Handbücher/Manuals

art of automation

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Manual

VIPA System 200V

Order No.: VIPA HB97E
Rev. 01/46

Chapter 1 Introduction

Outline

The focus of this chapter is on the introduction of the VIPA System 200V. Various options of configuring central and decentralized systems are presented in a summary.

The chapter also contains the general specifications of the System 200V, i.e. dimensions, installation and environmental conditions.

The chapter ends with a description of the 7-layer model and a table of the communication levels available in automation technology.

Below follows a description of:

- Introduction of the System 200V
- General information, i.e. installation, operational safety and environmental conditions
- 7-layer model and communication layers

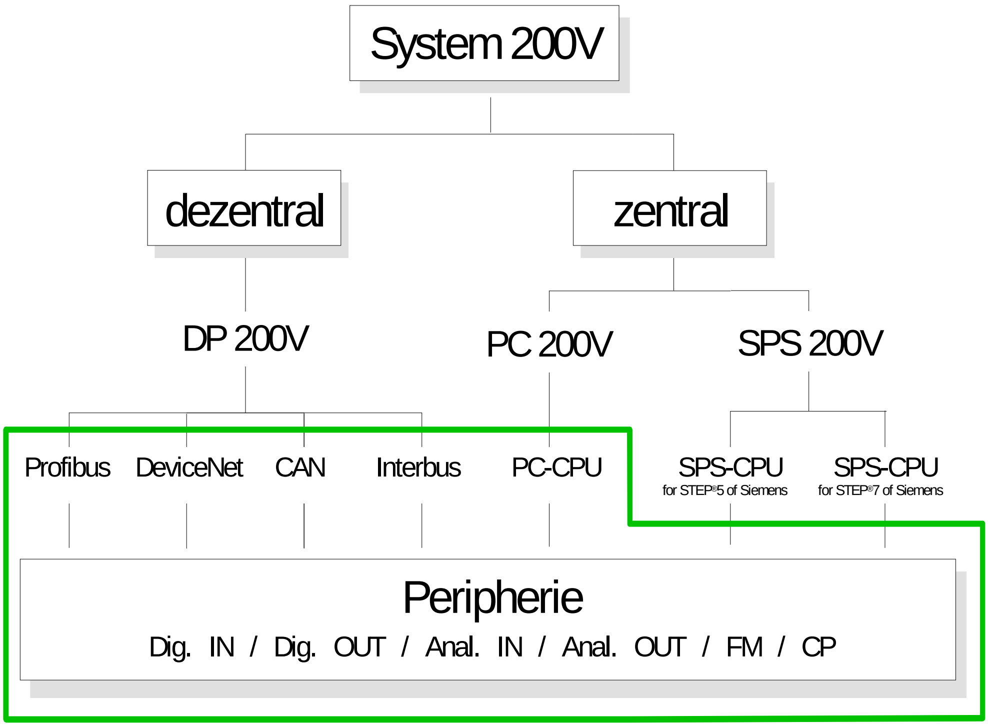
Contents

Overview

The System 200V

The System 200 V is a modular automation system for centralized and decentralized applications requiring low to medium performance specifications. The modules are installed directly on a DIN-rail. Bus connectors inserted into the DIN-rail provide the interconnecting bus.

The following figure illustrates the capabilities of the System 200V:



Components

Centralized system

The System 200 series consists of a number of PLC-CPUs. These are programmed in STEP®5 of Siemens and they are compatible with existing programs that are executable on the Siemens series 90U through 115U, STEP®7 of Siemens or in accordance with IEC 61131-3.

CPUs that are fitted with integrated Ethernet interfaces or additional serial interfaces simplify the integration of the PLC into an existing network or the connection from additional peripheral equipment.

The application program is saved in Flash RAM or an additional plug-in memory module.

The PC based CPU 288L can be used to implement operating/monitoring-, control applications or other file-processing applications.

The modules are programmed in C++, Pascal or in accordance with IEC 61131-3.

The PC 288-CPU provides an active interface to the back panel bus and it can be employed as central controller for all peripheral and function modules of the VIPA System 200V.

With the appropriate expansion interface the System 200V can support up to 4 rows.

Decentralized system

In combination with a Profibus DP-Master and -Slave the PLC-CPU's or the PC-CPU form the basis for a Profibus-DP network in accordance with DIN 19245-3. The DP network can be configured with any configuration tool. Parameters are saved in a plug-in Flash ROM module.

The module can also be configured directly via the Profibus network by means of the VIPA software WinNCS when this is used in conjunction with a Profibus-Master PC plug-in module that is available from the company Softing. Alternatively, all Profibus modules are available with a plastic FO-connector.

Other field-bus systems can be connected by means of slaves that can interface with Interbus, CANopen and DeviceNet.

Peripheral modules

A large number of peripheral modules are available form VIPA, for example digital as well as analog inputs/outputs, counter functions, displacement sensors, positioners and serial communication modules.

These peripheral modules can be used in centralized as well as decentralized mode.

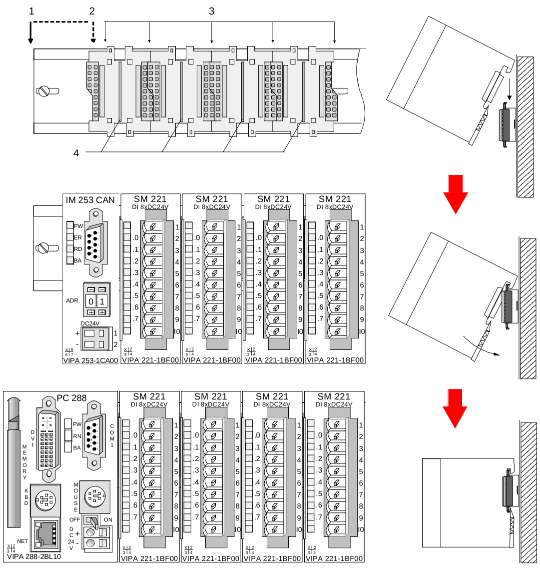
General description System 200V

Structure/ dimensions

- Standard 35mm DIN-rail
- Peripheral modules with recessed labelling
- Dimensions of the basic enclosure:
  1slot width: (HxWxD) in mm: 76x25,4x76 in inches: 3x1x3
  2slot width: (HxWxD) in mm: 76x50,8x76 in inches: 3x2x3

Installation

Please note that you can only install header modules like the CPU, the PC and couplers into plug-in location 1 or 1 and 2 (for double-width modules).



[1] Header modules like PC, CPU, bus couplers
[2] Double width header module or peripheral module
[3] Peripheral module
[4] Guide rails

Reliability

- Wiring by means of spring pressure connections on the front, gauge 0,8...2,5mm^2 or 1,5 mm^2 (18-pole plug)
- Complete isolation of the wiring when modules are exchanged
- Every module is isolated from the back panel bus
- EMC resistance ESD/Burst in accordance with IEC 801-2 / IEC 801-4 through to level 3: 8kV/2kV
- Shock resistance in accordance with IEC 68-2-6 / IEC 68-2-27 (1G/12G)

Environmental conditions

- Operating temperature: 0 ... +55°C
- Storage temperature: -40 ... +85°C
- Relative humidity: 95% without condensation
- Ventilation by means of a fan is not required

ISO/OSI reference model

Outline

The ISO/OSI reference model is based on a proposal that was developed by the International Standards Organization (ISO). This represents the first step towards an international standard for the different protocols. It is referred to as the ISO-OSI model. OSI is the abbreviation for **O**pen **S**ystems **I**nterconnection, the communication between open systems. The ISO/OSI reference model does not represent a network architecture as it does not define the services and protocols used by the different layers. The model simply specifies the tasks that the different layers must perform.
All current communication systems are based on the ISO/OSI reference model (OSI: **O**pen **S**ystem **I**nterconnection) which is defined by the ISO 7498 standard. The reference model structures communication systems into 7 layers that cover different communication tasks. In this manner the complexity of the communication between different systems is divided amongst different layers to simplify the task.
The following layers have been defined:

Layer	Function
Layer 7	Application Layer
Layer 6	Presentation Layer
Layer 5	Session Layer
Layer 4	Transport Layer
Layer 3	Network Layer
Layer 2	Data Link Layer
Layer 1	Physical Layer

Depending on the complexity and the requirements of the communication mechanisms a communication system may use a subset of these layers. Interbus-S and Profibus for instance only use layers 1 and 2. For this reason the following paragraphs will be limited to a short description of these layers.

Layers

Layer 1 Bit-communications layer (physical layer)

The bit-communications layer (physical layer) is concerned with the transfer of data bits via the communication channel. This layer is therefore responsible for the mechanical, electrical and the procedural interfaces and the physical communication medium located below the bit-communication layer:

- Which voltage represents a logical 0 or a 1.
- The minimum time that the voltage be present to be recognized as a bit.
- The pin assignment of the respective interface.

Layer 2 Security layer (data link layer)

This layer performs error-checking functions for bit strings transferred between two communicating partners. This includes the recognition and correction or flagging of communication errors and flow control functions.

The security layer (data link layer) converts raw communication data into a sequence of frames. This is where frame boundaries are inserted on the transmitting side and where the receiving side detects them. These boundaries consist of special bit patterns that are inserted at the beginning and at the end of every frame. The security layer often also incorporates flow control and error detection functions.

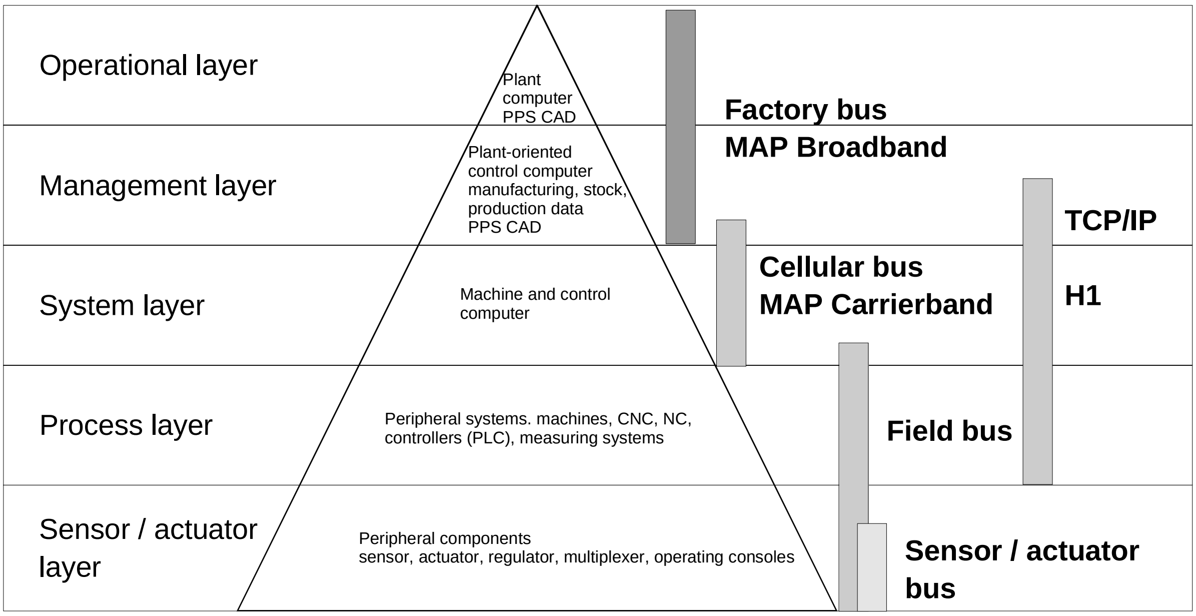
Layer 3 to 7

In accordance with Interbus-S and Profibus these layers have not been implemented on the bus couplers supplied by VIPA.

Communication layers employed by automation systems

The flow of information in a company presents a vast spectrum of requirements that must be met by the communication systems. Depending on the area of business the bus system or LAN must support a different number of users, different volumes of data must be transferred and the intervals between transfers may vary, etc.

It is for this reason that different bus systems are employed depending on the respective task. These may be subdivided into different classes. The following model depicts the relationship between the different bus systems and the hierarchical structures of a company:



It is common that very large volumes of data are transferred on the operational level that are not subject to timing restrictions. However, on the lowest level, i.e. the sensor / actuator level, an efficient transfer of rather small data volumes is essential. In addition, the bus system must often meet real-time requirements on the sensor / actuator level.
It is for this reason that Interbus-S is most suitable as the sensor / actuator bus for the cyclic transfer of low volume data packets at predefined intervals.

Chapter 2 Profibus-DP

Overview

This chapter contains a description of Profibus applications of the System 200V. A short introduction and presentation of the system is followed by the project design and configuration of the Profibus master and slave modules that are available from VIPA. The chapter concludes with a number of communication examples and the technical data.

Below follows a description of:

- System overview of the Profibus modules that are available from VIPA
- The principles of Profibus DP
- The construction project design of the Profibus masters IM 208 DP
- The construction project design of the Profibus slaves IM 253 DP
- Sample projects
- Technical data

Contents

Topic **Page**

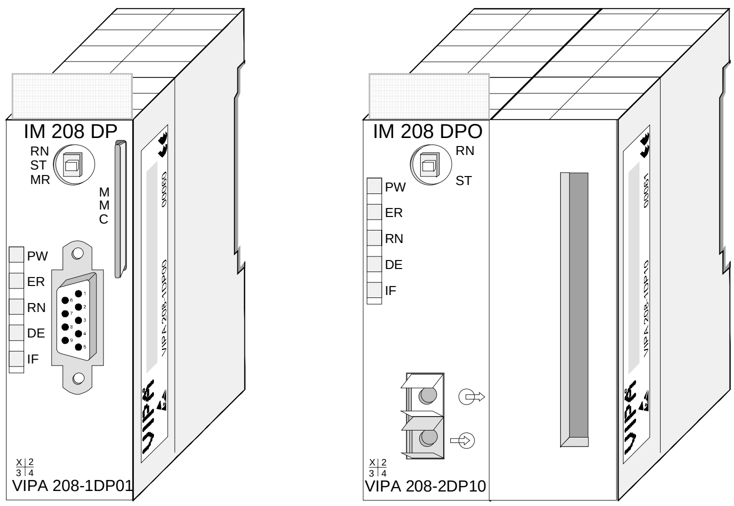
System overview

All System-200V Profibus modules are available with an RS485 as well as a FO connector. The following groups of Profibus modules are available at present:

- Profibus-DP master
- Profibus-DP slave with address selector
- Profibus-DP slave with LC display for the selected address and diagnostics
- Profibus-DP slave combination module
- CPU 21x DP - CPU 21x with integrated Profibus-DP slave for the Siemens S7 (refer to manual HB103).
- CPU 24x DP - CPU 24x with integrated Profibus-DP slave for the Siemens S5 (refer to manual HB99).

Profibus-DP master

- Profibus-DP master, class 1
- Project design using WinNCS of VIPA
- Project design by means of COM Profibus of Siemens is possible
- Project-related data is saved in the internal Flash-ROM or stored on a Flash-Memory card.

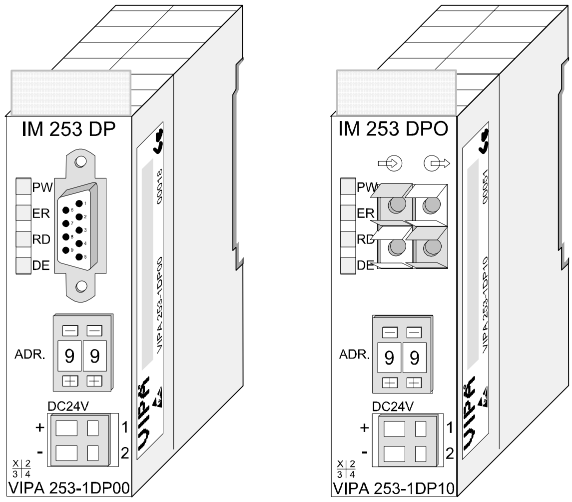


Ordering data DP master

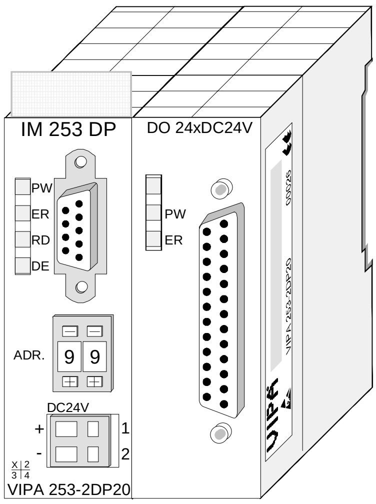
Type	Order number	Description
IM 208 DP	VIPA 208-1DP01	Profibus-DP master with RS485
IM 208 DPO	VIPA 208-2DP10	Profibus-DP master with FO connector

Profibus-DP slaves

- Version with RS485 interface or fiber optic connectors
- Online diagnostic protocol with time stamp
- DP slaves with an LCD are under development



Profibus-DP slave - combination modules



Ordering data DP slaves

Type	Order number	Description
IM 253 DP	VIPA 253-1DP00	Profibus-DP slave with address selector
IM 253 DPO	VIPA 253-1DP10	Profibus-DP slave with address selector and FO connector
IM 253 DP DO 24xDC24V	VIPA 253-2DP20	Profibus-DP slave with address selector and 24-port DO

Principles

General

Profibus is an international standard applicable to an open fieldbus for building, manufacturing and process automation. Profibus defines the technical and functional characteristics of a serial fieldbus system that can be used to create a low (sensor-/actuator level) or medium (process level) performance network of programmable logic controllers.

Profibus comprises an assortment of compatible versions. The following details refer to Profibus-DP.

Profibus-DP

Profibus-DP is a special protocol intended mainly for automation tasks in a manufacturing environment. DP is very fast, offers Plug and Play facilities and provides a cost-effective alternative to a parallel bus between PLC's and decentralised peripherals. Profibus-DP was designed for high-speed data communications on the sensor-actuator level.

The data transfer referred to as "Data Exchange" is cyclical. The master reads input values from the slaves and writes output information to the slave in one single bus cycle.

Master and slaves

Profibus distinguishes between active stations (master) and passive stations (slave).

Master devices

Master devices control the communications on the bus. It is also possible to operate with multiple masters on a Profibus. This is referred to as multi-master operation. The protocol on the bus establishes a logical Tokenring between intelligent devices connected to the bus. Only the master that has the token can communicate with its slaves.

A master (IM 208 DP or IM 208 DPO) is able to issue unsolicited messages if it is in possession of the access key (token). The Profibus protocol also refers to masters as active participants.

Slave-devices

A Profibus slave acquires data from peripheral equipment, sensors, drives and transducers. The VIPA Profibus couplers (IM 253 DP, IM 253 DPO and the CPU 24x DP, CPU 21x DP) are modular slave devices that transfer data between the System 200V periphery and the high-level master.

In accordance with the Profibus-standards these devices have no bus-access rights. They are only allowed to acknowledge messages or return messages to a master when this has issued a request. Slaves are also referred to as passive participants.

Communications

The bus transfer protocol provides two alternatives for the access to the bus:

Master with master

Master communications is also referred to as token-passing procedure. The token-passing procedure guarantees the accessibility of the bus. The permission to access the bus is transferred between individual devices in the form of a "token". The token is a special message that is transferred via the bus.

When a master is in possession of the token it has the permission to access the bus and it can communicate with any active or passive device. The token retention time is defined when the system is being configured. Once the token retention time has expired the token is passed to the following master which now has permission to access the bus and may therefore communicate with any other device.

Master-slave procedure

Data communications between a master and the slaves assigned to it is conducted automatically in a predefined and repetitive cycle by the master. You assign a slave to a specific master when you define the project. You can also define which DP-slaves are included and which are excluded from the cyclic exchange of data.

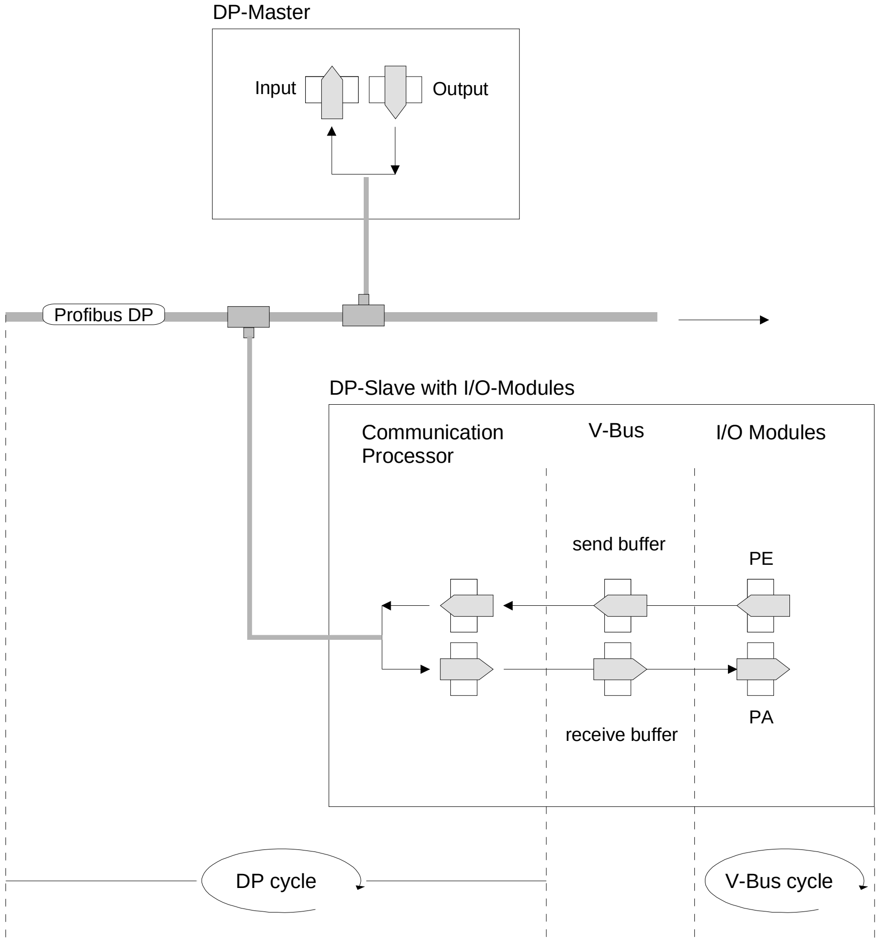
Data communications between master and slave can be divided into a definition, a configuration and a data transfer phase. Before a DP slave is included in the data transfer phase the master checks die whether the defined configuration corresponds with the actual configuration. This check is performed during the definition and configuration phase. The verification includes the device type, format and length information as well as the number of inputs and outputs. In this way a reliable protection from configuration errors is achieved.

The master handles the transfer of application related data independently and automatically. You can, however, also send new configuration settings to a bus couplers.

When the status of the master is DE "Data Exchange" it transmits a new series of output data to the slave and the reply received from the slave contains the latest input data.

Data transfer operation

Data is transferred cyclically between the DP master and the DP slave by means of transmit and receive buffers.



PE: process image of the inputs

PA: process image of the outputs

V-bus cycle

A V-bus cycle (V-Bus=VIPA back-panel bus) saved all the input data from the modules in the PE and all the output data from the PA in the output modules. When the data has been saved the PE is transferred into the ”send buffer” and the contents of the ”receive buffers” is transferred into PA.

DP cycle

During a Profibus cycle the master addresses all its slaves according to the sequence defined in the data exchange. The data exchange reads and writes data from/into the memory-areas assigned the Profibus.

The contents of the Profibus input area is entered into the ”receive buffer” and the data in the ”send buffer” is transferred into the Profibus output-area.

The exchange of data between DP master and DP slave is completed cyclically and it is independent from the V-bus cycle.

V-bus cycle ≤ DP-cycle

To ensure that the data-transfer is synchronized the V-bus cycle-time should always be less than or equal to the DP cycle-time.

The parameter is located in the GSD-file.

min_slave_interval = 3ms.

In an average system it is guaranteed that the Profibus-data on the V-bus is updated after a max. time of 3ms. You can therefore exchange data with the slave at intervals of 3ms.

Note!

When the V-bus cycle time exceeds the DP-cycle time the RUN-LED on the VIPA-Profibus slave is extinguished.

This function is supported as of hardware revision level 6.

Data consistency

The VIPA Profibus-DP masters provide ”word-consistency”!

Consistent data is the term used for data that belongs together by virtue of its contents. This is the high and the low byte of an analogue value (word consistency) as well as the control and status byte along with the respective parameter word for access to the registers.

The data consistency as applicable to the interaction between the periphery and the controller is only guaranteed for 1 byte. This means that input and output of the bits of a byte occurs together. This byte consistency suffices when digital signals are being processed.

Where the data length exceeds a byte, for example in analogue values, the data consistency must be extended. Profibus guarantees that the consistency will cater for the required length.

Restrictions

- A max. of 125 DP-slaves are supported by one DP-master - a max. of 32 slaves/segment
- You can only install or remove peripheral modules when you have turned the power off!
- The max. distance for RS485 cables between two stations is 1200m (depending on the Baud rate)
- The max. distance for FO based connections between two stations is 50m
- The maximum Baud rate is 12 MBaud
- The Profibus-address of operational modules must never be changed.

Diagnostics

Profibus-DP provides an extensive set of diagnostic functions for quick location of faults. Diagnostic messages are transferred via the bus and collected by the master.

Data communications medium

Profibus employs Screened twisted pair cable on the basis of the RS485 interfaces or a duplex fiber optic link (FO). The data transfer rate of both systems is limited to a max. of 12MBaud.

For details please refer to the "Installation guidelines".

Electrical system based on RS485

The RS485 interface uses differential voltages. It is for this reason that this interface is less susceptible to interference than a plain voltage or current based interface. The network may be configured as a daisy-chain or in a tree configuration. Your VIPA Profibus coupler carries a 9-pin socket. This socket is used to connect the Profibus coupler to the Profibus network as a slave.

Due to the bus structure of RS-485 any station may be connected or disconnected without interruptions and a system can be commissioned in different stages. Extensions to the system do not affect stations that have already been commissioned. Any failures of stations or new devices are detected automatically.

Optical system using fiber optic data links

The fiber optic system employs pulses of monochromatic light. The fiber optic cable can be used in the same manner as any normal cable and it is not susceptible to external electrical interference. Fiber optic systems have a linear structure. Each device requires two lines, a transmit and a receive line. It is not necessary to provide a terminator at the last device.

Due to the linear structure of the FO data link it is not possible to install or remove stations without interruption to data communications.

Addressing

Every device on the Profibus is identified by an address. This address must be unique in each bus system and may be a number anywhere between 0 and 125. The address of the VIPA Profibus coupler is set by the addressing switch located on the front of the module.

You must assign the address to the VIPA Profibus master during the configuration phase.

GSD-file

For configuration purposes you will receive a GSD-file containing the performance specifications of VIPA Profibus couplers.

The structure, contents and coding of the GSD file are defined by the Profibus user organization (PNO) and are available from this organization.

The GSD-file for VIPA Profibus-DP slaves is named: DP2V0550.GSD

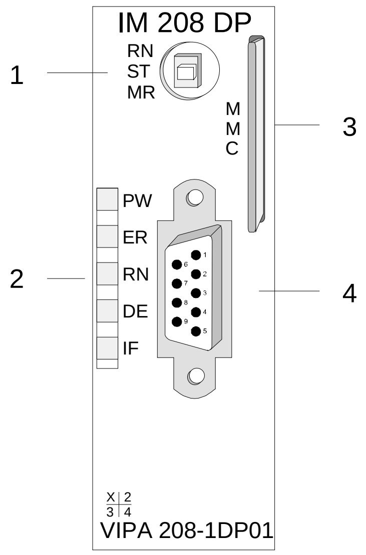
Install this GSD file into your configuration tool. You can obtain more detailed information on the installation of GSD files from the manual supplied with your configuration tool.

Construction of the IM 208 - DP master with RS485

Properties

- Class 1 Profibus-DP master
- 125 DP slaves can be connected to a DP master.
- Inserts the data areas of the slaves located on the V-bus into the addressing area of the CPU 24x
- Project configuration by means of VIPAs WinNCS or Siemens ComProfibus
- Diagnostic facilities

Front view IM 208 DP



[1] Operating mode switch RUN/STOP
[2] LED status indicators
[3] Slot for memory card
[4] RS485 interface

Components

LED's

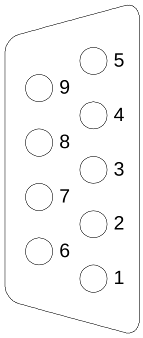
The module carries a number of LED's that are available for diagnostic purposes on the bus and for displaying the local status. The following table explains the different colors of the diagnostic LED's.

Designation	Color	Explanation
PW	yellow	Indicates that the supply voltage is available on the back panel bus.
ER	red	On when a slave has failed (ERROR).
RN	green	If RN is the only LED that is on, then the master status is RUN. The slaves are being accessed and the outputs are 0 ("clear" state). If both RN+DE are on the status of the Master is "operate". It is communicating with the slaves.
DE	yellow	DE (Data exchange) indicates Profibus communication activity.
IF	red	Initialization error for bad configurations.

RS485 interface

The VIPA Profibus master is connected to your Profibus network via the 9-pin socket.

The following figure shows the assignment of the individual pins



Pin	Assignment
1	shield
2	n.c.
3	RxD/TxD-P
4	CNTR-P
5	GND
6	5V (70mA max.)
7	n.c.
8	RxD/TxD-N
9	n.c.

Power supply

The Profibus master receives power via the back panel bus.

Operating mode selector

The operating mode selector is used to select operating modes STOP (ST) or RUN (RN).

The master will change to RUN mode if the operating mode selector is set to RN and parameters are acceptable.

When the operating mode switch is set to ST the master will change to STOP mode. In this mode all communications are terminated and the outputs of the allocated slaves will be set to 0 if the parameters are valid and the master issues an alarm to the controlling system.

The chapter on ”Operating modes” contains a detailed explanation of the change between RUN and STOP mode.

In position MR you can activate a download-mode for the transfer of your project data. For details, please refer to the section on "Transferring a project" below.

MMC as external storage medium

The VIPA MMC memory card is employed as an external storage medium. You can transfer your project-related data from the internal Flash-ROM into this memory card by means of the command "copy RAM to ROM" of the Siemens Hardware Manager.

The MMC memory card is available from VIPA with the order no.: VIPA 953-0KX00.

You initiate the transfer of project data from the MMC into the master by setting the operating mode selector into position MR. For details, please refer to the section on "Transferring a project" below.

Operating modes

Power On

The IM 208 interface is powered on. The configuration data is read from the memory card, the validity is verified and the data is stored in the internal RAM of the IM 208.

The master will change to RUN-mode automatically when the operating mode switch is in position RUN and the parameters are valid. In run-mode the LED's RN, DE and ER are turned on. The ER-LED is extinguished when all the configured slaves are available via data exchange.

STOP

In STOP mode the outputs of the allocated slaves will be set to 0 if the parameters are valid. Although no communications will take place, the master will remain active on the bus using current bus parameters and occupying the allocated bus address. To release the address the Profibus plug must be removed from the IM 208 interface.

STOP → RUN

In the RN position the master will re-boot: configuration data and bus parameters are retrieved from the memory card and saved into the internal RAM of the IM 208.

Next, the communication link to the slaves is established. At this time only the RN-LED will be on. Once communications has been established by means of valid bus parameters the IM 208 will change to RUN mode. The master interface displays this status by means of the LED's RN and DE.

The IM 208 will remain in the STOP mode and display a configuration error by means of the IF-LED if the parameters are bad or if the memory card was not inserted. The interface will then be active on the bus using the following default bus parameters:

Default-Bus-Parameter: address:1, communication rate:1,5 MBaud.

RUN

In RUN mode the RN- and DE-LED's are on. In this condition data transfers can take place. If an error should occur, e.g. slave defective, the IM 208 will indicate the event by means of the ER-LED and it will issue an alarm to the system on the next higher level.

RUN → STOP

The master is placed in STOP mode. It terminates communications and all outputs are set to 0. An alarm is issued to the system on the next higher level.

Configuration of IM 208 - DP master with RS485

General

You can use the function "Profibus" of the VIPA configuration tool WinNCS to configure the IM 208 master and the respective slaves.

The module transfer functions available in WinNCS provide many options for the data transfer to your master module.

IM 208 masters behave similar to IM 308-C and they can be configured as IM 308-C modules in the Siemens "Com Profibus" tool.

System 200V CPU applications

The IM 208 master modules can be used to connect up to 125 Profibus DP slaves to a System 200V CPU. The master communicates with the slaves and maps the data areas into the memory map of the CPU via the back panel bus. Input and output data are limited to a maximum of 256 byte each.

The CPU retrieves the I/O mapping data from all connected masters when the CPU is re-started.

Alarm processing is active, i.e. an error message from the IM 208 can STOP the CPU

The ER-LED is turned on if a slave should fail. If the delayed acknowledgment (QVZ) parameter was configured for a slave, a dropped acknowledgment will STOP the CPU. If QVZ has not been configured the CPU will continue running

When the BASP signal is available from the CPU the IM 208 sets the outputs of the connected periphery to zero.

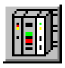
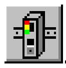
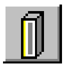
Note!

Refer to the documentation for your CPU for details on the interfacing requirements of the CPU.

Configuration under WinNCS

The Profibus master can be configured by means of the VIPA WinNCS configuration tool.

The WinNCS configuration procedure is outlined below:

1.	Start WinNCS and create a new project file for the "Profibus" function by clicking on **File** > *create/open*.
2.	If you have not yet done so, use  to insert a **Profibus function group** into the network window and click [Accept] in the parameter box.
3.	Use  to insert a **Profibus host/master** into the network window and specify the Profibus address of your master in the parameter window.
4.	Insert a **Profibus slave** into the network window by means of . Enter the Profibus address, the family "I/O" and the station type "DP200V" into the parameter window and click [Accept].
5.	Use  to define the configuration of every peripheral module that is connected to the corresponding slave via the back panel bus. You can select automatic addressing for the periphery by clicking [Auto] and display allocated addresses by means of [MAP]. For intelligent modules like the CP240 the configurable parameters will be displayed.
6.	When you have configured all the slaves with the respective periphery the bus parameters for Profibus must be calculated. Select the Profibus function group In the network window. In the parameter window click on the "Busparameter" tab in the parameter window. Select the required baud rate and click [calculate]. The bus parameters will be calculated - [Accept] these values. The bus parameters must be re-calculated with every change to the set of modules!
7.	Activate the master-level in the network window and export your project into a 2bf-file.
8.	Transfer the 2bf-file into your IM208 master (see "Transferring a project ").

Transferring a project

Overview

The transfer from your PC into the IM 208 DP-Master is performed by the "Green Cable" that is available form VIPA. You can transfer your project from your PC via the Profibus interface into the internal Flash-ROM of the IM 208 DP Master.

You can transfer the contents of the internal Flash-ROM into the MMC by means of the command "Copy RAM into ROM" of the Siemens STEP®7 Manager.

You can initiate a data transfer from the MMC into the internal Flash-ROM by means of the operating mode switch.

It is not possible to boot directly from the MMC.

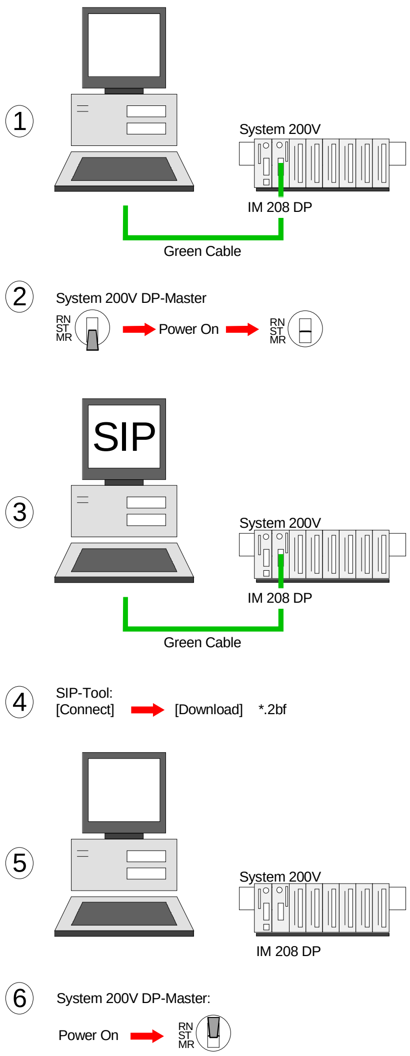
Using the "Green Cable" to transfer a project

You can transfer your projects from your PC into your IM 208 DP Master by means of the "Green Cable". The "Green Cable" is available from VIPA under order no.: VIPA 950-0KB00.

Requirements

You have configured the Profibus system and exported your project to a 2bf-file.

Procedure



- Connect the "Green Cable" to the serial interface of your PC and to the Profibus interface of the IM 208 DP master.
- Hold the operating mode switch of the Profibus master in position MR and turn the power supply on, only the PW-LED will light up on the Profibus master.
- Release the operating mode switch. → Now your Profibus master can receive serial Data via the Profibus interface.
- Turn your PC on and start the SIP tool that is supplied with WinNCS. Select the appropriate COM-port and establish a connection by means of [Connect]. When the connection has been established the SIP tool will display OK in the status line located at the top, otherwise an ERR message will be displayed.
- Click [Download], select your 2bf-file and transfer this file into the DP-master
- Terminate the connection and the SIP tool when the data has been transferred.
- Disconnect the "Green Cable" from the Master.
- Turn off the power supply of your master.
- Connect the master to the Profibus network and turn the power supply on again.
- Change the operating mode of the master to RUN. → Your IM 208 DP Profibus master is now connected to the network with the updated configuration. The configuration data is saved in the internal Flash-ROM. This data can now be transferred into the MMC memory card.

Transferring data from the internal Flash-ROM to the MMC

At present the only method to transfer the data from the internal Flash-ROM into the MMC is by means of the write command of the Siemens STEP®7 Manager in conjunction with a VIPA CPU 21x. Additional options will be available shortly.

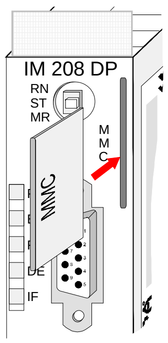
Requirements

The internal Flash-ROM of your IM 208 DP-master contains a project.

Procedure

- Connect your PC to the MPI-interface of the VIPA CPU 21x by means of the "Green Cable". The MPI-interface of the VIPA CPU 21x performs an internal RS232/MPI conversion when it is connected to the "Green Cable".
- Turn o the power to your System 200V.
- Insert a MMC into the Profibus master.
- Start the Siemens STEP®7 Manager.
- The sequence **Target system** > *Copy RAM to ROM* transfers the data from internal Flash-ROM of the master into the MMC. When this operation has completed the MMC can be removed.

Transferring data from the MMC into an internal Flash-ROM

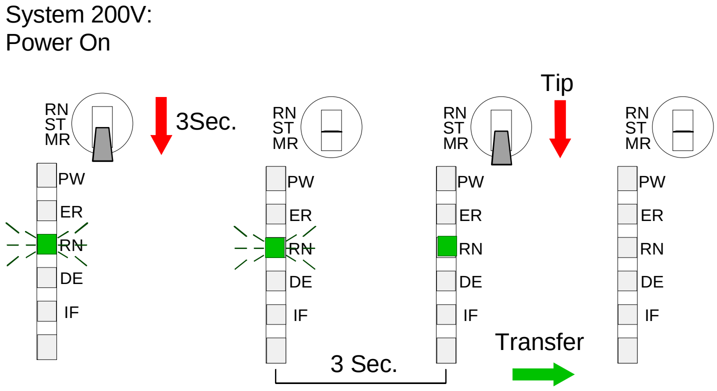


Requirements

A project is available in the MMC.

Procedure

- Insert the MMC memory module into your IM 208 DP-Master
- Turn on the power supply of your System 200V.
- Place and hold the operating mode switch of your master module in position MR. Hold this position until the RN-LED blinks.
- Release the switch and trigger the MR position again for a short period of time. → The data is transferred from the MMC into the internal Flash-ROM. The master indicates this status by turning the RN-LED on. The data transfer is complete when the RN-LED is turned off.
- At this point you can remove the MMC.
- Switch the master from STOP to RUN. → The IM 208 DP-Master will start with the new project located in the internal Flash-ROM.

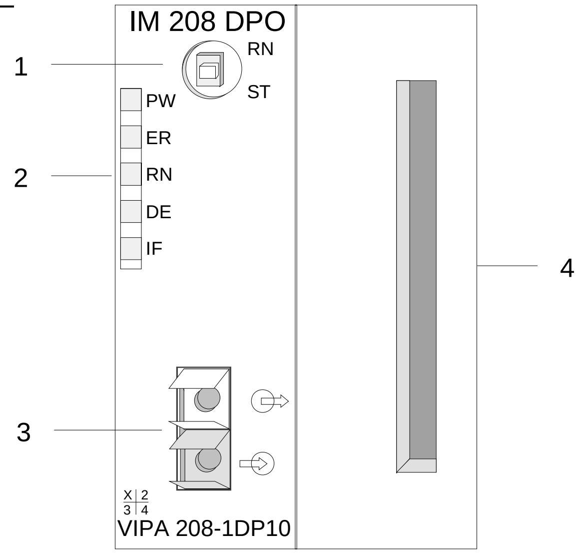


Construction of the IM 208 - DP master with a FO link

Properties

- Class 1 Profibus-DP-Master
- 125 DP-slaves can be connected to a DP master
- Maps the data areas of the slaves into the addressing area of the CPU 24x via the V-Bus
- Project configuration by means of VIPA WinNCS or Siemens ComProfibus
- Diagnostic facilities

Front view IM 208 DPO



[1] Operating mode switch RUN/STOP
[2] LED status indicator
[3] FO-interface
[4] Memory card slot

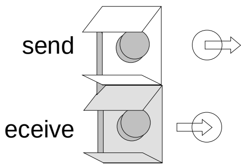
Components

LED's

The module carries a number of LED's that are available for diagnostic purposes on the bus and for displaying the local status. The following table explains the significance of the different colors of the diagnostic LED's.

Designation	Color	Explanation
PW	yellow	Indicates that the supply voltage is available on the back panel bus.
ER	red	On when a slave has failed (ERROR). .
RN	green	When only the RN LED is on, then the master status is RUN. The slaves are being accessed and the outputs are 0 ("clear" state). If both RN+DE are on the status of the Master is "operate". It is communicating with the slaves.
DE	yellow	DE (Data exchange) indicates Profibus communication activity.
IF	red	Initialization error for bad configurations.

FO link interface



This socket is provided for the fiber optic connection between your Profibus coupler and the Profibus. The figure shows the connections for this interface.

Power supply

The Profibus master receives power via the back panel bus.

Operating mode selector

The operating mode selector is used to select operating modes STOP (ST) or RUN (RN).

When the operating mode switch is placed in position RN and the parameters are valid the master changes to RUN mode.

When the operating mode switch is placed in position ST the master changes to STOP mode. . It terminates communications and all outputs are set to 0. An alarm is issued to the system on the next higher level.

This chapter contains a detailed explanation under the heading ”Operating modes”.

Flash Memory Card

You can insert a Flash Memory Card into this slot to transfer your configurations.

The Memory Card is available from VIPA under order no.: VIPA 374-1KH21.

When you are using a PG with a slot for a Memory Card you can save your project directly into the memory card.

If you are using a PC to configure your projects you can order an EPROM-programmer from VIPA under the order no.: VIPA Multi-Prommer. This device can save configuration data to the memory components that are used by the Siemens S5 and S7.

Applications in the IM 208

You may insert or remove the memory card from your IM 208 when the status is RUN and/or STOP. When the IM 208 receives power while the memory card is inserted or when the operating mode switch is changed from ST to RN the configuration data and bus parameters are transferred from the memory card into the internal RAM of the IM 208.

You can obtain detailed information on the data transfer into and from your master under the heading "Configuration of IM 208 - DP master".

Operating modes

Power On

Power is applied to the IM 208-interface. Configuration data is retrieved from the memory card, verified, and saved into the internal RAM of the IM 208.

The master will automatically change to RUN mode if the operating mode selector is set to RUN and parameters are acceptable. In RUN mode the LED's RN, DE and ER are on. As soon as all configured slaves are available in the data exchange the ER-LED is extinguished.

STOP

In STOP mode the outputs of the allocated slaves will be set to 0 if the parameters are valid. Although no communications will take place, the master will remain active on the bus using current bus parameters and occupying the allocated bus address. To release the address the Profibus plug must be removed from the IM 208 interface.

STOP → RUN

In the RN position the master will re-boot: configuration data and bus parameters are retrieved from the memory card and saved into the internal RAM of the IM 208.

Next, the communication link to the slaves is established. At this time only the RN-LED will be on. Once communications has been established by means of valid bus parameters the IM 208 will change to RUN mode. The master interface displays this status by means of the LED's RN and DE.

The IM 208 will remain in the STOP mode and display a configuration error by means of the IF-LED if the parameters are bad or if the memory card was not inserted. The interface will then be active on the bus using the following default bus parameters:

Default-Bus-Parameter: address:1, communication rate:1,5 MBaud.

RUN

In RUN mode the RN- and DE-LED's are on. In this condition data transfers can take place. If an error should occur, e.g. slave defective, the IM 208 will indicate the event by means of the ER-LED and it will issue an alarm to the system on the next higher level.

RUN → STOP

The master is placed in STOP mode. It terminates communications and all outputs are set to 0. An alarm is issued to the system on the next higher level.

Configuration of IM 208 - DP-Master with FO-link

General

You can configure the IM 208 master and the peripherals associated with the slaves by means of the "Profibus" functionality of the VIPA WinNCS configuration tool.

The block transfer functions of WinNCS provide many different methods for transferring data to your master module.

IM 208 masters behave in the same manner as the IM 308-C and they must be configured as IM 308-C in the Siemens "Com Profibus" configuration tool.

Applications in conjunction with System 200V CPU

IM 208 master modules can be used to connect up to 125 Profibus DP slaves to a System 200V CPU. The master communicates with the slaves and maps the data areas into the memory map of the CPU via the back panel bus. Input and output data are limited to a maximum of 256 byte each.

The master automatically fetches the I/O mapping data from all the masters when the CPU is re-started.

Alarm processing is active, i.e. an error message from the IM 208 can STOP the CPU.

The ER-LED is turned on if a slave should fail. If the delayed acknowledgment (QVZ) parameter was configured for a slave, a dropped acknowledgment will STOP the CPU. If QVZ has not been configured the CPU will continue running.

As soon as the BASP signal is available from the CPU the IM 208 sets the outputs of the connected periphery to zero.

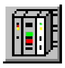
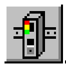
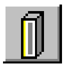
Note!

Please refer to the documentation of your CPU for details on the interfacing requirements of your CPU.

Configuration by means of WinNCS

The VIPA configuration tool WinNCS provides a user-friendly method for the configuration of your Profibus master.

Here follows a short outline of the configuration sequence under WinNCS:

1.	Start WinNCS and create a new project file for the "Profibus" function by clicking on **File** > *create/open*.
2.	If you have not yet done so, use  to insert a **Profibus function group** into the network window and click [Accept] in the parameter box.
3.	Use  to insert a **Profibus host/master** into the network window and specify the Profibus address of your master in the parameter window.
4.	Insert a **Profibus slave** into the network window by means of . Enter the Profibus address, the family "I/O" and the station type "DP200V" into the parameter window and click [Accept].
5.	Use  to define the configuration of every peripheral module that is connected to the corresponding slave via the back panel bus. You can select automatic addressing for the periphery by clicking [Auto] and display allocated addresses by means of [MAP]. For intelligent modules like the CP240 the configurable parameters will be displayed.
6.	When you have configured all the slaves with the respective periphery the bus parameters for Profibus must be calculated. Select the Profibus function group In the network window. In the parameter window click on the "Busparameter" tab in the parameter window. Select the required baud rate and click [calculate]. The bus parameters will be calculated - [Accept] these values. The bus parameters must be re-calculated with every change to the set of modules!
7.	Activate the master-level in the network window and export your project into a 2bf-file.
8.	Transfer the 2bf-file into your IM208 master. You have three possibilities for the data transfer between your PC and the IM208 master. The basis for all three is a 2bf-file that is created by means of the export function of WinNCS (see the following pages).

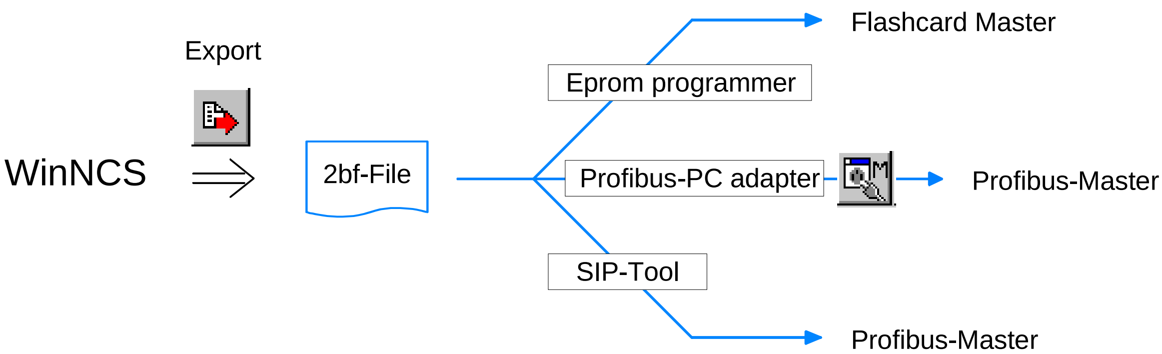
Transferring a project

Overview

Three different options are available to transfer data between your PC and the Profibus master:

- transfer via an EPROM programmer into a Flash-Card
- transfer via Profibus-PC master adapter
- transfer via SIP-Tool (supplied with WinNCS)

All three options require a 2BF-file that is created by means of the export function of WinNCS.



Transfer via EPROM programmer into a Flash-Card

You require a Memory Card and an external EPROM programmer with software to transfer your configuration into your System 200V Profibus master. The Memory Card is available from VIPA under the order no.: VIPA 374-1KH21.

You can read the 2bf-file into the EPROM programmer and program your Flash-Card.

Transfer via Profibus-PC card

WinNCS can also be used to transfer the data via a Master-PC adapter manufactured by Softing. This adapter can be used to establish a master-master link via Profibus. You can then transfer your 2bf-file by means of the module transfer functions  in both directions.

Transfer via SIP-Tool

VIPA can also supply a serial cable. This cable can be used to transfer the 2bf-file by means of the SIP-Tool into the IM208 master. The program SIP.EXE is supplied with WinNCS and it is located on the directory WinNCS\SIP.

Note!

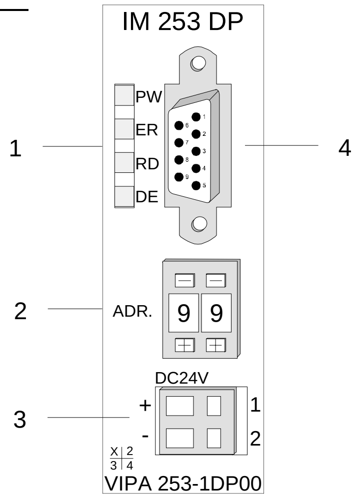
For details on the data transfer by means of WinNCS refer to the section "Data transfer" in the chapter "Profibus functionality" of the manual supplied with WinNCS.

Construction IM 253 - DP-Slave

Properties

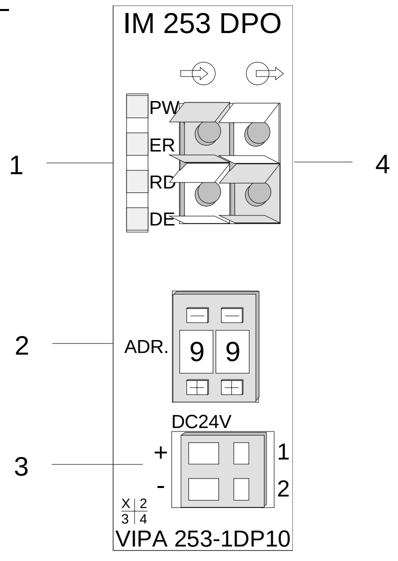
- Profibus-DP slave for a max. of 32 peripheral modules (a max. of 16 analog modules)
- A max. of 152 bytes of input data and 152 bytes output data
- Internal diagnostic protocol with a time stamp
- Integrated 24V DC power supply for the peripheral modules (3A max.)
- Supports all Profibus data transfer rates

Front view 253-1DP00



[1] LED status indicators
[2] Address selector
[3] Connector for 24V DC power supply
[4] RS485 interface

Front view 253-1DP10



[1] LED status indicators
[2] Address selector
[3] Connector for 24V DC power supply
[4] FO interface

Components

LED's

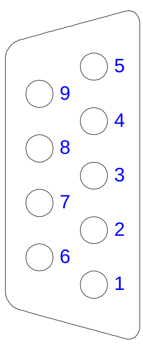
The module carries a number of LED's that are available for diagnostic purposes on the bus and for displaying the local status. The following table explains the different colors of the diagnostic LED's.

Designation	Color	Explanation
PW	yellow	Indicates that the supply voltage is available on the back panel bus. (Power).
ER	red	Turned on and off again when a restart occurs.
		Is turned on when an internal error has occurred.
		Blinks when an initialization error has occurred.
		Alternates with RD when the master configuration is bad (configuration error).
		Blinks in time with RD when the configuration is bad.
RD	green	Is turned on when the status is "Data exchange" and the V-bus cycle is faster than the Profibus cycle.
		Is turned off when the status is "Data exchange" and the V-bus cycle is slower than the Profibus cycle.
		Blinks when self-test is positive (READY) and the initialization has been completed successfully.
		Alternates with ER when the configuration received from the master is bad (configuration error).
		Blinks in time with ER when the configuration is bad
DE	yellow	DE (Data exchange) indicates Profibus communications activity.

RS485 interface

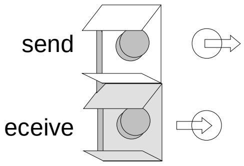
A 9-pin socket is provided for the RS485 interface between your Profibus slave and the Profibus.

The following diagram shows the pin-assignment for this interface:



Pin	Assignment
1	shield
2	n.c.
3	RxD/TxD-P
4	CNTR-P
5	GND
6	5V (70mA max.)
7	n.c.
8	RxD/TxD-N
9	n.c.

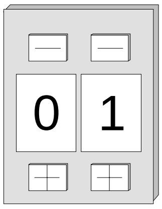
FO interface



These connectors are provided for the fiber optic link between your Profibus coupler and the Profibus.

The diagram shows the layout of the interface:

Address selector



This address selector is used to configure the address for the Bus-coupler.

Addresses may range from 1 to 99. Addresses must be unique on the bus.

When the address is set to 00 a once-off image of the diagnostic data is saved to Flash-ROM.

The slave address must have been selected before the bus coupler is turned on.

Attention!
The address must never be changed when the unit is running!

Power supply

Every Profibus slave coupler has an internal power supply. This power supply requires 24V DC. In addition to the electronics on the bus coupler the supply voltage is also used to power any modules connected to the back panel bus. Please note that the maximum current that the integrated power supply can deliver to the back panel bus is 3A.

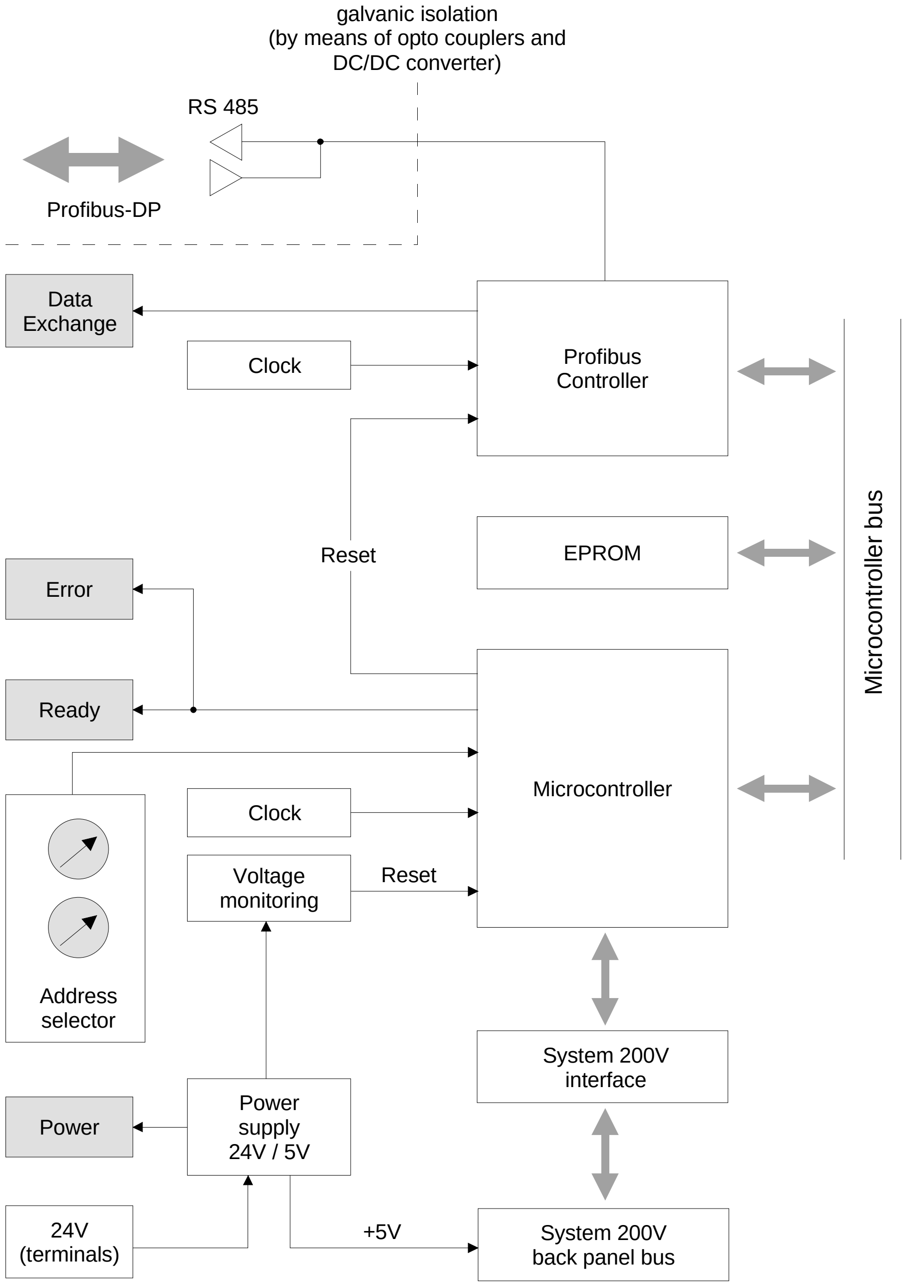
The power supply is protected against reverse polarity.

Profibus and back panel bus are galvanically isolated.

Attention!
Please ensure that the polarity is correct when connecting the power supply!

Block diagram

The block diagram below shows the hardware structure of the bus coupler as well as the internal communication paths:



Construction IM 253 DP, DO 24xDC24V

General

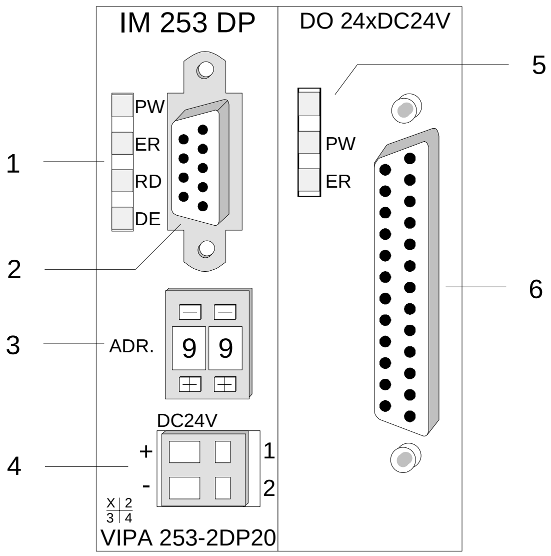
This module consists of a Profibus slave complete with an integrated 24-port output unit. The 24 output channels are controlled directly via the Profibus. The output channels are capable of a maximum load current of 1A. The total output current must never exceed 4A. The outputs are dc-coupled.

Properties

The following properties distinguish the Profibus output module IM 253 DP, DO 24xDC24V:

- Profibus slave
- 24 digital outputs
- dc-coupled
- Rated output voltage 24V DC, 1A max.
- LED for error indication when an overload, over temperature or short circuit is detected
- Suitable for the control of small motors, lamps, magnetic switches and contactors that must be controlled via Profibus.

Front view IM 253 DP, DO 24xDC24V



[1] LED's status indicator Profibus
[2] Profibus socket
[3] Address selector
[4] Connector for 24V DC power supply
[5] LED's status indicator output unit
[6] 25-pin socket for digital output

Attention!
In standalone operation the two sections of the module must be joined by means of the single bus connector that is supplied with the modules!

Components

The components of the Profibus section are identical with the components of the Profibus slave module that was described above.

LED's Profibus

The Profibus section carries a number of LED's that can also be used for diagnostic purposes on the bus.

Designation	Color	Explanation
PW	yellow	Indicates that the supply voltage is available (Power).
ER	red	Turned on and off again when a restart occurs.
		Is turned on when an internal error has occurred.
		Blinks when an initialization error has occurred.
		Alternates with RD when the master configuration is bad (configuration error).
		Blinks in time with RD when the configuration is bad.
RD	green	Is turned on when the status is "Data exchange" and the V-bus cycle is faster than the Profibus cycle.
		Is turned off when the status is "Data exchange" and the V-bus cycle is slower than the Profibus cycle.
		Blinks when self-test is positive (READY) and the initialization has been completed successfully.
		Alternates with ER when the configuration received from the master is bad (configuration error).
		Blinks in time with ER when the configuration is bad
DE	yellow	DE (Data exchange) indicates Profibus communications activity.

LED's digital output section

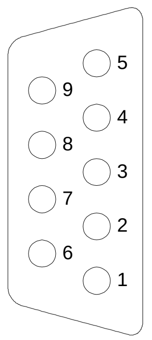
The digital output section is provided with 2 LED's that have the following function:

Designation	Color	Explanation
PW	yellow	Indicates that power is available from the Profibus section (Power).
ER	red	Is turned on when a short circuit, overload or over temperature are detected

Profibus RS485 interface

A 9-pin RS485 interface is used to connect your Profibus slave to your Profibus.

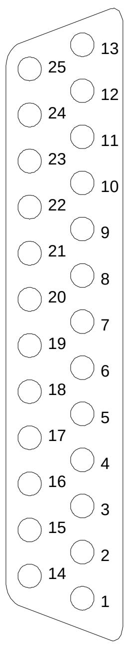
The following diagram shows the pin-assignment for this interface

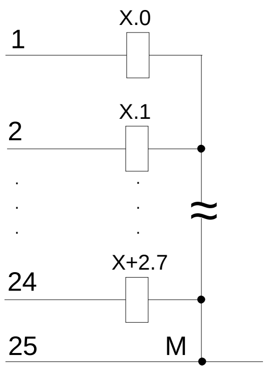


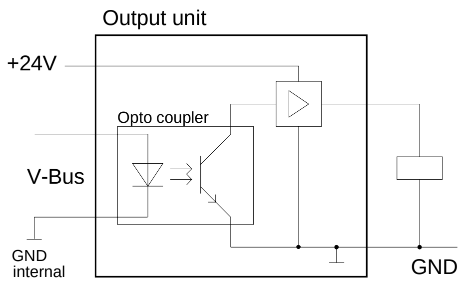
Pin	Assignment
1	shield
2	n.c.
3	RxD/TxD-P
4	CNTR-P
5	GND
6	5V (max. 70mA)
7	n.c.
8	RxD/TxD-N
9	n.c.

Output unit interfacing and block diagram

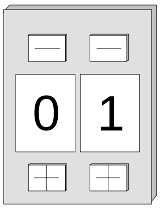
The 24V DC power supply to the output section is provided internally by the power supply of the slave section.







Address selector



This address selector is used to configure the address for the Bus-coupler.

Addresses may range from 1 to 99. Addresses must be unique on the bus.

When the address is set to 00 a once-off image of the diagnostic data is saved to Flash-ROM.

The slave address must have been selected before the bus coupler is turned on.

Attention!
The address must never be changed when the unit is running!

Power supply

Every Profibus slave coupler has an internal power supply. This power supply requires 24V DC. In addition to the electronics on the bus coupler the supply voltage is also used to power any modules connected to the back panel bus. Please note that the maximum current that the integrated power supply can deliver to the back panel bus is 3A.

The power supply is protected against reverse polarity.

Profibus and back panel bus are galvanically isolated.

Attention!
The internal fuse has blown if PW is not on when the unit is connected to power!

Configuration IM 253 - DP-Slave

General

The module is configured by means of the Profibus master configuration tool. During the configuration you will assign the required Profibus slave modules to your master module.

The direct allocation is defined by means of the Profibus address that you must set up on the slave module.

GSD file

VIPA supplies a diskette with every Profibus module. This diskette contains all the GSD and type files of the VIPA Profibus modules.

Please install the required files from your diskette into your configuration tool. Details on the installation of the GSD and/or type files are available from the manual supplied with your configuration tool.

The VIPA WinNCS configuration tool contains all GSD files!

Configuration by means of WinNCS

1. . . . 3.	Start WinNCS and configure a master system by means of and . For details refer to "Configuration of IM 208 - DP master" above.
4.	Insert a **Profibus slave** into the network box by means of . Enter the Profibus address, the family "I/O" and the station type "DP200V" into the parameter window and click [Accept].
5.	Use to define the configuration of every peripheral module that is connected to the corresponding slave via the back panel bus. You can select automatic addressing for the periphery by clicking [Auto] and display allocated addresses by means of [MAP]. For intelligent modules like the CP240 the configurable parameters will be displayed.
6.	Continue as described in the chapter under "Configuration of IM 208 - DP master".

In a configuration employing Profibus slave combination modules, e.g. the VIPA 253-2DP20 you must define the same parameters as indicated in table 4 above. When enter the configuration of your peripheral modules (5.) you must select the module type "253-2DP20"

Note

Every change in the arrangement of the modules must be followed by a re-calculation of the bus parameters!

Applications with the Siemens S7-400

The system S7-400 uses double-word addressing for the configuration, i.e. a double-word is assigned to every module during configuration. For digital modules the high bytes of the double-words are not used. You can avoid this problem by using the GSD file for the S7-400. This GSD file is located in the subdirectory ..\S7-400\ on the accompanying diskette.

If you are using the S7-400 GSD file you must first configure all digital inputs followed by all the digital outputs by specifying the respective sum in bytes. If there are no input or output modules you should enter 0 bytes.

When the digital modules have been configured you continue with the configuration of the analogue modules as usual.

Note!

Please note that the S7-400 system requires the plug-in location number under module parameters for the analogue modules. In this case the first peripheral module is located at plug-in location 0.

Applications with the Siemens IM 308-B

The diskette contains additional configuration type files for the Siemens configuration tools COM ET200 (DOS-version for IM 308-B) and COM ET200 (Windows-version).

Please refer to the `readme.txt` located on the diskette.

Note!

It may be necessary that you must implement certain modifications to the type file to ensure reliable operation of the system in applications that include the Siemens IM308-B. Please contact the VIPA hotline in this respect.

Diagnostic functions of the Profibus-DP slaves

Overview

Profibus-DP provides an extensive set of diagnostic functions for quick location of faults. Diagnostic messages are transferred via the bus and collected by the master.

The most recent 100 diagnostic messages along with a time stamp are stored in RAM and saved to the Flash ROM of every VIPA Profibus slave. These can be investigated by means of software or displayed via the LC display (under development).

Internal diagnostic System messages

The system also stores diagnostic messages like the status "Ready" or "Data Exchange". These are not sent to the master.

The contents of the diagnostic RAM is saved by the Profibus slave in a Flash-ROM when the status changes between "Ready" and "Data Exchange". After every restart it retrieves this data and deposits it in RAM.

Saving diagnostic data manually

You can manually save the diagnostic data in Flash-ROM by changing the address switch setting to 00 for a short while.

Diagnostic message in case of a power failure

When a power failure or a voltage drop is detected a time stamp is saved in the EEPROM. In the case that the available power should be adequate the diagnostic is transferred to the master.

The time stamp in the EEPROM is used to generate an under voltage/power-off diagnostic message at the time of the next restart and saved to the diagnostic-RAM.

Direct diagnostics of the Profibus slave module

If you are employing VIPA Profibus slaves you can transfer the latest diagnostic data directly from the module into your PC for analysis by means of the download cable and the "Slave info Tool" software that are available form VIPA.

Structure of the Profibus diagnostic data

The length of the diagnostic messages that are generated by the Profibus slave is 23 bytes. This is also referred to as the *device- related diagnostic-data*.

When the Profibus slave sends a diagnostic message to the master a 6 byte standard diagnostic block and 1 byte header is prepended to the 23 byte diagnostic data:

byte 0 ... byte 5	Standard diagnostic data	only for Profibus transfers
byte 6	Header device-related diagnostics	precedes message to master
byte 7 ... 29	**Device-related diagnostic data**	Diagnostic data that is saved internally.

Standard diagnostic data

Diagnostic data that is being transferred to the Master consists of the standard diagnostic data for slaves and a header byte that are prepended to the device-related diagnostic bytes.

The Profibus standards contain more detailed information on the structure of standard diagnostic data. These standards are available from the Profibus User Organization.

The structure of the standard diagnostic data for slaves is as follows:

Byte	Bit 7 ... Bit 0
0	Bit 0: permanently 0 Bit 1: slave not ready for data exchange Bit 2: configuration data mismatch Bit 3: slave has external diagnostic data Bit 4: slave does not support the requested function Bit 5: permanently 0 Bit 6: bad configuration Bit 7: permanently 0
1	Bit 0: slave requires re-configuration Bit 1: statistical diagnostics Bit 2: permanently 1 Bit 3: watchdog active Bit 4: freeze-command was received Bit 5: sync-command was received Bit 6: reserved Bit 7: permanently 0
2	Bit 0 ... Bit 6: reserved Bit 7: diagnostic data overflow
3	Master address after configuration FFh: slave was not configured
4	Ident number high byte
5	Ident number low byte

Header for device-related diagnostics

These bytes are only prepended to the device-related diagnostic data when this is being transferred via Profibus.

Byte	Bit 7 ... Bit 0
6	Bit 0 ... Bit 5: Length device-related diagnostic data incl. byte 6 Bit 6 ... Bit 7: permanently 0

Device-related diagnostics

Byte	Bit 7 ... Bit 0
7 ... 29	Device-related diagnostic data that can be stored internally by the slave for analysis.

Structure of the device related diagnostic data in the DP slave

As of revision level 6 all diagnostic data that is generated by the Profibus slave is stored in a ring-buffer along with the time stamp. The ring-buffer always contains the most recent 100 diagnostic messages.

You can analyze these messages by means of the "Slave Info Tool".

Since the standard diagnostic data (byte 0 ... byte 5) and the header (byte 6) are not stored the data in byte 0 ... byte 23 corresponds to byte 7 ... byte 30 that is transferred via Profibus.

The structure of the device-related diagnostic data is as follows:

Byte	Bit 7 ... Bit 0
0	Message 0Ah: DP parameter error 14h: DP configuration error length 15h: DP configuration error entry 1Eh: under voltage/power failure 28h: V-bus configuration error 29h: V-bus initialization error 2Ah: V-bus bus error 2Bh: V-bus delayed acknowledgment 32h: diagnostic alarm system 200 33h: process alarm system 200 3Ch: new DP-address was defined 3Dh: Slave status is ready (only internally) 3Eh: Slave status is Data_Exchange (only internally)
1	Module-No. or plug-in location 1 ... 32: Module-No. or plug-in location 0: Module-No. or plug-in location not available
2 ... 23	Additional information for message in byte 0

Overview of diagnostic-messages

The following section contains all the messages that the diagnostic data can consist of. The structure of byte 2 ... byte 23 depends on the message (byte 0). When the diagnostic data is transferred to the master via Profibus byte 7 of the master corresponds to byte 0 of the slave. The specified length represents the "length of the diagnostic data" during the Profibus data transfer.

0Ah

DP parameter error Length: 8

The parameter message is too short or too long

Byte	Bit 7 ... Bit 0
0	0Ah: DP parameter error
1	Module-No. or plug-in location 1 ... 32: Module-No. or plug-in location 0: Module-No. or plug-in location not available
2	Length user parameter data
3	Mode 0: Standard mode 1: 400-mode
4	Number of digital modules (slave)
5	Number of analog modules (slave)
6	Number of analog modules (master)

14h

DP configuration error - length Length: 6

Depending on the mode, the length of the configuration message is compared to the length of the default-configuration (modules detected on the V-Bus).

Byte	Bit 7 ... Bit 0
0	14h: DP configuration error - length
1	Module-No. or plug-in location 1 ... 32: Module-No. or plug-in location 0: Module-No. or plug-in location not available
2	Configuration data quantity (master)
4	Configuration data quantity (slave)
3	Mode 0: Standard mode 1: 400-mode

15h

DP configurations error - entry Length: 6

Depending on the mode and when the length of the configuration message matches the length of the default-configuration the different entries in the configuration message are compared to the default configuration.

Byte	Bit 7 ... Bit 0
0	15h: DP configuration error - entry
1	Module-No. or plug-in location 1 ... 32: Module-No. or plug-in location 0: Module-No. or plug-in location not available
2	Configuration byte master (module identifier)
4	Configuration byte slave (module identifier)
3	Mode 0: Standard mode 1: 400-mode

1Eh

Under voltage/power failure Length: 2

A time stamp is saved immediately to the EEPROM when a power failure or a voltage drop is detected. In the case that the available power should be adequate the diagnostic is transferred to the master. The time stamp in the EEPROM is used to generate an under voltage/power-off diagnostic message at the time of the next restart and saved to the diagnostic-RAM.

Byte	Bit 7 ... Bit 0
0	1Eh: Under voltage/power failure

28h

V-bus configuration error Length: 3

The configuration for the specified plug-in location failed.

Byte	Bit 7 ... Bit 0
0	28h: V-bus configuration error
1	Module-No. or plug-in location 1 ... 32: Module-No. or plug-in location 0: Module-No. or plug-in location not available

29h

V-bus initialization error Length: 2

General back panel bus error

Byte	Bit 7 ... Bit 0
0	29h: V-bus initialization error

2Ah

V-bus bus error Length: 2

Hardware error or module failure

Byte	Bit 7 ... Bit 0
0	2Ah: V-bus error

2Bh *V-bus delayed acknowledgment* Length: 2

Reading or writing from/to digital modules failed

Byte	Bit 7 ... Bit 0
0	2Bh: V-bus delayed acknowledgment

32h *System 200V diagnostic alarm* Length: 16

Byte	Bit 7 ... Bit 0
0	32h: System 200V diagnostic alarm
1	Module-No. or plug-in location 1 ... 32: Module-No. or plug-in location 0: Module-No. or plug-in location not available
2 ... 14	Data diagnostic alarm

33h *System 200V process alarm* Length: 16

Byte	Bit 7 ... Bit 0
0	33h: System 200V process alarm
1	Module-No. or plug-in location 1 ... 32: Module-No. or plug-in location 0: Module-No. or plug-in location not available
2 ... 14	Process alarm data

3Ch *A new DP-address was defined* Length: 2

When the slave has received the service with "Set Slave Address" it sends the respective diagnostic message and re-boots. The slave will then become available on the bus under the new address.

Byte	Bit 7 ... Bit 0
0	3Ch: A new DP-address was defined

3Dh *Slave status is ready* Length: none (only internal)

The ready status of the slave is only used internally and not transmitted via the Profibus.

Byte	Bit 7 ... Bit 0
0	3Dh: Slave status is ready

3Eh *Slave status is Data_Exchange* Length: bone (only internal)

The Data_Exchange status of the slave is only used internally and not transmitted via the Profibus.

Byte	Bit 7 ... Bit 0
0	3Eh: Slave status is Data_Exchange

Installation guidelines

Profibus in general

- The VIPA Profibus DP-network must have a linear structure.
- Profibus DP consists of a minimum of one segment with at least one master and one slave.
- A master must always be used in conjunction with a CPU.
- Profibus supports a max. of 125 devices.
- A max. of 32 devices are permitted per segment.
- The maximum length of a segment depends on the rate of transfer:

9,6 ... 187,5 kBaud	→	1000m
500 kBaud	→	400m
1,5 MBaud	→	200m
3 ... 12 MBaud	→	100m

- The network may have a maximum of 10 segments. Segments are connected by means of repeaters. Every repeater represents a device on the network.
- All devices communicate at the same baudrate, slaves adapt automatically to the baudrate.

Fiber optic system

- Only one fiber optic master may be used on a single line.
- Multiple masters may be employed with a single CPU as long as these are located on the back panel bus (please take care not to exceed the max. current consumption).
- The maximum length of a FO link between two slaves may not exceed 50m at 12Mbaud.
- The bus does not require termination.

Note!
You should place covers on the unused sockets on any fiber optic device connected to the bus to prevent being blinded by the light or to stop interference from external light sources. You can use the supplied rubber stoppers for this purpose. Insert the rubber stoppers into the unused openings on the FO interface.

electrical system

- The bus must be terminated at both ends.
- Masters and slaves may be installed in any combination.

combined system

- Any FO master must only be installed on an electrical system by means of an **O**ptical **L**ink **P**lug, i.e. slaves must not be located between a master and the OLP.
- Only one converter (OLP) is permitted between any two masters.

Installation and integration with Profibus

- Assemble your Profibus system using the required modules.
- Adjust the address of the bus coupler to an address that is not yet in use on your system.
- Transfer the supplied GSD file into your system and configure the system as required.
- Transfer the configuration into your master.
- Connect the Profibus cable to the coupler and turn the power supply on.

Note!

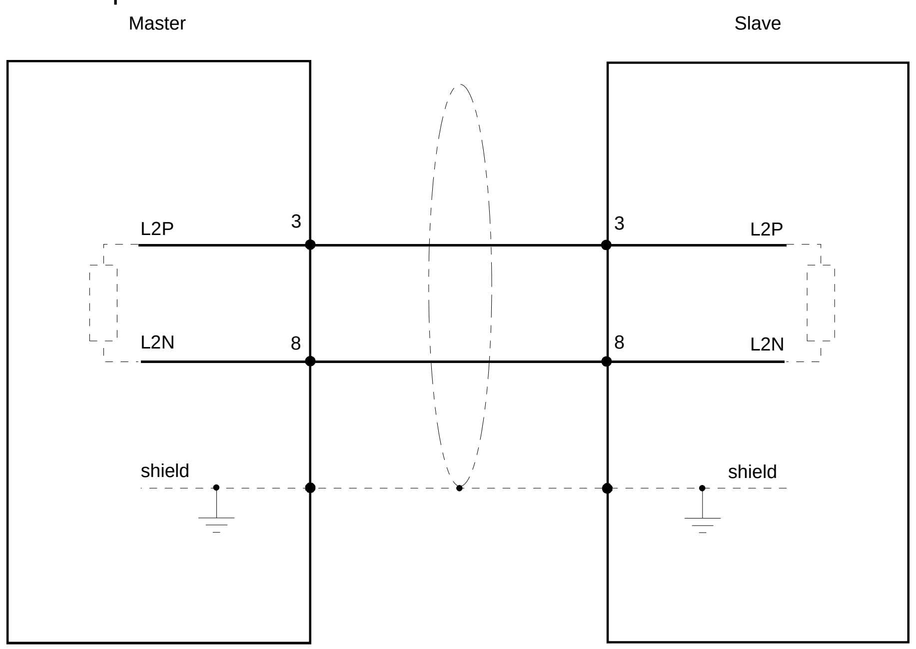
The Profibus line must be terminated with its characteristic impedance. Please ensure that the line is terminated by means of a termination resistor located at the last station on the bus is.

The FO Profibus system does not require termination!

Profibus using RS485

Profibus employs a screened twisted pair cable based on RS485 interface specifications as the data communication medium.

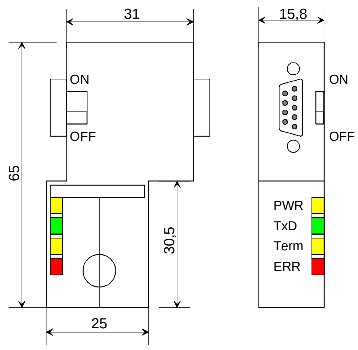
The following figure shows a Profibus connection using RS485 together with the required termination resistors:



Bus connector

In systems with more than two stations all partners are wired in parallel. For that purpose the bus cable must be connected in a continuous uninterrupted loop.

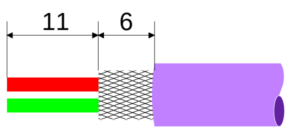
Via the order number VIPA 972-0DP10 you may order the bus connector "EasyConn". This is a bus connector with switchable terminating resistor and integrated bus diagnosis.



all in mm

To connect this connector please use the standard Profibus cable type A according to EN50170.

Under the order no. 905-6AA00 VIPA offers the "EasyStrip" deisolating tool, that makes the connection of the EasyConn much easier.



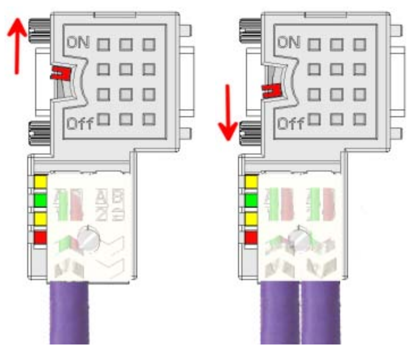
all in mm

Attention!

The bus cable has always to be terminated with the ripple resistor to avoid reflections and therefore communication problems!

Termination

The bus connector is provided with a switch that may be used to activate a terminating resistor.



Attention!

The terminating resistor is only effective, if the connector is installed at a slave and the slave is connected to a power supply.

Note!

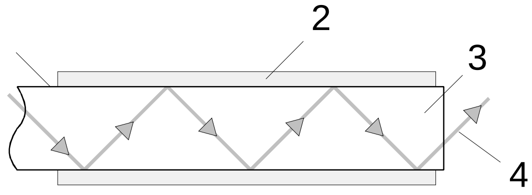
A complete description of installation and deployment of the terminating resistors is delivered with the connector.

Profibus wit FO link

The fiber optic cable (FO) transfers signals by means of electromagnetic waves at optical frequencies. Total reflection will occur at the point where the coating of the fiber optic cable meets the core since the refractive index of this material is lower than that of the core. This total reflection prevents the ray of light escaping from the fiber optic conductor and it will therefore travel to the end of the fiber optic cable.

The FO cable is provided with a protective coating.

The following diagram figure shows the construction of a fiber optic cable:



[1] Fiber coating
[2] Protective cover
[3] Fiber core
[4] Ray of light

The fiber optic system employs pulses of monochromatic light at a wavelength of 650nm. If the fiber optic cable is installed in accordance with the manufacturers guidelines it is not susceptible to external electrical interference. Fiber optic systems have a linear structure. Each device requires two lines, a transmit and a receive line (dual core). It is not necessary to provide a terminator at the last device.

The Profibus FO network supports a maximum of 126 devices (including the master). The maximum distance between two devices is limited to 50m.

Advantages of FO over copper cables

- wide bandwidth
- low attenuation
- no crosstalk between cores
- immunity to external electrical interference
- no potential difference
- lightning protection
- may be installed in explosive environments
- low weight and more flexible
- corrosion resistant
- safety from eavesdropping attempts

Fiber optic cabling under Profibus

The VIPA fiber optic Profibus coupler employs dual core plastic fiber optic cable as the communication medium. You must keep the following points in mind when you connect your Profibus FO-coupler: predecessor and successor must always be connected by means of a dual core FO-cable.

The VIPA bus-coupler carries 4 FO-connectors. The communication direction is defined by the color of the connector (darker: receive line, lighter: send line).

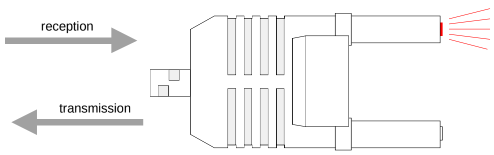
When the bus has been turned on you can recognize the receive line by the light while the darker line is the send line. VIPA recommends that you use the FO-connector supplied by Hewlett Packard (HP). Two different versions of these connectors are available:

FO-connector with crimp-type assembly

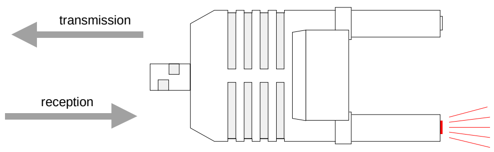
FO-connector without crimp-type assembly

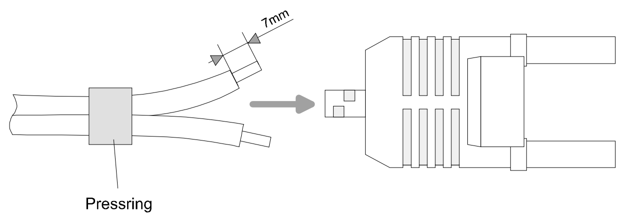
FO-connector with crimp-type assembly

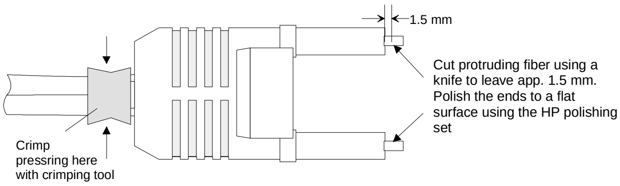
Connecton for predecessor



Connection for successor







HP order no.: HFBR-4506 (gray)

HFBR-4506B (black)

Advantages: polarity protection

You can only install the connector so that the side of the connector shown here faces to the right.

Disadvantages: special tool required

You require a special crimping tool from Hewlett Packard (HP order no.: HFBR-4597) for the installation of the press ring required for strain relief.

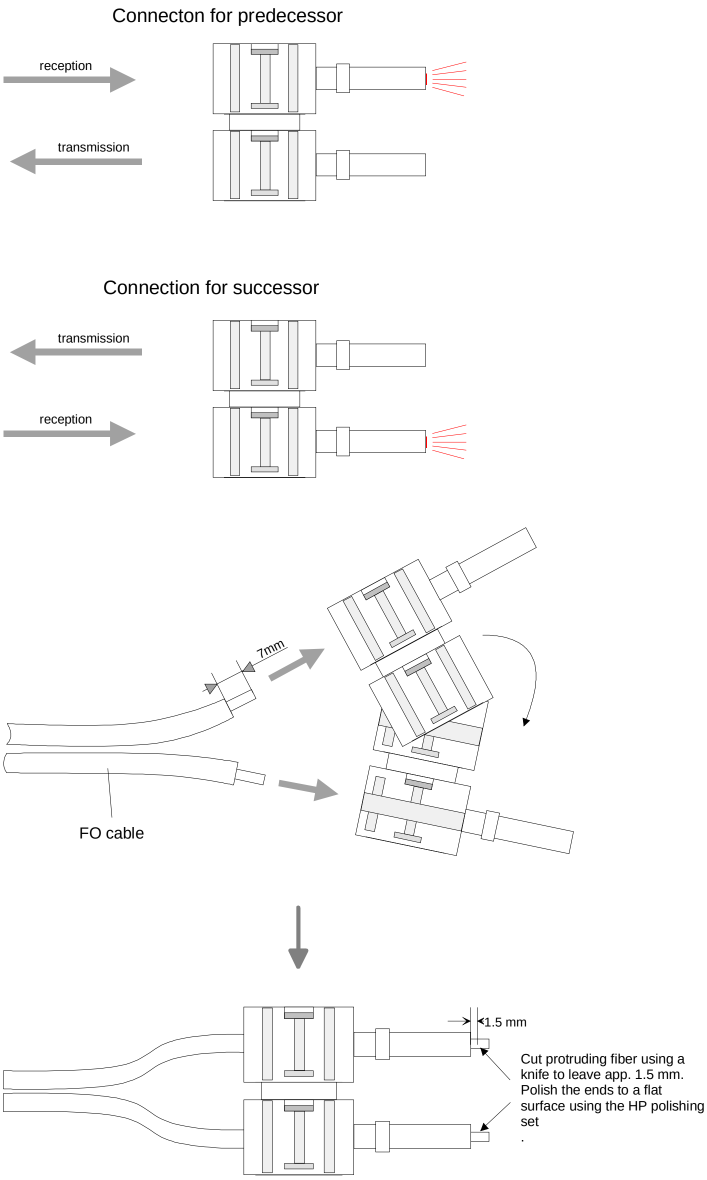
Connector installation

You install the connector by first pushing the pressring onto the dual core FO cable. Separate the two cores for a distance of app. 5 cm. Use a stripper to remove the protection cover so that app. 7 mm of the fiber is visible.

Insert the two cores into the plug so that the ends of the fiber optic cable protrude at the front. Keep an eye on the polarity of the cores (s.a.).

Push the pressring onto the plug and crimp the ring by means of the crimp tool. The description of how to trim and polish of the ends of the FO cores is identical to the 2nd connector type shown below.

FO-connector without crimp-type assembly



HP order no.: HFBR-4531

Advantages: no special tool required.

This shell of this type of plug is provided with an integrated strain relief.

The fiber optic cable is clamped securely when you clip the two sections of the shell together.

This system can be used to prepare simplex and duplex plugs. You can assemble a simplex plug by clipping the two sections of a shell together and a duplex plug by clipping two plugs together.

Disadvantages: no protection against polarity reversal.

These plugs can be inserted in two positions. Please check the polarity when you have turned on the power. The light emitting fiber is the fiber for reception.

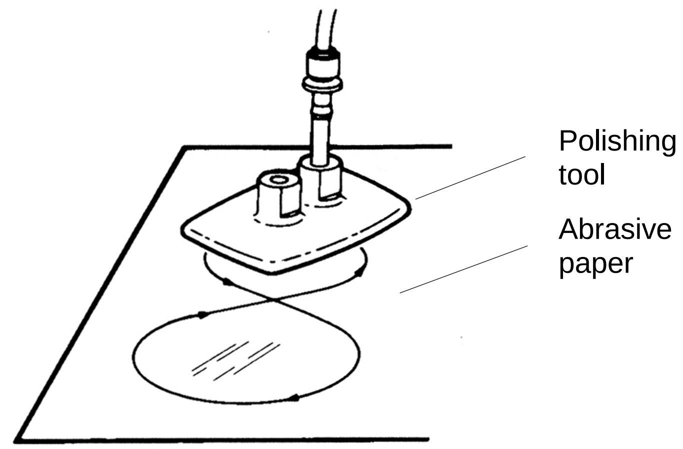
Assembling a plug:

2 complete plugs are required to assemble a duplex plug. Separate the two cores for a distance of app. 5cm.

Separate the two cores for a distance of app. 5 cm. Use a stripper to remove the protection cover so that app. 7 mm of the fiber is visible.

Insert the two cores into the plug so that the ends of the fiber optic cable protrude at the front. Keep an eye on the polarity of the cores (s.a.).

Cutting and polishing the ends of the FO cable



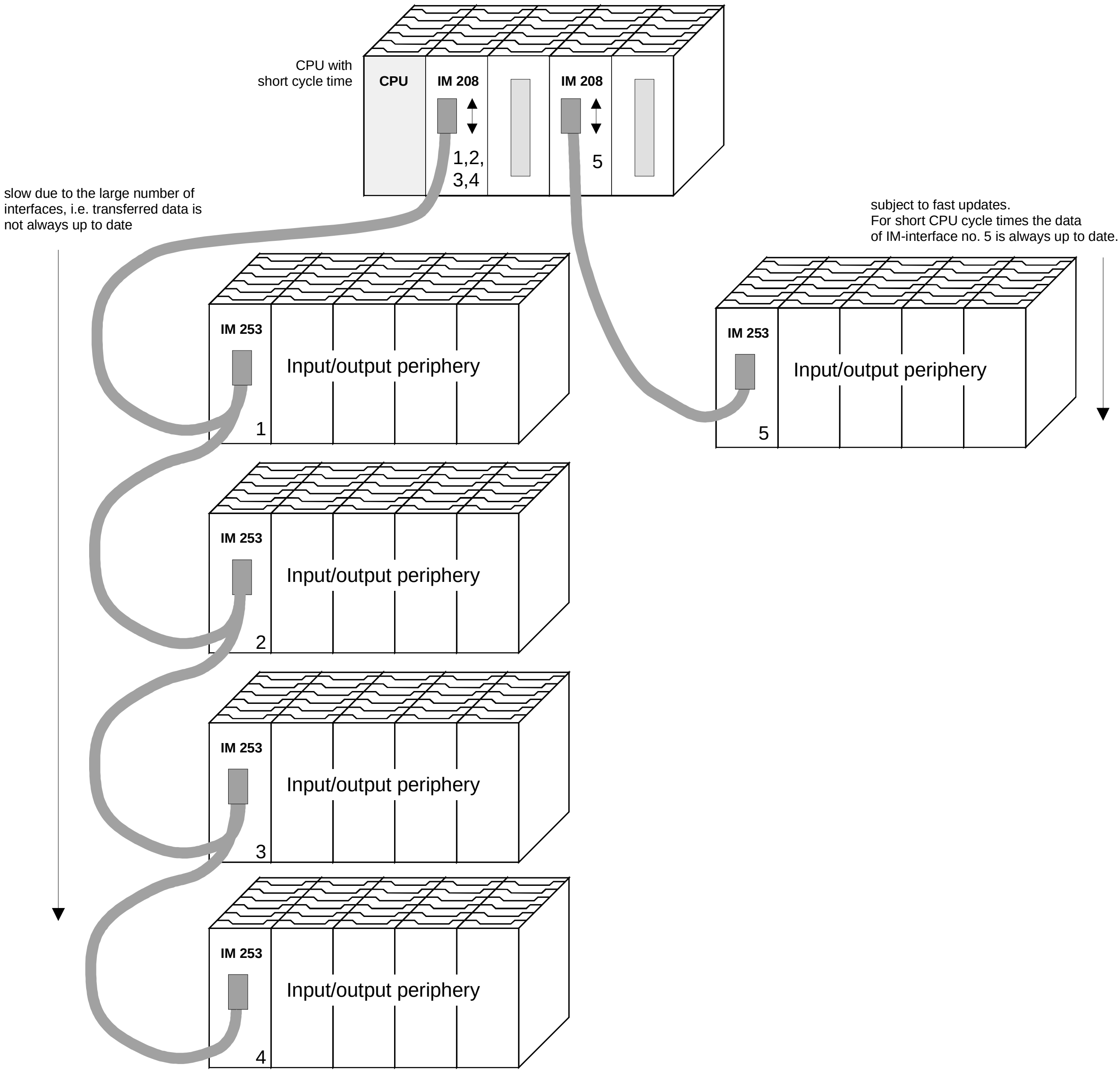
Cut protruding fiber using a knife so that app. 1.5 mm are still visible. Polish the ends to a flat surface using the HP polishing set (HP order no.:HFBR-4593).

