ADAM 8000

Distributed Control I/O System
User's Manual

About this manual

This manual describes all ADAM-8000 components that are available from Advantech with the exception of the CPUs. In addition to the product summary it contains detailed descriptions of the different modules. You are provided with information on the connection and the utilization of the different ADAM-8000 components. Every chapter is concluded with the technical data of the respective module.

A separate set of manuals is available for the CPUs.

Overview

Chapter 1: Introduction

This introduction presents the Advantech ADAM-8000 as a centralized as well as decentralized automation system.

The chapter also contains general information about the ADAM-8000, i.e. dimensions, installation and operating conditions.

Chapter 2: Profibus-DP

This chapter contains a description of Profibus applications for the ADAM-8000. The text describes the configuration of the Advantech Profibus master and slave modules as well as a number of different communication examples.

Chapter 3: CAN-Bus CANopen

This chapter deals with the Advantech CANopen slave and related CAN-bus applications. The structure of the program and the configuration of CAN slaves is explained by means of examples.

Chapter 4: DeviceNet

This chapter contains a description of the Advantech DeviceNet coupler. A description of the module is followed by an example of the configuration of the DeviceNet coupler and the configuration of the ADAM-8000 modules in the DeviceNet manager of Allen - Bradley. The chapter is concluded with an overview of diagnostic messages and Profibus interfacing options.

Chapter 5: Counter modules

This chapter deals with Advantech counter modules. The chapter also contains information on the SSI-module as well as the construction, configuration and the different counter modes along with the respective interfaces.

Chapter 6: Power supply

This chapter deals with external power supplies for the ADAM-8000. Here you can find a comprehensive set of safety related hints and information as well as details on the construction, the installation and commissioning of the module.

Chapter 7-8: Digital input/output modules

These chapters describe the digital peripheral modules that are available from Advantech. It provides all the information that is required for applications using these modules. Chapter 11 contains information on the input modules, chapter 12 contains information on the output modules and chapter 13 provides details on input/output modules.

Chapter 9-11: Analog input/output modules

These chapters contain a description of the analog peripheral modules. The chapter also provides all the information that is required for applications using each module. Chapter 14 describes the input modules, chapter 15 the output modules and chapter 16 the analog input/ouutput modules that are available from Advantech.

Chapter 12: System expansion modules

This chapter deals with the system expansion modules that are available for ADAM-8000. These include amongst others the bus expansion modules IM26x that provide for the expansion of a single bus row to cater for several rows and terminal modules required for the expansion of the available number of connections.

Chapter 13: Installation and installation-guidelines

This chapter provides all the information required for the installation and the hook-up of a controller using the components of the ADAM-8000.

The information contained in this manual is supplied without warranties.

The information is subject to change without notice.

Disclaimer of liability

The contents of this manual were verified with respect to the hard- and software.

However, we assume no responsibility for any discrepancies or errors. The information in this manual is verified on a regular basis and any required corrections will be included in subsequent editions.

Suggestions for improvement are always welcome.

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Table of Contents

User considerations

Objective and contents

This manual describes the modules that are suitable for use in the ADAM-8000. It contains a description of the construction, project implementation and the technical data.

Target audience

The manual is targeted at users who have a background in automation technology.

Structure of the manual

At present the manual consists of 18 chapters. Every chapter provides a self-contained description of a specific topic.

Guide to the document

The following guides are available in the manual:

- An overall table of contents at the beginning of the manual
- An overview of the topics for every chapter
- An index at the end of the manual.

Availability

The manual is available in:

- printed form, on paper
- in electronic form as PDF-file (Adobe Acrobat Reader)

Icons Headings

Important passages in the text are highlighted by following icons and headings:

Danger!
Immediate or likely danger.
Personal injury is possible.

Attention!
Damages to property is likely if these warnings are not heeded.

Note!
Supplementary information and useful tips

Safety information

Applications conforming with specifications

The ADAM-8000 is constructed and produced for:

- all Advantech ADAM-8000 components
- Communications and process control
- General control and automation applications
- Industrial applications
- operation within the environmental conditions specified in the technical data
- installation into a cubicle

Danger!
This device is not certified for applications in

- in explosive environments (EX-zone)

Documentation
The manual must be available to all personnel in the

- project design department
- installation department
- commissioning
- operation

The following conditions must be met before using or commissioning the components described in this manual:

- Modification to the process control system should only be carried out when the system has been disconnected from power!
- Installation and modifications only by properly trained personnel
- The national rules and regulations of the respective country must be satisfied (installation, safety, EMC ...)

Disposal
National rules and regulations apply to the disposal of the unit!

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Introduction

Outline

The focus of this chapter is on the introduction of the Advantech ADAM-8000. Various options of configuring central and decentralized systems are presented in a summary.

The chapter also contains the general specifications of the ADAM-8000, 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:

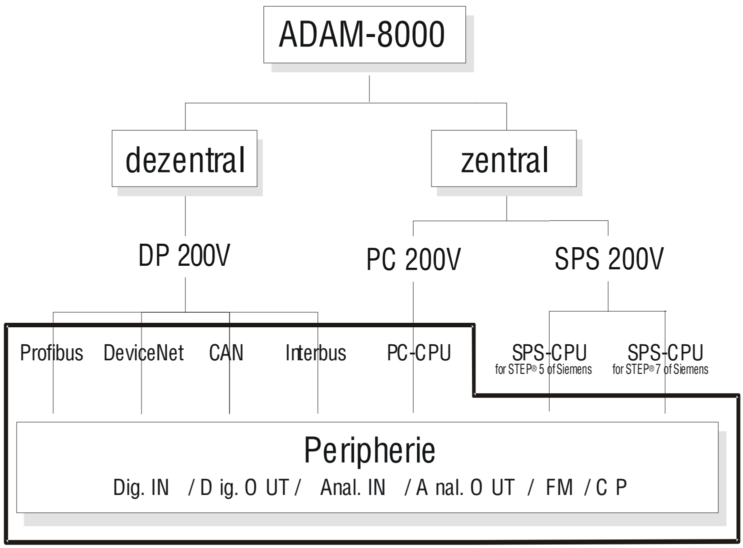
- Introduction of the ADAM-8000
- General information, i.e. installation, operational safety and environmental conditions
- 7-layer model and communication layers

Overview

The System 200V

The ADAM-8000 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 ADAM-8000:



Components

Centralized system

The ADAM-8000 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.

With the appropriate expansion interface the ADAM-8000 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 Advantech 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 Advantech, 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.

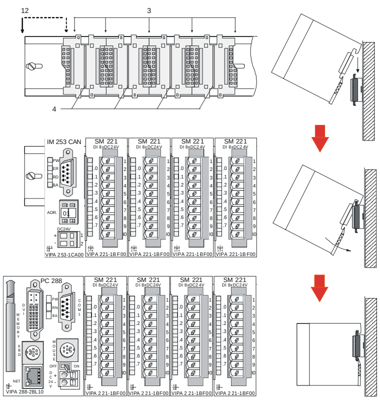
General description ADAM-8000

Structure/dimensions

- Standard 35mm DIN-rail
- Peripheral modules with recessed labelling
- Dimensions of the basic enclosure:
  1slot width: (H x W x D) in mm: 76 x 25,4 x 76 in inches: 3 x 1 x 3
  2slot width: (H x W x D) in mm: 76 x 50,8 x 76 in inches: 3 x 2 x 3

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, 5 mm^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: 8 kV/2 kV
- 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 Open Systems Interconnection, 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: Open System Interconnection) 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 Laye

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.

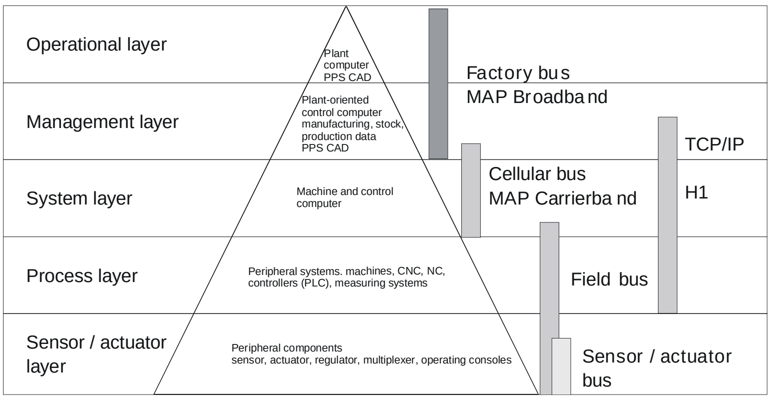
Layer 3 to 7

In accordance with Profibus these layers have not been implemented on the bus couplers supplied by Advantech.

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.

Profibus-DP

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Overview

This chapter contains a description of Profibus applications of the ADAM-8000. 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 Advantech. 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 Advantech
- 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

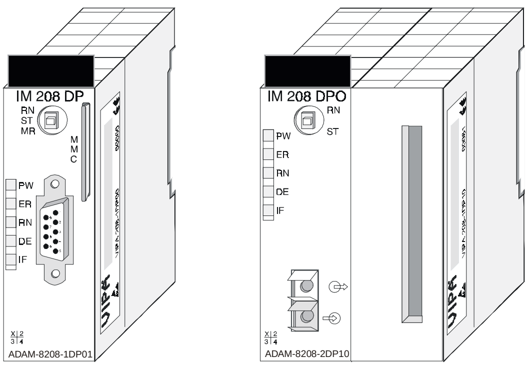
System overview

All ADAM-8K 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).

Profibus-DP master

- Profibus-DP master, class 1
- Project design using WinNCS of Advantech
- 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.

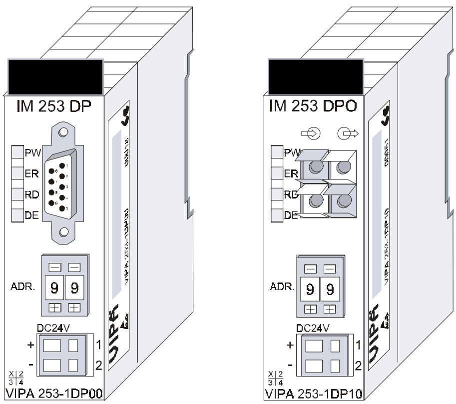


Ordering data DP master

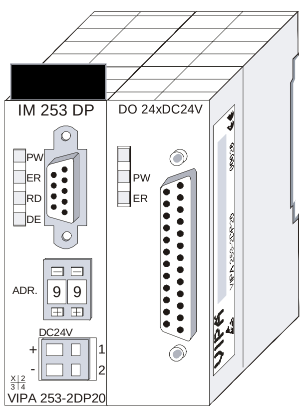
Type	Order number	Descriptio
IM 208 DP	ADAM8208-1DP01	Profibus-DP master with RS485
IM 208 DPO	ADAM8208-2DP10	Profibus-DP master with FO connector

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	ADAM8253-1DP00	Profibus-DP slave with address selector
IM 253 DPO	ADAM8253-1DP10	Profibus-DP slave with address selector and FO connector

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 multimaster 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 Advantech Profibus couplers (IM 253 DP, IM 253 DPO and the CPU 21x DP) are modular slave devices that transfer data between the ADAM-8000 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.

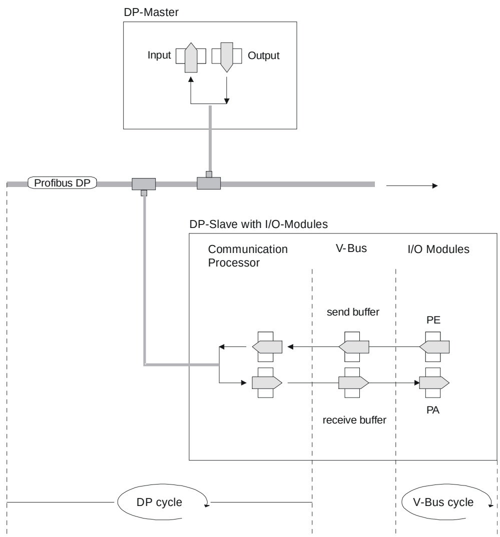
Data communications between master and slave can be divided into a definition, a configuration and a data transfer phase. Before a DP slave is included in the data transfer phase the master checks die whether the defined configuration corresponds with the actual configuration. This check is performed 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 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 Advantech-Profibus slave is extinguished.

This function is supported as of hardware revision level 6.

Data consistency

The Advantech 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 50 m
- 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 12 MB aud.

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 Advantech 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 Advantech Profibus coupler is set by the addressing switch located on the front of the module.

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

GSD-file

For configuration purposes you will receive a GSD-file containing the performance specifications of Advantech 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 Advantech Profibus-DP slaves is named: DP2V0550.GSD

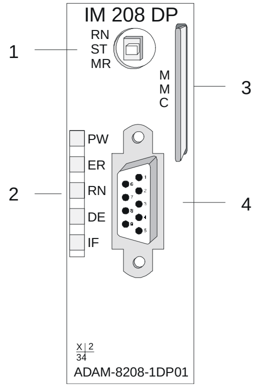
Install this GSD file into your configuration tool. You can obtain more detailed information on the installation of GSD files from the manual supplied with your configuration tool.

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
- 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

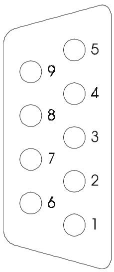
The module carries a number of LED's that are available for diagnostic purposes on the bus and for displaying the local status. The following table explains the different colors of the diagnostic LED's.

Designation	Color	Explanatio
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 ADAM-8000 Profibus master is connected to your Profibus network via the 9- pin socket.

The following figure shows the assignment of the individual pins



Pin	Assignmen
1	shield
2	n.c.
3	RxD/TxD-P
4	CNTR-P
5	GND
6	5 V (70 mA 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 Advantech 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.

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 Advantech 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.

System 200V CPU applications

The IM 208 master modules can be used to connect up to 125 Profibus DP slaves to a Advantech ADAM-8000 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

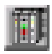
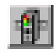
When the BASP signal is available from the CPU the IM 208 sets the outputs of the connected periphery to zero.

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 Advantech 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 Advantech. 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 Advantech under order no.: ADAM8950-0KB00.

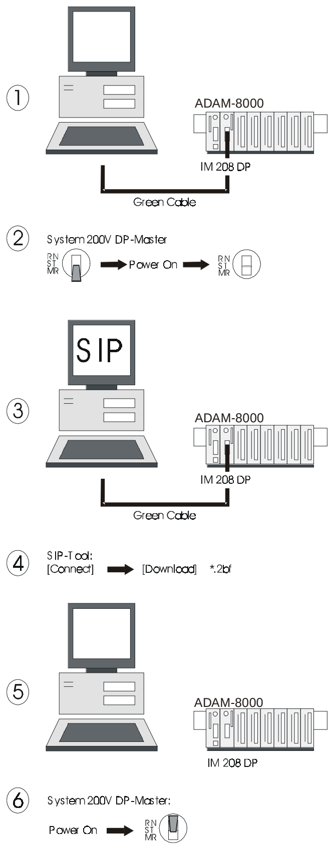
Requirements

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 ADAM-8000 CPU 21x. Additional options will be available shortly.

Requirements

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

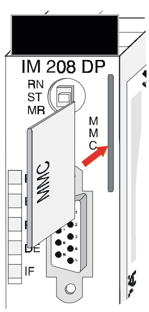
Procedure

- 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 ADAM-8000.
- 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

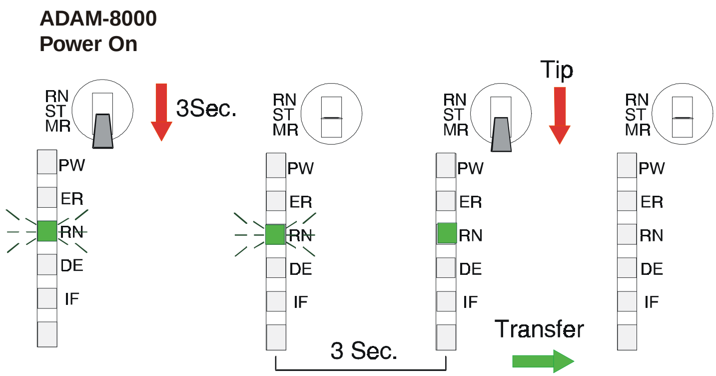
Requirements

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 ADAM-8000.
- 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.

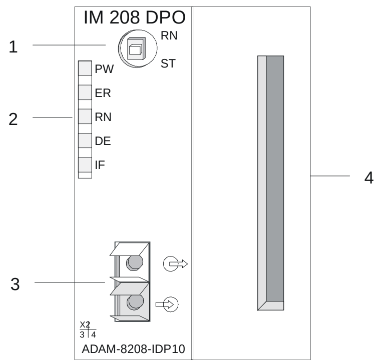


Construction of the IM 208 - DP master with a FO link

Properties

- Class 1 Profibus-DP-Master
- 125 DP-slaves can be connected to a DP master
- Project configuration by means of ADAM-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

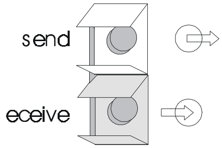
Components

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	Explanatio
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.

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

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 Advantech WinNCS configuration tool.

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

Applications in conjunction with ADAM-8000 CPU

IM 208 master modules can be used to connect up to 125 Profibus DP slaves to a ADAM-8000 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.

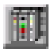
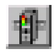
As soon as the BASP signal is available from the CPU the IM 208 sets the outputs of the connected periphery to zero.

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)

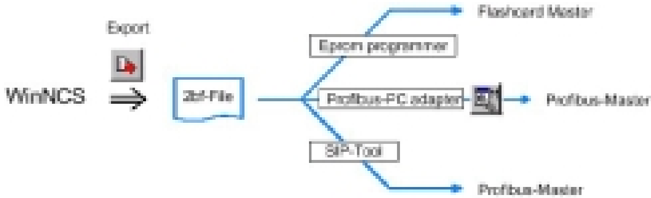
Transferring a project

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.

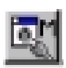


Transfer via EPROM programmer into a Flash-Card

You require a Memory Card and an external EPROM programmer with software to transfer your configuration into your ADAM-8000 Profibus master. The Memory Card is available from Advantech under the order no.: Advantech 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

Advantech 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.

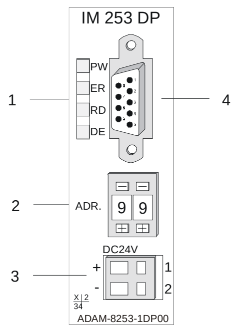
Note!
For details on the data transfer by means of WinNCS refer to the section "Data transfer" in the chapter "Profibus functionality" of the manual supplied with WinNCS.

Construction IM 253 - DP-Slave

Properties

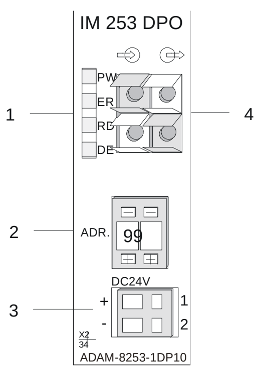
- Profibus-DP slave for a max. of 32 peripheral modules (a max. of 16 analog modules)
- A max. of 152 bytes of input data and 152 bytes output data
- Internal diagnostic protocol with a time stamp
- Integrated 24 V_{DC} power supply for the peripheral modules (3 A max.)
- Supports all Profibus data transfer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

Front view ADAM8253-1DP00



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

Front view ADAM8253-1DP10



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

Components

LED's

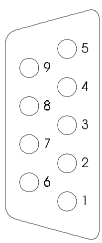
The module carries a number of LED's that are available for diagnostic purposes on the bus and for displaying the local status. The following table explains the different colors of the diagnostic LED's.

Designation	Color	Explanatio
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

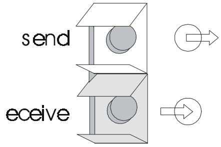
A 9-pin socket is provided for the RS485 interface between your Profibus slave and the Profibus.

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



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

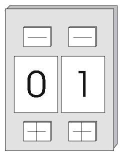
FO interface



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.

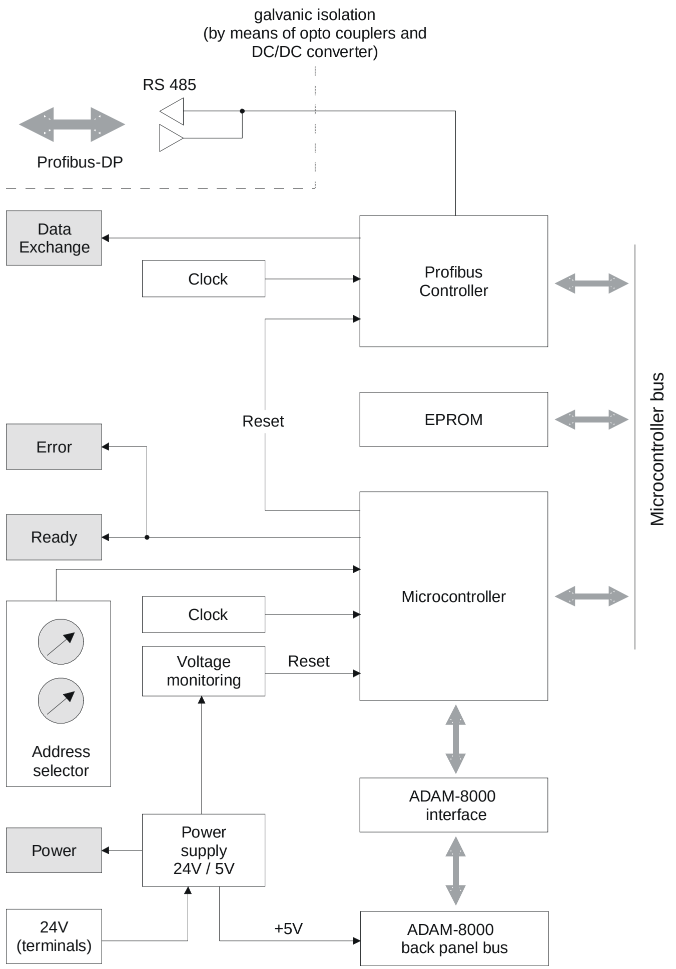
The power supply is protected against reverse polarity.

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:



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.

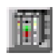
GSD file

VIPA supplies a diskette with every Profibus module. This diskette contains all the GSD and type files of the Advantech 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 Advantech 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 Advantech ADAM8253-2DP20 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 “ADAM8253-2DP20”

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 Advantech 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 Advantech 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 Advantech.

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 dat*a.

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

Device-related diagnostics

Byte	Bit 7 ... Bit
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	Messag 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

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	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

Byte	Bit 7 ... Bit
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	Mod 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	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	Mod 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	1Eh: Under voltage/power failur

28h

V-bus configuration error **Length: 3**

The configuration for the specified plug-in location failed.

Byte	Bit 7 ... Bit
0	28h: V-bus configuration erro
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 erro

2Ah

V-bus bus error **Length: 2**

Hardware error or module failure

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

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 acknowledgmen

32h

ADAM-8000 diagnostic alarm **Length: 16**

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

33h

ADAM-8000 process alarm **Length: 16**

Byte	Bit 7 ... Bit
0	33h: ADAM-8000 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 dat

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 define

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 read

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_Exchang

Installation guidelines

Profibus in general

- The Advantech 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 → 1000 m
  500 kBaud → 400 m
  1,5 MBaud → 200 m
  3 ... 12 MBaud → 100 m
- 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 Optical Link Plug, 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.

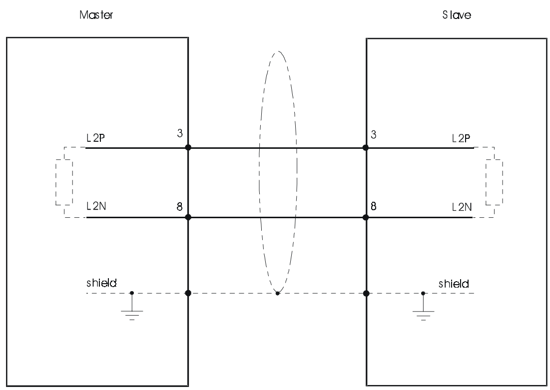
Note!
The Profibus line must be terminated with its characteristic impedance. Please ensure that the line is terminated by means of a termination resistor located at the last station on the bus is.

The FO Profibus system does not require termination!

Profibus using RS485

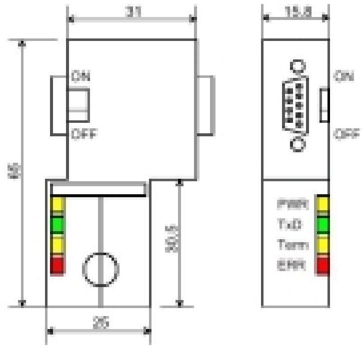
Profibus employs a screened twisted pair cable based on RS485 interface specifications as the data communication medium.

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



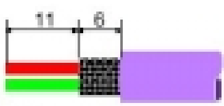
Bus connector

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.
Profibus connector 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.

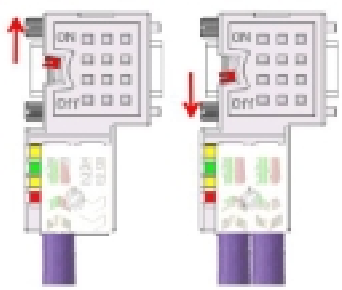


all in mm

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.

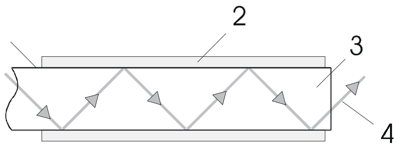
Note!
A complete description of installation and deployment of the terminating resistors is delivered with the connector.

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 wave-length of 650nm. If the fiber optic cable is installed in accordance with the manufacturers guidelines it is not susceptible to external electrical interfer-ence. 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 50 m.

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 Advantech 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 Advantech 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. Advantech 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

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

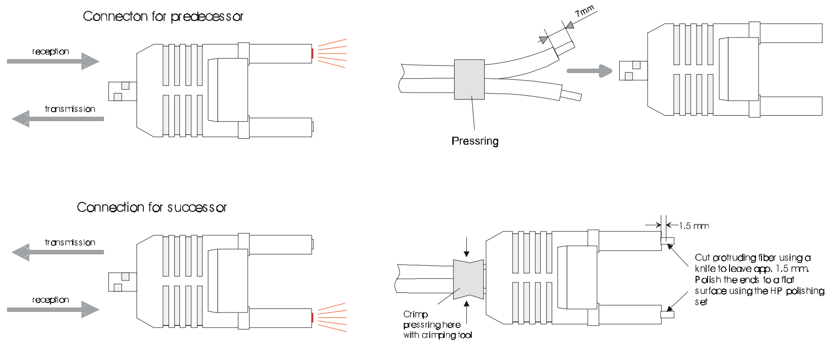
You require a special crimping tool from Hewlett Packard (HP order no.: HFBR-4597) for the installation of the press ring required for strain relief.

