SIEMENS

Documentation Supplement

C79000-Q8576-C017-03

U Periphery
6ES5 998-0PC22, Release 01

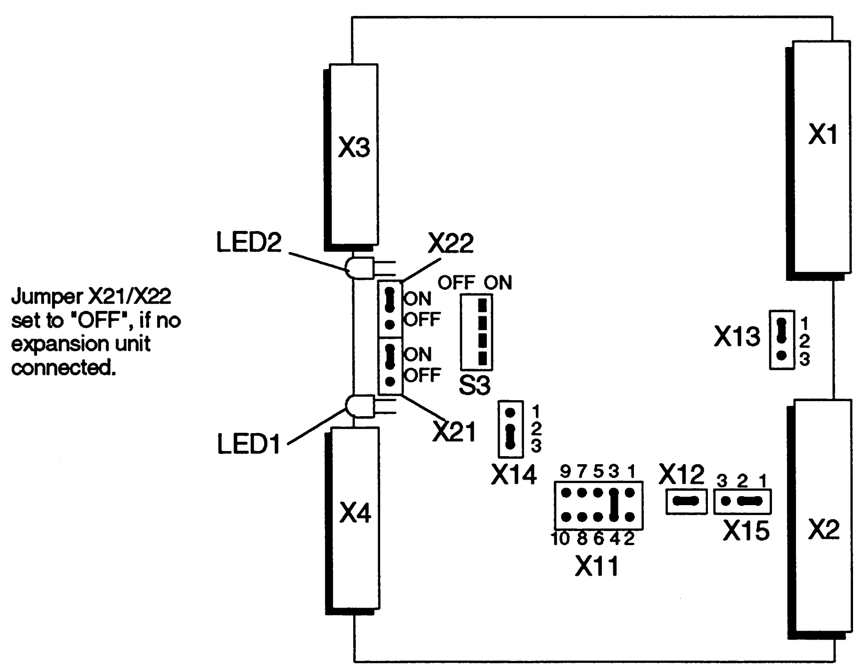
March 1993

This supplement contains additional information and corrections to the U Periphery manual which should be noted.

In the Instructions for the Interface Modules IM 304 and IM 314 (C79000-B8576-C716-02) in Part 4, on pages 14 and 16, the settings of the jumper on the jumper plug X15 are shown incorrectly. For the symmetrical connection CC - EG with IM 304 - IM 314R in S5-115H or S5-155H this jumper must be plugged between connections 1 and 2 (and not between 2 and 3).

The following diagram is therefore correct:

Symmetrical connection CC - EG with IM 304 - IM 314R (S5-115H, S5-155H)



> **Note:**
>
> A jumper may not be plugged on the jumper plug X15 between the connections 2 and 3.

In the descriptions for the expansion units in Parts 1, 2 and 3 you should ensure that the mains connection cable for the power supply units does not exceed a maximum cross-section of 0.75 mm^2.

1. 6ES5 4xx-4UA13 modules

   The 6ES5 4xx-4UA13 modules function in the same manner as the 6ES5 4xx-4UA12 modules and have the same technical data.

2. Connecting the power supply unit to the mains power supply

   With a power supply of 230 V/120 V AC you may only connect a cable with a maximum cross-section of 0.75 mm^2 to terminal 1.

3. Technical data of analog output module 6ES5 470-4UA12

   The maximum capacitive load including line capacity is 1 µF for version 04 onwards of this module.

4. Connecting resistance thermometers (e.g. Pt 100) to the 6ES5 465-.. analog output modules

   If you wish to perform measurements with the Pt 100 resistance thermometer, you can no longer use the channels 12 to 15.

5. Connecting transducers to the modules 6ES5 460-4UA11 and -4UA12

   When you use 2-wire transducers, the reference potential (common input) of these channels must be connected to L-. This removes the galvanic isolation between the channels and the power supply L+/L-.

6. Power supply module 6ES5 955-3NC13

   The technical data for output 4: 24 V at the front terminal are identical to the data for the 6ES5 955-3LC14 module.

SIEMENS

SIMATIC S5

U Periphery

Manual

Order No. 6ES5 998-0PC22
Release 01

Siemens Aktiengesellschaft

Contents		
Warning Information Suggestions/Corrections	C79000-R8576-C017	
Instructions: EG 183 U Expansion Unit EG 184 U Expansion Unit EG 187 U Expansion Unit Central Controller Interface Modules 310 and 312 Expansion Unit Interface Modules 300 and 301	C79000-B8576-C279-04	1
EG 185 U Expansion Unit	C79000-B8576-C096-01	2
EG 186 U Expansion Unit	C79000-B8576-C070-01	3
Symmetrical Interface IM 304 and IM 314	C79000-B8576-C716-02	4
Analog Input Modules Analog Output Modules	C79000-B8576-C300-06	5
Digital Input Modules Digital Output Modules	C79000-B8576-C312-08	6
Digital Input / Digital Output Module DI/DO 482	C79000-B8576-C575-03	7
Monitoring Module 313	C79000-B8576-C582-01	8
Load Current Supply Module 24V/4A 6ES5951-4LB11	C79000-B8576-C441-02	9
Installation Guide: Programmable Controllers of the U Series	C79000-B8576-C452-03	10
Technical Description: Enable Power Supply Module	C79000-T8576-C395-01	11
		12

Siemens Aktiengesellschaft

Order no.: 6ES5 998-0PC22

Order from: Gerätewerk Karlsruhe

Printed in the Federal Republic of Germany

SIEMENS

How to Use this Manual

The U Periphery manual contains the Instructions for the available peripheral modules of the U Periphery (not including the "intelligent" modules (IP's); these have their own individual Instructions).
The peripheral modules form the interface between the programmable controller (PLC) and the process.

There are **input modules, output modules and combined I/O modules.** The output modules convert the digital signals from the programmable controllers specifically into digital or analog signals, depending on the process.
The input modules convert the digital or analog process signals into digital values specific to the programmable controller.
The data transfer between the open-loop, calculating or closed-loop CPU and the peripheral modules is carried out via the S5 bus.
The process signals determine which input or output module is best suited to the automation task; a distinction must, however, be made between modules with floating or non-floating inputs and outputs. The decisive factor here is the difference in potential of the process signals or the interference voltage conditions (note the galvanic isolation between the process and the programmable controller and also between the individual channels of a module!).

If more than one subrack is required for an automation system, the user will find Instructions in this manual on **expansion units (EG's)** which can be used in various applications.

The signal exchange between the expansion units and the central controller (CC) or between the individual expansion units is carried out via **central controller interface modules or expansion unit interface modules**, also known as **interface modules (IM's)**.

The following modules have a special importance in this manual:
The **Monitoring module (MM)** monitors the data exchange between the central controller and the expansion units.
The **Load current supply** is principally used to supply 24 V to the process signals with small load (analog outputs, analog inputs, digital inputs and some digital outputs) and interference monitoring (partial short-circuit protection).
The **Enable supply** is principally used to provide the enable inputs of older programmable controllers with a power supply, which do not have an internal 24 V output for an enable supply. With newer programmable controllers the supply output of the power supply itself should be used (for power supplies with a 24 V enable supply output, see catalog ST54.1).
Parts of the automation system can be isolated from the process via *enable inputs*.

The Installation Guide gives further information on the installation and connection of CC's and EG's in cabinets.

SIEMENS

SIMATIC S5

Hinweise für den Anwender
Warning
Remarques pour votre sécurité

C79000-M8563-C567-01

Achtung!

Bei fehlendem Freigabesignal oder abgezogenem Frontstecker bzw. gezogener Baugruppe wird Quittungsverzug gemeldet. Alle Eingangsdaten dieser Baugruppe werden als 1-Signal gelesen.

Zum Abschalten von Teilprozessen nur die Freigabespannung der betreffenden Ausgabebaugruppe wegnehmen!

Der Programmierer muß im QVZ-OB sicherstellen, daß weder im Fehlerfall noch beim Tauschen einer Baugruppe ein gefährlicher Zustand im Prozeß oder an der Maschine auftreten kann.

Important!

If no enable signal is applied to the module or if the front connector or the modul is removed, all inputs of this module are read as a 1 signal.

In order to switch off subprocesses, only disconnect the enable voltage of the respective output module.

The user must program the QVZ organization block to make sure that neither in the case of a fault nor during replacement of the module a dangerous condition can occur in the process or in the plant.

Important!

En absence de signal de validation, ou si le connecteur frontal est débranché ou encore si la carte est débrochée, toutes les entrées de cette carte sont interprétées comme étant à l'état 1.

Pour arréter des processus partiels, il suffit de couper la tension de validation de la ou des cartes de sorties concernées.

Le bloc d'organisation de réaction au retard d'acquittement doit être programmé de manière qu'un défaut ou un remplacement de carte en cours de fonctionnement ne provoque pas l'apparition d'une situation dangereuse dans le processus ou sur la machine.

Warning

Risks involved in the use of so-called SIMATIC-compatible modules of non-Siemens manufacture

"The manufacturer of a product (SIMATIC in this case) is under the general obligation to give warning of possible risks attached to his product. This obligation has been extended in recent court rulings to include parts supplied by other vendors. Accordingly, the manufacturer is obliged to observe and recognize such hazards as may arise when a product is combined with products of other manufacture.

For this reason, we feel obliged to warn our customers who use SIMATIC products not to install so-called SIMATIC-compatible modules of other manufacture in the form of replacement or add-on modules in SIMATIC systems.

Our products undergo a strict quality assurance procedure. We have no knowledge as to whether outside manufacturers of so-called SIMATIC-compatible modules have any quality assurance at all or one that is nearly equivalent to ours. These so-called SIMATIC- compatible modules are not marketed in agreement with Siemens; we have never recommended the use of so-called SIMATIC-compatible modules of other manufacture. The advertising of these other manufacturers for so-called SIMATIC-compatible modules wrongly creates the impression that the subject advertised in periodicals, catalogues or at exhibitions had been agreed with us. Where so-called SIMATIC-compatible modules of non-Siemens manufacture are combined with our SIMATIC automation systems, we have a case of our product being used contrary to recommendations. Because of the variety of applications of our SIMATIC automation systems and the large number of these products marketed worldwide, we cannot give a concrete description specifically analyzing the hazards created by these so-called SIMATIC-compatible modules. It is beyond the manufacturer's capabilities to have all these so-called SIMATICcompatible modules checked for their effect on our SIMATIC products. If the use of so-called SIMATIC-compatible modules leads to defects in a SIMATIC automation system, no warranty for such systems will be given by Siemens.

In the event of product liability damages due to the use of so-called SIMATIC-compatible modules, Siemens are not liable since we took timely action in warning users of the potential hazards involved in so-called SIMATIC-compatible modules."

Safety-Related Guidelines for the User

1 General

This manual provides the information required for the intended use of the particular product. The documentation is written for technically qualified personnel such as engineers, programmers or maintenance specialists who have been specially trained and who have the specialized knowledge required in the field of instrumentation and control.

A knowledge of the safety instructions and warnings contained in this manual and their appropriate application are prerequisites for safe installation and commissioning as well as safety in operation and maintenance of the product described. Only qualified personnel as defined in section 2 have the specialized knowledge that is necessary to correctly interpret the general guidelines relating to the safety instructions and warnings and implement them in each particular case.

This manual is an inherent part of the scope of supply even if, for logistic reasons, it has to be ordered separately. For the sake of clarity, not all details of all versions of the product are described in the documentation, nor can it cover all conceivable cases regarding installation, operation and maintenance. Should you require further information or face special problems that have not been dealt with in sufficient detail in this documentation, please contact your local Siemens office.

We would also point out that the contents of this product documentation shall not become a part of or modify any prior or existing agreement, commitment or legal relationship. The Purchase Agreement contains the complete and exclusive obligations of Siemens. Any statements contained in this documentation do not create new warranties or restrict the existing warranty.

2 Qualified Personnel

Persons who are **not qualified** should not be allowed to handle the equipment/system. Non-compliance with the warnings contained in this manual or appearing on the equipment itself can result in severe personal injury or damage to property. Only **qualified personnel** should be allowed to work on this equipment/system.

Qualified persons as referred to in the safety guidelines in this manual as well as on the product itself are defined as follows:

- System planning and design engineers who are familiar with the safety concepts of automation equipment;
- Operating personnel who have been trained to work with automation equipment and are conversant with the contents of the manual in as far as it is connected with the actual operation of the plant;
- Commissioning and service personnel who are trained to repair such automation equipment and who are authorized to energize, deenergize, clear, ground and tag circuits, equipment and systems in accordance with established safety practices.

3 Danger Notices

The notices and guidelines that follow are intended to ensure personal safety, as well as protecting the product and connected equipment against damage.

The safety notices and warnings for protection against loss of life (the users or service personnel) or for protection against damage to property are highlighted in this manual by the terms and pictograms defined here. The terms used in this manual and marked on the equipment itself have the following significance:

Danger

indicates that death, severe personal injury or substantial property damage <u>will</u> result if proper precautions are not taken.

Warning

indicates that death, severe personal injury or substantial property damage <u>can</u> result if proper precautions are not taken.

Caution

indicates that minor personal injury or property damage <u>can</u> result if proper precautions are not taken.

Note

is an important information about the product, its operation or a part of the manual to which special attention is drawn.

Important

If in this manual "Important" should appear in bold type, drawing attention to any particularly information, the definition corresponds to that of "Warning", "Caution" or "Note".

4 Proper Usage

- The equipment/system or the system components may only be used for the applications described in the catalog or the technical description, and only in combination with the equipment, components and devices of other manufacturers as far as this is recommended or permitted by Siemens.
- The product described has been developed, manufactured, tested and the documentation compiled in keeping with the relevant safety standards. Consequently, if the described handling instructions and safety guidelines described for planning, installation, proper operation and maintenance are adhered to, the product, under normal conditions, will not be a source of danger to property or life.

⚠ **Warning**

- After opening the housing or the protective cover or after opening the system cabinet, certain parts of this equipment/system will be accessible, which could have a dangerously high voltage level.
- Only suitably qualified personnel should be allowed access to this equipment/system.
- These persons must be fully conversant with any potential sources of danger and maintenance measures as set out in this manual.
- It is assumed that this product be transported, stored and installed as intended, and maintained and operated with care to ensure that the product functions correctly and safely.

5 Guidelines for the Planning and Installation of the Product

The product generally forms a part of larger systems or plants. These guidelines are intended to help integrate the product into its environment without it constituting a source of danger.

The following facts require particular attention:

> **Note**
>
> Even when a high degree of safety has been designed into an item of automation equipment by means of multichannel configuration, it is still imperative that the instructions contained in this manual be exactly adhered to. Incorrect handling can render ineffective the preventive measures incorporated into the system to protect it against dangerous faults, and even create new sources of danger.

The following advice regarding installation and commissioning of the product should - in specific cases - also be noted.

> **Warning**
>
> - Follow strictly the safety and accident prevention rules that apply in each particular case.
> - Units which are designed as built-in units may only be operated as such, and table-mounted or portable equipment only with its casing closed.
> - In the case of equipment with a permanent power connection which is not provided with an isolating switch and/or fuses which disconnect all poles, a suitable isolating switch or fuses must be provided in the building wiring system (distribution board). Furthermore, the equipment must be connected to a protective ground (PE) conductor.
> - For equipment or systems with a fixed connecting cable but no isolating switch which disconnects all poles, the power socket with the grounding pin must be installed close to the unit and must be easily accessible.
> - Before switching on the equipment, make sure that the voltage range setting on the equipment corresponds to the local power system voltage.
> - In the case of equipment operating on 24 V DC, make sure that proper electrical isolation is provided between the mains supply and the 24 V supply. Only use power supply units to IEC 364-4-41 or HD 384.04.41 (VDE 0100 Part 410).
> - Fluctuations or deviations of the power supply voltage from the rated value should not exceed the tolerances specified in the technical specifications. Otherwise, functional failures or dangerous conditions can occur in the electronic modules/equipment.
> - Suitable measures must be taken to make sure that programs that are interrupted by a voltage dip or power supply failure resume proper operation when the power supply is restored. Care must be taken to ensure that dangerous operating conditions do not occur even momentarily. If necessary, the equipment must be forced into the "emergency off" state.
> - Emergency tripping devices in accordance with EN 60204/IEC 204 (VDE 0113) must be effective in all operating modes of the automation equipment. Resetting the emergency off device must not result in any uncontrolled or undefined restart of the equipment.

> **Caution**
>
> - Install the power supply and signal cables in such a manner as to prevent inductive and capacitive interference voltages from affecting the automation functions.
> - Automation equipment and its operating elements must be installed in such a manner as to prevent unintentional operation.
> - Automation equipment can assume an undefined state in the case of a wire break in the signal lines. To prevent this, suitable hardware and software measures must be taken when interfacing the inputs and outputs of the automation equipment.

6 Active and Passive Faults in Automation Equipment

- Depending on the particular task for which the electronic automation equipment is used, both **active** as well as **passive** faults can result in a **dangerous** situation. For example, in drive control, an active fault is generally dangerous because it can result in an unauthorized startup of the drive. On the other hand, a passive fault in a signalling function can result in a dangerous operating state not being reported to the operator.
- This differentiation of the possible faults and their classification into dangerous and non-dangerous faults, depending on the particular task, is important for all safety considerations in respect of the product supplied.

Warning

In all cases where a fault in an automation equipment can result in severe personal injury or substantial damage to property, ie. where a dangerous fault can occur, additional external measures must be taken or equipment provided to ensure or force safe operating conditions even in the event of a fault (e.g. by means of independent limit monitors, mechanical interlocks etc.).

7 Procedures for Maintenance and Repair

If measurement or testing work is to be carried out on an active unit, the rules and regulations contained in the "VBG 4.0 Accident prevention regulations" of the German employers liability assurance association (Berufsgenossenschaften) must be observed. Particular attention is drawn to paragraph 8 "Permissible exceptions when working on live parts". Use only suitable electrical tools.

Warning

- Repairs to an item of automation equipment may only be carried out by **Siemens service personnel** or an **authorized Siemens repair center.** For replacement purposes, use only parts or components that are contained in the spare parts list or listed in the "Spare parts" section of this manual. Unauthorized opening of equipment and improper repairs can result in loss of life or severe personal injury as well as substantial property damage
- Before opening the equipment, always remove the power plug or open the disconnecting switch.
- Only use the fuse types specified in the technical specifications or the maintenance instructions of this manual.
- Do not throw batteries into an open fire and do not carry out any soldering work on batteries (danger of explosion). Maximum ambient temperature 100°C. Lithium batteries or batteries containing mercury should not be opened or recharged. Make sure that the same type is used when replacing batteries.
- Batteries and accumulators must be disposed of as classified waste.
- The following points require attention when using monitors:
  Improper handling, especially the readjustment of the high voltage or fitting of another tube type can result in excessive X-ray radiation from the unit. The license to operate such a modified unit automatically lapses and the unit must not be operated at all.

Guidelines for Handling
Electrostatically Sensitive Devices (ESD)

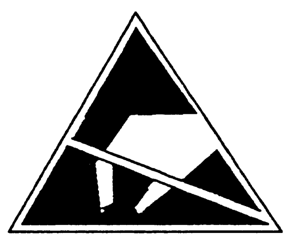
1 What is ESD?

VSLI chips (MOS technology) are used in practically all SIMATIC S5 and TELEPERM M modules. These VLSI components are, by their nature, very sensitive to overvoltages and thus to electrostatic discharge:

They are therefore defined as
"Electrostatically Sensitive Devices"

"ESD" is the abbreviation used internationally.

The following warning label on the cabinets, subracks and packing indicates that electrostatically sensitive components have been used and that the modules concerned are susceptible to touch:



ESDs can be destroyed by voltage and energy levels which are far below the level perceptible to human beings. Such voltages already occur when a component or a module is touched by a person who has not been electrostatically discharged. Components which have been subjected to such overvoltages cannot, in most cases, be immediately detected as faulty; the fault occurs only after a long period in operation.

An electrostatic discharge

- of 3500 V can be felt
- of 4500 V can be heard
- must take place at a minimum of 5000 V to be seen.

But just a fraction of this voltage can already damage or destroy an electronic component.

The typical data of a component can suffer due to damage, overstressing or weakening caused by electrostatic discharge; this can result in temporary fault behavior, e.g. in the case of

- temperature variations,
- mechanical shocks,
- vibrations,
- change of load.

Only the consequent use of protective equipment and careful observance of the precautions for handling such components can effectively prevent functional disturbances and failures of ESD modules.

2 When is a Static Charge Formed?

One can never be sure whether the human body or the material and tools which one is using are not electrostatically charged.

Small charges of 100 V are very common; these can, however, very quickly rise up to 35 000 V.

Examples of static charge:

– Walking on a carpet	up to 35 000 V
– Walking on a PVC flooring	up to 12 000 V
– Sitting on a cushioned chair	up to 18 000 V
– Plastic desoldering unit	up to 8 000 V
– Plastic coffee cup	up to 5 000 V
– Plastic bags	up to 5 000 V
– Books, etc. with a plastic binding	up to 8 000 V

3 Important Protective Measures against Static Charge

- Most plastic materials are highly susceptible to static charge and must therefore be kept as far away as possible from ESDs.
- Personnel who handle ESDs, the work table and the packing must all be carefully grounded.

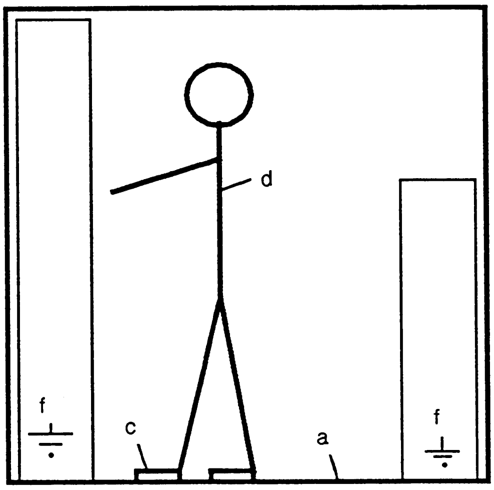
4 Handling of ESD Modules

- One basic rule to be observed is that electronic modules should be touched by hand only if this is necessary for any work required to be done on them. Do not touch the component pins or the conductors.
- Touch components only if
  - the person is grounded at all times by means of a wrist strap

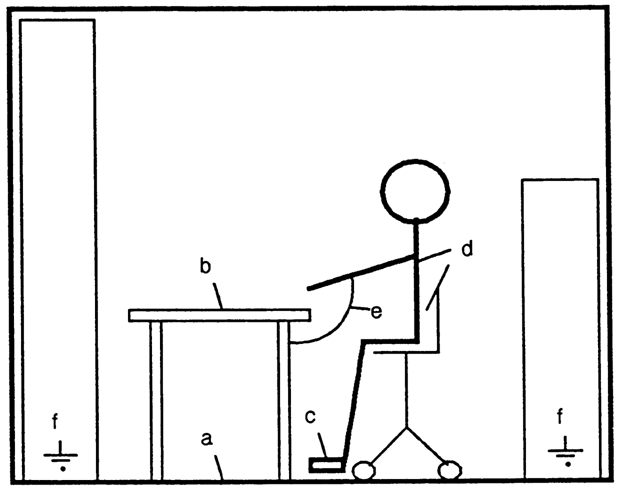
  or

  - the person is wearing special anti-static shoes or shoes with a grounding strip.
- Before touching an electronic module, the person concerned must ensure that (s)he is not carrying any static charge. The simplest way is to touch a conductive, grounded item of equipment (e.g. a blank metallic cabinet part, water pipe, etc.) before touching the module.
- Modules should not be brought into contact with insulating materials or materials which take up a static charge, e.g. plastic foil, insulating table tops, synthetic clothing, etc.
- Modules should only be placed on conductive surfaces (table with anti-static table top, conductive foam material, anti-static plastic bag, anti-static transport container).
- Modules should not be placed in the vicinity of monitors, TV sets (minimum distance from screen > 10 cm).

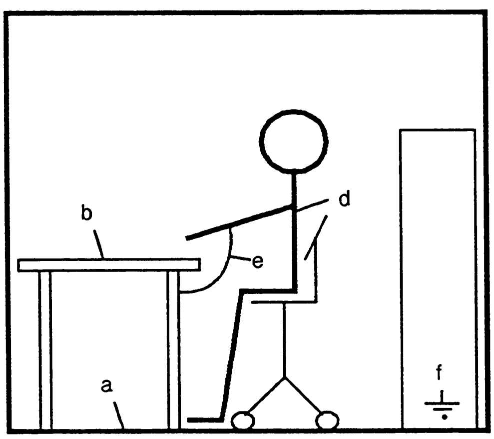
The diagram below shows the required protective measures against electrostatic discharge.



Standing position



Standing/sitting position



Sitting position

a Conductive flooring
b Anti-static table
c Anti-static shoes
d Anti-static coat
e Grounding wrist strap
f Grounding connection of the cabinets

5 Measurements and Modification to ESD Modules

- Measurements on modules may only be carried out under the following conditions:
  - The measuring equipment is grounded (e.g. via the PE conductor of the power supply system) or
  - when electrically isolated measuring equipment is used, the probe must be discharged (e.g. by touching the metallic casing of the equipment) before beginning measurements.
- Only grounded soldering irons may be used.

6 Shipping of ESD Modules

Anti-static packing material must always be used for modules and components, e.g. metalized plastic boxes, metal boxes, etc. for storing and dispatch of modules and components.

If the container itself is not conductive, the modules must be wrapped in a conductive material such as conductive foam, anti-static plastic bag, aluminium foil or paper. Normal plastic bags or foils should not be used under any circumstances.

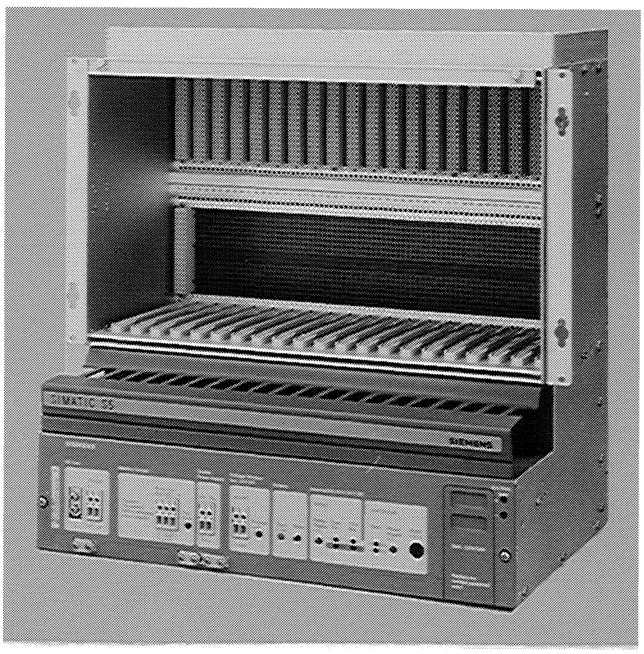
For modules with built-in batteries ensure that the conductive packing does not touch or short-circuit the battery connections; if necessary cover the connections with insulating tape or material.

SIEMENS

SIMATIC S5

Expansion unit 183 U — **6ES5 183-3UA.**
Expansion unit 184 U — **6ES5 184-3UA.**
Expansion unit 187 U — **6ES5 187-5UA.**
Central controller interface modules 310 and 312 — **6ES5 31 .- . . . .**
Expansion unit interface modules 300 and 301 — **6ES5 30 .- . . . .**

Operating instructions Order no. C79000-B8576-C279-04



Contents

		Page
1	**Technical Description**	**2**
1.1	Application	2
1.2	Design	2
1.3	Possible Configurations of the Expansion units	5
1.4	Technical Data	6
2	**Installation**	**12**
2.1	Installing the Expansion Unit	12
2.2	Connecting the Power Supplies	12
2.3	Notes on Start-up	14
2.4	Fan Monitoring	14
3	**Operation**	**15**
3.1	Controls and Displays	15
3.2	Jumper Assignment/ Changing Function	17
4	**Maintenance**	**22**
4.1	Inserting and Removing Modules	22
4.2	Changing the Fans	22
4.3	Bus Board Interface	23
4.4	Pin Assignment of the Front Connectors	24
4.5	Pin Assignment of the Power Supply Unit Interface	25
4.6	Connecting Cable 6ES5 721-0...	26
4.7	Terminator 760	27
5	**Spare Parts**	**28**

1 Technical Description

1.1 Application

SIMATIC S5 programmable controllers consist of a central controller (CC) and, if required, one or more expansion units (EU). Expansion units are connected if there are not enough module slots for I/O modules in the central controller.

The interface modules 300-5C, 301, 310 and 312-5C are used to connect the expansion units to each other and to the central controller.

The expansion units can be used with the S5 130 K, 130 W, 135 U, 150 K, 150 S, 150 U and 155 U programmable controllers.

1.2 Design

The 183 U expansion unit consists of a compact housing with cable duct and a power supply unit integrated in the fan unit.

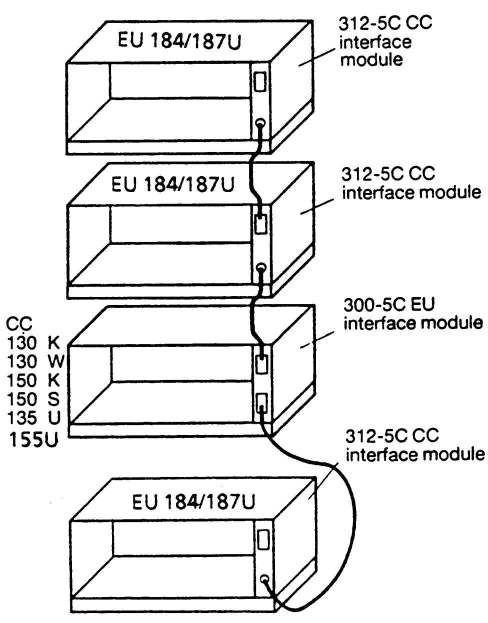
The 184 U expansion unit consists of a compact housing with cable duct and fan unit (without power supply unit).

Both expansion units have 21 module slots.

The 187 U expansion unit consists of a compact housing without cable duct, fan or power supply unit. The 187 U expansion unit has 11 module slots.

Centralized configuration

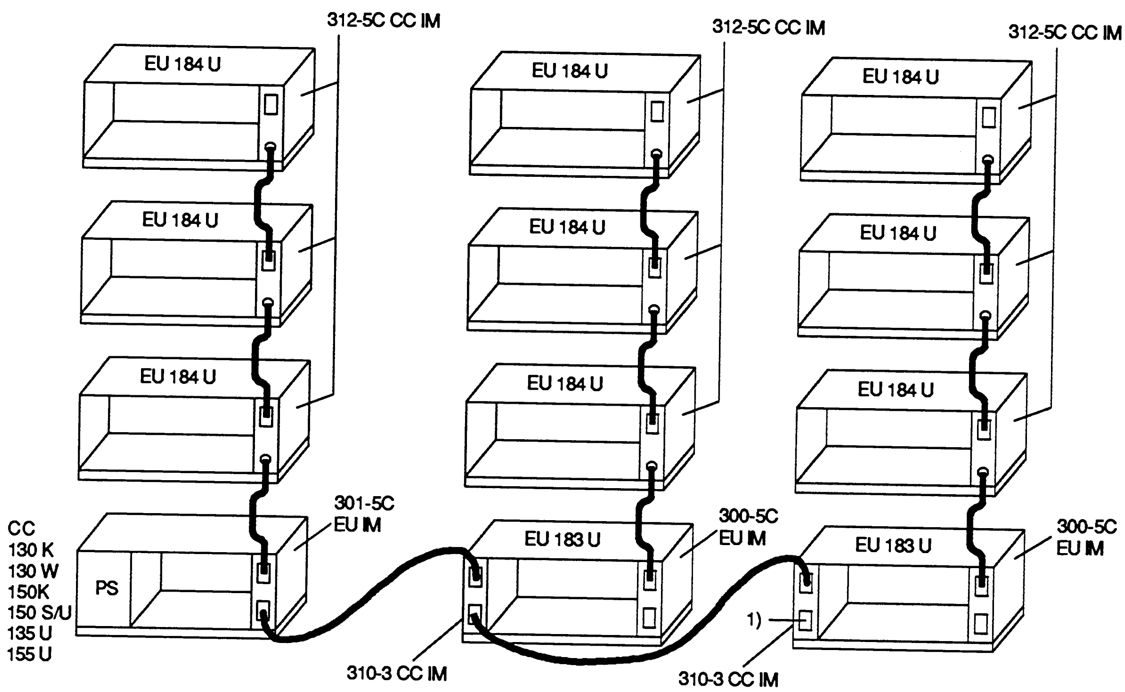
The units are installed close to each other, however, with a minimum clearance of 90 mm (e.g. in the cabinet).

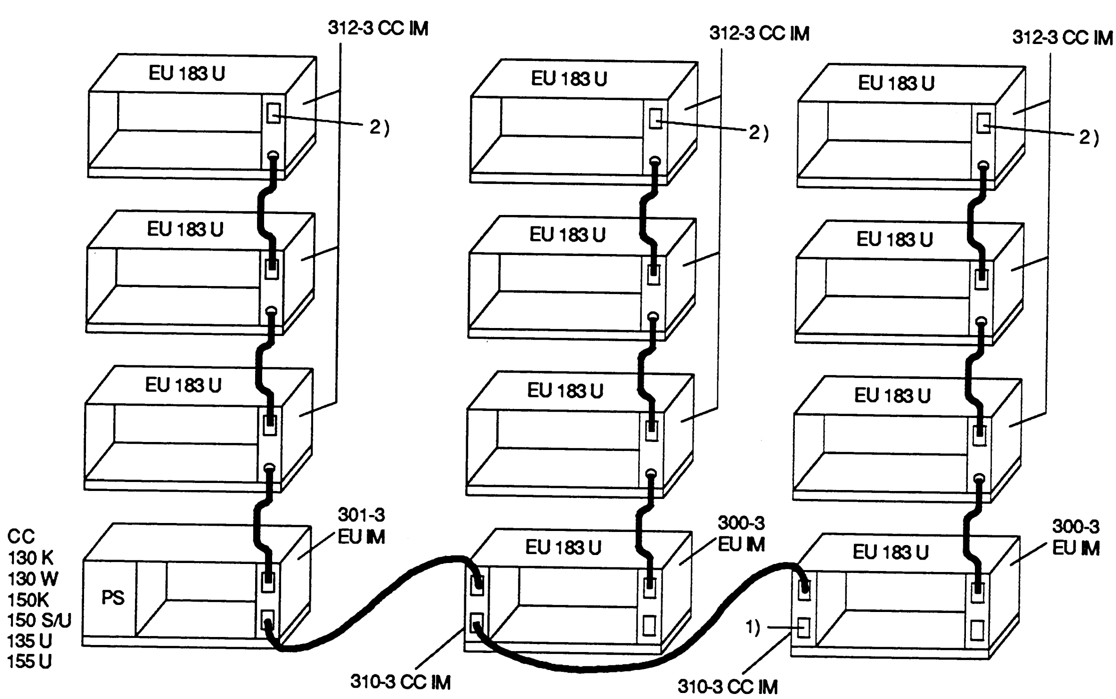


The total cable length from the central controller to the last expansion unit must not exceed 2 m.

Distributed configuration

The total cable length from the central controller to the last 310-3 CC interface module must not exceed 200 m, otherwise as for centralized configuration.



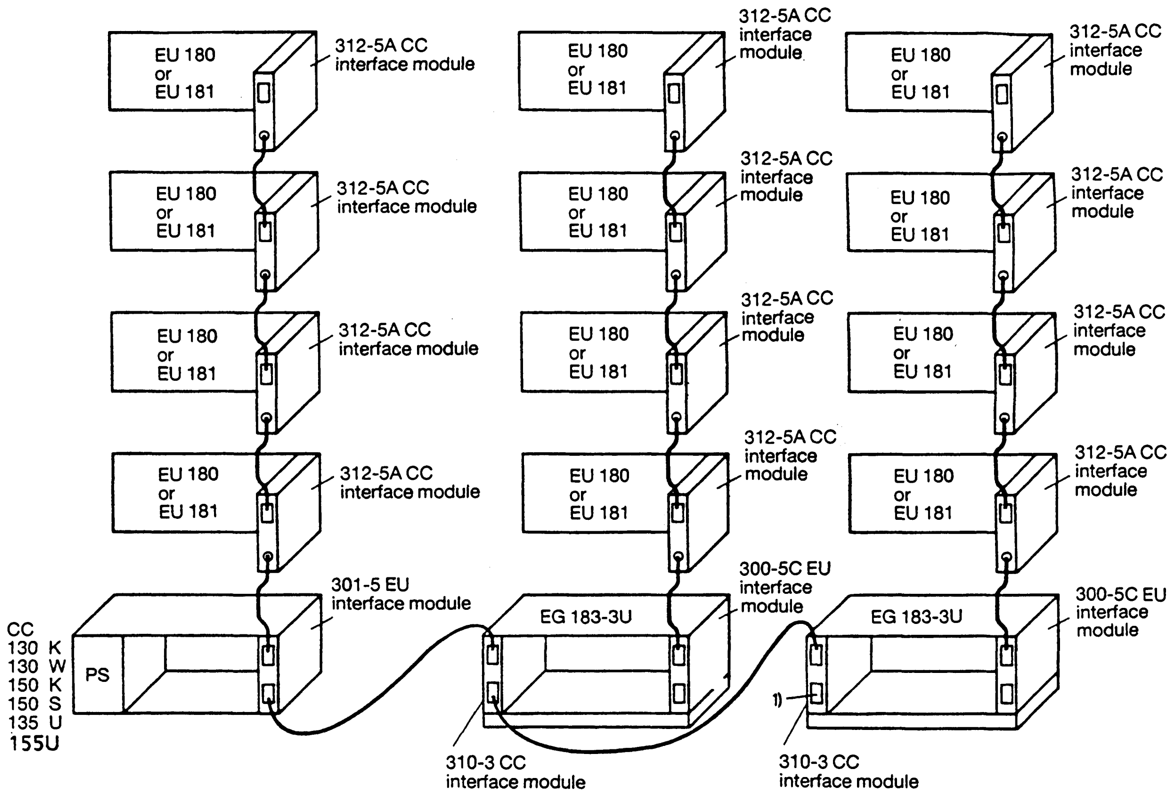


1) Terminator 6ES5 760-0AA11
2) Terminator 6ES5 760-0AB11

Connecting rugged expansion units

Make sure that the maximum load on the power supply unit in the central controller and/or in the EU 183 is not exceeded (see Section 1.4).

Operating instructions for rugged expansion units - order no. C79000-B8576-C226.



1) Terminator 6ES5 760-0AA11.

1.3 Possible Configurations of the Expansion Units

Modules \ Slots	3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163
CC/EU int. mod. 310	■																				
CC int. mod. 311	■																				
EU int. mod. 300																					■
Digital inputs/outputs	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Analog inputs/outputs	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IP 240 - 245	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Monitoring mod. 313	■																				■

Possible configurations in expansion unit 184 U

Modules \ Slots	3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163
CC int. mod. 312																					■
Digital inputs/outputs	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Analog inputs/outputs	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
IP 240 - 245	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Monitoring mod. 313	■																				

Possible configurations in expansion unit 187 U

Modules \ Slots.	3		19		35		51		67		83		99		115		131		147		163
CC int. mod. 312																					■
Digital inputs/outputs	■		■		■		■		■		■		■		■		■		■		
Analog inputs/outputs	■		■		■		■		■		■		■		■		■		■		
Monitoring mod. 313	■																				

1.4 Technical Data

Safety requirements	VDE 0160
Safety class	1
Degree of protection	IP 20
Operating temperature	0 to 55^{o}C
Transport and storage temperature	-40 to 70^{o}C
Humidity rating	max. 95% at 25^{o}C, (without condensation)
Operating altitude	max. 3500 m above sea level
Mechanical requirements	installation in fixed equipment, not necessarily free of vibration; installation on ships and in vehicles possible, observing special regulations, however, not directly on the engine.
Expansion unit 183 U/184 U	
Weight	approx. 14 kg / approx. 13 kg
Dimensions (W x H x D)	482 mm x 432 mm x 310 mm
Expansion unit 187 U	
Weight	approx. 11 kg
Dimensions (W x H x D)	482 mm x 266 mm x 220 mm

Power supply unit 6ES5 955-3LC14

Input

Rated input voltage U_{EN}	230/115 V AC + 10%/-18.7% [1])
Undervoltage signal U_E	< 187 V AC (or 93 V AC)
Input frequency f_E	48 to 63 Hz
Current input I_{EN} at rated load and U_{EN} = 230 V (or 115 V)	1.25 A (or 2.5 A)
Peak inrush current I_{Emax}	100 A (or 50 A)
Efficiency at rated load, with fan	typ. 61%

[1]) Voltage selector

Power supply buffering time	> 5 ms
Power factor	0.65
Input fuse protection	4 A fast-acting; 250 V; 6.3 mm x 32 mm; location F 26

<u>Output 1</u>

Rated output voltage U_{AN1}	5.1 V DC ± 0.5%
Range of output voltage	(0.95 to 1.05) x U_{AN1}
Rated output current I_{AN1}	18 A DC
Ripple	≤ 1% of U_{A1}
Dynamic voltage tolerances	
at sudden load change from 50% to 100% I_N	≤ 5% of U_{A1}
Settling time	≤ 5 ms
Overvoltage cut-off U_{A1}	6 V ± 5%
Undervoltage signal U_{A1}	4.75 V + 5%
Current limiting at overload	(1.05 to 1.15) x I_{AN1}

<u>Output 2</u>

Rated output voltage U_{AN2}	24 V DC + 25% / - 17%
Rated output current I_{AN2}	0.8 A DC [1])
Ripple	≤ 5% of U_{A2}
Fuse for overcurrent protection	1.5 A fast-acting; 250 V; 6.3 mm x 32 mm, location F90

<u>Output 4: 24 V front</u>

Rated output voltage U_{AN4}	24 V DC + 6 V/- 5 V
Rated output current I_{AN4}	0.4 A [1])
Current limiting (response threshold)	≥ 0.44 A
Undervoltage signal (LED on front panel)	16 V ± 20%
Capacitive load	max. 100 nF

[1]) Sum of output currents I_{A2} and I_{A4} ≤ 0.8 A DC

Fans	2 axial-flow fans
Input voltage	115 V AC, selectable (serial/parallel)
Delivery rate per fan	160 m^3/h (no load)
Fan monitoring	Air flow monitoring with PTC thermistor detectors; stoppage of one or both fans is detected and signalled (LED, relay) or cuts off the output voltages (can be disabled with jumper F-R).
Service life of a fan	typ. 30,000 to 40,000 h at 55°C; typ. 40,000 to 50,000 h at 30°
Additional monitoring	
24 V load voltage (voltage monitor ext.)	$\geq$ 14 to 20 V
Electrical isolation primary/secondary	yes

Power supply unit 6ES5 955-3NC13

Input	
Rated input voltage U_{EN}	24 V DC + 25%/- 17%
Undervoltage signal U_E	< 20 V DC
Current input I_{EN} at rated load and U_{EN} = 24 V	6.9 A
Peak inrush current I_{Emax}	250 A
Efficiency at rated load	typ. 67%
Power supply buffering time	> 5 ms
Input fuse protection	15 A medium time lag; 250 V; 6.3 mm x 32 mm; location F 1

Output 1

Rated output voltage U_{AN1}	5.1 V DC ± 0.5%
Range of output voltage	(0.95 to 1.05) x U_{AN1}
Rated output current I_{AN1}	18 A DC
Ripple	≤ 1% of U_{A1}
Dynamic voltage tolerances at sudden load change from 50% to 100% I_N	≤ 5% of U_{A1}
Settling time	≤ 5 ms
Overvoltage cut-off U_{A1}	6 V ± 5%
Undervoltage signal U_{A1}	4.75 V ± 5%
Current limiting at overload	(1.05 to 1.15) x I_{AN1}

Output 2

Rated output voltage U_{AN2}	24 V DC + 25% / - 17%
Rated output current I_{AN2}	0.8 A DC
Total current load of the 24 V and 15 V output	≤ 0.8 A
Ripple	≤ 5% of U_{A2}
Fuse for overcurrent protection	1.5 A fast-acting; location F90

Fans

Fans	2 axial-flow fans
Input voltage	24 V DC
Delivery rate per fan	160 m^3/h (no load)
Fan monitoring	Air flow monitoring with PTC thermistor detectors; stoppage of one or both fans is detected and signalled (LED, relay) or cuts off the output voltages (can be disabled with jumper F-R).
Service life of a fan	typ. 30,000 to 40,000 h at 55°C; typ. 40,000 to 50,000 h at 30°

Additional monitoring

24 V load voltage (voltage monitor ext.)	$\geq$ 14 to 20 V	
Interface module	**300-5C**	**301-5C**
Maximum current per interface	5 A	5 A [5])
Power supply (internal)	5 V $\pm$ 5%	5 V $\pm$ 5%
Maximum current input	0.6 A	0.75 A
Approximate weight	0.35 kg	0.3 kg

Interface module	**310-3**	**312-5C-3**
Power supply (internal)	5 V $\pm$ 5 %	5 V $\pm$ 5 %
Maximum current input	0.65 A	0.2 A
Approximate weight	0.3 kg	0.35 kg

Interface module	**300-3**	**301-3**
Maximum current input	0.6 A	0.75 A
Power supply (internal)	5 V $\pm$ 5%	5 V $\pm$ 5%
Maximum current input	0.6 A	0.75 A
Approximate weight	0.35 kg	0.3 kg

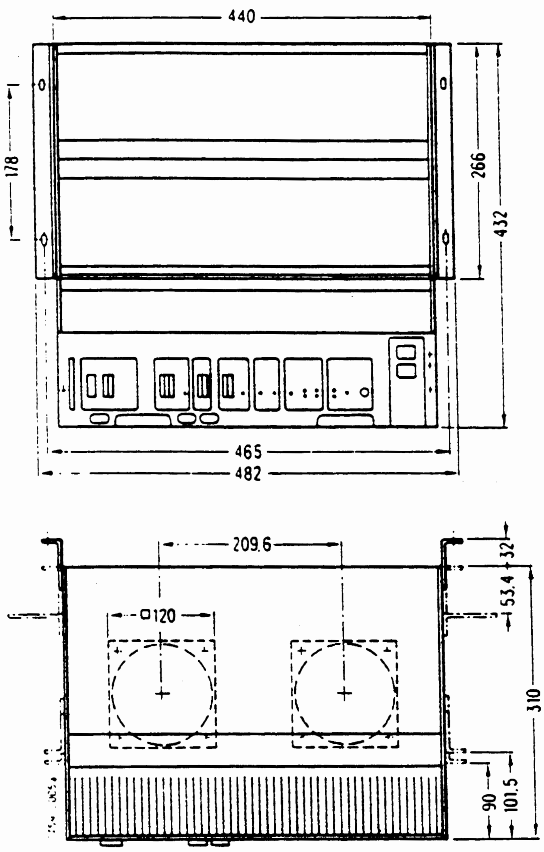
Cable lengths

312-5C CC interface module for EU 184 U (compact design)

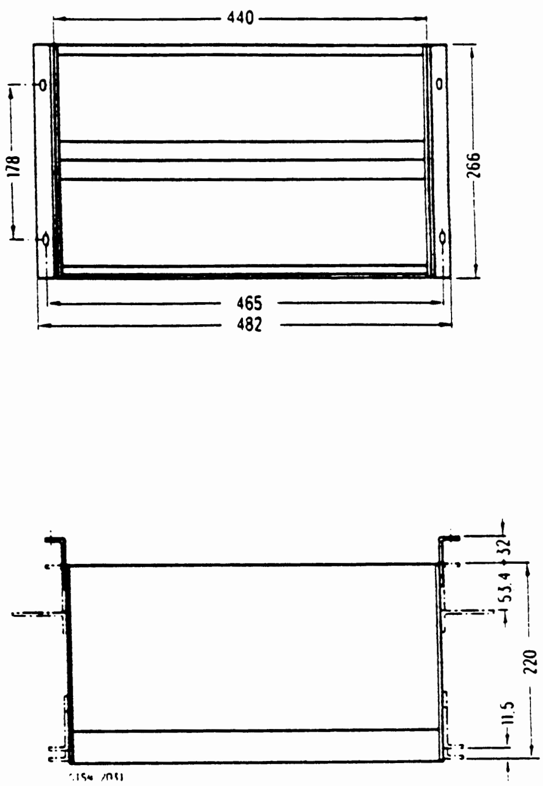
Order no.	Cable length	Configuration
6ES5 312-5CA11	0.5 m	EU above CC
6ES5 312-5CA21	1.5 m	EU beside CC
6ES5 312-3AB11	0.5 m	EU above CC
6ES5 312-3AB31	0.95 m	EU below CC

Fan units for expansion units	**6ES5 988-3LA11** 6ES5 184-3UA11	**6ES5 988-3NA11** 6ES5 184-3UA21
Power supply	220/110 V	24 V_
Tolerance	$\pm$15 %	-17 to +25 %
Current input	0.5 A eff.	1 A eff.

Expansion units EU 183U, EU 184U



Expansion unit EU 187U



Note: the output voltage (24 V_) is not wired on the bus board of the expansion unit.

2 Installation

2.1 Installation of the Expansion Unit

The expansion unit is suitable for installation in cabinets (see catalog ST 53), open racks or control desks.

It is secured in position using M6 screws and washers.

To allow unobstructed ventilation, a minimum clearance of 88.9 mm (2 U) must be maintained above, below and behind the expansion unit.

If the unit is wall-mounted, a clearance of 100 mm to the wall is required.

The total heat generated inside a cabinet must be dissipated either by natural convection or cabinet ventilation.

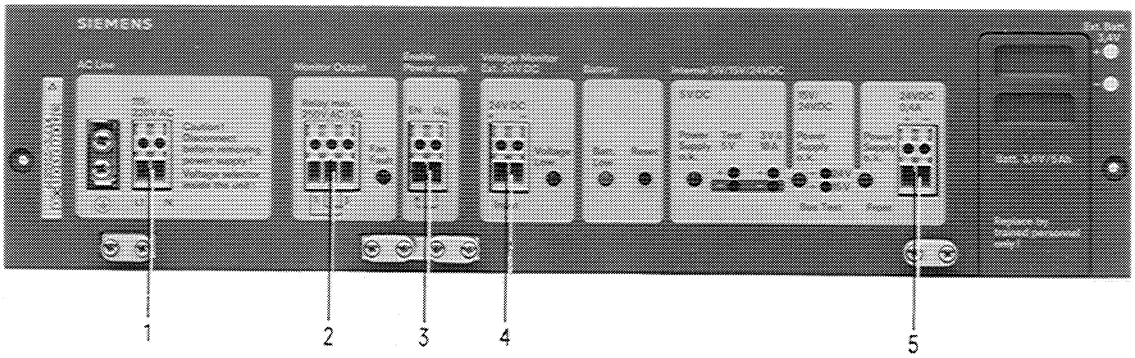
The dimensions of the expansion unit with modules and fans are as follows: (H x W x D) 440 mm x 490 mm x 352 mm.

2.2 Connecting the Power Supplies

The VDE regulations must be observed, particularly VDE 0100.

Cable clamps should be used to avoid strain on the cables.

Wire cross-section: 0.5 mm^2 to 4 mm^2
Length of cable to be stripped: 5 mm



1 AC line:
220 V input voltage (depending on type of power supply unit DC line 24 V also possible).

2 Monitor output:
The stoppage of one or both fans is signalled externally via the LED and relay contact and causes the output voltages to be switched off (function can be disabled with jumper F-R; then only relay signal and LED display).

1 2 3 (suggested wiring, see installation guidelines)

3 Enable power supply:
With one U_H output no more than 7 enable inputs (front terminal) may be energized (wiring suggestion see installation guidelines, not with EU 184 U).

4 Voltage monitor:
24 V load voltage monitoring input, must be connected or deactivated by jumper BA-EX in the power supply unit (not with the EU 184 U).

5 Output 24 V DC; 0.4 A:
This output can be used to supply the enable inputs of the U peripherals (not with the EU 184 U).

Fig. 7 Power supply connections

The relevant VDE regulations should be observed, particularly VDE 0100.

The terminals on the front panel are suitable for a cable cross-section up to 4 mm^2.

2.3 Notes on Start-up

The 220 V supply cable should be kept as far away from the other cables as possible.

The 24 V ground connection to terminal D1 (0 V) must be made via a short, strong cable (2.5 mm^2 cross-section) and be separated from the other signal cables.

The programmable controllers are supplied for operation with an earthed reference potential.

If the programmable controller is installed in a cabinet, the housing must be earthed to the cabinet rails by means of screws.

The metallic parts of the cabinet (side panels, door etc.) must be connected to each other by low-resistance wires (10 to 16 mm^2 cross-section). The cabinet must be connected to the PE conductor.

If the input or output cables are shielded, they must be clamped to a shielding bar with a low-resistance connection to the housing of the programmable controller.

The 24 V load voltage power supply unit must have a smoothing capacitor (approx. 200 uF per ampere load current). In addition, a screen winding is required for the transformer.

Inductive voltage peaks are limited on the output modules. To increase noise immunity, you are nevertheless recommended to fit quenching elements (e.g. diode 1 N 4004) to the coils and contactors to be energized.

If contactors are mounted in the same cabinet as the programmable controller, or in the vicinity of the cabinet, it is advisable to connect suppressors across the contactor coils (RC element with 0.25 uF).

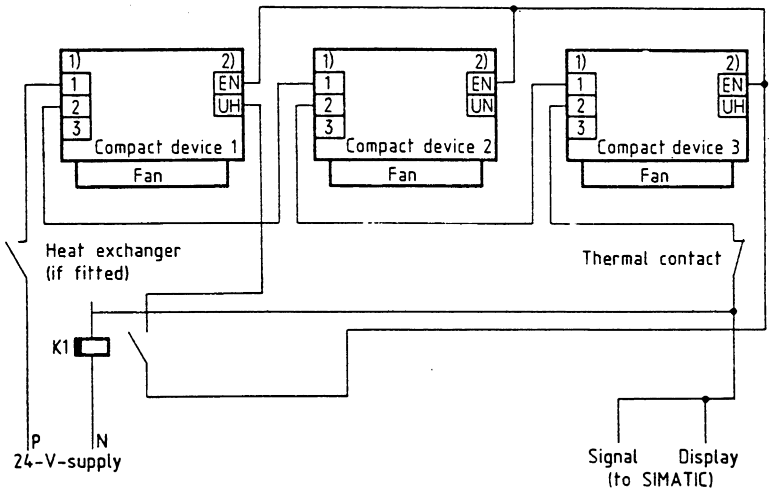
The installation guidelines, order no. C79000-B8576-C252 must be followed.

2.4 Fan Monitoring

If a fan fails, adequate cooling cannot be guaranteed. When supplied, all programmable controllers are wired so that the power supply unit is switched off if a fan fails.

If, for technical reasons, the power supply cannot be disconnected immediately, jumper F-R must be removed. You must, however, ensure that the power supply is switched off within 60 seconds.

If several units with fan assemblies are to be monitored together, the EN and U_H terminals for fan monitoring must be wired as shown in the following circuit diagram. In this case, all units will be switched off if a fan fails.



1) Relay, max. 250 V, 3 A
2) Enable power supply.

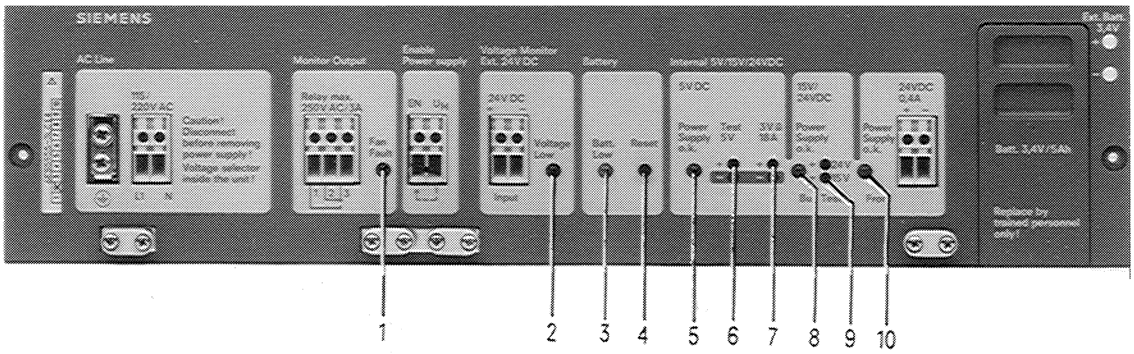
With fan unit only 1 (LED "fan fault")

3 Operation

3.1 Controls and Displays

EU interface module 300-5C/300-3

LEDs "I/O module fault"
The LEDs LD1 and/or LD2 are lit when there is a constant RDY signal (acknowledgement signal from an I/O module) at the upper and/or lower terminal strip.



1 LED "Fan Fault"
The red LED is lit if there is a fan malfunction. The power supply unit is then switched off (jumper F-R inserted) after a delay of 6 to 10 s. If, for technical reasons, the power supply cannot be switched off immediately, jumper F-R must be removed. The power supply must, however, be switched off within 60 s, otherwise the module may overheat.

2 LED "Voltage Low"
The red LED is lit if the voltage at the load voltage monitoring input is too low.

3 LED "Batt. Low"
No function in the EU

4 Key "Reset"
No function in the EU

5 LED "Power Supply O.K."
The green LED is lit when the output voltage of 5 V is present.

6 Test socket "Test 5 V"
The output current I_{A1} can be checked
(standard setting: 5.1 V DC ± 0.5%)

7 Test socket "3 V = 18 A"
The output current I_{A1} can be checked
(3 V = max. output current of the corresponding power supply unit)

8 LED "Power Supply O.K." (Bus)
The green LED is lit when the output voltage of 15 V (if the 15 V additional module is being used) <u>and</u> the output voltage of 24 V are present.

9 Test socket "15 V/24 V DC" (Bus)
a) The output voltage U_{A2} can be checked
(24 V DC + 25%/- 17%)
b) The output voltage U_{A3} can be checked
(15 V DC ± 5%, the 15 V additional module must be inserted)

10 LED "Power Supply O.K." (Front)
The green LED is lit if the output voltage of 24 V is present.

Fig. 8 Power supply units 6ES5 955-3...

EU interface module 301-5C/301-3

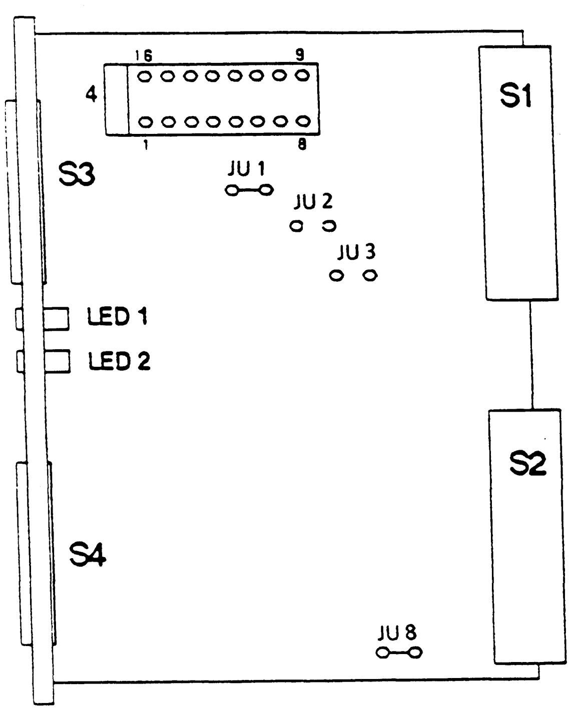
"Fault" LEDs
During static or dynamic warm restarts, the red LED 1 and/or LED 2 is lit if the internal supply voltage (5 V DC) or the external load voltage (24 V DC) fails.

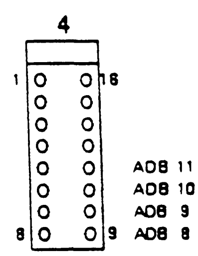
3.2 Jumper Assignments/Changing the Function

EU interface module 300-5C

Standard assignment	Function	Jumper in	Jumper out
	Clock pulse from front connector 3/35 to base connector 1z4	2	
x	Clock pulse not switched through	-	2
x	Test point; cannot be changed	1	
x	Switch through EANK	-	3
x	Additional delay of MEMR and MEMW by approx. 500 ns	8	

EU interface module 300-5C



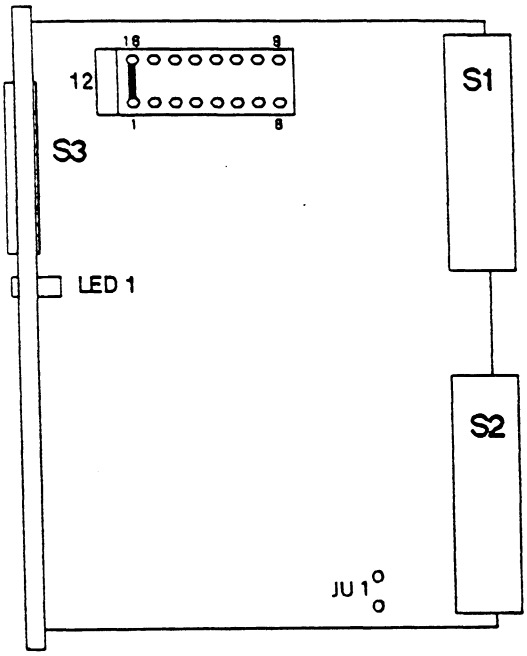


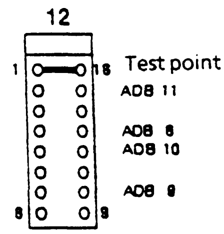
Adress expansion for the extended peripheral area (0 area) only with the S5 135U, 150U and 155U. Insert jumper 8-9 on jumper base 4.

EU interface module 300-3

Standard assignment	Function	Jumper in	Jumper out
x	Switch through CPKLA to 2z18	-	1

EU interface module 300-3



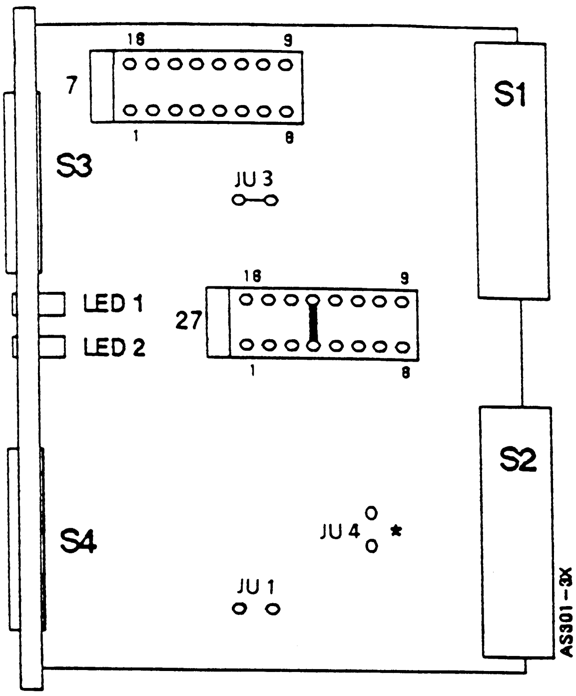


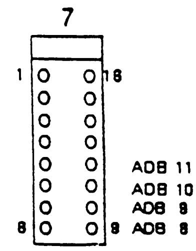
Adress expansion for the extended peripheral area (0 area) only with the S5 135U, 150S, 150 U and 155 U. Insert jumper 4-13 on jumper base 12.

EU interface module 301-3/301-5C

Standard assignment	Function	Jumper in	Jumper out
x	Test point;	3	-
x	Test point;	27/4-13	2
	CC and all EUs are reset	1	-
x	Only the EUs are reset	-	1
	Switch through PEU to ZGU	4	-

EU interface module 301-3

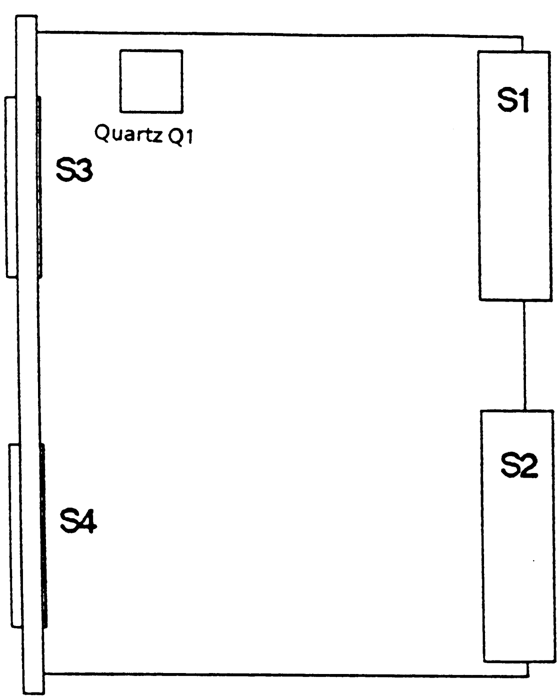




Adress expansion for the extended peripheral area (0 area) only with the S5 135 U, 150S, 150U and 155U. Insert jumper 8-9 on jumper base 7.

* not for 301-5C

CC-EU interface module 310-3



The quartz crystal Q1 is not standard.

Power supply unit

Function	Jumpers
Battery monitoring ($\overline{\text{BAU}}$) = active Battery monitoring (BAU) = inactive	NN-MM inserted * NN-MM open
Switch off PS after fan failure PS not switched off after fan failure (only signal LED, relay)	F-R inserted * F-R open
Operation with load voltage monitoring Operation without load voltage monitoring	BA-EX open * BA-EX inserted
Energizing the signal relay (Relay contact 2-3 inserted) by RLSA without $\overline{\text{RLSA}}$ by $\overline{\text{BASPA}}$ (UA < 4.75 V or load voltage monitoring ≤ 20 V - 25%) without BASPA If both jumpers are open, the energization of the relay is only dependent on the fan monitoring.	 RR-LL inserted * RR-LL open BB-AA inserted BB-AA open *

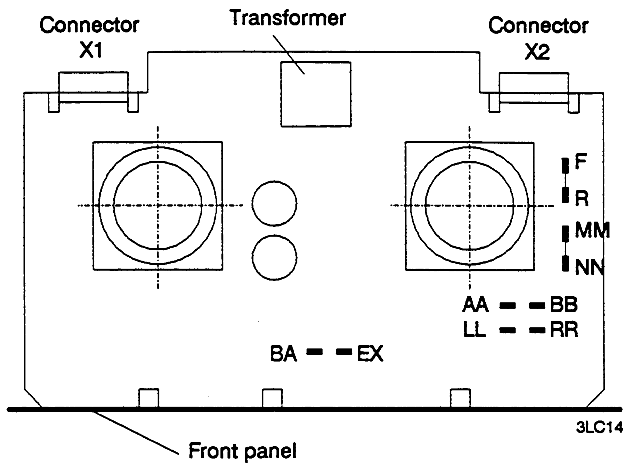
Relay signal when fan fails, $\overline{\text{RLSA}}$, $\overline{\text{BASPA}}$:

Situation		Signal		Output voltage switched off	
		LED	Relay contact	F-R open	F-R inserted *
Fan fault		lit	2-3 inserted	no	yes
and $\overline{\text{RLSA}}$ = low or BASPA = low		lit lit	2-3 inserted 2-3 inserted	no no	yes yes
Fan OK		unlit	2-1 inserted	no	no
and $\overline{\text{RLSA}}$ = low or BASPA = low		unlit unlit	2-3 inserted 2-3 inserted	no no	no no
Enable absent	BB-AA open	unlit	2-1 inserted	yes	yes
	BB-AA ins.	unlit	2-3 inserted	yes	yes
U_H-FRG open	RR-LL ins. $\overline{\text{RLSA}}$ = low	unlit	2-3 inserted	yes	yes

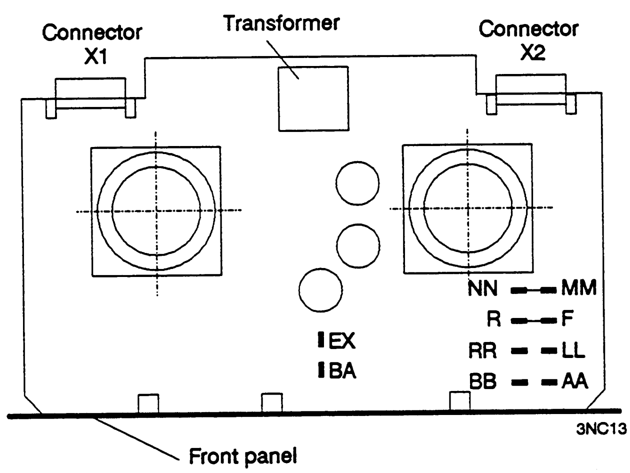
* As supplied

The jumper assignment shown is the setting when the unit is supplied.

Power supply unit 6ES5 955-3LC14



Power supply unit 6ES5 955-3NC13



4 Maintenance

4.1 Inserting and Removing Modules

The modules are removed by gripping the handles and pulling them out with a gentle rocking motion.

Modules must only be removed or inserted when the central controller, the expansion units and the sensors are switched off.

The fan assembly (with or without power supply unit) must be switched off before it is installed or removed.

4.2 Replacing the Fans

The service life of the fans (see technical data) depends on the number of operating hours, the ambient temperature and ambient conditions. If a fan fails during operation, the fan monitoring (jumper F-R inserted) prevents damage e.g. to the modules by switching off the power supply unit.

In certain cases it may be necessary to replace the fans prophylactically at appropriate intervals.

To replace the fans, the power supply unit must be switched off and dismantled, the mounting screws of the fans must be loosened and the power supply cable to the fans disconnected (plug-in connector). The fans are installed in the reverse order.

4.3 Pin Assignment of the Bus Board Interface

	I/O modules: EU 183 Slot 11 to 155; EU 184 Slot 3 to 155; EU 187 Slot 3 to 147			CC Interface modules 312-5C EU 184 Slot 163				EU int. modules 300-5-C I/O modules EU 183 Slot 163				CC in 310-3 EU 183 Slot 3			
Backpl. connect.	Pin	Pin row z	b	Pin	Pin row z	b	d	Pin	Pin row z	b	d	Pin	Pin row z	b	d
1	2	+5 V	0 V	2	+5 V	0 V	Shield	2	+5 V	0 V	Shield	2	+5 V	0 V	Shield
	4	-	PESP	4	-	PESP	+5 V	4	-	PESP	+5 V	4	Takt	PESP	+5 V
	6	CPKL	ADB0	6	CPKL	ADB0	+5 V	6	CPKL	ADB0	-	6	CPKL	ADB0	-
	8	MEMR	ADB1	8	MEMR	ADB1	+5 V	8	MEMR	ADB1	-	8	MEMR	ADB1	-
	10	MEMW	ADB2	10	MEMW	ADB2	+5 V	10	MEMW	ADB2	-	10	MEMW	ADB2	-
	12	RDY	ADB3	12	RDY	ADB3	+5 V	12	RDY	ADB3	-	12	RDY	ADB3	-
	14	DB0	ADB4	14	DB0	ADB4	+5 V	14	DB0	ADB4	+5 V	14	DB0	ADB4	+5 V
	16	DB1	ADB5	16	DB1	ADB5	+5 V	16	DB1	ADB5	+5 V	16	DB1	ADB5	+5 V
	18	DB2	ADB6	18	DB2	ADB6	0 V	18	DB2	ADB6	0 V	18	DB2	ADB6	0 V
	20	DB3	ADB7	20	DB3	ADB7	0 V	20	DB3	ADB7	0 V	20	DB3	ADB7	0 V
	22	DB4	0 V	22	DB4	0 V	0 V	22	DB4	0 V	0 V	22	DB4	0 V	0 V
	24	DB5	0 V	24	DB5	0 V	0 V	24	DB5	0 V	0 V	24	DB5	0 V	0 V
	26	DB6	0 V	26	DB6	0 V	0 V	26	DB6	0 V	0 V	26	DB6	0 V	0 V
	28	DB7	0 V	28	DB7	0 V	0 V	28	DB7	0 V	0 V	28	DB7	0 V	0 V
	30	-	BASP	30	-	BASP	0 V	30	EANK	BASP	0 V	30	-	BASP	0 V
	32	-	0 V	32	0 V	0 V	0 V	32	-	0 V	BASPA	32	-	0 V	BASPA
2								2	+5 V	0 V	-	2	+5 V	0 V	-
								4	-	-	0 V	4	-	-	0 V
								6	-	-	-	6	-	-	-
								8	-	-	-	8	-	-	-
								10	-	-	-	10	-	-	-
								12	+5 V	+5 V	+5 V	12	+5 V	+5 V	+5 V
								14	+5 V	+5 V	+5 V	14	+5 V	+5 V	+5 V
								16	+5 V	+5 V	+5 V	16	+5 V	+5 V	+5 V
								18	CPKLA	NAU	-	18	CPKLA	NAU	-
								20	-	-	-	20	-	-	-
								22	0 V	0 V	-	22	0 V	0 V	-
								24	0 V	0 V	-	24	0 V	0 V	-
								26	0 V	0 V	-	26	0 V	0 V	-
								28	0 V	0 V	-	28	0 V	0 V	-
								30	0 V	0 V	-	30	0 V	0 V	-
								32	0 V	0 V	-	32	0 V	0 V	-

4.4 Pin Assignment of the Front Connectors

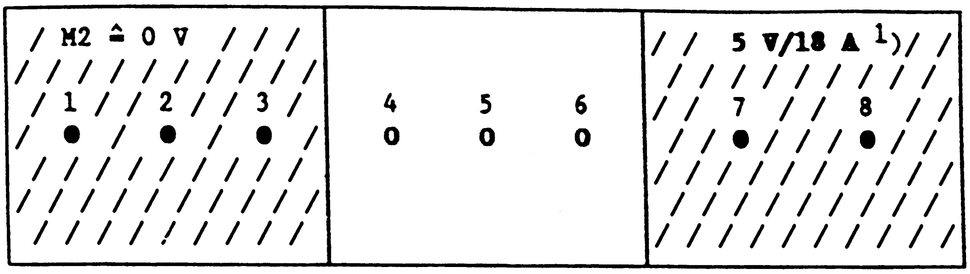
EU int. mod. 300-5C		EU int. mod. 301-5C		Pin no.	CC int. mod. 310-3		CC int. mod. 312-5C	
Terminal strip 3	Terminal strip 4	Terminal strip 3	Terminal strip 4		Terminal strip 3	Terminal strip 4	Terminal strip 3	Front connector 4
Mext	Mext	Mext	Mext	1	Mext	Mext	Mext	Mext
+5 V	+5 V	+5 V	ADB4	2	ADB4	ADB4	+5 V	+5 V
+5 V	+5 V	+5 V	ADB4	3	ADB4	ADB4	+5 V	+5 V
+5 V	+5 V	+5 V	ADB5	4	ADB5	ADB5	+5 V	+5 V
+5 V	+5 V	+5 V	ADB5	5	ADB5	ADB5	+5 V	+5 V
+5 V	+5 V	+5 V	ADB6	6	ADB6	ADB6	+5 V	+5 V
ADB1	ADB1	ADB1	ADB6	7	ADB6	ADB6	ADB1	ADB1
ADB4	ADB4	ADB4	ADB7	8	ADB7	ADB7	ADB4	ADB4
ADB7	ADB7	ADB7	ADB7	9	ADB7	ADB7	ADB7	ADB7
DB1	DB1	DB1	DB6	10	DB6	DB6	DB1	DB1
DB4	DB4	DB4	DB6	11	DB6	DB6	DB4	DB4
0 V	0 V	0 V	DB7	12	DB7	DB7	0 V	0 V
0 V	0 V	0 V	DB7	13	DB7	DB7	0 V	0 V
0 V	0 V	0 V	PEU	14	PEU	PEU	0 V	0 V
0 V	0 V	0 V	PEU	15	PEU	PEU	0 V	0 V
0 V	0 V	0 V	Rg0	16	-	+5 V	0 V	0 V
Mext	Mext	Mext	Mext	17	Mext	Mext	Mext	Mext
+5 V	+5 V	+5 V	ADB0	18	ADB0	ADB0	+5 V	+5 V
+5 V	+5 V	+5 V	ADB0	19	ADB0	ADB0	+5 V	+5 V
+5 V	+5 V	+5 V	ADB1	20	ADB1	ADB1	+5 V	+5 V
+5 V	+5 V	+5 V	ADB1	21	ADB1	ADB1	+5 V	+5 V
+5 V	+5 V	+5 V	ADB2	22	ADB2	ADB2	+5 V	+5 V
ADB0	ADB0	ADB0	ADB2	23	ADB2	ADB2	ADB0	ADB0
ADB3	ADB3	ADB3	ADB3	24	ADB3	ADB3	ADB3	ADB3
ADB6	ADB6	ADB6	ADB3	25	ADB3	ADB3	ADB6	ADB6
0 V	0 V	0 V	DB3	26	DB3	DB3	0 V	0 V
DB3	DB3	DB3	DB3	27	DB3	DB3	DB3	DB3
DB6	DB6	DB6	DB4	28	DB4	DB4	DB6	DB6
0 V	0 V	0 V	DB4	29	DB4	DB4	0 V	0 V
0 V	0 V	0 V	DB5	30	DB5	DB5	0 V	0 V
0 V	0 V	0 V	DB5	31	DB5	DB5	0 V	0 V
0 V	0 V	0 V	ZGU	32	ZGU	ZGU	0 V	0 V
0 V	0 V	0 V	ZGU	33	ZGU	ZGU	0 V	0 V
+5 V	+5 V	+5 V	MEMR	34	MEMR	MEMR	+5 V	+5 V
FAKT	FAKT	-	MEMR	35	MEMR	MEMR	-	-
CPKL	CPKL	CPKL	MEMW	36	MEMW	MEMW	CPKL	CPKL
MEMR	MEMR	MEMR	MEMW	37	MEMW	MEMW	MEMR	MEMR
MEMW	MEMW	MEMW	PESP	38	PESP	PESP	MEMW	MEMW
PESP	PESP	PESP	PESP	39	PESP	PESP	PESP	PESP
ADB2	ADB2	ADB2	BASP	40	BASP	BASP	ADB2	ADB2
ADB5	ADB5	ADB5	BASP	41	BASP	BASP	ADB5	ADB5
DB0	DB0	DB0	DB0	42	DB0	DB0	DB0	DB0
DB2	DB2	DB2	DB0	43	DB0	DB0	DB2	DB2
DB5	DB5	DB5	DB1	44	DB1	DB1	DB5	DB5
DB7	DB7	DB7	DB1	45	DB1	DB1	DB7	DB7
RDY	RDY	RDY	DB2	46	DB2	DB2	RDY	RDY
BASP	BASP	BASP	DB2	47	DB2	DB2	BASP	BASP
EANK	EANK	-	RDY	48	RDY	RDY	-	-
0 V	0 V	0 V	RDY	49	RDY	RDY	0 V	0 V
0 V	0 V	0 V	0 V	50	-	0 V	0 V	0 V

4.5 Pin Assignment of the Power Supply Unit Interface

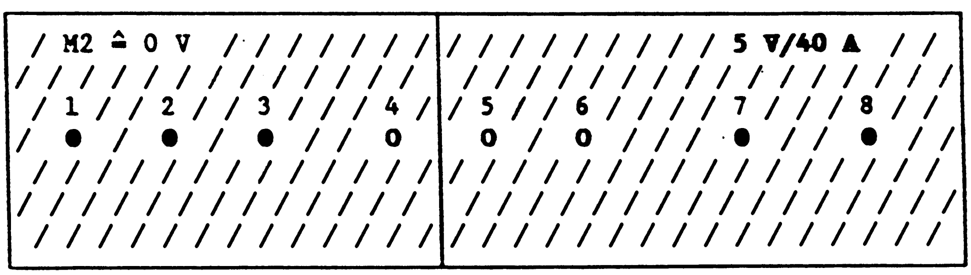
- Power connections

Subminiature connector X1, 8-pin, with 5/8 high current contacts, series D according to MIL-C24308, seen from the rear of the unit.

For -3LC14, -3NA11, -3NC12:

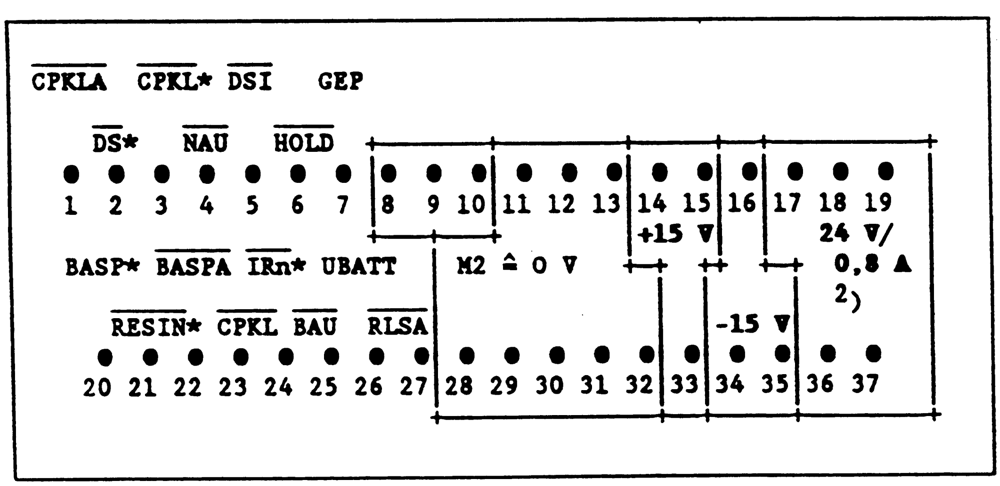


For -3LF12:



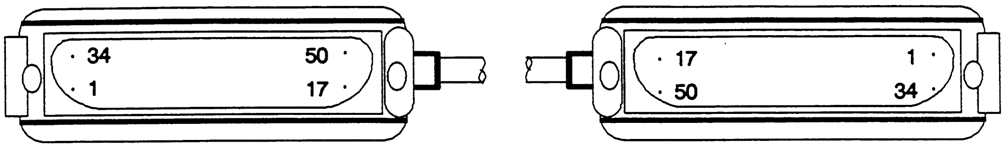
- Signal connections (incl. 24 V/0.8 A or 24 V/2.8 A for power supply unit -3LF12)

Subminiature connector X2, 37-pin, series D according to MIL-C24308, seen from the rear of the unit:



1) 5 V/10 A for power supply unit -3NA11.
2) 2.8 A for power supply unit -3LF12.
* Signals for MC-210 application.

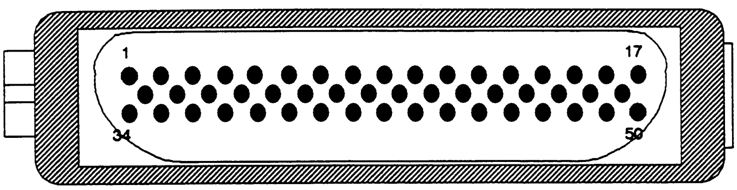
4.6 Connecting Cable 6ES5721-0...



Connector 1 Connector 2

Connector 1 50-pin contact	Bundle tube colour	Identifi-cation foil	Wire coulor	Connector 2 50-pin contact
20	1	red	white	20
21			brown	21
4			green	4
5	red		yellow	5
18			grey	18
19			pink	19
2			blue	2
3			red	3
24	2	green	white	24
25			brown	25
8			green	8
9	green		yellow	9
22			grey	22
23			pink	23
6			blue	6
7			red	7
26	3	white	white	26
27			brown	27
10			green	10
11	yellow		yellow	11
42			grey	42
43			pink	43
44			blue	44
45			red	45
28	4	white	white	28
29			brown	29
12			green	12
13	brown		yellow	13
46			grey	46
47			pink	47
30			blue	30
31			red	31
34	5	white	white	34
35			brown	35
36			green	36
37	black		yellow	37
38			grey	38
39			pink	39
40			blue	40
41			red	41
48	6	red	white	48
49			brown	49
14			green	14
15	blue		yellow	15
32			grey	32
33			pink	33
-	Shield			-

4.7 Terminator 760



Connector pin	WI-SCHI 180 Ω		Connector pin
28			8
29			9
26			6
27			7
46			4
47			5
44			2
45			3
42			24
43			25
38	1)		22
39			23
34	1)		20
35			21
36	1)		18
37			19
40	1)		12
41			13
48	2)		10
49			11
15			30
16			31
14			
50			
1) 100 Ω			
2) 150 Ω			

5 Spare Parts

Designation	Order no.	Spare part group 1)	Order from 2)
Power supply unit with fan	6ES5 995-3LC14 6ES5 955-3NC12	R R	GWE GWE
Fan unit	6ES5 988-3LA11 6ES5 988-3NA11	R R	GWE GWE
Fan set (2 off)			
for 6ES5 955-3LC14 and 6ES5 988-3LA11 (issue < 4)	6ES5 988-3LB21	N	GWE
for 6ES5 988-3LA11 (issue up to 4)	6ES5 988-3LB11	N	GWE
for 6ES5 955-3NC12 and 6ES5 988-3NA11	6ES5 988-3NB11	N	GWE
Air baffle	C79451-A3079-D501	N	
Fuses (Dim. 6.3 x 32 mm)		N	GWE
15 A slow	299461		
6 A fast	300095		
4 A fast	291963		
1.5 A fast	287268		
Filter holder	6ES5 981-0FA11	N	GWE
Filter mat (10 off)	6ES5 981-0EA11	N	GWE

1) R = can be repaired
N = cannot be repaired

2) If no department is specified, order from GWK.

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

Technical data subject to change

Siemens Aktiengesellschaft

Order No.: C79000-B8576-C279
Order from: Gerätewerk Karlsruhe
Printed in the Federal Republic of Germany

SIEMENS

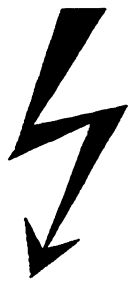
SIMATIC S5

EG 185 U Expansion Unit in Compact Design 6ES5185-3UA..

Instructions C79000-B8576-C096-01

Siemens has developed this document for its licensees and customers. The information contained herein is the property of Siemens and may not be copied, used, or disclosed to others without prior written approval from Siemens. Users are cautioned that the material contained herein is subject to change by Siemens at any time and without prior notice.

Siemens shall not be responsible for any damages, including consequential damages, caused by reliance on material presented, including but not limited to typographical, electronic, arithmetic, or listing errors.



⚠ WARNING

Hazardous voltage.

Can cause death, severe personal injury, or substantial property damage.

Restrict use to qualified personnel.
See safety instructions.

Only qualified personnel should install or maintain this equipment after becoming thoroughly familiar with all warnings, safety notices, and maintenance procedures contained in this manual. The successful and safe operation of this equipment is dependent upon proper handling, installation, operation, and maintenance.

The following are definitions of the terms “qualified person,” “danger,” “warning,” and “caution,” as applicable for this document.

Qualified Person
One who is familiar with the installation, construction, and operation of this equipment and the hazards involved. In addition, the person should have the following qualifications:

- Be trained and authorized to use and tag circuits and equipment in accordance with established safety practices
- Be trained in the proper care and use of protective equipment in accordance with established safety practices
- Be trained in rendering first aid

DANGER

Indicates that loss of life, severe personal injury, or substantial property damage will result if proper precautions are not taken.

WARNING

Indicates that loss of life, severe personal injury, or substantial property damage can result if proper precautions are not taken.

CAUTION

Indicates that minor personal injury or property damage can result if proper precautions are not taken.

First Printing, December 1986
Printed in the Federal Republic of Germany

Preface

This book includes a hardware, installation and maintenance guide for the EG 185 U expansion unit. You will find guidelines for operation and maintenance as well as technical specifications.

This book is intended for engineers, programmers and maintenance personnel who have a general knowledge of programmable controller concepts.

If you have any questions about the EG 185 U not answered in this book, please contact your local Siemens representative. Consult the appendix at the end of the publication no. C79000-B8576-C452 for a list of Siemens offices worldwide.

How to Use This Book

This section discusses information that may be helpful as you use this book.

Contents of This Book

- **Chapter 1: Technical Description**

  This chapter describes the area of application in which the EG 185 U expansion unit can be used and provides information on configuring the unit, its mode of operation and how the I/O modules are addressed.
  In addition, a list with the technical specifications for the expansion unit, the integrated power supply unit and the 15-V additional module (option) has been included.

- **Chapter 2: Installation**

  This chapter explains how to install the expansion unit together with the integrated power supply unit and the optional 15-V module.

- **Chapter 3: Operation**

  This chapter describes how to operate the programmable controller and discusses the control and display elements of the power supply unit, as well as the relay signals.

- **Chapter 4: Maintenance**

  This chapter gives information on how to change the backup battery, the interface assignment and the wiring of the interrupt signals.

- **Chapter 5: Spare Parts**

  This chapter contains a list of spare parts for the EG 185U.

- **Index**

  The index contains an alphabetical list of key terms and subjects covered in this book and their corresponding page numbers.

- **Remarks Form**

  The remarks form at the end of this book is provided for your comments and recommendations. Only if you are in the United States of America should you use the postage-paid form.

Training

Contact your local Siemens representative for information on training courses to aid you in becoming familiar with this product.

Reference Materials

We recommend the following books that support the EG 185 U system:

- *Catalog ST54.1: S5-135U, S5-155U and S5-155H Programmable Controllers*
  *(Publication No. E86010-K4654-A111-A6-7600)**

- *SIMATIC S5 U Periphery Manual*
  (Publication No. 6ES5 998-0PC21)

  Programmer Manuals:

- *PG 635 Programmer Manual*
  *(Publication No. 6ES5 835-0SC21)**

- *PG 675 Programmer Manual (S5-DOS)*
  *(Publication No. 6ES5 875-0SC21)**

- *PG 685 Programmer Manual*
  *(Publication No. 6ES5 885-0SC21)**

- *PG 695 Programmer Manual*
  *(Publication No. 6ES5 895-0SC21)**

- *STEP 5 for Personal Computers User Guide (Volume 2/2)*
  *(Publication No. 04-016-00-0188)**

---

* order this manual from your local Siemens representative

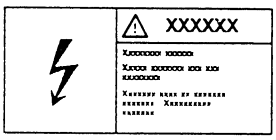
Conventions

Conventions

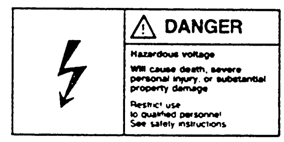
The following conventions are used in this book and are listed for your reference:

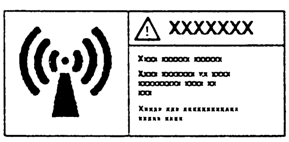
Convention | **Definition** | **Example**

A box that indicates a type of hazard, describes its implications, and tells you how to avoid the hazard is safety notation. Some safety notation includes a graphic symbol representing an electrical or radio frequency hazard. All safety notation has one of the following levels of caution:

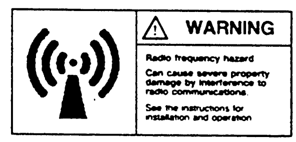


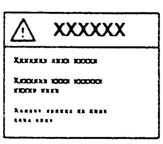
- A danger indicates that loss of life, severe personal injury, or substantial property damage will result if proper precautions are not taken.



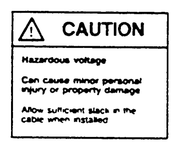


- A warning indicates that loss of life, severe personal injury, or substantial property damage can result if proper precautions are not taken.





- A caution indicates that minor personal injury or property damage can result if proper precautions are not taken.



Contents

Preface 0-1
How to Use This Book 0-3

Chapter 1 - Technical Description

1.1 Application 1-1
1.2 Design 1-2
1.3 Configuration 1-3
1.4 Technical Specifications 1-4

Chapter 2 - Installation

2.1 Installation of the Expansion Unit 2-1
2.2 Installation of the Power Supply Unit 2-1
2.3 Installation of the 15-V Module 2-2
2.4 Connection of the Supply Voltage 2-3
2.5 Connection of the Interconnecting Cables 2-4
2.6 Notes on Installation 2-4
2.7 Fan Monitor 2-5

Chapter 3 - Operation

3.1 General Instructions 3-1
3.2 Control and Display Elements 3-2
3.3 Power Supply Unit 6ES5 955-3xxyy 3-3

Chapter 4 - Maintenance

4.1 Inserting and Removing a Module 4-1
4.2 Change of the Backup Battery and the Fans 4-2
4.3 Interface Assignment of the bus PCB 4-3

Chapter 5 - Spare Parts

Page Overview S-1

Figures

1.1	Example of typical distributed configuration	1-2
1.2	Possible configurations of EG 185 U	1-3
1.3/1	Dimension drawing of EG 185 U	1-14
1.3/2	Dimension drawing of EG 185 U	1-15
2.1	Power supply unit, open	2-2
2.2	Connection of the supply voltage	2-3
2.3	Fan monitor	2-5
3.1	Power supply units 6ES5 955-3....	3-2
3.2	Location of the jumpers	3-4
4.1	Battery compartment	4-2

Tables

3.1	Jumper settings for power supply unit 6ES5 955-3xxyy	3-3
3.2	Reaction of the power supply to faults	3-5
4.1(1)	Interface assignment on the bus PCB	4-3
4.1(2)	Interface assignment on the bus PCB	4-4
5.1	Spare parts	5-1

Chapter 1
Technical Description

This chapter will give you information about the application, the design and possible configurations of the EG 185 U expansion unit. It also includes technical specifications and a dimension drawing.

1.1 Application

The EG 185 U expansion unit was developed to allow distributed use of communications processors (CPs) and intelligent I/O modules (IPs).

The unit has a 16 bit-wide address and data bus. It can be addressed by the central controller (CC) via the symmetrical interface (IM 304 - IM 314). It is also used in fault-tolerant SIMATIC S5 systems (IM 304 - IM 314 H/R).

The EG 185 U can be used in the S5 programmable controllers 135 U, 150 U, 155 U, 150 H and 155 H.

1.2 Design

The EG 185 U expansion unit consists of the following:

- Compact housing with cable duct and fan unit with integrated power supply unit,
- 21 slots for modules.

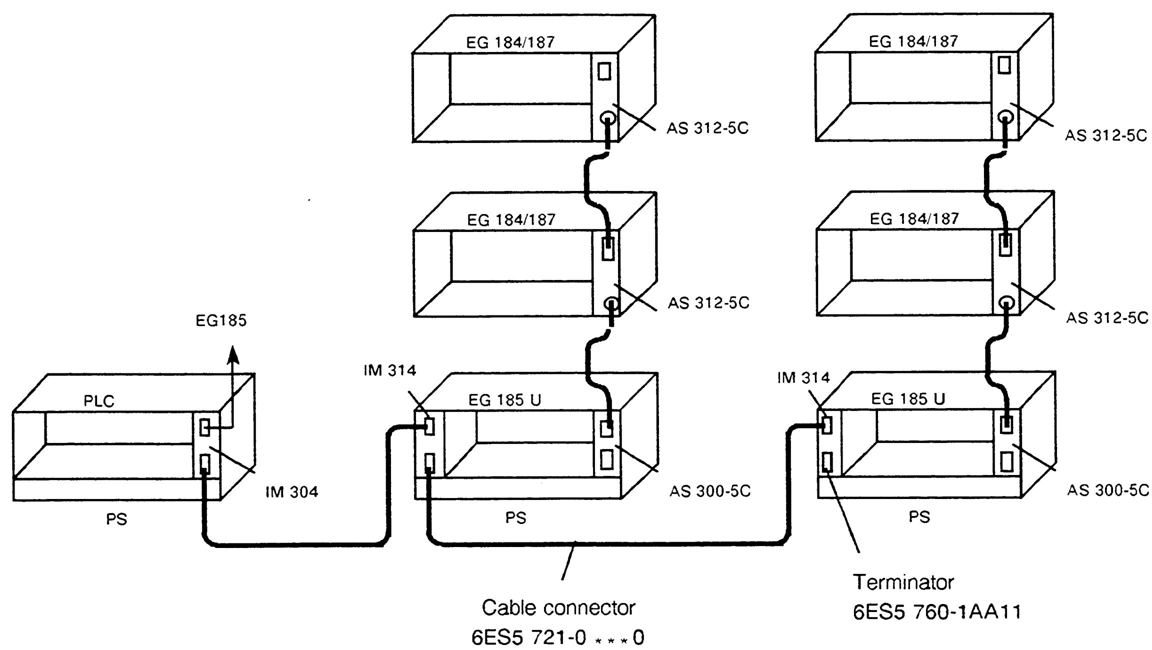
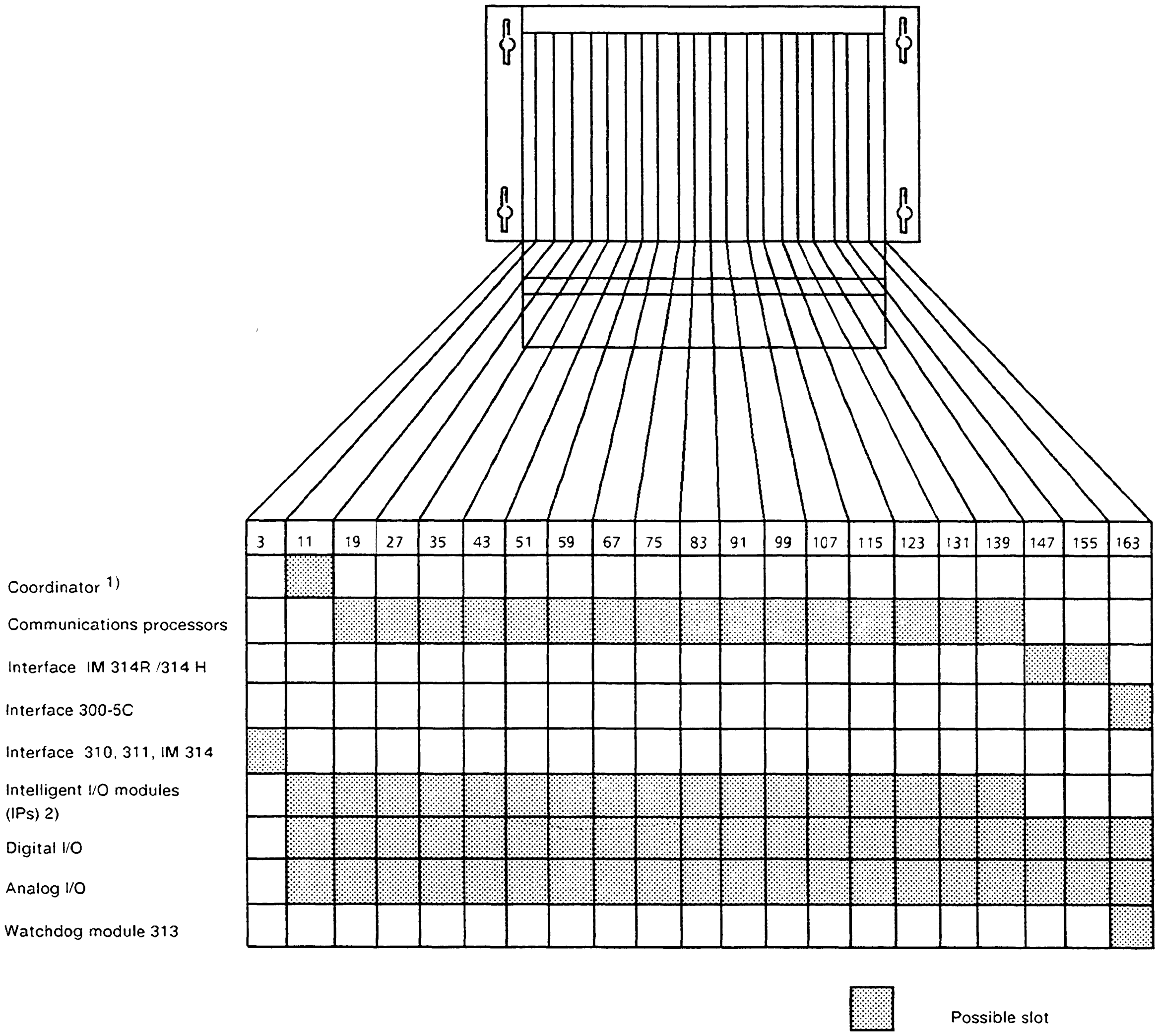


Fig. 1.1 Example of a typical distributed configuration

The total distance between the central controller CC and the most remote IM 314 must not exceed 600 m. A terminator is required at the last IM 314. Up to four EG 185 U expansion units can be connected to each interface of the IM 304.

1.3 Possible Configurations



1) For jumper settings, refer to instructions for coordinator.
2) IP 245, IP 260 and IP 261 also in slots 147, 155 and 163.
IP 257 in slots 147 and 155.