Insert the plug into the polishing tool and polish the fiber to achieve a plane surface as shown in the figure. The instructions that are included with the set contain a detailed description of the required procedure.

Example of a Profibus network

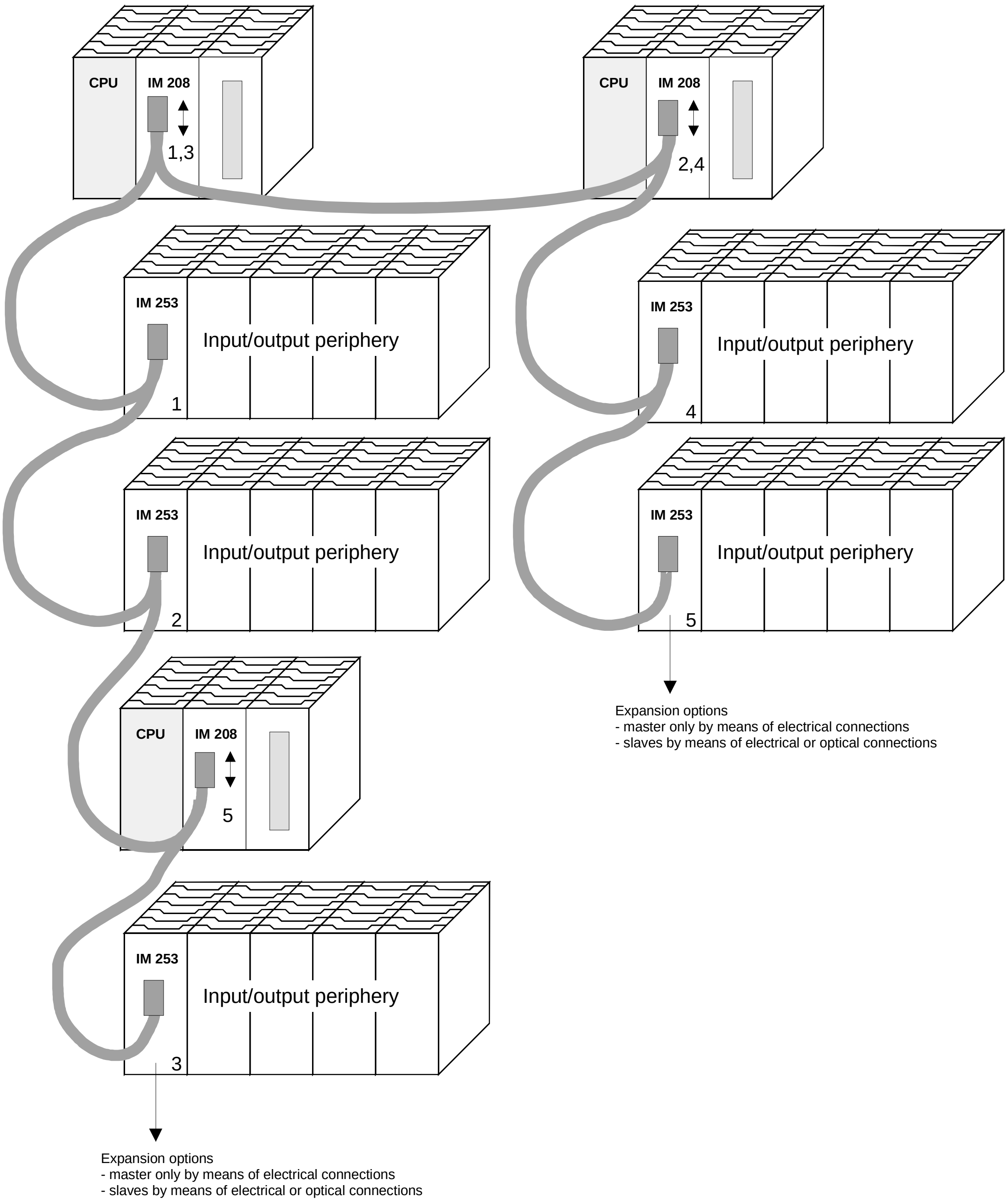
One CPU and multiple master interfaces

The CPU must have a short cycle time to ensure that the data from slave no. 5 (on the right) are always up to date. This type of structure is only suitable when the data from slaves on the slow trunk (on the left) is not critical. These locations should therefore not be connected to modules that are able to issue alarms.

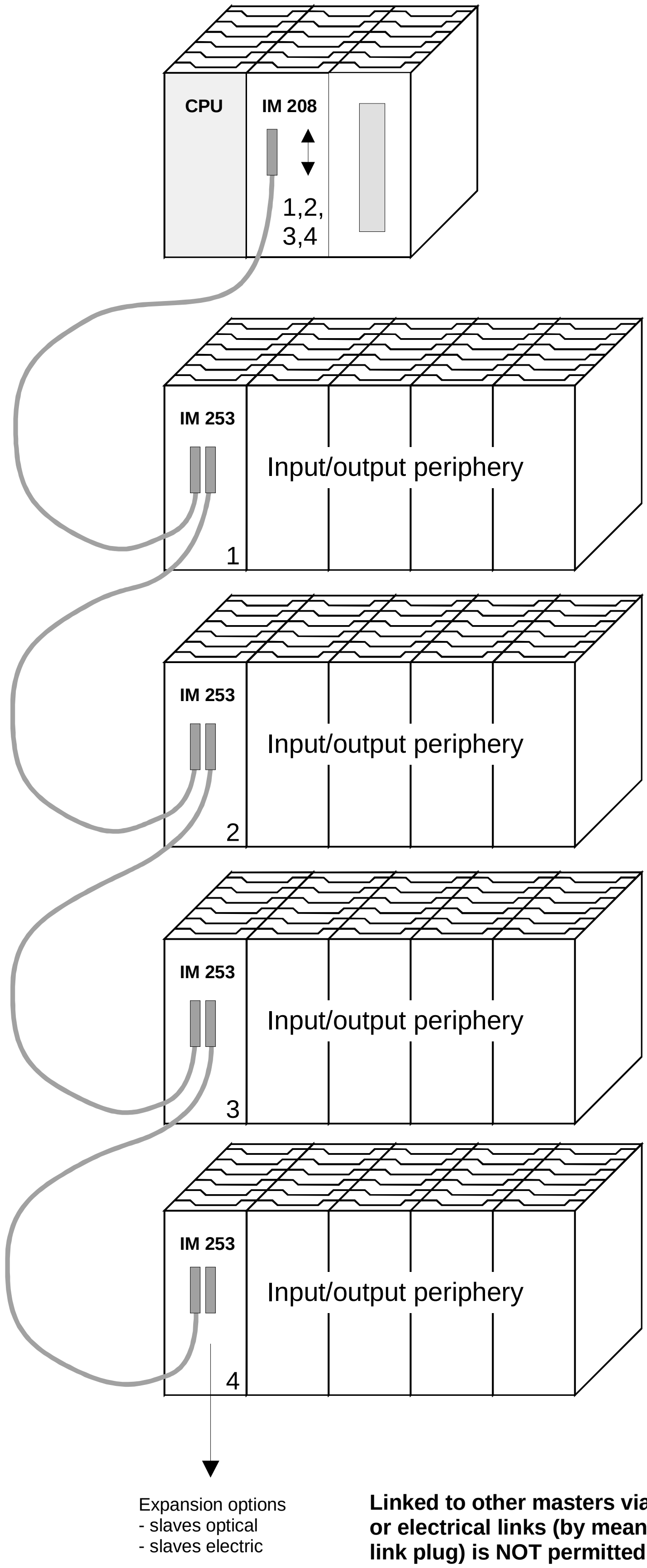


Multi master system

Multiple master interfaces on a single bus in conjunction with a number of slaves:



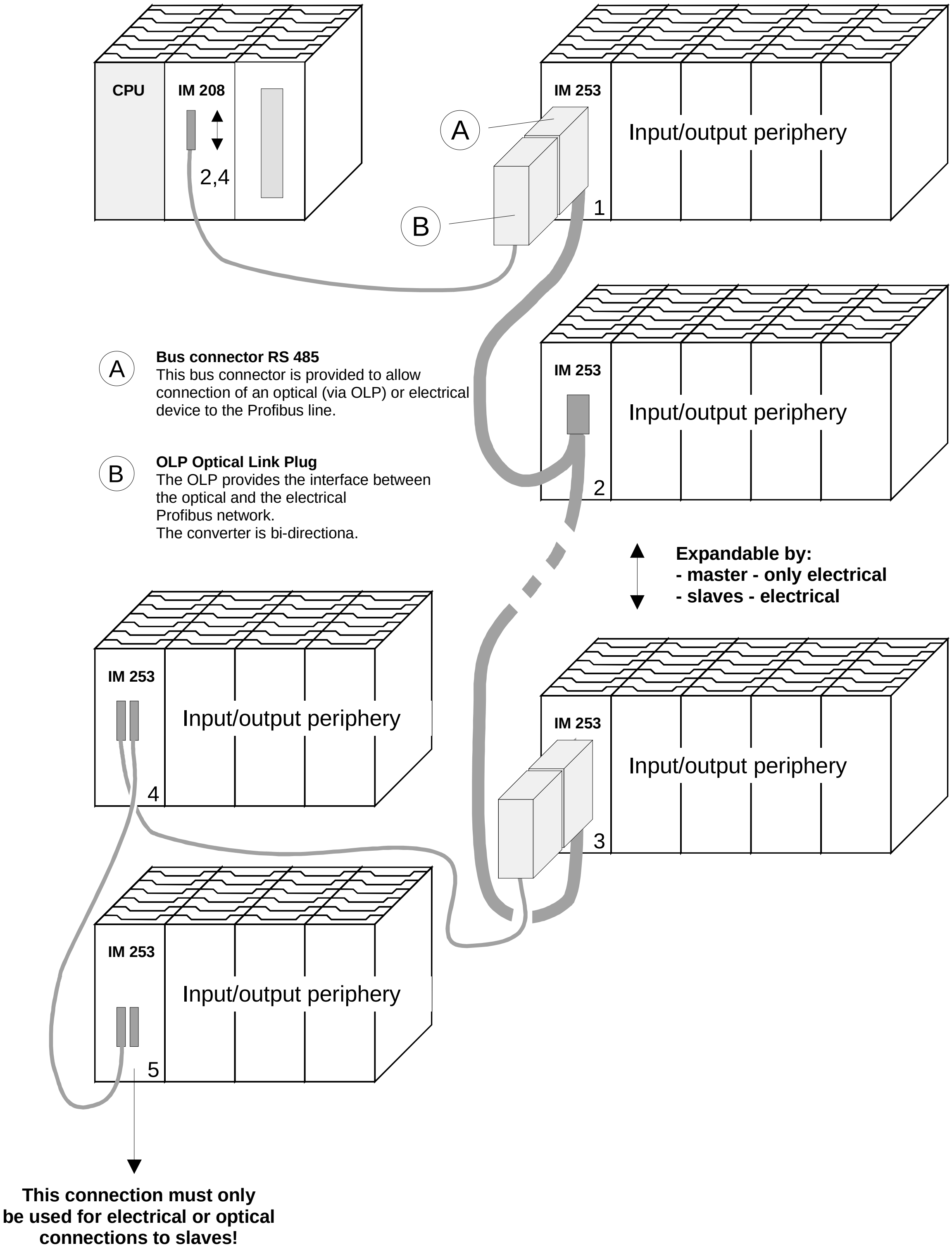
Optical Profibus



Linked to other masters via optical or electrical links (by means of an optical link plug) is NOT permitted!

Combination of optical and electrical Profibus

In a combined fiber optical Profibus systems only a single converter (OLP) may be installed between any two masters!



Commissioning

Overview

- Assemble your Profibus system.
- Configure your master system.
- Transfer the configuration into your master.
- Connect the Profibus cable to the coupler.
- Turn the power supply on.

Installation

Assemble your Profibus system using the required modules.

Every Profibus slave coupler has an internal power supply. This power supply requires an external 24V DC power supply. In addition to the circuitry of the bus coupler the supply voltage is also used to power any modules connected to the back panel bus.

Profibus and back panel bus are galvanically isolated.

Addressing

Adjust the address of every Profibus slave module as required.

Configuration in the master system

Configure your Profibus master in your master system. You can use the WinNCS of VIPA for this purpose.

Transferring your project

A number of different transfer methods are employed due to the fact that a number of different hardware versions of the VIPA Profibus master modules exist. These transfer methods are described in the master configuration guide for the respective hardware version.

Connecting a system by means of Profibus

In a system with more than two stations all stations are wired in parallel. For this reason the bus cable must be connected as an uninterrupted loop.

You must always keep an eye on the correct polarity!

Note!

To prevent reflections and associated communication problems the bus cable must always be terminated with its characteristic impedance!

Start-up behavior

IM 208 - Master

When the IM 208 interface is connected to a supply (Power On) the configuration data is read from the memory card, verified and stored into the internal RAM of the IM 208.

At power on the master will automatically change to RUN mode if the operating mode selector is set to RUN and if the parameters are acceptable. In RUN mode the LED’s RN and DE are on. When all the configured slaves have become available in the data exchange the ER-LED is extinguished.

In STOP mode the outputs of the allocated slaves will be set to 0 if the parameters are valid. Although no communications will take place, the master will remain active on the bus using current bus parameters and occupying the allocated bus address. To release the address the Profibus plug must be removed from the IM 208 interface.

IM 253 - slave

After power on the Profibus coupler executes a self test. This test checks the couplers internal functions and the communications via the back panel bus.

When the bus coupler has been initialized properly its status is set to "READY".

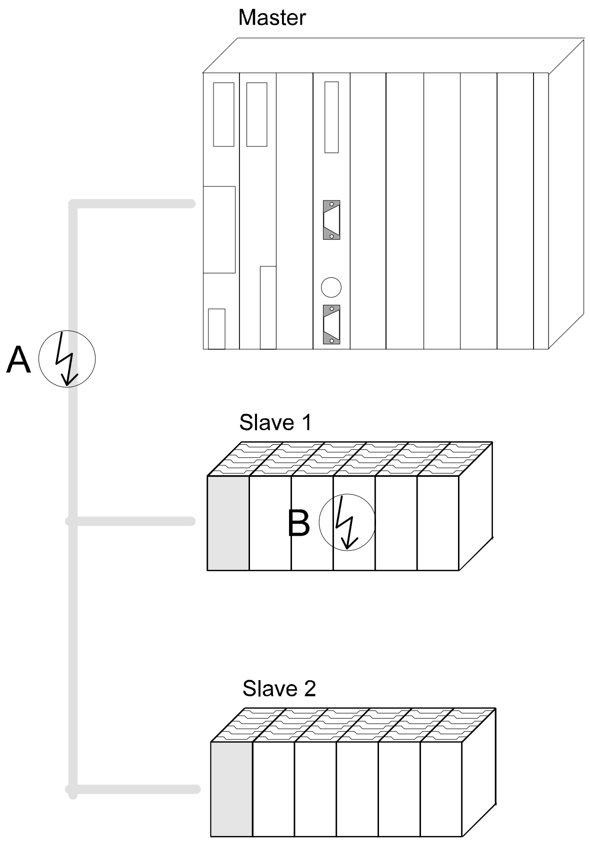
When the status is READY the slave receives the parameters that are located in the master and that were previously configured. When the parameters have been validated the status of the slave changes to "Data Exchange" DE.

The DE-LED is turned on when the module is communicating.

Should communication errors occur on the back panel bus the Profibus coupler will be placed in STOP mode and it will be re-started after app. 2 seconds. The RD-LED blinks when the test has returned a positive result.

Using the diagnostic LED's

The following example shows the reaction of the LED's for different types of network interruption.



Interruption at position A
The Profibus has an open circuit.
Interruption at position B
Communications via the back panel bus has been interrupted.

LED slave 1	Position of interruption	
LED	A	B
RD	blinks	off
ER	off	on
DE	off	off

LED slave 2	Position of interruption	
LED	A	B
RD	blinks	on
ER	off	off
DE	off	on

Example - System 200V with Profibus under WinNCS

Problem

The following example describes the configuration of a System 200V by means of WinNCS. The system must consist of centralized and decentralized peripherals. The decentralized peripherals should be linked by means of Profibus.

The contents of a counter that is generated in the centralized periphery (CPU 24x) must be transferred to the decentralized peripherals via the Profibus link for output via an output module.

This example employs output byte 16 for the transfer of the counter value.

Note!

You can also find this example in the HB91 "VIPA Component Library - VCL" manual that also contains a description of WinNCS.

This problem can be divided into the following section:

- Configuration of the centralized periphery (Profibus-Master IM 208 DP)
- Configuration of the decentralized periphery (Profibus-Slave IM 253 DP with I/O modules)
- Exporting the configuration as 2bf-file
- Installing the Profibus mapping in the CPU 24x by means of the 2bf-file.
- Transferring the 2bf-file into the Profibus master
- Transferring the s5d-file as DB1 into the CPU
- Creating the counter program and transferring it to the CPU 24x
- Creating labels

System requirements

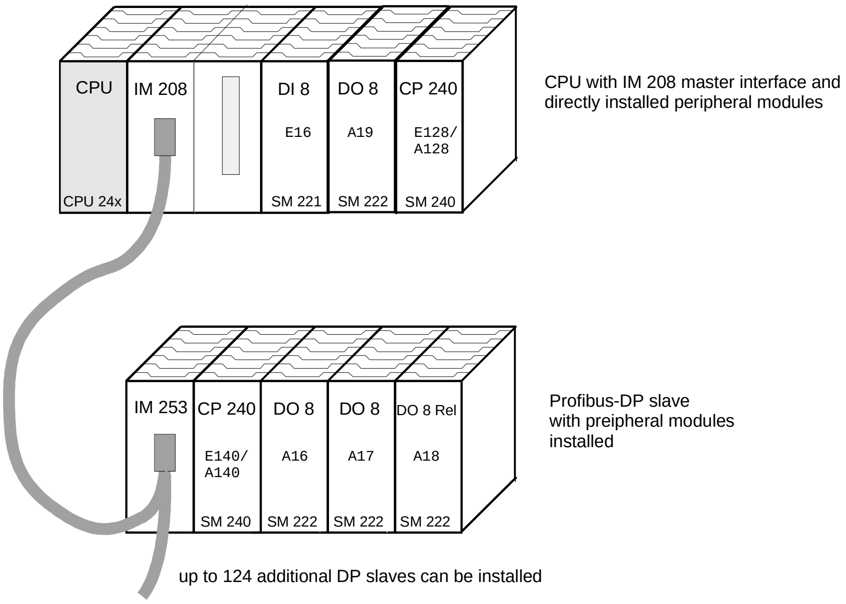
Minimum requirements for the System 200V modules

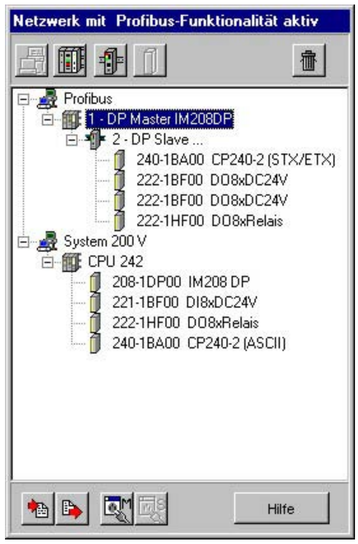
- CPU 24x
- IM 208 DP Profibus master
- IM 253 DP Profibus slave
- at least one output module

Software tools required

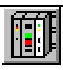
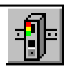
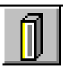
- WinNCS
- SIP.EXE (contained in WinNCS)
- SPS programming package, e.g. the VIPA MC5

System structure

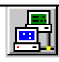
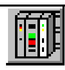
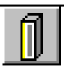
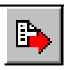




Configuration of the decentralized periphery (Profibus)

1.	Start WinNCS and create a new project file for the "Profibus" function by clicking on **File** > *create/open*.
2.	If you have not yet done so, use  to insert a **Profibus function group** into the network window and click [Accept] in the parameter box.
3.	Use  to insert a **Profibus host/master** into the network window and specify the Profibus address of your master in the parameter window.
4.	Insert a **Profibus slave** into the network window by means of . Enter the Profibus address, the family "I/O" and the station type "DP200V" into the parameter window and click [Accept].
5.	Use  to define the configuration of every peripheral module starting with the CP240 module "240-1BA00". You can select automatic addressing for the periphery by clicking [Auto]. For intelligent modules like the CP240 the configurable parameters will be displayed. Define the configuration for the output module "222-1BF00" that must output the counter using the o-addr. 16. Configure the remaining two modules "222-1BF00" and "222-1HF00" by means of the auto-addressing function.
6.	Activate the Profibus function group in the network window. Click on the "Busparameter" tab in the parameter window. Select the required baud-rate and click [calculate]. The bus parameters will be calculated - [Accept] these. The bus parameters must be re-calculated with every change of the module configuration!
7.	Activate the master-level in the network window and export your project into a 2bf-file.
8.	Transfer your 2bf-file into the Profibus master by means of the SIP-tool that is supplied.

Configuration of the centralized periphery (CPU 24x)

9.	Select the "System 200V" functionality in **Tools** > *System 200V*.
10	Insert a **System 200V function group** in the network window by means of  and click [Accept] in the parameter window.
11	Insert a CPU 24x in the network window by means of .
12	Use  to define the configuration of every peripheral module starting with the Profibus master "208-1DP00". As DP-master you enter the 2bf-file that you have exported above. Your Profibus together with the decentralized periphery is included as a representation of this module. Under [Map] this is displayed as the blue area. At this point you must configure the remaining System 200V modules as described in 5., "221-1BF00, "222-1HF00" and "240-1BA00".
13.	Activate the CPU-level in the network window and click on  export. Export your System 200V configuration into the default file `db1@@@st.s5d`. This s5d-file contains the DB1 that you can transfer to your CPU by means of the available programs like, for instance MC5 of VIPA.

Creating and printing labels

14	Activate the module level in the network window and open the "Label" tab (”Etikett”). Here you can define up to 9 lines of text. For most modules the respective operands are provided as defaults in accordance with the configuration - however, these may be overwritten. Once you have completed the edits click on [Accept].
15	Activate the option ”Labels” (”Etiketten”) in **File** > *Print options*.
16	When you have opened the network window of one of the module levels the page view will display the labels of all the modules of the selected level.
17	Insert the tractor-feed label forms that are available from VIPA into your printer (order no.: VIPA 292-1XY10).
18	Use the print button  in the page view to print the labels displayed above.

PLC program with counter

FB1:

```
L   AB16
I    1
T   AB16
```

OB1:

```
SPA FB1
```

Technical data

Profibus-DP master

IM 208 DP

Electrical data	VIPA 208-1DP01
Power supply Current consumption Isolation Status indicators Connections/interfaces	via back panel bus 380mA max. ≥ 500V AC via LED’s on the front 9-pin D-type socket Profibus connector
Profibus interface	
Connection Network topology Medium Data transfer rate Total length Max. no. of stations	9-pin D-type socket Linear bus, active bus terminator at both ends, radial lines are permitted. Screened twisted pair cable, under certain conditions unscreened lines are permitted. 9,6 kBaud to 12 MBaud 100 m without repeaters for 12 MBaud, 1000 m with repeaters 32 stations in any segment without repeaters. Extendible to 126 stations when using repeaters.
Combination with peripheral modules	
max. no of slaves max. no. of input bytes max. no. of output bytes	125 256 256
Dimensions and weight	
Dimensions (WxHxD) in mm Weight	25,4x76x76 110g

IM 208 DPO

Electrical data	VIPA 208-2DP10
Power supply Current consumption Isolation Status indicator Connections/interfaces	via rear panel bus max. 380mA ≥ 500V AC via LED’s located on the front 4-pole socket for fibre optic cable Profibus interface
Profibus interface	
Connection Network topology Medium Data transfer rate Total length Max. no. of stations	4-port socket for fibre optic cable Linear structure with dual FO cable, no bus terminator required dual-core fibre optic cable 12 MBaud max. 50 m between stations 126 stations incl. Master.
Combination with peripheral modules	
max. no of slaves max. no. of input bytes max. no. of output bytes	125 256 256
Dimensions and weight	
Dimensions (WxHxD) in mm Weight	50,8x76x76 110g

Profibus-DP-Slave

IM 253 DP

Electrical data	VIPA 253-1DP00
Power supply Current consumption Isolation Status indicator Connections/interfaces	24V DC, from ext. power supply connected to front 1A max. ≥ 500V AC via LED's on the front 9-pin D-type socket Profibus connector
Profibus interface	
Connection Network topology Medium Data transfer rate Total length Max. no. of stations	9-pin D-type socket Linear bus, active bus terminator at both ends, radial lines are permitted. Screened twisted pair cable, under certain conditions unscreened lines are permitted. 9,6 kBaud to 12 MBaud (automatic adjustment) 100 m without repeaters for 12 MBaud; 1000 m with repeaters 32 stations in any segment without repeaters. Extendible to 126 stations when using repeaters.
Diagnostic functions	
Standard diagnostics Extended diagnostics	The last 100 results are stored in Flash-ROM together with a time stamp. This data is accessible by means of a special tool and a cable. -
Combination with peripheral modules	
max. no of modules max. no. of digitals max. no of analogs	32 32 16
Dimensions and weight	
Dimensions (WxHxD) in mm Weight	25,4x76x76 80g

IM 253 DPO

Electrical data	VIPA 253-1DP10
Power supply Current consumption Isolation Status indicator Connections/interfaces	24V DC, from ext. power supply connected to front 1A max. ≥ 500V AC via LED's on the front 9-pin D-type socket Profibus connector
Profibus interface	
Connection Network topology Medium Data transfer rate Total length Max. no. of stations	4-port socket for fibre optic cable Linear structure with dual FO cable, no bus terminator required dual-core fibre optic cable 12 MBaud max. 50 m between stations 126 stations incl. Master.
Diagnostic functions	
Standard diagnostics Extended diagnostics	The last 100 results are stored in Flash-ROM together with a time stamp. This data is accessible by means of a special tool and a cable. -
Combination with peripheral modules	
max. no of modules max. no. of digitals max. no of analogs	32 32 16
Dimensions and weight	
Dimensions (WxHxD) in mm Weight	25,4x76x76 80g

Profibus-DP-slave combination module

IM 253 DP
DO 24xDC24V

Electrical data	VIPA 253-2DP20
Power supply Current consumption	24V DC, from ext. power supply connected to front 5A max.
Profibus interface	
Connection Network topology Medium Data transfer rate Total length Max. no of stations Status indicator	9-pin D-type socket Linear bus, active bus terminator at both ends. Screened twisted pair cable, under certain conditions unscreened lines are permitted. 9,6 kBaud to 12 MBaud (automatic adjustment) 100 m without repeaters for 12 MBaud; 1000 m with repeaters 32 stations in any segment without repeaters. Extendible to 126 stations when using repeaters. via LED’s on the front
Combination with peripheral modules	
max. no of modules max. digital I/O’s max. analog I/O’s	32 32 16
Output unit	
Number of outputs Rated load voltage Output current per channel Status indicator	24 24V DC (18...35V) supplied internally via Profibus coupler 1A (total current must not exceed 4A) Power (PW) fuse OK, Error (ER) short circuit, overload
Programming data	
Output data	4 Byte (3 bytes are used)
Dimensions and weight	
Dimensions (WxHxD) in mm Weight	50,8x76x76 150g

Chapter 3 Interbus

Overview

This chapter contains all the information that you require to connect your System 200V periphery to the Interbus.

A description of the Interbus principles is followed by details of the Interbus coupler, its installation and commissioning.

The chapter is concluded by the technical data.

Below follows a description of:

- System overview and Interbus principles
- Hardware structure, applications and commissioning of the Interbus coupler
- Technical data

Contents

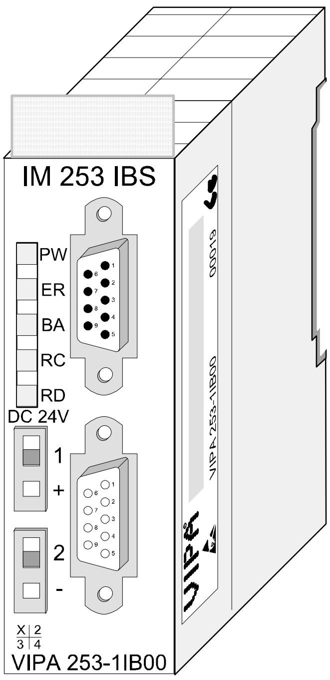
Ordering information

Order number	Description
VIPA 253-1IB00	Interbus Slave

System overview

You can use the VIPA Interbus slave to connect up to 16 input and 16 output modules of the System 200V to your Interbus.

At present one Interbus slave module is available from VIPA.



Ordering data

Order number	Description
VIPA 253-1IB00	Interbus Slave

Principles

General

Interbus is a pure master/slave system that has very few protocol overheads. For this reason it is well suited for applications on the sensor / actuator level. Interbus was developed by PHOENIX CONTACT, Digital Equipment and the technical University of Lemgo during the 80s. The first system components became available in 1988. To this day the communication protocol has remained virtually unchanged. It is therefore means that it is entirely possible to connect devices of the first generation to the most recent master interfaces (generation 4).

Interbus for sensor and actuator level

The widespread use of Interbus for sensor/actuator level applications may be ascribed to the relatively simple interfacing requirements that are supported by protocol driver chips. These reduce the number of external components required for direct input or output interfacing to a minimum.

Interbus devices are subject to the DIN standard 19258 that defines levels 1 and 2 of the protocol amongst others.

Interbus as shiftregister

The Interbus system is designed as a ring-type network with a centralized master-slave access procedure. It has the structure of a distributed shift-register. The different registers of the devices connected to the ring are a portion of this shift register. The master shifts the data through this shift register. The ring structure of the network permits simultaneous transmission and reception of data. Data may be sent in both directions on the ring, which uses a single cable.

ID-register

Every Interbus module has an ID-register (identification register). This register contains information on the type of module, the number of input and output registers as well as status and error flags.

Interbus master

The Interbus coupler can be used to control the peripheral modules of the System 200 V via Interbus. In this case the bus coupler replaces the CPU. The Interbus master reads and writes data from/to inputs and outputs respectively. The master is the link with respect to other systems. Every master can control a maximum of 4096 input/output points. These may be located on the local bus or they may be distributed amongst secondary structures connected by means of bus couplers.

It is possible to connect remote ring systems to the main ring to provide a structured system. These remote ring systems are connected by means of a "bus terminal module". You can also use these bus terminal modules for long distance communications.

Restrictions on the data capacity

The hardware overhead for Interbus devices increases in proportion with the width of the data. It is for this reason that the maximum data width was limited to 20 bytes for input data and 20 bytes of output data.

Secondary Interbus segments (peripheral busses) can be connected or disconnected by means of the respective bus coupler. It is for this reason that the bus can remain operational even if a fault occurs on a peripheral bus connection. The faulty segment can be disconnected from the bus.

Modes of operation

Interbus has two modes of operation:

- ID-cycle
  An ID-cycle is issued when the Interbus system is being initialized and also upon request. During the ID-cycle the bus-master reads the ID registers of every module connected to the bus to generate the process image.
- Data cycle

  The actual transfer of data occurs during the data cycle. During the data cycle the input data from the registers of all devices is transferred to the master and the output data is transferred from the master to the devices. This is a full duplex data transfer.

Communication medium

Although Interbus appears to have a simple linear structure (a single line linking the master with every module) it has the structure of a ring that includes the outbound line and the return line in a single cable. The last device on the ring closes the loop. On most devices this is an automatic function that occurs when no further line segments are connected.

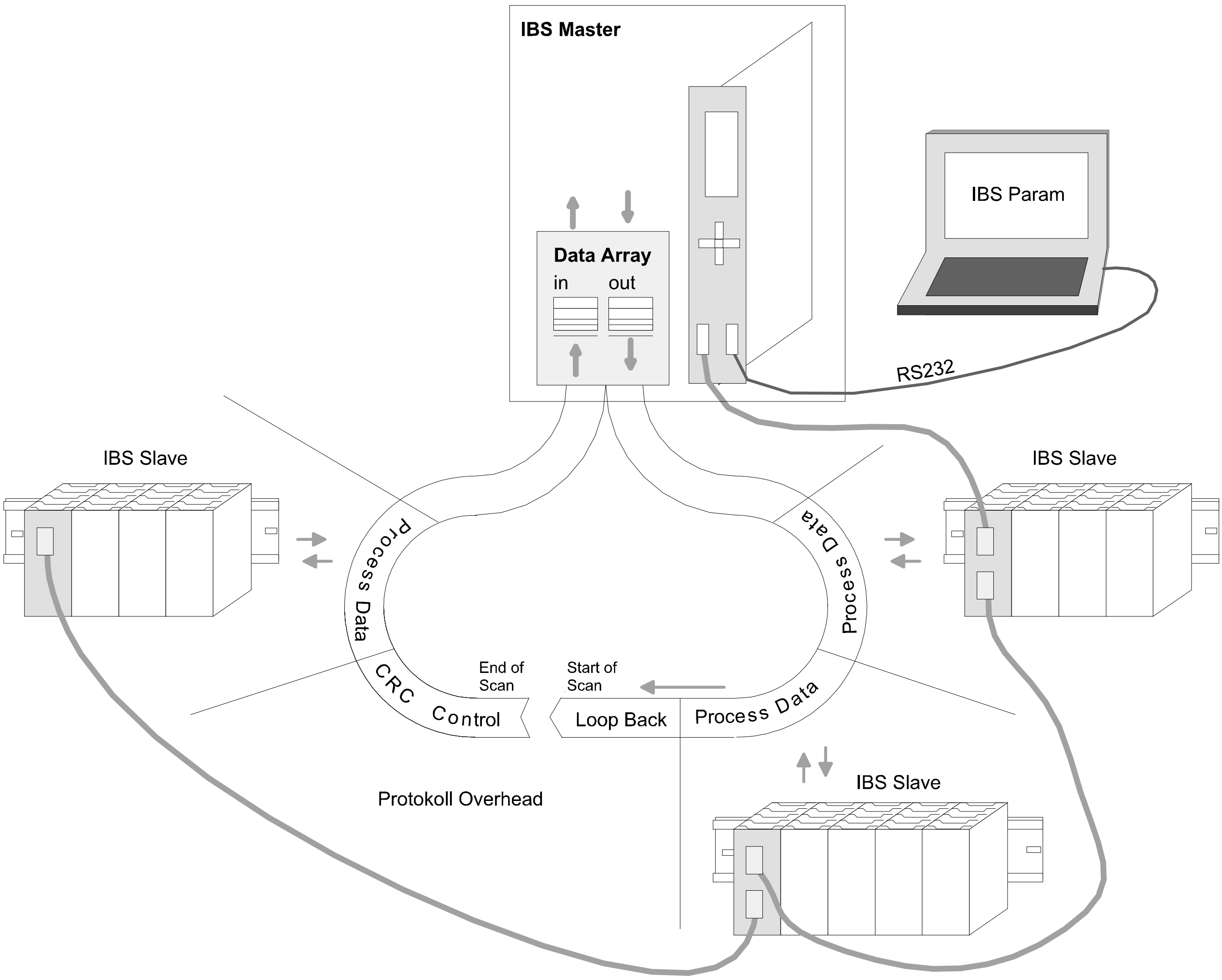
The physical level of Interbus is based upon the RS422 standard. The signals are connected by means of twisted pair lines. The outbound signal as well as the return signal of Interbus is re-routed via the same cable and every connected station. Communications between 2 devices require a 5-core cable due to the ring-based structure and the common logic ground. At a data communications rate of 500kBaud 2 adjacent stations on the ring may be located at a distance of no more than 400m. The integral repeater function of every device on the bus allows a total distance of up to 13km. The maximum number of devices on the bus is limited to 512.

Process data transfer

Interbus is based upon a ring structure that operates as a cyclic shift register. Every Interbus module inserts a shift register into the ring. The number of I/O points supported by the module determines the length of this shiftregister. A ring-based shift register is formed due to the fact that all the devices are connected in series and that the output of the last shift register is returned to the bus master. The length and the structure of this shift register depend on the physical construction of the entire Interbus system.

Interbus operates by means of a master-slave access method where the master also provides the link to any high-level control system. The ring-structure includes all connected devices actively in a closed communication loop.

In comparison to client-server protocols where data is only exchanged when a client receives a properly addressed command, Interbus communications is cyclic in nature and data is exchanged at constant intervals. Every data cycle addresses all devices on the bus.



Transfer of control and monitoring information

Process data words also contain control and monitoring information. This information is only transferred once at the beginning or at the end of the peripheral data of any data cycle. This is why this system is also referred to as a transmission frame procedure.

Communication principle

The communication principle is independent of the type of data being transferred:

Process data that must be transferred to the periphery is stored in output buffer of the master in the same sequence as the output stations are connected to the bus. The transfer occurs when the master shifts the "loopback word" through the ring. Following the loopback word all the output data is placed on the bus. This means that the data is shifted through the shift register. The information from the process is returned as input data to the input buffer of the master at the same time as the output data is being sent.

The output data is located at the correct position in the shift registers of the different stations when the entire transmission frame telegram has been sent and read back again. At this point the master issues a special control command to the devices on the bus to indicate the end of the data transfer cycle.

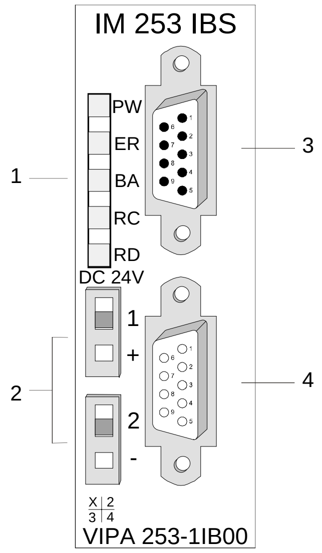
When the data check sequence has been processed output data for the process is transferred from the shift registers. This is stored in the devices connected to the bus and transferred to the respective periphery. At the same time new information is read from the periphery into the shiftregisters of the input devices in preparation for the next input cycle. This procedure is repeated on a cyclic basis. This means that the input and output buffers of the master are also updated cyclically. Interbus data communications is therefore full duplex in nature; i.e. both input data and output data are transferred during a single data cycle.

The shift register structure eliminates the need for addresses for every device as is common in other fieldbus systems. The address is defined by the location of the device in the ring.

The following diagram shows the structure of the transmission frame telegram as well as the structure of the ring:

VIPA Interbus coupler

Construction



[1] LED status indicators
[2] Power supply connector for the external 24V supply
[3] Interbus plug inbound interface
[4] Interbus socket outbound interface

Components

LED's

The module has a number of LED's are available for diagnostic purposes on the bus. The following table explains the purpose and the colour of the different LED's.

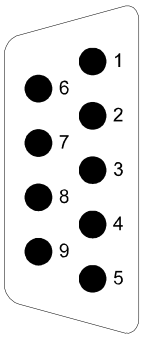
Name	Colour	Description
PW	green	Power LED
		Indicates that the supply voltage is available.
ER	red	Error
		Application error.
BA	green	Bus active
		The BA LED (bus active) indicates an active Interbus data transfer.
RC	green	Remotebus Check
		The RC LED (Remotebus Check) indicates that the connection to the previous Interbus device is OK (on) or that it has been interrupted (off).
RD	red	Remotebus disabled
		The RD LED (Remotebus Disabled) indicates that the outbound remote bus has been disabled.

Sockets and plugs

The interfaces for the inbound and the outbound bus lines are located on the front panel of the module. These consist of 9-pin D-type connectors.

The following diagram shows the pin assignment for this interface:

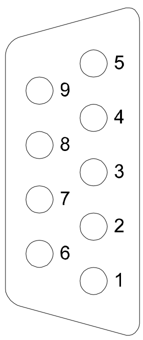
Inbound bus line (9 pin D-type, plug)



Pin	Assignment
1	DO
2	DI
3	GND1
4	GND *)
5	n.c.
6	/DO
7	/DI
8	+5V*) (90 mA)
9	reserved

*) power for the fiber optic converter.
This voltage is not isolated galvanically !

Outbound bus line (9 pin D-type, socket)



Pin	Assignment
1	DO
2	DI
3	GND
4	reserved
5	+ 5V (90 mA)
6	/DO
7	/DI
8	reserved
9	RBST

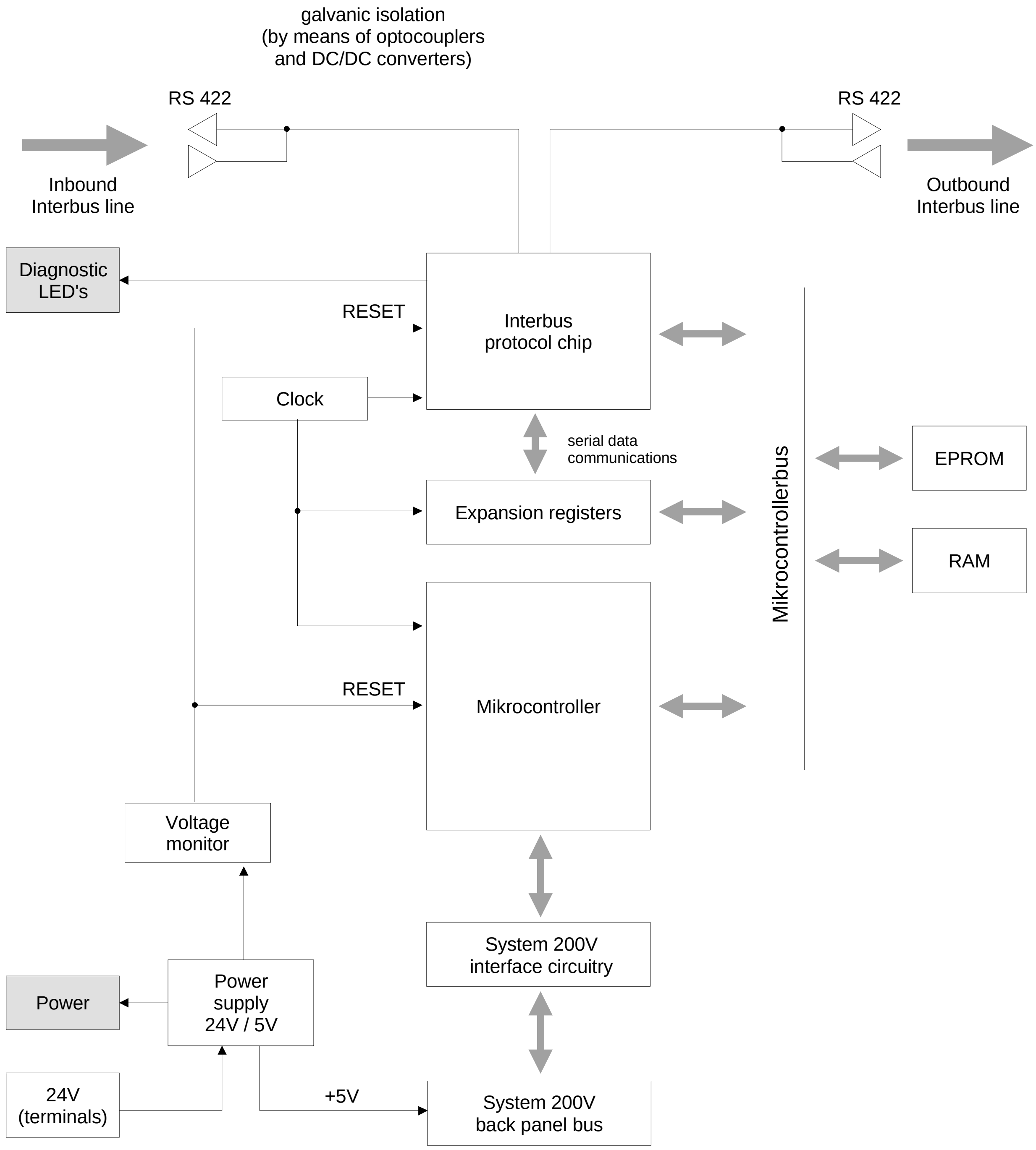
Power supply

The Interbus coupler has an internal power supply. This power supply requires an external voltage of 24V DC. In addition to the internal circuitry of the bus coupler the supply voltage is also used to power any devices connected to the back panel bus.

Interbus and the rear panel bus are isolated from each other.

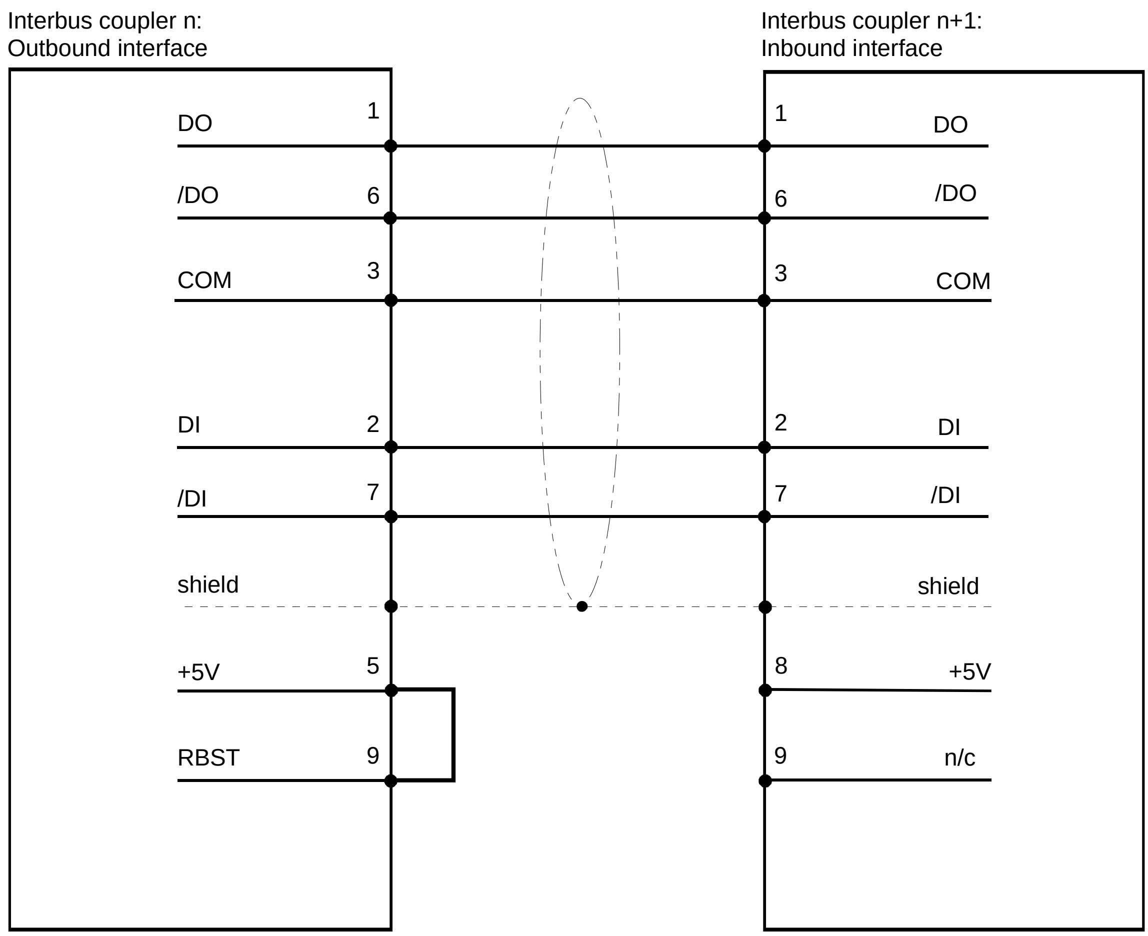
Note!
Please pay attention to the polarity of the power supply!

Block diagram The following block diagram shows the hardware structure of the bus coupler:



Connection to Interbus

Interbus wiring requirements



Isolation

Due to the fact that Interbus remote bus segments can be distributed over large areas it is necessary that individual segments are isolated galvanically to prevent problems that could be caused by potential differences. However, according to the recommendations of the Interbus club it is sufficient to provide galvanic isolation between inbound remote bus interfaces and the remainder of the circuitry. For this reason the outbound remote bus interface is at the same potential as the rest of the circuitry and the rear panel bus.

You must use metallic covers for plugs and these must be connected to the screen of the cable.

Note!

Please ensure that the link between pins 5 and 9 is installed on the plug for ”subsequent modules” as any subsequent slaves would not be detected if the link was not present!

Applications in conjunction with Interbus

Process data allocation

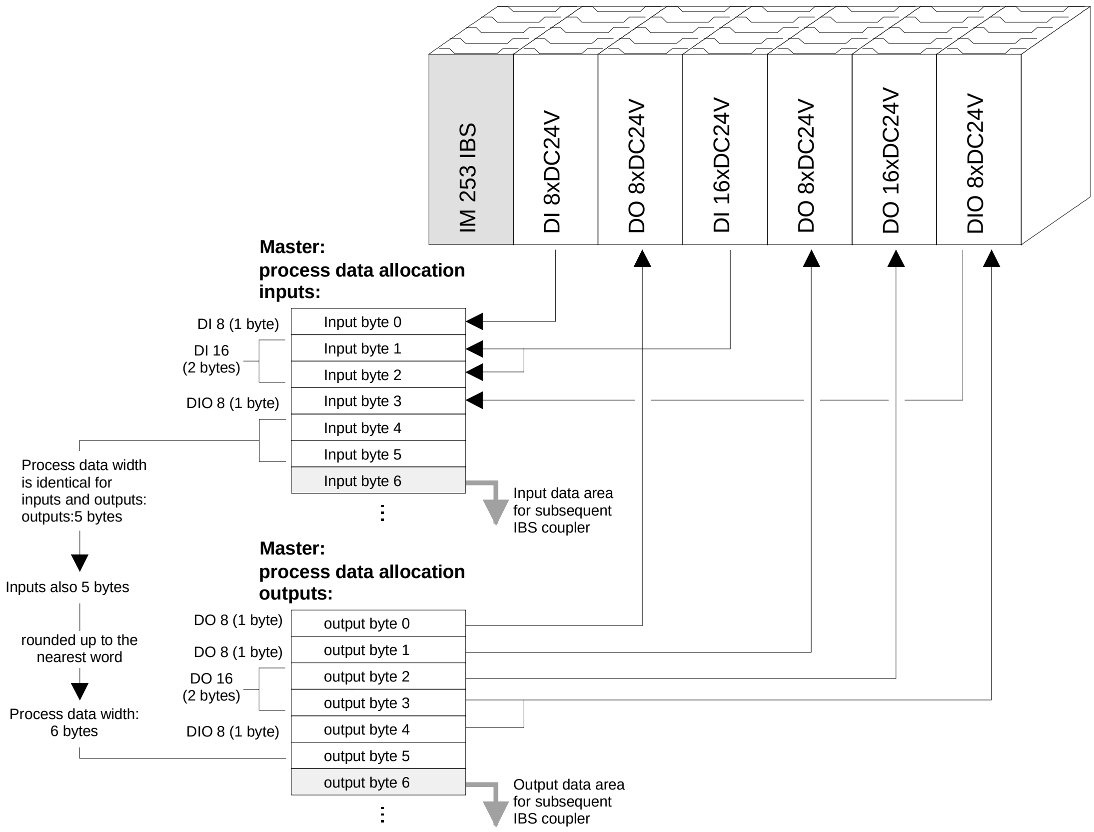
The bus coupler determines the configuration of the installed modules after power on and enters the respective data into the internal process image. This process image is sent to the master. From the process images the master generates a process data list for all couplers connected to the bus. The following two figures show the process data allocation list.

The bus coupler uses the following set of rules to generate the internal process image:

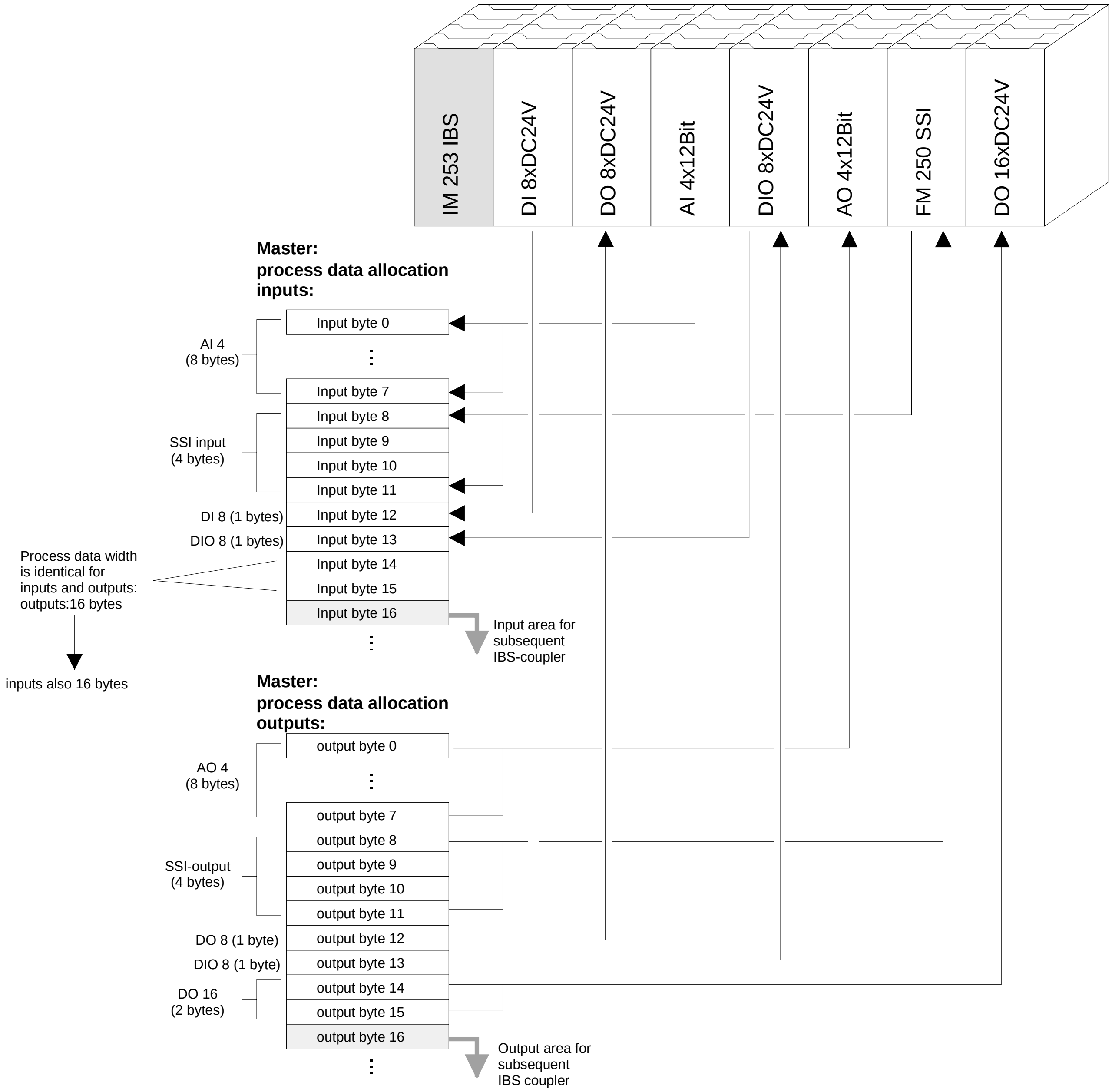
- Digital signals are bit-oriented, i.e. each channel is associated with a bit in the process image.
- Separate areas exist for input and output data.
- In the input and output areas non-digital modules are always placed before digital modules.
- The sequence of these allocations depends on the plug-in location starting from the bus coupler.
- Where the data width differs between inputs and outputs the larger of the two determines the data width used by the Interbus coupler. This is always rounded up to a complete word (20 byte max.).

The following figures are intended to show the allocation of the process data within the Interbus master.

Purely digital periphery



Combination of digital/analog periphery



Cyclic process data communications

A process image is employed to exchange input and output data. Communications with digital inputs and outputs is provided by separate data buffers which store the input and output conditions of the modules.

ID-code and ID-length

During the ID cycle that is executed when the Interbus system is being initialised the different modules connected to the bus identify themselves with their individual functionality and the word length. When the Interbus coupler is turned on it determines its Interbus length during the initialisation phase of the bus modules and generates the respective ID-code. Depending on the configuration the Interbus coupler replies with a message identifying it as an analogue or a digital remote bus device with variable word length.

Structure of the Interbus ID-code

The Interbus ID-code consists of 2 bytes. MSB (byte 2) describes the length of the data words that will be transferred. Where the width of the input and output data differs the larger value is used for the Interbus data width. The remaining 3 bits are reserved.

When the module is identified by means of the ID-code the master can only be informed of the data width by means of a word. It is for this reason that the data width is always an even number.

The LSB (byte 1) describes the type of bus module, i.e. the type of signal and other performance criteria like remote bus, peripheral bus module, PCP, ENCOM or DRIVECOM. Bits 1 and 2 determine the direction of the data.

Byte	Bit 7 ... Bit 0
1	Bit 1 ... Bit 0: Direction of data transfer: 00: not used 01: output 10: input 11: input/output Bit 3 ... Bit 2: terminal type Bit 7 ... Bit 4: terminal class The type and class are determined by the Interbus-Club
2	Bit 4 ... Bit 0: Data width 0 to 10 words (binary) Bit 7 ... Bit 5: reserved

Data consistency

Consistent data is the term used for data that belongs together by virtue of its contents. This is the high and the low byte of an analogue value (word consistency) as well as the control and status byte along with the respective parameter word for access to the registers.

The data consistency for a station is guaranteed by the Interbus data communication protocol. Synchronous scanning guarantees the consistency of the entire process image. Inconsistencies can arise due to asynchronous accesses to the data areas of the Interbus master from the control CPU. You can find information on secure access methods to the master interface in the respective manuals.

The basic data consistency is only guaranteed for 1 byte. This means that the bits belonging to a single byte were read or written as a single unit. This byte-related consistency suffices when digital signals are being processed. However, when the data length exceeds a byte, for instance for analogue values, then the data consistency must be expanded. You must ensure that you transfer consistent data properly from the Interbus master into your PLC.

For further information please refer to the manual for your Interbus master.

Restrictions

You may combine a maximum of 16 input and 16 output modules with an Interbus coupler. The maximum data width for the input and output data is 10 words.

The configuration of the bus coupler or peripheral modules via the Interbus PCP-protocol is not supported.

When the bus coupler is being initialised addresses are assigned to the ET200V peripheral module that are used by the bus coupler to communicate with the module under normal operating conditions. It is not possible to remove or insert any module while the system is active. This is due to the fact that addresses are only assigned after a POWER-ON or a RESET and since the data width of Interbus modules must not change while the system is operational.

In accordance with RS422 standards any remote bus segment (= distance between any two stations) may be at distances up to 400 m. The maximum total extent of the system is 12,8 km.

Note!

Before the change is implemented the respective bus coupler must be powered off. Please ensure that you change the initialisation in the master in accordance with the changes to the periphery!

Commissioning

Assembly and integration with Interbus

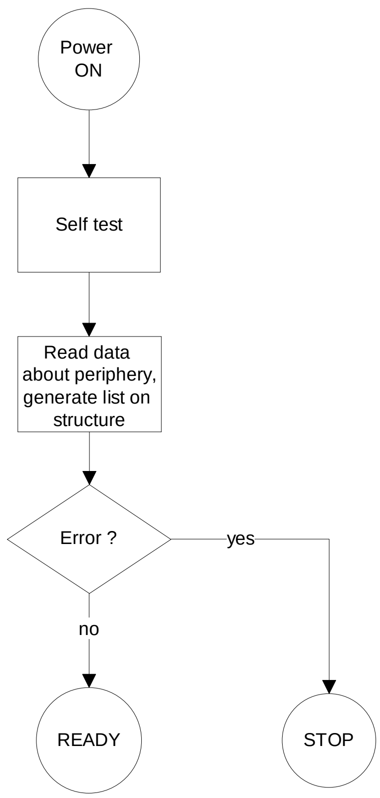
- Assemble your Interbus coupler using the required modules.
- Configure the Interbus coupler by means of the configuration tool that was supplied with the master.
- Connect the Interbus cable to the coupler and turn the power on.

Initialisation phase

During the power-on self-test the bus coupler checks the functionality of its components and communications via the back panel bus. The self-test is active while the PW LED is on. When the test has been completed successfully the RC and BA LED's are on.

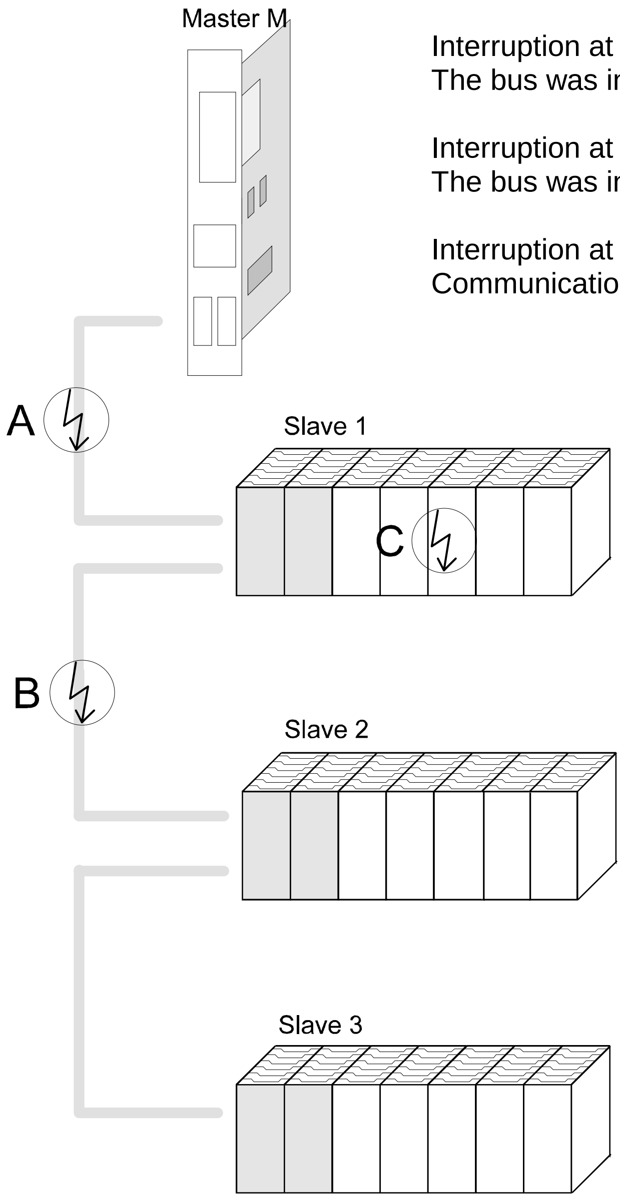
Now the peripheral structure is read in. First the number of modules connected to the bus is determined. Then the modules are identified by means of their type identifier. When the peripheral structure has been registered the location identifiers for the modules are generated. This is then transferred to the modules via the back panel bus. This procedure prepares an internal configuration list that is not externally accessible. These location identifiers provide the basis for directly addressed communications. When an error is recognised the status of the bus coupler is set to "STOP". Once the bus coupler has been initialised properly its status is set to "READY".

When an error has been removed, the bus coupler can only be returned to normal operation by switching it off and on.



Example of the use of the diagnostic LED's

The following example shows the reaction of the LED's to different types of network interruption.



Interruption at position A
The bus was interrupted between the master and slave 1.

Interruption at position B
The bus was interrupted between slave1 and slave2

Interruption at position C
Communications via the back panel bus was interrupted.

Slave 1	Interruption at position		
LED	A	B	C
ER	off	off	on
BA	off	off	on
RC	off	on	on
RD	on	on	off

Slave 2	Interruption at position		
LED	A	B	C
ER	off	off	off
BA	off	off	on
RC	off	off	on
RD	on	on	off

Slave 3	Interruption at position		
LED	A	B	C
ER	off	off	off
BA	off	off	on
RC	off	off	on
RD	on	on	on

Configuration of the master

As mentioned before, Interbus generates a data area containing both input and output bytes. The assignment of the modules connected to the bus coupler and the bits and bytes of the process image is provided by the bus coupler.

The Interbus master exchanges a contiguous input and output data block with every Interbus coupler. The data modules of the PLC or the configuration software allocate the bytes contained in this data block to the addresses of the process image.

Master-Software	Configuration software	Manufacturer
PLC-interfaces version <4	SYS SWT	Phoenix Contact
PLC-interfaces version <4	IBM CMD	Phoenix Contact
PC-interfaces version <3	SYS SWT	Phoenix Contact
general	SYS SWT	Phoenix Contact

Technical data

Interbus coupler
IM 253 IBS

Electrical data	VIPA 253-1IB00
Power supply	24V DC, ext. power supply connected to the front
Current consumption	300mA max.
Isolation	≥ 500V AC, according to DIN 19258
Status indicators	via LED’s located on the front
Connections / interfaces	9 pin D-type (plug) inbound remote bus 9 pin D-type (socket) outbound
Interbus interface	
Connection	remote bus, 9pin D-type as per DIN 19258
Network topology	Ring with an integrated return line
Medium	Screened twisted pair cable
Data transfer rate	500 kBit/s
Total length	12,8 km
Distance between two stations	400 m
digital inputs/outputs	max.160 input bits and 160 output bits
max. no. of stations	256
Combination with peripheral modules	
max. no. of modules	16
max. digital I/O	16 (process data width 20 I / 20 O)
max. analogue I/O	4 (process data width 10 I / 10 O) no configuration possible
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4x76x76
Weight	80g

Chapter 4 CAN-Bus CANopen

Overview

This chapter contains the description of the VIPA CANopen slave. The introduction to the system is followed by the description of the module. Another section of this chapter concerns CAN-Bus applications for the module. This section describes the message structure and the configuration of the module by means of examples. An extensive set of examples and an overview of the different module identifiers as well as the technical data conclude the chapter.

Below follows a description of:

- CAN-Bus principles
- The VIPA CANopen slave
- The Baudrate and Module-ID settings
- Application of the CANopen slave on the CAN-Bus with a message description
- Configuration examples
- Overview of the module identifiers
- Technical data

Contents

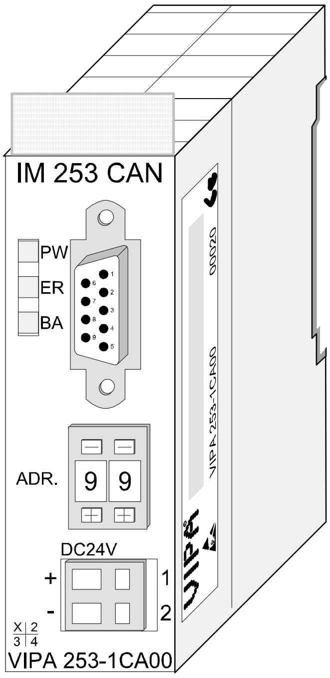
Ordering details

Order number	Description
VIPA 253-1CA00	CAN-Bus CANopen Slave

System overview

You can use the VIPA CAN-Bus coupler to link up to 32 modules (of 40 bytes each) of your System 200V periphery with CANopen.

A single CAN-Bus coupler is currently available from VIPA.



Ordering details

Order number	Description
VIPA 253-1CA00	CAN-Bus CANopen Slave

Principles

General

CAN-B (control area network) is an international standard for open fieldbus systems intended for building, manufacturing and process automation applications that was originally designed for automotive applications.

Due to its extensive error detection facilities the CAN bus system is regarded as the most secure bus system. It has a residual error probability of less than $4{,}7 \times 10^{-11}$. Bad messages are flagged and retransmitted automatically.

In contrast to Profibus and Interbus-S, the CAL-level-7-protocol (CAL=CAN application layer) defines various level-7 user profiles for the CAN bus. CANopen is a standard user profile defined by the CiA CAN in Automation association.

CANopen

CANopen is a user profile for industrial real-time systems, which is currently supported by a large number of manufacturers. CANopen was published under the heading of DS-301 by the CAN in Automation association (C.i.A). The communication specifications DS-301 define standards for CAN devices. These specifications mean that the equipment supplied by different manufacturers is interchangeable. The compatibility of the equipment is further enhanced by the equipment specification DS-401 that defines standards for the technical data and process data of the equipment. DS-401 contains the standards for digital and analog input/output modules.

CANopen comprises a communication profile that defines the objects that must be used for the transfer of certain data as well as the device profiles that specify the type of data that must be transferred by means of other objects.

The CANopen communication profile is based upon an object directory that is similar to the profile used by Profibus. The communication profile DS-301 defines two standard objects as well as a number of special objects:

- Process data objects (PDO)
  PDO's are used for real-time data transfers
- Service data objects (SDO)
  SDO's provide access to the object directory for read and write operations

Communication medium

CAN is based on a linear bus topology. You can use router nodes to construct a network. The number of devices per network is only limited by the performance of the bus driver modules.

The maximum distance covered by the network is determined by the runtimes of the signals. This means that a data rate of 1 Mbaud limits the network to 40m and 80 kBaud limits the network to 1000m.

The CAN-Bus communication medium employs a screened three-core cable (optionally a five-core).

The CAN-Bus operates by means of differential voltages. For this reason it is less sensitive to external interference than a pure voltage or current based interface. The network must be configured as a serial bus, which is terminated by a 120 Ω termination resistor.

Your VIPA CAN bus coupler contains a 9-pin socket. You must use this socket to connect the CAN bus coupler as a slave directly to your CAN bus network.

All devices on the network use the same Baud rate.

Due to the bus structure of the network it is possible to connect or disconnect any station without interruption to the system. It is therefore also possible to commission a system in various stages. Extensions to the system do not affect the operational stations. Defective stations or new stations are recognized automatically.

Bus access method

Bus access methods are commonly divided into controlled (deterministic) and uncontrolled (random) bus access systems.

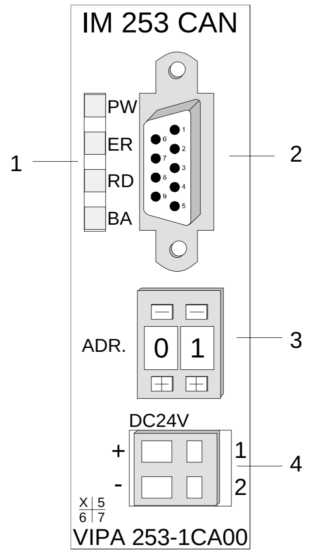
CAN employs a Carrier-Sense Multiple Access (CSMA) method, i.e. all stations have the same right to access the bus as long as the bus is not in use (random bus access).

Data communications is message related and not station related. Every message contains a unique identifier, which also defines the priority of the message. At any instance only one station can occupy the bus for a message.

CAN bus access control is performed by means of a collision-free, bit-based arbitration algorithm. Collision-free means that the final winner of the arbitration process does not have to repeat his message. The station with the highest priority is selected automatically when more than one station accesses the bus simultaneously. Any station that is has information to send will delay the transmission if it detects that the bus is occupied.

Bus coupler CANopen

Construction



[1] LED status indicators
[2] CAN-Bus socket
[3] Address or. Baud rate selector
[4] Connector for an external 24V supply

Components

LED's

The module is equipped with three LED's for diagnostic purposes. The following table shows how the diagnostic LED's are used along with the respective colors.

Name	Color	Description
PW	yellow	Indicates that the supply voltage is available.
ER	red	On when an error was detected in the back panel bus communications.
RD	green	Blinks at 1 Hz when the self-test was positive and the initialization was OK.
		Is turned on when data is being communicated via the VBUS.
BA	yellow	Off the self-test was positive and the initialization was OK.
		Blinks at 1 Hz when the status is "Pre-operational".
		Is turned on when the status is "Operational".
		Blinks at 10 Hz when the status is "Prepared".

Status indicator as a combination of LED's

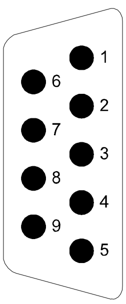
Various combinations of the LED's indicate the different operating statuses:

PW on ER on RD on BA on	Error during RAM or EEPROM initialization
PW on ER blinks 1 Hz RD blinks 1 Hz BA blinks 1 Hz	Baudrate setting activated
PW on ER blinks 10 Hz RD blinks 10 Hz BA blinks 10 Hz	Error in the CAN Baudrate setting
PW on ER off RD blinks 1 Hz BA off	Module ID-setting activated

9-pin D-type socket

The VIPA CAN-Bus coupler is connected to the CAN-Bus system by means of a 9-pin socket.

The following diagram shows the pin assignment for the interface



Pin	Assignment
1	n.c.
2	CAN low
3	CAN ground
4	n.c.
5	n.c.
6	optional ground
7	CAN high
8	n.c.
9	optional pos. supply

Address selector for Baudrate and module-ID

The address selector is used to specify the module-ID as well as the CAN Baud rate.

For details please refer to the section under the heading "Baudrate and Module-ID settings " in this chapter.

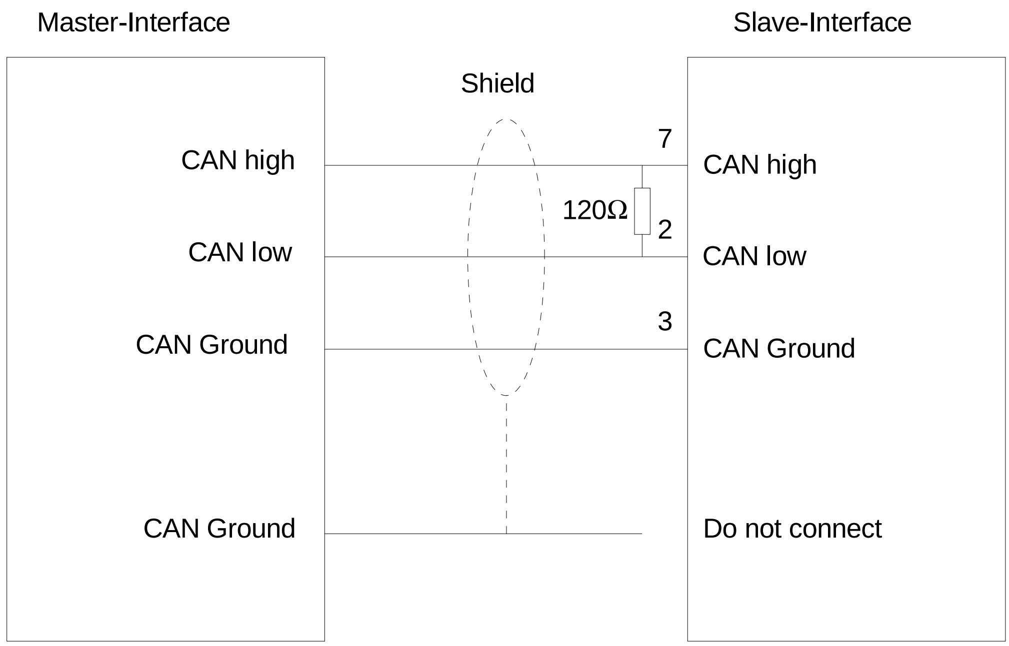
Power supply

The CAN-bus coupler is equipped with an internal power supply. This power supply requires an external supply of 24V DC. In addition to the internal circuitry of the bus coupler the supply voltage is also used to power any devices connected to the back panel bus. Please note that the maximum current available for the back panel bus from the internal power supply is limited to 3A.

CAN-Bus and back panel bus are isolated from each other.

CAN-Bus wiring

The CAN-Bus communication medium bus is a screened three-core cable.



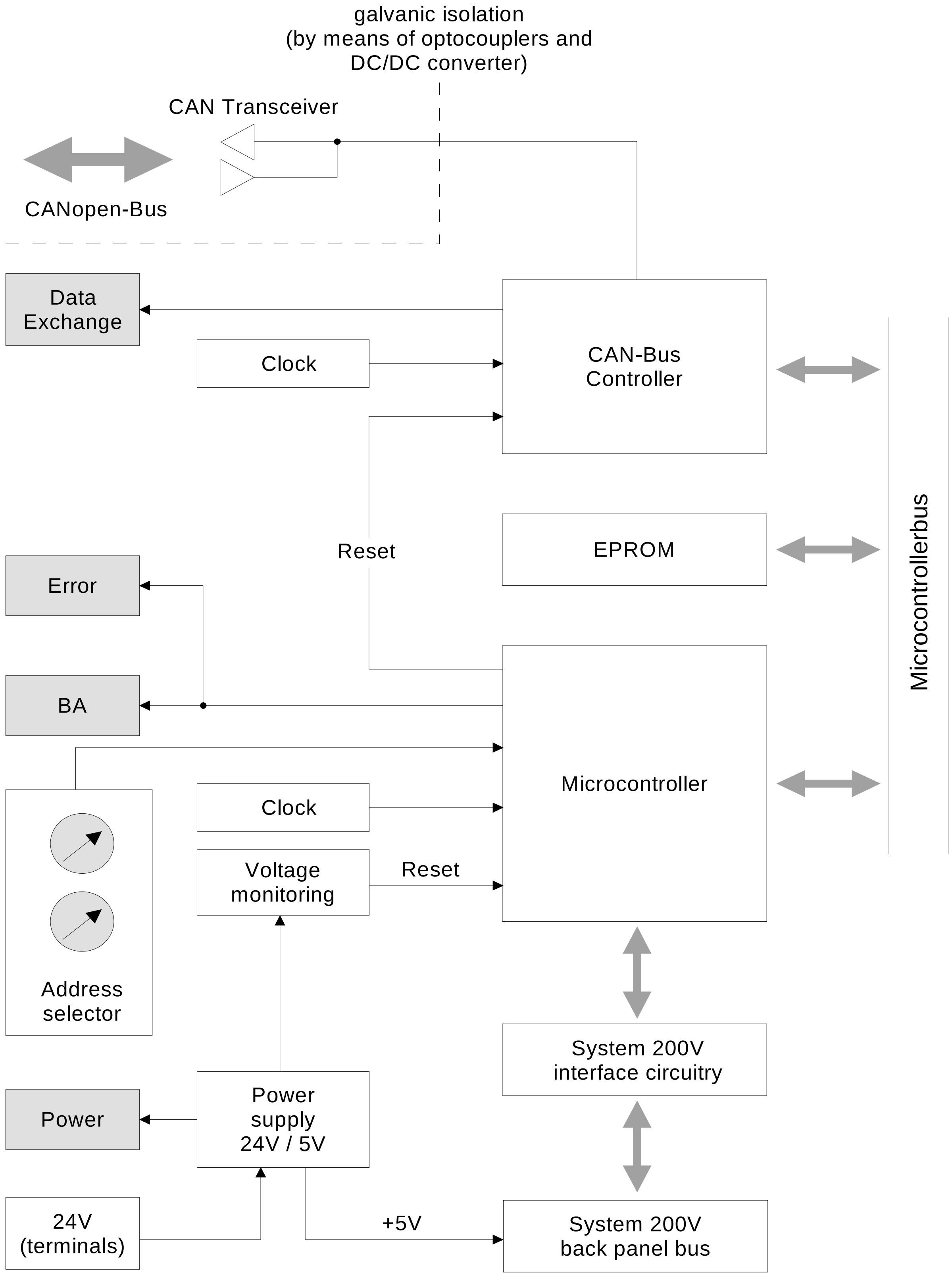
Line termination

All stations on systems having more than two stations are wired in parallel. This means that the bus cable must be looped from station to station without interruptions.

Note!

The end of the bus cable must be terminated with a 120 Ω termination resistor to prevent reflections and the associated communication errors!

Block diagram The following block diagram shows the hardware structure of the bus coupler and the internal communications:



Baudrate and module-ID settings

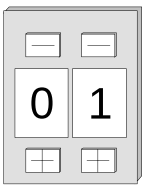
You have the option to specify the baudrate and the module-ID by setting the address selector to 00 within a period of 10s after you have turned the power on.

The selected settings are saved permanently in an EEPROM and can be changed at any time by means of the procedure shown above.

Specifying the Baudrate by means of the address selector

- Set the address selector to 00.
- Turn on the power to the CAN-Bus coupler

  The LED’s ER, RD, and BA will blink at a frequency of 1Hz. For a period of 5s you can now enter the CAN-Baudrate means of the address selector :



Address selector	CAN-Baudrate	max. guar. bus distance
"00"	1 Mbaud	25 m
"01"	500 kBaud	100 m
"02"	250 kBaud	250 m
"03"	125 kBaud	500 m
"04"	100 kBaud	600 m
"05"	50 kBaud	1000 m
"06"	20 kBaud	2500 m
"07"	10 kBaud	5000 m
"08"	800 kBaud	50 m

After 5 seconds the selected CAN-Baudrate is saved in the EEPROM.

Module-ID selection

LED’s ER and BA are turned off and the red RD-LED continues to blink.

At this point you have 5s to enter the required module-ID.

- Define the module-ID in a range between 01...99 by means of the address selection switch. Every module-ID may only exist once on the bus. The module-ID must be defined before the bus coupler is turned on.

  The entered module-ID's are accepted when a period of 5s has expired after which the bus coupler returns to the normal operating mode (status: "Pre-Operational").

Baudrate selection by an SDO-write operation

You can also modify the CAN-Baudrate by means of an SDO-Write operation to the object "2001h". The entered value is used as the CAN-Baudrate when the bus coupler has been RESET. This method is a most convenient when you must change the CAN-Baudrate of all the bus couplers of a system from a central CAN-terminal. The bus couplers use the programmed Baudrate when the system has been RESET.

Message structure

All CANopen messages have the following structure:

Identifier

Byte	Bit 7 ... Bit 0
1	Bit 3 ... Bit 0: most significant 4 bits of the module-ID Bit 7 ... Bit 4: CANopen function code
2	Bit 3 ... Bit 0: data length code (DLC) Bit 4: RTR-Bit: 0: no data (request code) 1: data available Bit 7 ... Bit 5: Least significant 3 bits of the module-ID

Data

Byte	Bit 7 ... Bit 0
3 ... 10	Data

An additional division of the 2-byte identifier into function portion and a module-ID gives the difference between this and a level 2 message. The function determines the type of message (object) and the module-ID addresses the receiver.

CANopen devices exchange data in the form of objects. The CANopen communication profile defines two different object types as well as a number of special objects.

The VIPA CAN-Bus coupler supports the following objects:

- 5 transmit PDO's
- 5 receive PDO's
- 2 standard SDO's
- 1 emergency object
- 1 network management object NMT
- node guarding

Every object is associated with a function code. You can obtain the required function code from the following table.

CANopen function codes

The following table lists the defined CANopen objects and function codes that are supported by the VIPA CAN-Bus coupler:

Object	Function code (4 bits)	Receiver	Definition	Function
NMT	0000	Broadcast	CiA DS-301	Network managem.
EMERGENCY	0001	Master	CiA DS-301	Error message
PDO1S2M	0011	Master, Slave (RTR)	CiA DS-301	Digital input data 1
PDO1M2S	0100	Slave	CiA DS-301	Digital output data 1
PDO2S2M	0101	Master, Slave (RTR)	CiA DS-301	Analog input data 1
PDO2M2S	0110	Slave	CiA DS-301	Analog output data 1
PDO3S2M	0111	Master, Slave (RTR)	Application spec.	D o. a input data 2
PDO3M2S	1000	Slave	Application spec.	D o. a input data 2
PDO4S2M	1001	Master, Slave (RTR)	Application spec.	D o. a input data 3
PDO4M2S	1010	Slave	Application spec.	D o. a input data 3
PDO5S2M	1101	Master, Slave (RTR)	Application spec.	D o. a input data 4
PDO5M2S	1111	Slave	Application spec.	D o. a input data 4
SDO1S2M	1011	Master	CiA DS-301	Configuration data
SDO1M2S	1100	Slave	CiA DS-301	Configuration data
Node Guarding	1110	Master, Slave (RTR)	CiA DS-301	Module monitoring

A detailed description of the structure and the contents of these objects is available in "CiA Communication Profile DS-301 Version 3.0" and "CiA Device Profile for I/O-Modules DPS 401 Version 1.4".

CANopen object PDO's

5 process data objects (PDO) are available for the exchange of process data communications. Every PDO consists of a maximum of 8 data bytes. The transfer of PDO's is not verified by means of acknowledgments since the CAN protocol guarantees the transfer.

5 transmit PDO's are available for input data and 5 receive PDO's are for output data. Every PDO has communication and mapping parameters that the user may change and save via the bus.

Below follows a list of the **COB-identifiers** for the receive and the send PDO-transfer that are pre-set after boot-up. The transmission type in the object directory (indices 0x1400-0x1404 and 0x1800-0x1804, subindex 0x02) is preset to asynchronous, event controlled (= 0xFF). The EVENT-timer (value * 1ms) can be used to transfer the PDO's on a cyclic basis.

Send PDO's

Send PDO-COB-ID's (inputs):

0x180 + module-ID: PDO1S2M digital (DS-301)

0x280 + module-ID: PDO2S2M analog (DS-301)

0x380 + module-ID: PDO3S2M digital or analog (depending on the installed I/O modules)

0x480 + module-ID: PDO4S2M digital or analog (depending on the installed I/O modules)

0x680 + module-ID: PDO5S2M digital or analog (depending on the installed I/O modules)

Depending on the module configuration, PDO's 3 to 5 are dynamically distributed amongst the digital inputs and analog inputs if it is necessary to transfer more than 8 bytes of digital or analog input data.

In this case the digital inputs are allocated first and the analog inputs are assigned to the most significant PDO's. It is not possible to assign a combination of digital and analog inputs to a single PDO.

The number of allocated input data bytes per I/O-module is shown in the table containing the module overview (refer to appendix).

Sample I/O-module complement

Here follows an example of the I/O-module allocation to explain how the PDO input bytes are assigned to the respective I/O-modules.

Plug-in location no.:	0	1	2	3	4	5	6	7	8	9
Module type	CAN BM	DI8	DI32	AO4	D032	DIO16	AI4	FM250	DI8	DI8
Number of bytes DI	-	1	4	-	-	2	-	-	1	1
Number of bytes AI	-	-	-	-	-	-	8	8	-	-

In this example the input bytes of the I/O-modules were assigned to the input PDO's as follows:

PDO-Type	Length	Typ	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
PDO1S2M	8	Dig.	DI8 locat. "1"	DI32 locat. "2"	DI32 locat. "2"	DI32 locat. "2"	DI32 locat. "2"	DIO16 locat. "5"	DIO16 locat. "5"	DI8 locat. "8"
PDO2S2M	8	Ana log	AI4 locat. "6"	AI4 locat. "6"	AI4 locat. "6"	AI4 locat. "6"	AI4 locat. "6"	AI4 locat. "6"	AI4 locat. "6"	AI4 locat. "6"
PDO3S2M	1	Dig.	DI8 locat. "9"							
PDO4S2M	8	Ana log	FM250 locat. "7"	FM250 locat. "7"	FM250 locat. "7"	FM250 locat. "7"	FM250 locat. "7"	FM250 locat. "7"	FM250 locat. "7"	FM250 locat. "7"
PDO5S2M	not valid									

Receive PDO's

Receive PDO-COB-IDs (outputs):

0x200 + module-ID: PDO1M2S digital (DS-301)

0x300 + module-ID: PDO2M2S analog (DS-301)

0x400 + module-ID: PDO3M2S

0x500 + module-ID: PDO4M2S

0x780 + module-ID: PDO5M2S

Depending on the module configuration, PDO's 3 to 5 are distributed amongst the digital inputs and analog inputs if it is necessary to transfer more than 8 bytes of digital or analog input data.

In this case the digital inputs are allocated first and the analog inputs are assigned to the most significant PDO's. It is not possible to assign a combination of digital and analog inputs to a single PDO.

The number of allocated input data bytes per I/O-module is shown in the table containing the module overview (refer to appendix).

The above example of the I/O-module allocation will be used in the following example to explain how the PDO output bytes are assigned to the respective I/O-modules.

Sample I/O-module complement:

Plug-in location no.:	0	1	2	3	4	5	6	7	8	9
Module type	CAN BM	DI8	DI32	AO4	D032	DIO16	AI4	FM250	DI8	DI8
Number of bytes DO	-	-	-	-	4	2	-	-	-	-
Number of bytes AO	-	-	-	8	-	-	-	10	-	-

In this example the output bytes of the I/O-modules are assigned as follows to the output PDO's:

PDO-type	Len.	Type	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
PDO1M2S	6	Dig.	DO32 locat. "4"	DO32 locat. "4"	DO32 locat. "4"	DO32 locat. "4"	DIO16 locat. "5"	DIO16 locat. "5"		
PDO2M2S	8	Ana log	AO4 locat. "3"	AO4 locat. "3"	AO4 locat. "3"	AO4 locat. "3"	AO4 locat. "3"	AO4 locat. "3"	AO4 locat. "3"	AO4 locat. "3"
PDO3M2S	8	Ana log	FM250 locat. "7"	FM250 locat. "7"	FM250 locat. "7"	FM250 locat. "7"	FM250 locat. "7"	FM250 locat. "7"	FM250 locat. "7"	FM250 locat. "7"
PDO4M2S	2	Ana log	FM250 locat. "7"	FM250 locat. "7"						
PDO5M2S	not valid									

Service-data-objects SDO's

The Service-Data-Object (SDO) is used for accesses to the object directory. You can use the SDO to read from or to write to the object directory. The CAL level-7 protocol contains the specifications for the Multiplexed-Domain-Transfer-Protocol that is used by the SDO's. You may use this protocol to transfer any amount of data. During the transfer the messages may be divided amongst a number of CAN-messages, each one with the same identifier (segmentation).

4 or 8 bytes of the first CAN message for the SDO contain protocol information. Only a single CAN message is required to access object directory entries with a length of four bytes or less. Where the length exceeds 4 bytes the transfer is segmented. Every additional segment of an SDO contains up to 7 bytes of user data. The last byte is provided with an ending label. SDO's are acknowledged, i.e. the reception of every message is acknowledged.