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.

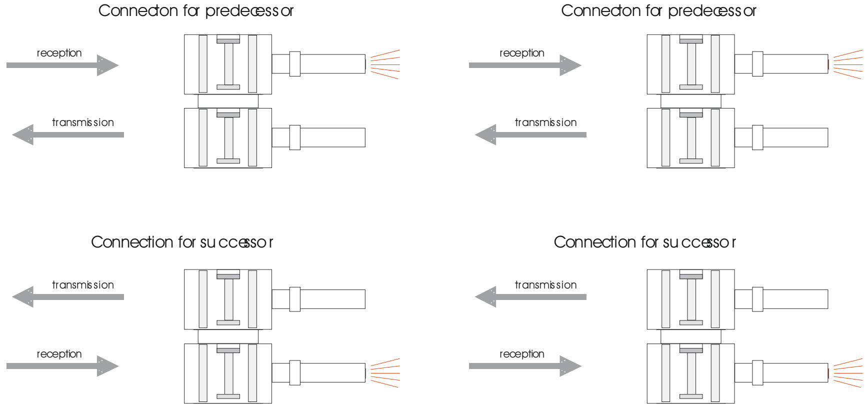
Disadvantages: no protection against polarity reversal.

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.).

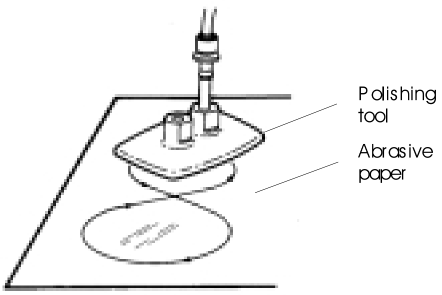


Cutting and polishing the ends of the FO cable

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.

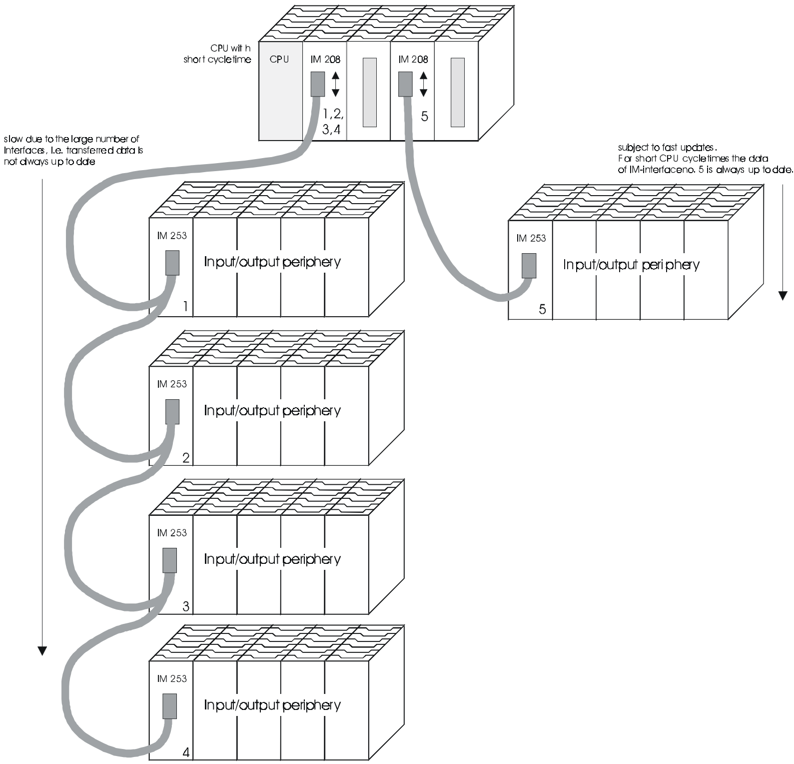
Cutting and polishing the ends of the FO cable



Example of a Profibus network

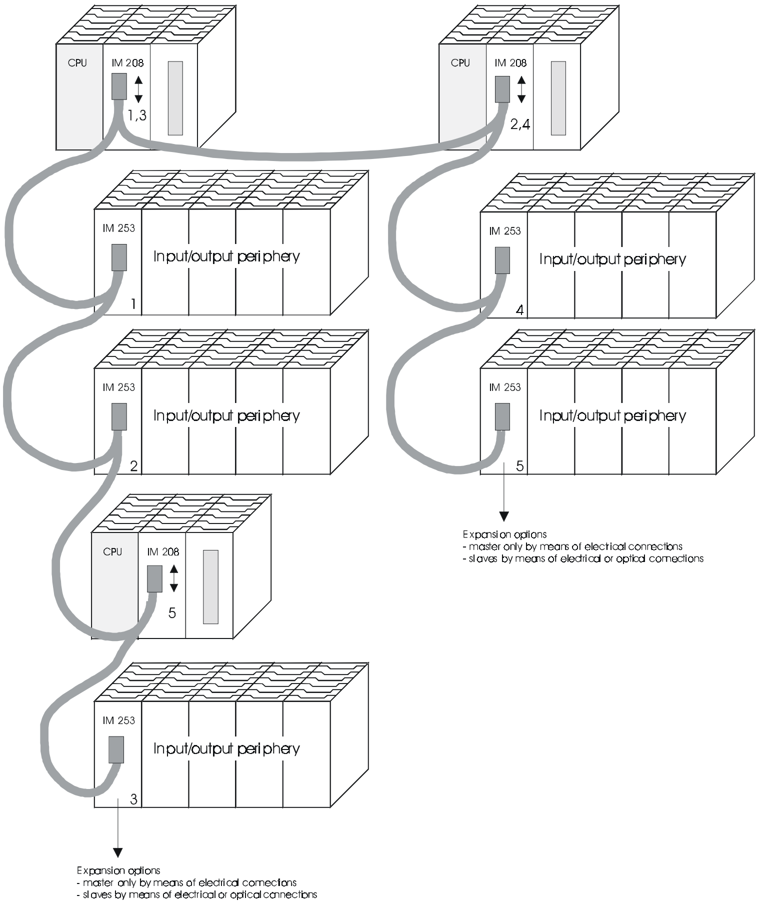
One CPU and multiple master interfaces

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

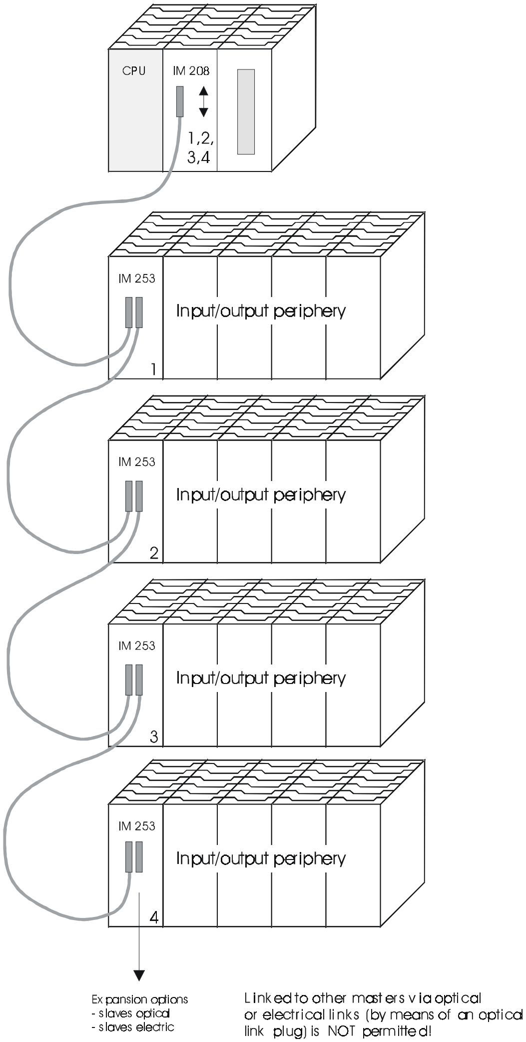
Multiple master interfaces on a single bus in conjunction with a number of slaves:

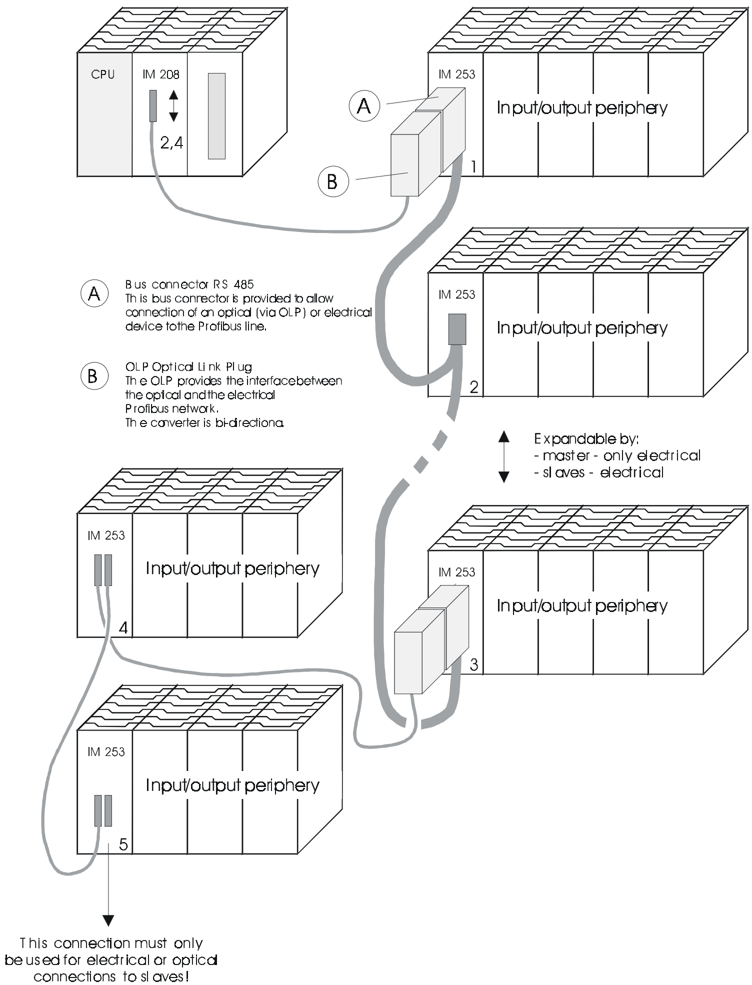


Optical Profibus

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!




CPU
IM 208
2,4
IM 253
A
B
Input/output periphery
1
A
Bus connector RS 485
This bus connector is provided to allow connection of an optical (via OLP) or electrical device to the Profibus line.
B
OLP Optical Link Plug
The OLP provides the interface between the optical and the electrical Profibus network.
The converter is bi-directional.
IM 253
Input/output periphery
2
Expandable by:
- master - only electrical
- slaves - electrical
IM 253
Input/output periphery
4
IM 253
Input/output periphery
3
IM 253
Input/output periphery
5
This connection must only be used for electrical or optical connections to slaves!

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 24 V_{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 Advantech 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 Advantech 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.

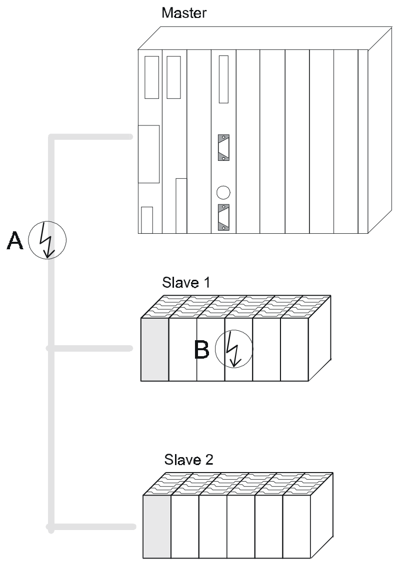
When the bus coupler has been initialized properly its status is set to "READY".

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 interruptio	
LED	A	B
RD	blinks	off
ER	off	on
DE	off	off

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

Example - ADAM-8000 with Profibus under WinNCS

Problem

The following example describes the configuration of a ADAM-8000 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 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 "Advantech Component Library -ACL" 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 21x 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

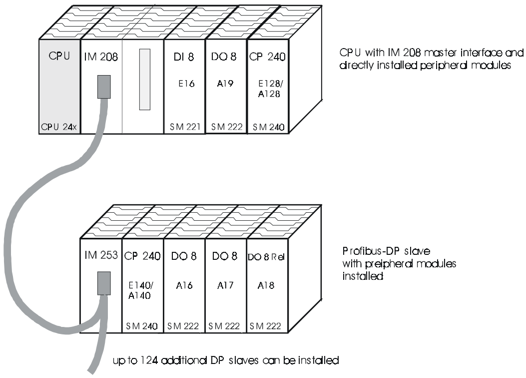
Minimum requirements for the ADAM-8000 modules

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

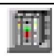
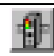
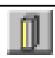
Software tools required

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

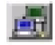
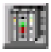
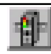
System structure



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 “ADAM 8222-1BF00” that must output the counter using the o-addr. 16. Configure the remaining two modules “ADAM 8222-1BF00” and “ADAM 8222-1HF00” 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 "ADAM-8000" functionality in **Tools >** *ADAM-8000*.
10.	Insert a **ADAM-8000 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 "ADAM 8208-1DP00". 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 ADAM-8000 modules as described in 5., "ADAM 8221-1BF.., "ADAM 8222-1HF00" and "ADAM 8240-1BA00".
13.	Activate the CPU-level in the network window and click on  export. Export your ADAM-8000 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 Advantech.

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 Advantech into your printer (order no.: Advantech 292-1XY10).
18.	Use the print button  in the page view to print the labels displayed above

PLC program with counter

```
FB1:        OB1:
L AB16      SPA FB1
I 1
T AB16
```

Technical data

Profibus-DP master

IM 208 DP

Electrical data	Advantech ADAM 8208-1DP01
Power supply	via back panel bus
Current consumption	380mA max.
Isolation	500 V_{AC}
Status indicators	via LED’s on the front
Connections/interfaces	9-pin D-type socket Profibus connecto
Profibus interface	
Connection	9-pin D-type socket
Network topology	Linear bus, active bus terminator at both ends, radial lines are permitted.
Medium	Screened twisted pair cable, under certain conditions unscreened lines are permitted.
Data transfer rate	9,6 kBaud to 12 MBaud
Total length	100 m without repeaters for 12 MBaud, 1000 m with repeaters
Max. no. of stations	32 stations in any segment without repeaters. Extendible to 126 stations when using repeaters
Combination with peripheral modules	
max. no of slaves	125
max. no. of input bytes	256
max. no. of output bytes	25
Dimensions and weight	
Dimensions (WxHxD) in mm	25, 4 x 76 x 76
Weight	110

IM 208 DPO

Electrical data	Advantech ADAM 8208-2DP10
Power supply	via rear panel bus
Current consumption	max. 380 mA
Isolation	500 V_{AC}
Status indicator	via LED's located on the front
Connections/interfaces	4-pole socket for fibre optic cable Profibus interfac
Profibus interface	
Connection	4-port socket for fibre optic cable
Network topology	Linear structure with dual FO cable, no bus terminator required
Medium	dual-core fibre optic cable
Data transfer rate	12 MBaud
Total length	max. 50 m between stations
Max. no. of stations	126 stations incl. Master
Combination with peripheral modules	
max. no of slaves	125
max. no. of input bytes	256
max. no. of output bytes	25
Dimensions and weight	
Dimensions (WxHxD) in mm	50, 8 x 76 x 76
Weight	110

Profibus-DP-Slave

IM 253 DP

Electrical data	Advantech ADAM 8253-1DP00
Power supply	24 V_{DC}, from ext. power supply connected to front
Current consumption	1A max.
Isolation	≥ 500 V_{AC}
Status indicator	via LED's on the front
Connections/interfaces	9-pin D-type socket Profibus connecto
Profibus interface	
Connection	9-pin D-type socket
Network topology	Linear bus, active bus terminator at both ends, radial lines are permitted.
Medium	Screened twisted pair cable, under certain conditions unscreened lines are permitted.
Data transfer rate	9, 6 kBaud to 12 MB aud (automatic adjustment)
Total length	100 m without repeaters for 12 MBaud; 1000 m with repeaters
Max. no. of stations	32 stations in any segment without repeaters. Extendible to 126 stations when using repeaters
Diagnostic functions	
Standard 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.
Extended diagnostics	-
Combination with peripheral modules	
max. no of modules	32
max. no. of digitals	32
max. no of analogs	16
Dimensions and weight	
Dimensions (WxHxD) in mm	25, 4 x 76 x 76
Weight	80g

IM 253 DPO

Electrical data	Advantech ADAM 8253-1DP10
Power supply	24 V_{DC}, from ext. power supply connected to front
Current consumption	1 A max.
Isolation	≥ 500 V_{AC}
Status indicator	via LED's on the front
Connections/interfaces	9-pin D-type socket Profibus connecto
Profibus interface	
Connection	4-port socket for fibre optic cable
Network topology	Linear structure with dual FO cable, no bus terminator required
Medium	dual-core fibre optic cable
Data transfer rate	12 MBaud
Total length	max. 50 m between stations
Max. no. of stations	126 stations incl. Master
Diagnostic functions	
Standard 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.
Extended diagnostics	-
Combination with peripheral modules	
max. no of modules	32
max. no. of digitals	32
max. no of analogs	16
Dimensions and weight	
Dimensions (WxHxD) in mm	25, 4 x 76 x 76
Weight	80g

Profibus-DP-slave combination module

IM 253 DP DO 24xDC24V

Electrical data	Advantech ADAM 8253-2DP20
Power supply	24 V_{DC}, from ext. power supply connected to front
Current consumption	5 A max.
Profibus interface	
Connection	9-pin D-type socket
Network topology	Linear bus, active bus terminator at both ends.
Medium	Screened twisted pair cable, under certain conditions unscreened lines are permitted.
Data transfer rate	9, 6 kBaud to 12 MBaud (automatic adjustment)
Total length	100 m without repeaters for 12 MB aud; 1000 m with repeaters
Max. no of stations	32 stations in any segment without repeaters. Extendible to 126 stations when using repeaters.
Status indicator	via LED’s on the front
Combination with peripheral modules	
max. no of modules	32
max. digital I/O’s	32
max. analog I/O’s	16
Output unit	
Number of outputs	24
Rated load voltage	24 V_{DC} (18...35 V) supplied internally via Profibus coupler
Output current per channel	1 A (total current must not exceed 4 A)
Status indicator	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	50, 8 x 76 x 76
Weight	150g

3

CAN-Bus CANopen

Overview

This chapter contains the description of the Advantech 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 Advantech 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

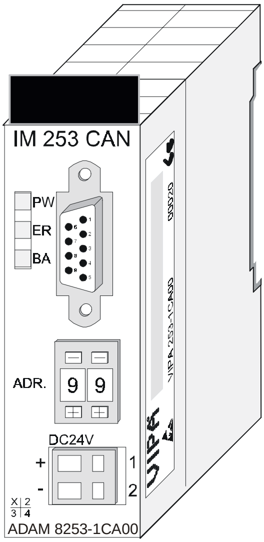
Ordering details

Order number	Description
ADAM 8253-1CA00	CAN-Bus CANopen Slav

System overview

You can use the Advantech CAN-Bus coupler to link up to 32 modules (of 40 bytes each) of your ADAM-8000 periphery with CANopen.

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



Ordering details

Order number	Description
ADAM 8253-1CA00	CAN-Bus CANopen Slav

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 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.

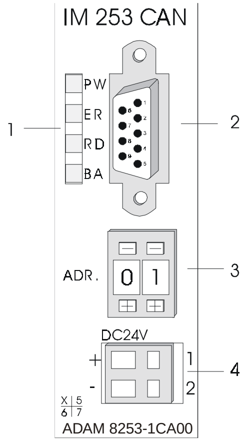
CAN employs a Carrier-Sense Multiple Access (CSMA) method, i.e. all stations have the same right to access the bus as long as the bus is not in use (random bus access).

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.

Nam	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

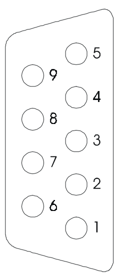
Various combinations of the LED's indicate the different operating statuses:

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 Advantech 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 l ow
3	CAN ground
4	n.c.
5	n.c.
6	optional ground
7	CAN h igh
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.

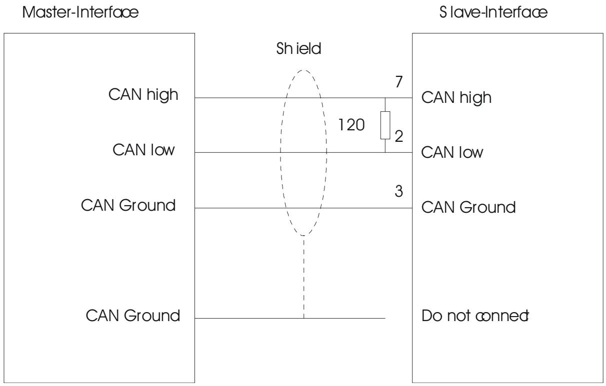
Power supply

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.



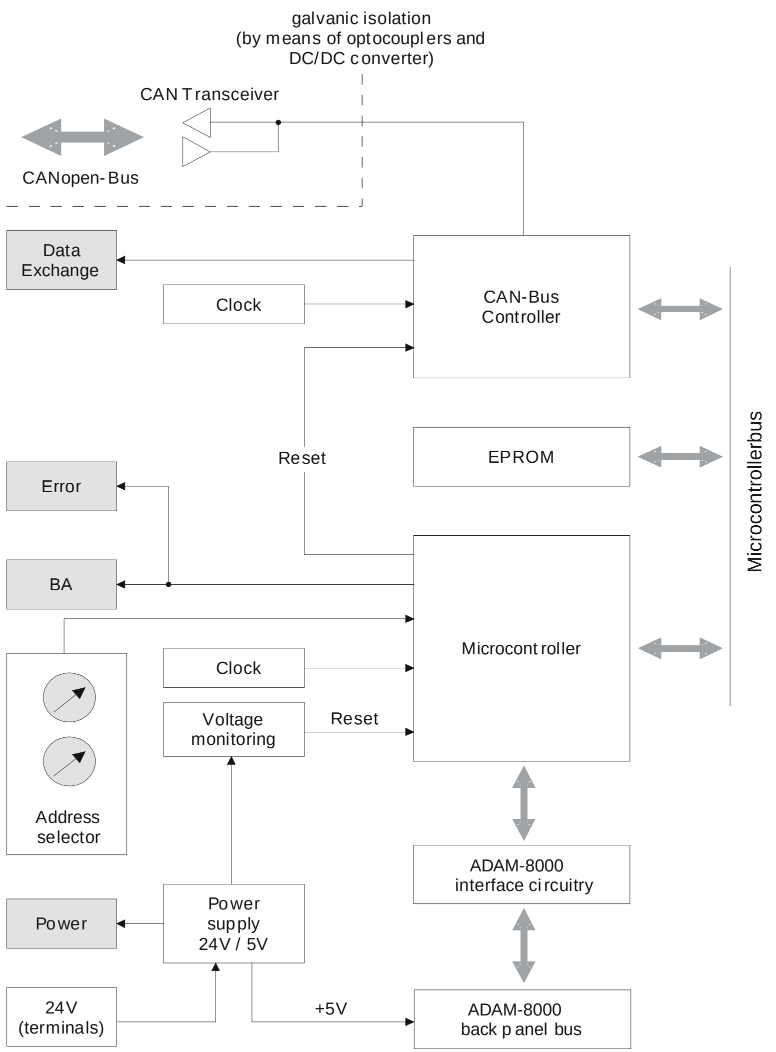
Line termination

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 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

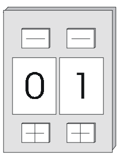
You have the option to specify the baudrate and the module-ID by setting the address selector to 00 within a period of 10s after you have turned the power on.

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 Advantech CAN-Bus coupler:

Object	Function code (4 bits)	Receiver	Definition	Functio
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
PDO1M2S	0100	Slave	CiA DS-301	Digital output data
PDO2S2M	0101	Master, Slave (RTR)	CiA DS-301	Analog input data
PDO2M2S	0110	Slave	CiA DS-301	Analog output data 1
PDO3S2M	0111	Master, Slave (RTR)	Application spec.	D o. a input data
PDO3M2S	1000	Slave	Application spec.	D o. a input data
PDO4S2M	1001	Master, Slave (RTR)	Application spec.	D o. a input data
PDO4M2S	1010	Slave	Application spec.	D o. a input data
PDO5S2M	1101	Master, Slave (RTR)	Application spec.	D o. a input data
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 monitorin

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	DI
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
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	Analog	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	Analog	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	notvali									

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	DI
Number of bytes DI	-	-	-	-	4	2	-	-	-	-
Number of bytes AI	-	-	-	8	-	-	-	10	-	-

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

PDO-Type	Length	Typ	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte
PDO1M2S	6	Dig.	DO32 locat. "4"	DO32 locat. "4"	DO32 locat. "4"	DO32 locat. "4"	DO16 locat. "4"	DO16 locat. "4"		
PDO2M2S	8	Analog	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	Analog	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	Analog	FM250 locat. "7"	FM250 locat. "7"						
PDO5M2S	notvali									

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 Identifie

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 modul 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 modul 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 byte 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

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.

