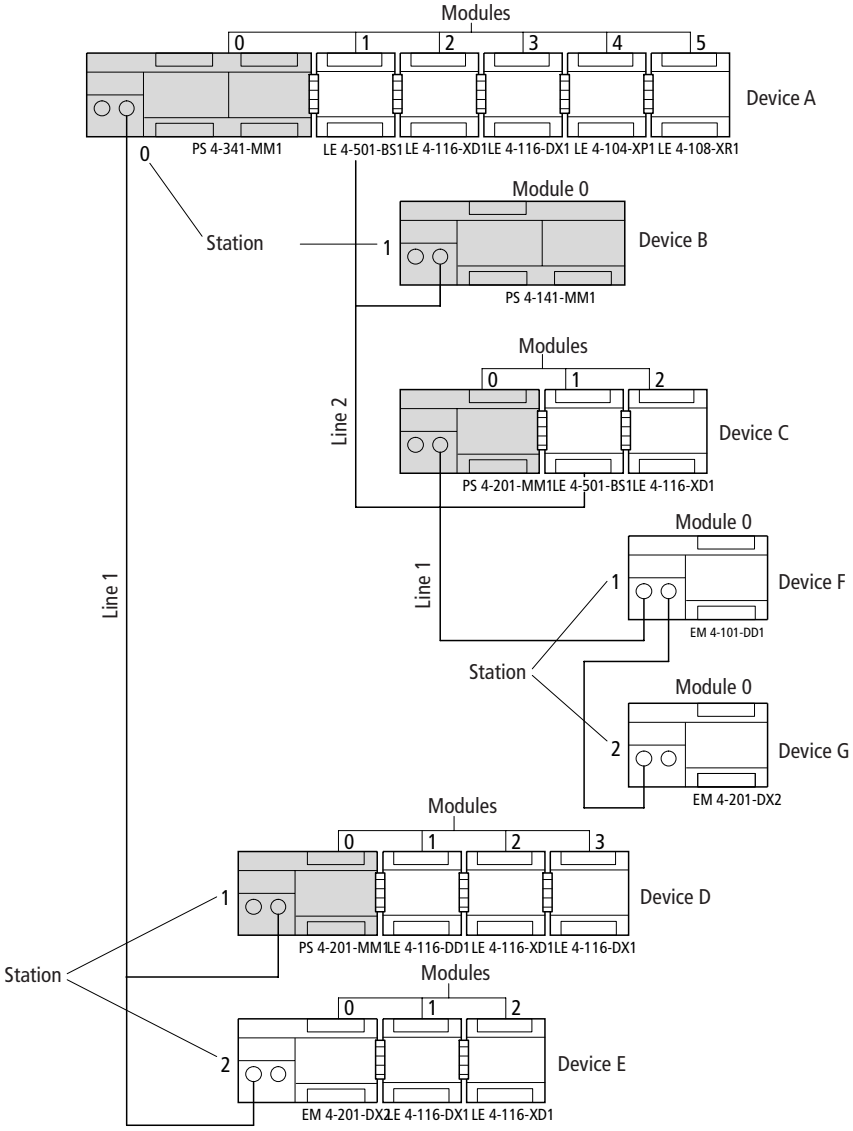


Figure 20: Configuration example

Configuration of device A

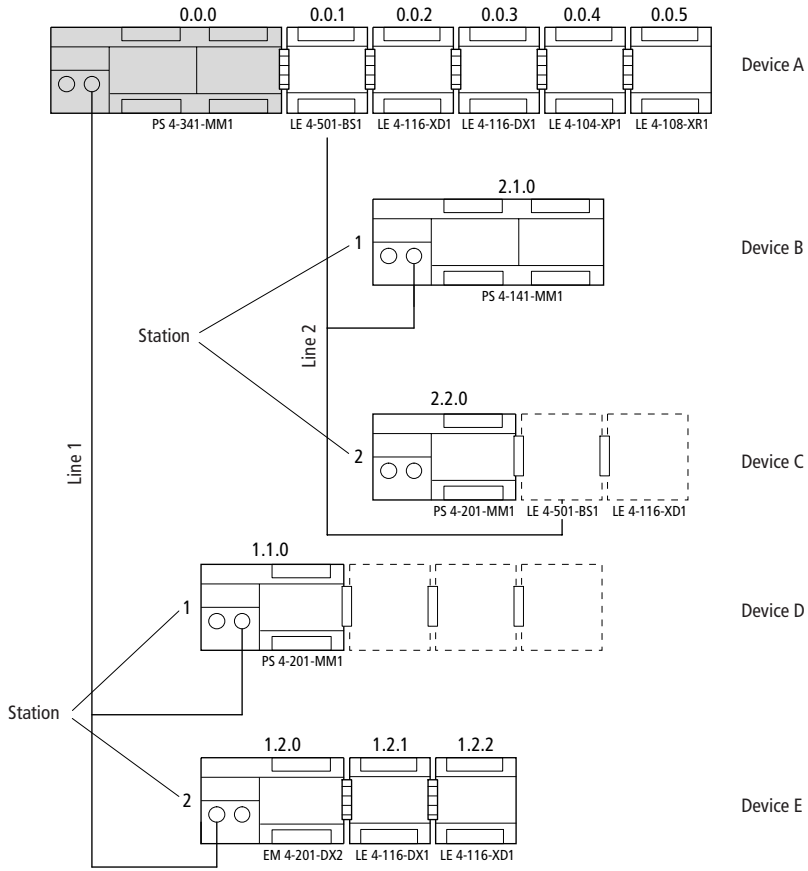


Figure 21: Configuration of device A

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Table 2: Configuration of device A

Device	Type	Line	Stn.	Module	Parameters
A	PS 4-341-MM1	0	0	0	Bus status: Master Baud rate: 375 kBit/s CRC status: OFF
	LE 4-501-BS1	0	0	1	Bus status: Master Baud rate: 375 kBit/s CRC status: OFF
	LE 4-116-XD1	0	0	2	–
	LE 4-116-DX1	0	0	3	–
	LE 4-104-XP1	0	0	4	–
	LE 4-108-XR1	0	0	5	–
B	PS 4-141-MM1	2	1	0	Input data: 20 Output data: 10
C	PS 4-201-MM1	2	2	0	Input data: 40 Output data: 38
D	PS 4-201-MM1	1	1	0	Input data: 25 Output data: 12
E	EM 4-201-DX2	1	2	0	–
	1. LE 4	1	2	1	–
	2. LE 4	1	2	2	–

