Technology components for PROFIBUS DP

Introduction

For manufacturers flexible and economic production is the only way of ensuring that products meet the rapidly changing needs of the customer. Distributed automation structures are one of the factors needed for flexible and economic production. The required flow of information is ensured by interconnecting the various areas of the system over local area networks.

In the field of industrial communications, networks complying with national and international standards enable the exchange of information at all levels of the automation hierarchy.

PROFIBUS DP fieldbus

The PROFIBUS DP fieldbus has become established at the field level, where a high-speed response is required and small amounts of data are generally exchanged.

PROFIBUS DP is an open fieldbus system and is standardized to European and international standards. This fieldbus system is also the basis for PROFIBUS PA, the fieldbus for process automation.

Features

The PROFIBUS DP fieldbus is characterized by the following features:

- Corresponds to IEC 61158-3, Ed. 2
- Comprehensive range of fieldbus components
- Data transmission via two-wire (RS 485) or fiber optic system
- Flexible and modular design of the automation system possible
- Connection to actuator-sensor interface possible
- Reduction in wiring overhead
- Up to 125 nodes can be connected with up to 32 per bus segment
- Short response times thanks to transmission rates of up to 12 Mbit/s
- Coverage of distances up to 23.8 km/14.7 miles
- Simple connection of devices through the availability of ASICS and interface modules
- PROFIBUS DP is the system bus for Totally Integrated Automation
- Leading PLC vendors recognize PROFIBUS DP as a standard interface for the field level.

ASICS and interface modules

The full documentation of the interface to the PROFIBUS DP fieldbus is available.

The ASICS and interface modules described below provide third-party vendors with a simple and cost-effective interface design for connecting their devices and systems to PROFIBUS DP.

Various ASICS and interface modules are available for different functional needs (master function, both simple and intelligent slave stations).

ASICS and interface modules are described on the following pages.

PROFINET

PROFINET is the new open Industrial Ethernet Standard for industrial automation. With it, devices can be linked from the field level up to the operations management level. In addition, PROFINET permits simple integration of existing fieldbus systems, e.g. the widely used PROFIBUS.

There will also be technological components for PROFINET in the future – development kits and ASICS for PROFINET are currently being prepared (see Product Brief on PROFINET technology components).

Lead-free

Two new European directives (2002/95/EG - RoHS, 2002/96/EG - WEEE) prohibit the use of components containing lead in many electric and electronic devices for environmental protection reasons as of 01.07.2006.

Although programmable controllers are not covered by these directives in the current statute document, we will also offer the PROFIBUS ASICS as lead-free versions. Through this we want to permit our customers to develop environmentally friendly products.
Fieldbus
PROFIBUS DP, PROFIBUS PA

Application
PROFIBUS is the bus system for the field and cell areas. Two versions are available for the various demands:

- PROFIBUS DP
- PROFIBUS PA.

PROFIBUS DP
The PROFIBUS DP fieldbus features high-speed communication with small amounts of data and high system availability. It corresponds to the IEC 61158 standard with the DP protocol variant. In addition, PROFIBUS DPV1 is the basis for PROFIBUS PA.

PROFIBUS PA
PROFIBUS PA is the PROFIBUS version for process automation. PROFIBUS PA uses transmission technology in accordance with IEC 1158-2. This transmission process can also be used for intrinsically safe applications. The communication protocols of PROFIBUS PA and PROFIBUS DP are identical. PROFIBUS DP communication protocol + IEC-1158-2 transmission technology = PROFIBUS PA.

Design
PROFIBUS DP is different for active bus participants and passive bus participants.

Active nodes (master)
- Programmable controllers, e.g. S7-300/S7-400
- PC-based Control Systems, e.g. WinAC
- SIMATIC programming devices and PCs
- HMI devices
- Machine controllers, e.g. SINUMERIK
- Control systems, e.g. SIMADYN
- Third-party PLCs

Passive nodes (slaves)
- Distributed I/O stations SIMATIC ET 200
- Controllers, e.g. S7-200/S7-300
- Field devices such as drives or human-machine interface units
- Field devices of process technology, e.g. SITRANS
- Third-party field devices

The PROFIBUS DP fieldbus can be installed in two-wire cable (RS 485), fiber optic or hybrid configurations.

Mode of operation
The nodes in the network share the transmission medium. A system is therefore required to control access to the network.

PROFIBUS DP operates according to the “master/slave token passing” access method, whereby only active nodes receive the right access to the network. The right to access is transferred by passing a token from one master to the next. If there is no request to send, the token is passed on to the next master. The passive bus nodes are polled directly by the master module assigned to them.

Open interfaces for PROFIBUS DP/PROFIBUS PA
The communication performance required for the short response times cannot be achieved using the usual standard components. Siemens has therefore developed several high-performance ASICs for interfacing the PROFIBUS DP. These ASICs handle a significant proportion of the communication. The interface modules supplied for master and slave applications are based on these ASICs.

