SIEMENS

SIMATIC S5-101U

Programmable Controller

Instructions   Order No.: EWA 4NEB 810 2119-02c
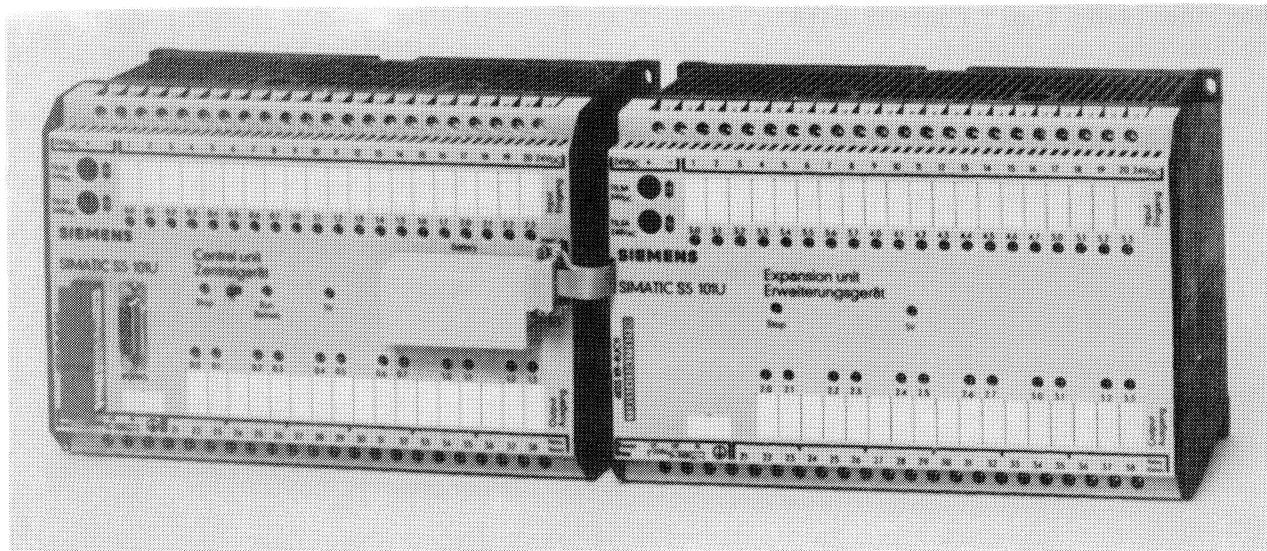

Fig. 1   S5-101U Programmable controller

1. Description

1.1 Application

The 101U is a programmable controller (PC) of the SIMATIC S5 system.
It was developed as a compact PC for automation tasks in the lower performance range as an economical replacement for up to 10 relays or contactors. The PC can be used for applications involving logic control with timing and counting functions.
The PC is programmed with the handheld 605U programmer, using statement lists (STL) or with the 670/675 CRT-based programmers in all three methods of representation, namely, statement list (STL), ladder diagram (LED) and control system flowchart or function chart (CSF).
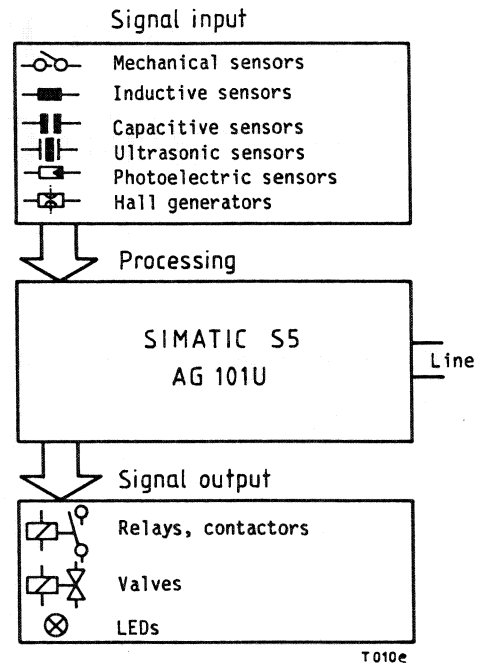
Fig. 2: Applications of the S5-101U programmable controller

1.2 Design

Compact PC for cabinet and wall mounting.

Screw-type terminals are used for all connections as in contactor systems (SIGUT SYSTEM)

Internal power supply for sensors in the relay version; no external sensor supply necessary

Receptacle for external memory submodule

Connector for programmer or SINEC L1 (TTY interface)

Power terminals

Connector for expansion unit for doubling the number of inputs and outputs
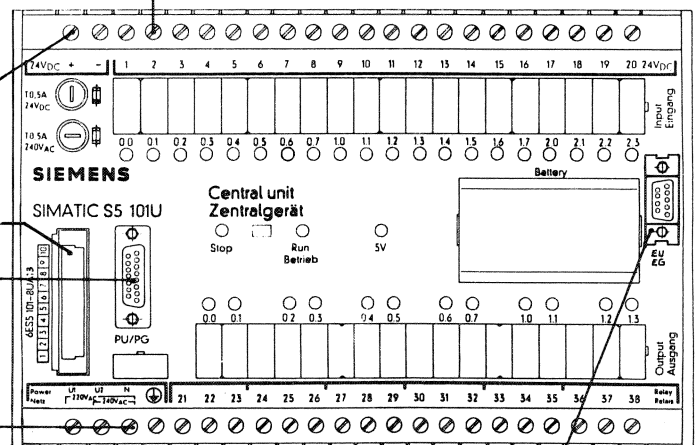
Fig. 3: S5-101U programmable controller (relay version)

1 - 1

1.3   Principle of operation

CENTRAL PROCESSING UNIT (CPU)

The CPU consists of a single-chip micro-
computer and performs the following func-
tions:
-Program processing
-Scanning of inputs and outputs (coils)
-Driving of outputs
-Programming of the memory submodule
 (EEPROM only)
-Servicing the serial port when a
 programmer is connected

INTERNAL MEMORY

The user program (up to 1024 state-
ments) is stored in the internal
memory. This memory also includes
an area for the process I/O image.
The internal memory can be supported
by a backup battery.

EXTERNAL MEMORY SUBMODULE

The user program is dumped in an
external memory submodule for long-
term storage (without battery back-
up being required).
Both an EPROM and an EEPROM submodule
are available:
-The EPROM submodule can only be pro-
 grammed with the PG670/PG675 pro-
 grammer.
 The EPROM can be erased with ultra-
 violet light.
-In the case of the EEPROM submodule,
 the program is stored and erased
 direct on the PC with the aid of the
 programmer
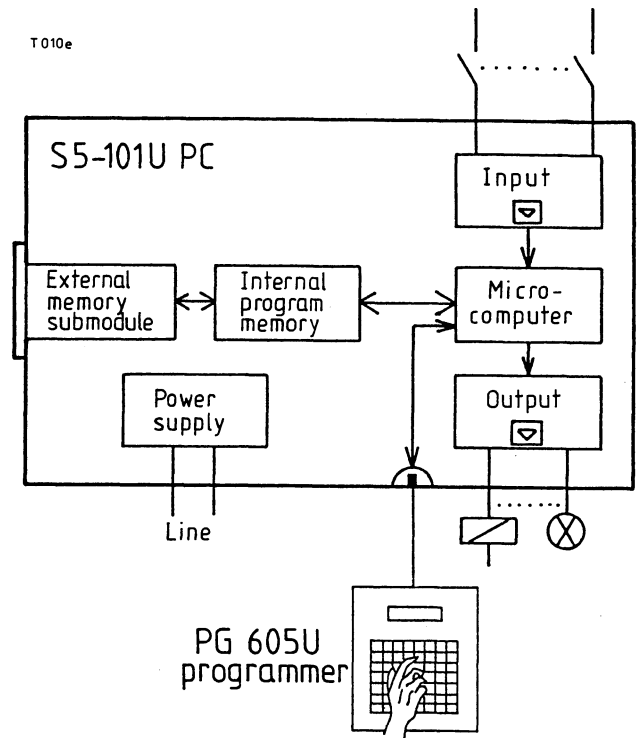
Fig. 4: Block diagram of the S5-101U

PROGRAM PROCESSING

The control functions of the S5-101U
are defined by a user program.
In order to be able to scan the user
program cyclically statement by state-
ment, the CPU performs the following
functions:

1. In the case of a cold restart (power
   switch from "Off" to "On" or mode
   selector from "Stop" to "Run"), the
   process output image* is erased,
   i.e. all outputs are set to zero.

2. The process input image* is updated,
   i.e. all signal statuses of the in-
   puts are scanned and written into
   the process input image.

3. The user program (PB1 or FB1) is
   scanned and processed statement by
   statement. When scanning the signal
   statuses of the inputs, the CPU
   accesses the process input image
   and not the actual inputs. When
   latching and unlatching the outputs
   (coils), only the process output
   image is overwritten to begin with.

4. Once the user program has been pro-
   cessed, the process output image
   is transferred to the actual out-
   puts.

5. Points 2, 3 and 4 are handled
   cyclically.

A scanning operation from cycle
checkpoint to cycle checkpoint takes
approx. 70 ms for 1024 statements
(binary).
If a scanning cycle is not completed
within 300 ms due to program errors
or faults, an internal monitor responds,
the PC enters the "Stop" status and
all outputs (coils) are switched off.
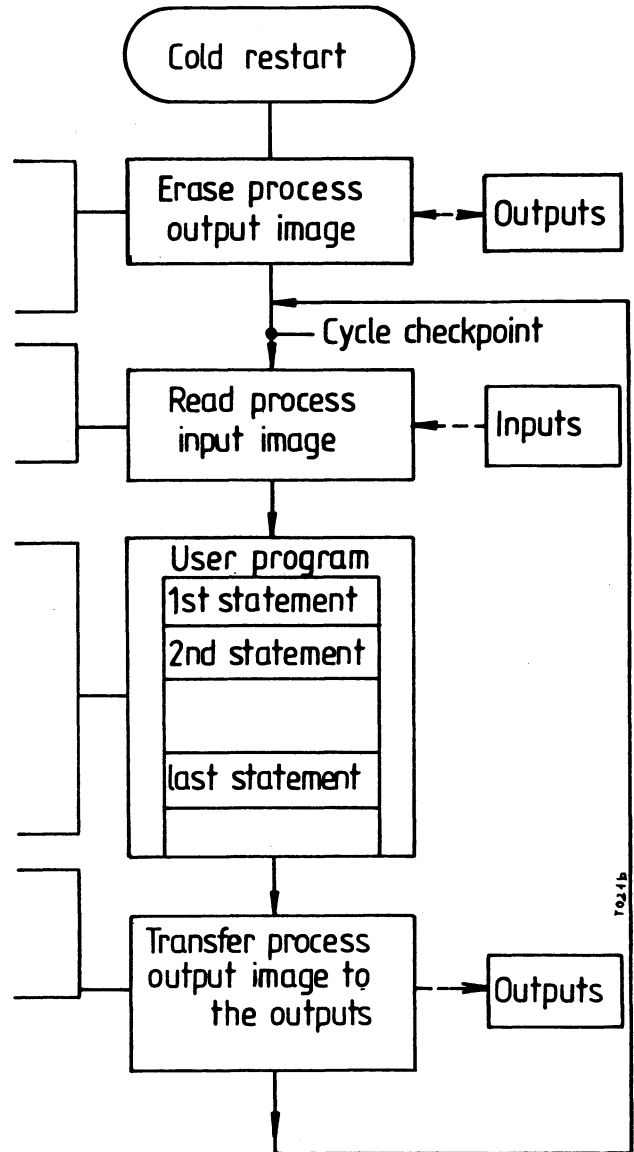
Fig. 5: Principle of operation of
the S5-101U

*Process I/O image:
Internal memory area in which the
signal status ("0" or "1") of the
inputs/outputs is stored.

