JetWeb

JX2-PROFI1

Operator's Manual

Jetter
AKTIENGESELLSCHAFT

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Edition 2.0

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This Manual is an Integral Part of the JetControl Module JX2-PROFI1:

Model:	
Serial Number:	
Year of Manufacture:	
Order Number:	

To be entered by the customer:

Inventory Number:	
Place of Operation:	

Significance of this Operator’s Manual

This manual is an integral part of the JX2-PROFI1 module, and

- must be kept in a way that it is always at hand until the JX2-PROFI1 module will be disposed of;
- if the JX2-PROFI1 module is sold, alienated or loaned, this manual must be handed over.

In any case you encounter difficulties to clearly understand the manual, please contact the manufacturer.
We would appreciate any kind of suggestion and contributions on your part and would ask you to inform or write us. This will help us to produce manuals that are more user-friendly and to address your wishes and requirements.

From this JX2-PROFI1 module may result unavoidable residual risks to persons and property. For this reason, any person who has to deal with the operation, transport, installation, maintenance and repair of the JX2-PROFI1 module must have been familiarised with it and must be aware of these dangers.
Therefore, this person must carefully read, understand and observe this manual, and especially the safety instructions.

Missing or inadequate knowledge of the manual results in the loss of any claim of liability on part of Jetter AG. Therefore, the operating company is recommended to have the instruction of the persons concerned confirmed in writing.

1 Safety Instructions

The JX2-PROFI1 module is in line with the current state of the art. The JX2-PROFI1 module complies with the safety regulations and standards in effect. Special emphasis was given to the safety of the users.

Of course, the following regulations apply to the user:

- relevant accident prevention regulations;
- accepted safety rules;
- EC guidelines and other country-specific regulations.

Usage as Agreed Upon

Usage as agreed upon includes operation in accordance with the operating instructions.
The JX2-PROFI1 module is used to control machinery, such as conveyors, production machines, and handling machines.
The supply voltage of the JX2-PROFI1 module is DC 24 V . This operating voltage is classified as SELV (Safety Extra Low Voltage). The JX2-PROFI1 module is therefore not subject to the EU Low Voltage Directive.
The JX2-PROFI1 module may only be operated within the limits of the stated data.

Usage Other Than Agreed Upon

The JX2-PROFI1 module must not be used in technical systems which to a high degree have to be fail-save, e.g. ropeways and aeroplanes.l

If the JX2-PROFI1 module is to be run under surrounding conditions, which differ from the conditions mentioned below, the manufacturer is to be contacted beforehand.

Who is Permitted to Operate the JX2-PROFI1 Module?

Only instructed, trained and authorised persons are permitted to operate the JX2-PROFI1 module.
Mounting and backfitting may only be carried out by specially trained personnel, as specific know-how will be required.

Maintaining the JX2-PROFI1 Module

The JX2-PROFI1 module is maintenance-free. Therefore, for the operation of the module no inspection or maintenance are required.

Decommissioning and Disposal of the JX2-PROFI1 Module

Decommissioning and disposal of the JX2-PROFI1 module are subject to the environmental legislation of the respective country in effect for the operator's premises.

Descriptions of Symbols

Danger

This sign is to indicate a possible impending danger of serious physical damage or death.

Caution

This sign is to indicate a possible impending danger of light physical damage. This sign is also to warn you of material damage.

Important!

This sign is to indicate a possible impending situation which might bring damage to the product or to its surroundings.

Note!

You will be informed of various possible applications and will receive further useful suggestions.

· / -

Enumerations are marked by full stops, strokes or scores.

Operating instructions are marked by this arrow.

Automatically running processes or results to be achieved are marked by this arrow.

Illustration of PC and user interface keys.

1.1 Ensure Your Own Safety

- Disconnect the JX2-PROFI1 module from the mains to carry out maintenance work. By doing so, you will prevent accidents resulting from electric voltage and moving parts.
- Safety and protective devices, e.g. the barrier and cover of the terminal box must never be shunted or by-passed.
- Dismantled protective equipment must be reattached prior to commissioning and checked for proper functioning.

Modifications and Alterations to the Module

For safety reasons, no modifications and changes to the JX2-PROFI1 module and its functions are permitted. Any modifications to the module not expressly authorised by the manufacturer will result in a loss of any liability claims to Jetter AG.

The original parts are specially designed for the JX2-PROFI1 module. Parts and equipment of other manufacturers are not tested on our part, and are, therefore, not released by us. The installation of such parts may impair the safety and the proper functioning of the JX2-PROFI1 module.

For any damages resulting from the use of non original parts and equipment any claims with respect to liability of Jetter AG are excluded.

Malfunctions

- Malfunctions or other damages are to be reported to an authorised person immediately.
- Safeguard the JX2-PROFI1 module against misuse or accidental use.
- Only qualified experts are allowed to carry out repairs.

Information Signs and Labels

- Writings, information signs, and labels always have to be observed and kept readable.
- Damaged or unreadable information signs and labels are to be exchanged.

1.2 Instructions on EMI

The noise immunity of a system corresponds to the weakest component of the system. For this reason, correct wiring and shielding of the cables is important.

Important!

Measures for increasing immunity to interference:

- On principle, physical separation should be maintained between signal and voltage lines.
- Shield both sides of the cable.
- The entire shield must be drawn behind the isolation, and then be clamped under an earthed strain relief with the greatest possible surface area.

When male connectors are used:

- Only use metallised connectors, e.g. SUB-D with metallised housing. Please take care of direct connection of the strain relief with the housing here as well (refer to Fig. 1).

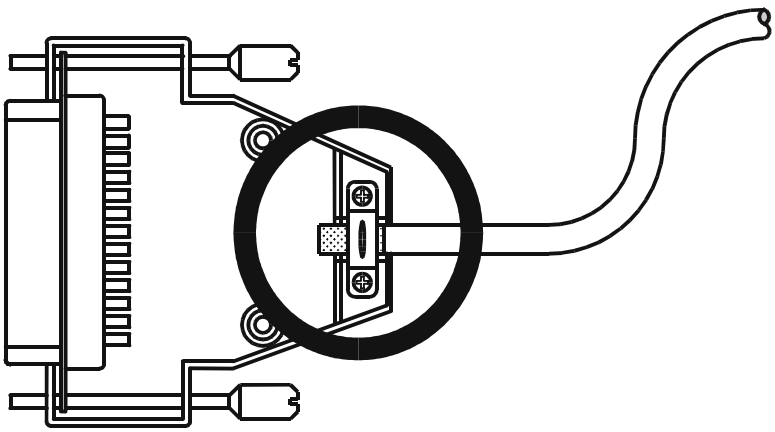


Fig. 1: Shielding of SUB-D connectors in conformity with the EMC standards.

1.3 Device Specific Prevention of Risks

1.3.1 Connecting Two PROFIBUS Participants

Danger

If two PROFIBUS participants being distant from each other are to be connected, please make sure they have got the same potential.

1.3.2 The Use of Specific Connectors

Danger

Only connectors specified as PROFIBUS connectors may be used, as they should already have been equipped with the terminating resistor, which can be activated with the help of a special switch.
For baud rates that are greater than 1.5 MBaud, specific PROFIBUS connectors for the reduction of cable capacitances must be applied.

Only use cables which have been specified as cable type A in the PROFIBUS Standard EN 50 170.

The maximum cable lengths defined in the PROFIBUS Standard EN 50 170 must be maintained.

