Fieldbus Appendix

Anybus-S Interbus 2Mbit/s RS422

SCM-1200-143
Rev. 1.04

Connecting Devices™

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About This Manual

How To Use This Manual

This manual provides an overview of the Anybus-S Interbus 2Mbit/s slave module and is intended to be used as a supplement to the Anybus-S Parallel Design Guide.

The reader of this document is expected to have basic knowledge in the Interbus fieldbus system, and communication systems in general.

Important user information

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Related Documentation

Document name	Author
Anybus-S Parallel Design Guide	HMS Industrial Networks AB

Revision list

Revision	Date	Author	Chapter	Description
1.00	2003-04-01	PeP	All	First release
1.01	2003-11-10	ToT	Appendix D	Corrected PCP example data
1.02	2003-12-06	PeP	Appendix D	Added power consumption
1.03	2005-11-04	ToT	Chapter 4 Appendix B	Added information about when the module itself generates 'StatErr'. Removed RBST signal since it does not exist. Corrected signal names for screw terminal bus output connector
1.04	2012-05-18	KeL	Chapter 3 Titlepage, preface	Added mailbox SET_MOD_FUNC Updated sales and support information

Conventions & Terminology

The following conventions are used throughout this manual:

- Numbered lists provide sequential steps
- Bulleted lists provide information, not procedural steps
- The term 'module' is used when referring to the Anybus module
- The term 'application' is used when referring to the hardware that is connected to the Anybus Application Connector
- Hexadecimal values are written in the format NNNNh, where NNNN is the hexadecimal value.

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About the Anybus-S Interbus 2Mbit/s RS422

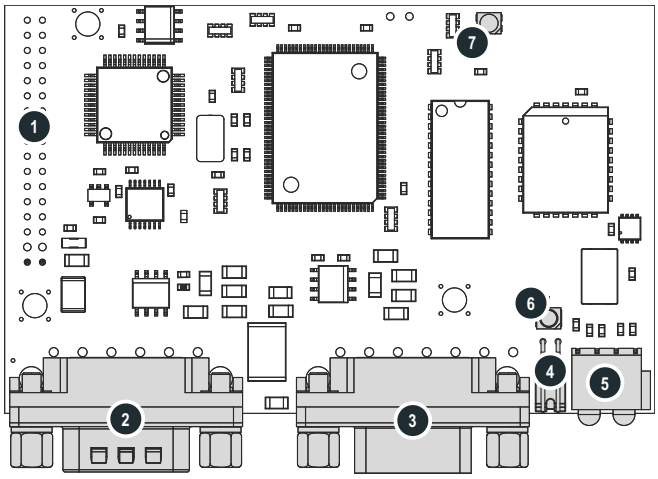
The Anybus-S Interbus 2Mbit/s module is a slave node that can be read from/written to by an Interbus master. Being a slave module, it cannot initiate communication to other nodes; it only responds to incoming requests.

Interbus has two ways of exchanging data; one through fast cyclical I/O data called 'Process Data', and one through a somewhat slower protocol called PCP, which is mainly used for configuration purposes. The module supports up to 10 words of data on the bus, out of which up to four words can be used for PCP.

Features

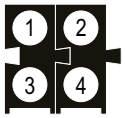
- **Galvanically isolated bus electronics**
- **500kbit/s and 2Mbit/s operation**
- **Up to 10 words of data (Process Data + PCP)**
- **PCP v2.0 (0, 1, 2 or 4 words)**

Overview



#	Description
1	Application Connector
2	Bus IN interface
3	Bus OUT interface
4	Baud rate Switch
5	Status Indicators
6	UL / Bus voltage OK indication
7	Anybus-S Watchdog (See general Anybus-S Parallel Design Guide)

Status Indicators



These LEDs indicate run time status and errors to the user.