1 - 3

2. Installation

2.1 Mechanical construction
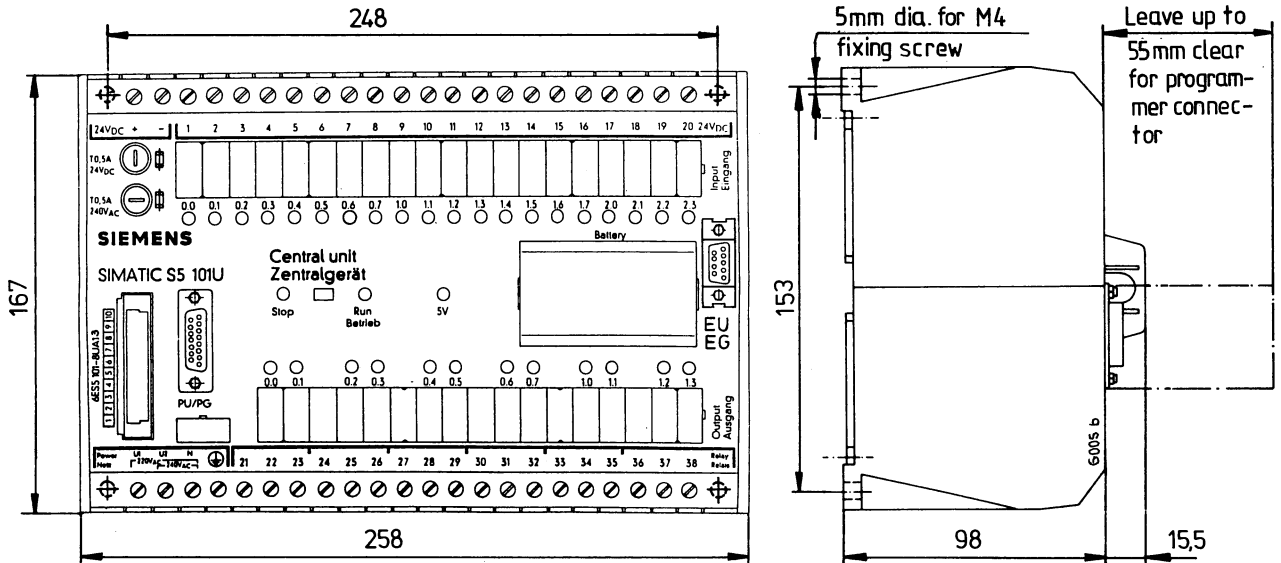
Fig. 6: Dimension diagram of the 101U

The S5-101U central controller (CC) and the S5-101U expansion unit (EU) both have the same dimensions.
Both units are attached side by side to a vertical mounting surface by means of four M4 bolts.
The inputs and outputs must be at the top and bottom (i.e. the units must not be turned through 90 deg.).

When installing the units, make sure that the maximum clearance of 30 mm is not exceeded.

In order to avoid the accumulation of heat, make sure
-that the maximum angle of inclination of 22.5 deg. is not exceeded
-that the minimum clearance of 200 mm between units mounted one above the other is observed.
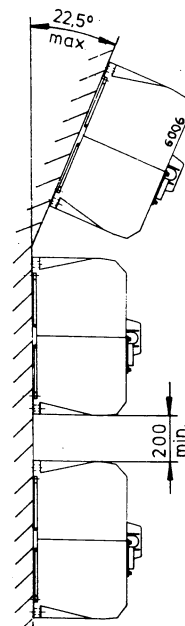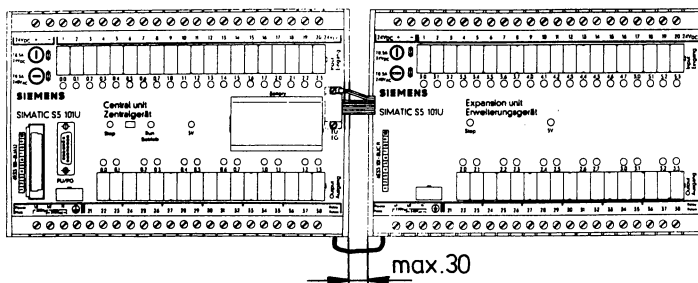
Fig. 7: Wall mounting arrangements

2.2 Electrical design

Screw-type terminals are used on the S5-101U for all electrical connections. Each terminal can take two conductors with the following cross-sectional areas:

Solid conductors   1 ...2.5mm^2
(17 to 13 AWG)
Stranded conductors   0.75...1.5mm^2
(18 to 15 AWG)
(with core end sleeves)

The screws should be tightened with a torque of between 80 and 120 Ncm. 10 mm of insulation should be removed from the end of the leads.

2.2.1 Installation guidelines

The PC and field devices (sensors and actuators) should be connected up as shown below (Example: CC (relay version) and EU (Triac version) connected to a common phase):
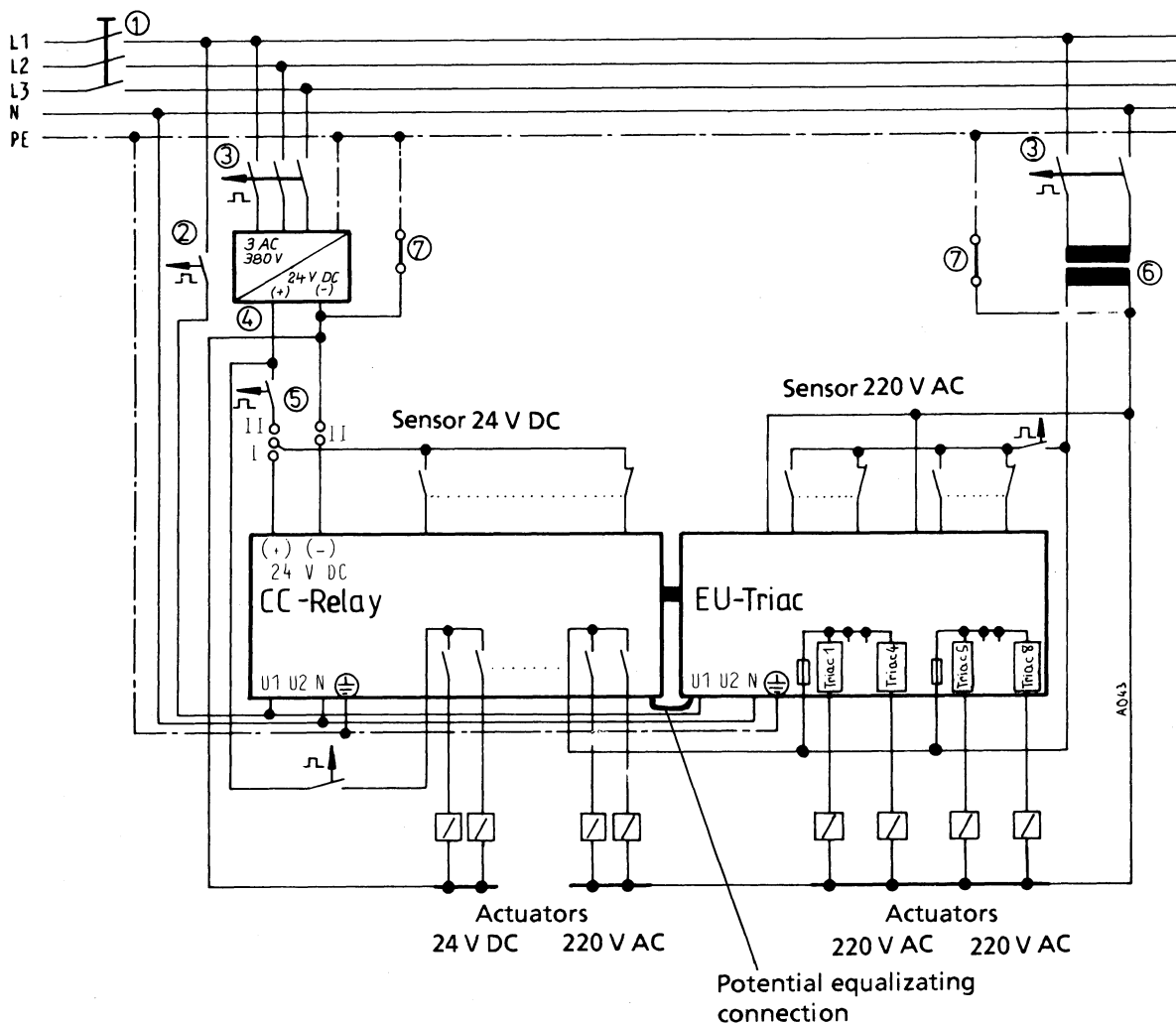
Fig. 8: Installation schematic for the S5-101U PC and field devices

When connecting up the PC, the following points should be noted:
- A common main switch (1) to VDE 0113 or isolating facility to VDE 0100 must be provided for the PC, sensors and actuators.
- The power connections of the CC and the EU must have a common fuse (max. fuse rating 6 A) (2).
  The CC and EU need only be fused separately if they are connected to different phases.
- Make sure that the power connection and the inputs and outputs of the same unit are not connected to different phases.
- A smaller conductor cross-sectional area can be used without fuses (3) for the power connection of the control circuits if the connecting line is less than 3 m long and is proof against earth faults and short-circuits.
- The power leads and I/O cabling must be run separately.
- A power supply unit (4) must be provided for the 24 V control circuits. 24 V lines must not be combined with lines carrying higher voltages in a common cable.
  The sensors (5) can be powered by the 24 V DC/300 mA power supply unit in the PC (connection I) or by an external 24 V power supply unit (connection II).

- In control circuits with more than five actuating coils, galvanic isolation by means of a control transformer (6) is recommended.
- Auxiliary circuits should be earthed either at one end (actuators and sensors must be arranged accordingly) or non-earthed auxiliary circuits with an insulation monitor must be provided.
  Earthed operation by means of a strap (7) between the protective earth conductor and the power supply unit or transformer is to be preferred.
- When connecting up the signal leads or bundling such leads, make sure that the ventilating slots of the PC are not covered. This applies in particular to the ventilating slots above the screw terminals.
- Cables must not be run in the immediate vicinity of the frontplate, or between CC and EU.

- The programmable controller has a high immunity to noise so that contactors can normally be operated in its immediate vicinity without having to take any additional measures to reduce noise.
- Make sure that the relay contacts of the outputs are fitted with varistors (max. leakage current 1mA at 275 V_{rms}).

2.2.2 Connection of the expansion unit

The 101U central controller and S5-101U expansion unit are connected to each other by a short flat ribbon cable.

Sufficient contact to chassis ground is ensured by securing the Cannon connector (1) with two screws (2). The tightening torque of the screws should be 25...30 Ncm. Only use M3x8 screws.

Switch off the power supply before interconnecting or disconnecting the central controller and the expansion unit.

The potential equalization conductor of the EU must be connected to the CC. Contact is established by a fixing screw on the CC.

