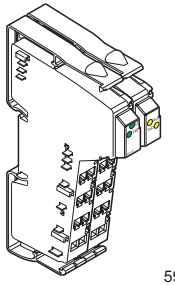
IB IL RS 232
IB IL RS 232-PAC

Inline Terminal
for Serial Data Transmission



5935A001

Data Sheet 01/2005

The item versions only differ in the scope of supply (see "Ordering Data" on page 36). Their function and technical data are identical.

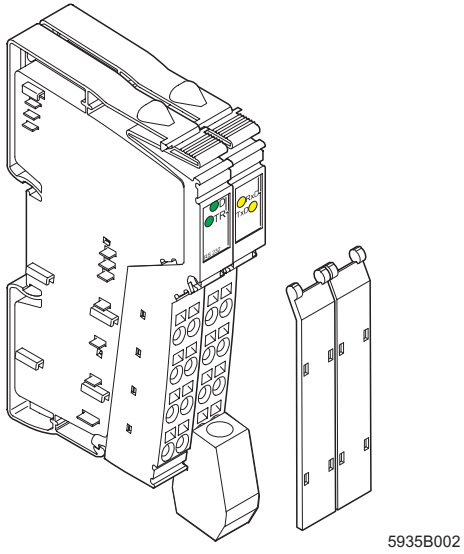
This data sheet is only valid in association with the "Configuring and Installing the INTERBUS Inline IB IL SYS PRO UM E" user manual.

Function

The terminal is designed for use within an Inline station. It enables the operation of off-the-shelf I/O devices with serial interfaces on INTERBUS.

Features

- A serial I/O channel (RS-232)
- DTR/CTS handshake supported
- Various protocols supported
- Transmission speed adjustable up to 38,400 baud
- Number of data bits, stop bits, and parity can be set
- 4-kbyte receive buffer and 1-kbyte transmit buffer
- Parameterization and data exchange via INTERBUS using PCP services
- Diagnostic and status indicators



5935B002

Figure 1 The terminal IB IL RS 232-PAC

Table of Contents

1 General Description 3
2 Internal Circuit Diagram 4
3 Connection Notes 6
4 Connection Examples 6
4.1 Capacitor Between Shield and FE 6
4.2 Shield Connected Directly to FE 7
5 Programming Data/Configuration Data 7
5.1 INTERBUS 7
5.2 Other Bus Systems 7
6 Data Storage and Transmission 8
6.1 Overview of the Supported Protocols 8
6.2 Transparent Protocol 9
6.3 End-to-End Protocol 9
6.4 Dual Buffer Protocol 10
6.5 3964R Protocol 10
6.6 XON/XOFF Protocol 11
7 PCP Communication 12
7.1 Object Dictionary 12
7.2 Object Description 13
7.3 PCP Mode Error Messages 22
8 V.24 Interface 22
8.1 V.24 Terminal Handshake Signals 23
8.2 V.24 Interface Wiring With Four-Wire Handshake 24
8.3 V.24 Interface Wiring Without Handshake 26
9 Process Data 28
9.1 Assignment of the OUT Process Data Word (~Control Word) 28
9.2 Assignment of the OUT Process Data Word (~Control Word) 29
9.3 Assignment of the IN Process Data Word (~Status Word) 30
9.4 Format of the IN Process Data Word (~Status Word) 31
10 Technical Data 33
11 Ordering Data 36

1 General Description

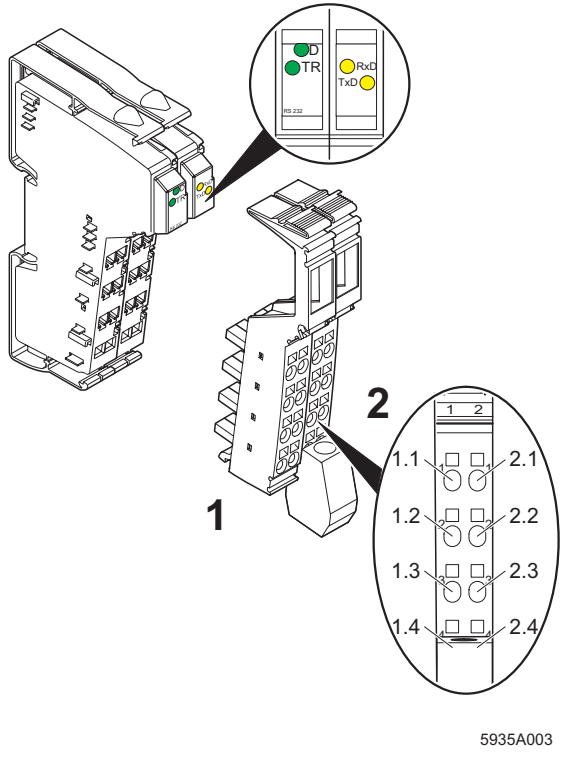


Figure 2 IB IL RS 232 with appropriate connectors

Application Examples

- Scale with RS-232 interface
- Label printer
- PC interface (e.g., communication between master and PC via INTERBUS)
- Control of indication elements
- Parameterization of intelligent field devices (e.g., frequency inverter)
- Transition to other protocols and media (e.g., radio)

Local Diagnostic and Status Indicators

Des.	Color	Meaning
D	Green	Bus diagnostics
TR	Green	PCP active
Serial Interface:		
RxD	Yellow	Terminal receives data from the connected device
TxD	Yellow	Terminal transmits data to the connected device

Terminal Assignment

Con-nec-tor	Termi-nal Point	Signal	Assignment
1	**1.4, 2.4**	**FE**	Functional earth ground
	All other terminal points of this connector are not used.		
2	**1.1**	**RxD**	Serial data input
	2.1	**TxD**	Serial data output
	1.2	**+5 V**	Control output, internally wired to +5 V DC
	2.2	**CTS**	Control input for hardware hand-shake
	1.3	**DTR**	Control output for hardware hand-shake
	2.3	**GND**	GND for serial interface
	1.4, 2.4	**Shield**	Shield connection

Observe the connection notes on page 6.