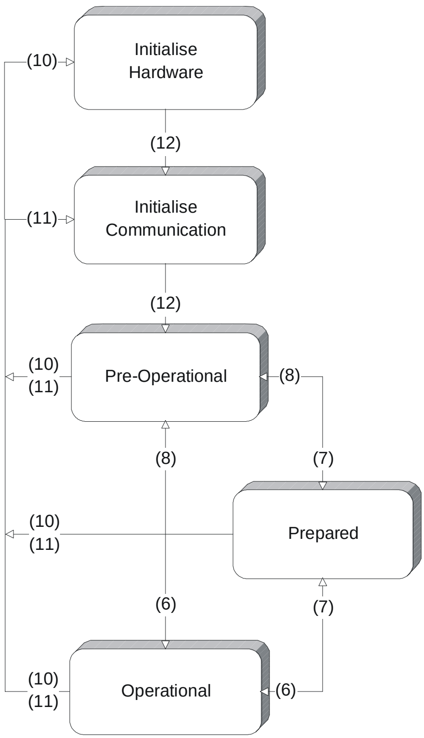
Additional error information for application specific errors:

Error detected	Byte 3	Byte 4	Byte 5	Byte 6	Byte7
Error during initialization of back panel modules	0x01	0x00	0x00	0x00	0x0
Error during module configuration check	0x02	Plug-in locat. no.	Number of modules	Retries	0x0
Error when checking module indices	0x03	0x00	0x00	0x00	0x0
Error when reading from digital inputs	0x10	0x00	0x00	0x00	0x0
Error when writing to digital outputs	0x11	0x00	0x00	0x00	0x0
Error when reading from analog inputs	0x20	Plug-in locat. no.	Channel number	Byte counter	0x0
Error when writing to analog outputs	0x21	Plug-in locat. no.	Channel number	Byte counter	0x0
Error when reading from counter inputs	0x22	Plug-in locat. no.	Channel number	Byte counter	0x0
Error when writing to counter outputs	0x23	Plug-in locat. no.	Channel number	Byte counter	0x0
Error when reading from the CP240-module	0x24	Plug-in locat. no.	Channel number	Byte counter	0x0
Error when writing to the CP240 module	0x25	Plug-in locat. no.	Channel number	Byte counter	0x0
Error when reading from the FM254-module	0x26	Plug-in locat. no.	Channel number	Byte counter	0x0
Error when writing to the FM254 module	0x27	Plug-in locat. no.	Channel number	Byte counter	0x0
Error when writing analog parameters	0x30	Plug-in locat. no.	Byte counter	Parameter record length	0x0
Error when writing counter parameters	0x31	Plug-in locat. no.	Byte counter	Parameter record length	0x0
Error when writing to the CP240 parameters	0x32	Plug-in locat. no.	Byte counter	Parameter record length	0x0
Error when writing to the FM254 parameters	0x33	Plug-in locat. no.	Byte counter	Parameter record length	0x0
Diagnostic alarm from an analog module	0x40 + Locat.	Diagnostic Byte 1	Diagnostic Byte 2	Diagnostic Byte 3	Diagnostic Byte
Process alarm from an analog module	0x80 + Locat.	Diagnostic Byte 1	Diagnostic Byte 2	Diagnostic Byte 3	Diagnostic Byte
Configuration error of the CAN-Bus coupler	0xAA	Highbyte SDO-Index	Lowbyte SDO-Index	Subindex	0x0

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 Advantech 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): I nitialization complete
enter Pre-operational
aut omatically

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 Advantech 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

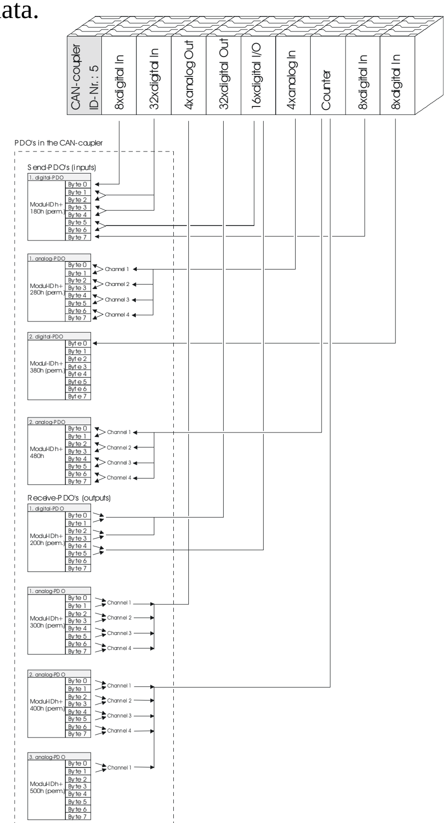
channel is associated with a bit located in the process image.

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.

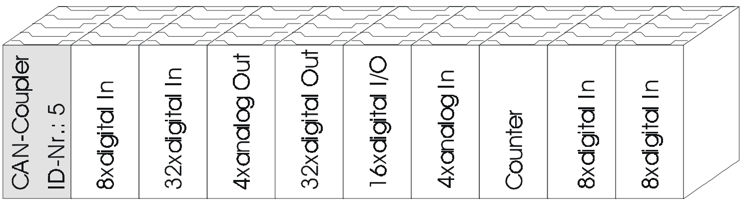


Configuration of the CAN bus coupler

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	Tota
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	9FC

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.

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								

4. Preparation of the receive-PDO's

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-con-figura-tion 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		0505000

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		2B2B000

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		020

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		0000000

C: Enabling the counter input interrupts

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

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		F

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		0000000

8. Enabling the operation of the CAN Bus coupler

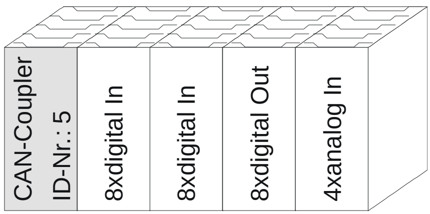
The device status of the CAN Bus coupler must be set to operational to allow it to transfer data. When the status of the bus coupler is operational it will reply with the input data.

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.

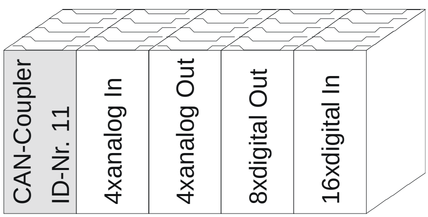
Here we are required to configure two CAN-Bus couplers as follows:

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.
5	EB144	8	1
11	EB170	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 ADAM-8000 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	ADAM 8253-1CA00
Power supply	24 V_{DC}, ext. power supply connected to the front
Current consumption	700mA max.
Isolation	≥500 V_{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, 4 x 76 x 76
Weight	80g

DeviceNet

4

Overview

This chapter contains the description of the Advantech 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:

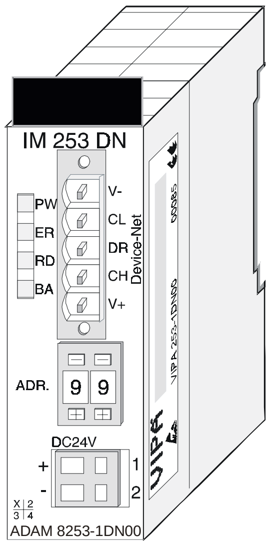
- DeviceNet principles
- Hardware description of the Advantech DeviceNet-coupler IM 253 DN
- Configuration by means of the *DeviceNet-Manager* inc. examples
- Diagnostics
- Interfacing options for Profibus
- Technical data

Ordering details DeviceNet

Type	Order number	Description
IM 253 DN	**ADAM 8253-1DN00**	DeviceNet-couple

System overview

You can use the Advantech DeviceNet-coupler coupler to link up to 32 modules (of 40 bytes each) of your ADAM-8000 periphery by means of DeviceNet. The following DeviceNet-components are currently available from Advantech.



Ordering details DeviceNet

Type	Order number	Description
IM 253 DN	**ADAM 8253-1DN00**	DeviceNet-couple

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 24 V_{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.

DeviceNet

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

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.

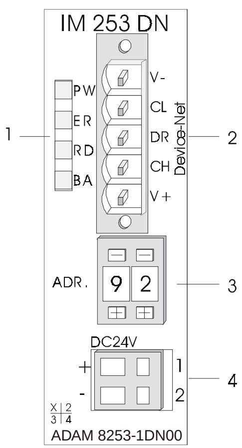
Advantech DeviceNet-coupler

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 ADAM8253-1DN00



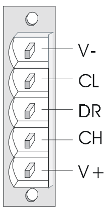
[1] LED status indicator
[2] DeviceNet connector
[3] Adress selector
[4] 24V DC power supply connector

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 statu

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.

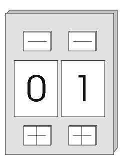


[V-] GND operating voltage
[CL] CAN low
[DR] DRAIN
[CH] CAN HIGH
[V+] 24 V DC operating voltage

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.

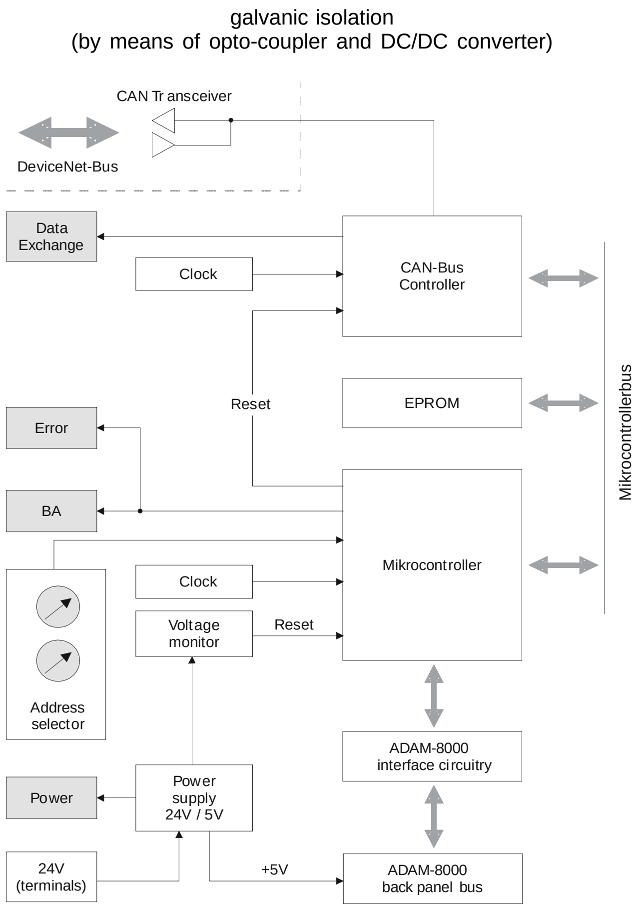
The power supply provides a max. of 3A to the circuitry of the module as well as the peripheral modules via the back panel bus.

The power supply must be connected to a 24 V_{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 ADAM-8000 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

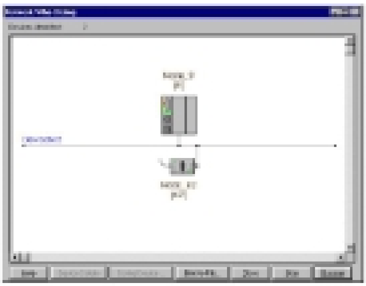
When the address is bad or if it already exists the ER-LED (red) will be turned on after power on.

Test in conjunction with the DeviceNet

Procedure

- Connect the PC containing the *DeviceNet-Manager* and the Advantech 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-Manage*r.
- Enter the same data rate into the manager that was selected on the bus coupler
- Start the function NETWORK WHO in the manager

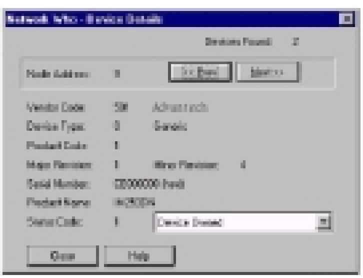
The following network windows is displayed:



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 Advantech GmbH) and other internal information.

Module configuration in the DeviceNet-manager

The ADAM-8000 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.

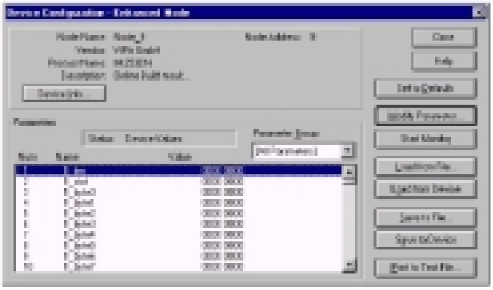
Procedure

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-Manage*r.

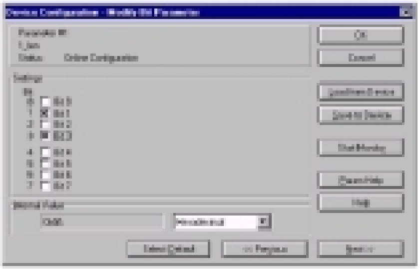
- Execute the function WHO in the *DeviceNet-Manage*r.
  This will open a network window that includes your coupler.
- Double-click the icon of the bus couplers for which you want to modify the parameter data.

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 Grou*p.
- 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.

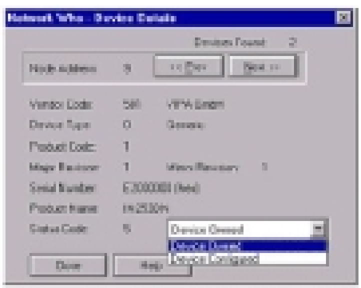
The following selection window is opened when you click [Save to Device]:

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”

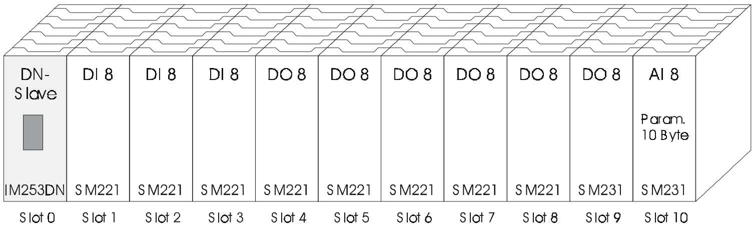
- If you were to request the “Device Details” the bit CONFIGURED would also be included.



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 ADAM-8000. Let us assume that the system has the following structure:

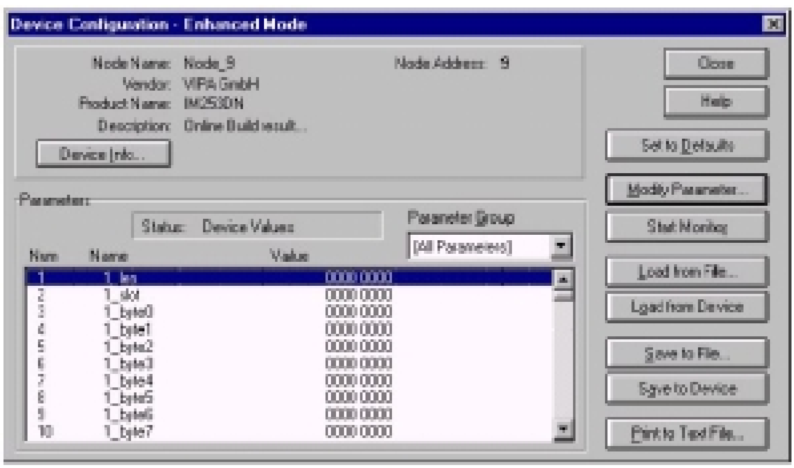


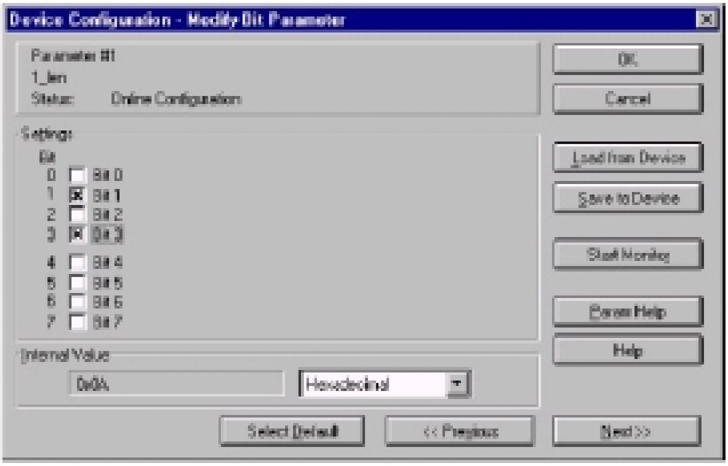
The example shows a DeviceNet-coupler with 10 modules; however, the modules installed in plug-in locations 1 to 9 can not be configured.

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:
The result is:

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

- 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 blink

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

POWER ON with DeviceNet without Master

LED	Descriptio
☐ 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 Advantech-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 and Master 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 ispermanently 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!

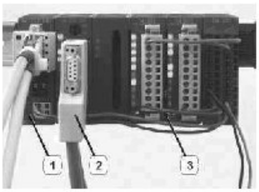
Profibus interface

Description

The modular ADAM-8000 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

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	ADAM 8253-1DN00
Power supply	24 V_{DC} ±15%, via an external power supply connected at the front
Current consumption	Bus coupler: 50mA incl. supply to the peripheral modules: 800 mA max.
Isolation between DeviceNet and back panel bus	500 Vrm
Function specific data	
Status indicator	by means of LED's on the front
Physical connection to DeviceNet	5-pin Open Style Connector
Network topology	Linear bus, spur lines up to 6 m in length
Communication medium	Screened 5-core cable
Communication rate	125, 250, 500 kBaud
Overall length of the bus	up to 500 m
Number of stations	64 max
Combination with peripheral modules	
Number of modules	32 max.
Inputs	256 byte max.
Outputs	256 byte max.
Mechanical data	
Dimensions (BxHxT)	25,4 x 76 x 76 mm
Weight	80

5 Count module

Overview

This chapter contains information on the interfacing and configuration of the counter module FM 250.

The 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:

- Counter module FM 250
- Technical data

System overview

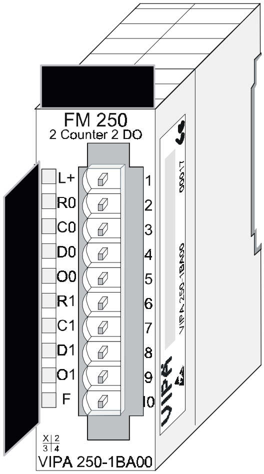
Here follows a summary of the measurement modules that are currently available from Advantech:

Counter module FM 250

Ordering details

Type	Order number	Description
FM 250	VIPA 250-1BA00	Counter module (2 counter 2 DO

Counter module FM 250



Note!
The following information is only applicable to counter modules with *order no.: ADAM8250-1BA00 and a revision level 5 and highe*r.

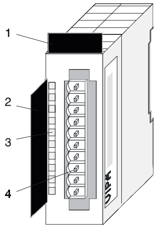
The counter module accepts the signals from transducers connected to the module and processes these pulses in accordance with the selected mode of operation. The module has 2 channels with a data resolution of 32 bit each.

These modules provide 24 counter modes and one 24 V output per channel that is controlled in accordance with the selected mode.

Properties

- two 32 bit channels
- 24 V_{DC} supply voltage or via back panel bus
- freely configurable 24 V_{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

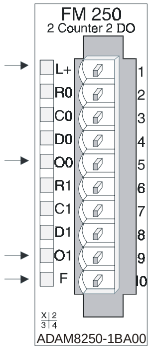
Construction



[1] Label for module name
[2] Label for bit-address with description
[3] LED status indicator
[4] Edge connector

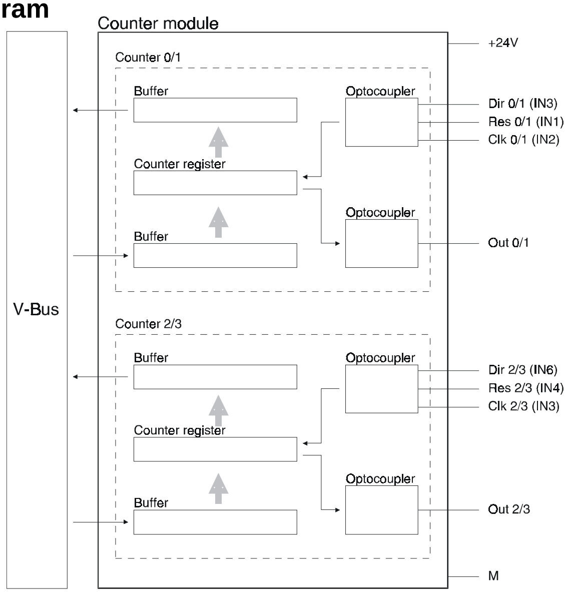
Status indicator pin assignment

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 +24 V_{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 b yte 1									Modue (0 ... 26) counter 0

	7							0	bit no.
Parameter b yte 2									Modue (0 ... 26) counter 1

Summary of counter modes and interfacing

Mode	maybe comb-ined	Function	IN1	IN2	IN3	IN4	IN5	IN6	OUT0	OUT1	Auto Rel-oad	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 counterdown/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/						
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:

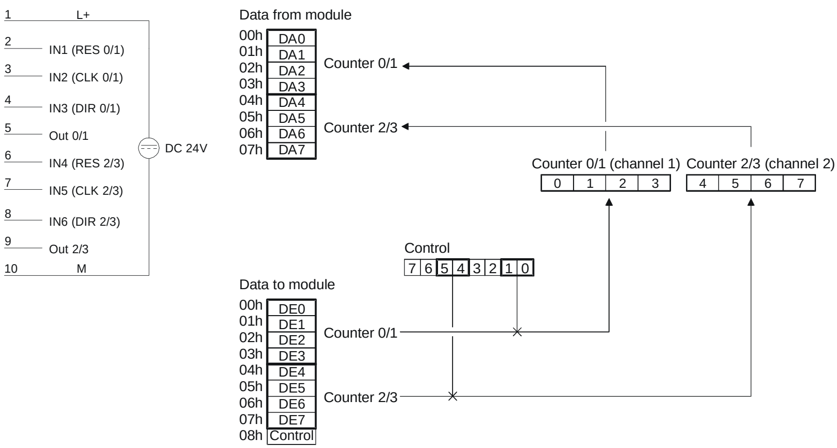
Parameter	Fref
0	10 MHz
1	1 M Hz
2	100 kHz
3	10 kHz

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.

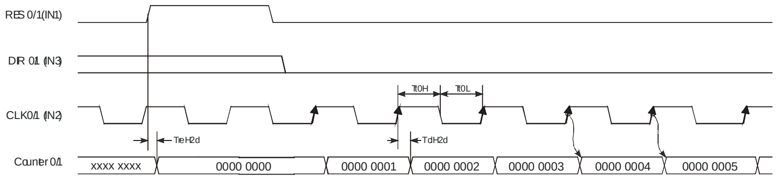
Pin assignment access to counter



Up-counter

In mode 0 a LOW level at the DIR input configures the counter for counting up.

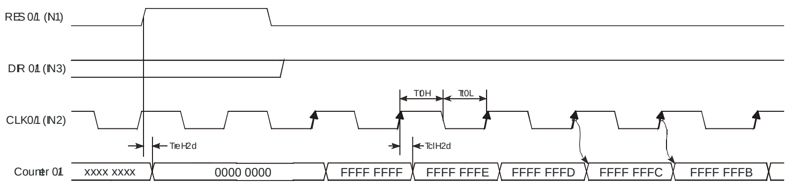
Timing diagram of the counter 0/1 example:



Down-counter

In mode 0 a HIGH level at the DIR input configures the counter for counting down.