2 Physical Dimensions

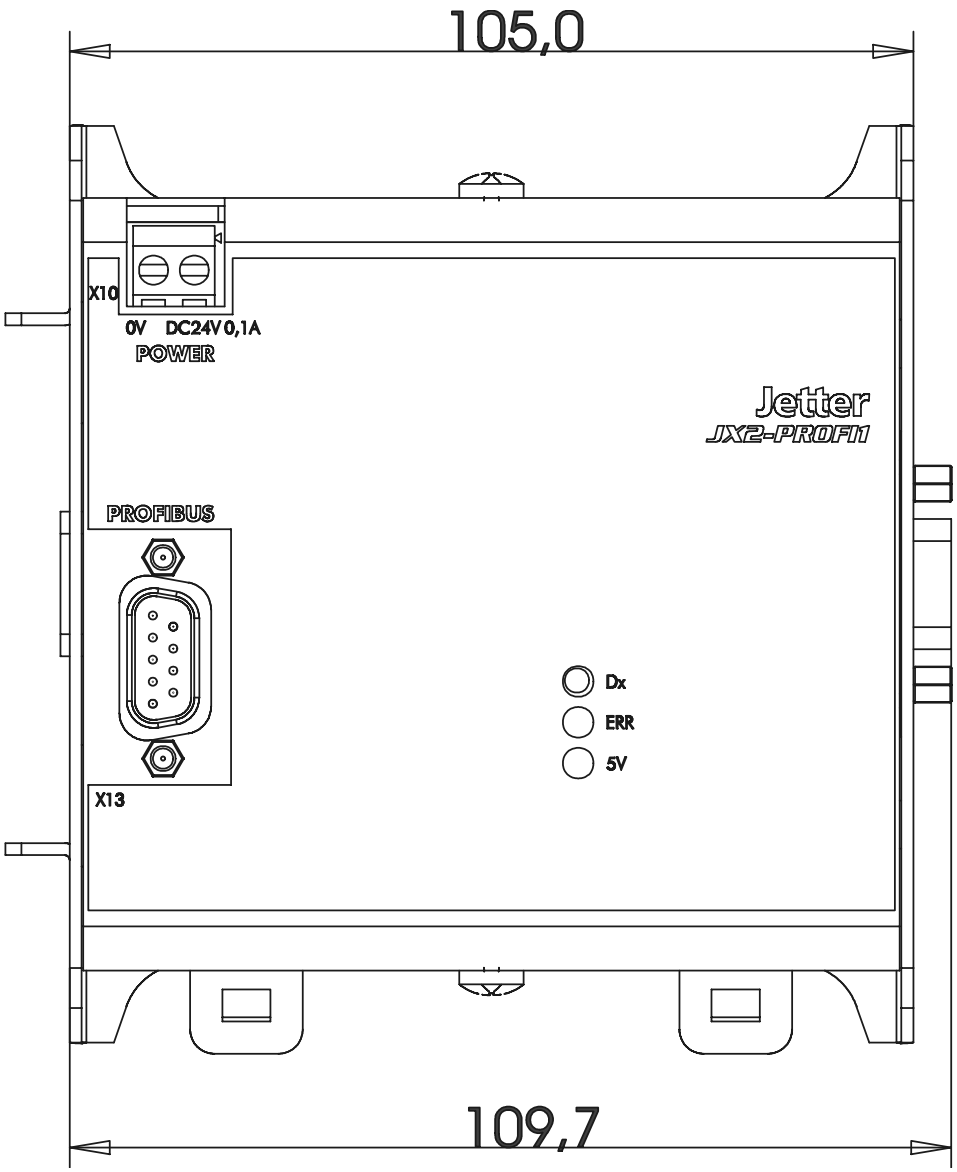


Fig. 2: Front View - JX2-PROFI1

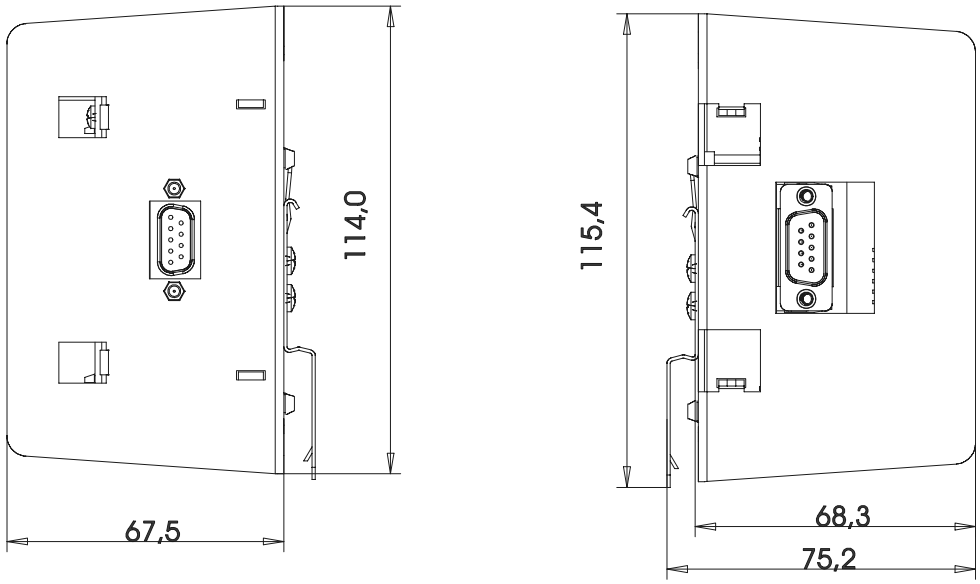


Fig. 3: Side View - JX2-PROFI1

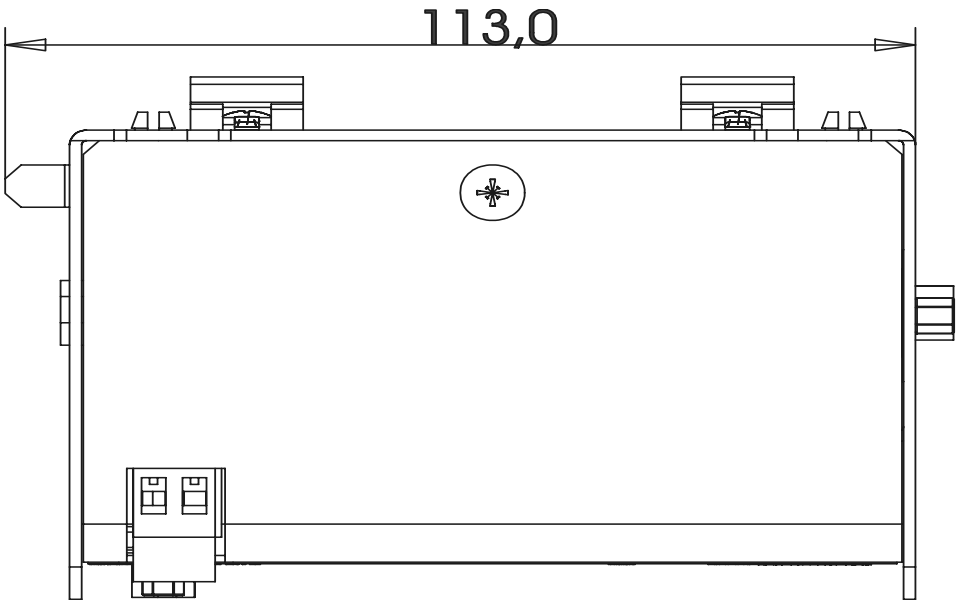


Fig. 4: Top View - JX2-PROFI1

3 Operating Parameters

Environmental Operating Parameters		
Parameter	**Value**	**Reference**
Operating Temperature Range	0 °C through 50 °C	
Storage Temperature Range	-25 °C through +70 °C	DIN EN 61131-2 DIN EN 60068-2-1 DIN EN 60068-2-2
Air Humidity / Humidity Rating	5 % to 95 % No condensing	DIN EN 61131-2
Pollution Degree	2	DIN EN 61131-2
Corrosion Immunity/ Chemical Resistance	No special protection against corrosion. Ambient air must be free from higher concentrations of acids, alcaline solutions, corrosive agents, salts, metal vapours, or other corrosive or electroconductive contaminants.	
Operating Altitude	Up to 2000 m above sea level	DIN EN 61131-2

Mechanical Operating Parameters		
Parameter	**Value**	**Reference**
Free Falls Withstanding Test	Height of fall (units within packing): 1 m	DIN EN 61131-2 DIN EN 60068-2-32
Vibration Resistance	10 Hz - 57 Hz: with an amplitude of 0.0375 mm for continuous operation (peak amplitude of 0.075 mm) 57 Hz -150 Hz: 0.5 g constant acceleration for continuous operation (1 g constant acceleration as peak value), 1 octave per minute, 10 frequency sweeps (sinusoidal), all three spatial axes	DIN EN 61131-2 DIN EN 60068-2-6
Shock Resistance	15 g occasionally, 11 ms, sinusoidal half-wave, 2 shocks in all three spatial axes	DIN EN 61131-2 DIN EN 60068-2-27
Degree of Protection	IP20, rear: IP10	DIN EN 60529

Mechanical Operating Parameters		
Mounting Position	Any position, snapped on DIN rail	