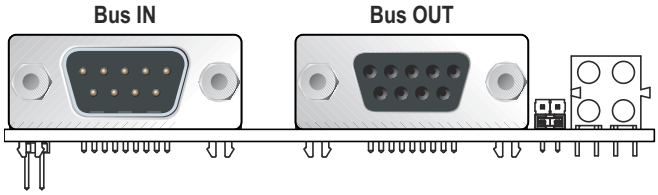
Led	Colour	Description
1 - CC/RC	Green	Cable connection is good and the Interbus master is not in reset mode.
2 - BA	Green	Bus active
3 - RD	Yellow	Remote bus disabled
4 - TR	Green	PCP-communication active. Hold time = 500ms

Application Connector

The application connector features a standard Anybus-S 2kbyte parallel interface. For further information, please consult the general Anybus-S Parallel Design Guide.

Fieldbus Connectors

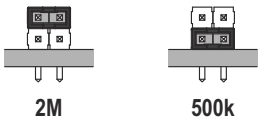
The module features D-sub connectors as standard. However, other connectors are also available. See Appendix B-1 "Connector Pinouts" for connector types and pinouts.



Baud Rate Switch

The module supports 2Mbit/s and 500kbit/s operation. To select the desired baud rate, just move the jumper cap to the corresponding location, see figure on the right.

Note: The baud rate must be selected before power on, i.e. it must not be changed during normal operation.



Compatible Products

This product is a member of the Anybus concept of interchangeable fieldbus modules. This makes it fully interchangeable with any Anybus-S supported fieldbus system with only little or no hardware and software adjustments.

Data Exchange

The module can use both fast I/O data and Parameter data. On the Interbus network, Fast I/O data is represented as Process Data, while Parameter Data is represented as PCP data. On InterBus, there is an equal amount of Input and Output Process Data. The amount of PCP data is equal to the total I/O length minus the size of the Process Data, for both Input and Output data.

Note: Not all Interbus masters, (especially older ones) support PCP-data. In this case, initialise the module with Process Data only.

The I/O lengths must be defined before the module can be used on the network. This is accomplished during initialization of the module. Consult the general Anybus-S Parallel Design Guide for more information.

The layout of the default PCP objects are arrays of 32 bytes (Unsigned 8), with no password or group protection. Objects 0x6000 through 0x603F are linearly mapped to the Parameter Output Data area and are both readable and writeable by the Interbus master. The objects 0x6040 to 0x607F are linearly mapped to the Parameter Output Data area and are read only by the Interbus master.

The objects are created to match the amount of Parameter Data indicated in the Anybus Init command.

Example:

If 48 bytes are desired as Output Parameter Data and 15 bytes are desired as input parameter data, this will result in the following objects:

0x6000 - Array with a length of 32 bytes.
0x6001 - Array with a length of 16 bytes.
0x6040 - Array with a length of 15 bytes.

Fieldbus Specific Mailbox Commands

Alter amounts of PCP words (SET_PCP_WORDS)

The amount of PCP words can be set to 0, 1, 2 or 4 words. If parameter data has been selected by the Anybus_INIT command, one PCP word is used by default. If no parameter data has been selected, the default number of PCP words is 0.

Parameter	Description
Command initiator	Application
Command Name	SET_PCP_WORDS
Message type	02h
Command number	0001h
Fragmented	No
Extended Header data	-
Command data	Number of PCP words
Response data	The message data contains the requested PCP length. If the SET_PCP_WORDS mailbox message is wrong, see error code. If error code Fh is displayed, see Extended word 8 for details: 0001h - Non valid value (0, 1, 2, 4). 0002h - Does not fit with the current process data length. 0003h - Can not disable PCP data since parameter data exists.

Command and response layout:

	Command	Expected response
Message ID	(ID)	(ID)
Message information	4002h	0002h
Command	0001h	0001h
Data size	0001h	0001h
Frame count	0001h	0001h
Frame number	0001h	0001h
Offset high	0000h	0000h
Offset low	0000h	0000h
Extended word 1	-	-
Extended word 2	-	-
Extended word 3	-	-
Extended word 4	-	-
Extended word 5	-	-
Extended word 6	-	-
Extended word 7	-	-
Extended word 8	-	Fault information
Message data byte 1	Number of PCP words	Number of PCP words

Set the Virtual Field Device Object (SET_VFD_OBJECT)

The Virtual Field Device Object can be altered to show other manufacturer, device name and revision strings than the ones that are shown by default. The strings should be entered in Pascal notation, i.e. the length of the string (no. of characters) should be placed first in the string. Each of the strings has a length of 16 characters (out of which one determines the length of the string).