CC fixing screw   EU potential
                     equalization conductor

Fig. 9: Connection of the S5-101U expansion unit

2.3 Terminal assignments of the central controller (CC)

2.3.1 Relay version (with full complement)

(6ES5 101-8UA13)
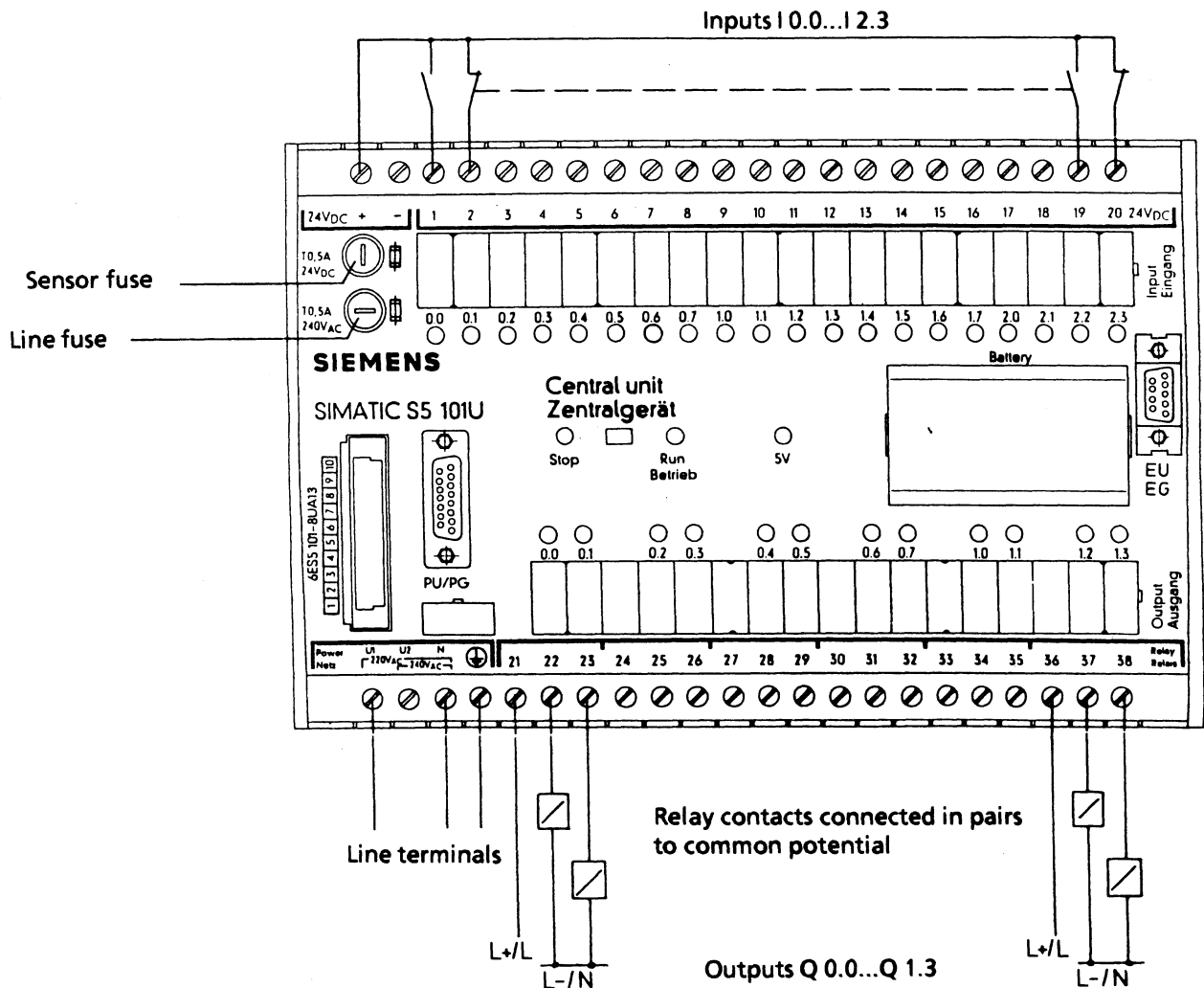
Fig. 10: Terminal assignments of the
S5-101U central controller (CC)
(relay version)
Configuration: 20 inputs/12 outputs

Line connection:
220 V or 240 V AC

V1: Phase (220 V AC)
V2: Phase (240 V AC)
N : Neutral
⏚: Protective earth
    conductor

Sensor power supply:
24 V DC (max. 300 mA)

The - 24 V DC terminal must be connected
internally with the inputs:
If an external 24 V power supply unit is
used, its - 24 V DC terminal must be con-
nected to the - 24 V DC terminal of the CC.
The + 24 V DC terminal of the CC remains
free in this case

2.3.2 Relay version (with partial complement)

(6ES5 101-8UB13)
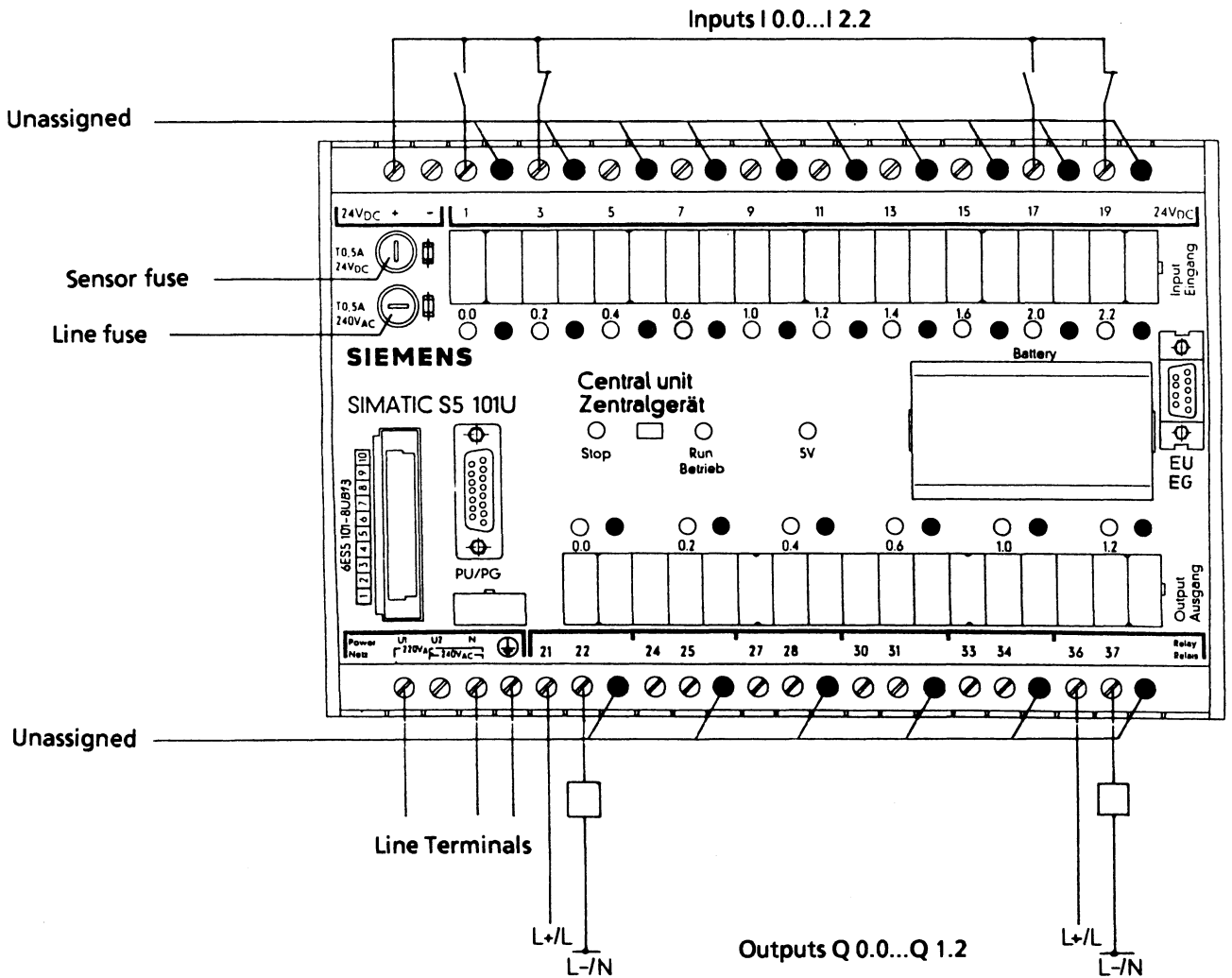
Fig. 11: Terminal assignments of the
S5-101U central controller (relay
version)
Configuration: 10 inputs/6 outputs

2.3.3 TRIAC version

(6ES5 101-8UA23)
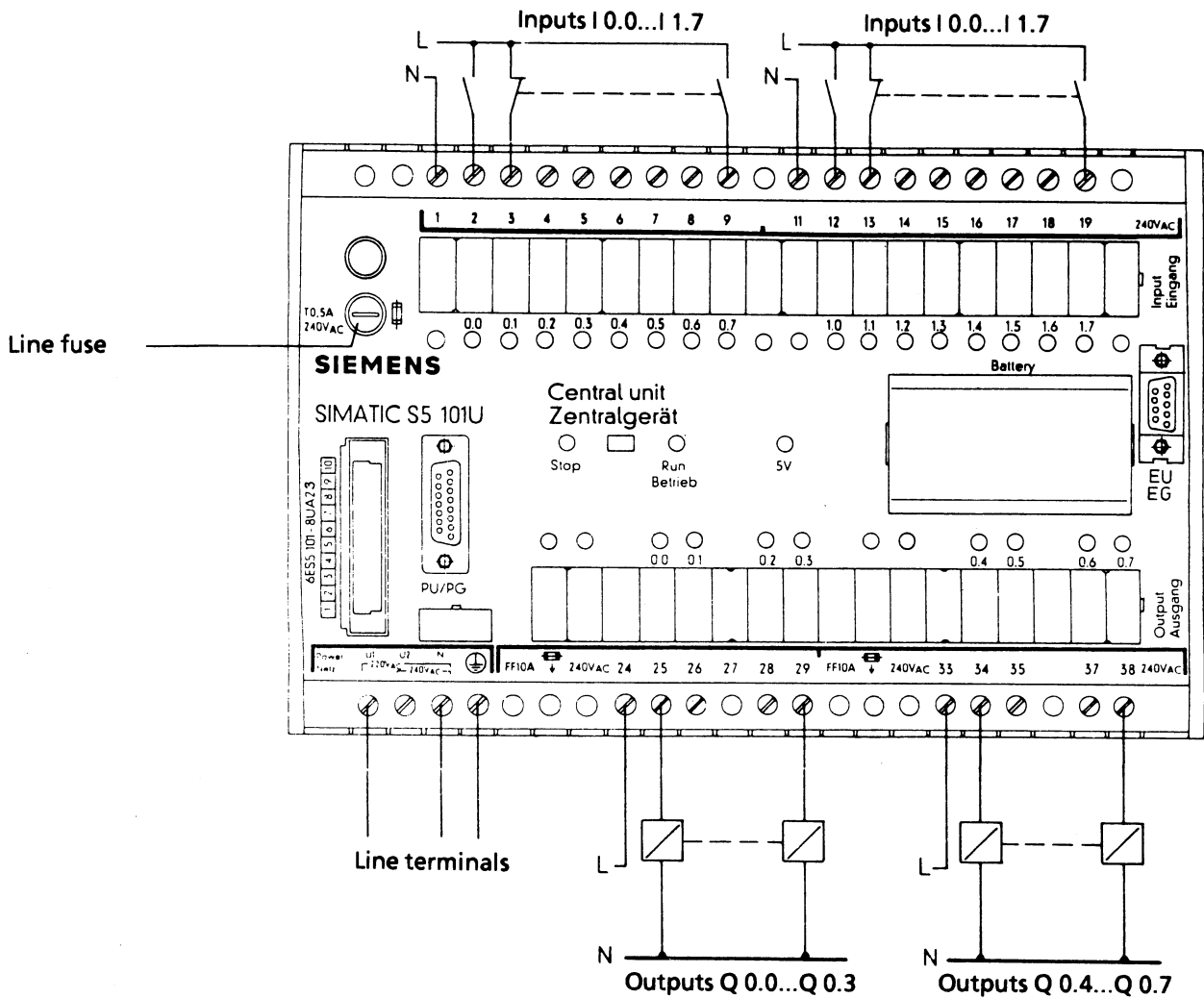
Fig. 12: Terminal assignments of the
S5-101U central controller
(Triac version)

Line connection:
220 V AC or 240 V AC

V1: Phase (220 V AC)
V2: Phase (240 V AC)
 N: Neutral
⏚: Protective earth conductor

Eight inputs or four outputs connected
to common potential.