Fig. 1.2 Possible Configurations of EG 185 U

1.4 Technical Specifications

Insulation class	C to VDE 0110
Test voltage	to VDE 0160
Protection class	1
Degree of protection	IP 00
Operating temperature	0 to 55 °C
Transport and storage temperature	-40 to 70 °C
Relative humidity	≤ 95 % at 25 °C, no condensat.
Operating altitude	≤ 3500 m above sea level
Mechanical stress	Mounting in fixed equipment which is not necessarily free of vibration; mounting on ships and in motor vehicles possible observing special regulations, but not directly on the engine assembly
Weight	approx. 14 kg
Dimensions (w x h x d)	482.6 mm x 432 mm x 310 mm

Power supply unit 6ES5 955-3LC14

Input

Rated input voltage U_{EN}	230/115 V AC + 10 %/- 18.7 % [1]
Undervoltage signal U_E	< 187 V AC (or 93 V AC)
Input frequency f_E	48 to 63 Hz
Input current I_{EN} at rated load and U_{EN} = 230 V (or 115 V)	1.25 A (or 2.5 A)
Max. inrush peak I_{Emax}	100 A (or 50 A)
Efficiency at rated load, with fans	typ. 61 %

[1]) Voltage selector

Stored energy time in case of power failure	> 5 ms
Power factor cos	0.65
Input fuse	4 A, quick-break; 250 V; 6.3 mm x 32 mm (F26 on power supply PCB)

Output 1

Rated output voltage U_{AN1}	5.1 V DC ± 0.5 %
Setting range of output voltage	(0.95 to 1.05) x U_{AN1}
Rated output current I_{AN1}	18 A DC
Ripple	≤ 1% of U_{A1}
Dynamic voltage tolerance in case of load impulse from 50 to 100% I_N	≤ 5% of U_{A1}
Settling time	≤ 5 ms
Overvoltage cutoff U_{A1}	6 V ± 5 %
Undervoltage signal U_{A1}	4.75 V + 5 %
Current limit at overload	(1.05 to 1.15) x I_{AN1}

Output 2: 24 V bus

Rated output voltage U_{AN2}	24 V DC + 25 %/- 16.66 %
Rated output current I_{AN2}	0.8 A DC [1]
Ripple	≤ 5 % of U_{A2}
Fuse for overcurrent protection	1.5 A, quick-break; 250 V; 6.3 mm x 32 mm (F90 on power supply PCB)

Output 3 with 15 V additional module

Rated output voltage U_{AN3}	15 V DC ± 5%
Rated output current I_{AN3}	0.5 A DC [1]
Ripple	≤ 5 % of U_{AN3}
Overvoltage protection	U_{A3} ≥ 18.5 V
Overcurrent protection I_{A3} through current limit	0.5 to 1.5 A
Undervoltage signal (LED on front panel)	U_{A3} ≤ 14 V ± 3%

[1]) The sum of the output currents I_{A2}, I_{A3} and I_{A4} ≤ 0.8 A DC.

Output 4: 24 V front

Rated output voltage U_{AN4}	24 V DC + 25 %/- 21 %
Rated output current I_{AN4}	0.4 A [1])
Current limit (response threshold)	≥ 0.44 A
Undervoltage signal (LED on the front panel)	16 V ± 20 %
Capacitive load	≤ 100 nF
Fans	2 axial fans
Input voltage	115 V AC, convertible (series/parallel)
Delivery rate per fan	160 m³/h (value during no-load operation)
Service life	typ. 30000 to 40000 h at 55 °C typ. 40000 to 50000 h at 30 °C
Fan monitoring	The air flow is monitored by PTC resistor sensors. If one or both fans stop, this is recognized and indicated by an LED signal and relay contact. This leads to the cut-off of output voltages after approx. 6 to 10 s (can be disabled at jumper F-R).

Power supply unit 6ES5 955-3NC13

Input

Rated input voltage U_{EN}	24 V DC + 25 %/- 16.66 %
Undervoltage signal U_E	< 20 V DC
Input current I_{EN} at rated load and U_{EN} = 24 V	6.9 A
Max. inrush current I_{Emax}	250 A
Efficiency at rated load	typ. 67 %
Stored energy time in case of power failure	> 5 ms
Input fuse	15 A, medium-blow; 250 V; 6.3 mm x 32 mm (F1 on power supply PCB)

[1]) The sum of output currents I_{A2}, I_{A3} and I_{A4} ≤ 0.8 A DC.

Output 1

Rated output voltage U_{AN1}	5.1 V DC ± 0.5 %
Setting range of output voltage	(0.95 to 1.05) x U_{AN1}
Rated output current I_{AN1}	18 A DC
Ripple	≤ 1% of U_{A1}
Dynamic voltage tolerance in case of load impulse from 50 to 100% I_N	≤ 5% of U_{A1}
Settling time	≤ 5 ms
Overvoltage cutoff U_{A1}	6 V ± 5 %
Undervoltage signal U_{A1}	4.75 V ± 5 %
Current limit at overload	(1.05 to 1.15) x I_{AN1}

Output 2:

Rated output voltage U_{AN2}	24 V DC + 25 %/- 16.66 %
Rated output current I_{AN2}	0.8 A DC 1)
Ripple	≤ 5 % of U_{A2}
Fuse for overcurrent protection	1.5 A, quick-break; 250 V; 6.3 mm x 32 mm (F90 on power supply PCB)

Output 3 with 15 V additional module

Rated output voltage U_{AN3}	15 V DC ± 5%
Rated output current I_{AN3}	0.5 A DC 1)
Ripple	≤ 5 % of U_{AN3}
Overvoltage protection	U_{A3} ≥ 18.5 V
Undervoltage signal (LED on the front panel)	U_{A3} ≤ 14 V ± 3 %
Overcurrent protection I_{A3} through current limit	0.5 to 1.5 A

Output 4: 24 V front

Rated output voltage U_{AN4}	24 V DC + 25 %/- 21 %
Rated output current I_{AN4}	0.4 A 1)
Current limit (response threshold)	≥ 0.44 A
Undervoltage signal (LED on the front panel)	16 V ± 20 %
Capacitive load	≤ 100 nF
Fans	2 axial fans
Input voltage Delivery rate per fan	24 V DC 160 m^3/h (value during no-load operation)
Service life	typ. 30000 to 40000 h at 55 °C typ. 40000 to 50000 h at 30 °C
Fan monitoring	The air flow is monitored by PTC resistor sensors. If one or both fans stop, this is recognized and indicated by an LED signal and relay contact. This leads to the cut-off of output voltages after approx. 6 to 10 s (can be disabled at jumper F-R).

Power supply unit 6ES5 955-3LF12

Input

Rated input voltage U_{EN} Undervoltage signal U_E	230/115 V AC + 10 %/- 18.7 % 2) < 187 V AC (93 V AC)
Input frequency f_E	48 to 63 Hz
Input current I_{EN} at rated load and U_{EN} = 230 V (115 V)	2.4 A (4.8 A)
Max. inrush current I_{Emax} Efficiency at rated load	250 A (100 A) typ. ≥ 70 % with fan
Stored energy time in case of power failure	> 5 ms
Power factor cos	0.73
Input fuse	6.3 A, quick-break; 250 V; 6.3 mm x 32 mm F107 on power supply PCB

1) The sum of the output currents I_{A2}, I_{A3} and $I_{A4} \leq$ 0.8 A DC.

2) Voltage selector

Output 1

Rated output voltage U_{AN1}	5.1 V DC ± 0.5 %
Setting range of output voltage	(0.95 to 1.05) x U_{AN1}
Rated output current I_{AN1}	40 A DC
Ripple	≤ 1% of U_{A1}
Dynamic voltage tolerance in case of load impulse from 50 to 100% I_N	≤ 5% of U_{A1}
Settling time	≤ 5 ms
Overvoltage cutoff U_{A1}	6 V + 5 %
Undervoltage signal U_{A1}	4.75 V + 5 %
Current limit at overload	(1.05 to 1.15) x I_{AN1}

Output 2:

Rated output voltage U_{AN2}	24 V DC + 25 %/- 17 %
Rated output current I_{AN2} [1])	2.8 A DC
Total current load of the 24 V and 15 V output	≤ 2.8 A
Ripple	≤ 5 % of U_{A2}
Fuse for overcurrent protection	4 A, quick-break; 250 V; 6.3 mm x 32 mm (F255 on power supply PCB)

Output 3 with 15 V additional module

Rated output voltage U_{AN3}	15 V DC ± 5%
Rated output current I_{AN3} [1])	2 A DC
Ripple	≤ 5 % of U_{AN3}
Overvoltage protection	U_{A3} ≥ 18.5 V
Undervoltage signal (LED on the front panel)	U_{A3} ≤ 14 V ± 3 %
Overcurrent protection I_{A3} through current limit	2 to 3 A

[1]) The sum of the output currents I_{AN2}, I_{AN3} and I_{AN4} ≤ 2.8 A

Output 4: 24 V front

Rated output voltage U_{AN4}	24 V DC (+ 6 V/-5 V)
Rated output current I_{AN4}	0.4 A [1])
Current limit (response threshold)	≥ 0.44 A
Undervoltage signal (LED on the front panel)	16 V ± 20 %
Capacitive load	≤ 100 nF
Fans	2 axial fans
Input voltage	230/115 V AC, convertible
Delivery rate per fan	160 m^3/h (value during no-load operation)
Service life	typ. 30000 to 40000 h at 55 °C typ. 40000 to 50000 h at 30 °C
Fan monitoring	The air flow is monitored by PTC resistor sensors. If one or both fans stop, this is recognized and indicated by an LED signal and relay contact. This leads to the cut-off of output voltages (can be disabled at jumper F-R).

Power supply unit 6ES5 955-3NF11

Input

Rated input voltage U_{EN}	24 V DC + 25 %/- 17 %
Undervoltage signal U_E	< 20 V DC
Input frequency f_E	-
Input current I_{EN} at rated load and U_{EN} = 24 V DC	17.5 A
Max. inrush current I_{Emax}	300 A
Efficiency at rated load	typ. 65%
Stored energy time in case of power failure	> 5 ms
Input fuse	30 A, medium-blow; 250 V; 6.3 mm x 32 mm F110 on power supply PCB

[1]) The sum of the output currents I_{A2}, I_{A3} and $I_{A4} \leq$ 2.8 A.

Output 1

Rated output voltage U_{AN1}	5.1 V DC + 0.5 %
Setting range of output voltage	(0.95 to 1.05) x U_{AN1}
Rated output current I_{AN1}	40 A DC
Ripple	≤ 1% of U_{A1}
Dynamic voltage tolerance in case of load impulse from 50 to 100% I_N	≤ 5% of U_{A1}
Settling time	≤ 5 ms
Overvoltage cutoff U_{A1}	6 V ± 5 %
Undervoltage signal U_{A1}	4.75 V + 5 %
Current limit at overload	(1.05 to 1.15) x I_{AN1}

Output 2:

Rated output voltage U_{AN2}	24 V DC + 25 %/- 17 %
Rated output current I_{AN2} 1)	2.8 A DC
Total current load of the 24 V and 15 V output	≤ 2.8 A
Ripple	≤ 5 % of U_{A2}
Fuse for overcurrent protection	4 A, quick-break; 250 V; 6.3 mm x 32 mm (F177 on power supply PCB)

Output 3 with 15 V additional module

Rated output voltage U_{AN3}	15 V DC ± 5%
Rated output current I_{AN3} 1)	2 A DC
Ripple	≤ 5 % of U_{AN3}
Overvoltage protection	U_{A3} ≥ 18.5 V
Undervoltage signal (LED on the front panel)	U_{A3} ≤ 14 V ± 3 %
Overcurrent protection I_{A3} through current limit	2 to 3 A

1) The sum of the output currents I_{AN2}, I_{AN3} and I_{AN4} ≤ 2.8 A

Output 4: 24 V front

Rated output voltage U_{AN4}	24 V DC (+ 6 V/- 5 V)
Rated output current I_{AN4} 1)	0.4 A
Current limit (response threshold)	≥ 0.44 A
Undervoltage signal (LED on the front panel)	16 V ± 20 %
Capacitive load	≤ 100 nF
Fans	2 axial fans
Input voltage	24 V DC
Delivery rate per fan	160 m^3/h (value during no-load operation)
Service life	typ. 30000 to 40000 h at 55 °C typ. 40000 to 50000 h at 30 °C
Fan monitoring	The air flow is monitored by PTC resistor sensors. If one or both fans stop, this is recognized and indicated by an LED signal and relay contact. This leads to the cut-off of the output voltages (can be disabled at jumper F-R).

1) The sum of the output currents I_{AN2}, I_{AN3} and I_{AN4} ≤ 2.8 A

Additional monitoring (common to all power supplies)

24 V load voltage ("Voltage Monitor Ext.")	≥ 14 to 20 V

Electrical isolation primary/secondary	**yes**

Back-up battery

Capacity	5 Ah
Voltage	+ 3.4 V
Service life	approx. 10 years, without discharging

Caution: Transportation
The back-up battery contains lithium (≥ 0.5 g). Special regulations for transportation must be adhered to.

The power supply units 6ES5 955-3LC14 and -3LF12 contain two integrated fans. They can be operated with either 230 V AC or 115 V AC. The appropriate voltage is selected using the voltage selector switch S10/S11 in the power supply unit.

The power supply units 6ES5 955-3NC13 and -3NF11 each contain two fans with a common 24 V DC supply.

Fan monitoring

The air flow is monitored by PTC resistor sensors.

If one or both fans stop, this is recognized and results in either a signal (LED, relay) being output or U_A switched off.

Jumper F-R closed: U_A switched off
Jumper F-R open: U_A remains on (U_A = output voltage)

Relay contact 1-2 closed: Fan ok
Relay contact 2-3 closed: Fan defective

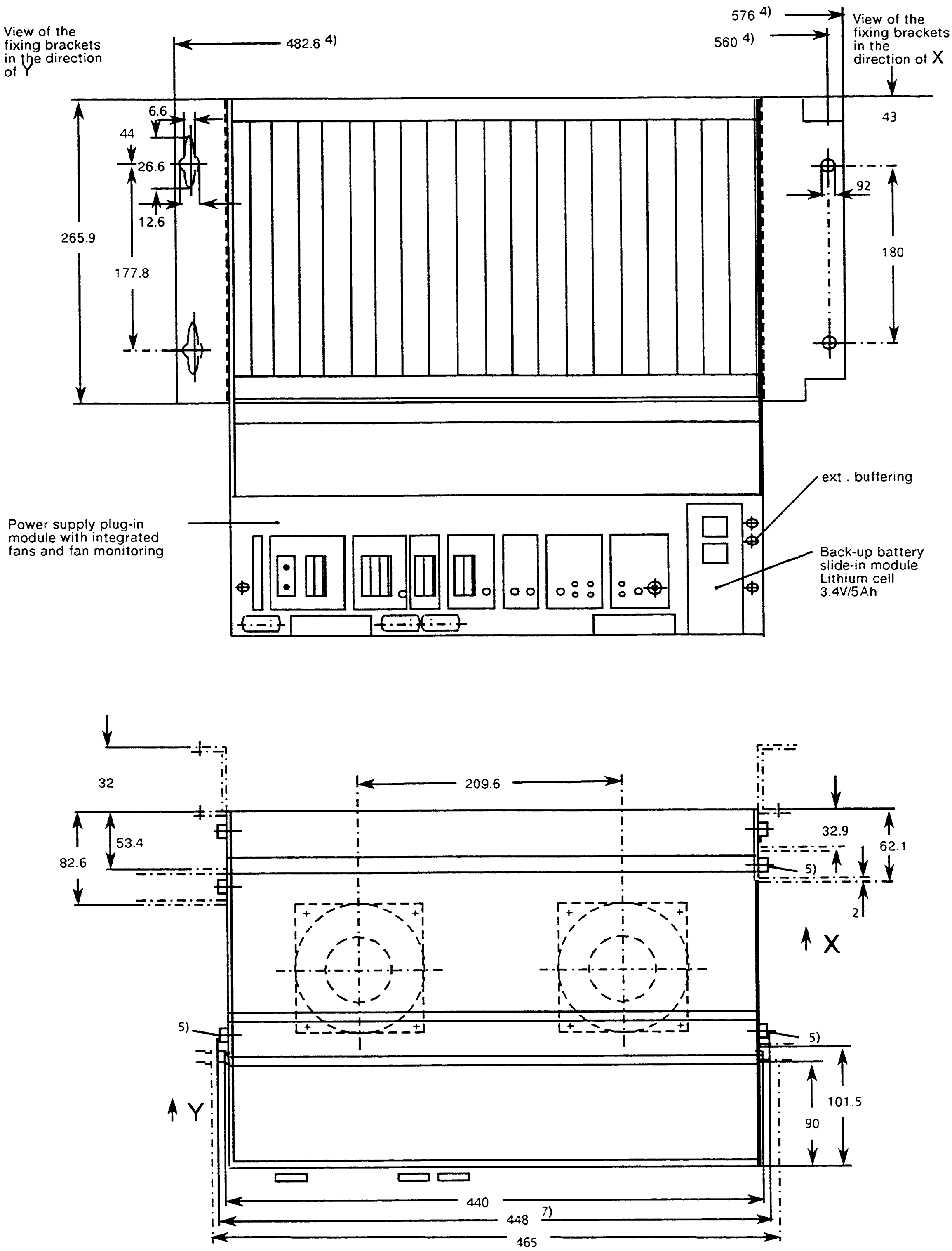
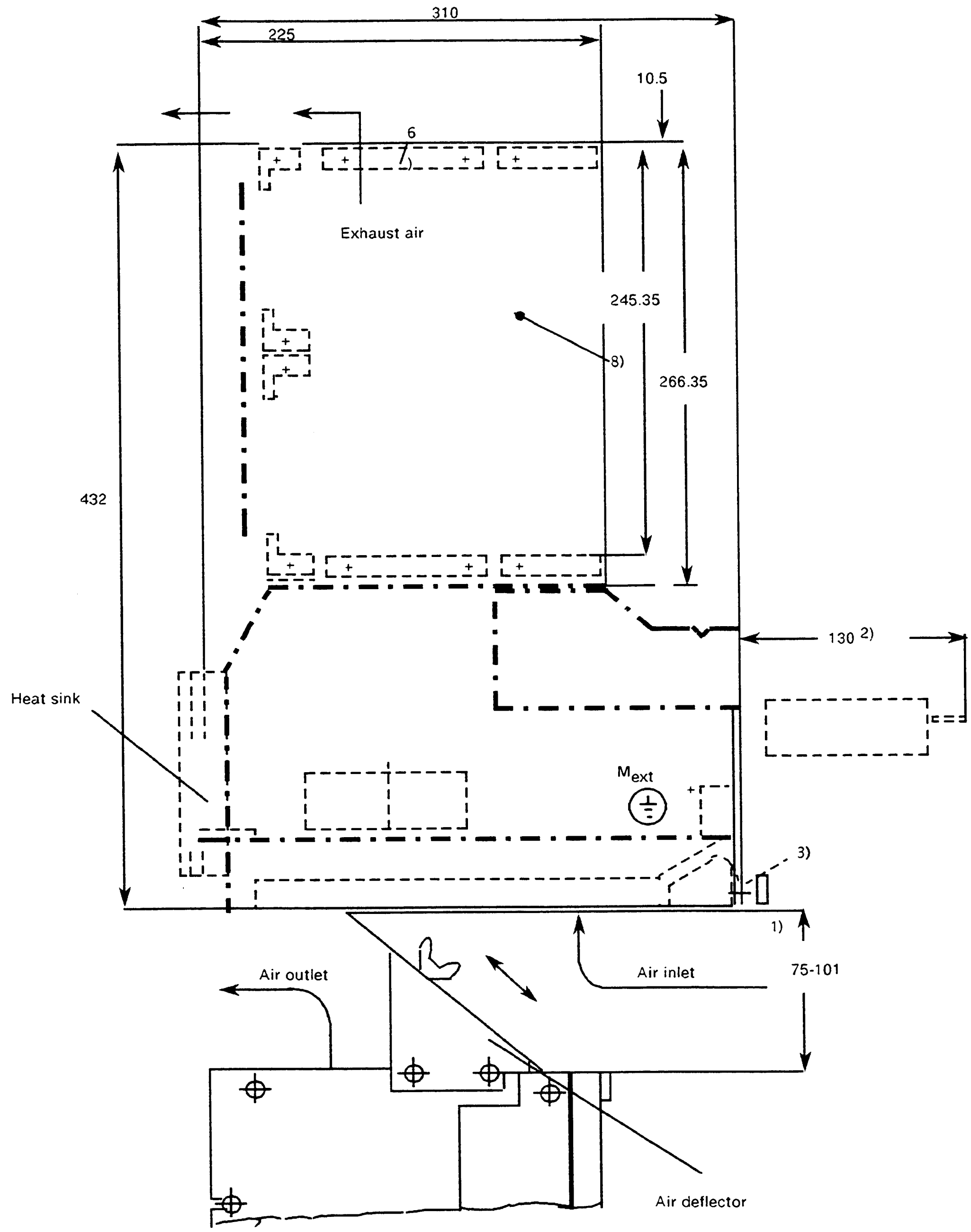


Fig. 1.3/1 Dimension drawing of EG 185 U



1) Air inlet - clearance for wall and cabinet mounting
2) Clearance for replacing the back-up battery
3) Clamp rail for screened cables
4) Dimensions of housing width, depending on arrangement of the fixing brackets
5) Fixing brackets srewed to the connecting bars
6) Top panel
7) Total width of the housing with fixing screws (height of screw heads)
8) Subrack construction: ES 902 for double Euroformat 233.4 x 160; mounting width: 28 standard slots

Fig. 1.3/2 Dimension drawing of EG 185 U

Chapter 2
Installation

In the following chapter, you will find instructions for installing the expansion unit together with the integrated power supply unit, as well as notes on the start-up and the fan monitoring.

2.1 Installation of the Expansion Unit

The expansion unit is designed for installation in cabinets, open racks or control desks.

M6 screws and washers should be used for fixing the unit.

For adequate ventilation, a minimum clearance of 75 mm must be provided above and below the unit, and 50 mm to either side and behind. If several EUs are installed one above the other, it is useful to install a deflector (6ES5 981-ODA11).

If the unit is wall-mounted, a clearance of 100 mm to the wall must be maintained.

The total heat generated inside a cabinet must be dissipated by either natural convection or forced ventilation.

The dimensions of the expansion unit including modules and fans are (w x h x d): 490 x 440 x 352 mm.

2.2 Installation of the Power Supply Unit

The power supply unit can be inserted or removed only if the power supply cable is disconnected. To remove the unit, loosen both screwed connections on the left and right side of the front panel and the protective conductor and pull out the power supply unit towards the front.

2.3 Installation of the 15-V Additional Module

The additional module can be connected only when the power is disconnected.

The power supply unit is removed as described in Section 2.2. Insert the 15-V additional module into the space provided.

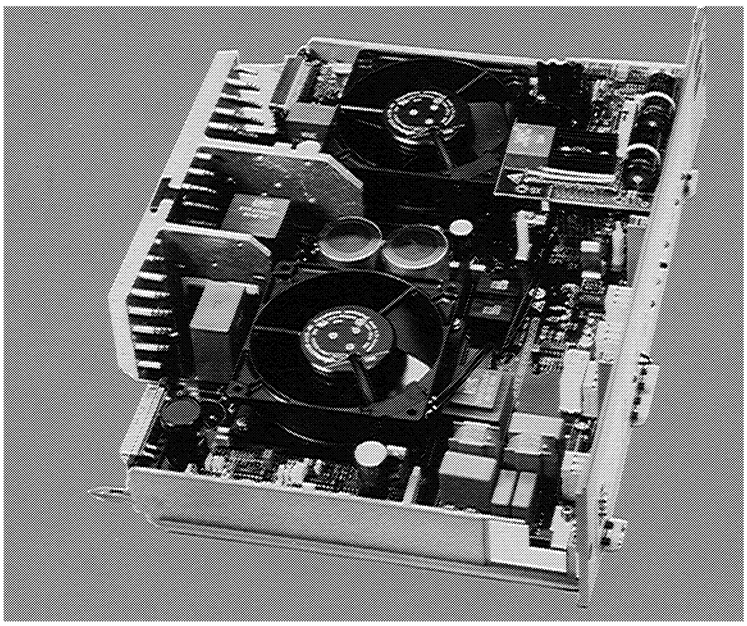


Fig. 2.1 Power supply unit, open

2.4 Connection of the Supply Voltage

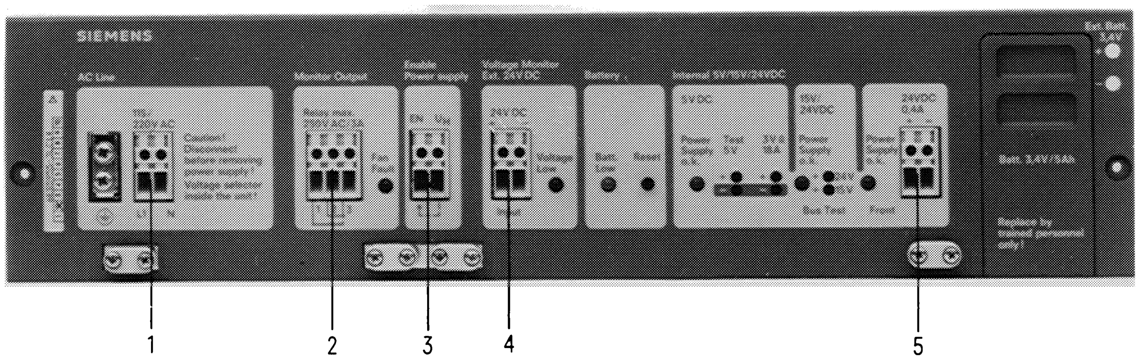


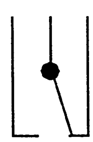
Fig. 2.2 Connection of the Supply Voltage

Note that the numbers that precede the following explanations correspond to the numbers in Fig. 2.2.

1 Dependent on the type of power supply:
AC Line: 230 V or 115 V (set the selector)
DC Line: 24 V Input voltage

2 Monitor Output:
Stoppage of one or both fans will be indicated by an LED and relay contact and leads to the cut-off of the output voltages (can be disabled by opening jumper F-R; then only relay signal and LED indication).
For other fault signals with additional jumper settings (see Section 3.3).

1 2 3 (Recommended switch position, see the Installation Guidelines)



3 Enable Power supply: EN = input; U_H = output
Absence of voltage from EN input leads to cut-off of the power supply. Not more than 7 EN-inputs (front connectors) can be triggered by a U_H-output (recommended switch position, see the Installation Guidelines).

4 Voltage Monitor:
24-V voltage input. This input is switched on as standard. If not required, the input can be deactivated by means of the jumper BA-EX (see page 3-3).

5 Output 24 V DC; 0,4 A:
This output can be used to supply the enable inputs of the U I/O modules.

The relevant regulations must be observed, especially VDE 0100.

The cable cross section of the front connectors must not exceed 4 mm^2.

2.5 Connecting Cables

The connecting cables for communications processors (CPs), intelligent peripherals (IPs) and interface modules of the central controller must be connected with front connectors. The front connectors must be locked by sliding the metal catch on the front side. The allocation of the connectors to the modules must be maintained, otherwise there is danger of damaged equipment.

2.6 Notes on Installation

230 V AC supply cables inside a cabinet can be laid in a common cable duct with signal lines providing they are screened.

The 24-V DC ground connection (load current supply to expansion unit) must be fed via a short connection (cross-section 2.5 mm^2) if used with non-floating modules.

The programmable controllers are supplied for operation with grounded reference potential.

The load power supply is mounted in the upper part of the cabinet.

If the programmable controller is mounted in a cabinet, the housing and the rack must be screwed together so that high conductivity is achieved between them.

The metal parts of the cabinet (side panels, doors, etc.) must have a low-resistance connection with each other (wire cross-section 10 to 16 mm^2). The cabinet must be connected to the protective ground conductor.

If a screened input/output cable is to be used, the screening must be clamped to a screening bar which has a low-resistance connection to the housing of the programmable controller. The external insulation of the cable should be removed in the immediate vicinity of the cable clamp and the screening screwed firmly to the screening bar, so that high conductivity is achieved.

The 24 V DC power supply unit must be equipped with a smoothing capacitor (approximately 200/uF per Ampere load current). Additionally, a screening coil is required for the transformer.

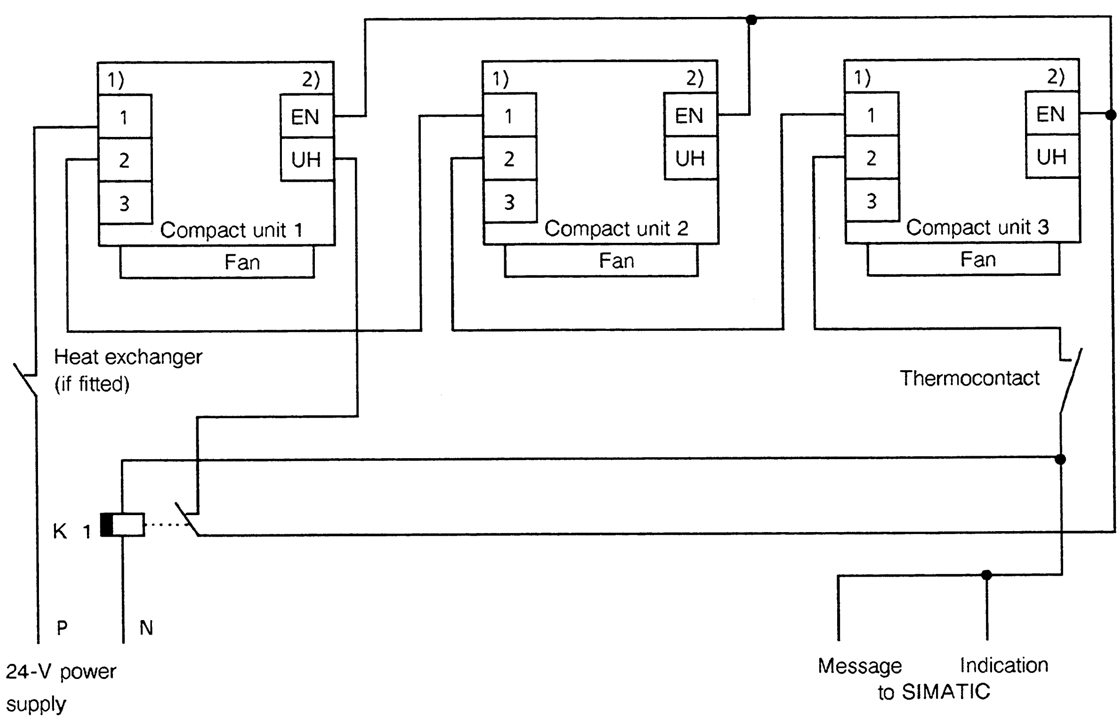
The Installation Guidelines, publication no. C79000-B8576-C452, must be followed.

2.7 Fan Monitoring

If a fan fails, adequate cooling can no longer be guaranteed. On delivery, all programmable controllers are therefore wired so that the power supply unit is switched off if a fan fails.

If, for technical reasons, the power supply cannot be switched off immediately, the jumper F-R must be opened. However, power must be switched off a maximum of 60 s after a fan fails.

If several units with fans are to be monitored together, the fan monitoring terminals EN and U_H must be connected according to the following diagram. All devices are switched off if a fan fails.



1) Relay, max. 250 V, 3 A
2) Enable power supply

Fig. 2.3 Fan monitoring

Chapter 3
Operation

This chapter explains the operation of the expansion unit, describes the display and control elements and the location of the jumpers.

3.1 General Instructions

- Voltage exceeding 50 V must not occur between the output connections and the protective earth conductor potential.
- The protective earth conductor must always be connected.
- In case of overvoltage at the output, the unit will be blocked (holding) (U_{A1} and U_{A2} $\leq$ 0.5 V).

  The power supply unit can be put into service again by switching off and on the supply voltage if the overvoltage is not due to internal errors.

- The correct function of the power supply unit is only guaranteed if a load of at least 1 A is connected to the +5 V side of units with a rated output current of 18 A or 2 A for units with a rated output current of 40 A.
- The supply voltage must reach its rated value within $\leq$ 200 ms.
- An air filter can be mounted at the bottom of the frame of the power supply unit.

3.2 Control and Display Elements

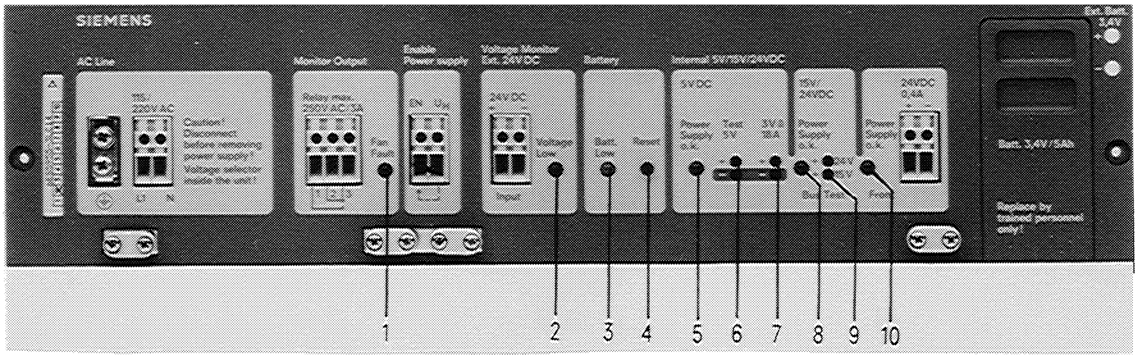


Fig. 3.1 Power supply units 6ES5 955-3...

Note that the numbers that precede the following explanations correspond to the numbers in Fig. 2.2:

1 LED "Fan Fault":
The red LED lights up if a fan fails. If jumper F-R is closed, the power supply unit stops with a delay of 6 to 10 s. If the expansion unit cannot be immediately switched off for technical reasons, the jumper F-R must be opened. However, the power must be switched off a maximum of 60 s to avoid the module being overheated.

2 LED "Voltage Low":
The red LED lights up if an overvoltage exists at the load voltage monitoring input.

3 LED "Batt. Low":
The yellow LED lights up if the battery voltage is below 2.7 V. The data buffered in the RAM is lost after power off/on.

4 Key "Reset":
After power on/off and with the LED "Batt. Low" lit, the acknowledgment button must be pressed; otherwise the PC remains in the stop condition after the battery has been changed and power switched on.

5 LED "Power Supply O.K.":
The green LED lights up if the output voltage of 5 V is present.

6 Test socket "Test 5 V":
Use this test socket to monitor the output voltage U_{A1}
(standard setting: 5.1 V DC $\pm$ 0.5%)

7 Test socket "3 V ≙ 18 A" or 3 V ≙ 40 A":
Use this test socket to monitor the output current I_{A1}
(3 V ≙ max. output current of the corresponding power supply unit)

8 LED "Power Supply O.K." (bus):
The green LED lights up if the output voltage of 15 V (with the 15 V additional module mounted) <u>and</u> the output voltage of 24 V are present.

9 Test sockets "15 V/24 V DC" (bus):
Use these test sockets to monitor the following output voltage:
a) output voltage U_{A2} (24 V DC + 25%/- 16.66%)
b) output voltage U_{A3} (15 V DC $\pm$ 5% if the additional 15 V module is connected)

10 LED "Power Supply O.K." (front):
The green LED lights up if the output voltage of 24 V is present.

3.3 Power Supply Unit 6ES5 955-3XXYY

Function of the jumpers on the power supply:

Function	Jumpers
Battery monitoring (/BAU) = on Battery monitoring (/BAU) = off	NN-MM closed * NN-MM open
PS switched off if fan fails PS not switched off if fan fails (only signal LED, relay)	F-R closed * F-R open
Operation with load voltage monitoring Operation without load voltage monitoring	BA-EX open* BA-EX closed
Activating the signal relay (relay contact 2-3 closed) - by fan fault - by battery fault signal2) - without battery fault signal - by undervoltage signal1) (BASPq = low) - without undervoltage signal	 independent of other jumpers RR-LL closed RR-LL open * BB-AA closed BB-AA open *

Table 3.1 Jumper settings for power supply unit 6ES5 955-3XXYY

* As supplied

1) If undervoltage ($U_Ü$ < 20 V - 25 %) occurs at the monitoring input (Voltage Monitor) (can be disabled with jumper BA-EX) or if undervoltage occurs at the output (U_A < 4.75 V) the signal "BASPq = low" is output; this means that all digital outputs will be switched off.

2) Undervoltage of the battery (U_{BATT} < 2,7 V) causes the battery error message (can be disabled with jumper MM-NN).
Apart from the "batt low" display and the output of the signal /BAU, the signal relay RR-LL can also be activated with the following power supplies:

Power supply:

6ES5 955-3NC13 from version 6

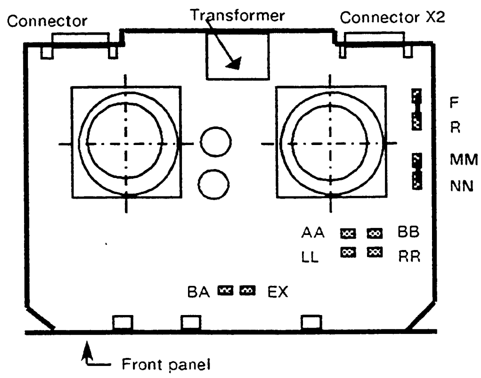
6ES5 955-3LC14 from version 7

6ES5 955-3NF11 from version 7

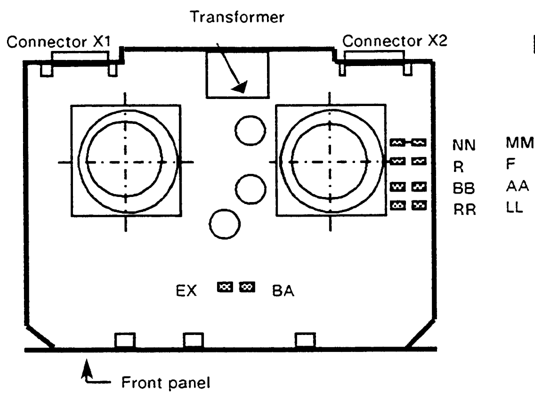
6ES5 955-3LF12 from version 5

Location of the jumpers

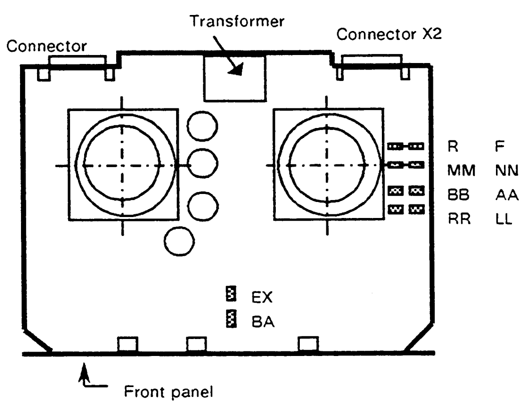
The position of the jumpers corresponds with the factory setting.



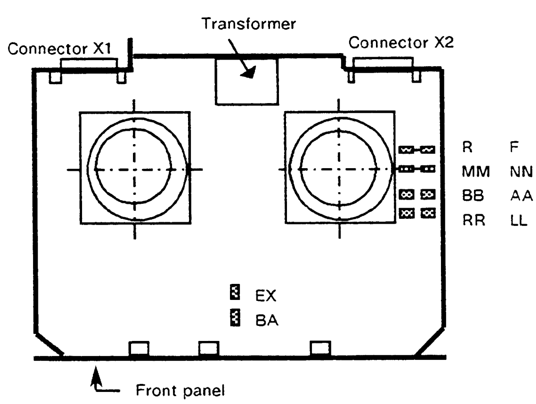
Power supply unit 6ES5 955-3LC14:



Power supply unit 6ES5 955-3NC13:



Power supply unit 6ES5 955-3LF12:



Power supply unit 6ES5 955-3NF11:

Fig. 3.2 Location of the jumpers

Reaction of the power supply to faults

If the power supply is switched off, relay contact 2-3 is closed and relay 1-2 is open.
If the power supply is free of faults, relay contact 1-2 is closed and relay contact 2-3 is open.
Apart from fan faults, other faults can also switch the signal relay (see jumper description) (relay contact 2-3 closed).
The following table describes the reaction of the power supply to faults (condition: jumper MM-NN closed, jumper BA-EX open).

<table>
<tr><td colspan="4" rowspan="3"></td><td colspan="2">Message</td><td colspan="2">Output voltage switched off</td></tr>
<tr><td rowspan="2">LED Fan Fault</td><td rowspan="2">Contact assembly closed</td><td colspan="2">Jumpers</td></tr>
<tr><td>F-R closed</td><td>F-R open</td></tr>
<tr><td rowspan="6">Jumper EN-UH (enable present)</td><td rowspan="5">No fan fault</td><td colspan="2">No battery fault and no undervoltage message</td><td rowspan="5">off</td><td>1-2</td><td rowspan="5">No</td><td rowspan="5">No</td></tr>
<tr><td rowspan="2">Battery fault</td><td>RR-LL closed 2)</td><td>2-3</td></tr>
<tr><td>RR-LL open</td><td>1-2</td></tr>
<tr><td rowspan="2">Under-voltage message 1)</td><td>BB-AA closed</td><td>2-3</td></tr>
<tr><td>BB-AA open</td><td>1-2</td></tr>
<tr><td>Fan fault</td><td colspan="2"></td><td>lit</td><td>2-3</td><td>Yes</td><td>No</td></tr>
<tr><td rowspan="5">Jumper UH-EN (enable present)</td><td rowspan="5">No fan fault</td><td colspan="2">No battery fault</td><td rowspan="5">off</td><td>1-2</td><td rowspan="5">Yes</td><td rowspan="5">Yes</td></tr>
<tr><td rowspan="2">Battery fault</td><td>RR-LL closed 2)</td><td>2-3</td></tr>
<tr><td>RR-LL open</td><td>1-2</td></tr>
<tr><td colspan="2">BB-AA closed</td><td>2-3</td></tr>
<tr><td colspan="2">BB-AA open</td><td>1-2</td></tr>
</table>

Table 3.2 Reaction of the power supply to faults

1) see note 1), page 3-3
2) Depends on the version, see note 2), page 3-3

Chapter 4
Maintenance

The following chapter explains how to handle modules and change the backup battery and the fans. Furthermore, it discusses the interface assignment of the bus PCB.

4.1 Inserting and Removing a Module

The modules are removed by gripping the lugs and pulling with a gentle rocking motion.

Modules must not be inserted or removed while CC, EGs, or field devices are still switched on.

The modules of the U-peripherals may be removed or inserted during operation; the special instructions concerning the functions of the enabling inputs must be observed.

The power supply unit must not be installed or removed whilst the power is switched on.

4.2 Changing the Backup Battery and the Fans

The back-up battery can be changed without any loss of data if the power supply unit is on or an external voltage (3.4 V) is present at the terminals "Ext. Batt.". The polarity must be correct.

The back-up battery must be changed at least every 3 years; this change depends neither on the memory configuration (buffer current) nor on the buffer function (capacity: 5.0 Ah).
To change the battery, proceed as follows:

- Pull down the cover.
- Pull out the battery compartment.
- Change the battery.

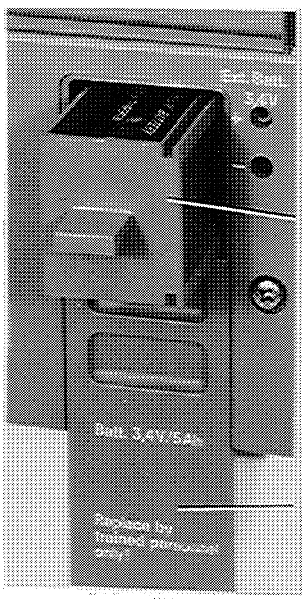


Fig. 4.1 Battery compartment

The service life of the fans (see Technical Specifications) depends on the operating time, the temperature and the ambient conditions. In case of a fan failure, damage, e.g. to the modules, can be avoided if the fan monitoring is switched on (jumper F-R closed); the power supply unit is then switched off.

Under some circumstances, it may be advisable to change the fans prophylactically at the appropriate maintenance intervals.

To change the fans, proceed as follows:

- Switch off the power suppy
- Remove the power supply unit
- Remove the screws securing the fans
- Disconnect the voltage supply of the fans (plug-in contact)
- The fans are installed following the reverse procedure

4.3 Interface Assignment of the Bus PCB

	CC interfaces 310, 311, IM 314 I/O modules Slot 3				Coordinator I/O modules Slot 11				Communications processor Intelligent peripherals I/O modules Slot 83 to 139			
Backpl. cnctor.	Pin no.	Pin row z	b	d	Pin no.	Pin row z	b	d	Pin no.	Pin row z	b	d
1	2	+5V	0 V		2	+5V	0 V		2	+5V	0 V	
	4		PESP		4		PESP	UBAT	4		PESP	UBAT
	6	$\overline{\text{CPKL}}$	ADB0	ADB12	6	$\overline{\text{CPKL}}$	ADB0	ADB12	6	$\overline{\text{CPKL}}$	ADB0	ADB12
	8	$\overline{\text{MEMR}}$	ADB1	ADB13	8	$\overline{\text{MEMR}}$	ADB1	ADB13	8	$\overline{\text{MEMR}}$	ADB1	ADB13
	10	$\overline{\text{MEMW}}$	ADB2	ADB14	10	$\overline{\text{MEMW}}$	ADB2	ADB14	10	$\overline{\text{MEMW}}$	ADB2	ADB14
	12	$\overline{\text{RDY}}$	ADB3	ADB15	12	$\overline{\text{RDY}}$	ADB3	ADB15	12	$\overline{\text{RDY}}$	ADB3	ADB15
	14	DB0	ADB4		14	DB0	ADB4		14	DB0	ADB4	
	16	DB1	ADB5		16	DB1	ADB5		16	DB1	ADB5	
	18	DB2	ADB6	0 V	18	DB2	ADB6		18	DB2	ADB6	
	20	DB3	ADB7	0 V	20	DB3	ADB7		20	DB3	ADB7	
	22	DB4	ADB8	0 V	22	DB4	ADB8		22	DB4	ADB8	
	24	DB5	ADB9	0 V	24	DB5	ADB9		24	DB5	ADB9	
	26	DB6	ADB10	0 V	26	DB6	ADB10		26	DB6	ADB10	
	28	DB7	ADB11	0 V	28	DB7	ADB11	$\overline{\text{DSi}}$	28	DB7	ADB11	$\overline{\text{DSi}}$
	30	$\overline{\text{DSI}}$	BASP	0 V	30		BASP		30		BASP	
	32		0 V	$\overline{\text{BASPq}}$	32		0 V	$\overline{\text{BASPq}}$	32		0 V	$\overline{\text{BASPq}}$
2	2	+5V	0 V		2	+5V	0 V		2	+5V	0 V	
	4	DB12	DB8	0 V	4	DB12	DB8		4	DB12	DB8	
	6	DB13	DB9	$\overline{\text{CPKL}}$	6	DB13	DB9	RxDS8	6	DB13	DB9	
	8	DB14	DB10		8	DB14	DB10	TxDS8	8	DB14	DB10	
	10	DB15	DB11		10	DB15	DB11	RxDS7	10	DB15	DB11	
	12		+5V		12		RxDS6	TxDS7	12			
	14		+5V		14	$\overline{\text{NAU}}$	TxDS6	RxDS5	14	$\overline{\text{NAU}}$		
	16		+5V		16	$\overline{\text{BAU}}$	RxDS4	TxDS5	16	$\overline{\text{BAU}}$		
	18	$\overline{\text{CPKLq}}$	$\overline{\text{NAU}}$		18	$\overline{\text{CPKLq}}$	TxDS4	RxDS3	18			
	20				20			TxDS3	20			
	22	0 V	0 V		22	$\overline{\text{PEU}}$		RxDS1	22	$\overline{\text{PEU}}$		
	24	0 V	0 V		24	$\overline{\text{GEP}}$	RxDS2	TxDS1	24	$\overline{\text{GEP}}$		
	26	0 V	0 V		26		TxDS2		26			
	28	0 V	0 V		28			SPRxD	28			
	30	0 V	0 V		30	M2	M2	M2	30	M2	M2	M2
	32	0 V	0 V		32	+24 V	0 V	+15 V	32	+24 V	0 V	+15 V

Table 4.1 (1) Interface assignment of the bus PCB

q = output
i = input

	PG-MUX Communicat. processor Intelligent peripherals I/O modules Slot 19 to 75				CC interface IM 314 R / 314 H I/O modules Slot 147, 155				Interface module 300 for EG 185 U I/O modules Slot 163			
Backpl. cnctor.	Pin no.	Pin row z	b	d	Pin no.	Pin row z	b	d	Pin no.	Pin row z	b	d
1	2	+5 V	0 V		2	+5 V	0 V	screen	2	+5 V	0 V	
	4		PESP	UBAT	4		PESP		4		PESP	+5 V
	6	$\overline{\text{CPKL}}$	ADB0	ADB12	6	$\overline{\text{CPKL}}$	ADB0	ADB12	6	$\overline{\text{CPKL}}$	ADB0	ADB12
	8	$\overline{\text{MEMR}}$	ADB1	ADB13	8	$\overline{\text{MEMR}}$	ADB1	ADB13	8	$\overline{\text{MEMR}}$	ADB1	ADB13
	10	$\overline{\text{MEMW}}$	ADB2	ADB14	10	$\overline{\text{MEMW}}$	ADB2	ADB14	10	$\overline{\text{MEMW}}$	ADB2	ADB14
	12	$\overline{\text{RDY}}$	ADB3	ADB15	12	$\overline{\text{RDY}}$	ADB3	ADB15	12	$\overline{\text{RDY}}$	ADB3	ADB15
	14	DB0	ADB4		14	DB0	ADB4		14	DB0	ADB4	+5 V
	16	DB1	ADB5		16	DB1	ADB5		16	DB1	ADB5	+5 V
	18	DB2	ADB6		18	DB2	ADB6		18	DB2	ADB6	0 V
	20	DB3	ADB7		20	DB3	ADB7		20	DB3	ADB7	0 V
	22	DB4	ADB8		22	DB4	ADB8		22	DB4	ADB8	0 V
	24	DB5	ADB9		24	DB5	ADB9		24	DB5	ADB9	0 V
	26	DB6	ADB10		26	DB6	ADB10		26	DB6	ADB10	0 V
	28	DB7	ADB11	$\overline{\text{DSi}}$	28	DB7	ADB11		28	DB7	ADB11	0 V
	30		BASP		30		BASP	0 V	30		BASP	0 V
	32		0 V	$\overline{\text{BASPq}}$	32	0 V	0 V	$\overline{\text{BASPq}}$	32		0 V	$\overline{\text{BASPq}}$
2		+5 V	0 V		2	+5 V	0 V		2	+5 V	0 V	
	4	DB12	DB8		4	NA0	SA0	0 V	4			
	6	DB13	DB9		6	NA1	SA1	CPKL	6			
	8	DB14	DB10		8	NA2	SA2		8			
	10	DB15	DB11		10	NA3	SA3		10			
					12				12	+5 V	+5 V	
	14	$\overline{\text{NAU}}$			14				14	+5 V	+5 V	
	16	$\overline{\text{BAU}}$			16				16	+5 V	+5 V	
	18				18	$\overline{\text{CPKLq}}$	$\overline{\text{NAU}}$		18	$\overline{\text{CPKLq}}$	$\overline{\text{NAU}}$	
	20				20	$\overline{\text{BASPq}}$	$\overline{\text{BASPq}}$		20			
	22	$\overline{\text{PEU}}$		TxDSn	22	0 V	0 V		22	0 V	0 V	
	24	$\overline{\text{GEP}}$			24	0 V	0 V		24	0 V	0 V	
	26		RxDSn		26	0 V	0 V		26	0 V	0 V	
	28			SPRxD	28	0 V	0 V		28	0 V	0 V	
	30	M2	M2	M2	30	0 V	0 V		30	0 V	0 V	
	32	+24 V	0 V	+15 V	32	0 V	0 V		32	0 V	0 V	

Table 4.1 (2) Interface assignment of the bus PCB

q = output
i = input

Chapter 5
Spare Parts

Table 5.1 lists spare parts for the EG 185 U. Order spare parts from your local Siemens representative. Consult the appendix for a list of Siemens offices worldwide.

Description	Order number	Spare part category [1]
Power supply unit and fan	6ES5 955-3LC14 6ES5 955-3NC13 -3NF11 -3LF12	R R R R
15-V additional module	6ES5 956-0AA12	R
Battery compartment	6XG3400-2AT00	N
Backup battery	W79084-L1001-B5	N
Air deflector	6ES5 981-0DA11	N
Fuses (6.3 x 32 mm) 15 A medium-blow 4 A quick-break 1.5 A quick-break	 41761815 41761794 41761782	N Order from: GWW-AST Nuremberg
Filter holder	6ES5 981-0FA11	N Order from: GWW-AST
Filter pad (pack of 10)	6ES5 981-0EA11	N Order from: GWW-AST
Fan (pack of 2)		N Order from: GWW-AST
PS: -3LC14/3LF12 PS: -3NC13/3NF11	6ES5 988-3LB21 6ES5 988-3NB11	

Table 5.1 Spare parts

1) R = item can be repaired
N = item cannot be repaired
If not specified, order from GWK.

EG 185U Expansion Unit

FOLD

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 192 ROSWELL, GA

Postage will be paid by addressee

Siemens Energy & Automation, Inc.
150 Hembree Park Drive
Roswell, GA 30077-9810

Attention: Technical Publications
Programmable Controls Business Unit

FOLD

SIEMENS

SIMATIC S5

EG 186 U Expansion Unit in Compact Design 6ES5186-3UA..

Instructions C79000-B8576-C070-01

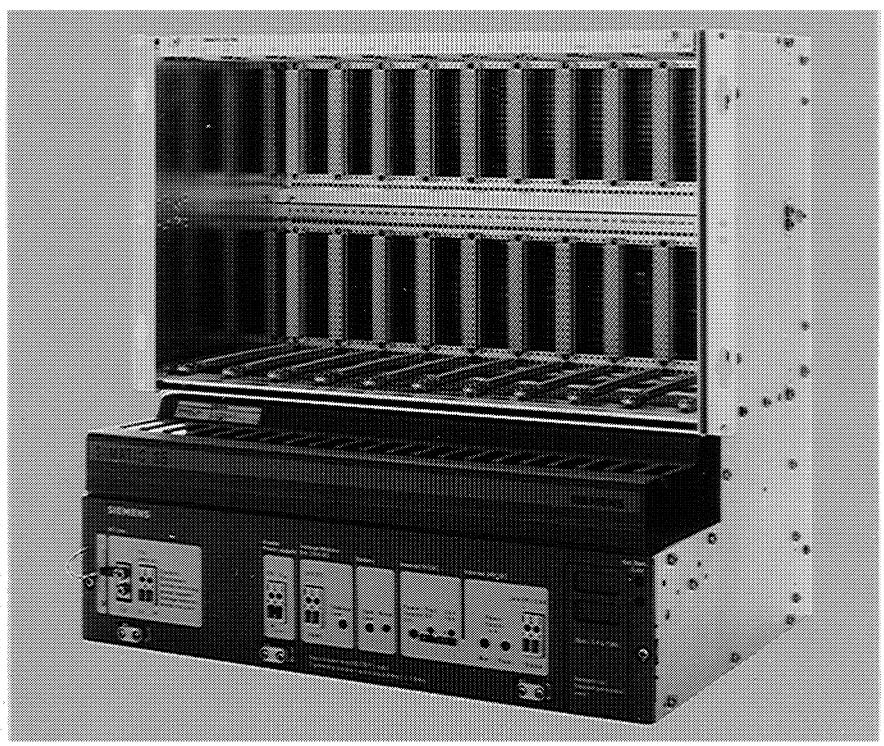


Fig. 1 EG 186 U expansion unit

Contents

		Page
1	**Technical Description**	**3**
1.1	Application	3
1.2	Design	3
1.3	Configurations	4
1.4	Specifications	5
2	**Installation**	**11**
2.1	Installation of the Expansion Unit	11
2.2	Installation of the Power Supply Unit	11
2.3	Connection of the Supply Voltage	12
2.4	Connection of the Interconnecting Cables	13
2.5	Notes on Installation	13
3	**Operation**	**15**
3.1	General Instructions	15
3.2	Control and Display Elements	16
3.3	Jumper Assignment	17
4	**Maintenance**	**19**
4.1	Inserting and Extracting of Modules	19
4.2	Change of Backup Battery	19
4.3	Spare Parts/Accessories	20
4.4	Interface Assignment of the Bus PCB	21
5	**Page Overview**	**23**

1 Technical Description

1.1 Application

The EG 186 U expansion unit has been developed to facilitate a distributed use of communications processors (CPs) and intelligent peripherals (IPs) without fans. The modules to be used with EG 186 U must be suitable for the operation without fan.

It has a 16 bit-wide address and data bus. It can be addressed by the CC via the symmetrical interface (IM 304 - IM 314). It is also used in fault-tolerant SIMATIC S5 systems (IM 304 - IM 314 H/R).

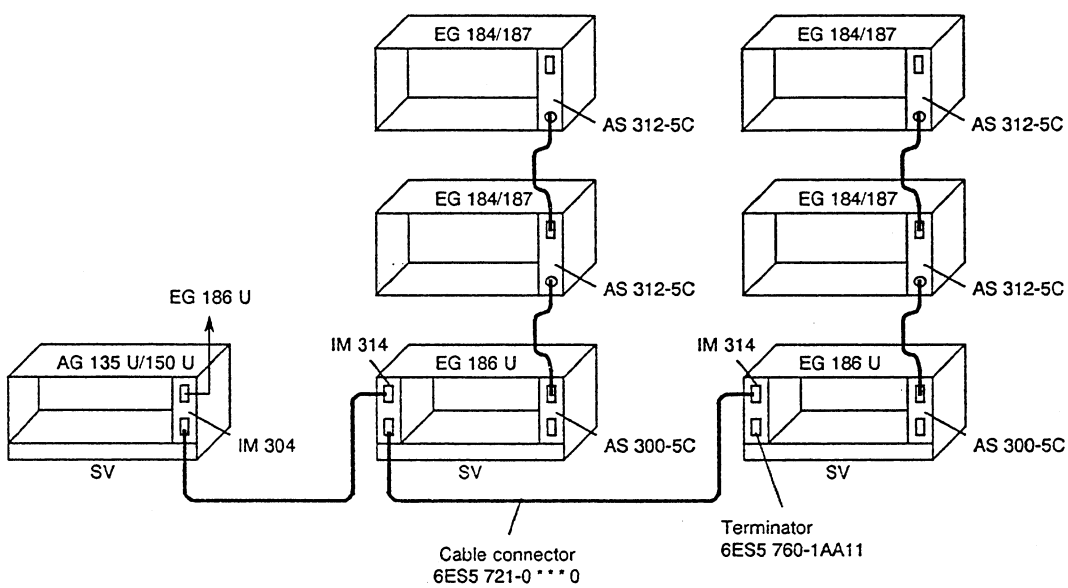
The EG 186 U can be used in the programmable controllers 135 U, 150 U and 155 U.

1.2 Design

The EG 186 U expansion unit consists of:

- Compact housing with cable duct and power supply unit,
- 11 slots for modules.

Typical distributed configuration:



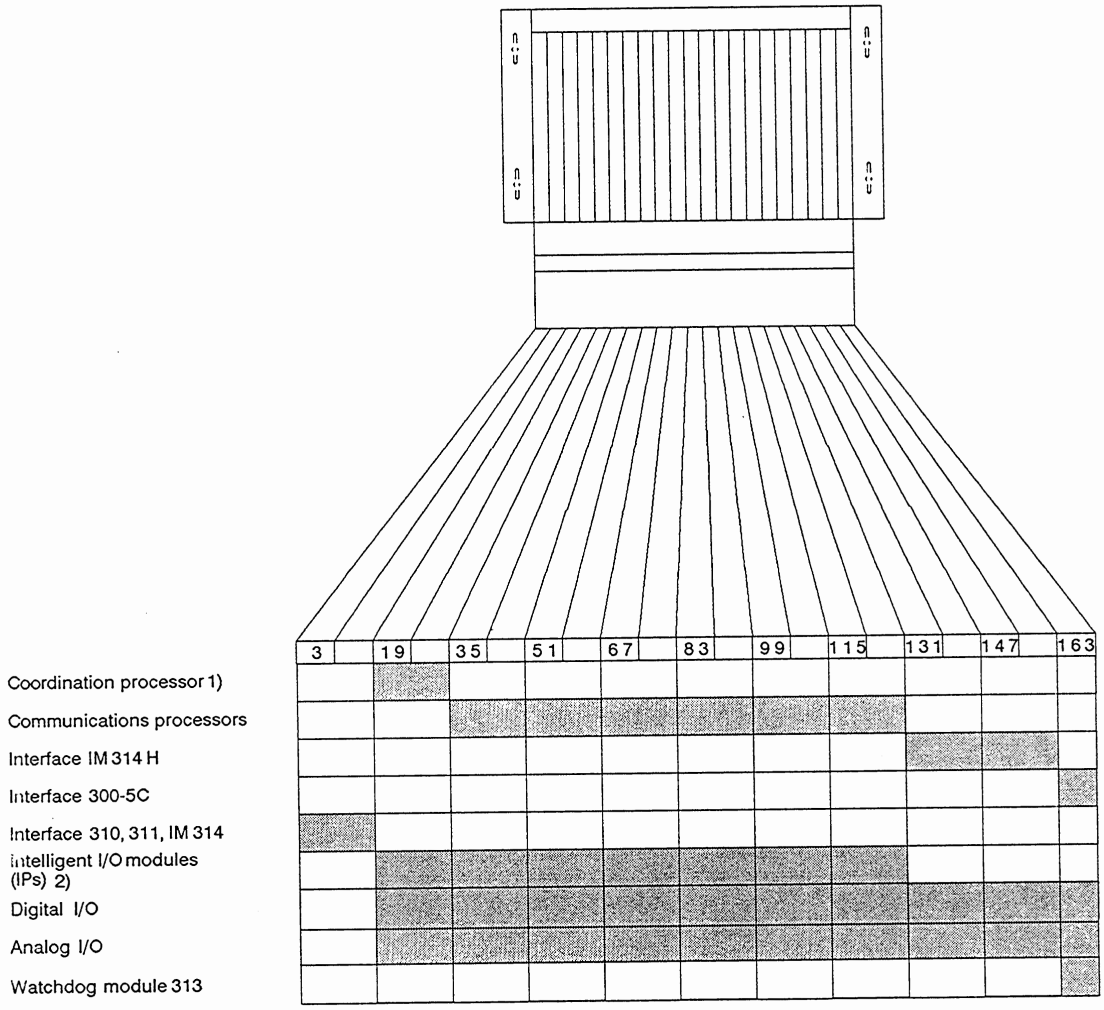
EG	Expansion unit	SV	Power supply
AG	Programmable controller	IM/AS	Interface module

Up to four expansion units EG 186 U can be connected to each interface of the IM 304.

Important:

The total distance between the CC and the most remote IM 314 must not exceed 600 m. The IM 304 has to be adapted with the appropriate position of jumpers to the actual length of cable (see operation instructions IM 304). A terminator is required at the last IM 314.

1.3 Configurations



1) Jumper setting: See instructions for the coordination processor

2) IP 245, IP 260 and IP 261 in addition in slots 147, 155 and 163.
IP 257 in slots 147 and 155.

= possible slot

1.4 Specifications

Applicable safety regulations	VDE 0160
Protection class	1
Degree of protection	IP 00
Operating temperature	0 to 55 °C
Transport and storage temperature	-40 to 70 °C
Relative humidity	≤ 95 % at 25 °C, no condensat.
Operating altitude	≤ 3500 m above sea level
Mechanical stressing	Mounting in fixed equipment which is not necessarily free of vibration; mounting on ships and in motor vehicles (observing any special regulations) but not directly on the engine assembly.
Weight	approx. 16 kg
Dimensions (w x h x d)	482.6 mm x 432 mm x 310 mm

Power supply unit 6ES5 955-5LB11

<u>Input</u>

Rated input voltage U_{EN}	230/115 V AC ± 10 %, commutable [1])
Undervoltage message U_E	< 187 V AC (or 93 V AC)
Input frequency f_E	47 to 63 Hz
Rated input current I_{EN} at rated load and U_{EN} = 230 V (or 115 V)	0.8 A (or 1.6 A)
Max. inrush current I_E	10 A for 5 ms (or 5 A)
Efficiency at rated load	typ. 70 %

[1]) Voltage selector; replace fuse

Stored energy time in case of power failure	$\geq$ 10 ms
Power factor cos	0.74
Input fuse	1 A (or 2 A), slow; 250 V; 6.3 x 32 mm (F1 on power supply PCB)

<u>Output 1</u>

Rated output voltage U_{AN1}	5.1 V DC $\pm$ 0.5 %
Setting range of output voltage	4.75 to 5.2 V
Rated output current I_{AN1}	15 A DC
Ripple	$\leq$ 1 % of U_{AN1}
Dynamic voltage tolerance in case of load impulse from 50 to 100 % I_N	 $\leq$ 5 % of U_{AN1}
Settling time	$\leq$ 5 ms
Overvoltage cutoff U_{A1}	6 V $\pm$ 5 %
Undervoltage message U_{A1}	4.82 V $\pm$ 1 %
Current limit at overload	(1.1 to 1.33) x I_{AN1}

<u>Output 2: 24 V front</u>

Rated output voltage U_{AN2}	24 V DC + 25 %/- 15 % (for $I_{AN1} \geq$ 2 A)
Rated output current I_{AN2}	(0.4 $\pm$ 0.1) A DC
Total current of 24 V output voltage	$\leq$ 0.5 A
Ripple	$\leq$ 0.5 % of U_{AN2}
Undervoltage message (LED on front panel)	U_{A2} < 14 V to 19 V
Electronic overcurrent protection	(0.4 $\pm$ 0.1) A DC

<u>Output 3: 24 V bus</u>

Rated output voltage U_{AN3}	24 V DC + 25 %/- 15 %
Rated output current I_{AN3}	0.5 A DC - I_{AN2}
Ripple	$\leq$ 0.5 % of U_{AN3}

Undervoltage message (LED on front panel)	U_{A3} < 14 V to 19 V
Electronic overcurrent protection	(0.5 ± 0.1) A

Complementary monitor

24 V load voltage (Voltage Monitor Ext.)	≥ 15 to 20 V

Galvanic isolation primary/secondary	yes

Backup battery

Capacity	5 Ah
Voltage	+ 3.4 V
Service life	approx. 10 years, without discharge

The power supply unit 6ES5 955-5LB11 can be operated with either 230 V AC or 115 V AC. The appropriate voltage is selected using the voltage selector switch S1 in the power supply unit.
The fuse F1 must be replaced.

Power supply unit 6ES5 955-5NB11

Input

Rated input voltage U_{EN}	24 V DC + 25 %/- 16.66 %
Undervoltage message U_E	< 16.9 V DC
Rated input current I_{EN} at rated load and U_{EN} = 24 V	5 A
Max. inrush current I_E	85 A/3 ms
Efficiency at rated load	typ. 70 %
Stored energy time in case of power failure	> 10 ms
Input fuse	10 A, slow, 250 V; 6.3 x 32 mm (F1 on power supply PCB)

Output 1

Rated output voltage U_{AN1}	5.1 V DC $\pm$ 0.5 %
Setting range of output voltage	4.75 to 5.2 V
Rated output current I_{AN1}	15 A DC
Ripple	$\leq$ 1 % of U_{AN1}
Dynamic voltage tolerance in case of load impulse from 50 to 100 % I_N	$\leq$ 5 % of U_{AN1}
Settling time	$\leq$ 5 ms
Overvoltage cutoff U_{A1}	6 V $\pm$ 5 %
Undervoltage message U_{A1}	4.82 V $\pm$ 1 %
Current limit at overload	(1.1 to 1.33) x I_{AN1}

Output 2: 24 V front

Rated output voltage U_{AN2}	24 V DC + 25 %/- 15 % (for $I_{AN1} \geq$ 2A)
Rated output current I_{AN2}	(0.4 $\pm$ 0.1) A DC
Total current of the 24 V output voltage	$\leq$ 0.5 A
Ripple	$\leq$ 0.5 % of U_{AN2}
Undervoltage message (LED on front panel)	U_{A2} < 14 V to 19 V
Electronic overcurrent protection	(0.4 $\pm$ 0.1) A DC

Output 3: 24 V bus

Rated output voltage U_{AN3}	24 V DC + 25 %/- 15 %
Rated output current I_{AN3}	0.5 A DC - I_{AN2}
Ripple	$\leq$ 0.5 % of U_{AN3}
Undervoltage message (LED on front panel)	U_{A3} < 14 V to 19 V
Electronic overcurrent protection	(0.5 $\pm$ 0.1) A

Complementary monitor

24 V load voltage (Voltage Monitor Ext.)	$\geq$ 15 to 20 V

Fusing of the internal 24 V

Input and output fuse	1 A, slow; 250 V; pigtail fuse (F201, F202 on power supply PCB)

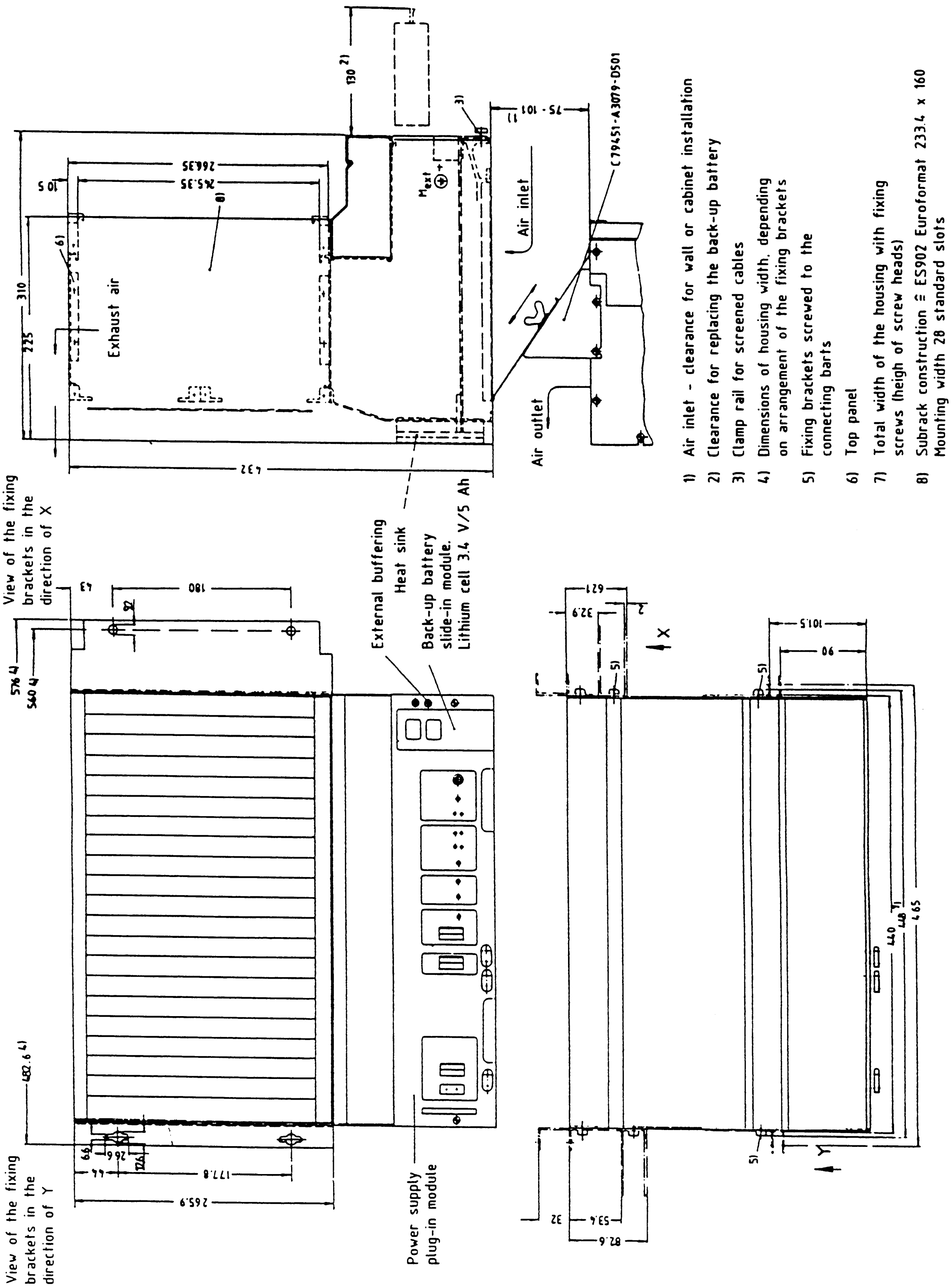
Galvanic isolation primary/secondary

yes

Backup battery

Capacity	5 Ah
Voltage	+ 3.4 V
Service life	approx. 10 years, without discharge

Dimension drawing



2 Installation

2.1 Installation of the Expansion Unit

The EU is designed for the installation in cabinets, open racks or control desks (see catalog ST 53).

M6 screws and washers should be used for fixing the unit.

In order to facilitate the necessary ventilation, a minimum space of 88.9 mm (2U) must be provided beneath, behind, and above the EU. If many EUs are mounted in a pile, it is useful to install a deflector (6ES5 981-0DA11).

If the unit is wall-mounted, a distance of 100 mm to the wall must be provided.

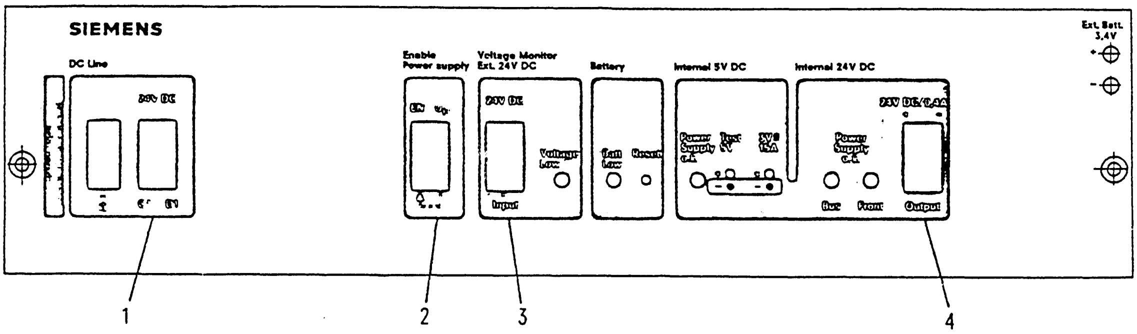
The total heat generated inside a cabinet must be dissipated by either natural convection or forced ventilation.

The dimensions of the EU including modules are (w x h x d):
490 x 440 x 352 mm.

2.2 Installation of the Power Supply Unit

The power supply unit can be connected or disconnected only if the supply cable conductor is isolated. To disassemble, remove both screwed connections on the left and the right side of the front panel and withdraw the power supply unit forwards.

2.3 Connection of the Supply Voltage



1 Depending on the type of the current supply
AC Line: 230 V or 115 V input voltage (commutate the selector on power supply unit; replace fuse)
DC Line: 24 V input voltage

2 Enable Power Supply:
Not more than 7 FRG-inputs (front connector) can be triggered by an U_H output (suggested switch position, see the Installation Guidelines).

3 Voltage Monitor:
The 24 V load voltage monitor input must be connected or be switched inactive by means of the jumper BA-EX in the power supply unit.

4 Output 24 V front:
This output can be used to supply the enable inputs of the U-periphery. A voltage of between 20 and 30 V and max. 0.4 A is available.

Fig. 2 Connection of the supply voltage

The relevant regulations must be observed, especially VDE 0100.

The cable section of the front connectors must not exceed 4 mm^2.

2.4 Connection of the Interconnecting Cables

The interconnecting cables for communications processors (CPs), intelligent peripherals (IPs) and interface modules of the central controller must be connected with front connectors. The front connectors must be locked by displacing the metal top on the front side. The order of the connectors must correspond to that of the modules, otherwise there is a danger of damage resulting.

2.5 Notes on Installation

Inside a cabinet, 230 V AC supply cables may be laid in a common cable duct with signal leads only if they are screened.

The 24 V DC ground connection (load current supply to expansion unit) must be fed via a short connection (cross-section $\geq 2.5\ mm^2$) if used with non-floating modules.

The programmable controllers are delivered to be used with grounded reference potential.

The load power supply is mounted in the upper part of the cabinet.

If the programmable controller is mounted into a cabinet, the housing and the rack must be screwed together in a manner most beneficial to conduction.

The metal parts of the cabinet (partitions, doors, etc.) must have a low-resistance connection with each other (wire cross-section 10 to 16 mm^2). The cabinet must be connected to the protective ground conductor.

If a screened input/output cable is to be used, the screening must be clamped to a screening bar which has a low-resistance connection to the housing of the programmable controller. The external insulation of the cable should be removed in the immediate vicinity of the cable clamp and the screening screwed firmly to the screening bar, so that high conductivity is achieved.

The 24 V DC power supply unit must be furnished with a smoothing capacitor (approximately 200 μF per ampere load current). Additionally, a screening coil is required for the transformer.

The Installation Guidelines, reference no. C79000-B8576-C452, must be followed.

3 Operation

3.1 General Instructions

- Voltage exceeding 50 V must not appear between the output connections and the protective ground conductor potential.

- The protective ground conductor must always be connected.

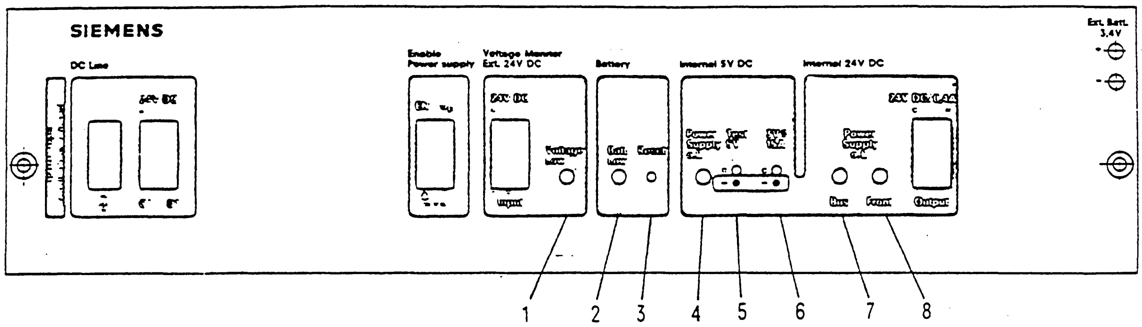
- In case of overvoltage at the output, the unit will be blocked holding (U_{A1} and $U_{A2} \leq 0.5$ V).

  The power supply unit can be put into service again by switching the supply voltage off and on again if the overvoltage is not due to internal errors.

- The correct function of the power suply unit is only guaranteed if a load of at least 1 A is connected to the 5 V side.

- The supply voltage must reach its rated value in a period of time that must not exceed 200 ms.

3.2 Control and Display Elements



1 LED "Voltage Low"
The red LED lights up if an undervoltage exists at the load voltage monitor input.

2 LED "Batt. Low"
The yellow LED lights up if the battery voltage is below 2.7 V. The data which is buffered in the RAM is lost upon power off/on.

3 Key "Reset"
After power on/off and when the LED "Batt. Low" still lights up, the acknowledgment button must be pressed; otherwise the progammable controller remains in the stop condition after battery change and power on.

4 LED "Power Supply O.K."
The green LED lights up if the output voltage of 5 V is present.

5 Test sockets "Test 5 V"
Monitoring possibility of the output voltage U_{AN1}
(standard setting: 5.1 V DC $\pm$ 0.5 %)

6 Test sockets "3 V ≙ 15 A"
Monitoring possibility of the output current I_{A1}
(3 V ≙ max. output current of the corresponding power supply unit)

7 LED "Power Supply O.K." (bus)
The green LED lights up if the output voltage of 24 V is present.

8 LED "Power Supply O.K." (front)
The green LED lights up if the output voltage of 24 V is present.

Fig. 3 Power supply units 6ES5 955-5...

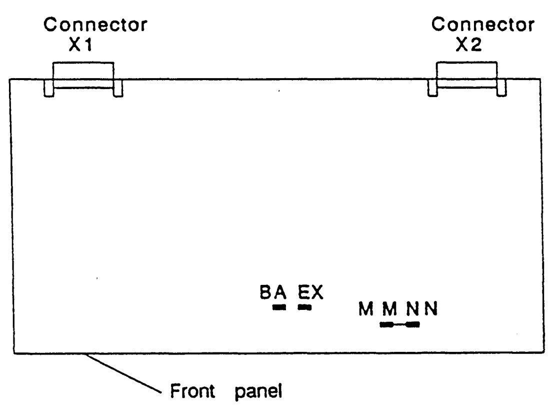
3.3 Jumper Assignment

Function	Jumpers
Battery monitoring (BAU) = On Battery monitoring (BAU) = Off	NN–MM closed * NN–MM open
Operation with load voltage monitoring Operation without load voltage monitoring	BA–EX open * BA–EX closed

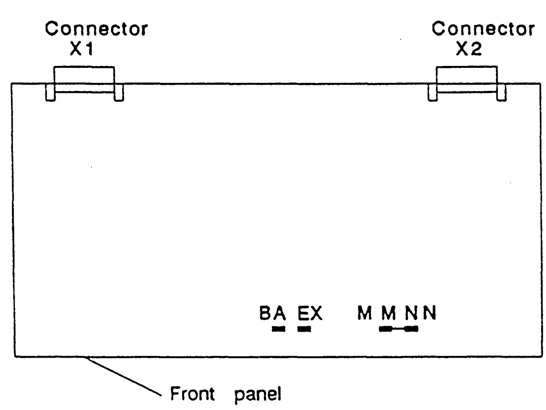
* = Factory setting

<u>Position of the jumpers</u>

Power supply unit 6ES5 955-5LB11:



Power supply unit 6ES5 955-5NB11:



4 Maintenance

4.1 Inserting and Extracting of Modules

The modules are removed by gripping the lugs and pulling with a gentle rocking motion.

Modules may only be inserted or removed while the central controller, expansion units or field devices are switched off.

The modules of the U-peripherals may be removed or inserted during operation; the special instructions concerning the functions of the enabling inputs must be observed.

The power supply unit must not be installed or removed whilst the power is switched on.

4.2 Change of the Backup Battery

The backup battery can be changed without any loss of memorized data if the power supply unit is on or an external voltage (3.4 V) is present at the connectors "Ext. Batt.". The correct polarity is to be observed.

The backup battery is to be changed at least every 3 years; this change depends neither on the memory change (backup current) nor on the backup function (capacity: 5.0 Ah). To change the battery, procede as follows:

- Pull down the cover.
- Pull the battery insert.
- Change the battery.

4.3 Spare Parts/Accessories

Description	Order number	Spare part category [1]	Order from [2]
Power supply units	6ES5 955-5LB11 6ES5 955-5NB11	R R	
Battery insert	6XG3400-3AT00	N	
Backup battery	W79084-L1001-B5	N	
Deflector sheet	6ES5 981-0DA11	N	
Fuses		N	
10 A slow-blow (6.3 x 32 mm)	W79054-L4012-M100		
1 A slow-blow (6.3 x 32 mm)	W79054-L4011-T100		
2 A medium-blow (6.3 x 32 mm)	W79054-L4011-F200		
1 A slow, pigtail	W79054-M1011-T100		

[1]) R = item can be repaired
N = item cannot be repaired

[2]) Order from GWK.

4.4 Interface Assignment of the Bus PCB

	CC interface modules 310, 311, IM 314 I/O modules Slot 3				Coordination processor Intelligent I/O mod. I/O modules Slot 19				PG-MUX Communications proc. Intelligent I/O mod. I/O modules Slots 19 to 115			
Backplane connector	Pin no.	Pin row z	b	d	Pin no.	Pin row z	b	d	Pin no.	Pin row z	b	d
1	2	+5 V	0 V		2	+5 V	0 V		2	+5 V	0 V	
	4		PESP		4		PESP	UBAT	4		PESP	UBAT
	6	$\overline{\text{CPKL}}$	ADB0	ADB12	6	$\overline{\text{CPKL}}$	ADB0	ADB12	6	$\overline{\text{CPKL}}$	ADB0	ADB12
	8	$\overline{\text{MEMR}}$	ADB1	ADB13	8	$\overline{\text{MEMR}}$	ADB1	ADB13	8	$\overline{\text{MEMR}}$	ADB1	ADB13
	10	$\overline{\text{MEMW}}$	ADB2	ADB14	10	$\overline{\text{MEMW}}$	ADB2	ADB14	10	$\overline{\text{MEMW}}$	ADB2	ADB14
	12	$\overline{\text{RDY}}$	ADB3	ADB15	12	$\overline{\text{RDY}}$	ADB3	ADB15	12	$\overline{\text{RDY}}$	ADB3	ADB15
	14	DB0	ADB4	IRA	14	DB0	ADB4		14	DB0	ADB4	IRA
	16	DB1	ADB5	IRB	16	DB1	ADB5		16	DB1	ADB5	IRB
	18	DB2	ADB6	IRC	18	DB2	ADB6		18	DB2	ADB6	IRC
	20	DB3	ADB7	IRD	20	DB3	ADB7		20	DB3	ADB7	IRD
	22	DB4	ADB8	0 V	22	DB4	ADB8		22	DB4	ADB8	
	24	DB5	ADB9	0 V	24	DB5	ADB9		24	DB5	ADB9	
	26	DB6	ADB10	0 V	26	DB6	ADB10		26	DB6	ADB10	
	28	DB7	ADB11	0 V	28	DB7	ADB11	$\overline{\text{DSI}}$	28	DB7	ADB11	$\overline{\text{DSI}}$
	30	$\overline{\text{DSI}}$	BASP	0 V	30		BASP		30		BASP	
	32		0 V	$\overline{\text{BASPq}}$	32		0 V	$\overline{\text{BASPq}}$	32		0 V	$\overline{\text{BASPq}}$
2	2	+5 V	0 V		2	+5 V	0 V		2	+5V	0 V	
	4	DB12	DB8	0 V	4	DB12	DB8		4	DB12	DB8	
	6	DB13	DB9	$\overline{\text{CPKL'}}$	6	DB13	DB9	RxDS8	6	DB13	DB9	
	8	DB14	DB10		8	DB14	DB10	TxDS8	8	DB14	DB10	
	10	DB15	DB11		10	DB15	DB11	RxDS7	10	DB15	DB11	
	12		+5 V		12		RxDS6	TxDS7				
	14		+5 V		14	$\overline{\text{NAU}}$	TxDS6	RxDS5	14	$\overline{\text{NAU}}$		
	16		+5 V		16	$\overline{\text{BAU}}$	RxDS4	TxDS5	16	$\overline{\text{BAU}}$		
	18	$\overline{\text{CPKLq}}$	$\overline{\text{NAU}}$		18	$\overline{\text{CPKLq}}$	TxDS4	RxDS3	18			
	20				20			TxDS3	20			
	22	0 V	0 V		22	$\overline{\text{PEU}}$		RxDS1	22	$\overline{\text{PEU}}$		TxDSn
	24	0 V	0 V		24	$\overline{\text{GEP}}$	RxDS2	TxDS1	24	$\overline{\text{GEP}}$		
	26	0 V	0 V		26		TxDS2		26		RxDSn	
	28	0 V	0 V		28			SPRxD	28			SPRxD
	30	0 V	0 V		30	M2	M2	M2	30	M2	M2	M2
	32	0 V	0 V		32	+24 V	0 V	+15 V	32	+24 V	0 V	+15 V

q = output
i = input

	CC interface IM 314H I/O modules Slots 131, 147				EU interface 300 I/O modules Slot 163			
Backplane connector	Pin no.	Pin row z	Pin row b	Pin row d	Pin no.	Pin row z	Pin row b	Pin row d
1	2	+5 V	0 V		2	+5 V	0 V	
	4		PESP		4		PESP	+5 V
	6	$\overline{\text{CPKL}}$	ADB0	ADB12	6	$\overline{\text{CPKL}}$	ADB0	ADB12
	8	$\overline{\text{MEMR}}$	ADB1	ADB13	8	$\overline{\text{MEMR}}$	ADB1	ADB13
	10	$\overline{\text{MEMW}}$	ADB2	ADB14	10	$\overline{\text{MEMW}}$	ADB2	ADB14
	12	$\overline{\text{RDY}}$	ADB3	ADB15	12	$\overline{\text{RDY}}$	ADB3	ADB15
	14	DB0	ADB4		14	DB0	ADB4	+5 V
	16	DB1	ADB5		16	DB1	ADB5	+5 V
	18	DB2	ADB6		18	DB2	ADB6	0 V
	20	DB3	ADB7		20	DB3	ADB7	0 V
	22	DB4	ADB8	0 V	22	DB4	ADB8	0 V
	24	DB5	ADB9	0 V	24	DB5	ADB9	0 V
	26	DB6	ADB10	0 V	26	DB6	ADB10	0 V
	28	DB7	ADB11	0 V	28	DB7	ADB11	0 V
	30		BASP	0 V	30		BASP	0 V
	32		0 V	$\overline{\text{BASPq}}$	32		0 V	$\overline{\text{BASPq}}$
2	2	+5 V	0 V		2	+5 V	0 V	
	4	NA0	SA0	0 V	4			
	6	NA1	SA1	$\overline{\text{CPKL'}}$	6			
	8	NA2	SA2		8			
	10	NA3	SA3		10			
	12				12	+5 V	+5 V	
	14				14	+5 V	+5 V	
	16				16	+5 V	+5 V	
	18	$\overline{\text{CPKLq}}$	$\overline{\text{NAU}}$		18	$\overline{\text{CPKLq}}$	$\overline{\text{NAU}}$	
	20	$\overline{\text{BASPq}}$	$\overline{\text{BASPi}}$		20			
	22	0 V	0 V		22	0 V	0 V	
	24	0 V	0 V		24	0 V	0 V	
	26	0 V	0 V		26	0 V	0 V	
	28	0 V	0 V		28	0 V	0 V	
	30	0 V	0 V		30	0 V	0 V	
	32	0 V	0 V		32	0 V	0 V	

q = output
i = input

SIEMENS

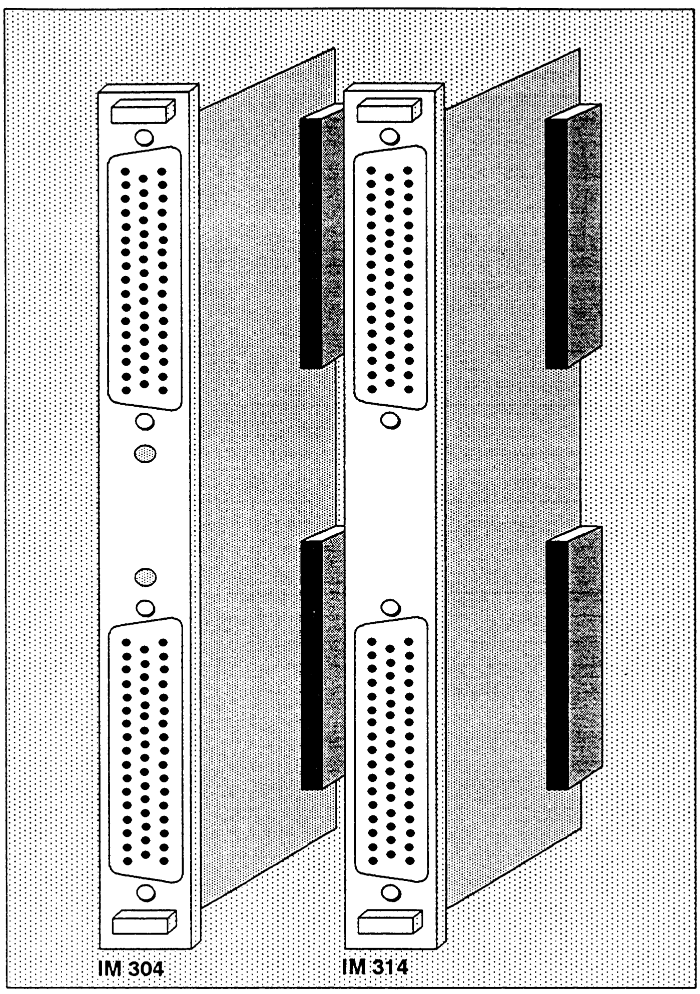
SIMATIC S5

Symmetrical Interface CC-EG / EG-EG

IM 304 Interface Module 6ES5 304-3UB11

IM 314 Interface Module 6ES5 314-3UA11

Instructions C79000-B8576-C716-02



Contents

1	**Technical Description**	**5**
1.1	Application	5
1.2	Interfacing with other Devices	5
1.2.1	Symmetrical Interface CC-EG	5
1.2.2	Parallel Interface CC-CC in the Fault Tolerant System	6
1.2.3	Symmetrical Interface CC-EG in the Fault Tolerant System	6
1.3	Transmission Mode	7
1.4	Design	7
1.5	Technical Specifications	8
2	**Installation**	**9**
2.1	Notes on Installation	9
2.2	Permitted Potential Differences	9
2.3	Pin Assignments of the Front and Backplane Connectors	10
2.4	Operating Modes / Jumper Settings on the IM 304	13
2.4.1	Jumper Settings	13
2.4.2	Significance of the Jumpers	1?
2.5	Setting the Module Address on the IM 314	16
3	**Operation**	**19**
4	**Spare Parts**	**21**
4.1	Pin Assignment of Connecting Cable 6ES5 721-0xxx0	22
4.2	Pin Assignment of Terminator 6ES5 760-1AA11	23
4.3	Pin Assignment of Terminator 6ES5 760-0HA11	24
5	**Abbreviations and Signal Names**	**25**
6	**Page Overview**	**26**

1 Technical Description

1.1 Application

The IM 304 interface module can be used in the central controllers S5-115U, S5-115F, S5-115H, S5-135U, S5-150U, S5-150H, S5-155U and S5-155H. On the central controller side, it is used for the symmetrical transmission of the central controller bus to the expansion units with a 16-bit address and 16-bit data bus (EG 185, EG 186). On the expansion unit side, the IM 314 interface module is required. Fault tolerant systems require the IM 314H or IM 314R.

The 16-bit address bus and 16-bit data bus are transmitted multiplexed on 16 common lines. The IM 304 interface module is also used in fault tolerant systems to connect the redundant central controllers. (Parallel interface IM 304 - IM 324).

1.2 Interfacing with other Devices

The IM 304 and IM 314 (H/R) interface modules can be used to interface with the following devices:

1.2.1 Symmetrical Interface from SIMATIC S5 Central Controllers (CCs) to SIMATIC S5 Expansion Units (EGs)

This permits (in conjunction with the EG 185, EG 186 and ER 701-3) the use of peripheral (I/O) modules, communications processors (CPs) and intelligent peripheral modules (IPs) in a distributed configuration. On the expansion unit side, the IM 314-3UA11 interface module must be used for this interface.

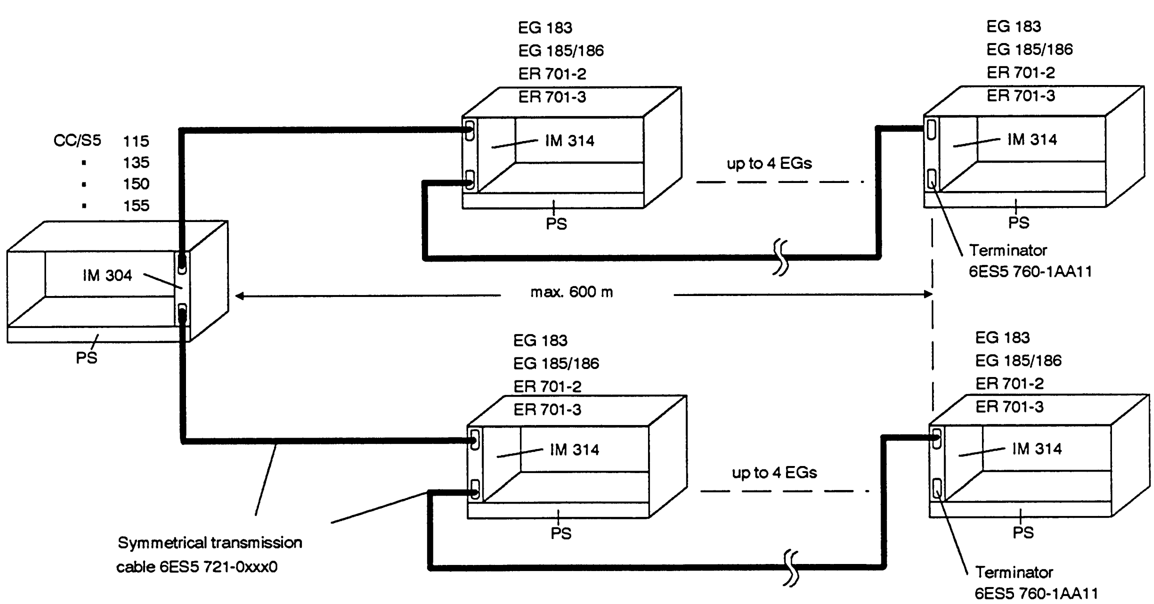


Fig. 1 Distributed configuration with the symmetrical interface IM 304 - IM 314

1.2.2 Parallel Interface between Central Controllers in the Fault Tolerant SIMATIC S5 System

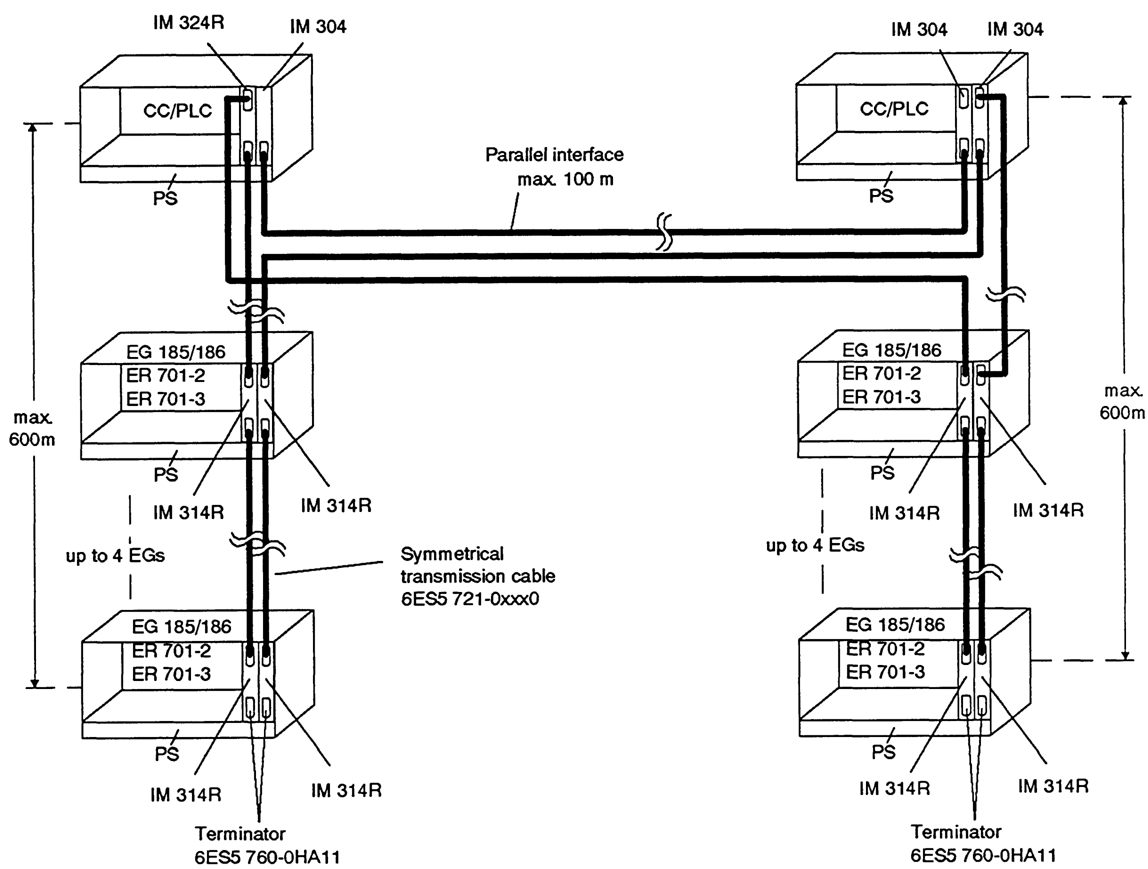
The IM 304 interface module can be used in the CCs S5-115F, S5-115H, S5-150H and S5-155H. At the other end of the link, the IM 324-3UAxx (in the S5-115F, S5-150H) or IM 324-3URxx (in the S5-155H, 115H) must be used. The link is only possible via the X4 interface (lower front connector).

The IM 304 interface module provides the following functions:

- bidirectional transmission of process-related data between the two central controllers,
- recognition of transmission errors by parity checks and monitoring of the data and addresses (only for S5-115F, S5-150H). This function is not possible when the module is used in the S5-115H/155H).