Configuration of device B

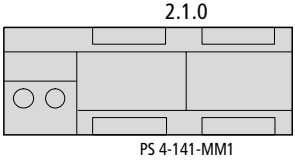


Figure 22: Configuration of device B

Table 3: Configuration of device B

Device	Type	Line	Stn.	Module	Parameters
B	PS 4-141-MM1	0	0	0	Bus status: Slave Input data: 10 Output data: 20 Remote control: OFF

Configuration of device C

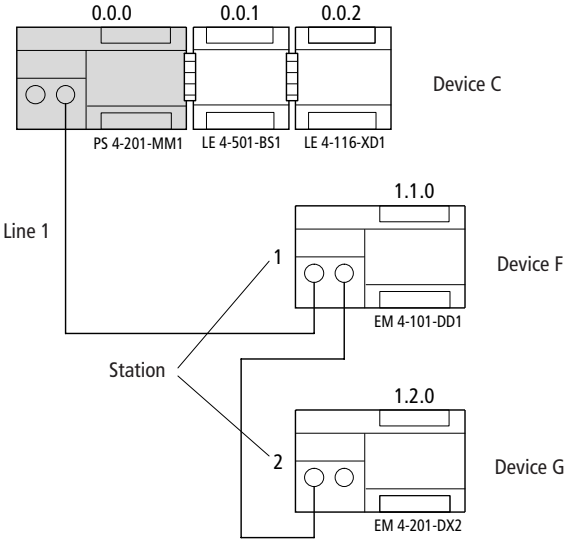


Figure 23: Configuration of device C

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Table 4: Configuration of device C

Device	Type	Line	Stn.	Module	Parameters
C	PS 4-201-MM1	0	0	0	Bus status: Master
	1. LE 4 (LE 4-501-BS1)	0	0	1	Bus status: Slave Input data: 38 Output data: 40 Remote control: OFF
	2. LE 4	0	0	2	–
F	EM 4-101-DD1	1	1	0	–
G	EM 4-201-DX2	1	2	0	–

Configuration of device D

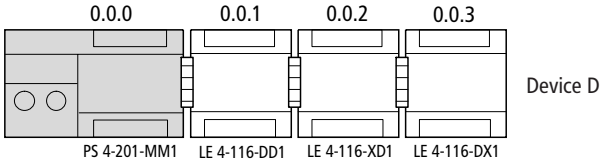


Figure 24: Configuration of device D

Table 5: Configuration of device D

Device	Type	Line	Stn.	Module	Parameters
D	PS 4-201-MM1	0	0	0	Bus status: Slave Input data: 12 Output data: 25 Remote control: OFF
	1. LE 4	0	0	1	–
	2. LE 4	0	0	2	–
	3. LE 4	0	0	3	–

5 Slave Addressing

Slaves without CPU

The master and slaves without CPU can communicate with one another using the Suconet K or K1 protocol. The master selects the protocol automatically according to the capabilities of the slaves. It is not necessary to set the receive or send data length in the topology configurator. Suconet K/ K1 selects the appropriate message length and automatically addresses the relevant data areas in your application.

This means that remote I/O operands can be accessed in exactly the same way as local I/O operands.

The general syntax rule for addressing I/O operands is:

```
Operand Data type Line.Station.Module.Byte.Bit
```

If the PS 4-300 is used as the master, the following slave operands can be addressed using the values specified in the table:

Table 6: Operand addressing for slaves without CPU

Operand	Line	Station	Module	Word/byte	Bit
I/Q/IS	1 to 3 (0 = master)	1 to 30 (line 1) 1 to 8 (line 2, 3) (0 = master)	1 to 5 (master local expansion modules) (0 = master basic unit)	0, 1, 2, ...	0 to 7
IB/IAB/ISB QAB					–
IW/QW/ IAW/ QAW/ICW			1 to 6 (slave local expansion modules) (0 = slave basic unit)	0, 2, 4, ...	–
ID/QD/ICD				0, 4, 8, ...	–

I = Input; Q = Output
IS = Status/diagnostics
IA = Analog input, QA = Analog output,
IC = Counter (function block)

Example
You wish to scan the inputs of slaves 1 and 2 in the diagram below.

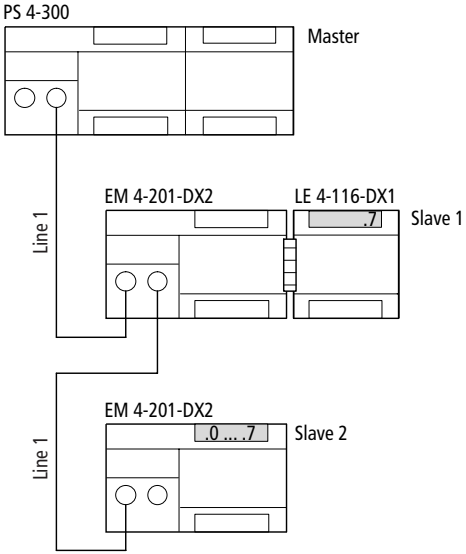


Figure 25: Configuration example for scanning the inputs of remote slaves

The syntax for scanning the inputs can be derived from the configuration:

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Table 7: Syntax for addressing slaves without CPU

IL program in ...	Data flow	Operand	Data type	Line	Stn.	Module	Byte/word	Bit	S 40 syntax
Master	Master ↑ Slave 1	I	Bit	1	1	1	0	7	LD% I1.1.1.0.7
	Master ↑ Slave 2	IB	Byte	1	2	0	0	–	LD% IB1.2.0.0

Slaves with CPU

The input and output operands cannot be accessed directly during communication between the master and slaves with CPU. The communication data must therefore be addressed using the RD/SD operands.

