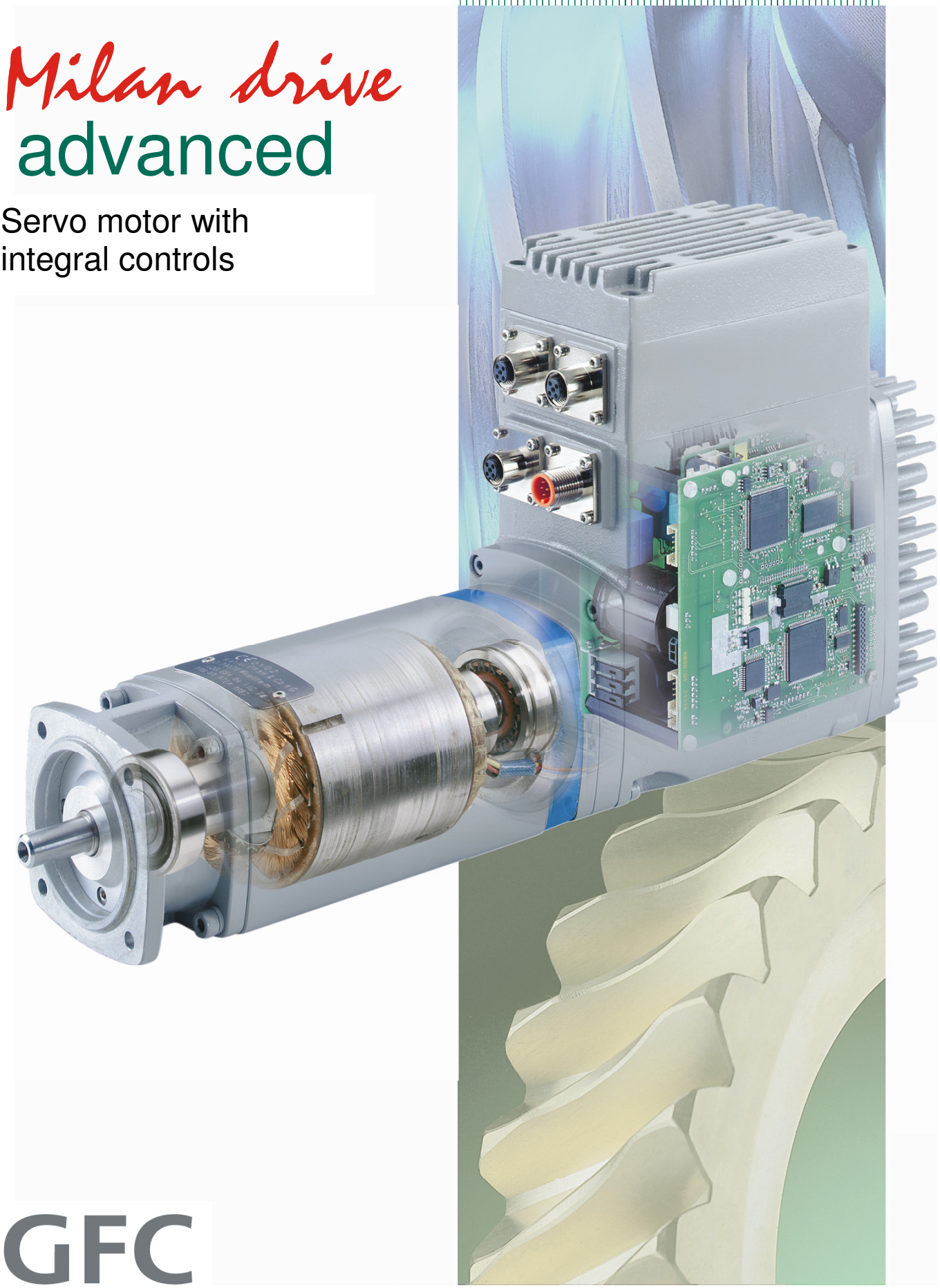
Interface description
PROFIBUS DP

Milan drive advanced

Servo motor with
integral controls



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Preface

Thoroughly read the present manual and all safety instructions and warnings in particular before installation and commissioning of the servo drive. Observe all warning plates attached to the device. Please make sure that all warning plates are legible and that missing or damaged signs are replaced.

The present user manual describes wiring, commissioning, functions and the protocol of the ***Milan Drive Advanced*** PROFIBUS interface. It is part of the overall documentation of the servo drives with Milan Drive Advanced integral electronics.
For information on installation, commissioning and functions of the Milan Drive Advanced, please refer to the corresponding user manuals.
A list of these user manuals can be found in the literature section.

For more detailed information refer to:

Website
For technical and general information, customers may refer to the following address:
http://www.milan-drive.de

Contact
In case you have any questions or problems when reading these operating instructions, please contact one of the addresses mentioned at the end of these instructions or the sales agent responsible for your area.

Possibly other functions may be available which are not described in this document. However, the manufacturer shall not be obliged to provide these functions with a new drive or when performing maintenance work.
The contents of this document were checked for compliance with the described hardware and software. Deviations may nevertheless occur; we assume no liability for full compliance with all data. The information contained in these documents is subject to regular revision and any required modification will be included in the next issue.

We reserve the right to alter the present document without prior notification.