PROFIBUS Support Centers
The Support Centers support field device manufacturers prior to and during the development, and carry out the required certification tests. In addition, they provide further information on the ASICs, interface modules and development kits. See page 12 for addresses.

PROFIBUS International
PROFIBUS International (PNO), which represents users and manufacturers of PROFIBUS products, provides e.g. a platform for co-operation and exchange of information.

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Fax: +49/721/96 58 589
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PROFIBUS ASICs

Overview

Application
The PROFIBUS ASICs facilitate the connection of third-party components and systems to the PROFIBUS fieldbus. Quick response times for the PROFIBUS DP, which are required for transmission rates of up to 12 Mbit/s, can only be achieved by using these ASICs. Various ASICs are available for different functional needs and applications.

Master ASICs
The ASPC 2 (Advanced Siemens PROFIBUS Controller) is an intelligent communications chip for master applications (DP, DPV1, DPV2). This ASIC is suitable for use in master interface modules for connection to PROFIBUS DP. The maximum transmission rate is 12 Mbit/s.

Intelligent slave ASICs
The SPC 3 (Siemens PROFIBUS Controller) is an intelligent communications block for intelligent slave applications (DPV1 without interrupts), and permits connection to PROFIBUS DP. The maximum transmission rate is 12 Mbit/s. The SPC 4-2 also supports PROFIBUS PA. An external microprocessor is additionally required to operate the SPC 3.

Slave ASIC with processor core
The DPC31 combines the functions of the SPC 3, SPC 41 and an 8031 processor in one chip (DPV1, DPV2). The DPC31 is a DP slave controller whose flexibility allows extremely versatile use. The DPC31 with its low power management is also designed for use in hazardous areas. It permits connection to PROFIBUS DP and PROFIBUS PA.

The DPC31 with the SIM 1-1 offers an integral compact solution for connection to PROFIBUS PA with a transmission procedure according to IEC 1158-2. The maximum transmission rate is 12 Mbit/s for PROFIBUS DP and 31.25 kbit/s for PROFIBUS PA.

Simple slave ASICs
The LSPM 2 is also a single-chip solution for simple slave applications. As a result of its small housing, it is particularly suitable for applications where space is limited. The maximum transmission rate is 12 Mbit/s.

ASICs for signal conditioning and conversion to other media
These ASICs function as supplements to existing PROFIBUS ASICs. They convert the signals into other media/transmission forms or condition the signals.

The SIM1-1 (Siemens Medium Attachment Unit) is required for signal adaptation to PROFIBUS PA.

The FOCSI (Fiber Optical Controller from Siemens) provides appropriate electrical conditioning and transfer of the received/sent optical signal. In order to link the signal into a fiber-optic cable, corresponding optical transmitters and receivers are required in addition to the FOCSI.
**Operation**

The ASICs handle a large part of the communications tasks between the bus node and the network.

The LSPM 2 handles all communications tasks completely independently. The correct signals only need to be applied to the pins. An additional processor or firmware is not required.

The ASICs of the SPC range (SPC 3, SPC 41, DPC31 and ASPC 2) are equipped with a processor interface. They require additional firmware for the interface between the ASIC and the application.

**Firmware**

The firmware is installed in a processor on the interface module or in the field device. The functions of the field device are included via the call interface. The scope of the firmware depends on the ASIC.

**Delivery arrangements**

The ASICs can be obtained through the worldwide distribution network of Siemens AG. Quantities of six ASICs can be ordered for testing. For series production, only multiples of an ASIC packaging unit (tray) are possible. The number of ASICs per package depends on the type of ASIC.

**Documentation**

The descriptions of the technology components are available for downloading free of charge at [www.ad.siemens.de/csi/dp](http://www.ad.siemens.de/csi/dp) under the title

- Distributed I/O / Technology Components / Manuals
PROFIBUS ASICs
LSPM 2

Application
The ASIC LSPM 2 (Lean Siemens PROFIBUS Multiplexer) is a single-chip solution for simple slave applications. Examples include sensors and actuators such as switches and indicators. The ASIC enables connection of these simple digital input/output devices to the PROFIBUS DP fieldbus. The smaller package makes the LSPM 2 particularly suitable for use in applications where space is at a premium.

The maximum transmission rate is 12 Mbit/s. The IM 184 interface module is implemented with the ASIC LSPM 2.

Design
The LSPM 2 has 32 input/output bits. It is accommodated in a MQFP package with 80 pins.

The subdivision of the input/output points into inputs and outputs is configurable. Pins are also provided on the ASICs for diagnostic information.

The LSPM 2 handles the complete data traffic independently. An additional microprocessor and firmware are not required. It is thus possible, using a small number of external components, to implement a simple connection to the PROFIBUS DP fieldbus.

Operation
The LSPM 2 handles the bus protocol fully independently. The pins only need to be connected to the input/output signals and bus cables.

The LSPM 2 operates as slave on the PROFIBUS DP network. When they receive an error-free message frame from the master, they generate the requested reply frames independently.

