CL300

CL300 Manual

Version 101

BOSCH
Automationstechnik

CL300

CL300
Manual

1070 072 113-101 (89.02) GB

Discretionary charge 20.– DM

ACHTUNG / CAUTION

ACHTUNG

Das Programmspeichermodul EPROM, 64 k–Worte 062 366, darf nur mit dem SPS–Betriebsprogramm ab Version 2.3 programmiert werden. Bei älteren Versionen des SPS–Betriebsprogramms kann das Programmspeichermodul zerstört werden.

CAUTION

The program memory card, 64 k–words 062 366, may only be programmed with PLC–Operating System from version 2.3. When using elder version than 2.3 the program memory card will be destroyed.

Contents

Preface

Keep this manual in a place where it is always accessible to user.

Note, CAUTION, WARNING

The use of **Note, CAUTION** and **WARNING** throughout this manual is subject to the following rules.

WARNING

This heading is used wherever an insufficient or lacking compliance with instructions can result in personal damage.

CAUTION

This heading is used wherever an insufficient or lacking compliance with instructions can result in damage to equipment or files.

Note

This heading is used to inform the user of special features or to draw the user's attention to additional information.

Contents

1 General Information

The CL300 Programmable Controller is a further addition to the line of existing Bosch Programmable Controllers CL100, PC200, PC400 and PC600, extending their capabilities.

The CL300 can be expanded and adapted to specific demands by adding intelligent additional modules, depending on the desired function.

The CL300 can be provided with standard interfaces to connect the Programmable Controller (PLC) to other control systems, computers, and standard peripherals.

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List of Illustrations

2 Configuration

2.1 Physical Configuration

"Physical Configuration" means the card cage as the basic structure, completed to form basic and expansion units, their dimensions as well as the configuration of individual expansion facilities.

The expansion modules AG/P, AG/Z, AG/DZ and AG/DU and other modules or units mentioned in the configuration chapter and shown in the illustrations, such as power supply unit (NT), central processing unit (ZE) and input/output modules are detailed in Chapter 4, or reference is made to separate descriptions.

The CL300 is made up of the following main components:

- Card cage
- System modules, such as power supply unit (NT) and central processing unit (ZE) with program memory module slot and built—in programming interface
- Peripheral modules, such as input and output modules
- Intelligent peripheral modules, such as positioning unit and external counter module
- Bus link (system expansion cable)
- Intelligent system modules, such as computer interface module or diagnostic module
- Fan unit

2.1.1 Card Cages

A variety of card cages can be used for the CL300 Programmable Controller and its expansions to suit application specific requirements.

2.1.1.1 Card Cage BGT301

The BGT301 Card Cage is a **19" metal rack** to accommodate 14 modules in dual Eurocard format. The lower part of the BGT301 offers additional space to install a **fan unit**. The **cable duct**, which swings open on the front side, is placed transversely on the lower front. A perforated mounting bracket is attached on each side of the BGT301. The upper side of the card cage has louvers to ensure heat dissipation of the CL300.

Power for the individual modules is supplied internally by the power supply unit via a bus bar integrated in the card cage. The modules communicate via the buses contained in the card cage:

- PERIPHERAL BUS and
- SYSTEM BUS

The **system bus** runs from slot 3 to slot 6, permitting to accommodate 3 intelligent system modules in slots 4, 5, and 6 in addition to the central processing unit **ZE301**. Slots 7 to 14 are designed for the accommodation of peripheral modules. With distributed expansion, slot 7 is provided for the expansion module **AG**/**DZ**. The following illustrations show the BGT301 Card Cage, its partitioning and dimensions.

Ordering Information

	Order No.
Card Cage BGT301	052 003
Cable Duct	054 152
Filler Panel, 1 module width	046 208

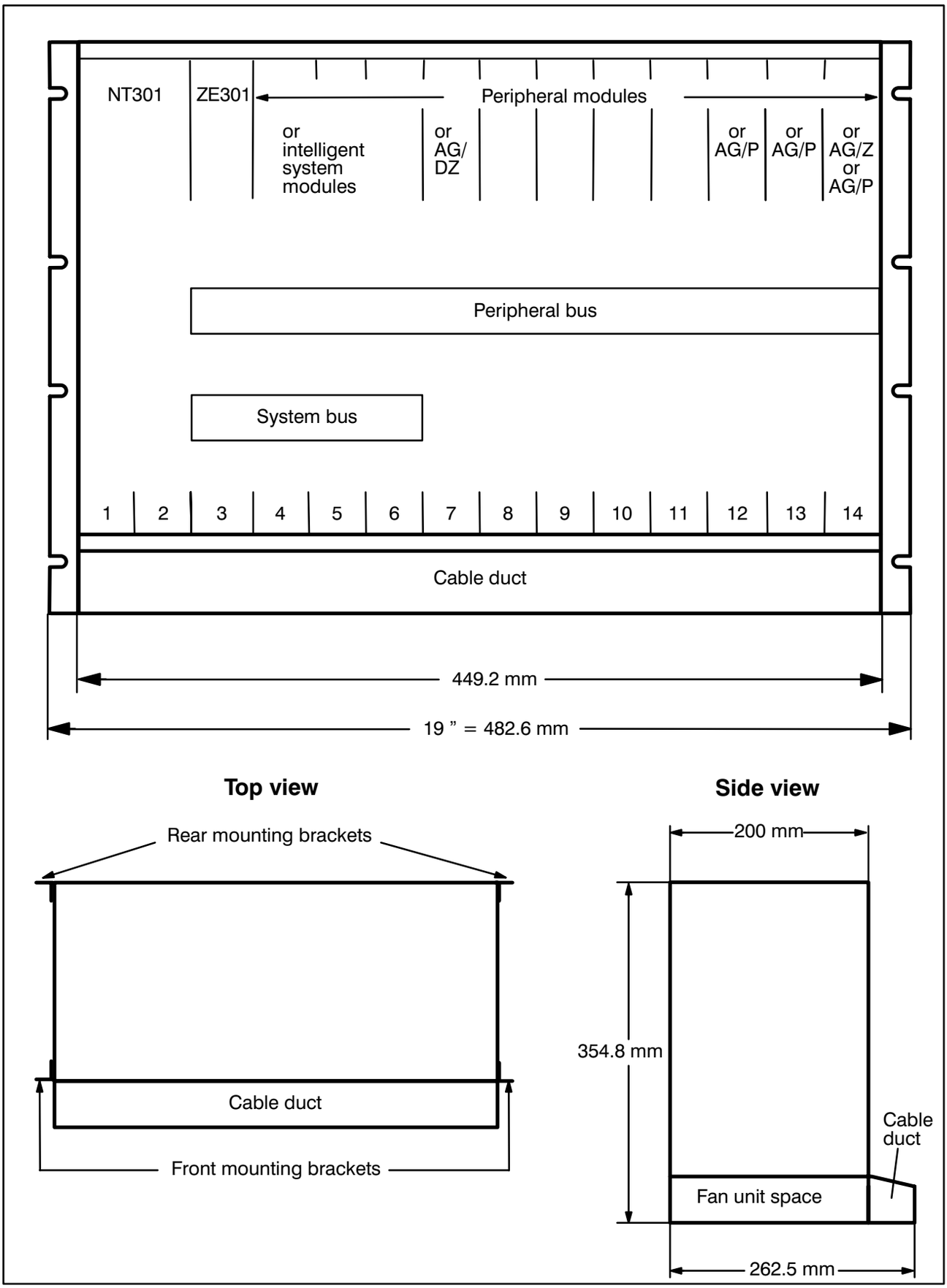


Fig. 2–1 Card Cage BGT301

2.1.1.2 Card Cage BGT301–K

The BGT301–K Card Cage is a 11.8" wide metal rack to accommodate 8 modules in dual Eurocard format. Except for their different widths, the BGT301–K and the BGT301 are identical.

The system bus runs from slot 3 to slot 6, permitting to accommodate 3 intelligent system modules in slots 4, 5, and 6 in addition to the central processing unit ZE301. Slots 7 and 8 are designed for the accommodation of peripheral modules. With distributed expansion, slot 7 is provided for the expansion module AG/DZ. The following illustrations show the BGT301–K Card Cage, its partitioning and dimensions.

Ordering Information

	Order No.
Card Cage BGT301–K	056 863
Filler Panel, 1 module width	046 208

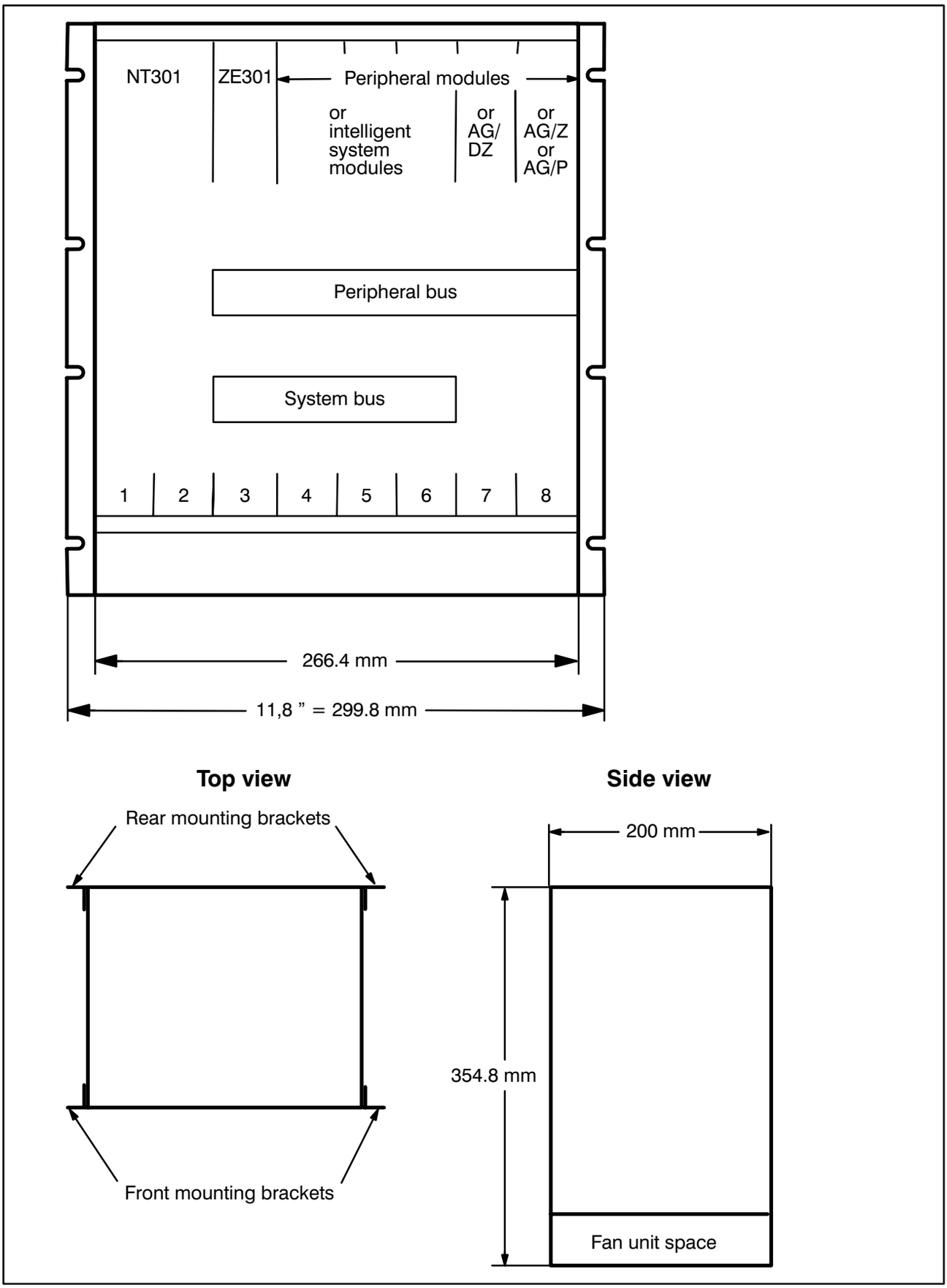


Fig. 2–2 Card Cage BGT301–K

2.1.1.3 Card Cage BGT300

The BGT300 Card Cage has the same dimensions as the BGT301 Card Cage.

The difference is its shorter SYSTEM BUS, allowing only peripheral modules to be accommodated in the card cage, in addition to the power supply unit and the central processing unit.

Ordering Information	Order No.
Card Cage BGT300	052 000
Cable Duct	054 152
Filler Panel, 1 module width	046 208

2.1.1.4 Card Cage BGT300–K

The BGT300–K Card Cage has the same dimensions as the BGT301–K Card Cage. The difference is its shorter SYSTEM BUS, allowing only peripheral modules to be accommodated in the card cage, in addition to the power supply unit and the central processing unit.

Ordering Information	Order No.
Card Cage BGT300–K	056 862
Filler Panel, 1 module width	046 208

2.1.2 Basic Unit GG301

The GG301 Basic Unit includes:

- BGT301 Card Cage
- NT301 Power Supply Unit in slots 1 and 2
- ZE301 Central Processing Unit in slot 3
- Up to three intelligent system modules in slots 4, 5, and 6, which are to be aligned left in the slot adjacent to the central processing unit. The R301 Computer Interface Module, for example, is an intelligent system module.
- Peripheral modules in slots 7 to 14. Among these are intelligent peripheral modules, such as
  - PU402 Positioning Unit
  - EZ50 External Counter Module.

With distributed expansion, slot 7 is provided for the AG/DZ.

Slots 4, 5, and 6 can also be occupied by peripheral modules. The illustration shows the configuration of the GG301 Basic Unit.

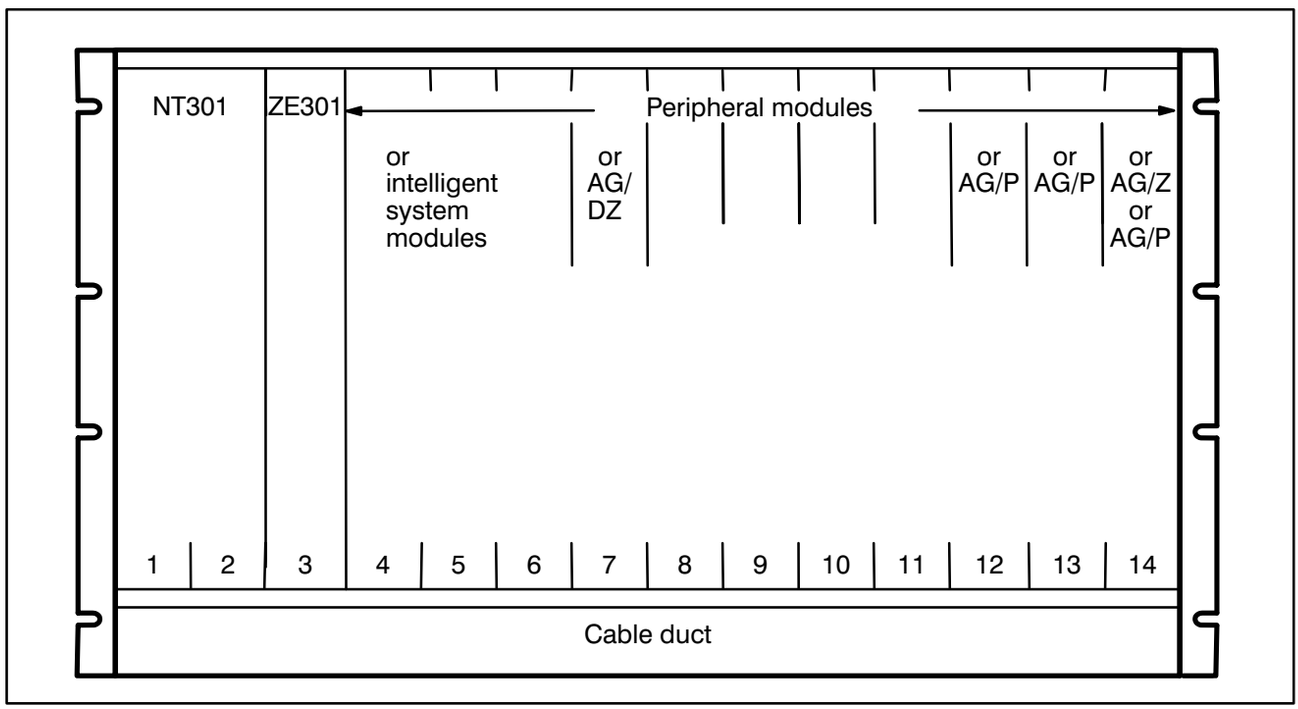


Fig. 2–3 Basic Unit GG301

2.1.3 Basic Unit GG301–K

The GG301–K Basic Unit includes:

- BGT301–K Card Cage
- NT301 Power Supply Unit in slots 1 and 2
- ZE301 Central Processing Unit in slot 3
- Up to three intelligent system modules in slots 4, 5, and 6, which are to be aligned left in the slot adjacent to the central processing unit. The R301 Computer Interface Module, for example, is an intelligent system module.
- Peripheral modules in slots 7 and 8. Among these are intelligent peripheral modules, such as
  - PU402 Positioning Unit
  - EZ50 External Counter Module.

With distributed expansion, slot 7 is provided for the AG/DZ.

Slots 4, 5 and 6 can also be occupied by peripheral modules. The illustration shows the configuration of the GG301–K Basic Unit.

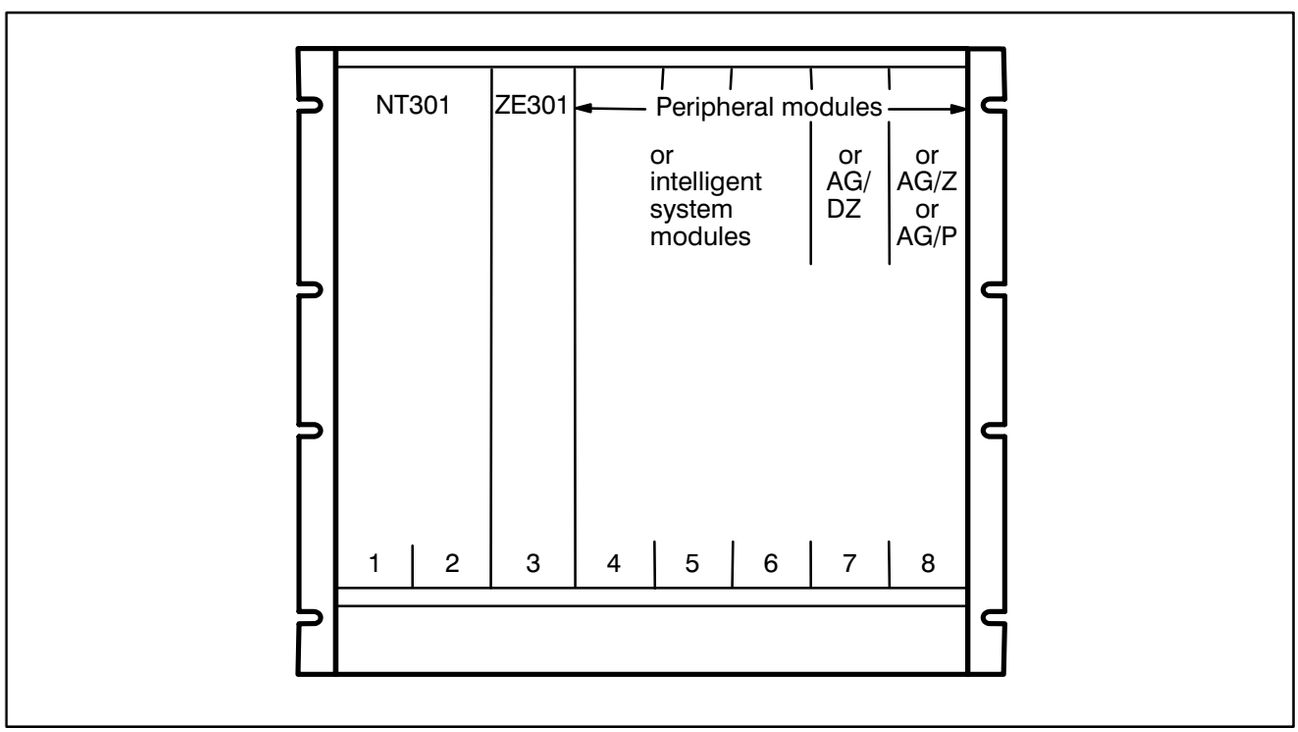


Fig. 2–4 Basic Unit GG301–K

2.1.4 Basic Unit GG300

The GG300 Basic Unit includes:

- BGT300 Card Cage
- NT300/301 Power Supply Unit in slots 1 and 2
- ZE300 Central Processing Unit in slot 3
- Peripheral modules in slots 4 to 14

The GG300 Basic Unit does not contain any intelligent system modules (only intelligent peripheral modules) nor any AG/DZ Remote Expansion Module.

Each basic unit is supplied with an info card which is inserted on the far left−hand side of the card cage. The info card contains maintenance and repair information.

The illustration shows the configuration of the GG300 Basic Unit.

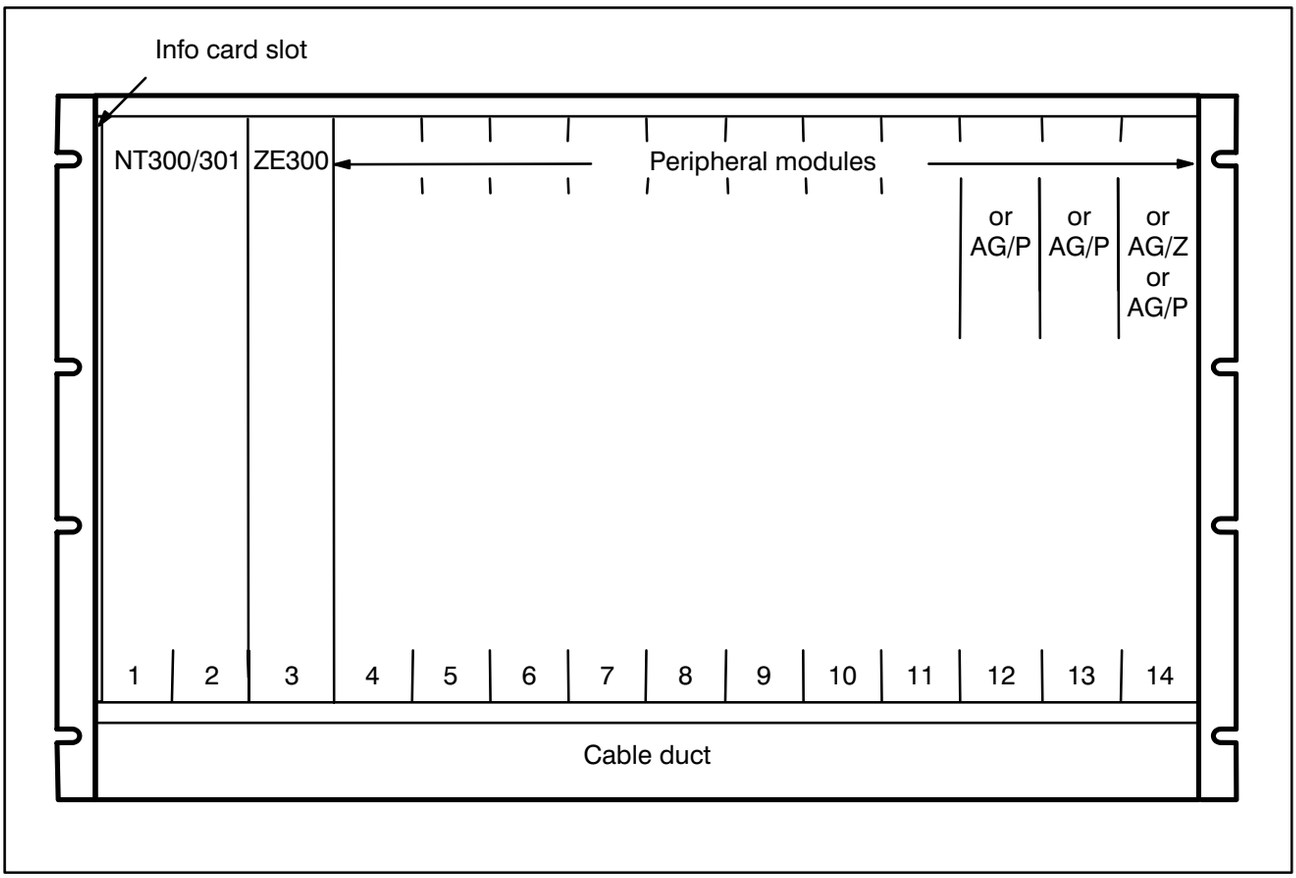


Fig. 2−5 Basic Unit GG300

2.1.5 Basic Unit GG300–K

The GG300–K Basic Unit includes:

- BGT300–K Card Cage
- NT300/301 Power Supply Unit in slots 1 and 2
- ZE300 Central Processing Unit in slot 3
- Peripheral modules in slots 4 to 8

The GG300–K Basic Unit does not contain any intelligent system modules (only intelligent peripheral modules) nor any AG/DZ Remote Expansion Module.

Each basic unit is supplied with an info card which is inserted on the far left–hand side of the card cage. The info card contains maintenance and repair information.

The illustration shows the configuration of the GG300–K Basic Unit.

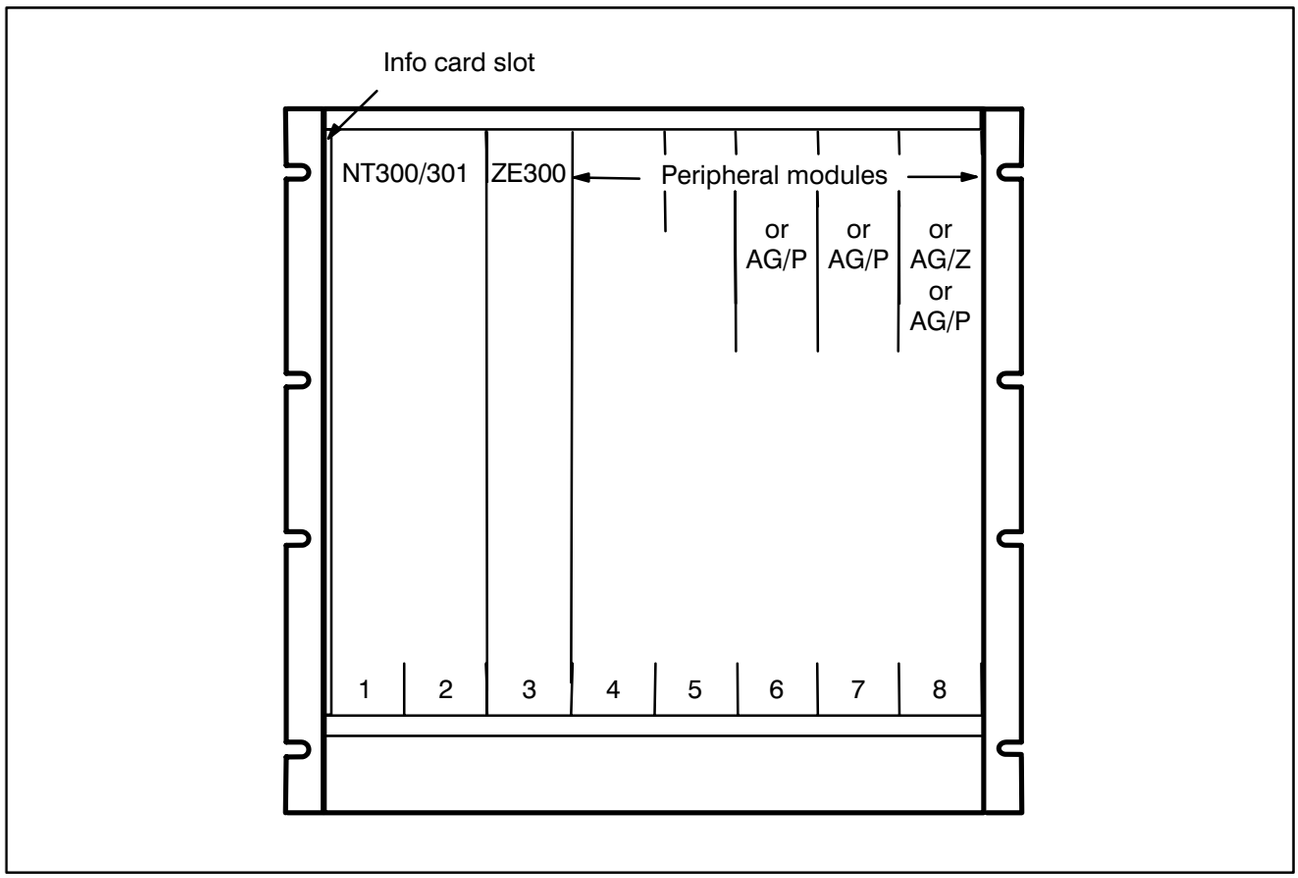


Fig. 2–6 Basic Unit GG300–K

2.1.6 Expansion Unit EG300

The EG300 Expansion Unit is used to expand the CL300.

The EG300 Card Cage has the same overall dimensions as the BGT300/301 Card Cages. It contains a peripheral bus but no system bus and can accommodate the following modules.

- Input/output modules
- Intelligent peripheral modules (e.g. EZ20 External Counter Module and PU402 Positioning Unit)
- Expansion modules

Ordering Information

	Order No.
Expansion Unit Card Cage14 slots	052 004
Cable Duct	054 152
Filler Panel, 1 module width	046 208

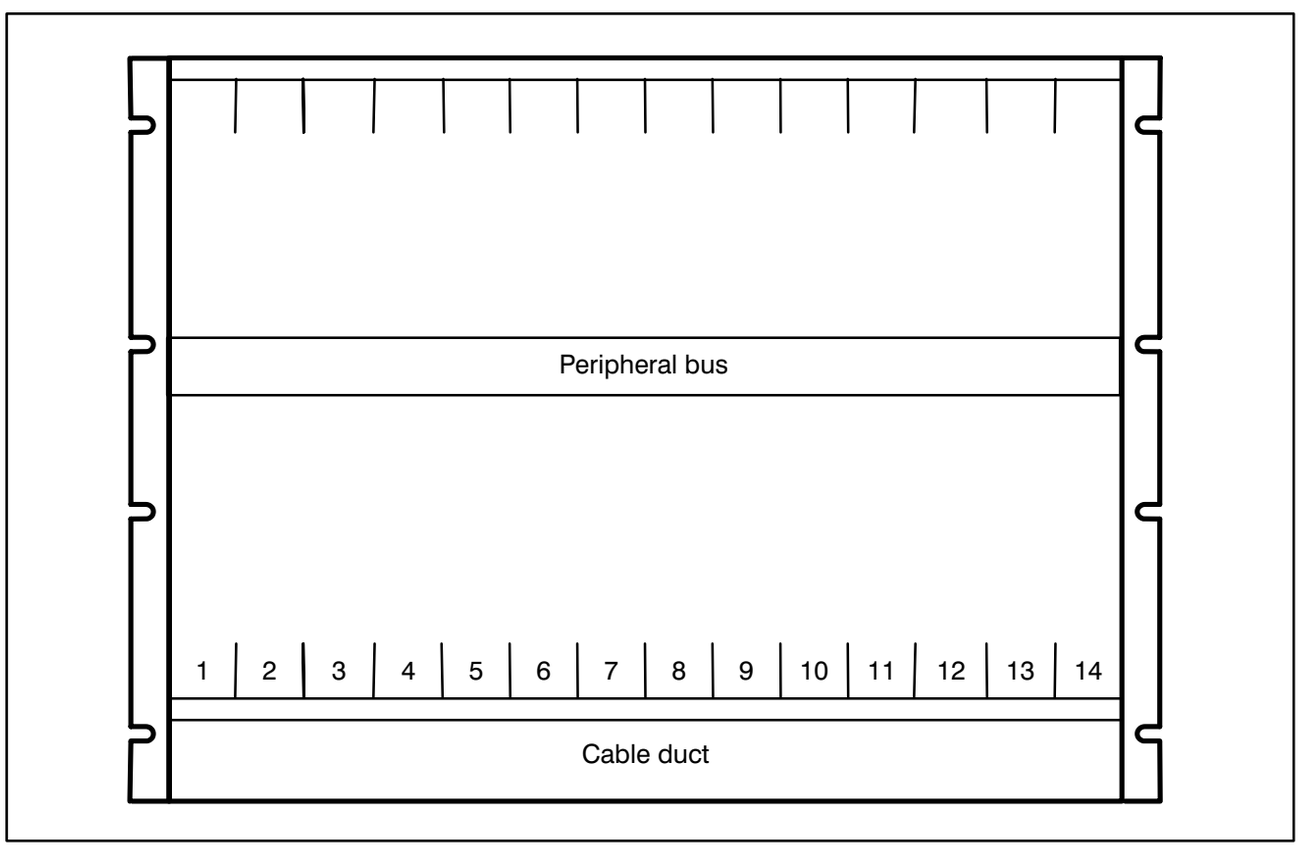


Fig. 2–7 Expansion Unit EG300

2.1.7 Multi—shelf Configuration

A multi—shelf configuration can be made up of a maximum of three shelves. Normally only one fan unit mounted in the lower unit is required for heat dissipation.

To ensure easy installation and removal of the fan unit, sufficient clearance should be provided under the corresponding unit.

Installation of a second fan unit can be necessary, depending on the expansion structure of the two upper units, e.g. the addition of modules having a higher power consumption.

Appropriate clearance should also be provided for these units.

The module description gives details when to install a fan unit.

The following illustration shows a possible three—shelf configuration consisting of 19 ” basic and expansion units with clearances provided for fan unit installation and removal plus the dimensions to be observed.

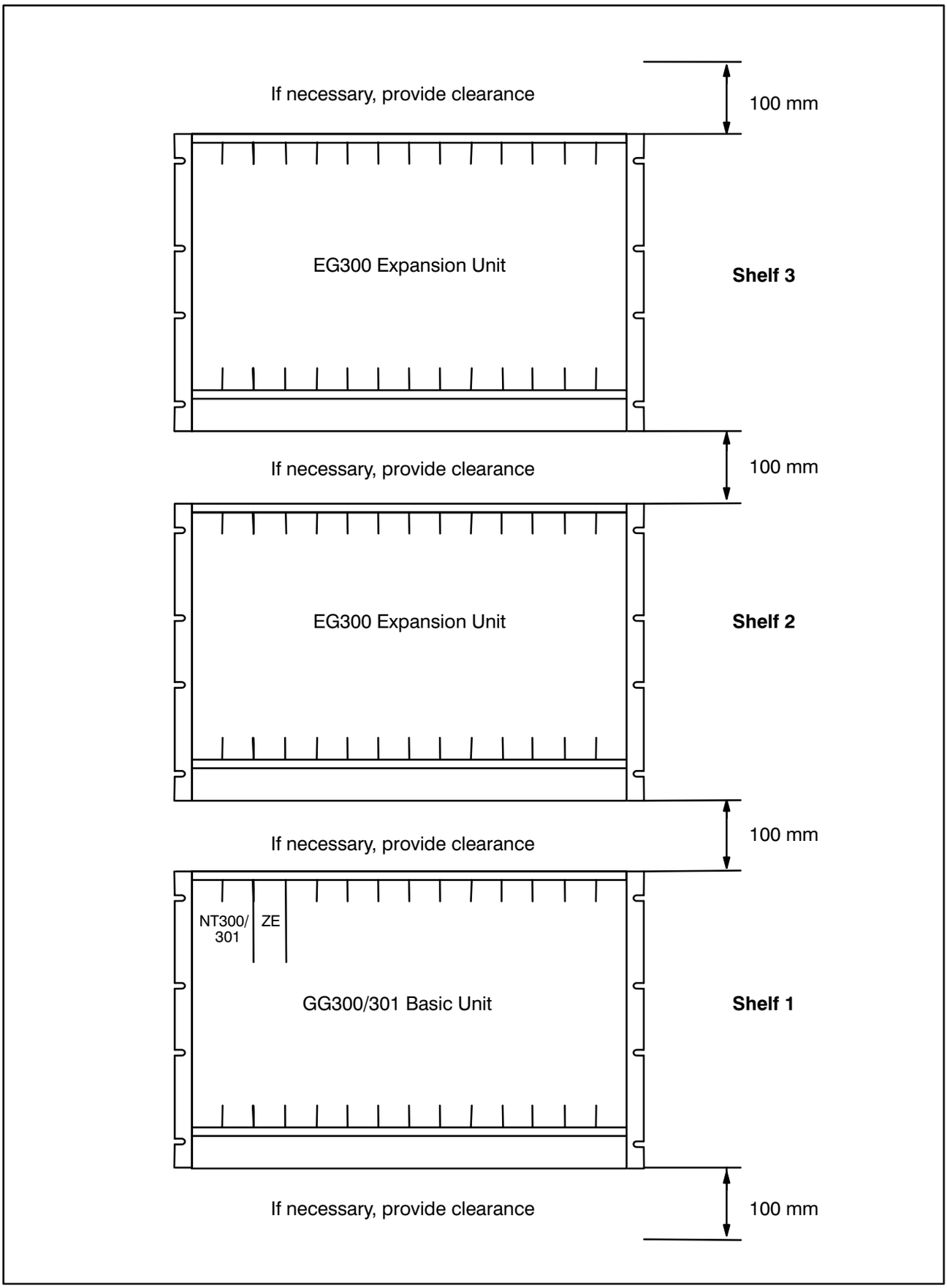


Fig. 2−8 Example of a Multi−shelf Configuration

2.1.8 Fan Unit

The use of a fan may be necessary to prevent heat accumulation, depending on the modules installed in the card cage.

The fan unit consists of one fan for models BGT300–K/301–K or two fans for models BGT300/301 and a filter mat. The fan unit has a failure contact which can be evaluated according to the requirements of the specific installation.

The failure contact responds only to the failure of one fan or both fans, but not in case of poor air supply due to strong contamination of the filter mat.

Fan operating: Contact closed

Fan failed: Contact open

The fan unit operates with an external voltage of 24 V DC, which can be fed to the fan unit from the left or from the right side of the card cage.

☞ **Note** ☜

The following description refers to the fan units of the BGT300/301. The same features apply to the fan unit of the BGT300–K/BGT301–K.

Installation

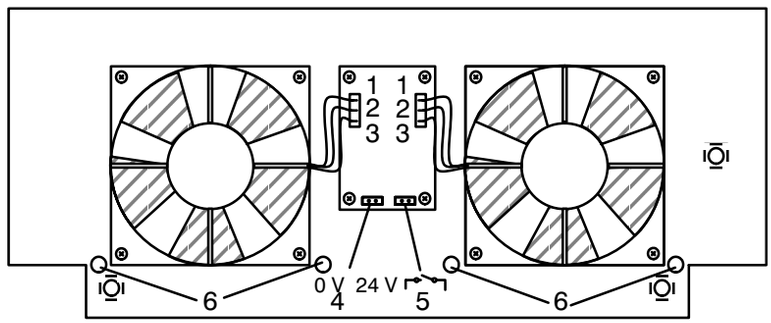
See fig. 2–9.

★ Place rear edge of fan unit (10) on the rear mounting surface of the card cage.