Issue	Note
1.05	First issue
1.06	General update
1.07	Update due to functional extension with firmware APP 02.00
1.09	Update due to functional extension with firmware APP 02.04

Table of contents

1 Safety instructions

1.1 Designated use

Milan Drive Advanced servo drives, also called MDA in the following, are designed as equipment for the use in industrial environments. As standard, the servo drives are designed for installation in industrial robots, pick and place units, and many other equipment and devices. For other applications, please consult us. The manufacturer is not liable for any damage resulting from use in other than the designated applications. Such risk lies entirely with the user. Observance of these operation instructions is considered as part of the servo drive's designated use.
Please read these instructions thoroughly as they are intended for your personal safety and also help enhancing the lifetime of your servo drive.

1.2 General notes

- During operation, parts move or rotate within this unit. Important dangers can arise from rotating shaft couplings with keyway and inserted parallel key. Remove inserted parallel keys or protect them against loosening by taking suitable measures.
- During operation, surfaces of the drive unit may heat up according to its enclosure protection. The surface temperature can rise up to above 100 °C. Before touching the unit, measure the temperature for safety reasons; if required, wait until it has cooled down to 40 °C.

1.3 Warnings and notes

Failure to observe of the warnings and notes may lead to serious injuries or damage. Qualified personnel must be thoroughly familiar with all warnings and notes in these operation instructions.
In order to highlight safety-relevant procedures in these operation instructions, the following safety instructions apply:

DANGER indicates an imminently hazardous situation, which – if the warnings and notes are not observed – could result in **death** or **serious damage to health** or **considerable material damage**. This note is only used in case of **danger to life** and a high level of hazard.

Danger sign on the type of danger and/ or pictograph on consequences, measures, or prohibitions	**DANGER**
	Type of hazard and its source **Possible consequence(s) on non-observance** → Measure(s) to avoid the hazard.

WARNING indicates a potentially hazardous situation, which – if the warnings and notes are not observed – could result in **death** or **serious damage to health** or **considerable material damage**.

Danger sign on the type of danger and/ or pictograph on consequences, measures, or prohibitions	**WARNING**
	Type of hazard and its source **Possible consequence(s) on non-observance** → Measure(s) to avoid the hazard.

CAUTION indicates a potentially hazardous situation, which – if the warnings and notes are not observed – could result in **minor injuries** or **material damage**.

Danger sign on the type of danger and/ or pictograph on consequences, measures, or prohibitions	**CAUTION**
	Type of hazard and its source **Possible consequence(s) on non-observance** → Measure(s) to avoid the hazard.

NOTE contains important information on the product or highlights a section of the documentation to which special attention should be paid.

Pictograph on consequences or measures	**NOTE**
	Type of hazard and its source **Possible consequence(s) on non-observance** → Measure(s) to avoid the hazard.

1.3.1 Used danger signs

Danger signs warn about a danger source.
Layout: yellow triangle and symbol.

General danger zone in combination with personal injuries!
Please heed all measures marked with the danger sign to prevent injuries or damage.

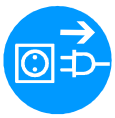
Hazardous electrical voltage!
Danger due to electric shock.

Hot surfaces
Danger of burns.

1.3.2 Used mandatory signs

Mandatory signs call on the user to do something to prevent a danger.
Layout: blue circle and symbol.

General mandatory sign
Heed instruction.



Caution
Disconnect plug before opening.

1.3.3 Further symbols

Information
Contains important tips and information. In case of non-observance, no damage is to be expected.

1.4 Commissioning (electrical connection)

	NOTE
	**For the Milan Drive Advanced servo drive, the motor and the controls are firmly connected as a unit.** → Proceed in compliance with the indications in the “RS 232 Firmware” user manual for assembly, installation and commissioning.

2 Short description

For the ***Milan Drive Advanced*** servo drive, the motor and the controls are firmly connected as a unit. In the standard version, the electrical connections are established via standardised signal (M12) and power plug/socket connectors (M23).

Motor:
The ***MES*** servo motors are three-phase synchronous motors with special permanent magnets. Permanent ambient temperatures up to 155 °C (insulation class F) are permitted. The motor temperature is monitored by a sensor integrated in the motor winding. As an option, the motor is also available with integral holding brake.

Electronics:
The ***DAC*** servo controls combine all components necessary for independent electronic controls in one housing. These are:

- a self-commutated intermediate circuit including a mains filter for direct connection to the mains,
- 4 quadrant operation (integral brake resistor)
- integral voltage supply for electronics
- sequence control and motor control
- fieldbus interfaces (option)
- digital galvanically isolated inputs and outputs
- analogue input
- RS232 interface for operation, parameter setting and programming.

Therefore, the ***Milan Drive Advanced*** may be operated independently for various drive solutions or may also be integrated in automation systems.

3 Profibus DP

3.1 Basic information on the PROFIBUS interface of the MDA

The PROFIBUS interface of the ***Milan Drive Advanced*** is based on the PROFIDRIVE PROFIBUS profile for variable speed drives, PROFIDRIVE. The device functions are mirrored in the communication with PROFIBUS DP. The max. transmission speed is 12 Mbit/s.