The COB identifiers provided for read and write access are:

- Receive-SDO: 600h + module-ID
- Transmit-SDO: 580h + module-ID

The object directory (cal_obj.c) contains the following entries (according to DS 301):

Variable-address		Contents
0020h		PDO Communication Parameter Record
0021h		Digital-PDO Mapping Parameter Record
0040h		Pre-defined Error Field Record
0041h		Digital-16-Bit-PDOInOut Types Record
0042h		Analog-PDOInOut Types Record
0043h		Counter-PDOInOut Types Record
0044h		Analog-PDOInput Interrupt Types Record
0045h		Counter-PDOParameter Types Record
0046h		Counter-PDOInput Interrupt Types Record
1000h		Device type
1001h		Error Register
1003h		Error field
1004h		Number of PDO's that are supported
1008h		Manufacturers name ("IMCA")
1009h		Hardware version (4.00)
100Ah		Software version (2.03)
100Bh		Node address
100Ch		Guard Time
100Dh		Life Time Factor
100Eh		Node Guarding Identifier

1014h		Emergency COB-ID
1017h		Heartbeat Producer Time (Value * 1ms)
1018h		Device identification Index 0: number of elements (permanently set to 4) Index 1: vendor-ID (0xAFFEAFFEhex) Index 2: hardware revision level (0x04hex) Index 3: software revision level (0x23hex) Index 4: date (0xDDMMYYYYhex)
1027h		Module list Index 0: number of modules that were installed Index 1..32: module identifier of the installed modules
1400h to 1404h		Communication parameter for receive-PDO's Index 0: number of entries (preset to 2) Index 1: COB-ID Index 2: transmission type (preset to 0xFFhex)
1600h to 1604h		Mapping parameter for receive PDO's (variable mapping was not implemented)
1800h to 1804h		Communication parameter for send-PDO's Index 0: number of entries (preset to 5) Index 1: COB-ID Index 2: transmission type (preset to 0xFFhex) Index 3: inhibit time (as of software revision 2.03) Index 5: event time (as of software revision 2.03)
1A00h to 1A04h		Mapping parameter for receive PDO's (variable mapping was not implemented)
2001h	X	Sub-index 0: CAN-Baudrate setting
2100h		Sub-index 0: erase EEPROM, after a RESET the bus coupler starts with the default values.
3001h	X	Analog parameter data for analog module 1 Sub-index 0: number of analog parameter data entries (inputs o. outputs) **per** analog module Sub-indices 1…4: 2 words of analog parameter data per sub-index Every sub-index consists of 2 data words. Here you enter your parameter bytes. Every analog input and analog output module has 16 bytes of parameter data, i.e. it occupies 4 sub-indices, e.g.: the first analog module is AO4 x 12-Bit and must be configured for +/- 10 Volt operation: Sub-index 1: 0x40 0x00 0x01 0x01 Sub-index 2: 0x01 0x01 0x00 0x00 Sub-index 3: 0x00 0x00 0x00 0x00 Sub-index 4: 0x00 0x00 0x00 0x00

3002h	X	Analog parameter data for 2. analog module Sub-index 0: number of analog parameter data items (inputs o. outputs) **per** analog module Sub-indices 1…4: 2 words of analog parameter data per sub-index For an example refer to 3001h
3003h	X	Analog parameter data for 3. analog module Sub-index 0: number of analog parameter data items (inputs o. outputs) **per** analog module Sub-indices 1…4: 2 words of analog parameter data per sub-index For an example refer to 3001h
3004h	X	Analog parameter data for 4. analog module Sub-index 0: number of analog parameter data items (inputs o. outputs) **per** analog module Sub-indices 1…4: 2 words of analog parameter data per sub-index For an example refer to 3001h
3005h	x	Analog parameter data for 5. analog module Sub-index 0: number of analog parameter data items (inputs o. outputs) **per** analog module Sub-indices 1…4: 2 words of analog parameter data per sub-index For an example refer to 3001h
3006h	x	Analog parameter data for 6. analog module Sub-index 0: number of analog parameter data items (inputs o. outputs) **per** analog module Sub-indices 1…4: 2 words of analog parameter data per sub-index For an example refer to 3001h
3007h	x	Analog parameter data for 7. analog module Sub-index 0: number of analog parameter data items (inputs o. outputs) **per** analog module Sub-indices 1…4: 2 words of analog parameter data per sub-index For an example refer to 3001h
3008h	x	Analog parameter data for 8. analog module Sub-index 0: number of analog parameter data items (inputs o. outputs) **per** analog module Sub-indices 1…4: 2 words of analog parameter data per sub-index For an example refer to 3001h
3101h	x	Parameter data for the 1. CP240 module Sub-index 0: baudrate Sub-index 1: protocol Sub-index 2: delayed acknowledgment Sub-index 3: character delay time Sub-index 4: attempts Sub-index 5: bit parameters Sub-index 6: 3964(R) parameter Sub-index 7: diagnostics enabled

3102h	x	Parameter data for 2. CP240 module Sub-index 0: baudrate Sub-index 1: protocol Sub-index 2: delayed acknowledgment Sub-index 3: character delay time Sub-index 4: attempts Sub-index 5: bit parameters Sub-index 6: 3964(R) parameter Sub-index 7: diagnostics enabled
3201h	x	Parameter data for 1. FM254–module Sub-index 0: number of FM254-parameter data items per module Sub-index 1: maximum rotational speed Sub-index 2: reserved Sub-index 3: reserved Sub-index 4: P_amplification Sub-index 5: pre-control factor Sub-index 6: sensor line no. Sub-index 7: reference rotational speed Sub-index 8: attained pos. window Sub-index 9: drag f.-window
3202h	x	Parameter data for 2. FM254–module Sub-index 0: number of FM254-parameter data items per module Sub-index 1: maximum rotational speed Sub-index 2: reserved Sub-index 3: reserved Sub-index 4: P_amplification Sub-index 5: pre-control factor Sub-index 6: sensor line no. Sub-index 7: reference rotational speed Sub-index 8: attained pos. window Sub-index 9: drag f.-window
3401h	x	Analog parameter (inputs a. outputs) Alternative options to write/read analog parameters. Sub-indices 0…32 (128 bytes): Sub-index 0: number of sub-indices Sub-index 1: parameter byte 0 ... 3 . Sub-index 32: parameter byte 124 ... 127 Every sub-index consists of 2 data words. Enter your parameter bytes here. Every analog input and analog output module has 16 bytes of parameter data, i.e. they occupy 4 sub-indices, e.g.: 1. analog module sub-indices 1 to 4, 2. analog module sub-indices 5 to 8 etc. ...

3402h	x	Counter parameters Sub-indices 0…4 (8 bytes): Every sub-index consists of 2 data words. Enter your parameter bytes here: Sub-index 0: number of sub-indices Sub-index 1: parameter byte 0 ... 1 . . Sub-index 4: parameter byte 6 ... 7
3412h	x	Counter control bytes Sub-index 0: number of sub-indices Sub-index 1: control byte 1 . . Sub-index 4: control byte 4
3421h	x	Counter-input interrupt trigger array (similar to 6421h)
3422h		Counter-input interrupt source array (similar to 6422h)
3423h	x	Counter-input interrupt enable (similar to 6423h)
3424h	x	Counter-input interrupt upper limit array (similar to 6424h)
3425h	x	Counter-input interrupt lower limit array (similar to 6425h)
3426h	x	Counter-input interrupt delta limit array (similar to 6426h)
3427h	x	Counter-input interrupt negative delta limit array (similar to 6427h)
3428h	x	Counter-input interrupt positive delta limit array (similar to 6428h)
6000h		Digital-input-8-bit array (see DS 401)
6002h	X	Polarity digital-input-8-bit array (see DS 401)
6100h		Digital-input-16-bit array (see DS 401)
6102h	x	Polarity digital-input-16-bit array (see DS 401)
6120h		Digital-input-32-bit array (see DS 401)
6122h	x	Polarity digital-input-32-bit array (see DS 401)
6200h		Digital-output-8-bit array (see DS 401)
6202h	x	Polarity digital-output-8-bit array (see DS 401)
6206h	x	Fault mode digital-output-8-bit array (see DS 401)
6207h	x	Fault State Digital-output-8-bit array (see DS 401)
6300h		Digital-output-16-bit array (see DS 401)
6302h	x	Polarity digital-output-16-bit array (see DS 401)
6306h	x	Fault mode digital-output-16-bit array (see DS 401)
6307h	x	Fault state digital-output-16-bit array (see DS 401)
6320h		Digital-output-32-bit array (see DS 401)
6322h	x	Polarity digital-output-32-bit array (see DS 401)
6326h	x	Fault Mode digital-output-32-bit array (see DS 401)
6327h	x	Fault State digital-output-32-bit array (see DS 401)

6401h		Analog-input array (see DS 401)
6402h		Counter-input array (see DS 401)
6404h		CP240-input array (see DS 401)
6411h		Analog-output array (see DS 401)
6412h		Counter-output array (see DS 401)
6414h		CP240-output array (see DS401)
6421h	x	Analog-input interrupt trigger array (see DS 401)
6422h		Analog-input interrupt source array (see DS 401)
6423h	x	Analog-input interrupt enable (see DS 401)
6424h	x	Analog-input interrupt upper limit array (see DS 401)
6425h	x	Analog-input interrupt lower Limit array (see DS 401)
6426h	x	Analog-input interrupt delta Limit array (see DS 401)
6427h	x	Analog-input interrupt negative delta Limit Array (see DS 401)
6428h	x	Analog-input interrupt positive delta Limit Array (see DS 401)
6443h	x	Fault Mode analog-output array (see DS 401)
6444h	x	Fault State analog-output array (see DS 401)

Entries with a gray background are available from software release 2.03 (index 100A)!

All entries identified by an "x" are saved in the EEPROM. When you change the current configuration all the parameter settings are erased.

A detailed description of the structure and contents of all these objects is available from "CiA Communication Profile DS-301 Version 3.0" and "CiA Device Profile for I/O-Modules DS 401 Version 1.4". All error messages (according to DS 301) required for the SDO transfers have been implemented using "Error-Class", "Error-Code" and "Additional-Code".

Emergency Object

The VIPA CAN-Bus coupler is provided with the emergency object to notify other devices connected to the CANopen bus with highest priority in the event that an internal error has occurred.

The emergency message employs the **COB-Identifier** that is pre-set at boot-up in the variable 1014h of the object directory in hexadecimal representation: **080h + Module-ID.**

Contents of CANopen EMERGENCY-message:

Byte-no.	Contents
0	Emergency Error Code (DS-301) low Byte
1	Emergency Error Code (DS-301) high Byte
2	Emergency Error Register (DS-301)
3	Application specific Error Code
4	Additional Error Information 1
5	Additional Error Information 2
6	Additional Error Information 3
7	Additional Error Information 4

Emergency messages are transmitted under the following conditions:

1. When the reset procedure has been completed an emergency message with a length = 0 is transmitted.
2. When a bus-coupler goes to STOP-mode due to a communication error on the back panel bus an emergency message with error code = 1000h (”Generic Error”), error register = 81h (”Generic Error” and ”Manufacturer specific Error” and length = 8 as well as additional error information is transmitted (see table below).
3. When a diagnostic or a process alarm occurs in an analog module an emergency message with error code = 1000h (”Generic Error”), error register = 81h (”Generic Error” and ”Manufacturer specific Error” and length = 8 as well as additional error information is transmitted (see table below).
4. When the diagnostic or process alarm disappears from an analog module an emergency message with error code = 0000h (”No Error”), error register = 00h (”No Error”) and length = 8 as well as additional error information is transmitted.

Additional error information for application specific errors:

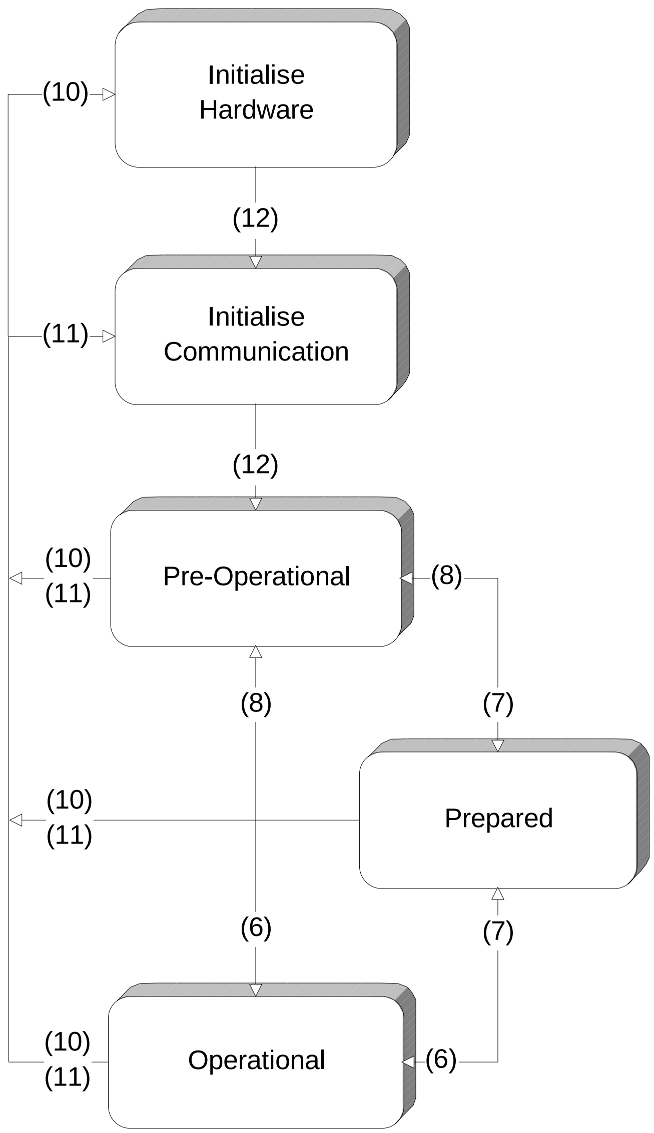
Error detected	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Error during initialization of back panel modules	0x01	0x00	0x00	0x00	0x00
Error during module configuration check	0x02	Plug-in locat. no.	Number of modules	Retries	0x00
Error when checking module indices	0x03	0x00	0x00	0x00	0x00
Error when reading from digital inputs	0x10	0x00	0x00	0x00	0x00
Error when writing to digital outputs	0x11	0x00	0x00	0x00	0x00
Error when reading from analog inputs	0x20	Plug-in locat. no.	Channel number	Byte counter	0x00
Error when writing to analog outputs	0x21	Plug-in locat. no.	Channel number	Byte counter	0x00
Error when reading from counter inputs	0x22	Plug-in locat. no.	Channel number	Byte counter	0x00
Error when writing to counter outputs	0x23	Plug-in locat. no.	Channel number	Byte counter	0x00
Error when reading from the CP240-module	0x24	Plug-in locat. no.	Channel number	Byte counter	0x00
Error when writing to the CP240-module	0x25	Plug-in locat. no.	Channel number	Byte counter	0x00
Error when reading from the FM254-module	0x26	Plug-in locat. no.	Channel number	Byte counter	0x00
Error when writing to the FM254-module	0x27	Plug-in locat. no.	Channel number	Byte counter	0x00
Error when writing analog parameters	0x30	Plug-in locat. no.	Byte counter	Parameter record length	0x00
Error when writing counter parameters	0x31	Plug-in locat. no.	Byte counter	Parameter record length	0x00
Error when writing to the CP240-parameters	0x32	Plug-in locat. no.	Byte counter	Parameter record length	0x00
Error when writing to the FM254-parameters	0x33	Plug-in locat. no.	Byte counter	Parameter record length	0x00
Diagnostic alarm from an analog module	0x40 + Locat.	Diagnostic Byte 1	Diagnostic Byte 2	Diagnostic Byte 3	Diagnostic Byte 4
Process alarm from an analog module	0x80 + Locat.	Diagnostic Byte 1	Diagnostic Byte 2	Diagnostic Byte 3	Diagnostic Byte 4
Configuration error of the CAN-Bus coupler	0xAA	Highbyte SDO-Index	Lowbyte SDO-Index	Subindex	0x00

NMT

Network management (NMT) provides the global services specifications for network supervision and management. This includes the sign-on and sign-off of the different network devices, the supervision of these devices as well as the processing of exceptions.

NMT-service messages have the COB-Identifier 0000h. An additional module-ID is not required. The length is always 2 data bytes. The first data byte contains the NMT-Command specifier:

NMT-Services of the VIPA CAN-Bus coupler (DS 301):



(6): "Start_Remote_Node"
NMT-Command specifier: 01h

(7): "Stop_Remote_Node"
NMT-Command specifier: 02h

(8): "Enter_Pre-operational_State"
NMT-Command specifier: 80h

(10): "Reset_Node"
NMT-Command specifier: 81h

(11): "Reset_Communication"
NMT-Command specifier: 82h

(12): Initialization complete
enter Pre-operational
automatically

The second data byte contains the module-ID (00h for a Broadcast Command).

Node Guarding

The bus coupler also supports the Node Guarding object as defined by CANopen to ensure that other devices on the bus are supervised properly.

Node Guarding operation is started when the first guard requests (RTR) is received from the master. The respective COB identifier is permanently set to 700h + module-ID at variable 100Eh in the object directory. If the coupler does not receive a guard request message from the master within the "Guard-Time" (object 100Ch) when the node-guarding mode is active the module assumes that the master is not operating properly. When the time determined by the product of "Guard-Time" (100Ch) and "Life-Time-Factor" (100Dh) has expired the module will automatically assume the status "Pre-Operational".

When either the "Guard-Time" (object 100Ch) or the "Life-Time-Factor" (100Dh) has been set to zero by an SDO download from the master, the expiry of the guard time is not monitored and the module remains in its current operating mode.

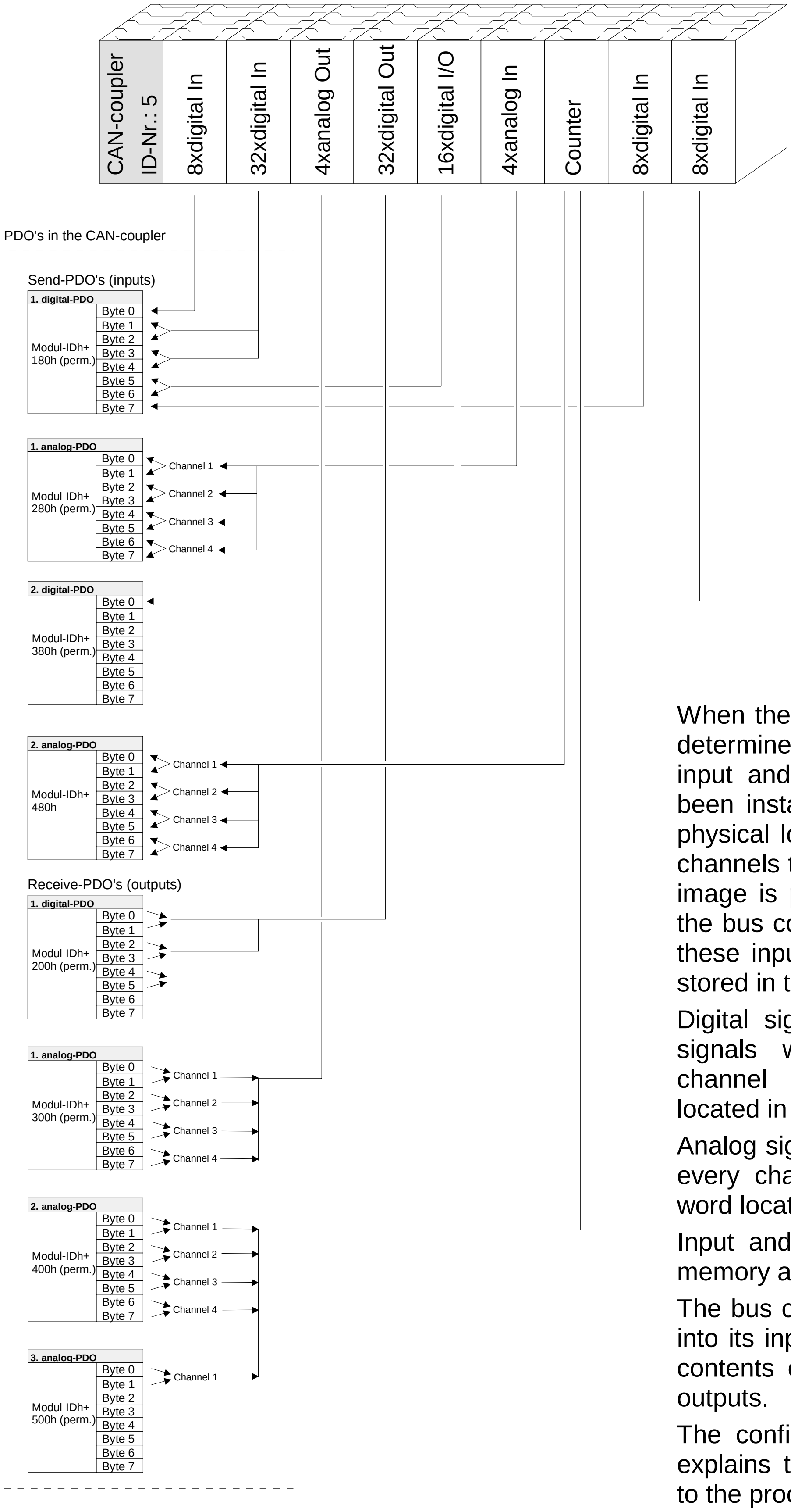
Heartbeat

From software version V2.03 (Index 100A) the VIPA CAN-coupler also supports the Heartbeat Mode in addition to Node Guarding.

When a value is entered into index 1017h (Heartbeat Producer Time) then the device status (Operational, Pre-Operational, ...) of the bus coupler is transferred by means of the COB-Identifier (700h+module-Id) when the Heartbeat-timer expires.

The Heartbeat mode starts automatically as soon as the index 1017h contains a value that is larger than 0.

The structure of the process image



When the bus coupler is turned on it determines the configuration of the input and output devices that have been installed. The allocation of the physical locations of the input/output channels to addresses in the process image is performed automatically by the bus coupler. The configuration of these input and output channels are stored in the process image.

Digital signals are single bit binary signals which means that every channel is associated with a bit located in the process image.

Analog signals are word oriented, i.e. every channel is associated with a word located in the process image.

Input and output data use different memory areas.

The bus coupler enters the input bits into its input buffer and transfers the contents of the output buffer to the outputs.

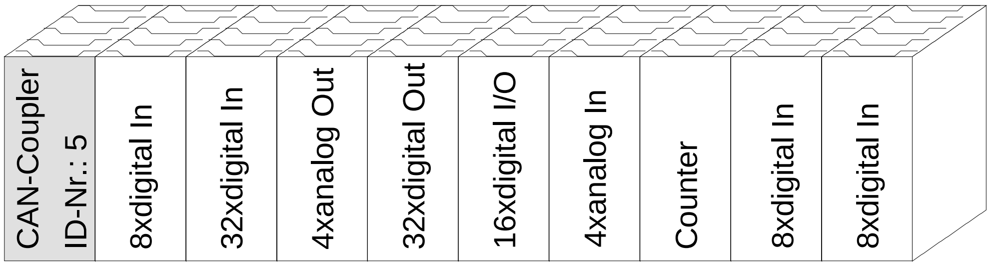
The configuration shown at the left explains the assignment of the I/Os to the process data.

Configuration of the CAN bus coupler

The configuration procedure for a CAN-Bus coupler is explained by means of an example.

Example 1

Define the configuration of a CAN-Bus coupler as follows:



Digital inputs	9 x 8 bit = 9 bytes	(2 PDO tx)
Digital outputs	6 x 8 bit = 6 bytes	(1 PDO rx)
Analog inputs	16 x 8 bit = 16 bytes	(2 PDO tx)
Analog outputs	18 x 8 bit = 18 bytes	(3 PDO rx)

Attention!
Always insert the bus-coupler at the left and the modules to the right of the bus-coupler.

1. Prepare a configuration table

To simplify the configuration we recommend that you prepare a table as shown below:

Plug-in locat. no.:	0	1	2	3	4	5	6	7	8	9	Total
Module type	CAN BM	DI8	DI32	AO4	D032	DIO16	AI4	FM250	DI8	DI8	
Module identifier	-	9FC1	9FC3	A5E0	AFD8	BFD2	15C4	B5F4	9FC1	9FC1	
Number of bytes DI	-	1	4	-	-	2	-	-	1	1	9
Number of bytes AI	-	-	-	-	-	-	8	8	-	-	16
Number of bytes DO	-	-	-	-	4	2	-		-	-	6
Number of bytes AO	-	-	-	8	-	-	-	10	-	-	18

2. Read the module identifier

The configuration on the back panel bus can be retrieved by means of the module list using the SDO read command in your master configuration tool. The result is only used to check and verify the table above.

Index	Subindex	Result	Value (hex)
1027	0	Number of installed modules	9
1027	1	Module identifier plug-in loc. 1	9FC1
1027	2	Module identifier plug-in loc. 2	9FC3
1027	3	Module identifier plug-in loc. 3	A5E0
1027	4	Module identifier plug-in loc. 4	AFD8
1027	5	Module identifier plug-in loc. 5	BFD2
1027	6	Module identifier plug-in loc. 6	15C4
1027	7	Module identifier plug-in loc. 7	B5F4
1027	8	Module identifier plug-in loc. 8	9FC1
1027	9	Module identifier plug-in loc. 9	9FC1

Note!
A summary of the module identifiers is located at the end of the chapter.

3. Preparation of the send-PDO’s

PDO-Type	Length	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
PDO1S2M 180h + NodeID 384dec+NodeID	8	DI8 Plug-in loc. "1"	DI32 Plug-in loc. "2"	DI32 Plug-in loc. "2"	DI32 Plug-in loc. "2"	DI32 Plug-in loc. "2"	DIO16 Plug-in loc. "5"	DIO16 Plug-in loc. "5"	DI8 Plug-in loc. "8"
PDO2S2M 280h + NodeID 640dec+NodeID	8	AI4 Plug-in loc. "6"	AI4 Plug-in loc. "6"	AI4 Plug-in loc. "6"	AI4 Plug-in loc. "6"	AI4 Plug-in loc. "6"	AI4 Plug-in loc. "6"	AI4 Plug-in loc. "6"	AI4 Plug-in loc. "6"
PDO3S2M 380h + NodeID 896dec+NodeID	1	DI8 Plug-in loc. "9"							
PDO4S2M 480h + NodeID 1152dec+NodeID	8	FM250 Plug-in loc. "7"	FM250 Plug-in loc. "7"	FM250 Plug-in loc. "7"	FM250 Plug-in loc. "7"	FM250 Plug-in loc. "7"	FM250 Plug-in loc. "7"	FM250 Plug-in loc. "7"	FM250 Plug-in loc. "7"
PDO5S2M 680h + NodeID 1664dec+NodeID	not valid								

For verification purposes you can read the respective COB-IDs via index 1800-1804 sub-index 1.

4. Preparation of the receive-PDO’s

PDO-Typ	Lenth	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
PDO1M2S 200h + NodeID 512dec+NodeID	6	DO32 Plug-in loc. "4"	DO32 Plug-in loc. "4"	DO32 Plug-in loc. "4"	DO32 Plug-in loc. "4"	DIO16 Plug-in loc. "5"	DIO16 Plug-in loc. "5"		
PDO2M2S 300h + NodeID 768dec+NodeID	8	AO4 Plug-in loc. "3"	AO4 Plug-in loc. "3"	AO4 Plug-in loc. "3"	AO4 Plug-in loc. "3"	AO4 Plug-in loc. "3"	AO4 Plug-in loc. "3"	AO4 Plug-in loc. "3"	AO4 Plug-in loc. "3"
PDO3M2S 400h + NodeID 1024dec+NodeID	8	FM250 Plug-in loc. "7"	FM250 Plug-in loc. "7"	FM250 Plug-in loc. "7"	FM250 Plug-in loc. "7"	FM250 Plug-in loc. "7"	FM250 Plug-in loc. "7"	FM250 Plug-in loc. "7"	FM250 Plug-in loc. "7"
PDO4M2S 500h + NodeID 1280dec+NodeID	2	FM250 Plug-in loc. "7"	FM250 Plug-in loc. "7"						
PDO5M2S 680h + NodeID 1920dec+NodeID	not valid								

For verification purposes you can read the respective COB-IDs via index 1400-1404 sub-index 1.

5. Configuration of send- and receive-PDO's in the master-configuration tool

The respective PDO's must be configured in the master configuration tool. The configuration procedure is described in the respective manuals.

6. Configuration of analog modules

Analog- and counter modules are configured in the object directory.

The first analog module consists of an AO4*12-Bit and this must be configured for +10V. The module is configured via the object directory entry 3001.

Operation	Index	Subindex	Default (h)	Value (h)
Read	3001	0	04	04
Read	3001	1	40000101	40000101
Read	3001	2	01010000	01010000
Read	3001	3	00000000	00000000
Read	3001	4	00000000	00000000
Write	3001	1		40000505
Write	3001	2		05050000

The second analog module consists of an AI4*16-Bit and this must be configured for +/-10V. The module is configured via the object directory entry 3002.

Operation	Index	Subindex	Default (h)	Value (h)
Read	3002	0	04	04
Read	3002	1	2E2E0000	40002E2E
Read	3002	2	2E2E0000	2E2E0000
Read	3002	3	00000000	00000000
Read	3002	4	00000000	00000000
Write	3002	1		40002B2B
Write	3002	2		2B2B0000

The counter module FM250 must be configured to operate in mode 2. The module is configured via the object directory entry 3402.

Operation	Index	Subindex	Default (h)	Value (h)
Read	3402	0	01	01
Read	3402	1	0000	0000
Write	3402	1		0202

7. Enable analog send-PDO's

By default the analog send-PDO's are blocked and they must be enabled by the user.

For our example this means that the PDO's for AI-module in plug-in location 6 and the counter module in plug-in location 7 must be enabled.

You have tow options to enable analog PDO's:

1. You can program an event-time by means of index 1800-1804 sub-index 5. When the timer expires the PDO is transferred irrespective of whether the data has been modified or not.

2. Interrupts for DS401 must be enabled for all the analog and counter inputs.

A: Enabling the analog input interrupt

Operation	Index	Subindex	Default (h)	Value (h)
Read	6423	0	00	00
Write	6423	0		FF

B: Enabling the interrupt for the different analog channels.

Definition of the number of analog channels:

Operation	Index	Subindex	Value
Read	6421	0	4

Index 0 of every object directory entry contains the number of available entries.

The AI-module has 4 analog channels. At this point the interrupts must be enabled for every channel.

Operation	Index	Subindex	Default (h)	Value (h)
Read	6421	1	00	00
Write	6421	1		FF
Read	6421	2	00	00
Write	6421	2		FF
Read	6421	3	00	00
Write	6421	3		FF
Read	6421	4	00	00
Write	6421	4		FF

The PDO's are transferred when the data has changed. For the analog input modules you can specify a delta-limit, upper-limit or lower-limit which will cause the transfer of the PDO's.

Operation	Index	Subindex	Default (h)	Value (h)
Read	6426	1	0000FFFF	0000FFFF
Write	6426	1		00000000
Read	6426	2	0000FFFF	0000FFFF
Write	6426	2		00000000
Read	6426	3	0000FFFF	0000FFFF
Write	6426	3		00000000
Read	6426	4	0000FFFF	0000FFFF
Write	6426	4		00000000

C: Enabling the counter input interrupts

Operation	Index	Subindex	Default (h)	Value (h)
Read	3423	0	00	00
Write	3423	0		FF

D: Enabling the interrupts for the different counter channels.

Determination of the number of counter channels:

Operation	Index	Subindex	Value
Read	3421	0	2

Index 0 of every object directory entry contains the number of available entries.

The FM-module has 2 counter channels. Only the interrupts must be enabled for each channel.

Operation	Index	Subindex	Default(h)	Value (h)
Read	3421	1	00	00
Write	3421	1		FF
Read	3421	2	00	00
Write	3421	2		FF

The PDO’s are transferred when the data has changed. For the counte modules you can specify a delta-limit, upper-limit or lower-limit which will cause the transfer of the PDO’s.

Operation	Index	Subindex	Default(h)	Value (h)
Read	3426	1	FFFFFFFF	FFFFFFFF
Write	3426	1		00000000
Read	3426	2	FFFFFFFF	FFFFFFFF
Write	3426	2		00000000

8. Enabling the operation of the CAN Bus coupler

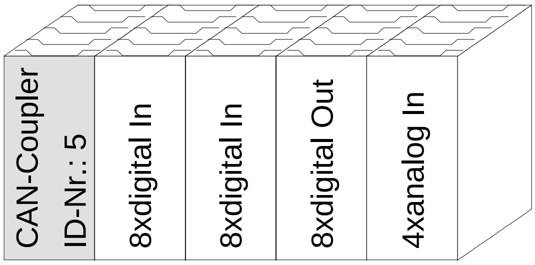
The device status of the CAN Bus coupler must be set to operational to allow it to transfer data. When the status of the bus coupler is operational it will reply with the input data.

Example 2

The following example is intended to explain the configuration of a CAN-Bus coupler. The master consists of the CANopen master for 115U, 135U and 155U of ANTAL ELECTRONIC. The respective manual contains detailed specifications about the CAN-Bus master and it's commissioning.

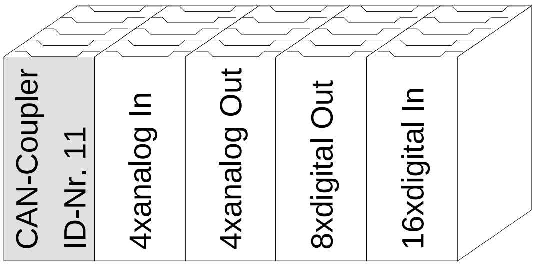
Here we are required to configure two CAN-Bus couplers as follows:

Coupler 1:



Digital inputs	2 x 8 bit = 2 bytes	(1 PDO tx)
Digital outputs	1 x 8 bit = 1 byte	(1 PDO rx)
Analog inputs	8 x 8 bit = 8 bytes	(1 PDO tx)
Analog outputs	-	

Coupler 2:



Digital inputs	1 x 16 bit = 2 bytes	(1 PDO tx)
Digital outputs	1 x 8 bit = 1 bytes	(1 PDO rx)
Analog inputs	8 x 8 bit = 8 bytes	(1 PDO tx)
Analog outputs	8 x 8 bit = 8 bytes	(1 PDO rx)

We recommend that you start with the preparation of a cross-reference list to improve the troubleshooting facilities and to reduce the time required for commissioning. Into this cross-reference list you must enter all I/O modules along with CAN-identifiers and byte length.

Example continued ...

The PDO numbers start from 0. Every PDO consists of 8 bytes.
The example results in the following cross-reference:

Digital input

ID-no.	Address	Byte length	PDO-no.
5		1	0
5		1	0
11		2	0

Digital output

ID-no.	Address	Byte length	PDO-no.
5		1	0
11		1	0

Analog input

ID-no.	Address	Byte length	PDO-no.
5		8	1
11		8	1

Analog output

ID-no.	Address	Byte length	PDO-no.
11		8	1

When the cross-reference has been prepared you can allocate the CAN-Bus couplers to the S5-addresses.

Let us assume that you wish to allocate the following addresses:

Coupler 1:	digital inputs	from EB8
	digital outputs	from AB8
	analog inputs	from EB144
Coupler 2:	digital inputs	from EB32
	digital outputs	from AB32
	analog inputs	from EB170
	analog outputs	from AB170

Example continued ...

This results in the following addresses for the cross-reference:

Digital input

ID-no.	Address	Byte length	PDO-no.
5	EB8	2	0
11	EB32	2	0

Digital output

ID-no.	Address	Byte length	PDO-no.
5	AB8	1	0
11	AB32	1	0

Analog input

ID-no.	Address	Byte length	PDO-no.
5	EB144	8	1
11	EB170	8	1

Analog output

ID-no.	Address	Byte length	PDO-no.
11	AB170	8	1

This makes it a simple matter to program the allocation data module. As mentioned before, the example above refers to the CAN bus master supplied by ANTAL ELECTRONIC.

The allocation data module has a fixed format of variable length. The module (except for DB0 and DB1) may be chosen as required. Where a PLC must support more than one interface module a separate data module is required for each board.

The allocation is made in groups. The sequence of these groups is fixed and mandatory:

Group 1:	Master Parameter
Group 2:	Synchronous devices
Group 3:	Asynchronous digital inputs
Group 4:	Asynchronous digital outputs
Group 5:	Analog inputs
Group 6:	Analog outputs
Group 7:	Communication modules

Groups (even unused ones!) must be separated by means of two data words containing KH=FFFF. The Master Parameter group is the only exception.

Example continued ...

These specifications result in the following data module, in this example DB7:

DB7 - Allocation data module:

1:	KY	=	000,000	0, no synchronous operations
2:	KY	=	000,200	Master-ID, base address of the SDO channel
3:	KH	=	FFFF	End of the group
4:	KH	=	FFFF	Synchronous devices
5:	KY	=	005,008	ID-no. 5, initial address EB8
6:	KY	=	002,000	Byte length 2, PDO-no. 0
7:	KY	=	011,032	ID-no. 11, start address EB32
8:	KY	=	02,000	Byte length 2, PDO-no. 0
9:	KH	=	FFFF	End of the group
10:	KH	=	FFFF	Digital inputs
11:	KY	=	005,008	ID-no. 5, initial address AB8
12:	KY	=	001,000	Byte length 1, PDO-no. 0
13:	KY	=	011,032	ID-no. 11, start address AB32
14:	KY	=	001,000	Byte length 1, PDO-no. 0
15:	KH	=	FFFF	End of the group
16:	KH	=	FFFF	Digital outputs
17:	KY	=	005,144	ID-no. 5, initial address EB144
18:	KY	=	008,001	Byte length 8, PDO-no. 1
19:	KY	=	011,170	ID-no. 11, start address EB170
20:	KY	=	008,001	Byte length 8, PDO-no. 1
21:	KH	=	FFFF	End of the group
22:	KH	=	FFFF	Analog inputs
23:	KY	=	011,170	ID-no. 11, initial address AB170
24:	KY	=	008,001	Byte length 8, PDO-no. 1
25:	KH	=	FFFF	End of the group
26:	KH	=	FFFF	Analog outputs
27:	KH	=	FFFF	End of the group
28:	KH	=	FFFF	Communication modules

Link DB7 to your system by means of FB209. You can obtain further information from the CAN master manual that is supplied by ANTAL ELECTRONIC.

Module identifiers

The following table contains the identifiers of all System 200V modules and the number of bytes used by the modules.

I/O-module type	Identifier (h)	Number of digital input bytes	Number of analog input bytes	Number of digital output bytes	Number of analog output bytes
DI 8 Bit	0x9FC1	1	-	-	-
DI 16 Bit	0x9FC2	2	-	-	-
DI 32 Bit	0x9FC4	4	-	-	-
DO 8 Bit	0xAFC8	-	-	1	-
DO 16 Bit	0xAFD0	-	-	2	-
DO 32 Bit	0xAFD8	-	-	4	-
DIO 8 Bit	0xBFC9	1	-	1	-
DIO 16 Bit	0xBFD2	2	-	2	-
AI4x12Bit	0x15C4	-	8	-	-
AO4x12Bit	0xA5E0	-	-	-	8
AI2/AO2x12Bit	0x35DD	-	4	-	4
CP240	0x1CC1	16	-	16	-
FM 250	0xB5F4	-	8	-	10
FM250-SSI	0xB5DB	-	4	-	4
FM 254	0x18CB	-	12	-	12

Technical data

CANopen coupler
IM 253 CAN

Electrical data	VIPA 253-1CA00
Power supply	24V DC, ext. power supply connected to the front
Current consumption	700mA max.
Isolation	$\geq$ 500V AC
Status indicator	by means of LED’s located on the front
Connectors/interfaces	9-pin D-type (socket) CAN-Bus connection
CAN-Bus interface	
Connection	9-pin D-type plug
Network topology	Linear bus, active bus termination at one end, radial spur-lines permitted.
Medium	Screened three-core cable, unscreened cable permitted - depending on environment.
Data transfer rate	10 kBps to 1 MBps
Max. overall length	1000 m at 50 kBps, without repeaters
Digital inputs/outputs	Any combination of a max. of 16 I/O modules per coupler.
Max. no. of stations	127 stations (depending on the master interface)
Combination with peripheral modules	
max. no. of modules	32
max. digital I/O	40 bytes each (40 bytes = 5 PDO’s x 8)
max. analog I/O	16 words each
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4x76x76
Weight	80g

Chapter 5 DeviceNet

Overview

This chapter contains the description of the VIPA DeviceNet-slave. The introduction to the system is followed by the description of the module. Another section of this chapter concerns the configuration by means of the *DeviceNet-Manager* of Allen - Bradley This section describes the configuration of the DeviceNet-coupler and the configuration of the System 200V modules.

A summary of the diagnostic messages, the procedure for connecting the DeviceNet-coupler to the Profibus and the technical data conclude the chapter.

Below follows a description of:

- DeviceNet principles
- Hardware description of the VIPA DeviceNet-coupler IM 253 DN
- Configuration by means of the *DeviceNet-Manager* inc. examples
- Diagnostics
- Interfacing options for Profibus
- Technical data

Contents

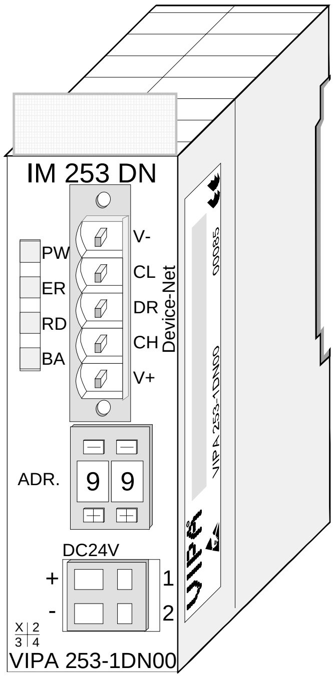
Ordering details DeviceNet

Type	Order number	Description
IM 253 DN	VIPA 253-1DN00	DeviceNet-coupler

System overview

You can use the VIPA DeviceNet-coupler coupler to link up to 32 modules (of 40 bytes each) of your System 200V periphery by means of DeviceNet.

The following DeviceNet-components are currently available from VIPA.



Ordering details DeviceNet

Type	Order number	Description
IM 253 DN	VIPA 253-1DN00	DeviceNet-coupler

Principles

General

DeviceNet is an open Low-End network that is based upon the physical properties of CAN-Bus. The bus is also used to supply the devices with the required 24V DC power.

You can use DeviceNet to install direct connections between your control system and simple industrial devices like sensors and switches as well as technologically advanced devices like frequency converters and bar-code readers.

Direct interfacing improves communications between the different devices and provides important diagnostic facilities at the device level.

DeviceNet

DeviceNet is an open device-net standard that satisfies the user profile for industrial real-time system applications.

The DeviceNet protocol has an open specification that is the property of and administered by the independent vendor organization "Open DeviceNet Vendor Association" ODVA.

This is where standardized device profiles are created to provide compatibility and exchangeability on logical level for simple devices of the same type.

In contrast to the classical source-destination model, DeviceNet uses a modern producer/consumer-model that requires data packets with identifier fields for the identification of the data.

This approach caters for multiple priority levels, more efficient transfers of I/O-data and multiple consumers for the data.

A device that has data to send *produces* the data on the network together with an identifier. All devices requiring data listen for messages. When a device recognizes a suitable identifier they act and *consume* the respective data.

DeviceNet carries two types of messages:

- *I/O-messages*
  Messages that are subject to critical timing constraints and that are contain data for control purposes that can be exchanged by means of a single or multiple connections and that employ identifiers with a high priority.
- *Explicit messages*
  These are used to establish multi-purpose point-to-point communication paths between two devices. These are used for the configuration of network couplers and for diagnostic purposes. These functions usually employ identifiers of a low priority.

Messages that are longer than 8 bytes are subject to the fragmentation service. A set of rules for Master/Slave-, Peer-to-Peer- and Multi-Master-connections is also available.

Communication medium

DeviceNet employs a master-line/spur-line topology with up to 64 network nodes. The maximum distance is either 500m at a rate of 125kBaud, 250m at a rate of 250kBaud or 100m at a rate of 500kBaud.

The length of the spur-lines can be up 6m while the total length of all spur lines depends on the Baudrate.

Network nodes can be removed from or inserted into the network without interruption of the network operation. New stations and failed stations are detected automatically.

DeviceNet employs a screened five-core cable the data communication medium.

DeviceNet uses differential voltages and for this reason it exhibits less sensitivity to interference than a voltage or current-based interface.

Signaling and power supply conductors are included in the same network cable. It is therefore possible to connect devices that obtain the operating voltage via the network as well as devices with an integrated power supply. Furthermore it is possible to connect redundant power supplies to the network that can guarantees the power supply when required.

Bus-access method

DeviceNet operates according to the Carrier-Sense Multiple Access (CSMA) principle, i.e. every station on the network can access the bus when it is not occupied (random access).

The exchange of messages is message oriented and not station oriented. Each message is provided with a unique and priorizing identifier. At any time only one station can occupy the bus with its messages.

The DeviceNet bus access control is subject to non-destructive, bit-wise arbitration. In this case non-destructive means that the successful station participating in the arbitration must not re-send its message. The most important station is selected automatically when multiple stations access the bus simultaneously. If station that is ready to send recognizes that the bus is occupied its send request is delayed until the current transfer has been completed.

Addressing

All stations on the bus must be uniquely identified by means of an ID-address. Every DeviceNet device has addressing facilities.

EDS-File

The properties of the DeviceNet units are supplied to you in the form of an EDS-file (Electronic Data Sheet) to configure a slave interface by means of your configuration tool.

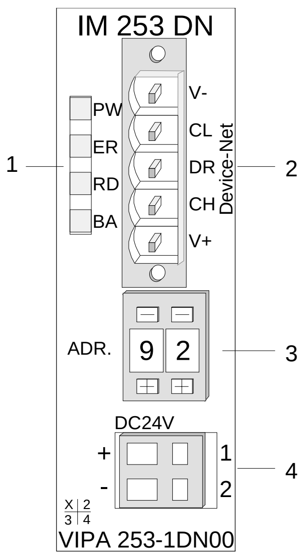
VIPA DeviceNet-coupler

The DeviceNet coupler IM 253 DN provides a simple method of interfacing any decentralized peripheral modules by means of the DeviceNet protocol.

Properties

- Group 2 only Device
  - employs the predefined connection set
- Poll only Device
  - no BIT STROBE mode support
  - no CHANGE OF STATE support
- Supports all Baudrates: 125, 250 and 500kBaud
- Address selection by means of switches
- Definition of the data rate by means of a special POWER ON procedure (start from address 90...92)
- LED status indicators
- a max. of 32 peripheral modules can be installed
- of these a max. of 8 can be configurable modules
- Module configuration by means of the DeviceNet manager
- Profibus-DeviceNet conversion is possible by combining the unit with a IM 208 DP

Front view 253-1DN00



[1] LED status indicator
[2] DeviceNet connector
[3] Adress selector
[4] 24V DC power supply connector

Components

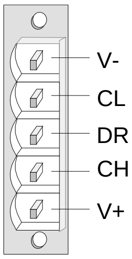
LED's

4 LED's on the front allow for the quick troubleshooting the current status of the module. A detailed description of the troubleshooting procedure by means of the LED's and the back panel is available in a section of the chapter on "Troubleshooting".

Name	Color	Description
PW	yellow	Power-LED: supply voltage available
ER	red	DeviceNet or back panel bus bus error
RD	green	Back panel bus status
BA	yellow	DeviceNet status

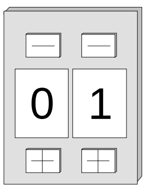
DeviceNet interfacing

The DeviceNet connection is provided by by a 5-pin Open Style connector. The pin assignment is imprinted on the front of the module.



[V-]	GND operating voltage
[CL]	CAN low
[DR]	DRAIN
[CH]	CAN HIGH
[V+]	24 V DC operating voltage

Address selector



The address selector is used for:

- the definition of the unique DeviceNet address
- programming of the data rate

Addresses:

0...63: DeviceNet address

90, 91, 92: set communication rate to 125, 250, 500 kBaud

Power supply

The bus coupler is provided with an integrated power supply. The power supply is protected from reverse polarity connections and over current conditions and it is isolated galvanically from the Fieldbus.

The power supply provides a max. of 3A to the circuitry of the module as well as the peripheral modules via the back panel bus.

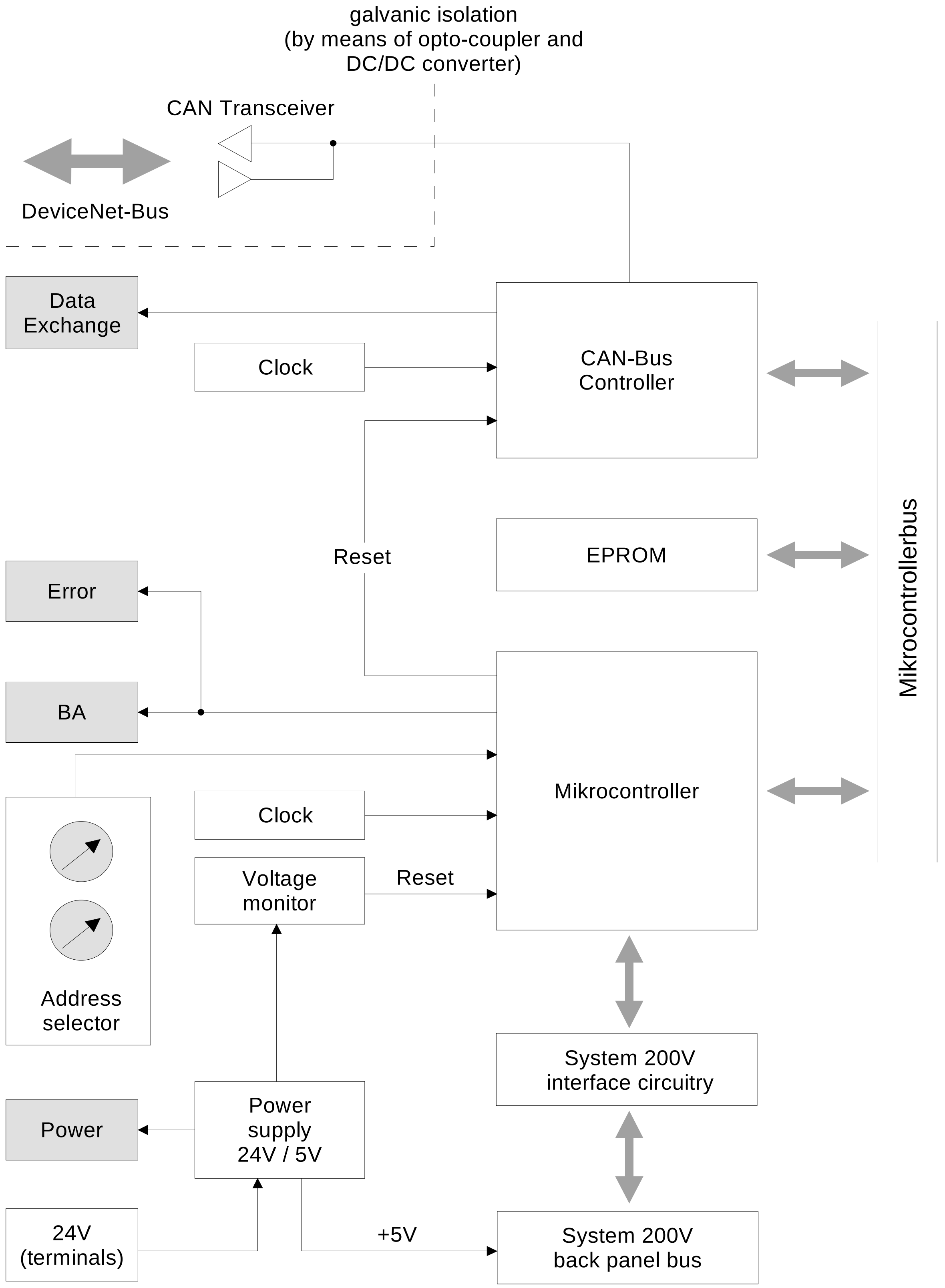
The power supply must be connected to a 24V DC ±15% power unit via two terminals located on the front of the module.

Note!

The DeviceNet-coupler does not require any current from the power that is available via the DeviceNet.

Block diagram

The following block diagram shows the hardware structure of the bus coupler in principle as well as the internal communications:



Configuration by means of the DeviceNet manager

Overview

The DeviceNet is configured by means of the *DeviceNet-Manager* software of Allen - Bradley.

The following steps are necessary for the configuration:

- Configuration of the *DeviceNet-Manager*
- Setting the communication rate and the Node-Address of the module
- Test on the DeviceNet
- Module configuration
- I/O-addressing of the DeviceNet-scanner (Master)

Configuration of the DeviceNet manager

During the configuration the module specific data of the VIPA DeviceNet coupler are defined and supplied to the DeviceNet manager.

The following steps are required:

- Insert the supplied diskette into your PC.
- Copy the file **IM253DN.BMP** to your PC into the directory **/DNETMGR/RES** of the *DeviceNet-Manager*
- The EDS-file is located in a sub-directory of 501.VND on the diskette. Copy the file **1.EDS** into the directory **/DNETMGR/EDS/501.VND/0.TYP/1.COD**

  You can also copy the entire tree

```
501.vnd
      |-- 0.typ
            |--1.cod
                  |-- 1.eds
                  |-- device.bmp
```

  into the directory DNETMGR/EDS.

Specifying Baudrate and Node-Address

You can set the baud rate as well as the Node-Address when the power has been turned off. These will be transferred into the module when you turn the respective power supply on.

Setting the comunication rate

All stations connected to the bus communicate at the same data rate. You can define the required data rate by means of the address selector.

- Turn the power supply off
- Set the address selector to the required Baudrate

Setting	Baudrate in kBaud
90	125
91	250
92	500

- Turn the power supply on

  The selected communication rate is saved to the EEPROM.

  At this point your DeviceNet-coupler is set to the correct Baudrate.

LED-indicator RD-LED ER-LED

When the Baudrate has been saved successfully the RD-LED (green) will be turned on.

When the data rate was selected incorrectly the ER-LED will be turned on.

Setting the DeviceNet Address

All stations connected to the bus must have a unique DeviceNet address. The address can be defined by means of the address selector when the supply has been turned off.

- Turn the power supply off
- Set the address selector to the required address.
  Please ensure that the address is unique in the system and that is is located between 0 and 63.
- Turn the power supply on

  The selected communication rate is saved to the RAM.

Note!

Any changes to the addressing will only become effective after a POWER ON or an automatic reset. Changes to settings are not recognized during normal operations.

LED indicator ER-LED

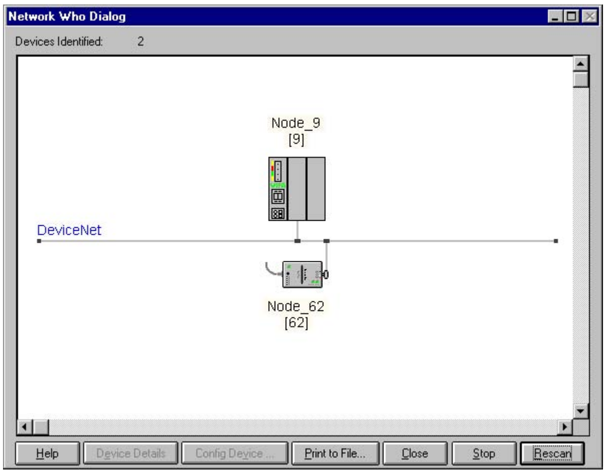
When the address is bad or if it already exists the ER-LED (red) will be turned on after power on.

Test in conjunction with the DeviceNet

Procedure

- Connect the PC containing the *DeviceNet-Manager* and the VIPA DeviceNet-coupler to the DeviceNet.
- Define the communication rate and the Node-Address on the coupler
- Turn the power supply to the bus coupler on.
- Start the *DeviceNet-Manager*.
- Enter the same data rate into the manager that was selected on the bus coupler
- Start the function NETWORK WHO in the manager

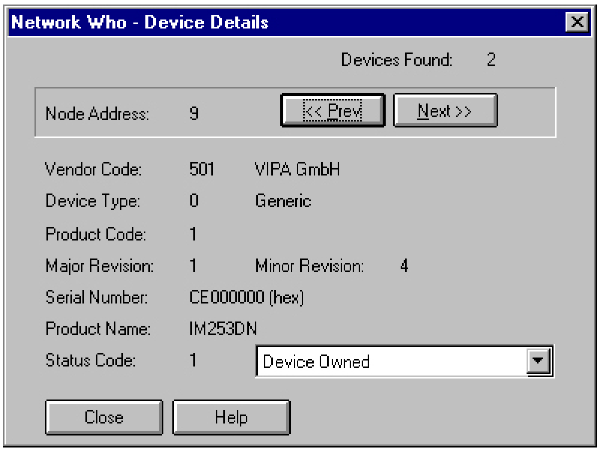
The following network windows is displayed:



Device Details

- Right-click the bus coupler.
- Select the function DEVICE DETAILS in the context menu.

The DEVICE DETAILS box is displayed on screen



Here you can display the Node-Address, the Vendor Code (in this case this is 501 for VIPA GmbH) and other internal information.

Module configuration in the DeviceNet-manager

The System 200V includes configurable modules like analog modules. When you are using these modules in conjunction with a DeviceNet-coupler the respective parameters must be saved in the DeviceNet-coupler.

Configuration in groups

The following conditions apply to the configuration:

- Parameter data is managed in groups in DeviceNet.
- Every DeviceNet-coupler can process and store a maximum of 144 bytes of parameter data.
- These 144 bytes are divided into 8 groups of 18 bytes each.
- Every group can contain the parameter data of 1 module.
- Groups are identified by a Prefix-No. (1...8) in the parameter name.
- The number of parameter bytes is defined in the parameter "Len" (1. parameter) of a group. The number of parameter bytes is available from the technical data contained in the documentation on the peripheral modules.
- The group-allocation for a module does not depend on the location or the installation sequence.
- The allocation of the plug-in location is defined by means of the "Slot"-parameter of a group (2. parameter)
- The values can be entered as bit-patterns when you double-click a parameter
- Unused groups are identified by a "Value" 0000 0000.

Procedure

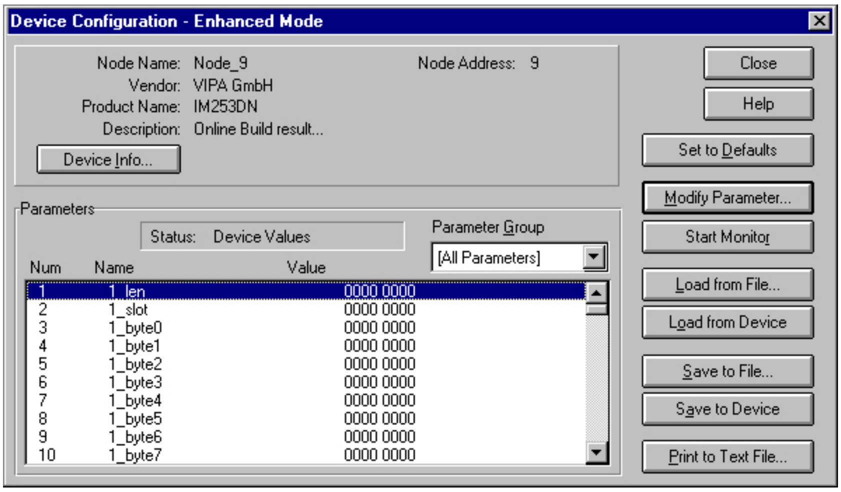
Condition: your IM 253 DN coupler is active on the bus.

Below follows a description of how the parameter sets are defined in the *DeviceNet-Manager*.

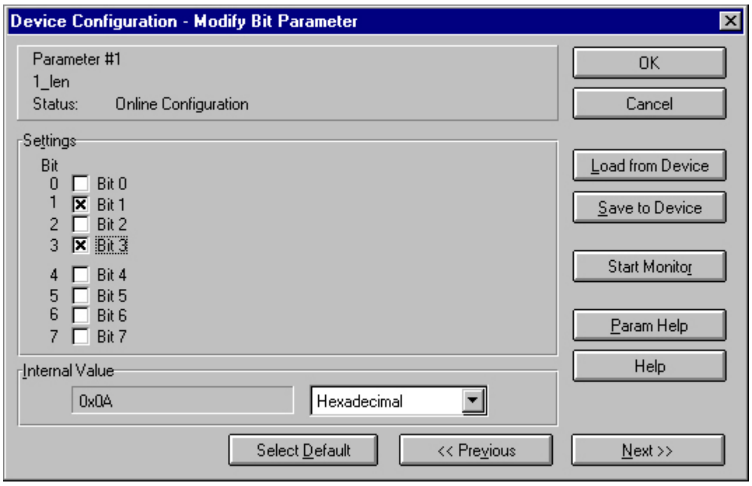
- Execute the function WHO in the *DeviceNet-Manager*.

  This will open a network window that includes your coupler.
- Double-click the icon of the bus couplers for which you want to modify the parameter data.

  The parameter data is read from the coupler and displayed in the following window:



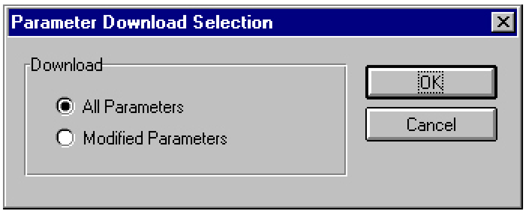
- Locate an unused group in the list of parameters (Value=0000 0000)
  You can display all 8 groups in the parameter list by entering "All Parameters" into the selection field *Parameter Group*.
- Double click the "Len"-parameter
  The following dialog box is displayed:



- Enter the number of parameter bytes for the module that you are configuring as a bit-coded definition. You can obtain the number from the documentation for the peripheral module. Set or reset the respective bits by clicking the checkbox.
- Click [OK] to close the mask. The next parameter (slot) of the same group is displayed when you click the button [Next>>].
- Now you must enter the plug-in location no. of the module you are configuring as a bit-code in the same manner.
  You can retrieve the input range by means of the button [Param Help].
- At this point you can enter a sequence of parameter bytes for your module by clicking [Next >>].
- If you wish to configure other modules you must select another unused group and proceed in the same manner.

- When you have entered all parameters into the different groups you can transfer and save the parameters in the DeviceNet-coupler by clicking the [Save to Device] button.

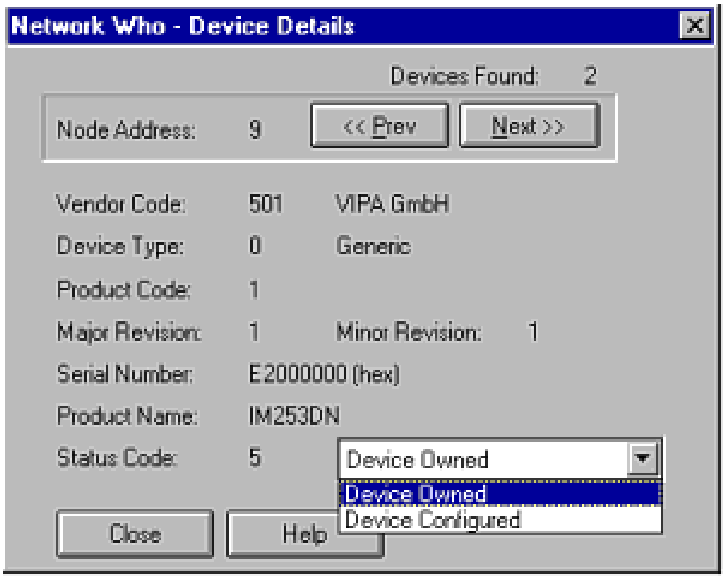
  The following selection window is opened when you click [Save to Device]:



  Here you can decide whether you will transfer all the parameters or only the parameters that were modified.

- During the transfer the "status"-text "Status: downloading" is displayed. When the transfer has completed the "status"-text changes to "Status: Device Values"

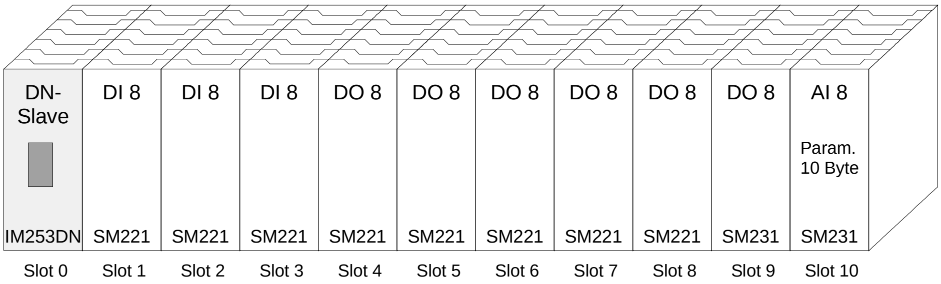
- If you were to request the "Device Details" the bit CONFIGURED would also be included.



When you have entered the parameter values and downloaded them into the DeviceNet-coupler the peripheral modules connected via the back panel bus have been configured as specified.

Example

The following example is intended to show the configuration of the System 200V. Let us assume that the system has the following structure:



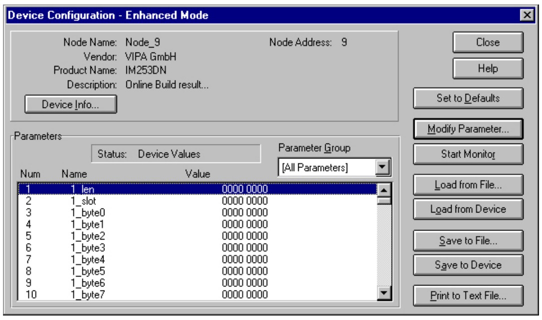
The example shows a DeviceNet-coupler with 10 modules; however, the modules installed in plug-in locations 1 to 9 can not be configured.

Below follows the description of the configuration of the analog-module in location 10:

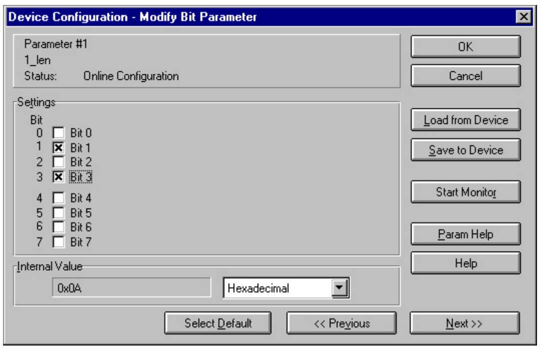
Precondition: - the hardware was assembled ans is active on the bus.

- the Allen - Bradley *DeviceNet-Manager* was installed.

- Execute the function WHO in the *DeviceNet-Manager* and open the parameter window by double-clicking the DeviceNet-coupler.



- Locate an unused group in the parameter list (Value=0000 0000)
- Double-click the "Len"-parameter.



The analog-module has 10 bytes of configuration data. Enter this value as a bit-coded value.

- Click [Next>>] and enter the location 10 as the "Slot".
- You can now enter the parameter bytes of your module by clicking [Next >>] repeatedly.

The analog-input-module has the following parameters

Byte	Bit 7 ... Bit 0	Default
0	Diagnostic alarm-byte: Bit 0 ... 5: reserved Bit 6: 0: Diagnostic alarm inhibited 1: Diagnostic alarm enabled Bit 7: reserved	00h
1	reserved	00h
2	Function-no. channel 0 (see module description)	2Dh
3	Function-no. channel 1 (see module description)	2Dh
4	Function-no. channel 2 (see module description)	2Dh
5	Function-no. channel 3 (see module description)	2Dh
6	Option-byte channel 0	00h
7	Option-byte channel 1	00h
8	Option-byte channel 2	00h
9	Option-byte channel 3	00h

- When all parameters have been entered into the group you can transfer and save the parameters in the DeviceNet-coupler by means of [Save to Device].
- During the transfer the "status"-text is displayed as "Status: downloading". When the transfer has been completed the "status"-text changes to "Status: Device Values"

Note!

Parameters can be changed at any time. For this purpose you must click [Load from Device], then enter the required changes and save them by means of [Save to Device].

I/O-addressing of the DeviceNet-scanner

The DeviceNet-coupler determines the modules installed on the back panel bus automatically and uses the result to generate the number of input and output bytes.

You must determine these two values when you configure the input/output modules and enter the in the DeviceNet-scanner (master):

- produced connection size (number of input bytes)
- consumed connection size (number of output bytes)

The addressing results from the sequence of the modules (plug-in location 1 to 32) and the base address that was defined in the DeviceNet-scanner for the bus coupler.

DeviceNet-Scanner configuration

- Set the DeviceNet-Scanner to connection type POLL IO.
- Define the parameters:
  "Receive data size" = number of input bytes
  "Transmit data size" = number of output bytes
- Define the base address (mapping) of receive data and transmit data in as required.
- Activate the DeviceNet-coupler IM 253 DN in the scan list.
- Start the DeviceNet-Scanner.

When the DeviceNet-Scanners has been configured the input and output modules are accessible via the defined addresses.

Example

The following 6 modules have been installed into the back panel bus:

Plug-in location	Installed module	Input data	Output data
Slot 0	DeviceNet-coupler	-	-
Slot 1	Digital Out SM 222		1 Byte
Slot 2	Digital Out SM 222		1 Byte
Slot 3	Digital In SM 221	1 Byte	
Slot 4	Analog In SM 231	4 Words	
Slot 5	Analog Out SM 232		4 Words
Total:		1+4*2=9 Byte	1+1+4*2=10 Byte

The result is:

- produced connection size: 9 bytes (sum of input bytes)
- consumed connection size: 10 bytes (sum of output bytes)

Diagnostics

Overview

The LED's installed to display the status allow for extensive diagnostics during the POWER ON - procedure as well as operation. The result of the diagnosis is determined by the combination of the different LED's and the current operational mode.

Explanation:

LED	Description
☐ off	LED turned off
☐ on	LED is permanently on
☒ blinks	LED blinks

The following operating modes are available depending on the position of the address selector:

- DeviceNet-Mode (address selector in position 0...63)
- Configuration-Mode (address selector in position 90...92)

DeviceNet-Mode

POWER ON without DeviceNet

LED	Description
☐ PW on ☐ ER off ☒ RD blinks ☐ BA off	After POWER ON the LED PW is turned on and indicates a properly operating power supply. The LED RD blinks since the configuration data stored in the EEPROM was transferred successfully into the peripheral modules
☐ PW on ☐ ER on ☐ RD off ☐ BA off	After POWER ON the LED PW is turned on. The LED ER is on due to errors on the back panel bus or when the configuration data could not be transferred into the peripheral modules.

POWER ON with DeviceNet without Master

LED	Description
PW on ER off RD blinks BA blinks	After POWER ON the LED PW is turned on. The LED RD blinks because: • the back panel bus is operating properly • the configuration data was transferred successfully from the EEPROM into the configurable peripheral modules. The LED BA blinks because: • at least one additional device is active on the DeviceNet, • and the address set up on the coupler is unique.
PW on ER on RD off BA off	After POWER ON the LED PW is turned on. The LED ER is on due to one of the following conditions on the DeviceNet-coupler: • bad address or address occupied by another device • data transfer rate is bad.
PW on ER on RD blinks BA blinks	After POWER ON the LED PW is on. The LED ER is turned on when the configuration data could not be transferred into the configurable peripheral module. The LED RD blinks because • the back panel bus is operating properly • the configuration data was not transferred into the configurable peripheral modules. The LED BA blinks because • at least one other device is active on the DeviceNet, • the address set up on the coupler is unique.

POWER ON mit DeviceNet und Master

LED	Description
PW on ER on RD blinks BA on	After POWER ON the LED PW is on. The LED ER is turned on since the configuration data was not transferred into the configurable peripheral modules. The LED RD blinks because • the back panel bus operates properly • the configuration data was not transferred into the configurable peripheral modules. The LED BA is turned on because the coupler has IM 253 DN established a DeviceNet-connection to a master. Note! The IM 253 DN coupler will execute a reset after 30s. An error that occurs during POWER ON with DeviceNet and master displays the same combination of LED's as a hardware error. It is possible to distinguish between these: • by interruption of the DeviceNet-connection → LED ER and RD blink! • with a network WHO in the DeviceNet-Manager → in case of a hardware-error the IM253DN will not appear on the network Please call the VIPA-hotline when a hardware error has occurred!

Proper operation with DeviceNet and Master

LED	Description
PW on ER off RD on BA on	After POWER ON the LED PW is on. The LED RD is turned on because the connection to the peripheral modules could be established via the back panel bus. The LED BA is turned on because the coupler IM253DN has established a DeviceNet-connection with a master.

Error during the operation with DeviceNet and Master

LED	Description
PW on ER on RD off BA on	After POWER ON the LED PW is on. The LED ER is turned on because an error was detected on the back panel bus. The LED BA is turned on because the IM 253 DN coupler has established a DeviceNet-connection with a master. Note! The IM 253 DN coupler will execute a reset after 30s.

Change of state from operational to module error status

LED	Description
PW on ER on RD off BA off	The LED ER is turned on for 1second because a module error was detected. Subsequently the coupler IM 253 DN will execute a reset. After the reset the coupler is re-started and it indicates the error by means of the respective LED-combination.

Indicators after a re-start and a reset

LED	Description
PW on ER on RD blinks BA on	The LED ER is turned on permanently and the LED RD blinks because the quantity of I/O-data was changed by the failure of the module. The configuration data could not be transferred. All Allen - Bradley scanners will display message #77.
PW on ER off RD on BA on	The LED ER is not turned on and the LED RD is permanently on because the quantity of I/O-data was modified by the failure of the module. The connection with the I/O-modules was established. All Allen - Bradley scanners will display message #77.

Change of state from operational to connection error status

LED	Description
PW on ER blinks RD blinks BA on	The LED ER blinks because the timer of the I/O-connection has detected an error. The LED RD blinks because the I/O-connection does not exist any longer. All inputs and outputs are set to null. The LED BA is turned on because the connection with the master is still established.

Configuration mode

POWER ON in configuration mode

LED	Description
PW on ER off RD on BA off	After POWER ON the LED PW is turned on and indicates that the power supply operates properly. The LED RD is turned on after a short delay since the Baudrate was transferred into the EEPROM.

Device error

LED	Description
PW on ER on RD off BA off	The address that was set up on the coupler is bad. Change the address to a valid setting: • 0...63 as node-address • 90...92 for the definition of the Baudrate
PW on ER on RD on BA on	When the coupler is not connected to the DeviceNet an error was detected in the internal EEPROM or in RAM. When a DeviceNet connection exists it is also possible that an error has occurred during the transfer of the configuration data into the peripheral modules. Note! Errors that occur during POWER ON with DeviceNet and master display the same combination of LED's as a hardware error. It is possible to distinguish between these: • by interruption of the DeviceNet-connection → LED ER and RD blink! • with a network WHO in the DeviceNet-Manager → in case of a hardware-error the IM253DN will not appear on the network Please call the VIPA-hotline when a hardware error has occurred!

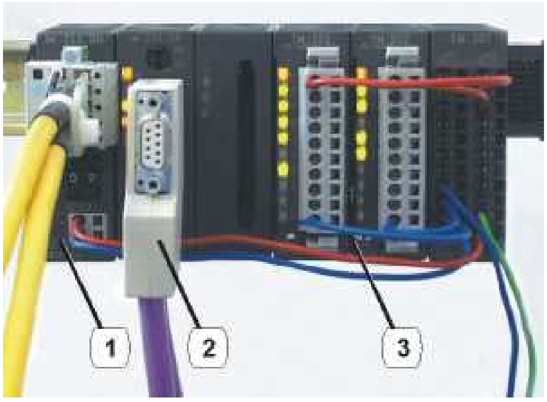
Profibus interface

Description

The modular System 200V can be used very easily to establish a DeviceNet / Profibus-Bridge. The Profibus-Master is simply installed together with the DeviceNet-coupler on the back panel bus.

The connection from the DeviceNet to Profibus DP can transfer 256 bytes of input and 256 bytes of output data.

In canses where the maximum quantity of data is not used is also possible to install peripheral modules in addition to the Profibus-master.



[1] DeviceNet-coupler IM 253 DN
[2] Profibus-Master IM 208 DP(0)
[3] Additional peripheral modules

Example

You want to provide a link between DeviceNet and Profibus DP. The following 4 modules were installed into the back panel bus:

Location (hex)	Installed module	I/O-data and addresses
Slot 0	DeviceNet-coupler IM 253 DN	-
Slot 1	Profibus-Master IM 208 DP	Input as of address 0 Output as of address 2
Slot 2	Digital Out SM 222	1 byte, address 0
Slot 3	Digital Out SM 222	1 byte, address 1

Procedure

- Assemble your system by installing the Profibus-Master IM 208 DP to the right of the DeviceNet-coupler, followed by the 2 output modules (see figure).
- Please ensure that the addresses of the directly installed peripheral modules have been reserved in your Profibus configuration tool. For details refer to the documentation on your Profibus-master.

The peripheral modules connected via Profibus DP and the output modules exchange data by means of the Profibus-master. This communicates with the DeviceNet-coupler via the back panel bus.

Technical data

DeviceNet-coupler
IM 253 DN

Electrical data	VIPA 253-1DN00
Power supply Current consumption Isolation between DeviceNet and back panel bus	24V DC ±15%, via an external power supply connected at the front Bus coupler: 50mA incl. supply to the peripheral modules: 800mA max. 500V rms
Function specific data	
Status indicator Physical connection to DeviceNet Network topology Communication medium Communication rate Overall length of the bus Number of stations	by means of LED's on the front 5-pin Open Style Connector Linear bus, spur lines up to 6 m in length Screened 5-core cable 125, 250, 500 kBaud up to 500 m 64 max.
Combination with peripheral modules	
Number of modules Inputs Outputs	32 max. 256 byte max. 256 byte max.
Mechanical data	
Dimensions (BxHxT) Weight	25,4 x 76 x 76 mm 80g

Chapter 7 Communication processor CP 240

Overview

This chapter contains a description of the construction and the interfaces of the communication processor CP 240. The chapter includes an explanation of the communication protocols as well as the standard handler blocks that are supplied with the processor.

The following description includes:

- the CP 240 with the various interfaces
- Standard handler blocks
- Technical data

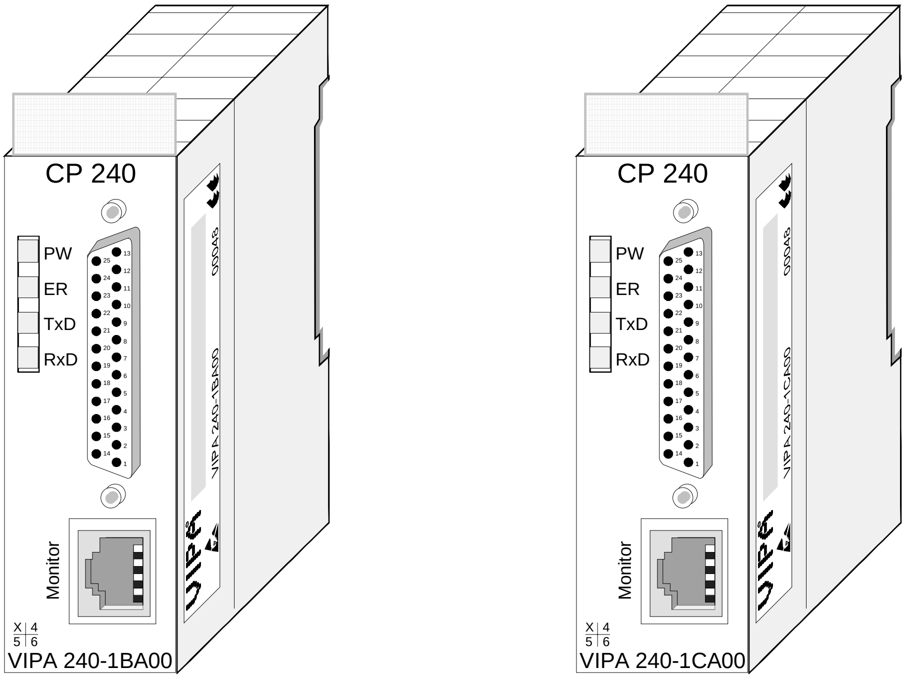
Contents

Ordering details CP 240

Type	Order number	Description
CP 240	VIPA 240-1BA00	CP with 20mA/RS232C-interface
CP 240	VIPA 240-1CA00	CP with RS422/485- interface
Diagnostic tool	UPI-FOX2	Diagnostic cable including software

System overview

The following section provides an overview of the communication processors that are currently available from VIPA:



Ordering data CP 240

Type	Order number	Description
CP 240	VIPA 240-1BA00	CP with 20mA/RS232C-interface
CP 240	VIPA 240-1CA00	CP with RS422/485- interface

Principles

General

The CP 240 module provides serial interfacing facilities between the processes of different source and destination systems.

The CP 240 modules have an integrated serial interface that can be configured by means of hardware to operate either as RS232C- or 20mA-resp. RS422 or RS485-interface.

The CP 240 modules obtain the required operating power via the back panel bus.

Protocols

The communication processor supports the ASCII, STX/ETX, 3964(R) and RK512 protocols and procedures.

Diagnostic facilities

The front of the unit provides access to a diagnostic interface for troubleshooting and service purposes. This interface carries the signals RxD and TxD at RS232-levels (TTL-levels).

VIPA can supply you with a diagnostic adapter (Order no.: UPI-FOX2) that contains the serial interface between the diagnostic interface and a PC. The software allows analysis of the signal stream and to test the operation of your interface.

Configuration

The CP can be configured by means of 16 bytes of configuration data that must contain the parameters required by the selected protocol.

Communications

Handler blocks that are supplied with the modules of the CPU-families 21x and 24x by VIPA control the serial communications.

Data transmitted between the CP240 and a communication partner is transferred via the serial interface in a 9 or a 12-bit character frame. Three different formats are available for every character frame. These formats differ in the number of data bits, with or without parity bit and the number of stop bits.

Character frame	Start-bit	Data bits	Parity bit	Stop bit
9 Bit	1	7	-	1
10 Bit	1	7	-	2
10 Bit	1	7	1	1
10 Bit	1	8	-	1
11 Bit	1	7	1	2
11 Bit	1	8	1	1
11 Bit	1	8	-	2
12 Bit	1	8	1	2

Protocols and procedures

The data transfer between any two communication partners is controlled by means of protocols or procedures as for instance:

- ASCII communications
- STX/ETX
- 3964(R)
- RK512

ASCII

ASCII data communications is one of the simple forms of data exchange that can be compared to a multicast/broadcast function.

Individual messages are separated by means of 2 windows in time. The sending station must transmit data messages within the character delay time (ZVZ) or receive window that was defined in the receiving station.

The receiving station must acknowledge the receipt of the message within the "time delay after command" (ZNA) or command window that was defined in the sending station.

These times can be used to establish a simple serial PLC-PLC communication link.

A send command is only flagged as "command completed without errors" (AFOF) when the data has been transferred and the ZNA has expired.

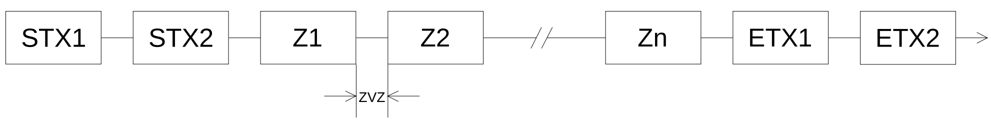
STX/ETX

STX/ETX is a simple protocol employing headers and trailers. The STX/ETX procedure is suitable for the transfer of ASCII-characters (20h…7Fh). It does not use block checks (BCC). Any data transferred to the periphery must be preceded by an STX (Start of Text) followed by the data characters. An ETX must be inserted as (End of Text) the terminating character.

The effective data, which includes all the characters between STX and ETX are transferred to the CPU when the ETX has been received.

When data is sent from the CPU to a peripheral device any user data is handed to the CP240 where it is enclosed with an STX start character and an ETX termination character and transferred to the communication partner.

Message structure:



You can define up to a max. of 2 start and end characters. It is also possible to specify a ZNA command window for the sending station.

3964(R)

The 3964(R) procedure controls the data transfer of a point-to-point link between the CP 240 and a communication partner. The procedure adds control characters to the message data when the data is being transferred. These control characters can be used by the communication partner to verify that the data has been received completely and without errors.

The procedure employs the following control characters:

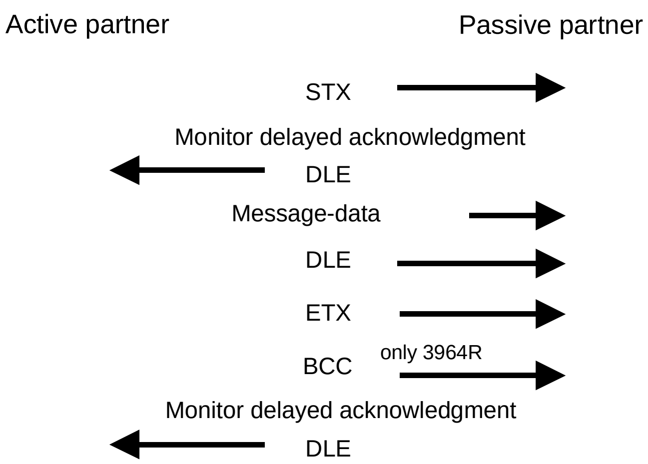
- STX Start of Text
- DLE Data Link Escape
- ETX End of Text
- BCC Block Check Character (only for 3964R)
- NAK Negative Acknowledge

Note!

When a DLE is transferred as part of the information it is repeated to distinguish between data characters and DLE control characters that are used to establish and to terminate the connection (DLE-duplication). The DLE-duplication is reversed in the receiving station.

The 3964(R) procedure requires that a lower priority is assigned to the communication partner. When communication partners issue simultaneous send commands the station with the lower priority will delay its send command.

Procedure

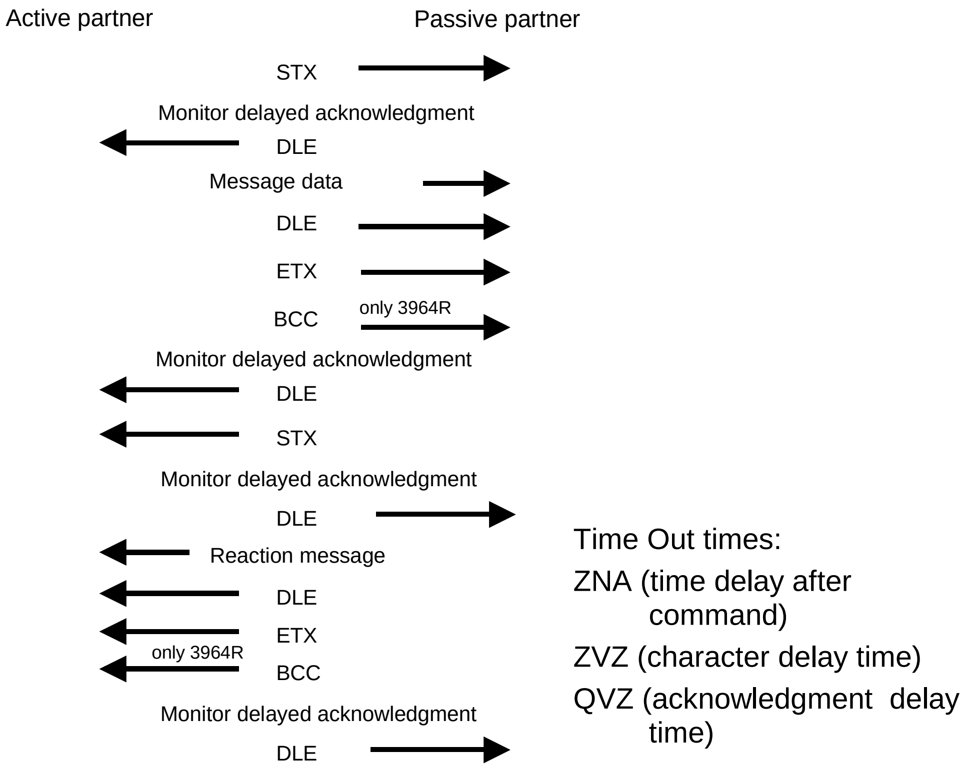


You can transfer a maximum of 250 bytes per message.

3964(R) with RK512

The RK512 is an extended form of the 3964(R) procedure. The difference is that a message header is sent ahead of the message data. The header contains data about the size, type and length of the message data.

Procedure



Time-Out times

The QVZ is monitored between STX and DLE and between BCC and DLE. ZVZ is monitored for the entire period for which a message is being received.

When the QVZ expires after an STX the STX is repeated. This process is repeated 5 times after which the attempt to establish a connection is terminated by the transmission of a NAK. The same sequence is completed when a NAK or any other character follows an STX.

When the QVZ expires after a message (following the BCC-byte) or when a character other than DLE is received the attempt to establish the connection and the message are repeated. This process is also repeated 5 times after which a NAK is transmitted and the attempt is terminated.

Passive operation

When the driver is expecting a connect request and it receives a character that is not equal to STX it will transmit a NAK. The driver does not respond with an answer to the reception of a NAK.

When ZVZ expires during the reception the driver will send a NAK and wait for another connect request.

The driver also sends a NAK when it receives an STX while it is not ready.

Block-Check-Character (BCC-byte)

The 3964R procedure appends a BlockCheck-Character to safeguard the transmitted data. The BCC-byte is calculated by means of an XOR-function over the entire data of the message, including the DLE/ETX.

When a BCC-bytes is received that differs from the calculated BCC a NAK is transmitted instead of the DLE.

Initialization conflict

If two stations should simultaneously attempt to issue a connect request within the QVZ then the station with the lower priority will transmit the DLE and change to receive mode.

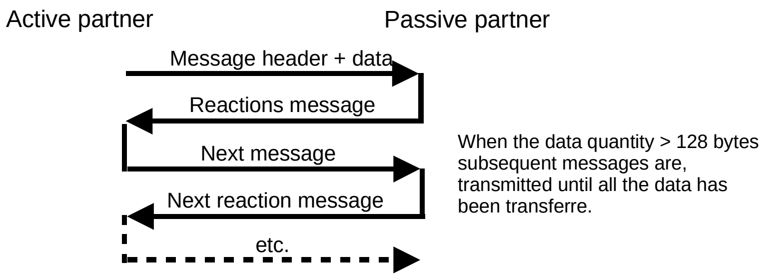
Data Link Escape (DLE-character)

The driver duplicates any DLE-character that is contained in a message, i.e. the sequence DLE/DLE is sent. During the reception the duplicated DLE's are saved as a single DLE in the buffer. The message always terminates with the sequence DLE/ETX/BCC (only for 3964R).

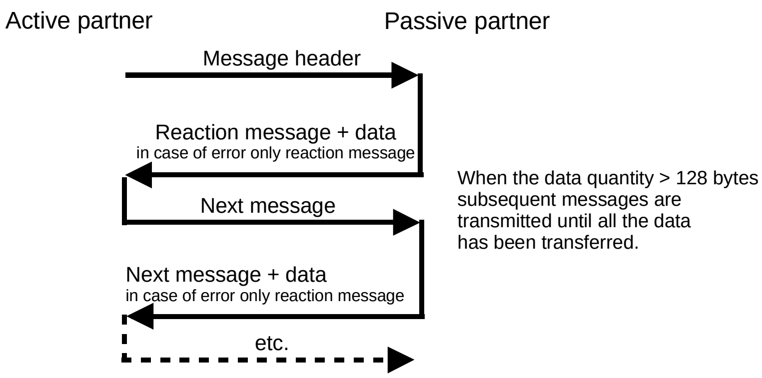
The control codes : 02h = STX
03h = ETX
10h = DLE
15h = NAK

Logical Message sequence

SEND (transmission of data)



FETCH (retrieving data)



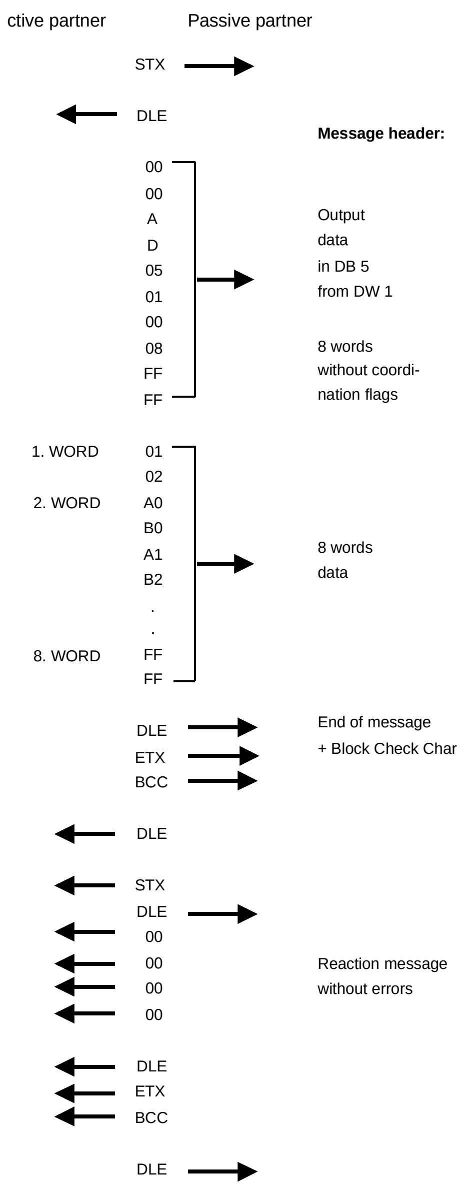
In both cases the procedure will time out after a maximum period of 5s during which a reaction must be received, else the reception is terminated.

Message contents

Every message has a header. Depending on the history of the message traffic this header will contain all the required information.

Structure of the output message

Sample output message



Normal message

Byte		
0 1	00 00	Message flag
2 3	A X	Output command type of data
4 5	xx xx	Parameter 1 Destination
6 7	yy yy	Parameter 2 Quantity
8 9	zz zz	Parameter 3 Coordination flag
10 - N	aa bb xy	Data

with N = 10 ... 127

Reaction message

Byte		
0 1 2	00 00 00	Flag for reaction message
3	xx	Error code

When the data exceeds >128 bytes additional messages will be sent.

Structure of additional messages

Next message

Byte		
0 1	FF 00	Flag for next message
2 3	A X	Output command Data type
4 - N	aa bb xy	Data

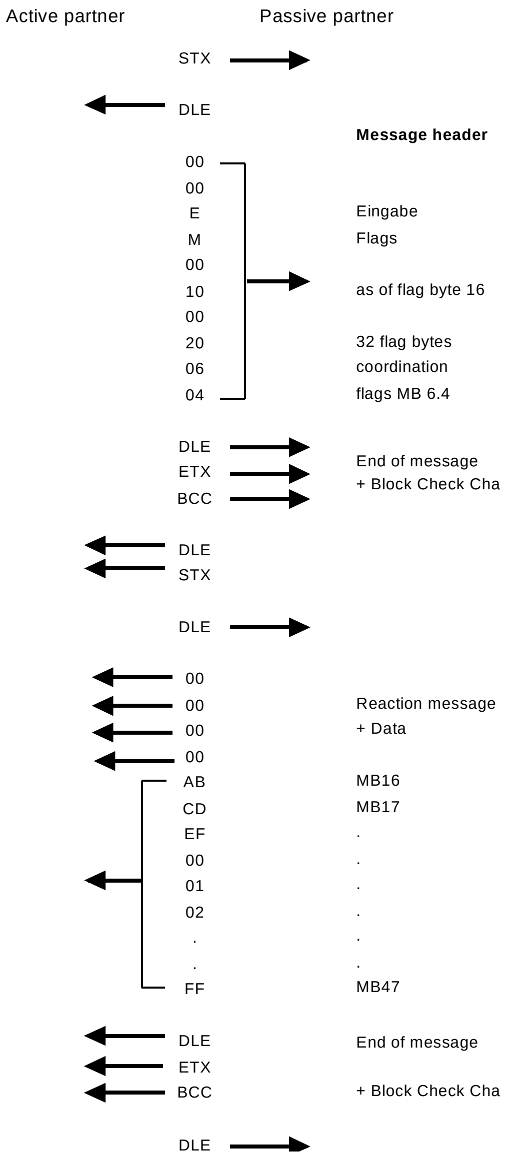
with N = 4 ... 127

Next reaction message

Byte		
0 1 2	FF 00 00	Flag for next reaction message
3	xx	Error code

Structure of the input message

Sample input message



Normal message

Byte		
0 1	00 00	Message identifier
2 3	E X	Input command Data type
4 5	xx xx	Parameter 1 Destination
6 7	yy yy	Parameter 2 Quantity
8 9	zz zz	Parameter 3 Coordinnation flag

Reaction message

Byte		
0 1 2	00 00 00	Reaction message flag
3	xx	Error code
4 - N	aa bb xy	Data

with N = 4 ... 127

When the data exceeds >128 bytes additional messages will be sent.