Parameter	Description
Command initiator	Application
Command Name	SET_VFD_OBJECT
Message type	02h
Command number	0002h
Fragmented	No
Extended Header data	-
Command data	Length and characters of the strings (Length byte itself not included in the size.)
Response data	The message data contains the requested length and values of the strings. If the SET_VFD_OBJECT mailbox message is wrong, see error code. If error code Fh is displayed, see Extended word 8 for details: 0001h - No PCP words. 0002h - String set to be longer than 15 bytes.

Command and response layout:

	Command	Expected response	
Message ID	(ID)	(ID)	
Message information	4002h	0002h	
Command	0002h	0002h	
Data size	0030h	0030h	
Frame count	0001h	0001h	
Frame number	0001h	0001h	
Offset high	0000h	0000h	
Offset low	0000h	0000h	
Extended word 1	-	-	
Extended word 2	-	-	
Extended word 3	-	-	
Extended word 4	-	-	
Extended word 5	-	-	
Extended word 6	-	-	
Extended word 7	-	-	
Extended word 8	-	Fault information	
Message data byte 1	Manufacturer name length	Manufacturer name length	*Length in bytes*
Message data byte 2	First character	First character	
Message data byte 3	Second character	Second character	
	..	..	
Message data byte 17	Device name length	Device name length	*Length in bytes*
Message data byte 18	First character	First character	
Message data byte 19	Second character	Second character	
	..	..	
Message data byte 33	Revision name length	Revision name length	*Length in bytes*
Message data byte 34	First character	First character	
Message data byte 35	Second character	Second character	

Set Start Index (SET_START_INDEX)

If the PCP objects are to be redefined, it is also possible to change the start index from which they originate. This mailbox has to be transmitted prior to sending down the mailbox command "Set PCP Object". Please note that this mailbox command will completely erase the existing Object Dictionary so that the new one can be created later with the above mentioned mailbox command. This mailbox command can only be used once. Also note that this mailbox command will generate an error if the PCP word length is set to 0. Suggested start index is 0x6000. Maximum index of the objects to be downloaded will be Start index + 0xFF.

Parameter	Description
Command initiator	Application
Command Name	SET_START_INDEX
Message type	02h
Command number	0003h
Fragmented	No
Extended Header data	-
Command data	Start index
Response data	The message data contains the requested start index. If the SET_START_INDEX mailbox message is wrong, see error code. If error code Fh is displayed see Extended word 8 for details: 0001h - No PCP words 0002h - Has already been defined 0003h - Value out of range (Valid range: 0100h - FF00h)

Command and response layout:

	Command	Expected response	
Message ID	(ID)	(ID)	
Message information	4002h	0002h	
Command	0003h	0003h	
Data size	0002h	0002h	
Frame count	0001h	0001h	
Frame number	0001h	0001h	
Offset high	0000h	0000h	
Offset low	0000h	0000h	
Extended word 1	-	-	
Extended word 2	-	-	
Extended word 3	-	-	
Extended word 4	-	-	
Extended word 5	-	-	
Extended word 6	-	-	
Extended word 7	-	-	
Extended word 8	-	Fault information	
Message data byte 1	Start index	Start index	*High byte*
Message data byte 2	Start index	Start index	*Low byte*

Set PCP Object (SET_PCP_OBJECT)

The object dictionary of the Anybus-S Interbus module can be changed to better suit the needs of a special implementation which uses the module. After setting a start index, new objects can be downloaded to the module. This mailbox can only be sent after the SET_START_INDEX mailbox has been sent.

Note: It is not recommended to download a new object dictionary without knowledge of the PCP-protocol.

Parameter	Description
Command initiator	Application
Command Name	SET_PCP_OBJECT
Message type	02h
Command number	0004h
Fragmented	No
Extended Header data	-
Command data	Contains information about the PCP object.
Response data	The message data contains the requested PCP-object. If error code Fh is returned please see the Extended word 8 for further information. 0001h - No start index given. 0002h - Index out of bounds. 0003h - Not a supported index type. 0004h - Error with the selection of IN/OUT buffer and the access rights. 0005h - Object outside the specified memory area length. 0006h - Too many characters in object name. 0007h - PCP-object length + 6 is larger than the PDU size.

