

Fieldbus Appendix

Anybus-M PROFIBUS DP-V1

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About This Document

How To Use This Document

This document 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 PROFIBUS fieldbus system, and communication systems in general. Please consult the general Anybus-S Parallel Design Guide for further information about the Anybus-S platform.

Important User Information

The data and illustrations found in this document are not binding. We, HMS Industrial Networks AB, reserve the right to modify our products in line with our policy of continuous product development. The information in this document is subject to change without notice and should not be considered as a commitment by HMS Industrial Networks AB. HMS Industrial Networks AB assumes no responsibility for any errors that may appear in this document.

There are many applications of this product. Those responsible for the use of this device must ensure that all the necessary steps have been taken to verify that the application meets all performance and safety requirements including any applicable laws, regulations, codes, and standards.

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The examples and illustrations in this document are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular implementation, HMS cannot assume responsibility or liability for actual use based on these examples and illustrations.

Warning:	This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.
ESD Note:	This product contains ESD (Electrostatic Discharge) sensitive parts that may be damaged if ESD control procedures are not followed. Static control precautions are required when handling the product. Failure to observe this may cause damage to the product.

Related Documents

Document name	Author
Anybus-S Parallel Design Guide	HMS
PROFIdrive - Profile Drive Technology (ver. 3)	PNO
PROFIBUS Specification EN50170	PNO
Extensions to EN50170 (DP-V1)	PNO
Digital Communications IEC61158 Type 3 (PROFIBUS)	IEC

Document History

Summary of Recent Changes (v1.31... v1.32)

Change	Page(s)
Corrected command number for FB_APPL_MSAC2_CNXX_STATUS	5-64
Added error code 0005h to Set Operationg Mode mailbox	5-5
Changed Bp_flag to reserved, updated the parameter tables	3-4
Corrected current slave address range	5-17
Corrected error code indices	5-17, 5-15, 5-21, 5-19
Corrected range of Slave_Para_Len	3-6
Changed LED-box measurement in mechanical drawing	C-1
Added Fault Information codes 0014h and 00FBh to FB_APPL_MSAC1_READ/WRITE	5-43, 5-45
Added note on degraded performance when using NetTool for monitoring	1-1

Revision List

[illegible]

Conventions & Terminology

The following conventions are used throughout this document:

- 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 device connected to the Anybus application connector
- Hexadecimal values are written in the format NNNNh, where NNNN is the hexadecimal value.
- Commands instructs the module to perform certain task
- Functions are commands that returns data

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About the Anybus-M PROFIBUS DP-V1

The Anybus-M PROFIBUS DP-V1 communication module provides complete PROFIBUS-DP-V0/DP-V1 master functionality via the patented Anybus-S application interface. The hardware is optimized for high throughput and can be used in mono- or multi-master networks up to 12 Mbit/s.

The module can be configured either externally using a PC-based configuration tool such as Anybus NetTool¹ for PROFIBUS, or internally via the application interface.

This product conforms to all aspects of the parallel Anybus-S application interface defined in the Anybus-S/M Parallel Design Guide, making it fully interchangeable with any other device following that specification.

Features

- Galvanically isolated PROFIBUS interface
- Controls up to 125 slaves
- Acyclic Communication (DP-V1, Class 1 & 2)
- Alarm Handling (DP-V1)
- Redundant operation (HSBY)
- Up to 4096 bytes of cyclical I/O (2048 bytes in each direction)
- 2kbyte or 4kbyte DPRAM modes
- Supports all common baudrates up to 12Mbps
- Configuration via application interface or using PC configuration tool

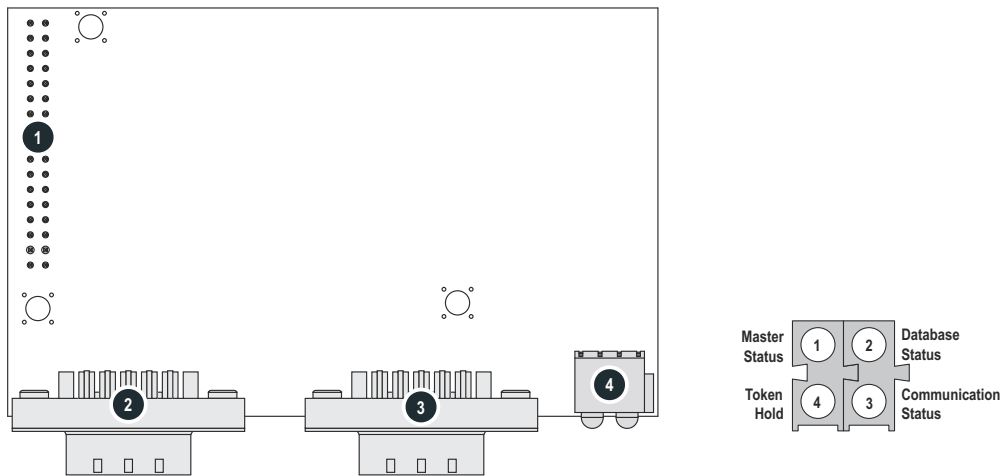
Fieldbus Conformance Notes

When using the default settings of all parameters, the module is pre-certified for network compliance. However, any parameter changes which require deviations from the standard GSD-file supplied by HMS will require re-certification.

For further information, please contact HMS.

1. Please note that the performance of the module may be affected when Anybus NetTool for PROFIBUS is used for online monitoring.

Overview



#	Item	Description
1	Application interface	See B-1 "Application Connector"
2	PROFIBUS interface	See B-1 "Fieldbus Interface"
3	Serial interface	See B-1 "Serial Interface"
4	Status LEDs	See below

Status LEDs

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

#	Name	State	Description
1	Master Status	Green	Operate mode
		Green, flashing	Clear mode
		Red	Stop mode
		Red, flashing	Operating as passive HSBY master
		Off	Offline
2	Database Status	Green	Database OK
		Green, flashing	Database download in progress
		Red	Database invalid
		Off	No database downloaded
3	Communication Status	Green	Data exchange with all configured slaves
		Green, flashing	Data exchange with at least one configured slave
		Red	Bus control error (possible bus short circuit or configuration error)
		Off	No data exchange with any of the configured slaves
4	Token Hold	Green	The module has the token
		Off	The module does not have the token
All	-	Red	Fatal error

Basic Operation

General Information

Software Requirements

Generally, no additional network support code needs to be written in order to support the Anybus-M PROFIBUS DP-V1 master; however in order to be able to take advantage of advanced network functionality, a certain degree of dedicated software support may be necessary.

For further information about the Anybus-M software interface, consult the general Anybus-S/M Parallel Design Guide.

Electronic Data Sheet (GSD)

On PROFIBUS, the characteristics of a device is stored in an ASCII data file with the suffix GSD. This file is used by the PROFIBUS configuration tool when setting up the network.

HMS supplies a generic .GSD-file which can be used as a basis for new implementations. However, due to the flexible nature of the Anybus-M concept, it is possible to alter the behaviour of the product in a way that invalidates the generic GSD-file.

See also...

- 1-1 “Fieldbus Conformance Notes”

‘Input’ and ‘Output’ Definitions

When using the Anybus-M PROFIBUS DP-V1 master together with the bus configuration software NetTool-PB it should be noted that different definitions for ‘Input Data’ and ‘Output Data’ are used:

- The conventions in this document and in the Anybus-M PROFIBUS DP-V1 follows the same convention as is used for other Anybus-S/Anybus-M modules; The term ‘Input Data’ refers to data written to the network while the term ‘Output Data’ refers to data received from the network, regardless of if the module is a master or a slave.
- NetTool-PB uses the same definition as an end user normally will see from a configuration tool; the term ‘Input Data’ refers to data read from a slave device while the term ‘Output Data’ refers to data written to a slave device.

At first the contradiction in these two definitions may appear as a problem but since the end users does not need to be aware of the definitions used between the Anybus-M PROFIBUS DP-V1 module and the application system, only the definition in the NetTool-BP will apply to them.

See also...

- 2-3 “Memory Map”

Initialisation Sequence

General

The initialisation sequence determines how the Anybus module will operate on the network, and certain basic operational parameters such as memory layout etc.

The initialisation sequence looks as follows:

■ Power On (Reset)

1. Send 'Start Init'¹

This step starts the initialisation sequence.

2. Send 'FB Init' (Optional)

This step initializes some of the more advanced functions in the master. If only basic master functionality is needed, this step can be omitted.

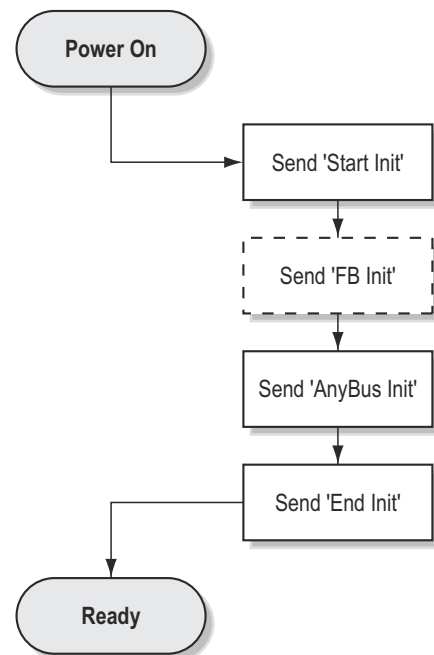
3. Send 'Anybus Init'¹

See also 2-2 “Data sizes in ANYBUS_INIT”.

4. Send 'End Init'¹

This step ends the initialisation sequence.

■ Ready



See also...

- 5-2 “Fieldbus Specific Initialisation (FB_INIT)”
- General Anybus-S/M Parallel Design Guide

Data sizes in ANYBUS_INIT

The following data sizes are accepted in ANYBUS_INIT:

Setting in ANYBUS_INIT	Standard Mode	Extended Mode
I/O length	2048	2048
DPRAM length	512	1536
Total length	2048	Total length

Note: ‘I/O length’ must be equal to ‘Total length’, since Parameter Data is not supported (acyclic communication is handled through the mailbox interface)

See also...

- 2-3 “Memory Map”
- 5-2 “Fieldbus Specific Initialisation (FB_INIT)”
- General Anybus-S/M Parallel Design Guide

1. For more information about this mailbox message, consult the general Anybus-S Parallel Design Guide.

Memory Map

General

The DPRAM in the Anybus-M PROFIBUS DP-V1 has been extended to allow fast access to larger amounts of cyclical fieldbus data. This is accomplished by using pin 34 of the application connector as address line 11 (A11), giving an effective address range of 4kbyte instead of the standard 2kbyte. The advantage of this is that while the total I/O size remains limited to 2kbyte, a larger portion of this I/O data can be accessed directly in the dual port memory instead of via the mailbox interface.

Note that this feature is optional; e.g. if A11/pin 34 is not implemented, the memory layout is consistent with the standard Anybus-S memory map.

Extended Mode (4kbyte DPRAM)

Address:	Area:	Access:	Description:
000h - 5FFh	Input Area (1536 bytes)	R/W	The structure of these areas is determined by the contents of the database. See 3-9 "DPRAM Address Assignment Modes" for more information.
600h - BFFh	Output Area (1536 bytes)	RO	
C00h - D1Fh	Mailbox In	R/W	See Anybus-S Parallel Design Guide
D20h - E3Fh	Mailbox Out	RO	- " -
E40h - FBFh	Fieldbus Specific Area	RO	See 6-1 "Fieldbus Specific Area"
FC0h - FFDh	Control Registers	R/W	See 7-1 "Control Register Area"
FFEh - FFFh	Handshake Registers	R/W	See Anybus-S Parallel Design Guide

Standard Mode (2kbyte DPRAM)

Address:	Area:	Access:	Description:
800h - 9FFh	Input Area (512 bytes)	R/W	The structure of these areas is determined by the contents of the database. See 3-9 "DPRAM Address Assignment Modes" for more information.
A00h - BFFh	Output Area (512 bytes)	RO	
C00h - D1Fh	Mailbox In	R/W	See Anybus-S Parallel Design Guide
D20h - E3Fh	Mailbox Out	RO	- " -
E40h - FBFh	Fieldbus Specific Area	RO	See 6-1 "Fieldbus Specific Area"
FC0h - FFDh	Control Registers	R/W	See 7-1 "Control Register Area"
FFEh - FFFh	Handshake Registers	R/W	See Anybus-S Parallel Design Guide

Note: The addresses in the 2kbyte map above have an offset of 800h when compared to the 2kbyte memory map found in the Anybus-S/M Design Guide. If an Anybus-S/M module with a 2kbyte memory model is used in an application designed for a 4kbyte memory model, or if the Anybus-M PROFIBUS DP-V1 is used in its 2kbyte mode in a 4kbyte memory model application, the application system software must take this offset into account when accessing the DPRAM (e.g. the 4kbyte model address A00h equals the 2kbyte model address 200h when the module does not use the A11 address pin).

PROFIBUS Implementation

Modes of Operation

The Anybus module can operate either as a combined Class 1 and 2 master, or as a Class 2-only master. The latter imposes the following restrictions:

- The module cannot communicate with any slaves that might be present in the database (Slave Record). However, it will communicate with other masters (token passing etc.). Therefore, in order for this mode to work, it is required that the database contains at least a valid Master Record.
- Mailbox commands intended for Class 1 operations will be rejected by the module.
- Redundant operation not possible

See also...

- 2-2 “Initialisation Sequence”
- 5-2 “Fieldbus Specific Initialisation (FB_INIT)”

Redundant Operation (HSBY)

The Anybus module supports redundant operation, allowing the module to operate in a redundant master system based on Anybus-M PROFIBUS DP-V1 masters.

This functionality imposes additional responsibility on the application, in that certain aspects of the communication must be handled in a specific manner to ensure proper operation in the event of a switch-over.

See also...

- 2-2 “Initialisation Sequence”
- 4-1 “Redundant Operation (HSBY)”

Supported PROFIBUS Services

The following table lists all service available according to the PROFIBUS specification.

Service	PROFIBUS Version	Master Class 1		Master Class 2	
		Request	Response	Request	Response
DDLML_Data-Exchange	DP-V0	✓	-	NS	-
DDLML_Set_Prm	DP-V0	✓	-	NS	-
DDLML_Chk_Cfg	DP-V0	✓	-	NS	-
DDLML_Slave_Diag	DP-V0	✓	-	✓	-
DDLML_Global_Control	DP-V0	✓	-	NS	-
DDLML_Get_Cfg	DP-V0	-	-	✓	-
DDLML_Set_Slave_Add	DP-V0	-	-	✓	-
DDLML_Read_Input	DP-V0	-	-	NS	-
DDLML_Read_Output	DP-V0	-	-	NS	-
DDLML_Get_Master_Diag	DP-V0	-	✓	✓	-
DDLML_Start_Seq	DP-V0	-	NS	NS	-
DDLML_Download	DP-V0	-	NS	NS	-
DDLML_Upload	DP-V0	-	NS	NS	-
DDLML_End_Seq	DP-V0	-	NS	NS	-
DDLML_Act_Param_Brct	DP-V0	-	NS	NS	-
DDLML_Act_Param	DP-V0	-	NS	NS	-
MSAC1_Read	DP-V1	✓	-	-	-
MSAC1_Write	DP-V1	✓	-	-	-
MSAL1_Alarm	DP-V1	-	✓	-	-
MSAL1_Alarm_Ack	DP-V1	-	✓	-	-
MSAC2_Initiate	DP-V1	-	-	✓	-
MSAC2_Read	DP-V1	-	-	✓	-
MSAC2_Write	DP-V1	-	-	✓	-
MSAC2_DataTransport	DP-V1	-	-	✓	-
MSAC2_Abort	DP-V1	-	-	✓	-
Data_eXchange_Broadcast	DP-V2	NS	-	-	-
Isochrone_mode (Takt sync)	DP-V2	NS	-	-	-
Extended_Set_Prm (Subscriber)	DP-V2	NS	-	-	-

✓ - Service supported
 NS - Service not supported

Database Management

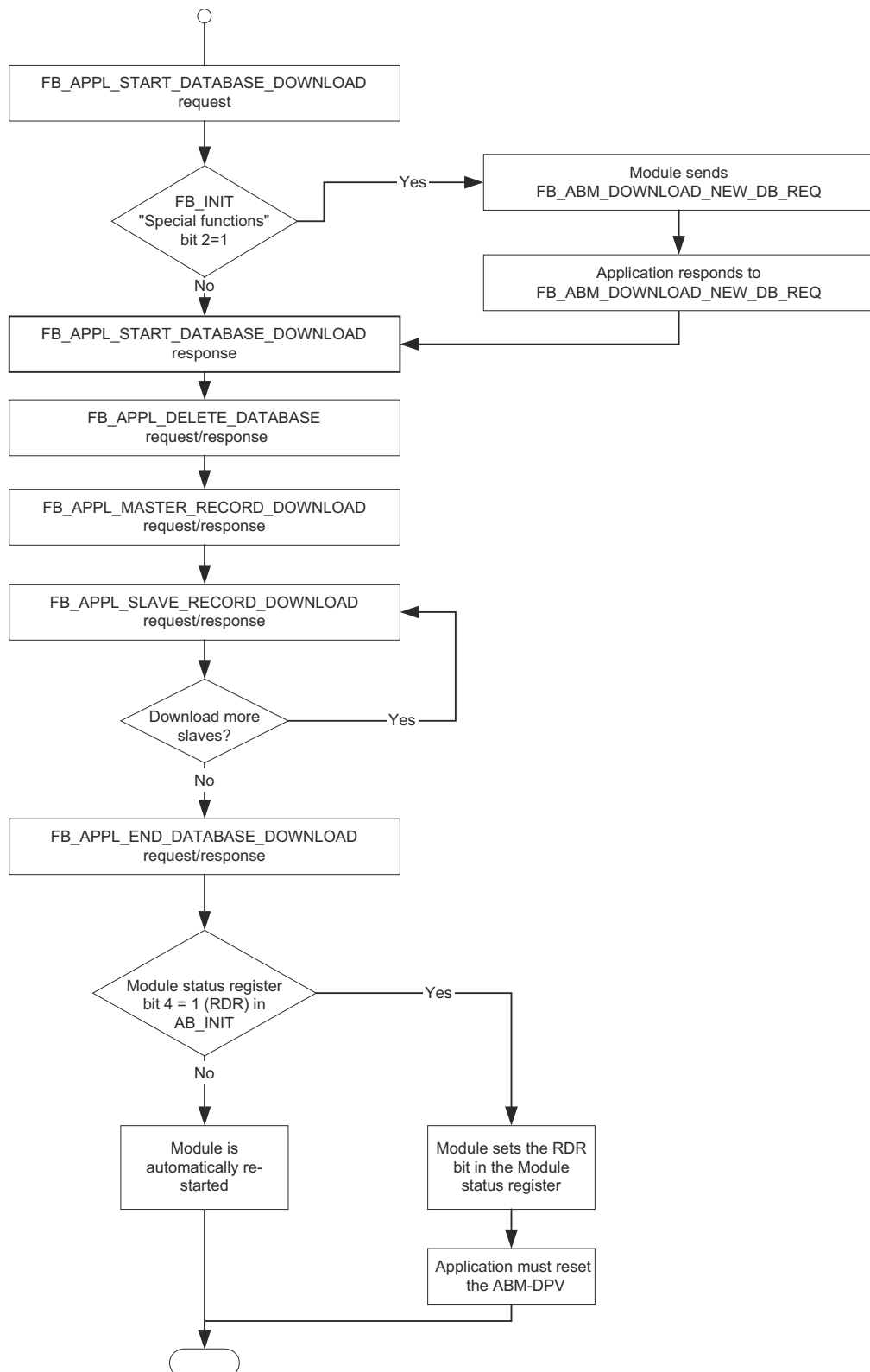
General

The module needs a bus database in order to know which slaves to establish connections to, how they shall be configured and how much data to exchange with them. In most cases the NetTool-BP configuration software from HMS will be used for this but it is also possible to use a third-party configurator and load the database into the module via the mailbox interface.

Note: This chapter is not intended to give technical background or technical details of the different database parameters or their usage. For questions concerning the PROFIBUS system itself, the official PROFIBUS specification documents should be considered the main source of information.

Database Download

If the database is supposed to be downloaded using mailbox messages the figure below illustrates the download procedure. For more information about these mailbox messages, see 5-29 “Database Management”.



Master Record Data Structure

The master record data block is made up of two structures:

- Bus Parameter Data Block
- Master User Data Block

Bus Parameter Data Block

This field contains parameter that are necessary for the overall bus communication.

Parameters written in *italic* are related to DP-V1.