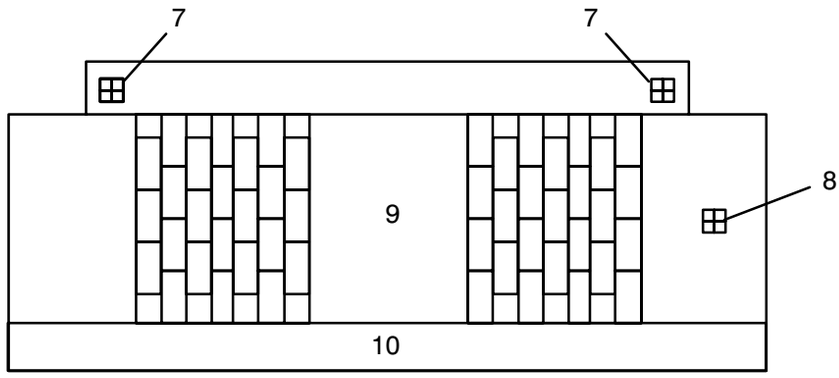
★ Connect the power supply.

★ Lift front side of fan unit to allow the fan unit latches (7) to latch.

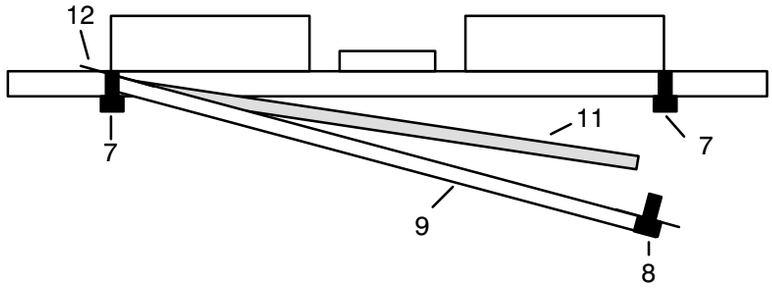
Top View



Bottom View



Front View



1 — Terminal red
2 — Terminal black
3 — Terminal yellow
4 — Power connector
5 — Failure contact
6 — Holes for cable clamps
7 — Fan unit latch
8 — Filter mat latch
9 — Perforated filter mat holder
The filter mat is located under the filter mat holder
10 — Rear edge of fan unit
11 — Filter mat
12 — Filter mat holder insertion slot

Fig. 2—9 Fan Unit of BGT300/301

Removal

★ Unlatch fan unit latches (7) in clockwise or counterclockwise direction and lower fan unit.

★ Remove the power connector.

★ Pull out fan unit towards the front.

☞ **Note** ☜

Unused slots should be covered with filler panels in order to ensure an optimum flow of cooling air.

Specifications

External Voltage Supply	24 V DC
Contact Voltage	60 V DC / 125 V AC max.
Switched Power	30 W / 60 VA max.
Switched Current	1 A max.

Ordering Information

	Order No.
Fan Unit 24 V DC for BGT300/301	052 243
Filter Mat	052 245
Fan Unit 24 V DC for BGT300−K/301−K	056 864
Filter Mat	056 916

2.1.9 Fanless Operation

Fanless operation of the CL300 is possible under the following conditions:

- Ambient temperature must not exceed 55 °C.
- Use of NT300 Power Supply Unit only.
- Sufficient flow of cooling air must be ensured to avoid heat accumulation.
- Central and parallel expansions are possible, but units must not be stacked.
- Intelligent modules, AG/DZ, and analog input/output modules are not permitted.
- I/O modules must be installed on the right—hand side of the central processing unit. All input modules come first, followed by all output modules.
- The following I/O modules may be used:

  Input Modules 24 V DC:

  - With 32 inputs and simultaneity factor = 0.5, alternating *****
  - With 16 inputs and simultaneity factor = 0.5, alternating *****

  Output Modules 24 V DC:

  - With 32 outputs, 0.2 A/output and simultaneity factor = 1
  - With 32 outputs, 0.5 A/output (see paragraph 4.4.1.2)
  - With 16 outputs, 2.0 A/output and simultaneity factor = 0.5, alternating *****
  - With 8 outputs, 2.0 A/output and simultaneity factor = 1

☞ **Note** ☜

*** Alternating means: Two adjacent inputs or outputs, respectively, should not be driven simultaneously over the average mean time.**

2.1.10 Card Cage Installation

The card cage can be mounted to a flat surface or in a rack, using the mounting brackets at the rear.

When the two mounting brackets are attached to the front edges of the card cage, the controller can be installed in a cabinet (with a flush front panel).

The 19 ” card cage can also be installed in a standard 19 ” mounting rack.

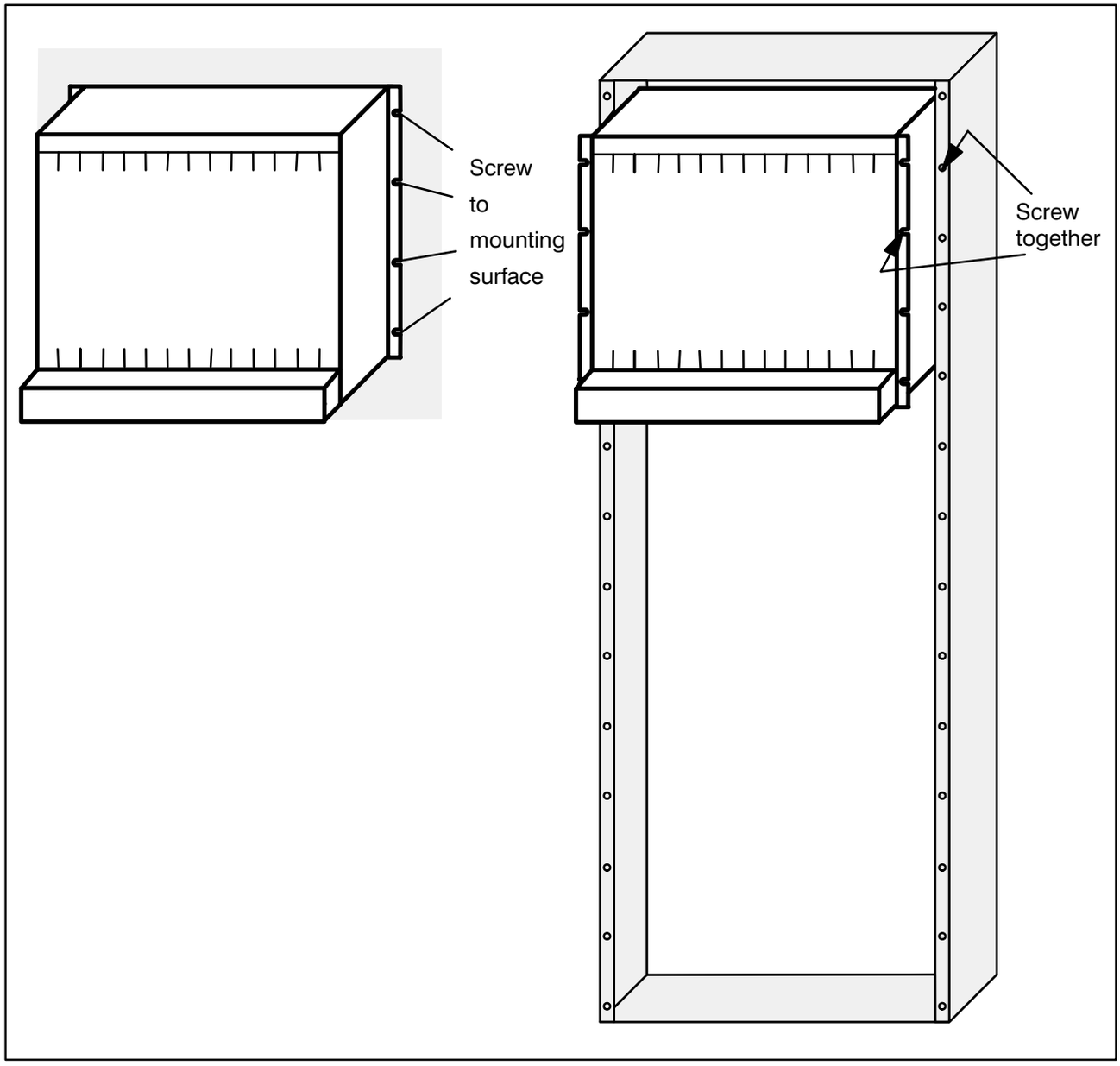


Fig. 2–10 Card Cage Installation

2.1.11 Module Installation

The module is installed in the appropriate card cage slot and secured with the two screws that are provided on the module.

Good tightening of the screws between the module and the card cage ensures good mechanical strength and good electrical contacts as well as high immunity to extreme disturbances and interferences.

Maximum torque of the mounting screws is 0.5 Nm.

2.1.12 Expansions

Several expansion options have been provided for the CL300 to meet various user–specific requirements. These options are described below.

2.1.12.1 Central Expansion

☞ **Note** ☜

The GG300—K and GG301—K Basic Units allow for central expansions. Further information is available on request.

A basic station as a result of central expansion includes one basic unit and a maximum of two expansion units. The illustration below shows the arrangement of the individual units and of the AG/Z Central Expansion Unit plus the connections required in this configuration made up of one GG300/301 Basic Unit and two EG300 Expansion Units.

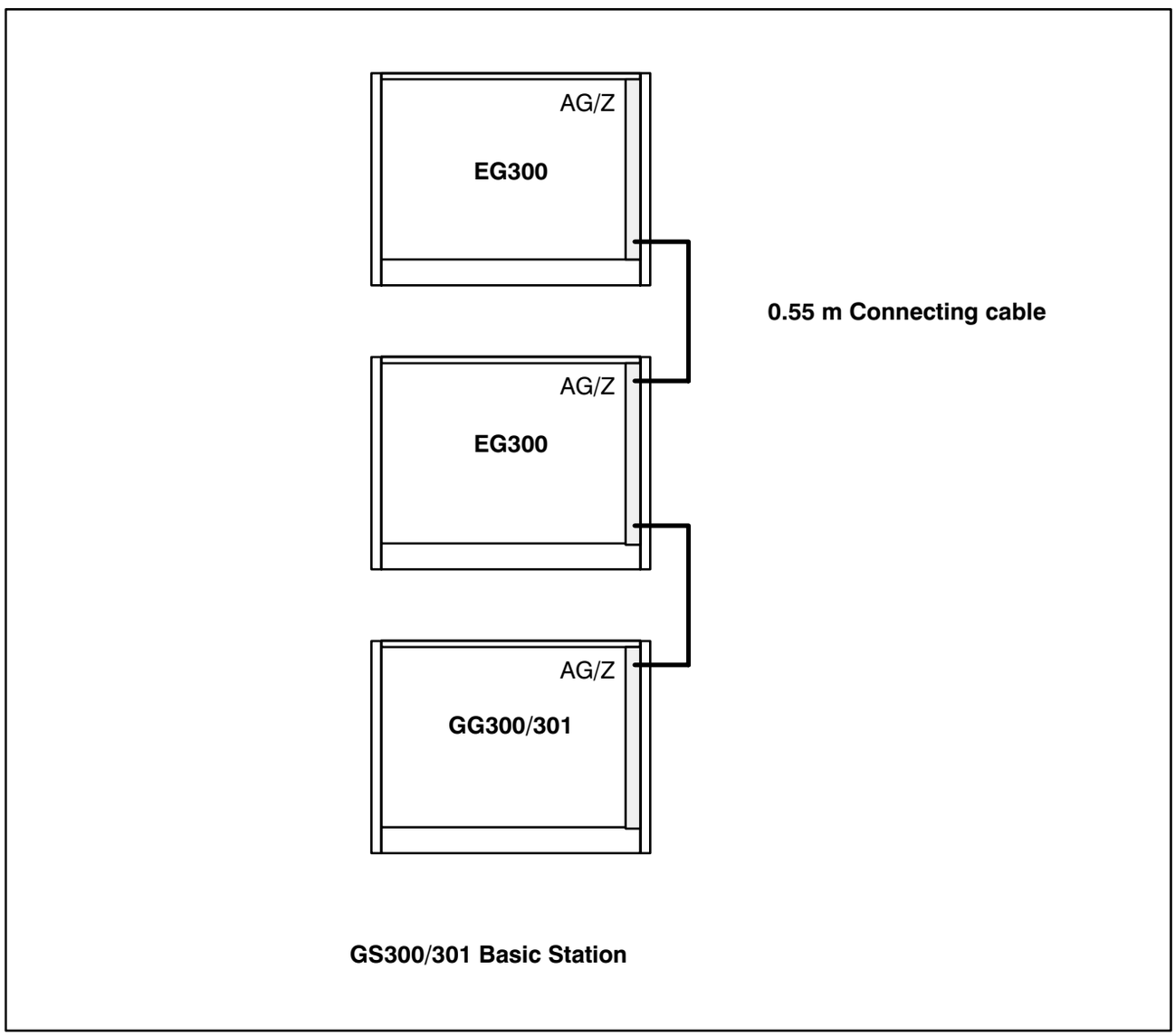


Fig. 2—11 Central Expansion

2.1.12.2 Parallel Expansion

Parallel expansion includes one basic station (1 basic unit and 2 expansion units) and one expansion station (3 EG300 Expansion Units in series) in a parallel configuration.

The illustration below shows the arrangement of the individual units, the AG/P Parallel Expansion Unit, the AG/Z Central Expansion Unit and the connections required.

The AG/P should be installed in the basic unit. The AG/Z Central Expansion Modules are installed in the EG300 Expansion Units.

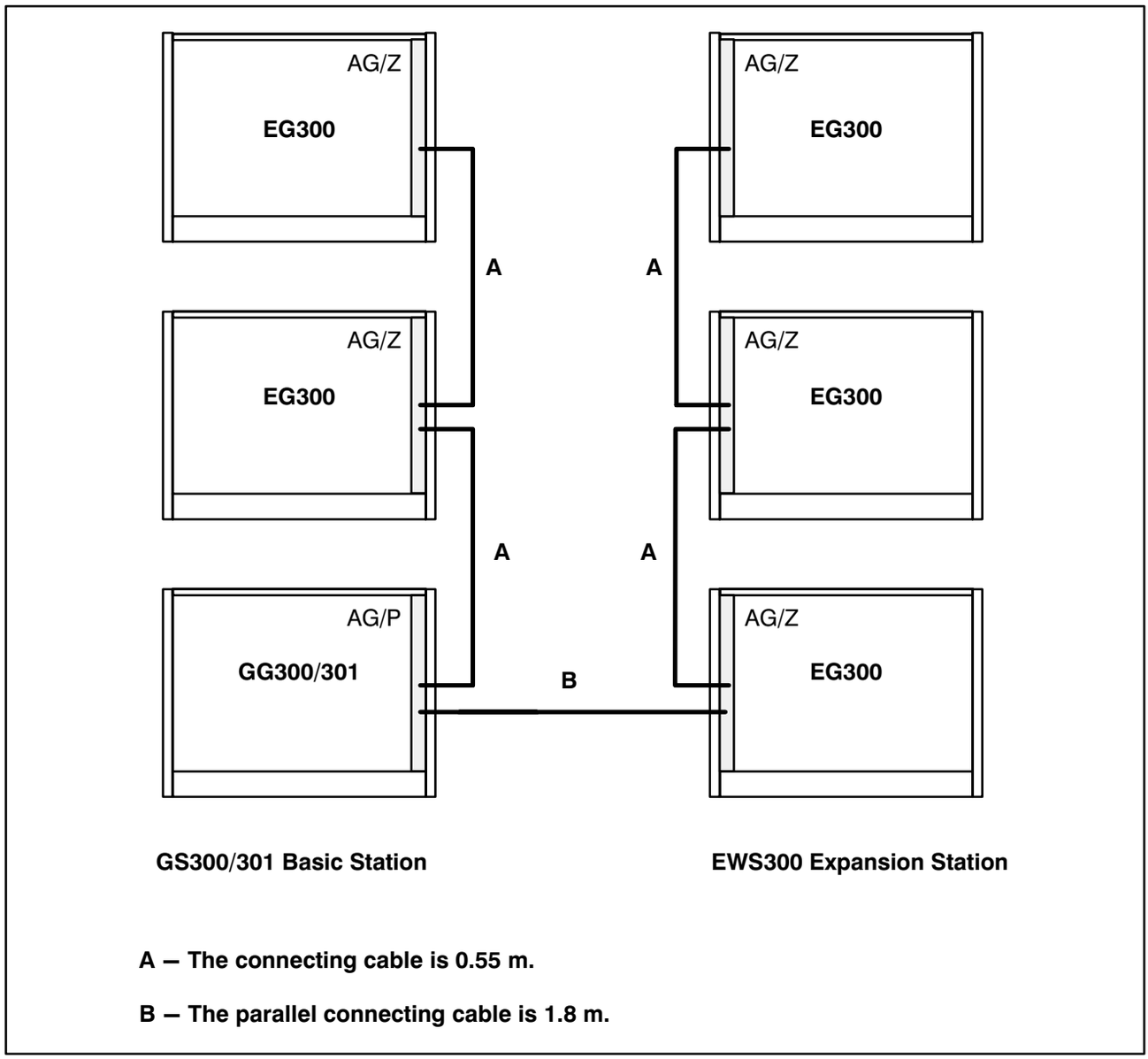


Fig. 2–12 Parallel Expansion

2.1.12.3 Distributed Expansion

Distributed expansion ensures communication between the GS301/ 301—K Basic Station and several remote EWS300 Expansion Stations.

Maximum distance from the basic station to the farthest expansion station is 800 m. Distributed expansion in its maximum configuration includes one basic station (1 x GG301/301—K and 2 x EG300) and 4 x 2 EWS300 Expansion Stations, connected to the distributed expansion station in GG301/301—K and forming two lines. The distance between the individual sections can be up to 200 m. Expansion module slots are detailed in paragraphs 2.1.12.4 and 2.1.12.5. The illustration below shows the arrangement of distributed expansion, using a GG301 Basic Unit.

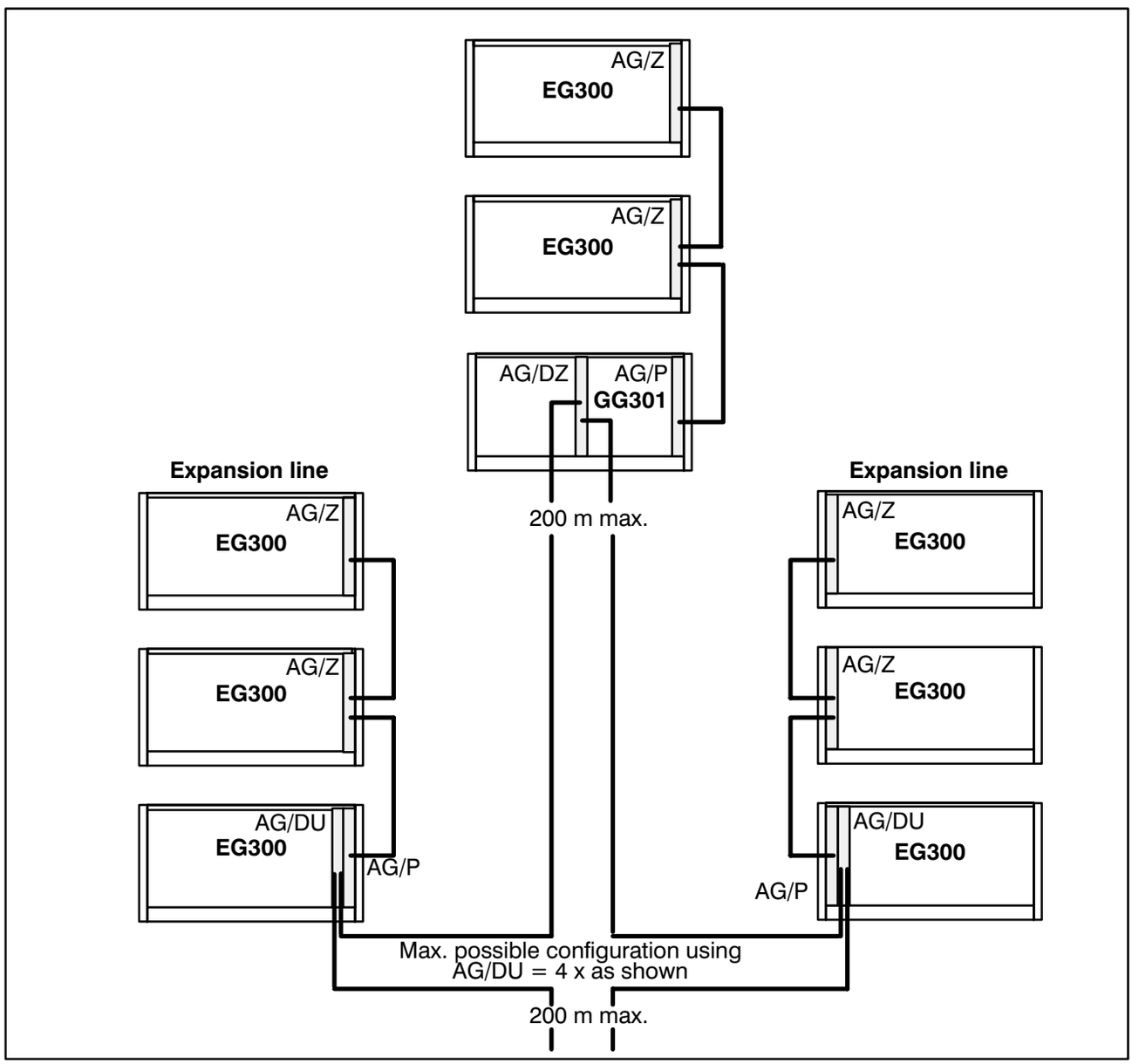


Fig. 2—13 Distributed Expansion

2.1.12.4 Expansion Module Slots

The hatched sections in the table below show which basic and expansion units can accommodate expansion modules.

The maximum number of expansion modules per card cage is not indicated in the table.

	Expansion Modules				Options	
	AG/Z	AG/P	AG/DZ	AG/DU		
GG300/300−K Basic Unit	X				either	
		X			or	
GG301/301−K Basic Unit	X				either	
		X			or	
			X		or	
	X		X		or	*
		X	X		or	
EG300 Expansion Unit	X				either	
				X	or	
	X			X	or	
		X		X	or	

Fig. 2−14 Expansion Module Slots

Example

* The GG301/301−K can simultaneously accommodate the AG/Z and AG/DZ Expansion Modules.

2.1.12.5 Slots of Individual Modules

☞ **Note** ☜

The modules installed in slots 1, 2, and 3 of the GG300/301 Basic Units should be operated in the same slots in the GG300—K/301—K. The modules installed in the right slots of the GG300/301 are shifted 6 slots to the left in the GG300—K/301—K.

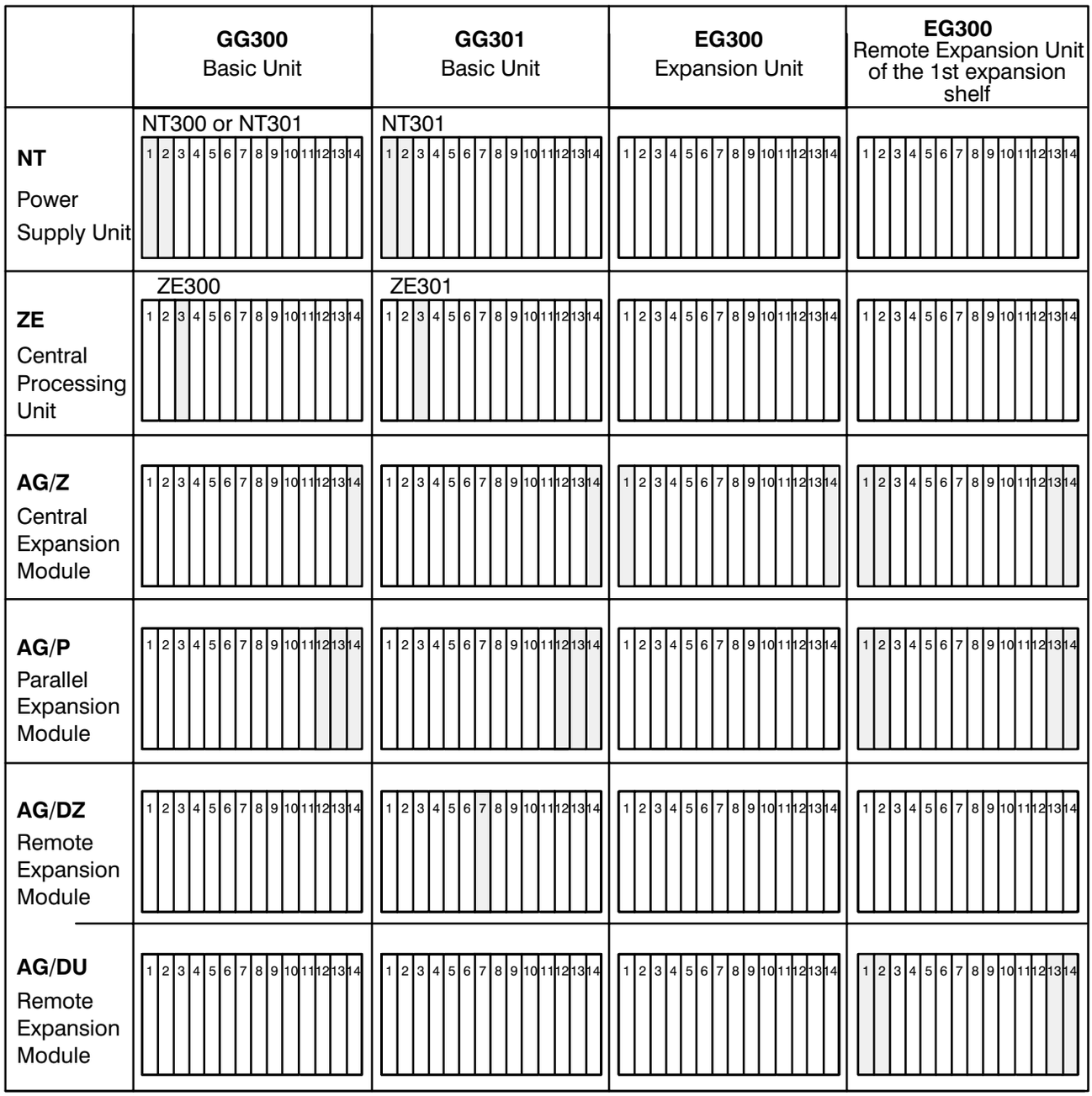


Fig. 2—15 Slots of Individual Modules (Sheet 1 of 2)

☞ **Note** ☜

The modules installed in slots 9 to 14 of the GG300/301 are not applicable in the GG300—K/301—K Basic Units.

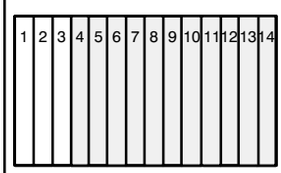
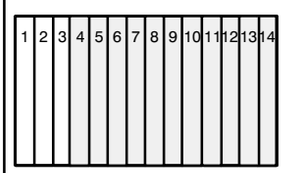
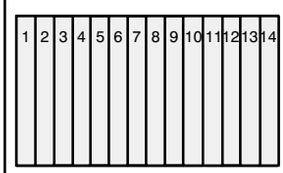
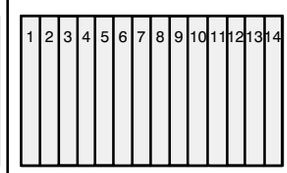
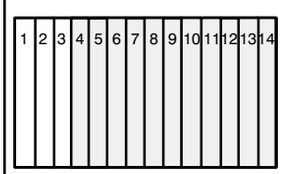
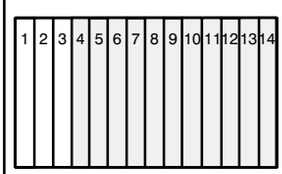
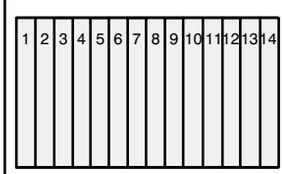
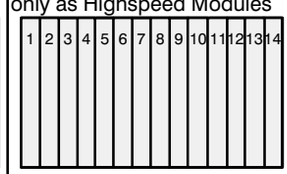
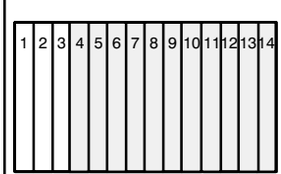
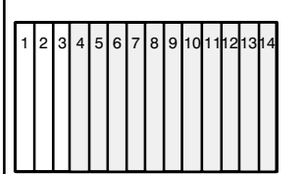
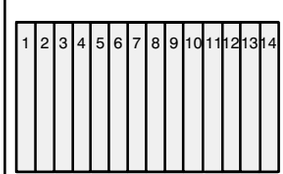
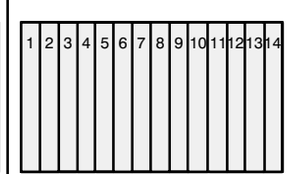
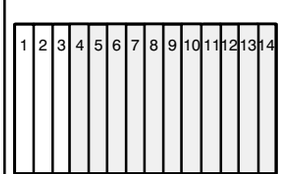
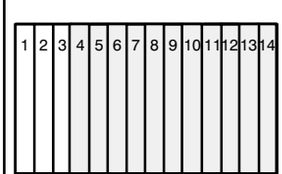
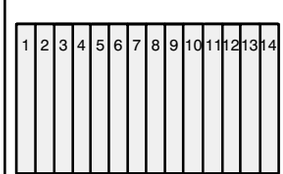
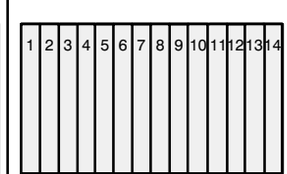
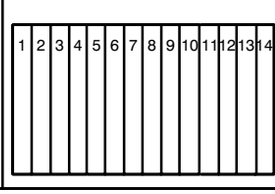
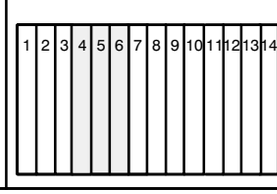
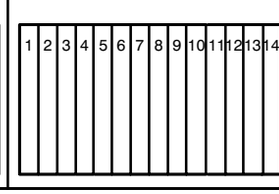
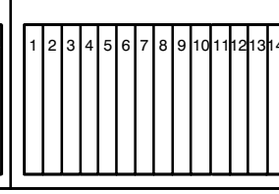
	GG300 Basic Unit	**GG301** Basic Unit	**EG300** Expansion Unit	**EG300** Remote Expansion Unit of the 1st expansion shelf
Digital and Analog Input and Output Modules				
IE High—speed and Interrupt—able Input Modules				only as Highspeed Modules 
PU401 Positioning Unit				
EZ50 External Counter Module				
R301 Computer Interface Modules				

Fig. 2—15 Slots of Individual Modules (Sheet 2 of 2)

2.2 Electrical Configuration

2.2.1 Regulations

The electrical connections of the CL300 Controller should comply with the regulations VDE 0100 and VDE 0113.

2.2.2 External Power Supply

Power for actuators and transducers is not supplied by the NT300/301 Power Supply Unit. Therefore, a separate load power supply is required.

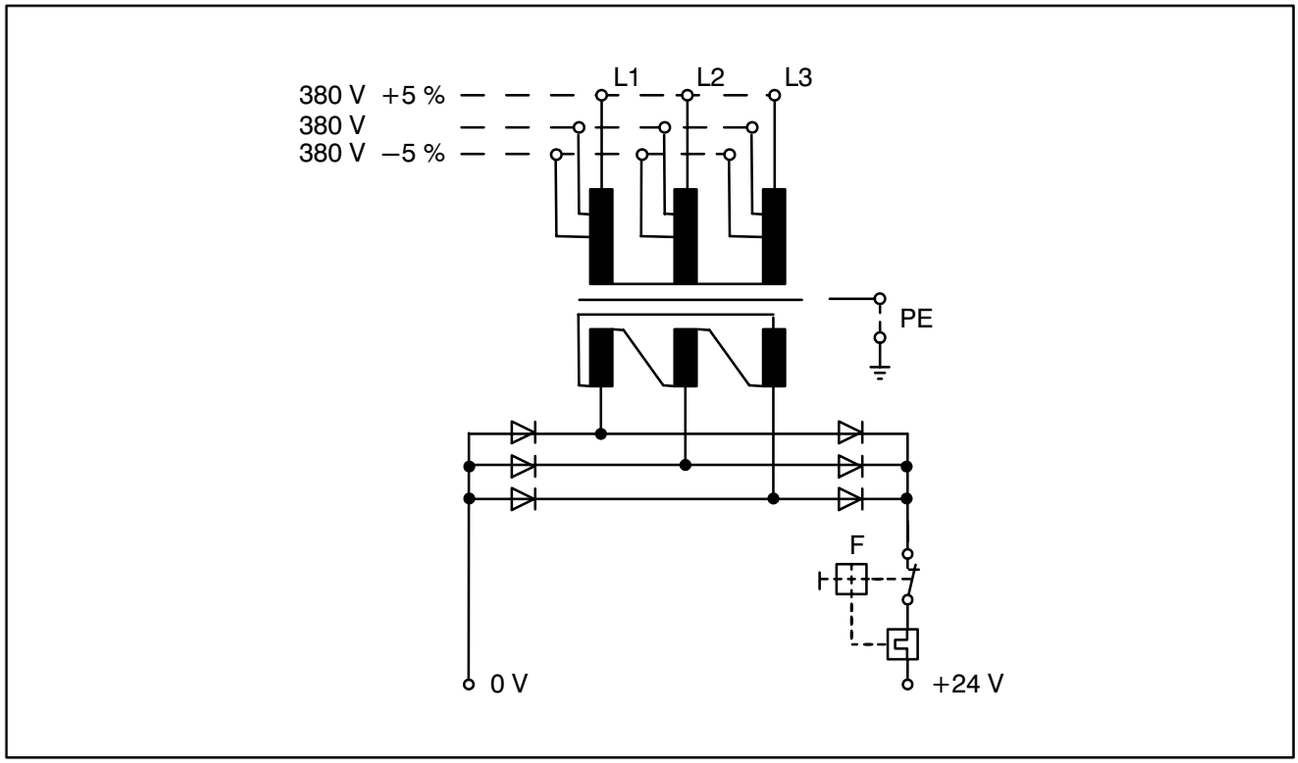


Fig. 2−16 Wiring Diagram

Specifications

Input Voltage	380 V/3−phase/50 Hz
Output Voltage	24 V DC to DIN 19240
Peak−to−average Ripple Factor	5 %
Max. Output Current	6 A, 10 A, 20 A, 40 A
Input Current at Nominal Load	0.3 A, 0.45 A, 0.83 A, 1.7 A
Connecting Terminals (mm^2)	1.5, 1.5, 2.5, 2,5
Protection Class	IP00
Dimensions H x W x D	165 mm x 300 mm x 100 mm, 185 mm x 340 mm x 140 mm, 240 mm x 420 mm x 140 mm

Ordering Information

			Order No.
24 V	DC	6 A	913 485
		10 A	913 486
		20 A	913 487
		40 A	913 488

2.2.3 Protective Ground Connection

With the use of expansion modules, the following points should be observed to ensure good protective ground connection:

- The basic unit and all expansion units should be connected to the protective ground wire. The connecting cross−section should be as large as possible.
- The flat−cable connector on the front panel of the destination expansion unit should be connected to the protective ground wire when two AG/Z units are interconnected.
- When an AG/P module is connected to an AG/Z module, the flat−cable connector on the AG/Z front panel should be connected to the protective ground wire.
- In case of interference problems, it is recommended to also connect the flat−cable connector on the AG/P front panel to the protective ground wire.

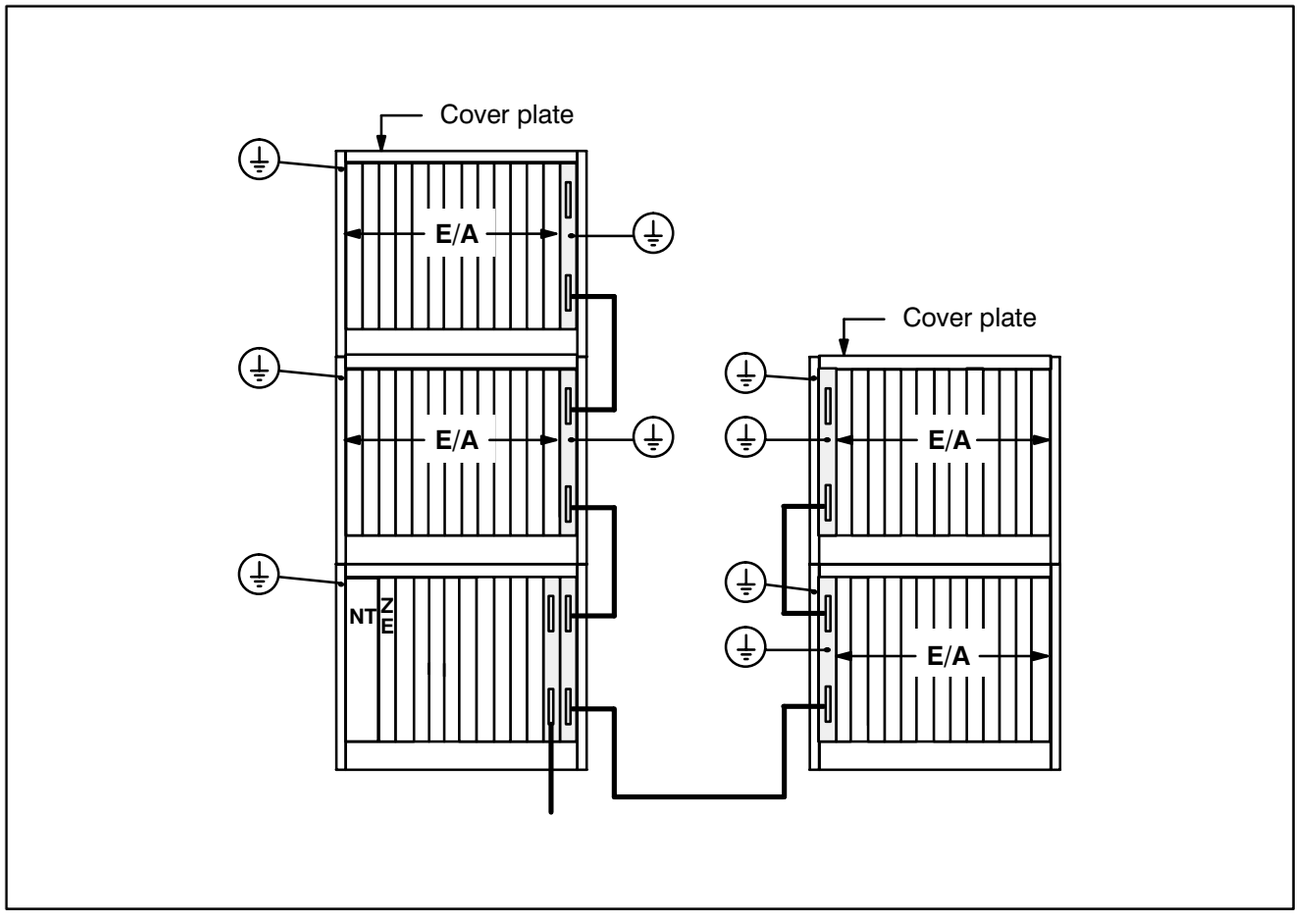


Fig. 2–17 Wiring Diagram (Example)

2.2.4 Power Consumption with Parallel Expansion

The internal operating voltages for both input and output modules of all expansion types are supplied by an NT300 or NT301 Power Supply Unit, located in the basic unit.