The general syntax rule for addressing the operands is:

Operand Data type Line.Station.Module.Byte.Bit

If the PS 4-300 is used as the master, the following slave operands can be addressed using the values specified in the table:

Table 8: Operand addressing for slaves with CPU

Operands	Line	Station	Module	Word/byte	Bit
RD/SD IS	1 to 3 (0 = master)	1 to 30 (line 1) 1 to 8 (line 2, 3) (0 = master)	1 to 5 (master local expansion modules) (0 = master basic unit)	0, 1, 2, ...	0 to 7
RDB/SDB ISB					–
RDW/SDW				0, 2, 4, ...	
RDD/SDD				0, 4, 8, ...	

RD = Receive data, i.e. set number of receive bytes
SD = Send data, i.e. set number of send bytes
IS = Status/diagnostics

Example

The PS 4-300 (master) exchanges “word” data with a slave with CPU. The number of send and receive bytes is defined when the stations are configured in the Sucosoft S 40 topology configurator (See "Topology Configuration" on page 37).

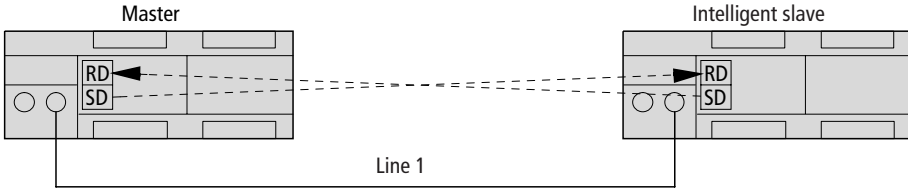


Figure 26: Configuration example for sending and receiving communication data to/from slaves with CPU

The syntax for sending and receiving the data can be derived from the configuration.

Table 9: Syntax for addressing slaves with CPU (data type: word)

IL program in ...	Data flow	Operand	Data type	Line	Stn.	Module	Byte/ word	Bit	Syntax
.Master	Master ← slave Master → slave	RDW/ SDW	Word	1	1	0	0	–	RDW1.1.0.0/ SDW1.1.0.0
Slave	Master ← slave Master → slave	RDW/ SDW	Word	0	0	0	0	–	RDW0.0.0.0/ SDW0.0.0.0

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6 Operation

Power-up behaviour

The PS 4-300 runs a system test when the power is switched on. The PLC then switches to the “Ready” or “Run” state if no hardware errors are detected.

The system test consists of the following routines:

- Memory test
- Hardware test
- Operating system test
- User program test

The results of the test are indicated by the “Ready”, “Run” and “Not Ready” LEDs. If the test is successful, these LEDs are lit continuously; if an error is detected, they flash.

The “Run” and “Not Ready” LEDs will flash if the PLC does not have an operating system, and the PLC is in boot status.

The PLC’s status depends on the position of the operating mode selector switch (See Table 10).

Shutdown behaviour

The PLC’s power supply detects when the power supply is switched off. Voltage dips of ≤ 10 ms can be bridged by the power supply unit. If a longer voltage dip occurs, the internal 5 V supply remains stable for at least another 5 ms. The microcontroller uses this time to save all the data needed to restart in the memory areas provided for this purpose.

Operating states of the PLC

The PLC has the following operating states: “Run”, “Ready”, “Not Ready”:



Communication with the PC is possible in all three operating states. This means, for example, that the current operating state of the PLC, the real-time clock and the diagnostic bits can always be read.

Ready

The “Ready” state has the following characteristics:

There is a user program in the PLC but the program is not running;

The outputs have been reset and disabled.

The PLC can be switched to “Ready”:

By pressing the “Reset” button, if the operating mode selector switch is set to “Halt”;

When the power is switched on, if the operating mode selector switch is set to “Halt”;

Using the programming software on the PC;

In slave mode, if the master switches to “Halt” (stop) and you have set the “Remote control” function to “ON” in the Sucosoft topology configurator.

Run

The user program is executed in the “Run” state.

The PLC can be switched to “Run”:

By pressing the “Reset” button, if the operating mode selector switch is set to “Run” or “Run M reset”;

When the power is switched on, if the operating mode selector switch is set to “Run” or “Run M reset”;

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Using the programming software on the PC;

In slave mode, if the master switches to “Run” and you have set the “Remote control” function to “ON” in the Sucosoft topology configurator.

Not Ready

The user program is not executed in the “Not Ready” state.

The PLC is switched to “Not Ready”:

In response to a hardware error or

In response to a serious error in the user program (e.g. cycle time violation).

Once the error has been rectified and acknowledged, the “Not Ready” can be cancelled as follows:

By pressing the reset button; if the operating mode selector switch is set to “Run M reset”, the PLC will switch to “Run” status;

By switching the power supply off and on again; if the operating mode selector switch is set to “Run M reset”, the PLC will switch to “Run” status;

Using the programming software on the PC.

Overview

Table 10: Overview of the operating states

Position of operating mode selector switch	PLC status before the action	Action		PLC status after the action (DSW = diagnostic status word)
		Press Reset button	Switch power off/ on	
1 (Halt)	Run	×	–	Ready
	Ready	×	–	Ready; DSW acknowledged
	Not Ready	×	–	Ready; DSW acknowledged
	Run	–	×	Ready, after remaining cycle processed[1)]
	Ready	–	×	Ready[1)]
	Not Ready	–	×	Not Ready
2 (Run)	Run	×	–	Acknowledgement of DSW
	Ready	×	–	Run[3)]
	Not Ready	×	–	Via “Ready” to “Run” (depends on setup)[2)]
	Run	–	×	Run (with start condition)[1)], after remaining cycle processed
	Ready	–	×	Run (depends on system parameter setup)[1)], [3)]
	Not Ready	–	×	Via “Ready” to “Run” (depends on system parameter setup)[1)]
3 (Run M reset)	Run	×	–	Acknowledgement of DSW
	Ready	×	–	Run (cold start)
	Not Ready	x	–	Run (cold start)
	Run	–	×	Run (cold start)[1)]
	Ready	–	×	Run (cold start)[1)]
	Not Ready	–	×	Run (cold start)[1)]

Legend for Table 10:

1) If the programs in the memory module and the PLC’s RAM are not the same, the program in the memory module is copied to the RAM.

2) The PLC switches to “Not Ready” if the start condition was set to “Halt” in the system parameter setup, i.e. a cold start is required.