Byte Offset	Designation	Type / [range]	Contents
0-1	Bus_Para_Len	UINT16 / [96]	Length of the entire Bus parameter block (i.e Bus_Para +Master_User_Data) including Bus_Para_Len
2	TS	UINT8 / [0-125]	Address of this station.
3	Data rate	UINT8 / [0-11]	11 = 45.45 kbit/s 10 = (Reserved) 9 = 12000 kbit/s 8 = 6000 kbit/s 7 = 3000 kbit/s 6 = 1500 kbit/s 5 = Reserved 4 = 500 kbit/s 3 = 187.5 kbit/s 2 = 93.75 kbit/s 1 = 19.2 kbit/s 0 = 9.6 kbit/s
4-5	T _{SL}	UINT16/ [maxT _{SDR} +15 to 16383]	Slot time. Max time the master will wait for a response from the addressed slave. Timebase: T _{bit}
6-7	minT _{SDR}	UINT16/ [11 to MIN(255, maxT _{SDR} -1, 34 + 2* T _{SET} + T _{QUI})]	Minimum Station Delay time Responder. This is the minimum waiting time for a slave until it is allowed to send the response frame to the master. minT _{SDR} in the Prm_Data for the slaves are based on this parameter. Timebase: T _{bit}
8-9 ^a	maxT _{SDR}	UINT16/ [35 + 2* T _{SET} + T _{QUI} to 1023]	Maximum Station Delay time Responder. The addressed slave must respond within this time. Timebase: T _{bit}
10	T _{QUI}	UINT8/ [0-MIN(31, minT _{SDR} -1)]	Quiet time. Time required for a transmitting node to switch from send to receive. Timebase: T _{bit}
11 ^a	T _{SET}	UINT8 / [1 to 255]	Setup time. Time elapsing in the node between a data frame being received and a response occurring. Timebase: T _{bit}
12-15	T _{TR}	UINT32/ [256 to 16776960] ^b	Target rotation time. This is the maximum time available for token rotation. The difference between the actual token rotation time (T _{RR}) determines how much time the master still has to send data frames to its slaves. Timebase: T _{bit}

Byte Offset	Designation	Type / [range]	Contents
16	G	UINT8 / [1-100]	GAP update factor. Determines how many token rounds occur, before a new active station (master) can be added to the logical token ring. (i.e frequency of FDL_status request on the bus)
17	HSA	UINT8 / [1-126]	Highest Station Address. Highest address of an active station (master). If a new master has an address greater than HSA it can not be added to the logical token ring.
18	max_retry_limit	UINT8 / [1-15]	Retry Limit. Defines how many attempts the master should send a request frame to a slave that is not responding. (A new attempt is made after T _{SL} has expired)
19	Bp_flag	UINT8 / [0]	Bit 0-7: (reserved, set to 0)
20-21	Min_Slave_Interval	UINT16 / [1 to 35791]	Smallest allowed period of time between two consecutive DP-slave poll cycles. Time base: 100us
22-23	Poll_Timeout	UINT16/ [1 to 2 ¹⁶ -1]	In case of Master-Master communication this parameter specifies the maximum period of time needed to get the response. Time base: 1ms
24-25	Data_Control_Time	UINT16/ [1 to 2 ¹⁶ -1]	This parameter specifies the maximum period of time for a DataExchange with every activated DP-slave. This time is also used for sending out the Global Control cyclically. Time Base: 10ms
26 ^a	Alarm_Max	UINT8 / [7 to 32]	This variable contains the maximum number of alarms per DP-V1 slave that can be handled by the master.
27 ^a	Max_User_Global_Control	UINT8 / [1]	This parameter defines the maximum number of Global_Control requests that may be started by the application at the same time.
28-31	Reserved	UINT8 / [0]	(reserved)

a. Not used by Anybus-M PROFIBUS DP-V1. However, range check is carried out.

b. The sum of the parameters 'Target rotation time (T_{TR})' in the 'Bus Parameter Data Block' and the 'Delta target rotation time (Delta_T_{TR})' in the 'Master User Data Block' must be in the 256 to 16776960 range.

Master User Data Block

This field contains data that is unique for the Anybus-M PROFIBUS DP-V1 implementation.

Byte Offset	Designation	Type / [range]	Contents
0-1	Master_User_Data_Len	UINT16 / [64]	Length of the Master_User_Data including Master_User_Data_Len
2-33	Master_Class2_Name	Visible String / [32]	Indicates the name of the DP-master (class 2) which provided the values for parameter set.
34-35	Tid1	UINT16/[37 to 1023]	Master idle time 1 ($Tid1 = 35 + 2 * T_{SET} + T_{QUI}$) Timebase: T_{bit}
36-37	Tid2	UINT16/[37 to 1023]	Master idle time 2 ($Tid2 = \max T_{SDR}$) Timebase: T_{bit}
38-39	Reserved	UINT16 / [0]	(reserved)
40-43	Delta_T _{TR}	UINT32/ [0 to 16776704] ^a	Delta target rotation time. If there are other masters on the bus, the total target rotation time for these masters should be entered here. Timebase: T_{bit}
44-47	Reserved	UINT32 / [0]	(reserved)
48-49	Repeater	UINT16	1: Repeater on bus 0: No repeater
50	Group_Sync	UINT8	Bit 0-7 corresponds to group 1-8. Example: If group 5 and 1 are "sync groups" and group 6, 2 and 1 are "freeze groups", then Group_Sync = 0x11 and Group_Freeze = 0x23.
51	Group_Freeze	UINT8	
52	Ident Number high	UINT8	Master ident-number assigned by PNO
53	Ident Number low	UINT8	
54	Addressing mode	UINT8	0: Byte addressing. 1: Word addressing. (See 3-11 "Addressing Mode & Storage Format")
55	Storage format	UINT8	0: Motorola (Big Endian) 1: Intel (Little Endian) (See 3-11 "Addressing Mode & Storage Format")
56-59 ^b	T _{CT}	UINT32 / [0]	(reserved for future DP-V2 functionality. Set to 0)
60 ^b	max T _{SH}	UINT8 / [0]	(reserved for future DP-V2 functionality. Set to 0)
61-63	Reserved	UINT8	(reserved)

a. The sum of the parameters 'Target rotation time (T_{TR})' in the 'Bus Parameter Data Block' and the 'Delta target rotation time (ΔT_{TR})' in the 'Master User Data Block' must be in the 256 to 16776960 range.

b. Not used by Anybus-M PROFIBUS DP-V1. However, range check is carried out.

Slave Record Data Structure

The slave record data is made up of the following data blocks:

- General Data Block
- Parameter Data Block (Prm_Data)
- Configuration Data Block (Cfg_Data)
- Address Table Block (Add_Tab)
- Slave User Data Block (Slave_User_Data)
- Extended User Parameter Data Block (Ext_User_Prm_Data)

General Data Block

Parameters written in *italic* are related to DP-V1.

Byte Offset	Designation	Type / [range]	Contents
0-1	Slave_Para_Len	UINT16/[44 to 1740]	Length of the entire "Slave parameter record" (in bytes) including the "Slave_Para_Len".
2	Sl_flag	UINT8	Flag that describes the properties of the slave. Bit 7: Active Bit 6: New_Prm Bit 5: Fail_Safe Bit 4: (reserved) Bit 3: <i>DP-V1_Supported</i> Bit 2: <i>DP-V1_Data_Types</i> Bit 1: <i>Extra_Alarm_SAP</i> Bit 0: (reserved)
3	Slave_Type	UINT8 / [0, 16-255]	0: DP-slave 1-15: (reserved) 16-255: Manufacturer specific
4	Max_Diag_Data_Len	UINT8 / [6-244]	Max diagnostic data length that the slave supports.
5	Reserved	UINT8/ [0]	Reserved
6	Max_Channel_Data_Len	UINT8/ [4-244]	Maximum size of the MSAC1-PDU (4 byte header + data) for the DP-V1 slave.
7	Diag_Upd_Delay	UINT8/ [0-15 (extendible to 255)]	This parameter is used to count the number of DDLM_Slave_Diag.con in state DIAG2 while Diag_Data.Prm_Req is still set (for slaves with reduced performance)
8	Alarm_Mode ^a	UINT8 / [0-7]	This parameter specifies the maximum number of possible active alarms. 0 = 1 alarm of each type 1 = 2 alarms in total 2 = 4 alarms in total 3 = 8 alarms in total 4 = 12 alarms in total 5 = 16 alarms in total 6 = 24 alarms in total 7 = 32 alarms in total
9	Add_Sl_Flag ^a	UINT8 / [0x00-0x03]	Bit 0 NA_To_Abort Bit 1 Ignore_Aclr Bit 2-7 (reserved)
10-11	MSAC1_Timeout	UINT16 / [1 to 2 ¹⁶ -1]	Specifies the maximum time it may take for a DP-V1-slave to respond to a DP-V1 request. Time Base: 10ms
12-15	Reserved	UINT8 / [0]	(reserved)

a. Not used by Anybus-M PROFIBUS DP-V1. However, range check is carried out.

Parameter Data Block

The following data is downloaded to the slave via the Set_Prm telegram.

Note: If 'Prm_data_len' is odd, an extra pad byte must be inserted at the end of the Prm_Data field.

Byte Offset	Designation	Type / [range]	Contents
0-1	Prm_data_len	UINT16 / [9 to 246]	Length of the "Parameter data block" (in bytes) including Prm_Data_Len, excluding any pad byte.
2	Station_status	UINT8	Bit 7: Lock_Req Bit 6: Unlock_Req Bit 5: Sync_Req Bit 4: Freeze_Req Bit 3: Watchdog_On Bit 2-0: (reserved)
3	WD_Factor1	UINT8 / [1 to 255]	The values entered in these two bytes represent the setting for the watchdog control (T_{WD}). If the master fails the outputs will enter a safe state after the expiration of this time. T_{WD} (in seconds) = 10 ms * WD_Factor1 * WD_Factor2
4	WD_Factor2	UINT8 / [1 to 255]	
5	minT _{SDR}	UINT8 [0 to maxT _{SDR}]	Minimum Station Delay time Responder This is the minimum waiting time for a DP-slave until it is allowed to send the response frame to the DP-Master. If 00h is entered the previous value remains.
6	Ident_Nr_High	UINT8	Ident number assigned by PNO
7	Ident_Nr_Low	UINT8	Ident number assigned by PNO
8	Group_Ident	UINT8	Group-belonging for Sync/Freeze
9 to Prm_data_len-2	UserPar	UINT8	Slave manufacturer specific data.
Odd	Possible pad byte	UINT8	If "Prm_data_len" is odd an extra pad byte must be inserted here.

Configuration Data Block

The following data is downloaded to the slave via the Chk_Cfg telegram.

Note: Cfg_Data_Len must start at an even address. If 'Cfg_data_len' is odd, an extra pad byte must be inserted at the end of the Cfg_Data field.

Byte Offset	Designation	Type / [range]	Contents
0-1	Cfg_Data_Len	UINT16 / [3-246]	Length of Cfg_Data (in bytes) including Cfg_Data_Len, excluding any pad byte.
2 to (Cfg_Data_Len-2)	Identifier byte	UINT8/ [Refer to DP-spec]	String of identifier bytes. This string specifies the expected I/O length and consistency for the slave.
Odd	Possible pad byte	UINT8	If "Cfg_data_len" is odd an extra pad byte must be inserted here.

Address Table Block

This structure describes how Process Data should be mapped in the DPRAM. See 3-9 “DPRAM Address Assignment Modes” for detailed information about address assignment.

Note: The first parameter (Add_Tab_Len) must start at an even address!

Byte Offset	Designation	Type / [range]	Contents
0-1	Add_Tab_Len	UINT16 / [6 to 980]	Length of the entire Address Table including Add_Tab_Len.
2	Add_Tab_In_Len	UINT8 / [0 to 244]	Number of input offset entries in the Add_Tab_In_Offset table. If Add_Tab_In_Len = 1 the process input area is considered to be contiguous, and the first (and only) word in Add_Tab_In_Offset is assumed to be the start offset of this contiguous area.
3	Add_Tab_Out_Len	UINT8 / [0 to 244]	Number of output offset entries in the Add_Tab_Out_Offset table. If Add_Tab_Out_Len = 1 the process output area is considered to be contiguous, and the first (and only) word in Add_Tab_Out_Offset is assumed to be the start offset of this contiguous area.
4 - ...	Add_Tab_In_Offset [Add_Tab_In_Len]	UINT16 / [1 to 244]	This field determines the offset addresses of the input-data and indicates the offset in number of words (if word addressing is used) or number of bytes (if byte addressing is used).
...	Add_Tab_Out_Offset [Add_Tab_Out_Len]	UINT16 / [1 to 244]	This field determines the offset addresses of the output-data and indicates the offset in number of words (if word addressing is used) or in number of bytes (if byte addressing is used).

Slave User Data Block

This field contains manufacturer specific data that characterize the slave for the master.

Byte Offset	Designation	Type / [range]	Contents
0-1	Slave_User_Data_Len	UINT16 / [6]	Length of the Slave_User_Data including Slave_User_Data_Len (Always 6 bytes)
2	OutputDataLen	UINT8 / [0-244]	Length of the used output data (in bytes).
3	InputDataLen	UINT8 / [0-244]	Length of the used output data (in bytes).
4-5		UINT8 / [0]	(reserved, set to zero.)

Extended User Parameter Data Block

In DP-V2 a new PROFIBUS telegram has been added to make it possible to download the ‘subscription table’ to a DP-V2 slave that operates in subscriber-mode. The following data will be downloaded to the DP-V2 master via this telegram. These parameters are not used at this time in the module.

Byte Offset	Designation	Type / [range]	Contents
0-1	Ext_User_Prm_Data_Len	UINT8 / [2 to 246]	Length of the Ext_User_Prm_Data including Ext_User_Prm_Data_Len. Set to 2,
2 to (Ext_User_Prm_Data_Len -1)	Ext_User_Prm_Data	UINT8	(reserved for future DP-V2 functionality)

DPRAM Address Assignment Modes

There are two different ways of assigning Process Data to the DPRAM, simple mode and complex mode. Which mode to use is defined in the Address Table, that is part of the slave record in the database.

A slave will be operated in complex mode if Add_Tab_In_Len or Add_Tab_Out_Len is greater than one, otherwise simple mode (see table below)

	Add_Tab_xxx_Len = 0	Add_Tab_xxx_Len = 1	Add_Tab_xxx_Len = 2..244
Add_Tab_In_Len:	(Slave has no input data)	Inputs are copied according to Simple Addressing mode.	Inputs are copied according to Complex Addressing mode
Add_Tab_Out_Len:	(Slave has no output data)	Outputs are copied according to Simple Addressing mode.	Outputs are copied according to Complex Addressing mode

- **Simple Mode**

In this mode all Process Data that belongs to a slave is located in a contiguous block. In other words, the data blocks, associated with each Identifier byte in the Cfg_Data, will be located after each other without gaps. Two offset-entries in the Address Table points out where the process in-/out data begins.

Simple addressing mode results in a smaller Address Table, which in turn gives a smaller database compared to complex addressing mode.

- **Complex Mode**

In this mode the data blocks that are associated with each Identifier byte in the Cfg_Data can be located anywhere in the Process Data area. This means that gaps in the Process Data for one slave is allowed.

One entry in the Cfg_Data results in one entry in the Address Table, except for Identifier bytes with no data. If one entry in Cfg_Data specifies both in- and output there will be two entries in Add_Tab (one for in and one for out).

It is possible to mix simple- and complex addressing mode, i.e. one slave can work in complex mode while another slave works in simple mode. It is even possible that a slaves input data is treated in a complex mode while its output data is treated in simple mode, and vice versa.

Example, Simple Mode

The slave in the example has 6 words input- and 10 words output data described by 4 Identifier bytes.

Offset:	DPRAM In area	CfgData	
0000h		Config_Data_Len=06h	
0040h	Identifier 1 = 4 words	Identifier 1=F3h	(4 words in + 4 words out consistency over total length)
	Identifier 2 = 2 words	Identifier 2=D1h	(2 words in, consistency over total length)
		Identifier 3=60h	(1 word out, consistency over unit)
		Identifier 4=E4h	(5 words out, consistency over total length)
		AddTab	
		Add_Tab_Len=08h	
		Add_Tab_In_Len=01h	
		Add_Tab_Out_Len=01h	
		Add_Tab_In_Offset=40h	
		Add_Tab_Out_Offset=60h	
Offset:	DPRAM Out area		
0000h			
0060h	Identifier 1 = 4 words		
	Identifier 3 = 1 word		
	Identifier 4 = 5 words		

Example, Complex Mode

(Same slave as in previous example using complex mode.)

Offset:	DPRAM In area	CfgData	
0000h		Config_Data_Len=06h	
0040h	Identifier 1 = 4 words	Identifier 1=F3h	(4 words in + 4 words out consistency over total length)
		Identifier 2=D1h	(2 words in, consistency over total length)
00C0h	Identifier 2 = 2 words	Identifier 3=60h	(1 word out, consistency over unit)
		Identifier 4=E4h	(5 words out, consistency over total length)
		AddTab	
		Add_Tab_Len=0Eh	
		Add_Tab_In_Len=02h	
		Add_Tab_Out_Len=03h	
		Add_Tab_In_Offset=40h	
		Add_Tab_In_Offset=C0h	
		Add_Tab_Out_Offset=60h	
		Add_Tab_Out_Offset=160h	
		Add_Tab_Out_Offset=084h	
Offset:	DPRAM Out area		
0000h			
0060h	Identifier 1 = 4 words		
0084h	Identifier 4 = 5 words		
0160h	Identifier 3 = 1 word		

Addressing Mode & Storage Format

The 'Addressing Mode'-parameter in the Master User Data Block determines the starting point of the modules in the I/O area of the DPRAM.

- **Byte addressing**

The I/O area is byte-oriented. Modules may start at any byte address (odd or even). The offsets in the Address table are specified in number of bytes.

- **Word addressing**

The I/O area is word-oriented. Modules must start at an *even* byte address. The offsets in the Address table are specified in number of 16-bit words.

Example:

Offset in DPRAM	Byte Addressing Mode		Word Addressing Mode	
	Byte Modules	Word Modules	Byte Modules	Word Modules
Byte 0	OB0/IB0	OW0/IW0	OB0/IB0	OW0/IW0
Byte 1	OB1/IB1		-	
Byte 2	OB2/IB2	OW1/IW1	OB1/IB1	OW1/IW1
Byte 3	OB3/IB3		-	
Byte 4	OB4/IB4	OW2/IW2	OB2/IB2	OW2/IW2
Byte 5	OB5/IB5		-	

Abbreviations:

OB0: Output Byte 0	OW1: Output Word 1
IB0: Input Byte 0	IW1: Input Word 1
etc.	

The 'Storage Format'-parameter in the Master User Data Block determines the byte representation in the DPRAM for a word module.

- **Motorola format (Big endian)**

This is the normal byte representation on a PROFIBUS Network.

- **Intel format (Little endian)**

Note: Using Intel format will slightly decrease the performance of the master since the data needs to be byte-swapped due to the Motorola format used on the PROFIBUS network.

Example:

Offset in DPRAM	Motorola Format	Intel Format
Byte 0	OW0/IW0 (High byte)	OW0/IW0 (Low byte)
Byte 1	OW0/IW0 (Low byte)	OW0/IW0 (High byte)
Byte 2	OW1/IW1 (High byte)	OW1/IW1 (Low byte)
Byte 3	OW1/IW1 (Low byte)	OW1/IW1 (High byte)
Byte 4	OW2/IW2 (High byte)	OW2/IW2 (Low byte)
Byte 5	OW2/IW2 (Low byte)	OW2/IW2 (High byte)

Redundant Operation (HSBY)

General Information

Definitions

The following terms are introduced in this chapter:

- **Active Master**

An Active Master behaves like a standard Class 1 DPV1-master, which additionally responds to incoming Ping-requests from the Passive Master (below).

- **Passive Master**

A Passive Master behaves like a Class 2 master, but will additionally initiate Ping-requests to the Active Master.

- **Switchover**

Process where the Passive Master takes control of the network and becomes Active.

Basics

A typical redundant system based on Anybus-M PROFIBUS DP-V1 masters consists of one Active Master and one Passive Master connected to the PROFIBUS line. Furthermore, the applications of these masters communicate through a separate link (e.g. ethernet) next to the PROFIBUS line.

Initially, the applications shall synchronize themselves (over the separate link) so that it is clear which application that controls the Active Master and which one that controls the Passive Master.

Once both masters are initialized, the Active Master starts exchanging data with its assigned slaves, while the Passive Master starts issuing Ping-requests which the Active Master responds. This Ping-sequence carries status information between the two masters, which shall be processed by the higher-level control system which in turn decides whether or not to perform a switchover.

See also...

- 4-2 “Redundant System Status”

Database

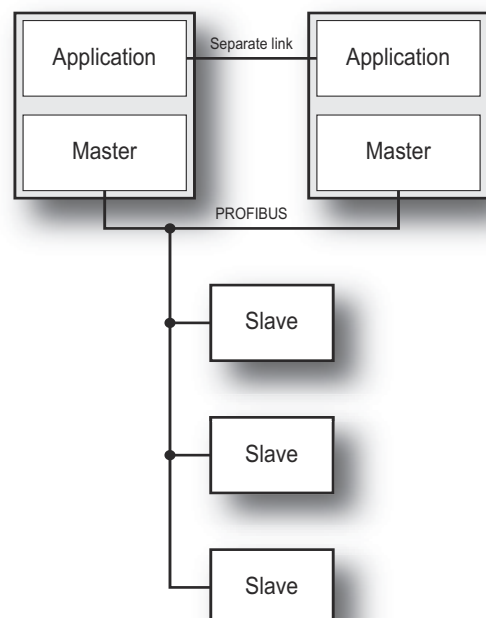
It is imperative that the PROFIBUS configuration in both masters are identical.

The following bus parameters should be considered (NetTool handles these parameters):

- Token rotation time (TTR)
- Slave watchdog time (WD_Factor1&2)
- Highest Station Address (HSA)
- Master Address

See also...

- 6-4 “HSBY Status Information (EA0h... EA7h)”



Redundant System Status

General

The 'HSBY Status Information'-registers in the Fieldbus Specific Area provides information about the overall network status and the remote- and local masters. This information is exchanged as part of the Ping-sequence described earlier, and shall be used as a basis when deciding whether or not to perform a switchover.

These registers are...

- **Remote Master Status**
This register holds various status flags indicating the overall state of the remote master.
- **Local Master Status**
This register is similar to the Remote Master Status, except that it carries the status information related to the local master.
- **Number of Remote Slaves**
This register indicates the number of slaves recognized by the remote master.
- **Number of Local Slaves**
This register indicates the number of slaves recognized by the local master.

See also...

- 4-1 "General Information"
- 4-2 "Redundant Master Status"
- 4-3 "Slave Status"
- 6-4 "HSBY Status Information (EA0h... EA7h)"

Redundant Master Status

As long as the Ping-sequence is running properly the 'COM'-bit in the 'Remote Master Status'-register is set, indicating to the local application that the remote master is fully operational. On the contrary, if the Ping-sequence is terminated, the 'COM'-bit is cleared, indicating that the remote master is non-operational or that the fieldbus link between the two masters is broken.

See also...

- 4-2 "General"
- 6-4 "HSBY Status Information (EA0h... EA7h)"

Slave Status

The 'HSBY Status Information'-registers hold information about the current on/offline status of the slaves on the network. This information consists of several parts, and allows a higher-level system to switch to the master that e.g. recognizes the most slaves.