Structure of additional messages

Next message

Byte		
0 1	FF 00	Flag for next message
2 3	E X	Input command data type

Next reaction message

Byte		
0 1 2	FF 00 00	Flag for next reaction message
3	xx	Error code
4 - N	aa bb xy	Data

with N = 4 ... 127

Coordination flags

The coordination flag is set in the partner PLC in active-mode when a message is being received. This occurs both, for input as well as output commands. When the coordination flag has been set and a message with this flag is received, then the respective data is not accepted (or transferred) and a reject message is sent (error code 32h). In this case the user must reset the coordination flag in the partner PLC.

CP 240 with 20mA/RS232C interface

Properties

- The order number of the communication processor is: VIPA 240-1BA00.
- RS232C- or 20mA interfacing selected by means of external wiring.
- Interface compatible with SSM BG41-43 with the VIPA MD26 (20mA/RS232) and the Siemens CP525.
- Protocols supported: ASCII, STX/ETX, 3964(R) and RK512
- Active or passive 20mA-interface
- 16 Byte data
- 8 Receive buffers of 256 bytes each and 1 send buffer with 256 bytes.
- Diagnostic functions via back panel bus.
- Diagnostic interface with TTL-levels.
- The serial interface is not isolated from the back panel bus
- Power supply via back panel bus

Properties of the 20mA interface

- Logical levels represented by currents
- Data transfers over distances of up to 1000m, depending on Baudrate
- Data transfer rate up to 19,2kBaud
- Point-to-point connections (active/passive)
- Bus connection

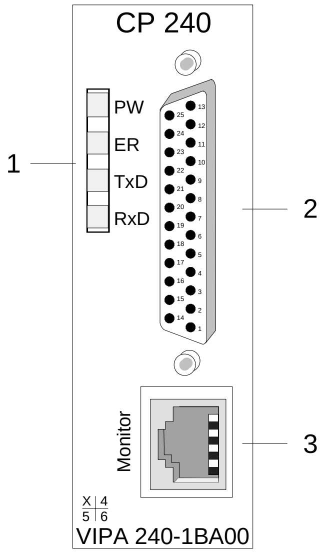
Options of the 20mA mode:

- Module is active station and supplies line current
- Module is passive station; partner station supplies the line current

Properties of the RS232C interface

- Logical signals as voltage levels
- Point-to-point links with serial fullduplex transfers in 2-wire technology
- Data transfers over distances of up to 15m
- Data transfers rate up to 115kBaud

Construction



[1] LED Status indicators
[2] 25-pin serial D-type socket (RS232C or 20mA)
[3] Diagnostic socket for troubleshooting purposes

Components

Power supply

The communication processor receives power via the back panel bus. Please note that the module requires an external 24V DC via the D-type socket if it should operate as an active 20mA-interface.

Please refer to "Application as an active 20mA interface" for more detailed information.

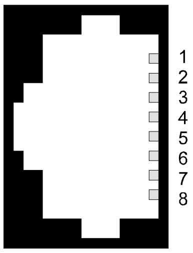
LED's

The communication processor is provided with 4 LED's for the purpose of displaying the operating status. The following table depicts the description and the color of these LED's.

Name	Color	Description
PW	yellow	Indicates that power is available
ER	red	Indicates errors: open circuit lines, overflow, parity error or framing errors The error LED is reset automatically after 4s. If diagnostics are enabled the error causes transmission of diagnostic bytes.
TxD	yellow	Transmit data
RxD	yellow	Receive data

Diagnostic interface

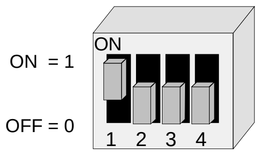
The RJ45 socket provides access to the RxD and TxD signals of the serial interface. The signals have already been converted to RS232x levels. The diagnostic interface has the following pin assignment:



Pin	Assignment
1	reserved
2	RxD
3	TxD
4	reserved
5	GND
6	VCC (5V)
7	channel selection
8	channel selection

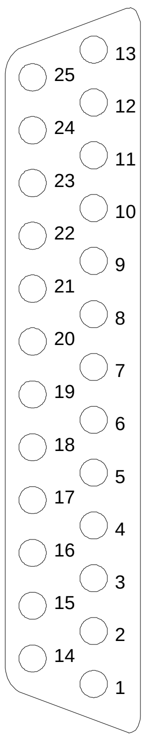
You can display and analyze the signals by means of a diagnostic cable and software that are available from VIPA (order no.: VIPA-UPI-FOX2).

Note!



Please remember that you can only use the diagnostic facilities when the following combination is set up on the DIP-switch of the diagnostic cable.

25-pin D-type socket



Pin	RS232C	20mA	Pin	RS232C	20mA
25	not connected	not connected	13	reserved	RxD+
24	reserved	Current sink 20mA -Tx	12	reserved	Current srce 20mA +Tx
23	RI	reserved	11	reserved	+24V
22	reserved	GND 24V	10	reserved	TxD+
21	reserved	Current sink 20mA -Rx	9	not conn.	not connected
20	Selection RS232C / 20mA		8	DTR	reserved
19	reserved	TxD-	7	GND	GND
18	CD	reserved	6	DSR	reserved
17	GND	GND	5	CTS	reserved
16	reserved	Current srce 20mA +Rx	4	RTS	reserved
15	+5V	+5V	3	RxD	reserved
14	reserved	RxD-	2	TxD	reserved
			1	shield	shield

Wiring

The communication processor is equipped with a single interface as shown above. This interface can be set to operate either as RS232C or as 20mA interface. The selection of the type of operating mode is controlled by means of pin 20 on the 25-pin socket:

- pin 20 at ground → RS 232C interface
- pin 20 open → 20mA interface

In the 20mA mode the interface can be operated in "active" or "passive" mode.

20mA Current source

The CP240 is provided with a 20mA current source for the active mode. This requires a 24V DC power supply via pins 11 (+24V) and 22 (24V common).

RS232C interface

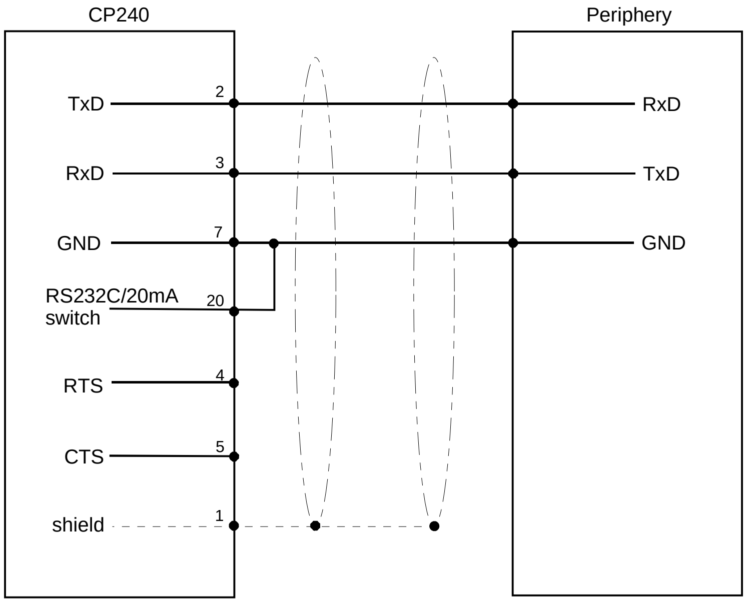
The CP 240 currently supports the following RS232C signals:

TxD Transmit Data

The transmit data is transferred via the TxD-line. When the transmit line is not used the CP240 places it at a logical "1".

RxD Receive Data

The receive data arrives via the RxD-line. When the receive line is not in use it must be must be held at a logical "1" by the transmitting station.



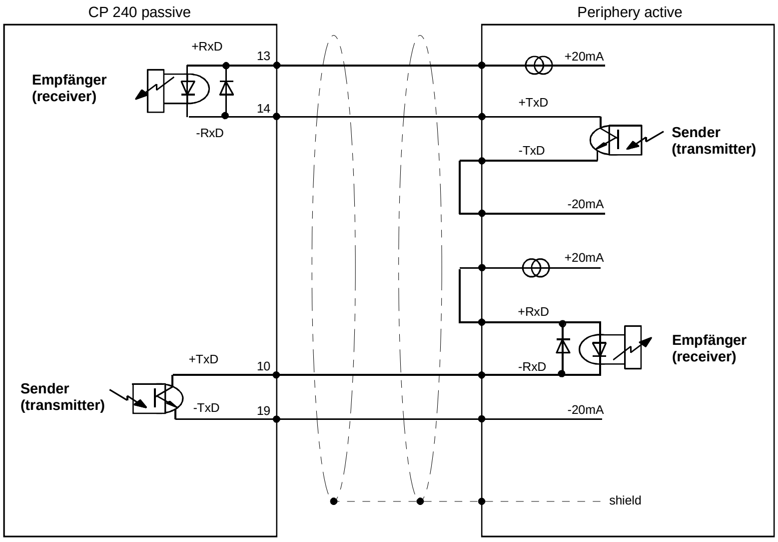
20mA interface

Options of the 20mA interface

- When the module is the passive station the partner station supplies the line current
- When the module is the active station it must supply the line current

Passive 20mA interface

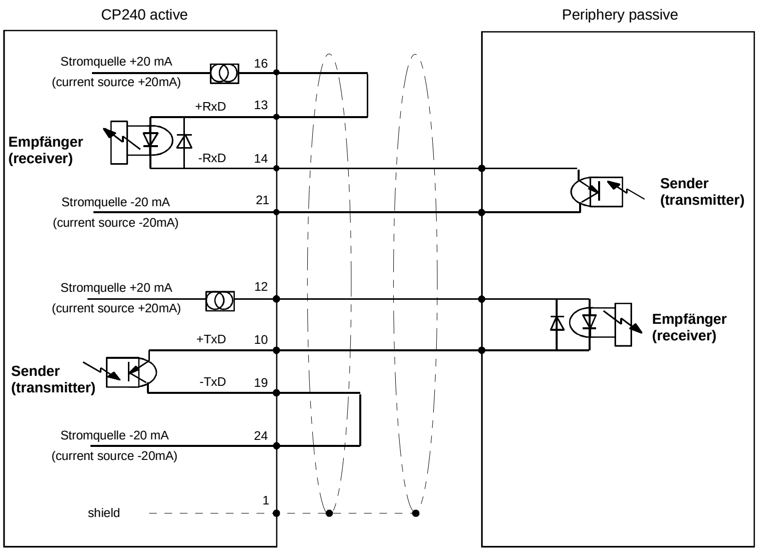
When the CP240 is used with a "passive" 20mA interface the required current is supplied by the periphery. In this case the CP 240 does not require an external power source.



Active 20mA interface

When the CP240 is used as the "active" 20mA interface the internal current source supplies the required 20mA. In this case the connected periphery represents the passive station.

Please note that the current source in the CP 240 requires an external source of 24V DC power connected to pin 11 and 22.



CP 240 with RS422/RS485 interface

Properties

- The communication processor has the order no.: VIPA 240-1CA00
- RS422 or RS485 interface
- Interface compatible with SSM BG41-43 with the VIPA MD21 (RS422/RS485) and the Siemens CP525
- Supports ASCII, STX/ETX, 3964(R) and RK512 protocols
- 16 byte parameter data
- 8 receive buffers of 256 bytes each and 1 transmit buffer of 256 bytes.
- Diagnostic function via the back panel bus.
- Diagnostic interface employing TTL levels.
- Isolation with respect to the back panel bus
- Power supplied via the back panel bus

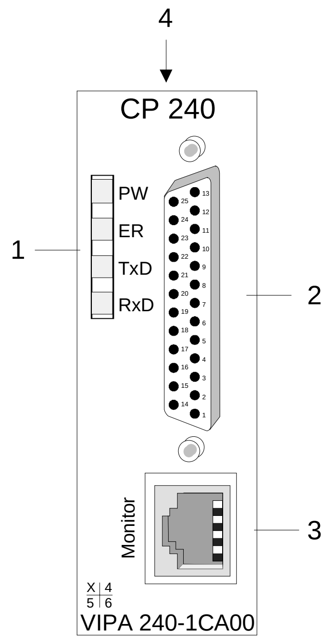
RS422 interface

- Logical states are represented by differential voltage levels on two twisted cores.
- Point-to-point link with a serial full-duplex transfer in 4-wire technology
- Multidrop connections
- High noise immunity
- Up to 16 stations can be connected
- Data transfer over distances of up to 1000m
- Data transfer rate up to 115kBaud

RS485 interface

- Logical states are represented by differential voltage levels on two twisted cores
- Serial bus connections by means of a two wire half-duplex link
- Multidrop connections
- High noise immunity
- Up to 32 stations can be connected
- Data transfer over distances of up to 500m
- Data transfer rate up to 115kBaud

Construction



[1] LED status indicators
[2] 25 pin serial D-type socket (RS422/485)
[3] Diagnostic socket for troubleshooting purposes
[4] Switchable termination resistor

Components

Power supply

The communication processor receives power via the back panel bus.

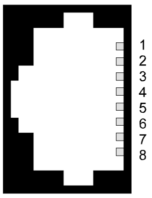
LED's

The communication processor is provided with 4 LED's for the purpose of displaying the operating status. The description and the color of these LED's is depicted by the following table.

Name	Color	Description
PW	yellow	Indicates that power is available
ER	red	Indicates errors: open circuit lines, overflow, parity error or framing errors. The error LED is reset automatically after 4s. If diagnostics are enabled the error causes transmission of diagnostic bytes.
TxD	yellow	Transmit data
RxD	yellow	Receive data

Diagnostic interface

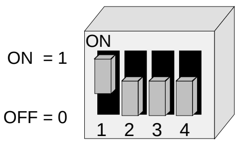
The RJ45 socket provides access to the RxD and TxD signals of the serial interface. The signals have already been converted to RS232 levels. The diagnostic interface has the following pin assignment:



Pin	Assignment
1	reserved
2	RxD
3	TxD
4	reserved
5	GND
6	VCC (5V)
7	channel selection
8	channel selection

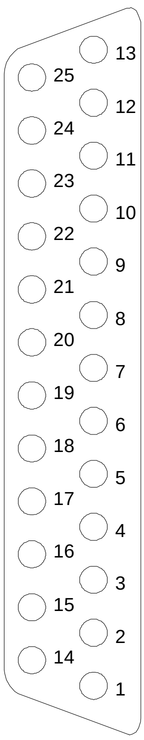
You can display and analyze the signals by means of a diagnostic cable and software that are available from VIPA (order no.: VIPA-UPI-FOX2).

Note!



Please remember that you can only use the diagnostic facilities when the following combination is set up on the DIP-switch of the diagnostic cable.

25-pin D-type socket

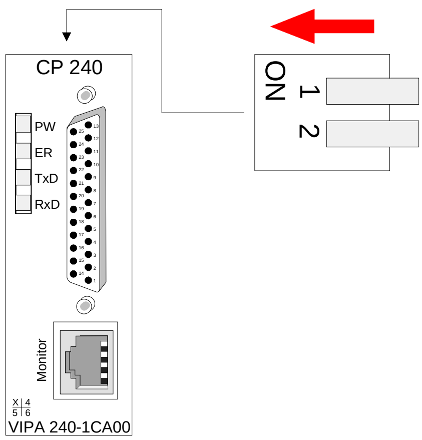


Pin	RS422/485	Pin	RS422/485
25	not connected	13	CTS-
24	not connected	12	CTS+
23	not connected	11	not connected
22	not connected	10	RTS+
21	not connected	9	RTS-
20	not connected	8	RxD+
19	not connected	7	GND
18	not connected	6	RxD-
17	GND iso	5	TxD-
16	not connected	4	TxD+
15	+5V	3	5V iso
14	not connected	2	not connected
		1	shield

Termination resistor

A 2-pole DIP switch is accessible via the top of the module. This switch connects a 100Ω termination resistor between the RxD and the TxD lines respectively.

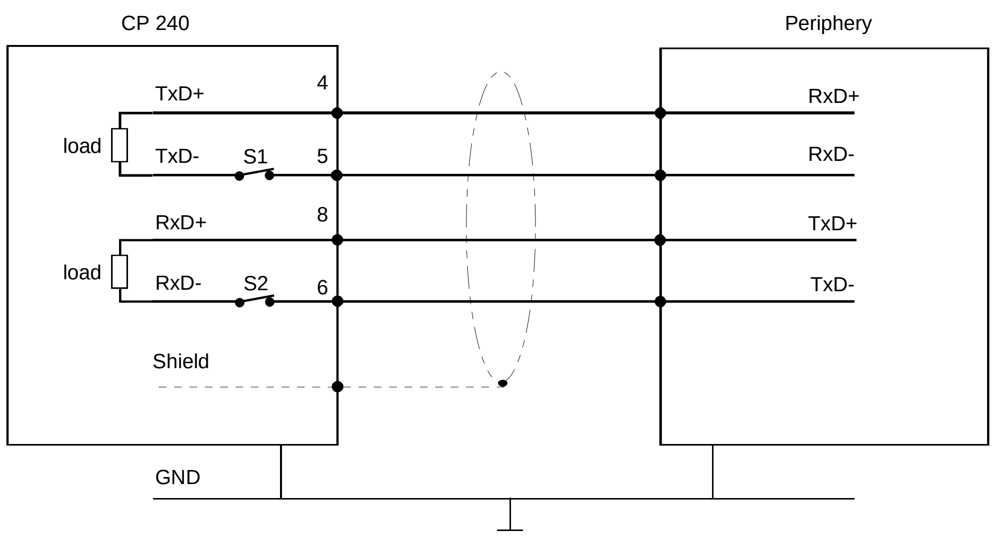
This is necessary in case of longer communication lines or higher data communication rates when the module is located at the physical end of the bus.



Wiring

The interface can be used for point-to-point links (RS422) or for a bus system where the transmission and reception is carried by the same line (RS485). In this case a bus master controls the operating mode by means of the SEL-signals.

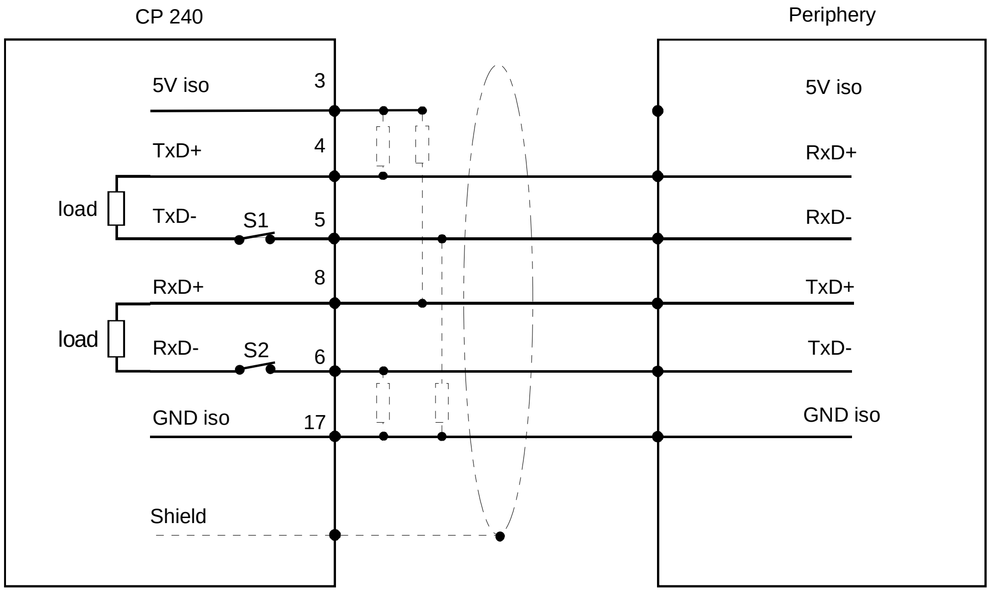
RS422 dc-coupled



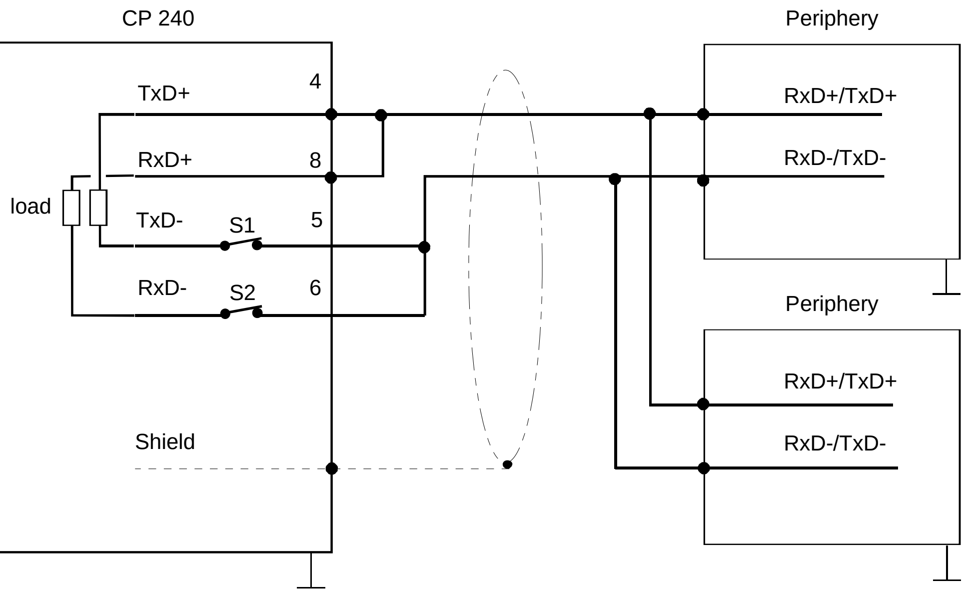
Attention!

The common connector of the interfaces of the devices must be connected.

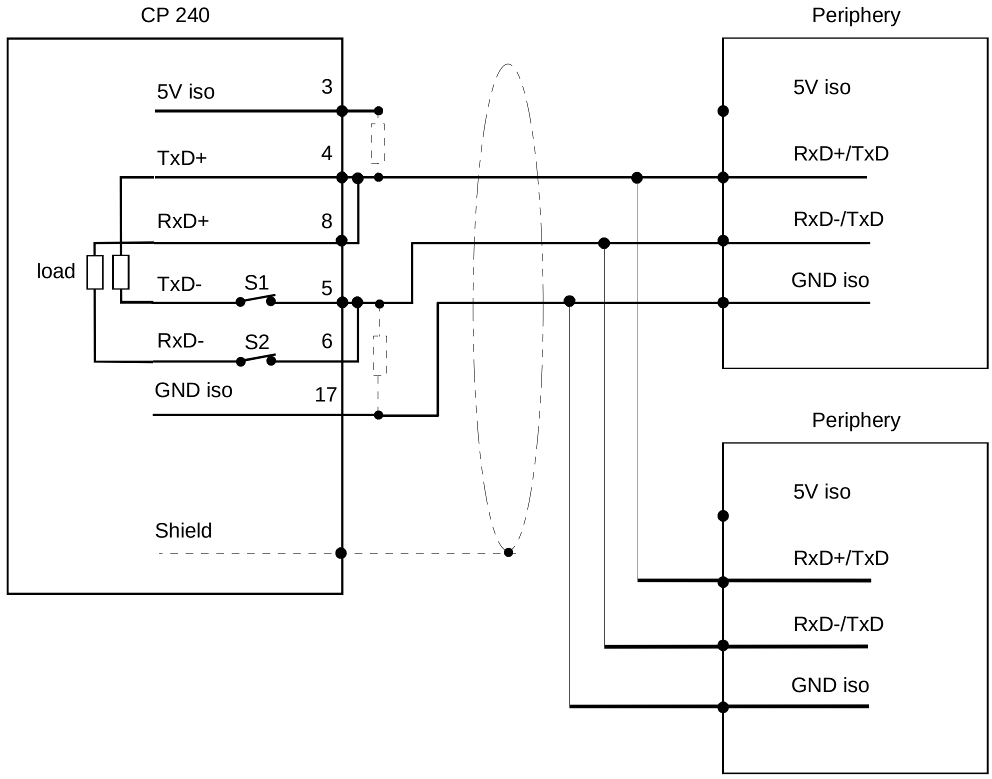
RS422 isolated



RS485 dc-coupled



RS485 isolated



Defined static level by means of resistors

Pin 3 of the isolated interfaces carry the isolated 5V supply with the respective ground GND on pin 17. You can use this isolated voltage to provide defined static voltage levels on the signaling lines by means of resistors and ensure that reflections are reduced to a minimum.

Configuration

General

You can configure the CP240 by means of 16 bytes of configuration data. The structure of the parameter data depends on the selected protocol or procedure.

Below follows a list of the parameter bytes with the respective default values.

Structure of the parameter bytes for ASCII

Byte	Function	Range	Default parameter
0	Baudrate	0h: Default (9600 Baud) 1h: 150 Baud 2h: 300 Baud 3h: 600 Baud 4h: 1200 Baud 5h: 1800 Baud 6h: 2400 Baud 7h: 4800 Baud 8h: 7200 Baud 9h: 9600 Baud Ah: 14400 Baud Bh: 19200 Baud Ch: 38400 Baud Dh: 57600 Baud Eh: 115200 Baud	0: 9600 Baud
1	Protocol	1: ASCII	1 (ASCII)
2	Bit 1/0 Data bits	00b: 5 Data bits 01b: 6 Data bits 10b: 7 Data bits 11b: 8 Data bits	11b: 8 Data bits
	Bit 3/2 Parity	00b: none 01b: odd 11b: even	00b: none
	Bit 5/4 Stopbits	01b: 1 10b: 1,5 11b: 2	01b: 1 Stopbit
	Bit 7/6 Flow control	00b: none 01b: Hardware 10b: XON/XOFF	00b: none
3	Reserved	0	0
4	ZNA (*20ms)	0..255	0
5	ZVZ (*20ms)	0..255	10
6	no. of receive buffers	1..8	1
7...15	reserved		

Structure of parameter bytes for STX/ETX

Byte	Function	Range of values	Default parameters
0	Baudrate	0h: .. Default (9600 Baud) 1h: .. 150 Baud 2h: .. 300 Baud 3h: .. 600 Baud 4h: .. 1200 Baud 5h: .. 1800 Baud 6h: .. 2400 Baud 7h: .. 4800 Baud 8h: .. 7200 Baud 9h: .. 9600 Baud Ah: . 14400 Baud Bh: . 19200 Baud Ch: . 38400 Baud Dh: . 57600 Baud Eh: . 115200 Baud	0: 9600 Baud
1	Protocol	2:.... STX/ETX	2 (STX/ETX)
2	Bit 1/0 Data bits	00b: 5 Data bits 01b: 6 Data bits 10b: 7 Data bits 11b: 8 Data bits	11b: 8 Data bits
	Bit 3/2 Parity	00b: none 01b: odd 11b: even	00b: none
	Bit 5/4 Stopbits	01b: 1 10b: 1,5 11b: 2	01b: 1 Stopbit
	Bit 7/6 Flow control	00b: none 01b: Hardware 10b: XON/XOFF	00b: none
3	Reserved	0	0
4	ZNA (*20ms)	0..255	0
5	TMO (*20ms)	0..255	10
6	Number of start flags	0..2	01
7	Start flag 1	0..255	02
8	Start flag 2	0..255	0
9	Number of end flags	0..2	01
10	End flag 1	0..255	03
11	End flag 2	0..255	0
12	not used		
13	not used		
14	not used		
15	not used		

Structure of the parameter bytes for 3964(R) / 3964(R) with RK512

Byte	Function	Range	Default parameters
0	Baudrate	0h:.. Default (9600 Baud) 1h:.. 150 Baud 2h:.. 300 Baud 3h:.. 600 Baud 4h:.. 1200 Baud 5h:.. 1800 Baud 6h:.. 2400 Baud 7h:.. 4800 Baud 8h:.. 7200 Baud 9h:.. 9600 Baud Ah: . 14400 Baud Bh: . 19200 Baud Ch: . 38400 Baud Dh: . 57600 Baud Eh: . 115200 Baud	0: 9600 Baud
1	Protocol	3:.... 3964 4:.... 3964R 5:.... 3964 + RK512 6:.... 3964R + RK512	3: 3964
2	Bit 1/0 Data bits	00b: 5 Data bits 01b: 6 Data bits 10b: 7 Data bits 11b: 8 Data bits	11b: 8 Data bits
	Bit 3/2 Parity	00b: none 01b: odd 11b: even	00b: none
	Bit 5/4 Stopbits	01b: 1 10b: 1,5 11b: 2	01b: 1 Stopbit
	Bit 7/6 Flow control	00b: none 01b: Hardware 10b: XON/XOFF	00b: none
3	Reserved	0	0
4	ZNA (*20ms)	0..255	0
5	ZVZ (*20ms)	0..255	10
6	QVZ (*20ms)	0..255	25
7	BWZ (*100ms)	0..255	100
8	STX repetitions	0..255	3
9	DBL	0..255	6
10	Priority	0:.... low 1:.... high	0: low
11	reserved	0	0
12	QVZ (*100ms) user acknowledgment RK512	0..255	50
13	not used		
14	not used		
15	not used		

Parameter description

Baudrate (for all protocols)

The data communication rate in bit/s (Baud).
You can select one of the following values:

0h:	Default (9600 Baud)
1h:	150 Baud
2h:	300 Baud
3h:	600 Baud
4h:	1200 Baud
5h:	1800 Baud
6h:	2400 Baud
7h:	4800 Baud
8h:	7200 Baud
9h:	9600 Baud
Ah:	14400 Baud
Bh:	19200 Baud
Ch:	38400 Baud
Dh:	57600 Baud
Eh:	115200 Baud

Default: 0 (9600Baud)

Protocol

The protocol that you wish to employ. This setting determines the structure of the remainder of the parameter data. The following options are available:

1: ...	ASCII
2: ...	STX/ETX
3: ...	3964
4: ...	3964R
5: ...	3964 and RK512
6: ...	3964R and RK512

Data communication parameter byte (for all protocols)

Here you define the physical data communication parameters. The structure of the byte is as follows:

Byte	Function	Range	Default parameter
2	Bit 1/0 Data bits	00b: 5 Data bits 01b: 6 Data bits 10b: 7 Data bits 11b: 8 Data bits	11b: 8 Data bits
	Bit 3/2 Parity	00b: none 01b: odd 11b: even	00b: none
	Bit 5/4 Stop bits	01b: 1 10b: 1,5 11b: 2	01b: 1 Stop bit
	Bit 7/6 Flow control	00b: none 01b: Hardware 10b: XON/XOFF	00b: none

Data bits

Quantity of *data bits* that represent a character.

Parity

The parity depends on the value and may be even or odd. For the purposes of the parity check the information bits are expanded by the parity bit. The value of the parity bit ("0" or "1") completes the value of all the bits to obtain a pre-arranged state. If the parity was not specified the parity bit is set to "1" but it is not included in the assessment.

Stop bits

The stop bits are appended to each character and signify the end of the character.

Flow control

This is a mechanism that synchronizes the data transfer when the transmitting station can send data faster than it can be processed by the receiving station. Flow control can be hardware- or software-based (XON/XOFF). Hardware flow control employs the RTS and CTS lines and these must therefore be wired accordingly.

Software flow control employs the control characters XON=11h and XOFF=13h. Please remember that your data must not contain these control characters.

Default: 13h (data bits: 8, parity: none, stop bits: 1, flow control: none)

Time delay after command (ZNA)
(for all protocols)

The delay time that must expire before a command is executed. The ZNA is specified in units of 20ms.

Range: 0 ... 255 *Default: 0*

Character delay time (ZVZ)
(for ASCII, 3964(R) and RK512)

The character delay time defines the maximum time that may expire between two characters of a single messages during the reception of the message. The ZVZ is defined in units of 20ms.

Range: 0 ... 255 *Default: 10*

Number of receive buffers
(only for ASCII)

Defines the number of receive buffers. When only 1 receive buffer is available no more data can be received while the receive buffer is occupied. The received data can be redirected into an unused receive buffer when you chain up to a maximum of 8 receive buffers.

Range: 1 ... 8 *Default: 1*

Timeout (TMO)
(only for STX/ETX)

TMO defines the maximum allowable time between the messages. TMO is specified in units of 20ms.

Range: 0 ... 255 *Default: 10*

Number of start flags
(only for STX/ETX)

You can select 1 or 2 start flags. When you select "1" as start flag the contents of the 2nd start flag (byte 8) is ignored.

Range: 0 ... 2 *Default: 1*

Start flag 1 and 2 (STX)
(only for STX/ETX)

The ASCII value of the start character that precedes a message to signify the start of a data transfer. You can select 1 or 2 start characters. When you are using 2 start characters you must specify 2 under "Number of start flags ".

Number of start flags:	*Range: 0 ... 2*	*Default: 1*
Start character 1, 2:	*Range: 0 ... 255*	*Default: 2 (char. 1)*
		0 (char. 2)

End character 1 and 2 (ETX)
(only for STX/ETX)

The ASCII value of the end character that follows a message to signify the end of the data transfer. You can specify 1 or 2 end characters. When you are using 2 end characters you must enter a 2 for "number of end flags".

Number of end flags:	*Range: 0 ... 2*	*Default: 1*
End character 1, 2:	*Range: 0 ... 255*	*Default: 3 (char. 1)*
		0 (char. 2)

Delayed acknowledgment time (QVZ)
(for 3964(R), RK512)

The delayed acknowledgment time defines the maximum allowable time for the acknowledgment form the partner when the connection is being established. The QVZ is specified in units of 20ms.

Range: 0 ... 255 *Default: 25*

Block wait time (BWZ)
(for 3964(R), RK512)

The BWZ is specified in units of 100ms.

Range: 0 ... 255 *Default: 100*

STX repetitions (for 3964(R), RK512)

Maximum number of attempts allows for a CP 240 to establish a connection.

Range: 0 ... 255 *Default: 3*

Repetitions of data blocks (DBL)
(for 3964(R), RK512)

Maximum number of message repetitions (incl. the 1. telegram) when errors are detected

Range: 0 ... 255 *Default: 6*

Priority
(for 3964(R), RK512)

A communication partner has a high priority when its transmit request supersedes the transmit request of a partner. When the priority is lower it must take second place after the transmit request of the partner.

The priorities of the two partners must be different for the 3964(R) protocols.

You can select one of the following settings:

0: low

1: high *Default: 0 (low)*

QVZ user acknowledgment RK512 (only for RK512)

This is the delay time during which an acknowledgment must be received from the partner to indicate that the data was received and processed (reaction message). The QVZ is specified in units of 100ms.

Range: 0 ... 255 *Default: 50*

Communications by means of standard handler blocks

Data communications is controlled by means of the handler blocks that are supplied with the hardware.

Note!
Modules with firmware revision level V1.06 or higher require that the handler block SYNCHRON is executed in the respective program. It is not possible to communicate with the CP 240 before the handler block has been executed since it enters a synchron identifier into the write and the read pointer, which must be acknowledged by the CPU.

The following blocks are supplied:

for CPU 24x

Name	FBs	Short description
SCP240	FB3	Send block for ASCII, STX/ETX and 3964(R)
RCP240	FB4	Receive block for ASCII, STX/ETX and 3964(R)
FETCH	FB20	Fetch block only for RK512
SEND	FB22	Send only for RK512
S/R_ALL	FB23	Send - Receive ALL only for RK512
SYNCHRON	FB25	Synchronization of the CP 240 from firmware rev. V1.06

for CPU 21x

Name	FCs	Short description
SEND_ACII_STX_3964	FC0	Send block for ASCII, STX/ETX and 3964(R)
RECEIVE_ACII_3964	FC1	Receive block for ASCII, STX/ETX and 3964(R)
FETCH_RK512	FC2	Fetch block only for RK512
SEND_RK512	FC3	Send only for RK512
S/R_ALL_RK512	FC4	Send - Receive ALL only for RK512
SYNCHRON_RESET	FC9	Synchronization of the CP 240 from firmware rev. V1.06

Standard handler blocks for the CPU 24x

ASCII, STX/ETX or 3964(R) communications

This type of communication procedure is always active, i.e. both partners must handle data transmission and reception in active mode. When data is transmitted neither the destination (transmission) nor the source (reception) are transferred.

Valid commands under ASCII, STX/ETX or 3964(R) are:

SCP240	FB3	(data transmission)
RCP240	FB4	(data reception)

RK512 communications

The linkage procedure RK512 employs a Master-Slave scheme. The master can request data from the "slave" by means of a FETCH and it can transfer data to the partner by means of a SEND. In this case the message header contains the destination or the source.

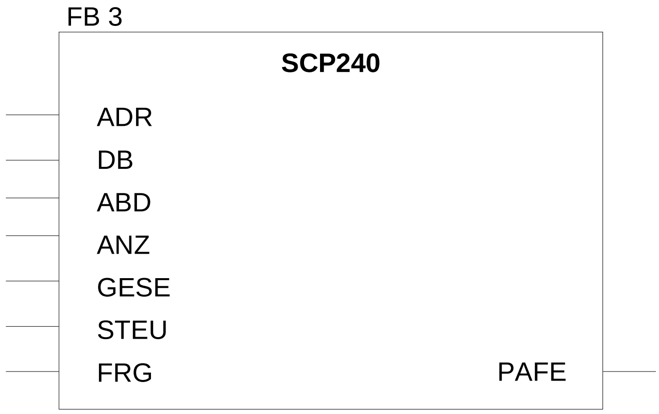
To enable the slave to react to jobs issued by the master a S/R_ALL (Send/Receive-All) must be executed cyclically within the slave.

Valid RK512 commands are:

FETCH	FB20	(request data)
SEND	FB22	(transmit data)
S/R_ALL	FB23	(slave reaction to requests)

SCP240 SEND (FB3)

This FB is used to transfer data to a peripheral unit in ASCII, STX/ETX. and 3964(R) mode.



ADR

Peripheral address for access to the CP 240 module. You must specify the peripheral address for the CP 240 system when you configure the DB1 (see above). This address must be located in the range from PY000 ... PY240.

For details please refer to the VIPA CPU 24x Manual HB99.

DB

The number of the data block that contains the transmit data.

ABD

Word-variable containing the number of the data word that contains the transmit data.

ANZ

Word-variable containing the number of bytes that must be transmitted.

GESE

This is an internal variable that controls the transmission of data. Here you must specify a flag-word that can be used by the handler block to store internal data.

STEU

Used by the handler block to store internal control bits. You must specify a flag byte where the handler block can store its control bits.

FRG

When you set this flag to 1 the data quantity specified in ANZ is transmitted once. Upon completion of the transmission the bit is set to 0. The block is not executed if this bit contains a 0 when FB 3 is accessed!

PAFE

The bits in this flag byte are set to ”0” when a function completes without error. When an error occurs an error code is entered here. This error code is cleared to ”0” automatically when the source for the error is removed.

The following errors can occur:

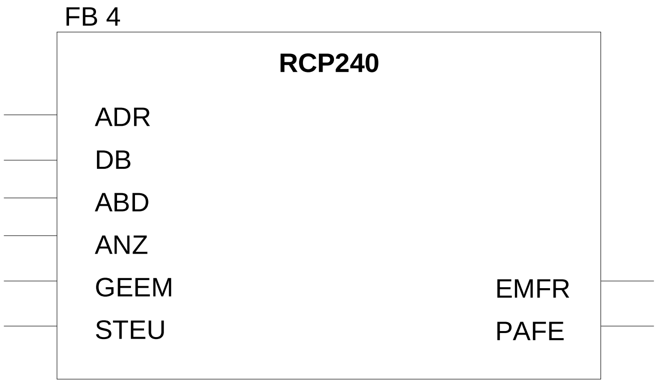
1 = Data block does not exist

2 = Data block too short

3 = Data block number not within the valid range

RCP240
RECEIVE (FB4)

This FB is used to receive data from a peripheral unit in ASCII, STX/ETX. and 3964(R) mode.



ADR

The peripheral address to access the CP 240 module. You must specify the peripheral address of the CP 240 system when you configure DB1 (see above). This address must be located in the range from PY000 ... PY240.

For details please refer to the VIPA CPU 24x Manual HB99.

DB

The number of the data module where the receive data must be stored.

ABD

Word-variable containing the number of the data word from where the receive data should be saved.

ANZ

Word-variable containing the number of bytes that must be transferred.

GEEM

This is an internal variable that controls the reception of data. Here you must specify a flag-word that can be used by the handler block to store internal data.

STEU

Used by the handler block to store internal control bits. You must specify a flag byte where the handler block can store its control bits.

EMFR

The flag-Bit EMFR (receive complete) is set when a message has been received completely and when it has been saved in the receive-DB. This bit is not reset automatically.

PAFE

All the bits in this flag byte are set to ”0” when a function completes without error. When an error occurs an error code is entered here. This error code is cleared to ”0” automatically when the source for the error is removed.

The following errors can occur:

1 = Data block does not exist

2 = Data block too short

3 = Data block number not within the valid range

FETCH Request data via RK512 (FB20)

This FB is used by a peripheral unit to request data using RK512. This FB is only valid in conjunction with RK512.

Note!

To enable the slave to react to requests issued by the master a S/R_ALL (Send/Receive-All) must be executed cyclically within the slave.

ADR

Peripheral address for access to the CP 240 module. You must specify the peripheral address for the CP 240 system when you configure the DB1 (see above). This address must be located in the range from PY000 ... PY240.

For details please refer to the VIPA CPU 24x Manual HB99.

QDB

The number of the data block that contains the transmit data.

QBDW

Word-variable containing the number of the data word where the transmit data starts.

LANG

Word-variable containing the number of bytes that must be transferred.

ZDB The number of the data block where the transmitted data must be stored.

ZBDW Word-variable containing the number of the data word from where the receive data should be saved.

KOOR This provides the configuration for the use of the coordination flag. The most significant byte must contain the byte-number and the least significant byte the bit-number of the coordination flag. If the coordination flag should not be required, both the most significant and the least significant byte must be set to 255.

The coordination flag controls access to the source area:

this flag protects your transmit data in the partner PLC from being overwritten. When the flag has been reset the data may again be overwritten.

ANZW Display word. The display word occupies a flag word. Status bits are stored in the right-hand byte. When the right-hand byte contains the flag ”ready with error” the left-hand byte contains an error number.

STEU Used by the handler block to store internal control bits. You must specify a flag byte where the handler block can store its control bits.

ANZ Word-variable containing the number of bytes that must be transferred.

GESE This is an internal variable that controls the transmission of data. Here you must specify a flag-word that can be used by the handler block to store internal data.

PAFE All the bits in this flag byte are set to "0" when a function completes without errors. When an error occurs an error code is entered here. This error code is cleared to "0" automatically when the source for the error is removed.

The following errors can occur:

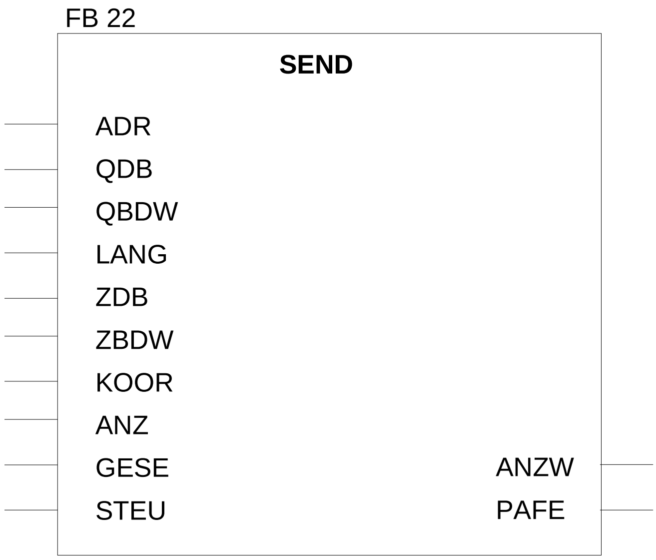
1 = Data block does not exist

2 = Data block too short

3 = Data block number not within the valid range

SEND send data by means of RK512 (FB22)

This FB is used to transfer data to a peripheral device by means of RK512. This FB is only valid under RK512.



Note!
In order that the slave can react to requests from the master the slave must execute a S/R_ALL (Send/Receive-All) in a cycle.

ADR

Peripheral address for access to the CP 240 module. You must specify the peripheral address for the CP 240 system when you configure the DB1 (see above). This address must be located in the range from PY000 ... PY240.

For details please refer to the VIPA CPU 24x Manual HB99.

QDB

The number of the data block that contains the transmit data.

QBDW

Word-variable containing the number of the data word where the transmit data starts.

LANG

Word-variable containing the number of bytes that must be transferred.

ZDB

The number of the data block where the transmitted data must be stored.

ZBDW Word-variable containing the number of the data word from where the receive data should be saved.

KOOR This provides the configuration for the use of the coordination flag. The most significant byte must contain the byte-number and the least significant byte the bit-number of the coordination flag. If the coordination flag should not be required, both the most significant and the least significant byte must be set to 255.

The coordination flag controls access to the source area:

when the flag is set your transmit data in the partner PLC is protected from being overwritten. When the flag is reset the data may again be overwritten.

STEU Used by the handler block to store internal control bits. You must specify a flag byte where the handler block can store its control bits.

PAFE All the bits in this flag byte are set to "0" when a function completes without errors. When an error occurs an error code is entered here. This error code is cleared to "0" automatically when the source for the error is removed.

The following errors can occur:

1 = Data block does not exist

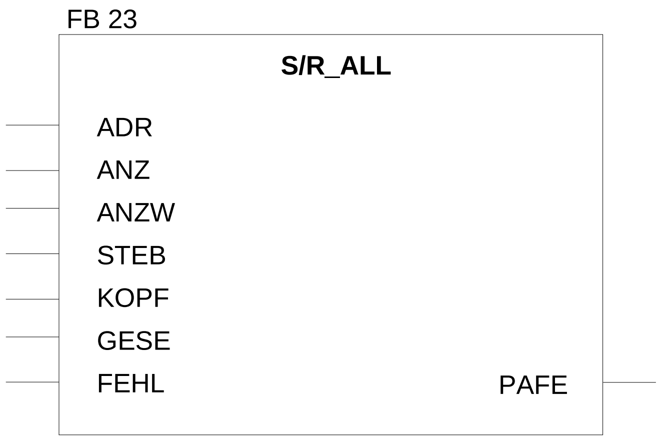
2 = Data block too short

3 = Data block number not within the valid range

S/R_ALL Reaction to Master-Request via RK512 (FB23)

When the system containing the CP 240 is used as the slave this FB must be executed by the slave CPU on a cyclic basis. The CP 240 can only react to the requests issued by the master if this is true. When a FETCH is received the data is transferred to the Master. Data that was received from the master by means of a SEND is accepted and stored, followed by an acknowledgment.

This FB is only valid for the RK512.



ADR

Peripheral address for access to the CP 240 module. You must specify the peripheral address for the CP 240 system when you configure the DB1 (see above). This address must be located in the range from PY000 ... PY240.

For details please refer to the VIPA CPU 24x Manual HB99.

ANZ

Word-variable containing the number of bytes that must be transferred.

ANZW

Display word. The display word occupies a flag word. Status bits are stored in the right-hand byte. When the right-hand byte contains the flag ”ready with error” the left-hand byte contains an error number.

STEB

Internal control byte.

KOPF

The start of the 10-byte bit-memory area where the RK512 message header is stored.

GESE

This is an internal variable that controls the transmission of data. Here you must specify a flag-word that can be used by the handler block to store internal data.

FEHL

Internal control byte.

PAFE

All the bits in this flag byte are set to "0" when a function completes without errors. When an error occurs the respective error code is stored in this location. This error code is cleared to "0" automatically when the source for the error is removed.

The following errors can occur:
1 = Data block does not exist
2 = Data block too short
3 = Data block number not within the valid range

SYNCRON
Synchronization (FB25)

This block must be executed in the cyclic portion of the program. This function acknowledges the start-up flag of the CP 240 and in this way synchronizing CPU and CP. Furthermore it is possible to reset the CP when communications should be interrupted to ensure that the start-up procedure is synchronized properly.

ADR

Peripheral address for access to the CP 240 module. You must specify the peripheral address for the CP 240 system when you configure the DB1 (see above). This address must be located in the range from PY000 ... PY240.

For details please refer to the VIPA CPU 24x Manual HB99.

ANL

The start-up was completed.

This bit informs the HTB that the CPU has executed a STOP/START or POWER-OFF/POWER-ON and that the synchronization is required.

The bit is cleared by the HTB when the synchronization procedure has completed.

NULL

A bit that is used internally for data exchanges with the CP.

REST

Reset of the CP 240.

The CP 240 is reset when the user sets this bit in the PLC program. When this bit is set the handler block enters the reset-flag in the CP and waits until this is acknowledged. The process continues as with the start-up.

STBS

Control bit SEND

Here you must specify the flag byte where the control bits for the Send-FB were saved.

STBR

Control bit RECEIVE

Here you must specify the flag byte where the control bits for the Receive-FB were saved.

TIME

Timer for the delay time until the Reset has been acknowledged.

Sample FB25 SYNCRON:

In OB21 and OB22 you must set the bit to "1" that was specified in descriptor ANL. When the block detects that a start-up has occurred it will acknowledge the synchron-flag and clear the control bits of the handler blocks for SEND and RECEIVE or FETCH and WRITE. When the synchronization has completed the block will reset the ANL bit to "0".

FB25 can also be used to reset the CP 240. For this purpose the bit specified for the label REST must be set. The result is that the FB issues the reset-flag to the CP 240 and waits until this is acknowledged.

Parameter description FB25

```
BAUSTEIN#FB25
BSTNAME #SYNCRON
BIB     #102
BEZ     #ADR   D:KF     MODULE ADDRESS
BEZ     #ANL   E:BI     START-UP WAS EXECUTED
BEZ     #NULL  E:BI     WRITE 0 INTO SZ/LZ
BEZ     #REST  E:BI     ISSUE RESET
BEZ     #STBS  E:BY     CONTROL BITS FOR SEND
BEZ     #STBR  E:BY     CONTROL BITS FOR RECEIVE
BEZ     #TIME  T        DELAY TIME FOR START-UP ACKN.
```

Programming example

```
      BAUSTEIN#OB21
      BIB     #6100
00000      :
00002      :UN  M 101.0      Start-up bit is 0
00004      :S   M 101.0      set it to 1
00006      :U   M 101.1      Send nulls is 1
00008      :R   M 101.1      and reset it
0000A      :
0000C      :
0000E      :BE
```

```
      BAUSTEIN#OB22
      BIB     #6100
00000      :
00002      :UN  M 101.0      Start-up bit is 0
00004      :S   M 101.0      set it to 1
00006      :U   M 101.1      Send nulls is 1
00008      :R   M 101.1      and reset it
0000A      :
0000C      :
0000E      :BE
```

```
      BAUSTEIN#FB223 (cyclic processing FB)
      BSTNAME #P3964
      BIB     #17100
0000A      :
0000C      :SPA FB 25
      NAME #SYNCRON
      ADR  =KF +128          Module address
      ANL  =M 101.0          Start-up was executed
      NULL =M 101.1          Send Nulls to CP (used
                             internally)
      REST =M 101.2          Reset the CP
      STBS =MB 107           Control bits for Send-FB
      STBR =MB 109           Control bits for Receive-FB
      TIME =T 19             Wait time acknowledgment
0001E      :
00020      :
00022      :U   M 101.0      While Synchron was not
                             acknowledged
00024      :BEB              End of program
00026      :                 After Synchron it is possible
                             to communicate
00028      :L   KB 0
0002A      :T   MW 102
0002C      :
0002E      :SPA FB 3
      NAME #SCP240
      ADR  =KF +128
      DB   =DB 10
      ABD  =MW 102
      ANZ  =MW 104
      GESE =MW 106
      STEU =MB 107
      FRG  =M 101.7
      PAFE =MB 108
00042      :
00044      :
00046      :SPA FB 4
      NAME #RCP240
      ADR  =KF +128
      DB   =DB 11
      ABD  =MW 102
      ANZ  =MW 114
      GEEM =MW 116
      STEU =MB 109
      EMFR =M 101.6
      PAFE =MB 110
0005A      :
0005C      :BE
```

Standard handler blocks for the CPU 21x

ASCII, STX/ETX or 3964(R) communications

This type of communication procedure is always active, i.e. both partners must handle data transmission and reception in active mode. When data is transmitted neither the destination (transmission) nor the source (reception) are transferred.

Valid commands under ASCII, STX/ETX or 3964(R) are:

SEND_ACII_STX_3964	FC0	(data transmission)
RECEIVE_ACII_STX_3964	FC1	(data reception)

RK512 communications

The linkage procedure RK512 employs a Master-Slave scheme. The master can request data from the "slave" by means of a FETCH and it can transfer data to the partner by means of a SEND. In this case the message header contains the destination or the source.

To enable the slave to react to jobs issued by the master a S/R_ALL (Send/Receive-All) must be executed cyclically within the slave.

Valid RK512 commands are:

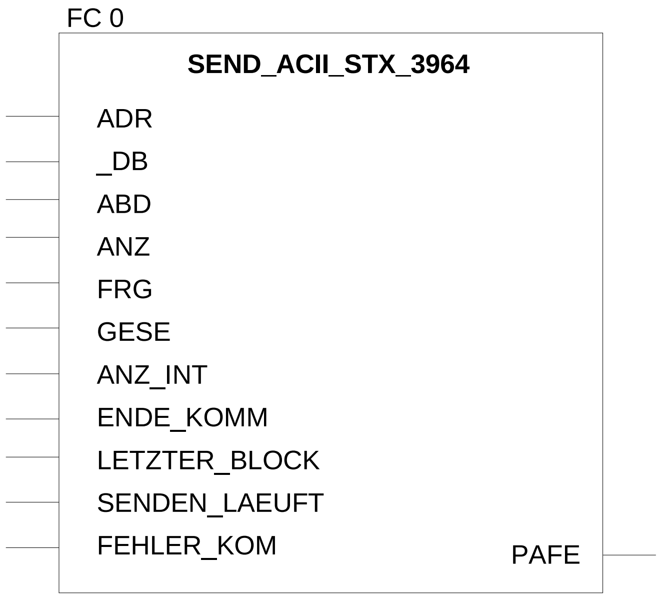
FETCH_RK512	FC2	(request data)
SEND_RK512	FC3	(transmit data)
S/R_ALL_RK512	FC4	(slave reaction to requests)

SEND_ASCII_STX_3964 (FC 0)

This FC is used to transfer data to a peripheral unit in ASCII, STX/ETX and 3964(R).

Labels _DB, ADB and ANZ define the transmit slot.

The bit FRG initiates the transmission of the data. When all the data has been transmitted the FRG bit is reset by the HTB.



ADR

Int: Peripheral address for access to the CP 240 module. In your configuration tool you must specify the peripheral address that will be used by the system to access the CP 240.

The addressing range is PY000 ... PY240.

_DB

Block_DB: the number of the data block that contains the transmit data.

ABD

Word: word-variable that contains the number of the data word that contains the characters that must be transmitted.

ANZ

Word: word-variable that contains the number of bytes that must be transmitted.

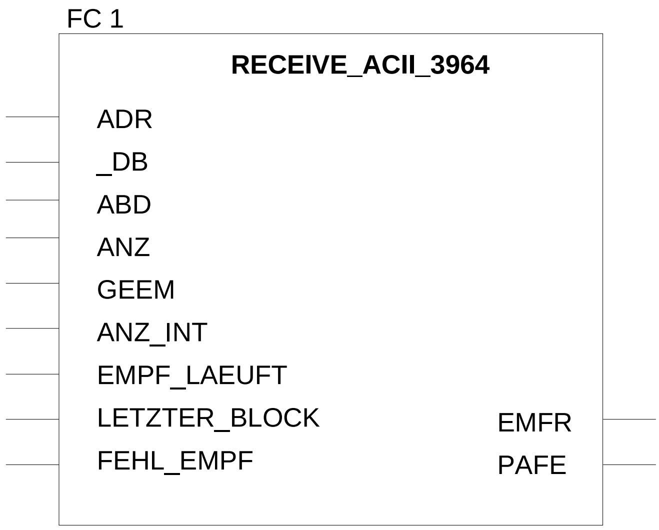
FRG transmit enable	Bool: when this flag-bit is set to "1" the data quantity specified in ANZ is transmitted once. After transmission the bit is reset to "0". If this bit is already at "0" when the FC is accessed the function is skipped immediately!
GESE	Word: quantity of data words that has already been transmitted.
ANZ_INT	Word: specifies the number of bytes to be transmitted.
ENDE_KOM	Bool: communications has been completed.
LETZTER_BLOCK	Bool: last block is being transmitted.
SENDEN_LAEUFT	Bool: the data block is being transmitted.
FEHLER_KOM	Bool: communication error.
PAFE	Byte: all the bits in this flag byte are set to "0" when a function completes without errors. When an error occurs the respective error code is stored in this location. This error code is cleared to "0" automatically when the source for the error is removed. The following errors can occur: 1 = Data block does not exist 2 = Data block too short 3 = Data block number not within the valid range

RECEIVE_ASCII_ STX_3964 (FC 1)

This FC is provided for the purpose of receiving data from a peripheral device in ASCII, STX/ETX and 3964(R) mode.

Labels _DB and ADB define the start of the transmit slot.

When output EMFR is set a new message has been retrieved completely. The length of the message is stored in ANZ. When the message has been analyzed the user resets this bit. The PLC will not accept any new messages while the bit is "1". Depending on the number of buffers any received messages are saved by the module.



ADR

Int: peripheral address for access to the CP 240 module. You specify the peripheral address that will be used by the system to access to the CP240 by means of your configuration tool.

The range of the address is PY000 ... PY240.

_DB

Block_DB: the number of the data module where the receive data must be stored.

ABD

Word: first data word of the receive slot.

ANZ

Word: word-variable that contains the number of bytes that must be received.

GEEM Word: the quantity of data that has already been received.

ANZ_INT Word: length of receive data in bytes.

EMPF_LAEUFT Bool: reception is active.

LETZTER_BLOCK Bool: the last block has been transmitted.

FEHL_EMPF Bool: communication error

PAFE Byte: all the bits in this flag byte are set to "0" when a function completes without errors. When an error occurs the respective error code is stored in this location. This error code is cleared to "0" automatically when the source for the error is removed.

The following errors can occur:
1 = Data block does not exist
2 = Data block too short
3 = Data block number not within the valid range

FETCH_RK512 (FC 2)

Request data by means of RK512

This FC is used to request data from a peripheral device using RK512. This FC can only be used in conjunction with RK512.

The purpose of the FETCH is to request the data from a communication partner. A message containing the source data is transmitted to the partner. The partner then compiles the data and returns them. Now the received data is saved to the specified destination data. When the FC is issued the data for the destination area is defined in the labels QDB, QBDW, LANG for the source area and the labels ZDB and ZBDW for the destination area.

When the FC is accessed the control bits are used to check whether a job is present and active or not. When all the control bits are "0" a new FETCH command is initiated. For this purpose the message header is transferred to the CP after which a delay is executed to receive the expected acknowledgment along with the application data. During the time that the partner has not sent the acknowledgment message the indicator word contains "job active". Only when the CP has signaled to the PLC that the acknowledgment message has been received and when the application data has been transferred will the indicator word be changed to "job completed" and the communication link to the CP be terminated. In case of communication errors the CP returns an error number to the PLC. The respective error number is entered into the indicator word and the bit "job completed with errors" is set.

The cyclic portion of the program must process the function until "job completed - with/without - errors" is set in the indicator word.

Note!
In order that the slave can react to requests from the master the slave must execute a S/R_ALL (Send/Receive-All) in a cycle.

ADR Int: Peripheral address for access to the CP 240 module. You specify the peripheral address that will be used by the system to access to the CP240 by means of your configuration tool.

The range of the address is PY000 ... PY240.

QDB Int: the number of the data block that contains the transmit data.

QBDW Int: first data word in the source data block.

LANG Int: data quantity that must be transmitted.

ZDB Block_DB: destination data block

The number of the data block where the transmitted data must be stored.

ZBDW Int: first data word in the destination data block.

KOOR Word: coordination byte allocation:

This provides the configuration for the use of the coordination flag. The most significant byte must contain the byte-number and the least significant byte the bit-number of the coordination flag. If the coordination flag should not be required, both the most significant and the least significant byte must be set to 255.

The coordination flag controls access to the source area:

when the flag is set your transmit data in the partner PLC is protected from being overwritten. When the flag is reset the data may again be overwritten.

ANZ Word: number of bytes received (intern).

GESE Word: number of bytes received (intern).

KOPF_GESE Bool: header was transmitted to partner.

WART_DATEN Bool: wait for data.

EMPF_LAEUFT Bool: receive active.

LETZTER_BLOCk Bool: last block was transmitted.

FEHL_KOM Bool: a communication error has occurred.

ANZW Word: display word. The display word occupies a flag word. Status bits are stored in the right-hand byte. When the right-hand byte contains the flag ”ready with error” the left-hand byte contains an error number.

PAFE Byte: all the bits in this flag byte are set to "0" when a function completes without errors. When an error occurs the respective error code is stored in this location. This error code is cleared to "0" automatically when the source for the error is removed.

The following errors can occur:

1 = Data block does not exist

2 = Data block too short

3 = Data block number not within the valid range

SEND_RK512 Transmit data by means of RK512 (FC 3)

The purpose of this FC is to transfer data to a peripheral device by means of RK512. This FB is only valid in conjunction with RK512.

The purpose of the SEND_RK512 is to transmit data from a defined source area of the PLC to a partner and to instruct the partner where this must deposit the data it has received. The source area is defined by means of the labels QDB, QBDW and LANG. The destination area of the partner is defined by means of the labels ZDB and ZBDW.

When the FC is accessed the control bits are used to check whether a job is present and active or not. When all the control bits are "0" a new send job is initiated. For this purpose the message consisting of the header and the application data is transferred to the CP after which a delay is executed to receive the expected acknowledgment.

While the partner has not sent the acknowledgment message the indicator word contains "job active". Only when the CP has signaled to the PLC that the acknowledgment message has been received will the indicator word be changed to "job completed" and the communication link to the CP be terminated. In case of communication errors the CP returns an error number to the PLC. The respective error number is entered into the indicator word and the bit "job completed with errors" is set.

The communication session with the CP is terminated. The cyclic portion of the program must process the function until "job completed - with/without - errors" is set in the indicator word.

Note!
In order that the slave can react to requests from the master the slave must execute a S/R_ALL (Send/Receive-All) in a cycle.

ADR Int: peripheral address for access to the CP 240 module. You specify the peripheral address that will be used by the system to access to the CP240 by means of your configuration tool.

The range of the address is PY000 ... PY240.

QDB Block_DB: the number of the data block that contains the transmit data.

QBDW Int: first data word of the transmit slot.

LANG Int: quantity of transmit data.

ZDB Int: the number of the data block where the transmitted data must be stored.

ZBDW Int: first data word of the receive slot.

KOOR Word: This provides the configuration for the use of the coordination flag. The most significant byte must contain the byte-number and the least significant byte the bit-number of the coordination flag. If the coordination flag should not be required, both the most significant and the least significant byte must be set to 255.

The coordination flag controls access to the source area:

when the flag is set your transmit data in the partner PLC is protected from being overwritten. When the flag is reset the data may again be overwritten.

ANZ Word: number of bytes transmitted (intern).

GESE Word: number of bytes transmitted (intern).

KOPF_GESENDET Bool: header was transmitted to partner.

ERSTER_BLOCK Bool: the first block of data was transmitted.

SENDE_LAEUFT Bool: transmission is active.

SENDEN_FERTIG Bool: data transmission completed.

LETZTER_BLOCK Bool: last block was transmitted.

FEHLER a communication error has occurred.

ANZW Word: indicator word - the indicator word occupies a flag-word. The right-hand byte is used to store status bits. The left-hand byte contains the error number if the right-hand byte should contain the identifier "completed with error".

PAFE Byte: All the bits in this flag byte are set to "0" when a function completes without errors. When an error occurs the respective error code is stored in this location. This error code is cleared to "0" automatically when the source for the error is removed.

The following errors can occur:

1 = Data block does not exist

2 = Data block too short

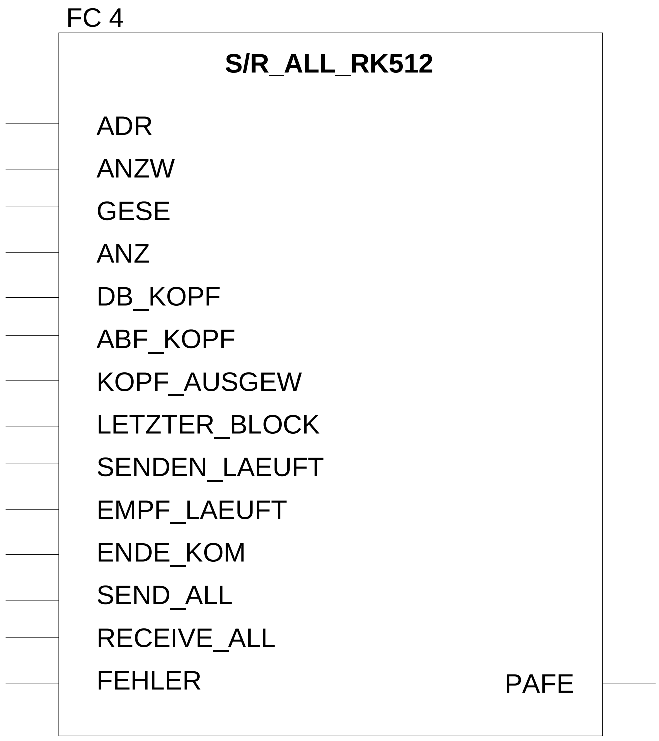
3 = Data block number not within the valid range

S/R_ALL_RK512 (FC 4)

The purpose of this block is to process FETCH and SEND jobs that were received from the partner.

When the system is used with the CP 240 as slave the slave CPU must access this FC cyclically. This is the only manner in which the CP 240 can react to the jobs issued by the master. After a FETCH the data is collected and transmitted to the master. The data that was received by a SEND from the master is retrieved, saved and acknowledged.

This FB is only valid in conjunction with RK512.



ADR

Int: peripheral address for access to the CP 240 module. You specify the peripheral address that will be used by the system to access to the CP240 by means of your configuration tool.

The range of the address is PY000 ... PY240.

ANZW

Word: display word. The display word occupies a flag word. Status bits are stored in the right-hand byte. When the right-hand byte contains the flag ”ready with error” the left-hand byte contains an error number.

GESE

Word: number of bytes received (intern).

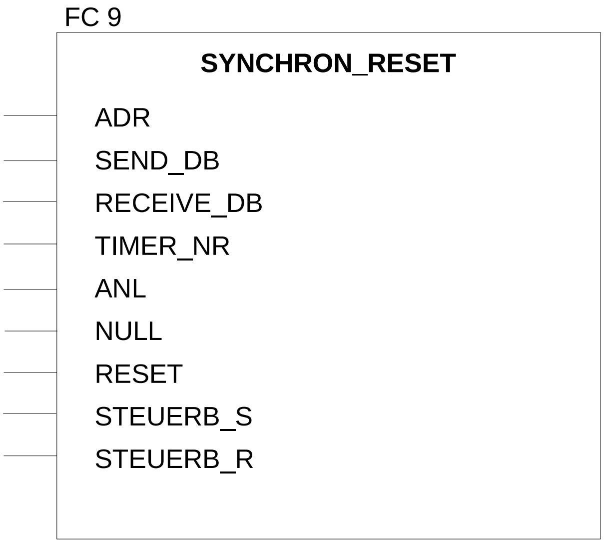
ANZ	Word: number of bytes received (intern).
ABF_KOPF	Word: first data word in the receive/transmit slot.
KOPF_AUSGEW	Bool: the telegram header has been analyzed.
LETZTER_BLOCK	Bool: last block was transmitted.
SENDEN_LAEUFT	Bool: transmission is active.
EMPF_LAEUFT	Bool: data reception is active.
ENDE_KOM	Bool: the message was transmitted/received completely.
SEND_ALL	Bool: the block operates in SEND-ALL mode.
RECEIV_ALL	Bool: the block operates in RECEIVE-ALL mode.
FEHLER	Bool: a communication error has occurred.
PAFE	Byte: all the bits in this flag byte are set to "0" when a function completes without errors. When an error occurs the respective error code is stored in this location. This error code is cleared to "0" automatically when the source for the error is removed. The following errors can occur: 1 = Data block does not exist 2 = Data block too short 3 = Data block number not within the valid range

SYNCHRON_ RESET synchronization and reset (FC 9)

This block must be accessed from the cyclic portion of the program. This function acknowledges the start-up flag from the CP 240 to establish synchronism between the CPU and the CP. Furthermore it is possible to reset the CP when communications should be interrupted to ensure that the start-up procedure is synchronized properly.

Start-up: After a reboot or a re-start the bit defined in label ANL must be set to "1" for a single cycle to inhibit processing of the SEND-/RECEIVE-blocks as long as this bit was not acknowledged by the function.

Reset: When the "RESET" bit is set a flag is transferred to the CP that causes this to clear all buffers and pointers. When the CP has completed this action it sets the synchron flag. When the CPU has acknowledged this flag the system can continue communicating.



ADR Int: peripheral address for access to the CP 240 module. You specify the peripheral address that will be used by the system to access to the CP240 by means of your configuration tool.

The range of the address is PY000 ... PY240.

SEND_DB Block_DB: data block for the data transfer to the CP.

RECEIVE_DB Block_DB: data block for the data transfer from the CP.

TIMER_NR Timer: number of the timer for the delay time.

ANL

Bool: the start-up will be executed.

This bit informs the HTB that the CPU has executed a STOP/START or POWER-OFF/POWER-ON and that synchronization is required.

The bit is cleared by the HTB when the synchronization has been completed.

NULL

Bool: send nulls to the CP (for internal purposes).

RESET

Bool: reset of the CP 240.

The CP 240 is reset when the user sets this bit in the PLC program. When this bit is set the handler block enters the reset-flag in the CP and waits until this is acknowledged. The process continues as with the start-up.

STEUERB_S

Byte: control bit for SEND-FC and S/R_ALL-FC.

Here you must specify the flag byte where the control bits for the SEND-FC were saved.

STEUERB_R

Byte: control bit for RECEIVE-FC and FETCH-FC.

Here you must specify the flag byte where the control bits for the RECEIVE-FC were saved.

Programming example

Call issued to the block from OB1

```
CALL  "DPRD_DAT"//Read data from modules
 LADDR  :=W#16#100
 RET_VAL:=MW100
 RECORD :=P#DB11.DBX 0.0 BYTE 16


CALL  FC     9              //call Synchron
 ADR       :=0              //1. DW in SEND/EMPF_DB
 SEND_DB   :=DB10           //Send_DB module
 RECEIVE_DB:=DB11           //Empfang_DB module
 TIMER_NR  :=T2             //Delay time Synchron
 ANL       :=M3.0           //Start-up completed
 NULL      :=M3.1           //Intermediate flag
 RESET     :=M3.2           //Execute module reset
 STEUERB_S :=MB2            //Control bits Sende_FC
 STEUERB_R :=MB1            //Control bits Receive_FC

U     M      3.0            //No SEND/RECEIVE processing
                            during start-up
SPB   schr

CALL  FC     1              //Receive data
 ADR          :=0           //1. DW in SEND/EMPF_DB
 SEND_DB      :=DB10        //Send_DB module
 EMPF_DB      :=DB11        //Empfang_DB module
 _DB          :=DB11        //Empfang_DB message
 ABD          :=W#16#14     //1. DW receive buffer
                            (DW20)
 ANZ          :=MW10        //Received data quantity
 EMFR         :=M1.0        //Receive completed
 PAFE         :=MB12        //Error byte
 GEEM         :=MW100       //Data used internally
 ANZ_INT      :=MW102       //Data used internally
 empf_laeuft  :=M1.1        //Data used internally
 letzter_block:=M1.2        //Data used internally
 fehl_empf    :=M1.3        //Data used internally


U     M      1.0            //Receive complete
R     M      1.0            //clear receive complete
```

```
      CALL  FC     0             //Send Data
       ADR          :=0          //1. DW in SEND/EMPF_DB
       SEND_DB      :=DB10       //Send_DB module
       EMPF_DB      :=DB11       //Empfang_DB module
       _DB          :=DB10       //Sende_DB message
       ABD          :=W#16#14    //1. DW send buffer
                                 (DW20)
       ANZ          :=MW14       //Send data quantity
       FRG          :=M2.0       //Specify send complete
       PAFE         :=MB16       //Error byte
       GESE         :=MW104      //Data used internally
       ANZ_INT      :=MW106      //Data used internally
       ende_kom     :=M2.1       //Data used internally
       letzter_block:=M2.2       //Data used internally
       senden_laeuft:=M2.3       //Data used internally
       fehler_kom   :=M2.4       //Data used internally


schr: CALL  "DPWR_DAT"           //Write data to module
       LADDR  :=W#16#100
       RECORD :=P#DB10.DBX 0.0 BYTE 16
       RET_VAL:=MW102



Program in start-up OB100

      UN    M      3.0
      S     M      3.0           //CPU will start-up
```

Technical data

CP 240 with 20mA/RS232C interface

Electrical data	VIPA 240-1BA00
Number of channels	1
Power supply	5V via back panel bus
Current consumption	200mA max.
ext. power supply	24V-supplyfor active 20mA interface connected to pin 11 (+24V) and pin 22 (common 24V) of socket on the front to generate the 20mA current.
Isolation	none
Status indicator (LED's)	By means of LED on the front
Connectors / interfaces	25pin D-type socket for RS232C and 20mA (switchable)
	ASCII-transfer, 3964(R), 3964(R) with RK512
Data transfer rate 20mA	19200 bit per second max. for a distance of 400 meter max.
Data transfer rate RS232C	max. 115200 Bit per second
Stop bits	1, 1.5, 2 (configurable)
Parity	none, even, odd (configurable)
Flow control	none, hardware, XON/XOFF
ZVZ	values from 0 to 5s
Programming data	
Input data	16 bytes
Output data	16 bytes
Parameter data	8 bytes
Diagnostic data	4 bytes
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	80 g

CP 240 with RS422/485-interface

Electrical data	VIPA 240-1CA00
Number of channels	1
Power supply	5V via back panel bus
Current consumption	200mA max.
ext. power supply	-
Isolation	>= 500V AC, according to DIN 19258
Status indicator (LED's)	By means of LED on the front
Connectors / interfaces	25pin D-type socket for RS422/RS485
	ASCII-transfer, 3964(R), 3964(R) with RK512
Data transfer rate	57600 bit per second max. for a distance of 1200 meters max.
Stop bits	1, 1.5, 2 (configurable)
Parity	none, even, odd(configurable)
Flow control	none, hardware, XON/XOFF
ZVZ	values from 0 to 5s
Programming data	
Input data	16 bytes
Output data	16 bytes
Parameter data	8 bytes
Diagnostic data	4 bytes
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	80 g

Chapter 8 Counter module

Overview

This chapter contains information on the interfacing and configuration of the SSI-module FM 250 S.

The different operating modes and counting options are described for the counter module FM 250, i.e. the behavior of the counter when the different input signals are connected.

Below follows a description of:

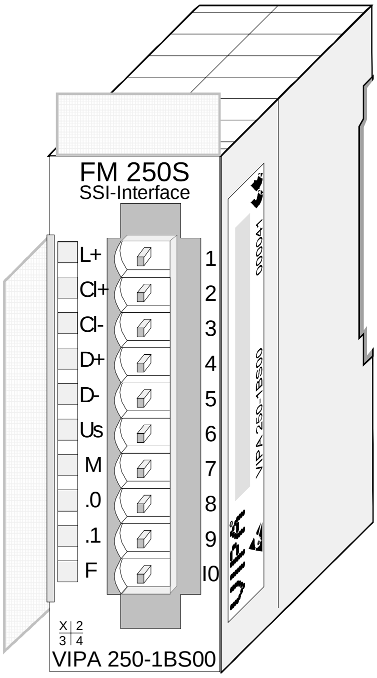
- SSI module FM 250S
- Counter module FM 250
- Technical data

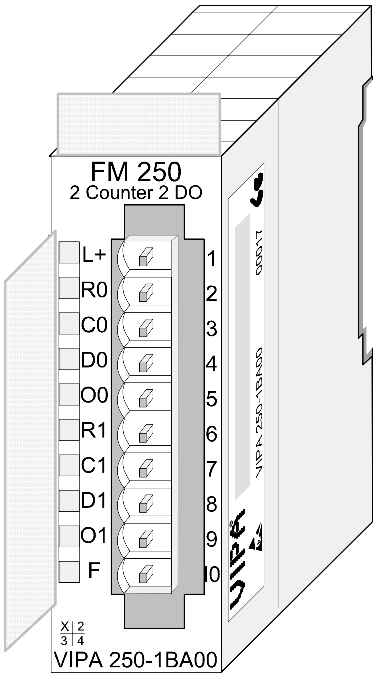
Contents

System overview

Here follows a summary of the measurement modules that are currently available from VIPA:

SSI-Interface FM 250 S, counter module FM 250





Ordering details

Type	Order number	Description
FM 250S	VIPA 250-1BS00	SSI-Interface
FM 250	VIPA 250-1BA00	Counter module (2 counter 2 DO)

SSI-Interface FM 250S

Principles

The SSI interface is a synchronous serial interface. SSI is the abbreviation for **S**ynchronous **S**erial **I**nterface. The SSI module provides the connection for transducers with absolute coding and a SSI interface.

The module converts the serial information of the transducer into parallel information for the controller. Data can be transferred in Gray- or in binary code.

Configurable outputs

The interface has connections for the SSI signals, clock, data and the transducer supply voltage as well as two additional outputs that may be set or reset when a limit value is exceeded.

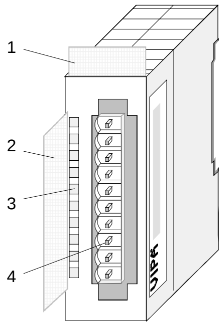
Output 0 can also be programmed as hold input. This causes the SSI transducer value to be frozen when a 24V high level is applied to output 0. A low level will cause the transducer to transmit the actual SSI values.

You can also configure the outputs that they will remain set if the BASP signal is active.

Properties

- Wiring does not depend on the length of the data word. The interface always uses 4 wires.
- Maximum security due to the use of symmetrical clock and data signals.
- Secure data acquisition die to the use of single-step Gray-code (configurable).
- Galvanic isolation of receiver and encoder by means of opto-couplers.
- 1 SSI-channel
- Direct power supply to the SSI transducer via front plug
- 24V DC power supply
- Baudrate selection between of 100 kBaud and 600 kBaud
- 2 configurable digital outputs, one may be used as hold-input to freeze the current SSI transducer value, configurable
- Measured value available in Gray or in binary code
- 4 bytes of parameter data
- 4 bytes of input data
- 4 bytes of output data
- Configuration by means of control byte

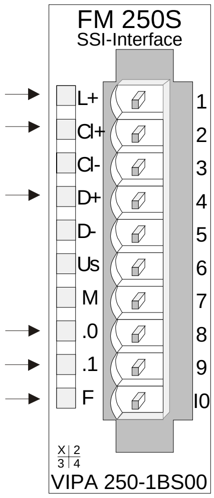
Construction



[1] Label for module name
[2] Label for bit-address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

LED	Description
L+	LED (yellow) Supply voltage available
Ci+	LED (green) Clock output
D+	LED (green) Transducer data input
.0	LED (green) Input/output 0
.1	LED (green) Input/output 1
F	LED (red) Error /overload



Pin	Assignment
1	Supply voltage +24V DC
2	CLK+
3	CLK-
4	DIR+
5	DIR-
6	SSI transducer supply voltage
7	Common SSI transducer supply
8	Input/outp. .0 and hold input
9	Input/ outp. .1
10	Common of supply voltage

LED's

The SSI-Interface has a number of LED's. The following table explains the significance of these LED's:

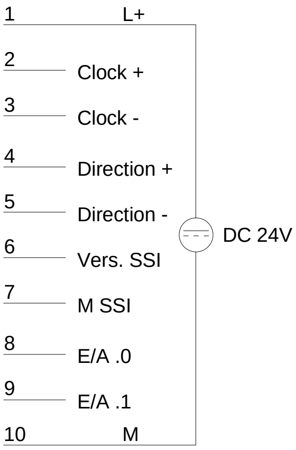
Name	Color	Description
L+	yellow	Indicates that 24V power is available
C+	green	ON when clock pulses are transmitted OFF when hold function has been activated and 24V at I/O .0
D+	green	ON when data is received from the transducer (wiring test)
.0	green	ON when 24V power is available at I/O .0
.1	green	ON when 24V power is available at I/O .1
F	red	ON when short circuit or overload is detected on one of the two I/O .0/.1

Line distances

The Baudrate depends on the length of the communication line and on the SSI transducer. Wiring must consist of screened twisted pair cables. The specifications below are only intended as a guideline.

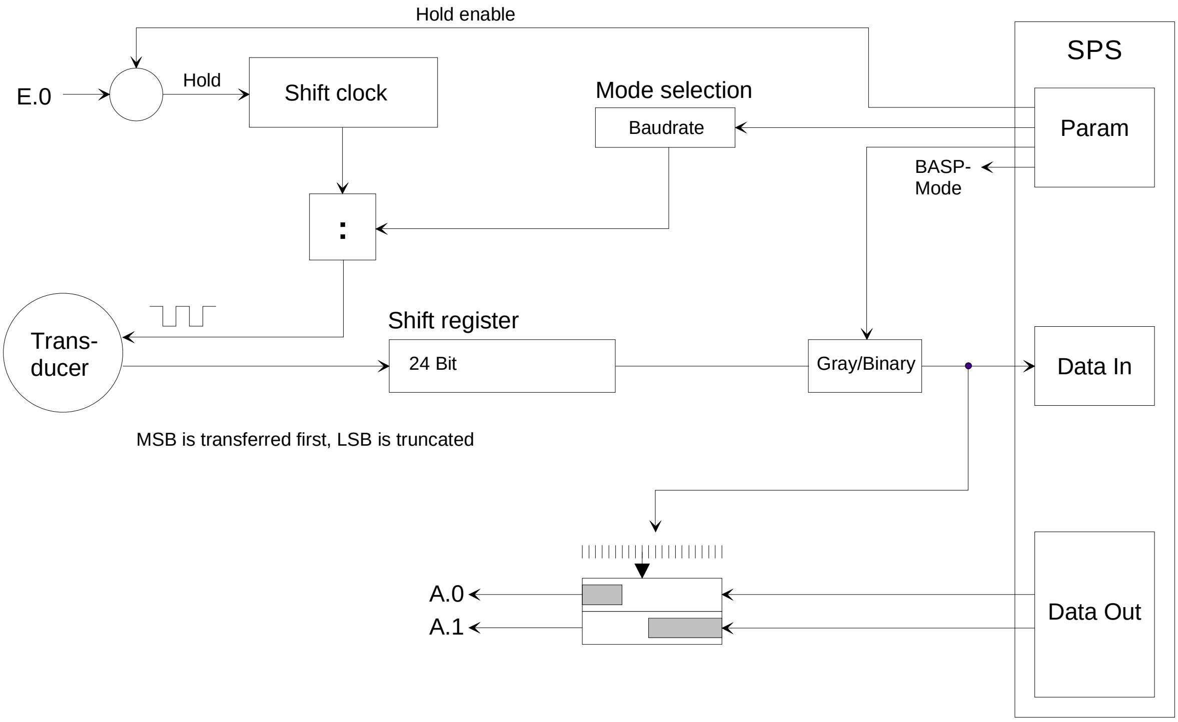
< 400m:	→	100kBaud
< 100m:	→	300kBaud
< 50m:	→	600kBaud

Wiring diagram



The SSI interface has an internal power supply. This power supply requires a voltage of 24V DC via L+ and M.
The supply voltage provides power to the interface electronics as well as the SSI transducer connected to terminals 6 and 7.

Block diagram



Configuration data

4 bytes of configuration data are transferred. In these bytes you can define the Baudrate, the coding and the analysis of the combined I/O .0 as well as the BASP-signal.

The structure of the configuration data is as follows:

Byte	Bit 0 ... Bit 7
0	Bit 0 ... Bit 7: reserved
1	Bit 0 ... Bit 7: reserved
2	Baudrate 0: 300 kBaud (default) 1: 100 kBaud 2: 300 kBaud 3: 600 kBaud 4...255: 300 kBaud
3	Bit 0: Coding 0: Binary-code (default) 1: Gray-code Bit 2: SSI-Format 0: Multiturn (24 bit) 1: Singleturn (12 bit) Bit 4: Hold-function 0: deactivate 1: activate Bit 7: BASP-signal 0: ignore 1: analyze

Parameter

Baudrate

The transducer connected to the SSI interface transmits serial data. It requires a clock pulse from the SSI interface. The Baudrate defines this clock. You must choose a value of 100, 300 and 600 kBaud. The default setting is 300 kBaud.

Coding

The Gray-code is a different form of binary code. The principle of the Gray-code is that two neighboring Gray-numbers will differ in exactly one single bit.

When the Gray-code is used, transmission errors can be detected easily as neighboring characters may only be different in a single location.

Table of rules for the Gray-code:

Decimal	Gray-Code
0	0 0 0 0
1	0 0 0 1
2	0 0 1 1
3	0 0 1 0
4	0 1 1 0
5	0 1 1 1
6	0 1 0 1
7	0 1 0 0
8	1 1 0 0
9	1 1 0 1
10	1 1 1 1
11	1 1 1 0
12	1 0 1 0
13	1 0 1 1
14	1 0 0 1
15	1 0 0 0

i.e. the last digit of the number results from the vertical repetition of the sequence "0 11 0", the penultimate digit results from the repetition "00 1111 00", the third-last number from the repetition of 4x"0", 8x"1" and again 4x"0", etc. (see columns in the table!).

Hold function

Here you can define that I/O .0 should be used as hold input. When you have activated this function, the current transducer value will be stored when I/O .0 is connected to 24V. The transducer value is only updated when the 24V level is removed from I/O .0.

In this case you must be aware that I/O .0 operates only in input mode.

BASP signal

BASP is a German abbreviation for command output inhibited, i.e. all outputs are reset and inhibited as long as the BASP signal is applied via the back panel bus. You can disable the evaluation of the BASP signals by setting this bit. This means that the outputs will remain set.

Access to the SSI Interface

Input data (Data In)

The input data from the SSI transducer has a length of 4 bytes. Byte 0 can be used as an I/O status indicator for the. Data is supplied in binary or in Gray-code, depending on the selected mode.

Byte	**Data In**
0	Bit 0: Status I/O .0. The status feedback only occurs when this output double-word for the respective I/O was preset! Bit 1: Status I/O .0. The status feedback only occurs when this output double-word for the respective I/O was preset! Bit 2-7: reserved
1	SSI transducer value: HB
2	SSI transducer value: MB
3	SSI transducer value: LB

Output data (Data Out)

Data Out provides the option of controlling the 2 I/O ports on the SSI interface depending on the value of a transducer input. Output data consists of 4 bytes.

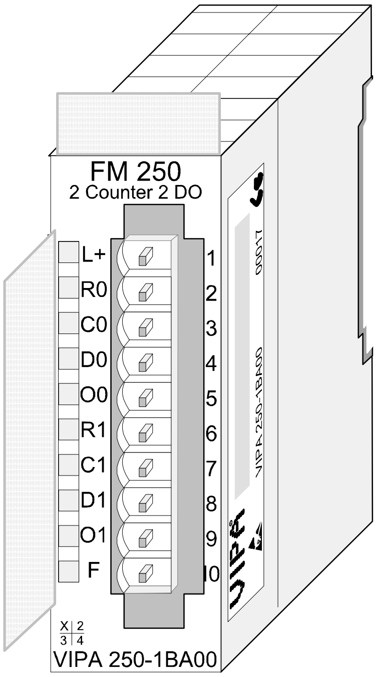
The SSI transducer stores 8 bytes of output data, i.e. you can define two comparative values along with the respective control-byte.

In the control byte you can specify how the reference value should affect which output and whether the status of the I/Os should be signaled via the input bytes.

The following table shows the assignment of these output bytes.

Byte	**Data Out**
0	Bit 0-1: preset value 00: no preset value 01: for output 0 10: for output 1 11: for both outputs Bit 2: status transfer into input data area 0: no status transfer 1: status transfer to input area Bit 3: set conditions for output 0: when actual value exceeds comparison value 1: when actual value is less than comparison value Bit 4-7: reserved
1	Comparison value: HB
2	Comparison value: MB
3	Comparison value: LB

Counter module FM 250



Note!

The following information is only applicable to counter modules with *order no.: VIPA 250-1BA00 and a revision level 5 and higher*.

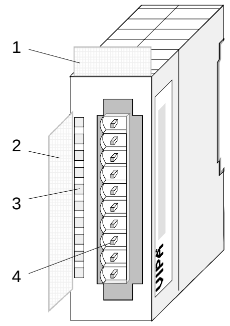
The counter module accepts the signals from transducers connected to the module and processes these pulses in accordance with the selected mode of operation. The module has 2 channels with a data resolution of 32 bit each.

These modules provide 24 counter modes and one 24V output per channel that is controlled in accordance with the selected mode.

Properties

- two 32 bit channels
- 24V DC supply voltage or via back panel bus
- freely configurable 24V DC outputs (0,5A max.)
- Counters and compare registers are loaded by means of a control byte
- Standard up-down counter with a resolution of 32 bits or 16 bits
- Comparison and auto-reload functions
- Different modes for encoder pulses
- Pulse-width measurements and frequency measurements

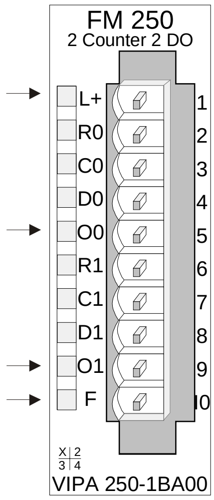
Construction



[1] Label for module name
[2] Label for bit-address with description
[3] LED status indicator
[4] Edge connector

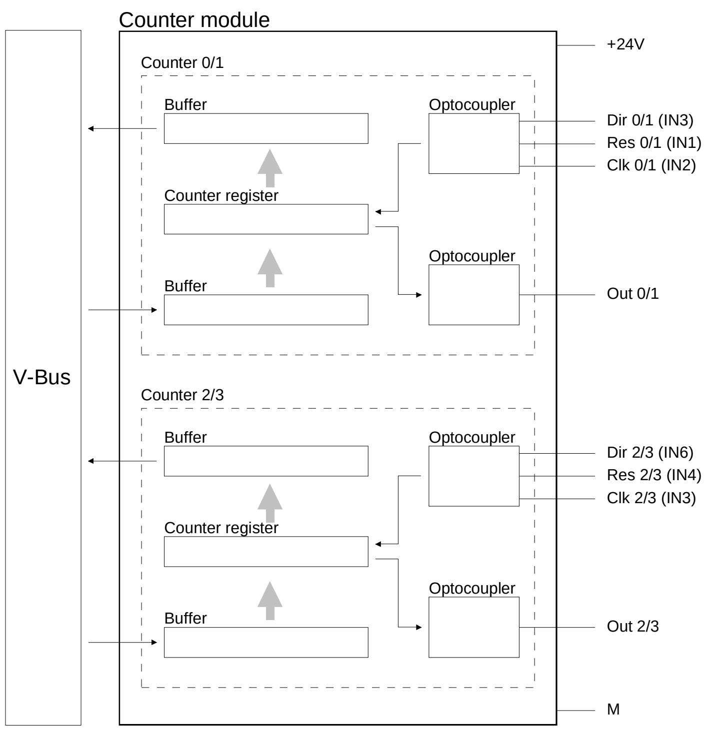
Status indicator pin assignment

LED	Description
L+	LED (yellow) Supply voltage available
O0	LED (green) Output counter 0
O1	LED (green) Output counter 1
F	LED (red) Error /overload



Pin	Assignment
1	Supply voltage +24V DC
2	IN1 input 1 counter 0/1
3	IN2 input 2 counter 0/1
4	IN3 input 3 counter 0/1
5	OUT0 output counter 0/1
6	IN4 input 4 counter 2/3
7	IN5 input 5 counter 2/3
8	IN6 input 6 counter 2/3
9	OUT1 output counter 2/3
10	Common of supply voltage

Block diagram



Access to the counter module

The module has 2 channels with a resolution of 32 bits each. You can use parameters to specify the mode for each channel. The pin-assignment for the channel is dependent upon the selected mode (see description of modes).

10 data bytes are required for the data input and output. Data output to a channel of a counter requires 10 bytes, for example for defaults or for comparison values. In the latter case byte 9 (control) is used to initiate a write operation into the required registers of the counter as every counter word is associated with a bit in the 9th byte. The respective values are transferred into the counter registers when they are toggled (0→1).

The 10th byte (status byte) controls the behavior of the counter during a restart of the next higher master module. You can set the counter level to remanent by means of a combination of bits 0 and 1; i.e. the original counter level will not be reset when the next higher master module restarts.

The following combinations are possible:

Bit 0=1, bit 1=0	counter value is remanent during restart
Bit 0=x, bit 1=1	counter value is reset during restart (default)

You can check your settings at any time by reading byte 10 of the output data.