2 Internal Circuit Diagram

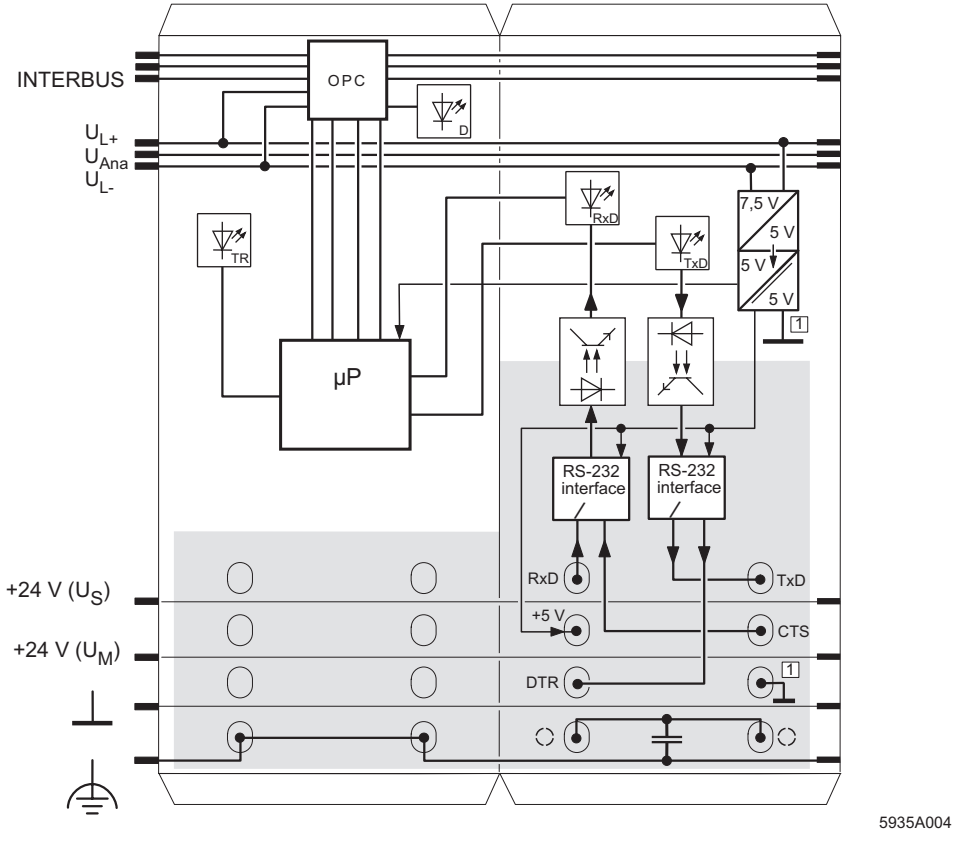
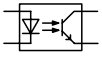


Figure 3 Internal wiring of the terminal points

Key:

Protocol chip

Diagnostic and status indicators with function information



Optocoupler

DC/DC converter with electrical isolation

Microprocessor

RS-232 interface

Capacitor

Ground, electrically isolated from ground of the potential jumper

Other symbols used are explained in the IB IL SYS PRO UM E user manual.

3 Connection Notes

By assigning terminal points 1.4 and 2.4 of both connectors you can connect the cable shield either using a capacitor (connector 2) or directly (connector 1) to the functional earth ground (FE).

Using the two connection options you can connect one side of the cable shield directly and one side using a capacitor to FE without additional effort. In this way, you can prevent the creation of ground loops that would occur if a shield with two direct connections were placed on FE.

If you connect the shield via connector 1, you must connect the shield connector on the left-hand side of the terminal. All wires must be connected to connector 2.

Ensure that on connector 2, terminal point 1.2 (+5 V) is exclusively used to provide the 5 V signal for the CTS input (terminal point 2.2), in the event of communication without handshake. In this case insert a jumper between the terminal points.

Any other use is not permitted.

4 Connection Examples

Use a connector with shield connection when installing the I/O device. Figure 4 shows the connection schematically (without shield connector).

4.1 Capacitor Between Shield and FE

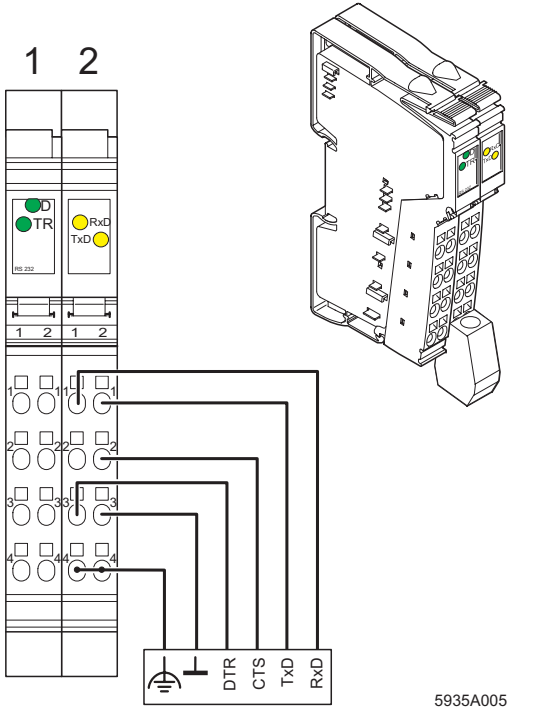


Figure 4 Connection of an I/O device with a serial interface

In this example the V.24 interface wiring for communication with 4-wire handshake is shown.

4.2 Shield Connected Directly to FE

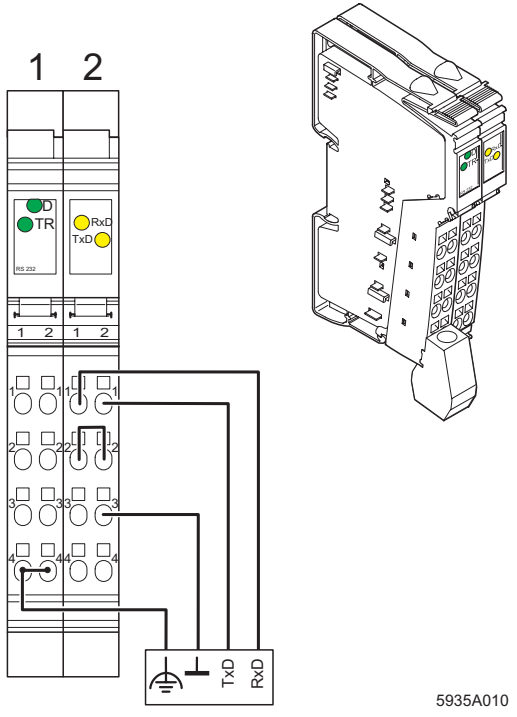


Figure 5 Connection of an I/O device with a serial interface

In this example the V.24 interface wiring for communication without handshake is shown. You should insert a jumper between connection points 1.2 (+5 V) and 2.2 (CTS).

5 Programming Data/ Configuration Data

5.1 INTERBUS

ID code	DC_{hex} (220_{dec})
Length code	01_{hex}
Process data channel	16 bits
Input address area	2 bytes
Output address area	2 bytes
Parameter channel (PCP)	4 bytes
Register length (bus)	6 bytes

5.2 Other Bus Systems

For the configuration data of other bus systems, please refer to the appropriate electronic device data sheet (GSD, EDS).

6 Data Storage and Transmission

The IB IL RS 232 terminal stores the received V.24 data in an intermediate buffer, until it is fetched from the V.24 interface by the INTERBUS controller board or the device.
V.24 data traffic can be managed using various protocols. The protocol used depends on the type of protocol supported by the peer.

