User Manual

Profibus Master Module

Doc. No. H252-PDPM-1.31

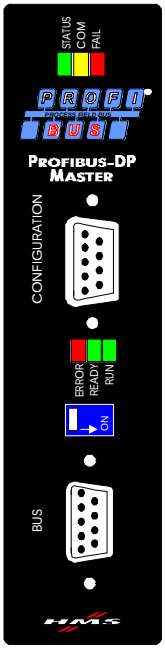

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Table of Contents

1. Introduction of PROFIBUS-DP

Profibus has a user international organisation called Profibus International, PI, and local national organisations, PNO.

The organisation assists members on a lot of matters concerning Profibus. For further information, contact PI/PNO on E-mail: 101644.2006@compuserve.com.

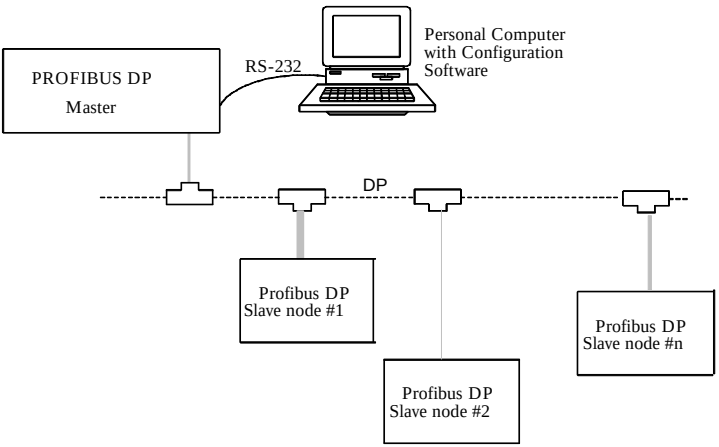
General Profibus information is available on Internet: WWW.PROFIBUS.COM.

Profibus-DP is used normally in industrial automation, to transfer fast data for motor controllers, MMI, I/O units and a lot of other industrial equipment.

1.1 Specifications

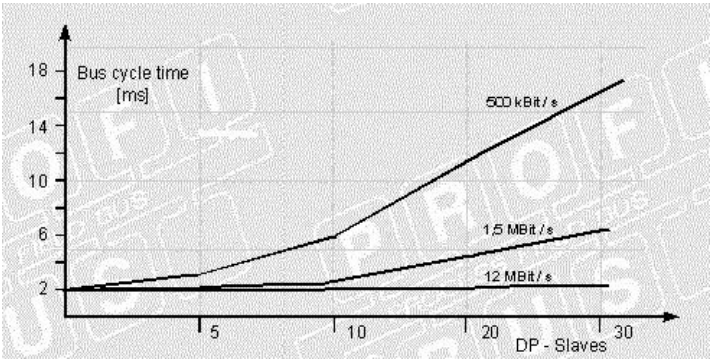
The media for the fieldbus is a shielded copper cable composed of a twisted pair. The baud rate for the bus is between 9.6kbaud to max. 12Mbaud. The Profibus-DP network can consist of 32 different modules (126 with a repeater) and the total amount of data for Profibus-DP are 246 Byte out/module and 246 Byte in/module.

Several different Profibus-DP Masters are available on the market, both for PLC-systems and PC computers



Picture 1: PROFIBUS-DP Overview

1.2 Technical Features for Profibus-DP



Picture 2: Bus cycle time of a Profibus-DP Mono Master system

Summary Technical Features PROFIBUS-DP

Transmission Technique: PROFIBUS DIN 19245 Part 1
-EIA RS 485 twisted pair cable or fibre optic
-9.6 kbit/s up to 12 Mbit/s, max. distance 200m at 1.5 Mbit/s extendible with repeaters

Medium Acces: hybrid medium access protocol according to DIN 19245 Part 1
-Mono-Master or Multi-Master systems supported
-Master and Slave Devices, max. 126 stations possible

Communications: Peer-to-Peer (user data transfer) or Multicast (synchronisation)
-Cyclic Master-Slave transfer and acyclic Master-Master data transfer

Operation Modes
-Operate: cyclic transfer of input and output data
-Clear: inputs are read and outputs are cleared
-Stop: only Master-Master functions are possible

Synchronization: enables synchronization of the inputs and/or outputs of all DP-Slaves
-Sync-Mode: Outputs are synchronized
-Freeze-Mode: Inputs are synchronized