Operating Parameters - Electrical Safety		
Parameter	**Value**	**Reference**
Class of Protection	III	DIN EN 61131-2
Dielectric Test Voltage	Functional ground is connected to chassis ground internally.	DIN EN 61131-2
Overvoltage Category	II	DIN EN 61131-2

Operating Parameters (EMC) - Emitted Interference		
Parameter	**Value**	**Reference**
Enclosure	Frequency 30 -230 MHz, limit 30 dB (µV/m) at 10 m distance frequency band 230-1000 MHz, limit 37 dB (µV/m) at 10 m distance (class B)	DIN EN 50081-1 DIN EN 55011 DIN EN 50081-2

Operating Parameters (EMC) - Immunity to Interference of Housing		
Parameter	**Value**	**Reference**
RF field, amplitude-modulated	Frequency band 27 - 1000 MHz Test field strength 10 V/m AM 80 % with 1 kHz Criterion A	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-3
Electro-magnetic HF field, pulse-modulated	Frequency 900 +/- 5 MHz Test field strength 10 V/m 50 % ON period Repetition frequency 200 Hz Criterion A	DIN EN 50082-2 DIN EN 61000-4-3

Operating Parameters (EMC) - Immunity to Interference of Housing		
ESD	Discharge through air: Test peak voltage 15 kV (Humidity Rating RH-2 / ESD-4) Contact Discharge: Test peak voltage 4 kV (severity level 2) Criterion A	DIN EN 50082-2 DIN EN 61131-2 DIN EN 61000-4-2

Operating Parameters (EMC) - Immunity to Interference of Signal Ports		
Parameter	**Value**	**Reference**
Asymmetric RF, amplitude-modulated	Frequency band 0.15 -80 MHz Test voltage 10 V AM 80 % with 1 kHz Source impedance 150 Ohm Criterion A	DIN EN 61000-6-2 DIN EN 61000-4-6
Burst	Test voltage 1 kV tr/tn 5/50 ns Repetition rate 5 kHz Criterion A	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-4

Operating Parameters (EMC) - Immunity to Interference of DC Power Supply In- and Outputs		
Parameter	**Value**	**Reference**
Asymmetric RF, amplitude-modulated	Frequency band 0.15 -80 MHz Test voltage 10 V AM 80 % with 1 kHz Source impedance 150 Ohm Criterion A	DIN EN 61000-6-2 DIN EN 61000-4-6
Burst	Test voltage 2 kV tr/tn 5/50 ns Repetition rate 5 kHz Criterion A	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-4

4 Technical Data

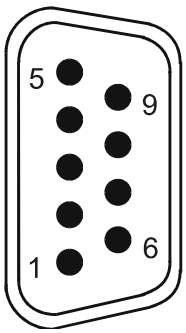
Technical Data - JX2-PROFI1	
Power Supply	• Centralised arrangement: via basic unit • Decentralised arrangement: via power supply
Voltage Supply	• DC 24 V • 0.1 A • at terminal X10
Connections to the basic unit via system bus	Male connector SUB-D, 9 pins
Connections	Power supply: screw terminals Profibus: female connector SUB-D, 9 pins
Enclosure	Metal
Dimensions (H x W x D in mm)	115 x 105 x 69
Mounting	DIN Rail
Heat loss	0.3 Watt

5 The Communication Module JX2-PROFI

5.1 The LEDs of the JX2-PROFI Module

The LEDs of the JX2-PROFI1 Module	
Designation	**Comment**
Dx	When this LED is lit, data exchange with the slave has been established successfully and correctly by the master
ERR	The LED is flashing: the module has not been configured completely yet; a correct station address has not been entered yet The LED is lit: An error has occurred; the reason for this error can be read out of a register
5 V	This LED indicates that the voltage supply of the module is ok

5.2 Pin Assignment of the Male SUB-D PROFIBUS Connector



Pin	Designation	Comment
1		
2		
3	RxD / TxD-P	Receive data / Sending data - positive
4	CNTR-P	Control signal for repeater (direction control)
5	DGND	Data transfer potential (ground to 5 V)
6	VP	Supply voltage of the terminating resistors - P, (P5V)
7		
8	RxD / TxD-N	Receive data / Sending data - negative
9		

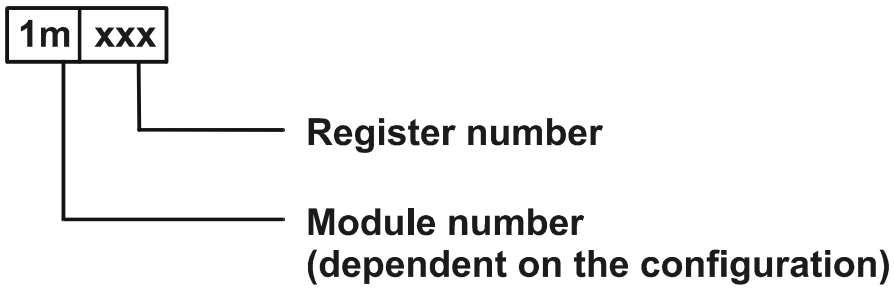
Fig. 5: Pin assignment of the male SUB-D 9-pin PROFIBUS connector

5.3 Features

5.4 The Registers of the JX2-PROFI1 Module

5.4.1 Definitions

Coding of the registers:



All registers that - referring to the PROFIBUS data exchange - are called **word registers, are 16 bit wide** (value range 0 .. 65535).
According to the PROFIBUS-DP standard, this data type is called "unsigned 16".

The terms "input" and "output" are always used from the "bus point of view", respectively from the view of the master. This means that inputs are sent from the slave to the master, outputs are sent from the master to the slave.

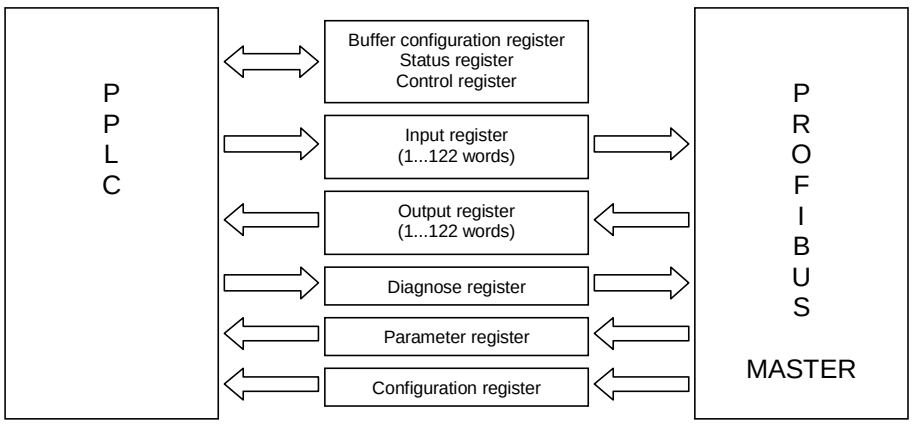


Fig. 6: Diagram: PPLC - PROFIBUS communication via registers

5.4.2 Configuring the JX2-PROFI1

After applying the power supply, the module delays, until a valid configuration via the registers has been made.
If the JX2-PROFI module has been configured correctly, communication with the PROFIBUS master will be processed automatically and independently from the user program. The user will be able to read and write data, to send diagnose telegrams and to monitor the status of the PROFIBUS via register.

Steps of configuration:

Buffer configuration
After start-up and initializing, the buffer configuration may have to be adjusted:
- Write the respective values into registers 1m112 and 1m113

Number of input and output words
Now set the number of PROFIBUS input and output words:
- Write the respective numbers into registers 1m102 and 1m103

After you have taken this following step, you will not be able to change the module configuration any more!

Initialize the PROFIBUS interface by setting the PROFIBUS station address
- Write the desired station address into register 1m107.

If, for example, a new station address is entered now, an error will be reported. Not before issuing a "reset“ command, you will be enabled again to alter the width of the I/O data and to assign a new station address.

Communication with the master
Check, whether communication has been established successfully:
- Call up register 1m100.

There is a difference between correct initialization of the JX2-PROFI module (bit 0 through 2) and established communication with the PROFIBUS master (bit 3).

If the connection with the master has been established properly, the following actions can be taken via the registers (see also Fig. 6: "Diagram: PPLC - PROFIBUS communication via registers", 24):

– Data can be exchanged via the input and output registers.
– Data can be read or written.
– Diagnose telegrams can be sent.
– The status of the PROFIBUS can be monitored.