Features
- PROFIBUS DP protocol
- Maximum transmission rate 12 Mbit/s
- Automatic detection of transmission rate
- RS 485 transmission protocol
- MQFP package with 80 pins
- Integrated ASIC circuit (glue logic)
- 32 input/output bits, of which up to 16 diagnostics inputs
- 8 separate diagnostics inputs
- User-specific allocation of input/output points to inputs and outputs
- Integrated watchdog timer
- External quartz port for 24 MHz and 48 MHz quartz/oscillator
- 5 V DC power supply
- Suitable for implementation of simple digital input/output modules

Firmware
No firmware is required for operation of the LSPM 2. The entire protocol handling is performed by the LSPM 2.
SPC 3 and SPC 4-2

Application

SPC 3, SPC 4-2
The ASICs SPC 3 and SPC 4-2 are intelligent communications blocks for intelligent slave applications. They allow connection even of complex slave devices to the PROFIBUS DP fieldbus.

The IM 183-1 interface module is implemented with the SPC 3. The maximum transmission rate is 12 Mbit/s.

ASIC SPC 4-2 is very similar to the SPC 3 with respect to application, design, mode of operation and features.

Design

SPC 3
The SPC 3 has a 1.5-KB message memory. It is located in a PQFP housing with 44 pins.

SPC 4-2
The SPC 4-2 has a 3-KB message memory.

Operation

The SPC 3/SPC 4-2 automatically handles all communications tasks of the PROFIBUS DP protocol. This means that protocol processing is significantly faster. In addition, the amount of software in the interface module’s microprocessor is reduced.

Bus access is hardware-based. The data transfer is by means of a 1.5-KB or 3 KB RAM. The interface to the application is designed as a data interface. This permits temporary decoupling from the bus.

To permit convenient operation with the microprocessor, firmware is available with call interfaces for the application.

Features

SPC 3, SPC 4-2

- Protocols: PROFIBUS DP, DPV1 (without interrupts), DPV 2
- Maximum transmission rate 12 Mbit/s
- Automatic determination of transmission rate
- Microprocessor support: 80C32, 80X86, 80C166, 80C165, 80C167 as well as HC11, HC16 and HC916 types
- RS 485 transmission mode
- PQFP housing with 44 pins
- Automatic handling of communications functions including the PROFIBUS DP protocol
- Integral watchdog timer
- External connection for 48-MHz crystal oscillator
- 5 V DC power supply

Special feature of SPC 4-2

- PROFIBUS PA with low power and synchronous interface

Firmware

Firmware (source code in "C") is available as the interface between the SPC registers and the application.

The firmware executes on the field device’s processor, and offers call interfaces for simple incorporation of the application. The firmware can also be used for the IM 182-1 and IM 183-1 interface modules.

The firmware is not essential for operation of the SPC 3 with the standard DP functions since the registers of the ASICs are exactly documented. However, the firmware means that users can save the required development work.

The firmware is required to use the enhanced DP functions DPV1 (read/write data record).
Communications chip
DPC31

Application
DPC31 combines the different features of the ASICs SPC 3 and SPC 4-2 in one chip, which means that this chip is suitable for a wide range of applications. The DPC 31 is an intelligent communications chip with an integrated processor core. It allows intelligent field devices to be connected to the PROFIBUS DP. Because of the power management system and the 3.3 V technology, the DPC 31 can also be used in process technology in connection with the PROFIBUS PA. The DPC 31 allows a slave application to be realized with minimal expenditure on external components.

Design
In order to be connected to the physical bus, the DPC 31 not only has an asynchronous interface for the RS485 interface, but also has a synchronous interface to the SIM1. This interface allows the DPC 31 to be connected to the synchronous transmission technology of the IEC 1158-2 structure, which uses PROFIBUS PA, via an energy-saving interface.

The DPC31 has a 6-KB RAM as message memory and an integral 8031 core together with 24-KB firmware ROM, packed in a PQFP housing with 100 pins.

Operation
The DPC 31 handles the entire DP slave protocol independently and relieves the application from all time-critical communication functions. All the necessary timer and monitoring functions are integrated in the DPC 31.

The interface to the application is made up of 6 Kilobytes of RAM, through which the application communicates with the communication part of the DPC 31. The interface takes the form of a data interface. Firmware with a call interface is also provided to facilitate operation with an external processor.

The integrated 8031 core is 100% compatible to standard 8031 derivatives. This means that all standard developing environments can be used for programming and debugging. 256 bytes of 'internal' RAM and the 'timer 2' of the 8032 derivatives are added to the integrated 8031 core, meaning that a genuine 8032 controller is available in the DPC 31.

The firmware ROM for the 8031 core has the following functions:
- Read and write functions for SPI compatible E²PROM
- Boot loader for single-chip applications
- All system functions necessary for the realization of a 'DP slave'.