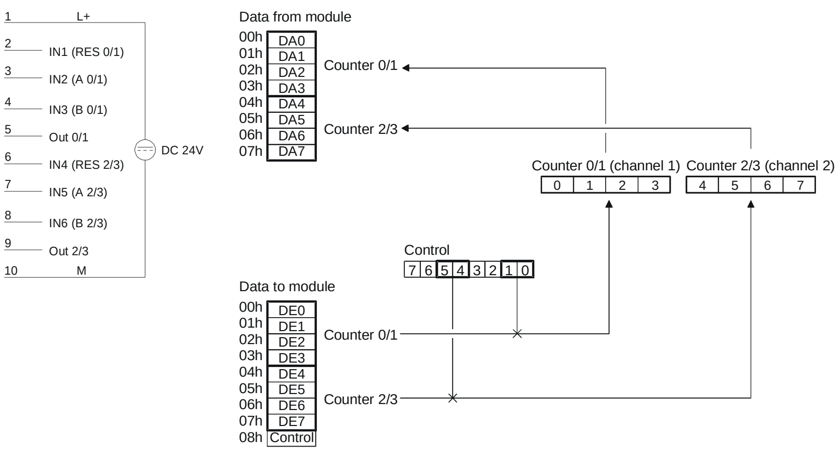
Timing diagram of the counter 0/1 example:



Mode 1 Encoder 1 edgeV

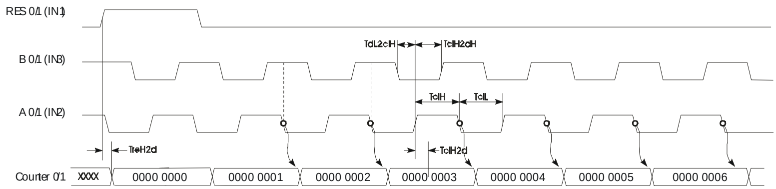
In mode 1 you can configure an encoder for one of the channels. Depending on the direction of rotation this encoder will increment or decrement the internal counter with every falling edge. The RES input must be at a low level during the counting process. A HIGH level clears the counter. When the counter 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



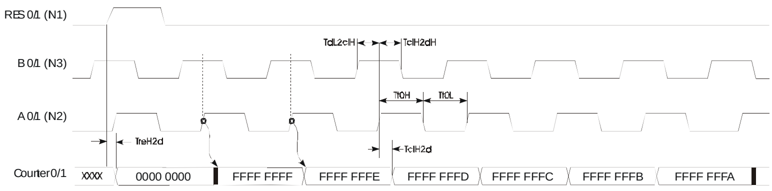
Up-counter

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

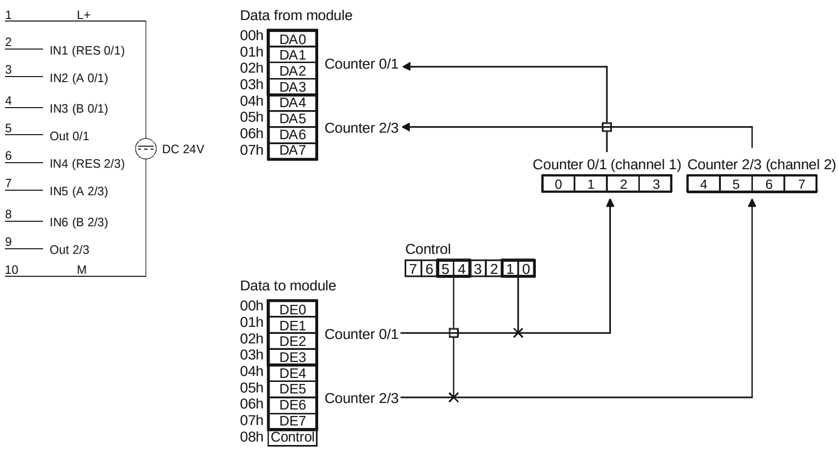
Every rising edge of the signal at input A decrements the internal counter if input B is at HIGH level at this moment. Timing diagram for the counter 0/1 example:



Mode 3 Encoder 2 edges

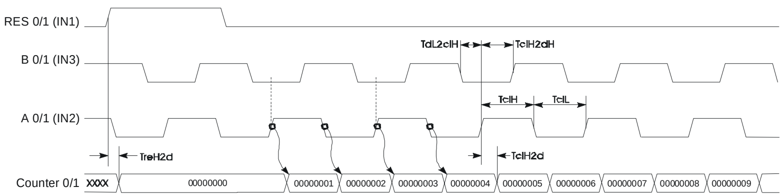
Every rising or falling edge of the signal at input A changes the counter by 1. The direction of the count depends on the level of the signal applied to input B. RES must be at a LOW level during the counting process. A HIGH level clears the counter. When the counter reaches zero, output OUT of the respective 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



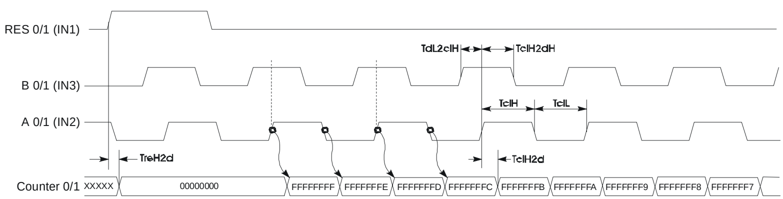
Up-counter

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

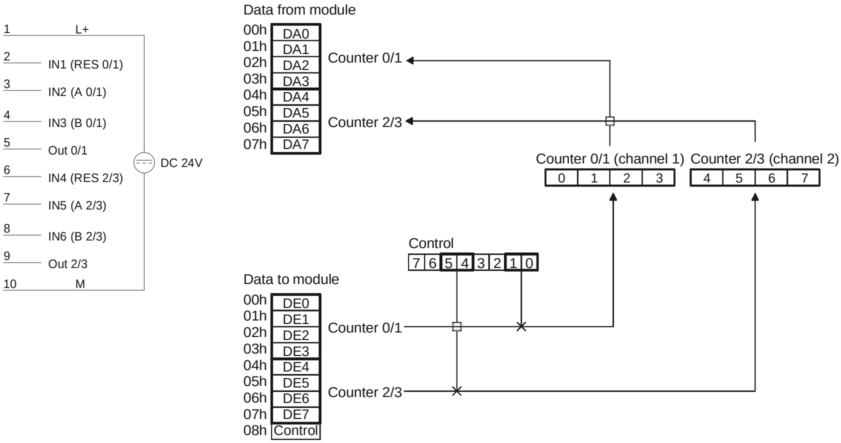
The counter is decremented by the rising edge of signal A if input B is at a HIGH level or by the falling edge of input A when input B is at a LOW level. Timing diagram for the counter 0/1 example:



Mode 5 Encoder 4 edges

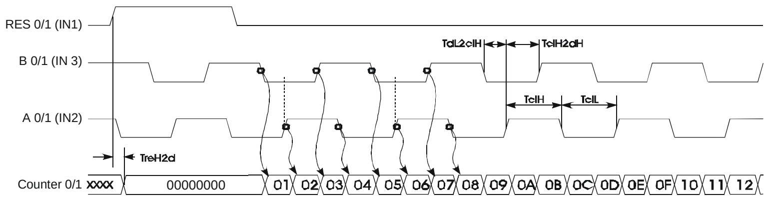
Every rising or falling edge at inputs A or B increments or decrements the counter. The direction depends on the level applied to the other input (B or A). RES must be at a LOW level during the counting process. A HIGH level clears the counter. When the counter reaches zero, output OUT of the respective 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



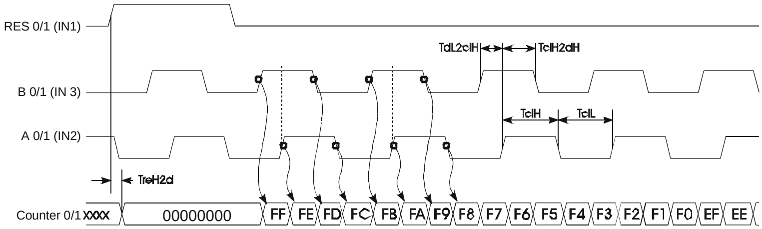
Up-counter

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 20s units in a buffer from where it can be retrieved (corresponds to f ref = 50kHz).

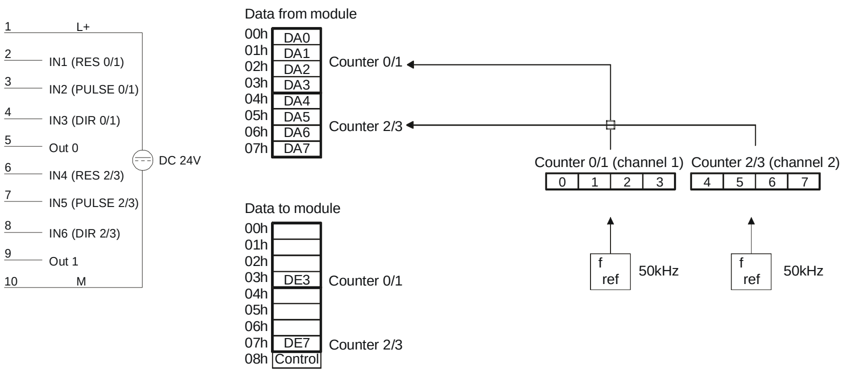
Input DIR determines the counting direction of the counter. If DIR is at a LOW level the counter counts up. A HIGH level lets the counter count down.

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.

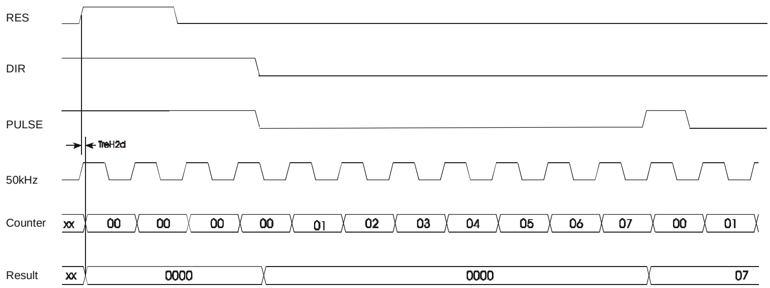
Signals Out 0 or Out 1 are not modified.

Pin assignment access to counter



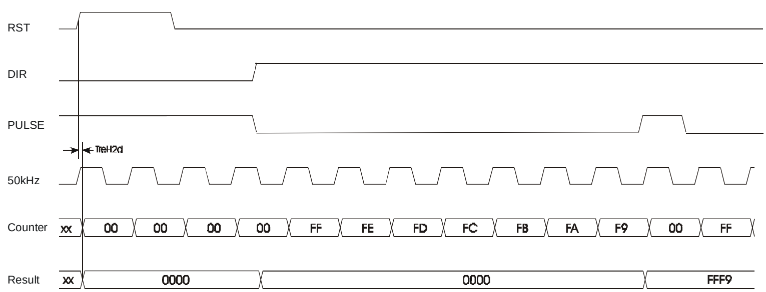
Up-counter

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:

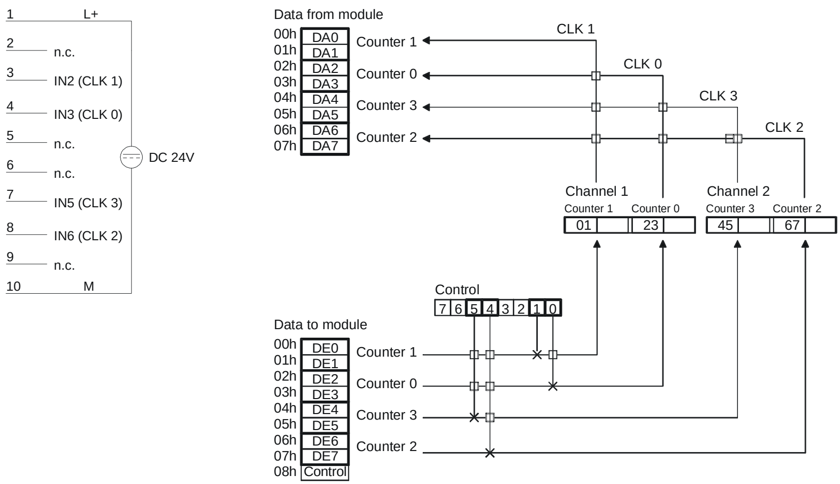
Mode 8 - counter 0/2 up, counter 1/3 up

Mode 9 - counter 0/2 down, counter 1/3 up

Mode 10 - counter 0/2 up, counter 1/3 down

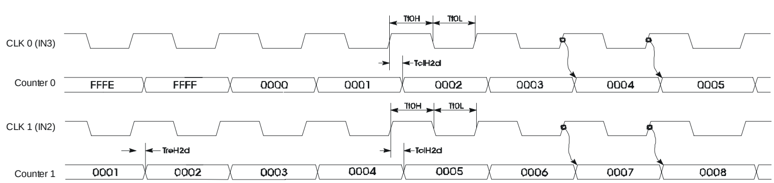
Mode 11 - counter 0/2 down, counter 1/3 down

Pin assignment access to counter



Timing diagram

Below follows a timing diagram depicting an example of counter 0 and counter 1 in mode 8:



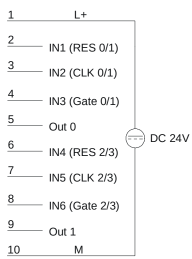
Mode 12 and 13 32 bit counter with gate

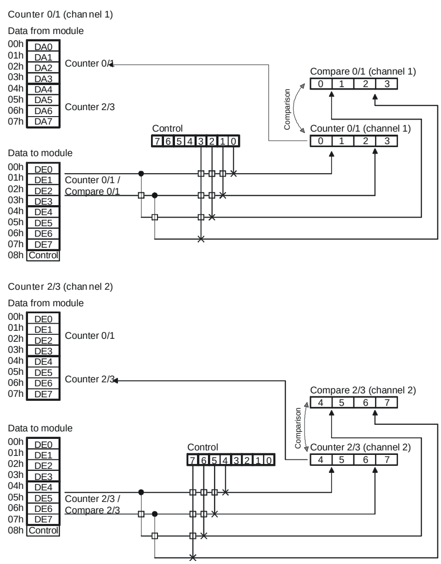
In mode 12 and mode 13 you can implement a 32 bit counter that is controlled by a gating signal (Gate). The direction of counting depends on the selected mode. Every rising edge of the input signal increments or decrements the counter provided that the Gate signal is at HIGH level. RES must be LOW during 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 100 ms while the counter continues counting.

Mode 12 - 32 Bit counter up + gate with compare

Mode 13 - 32 Bit counter down + gate with compare

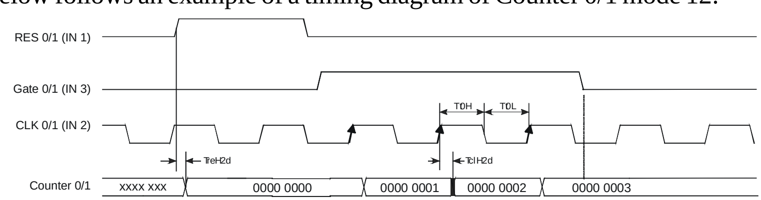
Pin assignment access to counter





Timing diagram

Below follows an example of a timing diagram of Counter 0/1 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.

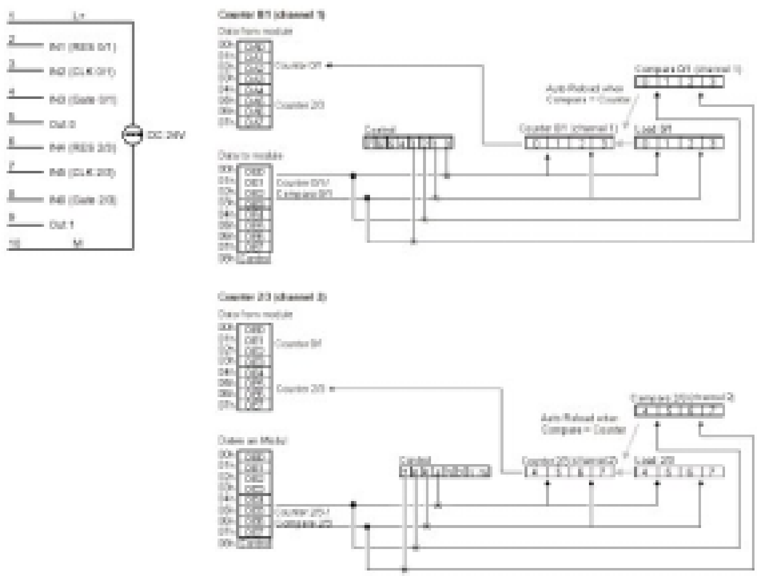
When an Auto Reload occurs the status of the respective output changes.

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



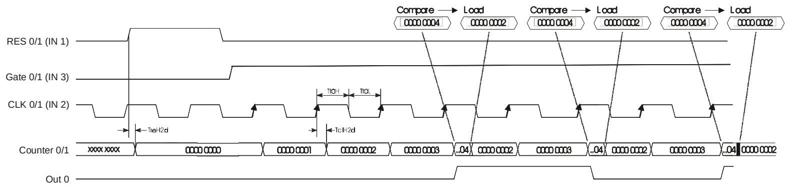
Example

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

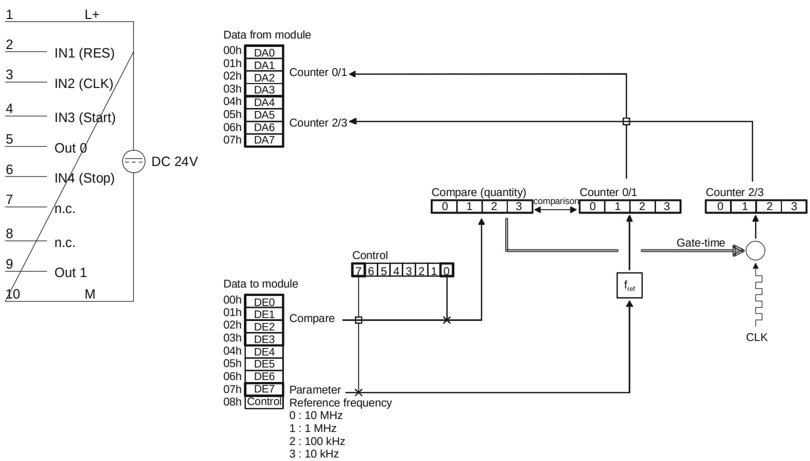
In this mode it is possible to determine the frequency of the signal that is applied to the CLK input. Counter 0/1 is provided with a reference signal by means of DE7 and a gate time that is controlled indirectly by the value n to determine the duration for which counter 2/3 is enabled. The value of 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:

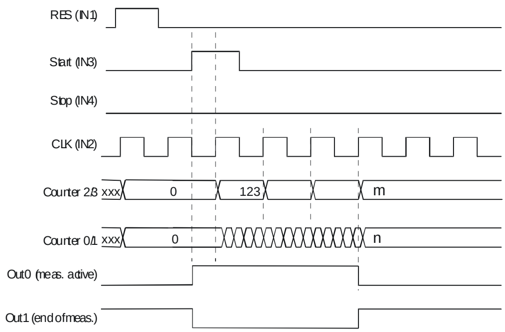
$$Frequency = \frac{fr \bullet m}{n}$$

where *fr* : reference frequency (is supplied via DE7 by means of control-bit 7)

m : counter 2/3 contents (number of CLK pulses)

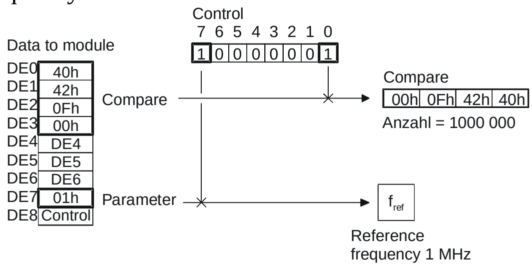
n : number of reference frequency pulses in counter 0/1 (equal to Compare, if the operation was not terminated prematurely by means of Stop)

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.

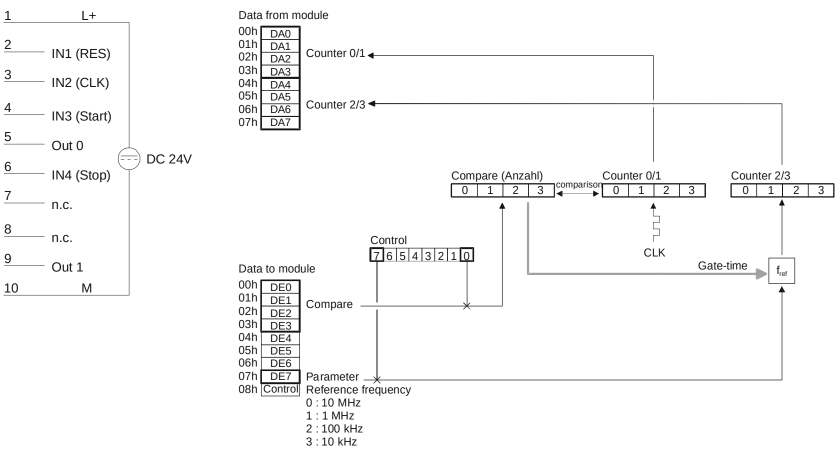
Mode 17 period measurement

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:

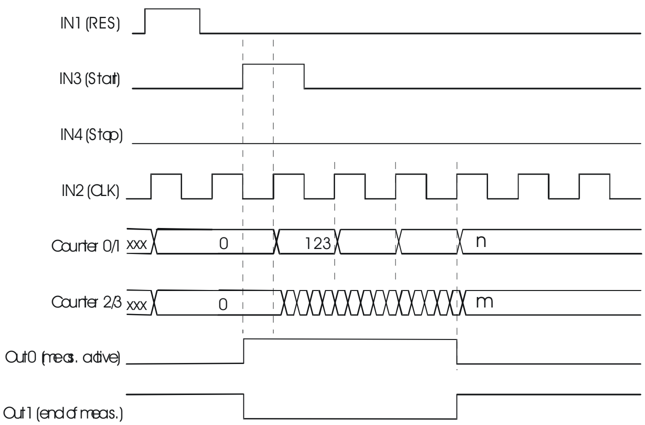
$$Frequency = \frac{fr \bullet m}{n}$$

where *f*r: 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:



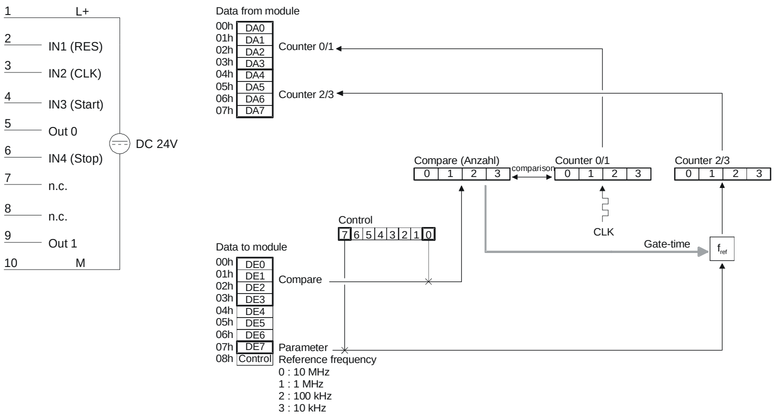
Mode 18 frequency measurement with gate output

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:

$$Frequency = \frac{fr \bullet m}{n}$$

where *fr*: Reference frequency (supplied in DE7 with control bit 7)

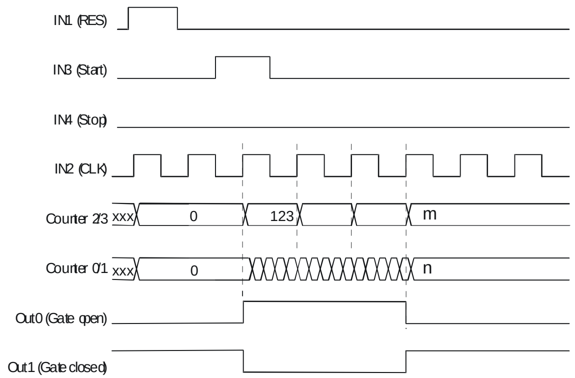
m: contents of counter 2/3 (CLK pulse count)

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.

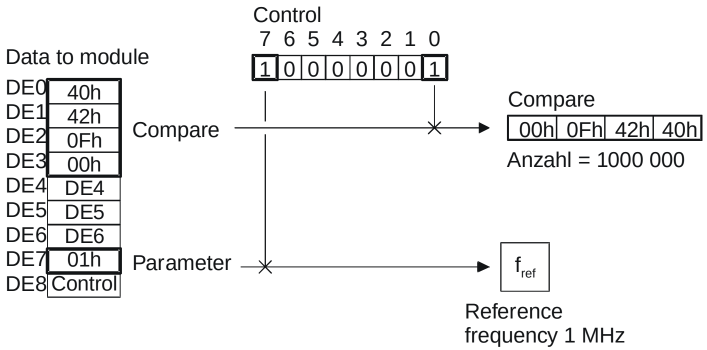
Timing diagram:



Example

Pulse count = 1000 000

Reference frequency = 1 MHz

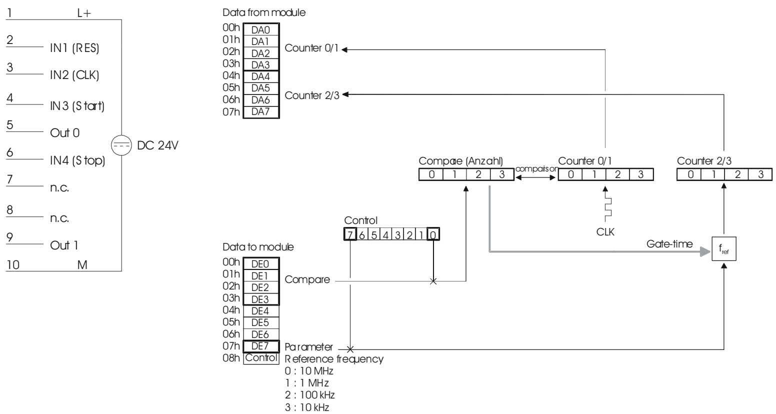


Mode 19 period measurement with gate output

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:

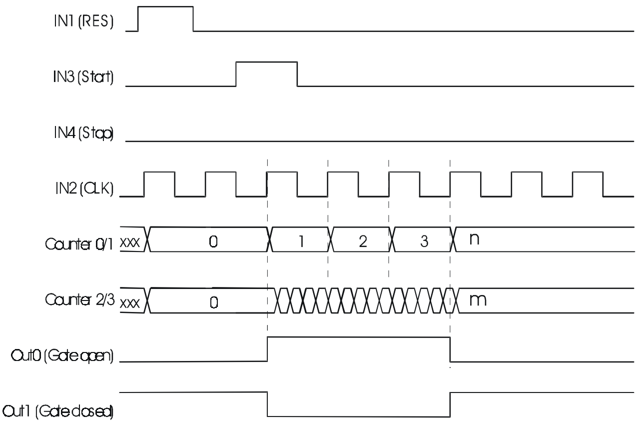
$$Frequency = \frac{fr \cdot m}{\mathrm{n}}$$

where *f*r: 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.

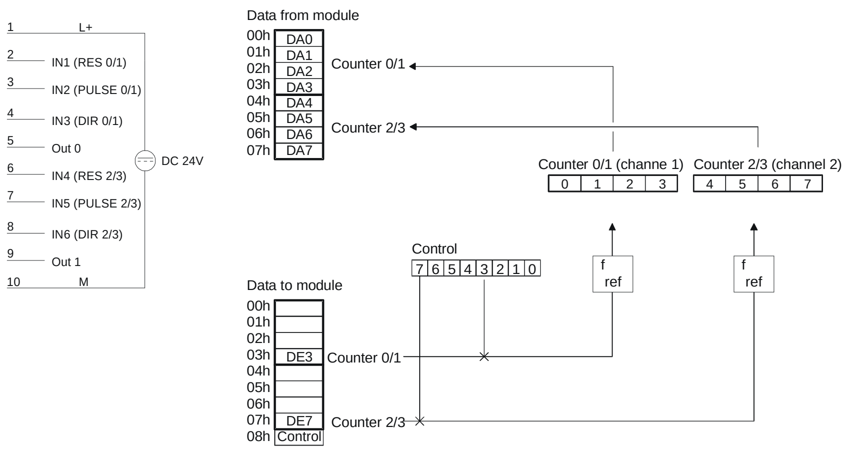
Input DIR controls the direction of the count. When DIR is held at a LOW level the counter counts UP. When DIR is at a HIGH level the counter counts DOWN.

RES must be held at LOW during the counting operation. A HIGH level clears the counter.

Fref is programmable.

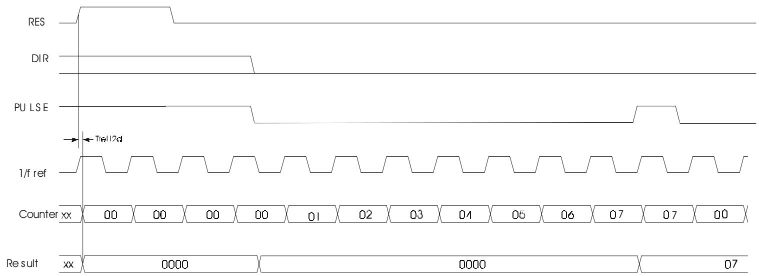
The OUT signal is not changed.