1.2.3 Symmetrical Interface from Central Controllers to Expansion Units in the Fault Tolerant SIMATIC S5 System

In this configuration, the IM 304 interface module is served by the IM 314H or IM 314R interface module on the expansion unit side of the connection.



1.3 Transmission Mode

The symmetrical interface corresponds to the IEA Standard RS 485.

It is constructed with symmetrical transmitters and receivers. Control signals, addresses and data are input and output via the cable. The monitoring signals PEU (peripheral not ready) and ZGU (central controller not ready) are excluded from this procedure and are transmitted as isolated signals using optocouplers.

The address and data width is 16 bits (bidirectional). The transmission is in the time division multiplex mode. Control and monitoring signals are transmitted separately.

1.4 Design

The IM 304 interface module is mounted on a board of double Eurocard (233.4 mm x 160 mm) height. It occupies 1 1/3 standard slots in the subrack. The connection to the S5 bus in the CC is via two 48-pin connectors conforming to DIN 41612, row 2. On the front panel there are two 50-pin D-connectors to connect the symmetrical cable and two LEDs.

The connection from the CCs to the EGs and between the EGs is established with prefabricated cables via the front connectors (for order number see Section 4, Spare Parts). The front connectors must be locked in place by sliding the metal catch. The assignment of front connectors to the modules must be adhered to.

1.5 Technical Specifications

– Power supply	+5V +/-5%
– Current consumption	IM 304 approx. 1.2 A IM 314 approx. 1.0 A
– Cable length	
– from IM 304 to IM 324U (only on interface X4)	max. 100 m
– from IM 304 to IM 324 R (only on interface X4)	max. 10 m
– from IM 304 to last IM 314 (per interface)	max. 600 m
– from IM 304 to last IM 314H/R (per interface)	max. 600 m
– IM 304 can be used in	S5-115U,S5-135U,S5-150U, S5-155U, S5-115F,S5-115H,S5-150H, S5-155H,
– Number and type of interface	2 parallel, symmetrical interfaces
– Transmission rate	2 Mbytes...100 kbytes/sec.
– Signal level at cable interface	Differential signal according to RS485
– Backplane connector	Two 48-pin ES 902, row 2
– Front connector	Two 50-pin male connectors
– Front panel width	20.32 mm (1 1/3 standard slots)
– Dimensions	160 x 233.4 mm^2
– Weight	IM 304: approx. 360 g IM 314: approx. 300 g
– Environmental conditions:	
– Operating temperature range	0 to +55°C
– Storage/transport	-40° to +70°C
– Relative humidity max.	95% at 25°C, no condensation
– Operating altitude max.	1500 m above sea level

2 Installation

The IM 304 can be plugged into the central controller of the S5-115U, S5-115F, S5-115H, S5-135U, S5-150U, S5-150H, S5-155U and S5-155H. The module is used for symmetrical connection of expansion units.

2.1 Notes on Installation

The maximum cable length per interface from the IM 304 in the CC to the last IM 314 or IM 314H/R in the EG is 600 metres. The actual cable length must be set at the IM 304 (see Section 2.4).

A maximum of four IM 314 or IM 314H/R interface modules can be connected per interface.

The IM 314 interface module of the last expansion unit of each group must be terminated with the terminator 6ES5 760-**1AA11**.

The IM 314H/R interface module of the last expansion unit is terminated with terminator 6ES5 760-**0HA11**.

Connection with the IM 324

The connection to the second CC up to a distance of maximum 100 m with the IM 324U/R is only possible via the front connector X4.

Connecting cable 6ES5-721-xxx (length key see Section 4, Spare Parts) is available to connect CCs or EGs with each other.

2.2 Permitted Potential Differences

To ensure the connection functions reliably, the potential differences between two S5 devices must not exceed **7 V. An equipotential bonding conductor should be connected.**

2.3 Pin Assignments of the Front and Backplane Connectors

Front connector pin assignment of the IM 304

1			18	+	AD 8	34	+	$\overline{\text{MEMR}}$
2	+	AD 12	19	-		35	-	
3	-		20	+	AD 9	36	+	$\overline{\text{MEMW}}$
4	+	AD 13	21	-		37	-	
5	-		22	+	AD 10	38	+	ALE
6	+	AD 14	23	-		39	-	
7	-		24	+	AD 11	40	+	BASP
8	+	AD 15	25	-		41	-	
9	-		26	+	AD 3	42	+	AD 0
10	+	AD 6	27	-		43	-	
11	-		28	+	AD 4	44	+	AD 1
12	+	AD 7	29	-		45	-	
13	-		30	+	AD 5	46	+	AD 2
14		PEU	31	-		47	-	
15		$\overline{\text{PEU}}$	32		ZGU	48	+	$\overline{\text{RDY}}$
16		------	33		$\overline{\text{ZGU}}$	49	-	
17		------				50		------

Interface X3

AD = address/data line

1			18	+	AD 8	34	+	$\overline{\text{MEMR}}$
2	+	AD 12	19	-		35	-	
3	-		20	+	AD 9	36	+	$\overline{\text{MEMW}}$
4	+	AD 13	21	-		37	-	
5	-		22	+	AD 10	38	+	ALE
6	+	AD 14	23	-		39	-	
7	-		24	+	AD 11	40	+	BASP/PAF *
8	+	AD 15	25	-		41	-	
9	-		26	+	AD 3	42	+	AD 0
10	+	AD 6	27	-		43	-	
11	-		28	+	AD 4	44	+	AD 1
12	+	AD 7	29	-		45	-	
13	-		30	+	AD 5	46	+	AD 2
14		(PEU) **	31	-		47	-	
15			32		ZGU/PAR *	48	+	$\overline{\text{RDY}}$
16		------	33			49	-	
17		------				50		------

Interface X4

* For parallel connection to IM 324U
** Signal disabled in parallel connection

Front connector pin assignment of the IM 314

Pin		Signal	Pin		Signal	Pin		Signal
1			18	+	AD 8	34	+	$\overline{\text{MEMR}}$
2	+	AD 12	19	-		35	-	
3	-		20	+	AD 9	36	+	$\overline{\text{MEMW}}$
4	+	AD 13	21	-		37	-	
5	-		22	+	AD 10	38	+	ALE
6	+	AD 14	23	-		39	-	
7	-		24	+	AD 11	40	+	BASP
8	+	AD 15	25	-		41	-	
9	-		26	+	AD 3	42	+	AD 0
10	+	AD 6	27	-		43	-	
11	-		28	+	AD 4	44	+	AD 1
12	+	AD 7	29	-		45	-	
13	-		30	+	AD 5	46	+	AD 2
14		PEUq	31	-		47	-	
15		$\overline{\text{PEUq}}$	32		ZGUi	48	+	$\overline{\text{RDY}}$
16		------	33		$\overline{\text{ZGUi}}$	49	-	
17		------				50		------

Interface X3

AD=address/data line
i = input q = output

Pin		Signal	Pin		Signal	Pin		Signal
1			18	+	AD 8	34	+	$\overline{\text{MEMR}}$
2	+	AD 12	19	-		35	-	
3	-		20	+	AD 9	36	+	$\overline{\text{MEMW}}$
4	+	AD 13	21	-		37	-	
5	-		22	+	AD 10	38	+	ALE
6	+	AD 14	23	-		39	-	
7	-		24	+	AD 11	40	+	BASP
8	+	AD 15	25	-		41	-	
9	-		26	+	AD 3	42	+	AD 0
10	+	AD 6	27	-		43	-	
11	-		28	+	AD 4	44	+	AD 1
12	+	AD 7	29	-		45	-	
13	-		30	+	AD 5	46	+	AD 2
14		PEUi	31	-		47	-	
15		$\overline{\text{PEUi}}$	32		ZGUq	48	+	$\overline{\text{RDY}}$
16		0 V	33		$\overline{\text{ZGUq}}$	49	-	
17						50		+5 V

Interface X4

i = input q = output

Backplane connector pin assignment of the IM 304

	d	b	z
2	------	M	+ 5 V
4	------		------
6	ADB 12	ADB 0	$\overline{\text{CPKL}}$
8	ADB 13	ADB 1	$\overline{\text{MEMR}}$
10	ADB 14	ADB 2	$\overline{\text{MEMW}}$
12	ADB 15	ADB 3	$\overline{\text{RDY}}$
14	------	ADB 4	DB 0
16	------	ADB 5	DB 1
18	------	ADB 6	DB 2
20	------	ADB 7	DB 3
22	------	ADB 8	DB 4
24	------	ADB 9	DB 5
26	------	ADB 10	DB 6
28	------	ADB 11	DB 7
30	------	BASP	------
32	------	M	------

Interface X1

(----- = not used)

	d	b	z
2	------	M	+ 5 V
4	------	DB 8	DB 12
6	------	DB 9	DB 13
8	------	DB 10	DB 14
10	------	DB 11	DB 15
12	------	------	------
14	------	------	($\overline{\text{PEU}}$) *
16	------	------	------
18	------	$\overline{\text{PEU}}$ *	------
20	------	------	------
22	------	------	------
24	------	------	------
26	------	------	------
28	------	------	------
30	------	------	------
32	------	M	------

Interface X2

*dependent on jumper plug X15

Backplane connector pin assignment of the IM 314

	d	b	z
2	------	M	+ 5 V
4	+5 V	PESP	------
6	ADB 12	ADB 0	$\overline{\text{CPKLq}}$
8	ADB 13	ADB 1	$\overline{\text{MEMR}}$
10	ADB 14	ADB 2	$\overline{\text{MEMW}}$
12	ADB 15	ADB 3	$\overline{\text{RDY}}$
14	------	ADB 4	DB 0
16	------	ADB 5	DB 1
18	------	ADB 6	DB 2
20	------	ADB 7	DB 3
22	M	ADB 8	DB 4
24	M	ADB 9	DB 5
26	M	ADB 10	DB 6
28	------	ADB 11	DB 7
30	M	BASP	$\overline{\text{DSI}}$
32	$\overline{\text{BASPq}}$	M	------

Interface X1

(----- = not used)

	d	b	z
2	------	M	+ 5 V
4	------	DB 8	DB 12
6	$\overline{\text{CPKLi}}$	DB 9	DB 13
8	------	DB 10	DB 14
10	------	DB 11	DB 15
12	------	+5 V	------
14	------	+5 V	------
16	------	+5 V	------
18	------	$\overline{\text{NAU}}$	$\overline{\text{CPKL}}$
20	------	-----	------
22	------	M	M
24	------	M	M
26	------	M	M
28	------	M	M
30	------	M	M
32	------	M	M

Interface X2

i = input, q = output

2.4 Operating Modes / Jumper Settings on the IM 304 (6ES5 304-3UB11)

2.4.1 Jumper Settings

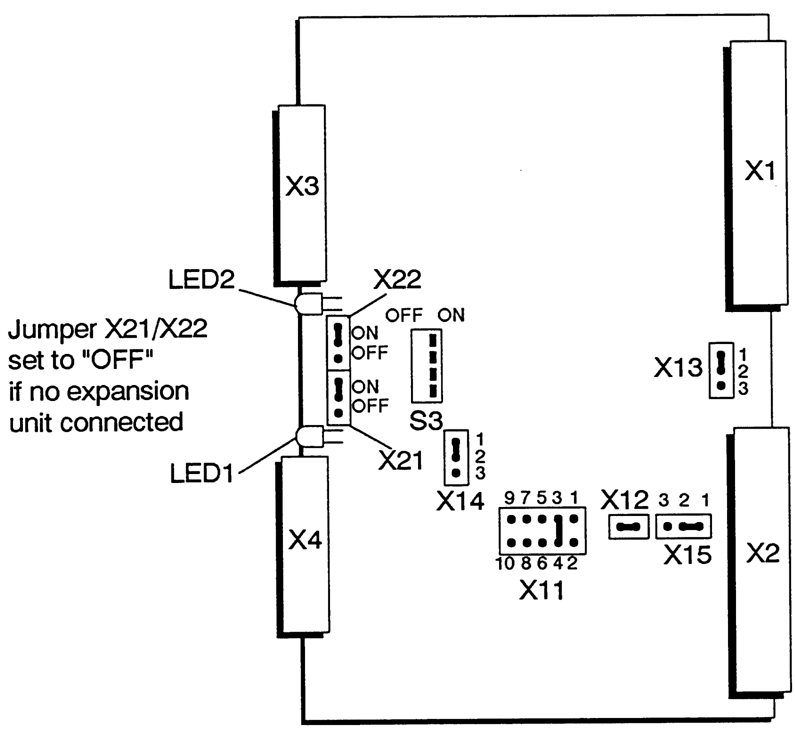
X11: Adapting to various cable lengths

	Jumper plug X11				
Jumper setting	9 7 5 3 1 *) 10 8 6 4 2	9 7 5 3 1 10 8 6 4 2	9 7 5 3 1 10 8 6 4 2	9 7 5 3 1 10 8 6 4 2	9 7 5 3 1 10 8 6 4 2
Cable length	max. 10 m	10 - 100 m	100 - 250 m	250 - 450 m	450 - 600 m

*) This setting is only permitted for the IM 304 - IM 324R link in the S5-155H.

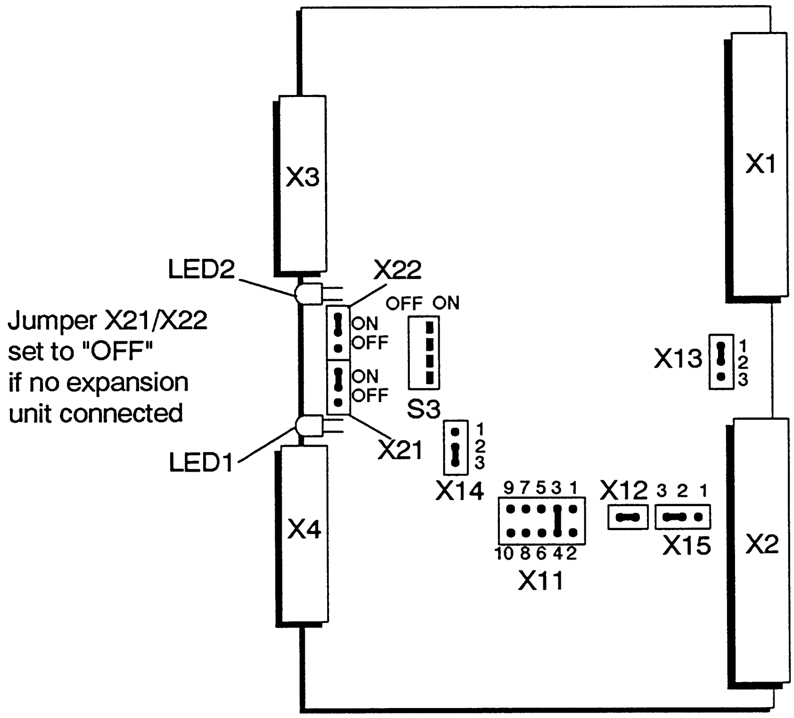
The longest connection at interface X3 or X4 is determined by the jumper setting at X11.

Symmetrical connection CC - EG with IM 304/IM 314 (S5-115U, S5-135U, S5-150U, S5-155U)

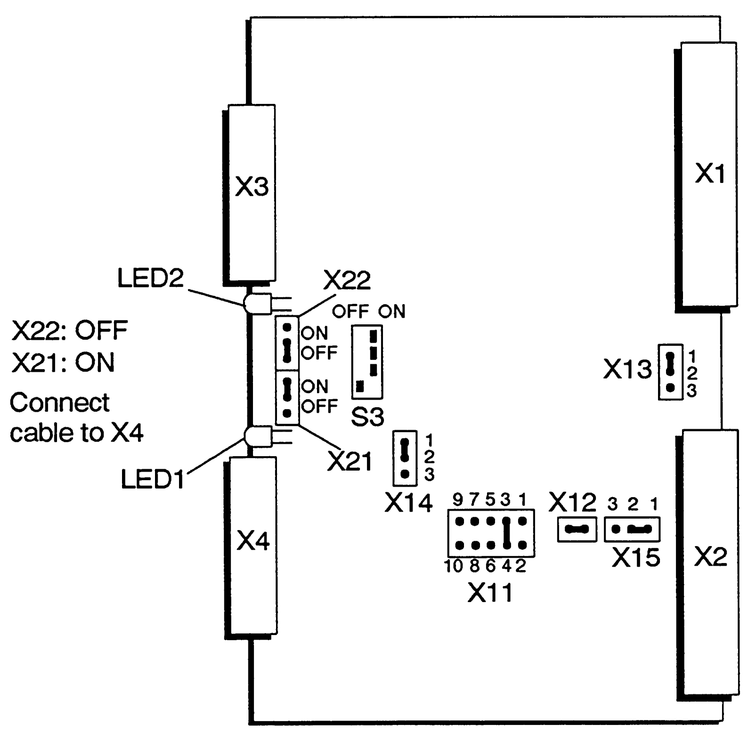


Jumpers as set at the factory

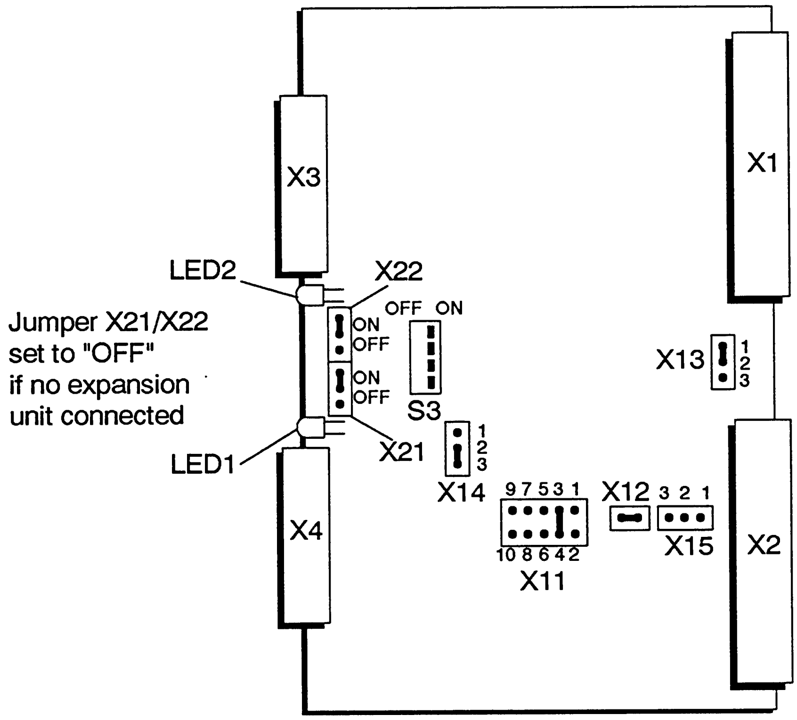
Symmetrical connection CC - EG with IM 304/IM 314R (S5-115H, S5-155H)



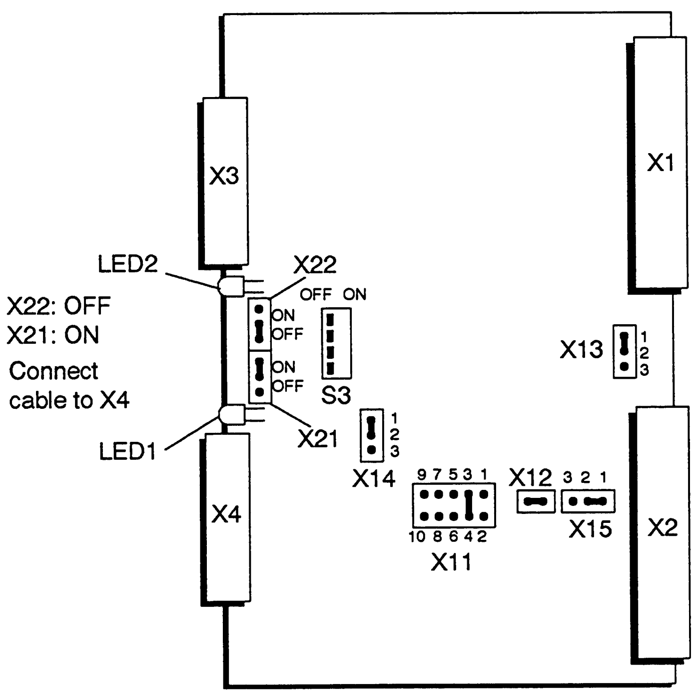
Parallel connection CC - CC with IM 304/IM 324R (S5-115H, S5-155H)



Symmetrical connection CC - EG with IM 304/IM 314H (S5-150H)



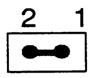
Parallel connection CC - CC with IM 304/IM 324U (S5-115F, S5-150H)



The cable length of the connection between the IM 304 and IM 324U must not exceed 100 m and between the IM 304 and IM 324R must not exceed 10 m. To connect the IM 304 and IM 324 or IM 324R, only the lower interface (X4) can be used. Jumper X2 must be set to "OFF".

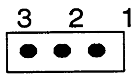
2.4.2 Significance of the Jumpers

X12

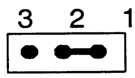


Test jumper - must always be plugged in.

X13

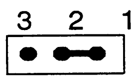


Data driver for D (8...15) on the S5 bus switched off.

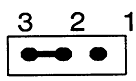


Data driver for D (8...15) on the S5 bus switched on.

X14

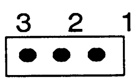


PEU (peripheral not ready) is generated, if one interface is reported as being "not ready".

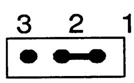


PEU (peripheral not ready) is generated, if both interfaces are reported as being "not ready".

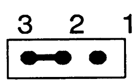
X15



The PEU signal generated by the IM 304 is not connected to the CC bus.

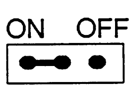


The output signal PEU from the IM 304 is connected to the S5 bus backplane connector 2, pin b18 (PEU).

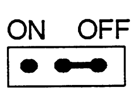


The output signal PEU from the IM 304 is connected to the S5 bus backplane connector 2, pin z14 (NAU).

X21

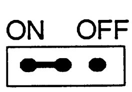


Interface X4 (lower front connector) is switched to on; the cable is connected.

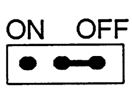


Interface X4 is switched to off. No cable is connected.

X22



Interface X3 (upper front connector) is switched to on; the cable is connected.



Interface X3 is switched to off. No cable is connected.

S3

Switchover to redundant mode.

2.5 Setting the Module Address on the IM 314

The module address (e.g. P area or Q area) is set at the IM 314. This setting is only valid for the digital and analog I/O modules.

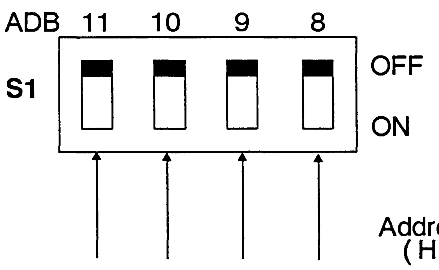
Fifteen address areas are available for the software interface. The digital and analog I/O modules in all areas are addressed by setting the DIP switches appropriately.

In the STEP 5 operation set, it is only possible to address the P and Q area.

<u>Addressing the P and Q area</u>

Module addresses used in the CC can no longer be used in the EG or in the P or Q area.

If peripheral modules are installed only in the expansion unit, all addresses both in the P and in the Q area can be addressed if the appropriate setting is made on the IM 314.



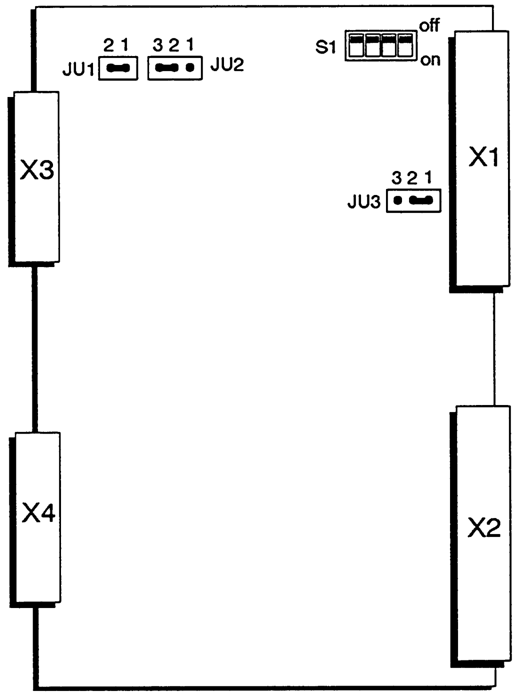
0 = switch OFF
X = switch ON

	11	10	9	8	Address (H)		Areas (H)	(D)
P area	0	0	0	0	0	*	F000 - F0FF	61440-61695
Q area	0	0	0	X	1		F100 - F1FF	61696-61951
	0	0	X	0	2		F200 - F2FF	61952 - 62207
	0	0	X	X	3		F300 - F3FF	62208 - 62464
	0	X	0	0	4		F400 - F4FF	62465 - 62720
	0	X	0	X	5		F500 - F5FF	62721 - 62976
	0	X	X	0	6		F600 - F6FF	62977 - 63232
	0	X	X	X	7		F700 - F7FF	63233 - 63488
	X	0	0	0	8		F800 - F8FF	63489 - 63744
	X	0	0	X	9		F900 - F9FF	63745 - 64000
	X	0	X	0	A		FA00 - FAFF	64001 - 64256
	X	0	X	X	B		FB00 - FBFF	64257 - 64512
	X	X	0	0	C		FC00 - FCFF	64513 - 64768
	X	X	0	X	D		FD00 - FDFF	64769 - 65024
	X	X	X	0	E		FE00 - FEFF	65025 - 65280
	X	X	X	X	F			not permitted

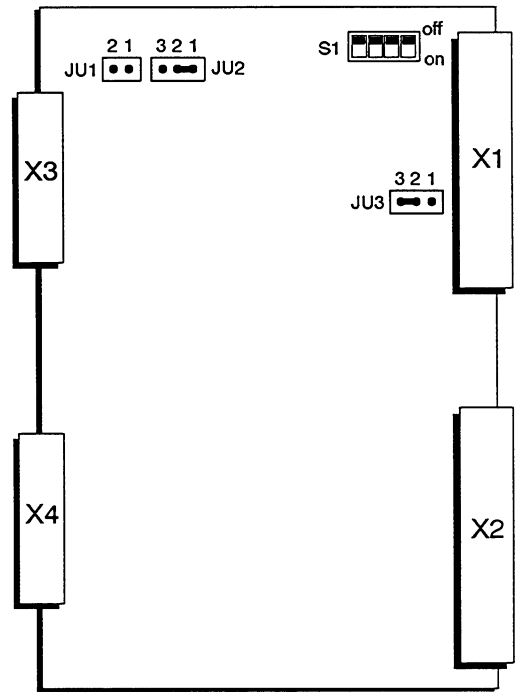
* Factory setting

Jumper settings on the IM 314

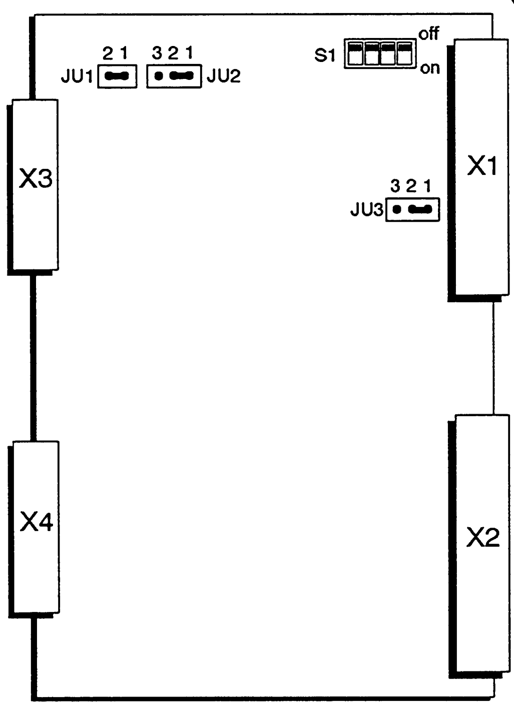
Installed in the EG 185U and EG 186U



Installed in the EG 183

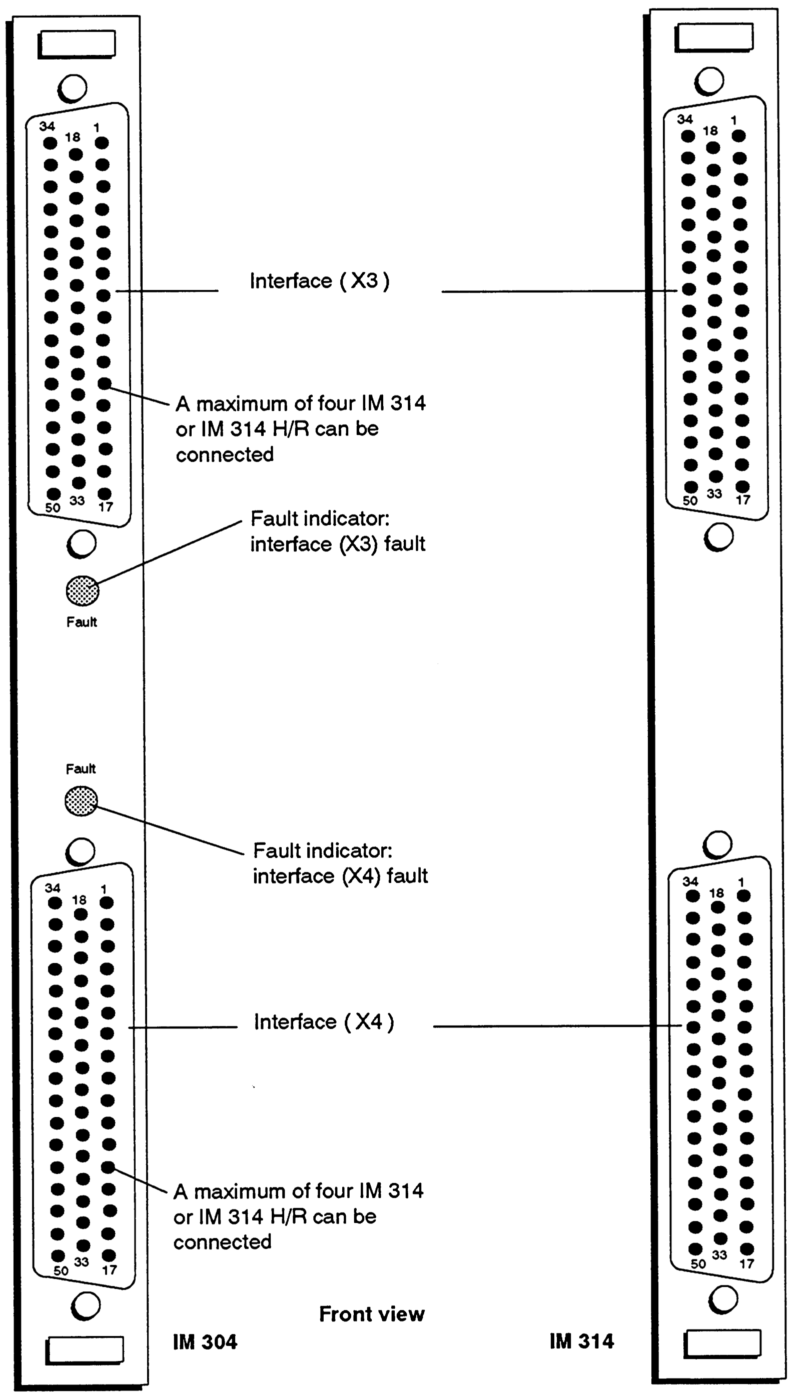


Installed in the ER 701-2 and ER 701-3 (S5-115)



3 Operation

Control and display elements



The "FAULT" LED is lit if there is a power failure in an expansion unit, if there is no terminator on the last IM 314, if there is a wire break or if the DIP switch S3 is set incorrectly.

4 Spare Parts

Mini-jumper coding socket	Order no.:	W79070-G2602-N2
Terminator	Order no.:	6ES5760-1AA11

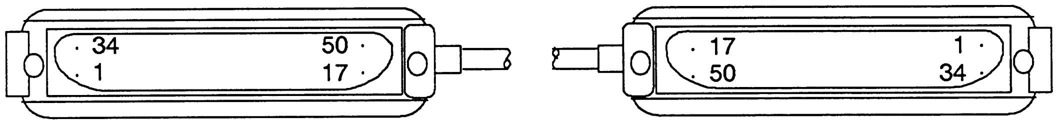
Connecting cable (721)

Order no.: 6ES5 721 - 0 □□□ 0

Standard lengths: 1m;1.6 m; 2.5 m; 3.2m; 5 m; 10 m
Special lengths: up to 600 m

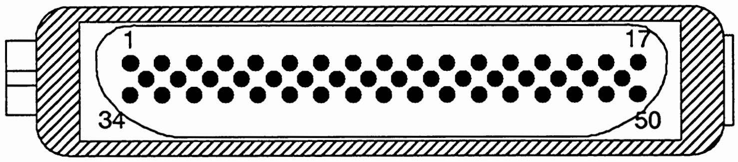
Length:			
1.00 m	B	B	0
1.60 m	B	B	6
2.00 m	B	C	0
2.50 m	B	C	5
3.20 m	B	D	2
5.00 m	B	F	0
8.00 m	B	J	0
10.00 m	C	B	0
12.00 m	C	B	2
16.00 m	C	B	6
20.00 m	C	C	0
25.00 m	C	C	5
32.00 m	C	D	2
40.00 m	C	E	0
50.00 m	C	F	0
63.00 m	C	G	3
80.00 m	C	J	0
100.00 m	D	B	0
120.00 m	D	B	2
160.00 m	D	B	6
200.00 m	D	C	0
250.00 m	D	C	5
320.00 m	D	D	2
400.00 m	D	E	0
500.00 m	D	F	0
600.00 m	D	G	0

4.1 Pin Assignment of Connecting Cable 6ES5 721-0xxx0



50-pin connector	Identification sleeve	Identification tape	Core color code	50-pin connector
20	1	rd	wt	20
21			br	21
4			gn	4
5	red		ye	5
18			gr	18
19	serial no. 16		pk	19
2			bl	2
3			rd	3
24	2	gn	wt	24
25			br	25
8			gn	8
9	green		ye	9
22			gr	22
23	serial no. 17		pk	23
6			bl	6
7			rd	7
26	3	wt	wt	26
27			br	27
10			gn	10
11	yellow		ye	11
42			gr	42
43	serial no. 18		pk	43
44			bl	44
45			rd	45
28	4	wt	wt	28
29			br	29
12			gn	12
13	brown		ye	13
46			gr	46
47	serial no. 19		pk	47
30			bl	30
31			rd	31
34	5	wt	wt	34
35			br	35
36			gn	36
37	black		ge	37
38			gr	38
39	serial no. 20		rs	39
40			bl	40
41			rt	41
48	6	rd	ws	48
49			br	49
14			gn	14
15	blue		yr	15
32			gr	32
33	serial no. 21		rd	33
-	Screen			-

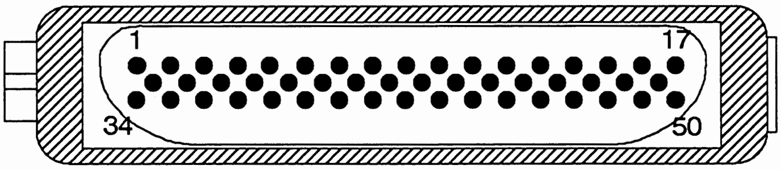
4.2 Pin Assignment of Terminator 6ES5 760-1AA11



Pin	Resistance 180 ohms or jumper		Pin
28			8
29			9
26			6
27			7
46			4
47			5
44			2
45			3
42			24
43			25
38	1)		22
39			23
34	1)		20
35			21
36	1)		18
37			19
40	1)		12
41			13
48	2)		10
49			11
15			30
16			31
14			
50			

1) 100 ohms
2) 150 ohms

4.3 Pin Assignment of Terminator 6ES5 760-0HA11



Pin	Resistance 180 ohms or jumper		Pin
28			8
29			9
26			6
27			7
46			4
47			5
44			2
45			3
42			24
43			25
38			22
39			23
34			20
35			21
36			18
37			19
40			12
41			13
14			10
16			11
50			30
15			31

5 Abbreviations and Signal Names

IM	Interface module for expansion units		
IM 304	"	"	6ES5 304 - 3UB 11
IM 314	"	"	6ES5 314 - 3UA 11
IM 314 H	"	"	6ES5 314 - 3UH 12 (S5-150H)
IM 314 R	"	"	6ES5 314 - 3UR 11 (S5-155H)
IM 324 U	"	"	6ES5 324 - 3UA 12 (S5-155F, S5-150H)
IM 324 R	"	"	6ES5 324 - 3UR 11 (S5-115H, S5-155H)

CP	Communications processor
IP	Intelligent (I/O) peripheral (with preprocessing)
HW	Hardware
EG	Expansion unit
CC	Central controller
PLC	Programmable controller

ALE	Address latch enable
MEMR	Memory read
MEMW	Memory write
BASP	Disable command output
RDY	Ready
PAF	Parity error
ZGU	Central controller not ready
PAR	Parity
PEU	Peripheral not ready
CPKL	Central processor ready
NAU	Power failure

SIEMENS

SIMATIC S5

Analog Input Modules

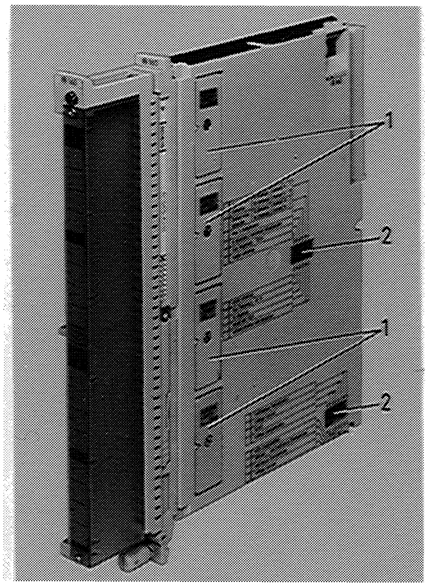
6ES5460-4UA1.
6ES5463-4U.1.
6ES5465-4UA1.

Analog Output Modules

6ES5470-4U.1.

Instructions

C79000-B8576-C300-06



1 Range submodules
2 Mode switch

Fig. 1 Analog input module 6ES5465-4UA11

Type of module	Number of inputs	Electrical isolation/groups	Order no. of the module	Range submodules (4 channels)	Order No. of the range submodule	Technical data on page
Analog input and submodules	8 16/8	Yes/8 inputs referred to 0 V and between each other No/none	6ES5460-4UA11 -4UA12 6ES5465-4UA11 -4UA12	50/500 mV/Pt 100 12.5/50/500mV/Pt100 50/500 mV/Pt 100 ± 1 V ± 10 V ± 20 mA 4 to 20 mA ± 5 V 4 to 20 mA/4-wire transducer	6ES5498-1AA11 6ES5498-1AA11 6ES5498-1AA11 6ES5498-1AA21 6ES5498-1AA31 6ES5498-1AA41 6ES5498-1AA51 6ES5498-1AA61 6ES5498-1AA71	5-1 5-6 5-14 5-19
Analog input	4	Yes/4 inputs referred to 0 V and between each other	6ES5463-4UA11 -4UA12 -4UB11 -4UB12	Ranges 1 V, 10 V, 20 mA, 4 to 20 mA		5-11
	Outputs			Output range		
Analog output	8 8 8	Yes/8 outputs referred to 0 V Yes/8 outputs referred to 0 V Yes/8 outputs referred to 0 V	6ES5470-4UA11 -4UA12 6ES5470-4UB11 -4UB12 6ES5470-4UC11 -4UC12	± 10 V/0 to 20 mA ± 10 V 1 to 5 V/4 to 20 mA		5-25 5-25 5-25

Contents

Page

1	**Description**	**1-1**
1.1	Application	1-1
1.2	Design	1-1
1.3	Principle of Operation	1-1
1.3.1	Analog Input Modules 460 and 465	1-3
1.3.2	Analog Input Module 463	1-8
1.3.3	Analog Output Module 470	1-11
1.4	Function of the Enable Inputs	1-13
1.5	Pin Assignments of the Backplane Connector	1-17
1.6	General Technical Data	1-17
2	**Assembly**	**2-1**
2.1	Removing and Inserting Modules	2-1
2.2	Module Identification Labelling	2-2
2.3	Installation Guidelines	2-3
3	**Operation**	**3-1**
3.1	Setting the Module Address	3-1
3.2	Digital Measured-value Representation with Analog Input Modules	3-4
3.2.1	Digital Measured-value Representation as Two's Complement	3-5
3.2.2	Digital Measured-value Representation as Absolute Value and Sign	3-6
3.2.3	Digital Measured-value Representation with Resistance Thermometers	3-7
3.2.4	Digital Measured-value Representation (Analog Input Module 463)	3-8
3.2.5	Digital Measured-value Representation with Current Measurement Ranges of 4 to 20 mA	3-9
3.3	Digital Measured-value Representation with Analog Output Modules	3-10
3.4	Connecting the Signal Lines	3-11
3.5	Connecting Sensors to Analog Input Modules	3-11
3.5.1	Connecting Current-type or Voltage-type Sensors	3-11
3.5.2	Connecting a Compensating Box for Thermo-electric Voltage Measurement	3-13
3.5.3	Connecting Resistance Thermometers (e.g. Pt 100) to Analog Input Modules 460	3-14
3.5.4	Connecting Resistance Thermometers (e.g. Pt 100) to Analog Input Modules 465	3-15
3.5.5	Open-circuit Signalling with Resistance Thermometers	3-17
3.5.6	Connecting Transducers	3-18
3.6	Connecting Loads to Analog Output Modules 470	3-19
3.6.1	Connecting Loads to Current and Voltage Outputs	3-19
3.6.2	Connection Loads to Voltage Outputs	3-20
4	**Spare Parts**	**4-1**
5	**Description of the Individual Modules**	5-1
5.1	Analog Input Module 6ES5 460-4UA11	5-1
5.1.1	Technical Data	5-1
5.1.2	Selecting the Mode	5-3
5.1.3	Range Submodule Complement	5-4
5.1.4	Pin Assignments of the Front Connector	5-5
5.2	Analog Input Module 6ES5 460-4UA12	5-6
5.2.1	Technical Data	5-6
5.2.2	Selecting the Mode	5-8

5.2.3	Range Submodule Complement	5-9
5.2.4	Pin Assignments of the Front Connector	5-10
5.3	Analog Input Module 6ES5 463-4UA11/-4UA12 and 6ES5 463-4UB11/-4UB12	5-11
5.3.1	Technical Data	5-11
5.3.2	Setting the Data Format for the Range of 4 to 20 mA	5-12
5.3.3	Connecting Sensors	5-12
5.3.4	Pin Assignments of the Front Connector	5-13
5.4	Analog Input Module 6ES5 465-4UA11	5-14
5.4.1	Technical Data	5-14
5.4.2	Selecting the Mode	5-15
5.4.3	Range Submodule Complement	5-17
5.4.4	Pin Assignments of the Front Connector	5-18
5.5	Analog Output Module 6ES5 465-4UA12	5-19
5.5.1	Technical Data	5-19
5.5.2	Selecting the Mode	5-20
5.5.3	Range Submodule Complement	5-22
5.5.4	Pin Assignments of the Front Connector	5-24
5.6	Analog Output Module 6ES5 470-4UA11/-4UA12, 470-4UB11/-4UB12 and 470-4UC11/-4UC12	5-25
5.6.1	Technical Data	5-25
5.6.2	Pin Assignment of the Front Connector	5-26
6	**Addressing the Process Interface Modules**	**6-1**
7	**Page Overview**	**7-1**

1 Description

1.1 Application

Analog input and output modules are used as process interface modules for the input and output of a wide range of analog process signals for programmable controllers which use the digital principle, such as the S5-130 W, -135 U, -150 K/S/U, -155 U and -210 A/B.

The analog input and output modules allow the implementation of control systems which require the processing of analog measured variables, or the continuous control of actuators.

1.2 Design

The modules are designed as plug-in PCBs for the ES 902 modular packaging system with a backplane and a plug connector which mates with a front connector. By means of screw terminals or crimp connections, the process signal lines can be directly connected to the front connector which is available separately.

Each module is equipped with a addressing switch (6 dip switches) for setting the module address. The analog input modules are additionally provided with two switches (8 dip switches) for selecting the mode and locations for range submodules.

The module is protected on both sides by covers. These covers are secured by means of thermally moulded plastic rivets.

1.3 Principle of Operation

Analog input and output modules whose signals are not fed via the process image are addressed over the address range 128 to 255 by the STEP-5 program. In principle, addressing over the range 0 to 127 is also possible with appropriate programming (refer to the load and transfer operations of the operations list).

The CPU emits an address byte (address bits ADB 0 to ADB 7) on the address bus, which contains the starting address of the module and the subaddress for selecting the input and output channels. This allows an arrangement in basic and extension units which is independent of the module locations.

The starting address of the module can be set on an addressing switch by the user. The subaddress (channel address) is decoded automatically on the module.

One data word (two data bytes) is required for processing an input or output. A module with 16 inputs thus occupies 32 byte addresses, and a module with 8 inputs or outputs occupies 16 byte addresses.

The following ranges are available for addressing the analog input/output modules (see also Chapter 6):

Number of inputs/ outputs	Address bit (ADB) Starting add. of modules			Channel add. (subaddress)				Byte selection
16	7	6	5	4	3	2	1	0
8	7	6	5	4	3	2	1	0
Significance	128	64	32	16	8	4	2	1

Address bit ADB 0 in the module address is used for byte selection. It is interpreted as follows:

0 = high byte
1 = low byte

o **Data transfer**

For the input and output of an analog measured value, two data bytes are output in immediate succession by the CPU with the TPW instruction (transfer I/O word), or read in with the LPW instruction (load I/O word); this is in word mode.

The data are transferred in bit-parallel mode using 8 bits in two's complement, or as the absolute value with sign (depending on the mode) and in left-justified mode.

o **Data traffic**

The CPU transfers the data in 2 bytes. The high byte (byte 0) is transferred under the address with ADB 0 = 0, and the low byte (byte 1) under address + 1 with ADB 0 = 1.

For reading or writing, signals PESP' and $\overline{MEMR}$/$\overline{MEMW}$ are emitted in addition to the address. The module acknowledges with $\overline{RDY}$.

1.3.1 Analog Input Modules 460 and 465

Two analog input modules of different design are available:

6ES5465-4UA11/-4UA12
- Non-floating
- 8/16 channels (commutable)
- 2/4 range submodules
- Max. permissible voltage between channels and from channels to 0-V ref.: 1 V

6ES5460-4UA11/-4UA12
- Floating
- 8 channels
- 2 range submodules
- Max. permissible isolated voltage between channels and from channels to 0-V ref.: 60 V AC/75 V DC

The block diagrams (Figs. 2 and 3) show the principle of operation and signal exchange between the analog input modules and the CPU.

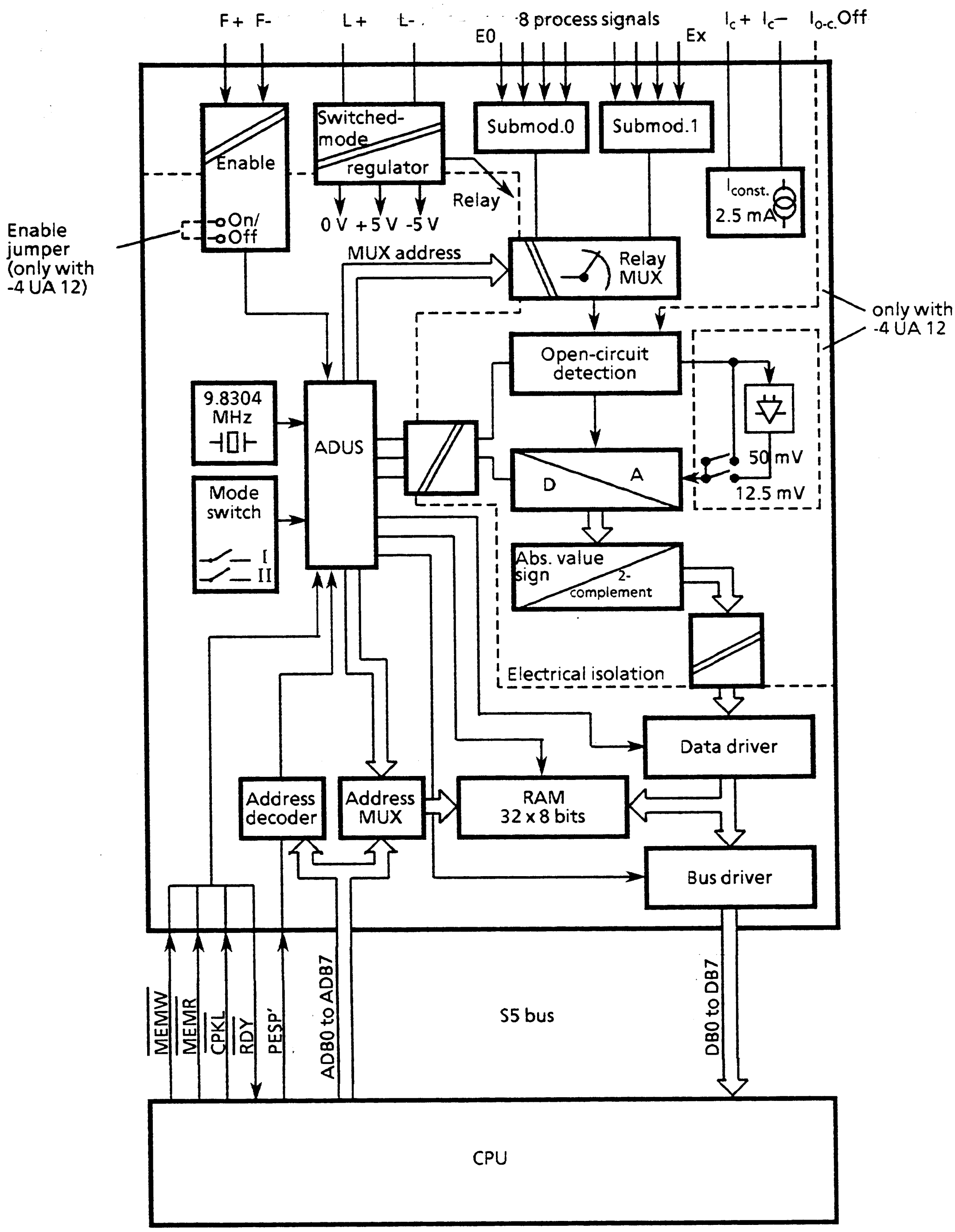
Depending on the application, the process signals are adjusted to the input level of the analog-to-digital converter (ADC) of the module by plug-in resistor dividers or shunt resistor submodules.

An ADC control unit controls the multiplexer, the analog-to-digital conversion and the transfer of the digitized measured values to the memory or the data bus of the programmable controller. The module mode, which can be set on two switches, is taken into account in the control system.

With the analog input module 460-4UA12, the measurement range ±12.5 mV can be selected after an amplifier has been connected. This leads to an improved resolution when measuring thermal e.m.f. With both analog input modules (460-4UA12 and 465-4UA12), the test current for open-circuit signalling can be disconnected, when +24 V is applied to pin 24 of the front connector and 0 V to pin 21 (L-). With a digital voltmeter which is shunted by the analog input channels during commissioning, this test current can cause a false interpretation of the measured quantity.

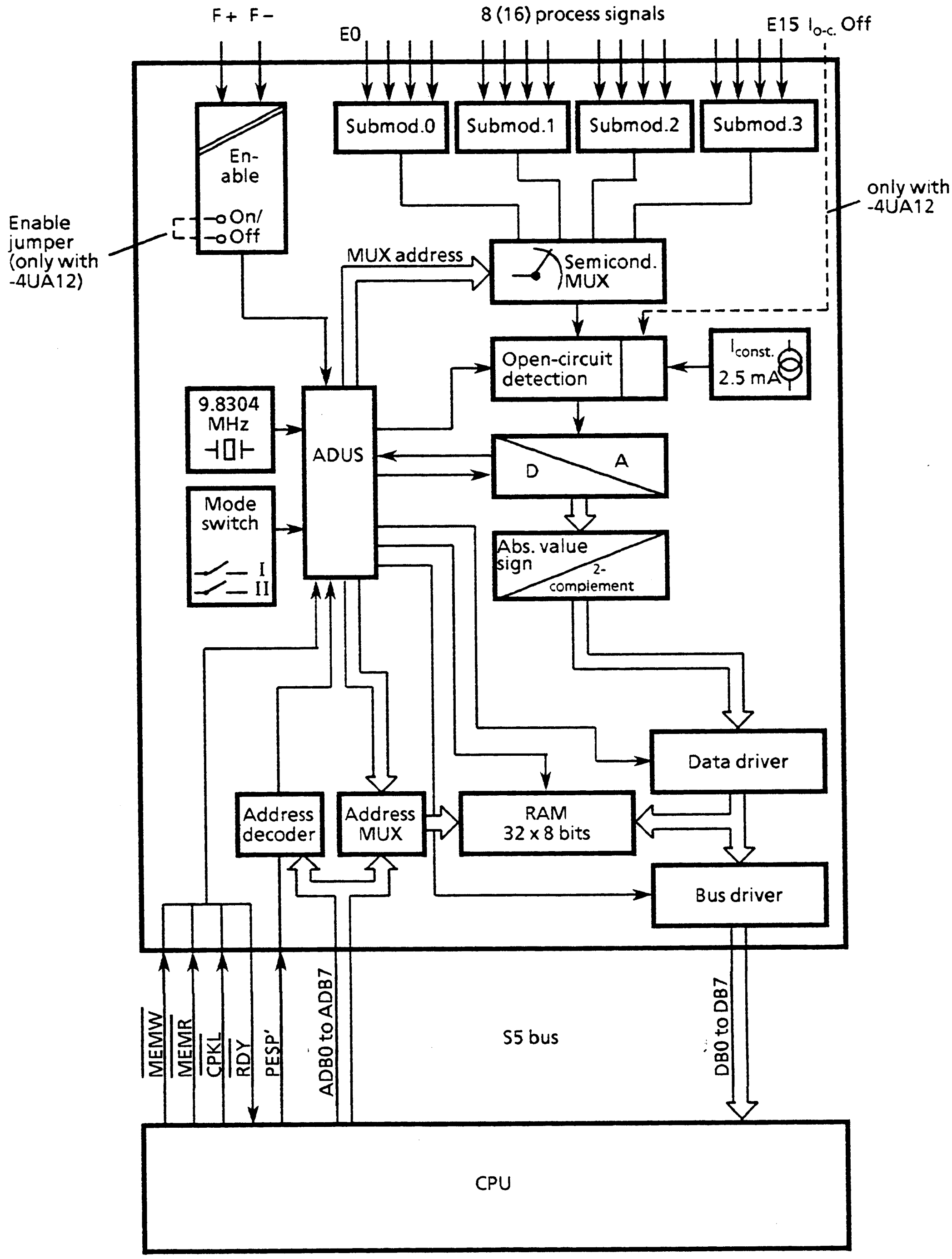
If the voltage is removed from enable inputs F+ and F- (e.g. by removing the front connector), the module is disconnected from the bus.

If, with the analog input modules 460-4UA12 and 465-4UA12, the enable jumper is removed, the modules can also be operated without enabling voltage. In this case, however, the modules cannot be disconnected from the bus any more.



A/D	Analog-to-digital converter (ADC)
ADB	Address bus
ADUS	ADC controller
CPKL	CPU ready signal
DB	Data bus
MEMR	Memory read (read signal)
MEMW	Memory write (write signal)
MUX	Multiplexer
PESP'	Memory I/O selection signal
RDY	Ready (acknowledgement signal)

Fig. 2 Block diagram with signal exchange between floating analog input module 460 and CPU



A/D	Analog-to-digital converter (ADC)
ADB	Address bus
ADUS	ADC controller
CPKL	CPU ready signal
DB	Data bus
MEMR	Memory read (read signal)
MEMW	Memory write (write signal)
MUX	Multiplexer
PESP'	Memory I/O selection signal
RDY	Ready (acknowledgement signal)

Fig. 3 Block diagram with signal exchange between non-floating analog input module 465 and CPU

The following can be selected on the mode switches for modes I and II:

Upper range value	50 mV	500 mV
Reference junction compensation	With	Without
Open-circuit signal with		
8-ch. operation	Channels 0 to 3	Without open-circuit signal
16-ch. operation	Channels 0 to 7	Without open-circuit signal
8-ch. operation	Channels 4 to 7	Without open-circuit signal
16-ch. operation	Channels 8 to 15	Without open-circuit signal
AC frequency suppression	50 Hz	60 Hz
Digital measured-value representation	Two's complement	Absolute value and sign
Number of channels	16	8
Scanning	Single	Cyclic
Gain (only with AE 460-4UA12)	x1 (50 mV)	x4 (12.5 mV)

o **Open-circuit signal**

When range submodule 6ES5498-1AA11 (continuity submodule) is used, the "open-circuit signalling" mode can be selected to allow monitoring of the sensors connected to the inputs. Open-circuit detection can be activated for 8 or 16 inputs with 16-channel operation, or for 4 or 8 inputs with 8-channel operation.

Before each coding sequence of the input value, a constant current is briefly fed to the input terminals (1.6 ms) and the voltage developing is checked for a limit. If the signal is measured at the input using a digital voltmeter, these current pulses may result in apparent signal variations. The coded value, however, is not influenced by this.

If these apparent signal variations are not desirable, e.g. during commissioning, with the analog input module 469-4UA12 the test current can be disconnected by applying +24 V to pin 24 of the front connector and 0 V to pin 21 (L-). Further, the switch for selecting the mode must be set to "without broken wire detection".

In the event of an open circuit in the sensor or in the incoming line, the voltage exceeds the limit and an open circuit is signalled (bit 1 in data byte 1). The ADC encodes the value 0.

Open-circuit signalling should only be activated when the range module 6ES5 498-1AA11 is used. When using the measuring modules 6ES5 498-1AA41, -1AA51 and -1AA71 no open circuit can be signalled, since the measuring inputs are provided with low-resistance shunts. With all other measuring modules, open-circuit signalling would lead to faults.

Further details relating to open-circuit signalling can be found in Chapter 3.5.5.

o **Overrange**

If the measurement range (4095 units) is exceeded, an overflow bit (bit 2^0 of the low byte) is set.
Applies only to 465-4UA11: This bit remains set for all the channels of the analog input module 465 when being operated in the cyclic mode. This is necessary, since, when only one channel is overdriven, the measured values of the subsequent channels may insignificantly be falsified too.

o **Cyclic scanning**

In this mode, the controller on the module continuously codes all measuring points. The digitized measured values are stored in the circulating memory under the channel-related address: the high byte under the address and the low byte under the address + 1. The measured values can then be read out of the circulating memory at any time without delay.

o **Single scanning**

In this mode, the coding of a measured value takes place on the initiative of the CPU. At the start of the conversion, the module must be addressed once by the CPU under the relevant channel address with a memory write ($\overline{MEMW}$). During coding, an activity bit (T = 1) is set on the data bus.

If T = 0, the digital value is valid. Repeated scanning of the activity bit causes loading of the bus and CPU. With different measured values, this results in aperiodic measured-value acquisition, which is not desirable for control tasks.

A better method is that of time-controlled program processing. With this type of program processing, certain program segments (e.g. FB 13) are automatically inserted into the program processing sequence by a time-controlled block in the 100-ms clock (OB 13). A constant time reference is thus achieved and the bus and CPU are relieved.

```
FB 13          OPRS-B                        LEN=22      ABS
                                                        PAGE 1

SEGMENT 1
NAME :SINGSCAN                     EXAMPLE: SINGLE SCANNING

0005       :
0006       :
0007       :L  PW128               READ ANALOG VALUE
0008       :T  FW128               IN AUXILIARY FLAG FW 128
0009       :A  F 129.2             SCANNING ACTIVITY BIT = 1?
000A       :JC =END                IF = 1, JUMP TO END
000B       :T  FW10                IF = 0, MEASURED VALUE IN FW 10
000C       :T  PB128               INITIALIZE SCANNING
000D END   :                       (1ST VALUE INVALID AFTER
000E       :                       INITIAL START)
000F       :
0010       :BE
```

o **Signal interchange between analog input module and CPU**

Analog values can be read by analog input modules using function block FB 40 ("read analog value").

This function block takes into account the special features of the different analog input modules. With a rated input signal, it provides a value between a lower and an upper limit at the output, irrespective of the module type. These limits are determined by the user.

Both cyclic and single scanning are possible.

See also FB 80 ("read analog value") for closed-loop control with the programmable controller S5-150S.

As an example, input 2 of an analog input module is to be scanned with address 128 (starting address) by the STEP-5 program. This setting of the addressing switch results in addresses 132 and 133 for input channel 2. The CPU reads the 2 bytes (control signal $\overline{\text{MEMR}}$) from the module memory, e.g. with a word instruction (LPW) or with two byte instructions (LPB). (Refer to the load and transfer operations of the operations list.)

The analog input module acknowledges with signal $\overline{\text{RDY}}$. The entire measured value (2 bytes = 16 bits) is stored in the CPU and subjected to further processing.

The ADC controller is reset with the signal $\overline{\text{CPKL}}$ = 1. The memory contents are retained. If $\overline{\text{CPKL}}$ = 0, the module issues the old stored values for the first cycle; at the second cycle, these values are updated.

Signal BASP is not evaluated by the analog input modules (see Chapter 1.5).

1.3.2 Analog Input Module 463

Caution: Apart from the special details and data given for the analog input module 463, Chapter 1.3.1 of these instructions is also applicable:

The analog input module 463 has four electrically isolated input channels. The analog input signals are digitized by voltage/frequency converters (V/F) and fed via a fast optocoupler into a counter. The integration time of the module 463-4UA11 is 20 ms and of the module 463-4UB11 is $16^2/_3$ ms; these integration times ensure optimum suppression of power frequency interference (50 or 60 Hz).

The sequential controller coordinates presetting of the counter, duration of the integration time and transfer of the counter values of the four input channels into the four measured-value memories.

Scaling the input range of each channel is achieved by suitable connection of the sensor and inserting jumpers in the front connector of the module (see pin assignments of front connector).

scanned one after the other by the STEP-5 program via the bus, using word instructions. The analog input module 463 thus occupies an address area of 8 bytes.

The measured values of the channels are stored under subaddresses ADB 0 to 2 as shown in the following table.

Module address					Subaddress			
					0	0	0	high-order byte, channel 0
					0	0	1	low-order byte, channel 0
					0	1	0	high-order byte, channel 1
					0	1	1	low-order byte, channel 1
					1	0	0	high-order byte, channel 2
					1	0	1	low-order byte, channel 2
					1	1	0	high-order byte, channel 3
					1	1	1	low-order byte, channel 3
ADB 7	ADB 6	ADB 5	ADB 4	ADB 3	ADB 2	ADB 1	ADB 0	

The module address is set via a switch fitted on the module cover (see Chapter 1.3 and 3.1).

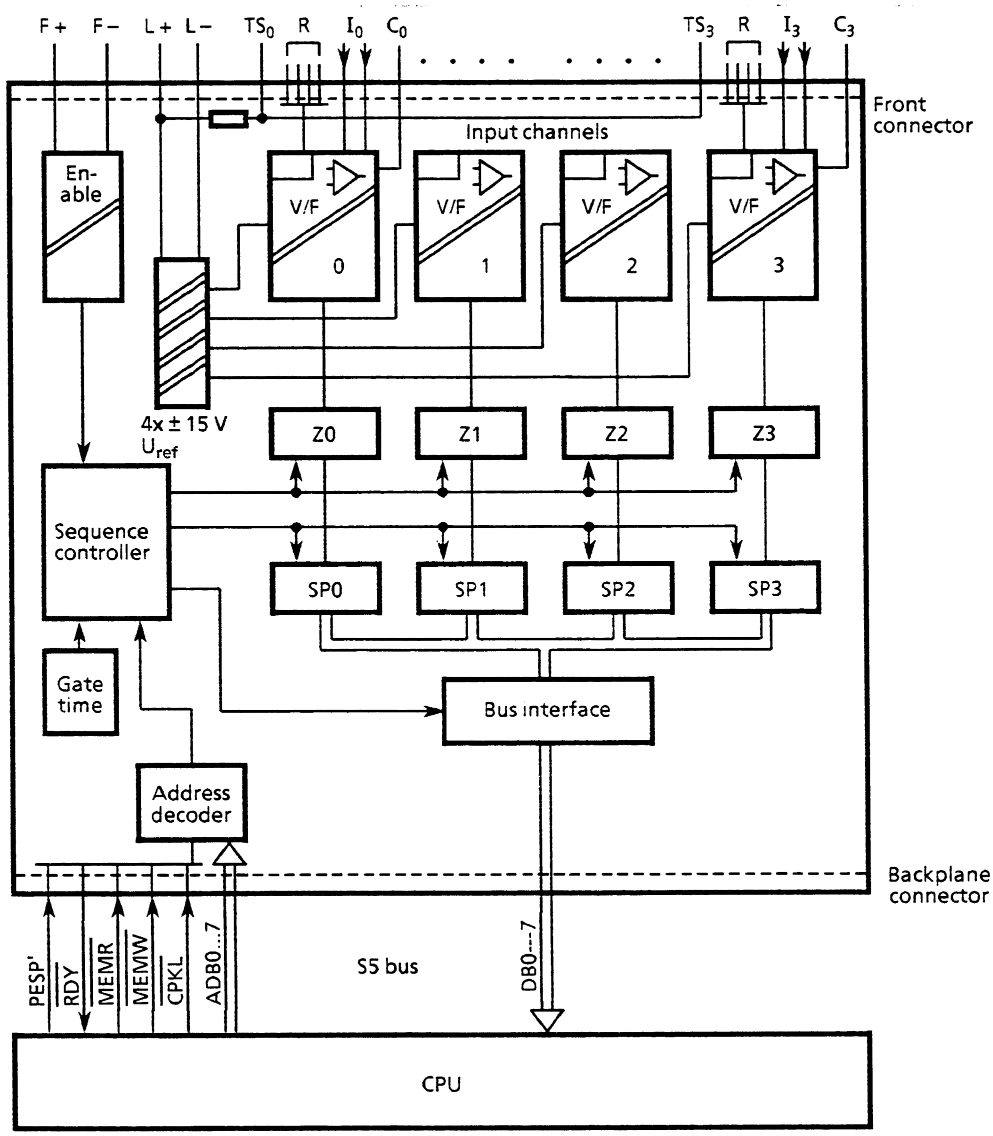
The analog input converts the analog value into the following data format as two's complement:

VZ	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4

High-order byte

2^3	2^2	2^1	2^0	0	0	0	]

Low-order byte



$C_{0...3}$	Common input (reference potential of inputs 0 to 3)	$TS_{0...3}$	Transducer supply (supply for 2-wire transducer of inputs 0 to 3)
$I_{0...3}$	Inputs 0 to 3	V/F	Voltage/frequency converter
R	Range		
Sp	Memory	Z	Counter

Fig. 4 Block diagram of analog input module 463

1.3.3 Analog Output Module 470

The block diagram (Fig. 5) shows the principle of operation and signal exchange between the CPU and an analog output module. An analog output module which is operated under its address transfers the digital measured value present on the data bus (DB 0 to DB 7) into the circulating memory via the controller.

The digital data of the circulating memory and the control signals are relayed via optocouplers to the digital-to-analog converter (DAC) and multiplexer, which are isolated by the programmable controller, and converted to an analog voltage.

In accordance with the transferred address, the multiplexer applies the analog value to the holding circuits and amplifiers for voltage and current for the relevant output A0 U/I to A7 U/I.

With 470-4U.11 analog output modules, the digital value 0 is written into the circulating memory with signal CPKL = 1 (with 470-4U.12, with the trailing edge of the CPKL signal). The analog output value in the form of voltage or current goes to 0. When CPKL = 0, the module is ready to output the new analog values.

Signal BASP is not evaluated by the analog output modules (see Chapter 1.5).

A switched-mode regulator on the PCB supplies the isolated part of the circuit with the necessary operating voltages. Interruption of the voltage from enable inputs F+ and F- (e.g. by removing the front connector) causes the module to be disconnected from the bus. If the enable jumper is removed in 470-4U.12-type analog output modules, these can also be operated without enable voltage. Then the modules can no longer be disconnected from the bus.

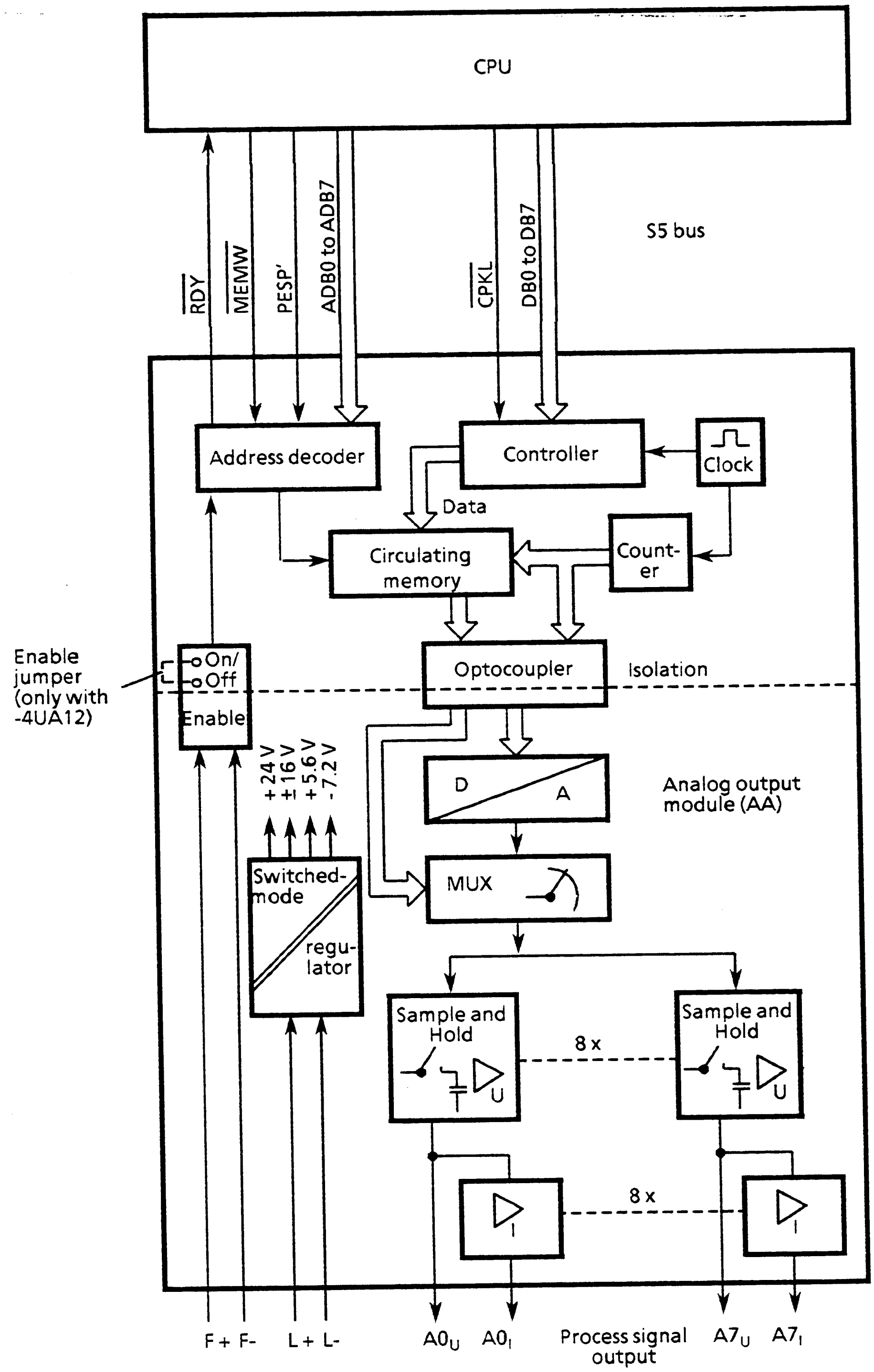
o **Signal interchange between CPU and analog output module**

With function block FB 41 ("output analog value"), analog signals can be output to the process via analog output modules. Values between a lower and an upper limit are to be specified for the function block. See also FB 81 ("output analog value") for closed-loop control with the S5-150S programmable controller.

As an example, output channel 3 of an analog output module is to be addressed with address 128 (starting address). The addresses for output channel 3 are 134 and 135 as given in Chapter 6.

The high byte (data byte 0) and the low byte (data byte 1) of the measured value to be output are transferred to the module memory by the CPU with signal $\overline{\text{MEMW}}$ in each case under addresses 134 and 135 respectively. This can be executed in the program with the TPW instruction (word instruction) or TPB instruction (byte instruction). The module acknowledges with signal $\overline{\text{RDY}}$.

The measured value thus located in the memory of the analog output module is fed to the loads at the output of the module in the form of a voltage and load-independent current, which are, with versions 4UA... and 4UC..., both available simultaneously. Version 4UB... has only voltage outputs.



ADB Address bus
CPKL CPU ready signal
D/A Digital-to-analog converter (DAC)
DB Data bus
MEMW Memory write (write signal)
MUX Multiplexer
PESP' Memory I/O selection signal
RDY Ready (acknowledgement signal)

Fig. 5 Block diagram with signal exchange between CPU and analog output module 470

1.4 Function of the Enable Inputs

An enable circuit is provided on the modules of the U series. By means of the enable inputs, certain modules can be interlocked or individual modules can be switched off while the CC is in operation.

Analog input/output modules are activated by applying an external voltage of 24 V to the inputs F+/F-. If no voltage is applied to F+/F-, no acknowledgement is output by the modules. With analog output modules, the analog value which has been output last remains stored.

With -4U.12-type modules, this enable function can be switched off by removing a plug-in jumper. Then the modules will be activated by request of the bus, irrespective of the voltage applied to F+/F-.

When the front connector is withdrawn from the front of the module the voltage to the enable inputs is lost. The module is switched off and sends no further acknowledgement signal. This means that the CC sets an acknowledgement delay bit (QVZ) (time-out).

Examples of the uses of the enable inputs:

- Switching off individual parts of a process; that means that analog outputs of different modules can be operated from a common load current supply and still be activated separately.

- The load voltage of individual modules can be monitored without additional effort. Reactions to load voltage failure can then be programmed in the QVZ organization block.

Please note the following design factors:

Switch on: The voltage on the enable inputs of the I/O modules must be present within 100 ms of switching the PC on.

Switch off: After switching off the PC the voltage on the enable inputs of the I/O modules must be present for as long as the internal 5 V is provided.
However, you need to switch off the 24-V load current supply for the analog output modules together with the PC. If the power supply is still applied to the modules and the PC is switched off, the analog output values might drift. (In this case, the analog sample-and-hold elements of the outputs are not updated any more since the 5 V supplied to the modules by the bus is missing.)

Please note the following when switching off the CC and devices supplying the enable inputs:

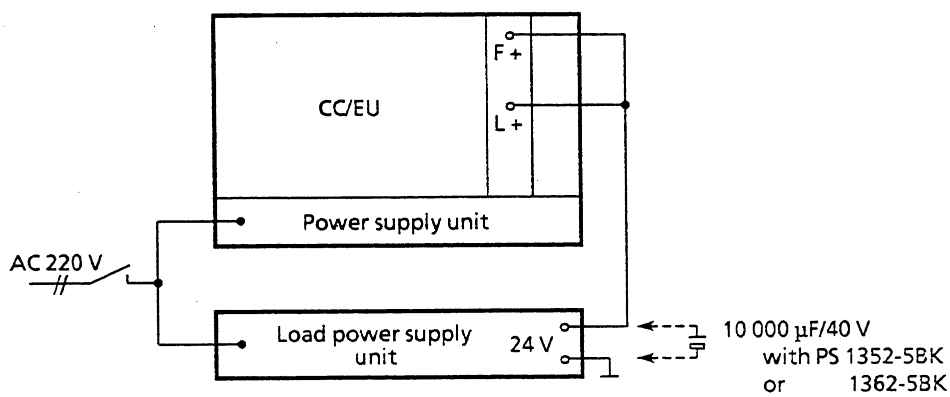
- **Switching off of both the CC/EU and the load power supply with a 220-V mains supply.**

- Correct functioning is guaranteed when the 24-V load power supply units have an output impedance of at least 4700 /uF per 10 A load current.

  Example: load current supply 6EV1334-4AK (220 V/24 V, 10 A)

- Devices which do not meet this requirement can be adapted by the parallel connection of a 10000 /uF/40 V capacitor.

  Example: load current supply 6EV1352-5BK (380 V/24 V, 20 A) and load current supply 6EV1362-5BK (380 V/24 V, 40 A)

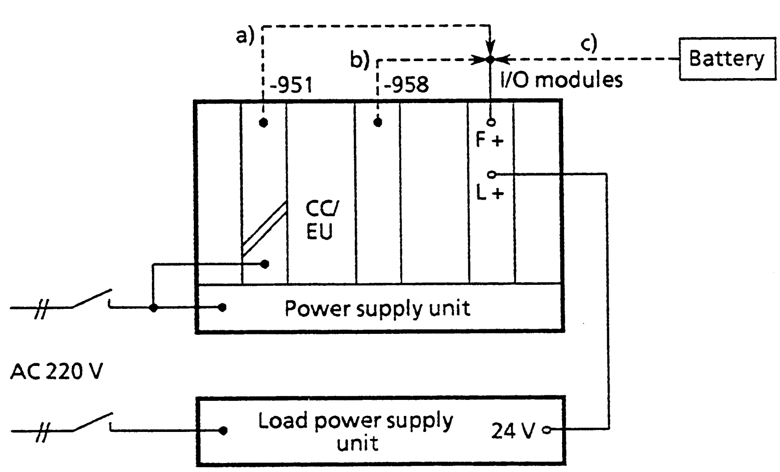


- **Switching off of the CC/EU and of the load current supply separately or together**

  If it must be possible to separately switch off the load current supply without influencing the enable condition of the modules, the following possibilities for the enable voltage are provided. These possibilities also exist when using the load current supply without additional capacitor and when switching them off together.

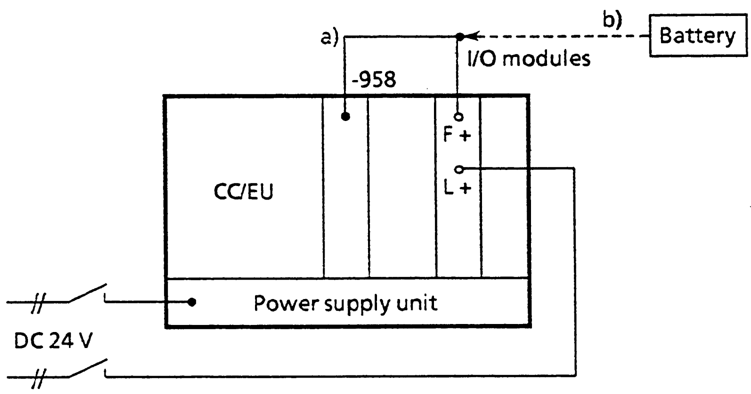
  - 220-V mains supply to the CC/EU and load current supply

  Enable inputs supplied by:
  a) Load current supply 6ES5951-4LB11
  b) Enable supply 6ES5958-4UA11
  c) Battery



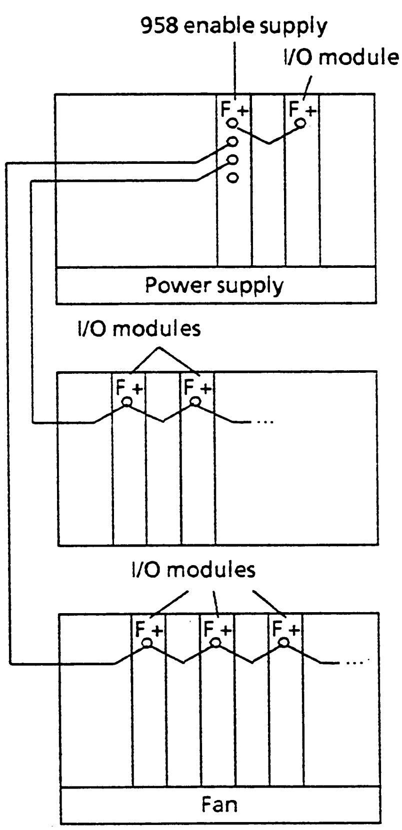
- 24-V supply to the CC/EU and peripherals

Enable inputs supplied by:
a) Enable supply 6ES5958-4UA11
b) Battery



The enable supply 6ES5 958-4UA11 can only be plugged into CCs and EUs with power supply incorporated.

The enable inputs of I/O modules mounted in EUs without a power supply (e.g. EU 184 U, EU 187 U) must be connected via a 958 enable supply unit being plugged in devices with a power supply.



o **Removal and insertion of peripheral modules during operation**

With the programmable controllers S5-130 K, -130 W and -135 U (S processor), the CC stops without acknowledgement when the front connector is removed thereby also removing the enable voltage.

Plugging and unplugging of peripheral modules during operation is possible in the case of S5-135 U (R processor), S5-150 K/S/U and S5-155 U.

Attention:

- If the enable signal is missing or if the front connector or the module is removed, the low byte and the high byte of this module will always be read as having FFH.

- Only remove the enable voltage from the relevant output module to switch off parts of a process.

- The programmer must ensure in the QVZ OB that neither an error nor the exchanging of a module can lead to a dangerous condition in the process or in the machine.

Attention: The following applies only to the analog input/output modules ...-4UA12.

o Switching off of the enable inputs via the enable jumper

The enable input (F+/F-) can be switched off on the module via the enable jumper located near the address switch.

After removing the enable jumper the module can be activated via the S5 peripheral bus even if the enable input F+/F- has been switched off. Enable voltage need not be connected any more.

Then, the modules respond to the removal or insertion as follows:

- After removing the front connector the module remains connected to the S5 peripheral bus. The module outputs the $\overline{RDY}$ signal to acknowledge (no acknowledgement delay in CC).

  OOH is normally read from the data bus of analog input modules. Analog output modules are connected according to the data applied to them. The load-voltage supply is interrupted.

- Only after removing the module, the acknowledgement delay (timeout) indicates to the CC that the module is missing. FFH is then read from the data bus.

Attention: If you insert or remove modules without enable jumper during operation, this may lead to faults of the S5 peripheral bus.

Be sure not to remove or insert the front connector or the module without enable jumper during operation.

1.5 Pin Assignments of the Backplane Connector

	b	z
2	0 V	+5 V
4	PESP'	
6	ADB 0	$\overline{\text{CPKL}}$
8	ADB 1	$\overline{\text{MEMR}}$
10	ADB 2	$\overline{\text{MEMW}}$
12	ADB 3	$\overline{\text{RDY}}$
14	ADB 4	DB 0
16	ADB 5	DB 1
18	ADB 6	DB 2
20	ADB 7	DB 3
22	ADB 8	DB 4
24	ADB 9	DB 5
26	ADB 10	DB 6
28	ADB 11	DB 7
30		
32	0 V	

ADB	Address bus
$\overline{\text{CPKL}}$	CPU ready signal
DB	Data bus (bidirectional)
$\overline{\text{MEMR}}$	Memory read (read signal)
$\overline{\text{MEMW}}$	Memory write (write signal)
PESP'	Memory I/O selection signal
$\overline{\text{RDY}}$	Ready (acknowledgement signal)

1.6 General Technical Data

Address range	128 to 255 (0 to 255)
Supply voltage L+	
- rated value	24 V
- ripple U_{pp}	3,6 V
- permissible range (including ripple)	20 to 30 V
- reference potential	L- = M = 0 V
Voltage for the floating enable inputs (with ...-4UA12: only necessary when enable jumper is plugged in)	F+ = + 24 V F- = 0 V
Line lengths for	
- analog input modules with rated input range of ±12.5 mV and ±50 mV	Max. 50 m with cables which are shielded and segregated from power cables (see Section 2.3.)
- analog input modules with rated input range of ±500 mV/±1/±5/±10 V/±20 mA, 4 to 20 mA and Pt 100	Max. 200 m, shielded
- analog output modules	Max. 200 m, shielded
Temperature range	
- operating temperature	0 to 60°C
- storage and shipping temp.	-40 to 70°C

Relative humidity	Max. 95% at 25°C, no condensation
Operating altitude	Max. 3500 m above sea level
Dimensions (W x H x D)	20 mm x 255 mm x 195 mm
Weight	Approx. 400 g

2 Assembly

2.1 Removing and Inserting Modules

The design of the modules and front connectors is such that the modules can be removed and inserted whilst the programmable controller or extension unit is in operation, without faults occurring when exchanging data with the neighboring modules (see also Chapter 1.3.1).

Applies only to analog input/output modules ...-4UA12:
If you insert or remove modules without an enable jumper during operation, this may lead to faults of the S5 peripheral bus.

Be sure not to remove or insert the front connector or the module without an enable jumper during operation.

A module is replaced as follows:

Detach the upper retaining rail on the subrack and swivel it upwards and out.

The front connector can be pressed out of the female connector of the module by slackening a screw in the upper part of the front connector. Contacts F+ and F- of the enable input at the upper end of the front connector are thus opened first. The module is disconnected from the S5 bus.

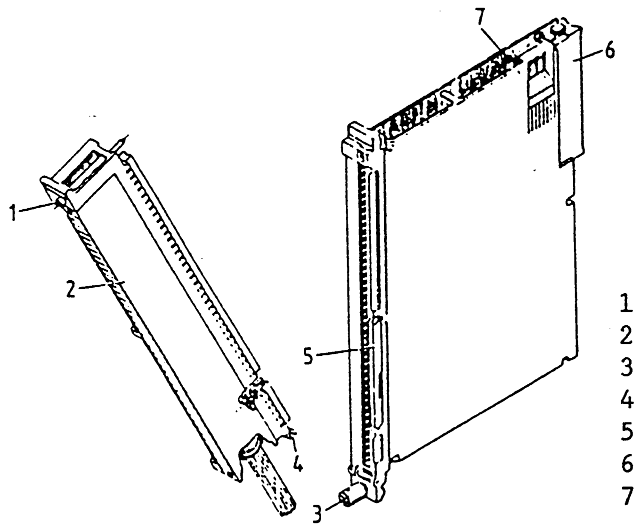
Applies only to 6ES5 ...-4UA12: When the enable jumper is removed the enable voltage is no longer effective and the module is **not** enabled by the bus.

The front connector can now be swivelled out and lifted out of the lower catch. The width of the catch is also a coding arrangement to prevent the front connector from being plugged into the wrong modules. (The front connectors with 115/240-V-AC wiring, for instance, cannot be plugged into analog or 24/60-V-DC modules.)

The module is released by turning a locking bolt by 90 degrees on the lower end of the module.

The module can be pulled out of the subrack by means of a swivel-mounted grip.

Modules are inserted in the reverse order.

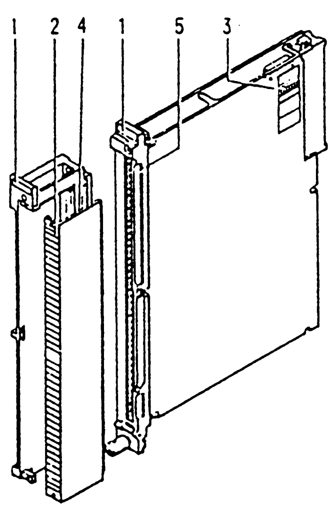


1 Screw
2 Front connector
3 Locking bolt
4 Catch
5 Grip
6 Backplane connector
7 Enable jumper (only with ...-4UA12)

Fig. 6 Module with front connector

2.2 Module Identification Labelling

The module and CPU are supplied with labels for marking the modules and front connectors; the labels are affixed as shown in Fig. 7.



1 Label with module address under which the module is addressed by the STEP-5 program
2 Marking strip with the reference number (MLFB no.) of the module; space to tick the output status of the module and to mark the channels
3 Label with the module address and markings for the required settings of the addressing switch
4 Marking strip for the terminal assignments or connection diagrams (strip in the cover of the front connector)
5 Type label

Fig. 7 Identification and labelling of modules

2.3 Installation Guidelines

Wiring of the supply and signal lines which are connected to the programmable controllers and front connectors of the modules, must be implemented in accordance with VDE specifications 0110 and 0160.

The line shields must be connected with clamps to a shield rail in the vicinity of the front connector; this rail is connected to the casing of the controller at low impedance.

Detailed instructions relating to the power supply, cabinet arrangement, cabinet ventilation, cabinet wiring and protective measures can be found in the "Installation Guidelines" (Ref. no. C79000-B8576-C452) and must be observed.

3 Operation

3.1 Setting the Module Address

The module address is set on an addressing switch on the module.

The label with the desired module address is affixed in a space beneath the addressing switch. Labels for all possible addresses are supplied with the S5 or can be ordered under the number 6ES5497-4UD11.

The individual switches to be switched on (address bit ADB) are marked by dots on the label in order to set the module address specified as a decimal number.

The address of the module is the sum of the decimal values of the switches which are set to the "On" position (●).

The individual switches of the addressing switch are pressed down with a ballpoint pen or similar instrument - do not use a pencil.

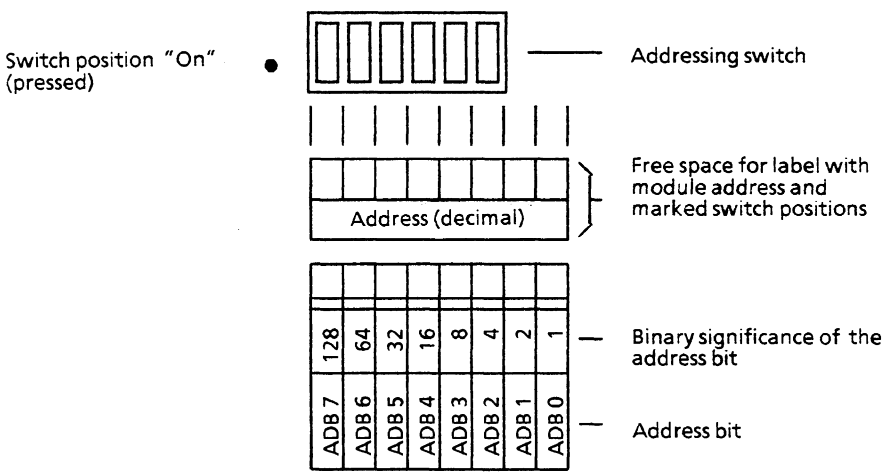


Fig. 8 Labelling the addressing switch

The address under which the module is addressed by the STEP-5 program is independent of the slot.

For analog input and output modules (4, 8 or 16 inputs or outputs) which are used in the S5 system, only the starting address is set. Other addresses (subaddresses) are decoded on the module.

If one of the 4, 8 or 16 inputs or outputs (channels 0 to 3, 0 to 7 or 0 to 15) of a module is to be addressed, the relevant subaddress is specified in the program.

The subaddress of the input or output, based on the starting address of the module, can be obtained as follows:

Starting address + channel number x 2 = subaddress

For example, a module with 8 inputs and starting address 160 occupies the address range

160 up to address 160 + 7 x 2 + 1 = 175.

In this example, the next free address for another module is 176.

Addresses which have already been assigned must not be set again.

However, analog inputs and analog outputs can have the same address with cyclic scanning because they are distinguished by the control signals $\overline{MEMR}$ and $\overline{MEMW}$. This is not possible with single scanning because analog input modules respond with an acknowledgement both for $\overline{MEMR}$ and for $\overline{MEMW}$.

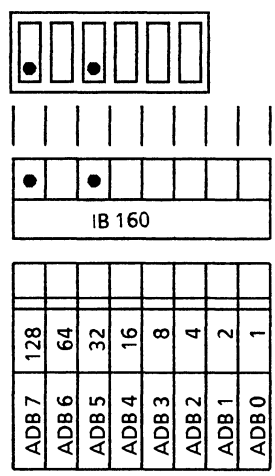
Example 1

In the case of an analog input module with starting address 160 (IB 160 = input byte 160), input channel 3 is to be scanned by the program.

The self-adhesive label with address 160 is affixed to the space on the module beneath the addressing switch. ADB 5 and ADB 7 are marked on the label.

The corresponding individual switches of the addressing switch are pressed down on the side marked by a dot on the module cover. The remaining switches are set to the opposite position. The starting address of the module is thus set. ADB 5 + ADB 7 results in

$2^5 + 2^7 = 32 + 128 = 160.$



The address 160 + 3 x 2 = 166 is entered into the program for input channel 3. Internal decoding on the module is as follows:

166 for byte 0; 167 for byte 1.

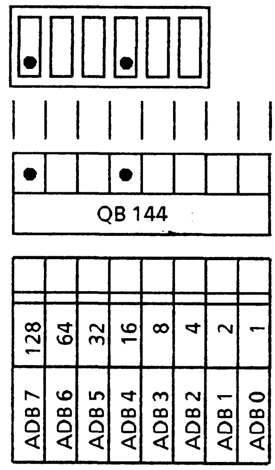
The assignments of inputs and outputs for the possible starting addresses can be found in Chapter 6.

Example 2

Analog output module with 8 outputs, starting address 144 (QB 144 = output byte 144), output channel 7

ADB 4 + ADB 7 results in

$2^4 + 2^7 = 16 + 128 = 144.$



The address 144 + 7 x 2 = 158 is entered into the program for output channel 7. Internal decoding on the module is as follows:

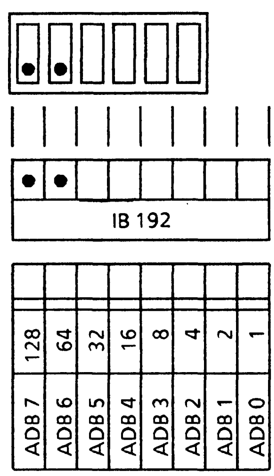
158 for byte 0; 159 for byte 1.

Example 3

Analog input module with 16 inputs, starting address 192 (IB 192 = input byte 192), input channel 15

ADB 6 + ADB 7 results in

$2^6 + 2^7 = 64 + 128 = 192.$



The address 192 + 15 x 2 = 222 is input into the program for input channel 15. Internal decoding on the module is as follows:

222 for byte 0; 223 for byte 1

3.2 Digital Measured-value Representation with Analog Input Modules

When an analog measured value has been coded, the digital result is stored in a RAM. The result is divided into 2 bytes which are addressed in succession.

Data bit	7	6	5	4	3	2	1	0	
Byte 0 (high byte)	2^{12}	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	Address n
Data bit	7	6	5	4	3	2	1	0	
Byte 1 (low byte)	2^4	2^3	2^2	2^1	2^0	T	F	]	Address n + 1

0: 0 to 4095 units
1: ±4096 units (overflow)

Two's complement representation. 2^{12} = sign for representation as absolute value and sign.

0: no open circuit
1: open circuit

0: not active (with cyclic free-running scanning)
1: active (with single input scanning, single coding)

3.2.1 Digital Measured-value Representation as Two's Complement (Rated Input Range ±50 mV, Analog Input Module 460, 465)

Units	Input voltage in mV	Byte 0								Byte 1								
		7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	
		2^{12}	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	T	F	]	
≥4096	100.0	0	1	1	1	1	1	1	1	1	1	1	1	1	0/1	0/1	1	Overflow
4095	99.976	0	1	1	1	1	1	1	1	1	1	1	1	1	0/1	0/1	0	Overdriving
2049	50.024	0	1	0	0	0	0	0	0	0	0	0	0	1	0/1	0/1	0	range
2048	50.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0/1	0/1	0	
2047	49.976	0	0	1	1	1	1	1	1	1	1	1	1	1	0/1	0/1	0	
1024	25.0	0	0	1	0	0	0	0	0	0	0	0	0	0	0/1	0/1	0	
1023	23.976	0	0	0	1	1	1	1	1	1	1	1	1	1	0/1	0/1	0	
1	0.024	0	0	0	0	0	0	0	0	0	0	0	0	1	0/1	0/1	0	
0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/1	0/1	0	Rated range
- 1	- 0.024	1	1	1	1	1	1	1	1	1	1	1	1	1	0/1	0/1	0	
-1023	- 24.976	1	1	1	0	0	0	0	0	0	0	0	0	1	0/1	0/1	0	
-1024	- 25.0	1	1	1	0	0	0	0	0	0	0	0	0	0	0/1	0/1	0	
-2047	- 49.976	1	1	0	0	0	0	0	0	0	0	0	0	1	0/1	0/1	0	
-2048	- 50.0	1	1	0	0	0	0	0	0	0	0	0	0	0	0/1	0/1	0	
-2049	- 50.024	1	0	1	1	1	1	1	1	1	1	1	1	1	0/1	0/1	0	Overdriving
-4095	- 99.976	1	0	0	0	0	0	0	0	0	0	0	0	1	0/1	0/1	0	range
-4096	-100.0	1	0	0	0	0	0	0	0	0	0	0	0	1	0/1	0/1	1	Overflow

T = Activity bit   F = Error bit   ] = Overflow bit

3.2.2 Digital Measured-value Representation as Absolute Value and Sign
(Rated Input Range ±50 mV, Analog Input Module 460, 465)

Units	Input voltage in mV	Byte 0								Byte 1								
		7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	
		VZ	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	T	F	]	
≥4096	100.0	0	1	1	1	1	1	1	1	1	1	1	1	1	0/1	0/1	1	Overflow
4095	99.976	0	1	1	1	1	1	1	1	1	1	1	1	1	0/1	0/1	0	Overdriving
2049	50.024	0	1	0	0	0	0	0	0	0	0	0	0	1	0/1	0/1	0	range
2048	50.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0/1	0/1	0	
2047	49.976	0	0	1	1	1	1	1	1	1	1	1	1	1	0/1	0/1	0	
1024	25.0	0	0	1	0	0	0	0	0	0	0	0	0	0	0/1	0/1	0	
1023	23.976	0	0	0	1	1	1	1	1	1	1	1	1	1	0/1	0/1	0	
1	0.024	0	0	0	0	0	0	0	0	0	0	0	0	1	0/1	0/1	0	
0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/1	0/1	0	
- 0	0.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0/1	0/1	0	Rated range
- 1	- 0.024	1	0	0	0	0	0	0	0	0	0	0	0	1	0/1	0/1	0	
-1023	- 24.976	1	0	0	1	1	1	1	1	1	1	1	1	1	0/1	0/1	0	
-1024	- 25.0	1	0	1	0	0	0	0	0	0	0	0	0	0	0/1	0/1	0	
-2047	- 49.976	1	0	1	1	1	1	1	1	1	1	1	1	1	0/1	0/1	0	
-2048	- 50.0	1	1	0	0	0	0	0	0	0	0	0	0	0	0/1	0/1	0	
-2049	- 50.024	1	1	0	0	0	0	0	0	0	0	0	0	1	0/1	0/1	0	Overdriving
-4095	- 99.976	1	1	1	1	1	1	1	1	1	1	1	1	1	0/1	0/1	0	range
-4096	-100.0	1	1	1	1	1	1	1	1	1	1	1	1	1	0/1	0/1	1	Overflow

T = Activity bit F = Error bit] = Overflow bit VZ = sign

Range limits for measurement range 4 to 20 mA:

Rated range	512 to 2560 units
Overdriving range	2561 to 4095 units
Overflow	From 4096 units

Bit 2^{12} is evaluated as a sign.

3.2.3 Digital Measured-value Representation with Resistance Thermometers

The resolution with Pt 100 resistance thermometers is approximately 1/4°C; 1 ohm ≙ 10 units. (Analog input module 460, 465).

Units	Input resistance in ohms	Byte 0								Byte 1								
		7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	
		VZ	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	T	F	]	
4096	400	0	1	1	1	1	1	1	1	1	1	1	1	1	0/1	0/1	1	Overflow
4095	399.90	0	1	1	1	1	1	1	1	1	1	1	1	1	0/1	0/1	0	Overdriving
2049	200.098	0	1	0	0	0	0	0	0	0	0	0	0	1	0/1	0/1	0	range
2048	200.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0/1	0/1	0	
2047	199.90	0	0	1	1	1	1	1	1	1	1	1	1	1	0/1	0/1	0	
1024	100.00	0	0	1	0	0	0	0	0	0	0	0	0	0	0/1	0/1	0	
1023	99.90	0	0	0	1	1	1	1	1	1	1	1	1	1	0/1	0/1	0	Rated range
1	0.098	0	0	0	0	0	0	0	0	0	0	0	0	1	0/1	0/1	0	
0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/1	0/1	0	

T = Activity bit   F = Error bit   ] = Overflow bit

When Pt 100 resistance thermometers are connected, the resulting maximum temperature in the rated range is 266°C. If steps are taken to ensure that the maximum temperature does not exceed 850°C, overdriving into the overdriving range is permissible. The resolution is then 4095 units. Unassigned inputs can be used for voltage measurements in the 500-mV range (see front connector assignments).