- The NT300 supplies a maximum current of 1.8 A at 12 V.
- The NT301 supplies a maximum current of 3.0 A at 12 V.

These values should not be exceeded.

With intelligent system modules, the more powerful NT301 Power Supply should be used.

If the power consumption with parallel expansion exceeds the maximum current which can be supplied by the power supply unit, the system configuration should be implemented using distributed expansion.

When calculating the maximum overall current consumption of a system, the following individual values should be taken as a basis:

- Digital Input Modules : 0.5 mA per activated input
- Digital Output Modules : 2.0 mA per activated output
- Analog Input Modules : 150.0 mA per module used
- Analog Output Modules : 80.0 mA per module used
- Positioning Unit PU401 : 30.0 mA per module used
- Central Processing Unit ZE300 : 100.0 mA
- Central Processing Unit ZE301 : 100.0 mA
- Distributed Expansion AG/DZ : 40.0 mA
- Parallel Expansion AG/P : 85.0 mA per module used
- Central Expansion AG/Z : 10.0 mA per module used
- External Counter Module EZ50 : 100.0 mA
- Interrupt Module IE 24V— : 30.0 mA
- Computer Interface Module R301 : 100.0 mA

2.2.5 Terminals and Connections

The CL300 Controller is supplied with a line voltage of 220 V/230 V or 110 V/115 V AC at a line frequency of 47 to 63 Hz. The voltage is switch—selectable using switch S1 on the power supply unit (see paragraph 4.1.4).

All electrical connections of the CL300 inputs and outputs are made using plug—in terminals. Each plug—in terminal (including the power supply connection) can accommodate a wire having a cross—section of up to 1,5 mm^2.

The link between basic unit and expansion unit or between several expansion units as well as the connections to computer interfaces, to programming units, to expansion modules, etc., are made via preformed system cables with system connectors on both ends.

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3 Operation

3.1 Program Execution

The CL300 user program can be executed in cyclic, interrupt—controlled and time—controlled manner.

Detailed descriptions of individual program execution steps are given in Chapter 5 “Software Description”.

3.2 Organizational Structure

The user program is stored in the CL300 RAM, EPROM or EEPROM.

The program memory is a plug—in module in the central processing unit.

The individual CL300 components communicate via 2 bus systems:

- System Bus
- Peripheral Bus

The system bus services the R301 Computer Interface Modules and other intelligent system modules.

The peripheral bus is the real controller bus for data transfer between peripheral modules (input/output modules, intelligent peripheral modules) and the central processing unit.

The central processing unit is organized in bits and words. It has two separate processors for high—speed bit and word processing. The instructions in the user program and the signal states of the input images contained in the user program are read,processed, and executed by the central processing unit which subsequently drives the respective outputs. Following each program end EP, the state of the inputs/outputs in the process image is updated. For fast acquisition of important signals, the central processing units can directly access the input/output signals. This operation can be user—determined by a special interface command type.

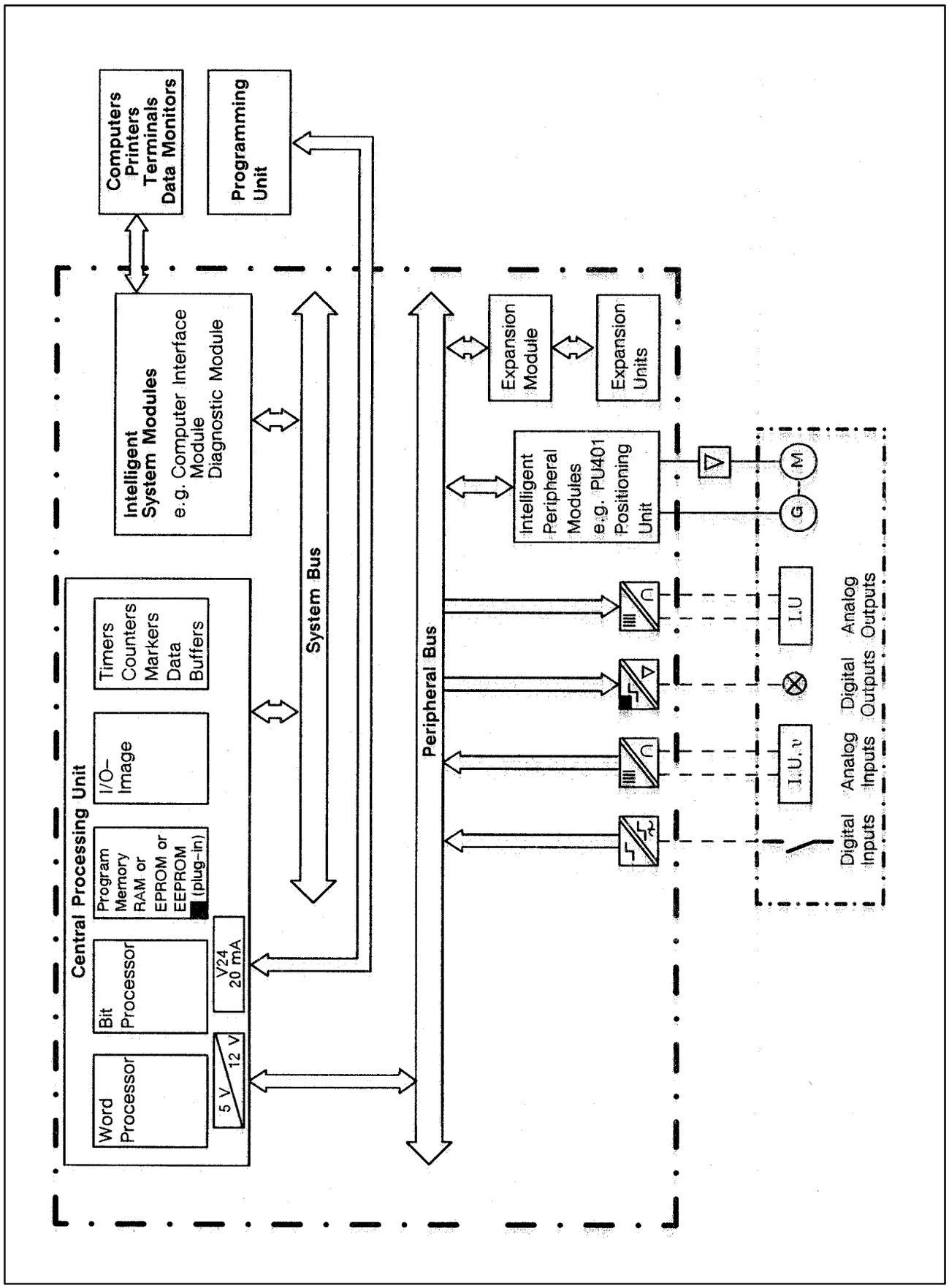

Fig. 3–1 Organizational Structure

3.3 Operating Modes

The CL300 can operate in the RUN and STOP modes, which can be set on the ZE300/301 central processing unit.

The start—up performance of the CL300 after power—on or from the stop state can be determined in the OM7 or OM8 Organizational Modules provided for that purpose.

3.3.1 RUN

In RUN mode the following sequence is performed:

- The user program is executed in cyclic, interrupt— or time—controlled manner.
- The timers started in the program time out.
- The inputs/outputs are enabled.

3.3.2 STOP

In STOP mode the following sequence is performed:

- The user program is not executed.
- With the use of a buffer battery and remanency switched on, the actual values of the remanent timers and counters, which were present prior to the stop state and the logic state of the remanent markers are maintained.
- The non−remanent operands (timers, counters, and markers) are assigned the logic state “0”.
- The outputs are assigned logic “0”.

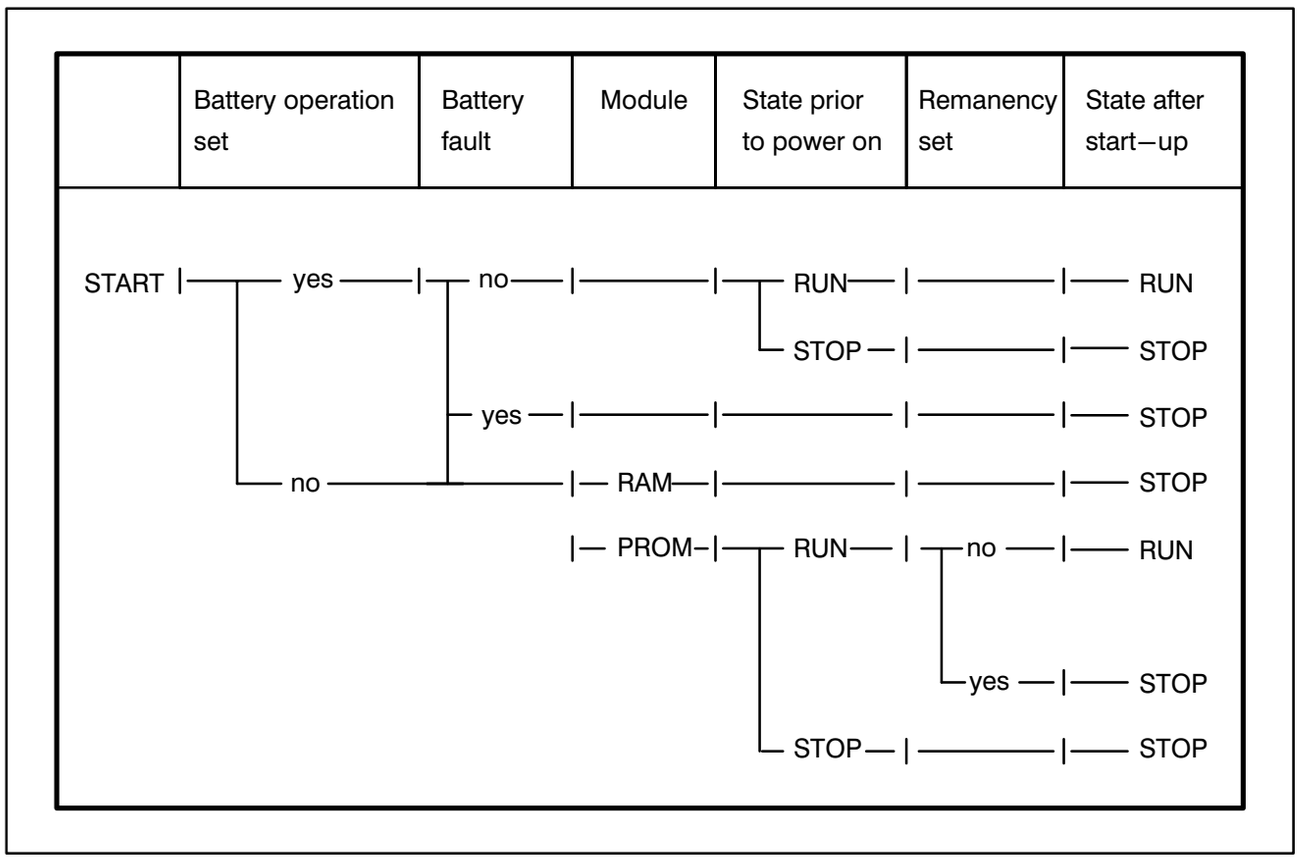

Fig. 3−2 Performance of the CL300

Process Image

The states of the inputs/outputs is reflected in the process image which is updated following each cycle. When the input/output operands are entered with interface identifiers II/IO, direct peripheral operations can by−pass the process image.

The process image is updated.

Direct addressing of the inputs/outputs is effected in byte—by—byte manner.

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List of Illustrations

4 System Modules

4.1 Power Supply Units NT300/301

Two different power supply units, NT300 and NT301, are used to provide the internal supply voltage for the CL300 controller.

- The NT300 Power Supply Unit is designed for use in the GG300/300–K Basic Unit operated without intelligent additional modules, and therefore consuming less power.

- The NT301 Power Supply Unit can be used in both the GG300/300–K and the GG301/301–K Basic Units. This unit is designed for maximum power requirements, i. e. when using intelligent system modules oder expansion units. The power consumption (12 V) of the individual modules has to be calculated.

4.1.1 Function

The Power Supply Units NT300 or NT301, respectively, occupy slots 1 and 2 of a card cage and can be supplied with input voltages of 115 V AC or 230 V AC at a line frequency of 47 to 63 Hz.

The desired input voltage can be selected using the selector switch S1 on the NT300 Power Supply Unit (see paragraph 4.1.4).

Input voltage selection is not necessary with the NT301 because the NT301 auto−ranges to the respective input voltage.

The power supply unit generates the following operating voltages for the CL300:

- +5 V for the logic circuits
- +12 V for the peripheral bus
- +12 V isolated for the interface
- ±3.4 V for the program memory module

The power supply unit performs the following monitoring functions:

- Monitoring of the input voltage for undervoltage
- Monitoring of the +5 V and the +12 V for overvoltage and undervoltage
- Monitoring of the temperature for 70 °C +10 % max.

If one of these monitoring functions trips, the power supply is deactivated and all controller outputs are reset to zero.

4.1.2 Operation

The power supply unit communicates with the ZE300/301 central processing unit via a part of the system bus.

The central processing unit receives signals, such as:

- Preventive battery fault indication
- Battery fault
- Power failure

The buffer battery integrated in the power supply unit provides a central supply of the CL300 memories which are to be buffered (retaining of remanent timers, counters, and markers) in case of a power failure.

The power supply unit is supplied without buffer battery which must be ordered separately. Buffer battery operation is set using jumper J2 (see paragraph 4.1.4).

If the temperature exceeds 70 °C, the controller is deactivated.

When the RAM module or the central processing unit is removed when the system is off, the power supply unit recognizes the missing module and signals a battery fault. In this case the ZE does not start.

Floating Contact

The power supply unit has a floating contact which opens in the case of a power failure of the 5 V/12 V voltages or of a central processing unit message “ZE in STOP”. The floating contact can be used according to the requirements of the specific installation.

The signal “ZE in STOP” can be interrupted on the NT by Jumper J1 (see 4.1.4 “Settings”), causing the floating contact to open only in case of power failure.

After switching on the power supply unit, the contact remains open until the power supply is stable. This prevents the contact from switching before the signal “ZE in STOP” has reached a defined state.

☞ **Note** ☜

The power supply unit does not supply the 24 V load voltage for transducers and actuators. This will require an additional external power supply.

4.1.3 Front Panel

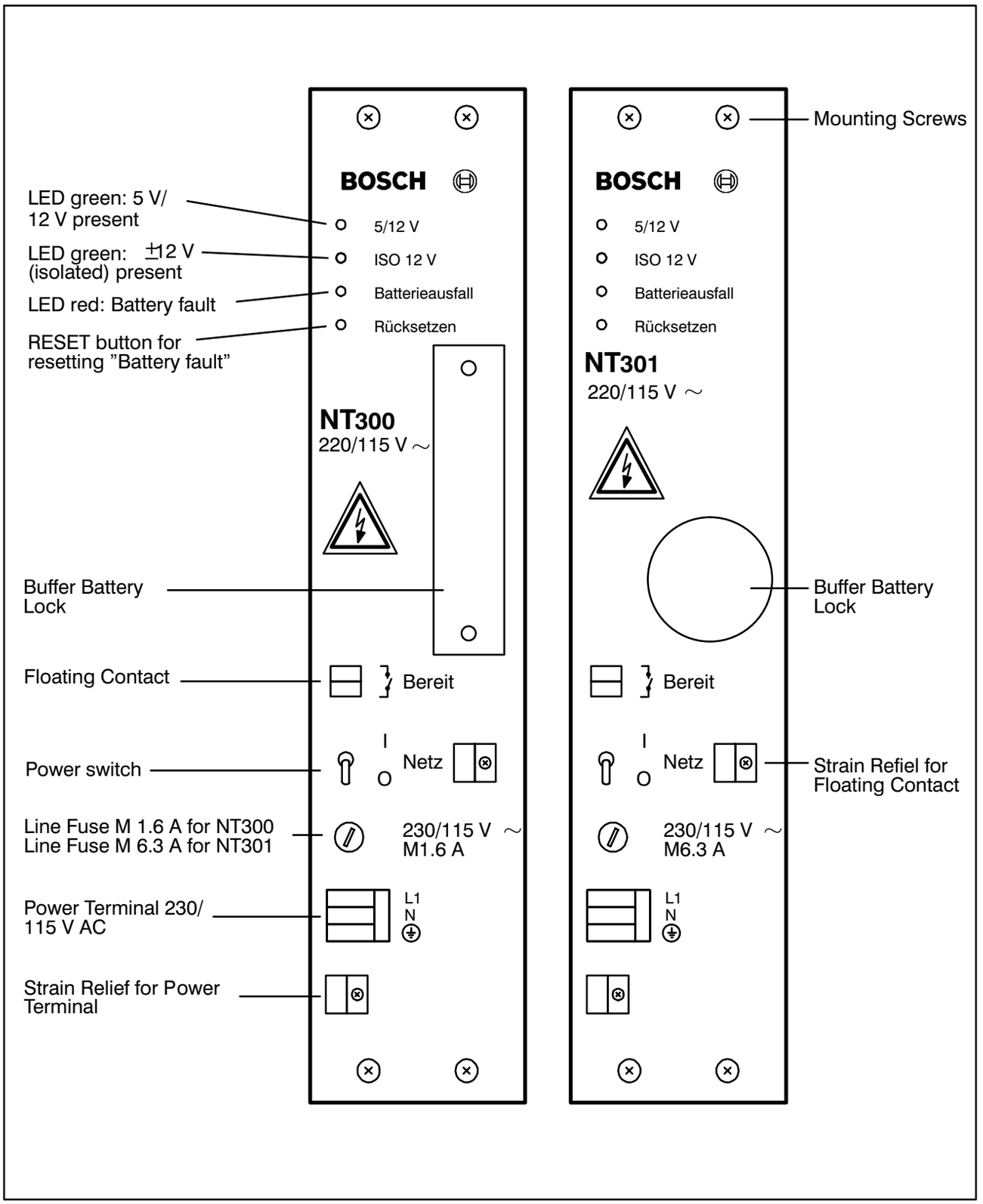


Fig. 4–1 Power Supply Units NT300/301

4.1.4 Settings

Switch S1 for setting the voltages of 115 or 230 V AC, respectively, on the NT300.

Voltage switch−over is performed automatically on the NT301.

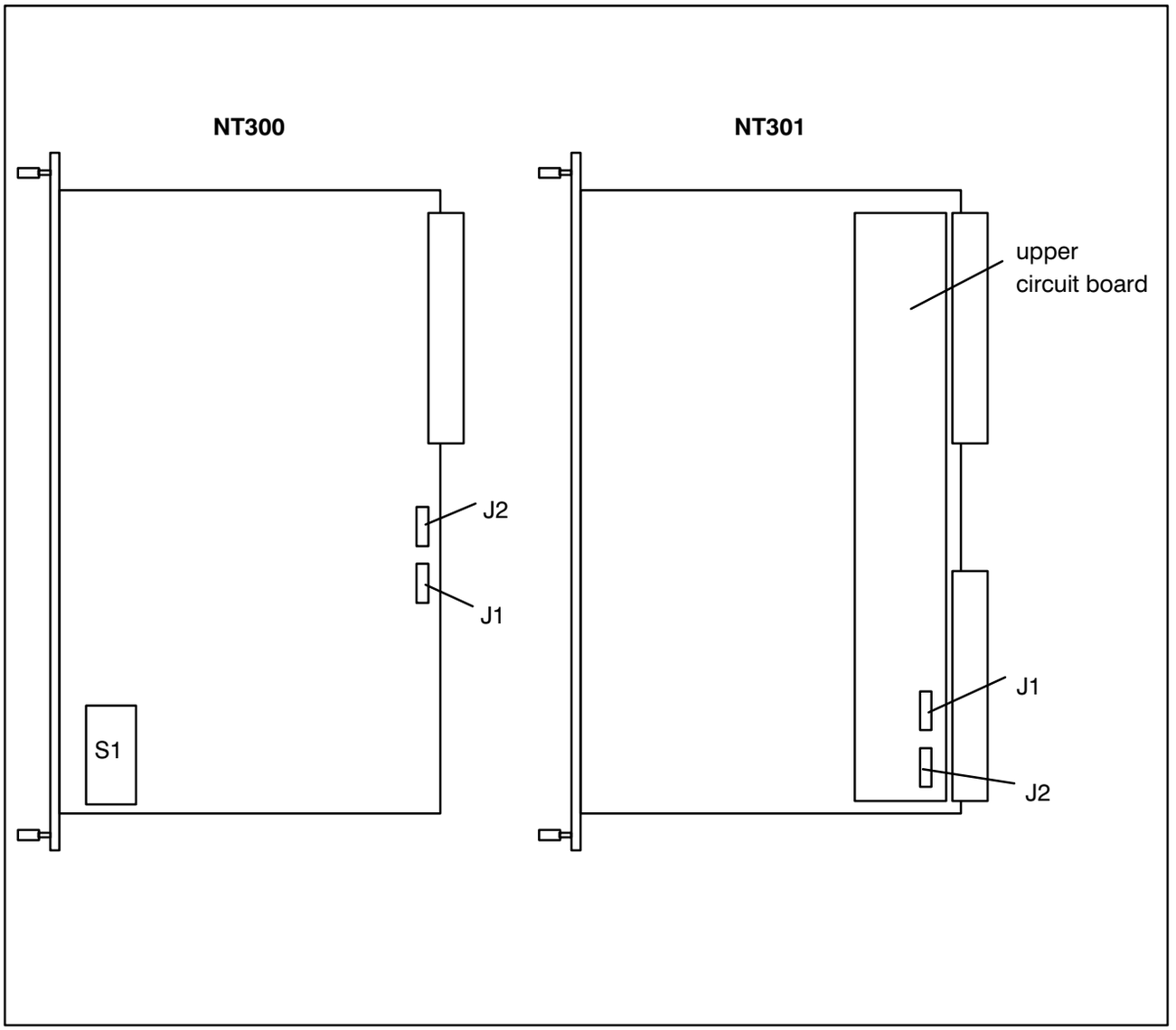


Fig. 4−2 Settings NT300/301

J1 for Floating Contact

- Position 1−2 for ZE in STOP **and** Power Failure
- Position 2−3 for Power Failure

J2 for Buffer Battery

- Position 1—2 for Battery Out of Service
- Position 2—3 for Battery Operation

Factory Settings

- Voltage switch in “230 V” position
- Jumper J1 in position 1—2
- Jumper J2 in position 2—3
- Battery not supplied
- 2—pin socket strip for floating contact, assembled

4.1.5 Buffer Battery Installation and Replacement

Caution

If the buffer battery has been used for buffering remanent timers, counters and markers, it must be replaced when the CL300 is switched ON to retain buffered the remanent timers, counters and markers.

Installation in the NT300

★ Unscrew the 2 Phillips screws and take out battery box (see Fig. 4−3).

★ Insert buffer battery (2). (Observe the polarity!)

★ Insert battery box and fasten Phillips screws.

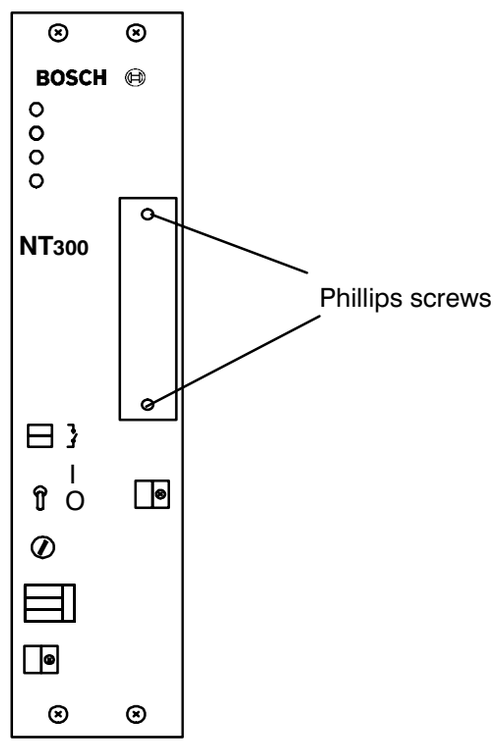


Fig. 4−3 Buffer Battery NT300

Replacement in the NT300

★ Make sure that the CL300 is switched **ON**

★ Unscrew the 2 Phillips screws and take out battery box (see Fig. 4–3).

★ Remove battery.

★ Insert new buffer battery. (Observe the polarity!)

★ Insert battery box and Phillips screws.

Installation in the NT301

★ Unscrew buffer battery cap (1), see Fig. 4–4.

★ Insert buffer battery (2). (Observe the polarity!)

★ Screw on buffer battery cap (1).

Replacement in the NT301

★ Unscrew buffer battery cap (1), see Fig. 4–4.

★ Press in buffer battery (2) with your thumb and quickly release so that the battery snaps out.

★ Insert new buffer battery. (Observe the polarity!)

★ Screw on buffer battery cap (1).

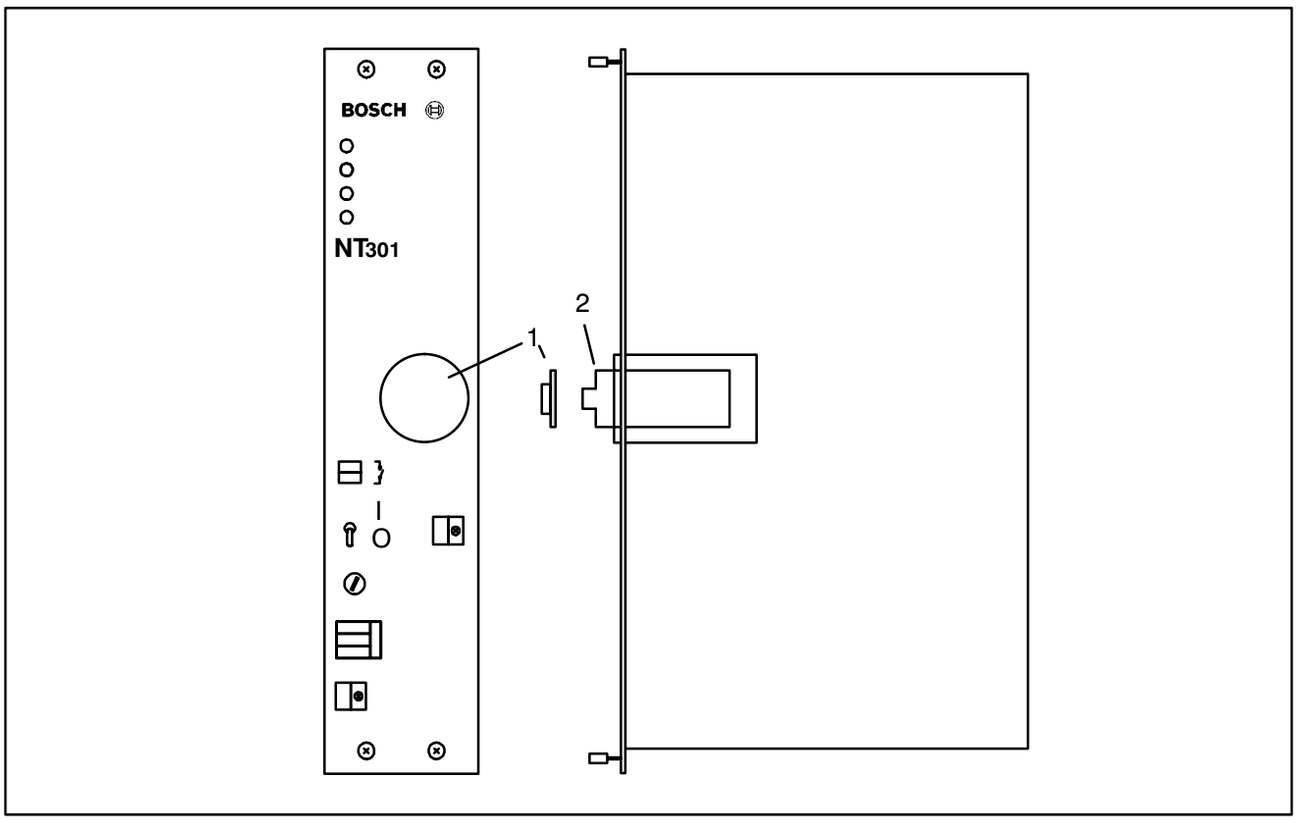


Fig. 4–4 Buffer Battery NT301

4.1.6 Specifications

	NT300	NT301
Input Voltage	220 V −15 % 110 V −15 %	230 V +10 % 115 V +10 %
Frequency	47−63 Hz	47−63 Hz
Line Voltage	>187 V or >93 V, resp.	
Line Fuse	M 1.6 A 230 V	M 6.3 A 230 V
Internal Supply Voltage	+5 V for logic circuits +12 V for peripheral bus ±12 V (isolated for interfaces)	
Internal Current Supply	+5 V 4 A +12 V 1.8 A isolated +12 V 0.5 A isolated −12 V −0.1 A	+5 V 8 A +12 V 3 A isolated +12 V 1 A isolated −12 V −0.5 A
Overvoltage Detection	+5 V at +6.0 V +12 V at +13.5 V isolated +12 V none	
Undervoltage Detection	+5 V at +4.6 V +12 V at +10.0 V isolated +12 V none	
Buffer Battery		
Battery Voltage	+3.4 V are derived from 5 V internal voltage	
Battery Life	1.75 Ah | 5.2 Ah	
Buffer Time	1 year	
Protection of Generated Voltages	All voltages are electronically protected against overvoltages and short−circuits	
Floating Contact		
Max. Switching Voltage	24 V DC	
Current Capacity	≤ 2 A	
Width	2 module width	
Humidity Class	F to DIN 40 040	
Mechanical Stress	Installation in stationary equipment not free from vibration	
Temperature Monitoring	+70°C +10 % −0 %	
Temperature Range		
Operating	55° C without flow of air	
Non−operating	−20 to +70 °C	

4.1.7 Ordering Information

	Order No.
Power Supply Unit NT300	052 001
Power Supply Unit NT301	052 002
Buffer Battery for NT300	914 446
Buffer Battery for NT301	914 447

4.2 Central Processing Units ZE 300/301

The ZE300 is used in the GG300/300–K Basic Unit. The ZE301 can be used both in the GG300/300–K and the GG301/301–K Basic Units. The ZE301 allows the use of intelligent system modules and remote expansion units.

4.2.1 Function

The ZE central processing unit is the heart of the CL300 Controller and has the following functions:

- Reading of input data
- Decoding and processing of the PLC instructions in the user program
- Data output
- Management of the data supplied by intelligent modules
- Management of the addressed timers
- Monitoring of the operations initiated by the user
- Detection of interrupt signals

4.2.2 Configuration

The ZE300 or ZE301 Central Processing Unit occupies slot 3 of the basic unit.

Power is supplied by the NT300 or NT301 Power Supply Unit.

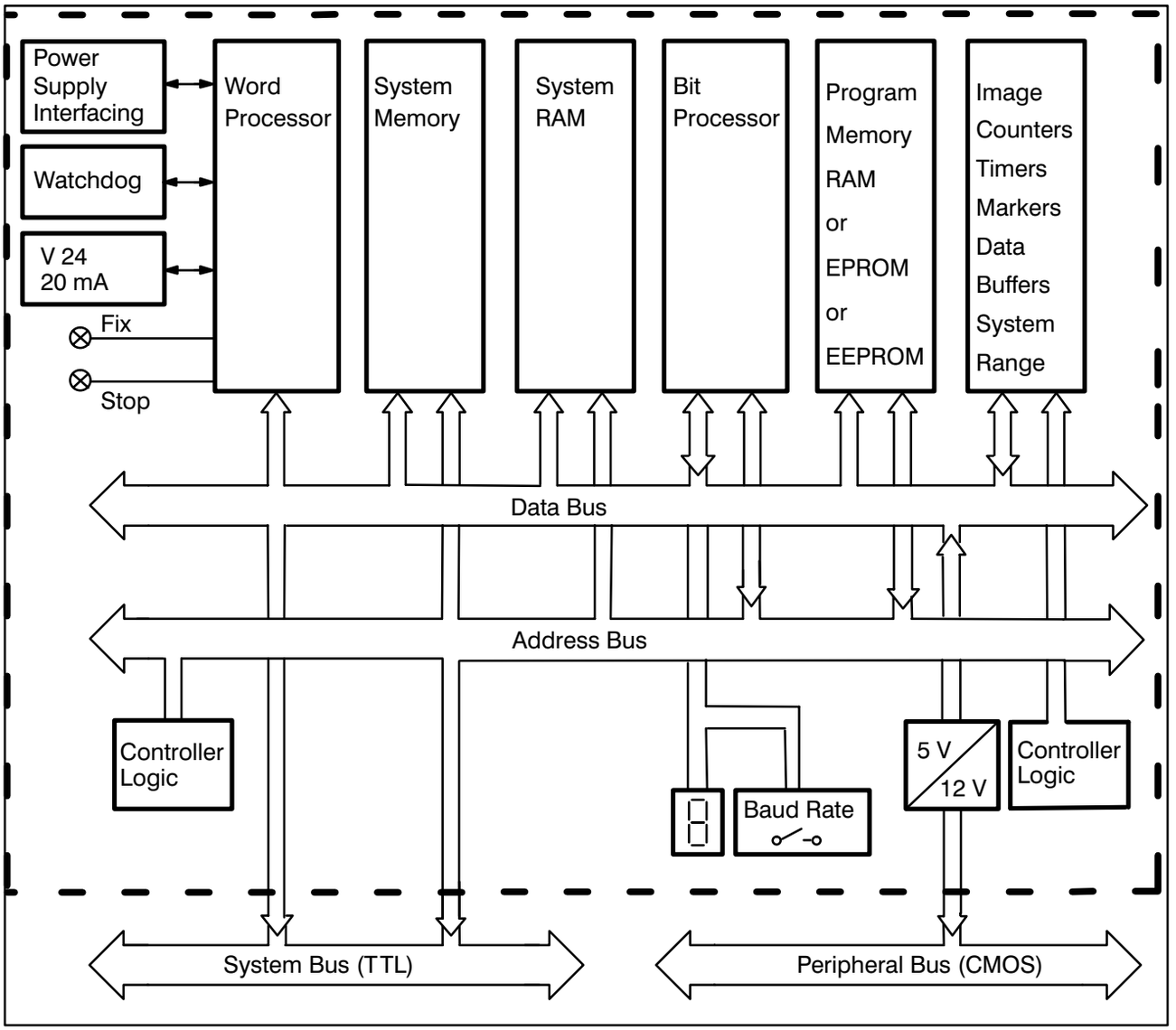


Fig. 4–5 ZE300/301

The ZE300/301 includes:

- Two processors
  - Bit processor
  - Word processor with registers and 16–bit processing width

- Memory area for
  - Input and output images
  - Markers (Remanency selectable)
  - Timers (Remanency selectable)
  - Counters (Remanency selectable)
  - Data buffers, remanent

  With remanency switched on in the ZE300/301, the remanent memory area for markers, timers and counters is buffered by the battery used in the NT300/301 in case of power failure.

- Slots for the following program memory modules:
  - RAM memory: 16 Kwords or 32 Kwords or
  - EPROM memory: 16 Kwords or 32 Kwords or
  - EEPROM memory: 16 Kwords

- Peripheral bus adapter for the system bus

- WATCHDOG monitoring of cycle time (appr. 1.6 sec) to assure proper operating program run. When the cycle time is exceeded, one bit is set in the special marker area.

- 25−pin D connector for V.24/20 mA interface, electrically isolated by optocouplers, for connection of the programming unit.

The 7−segment display on the ZE gives error and status information. Error messages are given in coded form and lead to a stop of the ZE.

Displayed Code	Possible Error Messages
8	OM 1 or DM not found
9	Processing error
A	Allocation list conflict
b	Battery failure
C	Module error
D	RAM image error
E	RAM operating error
F	Checksum error (Operating program)
	Possible Status Errors
0	Controlled SW−stop (e.g. via computer interface module)
1	Stop request by PLC command “HLT”
2	Outputs inhibited via PG
3	Single state, single step

☞ **Note** ☜

Please note the description of the 7−segment display on the info card!

For fast fault isolation, status information is collected in an interrupt stack to permit reconstruction of the program flow.

The following information can be requested using the PG4 Programming Unit.

- Absolute controller address
- Register contents of A, B, and C
- Status information
- Data module base address
- Module stack pointer
- PLC command
- I/O state counter
- Number of interrupts per cycle
- Cycle time counter
- Program flow stack

In this stack, program flags are collected by means of the PLC command "* n" (n = 0—31), which reflect the program flow prior to the abortion. The flags are set by the user at arbitrary points of the program and are stored in the flow stack.

The ZE provides the controller program with special markers for various status messages which can be evaluated according to the user's requirements.

Marker	**Event**
SM28.0—28.7	Error Byte
SM28.0	Module Stack Error
SM28.1	Opcode Error
SM28.2	Addressing Error
SM28.3	Module Management Error
SM28.4	Controller Addressing Error
SM28.5	Parameter Error
SM28.6	C/T Set—point Error
SM28.7	Cycle Time Error
SM29.0—29.7	Cycle Time Counter (x 10 ms)
SM30.0—30.7	Max. Cycle Time
SM31.0	Initializing Pulse
SM31.1	Preventive Battery Fault Indication

SM31.2	Flashing Indicator approx. 2 Hz
SM31.3	Carry
SM31.4	Forcing Marker
SM31.5	Overflow
SM31.6	Negative
SM31.7	Zero

All inputs/outputs can be forced, i. e. they can be overlaid by an arbitrary forcing mask. This forcing mask is entered by the programming unit. When forcing signals, the special marker SM 31.4 is set. Using the button “Reset Fix”, the forcing mask and the special marker are completely cleared.

4.2.3 Settings

V.24/20 mA Interface

The serial data signal is transferred to the 25−pin D connector as V.24 and 20 mA signals.

With the JP2 (see Fig. 4−6) jumper in position A, data transfer is made without a control signal.

With the JP2 (see Fig. 4−6) jumper in position B, data transfer is made with a control signal.

The ZE is supplied with the basic setting in position ”B”.