- **The 'R_SO'-bit ('Remote Master Status'-register)**

This bit indicates if the remote master recognizes any of its assigned slaves as being 'offline'

- **'No. of remote slaves'-register**

This register reflects the number of slaves detected by the remote master.

- **The 'L_SO'-bit ('Local Master Status'-register)**

This bit indicates if the local master recognizes any of its assigned slaves as being 'offline'.

- **'No. of local slaves'-register**

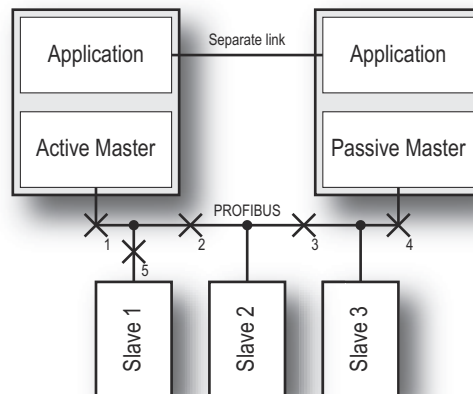
This register reflects the number of slaves detected by the local master.

Note 1: During a switchover, the Slave Status information will be reassembled. This means that the value of 'No. of local slaves' and the 'L_SO'-bit might dip for a short while until the Active (former Passive) master has detected its slaves properly.

Note 2: The Slave Status information is refreshed each time a slave is disconnected or fails. In all other cases the communication link is broken so the information would not reach the counterpart.

Example:

The figure shows a network with three slaves and two masters.



The following table lists the slave status information under different scenarios.

Type of failure	Active Master		Passive Master	
	L_SO	No. of Local Slaves	L_SO	No. of Local Slaves
No errors	1	3	1	3
Cable cut at 1	0	0	1	3
Cable cut at 2	0	1	0	2
Cable cut at 3	0	2	0	1
Cable cut at 4	1	3	0	0
Cable cut at 5	0	2	0	2

The Switchover

The application of the Passive Master must continuously monitor the 'COM'-bit in the 'Remote Master Status'-register to verify the status of the Active Master. If the 'COM'-bit indicates that the communication with the Active Master is lost, the application may consider a 'switchover' (i.e. a process where the Passive Master becomes active and takes control over the slaves). It is however not sure that a switchover is always the correct thing to do, since this might cause the situation to get even worse.

Consider the following scenarios which all of them causes the 'COM'-bit of the Passive Master to be cleared:

- **The Active Master is in reset**

Data exchange with all slaves has stopped.

A switchover would save the day.

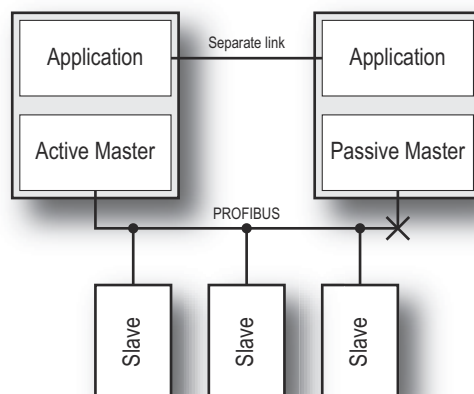
- **The application of the Active Master is malfunctioning**

To prevent the Active Master from running without a supervisor, the application should support the standard Watchdog mechanism¹. If the watchdog time elapses, the Anybus-M automatically leaves the PROFIBUS network.

A switchover would save the day.

- **The PROFIBUS line is broken (A)**

Consider a situation where the PROFIBUS connector is disconnected at the Passive Master while the rest of the network is working correctly.

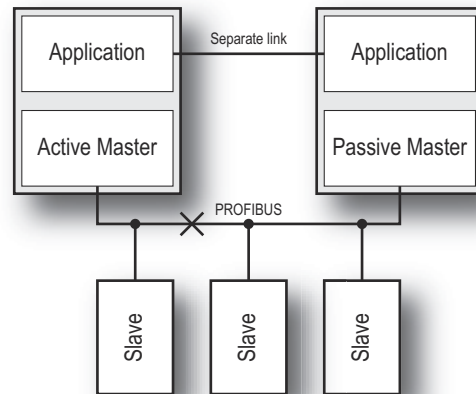


A switchover would be devastating.

1. Consult the general Anybus-S/M Design Guide for further information.

- **The PROFIBUS line is broken (B)**

Consider a situation where the PROFIBUS cable is cut somewhere in the middle of the two masters.



A switchover might be good or bad depending on how many slaves that is affected by the cable break.

Conclusion

These scenarios imply that there must be some kind of intelligence in the system that makes a decision whether to switch or not (e.g. a PLC-program). Please note that the Anybus-M never initiates a switchover; it just informs the application about the current situation and then it's up to the application or the higher-level control system to decide what to do.

See also...

- 4-2 "Redundant System Status"
- 4-6 "How to Implement a Redundant Application"
- 6-4 "HSBY Status Information (EA0h... EA7h)"

How to Implement a Redundant Application

Initialisation

To operate in a HSBY system, the ‘Special Functions’-register in FB_INIT needs to be setup as follows:

Special Functions	Bit	DP-V0 Application		DP-V1 Application	
		Active Master	Passive Master	Active Master	Passive Master
Initial HSBY State	6	Active (0)	Passive (1)	Active (0)	Passive (1)
DP-V0 HSBY	7	Enabled (1)	Enabled (1)	Enabled (1)	Enabled (1)
DP-V1 HSBY	8	Disabled (0)	Disabled (0)	Enabled (1)	Enabled (1)
FB_ABM_MSAL1_ALARM_CON	0	Disabled (1)	Disabled (1)	Enabled (0)	Enabled (0)
FB_ABM_MSAL1_ALARM_IND	1	Disabled (1)	Disabled (1)	Enabled (0)	Enabled (0)

See also...

- 4-7 “DP-V1 Handling”
- 5-2 “Fieldbus Specific Initialisation (FB_INIT)”

Runtime

The following actions needs to be performed during runtime:

- Poll the ‘Local’- and ‘Remote Master Status’-registers in the Fieldbus Specific Area, and forward this information to the higher-level control system for processing.
- Poll the ‘No. of Local Slaves’- and ‘No. of Remote Slaves’-registers in the Fieldbus Specific Area, and forward this information to a high-level control system for processing.
Caution: Even if the application of the Passive Master and the application of the Active Master read these registers simultaneously they might get different values, this since the two masters updates the registers asynchronously to each other. Therefore it is recommended to read the registers repeatedly until the returned value is stable.
- Although not actually exchanging data, the application of the Passive Master must keep the Input Data Area updated at all times, in order to be prepared for a switchover.
- When shifting operation mode (STOP, CLEAR or OPERATE), issue FB_APPL_SET_OPERATION_MODE to both the Active- and the Passive Master.

See also...

- 2-1 “‘Input’ and ‘Output’ Definitions”
- 4-7 “DP-V1 Handling”
- 5-71 “Set HSBY State (FB_APPL_SET_HSBY_STATE)”
- 6-4 “HSBY Status Information (EA0h... EA7h)”

DP-V1 Handling

General

In a redundant system, special care must be taken when dealing with acyclic requests (Read, Write and Alarm). If not, a dangerous situation could arise during switchover due to possible pending requests.

Example 1

An acyclic read request has been sent to a slave, but the Active Master crashes before it has fetched the response. A switchover takes place, but the former Passive Master is not aware of the pending read request, and hence doesn't fetch the response. This in turn causes any additional read requests to be rejected by the slave. The devastating result will be that the master re-starts the slave.

Example 2

A slave has issued an alarm to the Active Master, but the master crashes before the alarm has been processed. A switchover takes place, but the former Passive Master is not aware of the pending alarm situation, and hence doesn't finish processing the alarm. The slave however, waits for an alarm acknowledgement that will never come, which in turn may prevent the slave from issuing new alarms, or in worst case, cause a re-start of the slave.

Note: The following sections address the problems outlined above. Note that it is not possible to resolve all situations that can arise, but the risk for unwanted behaviour can at least be narrowed down to a minimum.

See also...

- 4-6 "Initialisation"
- 5-2 "Fieldbus Specific Initialisation (FB_INIT)"

Read- and Write requests

Acyclic Read/Write requests must be issued to both the Active- and the Passive Master. When processed, both masters will respond, given that both masters are healthy.

See also...

- 5-42 "Class 1 Read (FB_APPL_MSAC1_READ)"
- 5-44 "Class 1 Write (FB_APPL_MSAC1_WRITE)"

Alarm

When an Alarm indication is triggered, both the Active- and the Passive Master (given that both masters are healthy) issues FB_ABM_MSAL1_ALARM_IND. When the alarm has been processed by the higher-level system, a mailbox response shall be sent to both masters.

As a reaction to the previous action, the slave issues an Alarm Confirmation, which in turn causes both masters to issue FB_ABM_MSAL1_ALARM_CON.

See also...

- 5-67 "Alarm Indication (FB_ABM_MSAL1_ALARM_IND)"
- 5-69 "Alarm Confirmation (FB_ABM_MSAL1_ALARM_CON)"

Switchover Procedure

The application of the Passive Master is solely responsible for initiating a switchover. The Anybus never takes this decision; it only provides mechanisms for carrying out the switchover.

Timing when initiating a switchover is *crucial*. If not handled correctly, a dangerous situation with two Active- or two Passive Masters coexisting on the bus could arise.

1. First the application of the Active Master must force the Active Master to leave the network by performing a hardware reset of the Anybus.
2. When the Active Master has left the network, the application of the Passive Master shall instruct the master to become Active by issuing FB_APPL_SET_HSBY_STATE with 'HSBY state' set to 'Active'.
3. After a switchover, the application of the now Active (former passive) master must wait for the 'L_OD'-bit to become set before accessing the Output Data Area.
4. After a switchover the application of the previously Active Master may re-initialise the Anybus as a Passive Master. First, make sure that the counterpart operates an Active Master.

See also...

- 2-1 “‘Input’ and ‘Output’ Definitions”
- 4-6 “Runtime”
- 4-7 “DP-V1 Handling”
- 6-4 “HSBY Status Information (EA0h... EA7h)”

Fieldbus Specific Mailbox Commands

Application-initiated Messages

Command	Message	Allowed in 'Class 2-Only' Mode	Page
01h	FB_INIT	Yes	5-2
02h	FB_APPL_SET_OPERATION_MODE	No	5-5
03h	FB_APPL_SET_SLAVE_MODE	No	5-9
04h	FB_APPL_GET_SLAVE_DIAG	Partially	5-12
05h	FB_APPL_GET_SLAVE_CONFIG	Yes	5-14
06h	FB_APPL_SET_SLAVE_ADDRESS	Yes	5-16
08h	FB_APPL_GET_MASTER_DIAG	Yes	5-18
09h	FB_APPL_READ_SLAVE_INPUT	Yes	5-20
0Ah	FB_APPL_READ_SLAVE_OUTPUT	Yes	5-22
0Bh	FB_APPL_START_SLAVE	No	5-24
0Ch	FB_APPL_STOP_SLAVE	No	5-26
18h	FB_APPL_GET_LIVE_LIST	Yes	5-28
10h	FB_APPL_START_DATABASE_DOWNLOAD	Yes	5-29
11h	FB_APPL_END_DATABASE_DOWNLOAD	Yes	5-30
12h	FB_APPL_MASTER_RECORD_DOWNLOAD	Yes	5-31
13h	FB_APPL_MASTER_RECORD_UPLOAD	Yes	5-33
14h	FB_APPL_SLAVE_RECORD_DOWNLOAD	Yes	5-34
15h	FB_APPL_SLAVE_RECORD_UPLOAD	Yes	5-36
16h	FB_APPL_DELETE_DATABASE	Yes	5-38
17h	FB_APPL_GET_DATABASE_INFO	Yes	5-39
20h	FB_APPL_MSAC1_READ	No	5-42
21h	FB_APPL_MSAC1_WRITE	No	5-44
24h	FB_APPL_MSAC1_PROFIDRIVE_V3_PARAM_WRITE	No	5-46
25h	FB_APPL_MSAC2_INITIATE (Normal)	Yes	5-49
	FB_APPL_MSAC2_INITIATE (Expert)		
26h	FB_APPL_MSAC2_ABORT	Yes	5-54
27h	FB_APPL_MSAC2_READ	Yes	5-58
28h	FB_APPL_MSAC2_WRITE	Yes	5-60
29h	FB_APPL_MSAC2_DATA_TRANSPORT	Yes	5-62
2Bh	FB_APPL_MSAC2_CNXN_STATUS	Yes	5-64
41h	FB_APPL_SET_HSBY_STATE	No	5-71

Anybus-initiated Messages

The following messages may be issued spontaneously by the module:

Command	Message	Page
1Ah	FB_ABM_SHIFT_OPERATION_MODE_REQ	5-7
19h	FB_ABM_DOWNLOAD_NEW_DB_REQ	5-41
22h	FB_ABM_MSAL1_ALARM_IND	5-67
23h	FB_ABM_MSAL1_ALARM_CON	5-69
2Ah	FB_APPL_MSAC2_ABORT_IND	5-56

General

Fieldbus Specific Initialisation (FB_INIT)

This message contains additional information that is not present in ANYBUS_INIT. If this message is not sent, the parameters in this message will be set to their default setting.

Note: This command can only be sent during module initialisation, before ANYBUS_INIT.

Command Initiator	Application
Command Name	FB_INIT
Command No.	0001h
Firmware Revision	All

Command and response layout:

	Command	Expected response
Message ID	(ID)	(ID)
Message information	4002h	0002h
Command	0001h	0001h
Data size	0006h	0006h
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 word 1	DPRAM mode	DPRAM mode
Message data word 2	Special Functions	Special Functions
Message data word 3	Start-up Operating Mode	Start-up Operating Mode

Fieldbus specific init.
3 words of data (6 bytes)

- DPRAM Mode**
 - 0000h: Standard Mode (2kbyte DPRAM)
 - 0001h: Extended Mode (4kbyte DPRAM)¹

1. This requires the use of pin 34 as an extra address pin. See Appendix B-1 “Application Connector”

- Special Functions

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
							I	H	G	F	E	D	C	B	A
(MSB)							(LSB)								

Bit 0 (A) Handling of spontaneous mailbox 'FB_ABM_MSAL1_ALARM_CON'
(See 5-69 "Alarm Confirmation (FB_ABM_MSAL1_ALARM_CON)")

- 0: Send mailbox (default)
1: Do not send mailbox

Bit 1 (B) Handling of spontaneous mailbox 'FB_ABM_MSAL1_ALARM_IND'
(See 5-67 "Alarm Indication (FB_ABM_MSAL1_ALARM_IND)")

- 0: Send mailbox (default)
1: Do not send mailbox

Bit 2 (C) Ask application for permission before downloading a new database file
(See 5-41 "Download New Database Request (FB_ABM_DOWNLOAD_NEW_DB_REQ)")

- 0: Do not ask for permission (default)
1: Ask for permission

Bit 3 (D) Ask application for permission before shifting the operating mode
(See 5-5 "Set Operating Mode (FB_APPL_SET_OPERATION_MODE)" and 5-7 "Shift Operating Mode Request (FB_ABM_SHIFT_OPERATION_MODE_REQ)")

- 0: Do not ask for permission (default)
1: Ask for permission

Bit 4 (E) Handling of spontaneous mailbox 'FB_APPL_MSAC2_ABORT_IND'
(See 5-56 "Class 2 Connection Abort Indication (FB_APPL_MSAC2_ABORT_IND)")

- 0: Do not send mailbox (default)
1: Send mailbox

Bit 5 (F) Master Functionality (See 2-4 "Modes of Operation")

- 0: Module operates as a combined Class 1 and Class 2 Master.
1: Module acts as a Class 2 Master only; no cyclic data exchange possible.

Bit 6 (G) Initial HSBY State¹

This bit specifies the startup state in a redundant (HSBY) system.

- 0:** Active (default)
- 1:** Passive

See also...

- 4-1 “Redundant Operation (HSBY)”

Bit 7 (H) DP-V0 HSBY Enable/Disable

This bit enables redundant (HSBY) operation.

- 0:** Disable (default)
- 1:** Enable

See also...

- 4-1 “Redundant Operation (HSBY)”

Bit 8 (I) DP-V1 HSBY Enable/Disable¹

- 0:** Disable (default)
- 1:** Enable

See also...

- 4-1 “Redundant Operation (HSBY)”
- 4-7 “DP-V1 Handling”

- **Start-up Operating Mode**

Note: This parameter is not relevant when operating in ‘Class 2-Only’ mode (see previous page)

- 0040h:** Master automatically enters ‘STOP’ mode after initialisation
- 0080h:** Master automatically enters ‘CLEAR’ mode after initialisation
- 00C0h:** Master automatically enters ‘OPERATION’ mode after initialisation (default)

- **Fault Information**

- 0001h:** Invalid ‘DPRAM Mode’ setting
- 0002h:** Invalid ‘Special Functions’ setting
- 0003h:** Invalid ‘Start-up Operation Mode’ setting
- 0004h:** Command not allowed after ANYBUS_INIT
- 0005h:** Command not allowed after END_INIT
- 0006h:** Command not allowed before START_INIT

1. This setting has no effect when redundant operation (HSBY) is disabled (i.e. when bit 7 = 0 (zero))

Set Operating Mode (FB_APPL_SET_OPERATION_MODE)

This command allows setting the operating mode of the module, i.e. STOP, CLEAR or OPERATE.

Command Initiator	Application
Command Name	FB_APPL_SET_OPERATION_MODE
Command No.	0002h
Firmware Revision	All

Command and response layout:

	Command		Response	
Message ID	(ID)		(ID)	
Message information	4002h		0002h	
Command	0002h		0002h	
Data size	0000h		0000h	
Frame count	0001h		0001h	
Frame number	0001h		0001h	
Offset high	0000h		0000h	
Offset low	0000h		0000h	
Extended word 1	Req. mode	Conf. Req.	Act. mode	Conf. Req.
Extended word 2	-		-	
Extended word 3	-		-	
Extended word 4	-		-	
Extended word 5	-		-	
Extended word 6	-		-	
Extended word 7	-		Appl. Specific Error Code	
Extended word 8	-		Fault Information	

Set Operation Mode

- Req./Act. Mode**

40h: STOP
80h: CLEAR
C0h: OPERATE

The 'requested' mode is the mode that the module is requested to switch to, the 'actual' mode is the mode the module is after the message has been processed.

(Note: If mode 'OFFLINE' is desired, a 'SOFTWARE_RESET' mailbox should be issued. Consult the general Anybus-S Parallel Design Guide for more information)

- Conf. Req.**

00h: Confirmation is not required
01h: Confirmation required. The mailbox message 'FB_ABM_SHIFT_OPERATION_MODE_REQ' will be send by the module to confirm the request. (See 5-7 "Shift Operating Mode Request (FB_ABM_SHIFT_OPERATION_MODE_REQ)")

Note 1: This must also be enabled in the 'FB_INIT' mailbox command during module initialisation in order to have any effect.

Note 2: This setting has no effect when operating as a passive HSBY master.

- Appl. Specific Error Code**

This register may contain an application specific error or status code from the 'FB_ABM_SHIFT_OPERATION_MODE_REQ' message response.

- **Fault Information**

If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.

- 0001h:** Invalid operating mode
- 0002h:** Invalid 'Conf. Req.' setting
- 0003h:** Timeout or incorrect answering of the 'FB_ABM_SHIFT_OPERATION_MODE_REQ' message
- 0004h:** Application did not permit changing the operation mode. More information might be supplied in the 'Application Specific Error Code'.
- 0005h:** Change of operation mode is not allowed as application watchdog has expired.
- 00FEh:** Command not possible in 'Class 2-Only' mode.
- 00FFh:** Module offline (not initialised or no valid database).

Note about the 'Confirmation Request' and 'Application Specific Error Code'

The 'Confirmation Request' and 'Application Specific Error Code' registers are usually not applicable when an application system sends this command to the module via the DPRAM, they are mainly intended to be used by a configuration tool operating via the serial configuration port on the module such as the HMS NetTool-PB.

In most cases the 'Confirmation request' register should be set to 00h when this message is sent via the DPRAM since the application system will not need to acknowledge its own request to changing the operating mode. In case this message is sent to the module via the serial configuration port the 'Application Specific Error Code' register in the messages 'FB_ABM_SHIFT_OPERATION_MODE_REQ' and 'FB_APPL_SET_OPERATION_MODE' provides a possibility for the application system to return extra status information to the external configuration tool.

Shift Operating Mode Request (FB_ABM_SHIFT_OPERATION_MODE_REQ)

This command indicates to the application that the module has received a ‘FB_APPL_SET_OPERATION_MODE’ request, either from the application or from an external configuration tool via the serial configuration port.

The response of this message provides an application with the possibility to either confirm or deny a request to change the operating mode as well as the possibility to return extra status information to the originator of the ‘FB_APPL_SET_OPERATION_MODE’ message.

Note that this message must be replied to within three seconds. If this is not accomplished the response to the ‘FB_APPL_SET_OPERATION_MODE’ message will indicate ‘Timeout error’.

For more information about how to enable this mailbox, see 5-2 “Fieldbus Specific Initialisation (FB_INIT)” and 5-5 “Set Operating Mode (FB_APPL_SET_OPERATION_MODE)”

Note: This message is not sent if the requested operation mode equals the current operation mode.

Command Initiator	Anybus. Application is required to respond.
Command Name	FB_ABM_SHIFT_OPERATION_MODE_REQ
Command No.	001Ah
Firmware Revision	All

	Command		Response	
Message ID	(ID)		(ID)	
Message information	4002h		0002h	
Command	001Ah		001Ah	
Data size	0000h		0000h	
Frame count	0001h		0001h	
Frame number	0001h		0001h	
Offset high	0000h		0000h	
Offset low	0000h		0000h	
Extended word 1	Mode	-	Mode	-
Extended word 2	-		-	
Extended word 3	-		-	
Extended word 4	-		-	
Extended word 5	-		-	
Extended word 6	-		-	
Extended word 7	-		Application Specific Error	
Extended word 8	-		Return Code	

Shift Operation Mode Req.