Command and response layout:

	Command	Expected response	
Message ID	(ID)	(ID)	
Message information	4002h	0002h	
Command	0004h	0004h	
Data size	0017h	0017h	
Frame count	0001h	0001h	
Frame number	0001h	0001h	
Offset high	0000h	0000h	
Offset low	0000h	0000h	
Extended word 1	-	-	
Extended word 2	-	-	
Extended word 3	-	-	
Extended word 4	-	-	
Extended word 5	-	-	
Extended word 6	-	-	
Extended word 7	-	-	
Extended word 8	-	Fault information	
Message data byte 1	Start index	Start index	*High byte*
Message data byte 2	Start index	Start index	*Low byte*
Message data byte 3	Index type	Index type	
Message data byte 4	Password	Password	
Message data byte 5	Access groups	Access groups	
Message data byte 6	Buffer type	Buffer type	
Message data byte 7	Access rights	Access rights	*High byte*
Message data byte 8	Access rights	Access rights	*Low byte*
Message data byte 9	Offset	Offset	*High byte*
Message data byte 10	Offset	Offset	*Low byte*
Message data byte 11	Object name length	Object name length	
Message data byte 12-22	Object name string	Object name string	
Message data byte 23	Number of elements	Number of elements	

- **Index**

  The desired index of the PCP-object

- **Index Type**

  Type of variable of the object

  01h: Boolean
  02h: Integer (8 bit)
  03h: Integer (16 bit)
  04h: Integer (32 bit)
  05h: Unsigned (8 bit)
  06h: Unsigned (16 bit)
  07h: Unsigned (32 bit)
  08h: Floating point (32 bit)

- **Password**

  The desired password for the object

- **Access Groups**

  The objects access groups

- **Buffer Type**

  Selection whether the In or Out area of the module shall be used

  00h: Use the output buffer
  01h: Use the input buffer

- **Access rights**

  The access rights for the object

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
-	-	-	-	-	-	AW	AR	-	-	GW	GR	-	-	PW	PR

PR - Password read access
PW - Password write access
GR - Group read access
GW - Group write access
AR - All read access
AW - All write access

Example

To allow all to read the parameter but only let the ones with the correct password write to it, would give 0x0102 as access rights.

- **Offset**

  The offset within the parameter data area of the module to be used.

- **Object Name Length**

  Length of Object Name in bytes. Maximum value is 11.

- **Object Name String**

  Ascii string containing the Object Name. Maximum length is 11 bytes.

- **Number of Elements**

  The amount of elements within an array object. If set to 0, the object will be a simple variable object instead.

Set the PDU sizes (SET_PDU_SIZES)

This mailbox sets the sizes of the input and output PDU (Protocol Data Unit), which sets up the transmit and receive buffers used for PCP communication. In case larger objects are to be downloaded by the SET_PCP_OBJECT mailbox, it might be necessary to increase the PDU-sizes. The buffers should be at least 6 bytes larger than the payload data of the objects.

Parameter	Description
Command initiator	Application
Command Name	SET_PDU_SIZES
Message type	02h
Command number	0005h
Fragmented	No
Extended Header data	-
Command data	PDU lengths (Receive and Transmit is related to the Anybus-S node)
Response data	PDU lengths. If error code Fh is returned please see the Extended word 8 for further information. 0001h - PDU length less than 51 0002h - PDU length larger than 246

Command and response layout:

	Command	Expected response
Message ID	(ID)	(ID)
Message information	4002h	0002h
Command	0005h	0005h
Data size	0002h	0002h
Frame count	0001h	0001h
Frame number	0001h	0001h
Offset high	0000h	0000h
Offset low	0000h	0000h
Extended word 1	-	-
Extended word 2	-	-
Extended word 3	-	-
Extended word 4	-	-
Extended word 5	-	-
Extended word 6	-	-
Extended word 7	-	-
Extended word 8	-	Fault information
Message data byte 1	Receive PDU length	Receive PDU length
Message data byte 2	Transmit PDU length	Transmit PDU length

Set Module Function (SET_MOD_FUNC)

This mailbox is used to set the identity of the Interbus interface. It can only be sent during initialization.