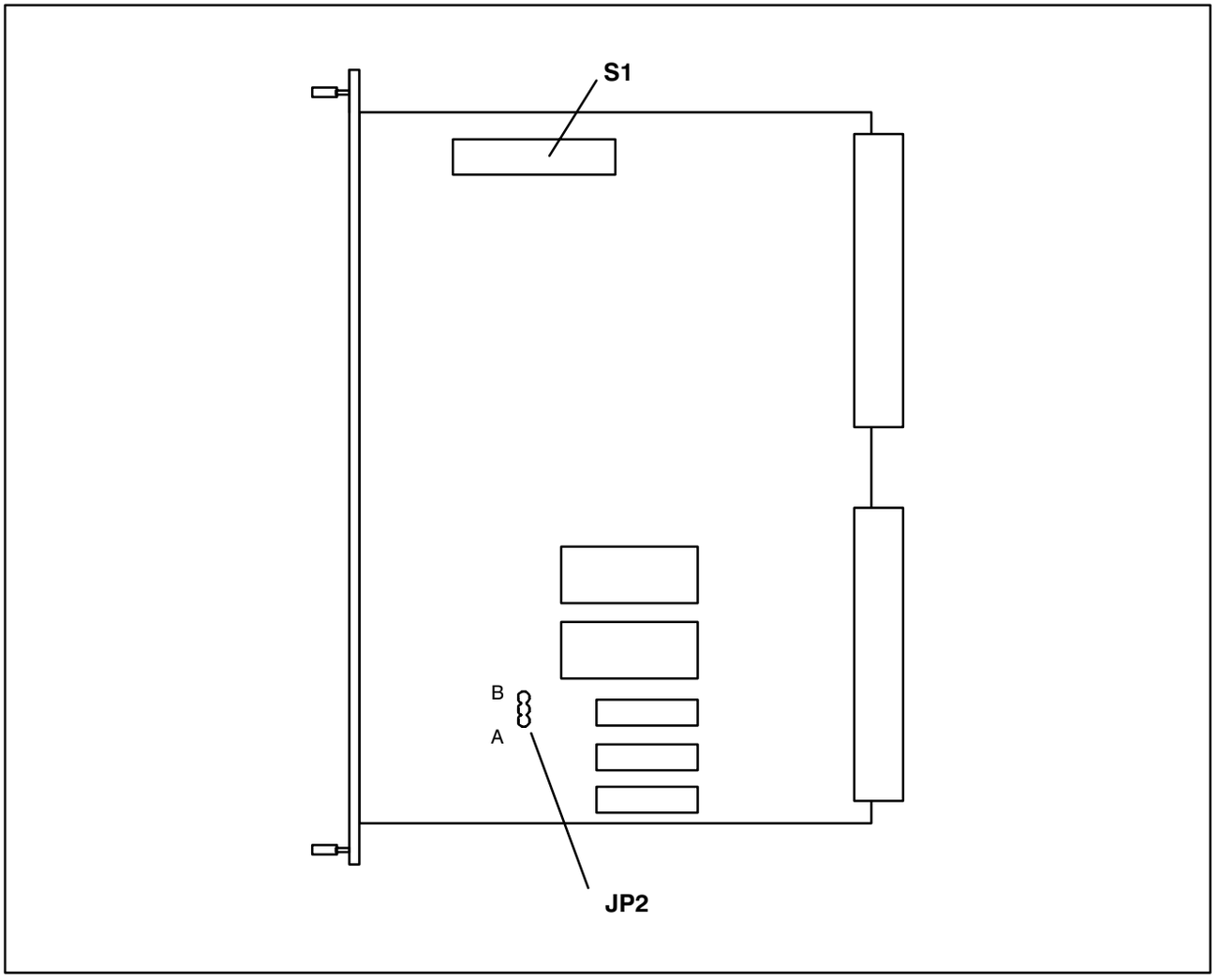


Fig. 4−6 ZE300/301 Settings

Setting of the Baud Rate

The baud rate is set to the values in the table below, using the 8−segment DIP switch S1 (see Fig. 4−6).

Transfer Rate (Baud)	DIP Switch Positions Switch 1	Switch 2	Switch 3
110	OFF	OFF	OFF
300	ON	OFF	OFF
600	OFF	ON	OFF
1200	ON	ON	OFF
2400	OFF	OFF	ON
4800	ON	OFF	ON
9600	OFF	ON	ON
19200	ON	ON	ON

Basic settings

The ZE is supplied with the following basic settings:

- 9600 baud transfer rate
- Asynchronous
- 1 start bit
- 8 data bits
- Even parity
- 1 stop bit
- JP2 in position “B” (with control signals)

4.2.4 Front Panel

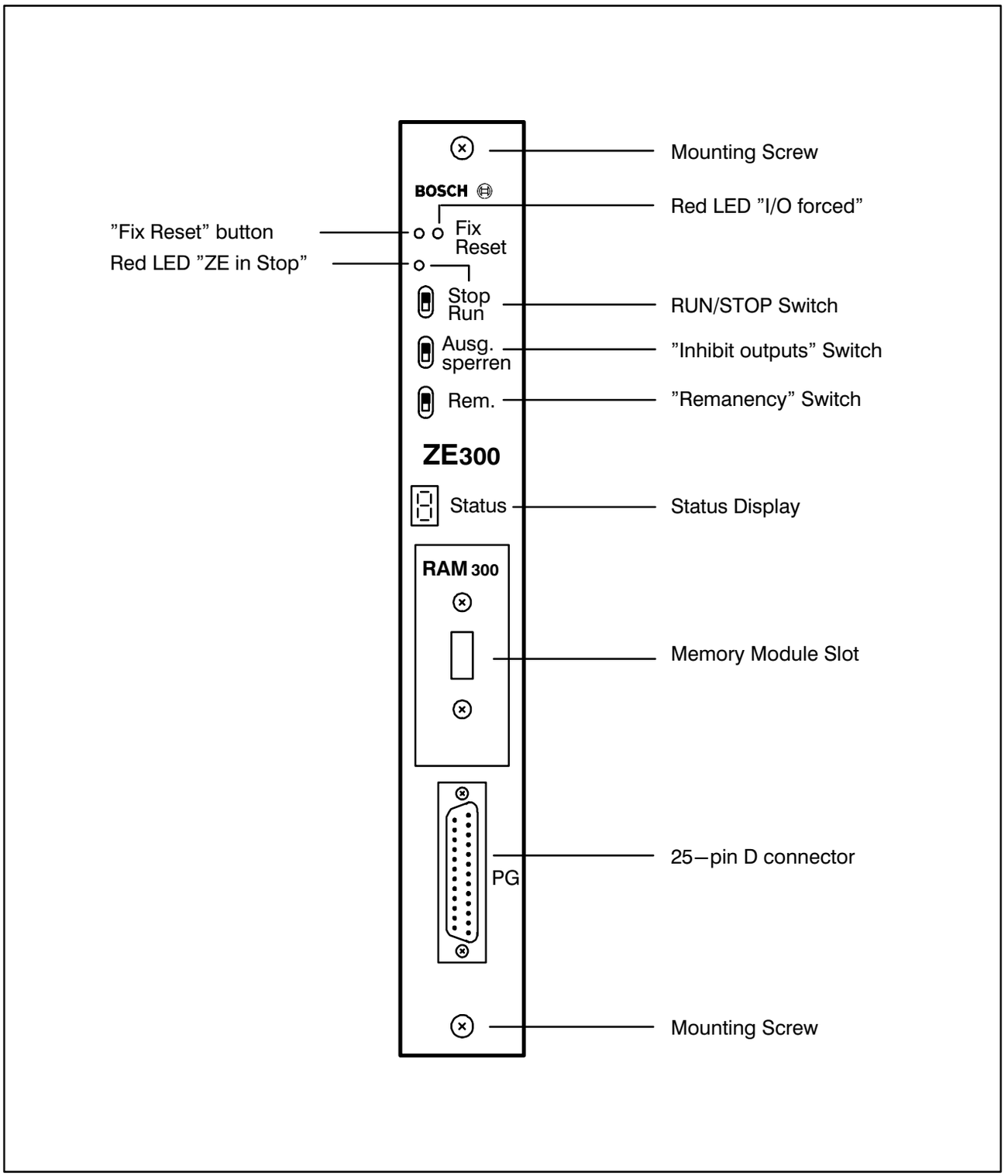


Fig. 4−7 Central Processing Units ZE300/301

Red LED ”I/O forced	LED lights when a signal of any kind is forced.
”Fix Reset”	“Fix Reset” button to delete all active forcings
Red LED “ZE in STOP”	When the LED lights, program execution is stopped and all outputs are reset to zero.
RUN/STOP Switch	• In RUN mode the program is executed. • In STOP mode the program is interrupted.
“Inhibit outputs” Switch	Outputs are reset to zero.
“Remanency” Switch	When remanency is activated, the remanent markers,timers and counters are buffered by the buffer battery in case of power failure.
25−pin D connector	25−pin D connector to accommodatethe combined V.24/20 mA interface for the connection of a programming unit.

4.2.5 Specifications

Supply Voltage	+5 V, ±5 %, 3050 mA max. (with EEPROM)
	+5 V buffered, ±5 %, 220 mA max. (operating)
	+12 V, ±5 %, 100 mA max. (without I/O card)
	isolated +12 V, ±5 %, 250 mA max.
	isolated −12 V, ±5 %, 25 mA max.
Stand−by Power Consumption	60 µA max. at 25 °C
Stand−by Voltage	> 2.5 V
Cycle Time	2.2 µs per bit processing command
	2.2−90 µs per word processing command
	60−150 µs per module processing command
	16 ms/K mean processing time with 75 % bit processing, 20 % word processing and 5 % module processing
Watchdog	T max. 1.6 s
Mechanical Stress	Installation in stationary equipment, not free from vibration
Ambient Temperature	0 °C to +55 °C
Non−operating Temperature	−20 °C to +70 °C

Humidity Class	F to DIN 40 040	
Dimensions	Dual Eurocard format	
Inputs	512 with process image (I) I0.0—I63.7	
	or	
	512 directly with process image tracking (II) II0.0—II63.7	
	512 additional inputs (EI) EI0.0—EI63.7	
Outputs	512 with process image (O) O0.0—O63.7	
	or	
	512 directly with process image tracking (IO) IO0.0—IO63.7	
	512 additional outputs (EO) EO0.0—EO63.7	
Marker	2048, M0.0—M255.7	
	Standard definition	M0.0—M127.7 non—remanent
		M128.0—M255.7 remanent
	Selectable Remanency Range in OM7:	M0.0—M255.7
Special Markers	32, SM0.0—SM31.7	
Times	Range	0.01—9990 s
	Increments	0.01 s, 0.1 s, 1.0 s, 10.0 s
	128 internal, T0—T127	
	Standard definition	T0—T63 non—remanent
		T64—T127 remanent

Selectable Remanency Range in OM7: T0—T127

Counters

Range: 0—8191 up/down

128 internal, C0—C127

Standard definition C0—C63 non—remanent

C64—C127 remanent

Selectable Remanency Range in OM7: C0—C127

Data Buffer

512 bytes, remanent DB0—DB511

RAM Buffering

1 year (central battery buffering in the power supply unit)

4.2.6 Ordering Information

	Order No.
Central Processing Unit ZE301	054 633
Central Processing Unit ZE300	052 009
RAM Memory 16 K	052 192
RAM Memory 32 K	056 768
EPROM Memory 16 K	052 190
EPROM Memory 32 K	056 769
EEPROM Memory 16 K	052 753

4.3 Input Modules

Caution

All specifications for input modules are referenced to operation with a fan unit.

4.3.1 Digital Input Modules

Function

The digital input modules are used for converting the external process signals to the internal signal levels.

Configuration

The input modules are available with 16 and 32 channels. For safer operation of the controller system, the DC or AC signals from the process are electrically isolated from the internal logic through the use of optocouplers. Each input has an LED for indication of signal status.

LED off ——> Signal status “0”

LED on ——> Signal status “1”

Specifications

The specifications of input modules are listed in the table below.

Digital Input Modules	see paragraph 4.3.1.1	4.3.1.2	4.3.1.3	4.3.1.4	4.3.1.5
Input Voltage	24 V DC	24 V DC	24 V DC	230 V AC	115 V AC
Number of Inputs	32	16	16	16	16
2–pin	no	no	yes	yes	yes
Frequency Range	–	–	–	47–63 Hz	
Logic ”0” Voltage Range	–3 V ... +6 V			0–65 V	0–35 V
Logic ”1” Voltage Range	+15 V ... +30 V			175–255 V	88–133 V
Input Current	approx. 15 mA			approx. 5.5 mA	approx. 6 mA
Switching Delay ”ON”	approx. 3 ms			5 ms typical	
Switching Delay ”OFF”	approx. 3 ms			25 ms typ.	30 ms typ.
Simultaneity Factor	100 %				
Width	1 module width				
Internal Power Consumption (12 V)	approx. 0.5 mA per activated input				

Fig. 4–8 Specifications of input modules

Connection

All transducers are connected by plug–in terminals. This allows module replacement without removal of the wire connections.

Cable Cross–section: 1.5 mm^2 max.

Current Capacity of 1 Terminal: 6 A max.

☞ **Note** ☜

The input modules require the 0 V connection. No external voltages other than the signal voltage are required.

Permissible Start Addresses

"Possible start addresses" are defined for addressing the input modules, depending on the number of input channels per module.

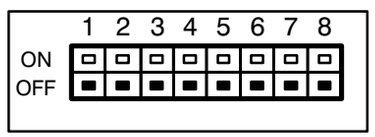
The possible start addresses for the individual 16– and 32–input cards are listed in the table below.

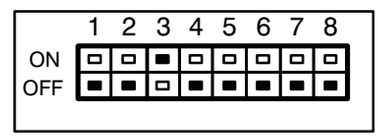
Inputs channels per module	Permissible Start Addresses
16	0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62
32	0 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60

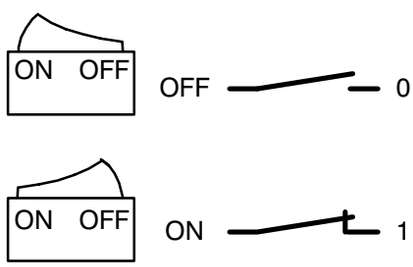
Fig. 4–9 StartAddresses

Addressing Example

The input modules are hardware–addressed by means of a DIL switch on each module.







Switch No.	1	2	3	4	5	6	7	8
Significance	2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7
Example (Address 4.0)	0	0	1	0	0	0	0	0
Example (Address 6.0)	0	1	1	0	0	0	0	0

Fig. 4–10 AddressingExample, DIL switches

Two 24 V DC modules with 16 inputs each shall be allocated the addresses 4.0 through 7.7.

Start address 4.0 is set on the first module using the DIL switch (see above).

Start address 6.0 is set on the second module using the DIL switch.

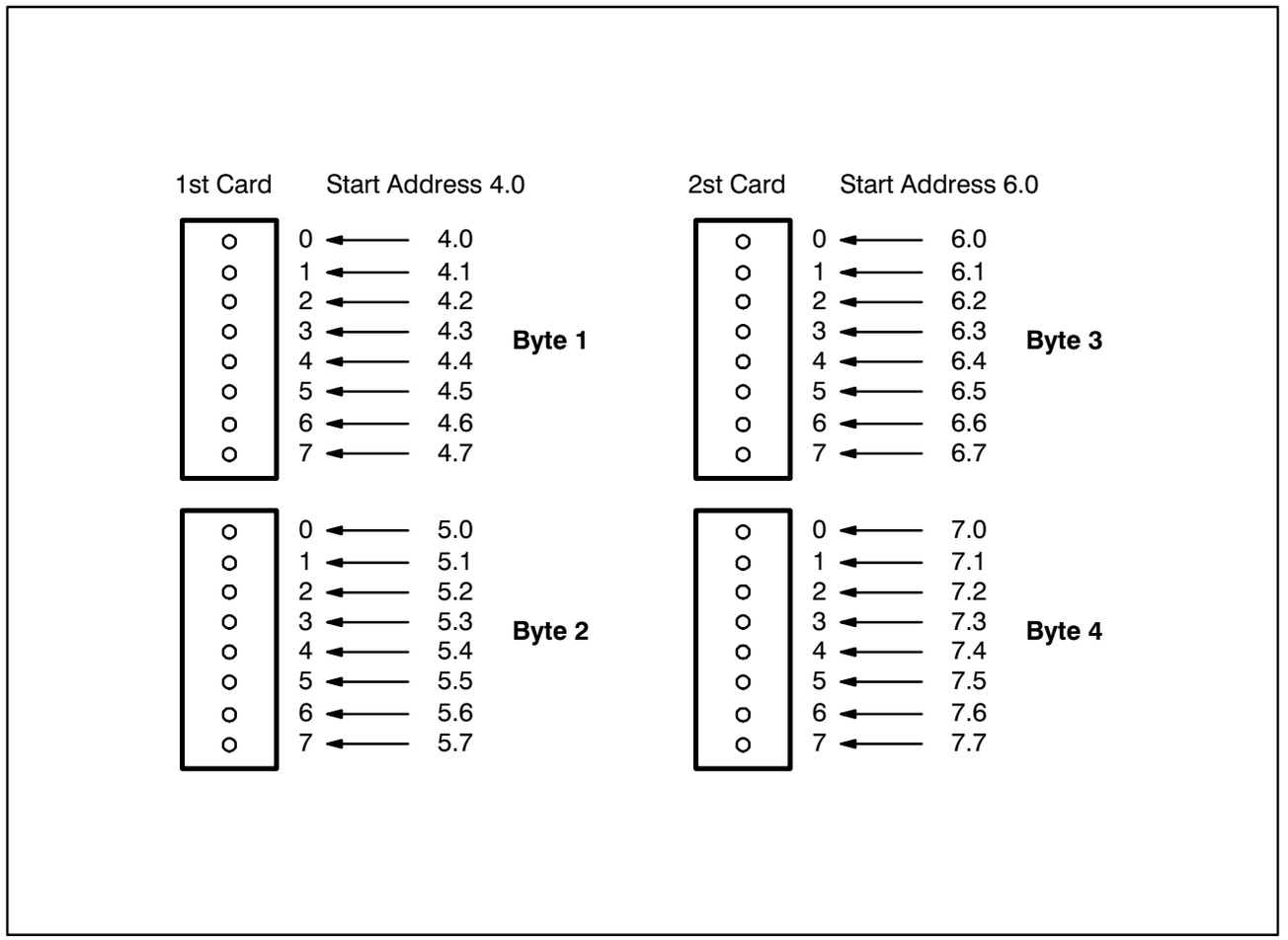


Fig. 4–11 AddressingExample

Ordering Information

Input Module				Order No.
24 V	DC	16 inputs		047 963
24 V	DC	32 inputs		047 961
24 V	DC	16 inputs	2–pin	044 312
230 V	AC	16 inputs	2–pin	046 267
115 V	AC	16 inputs	2–pin	046 427

4.3.1.1 E 24 V DC 32 inputs

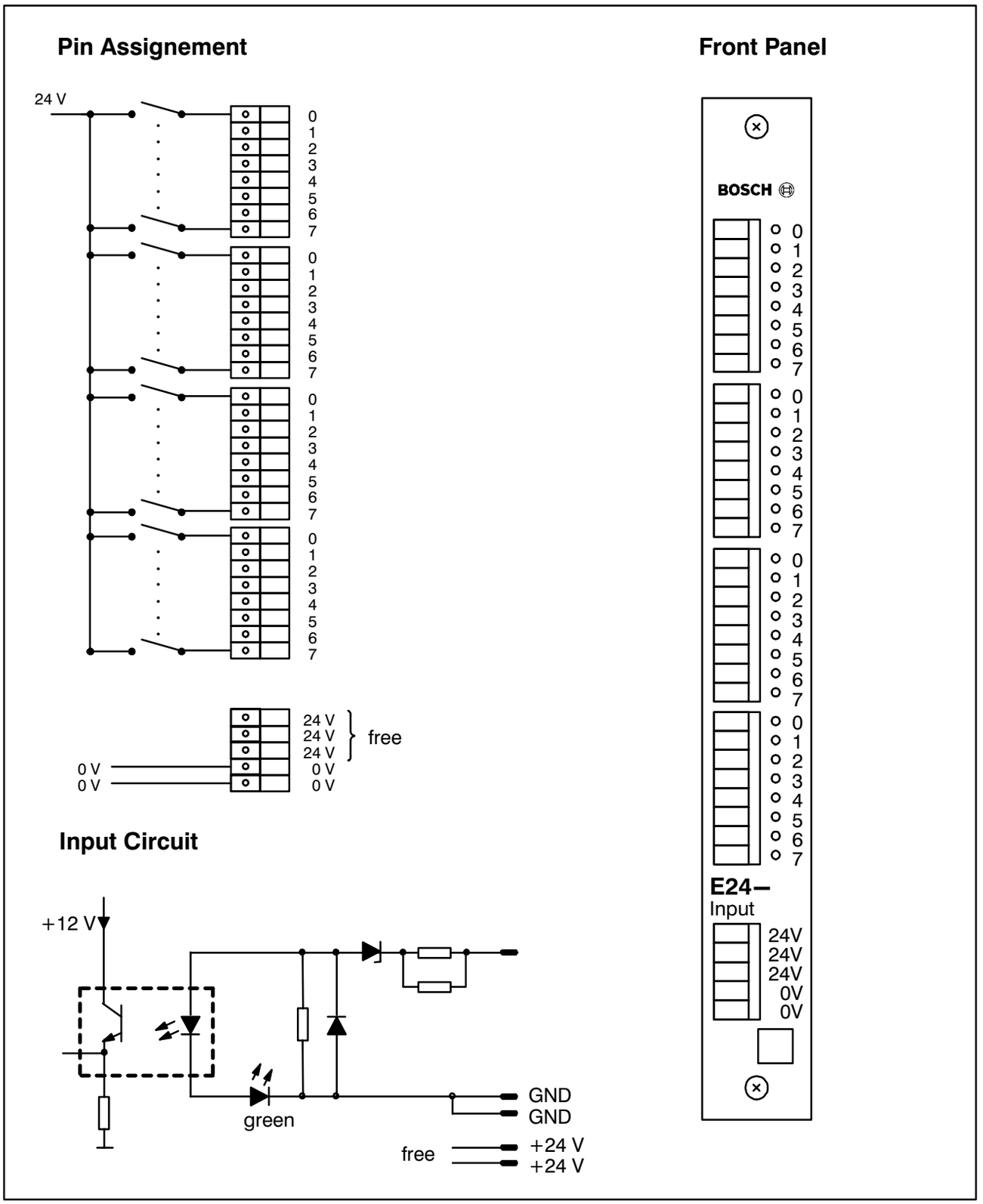


Fig. 4—12 E 24 V DC 32 inputs

4.3.1.2 E 24 V DC 16 inputs

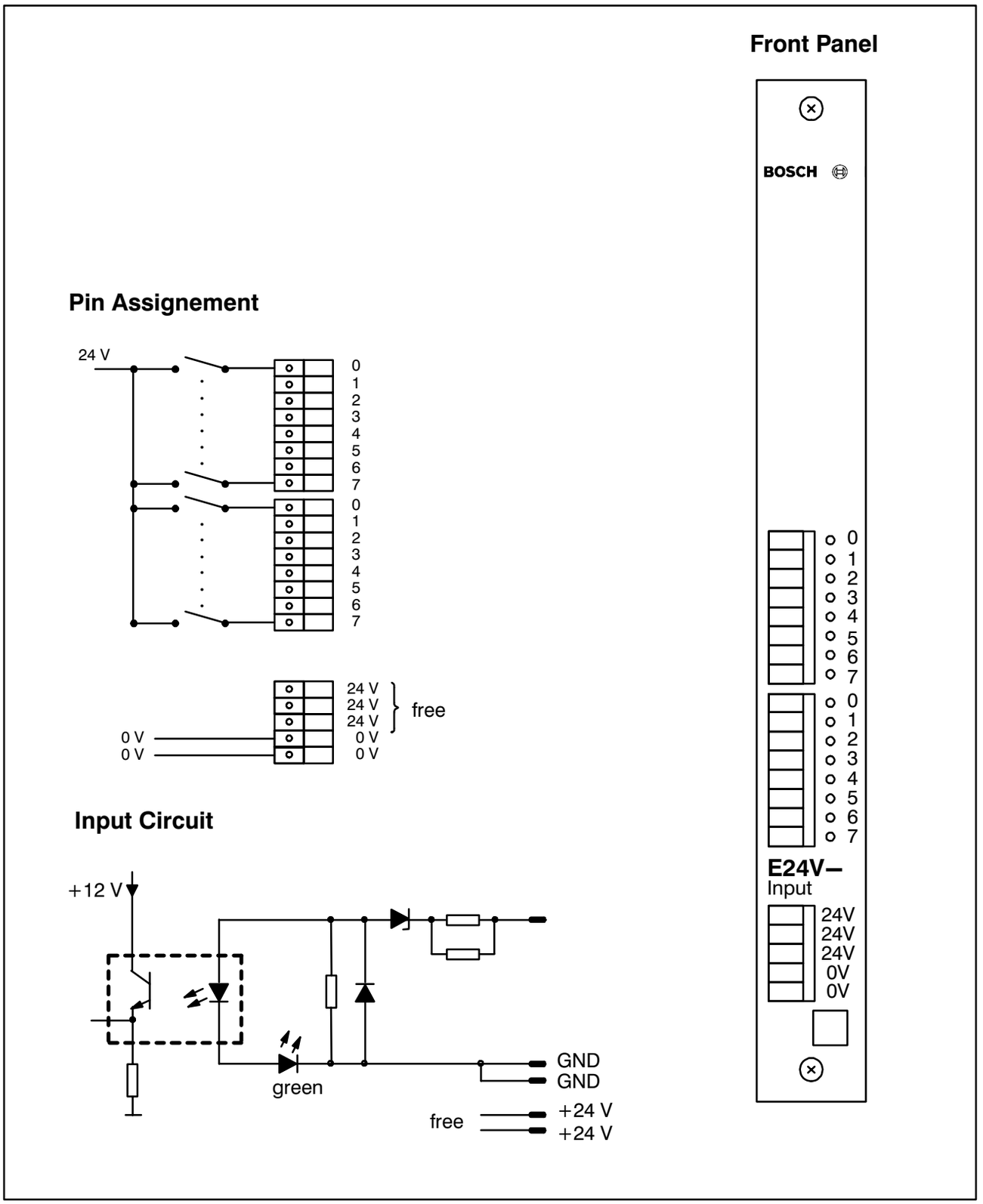


Fig. 4–13 E 24 V DC 16 inputs

4.3.1.3 E 24 V DC 16 inputs 2—pin

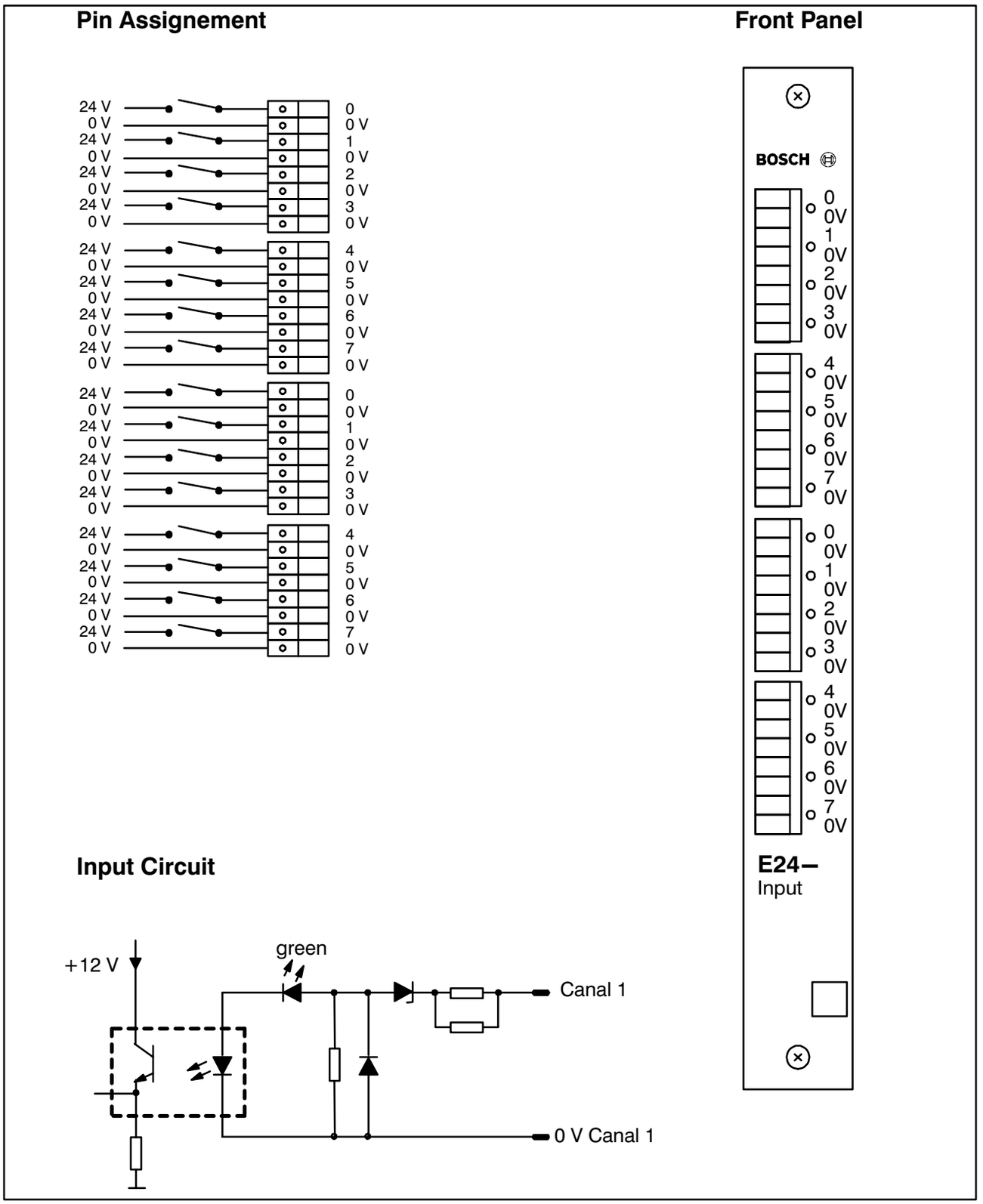
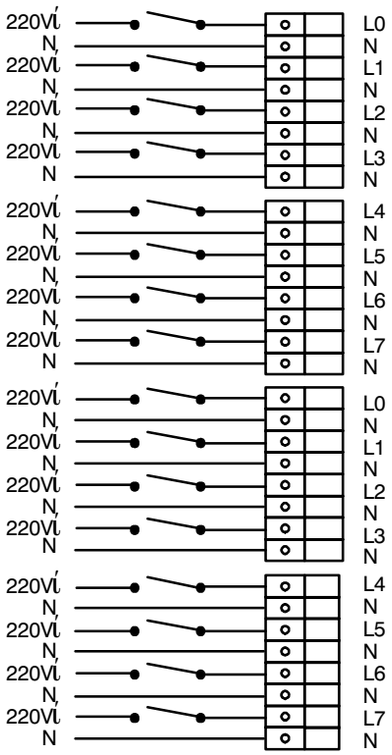


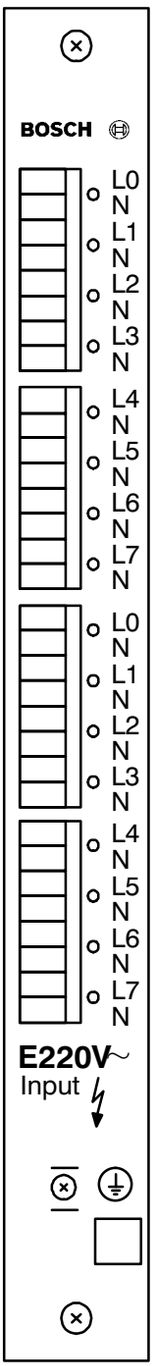
Fig. 4—14 E24 V DC 16 inputs 2—pin

4.3.1.4 E 220 V AC 16 inputs 2—pin

Pin Assignement



Front Panel



Input Circuit

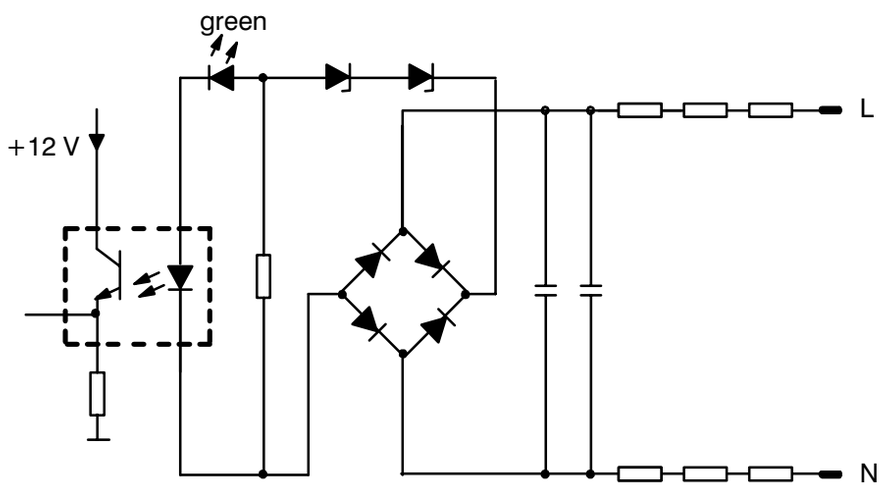


Fig. 4—15 E220 V AC 16 inputs 2—pin

☞ **Note** ☜

When using the E 220 V AC model, a fan unit should be installed in the card cage in the following cases.

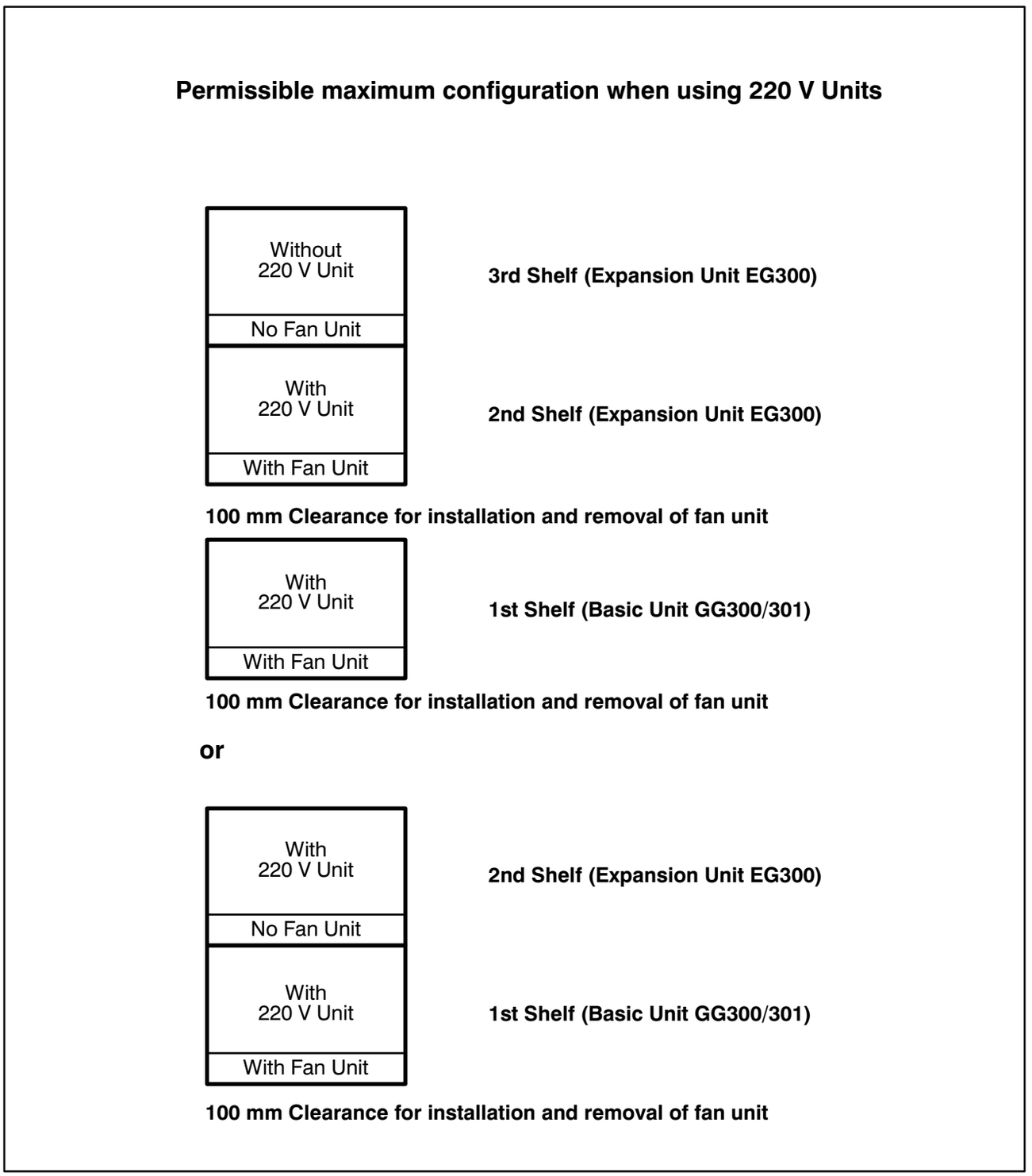
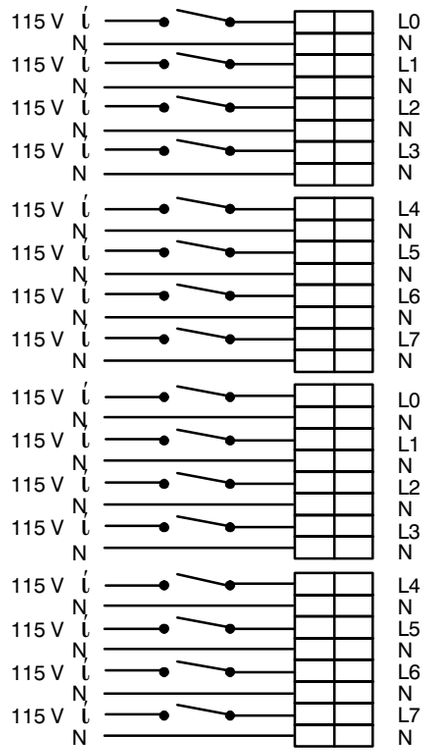


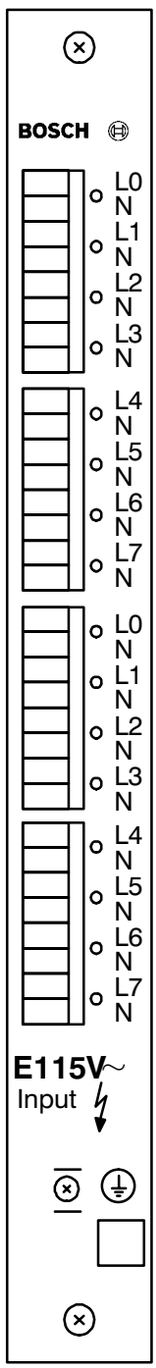
Fig. 4–16 Maximum configuration (220 V units)

4.3.1.5 E 115 V AC 16 inputs 2–pin

Pin Assignement



Front Panel



Input Circuit

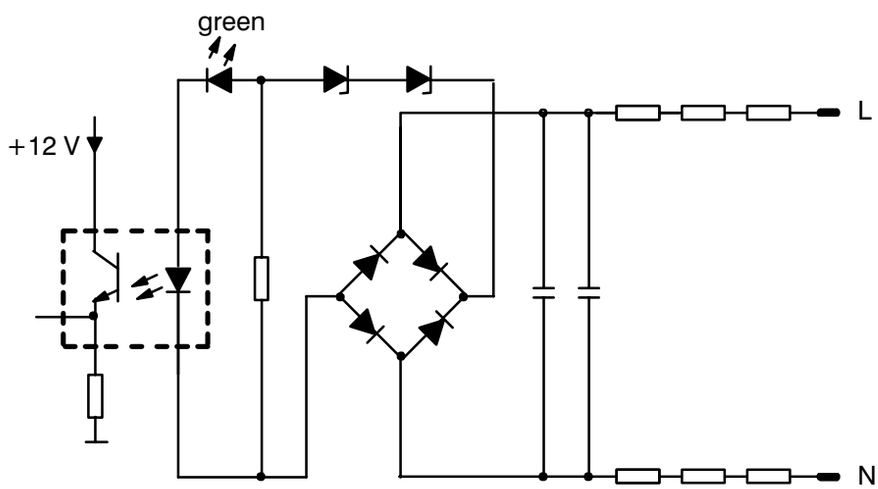


Fig. 4–17 E 115 V AC 16 inputs 2–pin

☞ **Note** ☜

When using the E 115 V AC model, a fan unit should be installed in the card cage in the following cases.