- Mode**
40h: STOP
80h: CLEAR
C0h: OPERATE
- Application Specific Error Code**

If supported by the initiator of the ‘FB_APPL_SET_OPERATION_MODE’ message, this register provides a possibility for the application system to return extended- or application specific information back to the initiator. The contents of this register is relayed back without any modifications and it is the task of the receiver of this register to translate it into useful information.

- **Return Code**

'Return Code' contents		'Application Specific Error' contents
0000h	Grant request	-
0001h	Deny request	Application specific error. (Optional)

Set Slave Mode (FB_APPL_SET_SLAVE_MODE)

In addition to station related user data transfer, which is executed automatically, the master can send control commands to a single slave, a group of slaves or all slaves simultaneously. These control commands are transmitted as multicast commands. This permits use of sync and freeze modes for event controlled synchronisation of the slaves.

The slaves begin sync mode when they receive a sync command from their assigned master. The outputs of all addressed slaves are then frozen in their current state. During subsequent user data transmissions, the output data are stored at the slaves, but the output states remain unchanged. The stored output data are not sent to the outputs until the next sync command is received. Sync mode is concluded with the unsync command.

Similarly, a freeze control command causes the addressed slaves to assume freeze mode. In this operating mode, the states of the inputs are frozen until the master sends the next freeze command. Freeze mode is concluded with the unfreeze command.

Note 1: Sending control commands is only possible in operating modes 'CLEAR' and 'OPERATE'

Note 2: This command cannot be issued when running as a passive HSBY master.

Note 3: Not all slaves supports this feature. Consult the documentation for the specific slave for further information.

Command Initiator	Application
Command Name	FB_APPL_SET_SLAVE_MODE
Command No.	0003h
Firmware Revision	All

Command and response layout:

Command			Response		Set Slave Mode
Message ID	(ID)		(ID)		
Message information	4002h		0002h		
Command	0003h		0003h		
Data size	0000h		0000h		
Frame count	0001h		0001h		
Frame number	0001h		0001h		
Offset high	0000h		0000h		
Offset low	0000h		0000h		
Extended word 1	Slave Address	Group Select	Slave Address	Group Select	
Extended word 2	Control Command	-	Control Command	-	
Extended word 3	-		-		
Extended word 4	-		-		
Extended word 5	-		-		
Extended word 6	-		-		
Extended word 7	-		Extended Fault Information		
Extended word 8	-		Fault Information		

- **Slave Address**

Range 0-125; 127

If the request applies for only one slave, that Slave Address must be entered in the range 0-125.

If a slave group is to be addressed, Slave Address should be 127 (Multicast address)

- **Group Select**

Range 01h - FFh (Bit coded)

This parameter decides which group that should be addressed., see below.

b7	b6	b5	b4	b3	b2	b1	b0
Group 8	Group 7	Group 6	Group 5	Group 4	Group 3	Group 2	Group 1

Example: To address Group 1, 2 and 4, the Group Select value should be 0Dh

If an individual slave should be addressed the correct group selection must also be made, since the slave will ignore the message if it does not belong to the requested group(s).

What group(s) a slave belongs to is determined during network configuration, and is downloaded during initialisation to each slave via the PROFIBUS telegram Set_Prm.

- **Control Command**

This parameter specifies the command to send.

Bit	Explanation
0 (LSB)	(reserved, set to zero)
1	(reserved, set to zero)
2	Unfreeze input data
3	Freeze input data
4	Unsynchronize output data
5	Synchronize output data
6	(reserved, set to zero)
7 (MSB)	(reserved, set to zero)

Combinations of the bits Unsync/Sync and Unfreeze/Freeze:

Bits 2 or 4	Bits 3 or 5	Explanation
0	0	No function
0	1	Function will be activated
1	0	Function will be inactive
1	1	Function will be inactive

- **Fault Information & Extended Fault Information**

If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.

'Fault Information' contents		'Extended Fault Information' contents	
0001h	Address out of range	-	
0002h	Group number 0 not permitted	-	
000Ah	Failed to send Global Control request	000Ah	Incorrect operation mode (Clear / Operate only)
		5001h	Invalid Freeze group (Group is not initiated to be Freeze group)
		5002h	Invalid Sync group (Group is not initiated to be a Sync group)
		5003h	Incorrect Control Command
		5004h	No Sync-/ or Freeze groups enabled in master configuration.
00FDh	Command not possible when running as passive HSBY master	-	
00FEh	Command not possible in 'Class 2-Only' mode	-	
00FFh	Module offline (not initialised or no valid database)	-	

Get Slave Diagnostics (FB_APPL_GET_SLAVE_DIAG)

This command reads diagnostic data from a specified slave.

Note 1: The response data size depends on the actual slave implementation. Range 6 - 244.

Note 2: This command cannot be issued when running as a passive HSBY master.

Command Initiator	Application
Command Name	FB_APPL_GET_SLAVE_DIAG
Command No.	0004h
Firmware Revision	All

Command and response layout:

Command			Response		Get Slave Diagnostics
Message ID	(ID)		(ID)		
Message information	4002h		0002h		
Command	0004h		0004h		
Data size	0000h		(Size of data)		
Frame count	0001h		0001h		
Frame number	0001h		0001h		
Offset high	0000h		0000h		
Offset low	0000h		0000h		
Extended word 1	Slave Address	Type of request	Slave Address	Type of request	
Extended word 2	-		-		
Extended word 3	-		-		
Extended word 4	-		-		
Extended word 5	-		Error code 1	Error code 2	
Extended word 6	-		Error code 3	Error code 4	
Extended word 7	-		Return Code		
Extended word 8	-		Fault Information		
			Station Status 1	Station Status 2	Response data word 1
			Station Status 3	Master Address	Response data word 2
			Ident Number		Response data word 3
			Extended Diagnostic Data		Response data word 4
					...
					...
					Response data word n

- **Slave Address**
Range 0-125, specifies the slave to read diagnostics from.
- **Type of request**
 - 00h:** Internal slave diagnostic request. The diagnostic information stored in the master is returned. Can only be requested for slaves configured by the master.
Note: Not allowed when operating in 'Class 2-Only' mode.
 - 01h:** External slave diagnostic request. A diagnostic request is sent on the network to the specified slave. Can be requested for all slaves on the network.
- **Error code [1 ...4]**
If 'Return Code' equals 8030h ('Negative indication from lower layer'), status values according to the DP-specification may be available in 'Error Code 1'. Error Codes 1, 3 and 4 are reserved. (See "Return Codes" and "Error Codes" in Appendix A-1 "DP Error Codes".)
- **Return Code**
See "Return Codes" in Appendix A-1 "DP Error Codes" and A-2 "DP-V1 Error Codes".
- **Fault Information**
If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.
 - 0001h:** Address out of range.
 - 0002h:** Incorrect 'Type of request'
 - 000Ah:** Failed to read diagnostic data from slave. (See above section about 'Return Code' for additional fault information.)
 - 000Bh:** Remote station failure. (See above section about 'Return Code' for additional fault information.)
 - 00FDh:** Command not possible when running as passive HSBY master
 - 00FEh:** Command not possible; module operates as a Class 2 master only.
 - 00FFh:** Module offline (not initialised or no valid database).
- **Station Status [1 ... 3]**
Consult EN50170 Vol. 2 for further information.
- **Master Address**
Address of the master that parameterized the slave
- **Ident Number**
Unique ID assigned by the PROFIBUS User Organization
- **Extended Diagnostic Data**
Slave user specific diagnostic data. Consult the documentation for the targeted slave for further information.

Get Slave Configuration (FB_APPL_GET_SLAVE_CONFIG)

This command reads the actual configuration (identifier bytes) of a specified slave.

Note: The response data size depends on the actual slave implementation. Range 6 - 244.

Command Initiator	Application
Command Name	FB_APPL_GET_SLAVE_CONFIG
Command No.	0005h
Firmware Revision	All

Command and response layout:

Command		Response	
Message ID	(ID)	(ID)	
Message information	4002h	0002h	
Command	0005h	0005h	Get Slave Configuration
Data size	0000h	(Size of data)	Number of identifier bytes (n)
Frame count	0001h	0001h	
Frame number	0001h	0001h	
Offset high	0000h	0000h	
Offset low	0000h	0000h	
Extended word 1	Slave Address	Slave Address	
Extended word 2	-	-	
Extended word 3	-	-	
Extended word 4	-	-	
Extended word 5	-	Error Code 1	Error Code 2
Extended word 6	-	Error Code 3	Error Code 4
Extended word 7	-	Return Code	
Extended word 8	-	Fault Information	
		Identifier byte 1	Response data byte 1
		Identifier byte 2	Response data byte 2
		Identifier byte 3	Response data byte 3
		...	
		Identifier byte n	Response data byte n

- **Slave Address**

Range 0-125, specifies the slave to read configuration from.

- **Error Code [1 ... 4]**

If 'Return Code' equals 8030h ('Negative indication from lower layer'), status values according to the DP-specification may be available in 'Error Code 2'. Error Codes 1, 3 and 4 are reserved. (See "Return Codes" and "Error Codes" in Appendix A-1 "DP Error Codes".)

- **Return Code**

See "Return Codes" in Appendix A-1 "DP Error Codes".

- **Fault Information**

If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.

0001h: Address out of range.

000Ah: Failed to execute request. (See 'Return Code' for additional fault information)

000Bh: Remote station failure. (See 'Return Code' for additional fault information)

00FFh: Module offline (not initialised or no valid database).

- **Identifier Bytes [1 ... n]**

Consult EN50170 Vol 2 for information about the structure of these bytes. Also, consult the documentation for the actual slave for further information.

Set Slave Address (FB_APPL_SET_SLAVE_ADDRESS)

This command makes it possible to set the node address of a specified slave, provided that the slave supports this feature.

Note: The message data size depends on the actual slave implementation, range 0 - 240 bytes.

Command Initiator	Application
Command Name	FB_APPL_SET_SLAVE_ADDRESS
Command No.	0006h
Firmware Revision	All

Command and response layout:

Command			Response	
Message ID	(ID)		(ID)	
Message information	4002h		0002h	
Command	0006h		0006h	
Data size	(Size of data)		(Size of data)	
Frame count	0001h		0001h	
Frame number	0001h		0001h	
Offset high	0000h		0000h	
Offset low	0000h		0000h	
Extended word 1	Current Slave Addr.	New Slave Address	Current Slave Addr.	New Slave Address
Extended word 2	Slave Ident Number		Slave Ident Number	
Extended word 3	No_add_Chg	-	No_add_Chg	-
Extended word 4	-		-	
Extended word 5	-		Error Code 1	Error Code 2
Extended word 6	-		Error Code 3	Error Code 4
Extended word 7	-		Return Code	
Extended word 8	-		Fault Information	
Message Data byte 1	Slave Data 1		Slave Data 1	
Message Data byte 2	Slave Data 2		Slave Data 2	
Message Data byte 3	Slave Data 3		Slave Data 3	
...	
Message Data byte 'n'	Slave Data n		Slave Data n	

Set Slave Address

No. of Slave Data bytes (n)

- **Current Slave Address**
Range 0-126, specifies the current address of the slave
- **New Slave Address**
Range 0-125, specifies the new address of the slave
- **Slave Ident Number**
Ident number for the slave, which address should be altered
- **No_add_Chg**
This parameter specifies whether it is allowed to change the slave address again at a later stage. If this is not allowed, then it is only possible to change the address with this function after initial reset. After the initial reset the slave takes the default address 126.
 - 00h:** Change of address is still possible at a later stage
 - 01h-FFh:** Change of address is only possible after the initial address (i.e. the default address = 126)
- **Error Code [1 ... 4]**
If 'Return Code' equals 8030h ('Negative indication from lower layer'), status values according to the DP-specification is available in 'Error Code 2'. Error Codes 1, 3 and 4 are reserved.
(See "Return Codes" and "Error Codes" in Appendix A-1 "DP Error Codes".)
- **Return Code**
See "Return Codes" in Appendix A-1 "DP Error Codes".
- **Fault Information**
If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.
 - 0001h:** Current slave address out of range.
 - 0002h:** New slave address out of range.
 - 000Ah:** Failed to execute request. (See 'Return Code' for additional fault information)
 - 000Bh:** Remote station failure. (See 'Return Code' for additional fault information)
 - 00FFh:** Module offline (not initialised or no valid database).
- **Slave Data**
With this parameter it is possible to deliver user specific data. The data is stored in the slave if possible (i.e. EEPROM, FLASH etc.)

Get Master Diag (FB_APPL_GET_MASTER_DIAG)

This command makes it possible to get information from a remote master on the network.

Note 1: The size of the response data depends on the request (range 1...244).

Note 2: This command cannot be issued when running as a passive HSBY master.

Command Initiator	Application
Command Name	FB_APPL_GET_MASTER_DIAG
Command No.	0008h
Firmware Revision	All

Command and response layout:

Command			Response		
Message ID	(ID)		(ID)		
Message information	4002h		0002h		
Command	0008h		0008h		Get Master Diag
Data size	0000h		(Size of data)		Size depends on request
Frame count	0001h		0001h		
Frame number	0001h		0001h		
Offset high	0000h		0000h		
Offset low	0000h		0000h		
Extended word 1	Remote Address	Identifier	Remote Address	Identifier	
Extended word 2	-		-		
Extended word 3	-		-		
Extended word 4	-		-		
Extended word 5	-		Error Code 1	Error Code 2	
Extended word 6	-		Error Code 3	Error Code 4	
Extended word 7	-		Return Code		
Extended word 8	-		Fault Information		
			(reserved)		Response data word 1
			Diagnostic data 1		Response data word 2
			Diagnostic data 2		Response data word 3
		
			Diagnostic data n		Response data word n

- **Remote Address**

Range 0-125, specifies the address of the master from which the diagnostic information shall be requested.

- **Identifier**

This parameter specifies the type information to request:

Value	Diagnostic Information
0...125	Diagnostic data of the DP-Slave with node address 0-125
126	System Diagnostics
127	Master Status
128	Data Transfer List
129...255	Reserved

- **Error Code [1 ... 4]**

If 'Return Code' equals 8030h ('Negative indication from lower layer'), status values according to the DP-specification is available in 'Error Code 2'. Error Codes 1, 3 and 4 are reserved.

(See "Return Codes" and "Error Codes" in Appendix A-1 "DP Error Codes".)

- **Return Code**

See "Return Codes" in Appendix A-1 "DP Error Codes".

- **Fault Information**

If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.

0001h: Current slave address out of range.

000Ah: Failed to execute request (See 'Return Code' for additional fault information).

000Bh: Remote station failure (See 'Return Code' for additional fault information).

00FDh: Command not possible when running as passive HSBY master

00FFh: Module offline (not initialised or no valid database).

- **Diagnostic Data**

(Consult EN50170 Volume 2 for further information).

Read Slave Input (FB_APPL_READ_SLAVE_INPUT)

This command allows a (class 2) master to read the input data of a specified slave.

Command Initiator	Application
Command Name	FB_APPL_READ_SLAVE_INPUT
Command No.	0009h
Firmware Revision	>=3.40

Command and response layout:

Command			Response		
Message ID	(ID)		(ID)		
Message information	4002h		0002h		
Command	0009h		0009h		<i>Read Slave Input</i>
Data size	0000h		(Size of data)		<i>Size depends on request</i>
Frame count	0001h		0001h		
Frame number	0001h		0001h		
Offset high	0000h		0000h		
Offset low	0000h		0000h		
Extended word 1	Slave Address	-	Slave Address	-	
Extended word 2	-		-		
Extended word 3	-		-		
Extended word 4	-		-		
Extended word 5	-		Error Code 1	Error Code 2	
Extended word 6	-		Error Code 3	Error Code 4	
Extended word 7	-		Return Code		
Extended word 8	-		Fault Information		
			Input Data Byte 1		Response data byte 1
			Input Data Byte 2		Response data byte 2
		
			Input Data Byte N		Response data byte N

- **Input Data Bytes [1... N]**
Actual slave input data. Size depends on the actual slave implementation (range: 1... 244 bytes).
- **Slave Address**
Range 0-125, specifies the address of the slave from which the data shall be requested.
- **Identifier**
(Consult EN50170 Volume 2 for further information).
- **Error Code [1 ... 4]**
If 'Return Code' equals 8030h ('Negative indication from lower layer'), status values according to the DP-specification is available in 'Error Code 2'. Error Codes 1, 3 and 4 are reserved.
(See "Return Codes" and "Error Codes" in Appendix A-1 "DP Error Codes".)
- **Return Code**
See "Return Codes" in Appendix A-1 "DP Error Codes".
- **Fault Information**
If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.
 - 0001h:** Slave address out of range
 - 000Ah:** Failed to execute request (See 'Return Code' for additional fault information)
 - 000Bh:** Remote station failure (See 'Return Code' for additional fault information)
 - 00FFh:** Module not initialised (only available after END_INIT)

Read Slave Output (FB_APPL_READ_SLAVE_OUTPUT)

This command allows a (class 2) master to read the output data of a specified slave.

Command Initiator	Application
Command Name	FB_APPL_READ_SLAVE_OUTPUT
Command No.	000Ah
Firmware Revision	>=3.40

Command and response layout:

Command		Response	
Message ID	(ID)	(ID)	
Message information	4002h	0002h	
Command	000Ah	000Ah	<i>Read Slave Output</i>
Data size	0000h	(Size of data)	<i>Size depends on request</i>
Frame count	0001h	0001h	
Frame number	0001h	0001h	
Offset high	0000h	0000h	
Offset low	0000h	0000h	
Extended word 1	Slave Address	Slave Address	
Extended word 2	-	-	
Extended word 3	-	-	
Extended word 4	-	-	
Extended word 5	-	Error Code 1	Error Code 2
Extended word 6	-	Error Code 3	Error Code 4
Extended word 7	-	Return Code	
Extended word 8	-	Fault Information	
		Output Data Byte 1	Response data byte 1
		Output Data Byte 2	Response data byte 2
	
		Output Data Byte N	Response data byte N

- **Output Data Bytes [1... N]**
Actual slave output data. Size depends on the actual slave implementation (range: 1... 244 bytes).
- **Slave Address**
Range 0-125, specifies the address of the slave from which the data shall be requested.
- **Identifier**
(Consult EN50170 Volume 2 for further information).
- **Error Code [1 ... 4]**
If 'Return Code' equals 8030h ('Negative indication from lower layer'), status values according to the DP-specification is available in 'Error Code 1'. Error Codes 1, 2 and 3 are reserved.
(See "Return Codes" and "Error Codes" in Appendix A-1 "DP Error Codes".)
- **Return Code**
See "Return Codes" in Appendix A-1 "DP Error Codes".
- **Fault Information**
If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.
 - 0001h:** Slave address out of range
 - 000Ah:** Failed to execute request (See 'Return Code' for additional fault information)
 - 000Bh:** Remote station failure (See 'Return Code' for additional fault information)
 - 00FFh:** Module not initialised (only available after END_INIT)

Start Slave (FB_APPL_START_SLAVE)

This command starts a selection of slaves that has previously been removed from the processing cycle using FB_APPL_STOP_SLAVE.

When a slave is started it is added to the processing cycle via a normal start-up sequence (SetPrm -> ChkCfg-> DataExchange).

This message is allowed in all Operation modes (i.e. STOP, CLEAR and OPERATE).

Note: The message will be accepted even if one or several slaves are not part of the configuration and can therefore obviously not be started. The application can however find out about this situation by evaluating the 'Fault information' and 'Message data words' of the response

Command Initiator	Application
Command Name	FB_APPL_START_SLAVE
Command No.	000Bh
Firmware Revision	>=3.40

Command and response layout:

	Command	Response	
Message ID	(ID)	(ID)	
Message information	4002h	0002h	
Command	000Bh	000Bh	FB_APPL_START_SLAVE
Data size	007Eh	007Eh	
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	-	Return Code	
Extended word 8	-	Fault Information	
Message Data byte 1	S_Slave 0	R_Slave 0	
Message Data byte 2	S_Slave 1	R_Slave 1	
Message Data byte 3	S_Slave 2	R_Slave 2	
Message Data byte 4	S_Slave 3	R_Slave 3	
...	
Message Data byte 125	S_Slave 124	R_Slave 124	
Message Data byte 126	S_Slave 125	R_Slave 125	

- **S_Slave [0... N]**

Byte-array stating which slaves/slaves that shall be started. Array index equals the slave address.

00h: Leave slave unaffected

01h: Start slave

Other: (reserved)

- **R_Slave [0... N]**

Byte-array stating the actual status of the slaves. Array index equals the slave address.

00h: Slave unaffected

01h: Slave started

02h: Warning - slave couldn't be started since it is not part of the configuration

- **Return Code**

See "Return Codes" in Appendix A-1 "DP Error Codes".

- **Fault Information**

If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.

0001h: Invalid setting in S_Slave[0... N]

0002h: At least one slave reports a warning (see R_Slave[0... N])

000Ah: Failed to execute request (see Return Code for further information)

00FEh: Command not possible in 'Class 2-Only' mode

00FFh: Module not initialised (command only permitted after END_INIT)

Stop Slave (FB_APPL_STOP_SLAVE)

This command removes (stops) a selection of slaves from the processing cycle.

When a slave is stopped it is removed from the processing cycle by means of the PROFIBUS telegram SetPrm (with UnlockFlag set).

This message is allowed in all Operation modes (i.e. STOP, CLEAR and OPERATE).

Note 1: The message will be accepted even if one or several slaves are not part of the configuration and can therefore obviously not be stopped. The application can however find out about this situation by evaluating the 'Fault information' and 'Message data words' of the response.

Note 2: It is possible to have an open DP-V1 Class 2 connection to a slave even if it is stopped.

Note 3: In a redundant (HSBY) application care must be taken so that stopping a slave does not trigger an undesired switchover. The application should send start- and stop commands to both active- and passive master in order to synchronize the masters.