Features
- PROFIBUS DP/DPV1/DPV2 protocol
- Maximum transmission rate 12 Mbit/s, using transmission method IEC 1158-2 31.25 kbit/s
- Automatic detection of transmission rate
- Asynchronous Interface according to PROFIBUS DP
- Synchronous interface according to PROFIBUS PA
- Integrated 8031 core
- SSC interface to connect SPI compatible components, such as E²ROMs or AD converters
- Standard 8031 interface
- External Intel and Motorola microprocessor interface
- Supply voltage 3.3 V DC
- PQFP housing with 100 pins

Firmware
There is firmware (source code in "C") for the DPC31 which makes using the component even simpler. The firmware is run on the processor of the field device and offers a simple function interface for simple linking of the application.
Medium Attachment Units
SIM 1-1 and FOCSI

Application
The SIM 1-1 (Siemens IEC Medium Attachment Unit) matches the signals for the connection of field devices to IEC 1158-2 and thus also to PROFIBUS PA.

PROFIBUS PA is the PROFIBUS version for process automation. The transmission process matches IEC 1158-2, the communication protocol is PROFIBUS DP.

PROFIBUS PA can also be used for intrinsically safe applications.

Design
The SIM 1-1 is an expansion of the DPC31 or SPC 4-2. Only a few external components are required in addition to this ASIC, in order to connect PROFIBUS PA field devices to an intrinsically safe network.

The SIM 1-1 is accommodated in a TQFP housing with 44 pins.

Operation
The SIM 1-1 supports all send and receive functions as well as the high-resistance tapping of the auxiliary power from the bus cable. It provides 2 stabilized power supplies and enables the installation of a galvanically isolated power supply. It can be connected to all IEC 1158-2 compliant Manchester encoders/decoders.

Features
- IEC 1158-2 compliant and thus PROFIBUS PA compliant transmission method
- Transmission rate is 31.25 kbit/s
- TQFP housing with 44 pins
- Extraction of auxiliary power of 3.3 V DC and 5 V DC or 5 V DC and 6.6 V DC (power loss up to 250 mW)
- Power consumption from the fieldbus to supply the unit can be set to up to 40 mA
- Integrated low power management

FOCSI for fiber-optic cables
The FOCSI (Fiber Optical Controller from Siemens) provides appropriate electrical conditioning and transfer of the received/sent optical signal when using fiber-optic cables for PROFIBUS DP. In order to link the signal into a fiber-optic cable, corresponding optical transmitters and receivers are required in addition to the FOCSI. The block can be used with all listed PROFIBUS DP ASICs.
Communications chip

ASPC 2

Application
The ASPC 2 is an intelligent communications chip for master applications. It allows connection to PROFIBUS DP and PROFIBUS FMS.

These ASICs are used to off-load communications handling tasks from programmable controllers, personal computers, drive controls and human-machine interfaces.

The IM 180 interface module is implemented with ASPC 2. The maximum transmission rate is 12 Mbit/s.

Design
The ASPC 2 is accommodated in an MQFP 100 housing.

Operation
The ASPC 2 handles the message frame and address codes and data backup sequences.

The PROFIBUS DP and PROFIBUS FMS protocols are handled completely by the firmware.

The ASPC 2 can address an external 1 Mbyte message frame memory. Bus access is hardware-driven.

A separate microprocessor and the appropriate firmware are required for operation. The ASPC 2 can be connected easily to all standard types of processor.

Features
- PROFIBUS DP and PROFIBUS FMS protocols
- Maximum transmission rate 12 Mbit/s
- RS 485 transmission
- Up to 125 active and passive nodes can be connected
- P-MQFP housing with 100 pins
- 16-bit data bus
- 1 Mbyte RAM addressable as external communications memory
- Services supported: Ident; request FDL status; SDN; SDA; SRD; SRD with distribution database; SM services
- 2 interrupt lines
- 5 V DC power supply
- Maximum power loss 0.9 W

Integration of the ASPC 2 ASIC in a master application

Firmware
The firmware for the ASPC 2 handles the entire protocol processing and all functions required for a PROFIBUS DP master connection.

The firmware for PROFIBUS DP is offered for device vendors within the framework of a license agreement.

The firmware is suitable for the 80C165 processor and has a size of approximately 80 KB. It is optionally available as source code or object code.
### Technical specifications

#### ASICs

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<td>RS 485</td>
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<td>–</td>
<td>■</td>
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<td>5 V/3.3 V DC</td>
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<td>TQFP, 44 pin</td>
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1) Worst case at full load

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#### ASICs

<table>
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<tr>
<th>ASICs</th>
<th>DPC31</th>
<th>SIM 1-1</th>
<th>FOCSI</th>
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<td>Medium Attachment Unit</td>
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<td>Transmission technology</td>
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<td>Fiber-optic cable</td>
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Interface modules, development kits

Overview

Applications
Various interface modules, based on the PROFIBUS DP ASICs described above, are available for master and slave applications.