Permissible maximum configuration when using 115 V Units

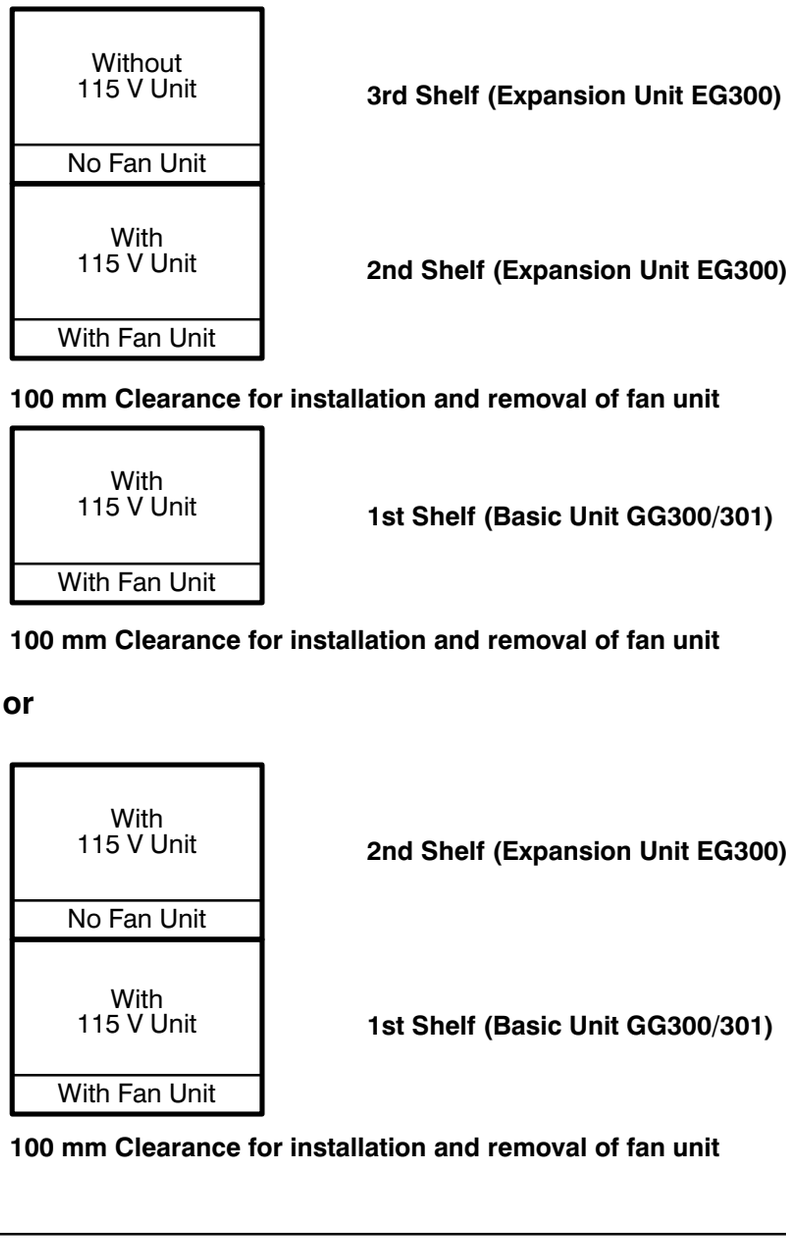


Fig. 4–18 Maximum configuration (115 V units)

4.3.2 High—speed Interruptable Input Module IE 24— 16 Inputs

Function

The IE module can be generally used as:

- 16—channel high—speed input module for the detection of short input signals
- 8—channel high—speed and 8—channel interruptable input module for fast response to input signals with higher priority, according to the equipment requirements. The operating modes can be selected on the module.

The IE module requires an external 24 V DC power supply.

It is not permitted to use the IE module address range for other I/O modules.

Configuration

The inputs are electrically isolated from the internal logic circuits through optocouplers. A comparator circuit provides improved noise immunity at the inputs. Each input is assigned an LED on the front panel.

Operation as a 16—channel High—speed Input Module

The module is seen by the central processing unit like an ordinary 16—channel input module. The high—speed input module is designed to capture the signal states at the time when the card is scanned as well as short signals which may occur during the remaining cycle time. These are temporarily stored on the card when a positive edge transition is present at the inputs, and are automatically reset only when the ZE has read the signals.

When scanning the signal states, the buffer memory is ORed to the current signal state. This ensures that input signals are safely detected.

Operation as an Interruptable Input Module

When a positive signal transition occurs at one of the I inputs, the signal is temporarily stored on the card, and a program interrupt request is made to the ZE.

The ZE interrupts the current PLC program and changes to the organizational module that is allocated to the interrupt input.

Interrupt Operation in the CL300

When using the IE module for interrupt operation in the CL300 Controller, please note the following:

- The IE module is to be operated in the extended inputs/outputs EI/EO.

- On the module the card address must be set to “0” because the inputs EI1.0, EI1.1, and EI1.2 are defined as interrupt signals. The remaining five I inputs are inhibited.

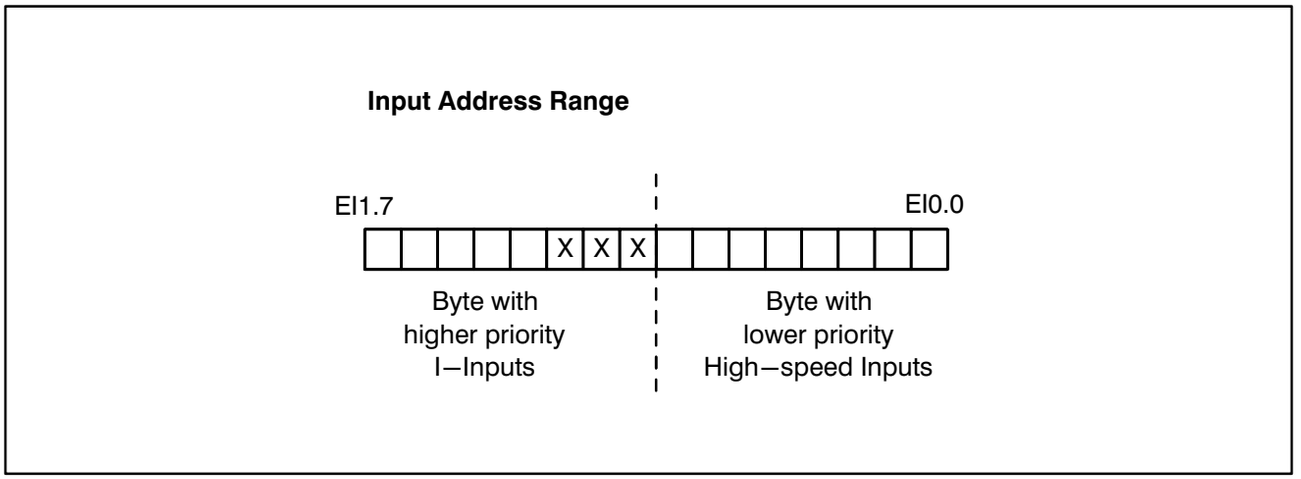


Fig. 4—19 Input address range IE 24— 16 inputs

- After the program has jumped to the appropriate interrupt organizational module OM2—OM4, all other interrupts are inhibited and can be reactivated using the PLC command “IF”.

- The PLC commands IR, IS, and IF are used to reset, inhibit or enable the interrupt inputs.

- The arithmetic registers A, B, C of the CL300 controller must be saved by the user, if necessary, after the jump to the interrupt organizational module.

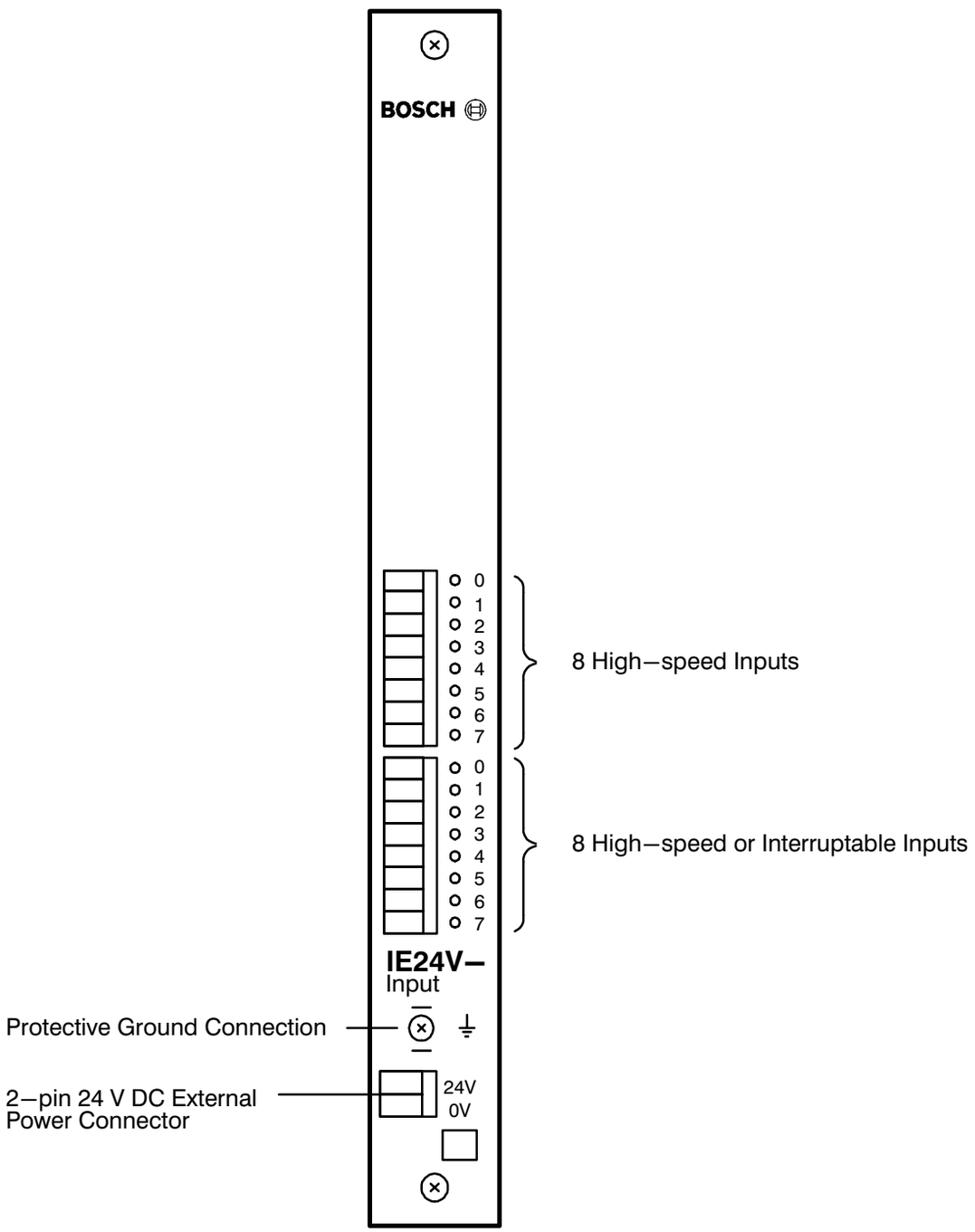


Fig. 4−20 High−speedInterruptable Input Module IE 24−

Slot

With the exception of expansion units in distributed expansion, the IE module (interrupt mode) can be installed in any slot that accepts peripheral modules.

☞ **Note** ☜

A detailed description of the module is given in “Technical Description” P.—No. 3913.

Specifications

External Supply Voltage	24 V DC to DIN 19240
External Current Consumption	max. 100 mA
Internal Current Consumption at 12 V	max. 30 mA
Voltage Range/Current Range	
Signal Range “0”	−3 V ... +5 V 0 ... 2.5 mA
Signal Range “1”	+13 V ... +30.2 V 5.5 ... 13.5 mA
Number of Inputs	16 8 are switchable in interrupt mode
Switching Delay “ON”	10 µs typical
Switching Delay “OFF”	20 µs typical
Simultaneity Factor	100 %
Width	1 module width
Dimensions	Dual Eurocard format

☞ **Note** ☜

Shielded cable should be used for signal lines.

Ordering Information

	Order No.
Interruptable Input Module IE 24 V	050 564

4.3.3 Analog Input Module, 16 Inputs

Function

The function of the analog input module is to detect voltages and currents and to measure temperatures by means of RTDs.

Analog input has its own control logic and performs data acquisition in a cycle which is independent of the controller. The digitized data are stored in a special memory from where they can be retrieved by the controller at any time.

The analog input module is operated in the extended inputs/outputs (IO/EO). It occupies one input and output word in the extended inputs/outputs.

A detailed description of the analog input module is given in “Technical Description” P.–No. 3779.

Specifications

Measuring Ranges and Maximum Input Rating	Voltage Measuring Range: ±50 mV to ±10 V Max. Overvoltage: Supply Volt. ±20 V Current Measuring Range: ±1 mA to ±20 mA Max. Overcurrent: 70 mA Temperature Measurement using RTDs (e.g. PT100) ±50 mV to ±10 V Temperature Measuring Range Total R for all RTDs: 4.5 kΩ
Number of Inputs	16 differential inputs 8 differential inputs with RTDs
Maximum Number of Cards per CL300	32

Transducer Connection	Two−wire connection Four−wire connection with RTDs
Wiring	Twisted pair, shielded
Max. Cable Length	200 m
Constant Current Source	2 mA for RTD measurements
Power Supply	24 V DC to DIN 19 240
Current Consumption	150 mA internal 300 mA external

Slot

The analog input module can be installed in slots 4 to 14 of the GG300/301 Basic Units, in slots 4 to 8 of the GG300−K/301−K Basic Units and in slots 1 to 14 of the expansion units.

☞ **Note** ☜

Analog input modules require the use of a fan unit in the card cage.

Ordering Information	Order No.
Analog Input Module, 16 Input Channels	046 088

4.4 Output Modules

Caution

All specifications for output modules are referenced to operation with a fan unit.

4.4.1 Digital Output Modules

Function

The digital output modules convert the internal signal levels to the external process signals.

Configuration

8−channel, 16−channel, and 32−channel output modules are available. The output circuits are electrically isolated from the internal logic circuits through optocouplers and are overload protected by fuse links or electronic circuit breakers. Each output has its own LED for indication of the signal state.

LED off −−> Logic “0”

LED on −−> Logic “1”

Connection

All transducers are connected by plug−in terminals. This allows the replacement of modules without removing the wire connections.

Cable Cross−section: 1.5 mm^2 max.

Current Capacity of 1 Terminal: 6 A max. per contact

Specifications

The following table lists the specifications of output modules.

Specifications

Digital Output Modules	see paragraph 4.4.1.1	4.4.1.2	4.4.1.3	4.4.1.4	4.4.1.5
Nominal Voltage	24 V DC	24 V DC	24 V DC	24 V DC	24 V DC
Permissible Voltage Range to DIN 19240	20.4 V–28.8 V and 5 % Ripple factor from superimposed AC				
Number of Outputs	32	32	16	16	16
Nominal Current per channel (24 V DC, 55 ℃)	0.2 A	0.5 A	0.5 A	0.5 A	2 A
Current Range	0.4 ... 200 mA	2 ... 500 mA	1 mA ... 0.5 A	4 mA ... 2 A	4 mA ... 2A
Logic "1" Level (2 A)			–2.5 V	– 2.5 V	–2.5 V
(Max. supp. volt.) (0.2 A)	–2.5 V				
(0.5 A)		–2.5 V			
Max. Leakage Current for "0"	0.2 mA	0.5 mA	0.5 mA	2 mA	2 mA
Switch–on Delay	40 µs				
Switch–off Delay	450 µs	350 µs	300 µs	300 µs	300 µs
Int. Current Consumption (12 V)	2 mA per activated output				
Overload Protection:			Fuse		
			FF 0.63 A	FF 2.5 A	
Electronic	Yes	Yes	–	–	Yes
Thermal	Yes	–	–	–	–
Limiting of Indirect Switch–off Volt. (typ.)	–0.6 V	–15 V	–15 V	–15 V	–15 V
Polarity Reversal Protection for Supp. Volt.	No	Fuse T 2 A	Limited	Limited	Fuse T 2 A
Simultaneity Factor (with fan)	100 %	see 4.4.1.2	100 %	50 %	50 %
Short–circuit Current	220– 500 mA	550– 760 mA	–	–	2.02–3.7 A
Lamp Load (8 Hz)	5 W	2 W	10 W	25 W	5 W
Max. Circuit–breaker size	Up to 00	Up to 00	Up to 2	Up to 8	Up to 8
Width	1 module width				

Fig. 4–21 Specifications of output modules (Sheet 1 of 3)

Digital Output Modules	see paragraph 4.4.1.6	4.4.1.7	4.4.1.8	4.4.1.9
Nominal Voltage	24 V DC	24 V DC	230/115 V AC	Aux. voltage 24 V DC
Permissible Voltage Range to DIN 19240	20.4 V–28.8 V and 5 % Ripple factor		+15 % –20 %	20.4 V–28.8 V and 5 % Ripple factor
Number of Outputs	8	16	8	16
Nominal Current per channel (24 V DC, 55 °C)	2 A	2 A	2 A	–
Current Range	4 mA–2 A	4 mA–2 A	20 mA–2A	–
Logic "1" Level (2 A) (Max. supp. volt.)	–2.5 V	–2.5 V	–3 V	Voltage drop across fuse
Max. Leakage Current for "0"	2 mA	2 mA	5 mA	S14–K300 across relay contacts
Switch–on Delay	40 µs	40 µs	max. full wave	5 ms
Switch–off Delay	300 µs	300 µs	max. half wave	8 ms
Int. Current Consumption (12 V)	2 mA per activated output			
Overload Protection:	Fuse FF 2.5 A		Fuse M 2.5 A	Fuse FF 2.5 A
Limiting of Indirect Switch–off Volt. (typ.)	–15 V	–15 V		–300 V
Polarity Reversal Protection for Supp. Volt.	Limited	Limited	–	No
Simultaneity Factor (with fan)	100 %	50 %	50 %	100 %
Lamp Load (8 Hz)	25 W	25 W	230 V: 500 W 115 V: 250 W	5 W
Max. Circuit–breaker size	8	8	230 V: 0–12 115 V: 0–10	8

Fig. 4–21 Specifications of output modules (Sheet 2 of 3)

Continuation

Digital Output Modules	see paragraph 4.4.1.6	4.4.1.7	4.4.1.8	4.4.1.9
Relay Contact Voltage max.				220 V AC
Relay Contact Switching Capacity				140 W/ 500 VA
Contact Resistance max.				30 Ω
Contact Bounce max.				1 ms
Max. Switching Frequency			resistive 20 Hz inductive 10 Hz capacitive 1 Hz	30 Hz
Width	1 module width			

Fig. 4–21 Specifications of output modules (Sheet 3 of 3)

Addressing

Output modules are hardware−addressed.

Possible start addresses for the individual 8−channel, 16−channel and 32−channel O modules are listed in the following table. An addressing example is explained in paragraph 4.3.1.

n−channel O card	Permissible Start Addresses															
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
16	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62
32	0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60

Fig. 4−22 Addressing

☞ **Note** ☜

The output modules require the 0 V connection and an additional external power supply.

Ordering Information

Output Module			Order No.
24 V DC	0.2 A	32 outputs	047 964
24 V DC	0.5 A	32 outputs short−circuit proof	050 560
24 V DC	0.5 A	16 outputs	048 483
24 V DC	2 A	16 outputs	048 485
24 V DC	2 A	16 outputs short−circuit proof	050 634
24 V DC	2 A	16 outputs 2−pin	044 305
24 V DC	2 A	8 outputs	041 438
230/115 V AC	2 A	8 outputs electronic	048 862
220 V AC	relay	16 outputs 2−pin	044 834

4.4.1.1 A 24 V DC 0.2 A 32 outputs

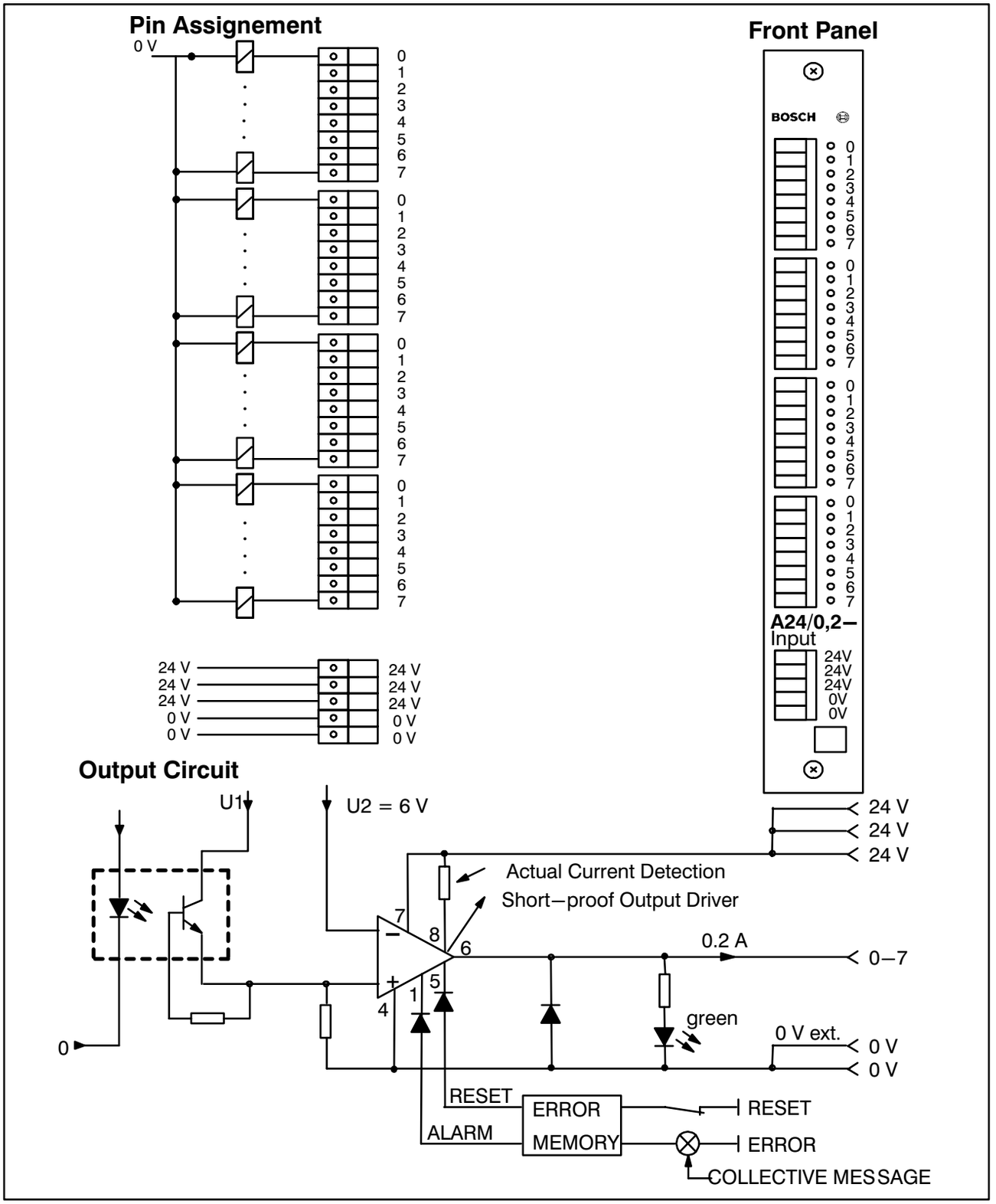


Fig. 4–23 A 24 V DC 0.2 A 32 outputs

Short–circuit Protection

The outputs are short–circuit protected by an electronic circuit breaker. In case of a short circuit, the front panel LED indicates “Circuit interrupted”. Pressing the reset button clears this indication. If the short–circuit remains after reset, the indication reappears.

4.4.1.2 A 24 V DC 0.5 A–e 32 outputs short–circuit proof

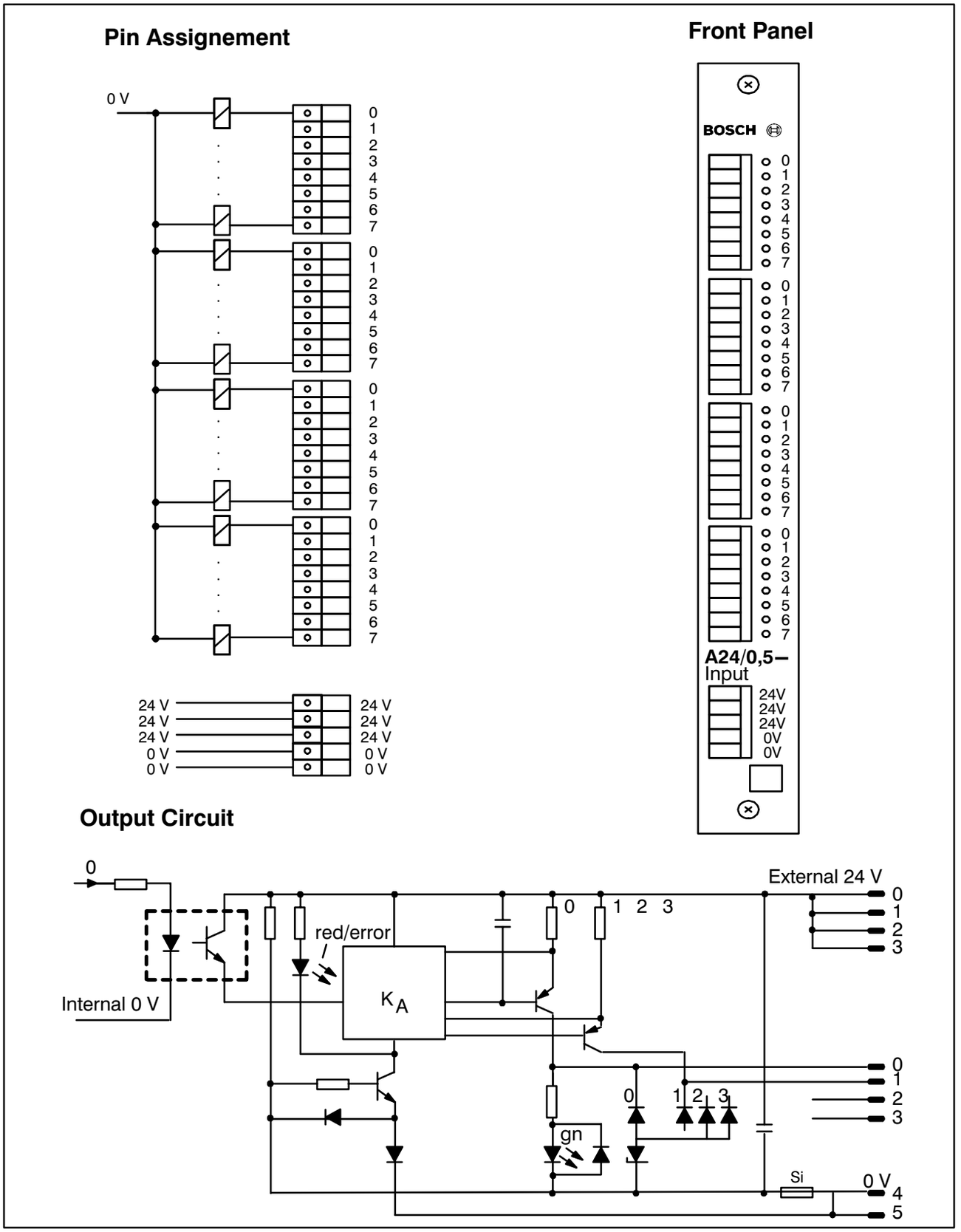


Fig. 4–24 A24 V DC 0.5 A–e 32 outputs short–circuit proof

Protection

The outputs are protected against:

- Polarity reversal (24 V DC)
- Short−circuit
- Overload.

In all these cases, the LED error indicator lights. In case of a short−circuit or overload the respective output is deactivated. After 2 ms the output is reactivated. If the short−circuit is still present, the output is deactivated again after 40 µs. This process is repeated after 2 ms.

Simultaneity

The following table shows that the simultaneity factor when driving the outputs is dependent on ambient temperature and on the use of a fan unit.

Ambient Temperature	Simultaneity Factor		
	Without Fan	With Fan in the Basic Unit	With Fan in the Card Cage
20 °C	80 %	100 %	100 %
55 °C	50 %	70 %	100 %

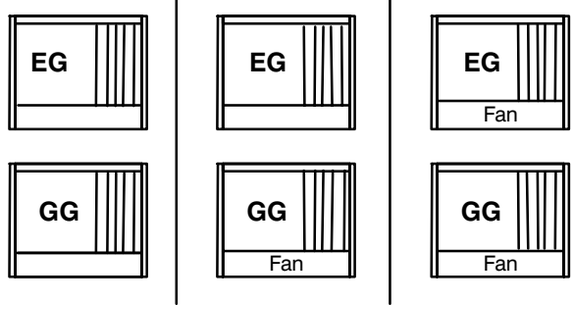


Fig. 4−25 Simultaneity

4.4.1.3 A 24 V DC 0.5 A 16 outputs

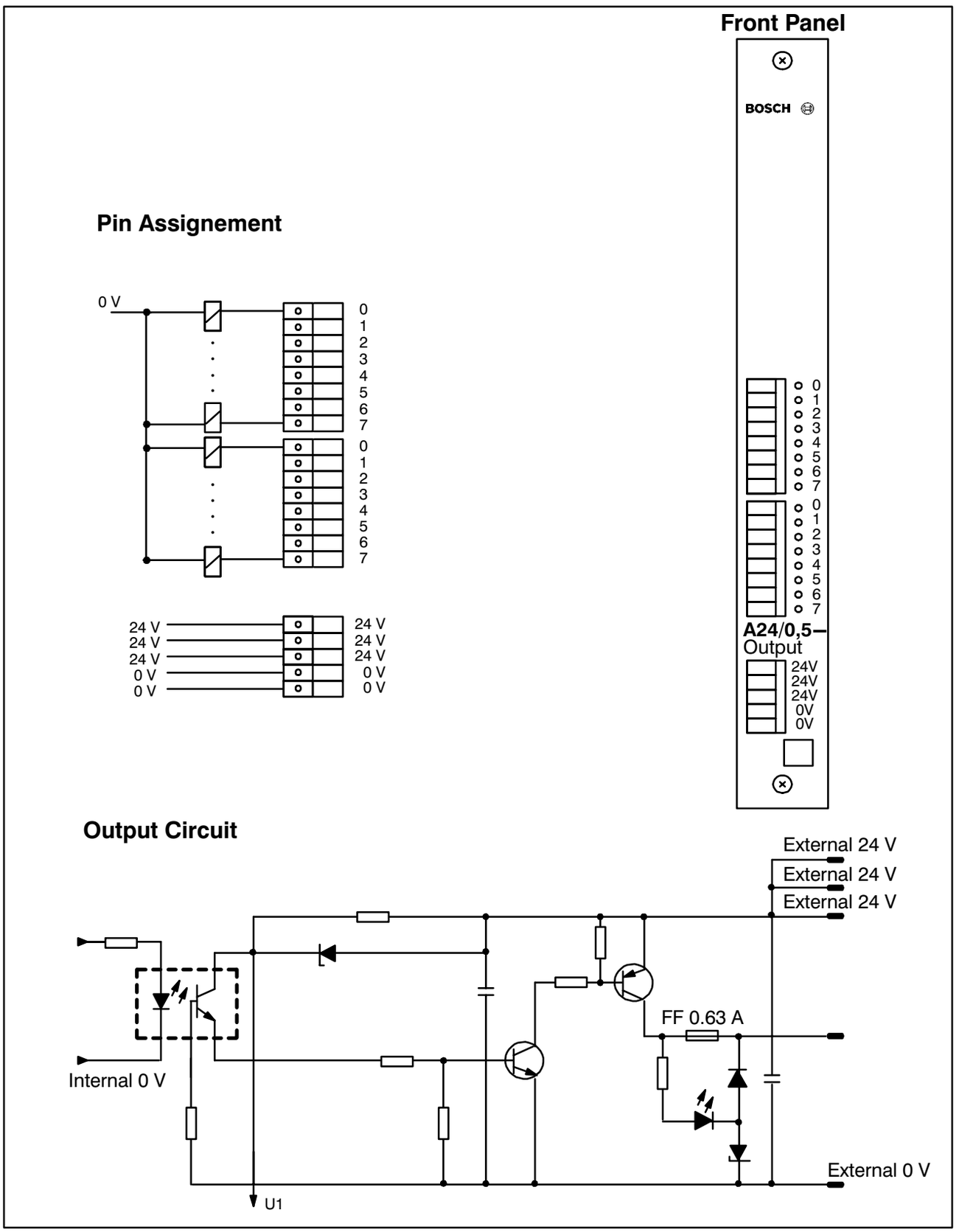


Fig. 4–26 A 24 V DC 0.5 A 16 outputs

4.4.1.4 A 24 V DC 2 A 16 outputs

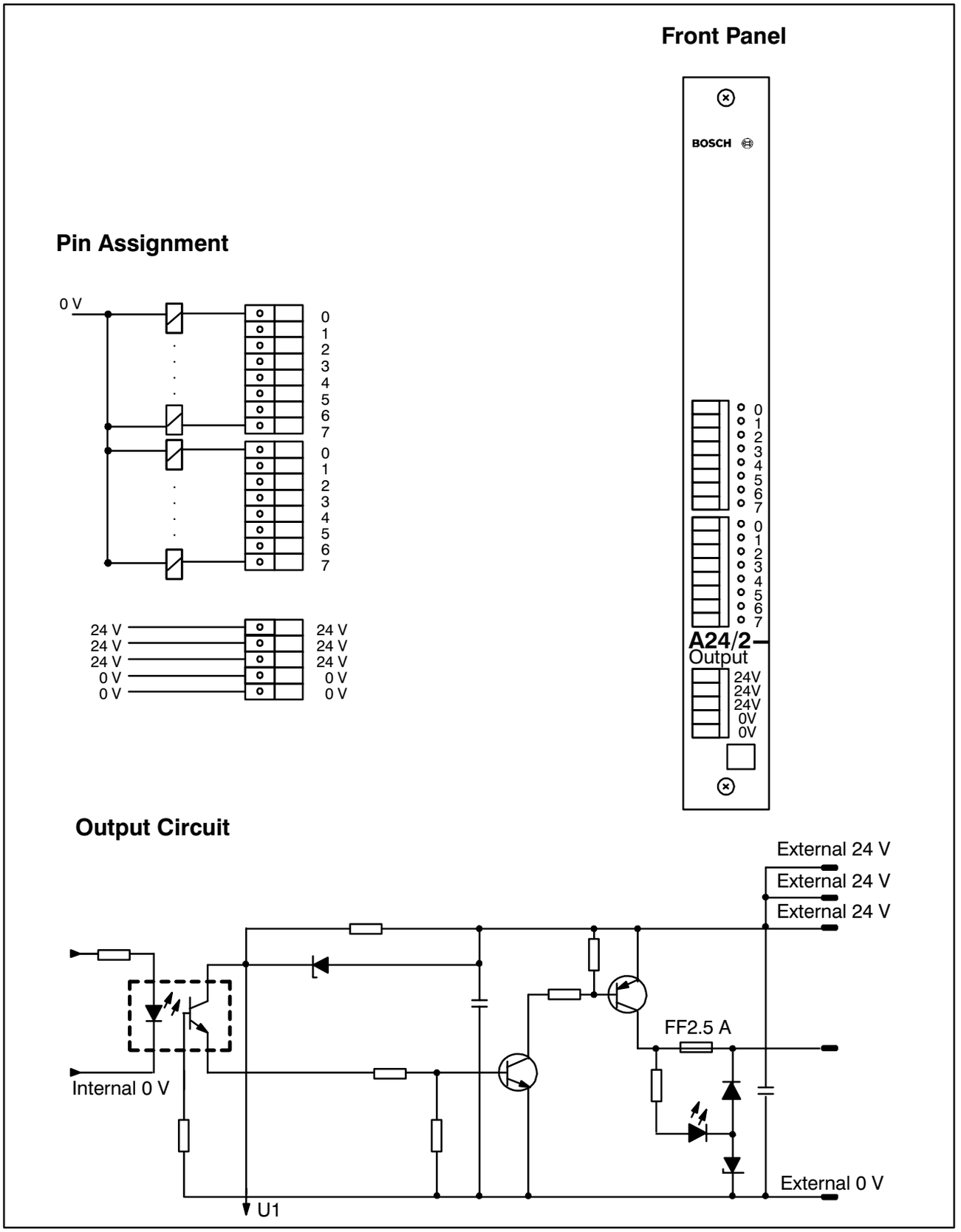


Fig. 4–27 A 24 V DC 2 A 16 outputs

4.4.1.5 A 24 V DC 2 A–e 16 outputs

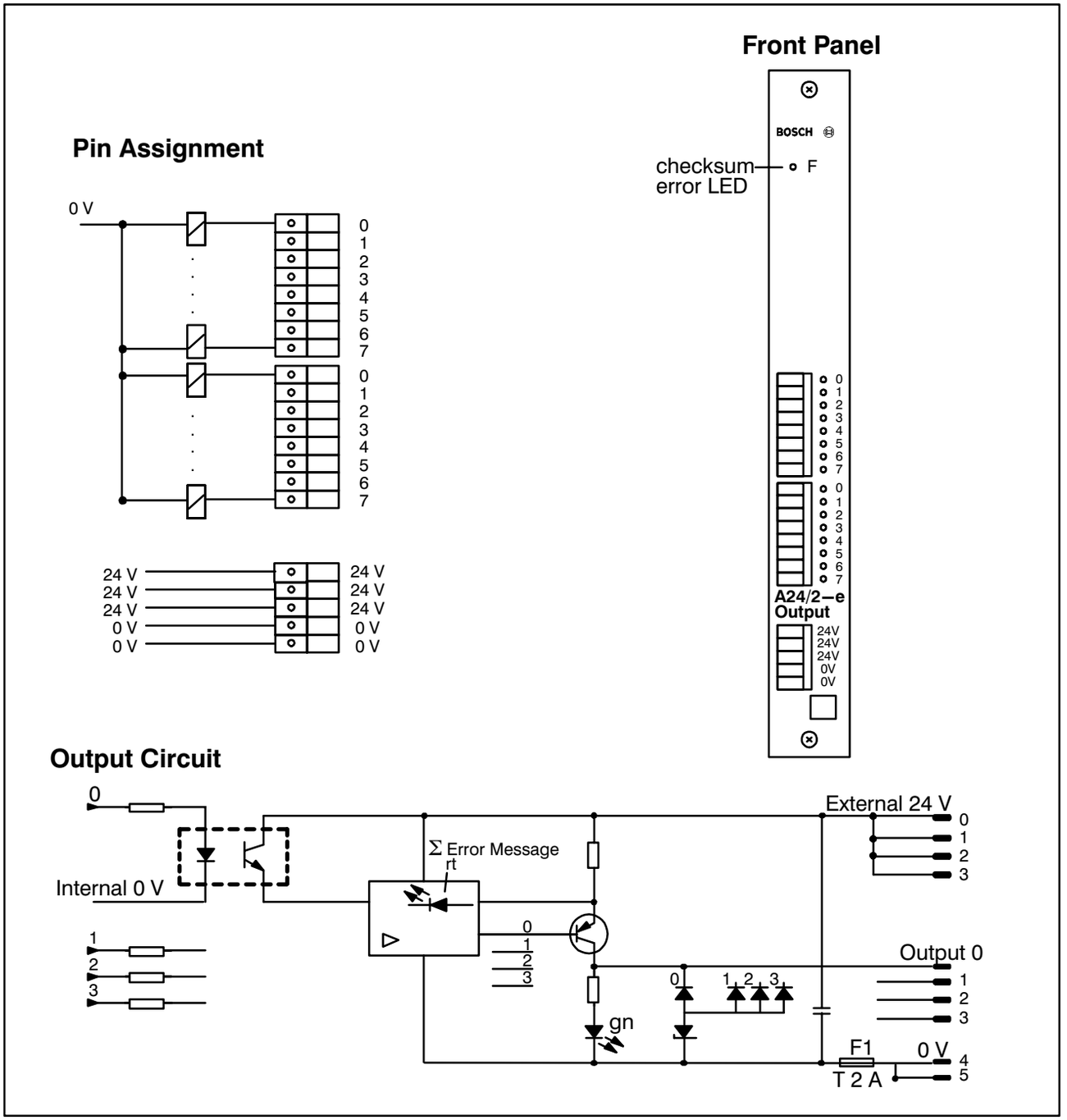


Fig. 4–28 A 24 V DC 2 A–e 16 outputs

Short–circuit protected to DIN VDE 0160 The module contains the power connection, 16 outputs with one LED each for signal state indication and a checksum error LED.