Functionality:
-Cyclic user data transfer betwen DP-Master(s) and DP-Slave(s)
-Activation or deactivation of individual DP-Slaves
-Checking of the configuration of the DP-Slaves
-Powerful diagnosis mechanisms, 3 hierarchical levels of the diagnosis messages
-Synchronization of inputs and/or outputs -
Address assignments for the DP-Slaves over the bus -
Configuration of the DP-Master (DPM1) over the bus -
max. 246 bytes input and output data per DP-Slave, typical 32 bytes

Security and protection mechanisms:
-All messages are transmitted with Hamming Distance HD=4
-Watch-Dog Timer at the DP-Slaves
Access protection for the inputs/outputs at the DP-Slaves
-Data transfer monitoring with configurable timer interval at th DP-Master (DPM1)

Device-Types:
-DP-Master Class 2 (DPM2) e.g. programming/ configuration device -
DP-Master Class 1 (DPM1) e.g. central controller like PLC, CNC, RC … -
DP-Slave e.g. Input/Output device with binary or analogue inputs/outputs, drives …

Cabling and Installation:
-Connecting or disconnecting of stations without affection of other stations

2. The PROFIBUS Master Module

This section contains a general technical and functional description of the Profibus master unit (PBM).

2.1 Configuration

The Profibus master module can be configured using the external Profibus-DP Configurator (please refer to separate documents regarding the external Configuration Software).

2.2 Features

All Baud rates from 9.6 kbit/s up to 12 Mbit/s

Up to 124 stations

Max. 512 bytes in of process data

Max. 512 bytes out of process data

2.3 Function Description

The Profibus Master module (PBM), is designed to operate as a master unit in a Profibus network.

The PBM works together with the H252 unit from Hitachi in a BSH base. Two PBM units can be installed in the same base and each PBM can handle 512 bytes of input and 512 bytes of output.

The PBM is easy to use and configure. The configuration is done using the external Profibus Configurator. The only configuration done on the PBM is the ”Hold/Clear” selection and the ”Byte Swap” selection, see section 3 for further details.

For the programmer the PBM module will act like a normal link module, i.e. the Profibus I/O-data is stored in the link area. If an error is detected the ERROR-flag is

set to one and the corresponding error code is indicated in the ERROR-words most significant byte.

The PBM module supports the Profibus diagnostic software. This tool is a standard Profibus program for diagnostics. The PC with the diagnostics software is connected to the master modules Configurator port, see section 4 for the Configuration ports location on the front panel.
Please note that the PBM initialisation sequence takes a few seconds after power up. The best operating conditions are therefor achieved when the PLC is turned off until the STATUS LED indicates that the initialisation is completed. I.e. the STATUS LED is stable instead of flashing.

2.4 Electronics Electrical Characteristics

Symbol	Description	Type.	Unit
I (VCC 5V)	Input Current	600	mA

3. Installation and Configuration

The following section contains a description over the installation and configuration steps which the user has to observe.

3.1 Hardware setup

The hardware setup is done with a DIP-switch on the PBM circuit board. The DIP-switch is located on the circuit board and consists of four switches of which only the first and last are used in this version.

The hardware setup controls the following functions:

Switch 1. Hold/Clear
Switch 2. Not used
Switch 3. Not used
Switch 4. Byte Swap

Switch 2-3 are not used in this version of the PBM module.

HOLD / CLEAR

This function gives the user the opportunity to select whether or not the output data from the master should be set to zero when the CPU key is changed to STOP mode.

When switch 1 is in ON position, output data from the PBM will be forced to zero. When switch 1 is in OFF position, the PBM freezes current output data.

BYTE SWAP

This function gives the user the opportunity to select whether the H252 shall swap the High and Low-Bytes of a Word or not.

When switch 4 is in ON position, the most significant and least significant byte of a word are swapped.

When switch 4 is in OFF position, no swap is made.

3.2 Software Setup

The only configuration done from the PLC setup is to specify the number of words desired in the input / output areas. The largest of these areas should then be used to specify the length of the input / output areas, since the PLC automatically always sets the input area and the output area to the same size.

The PBM modules uses the LINK AREAS in the PLC memory. The first PBM module (the one installed closest to the CPU) uses LINK AREA 1. If a second PBM module is installed it will use LINK AREA 2. The size of the input / output areas is specified by the LINK END address of each LINK AREA. The LINK START address must always be set to zero. See section 5 for a detailed example of the configuration and setup.