PROFIBUS DP interface modules provide third-party vendors with a simple means of connecting their products and systems to the PROFIBUS DP fieldbus.

The advantage of these interface modules is that they obviate the need to develop an additional external circuit.

Different interface modules are available for various functional requirements and applications.

Master interface modules
The CP 5613 communications processor enables the connection of a third-party device as master to PROFIBUS DP. The maximum transmission rate is 12 Mbit/s.

Slave interface modules
The IM 182-1 interface module is a simple PC card for slave applications. It is designed for PCs with ISA bus. The maximum transmission rate is 12 Mbit/s.

The IM 183-1 interface module enables the connection of a third-party device as a slave to PROFIBUS DP. The maximum transmission rate is 12 Mbit/s.

The IM 184 interface module enables the connection of a simple slave to PROFIBUS DP. The maximum transmission rate is 12 Mbit/s.

Design
The interface modules consist mainly of an ASIC, if necessary, a microprocessor for protocol handling as well as a memory.

The interface to the host system is implemented using a multirow connector strip, or the ISA bus or PCI bus.

Operation
The interface modules handle communications tasks between the bus node (master or slave) and the PROFIBUS DP network.

Data exchange between the interface module and the host system depends on the interface module, i.e. by using a dual-port RAM, the address and data bus, a serial interface or ports.

Development kits
The development kits let you develop and test PROFIBUS hardware and software applications that use PROFIBUS ASICs or interface modules (IM) (see pages 14 and 15).

The comprehensive hardware and software components of the packets are tuned to one another, and significantly reduce the development overhead for a PROFIBUS device.

The packages feature a functional development environment, which is able to accept your special hardware and software requirements. Consequently our PROFIBUS know-how is made available to others.

Our development team will assist and support you in your development activities. This support is included in the development kit.

Subsequently you will be able to have your device certified in one of our specialized integration centers.

Addresses of our Support Centers:
PROFIBUS Support Center
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D-90766 Fürth
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Tel.: ++1 (423)-262-2687
Fax: ++1(423)-461-2103
E-Mail: profibus.center@sea.siemens.com
www.sea.siemens.com/pic/default.html
Master interface module
IM 180

Application
The IM 180 interface module enables the connection of a third-party device as master to PROFINET. The IM 180 interface module handles the entire bus control independently.

Use of this interface module significantly reduces the communication load on programmable controllers, personal computers, drive controls and HMI systems. The maximum transmission rate is 12 Mbit/s.

Design
The IM 180 interface module consists mainly of an 80C165 microprocessor, the ASPC 2 ASIC, a Flash EPROM and RAM. The ASPC 2 ASIC is controlled by a 48 MHz oscillator chip.

The interface module is 100 x 100 mm (3.9 x 3.9 in.) in size and suitable for face-to-face mounting.

For the IM 180 interface module, a carrier board is available. This board is called IM 181 and can be used as a short ISA card in a programming device or PC.

Operation
The integrated ASPC 2 ASIC handles the bus protocol fully independently.

Communication with the host system takes place via a dual-port RAM interface. Data exchange is handled by the user program.

The host software for the power supply of the dual-port RAM must be created by the user.

Features
- Maximum transmission rate 12 Mbit/s
- PROFINET protocol handling by ASPC 2 ASIC
  - 80C165 microprocessor, 40 MHz clock frequency
  - 2 x 128K x 8-bit RAM user memory
  - 256K x 16-bit flash EPROM program and parameter memory
- 48 MHz oscillator chip for ASPC 2
- Host interface:
  - 16/8-bit data bus can be connected
  - dual-port RAM (8K x 16 bit)
  - 64-pin connector (4 rows)
  - optional 8/16-bit data bus connectable
- High-integrity data exchange via dual-port RAM
- 5 V DC power supply
- 0 to 70 °C permissible ambient temperature
- Dimensions (W x H): 100 x 100 mm (3.9 x 3.9 inch).

Firmware
The firmware is operated on the microprocessor and handles the entire protocol processing as well as all functions required for a master connection.

Driver
A corresponding driver is offered for Windows NT.

Demonstration software
The demonstration software for the IM 180 / IM 181-1 shows in exemplary manner how the dual-port RAM under the MS-DOS operating system of the IM 180 interface module is supplied and enables different operations of the IM 180 on the user interface.

Configuring
The IM 180 interface module can be easily configured with COM PROFINET configuring software. The user does not have to create his own configuring tool.
Slave interface modules
IM 184

Application
The IM 184 interface module enables the simple connection of a third-party device as slave to PROFIBUS DP. The maximum transmission rate is 12 Mbit/s.

The IM 184 is designed for simple slave applications such as the connection of simple sensors and actuators.

Design
The IM 184 interface module consists mainly of the LSPM 2 ASIC, a socket for the EEPROM and an RS 485 interface for connection to PROFIBUS DP.

LEDs are also provided for the operating states “RUN”, “BUS ERROR” and “DIAGNOSTICS”.