Inputs/outputs and line terminal must be
connected to a common phase.

2.3.4 Transistor version
(6ES5 101-8UA33)
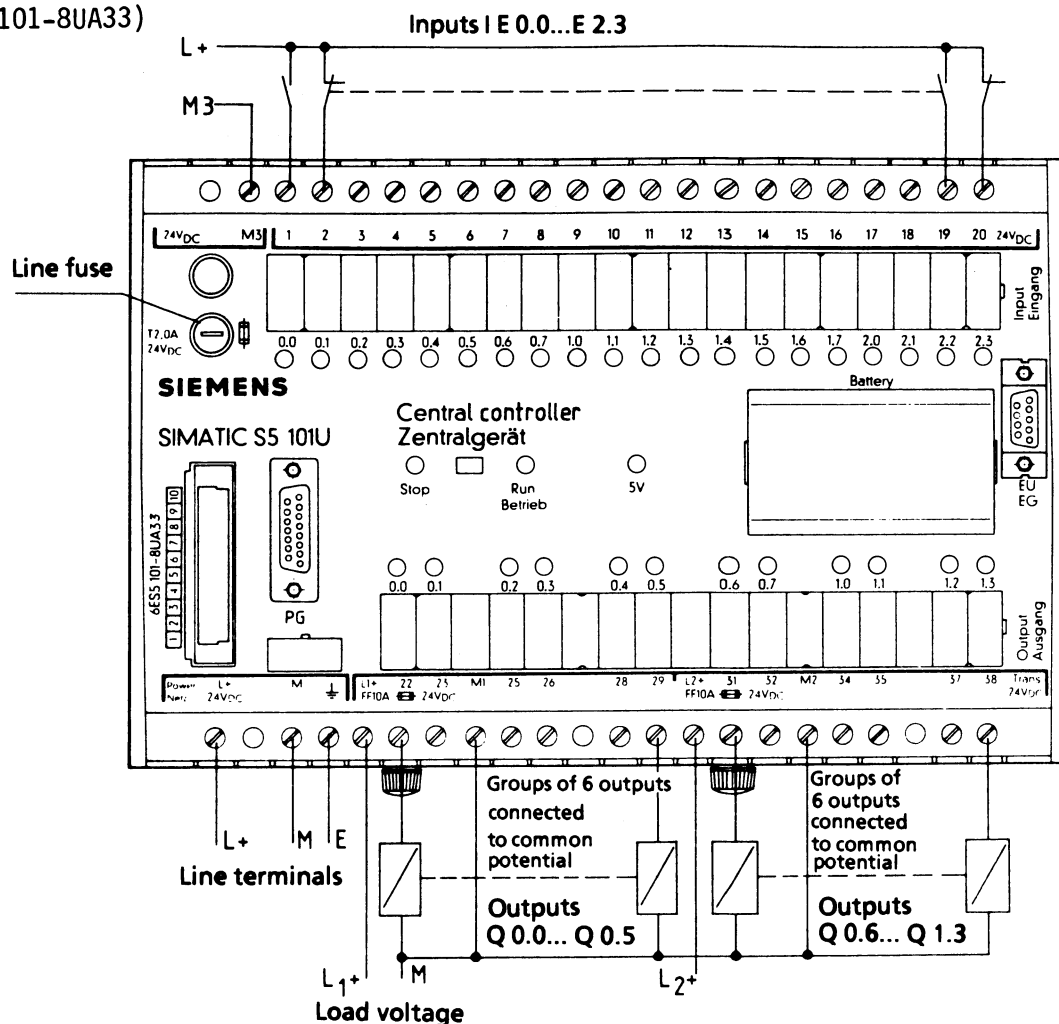
Fig. 13: Terminal assignments of the S5-101U central controller
(Transistor version)
Complement: 20 inputs/12 outputs

Line connection:

L+: 24 V DC (positive)
M: Reference voltage from L+ 0 V DC
⏚: System ground

-Connections M, M₁, M₂, M₃ and E
 are connected internally.

-M, M₁, M₂, M₃ and E must also be
 connected externally to improve the
 current carrying capacity.

Sensor supply voltage:
24 V DC/min 0..3 A

Load voltage: 24 V DC

-The load voltage, sensor voltage and
 line voltage can be taken from a
 common source.

2.4 Terminal assignments of the expansion unit (EU)

2.4.1 Relay version
(6ES5 101-8UC11)
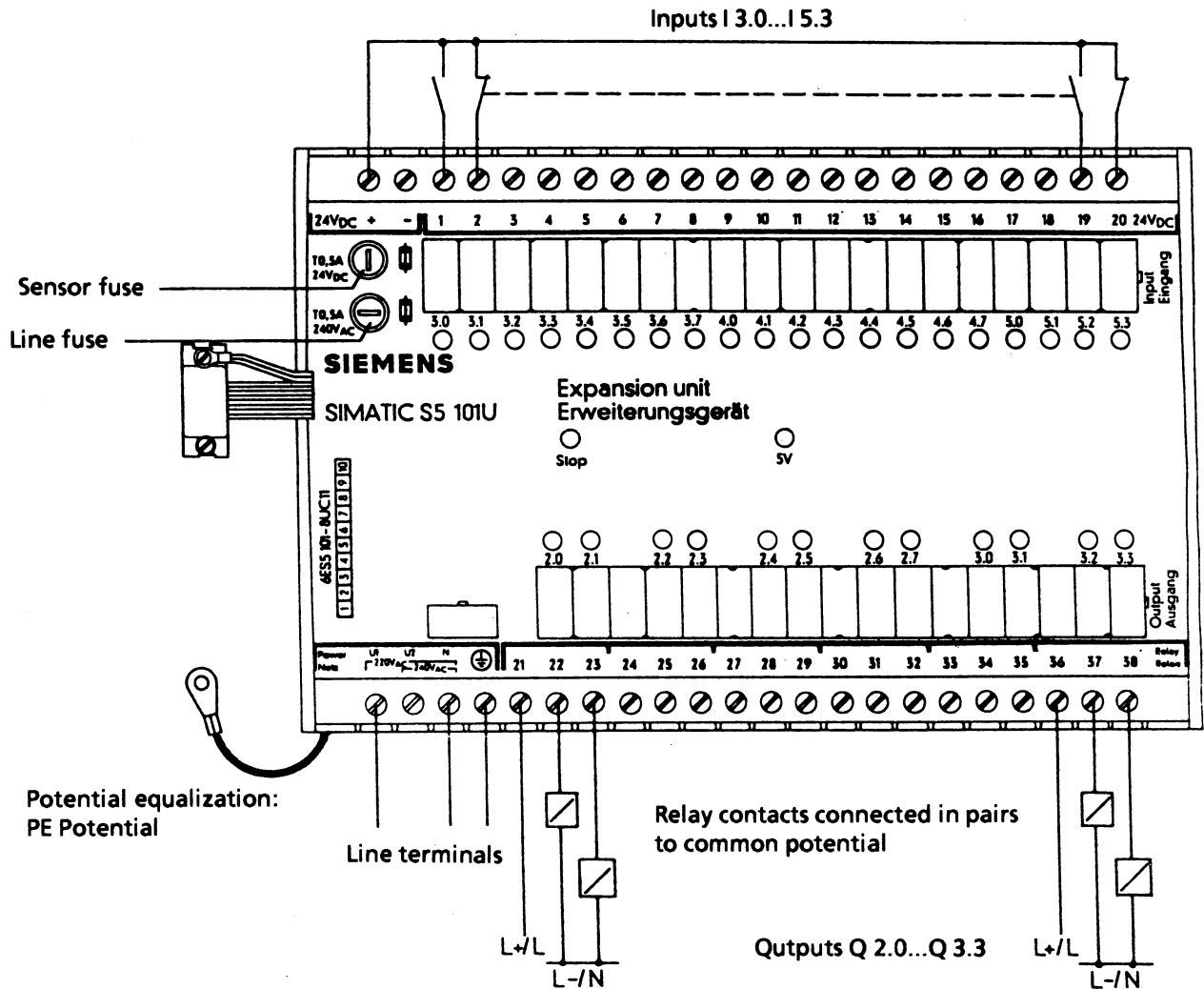
Fig. 14: Terminal assignments of the
S5-101U expansion unit (relay
version)

Line connection:
220 V or 240 V AC

Sensor power supply:
24 V DC (max. 300 mA)

V1: Phase (220 V AC)
V2: Phase (240 V AC)
 N: Neutral
⏚: Protective earth conductor

2.4.2 TRIAC version

(6ES5 101-8UC21)
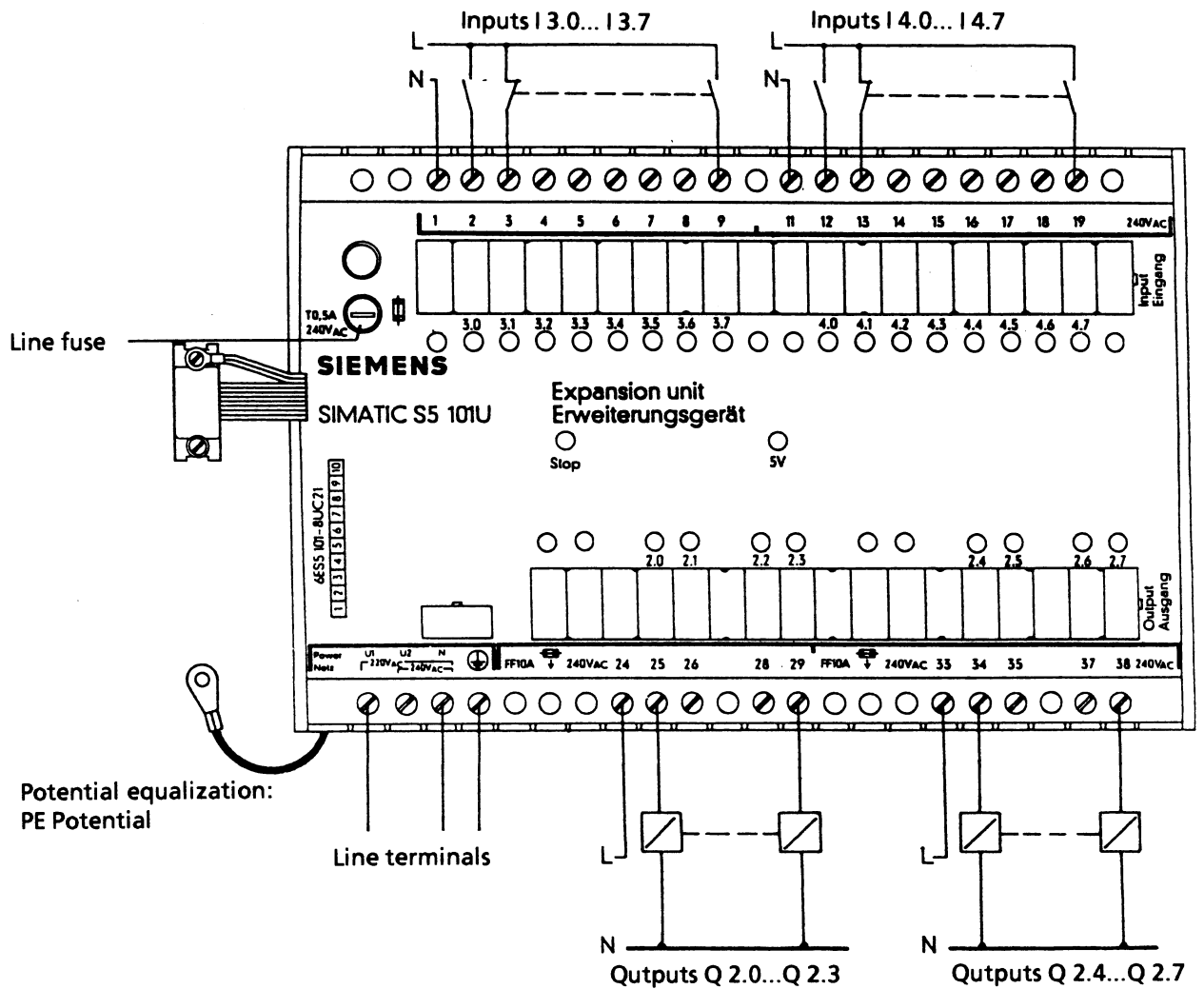
Fig. 15: Terminal assignments of the
S5-101U expansion unit (Triac
version)