The PROFIDRIVE profile:

The PROFIDRIVE profile is a standard for all manufacturers for building drives with PROFIBUS interface. The profile determines how drives are programmed and how the setpoints and actual values are transmitted. This makes it possible to interchange drives of different manufacturers. The profile contains specifications for the operation mode "Speed control" and "Positioning". It determines the basic drive functions and leaves room for user-specific expansions and developments.

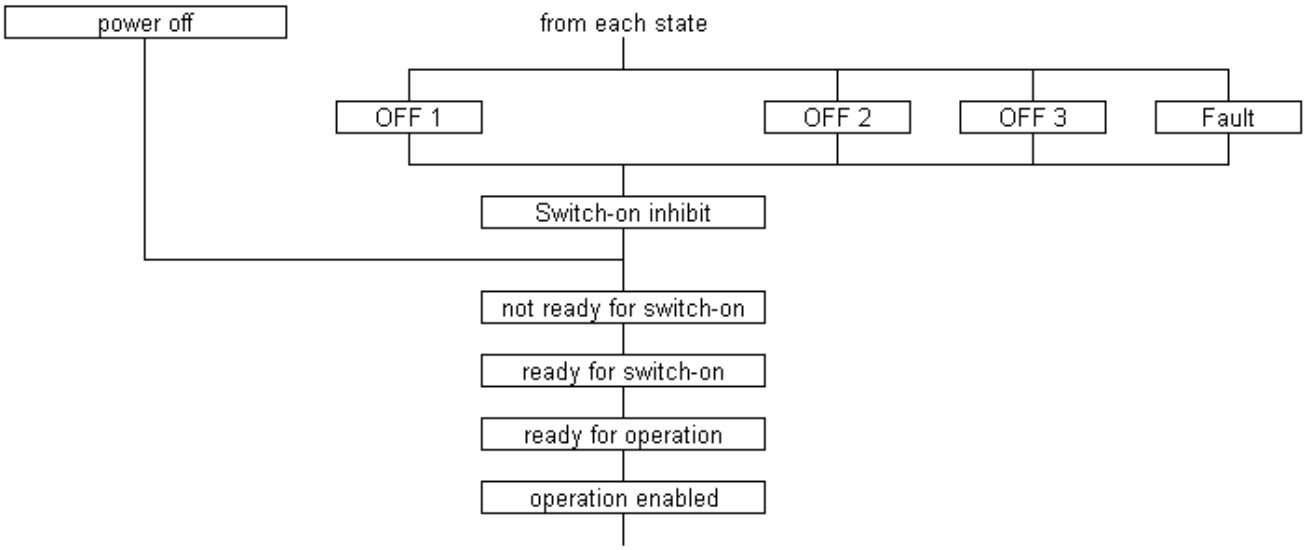
3.2 Functions of the PROFIBUS interface of the MDA

- Reading and programming the parameters and driving data records
- Execution of drive tasks
- Reference operation
- Reading of actual values, faults and warnings
- Logging of parameter and driving data record changes

3.3 Description of the finite state machine PROFIDRIVE V 2.0

The state machine of the PROFIDRIVE V 2.0 is influenced by the control word. Each bit has a special function. If several bits are changed at the same time, the functions may be only processed one after the other; i.e. the software implementation determines a certain sequence which does not necessarily conform to the desired sequence. For this reason and to ensure a smooth transition from one state to the other, it is imperatively required – unless stated otherwise – that only one bit is changed at a time for the desired function. Deviations and a typical sequence are presented and explained in the following.

3.3.1 Function diagram for basic controller



The illustration above shows the outlines of the state machine. For the signal sequence required to control the state machine, refer to the PROFIDRIVE PROFIBUS profile, issue September 1997, page 21 or to the examples in section 7 "Examples".

3.3.2 Function diagram for speed control operation mode

Refer to PROFIDRIVE PROFIBUS profile, issue September 1997, page 22
For a detailed description of the operation modes used with the MDA, refer to section 3.4 "Operation modes".
An example is shown in section 7, "Examples".

3.3.3 Function diagram for positioning operation mode

Refer to PROFIDRIVE PROFIBUS profile, issue September 1997, page 23
For a detailed description of the operation modes used with the MDA, refer to section 3.4 "Operation modes".
An example is shown in section 7, "Examples".

3.3.4 Control and parameter change rights

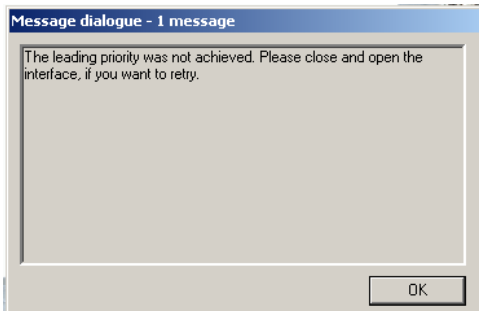
In the PROFIDRIVE profile, two change rights are managed: Parameter change rights (PKW) and the control change rights (PZD). These change rights may be granted separately to different users.

The bus master has to be granted the control change rights to be able to operate the MDA via bus master. The bus master automatically obtains the control change rights by starting up the finite state machine of the drive correctly, i.e. using the control word.
In case another user has already obtained the control change rights when the bus master starts up the finite state machine, the MDA remains in the "not ready for switch-on state".

As from Firmware APP 02.01, the drive already shows in the status word by means of the bit 9 status “priority request/local operation”, whether the leading priority over Profibus can be reached. To detect absence of control access, it is not necessary to boot the state machine.