3) The PLC carries out a cold start when the PLC is started for the first time after transferring the user program or rebooting the memory module.

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Start-up behaviour

The PLC can either be cold started or warm started:

Cold start

A cold start causes all the data fields (marker areas, inputs/outputs, module parameters) to be reset. Recipe markers are retained, however. The user program is executed again from the beginning.

A cold start can be initiated as follows:

- By pressing the “reset” button if the operating mode selector switch is set to “Run M reset”, provided that the PLC is set to either “Ready” or “Not Ready”;
- By switching on the power supply if the operating mode selector switch is set to “Run M reset”;
- Using the programming software on the PC, provided that the PLC is currently set to either “Ready” or “Not Ready”.

A cold start must always be carried out after transferring a user program to the PLC.

Warm start

A warm start causes the user program to be continued from the point at which it was interrupted to the end of the cycle. The outputs and communication data are set to “0” for the remainder of this cycle. The PLC is then initialised and the program is executed. Retentive markers and variables are retained.

The procedure for setting retentive marker areas is described in the “Sucosoft S 40 user interface” manual (AWB 2700-1305-GB):

A warm start can be initiated as follows:

By pressing the “reset” button if the operating mode selector switch is set to “Run”, provided that the PLC is currently set to “Ready”;

By switching on the power supply if the operating mode selector switch is set to “Run”;

Using the programming software on the PC, provided that the PLC is currently set to “Ready”.

Transferring programs

If the user program contains no syntax errors, the compiler in the programming device (PC) translates it into code that can be understood and run by the CPU. You must then load (transfer) the user program into the RAM of the CPU, where it will be executed by the microprocessor in the “Run” state.

PC → PLC

To transfer programs from the PC to the PLC, the PS 4-300 must be in the “Ready” or “Not Ready” state, although the operating mode selector switch on the operating panel can be set to any position.

▶ Transfer the program to the PLC (see the “Test and Commissioning” section of the “Sucosoft S 40 user interface” manual, AWB 2700-1305-GB).



Refer to "Programming via Suconet K" on page 72 for details of how to transfer the user program to the PLC via Suconet K.

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PC → memory module

- ▶ Switch off the PLC and plug in the memory module.
- ▶ Switch on the PLC. The PLC must be set to “Ready” or “Not Ready”.
- ▶ Transfer the program from the PC to the memory module (see the “Test and Commissioning” section of the “Sucosoft S 40 user interface” manual, AWB 2700-1305-GB).



If there is a program in the memory module, any program in the PLC will be overwritten.

Starting the PLC with a memory module plugged in

Follow the steps given below if you wish to start the PS 4-300 with a memory module already plugged in:

- ▶ Switch off the PLC and plug in the memory module. The operating mode selector switch can be set to any position.
- ▶ Switch on the PLC. Any program in the memory module will be transferred to the PS 4-300 and the PLC will run with the set start conditions:

Table 11: Start-up behaviour with a memory module plugged in

Program	Operating system	Start-up behaviour
Same user program on PLC and memory card	Operating system present/not present on memory card	No change
Different user programs on PLC and memory card	Operating system present on memory card	The operating system and user program are loaded from the memory card. The operating system and user program in the PLC memory are overwritten.
Different user programs on PLC and memory card	Operating system not present on memory card	The program is loaded from the memory card. Any program in the PLC memory is overwritten.

Programming via Suconet K

Several networked stations can be programmed and test and commissioning functions can be run from a single PC attached to Suconet K. This method applies to all stations that are connected to the line served directly by the master PLC. If one of these stations (e.g. LE 4-501-BS1) is at the head of another line, it will not be possible to access the remote stations attached to this line (dashed line in the following diagram). Further information on this topic can be found in the “Sucosoft S 40 user interface” manual (AWB 2700-1305-GB).

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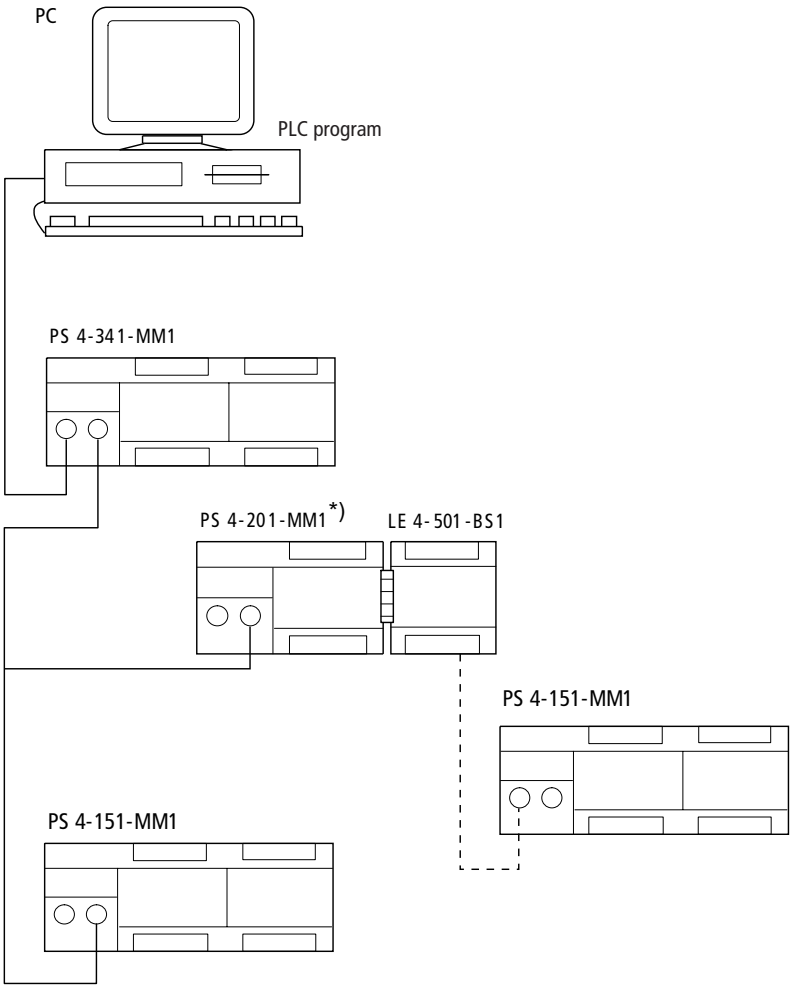


Figure 27: Network programming

*) Programming via Suconet K using the PS 4-201-MM1 requires version 05 or higher.