5.4.3 Overview of the JX2-PROFI Registers

Register No.	Comment	RW/ Ro
1m100	Status register	Ro
1m101	Command register	RW
1m102	Number of PROFIBUS input words	RW
1m103	Number of PROFIBUS output words	RW
1m107	Station address of the PROFIBUS slave	RW
1m112	Start address of the input words	RW
1m113	Start address of the output words	RW
1m114	Number of registers for "read data block"	RW
1m115	Number of registers for "write data block"	RW
1m116	Start address of the data registers for "read data block"	RW
1m117	Start address of the data registers for "write data block"	RW
1m118	Width of the input data for "read data block" (number of bytes)	Ro
1m119	Width of the output data for "write data block" (number of bytes)	Ro
1m120	Slot address of the data set for "read data block"	Ro
1m121	Slot address of the data set for "write data block"	Ro
1m122	Index of the data set for "read data block"	Ro
1m123	Index of the data set for "write data block"	Ro
1m132	Status of the DP state machine	Ro
1m133	Recognized baud rate	Ro
1m134	Error number	Ro
1m135	Status of the baud rate monitoring	Ro
1m136	Error number of the PROFIBUS initializing	Ro
1m139	Pending diagnose command	Ro
1m140	Width of the diagnose data (number of bytes)	RW
1m141 ... 1m145	System diagnose data (word mode, low byte first)	RW

Register No.	Comment	RW/ Ro
1m146 ... 1m156	User diagnose data (word mode, low byte first)	RW
1m160	Width of the received parameter data (number of bytes)	Ro
1m161 ... 1m165	System parameter data (word mode, low byte first)	Ro
1m166 ... 1m176	User parameter data (word mode, low byte first)	Ro
1m180	Width of the received configuring data (number of bytes)	Ro
1m181 ... 1m196	Configuration data (word mode, low byte first)	Ro
1m197	reserved	Ro
1m198	reserved	Ro
1m199	Software version	Ro
1m200 ... 1m209	System diagnose data (byte mode)	RW
1m210 ... 1m231	User diagnose data (byte mode)	RW
1m232 ... 1m241	System parameter data (byte mode)	Ro
1m242 ... 1m263	User parameter data (byte mode)	Ro
1m264 ... 1m295	Configuration data (byte mode)	Ro
1m300 ... 1m999	Register range of the data exchange registers	RW

Ro: Read only
RW: ReadWrite

5.4.4 Register Description

Register 1m100: Status Register

Each status register bit has got its specific meaning. This is a read-only register.

Bit Number	Status	Comment
0	0 1	The buffer configuration is invalid. The buffer configuration is correct.
1	0 1	A station address has not been defined yet. The set station address is valid.
2	0 1	The PROFIBUS controller has not been configured yet / it has not been configured correctly. Initialization has been successful.
3	0 1	The module has not been configured by the PROFIBUS master yet. The module is in the data exchange state, i.e. communication with the master has been established successfully.
4	1	The PROFIBUS master has sent a "read data block" request.
5	1	The PROFIBUS master has sent a "write data block" request.
6	1	Acyclic busy bit: Acyclic data are exchanged between the module and the PROFIBUS master; the acyclic data cannot be accessed at the moment.
7	1	Acyclic error bit: Although bit 6 had been set, an acyclic data range has been accessed.
13	1	Busy bit: This bit indicates that the latest action has not been completed by the module yet. After reset, this bit will be set. At the end of the initialization phase, it will be reset again. The same applies to command 5. After writing the station address, this bit will remain set, until the PROFIBUS controller has been initialized completely.
	0	no error

15	1	An error has occurred. Register 1m134 holds the reason for the error.
Value range:		23-bit signed integer
Value after reset:		1

Register 1m101: Command Register

Various actions can be triggered via the command register. A read access provides the command processed last.

Command No.	Comment
5	Reset the module. The module will be reset into its initial state. After having issued this command, the module must not be accessed before bit 13 in the status register has been reset.
6	The error bit in the status register and the error number register is cleared. With the help of this command, errors can be acknowledged. Resetting the module by issuing command 5 will not clear an error report.
7	A status diagnose telegram will be sent (see 6.3).
8	An extended diagnose telegram will be sent. The data written in the diagnose data registers are being transmitted to the PROFIBUS master as a diagnose telegram (see 6.3).
9	The module is set into the state of static diagnosis.
10	The latest transmitting of a diagnose telegram will be cancelled (see 6.3).
11	The "read data block" request of the master is confirmed by OK.
12	The "read data block" request of the master is confirmed by NOT OK.
13	The "write data block" request of the master is confirmed by OK.
14	The "write data block" request of the master is confirmed by NOT OK.
Value range:	0 .. 255
Value after reset:	0

Register 1m102: Number of PROFIBUS Input Words

In this register, the number of words is defined, which are supplied by this module as inputs for the PROFIBUS master. The PROFIBUS master must be configured for the same data width.

Note!

The memory of the PROFIBUS controller is limited; thus, it is not possible to transmit the maximum number of input and output data simultaneously. The total number of input and output words must not exceed 208. This limit is dependent on the entire module configuration (cyclic and acyclic data exchange) and can thus decrease accordingly (see 6.2).

Value range:	0 .. 122
Value after reset:	4

When initializing of the module by writing the station address has been completed, this register cannot be written into any more. The values that are entered after this will be refused.

Register 1m103: Number of PROFIBUS Output Words

In this register, the number of words is defined, which are transferred from the PROFIBUS master to this module. The PROFIBUS master must be configured for the same data length.

Note!

The memory of the PROFIBUS controller is limited; thus, it is not possible to transmit the maximum number of input and output data simultaneously. The total number of input and output words must not exceed 208. This limit is dependent on the entire module configuration (cyclic and acyclic data exchange) and can thus decrease accordingly (see 6.2).

Value range:	0 .. 122
Value after reset:	4

When initializing of the module by writing the station address has been completed, this register cannot be written into any more. The values that are entered after this will be discarded.

Register 1m107: Station Address of the PROFIBUS Slave

The station address is defined via this register. Additionally, the PROFIBUS interface will be initialized by writing into this register. After this, changing the station address respectively changing the configuration is not possible any more. Writing into this register once more will cause an error.
Not before issuing a reset command (command 5 in register 1m101), the module can be configured again. In the PROFIBUS master, the module must be configured as a slave for the same address.
After writing the station address, the busy-bit will remain set in the status register, until initializing of the PROFIBUS controller has been completed. The application must be delayed, until this bit has been cleared.

Value range:	0 .. 126
Value after reset:	0

Important!

Address 126 has been reserved for PROFIBUS slaves that support a change of station numbers via PROFIBUS; thus, it should not be used for the PROFIBUS module itself.

Register 1m112: Start Address of the Input Word Range

The register range of the input data can be shifted within the module. This register contains the start address of the input word range. Register 1m102 contains the number of input words, i.e. the size of this range. This means that after reset, registers 1m300 to 1m303 will contain the input words.
An extensive description of various configuring possibilities can be found in chapter 6.1 "Buffer Configuration".

Value range:	300 .. 999
Value after reset:	300

When initializing the module by entering the station address has been completed, writing into this register will not be possible any more. The values entered after this will be discarded.

Register 1m113: Start Address of the Output Word Range

The register range of the output data can be shifted within the module. This register contains the start address of the output word range. Register 1m103 contains the number of output words, i.e. the size of this range. This means that after reset, registers 1m400 to 1m403 will contain the output words.
An extensive description of various configuring possibilities can be found in chapter 6.1 "Buffer Configuration".

Value range:	300 .. 999
Value after reset:	400

When initializing the module by entering the station address has been completed, writing into this register will not be possible any more. The values entered after this will be discarded.

Register 1m114: Number of Registers for "Read Data Block"

In this register, the number of registers that are supplied for the PROFIBUS master by the module, in case a "read data block" request is made. Two bytes will be stored in each register.
The memory of the PROFIBUS controller is limited. This limit is dependent on the entire module configuration (cyclic and acyclic data exchange) and can thus decrease accordingly (see 6.2).

Value range:	1 .. 120
Value after reset:	4

After initializing the module by entering the station address, this register cannot be written into any more. The values entered after this will be discarded.