Command Initiator	Application
Command Name	FB_APPL_STOP_SLAVE
Command No.	000Ch
Firmware Revision	>=3.40

Command and response layout:

	Command	Response
Message ID	(ID)	(ID)
Message information	4002h	0002h
Command	000Ch	000Ch
Data size	007Eh	007Eh
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	-	Return Code
Extended word 8	-	Fault Information
Message Data byte 1	S_Slave 0	R_Slave 0
Message Data byte 2	S_Slave 1	R_Slave 1
Message Data byte 3	S_Slave 2	R_Slave 2
Message Data byte 4	S_Slave 3	R_Slave 3
...
Message Data byte 125	S_Slave 124	R_Slave 124
Message Data byte 126	S_Slave 125	R_Slave 125

FB_APPL_STOP_SLAVE

- **S_Slave [0... N]**

Byte-array stating which slaves/slaves that shall be stopped. Array index equals the slave address.

00h: Leave slave unaffected

01h: Stop slave

Other: (reserved)

- **R_Slave [0... N]**

Byte-array stating the actual status of the slaves. Array index equals the slave address.

00h: Slave unaffected

01h: Slave stopped

02h: Warning - slave couldn't be started since it is not part of the configuration

03h: Warning - slave already stopped

- **Return Code**

See "Return Codes" in Appendix A-1 "DP Error Codes".

- **Fault Information**

If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.

0001h: Invalid setting in S_Slave[0... N]

0002h: At least one slave reports a warning (see R_Slave[0... N])

000Ah: Failed to execute request (see Return Code for further information)

00FEh: Command not possible in 'Class 2-Only' mode

00FFh: Module not initialised (command only permitted after END_INIT)

Get Live List (FB_APPL_GET_LIVE_LIST)

This command returns 127 bytes of information about the nodes on the network. Every byte stands for one bus subscriber, and the position of the byte in the response data assigns the address (0-126), the contents assigns the Station Type (See below).

This command can be sent in all operation modes (i.e. STOP, CLEAR and OPERATE), however the module must be initialised properly with a valid database downloaded.

Command Initiator	Application
Command Name	FB_APPL_GET_LIVE_LIST
Command No.	0018h
Firmware Revision	All

Command and response layout:

	Command	Response	
Message ID	(ID)	(ID)	
Message information	4002h	0002h	
Command	0018h	0018h	Get Live List
Data size	0000h	007Fh	127 bytes of data
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	-	Return Code	
Extended word 8	-	Fault Information	
		Station Type 0	Response Data byte 1
		Station Type 1	Response Data byte 2
		Station Type 2	Response Data byte 3
		...	
		Station Type 126	Response Data byte 127

- Station Type [0 ... 126]**

- 00h:** Slave Station
- 01h:** Master Station not yet ready for Token ring (station only physically at the bus)
- 02h:** Master Station ready to enter Token ring (there is not yet any Token transmission)
- 03h:** Master Station in Token ring (Token transmission through the station)
- 04h:** Station does not exist

- Fault Information**

If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.

- 000Ah:** Failed to build Live List.
- 00FFh:** Module offline (not initialised or no valid database).

Database Management

(For more information about database management, see 3-1 “Database Management”).

Start Database Download (FB_APPL_START_DATABASE_DOWNLOAD)

This command indicates the start of database download.

Command Initiator	Application
Command Name	FB_APPL_START_DATABASE_DOWNLOAD
Command No.	0010h
Firmware Revision	All

Command and response layout:

	Command	Response
Message ID	(ID)	(ID)
Message information	4002h	0002h
Command	0010h	0010h
Data size	0000h	0000h
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	-	Application Specific Error Code
Extended word 8	-	Fault Information

Start Database Download

- **Application Specific Error Code**

This register is only applicable if this message is sent from an external tool via the serial configuration port and can in that case contain an application specific status code returned from the application using the module. Also see chapter 5-41 “Download New Database Request (FB_ABM_DOWNLOAD_NEW_DB_REQ)”.

- **Fault Information**

If ‘Invalid Other’ is returned in the Message Information word in the header of the response, information about the fault can be found here.

0001h: Command not allowed in this operating mode (only allowed in ‘STOP’ and ‘OFFLINE’ mode)

0002h: Application does not permit the download of a new database. Additional information may be available in ‘Application Specific Error Code’, see below.

0003h: Timeout or incorrect answer to ‘FB_ABM_DOWNLOAD_NEW_DB_REQ’ mailbox

End Database Download (FB_APPL_END_DATABASE_DOWNLOAD)

This command ends the database download. When the module recognize this command, it will do an error check of the downloaded database.

It is also possible to store a text string (Message Data word 1-32) that describes the database (example: filename, time/date, configuration tool type/version etc). This text string can then be read back with the 'FB_APPL_GET_DATABASE_INFO' message.

Command Initiator	Application
Command Name	FB_APPL_END_DATABASE_DOWNLOAD
Command No.	0011h
Firmware Revision	All

Command and response layout:

	Command	Response
Message ID	(ID)	(ID)
Message information	4002h	0002h
Command	0011h	0011h
Data size	(Size of data)	0000h
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	-	-
Message Data word 1 - 32	Database Description (ASCII, 64 characters)	Fault Information

End Database Download

- Database Description (Optional)**

Optional field. String of ASCII characters that describes the data base file. It is recommended to null-terminate the string after the last character.

- Fault Information**

If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.

0001h: Command not allowed in this operating mode (only allowed in 'STOP' and 'OFFLINE' mode).

0002h: 'FB_APPL_START_DATABASE_DOWNLOAD' not sent.

0003h: No master record downloaded.

Master Record Download (FB_APPL_MASTER_RECORD_DOWNLOAD)

This command allows handling over the master bus parameter set. For more information about the message data contents, see 3-3 “Master Record Data Structure”

Command Initiator	Application
Command Name	FB_APPL_MASTER_RECORD_DOWNLOAD
Command No.	0012h
Firmware Revision	All

Command and response layout:

	Command	Response	
Message ID	(ID)	(ID)	
Message information	4002h	0002h	
Command	0012h	0012h	Master Record Download
Data size	0060h	0000h	
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 Fault Information	
Extended word 8	-	Fault Information	
Message Data words 1 - 16	Bus Parameter Data		
Message Data word 17 - 48	Master User Data		

- **Bus Parameter Data**

See 3-3 “Bus Parameter Data Block”

- **Master User Data**

See 3-5 “Master User Data Block”

- **Fault Information**

If ‘Invalid Other’ is returned in the Message Information word in the header of the response, information about the fault can be found here.

- 0001h** Command not allowed in this operating mode (only allowed in ‘STOP’ and ‘OFFLINE’ mode)
- 0002h** ‘FB_APPL_START_DATABASE_DOWNLOAD’ has not been sent to the module
- 0003h** Cannot overwrite old configuration, delete database first.
- 0016h** Error in Bus Parameter Data (Message Dataword 1-16)
- 0017h** Error in Master User Data (Message Data word 17 - 48)

- **Extended Fault Information**

This word contains further information that points out the faulty parameter.

- 0007h:** Reserved parameter not set to zero!
- 0030h:** Invalid TS
- 0031h:** Invalid Data Rate
- 0032h:** Invalid T_{SL}
- 0033h:** Invalid $\min T_{SDR}$
- 0034h:** Invalid $\max T_{SDR}$
- 0035h:** Invalid T_{QUI}
- 0036h:** Invalid T_{SET}
- 0037h:** Invalid T_{TTR}
- 0038h:** Invalid GAP
- 0039h:** Invalid HSA
- 003Ah:** Invalid Max retry limit
- 003Bh:** Invalid BP_Flag
- 003Ch:** Invalid Min_Slave_Interval
- 003Dh:** Invalid Poll_Timeout
- 003Eh:** Invalid Data_Control_Time
- 003Fh:** Invalid Alarm_Max
- 0040h:** Invalid Max_UGC
- 0050h:** Invalid Master_User_Data_Length
- 0051h:** Invalid Tid1
- 0052h:** Invalid Tid2
- 0054h:** Invalid Delta_ T_{TR}
- 0056h:** Invalid Repeater
- 0057h:** Invalid Addressing Mode
- 0058h:** Invalid Storage Format
- 0059h:** Invalid T_{CT}
- 005Ah:** Invalid $\max T_{SH}$

Master Record Upload (FB_APPL_MASTER_RECORD_UPLOAD)

This command allows read back of the master bus parameter set. For more information about the response data contents, see 3-3 “Master Record Data Structure”

Command Initiator	Application
Command Name	FB_APPL_MASTER_RECORD_UPLOAD
Command No.	0013h
Firmware Revision	All

Command and response layout:

	Command	Response	
Message ID	(ID)	(ID)	
Message information	4002h	0002h	
Command	0013h	0013h	Master Record Upload
Data size	0000h	0060h	
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	
		Bus Parameter Data	Response Data words 1 - 16
		Master User Data	Response Data word 17 - 48

- Bus Parameter Data**

See 3-3 “Bus Parameter Data Block”

- Master User Data**

See 3-5 “Master User Data Block”

- Fault Information**

If ‘Invalid Other’ is returned in the Message Information word in the header of the response, information about the fault can be found here.

0001h: No database in flash (or download in progress)

Slave Record Download (FB_APPL_SLAVE_RECORD_DOWNLOAD)

This command allows handling over the slave parameter set. At least one mailbox must be downloaded per slave that is to be configured. If the slave record contains more than 256 bytes, it must be subdivided into several fragments.

Each fragment is sent in using the 'FB_APPL_SLAVE_RECORD_DOWNLOAD' command. The messages must be sent in successive order, e.g. if the record is divided in 2 fragments, the first message should have 'Fragment number' set to 1 and 'Number of Fragments' set to 2, and the second should have both parameters set to 2. If only one mailbox is needed to send the record, both 'Fragment number' and 'Number of Fragments' should be set to 1. A record can be divided in fragments smaller than 256 bytes.

Note: All 16/32-bit parameters must be properly aligned to even addresses. If a 16/32 bit parameter needs to be aligned, a "pad" byte must be inserted (set to zero) on the odd address. Pay special attention to Config_Data_Len and Add_Tab_Len since these parameters are located after byte arrays that might contain an odd number of bytes. Note that if pad bytes are inserted, Slave_Para_Len must not include these pad bytes.

For more information about the message data contents, see 3-6 "Slave Record Data Structure".

Command Initiator	Application
Command Name	FB_APPL_SLAVE_RECORD_DOWNLOAD
Command No.	0014h
Firmware Revision	All

Command and response layout:

Command			Response	
Message ID	(ID)		(ID)	
Message information	4002h		0002h	
Command	0014h		0014h	
Data size	(Dynamic, max. 0100h)		0000h	
Frame count	0001h		0001h	
Frame number	0001h		0001h	
Offset high	0000h		0000h	
Offset low	0000h		0000h	
Extended word 1	Node Address	Fragment Number	Node Address	Fragment Number
Extended word 2	Number of Fragments	-	Number of Fragments	-
Extended word 3	-		-	
Extended word 4	-		-	
Extended word 5	-		-	
Extended word 6	-		-	
Extended word 7	-		Extended Fault Information	
Extended word 8	-		Fault Information	
Message Data words 1..8	General Data Block			
Message Data words 9...n	Parameter Data Block			
Message Data words n+1...m	Configuration Data Block			
Message Data words m+1...x	Address Table Block			
Message Data words x+1...y	Slave User Data Block			
Message Data words y+1...z	Extended User Param. Data			

Slave Record Download

Fragment information

- "-

- **Node Address**
Address of the slave associated with the database entry
- **Fragment Number**
Range 1-255, specifies the current fragment number.
- **Number of Fragments**
Range 1-255, specifies the total number of fragments needed to send the whole slave record.
- **General Data Block**
See 3-6 “General Data Block”
- **Parameter Data**
See 3-7 “Parameter Data Block”
- **Configuration Data**
See 3-7 “Configuration Data Block”
- **Address Table Block**
See 3-8 “Address Table Block”
- **Slave User Data Block**
See 3-8 “Slave User Data Block”
- **Extended User Parameter Data**
See 3-8 “Extended User Parameter Data Block”
- **Fault Information**
If ‘Invalid Other’ is returned in the Message Information word in the header of the response, information about the fault can be found here.
 - 0001h:** Command is not allowed in this operation mode (only allowed in ‘STOP’ and ‘OFFLINE’ mode)
 - 0002h:** The ‘FB_APPL_START_DATABASE_DOWNLOAD’ mailbox has not been sent
 - 0003h:** Cannot overwrite old configuration, delete database first
 - 0004h:** Node address is out of range
 - 0005h:** Failed to allocate buffer to store temporary data
 - 0006h:** ‘Data size’ in header does not match the actual message data size
 - 0009h:** Unexpected node address (sending of a fragmented slave record is interrupted)
 - 000Ah:** Data for this slave already downloaded
 - 000Bh:** Invalid number of fragments
 - 000Ch:** Invalid fragment number
 - 0010h:** Error in Gen_Data
 - 0011h:** Error in Prm_Data
 - 0012h:** Error in Cfg_Data
 - 0013h:** Error in Add_Tab
 - 0014h:** Error in Slave_User_Data
 - 0015h:** Error in Ext_User_Prm_Data
- **Extended Fault Information**
This word contains further information that points out the exact faulty parameter.
 - 0007h:** Reserved parameter does not equal zero
 - 0020h:** Invalid Slave_Para_Len
 - 0021h:** Invalid Slave_Type
 - 0022h:** Invalid Sl_Flag
 - 0023h:** Invalid Max_Diag_Data_Len
 - 0025h:** Invalid Max_Channel_Data_Len
 - 0026h:** Invalid Diag_Upd_Delay
 - 0027h:** Invalid Alarm_Mode
 - 0028h:** Invalid Add_Sl_Flag
 - 0029h:** Invalid Special functions

Slave Record Upload (FB_APPL_SLAVE_RECORD_UPLOAD)

The current slave parameter set can be uploaded from the module using this command. If the data size of the slave that is being accessed is greater than 256 bytes, the module will transfer the message as multiple fragments. The total number of fragments required to transfer the record is indicated by 'Number of Fragments'. The application specifies what fragment to read in 'Fragment Number'. The first mailbox that is issued should have 'Fragment Number' set to 1, and the second should have 2 etc. until 'Fragment Number' equals 'Number of Fragments'. If for example the total data size of the slave record is 550 bytes, the first and second mailbox will contain 256 bytes and the last one 38 bytes.

Furthermore, pad bytes might be added after the Parameter Data and Configuration Data blocks. The reason for this is that word-sized parameters must be properly aligned to an even address.

For more information about the response data contents, see 3-6 "Slave Record Data Structure"

Command Initiator	Application
Command Name	FB_APPL_SLAVE_RECORD_UPLOAD
Command No.	0015h
Firmware Revision	All

Command and response layout:

Command			Response		
Message ID	(ID)		(ID)		
Message information	4002h		0002h		
Command	0015h		0015h		Slave Record Upload
Data size	0000h		(Dynamic, max. 0100h)		
Frame count	0001h		0001h		
Frame number	0001h		0001h		
Offset high	0000h		0000h		
Offset low	0000h		0000h		
Extended word 1	Node Address	Fragment Number	Node Address	Fragment Number	Fragment information
Extended word 2	-		Number of Fragments	-	
Extended word 3	-		-		-
Extended word 4	-		-		
Extended word 5	-		-		
Extended word 6	-		-		
Extended word 7	-		-		
Extended word 8	-		-		
			Fault Information		
			General Data Block		Response Data words 1..8
			Parameter Data Block		Response Data words 9...n
			Configuration Data Block		Response Data words n+1...m
			Address Table Block		Response Data words m+1...x
			Slave User Data Block		Response Data words x+1...y
			Extended User Parameter Data		Response Data words y+1...z

- **Node Address**
Address of the slave associated with the database entry. Range 0...125.
- **Fragment Number**
Range 1-255, specifies the current fragment number.
- **Number of Fragments**
Range 1-255, specifies the total number of fragments needed to send the whole slave record.
- **General Data Block**
See 3-6 “General Data Block”
- **Parameter Data**
See 3-7 “Parameter Data Block”
- **Configuration Data**
See 3-7 “Configuration Data Block”
- **Address Table Block**
See 3-8 “Address Table Block”
- **Slave User Data Block**
See 3-8 “Slave User Data Block”
- **Extended User Parameter Data**
See 3-8 “Extended User Parameter Data Block”
- **Fault Information**
If ‘Invalid Other’ is returned in the Message Information word in the header of the response, information about the fault can be found here.
 - 0001h:** No database in flash, or download in progress
 - 0002h:** There is no configuration for this slave
 - 0004h:** Node address is out of range
 - 0005h:** Out of memory
 - 000Ch:** Invalid Fragment Number

Delete Database (FB_APPL_DELETE_DATABASE)

This command allows deletion of the entire database stored in non-volatile memory. This command can only be sent after the 'FB_APPL_START_DATABASE_DOWNLOAD' message. Also see chapter 3-1 "Database Management" for more information.

Command Initiator	Application
Command Name	FB_APPL_DELETE_DATABASE
Command No.	0016h
Firmware Revision	All

Command and response layout:

	Command	Response
Message ID	(ID)	(ID)
Message information	4002h	0002h
Command	0016h	0016h
Data size	0000h	0000h
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

Delete Database

- Fault Information**

If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.

0001h: Command is not allowed in this operating mode (only allowed in 'STOP' and 'OFFLINE' mode)

0002h: The 'FB_APPL_START_DATABASE_DOWNLOAD' mailbox has not been sent to the module

Get Database Info (FB_APPL_GET_DATABASE_INFO)

This command fetches information about the stored database. (I.e. User specific data that was downloaded to the module in the Message Data 1-32 via mailbox

'FB_APPL_END_DATABASE_DOWNLOAD' or from the configuration tool.)

This message also returns information about the amount of allocated I/O-data in the input- and output areas. These sizes can be used by the application to set up the I/O-lengths for the ANYBUS_INIT message.

Command Initiator	Application
Command Name	FB_APPL_GET_DATABASE_INFO
Command No.	0017h
Firmware Revision	All

Command and response layout:

	Command	Response	
Message ID	(ID)	(ID)	
Message information	4002h	0002h	
Command	0017h	0017h	Get Database Info
Data size	0000h	0040h	
Frame count	0001h	0001h	
Frame number	0001h	0001h	
Offset high	0000h	0000h	
Offset low	0000h	0000h	
Extended word 1	-	Total Output Length	
Extended word 2	-	Total Input Length	
Extended word 3	-	Init Output size	
Extended word 4	-	Init Input size	
Extended word 5	-	No. of Slaves	-
Extended word 6	-	-	
Extended word 7	-	-	
Extended word 8	-	Fault Information	
		Database Description (ASCII, 64 characters)	Response Data word 1 - 32

- **Total Input Length, Total Output Length¹**
The sum of Input/Output lengths for all slaves in the database (in bytes).
- **Init Input size, Init Output size¹**
Required initialization Input/Output sizes for the current database. If the slaves are located in a contiguous block these sizes are the same as total Input/Output lengths.
- **Database Description**
String of ASCII characters that describes the data base file. This is the string that was written to the database by the 'FB_APPL_END_DATABASE_DOWNLOAD' command.
- **No. of Slaves**
Number of configured slaves in the database.
- **Fault Information**
If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.
0001h: No database in flash, or download in progress

1. Note that these input/output direction refers to the directions and naming used for the DPRAM areas, not to the input/output directions used in the bus database or the NetTool-PB. For more information, please check page 2-1 "Input' and 'Output' Definitions".

Download New Database Request (FB_ABM_DOWNLOAD_NEW_DB_REQ)

This message indicates to the application that the module has received a request to download a new database with the 'FB_APPL_START_DATABASE_DOWNLOAD' message.

The application must provide either a 'grant' or a 'deny' response to this message within three seconds, otherwise the 'FB_APPL_START_DATABASE_DOWNLOAD' message previously received by the module will be answered with a 'Timeout error'. When the application receives this message, it can perform specific actions (e.g. changing operating mode to STOP etc.) before the response is sent.

See 5-2 "Fieldbus Specific Initialisation (FB_INIT)" for more information about how to enable this mailbox message.

Command Initiator	Anybus. Application is required to respond.
Command Name	FB_ABM_DOWNLOAD_NEW_DB_REQ
Command No.	0019h
Firmware Revision	All

Command and response layout:

	Command	Application Response
Message ID	(ID)	(ID)
Message information	4002h	0002h
Command	0019h	0019h
Data size	0000h	0000h
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	-	Application Specific Error Code
Extended word 8	-	Response Information

Download New D.B. Request

- Application Specific Error Code**

If supported by the initiator of the 'FB_APPL_START_DATABASE_DOWNLOAD' message this register provides a possibility to return extended status information back to the initiator. The contents of this register is relayed back to the initiator without any modifications and it is the task of the receiver of this register to translate it into useful information.

- Response Information**

0000h: Application permits the module to download a new configuration

0001h: Application does not permit the module to download a new configuration. An Application Specific Error Code can be supplied in Extended Word 7.

Acyclic Communication, Class 1

Class 1 Read (FB_APPL_MSAC1_READ)

This command initiates a DP-V1 Class 1 acyclic read request. Consult EN50170 (DP-V1) for more information.

Command Initiator	Application
Command Name	FB_APPL_MSAC1_READ
Command No.	0020h
Firmware Revision	All

Command and response layout:

Command			Response	
Message ID	(ID)		(ID)	
Message information	4002h		0002h	
Command	0020h		0020h	
Data size	0000h		(Size of data)	
Frame count	0001h		0001h	
Frame number	0001h		0001h	
Offset high	0000h		0000h	
Offset low	0000h		0000h	
Extended word 1	Slave Addr.	Slot	Slave Addr.	Slot
Extended word 2	Index	Length	Index	Length
Extended word 3	-		-	
Extended word 4	-		-	
Extended word 5	-		-	Error Decode
Extended word 6	-		Error Code 1	Error Code 2
Extended word 7	-		Extended Fault information	
Extended word 8	-		Fault Information	
			Data 1	Response Data byte 1
			Data 2	Response Data byte 2
			Data 3	Response Data byte 3
		
			Data n	Response Data byte n

Class 1 Read
Number of data bytes (n)

- **Slave Address**

Station address of the slave responder

- **Slot & Index**

Used in the slave to address the desired data block.