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7 Test/Commissioning/Diagnostics

Status LEDs

The coloured light-emitting diodes (LEDs) enable quick and easy diagnosis of the PLC's functions and the status of the inputs and outputs can be seen at a glance.

Table 12: Meaning of the LEDs

LED	Status display	Meaning
Ready	Off	–
	On (yellow)	Self test successfully completed and CPU ready to start
	Flashing (for 3 seconds)	Suconet K error, e.g. station disconnected
Run	Off	Program in the "Halt" state (stopped)
	On (yellow)	User program is running
Not Ready	Off	CPU, no user program error
	On (red)	CPU error Severe error in user program
Battery	Off	Battery working correctly
	On (red)	Battery error[1)]
Status of inputs	Off	Input not activated
	On (green)	Input activated
Status of outputs	Off	Output not activated
	On (green)	Output activated



[1)] **Caution!**
Data may be lost if the battery does not supply sufficient power. Make sure that the power is switched on when you change the battery.

Diagnostics

Status information is scanned hierarchically via the diagnostic status word and the station's diagnostic bytes, as well as the diagnostic bytes of any local expansion modules connected to it.

Diagnostic status word

The diagnostic status word provides an overview of the various error messages. It consists of 16 bits. The diagnostic bits are subdivided into two categories:

Category D (diagnostics):

Category E (errors):

The category D diagnostic bits are for information. They can be displayed if the PLC is in the "Run" or "Ready" state.

Category E diagnostic bits switch the PLC to the "Not Ready" state when they appear.

In Sucosoft S 40, diagnostic bits are displayed in the "System diagnostics" window (see the "Test and Commissioning" chapter of AWB 2700-1305-GB).

The diagnostic bits can also be displayed via the input LEDs on the PLC using the follow procedure:

▶ Set the operating mode selector switch to "Halt" (stop) and refer to the following tables to interpret the operating state (do not press the "reset" button and the PLC will remain in the "Run" state). Set the operating mode selector switch to "Run" or "Run/M reset" and press the "reset" button to acknowledge the error message.

Table 13: Diagnostic bit display

LED	Run/Ready	Not Ready
.0.0	–	–
.0.1	DDS	ENR
0.2	DDK	ERT
.0.3	DLS	EDR
.0.4	DLK	EPM
.0.5	DMC	EWD
.0.6	DBM	EDC
.0.7	DAC	ECT
1.0	–	EHM
1.1	–	ECM
1.2	–	ECL
1.3	–	ETR
1.4	–	EIL
1.5	–	EOS
1.6	–	ECA
1.7	–	EAH

Table 14: Description of the diagnostic bits (Run/Ready)

Code	Meaning	Description of the error
DDS	Diagnostics Remote status	Error in the status of a remote expansion module. The basic unit's Suconet K interface has identified an error at one of the networked stations. The error can be located by checking the diagnostic byte of each of the stations.
DDK	Diagnostics Remote configuration	Error in the configuration of a remote expansion module. Possible causes: – Fewer Suconet stations than specified in the topology configurator – Fault in connection to station – Data transmission error
DLS	Diagnostics Local status	Error in the status of a local expansion module, e.g. digital outputs short-circuited.

Code	Meaning	Description of the error
DLK	Diagnostics Local configuration	Error in the configuration of a local expansion module; e.g. wrong/defective LE 4
DMC	Diagnostics Memory card	Backup not present; the memory module is defective or not present.
DBM	Diagnostics Battery module	The battery voltage is too low. Replace the battery.
DAC	Diagnostics Power failure	Power supply failure

Table 15: Description of the diagnostic bit (Not Ready)

Code	Meaning	Description of the error
ENR	Restart only with retentive marker reset	This message appears if you selected “Halt” option under “Start after Not Ready” in the PS 4-300 configuration and you attempted a warm start after a category “E” error occurred. In this situation you can only restart with a retentive marker reset.
ERT	Error Run-Time	The PLC identified a run-time error; e.g. array index violation.
EDR	Error Data Retention	Data retained in the operating system is corrupted.
EPM	Error Program Module	Error in program memory; error identified in the user program’s checksum.
EWD	Error Watch Dog	CPU failure; the CPU hardware watchdog has indicated a failure.
EDC	Error DC	DC supply failure in the basic unit
ECT	Error Cycle Time	Cycle time violation; the maximum cycle time set in the program was exceeded.
EHM	Memory error	The PLC’s memory is defective.
ECM	Error CRC Memory	The operating system is defective.
ECL	Error Clock	The real-time clock is defective.
ETR	Error Timer	The PS 4-300’s timer is defective.

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Code	Meaning	Description of the error
EIL	Error Illegal Code	An attempt was made to execute an illegal controller operation.
EOS	Error Operating System	An error was detected in the operating system. The PLC will have to be restarted.
ECA	Error CRC Application	The application has become corrupted.
EAH	Error Application Halt	The application stopped of its own accord.

Diagnostic byte for Suconet K stations

The diagnostic bytes for each station and any local expansion modules connected to them can be scanned to obtain more detail about the information contained in the diagnostic status word. Only read access is possible.

Every station and local expansion module on the Suconet K line has its own status information. The available information will depend on the type of Suconet station or local expansion module that is connected, i.e. the status information differs according to the type of station.



There is a group message containing status information for every station on the Suconet K line. This information relates to the basic unit and any local expansion modules (LE) connected to it.

The status information indicates, for example, whether

The device ID is incorrect

A device has been disconnected from the Suconet bus or is not responding

A short-circuit has occurred at a station's digital output, etc.

The status information and its meaning are described in the manuals for the individual Suconet stations and local expansion modules.

Message byte

The message byte contains information about the status of the PLC, image data relating to the networked stations, the PLC's start-up behaviour, etc. Only read access to the message byte is possible.