Register 1m115: Number of Registers for "Write Data Block"

In this register, the number of registers that are supplied for the PROFIBUS master by the module, in case a "write data block" request is made. Two bytes will be stored in each register.
The memory of the PROFIBUS controller is limited. This limit is dependent on the entire module configuration (cyclic and acyclic data exchange) and can thus decrease accordingly (see 6.2).

Value range:	1 .. 120
Value after reset:	4

After initializing the module by entering the station address, this register cannot be written into any more. The values entered after this will be discarded.

Register 1m116: Start Address of the Data Registers for "Read Data Block"

The register range of the input data can be shifted within the module. This register contains the start address of the range, in which the data to be transmitted to the master have been stored.

Register 1m114 contains the number of words, i.e. the size of this range. This means that after reset, registers 1m700 to 1m703 can contain the data for the master.
An extensive description of various configuring possibilities can be found in chapter 6.1 "Buffer Configuration".

Value range:	300 .. 999
Value after reset:	700

When initializing the module by entering the station address has been completed, writing into this register will not be possible any more. The values entered after this will be discarded.

Register 1m117: Start Address of the Data Registers for "Write Data Block"

The register range of the input data can be shifted within the module. This register contains the start address of the range, in which the data from the master have been stored.

Register 1m117 contains the number of words, i.e. the size of this range. This means that after reset, registers 1m800 to 1m803 can contain the data transmitted by the master.
An extensive description of various configuring possibilities can be found in chapter 6.1 "Buffer Configuration".

Value range:	300 .. 999

Value after reset:	800

When initializing the module by entering the station address has been completed, writing into this register will not be possible any more. The values entered after this will be discarded.

Register 1m118: Width of the Input Data for "Read Data Block" (Number of Bytes)

In case of a "read data block" request, the PROFIBUS-DP master will store the number of **bytes** that are to be read out of this data range in this register.
This register will be set by the PROFIBUS-DP master; it cannot be written into.

Value range:	0 .. 240
Value after reset:	0

Register 1m119: Width of the Output Data for "Write Data Block" (Number of Bytes)

In case of a "write data block" request, the PROFIBUS-DP master will store the number of **bytes** that have been written into the data block in this register.
This register will be set by the PROFIBUS-DP master; it cannot be written into.

Value range:	0 .. 240
Value after reset:	0

Register 1m120: Slot Address of the Data Block for "Read Data Block"

In case of a "read data block" request, the PROFIBUS-DP master will store the slot address of the data block that is to be read out of the data range in this register.
This register will be set by the PROFIBUS-DP master; it cannot be written into.

Value range:	0 .. 254
Value after reset:	0

Register 1m121: Slot Address of the Data Block for "Write Data Block"

In case of a "write data block" request, the PROFIBUS-DP master will store the slot address of the data block that has been written into the data range in this register.
This register will be set by the PROFIBUS-DP master; it cannot be written into.

Value range:	0 .. 254
Value after reset:	0

Register 1m122: Data Block Index for "Read Data Block"

In case of a "read data block" request, the PROFIBUS-DP master will store the data block index which is to be read out of the data range in this register.
This register will be set by the PROFIBUS-DP master; it cannot be written into.

Value range:	0 .. 254
Value after reset:	0

Register 1m123: Data Block Index for "Write Data Block"

In case of a "write data block" request, the PROFIBUS-DP master will store the data block index which has been written into the data range in this register.
This register will be set by the PROFIBUS-DP master; it cannot be written into.

Value range:	0 .. 254
Value after reset:	0

Register 1m132: State within the DP State Machine

The state of the PROFIBUS controller can be read out of this register.

Register Value	State
0	Wait_Prm
1	Wait_Cfg
2	Data_ex

This is a read-only register and must thus not be written into.

Register 1m133: Baud Rate that has been recognized

The PROFIBUS controller will automatically recognize the baud rate of the master. In this register, the baud rate recognized last will be stored.

Register Value	Baud Rate
0	12 MBaud
1	6 MBaud
2	3 MBaud
3	1.5 MBaud
4	500 kBaud
5	187.5 kBaud
6	93.75 kBaud
7	45.45 kBaud
8	19.2 kBaud
9	9.6 kBaud

This is a read-only register and must thus not be written into.

Register 1m134: Error Number

If an error occurs in this module, bit 15 of the status register 1m100 will be set; the error LED will be lit. If the error bit has been set, the cause of this error can be read out of this register.
This register is only valid, if bit 15 of status register 1m100 is set.
The error can be cleared by issuing command 6.

Register Value	Error Cause
0	An error has not occurred
1	Invalid station address. Possible reasons: – The station address that has been entered is outside the permitted range (0...126). – The station address has already been set. – The buffer configuration is invalid.
2	Input or output range error. The input or output ranges of cyclic and acyclic processing have been configured. Either an invalid width has been defined, or two ranges have overlapped.
3	Reserved
4	Reserved
5	Reserved
6	Error during initialization of the PROFIBUS controller. The exact error cause is displayed in register 1m136.
7	During a check of the parameter telegram of the master, an error has occurred. The configuration of the master differs from the configuration of the slave.
8	During a check of the configuration telegram of the master, an error has occurred. The configuration of the master differs from the configuration of the slave.
9	The width of the diagnose data is not correct. The width must be within the range 6...32.
10	The diagnose telegram sent last has not been received by the master yet; an attempt has been made to send another diagnose telegram. The sending process of the first telegram can be interrupted by issuing command 10.
11	After reset of the module, an error has been detected during a memory check.

This is a read-only register and must thus not be written into.

Register 1m135: Status of Baud Rate Monitoring

The PROFIBUS controller is equipped with a baud rate monitoring mechanism and can thus recognize a breakdown of the master. The status of this monitoring process can be read out of this register.

Register Value	Status
0	Baud_Search
1	Baud_Control
2	DP_Control

This is a read-only register and must thus not be written into.

Register 1m136: Error Number of the PROFIBUS Initializing

In this register, the extended error code of the PROFIBUS controller initializing will be stored.
The value in this register is only effective, if the error bit has been set in status register 1m100 and if value 6 has been written into error number register 1m134.

Register Value	Error Cause
0	An error has not occurred
49	The memory of the PROFIBUS controller is not large enough for the required amount of data. The number of input or output words, or the buffer size for acyclic functions must be reduced.
other values	reserved

This is a read-only register and must thus not be written into.

Register 1m139: Pending Diagnose Command

In this register, the latest diagnose command will be stored, until the master has fetched the diagnose data. **This register must be checked, before a new diagnose command is sent or before new diagnose data are entered.**
Please find an extensive description of the diagnose data processing in section 6.3 "Diagnose".

Register Value	Diagnose Command
0	There has no diagnose command been defined / the latest command has been carried out; the data have been fetched by the master
1	Status diagnose
2	Extended diagnose
3	Static diagnose

Value range:	0 ... 3
Value after reset:	0

Register 1m140: Length of the Diagnose Data (Number of Bytes)

In this register, the width of the diagnose data will be defined in bytes. Please find an extensive description of the diagnose data processing in the section "Diagnose".

Registers 1m141...1m156 and 1m200...1m231: Diagnose Data

The diagnose data are stored in the following registers:

1m141...1m156: Diagnose data (word mode, low byte first)
1m200...1m231: Diagnose data (byte mode)

The format of the diagnose data must agree with the description in section "Diagnose".

Register 1m160: Length of the Received Parameter Data (Number of Bytes)

The length of the parameter data (number of bytes) that have been received from the master can be read out of this register.
As this is only a status register, it must not be written into.

Registers 1m161...1m176 and 1m232...1m263: Parameter Data

When the module has been parameterized by the PROFIBUS master, these data can be read out of the registers for information purposes. In order to meet the requirements of various applications, these data can be read either in word mode or in byte mode. For the structure of the parameter data, please refer to the section "Parameter Telegram".
The first ten bytes are set by the master. Thus, the parameters set by the user in the master configuration tool will be stored in the registers starting from 1m166 respectively 1m242.

1m161...1m176: Diagnose data (word mode, low byte first)
1m232...1m263: Diagnose data (byte mode)

As these are only status registers, they must not be written into.

Register 1m180: Width of the Received Configuration Data (Number of Bytes)

The width of the configuration data (number of bytes) received from the master can be read out of this register as bytes.
As this is only a status register, it cannot be written into.

Registers 1m181...1m196 and 1m264...1m295: Configuration Data

Just as the parameter data, the configuration data will also be stored for status purposes. For the structuring of the configuration data, see section "Configuration Telegram".