3.2.4 Digital Measured-Value Representation
(Rated Input Range 0...1 V, 0...10 V, 0...20 mA, 4...20 mA; Analog Input Module 463)

Units	Rated range:					Byte 0	Byte 1	
	0...10 V	0...1 V (in mV)	0...20 mA	4...20 mA 1)	4...20 mA 2)	7 6 5 4 3 2 1 0 2^{11} 2^{10} 2^9 2^8 2^7 2^6 2^5 2^4	7 6 5 4 3 2 1 0 2^3 2^2 2^1 2^0 - - -]	
2047	19.99	1999	39.98	35.98	31.98	0 1 1 1 1 1 1 1	1 1 1 1 0 0 0 1	3)
1536	15.00	1500	30.00	28.00	24.00	0 1 1 0 0 0 0 0	0 0 0 0 0 0 0 1	
1535	14.99	1499	29.98	27.98	23.98	0 1 0 1 1 1 1 1	1 1 1 1 0 0 0 0	
1280					20.00	0 1 0 1 0 0 0 0	0 0 0 0 0 0 0 0	4)
1025	10.01	1001	20.02	20.02	16.02	0 1 0 0 0 0 0 0	0 0 0 1 0 0 0 0	
1024	10.00	1000	20.00	20.00	16.00	0 1 0 0 0 0 0 0	0 0 0 0 0 0 0 0	
1023	9.99	999.02	19.98	19.98	15.98	0 0 1 1 1 1 1 1	1 1 1 1 0 0 0 0	
512	5.00	500.00	10.00	12.00	8.00	0 0 1 0 0 0 0 0	0 0 0 0 0 0 0 0	
511	4.99	499.00	9.98	11.98	7.98	0 0 0 1 1 1 1 1	1 1 1 1 0 0 0 0	
256					4.00	0 0 0 1 0 0 0 0	0 0 0 0 0 0 0 0	5)
1	0.098	0.976	0.02	4.016	0.016	0 0 0 0 0 0 0 0	0 0 0 1 0 0 0 0	
0	0	0	0	4	0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	
- 1	-0.098	-0.976	-0.02	3.984	-0.016	1 1 1 1 1 1 1 1	1 1 1 1 0 0 0 0	
- 51	-0.5	-50	-1	3.184	-0.816	1 1 1 1 1 1 0 0	1 1 0 1 0 0 0 0	

] = Overflow bit

With the measurement range of 0 to 20 mA, a 50-ohm shunt resistance is used; with 4 to 20 mA, it is a 62.5-ohm resistance.

The shunt resistances on the analog input module 463 are fixed mounted resistances. Basically, open-circuit detection is not possible; with the current measurement range of 4 to 20 mA, open circuits can be detected via currents of less than 3 mA.

If the positive and negative terminals of the transducer are short-circuited when using 2-wire transducers (4 to 20 mA), the current is limited to approx. 28 mA. There is a short-circuit current flow of approx. 250 mA which sets the overflow bit for this duration on the short-circuited channel until the thermal current limiting circuit responds (approx. 3 s).

1) With setting of the data format from 0 to 1023 (switch is located on the module)
2) With setting of the data format from 256 to 1279 (switch is located on the module)
3) Overflow
4) Overdriving range
5) Rated range

3.2.5 Digital Measured-value Representation with Current Measurement Ranges of 4 to 20 mA

Measurement range 500 mV; submodule with 31.25-ohm shunt (6ES5498-1AA51/AA71).

The measurement range of 4 to 20 mA is resolved as 2048 units. If a representation of 0 to 2048 units is desired, 512 units must be subtracted by software. The following should be noted:

- As a result of the 31.25-ohm shunt resistance, an open-circuit signal cannot be output.

- Detection of the overdriving range can be achieved by scanning bits 2^9 and 2^{11}.

- Currents of less than 3 mA (open circuit) can be evaluated with bits $2^{11} = 0$, $2^{10} = 0$, $2^9 = 0$, $2^8 = 1$ and $2^7 = 0$.

- If the positive and negative terminals of the transducer are short-circuited when using the submodule 6ES5 498-1AA51 (for 2-wire transducers), the current is limited to approx. 28 mA. There is a short-circuit current flow of approx. 250 mA which sets the overflow bit for this duration on all channels until the thermal current limiting circuit in the submodule responds (approx. 3 s).

Units	Input current in mA	Input voltage in mV 1)	Byte 0								Byte 1								
			7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	
			VZ	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	T	F	]	
≥4096	≥32.000	1000	0	1	1	1	1	1	1	1	1	1	1	1	1	0/1	0	1	Overflow 2)
4095	31.992	999.76	0	1	1	1	1	1	1	1	1	1	1	1	1	0/1	0	0	Overdriving
3072	24.0	750	0	1	1	0	0	0	0	0	0	0	0	0	0	0/1	0	0	range
3071	23.992	749.76	0	1	0	1	1	1	1	1	1	1	1	1	1	0/1	0	0	Short circuit w.
2561	20.008	625.24	0	1	0	1	0	0	0	0	0	0	0	0	1	0/1	0	0	2-wire transduc.
2560	20.0	625	0	1	0	1	0	0	0	0	0	0	0	0	0	0/1	0	0	
2048	16.0	500	0	1	0	0	0	0	0	0	0	0	0	0	0	0/1	0	0	Rated range
512	4.0	125	0	0	0	1	0	0	0	0	0	0	0	0	0	0/1	0	0	
511	3.192	124.76	0	0	0	0	1	1	1	1	1	1	1	1	1	0/1	0	0	Undershooting
384	3.0	93.75	0	0	0	0	1	1	0	0	0	0	0	0	0	0/1	0	0	of rated range
383	2.992	93.5	0	0	0	0	1	0	1	1	1	1	1	1	1	0/1	0	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/1	0	0	Open circuit 2)

T = Activity bit F = Error bit] = Overflow bit VZ = sign

1) Equivalent
2) These ranges must be scanned by software.

3.3 Digital Measured-value Representation with Analog Output Modules

In the transfer of data from the data bus to the memory of the analog output module, no distinction between bipolar and unipolar types need be made. Two bytes per output are emitted by the CPU.

Data bit	7	6	5	4	3	2	1	0	
Byte 0 (high byte)	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	Address n
Data bit	7	6	5	4	3	2	1	0	
Byte 1 (low byte)	2^3	2^2	2^1	2^0	x	x	x	x	Address n + 1

x = irrelevant

Bit 2^{11} in the two's complement is interpreted as the sign:

0 for positive sign
1 for negative sign

Digital measured-value representation of output voltages and currents:

Units	Output voltage/current of modules 6ES5 470- -4UA/B11, -4UA/B12	-4UA11, -4UA12	-4UC11, -4UC12		Byte 0 (7 6 5 4 3 2 1 0) (2^{11} 2^{10} 2^9 2^8 2^7 2^6 2^5 2^4)	Byte 1 (7 6 5 4) (2^3 2^2 2^1 2^0)	Byte 1 (3 2 1 0) (x x x x)
1280	12.5 V	25.0 mA	6.0 V	24.0 mA	0 1 0 1 0 0 0 0	0 0 0 0	1) irre-
1025	10.0098 V	20.0195 mA	5.004 V	20.016 mA	0 1 0 0 0 0 0 0	0 0 0 1	levant
1024	10.0 V	20.0 mA	5.0 V	20.0 mA	0 1 0 0 0 0 0 0	0 0 0 0	
1023	9.99 V	19.98 mA	4.995 V	19.98 mA	0 0 1 1 1 1 1 1	1 1 1 1	
512	5.0 V	10.0 mA	3.0 V	12.0 mA	0 0 1 0 0 0 0 0	0 0 0 0	
256	2.5 V	5.0 mA	2.0 V	8.0 mA	0 0 0 1 0 0 0 0	0 0 0 0	irre-
128	1.25 V	2.5 mA	1.5 V	6.0 mA	0 0 0 0 1 0 0 0	0 0 0 0	levant
64	0.625 V	1.25 mA	1.25 V	5.0 mA	0 0 0 0 0 1 0 0	0 0 0 0	
1	9.8 mV	19.5 uA	1.004 V	4.016 mA	0 0 0 0 0 0 0 0	0 0 0 1	2)
0	0 V	0 mA	1.0 V	4.0 mA	0 0 0 0 0 0 0 0	0 0 0 0	
- 1	- 9.8 mV	0 mA	0.996 V	3.984 mA	1 1 1 1 1 1 1 1	1 1 1 1	
- 64	- 0.625 V	0 mA	0.75 V	3.0 mA	1 1 1 1 1 1 0 0	0 0 0 0	
- 128	- 1.25 V	0 mA	0.5 V	2.0 mA	1 1 1 1 1 0 0 0	0 0 0 0	
- 256	- 2.5 V	0 mA	0 V	0 mA	1 1 1 1 0 0 0 0	0 0 0 0	
- 512	- 5.0 V	0 mA	-1 V	0 mA	1 1 1 0 0 0 0 0	0 0 0 0	
-1024	-10.0 V	0 mA	-3.0 V	0 mA	1 1 0 0 0 0 0 0	0 0 0 0	
-1025	-10.0098 V	0 mA	-3.004 V	0 mA	1 0 1 1 1 1 1 1	1 1 1 1	1) irre-
-1280	-12.5 V	0 mA	-5.0 V	0 mA	1 0 1 1 0 0 0 0	0 0 0 0	levant

1) Overdriving range
2) Rated range

3.4 Connecting the Signal Lines

The modules are fitted with 42-way plug connectors with blades of 2.4 mm x 0.8 mm.

For the connection of signal lines, front connectors are available with crimp terminals for mounting widths of 20 mm and 40 mm and with screw terminals for a mounting width of 40 mm. Stranded conductors should be used to facilitate handling of the front connector. With the screw terminals, sleeves are not required because the screw terminals are provided with wire protectors.

Width of the screwdriver blade: 3.5 mm.

Type of connection	Connector type 6ES5 497-	Max. no. of terminals	Wire cross-section		Connector for rated voltage	Mounting width of module	
			Signal or supply line	Additional jumper in connector [1]			
Crimp contact	-4UA12 [2]	42	0.5 mm^2	0.5 mm^2	5...60 V_	20 mm	Operation with fan
	-4UA22 [2]	42	0.5 mm^2	0.5 mm^2	5...60 V_	40 mm	Operation without fan
Screw contact	-4UB12	42	0.5...2.5 mm^2	0.5...1.0 mm^2	5...60 V_	40 mm	
	-4UB31	42	0.5...1.5 mm^2	0.5...1.0 mm^2	5...60 V_	20 mm	

3.5 Connecting Sensors to Analog Input Modules

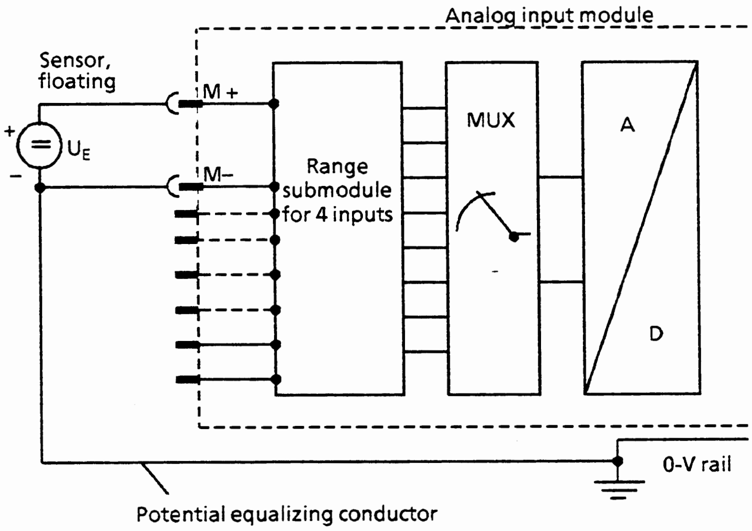
3.5.1 Connecting Current-type or Voltage-type Sensors

In the case of floating sensors it may occur that the measuring circuit assumes a potential against ground which exceeds the permissible potential difference U_{CM} (see maximum values of the individual modules). In order to prevent this, the negative potential of the sensor must be connected to the reference potential of the module (0-V rail).

[1] To provide multiple supply and earth potential connections and for connection of the enable input.

[2] For these connector types crimp contacts must be ordered separately.

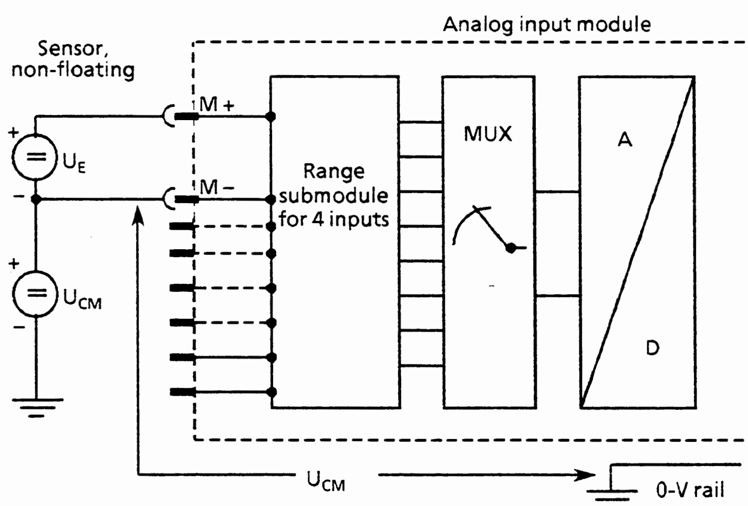
Example: Temperature measurement on a conductor rail with **isolated** thermocouples



In the worst case, the measuring circuit can develop an excessively high potential as a result of static charging or contact resistances. This must be prevented by a potential equalizing conductor.

With non-floating sensors, the permissible potential difference (U_{CM}) between the inputs and the 0-V rail must not be exceeded.

Example: The conductor rail temperature of an electroplating bath is to be measured with a **non-isolated** thermocouple.



The potential of the conductor rail with respect to the reference potential of the module is, for example, 24 V DC. An analog input module 460 with floating input is used (U_{CM} = 60 V AC/75 V DC). A potential equalizing conductor must not be installed in this case.

3.5.2 Connecting a Compensating Box for Thermo-electric Voltage Measurement

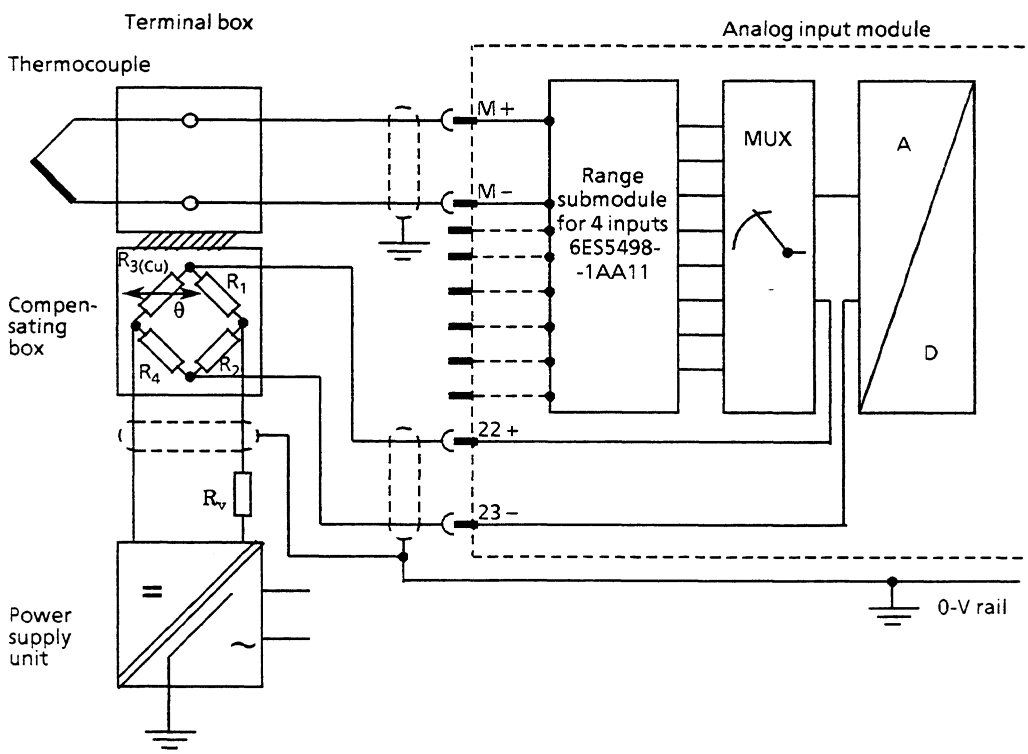
If room temperature fluctuations at the reference junction (e.g. in the terminal box) affect the measured result and the use of a thermostat is not desired, the influence of the temperature on the reference junction can be compensated for with a compensating box. For this purpose, the compensating box must be positioned so that it is in thermal contact with the terminals.

Of the four resistors, R1 to R4, of a compensating box which are arranged in a bridge circuit aligned at 0°C, R3 is temperature-dependent. In the event of a temperature deviating from 0°, a corresponding positive or negative compensating voltage is thus produced across the diagonal circuit of the bridge. Between -10 and 70°C, it cancels out the change in thermo-electric voltage caused by the temperature deviation (see Catalog MP 11 for compensating box). If the compensating box is aligned at 20°, this is to be taken into account when evaluating the temperature (20° measuring point temperature ≙ 0 mV).

With analog input modules, the group signal line leading out of the multiplexer is connected to pins 22 and 23 as an input for the compensating voltage. An input circuit which is common to all inputs must be set on mode switch 2.

The compensating box must be connected in a floating manner. The power supply unit of the compensating box must be equipped with a grounded shield winding in order to reject AC system interference.

A separate compensating box with its own separate power supply unit is required for each analog input module.

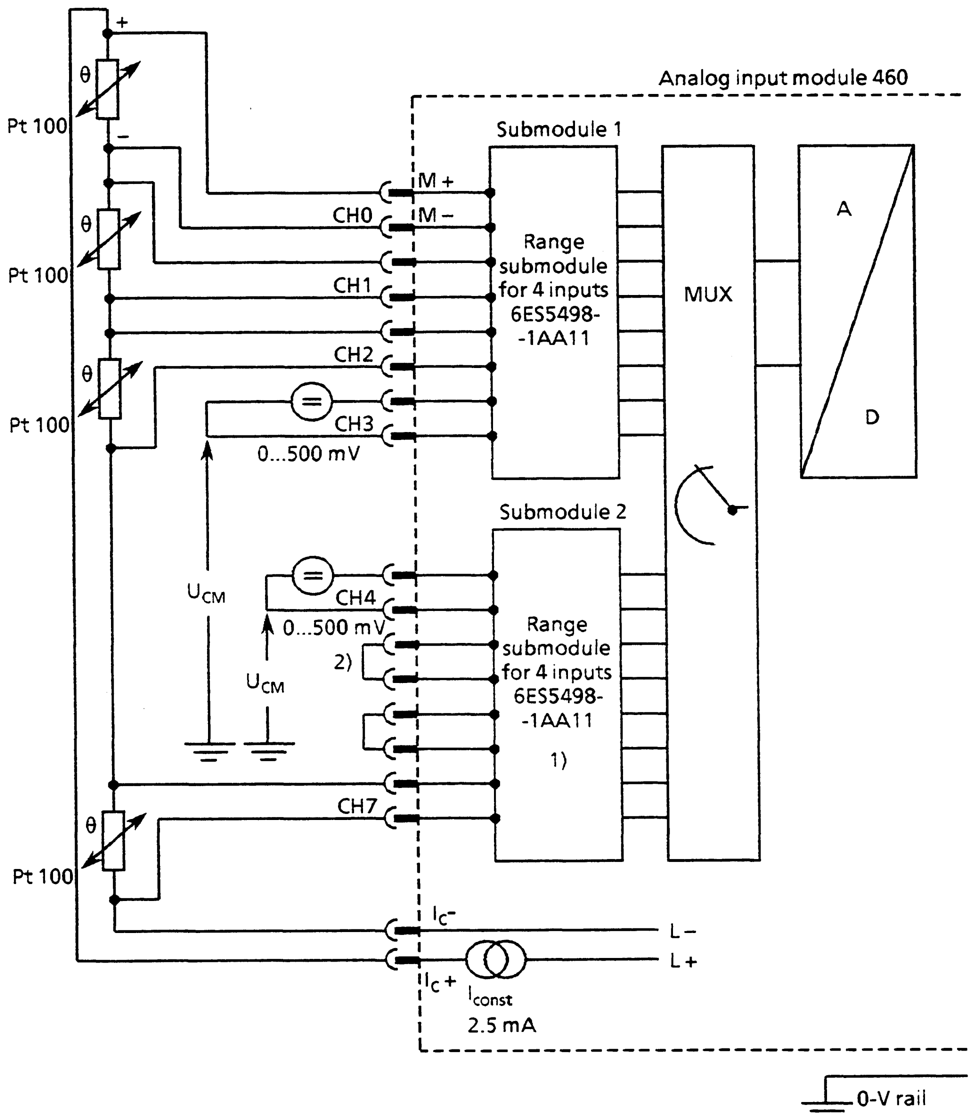


3.5.3 Connecting Resistance Thermometers (e.g. Pt 100) to Analog Input Modules 460

The resistance thermometers (maximum of 8 x Pt 100) which are connected in series are supplied with a current of 2.5 mA (I_C+/ I_C-) by a constant current generator. The voltage at the Pt 100 is picked off at measuring inputs M+ and M-.

A 100-ohm correction (100 ohms ≙ 0°C) must be executed by the CPU via the program.

Other voltage-type sensors can be connected in a floating arrangement (voltage range 500 mV) to inputs M+/M- of a submodule which have not been assigned to resistance thermometers.



1) If no PT 100 is connected to channels CH4 to CH7, other voltages and currents can be measured at these channels with the submodules 6ES5 498-1AA21, -1AA31, -1AA41, -1AA51, -1AA61 and -1AA71.

2) When the submodules 6ES5 498-1AA41, -1AA51 or -1AA71 are used, a short-circuit jumper is not necessary.

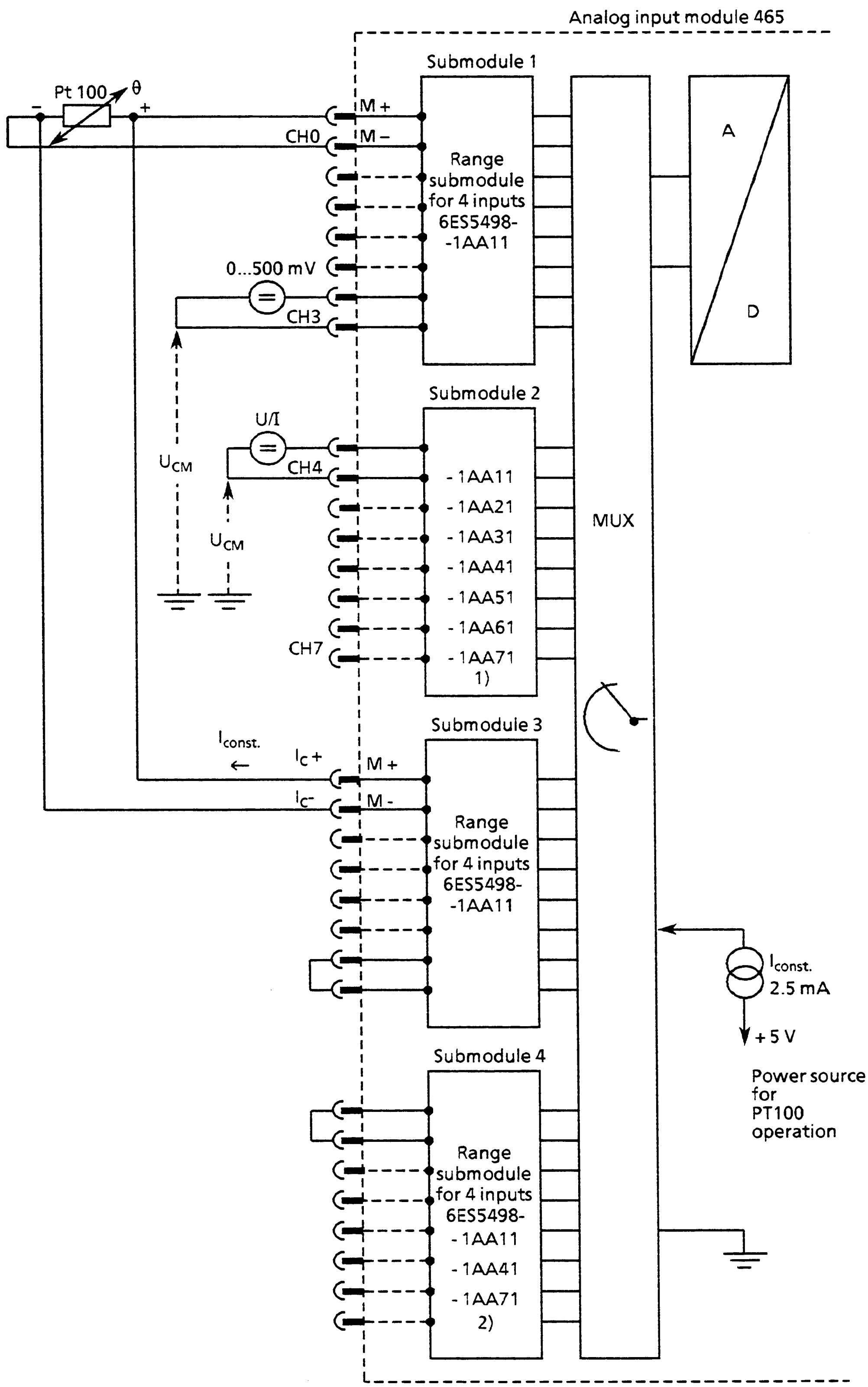
3.5.4 Connecting Resistance Thermometers (e.g. Pt 100) to Analog Input Modules 465

The resistance thermometer is supplied with a current of 2.5 mA (I_C+/I_C-) via a 6ES5498-1AA11 submodule by a constant current generator. The voltage at the Pt 100 is picked off at measuring inputs M+ and M-.

A 100-ohm correction (100 ohms ≙ 0°C) must be executed by the CPU via the program.

If resistance thermometers have been assigned to the inputs 0 to 3 only, other current-type and voltage-type sensors can be connected to the inputs 4 to 7 using the range submodules 6ES5 498 -1AA11, -1AA21, -1AA31, -1AA41, -1AA51, -1AA61 and -1AA71.

Note that the mode of the module must have been set to voltage range 500 mV.



1) When the submodules 6ES5 498-1AA21, -1AA31 and -1AA61 are used, open-circuit signalling may not be activated for this group of channels (CH4 to CH7).

2) When the submodules 6ES5 498-1AA41 and -1AA71 are used, a short-circuit jumper is not necessary.

3.5.5 Open-circuit Signalling with Resistance Thermometers

An open circuit in the lines to a resistance thermometer is indicated as follows:

Open-circuit at	Reaction of module, coded value	Error bit F 460	Error bit F 465
M+	0	1	1
M-	0	1	1
Pt 100	0 [1]	1	1
I_C+	0	0	0 [2]
I_C-	0	0	1

If the mode "without open-circuit signalling" is selected on the module, an open circuit at the resistance thermometer will be indicated with overflow.

Channels which have not been assigned can be used for voltage or current measurement if the supply outputs associated with the individual measuring channel are short-circuited by means of a wire jumper. Without this jumper, the error bit will be set for this channel and the value 0 coded.

Applies only to -4UA11:
The overflow bit remains active for approx. 1.5 s (] = 1), i.e. with cyclic operation all the remaining measuring points also indicate an overflow (] = 1). This is also the case with single scanning as long as the interval between two coding sequences is $\leq$ 1.5 s.

Applies only to -4UA12:
Switch 7 on the mode selection switch of the analog input module 465-4UA12 allows the I_{C+} lines to the resistance thermometer to be monitored for an open circuit when in the position "resistance thermometer". If there is an open circuit on this line the error bit will be set as on the other lines.

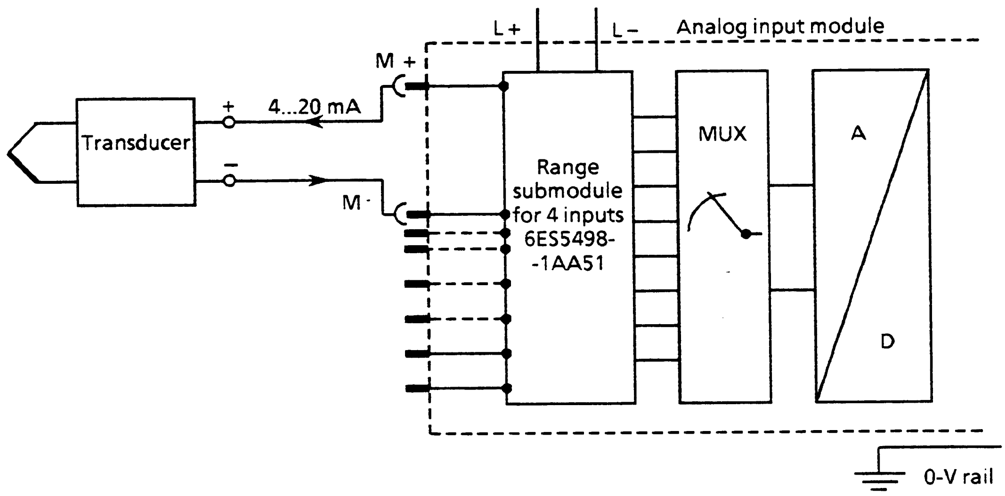
With analog input module 465, the switch 7 of mode switch I facilitates, when switched to "PT 100", open-circuit monitoring of the I_{C+} lines leading to the resistance thermometer (Pt-100 constant current supply). If there is an open circuit on these lines, the error bit will be set as on the other lines.

3) When the switch is in the position "voltage/current" (mV/mA), the I_{C+} lines are not monitored for open circuit (in the case of an open circuit on these lines, the error bit is not set, as with 465-4UA11). This position should only be selected to measure voltages and currents.

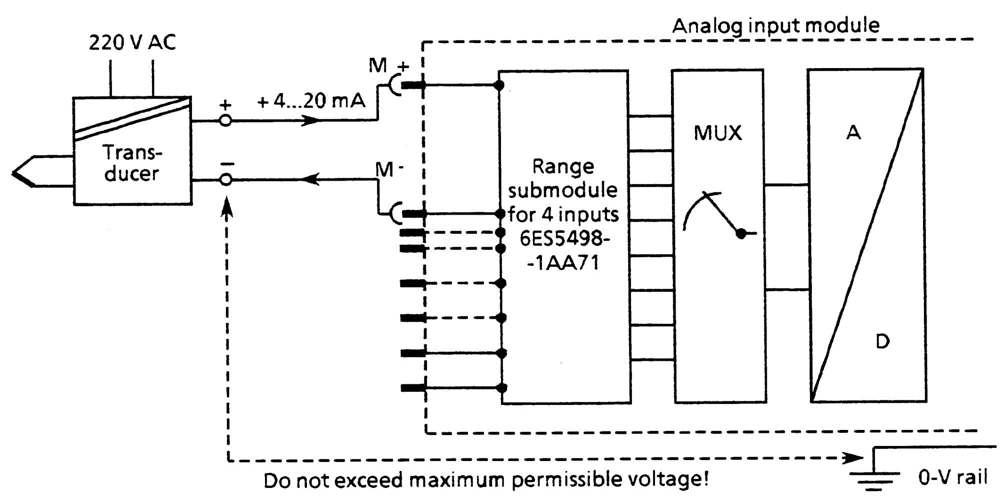
1) Because the auxiliary circuit is interrupted in the case of analog input module 460, the value 0 is coded also for unbroken Pt 100 resistors; the error bit is not set for these channels.
2) In case of analog input module 465-4UA12 the error bit is set to 1.
3) Reference from page 5-21, footnote 3).

3.5.6 Connecting Transducers

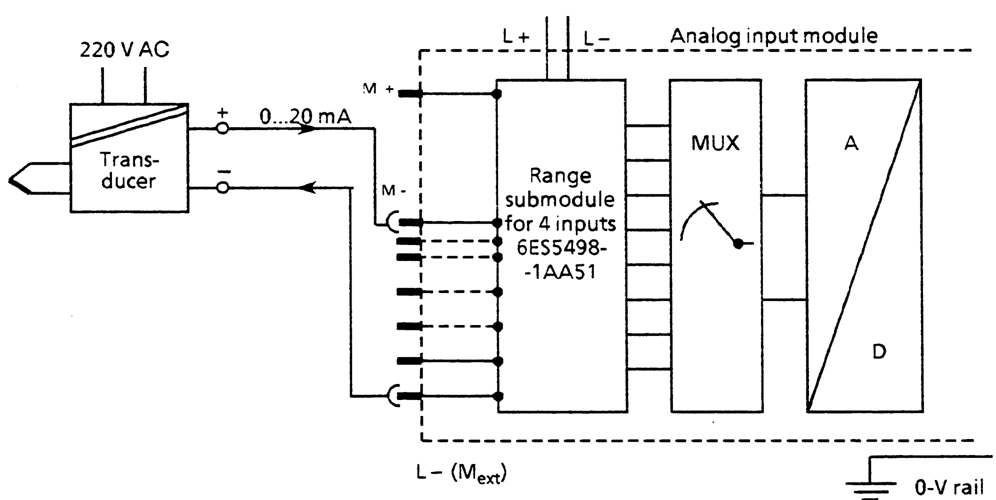
o **2-wire transducer (short-circuit-protected supply voltage via the range submodule of the analog input module)**



o **4-wire transducer (transducer with separate supply voltage)**

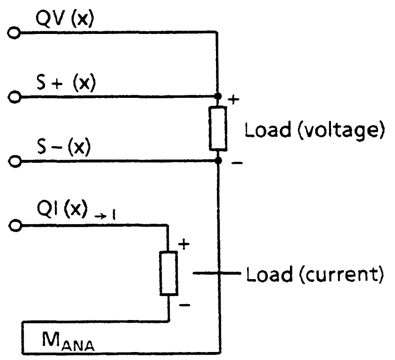


o **4-wire transducer connected to a 2-wire transducer module**



3.6 Connecting Loads to Analog Output Modules 470

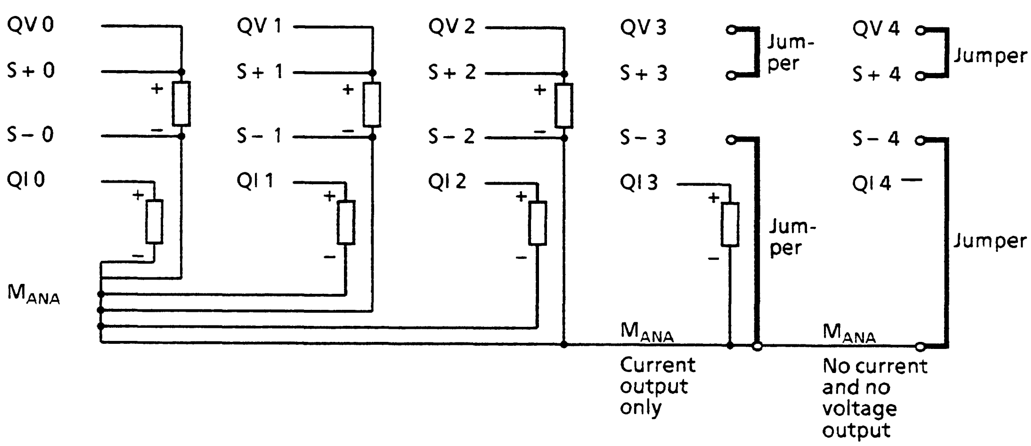
The voltage at the load is measured at high impedance via the sensor leads (S+/S-) of voltage output QV so that the load voltages are not falsified by voltage drops on the load lines. Leads S+(x) and S-(x) should therefore be directly connected to the load (4-wire circuit). The voltage drops on the lines from QV(x) to and from the load after M_{ANA} must not exceed 3 V.



QV(x)	Analog output, voltage on channels 0 to 7
QI(x)	Analog output, current on channels 0 to 7
S+(x)	Sensor lead (+) for channels 0 to 7
S-(x)	Sensor lead (-) for channels 0 to 7
M_{ANA}	Ground terminal of the analog section

3.6.1 Connecting Loads to Current and Voltage Outputs

If the current and voltage outputs are used with analog output modules 470-4UA/4UC.., the loads should be connected as follows:



When a load is connected to a voltage output and a large voltage drop is expected along the cables, the sensor lines S+(x) and S-(x) must be connected directly to the load.

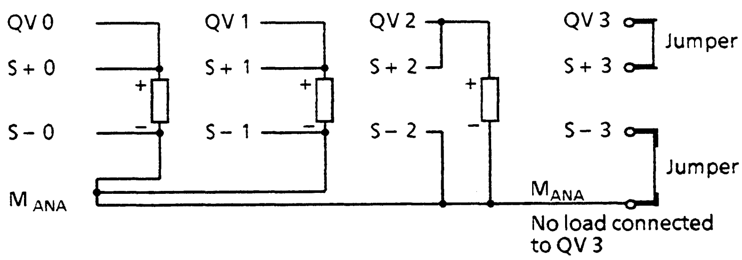
If the voltage outputs are not used, the sensor lines S+(x) must be connected in the front connector to the appropriate terminals of the voltage outputs (QV(x)) using wire jumpers. The sensor lines S-(x) must be connected to M_{ANA} using wire jumpers.

The same jumpers must also be inserted if only current outputs are used. Unused current outputs can be left open.

The maximum load for the current outputs, including the conductor resistance, must not exceed 300 ohms.

3.6.2 Connecting Loads to Voltage Outputs

The voltage outputs of the analog output module 470-4UB.. are wired as follows:



The sensor leads S+(x) and S-(x) must be wired to the load (four-wire circuit), if the voltage drop in the lines leading to the load cannot be ignored. The common connection for the voltage outputs is M_{ANA}. If the voltage drop in the lines leading to the load can be ignored, then, in the front connector, S+(x) can be connected with QV(x), and S-(x) with M_{ANA}.

If voltage outputs are not used, jumpers must be inserted in the front connector, e.g. QV(3) to S+(3) and S-(3) to M_{ANA} for unused voltage output 3 (see Chapter 3.6.1).

4 Spare Parts

Description	Order no.	Repairable	Order from
Miniature spring contact (Junior timer)			
Strip version	927973-3	N	Company AMP
250 individual contacts	927973-2 or 6XX3070	N	Company AMP
Spare labels for modules		N	Siemens GWK
6ES5 460-4UA11	C79451-A3079-C711		
-4UA12	C79451-A3079-C723		
6ES5 463-4U.11	C79451-A3079-C721		
-4U.12	C79451-A3079-C746		
6ES5 465-4UA11	C79451-A3079-C712		
-4UA12	C79451-A3079-C748		
6ES5 470-4UA11	C79451-A3079-C713		
-4UA12	C79451-A3079-C724		
6ES5 470-4UB11	C79451-A3079-C714		
-4UB12	C79451-A3079-C725		
6ES5 470-4UC11	C79451-A3079-C715		
-4UC12	C79451-A3079-C726		
Spare labels for addresses	6ES5 497-4UD11	N	GWK
42-way front connector (crimp contacts)			
20 mm	6ES5 497-4UA12	N	GWK
40 mm	6ES5 497-4UA22	N	GWK
42-way front connector (screw contacts)			
20 mm	6ES5 497-4UB31	N	GWK
40 mm	6ES5 497-4UB12	N	GWK

N = Not repairable
R = Repairable

5 Description of the Individual Modules

5.1 Analog Input Module 6ES5 460-4UA11

5.1.1 Technical Data

Rated input range with submodules for 4 channels each	
6ES5498-1AA11	±50 mV/±500 mV/Pt 100 [1)]
6ES5498-1AA21	±1 V
6ES5498-1AA31	±10 V
6ES5498-1AA41	±20 mA
6ES5498-1AA51	4 to 20 mA for 2-wire transd.
6ES5498-1AA61	±5 V
6ES5498-1AA71	4 to 20 mA for 4-wire transd.
Number of inputs	8 voltage/current inputs or 8 resistance inputs (Pt 100)
Measured-value representation	13 bits (two's complement) or 12 bits + sign; ±2048 units in rated range; 512 to 2560 units for 4 to 20 mA
Measuring principle	Integrating
Conversion principle	Voltage-time conversion (dual slope)
Isolation	Yes; 8 inputs between 0-V ref. and between inputs (not between Pt 100 inputs)
Permissible potential difference between the reference potentials of sensors and the module (U_{CM}), and between the sensors (channels)	Max. 60 V AC/75 V DC
Power supply	
- digital section from system bus	5 V ± 5%; typ. 150 mA
- analog section from load voltage	24 V; approx. 100 mA [2)]
- module enable F+/F-	24 V; approx. 5 mA
Constant current source for Pt 100 connection I_c+/I_c-	2.5 mA; TC = ±5 x 10^{-5}/K
Integration time	20 ms at 50 Hz; $16^2/_3$ ms at 60 Hz
Coding time per measured value	60 ms at 50 Hz; 50 ms at 60 Hz

1) 0 to 200 ohms ≙ -220 to 266°C
0 to 400 ohms ≙ -220 to 850°C
(overdriving range)

2) Plus 20 mA max. per 2-wire transducer connected

Cycle time for 8 measured values with 2048 units (max. delay time of measured-value acquisition)	Approx. 0.48 s at 50 Hz
Input impedance (with submodule) for input ranges	
- $\pm$50 mV/$\pm$500 mV/Pt 100	$\geq$ 10 Mohms
- $\pm$1 V	90 kohms
- $\pm$5 V/$\pm$10 V	50 kohms
- $\pm$20 mA	25 ohms
- 4 to 20 mA	31.25 ohms
Fault signal	
- on overflow	Yes, for all channels together
- on open circuit	Yes, configurable (at $\pm$50 mV, $\pm$500 mV and Pt 100 [1]))
Max. permissible input voltage without destruction	$\pm$18 V; 75 V for max. of 1 ms and duty factor of 1:20
Noise suppression for f = n x (50/60 Hz $\pm$ 1%)	
- with common-mode interference	$\geq$ 100 dB
- with differential-mode interference	$\geq$ 40 dB, noise voltage amplitude, but 100% of measurement range referred to peak value
Error, referred to rated value	
- linearity	$\pm$1 unit
- tolerance	$\pm$1 unit
- reversal error	$\pm$1 unit
- temperature error	1×10^{-4}/K
Error caused by submodules in input range	
- $\pm$1 V/$\pm$5 V/$\pm$10 V	2×10^{-3}; TC = $\pm 10 \times 10^{-5}$/K
- $\pm$20 mA/4 to 20 mA	10^{-3}; TC = $\pm 5 \times 10^{-5}$/K
Insulation voltage according to VDE 0160	Between inputs and ground point: tested with 500 V AC
Impulse test according to IEC 266-4	Between inputs and L-: U_s = 1 kV; 1.2/50 µs
Service life of relays	10^9 cycles; $\geq$ 12 years of cyclic operation with 400-ms cycle

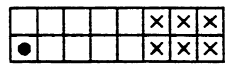
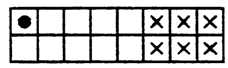
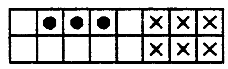
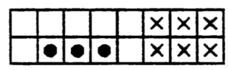
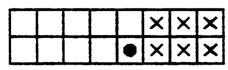
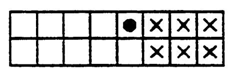
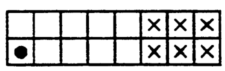
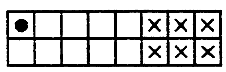
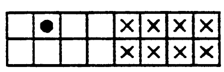
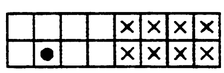
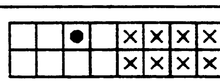
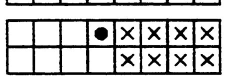
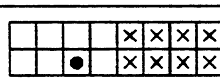
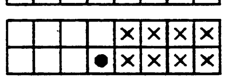
[1]) In the event of an open circuit in current-carrying lines I_c+ and I_c-, digital value 0 is indicated.

5.1.2 Selecting the Mode

The desired mode of the analog input module is selected by setting mode switches I and II according to the check list.

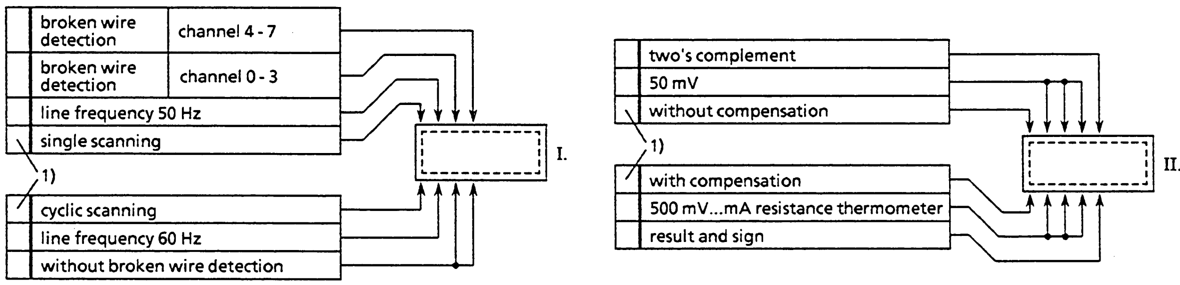
It should be noted that all individual dip switches of the two mode switch blocks marked with a dot must be set.

For selecting the desired operating mode, the switches are pressed downwards on the side marked with a dot.

Mode	Mode switch I (digital section)	Mode switch II (analog section)
Reference junction compensation with		
without		
Range 50 mV		
500 mV; mA		
Absolute value and sign		
Two´s complement		
Scanning cyclic		
single		
Mains frequency 50 Hz		
60 Hz		
Channels 0...3 with open-circuit signal		
channels 4...7		
Channels 0...3 without open-circuit signal		
channels 4...7		

X: switch is not used, any switch position is allowed.

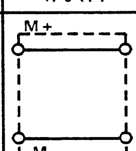
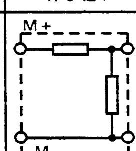
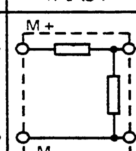
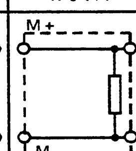
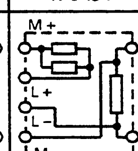
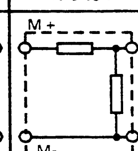
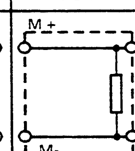
Labelling of the switches on the module cover:



5.1.3 Range Submodule Complement

Two submodules for connecting 4 inputs respectively can be plugged into one analog input module 460, being held in place by means of a screw.

Voltage divider, shunt and continuity submodules for the various measurement ranges are available.

	Range submodule type 6ES5 498-						
	-1AA11	-1AA21	-1AA31	-1AA41	-1AA51	-1AA61	-1AA71
Submodule circuits, 4x in each case							
Mode 500 mV/ mA/Pt 100	±500 mV Pt 100	±1 V	±10 V	±20 mA	4...20 mA 2-wire transducer	±5 V	4...20 mA 4-wire transducer
Mode 50 mV	±50 mV	(±100 mV) 2)	(±1 V) 2)	(±2 mA) 2)	-	(±500 mV) 2)	-

For one specified mode (50 mV or 500 mV), submodules of different measurement ranges can be plugged in for every 4 inputs. For the 500-mV mode, for example:

4 inputs, measurement range ±500 mV; 1 submodule 6ES5498-1AA11
4 inputs, measurement range ±10 V; 1 submodule 6ES5498-1AA31

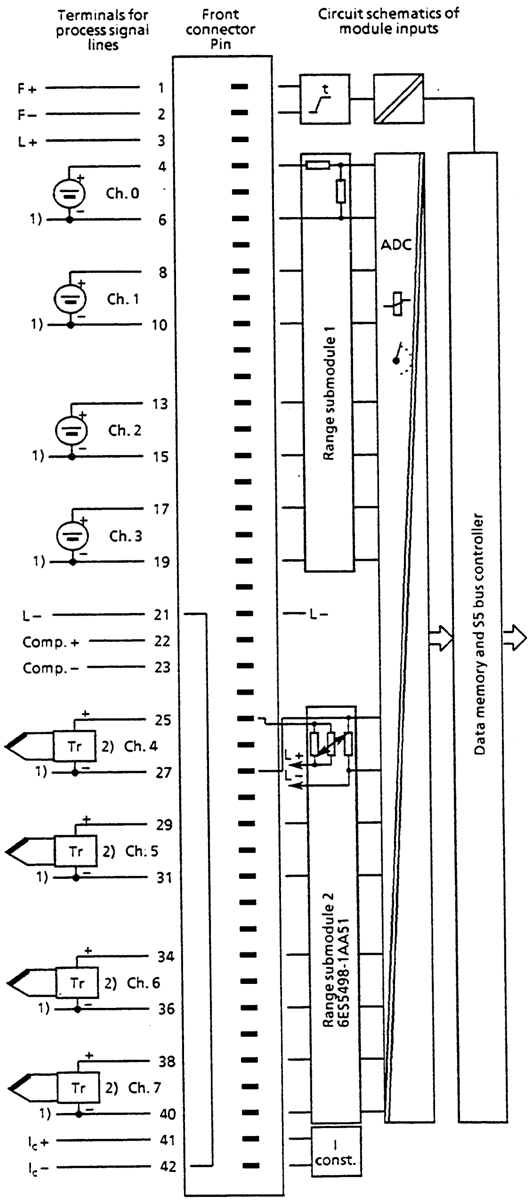
Unused inputs must be terminated with a submodule. If voltage divider or shunt submodules are used, then no jumpers need be inserted in the front connector. With continuity submodules, jumpers must be inserted in the front connector.

If open-circuit signalling can be activated for the unused inputs, terminating submodules are not necessary.

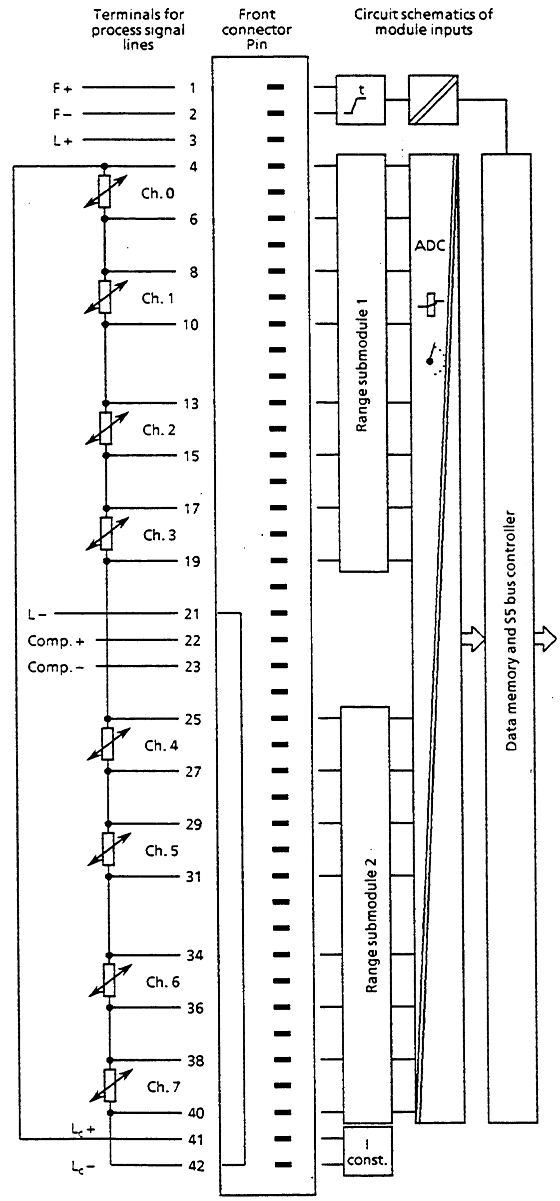
1) These fields are provided to mark the selected switch position.
2) Possible combination for 50 mV, but with greater error

5.1.4 Pin Assignments of the Front Connector

Voltage or current input or connection of 2-wire transducer



Resistance thermometers



Connection of 2-wire transducers is only possible with 500-mV mode.

Connect L- to central ground point (reference potential).

1) Keep to the permissible potential difference between the sensor ground and the reference potential of the modules, and between the sensor grounds

2) 2-wire transducer

5.2 Analog Input Module 6ES5 460-4UA12

5.2.1 Technical Data

Rated input range with submodules for 4 channels each	
6ES5498-1AA11	±12.5 mV/±50 mV/±500 mV/Pt 100 1)
6ES5498-1AA21	±1 V
6ES5498-1AA31	±10 V
6ES5498-1AA41	±5 mA/±20 mA
6ES5498-1AA51	4 to 20 mA for 2-wire transd.
6ES5498-1AA61	±5 V
6ES5498-1AA71	4 to 20 mA for 4-wire transd.
Number of inputs	8 voltage/current inputs or 8 resistance inputs (Pt 100)
Measured-value representation	13 bits (two's complement) or 12 bits + sign; ±2048 units in rated range; 512 to 2560 units for 4 to 20 mA
Measuring principle	Integrating
Conversion principle	Voltage-time conversion (dual slope)
Isolation	Yes; 8 inputs between 0-V ref. and between inputs (not between Pt 100 inputs)
Permissible potential difference between the reference potentials of sensors and the module (U_{CM}), and between the sensors (channels)	Max. 60 V AC/75 V DC
Power supply	
- Digital section from system bus	5 V ± 5%; typ. 150 mA
- Analog section from load voltage	24 V; approx. 100 mA 2)
- Module enable F+/F-	24 V; approx. 5 mA
- Test current disable L+	24 V; approx. 5 mA
Constant current source for Pt 100 connection I_{c+}/I_{c-}	2.5 mA; TC = $\pm 5 \times 10^{-5}$/K
Integration time	20 ms at 50 Hz; $16^2/_3$ ms at 60 Hz
Coding time per measured value	60 ms at 50 Hz; 50 ms at 60 Hz

1) 0 to 200 ohms ≙ -220 to 266°C
0 to 400 ohms ≙ -220 to 850°C
(overdriving range)

2) Plus 20 mA max. per 2-wire transducer connected

Cycle time for 8 measured values with 2048 units (max. delay time of measured-value acquisition)	Approx. 0.48 s at 50 Hz
Input impedance (with submodule) for input ranges	
- ±12.5 mV/±50 mV/±500 mV/Pt 100	≥ 10 Mohms
- ±1 V	90 kohms
- ±5 V/±10 V	50 kohms
- ±5 mA/±20 mA	25 ohms
- 4 to 20 mA	31.25 ohms
Fault signal, specific to measuring points,	
- on overflow	Yes
- on open circuit	Yes, configurable (at ±12.5 mV, ±50 mV, ±500 mV and Pt 100 [1]))
Max. permissible input voltage without destruction	±18 V; 75 V for max. of 1 ms and duty factor of 1:20
Noise suppression for f = n x (50/60 Hz ± 1%)	
- with common-mode interference	≥ 100 dB
- with differential-mode interference	≥ 40 dB, noise voltage amplitude, but 100% of measurement range referred to peak value
Error, referred to rated value	
- linearity	±1 unit
- tolerance	
with ≥50 mV	±1 unit
with ±12.5 mV	±3 units
- reversal error	
with ≥50 mV	±1 unit
with ±12.5 mV	±2 units
- temperature error	1×10^{-4}/K
Error caused by submodules in input range	
- ±1 V/±5 V/±10 V	2×10^{-3}; TC = $\pm 10 \times 10^{-5}$/K
- ±20 mA/4 to 20 mA	10^{-3}; TC = $\pm 5 \times 10^{-5}$/K
Insulation voltage according to VDE 0160	Between inputs and ground point: tested with 500 V AC
Impulse test according to IEC 266-4	Between inputs and L-: U_s = 1 kV; 1.2/50 µs
Service life of relays	10^9 cycles; ≥ 12 years of cyclic operation with 400-ms cycle

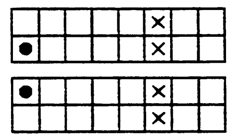
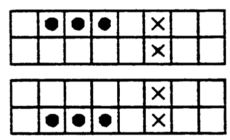
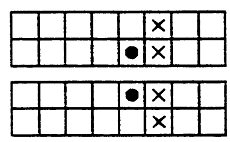
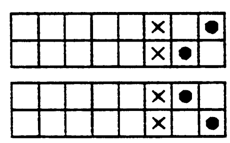
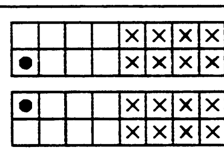
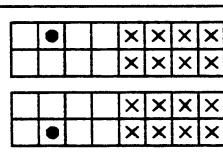
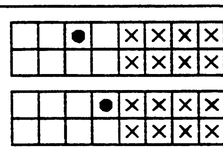
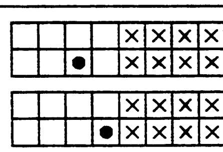
[1]) In the event of an open circuit in current-carrying lines I_c+ and I_c-, digital value 0 is indicated.

5.2.2 Selecting the Mode

The desired mode of the analog input module is selected by setting mode switches I and II according to the check list.

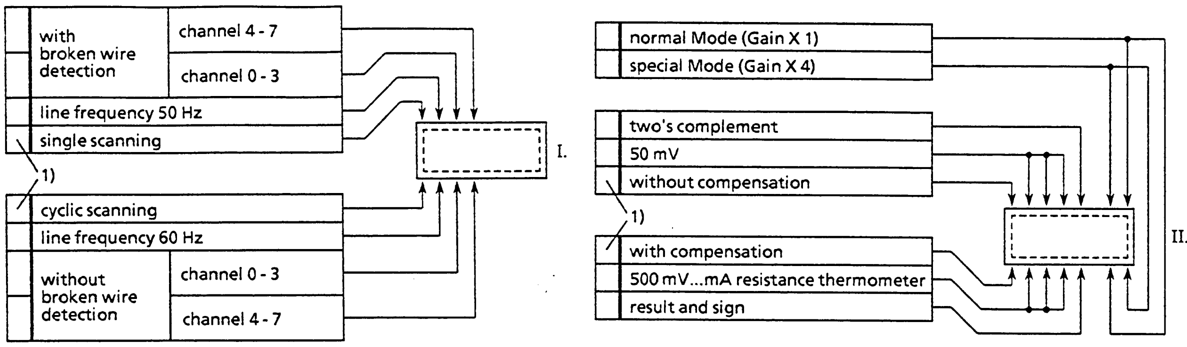
It should be noted that all individual dip switches of the two mode switch blocks marked with a dot must be set.

For selecting the desired operating mode, the switches are pressed downwards on the side marked with a dot.

Mode	Mode switch I (digital section)	Mode switch II (analog section)
Reference junction compensation with without		
Range 50 mV 500 mV; mA		
Absolute value and sign Two´s complement		
Gain x 1 (normal setting) Gain x 4		
Scanning cyclic single		
Mains frequency 50 Hz 60 Hz		
Channels 0..3 with open-circuit signal Channels 4...7		
Channels 0..3 without open-circuit signal Channels 4...7		

X: switch is not used, any switch position is allowed.

Labelling of the switches on the module cover:



5.2.3 Range Submodule Complement

Two submodules for connecting 4 inputs respectively can be plugged into one analog input module 460, being held in place by means of a screw.

Voltage divider, shunt and continuity submodules for the various measurement ranges are available.

	Range submodule type 6ES5 498-						
	-1AA11	-1AA21	-1AA31	-1AA41	-1AA51	-1AA61	-1AA71
Submodule circuits, 4x in each case	M+ M-	M+ M-	M+ M-	M+ M-	M+ L+ L- M-	M+ M-	M+ M-
Mode 500 mV/ mA/Pt 100 +Gain x 1	±500 mV Pt 100	±1 V	±10 V	±20 mA	4...20 mA 2-wire transducer	±5 V	4...20 mA 4-wire transducer
Mode 500 mV +Gain x 1	±50 mV	(±100 mV) 2)	(±1 V) 2)	(±2 mA) 2)	-	(±500 mV) 2)	-
Mode 500 mV/mA +Gain x 4	±125 mV 2)	±250 mV 2)	±2,5 V 2)	±5 mA 2)	-	±1,25 V 2)	-
Mode 50 mV +Gain x 4	±12,5 mV 2)	±25 mV 2)	-	±1,25 mA 2)	-	-	-

For one specified mode (50 mV or 500 mV), submodules of different measurement ranges can be plugged in for every 4 inputs. For the 500-mV mode, for example:

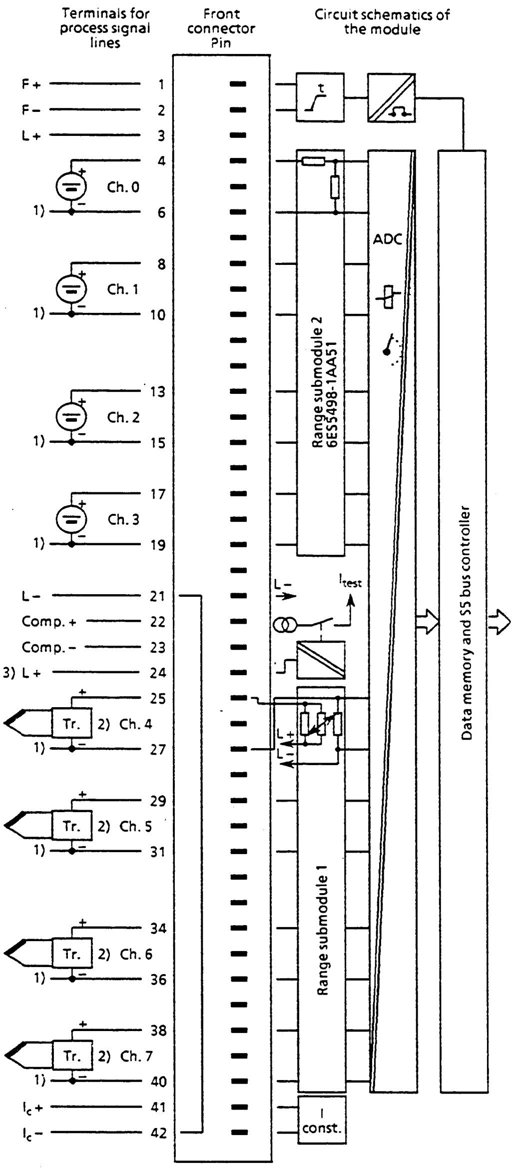
4 inputs, measurement range ±500 mV; 1 submodule 6ES5498-1AA11
4 inputs, measurement range ±10 V; 1 submodule 6ES5498-1AA31

Unused inputs need not be short-circuited.

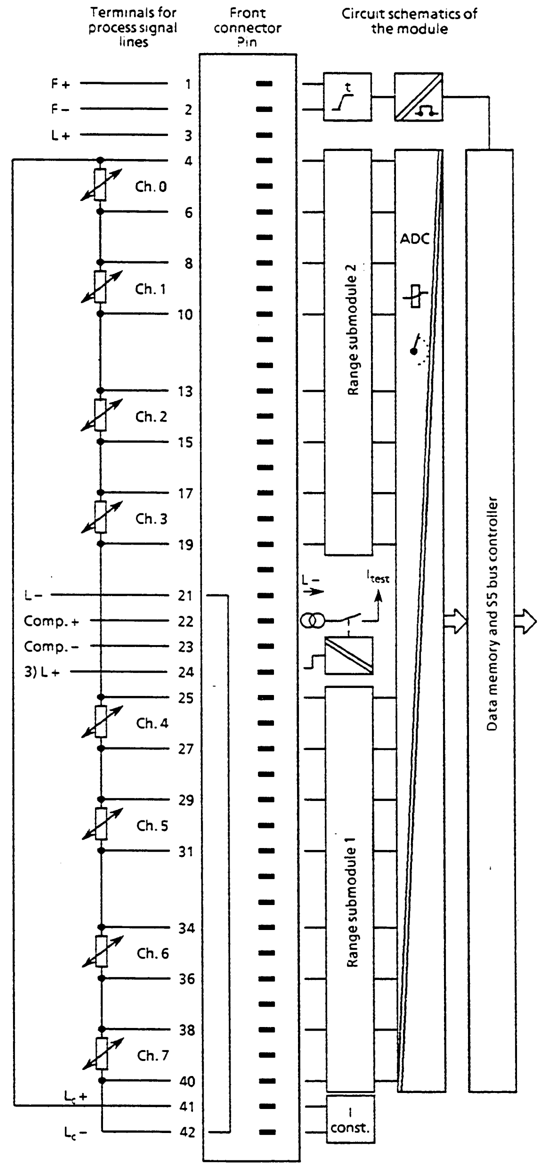
1) These fields are provided to mark the selected switch position.
2) Possible combination for 50 mV, but with greater error

5.2.4 Pin Assignments of the Front Connector

Voltage or current input or connection of 2-wire transducer



Resistance thermometers



Connection of 2-wire transducers is only possible with 500-mV mode.

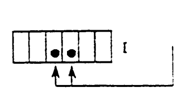
Connect L- to central ground point (reference potential).

1) Keep to the permissible potential difference between the sensor ground and the reference potential of the modules, and between the sensor grounds

2) 2-wire transducer

3) Only necessary for switching off the test current with open-circuit signalling inactive; 0 V to L- (see Chap. 1.3.1)

Position of switch I with open-circuit signalling inactive



without broken wire detection

5.3 Analog Input Module 6ES5 463-4UA11/-4UA12 and 463-4UB11/-4UB12

5.3.1 Technical Data

Rated input range (adjustable on front connector)	-0.05 to +1 V -0.5 to +10 V -1 to +20 mA +4 to 20 mA for 2-wire transd. +4 to 20 mA for 4-wire transd.
Number of inputs	4 voltage/current inputs
Measured-value representation	11 bits (two's complement) 1024 units in rated range
Overdriving range	100% (with full accuracy)
Fault signal on overflow	Yes (when overdrive is 50% or more)
Measuring principle	Integrating
Conversion principle	Voltage/frequency conversion
Electrical isolation	Yes; between 4 inputs and M and between the inputs
Permissible potential difference between reference potentials of sensors and module (U_{CM}) and between the sensors (channels)	Max. 25 V AC/60 V DC
Power supply	
- digital section from system bus	5 V $\pm$ 5%; typ. 150 mA
- analog section from load voltage	24 V, approx. 150 mA
- module enable F+/F-	24 V; approx. 7 mA
Integration time	
- 463-4UA11/-4UA12	20 ms at 50 Hz
- 463-4UB11/-4UB12	$16^2/_3$ ms at 60 Hz
Coding time per measured value	
- 463-4UA11/-4UA12	20 ms at 50 Hz
- 463-4UB11/-4UB12	$16^2/_3$ ms at 60 HZ
Cycle time for 4 measured values (max. delay time of measured-value acquisition)	
- 463-4UA11/-4UA12	20 ms at 50 Hz
- 463-4UB11/-4UB12	$16^2/_3$ ms at 60 Hz
Input impedance for input ranges	
- 1 V	> 10 Mohms
- 10 V	90 kohms
- 20 mA	50 ohms
- 4 to 20 mA	62.5 ohms

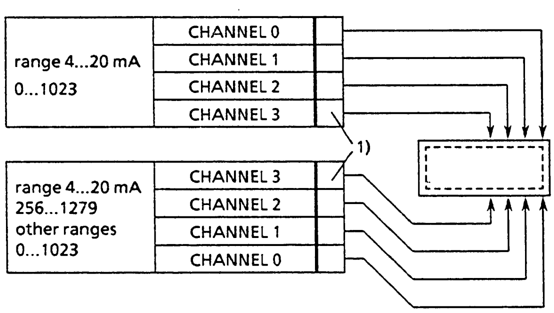
Max. permissible input voltage without destruction	$\pm$30 V; 75 V for 1 ms max. and duty factor 1:10
Noise suppression for	
- common-mode interference	$\geq$ 80 db (f = 0 to 50 kHz)
- differential-mode interference	$\geq$ 40 dB ($U_{St\,|\,r} \leq 0.1 * U_N$) measurement range, referred to the peak value
Error, referred to rated value	
- linearity	$\pm 5 \times 10^{-4}$
- tolerance	$\pm$1 unit
- temperature error	0.6×10^{-4}/K
Insulation voltage according to VDE 0160	Between inputs and ground point and between inputs: tested with 500 V AC
Impulse voltage test acc. to IEC 266-4	Between inputs and L-: U_s = 1 kV; 1.2/50 μs

5.3.2 Selecting the Data Format for the Range of 4 to 20 mA

When using the 4- to 20-mA inputs data representation can be selected either from 0 to 1023 bits or from 256 to 1279 bits by pressing the corresponding switch. In this case, different data formats can be selected for each of the four input channels.

When using the voltage or 0- to 20-mA inputs the corresponding switches remain in the "Off" position.

Labelling of the switches on the module cover



● Switch position "On" (pressed)

1) These fields are provided to mark the selected switch position

5.3.3 Connecting Sensors

The sensors are connected to the analog input module via shielded cables with a maximum length of 200 m. If these measuring cables are laid separately from power cables, the permissible length can be increased to 500 m.

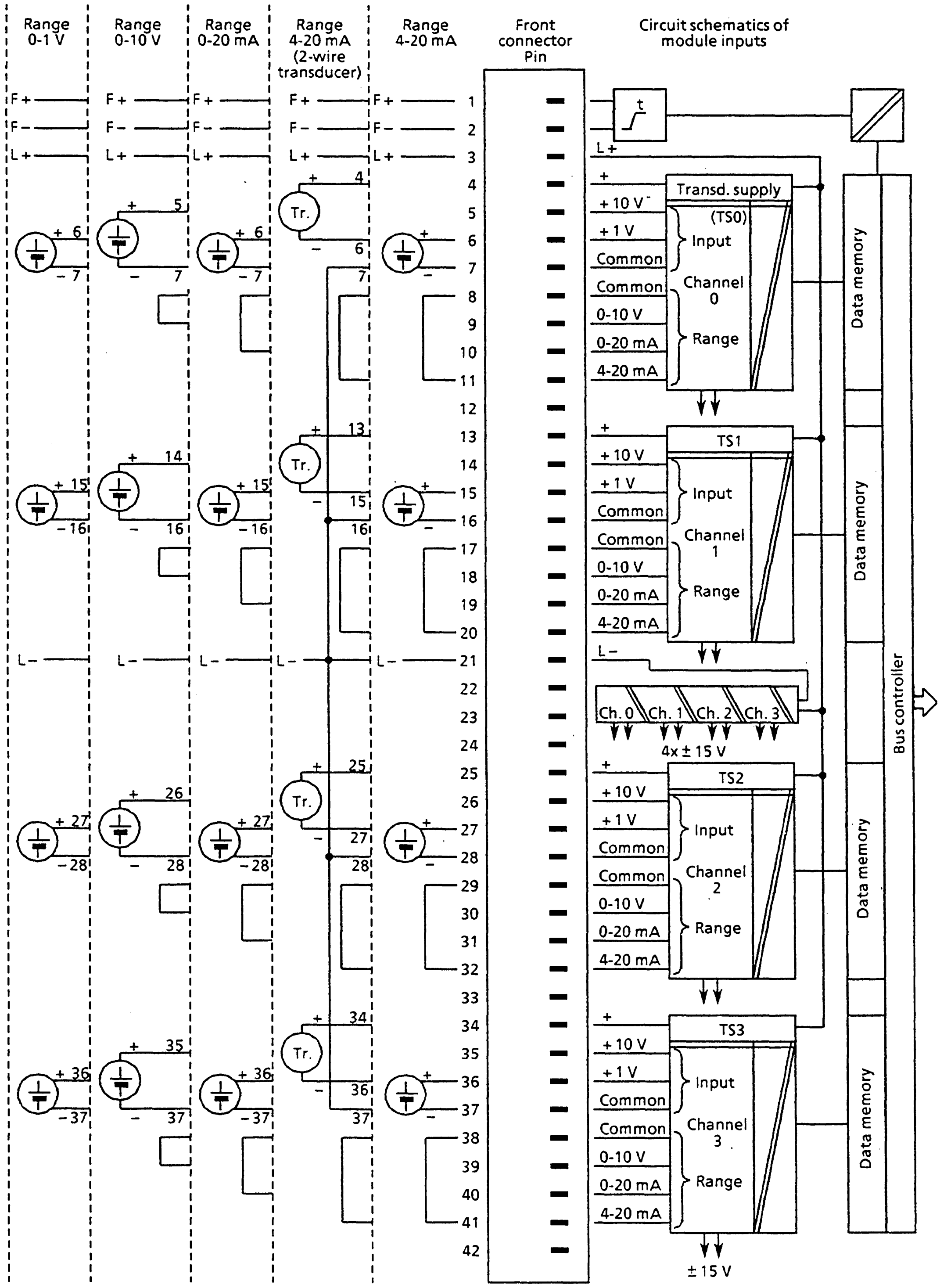
Voltage sensors, current sensors, 2-wire and 4-wire transducers can be connected in any combination as required. Four short-circuit-proof supply terminals are provided on the front connector for the connection of 2-wire transducers.

Caution: When using 2-wire transducers the reference potential (common input) of these channels must be connected to L-. The electrical isolation between the channels and the supply voltage L+/L- is thus inactivated.

Remember that the module's bus interface is activated with 24 V applied to the enable pins F+ and F- on the front connector.

5.3.4 Pin Assignments of the Front Connector

Connection of process signal lines and range setting



5.4 Analog Input Module 6ES5 465-4UA11

5.4.1 Technical Data

Rated input range with submodules for 4 channels each	
6ES5498-1AA11	±50 mV/±500 mV/Pt 100 1)
6ES5498-1AA21	±1 V
6ES5498-1AA31	±10 V
6ES5498-1AA41	±20 mA
6ES5498-1AA51	4 to 20 mA for 2-wire transd.
6ES5498-1AA61	±5 V
6ES5498-1AA71	4 to 20 mA for 4-wire transd.
Number of inputs	16 voltage/current inputs or 8 resistance inputs (Pt 100)
Measured-value representation	13 bit (two's complement) or 12 bits + sign ±2048 units in rated range; 512 to 2560 units at 4 to 20 mA
Measuring principle	Integrating
Principle of conversion	Voltage/time conversion (dual-slope)
Electrical isolation	No
Permissible potential difference between the reference potentials of sensors and the module (U_{CM}) and between the sensors (channels)	Max. ±1 V
Power supply	
- digital section from system bus	5 V ±5%, typ. 150 mA
- analog section from load voltage	24 V 2)
- module enable F+/F-	24 V; approx. 5 mA
Constant current source for Pt 100 connection I_c+/I_c-	2.5 mA; TC = $\pm 5 \times 10^{-5}$/K
Integration time	20 ms at 50 Hz; $16^2/_3$ ms at 60 Hz
Coding time per measured value with 2048 units	60 ms at 50 Hz; 50 ms at 60 Hz

1) 0 to 200 ohms ≙ -220 to 266°C;
0 to 400 ohms ≙ -220 to 850°C
(overdriving range)

2) Only necessary for 2-wire transducers. Max. 20 mA per transd.

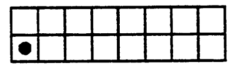
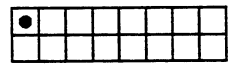
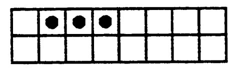
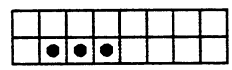
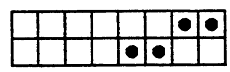
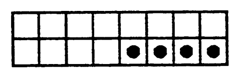
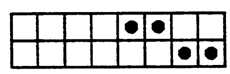
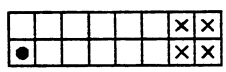
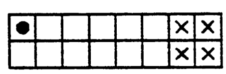
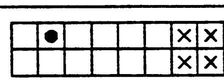
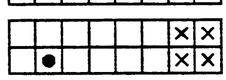
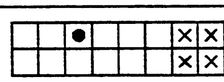
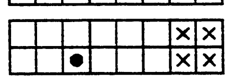
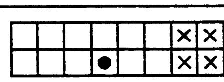
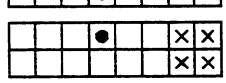
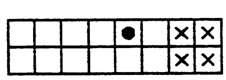
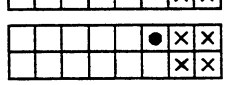
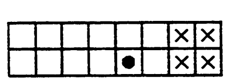
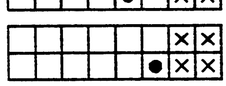
- for 8 measured values with 2048 units	Approx. 0.48 s at 50 Hz
- for 16 measured values with 2048 units	Approx. 0.96 s at 50 Hz
Input impedance (with module) for input ranges	
- ±50 mV/±500 mV/Pt 100	≥ 10 Mohms
- ±1 V	90 kohms
- ±5 V/±10 V	50 kohms
- ±20 mA	25 ohms
- 4 to 20 mA	31.25 ohms
Fault signal	
- on overflow	Yes
- on open circuit	Yes, configurable (at ±50 mV, ±500 mV and Pt 100)
Max. perm. input voltage without destruction	±18 V; 75 V for max. 1 ms and duty factor 1:20
Noise suppression for f = n x (50/60 Hz ±1%)	
- with common-mode interference	≥ 86 dB; but max. ±1 V
- with differential mode interference	≥ 40 dB, noise voltage amplitude but max. 100% of measurement range, referred to peak value
Error, related to nominal value	
- linearity	±1 unit
- tolerance	±1 unit
- error in reversal	±1 unit
- temperature fault	1×10^{-4}/K
Error caused by modules at input range	
- ±1 V/±5 V/±10 V	2×10^{-3}; TC = $\pm 10 \times 10^{-5}$/K
- ±20 mA/4 to 20 mA	1×10^{-3}; TC = $\pm 5 \times 10^{-5}$/K

5.4.2 Setting the Mode

The desired mode of the analog input module is selected by setting mode switches I and II according to the check list.

It should be noted that all individual dip switches of the two mode switch blocks marked with a dot must be set, and some functions are defined by several dip switches (e.g. 8 or 16-channel operation, open-circuit signal for 8 or 16 channels).

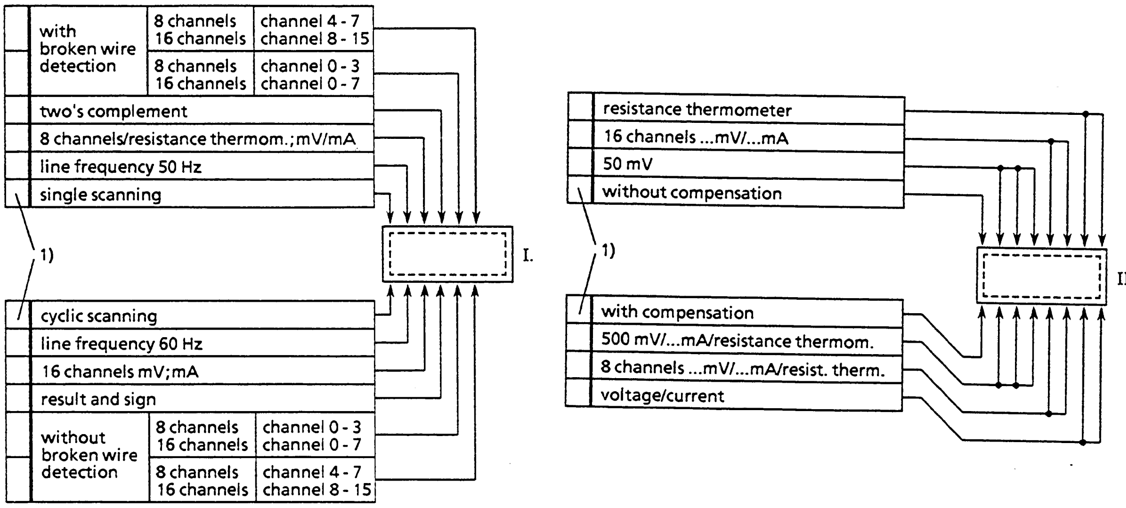
To select the desired operating modes, the switches are pressed downwards on the side marked with a dot.

Mode	Mode switch I (digital section)	Mode switch II (analog section)
Reference junction compensation with		
without		
Range 50 mV		
500 mV; Pt 100		
Pt 100 in 4-wire circuit 8 channels		
Current or voltage measurement 8 channels		
Current or voltage measurement 16 channels		
Scanning cyclic		
single		
Mains frequency 50 Hz		
60 Hz		
8 channels		
16 channels		
Absolute value and sign		
Two´s complement		
with open-circuit signal Channels 0 . . . 3 1) Channels 0 . . . 7 2)		
Channels 4 . . . 7 1) Channels 8 . . . 15 2)		
without open-circuit signal Channels 0 . . . 3 1) Channels 0. . . 7 2)		
Channels 4 . . . 7 1) Channels 8 . . . 15 2)		

X: switch is not used, any switch position is allowed.

1) With 8 channels 2) With 16 channels

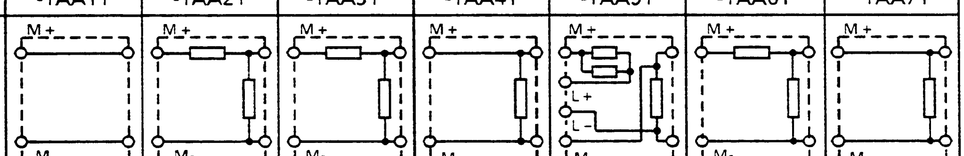
Labelling of the switches on the module cover:



5.4.3 Range Submodule Complement

Four submodules for connecting four inputs respectively can be plugged into an analog input module 465, being held in place with a screw.

Voltage divider, shunt and continuity submodules for the various measurement ranges are available.

	Range submodule type 6ES5 498-						
	-1AA11	-1AA21	-1AA31	-1AA41	-1AA51	-1AA61	-1AA71
Submodule circuits, 4x in each case							
Mode 500 mV/ mA/Pt 100	±500 mV Pt 100	±1 V	±10 V	±20 mA	4...20 mA 2-wire transducer	±5 V	4...20 mA 4-wire transducer
Mode 50 mV	±50 mV	(±100 mV) 2)	(±1 V) 2)	(±2 mA) 2)	-	(±500 mV) 2)	-

With a specified mode (50 mV or 500 mV), submodules of different measurement ranges can be plugged in for every 4 inputs, e.g. for the 500-mV mode:

4 inputs, measurement range ±500 mV; 1 submodule 6ES5498-1AA11
8 inputs, measurement range ±20 mA; 2 submodules 6ES5498-1AA41

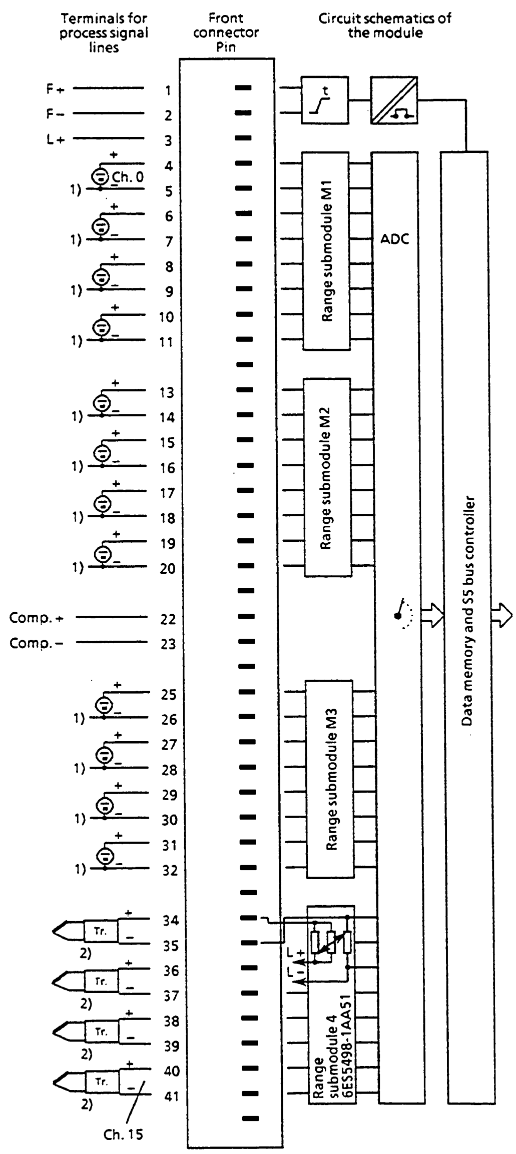
Unused inputs must be terminated with a submodule. If voltage divider or shunt submodules are used, then no jumpers need be inserted in the front connector. With continuity submodules jumpers must be inserted into the front connector. The negative pole of the inputs not used is to be connected to the frame (M_{ext}).

1) These fields are provided to mark the selected switch position.
2) Possible combination for 50 mV, but with a greater error.

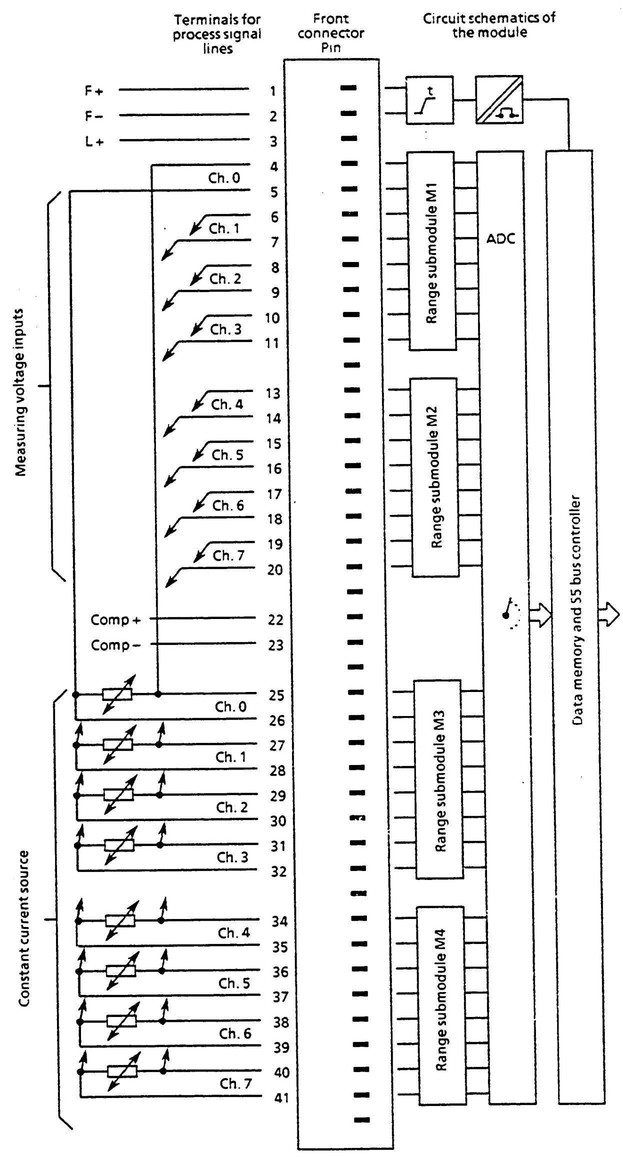
If open-circuit signalling can be activated for the unused inputs, terminating submodules and a connection between the negative pole and M_{ext} are not necessary.

5.4.4 Pin Assignments of the Front Connector

Voltage or current input or connection of 2-wire transducers



Resistance thermometers



Connection of 2-wire transducers is only possible with the 500-mV mode.

Connect L- to central ground point (reference potential).

1) Keep to the permissible potential difference between the sensor ground and the reference potential of the modules, and between the sensor grounds

2) 2-wire transducer

5.5 Analog Output Module 6ES5 465-4UA12

5.5.1 Technical Data

Rated input range with sub-modules for 4 channels each	
6ES5498-1AA11	±50 mV/±500 mV/Pt 100 [1]
6ES5498-1AA21	±1 V
6ES5498-1AA31	±10 V
6ES5498-1AA41	±20 mA
6ES5498-1AA51	4 to 20 mA for 2-wire transd.
6ES5498-1AA61	±5 V
6ES5498-1AA71	4 to 20 mA for 4-wire transd.
Number of inputs	16 voltage/current inputs or 8 resistance inputs (Pt 100)
Measured-value representation	13 bit (two's complement) or 12 bits + sign ±2048 units in rated range; 512 to 2560 units at 4 to 20 mA
Measuring principle	Integrating
Principle of conversion	Voltage/time conversion (dual-slope)
Electrical isolation	No
Permissible potential difference between the reference potentials of sensors and the module (U_{CM}) and between the sensors (channels)	Max. ±1 V
Power supply	
- digital section from system bus	5 V ±5%, typ. 150 mA
- analog section from load voltage	24 V [2]
- module enable F+/F-	24 V; approx. 5 mA
- test current disable L+	24 V; approx. 5 mA
Constant current source for Pt 100 connection I_c+/I_c-	2.5 mA; TC = ±5 x 10^{-5}/K
Integration time	20 ms at 50 Hz; $16^2/_3$ ms at 60 Hz
Coding time per measured value with 2048 units	60 ms at 50 Hz; 50 ms at 60 Hz

[1]) 0 to 200 ohms ≙ -220 to 266°C;
0 to 400 ohms ≙ -220 to 850°C
(overdriving range)

[2]) Only necessary for 2-wire transducers. Max. 20 mA per transd.

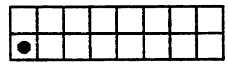
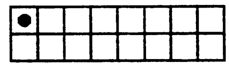
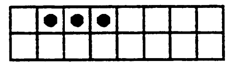
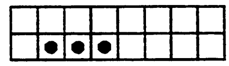
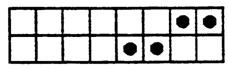
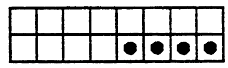
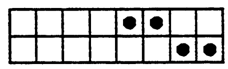
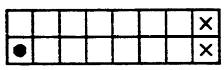
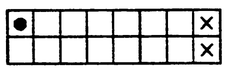
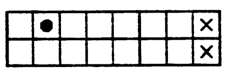
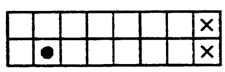
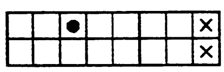
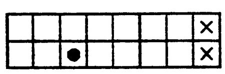
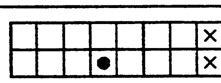
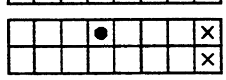
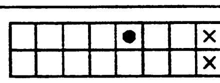
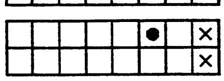
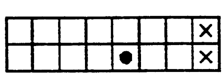
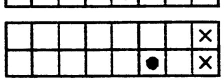
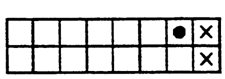
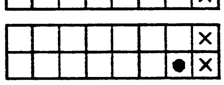
Cycle time (max. delay time of measured-value acquisition)	
- for 8 measured values with 2048 units	Approx. 0.48 s at 50 Hz
- for 16 measured values with 2048 units	Approx. 0.96 s at 50 Hz
Input impedance (with module) for input ranges	
- ±50 mV/±500 mV/Pt 100	≥ 10 Mohms
- ±1 V	90 kohms
- ±5 V/±10 V	50 kohms
- ±20 mA	25 ohms
- 4 to 20 mA	31.25 ohms
Fault signal, specific to measuring points,	
- on overflow	Yes
- on open circuit	Yes, configurable (at ±50 mV, ±500 mV and Pt 100)
Max. perm. input voltage without destruction	±18 V; 75 V for max. 1 ms and duty factor 1:20
Noise suppression for f = n x (50/60 Hz ±1%)	
- with common mode interference	≥ 86 dB; but max. ±1 V
- with differential mode interference	≥ 40 dB, noise voltage amplitude but max. 100% of measurement range, referred to peak value
Error, related to nominal value	
- linearity	±1 unit
- tolerance	±1 unit
- error in reversal	±1 unit
- temperature fault	1×10^{-4}/K
Error caused by modules at input range	
- ±1 V/±5 V/±10 V	2×10^{-3}; TC = $\pm 10 \times 10^{-5}$/K
- ±20 mA/4 to 20 mA	1×10^{-3}; TC = $\pm 5 \times 10^{-5}$/K

5.5.2 Selecting the Mode

The desired mode of the analog input module is selected by setting mode switches I and II according to the check list.

It should be noted that all individual dip switches of the two mode switch blocks marked with a dot must be set, and some functions are defined by several dip switches (e.g. 8 or 16-channel operation, open-circuit signal for 8 or 16 channels).

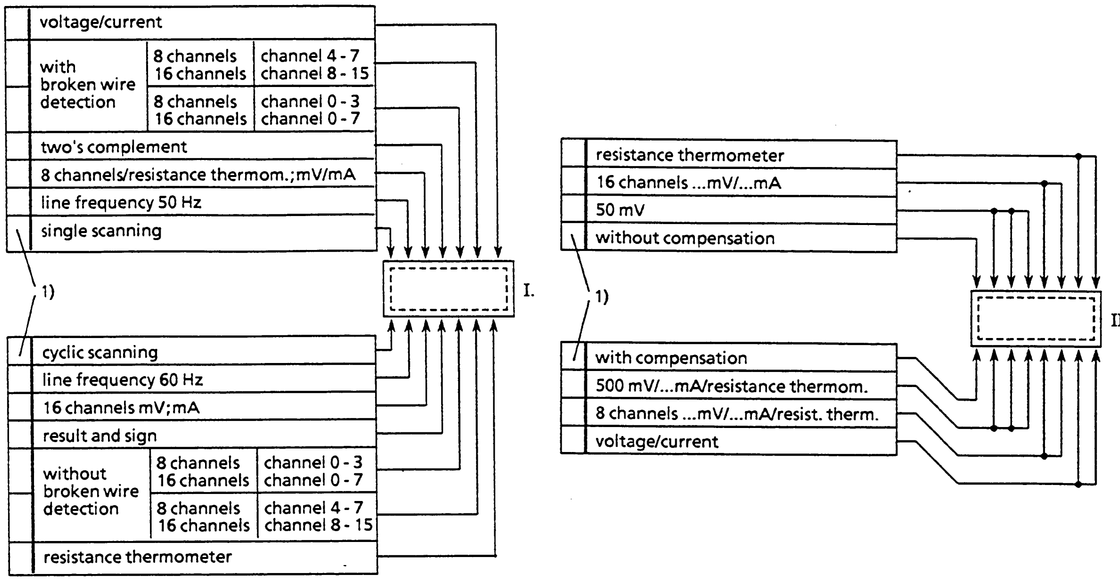
For selecting the desired operating modes, the dip switches are pressed downwards on the side marked with a dot.

Mode	Mode switch I (digital section)	Mode switch II (analog section)
Reference junction compensation with		
without		
Range 50 mV		
500 mV; Pt 100		
Pt 100 in 4-wire circuit 8 channels		
Current or voltage measurement 8 channels		
Current or voltage measurement 16 channels		
Scanning cyclic		
single		
Mains frequency 50 Hz		
60 Hz		
8 channels		
16 channels		
Absolute value and sign		
Two´s complement		
with open-circuit signal Channels 0 . . . 3 1) Channels 0 . . . 7 2)		
Channels 4 . . . 7 1) Channels 8 . . . 15 2)		
without open-circuit signal Channels 0 . . . 3 1) Channels 0 . . . 7 2)		
Channels 4 . . . 7 1) Channels 8 . . . 15 2)		
mV/mA 3)		
Pt 100 3)		

X: switch is not used, any switch position is allowed.

1) With 8 channels 2) With 16 channels 3) See chapter 3.5.5

Labelling of the switches on the module cover:



5.5.3 Range Submodule Complement

Four submodules for connecting four inputs respectively can be plugged into an analog input module 465, being held in place with a screw.

Voltage divider, shunt and continuity submodules for the various measurement ranges are available.

	Range submodule type 6ES5 498-						
	-1AA11	-1AA21	-1AA31	-1AA41	-1AA51	-1AA61	-1AA71
Submodule circuits, 4x in each case	M+ M-	M+ M-	M+ M-	M+ M-	M+ L+ L- M-	M+ M-	M+ M-
Mode 500 mV/ mA/Pt 100	±500 mV Pt 100	±1 V	±10 V	±20 mA	4...20 mA 2-wire transducer	±5 V	4...20 mA 4-wire transducer
Mode 50 mV	±50 mV	(±100 mV) 2)	(±1 V) 2)	(±2 mA) 2)	-	(±500 mV) 2)	-

With a specified mode (50 mV or 500 mV), submodules of different measurement ranges can be plugged in for every 4 inputs, e.g. for the 500-mV mode:

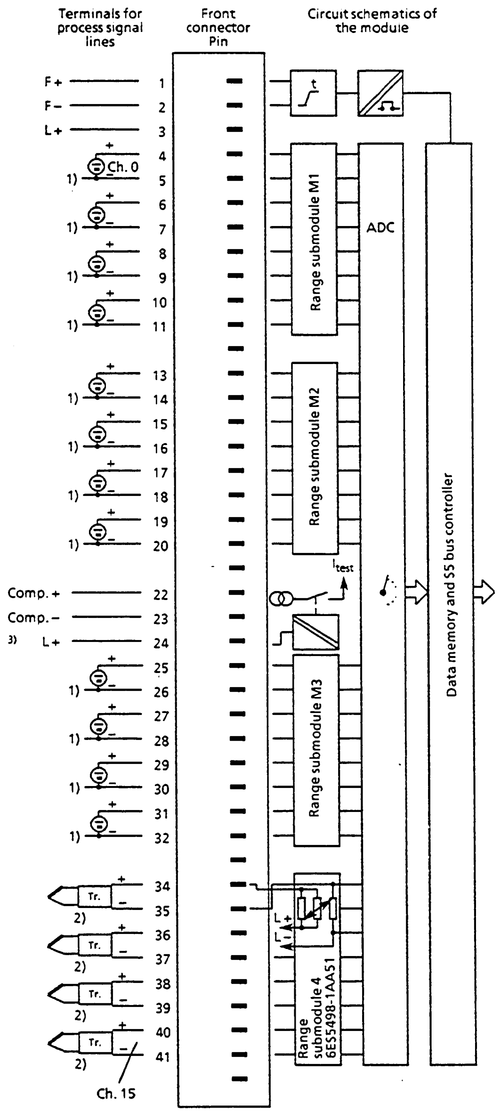
4 inputs, measurement range ±500 mV; 1 submodule 6ES5498-1AA11
8 inputs, measurement range ±20 mA; 2 submodules 6ES5498-1AA41

Unused inputs need not be short-circuited (in PT 100 mode this also applies to unused power outputs).

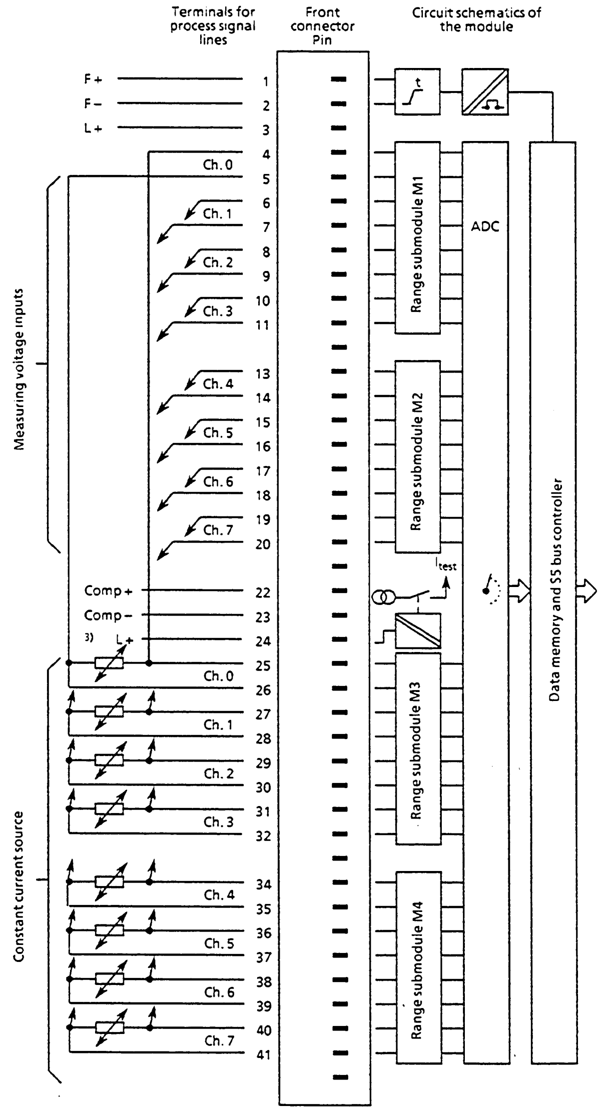
1) These fields are provided to mark the selected switch position
2) Possible combination for 50 mV, but with a greater error

5.5.4 Pin Assignments of the Front Connector

Voltage or current input or connection of 2-wire transducers



Resistance thermometers



Connection of 2-wire transducers is only possible with the 500-mV mode.

Connect L- to central ground point (reference potential).

