

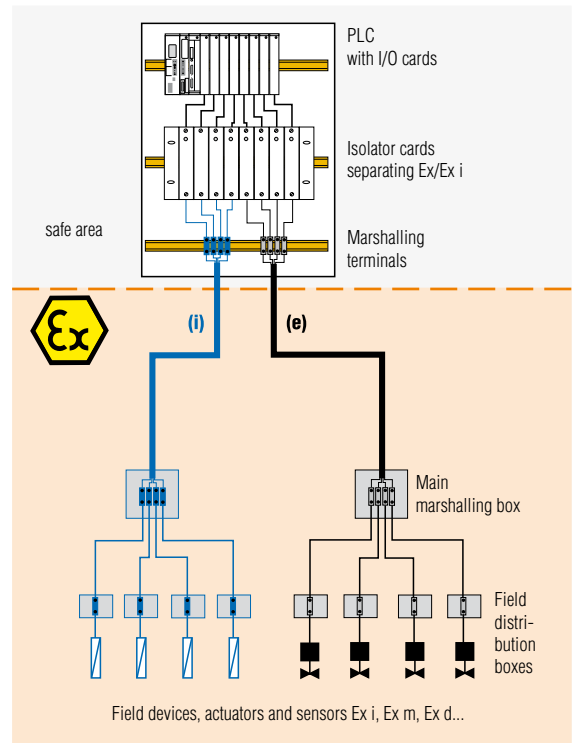


Today's industrial plant design

Industrial plant installations are still being designed on the conventional arrangement of a control room, which is located in the safe area. This contains the PLC or DCS unit, along with input and output cards and any intrinsically safe barriers/isolation cards. A large number of connection terminals are required within the switchgear cabinet, for both the out and incoming cable connections, to and from the field distribution boxes. This takes up a great deal of space, is often quite complex, and is an area which is susceptible to faults. Any extensions or modifications to the plant have to be planned well in advance.

Theory and practice

An ideal field bus system, networking a large number of actuators and sensors, is both costly and far from easy to implement. Fitting simple components such as proximity and limit switches with an additional interface for bus communication would make them considerably more expensive than the cost of the standard product. It is this high cost factor that stands in the way of the ideal field bus system becoming a reality.



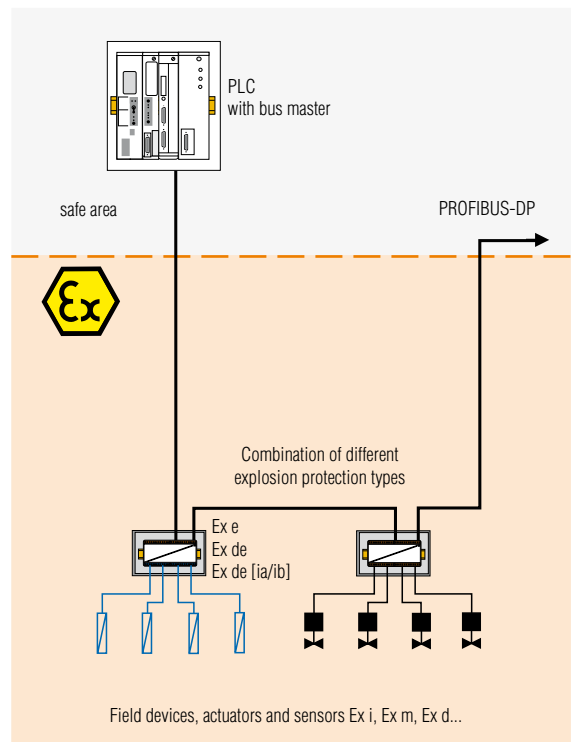
**MODEX . . .
innovative and practical**

Looking for a system that has real advantages over conventional cabling?

BARTEC has the solution. Using MODEX bus modules, standard bus systems can be connected directly from the safe area into the hazardous area.