6.1 Overview of the Supported Protocols

Protocol	Receive Memory	Transmit Memory	Special Features When Receiving
Transparent	4096 bytes	1023 bytes	
End-to-end	25 buffers each with 58 bytes	1023 bytes (including end characters)	Two end characters are filtered out
Dual buffer	2 buffers each with 58 bytes	1023 bytes (including end characters)	Only stores the most recently received data, end characters are filtered out
3964R	25 buffers each with 58 bytes	15 buffers each with 58 bytes	Data exchange with software handshake, time monitoring, and checksum
XON/XOFF	4096 bytes	1023 bytes	Software handshake

6.2 Transparent Protocol

If the transparent protocol is used, V.24 data is transmitted through the terminal in the same format it was received from the V.24 or user side (INTERBUS side).

The transmit FIFO (**F**irst-**I**n-**F**irst-**O**ut memory) can store 1023 bytes (1 kbyte), and the receive FIFO can store 4096 bytes (4 kbytes). If the terminal receives another character after the 4095^{th} character, the error pattern is stored in the receive FIFO. All other subsequent characters are ignored.

A CTS hardware handshake is supported with this protocol.

6.3 End-to-End Protocol

The V.24 data is conditioned for the end-to-end protocol.

If V.24 data is sent from the user side (INTERBUS side), two additional characters, the first and second delimiters, are attached for transmission to the V.24 side. The first and second delimiters are defined when the terminal is configured using the INIT-TABLE object.

V.24 data transmitted from the V.24 side can only be read by the user if the IB IL RS 232 terminal has received the first and second delimiters. The two end characters confirm that the V.24 data has been received without error and the maximum data length of 58 bytes has been observed. The delimiters are filtered out when the data is read by the INTERBUS side.

Unlike in the transparent protocol, the receive memory is not organized as a FIFO but as a buffer. There are 25 buffers available, each with 58 bytes. If the buffer size of 58 bytes is exceeded, without the two delimiters being detected, the buffer is overwritten again. Depending on the INIT-TABLE object, subindex $0C_{hex}$ (rotation switch), there are two variants.

Variant 1 ($0C_{hex} = 0$; default setting):
In the re-written buffer **only** the **new** data is available, i.e., data from the previous cycle is rejected.

Variant 2 ($0C_{hex} = 1$): The buffer is re-written character by character. If the two delimiters are detected the **new** characters **and** the **remaining** characters from the previous cycle are available in the re-written buffer (rotation).

The transmit FIFO can store 1023 bytes. The delimiters are attached to, and stored with, the data to be sent.

6.4 Dual Buffer Protocol

With this protocol, the **last** received data block is stored. A data block is defined as a sequence of V.24 characters with the first and second delimiter end characters, as in the end-to-end protocol.

As soon as a new data block is received, the previous one is overwritten. This is achieved by means of two buffers, which are written alternately. This means that one buffer will always be available to receive V.24 data, while the other will be storing the last received data block. A data block is only regarded as complete once both delimiters have been detected, one after the other. It can then be read from the INTERBUS side.

If the buffer size of 58 bytes is exceeded, without the two end characters (delimiters) being detected, the buffer is overwritten again. Depending on the INIT-TABLE object, subindex $0C_{hex}$ (rotation switch), there are two variants.

Variant 1 ($0C_{hex} = 0$): In the re-written buffer **only** the **new** data is available, i.e., data from the previous cycle is rejected.

Variant 2 ($0C_{hex} = 1$): The buffer is re-written character by character. If the two delimiters are detected the **new** characters **and** the **remaining** characters from the previous cycle are available in the re-written buffer (rotation).

The same conditions as in the end-to-end protocol apply to transmitting V.24 data. If V.24 data is transmitted from the user side (INTERBUS side), two additional characters, the first and second delimiters, are attached for transmission to the V.24 side.

6.5 3964R Protocol

This protocol, developed by Siemens, is the most complex. It uses beginning and end identifiers, a checksum, and a time monitoring function.
There are 15 buffers available for transmission and 25 buffers for reception.

Character delay time:	220 ms
Acknowledgment delay time:	2 s
Block waiting time:	10 s
Number of attempts to establish a connection:	6

The optional 3964 priority defines which device may transmit first (high priority) if there is an initialization conflict (several devices attempting to transmit data simultaneously).

6.6 XON/XOFF Protocol

This protocol operates in the same way as the transparent protocol, but uses a software handshake instead of a hardware handshake.

Data transmission with this protocol is controlled by the XON and XOFF characters. XON is preset to 11_{hex} and XOFF to 13_{hex}. These characters can also be defined when the terminal is configured using the INIT-TABLE object.

If the terminal receives an XOFF, no more V.24 data will be sent until an XON is received.

The terminal itself will transmit an XOFF if the available space in the receive memory is less than 5 bytes. As soon as more memory becomes available again, the module will transmit a single XON. The transmission does not depend on the CTS input.

V.24 data is not filtered when it is transmitted. Any characters, which occur with the code defined for XON and XOFF, are thus transmitted and may trigger undesirable events at the receiver.
When V.24 data is received, the XON and XOFF characters are filtered and are not available as data. Any characters with the XON or XOFF code are lost. Ensure that characters with these codes do not appear in the data stream.

7 PCP Communication

Information on PCP communication can be found in the "IBS SYS PCP G4 UM E" user manual (Order No. 27 45 16 9).

By default upon delivery, the terminal is configured for data transmission according to the parameters on page 17. The terminal can be configured to suit your application.

The terminal is configured in PCP mode using the "INIT-TABLE" object.

The programs IBS CMD (for standard controller boards) and IBS PC WORX (for Field Controllers (FC) and Remote Field Controllers (RFC)) are available for the configuration and parameterization of your INTERBUS system.

Additional information can be found in the "IBS CMD SWT G4 UM E" and "PC WORX 3 QS UM E" user manuals.

Parameter records and text strings are transmitted to or from a connected I/O device in PCP mode using the "V24-DATA" object.

7.1 Object Dictionary

Index	Data Type	A	L	Meaning	Object Name	Rights
$5FC1_{hex}$	Var of Unsigned 8	1	1	Module start indicator	START-IND	rd/wr
$5FE0_{hex}$	String Var of Octet String	1	58	Transmit/receive V.24 (RS-232) data	V24-DATA	rd/wr
$5FFF_{hex}$	Array of Unsigned 8	20	1	Terminal configuration	INIT-TABLE	rd/wr

N: Number of elements

L: Element length in bytes

rd: Read access permitted

wr: Write access permitted

7.2 Object Description

In the tables for the value ranges of objects or elements, designations used in the IBS CMD and IBS PC WORX programs are shown in *italics*.

START-IND Object

The object indicates whether or not the terminal was restarted.

After the voltage has been switched on (power up), the byte will always have a value of 01_{hex}. For a restart to be detected, the application must have set the byte to 00_{hex}. If it is then set to 01_{hex} again **by the terminal**, this indicates that it has been restarted.

The object has no meaning as far as the terminal functions are concerned.

Object Description:

Object	START-IND
Access	Read, write
Data type	Simple Var 1 bytes
Index	$5FC1_{hex}$
Subindex	00_{hex}
Length (byte)	01_{hex}
Data	Module start indicator

Value Range of the Object

	Module Start Indicator	
Code	**Meaning**	**Representation in CMD/PC WORX**
00_{hex}	Reset power up message	*Reset power up message*
01_{hex}	Power up completed	*Power up completed*

If **you** set the object to 01_{hex}, it has **no effect** on the function of the terminal.