- **Length**

This parameter specifies the number of bytes of the data block that has to be read. If the server data block length is less than requested, the length of the response will be the actual length of the data block. If the server data block is greater or equal, then the response will contain the same amount of data.

The slave may answer with an error response if the data access is not allowed.

- **Error Decode, Error Code 1 & Error Code 2**

If 'Fault Information' contains error code 0010h, more information according to the DP-V1 specification can be found here.

- **Fault Information & Extended Fault Information**

If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.

'Fault Information'		'Extended Fault Information' Contents
0001h	Address out of range	-
000Ah	Failed to execute request	Return Code. See A-2 "DP-V1 Error Codes"
000Bh	Remote station failure	
0010h	Remote station DP-V1 failure ^a	Function_Number
0011h	Length out of range (>240 bytes)	-
0012h	Slave does not support DP-V1	-
0013h	Slave not active or not present in configuration	-
0014h	Hot Standby Class 1 handling not active	
00FBh	No resources to handle request	
00FEh	Command not possible in 'Class 2-Only' mode	-
00FFh	Module offline (not initialised or no valid data-base)	-

a. See 'Error Decode, Error Code1 & Error Code2' above.

- **Data [1 ... n]**

Returned data

Class 1 Write (FB_APPL_MSAC1_WRITE)

This command initiates a DP-V1 Class 1 acyclic write request. Consult EN50170 (DP-V1) for more information.

Command Initiator	Application
Command Name	FB_APPL_MSAC1_WRITE
Command No.	0021h
Firmware Revision	All

Command and response layout:

	Command		Response		
Message ID	(ID)		(ID)		
Message information	4002h		0002h		
Command	0021h		0021h		Class 1 Write
Data size	(Size of data)		(Size of data)		Number of data bytes (n)
Frame count	0001h		0001h		
Frame number	0001h		0001h		
Offset high	0000h		0000h		
Offset low	0000h		0000h		
Extended word 1	Slave Addr.	Slot	Slave Addr.	Slot	
Extended word 2	Index	Length	Index	Length	
Extended word 3	-		-		
Extended word 4	-		-		
Extended word 5	-		-	Error Decode	
Extended word 6	-		Error Code 1	Error Code 2	
Extended word 7	-		Extended Fault information		
Extended word 8	-		Fault Information		
Message Data byte 1	Data 1		Data 1		
Message Data byte 2	Data 2		Data 2		
Message Data byte 3	Data 3		Data 3		
...		
Message Data byte n	Data n		Data n		

- **Slave Address**

Station address of the slave responder

- **Slot & Index**

Used in the slave to address the desired data block.

- **Length**

This parameter specifies the number of bytes that has to be written. If the destination data block size is less than required, the response will contain an error message. If the data block length is greater than or equal to the required length, the response contains the number of bytes that has been written. The slave may answer with an error response if the data access is not allowed.

- **Error Decode, Error Code 1 & Error Code 2**

If 'Fault Information' contains error code 0010h, more information according to the DP-V1 specification can be found here.

- **Fault Information & Extended Fault Information**

If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.

'Fault Information' Contents		'Extended Fault Information' Contents
0001h	Address out of range	-
000Ah	Failed to execute request	Return Code. See A-2 "DP-V1 Error Codes"
000Bh	Remote station failure	
0010h	Remote station DP-V1 failure ^a	Function_Number
0011h	Too much data is supplied to the slave (more than specified by parameter Max_Channel_Data_Len in database)	-
0012h	Slave does not support DP-V1	-
0013h	Slave not active or not present in configuration	-
0014h	Hot Standby Class 1 handling not active	-
00FBh	No resources to handle request	-
00FEh	Command not possible in 'Class 2-Only' mode	-
00FFh	Module offline (not initialised or no valid data-base)	-

a. See 'Error Decode, Error Code1 & Error Code2' above.

- **Data [1 ... n]**

Data that shall be written.

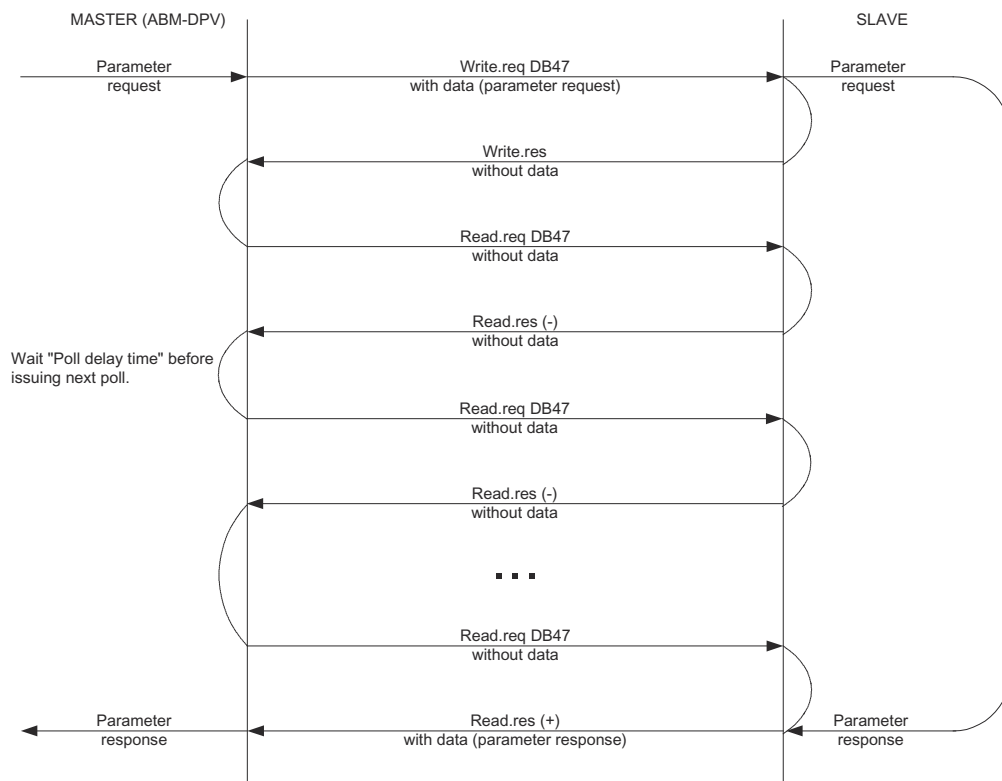
PROFIdrive V3 Acyclic Parameter Access (FB_APPL_MSAC1_PROFIDRIVE_V3_PARAM_WRITE)

This command initiates a PROFIdrive V3 acyclic parameter request. Consult PROFIdrive V3 for detailed information.

Note: This command cannot be issued when running as a passive HSBY master.

Command Initiator	Application
Command Name	FB_APPL_MSAC1_PROFIDRIVE_V3_PARAM_WRITE
Command No.	0024h
Firmware Revision	All

This mailbox will issue an acyclic Write command and poll the response using acyclic Read commands until the slave has generated an answer to the request, see figure below.



Command and response layout:

Command		Response	
Message ID	(ID)	(ID)	
Message information	4002h	0002h	
Command	0024h	0024h	<i>Profidrive v3 Acyclic Par. Acc.</i>
Data size	(request length)	(response length)	
Frame count	0001h	0001h	
Frame number	0001h	0001h	
Offset high	0000h	0000h	
Offset low	0000h	0000h	
Extended word 1	Slave Addr. Slot	Slave Addr. Slot	
Extended word 2	Index Length	Index Length	
Extended word 3	Poll Delay Time	Poll Delay Time	
Extended word 4	Maximum Number of Polls	Maximum Number of Polls	
Extended word 5	-	Function number Error Decode	
Extended word 6	-	Error code 1 Error code 2	
Extended word 7	-	Return Code	
Extended word 8	-	Fault Information	
Message Data byte 1	S_Data 1	R_Data 1	Message Data byte 1
Message Data byte 2	S_Data 2	R_Data 2	Message Data byte 2
Message Data byte 3	S_Data 3	R_Data 3	Message Data byte 3
...
Message Data byte n	S_Data n	R_Data m	Message Data byte m

- Slave Address**
Station address of the slave responder
- Slot**
In PROFIdrive this field is not used.
- Index**
In PROFIdrive this field is not used, and should be set to 2Fh.
- Length**
This parameter specifies the number of bytes that should be written. If the destination data block is smaller than required, the response will contain an error message (Error Code 1, Error Code 2). If the data block length is greater than or equal to the required length, the response contains the number of bytes that has been written.
The slave may answer with an error response if the data access is not allowed.
- Poll Delay Time**
Range: 5ms - 65535ms.
Delay time between two read polls of the response.
- Maximum Number of Polls**
Maximum number of polls that shall be completed before stop polling the module.
Range: 1 - 65535 polls

- **Function Number, Error Decode, Error Code 1 and Error Code 2**

If 'Fault Information' contains error code 000Bh, more information according to the DP-V1 specification can be found here.

- **Return Code**

See "Return Codes" in Appendix A-1 "DP Error Codes" and A-2 "DP-V1 Error Codes"

- **Fault Information**

If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.

0001h: Address out of range
0002h: "Poll delay time" too low
0003h: Invalid "Maximum number of polls"
0004h: Poll timeout. No response was received from the slave within the specified time.
000Ah: Failed to execute request (e.g. node is not online)¹
000Bh: Remote station failure (e.g. node received the request but didn't approve it)²
0011h: Too much data is supplied to the slave (more than specified by parameter Max_Channel_Data_Len in database)
00FDh: Command not possible when running as passive HSBY master
00FEh: Command not possible in 'Class 2-Only' mode
00FFh: Module offline (not initialised or no valid database)

- **S_Data [1 ... n]**

Data sent to the slave

- **R_Data [1 ... m]**

Data returned from the slave

1. See 'Return Code' for additional information
2. See 'Function Number, Error Decode, Error Code 1 & Error Code 2'

Acyclic Communication, Class 2

Class 2 Connection Initiate (FB_APPL_MSAC2_INITIATE)

This command establishes a DP-V1 Class 2 connection to a slave, and must be issued prior to using any of the following functions:

- "Class 2 Connection Abort (FB_APPL_MSAC2_ABORT)"
- "Class 2 Read (FB_APPL_MSAC2_READ)"
- "Class 2 Write (FB_APPL_MSAC2_WRITE)"
- "Class 2 Data Transport (FB_APPL_MSAC2_DATA_TRANSPORT)"
- "Class 2 Connection Status (FB_APPL_MSAC2_CNXXN_STATUS)"

The command supports two modes of operation (Normal or Expert):

- **Normal**
No message data is included in the command.
- **Expert**
The application must supply details for the connection (recommended for expert users only).

Note: The command and response layouts for both modes are specified on the following pages.

Command Initiator	Application
Command Name	FB_APPL_MSAC2_INITIATE
Command No.	0025h
Firmware Revision	2.20 or higher

Command and response layout (Normal):

Command		Response	
Message ID	(ID)	(ID)	
Message information	4002h	0002h	
Command	0025h	0025h	FB_APPL_MSAC2_INITIATE
Data size	0000h	(12 + S_Length + D_Length)	Size of data in bytes
Frame count	0001h	0001h	
Frame number	0001h	0001h	
Offset high	0000h	0000h	
Offset low	0000h	0000h	
Extended word 1	C_REF	C_REF	
Extended word 2	Slave Addr.	Max. Data Length	
Extended word 3	-	Min. Slave Send Timeout	
Extended word 4	-	-	
Extended word 5	-	Error Decode	
Extended word 6	-	Error Code 1	
Extended word 7	-	Error Code 2	
Extended word 8	-	Extended Fault Information	
		Fault Information	
		Send Timeout	Message Data word 1
		Features Supported 1	Message Data word 2
		Features Supported 2	Message Data word 3
		Profile Features Supported 1	Message Data word 4
		Profile Features Supported 2	Message Data word 5
		Profile Ident Number	Message Data word 6
		S_Type	...
		S_Length	...
		D_Type	...
		D_Length	...
		S_Address	Message Data word m
		D_Address	

Command and response layout (Expert):

	Command	Response	
Message ID	(ID)	(ID)	
Message information	4002h	0002h	
Command	0025h	0025h	FB_APPL_MSAC2_INITIATE
Data size	(12 + S_Length + D_Length)	(12 + S_Length + D_Length)	Size of data in bytes
Frame count	0001h	0001h	
Frame number	0001h	0001h	
Offset high	0000h	0000h	
Offset low	0000h	0000h	
Extended word 1	C_REF	C_REF	
Extended word 2	Slave Addr.	Slave Addr.	Max. Data Length
Extended word 3	-	Min. Slave Send Timeout	
Extended word 4	-	-	
Extended word 5	-	-	Error Decode
Extended word 6	-	Error Code 1	Error Code 2
Extended word 7	-	Extended Fault Information	
Extended word 8	-	Fault Information	
Message Data word 1	Send Timeout	Send Timeout	Response Data word 1
Message Data word 2	Features Supported 1	Features Supported 1	Response Data word 2
Message Data word 3	Profile Features Supported 1	Profile Features Supported 1	Response Data word 3
Message Data word 4	Profile Ident Number	Profile Ident Number	Response Data word 4
Message Data word 5	S_Type	S_Type	Response Data word 5
Message Data word 6	D_Type	D_Type	Response Data word 6
...	S_Address	S_Address	...
...	D_Address	D_Address	...
Message Data word n			Response Data word m

- **C_ref**
Connections references used to identify the connection later on.
Range: 1-128
- **Slave Address**
Address of the slave to which a connection shall be established. Range: 0...126
- **Max. Data Length**
The slave's maximum data length in bytes (reported by the slave in DP Initiate.res).
- **Min. Slave Send Timeout**
The minimum slave timeout value supported by the slave (in multiples of 10ms).
- **Error Decode, Error Code 1 & 2**
If 'Fault Information' equals 0010h, additional information according to the DP-V1 specification can be found here.
- **Extended Fault Information**
If 'Fault Information' equals 000Ah or 000Bh, additional information of the error can be found here. For more information, see A-3 "Class 2-Related Errors".
- **Fault Information**
If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.
 - 0001h:** Address out of range
 - 000Ah:** Failed to execute request (local error detected). See Extended Fault Information.
 - 000Bh:** Remote station failure. See Extended Fault Information.
 - 0010h:** Remote station DP-V1 failure. See Error Decode, Error Code 1 & 2
 - 00FFh:** Module not initialised.
- **Send Timeout**
Defines the control time (timebase 10ms) for the supervision of the connection between the slave and the master.
Range 6...65535 (equals 60....655350ms). Default is 1000ms.
- **Features Supported 1**
Identifies the supported C2-service functionality as follows:
 - b0:** DP-V1_RW. This bit is set if the services C2_Read and C2_Write are supported.
 - b1...7:** (reserved for future use)
Default value is 01h.
- **Features Supported 2**
(reserved for future use)
- **Profile Supported 1 & 2**
Identifies the supported service functionality regarding the used profile definition. The meaning of these registers are profile- and vendor specific. By default, both are set to 00h.
- **Profile Ident Number**
This parameter identifies a unique profile definition. The Profile Ident Number is taken from the pool of Ident Numbers managed by the PROFIBUS User Organisation (PNO).
Range: 0...65535. 0 = No profile (default).

- **S_Type**

This parameter indicates the presence of the optional Network/MAC address of the source.

b0: **1:** A Network/MAC address is present in S_Address.

0: The source is the endpoint of the connection.

b1...7: (reserved for future use)

Default value is 00h.

- **S_Length**

This parameter specifies the length of the S_Address parameter (see table below).

Default value is 02h.

- **D_Type**

This parameter indicates the presence of the optional Network/MAC address of the destination.

b0: **1:** A Network/MAC address is present in D_Address.

0: The destination (in this case the Anybus module) is the endpoint of the connection.

b1...7: (reserved for future use)

Default value is 00h.

- **D_Length**

This value specifies the length of the D_Address parameter (see table below).

Default value is 02h.

- **S_Address**

This field holds additional address information about the source. It's structure depends on the settings in S_Type.

S_Type	Type	Sub-parameter	Description
00h	Unsigned8	API	Identifies the application process instance of the source.
	Unsigned8	SCL	Identifies the access level of the source (0 = not used)
01h	Unsigned8	API	Identifies the application process instance of the source.
	Unsigned8	SCL	Identifies the access level of the source.
	Octet-string[6]	Network Address	Identifies the network address of the source according to ISO/OSI-Network addresses.
	Octet-string [S_Length - 8]	MAC Address	Identifies the MAC address of the source

- **D_Address**

This field holds additional address information about the destination. It's structure depends on the settings in D_Type.

D_Type	Type	Sub-parameter	Description
00h	Unsigned8	API	Identifies the application process instance of the destination.
	Unsigned8	SCL	Identifies the access level of the destination. (0 = not used)
01h	Unsigned8	API	Identifies the application process instance of the destination.
	Unsigned8	SCL	Identifies the access level of the destination.
	Octet-string[6]	Network Address	Identifies the network address of the destination according to ISO/OSI-Network addresses.
	Octet-string [D_Length - 8]	MAC Address	Identifies the MAC address of the destination

Class 2 Connection Abort (FB_APPL_MSAC2_ABORT)

This command terminates a DP-V1 Class 2 connection previously established using FB_APPL_MSAC2_INITIATE.

Command Initiator	Application
Command Name	FB_APPL_MSAC2_ABORT
Command No.	0026h
Firmware Revision	2.20 or higher

Command and response layout:

	Command		Response	
Message ID	(ID)		(ID)	
Message information	4002h		0002h	
Command	0026h		0026h	
Data size	0000h		0000h	
Frame count	0001h		0001h	
Frame number	0001h		0001h	
Offset high	0000h		0000h	
Offset low	0000h		0000h	
Extended word 1	C_REF		C_REF	
Extended word 2	Subnet	Reason Code	Subnet	Reason Code
Extended word 3	-		-	
Extended word 4	-		-	
Extended word 5	-		-	
Extended word 6	-		-	
Extended word 7	-		Extended Fault Information	
Extended word 8	-		Fault Information	

FB_APPL_MSAC2_ABORT
No message data

- **C_Ref**
Connection reference that shall be terminated.
- **Subnet**
This parameter encodes information about the origin of the abort initiator.
 - 0:** No
 - 1:** Local
 - 2:** Remote
 - 3...255:** (reserved)
- **Reason Code**
Indicates the reason for the abort request. Value is user-specific. Range 0...15.
- **Extended Fault Information**
If 'Fault Information' equals 000Ah or 000Bh, additional information of the error can be found here. For more information, see A-3 "Class 2-Related Errors".
- **Fault Information**
If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.
 - 000Ah:** Failed to execute request (local error detected). See Extended Fault Information.
 - 000Bh:** Remote station failure. See Extended Fault Information.
 - 00FFh:** Module not initialised.

Class 2 Connection Abort Indication (FB_APPL_MSAC2_ABORT_IND)

This message is issued spontaneously by the module when any of the established connections has been aborted for reasons not caused by the application (e.g. slave time-out, connection terminated by slave etc.). This message is *not* issued when a connection has been terminated using FB_APPL_MSAC2_ABORT.

Note: The application must *not* respond to this message!

Note: This feature can be disabled, see 5-2 “Fieldbus Specific Initialisation (FB_INIT)”

Command Initiator	Anybus
Command Name	FB_APPL_MSAC2_ABORT_IND
Command No.	002Ah
Firmware Revision	2.20 or higher

Message layout:

Message ID	(ID)	
Message information	4002h	
Command	002Ah	FB_APPL_MSAC2_ABORT_IND
Data size	0000h	No message data
Frame count	0001h	
Frame number	0001h	
Offset high	0000h	
Offset low	0000h	
Extended word 1	C_REF	
Extended word 2	Subnet	Reason Code
Extended word 3	Additional Detail	
Extended word 4	Locally Generated	
Extended word 5	-	
Extended word 6	-	
Extended word 7	-	
Extended word 8	-	

- **C_Ref**

Connection reference.

- **Subnet**

This parameter encodes information about the origin of the abort initiator.

- 0: No
- 1: Local
- 2: Remote
- 3...255: (reserved)

- **Instance/Reason**

This parameter encodes information about the reason for the abort request, and the protocol instance that caused it.

b7	b6	b5	b4	b3	b2	b1	b0
(reserved)		Instance Code		Reason Code			

Instance Code	Reason Code	Name	Meaning
b00: FDL	1	UE	See EN 50170 part 2
	2	RR	
	3	RS	
	9	NR	
	10	DH	
	11	LR	
	12	RDL	
	13	RDH	
	14	DS	Master is not in logical ring
	15	NA	No response from remote FDL
b01: C2	1	ABT_SE	Sequence error; service not allowed in this state
	2	ABT_FE	Invalid request PDU received
	3	ABT_TO	Timeout of the connection
	4	ABT_RE	Invalid response PDU received
	5	ABT_IV	Invalid service from user
	6	ABT_STO	Send_Timeout requested was too small
	7	ABT_IA	Invalid additional address information
	8	ABT_OC	Waiting for FDL_DATA_REPLY.con
	15	ABT_RES	Resource error
b10: User	-	-	-
b11: (reserved)	-	-	-

- **Additional Detail**

This parameter holds the Send_Timeout if the Instance/Reason code equals ABT_STO.

- **Locally Generated**

This parameter indicates the abort initiator.

- 0: Generated by the remote station
- 1: Generated by the master (local)

Class 2 Read (FB_APPL_MSAC2_READ)

This command issues a class 2 DP-V1 acyclic read request to a slave. Prior to issuing this command, a connection to the slave must have been established, see 5-49 “Class 2 Connection Initiate (FB_APPL_MSAC2_INITIATE)”.