You could benefit as follows:

- An appreciable saving of space in the control room
- MODEX replaces the I/O level, Ex isolation, marshalling boxes, main and field distribution boxes
- Bus cables replace elaborate parallel cabling and main cables
- Reduction of cable management systems
- Flexibility of planning and engineering
- Appreciable cost savings





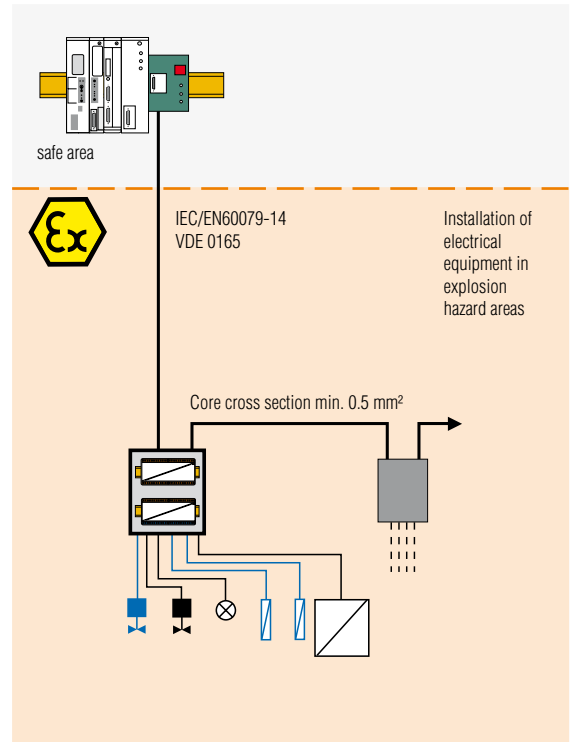
Bus systems in hazardous areas don't need to be intrinsically safe!

Components with a low power demand are often manufactured to meet the "intrinsically safe" requirement. The advantage of this is in the ease of use and replacement of sensors and actuators. However, in addition to sensors, motors, valves and heating systems are operated in hazardous areas and these require a great deal more power than can be supplied using intrinsically safe circuits.

Standard bus systems for direct links with the hazardous area

Using MODEX bus modules, standard bus systems can be linked directly from the safe area to the hazardous area - quickly and easily.

The IEC 60079-14 standard, which governs the installation of electrical equipment in hazardous areas, is the only standard that needs to be considered.



The key word is "combination"

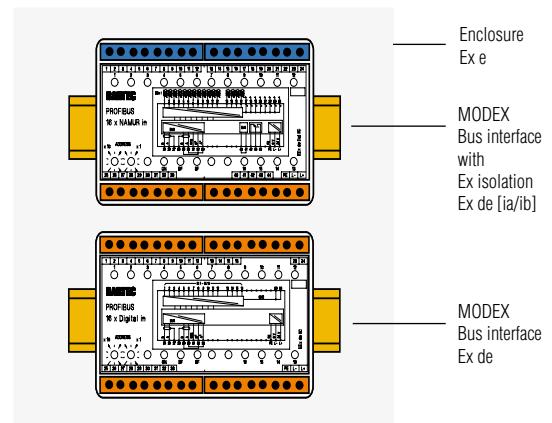
You have measuring and control circuits in different protection types and want to link them in a single system. BARTEC offers a solution through the combination of protection types. The benefits for you are a system which has:

- Flexibility, functionality and a high degree of safety and reliability

The system will also be suitable for both:

- intrinsically safe measuring circuits with a low power demand
- and for supplying consumers with a high power demand

MODEX... safe and proven



MODEX... the safe and reliable solution for standard bus systems in hazardous areas



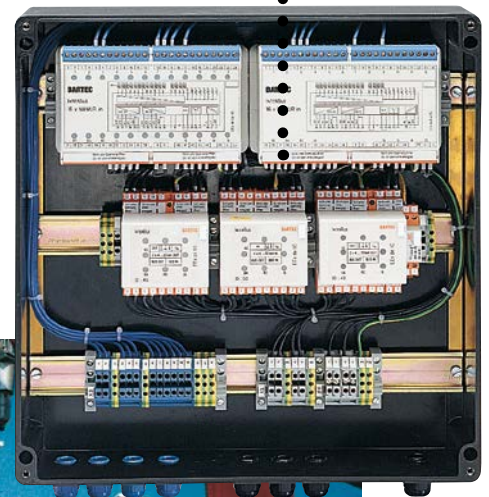
Local control units

MODEX decentralized local control units are enclosures in stainless steel, polyester or aluminium. They are fitted with a variety of MODEX components to suit individual applications.