Line connection:
220 V or 240 V AC

V1: Phase (220 V AC)
V2: Phase (240 V AC)
 N: Neutral
⏚: Protective earth conductor

Eight inputs or four outputs connected to
common potential.

Inputs/outputs and line terminal must be
connected to a common phase.

2.4.3 Transistor version
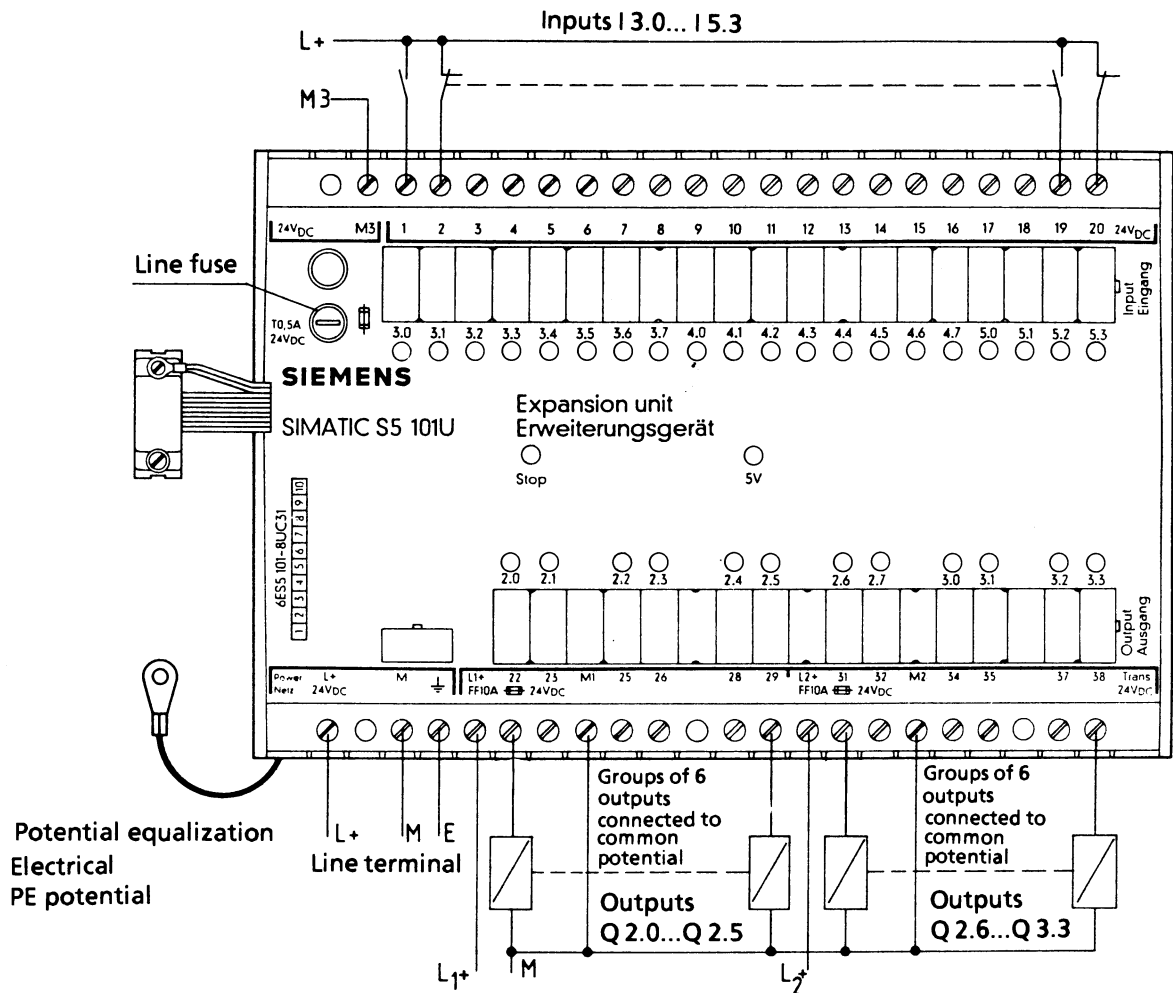
(6ES5 101-8UC31)

Inputs I 3.0 ... I 5.3

L+

M3

24VDC M3 | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 24VDC

Line fuse

T0.5A 24VDC

3.0 3.1 3.2 3.3 3.4 3.5 3.6 3.7 4.0 4.1 4.2 4.3 4.4 4.5 4.6 4.7 5.0 5.1 5.2 5.3

Input Eingang

SIEMENS

SIMATIC S5 101U

6ES5 101-8UC31

Expansion unit
Erweiterungsgerät

Stop   5V

2.0 2.1   2.2 2.3   2.4 2.5   2.6 2.7   3.0 3.1   3.2 3.3

Output Ausgang

Power L+   M   ⏚   L1+ 22 23 M1 25 26   28 29 L2+ 31 32 M2 34 35   37 38 Trans
Netz 24VDC   FF10A 24VDC   FF10A 24VDC   24VDC

Potential equalization
Electrical
PE potential

L+ M E
Line terminal

Groups of 6
outputs
connected to
common
potential

Outputs
Q 2.0...Q 2.5

Groups of 6
outputs
connected to
common
potential

Outputs
Q 2.6...Q 3.3

L1+   M

L2+

Fig. 16: Terminal assignments of the S5-101U expansion unit
(Transistor version)
Complement: 20 inputs/12 outputs

Line connection:

L+: 24 V DC (positive)
M: Reference voltage from L+ 0 V DC
⏚: System ground

-Connections M, M_1, M_2, M_3 and E
are connected internally.

-M, M_1, M_2, M_3 and E must also be
connected externally to improve the
current carrying capacity.

Irrespective of the operating mode, ter-
minal E of the expansion unit must be
connected to terminal E of the central
controller.

Load voltage: 24 V DC

-The load voltage, sensor voltage and
line voltage can be taken from a common
source.

3. Start-up and operation

3.1 Controls and displays
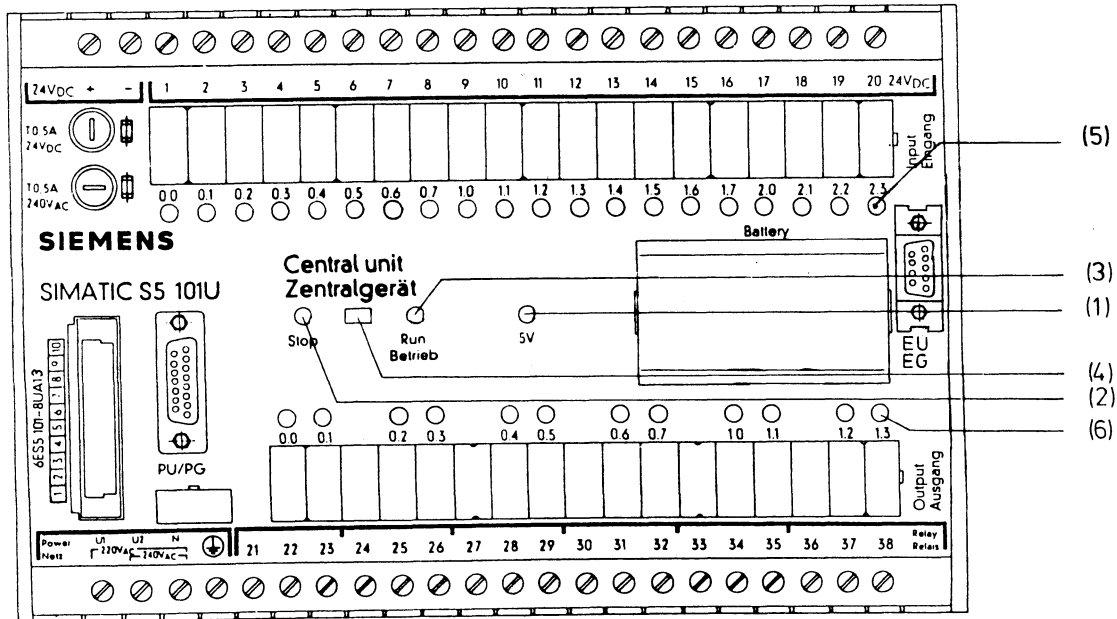
Fig. 17: Controls and displays of the
101U PC

The green "5V" LED (1) indicates that
the internal power supply for the PC
is available.
The red "Stop" LED (2) and the green
"Run" LED (3) indicate the two operat-
ing states of the PC.
The "Stop" and "Run" operating states
are selected with the mode selector (4)

The green LEDs for the inputs (5) light
up when the "1" signal is applied to the
input terminals and thus indicate the
signal state of the inputs direct. The
green LEDs for the outputs (6) are con-
nected in parallel with the excitation
coils of the output relays or the drivers
of the outputs and indicate the signal
status of the outputs.

3.2 The "Run" and "Stop" modes

The 101U PC has two operating modes -
"Stop" and "Run".
In the "Stop" mode - red LED (2) illu-
minated - the user program is not pro-
cessed. All outputs or coils are dis-
abled in this mode. The PC automatically
enters the "Stop" state when faults or
errors occur that prevent proper pro-
cessing of the program.

The "Stop" status of the PC can be
exited again by turning the mode
selector (4) to the "Run" position.
The red LED (2) darkens and the green
LED (3) lights up. The program is pro-
cessed in this mode. When the mode
selector (4) is in the "Run" position,
the operating state of the PC can be
modified additionally by the "PC stop"
and "PC start" functions of the pro-
grammer.

3.3　Power - up

When the power supply is switched on or on recovery of power following a power failure, the PC assumes the operating modes shown in Fig. 18.

A restart following power-up can be suppressed by the user program (see Programming instructions, Section 3.2).