Pin assignment access to counter



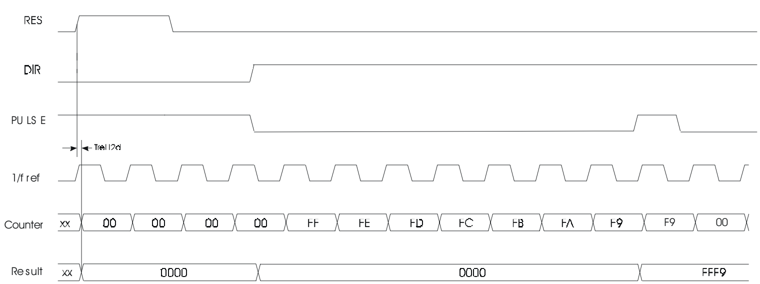
Up-counter

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

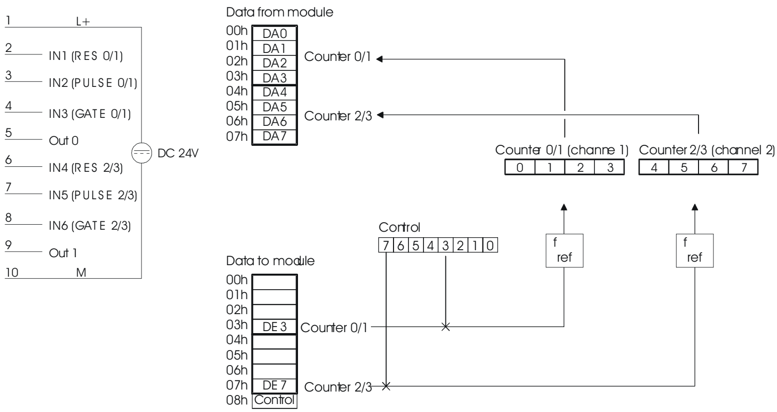
The pulse-width of a signal applied to the PULSE-input is determined by means of a programmable time base (f ref). The measurement starts with the falling edge of the input signal and it is stopped by the rising edge of the input signal. The rising edge of the input signal saves the resulting pulse-width 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.

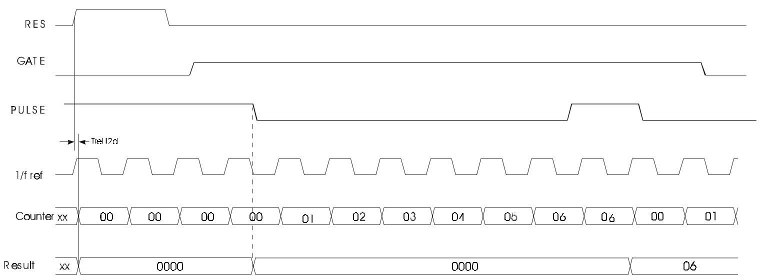
The OUT signal is not modified.

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

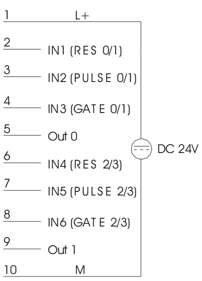
The pulse-width of a signal applied to the PULSE-input is determined by means of a programmable time base (f ref). The rising edge of the input signal saves the resulting pulse-width in units of 1/f ref. This is available to other devices.

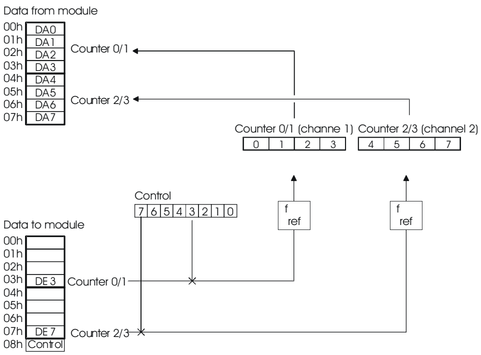
A condition for the function is that a HIGH level is applied to the GATE input.

Input RES must be at a LOW level. A HIGH level at this input would clear the counter.

The OUT signal is not modified.

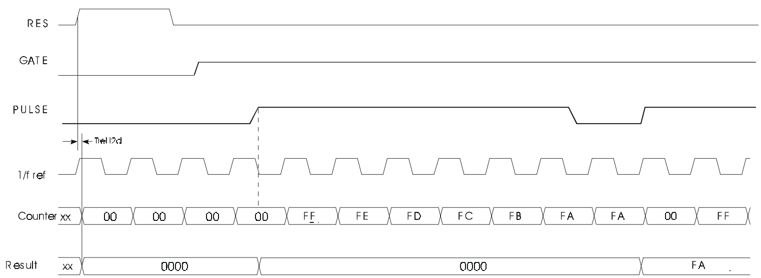
Pin assignment access to counter





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.

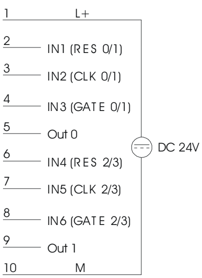


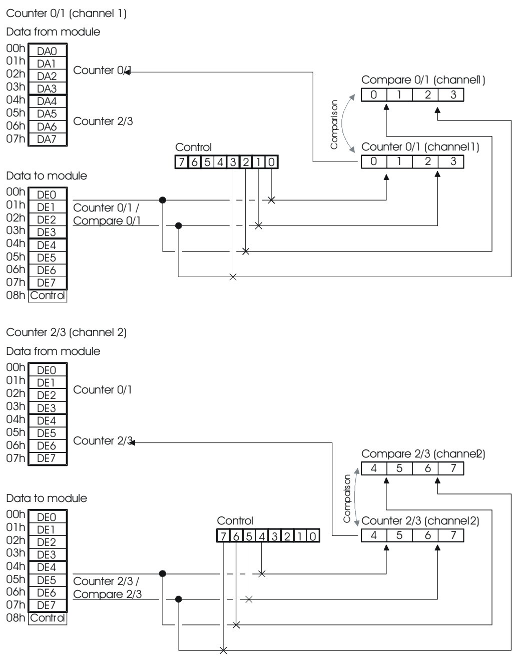
Mode 23 One Shot, direction of count is up, with gate, output signal

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

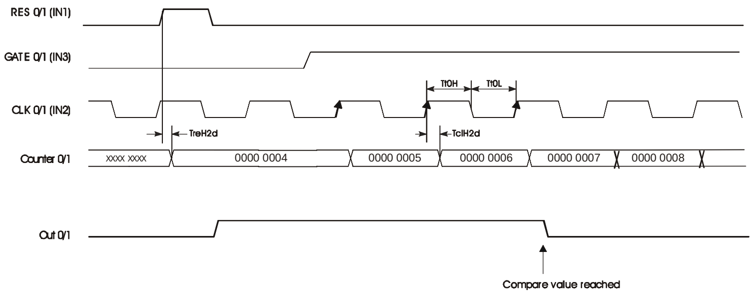
Pin assignment access to counter





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.

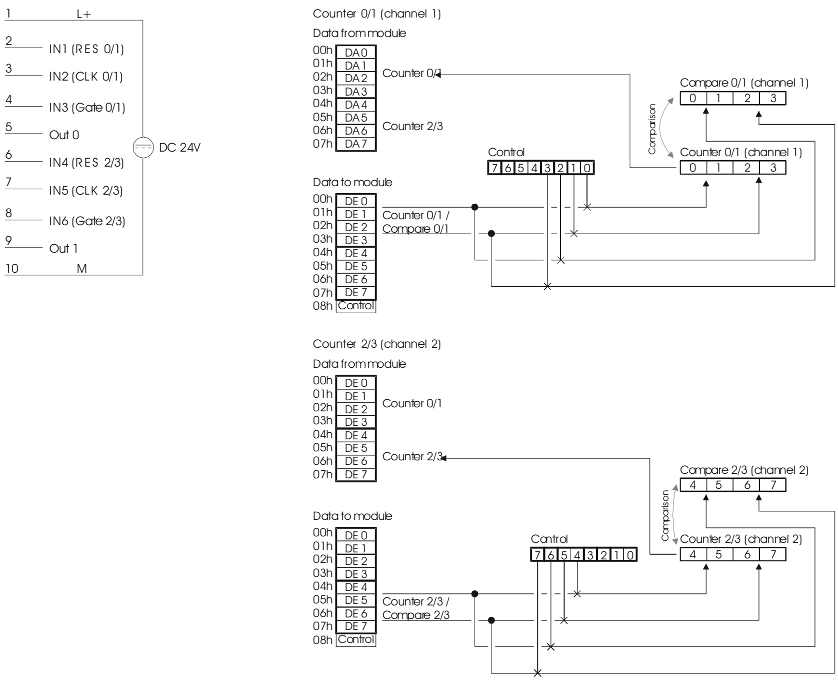
Stop by means of Control = termination

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.

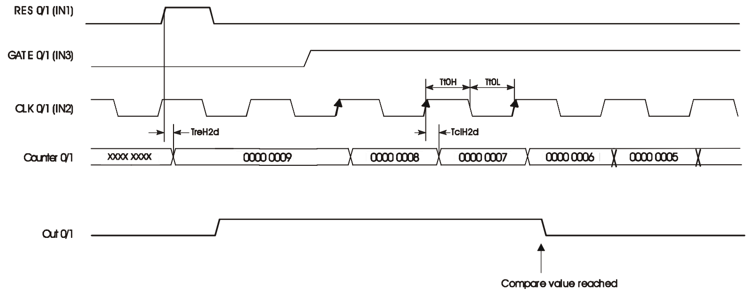
Mode 24 - One Shot, down with Gate-Input, Output set

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.

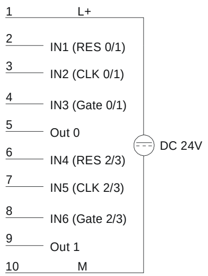
Stop by means of Control = termination

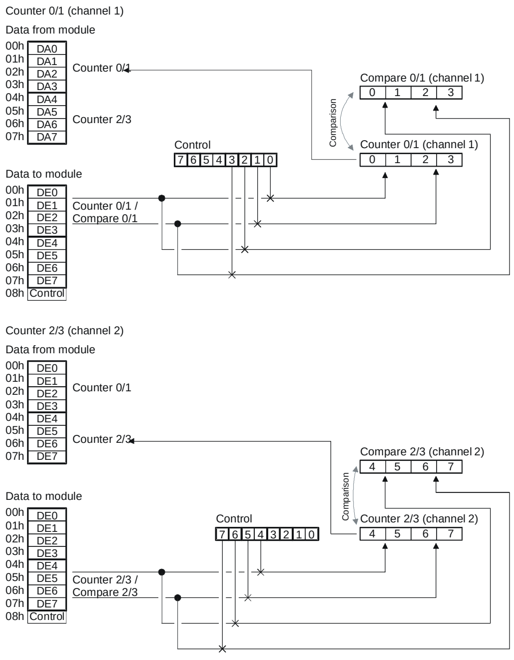
Mode 25 One Shot, direction of count is up, with reset signal

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

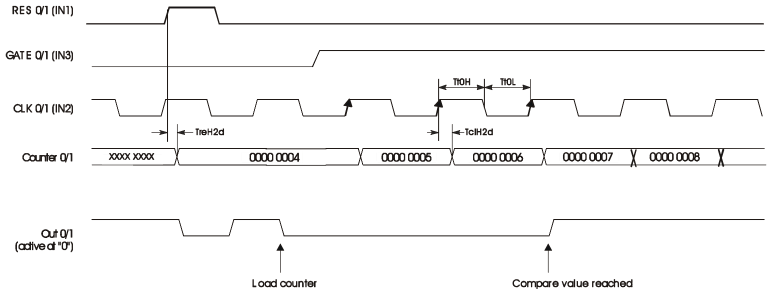
Pin assignment access to counter





Timing diagram

Example of counter 0/1 in mode 25:

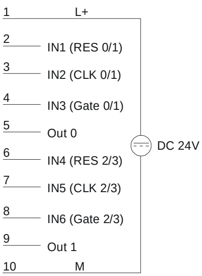


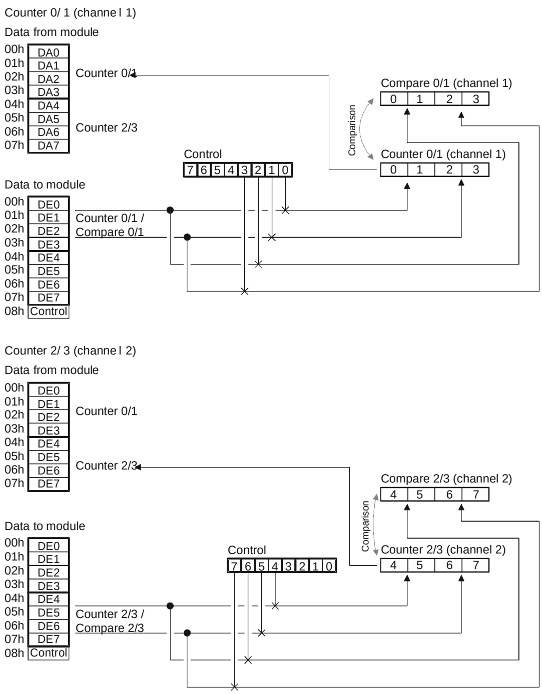
Mode 26 One Shot, direction of count is down, with reset signal

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

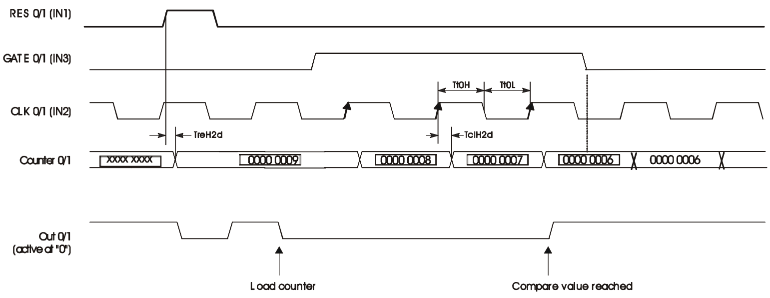
Pin assignment access to counter





Timing diagram

Example of counter 0/1 in mode 26:



Counter module

FM 250

Electrical data	Advantech 250-1BA0
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	80 mA via back panel bus
Isolation	yes
Output stage	24 V_{DC} high side switch 0, 5 A
Ext. power supply	24 V_{DC} (18 ... 28, 8 V)
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	100 g

6 Power supplies

Overview

This chapter contains descriptions of the ADAM-8000 power supplies.

Below follows a description of the:

- Power supply 2 A
- Power supply 4 A
- Installation and wiring
- Technical data

Ordering details

Order number	Description
ADAM 8207-1BA00	Power supply primary AC 100...240 V, secondary DC24 V, 2 A, 48 W

Safety precautions

Appropriate use

The power supplies were designed and constructed:

- to supply 24 V_{DC} to the ADAM-8000 components
- to be installed on a t-rail along with ADAM-8000 components
- to operate as 24 V_{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 ADAM-8000 power supplies.

Danger!

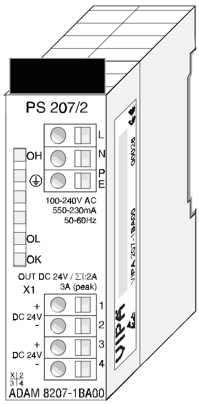
- The power supplies must be installed in protected environments that are only accessible to properly qualified maintenance staff!
- The power supplies are not certified for applications in explosive environments (EX-zone)!
- You must disconnect the power supply from the main power source before commencing 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 ADAM-8000 power supplies are provided with a wide-range-input that can be connected to 100 ... 240 V_{AC}. The output voltage is 24 V_{DC} at 2 A/48 W or 4A/96 W.

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 ADAM-8000 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
ADAM 8207-1BA00	Power supply primary AC 100...240 V, secondary DC24 V, 2 A, 48 W

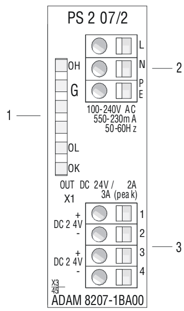
Power supply PS 207/2, 2A

Properties

The power supply is distinguished by the following properties:

- Wide-range-input 100...240 V_{AC} without manual intervention
- 24 V_{DC}, 2 A, 48 W output
- Can be installed on a t-rail together with other ADAM-8000 components or as “stand alone” devices
- Protection from short-circuits, overload and open circuits
- Typically 90% efficiency at Irated

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. 4 A.
OK	green	Turned on when the power supply operates properly and supplies 24 V_{DC} power.

Note!
Only one LED is on when the unit operates.

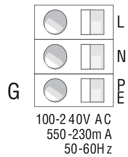
When all the LED’s are extinguished while the power supply is operational a short circuit is present or the power supply has failed.

Connector wiring

Input voltage INPUT 100...240V AC

The power supply must be connected to a source of AC power via the input connector.

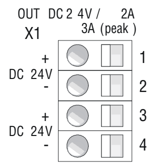
A fuse protects the input from overloads.



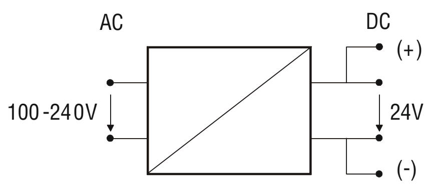
Output voltage OUTPUT 24 V_{DC}, 2A

Two connectors are provided for connection to System 200V modules that require an external source of 24 V_{DC}.

Both outputs are protected against short circuits protected and have an output voltage of 24 V_{DC} with a total current of 2 A 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 ADAM-8000 on the same T-rail. In this case the power supply must only be installed at one end of your ADAM-8000 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

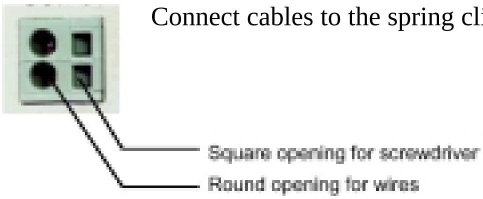
Wiring

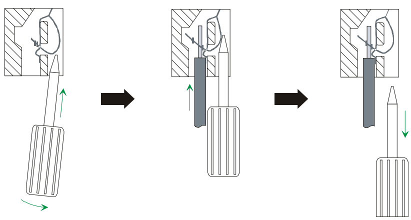
The connections to the power supply are provided by WAGO spring clip terminals.

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		100 ... 240 V_{AC}
Frequency		50 Hz / 60 Hz
Rated input current		0, 24 A / 230 V_{AC}
	power on surge	15A max.
Buffer time (at a mains voltage AC ≥150 V)		min.10 ms
Rated output voltage		24 V_{DC} ±5 %
	Ripple	< 100 mVss incl. Spikes
	Open circuit protection	yes
Rated output current		2A (50 W); 3A (peak)
Efficiency		typ. 90% at Irated
Dissipation		5 W 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 2 x 24 V_{DC} in parallel
Mechanical data		
Dimensions (W x H x D)		25,4 x 76 x 76 mm
Weight		250 g
Ordering details		
AC 100 V-240 V_{DC} 24 V/2 A		ADAM 8207-1BA00

7

Digital input modules

Overview

This chapter contains a description of the construction and the operation of the Advantech digital input modules.

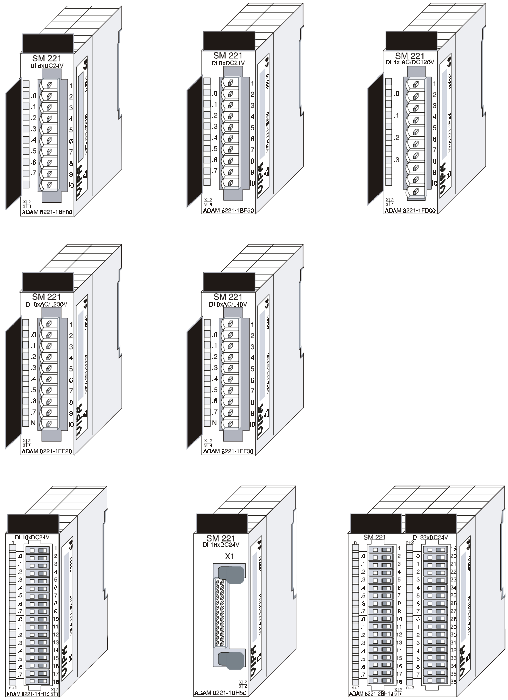
Below follows a description of:

- A system overview of the digital input modules
- Properties
- Constructions
- Interfacing and schematic diagram
- Technical data

System overview

Input modules SM 221

Here follows a summary of the digital input modules that are currently available from Advantech:



Ordering details input modules

Type	Order number	Page
DI 8xDC24V	ADAM 8221-1BF00	11-4
DI 8xDC24V active low input	ADAM 8221-1BF50	11-6
DI 4xAC/DC 90...230V	ADAM 8221-1FD00	11-8
DI 8xAC/DC 60...230V	ADAM 8221-1FF20	11-10
DI 8xAC/DC 24...48V	ADAM 8221-1FF30	11-14
DI 16xDC24V	ADAM 8221-BH10	11-16
DI 16xDC24V active low input	ADAM 8221-BH50	11-18
DI 32xDC24V	ADAM 8221-2BL10	11-20

DI 8xDC24V

Ordering details

DI 8xDC24V	ADAM 8221-1BF00

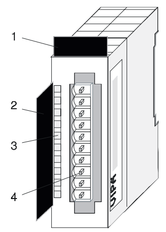
Description

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
- 24 V_{DC} rated input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of an LED

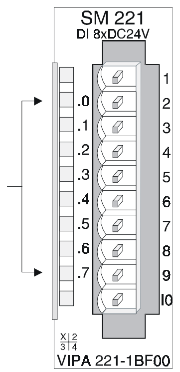
Construction



[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

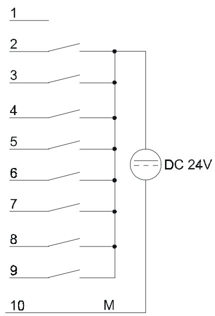
LED	Description
.0... .7	LED's (green) E.0 to E.7 A "1" signal level is recognized as of app. 15V and the respective LED is turned on

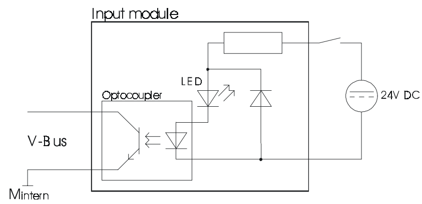


Pin	Assignment
1	not connected
2	Input E.0
3	Input E.1
4	Input E.2
5	Input E.3
6	Input E.4
7	Input E.5
8	Input E.6
9	Input E.7
10	Ground

Wiring diagram and schematic

Wiring diagram **Schematic diagram**





Technical data

Electrical data	ADAM 8221-1BF00
Number of inputs	8
Rated input voltage	24 V_{DC} (18 ... 28, 8 V)
Signal voltage “0”	0 ... 5 V
Signal voltage “1”	15 ... 28, 8 V
Input filter time delay	3 ms
Input current	typ. 7 mA
Power supply	5 V via back panel bus
Current consumption via back panel bus	20 mA
Isolation	500 Vrms (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 (W x H x D) in mm	25, 4 x 76 x 76
Weight	50 g

DI 8xDC24V active low input

Ordering details

DI 8xDC24V active low input ADAM 8221-1BF50

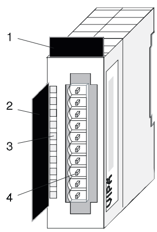
Description

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)
- 24 V_{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

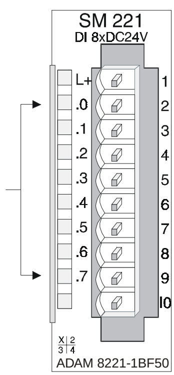
[2] Label for the bit address with description

[3] LED status indicator

[4] Edge connector

Status indicator connector assignment

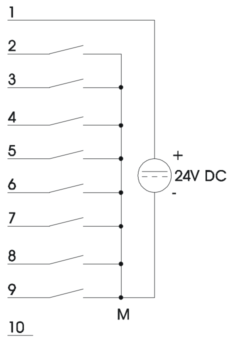
LED	Description
.0... .7	LED’s (green)
	E.0 to E.7
	when an input is at ground a “1” is detected and the respective LED is turned on



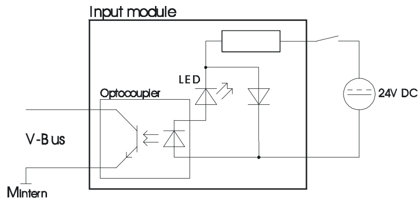
Pin	Assignment
1	+DC24V
2	Input E.0
3	Input E.1
4	Input E.2
5	Input E.3
6	Input E.4
7	Input E.5
8	Input E.6
9	Input E.7 / Ground
10	reserved

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	ADAM 8221-1BF50
Number of inputs	8
Rated input voltage	24V DC (18 ... 28,8V)
Signal voltage “0”	15 ... 28, 8 V
Signal voltage “1”	0 ... 5 V
Input filter time delay	3 ms
Input current	typ. 7 mA
Power supply	5 V via back panel bus
Current consumption via back panel bus	20mA
Isolation	500 Vrms (field voltage - back panel bus)
Status indicator	via LED’s located on the front
Programming specifications	
Input data	1 Byte
Output data	-
Parameter data	-
Diagnosticdata	-
Dimensions and weight	
Dimensions (W x H x D) in mm	25, 4 x 76 x 76
Weight	50 g

DI 4xAC/DC 90...230V

Ordering details

DI 4xAC/DC 90...230V ADAM 8221-1FD00

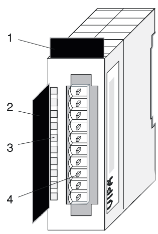
Description

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 ... 230 V AC/DC

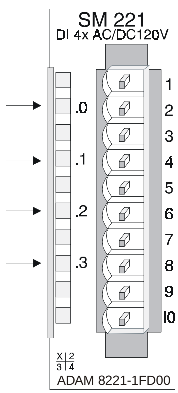
Construction



[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

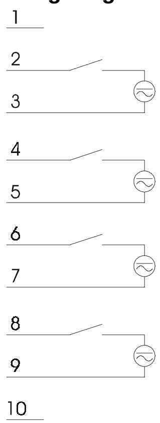
LED	Description
.0	LED's (green)
.1	E.0 to E.3
.2	from app. 80 V_{DC} or
.3	65 V_{AC} (50 Hz) a signal "1" is detected and the respective LED is turned on