The bus master must have the parameter change rights to be able to perform parameter changes via the bus master. If required, the bus master has to use PNU 927 first to obtain the parameter change rights. If another user has been granted the change rights beforehand, the user must abandon these change rights first.

To be able to access a MDA using the MDAwin operating software, the required change rights have to be available. The bus master may possibly have to abandon these change rights first. If the operating software cannot access one of the change rights, an information window for each not accessible right will be displayed.



3.3.5 Control word

Bit	Designation	
	Speed control operation mode	Positioning operation mode
0	ON 1 / OFF 1	
1	ON 2 / OFF 2	
2	ON 3 / OFF 3	
3	Enable operation / inhibit operation	
4	Inhibit operating condition / ramp-function generator	Cancel operating condition / drive task
5	Enable ramp-function generator / stop ramp-function generator	Operating condition / intermediate stop
6	Enable setpoint / inhibit setpoint	Activate drive task (flank)
7	Acknowledge fault / no meaning	
8	Inching 1 ON / inching 1 OFF	
9	Inching 2 ON / inching 2 OFF	
10	Control from automation unit / no control	
11	Start referencing / cancel referencing	
12	Output speed / Positioning	
13	Set reference / no meaning	
14	Setpoint setting via fieldbus/no setpoint setting	
15	Not used	

Explanation: To the left of the slash the meaning for the bit value = 1 can be found, to the right the meaning for the bit value = 0

3.3.6 Status word

Bit	Designation	
	Speed control operation mode	Positioning operation mode
0	Ready for switch-on / not ready for switch-on	
1	Ready for operation / not ready for operation	
2	Operation enabled / operation inhibited	
3	Fault / no fault	
4	No OFF 2 / OFF 2	
5	No OFF 3 / OFF 3	
6	Switch-on inhibit / no switch-on inhibit	
7	Warning / no warning	
8	Setpoint within tolerance range / setpoint not within tolerance range	contouring error / no contouring error
9	Control requested / local operation	
10	f or n reached / f or n not reached	Setpoint reached / setpoint not reached
11	Reference point set / no reference point set	
12	not used	Setpoint acknowledgement (flank)
13	Drive stationary/drive moving	
14 15	not used	

Explanation: To the left of the slash the meaning for the bit value = 1 can be found, to the right the meaning for the bit value = 0

NOTE

As from Firmware APP 02.01

a contouring fault is displayed in the status word in positive logic

the reference operation is only performed if bits 4 and 5 within the control word have been set.

3.4 Operation modes

The MDA allows selection between several types of control. They are included within the driving data records (DDR). To perform these control types, predefined operation modes have to be used in accordance with PROFIDRIVE.

The positioning operation mode is used for the modes of operation absolute, relative or modulo positioning. The relative positioning operation mode can be started even when no reference is set.

The speed control operation mode is used for the modes of operation speed control, torque control or contouring error control.

A plausibility check is performed before starting a driving data record. If the "Speed" operation mode is set and a driving data record with PID control activated, a fault is triggered.

3.4.1 Changing the operation mode

Even when starting up the PROFIDRIVE state machine, it either changes to the "Position" mode or the "Output speed" mode during the transition from "ready for operation" to "Operation enabled", depending on the value of bit 12 of the control word. For this transition, the bit has to be present accordingly (0: position, 1: output speed).
Before changing the operation mode, an active driving data record either has to be completed or stopped. Only then the operation mode can be changed via bit 12. Now you can freely change over between the two operation modes.

The main difference is the way the driving data records (DDR) are started. Whereas bit 6 starts a driving data record with any flank in the positioning mode and the driving data record can only be actively stopped via OFF1, OFF2 or OFF3, a driving data record is started with a positive flank and stopped again with a negative flank (switch function) in the speed mode. Some of the bit configurations in the status word are also different.

3.4.2 Speed control operation mode

If the control word is set in bit 12, the drive is in the speed control and torque control operation mode.