A power up cannot be triggered in this way.
However, it is not possible to detect a terminal restart.

V24-DATA Object

This object is used for transmitting and receiving V.24 data.

Object Description:

Object	V24-DATA
Access	Read, write
Data type	String Var of Octet String 1 x 58 bytes
Index	$5FE0_{hex}$
Subindex	00_{hex} (only access to all data possible)
Length (byte)	00_{hex} Amount of data present in the buffer : $3A_{hex}$ Maximum length of the object
Data	Transmit/receive V.24 data

If no V.24 data is available on a read access, a read response (read service reply) is generated with result (+) and length = 0.

With a protocol data unit (PDU size) of 64 bytes a maximum of 58 characters can be transmitted.

The length of the read or write service depends on the number of V.24 characters to be transmitted. If, for example, 20 V.24 characters are to be read, the read response will be 24 bytes long (20 bytes V.24 data + 4 bytes PCP overhead).

Error Messages for the V24-DATA Object:

– If, during a write service, there is not enough transmit memory available for V.24 data, the service will be answered with a negative confirmation.

The parameters are:

Error_Class	8
Error_Code	0
Additional_Code	0022_{hex}
Meaning	No character of the V.24 data will be accepted from this service

– A write service without user data (length = 0) will be answered with a negative confirmation.

The parameters are:

Error_Class	8
Error_Code	0
Additional_Code	0030_{hex}
Meaning	Value is out of range

INIT-TABLE Object

Writing the INIT-TABLE object with a write service configures the terminal.

Object Description

Object	INIT-TABLE
Access	Read, write
Data type	Array of Unsigned 8 20 x 1 bytes
Index	$5FFF_{hex}$
Subindex	00_{hex} Write all elements 01_{hex} Protocol 02_{hex} Baud rate 03_{hex} Data width 04_{hex} Reserved 05_{hex} Reserved 06_{hex} Error pattern 07_{hex} First delimiter 08_{hex} Second delimiter 09_{hex} 3964R priority $0A_{hex}$ Output type $0B_{hex}$ DTR control system $0C_{hex}$ Rotation switch $0D_{hex}$ XON pattern $0E_{hex}$ XOFF pattern $0F_{hex}$ Reserved : : 14_{hex} Reserved
Length (byte)	14_{hex} Subindex 00_{hex} 01_{hex} Subindex 01_{hex} to 14_{hex}
Data	Configuration of the IB IL RS 232 terminal

INIT-TABLE Object Elements

Element		Meaning	Default Setting		Data Type
dec	hex		Code	Meaning	
1	1	Protocol	00_{hex}	Transparent	Unsigned 8
2	2	Baud rate	07_{hex}	9600 baud	Unsigned 8
3	3	Data width	02_{hex}	8 data bits, even parity, 1 stop bit	Unsigned 8
4	4	Reserved	00_{hex}		Unsigned 8
5	5	Reserved	00_{hex}		Unsigned 8
6	6	Error pattern	24_{hex}	($)	Unsigned 8
7	7	First delimiter	$0D_{hex}$	Carriage Return (CR)	Unsigned 8
8	8	Second delimiter	$0A_{hex}$	Line Feed (LF)	Unsigned 8
9	9	3964R priority	00_{hex}	Low	Unsigned 8
10	A	Output type	00_{hex}	RS 232	Unsigned 8
11	B	DTR control system	00_{hex}	Automatic	Unsigned 8
12	C	Rotation switch	00_{hex}	No rotation	Unsigned 8
13	D	XON pattern	11_{hex}		Unsigned 8
14	E	XOFF pattern	13_{hex}		Unsigned 8
15-20	F-14	Reserved	00_{hex}		Unsigned 8

Element Value Range

The options in bold are default settings.

	Protocol *(Protocol)*	
Code	**Meaning**	**Representation in CMD/ PC WORX**
00_{hex}	**Transparent**	***Transparent***
01_{hex}	End-to-end	*End-End*
02_{hex}	Dual buffer	*Dual buffer*
03_{hex}	3964R	*3964R*
04_{hex}	XON/XOFF	*XON/XOFF*

	Baud Rate *(Baud Rate)*
Code	**Value**
00_{hex}	110
01_{hex}	300
02_{hex}	600
03_{hex}	1200
04_{hex}	1800
05_{hex}	2400
06_{hex}	4800
07_{hex}	**9600**
08_{hex}	19200
09_{hex}	38400

	Data Width *(Data Width)*			
Code	**Meaning**			**Representation in CMD/PC WORX**
	Data Bits	**Parity**	**Stop Bits**	
00_{hex}	7	Even	1	*7 data bits, even parity, 1 stop bit*
01_{hex}	7	Odd	1	*7 data bits, odd parity, 1 stop bit*
02_{hex}	**8**	**Even**	**1**	***8 data bits, even parity, 1 stop bit***
03_{hex}	8	Odd	1	*8 data bits, odd parity, 1 stop bit*
04_{hex}	8	Without	1	*8 data bits, without parity, 1 stop bit*
05_{hex}	7	Without	1	*7 data bits, without parity, 1 stop bit*
06_{hex}	7	Even	2	*7 data bits, even parity, 2 stop bits*
07_{hex}	7	Odd	2	*7 data bits, odd parity, 2 stop bits*
08_{hex}	8	Even	2	*8 data bits, even parity, 2 stop bits*
09_{hex}	8	Odd	2	*8 data bits, odd parity, 2 stop bits*
$0A_{hex}$	8	Without	2	*8 data bits, without parity, 2 stop bits*
$0B_{hex}$	7	Without	2	*7 data bits, without parity, 2 stop bits*

	Error Pattern
Code	**Meaning**
24_{hex}	**$**
xx_{hex}	Any character

	First Delimiter
Code	**Meaning**
$0D_{hex}$	**Carriage return (CR)**
xx_{hex}	Any character

Second Delimiter	
Code	**Meaning**
$0A_{hex}$	**Line Feed (LF)**
xx_{hex}	Any character

	3964R Priority	
Code	**Meaning**	**Representation in CMD/PC WORX**
00_{hex}	**Low Priority**	***Low priority***
01_{hex}	High priority	*High priority*

	Output Type
Code	**Meaning**
00_{hex}	**RS-232**

	DTR Control	
Code	**Meaning**	**Representation in CMD/PC WORX**
00_{hex}	**Automatic**	***Automatic***
01_{hex}	Via process data	*Via process data*

	Rotation Switch	
Code	**Meaning**	**Representation in CMD/PC WORX**
00_{hex}	**No rotation**	***No rotation***
01_{hex}	Rotation	*Rotation*

	XON Pattern
Code	**Meaning**
11_{hex}	
xx_{hex}	Any character (not the same as XOFF pattern)

	XOFF Pattern
Code	**Meaning**
13_{hex}	
xx_{hex}	Any character (not the same as XON pattern)

The **error pattern** contains the character that is written to the FIFO if a V.24 character was received with errors (this does not apply to the 3964R protocol). This can be the result of, for example, parity errors, exceeded value ranges or noise interference. In the transparent and XON/XOFF protocols, the pattern is also used if the receive FIFO is full and further characters are received.