1m181...1m196: Diagnose data (word mode, low byte first)
1m264...1m295: Diagnose data (byte mode)

As these are only status registers, they must not be written into.

Register 1m197: Reserved

As this is only a status register, it must not be written into.

Register 1m198: Reserved

As this is only a status register, it must not be written into.

Register 1m199: Software Version

This register contains the software version number. The value corresponds to the version number times a hundred, this means that in case of version number 1.01, the register contains value 101.

As this is only a status register, it must not be written into.

Register 1m300...1m999: Range of Data

If a register from outside the range of configured data is read, the module will report back -1 (0xFFFFFF). Writing access to these registers will be ignored.
The same applies, if the configuration is invalid (status register bit 0 = 0).

The following rules apply within the configured ranges:

Input words:
A reading access will always cause the latest input value to be reported back.
A writing access will cause the new input value to be set.

Output words:
If the module is in data exchange mode, and if a valid station address has been defined, a reading access will cause the latest value of the PROFIBUS-DP master to be reported back. If the prerequisites have not been met, value -65536 (0xFF0000) will be reported back.
A writing access will never be possible, as these values are set by the PROFIBUS-DP master.

Reading and writing the acyclic data blocks:
A reading access will normally report back the latest value of the register. In case the data block has been inhibited by operating system of the module (status register bit 6 = 1), value -1 (0xFFFFFF) will be reported back and bit 7 will be set in the status register.
A new value can be set by writing access. In case bit 6 has been set in the status register, this value will be ignored and bit 7 will be set in the status register.

6 Description of Operations

6.1 Buffer Configuration

Data exchange between the user program and the PROFIBUS master is carried out via input and output registers. Each of these registers contains a data word of 16 bit. In order to keep the user program as flexible as possible, the memory area, to which this registers are to belong, is freely selectable. Two registers have been made available for this purpose. One register contains the start address of the respective memory area, the other register contains the number of data registers. This way, the input data starting from register 1m300, for example, and the output data starting from register 1m400, can be positioned.
As up to 122 input registers can be used, the memory areas would overlap in a configuration as the one described above. In order to avoid this, the configuration of the buffers can now be altered as well. The sketch below is to illustrate the interplay of the registers:

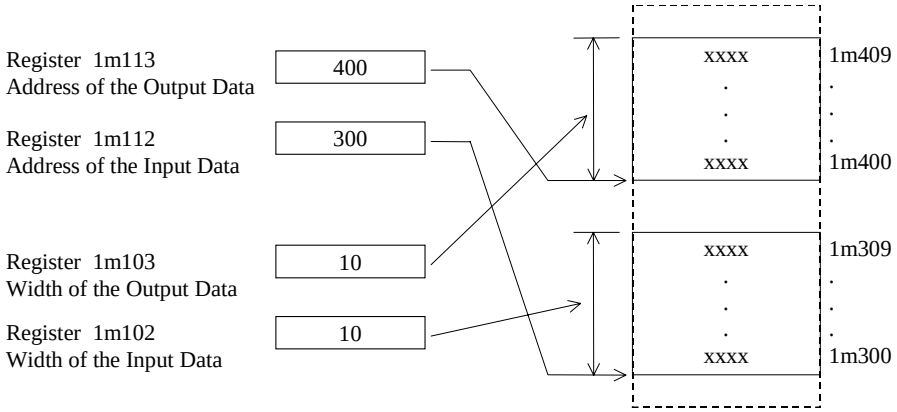


Fig. 7: Structure of the input and output buffers

The address range of registers 1m300 through 1m999 is freely available to the user. The data buffers can be freely distributed within this range. Letter m stands for the module number, which is dependent on the configuration of the controller.
The buffers may only be configured during the initialization phase. Under any other circumstances, the structure of the buffers cannot be changed. This is to keep the user from making access to a register which has not been defined.
When the user alters one of the buffer configuration registers, a check-up will be made to ensure that the changed buffer configuration is correct. Among other features, overlapping of various ranges and exceeding the permitted maximum widths will be checked. In case an error has occurred in this process, it will be displayed both in the error register 1m134 and in the error LED.

7 The Services

7.1 Acyclic Services

With the help of the acyclic services, the PROFIBUS-DP master can transmit data blocks to the slave (write data block) or query them from the slave (read data block), yet being independent from the time of cyclic data exchange. Such a request is signalized through a bit in the status register. In this case, the master will transmit the number of bytes, a slot address and an index which serve for more detailed identification of the required data block. The slave will be enabled by the slot address and the index to reconstruct various logic ranges in a slave. Each request made by the master (bit 4, respectively bit 5 in the status register) must be confirmed by issuing a command (commands 11 through 15 in the command register).
Acyclic data exchange can only be carried out with the same master as also serves the slave in cyclic data exchange.

Module configuration is carried out via the register pairs "Number of Registers" (reg. 1m114 respectively reg. 1m115) and "Start Address of the Data Registers" (reg. 1m116 respectively reg. 1m117) in analogy with the configuration of normal data exchange. Please mind that the registers are addressed as 16-bit words in the data range, i.e. in order to transmit 20 byte, 10 registers must be reserved.
This configuration can only be made during initialization, i.e. before writing the station address.

7.2 Description: "Read Data Block"

If the master has sent a "Read Data Block" request, bit 4 will be set in the status register. Now, the programming tool will be able to react. In register 1m118 the number of bytes that are to be read by the master have been written.

Note!

In each data register, there are two bytes.

The master causes the slot address to be written into register 1m120 and the index of the data block that is to be read by the master into register 1m122. The user can write the data into the respective data registers, confirm their being valid by issuing command 11 and make them available to the master.
If the user does not want to carry out the "Read Data Block" request, as, for example, he does not want the slot address to be transmitted, he can issue command 12 to the master.
Not before one of the commands has been transmitted, bit 4 of the status register will be cleared.

If the master requires more data than there is space for in the reserved registers, their length will automatically be shortened to the maximum possible length.

7.3 Description: "Write Data Block"

If the master has transmitted a "Write Data Block" request, bit 5 is set in the status register. Now the programming tool is able to react. Out of register 1m118, the number of bytes can be read which have been written into the data registers by the master.

Note!

In each data register, there are two bytes.

The master causes the slot address to be entered into register 1m121 and the index of the dat block that is to be written into register 1m123 by the master.
The user will then be able to read the data out of the respective data registers and to confirm them to be valid by issuing command 13. If the user does, for example, not want to meet the "Write Data Block" request, because he does not want to operate the required slot address, he can inform the master by issuing command 14.
Not before one of these commands has been transmitted, bit 5 of the status register will be cleared. If the master is going to write more data than there will be room for in the reserved registers, an error message will automatically be sent to the master, whereas bit 5 will not be set.

7.4 Access to the data registers of the acyclic services besides a request made by the master

On principle, the user should only access these data ranges if requested by the master. If it is still necessary to occupy the data range with data, even before a request has been made by the master (e.g. for very time-critical applications), this may only be done, if bit 6 has not been set in the status register. This bit is there to indicate that the operating software of the JX2-PROFI module is accessing data at that moment. In order to keep up data integrity, the possibility of access to these data ranges will be ignored during this application, whereas bit 7 is set in the status register.