Command Initiator	Application
Command Name	FB_APPL_MSAC2_READ
Command No.	0027h
Firmware Revision	2.20 or higher

Command and response layout:

Command			Response	
Message ID	(ID)		(ID)	
Message information	4002h		0002h	
Command	0027h		0027h	
Data size	0000h		(data size)	
Frame count	0001h		0001h	
Frame number	0001h		0001h	
Offset high	0000h		0000h	
Offset low	0000h		0000h	
Extended word 1	C_REF		C_REF	
Extended word 2	Slot	Index	Slot	Index
Extended word 3	Length	-	Length	-
Extended word 4	-		-	
Extended word 5	-		-	Error Decode
Extended word 6	-		Error Code 1	Error Code 2
Extended word 7	-		Extended Fault Information	
Extended word 8	-		Fault Information	
			Read Data	

FB_APPL_MSAC2_READ
Size of data in bytes

- **C_Ref**
Connection reference.
- **Slot**
Used in the slave for addressing of the desired data block.
- **Index**
Used in the slave for addressing of the desired data block.
- **Length**
Number of bytes to read.
- **Error Decode, Error Code 1 & 2**
If 'Fault Information' equals 0010h, additional information according to the DP-V1 specification can be found here.
- **Extended Fault Information**
If 'Fault Information' equals 000Ah or 000Bh, additional information of the error can be found here. For more information, see A-3 "Class 2-Related Errors".
- **Fault Information**
If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.
 - 000Ah:** Failed to execute request (local error detected). See Extended Fault Information.
 - 000Bh:** Remote station failure. See Extended Fault Information.
 - 0010h:** Remote station DP-V1 failure. See Extended Fault Information.
 - 00FFh:** Module not initialised.
- **Read Data**
Read data.

Class 2 Write (FB_APPL_MSAC2_WRITE)

This command issues a class 2 DP-V1 acyclic write request to a slave. Prior to issuing this command, a connection to the slave must have been established, see 5-49 “Class 2 Connection Initiate (FB_APPL_MSAC2_INITIATE)”.

Command Initiator	Application
Command Name	FB_APPL_MSAC2_WRITE
Command No.	0028h
Firmware Revision	2.20 or higher

Command and response layout:

	Command		Response	
Message ID	(ID)		(ID)	
Message information	4002h		0002h	
Command	0028h		0028h	
Data size	(data size)		(data size)	
Frame count	0001h		0001h	
Frame number	0001h		0001h	
Offset high	0000h		0000h	
Offset low	0000h		0000h	
Extended word 1	C_REF		C_REF	
Extended word 2	Slot	Index	Slot	Index
Extended word 3	Length	-	Length	-
Extended word 4	-		-	
Extended word 5	-		-	Error Decode
Extended word 6	-		Error Code 1	Error Code 2
Extended word 7	-		Extended Fault Information	
Extended word 8	-		Fault Information	
Message Data byte 1	Write Data		Write Data	
...				
...				
Message Data byte n				

FB_APPL_MSAC2_WRITE

Size of data in bytes

- **C_Ref**
Connection reference.
- **Slot**
Used in the slave for addressing of the desired data block.
- **Index**
Used in the slave for addressing of the desired data block..
- **Length**
Number of bytes to write.
- **Error Decode, Error Code 1 & 2**
If 'Fault Information' equals 0010h, additional information according to the DP-V1 specification can be found here.
- **Extended Fault Information**
If 'Fault Information' equals 000Ah or 000Bh, additional information of the error can be found here. For more information, see A-3 "Class 2-Related Errors".
- **Fault Information**
If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.
 - 000Ah:** Failed to execute request (local error detected). See Extended Fault Information.
 - 000Bh:** Remote station failure. See Extended Fault Information.
 - 0010h:** Remote station DP-V1 failure. See Extended Fault Information.
 - 00FFh:** Module not initialised.
- **Write Data**
Data to write.

Class 2 Data Transport (FB_APPL_MSAC2_DATA_TRANSPORT)

This command issues a combined class 2 DP-V1 acyclic read/write request to a slave. Prior to issuing this command, a connection to the slave must have been established, see 5-49 “Class 2 Connection Initiate (FB_APPL_MSAC2_INITIATE)”.

Command Initiator	Application
Command Name	FB_APPL_MSAC2_DATA_TRANSPORT
Command No.	0029h
Firmware Revision	2.20 or higher

Command and response layout:

	Command		Response		
Message ID	(ID)		(ID)		
Message information	4002h		0002h		
Command	0029h		0029h		FB_APPL_MSAC2_DATA_TRANSPORT
Data size	(data size)		(data size)		Size of data in bytes
Frame count	0001h		0001h		
Frame number	0001h		0001h		
Offset high	0000h		0000h		
Offset low	0000h		0000h		
Extended word 1	C_REF		C_REF		
Extended word 2	Slot	Index	Slot	Index	
Extended word 3	Length	-	Length	-	
Extended word 4	-		-		
Extended word 5	-		-	Error Decode	
Extended word 6	-		Error Code 1	Error Code 2	
Extended word 7	-		Extended Fault Information		
Extended word 8	-		Fault Information		
Message Data byte 1	Write Data		Read Data		
...					
...					
Message Data byte n					

- **C_Ref**
Connection reference.
- **Slot**
Used in the slave for addressing of the desired data block. Range 0...254.
- **Index**
Used in the slave for addressing of the desired data block. Range 0...254.
- **Length**
Number of bytes to read/write.
- **Error Decode, Error Code 1 & 2**
If 'Fault Information' equals 0010h, additional information according to the DP-V1 specification can be found here.
- **Extended Fault Information**
If 'Fault Information' equals 000Ah or 000Bh, additional information of the error can be found here. For more information, see A-3 "Class 2-Related Errors".
- **Fault Information**
If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.
 - 000Ah:** Failed to execute request (local error detected). See Extended Fault Information.
 - 000Bh:** Remote station failure. See Extended Fault Information.
 - 0010h:** Remote station DP-V1 failure. See Extended Fault Information.
 - 00FFh:** Module not initialised.
- **Write Data**
Data to write.
- **Read Data**
Read data.

Class 2 Connection Status (FB_APPL_MSAC2_CNXXN_STATUS)

This command returns the current status of a class 2 DP-V1 specific connection. Preferably, this command is used in conjunction with the DP-V1 C2 Connection Livelist (see 6-3 “Class 2 Connection Livelist (E80h... E8Fh)”) when the livelist indicates that a connection has been closed, the reason for closing may be determined using this command.

Command Initiator	Application
Command Name	FB_APPL_MSAC2_CNXXN_STATUS
Command No.	002Bh
Firmware Revision	2.20 or higher

Command and response layout:

	Command	Response	
Message ID	(ID)	(ID)	
Message information	4002h	0002h	
Command	002Bh	002Bh	FB_APPL_MSAC2_CNXXN_S TATUS
Data size	(data size)	(data size)	Size of data in bytes
Frame count	0001h	0001h	
Frame number	0001h	0001h	
Offset high	0000h	0000h	
Offset low	0000h	0000h	
Extended word 1	C_REF	C_REF	
Extended word 2	-	Status	Add Info
Extended word 3	-	-	
Extended word 4	-	-	
Extended word 5	-	-	
Extended word 6	-	-	
Extended word 7	-	Extended Fault Information	
Extended word 8	-	Fault Information	
		Subnet	Instance/ Reason
		Additional Detail	Message Data word 1
		Locally Generated	Message Data word 2
			Message Data word 3

- **C_Ref**

Connection reference.

- **Status**

This flag reflects the current status of the specified connection reference (C_Ref).

0: No connection, or connection has been closed

1: Connection is alive and open.

- **Add Info**

This flag indicates if additional information is present in Message Data words 1...3.

0: No message data

1: Message data available

- **Extended Fault Information**

If 'Fault Information' equals 000Ah or 000Bh, additional information of the error can be found here. For more information, see A-3 "Class 2-Related Errors".

- **Fault Information**

If 'Invalid Other' is returned in the Message Information word in the header of the response, information about the fault can be found here.

000Ah: Failed to execute request (local error detected). See Extended Fault Information.

000Bh: Remote station failure. See Extended Fault Information.

0010h: Remote station DP-V1 failure. See Extended Fault Information.

00FFh: Module not initialised.

- **Subnet**

This parameter encodes information about the origin of the abort initiator.

0: No

1: Local

2: Remote

3...255: (reserved)

- **Instance/Reason**

This parameter encodes information about the reason for the abort request, and the protocol instance that caused it.

b7	b6	b5	b4	b3	b2	b1	b0
(reserved)		Instance Code		Reason Code			

Instance Code	Reason Code	Name	Meaning
b00: FDL	1	UE	See EN 50170 part 2
	2	RR	
	3	RS	
	9	NR	
	10	DH	
	11	LR	
	12	RDL	
	13	RDH	
	14	DS	Master is not in logical ring
	15	NA	No response from remote FDL
b01: C2	1	ABT_SE	Sequence error; service not allowed in this state
	2	ABT_FE	Invalid request PDU received
	3	ABT_TO	Timeout of the connection
	4	ABT_RE	Invalid response PDU received
	5	ABT_IV	Invalid service from user
	6	ABT_STO	Send_Timeout requested was too small
	7	ABT_IA	Invalid additional address information
	8	ABT_OC	Waiting or FDL_DATA_REPLY.con
	15	ABT_RES	Resource error
b10: User	-	-	-
b11: (reserved)	-	-	-

- **Additional Detail**

This parameter holds the Send_Timeout if the Instance/Reason code equals ABT_STO.

- **Locally Generated**

This parameter indicates the abort initiator.

- 0: Generated by the remote station
- 1: Generated by the master (local)

DP-V1 Alarm Handling

Alarm Indication (FB_ABM_MSAL1_ALARM_IND)

This message indicates to the application that a DP-V1 slave has transferred an Alarm message to the master. This mailbox message is sent spontaneously by the module, i.e. the module itself initiates the mailbox communication.

Detailed information about the alarm cause is presented in extended words 1 - 3 and in the message data field, see below.

The application must provide a response to this command, which will trigger the module to send an MSAC1_Alarm_Ack to the slave. This will tell the slave that the alarm has been configured by the master. The slave will in turn respond with a confirmation message, see 5-69 “Alarm Confirmation (FB_ABM_MSAL1_ALARM_CON)”

Note: This feature can be disabled, see 5-2 “Fieldbus Specific Initialisation (FB_INIT)”

Command Initiator	Anybus. Response required from application.
Command Name	FB_ABM_MSAL1_ALARM_IND
Command No.	0022h
Firmware Revision	All

Command and response layout:

	Indication		Application Response	
Message ID	(ID)		(ID)	
Message information	4002h		0002h	
Command	0022h		0022h	
Data size	(request length)		0000h	
Frame count	0001h		0001h	
Frame number	0001h		0001h	
Offset high	0000h		0000h	
Offset low	0000h		0000h	
Extended word 1	Slave Addr.	Slot Number	-	Alarm Indication
Extended word 2	Seq Number	Alarm Spec Ack	-	
Extended word 3	Alarm Type	Ext Diag	-	
Extended word 4	-		-	
Extended word 5	-		-	
Extended word 6	-		-	
Extended word 7	-		-	
Extended word 8	Fault Information		-	
Message Data byte 1	Data 1			
Message Data byte 2	Data 2			
Message Data byte 3	Data 3			
...	...			
Message Data byte n	Data n			

- **Slave Address¹**
Station address of the slave that indicates the alarm
- **Slot Number¹**
Used by the slave to indicate the source of the alarm
Range 0 - 254
- **Seq Number¹**
Unique identification number of the alarm
Range 0 - 31
- **Alarm Spec Ack¹**
Gives additional information about the Alarm, such as an error appears, or disappears. It also indicates whether the slave needs additional acknowledge from the Master (Example: Writing to a certain memory area with an Acyclic Write request)
Range 0 - 7
- **Alarm Type¹**
Identifies the alarm type, such as Process Alarm, Plug Alarm etc.
Range 1 - 6, 32 - 126
- **Extended Diagnostic Flag¹**
FFh: Slave sends an alarm message with “Extended Diag flag” set
00h: Slave sends an alarm message with “Extended Diag flag” cleared
- **Data [1 ... n]**
Additional manufacturer specific alarm information (Alarm - PDU)
- **Fault Information**
If the Message Information word in the header of the message indicates ‘Invalid Other’, additional information is available in this register.
003Eh: Module has received an invalid alarm indication data structure from a DP-V1 slave. (‘Slave Address’ contains the node address of the slave that issued the erroneous indication)
Note: The application does not have to respond in this case, since the module can’t send an Alarm Acknowledge to the slave because of this fault.

1. Consult the PNO document ‘Extensions to EN50170 (DPV)’ for more information on how to interpret these parameters.

Alarm Confirmation (FB_ABM_MSAL1_ALARM_CON)

This message indicates to the application that a slave has confirmed a previous MSAC1_Alarm_Ack, see 5-67 “Alarm Indication (FB_ABM_MSAL1_ALARM_IND)”. This mailbox message is sent spontaneously by the module, i.e. the module itself initiates the mailbox communication.

Note: The application must *not* respond to this message!

Note: This feature can be disabled, see 5-2 “Fieldbus Specific Initialisation (FB_INIT)”

Command Initiator	Anybus. Application is <i>not</i> required to respond.
Command Name	FB_ABM_MSAL1_ALARM_CON
Command No.	0023h
Firmware Revision	All

Message layout:

	Indication		Application Response
Message ID	(ID)		(no response)
Message information	4002h		
Command	0023h		
Data size	0000h		
Frame count	0001h		
Frame number	0001h		
Offset high	0000h		
Offset low	0000h		
Extended word 1	Slave Addr.	Slot Number	
Extended word 2	Seq Number	Alarm Spec Ack	
Extended word 3	Alarm Type	Ext Diag	
Extended word 4	-		
Extended word 5	-	Error Decode	
Extended word 6	Error Code 1	Error Code 2	
Extended word 7	Extended Fault Information		
Extended word 8	Fault Information		

- **Slave Address¹**
Station address of the slave that indicates the alarm
- **Slot Number¹**
Used by the slave to indicate the source of the alarm
Range 0 - 254
- **Seq Number¹**
Unique identification number of the alarm
Range 0 - 31
- **Alarm Spec Ack¹**
Gives additional information about the Alarm, such as an error appears, or disappears. It also indicates whether the slave needs additional acknowledge from the Master (Example: Writing to a certain memory area with an Acyclic Write request)
Range 0 - 7
- **Alarm Type¹**
Identifies the alarm type, such as Process Alarm, Plug Alarm etc.
Range 1 - 6, 32 - 126
- **Extended Diagnostic Flag¹**
FFh: Slave sends an alarm message with “Extended Diag flag” set
00h: Slave sends an alarm message with “Extended Diag flag” cleared
- **Error Decode, Error Code 1 & Error Code 2**
If ‘Fault Information’ contains error code 0010h, more information according to the DP-V1 specification can be found here.
- **Fault Information & Extended Fault Information**
If the Message Information word in the header of the message indicates ‘Invalid Other’, additional information is available in this register.

‘Fault Information’ Contents		‘Extended Fault Information’ Contents
000Ah	Failed to execute request	Return Code. See A-2 “DP-V1 Error Codes”
000Bh	Remote station failure	
0010h	Remote station DP-V1 failure ^a	Function_Number

a. See ‘Error Decode, Error Code1 & Error Code2’ above.

1. Consult the PNO document ‘Extensions to EN50170 (DPV)’ for more information on how to interpret these parameters.

Redundant Operation

Set HSBY State (FB_APPL_SET_HSBY_STATE)

This command is used to shift HSBY state. The response indicates the result.

Note: This command cannot be issued during initialisation.

Command Initiator	Application
Command Name	FB_APPL_SET_HSBY_STATE
Command No.	0041h
Firmware Revision	>=3.40

Command and response layout:

	Command	Response	
Message ID	(ID)	(ID)	
Message information	4002h	0002h	
Command	0041h	0041h	FB_APPL_SET_HSBY_STATE
Data size	0000h	0000h	(no data)
Frame count	0001h	0001h	
Frame number	0001h	0001h	
Offset high	0000h	0000h	
Offset low	0000h	0000h	
Extended word 1	HSBY State (Command)	HSBY State (Response)	
Extended word 2			
Extended word 3			
Extended word 4	-	-	
Extended word 5	-		
Extended word 6	-		
Extended word 7	-		
Extended word 8	-	Fault Information	

- HSBY State (Command)**

0000h: Not Connected
 0001h: Passive
 0002h: Active

- HSBY State (Response)**

0000h: Not Connected
 0001h: Passive
 0002h: Active
 0003h: Stand-alone (HSBY not enabled)

- Fault Information**

If the Message Information word in the header of the message indicates 'Invalid Other', additional information is available in this register.

0001h: Unrecognized 'HSBY state' in command
 0002h: State shift not allowed
 0003h: State shift not allowed since Anybus operates as a stand-alone master
 00FEh: Command not possible; Anybus operates as a 'Class 2-only master'
 00FFh: Module not initialised (command only possible after END_INIT)

Fieldbus Specific Area

General

This area holds information about the master and the slaves on the network. Note that all registers in this area is read-only.

Overview

Location:	Contents:	Access:	Comments:
E40h - E4Fh	Slave Configured List	RO	See 6-2 "Slave Configured List (E40h... E4Fh)"
E50h - E5Fh	Data Transfer List	RO	See 6-2 "Data Transfer List (E50h... E5Fh)"
E60h - E6Fh	Slave Diagnostic List	RO	See 6-2 "Slave Diagnostic List (E60h... E6Fh)"
E70h - E76h	Master Status Field	RO	See 6-3 "Master Status Field (E70h... E72h)"
E77h - E7Fh	Master Init Field	RO	See 6-3 "Master Init Field (E77h... E7Ch)"
E80h - E8Fh	Class 2 Connection Live-list	RO	See 6-3 "Class 2 Connection Live-List (E80h... E8Fh)"
E90h - E9Fh	(debug Info, reserved)	RO	(This area contains debugging information that may be useful when contacting technical support)
EA0h - EA7h	HSBY Status Information	RO	See 6-4 "HSBY Status Information (EA0h... EA7h)"
EA8h - FBFh	(debug Info, reserved)	RO	(This area contains debugging information that may be useful when contacting technical support)

Registers

Slave Configured List (E40h... E4Fh)

This is a 16-byte array with bit fields where one bit is assigned to each slave station. The associated bit is set if the slave is present in the database.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
E40h	Slave 7	Slave 6	Slave 5	Slave 4	Slave 3	Slave 2	Slave 1	Slave 0
E41h	Slave 15	Slave 14	Slave 13	Slave 12	Slave 11	Slave 10	Slave 9	Slave 8
E42h	Slave 23	Slave 22	Slave 21	Slave 20	Slave 19	Slave 18	Slave 17	Slave 16
E43h	Slave 31	Slave 30	Slave 29	Slave 28	Slave 27	Slave 26	Slave 25	Slave 24
E44h	Slave 39	Slave 38	Slave 37	Slave 36	Slave 35	Slave 34	Slave 33	Slave 32
...
E4Fh	Slave 127	Slave 126	Slave 125	Slave 124	Slave 123	Slave 122	Slave 121	Slave 120

Data Transfer List (E50h... E5Fh)

This is a 16-byte array with bit fields where one bit is assigned to each slave station. The associated bit is set if the slaves has reached or retained the “Data Exchange” state at least once during the approx. last three data cycles.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
E50h	Slave 7	Slave 6	Slave 5	Slave 4	Slave 3	Slave 2	Slave 1	Slave 0
E51h	Slave 15	Slave 14	Slave 13	Slave 12	Slave 11	Slave 10	Slave 9	Slave 8
E52h	Slave 23	Slave 22	Slave 21	Slave 20	Slave 19	Slave 18	Slave 17	Slave 16
E53h	Slave 31	Slave 30	Slave 29	Slave 28	Slave 27	Slave 26	Slave 25	Slave 24
E54h	Slave 39	Slave 38	Slave 37	Slave 36	Slave 35	Slave 34	Slave 33	Slave 32
...
E5Fh	Slave 127	Slave 126	Slave 125	Slave 124	Slave 123	Slave 122	Slave 121	Slave 120

Slave Diagnostic List (E60h... E6Fh)

This is a 16-byte array with bit fields where one bit is assigned to each slave station. When a slave leaves the “Deactivate” state for the first time the associated bit is set. This bit is then cleared when the slave enters “Data Exchange” state. If a slave indicates “Extended Diagnostics” when it is in “Data Exchange” state, the associated bit is set.

When a bit is set the diagnostics for that particular slave can be read using the mailbox command ‘FB_APPL_GET_SLAVE_DIAG’.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
E60h	Slave 7	Slave 6	Slave 5	Slave 4	Slave 3	Slave 2	Slave 1	Slave 0
E61h	Slave 15	Slave 14	Slave 13	Slave 12	Slave 11	Slave 10	Slave 9	Slave 8
E62h	Slave 23	Slave 22	Slave 21	Slave 20	Slave 19	Slave 18	Slave 17	Slave 16
E63h	Slave 31	Slave 30	Slave 29	Slave 28	Slave 27	Slave 26	Slave 25	Slave 24
E64h	Slave 39	Slave 38	Slave 37	Slave 36	Slave 35	Slave 34	Slave 33	Slave 32
...
E6Fh	Slave 127	Slave 126	Slave 125	Slave 124	Slave 123	Slave 122	Slave 121	Slave 120

Master Status Field (E70h... E72h)

Location	Contents	Description
E70h	Operation State	00h - Offline 40h - Stop 80h - Clear C0h - Operate
E71h	Ident number (msb)	PNO Ident number
E72h	Ident number (lsb)	
E73h	(reserved)	-
E74h		
E75h		
E76h		

Master Init Field (E77h... E7Ch)

This field reflects the settings in the FB_INIT mailbox command.

Location	Contents	Description
E77h	(reserved)	-
E78h	DPRAM mode	See 5-2 "Fieldbus Specific Initialisation (FB_INIT)"
E79h	(reserved)	-
E7Ah	Special Functions	See 5-2 "Fieldbus Specific Initialisation (FB_INIT)"
E7Bh	(reserved)	-
E7Ch	Start-up Operating Mode	See 5-2 "Fieldbus Specific Initialisation (FB_INIT)"
E7Dh	(reserved)	-
E7Eh		
E7Fh		

Class 2 Connection Live-List (E80h... E8Fh)

This field reflects the status of all DP-V1 Class 2 connections. Each bit in the field corresponds to a single connection reference (C_REF). If set, a connection has been opened and is alive. If zero, the connection has either been terminated or never been opened. In such case, additional information can be read using the mailbox command FB_APPL_MSAC2_CNXXN_STATUS (5-64 "Class 2 Connection Status (FB_APPL_MSAC2_CNXXN_STATUS)").