Data sent to module

00h	DE0	Zähler 0/1
01h	DE1	
02h	DE2	
03h	DE3	
04h	DE4	Zähler 2/3
05h	DE5	
06h	DE6	
07h	DE7	
08h	Control	
09h	Status	

Data received from module

00h	DA0	Zähler 0/1
01h	DA1	
02h	DA2	
03h	DA3	
04h	DA4	Zähler 2/3
05h	DA5	
06h	DA6	
07h	DA7	
08h		
09h	Status	

Configuration parameters

The configuration parameters consist of 2 bytes. You must use these bytes to define the operating mode of each channel by means of a mode number. This chapter contains a detailed description of the different modes towards the end. The different combinations of the various modes are available from the table on the next page. The procedure for the transfer of parameter-bytes is available from the description for the System-200V bus coupler or the master system.

	7							0	bit no.
Parameter byte 1									Modue (0 ... 26) counter 0

	7							0	bit no.
Parameter byte 2									Modue (0 ... 26) counter 1

Summary of counter modes and interfacing

Mode	may be combi ned	Function	IN1	IN2	IN3	IN4	IN5	IN6	OUT0	OUT1	Auto Re-load	Com-pare Load
			Counter 0/1			**Counter 2/3**						
0	yes	32 bit counter	RES	CLK	DIR	RST	CLK	DIR	=0	=0	no	=0
1	yes	Encoder 1 edges	RES	A	B	RST	A	B	=0	=0	no	=0
3	yes	Encoder 2 edges	RES	A	B	RST	A	B	=0	=0	no	=0
5	yes	Encoder 4 edges	RES	A	B	RST	A	B	=0	=0	no	=0
			Counter 1 counter 0			**Counter 3 counter 2**						
8	yes	2x16 bit counter up/up	-	CLK	CLK	-	CLK	CLK	-	-	no	no
9	yes	2x16 bit counter down/up	-	CLK	CLK	-	CLK	CLK	-	-	no	no
10	yes	2x16 bit counter up/down	-	CLK	CLK	-	CLK	CLK	-	-	no	no
11	yes	2x16 bit counter down/down	-	CLK	CLK	-	CLK	CLK	-	-	no	no
			Counter 0/1			**Counter 2/3**						
12	yes	32 bit counter up + gate	RES	CLK	Gate	RST	CLK	Gate	=comp	=comp	no	yes
13	yes	32 bit counter down + gate	RES	CLK	Gate	RST	CLK	Gate	=comp	=comp	no	yes
14	yes	32 bit counter up + gate	RES	CLK	Gate	RST	CLK	Gate	=comp	=comp	yes	yes
15	yes	32 bit counter down + gate	RES	CLK	Gate	RST	CLK	Gate	=comp	=comp	yes	yes
			Combination of counter 0 ... 3									
16	no	Frequency measurement	RES	CLK	Start	Stop	-	-	Meas. active	Meas. compl.	no	yes
17	no	Period measurement	RES	CLK	Start	Stop	-	-	Meas. active	Meas. compl.	no	yes
18	no	Frequency measurement with gate-output	RES	CLK	Start	Stop	-	-	Meas. gate	Gate	no	yes
19	no	Period measurement with gate-output	RES	CLK	Start	Stop	-	-	Meas. gate	Gate	no	yes
			Counter 0/1			**Counter 2/3**						
6	yes	Pulse low, 50kHz with Direction Input	RES	Pulse	DIR	RES	Pulse	DIR	-	-		
20	yes	Pulse low, prog. time-base with Direction Input	RES	Pulse	DIR	RES	Pulse	DIR	-	-		
21	yes	Pulse low, up, prog. time-base with Gate	RES	Pulse	Gate	RES	Pulse	Gate	-	-		
22	yes	Pulse high, up, prog. time-base with Gate	RES	Pulse	Gate	RES	Pulse	Gate	-	-		
			Counter 0/1			**Counter 2/3**						
23	yes	One Shot, up, Set	RES	CLK	Gate	RES	CLK	Gate			no	yes
24	yes	One Shot, down, Set	RES	CLK	Gate	RES	CLK	Gate			no	yes
25	yes	One Shot, up, Reset	RES	CLK	Gate	RES	CLK	Gate			no	yes
26	yes	One Shot, down, Reset	RES	CLK	Gate	RES	CLK	Gate			no	yes

Due to technical advances the revision level and the functionality of the counter module was continuously expanded. Below follows a list that allocates the different modes to the revision level:

Mode 0-5	revision level 3
Mode 0-17	revision level 4
Mode 0-19	revision level 5
Mode 6, 20-26	revision level 6/7

Terminology:

RES

RESET-Signal that must be LOW during the measuring process. A HIGH level erases one or both counters, depending on the selected mode.

CLK

The clock signal from the transducer

Start or Stop

A HIGH-level starts or stops the counter. When the start level is active the counter will start with the next CLK-pulse that corresponds to the selected mode.

DIR

In mode 0 the level of the DIR signal determines the direction of the counting process.

LOW level: count up

HIGH level: count down

Auto Reload

The Auto-Reload function transfers a user-defined value into the counter when the counter reaches the number contained in the compare-register.

Compare Load

You can use the compare function to specify a comparison value for the counter. Depending on the selected mode an output is activated or the counter is re-started when the counter reaches this value.

Gate

Gate signal enabling the counter (mode 12 ... 15).

Measurement gate

Status indicator of the counter activity - is set to a HIGH level after the 1st CLK signal and LOW level after the last CLK signal (mode 18 ... 19).

Pulse

The pulse-width of the introduced signal is determined by means of the internal time base.

Fref

Reference- or clock frequency that is set permanently to 50kHz in mode 6.

The clock frequency Fref for counter mode 20, 21, 22 is programmable:

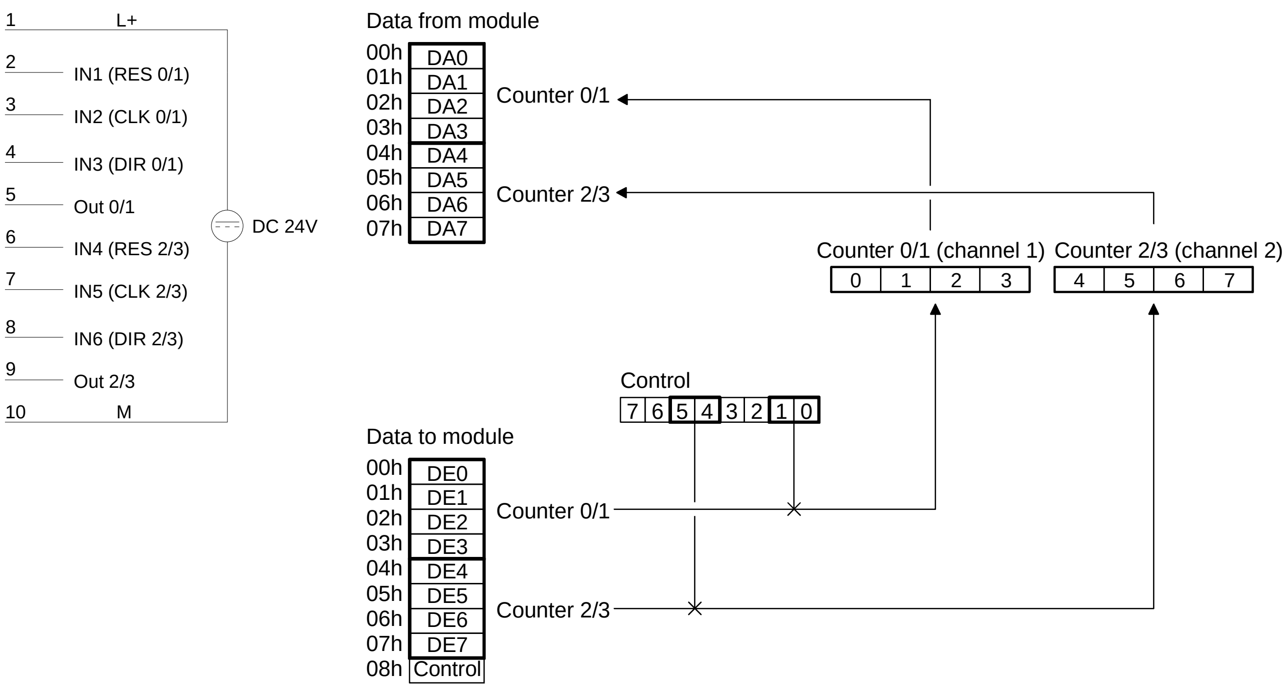
Parameter	Fref
0	10 MHz
1	1 MHz
2	100 kHz
3	10 kHz

Counter modes

Mode 0
32 bit counter

In mode 0 two counters (16 bit) are combined to produce a 32 bit counter. You determine the direction by means of the DIR input (IN3 or IN6). Every rising or falling edge of the input clock signal increments or decrements the counter. During the counting process the RES signal must be at a LOW level. If the RES signal is at a HIGH level the counter is cleared. When the counter reaches zero, output OUT of the respective counter is active for a minimum period of 100ms, even if the counter should continue counting. If the counter stops at zero the output remains active.

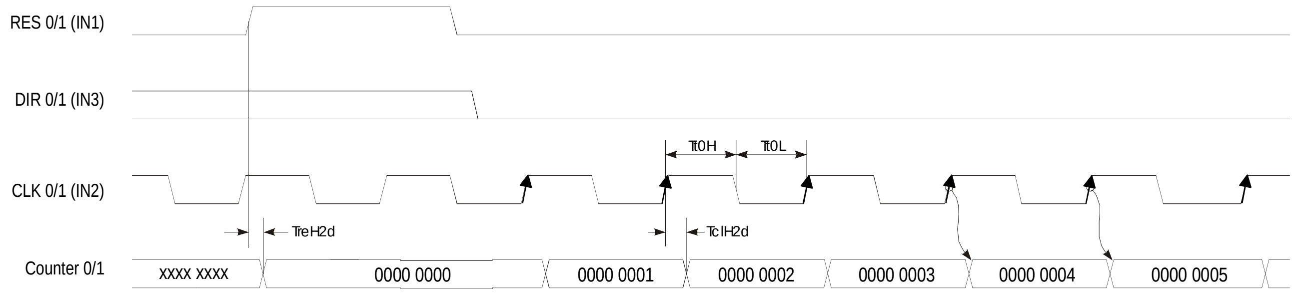
Pin assignment access to counter



Up-counter

In mode 0 a LOW level at the DIR input configures the counter for counting up.

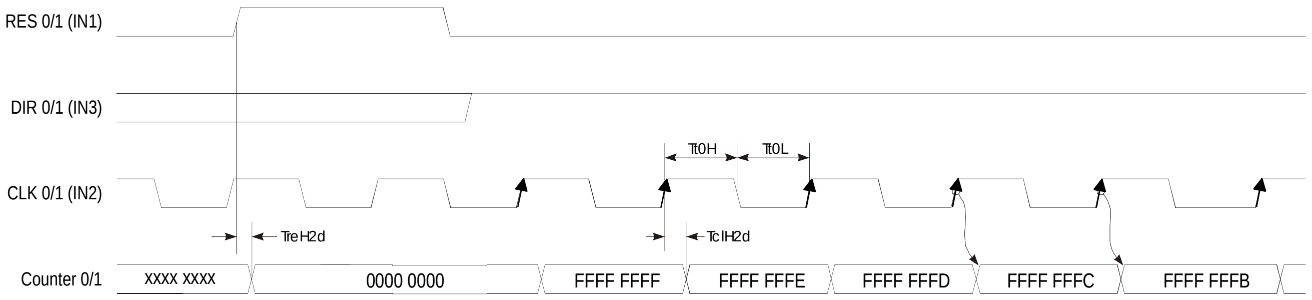
Timing diagram of the counter 0/1 example:



Down-counter

In mode 0 a HIGH level at the DIR input configures the counter for counting down.

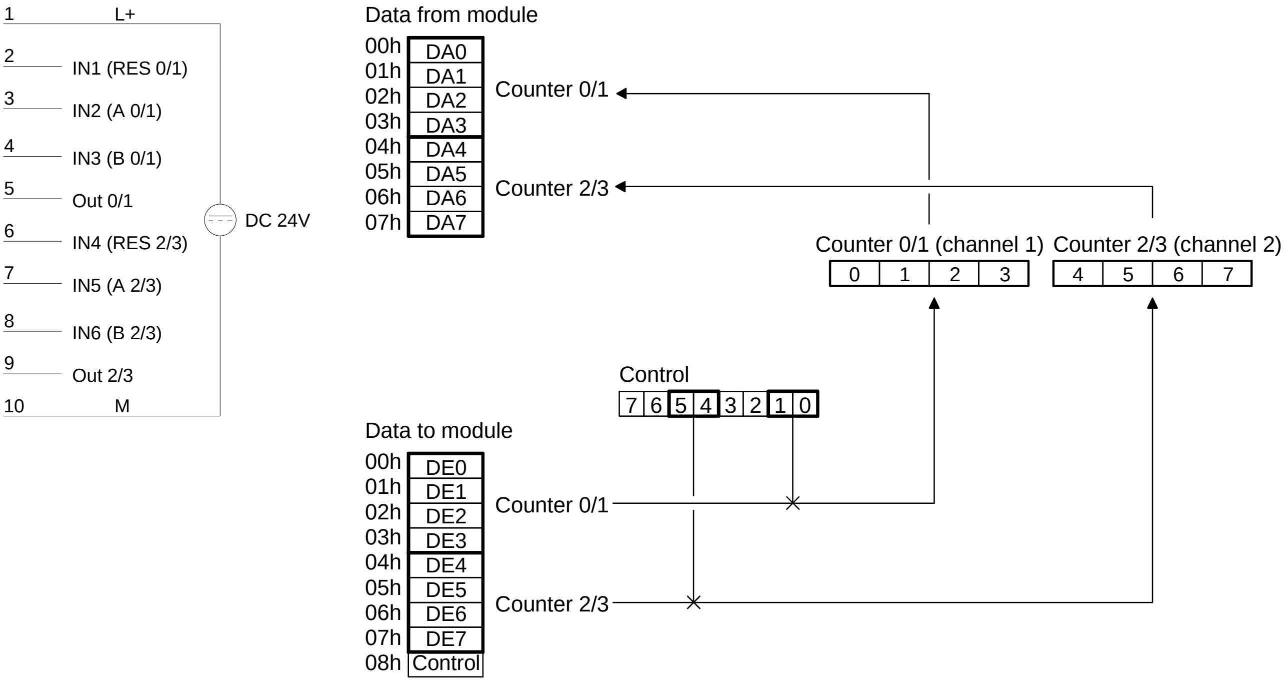
Timing diagram of the counter 0/1 example:



Mode 1 Encoder 1 edge

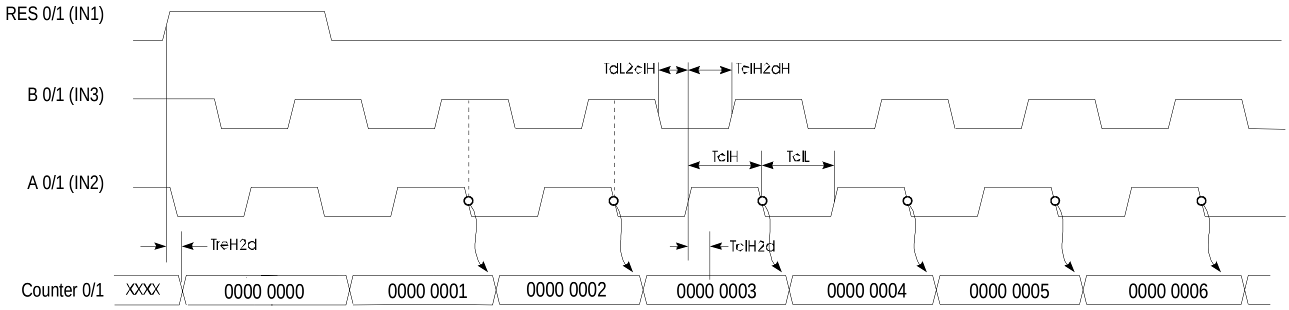
In mode 1 you can configure an encoder for one of the channels. Depending on the direction of rotation this encoder will increment or decrement the internal counter with every falling edge. The RES input must be at a low level during the counting process. A HIGH level clears the counter. When the counter reaches zero, output OUT of the respective counter is active for a minimum period of 100ms, even if the counter should continue counting. If the counter stops at zero the output remains active.

Pin assignment access to counter



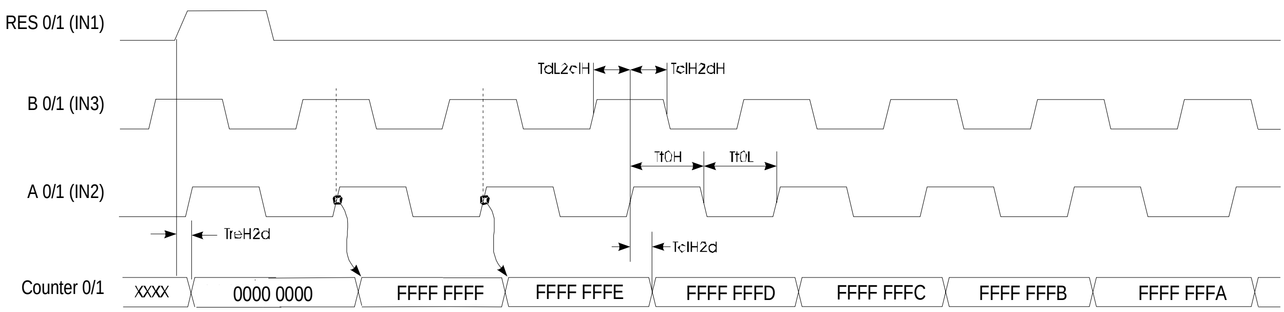
Up-counter

Every falling edge of the signal at input A increments the counter if input B is at HIGH level at this moment. Timing diagram for the counter 0/1 example:



Down-counter

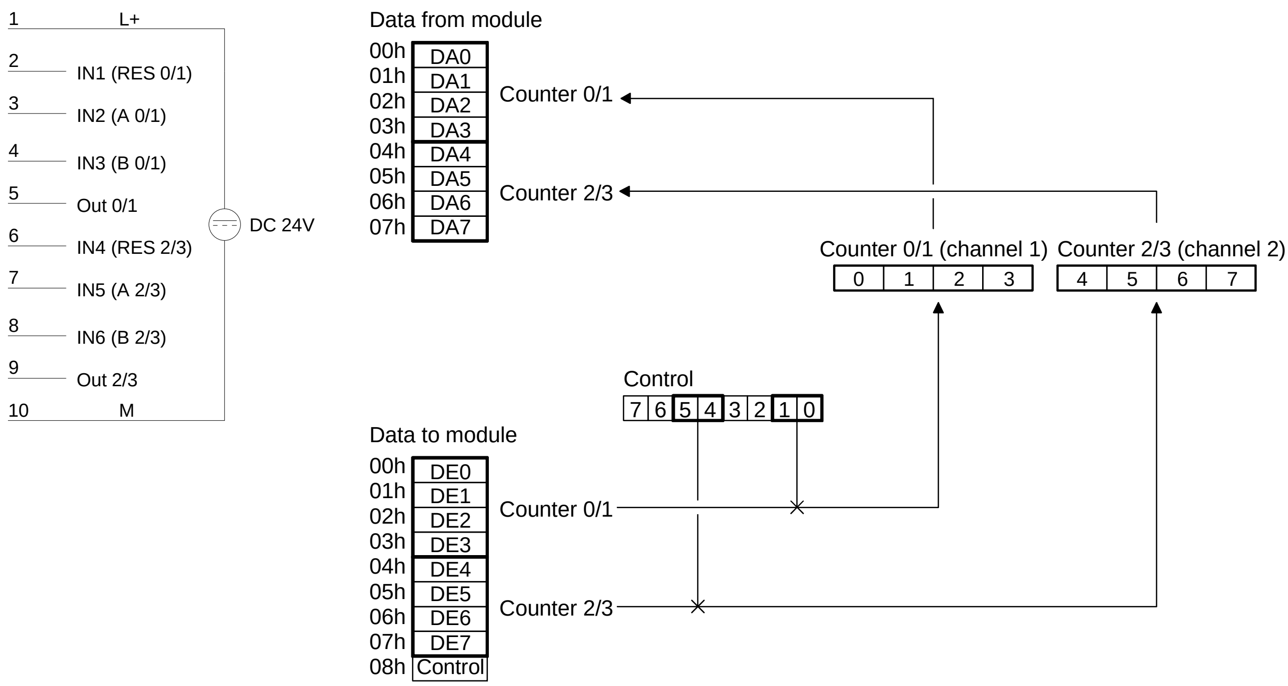
Every rising edge of the signal at input A decrements the internal counter if input B is at HIGH level at this moment. Timing diagram for the counter 0/1 example:



Mode 3
Encoder 2 edges

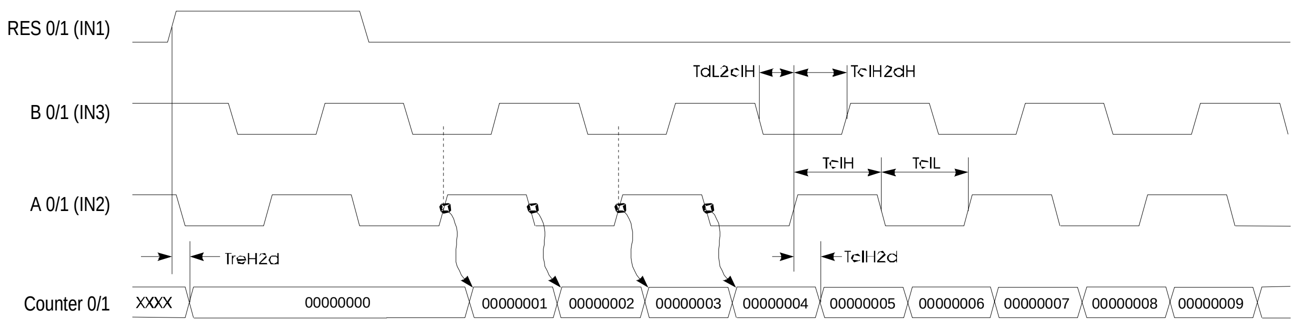
Every rising or falling edge of the signal at input A changes the counter by 1. The direction of the count depends on the level of the signal applied to input B. RES must be at a LOW level during the counting process. A HIGH level clears the counter. When the counter reaches zero, output OUT of the respective counter is active for a minimum period of 100ms, even if the counter should continue counting. If the counter stops at zero the output remains active.

Pin assignment
access to counter



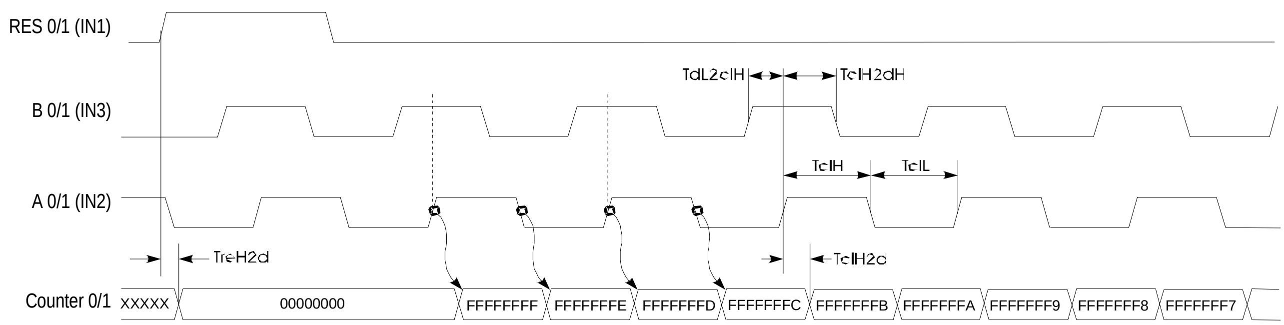
Up-counter

The counter is incremented by the rising edge of signal A if input B is at a LOW level or by the falling edge of input A when input B is at a HIGH level. Timing diagram for the counter 0/1 example:



Down-counter

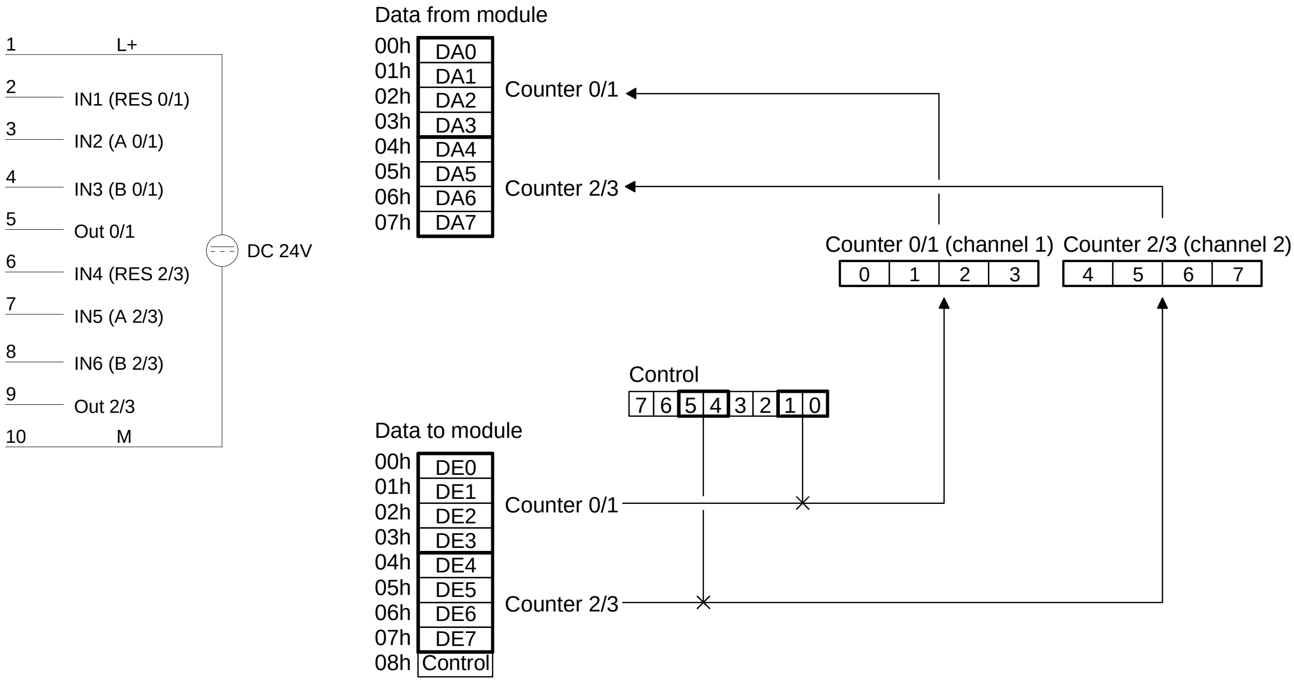
The counter is decremented by the rising edge of signal A if input B is at a HIGH level or by the falling edge of input A when input B is at a LOW level. Timing diagram for the counter 0/1 example:



Mode 5
Encoder 4 edges

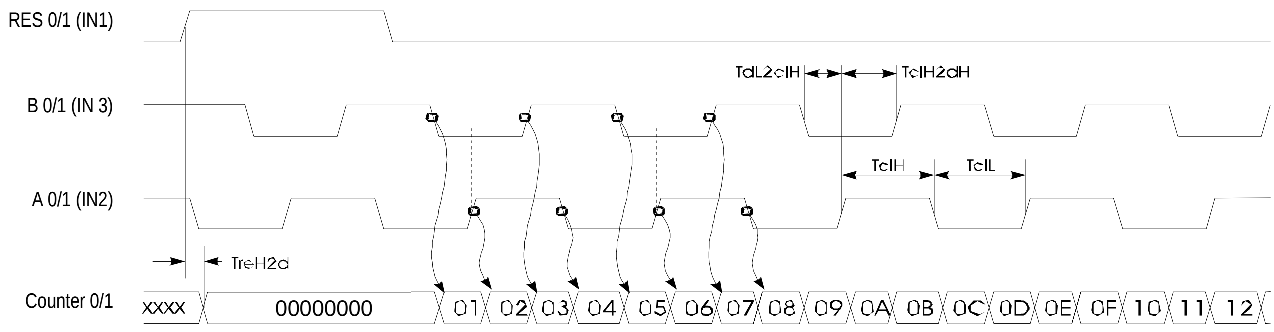
Every rising or falling edge at inputs A or B increments or decrements the counter. The direction depends on the level applied to the other input (B or A). RES must be at a LOW level during the counting process. A HIGH level clears the counter. When the counter reaches zero, output OUT of the respective counter is active for a minimum period of 100ms, even if the counter should continue counting. If the counter stops at zero the output remains active.

Pin assignment access to counter



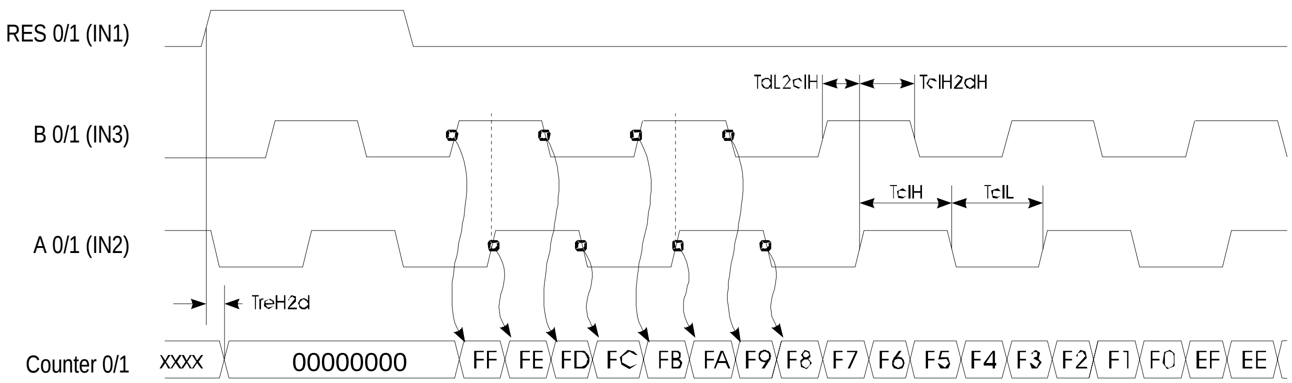
Up-counter

The counter is incremented when a rising edge is applied to B while input A is at a HIGH level or if a falling edge is applied to B when input A is at a LOW level. Alternatively it is also incremented when a rising edge is applied to A when input B is at a LOW level of by a falling edge at A when input B is at a HIGH level. Timing diagram for the counter 0/1 example:



Down-counter

The counter is decremented when a rising edge is applied to B while input A is at a LOW level or if a falling edge is applied to B when input A is at a HIGH level. Alternatively it is also decremented when a rising edge is applied to A when input B is at a HIGH level of by a falling edge at A when input B is at a LOW level. Timing diagram for counter 0/1 example:



Mode 6 pulse-width measurements, Pulse low, 50kHz with direction control

The pulse-width of a signal connected to the CLK input is determined by means of an internal time base and saved. The measurement is started with the falling edge of the input signal and it is stopped by the rising edge of the input. This saves the value in 20µs units in a buffer from where it can be retrieved (corresponds to f ref = 50kHz).

Input DIR determines the counting direction of the counter. If DIR is at a LOW level the counter counts up. A HIGH level lets the counter count down.

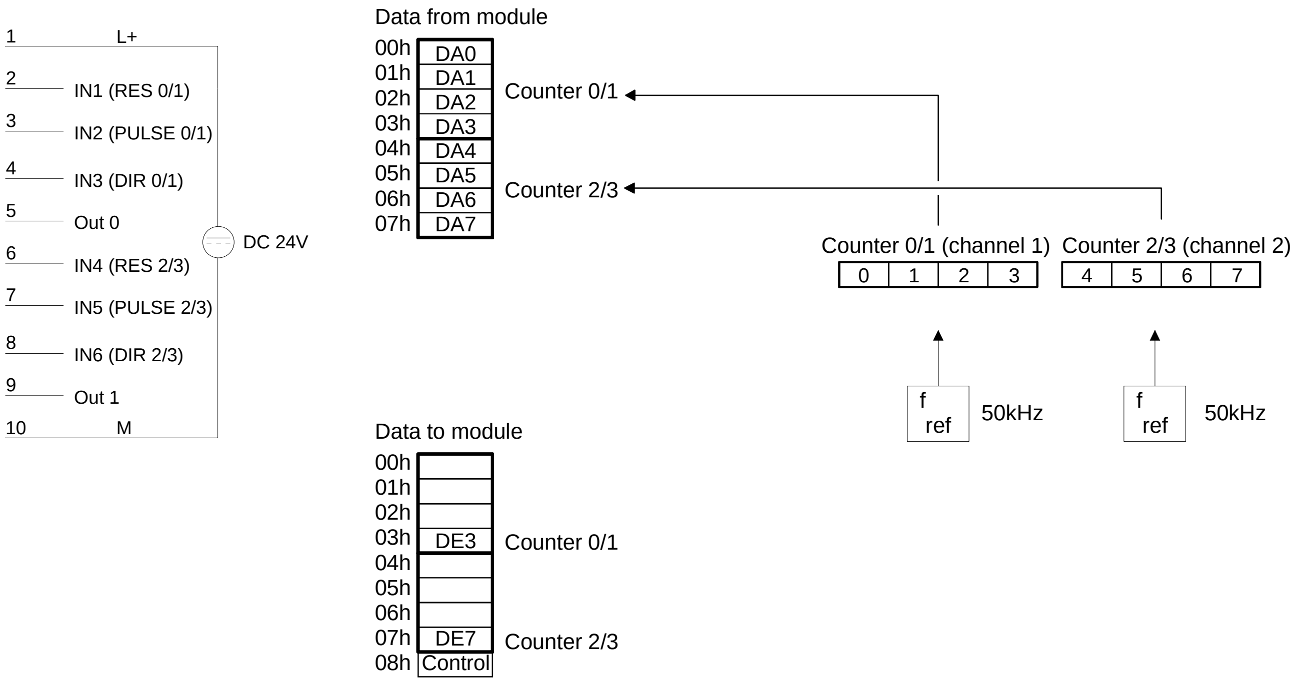
The input RES must be at a LOW level. A HIGH at this input would clear the counter.

With the rising edge of the signal pulse a result is transferred into the DA-area;

the result remains available until it is overwritten by the next new result.

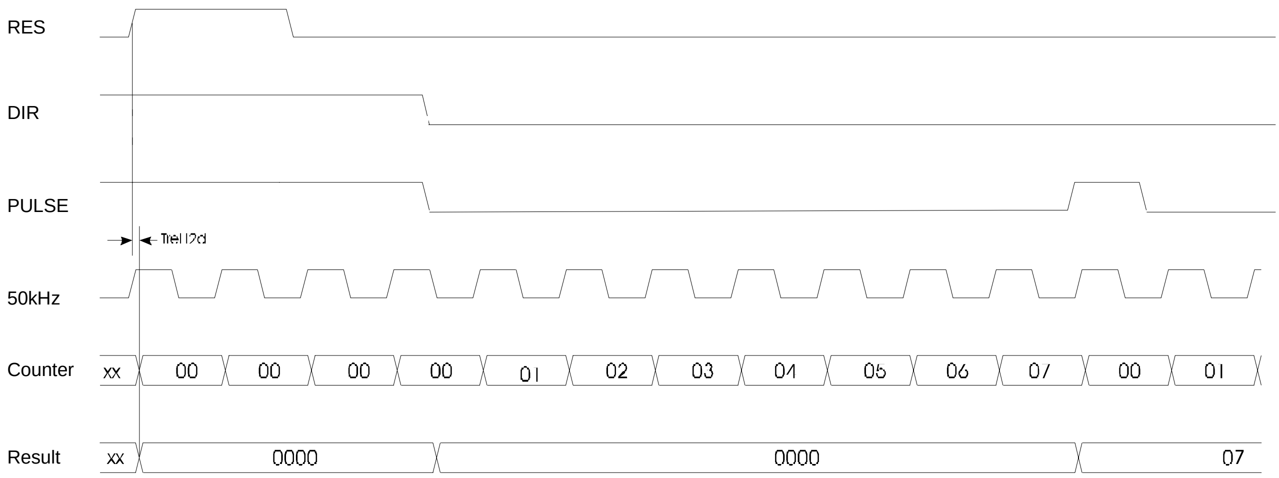
Signals Out 0 or Out 1 are not modified.

Pin assignment access to counter



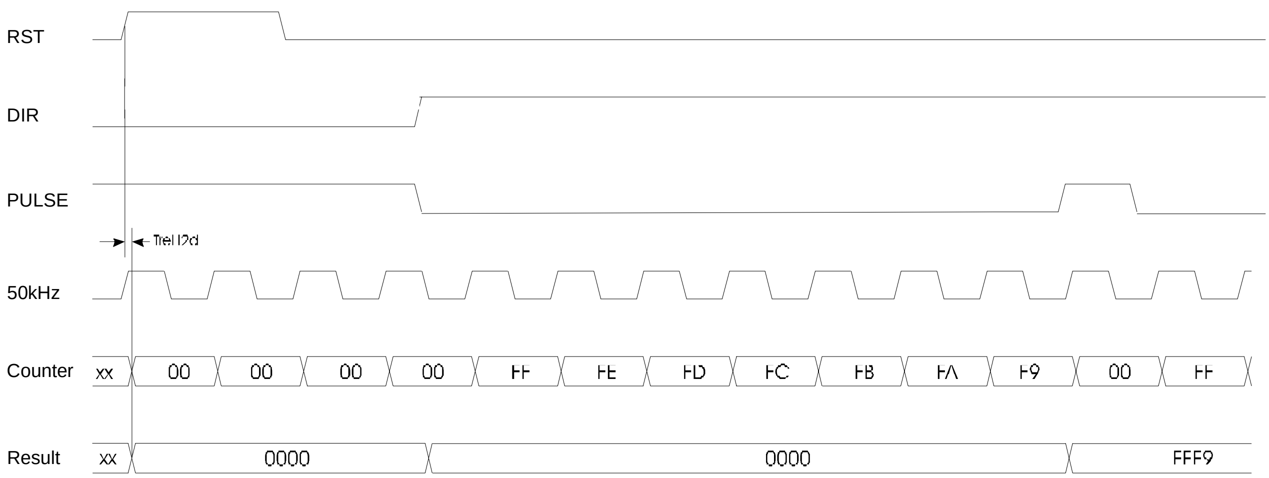
Up-counter

The RES-signal (R0) and the DIR-signal (D0) are reset. The measurement is started by the falling edge at input PULSE (C0) and the counter is clocked up by the 50kHz-clock. The rising edge of the signal at input PULSE (C0) terminates the count operation and the result is transferred into the result register. The result is available to the PLC. The value remains in the result register until a new measurement has been completed which overwrites the register.



Down-counter

The RES-signal (R0) is reset and the DIR-signal (D0) is placed at a HIGH level. The measurement is started by the falling edge at input PULSE (C0) and the counter is clocked down by the 50kHz-clock. The rising edge of the signal at input PULSE (C0) terminates the count operation and the result is transferred into the result register. The result is available to the PLC. The value remains in the result register until a new measurement has been completed which overwrites the register.



Mode 8 ... 11 two-input counter function

In this mode each channel provides 2 counters of 16 bits each. The rising edge of the input clock CLK x increments or decrements the respective counter. In this mode each counter can also be preset to a certain value by means of a control-bit. Outputs are not available. A RESET is also not available. The following combinations are possible for every channel:

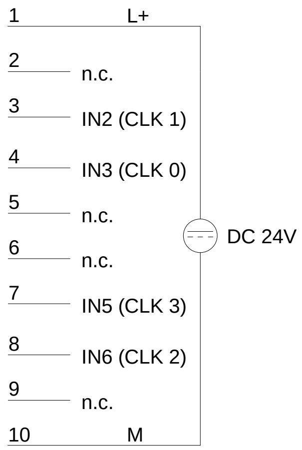
Mode 8 - counter 0/2 up, counter 1/3 up

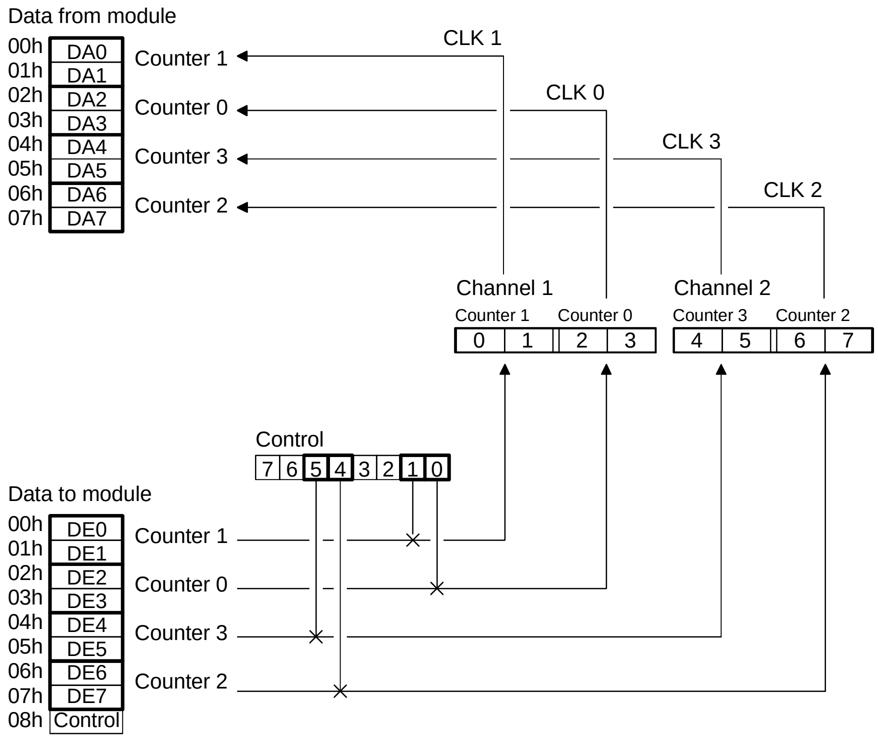
Mode 9 - counter 0/2 down, counter 1/3 up

Mode 10 - counter 0/2 up, counter 1/3 down

Mode 11 - counter 0/2 down, counter 1/3 down

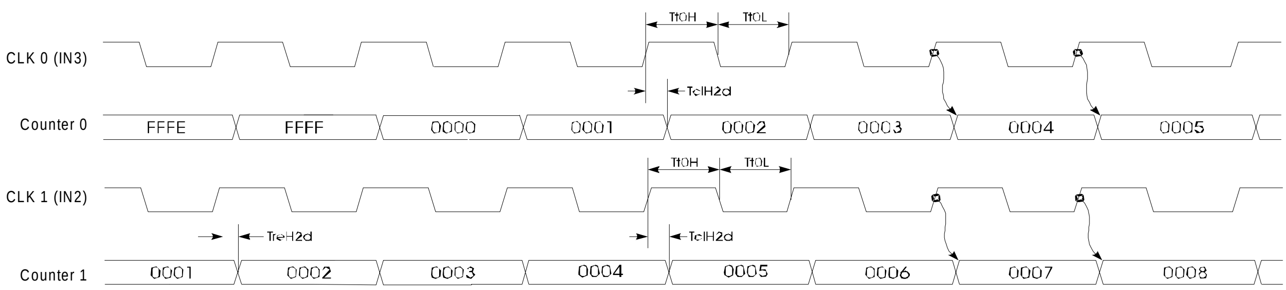
Pin assignment access to counter





Timing diagram

Below follows a timing diagram depicting an example of counter 0 and counter 1 in mode 8:



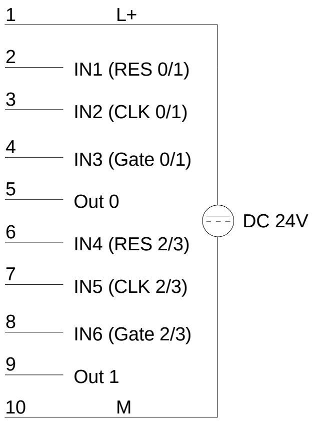
Mode 12 and 13 32 bit counter with gate

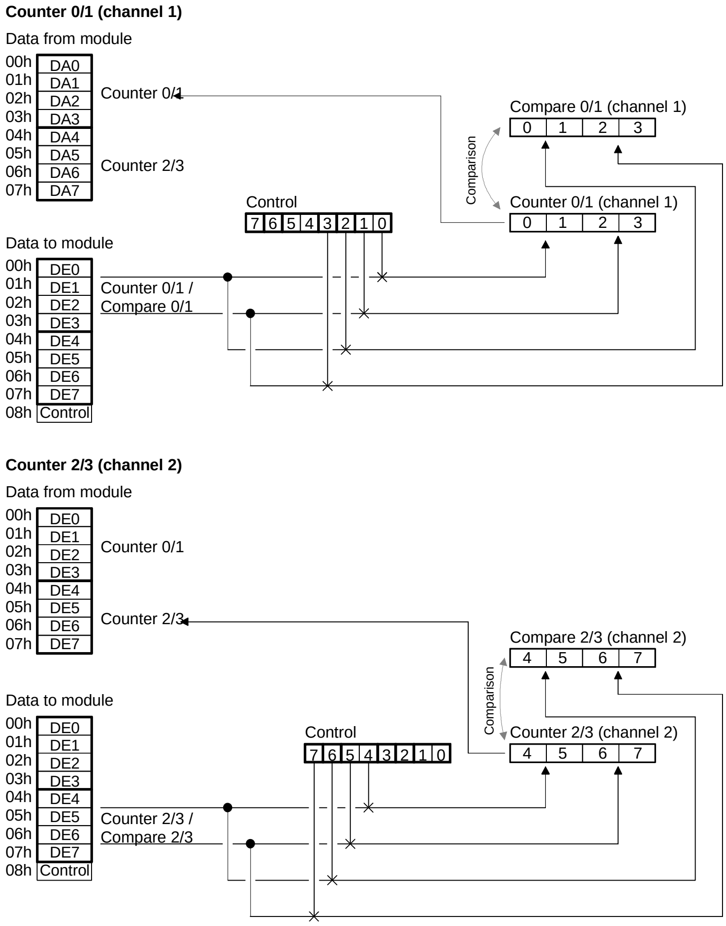
In mode 12 and mode 13 you can implement a 32 bit counter that is controlled by a gating signal (Gate). The direction of counting depends on the selected mode. Every rising edge of the input signal increments or decrements the counter provided that the Gate signal is at HIGH level. RES must be LOW during the counting process. A HIGH level clears the counter. When the counter reaches the value that was previously loaded into the compare register, output OUT is set active for a minimum period of 100ms while the counter continues counting.

Mode 12 - 32 Bit counter up + gate with compare

Mode 13 - 32 Bit counter down + gate with compare

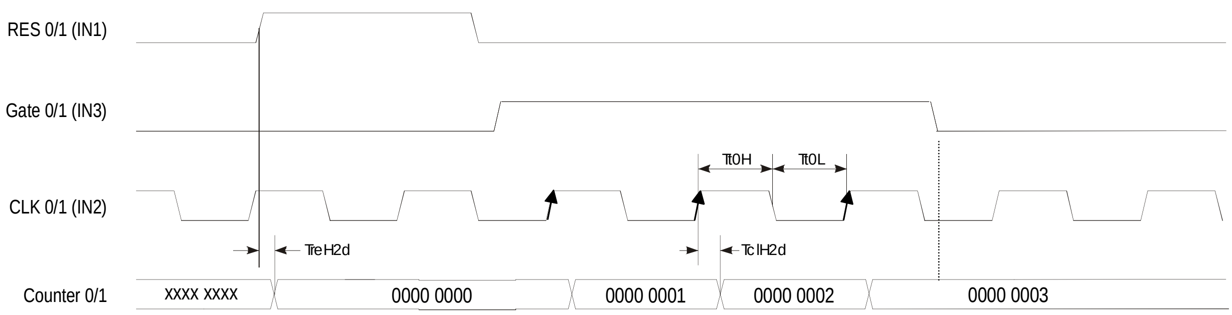
Pin assignment access to counter





Timing diagram

Below follows an example of a timing diagram of Counter 0/1 in mode 12:



Mode 14 and 15 32 bit counter with gate and Auto Reload

Modes 14 and 15 operate in the same manner as mode 12 and 13 with the addition of an Auto-Reload function. The "Auto Reload" is used to define a value in the load-register that is used to pre-set the counter automatically when it reaches the compare value.

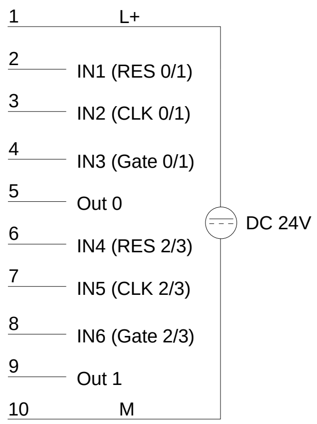
A HIGH pulse applied to RES clears the counter to 0000 0000. A HIGH level applied to GATE enables the counter so that is incremented/decremented by every rising edge of the CLK signal. As long as Gate is HIGH the counter will count every rising edge of the signal applied to CLK until the count is one less than the value entered into Compare. The next pulse overwrites the counter with the value contained in the Load register. This process continues until GATE is set to a LOW level. When an Auto Reload occurs the status of the respective output changes.

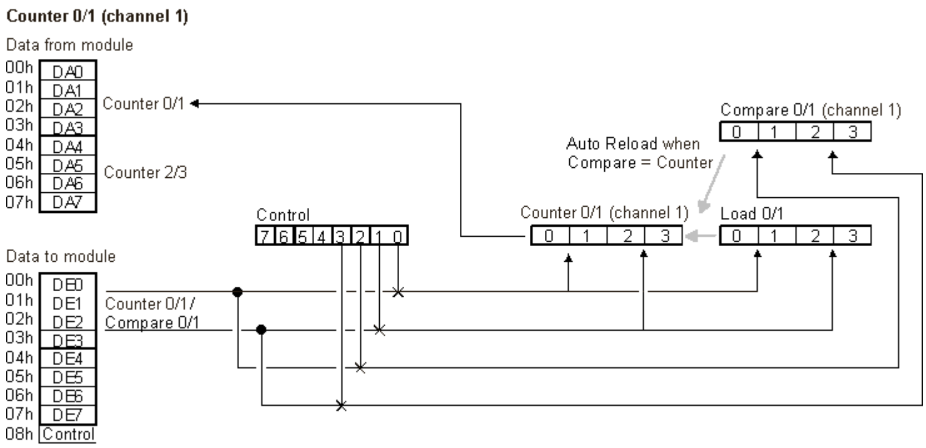
The RES signal only resets the counter and not the output signals.

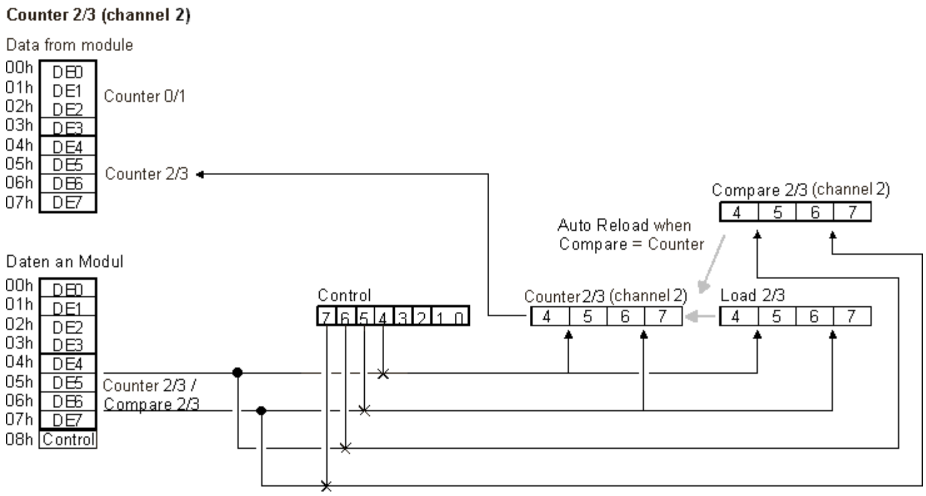
Mode 14 - 32 bit counter up + gate with compare and Auto-Reload

Mode 15 - 32 bit counter down + gate with compare and Auto-Reload

Pin assignment access to counter







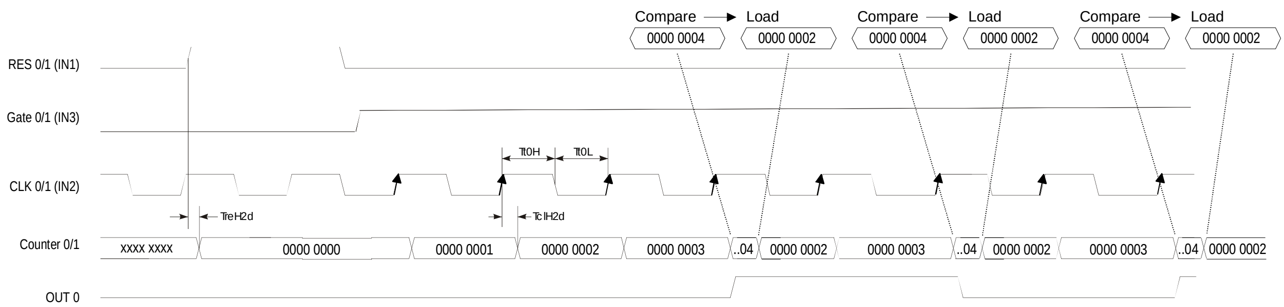
Example

This example is intended to explain the operation of the counters in mode 14 and 15.

A HIGH pulse applied to RES clears the counter to 0000 0000. A HIGH level applied to GATE enables the counter. As long as Gate is HIGH the counter will count every rising edge of the signal applied to CLK until the count is one less than the value entered into Compare. In this example the counter counts to 0000 0004 followed immediately by an "Auto Reload", i.e. the counter is pre-set to the contents of the Load register (in this case 0000 0002). The level of output OUT 0 changes every time an Auto Reload is executed.

In this example the counter counts from 0000 0002 to 0000 0004 as long as the GATE input is at a HIGH level.

Every Load operation changes the status of output OUT 0.



Mode 16 frequency measurement

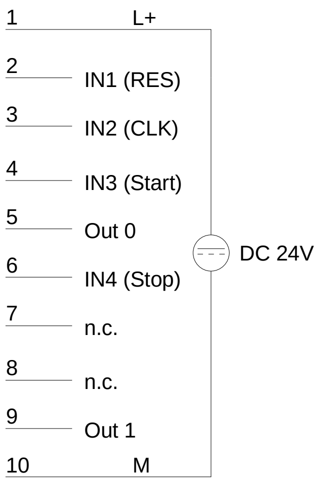
In this mode it is possible to determine the frequency of the signal that is applied to the CLK input. Counter 0/1 is provided with a reference signal by means of DE7 and a gate time that is controlled indirectly by the value n to determine the duration for which counter 2/3 is enabled. The value of n can range from 1 to 2^{32}-1 and it is loaded into the Compare register.

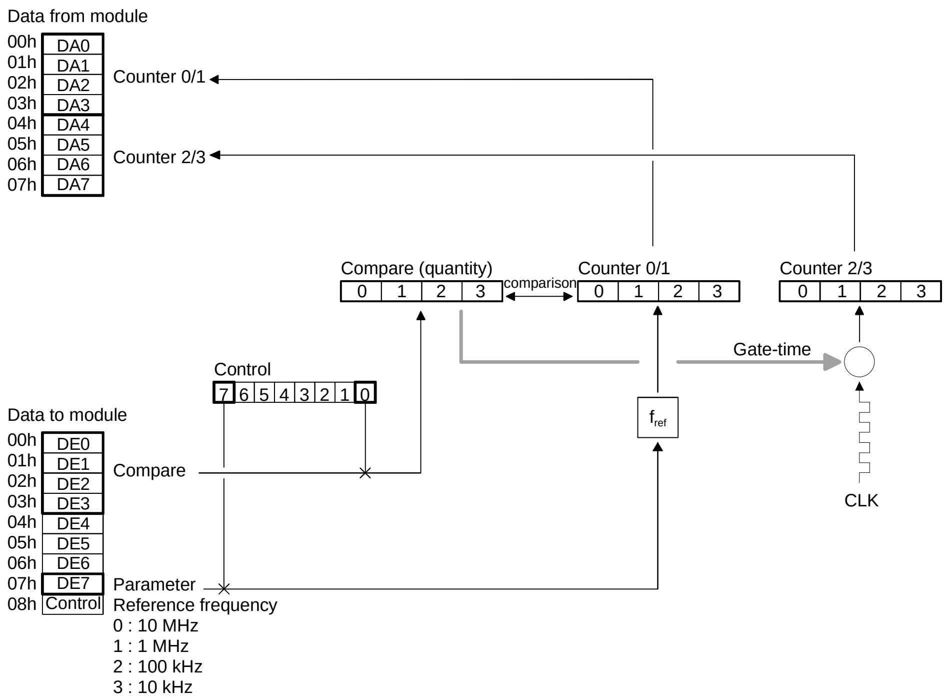
When enabled by the rising edge of the signal applied to Start, counter 0/1 counts reference pulses of the reference clock generator from the first rising edge of the CLK signal.

During this time counter 2/3 counts every rising edge of the CLK signal. Both counters are stopped when counter 0/1 reaches the Compare value or when a HIGH level is applied to Stop. You can calculate the frequency by means of the formula shown below.

This mode can not be combined with other modes!

Pin assignment access to counter





Frequency calculation

When the measurement has been completed you can calculate the frequency as follows:

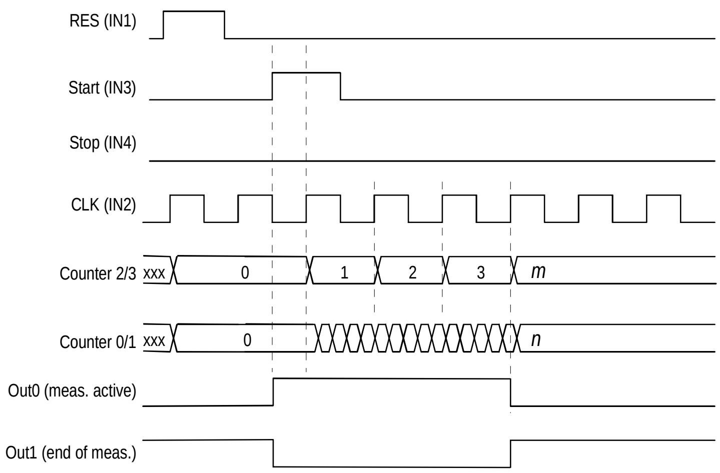
$$Frequency = \frac{fr \cdot m}{n}$$

where *fr* : reference frequency (is supplied via DE7 by means of control-bit 7)

m : counter 2/3 contents (number of CLK pulses)

n : number of reference frequency pulses in counter 0/1 (equal to Compare, if the operation was not terminated prematurely by means of Stop)

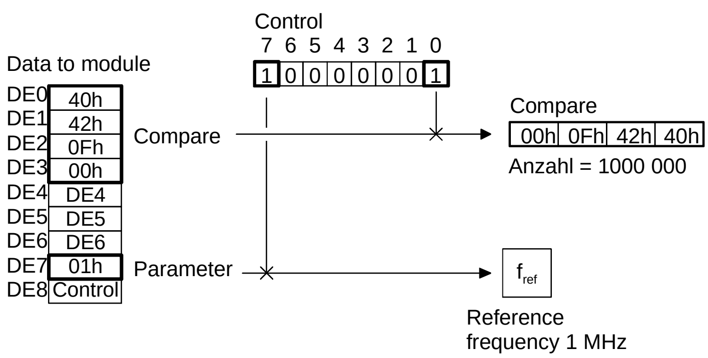
Timing diagram



Example

Quantity = 1000 000 pulses

Reference frequency = 1 MHz



Using a frequency of 1 MHz and 1000 000 pulses will return 1 Hz, i.e. when the measurement is completed counter 2/3 contains the frequency directly - no conversion is required.

Note!

Counter 2/3 will indicate the exact frequency if you choose *fr* and *n* so that the formula returns 1 Hz precisely.

Mode 17 period measurement

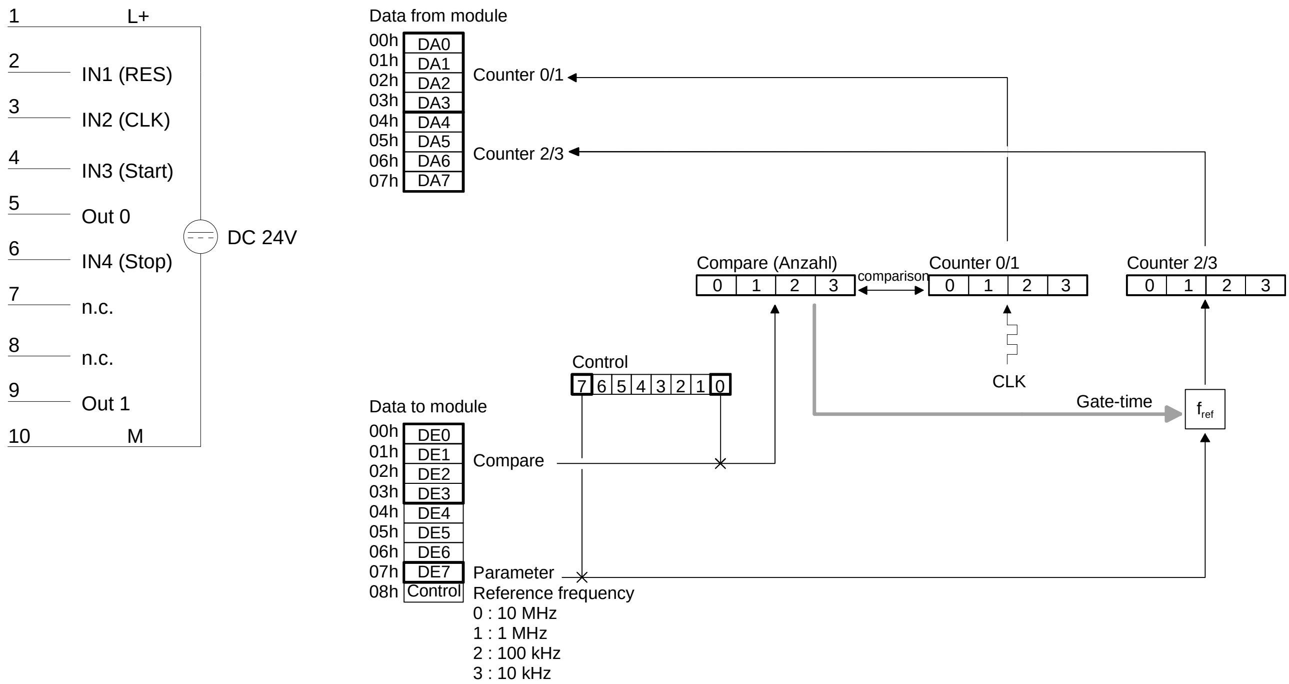
This mode is used to determine the average period of n measuring intervals of a signal that is connected to the CLK input. For this purpose you supply a reference clock to counter 2/3 by means of DE7 and indirectly a gate time defined by the value of n for which counter 2/3 is enabled. The value of n can range from 1 to 2^{32}-1 and it is loaded into the Compare register.

The measurement period begins when a rising edge is applied to Start. During this period counter 2/3 counts reference pulses from the reference clock generator starting with the first rising edge of the CLK signal.

In the mean time counter 0/1 counts every rising edge of the CLK signal. Both counters are stopped when the count in counter 0/1 reaches the Compare value or when Stop is set to a HIGH level. You can then calculate the average period by means of the formula shown below.

This mode can not be combined with other modes!

Pin assignment access to counter



Period calculation

When the measurement has been completed you can calculate the period as follows:

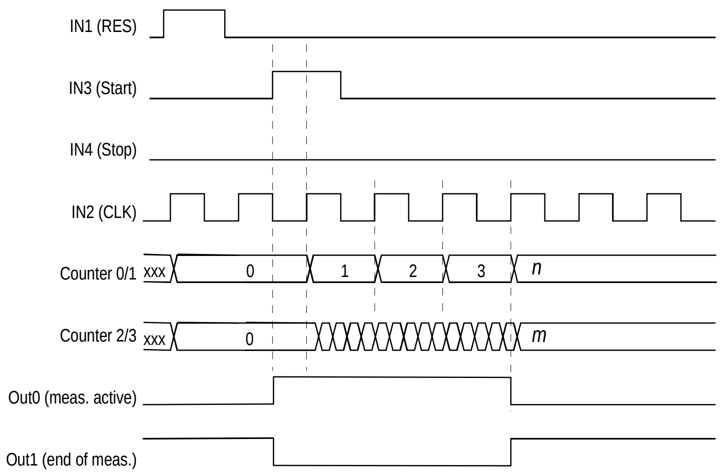
$$Period = \frac{n}{fr \cdot m}$$

where *fr*: reference frequency (supplied in DE7 with control bit 7)

m: contents of counter 2/3 (counts reference clock pulses)

n: number of CLK-pulses in counter 0/1 (corresponds to Compare, provided it was not terminated prematurely by Stop)

Timing diagram:

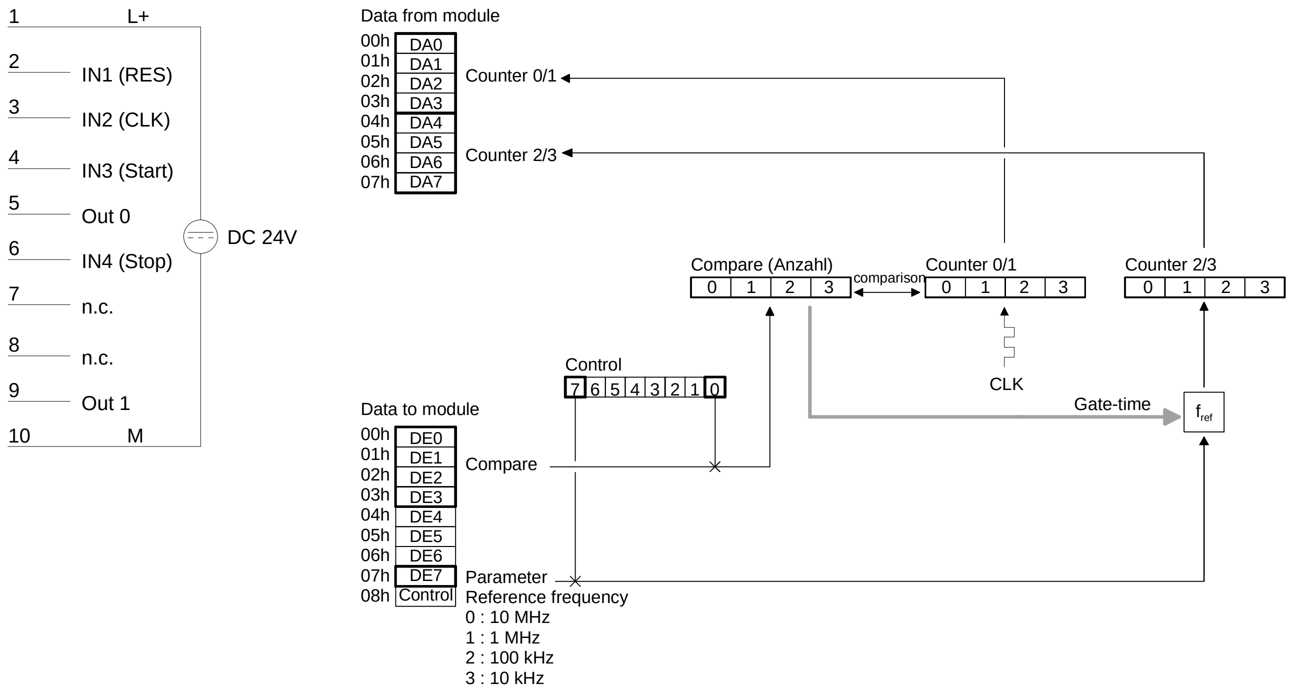


Mode 18 frequency measurement with gate output

The operation of mode 18 is similar to mode 16. The only difference is the manner in which OUT 0 and OUT 1 are controlled. In this case OUT 0 is only activated when the counting operation starts and it is deactivated when counting ends, i.e. OUT 0 provides an indication of the internal gate. OUT 1 provides the inverted status of the gate.

This mode can not be combined with other modes!

Pin assignment access to counter



Frequency calculation

When the measurement has been completed you can calculate the frequency as follows:

$$Frequency = \frac{fr \cdot m}{n}$$

where *fr*: Reference frequency (supplied in DE7 with control bit 7)

m: contents of counter 2/3 (CLK pulse count)

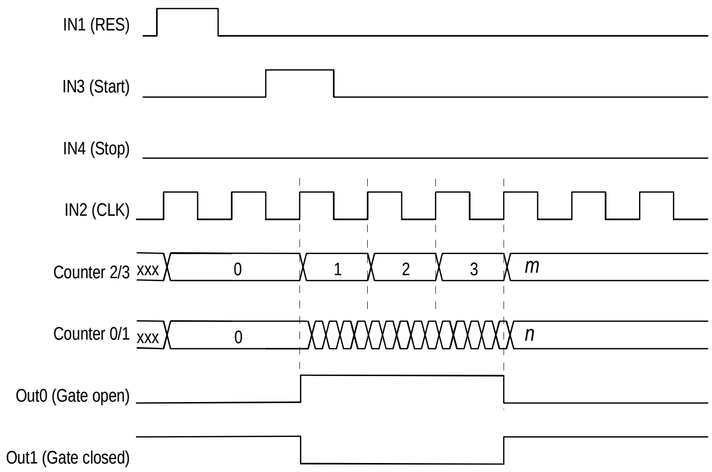
n: number of pulses of the reference frequency in counter 0/1 (corresponds to Compare provided it was not terminated prematurely by Stop)

Note!

Counter 2/3 will indicate the exact frequency if you choose *fr* and *n* so that the formula returns 1 Hz precisely.

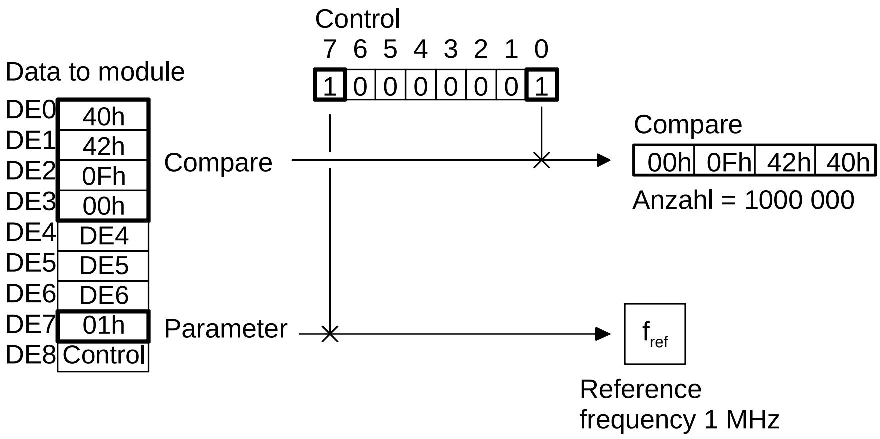
For example when the applied frequency is 1 MHz and the number of pulses is 1000 000 the result will be 1 Hz, i.e. counter 2/3 contains the precise frequency after the measurement - this does not require further conversion.

Timing diagram:



Example

Pulse count = 1000 000
Reference frequency = 1 MHz

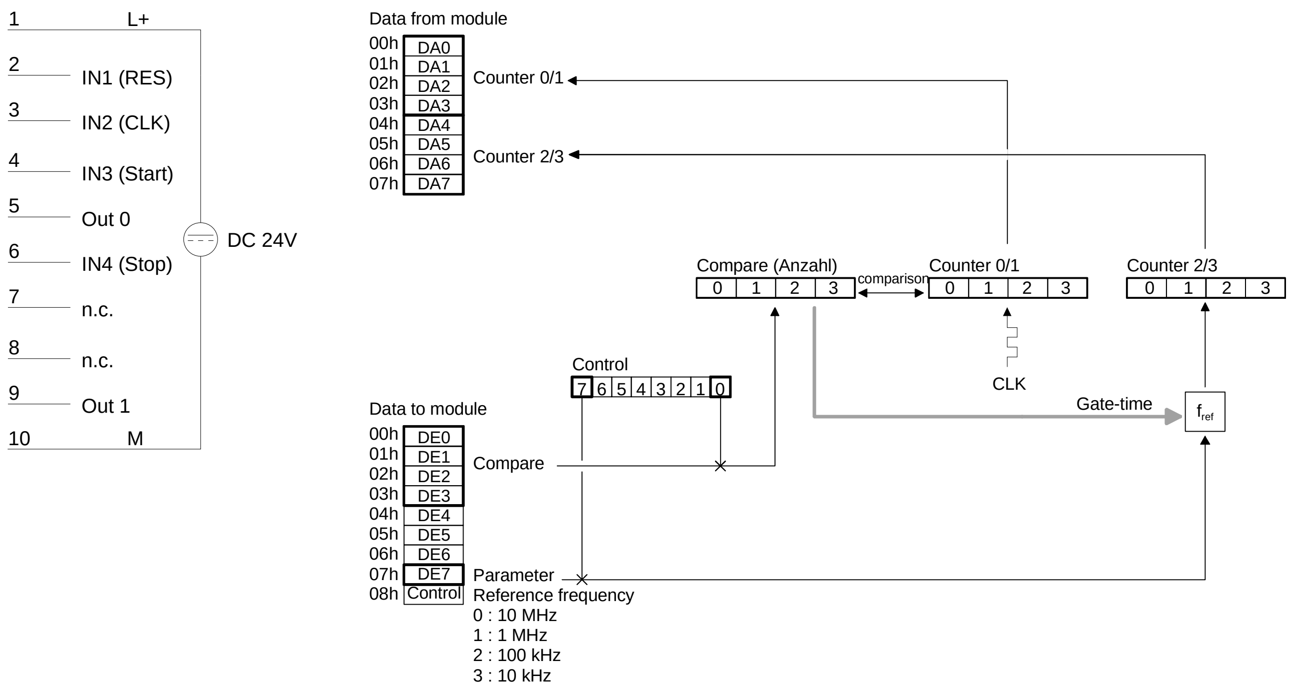


Mode 19 period measurement with gate output

The operation of mode 19 is identical to mode 17. The only difference is the manner in which OUT 0 and OUT 1 are controlled. Other than for mode 17, OUT 0 is only activated when the counting operation starts and it is deactivated when counting ends, i.e. OUT 0 provides an indication of the internal gate. OUT 1 provides the inverted status of the gate.

This mode can not be combined with other modes!

Pin assignment access to counter



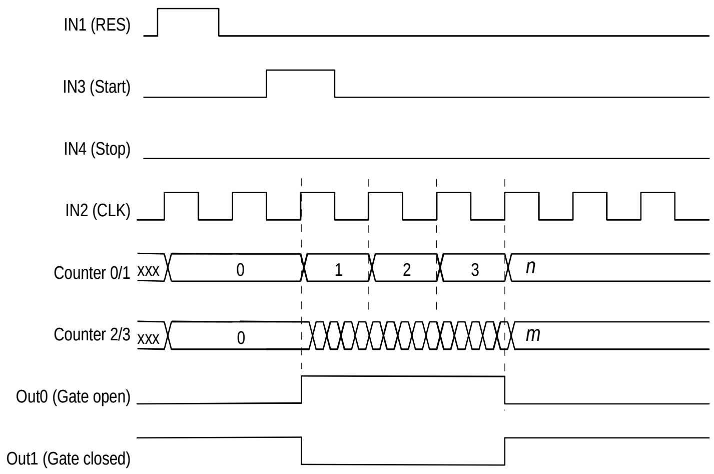
Period calculation

When the measurement has been completed you can calculate the mean period as follows:

$$Period = \frac{n}{fr \cdot m}$$

where *fr*: Reference frequency (supplied in DE7 with control bit 7)
m: contents of counter 2/3 (reference clock pulse count)
n: number of CLK pulses in counter 0/1 (corresponds to compare, provided it was not terminated prematurely by Stop)

Timing diagram:



Mode 20 pulse measurements, pulse down

prog. time-base, with direction control

The pulse-width of a signal that is applied to the PULSE input is determined by means of an internal time-base. The measurement is started by the falling edge of the input signal and ends with the rising edge. The rising edge of the measured signal stores the resulting pulse-width in units of 1/Fref.

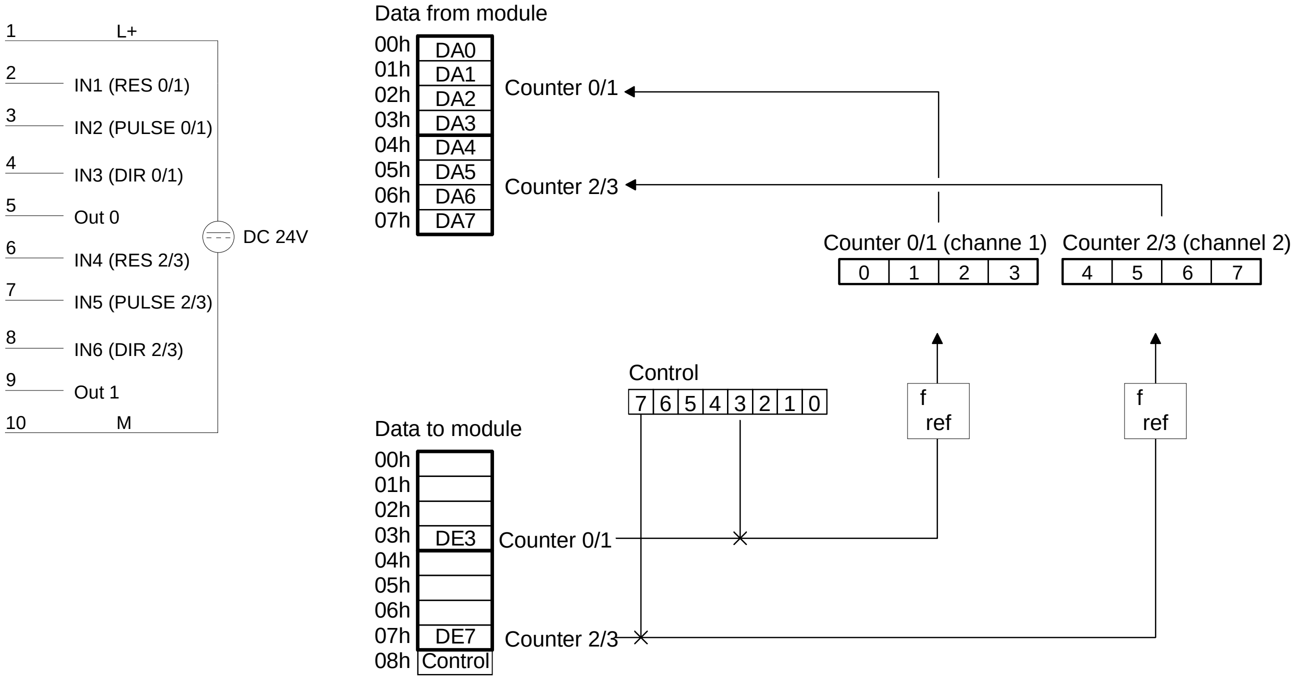
Input DIR controls the direction of the count. When DIR is held at a LOW level the counter counts UP. When DIR is at a HIGH level the counter counts DOWN.

RES must be held at LOW during the counting operation. A HIGH level clears the counter.

Fref is programmable.

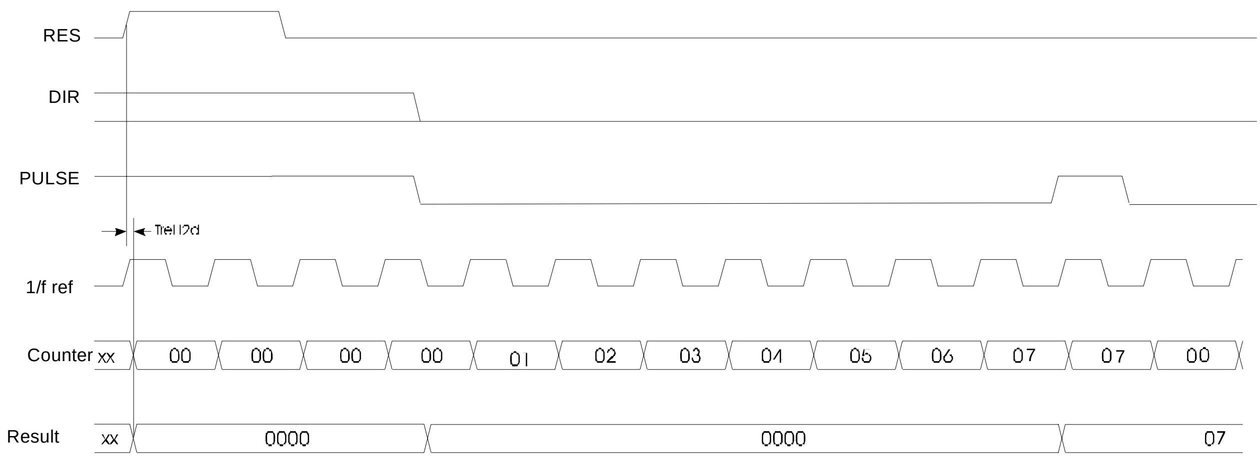
The OUT signal is not changed.

Pin assignment access to counter



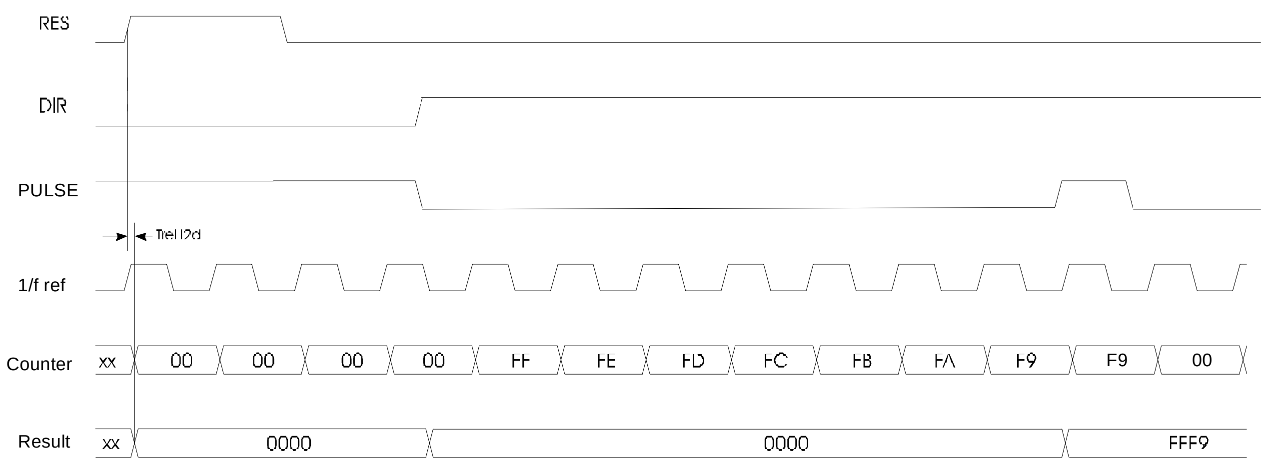
Up-counter

The RES-signal (R0) and the DIR-signal (D0) are set to low. Subsequently the measurement is started with the falling edge of PULSE (C0) and the counter counts up in accordance with the selected time-base. A rising edge at PULSE (C0) terminates the counting operation and the accumulated count is transferred into the result register. The result register is available to the PLC. The value remains in the result register until a new measurement has been completed and the register is changed by the new result.



Down-counter

The RES-signal (R0) is set to low and the DIR-signal (D0) to high. Subsequently the measurement is started with the falling edge of PULSE (C0) and the counter counts down in accordance with the selected time-base. A rising edge at PULSE (C0) terminates the counting operation and the accumulated count is transferred into the result register. The result register is available to the PLC. The value remains in the result register until a new measurement has been completed and the register is changed by the new result.



Mode 21 pulse-width measurement, pulse low

Direction up, prog. time-base, with enable

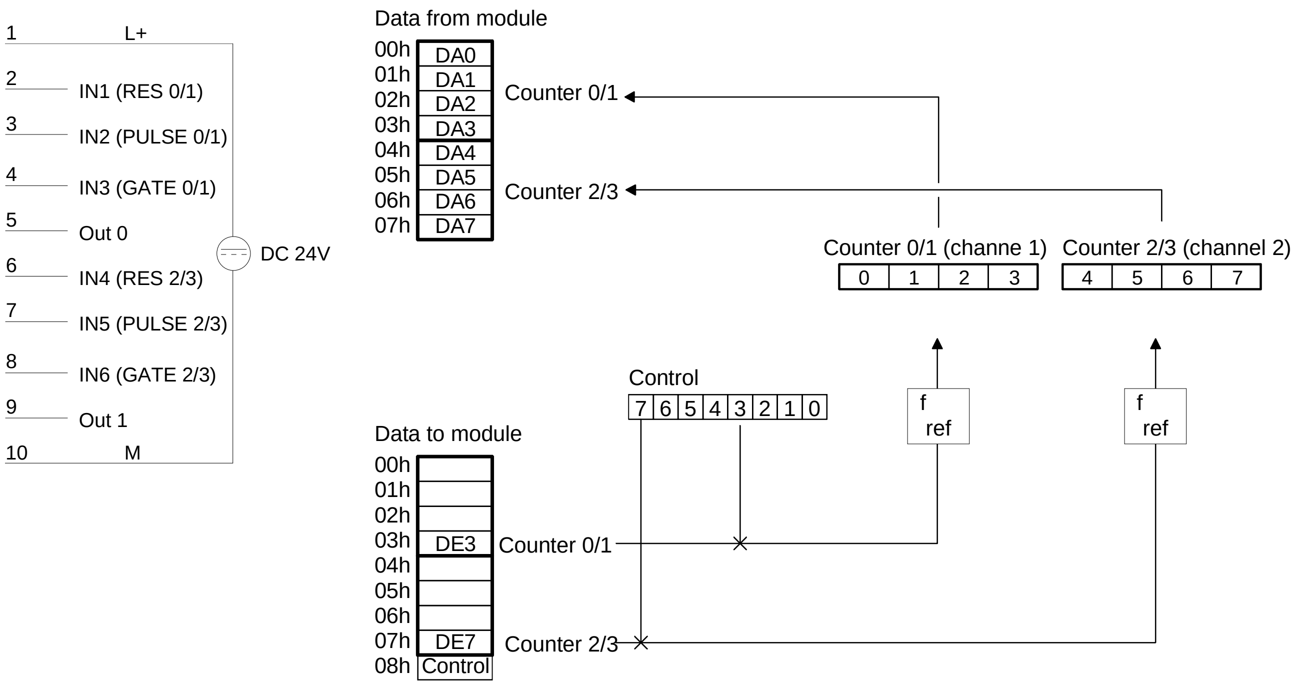
The pulse-width of a signal applied to the PULSE-input is determined by means of a programmable time base (f ref). The measurement starts with the falling edge of the input signal and it is stopped by the rising edge of the input signal. The rising edge of the input signal saves the resulting pulse-width in units of 1/f ref. This is available to other devices.

A condition for the function is that a HIGH level is applied to the GATE input.

Input RES must be at a LOW level. A HIGH level at this input would clear the counter.

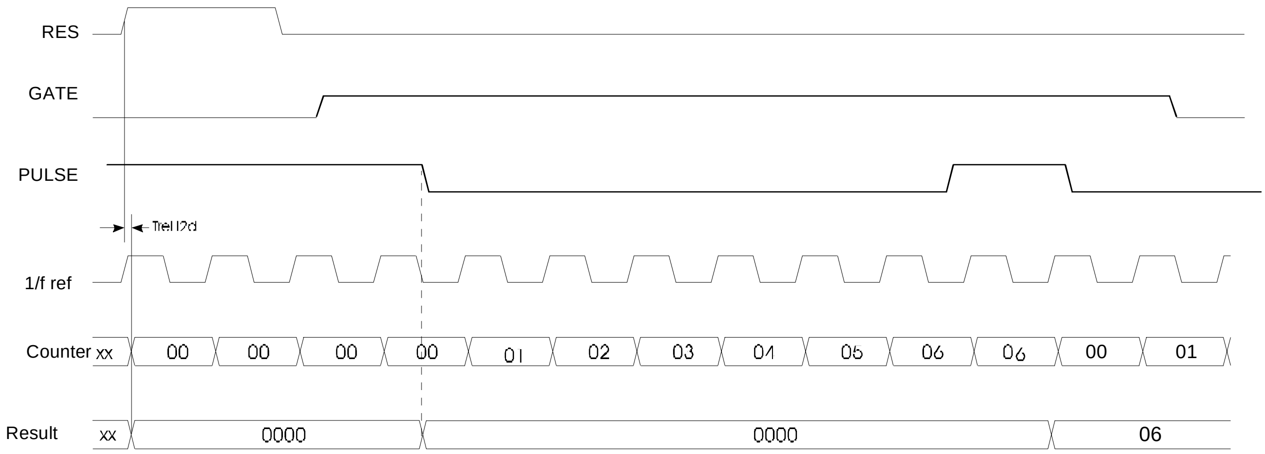
The OUT signal is not modified.

Pin assignment access to counter



Up-counter

A low level is applied to the RES (R0). The measurement can only be started when the GATE-signal is at a HIGH level. The measurement is started with the falling edge of PULSE (C0) and the counter counts up in accordance with the selected time-base. A rising edge at PULSE (C0) terminates the counting operation and the accumulated count is transferred into the result register. The result register is available to the PLC. The value remains in the result register until a new measurement has been completed and the register is changed by the new result. The GATE signal must be held at a HIGH level for the entire cycle, since the measurement could otherwise not be completed.



Mode 22 pulse-width measurement, pulse high

Direction down, prog. Time base, with enable

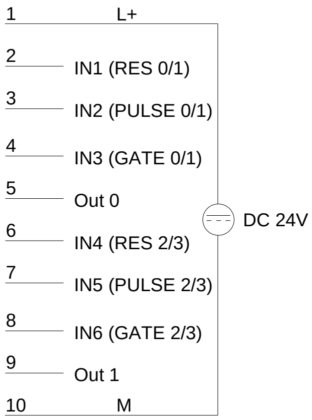
The pulse-width of a signal applied to the PULSE-input is determined by means of a programmable time base (f ref). The rising edge of the input signal saves the resulting pulse-width in units of 1/f ref. This is available to other devices.

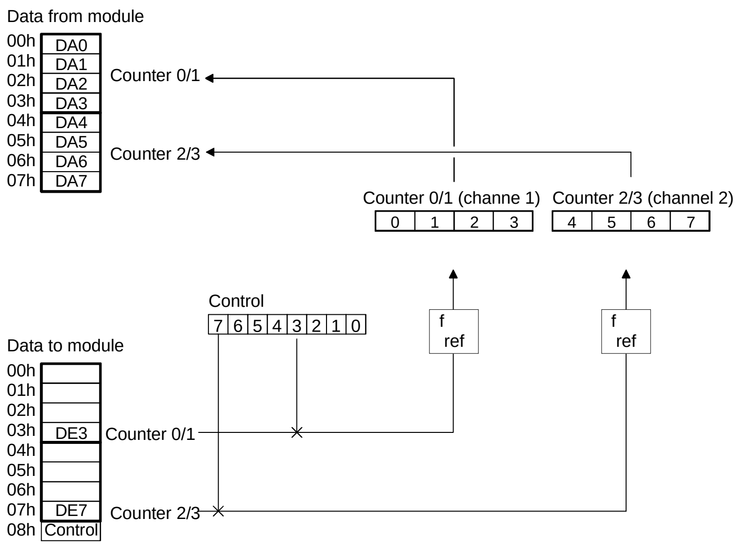
A condition for the function is that a HIGH level is applied to the GATE input.

Input RES must be at a LOW level. A HIGH level at this input would clear the counter.

The OUT signal is not modified.

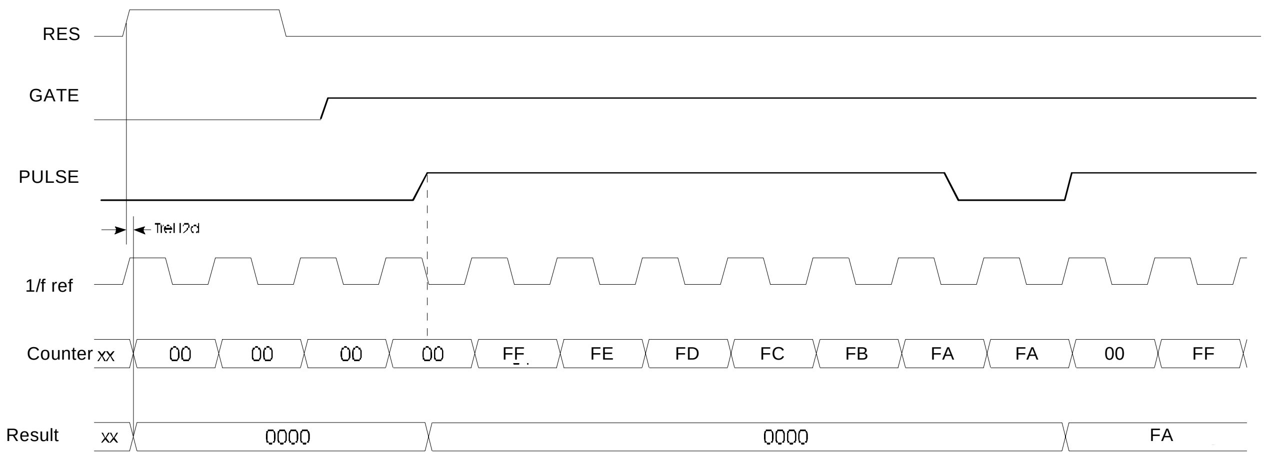
Pin assignment access to counter





Down-counter

The RES-signal (R0) is set to low. The measurement can only be started when the GATE signal is at a HIGH level. The measurement is started with the rising edge of PULSE (C0) and the counter counts down in accordance with the selected time-base. A falling edge at PULSE (C0) terminates the counting operation and the accumulated count is transferred into the result register. The result register is available to the PLC. The value remains in the result register until a new measurement has been completed and the register is changed by the new result. A condition for the function is that a HIGH level is applied to the GATE input.