The LSPM 2 ASIC is controlled by a 48 MHz oscillator chip.

The interface is as small as a cheque card and suitable for face-to-face mounting.

Operation
The integrated LSPM 2 ASIC handles the PROFIBUS DP bus protocol fully independently.

Communication with the host system takes place via a connector strip. For this purpose, the required input/output signals must be supplied to the connector strip.

Customized settings are implemented using jumpers.

Features
- Maximum transmission rate 12 Mbit/s
- Automatic detection of the transmission rate on the fieldbus
- PROFIBUS DP protocol handling by LSPM 2 ASIC
- 48 MHz oscillator chip for LSPM 2
- 32 configurable inputs/outputs, of which up to 16 can be used as diagnostics inputs
- 8 separate diagnostics inputs
- Connection:
  - 2 x 34-pin connectors for connection to host network
  - 10-pin connector for RS 485
- Floating RS 485 interface for PROFIBUS DP
- Slot for EEPROM (64 x 16 bits) (optional for address setting)
- 5 V DC power supply
- Power consumption typ. 100 mA
- Polarity reversal protection
- 0 to 70 °C permissible ambient temperature
- Dimension (W x H): 85 x 64 mm (3.3 x 2.5 in) (modular design).

Firmware
No firmware is required for the operation of the IM 184 interface module.

The entire protocol processing is handled by the ASIC on the interface module.

IM 184 slave interface module
Slave interface module IM 183-1

Application
The IM 183-1 interface module enables the connection of a third-party device as slave to PROFIBUS DP. The maximum transmission rate is 12 Mbit/s.

The IM 183-1 is designed for intelligent slave applications.

Design
The IM 183-1 interface module consists mainly of the SPC 3 ASIC, the 80C32 microprocessor, an EPROM and RAM memory and an RS 485 interface for connection to PROFIBUS DP.

An RS 232 interface is also provided on the module for the connection of devices with an RS 232 interface, such as PCs, to the PROFIBUS DP fieldbus.

The SPC 3 ASIC is controlled by a 48 MHz oscillator chip.

The interface is as small as a cheque card and suitable for face-to-face mounting.

Operation
The integrated SPC 3 ASIC handles the bus protocol fully independently.

Communication with the host system takes place via the address and data bus which are routed to the connector strip. Data exchange is handled by the user program.

The 80C32 processor enables the additional integration of applications.

Features
- Maximum transmission rate 12 Mbit/s
- Automatic detection of the transmission rate on the fieldbus
- PROFIBUS DP protocol handling by SPC 3 ASIC
- Module core
  - CPU 80C32 microprocessor
  - 20 MHz clock frequency
  - 32 Kilobytes SRAM user memory
  - 32 Kilobytes or 64 Kilobytes EPROM program memory
- 48 MHz oscillator chip for SPC 3
- The host interface is the address and data bus on the interface module
- Connection
  - 50-pin connector for connection to host network
  - 14-pin connector for RS 232
  - 10-pin connector for RS 485
- Software reset for ASIC SPC 3
- 5 V DC power supply
- Power consumption typ. 100 mA
- Floating RS 485 interface for PROFIBUS DP
- 0 to 70 °C permissible ambient temperature
- Dimensions (W x H): 86 x 76 mm (3.3 x 2.7 in.) (modular design).

Firmware
Firmware (source code in C programming language) is supplied as an interface between the registers of the SPC 3 and the application.

The firmware is operated on the microprocessor and provides call interfaces for simple integration of the application.

The firmware contains approximately 4 to 24 kilobytes including examples.

The firmware is not absolutely necessary to operate the IM 183-1 interface module with the DP standard functions, since the registers of the ASICs’ SPC 3 are precisely documented. The firmware enables the user to save time he would otherwise require for development work.

The firmware is required for the use of the additional DPV1/DPV2 DP functions.
Slave interface module
IM 182-1

Application
The IM 182-1 interface module is a simple PC card for PROFIBUS DP slave applications. The 182-1 is designed for PCs with ISA bus. The maximum transmission rate is 12 Mbit/s.

Design
In principle, the IM 182-1 consists of the SPC 3 ASIC as well as an RS 485 interface for connecting a PROFIBUS DP. SPC 3 ASIC is controlled by a 48 MHz oscillator chip.

Operation
The integrated ASIC SPC 3 carries out the PROFIBUS DP bus protocol completely independently. The RAM's ASIC or the firmware must be linked by the user into his/her application.

Features
- Maximum transmission rate 12 Mbit/s
- PROFIBUS DP protocol handling by SPC 3 ASIC
- 48 MHz oscillator chip for SPC 3
- Isolated RS 485 interface for PROFIBUS DP
- Isolated power supply for the RS 485 interface on board
- DIP switch for setting the address space of the I/O addresses and the interrupt cables
- 5 V DC power supply
- Power consumption typ. 250 mA
- 0 to 60 °C permissible ambient temperature.