Table 16: Message status byte

Bit no.	Code	Meaning
0	ISA	1st cycle after start
1	IRE	1st cycle after pressing the reset button; set for the duration of one cycle
2	IFO	Static forcing active
3	REC	Remaining cycle after a warm start. The PS 4-300 executes the remainder of the cycle after a warm start.
4	ICS	This bit indicates the type of restart for the 1st cycle: 1 = cold start, 0 = warm start
5	NKD_1	New data transfer to the on-board SBI
6	NKD_2	New data transfer to the SBI of the 1st local expansion module (LE 4-501-BS1)
7	NKD_3	New data transfer to the SBI of the 2nd local expansion module (LE 4-501-BS1)

For further information on message byte, refer to the "Startup" chapter of the "Sucosoft S 40 user interface" manual (AWB 2700-1305-GB).

For further information on message byte, refer to the "PLC_Message" function block description in the manual "Language elements for PS 4-150/-200/-300 and PS 416" (AWB 2700-1306 GB).

Appendix

Accessories

Designation	Type	Description/application
Programming cable	ZB 4-303 KB1	Adapter for programming the PS 4-300 from a PC
Memory module	ZB 4-901-SF1	1 MB flash memory module for use as a user program backup and recipe memory
	ZB 4-128-SF1	128 KB flash memory (recipe memory)
Screw terminal	ZB 4-110-KL1	Screw terminal for the input/output level
Twin-level terminal block	ZB 4-122-KL1	Twin-level terminal block for distributing potential, e.g. for connecting 3-pole proximity switches to a PLC or local expansion module.
Hinged cover	ZB 4-101-GZ1	Hinged cover for labelling the inputs and outputs (PS 4, EM 4, LE 4)
Fixing foot (bracket)	ZB 4-101-GF1	Foot for screwing the PS 4 onto a mounting plate
Back-up battery	ZB 4-600-BT1	Battery for backing up the PS 4-300's RAM.
Simulator	ZB 4-108-ES1	Digital input simulator
Data cable	KPG 1-PS3	Cable between the PS 4-300 and slave; length: 0.5 m
T connector	TBA 3.1	For connecting a station to the Suconet K/K1 line
Data plug connector	S 1-PS3	5-pole DIN connector for RS 485 interface of the PS 4-201-MM1
Cable	LT 309.096	Cable, 2 × 0.5 mm^2, screened and twisted for making up Suconet K cables
Screen grounding kit	ZB 4-102-KS1	Screen grounding kit for Suconet
Snap-on mounting for the top-hat rail	FM4/TS35	Manufactured by Weidmüller, order number 068790
Clip for snap-on mounting	KLBü3-8SC	Manufactured by Weidmüller, order number 169226

Slave addressing **Receive bytes**

Slave	Byte 1	Byte 2	Byte 3	...	Last byte	Data type
EM 4-111-DR1	IBx.y.0.0					Bit, byte
EM 4-101-DD1/88	IBx.y.0.0					Bit, byte
EM 4-101-DD1/106	IBx.y.0.0	IBx.y.0.1				Bit, byte
EM 4-101-AA1 V01	IABx.y.0.0	IABx.y.0.1	IABx.y.0.2	...	IABx.y.0.5	Byte
EM 4-101-AA1 V02						
AA1B64 (8-bit/SBI)	IABx.y.0.0	IABx.y.0.1	IABx.y.0.2	...	IABx.y.0.5	Byte
AA1W33 (12-bit/SBI)	IAWx.y.0.0		IAWx.y.0.2		IAWx.y.0.4	Word
EM 4-101-AA2						
AA2B84	IABx.y.0.0	IABx.y.0.1	IABx.y.0.2	...	IABx.y.0.7	Byte
AA2W84	IAWx.y.0.0		IAWx.y.0.2	...	IAWx.y.0.14	Word
EM 4-201-DX1	IBx.y.0.0	IBx.y.0.1				Bit, byte
EM 4-201-DX2	IBx.y.0.0	IBx.y.0.1				Bit, byte, word
PS 4-1x1, passive	IBx.y.0.0	–	IABx.y.0.0		IABx.y.0.1	(Bit), byte
PS 4-1x1, active	RDBx.y.0.0	RDBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.6	Bit, byte
PS 4-141-MM1	RDBx.y.0.0	RDBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.77	Bit, byte, word
PS 4-151-MM1	RDBx.y.0.0	RDBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.77	Bit, byte, word
PS 4-201-MM1	RDBx.y.0.0	RDBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.77	Bit, byte, word
PS 4-341-MM1	RDBx.y.0.0	RDBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.119	Bit, byte, word
PS 4-401-MM1	RDBx.y.0.0	RDBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.6	Byte, word
PS 4-401-MM2	RDBx.y.0.0	RDBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.83	Bit, byte, word
PS 316 (SBI)/306	RDBx.y.0.0	RDBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.6	Bit, byte, word
EPC 335	RDBx.y.0.0	RDBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.6	Bit, byte, word
PS 3-DC	IBx.y.0.0	IBx.y.0.1	IABx.y.0.0	...	IABx.y.0.3	(Bit), byte
PS 3-AC	IBx.y.0.0	IBx.y.0.1	IABx.y.0.0	...	IABx.y.0.3	(Bit), byte
PS 3-8	IBx.y.0.0	IBx.y.0.1				Bit, byte
LE 4-501-BS1	RDBx.y.0.0	RDBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.77	Bit, byte, word
CM 4-501-FS1	IBx.y.0.0	RDBx.y.0.1	RDBx.y.0.1	...	RDBx.y.0.5	Bit, byte
SBI-AMD3	RDBx.y.0.0	RDBxBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.6	Byte, word
SBI-AMX	RDBx.y.0.0	RDBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.6	Byte, word