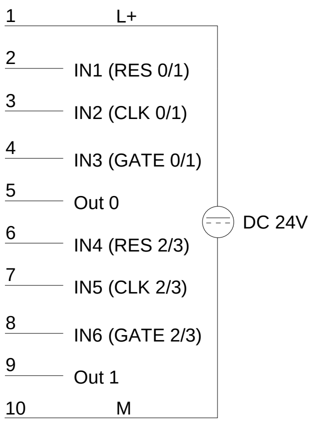


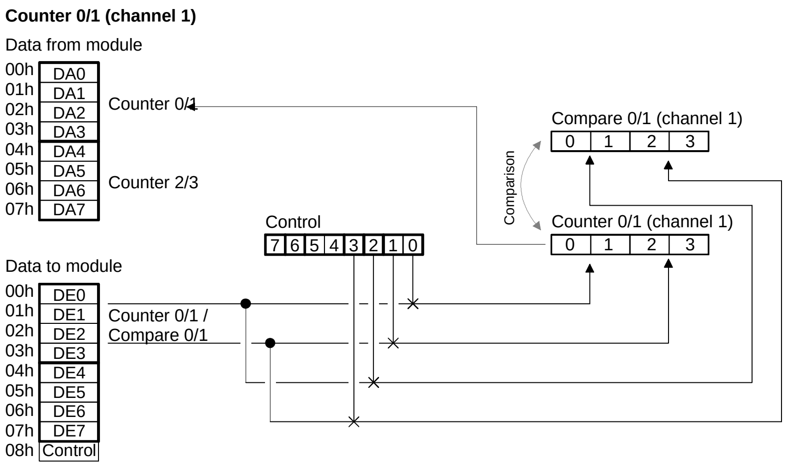
Mode 23
One Shot, direction of count is up, with gate, output signal

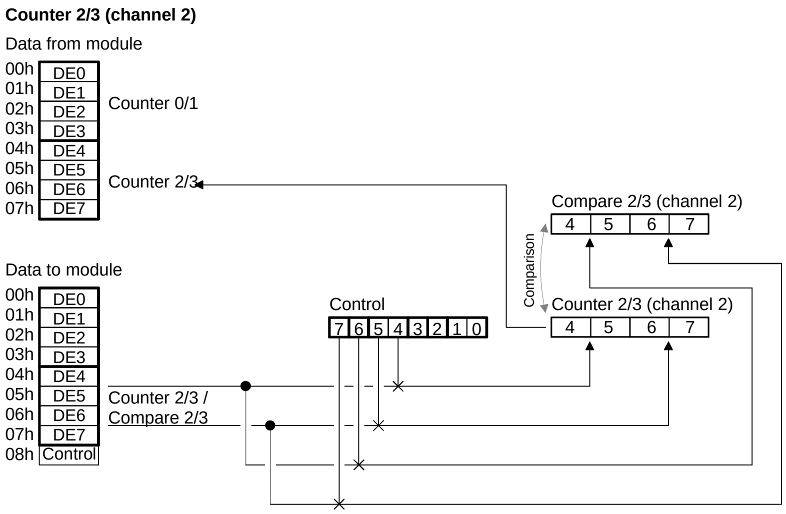
In mode 23 you can implement one 32 bit counter per channel, each one controlled by the signal applied to the gate input. Every rising edge of the input clock increments the counter as long as the signal applied to GATE is HIGH. RES must be at a LOW level. A HIGH level at this input would clear the counter. OUT changes to HIGH when the counter is loaded. OUT is cleared when the value entered into COMPARE is reached. The counter will continue the count operation after the value in COMPARE was reached.

Mode 23 - One Shot, up with Gate-Input, Output set

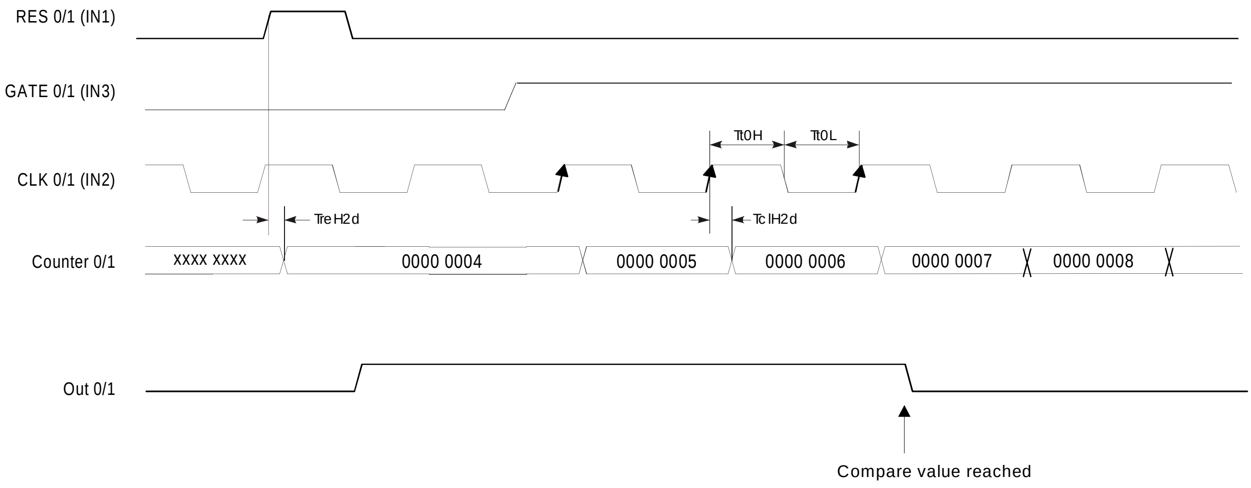
Pin assignment access to counter







Timing diagram Example of counter 0/1 in mode 23:



1. The RES signal changes to LOW.
2. Compare is loaded once.
3. Counter (subject to Control) is loaded with, e.g. 0004.
4. The GATE signal is active.

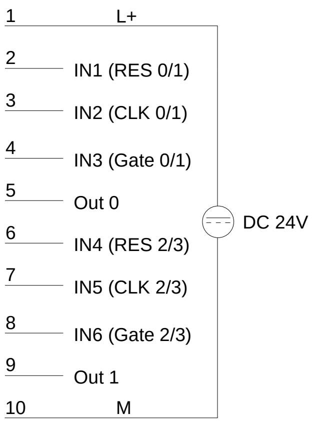
Stop by means of Control = termination

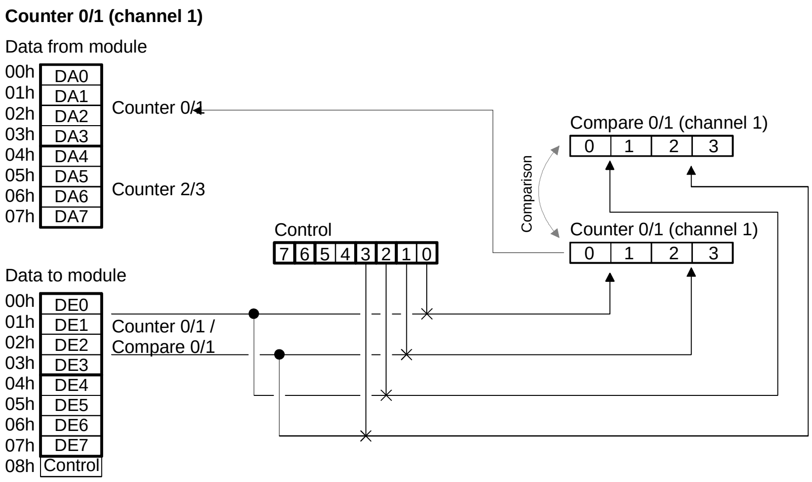
Mode 24
One Shot, direction down, with gate, output signal

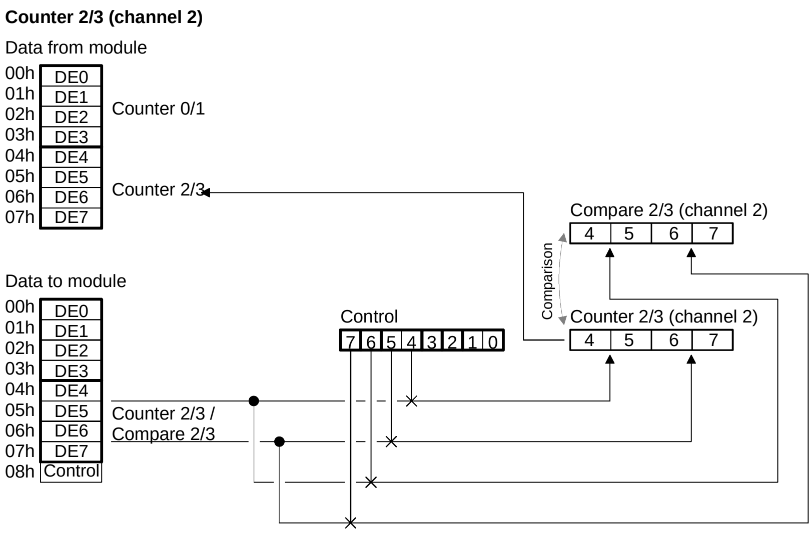
In mode 24 you can implement one 32 bit counter per channel, each one controlled by the signal applied to the gate input. Every rising edge of the input clock decrements the counter as long as the signal applied to GATE is HIGH. RES must be at a LOW level. A HIGH level at this input would clear the counter. OUT changes to HIGH when the counter is loaded. OUT is cleared when the value entered into COMPARE is reached. The counter will continue the count operation after the value in COMPARE was reached.

Mode 24 - One Shot, down with Gate-Input, Output set

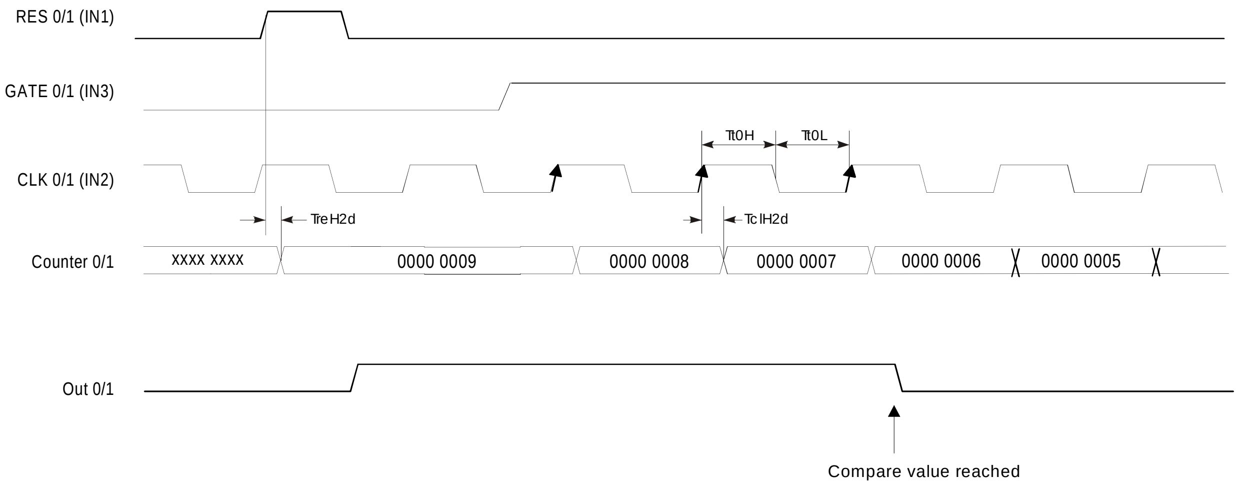
Pin assignment access to counter







Timing diagram Example of counter 0/1 in mode 24:



1. The RES signal changes to LOW.
2. Compare is loaded once.
3. Counter (subject to Control) is loaded with, e.g. 0009.
4. The GATE signal is active.

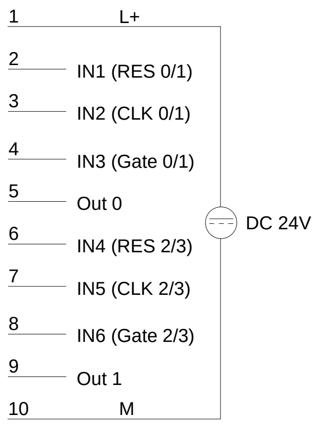
Stop by means of Control = termination

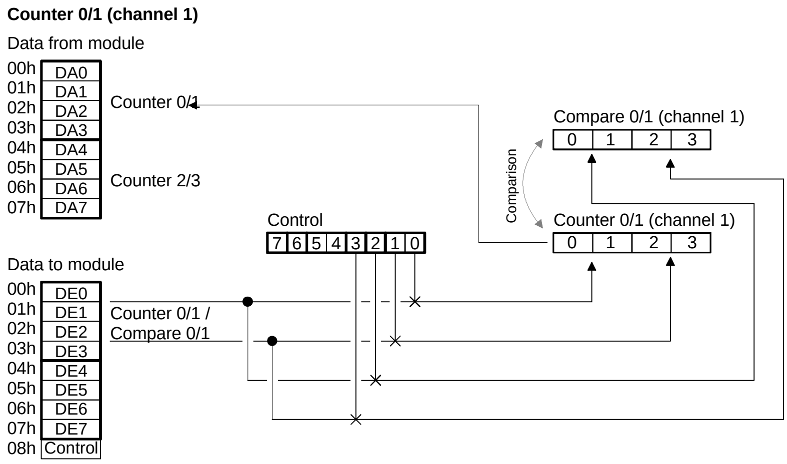
Mode 25
One Shot, direction of count is up, with reset signal

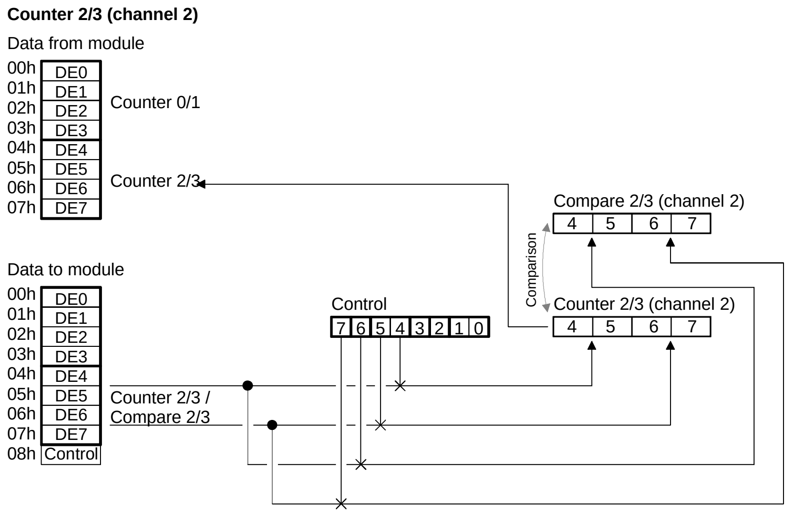
In mode 25 you can implement one 32 bit counter per channel, each one controlled by the signal applied to the gate input. Every rising edge of the input clock increments the counter as long as the signal applied to GATE is HIGH. RES must be at a LOW level. A HIGH level at this input would clear the counter. OUT (active 0) changes to LOW when the counter is loaded. OUT becomes HIGH when the value entered into COMPARE is reached.

Mode 25 One Shot, up, Reset

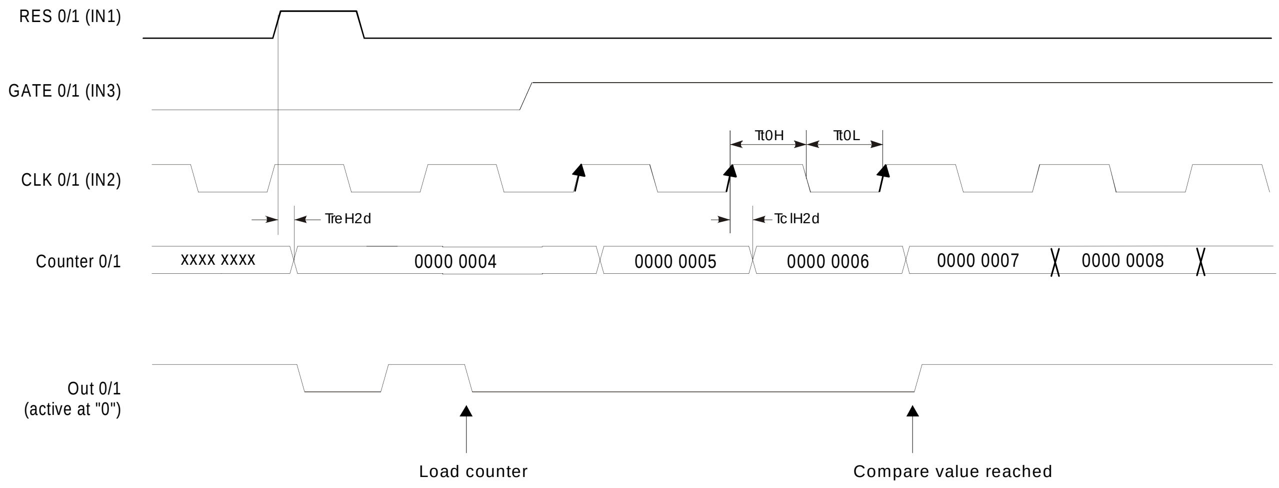
Pin assignment access to counter







Timing diagram Example of counter 0/1 in mode 25:

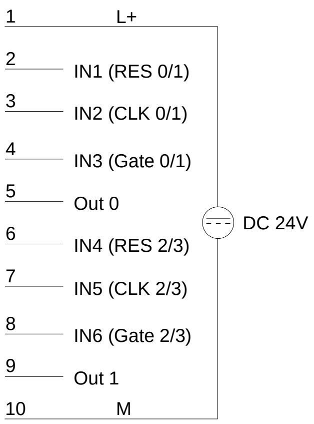


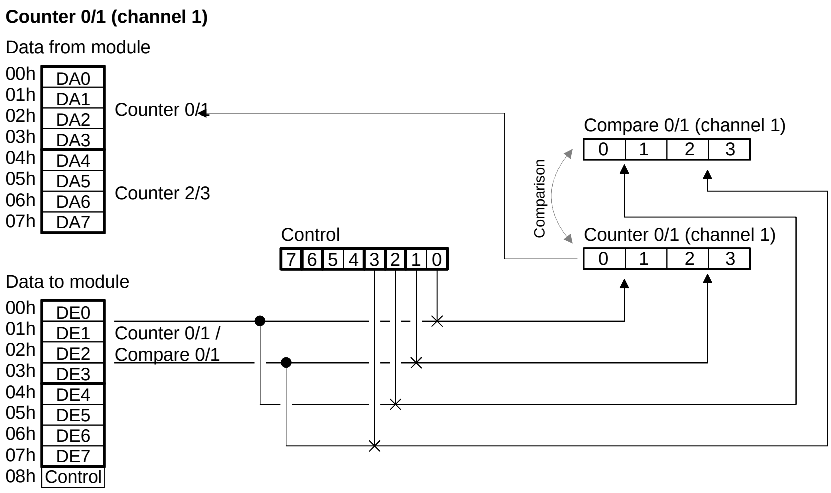
Mode 26 One Shot, direction of count is down, with reset signal

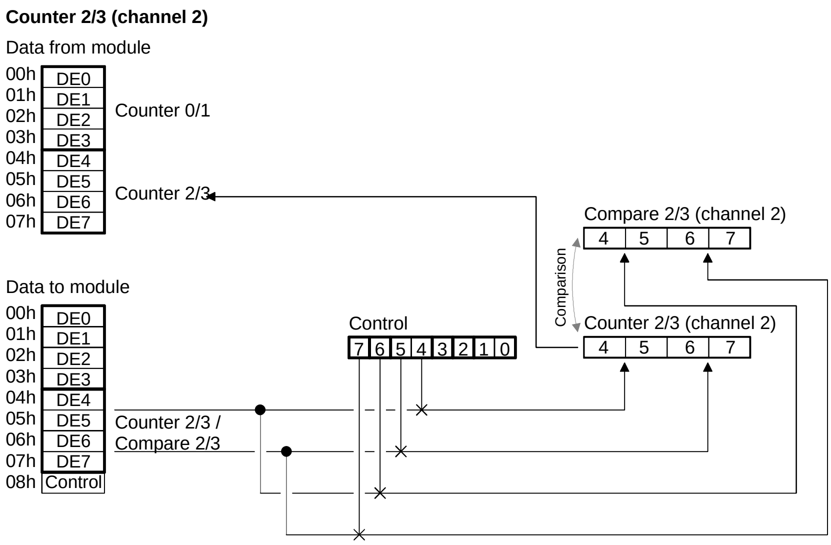
In mode 26 you can implement one 32 bit counter per channel, each one controlled by the signal applied to the gate input. Every rising edge of the input clock decrements the counter as long as the signal applied to GATE is HIGH. RES must be at a LOW level. A HIGH level at this input would clear the counter. OUT (active 0) changes to LOW when the counter is loaded. OUT becomes HIGH when the value entered into COMPARE is reached.

Mode 26 One Shot, down, Reset

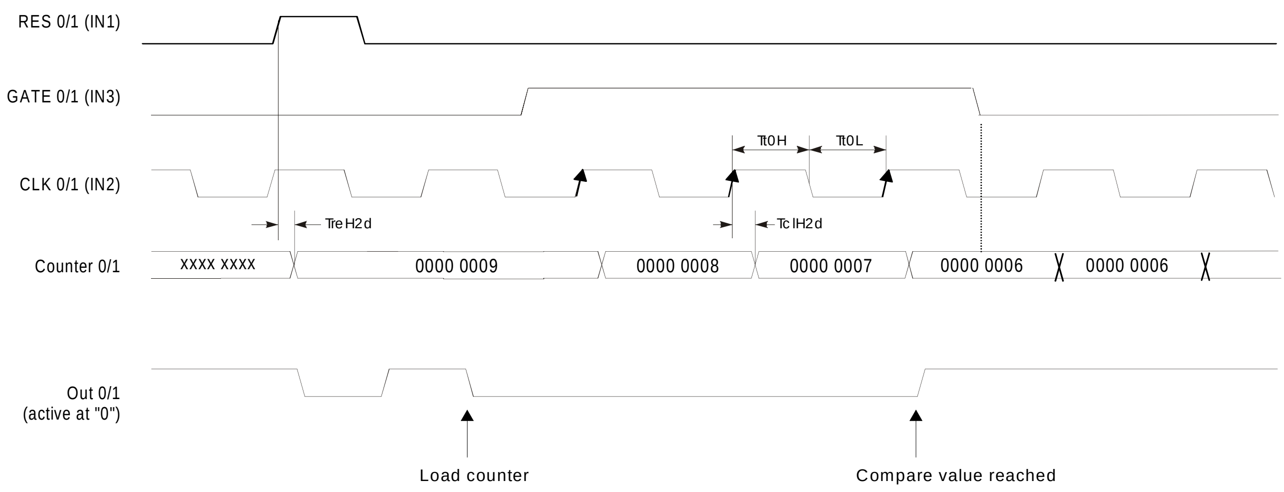
Pin assignment access to counter







Timing diagram Example of counter 0/1 in mode 26:



Technical data

SSI-Module
FM 250 S

Electrical data	VIPA 250-1BS00
Number of channels	1
Number of outputs	2
Current consumption	200mA via back panel bus
Isolation	yes
SSI-interface	Transducer supply voltage
Signal cable	RS422, isolated
Clock	RS422, isolated
Baudrate	configurable:
	100 / 300 / 600 kBaud (default: 300 kBaud)
Signal voltage "0"	-5 ... 7V
Signal voltage "1"	13 ... 36V
Output stage	24V DC high side switch 0,5A
Ext. power supply	24V DC (18 ... 28,8V)
Status indicator	by means of LED’s located on the front
Programming specifications	
Input data	4 Bytes
Output data	4 Bytes, 8 byte buffer in the module
Parameter data	4 Bytes
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD)	25,4 x 76 x 76 mm
Weight	100g

Counter module FM 250

Electrical data	VIPA 250-1BA00
Number of counters	2 or 4
Counter resolution	32 Bit or 16 Bit
Number of operating modes	26
Counter frequency	1 MHz max.
Current consumption	80mA via back panel bus
Isolation	yes
Output stage	24V DC high side switch 0,5A
Ext. power supply	24V DC (18 ... 28,8V)
Status indicator	via LED's located on the front
Programming specifications	
Input data	10 Bytes
Output data	9 Bytes
Parameter data	2 Bytes
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD)	25,4 x 76 x 76 mm
Weight	100g

Chapter 9 MotionControl Modules

Outline

This chapter contains information about the installation, the data transfer and the operating modes of the MotionControl modules.

The following text describes:

- Installation
- Parameterization
- Data transfer
- Technical data

Content

System Overview

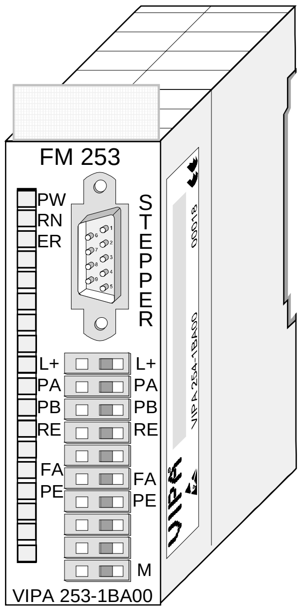
General

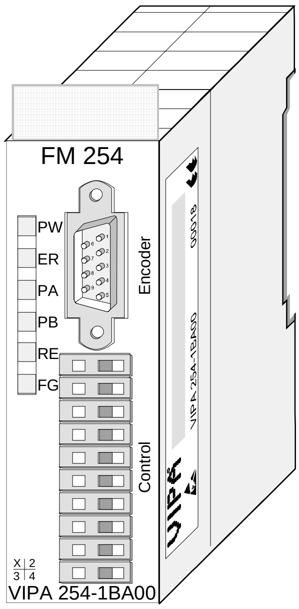
The MotionControl modules described here are modules for machine drives with a high pulse.

The modules may be used for point-to-point positioning as well as for complex drive outlines with need for a high level of precision, dynamics and speed.

Depending on the module you may control stepper motors or servo drives.

MotionControl modules





Order data

Type	Order number	Description
FM 253	VIPA 253-1BA00	MotionControl Module Stepper
FM 254	VIPA 254-1BA00	MotionControl Module Servo

MotionControl Stepper FM 253

Properties

The FM 253 is a positioning module for controlling a stepper motor.

The module works independently and is controlled via an according user application at the CPU.

The module has the following characteristics:

- Microprocessor controlled positioning module for controlling a 1axis drive with stepper motor.
- Operating round and linear axis
- Different operating modes
- The module works independently and is controlled via an user application at the System 200V.
- The parameterization data is stored in the internal Flash memory. There is no battery required.
- The module contains 3 inputs for connecting end switches and is able to control 2 outputs. The states of the in-/outputs is additionally shown via LEDs.

Application areas

The module may be employed for simple positioning tasks as well as for complex drive outlines with a need for a high level of precision at the positioning.

Stepper motors are employed where a maximum torque at low rotational speed is required and the target position shall be reached and held without overshoot.

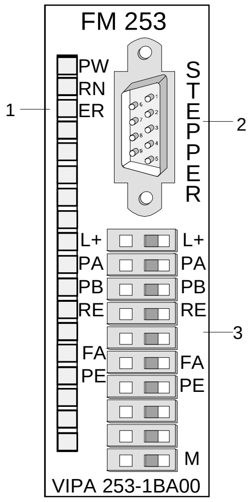
Operating modes

The operating mode is preset via your application program. The module supports the following operating modes:

- Positioning operating absolute
- Positioning operating relative
- Reference run
- Permanent run axis
- Set position
- Set parameters
- Delete errors
- Read inputs

Construction FM 253

Front view



[1] LED Status monitor
[2] Plug for drive
[3] Connection for supply voltage, end switch and outputs

Components

LEDs

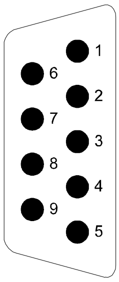
The FM 253 has some LEDs at the front used for status monitoring.

The usage and the according colors of these LEDs are shown in the following table:

Label	Color	Description
PW	Yellow	DC 24V supply voltage is applied
RN	Green	RUN: control active
ER	Red	Internal error
L+	Yellow	DC 24V supply voltage for outputs is applied
PA	Green	Limit value A overrun, input PA is set
PB	Green	Limit value B overrun, input PB is set
RE	Green	Reference point overrun
FA	Green	Drive in run
PE	Green	Drive reached position

Stepper interface

Via this interface your stepper motor is connected. The interface appears as 9pin D-type-plug and works with RS422 level. It has the following pin assignment:



Pin	Assignment
1	PULSE_P: (+) pulse output
2	DIR_P: (+) direction signal
3	ENABLE_P: (+) release signal
4	READY+: (+) readiness message
5	GND: ground
6	PULSE_N: (-) pulse output
7	DIR_N: (-) direction signal
8	ENABLE_N: (-) release signal
9	READY-: (-) readiness message

Control interface

The control interface provides connection possibilities for end switches and output elements. The interface has the following pin assignment:

Pin	Assignment
1	Supply voltage DC 24V for outputs
2	Input: end switch PA
3	Input: end switch PB
4	Input: reference switch
5	reserved
6	Output: axis in motion
7	Output: position reached
8	reserved
9	reserved
10	Ground 24V

Connecting a drive to FM 253

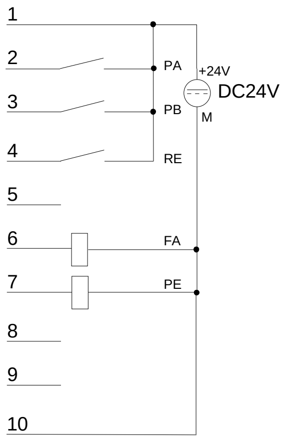
Connection stepper motor

The connection of a stepper motor is exclusively via the stepper interface.

Connection of supply voltage, end switch and output units

Voltage supply

The module itself is provided via the back plane bus. The deployment of the integrated digital outputs requires an additional voltage supply. The connection of an additional DC 24V supply voltage takes place via the clamps 1 and 10 of the control interface.



Inputs for end switches

You may connect up to 3 end switches to the module. Connectable are closer which signal is inverted in the module.

At terminals 2 and 3 (PA and PB) you connect the end switches with which you limit the distance. As soon as one of these switches is operated, the drive is stopped immediately and may only be driven into the other direction.

Terminal 4 is for the connection of the reference switch which is responsible for the tuning with the FM 253 module.

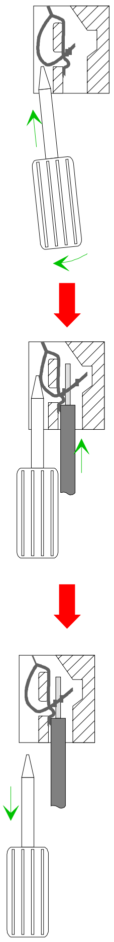
Outputs

The module contains 2 outputs that are only controlled by the module:

- FA - drive in run (clamp 6)
- PE - drive reached position (clamp 7)

The states of the outputs are shown via the according LEDs.

Cabling



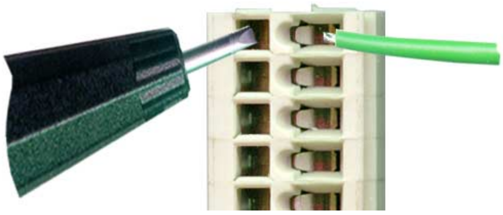
The end switches and the outputs are to connect at the control interface. Herefore a 10pin plug with CageClamp technology from WAGO is used. The cabling with CageClamps is very fast and in opposite to screw connections vibration secure.

You may connect cores with a core cross-section from 0.08mm^2 up to 1.5mm^2.

The cabling is analog to the big CageClamps of the System 200V.

Push the spring in the square opening with a fitting screwdriver more inside and insert the core into the rectangular opening.

By releasing the screwdriver the core is securely fixed.



Data transfer CPU >> FM 253

Drive data

The MotionControl Stepper module fetches a data block from the CPU cyclically and analyzes it.

The data block has a length of 16Byte and the following structure:

Byte No.	Content	Length
0-3	Scheduled position	4Byte
4-7	Scheduled frequency	4Byte
8-9	Reserved	
10	Mode	1Byte
11	Index	1Byte
12-15	Variable parameters	4Byte

Via the MODE-Byte the contents of the data block are specified. The following functions may be initiated via the MODE-Byte:

Mode (Byte 10)

Bit 7 ... Bit 0	Preset in Byte	Response in Byte
00: Idle-Mode - no status change of the drive, serves for parameter changes	-	-
01: Positioning relative - driving the preset number of steps	0-3: rel. set position	-
02: Reference run - calibration of the drive		
03: Permanent run axis - drive runs with scheduled frequency	15: Parameter bits 4-7: set frequency	- -
04: Read inputs - responds with the end switches states	-	15: State
05: Motor parameters - transmits parameters depending on index	11: Index, 12-15: Parameter	-
06: Set position - sets the recent position in the module without moving the drive	0-3: Set position	-
07: Delete error - deletes the error bit activated with 1	14-15: Error bit	-
08: Positioning absolute - drive to scheduled position	0-3: abs. set position	-

Parameter transfer (Mode = 05h)

Via **Index (Byte 11)** you set the parameter which value may be predefined via **Byte 12-15**. The value is transferred to the module by setting the **Mode 05h in Byte 10**.

More detailed information follows below.

Parameterization FM 253

Overview

The parameter data is transferred to the module together with the drive data in the 16Byte sized data block. For the parameterization you type the parameter to change in the **Index-Byte (Byte 11)** via the **Index-No.**.

The new value is fixed in **Byte 12-15**.

As soon as you set the **Mode-Byte (Byte 10)** to **05h**, the parameter is transferred to the module.

Please regard, that new parameters are only taken over when there has been a mode change before. For this you switch into the IDLE-Mode (MODE-Byte 10 = 00h) after every parameter transfer.

Store parameters in the Flash

The parameters that you transfer to the module are stored in the RAM. As long as the module is supplied with voltage, the parameters are preserved. Via the index no. 97h you also have the possibility to store the parameters in the internal Flash.

So the parameters are available again after PowerOn.

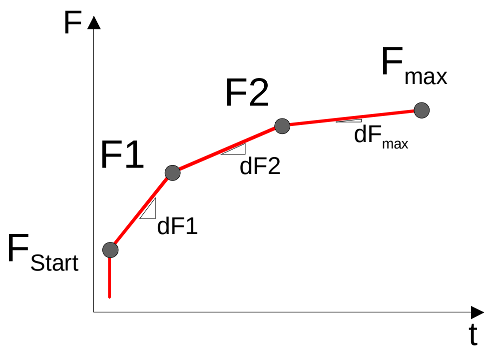
Parameterization via FCs

You get FCs from VIPA that should make the deployment of the FM 253 easier. For example you may parameterize your module via the FCs 201 and 202.

The control of the drive functions via FC 200. Via this FC you may access all modes except "Set parameters".

Context of the parameters

The following illustration shows the important contexts of the parameters. The assignment of the according index no. is to find in the table below.



Set index at parameter

Via the index no. you fix the parameter in Byte 11, where the value may be preset in Byte 12-15.

Index	Parameter	Unit	Value range	Default	Description
00h	Fstart	Hz	UINT32	200	Start frequency
01h	F1	Hz	UINT32	4000	Limit frequency 1
02h	dF1	Hz	UINT32	100	Acceleration of Fstart ⇒ F1
03h	F2	Hz	UINT32	10000	Limit frequency 2
04h	dF2	Hz	UINT32	60	Acceleration of F1 ⇒ F2
05h	Fmax	Hz	UINT32	30000	Maximum drive frequency
06h	dFmax	Hz	UINT32	40	Acceleration of F2 ⇒ Fmax
07h	Fpos	Hz	UINT32	30000	Frequency at positioning
08h	Fref	Hz	UINT32	1000	Frequency for reference run
10h	Fist	Hz	UINT32	-	Recent motor frequency (read only)
11h	Fsoll	Hz	UINT32	-	Recent set frequency (read only)
13h	FTarget	Hz	UINT32	-	Target frequency (read only)
97h				-	Store parameters in Flash
98h				-	Read parameters from Flash (State like after PowerON)
99h				-	Load default parameters

Note!

When setting parameters for the drive, you should remember the following rules:

- **dF1** should always be **smaller** than **Fstart**
- **dF2** should be the **half** of **dF1**
- **dFmax** should be the **half** of **dF2**

For this the following context appears:

$$4 \cdot dF_{max} = 2 \cdot df2 = dF1 < F_{Start}$$

Wrong inputs are partly corrected by the firmware of the module.

Operating modes FM 253

Overview

By setting according bits in the MODE-Byte you may set the following operating modes described below:

- IDLE-Mode
- Positioning relative / absolute
- Permanent run
- Set position
- Reference run

IDLE-Mode

Default: Byte 10 = 00h

In the IDLE-Mode no state change of the drive occurs. For new data is only taken over by the module after an state change, you may initiate a mode change by jumping into the IDLE-Mode and back again.

Via the IDLE-Mode you may e.g. start a new order, for a mode change is recognized by the jump into the IDLE-Mode.

The operating mode IDLE should always be called when no action shall be initiated. For initiating an action you normally branch into another mode only for a short time and switch then back to the IDLE-Mode.

Positioning relative

Default: Byte 10 = 01h, Byte 0-3 = relative set position

At the relative positioning a predefined number of steps is added to the recent position and then approached.

Herefore you have to predefine the position offset (number of steps) as relative scheduled position in Byte 0-3 and then set the **Mode (Byte10) to 01h.**

By setting the Byte 10 to 01h the relative positioning starts.

For acceleration and frequency of the drive, the values set in the parameters are used. If there are no presetting, the default values are used.

As long as the drive is operating, the output **"Axis in run"** is set. After reaching the position this output is cleared and the output **"Position reached"** is set.

Positioning absolute

Default: Byte 10 = 08h, Byte 0-3 = absolute set position

At the absolute positioning an absolute scheduled position is approached.

Herefore you have to predefine the position (number of steps) as absolute scheduled position in Byte 0-3 and then set the **Mode (Byte 10) to 08h**.

By setting the Byte 10 to 08h the absolute positioning starts.

For acceleration and frequency of the drive, the values set in the parameters are used. If there are no presetting, the default values are used.

As long as the drive is operating, the output **"Axis in run"** is set. After reaching the position this output is cleared and the output **"Position reached"** is set.

Permanent run

Default: Byte 10 = 03h, Byte 4-7 = Scheduled frequency

At permanent run the axis rotates with the set frequency until it is changed.

Herefore you have to predefine the rotational speed as set frequency in Byte 4-7 and then set **Mode (Byte10) to 03h.**

By setting Byte 10 to 03h the drive starts and rotates with the given frequency until a new frequency value is set.

A new frequency is only taken over at mode change. This is reachable by changing into the IDLE-Mode (Byte 10 = 00h) after the start-up of the drive. Now type the new scheduled frequency and set Byte 10 back to 03h. The drive is set to the new frequency immediately.

For acceleration of the drive, the values set in the parameters are used. If there are no presetting, the default values are used.

As long as the drive is operating, the output **"Axis in run"** is set. By presetting 00h as scheduled frequency (mode change required) the drive stops and the output is set back.

Stop drive by permanent run and set frequency = 00h

By setting a scheduled frequency of 00h in Byte 4-7 and the mode 03h in Byte 10 you may stop the drive at any time.

Note!

Please regard, that a frequency change is only recognized by the module via a mode change. This is also valid for stopping the drive. For a mode change, use the short time jump to the IDLE-Mode.

Set position

Default: Byte 10 = 06h, Byte 0-3: Position value

In the operating mode "Set position" you may assign a new value to the recent actual value.

Herefore you predefine the new value in Byte 0-3 and then set the MODE-Byte 10 to 06h.

Reference run

Default: Byte 10 = 02h, Byte 15 = Control bits for reference run

The reference run supports the calibration of your drive system. The reference point should be inside the drive outline.

Before starting a reference run you have to specify the type of the reference run and the direction to run to in Byte 15.

By setting Byte 10 to 02h, the drive starts with its reference run.

As frequency the reference frequency set in the parameters are used. If there are no parameters, the default values are used.

There are 6 different possibilities for the reference drive that are predefined via Byte 15:

- Reference run to reference switch and delete position counter
- Reference run to reference switch and keep position counter
- Reference run to end switch B and delete position counter
- Reference run to end switch B and keep position counter
- Reference run to end switch A and delete position counter
- Reference run to end switch A and keep position counter

Control bits for the reference run

The control bits in Byte 15 have the following assignment:

Byte 15	Parameter
Bit 0	1: Direction forward 0: Direction backward
Bit 1	1: delete position after reference run 0: keep position after reference run
Bit 2	Reference run to reference switch
Bit 3	Reference run to end switch B
Bit 4	Reference run to end switch A

Note!

When starting a reference run, please regard, that you always have to set a direction via Bit 0 and that you may set only one bit in the Bits 2...4!

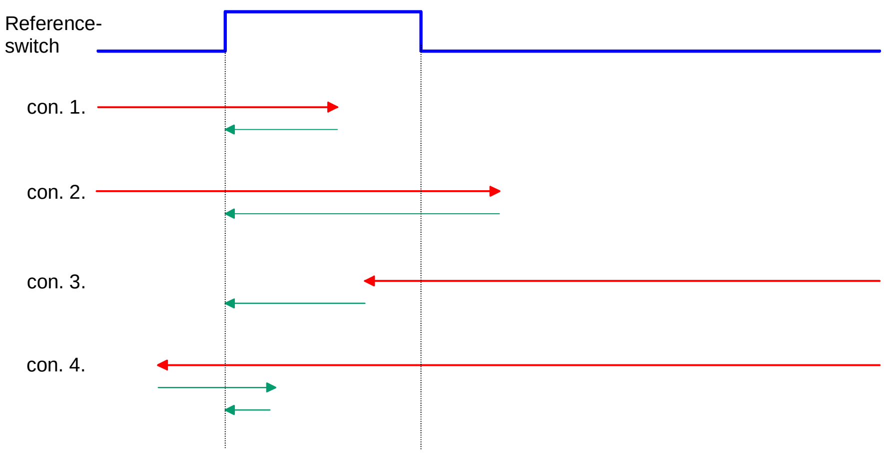
Reference run to reference switch

The reference run starts always with the speed predefined in FREF. The direction has to be preset in the variable parameter (Byte 15, Bit 0). As soon as the ascending edge of the reference switch is recognized, the motor slows down to FSTART.

Depending on the reference speed the drive may overrun the reference switch or not during slow down.

The following 4 drives to the reference switch are possible:

1. Motor comes from the left side, slows down inside the reference switch and drives backward with FSTART until the descending edge of the reference switch is recognized.
2. Motor comes from the left side, overruns the reference switch during slow down and drives backward with FSTART over the ascending edge until the descending edge of the reference switch is recognized.
3. Motor comes from the right side, slows down inside the reference switch and drives with FSTART until the descending edge of the reference switch is recognized.
4. Motor comes from the left side, overruns the reference switch during slow down, it changes the rotational direction and drives with FSTART until the ascending edge of the reference switch is recognized, switches the direction again and drives on until the descending edge of the reference switch is recognized.



Reference run to end switch

You may limit your distance via the end switches A and B.

At the reference run to end switch the drive starts and drives with the preset speed FREF and the predefined rotational direction until the according end switch gets active, stops abruptly, changes its rotational direction and drives with FSTART until the end switch is inactive again.

Note!

If you use the reference run to end switch, you have to regard, that there is enough space behind the end switch for the motor to slow down!

Data transfer FM 253 >> CPU

Respond message

The MotionControl Stepper module sends a data block to the CPU cyclically that contains several information about the recent state of the drive. The data block has a length of 16Byte and the following structure:

Byte no.	Content	Length
0-3	actual position	4 Byte
4-7	actual frequency	4 Byte
8-9	error messages	2 Byte
10	actual mode	1 Byte
11	state	1 Byte
12-15	data of variables	4 Byte

Actual position, actual frequency

Via this two parameters the actual position and frequency of your drive is always shown.

Error messages

The recently recognized errors are monitored via the error bits of Byte 8-9. The errors remain active until the according Bits are set back.

As long as an error is still valid, the according error bit is set again after the reset.

The following error messages are used:

Error byte (Byte 8-9)

Byte 9	Description
Bit 0	Error in the internal state administration
Bit 1	System has been booted (always after PowerON)
Bit 2	Error at proofing Flash parameters, motor parameters not valid
Bit 3	This function is not permitted during motor run
Bit 4	Motor is recently blocked
Bit 5	Error at positioning the motor
Bit 6	End switch is/was active
Bit 7	Frequency has been limited to FMAX
Byte 8	
0	General error at the motor

Set back error messages

For deleting an active error (Byte 8-9) you have to set the according error bit in the variables parameter (Byte 14-15) to "1".

As soon as you set the **Mode (Byte 10) to 07h**, the according errors in the module are set back. You may also set back several error messages at the same time. FFFFh in Byte 14-15 for example sets back all errors.

Recent mode

Here you always find the mode that your FM 253 has at the moment.

The following modes may be shown:

Mode (Byte 10)

Byte	Mode
10	00h: IDEL 01h: Positioning relative 02h: Reference run 03h: Permanent run axis 04h: Read inputs 05h: Change motor parameters 06h: Set position 07h: Delete error 08h: Positioning absolute

State

The STATE-Byte shows you the state of the drive.

The following state messages may be shown:

State (Byte 11)

Byte 11	State
Bit 0	1: Drive in run 0: Drive in stop
Bit 1	1: Direction forward 0: Direction backward
Bit 2	1: Drive in position 0: Drive not in position

Read inputs

For reading the inputs, the **Mode (Byte 10)** is set **to 04h** and now the module shows the state of the end switches and the reference switch in the variables data (Byte 15).

Inputs (Byte 15)

Byte 15	Input
Bit 0	State PA end switch (1: operated, 0: not operated)
Bit 1	State PB end switch (1: operated, 0: not operated)
Bit 2	State RE reference switch (1: operated, 0: not operated)

Handling blocks for FM 253

Overview

There are different handling blocks available with the FM 253 to make the usage of the module more comfortable. The following handling blocks are available for the FM 253 at this time:

Block	Description
FC 200	Control drive
FC 201	Adjustment of a parameter
FC 202	Adjustment of all drive parameters (Index 0...9)

FC 200 Control drive

This FC serves the control of your drive by transferring the drive data to the module through setting the according mode.

With this FC you may transfer all modes except "Set parameters" and the according parameters to the module.

Data transfer to FM 253 with SET_MODE = 1

- Set the mode.
- Give data to the according parameters.
- Start the transfer by setting SET_MODE to 1. When the mode is started, the module SET_MODE is set back at the next cycle and shows the actual data of the FM 253.

Data transfer to CPU with SET_MODE = 0

At the call of the FC 200 with SET_MODE = 0, the actual data of the FM 253 is shown via the labels ACT_POSITION, ACT_FREQUENCY, ACT_MODE, ERROR, STATE and VAR_DATA.

It is convenient to store the single values in a data block. In the following example we used DB5 for this purpose.

Parameters

Address	Declaration	Name	Type	Start value	Comment
0.0	in	ADDRESS	INT		Set basic address
2.0	in	SET_POSITION	DINT		Transfer position values
6.0	in	SET_FREQUENCY	DINT		Transfer frequency at permanent run
10.0	in	VARIABLES	DWORD		Transfer variables at reference run
14.0	in	MODE	INT		Transfer mode to change
16.0	out	ACT_POSITION	DINT		Response actual position
20.0	out	ACT_FREQUENCY	DINT		Response actual frequency
24.0	out	ERROR	INT		Error word
26.0	out	ACT_MODE	INT		Response actual mode
28.0	out	STATE	BYTE		Response status bits
30.0	out	VAR_DATA	DWORD		Response variables
34.0	in_out	SET_MODE	BOOL		Start function

ADDRESS

Start address from where on the FM 253 is stored in the CPU.

SET_POSITION

In mode 01, 06 and 08 you fix the scheduled position for the drive here.

SET_FREQUENZ

In mode 03 you fix the scheduled rotational speed as set frequency.

VARIABLES

Fix here the control bits for the reference run (MODE = 02) and for setting the errors back (MODE = 07).

The control bits for the reference run have the following assignment:

Control bits

VARIABLE-Byte	Parameter
Bit 0	1: Direction forward 0: Direction backward
Bit 1	1: after reference run delete position 0: after reference run keep position
Bit 2	Reference run to reference switch
Bit 3	Reference run to end switch B
Bit 4	Reference run to end switch A

An overview over the error-bit-assignment follows below.

MODE

With this parameter you transfer the mode to the FM 253. The following modes are possible:

Mode

Value	Description	Default in	Response in
00	Idle-Mode - no status change of the drive, serves for parameter changes	-	-
01	Positioning relative - driving the preset number of steps	SET_POSITION	-
02	Reference run - calibration of the drive	VARIABLES	-
03	Permanent run axis - drive runs with scheduled frequency	SET_FREQUENCY	-
04	Read inputs - responds with the end switches states	-	VAR_DATA
06	Set position - sets the recent position in the module without moving the drive	SET_POSITION	-
07	Delete error - deletes the error bit activated with 1	VARIABLES	-
08	Positioning absolute - drive to scheduled position	SET_POSITION	-

ACT_POSITION, ACT_FREQUENCY

Via those parameters the recent actual position and actual frequency of your drive is shown.

ERROR

Here you may find error messages if occurred. The errors remain active until the error cause is removed and the according bits are set back. The following error messages may occur:

Error messages

ERROR-Byte 1	Description
Bit 0	Error in the internal state administration
Bit 1	System booted (always after PowerON)
Bit 2	Error at validating the Flash parameters, motor parameters not valid
Bit 3	Function is not available during motor run
Bit 4	Motor is blocked
Bit 5	Error at positioning the motor
Bit 6	End switch is/was active
Bit 7	Frequency has been limited to FMAX
ERROR-Byte 0	
0	General error at the motor

The clearing of the error messages takes place via MODE = 07 and VARIABLE = Error bytes.

ACT_MODE

Responds the mode in which the module is at this moment.

STATE

The STATE-Byte shows you information about the state of the drive. The following state messages may occur:

State

STATE-Byte	State
Bit 0	1: Drive in run 0: Drive in stop
Bit 1	1: Direction forward 0: Direction backward
Bit 2	1: Drive in position 0: Drive not in position

VAR_DATA

In VAR_DATA the state of the inputs is returned after you requested this by MODE = 04. For reading the inputs the **Mode 4** is set and now the module shows the state of the end switches and the reference switch in the variables data (Byte 15).

Inputs

VAR_DATA-Byte	Input
Bit 0	State PA end switch (1: operated, 0: not operated)
Bit 1	State PB end switch (1: operated, 0: not operated)
Bit 2	State RE reference switch (1: operated, 0: not operated)

SET_MODE

After you defined the according parameters the data is transferred to your module via SET_MODE = 1.

When the mode has been started, the module sets back again the SET_MODE in the next cycle and returns the actual data of the FM 253.

Example

```
DB 5
DBD  0 Position        DINT    L#0      Position value
DBD  4 Frequency       DINT    L#0      Frequency for permanent run
DBW  8 reserve         WORD    W#16#0
DBW 10 MODE            INT     0        Mode
DBW 12 Index           INT     0        Index default
DBD 14 Variable_PARAM  DWORD   DW#16#0  Var. for Ref.run/Param...
DBW 18 Reserve1        WORD    W#16#0
DBD 20 Act_Position    DINT    L#0      actual position
DBD 24 Act_Frequency   DINT    L#0      actual frequency
DBW 28 Error           INT     0        error monitor
DBW 30 ACT_Mode        INT     0        actual mode
DBW 32 State           BYTE    B#16#0   State response
DBD 34 VAR_DATA        DWORD   DW#16#0  Return parameter/data

CALL  FC 200                  //FC for Stepper module
    ADDRESS      :=128        //Module address
    SET_POSITION :=DB5.DBD 0  //DBD with position for abs/rel
    SET_FREQUENCY:=DB5.DBD 4  //DBD with frequency for permanent run
    VARIABLES    :=DB5.DBD14  //Delete data for Ref_Run/Del error
    MODE         :=DB5.DBW10  //Mode default for new order
    SET_MODE     :=M1.0       //Start order
    ACT_POSITION :=DB5.DBD20  //actual position
    ACT_FREQUENCY :=DB5.DBD24 //actual frequency
    ERROR        :=DB5.DBW28  //Monitor error
    ACT_MODE     :=DB5.DBW30  //actual mode
    STATE        :=DB5.DBW32  //State bits from module
    VAR_DATA     :=DB5.DBD34  //Return of values
                                e.g. read inputs
```

FC 201 - set a parameter

With the FC 201 it is possible to set a parameter at the FM 253.

Parameter

Address	Declaration	Name	Type	Start value	Comment
0.0	in	ADDRESS	INT		Fixed basic address
2.0	in	INDEX	INT		Transfer INDEX for parameters
4.0	in	PARAMETER	DWORD		Transfer parameter value
	out				
8.0	in_out	SET_PARA	BOOL		Start parameter transfer

ADDRESS

Start address from where on the FM 253 is stored in the CPU.

INDEX

Via INDEX you fix the parameter where the value is set in PARAMETER.

Index	Parameter	Unit	Value range	Default	Description
00h	Fstart	Hz	UINT32	200	Start frequency
01h	F1	Hz	UINT32	4000	Limit frequency 1
02h	dF1	Hz	UINT32	100	Acceleration from Fstart ⇒ F1
03h	F2	Hz	UINT32	10000	Limit frequency 2
04h	dF2	Hz	UINT32	60	Acceleration from F1 ⇒ F2
05h	Fmax	Hz	UINT32	30000	Maximum drive frequency
06h	dFmax	Hz	UINT32	40	Acceleration from F2 ⇒ Fmax
07h	Fpos	Hz	UINT32	30000	Frequency at positioning
08h	Fref	Hz	UINT32	1000	Frequency for reference run
10h	Fist	Hz	UINT32	-	Actual motor frequency (read only)
11h	Fsoll	Hz	UINT32	-	Actual sched. frequency (read only)
13h	FTarget	Hz	UINT32	-	Target frequency (read only)
97h				-	Store parameters in Flash
98h				-	Read parameters from Flash (State like after PowerON)
99h				-	Load default parameters

PARAMETER

Here you type the value of the parameter specified via INDEX.

SET_PARA

After you filled the according parameters, the parameter is transferred to your module via SET_PARA = 1. After the transfer SET_PARA is set back automatically.

Parameterize FC 202 - FM 253

Via the FC 202 you may adjust all relevant parameters of the FM 253.

Parameter

Address	Declaration	Name	Type	Start value	Comment
0.0	in	DATA_DB	BLOCK_DB		Data block with parameters
2.0	in	ADDRESS	INT		Module address
	out				
4.0	in_out	START	BOOL		Start parameter transfer
4.1	in_out	RUN	BOOL		Transfer single runs

DATA_DB

Please fix here the data block where your parameters are stored.

The DB has the following structure:

```
DBD  0 Fstart        DINT   L#0  Start frequency
DBD  4 F1            DINT   L#0  Limit frequency 1
DBD  8 F2            DINT   L#0  Limit frequency 2
DBD 12 Fmax          DINT   L#0  Maximum drive frequency
DBD 16 dF1           DINT   L#0  Acceleration Fstart --> F1
DBD 20 dF2           DINT   L#0  Acceleration F1 --> F2
DBD 24 dFmax         DINT   L#0  Acceleration F2 --> Fmax
DBD 28 Fpos          DINT   L#0  Frequency at positioning
DBD 32 Fref          DINT   L#0  Frequency at reference run
DBD 36 StepRepeat    DINT   L#0  Step between frequency calculation
```

ADDRESS

Start address from where on the FM 253 is stored in the CPU.

START

After you created the DB you may transfer your parameters to your module via START = 1.

As soon as all parameters are transferred, START is set back again.

RUN

This variable stores one cycle spreading state and it is responsible for the single parameter transfer.

MotionControl Servo FM 254

Features

- Microprocessor controlled positioning module for drives with an analog set point interface (±10V control voltage)
- 7 operating modes
- closed-loop position control
- The module operates independently and it is controlled by means of an application program in the System 200V.
- Data is saved in Flash-RAM. No backup battery is required.

Application areas

The positioning module can be employed for simple position control tasks as well as profile-controlled drive outlines that meet the most stringent requirements with respect to dynamics, accuracy and speed.

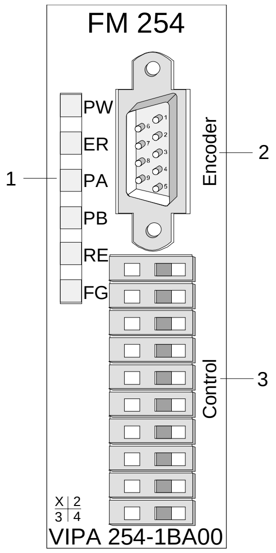
Due to the various modes of operation the module can also be employed for positioning applications on machines that employ very high clock rates.

Typical applications:

- Production and transportation equipment, transfer lines and assembly lines
- Presses
- Woodworking machines
- Handling equipment
- Feeder devices
- Packing machines
- Auxiliary actuators for lathes and milling machines

Construction FM 254

Front view



[1] LED status indicators
[2] Encoder interface
[3] Connector for supply voltage, drive, end switch and outputs

Components

LEDs

The positioning module FM 254 has 6 status indicator LEDs.

The following table contains the description and the respective color of these LEDs.

Label	Color	Description
PW	Yellow	24V DC supply voltage is applied
ER	Red	internal error
PA	Green	Limit value A overrun, input PA is set
PB	Green	Limit value B overrun, input PB is set
RE	Green	Reference point overrun
FG	Green	Drive released

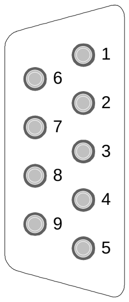
Note!

If the PW-LED is not on during operation, this may depend on a short circuit in the DC 24V voltage supply.

Please control also the connections of the encoder plug.

If the LED remains off even when you disconnect the encoder plug, the module has a defect.

Encoder interface



Pin	Assignment
1	+24V encoder power
2	+5V encoder power
3	R+ clock input null pulse
4	B+ clock input
5	A+ clock input
6	Ground encoder power
7	R- clock input null pulse
8	B- clock input
9	A- clock input

Control interface

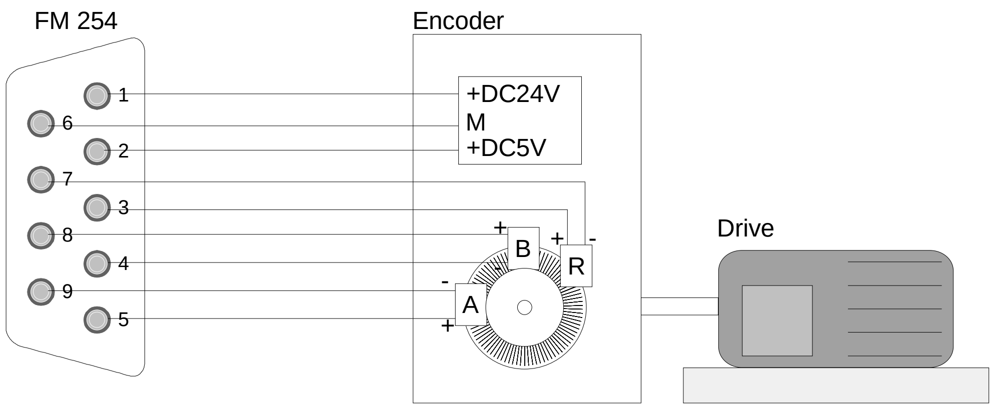
Pin	Assignment
1	DC 24V supply voltage
2	Ground 24V
3	Input for start switch (low active)
4	Input for end switch (low active)
5	Input for reference switch (low active)
6	reserved
7	Output regulator release
8	Analog output ground
9	Analog output +
10	Screen

Connecting a drive with encoder to FM 254

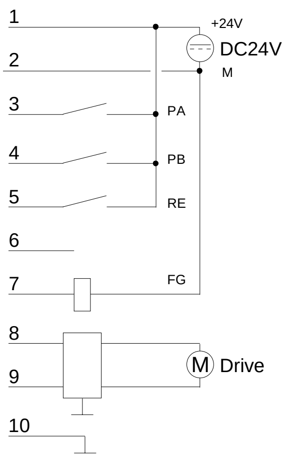
Connection of an encoder

The encoder is wired to the 9pin D-type connector located at the front. The module supplies the encoder with the required DC 24V and DC 5V voltages.

The following figure shows the connection of an encoder:



Connection of supply voltage, drive, end switch and outputs



Power supply

The module requires a power supply of DC 24V via pins 1 and 2.

End switches

You may connect up to 3 end switches to the module. Connectable are closer which signal is inverted in the module.

The end switches for the extremes of the distance are connected to terminals 3 and 4. The drive will be stopped immediately as soon as one of these switches is operated. In this situation may only be driven into the opposite direction.

The reference switch is connected to terminal 5. This is required to tune the drive to the positioning module.

The end switch that stops the drive in the mode hardware-controlled run is also connected to terminal 5.

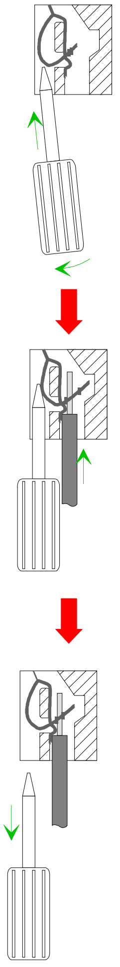
Outputs

The module has 2 outputs that are controlled directly by the module. At present, however, only the output "Controller Enable" (pin 7) is available. The second output is intended for future expansion. You enable the output by setting bit 0 in the traversing data.

Drive

Pin 8 and 9 supply an analog signal for ±10V regulator control.

Cabling



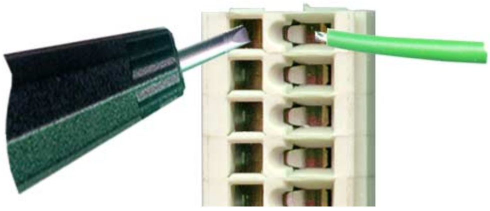
The drive and the end switches are to connect at the control interface. Herefore a 10pin plug with CageClamp technology from WAGO is used. The cabling with CageClamps is very fast and in opposite to screw connections vibration secure.

You may connect cores with a core cross-section from $0.08mm^2$ up to $1.5mm^2$.

The cabling is analog to the big CageClamps of the System 200V.

Push the spring in the square opening with a fitting screwdriver more inside and insert the core into the rectangular opening.

By releasing the screwdriver the core is securely fixed.



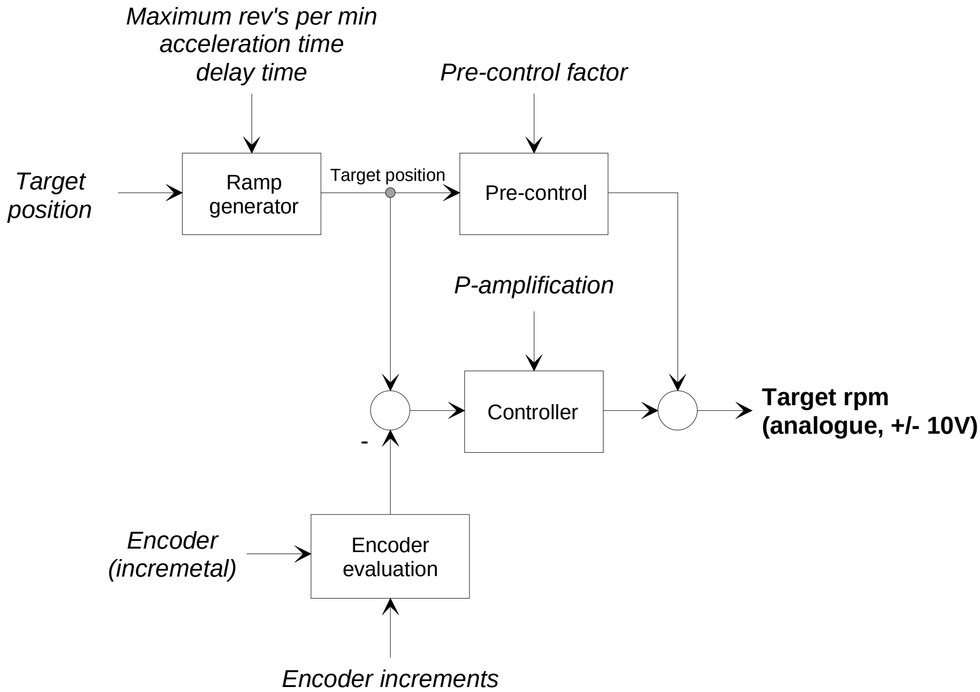
Summary of parameters and transfer values FM 254

The following table lists all the parameters and transfer values. A block diagram depicts the interaction between the parameters.

Overview

Value	Size	Unit	Physical range
Destination position Set position Actual position	32Bit	$\frac{\text{1 rotation}}{2^{16}}$	0.0 ... 65535.9999 revs.
Maximum rpm.	16Bit	1/min	10 ... 300000 1/min
Acceleration time Delay time	16Bit	10 ms	10 ms ... 100 s
P-amplification	16Bit	0.1	0.0 ... 1000.0
Pre-control factor	16Bit	0.1	0.0 ... 1.0
Encoder increments	16Bit	1	10 ... 10000
Operating mode	16Bit	binary coding	

Block diagram



Parameterization FM 254

When commissioning the MotionControl Servo module it requires 16Byte of parameter data. These have the following structure:

Parameter data (write only)

Byte no.	Name	Length	Range	Unit
1, 0	Maximum rotat. speed	2Byte	10.....1000	1/min
3, 2	reserved	2Byte	-	-
5, 4	reserved	2Byte	-	-
7, 6	P-amplification	2Byte	0.0 ... 1000.0	0.1
9, 8	Pre-control factor	2Byte	0.0 ... 1.0	0.1
11, 10	Encoder increments	2Byte	10 ... 10000	1
13, 12	Reference rot. speed	2Byte	10 ... 1000	1/min
14	Pos. reached window	1Byte	0.....255	1INK
15	Drag distance	1Byte	4.....1020	4INK

Parameter description

Maximum rotational speed

Defines the maximum rotations for your drive.

P-amplification, Pre-control factor

These values control the regulation properties.

Encoder increments

This parameter matches your MotionControl Servo module to the encoder.

Reference rotational speed

This value for the rotational speed is used for the reference run that is required by the MotionControl Servo module to re-acquire parameters for the control path.

Pos-reached-window

When the target position has been reached, this position is maintained by continuous control of the drive. The drive is never stopped.

You can specify a window by entering certain increments into the *Pos-reached-window.* These define the tolerance by which the actual value may differ from the target position before the drive is controlled, i.e. when the drive is stationary.

Drag distance

This parameter defines the drag error or the difference between the actual and the set value, which causes the drive to be stopped.

Data transfer CPU >> FM 254

Traversing data

The CPU can control the MotionControl Servo module by writing the following values into the FM 254 module:

Byte no.	Name	Length	Range	Unit
3, 2, 1, 0	Target position	4Byte	32 Bit Integer	Encoder increments
5, 4	Control bytes	2Byte		
7, 6	Rot. speed	2Byte	10.....6000	1/min
9, 8	Acceleration time	2Byte	1...10000	10ms
13, 12 ,11, 10	Parameter field	4Byte		
15, 14	Field identifier	2Byte		

Control bytes (Byte 4 and Byte 5)

Byte	Bit 7 ... Bit 0
4	Bit 0: Enable Bit 1: Operating mode reference run positive Bit 2: Operating mode reference run negative Bit 3: Operating mode hardware-controlled run positive Bit 4: Operating mode hardware-controlled run negative Bit 5: Operating mode incremental dimension Bit 6: Operating mode infinite incremental dimension Bit 7: Taking over target position
5	Bit 0: reserved Bit 1: Non-maintained command mode direction of rotation pos. Bit 2: Non-maintained command mode direction of rotation neg. Bit 7 ... Bit 3: reserved

These operating modes are described below.

Parameter field and Field identifiers (Byte 10 ... Byte 14)

You can send additional parameters with the traversing data to the MotionControl Servo module by specifying a field identifier. The parameters for the respective field identifier must be entered into the parameter field (Byte 10...13).

The FM 254 will use the default settings shown below if you do not transfer any field identifiers.

Field identifier	Description	Range	Unit	Default setting
FF01h	Software end switch (+)	32Bit Integer	Encoder increments	7FFF.FFFF
FF02h	Software start switch(-)	32Bit Integer	Encoder increments	8000.0001
FF03h	Rot. speed at non-maintained command mode	10.....6000	1/min	Reference rot. speed
FF04h	Delay time	1...10000	10ms	Acceleration time

Operating modes FM 254

Overview

The following operating modes can be selected by setting the respective bit in the control byte:

- Positioning operation (positioning to an absolute target position)
- Reference run (system calibration)
- Hardware run (drive to reference switch)
- Incremental run (use addition to approach a relative target)
- Infinite incremental run (relative traversal without counter overflow)
- Non-maintained command mode

Positioning operation

Operation

During the positioning operation the absolute target position is only transferred to the FM 254, if the bit "Taking over target position" is set.

If a new position is specified with the enable bit set, the drive moves to the respective position ± POS-REACHED-WINDOW with the values that were previously specified for the rotational speed and the acceleration/delay and sets the "Position reached"-Bit. After transferring the parameters for the traversal, you can start the drive by setting the enable bit. During the traversal the module indicates the direction of rotation by setting bit 1 or 2.

Should the deviation between set and actual position exceed the window specified for the drag error, the positioning operation is terminated and the motor is stopped. The program is notified by means of an active drag error bit 0 in Byte 5. You can clear the drag error bit by resetting the enable bit. This also sets the set position to the actual position.

The drive is also stopped if soft- or hardware switches are passed that terminate the traversal distance.

The operation can be continued at any time by setting the enable bit.

The acceleration/delay time can be modified before a new command is issued.

It is always possible to specify a new value for the rotational speed by modifying the traversing data. If the rotational speed is changed while movement is taking place, the new value is attained respecting the current acceleration/delay times.

Control bytes

The control bytes that you use to specify this operating mode are an integral part of the traversal data.

A general description of the traversal data is available on pages 9-30.

Byte	Bit 7 ... Bit 0
4	Bit 0: enable (drive is started) Bit 6 ... Bit 1: 0 Bit 7: irrelevant
5	Irrelevant

Reference run

Operation

The reference run calibrates your drive system. The point of reference should be located on the path of traversal.

Start the reference run:

- Set the enable bit.
- Release the reference run by means of the bit "Reference run positive" or "Reference run negative".
  - → The drive will travel to the point of reference using the reference rotational speed specified in the parameter set.
  - → As soon as the point of reference is passed, the reference switch is operated (LED RE is turned off).
  - → The position of the point of reference is recorded in memory.
  - → The drive is reversed up to the next encoder zero pulse.

This concludes the reference run and the bit "Reference detected" is set.

Note!
Please remember that a set position is not required for operating mode "Reference run". The set position is ignored.

Control bytes

The control bytes that you use to select this operating mode are included in the traversing data.

A general description of the traversal data is available on pages 9-30.

Byte	Bit 7 ... Bit 0
4	Bit 0: enable (drive is started) Bit 2 ... Bit 1: 01: reference run positive 10: reference run negative Bit 6 ... Bit 3: 0 Bit 7: irrelevant
5	Irrelevant

Hardware run

Operation

This mode is only used to approach a target position until the drive is stopped by an overrun end switch. The end switch must be connected to the reference switch input.

The traversal is governed by the values that were specified for rotational speed and acceleration or delay times. After the end switch is reached the respective position is stored internally and the drive is stopped with the specified delay time.

When the drive has stopped, it is reversed to the position of the end switch where it is stopped finally. At this point bit 3 is set to indicate "Position reached". For the reverse movement the MotionControl Servo module uses the reference rotational speed specified in the parameterization.

A new traversal can be initiated by toggling the bits "enable" and "HW ref. positive".

The acceleration/delay time can be modified before a new job is initiated.

If the rotational speed is altered when during the traversal, the new value is achieved by means of the current acceleration/delay time values.

Note!

Please remember that a set position is not required for operating mode "Hardware run". The set position is ignored.

Control bytes

The control bytes that you use to select this operating mode are included in the traversing data.

A general description of the traversal data is available on pages 9-30.

Byte	Bit 7 ... Bit 0
4	Bit 0: enable (drive is started) Bit 2 ... Bit 1: 0 Bit 4 ... Bit 3: 01: Hardware run positive 10: Hardware run negative Bit 6 ... 5: 0 Bit 7: irrelevant
5	Irrelevant

Incremental run

Operation

The incremental mode makes use of relative positions, i.e. the value supplied as set position is added to the actual position.

When the enable bit is set, the drive travels in a positive or negative direction for the specified relative value. The drive uses the predefined values for rotational speed and acceleration to travel to the new position. If the position is negative the drive will be reversed.

You can modify the acceleration/delay time before you initiate a new job.

If the rotational speed is altered when during the traversal, the new value is achieved by means of the current acceleration/delay time values.

Control bytes

The control bytes that you use to select this operating mode are included in the traversing data.

A general description of the traversal data is available on pages 9-30.

Byte	Bit 7 ... Bit 0
4	Bit 0: enable (drive is started) Bit 4 ... Bit 1: 0 Bit 5: 1 (Incremental run) Bit 6: 0 Bit 7: irrelevant
5	Irrelevant

Infinite incremental mode

Operation

In this mode the position supplied as a value is approached as a relative position when enabled. When the position is reached, the set and the actual position are set to zero. You can use this mode to move the drive in one direction without counter overflow condition.

You can modify the acceleration/delay time before you initiate a new job.

You may specify a new value for the rotational speed at any time. If the rotational speed is altered during the traversal, the new value is achieved by means of the current acceleration/delay time values.

Control bytes

The control bytes that you use to select this operating mode are included in the traversing data.

A general description of the traversal data is available on pages 9-30.

Byte	Bit 7 ... Bit 0
4	Bit 0: enable (drive is started) Bit 5 ... Bit 1: 0 Bit 6: 1 (Infinite incremental run) Bit 7: irrelevant
5	Irrelevant

Non-maintained command mode

Operation

The drive is released by setting Bit 0 in Byte 4 (enable) with before opposed rotational speed and acceleration. By setting Bit 1 or Bit 2 in Byte 5, a rotation direction is given and the drive starts. The drive stops as soon as Bit 1 or Bit 2 of Byte 5 is set back.

Control bytes

The control bytes that you use to select this operating mode are included in the traversing data.

A general description of the traversal data is available on pages 9-30.

Byte	Bit 7 ... Bit 0
4	Bit 0: enable (drive is started)
5	Bit 0: V1.08 - Reset counter at non-maintained command mode (edge 0 after 1 sets back the actual position to zero) *1) Bit 1: 1 direction of rotation positive Bit 2: 1 direction of rotation negative

Note!

*1) The reset of the counter may only be executed in the non-maintained command mode. During positioning mode the regulator would throw a drag error because of the jumping actual value.

Data transfer FM 254 >> CPU

The following values are transferred cyclically by the MotionControl Servo module to the CPU and stored.

Byte no.	Name	Length	Range	Unit
3, 2, 1, 0	Set position	4Byte	32Bit Integer	Encoder increments
7, 6, 5, 4	Actual position	4Byte	32Bit Integer	Encoder increments
9, 8	Set rotational speed	2Byte	10.....6000	1/min
11, 10	Operating mode	2Byte	binary coded	
13, 12	reserved	2Byte	-	-
15, 14	Reply field identifier	2Byte		hex

Operating state

Byte	Bit 7 ... Bit 0
10	Bit 0: enable issued Bit 1: clockwise rotation Bit 2: anticlockwise rotation Bit 3: position reached Bit 4: HW start switch operated Bit 5: HW end switch operated Bit 6: HW reference switch operated Bit 7: Reference detected
11	Bit 0: Drag error detected Bit 4: SW end switch anticlockwise rotation Bit 5: SW end switch clockwise rotation Bit 7 ... 1: irrelevant

Example

If the MotionControl Servo module was addressed starting at peripheral address PY128 in your CPU, you may obtain the "set position" from PY128 to PY131.

Other values follow these values in the peripheral area in accordance with the list above.

For example, the 2Byte for the "Operating state" are located at PY138...PY139.

Technical data

MotionControl
Stepper
FM 253

Electrical data	VIPA 253-1BA00
Number of axis	1
Voltage supply	external DC 20 ... 30V
Current consumption backplane bus	typ. 320mA, max. 500mA
Status monitor	via LEDs at the frontside
Connectors / Interfaces	
"Drive"-Interface	Output for pulse, direction and release with RS422
Max. Impulsefrequence	200kHz
Digital inputs	
Number	3
Function	2 end switch, reference switch
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28,8V
Digital outputs	
Number	2
Function	"axis in motion", "position reached"
Output current	1A protected against sustained short circuits
Potential separation	yes
Programming data	
Input data	16Byte
Output data	16Byte
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4 x 76 x 76
Weight	80g

MotionControl Servo module FM 254

Electrical data	VIPA 254-1BA00
Voltage supply	external DC 20 ... 30V
Current consumption	200mA
Current consumption backplane bus	100mA
Status indicator	via LEDs on the frontside
Connectors / interfaces	
Encoder	Incremental encoder
Signal voltages	5V as per RS 422
Supply voltage	5.2V / 300mA
	24V / 300mA
Input frequency and line length	1MHz max. with 10m screened line
	500kHz max. with 35m screened line
Control	
Set point output	-10 ... +10V
Digital inputs	
Number	3
Supply voltage	DC 24V
Digital outputs	
Number	1
Potential separation	no
Output current	0.5A
Lamp load	5W
Programming data	
Input data	16Byte
Output data	16Byte
Parameter data	16Byte
Diagnostic data	-
Dimensions and Weight	
Dimensions (WxHxD) in mm	25.4 x 76 x 76
Weight	80g

Chapter 10 Power supplies

Overview

This chapter contains descriptions of the System 200V power supplies.

Below follows a description of the:

- Power supply 2A
- Power supply 4A
- Installation and wiring
- Technical data

Contents

Ordering details

Order number	Description
VIPA 207-1BA00	Power supply primary AC 100...240V, secondary DC24V, 2A, 48W
VIPA 207-2DA00	Power supply primary AC 100...240V, secondary DC24V, 4A, 96W

Safety precautions

Appropriate use

The power supplies were designed and constructed:

- to supply 24V DC to the System 200V components
- to be installed on a t-rail along with System 200V components
- to operate as 24V DC "stand alone" power supplies
- for installation in a control cabinet with sufficient ventilation
- for industrial applications

The following precautions apply to applications employing the System 200V power supplies.

Danger!

- The power supplies must be installed in protected environments that are only accessible to properly qualified maintenance staff!

- The power supplies are not certified for applications in explosive environments (EX-zone)!

- You must disconnect the power supply from the main power source before commencing installation or maintenance work, i.e. before you start to work on a power supply or the supply cable the main supply line must be disconnected (disconnect plugs, on permanent installations the respective circuit breaker must be turned off)!

- Only properly qualified electrical staff is allowed to install, connect and/or modify electrical equipment!

- To provide a sufficient level of ventilation and cooling to the power supply components whilst maintaining the compact construction it was not possible to protect the unit from incorrect handling and a proper level of fire protection. For this reason the required level of fire protection must be provided by the environment where the power supply is installed (e.g. installation in a switchboard that satisfies the fire protection rules and regulations)!

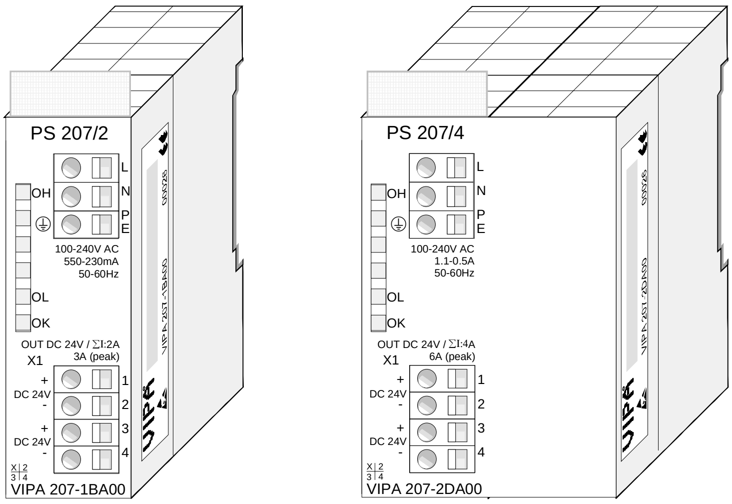
- Please adhere to the national rules and regulations of the location and/or country where the units are installed (installation, safety precautions, EMC ...).

System overview

The System 200V power supplies are provided with a wide-range-input that can be connected to 100 ... 240V AC. The output voltage is 24V DC at 2A/48W or 4A/96W.

Since all inputs and outputs are located on the front of the unit and since the enclosure is isolated from the back panel bus you can install the power supply along with the System 200V on the same t-rail or you can use it as a separate external power supply.

The following power supplies are currently available:



Ordering details

Order number	Description
VIPA 207-1BA00	Power supply primary AC 100...240V, secondary DC24V, 2A, 48W
VIPA 207-2DA00	Power supply primary AC 100...240V, secondary DC24V, 4A, 96W

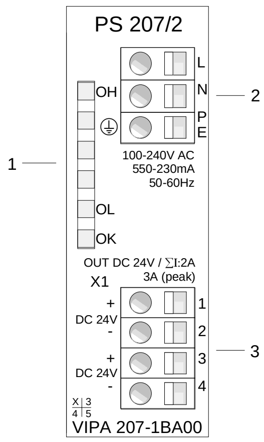
Power supply PS 207/2, 2A

Properties

The power supply is distinguished by the following properties:

- Wide-range-input 100...240V AC without manual intervention
- 24V DC, 2A, 48W output
- Can be installed on a t-rail together with other System 200V components or as "stand alone" devices
- Protection from short-circuits, overload and open circuits
- Typically 90% efficiency at I_{rated}

Construction



[1] LED status indicator
[2] AC IN 100 ... 240V
[3] DC OUT 24V, 2A, 48W

LED's

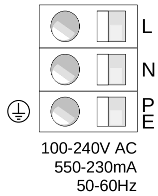
The front of the power supply carries 3 LED's for troubleshooting purposes. The following table lists the significance and the respective color.

Name	Color	Description
OH	red	Overheat: turned on by excessive temperatures
OL	yellow	Overload: turned on when the total current exceeds the maximum capacity of app. 4A.
OK	green	Turned on when the power supply operates properly and supplies 24V DC power.

Note!
Only one LED is on when the unit operates.
When all the LED's are extinguished while the power supply is operational a short circuit is present or the power supply has failed.

Connector wiring

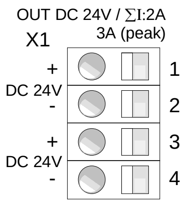
Input voltage INPUT 100...240V AC



The power supply must be connected to a source of AC power via the input connector.

A fuse protects the input from overloads.

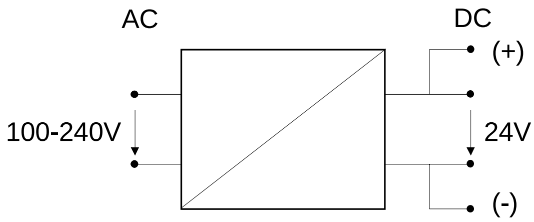
Output voltage OUTPUT 24V DC, 2A



Two connectors are provided for connection to System 200V modules that require an external source of 24V DC.

Both outputs are protected against short circuits protected and have an output voltage of 24V DC with a total current of 2A max.

Block diagram



Danger!

- You must disconnect the power supply from the main power source before commencing installation or maintenance work, i.e. before you start to work on a power supply or the supply cable the main supply line must be disconnected (disconnect plugs, on permanent installations the respective circuit breaker must be turned off)!
- Only properly qualified electrical staff is allowed to install, connect and/or modify electrical equipment!

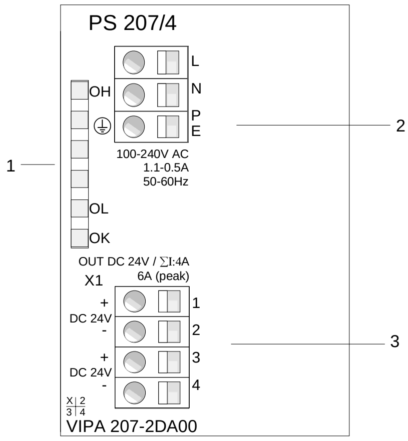
Power supply PS 207/4, 4A

Properties

The power supply is distinguished by the following properties:

- Wide-range-input 100...240V AC without manual intervention
- 24V DC, 4A, 96W output
- Can be installed on a t-rail together with other System 200V components or as "stand alone" devices
- Protection from short-circuits, overload and open circuits
- Typically 90% efficiency at I_{rated}

Construction



[1] LED status indicator
[2] AC IN 100 ... 240V
[3] DC OUT 24V, 4A, 96W

LED's

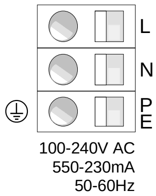
The front of the power supply carries 3 LED's for troubleshooting purposes. The following table lists the significance and the respective color.

Name	Color	Description
OH	red	Overheat: turned on by excessive temperatures
OL	yellow	Overload: turned on when the total current exceeds the maximum capacity of app. 4A.
OK	green	Turned on when the power supply operates properly and supplies 24V DC power.

Note!
Only one LED is on when the unit operates.
When all the LED's are extinguished while the power supply is operational a short circuit is present or the power supply has failed.

Connector wiring

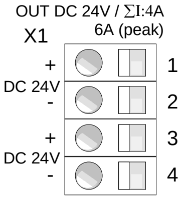
Input voltage
INPUT
100...240V AC



The power supply must be connected to a source of AC power via the input connector.

A fuse protects the input from overloads.

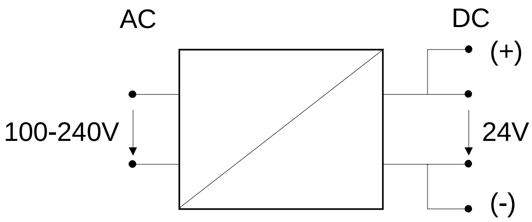
Output voltage
OUTPUT
24V, 4A DC



Two connectors are provided for connection to System 200V modules that require an external source of 24V DC.

Both outputs are protected against short circuits protected and have an output voltage of 24V DC with a total current of 4A max.

Block diagram



Danger!

- You must disconnect the power supply from the main power source before commencing installation or maintenance work, i.e. before you start to work on a power supply or the supply cable the main supply line must be disconnected (disconnect plugs, on permanent installations the respective circuit breaker must be turned off)!

- Only properly qualified electrical staff is allowed to install, connect and/or modify electrical equipment!

Installation

Installation

The power supplies can be installed by two different methods:

- You can install the power supply along with the System 200V on the same T-rail. In this case the power supply must only be installed at one end of your System 200V since the back panel bus would otherwise be interrupted.
  The power supplies are not connected to the back panel bus.

- Installed as "stand alone" power supply on a T-rail.

Please ensure proper and sufficient ventilation for the power supply when you select the installation location.

Danger!

- The power supplies must be installed in protected environments that are only accessible to properly qualified maintenance staff!

- You must disconnect the power supply from the main power source before commencing installation or maintenance work, i.e. before you start to work on a power supply or the supply cable the main supply line must be disconnected (disconnect plugs, on permanent installations the respective circuit breaker must be turned off)!

- Only properly qualified electrical staff is allowed to install, connect and/or modify electrical equipment!

- To provide a sufficient level of ventilation and cooling to the power supply components whilst maintaining the compact construction it was not possible to protect the unit from incorrect handling and a proper level of fire protection. For this reason the required level of fire protection must be provided by the environment where the power supply is installed (e.g. installation in a switchboard that satisfies the fire protection rules and regulations)!

- Please adhere to the national rules and regulations of the location and/or country where the units are installed (installation, safety precautions, EMC ...).

Wiring

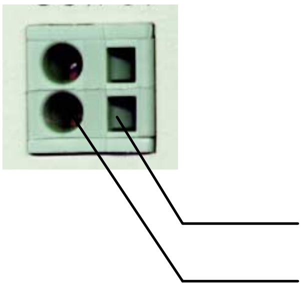
Wiring

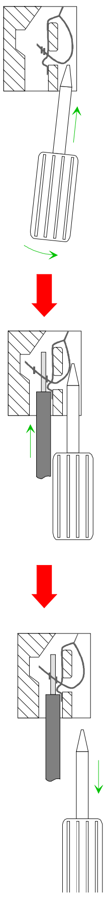
The connections to the power supply are provided by WAGO spring clip terminals.

The terminals can accommodate wires of a diameter of 0,8 mm^2 to 2,5 mm^2. You can use flexible multi-strand wires as well as solid conductors.

Wiring by means of spring clip terminals

Connect cables to the spring clip contacts as follows:





The sequence shown on the left explains the steps that you must follow to wire the power supply.

- Insert a suitable screwdriver at a slight angle into the square hole as shown.
- Push and hold the screwdriver in the opposite direction to open the spring contact.
- Insert the stripped end of the interconnecting wire into the round hole. You may use wires of a diameter of 0,08 mm^2 to 2,5 mm^2.
- When you remove the screwdriver the inserted wire is clamped and connected securely by the spring clip contact.

Danger!

- You must disconnect the power supply from the main power source before commencing installation or maintenance work, i.e. before you start to work on a power supply or the supply cable the main supply line must be disconnected (disconnect plugs, on permanent installations the respective circuit breaker must be turned off)!
- Only properly qualified electrical staff is allowed to install, connect and/or modify electrical equipment!

Technical data

Power supply
PS 207, 2A, 48W

Electrical data	PS 207/2
Rated input voltage Frequency Rated input current - power on surge Buffer time (at a mains voltage AC ≥150V) Rated output voltage - Ripple - Open circuit protection Rated output current Efficiency Dissipation Parallel connection permitted Status indicators (LED)	100...240V AC 50 Hz / 60 Hz 0,24A / 230V AC 15A max. min.10 ms 24V DC ± 5 % < 100 mV_{ss} incl. Spikes yes 2A (50 W); 3A (peak) typ. 90% at I_{rated} 5 W at the rated load yes via LED's located on the front
Operating conditions	
Operating temperature Storage EMC Certification/CE General protection Installation Terminals	0°C...55°C (55°C at reduced load) - 25°C...+ 85°C DIN EN 61000 / Teil4-8 yes Short circuit; overload; over temperature IP 20 DIN-rail Spring clip Input L, N, PE Output 2x24V DC in parallel
Mechanical data	
Dimensions (WxHxD) Weight	25,4 x 76 x 76 mm 250 g
Ordering details	
AC 100V-240V DC 24V / 2A	VIPA 207-1BA00

Power supply
PS 207, 4A, 96W

Electrical data	PS 207/4
Rated input voltage	100...240V AC
Frequency	50 Hz / 60 Hz
Rated input current	0,5A / 230V AC
- power on surge	15A max.
Buffer time (at a mains voltage AC ≥150V)	min.10 ms
Rated output voltage	24V DC ± 5 %
- Ripple	< 100 mV_{ss} incl. Spikes
- Open circuit protection	yes
Rated output current	4A (100 W)
Efficiency	typ. 90% at I_{rated}
Dissipation	10W at the rated load
Parallel connection permitted	yes
Status indicators (LED)	via LED's located on the front
Operating conditions	
Operating temperature	0°C...55°C (55°C at reduced load)
Storage	- 25°C...+ 85°C
EMC	DIN EN 61000 / Teil4-8
Certification/CE	yes
General protection	Short circuit; overload; over temperature IP 20
Installation	DIN-rail
Terminals	Spring clip Input L, N, PE Output 2x24V DC in parallel
Mechanical data	
Dimensions (WxHxD)	50,8 x 76 x 76 mm
Weight	450 g
Ordering details	
AC 100V - 240V DC 24V / 4A	VIPA 207-2DA00

Chapter 11 Digital input modules

Overview

This chapter contains a description of the construction and the operation of the VIPA digital input modules.