Protection

A fuse (T2A) is provided for protection against polarity reversal of the supply voltage. In case of a short circuit or overload the respective output is deactivated and the checksum error LED lights. After 2 ms the output is reactivated. If the short circuit is still present, the output is deactivated again after 40 µs. The process is repeated after 2 ms.

4.4.1.6 A 24 V DC 2 A 8 outputs

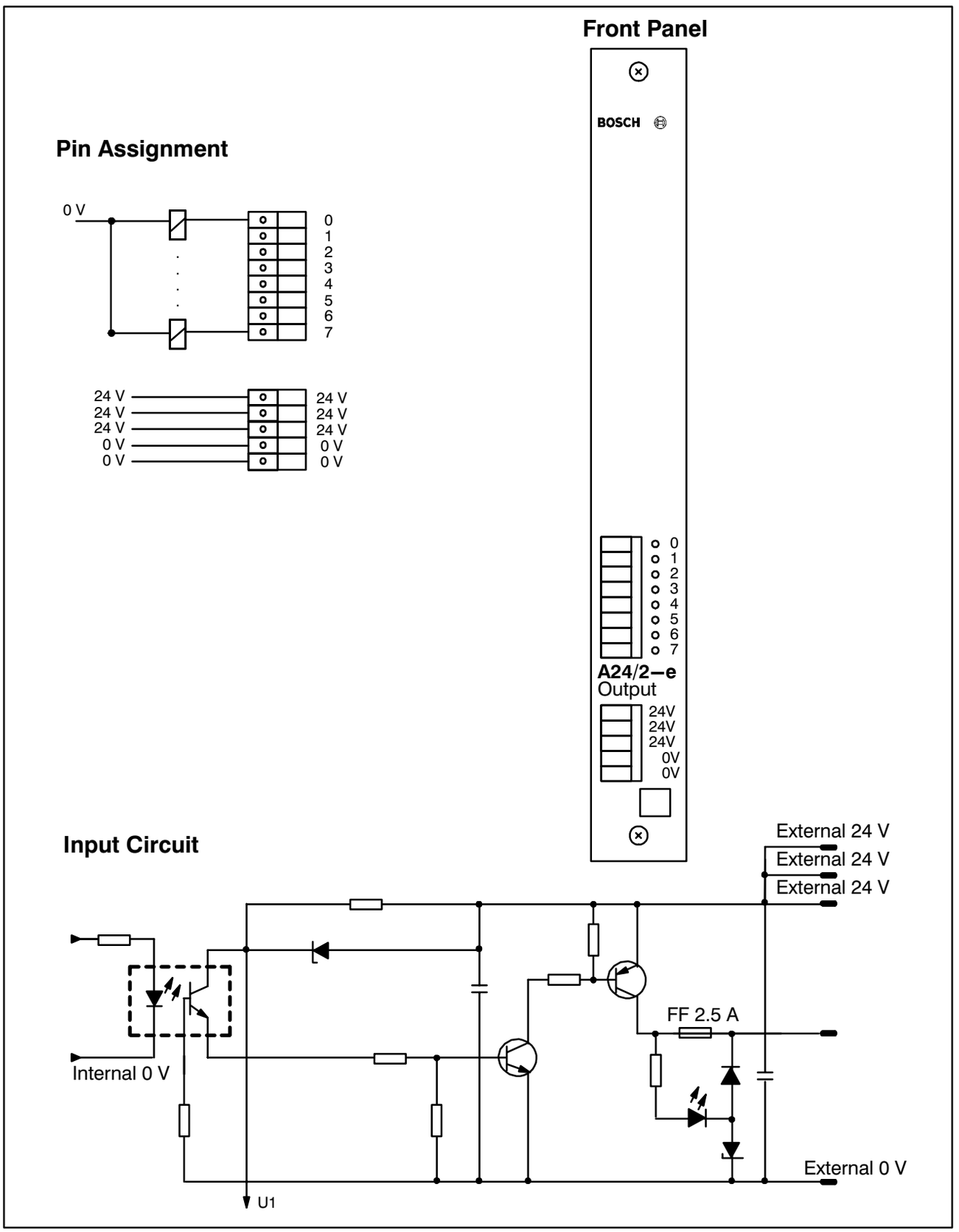


Fig. 4–29 A 24 V DC 2 A 8 outputs

4.4.1.7 A 24 V AC 2 A 2–pin 16 outputs

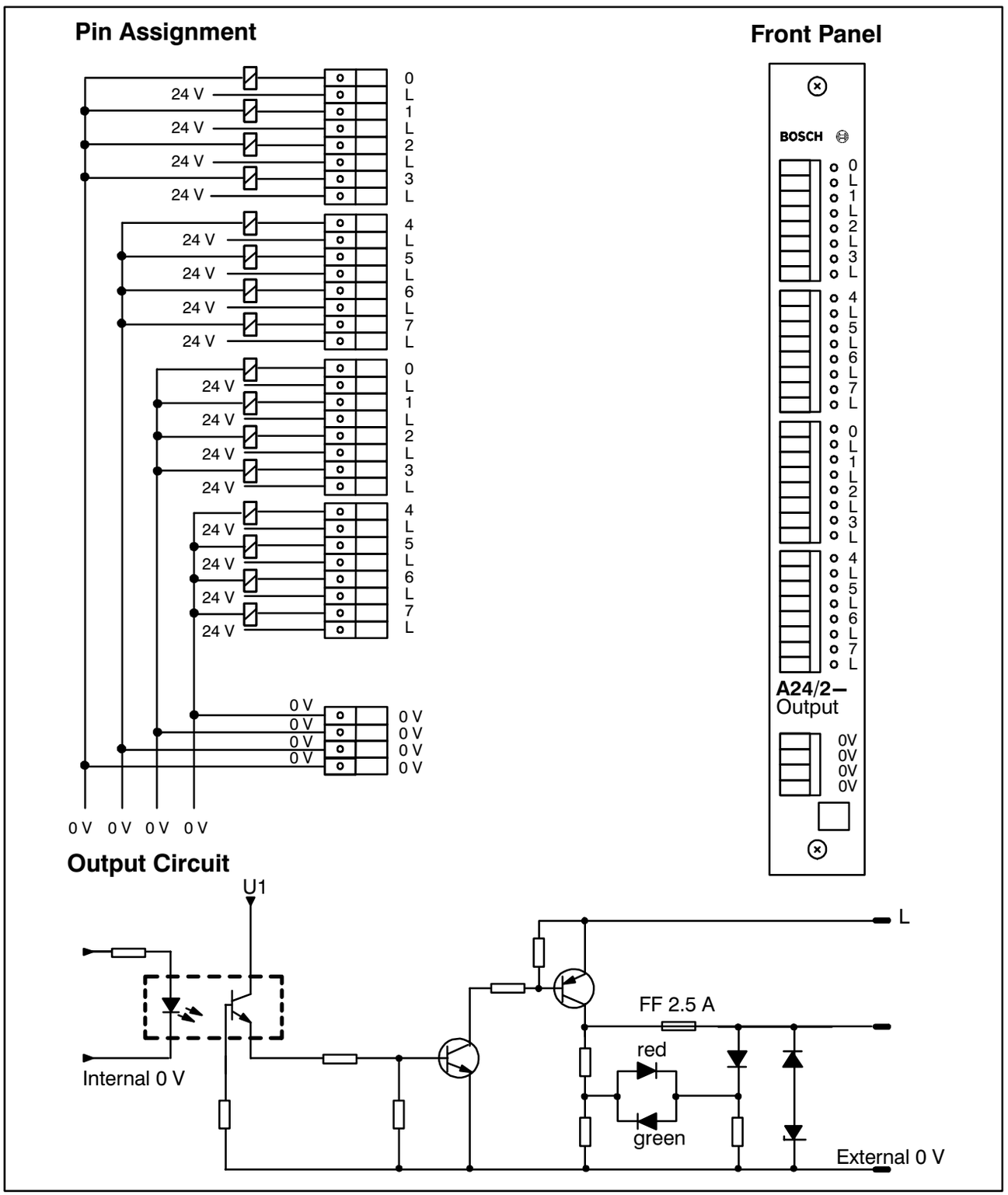


Fig. 4–30 A24 V AC 2 A 2–pin 16 outputs

A common ground (0 V) is provided for 4 outputs each. The output state is indicated by the green LED and a blown fuse is indicated by the red LED. The red LED can only indicate a blown fuse when an output is driven.

4.4.1.8 A 230/115 V AC 2 A electronic 8 outputs

The module is designed to operate with 230 V and/or 115 V supply voltage. Voltage can be selected using the voltage switch (S1/2) on the module.

Switch position “1”: 115 V
Switch position “2”: 230 V

The module contains two independent, electrically isolated circuits with 4 outputs each. Each circuit has a separate power supply. The circuits may have the same or different AC potentials with a maximum voltage differential of 500 V.

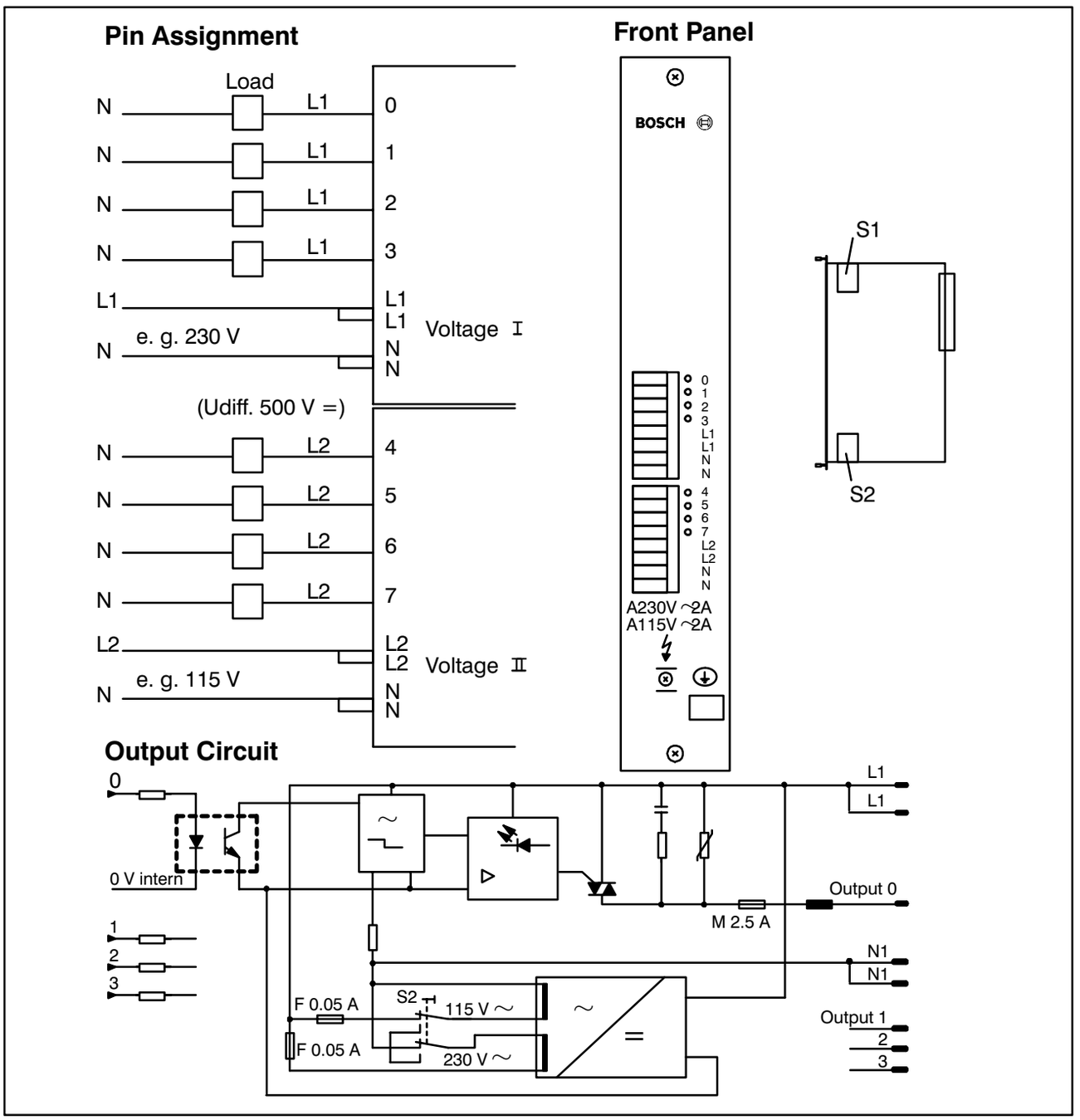


Fig. 4–31 A 230/115 V AC 2 A electronic 8 outputs

4.4.1.9 AR 220 V AC 2 A Relay 16 outputs 2–pin 24 V DC auxiliary voltage

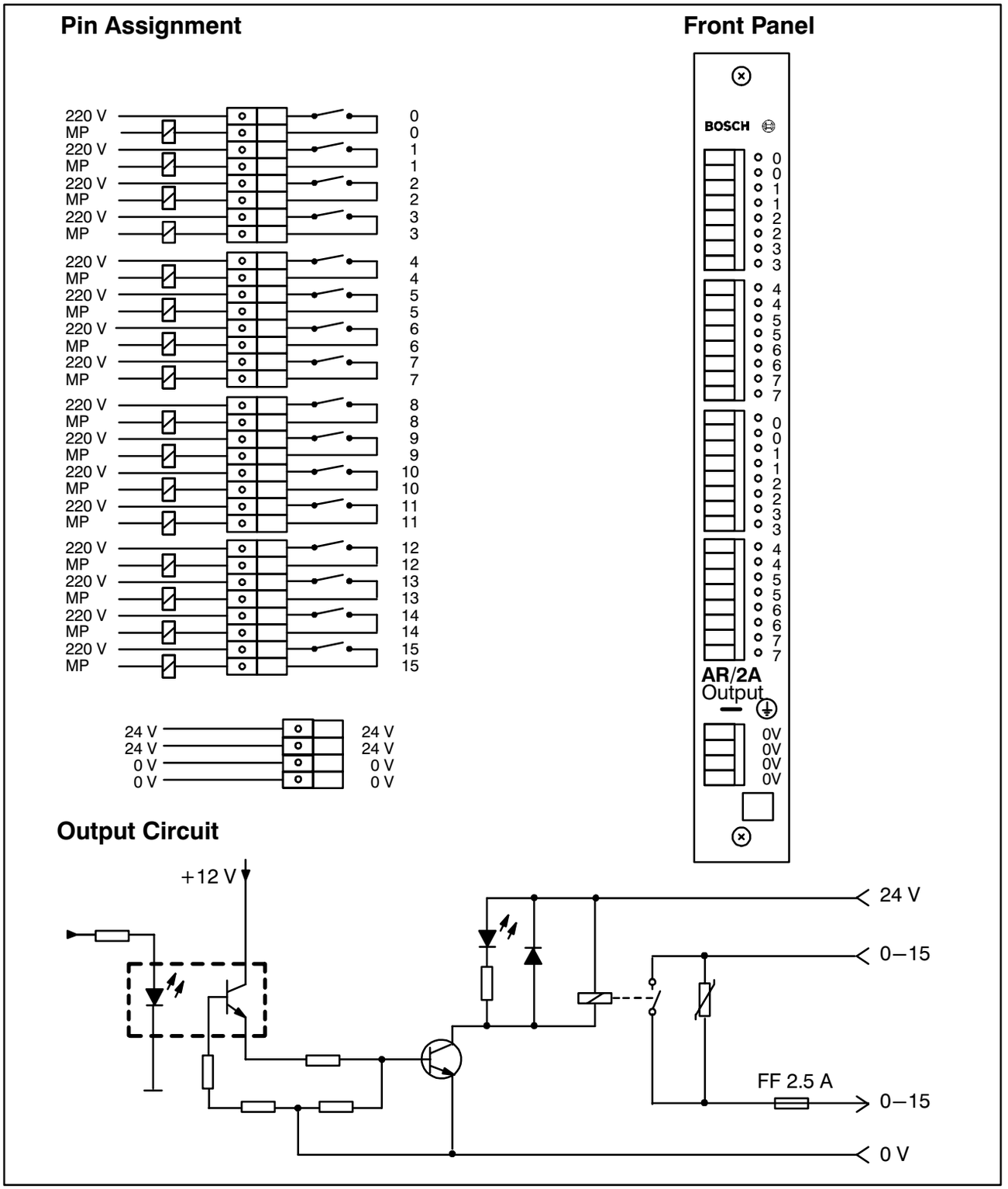


Fig. 4–32 AR 220 V AC 2 A Relay 16 outputs 2–pin 24 V DC auxiliary voltage

☞ **Note** ☜

The relay output modules require a fan unit in the card cage.

4.4.2 Analog Output Module with 4 Output Channels

Function

The analog output module is used to output analog voltages and currents.

Since the output module is used in the extended outputs, it has no effect on the number of digital modules. It occupies one word in the extended output range (EO).

☞ **Note** ☜

Analog output modules must not have the same addresses as analog input modules.

The module contains 4 output channels which may independently assume any voltage or current value, according to the range being set. All voltages or currents are referenced to a common ground potential.

The outputs are electrically isolated through optocouplers.

A detailed description of the analog output module is given in “Technical Description”, P.—No. 3778.

Specifications

Voltage Ranges	±10 V, ±5 V, ±2.5 V
Current Ranges	±20 mA, ±10 mA, ±5 mA
Number of Outputs	4
Max. Number of Cards per CL300	32
Wiring	Twisted pair, shielded
Max. Cable Length	200 m
Max. Burden Resistance	U: $\geq$ 500 Ω, I: $\leq$ 500 Ω referenced to 0 V
Short—circuit Protection	Permanent short—circuit protection
Grade	±0.2 % typical ±0.5 % max.

Supply Voltage	24 V DC ±20 %
Current Consumption	int. 80 mA max. ext. 300 mA max.
Width	1 module width

☞ **Note** ☜

The outputs assume a defined state in case of controller power failure.
Analog output modules require the use of a fan unit in the card cage.

Ordering Information	Order No.
Analog Output Module with 4 Output Channels	047 966

4.5 Central Expansion Module AG/Z

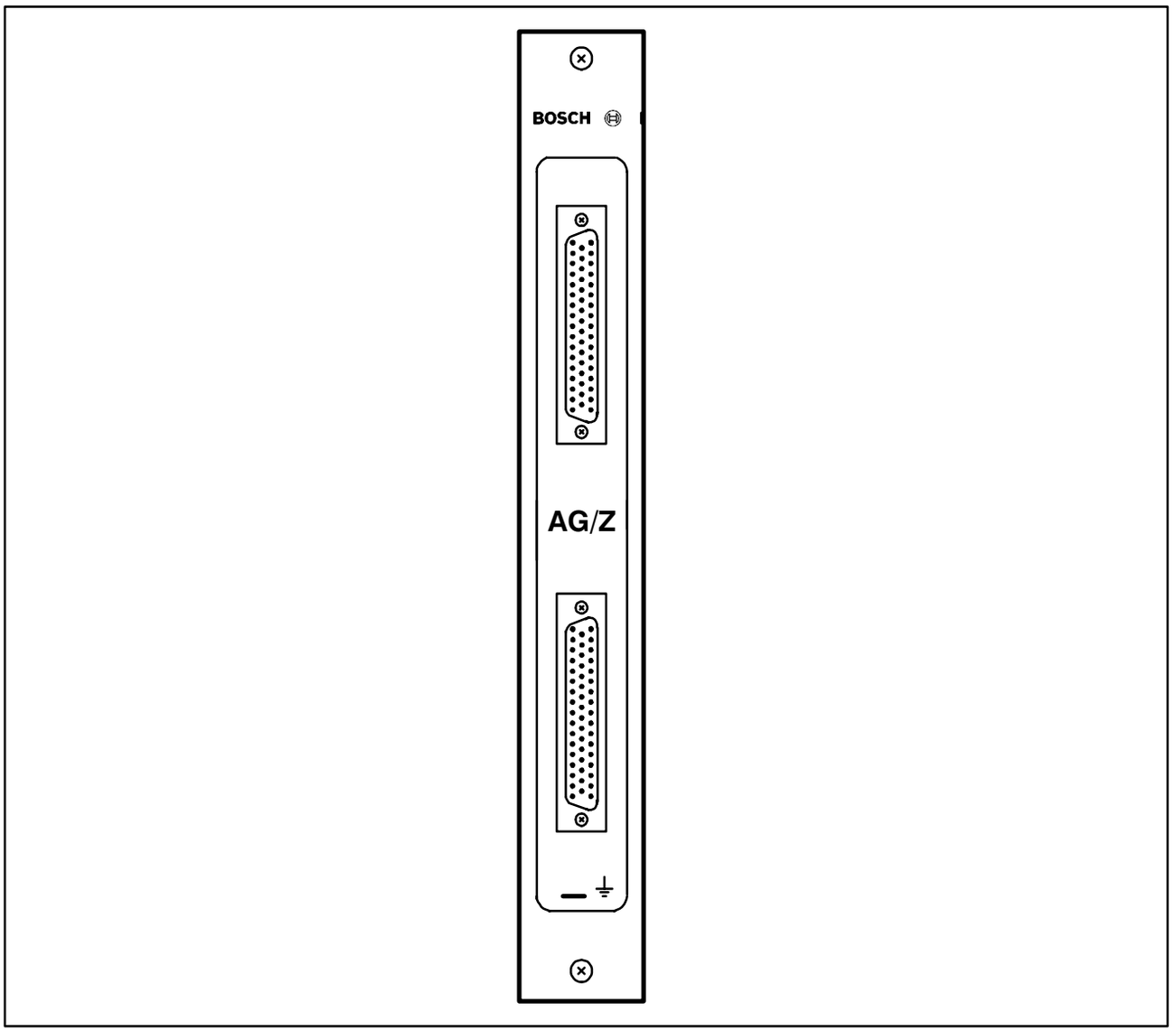


Fig. 4–33 Central Expansion Module AG/Z

Function

The AG/Z Expansion Module is designed for centralized expansion of the CL300. It provides the internal operating voltages and the peripheral bus for the expansion units.

Configuration

Up to 2 expansion units are connected to a basic unit or remote expansion unit, depending on the configuration. These units are located in a central site. Several basic configurations are possible.

Connection

The connection is made through a 0.55 m cable and the two 50−pin female connectors on the module front panel. These two connectors are connected in parallel so that the connection can optionally be made using the upper or the lower connector.

Slot

The AG/Z is to be installed in slot 14 of the GG300/301 and in slot 8 of the GG300−K/301−K basic unit. It can be installed in slots 1, 2, 13 or 14 in expansion units, depending on the configuration. For further information see paragraph 2.1.12.5.

Specifications

Width	1 module width
Cable length between 2 Expansion Modules	0.55 m
Internal Power Consumption	12 V/10 mA

Ordering Information

	Order No.
AG/Z Central Expansion Module	041 523
Interconnection Cable 0.55 m	041 535

4.6 Parallel Expansion Module AG/P

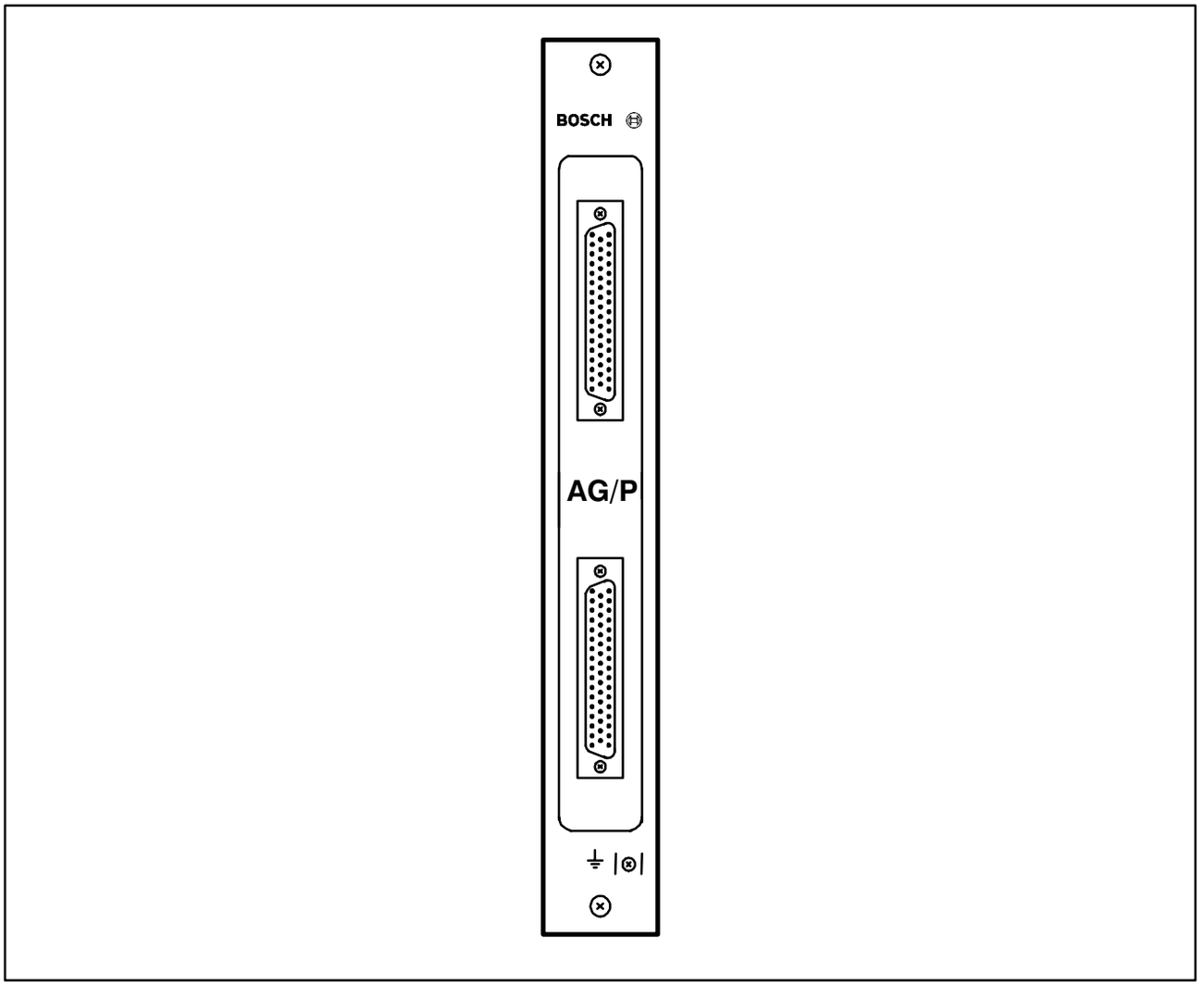


Fig. 4–34 Parallel Expansion Module AG/P

Function

In addition to central expansion, the AG/P Parallel Expansion Module adds length to the peripheral bus, using drivers and short cables. It permits the use of a larger number of expansion units.

Configuration

It is possible to use up to 3 AG/Ps in the basic unit. This will always require a marginal analysis as to power consumption and address range.

Two female connectors on the front panel of each module permit the connection of two central expansions. For this purpose, the AG/P is installed in the basic unit in the place of the AG/Z Central Expansion Module. The AG/P is connected to an AG/Z Central Expansion Module of the expansion station (3 expansion units max.) through standard interconnection cables.

Parallel expansion may include one basic station (1 GG Basic Unit connected in series with 2 expansion units) and up to 3 expansion stations (3 expansion units each).

Connection

The AG/P Expansion Module is connected to the expansion station with 0.55 m or 1.8 m standard interconnection cables.

Slots

With purely parallel expansion the AG/P cards can occupy the last 3 slots in the basic unit.

With distributed expansion the AG/P can be installed in the expansion unit in slots 1, 2, 13 or 14. For further information see paragraph 2.1.12.5.

Power Supply

The internal voltages for the expansion stations are provided by the power supply unit installed in the basic unit. Power consumption of the individual modules and units is indicated in paragraph 2.2.4.

Protective Ground Connection

All expansion stations must be connected to the central protective ground terminal (see paragraph 2.2.3).

Specifications

Cable Length Between AG/P and AG/Z	0.55 m or 1.8 m
Power Consumption	12 V 85 mA
Width	1 module width
Dimensions	Dual Eurocard format

☞ **Note** ☜

A detailed description of the AG/P Module is given in "Module Description" P.—No. 3791.

Ordering Information

	Order No.
AG/P Parallel Expansion Module	047 944
Interconnection Cable 1.8 m	048 081
Interconnection Cable 0.55 m	041 535

4.7 Remote Expansion Modules AG/DZ and AG/DU

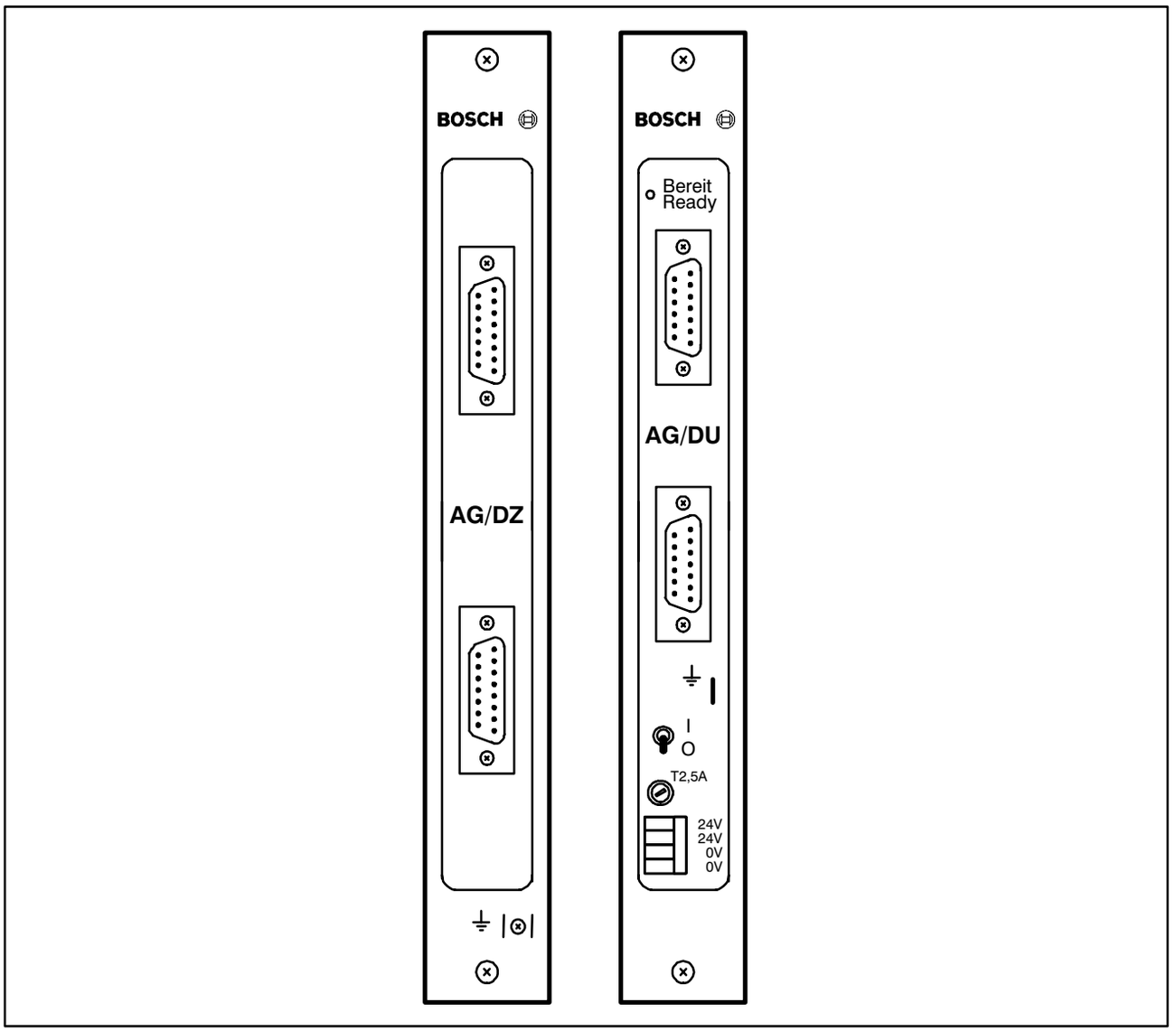


Fig. 4–35 Remote Expansion Modules AG/DZ and AG/DU

Function

Large geographical distances between the installations to be controlled usually result in extensive wiring. This wiring effort can be reduced with a distributed architecture of the input/output units, and only a shielded twisted–pair cable is required.

As to the input/output modules, distributed expansion replaces the transmission of analog signals by digital transmission to avoid susceptibility to interference.

Configuration

To implement distributed expansion, the AG/DZ Expansion Module is centrally installed in the basic unit, and the AG/DUs are remotely installed in the expansion units.Distributed expansion requires the use of the GG301/301—K Basic Unit.

A maximum of 2 expansion lines can be connected to each AG/DZ. Each expansion line can contain up to 4 expansion stations, which in turn can be expanded centrally and/or in parallel (see 2.1.12.3).

Function

Communication between the expansion stations and the central processing unit is handled by input and output images. These are contained in the AG/DZ Expansion Module and are also maintained in the working memory of the AG/DU module. The output image is written by the central processing unit, read by the AG/DZ and transmitted to the AG/DU. The input image is the reciprocal representation of the output image. The I/O level can be accessed directly. For this purpose, the AG/DZ sends a WAIT signal to the ZE.

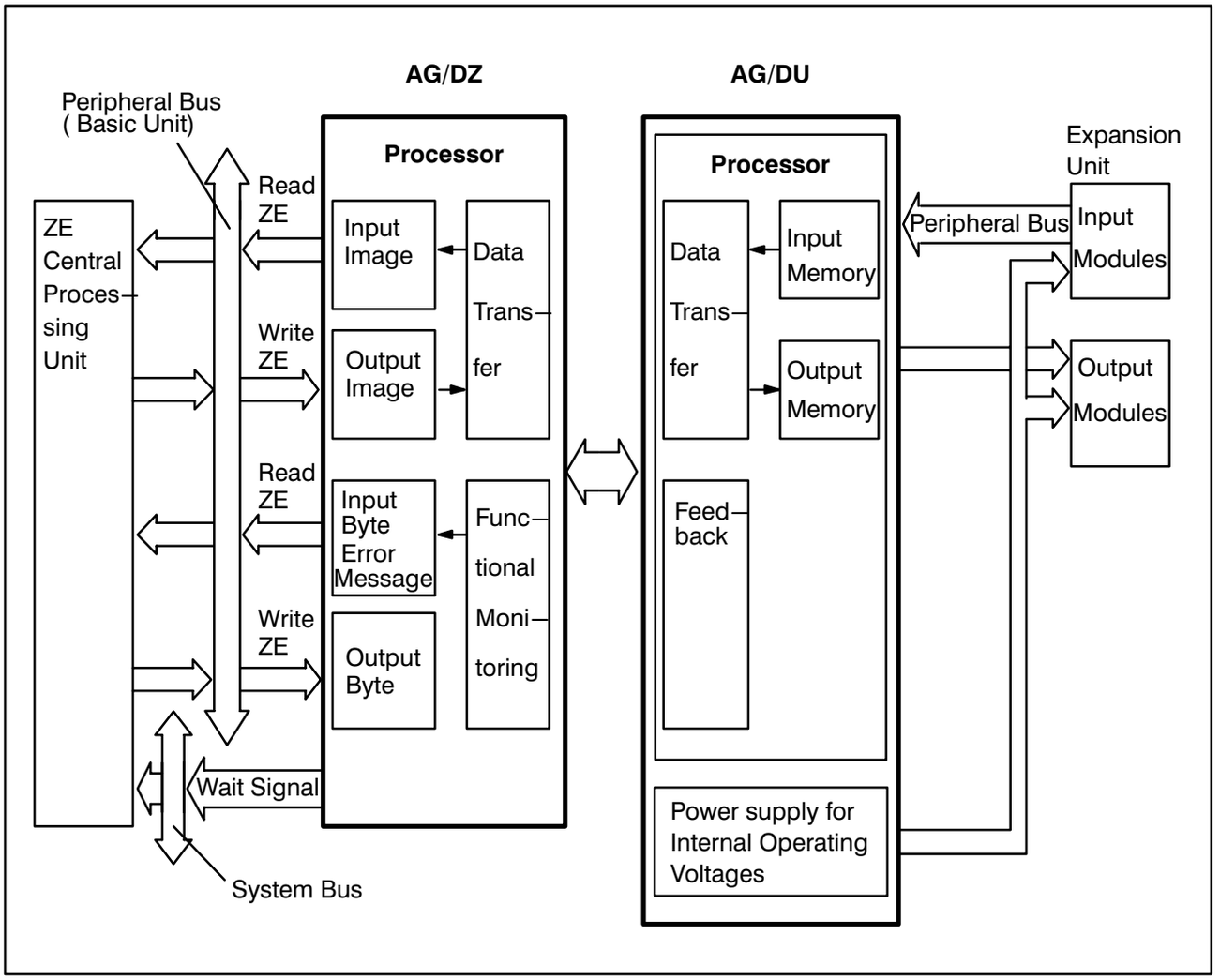


Fig. 4—36 Function AG/DZ and AG/DU

The AG/DZ Expansion Module monitors the remote stations for bus interruptions, power failure, and data transmission and passes the error messages to the ZE.

The AG/DU has its own power supply which requires an input voltage of 24 V DC. The power supply provides the internal 12 V and 5 V voltages for the input/output modules of the expansion station.

Connection

The connection between the AG/DZ and AG/DU or between two AG/DU modules is made using a shielded cable with connectors on both ends.

Addressing

The AG/DZ module requires one input and one output address (byte address) in the basic unit. Address selection is made through a 8– segment DIL switch (see paragraph 4.3.1 Digital Input Modules).

The AG/DU module requires no I/O addresses. Each expansion station within the expansion line is allocated a station address (address range 0 – 3) which is set with a 2–segment switch on the AG/DU.