POWER OFF ↓ POWER ON	Current position of mode selector of the PC on power-up	Operating mode of PC prior to power-up	Error identifier* set	Operating mode following power-up
	STOP			➤ STOP
	RUN	STOP		➤ STOP
		RUN	YES	➤ STOP
			NO	➤ RUN
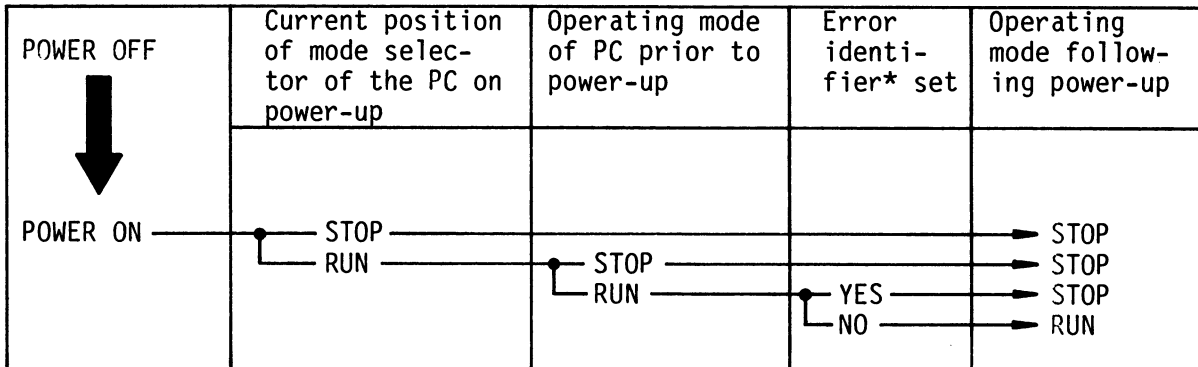
Fig. 18: Automatic mode setting following power-up

* see interrupt stack (Section 4.2)

3.4　Using the memory submodules modules

There are two different memory submodules available for the S5-101U programmable controller (Fig. 19). The submodules are used for additional program dumping or for copying programs should only one memory module be used for several PCs.

When the power supply is switched on or the PC is switched to "Run", the contents of the submodule are copied into the internal memory (RAM) and processed from there. A backup battery provides support for at least three years in the event of a power failure.

Memory submodule	EPROM	EEPROM
Program dump	PG 615 (with adapter 984-2UA11) PG 670 (with adapter 984-0UA11) PG 675	PG 615 PG 670 (without 984 adapter) PG 675
Program erasure	Only with special UV lamp (erasure time: 30 min)	Direct in the PC with PG 605U/PG 615 PG 670/PG 675 (Programmer function: PG→PC)
Program modification by means of programmer	Only erasure of entire program possible	possible

Fig. 19: Differences between the EPROM and EEPROM submodules.

POWER OFF ↓ POWER ON	External memory submodule plugged into PC	Submodule program can be interpreted by PC	PC fitted with back-up battery	Program in internal program memory
	●— YES ───────	●— YES ───────	───────────►	is overwritten by the program from the memory submodule
		(EPROM plugged in) ┌─ NO ────	───────────►	is lost (PC "Stop")
		└─ NO ──── (EEPROM plugged in)	───────────►	is lost; EEPROM is erased; reprogramming possible
	└ NO ───────		●— NO ────►	is lost
			└─YES────►	is retained

Fig. 20: PC power-up response with
and without memory submodule

The dumping of the program on memory submodules is described in the Programming Instructions, Section "Program dump".

If various programs have been dumped in memory submodules, the relevant program can be executed in the PC simply by replacing the submodules.

Different programs can be loaded into the PC without the aid of a programmer by simply interchanging the memory submodules.

The PC always copies the program from the memory submodule into the internal program memory on power-up or on recovery of the power after a failure as well as when the mode selector is changed over to "Run". A program already in the program memory is overwritten even if the memory submodule plugged in is empty.

3.5 Operation with the expansion unit

The following points should be given special attention as the central controller (CC) and the expansion unit (EU) have separate power supply units:

- The outputs of the CC and the EU are disabled as soon as the PC enters the "Stop" state.
- In the event of a power failure in the CC, the EU automatically disables its outputs.
- In the event of a power failure in the EU, all inputs of the process I/O image which are assigned to the EU assume signal status "1".
  (not under undervoltage conditions)

The same applies in the case of a break in the bus connection between the CC and the EU. A fault in the EU can be detected by scanning input I 5.3.
This only applies to total failure.

I 5.3 = "1": Fault in EU
I 5.3 = "0": EU o.k.

If an expansion unit of the
   relay version
   transistor version
is used, input I 5.3 must remain unconnected for this purpose.

3.6 Operation in the SINEC L1 local area network

The SINEC L1 local area network is used for interconnecting programmable controllers of the low-end performance range and operates on the Master-Slave principle. The CP 530 communications processor is always the master, and the slaves the CPUs of all small PCs.
A BT 777 bus terminal for signal level conversion is required for each mode or station in the network. This terminal is connected to the programmer interface part of the slave or to the SINEC L1 part of the CP 530. A four-core shielded cable, which interconnects the various bus terminals, is used as the actual transversion medium. One master and up to 30 slaves can be connected to the SINEC L1 bus.

For further details, please refer to the Instructions and Programming Instructions of the SINEC L1 Local Area Network.
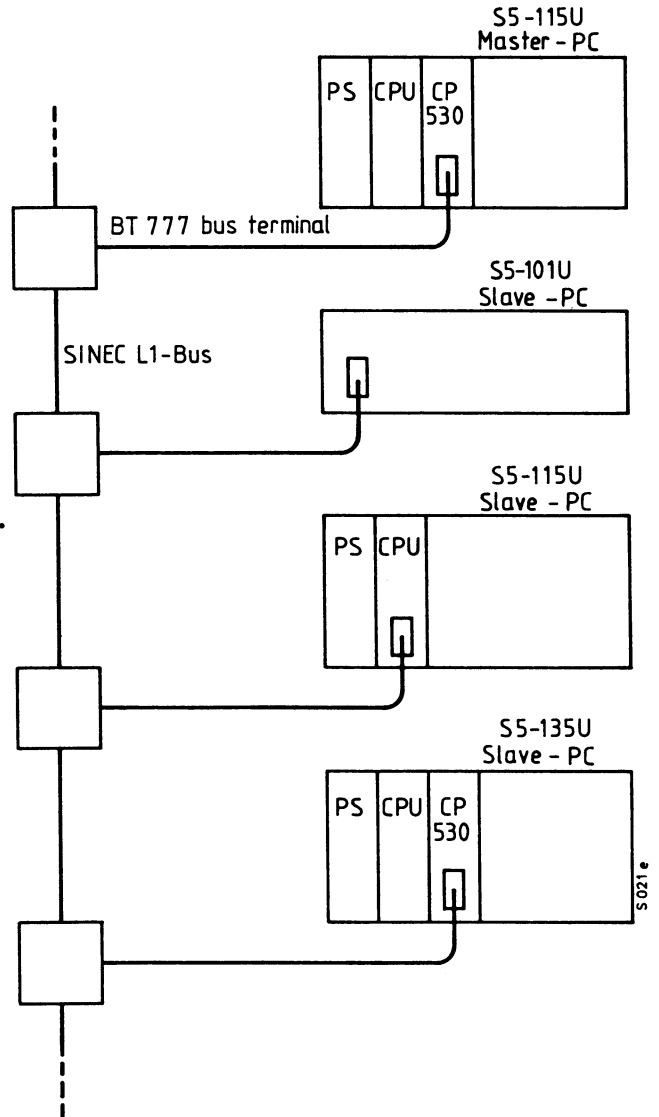
Fig. 20 a: Example of a SINEC L1 network

3 - 4

3.7   Start-up

On PC start-up, the following sequence of operator procedures must be observed.

Condition	Operator procedure	Remarks
Process and S5-101U PC dead, i.e. the main switch (see Fig. 8) is open.	-Check power terminals (PE conductor must be connected) -Check whether all screw terminals are properly tightened -Make sure that there are no connections between 24V lines and lines carrying higher voltages. -Withdraw the memory submodule	Visual check of the system, observing VDE 0100 and 0113.
Disconnect fuses for sensors and actuators. Switch off power circuits of the actuators. Close the main switch (see Fig. 8)	-Switch PC to "Stop" without memory submodule and connect the PG 605U, 670 or 675 programmer. -Reset the PC with the programmer "ERASE PROGRAM" function and then set the PC to "Run"	When the main switch is closed, the green "5V" and red "Stop" LEDs light up. The red "Stop" LED darkens and the green "Run" lights up
Insert the fuses for the sensors. The fuse for the actuators and power circuits remain disconnected.	-Actuate all sensors one after the other.	If the sensors are properly connected, the corresponding LEDs at the inputs will light up.
Insert the fuses for the actuators. The power circuits for the actuators remain disconnected (Fig. 8).	-Each output of the I/Os can now be driven with the "Force" programmer function.	The LEDs of the forced outputs light up and the switch positions of the relevant actuators change.
The power circuits for the actuators remain disconnected.	-Put the PC to "Stop" -Enter the program with the aid of the programmer and transfer it to the PC - Put the PC to "Run", test and correct program. - Put the PC to "Stop".	The red "Stop" LED lights up. Set PC to "Stop" before debugging.
When the program has been fully tested, switch on the power circuits for the actuators.	-Put the PC to "Run"	The PC must now process the program properly

4. Maintenance and repair

4.1 Error/Fault diagnosis

Most errors occur when entering
and testing the program.
In these cases, detailed error in-
formation is provided by the pro-
grammer. This is described in more
detail in the operating instructions
of the respective programmer.
The programmer has the following
diagnostic functions for testing
the program and for troubleshooting:
-"Program-independent signal status
display"
(Programming instructions, Section 4)

-"Direct signal status display"
(Programming instructions, Section 4)
-Display of interrupt stack
(p. 4.2)

If the PC does not enter the "Run" state
when the power is switched on or the
mode selector is actuated, or should it
leave the "Run" state during normal pro-
cessing, the cause of the interrupt can
be investigated with the programmer
"DISPLAY I-STACK" function.