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Slave	Byte 1	Byte 2	Byte 3	...	Last byte	Data type
SIS type 80D0 to SIS type 80EF	RDBx.y.0.0	RDBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.6	Bit, byte, word
A 4-220.1	RDBx.y.0.0	RDBx.y.0.1				Byte, word
A 5-220.1	RDBx.y.0.0	RDBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.6	Byte, word
VTP 0-H-Tx	RDBx.y.0.0	RDBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.6	Byte, word
VTP 1/2-H-T6	RDBx.y.0.0	RDBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.17	Byte, word
ZB 4-501-UM2	RDBx.y.0.0	RDBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.23	Bit, byte, word
RMQ 16I	IBx.y.0.0	IBx.y.0.1				Bit, byte
RBI 1.1	RDBx.y.0.0	RDBx.y.0.1	RDBx.y.0.2	...	RDBx.y.0.6	Bit, byte

x = line, y = station

Send bytes

Slave	Byte 1	Byte 2	Byte 3	...	Last byte	Data type
EM 4-111-DR1	QBx.y.0.0					Bit, byte
EM 4-101-DD1/88	QBx.y.0.0					Bit, byte
EM 4-101-DD1/106	QBx.y.0.0	QBx.y.0.1				Bit, byte
EM 4-101-AA1 **V01**	QABx.y.0.0	QABx.y.0.1	QABx.y.0.2	–	QABx.y.0.4	Byte
EM 4-101-AA1 **V02**						
AA1B64 (8-bit/SBI)	QABx.y.0.0	QABx.y.0.1	QABx.y.0.2	–	QABx.y.0.4	Byte
AA1W33 (12-bit/SBI)	QAWx.y.0.0		QAWx.y.0.2		QAWx.y.0.4	Word
EM 4-101-AA2						
AA2B84	QABx.y.0.0	QABx.y.0.1	QABx.y.0.2	–	QABx.y.0.3	Byte
AA2W84	QAWx.y.0.0		QAWx.y.0.2	...	QAWx.y.0.6	Word
EM 4-201-DX1	QBx.y.0.0	QBx.y.0.1				Bit, byte
EM 4-201-DX2	QBx.y.0.0	QBx.y.0.1				Bit, byte, word
PS 4-1x1, passive	QBx.y.0.0	–	–		–	(Bit), byte
PS 4-1x1, active	SDBx.y.0.0	SDBx.y.0.1	SDBx.y.0.2	...	SDBx.y.0.5	Bit, byte
PS 4-141-MM1	SDBx.y.0.0	SDBx.y.0.1	SDBx.y.0.2	...	SDBx.y.0.77	Bit, byte, word
PS 4-151-MM1	SDBx.y.0.0	SDBx.y.0.1	SDBx.y.0.2	...	SDBx.y.0.77	Bit, byte, word
PS 4-201-MM1	SDBx.y.0.0	SDBx.y.0.1	SDBx.y.0.2	...	SDBx.y.0.77	Bit, byte, word

Slave	Byte 1	Byte 2	Byte 3	...	Last byte	Data type
PS 4-341-MM1	SDBx.y.0.0	SDBx.y.0.1	SDBx.y.0.2	...	SDBx.y.0.119	Bit, byte, word
PS 4-401-MM1	SDBx.y.0.0	SDBx.y.0.1	SDBx.y.0.2	...	SDBx.y.0.5	Byte, word
PS 4-401-MM2	SDBx.y.0.0	SDBx.y.0.1	SDBx.y.0.2	...	SDBx.y.0.83	Bit, byte, word
PS 316 (SBI)/306	SDBx.y.0.0	SDBx.y.0.1	SDBx.y.0.2	...	SDBx.y.0.5	Bit, byte, word
EPC 335	SDBx.y.0.0	SDBx.y.0.1	SDBx.y.0.2	...	SDBx.y.0.5	Bit, byte, word
PS 3-DC	QBx.y.0.0	QBx.y.0.1	QABx.y.0.0		QABx.y.0.0	(Bit), byte
PS 3-AC	QBx.y.0.0	QBx.y.0.1	QABx.y.0.0		QABx.y.0.0	(Bit), byte
PS 3-8	QBx.y.0.0	QBx.y.0.1				Bit, byte
LE 4-501-BS1	SDBx.y.0.0	SDBx.y.0.1	SDBx.y.0.2	...	SDBx.y.0.77	Bit, byte, word
CM 4-501-FS1	QBx.y.0.0	SDBx.y.0.1	SDBx.y.0.1	...	SDBx.y.0.5	Bit, byte
SBI-AMD3	SDBx.y.0.0	SDBx.y.0.1	SDBx.y.0.2	...	SDBx.y.0.5	Byte, word
SBI-AMX	SDBx.y.0.0	SDBx.y.0.1	SDBx.y.0.2	...	SDBx.y.0.5	Byte, word
SIS type 80D0 to SIS type 80EF	SDBx.y.0.0 SDBx.y.0.0	SDBx.y.0.1 RDBx.y.0.1	SDBx.y.0.2 SDBx.y.0.2	... ...	SDBx.y.0.5 SDBx.y.0.5	Bit, byte, word Bit, byte, word
A 4-220.1	SDBx.y.0.0	SDBx.y.0.1				Byte, word
A 5-220.1	SDBx.y.0.0	SDBx.y.0.1	SDBx.y.0.2	...	SDBx.y.0.5	Byte, word
VTP 0-H-Tx	SDBx.y.0.0	SDBx.y.0.1	SDBx.y.0.2	...	SDBx.y.0.5	Byte, word
VTP 1/2-H-T6	SDBx.y.0.0	SDBx.y.0.1	SDBx.y.0.2	...	SDBx.y.0.17	Byte, word
ZB 4-501-UM2	SDBx.y.0.0	SDBx.y.0.1	SDBx.y.0.2	...	SDBx.y.0.23	Bit, byte, word
RMQ 16l	QBx.y.0.0	QBx.y.0.1				Bit, byte
RBI 1.1	SDBx.y.0.0	SDBx.y.0.1	SDBx.y.0.2	...	SDB x.y.0.5	Bit, byte

x = line, y = station

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Technical data

General	
Standards	EN 61 131-2, EN 50 178
Ambient temperature	0 to 55 °C
Storage temperature	–20 °C to 70 °C
Vibration resistance	1 g/0 to 150 Hz
Shock resistance	15 g/11 ms
Vibration	Constant 1 g, f = 0 – 150 Hz
EMC	
Programming interface	RS 232, length of programming cable < 3 m (10 ft)
Network interface	RS 485
Bus	Suconet K
Data cable length	600 m/300 m
Transmission speed	187.5 kBaud to 375 kBaud
Operating mode	Master/slave
Degree of protection	IP 20
Rated insulation voltage U_i	600 V AC
Real-time clock	Yes
Accuracy of real-time clock	6.1 min/year (battery-backed)
Battery (life)	Typically 5 years
Expansion capacity (local)	Up to 5 LEs
Expansion capacity (remote)	Up to 30 stations
User program and data memory (internal)	512 KB
Memory modules (external)	1 MB (backup/recipe memory)
Typical cycle time for 1 K instructions (bits, bytes)	0.5 ms
Number of inputs (local)	16
Number of outputs (local)	14
Weight	Approx. 700 g
Power requirement for CPU	
Rated voltage U_e	24 V DC
Admissible range	20.4 to 28.8 V DC