3.4.2.1 Control word for speed control operation mode

Bit	Value	Designation	Note
0	1	ON 1	Ready for operation Forces bit 1 in the status word
	0	OFF 1	Brakes drive at ramp, switches off motor current when drive stands still
1	1	ON 2 Power electronics on	OFF 2 command cancelled Forces bit 4 in the status word
	0	OFF 2 Power electronics off	Switches off motor current, drive tapers off
2	1	ON 3 Quick stop off	OFF 3 command cancelled Forces bit 5 in the status word
	0	OFF 3 Quick stop on	Runs down to current limit, switches off motor current when drive stands still. A fault occurs.
3	1	Enable operation	Forces bit 2 in the status word
	0	Inhibit operation	Switches off motor current, drive tapers off
4	1	Operating condition	Must be continuously present to enable execution of a drive task.
	0	Inhibit ramp-function generator, RF0	Runs down to current limit, drive stops with retaining torque.
5	1	Enable ramp-function generator	Must be continuously present to enable execution of a drive task.
	0	Stop ramp-function generator	Freezes the current output speed.
6	1	Activate drive task	Flank starts a driving data record.
	0	Stop drive task	Flank stops the driving data record.
7	1	Ack fault	Collective signal is acknowledged in case of positive flank, drive is in 'Fault' mode until fault is eliminated, then changes to 'Switch-on inhibit'.
	0	No meaning	
8	1	Inching 1 ON	Drive runs with the settings of PNU898 (DDR101). This is a standard driving data record, whereas only a speed driving data record is useful.
	0	Inching 1 OFF	The drive remains in its position
9	1	Inching 2 ON	Drive runs with the settings of PNU899 (DDR102). This is a standard driving data record, whereas only a speed driving data record is useful.
	0	Inching 2 OFF	The drive remains in its position
10	1	Control from automation unit	Control via Profibus DP, process data valid
	0	No control	Process data invalid
11	1	Start referencing	The reference procedure is started with a change from 0 to 1. Bit 11 in the status word is set to 0. Drive runs with the settings for "Reference operation". Precondition: Operation is enabled.
	0	Stop referencing	An ongoing reference procedure is stopped, drive stops at ramp
12	1	Speed mode	Drive in the speed mode (bit 6 == On/off switch) Has to be present during the transition from "ready for operation" to "Operation enabled".
	0	Position mode	Drive in the position mode (bit 6 == toggle function) Has to be present during the transition from "ready for operation" to "Operation enabled".
13	1	Set reference	Reference is set directly without a reference operation
	0	No meaning	
14	1	setpoint setting	used to release the setpoint presetting via fieldbus within PZD 5 and 6 (as from Firmware APP 02.04)
	0	No setpoint setting	Setpoint presetting via PZD 5 and 6 disabled
15		reserved	

3.4.3 Positioning operation mode

If bit 12 is not set in the control word, the drive is in the positioning operation mode (absolute, relative or modulo).

3.4.3.1 Control word for position control operation mode

Bit	Value	Designation	Note
0	1	ON 1	Ready for operation, Forces bit 1 in the status word
	0	OFF 1	Brakes drive at ramp, switches off motor current when drive stands still
1	1	ON 2 Power electronics on	OFF 2 command cancelled Forces bit 4 in the status word
	0	OFF 2 Power electronics off	Switches off motor current, drive tapers off
2	1	ON 3 Quick stop off	OFF 3 command cancelled Forces bit 5 in the status word
	0	OFF 3 Quick stop on	Runs down to current limit, switches off motor current when drive stands still. A fault occurs.
3	1	Enable operation	Forces bit 2 in the status word
	0	Inhibit operation	Switches off motor current, drive tapers off
4	1	Operating condition	Must be continuously present to enable execution of a drive task.
	0	Stop, RF0	Runs down to current limit, drive stops with retaining torque.
5	1	Operating condition	Must be continuously present to enable execution of a drive task.
	0	Intermediate stop	Drive brakes at ramp on n = 0 and stops with retaining torque. The drive task is not cancelled. In case of a change to bit 5 = 1, the drive task will be resumed.
6	1	Activate drive task	Each flank releases a drive task or a new setpoint (toggle bit). A flank change must only be performed if the previous drive task has been acknowledged with bit 12 of the status word and if bit 11 (reference point) has been set.
	0		
7	1	Acknowledge fault	Collective signal is acknowledged in case of positive flank, drive is in 'Fault' mode until fault is eliminated, then changes to 'Switch-on inhibit'.
	0	No meaning	
8	1	Inching 1 ON	Drive runs with the settings of PNU898 (DDR101). This is a standard driving data record, whereas only a speed driving data record is useful.
	0	Inching 1 OFF	The drive remains in its position
9	1	Inching 2 ON	Drive runs with the settings of PNU899 (DDR102). This is a standard driving data record, whereas only a speed driving data record is useful.
	0	Inching 2 OFF	The drive remains in its position.
10	1	Control from automation unit	Control via Profibus DP, process data valid
	0	No control	Process data invalid
11	1	Start referencing	The reference procedure is started with a change from 0 to 1. The bit 11 in the status word is set to 0. Drive runs with the settings for "Reference operation". Precondition: Operation is enabled.
	0	Stop referencing	An ongoing reference procedure is stopped, drive stops at ramp
12	1	Speed mode	Drive in the speed mode (bit 6 == On/off switch) Has to be present during the transition from "ready for operation" to "operation enabled".
	0		Drive in the position mode (bit 6 == toggle function). Has to be present during the transition from "ready for operation" to "operation enabled".
13	1	Set reference	Reference is set directly without a reference operation
	0	No meaning	
14		setpoint setting	Refer to the control word of the speed control mode
15		reserved	

3.4.4 Local peripheral devices

This function is available for firmware version APP 02.00 and operating software version MDAwin 02.00 and higher.

As standard, the MDA is equipped with four digital and analogue inputs and outputs each as well as one analogue input. The inputs and outputs may be assigned specific functions; for a detailed description refer to the "I/O drive window" in the "RS232 Firmware" user manual.

The "PB-I/O extension" function can be used to directly control the digital outputs via PZD from the bus master. For this, the MDA has to be programmed with PPO type 5 or 6 as bus device. If this function is selected, the respective output cannot perform an internal MDA function at the same time. The PPO types 5 and 6 correspond to the combinations type1/type2 or type3/type4 extended by two words for the input and output section of the drive. The PPO types are described in detail in the "Communication" section.

The PPO types are described in the “communication” section.