The **first delimiter** and the **second delimiter** contain the end characters for the dual buffer and the end-to-end protocols.

The value in the **3964R priority** element defines the priority of a device if there is an initialization conflict (more than one device attempting to transmit data simultaneously). The device with priority level 1has priority over the device with priority level 0.

XON pattern and **XOFF pattern** contain the control characters for the XON/XOFF protocol The characters must not be the same.

The **rotation switch** determines how the buffer is re-written when it is full and the two end characters (delimiters) have not been detected.
No rotation:
In the re-written buffer **only** the **new** data is available, i.e., data from the previous cycle is rejected.
Rotation:
The buffer is re-written character by character. If the two delimiters are detected the **new** characters **and** the **remaining** characters from the previous cycle are available in the re-written buffer.

If at least one element of the INIT-TABLE object is written, the pointers for the transmit and receive FIFOs will be reset. This means that all transmit and receive data that has not yet been processed is lost.

INIT-TABLE Object Error Messages

– If an element with an invalid value is written during a write service, the service will be acknowledged with a negative confirmation.

The parameters are:

Error_Class	8
Error_Code	0
Additional_Code	$xx30_{hex}$
Meaning	Value is out of range

The high byte of the ADDITIONAL_CODE (xx) contains the number of the affected element. If several elements are affected, the highest number is given. If, for example, the DTR control element is written with the value 2, an error message with the ADDITIONAL_CODE $0B30_{hex}$ will be displayed, because the 11^{th} element is faulty.

– An error message will be generated for a write request with the subindex 0 (write entire table) in which the XON/XOFF protocol is to be set and the XON pattern is the same as the XOFF pattern.

The parameters are:

Error_Class	8
Error_Code	0
Additional_Code	$0E30_{hex}$
Meaning	Parameterization error

– If a reserved element is written, the value must equal 0, otherwise an error message is generated.

The parameters are:

Error_Class	8
Error_Code	0
Additional_Code	$xx30_{hex}$
Meaning	Parameterization error

7.3 PCP Mode Error Messages

The terminal error messages have parameters
Error_Class = 8 (device-specific error) and Error_Code = 0 (no communication error).

The precise error cause is indicated via the Additional_Code. The low byte of the ADDITIONAL_CODE specifies the error cause. The high byte of the ADDITIONAL_CODE (xx) contains the number of the affected element. If several elements are affected, the highest number is given.

The following ADDITIONAL_CODEs can occur on this terminal:

0022_{hex}	No character of the V.24 (RS-232) data will be accepted from this service
$xx30_{hex}$	Value is out of range or parameterization error
0000_{hex}	Hardware fault

For additional information on error messages in PCP mode, please refer to the IBS SYS PCP G4 UM E user manual
(Order No. 27 45 16 9) and your controller board user manual.

8 V.24 Interface

The V.24 (RS-232) interface on the IB IL RS 232 terminal represents some form of DTE (data termination equipment). This means that connector 2 terminal point 2.1 (TxD) is always used to transmit and connector 2 terminal point 1.1 (RxD) is always used to receive.

According to the standard, some form of DCE (data communication equipment) is connected to the V.24 interface as a peer. DTE can also be connected. Please refer to the connection notes under 8.2 and 8.3.

Measuring the voltage between the connection points for the TxD and GND signals in idle state will determine whether the device to be connected to the V.24 interface is a form of DTE or DCE. If the voltage measures approximately **-5 V**, the device is a form of **DTE**. If the voltage is approximately **0 V**, the device is a form of **DCE**.

Example: When using a 25-pos. standard connector (see Figure 5 on page 7) the voltage between **pin 2 (TxD) and pin 7 (GND)** must be measured.

8.1 V.24 Terminal Handshake Signals

Any device with a V.24 interface can be connected to the V.24 interface on the IB IL RS 232 terminal. Both the IB IL RS 232 terminal and the device connected to the V.24 interface can act as transmitter **and** receiver for data exchange. As errors can occur during data exchange if both devices transmit or receive simultaneously, the **handshake** is used as a procedure for the mutual signaling of clear to receive and clear to transmit.

The IB IL RS 232 terminal supports DTR and CTS handshake signals. Each uses one wire of the connecting cable.

The connecting signals are described from the point of view of the IB IL RS 232 terminal, i.e., from the point of view of the DTE.

Handshake signals:

Signal	Meaning	Direction
CTS (Clear To Send)	The IB IL RS 232 terminal receives the CTS signal from the connected device via the V.24 interface. If the CTS signal is set to *High*, the terminal can transmit data.	Input
	 The exception is 3964R, XON/XOFF Protocol	
DTR (Data Terminal Ready)	The DTR signal is transmitted from the IB IL RS 232 terminal, i.e., set to *High*, once it is ready to receive. The peer at the V.24 interface can now transmit. After 4095 characters (4 kbytes) the terminal receive buffer is full, and the DTR signal is set to *Low*. As soon as more characters are read from the bus side, the DTR signal is set to *High* and the terminal is ready to receive.	Output
	 With the transparent, XON/XOFF, and end-to-end protocols, DTR is set to "0" if fewer than 15 characters are free in the receive FIFO.	

8.2 V.24 Interface Wiring With Four-Wire Handshake

The TxD, RxD, DTR, and CTS signals are used for a four-wire handshake connection between the IB IL RS 232 terminal and the device to be connected. Each signal corresponds to one wire in the connecting cable. An Inline male connector is required on the IB IL RS 232 terminal side.
A 9 or 25-pos. socket is required on the opposite side depending on the device to be connected. Both GND pins are also wired.

In Figure 6 and Figure 7 the shield connector is connected on the right-hand side of the terminal. In this case, a capacitor is placed between the shield and FE.

If the shield is to be placed directly on FE, the shield connector must be connected on the left-hand side of the terminal.

Observe the connection notes on page 6.

In Figure 6 and Figure 7 it is assumed that the signal assignment of the connectors for the device to be connected corresponds to the assignment of a PC connector.
In individual cases, however, the signal assignment of the pins might be different because the DTE-DTE connections as well as the connections between 25-pos. and 9-pos. connectors and sockets are not standardized.