3.3 Profibus Bus-cable

The pin layout of the Profibus connector follows the Profibus-DP standard according to the specifications below:

Pin in D-SUB	Pin in other connector types	Signal
1	5	Shield
2	-	-
3	4	B-Line
4	6	RTS (TTL)
5	2	GND Bus
6	1	+5V Bus
7	-	-
8	3	A-Line
9	-	-

4. Indications and PBM front panel

All Profibus status information is available on the PBM front panel according to figure 4.

4.1 Information available for the PLC

There is also some information for the PLC, this information is stored in the WR area according to the table below:

NAME	ADDRESS LINK 1	ADDRESS LINK2
ERROR	WRF0F9	WRF159
MAX REFRESH TIME	WRF13D	WRF19D
MIN REFRESH TIME	WRF13E	WRF19E
PREVIOUS REFR. TIME	WRF13F	WRF19F

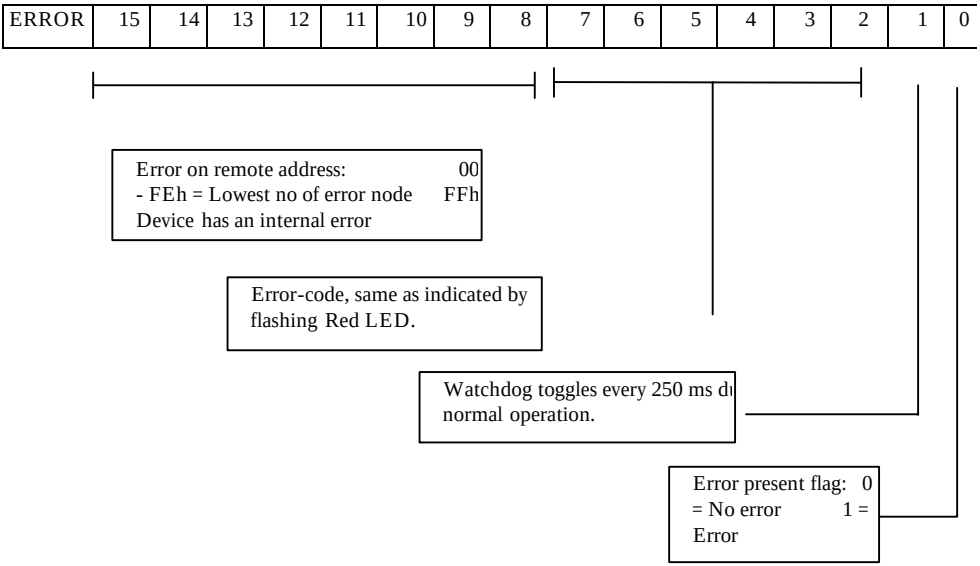


Figure 3. Content of ERROR-word

Bit 0 in the ERROR register is set if the PBM is in error-mode (Red LED flashing a number of times equivalent with the error-code). The error-code is stored in the Least significant byte, bits2-7, see figure 3. Bit 1 in the ERROR register is toggling every 250 ms during normal operation (data is transferred). This bit is working as a watchdog for the PLC-program.
The min, max and previous time is the time of one communication cycle. Min and max refresh time is the longest and shortest times measured. Previous refresh time is the time that the last communication cycle used. The times are all measured in ms. Note that the cycle time here refers to the transfer of data between the PLC and the PBM and does not to the bus cycle time

4.2 The LED indicators

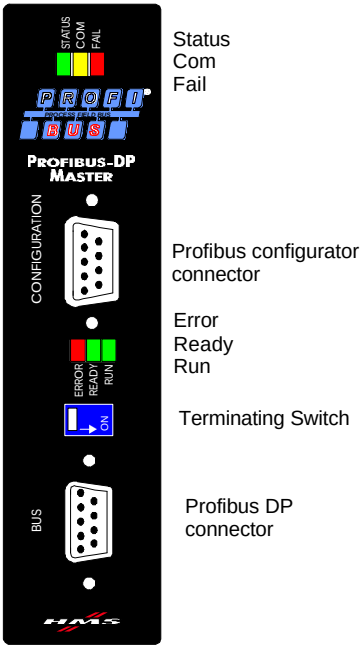


Figure 4. The LED indicators

The LED's (Light Emitting Diodes) indicates the following:

LED	*Function*
STATUS	Flashing: The module is initialising. Lit: Profibus Master Module is ready.
COM	PLC is running and the module is transferring data.
FAIL	Flashing: The number of flashes separated by a longer delay, is equivalent to the error code.
ERROR	Bus Error.
READY	Lit: The master-part of the module is Ready to communicate. Flashing: New configuration is being downloaded.
RUN	Lit: The device is transferring data to the Profibus Network. Flashing: Initialising the Profibus network..