Note: The mailbox does not check that the Module Function that is set, has any correspondence in reality.

Parameter	Description
Command initiator	Application
Command Name	SET_MOD_FUNC
Message type	02h
Command number	0006h
Fragmented	No
Extended Header data	-
Message data	Contains mirrored data
Response data	The response indicates if the command was accepted

Command and response layout:

	Command	Expected response
Message ID	(ID)	(ID)
Message information	4002h	4002h
Command	0006h	0006h
Data size	0001h	0001h
Frame count	0001h	0001h
Frame number	0001h	0001h
Offset high	0000h	0000h
Offset low	0000h	0000h
Extended word 1	-	-
Extended word 2	-	-
Extended word 3	-	-
Extended word 4	-	-
Extended word 5	-	-
Extended word 6	-	-
Extended word 7	-	-
Extended word 8	-	Fault Information
Message data byte 1	Module Function	Module Function

- **Module Function**

  Types of module function codes that are recommended.

  01h: Digital output module
  02h: Digital input module
  03h: Digital input and output modules
  31h: Analog output module
  32h: Analog input module
  33h: Analog input and output modules
  F0h: Modules with parameter channel (2 PCP words)
  F1h: Modules with parameter channel (4 PCP words)
  F3h: Modules with parameter channel (1 PCP word)

  Any function code, except 0, can be set, but the module codes specified above are recommended. An incorrect value will be indicated with fault information “Invalid Other” (0001h).

Fieldbus Specific Area

This area contains data that is used for fieldbus specific features.

Address (Hex)	Contents	Access
640h	StatErr Indication	Read / Write
641h - 64Fh	(reserved)	-
650h	ModAck Counter	Read Only
651h	Physical Interface Type	Read Only
652h	Actual Baud rate	Read Only
653h - 65Fh	(reserved)	-

StatErr Indication (640h, R/W)

b7	b6	b5	b4	b3	b2	b1	b0
-	-	-	-	-	-	-	STERR

The StatErr Indication bit is used when the application needs to indicate a serious fault to the master. For the master to recognize a fault, the STERR bit must be set for at least 300ms. The master can acknowledge the fault by increasing the ModAck Counter register in the Fieldbus specific output area.

Note that the module itself can also use the StatErr Indication to tell the bus master that the application has stopped operating though this will not be visible via the STERR bit in this register. This occurs if the difference between the outbound and inbound watchdog counter registers in the DPRAM exceeds the value specified in the Anybus_INIT mailbox message. Also note that a watchdog counter error is a non recoverable error, the module must be reset in order to clear it.

ModAck Counter (650h, RO)

If a serious fault has been reported by the application via the StatErr Indication register in the Fieldbus specific output area, the master can acknowledge the fault by increasing this register. If the reported error no longer exists, the StatErr signal should be removed.

Actual Baud Rate (652h, RO)

After initialisation, this register indicates what baud rate that is configured for the module. The module is locked to this baud rate and can not be used with masters that uses other baud rates.

Values: 00h - 500kbit/s
01h - 2Mbit/s

Control area

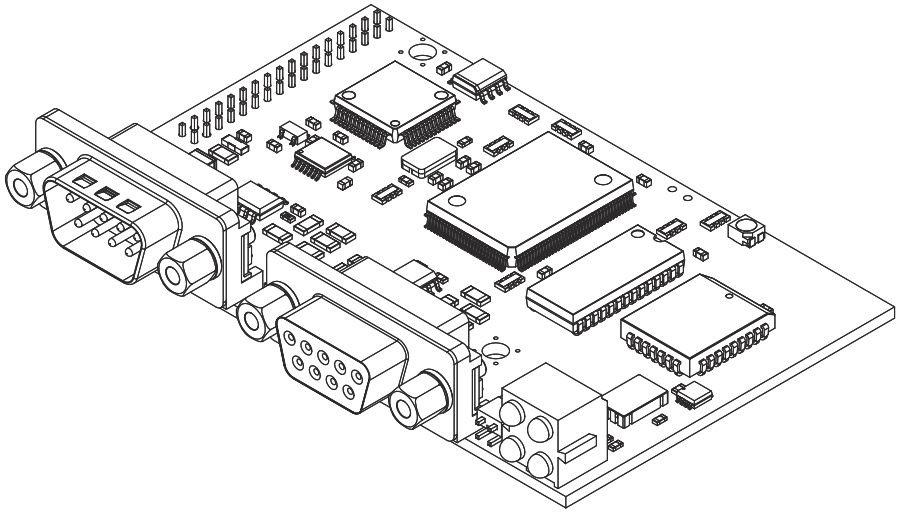
For further information about the Control Area contents, please see the Anybus-S Design Guide.