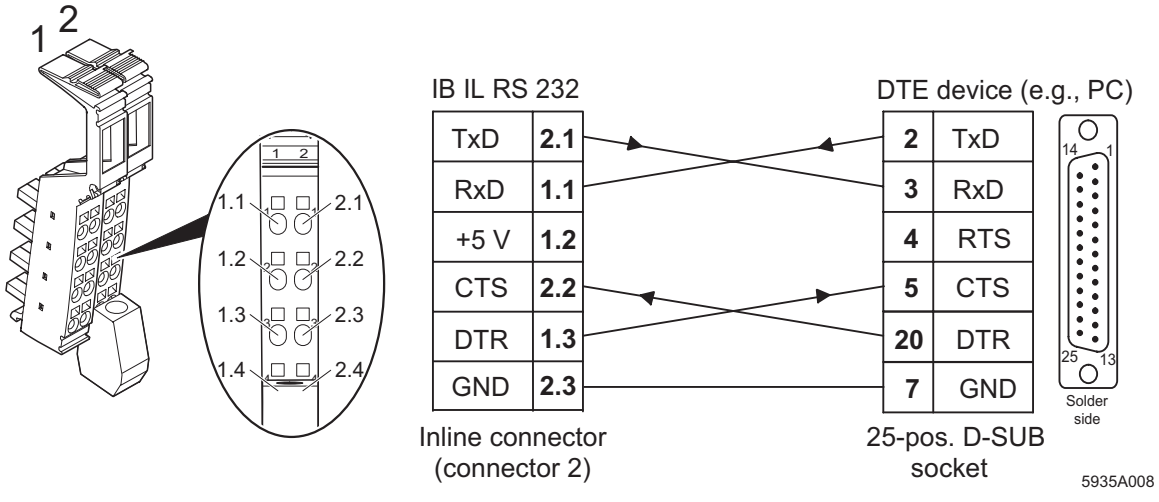


Figure 6 V.24 interface wiring with handshake for **DTE** (25-pos.)

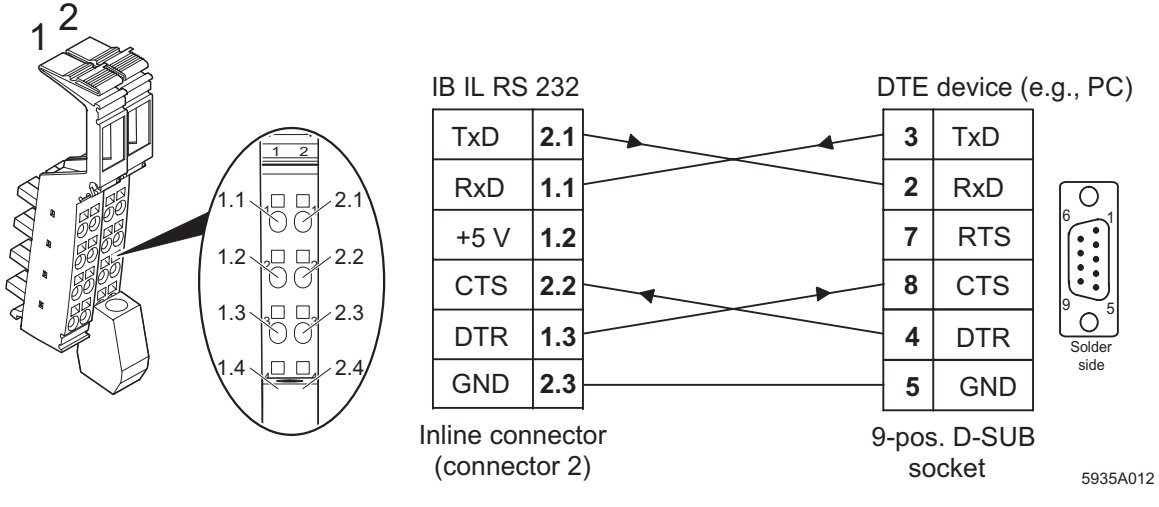


Figure 7 V.24 interface wiring with handshake for **DTE** (9-pos.)

8.3 V.24 Interface Wiring Without Handshake

For wiring without handshake, the transmission can only be executed with the help of both TxD and RxD signals. Both wires for the TxD and RxD signals, in the same way as the GND contacts, are connected to the IB IL RS 232 terminal male connector and are soldered to the socket on the side of the device to be connected.

In addition, a jumper is connected on the male connector between the terminal points for the +5 V and CTS signals and on the socket between the pins for the RTS and CTS signals.

This simulates the constant ready to receive state of the peer, and the connected device will always be able to transmit via the V.24 interface.

In Figure 8 and Figure 9 the shield connector is connected on the right-hand side of the terminal. In this case, a capacitor is placed between the shield and FE.

If the shield is to be placed directly on FE, the shield connector must be connected on the left-hand side of the terminal.

Observe the connection notes on page 6.

In Figure 8 and Figure 9 it is assumed that the signal assignment of the connectors for the device to be connected corresponds to the assignment of a PC connector.
In individual cases, however, the signal assignment of the pins might be different because the DTE-DTE connections as well as the connections between 25-pos. and 9-pos. connectors and sockets are not standardized.
The terminal sets the DTR signal to *Low* before the receive FIFO overflows. As the DTR signal is not evaluated for wiring without handshake, some of the data sent to the terminal via the V.24 interface may be lost until the terminal is ready to receive again.

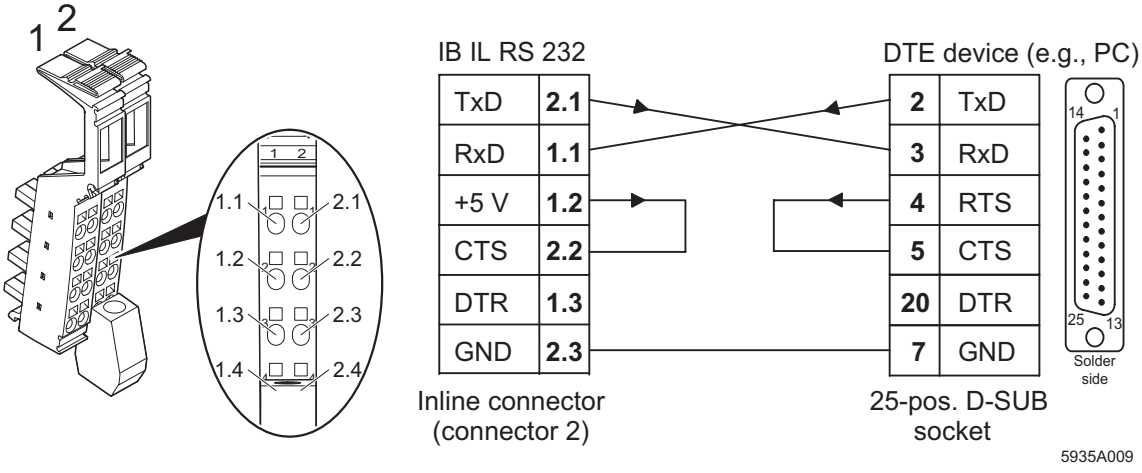


Figure 8 V.24 interface wiring without handshake for **DTE** (25-pos.)