1) Keep to the permissible potential difference between the sensor ground and the reference potential of the modules, and between the sensor grounds
2) 2-wire transducer
3) Only necessary for switching off the test current with open-circuit signalling inactive (0 V at common frame with L-)

5.6 Analog Output Module 6ES5 470-4UA11/-4UA12, 470-4UB11/-4UB12 and 470-4UC11/-4UC12

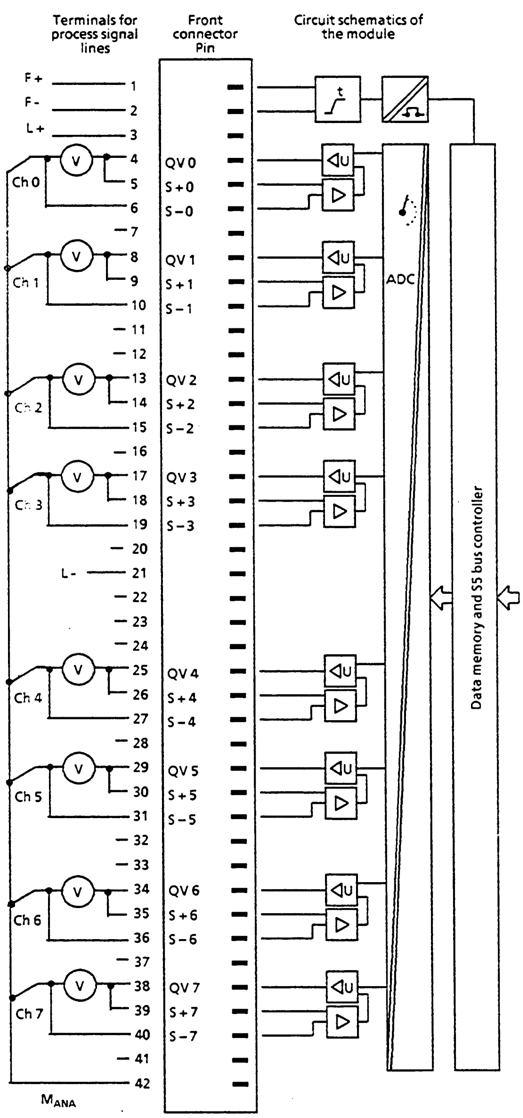
5.6.1 Technical Data

Rated output range	
- 6ES5470-4UA11/-4UA12	0 to ±10 V and 0 to 20 mA parallel with ±1024 units
- 6ES5470-4UB11/-4UB12	±10 V with ±1024 units
- 6ES5470-4UC11/-4UC12	1 to 5 V and 4 to 20 mA parallel with 0 to 1024 units
Number of outputs	8 voltage and current outputs, open-circuit- and short-circuit-proof
Electrical isolation	Yes; 8 outputs with respect to M_{ext}
Measured-value representation	12 bits (two's complement)
Linearity in the range of ±1024 units	±2 LSB = ±0.2%
Operating error limits (0 to 60°C)	±0.6%
Permissible overdriving	Approx. 25% (±1024 to ±1272 units)
Short-circuit current with voltage output	Approx. 25 mA
No-load voltage with current output	Max. 18 V
Output current with voltage output	Max. 3 mA
Max. capacitive load incl. line capacity	< 100 nF
Delay time between data transfer and analog value output	≤ 1 ms
Load resistance	
- with voltage output	≥ 3.3 kohms
- with current output	≤ 300 ohms
Temperature coefficient for voltage and current outputs	1×10^{-4}/K
Permissible voltage drop on voltage output lines	±0.3 V at max. output voltage

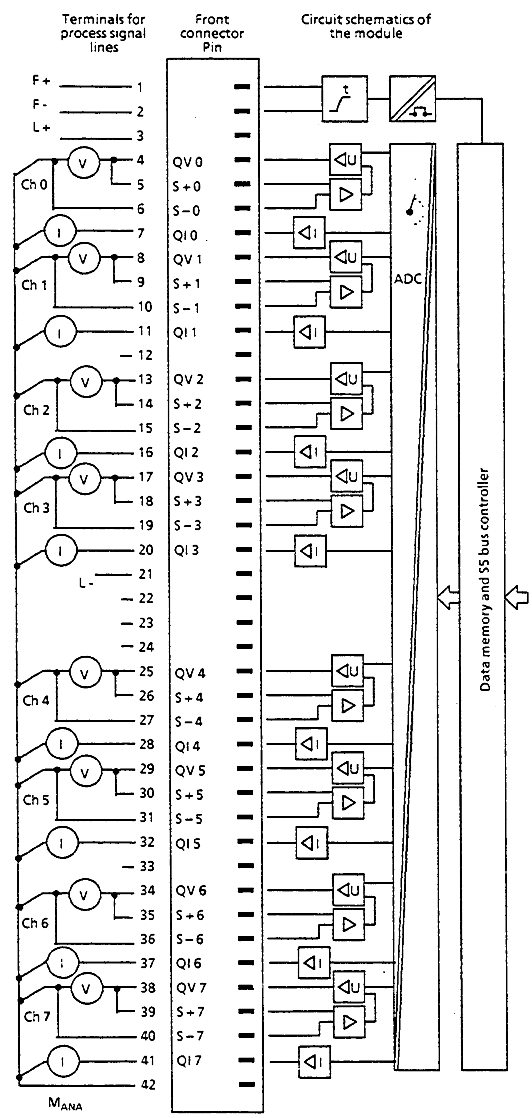
Power supply	
- dig. section from system bus	5 V ±5%; approx. 250 mA
- analog section from load volt.	24 V; 200 to 400 mA
- module enable F+/F-	24 V; approx. 7 mA
Perm. potential difference U_{CM} between reference potentials of the load and the casing	Max. 60 V AC/75 V DC
Insulation voltage acc. to VDE 0160	Betw. outputs and casing: tested with 500 V AC
Impulse test according to IEC 255-4	Between outputs and L-: U_s = 1 kV; 1.2/50 µs

5.6.2 Pin Assignments of the Front Connector

6ES5470-4UB11
6ES5470-4UB12



6ES5470-4UA11/-4UC11
6ES5470-4UA12/-4UC12



6 Addressing the Process Interface Modules

Addressing of process interface modules with 16 channels

Channel no.						0		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15	
Subaddress (internal)				0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
				1	2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
Start address				2	4	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
				3	8	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
ADB	7	6	5	4	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DW	128	64	32			HB	LB	HB	LB	HB	LB	HB	LB	HB	LB	HB	LB	HB	LB	HB	LB	HB	LB	HB	LB	HB	LB	HB	LB	HB	LB	HB	LB	HB	LB	HB	LB
Addressing switch	●					128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
	●		●			160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
	●	●				192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
	●	●	●			224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255

DW Binary significance
HB High byte
LB Low byte
● Dip switch pressed

Addressing of process interface modules with 8 channels

Channel no.							0		1		2		3		4		5		6		7	
Subaddress (internal)					0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
					1	2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
Start address					2	4	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
					3	8	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
ADB	7	6	5	4																		
DW	128	64	32	16			HB	LB	HB	LB	HB	LB	HB	LB	HB	LB	HB	LB	HB	LB	HB	LB
Addressing switch	●						128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
	●			●			144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
	●		●				160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
	●		●	●			176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
	●	●					192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
	●	●		●			208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
	●	●	●				224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
	●	●	●	●			240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255

Addressing of process interface modules with 4 channels (463-4UA../-4UB..):

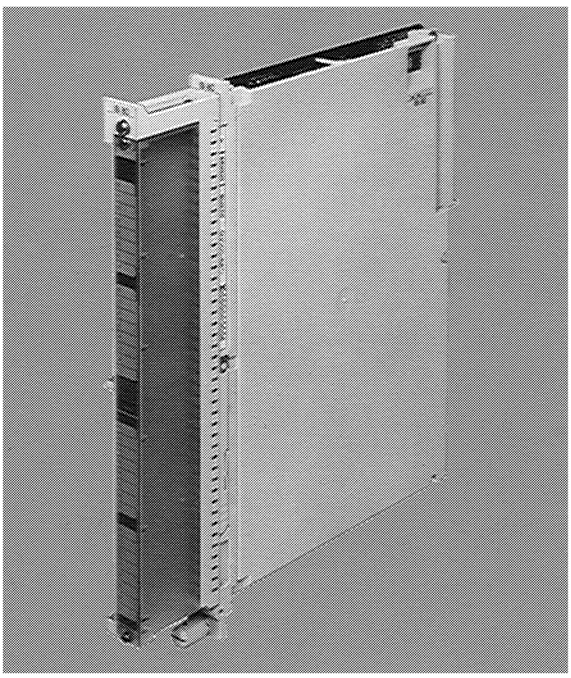
Channel number							0		1		2		3	
Subaddress (internal) / Start address					0	1	0	1	0	1	0	1	0	1
					1	2	0	0	1	1	0	0	1	1
					2	4	0	0	0	0	1	1	1	1
ADB	7	6	5	4	3		HB	LB	HB	LB	HB	LB	HB	LB
DW	128	64	32	16	8									
	●						128	129	130	131	132	133	134	135
	●				●		136	137	138	139	140	141	142	143
	●			●			144	145	146	147	148	149	150	151
	●			●	●		152	153	154	155	156	157	158	159
	●		●				160	161	162	163	164	165	166	167
	●		●		●		168	169	170	171	172	173	174	175
	●		●	●			176	177	178	179	180	181	182	183
Address-ing switch	●		●	●	●		184	185	186	187	188	189	190	191
	●	●					192	193	194	195	196	197	198	199
	●	●			●		200	201	202	203	204	205	206	207
	●	●		●			208	209	210	211	212	213	214	215
	●	●		●	●		216	217	218	219	220	221	222	223
	●	●	●				224	225	226	227	228	229	230	231
	●	●	●		●		232	233	234	235	236	237	238	239
	●	●	●	●			240	241	242	243	244	245	246	247
	●	●	●	●	●		248	249	250	251	252	253	254	255

SIEMENS

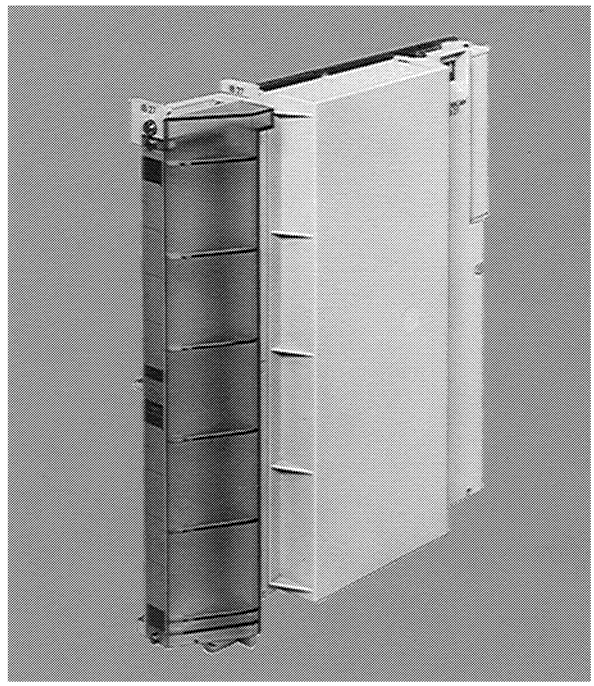
SIMATIC S5
Digital Input Modules
Digital Output Modules

6ES5 4..-4U.1.

Instructions C79000-B8576-C312-08



Digital input module 6ES5 420-4UA12



Digital input module 6ES5 436-4UB12

Type of module	Inputs or outputs		Input or output current	Galvanic isolation/ groups		Order no.	Technical specifications
	Number	Rated voltage					
Digital input	32	24 V DC	8.5 mA	no	–	6ES5420-4UA11/12	Page 33
	32	24 V DC	7.0 mA	yes	1 x 32	6ES5430-4UA11/12	Page 35
	16	24 to 60 V DC	4.5 to 7.5 mA	yes	16 x 1	6ES5431-4UA11/12	Page 37
	32	24 V DC	8.5 mA	yes	4 x 8	6ES5432-4UA11/12	Page 39
	32	5 to 15 V DC	1.3 mA	yes	1 x 32	6ES5434-4UA11/12	Page 41
	16	24 to 60 V AC	15 to 25 mA	yes	2 x 8	6ES5435-4UA11/12	Page 44
	16	115 to 240 V AC	15 to 25 mA	yes	2 x 8	6ES5436-4UA11/12	Page 46
	8	115 to 240 V AC	15 to 25 mA	yes	8 x 1	6ES5436-4UB11/12	Page 48
Digital output	32	24 V DC	0.5 A	no	–	6ES5441-4UA11/12	Page 50
	32	24 V DC	0.5 A	yes	1 x 32	6ES5451-4UA11/12	Page 53
	16	24 V DC	2.0 A	yes	16 x 1	6ES5453-4UA11/12	Page 56
	16	24 V DC	2.0 A	yes	1 x 16	6ES5454-4UA11/12	Page 59
	16	24 to 60 V AC	2.0 A	yes	2 x 8	6ES5455-4UA11/12	Page 62
	16	115 to 240 V AC	2.0 A	yes	2 x 8	6ES5456-4UA11/12	Page 64
	8	115 to 240 V AC	2.0 A	yes	8 x 1	6ES5456-4UB11/12	Page 66
	16	24 to 60 V DC	0.5 A	yes	16 x 1	6ES5457-4UA12	Page 68
	16	Relay 60 V	0.5 A	yes	16 x 1	6ES5458-4UA11/12	Page 70

Contents **Page**

1	**Description**	**2**
1.1	Application	2
1.2	Construction	2
1.3	Principle of Operation	3
1.3.1	Digital Input Modules	3
1.3.2	Digital Output Modules	5
1.3.3	Digital Input Module 6ES5432-4UA1. (with Group Signal and Interrupt)	7
1.3.4	Signalling Output	13
1.3.5	Functions of the Enable Inputs	14
1.4	General Technical Specifications	19
1.5	Pin Assignment of the Backplane Connector	21
2	**Installation**	**22**
2.1	Withdrawing and Inserting Modules	22
2.2	Identification of Modules	23
2.3	Installation Guidelines	24
3	**Operation**	**25**
3.1	Setting the Module Address	25
3.2	Connecting the Signal Leads	27
3.3	Connecting Outputs in Parallel and Switching the Load on via a Contact	28
3.4	Connecting Input/Output Modules to Two Power Supply Units	29
3.5	Short-circuit Protection and Fusing of DC Digital Output Modules	30
4	**Spare Parts**	**31**
5	**Technical Specifications of Modules**	**33**
5.1	Digital Input Modules 6ES5 420-4UA11 and -4UA12	33
5.2	Digital Input Modules 6ES5 430-4UA11 and -4UA12	35
5.3	Digital Input Modules 6ES5 431-4UA11 and -4UA12	37
5.4	Digital Input Modules 6ES5 432-4UA11 and -4UA12	39
5.5	Digital Input Modules 6ES5 434-4UA11 and -4UA12	41
5.6	Digital Input Modules 6ES5 435-4UA11 and -4UA12	44
5.7	Digital Input Modules 6ES5 436-4UA11 and -4UA12	46
5.8	Digital Input Modules 6ES5 436-4UB11 and -4UB12	48
5.9	Digital Output Modules 6ES5 441-4UA11 and -4UA12	50
5.10	Digital Output Modules 6ES5 451-4UA11 and -4UA12	53
5.11	Digital Output Modules 6ES5 453-4UA11 and -4UA12	56
5.12	Digital Output Modules 6ES5 454-4UA11 and -4UA12	59
5.13	Digital Output Modules 6ES5 455-4UA11 and -4UA12	62
5.14	Digital Output Modules 6ES5 456-4UA11 and -4UA12	64
5.15	Digital Output Modules 6ES5 456-4UB11 and -4UB12	66
5.16	Digital Output Module 6ES5 457-4UA12	68
5.17	Digital Output Modules 6ES5 458-4UA11 and -4UA12	70
6	**Addressing the Input and Output Modules**	**73**
7	**Example of a Label**	**74**
8	**Page Overview**	**75**

1 Description

1.1 Application

Digital input and output modules enable the SIMATIC S5 130 K/W, 135 U, 150 K/S/U and 155 U programmable controllers to handle a wide variety of process signals.

Digital input modules convert the external process signals to the internal signal level of the programmable controllers. Any interference and momentary voltage peaks at the inputs are suppressed.

Digital output modules convert the control signals processed in the programmable controller to the appropriate level for the process.

1.2 Construction

The modules are designed as plug-in PCBs of the ES 902 modular packaging system, with a backplane connector and a plug connector which mates with a front connector. By means of screw terminals or crimp snap-on connections, the process signal lines can be connected direct to the front connector, which must be ordered separately.

Alongside the plug connector is a row of green LEDs arranged in byte groups for displaying the signal status of the inputs or outputs.

DC voltage output modules also have red LEDs to indicate short-circuits between the output lines and ground (L-) within a module.

AC voltage output modules have red LEDs to indicate a blown fuse.

Each module is equipped with a 6, 7, or 8-pole addressing switch for setting the module address.

The module is protected on both sides by covers secured by means of plastic studs.

The 6ES5...-4U... modules are designed for use in the S5-135 U, S5-150 U and S5-155 U programmable controllers and the respective expansion units of the U range. In order to use the modules in other units, the lower locking bar must be removed from the subrack.

1.3 Principle of Operation

1.3.1 Digital Input Modules

As shown in the block diagram (Fig. 1), the process signals are conditioned in the input circuit of the digital input module for processing at the internal level of the module. The input circuit suppresses any interference and the signal statuses at the inputs are displayed on LEDs on the frontpanel of the module. Most digital input modules supply isolated signals to the data registers.

An external signal at the enable input can disable processing of the input signals and disconnect the module from the S5 bus. Modules designed for AC voltages have a jumper inserted in the front connector.

The module address is set on an addressing switch. The controller issues a $\overline{\text{RDY}}$ acknowledgement signal to the CPU if the address on the system bus recognized by the address decoder is identical with the address set. The STEP 5 program addresses the modules by their parameters (byte address and bit address).

If, for example, input I 1.0 of a digital input module is to be scanned by the STEP 5 program, the CPU transmits the address 1 (byte address = address bits ADB 0 to ADB 7) and the control signal $\overline{\text{MEMR}}$. The module with the byte address 1 recognizes this address and transmits the $\overline{\text{RDY}}$ acknowledgement signal to the CPU.

The signal status of the inputs of byte 1 (DB 0 to DB 7) is transmitted to the CPU via the data bus.

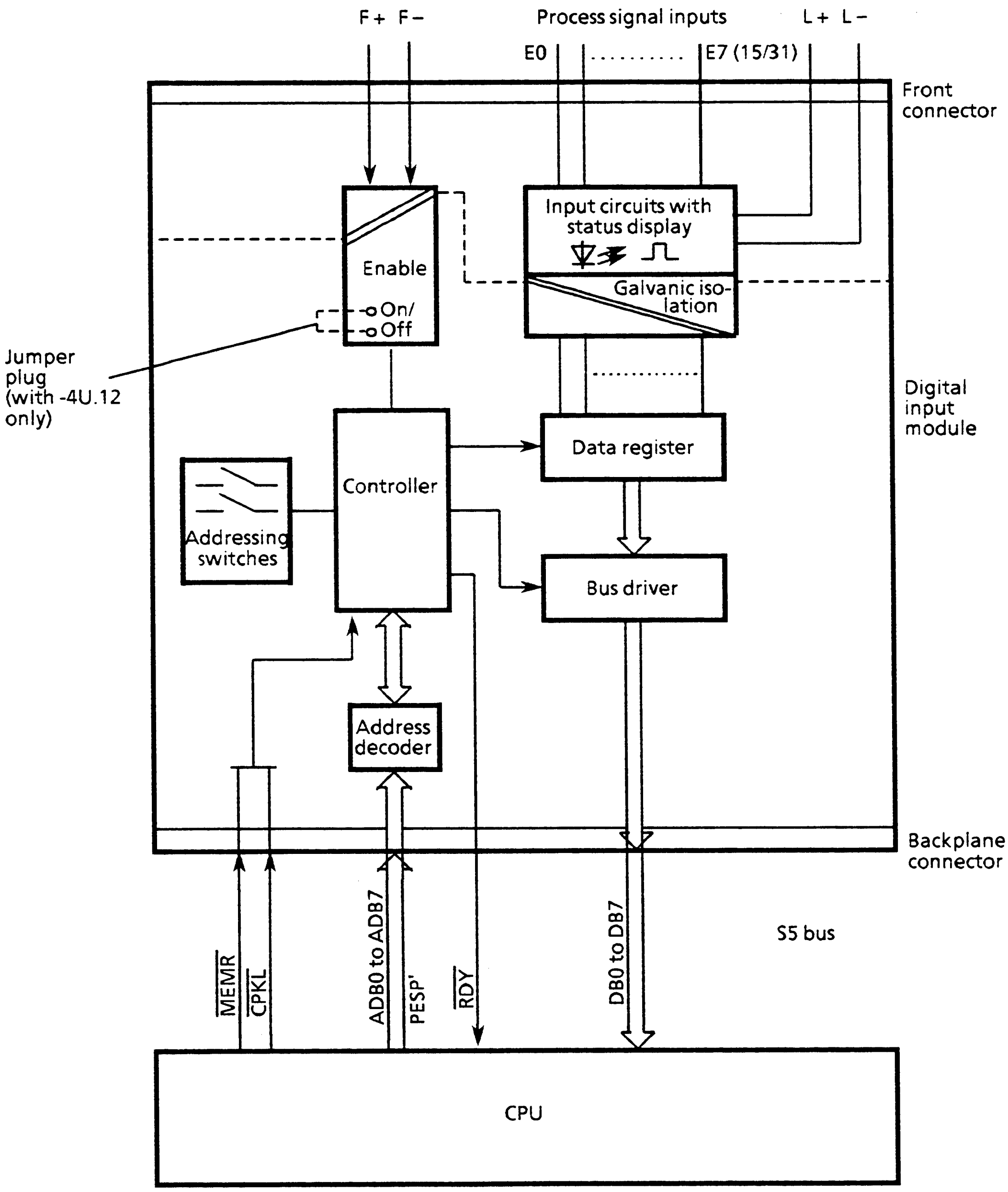


Fig. 1 Signal transfer between the CPU and the digital input module

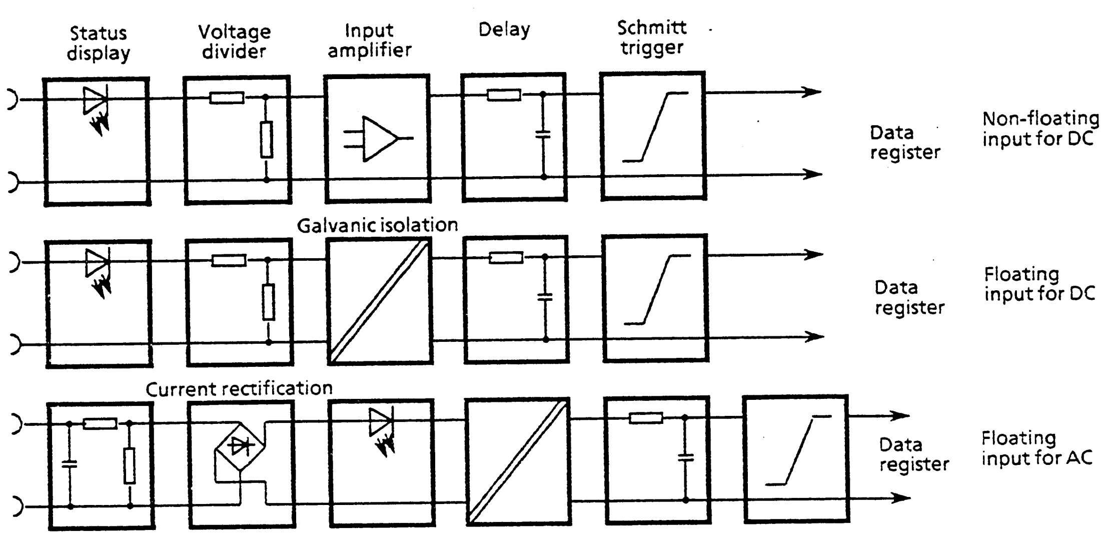


Fig. 2 Principle of the input circuits

1.3.2 Digital Output Modules

Fig. 3 is a block diagram showing the transfer of signals between the digital output modules and the CPU. The data are transferred from the S5 bus if the module is enabled by a signal at the enable input (F+/F-), if the module address set on the addressing switch is identical with that transmitted by the CPU and if the $\overline{\text{MEMW}}$ signal is applied.

The controller causes the data from the data bus (DB 0 to DB 7) to be transferred to the data register and, on most of the modules, reach the outputs in the form of isolated signals.

Modules with the appropriate output circuits are available to supply all the voltages and currents required in the process.

The frontplate of the module has LEDs which indicate the signal status of the outputs (green LEDs) and short-circuts in the lines connected (red LEDs).

In order to set output 1.0 of a digital output module, for example, the address 1 and the control signal $\overline{\text{MEMW}}$ are transmitted by the CPU.

The output module with byte address 1 recognizes the address and transmits the $\overline{\text{RDY}}$ acknowledgement signal to the CPU.

The outputs are driven in keeping with the data on the data bus (DB 0 to DB 7)

In the case of digital output modules, only the outputs are set to 0 by the BASP (Disable command output) signal from the CPU. The data memories on the modules retain their status.

These memories are reset by the $\overline{\text{CPKL}}$ (CPU Ready) signal.

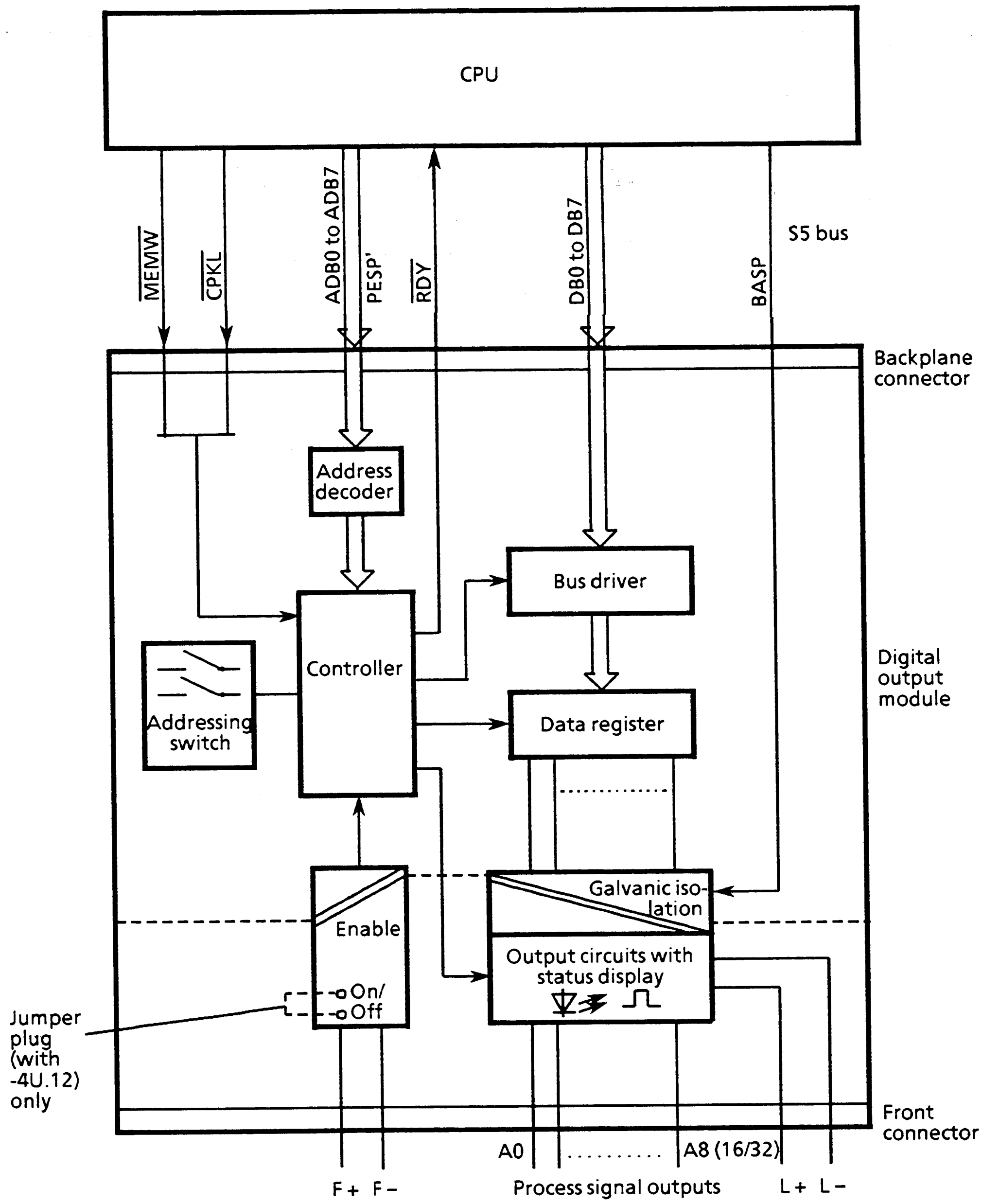


Fig. 3 Signal interchange between CPU and digital output modules

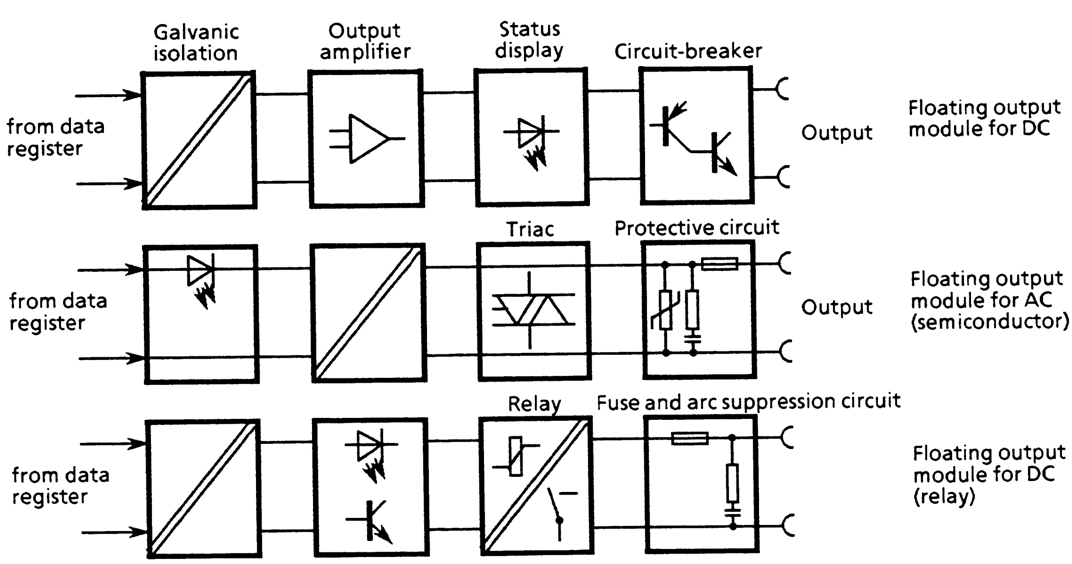


Fig. 4 Block diagram of the output circuits

1.3.3 Digital Input Module 6ES5432-4UA1. (with Group Signal and Interrupt)

The following operating modes are possible on the 432 module when specific jumpers and switches have been set:

- Digital input without group signal and interrupt,
- Digital input with group signal,
- Digital input with interrupt,
- Digital input in mixed operation with group or interrupt signal.

The principle of operation with group signal (byte E0) and interrupt depends on the device used and is therefore described in the manual for your programmable controller.

Signal changes at the process inputs of the digital input module 432 determine the generation of a group signal or an interrupt. The statuses at the inputs are recognized by scanning the peripheral bytes n to (n + 3). For scanning the peripheral bytes, the start address n is to be set using the address switch S4, as with all other I/O modules.

Since the organization blocks for interrupt processing (interrupt OBs) are always automatically accessed by the programmable controller at their "block boundaries", the change of the process signal must be present for at least the time it takes to process the largest program block and the double input delay time. (**Exception:** 155U-mode which includes scanning at the "command boundaries": in this case, the double input delay time is sufficient.)

When the module is used in the central controller (CC), the addresses used in the P range are not allowed for applications in the Q range. The module decodes only eight address bits and PESP' as is the case with all other I/O modules.

Digital input without group signal and interrupt

The peripheral bytes may be scanned in any sequence. The module functions like a digital input and offers input delays to be set byte by byte in typical stages of 0.3 and 1.0 and 3.0 ms.

This module can be plugged into all peripheral slots for use with digital inputs.

For how to set the mode of operation see the table "Setting of switches and jumpers" on page 12.

Digital input with group signal (S5-150U, S5-155U: 150U mode)

Any alteration to a bit in the input byte IB 0 ("0" -> "1" or "1" -> "0") leads to a jump in the alarm OB (bit 0.0 in OB 2, bit 0.1 in OB 3 etc. bit 0.7 in OB 9) at the block limits (S5-150U) or command limits (S5-155U: 150U mode). The triggering of an alarm OB is therefore also possible with normal digital input modules at the input address IB 0.
The 432 module automatically decodes the address byte E0. By scanning byte E0 at the block boundaries, the system recognizes every change of the process signal. Each bit of byte E0 is active on a specific interrupt OB (refer to programmable controller manual).

Use switch S2 to assign the 432 module to one of the interrupt OBs. One of these modules must be switched to 'master' which serves bit E0.0 and receives acknowledgment from byte E0. The remaining modules function as slaves and do not acknowledge byte E0 (also refer to table on page 12 "Setting of switches and jumpers" as well as to the example on page 13).

Scanning the process inputs:

In the interrupt OB that you specified using byte E0 and switch S2 you may program the following:

```
L  PW128    (Load peripheral word)
T  FW0      (Transfer flag word)
L  PW130    etc.
T  FW2
```

While the cyclic program is running only the flag word (FW) may be accessed.

- Accessing of the peripheral bytes in the process image leads to a loss of interrupt capability. You must therefore address the module starting from address 128.

- Double accesses to peripheral bytes are not permitted (loss of interrupt capability).

- The four peripheral bytes of a module must be scanned one after the other in ascending order. The scanning of byte n disables the input circuit, the scanning of byte (n + 3) enables it again.

- Only one module may be scanned by each interrupt OB. Up to eight modules can thus be plugged into each programmable controller.

- The modules can be plugged into every slot which is used for digital inputs, but only max. 8 modules together in one central controller or one expansion unit (EU).

- While the central controller is in Stop, any alteration of an input signal could lead to setting the interrupt memory on the module. This would mean jumping directly to an interrupt OB after a cold or warm restart and carrying out the procedure in the OB. To prevent this we recommend you proceed as follows: by the absolute setting of a flag bit (e.g. :S FY 0.0) in the corresponding start OBs (OB 20, OB 21, OB 22) and the scanning of every interrupt OB used (OB 2...OB 9) the start-up is recognized. Thus the interrupt OBs are prevented from further action. In a cyclic or time-controlled program the flag bit must be reset (e.g. :R FY 0.0).

Digital input with interrupt (S5-135U, S5-155U: 155U-mode)

A change of the process signal causes an interrupt to be generated on the 432 module. This interrupt is transmitted to the appropriate CPU via slot-oriented interrupt leads (refer to programmable controller manual). The interrupts are processed in the assigned interrupt OBs. To set the module to the respective interrupt line see the table "Setting of switches and jumpers" on page 12.

Scanning the process inputs:

In the corresponding interrupt OB you may program the following command sequence:

```
L  PW132    (Load peripheral word)
T  FW10     (Transfer flag word)
L  PW134    etc.
T  FW12
```

While the cyclic program is running only the flag word (FW) may be accessed.

- Accessing of the peripheral bytes in the process image leads to a loss of interrupt capability. You must therefore address the module starting from address 128.

- Double accesses to peripheral bytes, even by different CPUs, are not permitted (loss of interrupt capability).

- The four peripheral bytes of a module must be scanned one after the other in ascending order. The scanning of byte n disables all input circuits of the module, the scanning of byte (n + 3) re-enables them.

- Several 432 modules may be scanned by each interrupt OB (up to eight modules).

- In 155U-mode the interrupt OBs may be interrupted by OBs of higher priority at the command boundaries. To avoid loss of interrupt capability the OB for process interrupts must be non-interruptible (refer to the Programming Guide of your programmable controller).

- The programmable controller must process the interrupts in level triggering mode (normal case).

- When a module is removed during operation, this is not detected by the programmable controller: no acknowledgment delay (NAK), no addressing error (ADF). The reason is that the interrupt OB is not processed when an interrupt is missing; thus, the peripheral addresses cannot be accessed.

- The modules can be plugged into every interruptible slot of the central controller.

- After switching on the central controller you need to scan the four peripheral bytes in the OBs for cold and warm restart

(OB 20, OB 21, OB 22). Any interrupts which may still be present will then be reset.

Special features:

Do not plug the modules into slots for interfaces and processors.
The D row of the bus connector X1 (d14, d16, d18, d20, d22, d24, d26) can be bridged by the interrupt switch. In this case if the module is plugged in;

- at the interface slot the module will be damaged
- at the processor slot false signals will be produced.

If you nevertheless wish to achieve maximum capacity from your subrack by occupying all interface slots with this module, please observe the following:

> **Switch block S1 (interrupt switches $\overline{\text{IRA}}$ to $\overline{\text{INT}}$) must be switched off. The S1 rocker switches may not be switched in the direction of the dot ( ).**

During **interrupt analysis on the S5 135U** at least one switch on switch block S1 must be switched on. In this case the module may only be plugged into a slot intended for interrupt analysis.

Recognizing the module which is triggering the interrupt

With the jumper X4 = ON the module acknowledges the input byte IB 0. Thus if only one module is being used in the programmable controller its removal is detected by timeout (QVZ). The byte IB 0 can also be used in interrupt mode to ascertain from which module the interrupt signal is being triggered. Here each module occupies one bit in the input byte IB 0. One module must be set as master on IB 0, bit 0. The remaining bits 1...7 can be occupied by modules in the slave setting.
The jumper X3 and the switch S2 must be set according to the settings with the group signal.

Input byte IB 0 not activated.

The module 432-4UA12 allows the input byte IB 0 to be switched off by setting the jumper X4 = OFF. Then the input byte is not acknowledged and is freely available for other modules.
A 432-4UA12 module which has been removed is not recognized by a timeout (QVZ).

<u>Digital input in mixed operation with group or interrupt signal</u>

In mixed operation, there are one or more peripheral bytes which are not subject to interrupt triggering. Switch S3 (edge selection) is deactivated for one to three peripheral bytes.

The operation of the module is determined by the interrupt detection

- with group signal or
- with interrupt

and is to be set accordingly. Those bytes which are not subject to interrupt detection must also be read from the corresponding interrupt OBs, in order to reset the interrupt memory.

The input bytes which are not subject to interrupt triggering may only be read after scanning the interrupt OBs. Reading these input bytes directly is not permitted because alarms may be lost in the process. In order to be able to process the most up-to-date process data of the input bytes, the corresponding interrupt OB must be run as often as possible (cyclically if possible).

<u>Functions of the jumpers and switches on the module</u>
(Position on the PCB as shown in the figure in section 5.4):

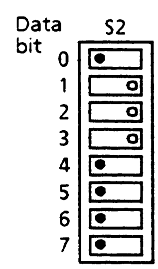
Jumper: X3 plugged in (on) = Module as master
open (off) = Module as slave
X4 plugged in (on) = with group signal generation
open (off) = without group signal generation
Note: With 6ES5 432-4UA11, X4 must be plugged in (on) even with interrupt.

Switch: S1 Signal changes at the inputs placed on interrupt lines $\overline{\text{IRA}}$... $\overline{\text{IRG}}$ and $\overline{\text{INT}}$
S2 Parameter assignments for 1 master and 7 slave modules
S3 Selection of the input signal edge which initiates the generation of a group signal/interrupt (bytes 0...3)
S4 Module address
S5 Input delay time 0.3/1.0/3.0 ms for bytes 0...3 (8 inputs = 1 byte)

<u>Example</u>

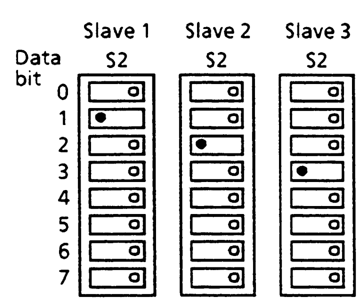
In the example, four 432 modules with group signal generation (1 master module and 3 slave modules) are used.

Jumpers and switches on the <u>master module</u>:



X3 = on, X4 = on
S1/0..7 = open
S3: after selecting edge, 1 byte each
S4: according to address label, e.g. IB 128
S5: after selecting delay time, 1 byte each

Jumpers and switches on the <u>slave modules</u>:



Slave 1: X3 = off, X4 = on
S1/0..7 = open, S4 = IB 132

Slave 2: X3 = off, X4 = on
S1/0..7 = open, S4 = IB 136

Slave 3: X3 = off, X4 = on
S1/0..7 = open, S4 = IB 140

Both in the master and in the slave modules, the edge (S3) and the delay time (S5) can be selected for each individual byte.

Setting of switches and jumpers for the different modes

Which programmable controller/expansion unit?	S5-135U S5-150U S5-155U EG-183..187U	S5-135U S5-155U: in 155U mode		S5-150U S5-155U: in 150U mode EG-183..187U		
Operating mode of the DI 432	without interrupt or group signal	with interrupt	in mixed operation with interrupt	with group signal master module	with group signal slave module	in mixed operation with group signal
Parameters for group signal	—	—	—	0.0	0.1...0.7	as with group signal master & slave module
X 3 Plug-in jumper	rem.	ins.	ins.	ins.	rem.	ins./rem. as with group signal master & slave module
X 4 Plug-in jumper	rem.	on: IB acknowledged off: IB not ack. (only with -4UA12)	on: IB acknowledged off: IB not ack. (only with -4UA12)	ins.	ins.	ins.
S 1 Interrupt assignment	off	on IRA....INT	on IRA....INT	off	off	off
S 2 Data byte		off	off	on S2/0 and those not being occupied by slave	on S2/1...7 following each data bit	as with group signal master & slave module
S 3 Edge selection for each byte 1)			for inputs without interrupt else:			for inputs without group signal else:
S 4 Module address	0......255	128....255	128....255	128....255	128....255	128....255
S 5 Input delay for each byte	Selection 0.3/1/3 ms	Selection 0.3/1/3 ms	Selection 0.3/1/3 ms	Selection 0.3/1/3 ms	Selection 0.3/1/3 ms	Selection 0.3/1/3 ms

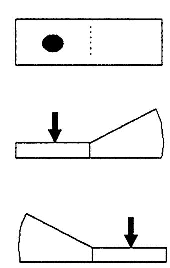
ins. = Plug-in jumper inserted
rem. = Plug-in jumper removed

on = Rocker switch in ON position
off = Rocker switch in OFF position

Rocker switch

ON

OFF



1) **Edge selection:**

positive edge

negative edge

positive and negative edge

no edge — In this position, no group signal or interrupt is output for the byte in question.

1.3.4 Signalling Output

In the case of digital output voltages for DC, signalling output H+ supplies a signal if a short-circuit to ground (L-) or an overcurrent is detected at one or more outputs of the modules. The signalling outputs are decoupled by means of diodes. Up to sixteen outputs can be connected in parallel. Make sure that galvanic isolation is not defeated by connecting outputs in parallel. To guarantee the function of the signalling output, the input 1L+ of the modules 6ES5 441-4UA1., 6ES5 451-4UA1. and 6ES5 454-4UA1. must be connected to 24 V. On the digital output modules 6ES5 453-4UA1. and 6ES5 457-4UA12 the floating signalling output must be supplied separately.

1.3.5 Function of the Enable Inputs

The modules of the U range incorporate enable circuits. The enable inputs can be used to interlock certain modules or switch individual modules off during operation of the programmable controller.

I/O modules whose order numbers end in ...-4U.12 offer the additional feature of changing the enable mode. The modules are therefore equipped with a jumper located next to the addressing switch. It can be accessed from the top (see Fig. below).

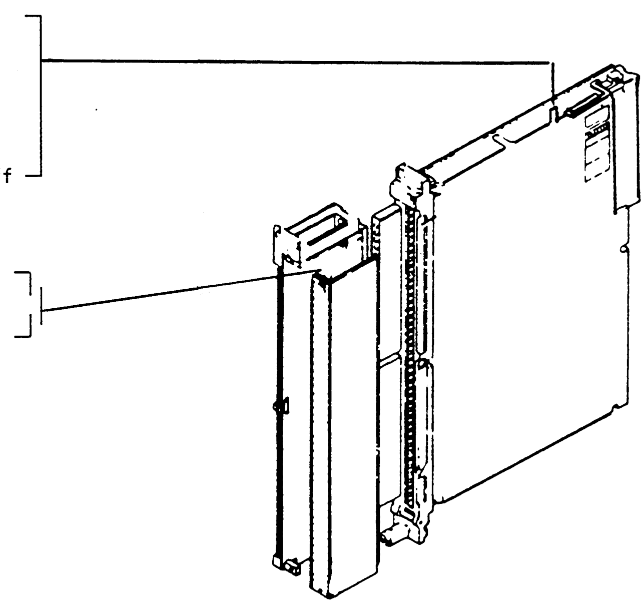


Fig. 5 Jumper location

1.3.5.1 With Active Enable Input (Factory Setting)

Modules with DC inputs or outputs are enabled by applying an external voltage to the inputs F+/F-.

Modules with AC inputs or outputs are enabled by means of a jumper in the front connector.

The power supply of the enable inputs is interrupted when the front connector is detached from the front panel of the module; the module is thus switched off and no longer issues acknowledgement signals, i.e. the CC recognizes an acknowledgement delay (timeout).

Examples of the function of enable inputs:

- Individual subprocesses can be switched off individually with very little control power, i.e. the outputs of the individual module can be connected to a common load power supply unit and activated separately.

- The load voltage of each individual module can be monitored without any additional effort. Reactions to load power failures can be programmed in the QVZ (timeout) organization block as required.

The following must be noted when configuring the system:

Power on: Max. 100 ms after switching on the PC, voltage must be present at the enable inputs of the I/O modules.

Power off: After switching off the PC, the supply voltage must be present at the enable inputs of the I/O modules as long as the internal 5 V voltage is present.

Please note the following for switching off the PC and the supply units for the enable inputs:

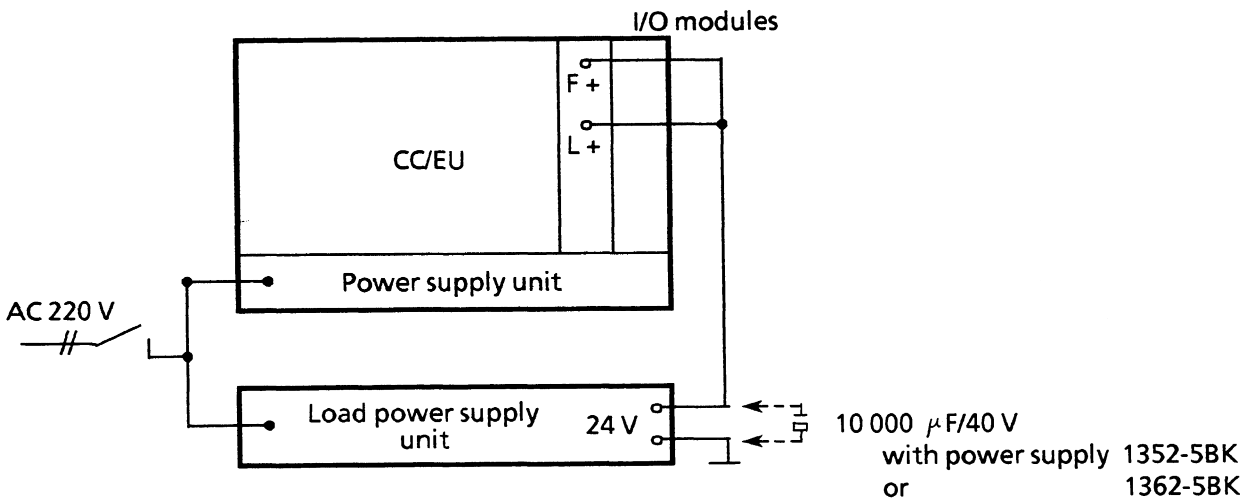
1. **Switching off CCs/EUs and the load power supply simultaneously with 220-V power supply**

   Proper functioning of the module is ensured if the 24-V load power supply unit has at least a capacitance of 4700 μF connected at its output for every 10 A of load current.

   Example: Load power supply 6EV1334-4AK (220 V/24 V, 10 A)

   In units which do not fufil this condition, a capacitor of 10,000 μF/40 V can be connected in parallel.

   Example: Load power supply unit 6EV1352-5BK (380 V/24 V, 20 A) and load power supply 6EV1362-5BK (380 V/24 V, 40 A).



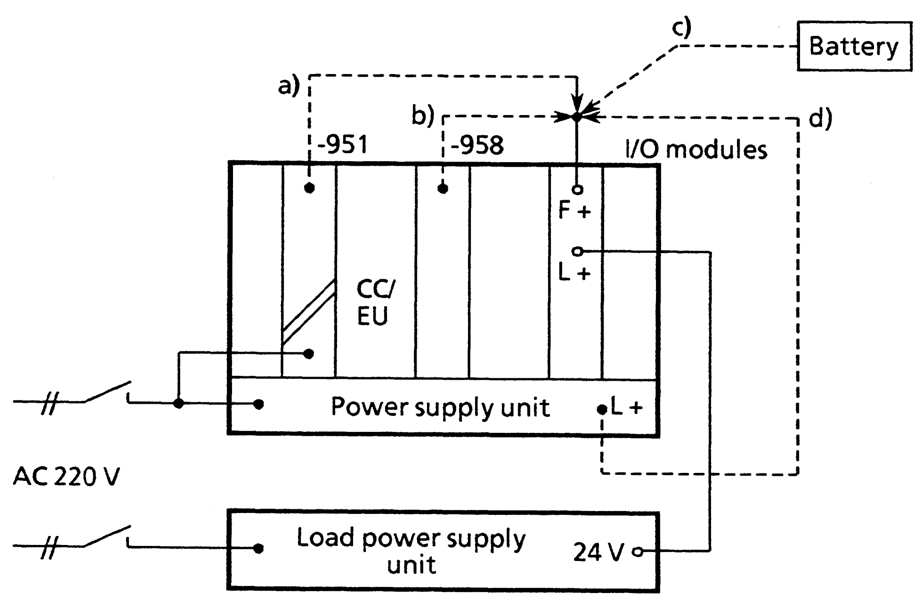
2. Switching off the CCs/EUs and the load power supply separately or simultaneously

The following facilities are available for switching off the load power supply and the power supply for the enable inputs separately. In all these cases, simultaneous switching off and the use of a load power supply unit without additional capacitor are possible.

- <u>220-V power supply for CC/EU with load power supply</u>

  Enable inputs supplied by:

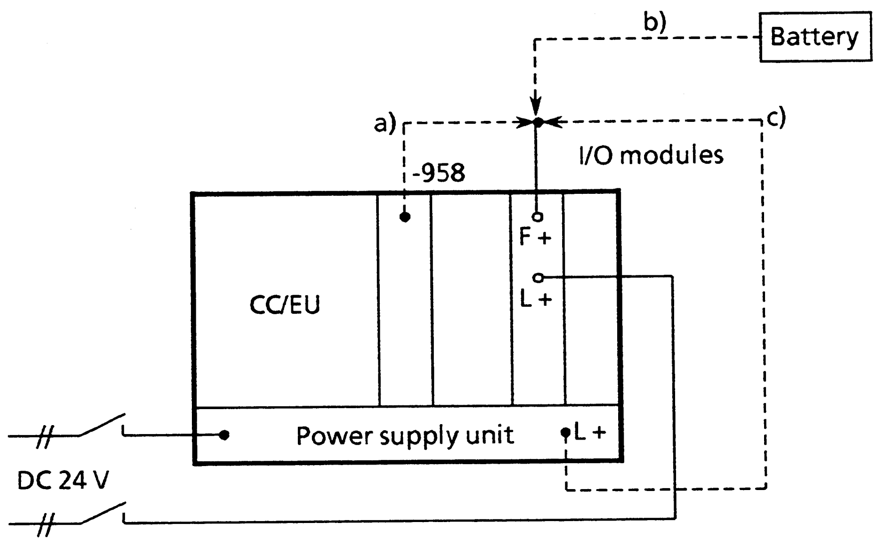
  a) Load power supply unit   6ES5951-4LB11
  b) Enable power supply unit 6ES5958-4UA11
  c) Battery
  d) 24 V/0.4 A terminals on the front panel of the system power supply unit from versions 6ES5955-3LC14
  -3LF12
  -5LB11 onwards.



- <u>24 V power supply for CC/EU and I/Os</u>

  Enable inputs supplied by:

  a) Enable power supply 6ES5958-4UA11
  b) Battery
  c) 24 V/0.4 A terminals on the front panel of the system power supply unit from versions 6ES5955-3NA12
  -3NC13
  -3NF11
  -5NB11 onwards.



1.3.5.2 With Switched-off Enable Input (applies only to ...-4U.12 modules with open plug-in jumper)

If you do **not wish to remove and plug in the modules during operation** the enable inputs (F+/F-) need not be wired. The jumper for switching the enable mode is then to be removed.

The module is now functionally compatible with the compact and rugged I/O modules.

When the module is used in the programmable controllers 115 U (with processors 941 and 942) 130 K, 130 W and 135 U (S processor) it is advisable to operate the module with switched-off enable input. Else, when the front connector is removed (i.e. it is disconnected from the enable power supply unit) the programmable controller enters the stop state and signals acknowledgment delay (timeout).

1.3.5.3 Removing and Inserting of I/O Modules

- **Active enable input:**
  Removing and inserting modules during operation is possible in the following programmable controllers:

  S5-115 U (processors 943 and 944),
  S5-135 U (R processor, S/R processor),
  S5-150 K/S/U and
  S5-155 U.

  Important

  If no enable signal is applied to the module or if the front connector or the module is removed, acknowledgment delay is signalled. All input data of this module is read as a "1" signal on the S5-150 S/U and the S5-135 with S and R processor and on all other programmable controllers and CPUs as a "0" signal.

- **Switched-off enable input:**
  I/O modules may be removed or plugged in only if the CPU is in the stop state.

  Important

  When the front connector is removed no further acknowledgment delay is signalled by the module and all input data is read as a "0" signal.
  When a module is removed all input data of this module is read as a "1" signal on the S5-150 S/U and the S5-135 with S and R processor and on all other programmable controllers and CPUs as a "0" signal.

  The user must program the QVZ organization block to make sure that neither in the case of a fault nor during replacement of the module a dangerous condition can occur in the process or in the plant.

1.4 General Technical Specifications

Programming

Operand identifiers	
for inputs	I = Input
for outputs	Q = Output
Parameters	0.0 to 255.7

Environmental conditions

Operating temperature [1]	
with fan	0 to 60 °C
without fan [2]	0 to 55 °C
Storage and transportation temperature	-40 to 70 °C
Relative atmospheric humidity	up to 95% at 25 °C no condensation
Max. altitude	3500 m (11480 ft.) (above sea-level)

Terminals

Power supply for inputs and outputs	
Rated DC voltage of the module	L+
Reference potential for DC voltage	L-
Rated AC voltage of the module	L
Reference potential for AC voltage	N
Permissible length of cable for digital output modules	The line impedance and the supply voltage tolerance should be noted, for the particular output current
Enable inputs	F+ F- (enable voltage corresponding to the rated voltage of the module)
Short-circuit signalling output	H+ (supply of 1L+, referred to L- of the module)

Max. permissible supply voltage	
at 24 V DC rated voltage (L+/L-)	36 V DC for 100 ms
at 220 V AC rated voltage (L/N)	276 V AC for 100 ms
Ripple U_{pp} of the supply voltage at rated DC voltage	Max. 15% [3]

Noise suppression at the digital inputs	$\geq$ 1.5 ms 4)
Max. noise pulse duration of digital outputs	$\leq$ 1.5 ms 4) 5)
Protective circuits for inductive loads	protective elements to limit the cut-off voltage are available on the digital output modules. Additional arc suppression circuits at the load are not required. Exception: Relay output 458-4UA1 (see technical data).

1) Inlet temperature at the bottom of the subrack.
2) Spacing between PCBs 40 mm (1.6 in.).
3) In the range of supply voltage the ripple is included.
4) Unless otherwise specified.
5) Must not cause the signal receiver (actuator) to respond.

1.5 Pin Assignments of the Backplane Connector

	d	b	z
2		0 V	+5 V
4		PESP	
6		ADB 0	CPKL
8		ADB 1	MEMR
10		ADB 2	MEMW
12		ADB 3	RDY
14	IRA 1)	ADB 4	DB 0
16	IRB 1)	ADB 5	DB 1
18	IRC 1)	ADB 6	DB 2
20	IRD 1)	ADB 7	DB 3
22	IRE 1)		DB 4
24	IRF 1)		DB 5
26	IRG 1)		DB 6
28			DB 7
30		BASP	INT 1)
32		0 V	

ADB	Address bus
BASP	Command output disable
CPKL	CPU Ready
DB	Data bus (bidirectional)
IR.	Interrupt signal
INT	Interrupt signal
MEMR	Memory read
MEMW	Memory write
PESP'	I/O select signal
RDY	Ready

1 Only for the module 6ES5 432-4U...

2 Installation

2.1 Withdrawing and Inserting Modules

Modules can be withdrawn and plugged in while the programmable controller is in operation without resulting in faults on the bus (see also Chapter 1.3.5).

Important: When removing or plugging in the front connector during operation, dangerous voltages (> 25 V AC or > 60 V DC) can be present at the pins of the module. If voltages of this magnitude are applied to the front connector (e.g. in the 435, 436, 455 and 456 modules), the module may only be replaced by electricians or other trained personnel who can assure that the pins of the module are not touched.

To replace a module, proceed as follows:

Undo the screws of the top locking bar on the subrack and swing it up.

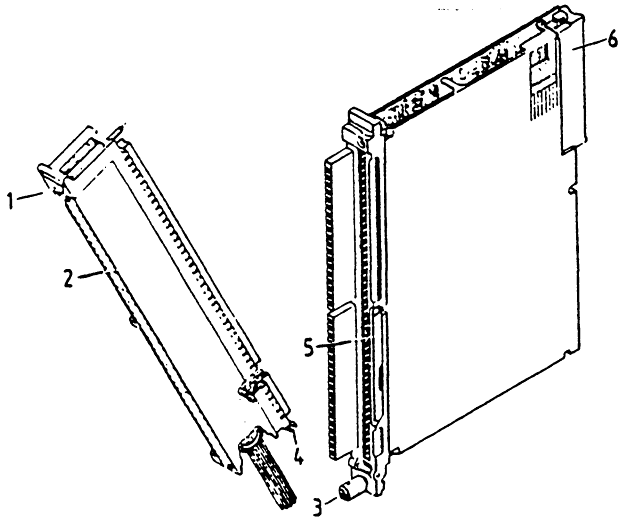
The front connector is forced out of the socket connector on the module by slackening a screw at the top of the front connector. This causes the F+ and F- contacts of the enabling input at the top end of the front connector to be opened first. The outputs are thus dead and the module is disconnected from the S5 bus (with active enable input only, see subsection 1.3.5.1).

The front connector can now be lifted out of the bottom bearing. The fork which fits into the bearing also acts as a coding key to prevent front connectors from being plugged onto the wrong modules (e.g. a 220 V AC front connector on modules with 24 V DC outputs).

The module is unlocked by turning a knob at the bottom end of the module through 90°. The module can then be pulled out of the subrack by means of the hinged extraction handle.

The module is plugged into the subrack in the reverse order.

Before plugging the front connector in, the module must be locked in position by turning the knob.

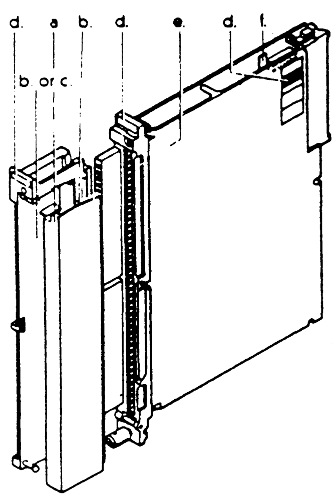


1 Screw
2 Front connector
3 Knob
4 Coding key
5 Extraction handle
6 Backplane connector

Fig. 6 20-mm wide module and front connector with crimp snap-on contacts

2.2 Identification of Modules

The set of labelling strips is supplied with the modules for identifying them and the front connectors and a set of addressing lables is supplied with the central controller. The figure shows the arrangement of the labels. The address stickers are supplied already printed with the addresses. The strips for identifying the signal cable terminals can be labelled with a typewriter.



a Labelling strip with order number coloured to distinguish between the various module types, as well as fields for marking the revision status and for user-specific labelling of the channels.
Identification colours:
Digital input modules for DC voltages: blue
Digital input modules for AC voltages: red
Digital output modules for DC voltages: green
Digital output modules for AC voltages: orange
Always update the revision status when replacing modules.

b/c Labelling strip for terminal identification or terminal connection diagrams in the front connector

d Sticker with the address (output byte QB n or input byte IB n) under which the module is referenced in the STEP 5 program (adddress sticker supplied with PC) and for identifying the settings of the addressing switch

e Nameplate

f Jumper for adjusting the enable mode

Fig. 7 Module identification system

2.3 Installation Guidelines

The power supply and signal lines to the programmable controller and front connectors of the modules should be connected in keeping with VDE 0100, 0110 and 0160 or local regulations.

If shielded cables are used, the cable shields should be connected to a shield bar in the immediate vicinity of the front connector. This bar should be connected to the housing of the programmable controller through a low resistance.

For details on the power supply, cabinet configuration, cabinet cooling, wiring and protective measures, please refer to the publication entitled "Installation guidelines".

3 Operation

3.1 Setting the Module Address

The module address is set on an addressing switch on the actual module.

The addresses for digital input modules (input bytes IB 0 to 255) and digital output modules (output bytes QB 0 to 255) is the sum of the binary significances obtained by pressing the individual switch toggles into the ON position (o).

The label with the desired module address is attached to a labelling field under the addressing switch (labels for all possible addresses are supplied together with the CC).

The switch toggles are identified by dots on the label to enable the module address specified as a decimal number to be set (IB n or QB n).

The individual toggles of the addressing switch can be pressed down with a ballpoint pen or similar pointed object (do not use a pencil).

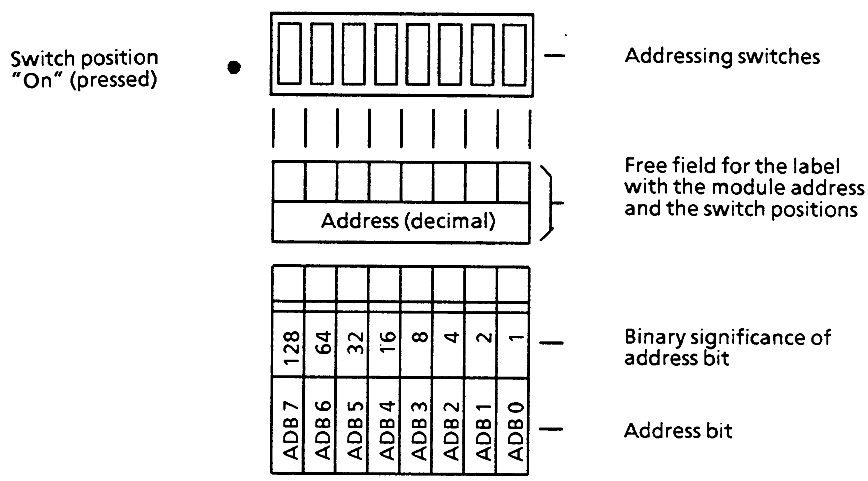


Fig. 8 Labelling the addressing switch

The address byte under which the module is referenced by the STEP 5 program is slot-independent.

In the case of modules with 16 or 32 inputs or outputs, i.e. 2 or 4 bytes, only the lowest address (starting address) for the first byte is set in each case. The addresses of the following bytes of the same module are decoded on the module.

If, for example, the address 20 is set in the case of the 16-bit module (2 bytes), the following address 21 is decoded internally and is no longer accessible. The next address will then be 22.

On a 32-bit module (4 bytes) with the starting address 20, the addresses 21, 22 and 23 would be decoded internally. In this case, the next free address would be 24.

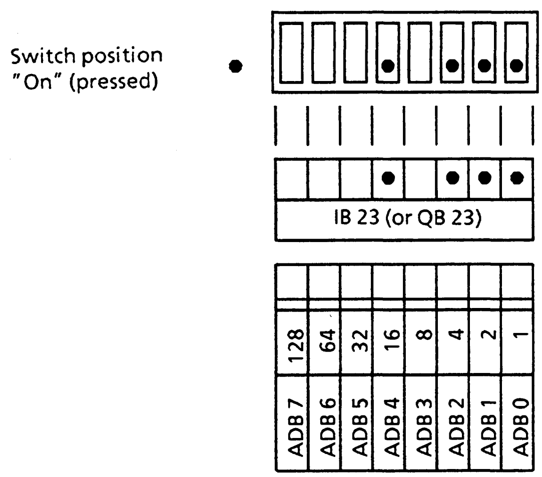
Addresses that have already been used must no longer be set. However, digital input and output modules can have the same address since they are distinguished by the $\overline{MEMR}$ and $\overline{MEMW}$ control signals.

Example 1 (Module address 23)

Digital input module with eight inputs (IB 23) or digital output module with eight outputs (QB 23).

The address is equal to the sum of the binary significances set with the individual coding switches:

$$23 = 1 + 2 + 4 + 16 = 2^0 + 2^1 + 2^2 + 2^4$$

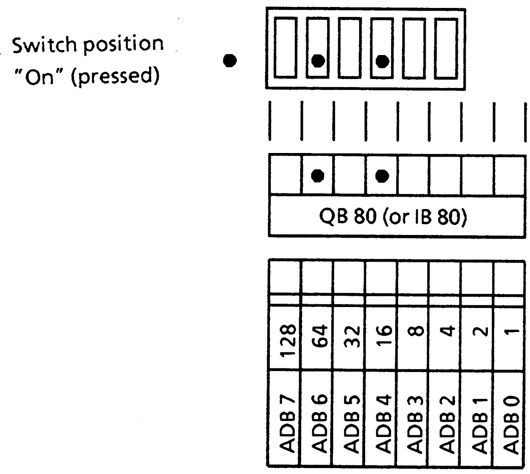


Example 2 (Module address 80)

Digital input module with 32 inputs (IB 80) or digital output module with 32 outputs (QB 80)

The address is equal to the sum of the binary significances set by means of the individual coding switches:

$80 = 16 + 64 = 2^4 + 2^6$



3.2 Connecting the Signal Leads

The modules have 20 or 42-pin plug connectors with pins measuring 2.4 mm x 0.8 mm.

Front connectors for 20 and 40 mm (0.8 and 1.6 in.) mounting width for crimp snap-on connectors and 40 mm mounting width for screw terminals are provided for connecting the individual signal cables (see Fig. 9).

Stranded conductors should be used as these make it easier to work with the front connector. When the crimp snap-on contact is inserted into the plastic body, it clicks into place. This clicking indicates that the contact has locked into position. When marshalling the leads or changing a wrong connection, for instance, the contacts can be extracted by means of a special tool without having to pull out the front connector.

Core end sleeves are not required for the screw terminals since terminals already incorporate facilities to prevent severing of the conductors. However, 7 mm (0.3 in.) long end sleeves to DIN 46 288 can be used [1]).

The terminals can take two conductors with cross-sectional areas of 2.5 mm^2 (13 AWG).

Width of screwdriver blade: 3.5 mm.

Type of connection	Connector type 6ES5497-	Max. No. of poles	Cross-sectional area of signal of supply conductor	Connector for rated voltage	Fork width mm	Width of front connector	Module type 6ES5... Type of operation with fan	without fan
Crimp snap-on contact 1)	4UA12	42	0.5...1.5 mm²	5...60 V DC	12	20 mm	420, 430, 431, 432, 434, 441, 451, 458	-
	4UA22	42	0.5...1.5 mm²	5...60 V DC	12	40 mm	453, 454, 457	420, 430, 431, 432, 434, 441, 451, 453, (454), 457, 458
	4UA42	20	0.5...1.5 mm²	24...240 V AC	14	40 mm	435, 436, 455, 456	
Screw terminal	4UB12	42	0.5...2 x 2.5 mm²	5...60 V DC	12	40 mm	420, 430, 431, 432, 434, 441, 451, 453, (454), 457, 458	
	4UB22	25	0.5...2 x 2.5 mm²	5...60V DC	12	40 mm	454	
	4UB42	20	0.5...2 x 2.5 mm²	24...240 V AC	14	40 mm	435, 436, 455, 456,	

Fig. 9 Terminating methods for front connectors
1) For order number and tools see Chapter 4

3.3 Connecting Outputs in Parallel and Switching the Load on via a Contact

Important: Outputs must not be connected in parallel in order to increase the load.

o Digital output modules for DC

Two outputs of a module can be connected in parallel if they are decoupled by means of diodes (453).

An extra diode must be connected in the output lines of modules that do not contain diodes (441, 451, 454). Where the signal statuses and power supplies of the two outputs differ, the maximum permissible output current corresponds to that of the output with the lower current.

The contact (e.g. for manual mode) is connected to one of the two L+ lines.

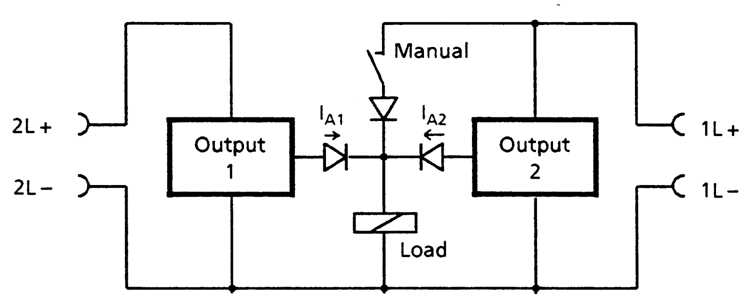


Fig. 10 Connecting DC outputs in parallel without load increase

o Digital output modules for AC

Outputs can be connected in parallel without increasing the load if they are connected to the same phase (L) and neutral conductor (N).

The load per output must be at least 50 mA in order to maintain the permissible residual voltage for "0" signal. The maximum switching current of 2 A per load must not be exceeded.

The load can also be switched by means of a contact.

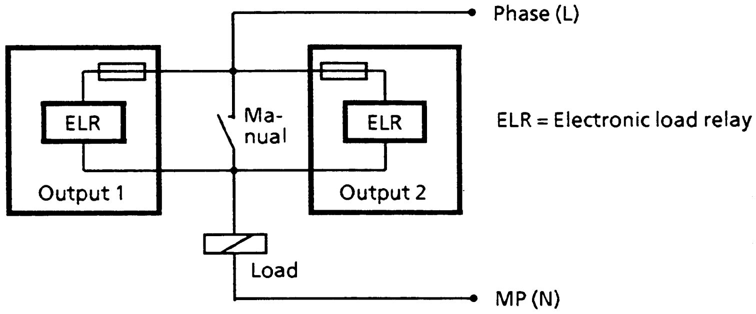


Fig. 11 Connecting AC outputs in parallel without increasing the load

3.4 Connecting Input/Output Modules to Two Power Supplies

The two examples below show the power supply of inputs and outputs of different modules from two different power supply units.

In the case of non-floating input/output modules, the negative poles (L-) of the power supplies are connected to system ground (M) since the inputs of the 420 module are already connected to M (0 V potential) on the module.

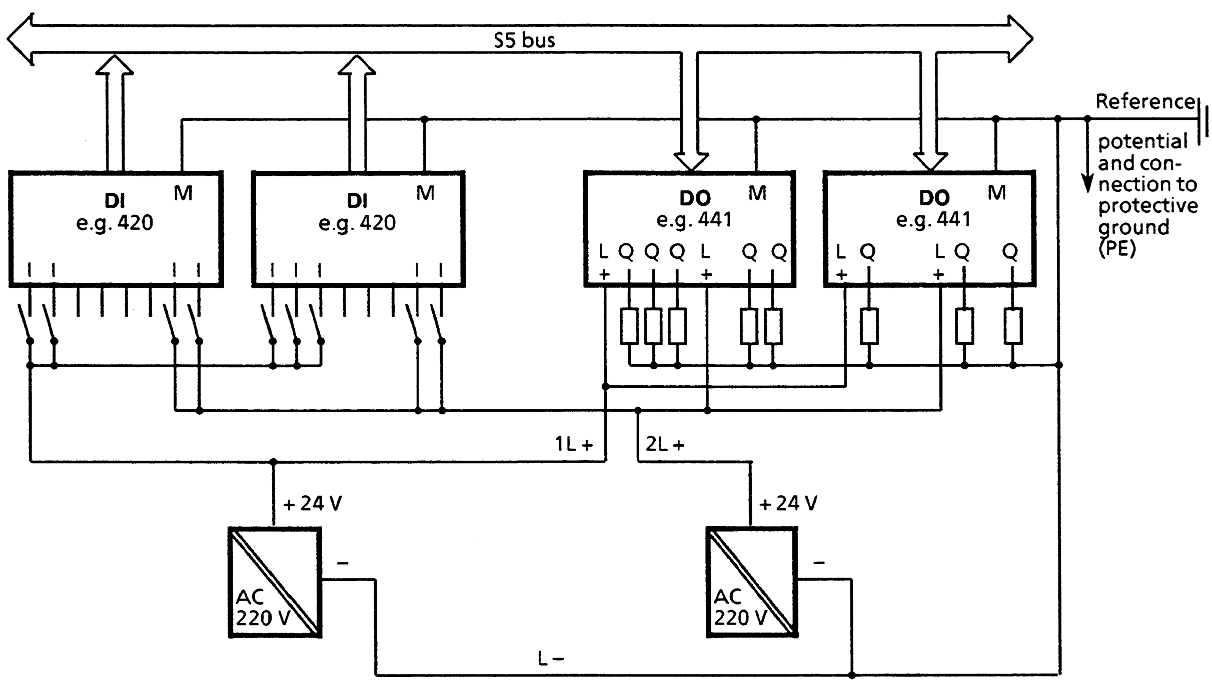


Fig. 12 Using two power supply units for non-floating input/ output modules

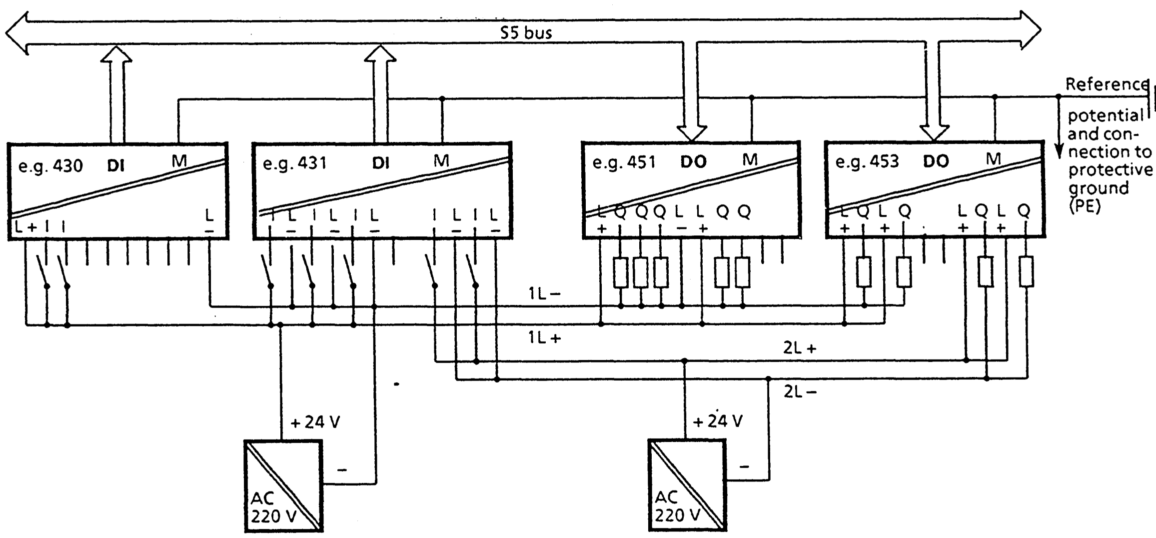


Fig. 13 Using two power supply units for floating input/output modules

In the case of floating modules, the inputs or outputs can be powered from two separate power supply units due to the fact that groups of input or outputs are isolated internally on the module.

It must be noted that, when connecting the inputs or outputs of two floating modules to one power supply unit, the modules are no longer isolated.

3.5 Short-circuit Protection and Fusing of DC Digital Output Modules

In addition to the electronic short-circuit protection, the module also has fuse links. These fuses also provide protection against polarity reversal of the power supply terminals.

The resistance R specified in the technical specifications for electronic short-circuit protection corresponds to the maximum permissible line impedance.

In the event of a short-circuit, 2 to 3 times the nominal output current flows briefly through the output before the clocked electronic short-circuit protection responds.

When selecting the load power supply unit, make sure that an adequate short-circuit current is available allowing for all output loads connected (number of outputs "On" simultaneously) (diversity factor).

In the case of non-stabilized load power supplies, this higher current is generally ensured.

With stabilized load power supplies, especially if the output loads are low, e.g. up to 20 A, an adequate short-circuit current level must be ensured.

4 Spare Parts

Designation	Order number	repairable (yes/no)	can be ordered from
Mini-snap-in contact (junior timer) supplied as			
bandolier	927973-3	no	AMP
single contacts	927973-2 or	no	AMP
	6XX3070		see catalog
	(in packs of 250)		ET 1
Cramping tool	6XX3071	no	s. cat. ET 1
Core and sleeves	e.g. A2,5-7 (DIno46 228)	no	
Extraction tool	6ES5 497-4UC11	no	GWK
Labelling set for modules [1]		no	GWK
6ES5 420-4UA11	C79451-A3079-C700		
-4UA12	C79451-A3079-C728		
6ES5 430-4UA11	C79451-A3079-C701		
-4UA12	C79451-A3079-C729		
6ES5 431-4UA11	C79451-A3079-C702		
-4UA12	C79451-A3079-C732		
6ES5 432-4UA11	C79451-A3079-C722		
-4UA12	C79451-A3079-C733		
6ES5 434-4UA11	C79451-A3079-C703		
-4UA12	C79451-A3079-C734		
6ES5 435-4UA11	C79451-A3079-C718		
-4UA12	C79451-A3079-C735		
6ES5 436-4UA11	C79451-A3079-C709		
-4UA12	C79451-A3079-C736		
6ES5 436-4UB11	C79451-A3079-C716		
-4UB12	C79451-A3079-C737		
6ES5 441-4UA11	C79451-A3079-C704		
-4UA12	C79451-A3079-C738		
6ES5 451-4UA11	C79451-A3079-C705		
-4UA12	C79451-A3079-C739		
6ES5 453-4UA11	C79451-A3079-C706		
-4UA12	C79451-A3079-C740		
6ES5 454-4UA11	C79451-A3079-C707		
-4UA12	C79451-A3079-C741		
6ES5 455-4UA11	C79451-A3079-C719		
-4UA12	C79451-A3079-C742		
6ES5 456-4UA11	C79451-A3079-C710		
-4UA12	C79451-A3079-C743		
6ES5 456-4UB11	C79451-A3079-C717		
-4UB12	C79451-A3079-C744		
6ES5 457-4UA12	C79451-A3079-C727		
6ES5 458-4UA11	C79451-A3079-C708		
-4UA12	C79451-A3079-C745		

[1] Labelling sets for -4U.12 will be delivered in lieu of those for -4U.11 if these are no longer available

Designation	Order number	repairable (yes/no)	can be ordered from
Labelling set for addresses	6ES5 497-4UD11	no	GWK
Arc-suppression module	6ES5 498-1AB11	no	GWK
Coding jumper (e.g. for 6ES5 432-4UA11 or for switching the enable mode	W79070-G2602-N2	no	GWK
Fuse for 6ES5 456-4UB12 3.5 A, quick/250V UL/CSA	W79054-L1021-F350	no	GWK
Fuse for 6ES5 455-4UA12 6ES5 456-4UA12 6.3 A, quick/250V	W79054-L1011-F630	no	GWK

5 Specifications of the Modules

5.1 Digital Input Module 6ES5420-4UA11 and 6ES5420-4UA12 (acc. to UL/CSA Requirements)

Rated input voltage	24 V DC
Number of inputs	32
Type of inputs	Non-floating
Input voltage	
"0" signal	-33 to 5 V
"1" signal	13 to 33 V
Rated input current	8.5 mA
Input frequency	max. 100 Hz
Delay	3 ms typ. (1.4 to 5 ms)
Input resistance	2.8 kohms (typ.)
Diversity factor (number of inputs "On" simultaneously)	100%
Permissible length of cable	max. 600 m, unshielded; max. 1000 m, shielded

Power supply

Digital section from system bus	5 V, typ. 80 mA
Supply voltage for 2-wire BERO proximity limit switches	22 to 33 V

Enable input (F+)

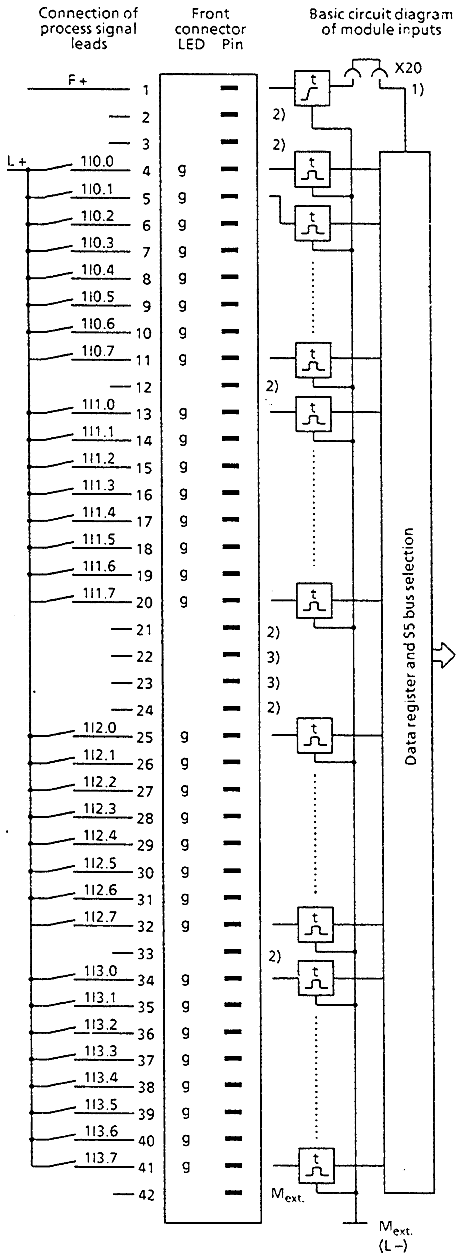
Rated input voltage	24 V DC
Input voltage	
"0" signal	-33 to 5 V
"1" signal	13 to 33 V
Rated input current	5 mA
Permissible length of cable	max. 200 m

Safety test

Impulse voltage test to IEC 255-4	Input to L-: U_S = 1 kV; 1.2/50 μs waveform
RIV (radio interference voltage) test to IEC 255-4	Input to L-: U_S = 1 kV; 1 MHz

Physical data

Dimensions (WxHxD)	20 mm x 255 mm x 195 mm (0.8 in x 10 in x 7.7 in)
Approx. weight	0.4 kg (1 lb.)



Example for the labelling of an input:

(1)I 1.5

- Input 5 (5th bit); Possible: 0 to 7
- Address of input byte (1st byte); Possible: 0 to 255
- I = Input
- 1st group (not specified in the address)

g = Green LED (status display)
F+ = Enabling input

L- of the power supply unit to reference potential (PE).

1) Enable mode switch (only applies to ...-4UA12), jumper inserted: enable input is active (factory setting)

2) The connection is not internally connected. Creepage and ventilation paths of 0.8mm have been retained. **Warning:** When connecting voltages in the input voltage area or above, these distances are, according to UL and CSA, not adequate. (But according to German standards (VDE) permissible).

3) The connection is not internally established. When connecting voltages in the input voltage area UL, CSA and the German standards (VDE) are met.

5.2 Digital Input Module 6ES5430-4UA11 and 6ES5430-4UA12 (acc. to UL/CSA Requirements)

Rated input voltage	24 V DC
Number of inputs	32
Type of inputs	Floating, 1 group with 32 inputs
Input voltage	
"0" signal	-3 to 7 V
"1" signal [1]	13 to 33 V
Rated input current	7.0 mA
Input frequency	max. 100 Hz
Delay	3 ms typ. (1.4 to 5 ms)
Response time	6 ms typ. (4 to 10 ms)
Input resistance	3.3 kohms (typ.)
Diversity factor (number of inputs "On" simultaneously)	100%
Permissible length of cable	max. 600 m, unshielded; max. 1000 m, shielded

Power supply

Digital section from system bus	5 V, typ. 100 mA
Supply voltage for 2-wire BERO proximity limit switches	22 to 33 V
Supply voltage L+/L-	24 V (20 to 30 V)
Current consumption from L+/L-	approx. 100 mA

Enable input (F+/F-)

Rated input voltage	24 V DC
Input voltage	
"0" signal	-33 to 5 V
"1" signal	13 to 33 V
Rated input current	5 mA
Permissible length of cable	max. 200 m

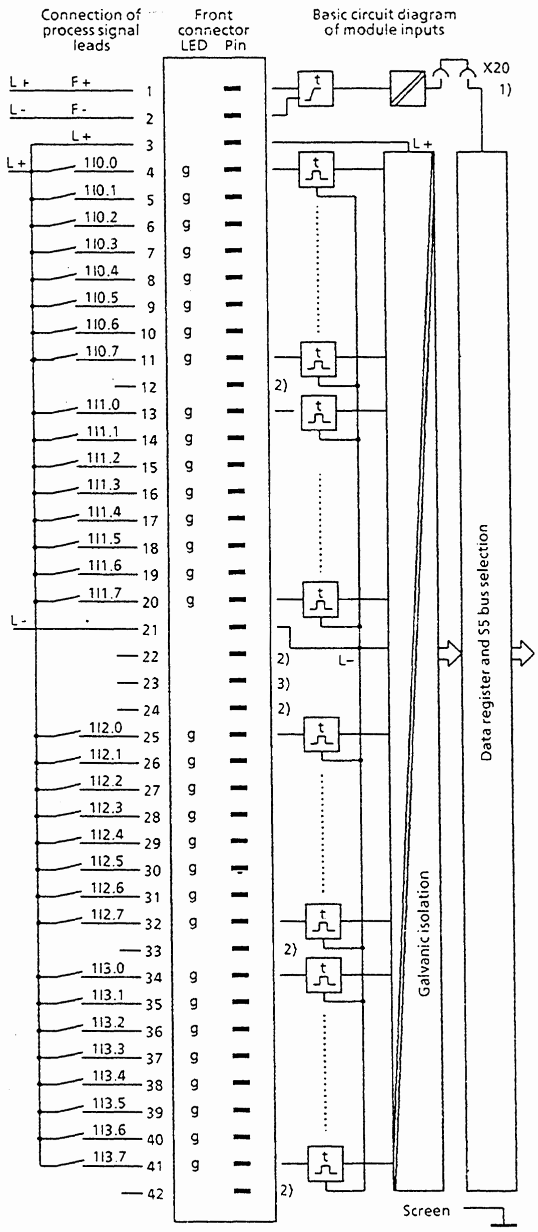
Safety test

Voltage test to VDE 0160	Group to casing: 1250 V AC
Impulse voltage test to IEC 255-4	Input to L-: U_s = 1 kV; 1.2/50 µs waveform
RIV (radio interference voltage) test to IEC 255-4	Input to L-: U_s = 1 kV; 1 MHz

Physical data

Dimensions (WxHxD)	20 mm x 255 mm x 195 mm (0.8 in x 10 in x 7.7 in)
Approx. weight	0.4 kg (1 lb.)

[1] Polarity reversal of up to eight inputs per module permissible.



Example for the labelling of an input:

(1)I 3.5

- Input 5 (5th bit) Possible: 0 to 7
- Address of input byte (3rd byte); Possible: 0 to 255
- I = Input
- 1st group (not specified in the address)

g = Green LED (status display)
F+/F- = Enabling input

1) Enable mode switch (only applies to ...-4UA12), jumper inserted: enable input is active (factory setting)

2) The connection is not internally connected. Creepage and ventilation paths of 0.8mm have been retained. **Warning:** When connecting voltages in the input voltage area or above, these distances are, according to UL and CSA, not adequate. (But according to German standards (VDE) permissible).

3) The connection is not internally established. When connecting voltages in the input voltage area UL, CSA and the German standards (VDE) are met.

5.3 Digital Input Module 6ES5431-4UA11 and 6ES5431-4UA12 (acc. to UL/CSA Requirements)

Rated input voltage	24 V DC to 60 V DC
Number of inputs	16
Type of inputs	Floating, 16 inputs
Input voltage	
"0" signal	-33 to 8 V
"1" signal	13 to 72 V
Rated input current	4.5 to 7.5 mA (24 to 60 V DC)
Input frequency	max. 100 Hz
Delay	3 ms typ. (1.4 to 5 ms)
Diversity factor (number of inputs "On" simultaneously)	100%
Permissible length of cable	max. 400 m, unshielded; max. 1000 m, shielded

<u>Power supply</u>

Digital section from system bus	5 V, typ. 90 mA
Supply voltage for 2-wire BERO proximity limit switches	22 to 72 V

<u>Enable input (F+/F-)</u>

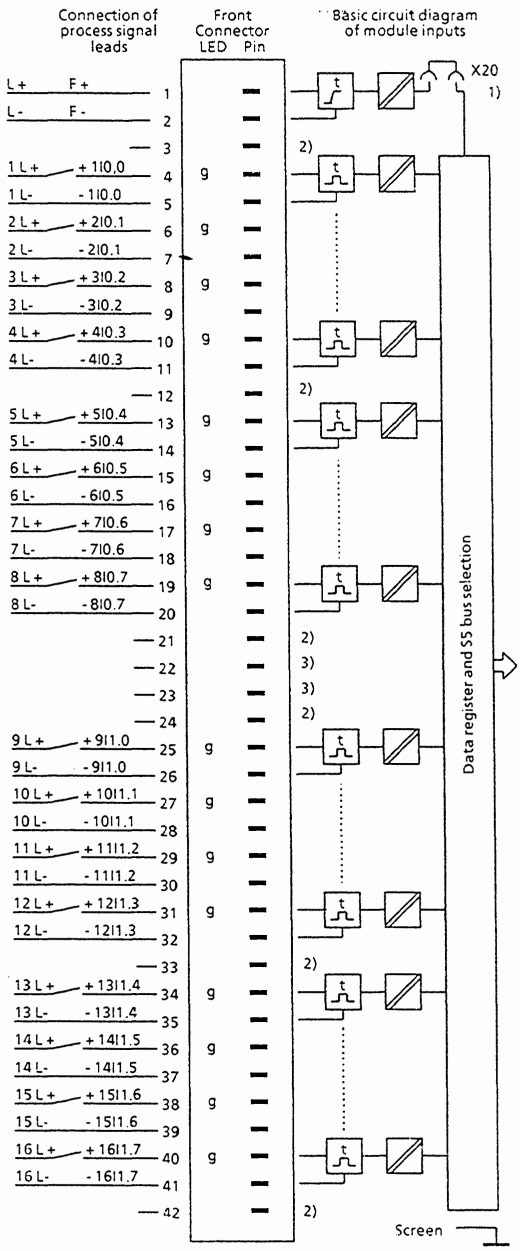
Rated input voltage	24 V DC to 60 V DC
Input voltage	
"0" signal	-72 to 8 V
"1" signal	13 to 72 V
Rated input current	5 mA (at 48 V DC)
Permissible length of cable	max. 200 m

<u>Safety test</u>

Voltage test to VDE 0160	Group to casing: 1250 V AC; Group to group: 1250 V AC
Impulse voltage test to IEC 255-4	Input to L-: U_S = 1 kV; 1.2/50 μs waveform
RIV (radio interference voltage) test to IEC 255-4	Input to L-: U_S = 1 kV; 1 MHz

<u>Physical data</u>

Dimensions (WxHxD)	20 mm x 255 mm x 195 mm (0.8 in x 10 in 7.7 in)
Approx. weight	0.4 kg (1 lb.)



Example for the labelling of an input:

(8)I 0.7

- Input 7 (7th bit); Possible: 0 to 7
- Address of input byte (0th. byte); Possible: 0 to 255
- I = Input
- 8th group (not specified in the address)

g = Green LED (status display)
F+/F- = Enabling input

1) Enable mode switch (only applies to ...-4UA12), jumper inserted: enable input is active (factory setting)

2) The connection is not established internally. Creepage and ventilation paths of 0.8mm have been retained.
Warning: When connecting voltages in the input voltage area or above, these distances are, according to UL and CSA, not adequate. (But according to German standards (VDE) permissible).

3) The connection is not established internally. When connecting voltages in the input voltage area UL, CSA and the German standards (VDE) are met.

5.4 Digital Input Module 6ES5432-4UA11 and 6ES5432-4UA12 (acc. to UL/CSA Requirements)

Rated input voltage	24 V DC
Number of inputs	32
Type of inputs	Floating, 4 groups with 32 inputs
Input voltage	
for "0" signal	-33 to 5 V
for "1" signal	13 to 33 V
Rated input current	8.5 mA
Input frequency	max. 100 Hz/300 Hz/1 kHz
Delay (selectable)	3 ms/1 ms/0.3 ms
Input resistance	2.8 kohms (typ.)
Diversity factor (number of inputs "On" simultaneously)	100%
Permissible length of cable	max. 600 m, unshielded (3 ms); max. 200 m, unshielded (1 ms); max. 50 m, unshielded (0.3 ms)

Power supply

Digital section from system bus	5 V, typ. 200 mA
Supply voltage for two-wire BERO	22 to 33 V

Enable input (F+/F-)

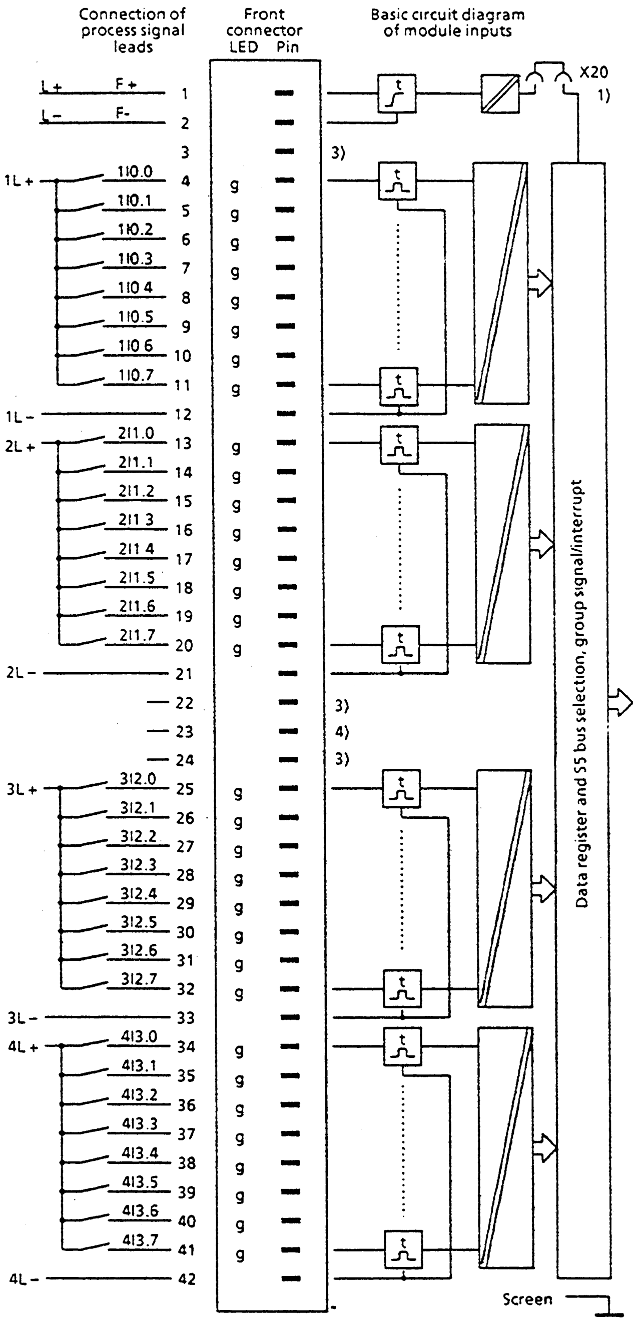
Rated input voltage	24 V DC
Input voltage	
"0" signal	-33 to 5 V
"1" signal	13 to 33 V
Rated input current	5 mA
Permissible length of cable	max. 200 m

Safety tests

Voltage test to VDE 0160	Group to group: 1250 V AC Group to ground: 1250 V AC
Impulse voltage test IEC 255-4	Input to L-: U_S = 1 kV; 1.2/50 µs waveform
RIV test to to IEC 255-4	Input to L-: U_S = 1 kV; 1 MHz

Physical data

Dimensions (WxHxD)	20 mm x 255 mm x 195 mm (0.8 in x 10 in 7.7 in)
Approx. weight	0.55 kg (1.2 lbs)



Example for the labelling of an input

(4)I 3.5

- Input 5 (5th bit) Possible: 0 to 7
- Address of input byte Bytes (3rd byte); Possible: 0 to 255 [2])
- I = Input
- 4th group (not specified in the address)

g = Green LED (status display)

F+/F- = Enabling input

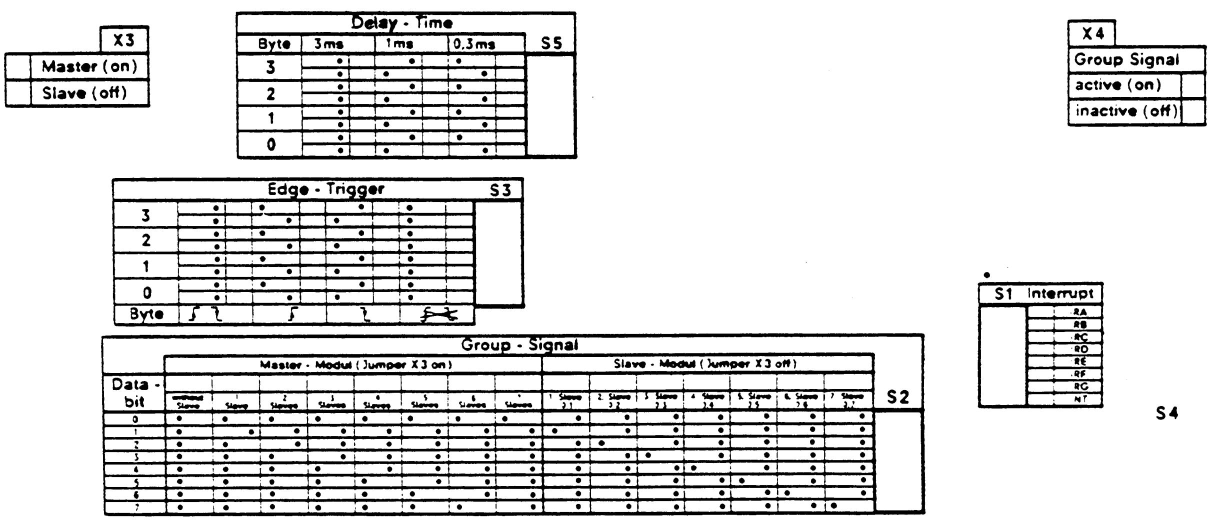
[1]) Enable mode switch (only applies to ...-4UA12), jumper inserted: enable input is active (factory setting)

[2]) 128 to 255 for group signal and interrupt.

[3]) The connection is not established internally. Creepage and ventilation paths of 0.8mm have been retained. **Warning**: these distances not adequate acc. to UL & CSA when connecting voltages in input voltage area or above. (VDE/German permissible).

[4]) The connection is not established internally. UL, CSA and VDE standards are met when connecting voltages in input voltage area.

Labelling of the module cover:



5.5 Digital Input Module 6ES5434-4UA11 and 6ES5434-4UA12 (acc. to UL/CSA Requirements)

Rated input voltage (LH+)	5 to 15 V DC
Rated input voltage (L+)	12 to 24 V DC (NAMUR) 1)
Number of inputs	32
Type of inputs	Floating, 1 group with 32 inputs
Input voltage	
TTL: for "0" signal	0 to 0.8 V
for "1" signal	2.4 to 5.0 V
CMOS: for "0" signal	0 V to 0.3 x LH+
for "1" signal	0.7 x LH+ to 1 x LH+
Rated input current	
TTL: for "0" signal	-1 mA
for "1" signal	0.1 mA or open input
CMOS: for "0" signal	-1 to -3 mA (5 to 15 V)
for "1" signal	0.1 to 0.3 mA (5 to 15 V)
NAMUR: for "0" signal	$\leq$ 1.2 mA
for "1" signal	$\geq$ 2.1 mA
Internal resistance	1 kohm (typ.)
Line impedance	max. 50 ohms
Input frequency	max. 100 Hz
Delay	3 ms (typ.) (1.4 to 5 ms)
Diversity factor (number of inputs "On" simultaneously)	100%
Permissible length of cable	
TTL/CMOS	max. 200 m, unshielded
NAMUR	max. 600 m, unshielded

Power supply

Digital section from system bus	5 V, typ. 80 mA
Supply voltage L+/L-	24 V (20 to 30 V)
Current consumption from L+/L-	100 mA each
Current consumption from LH+/LH-	150 mA each at 15 V 2)

Enable input (F+/F-)

Rated input voltage	15 V DC
Input voltage	
for "0" signal	-15 to 2 V
for "1" signal	4 to 33 V
Rated input current	5 mA
Permissible length of cable	max. 100 m

1) NAMUR = Sensor with current output to DIN 19234 (Standards committee for instrumentation and control). The module is, however, not intrinsically safe.