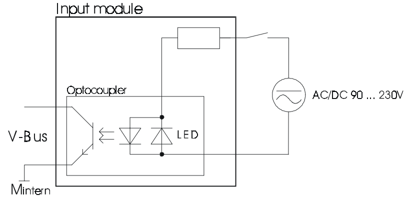
Pin	Assignment
1	not connected
2	E.0
3	Neutral conductor E.0
4	E.1
5	Neutral conductor E.1
6	E.2
7	Neutral conductor E.2
8	E.3
9	Neutral conductor E.3
10	not connected

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	ADAM 8221-1FD00
Number of inputs	4
Rated input voltage	AC/DC 90 ... 230 V
Signal voltage “0”	AC/DC 0 ... 35 V
Signal voltage “1”	AC/DC 90 ... 230 V
Input filter time delay	25 ms
Frequency of input voltage	50 ... 60 Hz
Input resistor	136 kΩ
Power supply	5 V via back panel bus
Current consumption via back panel bus	80 mA
Isolation	500 Vrms (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 (W x H x D) in mm	25, 4 x 76 x 76
Weight	50 g

DI 8xAC/DC 60...230V

Ordering details

DI 8xAC/DC 60...230V ADAM 8221-1FF20

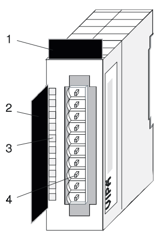
Description

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 ... 230 VAC/DC
- Status indicator for each channel by means of an LED

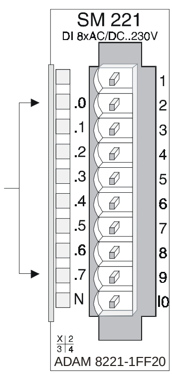
Construction



[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

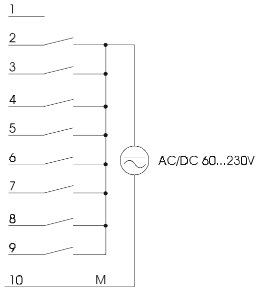
LED	Description
.0... .7	LED's (green) E.0 to E.7 from app. 55 V_{DC} or 45 V_{AC} (50 Hz) a signal "1" is detected and the respective LED is turned on



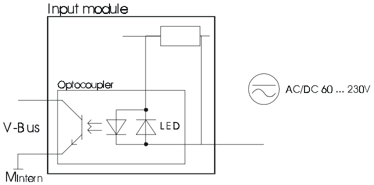
Pin	Assignment
1	not connected
2	Input E.0
3	Input E.1
4	Input E.2
5	Input E.3
6	Input E.4
7	Input E.5
8	Input E.6
9	Input E.7
10	Neutral conductor

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	**ADAM 8221-1FF20**
Number of inputs	8
Rated input voltage	AC/DC 60 ... 230 V
Signal voltage “0”	AC/DC 0 ... 35 V
Signal voltage “1”	AC/DC 60 ... 230 V
Input filter time delay	25 ms
Frequency of input voltage	50 ... 60 Hz
Input resistor	136 k
Power supply	5 V via back panel bus
Current consumption via back panel bus	80 mA
Isolation	500 Vrms (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 (W x H x D) in mm	25, 4 x 76 x 76
Weight	50 g

DI 8xAC/DC 24...48V

Ordering details

DI 8xAC/DC 24...48V ADAM 8221-1FF30

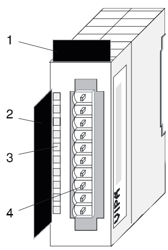
Description

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

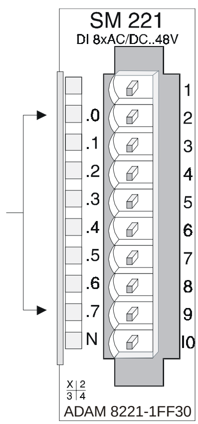
[2] Label for the bit address with description

[3] LED status indicator

[4] Edge connector

Status indicator connector assignment

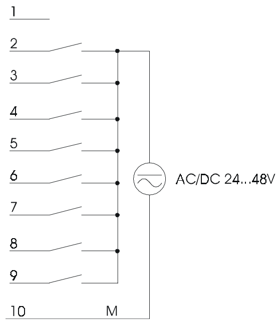
LED	Description
.0... .7	LED's (green) E.0 to E.7 from app. 14 V_{DC} or 12V_{AC} (50Hz) a signal "1" is detected and the respective LED is turned on



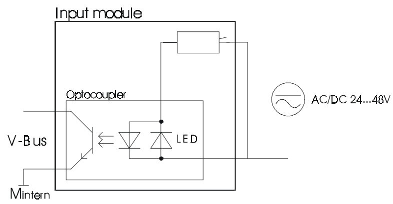
Pin	Assignment
1	not connected
2	Input E.0
3	Input E.1
4	Input E.2
5	Input E.3
6	Input E.4
7	Input E.5
8	Input E.6
9	Input E.7
10	Neutral conductor

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	ADAM 8221-1FF30
Number of inputs	8
Rated input voltage	AC/DC 24 ... 48 V
Signal voltage “0”	AC/DC 0 ... 8 V
Signal voltage “1”	AC/DC 18 ... 48 V
Input filter time delay	25ms
Frequency of input voltage	50 ... 60 Hz
Input resistor	16, 4 k
Power supply	5 V via back panel bus
Current consumption via back panel bus	80 mA
Isolation	500 Vrms (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 (W x H x D) in mm	25, 4 x 76 x 76
Weight	50 g

DI 16xDC24V

Ordering details

DI 16xDC24V ADAM 8221-1BH10

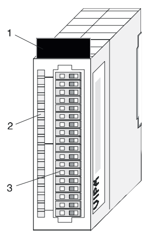
Description

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
- 24 V_{DC} rated input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of an LED

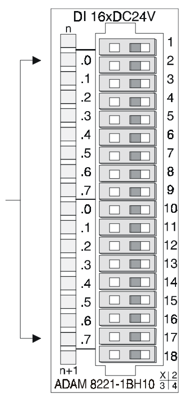
Construction



[1] Label for the name of the module
[2] LED status indicator
[3] Edge connector

Status indicator connector assignment

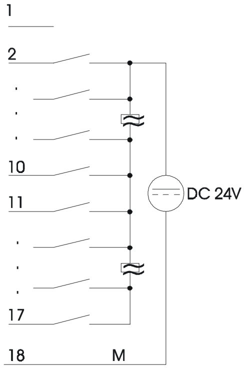
LED	Description
.0 7	LED's (green)
	E.0 to E.7 (per byte) A "1" signal level is recognized as of app. 15V and the respective LED is turned on

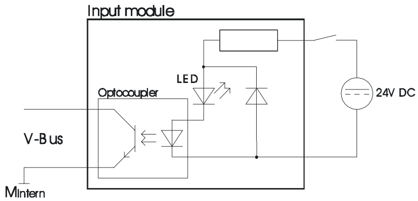


Pin	Assignment
1	not connected
2	Input E.0
3	Input E.1
4	Input E.2
.	.
.	.
.	.
15	Input E.13
16	Input E.14
17	Input E 15
18	Ground

Wiring and schematic diagram

Wiring diagram **Schematic diagram**





Technical data

Electrical data	ADAM 8221-1BH10
Number of inputs	16
Rated input voltage	24 V_{DC} (18 ... 28, 8 V)
Signal voltage “0”	0 ... 5 V
Signal voltage “1”	15 ... 28, 8 V
Input filter time delay	3 ms
Input current	typ. 7 mA
Power supply	5 V via back panel bus
Current consumption via back panel bus	20 mA
Isolation	500 Vrms (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 (W x H x D) in mm	25, 4 x 76 x 76
Weight	50 g

DI 16xDC24V active low input

Ordering details

DI 16xDC24V active low input ADAM 8221-1BH50

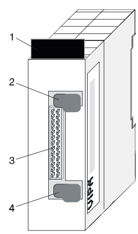
Description

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)
- 24 V_{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

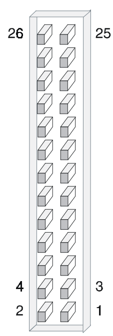
[3] Recessed connector for the interface to a conversion module UB4x via the flattened round cable

[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

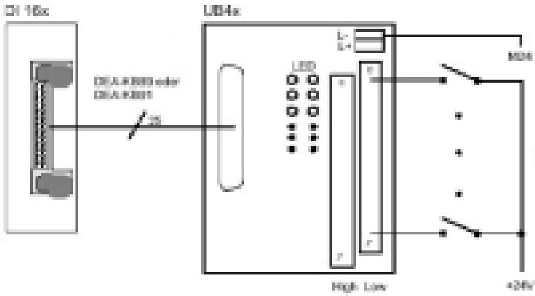
Connector



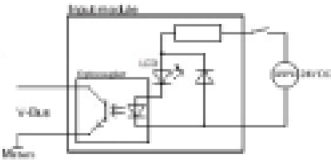
Connector assignment module

Pin	Assignment
23...26	Supply voltage
22	+24V DC
21	Input E.0
.	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	ADAM 8221-1BH50
Number of inputs	16
Rated input voltage	24 V_{DC} (18 ... 28, 8 V)
Signal voltage “0”	15 ... 28, 8 V
Signal voltage “1”	0 ... 5 V
Input filter time delay	3 ms
Input current	typ. 7 mA
Power supply	5 V via back panel bus
Current consumption via back panel bus	20 mA
Isolation	500 Vrms (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 (W x H x D) in mm	25, 4 x 76 x 76
Weight	50 g

DI 32xDC24V

Ordering details

DI 32xDC24V ADAM 8221-2BL10

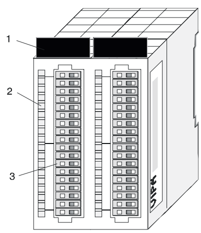
Description

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
- 24 V_{DC} rated input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of an LED

Construction



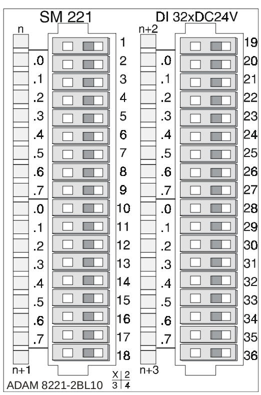
[1] Label for the name of the module

[2] LED status indicator

[3] Edge connector

Status indicator connector assignment

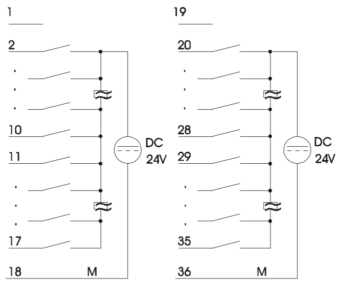
LED	Description
0... .15	LED’s (green) E.0 to E.7 (per byte) A “1” signal level is recognized as of app. 15V and the respective LED is turned on



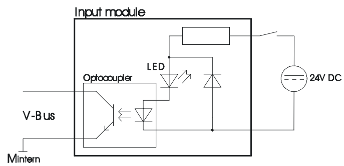
Pin	Assignment
1	Not connected
2...17	Input E.0...E.15
.	.
.	.
.	.
18	Ground
19	Not connected
.	.
.	.
.	.
20 ... 35	Input E.16...E.31
36	Ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	**ADAM 8221-2BL10**
Number of inputs	32
Rated input voltage	24 V_{DC} (18 ... 28, 8 V)
Signal voltage “0”	0 ... 5 V
Signal voltage “1”	15 ... 28, 8 V
Input filter time delay	3 ms
Input current	typ. 7 mA
Power supply	5 V via back panel bus
Current consumption via back panel bus	20 mA
Isolation in 2 groups of 16 inputs each	500 Vrms (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 (W x H x D) in mm	50, 8 x 76 x 76
Weight	50 g

8 Digital output modules

Overview

This chapter contains a description of the construction and the operation of the Advantech digital output modules.

Below follows a description of:

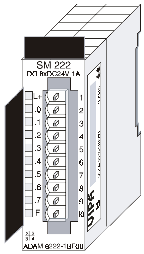
- A system overview of the digital output modules
- Properties
- Construction
- Interfacing and schematic diagram
- Technical data

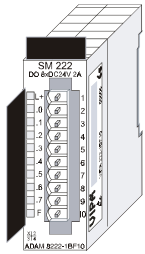
System overview

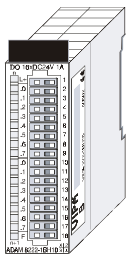
Output modules SM 222

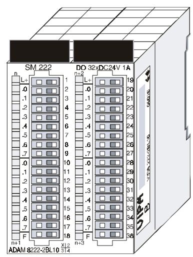
Here follows a summary of the digital output modules that are currently available from Advantech:

DC24V output modules





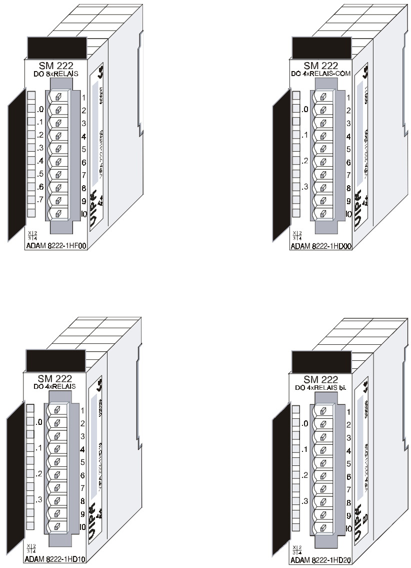




Ordering details DC24V output modules

Type	Order number	Page
DO 8xDC24V 1A	**ADAM 8222-1BF00**	12-4
DO 8xDC24V 2A	**ADAM 8222-1BF10**	12-6
DO 16xDC24V 1A	**ADAM 8222-1BH10**	12-10
DO 32xDC24V 1A	**ADAM 8222-2BL10**	12-14

Relay output module



Ordering details relay output modules

Type	Order number	Page
DO 8xRelais COM	**ADAM 8222-1HF00**	12-16
DO 4xRelais COM	**ADAM 8222-1HD00**	12-18
DO 4xRelais	**ADAM 8222-1HD10**	12-20
DO 4xRelais bistable	**ADAM 8222-1HD20**	12-22

DO 8xDC24V 1A

Ordering details

DO 8xDC24V 1A ADAM 8222-1BF00

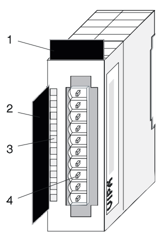
Description

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

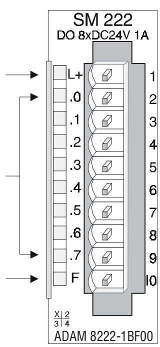
[2] Label for the bit address with description

[3] LED status indicator

[4] Edge connector

Status indicator connector assignment

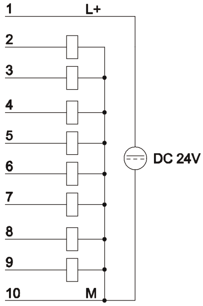
LED	Description
L+	LED (yellow) Supply voltage available
.0... .7	LED's (green) A.0 to A.7 when an output is active the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error



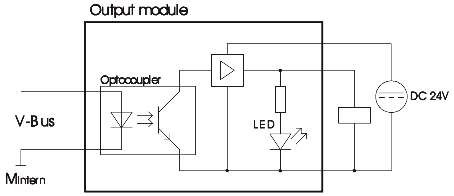
Pin	Assignment
1	24 V_{DC} supply voltage
2	Output A.0
3	Output A.1
4	Output A.2
5	Output A.3
6	Output A.4
7	Output A.5
8	Output A.6
9	Output A.7
10	Supply ground

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	ADAM 8222-1BF00
Number of outputs	8
Rated load voltage	24 V_{DC} (18 ... 35 V) from ext. power supply
No-load current consumption at L+ (all A.x=off)	10 mA
Output current per channel	1 A protected against sustained short circuits
Current consumption via back panel bus	50 mA
Voltage supply	5 V 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 (W x H x D) in mm	25, 4 x 76 x 76
Weight	50 g

DO 8xDC24V 2A

Ordering details

DO 8xDC24V 2A ADAM 8222-1BF10

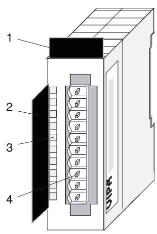
Description

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
- 24 V_{DC} supply voltage
- Output current 2 A
- 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

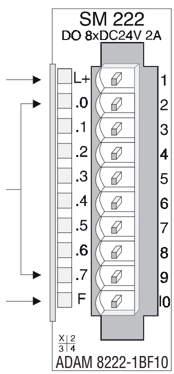
[2] Label for the bit address with description

[3] LED status indicator

[4] Edge connector

Status indicator connector assignment

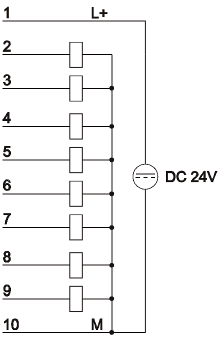
LED	Description
L+	LED (yellow) Supply voltage available
.0... .7	LED’s (green) A.0 to A.7 when an output becomes active the respective LED is turned on
F	LED (red) Overload, overheat, short circuit error



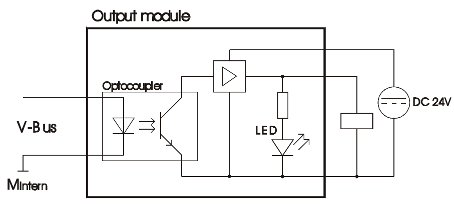
Pin	Assignment
1	24 V_{DC} supply voltage
2	Output A.0
3	Output A.1
4	Output A.2
5	Output A.3
6	Output A.4
7	Output A.5
8	Output A.6
9	Output A.7
10	Supply ground

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	ADAM 8222-1BF10
Number of outputs	8
Rated load voltage	24 V_{DC} (18 ... 35 V) from ext. power supply
No-load current consumption at L+ (all A.x=off)	10 mA
Output current per channel	2 A short circuit protected
Diversity factor	ID=50% (8 A)
Current consumption via back panel bus	50 mA
Total current of all 8 channels	10 A
Voltage supply	5 V 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 (W x H x D) in mm	25, 4 x 76 x 76
Weight	50 g

DO 16xDC24V 1A

Ordering details

DO 16xDC24V 1A ADAM 8222-1BH10

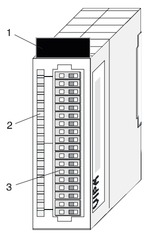
Description

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
- 24 V_{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

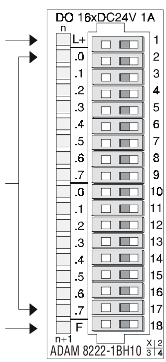
Construction



[1] Label for the name of the module
[2] LED status indicator
[3] Edge connector

Status indicator connector assignment

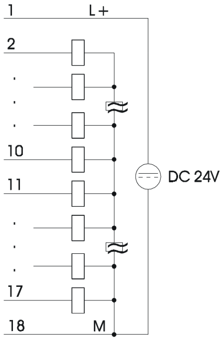
LED	Description
L+	
A.0 ... A.7	ED (yellow)
	Supply voltage available
F	LED's (green)
	A.0 to A.7 (per Byte)
	when an output is active the respective LED is turned on
L	LED (red)
	Overload, overheat or short circuit error



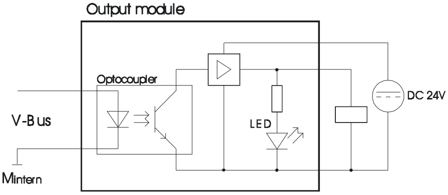
Pin	Assignment
1	24 V_{DC} supply voltage
2	Output A.0
3	Output A.1
.	.
.	.
.	.
16	Output A.14
17	Output A.15
18	Supply ground

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	ADAM 8222-1BH10
Number of outputs	16
Rated load voltage	24 V_{DC} (18 ... 35 V) from ext. power supply
No-load current consumption at L+ (all A.x=off)	10 mA
Output current per channel	1A short circuit protected
max. total current	10 A
Current consumption via back panel bus	85 mA
Voltage supply	5 V 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 (W x H x D) in mm	25, 4 x 76 x 76
Weight	50 g

DO 32xDC24V 1A

Ordering details

DO 32xDC24V 1A ADAM 8222-2BL10

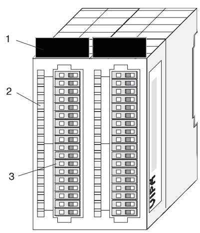
Description

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
- 24 V_{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



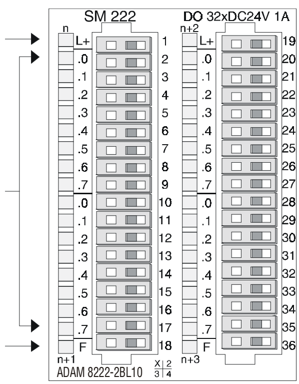
[1] Label for the name of the module

[2] LED status indicator

[3] Edge connector

Status indicator connector assignment

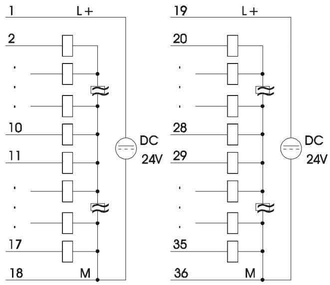
LED	Description
L+	LED (yellow) Supply voltage available
.0 7	LED’s (green) A.0 to A.7 (per Byte) when an output is active the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error



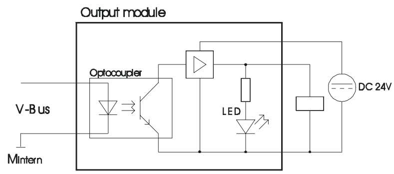
Pin	Assignment
1	24 V_{DC} supply voltage
2	Output A.0
3	Output A.1
…	…
17	Output A.15
18	Supply ground
19	24 V_{DC} supply voltage
20	Output A.16
…	…
34	Output A.30
35	Output A.31
36	Supply ground

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Technical data

Electrical data	ADAM 8222-2BL10
Number of outputs	32
Rated load voltage	24 V_{DC} (18 ... 35V) from ext. power supply
No-load current consumption at L+ (all A.x=off)	15 mA
max. Output current per channel	1A short circuit protected
max. Contact load	10 A
Current consumption via back panel bus	165 mA
Voltage supply	5 V 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 (W x H x D) in mm	50, 8 x 76 x 76
Weight	50 g

DO 8xRelais COM

Ordering details

DO 8xRelais COM ADAM 8222-1HF00

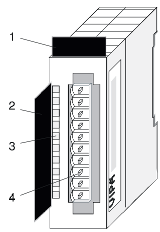
Description

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 230 V / DC 30 V_{AC}
- Output current per channel 5A (230 V / DC 30 V_{AC})
- Suitable for motors, lamps, magnetic valves and DC contactors
- Active channel indication by means of an LED

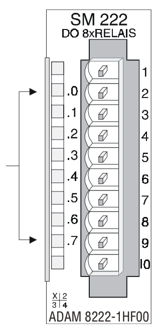
Construction



[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

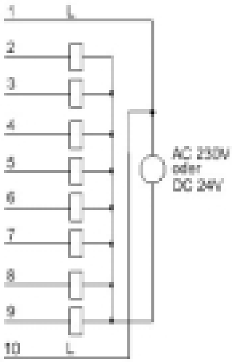
LED	Description
.0... .7	LED's (green) A.0 to A.7 when an output is active the respective LED is turned on



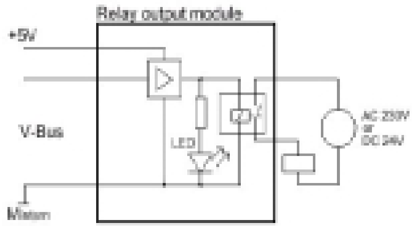
Pin	Assignment
1	Supply voltage L
2	Relay output. A.0
3	Relay output. A.1
4	Relay output. A.2
5	Relay output. A.3
6	Relay output. A.4
7	Relay output. A.5
8	Relay output. A.6
9	Relay output. A.7
10	Supply voltage L

Wiring diagram and schematic

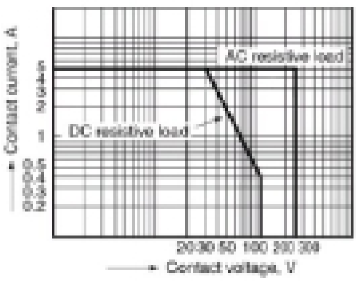
Wiring diagram



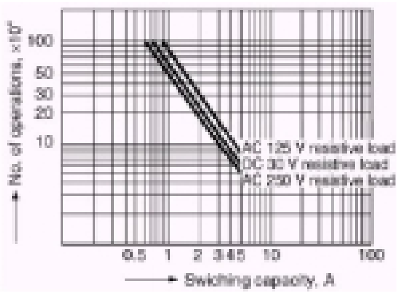
Schematic diagram



Maximum load



Service life



Technical data

Electrical data	ADAM 8222-1HF00
Number of outputs	8 via relay
Rated load voltage	230 V_{AC} or 30 V_{DC} max.
No-load current consumption at L+ (all A.x=off)	-
Total current	with 1 L: max. 8 A with 2 L: max. 16 A
max. Output current per channel	AC 230 V: 5 A / DC 30 V: 5A
Current consumption via back panel bus	250 mA
Voltage supply	5 V via back panel bus
Switching rate	max. 100 Hz
Status indicator	via LED’s located on the front
Programming specifications	
Input data	-
Outputdata	1 Byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (W x H x D) in mm	25, 4 x 76 x 76
Weight	80 g

DO 4xRelais COM

Ordering details

DO 4xRelais COM ADAM 8222-1HD00

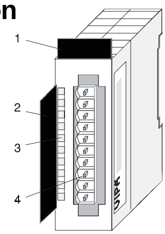
Description

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 230 V/ DC 30 V_{AC}
- Output current per channel 5 A (230 V / DC 30 V_{AC})
- Suitable for motors, lamps, magnetic valves and DC contactors
- Active channel indication by means of an LED

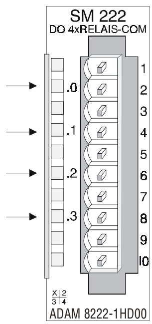
Construction



[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

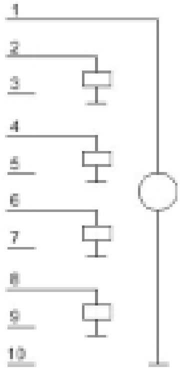
LED	Description
.0... .3	LED’s (green) A.0 to A.3 when an output is active the respective LED is turned on