The following charts are to illustrate the time characteristics of the respective services:

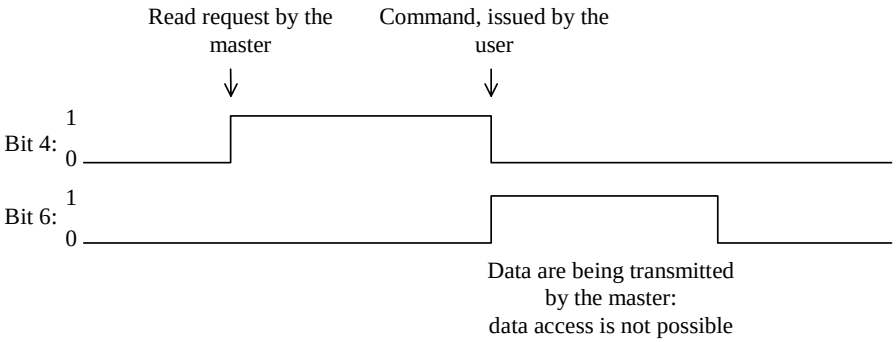


Fig. 8: Time characteristic: Read data block

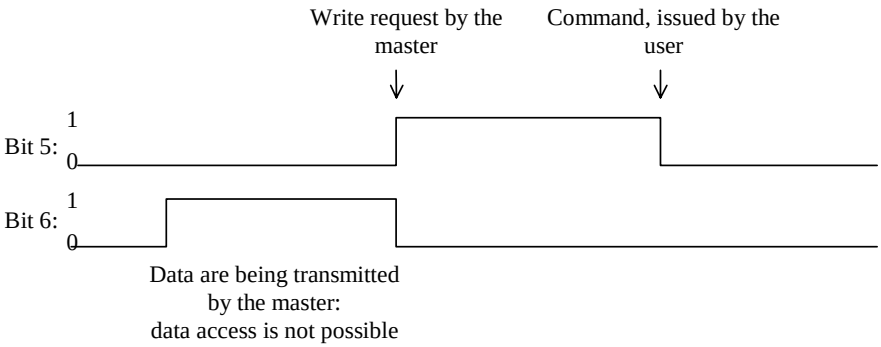


Fig. 9: Time characteristic: Write data block

7.5 Calculation of the Maximum Data Lengths

IN *3 + OUT*3 + AC ≤ 632

IN:	Round up the value of register 1m102 to the next highest value divisable by 4.
OUT:	Round up the value of register 1m103 to the next highest value divisable by 4.
AC:	Read the highest common value out of register 1m114 or 1m115. Round it up to the next highest value divisable by 4.

7.6 Diagnose

The PROFIBUS module offers the possibility of sending diagnose telegrams. The diagnose mechanism of the PROFIBUS-DP consists of two steps: First, the slave signalizes to the master, that there are new diagnose data. Being the slave, it can never start communication; it will, in a standard data exchange, respond by a telegram of high priority, though. Then, the master will send a diagnose request to the slave, which will, in return, transmit the present diagnose data.

From the user's point of view, the diagnose process is structured as follows:

7.6.1 Registers for Diagnose Data

From the user's point of view, the process is structured as follows:

Register 1m139:	Check, whether carrying out a diagnose command has been completed, i.e. whether the diagnose telegram sent last has been fetched by the master. The register value must be 0 then. Only then, a new diagnose telegram can be created. This is to make sure that diagnose information does not get lost. To interrupt the transmission of a diagnose telegram, issue command 10 (see section 6.3.2 "Commands for Transmitting Diagnose Data").
Register 1m140:	Enter the length of the diagnose data in byte. The length must amount to between 10 and 32 bytes. • Length = 10 bytes: Only the standard diagnose data are transmitted according to the PROFIBUS specification. • Length = (10 + number of user bytes) bytes: Additional transfer of user diagnose data (e.g. if diagnose data of 4 bytes are to be transmitted to the master, length = 14 must be written into the register).
Register 1m146:	From this register onwards, the diagnose data can be entered in word mode now, the LowByte being placed on the lower address.
Register 1m210:	From this register onwards, the above registers can also be accessed in byte mode, the LowByte being placed on the lower address.
Register 1m141 to 1m145 (resp. 1m200 to 1m209):	These registers are already occupied with the standard diagnose data and must not be changed.

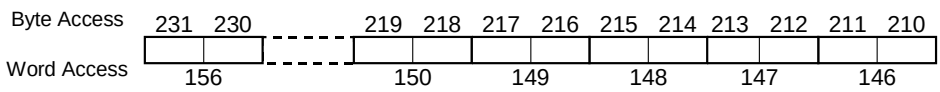


Fig. 10: Structuring of the registers for user diagnose data

7.6.2 Commands for the Transmission of Diagnose Data

The transmission of diagnose telegrams can be started by issuing certain commands:

Command Number	Meaning
7	Transmit a status diagnose telegram: This telegram is transmitted either with or without user data, depending on the defined length.
8	Transmit an extended diagnose telegram: This telegram must always contain diagnose data of the user. The user should transmit a status diagnose telegram when the cause of the diagnose has been removed. For this purpose, the data length must be >10.
9	The module is set into the state of static diagnose: In this state, no data will be exchanged with the master in cyclic mode any more. The master will only query the diagnose telegrams of the slave, which is necessary in case there are no valid data to be supplied. The static diagnose mode can be left by transmitting a status diagnose or by applying an extended diagnose.
10	The transmission of the latest diagnose telegram is interrupted.

7.6.3 Transmission of Diagnose Data from the Master’s Point of View

When the PROFIBUS-DP master’s point of view is taken, please note that the user data of the diagnose telegrams of the PROFIBUS module are always device specific. The first four user bytes of a diagnose telegram contain a header according to the DPV1 expansions. The transmitted user diagnose data will not be saved before the 5th byte (or, if the 6 bytes according to the DP standard are considered, they will not be saved before the 11th byte). This must also be taken into account, if the telegram length in the master is to be evaluated.

7.6.4 Survey of the Entire Range of Diagnose Data Registers

If the user is well acquainted with the PROFIBUS-DP standard and its DPV1 extensions, he can freely access the user data. The first 6 bytes must never be altered, as they will be overwritten with certain values by the PROFIBUS controller. Starting from the 7th byte, the external diagnose data can be entered according to the standard. Thus it will also be possible to transmit identification and channel-related diagnose telegrams.
The length that is defined in length register 1m140 must also contain all bytes, the 6 DP standard bytes included.
Please do also mind the correct sequence of data input here as well, i.e. the length must be entered first; only after this, the data can be altered.
Writing into the length register will always overwrite the 7th byte of the diagnose telegram automatically.

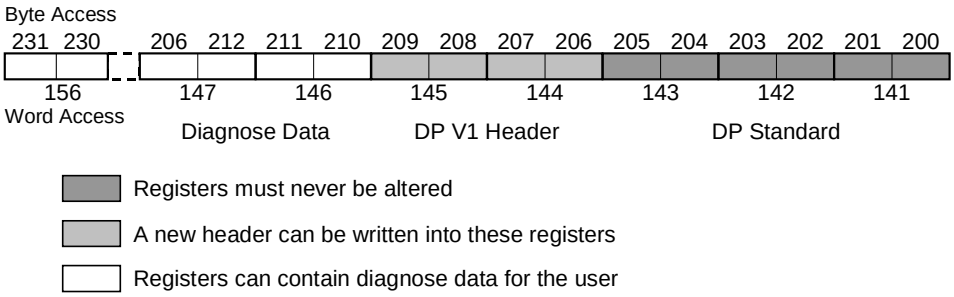


Fig. 11: Structuring of the entire range of diagnose data registers

8 Sample Programs

8.1 Example 1: Basic Program

```
TASK tInit
;
;
      WHEN ;wait, until Init is finished
         BIT_CLEAR (rPB_Status, 13)
        THEN
         REGISTER_LOAD (rPB_NumIn, 16) ;number of input words
         REGISTER_LOAD (rPB_NumOut, 16) ;number of output words
         REGISTER_LOAD (rPB_StationAdr, 4)
      WHEN ;wait, until module is active
         BIT_CLEAR (rPB_Status, 13)
        THEN ;module has been initialized
             ;data exchange can be started
LABEL lEndless
         GOTO lEndless
;
TASK tDataExchange
      WHEN
         BIT_SET (rPB_Status, 3) ;master operates the module
        THEN
         REGISTER_LOAD (rPB_DataIn, @500)  ;transmit data
                                           ;to the master
         REGISTER_LOAD (@501, rPB_DataOut) ;transmit data
                                           ;from the master
         GOTO tDataExchange
End of program
```

Symbol File:

	Name	Value	Default
1	tInit	0	
2	tDataExchange	1	
3			
4	sEndless	!	
5			
6	rPB_Status	12100	
7	rPB_Command	12101	
8	rPB_NumIn	12102	
9	rPB_NumOut	12103	
10	rPB_StatAdr	12107	
11			
12	rPB_DataIn	12300	
13	rPB_DataOut	12400	