4.3 Termination

The end nodes in a Profibus-DP network has to be terminated to avoid reflections on the bus line. The Profibus-DP master module is equipped with a termination switch to accomplish this in an easy way. If the module is used as the first or last module in a network the termination switch has to be in ON position. Otherwise the switch has to be in OFF position.

PLEASE NOTE: If an external termination connector is used the switch must be in OFF position.

Termination switch **ON**	Bus termination enabled If the module is the last or first module, the bus termination has to be set on, or an external termination connector has to be used
Termination switch **OFF**	Bus termination disabled

4.4 Error Codes

Error is indicated when the FAIL-LED is flashing. The error code is determined by the number of flashes done by the LED.

The Error Codes correspond to the following messages:

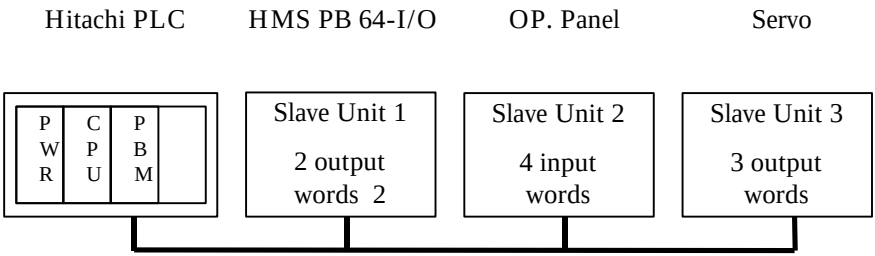
Error Code	Type of Error
1	Failed to initialise Profibus-DP Master.
2	Start Address of the LINK AREA in the PLC is not zero.
3	LINK LENGTH of the PLC equals zero or is larger than FF Hex.
4	Slot is not configured as LINK in the PLC.
5	Communication with PLC failed.
6	Internal Error on Profibus-DP Master.

5. Programming the PBM

The following section contains a simple step by step guide about how to use the PBM in a project.

5.1 Make a map over the Profibus-DP Network.

The first step is to document (Map) the Profibus-DP system in the application. Doing so the number of input and output words will be given. If either the input area or the output area exceeds 255 words, two separate Profibus networks have to be used.



5.2 Installing the PBM-module.

The PBM module fits in a BSH base with a H252 Hitachi CPU. The only hardware set-up done on the PBM circuit is the ”Hold/Clear” configuration described above. If two PBM modules are installed in the same base, the PBM module closest to the CPU will operate on LINK AREA 1 and the second will operate on LINK AREA 2.

5.3 Configuring the Profibus-DP Master.

Use the Profibus-DP configurator port to configure the Profibus-DP network. Write down on which addresses the different modules input and output words are mapped. Also make sure that the network node addresses match with the ones designated to the modules.

Note: The addresses given in the Configurator software are given in byte units and the addresses in the PLC is given in word units.
Example of Configuration:

Node Name	Node Address	Input Area (bytes)	Output Area (bytes)
HMS PB 64-I/O	02	0-3	0-3
OP. Panel	03	4-11	-
Servo	04	-	4-9

5.4 Transfer the Profibus-DP MAP to the PLC programming project.

When the Profibus system is configured the MAP has to be transferred to the PLC program. Observe that the PLC automatically dedicates the same size to both input and output areas. Therefor the largest of the two has to be used when determining the LINK LENGTH. Since only one PBM module is needed it will work with data in LINK AREA 1. The system above gives the following PLC set-up:

WL1 START address:	00H	(always zero)
WL1 END address:	05H	(the largest address is the input with 6 words (12 bytes))

Address	*Label*	*Description*
WL0000	HMS64_OUT1	First output word of the PB 64-I/O module
WL0001	HMS64_OUT2	Second output word of the PB 64-I/O module
WL0002	SERVO_1	First output word of the Servo module
WL0003	SERVO_2	Second output word of the Servo module
WL0004	SERVO_3	Third output word of the Servo module
WL0005	-	Does not exist as output to the Profibus network
WL0006	HMS64_IN1	First input word of the PB 64-I/O module
WL0007	HMS64_IN2	Second input word of the PB 64-I/O module
WL0008	OP_1	First input word of the Op. Panel
WL0009	OP_2	Second input word of the Op. Panel
WL000A	OP_3	Third input word of the Op. Panel
WL000B	OP_4	Fourth input word of the Op. Panel

5.5 Write the PLC program.

The last step is to write the actual PLC program. If all the steps above are accomplished the program will be much easier to write and maintain for the future.