The digital inputs as well as the analogue input can directly be read out by the bus master using PZD. For this, the MDA has to be programmed with PPO type 5 or 6 as bus device. The inputs may be assigned a specific function; for a detailed description refer to the "I/O drive window" in the "RS232 Firmware" user manual. If the inputs are assigned the "None" function, the state of the inputs is only displayed to bus master and triggers no reaction in the drive.

PPO types 5 and 6 are described in the following.

PPO type 5
The master can only determine the PPO type as PPO Read and PPO Write. It cannot be mixed with other PPO types.

PZD for PPO-Read	PZD1:	Status word
	PZD2:	Main actual value = active driving data record
	PZD3:	Actual output speed
	PZD4:	Actual torque
	PZD5 and 6:	Actual position
	PZD7:	Digital inputs
	PZD8:	Analogue input
PZD for PPO Write	PZD1:	Control word
	PZD2:	Main setpoint = driving data record which needs to be activated
	PZD3:	Not assigned
	PZD4:	Not assigned
	PZD5 and 6:	Setpoint
	PZD7:	Digital outputs
	PZD8:	Not assigned

The function direct setpoint setting with PZD5 and 6 is available from firmware version APP 02.04 and higher. For a detailed description refer to the setpoint setting with PZD section in this manual.

PPO type 6
The master can only determine the PPO type as PPO Read and PPO Write. It cannot be mixed with other PPO types. For PZD, PPO type 6 is identical to type 5; in addition, the parameters can be programmed using the PKW mechanism.

3.4.5 Override

This function is available for firmware version APP 02.00 and operating software version MDAwin 02.00 and higher.

The MDA offers the possibility to adapt the preset running speed/output speed (in per cent) via PROFIBUS during operation. This function may only be used for the operation modes positioning, output speed and contouring error and is activated using PNU 1023. Two variants of this function are available.
The first variant (n-override) can only be used to influence the preset running speed/output speed within a range of 0 – 255%. To this end, all global limits have to be set accordingly or the increase of the running speed/output speed must be technically feasible.
The second variant additionally offers the possibility to adapt the acceleration and deceleration ramps in per cent within a range of 0 – 100 %. Within an active driving data records or in case of linked records without standstill, only the n-override may be performed. The adaptation of the acceleration or deceleration ramps is only possible after a driving data record has been restarted.

3.4.6 Setpoint setting with PZD

This function is available from firmware version APP 02.04 and operating software version MDAwin 02.04.

As from firmware version APP 02.04, MDA is able to directly specify setpoints via the process data channel without having to record these into the parameter string of the DDR and having to start up again. This allows specifying e.g. the setpoints for speed, torque or position within the running driving data record.
For this, the firmware APP 02.04 and the GSD file in version V4 are required. Due to the limited value range of the setpoint from external being also used via the analogue input, position setpoints can only be processed up to 15 bits.

To being able to use the setpoint specifications via fieldbus, the drive must be operated via PPO types 2, 5 or 6 by the PLC. The setpoint channel is only activated in these types via process data words PZD 5 and 6. In addition, activate the “nominal value externally allowed” check mark within the characteristics of the DDR and Bit 14 “setpoint specification” within the control word.

3.5 Communication

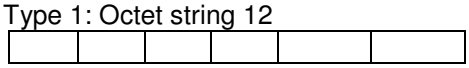
The communication with the MDA is accomplished via PROFIBUS DP. The max. transmission speed is 12 Mbit/s. A standardised PROFIBUS cable as well as active termination on both sides of the bus cable are imperatively required.

3.5.1 Parameter process data object PPO

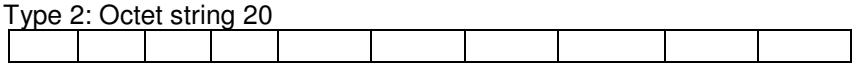
The profile PROFIDRIVE of PROFIBUS provides for the following parameter process data objects (PPO):

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
PKW								PZD																			
PKE		IND		PWE				PZD1 STW ZSW		PZD2 HSW HIW		PZD3		PZD4		PZD5		PZD6		PZD7		PZD8		PZD9		PZD10	

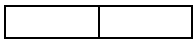
Type 1: Octet string 12



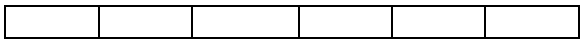
Type 2: Octet string 20



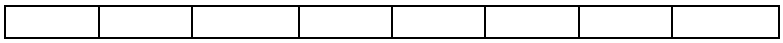
Type 3: Octet string 4



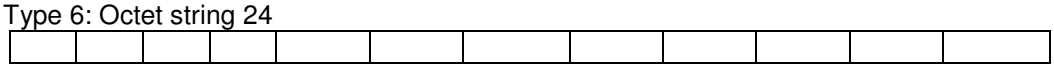
Type 4: Octet string 12



Type 5: Octet string 16



Type 6: Octet string 24



PKW: Parameter identification value
PZD: Process data
PKE: Parameter ID (1st and 2nd octet)
IND: Subindex (3rd octet), 4th octet is reserved
PWE: Parameter value (5th to 8th octet)
STW: Control word
ZSW: Status word
HSW: Main setpoint
HIW: Main actual value

The master may determine different types of PPO-Read and PPO-Write. But it is only permitted to mix type1/type2 (with PKW component) or type3/type4 (without PKW component).

Milan Drive Advanced supports PPO types 1 to 4.