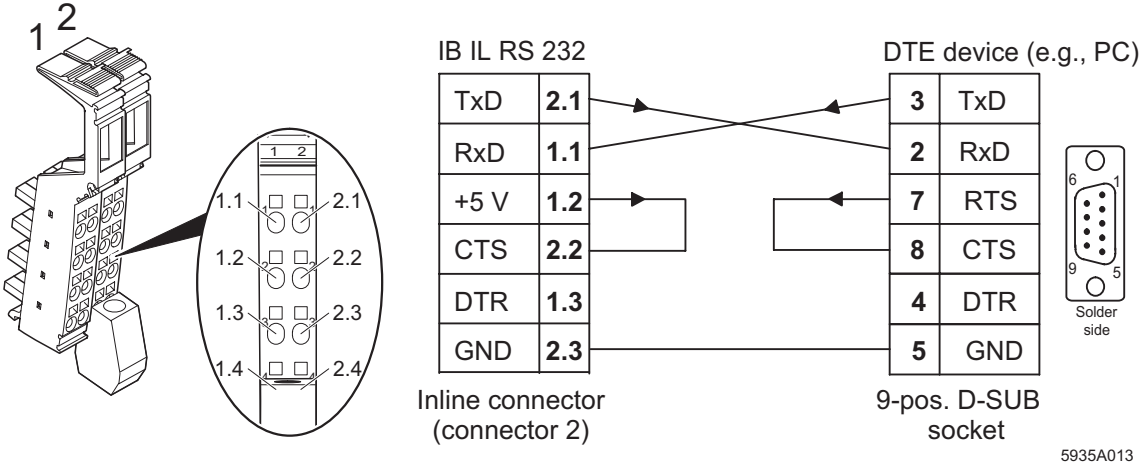


Figure 9 V.24 interface wiring without handshake for **DTE** (9-pos.)

9 Process Data

For the assignment of the illustrated (byte.bit) view under 9.1 and 9.3 to your control or computer system, please refer to the DB GB IBS SYS ADDRESS data sheet, Order No. 90 00 99 0.

9.1 Assignment of the OUT Process Data Word *(~Control Word)*

(Word.bit) view	Word	Word 0															
	Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
(Byte.bit) view	Byte	Byte 0								Byte 1							
	Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Assignment		Reserved								DTR	Reserved	Reserved	Reserved	Execute re-initialization	Reset transmit error	Reset receive error	Reserved

Set all reserved bits to 0.

9.2 Assignment of the OUT Process Data Word *(~Control Word)*

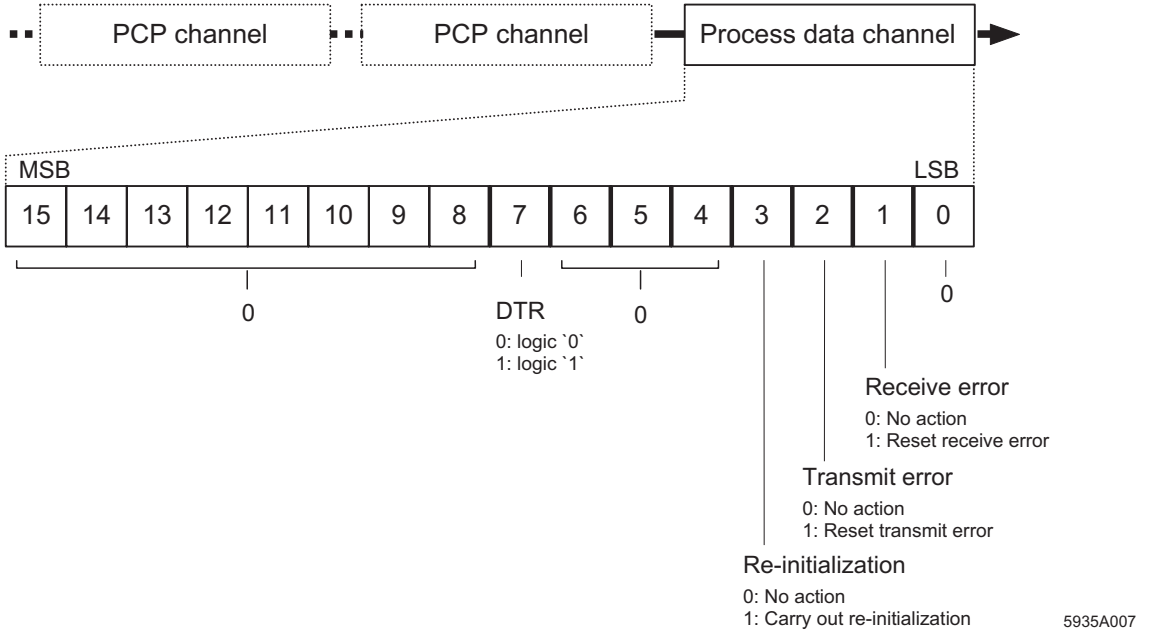


Figure 10 Format of the OUT process data word in the INTERBUS ring

The DTR signal can only be generated when "DTR control via process data" is enabled.

If the control word has the contents $3C00_{hex}$, then the status word returns the firmware version.

Example:

Status word (hex)	1	2	3	0
	Firmware version 1.23			0

9.3 Assignment of the IN Process Data Word *(~Status Word)*

(Word.bit) view	Word	Word 0															
	Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
(Byte.bit) view	Byte	Byte 0								Byte 1							
	Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Assignment		Number of received characters								Reserved	Send buffer not empty	Send buffer full	Receive buffer full	Re-initialization executed	Transmit error	Receive error	Receive buffer not empty