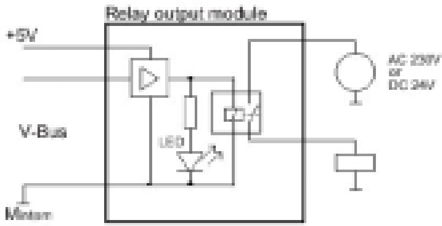
Pin	**Assignment**
1	Supply voltage
2	Relay output. A.0
3	not connected
4	Relay output. A.1
5	not connected
6	Relay output. A.2
7	not connected
8	Relay output. A.3
9	not connected
10	Supply voltage

Wiring diagram and schematic

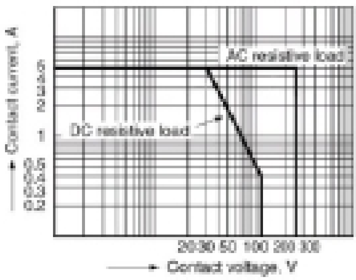
Wiring diagram



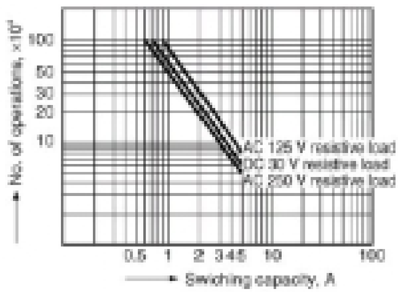
Schematic diagram



Maximum load



Service life



Technical data

Electrical data	ADAM 8222-1HD00
Number of outputs	4 via relay
Rated load voltage	230 V_{AC} or 30 V_{DC}
No-load current consumption at L+ (all A.x=off)	-
Total current	max. 8 A
max. Output current per channel	AC 230V: 5A / DC 30V: 5A
Current consumption via back panel bus	125 mA
Voltage supply	5 V via back panel bus
Switching rate	max. 100 Hz
Status indicator	via LED's located on the front
Programming specifications	
Input data	-
Outputdata	1 Byte (Bit 0 ... Bit 3)
Parameter data	-
Diagnosticdata	-
Dimensions and weight	
Dimensions (W x H x D) in mm	25, 4 x 76 x 76
Weight	80 g

DO 4xRelais

Ordering details

DO 4xRelais ADAM 8222-1HD10

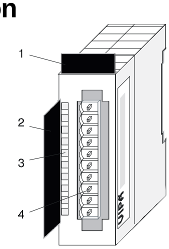
Description

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 230 V_{AC} / 30 V_{DC} (may be mixed)
- Max. output current per channel 5 A (230 V_{AC} / 30V_{DC})
- Suitable for motors, lamps, magnetic valves and DC contactors
- Active channel indication by means of an LED

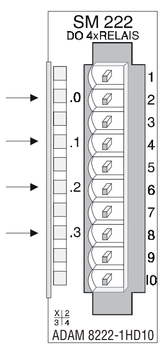
Construction



[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

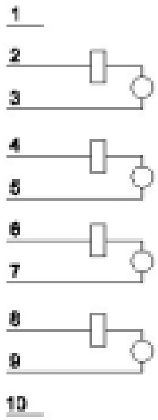
LED	Description
.0... .3	LED's (green) A.0 to A.3 when an output is active the respective LED is turned on



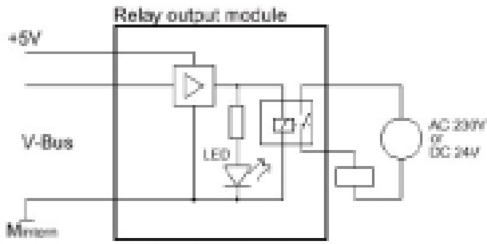
Pin	Assignment
1	not connected
2+3	Relay output. A.0
4+5	Relay output. A.1
6+7	Relay output. A.2
8+9	Relay output. A.3
10	not connected

Wiring diagram and schematic

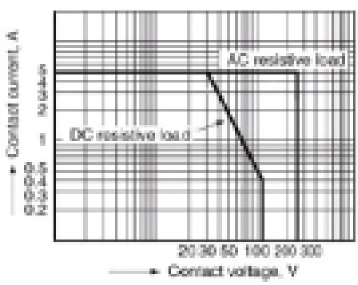
Wiring diagram



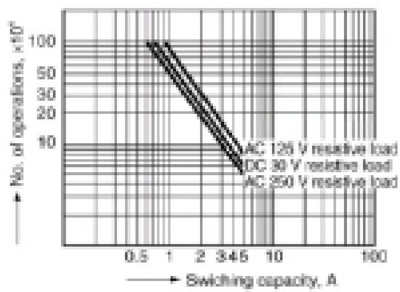
Schematic diagram



Maximum load



Service life



Technical data

Electrical data	ADAM 8222-1HD10
Number of outputs	4 via relay
Rated load voltage	230 V_{AC} or max. 30 V_{DC}
max. Output current	230 V_{AC}: 5 A / 30 V_{DC}: 5 A
Current consumption via back panel bus	125 mA
Voltage supply	5 V via back panel bus
Switching rate	max. 100 Hz
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 (W x H x D) in mm	25, 4 x 76 x 76
Weight	80 g

DO 4xRelais bistable

Ordering details

DO 4xRelay bistable ADAM 8222-1HD20

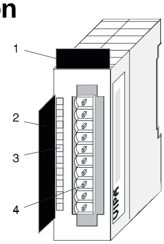
Description

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 230 V_{AC} / 30 V_{DC} (may be mixed)
- Max. Output current per channel 16A (230V_{AC} / 30 V_{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

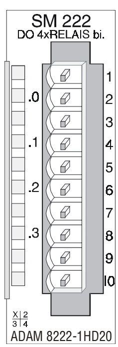
[3] LED's (not used)

[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

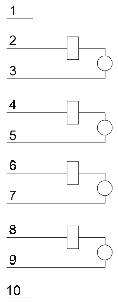
When one of bits 0...3 is set the respective channel is activated. Setting one of bits 4..7 resets the respective output after at least 50ms.



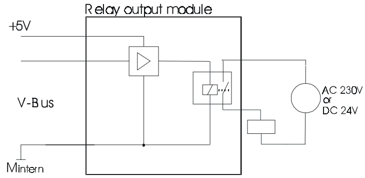
Pin	Assignment
1	not connected
2+3	Relay output. A.0
4+5	Relay output. A.1
6+7	Relay output. A.2
8+9	Relay output. A.3
10	not connected

Wiring diagram and schematic

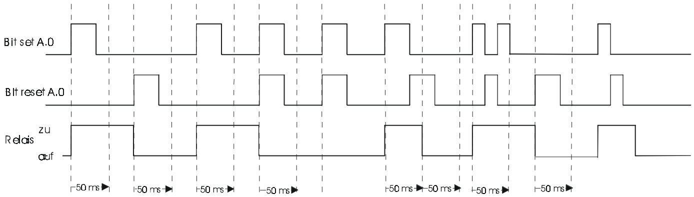
Wiring diagram



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	ADAM 8222-1HD20
Number of outputs	4 via relay
Rated load voltage	230 V_{AC} or 30 V_{DC}
max. Output current per channel	AC 230 V: 16 A/DC 30 V: 16 A
Current consumption via back panel bus	125 mA
Voltage supply	5 V via back panel bus
Switching rate	max. 100 Hz
Status indicator	-
Programming specifications	
Input data	-
Output data	1 Byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (W x H x D) in mm	25, 4 x 76 x 76
Weight	80 g

9

Analog input modules

Overview

This chapter contains a description of the construction and the operation of the Advantech analog input modules.

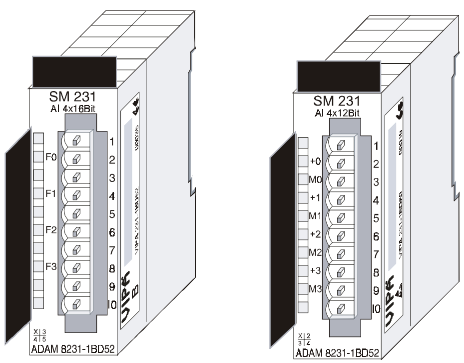
Below follows a description of:

- A system overview of the analog input modules
- Properties
- Constructions
- Interfacing and schematic diagram
- Technical data

System overview

Input modules SM 231

Here follows a summary of the analog input modules that are currently available from Advantech:



Ordering details input modules

Type	Order number
AI4x16Bit, multi-input	ADAM 8231-1BD52
AI4x12Bit, 4 ... 20mA, isolated	ADAM 8231-1BD60

General

Cabling for analog signals

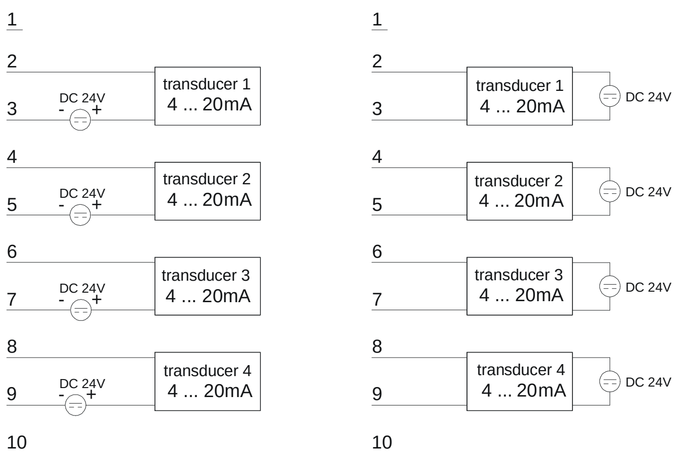
You should only use screened twisted pair cable when you are connecting analogue signals. These cables reduce the effect of electrical interference. The screen of the analogue signal cable should be grounded at both ends. In situations where the equipment at the being connected by the cable is at different 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:

2-Wire interfacing **4- Wire interfacing**



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 ADAM 8231-1BD52

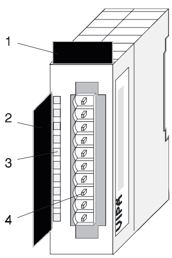
Description

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.

- 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 5 V
- LED for signaling open circuits in current loop operation
- Diagnostic function

Properties Construction



[1] Label for the name of the module

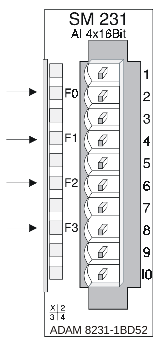
[2] Label for the bit address with description

[3] LED status indicator

[4] Edge connector

Status indicators Connector assignment

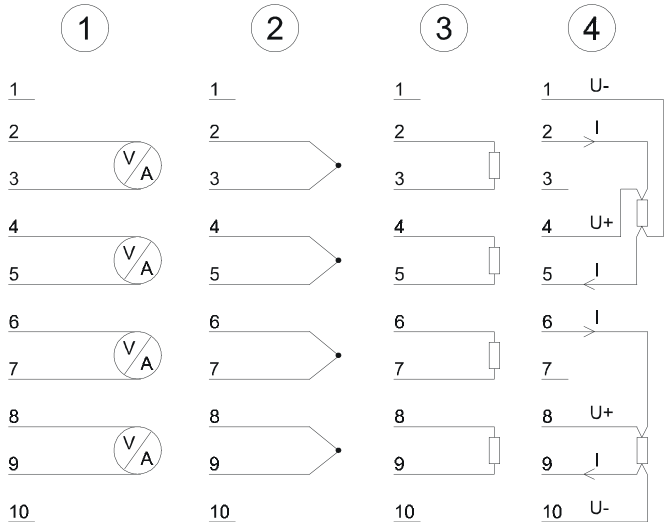
LED	Description
F0 ... F3	LED (red): turned on when an open circuit exists on the 4 ... 20 mA sensor circuits blinks when the current > 40 mA current sensor circuits



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 ADAM 8231-1BD52 was developed from the ADAM 8231-1BD52. 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 .. +50°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)
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 complement1)2)5)	1)2)4) ±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)

No.	Function	Measurement range/representation	Tolerance	Conn.
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...50 mV Siemens S7-format	0...50 mV/59, 25 mV = maximum usable range before over range occurs (32767) 0...50 mV = rated value (0...27648)	1) ±0,1% of final value	(1)
28h	Voltage ±10 V Siemens S7-format	±11, 85 V/11,85 V = max. value before over range occurs (32767) -10...10 V= rated range (-27648...27648) -11, 85 V= min. value before under range (-32767) two's complement	1) ±0,05% of final value	(1)
29h	Voltage ±4 V Siemens S7-format	±4, 74 V/4, 74 V = max. value before over range occurs (32767) -4...4 V = rated range (-27648...27648) -4, 74 V = min. value before under range (-32767) two's complement	1) ±0,05% of final value	(1)
2Ah	Voltage ±400 mV Siemens S7-format	±0, 474 V/474 mV = max. value before over range occurs (32767) -400...400 mV = rated range (-27648...27648) -474 mV = min. value before under range (-32767) two's complement	1) ±0,1% of final value	(1)
2Bh	Voltage ±10 V Siemens S5-format	±11, 85 V /12, 5 V = max. value before over range occurs (20480) -10...10 V = rated range (-16384...16384) -12, 5 V = min. value before under range (-20480) Numeric representation: same as for AI 4x12Bit	1) ±0,2% of final value	(1)
2Ch	Current ±20 mA Siemens S7-format	±23, 70 mA /23, 70 mA = max. value before over range occurs (32767) -20...20 mA = rated value (-27648...27648) -23, 70 mA = min. value before under range (-32767) two's complement	1) ±0,05%of final value	(1)
2Dh	Current 4...20 mA Siemens S7-format	1,185 .. +22, 96 mA/22, 96 mA = max. value before over range occurs (32767) 4 ... 20 mA = rated range (0...27648) 0 mA = min. value before under range (-5530)	1) ±0,05% of final value	(1)
2Eh	Current 4 ... 20 mA Siemens S5-format	1,185 .. +22, 96 mA /22,96 mA = max. value before over range occurs (20480) 20 mA = 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 ±20 mA Siemens S5-format	±23, 70 mA /23, 70 mA = max. value before over range occurs (19456) -20...20 mA = rated value (-16384...16384) -23,70 mA = 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)

No.	Function	Measurement range/representation	Tolerance	Conn.
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...50 mV	0...50 mV /59.25 mV = max. value before over range occurs (5925) 0...50 mV = rated range (0...5000) two's complement	[1]) ±0,1% of final value	(1)
58h	Voltage ±10V	±11, 85 V / 11, 85 V= max. value before over range -10...10 V= rated range (-10000...10000) -11, 85 V= min. value before under range (-11850) two's complement	[1]) ±0,05% of final value	(1)
59h	Voltage ±4V	±4, 74 V /4, 74 V = max. value before over range occurs (47400) -4...4 V = rated range (-40000...40000) -4, 74 V = min. value before under range (-47400) two's complement	[1]) ±0,05% of final value	(1)
5Ah	Voltage ±400 mV	±0, 474 V/474 mV = max. value before over range occurs (47400) -400...400 mV = rated range (-40000...40000) -474 mV = min. value before under range (-47400) two's complement	[1]) ±0,1% of final value	(1)
5Ch	Current ±2 0 mA	±23, 70 mA /23, 70 mA = max. value before over range occurs (23700) -20... 20 mA = rated value (-20000...20000) -23, 70 mA = min. value before under range (-23700) two's complement	[1]) ±0,05% of final value	(1)
5Dh	Current 4...2 0 mA	1, 185 .. +22, 96 mA /22 ,96 mA = max. value before over range occurs (22960) 4...20 mA = rated range (0...16000) 0 mA = 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:

$$Value = 27648 \bullet \frac{U}{10}, \qquad U = Value \bullet \frac{10}{27648}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0V	0	0000
5V	8192	2000
10V	16384	4000

Formulas for the calculation:

$$Value = 16384 \bullet \frac{U}{10}, \qquad U = Value \bullet \frac{10}{16384}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
+1V	0	0
+3V	+13824	3600
+5V	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \bullet \frac{U-1}{10}, \qquad U = Value \bullet \frac{4}{27648} + 1$$

U: voltage, Value: decimal value

+/-4V

Voltage	Decimal	Hex
-4V	-27648	9400
0V	0	0
4V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \bullet \frac{U}{4}, \qquad U = Value \bullet \frac{4}{27648}$$

U: voltage, Value: decimal value

+/-400mV

Voltage	Decimal	Hex
-4V	-27648	9400
0V	0	0
4V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \bullet \frac{U}{400}, \qquad U = Value \bullet \frac{400}{27648}$$

U: voltage, Value: decimal value

4....20mA

Current	Decimal	Hex
+4 mA	0	0
+12 mA	+13824	3600
+20 mA	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \bullet \frac{I - 4}{16}, \qquad I = Value \bullet \frac{16}{27648} + 4$$

I: voltage, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20 mA	-27648	9400
-10 mA	-13824	CA00
0 mA	0	0
+10 mA	+13824	3600
+20 mA	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \bullet \frac{I}{20}, \qquad I = Value \bullet \frac{20}{27648}$$

I: voltage, 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 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	Defaul
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	ADAM 8231-1BD52
Number of inputs	4 differential inputs
Input resistance	inductive:10 M (voltage range) capacitive:100 K(voltage range) 50Ω (current range)
Power supply	5 V via back panel bus
Current consumption	240 mA via back panel bus
Isolation w.r.t. back panel bus	yes, isolation tested to 500 Vrms
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 (W x H x D)	25, 4 x 76 x 76 mm
Weight	100 g

AI 4x12Bit, 4 ... 20mA, isolated

Ordering details

AI 4x12Bit, 4...20mA, isolated   ADAM 8231-1BD60

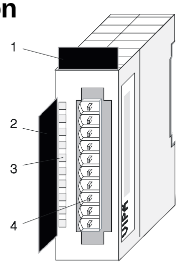
Description

The module has 4 inputs that are permanently configured to measure current signals (4 ... 20 mA). 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

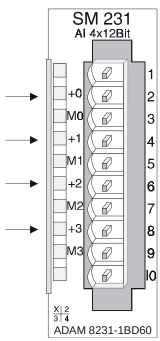
[2] Label for the bit address with description

[3] LED status indicator

[4] Edge connector

Status indicators Connector assignment

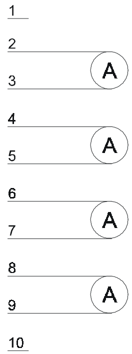
LED	Description
+0	LED (red)
+1	open circuit detection
+2	This LED's is turned on
+3	when the transducer is disconnected.



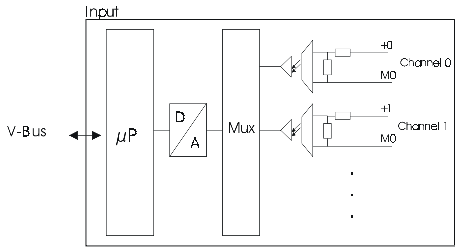
Pin	Assignment
1	
2	pos. connection K.0
3	Channel 0 common
4	pos. connection K.1
5	Channel 1 common
6	pos. connection K.2
7	Channel 2 common
8	pos. connection K.3
9	Channel 3 common
10	

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	**ADAM 8231-1BD60**
Number of inputs	4 individually isolated
Current measuring range	4 ... 20 mA
Input filter time delay	3 ms
Input resistance	20
Power supply	5 V via back panel bus
Current consumption	250 mA via back panel bus
Isolation	yes, every channel separately, isolation tested at 500 Vrms
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 (W x H x D)	25, 4 x 76 x 76 mm
Weight	120 g

10 Analog output modules

Overview

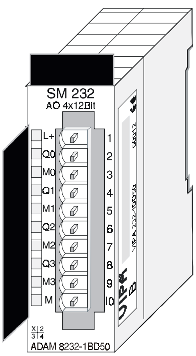
This chapter contains a description of the construction and the operation of the Advantech analog output modules.

Below follows a description of:
- A system overview of the analog output modules
- Properties
- Constructions
- Interfacing and schematic diagram
- Technical data

System overview

Output modules SM 232

Here follows a summary of the analog output modules that are currently available from Advantech:



Ordering details output modules

Type	Order number
AO4x12Bit, multi-output	ADAM 8232-1BD50

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 ADAM 8232-1BD50

Description

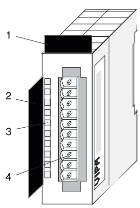
This module provides 4 outputs that can be configured individually. The module occupies a total of 8 bytes of output data (2 bytes per channel) in the process image. These values must be defined as left justified two's complement entries.

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

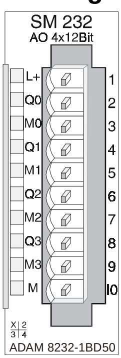
[2] Label for the bit address with description

[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



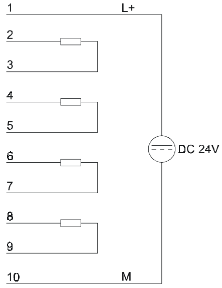
Pin	Assignment
1	24 V_{DC} supply voltage
2	+ Channel 0
3	Channel 0 common
4	+ Channel 1
5	Channel 1 common
6	+ Channel 2
7	Channel 2 common
8	+ Channel 3
9	Channel 3 common
10	Supply voltage common

Note!

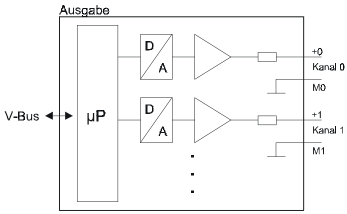
Please note that the diagnostic LED's of the **entire** module are denoted M3!

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Function no. allocation

No.	Function	Output range	Tolerance
00h	no output		
01h	Voltage ±10 V Siemens S5-format	±11,85 V 12, 5 V = max. value before over range occurs (20480) -10...10 V = rated range (-16384...16384) -12, 5 V = min. value before under range (-20480)	[1]) ±0,2% of final value
02h	Voltage 1...5 V Siemens S5-format	0...6 V 6 V = max. value before over range occurs (20480) 1...5 V = rated range (0...16384) 0 V = min. value before under range (-4096)	[1]) ±0,05% of final value
05h	Voltage 0...10 V Siemens S5-format	0...12, 5 V 12, 5 V = max. value before over range occurs (20480) 0...10 V = rated range (0...16384)	[1]) ±0,2% of final value
09h	Voltage ±10 V Siemens S7-format (two's complement)	±11, 85 V 11, 85 V= max. value before over range occurs (32767) -10 V...10 V = rated range (-27648...27648) -11,85 = min. value before under range (-32767)	[1]) ±0,05% of final value
0Ah	Voltage 1...5 V Siemens S7-format (two's complement)	0...5, 75 V 5, 75 V = max. value before over range occurs (32767) 1...5 V = rated range (0...27648) 0 V = min. value before under range (-6912)	[1]) ±0,05%of final value
0Dh	Voltage 0...10 V Siemens S7-format (two's complement)	0...11, 5 V 11, 5 V = max. value before over range occurs (32767) 0...10 V = rated range (0...27648) no under range available	[1]) ±0,2% of final value

No.	Function	Output range	Tolerance
03h	Current ±20 mA Siemens S5-format	±23,70 mA 23,70mA = max. value before over range occurs (20480) 20...20 mA = rated range (-16384...16384) -23, 70 mA = min. value before under range (-20480)	[1]) ±0,2% of final value
04h	Current 4...20 mA Siemens S5-format	0...23, 70 mA 23, 70 mA = max. value before over range occurs (20480) 4...20 mA = rated range (0...16384) 0 mA = min. value before under range (-4096)	[1]) ±0,2% of final value
06h	Current 0...20 mA Siemens S5-format	0...23, 70 mA 23, 70 mA = max. value before over range occurs (20480) 0...20 mA = rated range (0...16384) no under range available	[1]) ±0,2% of final value
0Bh	Current ±20 mA Siemens S7-format (two's complement)	±23, 70 mA 23, 70 mA = max. value before over range occurs (32767) -20...20mA = rated range (-27648...27648) -23, 70 mA = min. value before under range (-32767)	[1]) ±0,05% of final value
0Ch	Current 4...20 mA Siemens S7-format (two's complement)	0...22, 96 mA 22, 96 mA = max. value before over range occurs (32767) 4...20 mA = rated range (0...27648) 0 mA = min. value before under range (-5530)	[1]) ±0,05% of final value
0Eh	Current 0...2 0mA Siemens S7-format (two's complement)	0...22, 96 mA 22, 96 mA = max. value before over range occurs (32767) 0...20 mA = 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:

$$Value = 16384 \bullet \frac{U}{10}, \qquad U = Value \bullet \frac{10}{16384}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0 V	0	0000
5 V	8192	2000
10 V	16384	4000

Formulas for the calculation:

$$Value = 16384 \bullet \frac{U}{10}, \qquad U = Value \bullet \frac{10}{16384}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
+1 V	0	0
+3 V	+8192	2000
+5 V	+16384	4000

Formulas for the calculation:

$$Value = 16384 \bullet \frac{U\text{-}1}{4}, \qquad U = Value \bullet \frac{4}{16384} + 1$$

U: voltage, Value: decimal value

4....20mA

Current	Decimal	Hex
+4 mA	0	0
+12 mA	+8192	2000
+20 mA	+16384	4000

Formulas for the calculation:

$$Value = 16384 \bullet \frac{I - 4}{16}, \qquad I = Value \bullet \frac{16}{16384} + 4$$

I: current, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20 mA	-16384	C000
-10 mA	-8192	E000
0 mA	0	0
+10 mA	+8192	2000
+20 mA	+16384	4000

Formulas for the calculation:

$$Value = 16384 \bullet \frac{I - 4}{16}, \qquad I = Value \bullet \frac{16}{16384} + 4$$

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		Hex
-10V	-27648	9400
-5V	-13824	CA00
0V	0	0
+5V	13824	3600
+10V	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \bullet \frac{U}{10}, \qquad U = Value \bullet \frac{10}{27648}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0 V	0	0000
5 V	8192	2000
10 V	16384	4000

Formulas for the calculation:

$$Value = 16384 \bullet \frac{U}{10}, \qquad U = Value \bullet \frac{10}{16384}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
+1 V	0	0
+3 V	+13824	3600
+5 V	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \bullet \frac{U - 1}{4}, \qquad U = Value \bullet \frac{4}{27648} + 1$$

U: voltage, Value: decimal value

+/-4V

Voltage	Decimal	Hex
-4V	-27648	9400
0V	0	0
4V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \bullet \frac{U}{4}, \qquad U = Value \bullet \frac{4}{27648}$$

U: voltage, Value: decimal value

+/-400mV

Voltage	Decimal	Hex
-400 mV	-27648	9400
0 V	0	0
400 mV	27648	6C00

Formulas for the calculation:

$$Value = 27648 \bullet \frac{U}{400}, \qquad U = Value \bullet \frac{400}{27648}$$

U: voltage, Value: decimal value

4....20mA

Current	Decimal	Hex
+4 mA	0	0
+12 mA	+13824	3600
+20 mA	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \bullet \frac{I - 4}{16}, \qquad I = Value \bullet \frac{16}{27648} + 4$$

I: voltage, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20 mA	-27648	9400
-10 mA	-13824	CA00
0 mA	0	0
+10 mA	+13824	3600
+20 mA	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \bullet \frac{I}{20}, \qquad I = Value \bullet \frac{20}{27648}$$

I: voltage, 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	ADAM 8232-1BD50
Number of outputs	4
Voltage range	±10 V, 1 ... 5 V, 0 ... 10 V
Current range	±20 mA, 4 ... 20 mA, 0 ... 20 mA
Actuator resistance	min. 500 (voltage range) max. 500 (current range)
Short circuit current	30 mA
Power supply	5 V via back panel bus 24 V ±20% externally
Current consumption	via back panel bus: 20 mA 24 V_{DC} externally: 200 mA
Isolation	500 Vrms (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 (W x H x D)	25, 4 x 76 x 76 mm
Weight	100 g

11

Analog input/output module

Overview

This chapter contains a description of the construction and the operation of the Advantech analog input/output modules.