In the event of a fault on the 101U, the following troubleshooting procedure is re-
commended:

```
┌──────────────────────────┐
│          START           │
└──────────────────────────┘
             │
┌──────────────────────────┐
│ Put mode selector to "STOP"— Switch
│         on power         │
└──────────────────────────┘
             │
┌──────────────────────────┐         NO    ┌─────────────────────────────┐
│    Green "+5V" LED lit?   │ ────────────→ │    Check mains voltage      │
└──────────────────────────┘               │ Check mains fuse and terminals│
             │ YES                          └─────────────────────────────┘
┌──────────────────────────┐         YES   ┌─────────────────────────────┐
│  All input LEDs always dark? │ ─────────→ │  Check fuses for sensor voltage │
└──────────────────────────┘               │      Check sensor wiring    │
             │ NO                           └─────────────────────────────┘
┌──────────────────────────┐
│  Put mode selector to "RUN" │
└──────────────────────────┘
             │
┌──────────────────────────┐         NO
│    PC enters "RUN" mode?  │ ─────────┐
└──────────────────────────┘          │    ┌─────────────────────────────┐
             │ YES                     ├──→ │   Interrupt stack (see p.4.2) │
┌──────────────────────────┐    YES    │    └─────────────────────────────┘
│ PC enters "STOP" status during operation? │ ┘
└──────────────────────────┘
             │ NO
┌──────────────────────────┐    YES        ┌─────────────────────────────┐
│ Wrong or no program processing? │ ──────→ │      Check user program     │
└──────────────────────────┘               └─────────────────────────────┘
             │ NO
┌──────────────────────────┐
│           END            │
└──────────────────────────┘
```
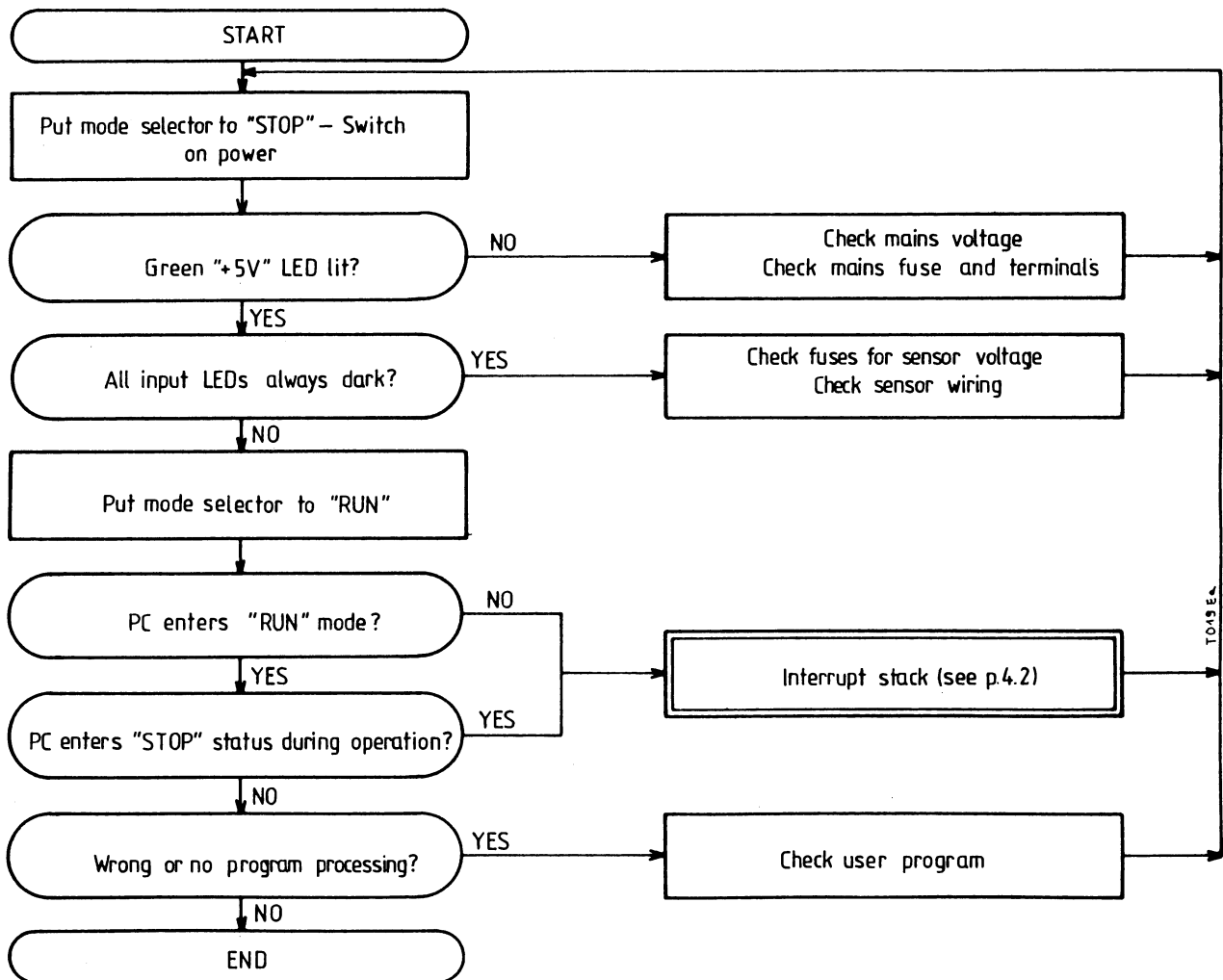
Fig. 21: Troubleshooting procedure

4.2 Interrupt stack

The interrupt stack (I-STACK) is a LIFO memory in which the operating system of the S5-101U enters the cause of the interrupt when the PC goes into the "Stop" state.

In the case of the PG670/PG675 CRT-based programmers, the I-STACK is displayed in the form of a table. With the hand-held PG 605U programmer, the I-STACK is called byte by byte. The following assignments apply:

BYTE										
1	Ø								SD5-HIGH	
2	Ø								SD5-LOW	
3	STP ZUS	STP ANZ	Ø	Ø	Ø	Ø	Ø	Ø	SD6-HIGH	System data word
4	Ø								SD6-LOW	
5	ASP NEP	ASP NRA	KOPF NI	Ø	ASP NEEP	Ø	Ø	Ø	SD7-HIGH	
6	Ø								SD7-LOW	
7	Ø								IRRELEVANT	
8	Ø								IRRELEVANT	
9	STO SCH	Ø	Ø	Ø	NNN	STS	Ø	Ø	UAW-HIGH	Interrupt condition code word
10	NAU	Ø	Ø	ZYK	Ø	Ø	BAU	Ø	UAW-LOW	
11	Ø								IRRELEVANT	
12	Ø	Ø	Ø	Ø	OR	Ø	RLO	ERAB	CONDITION CODES	
13	Ø					OR	RLO	FKT	6th BRACKET LEVEL	
14	Ø								IRRELEVANT	
15	Ø					OR	RLO	FKT	4th BRACKET LEVEL	
16	Ø					OR	RLO	FKT	5th BRACKET LEVEL	
17	Ø					OR	RLO	FKT	2nd BRACKET LEVEL	
18	Ø					OR	RLO	FKT	3rd BRACKET LEVEL	
19									NESTING DEPTH	
20	Ø					OR	RLO	FKT	1st BRACKET LEVEL	
21	Ø								IRRELEVANT	
22	Ø								IRRELEVANT	
23	Ø								IRRELEVANT	
24	Ø								IRRELEVANT	
25									SAZ-HIGH	Step address counter
26									SAZ-LOW	
27	Ø								OPERATION REGISTER- HIGH	
28	Ø								OPERATION REGISTER- LOW	
29									ACCU2-HIGH	
30									ACCU2-LOW	
31									ACCU1-HIGH	
32									ACCU1-LOW	

Read-out possible only when PC is in STOP state

Fig. 22: Interrupt stack

Explanations in connection with the I-STACK

Byte 3   STPZUS: PC at "Stop" (external; e.g. programmer)
            STPANZ: PC at "Stop" (internal)

Byte 5   KOPFNI: Block header cannot be interpreted
            ASPNEP: User EPROM
            ASPNEEP: User EEPROM
            ASPNRA: User RAM
                       (no submodule inserted)

Byte 9   STOSCH: Mode selector at "Stop"
            NNN: Programming error; illegal operation for 101U
            STS: Programmable "Stop"

Byte 10   NAU: Power failure
            ZYK: Scan time exceeded
            BAU: Battery low

Byte 12   OR: Identifier bit for OR memory
            VKE: Result of logic operation
            ERAB: Identifier bit for first scan

Byte 13   FKT: Function 1=U(; 0=O(

Interrupt condition code word: Provides indication of reason for PC stopping
                                       and important pointers for troubleshooting

Nesting depth: Binary/decimal display of nesting depth (1...6)

STEP address counter: Indicates the address at which the program has aborted
                     (1400H...1600H)

Accu 2/accu 1: Indicates the pattern of the second-last/last load operation.

4.3   Changing the backup battery

The lithium battery has a support time
of at least three years.

Flag (internal relay) F 63.6 is set if
the voltage drops below the level re-
quired for battery backup. The
user program can thus respond accor-
dingly (see also Programming Instruc-
tions, Section 3.2).

The backup battery can be changed with
the PC in the "Run" state, proceeding
as follows:
- Remove the cover of the battery
  compartment
- Take out the old battery
- Insert the new battery (noting
  polarity)
- Replace the battery compartment
  cover
- Exhausted lithium batteries
  are not rechargeable and must
 be disposed of properly (i.e
  not simply thrown into a trash
  can).
Only the lithium battery in the list
of spare parts may be used.
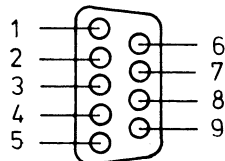
4.4 Interface assignments

Memory submodule interface

a	b	c	
V_{SS}	M	AD12	1
AD2	AD1	AD0	2
AD5	AD4	AD3	3
AD8	AD7	AD6	4
AD11	AD10	AD9	5
$\overline{RD}$			6
		$\overline{PGM4/WR}$	7
			8
			9
D2	D1	D0	10
D5	D4	D3	11
	D7	D6	12
	$\overline{CS1}$	$\overline{CS1}$	13
		$\overline{CS2}$	14
K4		Vpp	15
K5	$\overline{RD}$	Vpp	16

Fig. 23: Assignment of interface signals to the memory submodule
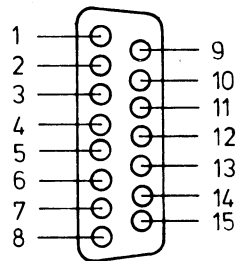
1 Shielding/earth, external
2 Rec-
3 V_{PU} +5.2V
4 -
5 Zero volt reference potential, internal
6 Driver+
7 Driver-
8 Shielding/earth, external
9 Rec+
10 -
11 T/20mA- (current source/transmitter)
12 Zero V reference potential internal
13 R/20mA- (current source/receiver)
14 V_{PU} +5.2V
15 Zero V reference potential, internal

Fig. 24: Assignment of interface signals to the PG605U programmer

1 DIR
2 BASPIE
3 CSIO 0
4 P2.3
5 P2.1
6 CSIO 1
7 PROG
8 P2.2
9 P2.0

Fig. 25: Assignment of interface signals to the S5-101U expansion unit

5. Technical specifications

5.1 General data

Temperature range:
Low temperature limit   0°C (K) | to
High temperature limit   55°C (V) | DIN
Casing inlet air temp.   ≤55°C | 40 040
Storage temperature   -40°C...+70°C

Humidity rating:
F to DIN 40 040
95% relative atmospheric humidity
at $25^{\circ}C$

RF interference suppression: A to VDE 0871

Degree of protection:
IP20 to DIN 40 050 (no protection against water)

Creepage distances and clearances in air to VDE 0160

Dimensions: 285 mm x 167 mm x 114 mm (WxHxD)
(II. 2 in. x 6.6 in. x 4.5 in.)

Vibration test to DIN 40 046, Part 8 and IEC 68, Part 2-6

Frequency range	Amplitude of acceleration	deflection
10 to 58 Hz	0,075 mm	---
over 58 up to 500 Hz	---	1 g

Impact test: 15g/11ms, trapezoidal to DIN 40 046, Part 7

Weight: approx. 2.7 kg relay/triac version
approx. 1.7 kg transistor version

Model	Input voltage Tolerance, Frequency	Max. current consomption	Power dissipation at full load, typical	Internal power supply for sensors
CC, relay 6ES5 101-8UA13* 6ES5 101-8UB13	220 V AC/240 V AC -15 %, +10 % 48...63 Hz	260 mA	29 W	24 V DC/300 mA (20 V...30 V)
		200 mA	22 W	
EU, relay 6ES5 101-8UC11		200 mA	23 W	
CC Triac 6ES5 101-8UC23	220 V AC/240 V AC -15 %, +10 % 48...63 Hz	180 mA	23 W	
EU Triac 6ES5 101-8UC21		150 mA	18 W	

* Power supply fuse: 250 mA slow (6.3x32 mm)
All other fuses: 500 mA slow (6.3x32 mm)

CC-transistor 6ES5 101-8UA33	24 V DC rated 20 to 30 V range inclusive	0.9 A	22 W	Fuse 6.3 x 32 mm 2 A; slow
EU-transistor 6ES5 101-8UC31	3 V_{pp} superimposed 0 Hz	0.6 A	14 W	Fuse 6.3 x 32 mm 0.5 A; slow

(only for 24 V version)
Floating operation: In floating operation, all voltages connected must be extra-low voltages in accordance with VDE 0100/5.73 §8c or equivalent. If not, the ⊥ terminal must be connected to the PE conductor.