All BARTEC enclosures are certified as conforming to the "CENELEC" European Standards and meet all of the requirements relating to impact resistance, ageing, antistatic properties and IP rating. The assembled unit containing the MODEX I/O and interface components is also fully approved.

MODEX local control units can be opened while in operation

Work may be carried out on intrinsically safe circuits, provided that all live parts, which are not intrinsically safe (Ex i) are protected by a cover (see detail illustration) which is at least IP 30 (cf. EN 60079-7; 2003).



MODEX local control units

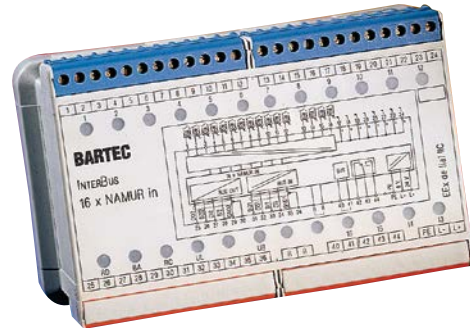


Local installation

MODEX local control units, are installed in the immediate vicinity of the sensors and actuators, inside the hazardous area. They replace the I/O level, Ex isolation, main marshalling box and other field distribution boxes.

Sensors and actuators are wired directly to the control units. The individual control units are networked to one another and to the control room, by means of a standard bus system.

The direct networking appreciably cuts planning, installation and inspection costs.



MODEX proves its merit... on the spot

The wide variety of MODEX modules available, enables versatile solutions to be created for a large number of different applications. In accordance with customers' requirements, BARTEC fits MODEX into Ex e enclosures and delivers them as local control units, certified for hazardous areas.

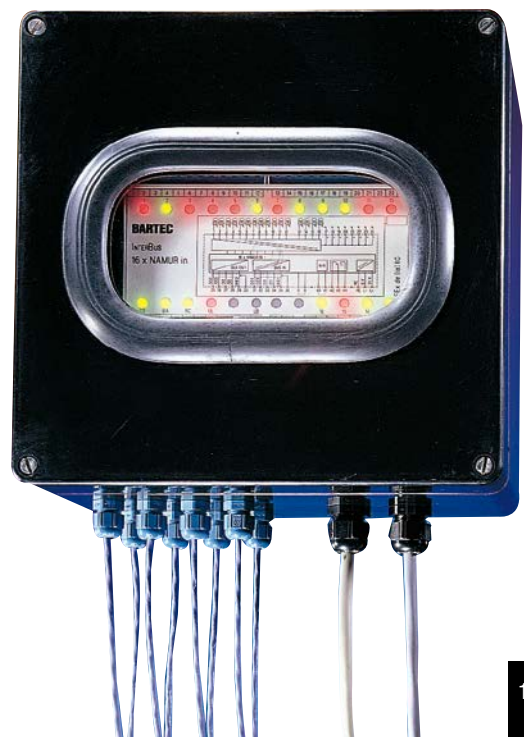
The decentralized use of MODEX control units, enables modular systems to be built up, tested and extended. To increase system availability both the power supply and bus cabling can be installed with redundancy.

- relays
- fuses
- measuring transducers Pt100
- power supply units
- switch amplifiers

Commissioning/service/maintenance

LEDs on the MODEX modules, give a clear and direct overview of the various operating conditions, such the status of the Voltage, the Bus and Channel Activated, etc.

Signals can be indicated locally via volt free relay contacts. All signals normally sent in bus systems are, of course, also available to the control room.





MODEX modules












MODEX modules are flameproof certified, plastic enclosures, in which electrical components or sub-assemblies are installed.

The individual modules are connected to one another by means of „increased safety“ terminals.

All MODEX modules are tested and PTB certified to Ex de IIC or Ex de [ia/ib] IIC.