Below follows a description of:

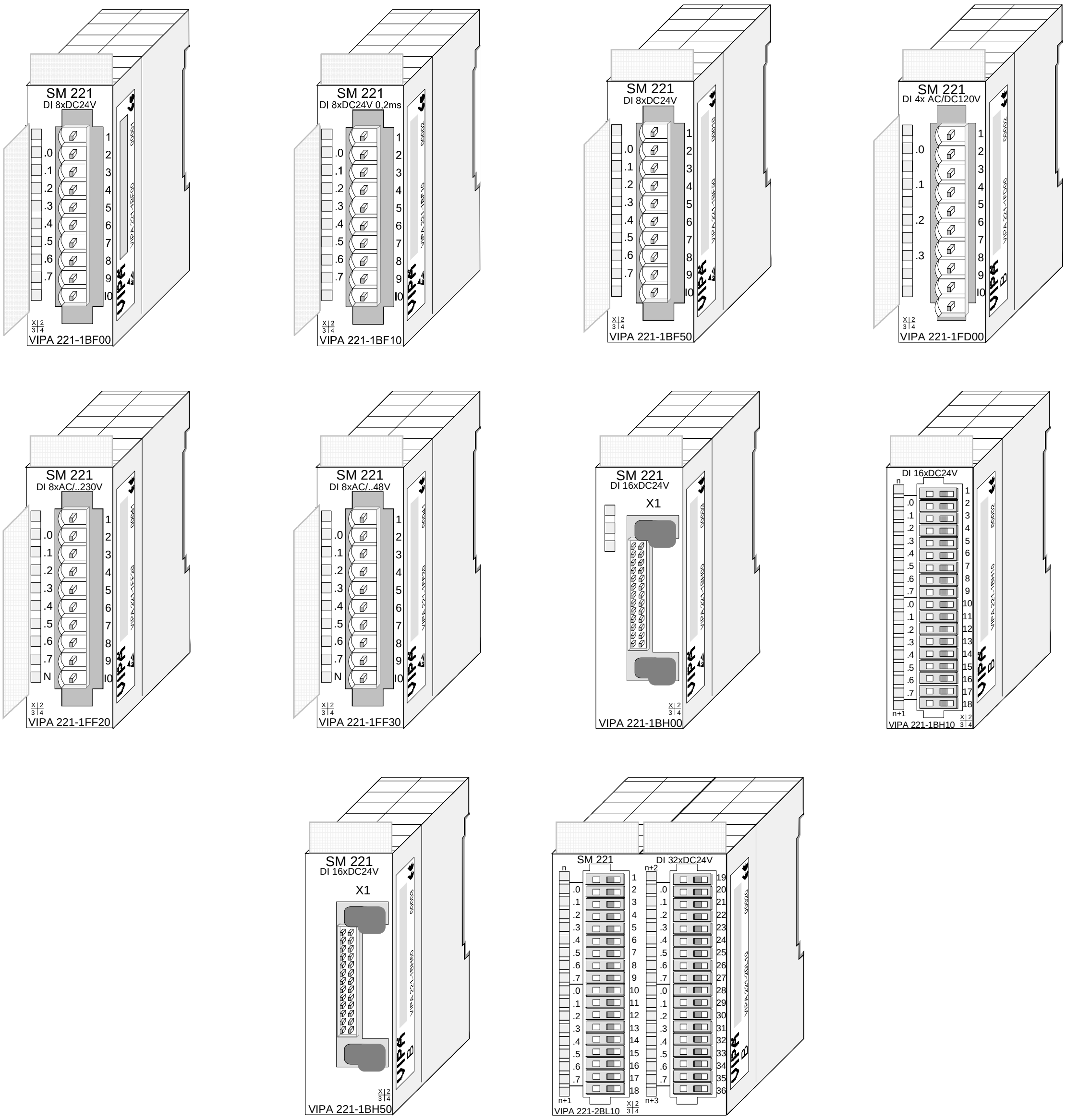
- A system overview of the digital input modules
- Properties
- Constructions
- Interfacing and schematic diagram
- Technical data

Contents

System overview

Input modules SM 221

Here follows a summary of the digital input modules that are currently available from VIPA:



Ordering details input modules

Type	Order number	Page
DI 8xDC24V	VIPA 221-1BF00	11-4
DI 8xDC24V 0,2ms	VIPA 221-1BF10	11-6
DI 8xDC24V active low input	VIPA 221-1BF50	11-8
DI 4xAC/DC 90...230V	VIPA 221-1FD00	11-10
DI 8xAC/DC 60...230V	VIPA 221-1FF20	11-12
DI 8xAC/DC 24...48V	VIPA 221-1FF30	11-14
DI 16xDC24V	VIPA 221-1BH00	11-16
DI 16xDC24V	VIPA 221-1BH10	11-18
DI 16xDC24V active low input	VIPA 221-1BH50	11-20
DI 32xDC24V	VIPA 221-2BL10	11-22

DI 8xDC24V

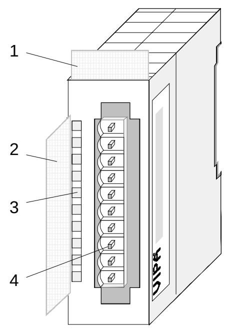
Ordering details DI 8xDC24V VIPA 221-1BF00

Description The digital input accepts binary control signals from the process and provides an electrically isolated interface to the central bus system. The module has 8 channels, each one with a light emitting diode to indicate the status of the channel.

Properties

- 8 floating inputs, isolated from the back panel bus
- 24V DC rated input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of an LED

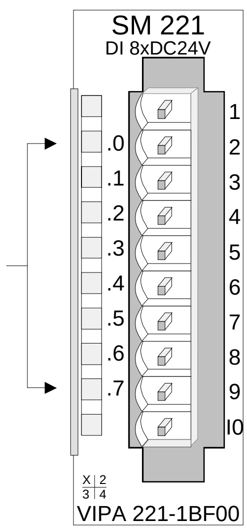
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator connector assignment

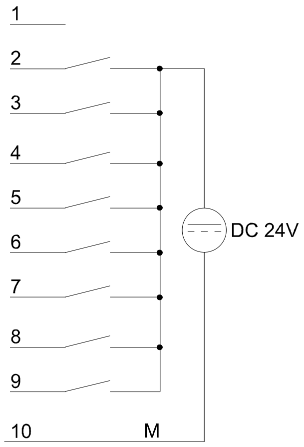
LED	Description
.0... .7	LED's (green) E.0 to E.7 A "1" signal level is recognized as of app. 15V and the respective LED is turned on



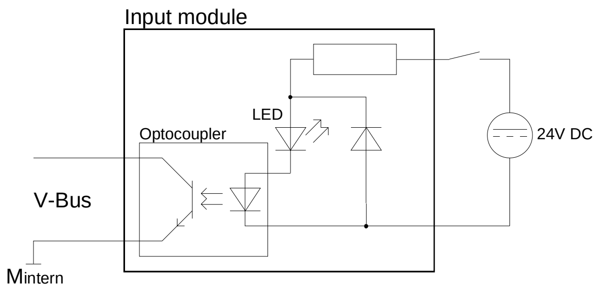
Pin	Assignment
1	not connected
2	Input E.0
3	Input E.1
4	Input E.2
5	Input E.3
6	Input E.4
7	Input E.5
8	Input E.6
9	Input E.7
10	Ground

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1BF00
Number of inputs	8
Rated input voltage	24V DC (18 ... 28,8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28,8V
Input filter time delay	3ms
Input current	typ. 7mA
Power supply	5V via back panel bus
Current consumption via back panel bus	20mA
Isolation	500Vrms (field voltage - back panel bus)
Status indicator	via LED’s located on the front
Programming specifications	
Input data	1 Byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	50g

DI 8xDC24V 0,2ms

Ordering details

DI 8xDC24V 0,2ms VIPA 221-1BF10

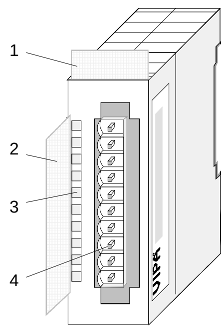
Description

The digital input accepts binary control signals from the process and provides an electrically isolated interface to the central bus system. The module has 8 channels, each one with a light emitting diode to indicate the status of the channel.

Properties

- 8 floating inputs, isolated from the back panel bus
- Delay time 0,2ms
- 24V DC rated input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of an LED

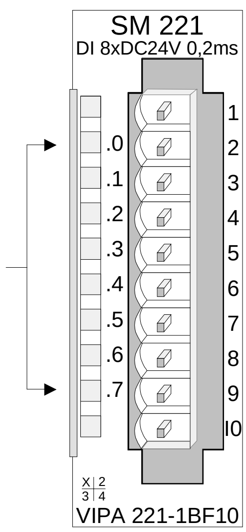
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator connector assignment

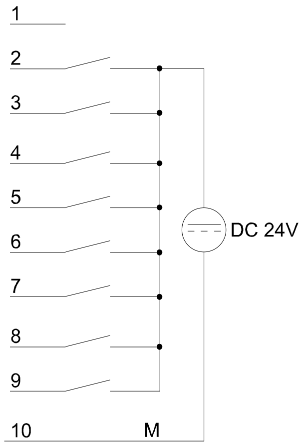
LED	Description
.0... .7	LED's (green) E.0 to E.7 A "1" signal level is recognized as of app. 15V and the respective LED is turned on



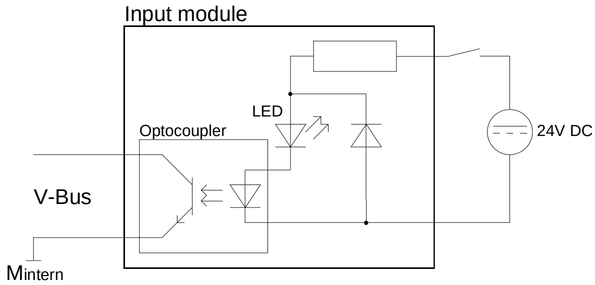
Pin	Assignment
1	not connected
2	Input E.0
3	Input E.1
4	Input E.2
5	Input E.3
6	Input E.4
7	Input E.5
8	Input E.6
9	Input E.7
10	Ground

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1BF10
Number of inputs	8
Rated input voltage	24V DC (18 ... 28,8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28,8V
Input filter time delay	0,2ms
Input current	typ. 7mA
Power supply	5V via back panel bus
Current consumption via back panel bus	20mA
Isolation	500Vrms (field voltage - back panel bus)
Status indicator	via LED’s located on the front
Programming specifications	
Input data	1 Byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	50g

DI 8xDC24V active low input

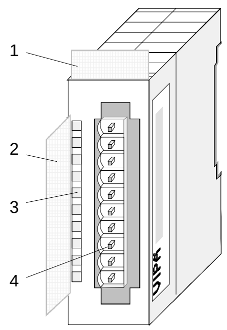
Ordering details DI 8xDC24V active low input VIPA 221-1BF50

Description The digital input accepts binary control signals from the process and provides an electrically isolated interface to the central bus system. The module has 8 channels, each one with a light emitting diode to indicate the status of the channel. The input becomes active when it is connected to ground.

Properties

- 8 floating inputs, isolated from the back panel bus
- Active low input (signal level ”1” when input is at ground)
- 24V DC rated input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of an LED

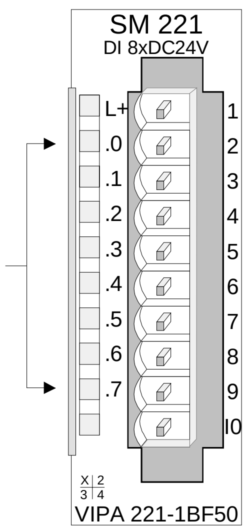
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator connector assignment

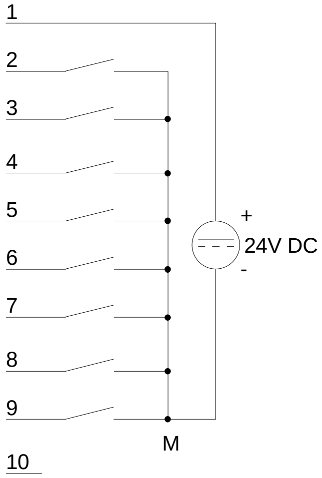
LED	Description
.0... .7	LED’s (green) E.0 to E.7 when an input is at ground a "1" is detected and the respective LED is turned on



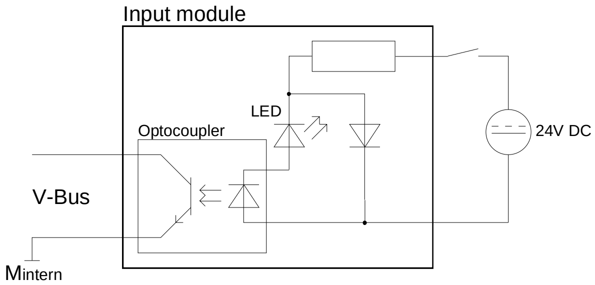
Pin	Assignment
1	+DC24V
2	Input E.0
3	Input E.1
4	Input E.2
5	Input E.3
6	Input E.4
7	Input E.5
8	Input E.6
9	Input E.7 / Ground
10	reserved

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1BF50
Number of inputs	8
Rated input voltage	24V DC (18 ... 28,8V)
Signal voltage "0"	15 ... 28,8V
Signal voltage "1"	0 ... 5V
Input filter time delay	3ms
Input current	typ. 7mA
Power supply	5V via back panel bus
Current consumption via back panel bus	20mA
Isolation	500Vrms (field voltage - back panel bus)
Status indicator	via LED’s located on the front
Programming specifications	
Input data	1 Byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	50g

DI 4xAC/DC 90...230V

Ordering details DI 4xAC/DC 90...230V VIPA 221-1FD00

Description

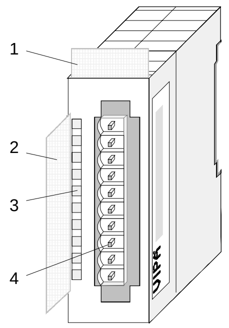
The digital input accepts binary control signals from the process and provides an electrically isolated interface to the central bus system.

The module has 4 channels and the respective status is displayed by means of LED's.

Properties

- 4 floating inputs, isolated from the back panel bus and from each other
- Status indicator for each channel by means of an LED
- Rated input voltage 90 ... 230V AC/DC

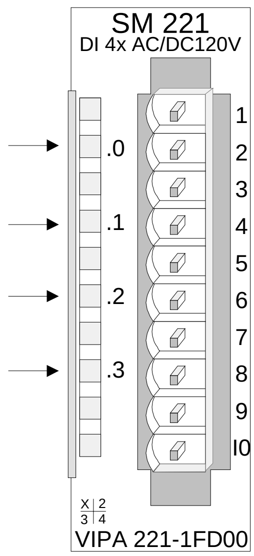
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator connector assignment

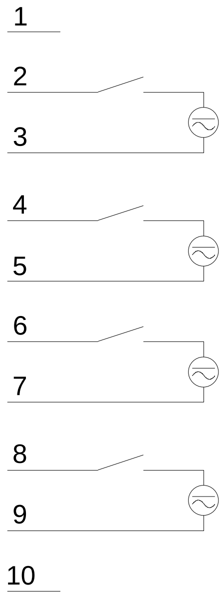
LED	Description
.0	LED's (green)
.1	E.0 to E.3
.2	from app. 80V DC or
.3	65V AC (50Hz) a signal "1" is detected and the respective LED is turned on



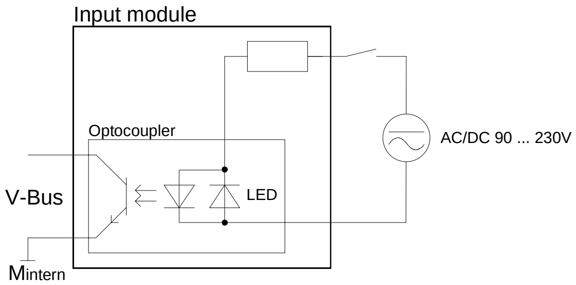
Pin	Assignment
1	not connected
2	E.0
3	Neutral conductor E.0
4	E.1
5	Neutral conductor E.1
6	E.2
7	Neutral conductor E.2
8	E.3
9	Neutral conductor E.3
10	not connected

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1FD00
Number of inputs	4
Rated input voltage	AC/DC 90 ... 230V
Signal voltage "0"	AC/DC 0 ... 35V
Signal voltage "1"	AC/DC 90 ... 230V
Input filter time delay	25ms
Frequency of input voltage	50 ... 60Hz
Input resistor	136kΩ
Power supply	5V via back panel bus
Current consumption via back panel bus	80mA
Isolation	500Vrms (field voltage - back panel bus)
Status indicator	via LED’s located on the front
Programming specifications	
Input data	1 Byte (Bit 0 ... Bit 3)
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	50g

DI 8xAC/DC 60...230V

Ordering details DI 8xAC/DC 60...230V VIPA 221-1FF20

Description

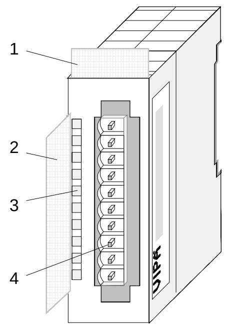
The digital input accepts binary control signals from the process and provides an electrically isolated interface to the central bus system.

The module has 8 channels, each one with a light emitting diode to indicate the status of the channel.

Properties

- 8 inputs, isolated from the back panel bus
- Rated input voltage 60 ... 230V AC/DC
- Status indicator for each channel by means of an LED

Construction



[1] Label for the name of the module

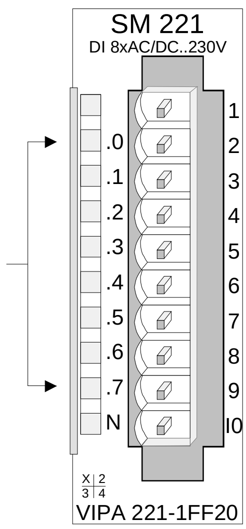
[2] Label for the bit address with description

[3] LED status indicator

[4] Edge connector

Status indicator connector assignment

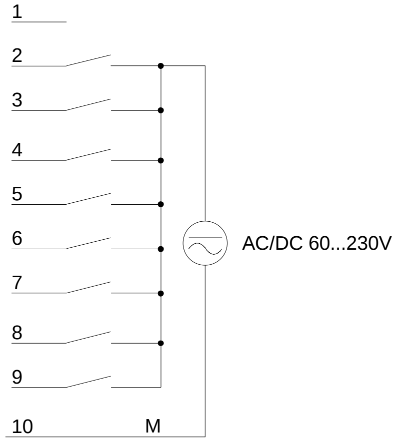
LED	Description
.0... .7	LED's (green) E.0 to E.7 from app. 55V DC or 45V AC (50Hz) a signal "1" is detected and the respective LED is turned on



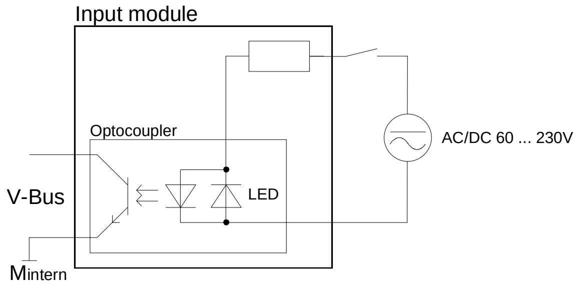
Pin	Assignment
1	not connected
2	Input E.0
3	Input E.1
4	Input E.2
5	Input E.3
6	Input E.4
7	Input E.5
8	Input E.6
9	Input E.7
10	Neutral conductor

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1FF20
Number of inputs	8
Rated input voltage	AC/DC 60 ... 230V
Signal voltage "0"	AC/DC 0 ... 35V
Signal voltage "1"	AC/DC 60 ... 230V
Input filter time delay	25ms
Frequency of input voltage	50 ... 60Hz
Input resistor	136kΩ
Power supply	5V via back panel bus
Current consumption via back panel bus	80mA
Isolation	500Vrms (field voltage - back panel bus)
Status indicator	via LED’s located on the front
Programming specifications	
Input data	1 Byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	50g

DI 8xAC/DC 24...48V

Ordering details DI 8xAC/DC 24...48V VIPA 221-1FF30

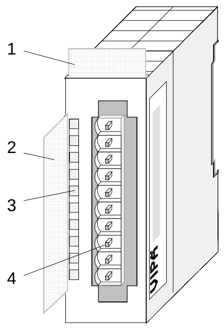
Description The digital input accepts binary control signals from the process and provides an electrically isolated interface to the central bus system.

The module has 8 channels, each one with a light emitting diode to indicate the status of the channel.

Properties

- 8 floating inputs, isolated from the back panel bus
- Rated input voltage AC/DC 24 ... 48V
- Status indicator for each channel by means of an LED

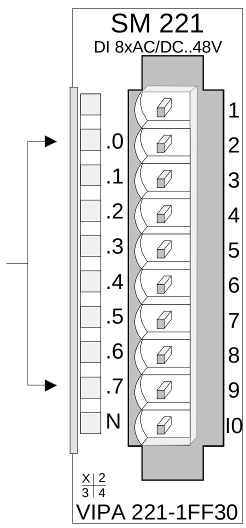
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator connector assignment

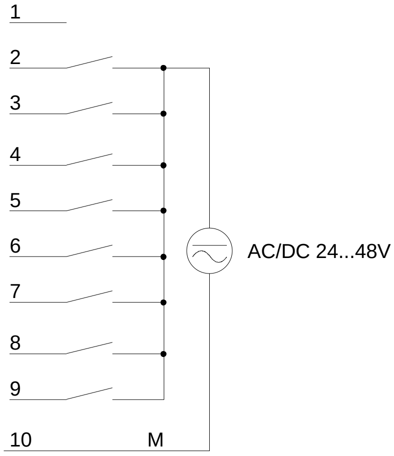
LED	Description
.0... .7	LED's (green) E.0 to E.7 from app. 14V DC or 12V AC (50Hz) a signal "1" is detected and the respective LED is turned on



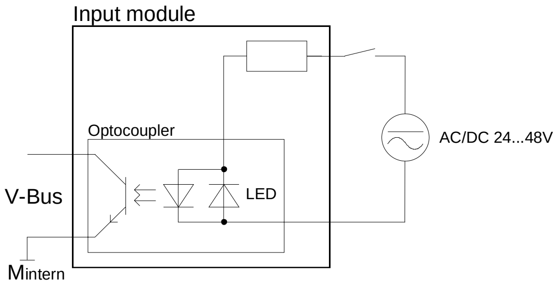
Pin	Assignment
1	not connected
2	Input E.0
3	Input E.1
4	Input E.2
5	Input E.3
6	Input E.4
7	Input E.5
8	Input E.6
9	Input E.7
10	Neutral conductor

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1FF30
Number of inputs	8
Rated input voltage	AC/DC 24 ... 48V
Signal voltage "0"	AC/DC 0 ... 8V
Signal voltage "1"	AC/DC 18 ... 48V
Input filter time delay	25ms
Frequency of input voltage	50 ... 60Hz
Input resistor	16,4kΩ
Power supply	5V via back panel bus
Current consumption via back panel bus	80mA
Isolation	500Vrms (field voltage - back panel bus)
Status indicator	via LED’s located on the front
Programming specifications	
Input data	1 Byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	50g

DI 16xDC24V

Ordering details

DI 16xDC24V VIPA 221-1BH00

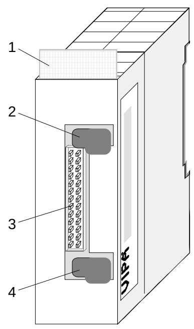
Description

The digital input accepts binary control signals from the process and provides an electrically isolated interface to the central bus system. This module requires a UB4x-converter. It has 16 channels that indicate the respective status via LED's on the UB4x. The module must be connected to the converter module (DEA-UB4x) by means of a flattened round cable (DEA-KB91C).

Properties

- 16 inputs, isolated from the back panel bus
- 24V DC rated input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of a LED located on the conversion module UB4x

Construction

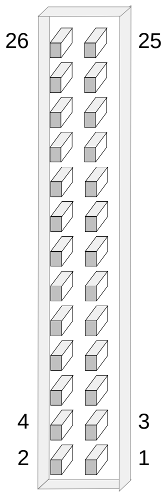


[1] Label for the name of the module
[2] Clip
[3] Recessed connector for the interface to a conversion module UB4x via the flattened round cable
[4] Clip

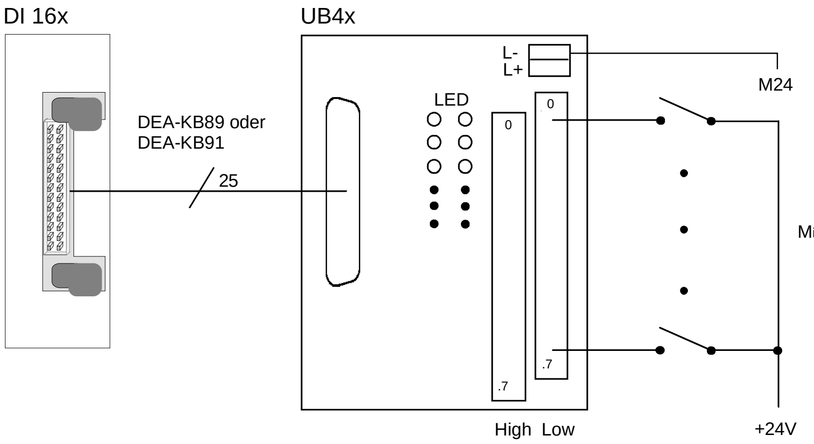
Status indicator on UB4x

LED	Description
0... .15	LED's (yellow) E.0 to E.7 High E.0 to E.7 Low A "1" signal level is recognized as of app. 15V and the respective LED is turned on
L+ L-	LED (green) Supply voltage available

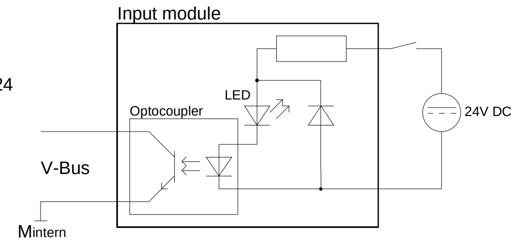
Connector assignment module

Connector	Pin	Assignment
	23...26	Supply voltage +24V DC
	22	Input E.0
	21	Input E.1
	.	.
	.	.
	.	.
	8	Input E.14
	7	Input E.15
	1...6	Supply voltage Ground

Interface to UB4x



Schematic diagram module



Technical data

Electrical data	VIPA 221-1BH00
Number of inputs	16
Rated input voltage	24V DC (18 ... 28,8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28,8V
Input filter time delay	3ms
Input current	typ. 7mA
Power supply	5V via back panel bus
Current consumption via back panel bus	20mA
Isolation	500Vrms (field voltage - back panel bus)
Status indicator	via LED's located on the UB4x
Programming specifications	
Input data	2 Byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	50g

DI 16xDC24V

Ordering details DI 16xDC24V VIPA 221-1BH10

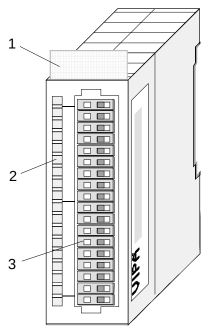
Description

The digital input accepts binary control signals from the process and provides an electrically isolated interface to the central bus system. It has 16 channels that indicate the respective status by means of LED's.

Properties

- 16 inputs, isolated from the back panel bus
- 24V DC rated input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of an LED

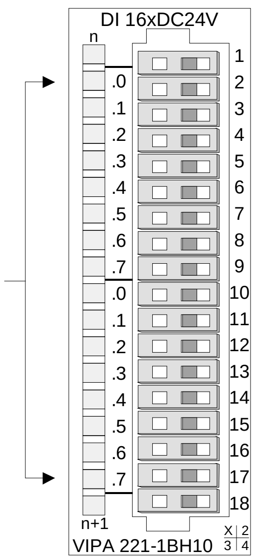
Construction



[1] Label for the name of the module
[2] LED status indicator
[3] Edge connector

Status indicator connector assignment

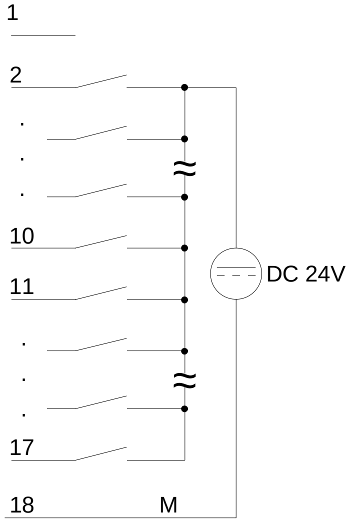
LED	Description
.0 7	LED's (green) E.0 to E.7 (per byte) A "1" signal level is recognized as of app. 15V and the respective LED is turned on



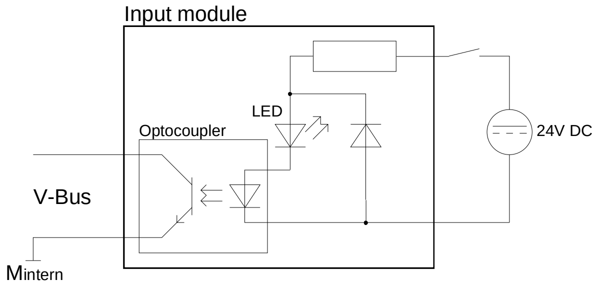
Pin	Assignment
1	not connected
2	Input E.0
3	Input E.1
4	Input E.2
.	.
.	.
.	.
15	Input E.13
16	Input E.14
17	Input E 15
18	Ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1BH10
Number of inputs	16
Rated input voltage	24V DC (18 ... 28,8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28,8V
Input filter time delay	3ms
Input current	typ. 7mA
Power supply	5V via back panel bus
Current consumption via back panel bus	20mA
Isolation	500Vrms (field voltage - back panel bus)
Status indicator	via LED’s located on the front
Programming specifications	
Input data	2 Byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	50g

DI 16xDC24V active low input

Ordering details DI 16xDC24V active low input VIPA 221-1BH50

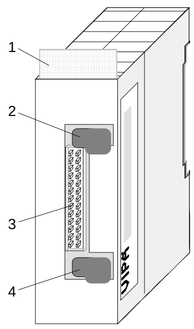
Description

The digital input accepts binary control signals from the process and provides an electrically isolated interface to the central bus system. The input becomes active when it is connected to ground. This module requires a converter (DEA-UB4x). It has 16 channels that indicate the respective status via LED's on the UB4x. The module must be connected to the converter module (DEA-UB4x) by means of a flattened round cable (DEA-KB91C).

Properties

- 16 inputs, isolated from the back panel bus
- Active low input (signal level "1" when input is at ground)
- 24V DC rated input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of a LED on the conversion module

Construction



[1] Label for the name of the module

[2] Clip

[3] Recessed connector for the interface to a conversion module UB4x via the flattened round cable

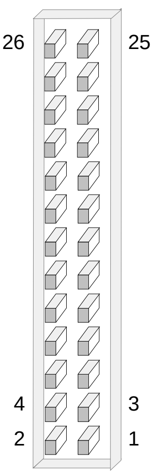
[4] Clip

Status indicator on UB4x

LED	Description
0... .15	LED's (yellow) E.0 to E.7 High E.0 to E.7 Low A "1" signal level is recognized as of app. 15V and the respective LED is turned on
L+ L-	LED (green) Supply voltage available

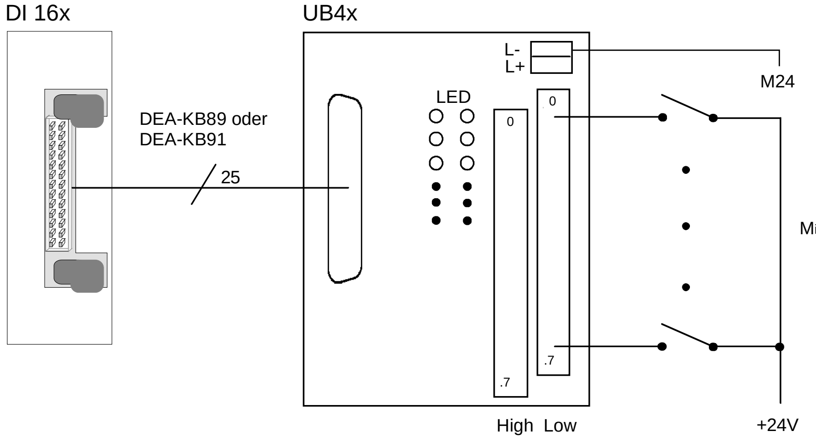
Connector assignment module

Connector

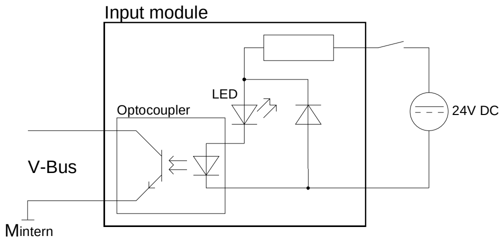


Pin	Assignment
23...26	Supply voltage +24V DC
22	Input E.0
21	Input E.1
.	.
.	.
.	.
8	Input E.14
7	Input E.15
1...6	Supply voltage Ground

Interface to UB4x



Schematic diagram module



Technical data

Electrical data	VIPA 221-1BH50
Number of inputs	16
Rated input voltage	24V DC (18 ... 28,8V)
Signal voltage "0"	15 ... 28,8V
Signal voltage "1"	0 ... 5V
Input filter time delay	3ms
Input current	typ. 7mA
Power supply	5V via back panel bus
Current consumption via back panel bus	20mA
Isolation	500Vrms (field voltage - back panel bus)
Status indicator	via LED's located on the UB4x
Programming specifications	
Input data	2 Byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	50g

DI 32xDC24V

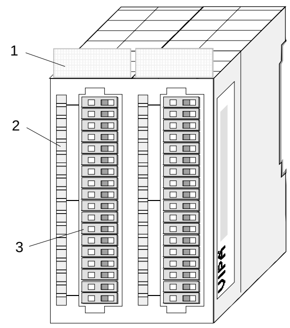
Ordering details DI 32xDC24V VIPA 221-2BL10

Description The digital input accepts binary control signals from the process and provides an electrically isolated interface to the central bus system It has 32 channels that indicate the respective status by means of LED's.

Properties

- 32 inputs, isolated from the back panel bus
- 24V DC rated input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of an LED

Construction



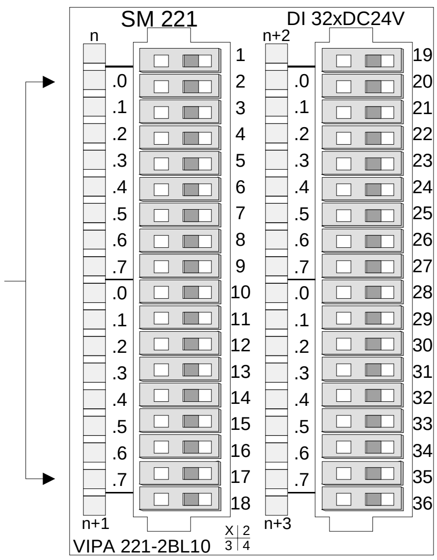
[1] Label for the name of the module

[2] LED status indicator

[3] Edge connector

Status indicator connector assignment

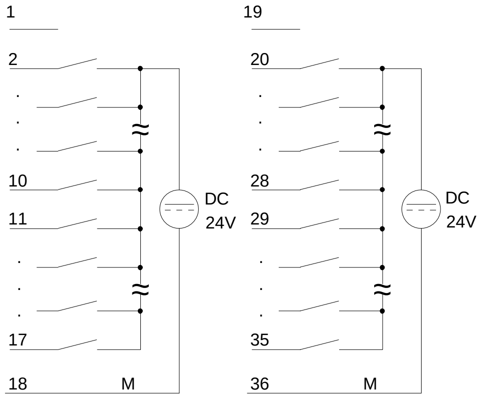
LED	Description
.0 7	LED's (green) E.0 to E.7 (per byte) A "1" signal level is recognized as of app. 15V and the respective LED is turned on



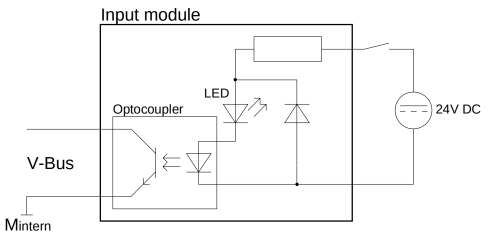
Pin	Assignment
1	Not connected
2...17	Input E.0...E.15
.	.
.	.
.	.
18	Ground
19	Not connected
.	.
.	.
.	.
20 ... 35	Input E.16...E.31
36	Ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-2BI10
Number of inputs	32
Rated input voltage	24V DC (18 ... 28,8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28,8V
Input filter time delay	3ms
Input current	typ. 7mA
Power supply	5V via back panel bus
Current consumption via back panel bus	20mA
Isolation	in 2 groups of 16 inputs each 500Vrms (field voltage - back panel bus)
Status indicator	via LED's located on the front
Programming specifications	
Input data	4 Byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	50,8 x 76 x 76
Weight	50g

Chapter 12 Digital output modules

Overview

This chapter contains a description of the construction and the operation of the VIPA digital output modules.

Below follows a description of:

- A system overview of the digital output modules
- Properties
- Construction
- Interfacing and schematic diagram
- Technical data

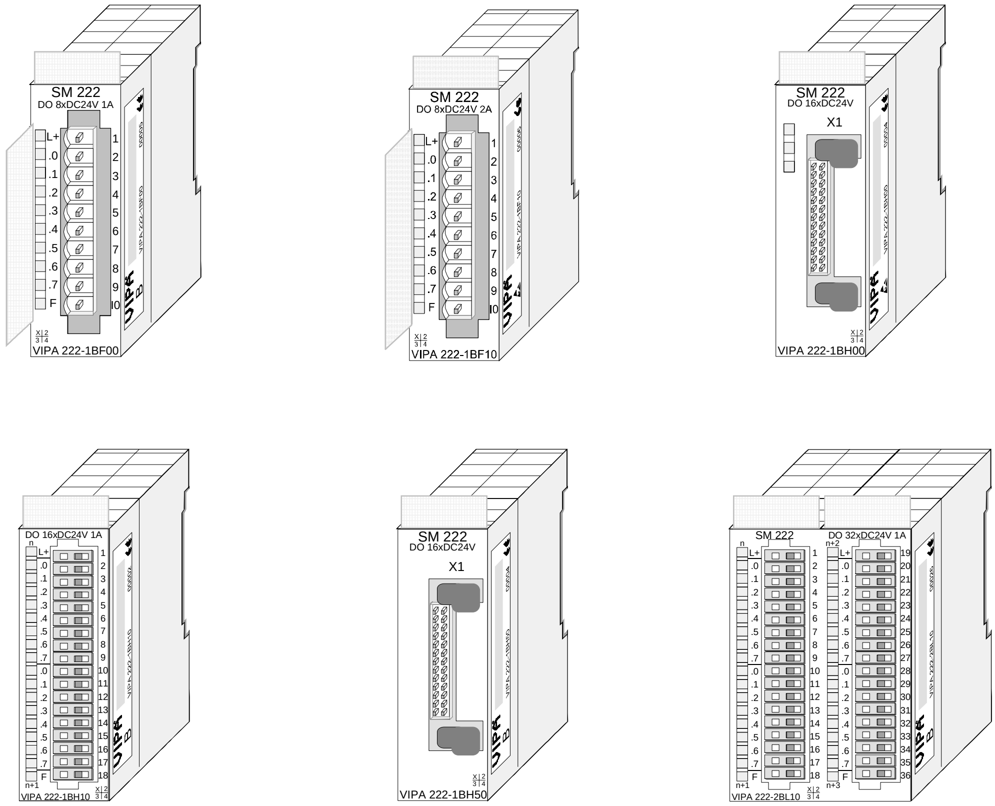
Contents

System overview

Output modules SM 222

Here follows a summary of the digital output modules that are currently available from VIPA:

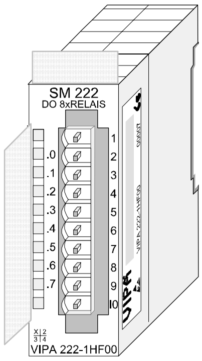
DC24V output modules

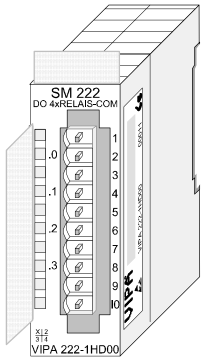


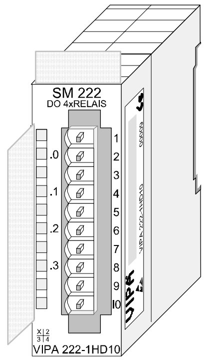
Ordering details DC24V output modules

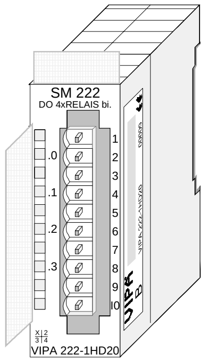
Type	Order number	Page
DO 8xDC24V 1A	VIPA 222-1BF00	12-4
DO 8xDC24V 2A	VIPA 222-1BF10	12-6
DO 16xDC24V 0,5A	VIPA 222-1BH00	12-8
DO 16xDC24V 1A	VIPA 222-1BH10	12-10
DO 16xDC24V 0,5A NPN	VIPA 222-1BH50	12-12
DO 32xDC24V 1A	VIPA 222-2BL10	12-14

Relay output module





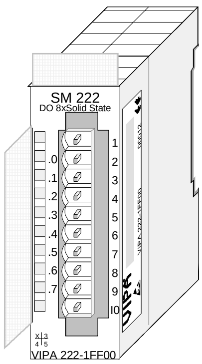


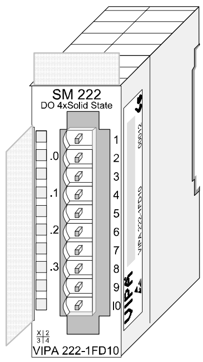


Ordering details relay output modules

Type	Order number	Page
DO 8xRelais COM	VIPA 222-1HF00	12-16
DO 4xRelais COM	VIPA 222-1HD00	12-18
DO 4xRelais	VIPA 222-1HD10	12-20
DO 4xRelais bistable	VIPA 222-1HD20	12-22

Solid-state output modules





Ordering details solid-state output modules

Type	Order number	Page
DO 8xSolid State COM	VIPA 222-1FF00	12-25
DO 4xSolid State	VIPA 222-1FD10	12-27

DO 8xDC24V 1A

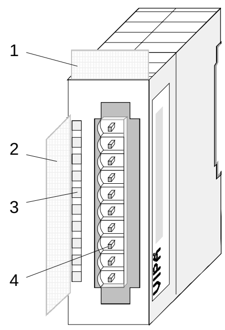
Ordering details DO 8xDC24V 1A VIPA 222-1BF00

Description The digital output module accepts binary control signals from the central bus system and transfers them to the process level via outputs. The module requires a supply of 24V DC via the connector on the front. It provides 8 channels and the status of each channel is displayed by means of an LED.

Properties

- 8 outputs, isolated from the back panel bus
- 24V DC supply voltage
- 1A output current rating
- Suitable for magnetic valves and DC contactors
- LED's for supply voltage and error message
- Active channel indication by means of an LED

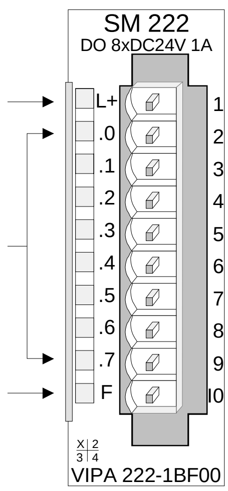
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator connector assignment

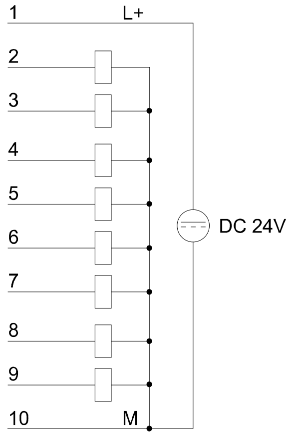
LED	Description
L+	LED (yellow) Supply voltage available
.0... .7	LED's (green) A.0 to A.7 when an output is active the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error



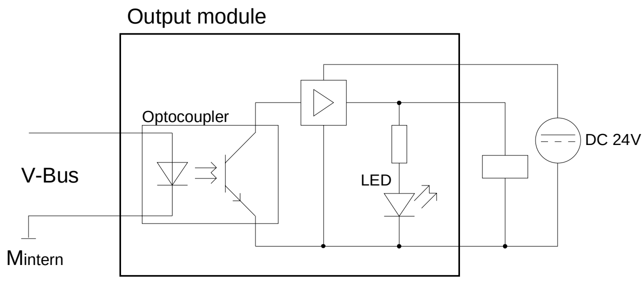
Pin	Assignment
1	24V DC supply voltage
2	Output A.0
3	Output A.1
4	Output A.2
5	Output A.3
6	Output A.4
7	Output A.5
8	Output A.6
9	Output A.7
10	Supply ground

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 222-1BF00
Number of outputs	8
Rated load voltage	24V DC (18...35V) from ext. power supply
No-load current consumption at L+ (all A.x=off)	10mA
Output current per channel	1A protected against sustained short circuits
Current consumption via back panel bus	50mA
Voltage supply	5V via back panel bus
Status indicator	via LED's located on the front
Programming specifications	
Input data	-
Output data	1 Byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	50g

DO 8xDC24V 2A

Ordering details DO 8xDC24V 2A VIPA 222-1BF10

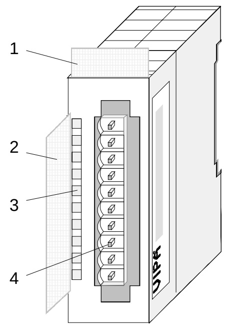
Description

The digital output module accepts binary control signals from the central bus system and transfers them to the process level via outputs. The module requires a 24V DC supply via the connector located on the front. It provides 8 channels and the status of each channel is displayed by means of an LED. The maximum load current per output is 2A.

Properties

- 8 outputs, isolated from the back panel bus
- 24V DC supply voltage
- Output current 2A
- Suitable for magnetic valves and DC contactors
- LED's for supply voltage and error message
- Active channel indication by means of an LED

Construction



[1] Label for the name of the module

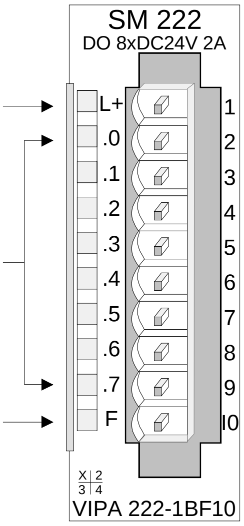
[2] Label for the bit address with description

[3] LED status indicator

[4] Edge connector

Status indicator connector assignment

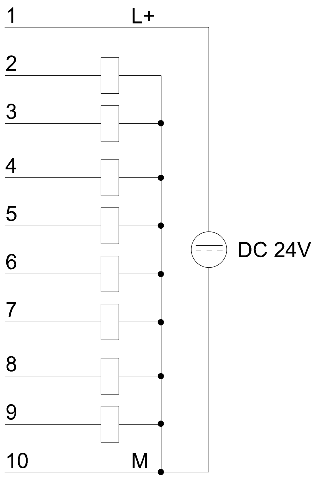
LED	Description
L+	LED (yellow) Supply voltage available
.0... .7	LED's (green) A.0 to A.7 when an output becomes active the respective LED is turned on
F	LED (red) Overload, overheat, short circuit error



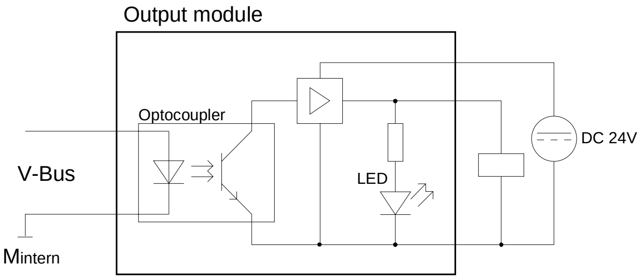
Pin	Assignment
1	24V DC supply voltage
2	Output A.0
3	Output A.1
4	Output A.2
5	Output A.3
6	Output A.4
7	Output A.5
8	Output A.6
9	Output A.7
10	Supply ground

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 222-1BF10
Number of outputs	8
Rated load voltage	24V DC (18...35V) from ext. power supply
No-load current consumption at L+ (all A.x=off)	10mA
Output current per channel	2A short circuit protected
Diversity factor	I_D=50% (8A)
Current consumption via back panel bus	50mA
Total current of all 8 channels	10A
Voltage supply	5V via back panel bus
Status indicator	via LED's located on the front
Programming specifications	
Input data	-
Output data	1 Byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	50g

DO 16xDC24V 0,5A

Ordering details DO 16xDC24V 0,5A VIPA 222-1BH00

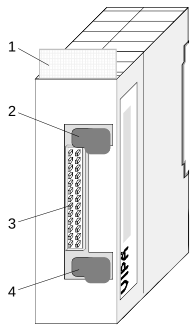
Description

The digital output module accepts binary control signals from the central bus system and transfers them to the process level via outputs. The module requires 24V via the connector on the front. Es hat 16 channels and the status of each channel is displayed by means of an LED. . This module requires a converter (DEA-UB4x). The module must be connected to the converter module by means of a flattened round cable (DEA-KB91C).

Properties

- 16 outputs, isolated from the back panel bus
- 24V DC supply voltage
- Output current 0,5A
- Suitable for magnetic valves and DC contactors
- LED's for supply voltage and error message
- Active channel indication by means of a LED located on converter module UB4x

Construction

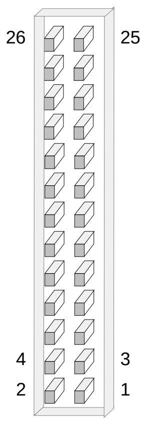


[1] Label for the name of the module
[2] Clip
[3] Recessed connector for the interface to a conversion module UB4x via the flattened round cable
[4] Clip

Status indicator on UB4x

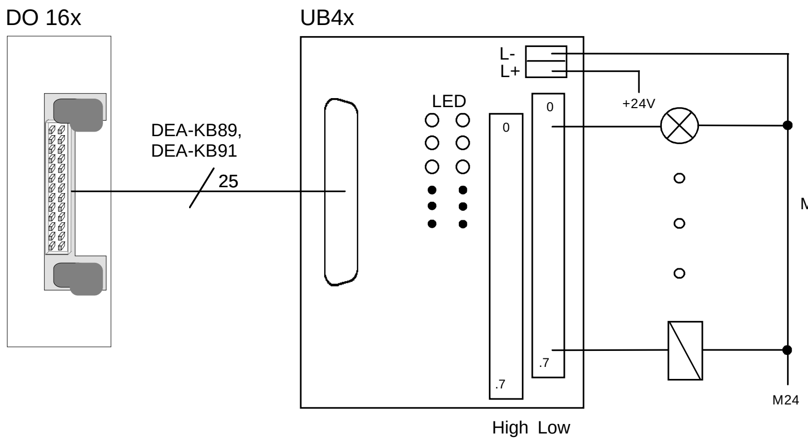
LED	Description
0... .15	LED's (yellow) A.0 to A.7 High A.0 to A.7 Low when an output is active the respective LED is turned on
L+ L-	LED (green) Supply voltage available

Connector assignment module

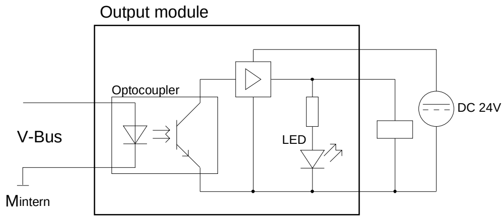


Connector	Pin	Assignment
	23...26	24V DC supply voltage
	22	Output A.0
	21	Output A.1
	.	.
	.	.
	.	.
	8	Output A.14
	7	Output A.15
	1...6	Supply ground

Interfacing of UB4x



Schematic diagram module



Technical data

Electrical data	VIPA 222-1BH00
Number of outputs	16
Rated load voltage	24V DC (18 ... 35V) from ext. power supply
No-load current consumption at L+ (all A.x=off)	10mA
Output current per channel	0,5A short circuit protected
Current consumption via back panel bus	100mA
Voltage supply	5V via back panel bus
Status indicator	via LED's located on the UB4x
Programming specifications	
Input data	-
Output data	2 Byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	50g

DO 16xDC24V 1A

Ordering details

DO 16xDC24V 1A VIPA 222-1BH10

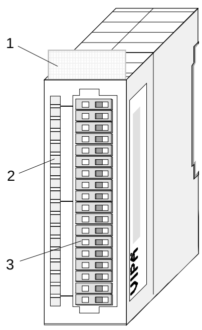
Description

The digital output module accepts binary control signals from the central bus system and transfers them to the process level via outputs. The module requires 24V via the connector on the front. Es hat 16 channels and the status of each channel is displayed by means of an LED.

Properties

- 16 outputs, isolated from the back panel bus
- 24V DC supply voltage
- 1A output current rating
- Suitable for magnetic valves and DC contactors
- LED’s for supply voltage and error message
- Active channel indication by means of an LED

Construction



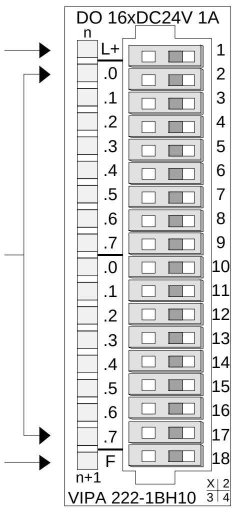
[1] Label for the name of the module

[2] LED status indicator

[3] Edge connector

Status indicator connector assignment

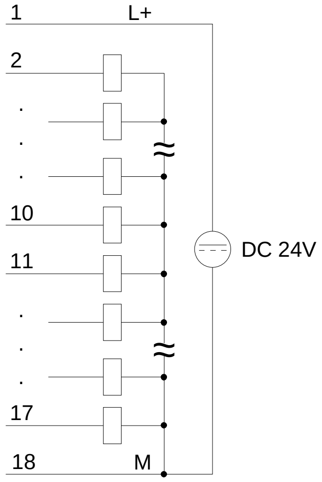
LED	Description
L+	LED (yellow) Supply voltage available
A.0 ... A.7	LED’s (green) A.0 to A.7 (per Byte) when an output is active the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error



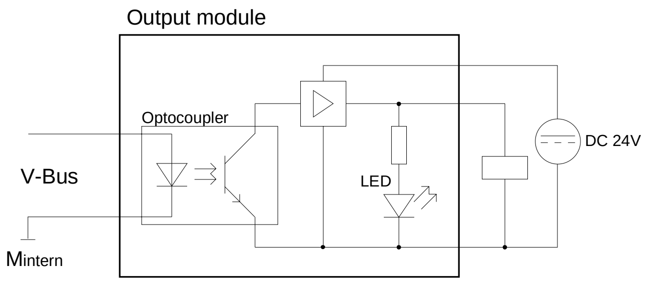
Pin	Assignment
1	24V DC supply voltage
2	Output A.0
3	Output A.1
.	.
.	.
.	.
16	Output A.14
17	Output A.15
18	Supply ground

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 222-1BH10
Number of outputs	16
Rated load voltage	24V DC (18 ... 35V) from ext. power supply
No-load current consumption at L+ (all A.x=off)	10mA
Output current per channel	1A short circuit protected
max. total current	10A
Current consumption via back panel bus	85mA
Voltage supply	5V via back panel bus
Status indicator	via LED’s located on the front
Programming specifications	
Input data	-
Output data	2 Byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	50g

DO 16xDC24V 0,5A NPN

Ordering details DO 16xDC24V 0,5A NPN VIPA 222-1BH50

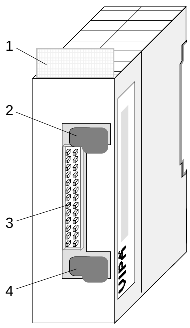
Description

The digital output module accepts binary control signals from the central bus system and controls the connected loads at the process level via Mosfet outputs. It provides 16 channels that operate as Low-Side switches and that are interconnected via the load voltage. Low-Side switches are suitable for the control of grounds. When a short circuit occurs between the switched line and ground the result is that the load is activated until the short circuit has been removed. Short circuits do not place an additional load on the supply voltage. The module is connected to a converter module by means of the flattened round cable (DEA-KB91C).

Properties

- 16 Low-Side outputs
- Maximum external load voltage 32V DC
- Output current per channel 0,5A
- Suitable for small motors, lamps, magnetic valves and contactors
- Status indicator for the channels by means of LED's located on the conversion module (DEA-UB4x)

Construction



[1] Label for the name of the module

[2] Clip

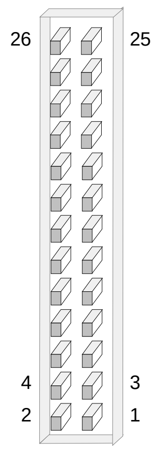
[3] Recessed connector for the interface to a conversion module UB4x via the flattened round cable

[4] Clip

Status indicator on the UB4x

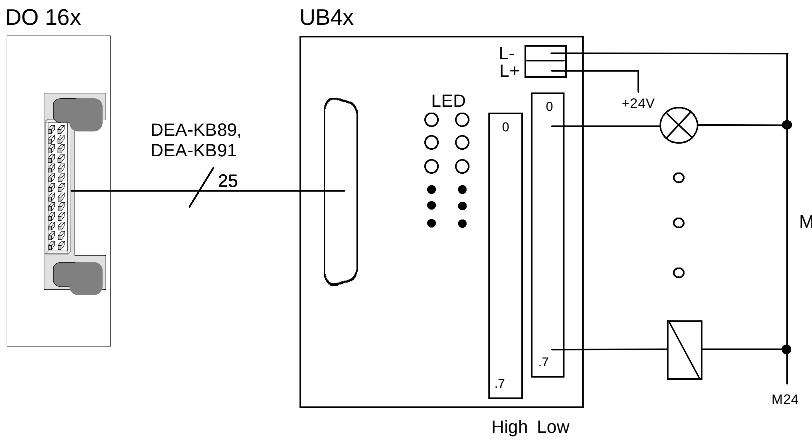
LED	Description
0... .15	LED's (yellow) A.0 to A.7 High A.0 to A.7 Low when an output is active the respective LED is turned on
L+ L-	LED (green) Supply voltage available

Connector assignment module

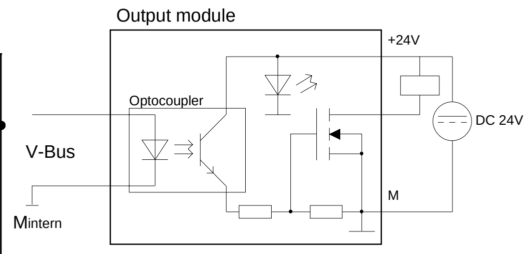


Connector	Pin	Assignment
	23...26	24V DC supply voltage
	22	Output A.0
	21	Output A.1
	.	.
	.	.
	.	.
	8	Output A.14
	7	Output A.15
	1...6	Supply ground

Interfacing of UB4x



Schematic diagram module



Technical data

Electrical data	VIPA 222-1BH50
Number of outputs	16 via Low-Side
Rated load voltage	max. DC 24V
max. Output current per channel	0,5A
Current consumption via back panel bus	50mA
Voltage supply	5V via back panel bus
Switching rate	20kHz max.
Status indicator	(via LED's located on the UB4x)
Programming specifications	
Input data	-
Output data	2 Byte (Bit 0 ...Bit 15)
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	80g

DO 32xDC24V 1A

Ordering details DO 32xDC24V 1A VIPA 222-1BL10

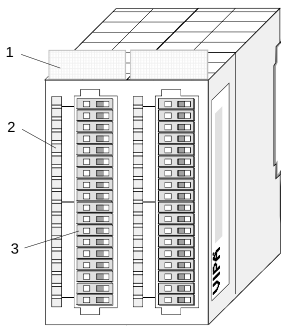
Description

The digital output module accepts binary control signals from the central bus system and transfers them to the process level via outputs. The module requires 24V via the connector on the front. Es hat 32 channels and the status of each channel is displayed by means of an LED.

Properties

- 32 outputs, isolated from the back panel bus
- 24V DC supply voltage
- Output current per channel 1A
- Suitable for magnetic valves and DC contactors
- LED's for supply voltage and error message
- Active channel indication by means of an LED

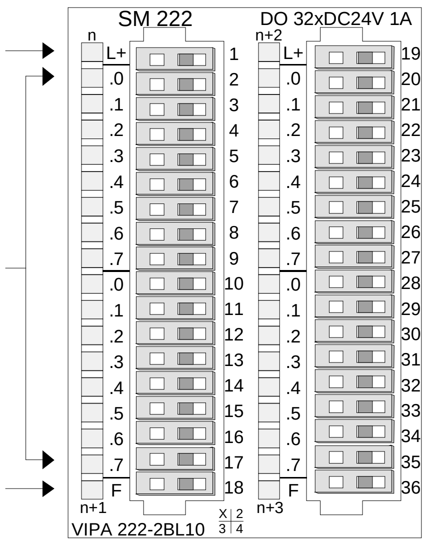
Construction



[1] Label for the name of the module
[2] LED status indicator
[3] Edge connector

Status indicator connector assignment

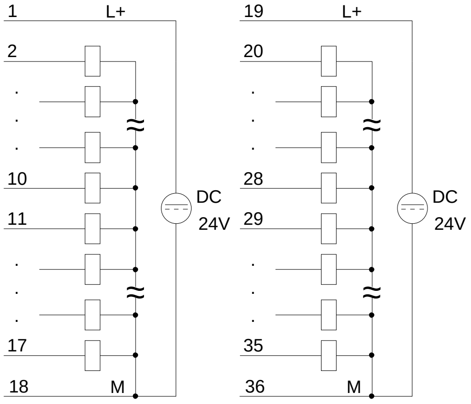
LED	Description
L+	LED (yellow) Supply voltage available
.0 7	LED's (green) A.0 to A.7 (per Byte) when an output is active the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error



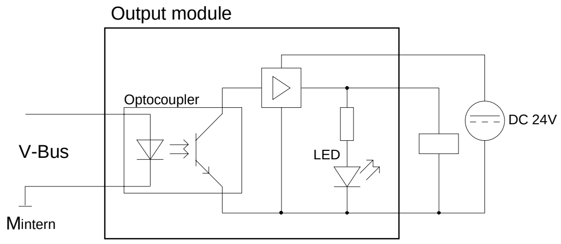
Pin	Assignment
1	24V DC supply voltage
2	Output A.0
3	Output A.1
...	...
17	Output A.15
18	Supply ground
19	24V DC supply voltage
20	Output A.16
...	...
34	Output A.30
35	Output A.31
36	Supply ground

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 222-1BL10
Number of outputs	32
Rated load voltage	24V DC (18 ... 35V) from ext. power supply
No-load current consumption at L+ (all A.x=off)	15mA
max. Output current per channel	1A short circuit protected
max. Contact load	10A
Current consumption via back panel bus	165mA
Voltage supply	5V via back panel bus
	in groups of 16 outputs each
Status indicator	via LED’s located on the front
Programming specifications	
Input data	-
Output data	4 Byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	50,8 x 76 x 76
Weight	50g

DO 8xRelais COM

Ordering details DO 8xRelais COM VIPA 222-1HF00

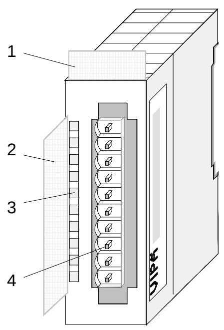
Description

The digital output module accepts binary control signals from the central bus system and controls the connected loads at the process level via relay outputs. The module derives power from the back panel bus. The load voltage must be connected to terminal 1. When the total current exceeds 8A you must balance the load current between terminals 1 and 10. The module has 8 channels and the status of each channel is displayed by means of an LED.

Properties

- 8 Relay outputs
- Power supply via back panel bus
- External load voltage 230V / DC 30V AC
- Output current per channel 5A (230V / DC 30V AC)
- Suitable for motors, lamps, magnetic valves and DC contactors
- Active channel indication by means of an LED

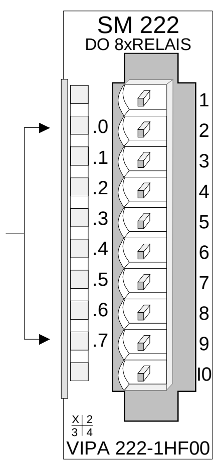
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator connector assignment

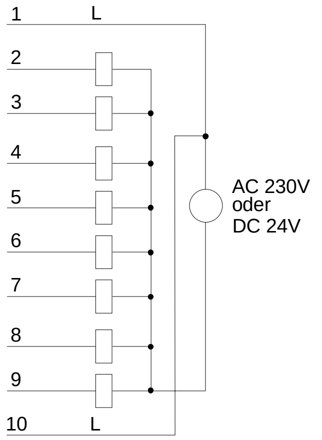
LED	Description
.0... .7	LED's (green) A.0 to A.7 when an output is active the respective LED is turned on



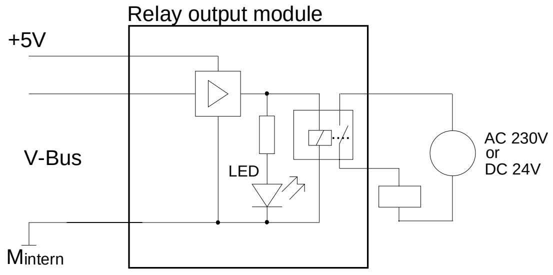
Pin	Assignment
1	Supply voltage L
2	Relay output. A.0
3	Relay output. A.1
4	Relay output. A.2
5	Relay output. A.3
6	Relay output. A.4
7	Relay output. A.5
8	Relay output. A.6
9	Relay output. A.7
10	Supply voltage L

Wiring diagram and schematic

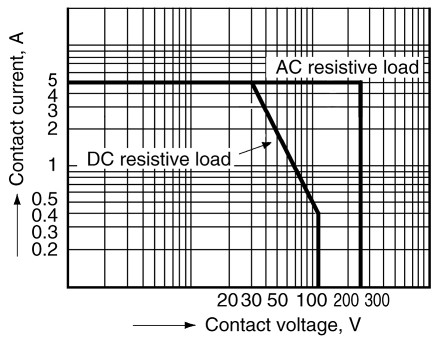
Wiring diagram



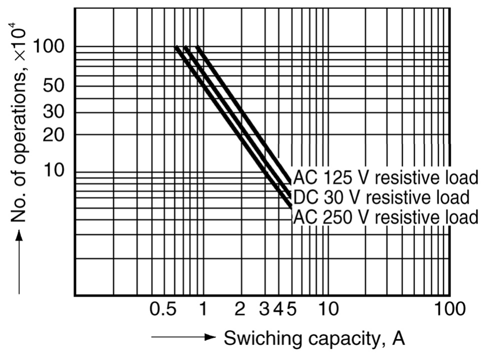
Schematic diagram



Maximum load



Service life



Technical data

Electrical data	VIPA 222-1HF00
Number of outputs	8 via relay
Rated load voltage	230V AC or 30V DC max.
No-load current consumption at L+ (all A.x=off)	-
Total current	with 1 L: max. 8A with 2 L: max. 16A
max. Output current per channel	AC 230V: 5A / DC 30V: 5A
Current consumption via back panel bus	250mA
Voltage supply	5V via back panel bus
Switching rate	max. 100Hz
Status indicator	via LED's located on the front
Programming specifications	
Input data	-
Output data	1 Byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	80g

DO 4xRelais COM

Ordering details DO 4xRelais COM VIPA 222-1HD00

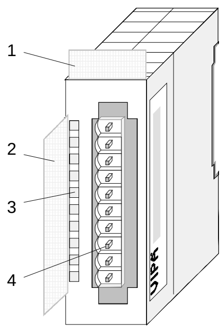
Description

The digital output module accepts binary control signals from the central bus system and controls the connected loads at the process level via relay outputs. The module derives power from the back panel bus. The module has 4 channels and the status of each channel is displayed by means of an LED. The load voltage that is applied to a channel when the signal is "1" must be connected to terminals 1 and 10.

Properties

- 4 Relay outputs with a common return
- Power supply via back panel bus
- External load voltage 230V / DC 30V AC
- Output current per channel 5A (230V / DC 30V AC)
- Suitable for motors, lamps, magnetic valves and DC contactors
- Active channel indication by means of an LED

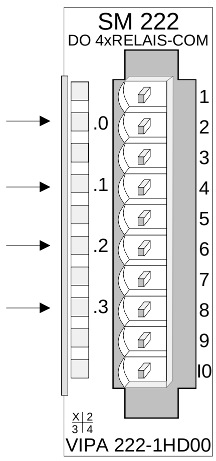
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator connector assignment

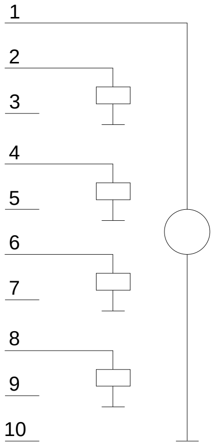
LED	Description
.0... .3	LED’s (green) A.0 to A.3 when an output is active the respective LED is turned on



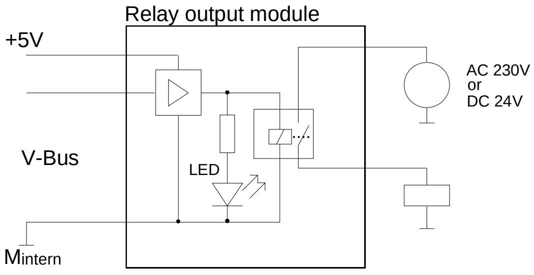
Pin	Assignment
1	Supply voltage
2	Relay output. A.0
3	not connected
4	Relay output. A.1
5	not connected
6	Relay output. A.2
7	not connected
8	Relay output. A.3
9	not connected
10	Supply voltage

Wiring diagram and schematic

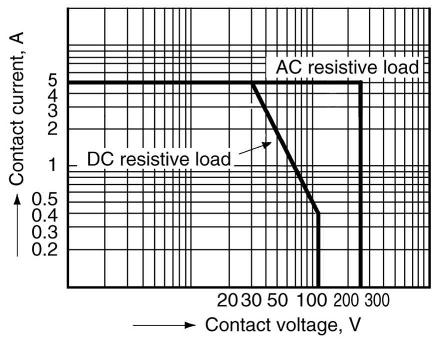
Wiring diagram



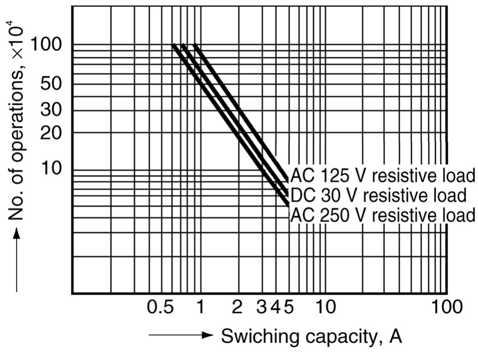
Schematic diagram



Maximum load



Service life



Technical data

Electrical data	VIPA 222-1HD00
Number of outputs	4 via relay
Rated load voltage	230V AC or 30V DC
No-load current consumption at L+ (all A.x=off)	-
Total current	max. 8A
max. Output current per channel	AC 230V: 5A / DC 30V: 5A
Current consumption via back panel bus	125mA
Voltage supply	5V via back panel bus
Switching rate	max. 100Hz
Status indicator	via LED’s located on the front
Programming specifications	
Input data	-
Output data	1 Byte (Bit 0 ... Bit 3)
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	80g

DO 4xRelais

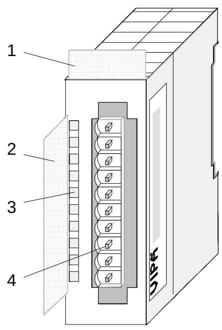
Ordering details DO 4xRelais VIPA 222-1HD10

Description The digital output module accepts binary control signals from the central bus system and controls the connected loads at the process level via relay outputs. The module derives power from the back panel bus. The module has 4 isolated channels that operate as switches and the status of each channel is displayed by means of a LED. Power required by active loads must be supplied externally.

Properties

- 4 galvanically isolated relay-outputs
- Power supply via back panel bus
- External load voltage 230V AC / 30V DC (may be mixed)
- Max. output current per channel 5A (230V AC / 30V DC)
- Suitable for motors, lamps, magnetic valves and DC contactors
- Active channel indication by means of an LED

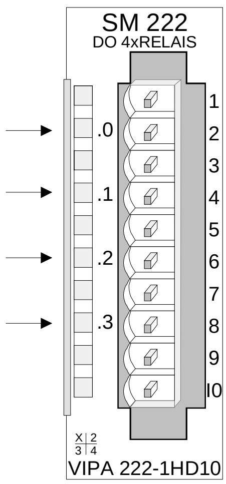
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator connector assignment

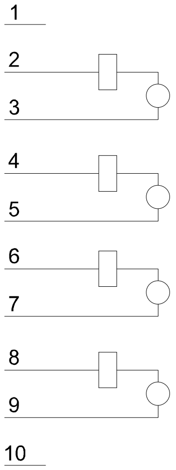
LED	Description
.0... .3	LED's (green) A.0 to A.3 when an output is active the respective LED is turned on



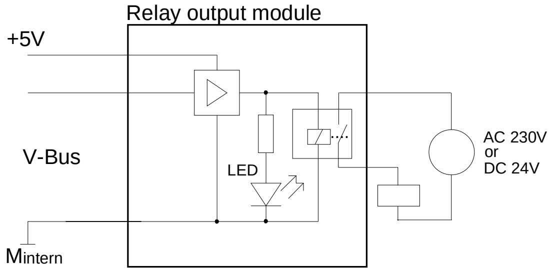
Pin	Assignment
1	not connected
2+3	Relay output. A.0
4+5	Relay output. A.1
6+7	Relay output. A.2
8+9	Relay output. A.3
10	not connected

Wiring diagram and schematic

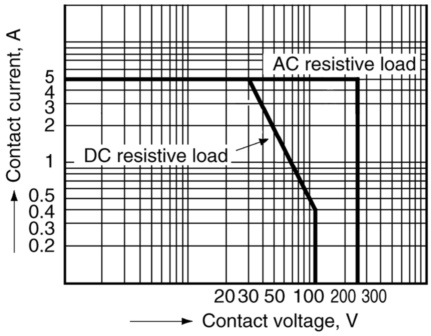
Wiring diagram



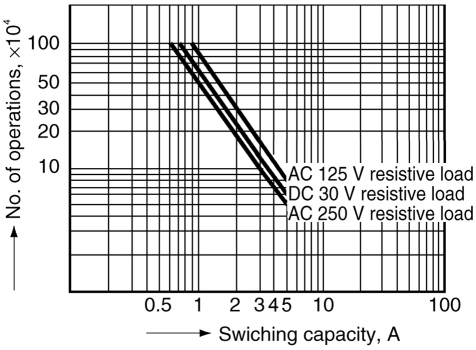
Schematic diagram



Maximum load



Service life



Technical data

Electrical data	VIPA 222-1HD10
Number of outputs	4 via relay
Rated load voltage	230V AC or max. 30V DC
max. Output current	230V AC: 5A / 30V DC: 5A
Current consumption via back panel bus	125mA
Voltage supply	5V via back panel bus
Switching rate	max. 100Hz
Status indicator	via LED's located on the front
Programming specifications	
Input data	-
Output data	1 Byte (Bit 0 ... Bit 3)
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	80g

DO 4xRelais bistable

Ordering details

DO 4xRelay bistable VIPA 222-1HD20

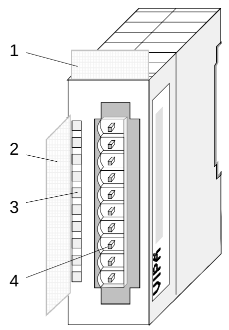
Description

The digital output module accepts binary control signals from the central bus system and controls the connected loads at the process level via bistable relay outputs. The module derives power from the back panel bus. The module has 4 channels that operate as switches. The status of the respective switch is retained if the power from the controlling system fails.

Properties

- 4 galvanically isolated relay outputs
- Power supply via back panel bus
- External load voltage 230V AC / 30V DC (may be mixed)
- Max. Output current per channel 16A (230V AC / 30V DC)
- Suitable for motors, lamps, magnetic valves and DC contactors

Construction



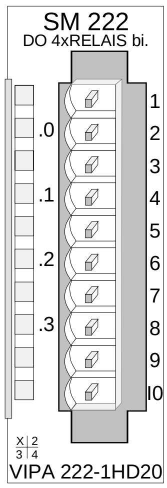
[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED's (not used)
[4] Edge connector

Output byte /
Connector assignment

Bit	Description
Bit 0	set A.0
Bit 1	set A.1
Bit 2	set A.2
Bit 3	set A.3
Bit 4	reset A.0
Bit 5	reset A.1
Bit 6	reset A.2
Bit 7	reset A.3

When one of bits 0...3 is set the respective channel is activated.

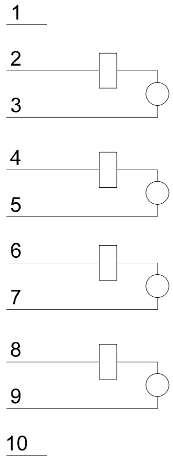
Setting one of bits 4..7 resets the respective output after at least 50ms.



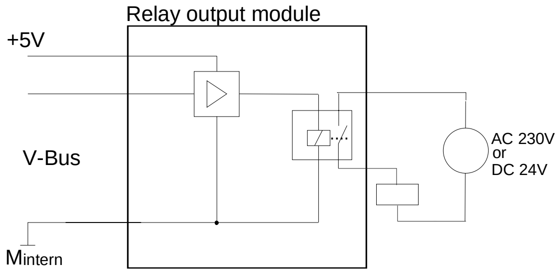
Pin	Assignment
1	not connected
2+3	Relay output. A.0
4+5	Relay output. A.1
6+7	Relay output. A.2
8+9	Relay output. A.3
10	not connected

Wiring diagram and schematic

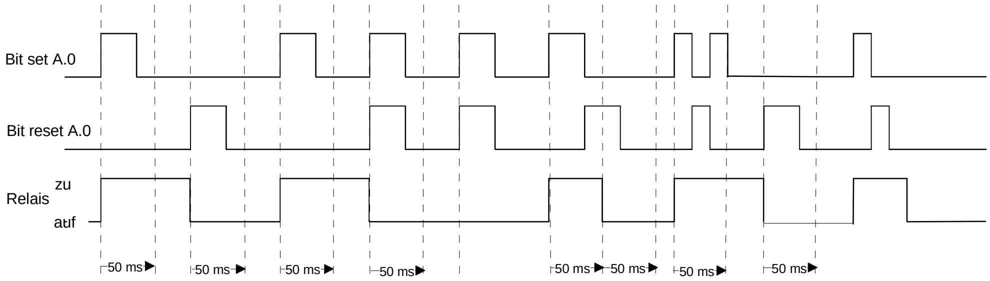
Wiring diagram



Schematic diagram



Signaling diagram



Note!

Please remember that a relay output that has been set can only be reset after at least 50ms when the set-signal has been removed.

Technical data

Electrical data	VIPA 222-1HD20
Number of outputs	4 via relay
Rated load voltage	230V AC or 30V DC
max. Output current per channel	AC 230V: 16A / DC 30V: 16A
Current consumption via back panel bus	125mA
Voltage supply	5V via back panel bus
Switching rate	max. 100Hz
Status indicator	-
Programming specifications	
Input data	-
Output data	1 Byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	80g

DO 8xSolid State COM

Ordering details DO 8xSolid State COM VIPA 222-1FF00

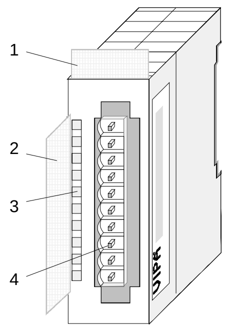
Description

The solid-state output module accepts binary control signals from the central bus system and controls the connected loads at the process level via solid-state relay outputs. The module derives power from the back panel bus. The module has 8 channels that are interconnected via the load voltage that act as switches and display the status by means of LED's. Solid-state relays change state when the load voltage passes through zero (AC).

Properties

- 8 Solid-state outputs with active channel indication by means of a LED
- Extended service life due to the fact that the load voltage (provided this is AC) is switched when it passes through zero
- External load voltage 230V AC or 30V DC
- Max. output current per channel 0,5A (AC 230V / DC 30V)
- Suitable for small motors, lamps, magnetic valves and contactors

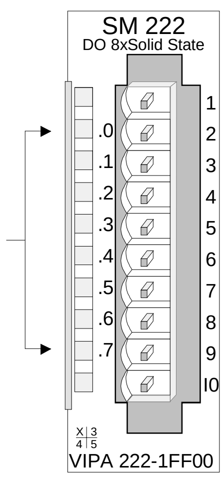
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator connector assignment

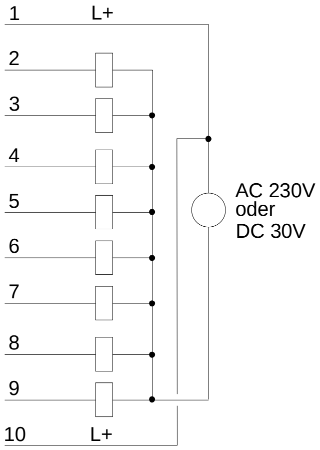
LED	Description
.0 7	LED's (green) A.0 to A.7 when an output is active the respective LED is turned on



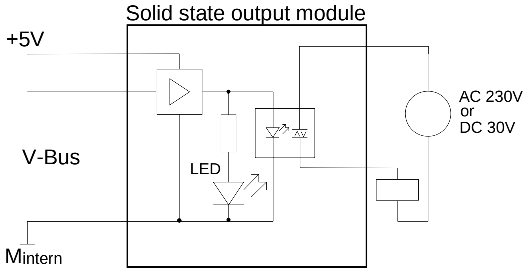
Pin	Assignment
1	Supply voltage
2	Output A.0
3	Output A.1
4	Output A.2
5	Output A.3
6	Output A.4
7	Output A.5
8	Output A.6
9	Output A.7
10	Supply voltage

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 222-1FF00
Number of outputs	8 via solid-state
Rated load voltage	230V AC or 30V DC
max. Output current per channel	230V AC: 0,5A / 30V DC: 0,5A
Contact resistance	typ. 2,1Ω , max. 3,2Ω
Current consumption via back panel bus	50mA
Voltage supply	5V via back panel bus
Switching rate	max. 100Hz
Status indicator	via LED’s located on the front
Programming specifications	
Input data	-
Output data	1 Byte (Bit 0 ... Bit 7)
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	80g

DO 4xSolid State

Ordering details

DO 4xSolid State VIPA 222-1FD10

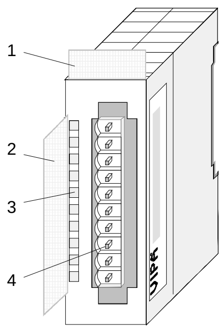
Description

The solid-state output module accepts binary control signals from the central bus system and controls the connected loads at the process level via solid-state relay outputs. The module derives power from the back panel bus. The module has 4 separate channels that operate as switches and display the status by means of LED's. Active loads must be supplied with external power.

Properties

- 4 galvanically isolated solid-state outputs
- Power supply via back panel bus
- External load voltage 230V AC or 30V DC
- Max. output current per channel 0,5A (230V AC / 30V DC)
- Suitable for motors, lamps, magnetic valves and contactors
- Active channel indication by means of an LED

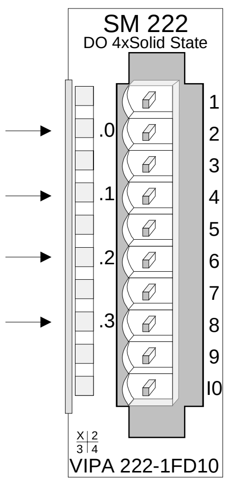
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator connector assignment

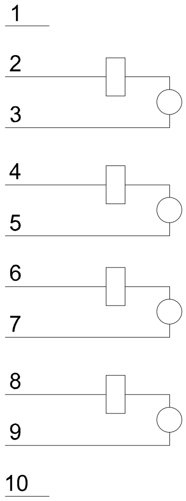
LED	Description
.0... .3	LED's (green) A.0 to A.3 when an output is active the respective LED is turned on



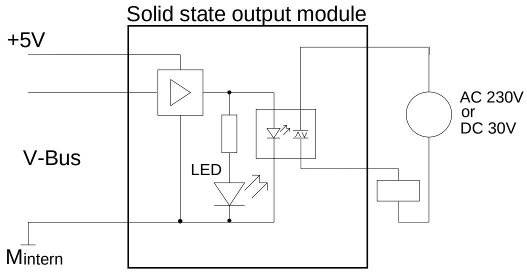
Pin	Assignment
1	not connected
2+3	Output A.0
4+5	Output A.1
6+7	Output A.2
8+9	Output A.3
10	not connected

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 222-1FD10
Number of outputs	4 via solid state
Rated load voltage	230V AC or 30V DC
max. output current per channel	230V AC: 0,5A / 30V DC: 0,5A
Current consumption via back panel bus	50mA
Voltage supply	5V via back panel bus
Switching rate	max. 100Hz
Status indicator	via LED’s located on the front
Programming specifications	
Input data	-
Output data	1 Byte (Bit 0 ... Bit 3)
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	80g

Chapter 13 Digital input/output modules

Overview

This chapter contains a description of the construction and the operation of the VIPA digital input/output modules.

Below follows a description of:

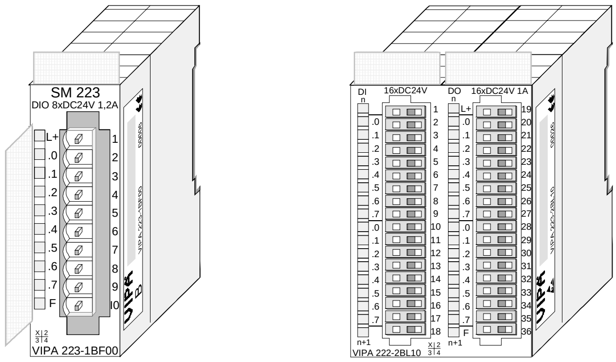
- A system overview of the digital input/output modules
- Properties
- Construction
- Interfacing and schematic diagram
- Technical data

Contents

System overview

Input/output modules SM 223

Here follows a summary of the digital input/output modules that are currently available from VIPA:



Ordering details input/output modules

Type	Order number
DIO 8xDC24V 1A	VIPA 223-1BF00
DI 16xDC24V, DO 16xDC24V 1A	VIPA 223-2BL10

DIO 8xDC24V 1A

Ordering details DIO 8xDC24V 1A VIPA 223-1BF00

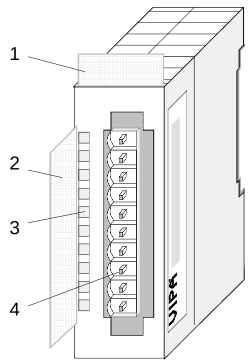
Description

This module is a combination module. It has 8 channels that can be used as input or as output channel. The status of the channels is displayed by means of LED's. Every channel is provided with a diagnostic function, i.e. when an output is active the respective input is set to "1". When a short circuit occurs at the load the input is held at "0" and the error can be detected by analysis of the input.

Properties

- 8 channels, isolated from the back panel bus (as input or output)
- Diagnostic function
- Rated input voltage 24V DC / supply voltage 24V DC
- Output current 1A
- LED error display for overload, overheat or short circuit
- Active channels displayed by means of an LED

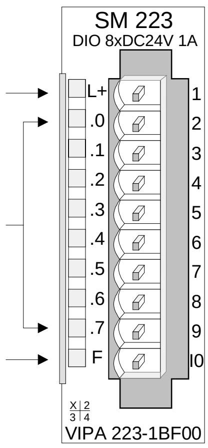
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator connector assignment

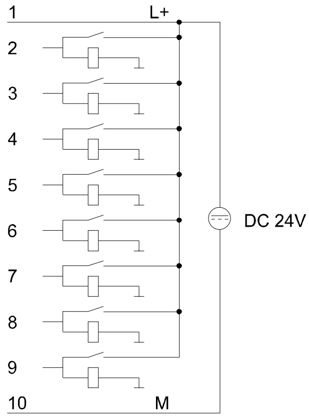
LED	Description
L+	LED (yellow) Supply voltage available
.0 7	LED's (green) when the input signal is "1" or the output is active the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error



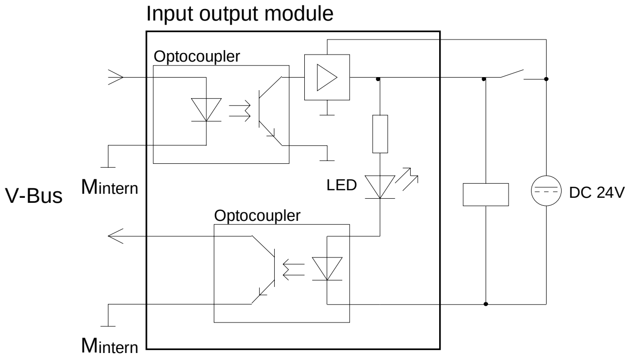
Pin	Assignment
1	+24V DC supply voltage
2	Channel K.0
3	Channel K.1
4	Channel K.2
5	Channel K.3
6	Channel K.4
7	Channel K.5
8	Channel K.6
9	Channel K.7
10	Supply ground

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 223-1BF00
Number of channels	8
Rated load voltage	DC 24V (18...35V) via ext. power source
No-load current consumption at L+ (all A.x=off)	50mA
Output current per channel	1A protected against short circuits
Rated input voltage	24V DC (18 ... 35V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 30V
Input filter time delay	3ms
Input current	typ. 7mA
Voltage supply	5V via back panel bus
Current consumption via back panel bus	60mA
Data requirements in the process image	1 Byte PAA, 1 Byte PAE
Status indicator	via LED’s located on the front
Programming specifications	
Input data	1 Byte
Output data	1 Byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25,4 x 76 x 76
Weight	50g

DI 16xDC24V, DO 16xDC24V 1A

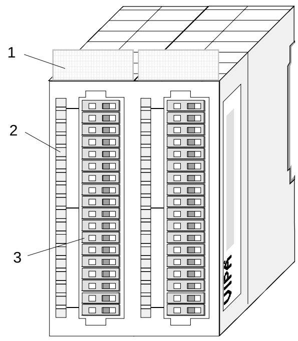
Ordering details DI 16xDC24V, DO 16xDC24V 1A VIPA 223-1BL10

Description The module has 32 channels that are isolated from the back panel bus. 16 channels operate as inputs and 16 as outputs. The status of the channels is displayed by means of LED's.

Properties

- 32 channels, of these 16 input and 16 output channels
- Rated input voltage 24V DC
- Supply voltage 24V DC(external) for outputs
- Output current 1A per channel
- LED error display for overload, overheat or short circuit
- Active channels displayed by means of an LED

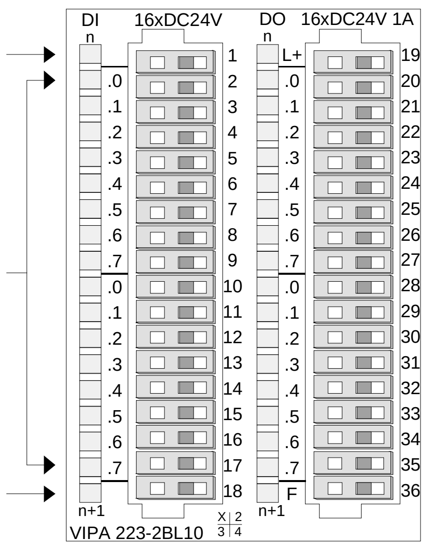
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator connector assignment

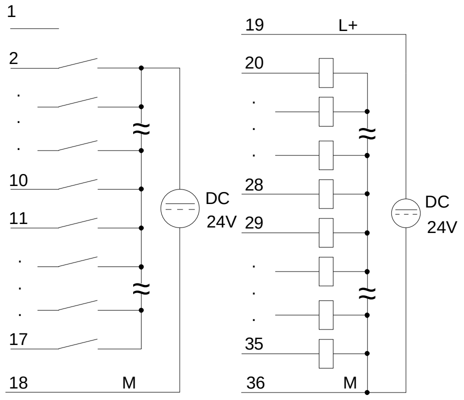
LED	Description
L+	LED (yellow) Supply voltage available
.0 7	LED's (green) E.0 ... E.7 (per Byte) A.0 ... A.7 (per Byte) when the signal (input) is "1" or the output is active the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error



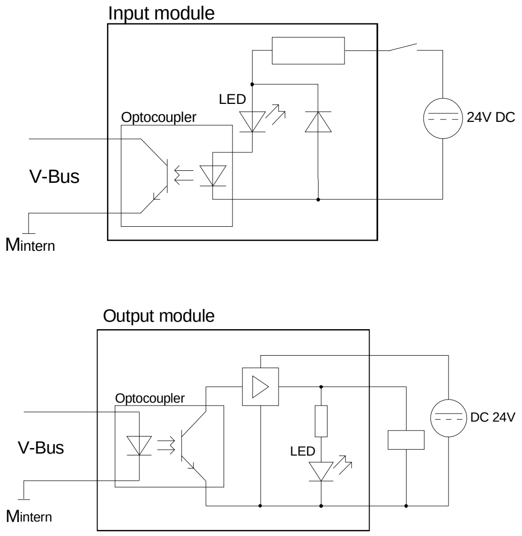
Pin	Assignment
1	not connected
2	Input E.0
.	.
.	.
.	.
17	Input E.15
18	Ground for inputs
19	Supply voltage +24V
20	Output A.0
.	.
.	.
.	.
35	Output A.15
36	Supply voltage ground outputs

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 223-2BL10
Number of channels	32
Rated load voltage	DC 24V (18...35V) via ext. power source
No-load current consumption at L+ (all A.x=off)	10mA
Output current per channel	1A protected against short circuits
max. contact load per connector	10A
Rated input voltage	24V DC (18 ... 35V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 30V
Input filter time delay	3ms
Input current	typ. 7mA
Voltage supply	5V via back panel bus
Current consumption via back panel bus	100mA
Data requirements in the process image	2 Byte PAA, 2 Byte PAE
Status indicator	via LED’s located on the front
Programming specifications	
Input data	2 Byte
Output data	2 Byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	50,8 x 76 x 76
Weight	100g

Chapter 14 Analog input modules

Overview

This chapter contains a description of the construction and the operation of the VIPA analog input modules.