9.4 Format of the IN Process Data Word *(~Status Word)*

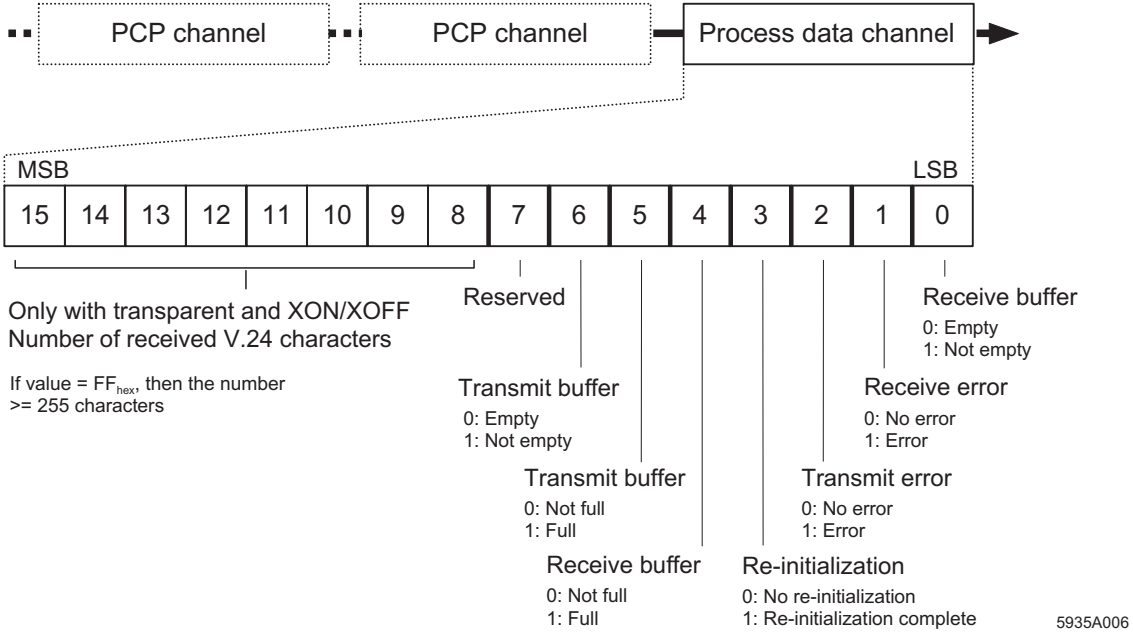


Figure 11 Format of the IN process data word in the INTERBUS ring

Bit/Status	Effect	Protocol
Bit 0 = '1'	The receive buffer is not empty, characters to be read are available.	All
Bit 1 = '1'	The receive error indicates that a 3964R telegram could not be received without error after six transmit attempts by the V.24 peer or after the block waiting time had elapsed.	3964R
Bit 2 = '1'	The transmit error indicates that a 3964R telegram could not be transmitted from the module to the V.24 peer without error after six transmit attempts. The telegram was rejected.	3964R
Bit 3 = '1'	A re-initialization was executed; transmit and receive buffers are now empty.	All
Bit 4 = '1'	The receive buffer is full: Transparent and XON/XOFF protocol:Residual capacity: < 15 characters 3964R and end-to-end protocol:Residual capacity: none	Transparent, end-to-end, 3964R, XON/XOFF
Bit 5 = '1'	The transmit buffer is full: 3964R protocol:Residual capacity: none Dual buffer, transparent, end-to-end, XON/XOFF protocol:Residual capacity: ≤30 characters	All
Bit 6 = '1'	The transmit buffer is not empty, characters to be sent are available.	All
Bit 7 = '1'	Reserved	

Both error bits (bit 1 and 2) are not automatically reset. They can only be reset by the OUT process data word.

10 Technical Data

General Data	
Order Designation (Order No.)	IB IL RS 232 (27 27 34 9) IB IL RS 232-PAC (28 61 35 7)
Housing dimensions (width x height x depth)	24.4 mm x 120 mm x 71.5 mm
Weight	90 g (without connectors), 128 g (including connectors)
Mode	Process data mode with 1 word PCP mode with two words
Permissible temperature (operation)	-25°C to +55°C
Permissible temperature (storage/transport)	-25°C to +85°C
Permissible humidity (operation)	75% on average, 85% occasionally

In the range from - 25°C to + 55°C appropriate measures against increased humidity (> 85%) must be taken.

Permissible humidity (storage/transport)	75% on average, 85% occasionally

For a short period, slight condensation may appear on the outside of the housing if, for example, the terminal is brought into a closed room from a vehicle.

Permissible air pressure (operation)	80 kPa to 106 kPa (up to 2,000 m above sea level)
Permissible air pressure (storage/transport)	70 kPa to 106 kPa (up to 3,000 m above sea level)
Degree of protection	IP20 according to IEC 60529
Class of protection	Class 3 according to VDE 0106, IEC 60536

The terminals must be installed in closed metal control cabinets so that the operation meets the requirements of the Schifffahrtsklassifikations-Gesellschaft (GL).

Interfaces	
INTERBUS	
Local bus	Through data routing
Serial RS-232 Interface	
Type	V.24 (RS-232) interface with DTR/CTS hand-shake Data terminal equipment (DTE) version Electrical data according to EIA (RS) 232, CCITT V.28, DIN 66259 Part 1
Input impedance	5 kΩ typical
Permissible input voltage area	-30 V to +30 V
Switching thresholds	0.8 V to 2.4 V
Hysteresis	0.5 V, typical
Output voltage "HIGH" (with 3 kΩ load)	6.7 V, typical
Output voltage "LOW" (with 3 kΩ load)	-6.7 V, typical
Output voltage "HIGH" (no-load operation)	≤ 25 V
Output voltage "LOW" (no-load operation)	≥ -25 V
Permissible load capacity	2500 pF
Short-circuit protected against GND	Yes
Short-circuit current	±60 mA, maximum

Power Consumption	
Communications power U_L	7.5 V
Current consumption at U_L	155 mA, typical; 225 mA, maximum*
Total power consumption	Approx. 1.163 W, typical, 1.688 W, max.*
* All serial interface connections short circuited.	

This terminal takes no current from the U_M and U_S potential jumpers.

Supply of the Module Electronics Through the Bus Terminal	
Connection method	Potential routing

Power Dissipation	
Power dissipation in the module P_{EL} = 1.163 W	
Power dissipation of the housing P_{HOU}	1.2 W, max. (within the permissible operating temperature)

Limitation of Simultaneity, Derating
No limitation of simultaneity, no derating

Safety Equipment
None

Electrical Isolation / Isolation of the Voltage Areas
 Electrical isolation of the logic level from the serial interface is ensured by the DC/DC converter.
Common Potentials
The serial interface control and data lines have galvanically the same potential. FE is a separate potential area.
Separate Potentials in the System Consisting of Bus Terminal/Power Terminal and I/O Terminal

- Test Distance	- Test Voltage
5 V supply incoming remote bus / 7.5 V supply (bus logic)	500 V AC, 50 Hz, 1 min
5 V supply outgoing remote bus / 7.5 V supply (bus logic)	500 V AC, 50 Hz, 1 min
RS-232 interface / 7.5 V supply (bus logic)	500 V AC, 50 Hz, 1 min
RS-232 interface / 24 V supply (I/O)	500 V AC, 50 Hz, 1 min
RS-232 interface / functional earth ground	500 V AC, 50 Hz, 1 min
7.5 V supply (bus logic) / 24 V supply (I/O)	500 V AC, 50 Hz, 1 min
7.5 V supply (bus logic) / functional earth ground	500 V AC, 50 Hz, 1 min
24 V supply (I/O) / functional earth ground	500 V AC, 50 Hz, 1 min

Error Messages to the Superior Control System
None

11 Ordering Data

Description	Order Designation	Order No.
Inline terminal for serial data transmission including connectors and labeling field	IB IL RS 232-PAC	28 61 35 7
Inline terminal for serial data transmission	IB IL RS 232	27 27 34 9
Two connectors are needed for the complete fitting of the IB IL RS 232 terminal. These are included in the connector set listed below.		
Connector set with a standard connector and a shield connector pack of 1 set	IB IL AO/CNT-PLSET	27 32 66 4
"Configuring and Installing the INTERBUS Inline Product Range" user manual	IB IL SYS PRO UM E	27 43 04 8

Make sure you always use the latest documentation. It can be downloaded at www.download.phoenixcontact.com.
A conversion table is available on the Internet at www.download.phoenixcontact.com/general/7000_en_00.pdf.

PHOENIX CONTACT GmbH & Co. KG
Flachsmarktstr. 8
32825 Blomberg
Germany

+ 49 - (0) 52 35 - 3-00

+ 49 - (0) 52 35 - 3-4 12 00

www.phoenixcontact.com

Worldwide Locations:
www.phoenixcontact.com/salesnetwork