*MODEX . . .
the perfect bus connection for PROFIBUS-DP*

Selection chart PROFIBUS-DP

	Application Sensor/actuator	Signals	Ex protection	Channels
	Switch	digital in	Ex e/Ex i	16
	Proximity switch	digital in	Ex e/Ex i	16
	Electronic switch	digital in	Ex e/Ex i	16
	Solenoid valve	digital out	Ex e/Ex i	16
	Visual signals	digital out	Ex e/Ex i	16
	Acoustic signals	digital out I/O	Ex e	16
			Ex i	16 oder 8/4 I/O
	Transmitter	analog in	Ex i	8 oder 4/4
	Power sources	analog in I/O	Ex i	8 oder 4/4 I/O
	I/- converter	analog out	Ex e/Ex i	8
	Positioner	analog out	Ex e/Ex i	8
	Switch	Relais out	Ex e/Ex i	8



Selection chart Enclosure sizes MODEX modules

Enclosure size	Length (mm)	Width (mm)	Height (mm)
I	60	15	75
II	60	30	75
III	90	30	94
IV	90	75	94
V	100	170	94

Selection chart MODEX PROFIBUS modules

Type	Features	Ex protection	Size	➔ Order no.
16 x digital in	16 digital inputs DC 24 V Direct tripping of limit switches	Ex II 2G Ex de IIC	V	07-7331-2302/0000
16 x digital in NAMUR	16 inputs for Proximity switches or mechanical contacts	Ex II 2(1)G Ex de [ia] IIC	V	07-7331-2303/_000
16 x digital out	16 digital outputs DC 24 V/500 mA; Direct tripping of encapsulated solenoid valves	Ex de IIC	V	07-7331-2301/0000
16 x digital out	16 intrinsically safe outputs	Ex II 2G Ex de [ib] IIC	V	07-7331-2301/1_00
8 x 4 to 20 mA	8 analogue inputs 4 to 20 mA Ex i for 2-wire transmitter	Ex II 2(1)G Ex de [ia] IIC	V	07-7331-2304/0000
8 x 4 to 20 mA	8 analogue inputs for 2-wire transmitter or active 4 to 20 mA	Ex II 2(1)G Ex de [ia] IIC	V	07-7331-230H/0000
8 x 4 to 20 mA in passiv	8 analogue inputs for 4 to 20 mA for 4-wire transmitter	Ex II 2(1)G Ex de [ia] IIC	V	07-7331-2304/2000
8 x analog out	8 analogue outputs 4 to 20 mA Ex i; load 0 to 500 Ω	Ex II 2(1)G Ex de [ia] IIC	V	07-7331-2306/_000
4 x 4 to 20 mA analog in/analog out	4 analogue inputs and 4 analog outputs	Ex II 2(1)G Ex de [ia] IIC	V	07-7331-230H/1010
Valve controller 4 out/8 in	4 digital outputs for Ex i valves 8 digital inputs for limit switch signal	Ex II 2(1)G Ex de [ia] IIC	V	07-7331-2305/_000
4 x RTD in	4 Pt100/Pt1000 or potentiometer; Temperature sensors, two or three wire	Ex II 2(1)G Ex de [ia] IIC	V	07-7331-2307/0000
8 x Relais out	8 outputs AC 250 V/5 A or DC 100 V/2 A Mech. service life 10 million operations	Ex II 2G Ex de IIC	V	07-7331-2308/0000
8 x Relais out	8 changeover for Ex i circuits Mech. service life 10 million operations	Ex II 2G Ex de [ib] IIC	V	07-7331-2308/1000
Coupler/Repeater	Coupler: Signal Refresh Repeater: Signal Refresh and Time Refresh	Ex II (2)G Ex de [ib] IIC	V	07-7311-9.WP/....
LWL-Coupler	Optical waveguide-coupler for long distances interference free signal transmission	Ex II 2G Ex de [ib] IIC	IV	07-7311-97WP/....
Terminator	active PROFIBUS bus terminal resistor	Ex II 2G Ex de IIC	III	07-7311-93WP/0000



Brief technical description

**Extract from the brief technical description of PROFIBUS-
from the PROFIBUS user organisation of September 1999**

The RS 485 transmission technology

RS 485 transmission is the transmission technology most frequently used by PROFIBUS. The application area includes all areas in which high transmission speed and simple, inexpensive installation are required. Twisted pair shielded copper cable with one conductor pair is used.