2) As output, each can be loaded with 120 mA. The current consumption from L+/L- increases accordingly. Output voltage approx. 8.5 V.

Safety tests

Voltage test to VDE 160	Group to earth: 1250 V AC
Impulse voltage test to IEC 255-4	Input to L-: U_S = 1 kV; 1.2/50 µs waveform
RIV test to IEC 255-4	Input to L-: U_S = 1 kV; 1 MHz

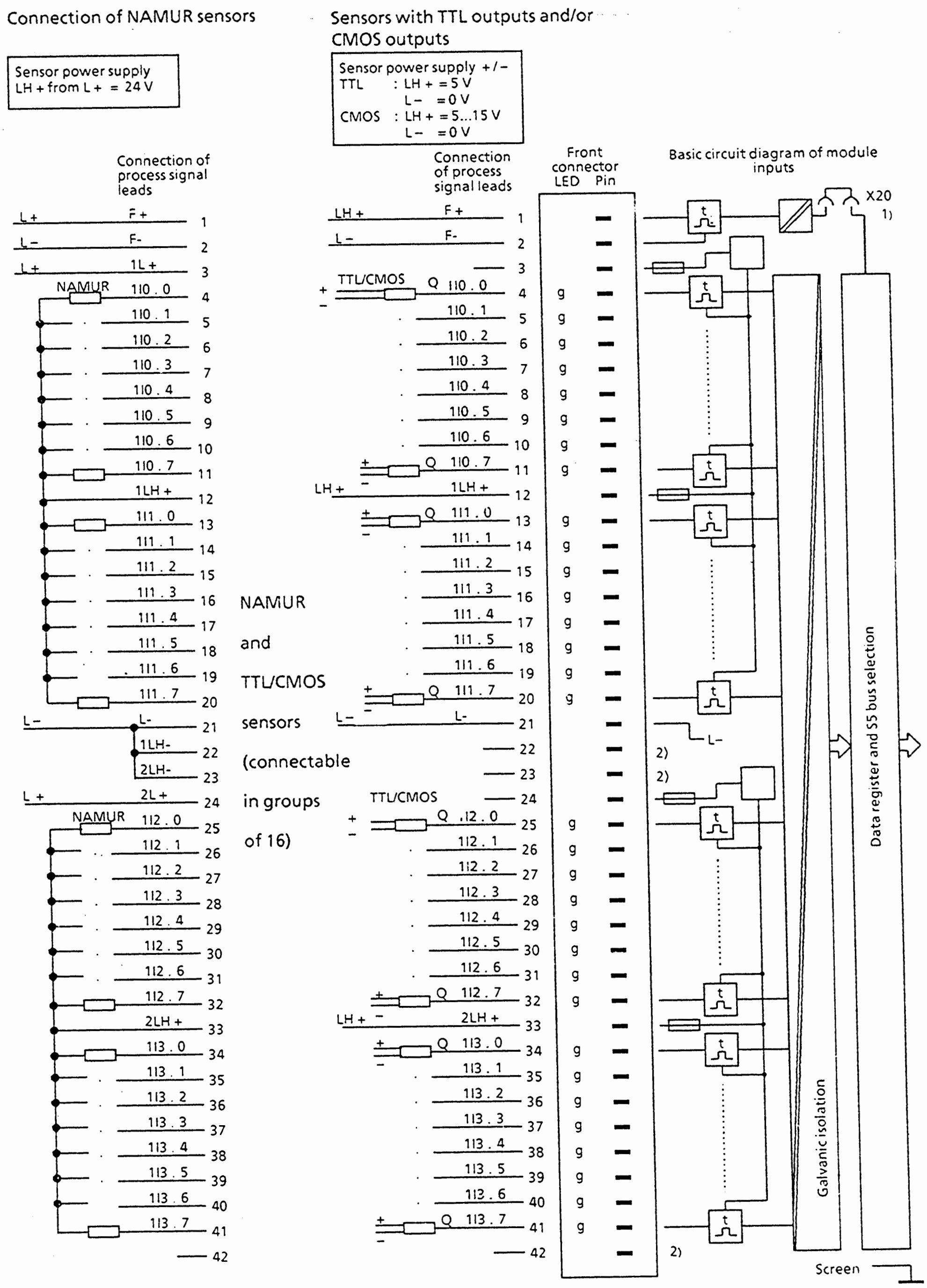
Physical data

Dimensions (WxHxD)	20 mm x 255 mm x 195 mm (0.8 in x 10 in 7.7 in)
Approx. weight	0.45 kg (1.1 lbs)

Connection of sensors to the inputs of the 434 digital input module via the front connector and the power supply of the sensors:

Sensor type	Bytes 0 and 1 (I0.0 to I1.7)			Bytes 2 and 3 (I2.0 to I3.7)		
	1L+	1LH+	1LH-	2L+	2LH+	2LH-
NAMUR	L+ (24 V)	Sensor supply	Jumper to L-	L+ (24 V)	Sensor supply	Jumper to L-
CMOS	-	5...15 V	-	-	5...15 V	-
TTL	-	5 V	-	-	5 V	-

With CMOS and TTL sensors the open inputs have signal "1" (LED lit).



g = Green LED (status display)
F+/F- = Enabling input

1) Enable mode switch (only applies to ...-4UA12), jumper inserted: enable input is active (factory setting)

2) The connection is not established internally. Creepage and ventilation paths of 0.8mm have been retained. **Warning:** when connecting voltages in input voltage area or above, these distances not adequate acc. to UL and CSA. (VDE permissible).

Example for the labelling of an input

(1)I 1.5

- Input 5 (5th bit) Possible: 0 to 7
- Address of input byte (1st byte); Possible: 0 to 255
- I = Input
- 1st group (not specified in the address)

5.6 Digital Input Module 6ES5435-4UA11 6ES5435-4UA12 (acc. to UL/CSA Requirements)

Rated input voltage	24 to 60 V AC (47 to 63 Hz)
Number of inputs	16
Type of inputs	Floating 2 groups of 8 inputs
Input voltage	
"0" signal	0 to 15 V AC
"1" signal	20 to 72 AC
Rated input current	
at 48 VAC	typ. 15 mA
at 60 V AC	typ. 20 mA
Input current for two-wire BERO proximity switch	
"0" signal	≤ 5 mA
"1" signal	≥ 10 mA
Input frequency	Max. 20 Hz as pulse train
Delay	
positive-going edge	5 ms typ. (2 to 15 ms)
negative-going edge	20 ms typ. (10 to 25 ms)
Input resistance	3 kohms (typ.)
Diversity factor (number of inputs "On" simultaneously)	
with fan	100%
without fan	75% at 60 V; 100% at 35 °C; 100% at 30 V
Permissible length of cable	max. 600 m, unshielded; max. 1000 m, shielded

<u>Power supply</u>

Digital section from system bus	5 V, typ. 100 mA

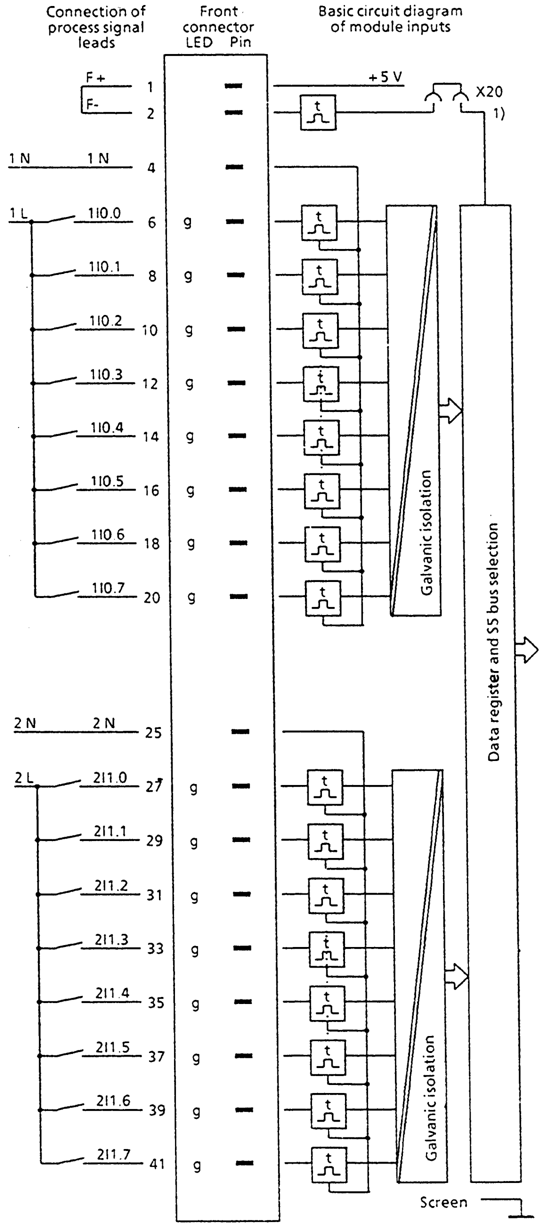
<u>Enable input (F+/F-)</u>	Jumper in front connector

<u>Safety test</u>

Voltage test to VDE 0160	Group to group: 2000 V AC; Group to casing: 1500 V AC
Impulse voltage test to IEC 255-4	Input to L-: U_S = 2.5 kV; 1.2/50 µs waveform
RIV (radio interference voltage) test to IEC 255-4	Input to L-: U_S = 2.5 kV; 1 MHz

<u>Physical data</u>

Dimensions (WxHxD)	40 mm x 255 mm x 195 mm (0.8 in x 10 in 7.7 in)
Approx. weight	0.55 kg (1.2 lbs)



Example for the labelling of an input:

(2)I 1.2

- Input 2 (2nd bit); Possible: 0 to 7
- Address of input byte Bytes (1st byte); Possible: 0 to 255
- I = Input
- 2nd group (not specified in the address)

g = Green LED (status display)
F+/F- = Enabling input

1) Enable mode switch (only applies to ...-4UA12), jumper inserted: enable input is active (factory setting)

5.7 Digital Input Module 6ES5436-4UA11 and 6ES5436-4UA12 (acc. to UL/CSA Requirements)

Rated input voltage	115 to 240 V AC (47 to 63 Hz)
Number of inputs	16
Type of inputs	Floating, 2 groups of 8 inputs
Input voltage	
"0" signal	0 to 60 V AC
"1" signal	90 to 264 V AC
Rated input current	
at 115 V AC	typ. 15 mA
at 240 V AC	typ. 25 mA (2-wire BERO proximity switch can be connected)
Input frequency	max. 20 Hz as pulse train
Delay	
on positive-going edge	typ. 5 ms (2 to 15 ms)
on negative-going edge	typ. 20 ms (10 to 25 ms)
Input resistance	typ. 10 kohms
Diversity factor (number of inputs "On" simultaneously)	
with fan	100%
without fan	75% at 240 V AC; 100% at 35 ^{o}C; 100% at 115 V AC
Permissible length of cable	max. 600 m, unshielded; max. 1000 m, shielded

<u>Power supply</u>

Digital section from system bus	typ. 5 V, 100 mA

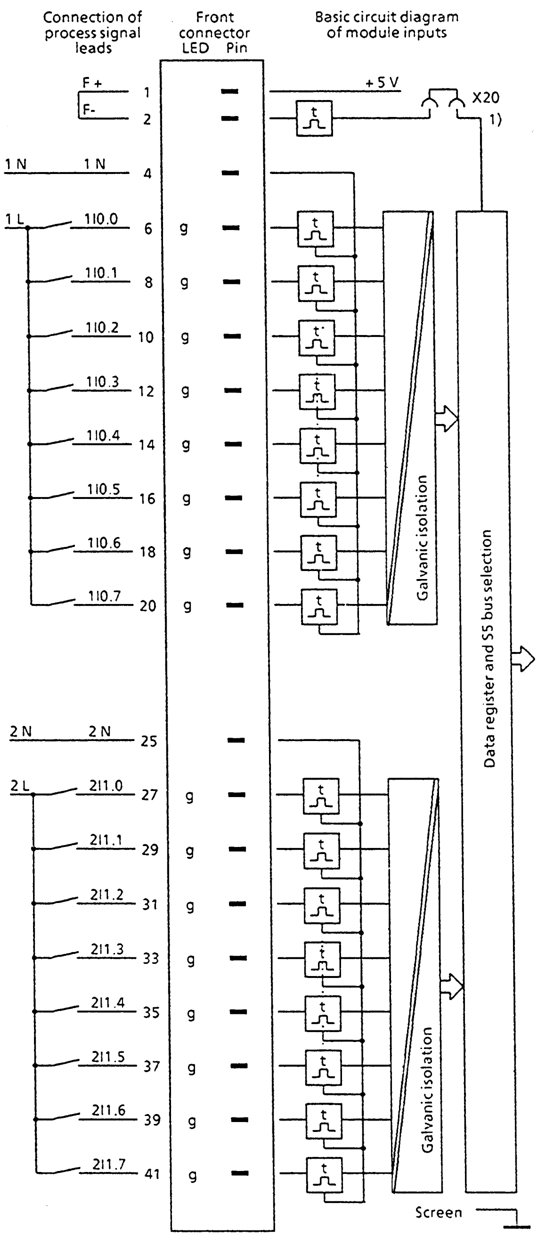
<u>Enabling input (F+/F-)</u>	Jumper in front connector

<u>Safety test</u>

Voltage test to VDE 0160	Group to group: 2000 V AC Group to ground: 1500 V AC
Impulse voltage test to IEC 255-4	Input of L-: U_S = 2.5 kV; 1.2/50 µs waveform
RIV (radio interference voltage) test to IEC 255-4	Input to L-: U_S = 2.5 kV; 1 MHz

<u>Physical data</u>

Dimensions (WxHxD)	40 mm x 255 mm x 195 mm (1.6 in x 10 in x 7.7 in)
Approx. weight	0.55 kg (1.2 lbs)



Example for the labelling of an input:

(1)I 0.4

- Input 4 (4th bit); Possible: 0 to 7
- Address of input byte (0th byte); Possible: 0 to 255
- I = Input
- 1st group (not specified in the address)

g = Green LED (status display)
F+/F- = Enabling input (jumper in front connector)

[1]) Enable mode switch (only applies to ...-4UA12), jumper inserted: enable input is active (factory setting)

5.8 Digital Input Module 6ES5436-4UB11 and 6ES5436-4UA12 (acc. to UL/CSA Requirements)

Rated input voltage	115 to 240 V AC (47 to 63 Hz)
Number of inputs	8
Type of inputs	Floating, 8 inputs
Input voltage	
"0" signal	0 to 60 V AC
"1" signal	90 to 264 V AC
Rated input current	
at 115 V AC	typ. 15 mA
at 240 V AC	typ. 25 mA (two-wire BERO proximity switch can be connected)
Input frequency	max. 20 Hz as pulse train
Delay	
on positive-going edge	typ. 5 ms (2 to 15 ms)
on negative-going edge	typ. 20 ms (10 to 25 ms)
Input resistance	typ. 10 kohms
Diversity factor (number of inputs "On" simultaneously)	100%
Permissible length of cable	max. 600 m, unshielded; max. 1000 m, shielded

<u>Power supply</u>

Digital section from system bus	5 V, typ. 80 mA

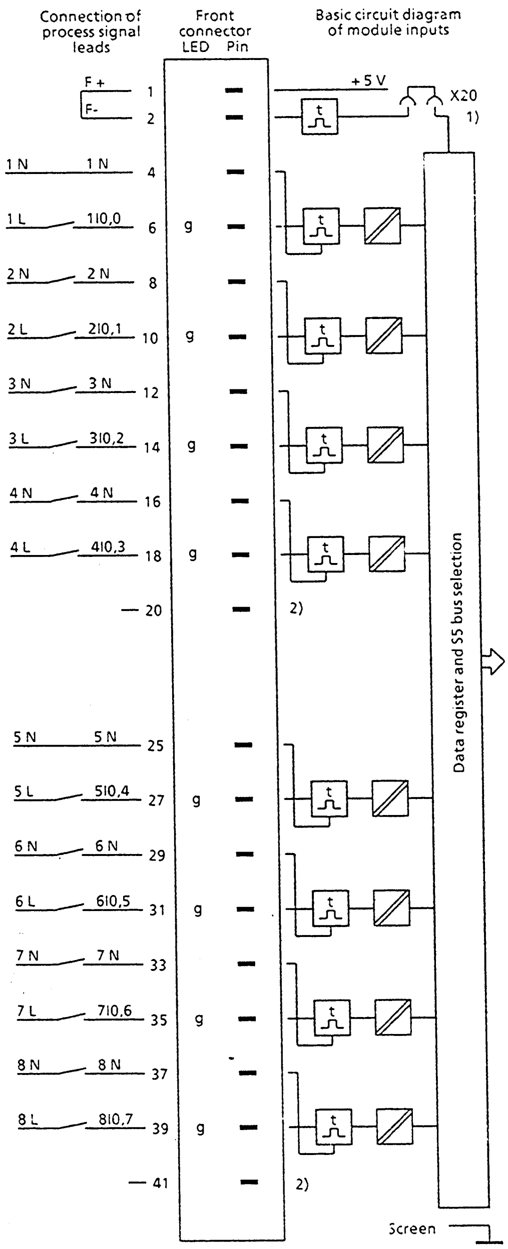
<u>Enabling input (F+/F-)</u>	Jumper in front connector

<u>Safety test</u>

Voltage test to VDE 0160 VDE 0160/UL 508	Group to group: 2000 V AC; Group to ground: 1500 V AC
Impulse voltage test to IEC 255-4	Input to L-: U_S = 2.5 kV; 1.2/50 µs waveform
RIV (radio interference voltage) test to IEC 255-4	Input to L-: U_S = 2.5 kV; 1 MHz

<u>Physical data</u>

Dimensions (WxHxD)	40 mm x 255 mm x 195 mm (0.8 in x 10 in 7.7 in)
Approx. weight	0.5 kg (1.2 lbs.)



Example for the labelling of an input:

(6)I 0.5

- Input 5 (5th bit) Possible: 0 to 7
- Address of input byte (0th byte); Possible: 0 to 255
- I = Input
- 6th group (not specified in the address)

g = Green LED (status display)
F+/F- = Enabling input (jumper in front connector)

1) Enable mode switch (only applies to ...-4UA12), jumper inserted: enable input is active (factory setting)

2) The connection is not established internally. When connecting voltages in the input voltage area UL, CSA and the German standards (VDE) are met.

5.9 Digital Output Module 6ES5441-4UA11 and 6ES5441-4UA12 (acc. to UL/CSA Requirements)

Rated input voltage L+	24 V DC
Number of outputs	32, current limited [1])
Type of outputs	Non-floating
Supply voltage range	20 to 30 V DC
Fusing	6.3 A, slow 1 fuse per 8 outputs
Output voltage	
"1" signal	min. L+ - 1.5 V
"0" signal	Max. 3 V
Switching current (resistive, inductive load)	5 mA to 0.5 A
Leakage current at "0" signal	Max. 0.5 mA
Lamp switching current	Max. 0.22 A (5 W)
Switching frequency	
resistive load	Max. 100 Hz
inductive load	Max. 2 Hz at 0.3 A; Max. 0.5 Hz at 0.5 A
Voltage induced on circuit interruption	Limited to L+ - 47 V
Total switching current	Max. 4 A per 8 outputs
Diversity factor (number of inputs "On" simultaneously)	
with fan	100%
without fan	50%; 100% to 35 °C
Permissible length of cable	Max. 400 m, unshielded;

<u>Power supply</u>

Digital section from system bus	5 V, typ. 80 mA
Current consumption from L+/L-	24 V, typ. 150 mA

<u>Enabling input (F+)</u>

Rated input voltage	24 V DC
Input voltage	
"1" signal	13 to 33 V
"0" signal	-33 V to 5 V
Rated input current	5 mA
Permissible length of cable	Max. 200 m

<u>Short-circuit monitoring (F+)</u>

Indication for signal output (H+)	Red LED for groups of 8 outputs
Output voltage referred to L- (supply of 1L+)	
"1" signal	Min. 1L+ - 5 V
"0" signal	Max. 3 V
Switching current	Max. 10 mA, limited

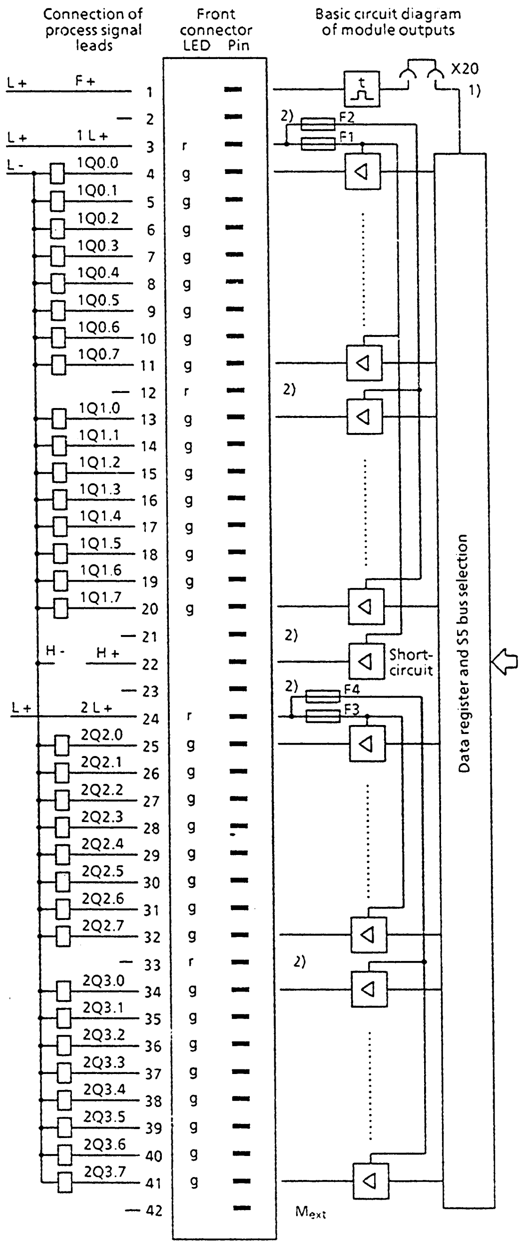
[1]) Short-circuit protection responds at line resistance $\leq$ 15 ohms.

Safety tests

Impulse voltage test to IEC 255-4	Output to L-: U_S = 1 kV 1.2/50 µs waveform
RIV test to IEC 255-4	Output to L-: U_S = 1 kV; 1 MHz

Physical data

Dimensions (WxHxD)	20 mm x 255 mm x 195 mm (0.8 in x 10 in x 7.7 in)
Approx. weight	0.45 kg (1.1 lbs)



Example for the labelling an output:

(2)Q 2.6

- Output 6 (6th bit); Possible: 0 to 7
- Address of output byte (2nd byte); Possible: 0 to 255
- Q = Output
- 2nd pin L+ (not specified in the address)

g = Green LED (status display)
r = red LED (short-circuit indication)
F+ = Enabling input, referred to M potential

Connect L- of power supply unit to system ground (M)

1) Enable mode switch (only applies to ...-4UA12), jumper inserted: enable input is active (factory setting)

2) The connection is not established internally. Creepage and ventilation paths of 0.8mm have been retained. **Warning:** when connecting voltages in the input voltage area or above, these distances are, according to UL and CSA, not adequate. (But according to German standards (VDE) permissible).

5.10 Digital Output Module 6ES5451-4UA11 and 6ES5451-4UA12 (acc. to UL/CSA Requirements)

Rated input voltage	24 V DC
Number of outputs	32 current limited 1)
Type of outputs	Floating, 1 group of 32 outputs
Supply voltage range	20 to 30 V DC
Fusing	6.3 A, slow 1 fuse per 8 outputs
Output voltage	
"1" signal	min. L+ - 1.5 V
"0" signal	max. 3 V
Switching current (resistive, inductive load)	5 mA to 0.5 A
Leakage current at "0" signal	max. 0.5 mA
Lamp switching current	max. 0.22 A (5 W)
Switching frequency	
Resistive load	max. 100 Hz
Inductive load	max. 2 Hz at 0.3 A; max. 0.5 Hz at 0.5 A
Voltage induced on circuit interruption	Limited to L+ - 47 V
Total switching current	max. 4 A per 8 outputs
Diversity factor (number of outputs "On" simultaneously)	
with fan	100%
without fan	50%; 100% to 35 °C
Permissible length of cable	max. 400 m, unshielded;

Power supply

Digital section from system bus	5 V, typ. 120 mA
Current consumption from L+/L-	24 V, typ. 150 mA

Enable input (F+/F-)

Rated input voltage	24 V DC
Input voltage	
"1" signal	13 to 33 V
"0" signal	- 33 V to 5 V
Rated input current	5 mA
Permissible length of cable	max. 200 m

Short-circuit monitoring

Indication for signal output (H+)	Red LED for groups of 8 outputs
Output voltage referred to L- (supply of 1 L+)	
"1" signal	min. 1L+ - 5 V
"0" signal	max. 3 V
Switching current	max. 10 mA, limited

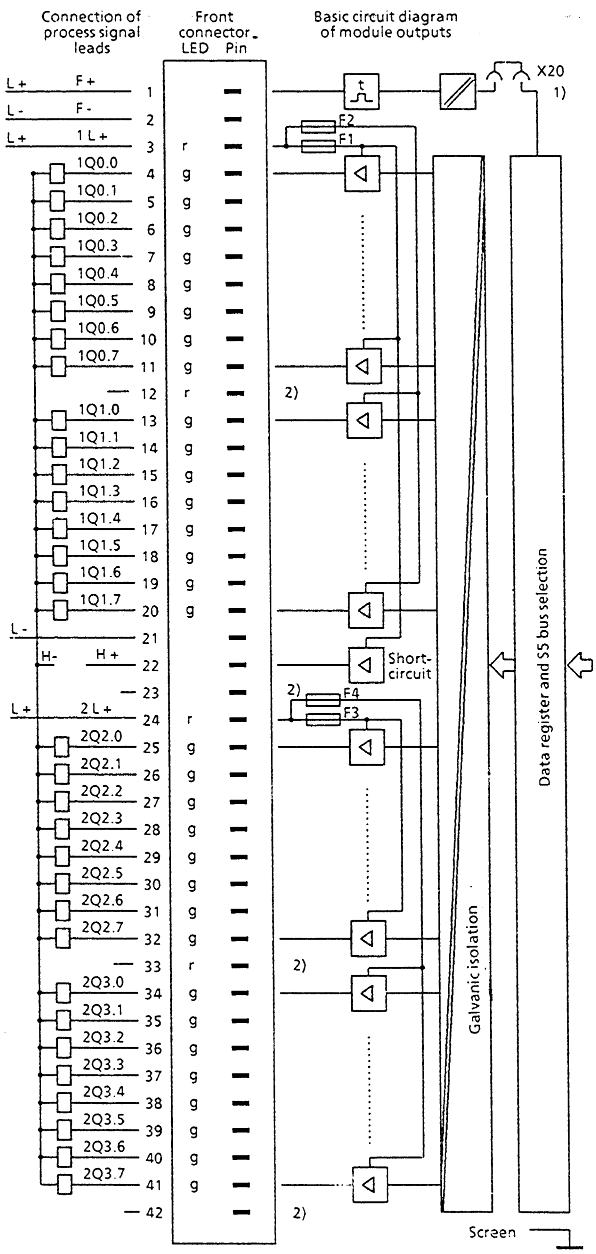
1) Short-circuit protection responds at line resistance ≤ 15 ohms.

Safety test

Voltage test to VDE 0160	Group to group: 1250 V AC; Group to casing: 1250 V AC
Impulse voltage test to IEC 255-4	Output to L-: U_S = 1 kV; 1.2/50 µs waveform
RIV (radio interference voltage) test to IEC 255-4	Output to L-: U_S = 1 kV; 1 MHz

Physical data

Dimensions (WxHxD)	20 mm x 255 mm x 195 mm (0.8 in x 10 in 7.7 in)
Approx. weight	0.45 kg (1.1 lbs)



Example for the labelling of an input:

(1)Q 1.6

- Output 6 (6th bit); Possible: 0 to 7
- Address of output bytes (1st byte); Possible: 0 to 255
- Q = Output
- 1st terminal L+ (not specified in the address)

g = Green LED (status display)
r = Red LED (short-circuit indication)
F+ = Enabling input

1) Enable mode switch (only applies to ...-4UA12), jumper inserted: enable input is active (factory setting)

2) The connection is not established internally. Creepage and ventilation paths of 0.8mm have been retained.
Warning: when connecting voltages in the input voltage area or above, these distances are, according to UL and CSA, not adequate. (But according to German standards (VDE) permissible).

5.11 Digital Output Module 6ES5453-4UA11 and 6ES5453-4UA12 (acc. to UL/CSA Requirements)

Rated supply voltage L+	24 V DC
Number of outputs (decoupled via diodes)	16, current-limited [1]
Type of outputs	Floating, 16 outputs
Supply voltage range	20 to 30 V DC
Fusing	16 x 2.5 A, slow
Output voltage	
"1" signal: (L+) switch	min. L+ - 2.5 V
(L-) switch	max. 2.5 V
"0" signal: (L+) switch	max. 3 V
(L-) switch	min. L+ - 3 V
Switching current (resistive, inductive load)	10 mA to 2.0 A [2]
Leakage current at "0" signal	max. 1 mA
Lamp switching current	max. 0.45 A (10 W)
Switching frequency	
Resistive load	max. 100 Hz
Inductive load	max. 0.2 Hz at 1 A; 0.1 Hz at 2 A
Voltage induced on circuit interruption	Limited to L+ - 47 V
Diversity factor (number of outputs "On" simultaneously)	
with fan	100%
without fan	25%; 50% to 20 °C
Permissible length of cable	max. 400 m, unshielded;

Power supply

Digital section from system bus	5 V, typ. 120 mA

Enable input (F+/F-)

Rated input voltage	24 V DC
Input voltage	
"1" signal	13 V to 33 V
"0" signal	-33 V to 5 V
Rated input current	5 mA
Permissible length of cable	max. 200 m

Short-circuit monitoring

Indication for	Red LED for 16 outputs
Signal output (H+, H-), floating	
Output voltage at L+ switch	
"1" signal	min. L+ - 5 V
"0" signal	max. 3 V
Switching current	max. 10 mA, limited

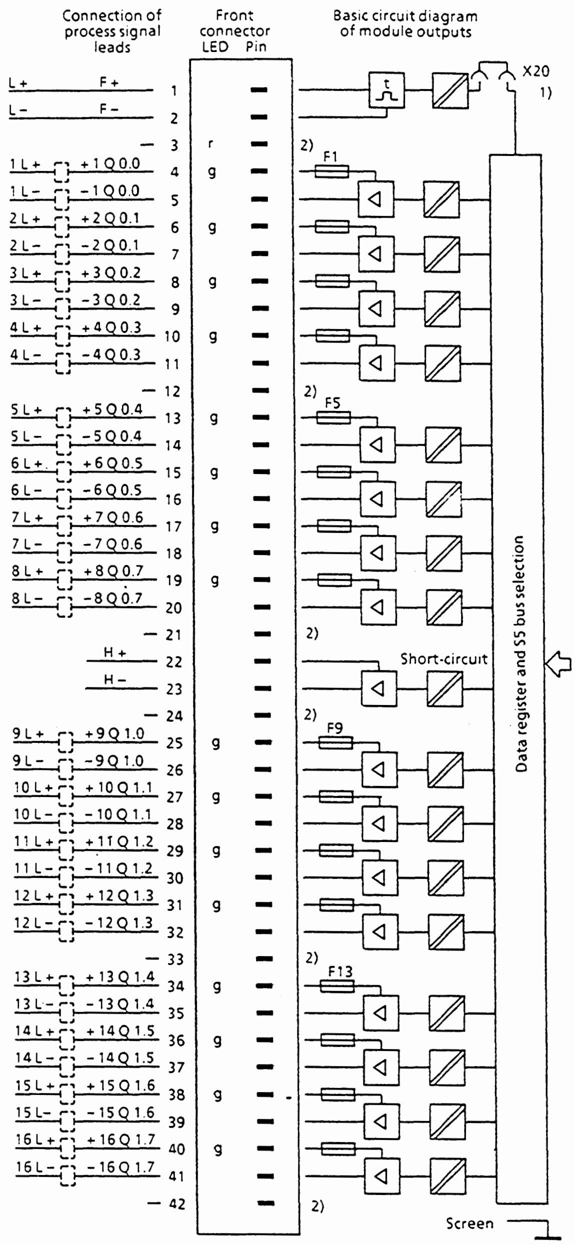
[1]) Short-circuit protection responds at line resistance $\leq$ 3.6 ohms
[2]) One digital input permissible as a minimum load

Safety test

Voltage test to VDE 0160	Group to group: 500 V AC (in -4UA11); 1250 V AC (in -4UA12); Group to ground: 500 V AC (in -4UA11); 1250 V AC (in -4UA12);
Impulse voltage test to IEC 255-4	Output to L-: U_S = 1 kV; 1.2/50 µs waveform
RIV (radio interference voltage) test to IEC 255-4	Output to L-: U_S = 1 kV; 1 MHz

Physical data

Dimensions (WxHxD)	40 mm x 255 mm x 195 mm (0.8 in x 10 in x 7.7 in)
Approx. weight	0.6 kg (1.3 lbs)



Example for the labelling of an output:

(7)Q 0.6

- Output 6 (6th bit); Possible: 0 to 7
- Address of output byte (0th byte); Possible: 0 to 255
- Q = Output
- 7th terminal L+ (not specified in the address)

g = Green LED (status display)
r = Red LED (short-circuit indication)
F+/F- = Enabling input

1) Enable mode switch (only applies to ...-4UA12), jumper inserted: enable input is active (factory setting)

2) The connection is not established internally. Creepage and ventilation paths of 0.8mm have been retained.
Warning: when connecting voltages in the input voltage area or above, these distances are, according to UL and CSA, not adequate. (But according to German standards (VDE) permissible).

5.12 Digital Output Module 6ES5454-4UA11 and 6ES5454-4UA12 (acc. to UL/CSA Requirements)

Rated input voltage L+	24 V DC
Number of outputs	16, current limited 1)
Type of outputs	Floating, 1 group of 16 outputs
Supply voltage range	20 to 30 V DC
Fusing	6.3 A, slow; 1 fuse per 4 outputs
Output voltage	
"1" signal	min. L+ - 2 V
"0" signal	max. 3 V
Switching current (resistive, inductive load)	10 mA to 2 A 2)
Leakage current at "0" signal	max. 1 mA
Lamp switching current	max. 0.45 A (10 W)
Switching frequency	
Resistive load	max. 100 Hz
Inductive load	max. 0.2 Hz at 1 A; max. 0.1 Hz at 2 A
Voltage induced on circuit interruption	Limited to L+ - 47 V
Total switching current	max. 4 A per 4 outputs
Diversity factor (number of outputs "On" simultaneously)	50%
Permissible length of cable	max. 400 m, unshielded;

<u>Power supply</u>

Digital section from system bus	5 V, typ. 100 mA
Current consumption from L+/L-	24 V, typ. 100 mA

<u>Enable input (F+)</u>

Rated input voltage	24 V DC
Input voltage	
"1" signal	13 to 33 V
"0" signal	-33 to 5 V
Rated input current	5 mA
Permissible length of cable	max. 200 m

<u>Short-circuit monitoring</u>

Indication for signal output (H+)	Red LED for each group of 4 outputs
Output voltage referred to L- (supply of 1L+)	
"1" signal	min. 1L+ - 5 V
"0" signal	max 3 V
Switching current	max. 10 mA, limited

1) Short-circuit protection responds at line resistance $\leq$ 4.75 ohms

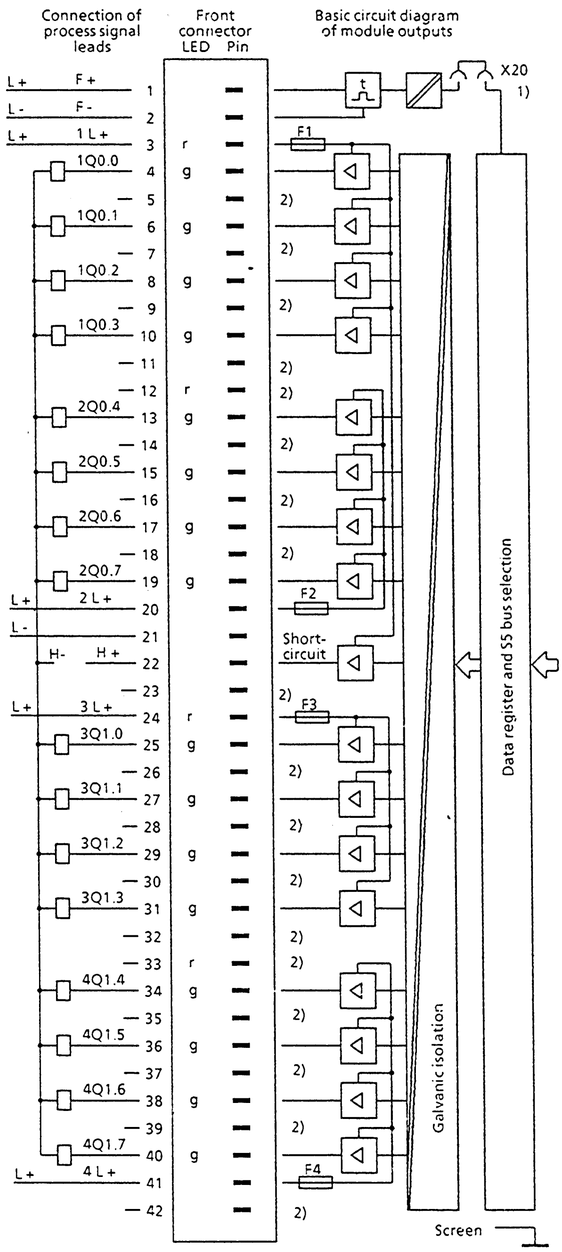
2) One digital input permissible as a minimum load

Safety tests

Voltage test to VDE 0160	Group to group: 1250 V AC; Group to ground: 1250 V AC
Impulse voltage test to IEC 255-4	Output to L-: U_S = 1 kV; 1.2/50 μs waveform
RIV (radio interference voltage) test to IEC 255-4	Output to L-: U_S = 1 kV; 1 MHz

Physical data

Dimensions (WxHxD)	40 mm x 255 mm x 195 mm (1.6 in x 10 in 7.7 in)
Approx. weight	0.55 kg (1.1 lbs)



Example for the labelling of an output:

(4)Q 1.6

- Output 6 (6th bit) Possible: 0 to 7
- Address of output bytes (1st byte); Possible: 0 to 255
- Q = Output
- 4th terminal L+ (not specified in the address)

g = Green LED (status display)
r = Red LED (short-circuit display)
F+/F- = Enabling input

1) Enable mode switch (only applies to ...-4UA12), jumper inserted: enable input is active (factory setting)

2) The connection is not established internally. Creepage and ventilation paths of 0.8mm have been retained.
Warning: when connecting voltages in the input voltage area or above, these distances are, according to UL and CSA, not adequate. (But according to German standards (VDE) permissible).

5.13 Digital Output Module 6ES5455-4UA11 and 6ES5455-4UA12 (acc. to UL/CSA Requirements)

Rated supply voltage L	24 to 60 V AC (47 to 63 Hz)
Number of outputs	16, conditionally current-limited [1])
Type of outputs	Floating, 2 groups, 8 outputs each
Supply voltage range	20 to 72 V AC
Fusing	6.3 A, fast; 1 fuse per 4 outputs
Output voltage	
"1" signal	min. L - 1.5 V
"0" signal (leakage current)	max. 5 mA
Switching current (resistive, inductive load)	
with fan	40 mA to 2 A; max. 6 A per 4 outputs
without fan	40 mA to 1 A; max. 4 A per 4 outputs
Lamp switching current	
with fan	40 mA to 2 A; max. 2.5 A per 4 outputs
without fan	40 mA to 1 A; max. 2.5 A per 4 outputs
Max. inrush current	
$\leq$ 3 ms	25 A/group
$\leq$ 20 ms	15 A/group
$\leq$ 50 ms	13 A/group
Permissible length of cable	max. 300 m, unshielded;

<u>Power supply</u>

Digital section from system bus	5 V, typ. 100 mA
<u>Enabling input (F+/F-)</u>	Jumper in front connector

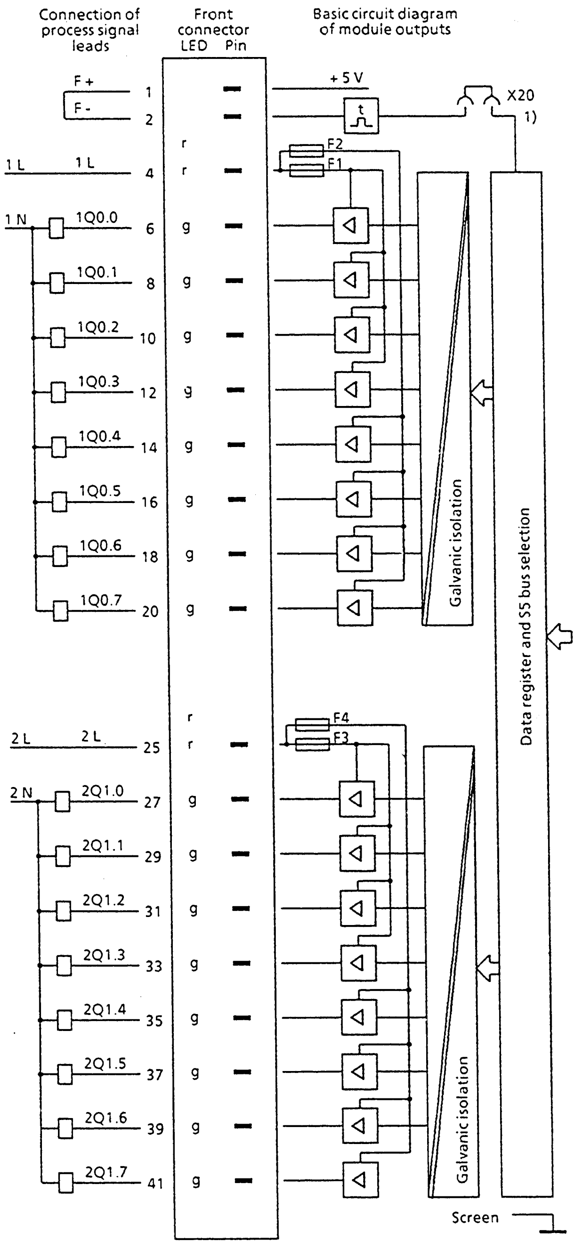
<u>Safety tests</u>

Voltage test to VDE 0160/UL 508	Group to group: 2000 V AC; Group to ground: 1500 V AC
Impulse voltage test to IEC 255-4	Output to L-: U_S = 2.5 kV; 1.2/50 µs waveform
RIV test to IEC 255-4	Output to L-: U_S = 2.5 kV; 1 MHz

<u>Physical data</u>

Dimensions (WxHxD)	40 mm x 255 mm x 195 mm (1.6 in x 10 in x 7.7 in)
Approx. weight	approx. 0.7 kg (1.5 lbs)

[1]) Fused protection



Example for the labelling of an output:

(2)Q 1.2

- Output 2 (2nd bit); Possible: 0 to 7
- Address of output byte (1st byte); Possible: 0 to 255
- Q = Output
- 2nd terminal L (not specified in the address)

g = Green LED (status display
r = Red LED (fuse indicator)
F+/F- = Enabling input (jumper in front connector)

1) Enable mode switch (only applies to ...-4UA12), jumper inserted: enable input is active (factory setting)

5.14 Digital Output Module 6ES5456-4UA11 and 6ES5456-4UA12 (acc. to UL/CSA Requirements)

Rated supply voltage L	115 to 240 V AC (47 to 63 Hz)
Number of outputs	16, conditionally current-limited [1]
Type of outputs	Floating, 2 groups, 8 outputs each
Supply voltage range	88 to 264 V AC
Fusing	6.3 A, fast; 1 fuse per 4 outputs
Output voltage	
"1" signal	min. L - 1.5 V
"0" signal (leakage current)	max. 5 mA
Switching current (resistive, inductive load)	
with fan	40 mA to 2 A; [2] max. 6 A per 4 outputs
without fan	40 mA to 1 A; [2] max. 4 A per 4 outputs
Lamp switching current	
with fan	40 mA to 2 A; max. 2.5 A per 4 outputs
without fan	40 mA to 1 A; max. 2.5 A per 4 outputs
Contactor size	
per fuse group	00 (type 3TB40) to 14 (type 3TB58) at 240 V AC 00 (type 3TJ..) to 10 (type 3TB54) at 115 V AC
for all outputs	0 (type 3TB40) to 8 (type 3TB52) at 240 V AC 00 (type 3TJ..) to 4 (type 3TB48) at 115 V AC
Max. inrush current	
$\leq$ 3 ms	25 A/group
$\leq$ 20 ms	15 A/group
$\leq$ 50 ms	13 A/group
Permissible length of cable	max. 300 m, unshielded;

Power supply

Digital section from system bus	5 V, typ. 100 mA

Enabling input (F+/F-)	Jumper in front connector

Safety tests

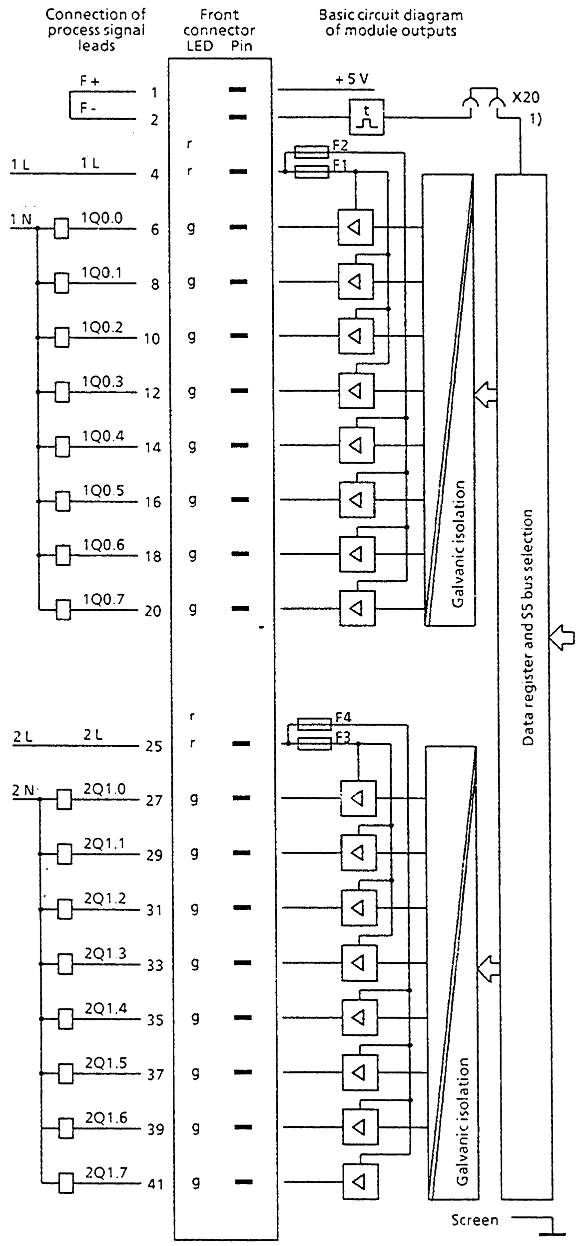
Voltage test to VDE 0160/UL 508	Group to group: 2000 V AC; Group to ground: 1500 V AC
Impulse voltage test to IEC 255-4	Output to L-: U_S = 2.5 kV; 1.2/50 μs waveform
RIV (radio interference voltage) test to IEC 255-4	Output to L-: U_S = 2.5 kV; 1 MHz

[1] Fused protection
[2] 3TJ-type contactors can only be triggered at 115 V AC

Physical data

Dimensions (WxHxD) 40 mm x 255 mm x 195 mm (1.6 in x 10 in x 7.7 in)

Approx. weight 0.7 kg (1.5 lbs)



Example for the labelling of an output:

(2)Q 1.6

- Output 6 (6th bit); Possible: 0 to 7
- Address of output byte (1st byte); Possible: 0 to 255
- Q = Output
- 2nd terminal (not specified in the address)

g = Green LED (status display)
r = Red LED (fuse indicator)
F+/F- = Enabling input (jumper in front connector)

1) Enable mode switch (only applies to ...-4UA12), jumper inserted: enable input is active (factory setting)

5.15 Digital Output Module 6ES5456-4UB11 and 6ES5456-4UB12 (acc. to UL/CSA Requirements)

Rated supply voltage	115 to 240 V AC (47 to 63 Hz)
Number of outputs	8, conditionally current-limited [1]
Type of outputs	Floating, 8 outputs
Supply voltage range	88 to 264 V AC
Fusing	6.3 A, fast (in -4UB11); 3.5 A, fast (in -4UB12; UL/CSA) 1 fuse per output
Output voltage	
"1" signal	min. L - 1.5 V
"0" signal	max. 5 mA
Switching current	
with fan	40 mA to 2 A; [2]
without fan	40 mA to 1 A; [2]
Lamp switching current	
with fan	40 mA to 2 A;
without fan	40 mA to 1 A;
Contactor size, applies to -4UB11/-4UB12	0 (type 3TB40) to 14 (type 3TB58) at 240 V AC
only to -4UB11	00 (type 3TJ..) to 10 (type 3TB54) at 115 V AC
only to -4UB12	00 (type 3TJ..) to 8 (type 3TB52) at 115 V AC

Max. inrush current	-4UB11	-4UB12
$\leq$ 3 ms	25 A	16 A
$\leq$ 20 ms	15 A	8 A
$\leq$ 50 ms	13 A	6.5 A

Switching capacity per module	
for UL	max. 1440 VA
for CSA	max. 2000 VA
Permissible length of cable	max. 300 m, unshielded;

Power supply

Digital section from system bus	5 V, typ. 100 mA

Enabling input (F+/F-)	Jumper in front connector

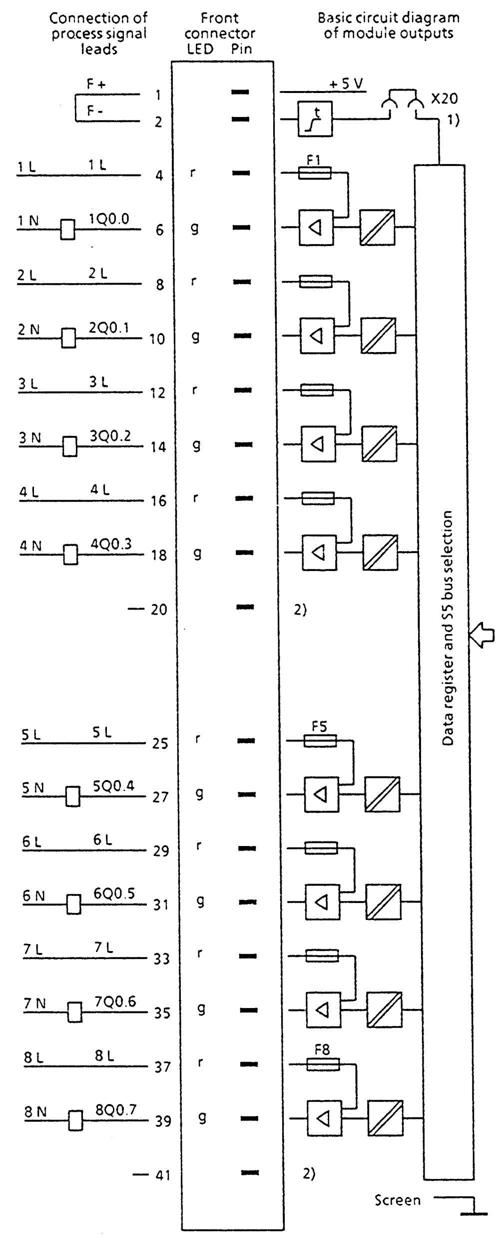
Safety tests

Voltage test to VDE 0160	Group to group: 2000 V AC; Group to ground: 1500 V AC
Impulse voltage test to IEC 255-4	Output to L-: U_S = 2.5 kV; 1.2/50 µs waveform
RIV (radio interference voltage) test to IEC 255-4	Output to L-: U_S = 2.5 kV; 1 MHz

1) Fused protection
2) 3TJ-type contactors can only be triggered at 115 V AC

Physical data

Dimensions (WxHxD)	40 mm x 255 mm x 195 mm (1.6 in x 10 in x 7.7 in)
Approx. weight	0.6 kg (1.3 lbs)



Example for the labelling of an output:

(3)Q 0.2

- Output 2 (2nd bit); Possible: 0 to 7
- Address of output byte (0th byte); Possible: 0 to 255
- Q = Output
- 3rd terminal L (not specified in the address)

g = Green LED (status display)
r = Red LED (fuse indicator)
F+/F- = Enabling input (jumper in front connector)

1) Enable mode switch (only applies to ...-4UB12), jumper inserted: enable input is active (factory setting)

2) The connection is not established internally. When connecting voltages in the input voltage area UL, CSA and the German standards (VDE) are met.

5.16 Digital Output Module 6ES5457-4UA12 (acc. to UL/CSA Requirements)

Rated supply voltage L+	24 to 60 V DC
Number of outputs (isol. via diodes)	16, short-circuit proof 1)
Type of outputs	Floating, 16 outputs
Supply voltage range	20 to 60 V DC
Fusing	16 x 1 A, slow
Output voltage	
"1" signal: (L+) switch	min. L+ - 2.5 V
(L-) switch	max. 2.5 V
"0" signal: (L+) switch	max. 3 V
(L-) switch	min. L+ - 3 V
Switching current (resistive, inductive load)	5 mA to 0.5 A 2)
Leakage current at "0" signal	max. 1 mA
Lamp switching current	max. 0.22 A (5 W)
Switching frequency	
Resistive loads	max. 100 Hz
Inductive loads (≤ 50 mA)	max. 2 Hz at 0.5 A
Voltage induced on circuit interruption	Limited to L+ - 75 V
Diversity factor	
with fan	100%
without fan	50%; 100% up to 35 °C
Permissible length of cable	max. 400 m, unshielded

Power supply

Digital section from system bus	5 V, typ. 120 mA

Enabling input (F+/F-)

Rated input voltage	24 to 60 V DC
Input voltage	
"1" signal	13 to 72 V
"0" signal	-72 to 8 V
Rated input current	
at 24 V DC	2.5 mA
at 48 V DC	5 mA
at 60 V DC	6.5 mA
Permissible length of cable	max. 200 m

Short-circuit monitoring

Indication	Red LED for 16 outputs
Signal output (H+,H-),	
Output voltage referred to L+ switch	
"1" signal	min. L+ - 5 V
"0" signal	max. 3 V
Switching current	max. 10 mA, short-circuit proof

1) Short-circuit protection responds at line resistance ≤ 9 ohms at 24 V DC, ≤ 30 ohms at 60 V DC

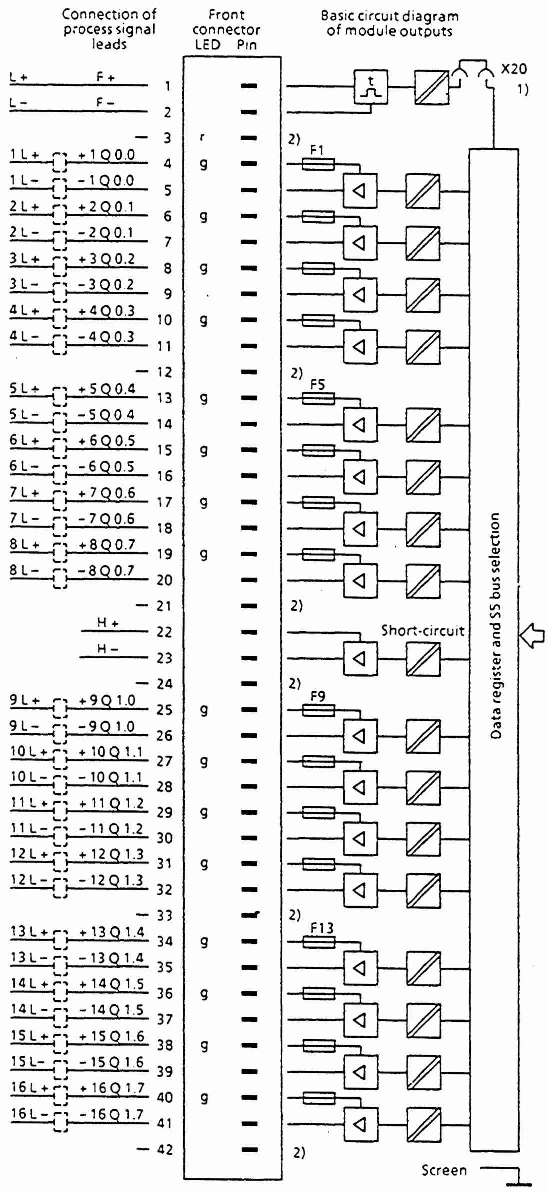
2) One digital input is permissible for minimum load

Safety tests

Voltage test to VDE 0160	Group to group: 1250 V AC; Group to ground: 1250 V AC
Impulse voltage test to IEC 255-4	Output to L-: U_S = 1 kV; 1.2/50 µs
RIV test to IEC 255-4	Output to L-: U_S = 1 kV; 1 MHz

Physical data

Dimensions (WxHxD)	20 mm x 255 mm x 195 mm (0.8 in x 10 in x 7.7 in)
Approx. weight	0.6 kg (1.3 lbs)



Example for the labelling of an output:

(7)Q 0.6

- Output 6 (6st bit) Possible: 0 to 7
- Address of output byte (0th byte); Possible: 0 to 255
- Q = output
- 7st terminal L+ (not specified in the address)

g = Green LED (status display)
r = Red LED (short-circuit indication)
F+/F- = Enable input

1) Enable mode switch
jumper inserted: enable input is active (factory setting)

2) The connection is not established internally. Creepage and ventilation paths of 0.8mm have been retained.
Warning: when connecting voltages in the input voltage area or above, these distances are, according to UL and CSA, not adequate. (But according to German standards (VDE) permissible).

5.17 Digital Output Module 6ES5458-4UA11 and 6ES5458-4UA12 (acc. to UL/CSA Requirements)

Rated supply voltage L+	24 V DC
Number of outputs	16
Type of outputs	Floating, 16 outputs
Supply voltage range	20 to 30 V DC
Fusing	16 x 1 A, slow [1]
Output	Relay contact
Switching capacity for resistive loads	
with arc suppression	60 V DC/48 V AC, 0.5 A [2]
without arc suppression	60 V DC/48 V AC, 70 mA
Service life of contacts	10^8 switching cycles
Switching current (inductive loads)	max. 0.5 A with arc suppression and external arc suppression circuits (see circuit examples).
Lamp switching current	max. 0.1 A with arc suppression
Switching frequency	
Resistive loads	max. 100 Hz (pick-up, drop-out 1 ms)
Inductive loads	max. 10 Hz to 50 mA max. 2 Hz to 0.3 A max. 0.5 Hz to 0.5 A
Diversity factor (number of outputs "On" simultaneously)	100%
Permissible length of cable	max. 400 m, unshielded

Power supply

Digital section from system bus	5 V, typ. 80 mA
Current consumption from L+/L-	typ. 200 mA

Enabling input (F+/F-)

Rated input voltage	24 V DC
Input voltage	
"1" signal	13 to 33 V
"0" signal	-33 to 5 V
Rated input current	5 mA
Permissible length of cable	max. 200 m

Safety tests

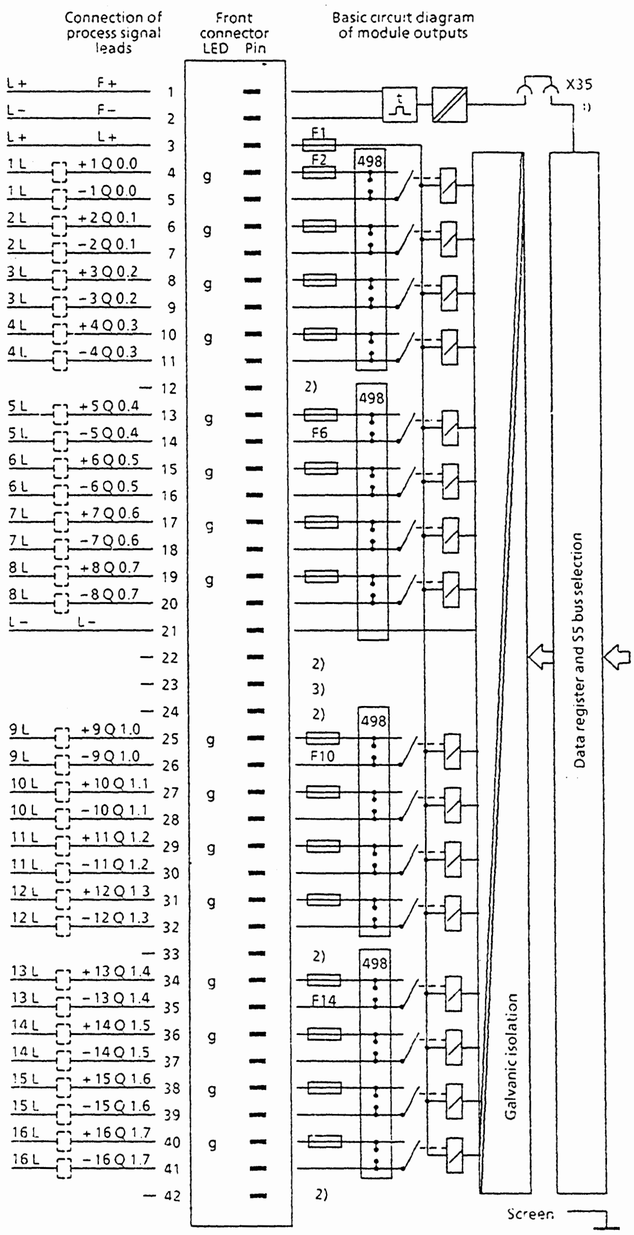
Voltage test to VDE 0160/UL	Group to group: 500 V AC; Group to ground: 500 V AC
Impulse voltage test to IEC 255-4	Output to L-: U_s = 1 kV; 1.2/50 µs
RIV test to IEC 255-4	Output to L-: U_s = 1 kV; 1 MHz

[1] The fuse does not protect the contact. If overloaded, the relay must be replaced

[2] For UL, resistive loads of max. 50 V/0.5 A

Physical data

Dimensions (WxHxD)	20 mm x 255 mm x 195 mm (0.8 in x 10 in x 7.7 in)
Approx. weight	0.45 kg (1 lb.)



Example for the labelling of an output:

(1)Q 0.1

- Output 1 (1st bit); Possible: 0 to 7
- Address of output byte (0th byte); Possible: 0 to 255
- Q = output
- 2nd group (not specified in the address)

Arc-suppression module 6ES5498-1AB11 (four RC elements per module):

g = Green LED (status display)
F+/F- = Enable input

1) Enable mode switch (only applies to ...-4UA12), jumper inserted: enable input active (factory setting)

2) The connection is not established internally. Creepage and ventilation paths of 0.8mm have been retained.
Warning: when connecting voltages in the input voltage area or above these distances are not adequate according to UL & CSA. (But permissible acc. to German standards (VDE)).

3) The connection is not established internally. When connecting voltages in the input voltage area UL, CSA & VDE standards are met.

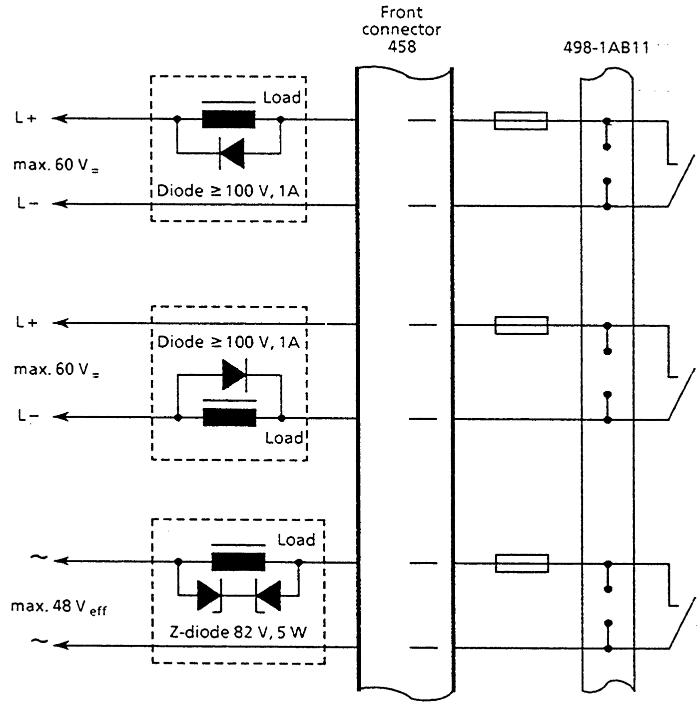
External arc suppression for inductive load:

o For DC:

M switch;

P switch;

o For AC:



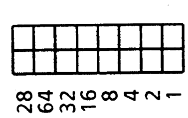
6 Addressing the Input and Output Modules

Significance Byte address

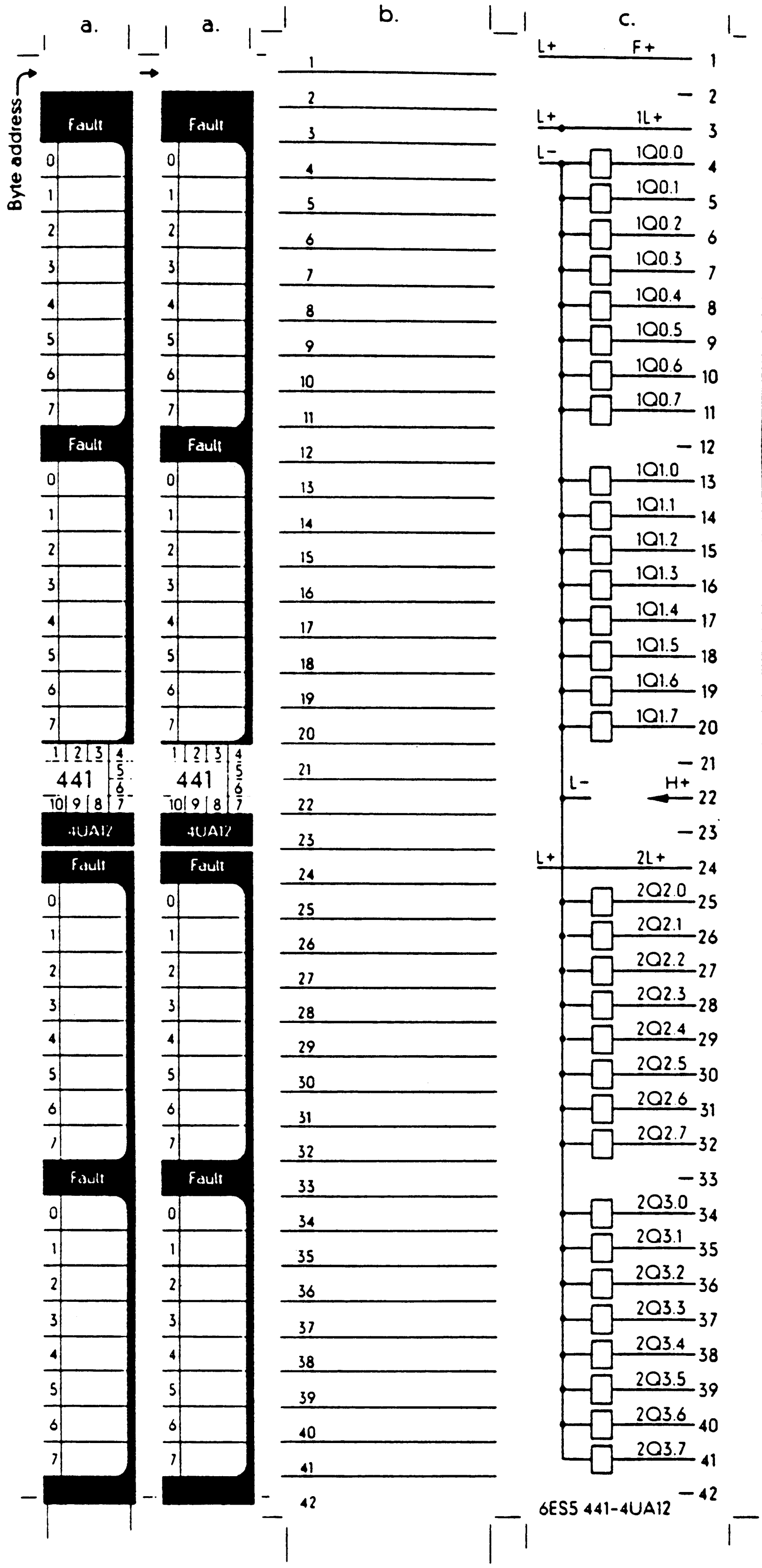
1 2 4 8																
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
1)	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
1)	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
1)	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
1)	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
1)	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
1)	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
1)	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
1)	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255
8 Channels	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16 Channels	x		x		x		x		x		x		x		x	
32 Channels	x				x				x				x			

1) Address range for digital input and digital output modules whose signals bypass the process image

Switch position
ON ●
Significance



7 Example of a Label



6ES5 441-4UA12
Digital output module
32 Outputs
24VDC/0,5A non floating
short circuit protected

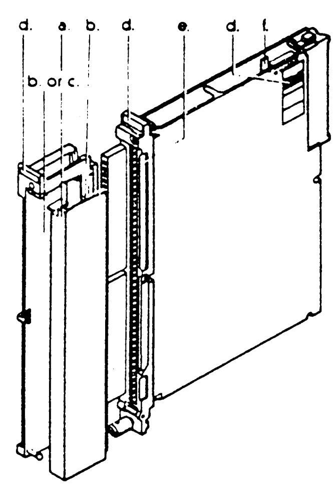
Enable input(F+)
24VDC/5mA non floating

Short circuit alarm output
(H+/L-)
24VDC/10mA
current limited

Connect L- of the power supply to central earth point (reference potential)

Adjust address I

For further details see operating instructions.



d. Address labels are attached to the programmable controller
e. Type
f. Jumper for enable mode (F+) inactive: without jumper

SIEMENS

SIMATIC S5
Digital Input and Output Modules
DI/DO 482

6ES5 482-4UA11

Instructions

C79000-B8576-C575-03

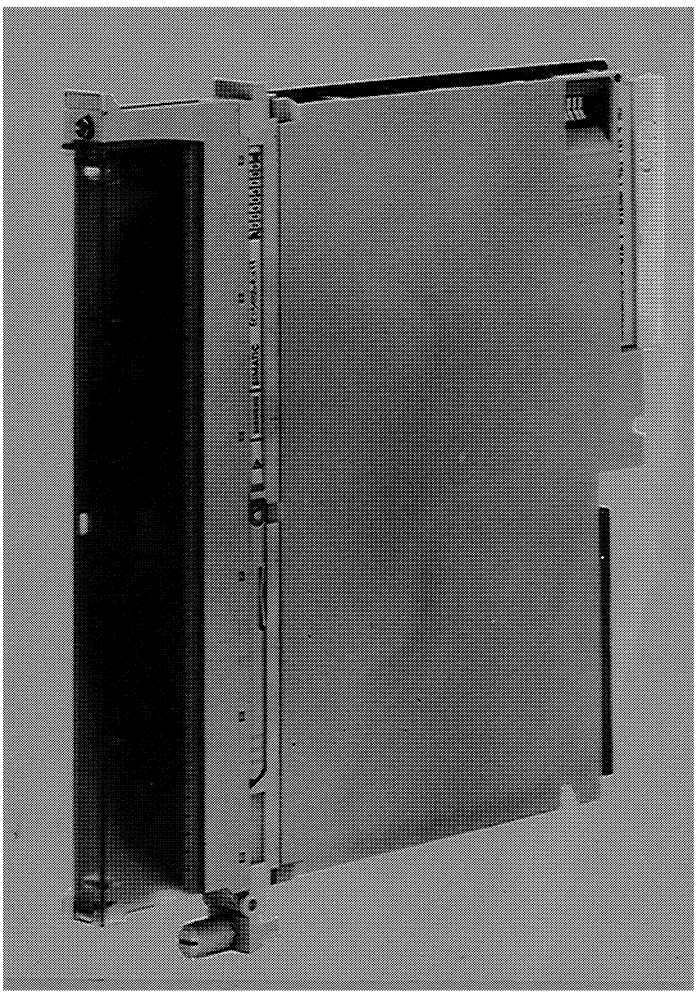


Fig. 1 DI/DO 482

Contents

		Page
1	**Technical Description**	**3**
1.1	Application	3
1.2	Design	3
1.3	Mode of Operation	4
1.3.1	Digital Input	4
1.3.2	Digital Output	6
1.3.3	Alarm Output	8
1.3.4	Release Input	8
1.3.5	Synchronization Input/Output	9
1.4	Technical Data	10
1.5	Pin Assignment of the Local Bus Interface	14
1.6	Pin Assignment of the S5 Bus Interface	15
1.7	Front Connector and Diode Strip Pin Assignment	16
2	**Installation**	**17**
2.1	Removing and Inserting Modules	17
2.2	Connecting Signal Lines	18
2.3	Installation Guidelines	18
3	**Operation**	**19**
3.1	Selecting the Bus Interface	19
3.2	Setting the Module Address	19
3.3	Address Area of the Module	20
3.4	Parallel Wiring of Outputs and Switching on the Load via a Contact	21
3.5	Electrical Isolation and Distribution of the Channels	21
3.6	Switching over the I/O Byte (Channels 9 to 16)	21
3.7	Short Circuit Protection and Fusing the Digital Output	22
4	**Spare Parts**	**23**
5	**Page Overview**	**24**

1 Technical Description

1.1 Application

The digital input/output module 6ES5 482-4UA11 is a process interface module which allows the processing of process signals in conjunction with the intelligent I/O module IP 257 in the SIMATIC S5 programmable controllers 135U and 155U and the expansion units EG 185U and EG 185U. It is also possible to operate the DI/DO 482 without the IP 257 in the S5 130K/W, 135U and 155U and corresponding EUs.

With the digital input, the external process signals are matched to the interface signal level of the programmable controllers. Disturbances are suppressed and brief overvoltage peaks are reduced. The digital output converts the internal signal level of the unit to the external process signals.

The DI/DO can operate either with two input bytes and two output bytes or with three input bytes and one output byte.

1.2 Design

The module is designed as a plug-in PCB with a multipoint connector for the insertion of a front plug. The separately supplied front plug with screw or crimp fasteners can be connected to the process signal cables. The front panel has green LEDs to display the signal status of inputs or outputs. The LEDs are arranged in bytes and identified as bits 0 to 7.

The digital output also has red LEDs to indicate short circuits between output lines and ground (L-) within a group of outputs.

The module differs from the previous digital process interface modules in that in addition to the central controller or expansion unit (backplane connector X1), it also has a local bus interface (backplane connector X3). This is intended to provide a direct connection to the IP 257
(6ES5 257-4UA11) via a separate local bus (6ES5 751-2AA11). The mechanical connection is via a 37-pin subminiature D connector and ribbon cable. At the local bus interface and at the front connector there are two additional channels available - a synchronization input and synchronization output.

The bus interface is selected using a sliding switch. It is not possible to operate both interfaces at the same time.

The module also has an addressing switch to set the module address.

The module is protected by covers on both sides.

1.3 Mode of Operation

1.3.1 Digital Input

As shown in the block diagram (Fig. 2) the process signals at the digital inputs are conditioned to match the interface module level in the input circuit. The input circuit suppresses disturbances and indicates the signal status at the inputs with LEDs on the front panel of the module. The signals are then isolated and passed on to the data memory.

By removing a jumper at the release input, the processing of input signals can be blocked and the module disconnected from the S5 bus (see section "Release Input").

The module address is set at an address switch. The module is addressed by the STEP 5 user program under its byte address. The DI/DO sends an acknowledgement signal RDY/ to the CPU when the address read on the S5 bus by the address decoder matches the set address and a read or write signal is active.

If, for example, input 1.0 of the digital input is to be scanned by the STEP 5 program, then the address 1 (byte address = address bit ADB 0 to ADB 7) and the control signal MEMR/ are sent by the CPU or the IP module. The module with the byte address 1 recognizes this address. The signal status of the inputs of byte 1 (data bits 0 to 7) is put on the data bus (DB 0 to DB 7). Then the acknowledgement signal RDY/ is sent to the CPU (via the S5 bus) or to the IP module (via the local bus).

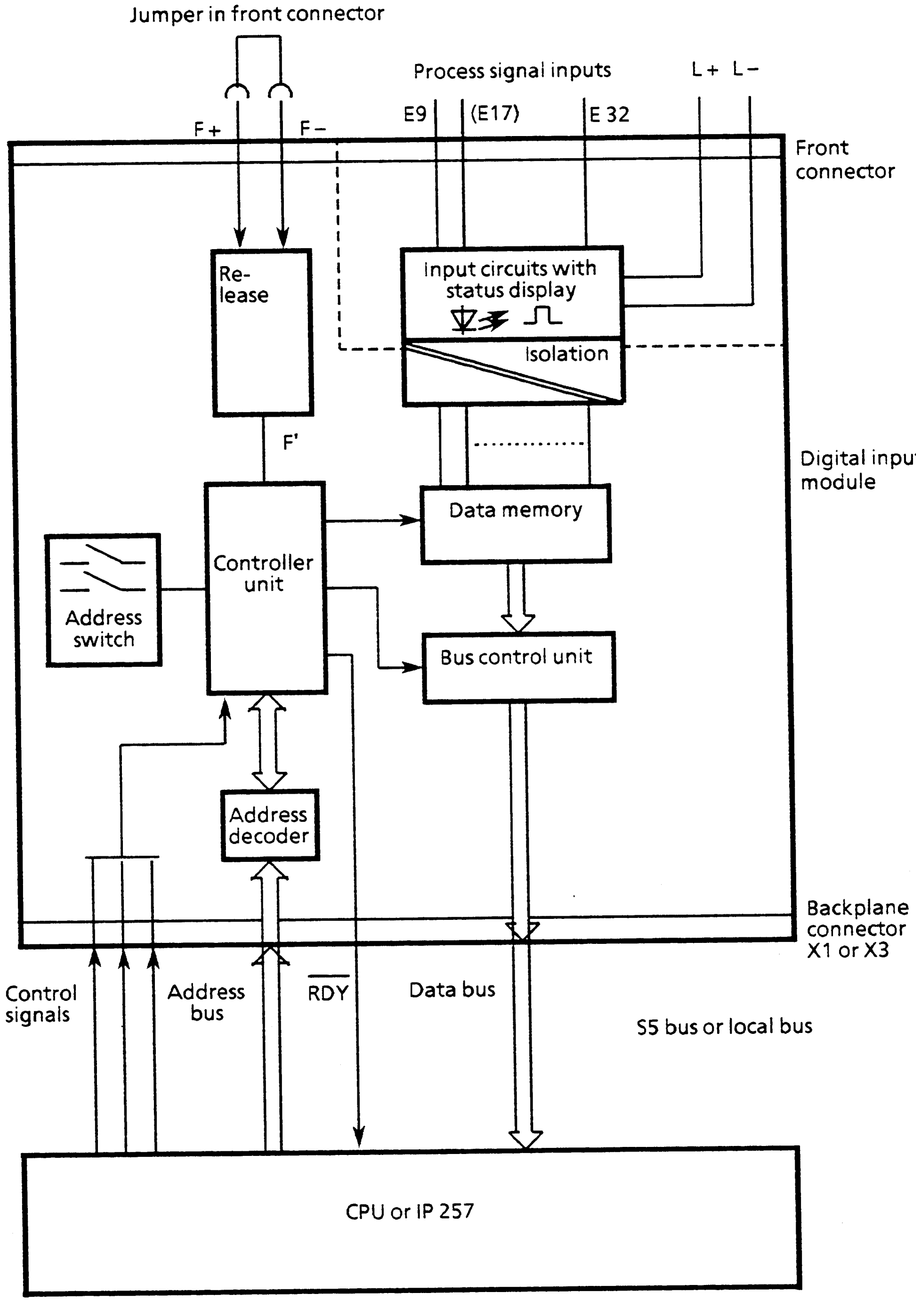


Fig. 2 Signal exchange between the CPU or IP 257 and digital input

1.3.2 Digital Output

Fig. 3 shows the block diagram and signal exchange between the digital output and the CPU or IP 257. The data from the bus are accepted if the module is released by the inserted jumper at the release input F+/F- (see section "Release Input"), the address set at the address switch matches the address sent by the CPU and the signal MEMW/ is active.

The module controller controls the acceptance of the data from the data bus (DB 0 to DB 7) in the data memory and the output of the output circuits (isolated) to the outputs.

On the front panel of the module there are LEDs which indicate the signal status of the outputs (green LEDs) and short circuits on the connected lines (red LEDs).

If, for example, output byte 0 of the digital output is to be set, the address 0 and control signal MEMW/ are sent by the CPU or IP 257. The digital output with the byte address 0 recognizes this address and accepts the data from the data bus (DB 0 to DB 7) in the output register for byte 0. This data is switched to the outputs of the module via the output circuit. The acknowledgement signal RDY/ is sent to the CPU or IP 257.

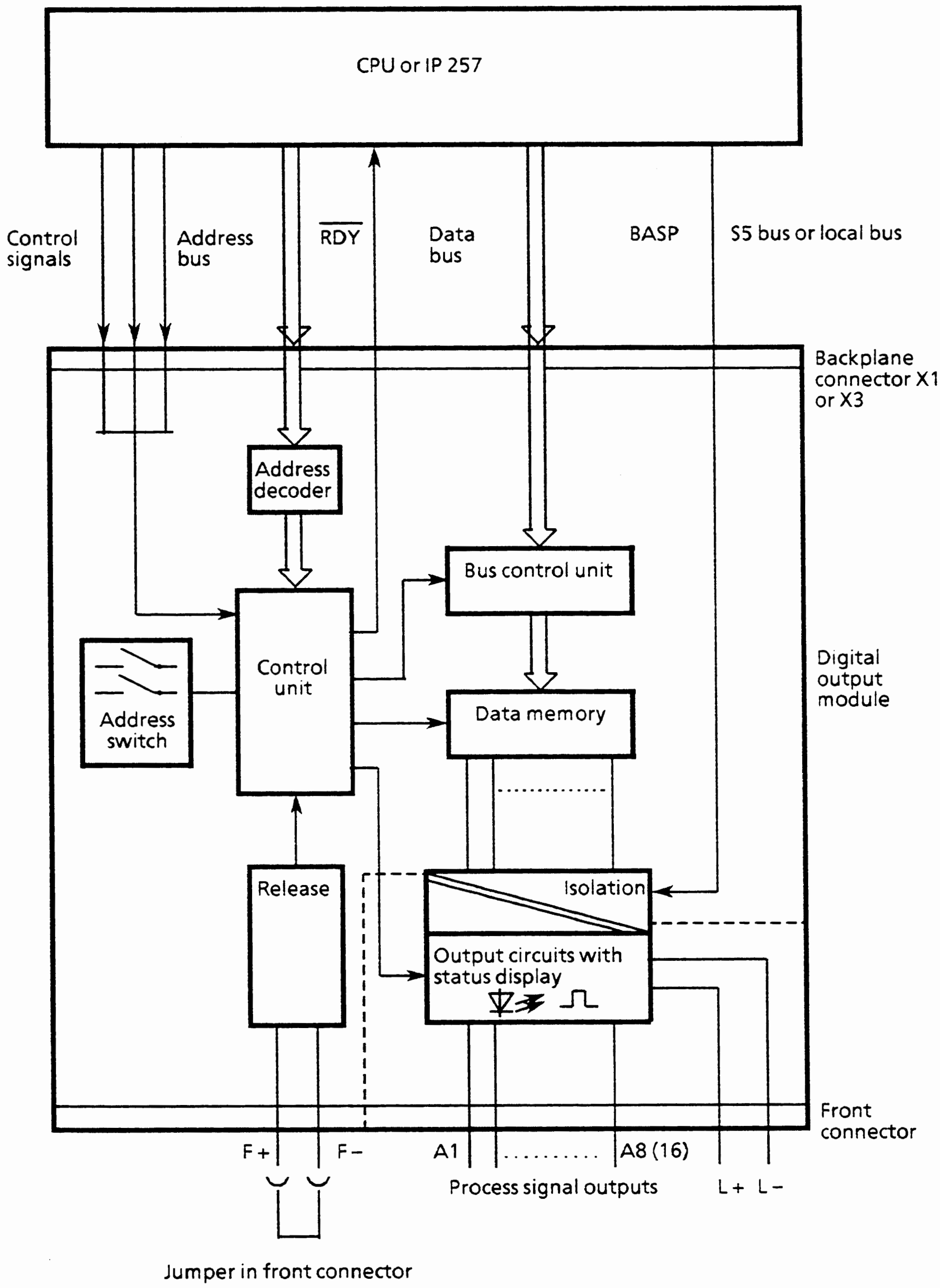


Fig. 3 Signal exchange between the CPU or IP 257 and digital output

1.3.3 Alarm Output

The alarm output H+ of the digital output provides a signal when there is a short circuit between one or more outputs and ground (L-) or if overcurrent is recognized. The alarm output is isolated by a diode.

1.3.4 Release Input

The module has a release circuit. Via the release inputs, it is possible to disable certain modules while the PC is in operation.

The release input of the DI/DO 482 can be activated by means of jumper X 20.

Jumper X20 open:	module cannot be disabled via release input (release input inactive).
Jumper X20 inserted:	in the front connector a wire jumper must be inserted between pin 1 and pin 2. Removing the front connector then causes the module to be switched off and no further acknowledgement is output.

Examples of using the release input:

- Disabling of individual subprocesses almost without power being required, i.e. outputs of different modules can be operated with a common load current supply and nevertheless be activated separately.
- The load voltage of each individual module can be monitored without difficulty. All reactions to load voltage failure can be programmed in the QVZ organization block.

IMPORTANT
When planning systems, the following must be taken into account:

Switching on:	at least 100 ms after the PC is switched on, the release input must be closed (i.e. F+ and F- must be electrically connected).
Switching off:	after switching off the PC, the release input must remain closed as long as the internal 5 V are present.

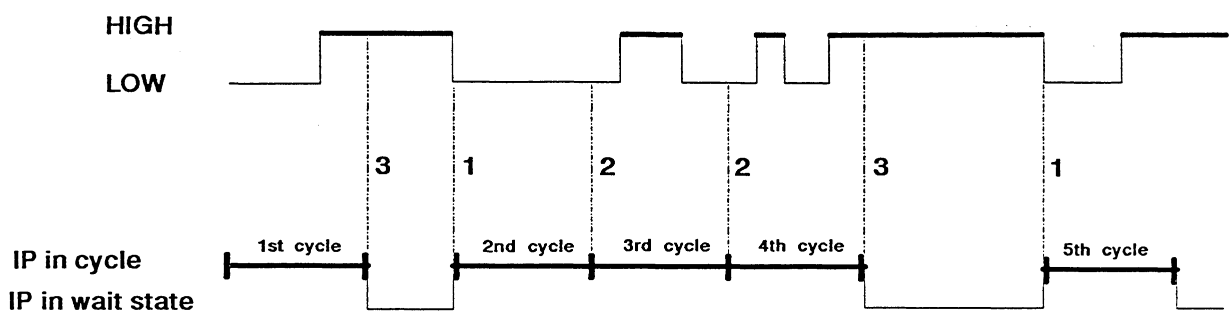
IMPORTANT
When programming the CPU, the QVZ-OB must be programmed so that neither an error nor replacing a module can result in a dangerous state arising in the process or in the machine.
When operating with the IP 257, no reaction can be programmed; the IP stops if there is no release from the DI/DO 482.

1.3.5 Synchronization Input/Output

On the front connector of the module there is a synchronization input and a synchronization output (SynIn, SynOut).

With an appropriate signal at the synchronization input, the IP 257 can operate with fixed cycles and/or cycles controlled externally. The condition for this mode is that jumper 20 on the IP is inserted. After an initialization phase, the IP begins cyclic execution. First, the IP checks whether the cycle is to be synchronized. If a synchronization request is active (HIGH level at input) the IP changes to the wait state. If there is a LOW signal, the IP continues executing the program in the RUN mode (see also the corresponding section in the programming or operating instructions for the IP). If several DI/DO 482's are being used, make sure that the synchronization inputs are ORed. If inputs are not connected, they have a LOW signal.

The following example shows the cycle synchronization with the synchronization input of the DI/DO.



1 Transition from HIGH to LOW level: IP starts cycle
2 LOW level at cycle end: IP continues immediately to next cycle
3 HIGH level at cycle end: IP changes to wait state

The IP sends its own cycle start signal at the beginning of each cycle. This cycle start signal can be passed on from the synchronization output, e.g. to synchronize another IP 257.

When operating the DI/DO 482 (without IP 257) via the S5 bus interface, the synchronization input and output have no function.

1.4 Technical Data

Programming

Operand identifiers	
for inputs	I
for outputs	Q
Parameters	when addressing via the bus interface: 0.0 to 255.7, when addressing the local bus: 0.0 to 15.7

Ambient conditions

Operating temperature [1]	
in devices with a fan	0 to 60° C
in devices without a fan [2]	0 to 55° C
Storage and transport temperature	- 40 to + 70° C
Relative humidity	max. 95 % at 25° C no dew
Operating altitude	max. 3500 m above sea level

Connections

Power supply for inputs and outputs	
rated DC voltage	L +
reference potential for DC voltage	L -
Permitted line length with digital output modules	for each output current the line resistance and the tolerance of the supply voltage must be taken into account.
Release inputs (F +, F -)	jumper on the front connector
Short circuit alarm output	H + (supplied by L +)

1) Temperature of the incoming air below the subrack

2) Distance between the PCBs 40 mm

Max. permissible supply voltage at rated voltage 24 V DC (L+/L-)	36 V DC for 100 ms
Ripple U_{pp} of the supply voltage at rated voltage	max. 15% [3]
Interference suppression of the digital inputs	≥ 150 µs
Interference pulse length of the digital inputs	≤ 1.5 ms [4]

Power supply

Current input from system bus	5 V, typically 90 mA

Digital inputs

Rated input voltage	24 V DC
Number of inputs	min. 16, max. 24
Galvanically isolated	yes
Input voltage for signal 0 for signal 1	 - 33 V to +5 V +13 V to +33 V
Rated input current	typ. 8. 5 mA
Delay time	typ. 300 µs
Input resistance	typ. 2.8 kΩ
Coincidence factor	100 %
Permitted cable length	max. 50 m
Power supply for 2 wire BERO	22 V to 33 V

Release input F+/F-	jumper in front connector
Synchronisation input	for technical data see digital inputs

3) The ripple is included in the range of the supply voltage

4) Must be jumpered by the signal receiver.

Safety tests

Voltage test according to VDE 100	group against housing: 1250 V_{eff}
Surge voltage test according to IEC 255-4	input against L –: U_{pp} = 1 kV 1.2/50 µs
Interference voltage test according to IEC 255-4	input against L –: U_{pp} = 1 kV 1 MHz

Digital inputs

Supply voltage L +	24 V DC
Number of outputs	min. 8, max. 16 short circuit-proof [5]
Galvanically isolated	yes
Range of supply voltage	20 V to 30 V
Fuse	6.3 A, slow-blow 1 fuse per 8 outputs
Output voltage for signal 1 for signal 0	 min. L + minus 1.5 V max. + 3 V
Switching current (ohmic, inductive load)	5 mA to 0.5 A
Switching frequency with ohmic load with inductive load	max. 120 Hz max. 2 Hz at 0.3 A max. 0.5 Hz at 0.5 A
Voltage induced on circuit interruption	limited to L + and - 27 V
Total switching current	max. 4 A per 8 outputs
Coincidence factor with fan	100 %
Coincidence factor without fan	50 %; 100 % to 35° C
Permitted cable length	max. 400 m
Current consumption L + /L -	24 V, typ. 30 mA

Short circuit monitoring

Indicator	red LED for each of 8 outputs
Alarm (H +)	

[5] Short circuit protection activated when short-circuited load resistance and line resistance $\leq$ 15 Ω

Output voltage relative to L -	
for signal 1	min. L+ minus 5 V
for signal 0	max. +3 V
Switching current	max. 10 mA, current limited

Synchronization output

Output voltage relative to L -	
for signal 1	min. L+ minus 5 V
for signal 0	max. +3 V
Switching current	max. 10 mA, current limited

Mechanical data

Dimensions (w x h x d)	20 mm x 255 mm x 195 mm
Weight	approx. 0.4 kg

1.5 Pin Assignment of the Local Bus Interface

Backplane connector X3

	1	/IOSYN IN	Synchronization input
M5V 20			
	2	IOSYN OUT	Synchronization output
M5V 21			
	3	IOBASP	Block command output
M5V 22			
	4	/IOCPKL	Central processor ready
M5V 23			
	5	/IOMEMR	Memory read
M5V 24			
	6	/IOMEMW	Memory write
M5V 25			
	7	/IORDY	Acknowledgement signal
M5V 26			
	8	IO ADB0	Address bit 0
M5V 27			
	9	IO ADB1	Address bit 1
M5V 28			
	10	IO ADB2	Address bit 2
M5V 29			
	11	IO ADB3	Address bit 3
M5V 30			
	12	IO DB0	Data bit 0
M5V 31			
	13	IO DB1	Data bit 1
M5V 32			
	14	IO DB2	Data bit 2
M5V 33			
	15	IO DB3	Data bit 3
M5V 34			
	16	IO DB4	Data bit 4
M5V 35			
	17	IO DB5	Data bit 5
M5V 36			
	18	IO DB6	Data bit 6
M5V 37			
	19	IO DB7	Data bit 7

1.6 Pin Assignment of the S5 Bus Interface

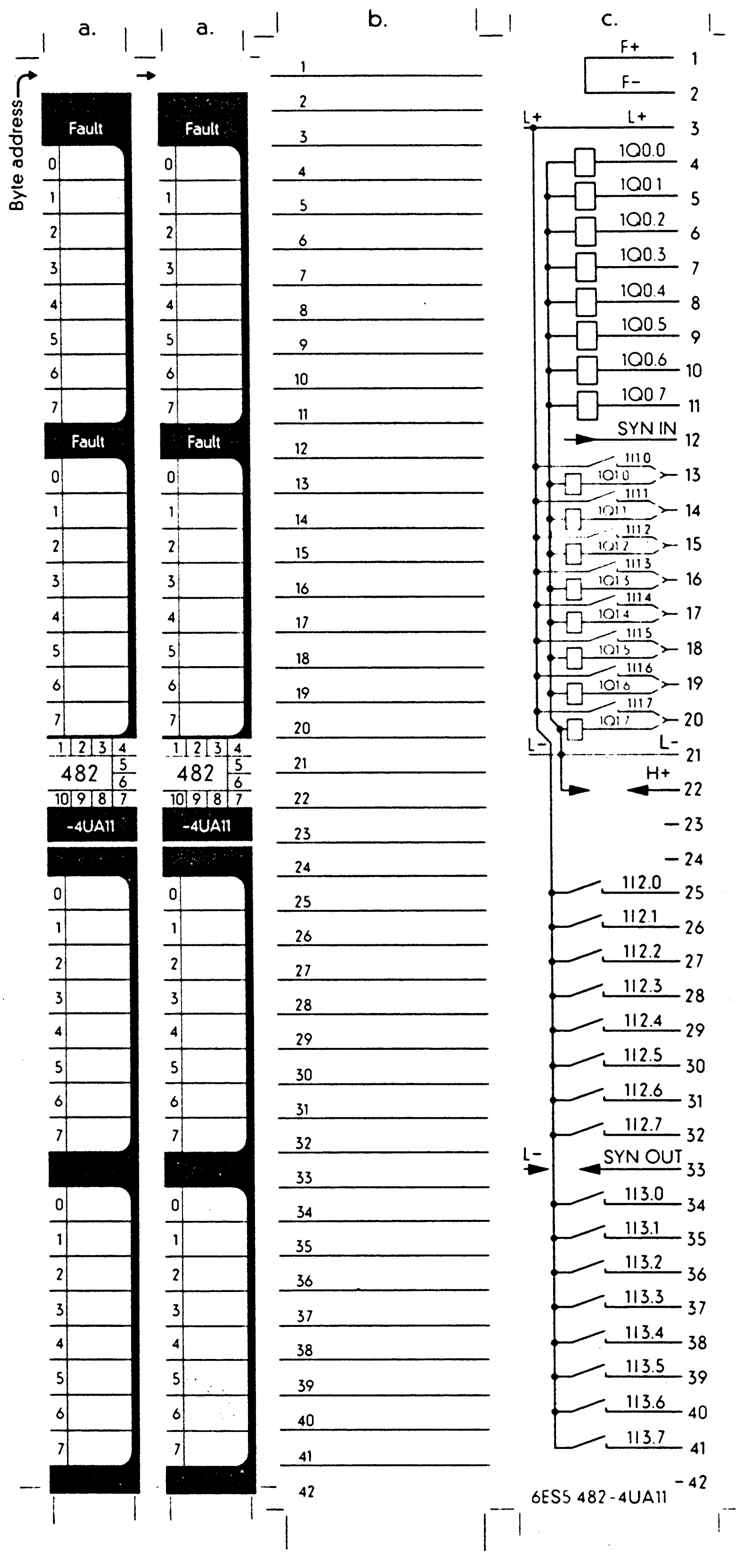
Backplane connector X1

	d	b	z
2		0 V	+5 V
4		PESP	
6		ADB 0	/CPKL
8		ADB 1	/MEMR
10		ADB2	/MEMW
12		ADB 3	/RDY
14		ADB 4	DB 0
16		ADB 5	DB 1
18		ADB 6	DB 2
20		ADB 7	DB 3
22			DB 4
24			DB 5
26			DB 6
28			DB 7
30		BASP	
32		0 V	

ADB Address bus
DB Data bus
BASP Block command output
/CPKL CPU ready signal*
/MEMR Memory read
/MEMW Memory write
PESP Select signal for I/Os
/RDY Ready

*/XYZ = XYZ signal is low active.

1.7 Front Connector and Diode Strip Pin Assignment



6ES5 482-4UA11
Digital I/O module

24 Inputs
24 VDC/8,5mA
floating

16 Outputs
24 VDC/0,5A
floating
short circuit protected

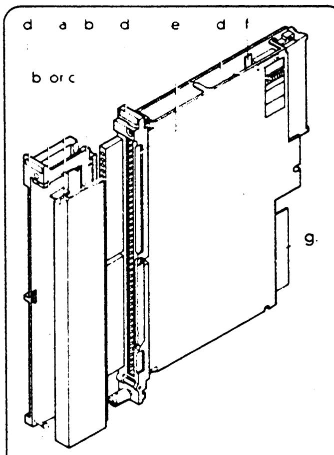
Short circuit alarm output
(H+/L-)
24 VDC/10mA
current limited

Sync input (SYN IN)
24 VDC/8,5mA floating

Sync output (SYN OUT)
24 VDC/10mA
current limited

Adjust address!

For further details see operating instructions.



d. Address labels are attached to the programmable controller
e. Type
f. Jumper for enable-mode (F+,F-) inactiv: without jumper
g. Internal I/O connector

2 Installation

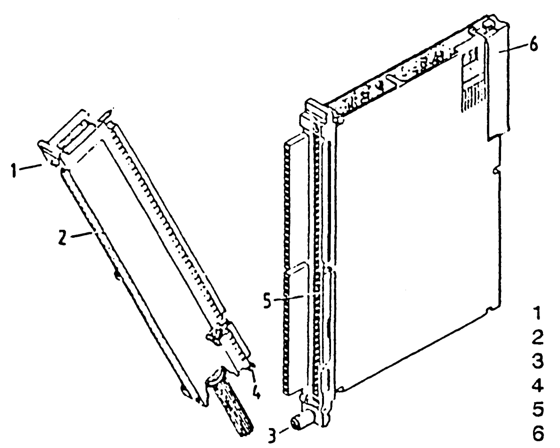
2.1 Removing and Inserting Modules

The construction of the module and the front connector allows the module to be removed and inserted while the PC is in operation.

IMPORTANT
The module can only be replaced (while voltage is applied) by qualified electronics engineers or trained personnel, who must make sure that the pins of the module are not touched.