All available I/O addresses can be used in the expansion units. An address must not be allocated more than once within one expansion line.

Slot

The AG/DZ occupies slot 7 in the GG301/301–K Basic Unit. The AG/DU occupies slots 1, 2, 13, or 14 in the expansion unit, depending on the expansion configuration, see paragraph 2.1.12.5.

Specifications

Max. Number of AG/DZs per CL300	1
Max. Number of AG/DUs per Expansion Line (EWL)	4
Max. Transmission Distance between AG/DZ and AG/DU or between AG/DU and AG/DU	200 m
Total Transmission Distance	4 x 200 m
Transmission Rate	187.5 kbaud
External Power Supply AG/DU	24 V DC
Max. Power Consumption	
AG/DZ	12 V 0.03 A 5 V 1.80 A
AG/DU	24 V 4 A 12 V 3 A

Width	1 module width

☞ **Note** ☜

A detailed description of the AG/DZ and AG/DU Modules is given in “Module Description” P.—No. 3815.

Ordering Information

	Order No.	
AG/DZ	048 093	Revision 2 or later
AG/DU	048 166	Revision 2 or later
Connector Kit for 1 cable	048 983	
Cable (specify length with order)	912 628	

4.8 Intelligent System Modules

The CL300 is a programmable logic controller (PLC) system with coprocessing capabilities, which allows the use of intelligent system modules.

These intelligent system modules are designed for communication with other PLC systems or computers and can only be connected to the system bus; they include the following modules:

- R301 Computer Interface Module
- DB301 Diagnostic Module (in preparation)

The intelligent system modules work largely independent of each other and of the central processing unit. This allows to offload tasks from the central processor, which results in shorter response and cycle times in parallel processes.

4.9 Intelligent Peripheral Modules

In addition to the use of the intelligent system modules R301 and DB301, the CL300 permits the use of intelligent peripheral modules which, however, can only be connected to the peripheral bus. Among these are the following:

- PU401 Positioning Unit (description P.—No. 3733)
- EZ50 External Counter Module (description P.—No. 3893)

Contents

List of Illustrations

5 Software Description

5.1 Program Structure

Due to its modular design, the CL300 controller allows the user to break up his/her program into functional blocks, i. e. to achieve a clearly structured program. Different module types are available.

The CL300 uses the following module types:

- Organizational Modules
- Program Modules
- Data Modules

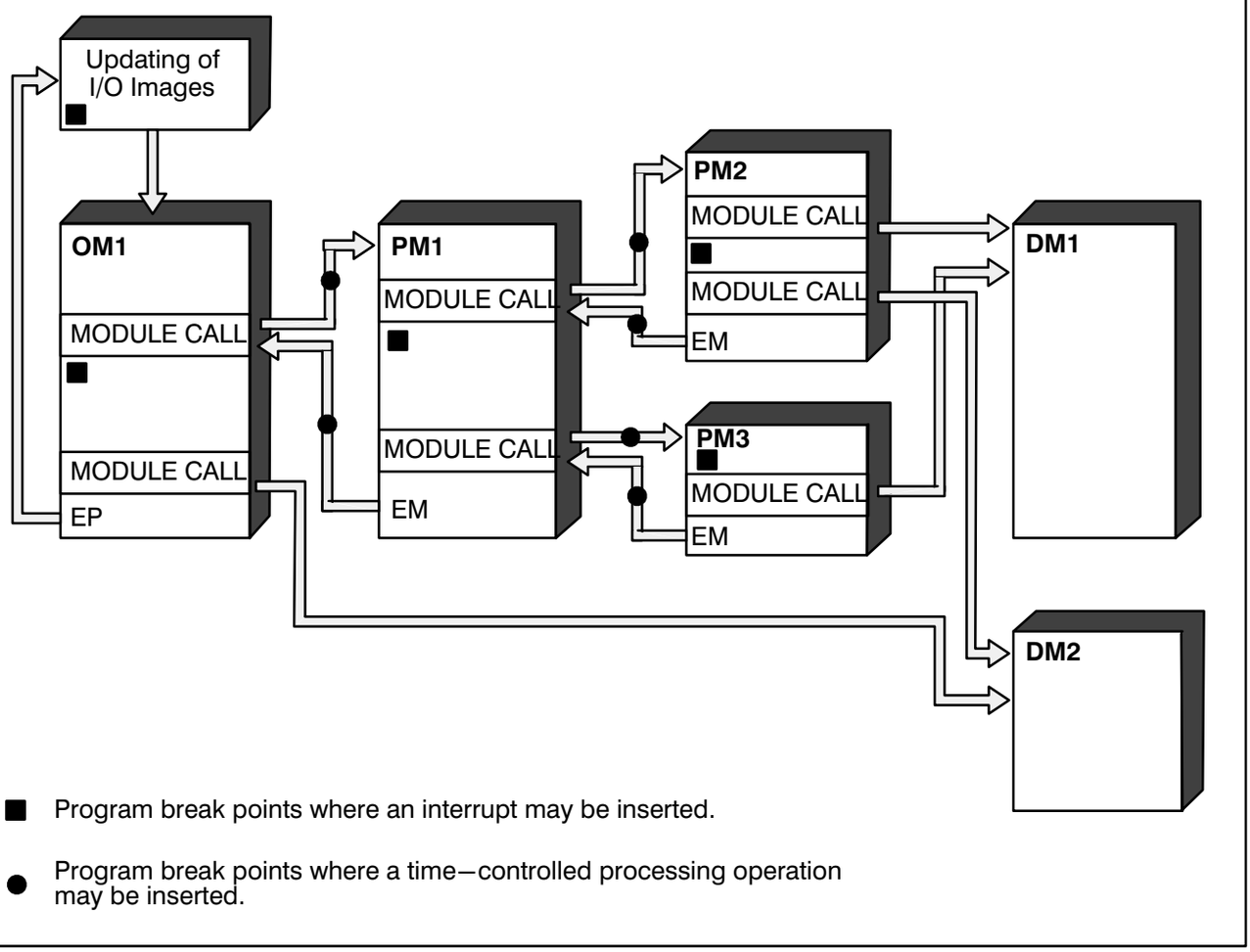


Fig. 5−1 Relationship of all module types (Example)

5.1.1 Organizational Modules OM

The organizational modules are the link between the system program and the user program. They are programmed in the same way as program modules but they can only be called up by the system program.

The user can determine programs in the different organizational modules to be executed in response to certain events, e.g. time sequences, start−up behavior, etc. 9 organizational modules are available for the CL300:

OM1	for cyclic program flow
OM2 to OM4	for interrupt control via the inputs EI1.0−EI1.2
OM5 and OM6	for time controlled program execution with variable time bases
OM7 and OM8	for starting up by cold start or restart, etc. (see paragraph 5.3)
OM9	for error handling

Module length is 256 instructions and can be expanded if necessary. No parameters can be set in organizational modules.

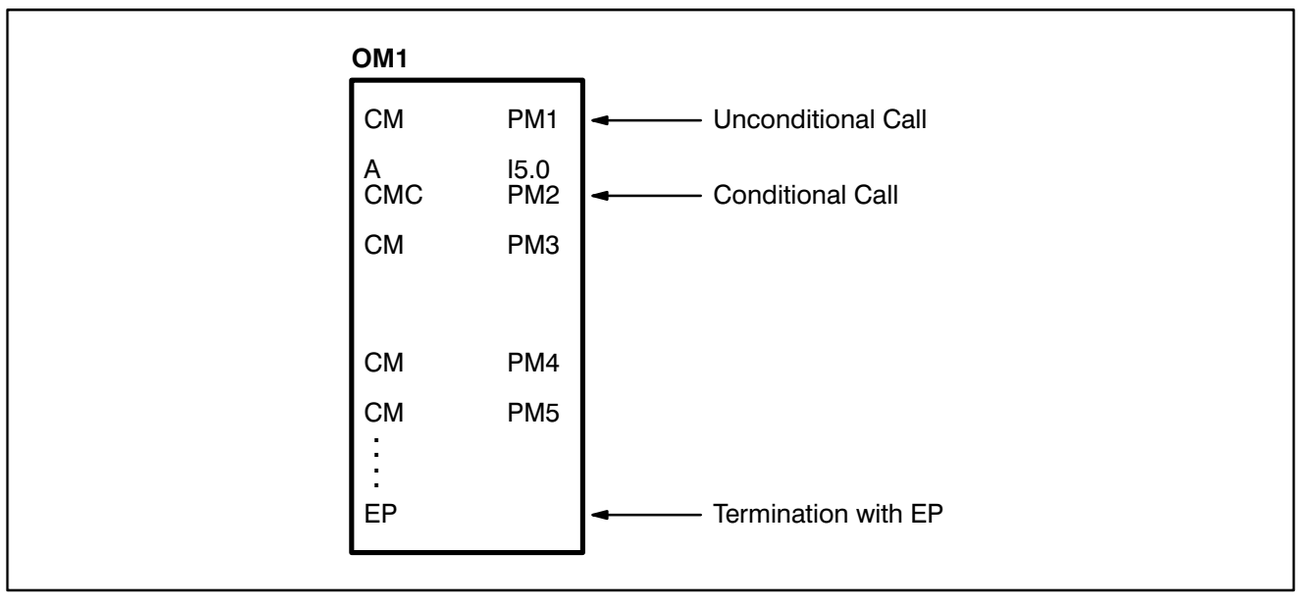


Fig. 5−2 Example of module calls in OM1

The OM1 is terminated with end of program (EP). All other OMs can be terminated with end of program (PE) or with end of module (ME).

5.1.2 Program Modules PM

The program modules contain program segments which are related with respect to their technological or functional features, e.g. program modules for tool changers, transfer units, etc. From a program module, other program modules and data modules can be called.

Due to the possibility of parametrization, these PMs can be written independent of the actual operands. During module call, the current parameters for the respective processing operation are passed to the program modules.

Possible parameter types are:

- Input parameters: operands, constants
- Output parameters: operands

A total number of 512 Program Modules are available. Module length is 256 instructions and can be expanded if necessary.Program modules and organizational modules combined allow a nesting depth of 32 modules.

A program module is normally terminated with end of module (EM). If end of program (EP) is used as the terminating command, the program is aborted and an input/output cycle is started.

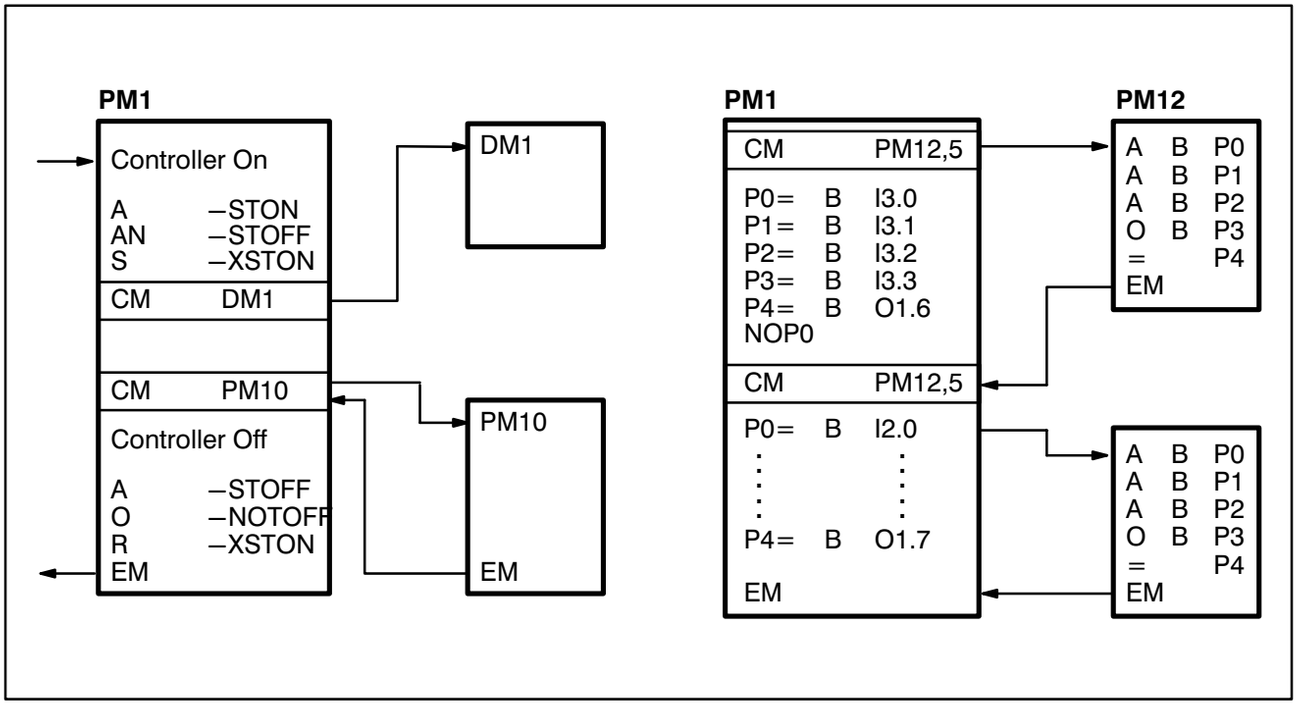


Fig. 5–3 Exampleof programming Program Modules

5.1.3 Data Modules DM

Data modules may contain all fixed and variable data defined by the user as well as texts and messages. By means of the start−up organizational modules OM7 and OM8, the user can copy any data module from the user program memory to a data buffer range DB. This data range is always available as a high−speed read/write memory (also with EPROM).

All data modules that have not been copied can be used as a read/write memory if a RAM module is used.

Write access to data modules in EPROM/EEPROM operation is not permitted during program execution.

256 modules are available. Module length is 256 words.

5.2 Program Flow

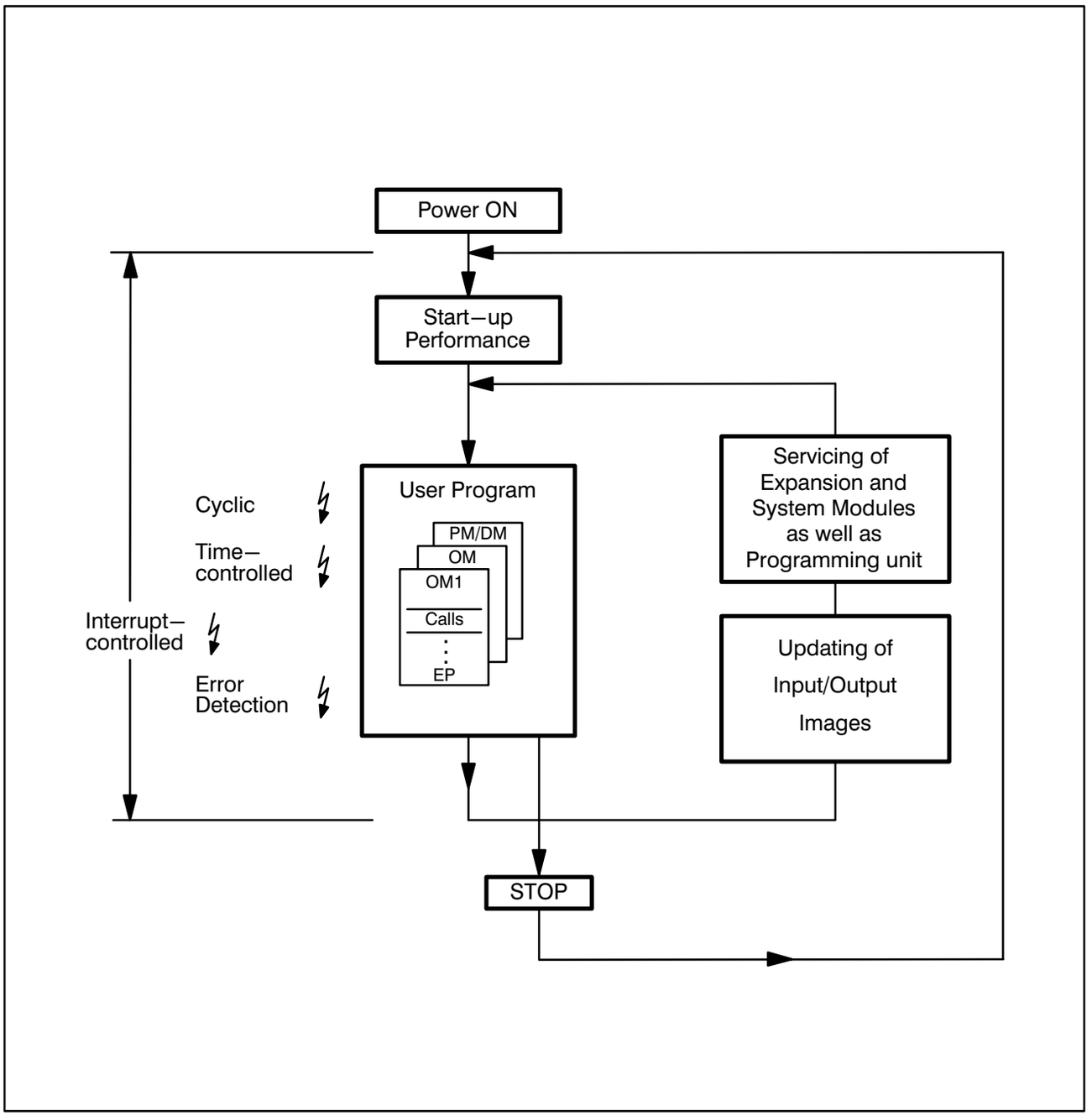


Fig. 5—4 Flow diagram of the CL300

Start–up Performance

When the CL300 controller is switched on, the system hardware in the central processing unit is checked (approx. 2 sec.). The following units are function–tested:

- Image RAM
- Operating RAM
- Operating EPROM
- Central battery
- 7–segment display
- Status LEDs

During this test phase all LEDs of the central processing unit light, and the 7–segment display shows an “8” with a decimal point.

In the start–up organizational module OM7 the following system parameters can be defined or modified:

- Copying of control word to activate I/O allocation list checking and data module
- I/O allocation list generation
- Definition of remanency ranges T/C/M
- Watchdog (cycle time monitoring)
- Copying of any data module to the data buffer (DB)
- Time Base for OM5 and OM6

These functions are programmed in system range S0 – S46.

The programmable organizational modules OM7 and OM8 allow the user to determine the start–up performance of the CL300 after “power on” or from the “stop state”. If OM7 and OM8 are not programmed, start–up is performed as standard (see Fig. 5–5) and the program is executed as defined in OM1.

The Fig. 5–5 shows the controller performance during start–up after **Cold Start** or **Restart**.

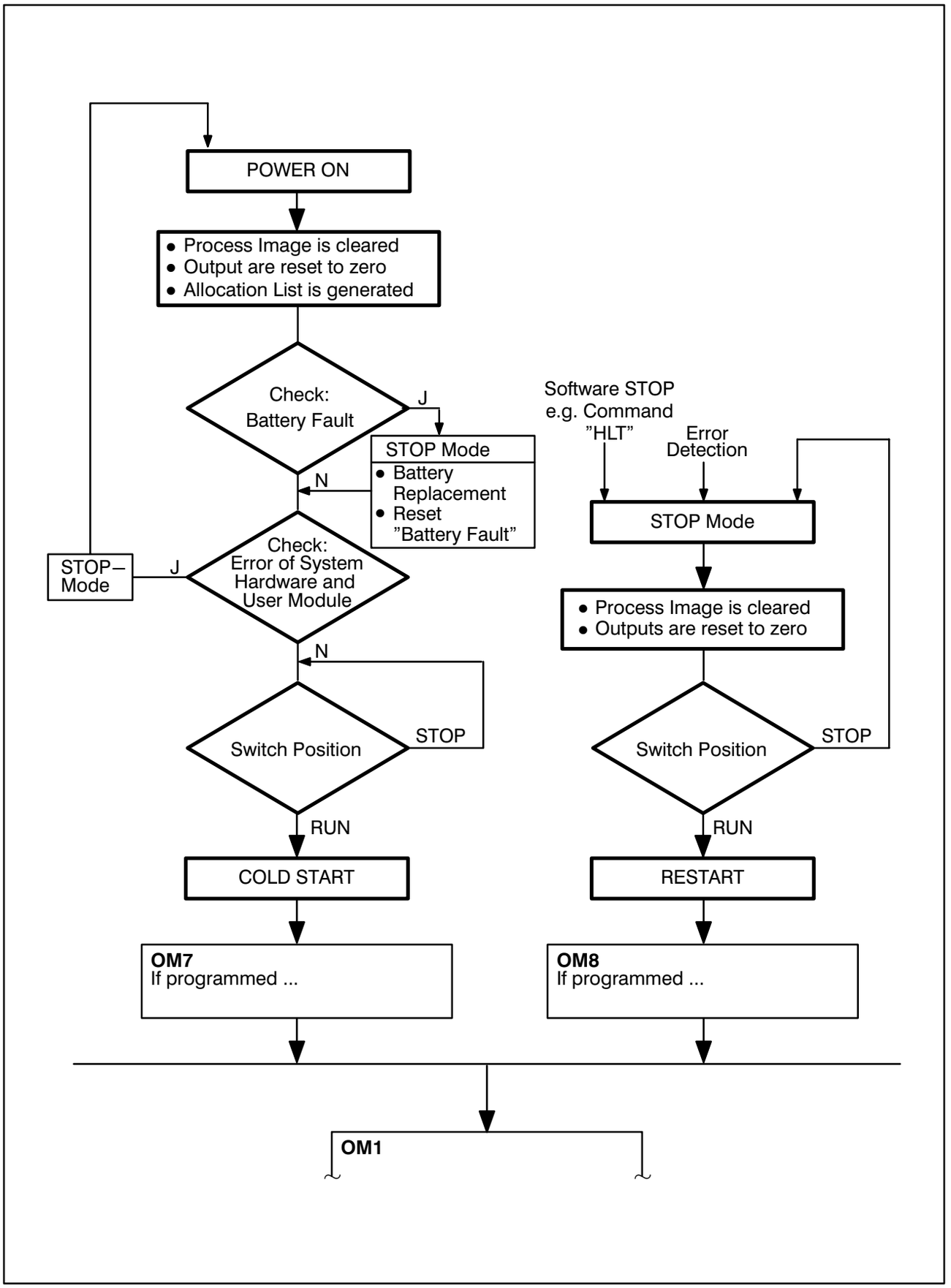


Fig. 5–5 Start–upperformance

I/O Allocation List

On start−up following “power on”, an I/O allocation list is automatically generated. This list specifies which module type is allocated to the individual modules. This actual allocation list can then be compared to a set allocation list that can be programmed in OM7.

On start−up from the stop state, the present allocation list is also compared to the set allocation list that can be programmed in OM7.

If no start−up performance is programmed in OM7 and OM8, standard start−up is performed. In this case, no allocation list checking is executed.

If an error is detected during I/O allocation list checking, it is displayed on the 7−segment display in coded form, and controller start−up is inhibited.

Watchdog (Cycle time monitoring)

The ZE central processing unit monitors the cycle time for the hardware−set maximum value of approx. 1.6 s.

Below this value, another cycle time limit can be programmed in the OM7 organizational module.

When the cycle time is exceeded, the special marker bit SM28.7 is set. Subsequently, OM9 is called. In OM9 the user can program the system response to exceeding cycle time. After execution of OM9 or if OM9 is not programmed, the controller assumes the stop state, and all the outputs are reset.

Standard cycle time monitoring is approx. 1.6 s.

Remanency

The remanency ranges of markers, timers, and counters can be user−programmed in the OM7 organizational module. If no range is programmed, the remanency range “Semi−remanent” (upper address range) is standard. Remanency can be selected using the remanency switch on the ZE.

Time Base

The user can define 2 time bases in OM7 (Factor * 10 ms, 10 min. max.) for time−controlled program execution using the OM5 and OM6 organizational modules. Without time bases being defined in OM7, no time−controlled execution is possible.

Copy Data Module

If the user wants to copy a given data module or parts of this data module from the user program to a data buffer range (DB) upon controller start−up, he/she can define this in OM7. No copy is standard.

5.3 Program Execution

Program execution is defined in the organizational modules. The user can influence the system performance, e.g. start−up, by means of the available OMs. Events like error detection, interrupt inputs and time−outs during program execution result in the automatic call of the respective organizational module.

The following table gives a summary of the criteria which define the organizational modules for a given type of program execution. The user program can be executed in cyclic, interrupt−controlled and time−controlled manner.

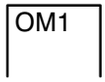
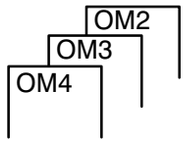
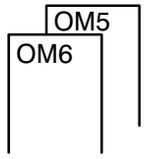
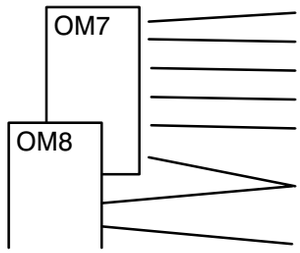
OM No.		Execution
1		Cyclic
2 **3** **4**		Interrupt−controlled, Interrupt Inputs EI1.0 1st Priority EI1.1 2nd Priority EI1.2 3rd Priority
5 **6**		Time−controlled Execution Time Base 1 for OM5 with priority Time Base 2 for OM6 Time Base programmable in OM7
7 **8**		− Start−up following ”power on” − Define remanency range (T, C, M) − Allocation list generation − Define watchdog − Define time bases for time−controlled execution (OM5,6) − Copy any data module to the data buffer range − Start−up from the stop state
9		Error Detection − Cycle time exceeded − Module nesting depth > 32 − Invalid command − Call of a non−existing module

Fig. 5−6 OrganizationalModules

5.3.1 Cyclic Program Execution

The modules of the user program are executed according to the sequence specified in the OM1 organizational module. OM1 is automatically called by the system after start−up.

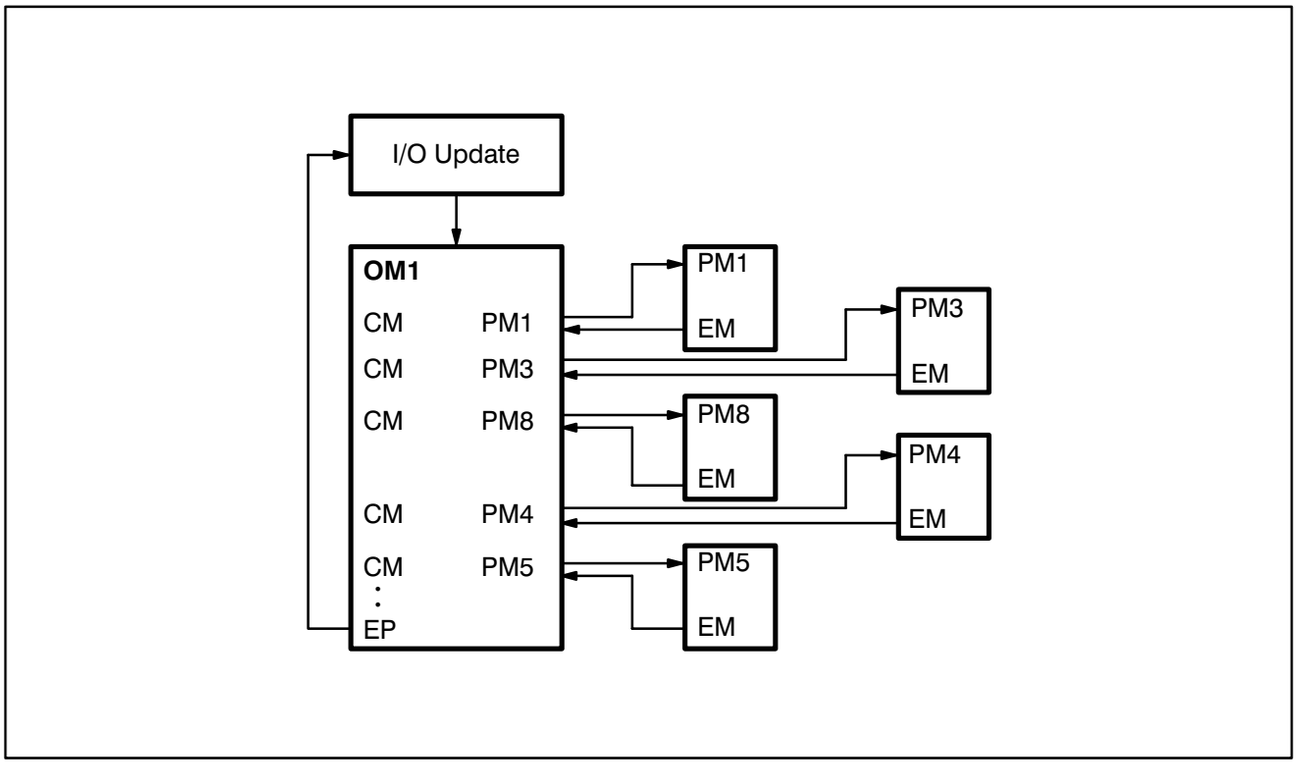


Fig. 5−7 Cyclic Program Execution

5.3.2 Interrupt−controlled Program Execution

When a positive edge of one of the special interface input interrupt signals EI1.0−EI1.2 occurs, cyclic program execution is interrupted after the current command has been executed, and another organizational module, OM2, OM3, or OM4 with a fixed allocation to the interrupt input is started. Interrupt input priority is EI1.0, EI1.1 and EI1.2.

In this organizational module, the user can program the desired response to the interrupt signal. Further interrupts are disabled, but can be enabled using the PLC command “IF”. After interrupt signal processing, cyclic program execution is resumed at the point of interruption.

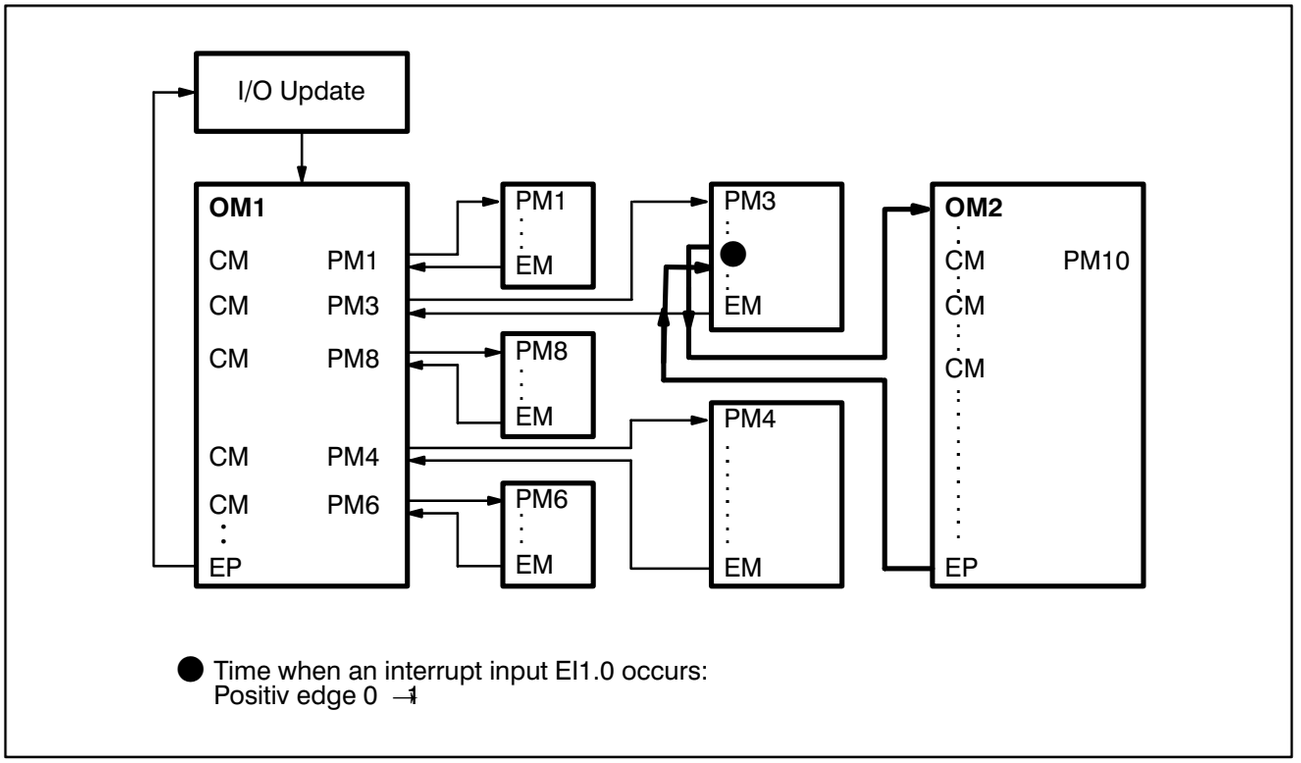


Fig. 5–8 Interrupt–controlledProgram Execution

5.3.3 Time–controlled Program Execution

The organizational modules OM5 and OM6 are processed using a predeterminded time base (factor * 10 ms, 10 min max.). For this purpose, cyclic program execution is interrupted only between two program module calls (on module call or end of module) and is resumed at the point of interruption when the processing is terminated.

Interrupt–controlled program execution has a higher priority than time–controlled program execution.

Time bases can be programmed in OM7.

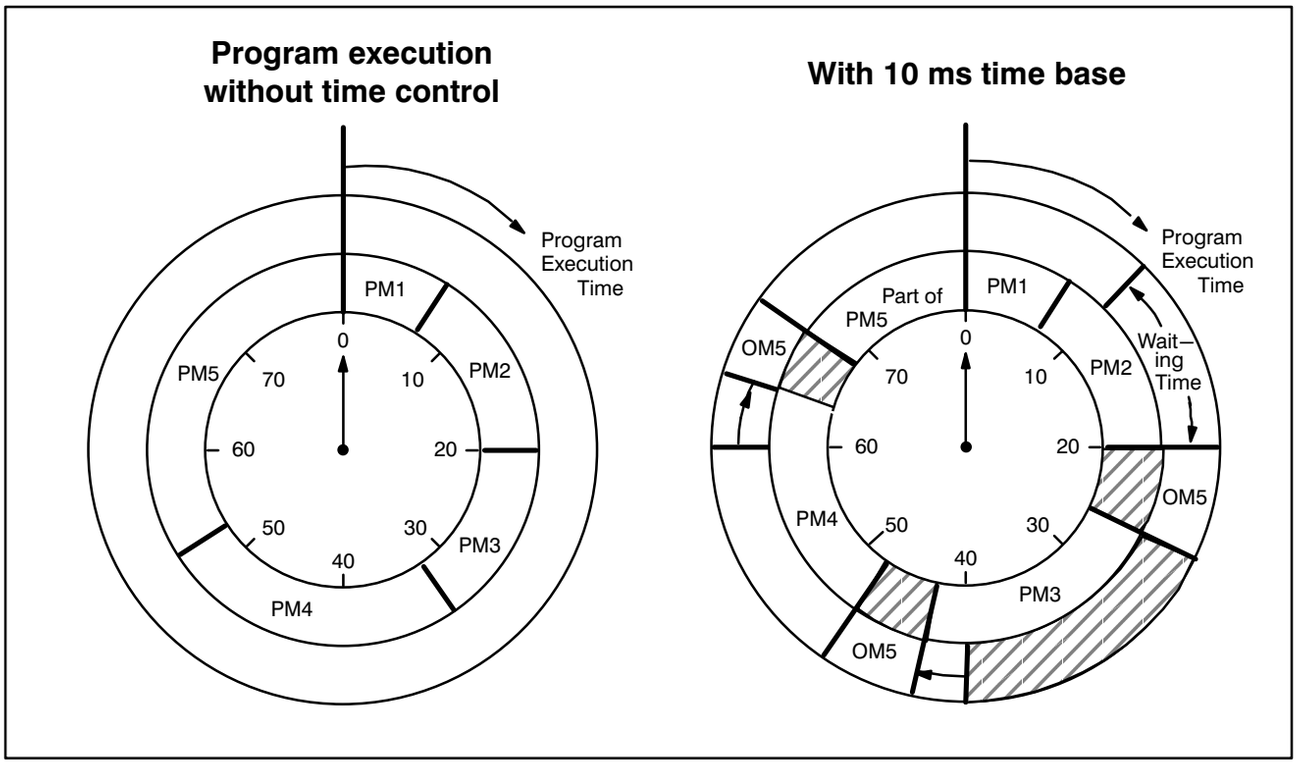


Fig. 5—9 Time—controlledprogram execution

5.3.4 Definition of Variables in OM7

The organizational module OM7 allows the user to set various system variables **S** which stored in the internal system range.

Before OM7 is processed, the system variables are set to default values, and the system checks whether OM7 is present. When OM7 is in the PLC memory, it will be processed.

Definitions in OM7 are to be made by means of the system variables listed below.

Control Word S0

Bit 1 Compare I/O allocation lists

Bit 2 Copy data module to data buffer

Default No comparison of allocation lists
No copy of data modules

Example

```
;Comparison of allocation lists desired
L       W       K0002H,B ;Load K0002H to register B
T       W       B,S0
;Copy data module to DB
L       W       K0004H,B
T       W       B,S0
```

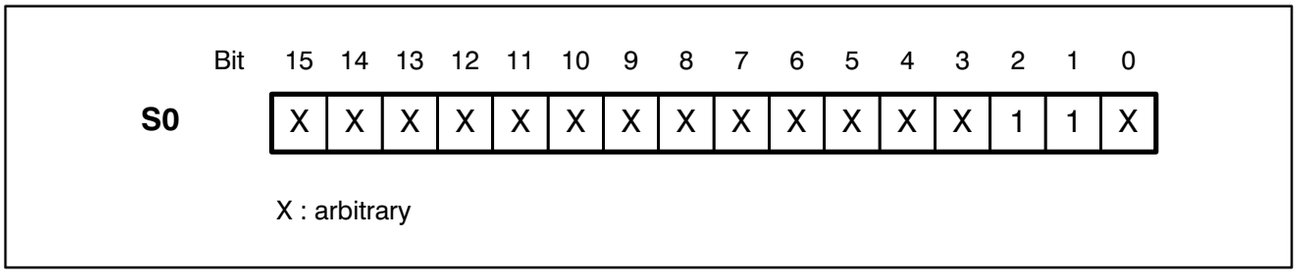


Fig. 5–10 ControlWord S0

Cycle Time S2

Main software watch dog (factor * 10 ms)

Default approx. 1.6 sec

Example

```
;Factor definition in OM7
L       W       K120D,B ;Watchdog = 1.2 sec
T       W       B,S2
```

Entries which exceed the value of the hardware watchdog (approx. 1.6 sec) have no effect.

Time Base 1 S4

Time base for time–controlled program execution in OM5 (factor * 10 ms, 10 min max.)

Default inactive (0)

Example

```
;Factor definition in OM7
L       W       K6000D,B ;Time base = 1 min
T       W       B,S4
```

Time Base 2 S6

Time base for time−controlled program execution in OM6 (factor * 10 ms, 10 min max.)