The PKW component is used for parameter transmission, the PZD component for handling the operation functions.
The PKW component is the parameter channel which uses confirmed communication services only.
The PZD component is the process data channel and uses non-confirmed communication services.
The status word and the actual values can be used to check the drive's reactions to the commands.

3.5.1.1 PPO type 1

The master can determine PPO type 1 as PPO-Read and PPO-Write.

PKW	The parameters can be altered via the PKW mechanism.	
PZD for PPO-Read	PZD1:	Status word
	PZD2:	Main actual value = active driving data record
PZD for PPO-Write	PZD1:	Control word
	PZD2:	Main setpoint = driving data record which needs to be activated

3.5.1.2 PPO type 2

The master can determine PPO type 2 as PPO-Read.

PKW	The parameter processing can be altered via the PKW mechanism.	
PZD for PPO-Read	PZD1:	Status word
	PZD2:	Main actual value = active driving data record
	PZD3:	Output speed
	PZD4:	Torque
	PZD5 and 6:	Position
PZD for PPO-Write	PZD1:	Control word
	PZD2:	Main setpoint = driving data record which needs to be activated
	PZD3 and 4	not used
	PZD5 and 6:	Position
	PZD5 und 6:	Setpoint

The function PPO Write is available from firmware version APP 02.04 and higher. This allows direct setpoint specification via PZD 5 and 6 via fieldbus.For a detailed description refer to the Setpoint setting with PZD section in this manual.

3.5.1.3 PPO type 3

The master can determine PPO type 3 as PPO-Read and PPO-Write.

PZD for PPO-Read	PZD1:	Status word
	PZD2:	Main actual value = active driving data record
PZD for PPO-Write	PZD1:	Control word
	PZD2:	Main setpoint = driving data record which needs to be activated

3.5.1.4 PPO type 4

The master can determine PPO type 4 only as PPO-Read.

PZD for PPO-Read	PZD1:	Status word
	PZD2:	Main actual value = active driving data record
	PZD3:	Actual speed
	PZD4:	Actual torque
	PZD5 and 6:	Actual position

The PPO types 5 and 6 are described in the “local peripheral devices” section.

3.5.2 PKW processing

The parameters can be altered via the PKW mechanism in cyclic data transfer. The following tasks are processed using the PKW mechanism:

Handling and viewing parameters (Master -> Slave)

In the PKW mechanism the master defines a task; the slave processes the task and creates the appropriate response. Tasks and responses cannot be blocked, every PPO-Write contains exactly one command and every PPO-Read contains exactly one response. Therefore a maximum of 4 octets of process data can be transmitted with one task or one response. The task/response and the associated parameters are coded in the parameter ID.

Parameter ID (PKE)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
AK					Parameter number (PNU)										

Task/response processing

The task/response processing procedures are defined in such a way that the ID indicates which fields of the PKW interface (IND, PWE) must also be evaluated. Further, a differentiation is made between the parameter value and the parameter description.

The task and response IDs printed in **bold** in the following two tables are currently used for the ***MDA***.

Table Task IDs (Master -> Slave)

Task ID	Function	Response ID	
		positive	negative
0	**No task**	**0**	
1	**Request parameter value**	**1,2**	**7**
2	**Change parameter value (word)**	**1**	**7,8**
3	Change parameter value (double word)	2	7,8
4	Request description element	3	7
5	Change description element	3	7,8
6	**Request parameter value (array)**	**4,5**	**7**
7	**Change parameter value (array word)**	**4**	**7,8**
8	**Change parameter value (array double word)**	**5**	**7,8**
9	Request number of array elements	6	7

The right column in the task ID table refers to the response ID table and contains the normal responses associated with the task (positive) and also under fault conditions (negative). The master transfers a task to a slave with PPO-Write. It repeats this task at least until a response comes in from the slave with PPO-Read. This procedure ensures task/response transfer at the user level. Only one task is being processed at any given time. A slave provides the response until the master creates a new task. If the response contains a parameter value, each repetition from the slave always transmits the current value (cyclic processing). These are all responses to the tasks "Request parameter value" and "Request parameter value (array)". The PWE transfer of words is realised using octet 7 and octet 8 of the PPO, and double words are transferred using octet 5 to octet 8 of the PPO.

For tasks and responses which refer to array elements, the IND (octet 3 of the PPO) contains the array subindex. For tasks and responses which refer to parameter descriptions, the IND (octet 3 of the PPO) contains the record subindex of the parameter description corresponding to the object definition in the "Profidrive Profibus profile Issue September 1997, section 5.1 parameters". In case of tasks which cannot be executed, the slave responds with an error number in octet 7 and octet 8 from PPO-Read (interpreted as Integer16).

Table Response IDs (slave -> master)

Response ID	Function
0	**No response**
1	**Transmit parameter value (word)**
2	**Transmit parameter value (double word)**
3	Transmit description element
4	**Transmit parameter value (array word)**
5	**Transmit parameter value (array double word)**
6	Transmit number of array elements
7	**Task cannot be executed (with fault number)**
8	**No programming rights for PKW interface**
9	Parameter data signal word
10	Parameter data signal double word

Table Error numbers for response

Error number	Meaning
0	Impermissible PNU
1	Parameter value cannot be changed
2	Upper or lower value limit exceeded
3	Faulty subindex
4	Not used
5	Wrong data type
6 - 9	Not used
10	Access group (user level) wrong/Read-only parameters
11 - 100	Not used
101	Impermissible task ID

The error numbers 0 to 100 are defined or reserved depending on the PROFIDRIVE profile.