(only for 24 V version)
The CC and EU are protected electronically against polarity reversal. If the voltage source has electronic current limitation, the dynamic overload factor of the supply voltage must be ≥ 5 A and the load voltage ≥ 20 A to trigger the appliance fuses in the case of a fault.

Model	Input voltage Tolerance, Frequency	Max. current consomption	Power dissipation at full load, typical	Internal power supply for sensors
CC-relay 6ES5 101-8UU13 6ES5 101-8UW13	115 V AC -15% +10% 48 ... 63 Hz	520 mA	29 W	24 V DC / 300 mA (20 V ... 30V)
EU-relay 6ES5 101-8UX11				

Power supply fuse: 1 A slow (6.3x32 mm)   m)
Sensor voltage fuse: 0,5 A slow (6.3x32 mm))

5.2   CPU / memory submodule

Operations:
Binary operations
Setting/resetting operations
Load and transfer operations
Timer and counter operations
Comparison (relational) operations
Arithmetic functions
Digital logic
Shift operations
Jump operations

Processing time for one binary operation:
approx. 70 µs

Internal program memory:
RAM for 1024 statements; supported
for at least three years if a back-
up battery is used

Memory submodules (plug-in):
a) EPROM submodule for 1024 statements
   Storage of program:
   on PG 615 (with adapter 984-2UA11)
   on PG 670 (with adapter 984-0UA11)
   on PG 675
   Program erasure: UV lamp

b) EEPROM submodule for 1024 statements
   Storage and erasure of program also
   direct on the PC with all programmes

Addressing: CC   EU
  40 inputs   (I0.0...I2.3)   (I3.0...I5.3)
  24 outputs   (Q0.0...Q1.3)   (Q2.0...Q3.3)

512 flags or inter- (F0.0...F63.7)
    nal relays
256 retentive   (F0.0...F31.7)*

 16 counters   (C0...C15)   Range 1...999
 16 timers   (T0...T15)   Range 10 ms...9990s

* with backup battery only

5.3   I/Os

In all models except the transistor
version, the inputs are galvani-
cally isolated from the internal power
supply by means of optocouplers.

The signal statuses of the inputs are
indicated by green LEDs; the LEDs are
driven by the signal voltage of the
inputs.

CC (relay version) 6ES5 101-8UA13, 6ES5 101-8UU13
EU (relay version) 6ES5 101-8UC11, 6ES5 101-8UX11

Number of inputs	Rated input voltage	Rated input voltage for		Nominal input current for "1" signal	Delay, typical		Maximum length of line (24 V DC and 220 V lines run separately)	Insulation	
		"0" signal	"1" signal		ON	OFF		for nominal voltage	tested at
20 floating	24 V DC 2)	-35V...+4.5V or input open	+13V...+35V	8.5 mA 1)	3 ms	6 ms	600 m	36 V DC	500 V AC

5 - 2

Number of outputs	Contact switching capacity	Service life in switching cycles	Maximum switching frequency	Diversity factor	Insulation for nominal voltage	tested at
12 relays Connected in pairs to common potential 3)	I_{th2}:5A 4) I_e(AC11):1.5 A/250 V I_e(DC11):0.5 A/ 30 V Pilot duty rating: B300, R300	1,5 x 10^6 2,0 x 10^5	10 Hz resist. 2 Hz induct.	100%	250 V AC	2.0 kV AC

1) Applies also to two-wire proximity switches (voltage: 22V...30V DC)
2) If an external power supply unit is used, a smoothing capacitor must be fitted
3) Card relays of type E V23027-B002-A402 (SIEMENS); leakage current of parallel varistor≤1mA.
4) To VDE 0660, Part 200

CC (relay version) 6ES5 101-8UB13, 6ES5 101-8UW13

Number of inputs	Rated input voltage	Rated input voltage for "0" signal	"1" signal	Nominal input current for "1" signal	Delay, typical ON	OFF	Maximum length of line (24 V DC and 220 V lines run separately)	Insulation for nominal voltage	tested at
10 floating	24 V DC 2)	-35V...+4.5V or input open	+13V...+35V	8.5 mA 1)	3 ms	6 ms	600 m	36 V DC	500 V AC

Number of outputs	Contact switching frequency	Service life in switching cycle	Maximum switching frequency	Diversity factor (numb. of outputs "on" simultaneity)	Insulation for nominal voltage	tested at
6 relays grouped in pairs 3)	I_{th2}:5A 4) I_e(AC11):1.5 A/250 V I_e(DC11):0.5 A/ 30 V Pilot duty rating: B300, R300	1,5 x 10^6 2,0 x 10^5	10 Hz resist. 2 Hz induct.	100%	250 V AC	2.0 kV AC

T009

1) Applies also to two-wire proximity switches (voltage: 22V...30 V DC)
2) If an external power supply unit is used, a smoothing capacitor must be fitted
3) Card relays of type E V23027-B002-A402 (SIEMENS); leakage current of parallel varistor 1mA.
4) To VDE 0660, Part 200

The signal statuses of the outputs are indicated by green LEDs connected in parallel with the excitation coils of the relays.

The relay contacts are fitted with varistors (maximum leakage current 1 mA)

CC (Triac version) 6ES5 101-8UA23
EU (Triac version) 6ES5 101-8UC21

Number of inputs	Rated input voltage	Rated input voltage for "0" signal	"1" signal	Nominal input current for "1" signal	Delay and switching frequency, typical ON	OFF	Maximum length of line (24 V DC and 220 V lines run separately)	Insulation for nominal voltage	tested at
16 float. groups of 8 connec.	220 V AC +20% −	0...40 V AC or input open	159...264 V AC	typ. 20 mA 1)	8 ms	15 ms	300 m	250V AC	2.0 kV AC
					10 Hz				

Number of outputs	Output current for "1" signal and at 264 V AC	Leakage current for "0" signal	Maximum switching frequency	Diversity factor	Insulation for nominal voltage	tested at
8 groups of four connected to common potential and with 10 A FF (fast) fuse	50mA...1.0A resist. 50mA...0.5A induct. Lamp load max. 60 W	max. 5 mA	10 Hz resist 2 Hz induct Lamp load 8 Hz	100%	250 V AC	1.5 kV AC

T009

1) Suitable for AC-proximity switches

The signal statuses of the outputs are indicated by green LEDs connected in parallel with the Triacs.

CC (transistor version) 6ES5 101-8UA33
EU (transistor version) 6ES5 101-8UC31

The inputs are galvanically connected
via reference potential M_3 with the in-
put and the load voltage (outputs).

Green LEDs display the statuses of the
inputs. The LEDs are powered by the
signal voltage of the inputs.

| Number of inputs | Rated input voltage | Input voltage for | | Nominal input current for "1" signal | Delay, typical | | Maximum length of line (24 V DC and 220 V lines run separately) | Insulation for nominal voltage |
		"0" signal	"1" signal		ON	OFF		
20 non-floating	24 V DC 2)	-35V..+4.5V or input open	+13V...+35V	8.5 mA 1)	3 ms	6 ms	600 m	None – non-floating

1) Applies also to two-wire proximity switch)
   (voltage: 22 V...30 V DC)
2) If an external power supply unit is used, a
   smoothing capacitor must be fitted

The outputs are connected galvanically via
reference potential M_1 and M_2 with
the line input and the sensor voltage.
The statuses of the inputs are displayed
by green LEDs switched in parallel to the
outputs.

The LEDs are powered by the load voltage
of the outputs. Load voltage range
V_L = 20 V to 30 V DC 0 Hz inclusive of
$3 V_{pp}$ superimposed AC voltage.

Number of outputs	Output current at "1" signal and V_L	Residual current at "0" signal	Max. switching frequency	Diversity factor (number) outputs "on" simultaneity	Max. lead length
12 non-floating, connected in groups of 6 to common potential and 10 A superfast fuse	Signal level: V_L -1.5 V Max. 1.0 A to $T_u \le$ +40°C Max. 0.5 A to $T_u \le$ +55°C Lamp lead 5W to $T_u \le$ 55°C 9W to $T_u \le$ 40°C with I_{EN} = 10 x 1Rated Inductive load: 8 W to $T_u \le$ +55°C	Max. 1mA	100 Hz resistive without allowing for cycle time 2 Hz inductive 8 Hz lamp load	100 %	100 m

Limitation of voltage induced on circuit interruption
at $V_L \le$ 30 V DC: $\le$ - 2.5 V
Short-circuit protection: electronic
                        - all outputs current-limited
                        - constant short-circuit permissible only for one output
                          at Tu $\le$ +30 °C
                          Max. lead resistance 1.5 Ohm

6. Spare parts and accessories

SPARE PARTS	Order No.
101U programmable controller, relay version (20E/12A)*	6ES5 101-8UA13
101U programmable controller, relay version (10E/6A)*	6ES5 101-8UB13
101U programmable controller, relay version (20E/12A)*	6ES5 101-8UU13
101U programmable controller, relay version (10E/6A)*	6ES5 101-8UW13
101U programmable controller, Triac version (10E/6A)*	6ES5 101-8UA23
101U programmable controller, transistor version (20E/12A)*	6ES5 101-8UA33
101U expansion unit, relay version (20E/12A)	6ES5 101-8UC11
101U expansion unit, relay version (20E/(12A)	6ES5 101-8UX11
101U expansion unit, Triac version (16E/8A)	6ES5 101-8UC21
101U expansion unit, transistor version (20E/12A)* 375 memory submodule with	6ES5 101-8UC31
EPROM for 1K statements EEPROM for 1K statements (5 V type)	6ES5 375-0LA15 6ES5 375-0LC11
984 U adapter ** PG670 programmer adapter for the memory submodules of the U-type PCs	6ES5 984-0UA11
UV erasing facility **	6ES5 985-0AA11
S5-101 simulator (for the S5-101 with 24 V inputs) ***	6ES5 788-0LB11
Lithium battery (for RAM backup)	6ES5 980-0AE11

G-type fuse-link 6.3 x 32 mm
           250 mA (slow) (10 pcs.)
           500 mA (slow) (10 pcs.)
           10 AF (fast) (10 pcs.)
           1 A (slow) (10 pcs.)
           2 A (slow) (10 pcs.)
	6ES5 980-3BA11
	 6ES5 980-3BA21
	 6ES5 980-3BC41
	 6ES5 980-3BA31
	 6ES5 980-3BA71

731 interconnecting cable (1=3, 2 m) * for connecting up the PG670/PG675 programmers to the 101U PC	6ES5 731-1BD20
PG605U programmer with German labelling English labelling French labelling	 6ES5 605-0UA11 6ES5 605-0UB11 6ES5 605-0UC11
Carrying case for the PG 605U programmer PG 615 programmer, German labelling (without Operating system submodule) Operating system submodule for PG 615 programmer German English French	6ES5 986-0LA11 6ES5 615-0UA11 6ES5 815-0UA11 6ES5 815-0UB11 6ES5 815-0UC11
101U PC manual German English French	 6ES5 998-0UC13 6ES5 998-0UC23 6ES5 998-0UC33

* E = Inputs
  A = Outputs
Obtainable from EWA
Exceptions::
** Obtainable from GWK
*** Obtainable from Werkstatt Fürth