Default inactive (0)

Example

```
;Factor definition in OM7
L     W     K600D,B ;Time base = 6 s
T     W     B,S6
```

Data Module S8

Length and number of the data module to be copied to DB (Data Buffer)

Default Length and number = 0

Example

```
;Definition of module number and module length
L     W     K01FFH,B ;DM No. = 1, Length = 256 words
T     W     B,S8
```

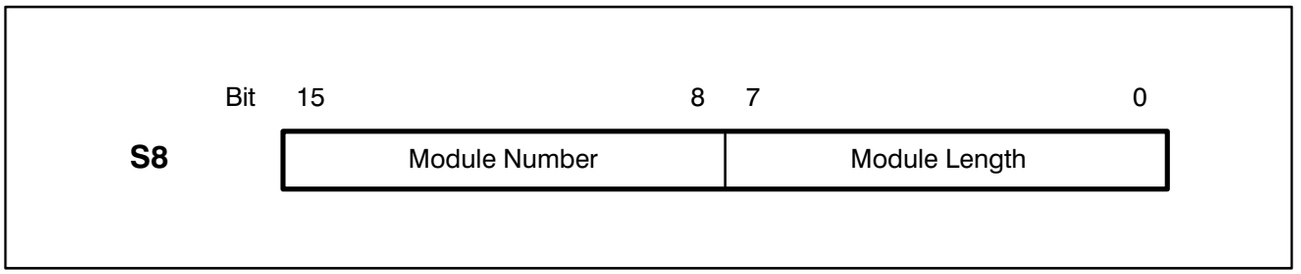


Fig. 5−11 DataModule S8

Marker Remanency S10

Limiting (byte) address for marker remanency

Default Byte 0−127 non−remanent (M0−M127)
Byte 128−255 remanent (M128−M255)

Example

```
;Definition of the marker remanency limit
L     W     K101D,B ;M101 1st marker remanent byte
T     W     B,S10
```

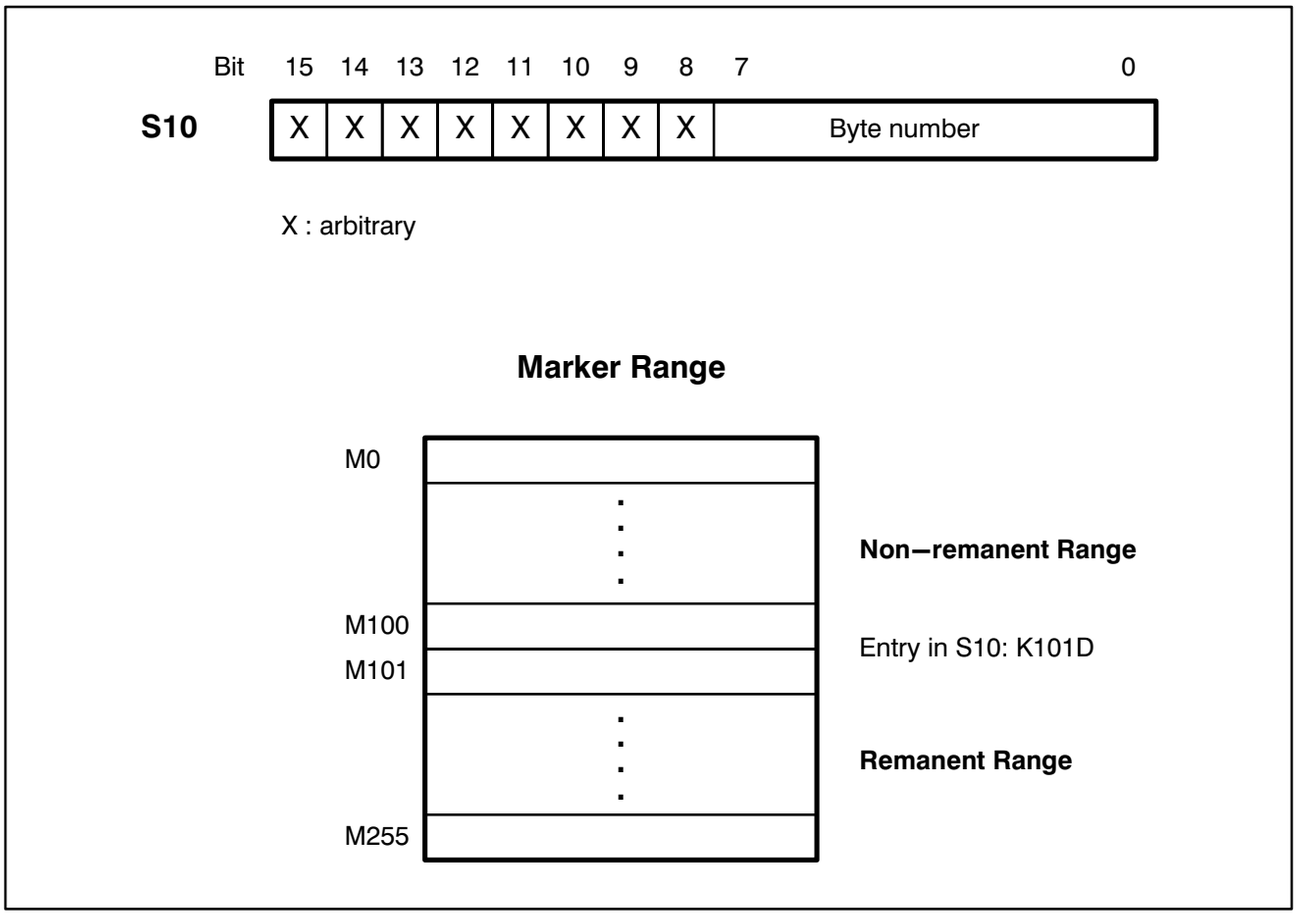


Fig. 5—12 MarkerRemanency S10

Time Remanency S12

Limiting (byte) address for timer remanency

Default Byte 0—7 non—remanent (T0—T63)
Byte 8—15 remanent (T64—T127)

Example

```
;Definition of the timer remanency limit
L       W       K4H,B ;T32 = 1st remanent timer
T       W       B,S12
```

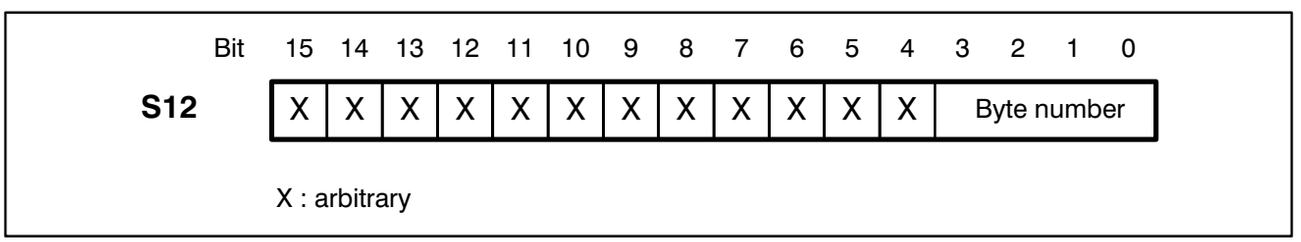


Fig. 5—13 TimeRemanency S12

Counter Remanency S14

Limiting (byte) address for counter remanency

Default Byte 0–7 non–remanent (C0–C63)
Byte 8–15 remanent (C64–C127)

Example

```
;Definition of the counter remanency limit
L     W     K2H,B ;C16 = 1st remanent counter
T     W     B,S14
```

Allocation Lists S16–S46

Set allocation lists for input and output modules.

Default no set allocation list defined

Allocation

S16, S18, S20, S22	4 words for input allocation (I0–I63)
S24, S26, S28, S30	4 words for output allocation (O0–O63)
S32, S34, S36, S38	4 words for extended input allocation (EI0–EI63)
S40, S42, S44, S46	4 words for extended output allocation (EO0–EO63)

Bit 1 = Byte allocated

Bit 0 = Byte not allocated (default), no set allocation list defined

Example

```
;1 word input allocation in S16, input bytes 0, 1, 4, 5 are used
L    W    K0033H,B
T    W    B,S16
```

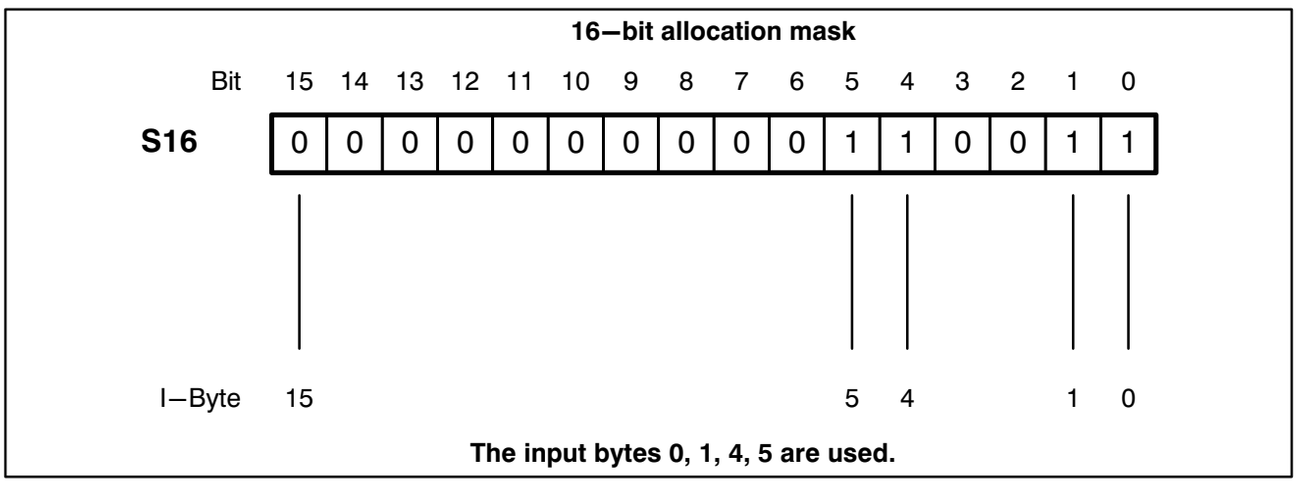


Fig. 5–14 Allocation Lists S16–S46 (Example)

5.4 Programming Language

5.4.1 Control Command Structure

The control commands are executed in accordance with DIN 19239. They comprise an **operation part** and an **operand part**. The control command may also consist of the operation part only, e.g. open brackets (, end of program (EP).

Operation Part

The operation part consists of up to 4 characters in the form of a command mnemonic. It is divided into the **operator** (OPR) and the **operator attribute** (OPA). The attribute defines the **data format**.

Operand Part

The operand part contains the necessary data to execute a command. Operands can be written in **symbolic** or **absolute notation**. The operand part (depending on the operation part) is composed of one or two **operands**. Each of these operands consists of an **operand identifier** and a **parameter**. The parameter can be a bit, byte, or word address (data format). In symbolic notation, the operand is identified with a preceding "–" and can consist of up to 8 characters (alphanumeric).

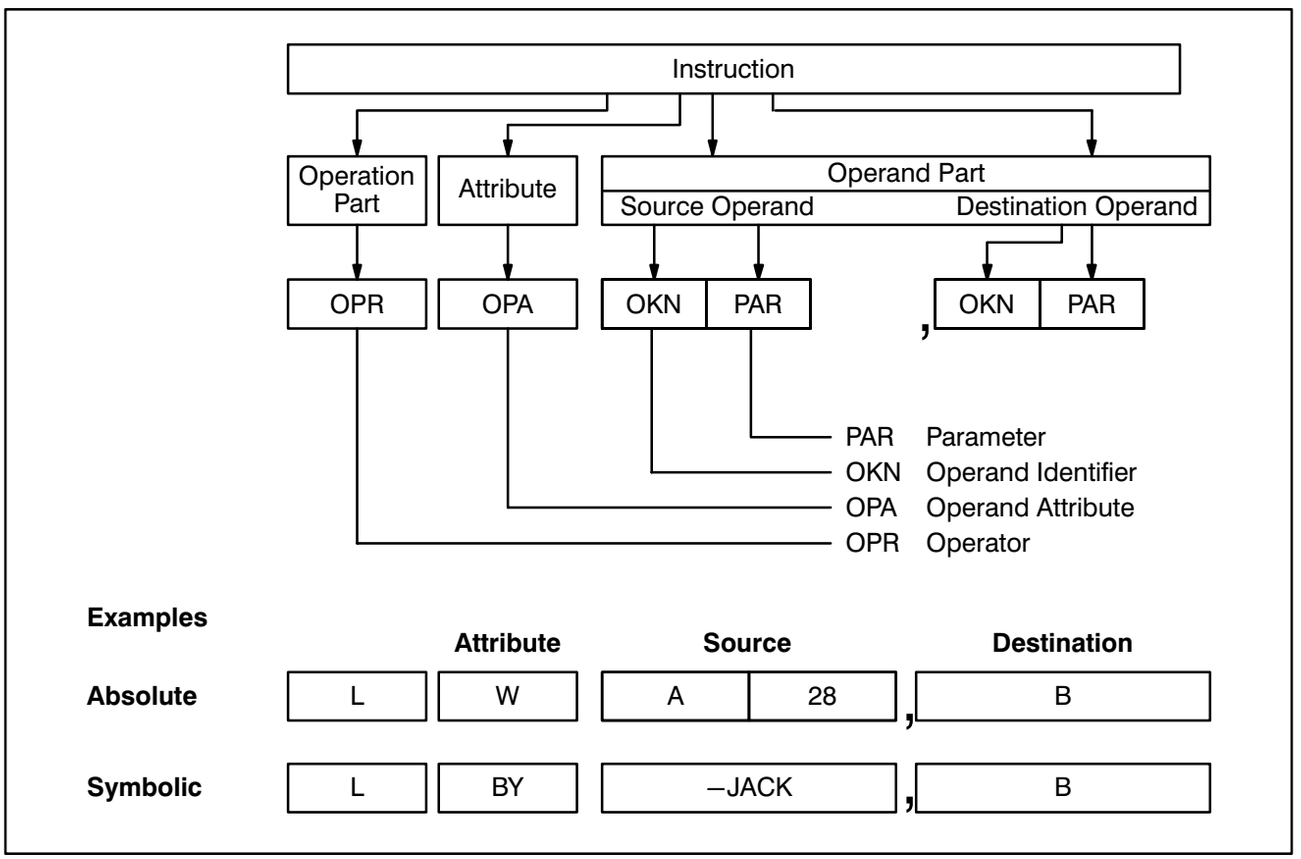


Fig. 5–15 Control command structure

5.4.2 Data Formats and Register Structure

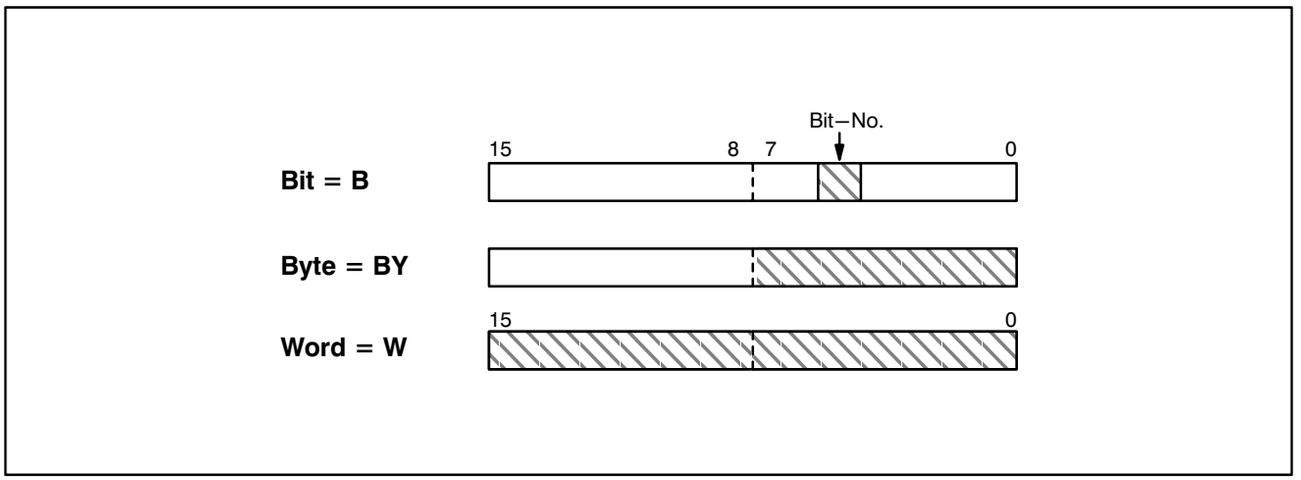


Fig. 5—16 Data Formats

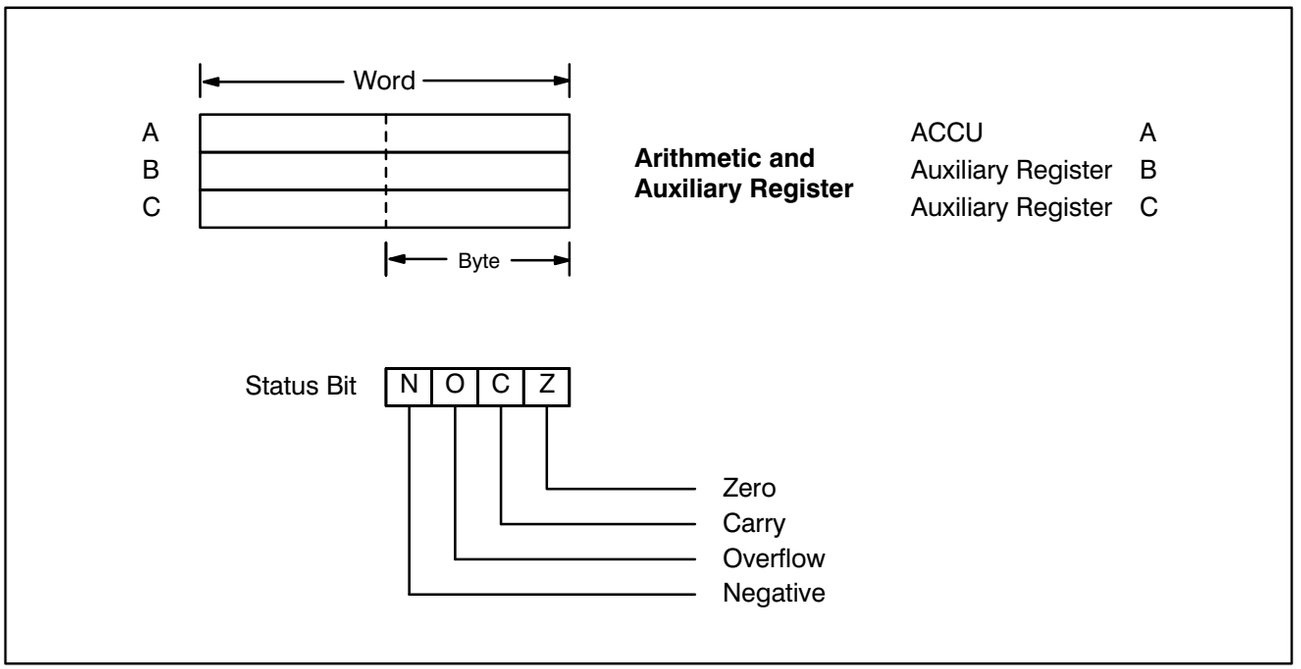


Fig. 5—17 Register Structure

5.4.3 Addressing Modes

Register — Register

Example

L W A,B

The content of register A is loaded into register B.

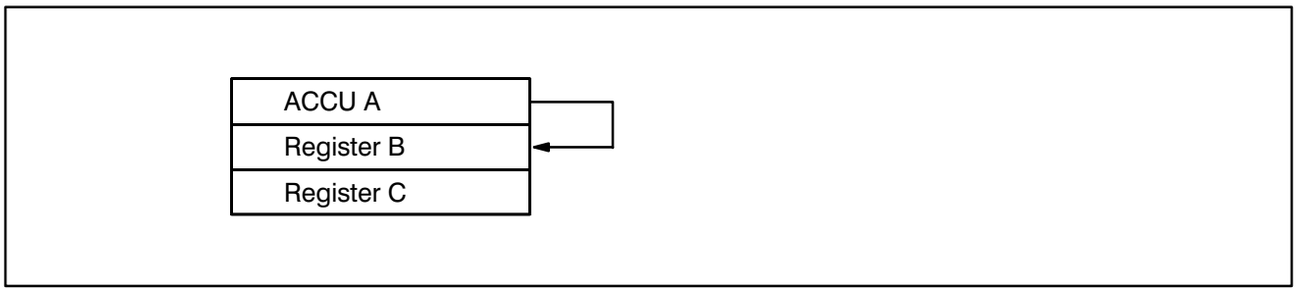


Fig. 5–18 Register– Register

Register — Direct

Example

L BY E15,B

The content of a peripheral address is loaded into a register.

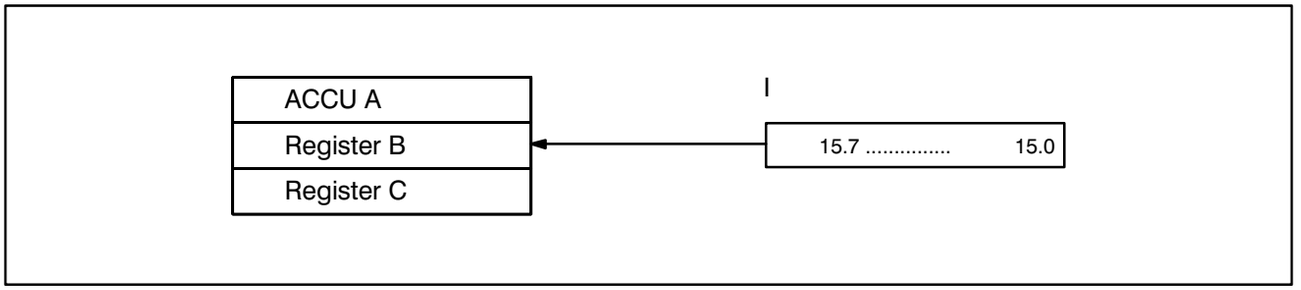


Fig. 5–19 Register– Direct

Register — Immediate

Example

L W K1234H,B

A constant indicated in the command is loaded into a register.

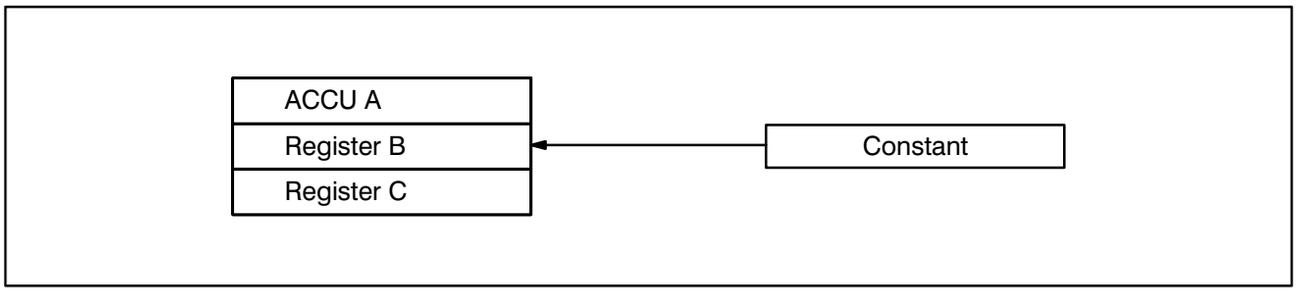


Fig. 5–20 Register– Immediate

Register Indirect

Example

L W [C],A

Register A is loaded with the peripheral content whose address is in register C.

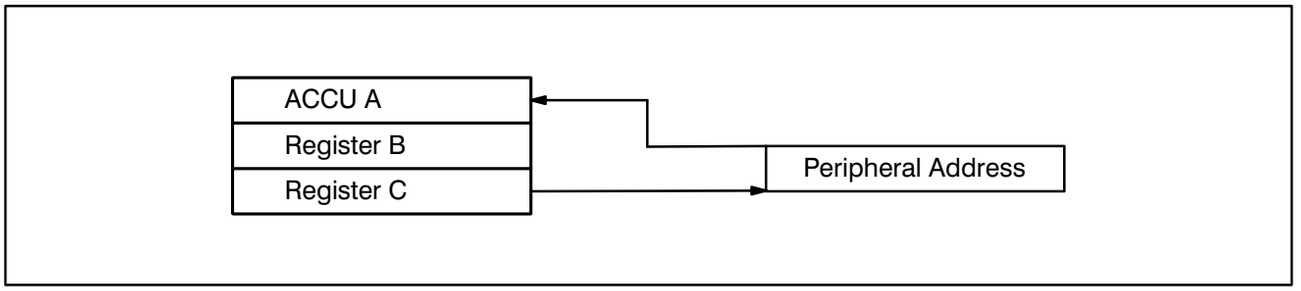


Fig. 5–21 Register– Indirect

5.4.4 Address Ranges

Operand	Byte Address	Word Address	Bit Address
I/O	0 – 63	Even byte	0.0 – 63.7
II/IO	0 – 63	addresses	
EI/EO	0 – 63	only	
M	0 – 255		0.0 – 255.7
D	0 – 511		
T			0 – 127D
C			0 – 127D
SM	28 – 31		28.0 – 31.7
DB	0 – 511		
P			
S	0 – 63		0 – 31D

Fig. 5–22 AddressRanges

Explanation of Operand Signs

C	Counter	IO	Interface Output
D	Data Module Word	M	Marker
DB	Data Buffer	O	Output
EI	Extended Input	P	Parameter
EO	Extended Output	S	System Range
I	Input	SM	Special Marker
II	Interface Input	T	Timer

Special Marker (SM) Code List

SM31.0	Initializing Pulse
SM31.1	Preventive Battery Fault Indication
SM31.2	Flashing Indicator (2 Hz)
SM31.3	Carry
SM31.4	Forcing Marker
SM31.5	Overflow
SM31.6	Negative
SM31.7	Zero
SM30.0–30.7	Max. Cycle Time
SM29.0–20.7	Cycle Time Counter (x 10 ms)

SM28.0−28.7	Error Byte
SM28.0	Module Stack Error
SM28.1	Opcode Error
SM28.2	Addressing Error
SM28.3	Module Management Error
SM28.4	Controller Addressing Error
SM28.5	Parameter Error
SM28.6	C/T Set−point Error
SM28.7	Cycle Time Error

System Range Code List

S0 (Bit 1)	I/O allocation list desired
S0 (Bit 2)	Copy data module to data buffer
S2	Main software watchdog (factor * 10 ms)
S4	Time base definition for time−controlled processing in OM5
S6	Time base definition for time−controlled processing in OM6
S8	Defining length and number of module to be coied
S10	Defining the limiting (byte) address for marker remanency
S12	Defining the limiting (byte) address for timer remanency
S14	Defining the limiting (byte) address for counter remanency
S16−S46	Set allocation lists for input and output modules
S16−S22	4 words for input allocation
S24−S30	4 words for output allocation
S32−S38	4 words for extended input allocation
S40−S46	4 words for extended output allocation

Representation of Constants

K0000000000000000B−K1111111111111111B	Binary value
K000000O−K177777O	Octal value
K00000D−K65535D	Decimal value
K0000H−KFFFFH	Hexadecimal value
K”AB”	2 ASCII characters
K0C−K8191C	Counter value
K0.TB−K999.TB	
Timer value	

Time values are not entered directly, but with a time base indication.

TB = 0	10 ms
TB = 1	100 ms
TB = 2	1 s
TB = 3	10 s

Absolute Address Allocation

The following list shows the structure of indirect addresses which are entered in register C.

from	to	
0000	000F	Counter states of counter bytes 0—15
0010	001F	Timer states of timer bytes 0—15
0020	003F	Special marker bytes SM0—SM31
0080	00BF	Input bytes I0—I63
00C0	00FF	Output bytes O0—O63
0100	01FF	Marker bytes M0—M255
0200	03FF	Data buffer byte DB0—DB511
0400	043F	System range S0—S63
0600	06FF	Actual counter bytes 0—255
0700	07FF	Actual timer bytes 0—255
0800	09FF	Data module bytes D0—D511
0A00	0A3F	Interface input bytes II0—II63
0C00	0C3F	Interface output bytes IO0—IO63
0E00	0E3F	Extended input bytes EI0—EI63
1000	103F	Extended output bytes EO0—EO63

5.5 Programming Considerations

5.5.1 Program Generation and Programming

Program generation and programming of the CL300 Programmable Controller is made using the PG3, PG3R, or PG4 Programming Units in the form of an instruction list (IL) or of a ladder diagram (LD).

There are two possible ways of programming:

Online Programming

The programming unit is connected to a plug−in terminal on the central processing unit of the CL300. Then, the program can be loaded into the controller RAM or EEPROM memory and tested.

Program amendments or modifications can be made during program execution. This, however, requires the program to be stored in a RAM memory module.

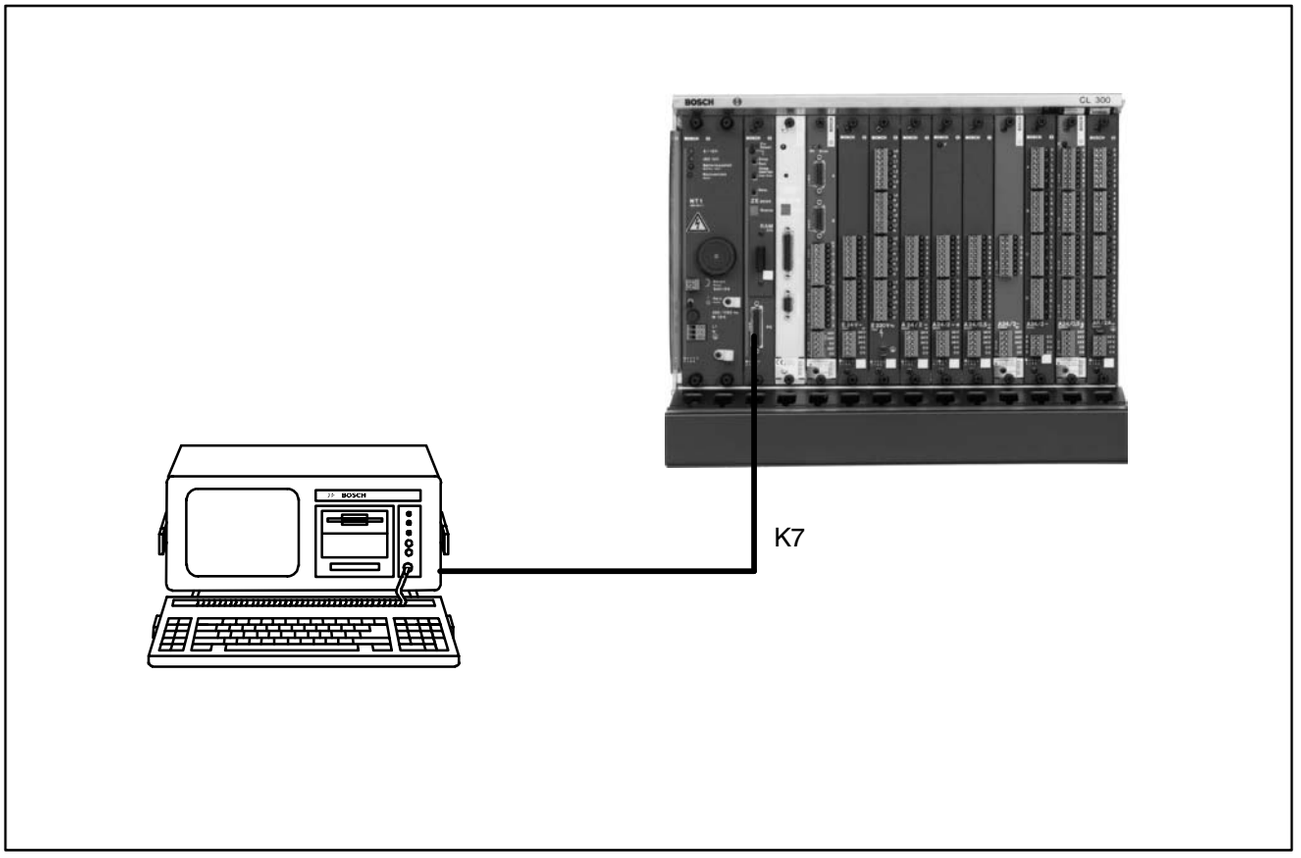


Fig. 5−23 OnlineProgramming

Offline Programming

Offline programming is made with the programming unit but without a connection to the CL300. The sequence is as follows:

- Program generation
- Storage on a floppy disk
- Documentation
- Program transfer to an EPROM memory module (in preparation) which is plugged into the programming unit slot provided for that purpose
- Insertion of the loaded EPROM into the central processing unit

5.5.2 Program Documentation

Symbol Tables

In symbol tables, symbolic names are assigned to the absolute addresses of inputs, outputs, markers, timers, counters, organizational modules, program modules, data modules, and data constants. The symbolic names may comprise up to 8 alphanumeric characters. For each symbol, an additional symbol annotation of up to 40 characters can also be defined.

Cross–reference List

The cross–reference list specifies the module and the instruction line where a given operand has been programmed. This output may either be a sorted sequence of absolute addresses (numeric) or of symbol names (alphabetic). Another sorting criterion is the command type used.

The module list can also be sorted and output according to module types.

Instruction List IL

The instruction list is a list of instructions written in mnemonic form.

The IL is subdivided into program branches. Following each terminating operation (=, S, R, ...), a new branch is opened. Each branch can have any number of texts allocated to it. The control instructions are arranged vertically. Each instruction can have a line annotation in the IL, beginning with ";".

If required, the IL can be printed with symbol or line annotations or both.

Ladder Diagram LD

Derived from the circuit diagram, the ladder diagram is a graphic representation of the program. The connections between input and output signals are shown by means of contact symbols.

The ladder diagram is subdivided into program branches. Each program branch can have any number of texts allocated to it. Following each terminating operation, a new branch is opened.

Signal flow is from left to right. Up to 7 contact symbols may be used in series.

5.5.3 Program Testing

Program testing is performed directly on the CL300 Programmable Controller.

Program testing permits to check the link conditions of the individual circuit paths for their logic function through the status indications of the input and output signals.

The interrupt stack allows extensive diagnostic functions to be performed.

Forcing

The test mode allows forcing of inputs/outputs and of interface inputs/outputs.

Forcing is performed with the programming unit. It is signalized by the special marker SM 31.4 and can be evaluated in the controller program.

The selected signal is allocated a defined state of “1” or “0”, independent of its state.

As long as a signal is forced, the LED display “FIX” of the ZE front panel lights.

The complete forcing mask on the central processing unit is cleared and the forcing markers are reset by pressing the “Reset Fix” button on the central processing unit.

Program Flags

Using the command * n (n = 0 – 31), the user can store program flags in the program flow stack of the interrupt stack. These program flags reflect the program flow prior to program abortion.

The program flags can be set by the user at arbitrary points of the program. As soon as the program arrives at a flag point, this is stored in the flow stack. In this way, the user has a rough image of the most recently executed program.

Contents

6 Preparation for Use

Before operating of the CL300, please check the following:

★ Make sure that the system configuration complies with the regulations VDE 0100 and 0113 (see chapter 2.2 Electrical Configuration).

★ Check for correct jumper settings on the modules.

★ Check for the correct supply voltage on the power supply unit (230 V/115 V).

★ Check if the modules are in the correct slots (Intelligent system modules in slots 4 — 6 of the GG301 orGG301—K).

★ Check if the modules are properly bolted to the card cage.

★ Make sure that the power supply connections are correct.

★ Check for protective ground connection.

★ Make sure that the 220 V AC circuit connections are not interchanged with the 24 V DC circuit connections.

★ Check if the buffer battery is installed in the power supply unit as described in paragraph 4.1.5.

★ Check if the controller program module is installed.

★ Switch off remanency on the ZE central processing unit. (This will clear all markers, timers and counters.)

★ Press ”Ausgänge sperren” (Inhibit outputs) switch on the central processing unit. (No output signals are generated.)

★ Switch on “Stop” mode on the central processing unit.

★ Switch on power supply.

Now the green power supply LEDs on the power supply unit should light.

The red LED “Stop” on the central processing unit should also light.

If the buffer battery has been used for the first time, a battery fault is indicated on the power supply unit and on the 7—segment display of the central processing unit.

After the “Reset” button is pressed, the controller goes into stop mode.

★ Connect the programming unit to the central processing unit.

★ Enter the program and then load it into the controller.

★ Select “RUN” mode.

★ Test the program and modify it, if necessary.

★ Switch on the power circuit of the outputs.

★ Reset “Ausgänge sperren” (Inhibit outputs) function.

★ The CL300 controller is now ready for operation.

Contents

List of Illustrations

7 Maintenance

7.1 Buffer Battery Replacement

The buffer battery should be replaced in the following cases with the CL300 controller is switched on:

- After one year of operating time.
- When the special marker SM31.1 “Preventive battery fault indication” is set.
- When the “Battery Fault” LED lights after the controller is switched on. If this is the case, data loss may already have occurred.

To prevent this, we recommend to always keep a buffer battery in stock.

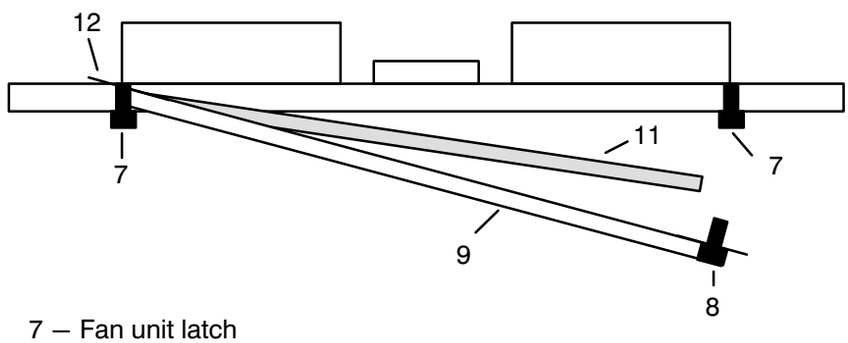
Procedure

Buffer battery replacement is to be made as described in paragraph 4.1.5.

7.2 Fan Unit Filter Replacement

The filter should be regularly inspected for contamination and be replaced, if necessary.

Fan Unit — Front View



7 — Fan unit latch
8 — Filter mat latch
9 — Filter mat holder
11 — Filter mat
12 — Filter mat holder insertion slot

Fig. 7–1 Fan Unit — Front View

Procedure

★ Remove fan unit as described in paragraph 2.1.8.

★ Inspect filter mat for contamination and replace it, if necessary, as follows.

★ Turn latch (8) clockwise or counterclockwise to unlatch.

★ Loosen filter mat holder (9) and remove it from slot (12) by pulling it towards the right.

★ Replace filter mit (11).

★ Insert filter mat holder (9) into slot (12) and close.

★ Press latch (8) to latch.

★ Install fan unit as described in paragraph 2.1.8.

Contents

8 Specifications

Ambient Temperature	0 to +55 °C
Non—operating Temperature	−20 to +70 °C
Humidity Class	F to DIN 40 040
Mechanical Stress	Installation in stationary equipment, not free from vibration
Mounting Dimensions	19 ” for standard cabinets H = 354.8 mm, W = 482.6 mm, D = 200 mm Including cable duct D = 262.5 mm 11.8 ” basic units H = 354.8 mm, W = 299.8 mm, D = 200 mm
Card Dimension	Dual Eurocard format
Weight of a Full Card Cage	19 ” approx. 20 kg 11.8 ” approx. 16 kg
Protection Class	IP 20 to DIN 40 050
Power Supply	220/230 V AC −15 % +10 % 110/115 V AC −15 % +10 %
Frequency Range	47−63 Hz

Line Fuse	M 1.6 A/230 V for NT300 M 6.3 A/230 V for NT301
Signal Voltages	24 V DC 115/230 V AC
Load Currents	2 A max. per output

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