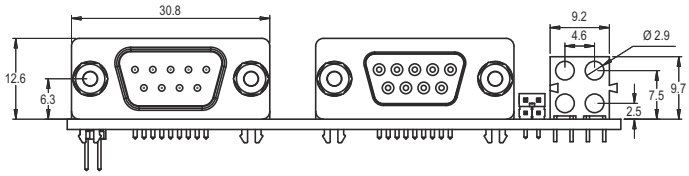
Fieldbus Type

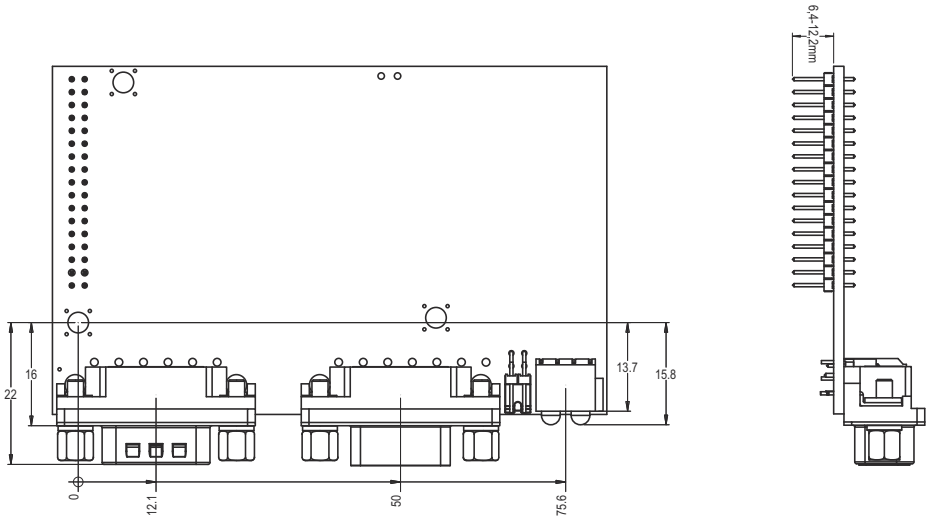
Values: 0011h - Interbus 2Mbit/s

Mechanical Specification

The circuit board is designed according to the Anybus-S specification. Consult the general Anybus-S Parallel Design Guide for more information.





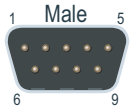


Connector Pinouts

Fieldbus Connector - Bus IN

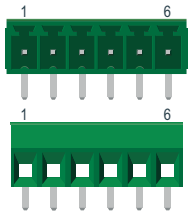
Male 9-pin D-sub (Recommended)

Pin	Signal	Description
Housing	PE	Protective Earth
1	DO1	Non inverted data output
2	DI1	Non inverted data input
3	GND	Signal ground
4	NC	-
5	NC	-
6	/DO1	Inverted data output
7	/DI1	Inverted data input
8	NC	-
9	NC	-



Screw terminal / Pluggable Screw Terminal

Pin	Signal	Description
1	/DO1	Inverted data output
2	DO1	Non inverted data output
3	/DI1	Inverted data input
4	DI1	Non inverted data input
5	GND	Signal ground
6	PE	Protective Earth