Below follows a description of:

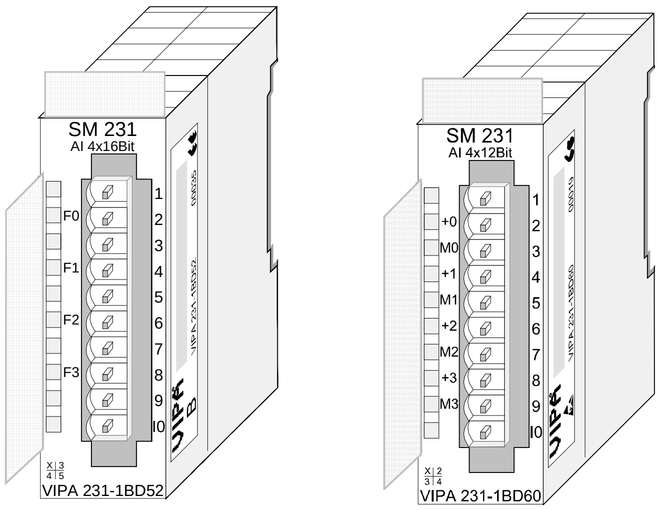
- A system overview of the analog input modules
- Properties
- Constructions
- Interfacing and schematic diagram
- Technical data

Contents

System overview

Input modules SM 231

Here follows a summary of the analog input modules that are currently available from VIPA:



Ordering details input modules

Type	Order number
AI4x16Bit, multi-input	VIPA 231-1BD52
AI4x12Bit, 4 ... 20mA, isolated	VIPA 231-1BD60

General

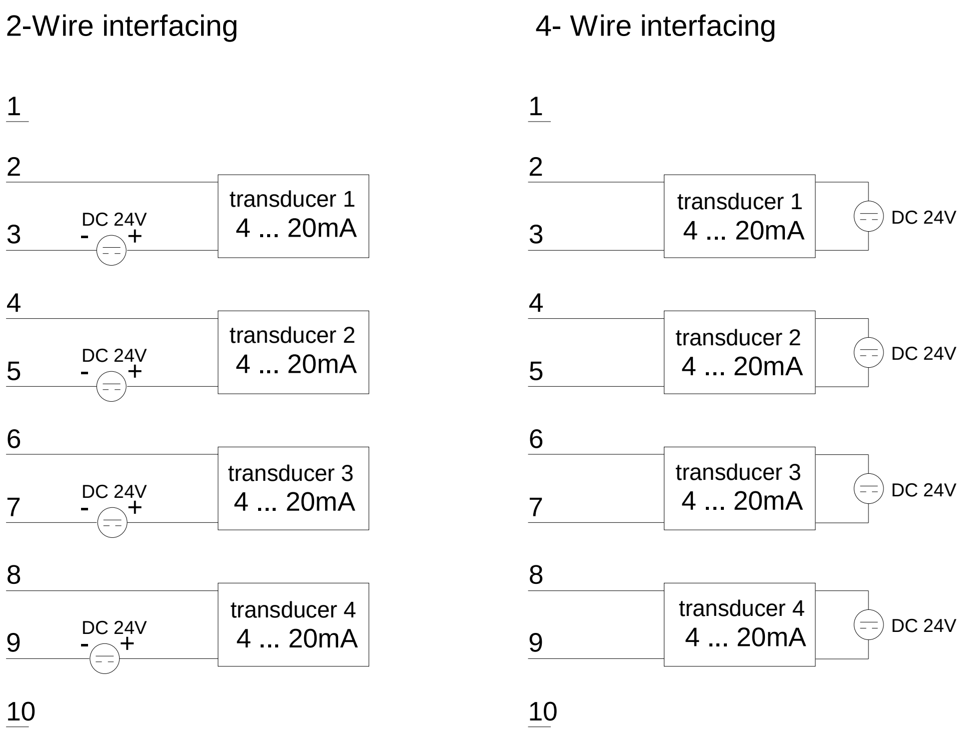
Cabling for analog signals

You should only use screened twisted pair cable when you are connecting analogue signals. These cables reduce the effect of electrical interference. The screen of the analogue signal cable should be grounded at both ends. In situations where the equipment at the being connected by the cable is at different electrical potentials it is possible that a current will flow to equalize the potential difference. This current could interfere with the analog signals. Under these circumstances it is advisable to ground the screen of the signal cable at one end only.

Connecting transducers

Our analogue input modules provide a large number of input configurations for 2-wire and 4-wire transducers.

Please remember that transducers require an external power source. You must connect an external power supply in line with any 2-wire transducer. The following diagram explains the connection of 2- and 4-wire transducers:



Note!

Please ensure that you connect transducers with the correct polarity!
Unused inputs should be short circuited by placing a link between the positive connection and the common ground for the channel.

AI 4x16Bit, multi-Input

Ordering details AI 4x16Bit multi-input VIPA 231-1BD52

Description

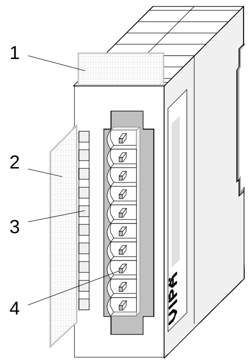
The module has 4 inputs that can you can configure individually. The module requires a total of 8 input data bytes in the process image (2 bytes per channel).

Isolation between the channels on the module and the back panel bus is provided by means of DC/DC converters and optocouplers.

Properties

- the different channels are individually configurable and can be turned off
- the common signal inputs of the channels are isolated from each other and the permitted potential difference is up to 5V
- LED for signaling open circuits in current loop operation
- Diagnostic function

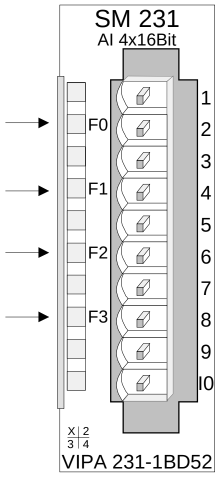
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicators
Connector assignment

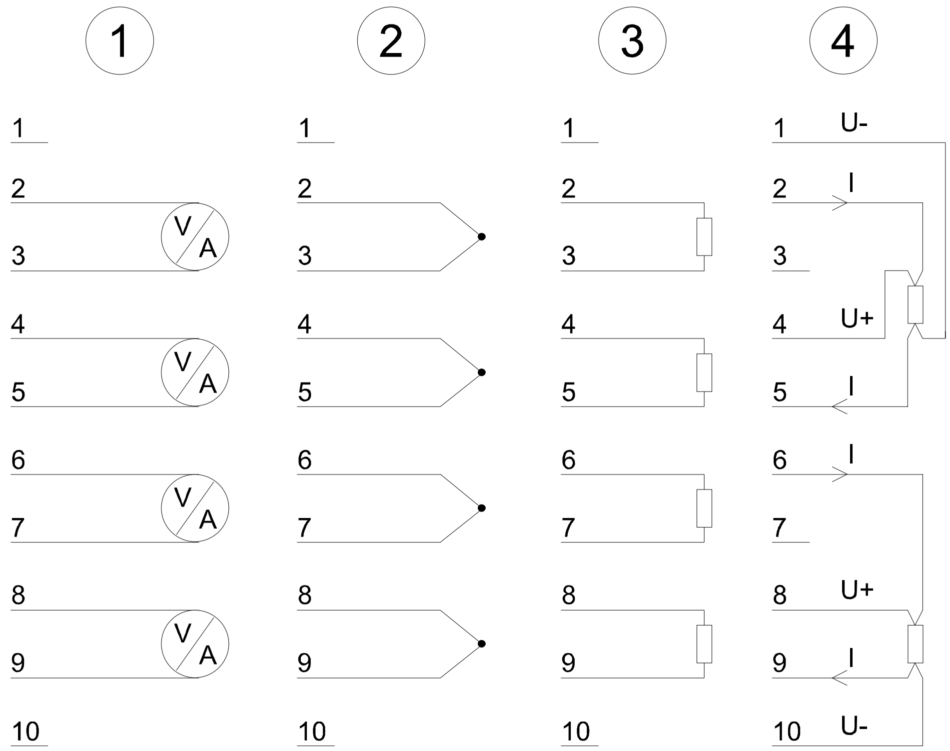
LED	Description
F0 ... F3	LED (red): turned on when an open circuit exists on the 4...20mA sensor circuits blinks when the current > 40mA current sensor circuits



Pin	Assignment
1	For four-wire systems channel 0
2	+ channel 0
3	Channel 0 common
4	+ channel 1
5	Channel 1 common
6	+ channel 2
7	Channel 2 common
8	+ channel 3
9	Channel 3 common
10	For four-wire systems channel 2

Wiring diagrams

Note!
Please note that the module 231-1BD52 was developed from the 231-1BD50. The measuring function no longer starts at 00h but it is offset by one to 01h. The measurement function no. 00h does not affect permanently stored configuration data.



Note!
Unused inputs on activated channels must be connected to the respective ground. This is not necessary when the unused channels are turned off by means of FFh.

Function no. Assignment

No.	Function	Measurement range / representation	Tolerance	Conn.
00h	Does not affect permanently stored configuration data			
01h	Pt100 in two-wire mode	-200 .. +850°C / in units of 1/10°C, two's complement	1)2)3) ±1°C	(3)
02h	Pt1000 in two-wire mode	-200 .. +500°C / in units of 1/10°C, two's complement	1)2)3) ±1°C	(3)
03h	NI100 in two-wire mode	-50 .. +250°C / in units of 1/10°C, two's complement	1)2)3) ±1°C	(3)
04h	NI1000 in two-wire mode	-50 .. +250°C / in units of 1/10°C, two's complement	1)2)3) ±1°C	(3)
05h	Resistance measurement 60Ohm two-wire	- / 60Ω= final value (32767)	1)2)3) ±0,2% of final value	(3)
06h	Resistance measurement 600Ohm two-wire	- / 600Ω = final value (32767)	1)2)3) ±0,1% of final value	(3)
07h	Resistance measurement 3000Ohm two-wire	- / 3000Ω = final value (32767)	1)2)3) ±0,1% of final value	(3)
08h	Resistance measurement 6000Ohm two-wire	- / 6000Ω = final value (32767)	1)2)3) ±0,1% of final value	(3)
09h	Pt100 via four-wire connection	-200 .. +850°C / in units of 1/10°C, two's complement	1)2) ±0,5°C	(4)
0Ah	Pt1000 via four-wire connection	-200 .. +500°C / in units of 1/10°C, two's complement	1)2) ±0,5°C	(4)
0Bh	NI100 via four-wire connection	-50 .. +250°C / in units of 1/10°C, two's complement	1)2) ±0,5°C	(4)
0Ch	NI1000 via four-wire connection	-50 .. +250°C / in units of 1/10°C, two's complement	1)2) ±0,5°C	(4)
0Dh	Resistance measurement 60Ohm four-wire	- / 60Ω= final value (32767)	1)2) ±0,1% of final value	(4)
0Eh	Resistance measurement 600Ohm four-wire	- / 600Ω= final value (32767)	1)2) ±0,05% of final value	(4)
0Fh	Resistance measurement 3000Ohm four-wire	- / 3000Ω = final value (32767)	1)2) ±0,05% of final value	(4)
10h	Thermoelement type J , externally compensated	-210 °C .. 850 °C / in units of 1/10°C, two's complement	1)2)4) ±1°C	(2)
11h	Thermoelement type K, externally compensated	-270 °C .. 1200 °C / in units of 1/10°C, two's complement	1)2)4) ±1,5°C	(2)
12h	Thermoelement type N, externally compensated	-200 °C .. 1300 °C / in units of 1/10°C, two's complement	1)2)4) ±1,5°C	(2)
13h	Thermoelement type R, externally compensated	-50 °C .. 1760 °C / in units of 1/10°C, two's complement	1)2)4) ±4°C	(2)

No.	Function	Measurement range / representation	Tolerance	Conn.
14h	Thermoelement type T, externally compensated	-270 °C .. 400 °C **/** in units of 1/10°C, two's complement	[1][2][4] ±1,5°C	(2)
15h	Thermoelement type S, externally compensated	-50 °C .. 1760 °C **/** in units of 1/10°C, two's complement	[1][2][4] ±5°C	(2)
18h	Thermoelement type J, internally compensated	-210 °C .. 850 °C **/** in units of 1/10°C, two's complement	[1][2][5] ±1,5°C	(2)
19h	Thermoelement type K, internally compensated	-270 °C .. 1200 °C **/** in units of 1/10°C, two's complement	[1][2][5] ±2°C	(2)
1Ah	Thermoelement type N, internally compensated	-200 °C .. 1300 °C **/** in units of 1/10°C, two's complement	[1][2][5] ±2°C	(2)
1Bh	Thermoelement type R, internally compensated	-50 °C .. 1760 °C **/** in units of 1/10°C, two's complement	[1][2][5] ±5°C	(2)
1Ch	Thermoelement type T, internally compensated	-270 °C .. 400 °C **/** in units of 1/10°C, two's complement	[1][2][5] ±2°C	(2)
1Dh	Thermoelement type S, internally compensated	-50 °C .. 1760 °C **/** in units of 1/10°C, two's complement	[1][2][4] ±5°C	(2)
27h	Voltage 0...50mV Siemens S7-format	0...50mV **/** 59,25mV = maximum usable range before over range occurs (32767) 0...50mV = rated value (0...27648) two's complement	[1] ±0,1% of final value	(1)
28h	Voltage ±10V Siemens S7-format	±11,85V **/** 11,85V= max. value before over range occurs (32767) -10...10V= rated range (-27648...27648) -11,85V= min. value before under range (-32767) two's complement	[1] ±0,05% of final value	(1)
29h	Voltage ±4V Siemens S7-format	±4,74V **/** 4,74V = max. value before over range occurs (32767) -4...4V = rated range (-27648...27648) -4,74V = min. value before under range (-32767) two's complement	[1] ±0,05% of final value	(1)
2Ah	Voltage ±400mV Siemens S7-format	±0,474V **/** 474mV = max. value before over range occurs (32767) -400...400mV = rated range (-27648...27648) -474mV = min. value before under range (-32767) two's complement	[1] ±0,1% of final value	(1)
2Bh	Voltage ±10V Siemens S5-format	±11,85V **/** 12,5V = max. value before over range occurs (20480) -10...10V = rated range (-16384...16384) -12,5V = min. value before under range (-20480) Numeric representation: same as for AI 4x12Bit	[1] ±0,2% of final value	(1)
2Ch	Current ±20mA Siemens S7-format	±23,70mA **/** 23,70mA = max. value before over range occurs (32767) -20...20mA = rated value (-27648...27648) -23,70mA = min. value before under range (-32767) two's complement	[1] ±0,05% of final value	(1)

No.	Function	Measurement range / representation	Tolerance	Conn.
2Dh	Current 4...20mA Siemens S7-format	1,185 .. +22,96mA **/** 22,96mA = max. value before over range occurs (32767) 4...20mA = rated range (0...27648) 0mA = min. value before under range (-5530) two's complement	[1] ±0,05% of final value	(1)
2Eh	Current 4...20mA Siemens S5-format	1,185 .. +22,96mA **/** 22,96mA = max. value before over range occurs (20480) 20mA = rated range (0...16384) 0mA = min. value before under range (-4096) Numeric notation: same as AI 4x12Bit	[1] ±0,2% of final value	(1)
2Fh	Current ±20mA Siemens S5-format	±23,70mA **/** 23,70mA = max. value before over range occurs (19456) -20...20mA = rated value (-16384...16384) -23,70mA = min. value before under range (-19456) two's complement	[1] ±0,05% of final value	(1)
32h	Resistance measurement 6000Ohm four-wire	- / 6000Ω= final value (32767)	[1][2] ±0,05% of final value	(4)
33h	Resistance measurement 6000Ohm four-wire	- / 6000Ω= final value (6000)	[1][2] ±0,05% of final value	(4)
35h	Resistance measurement 60Ohm two-wire	- **/** 60Ω= final value (6000)	[1][2][3] ±0,2% of final value	(3)
36h	Resistance measurement 600Ohm two-wire	- **/** 600Ω = final value (6000)	[1][2][3] ±0,1% of final value	(3)
37h	Resistance measurement 3000Ohm two-wire	- **/** 3000Ω = final value (30000)	[1][2][3] ±0,1% of final value	(3)
38h	Resistance measurement 6000Ohm two-wire	- / 6000Ω = final value (6000)	[1][2][3] ±0,1% of final value	(3)
3Dh	Resistance measurement 60Ohm four-wire	- **/** 60Ω= final value (6000)	[1][2] ±0,1% of final value	(4)
3Eh	Resistance measurement 600Ohm four-wire	- **/** 600Ω= final value (6000)	[1][2] ±0,05% of final value	(4)
3Fh	Resistance measurement 3000Ohm four-wire	- **/** 3000Ω = final value (30000)	[1][2] ±0,05% of final value	(4)
57h	Voltage 0...50mV	0...50mV **/** 59.25mV = max. value before over range occurs (5925) 0...50mV = rated range (0...5000) two's complement	[1] ±0,1% of final value	(1)
58h	Voltage ±10V	±11,85V **/** 11,85V= max. value before over range occurs (11850) -10...10V= rated range (-10000...10000) -11,85V= min. value before under range (-11850) two's complement	[1] ±0,05% of final value	(1)
59h	Voltage ±4V	±4,74V **/** 4,74V = max. value before over range occurs (47400) -4...4V = rated range (-40000...40000) -4,74V = min. value before under range (-47400) two's complement	[1] ±0,05% of final value	(1)

No.	Function	Measurement range / representation	Tolerance	Conn.
5Ah	Voltage ±400mV	±0,474V ***/*** 474mV = max. value before over range occurs (47400) -400...400mV = rated range (-40000...40000) -474mV = min. value before under range (-47400) two's complement	[1]) ±0,1% of final value	(1)
5Ch	Current ±20mA	±23,70mA ***/*** 23,70mA = max. value before over range occurs (23700) -20...20mA = rated value (-20000...20000) -23,70mA = min. value before under range (-23700) two's complement	[1]) ±0,05% of final value	(1)
5Dh	Current 4...20mA	1,185 .. +22,96mA ***/*** 22,96mA = max. value before over range occurs (22960) 4...20mA = rated range (0...16000) 0mA = min. value before under range (-400) two's complement	[1]) ±0,05% of final value	(1)
FFh	Channel not active (turned off)			

[1]) measured at an ambient temperature of 25°C, velocity of 15 conversions/s

[2]) excluding errors caused by transducer inaccuracies

[3]) excluding errors caused by contact resistance and line resistance

[4]) the compensation of the neutralization must be implemented externally

[5]) the compensation for the neutralization is implemented internally by including the temperature of the front plug. The thermal conductors must be connected directly to the front plug, and where necessary these must be extended by means of thermoelement extension cables

Note!
The module is pre-set to the range "±10V voltage" range.

Numeric notation in Siemens S7-format

Analog values are represented as a two's complement value

Numeric notation:

Byte	Bit 7 ... Bit 0
0	Bit 0 ... 7: binary measured value
1	Bit 0 ... 6: binary measured value Bit 7: sign 0 positive 1 negative

+/- 10V

Voltage	Decimal	Hex
-10V	-27648	9400
-5V	-13824	CA00
0V	0	0
+5V	13824	3600
+10V	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0V	0	0000
5V	8192	2000
10V	16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{16384}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
+1V	0	0
+3V	+13824	3600
+5V	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U-1}{4}, \quad U = Value \cdot \frac{4}{27648} + 1$$

U: voltage, Value: decimal value

+/-4V

Voltage	Decimal	Hex
-4V	-27648	9400
0V	0	0
4V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{4}, \quad U = Value \cdot \frac{4}{27648}$$

U: voltage, Value: decimal value

+/-400mV

Voltage	Decimal	Hex
-400mV	-27648	9400
0V	0	0
400mV	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{400}, \quad U = Value \cdot \frac{400}{27648}$$

U: voltage, Value: decimal value

4....20mA

Current	Decimal	Hex
+4mA	0	0
+12mA	+13824	3600
+20mA	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I-4}{16}, \quad I = Value \cdot \frac{16}{27648} + 4$$

I: current, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20mA	-27648	9400
-10mA	-13824	CA00
0mA	0	0
+10mA	+13824	3600
+20mA	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{27648}$$

I: current, Value: decimal value

Measurement data acquisition

During a measurement the data is stored in the data input area. The table above shows the allocation of the data to a measured value as well as the respective tolerance.

The following figures show the structure of the data input area:

Data input area:

Byte	Bit 7 ... Bit 0
0	High-Byte channel 0
1	Low-Byte channel 0
2	High-Byte channel 1
3	Low-Byte channel 1
4	High-Byte channel 2
5	Low-Byte channel 2
6	High-Byte channel 3
7	Low-Byte channel 3

Note!

Only channels 0 and 2 are used in four-wire systems.

Parameter data

You can configure every channel individually. 10 bytes are available for the configuration data. Configuration parameters are stored in permanent memory and they will be retained even if power is turned off.

The following table show the structure of the parameter area:

Parameter area:

Byte	Bit 7 ... Bit 0	Default
0	Diagnostic alarm-byte: Bit 0 ... 5: reserved Bit 6: 0: diagnostic alarm inhibited 1: diagnostic alarm enabled Bit 7: reserved	00h
1	reserved	00h
2	Function-no. channel 0 (see table)	2Dh
3	Function-no. channel 1 (see table)	2Dh
4	Function-no. channel 2 (see table)	2Dh
5	Function-no. channel 3 (see table)	2Dh
6	Option-Byte channel 0	00h
7	Option-Byte channel 1	00h
8	Option-Byte channel 2	00h
9	Option-Byte channel 3	00h

Parameter

Diagnostic alarm

The diagnostic alarm is enabled by means of bit 6 of byte 0. In this case an error a 4-byte diagnostic message will be issued to the master system.

Function-no.

Here you must enter the function number of your measurement function for every channel. The allocation of the function number to a measurement function is available from the table above.

Option-Byte

Here you can specify the conversion rate. In addition selection and envelope functions have been implemented.

Note!

Please note that the resolution is reduced when conversion rate are increased due to the decrease in the integration time.

The format of the data transfer remains the same. The only difference is that the lower set of bits (LSB's) lose significance for the analog value.

Structure of the option-byte:

Byte	Bit 7 ... Bit 0	Resolution	Default
6 ... 9	Option-Byte:		00h
	Bit 0 ... 3: rate*		
	0000 15 conversions/s	16	
	0001 30 conversions/s	16	
	0010 60 conversions/s	15	
	0011 123 conversions/s	14	
	0100 168 conversions/s	12	
	0101 202 conversions/s	10	
	0110 3,7 conversions/s	16	
	0111 7,5 conversions/s	16	
	Bit 4 ... 5: Selection function		
	00 deactivated		
	01 use 2 of 3 values		
	10 use 4 of 6 values		
	Bit 6 ... 7: Envelope function		
	00 deactivated		
	01 envelope ± 8		
	10 envelope ± 16		

*) These specifications apply to 1-channel operation. For multi-channel operations the conversion rate per channel can be calculated by dividing the specified conversion rate by the number of active channels.

Diagnostic data

When you enable alarms in byte 0 of the parameter area, modules will transfer 4 diagnostic bytes with pre-defined contents to your master when an error is detected. Please note that analogue modules only use the first two bytes for diagnostic purposes. The remaining bytes are not used.

The structure of the diagnostic bytes is as follows:

Diagnostic data:

Byte	Bit 7 ... Bit 0	Default
0	Bit 0: Module malfunction Bit 1: constant 0 Bit 2: external error Bit 3: channel error present Bit 4 ... 7: reserved	-
1	Bit 0 ... 3 class of module 0101 analog module Bit 4: channel information available	-
2	not assigned	-
3	not assigned	-

Technical data

Electrical data	VIPA 231-1BD52
Number of inputs	4 differential inputs
Input resistance	inductive:10MΩ (voltage range) capacitive:100KΩ(voltage range) 50Ω (current range)
Power supply	5V via back panel bus
Current consumption	240mA via back panel bus
Isolation w.r.t. back panel bus	yes, isolation tested to 500Vrms
Status indicators	via LED's on the front
Programming specifications	
Input data	8 Bytes (1 word per channel)
Output data	-
Parameter data	10 Bytes
Diagnostic data	4 Bytes
Dimensions and weight	
Dimensions (WxHxD)	25,4 x 76 x 76 mm
Weight	100g

AI 4x12Bit, 4 ... 20mA, isolated

Ordering details

AI 4x12Bit, 4...20mA, isolated VIPA 231-1BD60

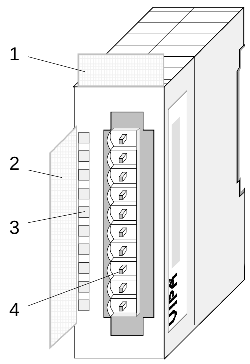
Description

The module has 4 inputs that are permanently configured to measure current signals (4 ... 20mA). This module requires a total of 8 bytes of the process image for the input data (2 bytes per channel) and it is configured by means of 1 byte containing parameter specifications. The measured values are returned in S5-format. DC/DC converters and isolation amplifiers are employed to provide electrical isolation for the channels of the module with respect to the back panel bus and between the different channels.

Properties

- 4 inputs, channels isolated from the back panel bus and from each other
- Permanently configured for current measurements
- Suitable for transducers with 4 ... 20mA outputs
- LED's to indicate open circuit connections
- Galvanic isolation of the channels by means of isolation amplifiers

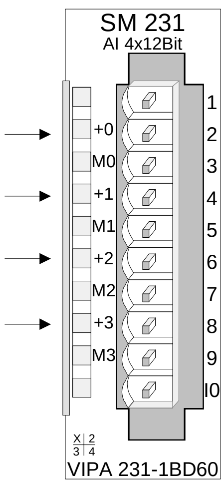
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicators
Connector assignment

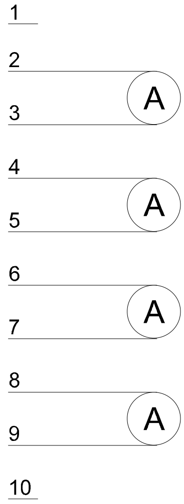
LED	Description
+0	LED (red)
+1	open circuit detection
+2	This LED's is turned on
+3	when the transducer is disconnected.

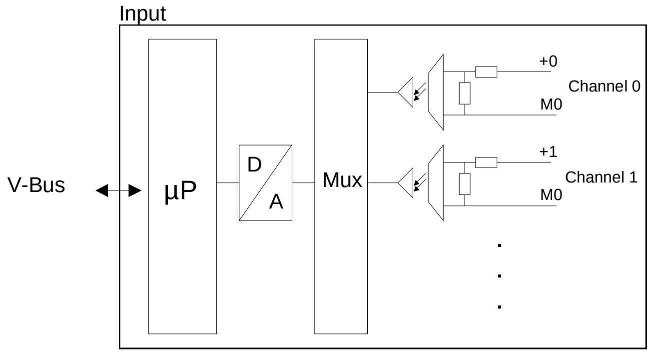


Pin	Assignment
1	
2	pos. connection K.0
3	Channel 0 common
4	pos. connection K.1
5	Channel 1 common
6	pos. connection K.2
7	Channel 2 common
8	pos. connection K.3
9	Channel 3 common
10	

Wiring diagram and schematic

Wiring diagram **Schematic diagram**





Configuration

The module is configured by means of one byte of parameter data.

Parameter data:

Byte	Bit 7 ... Bit 0
0	Bit 6: 0: open circuit detection off 1: open circuit detection on

Numeric notation

Input data is stored in a word in Siemens S5-format. The word contains the binary value and information bits:

Numeric notation:

Byte	Bit 7 ... Bit 0
0	Bit 0: overflow bit 0: value located within measuring range 1: measuring range exceeded Bit 1: error bit (set by internal errors) Bit 2: activity bit (always 0) Bit 3 ... 7: **binary measured value** (see table below)
1	Bit 0 ... 6: **binary measured value** (see table below) Bit 7: sign 0 positive 1 negative

The following table shows the allocation of binary values to the respective measured values.

Numeric notation in Siemens S5-format

Measured value in mA	Units	**Binary measured value**	T	E	Ü	Range
24,0	2560	0 1 0 1 0 0 0 0 0 0 0 0 0	0	0	0	over range occurs
20,016	2049	0 1 0 0 0 0 0 0 0 0 0 0 1	0	0	0	
20,0	2048	0 1 0 0 0 0 0 0 0 0 0 0 0	0	0	0	rated range
19,98	2047	0 0 1 1 1 1 1 1 1 1 1 1 1	0	0	0	
12,0	1024	0 0 1 0 0 0 0 0 0 0 0 0 0	0	0	0	
8,0	512	0 0 0 1 0 0 0 0 0 0 0 0 0	0	0	0	
6,0	256	0 0 0 0 1 0 0 0 0 0 0 0 0	0	0	0	
5,0	128	0 0 0 0 0 1 0 0 0 0 0 0 0	0	0	0	
4,016	2	0 0 0 0 0 0 0 0 0 0 0 1 0	0	0	0	
4,008	1	0 0 0 0 0 0 0 0 0 0 0 0 1	0	0	0	
4	0	0 0 0 0 0 0 0 0 0 0 0 0 0	0	0	0	
3,984	-2	1 1 1 1 1 1 1 1 1 1 1 1 0	0	0	0	Under range
3,0	-128	1 1 1 1 1 1 0 0 0 0 0 0 0	0	0	0	
2,0	-256	1 1 1 1 1 0 0 0 0 0 0 0 0	0	0	0	
1,0	-384	1 1 1 1 0 1 0 0 0 0 0 0 0	0	0	0	
0,0	-512	1 1 1 1 0 0 0 0 0 0 0 0 0	0	0	0	

Technical data

Electrical data	VIPA 231-1BD60
Number of inputs	4 individually isolated
Current measuring range	4 ... 20mA
Input filter time delay	3ms
Input resistance	20Ω
Power supply	5V via back panel bus
Current consumption	250mA via back panel bus
Isolation	yes, every channel separately, isolation tested at 500Vrms
Status indicators	via LED’s on the front
Programming specifications	
Input data	8 Bytes (1 word per channel)
Output data	-
Parameter data	1 Byte
Diagnostic data	4 Byte
Dimensions and weight	
Dimensions (WxHxD)	25,4 x 76 x 76 mm
Weight	120g

Chapter 15 Analog output modules

Overview

This chapter contains a description of the construction and the operation of the VIPA analog output modules.

Below follows a description of:

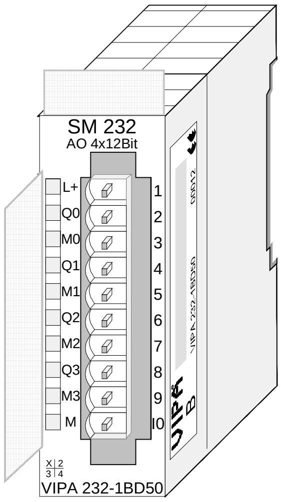
- A system overview of the analog output modules
- Properties
- Constructions
- Interfacing and schematic diagram
- Technical data

Contents

System overview

Output modules SM 232

Here follows a summary of the analog output modules that are currently available from VIPA:



Ordering details output modules

Type	Order number
AO4x12Bit, multi-output	VIPA 232-1BD50

General

Cabling for analog signals

You should only use screened twisted pair cable when you are connecting analogue signals. These cables reduce the effect of electrical interference. The screen of the analogue signal cable should be grounded at both ends. In situations where the equipment at the being connected by the cable is at different electrical potentials it is possible that a current will flow to equalize the potential difference. This current could interfere with the analog signals. Under these circumstances it is advisable to ground the screen of the signal cable at one end only.

Connecting loads and actuators

Due to the fact that actuators also require a source of external power they may also be connected to actuators by means of 2 wires or 4 wires. Where control signals are supplied to 2-wire-actuators a power supply must be connected in series with the control cable. 4-wire actuators are connected to an external power source.

Note!

Please ensure that you connect actuators to the correct polarity!
Unused output terminals must not be connected!

AO 4x12Bit, Multi-Output

Ordering details AO 4x12Bit Multi-Output VIPA 232-1BD50

Description

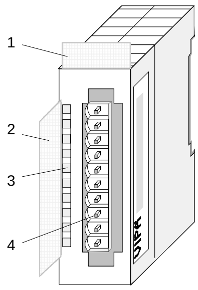
This module provides 4 outputs that can be configured individually. The module occupies a total of 8 bytes of output data (2 bytes per channel) in the process image. These values must be defined as left justified two's complement entries.

Galvanic isolation between the channels on the module and the back panel bus is provided by means of DC/DC converters and optocouplers. The module requires an external supply of 24V DC.

Properties

- 4 outputs with common ground
- Outputs with individually configurable functions
- Suitable for connection to actuators requiring ±10V, 1 ... 5V, 0 … 10V, ±20mA, 4 … 20mA or 0 ... 20mA inputs
- Diagnostic LED and diagnostic function

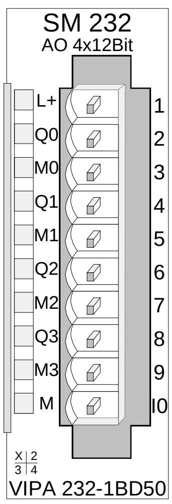
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator
Connector assignment

LED	Description
M3	Diagnostic LED (red) turned on by: - a short circuit is detected at the control voltage output - an open circuit is detected on the current output line - the CPU is in STOP mode - the bus coupler does not receive supply voltage

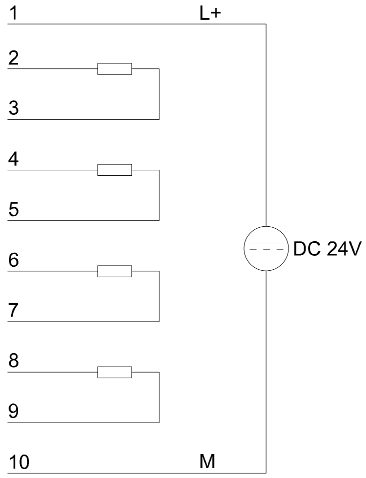


Pin	Assignment
1	24V DC supply voltage
2	+ Channel 0
3	Channel 0 common
4	+ Channel 1
5	Channel 1 common
6	+ Channel 2
7	Channel 2 common
8	+ Channel 3
9	Channel 3 common
10	Supply voltage common

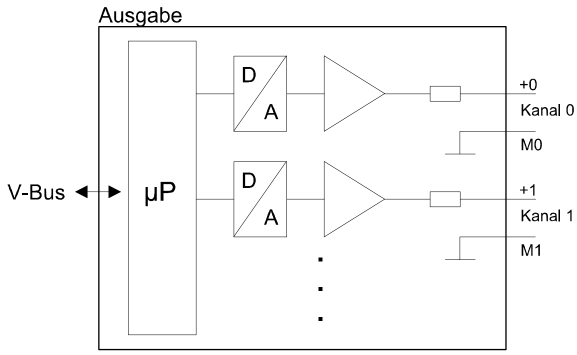
Note!
Please note that the diagnostic LED's of the **entire** module are denoted M3!

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Function no. allocation

No.	Function	Output range	Tolerance
00h	no output		
01h	Voltage ±10V Siemens S5-format	±11,85V 12,5V = max. value before over range occurs (20480) -10...10V = rated range (-16384...16384) -12,5V = min. value before under range (-20480)	1) ±0,2% of final value
02h	Voltage 1...5V Siemens S5-format	0...6V 6V = max. value before over range occurs (20480) 1...5V = rated range (0...16384) 0V = min. value before under range (-4096)	1) ±0,05% of final value
05h	Voltage 0...10V Siemens S5-format	0...12,5V 12,5V = max. value before over range occurs (20480) 0...10V = rated range (0...16384) no under range available	1) ±0,2% of final value
09h	Voltage ±10V Siemens S7-format (two's complement)	±11,85V 11,85V= max. value before over range occurs (32767) -10V...10V = rated range (-27648...27648) -11,85 = min. value before under range (-32767)	1) ±0,05% of final value
0Ah	Voltage 1...5V Siemens S7-format (two's complement)	0...5,75V 5,75V = max. value before over range occurs (32767) 1...5V = rated range (0...27648) 0V = min. value before under range (-6912)	1) ±0,05% of final value
0Dh	Voltage 0...10V Siemens S7-format (two's complement)	0...11,5V 11,5V = max. value before over range occurs (32767) 0...10V = rated range (0...27648) no under range available	1) ±0,2% of final value

No.	Function	Output range	Tolerance
03h	Current ±20mA Siemens S5-format	±23,70mA 23,70mA = max. value before over range occurs (20480) -20...20mA = rated range (-16384...16384) -23,70mA = min. value before under range (-20480)	[1]) ±0,2% of final value
04h	Current 4...20mA Siemens S5-format	0...23,70mA 23,70mA = max. value before over range occurs (20480) 4...20mA = rated range (0...16384) 0mA = min. value before under range (-4096)	[1]) ±0,2% of final value
06h	Current 0...20mA Siemens S5-format	0...23,70mA 23,70mA = max. value before over range occurs (20480) 0...20mA = rated range (0...16384) no under range available	[1]) ±0,2% of final value
0Bh	Current ±20mA Siemens S7-format (two's complement)	±23,70mA 23,70mA = max. value before over range occurs (32767) -20...20mA = rated range (-27648...27648) -23,70mA = min. value before under range (-32767)	[1]) ±0,05% of final value
0Ch	Current 4...20mA Siemens S7-format (two's complement)	0...22,96mA 22,96mA = max. value before over range occurs (32767) 4...20mA = rated range (0...27648) 0mA = min. value before under range (-5530)	[1]) ±0,05% of final value
0Eh	Current 0...20mA Siemens S7-format (two's complement)	0...22,96mA 22,96mA = max. value before over range occurs (32767) 0...20mA = rated range (0...27648) no under range available	[1]) ±0,2% of final value

[1)] determined at an ambient temp. of 25°C, conversion rate of 15/s

Numeric notation in Siemens S5-format

Input data is saved into a word in Siemens S5-format. The word consists of the binary value and the information bits.

Numeric notation:

Byte	Bit 7 ... Bit 0
0	Bit 0: overflow bit 0: value located within measuring range 1: measuring range exceeded Bit 1: error bit (set by internal errors) Bit 2: activity bit (always 0) Bit 3 ... 7: binary measured value
1	Bit 0 ... 6: binary measured value Bit 7: sign 0 positive 1 negative

+/- 10V

Voltage	Decimal	Hex
-10V	-16384	C000
-5V	-8192	E000
0V	0	0
+5V	8192	2000
+10V	+16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{16384}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0V	0	0000
5V	8192	2000
10V	16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{16384}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
+1V	0	0
+3V	+8192	2000
+5V	+16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{U-1}{4}, \quad U = Value \cdot \frac{4}{16384} + 1$$

U: voltage, Value: decimal value

4....20mA

Current	Decimal	Hex
+4mA	0	0
+12mA	+8192	2000
+20mA	+16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{I-4}{16}, \quad I = Value \cdot \frac{16}{16384} + 4$$

I: current, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20mA	-16384	C000
-10mA	-8192	E000
0mA	0	0
+10mA	+8192	2000
+20mA	+16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{16384}$$

I: current, Value: decimal value

Siemens S7-format The analog values is represented in two's complement format.

Numeric representation:

Byte	Bit 7 ... Bit 0
0	Bit 0 ... 7: binary measured vale
1	Bit 0 ... 6: binary measured vale Bit 7: sign 0 positive 1 negative

+/- 10V

Voltage	Decimal	Hex
-10V	-27648	9400
-5V	-13824	CA00
0V	0	0
+5V	13824	3600
+10V	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0V	0	0000
5V	8192	2000
10V	16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{16384}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
+1V	0	0
+3V	+13824	3600
+5V	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U-1}{4}, \quad U = Value \cdot \frac{4}{27648} + 1$$

U: voltage, Value: decimal value

+/-4V

Voltage	Decimal	Hex
-4V	-27648	9400
0V	0	0
4V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{4}, \quad U = Value \cdot \frac{4}{27648}$$

U: voltage, Value: decimal value

+/-400mV

Voltage	Decimal	Hex
-400mV	-27648	9400
0V	0	0
400mV	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{400}, \quad U = Value \cdot \frac{400}{27648}$$

U: voltage, Value: decimal value

4....20mA

Current	Decimal	Hex
+4mA	0	0
+12mA	+13824	3600
+20mA	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I-4}{16}, \quad I = Value \cdot \frac{16}{27648} + 4$$

I: current, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20mA	-27648	9400
-10mA	-13824	CA00
0mA	0	0
+10mA	+13824	3600
+20mA	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{27648}$$

I: current, Value: decimal value

Data output

The value of the output data must be entered into the data output area. For every channel you can configure the relationship between the output value and the respective current or voltage by means of a function no..

The following table shows the structure of the data output area:

Data output area:

Byte	Bit 7 ... Bit 0
0	High-Byte channel 0
1	Low-Byte channel 0
2	High-Byte channel 1
3	Low-Byte channel 1
4	High-Byte channel 2
5	Low-Byte channel 2
6	High-Byte channel 3
7	Low-Byte channel 3

Configuration

6 bytes of parameter data are available for the configuration data. These parameters are stored in non-volatile memory and are available after the unit has been powered off.

The following table shows the structure of the parameter data:

Parameter area:

Byte	Bit 7 ... Bit 0
0	Diagnostic alarm byte: Bit 0 ... 5: reserved Bit 6: 0: diagnostic alarm inhibited 1: diagnostic alarm enabled Bit 7: reserved
1	reserved
2	Function-no. channel 0
3	Function-no. channel 1
4	Function-no. channel 2
5	Function-no. channel 3

Parameter

Diagnostic alarm

You can enable diagnostic alarms by means of bit 6 of byte 0. When an error occurs 4 diagnostic bytes are transmitted to the master system.

Function-no.

Here you must enter the function no. of the output function for every channel. The relationship between the function-number and the output functions is available from the function-no. allocation table.

Diagnostic data

When you enable alarms in byte 0 of the parameter area, modules will transfer 4 diagnostic bytes with pre-defined contents to your master when an error is detected. Please note that analogue modules only use the first two bytes for diagnostic purposes. The remaining bytes are not used.

The structure of the diagnostic bytes is as follows:

Diagnostic data:

Byte	Bit 7 ... Bit 0	Default
0	Bit 0: Module malfunction Bit 1: Constant 0 Bit 2: External error Bit 3: Channel error present Bit 4 ... 7: reserved	-
1	Bit 0 ... 3 class of module 0101 analog module Bit 4: channel information available	-
2	not assigned	-
3	not assigned	-

Technical data

Electrical data	VIPA 232-1BD50
Number of outputs	4
Voltage range	±10V, 1 ... 5V, 0 ... 10V
Current range	±20mA, 4 ... 20mA, 0 ... 20mA
Actuator resistance	min. 500Ω (voltage range) max. 500Ω (current range)
Short circuit current	30mA
Power supply	5V via back panel bus 24V ±20% externally
Current consumption	via back panel bus: 20mA 24V DC externally: 200mA
Isolation	500Vrms (field voltage - back panel bus)
Status indicators	via LED's on the front
Programming specifications	
Input data	-
Output data	8 Byte (1 word per channel)
Parameter data	6 Byte
Diagnostic data	4 Byte
Dimensions and weight	
Dimensions (WxHxD)	25,4 x 76 x 76 mm
Weight	100g

Chapter 16 Analog input/output module

Overview

This chapter contains a description of the construction and the operation of the VIPA analog input/output modules.

Below follows a description of:

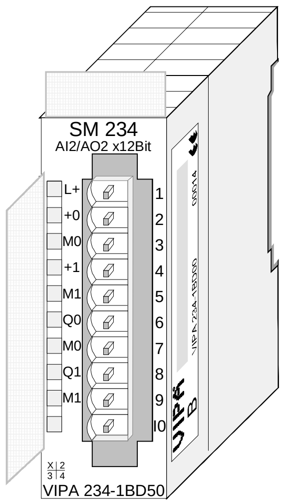
- A system overview of the analog input/output modules
- Properties
- Construction
- Wiring and schematic diagram
- Configuration data
- Function number allocation
- Technical data

Contents

System overview

Input/output modules SM 234

Here follows a summary of the analog input/output modules that are currently available from VIPA:



Ordering details input/output modules

Type	Order number
AIO2x12Bit, Multi In/Output	VIPA 234-1BD50

General

Cabling for analog signals

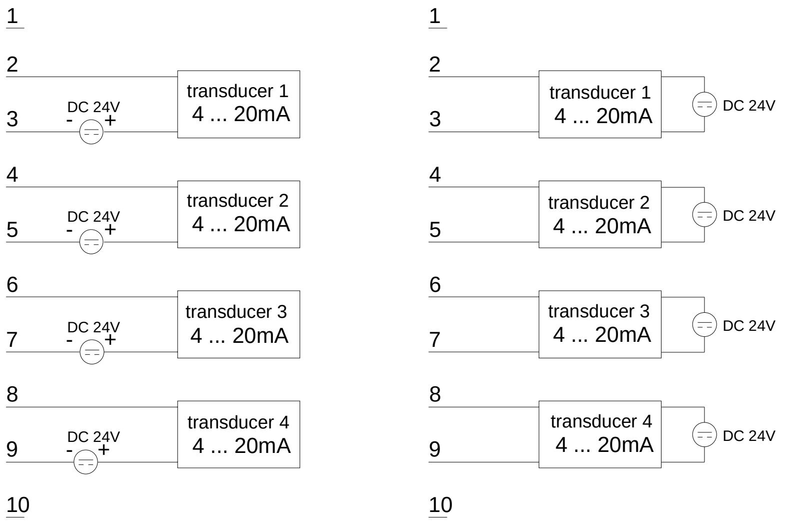
You should only use screened twisted pair cable when you are connecting analogue signals. These cables reduce the effect of electrical interference. The screen of the analogue signal cable should be grounded at both ends. In situations where the equipment at the being connected by the cable is at different electrical potentials it is possible that a current will flow to equalize the potential difference. This current could interfere with the analog signals. Under these circumstances it is advisable to ground the screen of the signal cable at one end only.

Connecting transducers

Our analogue modules provide a large number of configuration options suitable for 2-wire and 4-wire transducers.

Please remember that transducers require an external power source. You must connect an external power supply in line with any 2-wire transducer. The following diagram explains the connection of 2- and 4-wire transducers:

2-Wire interfacing 4- Wire interfacing



Connecting loads and actuators

Due to the fact that actuators also require a source of external power they may also be connected to actuators by means of 2 wires or 4 wires. Where control signals are supplied to 2-wire-actuators a power supply must be connected in series with the control cable. 4-wire actuators are connected to an external power source.

Note!

Please ensure that you connect actuators to the correct polarity!
Unused output terminals must not be connected!

AI2/AO2 x12Bit, Multi In/Output

Ordering details

AI2/AO2x12Bit Multi-In/Output VIPA 234-1BD50

Description

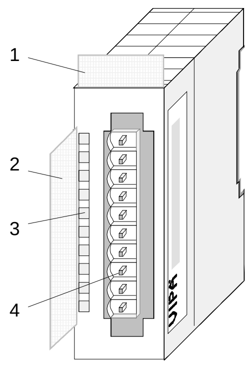
This module has 2 analog inputs and 2 analog that can be configured individually. The module occupies a total of 4 bytes of input and 4 bytes of output data.

Galvanic isolation between the channels on the module and the back panel bus is provided by means of DC/DC converters and optocouplers. The module requires an external supply of 24V DC.

Properties

- 2 inputs and 2 outputs with common ground
- Outputs with individually configurable functions
- Suitable for connection to transducers and actuators with ±10V, 1 ... 5V, 0 ... 10V, ±20mA or 4 ... 20mA inputs or outputs
- Diagnostic LED
- Input/output ranges: current: -20 ... 0 .. 4 ... 20mA
  voltage: -10 ... 0 .. 1 ... 5 ... 10V

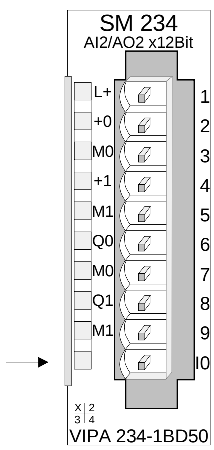
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator
Connector assignment

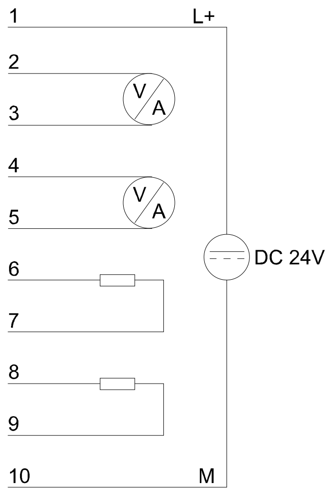
LED	Description
	Diagnostic LED (red) turned on by: a short circuit is detected at the control voltage output an open circuit is detected on the current output line



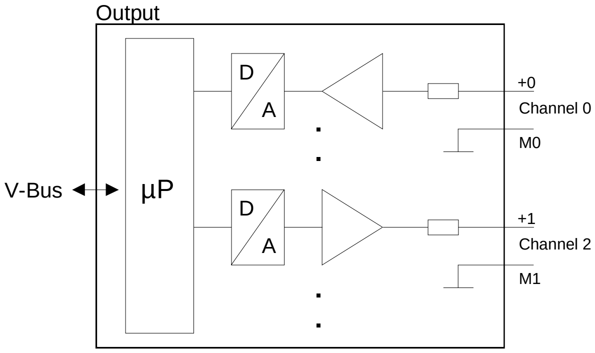
Pin	Assignment
1	24V DC supply voltage
2	pos. connection E.0
3	Channel 0 common
4	pos. connection E.1
5	Channel 1 common
6	pos. connection A.2
7	Channel 2 common
8	pos. connection A.3
9	Channel 3 common
10	Supply voltage common

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Function no. allocation

No.	Function	Output or input range	Tolerance
01h	Voltage ±10V Siemens S5-format	±11,85V 12,5V = max. value before over range occurs (20480) -10...10V = rated range (-16384...16384) -12,5V = min. value before under range (-20480)	[1]) ±0,2% of final value
02h	Voltage 1...5V Siemens S5-format	0...6V 6V = max. value before over range occurs (20480) 1...5V = rated range (0...16384) 0V = min. value before under range (-4096)	[1]) ±0,05% of final value
05h	Voltage 0...10V Siemens S5-format	0...12,5V 12,5V = max. value before over range occurs (20480) 0...10V = rated range (0...16384) no under range available	[1]) ±0,2% of final value
09h	Voltage ±10V Siemens S7-format (two's complement)	±11,85V 11,85V= max. value before over range occurs (32767) -10V...10V = rated range (-27648...27648) -11,85 = min. value before under range (-32767)	[1]) ±0,05% of final value
0Ah	Voltage 1...5V Siemens S7-format (two's complement)	0...5,75V 5,75V = max. value before over range occurs (32767) 1...5V = rated range (0...27648) 0V = min. value before under range (-6912)	[1]) ±0,05% of final value

No.	Function	Output or input range	Tolerance
0Dh	Voltage 0...10V Siemens S7-format (two's complement)	0...11,5V 11,5V = max. value before over range occurs (32767) 0...10V = rated range (0...27648) no under range available	[1]) ±0,2% of final value
03h	Current ±20mA Siemens S5-format	±23,70mA 23,70mA = max. value before over range occurs (20480) -20...20mA = rated range (-16384...16384) -23,70mA = min. value before under range (-20480)	[1]) ±0,2% of final value
04h	Current 4...20mA Siemens S5-format	0...23,70mA 23,70mA = max. value before over range occurs (20480) 4...20mA = rated range (0...16384) 0mA = min. value before under range (-4096)	[1]) ±0,2% of final value
06h	Current 0...20mA Siemens S5-format	0...23,70mA 23,70mA = max. value before over range occurs (20480) 0...20mA = rated range (0...16384) no under range available	[1]) ±0,2% of final value
0Bh	Current ±20mA Siemens S7-format (two's complement)	±23,70mA 23,70mA = max. value before over range occurs (32767) -20...20mA = rated range (-27648...27648) -23,70mA = min. value before under range (-32767)	[1]) ±0,05% of final value
0Ch	Current 4...20mA Siemens S7-format (two's complement)	0...22,96mA 22,96mA = max. value before over range occurs (32767) 4...20mA = rated range (0...27648) 0mA = min. value before under range (-5530)	[1]) ±0,05% of final value
0Eh	Current 0...20mA Siemens S7-format (two's complement)	0...22,96mA 22,96mA = max. value before over range occurs (32767) 0...20mA = rated range (0...27648) no under range available	[1]) ±0,2% of final value

1) determined at an ambient temp. of 25°C, conversion rate of 15/s, selection and envelope function turned off.

Numeric notation in Siemens S5-format

Input data is saved into a word in Siemens S5-format. The word consists of the binary value and the information bits.

Numeric notation:

Byte	Bit 7 ... Bit 0
0	Bit 0: overflow bit 0: value located within measuring range 1: measuring range exceeded Bit 1: error bit (set by internal errors) Bit 2: activity bit (always 0) Bit 3 ... 7: binary measured value
1	Bit 0 ... 6: binary measured value Bit 7: sign 0 positive 1 negative

+/- 10V

Voltage	Decimal	Hex
-10V	-16384	C000
-5V	-8192	E000
0V	0	0
+5V	8192	2000
+10V	+16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{16384}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0V	0	0000
5V	8192	2000
10V	16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{16384}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
+1V	0	0
+3V	+8192	2000
+5V	+16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{U-1}{4}, \quad U = Value \cdot \frac{4}{16384} + 1$$

U: voltage, Value: decimal value

4....20mA

Current	Decimal	Hex
+4mA	0	0
+12mA	+8192	2000
+20mA	+16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{I-4}{16}, \quad I = Value \cdot \frac{16}{16384} + 4$$

I: current, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20mA	-16384	C000
-10mA	-8192	E000
0mA	0	0
+10mA	+8192	2000
+20mA	+16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{16384}$$

I: current, Value: decimal value

Siemens S7-format

The analog values are represented in two's complement format.

Numeric representation:

Byte	Bit 7 ... Bit 0
0	Bit 0 ... 7: binary measured vale
1	Bit 0 ... 6: binary measured vale Bit 7: sign 0 positive 1 negative

+/- 10V

Voltage	Decimal	Hex
-10V	-27648	9400
-5V	-13824	CA00
0V	0	0
+5V	13824	3600
+10V	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0V	0	0000
5V	8192	2000
10V	16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{16384}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
+1V	0	0
+3V	+13824	3600
+5V	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U-1}{4}, \quad U = Value \cdot \frac{4}{27648} + 1$$

U: voltage, Value: decimal value

+/-4V

Voltage	Decimal	Hex
-4V	-27648	9400
0V	0	0
4V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{4}, \quad U = Value \cdot \frac{4}{27648}$$

U: voltage, Value: decimal value

+/-400mV

Voltage	Decimal	Hex
-400mV	-27648	9400
0V	0	0
400mV	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{400}, \quad U = Value \cdot \frac{400}{27648}$$

U: voltage, Value: decimal value

4....20mA

Current	Decimal	Hex
+4mA	0	0
+12mA	+13824	3600
+20mA	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I-4}{16}, \quad I = Value \cdot \frac{16}{27648} + 4$$

I: current, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20mA	-27648	9400
-10mA	-13824	CA00
0mA	0	0
+10mA	+13824	3600
+20mA	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{27648}$$

I: current, Value: decimal value

Data output

The following table shows the structure of the data input and output area:

Data input area /Data output area:

Byte	Bit 7 ... Bit 0
0	High-Byte channel 0
1	Low-Byte channel 0
2	High-Byte channel 1
3	Low-Byte channel 1
4	High-Byte channel 2
5	Low-Byte channel 2
6	High-Byte channel 3
7	Low-Byte channel 3

Configuration

6 bytes of parameter data are available for the configuration data. These parameters are stored in non-volatile memory and are available after the unit has been powered off.

The following table shows the structure of the parameter data:

Parameter area:

Byte	Bit 7 ... Bit 0
0	Diagnostic alarm byte: Bit 0 ... 5: reserved Bit 6: 0: diagnostic alarm inhibited 1: diagnostic alarm enabled Bit 7: reserved
1	reserved
2	Bit 0 ... 3: Function-no. channel 0 00h: no output 01h ... 0Eh: see table Bit 4 ... 7: reserved always at 0000
3	Bit 0 ... 3: Function-no. channel 1 00h: no output 01h ... 0Eh: see table Bit 4 ... 7: reserved always at 0000
4	Bit 0 ... 3: Function-no. channel 2 00h: no output 01h ... 0Eh: see table Bit 4 ... 7: reserved always at 0000
5	Bit 0 ... 3: Function-no. channel 3 00h: no output 01h ... 0Eh: see table Bit 4 ... 7: reserved always at 0000

Parameter

Diagnostic alarm

You can enable diagnostic alarms by means of bit 6 of byte 0. When an error occurs 4 diagnostic bytes are transmitted to the master system.

Function-no.

Here you must enter the function no. of the output function for every channel. The relationship between the function-number and the output functions is available from the function-no. allocation table.

Diagnostic data

When you enable alarms in byte 0 of the parameter area, modules will transfer 4 diagnostic bytes with pre-defined contents to your master when an error is detected. Please note that analogue modules only use the first two bytes for diagnostic purposes. The remaining bytes are not used.

The structure of the diagnostic bytes is as follows:

Diagnostic data:

Byte	Bit 7 ... Bit 0	Default
0	Bit 0: Module malfunction Bit 1: Constant 0 Bit 2: External error Bit 3: Channel error present Bit 4 ... 7: reserved	-
1	Bit 0 ... 3 class of module 0101 analog module Bit 4: channel information available	-
2	not assigned	-
3	not assigned	-

Technical data

Electrical data	VIPA 234-1BD50
Number of inputs/outputs	2/2
Voltage range	±10V, 1 ... 5V, 0 ... 10V
Current range	±20mA, 4 ... 20mA, 0 ... 20mA
Input resistance	100kΩ (voltage range) 50Ω (current range)
Actuator resistance (for outputs)	min. 500Ω (voltage range) max. 500Ω (current range)
Short circuit current	30mA
Power supply	5V via back panel bus 24V ±20% externally
Current consumption	via back panel bus: 20mA 24V DC externally: 100mA
Isolation	500Vrms (field voltage - back panel bus)
Status indicators	via LED’s on the front
Programming specifications	
Input data	4 Byte (1 word per channel)
Output data	4 Byte (1 word per channel)
Parameter data	6 Byte
Diagnostic data	4 Byte
Dimensions and weight	
Dimensions (WxHxD)	25,4 x 76 x 76 mm
Weight	100g

Chapter 17 System expansion modules

Overview

The chapter contains a description of additional components and accessories that are available from VIPA for the System 200V.

A general overview is followed by the description of the bus expansion module that can be used to split a single System 200V row over up to 4 rows.

The chapter concludes with the terminal modules. These modules provide connection facilities for signaling cables as well as supply voltages for your System 200V.

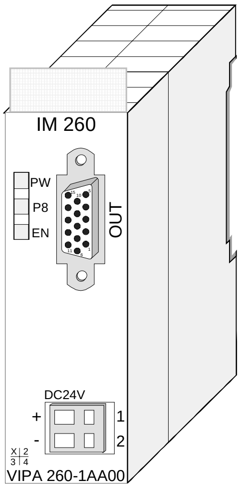
Below follows a description of:

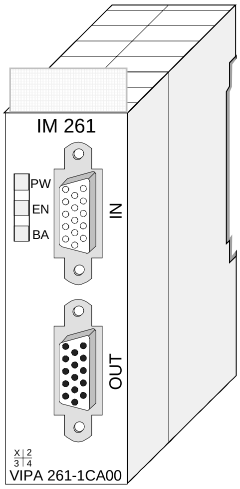
- System overview of additional components
- Bus expansion with IM 260 and IM 261
- Terminal module CM 201

Contents

System overview

Bus expansion

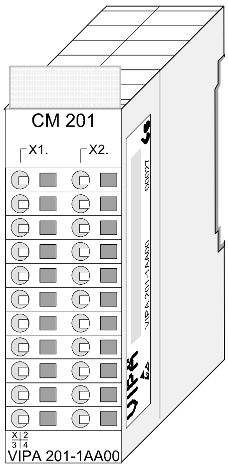




Ordering details Bus expansion

Type	Order number	Description
IM 260	VIPA 260-1AA00	Basic interface row 1
IM 261	VIPA 261-1CA00	Interface for rows 2. ... 4
Cable 0,5m	VIPA 260-1XY05	Interconnecting cable, 0,5m length
Cable 1m	VIPA 260-1XY10	Interconnecting cable, 1m length
Cable 1,5m	VIPA 260-1XY15	Interconnecting cable, 1,5m length
Cable 2m	VIPA 260-1XY20	Interconnecting cable, 2m length
Cable 2,5m	VIPA 260-1XY25	Interconnecting cable, 2,5m length

Terminal module



Ordering details Terminal module

Type	Order number	Description
CM 201	VIPA 201-1AA00	Dual terminals gray/gray
CM 201	VIPA 201-1AA10	Dual terminals green-yellow/gray
CM 201	VIPA 201-1AA20	Dual terminals red/blue

Bus expansion IM 260, IM 261

The system consisting of IM 260, IM 261 and interconnecting cables is an expansion option that you can use to split the System 200V over up to 4 rows.

This system can only be installed in a centralized System 200V where a PC 288 or a CPU is employed as the master station!

For bus expansion purposes you must always include the basic interface IM 260. The basic interface can then be connected to up to 3 additional System 200V rows by means of the appropriate interconnecting cables and the IM 261 interfacing module for rows.

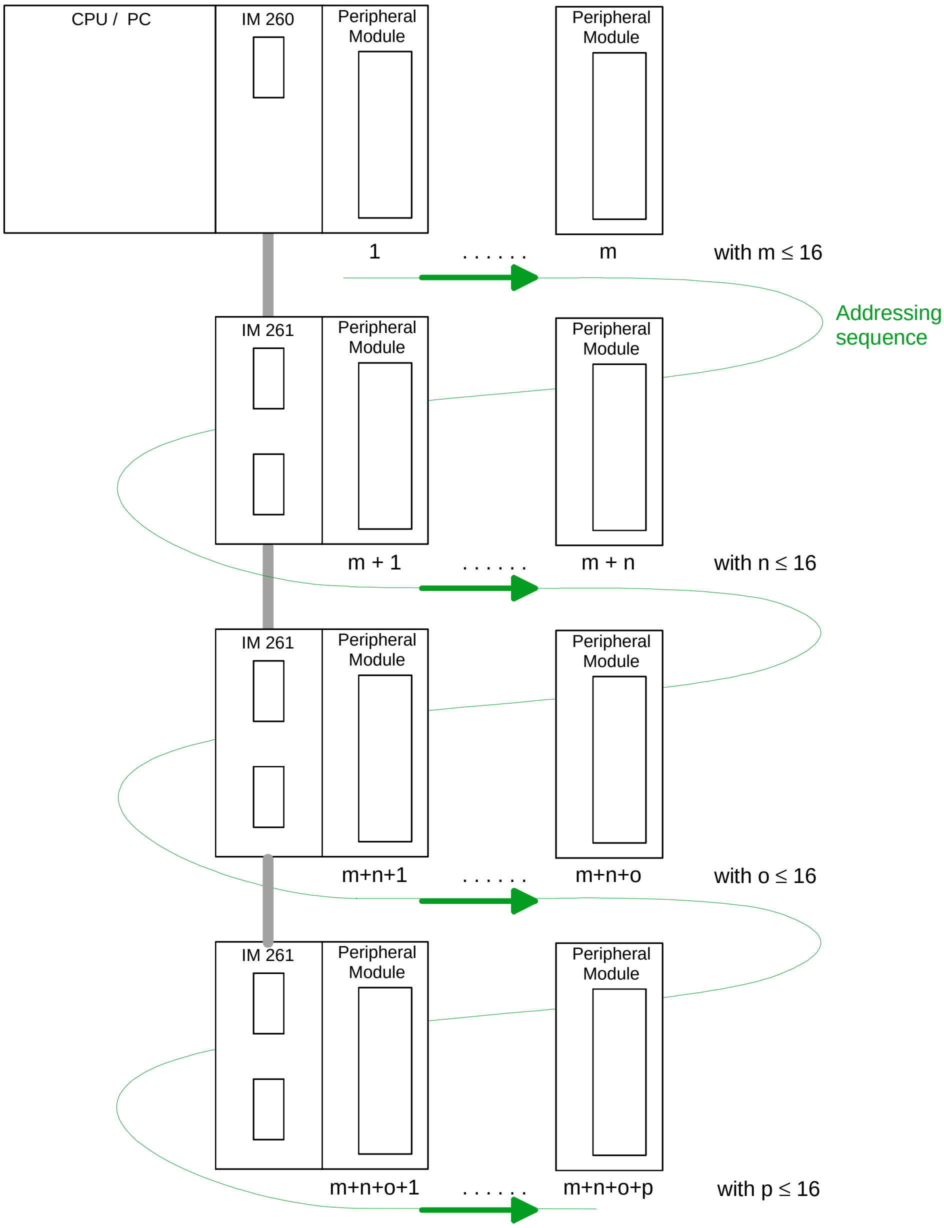
Please note!

Certain rules and regulations must be observed when the bus expansion modules are being employed:

- The bus expansion must be used in conjunction with the PC 288 (VIPA 288-2BL10) or a CPU (combi-CPU's are also permitted). The system must never be employed in decentralized systems, e.g. behind a Profibus-DP-Slave!
- The system caters foe a maximum of 4 rows.
- Every row can carry a maximum of 16 peripheral modules.
- The max. total quantity of 32 peripheral modules must not be exceeded.
- In critical environments the total length of interconnecting cables should not exceed a max. of 2m.
- Every row can derive a max. current of 1.5A from the back panel bus, while the total current is limited to 4A.
- A peripheral module <u>must</u> be installed next to the IM 260 basic interface!

Construction

The following figure shows the construction of a bus expansion under observance of the installation requirements and rules:



Where: $m + n + o + p \leq 32$

Note!

The bus expansion must only be used in conjunction with the PC 288 (VIPA 288-2BL10) or a CPU (combi-CPU's are also permitted)!

The bus expansion module is supported as of the following minimum firmware revision levels:

CPU compatible with Siemens STEP® 5: from Version 2.07

CPU compatible with Siemens STEP® 7: from Version 1.0

CPU for IEC1131: from Version 1.0

Status indicator Basic interface IM 260

LED	Color	Description
PW	yellow	Supply voltage available
P8	yellow	Supply voltage for subsequent rows is active
EN	yellow	Back panel bus communications active

Status indicator row interface IM 261

LED	Color	Description
PW	yellow	Supply voltage available via IM 260
EN	yellow	Back panel bus communications active
BA	red	Outputs inhibited (BASP) is active

Ordering details Cables

Type	Order number	Description
Cable 0,5m	VIPA 260-1XY05	Interconnecting cable, 0,5m length
Cable 1m	VIPA 260-1XY10	Interconnecting cable, 1m length
Cable 1,5m	VIPA 260-1XY15	Interconnecting cable, 1,5m length
Cable 2m	VIPA 260-1XY20	Interconnecting cable, 2m length
Cable 2,5m	VIPA 260-1XY25	Interconnecting cable, 2,5m length

Technical data

Electrical data	VIPA 260-1AA00	VIPA 261-1CA00
Power supply	24V DC via front	-
Current consumption	1,9A	-
Current consumption back panel bus	30mA	-
Power supply back panel bus an IM 261	-	max. 1,5A per row (max. total 4A)
max. cable distance betw. 1st. and last row	2,5m	
Dimensions and weight		
Dimensions (WxHxD) in mm	25,4 x 76 x 76	25,4 x 76 x 76
Weight	80g	50g

Terminal module CM 201

2xX 11 Pole

The terminal module is available under order no.: VIPA 201-1AA00.

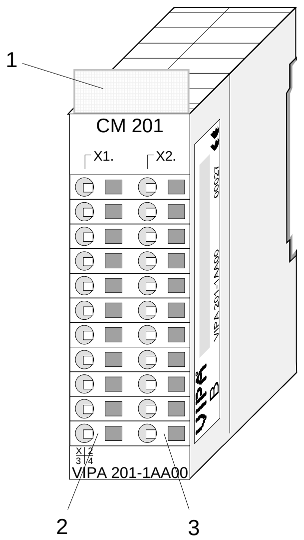
This module is a complementary module providing 2 or 3 wire connection facilities. The module is not connected to the system bus.

Properties

- 2 separate rows of 11 electrically interconnected terminals.
- No connection to the system bus.
- Maximum terminal current 10A.

Construction and schematic diagram

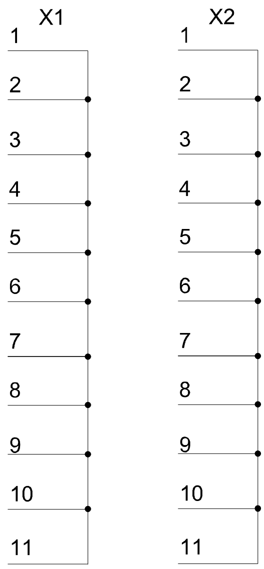
Construction



Description

[1] Label
[2] 1st. terminal strip
[3] 2nd. terminal strip

Schematic diagram



Technical data

Electrical data	VIPA 201-1AA00	VIPA 201-1AA10	VIPA 201-1AA20
Number of rows	2	2	2
Number of terminals per row	11	11	11
Maximum terminal current	10A	10A	10A
Terminal color	gray/gray	green-yellow/gray	red/blue
Dimensions and weight			
Dimensions (WxHxD) in mm	25,4 x 76 x 76	25,4 x 76 x 76	25,4 x 76 x 76
Weight	50g	50g	50g

Chapter 18 Assembly and installation guidelines

Overview

This chapter contains the information required to assemble and wire a controller consisting of Systems 200V components.

Below follows a description of:

- a general summary of the components
- steps required for the assembly and for wiring
- EMC-guidelines for assembling the System 200V

Contents

Overview

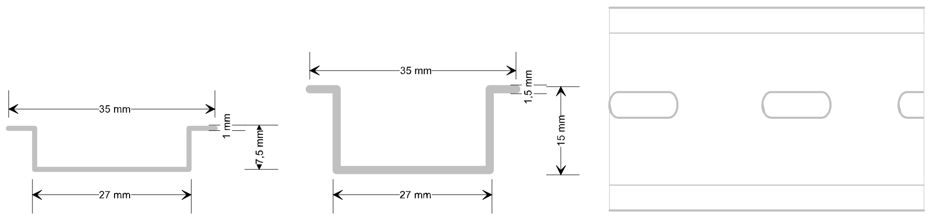
General

The modules are installed on a carrier rail. A bus connector provides interconnections between the modules. This bus connector links the modules via the back panel bus of the modules and it is placed into the T-rail that carries the modules.

The back panel bus connector is isolated and available from VIPA in width of 1-, 2-, 4- or 8-connections.

T-rail

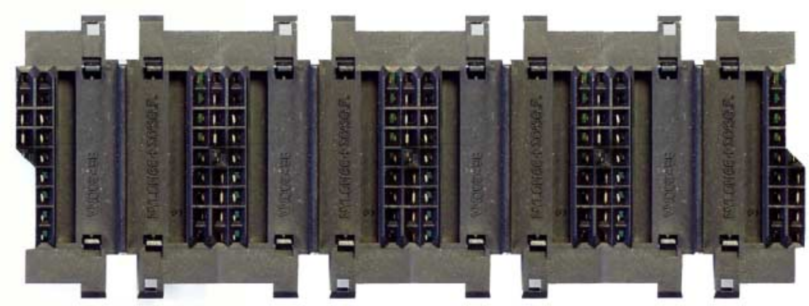
You can use the following standard 35mm T-rails to mount the System 200V modules:



Bus connector

System 200V modules communicate via a back panel bus connector. This back panel bus connector is available in versions of 1-, 2-, 4- and 8-connections.

The following figure shows a 1-connector and a 4-connector bus:



The bus connector is isolated and must be inserted into the T-rail until it clips in its place and the bus-connections protrude from the rail.

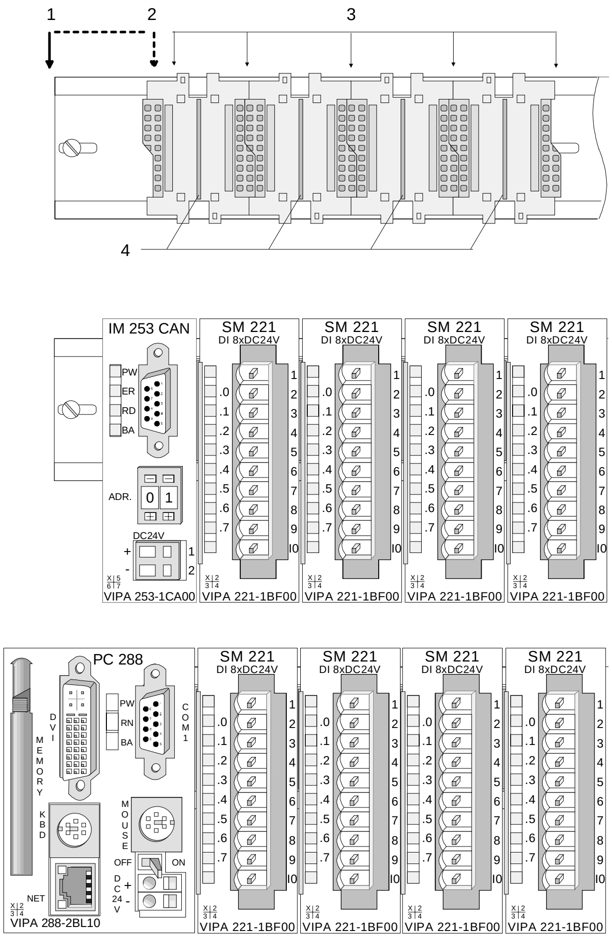
Ordering data

Type	Order number	Description
Bus connector	VIPA 290-0AA10	Bus connector 1-connection
Bus connector	VIPA 290-0AA20	Bus connector 2-connection
Bus connector	VIPA 290-0AA40	Bus connector 4-connection
Bus connector	VIPA 290-0AA80	Bus connector 8-connection
T-rail	VIPA-290-0AF30	35x15mm, 1,5mm gauge, drilled 530mm length

T-rail installation

The following figure shows the installation of a 4-connector bus connector in a T-rail and the plug-in locations for the modules.

The different plug-in locations are defined by the guide rails.

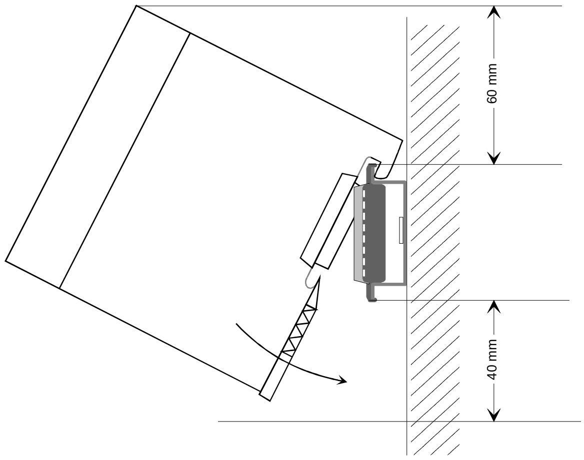


[1] Header module like PC, CPU, bus-coupler
[2] Main module if this is a double width module or peripheral module
[3] Peripheral module
[4] Guide rails

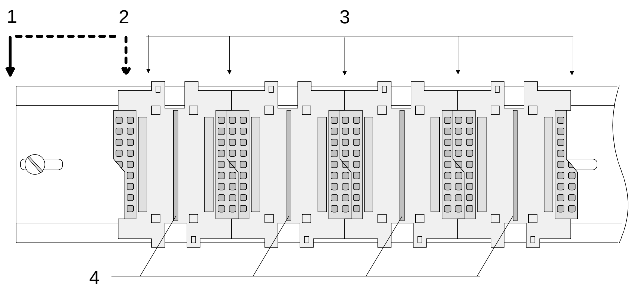
Assembly

Please follow these rules during the assembly!

- Turn the power supply off before you insert or remove any modules!
- Make sure that a clearance of at least 60 mm exists above the bus rail and 40 mm below the bus rail.



- Every row must be completed from left to right and it must start with a header module (PC, CPU, and bus coupler).

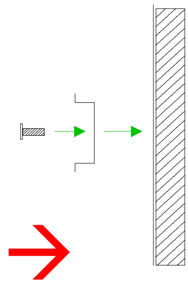


[1] Header module like PC, CPU, bus coupler
[2] Header module when this is a double width or a peripheral module
[3] Peripheral module
[4] Guide rails

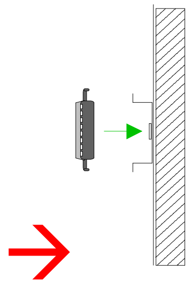
- Modules must be installed adjacent to each other. Gaps are not permitted between the modules since this would interrupt the back panel bus.
- A module is only installed properly and connected electrically when it has clicked into place with an audible click.
- Plug-in locations after the last module can remain unoccupied.

Assembly procedure

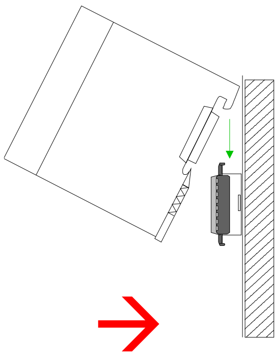
The following sequence represents the assembly procedure as viewed from one side.



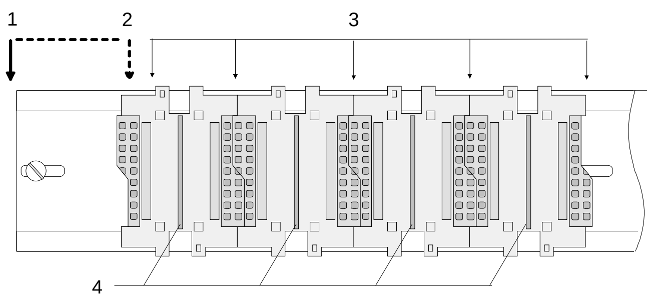
- Install the T-rail. Please ensure that you leave a module installation clearance of at least 60 mm above the rail and at least 40 mm below the rail.



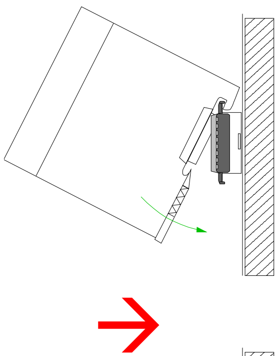
- Press the bus connector into the rail until it clips securely into place and the bus-connectors protrude from the T-rail. This provides the basis for the installation of your modules.

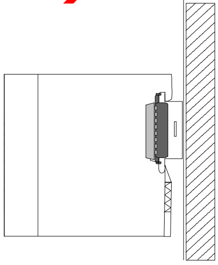


- Start at the outer left location with the installation of your header module like CPU, PC or bus coupler and install the peripheral modules to the right of this.



[1] Header module like PC, CPU, bus coupler
[2] Header module when this is a double width or a peripheral module
[3] Peripheral module
[4] Guide rails



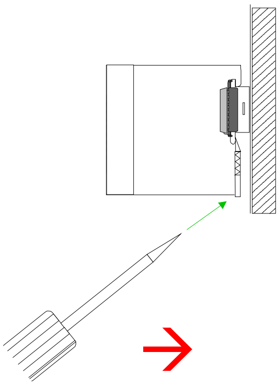


- Insert the module that you are installing into the T-rail at an angle of 45 degrees from the top and rotate the module into place until it clicks into the T-rail with an audible click. The proper connection to the back panel bus can only be guaranteed when the module has properly clicked into place.

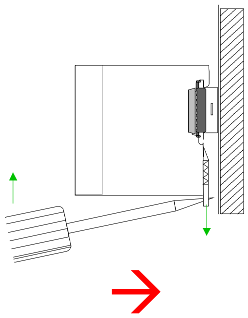
Attention!
Power must be turned off before modules are installed or removed!

Removal procedure

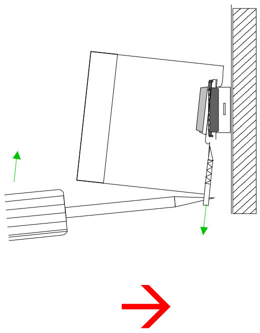
The following sequence shows the steps required for the removal of modules in a side view.



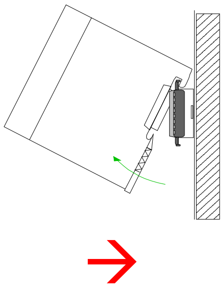
- The enclosure of the module has a spring-loaded clip at the bottom by which the module can be removed from the rail.
- Insert a screwdriver into the slot as shown

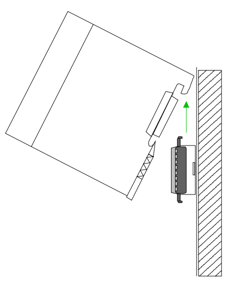


- The clip is unlocked by pressing the screwdriver in an upward direction.



- Withdraw the module with a slight rotation to the top.





Attention!

Power must be turned off before modules are installed or removed!

Please remember that the back panel bus is interrupted at the point where the module was removed!

Wiring

Most peripheral modules are equipped with a 10 pole or an 18-pole connector. This connector provides the electrical interface for the signaling and supply lines of the modules.

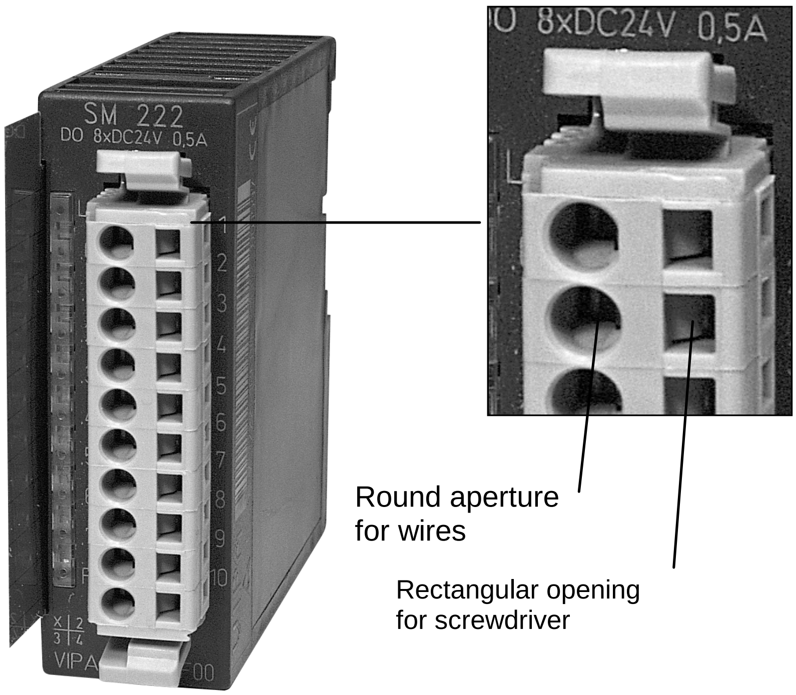
The modules carry WAGO spring-clip connectors for the interconnections and wiring.

The spring-clip connector technology simplifies the wiring requirements for signaling and power cables.

In contrast to screw-terminal connections, spring-clip wiring is vibration proof. The assignment of the terminals is contained in the description of the respective modules.

You can connect conductors with a diameter from 0,08 mm^2 to 1,5 mm^2 (up to 1,5 mm^2 for 18-pole connectors).

The following figure shows a module with a 10-pole connector.

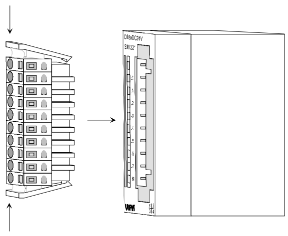


Note!

The spring-clip is destroyed if you should insert the screwdriver into the opening for the hook-up wire!

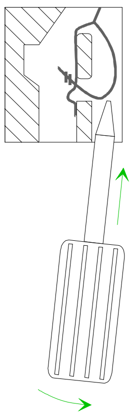
Make sure that you only insert the screwdriver into the square hole of the connector!

Wiring procedure

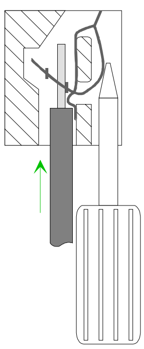


- Install the connector on the module until it locks with an audible click. For this purpose you must press the two clips together as shown.
  The connector is now in a permanent position and can easily be wired.

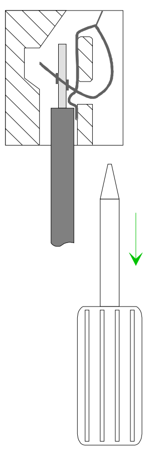
The following section shows the wiring procedure from above.



- Insert a screwdriver at an angel into the square opening as shown
- You must press and hold the screwdriver in the opposite direction to open the contact spring.



- Insert the stripped end of the hook-up wire into the round opening. You can use wires with a diameter of 0,08 mm^2 to 2,5 mm^2 (1,5mm^2 for 18-pole connectors).



- When you remove the screwdriver the wire is clipped securely.

Wire the power supply connections first
followed by the signal cables (inputs and outputs)

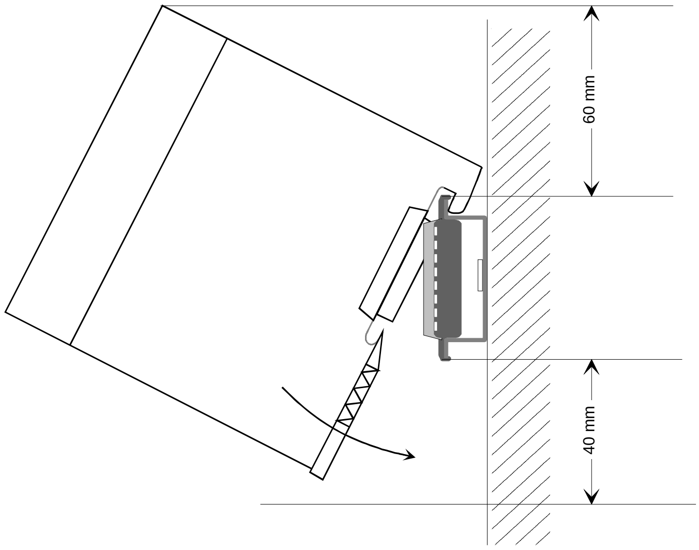
Installation dimensions

Here follow all the important dimensions of the System 200V.

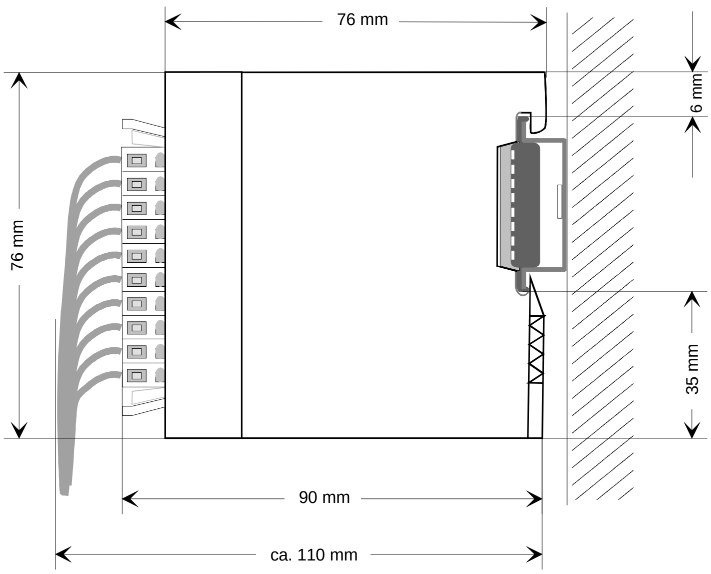
Dimensions Basic enclosure

1-slot width (H x W x D) in mm: 76 x 25,4 x 76
2-fach width (H x W x D) in mm: 76 x 50,8 x 76

Installation dimensions



Installed and wired dimensions



Automatic labeling

The System 200V peripheral modules have a label that can be used for automatic labeling.

Labeling by means of WinNCS

You can use the labeling components of WinNCS to print the required labels. WinNCS is the VIPA configuration tool that has a special label printing feature for the System 200V labels of the.

Labeling by means of WinLP

VIPA can supply the label-printing package, WinLP, to create the labels for a Siemens S7 project. This generates labels for the System 200V from the Siemens S7-cfg-file.

Ordering details

Type	Order number	Description
WinNCS	VIPA SW-WinNCS	Configuration and labeling software for the System 200V under Win9x/NT incl. WinLP
Demo-Software	VIPA SW-Tool Demo	Demo versions of all VIPA-tools incl. full labeling functions under WinNCS
Block of labels	VIPA 292-1XY00	10 label cards with covers
Sheets of labels	VIPA 292-1XY10	10 perforated sheets of labels 8 labels each

Installation guidelines

General

The installation guidelines contain information on the proper assembly of System 200V systems. Here we describe possible paths in which interference like the electromagnetic compatibility (EMC) can enter controller and how you must approach shielding and screening issues.

What is EMC?

The term electromagnetic compliance (EMC) refers to the ability of an electrical device to operate properly in an electromagnetic environment without interference from the environment or without the device causing illegal interference to the environment.

All System 200V components were developed for applications in harsh industrial environments and they comply with EMC requirements to a large degree. In spite of this you should implement an EMCC strategy before installing any components which should include any possible source of interference.

Possible sources for disturbances

Electromagnetic interference can enter your system in many different ways:

- Fields
- I/O signal lines
- Bus systems
- Power supplies
- Protective conductors

Interference is coupled into your system in different ways, depending in the propagation medium (via cabling or without cabling) and the distance to the source of the interference.
We differentiate between:

- Galvanic coupling
- Capacitive coupling
- Inductive coupling
- Radiated power coupling

The most important rules for ensuring EMC

In many cases, adherence to a set of very elementary rules is sufficient to ensure EMC. For this reason we wish to advise you to heed the following rules when you are installing these controllers.

- During the installation of your components you must ensure that any inactive metal components are grounded via a proper large-surface earth.
    - Install a central connection between the chassis ground and the earthing/protection system.
    - Interconnect any inactive metal components via low-impedance conductors with a large cross-sectional area.
    - Avoid aluminum components. Aluminum oxidizes easily and is therefore not suitable for grounding purposes.
- Ensure that wiring is routed properly during installation.
    - Divide the cabling into different types of cable. (Heavy current, power supply, signal- and data lines).
    - Install heavy current lines and signal or data lines in separate channeling or cabling trusses.
    - Install signaling and data lines as close as possible to any metallic ground surfaces (e.g. frames, metal rails, sheet metal).
- Ensure that the screening of lines is grounded properly.
    - Data lines must be screened.
    - Analog lines must be screened. Where low-amplitude signals are transferred it may be advisable to connect the screen on one side of the cable only.
    - Attach the screening of cables to the ground rail by means of large surface connectors located as close as possible to the point of entry. Clamp cables mechanically by means of cable clamps.
    - Ensure that the ground rail has a low-impedance connection to the cabinet/cubicle.
    - Use only metallic or metalized covers for the plugs of screened data lines.
- In critical cases you should implement special EMC measures.
    - Connect snubber networks to all inductive loads that are not controlled by System 200 V modules.
    - Use incandescent lamps for illumination purposes inside cabinets or cubicles, do not use of fluorescent lamps.
- Create a single reference potential and ensure that all electrical equipment is grounded wherever possible.
    - Ensure that earthing measures are implemented effectively. The controllers are earthed to provide protection and for functional reasons.
    - Provide a star-shaped connection between the plant, cabinets/cubicles of the System 200 V and the earthing/ protection system. In this way you can avoid ground loops.
    - Where potential differences exist you must install sufficiently large equipotential bonding conductors between the different parts of the plant.

Screening of cables

The screening of cables reduces the influence of electrical, magnetic or electromagnetic fields; we speak of attenuation.

The earthing rail that is connected conductively to the cabinet diverts interfering currents from screen conductors to ground. It is essential that the connection to the protective conductor is of low impedance as the interfering currents could otherwise become a source of trouble in themselves.

The following must be noted when cables are screened:

- Use cables with braided screens wherever possible.
- The coverage of the screen should exceed 80%.
- Screens should always be grounded at both ends of cables. High frequency interference can only be suppressed by grounding cables on both ends.

  Grounding at one end can become necessary under exceptional circumstances. However, this only provides attenuation to low frequency interference. One-sided earthing may be of advantage where:

  - It is not possible to install equipotential bonding conductors
  - Analogue signals (in the mV or µA range) are transferred
  - Foil-type shields (static shields) are used.
- Always use metallic or metallized covers for the plugs on data lines for serial links. Connect the screen of the data line to the cover. Do **not** connect the screen to PIN 1 of the plug!
- In a stationary environment it is recommended that the insulation is stripped from the screened cable without breaking the cable to attach the screen to the screening- or protective ground rail.
- Connect screening braids by means of metallic cable clamps. These clamps must have a good electrical and large surface contact with the screen.
- Attach the screen of a cable to the grounding rail directly where the cable enters the cabinet/cubicle. Continue the screen right up to the System 200 V module but do **not** connect the screen to ground at this point!

Please heed the following when you assemble the system!

Where potential differences exist between earthing connections it is possible that an equalising current could be established where the screen of a cable is connected at both ends.

Remedy: install equipotential bonding conductors