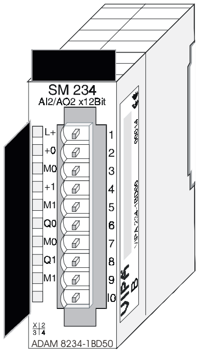
Below follows a description of:

- A system overview of the analog input/output modules
- Properties
- Construction
- Wiring and schematic diagram
- Configuration data
- Function number allocation
- Technical data

System overview

Input/output modules SM 234

Here follows a summary of the analog input/output modules that are currently available from Advantech



Ordering details input/output modules

Type	Order number
AIO2x12Bit, Multi In/Output	ADAM 8234-1BD50

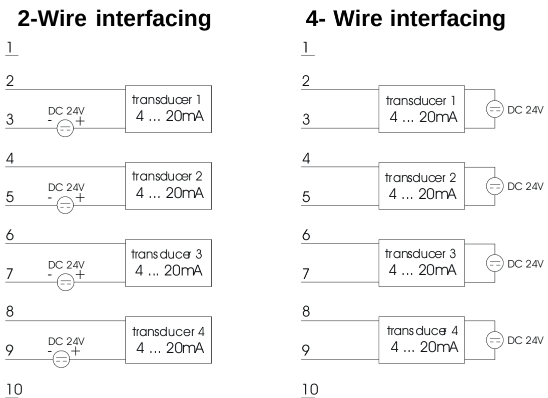
General

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:



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 ADAM 8234-1BD50

Description

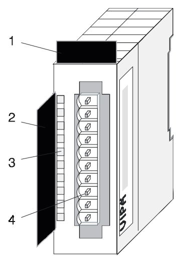
This module has 2 analog inputs and 2 analog that can be configured individually. The module occupies a total of 4 bytes of input and 4 bytes of output data.

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 24 V_{DC}.

Properties

- 2 inputs and 2 outputs with common ground
- Outputs with individually configurable functions
- Suitable for connection to transducers and actuators with ±10 V, 1 ... 5 V, 0 ... 10 V, ±20 mA or 4 ... 20 mA inputs or outputs
- Diagnostic LED
- Input/output ranges: current: -20 ... 0 .. 4 ... 20 mA
  voltage: -10 ... 0 .. 1 ... 5 ... 10 V

Construction



[1] Label for the name of the module

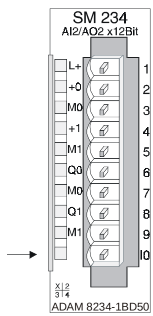
[2] Label for the bit address with description

[3] LED status indicator

[4] Edge connector

Status indicator Connector assignment

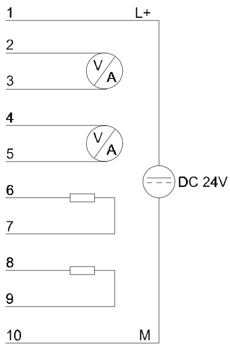
LED	Description
	Diagnostic LED (red) turned on by: a short circuit is detected at the control voltage output an open circuit is detected on the current output line



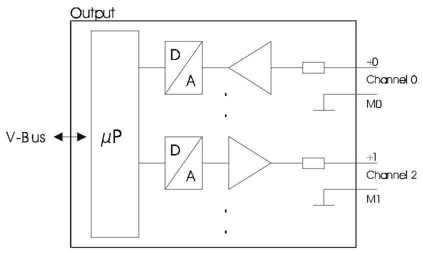
Pin	Assignment
1	24 V_{DC} supply voltage
2	pos. connection E.0
3	Channel 0 common
4	pos. connection E.1
5	Channel 1 common
6	pos. connection A.2
7	Channel 2 common
8	pos. connection A.3
9	Channel 3 common
10	Supply voltage common

Wiring diagram and schematic

Wiring diagram



Schematic diagram



Function no. allocation

No.	Function	Output or input range	Tolerance
01h	Voltage ±10 V Siemens S5-format	±11, 85 V 12, 5 V = max. value before over range occurs (20480) -10...10 V = rated range (-16384...16384) -12, 5 V = min. value before under range (-20480)	[1]) ±0,2% of final value
02h	Voltage 1...5 V Siemens S5-format	0...6 V 6 V = max. value before over range occurs (20480) 1...5 V = rated range (0...16384) 0 V = min. value before under range (-4096)	[1]) ±0,05% of final value
05h	Voltage 0...10 V Siemens S5-format	0...12, 5 V 12, 5 V = max. value before over range occurs (20480) 0...10 V = rated range (0...16384) no under range available	[1]) ±0,2% of final value
09h	Voltage ±10 V Siemens S7-format (two's complement)	±11, 85 V 11, 85 V= max. value before over range occurs (32767) -10 V...10 V = rated range (-27648...27648) -11, 85 = min. value before under range (-32767)	[1]) ±0,05% of final value
0Ah	Voltage 1...5 V Siemens S7-format (two's complement)	0...5, 75 V 5, 75 V = max. value before over range occurs (32767) 1...5 V = rated range (0...27648) 0 V = min. value before under range (-6912)	[1]) ±0,05% of final valu

No.	Function	Output or input range	Tolerance
0Dh	Voltage 0...10 V Siemens S7-format (two's complement)	0...11, 5 V 11, 5 V = max. value before over range occurs (32767) 0...10 V = rated range (0...27648) no under range available	[1]) ±0,2% of final value
03h	Current ±20 mA Siemens S5-format	±23, 70 mA 23, 70 mA = max. value before over range occurs (20480) -20...20 mA = rated range (-16384...16384) -23, 70 mA = min. value before under range (-20480)	[1]) ±0,2% of final value
04h	Current 4...20 mA Siemens S5-format	0...23, 70 mA 23, 70 mA = max. value before over range occurs (20480) 4...20 mA = rated range (0...16384) 0 mA = min. value before under range (-4096)	[1]) ±0,2% of final value
06h	Current 0...20 mA Siemens S5-format	0...23, 70 mA 23, 70 mA = max. value before over range occurs (20480) 0...20 mA = rated range (0...16384) no under range available	[1]) ±0,2% of final value
0Bh	Current ±20 mA Siemens S7-format (two's complement)	±23, 70 mA 23, 70 mA = max. value before over range occurs (32767) -20...20 mA = rated range (-27648...27648) -23, 70 mA = min. value before under range (-32767)	[1]) ±0,05% of final value
0Ch	Current 4...20mA Siemens S7-format (two's complement)	0...22, 96 mA 22, 96 mA = max. value before over range occurs (32767) 4...20 mA = rated range (0...27648) 0 mA = min. value before under range (-5530)	[1]) ±0,05% of final value
0Eh	Current 0...20mA Siemens S7-format (two's complement)	0...22, 96 mA 22, 96 mA = max. value before over range occurs (32767) 0...20 mA = 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 exceede 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
-10 V	-16384	C000
-5 V	-8192	E000
0 V	0	0
+5 V	8192	2000
+10 V	+16384	4000

Formulas for the calculation:

$$Value = 16384 \bullet \frac{U}{10}, \qquad U = Value \bullet \frac{10}{16384}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0 V	0	0000
5 V	8192	2000
10 V	16384	4000

Formulas for the calculation:

$$Value = 16384 \bullet \frac{U}{10}, \qquad U = Value \bullet \frac{10}{16384}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
+1 V	0	0
+3 V	+8192	2000
+5 V	+16384	4000

Formulas for the calculation:

$$Value = 16384 \bullet \frac{U - 1}{4}, \qquad U = Value \bullet \frac{4}{16384} + 1$$

U: voltage, Value: decimal value

4....20mA

Current	Decimal	Hex
+4 mA	0	0
+12 mA	+8192	2000
+20 mA	+16384	4000

Formulas for the calculation:

$$Value = 16384 \bullet \frac{I - 4}{16}, \qquad I = Value \bullet \frac{16}{16384} + 4$$

U: voltage, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20 mA	-16384	C000
-10 mA	-8192	E000
0 mA	0	0
+10 mA	+8192	2000
+20 mA	+16384	4000

Formulas for the calculation:

$$Value = 16384 \bullet \frac{I}{20}, \qquad I = Value \bullet \frac{20}{16384}$$

U: voltage, 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
-10 V	-27648	9400
-5 V	-13824	CA00
0 V	0	0
+5 V	13824	3600
+10 V	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \qquad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0 V	0	0000
5 V	8192	2000
10 V	16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{U}{10}, \qquad U = Value \cdot \frac{10}{16384}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
+1 V	0	0
+3 V	+13824	3600
+5 V	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U-1}{4}, \qquad U = Value \cdot \frac{4}{27648} + 1$$

U: voltage, Value: decimal value

+/-4V

Voltage	Decimal	Hex
-4 V	-27648	9400
0 V	0	0
4 V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \bullet \frac{U}{4}, \qquad U = Value \bullet \frac{4}{27648}$$

U: voltage, Value: decimal value

+/-400mV

Voltage	Decimal	Hex
-400 mV	-27648	9400
0 V	0	0
400 mV	27648	6C00

Formulas for the calculation:

$$Value = 27648 \bullet \frac{U}{400}, \qquad U = Value \bullet \frac{400}{27648}$$

U: voltage, Value: decimal value

4....20mA

Current	Decimal	Hex
+4 mA	0	0
+12 mA	+13824	3600
+20 mA	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \bullet \frac{I - 4}{16}, \qquad I = Value \bullet \frac{16}{27648} + 4$$

I: voltage, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20 mA	-27648	9400
-10 mA	-13824	CA00
0 mA	0	0
+10 mA	+13824	3600
+20 mA	+27648	6C00

Formulas for the calculation:

$$Value = 27648 \bullet \frac{I}{20}, \qquad I = Value \bullet \frac{20}{27648}$$

I: voltage, 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 availabl	-
2	not assigned	-
3	not assigned	-

Technical data

Electrical data	ADAM 8234-1BD50
Number of inputs/outputs	2/2
Voltage range	±10 V, 1 ... 5 V, 0 ... 10 V
Current range	±20 mA, 4 ... 20 mA, 0 ... 20 mA
Input resistance	100 Ω (voltage range) 50 Ω (current range)
Actuator resistance (for outputs)	min. 500 Ω (voltage range) max. 500 Ω (current range)
Short circuit current	30 mA
Power supply	5 V via back panel bus 24 V ±20% externally
Current consumption	via back panel bus: 20 mA 24 V_{DC} externally: 100 mA
Isolation	500 Vrms (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 (W x H x D)	25, 4 x 76 x 76 mm
Weight	100 g

System expansion modules

12

Overview

The chapter contains a description of additional components and accessories that are available from Advantech for the ADAM-8000.

A general overview is followed by the description of the bus expansion module that can be used to split a single ADAM-8000 row over up to 4 rows.

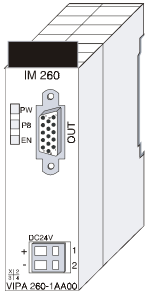
The chapter concludes with the terminal modules. These modules provide connection facilities for signaling cables as well as supply voltages for your ADAM-8000.

Below follows a description of:

- System overview of additional components
- Bus expansion with IM 260
- Terminal module CM 201

System overview

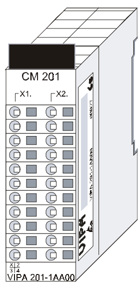
Bus expansion



Ordering details Bus expansion

Type	Order number	Description
IM 260	VIPA 260-1AA00	Basic interface row 1
Cable 0, 5 m	VIPA 260-1XY05	Interconnecting cable, 0, 5 m length
Cable 1 m	VIPA 260-1XY10	Interconnecting cable, 1 m length
Cable 1, 5 m	VIPA 260-1XY15	Interconnecting cable, 1, 5 m length
Cable 2 m	VIPA 260-1XY20	Interconnecting cable, 2 m length
Cable 2, 5 m	VIPA 260-1XY25	Interconnecting cable, 2, 5 m length

Terminal module



Ordering details Terminal module

Type	Order number	Description
CM 201	VIPA 201-1AA20	Dual terminals red/blue

Bus expansion IM 260

The system consisting of IM 260 and interconnecting cables is an expansion option that you can use to split the ADAM-8000 over up to 4 rows.

This system can only be installed in a centralized ADAM-8000 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 ADAM-8000 rows by means of the appropriate interconnecting cables for rows.

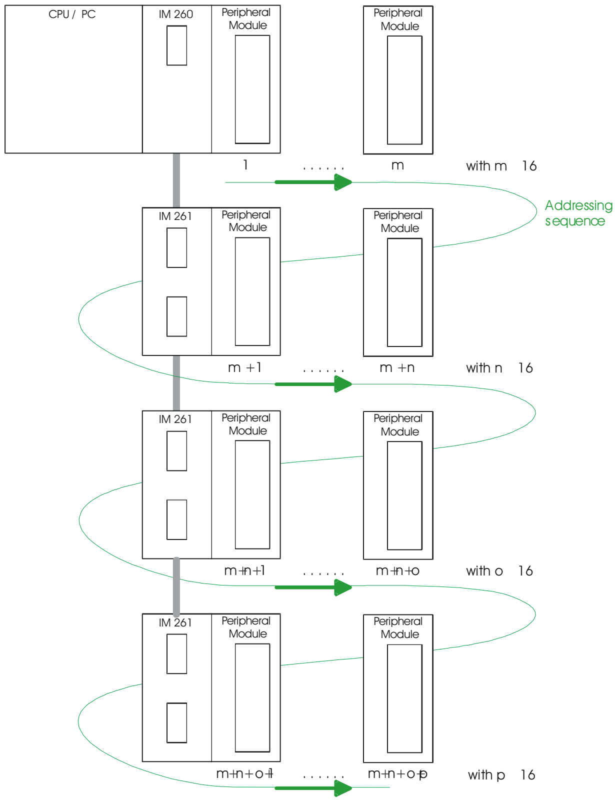
Please note!

Certain rules and regulations must be observed when the bus expansion modules are being employed:

- 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 must 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 32

Note!

The bus expansion must only be used in conjunction 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

Technical data

Electrical data	ADAM8260-1AA00
Power supply	24 V_{DC} via front
Current consumption	1, 9 A
Currentconsumption back panel bus	30 mA
Power supply back panel bus an IM 261	-
max. cable distance betw. 1st. and last row	2,5m
Dimensions and weight	
Dimensions (W x H x D) in mm	25, 4 x 76 x 76
Weight	80 g

Terminal module CM 201

2xX 11 Pole

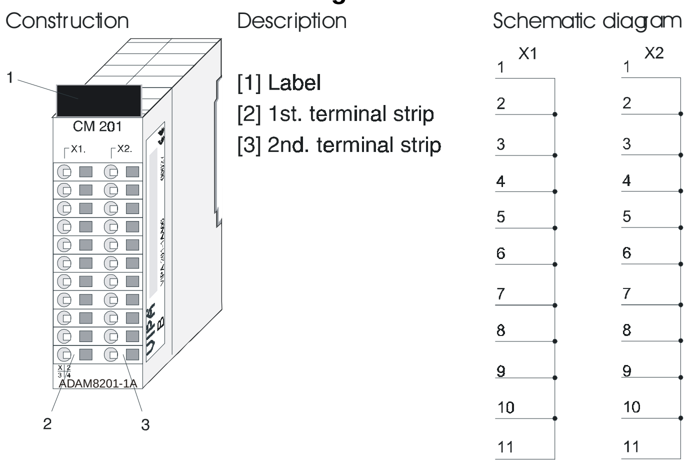
The terminal module is available under order no.: ADAM8201-1AA20.

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 10 A.

Construction and schematic diagram



Technical data

Electrical data	ADAM8201-1AA20
Number of rows	2
Number of terminals per row	11
Maximum terminal current	10 A
Terminal color	red/blue
Dimensions and weight	
Dimensions (W x H x D) in mm	25, 4 x 76 x 76
Weight	50 g

13 Assembly and installation guidelines

Overview

This chapter contains the information required to assemble and wire a controller consisting of ADAM-8000 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 ADAM-8000

Overview

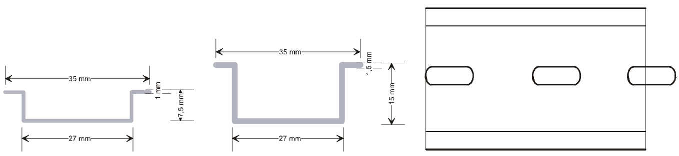
General

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.

You can use the following standard 35 mm T-rails to mount the ADAM-8000 modules:

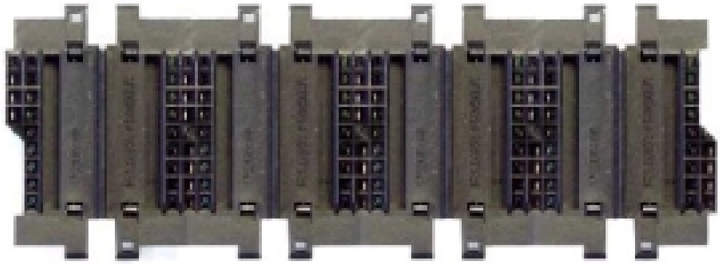
T-rail



Bus connector

ADAM-8000 modules communicate via a back panel bus connector. This back panel bus connector is available in versions of 1-, 2-, 4- and 8- connec-tions.

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.

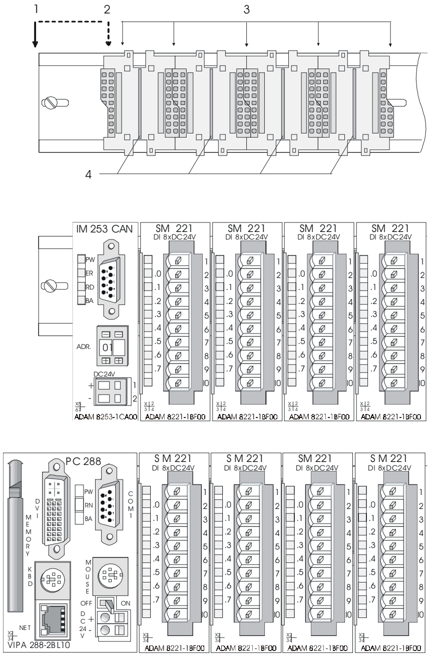
Ordering data

Type	Order number	Description
Bus connector	ADAM8290-0AA10	Bus connector 1-connection
Bus connector	ADAM8290-0AA20	Bus connector 2-connection
Bus connector	ADAM8290-0AA40	Bus connector 4-connection
Bus connector	ADAM8290-0AA80	Bus connector 8-connection

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.

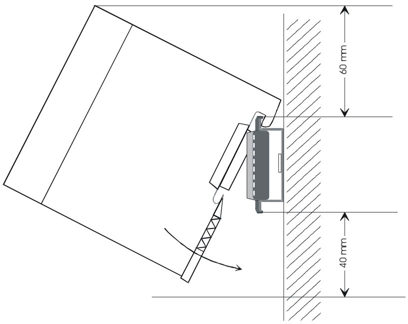


[1] Header module like PC, CPU, bus-coupler
[2] Main module if this is a double width module or peripheral module
[3] Peripheral module
[4] Guide rails

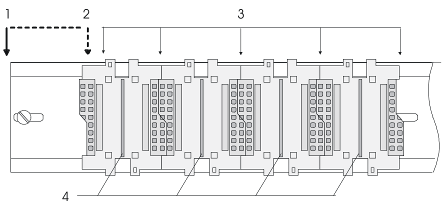
Assembly

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).

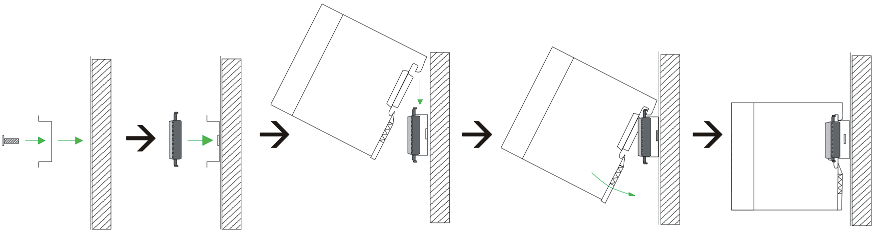


[1] Header module like PC, CPU, bus coupler
[2] Header module when this is a double width or a peripheral module
[3] Peripheral module
[4] Guide rails

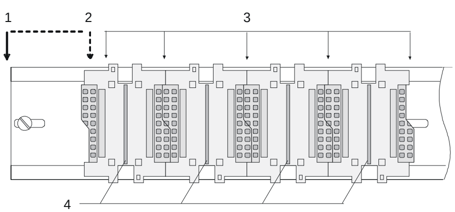
- Modules must be installed adjacent to each other. Gaps are not permitted between the modules since this would interrupt the back panel bus.
- A module is only installed properly and connected electrically when it has clicked into place with an audible click.
- Plug-in locations after the last module 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.
- 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.
- 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.

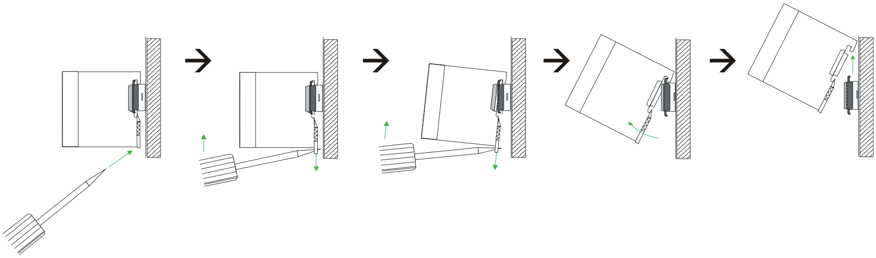


[1] Header module like PC, CPU, bus coupler
[2] Header module when this is a double width or a peripheral module
[3] Peripheral module
[4] Guide rails

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.

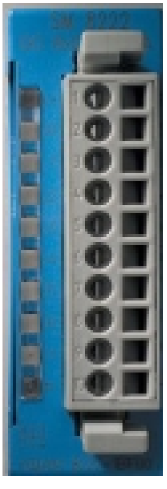
The modules carry WAGO spring-clip connectors for the interconnections and wiring.

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.



Round aperture for wires

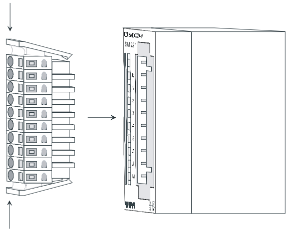
Rectangular opening for screwdriver

Note!

The spring-clip is destroyed if you should insert the screwdriver into the opening for the hook-up wire!

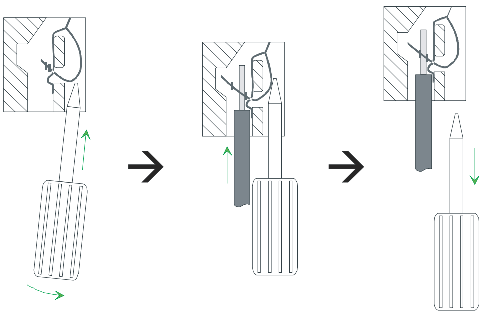
Make sure that you only insert the screwdriver into the square hole of the connector!

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 mm2 to 2, 5 mm^2 (1, 5 mm^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

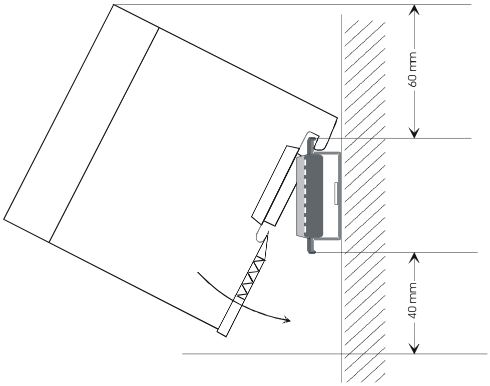
Here follow all the important dimensions of the ADAM-8000.

Dimensions Basic enclosure

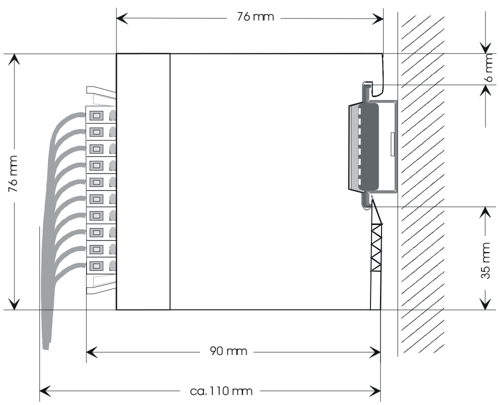
1-slot width (H x W x D) in mm: 76 x 25, 4 x 76

2-fach width (H x W x D) in mm: 76 x 50, 8 x 76

Installation dimensions



Installed and wired dimensions



Installation guidelines

General

The installation guidelines contain information on the proper assembly of ADAM-8000 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 ADAM-8000 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 ADAM-8000 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 ADAM-8000 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