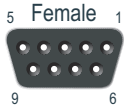
2mm Board to Board connector

Pin	Signal	Description
1	PE	Protective Earth
2	DO1	Non inverted data output
3	DI1	Non inverted data input
4	/DO1	Inverted data output
5	/DI1	Inverted data input
6	GND	Signal ground
7	NC	-
8	NC	-
9	NC	-
10	NC	-

Fieldbus Connector - Bus OUT

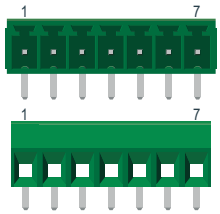
Female 9-pin D-sub (Recommended)

Pin	Signal	Description
Housing	PE	Protective Earth
1	DO2	Non inverted data output
2	DI2	Non inverted data input
3	GND	Signal ground
4	NC	-
5	GND	Signal ground
6	/DO2	Inverted data output
7	/DI2	Inverted data input
8	NC	-
9	NC	-



Screw terminal / Pluggable Screw Terminal

Pin	Signal	Description
1	PE	Protective Earth
2	/DO2	Inverted data output
3	DO2	Non inverted data output
4	/DI2	Inverted data input
5	DI2	Non inverted data input
6	GND	Signal ground
7	NC	-



2mm Board to Board connector

Pin	Signal	Description
1	PE	Protective Earth
2	GND	Signal ground
3	NC	-
4	NC	-
5	NC	-
6	GND	Signal ground
7	/DI2	Inverted data input
8	/DO2	Inverted data output
9	DI2	Non inverted data input
10	DO2	Inverted data output

Environmental Specification

Temperature

Operating

+0 to +70 degrees Celsius

Test performed according to IEC-68-2-1 and IEC 68-2-2.

Non Operating

-15 to +85 degrees Celsius

Test performed according to IEC-68-2-1 and IEC 68-2-2.

Relative Humidity

The product is designed for a relative humidity of 5 to 95% non condensing.

Test performed according to IEC 68-2-30.

EMC compliance

Emission

According to EN 50 081-2:1993

Tested per 55011:1990, class A, radiated

Immunity

According to EN 61000-6-2:1999

Tested per	EN 61000-4-2:1995
	EN 61000-4-3:1996
	EN 61000-4-4:1995
	EN 61000-4-5:1995
	EN 61000-4-6:1996

Electrical Characteristics

Supply Voltage

Both the module electronics and the fieldbus interface requires a regulated 5V DC power supply. For more information regarding power requirements, consult the Anybus-S Parallel Design Guide.

Power Consumption

The maximum total power consumption for bus and electronics is 400mA.

PE Grounding

A PE-connection is included on one of the mounting holes according to the Anybus-S specification.

Calculating the PCP Transmission Time

The formula below can be used to calculate the transmission time for a PCP message.

Formula:

```
TD = TL + Gm( OD, N ) * Z + TL7
Gm = ( OD, N ) = (( N + OD - 1 ) / m ) + 1
```

TD	Transmission time of a PCP service in milliseconds
TL	Latency 2 * Z (milliseconds)
OD	Service dependent overhead
N	User data
Z	Interbus cycle time (milliseconds)
TL7	Layer 7 runtime typical 4.0 milliseconds
m	Width of parameter channel (in bytes) - 1 (control information)
Gm(OD, N)	Number of cycles that are required to transmit the overhead and user data

The division through m should be an integer division.

Example:

The following example uses the above formula to calculate the PCP transmission time for a Write service.

Write Request:
OD = 7 bytes for one write request
N = 128 bytes (e.g. one parameter set)
Z = 1.5 milliseconds

Read Response:
OD = 4 bytes for a read response
N = 0 bytes (no user data)
Z = 1.5 milliseconds

Description	m	Gm	Td
Write Request: Parameter channel with a width of 1 word	2 - 1	135	209.5 ms
Write Request: Parameter channel with a width of 2 words	4 - 1	45	74.5 ms
Write Request: Parameter channel with a width of 4 words	8 - 1	20	37 ms
Read Response: Parameter channel with a width of 1 word	2 - 1	4	13ms
Read Response: Parameter channel with a width of 2 words	4 - 1	2	10 ms
Read Response: Parameter channel with a width of 4 words	8 - 1	1	8.5 ms