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Residual ripple of input voltage	< 5 %
Polarity reversal protection	Yes
Rated current I_e	Typically 250 + 300 mA per LE
Inrush current and duration	4 A < 5 ms
Power consumption	Approx. 6.6 W
Power dissipation (for device as a whole)	Approx. 6.5 W
Bridging of voltage dips	
Duration of dip	10 ms
Repetition rate	1 s
Error display	Yes (LEDs)
Protection class	1
Electrically isolated	Yes
Terminals	Screw terminals
Conductor cross-sections	
Flexible with ferrule	0.22 to 2.5 mm^2
Solid	0.22 to 2.5 mm^2
Rated insulation voltage	600 V AC

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Inputs	
Number of inputs	16
Rated voltage U_e	24 V DC
For “0” signal	$\leq$ 5 V DC (limit value type 1)
For “1” signal	$\geq$ 15 V DC (limit value type 1)
Maximum ripple	< 5 %
Rated current I_e	
For “0” signal	Typically 6 mA at 24 V DC
Delay time	
For “0” to “1”	Max. 100 µs
For “1” to “0”	Max. 100 µs
Electrical isolation	Yes
Electrical isolation between inputs	No
Status indication of inputs	Yes (LEDs)
Terminals	Plug-in screw terminals
Conductor cross-section	
Flexible with ferrule	0.22 to 1.5 mm^2
Solid	0.22 to 2.5 mm^2
Incremental encoder	
Track A	I0.0
Track B	I0.1
Track C	I0.2
Pulse train frequency	50 kHz
Ref. limit switch	I0.3
“High-speed counter” input	I0.0/I0.1
Pulse train frequency	50 kHz
Pulse shape	Square
Pulse duration	50 %
Edge duration	$\leq$ 3 %
Alarm input	I1.0, I1.1

Analog inputs	
Number	2
Signal range	0 V to 10 V
Total error	Typically 0.8 % of full scale
No. of conversions	1 × per cycle
Input resistance	20 kΩ
Sensor element connection type	Two-wire connection to transmitter
Digital representation of input signal	10 bits (1024 units)
Setpoint potentiometer	
Number	2
Range of values	10 bits (1024 units)
Adjustment	With screwdriver
Outputs	
Number of outputs	14
Rated voltage U_e	24 V DC
Admissible range	20.4 to 28.8 V DC
Polarity reversal protection	Yes
Maximum ripple	≤ 5 %
Electrical isolation	
In groups	No
Rated current I_e	
For “1” signal	0.5 A at 24 V DC
Lamp load	4 W without series resistor
Utilization factor g	1
Relative duty factor (DF.)	100 %
Parallel connection of outputs	
Number of outputs	Up to 4
Total maximum current	2 A
Total minimum current	250 mA
Residual current for “0” signal	Approx. 140 µA
Short-circuit protection	Yes, without manual reset

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Short-circuit release current	Max. 1.2 A over 3 ms per output
Off delay	Typically 100 µs
Limiting of the breaking voltage	
for inductive loads	Yes, –21 V (at U_N = 24 V DC)
Switching rate per hour	
For time constant $t \leq 72$ ms	4800 (G = 1) 7500 (G = 0.5)
For time constant $t \leq 15$ ms	18,000 (G = 1)
Power supply	
Polarity reversal protection	Yes
Admissible range	20.4 to 28.8 V DC
Max. residual ripple	≤ 5 %
Status display for outputs	Yes (LEDs)
Terminals	Plug-in screw terminals
Conductor cross-sections	
Flexible with ferrule	0.22 to 1.5 mm^2
Solid	0.22 to 2.5 mm^2
Analog outputs	
Number	1
Bit resolution	12 (4096 units)
Total error	Typically 0.4 % of full scale
Output variables	0 to 10 V DC/2 mA
Connection type	Two-wire connection

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General EMC specifications for automation equipment			
Emission	EN 55 011/22 Class A		
Interference immunity			
ESD	EN 61 000-4-2	Contact discharge Air discharge	4 kV 8 kV
RFI	ENV 50 140	AM/PM	10 V/m
Burst	EN 61 000-4-4	Mains/digital I/O Analog I/O, fieldbus	2 kV 1 kV
Surge	ENV 50 142	Digital I/O, asymmetrical Mains DC, asymmetrical Mains DC, symmetrical Mains AC, asymmetrical Mains AC, symmetrical	0,5 kV 1 kV 0.5 kV 2 kV 1 kV
Immunity to line-conducted interference	ENV 50 141	AM	10 V

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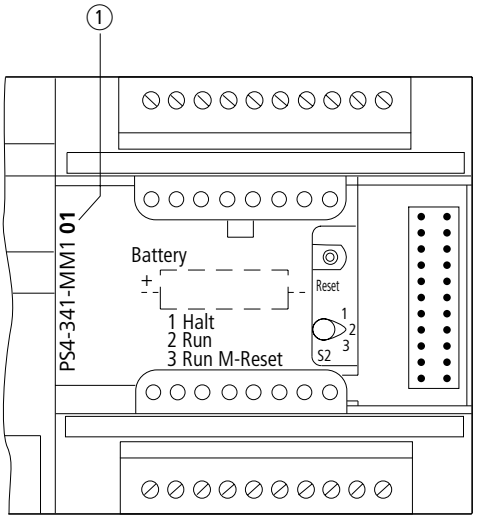
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Verwendung/Use/Utilisation/Utilizzo/Uso
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Modul **Module** **Modulo** **Módulo**		
ZB4-901-SF1		
ZB4-901-SF2		

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