Firmware
A firmware (in the ANSI C source code) is offered as an interface between the registers of the SPC 3 and the application. The firmware is operated on the microprocessor of the host system and offers call interfaces for easy linking of the IM 182-1.

The firmware contains approximately 4 to 24 Kilobytes including examples.

The firmware is not absolutely necessary to operate the IM 182-1 interface module with the DP standard functions, since the registers of the ASICS' SPC 3 are precisely documented. The user saves time which would otherwise be spent for the required development work.

The firmware is required for the use of the additional DPV1/DPV2 DP functions.

Driver
A corresponding driver is offered for Windows NT.

Block diagram of the IM 182-1 slave interface module
Development kits
Development kit 4

Application
The development kit 4 offers you evaluation and development of Master and Slave applications for PROFIBUS DP.

Hardware components
- Master interface module CP 5613
- Slave interface module IM 183-1 – intelligent slave, with ASIC SPC 3
- Slave interface module IM 184 – simple slave, with ASIC LSPM 2
- Bus connector and bus cable

Software components
- COM PROFIBUS – needed to configure the bus system
- Firmware for IM 183-1 – original firmware for ASIC SPC3, including development licence
- Simulation software – to test and operate the components

Documentation
A complete English and German set is included on the accompanying CD.

Development of slaves
The purpose of the development kit is to develop PROFIBUS slaves with ASIC SPC 3 and LSPM 2.

Similarly, it is possible to develop PROFIBUS slaves directly with the IM 183-1 or IM 184 (as a piggy-back unit in your own electronics).

In order to establish a small, running PROFIBUS network, you must plug the CP 5613 master interface module into a PC (PCI slot). Then, connect it with the IM 183-1 slave interface module.

The simulation software lets you assign parameters to the IM and control the slaves. As a result, you can quickly become acquainted with the design and functions of the field bus PROFIBUS DP.

The simulation software is installed on the PC and enables you to control and query the slaves. In the process, diagnostic data of the slaves and inputs can be read, and slave outputs be set. The program examples exist in source code, and are well-documented. Based on the examples, you can develop your own functioning software and hardware.

Master system CP 5613
The CP 5613 and the simulation software constitute an operative PROFIBUS master. Based on this, you can quickly develop a master application.

Proprietary master systems
If you wish to develop your own master interface module, you need the ASPC2 master firmware set, with corresponding licence. This software is available in object code and in source code. The software was designed for the 80C165 processor.

The master licence and the firmware is not included in the development kit. Additional information is available in the support centers.

Service
The cost-free support of our customers, performed by the integration centers, is a constituent of the development kits.

The addresses of our support centers are shown on page 12.
Development kits
Development kit PROFIBUS DP/PA

Application
The development kit permits the design of PROFIBUS slaves with different PROFIBUS standards:
- PROFIBUS DPV1 (RS 485)
- PROFIBUS PA (IEC 1158)
- PROFIBUS based on fiber-optic cables

Supported target systems:
The development environment shows the implementation of applications with PROFIBUS ASICs DPC31.
Furthermore, use of the ASIC SIM 1 is emphasized as a Medium Attachment Unit (cf. page 7) for adaptation to the PROFIBUS PA system according to IEC 1158-2 as well as application of the SIM 1-1 and FOCSI chips.

Hardware components
- DPC31 Development Board; for developing and testing your own applications
- CP 5613, the master interface module for the PC (PCI board)
- Optical bus terminal to interface copper wires with optical cables
- PROFIBUS DP cable, copper, pre-assembled, violet
- PROFIBUS DP fiber optical cable, plastic, pre-assembled
- PROFIBUS PA cable, blue

Software components
- Test and simulation software for PC use (under WinNT), in conjunction with master board CP 5613
- Example program for the DPC31 board, with easy-to-use user interface incl. driver for PROFIsafe (driver is not included in scope of delivery)
- DPC31 original DPV1 firmware, including development licence
- Parameter assignment software "COM PROFIBUS" for CP 5613, for DP operation

Process Device Manager PDM
PDM is a uniform and cross-vendor tool for configuration, parameterization, commissioning and diagnostics of intelligent process devices. The enclosed PDM demonstration software is fully usable PDM software limited to two months’ use. Following purchase of the license, the PDM software can subsequently be used without limitations.

Functions
The development kit contains all components required to develop a PROFIBUS slaves with ASICs DPC31 and SIM 1-1.

The program examples exist in source code and are well documented. The hardware configuration is documented with circuit diagrams.

The CP 5613, which is included in the delivery, must be installed in a PCI slot in the PC. Then, install the demo software (WinNT), to obtain a functioning PROFIBUS DP master. Use the configuration tool "COM PROFIBUS" to assign parameters to the CP 5613 and to the PROFIBUS configuration (with DPC 31 board).

If you intend to develop a PROFIBUS DP slave to RS 485, you must couple the DPC31 board to the PC master by using the copper PROFIBUS cable included in the delivery.

If the line consists of optical cables, use the optical bus terminal (also included in the delivery) in order to convert the interface to fiber optics.