The RS 485 transmission technology is easy to handle. Installation of the twisted pair cable does not require expert knowledge. The bus structure permits addition and removal of stations or step-by-step commissioning of the system without influencing the other stations. Later expansions have no effect on stations which are already in operation. Transmission speeds between 9.6 kbit/sec and 12 Mbit/sec are available. One unique transmission speed is selected for all devices on the bus when the system is commissioned.

Installation instructions for RS 485

All devices are connected in a bus structure (i.e., line). Up to 32 stations (master or slaves) can be connected in one segment. The bus is terminated by an active bus terminator at the beginning and end of each segment.

To ensure error-free operation, both bus terminators must always be powered. The bus terminator can usually be switched in the devices or in the bus terminator connectors. In the case of more than 32 users, or to enlarge the area of the network, repeaters (line amplifiers) must be used to link up the individual bus segments. The maximum cable length depends on the transmission speed, see Table 2. Cable length specifications in Table 2 are based on type-A cable with the following parameters:

■ Impedance	135 to 165 Ω
■ Capacity	< 30 pF/m
■ Loop resistance	110 W/km
■ Wire gauge	0.64 mm
■ Conductor area	> 0.34 mm ²

The use of cables, type B used in former times is not recommended generally.



Baud rate (kbits/s)	9.6	19.2	93.75	187.5	500	1 500	12 000
Range/Segment	1 200 m	1 200 m	1 200 m	1 000 m	400 m	200 m	100 m

Table 2: Range based on transmission speed for type-A cable

Fiber type	Properties
Multimode glass-fiber	Medium distance 2 to 3 km range
Monomode glass-fiber	Long distance > 15 km range
Plastic fiber	Short distance < 80 m range
PCS/HCS fiber	Short distance approx. 500 m range

Table 7: Properties of fiber-optic cables

PROFIBUS cable

PROFIBUS cables are offered by various well-known manufacturers. A particular feature is the fast-connect system which, thanks to a special cable and special cable stripper, allows fast, reliable and extremely simple wiring. When connecting the stations, make sure that the data lines are not reversed. Use of shielded data lines is absolutely essential for achieving high system immunity against high electromagnetic emissions. The shield should be connected to protective ground on both sides and with good conductivity using large-area shield clamps. In addition, it is recommended that data lines be kept separate from all high-voltage cables. The use of stub lines must be avoided for data transmission speeds of 1.5 Mbit/s.

Commercially available plug connectors permit the incoming data cable and the outgoing data cable to be connected directly in the connector. This means that stub lines do not have to be used, and the bus connector can be connected and disconnected at the bus at all times without interrupting data communication.

Whenever problems occur in PROFIBUS networks, in 90 % of all cases they can be attributed to incorrect wiring and installation. These problems can often be solved using bus testers, which can detect many typical wiring faults even before commissioning. For the addresses of supplier of the many different connectors, cables, repeaters and bustesters, please refer to the PROFIBUS Product Guide.

Fiber-optic cables

Fiber-optic conductors may be used in PROFIBUS for applications in environments with very high electromagnetic interference, for electrical isolation or to increase the maximum network distance for high transmission speeds. Various types of fibers are available, with different characteristics with respect to distance, price and application.

PROFIBUS segments using fiber-optic technology are designed using either a star or a ring structure. The PROFIBUS fiber optic components from some manufacturers also allow the creation of redundant fiber optic links with automatic switchover to the alternative physical transmission route in the event of a fault. Many manufacturers also offer couplers between RS485 transmission links and optical fibers. This provides a method of switching at any time between RS485 transmission and fiber optic transmission within one system. See PROFIBUS guideline 2.021 for the specification of the PROFIBUS fiber-optic transmission technique. For an overview of the fiber-optic components available for PROFIBUS, please refer to the current PROFIBUS Product Guide.