The module is replaced as follows:

- Loosen the upper locking bar on the subrack and swing upwards.
- By loosening a screw in the upper part of the front connector, the front connector can be pressed out of the module socket. The contacts F + and F- of the release input at the upper end of the front connector are then opened first. The outputs no longer carry current and the module is disconnected from the S5 bus. The CPU or IP 257 no longer receives an acknowledgement if it addresses the module. The CPU continues to operate if no stop is programmed in the corresponding error OB; the IP 257 stops.
- The front connector can now be tilted out and lifted out of the lower fork.
- By turning a knob at the bottom end of the module through 90°, the module is released. Using a hinged handle, the DI/DO 482 can be pulled out of the subrack.
- The module is inserted by following the above procedure in reverse.
- Before the front connector can be inserted, the module must be locked by turning the knob.



1 Screw
2 Front connector
3 Knob
4 Holding fork
5 Handle
6 Backplane connector

Fig. 4 20 mm wide module and front connector with crimp contacts

2.2 Connecting the Signal Lines

The DI/DO 482 has a 42-pin male multipoint connector with blades of 2.4 mm x 0.8 mm.

20 mm and 40 mm wide front connectors with crimp or screw connections are available for connecting the signal lines.

Stranded wires should be used to make it easier to work with the front connector.

When using the crimp contact in the plastic body of the front connector, a "click" can be clearly heard. This indicates that the contact is locked. When rewiring or if the incorrect assignment is made, the contacts can be released without the front connector being removed.

When using the screw connection, wire end ferrules are not required, since the screw contacts have a wire protector. Wire end ferrules 7 mm long according to DIN 46288 can, however, be used.

The maximum contact area is 2 x 2.5 mm^2.

Type of connection	Connector type 6ES5497	Max. pins	Cross section of signal or power line	Connector for rated voltage	Fork width mm	Front connector width	Module type 6ES5... Type of operation with fan	without fan
Crimp contact	-4UA12	42	0.5...1,5 mm^2	5...60 V.	12	20 mm	X	
	-4UA22	42	0.5...1,5 mm^2	5...60 V.	12	40 mm		X
Screw contact	-4UB12	42	0.5...2 x 2,5 mm^2	5...60 V.	12	40 mm		X
	-4UB31	42	0.5...1,5 mm^2	5...60V.	12	20 mm	X	

Fig. 5 Connecting the front connector

2.3 Installation Guidelines

The wiring must comply with legal requirements such as the VDE specifications and accident prevention regulations.

If shielded cables are used, the shields must be connected close to the front connector with cable clamps on a shielding bus which has a low resistance connection to the cabinet of the programmable controller.

Detailed instructions regarding the power supply, the cabinet configuration, cabinet cooling, cabinet wiring and protective measures can be found in "Installation Guidelines" (reference no. C79000-B8576-C452).

3 Operation

3.1 Selecting the Bus Interface

The bus interface is selected using the sliding switch S2.

Switch position 2: DI/DO 482 operates via the local bus interface to the IP 257.

Switch position 1: DI/DO 482 (without IP 257) operates via the bus interface to the PC.

3.2 Setting the Module Address

The module address is set on the module with an address switch.

The address of the DI/DO is the sum of the dual values set by pressing down the individual rocker switches.

A label indicating the selected module address is stuck on in the labelling field below the address switch. The rocker switches to be set to the ON position are indicated by dots on the label.

The address byte at which the module is addressed by the STEP 5 user program, is not dependent on the slot.

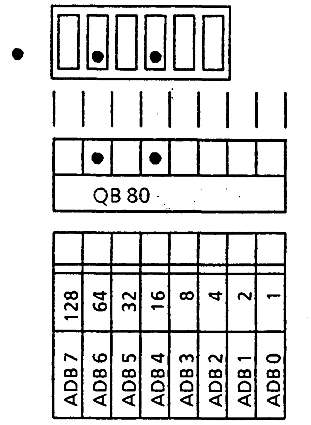
Only the lowest address (start address) for the first byte is set. The addresses for the three following bytes of the same DI/DO are decoded on the module. For example, if the start address is 20 on this 32-bit module, the addresses 21, 22 and 23 are decoded internally. The next free address would be 24.
Addresses already used for other modules on the same bus or in the same addressing area must not be used again.

Example: (module address 80)

The address is the sum of the binary values set with the individual coding switches, as follows:

$80 = 16 + 64 = 2^4 + 2^6$

Switch position "on" (pressed)



3.3 Address Area of the Module

When addressing via the S5 bus interface, the start address can be set in the range from 0 to 252. The following assignment applies:

Switch S1/	1:	address bit	ADB2
	2:		ADB3
	3:		ADB4
	4:		ADB5
	5:		ADB6
	6:		ADB7

When addressing via the local bus interface to the IP 257, the start address can be set in the range 0 to 12 as follows:

Switch S1/	1:	address bit	ADB2
	2:		ADB3

Switch S1/3...6: no function

The address set must be divisible by four without a remainder.

Switch position "on" (pressed)

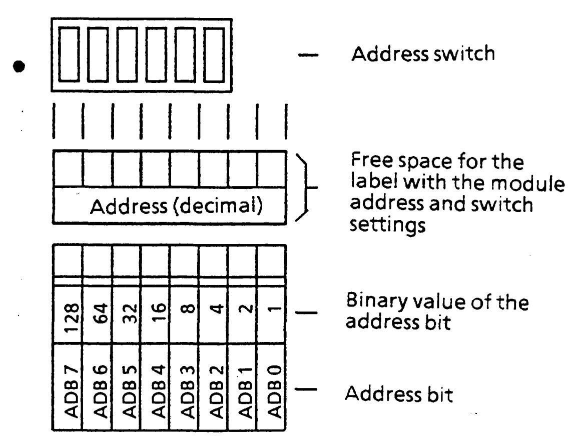


Fig. 6 Labelling of the address switch

3.4 Parallel Wiring of Outputs and Switching on the Load via a Contact

IMPORTANT
Wiring outputs in parallel to increase the load is not permitted.

Two outputs of a DI/DO 482 can be wired in parallel providing they are isolated by diodes. Since there are no diodes in the output lines of the module, an external diode must be installed.

The contact (e.g. for manual operation) is connected to L +.

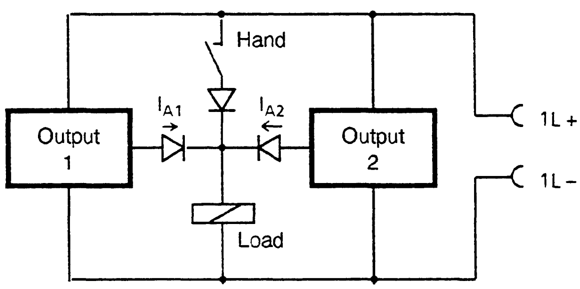


Fig. 7 Wiring outputs in parallel without increasing the load

3.5 Electrical Isolation and Distribution of the Channels

The module has 32 channels, which are galvanically isolated together: i.e. there is no division into electrically isolated groups within the module.

Channels 1 to 8 are digital outputs, channels 17 to 32 are digital inputs; channels 9 to 16 can be operated individually either as inputs or outputs. Channels not required should neither be connected nor addressed by the program. When using these channels as inputs, care must be taken that the corresponding bits remain set to logical 0 in the output register. The output register is automatically reset when the PC or expansion unit is switched on.

3.6 Switching Over the I/O Byte (Channels 9 to 16)

The operation of channels 9 to 16 as inputs or outputs depends solely on the user program. When the DI/DO is read, the byte is used as an input; when the DI/DO is written to, the byte is used as an output. Owing to the double function of the byte, the output byte can also be read back.

3.7 Short Circuit Protection and Fusing the Digital Output

To fuse the installation cables and to protect the module, there are also mechanical fuses in addition to the electronic short circuit protection. The mechanical fuses are also a protection against incorrect connection of the power supply terminals.

To ensure the correct function of the electronic short circuit protection the maximum line resistance may not exceed 15Ω .

In the case of a short circuit, two or three times the rated output current flows at the output before the clocked electronic short circuit protection is activated.

When selecting the load current power supply unit, make sure that taking into account all the connected output loads (including the coincidence factor) the increased short circuit current is available. With non-stabilized power supply units, the excess current is generally available.

With stabilized load power supply units - particularly with low output power (up to 20 A) - a suitable excess current must be taken into account.

4 Spare Parts

Spare Part	Order number
Spring contact for crimping	6XX3070 (see catalog ET1)
Pliers	6XX3071 (see catalog ET1)
Wire end ferrules	e.g. A2, 5 - 7 (DIN 46 228)
Releasing tool	6ES5 497 - 4UC11
Set of labels for module	C79451 - A3079 - C749
Set of labels for addresses	6ES5 497 - 4UD11
Fuse, slow-blow 6.3 A / 125 V	W79054 - M1041 - T630

SIEMENS

SIMATIC S5
Monitoring Module

6ES5 313-3AA12

Instructions

Order No. C79000-B8576-C582-01

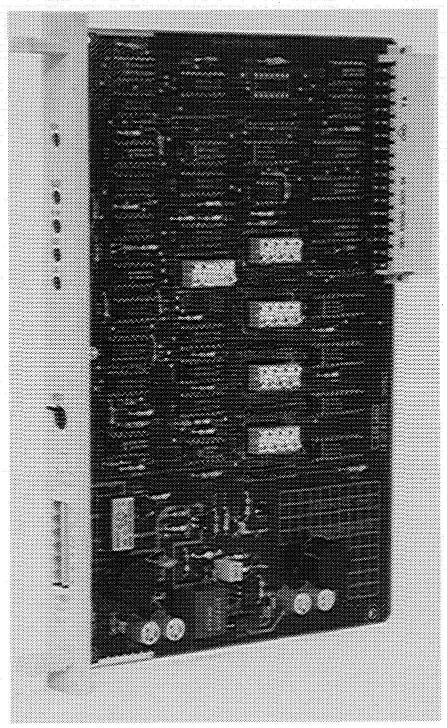


Fig. 1 Monitoring module

Contents

		Page
1	Application	2
2	Design	2
3	Mode of Operation	3
3.1	Block Diagram	3
3.2	Fault Detection	4
3.3	Resetting	5
4	Installation	6
4.1	Possible Configurations	6
4.2	Removing and Plugging	6
4.3	Connecting the RESET Input	7
4.4	Switch Positions of the Relay Contact	7
4.5	Installation Guidelines	7
5	Operation	8
5.1	Addressing	10
5.2	Setting the Address Switches S1, S2, S3, S4	12
5.3	Setting the Switch S5	13
6	Technical Data	14
7	Address Table	16

1 Application

The monitoring module (MM) can be used in the extension units of the programmable controllers S5-115 U, S5-130 K, S5-135 U, S5-150 K/S/U and S5-155 U.

The module monitors the data bus, the address bus as well as the control signals MEMW/, MEMR/ and RDY/. Faults are displayed via four red LEDs on the front panel. A group signal is output simultaneously via a floating contact. Following a fault, the module can be reset by means of the RESET key on the front panel or the RESET input (see Section 4.3).

2 Design

The MM is designed as a plug-in PCB in double Euroformat with a 32-pin blade connector for the S5 bus.

A connector for the relay contact and RESET input as well as one green LED, four red LEDs and a RESET key are located on the front panel.

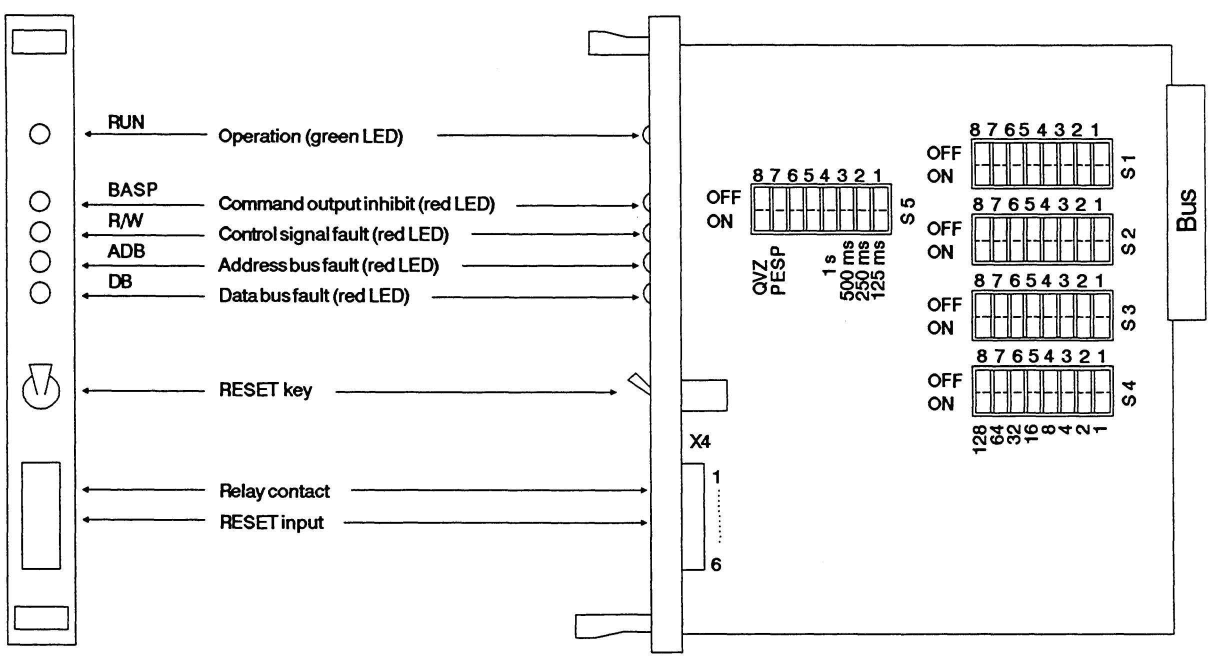


Fig. 2 Location of the coding switches

3 Mode of Operation

3.1 Block Diagram

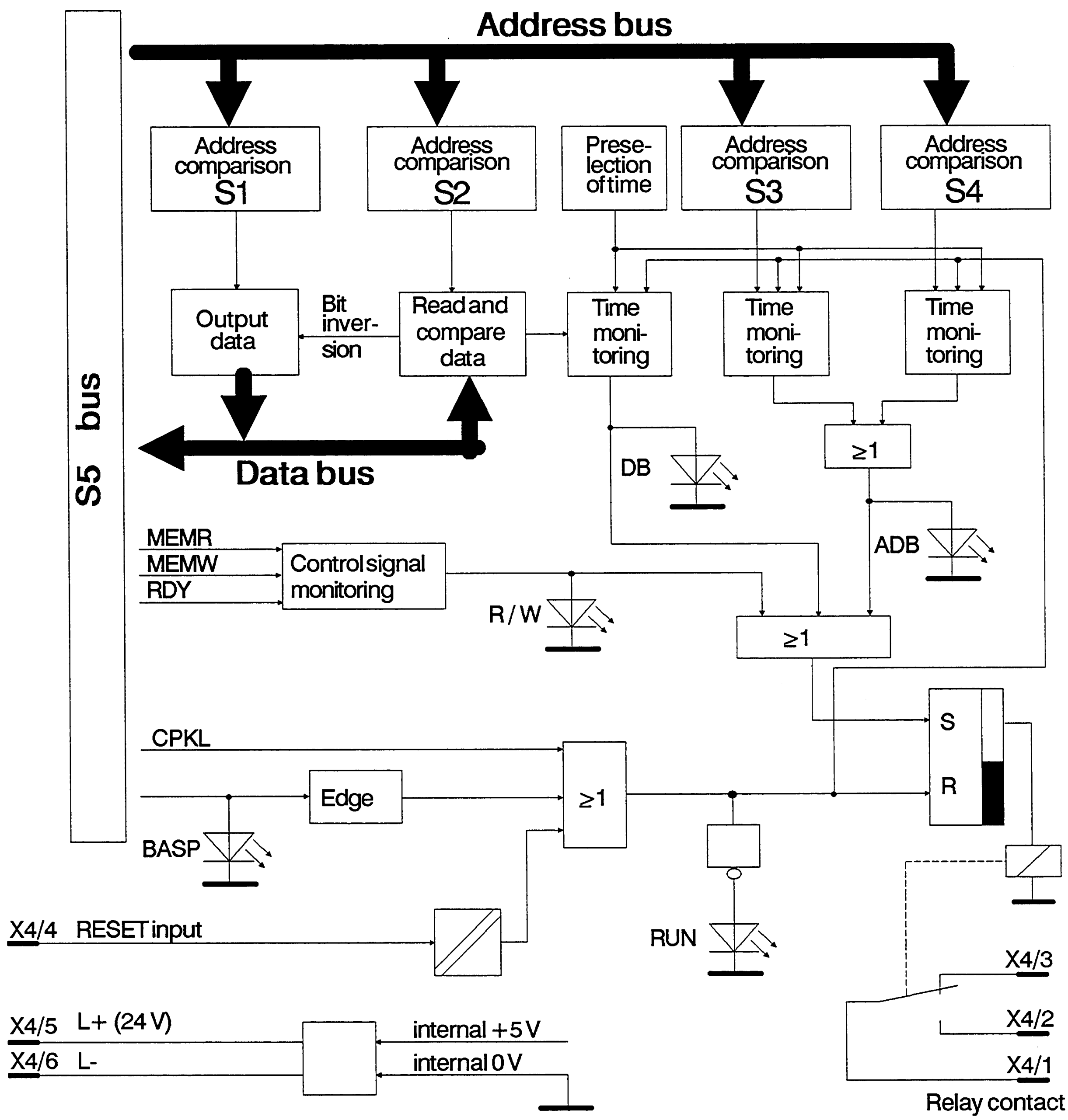


Fig. 3 Block diagram

3.2 Fault Detection

From an address which has been set at switch S1, the data (55H or AAH) is read by the CPU from the MM. This data is to be written back by the CPU to the address set at switch S2. The module inverts the accurate incoming data bit by bit (from 55H to AAH or vice versa) which is read again in the next cycle from the address set at S1.

Data bus faults

If the data which has been set on the MM is not returned within the set monitoring time, the module signals a data bus fault.

Detectable faults: interruption of the data lines; short-circuit against ground and +5V; short-circuits between adjacent data lines, e.g. DB0-DB1, DB1-DB2 etc.

Non-detectable faults: short-circuits between even data lines DB0-DB2-DB4-DB6 and between odd data lines DB1-DB3-DB5-DB7.

Address bus faults:

The addresses which have been set at switches S3 and S4, are only "listened to" by the MM, i.e. they do not output an acknowledgment signal (RDY/) and are not active on the data bus. If one or both addresses are not accessed again within the monitoring time, the MM signals an address bus fault.

Detectable / non-detectable faults: the same as for the data bus, if the inverse addresses 85 (55H) and 170 (AAH) have been set at the addressing switches S3 and S4 of all MMs.

Control line faults:

A control line fault (R/W) occurs, if

- the write signal (MEMW/) and the read signal (MEMR/) are active simultaneously,
- the acknowledgment signal (RDY/) is active without a MEMW/ or MEMR/ signal
- the address line 'peripheral memory' (PESP') has not changed from status "1" to "0".

Evaluation of the control signal PESP' can be turned off with the S5/7 switch. If the module is used in a programmable controller into which only I/O modules may be plugged (i.e. no memory modules or CPs), this switch must always be turned off. In this configuration, only I/O accesses to the bus are carried out and the PESP' signal always has the status "1".

It should also be turned off when using the AS 301, AS 302[1]), AS 304 and AS 308 interface modules for extension units, since a permanent PESP' signal can be applied to them.

BASP:

If a command output inhibit (BASP) is active, the "BASP" LED is lit.

Messages:

If one or more faults occur, the corresponding LEDs are lit, the relay contact commutes and the module does not acknowledge any more with the RDY/ signal. This acknowledgment delay may be suppressed by opening the S5/8 switch.

3.3 Resetting

There are several ways of resetting the module:

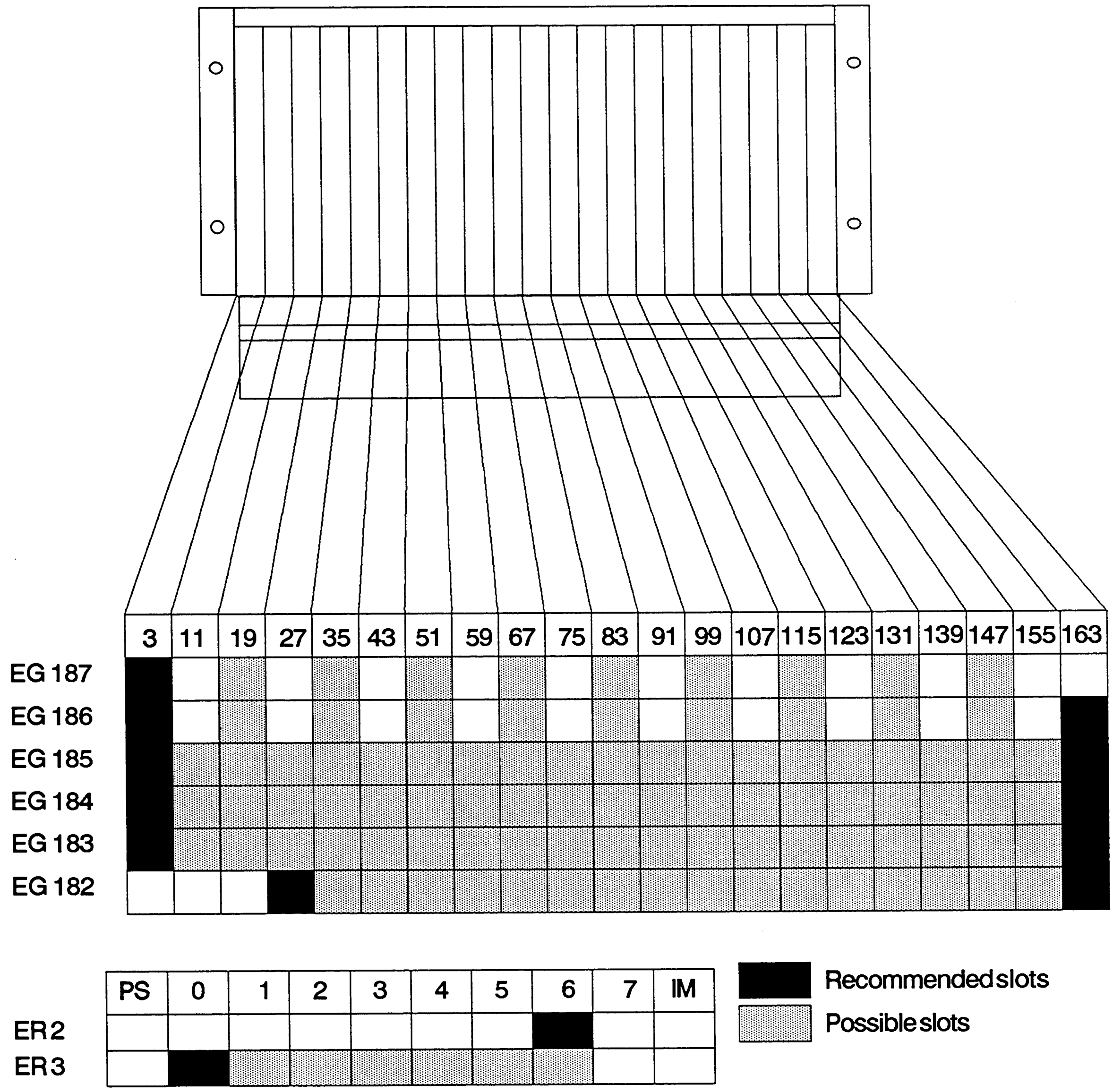
- CPKL/ signal = "1" (when the PC is switched on);
- Trailing edge of the BASP signal (during startup of the PC or following return of the load voltage);
- Applying 24 V to the front connector X4 between connections 4 (RESET input) and 6 (L-) or
- Linking connections 4 (RESET input) and 5 (L+) with connector X4.

---

1 In the S5 115U, the MM cannot be used together with the AS 302/311 coupling.

4 Installation

4.1 Possible Configurations



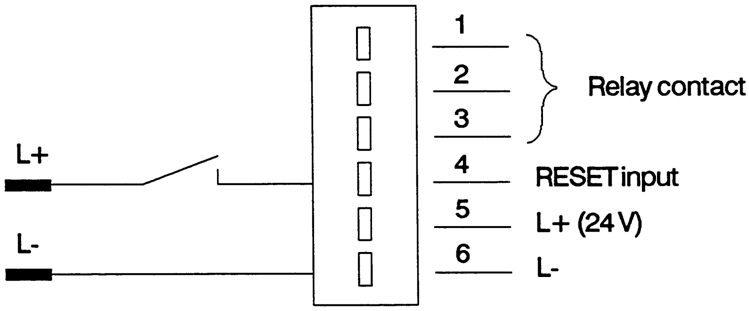
EG/ER = Extension unit
IM = Interface module
PS = Power supply

4.2 Removing and Plugging

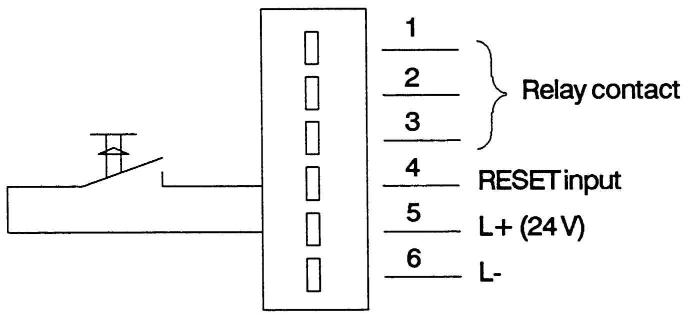
The module is to be pulled out by gently lifting and lowering the handles. The MM may only be removed or plugged in if the extension unit is switched off.

4.3 Connecting the RESET Input

RESET input (floating) with external 24-V supply

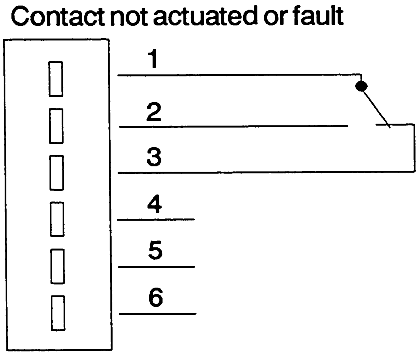


RESET input with internal 24-V supply



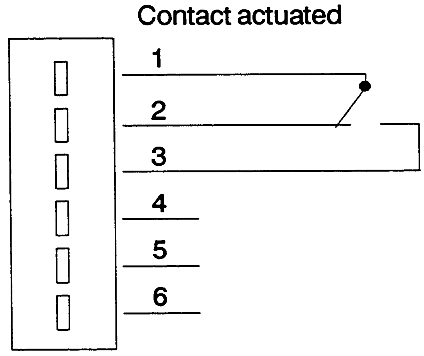
4.4 Switch Positions of the Relay Contact

Contact not actuated or fault



Contact 1-3 closed

Contact actuated



Contact 1-2 closed

4.5 Installation Guidelines

The module is to be wired according to the VDE regulations 0100, 0110 and 0160.

Detailed information on power supply, cabinet design, cabinet ventilation, cabinet wiring and protective measures can be found in the Installation Guide for "Programmable controllers of the U-series" (order no. C79000-B8576-C452) and should be observed.

5 Operation

Switch S1 (Read) and S2 (Write):

The addresses set at these switches are acknowledged by the MM with RDY/ and are therefore not to be used again for inputs and outputs in this programmable controller (double addressing is not allowed).

Switch S3 (Listen) and S4 (Listen):

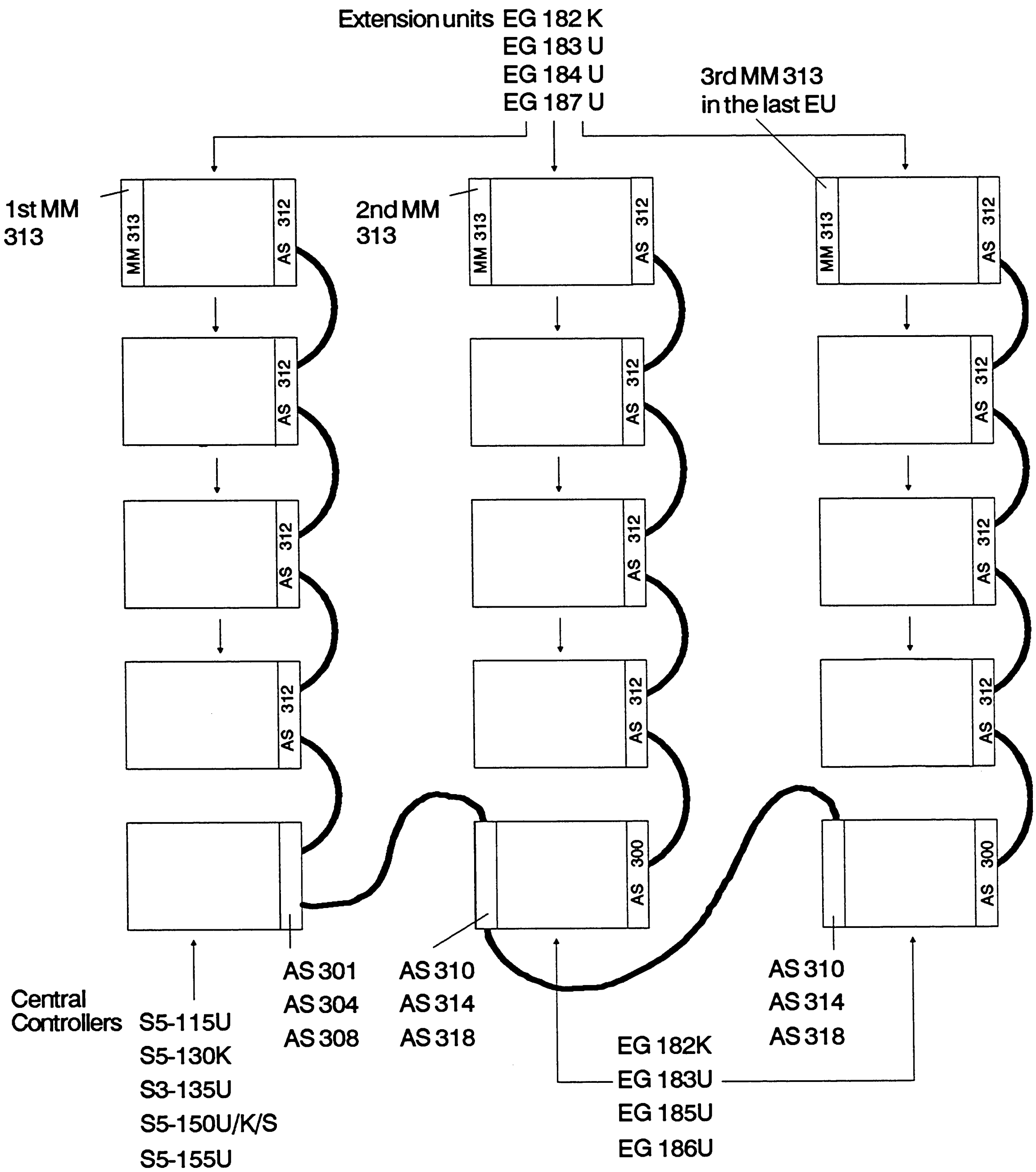
No acknowledgment signal (RDY/) is returned by the MM to the addresses set the switches S3 and S4. These addresses must be accessed by the programmable controller as input or output addresses. This means that they must be occupied by I/O modules or by one MM at switches S1 and S2. These modules must have been plugged into the last extension unit.

To achieve optimum address bus monitoring, inverse addresses should be used [e.g. 85 (55H) [2]) and 170 (AAH)].
It is advisable to make sure that the setting of switches S3 and S4 is the same on all MMs used. The setting of switches S1 and S2 as well as S3 and S4 should be the same on the MM in the last EU.

Switch	Input address can be accessed using MEMR/ (READ)	Output address can be accessed using MEMW/ (WRITE)	Acknowledged by module with RDY/
S1	*		*
S2		*	*
S3	*	*	
S4	*	*	

2 Select addresses 213 (D5H) and 170 (AAH) when using the module in the S5 115U. For exceptions refer to page 11.

Example:



Extension units EG 182 K
EG 183 U
EG 184 U
EG 187 U
3rd MM 313
in the last EU
1st MM
313
2nd MM
313
MM 313
AS 312
AS 300
AS 301
AS 304
AS 308
AS 310
AS 314
AS 318
AS 310
AS 314
AS 318
Central
Controllers
S5-115U
S5-130K
S3-135U
S5-150U/K/S
S5-155U
EG 182K
EG 183U
EG 185U
EG 186U

5.1 Addressing

Example 1: S5-130 K, S5-135 U, S5-150 U/K/S or S5-155 U

	1st MM	2nd MM	3rd MM in the last EU
S1	e.g.127 (7FH) [3]	e.g.126 (7EH) [3]	85 (55H) [4]
S2	e.g.127 (7FH) [3]	e.g.126 (7EH) [3]	170 (AAH) [4]
S3	85 (55H) [5]	85 (55H) [5]	85 (55H) [5]
S4	170 (AAH) [5]	170 (AAH) [5]	170 (AAH) [5]

User program in OB 1 or FB 0

without S5-DOS	with S5-DOS
:	:
L IB 127	L PY 127
T QB 127	T PY 127
L IB 126	L PY 126
T QB 126	T PY 126
L IB 85	L PY 85
T PB 170	T PY 170
BE	BE

---

3 Possible addresses: 0 (00H) to 255 (FFH)

4 To achieve optimum fault detection, set the inverse addresses 85 (55H) and 170 (AAH) at S1 and S2.

5 Since the addresses of the MM switches S3 and S4 are not acknowledged, this must be carried out by the MM contained in the last EU (the most remote from the CC). The addresses 85 (55H) or 170 (AAH) of this MM must be coded at switches S1 or S2, respectively. These addresses may not be occupied for I/O tasks any more.

Example 2: <u>S5-115 U</u>

S1	e.g.128 (80H) [6]	e.g.129 (81H) [6]	213 (D5H) [7][8]
S2	e.g.128 (80H) [6]	e.g.129 (81H) [6]	170 (AAH) [7]
S3	213 (D5H) [7][8]	213 (D5H) [7][8]	213 (D5H) [7][8]
S4	170 (AAH) [7]	170 (AAH) [7]	170 (AAH) [7]

<u>User program in OB 1 or FB 0</u>

without S5-DOS	with S5-DOS
:	:
L PB 128	L PY 128
T PB 128	T PY 128
L PB 129	L PY 129
T PB 129	T PY 129
L PB 213 [8]	L PY 213 [8]
T PB 170	T PY 170
BE	BE

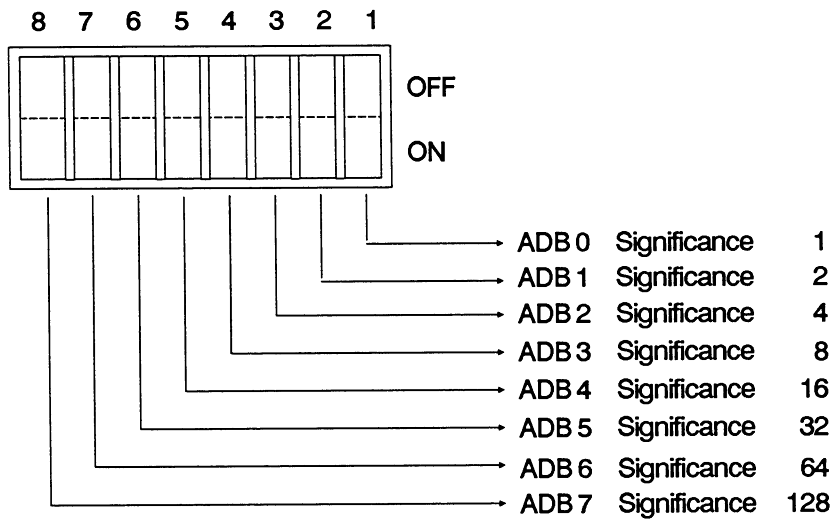
[6] When using the MM in the S5-115 U, always select addresses > 127 since that is the only way to address byte by byte.

[7] To achieve maximum fault detection, select inverse addresses > 127, e.g. 213 (D5H) and 170 (AAH). In this combination, the address bit ADB 7 is not monitored.

[8] If ADB 7 is also to be monitored, the address 84/85 (54H/55H) in the last EU must be occupied by an input or output module and cyclically accessed by the user program. Set address 85 (55H) in place of 213 (D5H) at switch S3 of all MMs. Select any address between 128 (80H) and 255 (FFH) for switch S1 of the MM in the last EU.
As an alternative, you may access the address at S1 of the MM in the last EU via direct access (without process image) using L PB 85 or L PY 85. Then, the addresses <u>84 and 85</u>, (54H) and (55H), in the process image may not be used any longer by other inputs. The address at S3 of all MMs is then to be set to 85 (55H).

5.2 Setting the Address Switches S1, S2, S3, S4

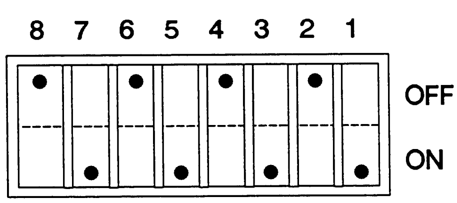
The addresses are set as one-byte addresses as in the case of I/O modules.



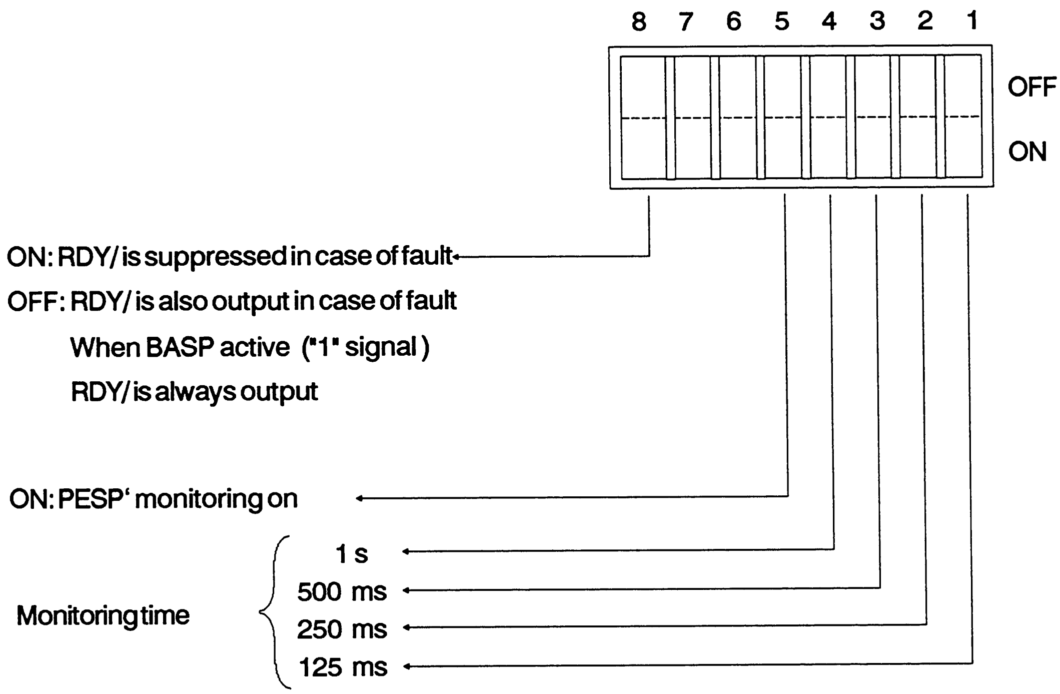
The significance of the rockers pressed down to ON at the switches must be added.

Example: Address 85 is to be set.

rockers to be pressed down to ON	Significance
1 (ADB 0)	1
3 (ADB 2)	4
5 (ADB 4)	16
7 (ADB 6)	64
	85



5.3 Setting the Switch S5



Select the monitoring time (between 125 ms and 1 s) by activating one of the switches S5/1 to S5/4. If none of the four switches S5/1 to S5/4 is in ON position, for safety reasons, the monitoring time has been set to 1 s.

If serial interface modules and the coupling between AS 304 and AS 314 are used, the PESP' monitoring is to be switched off (see Section 3.2: Control line faults).

Should the acknowledgment signal (RDY/) not be suppressed in the event of a fault, the switch S5/8 must be in OFF position.

When a BASP signal is active the RDY/ signal will always be output.

6 Technical Data

Power supply

Supply voltage of the system bus	+5 V ± 5 %
Power consumption	max. 450 mA

Reset input

Rated input voltage	24 V DC
Electrical isolation	yes
Input voltage	
for 0 signal	-33 to +5 V DC or input open
for 1 signal	+13 to +33 V DC
Input current	8.5 mA
Permissible cable length	max. 100 m, unscreened

Sensor supply for RESET input

Rated output voltage	24 V DC
Electrical isolation	yes
Output voltage	20 to 30 V DC short-circuit-proof to L-
Output current	max. 20 mA

Relay contact

Loading of contact with resistive load or inductive load	max. 30 V DC / 1 A

Safety test

Voltage test acc. to VDE 0160	
Relay contacts referred to internal	500 V r.m.s.
RESET input referred to internal	500 V r.m.s.
RESET input ref. to relay contacts	500 V r.m.s.
Impulse voltage test acc. to IEC 255-4	
Input referred to ground	1 kV; 1.2/50 µs

Interference test

Radio interference test acc. to IEC 255-4	Input referred to ground: 1 kV; 1 MHz
Radio interference test acc. to IEC 65(Co)39	Input referred to ground: 1 kV; burst

Mechanical data

Dimensions (w x h x d)	20 mm x 243 mm x 193 mm
Weight	270 g

Ambient conditions

Operating temperature	0 to +60 °C
Storage and transportation temperature	-25 to +70 °C
Relative humidity	max. 95 % at 25 °C; no condensation
Operating height	max. 3500 m above sea level
Vibration acc. to IEC 68-2-6	10 to 57 Hz, 0.15 mm; 57 to 500 Hz, 2*g*
Shock acc. to IEC 68-2-27	12 shocks, half sine; 15*g* / 11 ms

Pin assignment of bus connector X1

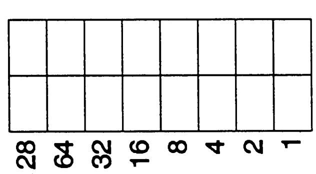
	b	z
2	0 V	+5 V
4	PESP'	-
6	ADB 0	CPKL/
8	ADB 1	MEMR/
10	ADB 2	MEMW/
12	ADB 3	RDY/
14	ADB 4	DB 0
16	ADB 5	DB 1
18	ADB 6	DB 2
20	ADB 7	DB 3
22	-	DB 4
24	-	DB 5
26	-	DB 6
28	-	DB 7
30	BASP	-
32	0 V	0 V

7 Address Table

Significance Byteaddress

1 2 4 8 / 128 64 32 16																
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255

Switch position ON ●



Siemens Aktiengesellschaft

Order No.: C79000-B8576-C582-01
Order from: Gerätewerk Karlsruhe
Printed in the Federal Republic of Germany
AG 0589 0.5 SD 16 En

SIEMENS

SIMATIC S5

Load current supply module 24 V/4 A

6ES5951-4LB11

Instructions Order No. C79000-B8576-C441-02

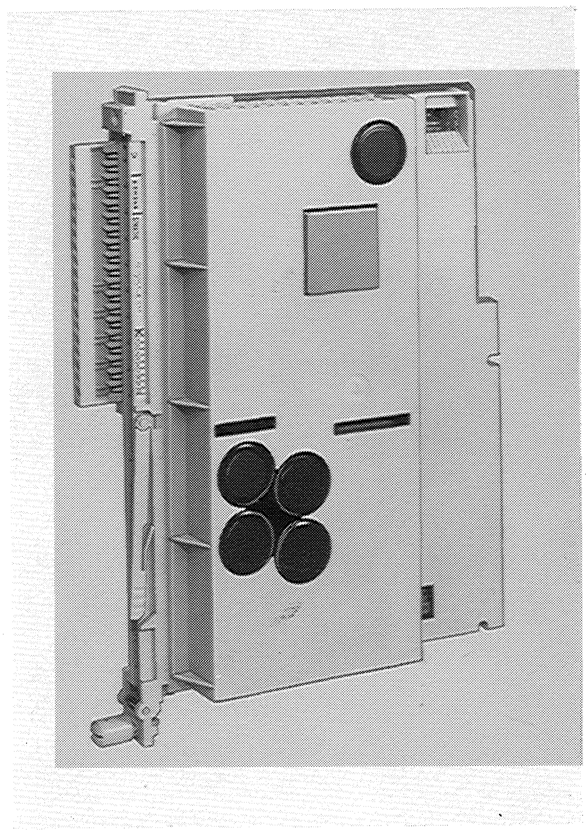


Fig. 1 Load current supply module 6ES5951-4LB11

Contents

		Page
1	**Range of application**	2
2	**Design**	2
3	**Mode of operation**	2
4	**Start-up**	4
5	**Technical data**	5
6	**Spare parts**	6
7	**Pin assignment of the front connector**	7

1 Range of application

The load current supply module 951 supplies an isolated, electronically stabilized DC output voltage of 24 V and can be used with SIMATIC S5 units to supply load current circuits and enable inputs of modules of the U peripherals.

2 Design

The module is in double euroformat for the ES 902 packaging system. All connections for the supply voltage, the DC voltage outputs as well as for the signal output and the inhibit inputs are located on a 20-way front connector. The module is two slots (40 mm) wide.

3 Mode of operation

The module contains a primary switched-mode power supply with a 4-A power output (1L+) for ohmic and inductive loads protected against permanent short-circuits. The fault-free operating status is indicated by a green LED and signaled by the switchover contact of a relay.

The module has, besides the power output, four other outputs (2L+ to 5L+) for ohmic loads, each with a current carrying capacity of 0.5 A. The operating state of every output is signaled by a green LED.

The sum of all load currents of the outputs 1L+ to 5L+ is max. 4 A. If one or more outputs are overloaded (short-circuit), the assigned green LEDs go out and these outputs are switched off.

A red LED signals the short-circuit of the outputs 2L+ to 5L+ and the signal output H+ shows 1-signal. If the short-circuit is eliminated, these outputs automatically return to normal operation.

The outputs 2L+ to 5L+ can be switched off individually by low-level at the inhibit inputs.

If the output 1L+ is overloaded with a current > 5.5 A for a few seconds, the module switches off. To re-activate, the mains voltage must be switched off and on again after removal of the overload.

The design of the module is shown in the block diagram (Fig. 2).

The output voltage generated by the switch controller is compared with a reference voltage and then led to the pulse width modulator via an optical isolator to control the switch-on time of the switching transistor.

The overload-protection circuit monitors the current of the switching transistor, which is proportional to the output current of the module. If the output current exceeds the set limit value for a few seconds, the pulse width modulator is blocked.

A four-fold driver circuit, with the four outputs 2L+ to 5L+ of 0.5 A each and a common overload signal output with a red LED for indicating an overload, is parallel to the output 1L+ and has a max. load of 4 A.

The outputs of the four-fold driver circuit can be switched off individually by four inhibit inputs.

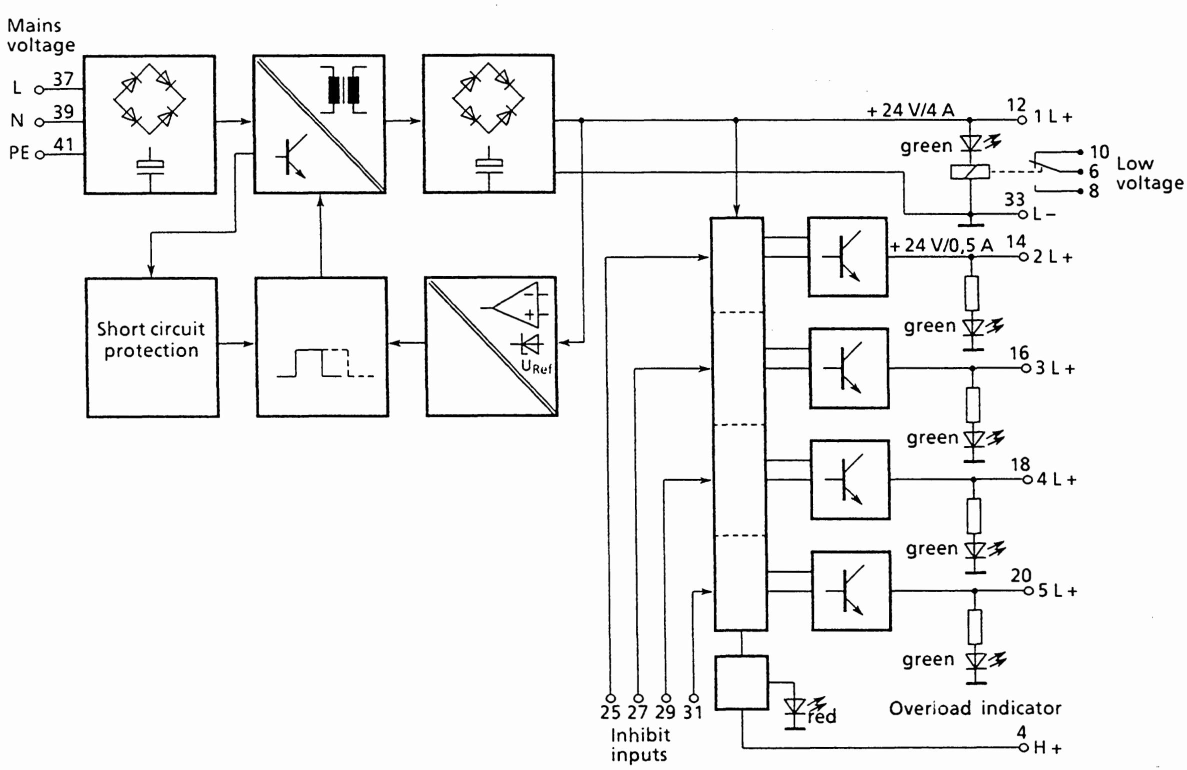


Fig. 2 Block diagram

4 Start-up

- Setting the mains voltage

The module is set at a mains voltage of 230 V AC on delivery.

The inscription visible on the voltage selector switch must match the mains voltage at the installation site.

Attention! With 115 V AC, a 2-A mains fuse (slow-blow) must be used.

- Connection of the power supply lines

The following must be provided when connecting the power supply lines to a permanent installation:

- a protection device (fuse or automatic cut-out) and

- a disconnecting device, so that the module can be released.

The power supply lines must be connected in accordance with VDE 0100 and VDE 0160.

5 Technical data

Input voltage	
- nominal value	230/115 V AC
- permitted range	
at 230 V AC	187 to 253 V AC
at 115 V AC	93 to 127 V AC
Mains frequency	
- nominal value	50 Hz
- permitted range	47 to 63 Hz
Mains fuse	
- at 230 V AC	1 A, slow
- at 115 V AC	2 A, slow
Galvanic isolation	yes
Input current	
- nominal value	
at 230 V AC	0.85 A
at 115 V AC	1.55 A
Starting current	
- at 230 V AC	10 A
- at 115 V AC	5 A
Output voltage	
- nominal value	24 V
- tolerance	±2 V
Maximum output current	
- output 1L+	4 A
- outputs 2L+ to 5L+	0.5 A each (ohmic load only)
Total current for outputs 1L+ to 5L+	max. 4 A
Overload signal output for outputs 2L+ to 5L+	24 V/10 mA, current-limited
Contact load of the relay with undervoltage signal	3 A/max. 250 V AC
Inhibit inputs for outputs 2L+ to 5L+	current input 2.5 mA
Radio interference level in the range 10 kHz to 30 MHz	limit value class A accord. to VDE 0871
Temperature range[1]	
- devices with fan	0 to 60°C
- devices without fan[2]	0 to 55°C
Temperature for storage and transport	-40 to 70°C

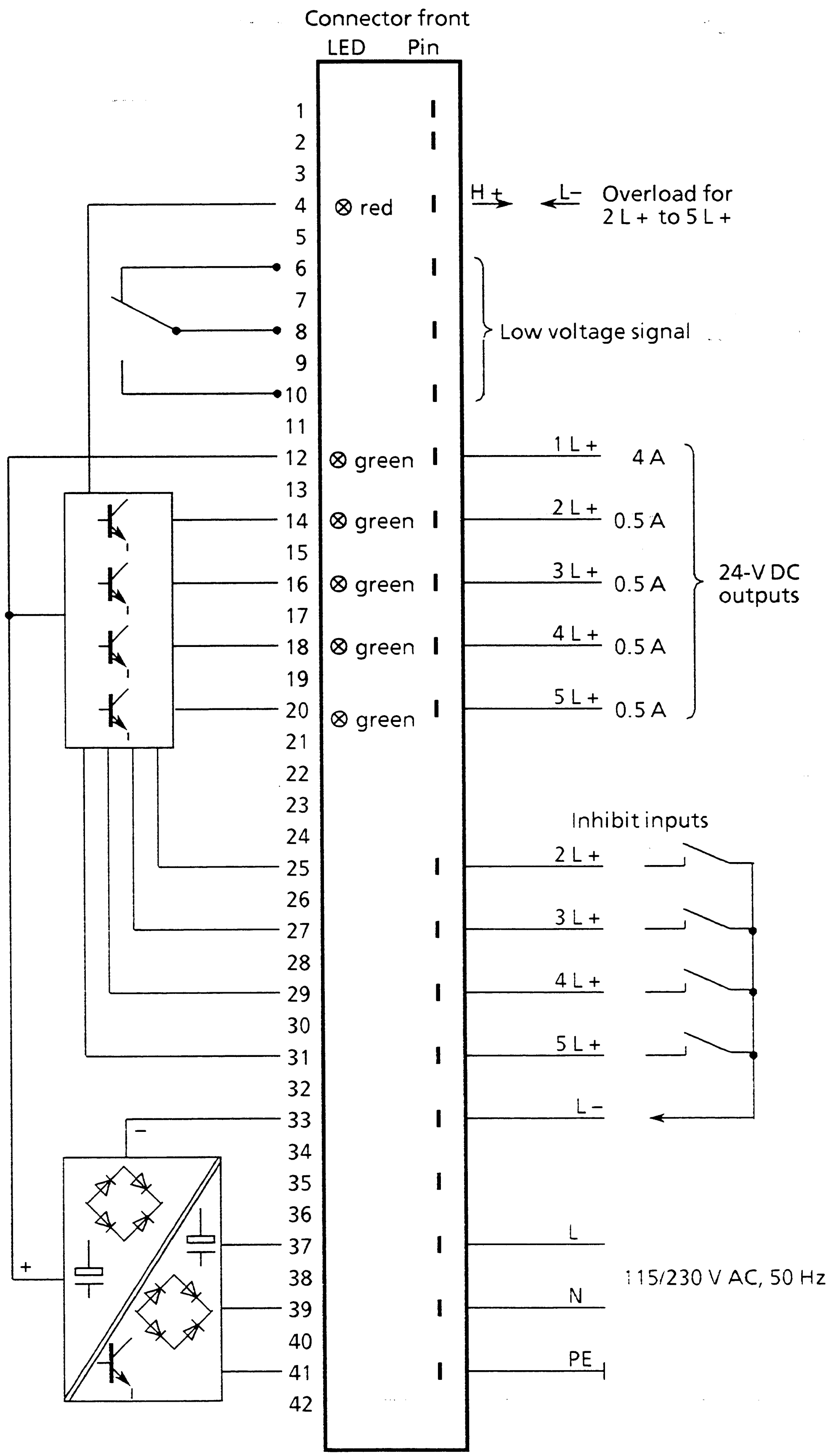
[1] Temperature of incoming air under the module rack
[2] Distance between the modules: 40 mm

Relative atmospheric humidity	max. 95% at 25°C no condensation
Altitude	max. 3500 m
Insulation voltage accord. to VDE 0160	
- mains against earthing point	tested with 1500 V AC
- output against earthing point	tested with 500 V AC

6 Spare parts

Fuse	
1 A, slow-blow	W79054-L4011-T100
2 A, slow-blow	W79054-L4011-T200
Front connector, 20 contacts (crimp-contacts) 40 mm	6ES5497-4UA42
Front connector, 20 contacts (screw contacts) 40 mm	6ES5497-4UB42

7 Pin assignment of the front connector



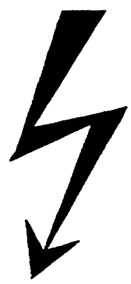
SIEMENS

SIMATIC S5

Programmable Controllers of the U-Series

Installation Guide

Publication No. C79000-B8576-C452-03



WARNING

Hazardous voltage.

Can cause death, severe personal injury, or substantial property damage.

Restrict use to qualified personnel.
See safety instructions.

Only qualified personnel should install or maintain this equipment after becoming thoroughly familiar with all warnings, safety notices, and maintenance procedures contained in this manual. The successful and safe operation of this equipment is dependent upon proper handling, installation, operation, and maintenance.

The following are definitions of the terms "qualified person," "danger," "warning," and "caution," as applicable for this document.

Qualified Person
One who is familiar with the installation, construction, and operation of this equipment and the hazards involved. In addition, the person should have the following qualifications:

- Be trained and authorized to use and tag circuits and equipment in accordance with established safety practices
- Be trained in the proper care and use of protective equipment in accordance with established safety practices
- Be trained in rendering first aid

DANGER
Indicates that loss of life, severe personal injury, or substantial property damage will result if proper precautions are not taken.

WARNING
Indicates that loss of life, severe personal injury, or substantial property damage can result if proper precautions are not taken.

CAUTION
Indicates that minor personal injury or property damage can result if proper precautions are not taken.

First Printing, September 1989
Printed in the Federal Republic of Germany

Preface

This book describes the installation procedure for programmable controllers of the U-Series. It discusses different configurations, power supplies, wiring, fans, heat dissipation, temperature monitoring, and safety measures. This book also provides information on cabinet design, ventilation, and wiring.

This book is intended for engineers, programmers, and maintenance personnel who have a general knowledge of programmable controller concepts.

If you have any questions about installing programmable controllers of the U-Series not answered in this book, please contact your local Siemens representative. Consult the appendix at the end of the entire manual for a list of Siemens offices worldwide. In the United States of America, please call 1-800-322-7224.

Contents

Preface iii
How to Use This Book ix

Chapter 1 - Installation in Cabinets

1.1 Centralized Configuration 1-5
1.2 Distributed Configuration 1-6

Chapter 2 - Power Supply

2.1 Internal Power Supply 2-1
2.2 Load Current Supply (External Power Supply) 2-2
2.3 Primary Power Supply for Central Controllers, Expansion Units, and Process Peripherals from Grounded Battery or Grounded Power Supply Units 2-3
2.4 Primary Power Supply for Central Controllers, Expansion Units, and Process Peripherals from Nongrounded Battery or Nongrounded Power Supply Units .. 2-4
2.5 Primary Power Supply for Central Controllers, Expansion Units, and Process Peripherals from Centrally Grounded Battery or Centrally Grounded Power Supply Units 2-5
2.6 Load Current Supply from Two External Power Supply Units for Floating or Nonfloating U-Series Modules 2-6
2.7 Back-Up Battery 2-8
2.8 Power Supply to Enable Inputs of the Peripheral Modules 2-8
2.8.1 Same Power Off Switch for the Central Controller/Expansion Unit and the Load Power Supply from a 220 V AC/115 V AC Power Supply 2-9
2.8.2 Separate or Same Power Off Switch for the Central Controller/Expansion Unit and the Load Current Supply 2-10
2.8.3 Removing and Plugging In Input/Output Modules While the Programmable Controller is Operating 2-12

Chapter 3 - Installing Configuration Wiring (without Considering Grounding)

Chapter 4 - Fan, Battery, and Temperature Monitoring

Chapter 5 - Cabinet Ventilation and Power Loss (Heat Dissipation)

5.1 Power Loss (Heat Dissipation) of Modules 5-1
5.2 Power Loss (Heat Dissipation) in a Cabinet and Cabinet Cooling 5-4

Chapter 6 - Cabinet Design

6.1 Ventilation Clearances 6-1
6.2 Installation Example 6-2

Chapter 7 - Cabinet Wiring

7.1 Connector Specifications 7-1
7.1.1 Connectors for Power 7-1
7.1.2 Connectors for Process Signal Lines to Peripheral Modules 7-1
7.2 Wiring Layout 7-3
7.2.1 Wiring Layout inside the Cabinet 7-3
7.2.2 Wiring Layout outside the Cabinet 7-3

7.3 Grounding 7-3
7.4 Protection against Dangerous Currents 7-4
7.5 Potential Equalization 7-4
7.6 Measures against Noise Interference 7-5
7.6.1 Noise Suppression on Alternating Current Power Lines Using Filter 7-5
7.6.2 Noise Suppression on Direct Current Power Lines Using Diverting Capacitors 7-6
7.6.3 Inductance Suppression 7-6
7.6.4 Inductance Separation 7-6
7.6.5 Protection against Electrostatic Discharge 7-6
7.6.6 Cabinet Lighting 7-7
7.7 Shielding and Permissible Cable Lengths 7-7
7.7.1 Grounding the Cable Shielding at One End 7-9
7.7.2 Grounding the Cable Shielding at Both Ends 7-9
7.8 Protection against Lightning 7-10
7.9 Main Power Connection for Programmers 7-10

Chapter 8 - Safety Measures

Index Index-1

Figures

1-1 Housing with Power Supply and Fans for a U-Series Central Controller or Expansion Unit 1-1
1-2 Housing Dimensions for a Central Controller or an Expansion Unit 1-2
1-3 Centralized Configuration with the S5-135U, S5-150U, or S5-155U Central Controller and S5-184U Expansion Units 1-5
1-4 Example for Distributed Configuration with the S5-135U, S5-150U, or S5-155U Central Controller and the S5-183U and S5-184U Expansion Units 1-6
2-1 Possible Connections for Sensors or Actuators of Process Peripherals on Grounded Power Supply Units 2-3
2-2 Possible Connections for Sensors or Actuators of Process Peripherals on Nongrounded Power Supply Units 2-4
2-3 Possible Connections for Sensors or Actuators of Process Peripherals on Centrally Grounded Power Supply Units 2-5
2-4 Connection to Floating and Nonfloating Modules 2-6
2-5 Feeding Nonfloating Input/Output Modules from Two External Power Supply Units 2-7
2-6 Feeding Floating Input/Output Modules from Two External Power Supply Units 2-7
2-7 Same 220 V AC/115 V AC Power Supply for Central Controller/Expansion Unit and Load Current Supply for I/Os 2-9
2-8 Separate 220 V AC/115 V AC Power Supply for Central Controller/Expansion Unit and Load Current Supply for I/Os 2-10
2-9 24 V DC Power Supply for Central Controller/Expansion Unit and I/Os 2-11
2-10 Supplying Enable Inputs from the Central Controller to Expansion Units without an Integrated Power Supply Unit 2-12
3-1 Configuration Wiring 3-2
4-1 Connection Terminals on the Power Supply Unit of a U-Series Unit 4-1
4-2 Jumper Layout on a Power Supply Unit (e.g., 6ES5 955-3LC12) 4-2
4-3 Wiring Recommendation for Fan/Temperature Monitoring When Using the S5-135U and the S5-183U in the Same Cabinet 4-3

5-1 Maximum Ambient Temperature of a Cabinet Depending on the Installed Power Loss (Heat Dissipation) 5-4
5-2 Cabinet Design 5-6
6-1 Installation Clearances 6-2
6-2 Installation Example 6-3
7-1 Potential Equalization for Distributed Installation 7-5
7-2 Signal Transfer for Distributed Installation 7-5
7-3 Layout of Noise Suppression Capacitors 7-6
7-4 Measures to Suppress Fluorescent Lamp Noise in a Cabinet 7-7
7-5 Connecting the Cable Shielding to the Shielding Bar 7-9
7-6 Placement of Elements That Protect against Lightning 7-10

Tables

1-1 Fan Subassemblies with or without Integrated Power Supply Units 1-3
3-1 Cable Lengths and Cross Sections 3-3
5-1 Power Loss Values of Modules Used in U-Series Units 5-1
5-2 Maximum Ambient Temperature for Specific Cabinet Designs 5-5
7-1 Specifications for Front Connectors 7-2
7-2 Maximum Permissible Cable Length for Digital Signal Lines in the Same Cable .. 7-7
7-3 Cable Lengths and Differences in Potential for Analog Modules 7-8

How to Use This Book

This section discusses information that may be helpful as you use this book.

Contents of This Book

- Chapter 1 - Installation in Cabinets

  This chapter provides the dimensions for the central housing of U-Series programmable controllers and discusses fan subassemblies and integrated power supply units. It explains centralized and distributed configurations.

- Chapter 2 - Power Supply

  This chapter discusses the internal power supply for central controllers and expansion units and load current supply for the peripheral modules, sensors, and actuators. It provides information on the back-up battery and on grounded, nongrounded, and centrally grounded power supply units. The chapter also includes details on load current supply from two power supply units for floating and nonfloating peripheral modules and power supply to enable inputs of peripheral modules.

- Chapter 3 - Installing Configuration Wiring (without Considering Grounding)

  This chapter provides information on configuration wiring and cable lengths.

- Chapter 4 - Fan, Battery, and Temperature Monitoring

  This chapter discusses the function of the fans and their monitor in the subassembly of U-Series housings. It also discusses the option of having the battery monitor operate a relay contact.

- Chapter 5 - Cabinet Ventilation and Power Loss (Heat Dissipation)

  This chapter indicates the maximum power loss dissipation per U-Series unit and lists the power loss values of modules used in these devices. It provides recommendations for cabinet design and cabinet cooling.

- Chapter 6 - Cabinet Design

  This chapter lists required installation clearances and provides an installation example.

- Chapter 7 - Cabinet Wiring

  This chapter lists requirements and recommendations for wiring cabinets containing U-Series units. It includes information on connectors, grounding, potential equalization, noise suppression, and shielding.

- Chapter 8 - Safety Measures

  This chapter provides safety recommendations for configuring programmable controller systems.

- Index

  The index contains an alphabetical list of key terms and subjects covered in this book and their corresponding page numbers.

- Remarks Form

  The remarks form is provided for your comments and recommendations. Only if you are in the United States of America should you use the postage-paid form.

Training

Contact your local Siemens representative for information on training courses to aid you in becoming familiar with this product. Consult the appendix at the end of the entire manual for a list of Siemens offices worldwide.

Reference Materials

It is recommended that you have the following books that support U-Series systems:

- *S5-135U Programmable Controller Manual*

  (Publication No. 6ES5 998-0UL21)[1]

- *S5-150U Programmable Controller Manual*

  (Publication No. 6ES5 998-0AL21)[1]

- *S5-155U Programmable Controller Manual*

  (Publication No. 6ES5 998-0UM21)[1]

- *U Periphery Manual*

  (Publication No. 6ES5 998-0PC21)[1]

- *S5-135U and S5-150U Programmable Controllers Catalog ST 54.1*

  (Publication No. E86010-K4654-A111-A3-7600)[1]

---

1 Order the appropriate book from your local Siemens representative.

- Programmer Manuals[1]:

  PG 635 Programmer Manual

  (Publication No. 6ES5 835-0SC21)

  PG 675 Programming Unit

  (Publication No. 6ES5 998-0US21)

  PG 675 Programmer Manual (using S5-DOS)

  (Publication No. 6ES5 875-0SC21)

  PG 685 Programmer Manual

  (Publication No. 6ES5 885-0SC21)

  PG 695 Programmer Manual

  (Publication No. 6ES5 895-0SC21)[2]

- *STEP 5 for Personal Computers User Guide (Volume 2 of 2)*

  (Publication No. 04-016-03-0788)[3]

- *STEP 5 Language Primer*

  (Publication No. 05-019-02-1285)[3]

---

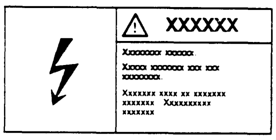
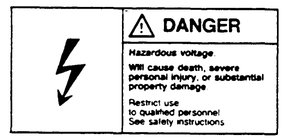
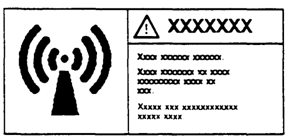
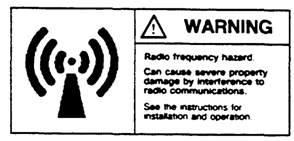
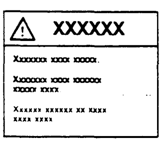
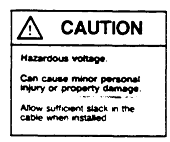
1 Order the appropriate programmer manual from your local Siemens representative.

2 This programmer is not presently available in the U.S.A.

3 Order fromSiemens Energy & Automation, Inc.
Programmable Controls Business Unit
150 Hembree Park Drive
Roswell, GA 30077-9810
U.S.A.

Conventions

The following conventions are used in this book and are listed for your reference:

Convention	Definition	Example
	A box that indicates a type of hazard, describes its implications, and tells you how to avoid the hazard is safety notation. Some safety notation includes a graphic symbol representing an electrical or radio frequency hazard. All safety notation has one of the following levels of caution:	
	• A danger indicates that loss of life, severe personal injury, or substantial property damage will result if proper precautions are not taken.	
	• A warning indicates that loss of life, severe personal injury, or substantial property damage can result if proper precautions are not taken.	
	• A caution indicates that minor personal injury or property damage can result if proper precautions are not taken.	

Depending on configuration, central controllers and expansion units can be installed with different fan subassemblies and power supply units (see Table 1-1).

Module power loss (heat dissipation) contributes to temperature increase inside the cabinet. Calculate power loss according to the list in Table 5-1.

Fan Subassembly with Power Supply Unit				**Central Controllers and Expansion Units**					
Input Voltage	**5 V DC**	**24 V DC Total**[1]	**15 V DC**	**CC 135U**	**CC 150U 155U**	**EU 183U**	**EU 184U**	**EU 185U**	**EU 186U**
115 V AC/ 230 V AC floating	18 A	0.8 A	0.5 A	X		X		X	
115 V AC/ 230 V AC floating	40 A	2.8 A	2.0 A	X	X			X	
24 V DC nonfloating	10 A	0.8 A	0.5 A	X					
24 V DC floating	18 A	0.8 A	0.5 A	X		X		X	
24 V DC floating	40 A	2.8 A	2.0 A	X	X			X	
Power Supply Unit without Fans				**Central Controllers and Expansion Units**					
Input Voltage	**5 V DC**	**24 V DC Total**[1]	**15 V DC**	**CC 135U**	**CC 150U 155U**	**EU 183U**	**EU 184U**	**EU 185U**	**EU 186U**
115 V AC/ 230 V AC floating	15 A	0.4 A							X
24V DC	15 A	0.4 A							X
Fan Subassembly without Power Supply Unit									
Input Voltage									
115 V AC/ 230 V AC							X		
24 V DC							X		

[1] This is the total current capacity available by either the front terminal or the backplane.

Table 1-1. Fan Subassemblies with or without Integrated Power Supply Units

You can arrange a central controller with various expansion units in the same cabinet or in adjacent cabinets located 2 m (6.6 ft.) or less away.[1] This is called a "centralized configuration." You can also put expansion units in cabinets that are as far away as 1000 m (3281 ft.).[2] This is called a "distributed configuration."

⚠ CAUTION
Hazardous current. **Can cause minor property damage.** Apply no more than 5 A current to the bus cables when you use interface modules to connect central controllers to expansion units that have no power supply units.

---

1 The maximum total cable length from the central controller to the most distant expansion unit is 2.0 m (6.6 ft.). The maximum total cable length between a central controller and an expansion unit is 1.5 m (4.9 ft.). Where dimensions are indicated in meters and feet, the conversion factor is 3.281 (1m = 3.28 ft.) with feet rounded off to the nearest tenth of a foot.

2 The maximum total cable length from the central controller to the most distant expansion unit is 1000 m (3281 ft). The maximum total cable length between a central controller and an expansion unit is 1000 m (3281 ft.).

1.1 Centralized Configuration

In a centralized configuration, you can put expansion units in the same cabinet as the central controller or in adjacent cabinets. Maintain a clearance of at least 75 mm (2.93 in.) but no more than 100 mm (3.9 in.) between devices. The maximum total cable length from the central controller to the most distant expansion unit is 2 m (6.6 ft.).

Figure 1-3 shows a configuration with the S5-135U, S5-150U, or S5-155U central controller and two S5-184U expansion units with the appropriate interface modules. To achieve a similar centralized configuration, plug an IM 300-5C interface module into the central controller and an IM 312-5C interface module into each expansion unit to connect up to three S5-184Us to the central controller. The cable connector of the IM 312-5C interface module has a maximum length of 1.5 m (4.9 ft.). See the *S5-135U and S5-150U Programmable Controllers Catalog ST 54.1*[1] and the *U Periphery Manual*[2] for other configurations.

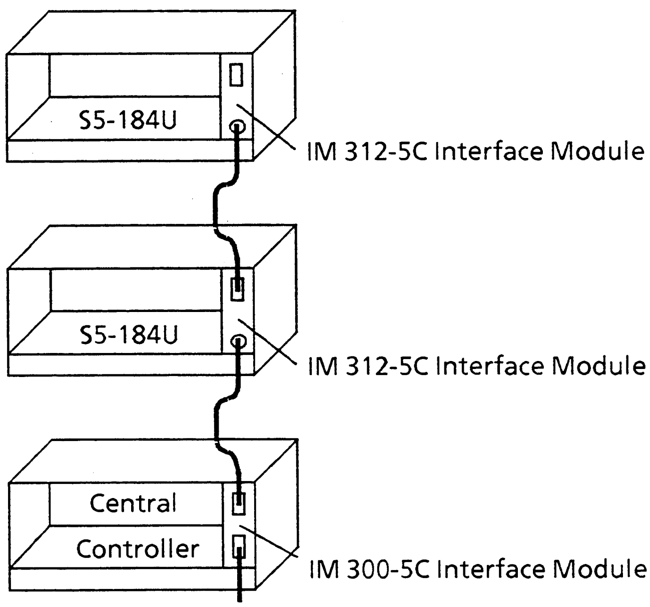


Figure 1-3. Centralized Configuration with the S5-135U, S5-150U, or S5-155U Central Controller and S5-184U Expansion Units

1 Publication no. E86010-K4654-A111-A3-7600

2 Publication no. 6ES5 998-0PC21

1.2 Distributed Configuration

In a distributed configuration, the expansion units are arranged in a cabinet that is up to 1000 m (3281 ft.) from the central controller. Figure 1-4 shows a version of a distributed configuration with a maximum total cable length of 200 m (656.2 ft.).

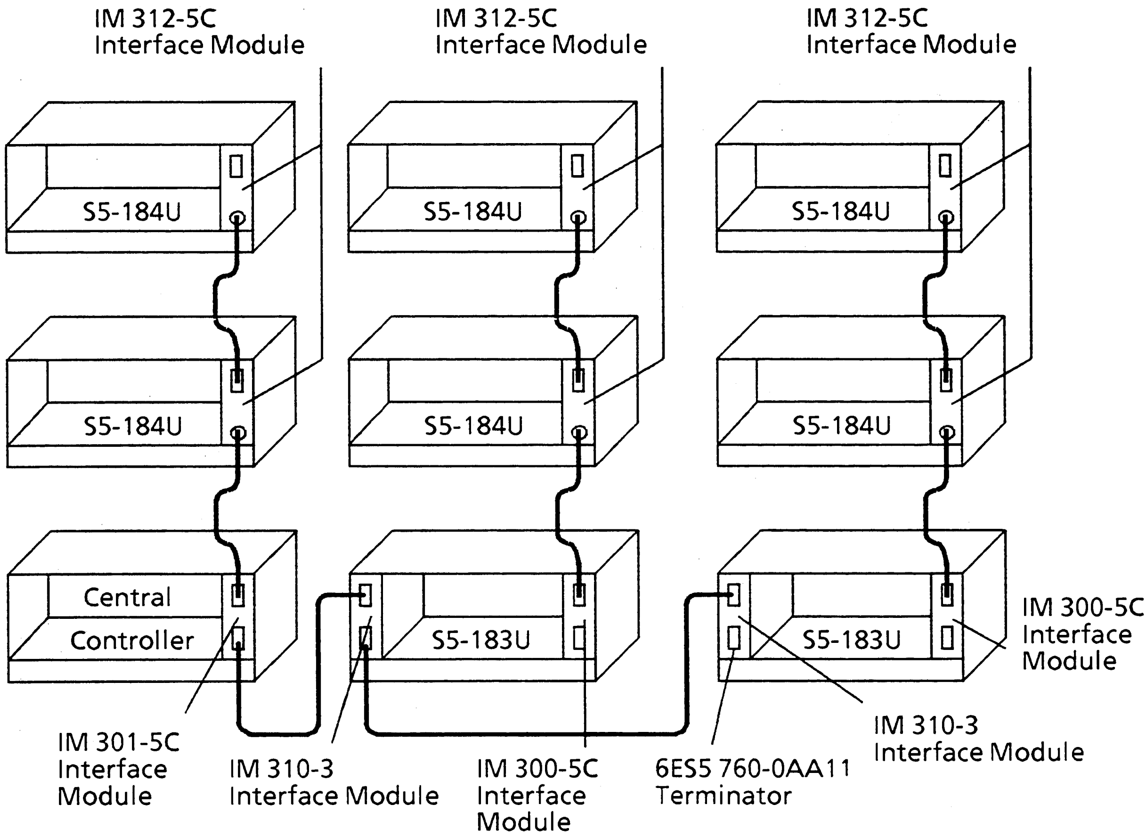


Figure 1-4. Example for Distributed Configuration with the S5-135U, S5-150U, or S5-155U Central Controller and the S5-183U and S5-184U Expansion Units

To achieve a distributed configuration similar to the one shown in Figure 1-4, plug an IM 301-5C interface module into the central controller. You can use up to four IM 301-5C interface modules in one central controller. Plug an IM 310-3 interface module into each S5-183U expansion unit to connect up to four expansion units to the IM 301-5C in the central controller for a distributed configuration. Always put a 6ES5 760-0AA11 terminator in the last IM 310-3 interface module and into any unused distributed configuration connections of the IM 301-5C interface module. The maximum total cable length from the central controller to the most distant expansion unit is 200 m (656.2 ft.). In this distributed configuration, you can connect an IM 301-5C interface module only to an S5-183U expansion unit.

Plug an IM 312-5C interface module into each S5-184U expansion unit to connect up to three S5-184Us to an S5-183U expansion unit or to a central controller in centralized configuration. You can use IM 304 and IM 314 interface modules to cover distances of up to 600 m (1968.6 ft.) between the central controller and the last expansion unit.

See the *S5-135U and S5-150U Programmable Controllers Catalog ST 54.1*, the *U Periphery Manual*, or the appropriate hardware and installation guide for other configurations with different interface modules.

NOTE

Use only the original cable connectors between interface modules. Connect the shielding of these cables at both ends (do not separate). The low-impedance shielding connection via the contact surfaces on the printed circuit boards and the grounding wiper in the module guide tacks must not be interrupted.

Chapter 2
Power Supply

The following power supplies are necessary for installing SIMATIC S5 systems:

- an integrated internal power supply for central controllers and expansion units
- a load current supply (external power supply) for peripheral modules, sensors, and actuators

2.1 Internal Power Supply

The power supplies built into the housings of U-Series central controllers and expansion units provide internal voltages of 5 V DC, 15 V DC[1], and 24 V DC from the 230 V AC/115 V AC or 24 V DC input voltage. When configuring central controllers and expansion units, make sure that the rated current of each built-in power supply unit is not exceeded. Consult the *S5-135U and S5-150U Programmable Controllers Catalog ST 54.1* for the current consumption of individual modules on the 5 V side.

Floating and nonfloating power supply units are available for the 24 V DC input voltage (see Table 1-1). The permissible input voltages are as follows:

- nominal: 20 V DC to 30 V DC
- surge: 36 V DC for 100 msec.

For power supply units with rated input voltage of 230 V AC/115 V AC, the permissible input voltages are as follows:

- nominal voltage at 115 V AC: 97 V AC to 132 V AC
- nominal voltage at 230 V AC: 187 V AC to 253 V AC

[1] The power supply unit provides an internal voltage of 15 V DC only if the 15 V submodule is inserted (see the *S5-135U and S5-150U Programmable Controllers Catalog ST 54.1*).

2.2 Load Current Supply (External Power Supply)

For load current supply, you can use Siemens power supply units of the 6EV13.. series (20 A and 40 A output current) to supply peripheral modules and also central controllers and expansion units with 24 V DC input voltage. Consult the *S5-135U and S5-150U Programmable Controllers Catalog ST 54.1* and the *Modular Packaging Systems and Power Supplies for Industrial Electronics ET 1 Catalog*[1] for more information.

When selecting and calculating the DC load current supplies for digital output modules (U-Series), note the following points:

- In addition to electronic short-circuit protection, the DC digital output modules have fuses to protect the cables and signal lines against overcurrent and to protect themselves against short circuiting. These fuses also protect against polarity reversal of the supply voltage connections.
- The resistance (R) for electronic short-circuit protection of digital output modules corresponds to the maximum permissible cable resistance. The value of resistance (15 ohms for 0.5 A outputs, 3.6 ohms or 4.75 ohms for 2 A outputs) is listed in the technical specifications for digital output modules in the *U Periphery Manual*[2].
- If you consider that all output loads are connected (note the total load rating), and in the event of a short circuit, the timed electronic short-circuit protection does not become effective immediately. Two to three times the rated output current can flow at the output for a short period before the short-circuit protection takes effect. This current surge is generally found in unregulated load current supply devices.
- Where regulated load current supply devices are concerned, especially in the case of small output power up to 20 A, a corresponding current surge must be considered.

NOTE

You must ensure that a secure electric separation exists for all power supply units that feed SIMATIC S5 devices and modules according to specifications required in your country.[3]

---

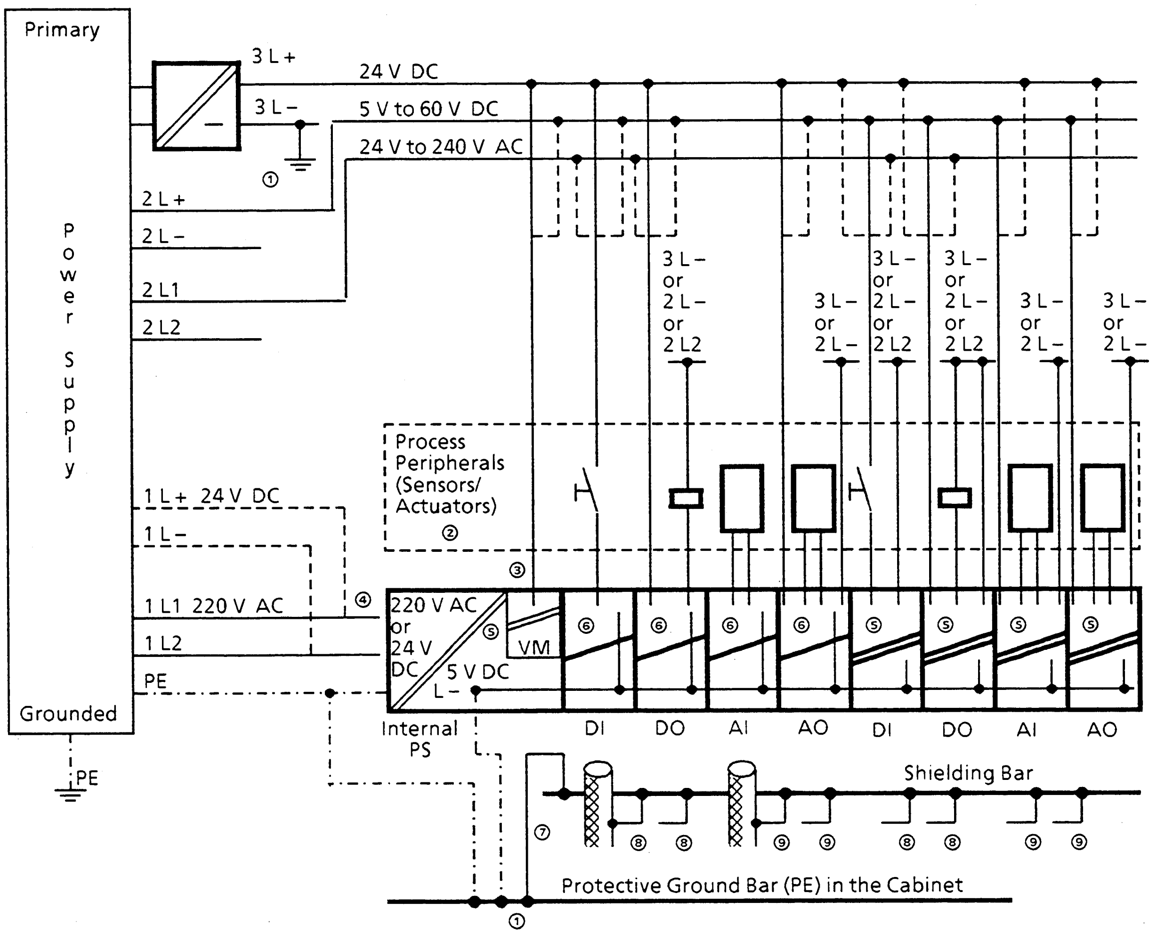
1 E86010-P4101-A104-A8-7600

2 Publication no. 6ES5 998-OPC21

3 In the U.S.A., make the electric separation according to specifications outlined in UL 478 (approximate equivalent of VDE 0160).

2.3 Primary Power Supply for Central Controllers, Expansion Units, and Process Peripherals from Grounded Battery or Grounded Power Supply Units

The internal reference voltage (5 V DC) of U-Series central controllers and expansion units is grounded. Grounded operation is preferable to nongrounded or centrally grounded operation because of better noise immunity. Figure 2-1 shows possible connections for sensors or actuators of process peripherals on grounded power supply units.

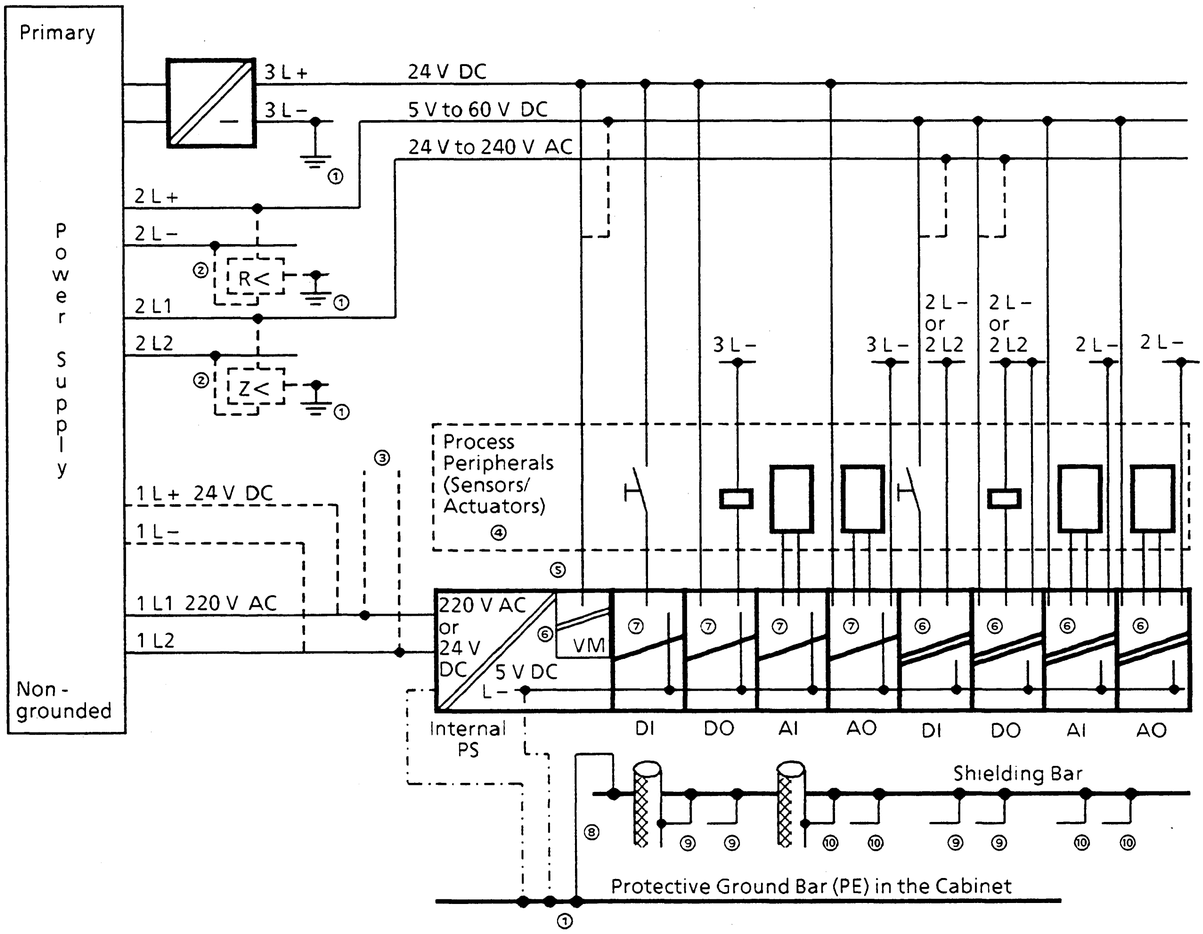


① Housing potential (cabinet potential) is equal to protective ground (PE = protective earth, protective ground).
② Protective ground to housings of sensors and actuators is required.
③ Load voltage monitor L+ (24 V DC) (VM = voltage monitor)
④ There is no galvanic isolation with a 24 V DC/10 A power supply unit. Smooth operation is possible only on a grounded primary power supply unit.
⑤ Floating module
⑥ Nonfloating module
⑦ Use a connecting cable with as large a cross section as possible (black). If you use the shielding as protective ground, connect it at both ends (green-yellow).
⑧ Use cable shielding for digital modules, if it is available Provide shielding for relatively long cables (see Table 7-2). You can connect shielding at one or both ends.
⑨ For analog modules, connect shielding at the cabinet entry only Continue it to the module.

Figure 2-1. Possible Connections for Sensors or Actuators of Process Peripherals on Grounded Power Supply Units

2.4 Primary Power Supply for Central Controllers, Expansion Units, and Process Peripherals from Nongrounded Battery or Nongrounded Power Supply Units

Figure 2-2 shows possible connections for sensors or actuators of process peripherals on nongrounded power supply units.

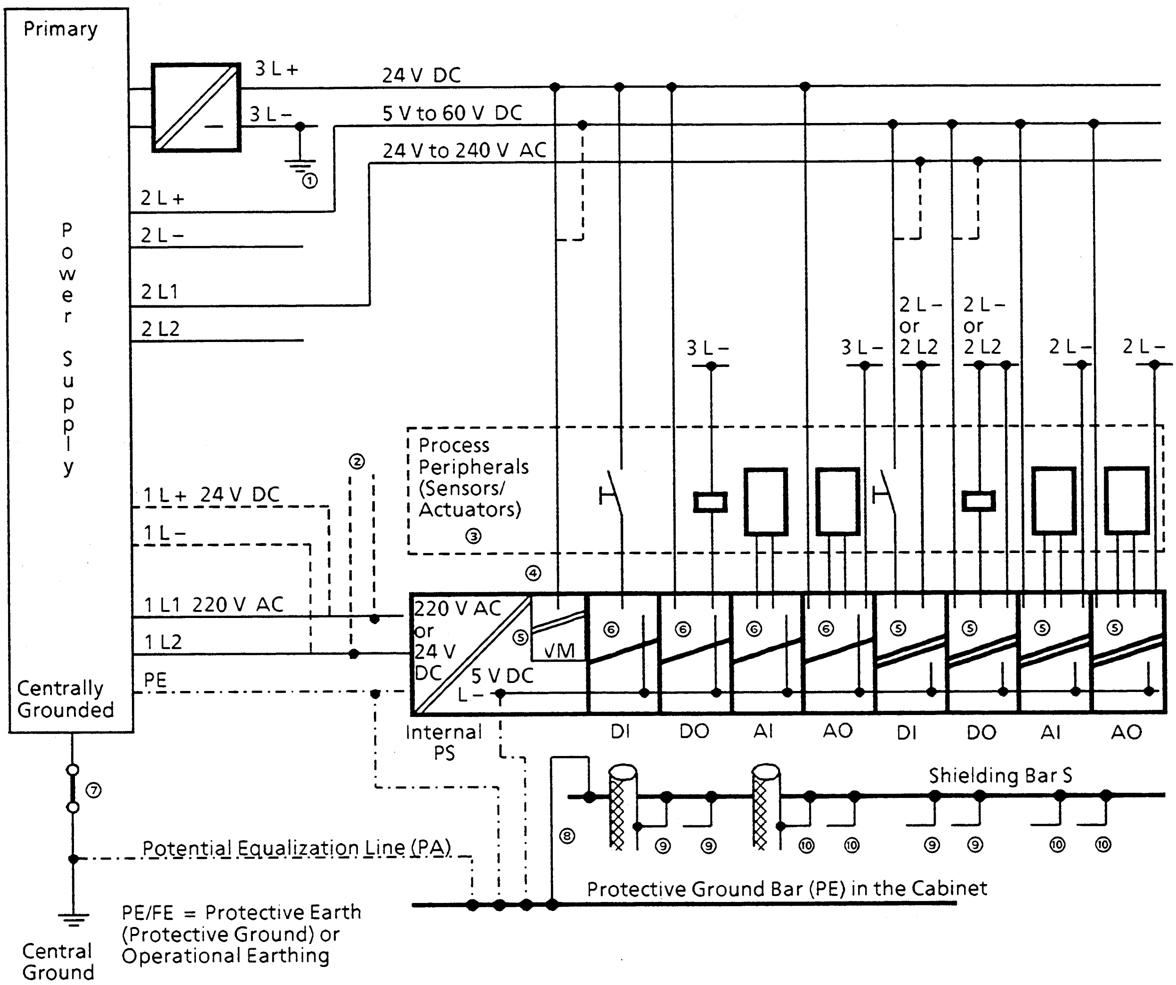


① Housing potential (cabinet potential) is equal to protective ground (PE = protective earth, protective ground).
② Isolation-Monitoring equipment is required if double errors could possibly trigger dangerous movements and/or if voltages are greater than 50 V AC or 120 V DC. Only one isolation monitor is required per supply system.
③ There is no galvanic isolation with a 24 V DC/10 A internal power supply unit. Consequently, operation on a nongrounded primary power supply unit is not possible directly. Voltage feed via 3 L+/L- is required.
④ Protective ground to housings of sensors and actuators is required. This ground is not necessary for safely generated low voltages.
⑤ Load voltage monitor L+ (24 V DC) (VM = voltage monitor)
⑥ Floating module
⑦ Nonfloating module
⑧ Use a connecting cable with as large a cross section as possible (black). If you use the shielding as protective ground, connect it at both ends (green-yellow).
⑨ Use cable shielding for digital modules, if it is available. Provide shielding for relatively long cables (see Table 7-2) You can connect shielding at one or both ends.
⑩ For analog modules, connect shielding at the cabinet entry only. Continue it to the module.

Figure 2-2. Possible Connections for Sensors or Actuators of Process Peripherals on Nongrounded Power Supply Units

2.5 Primary Power Supply for Central Controllers, Expansion Units, and Process Peripherals from Centrally Grounded Battery or Centrally Grounded Power Supply Units

Figure 2-3 shows possible connections for sensors or actuators of process peripherals on centrally grounded power supply units.



① Housing potential (cabinet potential) is equal to protective ground (PE = protective earth, protective ground).
② There is no galvanic isolation with a 24 V DC/10 A internal power supply unit. Consequently, operation on a centrally grounded primary power supply unit is not possible directly. Voltage feed via 3 L+/L- is required.
③ Protective ground to housings of sensors and actuators is required. This ground is not necessary for safely generated low voltages.
④ Load voltage monitor L+ (24 V DC) (VM = voltage monitor)
⑤ Floating module
⑥ Nonfloating module
⑦ This connection can be detached for testing purposes.
⑧ Use a connecting cable with as large a cross section as possible (black). If you use the shielding as protective ground, connect it at both ends (green-yellow).
⑨ Use cable shielding for digital modules, if it is available. Provide shielding for relatively long cables (see Table 7-2). You can connect shielding at one or both ends.
⑩ For analog modules, connect shielding at the cabinet entry only. Continue it to the module.

Figure 2-3. Possible Connections for Sensors or Actuators of Process Peripherals on Centrally Grounded Power Supply Units

2.6 Load Current Supply from Two External Power Supply Units for Floating or Nonfloating U-Series Modules

U-Series digital modules are available in nonfloating and floating versions. For the nonfloating modules, the reference voltage of the external process signals (M_{ext}) has to be connected to the internal reference voltage (M_{int}, i.e., PE) (see Figure 2-4). For floating modules, an optocoupler separates the external voltages from the internal ones.

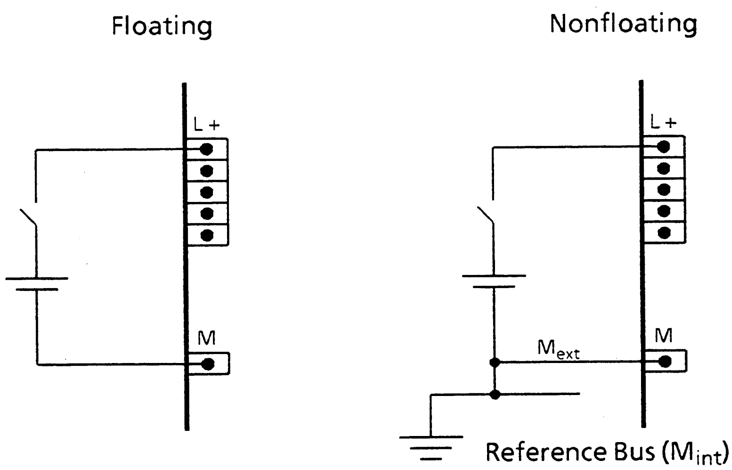


Figure 2-4. Connection to Floating and Nonfloating Modules

Figures 2-5 and 2-6 show how inputs and outputs of different U-Series modules are fed from two external power supply units, PS 1 and PS 2.

For U-Series nonfloating input/output modules, the negative pole (L-) of the external power supply units must be connected to the reference potential ground (U-Series unit housing/cabinet housing) since the inputs of module 6ES5 420-4UA11 used in the example (see Figure 2-5) are already connected from the module to the U-Series housing ground (M is connected to PE). Q in this example denotes a latching output (e.g., flip-flop).