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
E80h	C_REF 8	C_REF 7	C_REF 6	C_REF 5	C_REF 4	C_REF 3	C_REF 2	C_REF 1
E81h	C_REF 16	C_REF 15	C_REF 14	C_REF 13	C_REF 12	C_REF 11	C_REF 10	C_REF 9
E82h	C_REF 24	C_REF 23	C_REF 22	C_REF 21	C_REF 20	C_REF 19	C_REF 18	C_REF 17
E83h	C_REF 32	C_REF 31	C_REF 30	C_REF 29	C_REF 28	C_REF 27	C_REF 26	C_REF 25
E84h	C_REF 40	C_REF 39	C_REF 38	C_REF 37	C_REF 36	C_REF 35	C_REF 34	C_REF 33
...
E8Fh	C_REF 128	C_REF 127	C_REF 126	C_REF 125	C_REF 124	C_REF 123	C_REF 122	C_REF 121

HSBY Status Information (EA0h... EA7h)

This area holds status information for redundant (HSBY) applications. This information should normally be forwarded to a higher level control system, which in turn determines whether or not a switchover shall be carried out.

See also...

- 4-1 “Redundant Operation (HSBY)”
- 4-2 “Redundant System Status”
- 4-6 “How to Implement a Redundant Application”

Location	Contents	Description
EA0h	Remote Master Status ^a	See 6-4 “Remote Master Status”
EA1h	No. of Remote Slaves ^a	This register indicates the number of slaves recognized by the remote master.
EA2h... EA3	-	(reserved, ignore)
EA4h	Local Master Status ^b	See 6-5 “Local Master Status”
EA5h	No. of Local Slaves ^b	This register indicates the number of slaves recognized by the local master.
EA6h... EAFh	-	(reserved, ignore)

- a. The contents of this register is valid only when the 'COM'-bit ('Remote Master Status'-register) is set (1).
 b. The contents of this register is valid only when the 'HS'-bit ('Local Master Status'-register) is set (1).

- **Remote Master Status**

Bit	Name	Meaning
0	R_PA	This bit indicates if the remote master is Passive or Active. <u>Value:</u> <u>Meaning:</u> 0: The remote master operates as an Active Master 1: The remote master operates as a Passive Master
1	R_SO	This bit indicates if the remote master recognizes any of its assigned slaves as being 'offline'. <u>Value:</u> <u>Meaning:</u> 0: At least one slave is 'offline' 1: All slaves OK
2	R_CE	This bit indicates if the remote master has recognized a critical error. Note that it is quite possible that the master is still exchanging data with its assigned slaves. <u>Value:</u> <u>Meaning:</u> 0: No critical errors detected 1: Critical error detected
3	R_DB	This bit indicates if the remote master has detected a database mismatch. <u>Value:</u> <u>Meaning:</u> 0: Database OK 1: Database mismatch
4	R_OD	This bit indicates if the Output Data area in the remote master holds valid data. <u>Value:</u> <u>Meaning:</u> 0: Output Data not valid 1: Output Data valid
5	-	(reserved, mask off and ignore)
6		
7	COM	This bit indicates if a remote master is detected <u>Value:</u> <u>Meaning:</u> 0: Remote master not sensed 1: Remote master sensed

- Local Master Status

Bit	Name	Meaning
0	L_PA	This bit indicates if the local master is Passive or Active. <u>Value:</u> <u>Meaning:</u> 0: The local master operates as an Active Master 1: The local master operates as a Passive Master
1	L_SO	This bit indicates if the local master recognizes any of its assigned slaves as 'offline'. <u>Value:</u> <u>Meaning:</u> 0: At least one slave is 'offline' 1: All slaves OK
2	L_CE	This bit indicates if the local master has recognized a critical error. Note that it is quite possible that the master is still exchanging data with its assigned slaves. <u>Value:</u> <u>Meaning:</u> 0: No critical errors detected 1: Critical error detected
3	L_DB	This bit indicates if the local master has detected a database mismatch. <u>Value:</u> <u>Meaning:</u> 0: Database OK 1: Database mismatch
4	L_OD	This bit indicates if the Output Data area in the local master holds valid data. <u>Value:</u> <u>Meaning:</u> 0: Output Data not valid 1: Output Data valid
5	-	(reserved, mask off and ignore)
6		
7	HS	This bit indicates if redundant (HSBY) operation has been enabled <u>Value:</u> <u>Meaning:</u> 0: HSBY disabled 1: HSBY enabled

Control Register Area

General

The contents of this area is thoroughly described in the Anybus-S Parallel Design Guide. This chapter describes how to interpret the information when using the Anybus-M PROFIBUS DP-V1 module.

Note that all registers in this area is read-only.

Registers

Module Status Register (FE2h...FE3h)

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
(reserved)					APRS	CD	APFC	(reserved)			RDR	FBSPU	FBS	FBFC	FBRS
(MSB)															(LSB)

- **FBRS**
 - 0:** There is Data Exchange with any of the assigned slaves
 - 1:** There is Data Exchange with at least one of the assigned slaves
- **FBFC**
 - 0:** Data from a slave in the OUT area are cleared if a slave is not in Data Exchange
 - 1:** Data from a slave in the OUT area are frozen if a slave is not in Data Exchange
- **FBS**
 - :** (Not used, set to zero)
- **FBSPU**
 - :** (Not used, set to zero)
- **RDR**
 - 0:** No action
 - 1:** A reset is requested by the module since a new database has been downloaded.
- **APFC**
 - :** (Not used, set to zero)
- **CD**
 - :** (Not used, set to zero)
- **APRS**
 - (See 7-2 “Watchdog Counter IN (FD2h...FD3h)”)
 - 0:** Application stopped
 - 1:** Application running

Changed Data Field (FECh...FEBh)

This field is not used by the Anybus-M PROFIBUS DP-V1.

Event Cause (FECh...FEDh)

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
(reserved)												RST	FBON	FBOF	CD
(MSB)												(LSB)			

- **CD**
-: (Not used, ignore)
- **FBOF (Redefinition)**
0: FBOF-event not issued
1: A FBOF-event has been issued. There is no data exchange with any of the assigned slaves (i.e. FBRS bit in Module Status register is cleared by the module)
- **FBON (Redefinition)**
0: FBON-event not issued
1: A FBON-event has been issued. Exchanging data with at least one of the assigned slaves (i.e. FBRS bit in Module Status register is set by the module)
- **RST - Reset notification**
0: RST-event not issued
1: A RST-event has been issued. The module requests the application to reset the module since a new database has been downloaded (i.e. the RDR bit in the Module Status register is set by the module)

Event Notification (FEEh...FEFh)

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
(reserved)												RST	FBON	FBOF	CD
(MSB)												(LSB)			

- | | |
|---|---|
| <ul style="list-style-type: none"> • CD
-: (Not used, ignore) • FBOF (Redefinition)
 0: FBOF-event disabled
 1: FBOF-event enabled | <ul style="list-style-type: none"> • FBON (Redefinition)
 0: FBON-event disabled
 1: FBON-event enabled • RST - Reset notification
 0: RST-event disabled
 1: RST-event enabled |
|---|---|

Watchdog Counter IN (FD2h...FD3h)

The application may enable the watchdog function in the Anybus module during initialization (Refer to the 'Anybus Init'-telegram in the general Anybus-S Parallel Design Guide). If this function is enabled and the application stops updating the watchdog register (application stopped) the module will automatically enter STOP mode after the specified watchdog time.

See also 7-1 "Module Status Register (FE2h...FE3h)".

Error Codes

DP Error Codes

Return Codes

For the messages that returns a status value called 'Return Code' the following table is used to interpret the meaning of these responses.

Value	Name	Meaning
8010h	DPMC_ERR_V1C_CLOSED	Internal DPMC instance does no longer exist.
8011h	DPMC_ERR_V1C_STOPPED	Internal DPMC instance has already been stopped
8012h	DPMC_ERR_V1C_STARTED	Internal DPMC instance has already been started
8013h	DPMC_ERR_V1C_STATE_UNKNOWN	Internal DPMC instance has entered an undefined state
8021h	DPMC_ERR_V1C_REQ_ACTIVE	A request is already active
8022h	DPMC_ERR_V1C_NOT_ALLOWED	Internal DPMC module not initialized correctly
8023h	DPMC_ERR_V1C_INVALID_PAR	Invalid parameter in user request
8024h	DPMC_ERR_V1C_MEM_ALLOC	Internal memory allocation error
8025h	DPMC_ERR_V1C_L2_REQ	Unknown opcode in the confirmation
8026h	DPMC_ERR_V1C_TIMEOUT	Active request terminated with timeout
8028h	DPMC_ERR_V1C_INVALID_LEN	Invalid length in user request
8030h	DPMC_ERR_V1C_REQ_NEG	Negative indication from lower layer (see 'Error Codes' below)
8031h	DPMC_ERR_V1C_REQ_RE	Message frame format error in response
8042h	DPMC_ERR_V1C_REQ_WITHDRAW	Request was recalled
8043h	DPMC_ERR_V1C_REQ_NOT_FOUND	Associated request block not found
80C1h	DPMC_ERR_V1C_MM_FE	Format error in request frame
80C2h	DPMC_ERR_V1C_MM_NI	Function not implemented
80C3h	DPMC_ERR_V1C_MM_AD	Access denied
80C4h	DPMC_ERR_V1C_MM_EA	Area too large
80C5h	DPMC_ERR_V1C_MM_LE	Data block length to large
80C6h	DPMC_ERR_V1C_MM_RE	Format error in response frame
80C7h	DPMC_ERR_V1C_MM_IP	Invalid parameter
80C8h	DPMC_ERR_V1C_MM_SC	Sequence conflict
80C9h	DPMC_ERR_V1C_MM_SE	Sequence error
80CAh	DPMC_ERR_V1C_MM_NE	Area non existent
80CBh	DPMC_ERR_V1C_MM_DI	Data incomplete or incorrect
80CCh	DPMC_ERR_V1C_MM_NC	Master parameter set not compatible

Error Codes

Consult the PROFIBUS DP specification for information on how to interpret these status values.

Value	Name	Meaning
01h	L2_STATUS_UE	(Consult the PROFIBUS DP specification)
02h	L2_STATUS_RR	
03h	L2_STATUS_RS	
0Ch	L2_STATUS_RDL	
0Dh	L2_STATUS_RDH	
0Fh	L2_STATUS_NA	

DP-V1 Error Codes

Class 1-Related Errors

Related mailbox commands:

- Class 1 Read (FB_APPL_MSAC1_READ)
- Class 1 Write (FB_APPL_MSAC1_WRITE)
- PROFIdrive V3 Acyclic Parameter Access (FB_APPL_MSAC1_PROFIDRIVE_V3_PARAM_WRITE)

Possible error codes in Message Data word 'Return Code'

Value	Name	Meaning
0000h	DPMC_ERR_M_NO_INFO	No additional information
0003h	DPMC_ERR_M_MEM_ALLOC	Internal memory allocation error
0004h	DPMC_ERR_M_L2_REQ	Unknown opcode in the confirmation
0005h	DPMC_ERR_M_INVALID_PAR	Invalid parameter in user request
0007h	DPMC_ERR_M_NOT_IN_DATA	Slave is not in DataExchange (thus no DP-V1 request can exist)
0012h	DPMC_ERR_M_REQ_ACTIVE	A request is already active
0018h	DPMC_ERR_M_NOT_ALLOWED	Internal DPMC module not initialized correctly
0021h	DPMC_ERR_M_CLOSED	Internal DPMC instance no longer exists
0022h	DPMC_ERR_M_STOPPED	Internal DPMC instance has already been stopped
0023h	DPMC_ERR_M_STARTED	Internal DPMC instance has already been started
0024h	DPMC_ERR_M_STATE_UNKNOWN	Internal DPMC instance has entered an undefined state
002Bh	DPMC_ERR_M_BLOCK_LEN_INVALID	Buffer provided by the user is not sufficient
002Fh	DPMC_ERR_M_SLAVE_NOT_FOUND	Slave does not respond
0031h	DPMC_ERR_M_TIMEOUT	Active request terminated with timeout
0034h	DPMC_ERR_M_INVALID_LEN	Invalid length in user request
0035h	DPMC_ERR_M_REQ_NEG	Negative indication from lower layer
0036h	DPMC_ERR_M_REQ_RE	Message frame format error in response
0037h	DPMC_ERR_M_REQ_WITHDRAW	Request was recalled
0038h	DPMC_ERR_M_REQ_NOT_FOUND	Associated request block not found
0040h	DPMC_ERR_M_MM_FE	Format error in request frame
0041h	DPMC_ERR_M_MM_NI	Function not implemented
0042h	DPMC_ERR_M_MM_AD	Access denied
0043h	DPMC_ERR_M_MM_EA	Area too large
0044h	DPMC_ERR_M_MM_LE	Data block length too large
0045h	DPMC_ERR_M_MM_RE	Format error in response frame
0046h	DPMC_ERR_M_MM_IP	Invalid parameter
0047h	DPMC_ERR_M_MM_SC	Sequence conflict
0048h	DPMC_ERR_M_MM_SE	Sequence error
0049h	DPMC_ERR_M_MM_NE	Area non-existent
004Ah	DPMC_ERR_M_MM_DI	Data incomplete or incorrect
004Bh	DPMC_ERR_M_MM_NC	Master parameter set not compatible
004Ch	DPMC_ERR_M_S7_XA	PROFIBUS error for DP-V1 (NRS-PDU received)
004Dh	DPMC_ERR_M_S7_XR	
004Eh	DPMC_ERR_M_S7_XW	

Class 2-Related Errors

Related mailbox commands:

- Class 2 Connection Initiate (FB_APPL_MSAC2_INITIATE)
- Class 2 Connection Abort (FB_APPL_MSAC2_ABORT)
- Class 2 Connection Abort Indication (FB_APPL_MSAC2_ABORT_IND)
- Class 2 Read (FB_APPL_MSAC2_READ)
- Class 2 Write (FB_APPL_MSAC2_WRITE)
- Class 2 Data Transport (FB_APPL_MSAC2_DATA_TRANSPORT)
- Class 2 Connection Status (FB_APPL_MSAC2_CNXXN_STATUS)

Possible error codes in extended word 'Extended Fault Information'.

Value	Name	Meaning
0001h	FBO_DP-V1_C2_SLAVE_NOT_FOUND	The specified slave cannot be found
0002h	FBO_DP-V1_C2_C_REF_OUT_OF_RANGE	The specified connection reference is out-of-range
0003h	FBO_DP-V1_C2_C_REF_ALREADY_IN_USE	The specified connection reference is already in use
0004h	FBO_DP-V1_C2_C_REF_NOT_IN_USE	A connection with this reference does not exist
0005h	FBO_DP-V1_C2_REQ_SIZE_TOO_BIG	Too much data supplied to the slave
0006h	FBO_DP-V1_C2_CONNECTION_ABORTED	The specified connection reference has been aborted. ^a
0007h	FBO_DP-V1_C2_ONE_CMD_PER_C_REF	Only one command per connection can be executed at a time
0008h	FBO_DP-V1_C2_SEND_TIMEOUT_TOO_SMALL	The passed send-timeout is too small ^b
0009h	FBO_DP-V1_C2_NO_MORE_CONNECTIONS	Slave does not support any more connections, or does not support DP-V1
0010h	FBO_DP-V1_C2_OTHER_ERROR	Other error

a. The reason can be read using the FB_APPL_MSAC2_CNXXN_STATUS message, see "Class 2 Connection Status (FB_APPL_MSAC2_CNXXN_STATUS)" on page 64

b. The minimum send-timeout of the slave is indicated in the mailbox response.

Message Error Codes (END_INIT)

General Information

The END_INIT mailbox message returns error codes if initialisation and start-up of the PROFIBUS stack and/or ASIC was not possible. In this case the error code returned in Extended Word 8 will indicate the reason of the failure.

Extended Word 8

Value	Meaning	Suggested Action
0002h	Failed to initialise Layer2 memory manager	Check and verify that the bus- and/or master parameter records are correct with respect to the network and the attached nodes. If problems persists, record the database contents and contact HMS technical support.
0003h	Failed to allocate memory for the Layer2 memory manager	
0004h	Failed to start Layer2 module	
0005h	Failed to start Layer2 device	
0006h	Failed to perform Layer2 MAC reset	
0007h	Failed to open FDL canal to Layer2	
0008h		
0009h	Failed to initialise the DPMC module	
000Ah	Failed to open the DPMC channel	
000Bh	Failed to start the DPMC_M module	
000Ch	Failed to start the DPMC_V1C module	
000Dh	Failed to start the DPMC_V1S module	

Extended Word 7

This register may, depending on the error code in Extended Word 8, contain additional information. Be sure to include this error code, if available, in any report sent to HMS.

Connectors

Application Connector

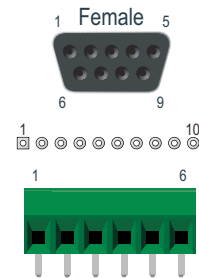
The application connector features a standard Anybus-S 2kbyte parallel DPRAM interface. However, by utilizing pin 34 of the application as address line 11 (A11), the module supports an effective address range of 4kbyte instead of the standard 2kbyte.

(Consult the general Anybus-S Parallel Design Guide for more information.)

Fieldbus Interface

Pinouts for various connector types are presented below. The standard connector is a 9-pin female dsub.

D-Sub (female)	Board to Board	Screw Terminal	Signal
Housing	1	5	Cable shield
1	4	-	-
2	7	-	-
3	6	4	B-Line
4	3	6	RTS
5	2	2	GND_BUS
6	8	1	+5V BUS (output)
7	9	-	-
8	5	3	A-Line
9	10	-	-

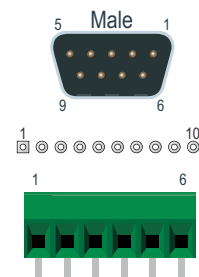


Serial Interface

This is an RS232-compatible serial interface, intended to be used with PC based configuration tools such as Anybus NetTool for PROFIBUS.

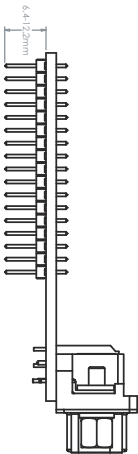
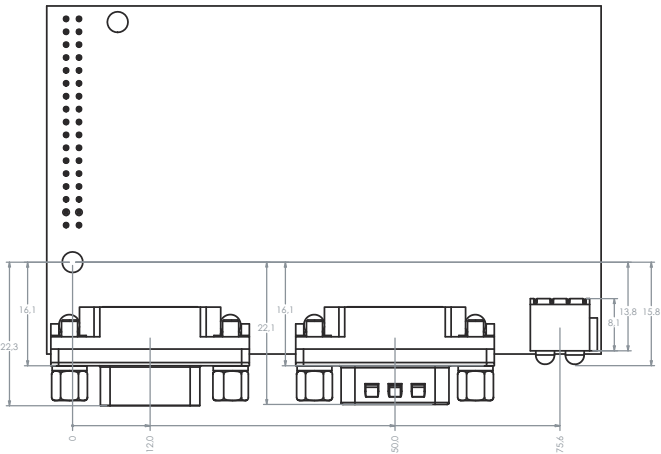
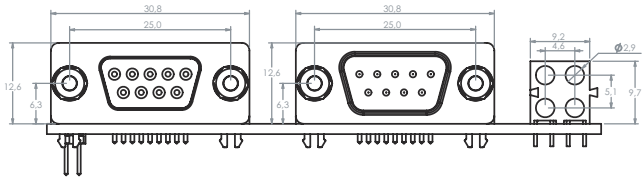
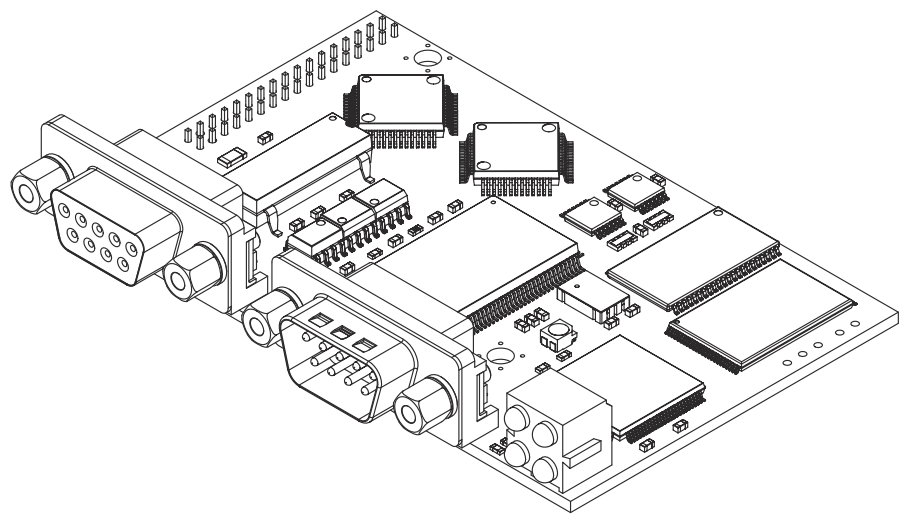
Pinouts for various connector types are presented below. The standard connector is a 9-pin dsub (male).

D-Sub (male)	Board to Board	Screw Terminal	Signal
Housing	1	-	PE
1	2	-	-
2	3	1	RxD
3	6	2	TxD
4	9	3	-
5	10	4	GND
6	4	-	-
7	5	5	-
8	7	6	-
9	8	-	-



Mechanical Specification

The PCB is designed according to the Anybus-S specification.



Electrical Characteristics

Power Supply

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 total maximum power consumption from the application side is 370mA

Protective Earth (PE) Requirements

In order to ensure proper EMC behaviour, the module must be properly connected to protective earth as described in the general Anybus-S Parallel Design Guide.

Environmental Specification

Temperature

Operating

+0 to +70 degrees Celsius

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

Non Operating

-25 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 55011:1998, 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