The accompanying fiber optic cable must be connected to the optical interface of the DPC31 board.

If the line is a PROFIBUS PA line, the DPC31 board must be connected over a DP/PA coupler. To achieve this, the supplied PROFIBUS DP cable must be plugged into the DP/PA coupler, and the supplied blue PROFIBUS PA cable must be wired from the DP/PA coupler to the PA port of the DPC31 board. The PROFIBUS PA devices must be configured with the supplied PDM software.

The PROFIBUS DP/PA coupler (required if you wish to develop PROFIBUS PA applications) converts the PROFIBUS DP technology to PROFIBUS PA. It is not included in the kit and must be ordered separately.

The example application is stored in the firmware EPROM of the DPC31 boards, and starts to communicate with the master once the cables are connected properly.

The software enables you to edit the functions included in the example, e.g. by changing the “limit values”.

Based on this operative example you can develop your own hardware and software.

Documentation
The complete English and German documentation is included on the accompanying CD.

Service
The cost-free support of our customers, performed by the support centers, is a constituent of the development kits. The addresses of our support centers are shown on page 12.
Development kit PROFIsafe

**Application**
The PROFIsafe development kit can be used to develop and test safety-relevant slave applications for connection to the PROFIBUS DP.
The slaves are certified up to SIL 3 according to IEC 61508.
The PROFIsafe development kit is based on the PROFIBUS development kit 5.

**Software components**
The PROFIsafe development kit contains the following software components:
- PROFIsafe Driver for Slaves – source code and documentation
- CRC-Calc-Tool – calculation tool for generation of GSD CRC
- PROFIsafe-Monitor – PROFIsafe master simulation for testing of driver implementation

**Documentation**
All required documentation is available in German and English on an enclosed CD.

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**Architecture of a fail-safe application**
## Technical specifications

### Interface modules, development kits

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<th>IM 183-1</th>
<th>IM 182-1</th>
<th>IM 180</th>
<th>IM 181</th>
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<tr>
<td>Application</td>
<td>Simple slave applications</td>
<td>Slave applications</td>
<td>Master applications</td>
<td>Carrier board for IM 180 interface&lt;sup&gt;1)&lt;/sup&gt;</td>
<td>-</td>
</tr>
<tr>
<td>Max. transmission rate</td>
<td>9.6 kbit/s … 12 Mbit/s with automatic baud rate detection</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Protocols</td>
<td>PROFIBUS DP</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>ASIC</td>
<td>LSPM 2</td>
<td>SPC 3</td>
<td>ASPC 2</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Microprocessor</td>
<td>Not required</td>
<td>80C32 (20 MHz)</td>
<td>Processor of PC/PG</td>
<td>80C165 (40 MHz)</td>
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</tr>
<tr>
<td>Size of firmware</td>
<td>Not required</td>
<td>4 ... 24 KB (incl. test program)</td>
<td>80 KB</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Memory capacity</td>
<td>-</td>
<td>32 KB SRAM</td>
<td>64 KB EPROM</td>
<td>2 x 128 KB</td>
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<td>Host interface</td>
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<td>-</td>
<td>Dual-port-RAM</td>
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<td>-</td>
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<tr>
<td>Permissible ambient temperature</td>
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<td>0 ... 60 °C</td>
<td>0 ... 70 °C</td>
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<td>-</td>
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<td>Power supply</td>
<td>5 V DC</td>
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<tr>
<td>Power consumption</td>
<td>150 mA typ.</td>
<td>250 mA typ.</td>
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<td>-</td>
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<tr>
<td>Board size, mm (inch)</td>
<td>85 x 64 (3.3 x 2.5)</td>
<td>86 x 76 (3.3 x 2.7)</td>
<td>168 x 105 (6.6 x 4.1)</td>
<td>100 x 100 (3.9 x 3.9)</td>
<td>168 x 105 (6.6 x 4.1)</td>
</tr>
</tbody>
</table>

<sup>1)</sup> for PC ISA slot

### Development kits

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<td>Application</td>
<td>Master and slave applications for PROFIBUS DP</td>
<td>Development of PROFIBUS slaves</td>
</tr>
</tbody>
</table>
| Hardware components | • Master interface CP 5613  
• Slave interface IM 184 | • DPC31 Development Board  
• Master interface CP 5613 (PCI)  
• Optical bus terminal for conversion of copper to fiber-optic cables |
| Software components | • COM PROFIBUS  
• Firmware IM 183-1 (original firmware for SPC 3 incl. development license)  
• Simulation software for testing and operation of components | • COM PROFIBUS for CP 5613 (for DP operation)  
• DPC31 original DPV1 firmware (incl. development license)  
• Example program for DPC31  
• Test and simulation software (for PC application of the CP 5613 with Windows NT) |
| Documentation     | On CD-ROM in German and English | Safety-relevant slave applications for PROFIBUS DP |

For further details, see SIMATIC Manuals Guide

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