8.2 Example 2

This example is to demonstrate the communication process when diagnose telegrams and acyclic services are being made use of. A complete and effective error evaluation will not be made here; in this example, only the basic principle of error evaluation is to be illustrated.

```
TASK tInit
     REGZERO 400
;reset diagnose trigger
     ;
  WHEN
;wait, until Init is finished
     BIT_CLEAR (rPB_Status, 13)
    THEN
     ;
     REGISTER_LOAD (rPB_Command, 5)                  ;reset
  WHEN
;wait, until Init is finished
     BIT_CLEAR (rPB_Status, 13)
    THEN
     REGISTER_LOAD (rPB_Command, 6)                  ;delete error
     ;
     ;
;configuration of cyclic services
     REGISTER_LOAD (rPB_StartIN, 300)
     REGISTER_LOAD (rPB_StartOUT, 400)
     REGISTER_LOAD (rPB_NumIN, 4)
;number of input words
     REGISTER_LOAD (rPB_NumOUT, 4)
;number of output words
     ;
     ;configuration of the acyclic services
     REGISTER_LOAD (rPB_StartDSL, 600)
     REGISTER_LOAD (rPB_StartDSS, 800)
     REGISTER_LOAD (rPB_NumDSL, 120)
;600...719
     REGISTER_LOAD (rPB_NumDSS, 120)
;800...919
     ;
     ;
     REGISTER_LOAD (rPB_StatAdress, 3)
;slave no. 3
  WHEN
     ;wait, until module is active
     BIT_CLEAR (rPB_Status, 13)
```

```
   THEN
     ;the module has been initialized
     ;data exchange can be started
LABEL lEndless
     DELAY 100
     GOTO mEndless
     ;
TASK tDataExchange
  WHEN
     BIT_SET (rPB_Status, 3)
     ;the master operates the module
   THEN
     COPY (4, 500, rPB_DataIN)
     ;transmit data to the master
     COPY [4, rPB_DataOUT, 510)
     ;transmit data from the master
     ;here, the data transmitted to and from
     ;the master will be evaluated
     DISPLAY_TEXT (0, 13, "IN:")
     DISPLAY_REG (0, 4, rPB_DataIN)
     DISPLAY_TEXT (0, 13, "OUT:")
     DISPLAY_REG (0, 17, rPB_DataOUT)
     GOTO tDataExchange
     ;
TASK tProcess
     ;simulate a process
     REGINC 500
     REGDEC 501
     DELAY 1
     GOTO tProcess
TASK tError
  WHEN
     BIT_SET (rPB_Status, 15)
   THEN
     DISPLAY_TEXT (0, 25, "Error")
     DISPLAY_REG (0, 33, rPB_Error)
     DELAY 50
     ;display, for example, for 5 s
     ;here, errors will be evaluated
     ;the error can be acknowledged, if necessary
     REGISTER_LOAD (rPB_command, 6)
     ;acknowledge the error
     DISPLAY_TEXT (0, 25, "$")
     GOTO tError
     ;
TASK tDiagnose
  WHEN
     BIT_SET (rPB_Status, 3)
```

```
      ;the master operates the module
      AND
      NOT
      REGZERO 400
      ;start diagnose
    THEN
  IF
      REG 400
      =
      1
      ;1: e.g. simple diagnose
    THEN
  IF
      CALL suDiag1
    THEN
  IF
      REG 400
      =
      2
      ;2: e.g. extended diagnose
    THEN
      CALL suDiag2
    THEN
  IF
      REG 400
      >
      10
      ;>10: static diagnose
    THEN
      CALL suDiag3
    THEN
      REGZERO 400
      ;the diagnose has been processed
      GOTO tDiagnose
      ;
LABEL sTestDiag
      ;test, whether there is still a former
      ;diagnose to be processed
  IF
      NOT
      REGZERO rPB_LatestDiag
    THEN
      ;here, error evaluation will be carried out
      ;issue command 10, if necessary
      DISPLAY_TEXT (0, 25, "former diagn found")
      DELAY 50
      DISPLAY_TEXT (0, 25, "$")
      REGISTER_LOAD (rPB_Command, 10)
```

```
     ;delete former diagnose
   THEN
     RETURN
     ;
LABEL suDiag1
     CALL sTestDiag
     REGISTER_LOAD (rPB_DiagLen, 10)
     ;no user data
     REGISTER_LOAD (rPB_Command, 7)
     ;simple diagnose
     RETURN
     ;
LABEL suDiag2
     CALL sTestDiag
     REGISTER_LOAD (rPB_DiagLen, 14)
     ;4 byte user data
     REGISTER_LOAD (rPB_DiagData1, 1)
     ;first word
     REGISTER_LOAD (rPB_DiagData2, 65535)
     ;second word
     REGISTER_LOAD (rPB_Command, 8)
     ;extended diagnose
   THEN
  WHEN
     REGZERO 400
     ;wait, until diagnose trigger has been reset
   THEN
     ;transmit these data to the master
     CALL sTestDiag
     REGISTER_LOAD (rPB_DiagLen, 10)
     ;no user data
     REGISTER_LOAD (rPB_Command, 7)
     ;simple diagnose
     RETURN
     ;
LABEL suDiag3
     CALL sTestDiag
     REGISTER_LOAD (rPB_DiagLen, 12)
     ;2 byte user data
     REGISTER_LOAD (rPB_DiagData1, 255)
     ;first word
     REGISTER_LOAD (rPB_Command, 9)
     ;static diagnose
   THEN
  WHEN
     REGZERO 400
     ;wait, until diagnose trigger has been reset
   THEN
```

```
    ;transmit these data to the master
    CALL sTestDiag
    REGISTER_LOAD (rPB_DiagLen, 10)
    ;no user data
    REGISTER_LOAD (rPB_Command, 7)
    ;simple diagnose
    RETURN
    ;
    ;
TASK tAcyclServices
 WHEN
    BIT_SET (rPB_Status, 3)
    ;the master operates the module
    (
    BIT_SET (rPB_Status, 4)
    ;read request
    OR
    BIT_SET (rPB_Status, 5)
    ;write request
    )
  THEN
 IF
    BIT_SET (rPB_Status, 4)
    ;read request
  THEN
    CALL suAcyclDSL
  THEN
 IF
    BIT_SET (rPB_Status, 5)
    ;write request
  THEN
    CALL suAcyclDSS
  THEN
    GOTO tAcyclServices
    ;
LABEL suAcyclDSL
    ;read data block
    ;here, the slot address and the index can be
    ;evaluated and command 12 can be issued
    ;if required
    REG 100
    ;calculate the number of words
    =
    REG rPB_DSLLen
    +
    1
    /
    2
```

```
      COPY (100, 600, 12600)
      ;copy the data
      REGISTER_LOAD (rPB_command, 11)
      ;the data are ok
      RETURN
      ;
      ;
LABEL suAcyclDSS
      ;write data block
      ;here, the slot address and the index can be
      ;evaluated and command 12 can be issued
      ;if required
  IF
      REG rPB_DSSIndex
      ;accept, for example, only index 5
      =
      5
    THEN
      REG 100
      ;calculate the number of words
      =
      REG rPB_DSSLen
      ;number of bytes
      +
      1
      /
      2
      COPY (100, 12800, 800)
      ;copy the data
      REGISTER_LOAD (rPB_command, 13)
      ;data are ok
    ELSE
      REGISTER_LOAD (rPB_command, 14)
      ;data are not ok
    THEN
      RETURN
      ;
      ;
End of program
```

Symbol File

	Name	Value	Default
1	tInit	0	
2	tDataExchange	1	
3	tProcess	2	
4	tError	3	
5	tDiag	4	
6	tAcyclServices	5	
7			
8	sEndless	!	
9			
10	sTestDiag	!	
11	suDiag1	!	
12	suDiag2	!	
13	suDiag3	!	
14			
15	suAcyclDBR	!	
16	suAcyclDSS	!	
17			
18			
19	rPB_Status	12100	
20	rPB_Command	12101	
21			
22	rPB_NumIn	12102	
23	rPB_NumOut	12103	
24	rPB_StatAdr	12107	
25	rPB_StartIN	12112	
26	rPB_StartOUT	12113	
27			
28	rPB_NumDBR	12114	
29	rPB_NumDBW	12115	
30	rPB_StartDBR	12116	
31	rPB_StartDBW	12117	
32	rPB_DBRLen	12118	
33	rPB_DBWLen	12119	
34	rPB_DBRSlot	12120	
35	rPB_DBWSlot	12121	
36	rPB_DBRIndex	12122	
37	rPB_DBWIndex	12123	
38			
39	rPB_Error	12134	
40			
41	rPB_LatestDiag	12139	
42	rPB_DiagLen	12140	

```
43  rPB_DiagData1         12146
44  rPB_DiagData2         12147
45
46  rPB_DataIn            12300
47  rPB_DataOut           12400
```

Appendices

Appendix A: List of Illustrations

Appendix B: Index

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