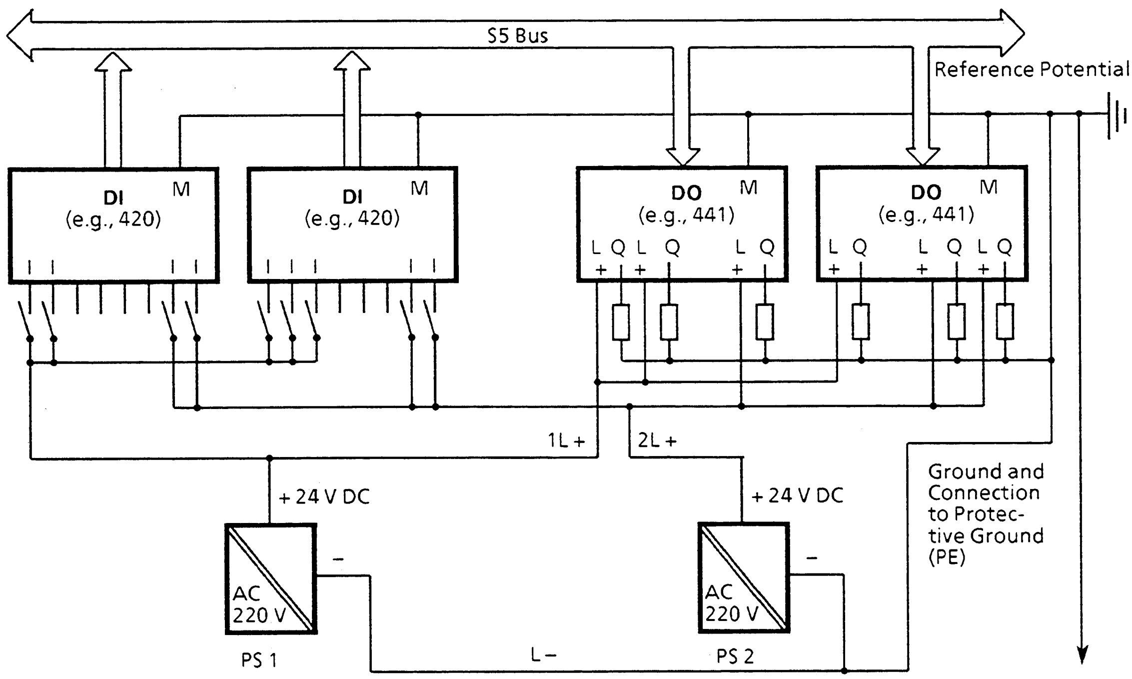


Figure 2-5. Feeding Nonfloating Input/Output Modules from Two External Power Supply Units

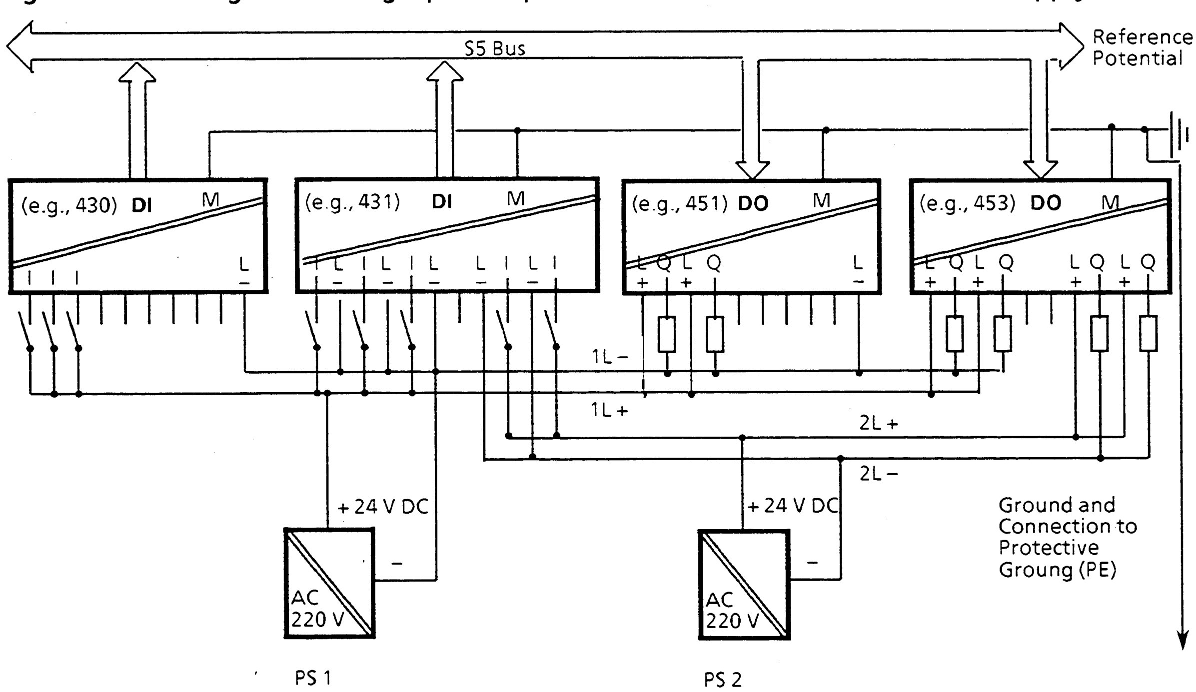


Figure 2-6. Feeding Floating Input/Output Modules from Two External Power Supply Units

Where floating modules are concerned, you can feed inputs and outputs with two power supply units by dividing the I/Os into floating (isolated) groups.

NOTE

When inputs or outputs from two floating (isolated) groups are connected to one power supply unit, the modules are no longer isolated.

If you are using central controllers and expansion units with connection to the main power, a Siemens power supply unit of the 6EV13.. or 6ES5 950-8MD.. series with galvanic isolation is recommended to feed the process peripherals (load voltage). Connect the 24 V DC load voltage to the load voltage monitor input ("Monitor Input").

2.7 Back-Up Battery

Each S5-135U, S5-150U, and S5-155U housing has an integrated back-up battery in addition to the power supply unit. You can change the battery without losing any data if the power supply is switched on or if you apply an external voltage to the "Ext. Batt." terminals (3.4 V).

NOTE

Make sure the polarity of the external voltage is correct. The "Monitor Output" signal relay can also report a battery failure.

2.8 Power Supply to Enable Inputs of the Peripheral Modules

U-Series peripheral modules have an enable circuit for communication between peripheral modules and S5 bus signals. You can use the enable inputs to switch on certain modules permanently or to switch off certain modules while the programmable controller is operating.

For modules with direct voltage inputs or outputs, supplying an external voltage to the F+/F- inputs triggers the enable. For modules with alternating voltage inputs or outputs, a jumper in the front connector triggers the enable.

Pivoting the front connector forward, away from the front of the module, interrupts the voltage supply for the enable inputs. The module is switched off and no longer gives an acknowledge signal when a CPU attempts to access it. A time-out error (QVZ) results.

NOTE

When a time-out error occurs, CPUs react as follows:

- **CPU 921 (S-Processor) goes into the "STOP" mode.**
- **CPU 922 (R-Processor), CPU 928, CPU 946/947 (S5-155U), and CPUs of the S5-150U**
  - **continue to run**
  - **react as programmed in error OBs called by QVZ**

When an I/O module is not plugged in or does not give the "RDY" signal, CPU 928 and CPU 946/947 (S5-155U) write 0 into the process image input table for all missing inputs. All other CPUs write 1 into the table.

The following two examples illustrate the function of the enable inputs:

- Individual parts of a process can be shut off using very little power. This means that outputs of different modules can be run on the same load current supply and still be activated separately.

- The load voltage of each individual module can be monitored without additional overhead. You can program optional reactions to load voltage failure in the QVZ organization block.

When configuring systems, note the following requirements:

- Power up - Voltage must be at the enable inputs of the I/O modules within 100 msec. after the programmable controller has been switched on.

- Power down - After the programmable controller has been switched off, the voltage must remain at the enable inputs of the I/O modules as long as the internal 5 V is available.

For switching off programmable controllers and devices supplying the enable inputs, note the information in subsections 2.8.1 through 2.8.3.

2.8.1 Same Power Off Switch for the Central Controller/Expansion Unit and the Load Power Supply from a 220 V AC/115 V AC Power Supply

Proper functioning is guaranteed if the 24 V DC load power supply has an output capacity of at least 4700 µF per 10 A rated load current (e.g., the 6EV1 334-4AK [220 V AC/24 V DC, 10 A]). You can adapt devices that do not meet this requirement by connecting a capacitor of 10000 µF/40 V in parallel (e.g., in the case of the 6EV1 352-5BK [380 V AC /24 V DC, 20 A] load current supplies and the 6EV1 362-5BK [380 V AC/24 V DC, 40 A] load current supply). See Figure 2-7.

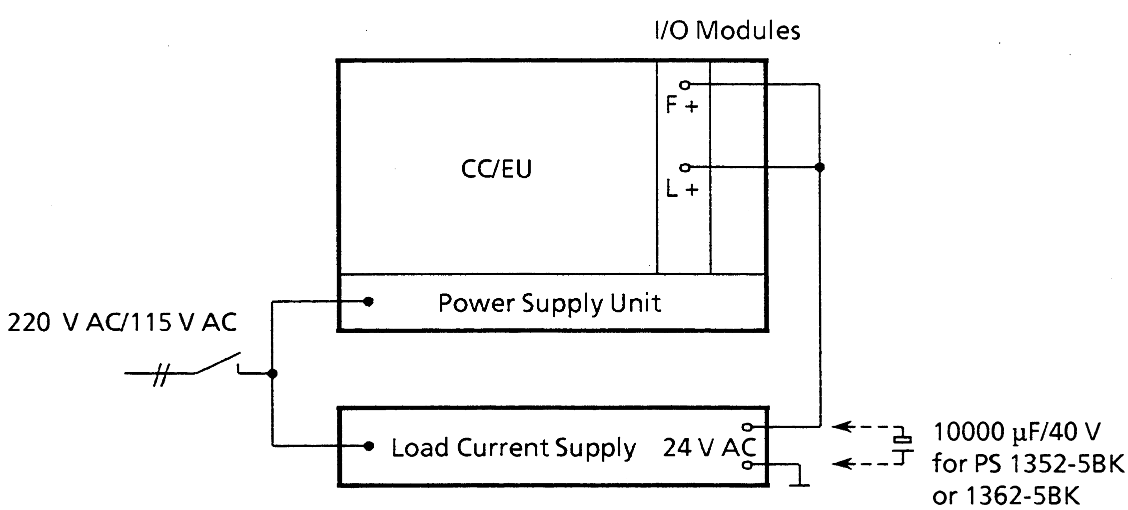


Figure 2-7. Same 220 V AC/115 V AC Power Supply for Central Controller/Expansion Unit and Load Current Supply for I/Os

2.8.2 Separate or Same Power Off Switch for the Central Controller/Expansion Unit and the Load Current Supply

The following capabilities for generating the enable voltage are available if you have to switch off the load current supply separately without influencing the enable of the modules. These capabilities are also available when the load current supply without additional capacitor and same power off switch is used.

Figure 2-8 shows a 220 V AC/115 V AC power supply for a central controller or an expansion unit and load current supply where the enable inputs of I/O modules are supplied by the following sources:

1. 6ES5 951-4LB11 Load Current Supply
2. 6ES5 958-4UA11 Enable Supply
3. Battery
4. Enable Supply Direct from the Power Supply Unit (Note Load and Order Number)

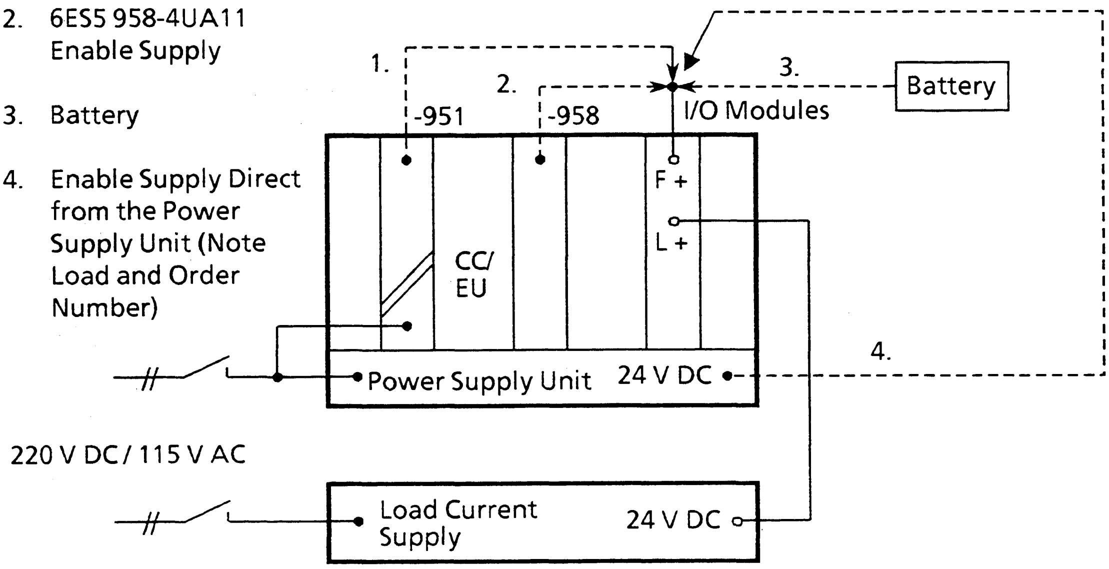


Figure 2-8. Separate 220 V AC/115 V AC Power Supply for Central Controller/ Expansion Unit and Load Current Supply for I/Os

Figure 2-9 shows a 24 V DC supply for a central controller or an expansion unit and I/Os where the enable inputs of I/O modules are supplied by the following sources:

1. 6ES5 958-4UA11 Enable Supply
2. Battery
3. Enable Supply Direct from the Power Supply Unit

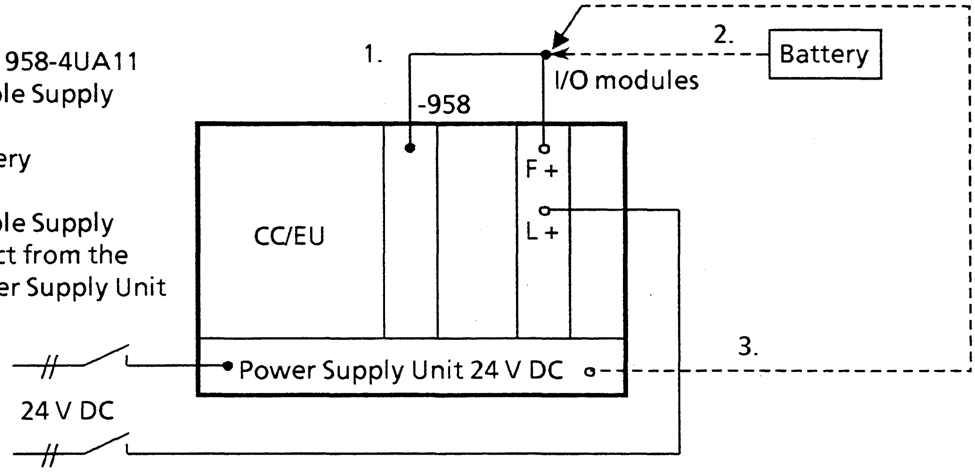


Figure 2-9. 24 V DC Supply for Central Controller/Expansion Unit and I/Os

You can plug the 6ES5 958-4UA11 enable supply only into a central controller or an expansion unit housing that has an integrated power supply unit subassembly.

Use a 958 enable supply plugged into a unit with an integrated power supply unit to connect enable inputs of peripheral modules in expansion units that have no integrated power supply unit (e.g., S5-184U or S5-187U). See Figure 2-10.

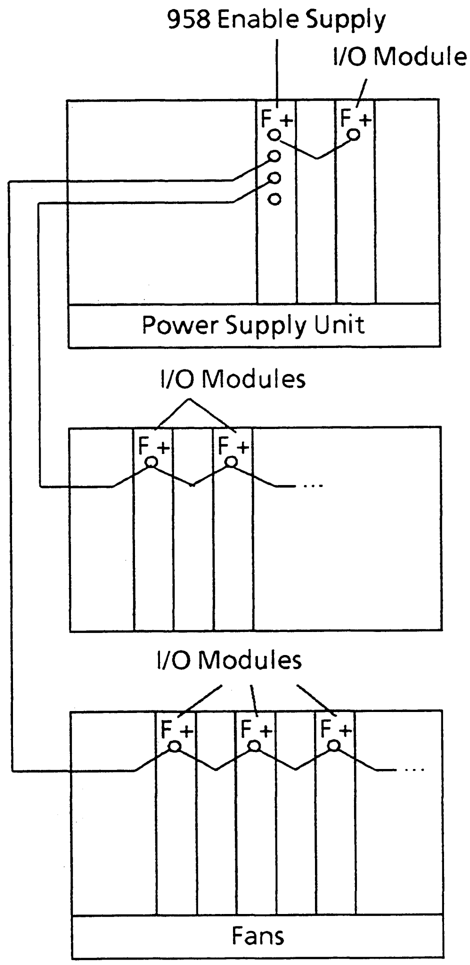


Figure 2-10. Supplying Enable Inputs from the Central Controller to Expansion Units without an Integrated Power Supply Unit

2.8.3 Removing and Plugging In Input/Output Modules While the Programmable Controller Is Operating

The S5-130K, S5-130W, and the S5-135U programmable controllers (with the S-Processor only) go into the "STOP" mode with a time-out signal when the front connector is removed, because removing the front connector removes the enable voltage. However, with the S5-135U (with CPU 922 {the R-Processor}, and CPU 928), S5-150K/S/U, and S5-155U (CPU 946/947) programmable controllers, you can remove and plug in input/output modules while the programmable controller is running and it will not go into the "STOP" mode. However, the QVZ signal (time-out) will light up on the CPU.

⚠ WARNING

Loss of process control.

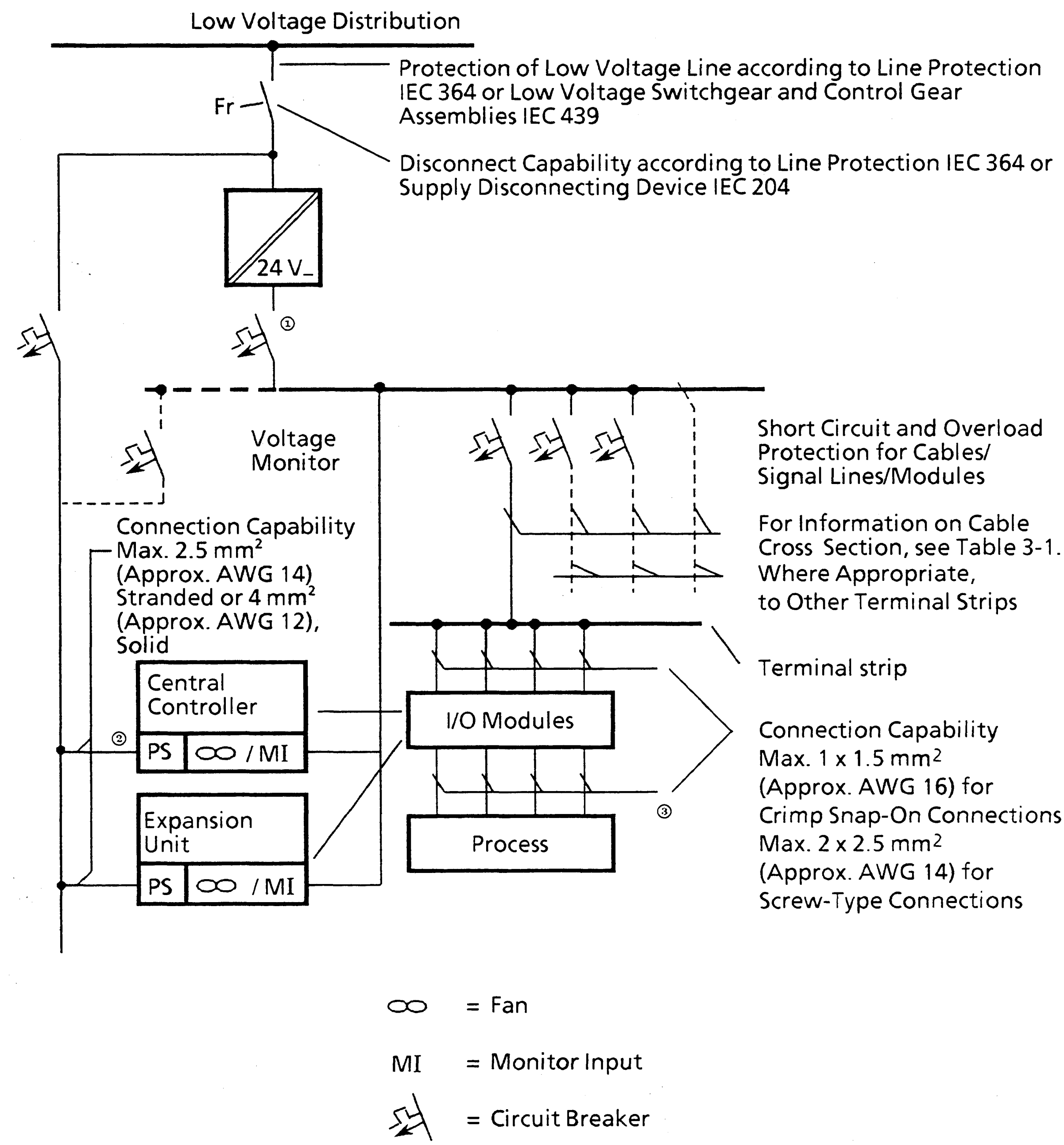
Can cause death, severe personal injury, or substantial property damage.

With no enable signal, or with a disconnected front connector or module, all inputs of this module are read as signal level 1. However, CPU 928 and CPU 946/947 write 0 into the process image input table. Maintain the enable input voltage of the modules that affect outputs directly, or ensure that the program can handle all input signals at signal level 1 or 0, depending on the CPU.

Remove only the enable voltage of the appropriate output modules to switch off parts of a process. Program the QVZ organization block to avoid hazardous conditions in the process if a fault occurs or a module is disconnected.

Chapter 3
Installing Configuration Wiring (without Considering Grounding)

When supplying power to process peripheral modules with 24 V DC and to central controllers or expansion units with 240 V AC or 24 V DC, note the information in Figure 3-1 and Table 3-1.



① Not applicable if the power supply has a protective ground

② Current consumption per central controller/expansion unit:
For example, at 24 V DC (Io = 18 A), it is approximately 6.9 A. At 240 V AC (Io = 18 A), it is approximately 1.2 A.

③ The fuses in the output modules can protect the output lines against short circuit and overload if cross sections and cable lengths are assigned properly (see Table 3-1). However, the input signal lines always need additional fuse protection. Where appropriate, an output can be used.

Figure 3-1. Configuration Wiring

Rated Current (A) of the Protective Device	Cross Section in mm^2 (Approximate AWG)	
	For Cable Length <1 m (3.3 ft.)	For Cable Length 1 m to 2.5 m (3.3 to 8.2 ft.)
<2	1.0 (18)	1.5 (16)
2 to 6	1.5 (16)	2.5 (14)
6 to 10	2.5 (14)	4.0 (12)
10 to 16	4.0 (12)	6.0 (10)
16 to 25①	6.0 (10)	10.0 (8)
25 to 40①	10.0 (8)	16.0 (6)

① For fuse protection in this current range, the lines from the terminal strip to the module have to be grounded and short-circuit proof under certain circumstances.

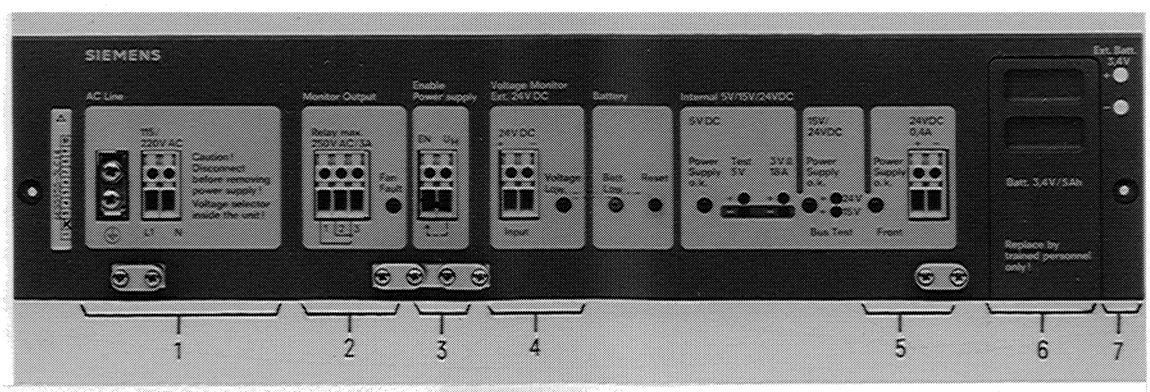
Table 3-1. Cable Lengths and Cross Sections

If you supply the process peripheral modules with 220 V AC/115 V AC, the same concept applies, but the values of Table 3-1 must be changed accordingly.

Chapter 4
Fan, Battery, and Temperature Monitoring

Two fans built into the power supply slide-in subassembly in the bottom of the housing of each compact unit of the U-Series prevent heat accumulation.[1] A monitor checks the stream of air produced by the fans to make sure that heat is dissipated sufficiently. If one or both fans stop, the monitor uses a relay contact to output a signal that activates an LED ("Monitor Output," see Figure 4-1). The relay contacts function as follows:

- Relay contact 1-2 is closed - The fan is running.
- Relay contact 2-3 is closed - The fan is defective.



1 Supply voltage 230 V AC/115 V AC or 24 V DC
2 Signal output for fan monitor ("Monitor Output") and/or optional battery monitor
3 Enable of the +5 V DC/+15 V DC/+24 V DC internal supply voltages (e.g., jumper EN-U_H closed)
4 Monitoring of the load voltage ("Voltage Monitor")
5 Enable supply 24 V DC terminals
6 Back-Up battery
7 External battery voltage points

Figure 4-1. Connection Terminals on the Power Supply Unit of a U-Series Unit

---

1 Some expansion units do not have a power supply unit or fans and some have fans only.

A battery failure can also activate this relay contact. This is optional and works in addition to fan-fault activation. The relay contacts function as follows:

- Relay contact 1-2 is closed - The fan is running and the battery is functioning properly.
- Relay contact 2-3 is closed - The fan is defective and/or the battery is low.

Use jumper F-R on the power supply unit to select whether the fan monitor shuts off the V_O internal voltage (5 V) when a fan stops (see Figure 4-2). The jumper settings function as follows:

- Jumper F-R is closed - V_O is switched off.
- Jumper F-R is open - V_O is not switched off. (A contact puts out a signal.)

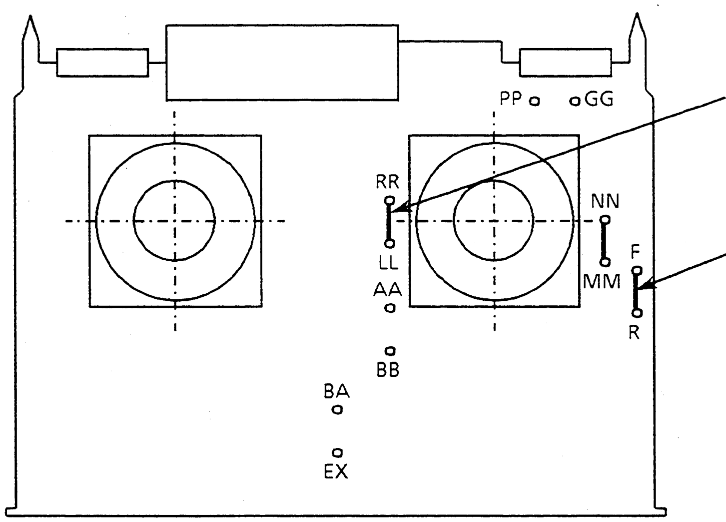


Figure 4-2. Jumper Layout on a Power Supply Unit (e.g., 6ES5 955-3LC12)

If for any special reasons the voltage (5 V) is not supposed to be shut off immediately for your application, open jumper F-R and make other arrangements to shut off the power. In such a case, a time delay relay (TDR) can implement this, but must shut down the voltage no later than 60 seconds after the monitor gives the signal (see Figure 4-3).

You can use jumper RR-LL to select whether the signal relay ("Monitor Output") is triggered not only by fan fault but also by battery failure. The jumper settings are as follows:

- Open (setting as delivered) - Signal relay is triggered by fan fault.
- Closed - Signal relay is triggered by fan fault and/or battery failure.

Consult the appropriate power supply unit hardware and installation guide for information on the functions and locations of the other jumpers.

Fan, Battery, and Temperature Monitoring with Several U-Series Units in One Cabinet

If you want to use one monitor for several U-Series units that have fan subassemblies, wire terminals EN and U_H for monitoring according to the circuit diagram shown in Figure 4-3. In this case, if one fan stops, all units are shut off.

The fan monitor can shut off the units. A thermal contact in the cabinet in combination with a heat exchanger can also shut them off. The heat exchanger can also have a thermal contact. A time delay relay (TDR) activates the contacts. Place the cabinet thermal contact at the top of the cabinet in the exhaust of the top unit. You can mount the heat exchanger (with or without thermal contact) in the cabinet, on the cabinet door, or outside the cabinet.

One U_H output can trigger a maximum of seven EN inputs (F).

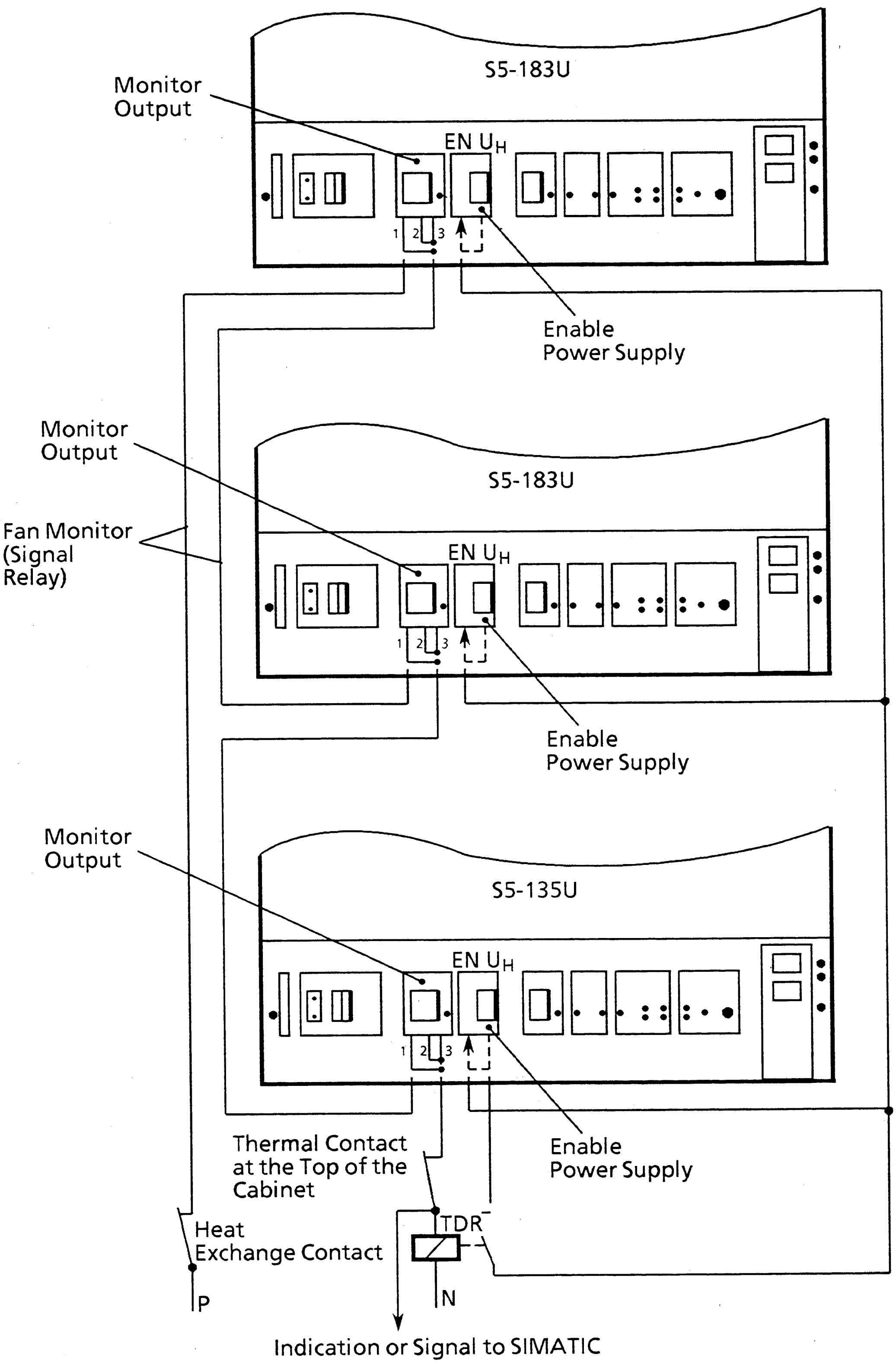


Figure 4-3. Wiring Recommendation for Fan/Temperature Monitoring When Using the S5-135U and the S5-183U in the Same Cabinet

Chapter 5
Cabinet Ventilation and Power Loss (Heat Dissipation)

When configuring U-Series units, make sure that the fans' capability to dissipate power loss (heat dissipation) is not exceeded. The maximum power loss dissipation per unit with an intake temperature of 55° C is 250 W. This power loss value increases by 20 W for every 1° C decrease of the air intake temperature.

5.1 Power Loss (Heat Dissipation) of Modules

Table 5-1 indicates the power loss values of modules used in U-Series units.

Module	Order No.	Power Loss
Power Supply Units		
230 V AC/115 V AC; 5 V, 18 A	6ES5 955-3LC14	Maximum 75.0 W
230 V AC/115 V AC; 5 V, 40 A	6ES5 955-3LF12	Maximum 140.0 W
24 V DC; 5 V, 18 A	6ES5 955-3NC12	Maximum 55.0 W
24 V DC; 5 V, 10 A	6ES5 955-3NA12	Maximum 50.0 W
24 V DC; 5 V, 40 A	6ES5 955-3NF11	Maximum 150.0 W
230 V AC/115 V AC; 5 V,15 A	6ES5 955-5LB11	Maximum 25.0 W
24 V DC; 5 V, 15 A	6ES5 955-5NB11	Maximum 25.0 W
S5-135U		
CPU 920 (M-Processor)	6ES5 920-3UA11	11.0 W
CPU 921 (S-Processor)	6ES5 921-3UA11/12	15.0 W
CPU 922 (R-Processor)	6ES5 922-3UA11	11.0 W
Coordinator 923A	6ES5 923-3UA11	2.5 W
Coordinator 923C	6ES5 923-3UC11	5.5 W

Table 5-1. Power Loss Values of Modules Used in U-Series Units

Module	Order No.	Power Loss
S5-135U		
CPU 928	6ES5 928-3UA11 6ES5 928-3UA12	15.0 W 17.5 W
S5-150U		
Central Processing Units	6ES5 924S to 6ES5 927S	63.5 W
External Memory Interface Module	6ES5 341	7.5 W
Parity Module	6ES5 342	7.5 W
Bus Connection CC/EU	6ES5 775-3AA11/21	3.5 W
S5-155U		
CPU 946	6ES5 946-3UA11/21	30 W
CPU 947	6ES5 947-3UA11/21	10 W
Interface Modules		
EU Interface Module	6ES5 300	3.0 W
EU/CC Interface Module	6ES5 301	4.0 W
EU Interface Module	6ES5 302	10.0 W
EU Interface Module	6ES5 304	7.5 W
EU/CC Interface Module	6ES5 308	2.5 W
EU/CC Interface Module	6ES5 310	3.0 W
EU/CC Interface Module	6ES5 310 H	2.0 W
EU/CC Interface Module	6ES5 311	7.5 W
CC Interface Module	6ES5 312	1.5 W
CC Interface Module	6ES5 314	5.0 W
CC Interface Module	6ES5 318-3U	2.0 W
Programmer Interface Module	6ES5 511	8.5 W
Interface Module	6ES5 512 C/H	7.5 W

Table 5-1. Power Loss Values of Modules Used in U-Series Units (Cont.)

Module	Order No.	Power Loss
Communications Processors (CPs)		
CP 524	6ES5 524	7.5 W
CP 525	6ES5 525	10.5 W
CP 526	6ES5 526	11.0 W
CP 535	6ES5 535	18.5 W
CP 536	6ES5 536	12.0 W
Memory Modules		
Memory Module	6ES5 340-3	Maximum 4.5 W
Memory Module with Submodules	6ES5 350-3	Maximum 10.0 W
355 Memory Module	6ES5 355-3UA11	[1]
Input/Output Modules, Digital		
Input Module	6ES5 420-4U..	Maximum 7.0 W
Input Module	6ES5 430-4U..	Maximum 8.3 W
Input Module	6ES5 431-4U..	2.2 to 7.7 W (24 to 60 V)
Input Module	6ES5 432-4U..	Maximum 7.5 W
Input Module	6ES5 434-4U..	Maximum 5.5 W
Input Module	6ES5 435-4U..	Maximum 3.5 W at 24 V Maximum 18.0 W at 60 V
Input Module	6ES5 436-4UA.	Maximum 3.5 W at 115 V Maxium 17.0 W at 240 V
Input Module	6ES5 436-4UB.	Maximum 2.0 W at 115 V Maximum 8.5 W at 240 V
Output Module	6ES5 441-4U..	Maximum 17.0 W
Output Module	6ES5 451-4U..	Maximum 17.0 W
Output Module	6ES5 453-4U..	Maximum 49.0 W
Output Module	6ES5 454-4U..	Maximum 17.5 W

[1] Maximum without submodules = 6 W, with three RAM submodules = 7 W, with three EPROM submodules = 9 W

Table 5-1. Power Loss Values of Modules Used in U-Series Units (Cont.)

Module	Order No.	Power Loss
Output Module	6ES5 455-4U..	Maximum 39.0 W
Output Module	6ES5 456-4UA.	Maximum 39.0 W
Output Module	6ES5 456-4UB.	Maximum 18.0 W
Output Module	6ES5 457-4U..	Maximum 13.0 W
Output Module	6ES5 458-4U..	Maximum 5.2 W
Input/Output Modules, Analog		
Input Module	6ES5 460-4U..	Maximum 3.5 W
Input Module	6ES5 463-4U..	Maximum 5.0 W
Input Module	6ES5 465-4U..	Maximum 1.5 W
Output Module	6ES5 470-4U..	Maximum 9.0 W

Table 5-1. Power Loss Values of Modules Used in U-Series Units (Cont.)

The maximum values in Table 5-1 apply for full load or for permissible module power loss when the total load rating is considered.

5.2 Power Loss (Heat Dissipation) in a Cabinet and Cabinet Cooling

The power loss that can be dissipated from a cabinet depends on the cabinet design, its ambient temperature, and the arrangement of units in the cabinet (see Figure 5-1).

[1] Closed cabinet with heat exchanger
[2] Cabinet with air intake slots
[3] Closed cabinet with convection and forced circulation using fans

Figure 5-1. Maximum Ambient Temperature of a Cabinet Depending on the Installed Power Loss (Heat Dissipation)

Figure 5-1 shows the permissible ambient temperature of a cabinet with dimensions of 600 mm x 600 mm x 2200 mm (23.4 in. x 23.4 in. x 85.8 in.) depending on the installed power loss. The values indicated apply only to an arrangement of units as shown in Figures 6-1 and 6-2.

The following example calculates the total power loss for a specific device configuration. Table 5-2 lists the maximum ambient temperature for specific cabinet designs.

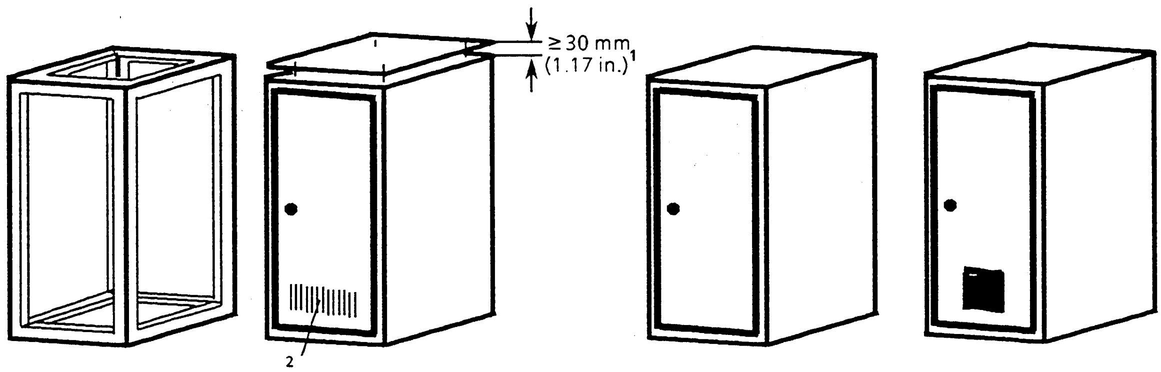
Example: Total Power Loss for a Configuration with One Central Controller and Two Expansion Units

One central controller	200 W
Two expansion units, each with 250 W power loss	500 W
One load power supply unit, 24 V DC/40 A, 6EV1 360 (full load)	200 W
Total power loss	900 W

Cabinet Design	Maximum Ambient Temperature
Closed, with convection and forced circulation	Not possible
Open	Approximately 33° C
Closed, with heat exchanger	Approximately 42° C
Framework/Wall	Maximum 55° C

Table 5-2. Maximum Ambient Temperature for Specific Cabinet Designs

The environmental conditions where you set up the programmable controller are a deciding factor in selecting the type of cabinet protection (see Figure 5-2).



Framework/Wall	Open Cabinet with Airflow Ventilation	Closed Cabinet with Convection and Forced Circulation	Closed Cabinet with Heat Exchanger
≤ IP1X[3]	≥ IP2X[4]	≥ IP5X[5]	≥ IP5X[5]
Locate only in clean, dry rooms.		Locate where desired.	
Locate only in electrical operating areas or closed electrical operating areas.			

1 Note protection against electric shock.
2 Cross section of the air slots > 600 cm² (93 in.²)
3 IP1X stands for an environmental rating. The first number (0 to 6) after IP is the dry particle rating and the second number (0 to 8) is the moisture rating. For this example, the moisture rating is not specified so it is denoted by an "X."
IP1X = protection against large solids (750 mm or 29.25 in.)
4 IP2X = protection against medium solids (712 mm or 27.77 in.)
5 IP5X = protection against surface dust

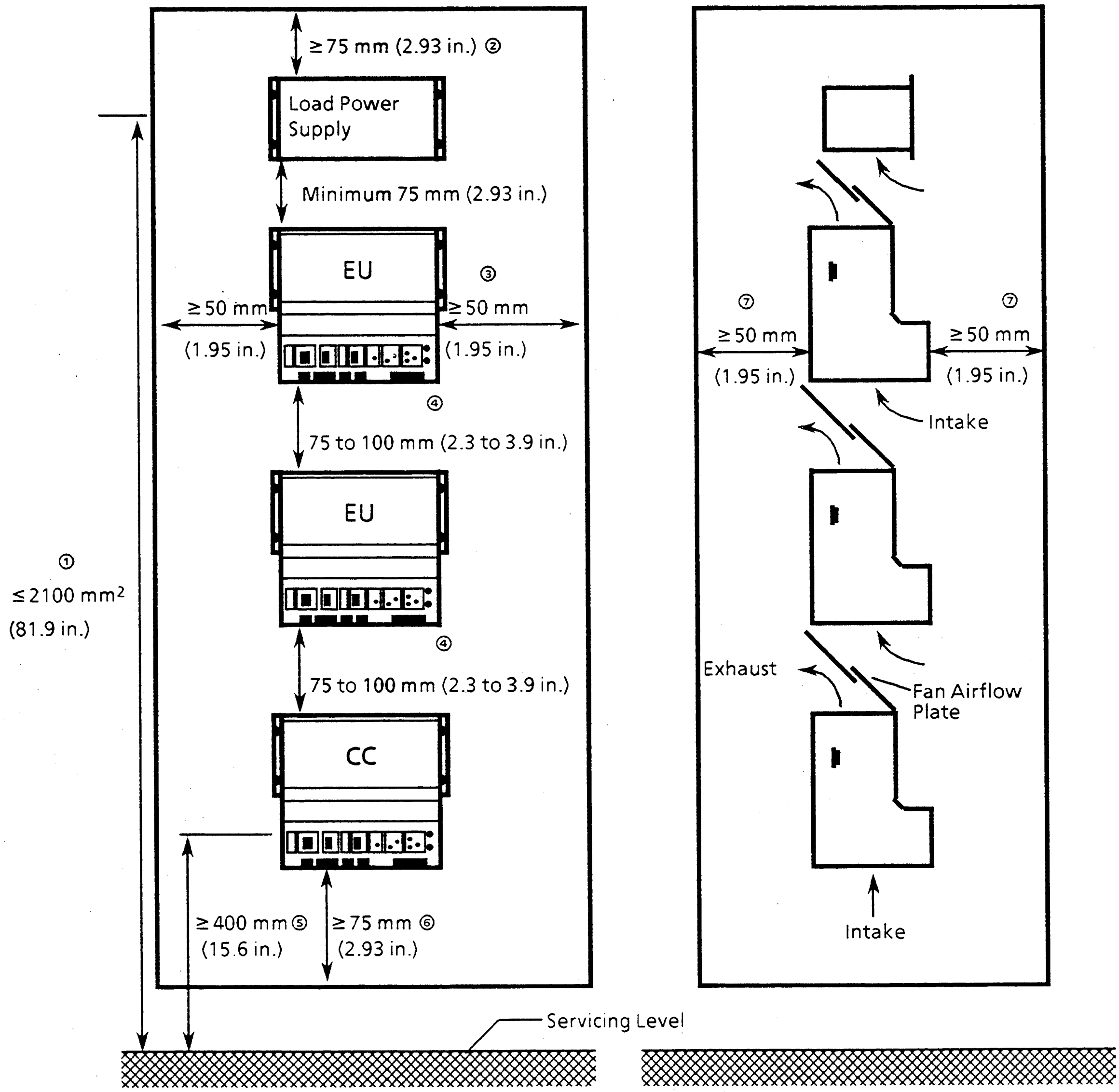
Figure 5-2. Cabinet Design

Chapter 6
Cabinet Design

This chapter provides requirements and recommendations for cabinet design.

6.1 Ventilation Clearances

No more than three U-Series units can be arranged one over the other because of the required clearance and the maximum permissible height for controls (see Figure 6-1).

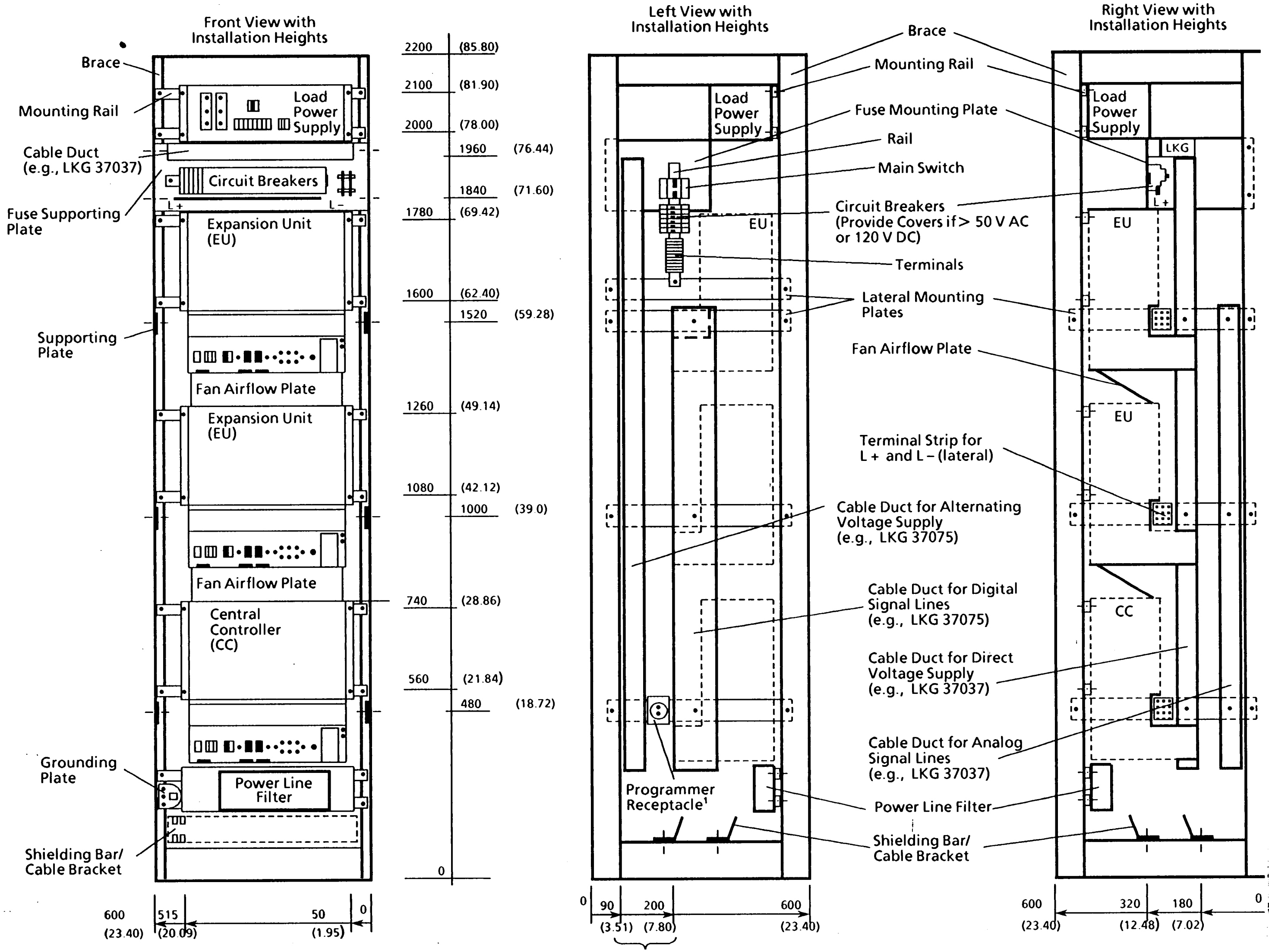


① Consult the appropriate power installation standards for specific height of high voltage supply (e.g., VDE 0106) and maximum height for controls (e.g., IEC 204).
② Minimum 75 mm (2.93 in.) for closed top plate. Smaller clearances are possible with perforated top plate and additionally recessed venting top.
③ For connecting units next to each other (with the IM 312 interface module), a maximum clearance of 400 mm (15.6 in.) is possible.
④ Clearance for air intake and exhaust minimum 75 mm (2.93 in.), maximum 100 mm (3.9 in.) because of cable lengths between the CC/EU interface modules
⑤ Minimum height for controls is 400 mm (15.6 in.) above the servicing level and 200 mm (7.8 in.) for connections.
⑥ Minimum clearance 75 mm (2.93 in.) to large obstacles in the air-intake space
⑦ Clearance for air circulation. (Cabinets that are 400 mm [15.6 in.] deep are sufficient.)

Figure 6-1. Installation Clearances

6.2 Installation Example

Figure 6-2 shows an example of a U-Series unit installation. Dimensions are in millimeters with inches indicated in parentheses.



¹ See section 7.9 for more information on the programmer receptacle.

Figure 6-2. Installation Example

The example shows an installation on mounting rails in an 8MF cabinet (2200 mm x 600 mm x 600 mm, = 85.8 in. x 23.4 in. x 23.4 in.). In addition to being economical, this design has the following advantages:

- You can make this installation in all cabinets without additional parts.
- The installation is independent of the cabinet width (550 mm to 1200 mm possible, = 21.45 in. to 46.8 in.).
- You can install the units asymmetrically. You can gain more space on one side for running signal cables.
- All devices, including load power supplies, can be installed and removed from the front, even after initial installation. You do not need to remove the nuts on the U-Series units. You need only loosen them. Then you can install or remove the units (one-man installation).
- Running analog, digital, and power lines in separate ducts increases noise immunity against signals interfering with each other.
- A power line filter is recommended to suppress interference on the power line where it enters the cabinet.

Chapter 7
Cabinet Wiring

This chapter lists requirements and recommendations for wiring cabinets containing U-Series units.

7.1 Connector Specifications

This section provides specifications for power and process signal line connectors.

7.1.1 Connectors for Power

The connection terminals for U-Series units are suitable for the following types of wire:

- maximum 4 mm^2 (approximately AWG 12) solid
- maximum 2.5 mm^2 (approximately AWG 14) stranded with solderless crimp connector

7.1.2 Connectors for Process Signal Lines to Peripheral Modules

The peripheral modules have 20-, 25-, or 42-point front connectors. Connector blade dimensions are 2.4 mm x 0.8 mm (0.09 in. x 0.03 in.).

Front connectors with crimp snap-on contacts and screw-type contacts for an installation width of 20 mm (0.78 in.) and 40 mm (1.56 in.) are available to connect signal lines (see Table 7-1). Use stranded conductors for easy handling of the front connector. If you use screw-type contacts, solderless crimp connectors (wire pin) are not necessary since the screw contact terminals have wire protection. Use screwdrivers with the following flat blade widths:

- 2.8 mm (0.11 in.) for the 4UB31
- 3.5 mm (0.14 in.) for all others

Connection Type	Connector Type 6ES5497 -	Max. No. of Pins	Cross Section of Signal or Power Line	Connector for Rated Voltage	Fork Width mm (in.)[2]	Front Connector Width mm (in.)	Module Type 6ES5... Type of Operation	
							with Fans	without Fans
Crimp Snap-On Contact[1]	4UA12	42	0.5 to 1.5 mm2 (approximately AWG 20 to 16)	5 V DC to 60 V DC	12 (.47)	20 (0.78)	420, 430, 431, 432, 434, 441, 451, 458	-
	4UA22	42	0.5 to 1.5 mm2 (approximately AWG 20 to 16)	5 V DC to 60 V DC	12 (.47)	40 (1.56)	453, 454	420, 430, 431, 432, 434, 441, 451, 453, (454), 458
	4UA42	20	0.5 to 1.5 mm2 (approximately AWG 20 to 16)	24 V AC to 240 V AC	14 (.55)	40 (1.56)	435, 436, 455, 456	
Screw-Type Contact	4UB12	42	0.5 to 2 x 2.5 mm2 (approximately AWG 20 to 2 x AWG 14)	5 V DC to 60 V DC	12 (.47)	40 (1.56)	420, 430, 431, 432, 434, 441, 451, 453, (454), 458	
	4UB22	25	0.5 to 2 x 2.5 mm2 (approximately AWG 20 to 2 x AWG 14)	5 V DC to 60 V DC	12 (.47)	40 (1.56)	454	
	4UB31	42	0.5 to 2 x 1.5 mm2 (approximately AWG 20 to 2 x AWG 16)	5 V DC to 60 V DC	12 (.47)	20 (0.78)	420, 430 431, 432, 434, 441, 451, 458	-
	4UB42	20	0.5 to 2 x 2.5 mm2 (approximately AWG 20 to 2 x AWG 14)	24 V AC to 240 V AC	14 (.55)	40 (1.56)	435, 436, 455, 456	

1 Consult the *S5-135U and S5-150U Programmable Controllers Catalog ST 54.1* for information on contacts and tools

2 To protect against plugging the wrong front connector into a module, the front connectors for AC voltage connections have a pivot hinge width of 14 mm (0.55 in.) and those for DC voltage connections have a pivot hinge width of 12 mm (0.47 in.).

Table 7-1. Specifications for Front Connectors

7.2 Wiring Layout

With reference to interference, differentiate among the following **wiring groups**:

- 110 V AC to 380 V AC supply lines for programmable controllers, expansion units, and external power supplies
- 24 V DC supply lines
- Digital signal lines for alternating voltage
- Digital signal lines for direct voltage
- Analog signal lines

When running signal and supply lines in a cabinet, follow the guidelines in IEC 439. When running them outside the cabinet, follow the guidelines in IEC 364.

Generally, analog lines must be run in shielded cables both inside and outside a cabinet (see section 7.7).

7.2.1 Wiring Layout inside the Cabinet

For wiring layouts **inside** the cabinet, run all **wiring groups** separately in the cabinet. The term "separate" applies to the following groups:

- wiring ducts (minimum clearance 2 cm, = 0.78 in.)
- wiring bundles
- cables
- shielded cables

You can run 220 V AC/115 V AC line voltage cables in the same wiring duct as signal lines only if the supply lines are properly shielded. Run single lines for digital direct voltage and alternating voltage signals in separate wiring ducts in the cabinet.

7.2.2 Wiring Layout outside the Cabinet

For wiring layouts **outside** the cabinet, run separate cables for direct voltage digital signals, alternating voltage digital signals, and analog signals. You can run signal cables in the same ducts as power cables. You can run signal cables and power cables up to 380 V AC without any clearance. However, to decrease noise interference, run the cables with a clearance of approximately 10 cm (3.9 in.). Maintain a minimum clearance of 10 cm (3.9 in.) between signal cables and power cables over 500 V AC. Maintain a clearance greater than 30 cm (11.7 in.) for power cables over 1 kV AC.

7.3 Grounding

Grounding refers to a conducting connection of inactive metal parts (see VDE 0160). In accordance with this, use tooth-lock washers to fasten the U-Series unit frames to the cabinet braces to form a good metallic contact. The braces must also form a good contact with the cabinet housing. When mounting a unit on a wall, connect the unit housing to the ground potential (e.g., protective ground bar) with a cross section $\geq$ 10 mm^2 (approximately AWG 6).

7.4 Protection against Dangerous Currents

Use a protective conductor ($\geq$ 10 mm^2, approximately AWG 6) to connect the cabinet to the protective ground of the distribution board. The 220 V AC/115 V AC supplies of the units in the cabinet are connected to this board.

For 24 V DC power, connect the unit to the central grounding point or to the protective ground of the distribution board that supplies power to the outlet for the programmer ($\geq$ 10 mm^2, approximately AWG 6). Connect the protective ground of the leads of the central controller, expansion unit, or power supply unit to their own protective ground terminals.

If you have several adjacent cabinets, either bolt them together to provide good contact or connect a protective ground ($\geq$ 10 mm^2, approximately AWG 6) to each cabinet. Follow the instructions listed in this section as a protective measure against dangerous currents from the cabinet and the installed equipment.

7.5 Potential Equalization

For distributed configurations, differentiate between the following cases:

- A separate location (up to 200 m, = 656.2 ft.) of central controllers and expansion units when connected by the IM 301/IM 310 interface modules (see Figure 7-1). The IM 301/IM 310 interface modules are nonfloating. Potential differences up to 7 V are permissible.
- A separate location (up to 1000 m, = 3281 ft.) of central controllers and expansion units with serial connection using the IM 302/IM 311 interface modules (see Figure 7-1). The IM 302/IM 311 interface modules are floating.
- Signal transfer between separate systems via floating input/output modules (see Figure 7-2).

In the first case, provide a potential equalization line (connecting line $\geq$ 10 mm^2, approximately AWG 6), between the braces of the cabinet or the housing frames. For the other two cases, a potential equalization line is recommended.

If the IM 301/IM 310 nonfloating interface modules are used for centralized configuration in the same cabinet or in adjacent ones, you can make an additional signal transfer using nonfloating input/output modules. A potential equalization line is required in this case.

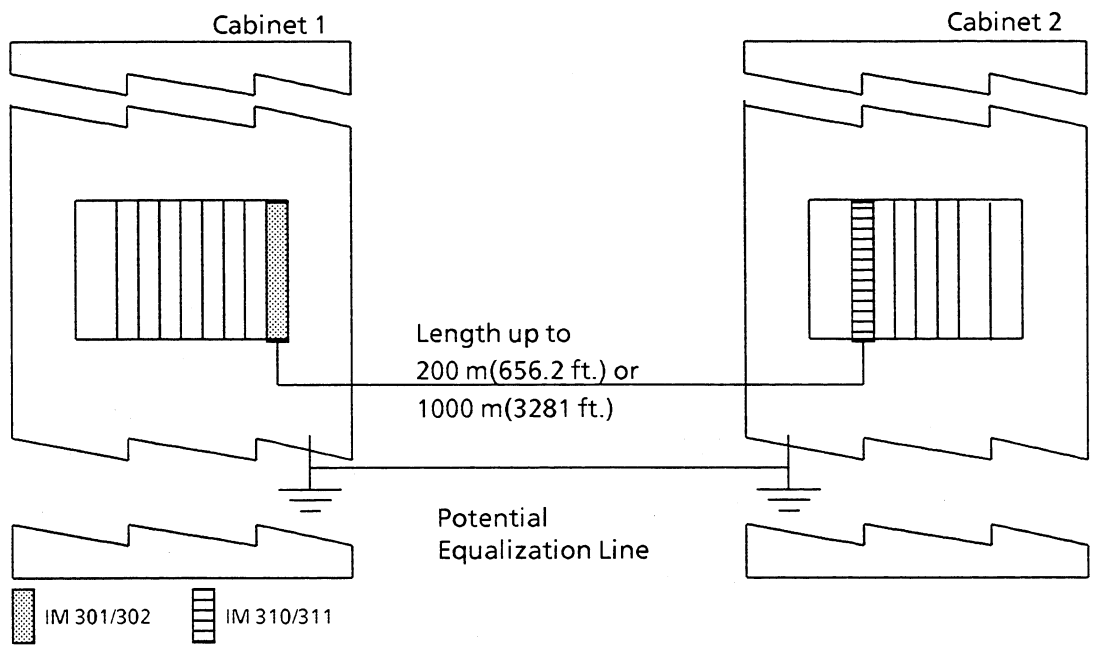


Figure 7-1. Potential Equalization for Distributed Installation

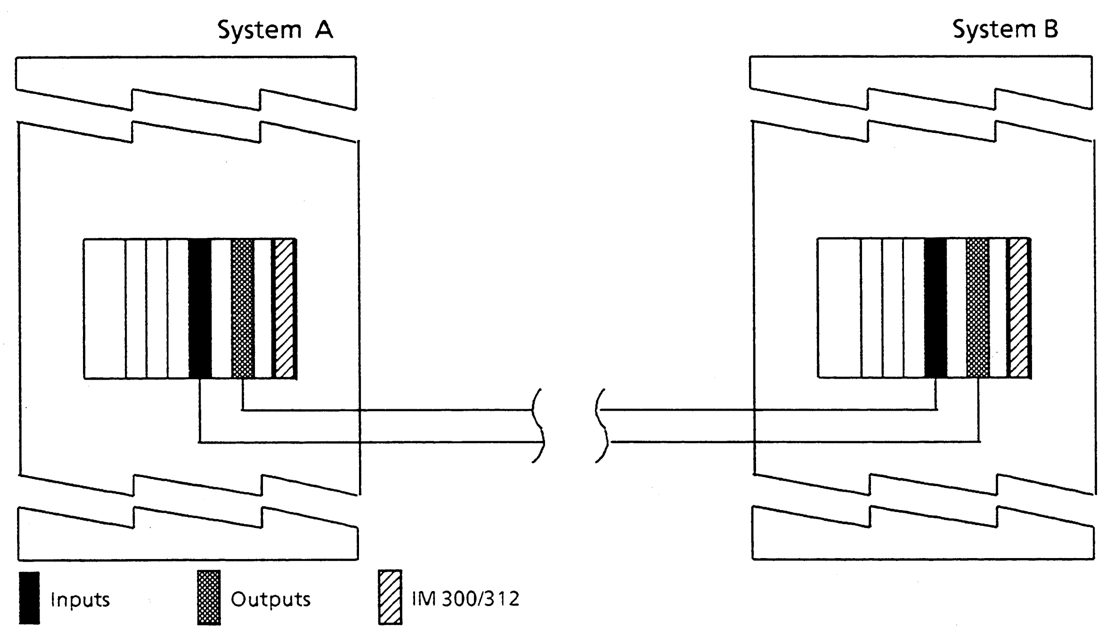


Figure 7-2. Signal Transfer for Distributed Installation

7.6 Measures against Noise Interference

This section provides recommendations for system noise suppression to prevent noise interference peaks on signal and supply lines in a cabinet.

7.6.1 Noise Suppression on Alternating Current Power Lines Using Filter

When supplying the cabinet from a 220 V AC/115 V AC power line, install a power line filter in the line (e.g., B84299-K64, 250 V AC/10 A) (see Figure 6-2). Connect the ground of the power line filter to the central grounding point in the cabinet via the shortest route possible.

7.6.2 Noise Suppression on Direct Current Power Lines Using Diverting Capacitors

When a 24 V DC power line supplies a cabinet, noise interference can be brought in over the power line. It is recommended that you install noise suppression capacitors where the 24 V DC power line enters the cabinet. Mount them on the cabinet ground or the shielding bar.

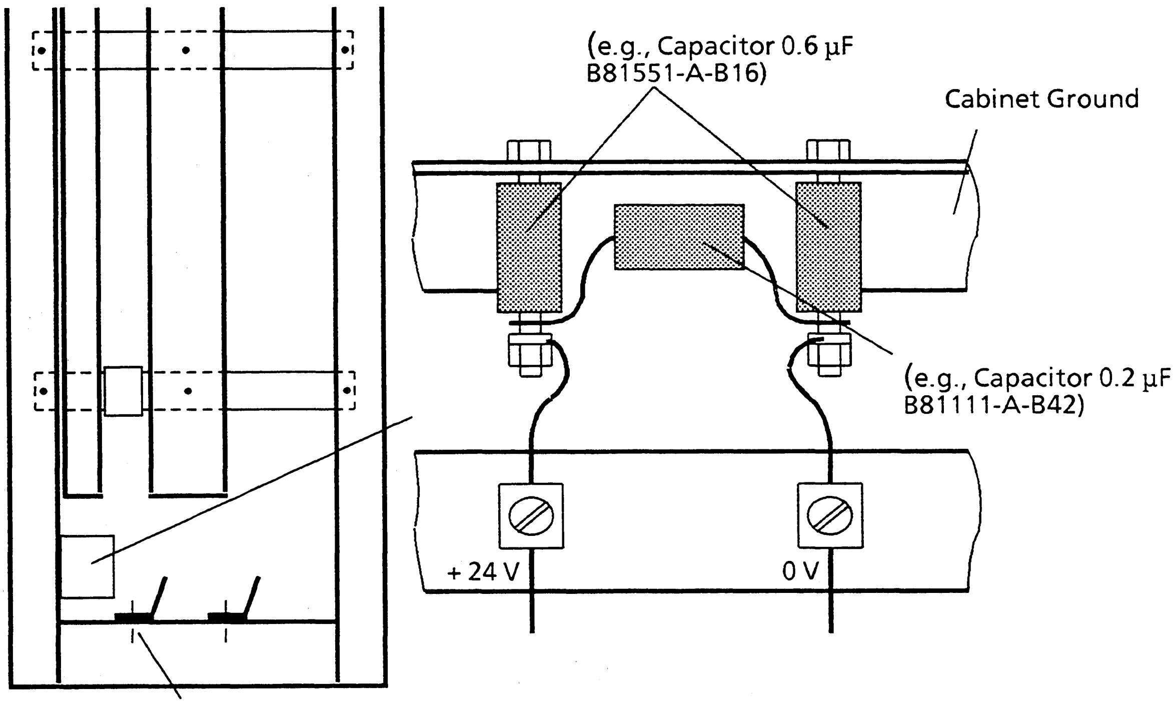


Figure 7-3. Layout of Noise Suppression Capacitors

7.6.3 Inductance Suppression

Provide RC arc suppression elements for inductances that are installed in the same cabinet and are not connected directly to SIMATIC outputs (e.g., contactor and relay coils).

7.6.4 Inductance Separation

Sheet metal barriers are recommended to separate the part of the cabinet that contains large inductances such as transformers or contactors.

7.6.5 Protection against Electrostatic Discharge

Use metal housings or cabinets that are closed in on all sides to protect controllers and modules against electrostatic discharge. Connect these housings or cabinets to the grounding point where you set them up so as to form a good contact. If you are using enclosures for smaller units (e.g., PC/ET 100U), cast metal or sheet metal housings are preferable to plastic ones. Use grounding bands or contact clips to connect doors or top plates of housings to the grounded housing bodies.

If you must work on the system when the cabinet is open, follow the guidelines to protect components and modules against electrostatic discharges (e.s.d.). See the appropriate guide for handling components and modules sensitive to electrostatic discharge[1].

---

[1] Order No. C79000-B0676-C070-01

7.6.6 Cabinet Lighting

For reasons of noise immunity, do not use fluorescent lamps to light the cabinet. If you must use fluorescent lamps, take the precautions illustrated in Figure 7-4.

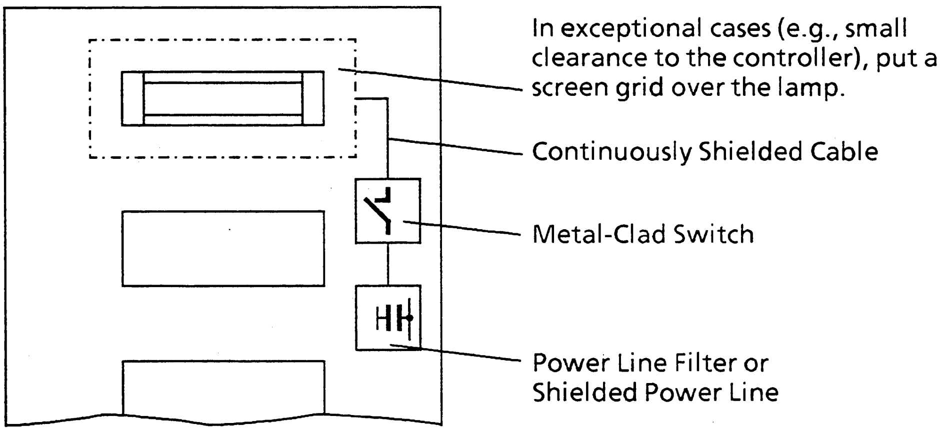


Figure 7-4 . Measures to Suppress Fluorescent Lamp Noise in a Cabinet

7.7 Shielding and Permissible Cable Lengths

It is recommended that analog signal lines be shielded. However, digital lines can be unshielded up to certain lengths. See Tables 7-2 and 7-3 for information on permissible cable lengths.

Module	Cable Length in Meters (and Feet, in Parentheses)	
	Unshielded	Shielded
Outputs	400 (1312.4)	1000 (3281.0)
Inputs, 24 V DC	600 (1968.6)	1000 (3281.0)
Inputs, 220 V AC	600 (1968.6)	1000 (3281.0)
Inputs, 431, 24 V DC to 60 V DC	400 (1312.4)	1000 (3281.0)
Inputs, 434, 5 V DC to 15 V DC	200 (656.2)/ 600 (1968.6)[1]	600 (1968.8)/ 1000 (3281.0)[1]

[1] These cable lengths apply if NAMUR sensors are connected.

Table 7-2. Maximum Permissible Cable Length for Digital Signal Lines in the Same Cable

Module 6ES5 ... (Input Range)	Cable Lengths in Meters[1] (and Feet, in Parentheses)	Potential Differences[2]
460 (V_i = 50 mV) (V_i = 500 mV)	 50 (164.1) 200 (656.2)	60 V AC/75 V DC
463	200 (656.2)	25 V AC/60 V DC
465 (V_i = 50 mV) (V_i = 500 mV)	 50 (164.1) 200 (656.2)	± 1.0 V
470	200 (656.2)	60 V AC/75 V DC (only to chassis ground)

1 These figures represent the recommended cable lengths of input and output lines to analog modules when they are in the same, shielded cable.

2 These figures represent the permissible difference in potential of input and output channels to the grounding point (potential ground) and of the channels among themselves.

Table 7-3. Cable Lengths and Differences in Potential for Analog Modules

The following recommendations apply to shielding:

- Connect cable shieldings to a shielding bar in the cabinet near the cable entry. Connect braided shielding to the shielding bar with as large a cross section as possible (e.g., with metal cable clamps that enclose the shielding).

- For cables with foil shielding, connect sheath wire to the shielding bar by the shortest route possible (approximately 3 cm, = 1.17 in.). The shielding bar must have good metallic contact to the cabinet's supporting braces, the cabinet itself, and the central grounding point in the cabinet.

- Shielding bars for analog signal lines can be isolated and connected at a central point to the reference potential or to ground.

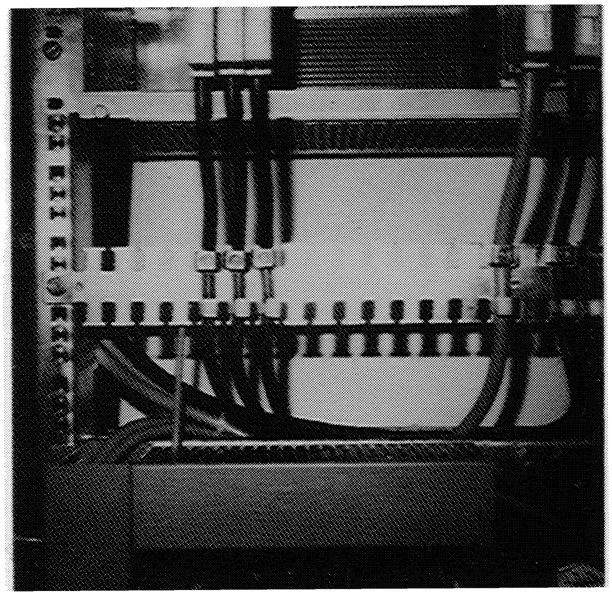


Figure 7-5. Connecting the Cable Shielding to the Shielding Bar

7.7.1 Grounding the Cable Shielding at One End

For grounding analog signal lines at one end that carry low-level signals (mV or µA), connect one end of the cable shielding in the cabinet to the shielding bar.

Extending the shielding found within the cable from the shielding bar to the module may be necessary for your application. In such a case, do not connect this shielding to the module because such a connection could establish a grounding loop. For grounding digital signal lines at one end, the shielding always ends at the shielding bar.

Grounding the cable shielding at one end is practical when it is not possible to run a low-resistance potential equalization line to the other end of the cable or when you only have to deal with low-frequency or static noise.

7.7.2 Grounding the Cable Shielding at Both Ends

Grounding cable shielding of digital signal lines at both ends guarantees especially good suppression of high-frequency interference. A low-resistance potential equalization line is necessary to accomplish such grounding. The resistance must be approximately 10% of the resistance of the braided shielding.

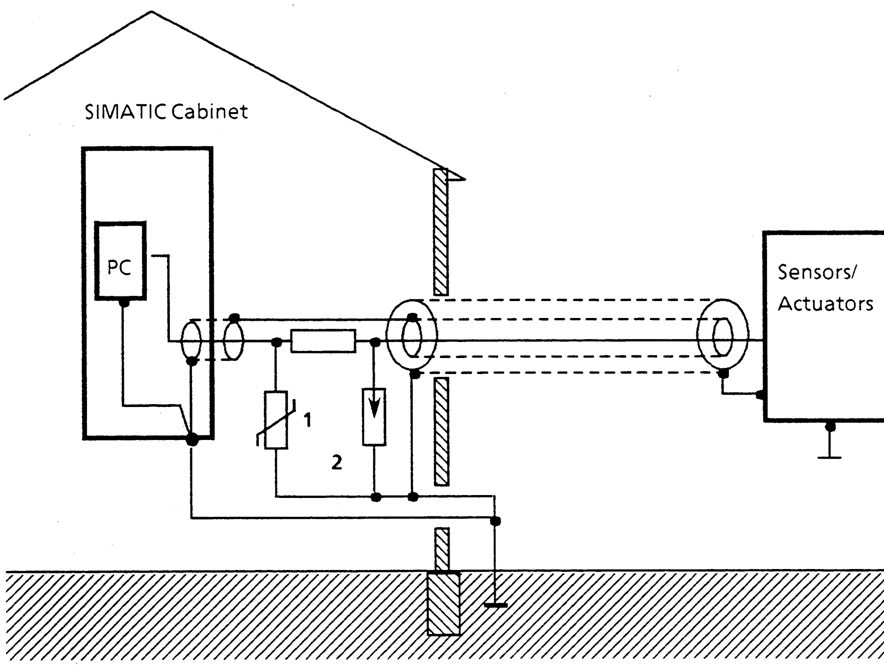
Factory supplied bus cables that transmit the device-internal bus entirely or partially (e.g., expansion unit interface modules) have shielding connected to ground at both ends. Do not disassemble these connectors.

Use the shielding connections on the modules themselves only in exceptional cases (e.g., when there is only one shielded cable and therefore no shielding bar is necessary).

7.8 Protection against Lightning

If you run S5 device cables and lines outside buildings, use shielded cables. The shielding must be able to carry a current and be connected to ground at both ends. For analog signal lines, use double-shielded cables. The inner shielding can be grounded at one end only, as described in section 7.7.

Also, connect the signal lines to elements that provide overvoltage protection (varistors and lightning arresters filled with inert gas). If possible, these elements should be at the point where the cable enters the building or at least where it enters the cabinet.



1 Varistor (SIOV: Siemens zinc oxide varistor)
2 Lightning arrester

Figure 7-6. Placement of Elements That Protect against Lightning

7.9 Main Power Connection for Programmers

In each cabinet group, provide a grounded receptacle to supply power for a programmer. The receptacle should have the protective ground from the distribution board to which the cabinet is connected.

Chapter 8
Safety Measures

When configuring systems that have programmable controllers, as is the case with protective equipment, follow the relevant VDE regulations (e.g., VDE 0113 and VDE 0100). Pay special attention to the following points:

- Prevent conditions that can injure people or property.
- When power is restored after a power failure or after EMERGENCY STOP units are released, machines must not be able to restart automatically.
- When a programmable controller malfunctions, commands for EMERGENCY STOP units and safety limit switches must remain effective under all circumstances. These safety measures must have a direct effect on the actuators in the power circuit.
- When EMERGENCY STOP units are activated, safety must be guaranteed for people and the controlled system as follows:
  - Actuators and drives that could cause dangerous situations (e.g., main spindle drives for machine tools) must be shut off.
  - On the other hand, actuators and drives that could endanger people or the controlled system by being shut off (e.g., clamping devices) must <u>not</u> be shut off by EMERGENCY STOP devices.
- The programmable controller must be able to record the activation of EMERGENCY STOP equipment and the user program must be able to cope with this activation and evaluate it.

Index

A

Acknowledge signal, 2-8
Air circulation clearance, 6-2
Air intake clearance, 6-2
Alternating current lines, noise suppression, 7-5
Alternating voltage, cable duct, 6-3
Analog module, potential difference, 7-8
Analog signal line, 7-3
- cable duct, 6-3
- double-shielded cable, 7-10
- grounding at one end, 7-9
- outside buildings, 7-10
- shielding bar, 7-8

B

Battery
- centrally grounded, 2-5
- failure, 2-8, 4-1 to 4-2
- grounded, 2-3
- monitoring, 4-1 to 4-2
- nongrounded, 2-4

Bus, reference, 2-6

C

Cabinet
- cooling, 5-4 to 5-6
- design, 6-1 to 6-4
- lighting, 7-7
- ventilation, 5-1
- wiring, 7-1 to 7-10

Cable
- digital signal lines, 7-7
- double-shielded, 7-10
- outside buildings, 7-10
- power, 7-3
- shielded, 7-3

Cable bracket, 6-3, 7-6
Cable duct, 1-1, 6-3
Cable length, 3-3, 7-7 to 7-8
Cable shielding, 7-9
Capacitor
- diverting, 7-6
- noise suppression, 7-6

Central grounding point, 7-4
Centralized configuration, 1-4, 1-5, 7-4
Circuit breaker, 6-3
Clearance
- air circulation, 6-2
- air intake, 6-2
- cable, 7-3
- exhaust, 6-2
- installation, 6-2 to 6-4
- ventilation, 6-1 to 6-2

Communication between peripheral modules and S5 bus signals, 2-8
Communications processor, 5-3
Configuration
- centralized, 1-4, 1-5
- distributed, 1-4, 1-6, 7-4

Configuration wiring, 3-1 to 3-3
Connection
- actuator, 2-3, 2-4, 2-5
- floating module, 2-6
- nonfloating module, 2-6
- sensor, 2-3, 2-4, 2-5

Connection terminal, 4-1, 7-1
Connection type, 7-1, 7-2
Connector
- crimp, 7-1, 7-2
- front, 2-8, 7-1 to 7-2
- power line, 7-1
- signal line, 7-1

Connector pins, 7-2
Connector specifications, 7-1 to 7-2
Contacts
- crimp snap-on, 7-1 to 7-2
- relay, 4-1, 4-2
- screw-type, 7-1 to 7-2
- thermal, 4-2, 4-3

Contact terminals, 7-1
Controls, maximum permissible height, 6-1 to 6-2
CPU, reaction to time-out error, 2-8
Crimp connector, 7-1, 7-2
Crimp snap-on contacts, 7-1 to 7-2
Cross section, 3-3, 7-8
- power line, 7-2
- signal line, 7-2

Current consumption, 3-2
- individual modules, 2-1

D

Dangerous currents, protection against, 7-4
Design, cabinet, 6-1 to 6-4
Digital output module, load current supply, 2-2
Digital signal line
- alternating voltage, 7-3
- cable duct, 6-3
- direct voltage, 7-3
- grounding at one end, 7-9
- same cable, 7-7

Dimensions, housing, 1-2
Direct current power line, noise suppression, 7-6
Direct voltage, cable duct, 6-3

Distributed configuration, 1-4, 1-6
potential equalization, 7-4
potential equalization line, 7-5
signal transfer, 7-5
Distribution board, 7-4
Diverting capacitor, noise suppression, 7-6

E
Electric separation, 2-2
Electronic short-circuit protection, 2-2
resistance, 2-2
Electrostatic discharge, protection against, 7-6
EMERGENCY STOP devices, 8-1
Enable, supply voltage, 4-1
Enable circuit, 2-8
Enable inputs, 2-8 to 2-13
Enable power supply, 4-3
Enable signal, 2-13
Enable supply 6ES5 958-4UA11, 2-10, 2-11
Enable voltage, 2-13
EN inputs (F), 4-3
Environmental rating (IP), 5-6
Exhaust clearance, 6-2
Expansion unit without power supply unit, 1-4, 2-11
Expansion unit interface module, 7-9
External power supply, 2-2
lines, 7-3
External process signal, reference voltage (M_{ext}), 2-6

F
Fan, 1-1, 1-3
Fan airflow plate, 6-3
Fan fault (*See* fan monitoring)
Fan monitoring, 4-1 to 4-3
Fan subassembly
with power supply unit, 1-3
without power supply unit, 1-3
Filter, power line, 7-5
Flip-Flop, 2-7
Fluorescent lamps, noise, 7-7
Fork width, 7-2
Front connector, 2-8, 7-1 to 7-2
removing, 2-13
width, 7-2
Fuse, 2-2, 3-2
digital output module, 2-2
supporting plate, 6-3

G
Galvanic isolation, 2-3, 2-4, 2-5
Ground, 2-3, 2-4, 2-5
housing, 2-7
reference potential, 2-7
Grounding, 7-3
analog signal lines at one end, 7-9
cable shielding at one end, 7-9
digital signal lines at one end, 7-9
Grounding loop, 7-9
Grounding plate, 6-3
Grounding point, 7-6
Ground potential, cross section, 7-3
Groups
floating, 2-8
isolated, 2-8

H
Heat accumulation, 4-1
Heat dissipation, 5-1 to 5-6
in a cabinet, 5-4 to 5-6
Heat exchanger, 4-2, 4-3
Housing
compact, 1-1
dimensions, 1-2
ground, 2-7
U-Series CC/EU, 1-1

I
Inductance suppression, 7-6
Input
enable, 2-8 to 2-13
voltage monitor, 2-8
Input/output
alternating voltage, 2-8
direct voltage, 2-8
Input/output module, power loss, 5-3, 5-4
Input voltage, 2-1
alternating current, 2-1
direct current, 2-1, 2-2
nominal, 2-1
surge, 2-1
Installation
cabinet, 1-1
clearance, 6-2 to 6-4
example, 6-2 to 6-4
heights, 6-3
Interface module
cable connector, 1-6
expansion unit, 7-9
floating, 7-4
IM 300-5C in centralized configuration, 1-5
IM 300/IM 312 in distributed configuration, 7-5
IM 301-5C in distributed configuration, 1-6
IM 301/IM 302 in distributed configuration, 7-5
IM 301/ IM 310 potential equalization, 7-4, 7-5
IM 302/IM 311 potential equalization, 7-4, 7-5
IM 304 in distributed configuration, 1-6

IM 310-3 in distributed configuration, 1-6
IM 310/IM 311 in distributed configuration, 7-5
IM 312-5C in centralized configuration, 1-5
IM 312-5C in distributed configuration, 1-6
IM 314 in distributed configuration, 1-6
nonfloating, 7-4
power loss, 5-2
Interference, 7-3
noise, 7-5 to 7-7
Interference suppression, grounding cable shielding, 7-9
Internal reference voltage (M_{int}), 2-3, 2-6
IP (*See* Environmental rating)
Isolation, galvanic, 2-3, 2-4, 2-5
Isolation monitor, 2-4

J

Jumper layout, power supply unit, 4-2

L

LED
"Monitor Output," 4-1
Lighting, cabinet, 7-7
Lightning, protection against, 7-10
Limit switch, safety, 8-1
Load current supply, 2-1, 2-2, 2-9
digital output module, 2-2
from two external power supply units, 2-6
regulated, 2-2
unregulated, 2-2
Load power supply, 6-3
220 V AC/115 V AC, 2-9
Load voltage
failure, 2-9
monitor, 2-3, 2-4, 2-5

M

Main switch, 6-3
Memory module, 5-3
M_{ext} (*See* Reference voltage of external process signals)
M_{int} (*See* Internal reference voltage)
Module
floating, 2-6
floating input/output, 2-7 to 2-8
heat dissipation, 5-1 to 5-6
nonfloating, 2-6
nonfloating input/output, 2-7, 7-4
power loss, 5-1 to 5-6
process peripheral, 3-1
removing input/output, 2-12
Monitor
fan, 4-1 to 4-3
isolation, 2-4
load voltage, 2-3, 2-4, 2-5
temperature, 4-1 to 4-3
voltage, 3-2, 4-1
Monitoring,
battery, 4-1 to 4-2
Monitor input, voltage, 2-8
Monitor output, 4-3
"Monitor Output"
LED, 4-1
signal relay, 2-8, 4-1, 4-2
Mounting plate, 6-3

N

Noise, fluorescent lamp, 7-7
Noise immunity, 2-3, 6-5, 7-7
Noise interference, 7-3
measures against, 7-5 to 7-7
Noise suppression, 7-5 to 7-7
alternating current lines, 7-5
capacitor, 7-6
direct current power lines, 7-6

O

Optocoupler, 2-6
Output, latching, 2-7
Overload protection, 3-2
Overvoltage protection, 7-10

P

Pins, connector, 7-2
Pivot hinge, width, 7-2
Potential
cabinet, 2-3, 2-4, 2-5
housing, 2-3, 2-4, 2-5
Potential difference, 7-4, 7-8
Potential equalization, 7-4
Potential equalization line, 7-5, 7-9
Power cable, 7-3
Power connection, programmer, 7-10
Power down, 2-9
Power line, cross section, 7-2
Power line filter, 6-3, 6-5, 7-5
Power loss, 5-1 to 5-6
in a cabinet, 5-4 to 5-6
Power off switch, 2-9
same for CC/EU and load current supply, 2-10 to 2-11
separate for CC/EU and load current supply, 2-10 to 2-11
Power supply, 2-1 to 2-13
24 V DC, 2-11
220 V AC/115 V AC, 2-10
enable, 4-3
external, 2-2
integrated internal, 2-1
internal voltages, 2-1

load current, 2-1, 2-2
primary, 2-3, 2-4, 2-5
to enable inputs, 2-8 to 2-9
Power supply unit, 1-1, 1-3
24 V DC, 1-3
115 V AC/240 V AC, 1-3
centrally grounded, 2-5
connection terminals, 4-1
external, 2-6, 2-7
floating, 1-3, 2-1
grounded, 2-3
jumper layout, 4-2
nonfloating, 1-3, 2-1
nongrounded, 2-4
power loss, 5-2
Power up, 2-9
Primary power supply, 2-3, 2-4, 2-5
from centrally grounded battery or centrally grounded power supply units, 2-5
from grounded battery or grounded power supply units, 2-3
from nongrounded battery or nongrounded power supply units, 2-4
Process, parts of, 2-9, 2-13
Process peripheral, 2-3, 2-4, 2-5
Process peripheral module
220 V AC/115 V AC supply, 3-3
supplying power to, 3-1
Process signal, external, 2-6
Programmer
main power connection, 7-10
receptacle, 6-3
Protection
against dangerous currents, 7-4
against lightning, 7-10
fuse, 3-2
overvoltage, 7-10
Protective earth, 2-3, 2-4, 2-5
Protective ground, 2-3, 2-4, 2-5, 7-4
Protective ground bar, 7-3

Q

QVZ organization block, 2-8, 2-9, 2-13
QVZ signal (*See* Time-Out signal)

R

Rail, mounting, 6-3
Rated current of protective devices, 3-3
Rated voltage, connector for, 7-2
Rating
dry particle, 5-6
environmental (IP), 5-6
Reference bus, 2-6
Reference potential, shielding bar connection to, 7-8
Reference potential ground, 2-7
Reference voltage
external process signals (M_{ext}), 2-6
internal (M_{int}), 2-3, 2-6
Relay,
contacts, 4-1, 4-2
signal, 4-1, 4-2
time delay (TDR), 4-2, 4-3
Resistance
cable, 2-2
electronic short-circuit protection, 2-2

S

S5-135U
back-up battery, 2-8
centralized configuration example, 1-5
distributed configuration example, 1-6
fan and temperature monitoring, 4-3
fan subassembly, 1-3
power loss, 5-1
power supply unit, 1-3
S5-150U
back-up battery, 2-8
centralized configuration example, 1-5
distributed configuration example, 1-6
fan subassembly, 1-3
power loss, 5-2
power supply unit, 1-3
S5-155U
back-up battery, 2-8
centralized configuration example, 1-5
distributed configuration example, 1-6
power loss, 5-2
S5-183U
distributed configuration example, 1-6
fan and temperature monitoring, 4-3
fan subassembly, 1-3
power supply unit, 1-3
S5-184U
centralized configuration example, 1-5
distributed configuration example, 1-6
fan subassembly, 1-3
Safety limit switch, 8-1
Safety measures, 8-1
Screw-Type contacts, 7-1 to 7-2
Separation, electric, 2-2
Shielding, 2-3, 2-4, 2-5, 7-7 to 7-9, 7-10
analog module, 2-3, 2-4, 2-5
braided, 7-8
connected to ground at both ends, 7-10
connection at both ends, 2-3, 2-4, 2-5
connection at one end, 2-3, 2-4, 2-5
connection to modules, 7-9
digital modules, 2-3, 2-4, 2-5
foil, 7-8
Shielding bar, 2-3, 2-4, 2-5, 6-3, 7-6, 7-8, 7-9
analog signal lines, 7-8

Short-Circuit protection, 3-2
  electronic, 2-2
Signal, acknowledge, 2-8
Signal lines
  analog, 7-3
  cross section, 7-2
  digital, 7-3
Signal relays, 4-1, 4-2
Signal transfer, distributed installation, 7-4, 7-5
Specifications, connector, 7-1 to 7-2
"STOP" mode, 2-12
Subassembly, 1-1
  fan, 1-1, 1-3
  fan with power supply unit, 1-3
  integrated power supply unit, 1-1, 1-3
Supply lines, 7-3
  24 V DC, 7-3
  110 V AC to 380 V AC, 7-3
Supply voltages, enable, 4-1

T

TDR (*See* Relay, time delay)
Temperature, cabinet, 5-4 to 5-5
Temperature monitoring, 4-1 to 4-3
Terminal
  contact, 7-1
  "Ext. Batt.," 2-8
  protective ground, 7-4
Terminal strip, 3-2
  for L + and L- (lateral), 6-3
Terminator 6ES5 760-0AA11, distributed configuration example, 1-6
Thermal contacts, 4-2, 4-3
Time delay relay (TDR), 4-2, 4-3
Time-Out signal (QVZ), 2-8, 2-12
Tools, crimp snap-on contact, 7-2

U

U_H output, 4-2, 4-3

V

Varistor, 7-10
Ventilation, cabinet, 5-1
Ventilation clearance, 6-1 to 6-2
Voltage
  external, 2-8
  input, 2-1
  internal reference, 2-3
  reference, 2-6
Voltage monitor, 3-2, 4-1
Voltage monitor input, 2-8
Voltage monitor load, 2-3, 2-4, 2-5

W

Wire protection, 7-1
Wire types
  solid, 7-1
  stranded, 7-1
Wiring
  cabinet, 7-1 to 7-10
  configuration, 3-1 to 3-3
Wiring groups, 7-3
Wiring layout, 7-3
  inside the cabinet, 7-3
  outside the cabinet, 7-3
Wiring recommendation, fan and temperature monitoring, 4-3

Appendix
SIEMENS Addresses Worldwide

European Companies and Representatives

Austria
Siemens AG Österreich
Vienna
Bregenz
Graz
Innsbruck
Klagenfurt
Linz
Salzburg

Belgium
Siemens S.A.
Brussels
Liège
Siemens N.V.
Brussels
Antwerp
Ghent

Bulgaria
Office RUEN at the INTERPRED Association, representative of Siemens AG
Sofia

Czechoslovakia
EFEKTIM
Technical Consulting
Office Siemens AG
Prague

Denmark
Siemens A/S
Copenhagen, Ballerup
Hojbjerg

Federal Republic of Germany
Siemens AG
Branch Offices
Berlin (West)
Bremen
Cologne
Dortmund
Düsseldorf
Essen
Frankfurt/Main
Hamburg

Federal Republic of Germany (cont.)
Hannover
Mannheim
Munich
Nuremberg
Saarbrücken
Stuttgart

Finland
Siemens Osakeyhtiö
Helsinki

France
Siemens S.A.
Paris, Saint-Denis
Lyon, Caluire-et-Cuire
Marseilles
Metz
Seclin (Lille)
Strasbourg

Great Britain
Siemens Ltd.
London, Sunbury-on-Thames
Birmingham
Bristol, Clevedon
Congleton
Edinburgh
Glasgow
Leeds
Liverpool
Newcastle

Greece
Siemens A.E.
Athens
Thessaloniki

Hungary
SICONTACT GmbH
Budapest

Iceland
Smith & Norland H/F
Reykjavik

Ireland
Siemens Ltd.
Dublin

Italy
Siemens S. p. A.
Milan
Bari
Bologna
Brescia
Casoria
Florence
Genoa
Macomer
Padua
Rome
Turin

Luxembourg
Siemens S.A.
Luxembourg

Malta
J.R. Darmanin & Co., Ltd.
Valletta

Netherlands
Siemens Nederland N.V.
The Hague

Norway
Siemens A/S
Oslo
Bergen
Stavanger
Trondheim

Poland
PHZ Transactor S.A.
Warsaw
Gdańsk-Letnica
Katowice

Portugal
Siemens S.R.A.L.
Lisbon
Faro
Leiria
Porto

Romania
Siemens birou de consultaţii tehnice
Bucharest

Spain
Siemens S.A.
Madrid

Sweden
Siemens AB
Stockholm
Eskilstuna
Göteborg
Jönköping
Luleå
Malmö
Sundsvall

Switzerland
Siemens-Albis AG
Zurich
Bern
Siemens-Albis S.A.
Lausanne, Renens

Turkey
ETMAŞ
Istanbul
Adana
Ankara
Bursa
Izmir
Samsun

U.S.S.R.
Permanent Representation of Siemens AG
Moscow

Yugoslavia
Generalexport
OOUR Zastupstvo
Belgrade
Ljubljana
Rijeka
Sarajevo
Skopje
Zagreb

Companies and Representatives outside Europe

Africa

Algeria
Siemens Bureau
Alger
Algiers

Angola
Tecnidata
Luanda

Burundi
SOGECOM
Bujumbura

Egypt
Siemens Resident Engineers
Cairo-Mohandessin
Alexandria
Centech
Zamalek-Cairo

Ethiopia
Addis Electrical Engineering Ltd.
Addis Ababa

Ivory Coast
Siemens AG
Succursale Côte d'Ivoire
Abidjan

Kenya
Achelis (Kenya) Ltd.
Nairobi

Libya
Siemens AG
Branch Office Libya
Tripoli

Mauritius
Rey & Lenferna Ltd.
Port Louis

Morocco
SETEL
Société Electrotechnique et de Télécommunications S.A.
Casablanca

Mozambique
Siemens Resident Engineer
Maputo

Namibia
Siemens Resident Engineer
Windhoek

Nigeria
Electro Technologies Nigeria Ltd. (Eltec)
Lagos

Rwanda
Etablissement Rwandais
Kigali

South Africa
Siemens Ltd.
Johannesburg
Cape Town
Durban
Middleburg
Newcastle
Port Elizabeth
Pretoria

Sudan
National Electrical & Commercial Company (NECC)
Khartoum

Swaziland
Siemens (Pty.) Ltd.
Mbabane

Tanzania
Tanzania Electrical Services Ltd.
Dar es Salaam

Tunensia
Sitelec S.A.
Tunis

Zaire
SOFAMATEL S.P.R.L.
Kinshasa

Zambia
Electrical Maintenance Lusaka Ltd.
Lusaka
for mining:
General Mining Industries Ltd.
Kitwe

Zimbabwe
Electro Technologies Corporation (Pvt.) Ltd.
Harare

America

Argentina
Siemens S.A.
Buenos Aires
Bahía Blanca
Córdoba
Mendoza
Rosario

Bolivia
Sociedad Comercial e Industrial Hansa Ltd.
La Paz

Brazil
Siemens S.A.
São Paulo
Belém
Belo Horizonte
Brasília
Campinas
Curitiba
Florianópolis
Fortaleza
Porto Alegre
Recife
Rio de Janeiro
Salvador de Bahía
Vitoria

Canada
Siemens Electric Ltd.
Montreal, Québec
Toronto, Ontario

Chile
INGELSAC
Santiago de Chile

Columbia
Siemens S.A.
Bogotá
Baranquilla
Cali
Medellín

Costa Rica
Siemens S.A.
San José

Ecuador
Siemens S.A.
Quito
OTESA
Guayaquil
Quito

El Salvador
Siemens S.A.
San Salvador

Guatemala
Siemens S.A.
Ciudad de Guatemala

Honduras
Representaciones Electroindustriales S. de R.L.
Tegucigalpa

Mexico
Siemens S.A.
México, D.F.
Culiacán
Gómez Palacio
Guadalajara
León
Monterrey
Puebla

Nicaragua
Siemens S.A.
Managua

Paraguay
Rieder & Cia., S.A.C.I.
Asunción

Peru
Siemsa
Lima

United States of America
For programmable controls:
Siemens Energy & Automation, Inc.
Programmable Controls Business Unit
Roswell, Georgia

Uruguay
Conatel S.A.
Montevideo

Venezuela
Siemens S.A.
Caracas
Valencia

Asia

Bahrain
Transitec Gulf
Manama
or
Siemens Resident Engineer
Abu Dhabi

Bangladesh
Siemens Bangladesh Ltd.
Dacca

China, People's Republic of
Siemens Represen-
tative Office
Beijing
Canton
Shanghai

Hong Kong
Jebsen & Co., Ltd.
Hong Kong

India
Siemens India Ltd.
Bombay
Ahmedabad
Bangalore
Calcutta
Madras
New Dehli
Secundarabad

Indonesia
P.T.Siemens Indonesia
Djakarta
P.T. Dian-Graha Elektrika
Djakarta
Bandung
Medan
Surabaya

Iran
Siemens Sherkate
Sahami Khass
Tehran

Iraq
Samhiry Bros. Co. (W.L.L.)
Baghdad
or
Siemens AG (Iraq Branch)
Baghdad

Japan
Siemens K.K.
Tokyo

Jordan
Siemens AG (Jordan
Branch)
Amman
or
A.R. Kevorkian Co.
Amman

Korea (Republic)
Siemens Electrical
Engineering Co., Ltd.
Seoul
Pusan

Kuwait
National & German
Electrical and Electronic
Service Co. (INGEECO)
Kuwait, Arabia

Lebanon
Ets. F.A. Kettaneh S.A.
Beirut

Malaysia
Siemens AG
Malaysian Branch
Kuala Lumpur

Oman
Waleed Associates
Muscat
or
Siemens Resident
Engineers
Dubai

Pakistan
Siemens Pakistan
Engineering Co., Ltd.
Karachi
Islamabad
Lahore
Peshawer
Quetta
Rawalpindi

Philippines
Maschinen & Technik Inc.
(MATEC)
Manila

Qatar
Trags Electrical
Engineering and
Air Conditioning Co.
Doha
or
Siemens Resident Engineer
Abu Dhabi

Saudi Arabia
Arabia Electric Ltd.
(Equipment)
Jeddah
Damman
Riyadh

Sri Lanka
Dimo Limited
Colombo

Syria
Siemens AG
(Damascus Branch)
Damascus

Taiwan
Siemens Liaison Office
Taipei
TAI Engineering Co., Ltd.
Taipei

Thailand
B. Grimm & Co., R.O.P.
Bangkok

**United Arab
Emirates**
Electro Mechanical Co.
Abu Dhabi
or
Siemens Resident Engineer
Abu Dhabi
Scientechnic
Dubai
or
Siemens Resident Engineer
Dubai

Yemen (Arab Republic)
Tihama Tractors &
Engineering Co.o., Ltd.
Sanaa
or
Siemens Resident Engineer
Sanaa

Australia

Australia
Siemens Ltd.
Melbourne
Brisbane
Perth
Sydney

New Zealand
Siemens Liaison Office
Auckland

SIEMENS

SIMATIC S5

Enable power supply module **6ES5 958-4UA11**

Technical Description Order No. C79000-T8576-C395-01

Application

The module supplies a system-compatible 24-V voltage for the enable inputs of up to 80 compact modules 6ES5 4..-4U.11, which permits a problem-free operation, particularly when switching the programmable controller on or off.

Mode of operation

The 24-V auxiliary voltage is fed into the enable power supply module from the following power supply units via the lower bus plug. The maximum current to be drawn must not exceed the values given below.

		Maximum current of the auxiliary voltage
6ES5 955-3LC13	115 V/220 V/5 V/18 A	0.8 A
-3LF11	115 V/220 V/5 V/40 A	2.8 A
-3NA11	24 V/5 V/10 A	0.8 A
-3NC11	24 V/5 V/18 A	0.8 A
-3NF11	24 V/5 V/40 A	2.8 A

The following locations are available:

AG 135 U			19	27	35	43	51	59	67												
AG 150 U	3	11	19	27										107	115	123	131				
EG 185 U		11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139			

Output voltage: 24 V/max. 400 mA (electronically short-circuit-proof)

Front plug: 42 pin

Connector pin assignments: Pins 1 to 21 positive; Pins 22 to 42 negative

SIEMENS

Siemens Aktiengesellschaft

Order No.: C79000-T8576-C395-01

Order from: Gerätewerk Karlsruhe

Printed in the Federal Republic of Germany

AG 0589 0.5 SD 2 En