3.5.3 Transmission of PPOs with Profibus DP, the Data_Exchange function

When Profibus-DP is used only cyclic data exchange with PPOs is available. Furthermore DP offers the function Data_Exchange with which cyclic data can be transmitted to the slave and also collected from the slave at the same time. The input and output data which are exchanged with Data_Exchange hereby correspond to the described PPO types. The change of the PPO type during ongoing operation is not possible.

3.5.4 Configuration of the PPO type, the Check_Configuration function

In the Profibus DP communication model, a modular slave consists of a number of input modules, output modules or combined input/output modules. A module is hereby described by a so-called ID. It contains the information about the direction of the module (input or output), the number of input or output bytes of the module and the data consistency of the module (byte or word consistency or consistency over the entire length). The information about the modules present in the slave and their IDs is also called slave configuration. The programmed configuration in the DP master is sent from the DP master to the DP slave when establishing cyclic communication with the Check_Configuration function. The slave checks whether the received configuration is compatible with the permissible configuration.
This means that each PPO type must be copied to modules and described by the corresponding IDs. PPOs which are sent to the slave from the master are interpreted as output data (WritePPO). PPOs which are received by the master from the slave are interpreted as input data (ReadPPO).
There are 4 different configurations available for the PPO types.

	PPO-Write type	PPO-Read type	Configuration data	Output bytes	Input bytes
1.	3	3	0xE1, 0xD1	4	4
2.	3	4	0xE1, 0xD5	4	12
3.	1	1	0xE5, 0xD5	12	12
4.	1	2	0xE5, 0xD9	12	20

Available for firmware version APP 02.00 and operating software version MDAwin 02.00 and higher and GSD-file V4:

5.	5	5		20	20
6.	6	6		28	28

Available for firmware version APP 02.04 and operating software version MDAwin 02.04 and higher and GSD-file V5:

7.	2	2	0xE9, 0xD9	20	20

The first two configurations cannot be used for programming the drive, but they do not burden the Profibus as strongly, as 16 bytes less per telegram (8 bytes outgoing data and 8 bytes incoming data) need to be transmitted. For configurations 1 (STW/ZSW and HSW/HIW) and 3 (parameter, STW/ZSW and HSW/HIW) only the process data which are most necessary are transmitted, which burdens the Profibus with 8 bytes per telegram less than the configurations 2 and 4 (+ actual values).

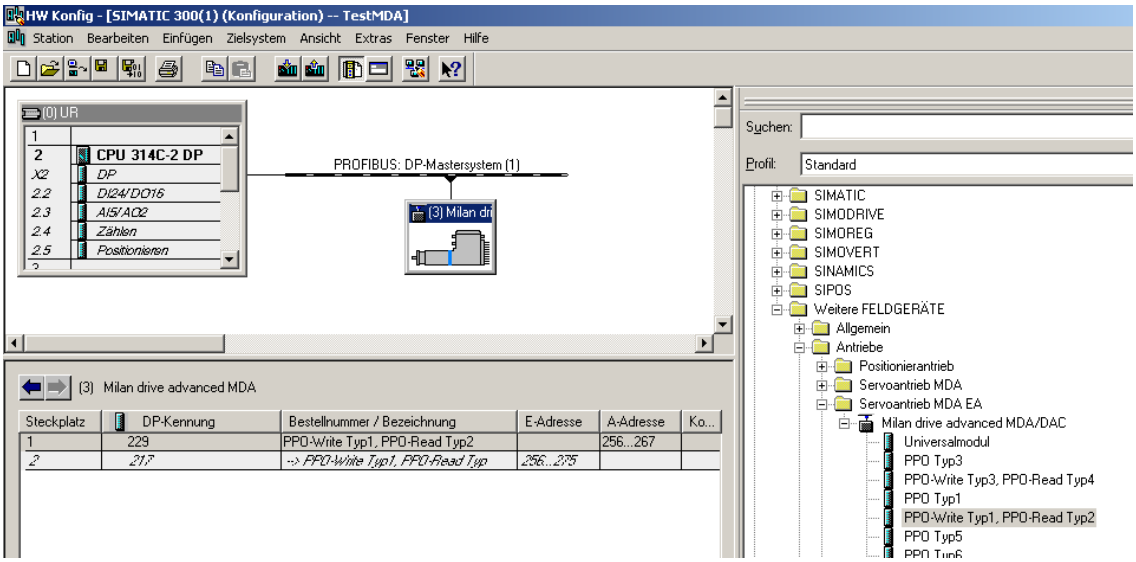
3.6 Programming of the master sub-assembly

3.6.1 Configuration of the controls

When using Siemens S7 controls, the MDA is connected via the graphic user interface of the hardware configuration in Step7 to the master controls.

When using MDA for the first time, you have to import the GSD file on the enclosed CD into Step7. From firmware version APP 02.00: The GSD file includes a picture of the drive in BMP format. If the picture is in the same path when reading the GSD file, the MDA may be displayed in the hardware configuration window.

You may drag the MDA, using drag & drop, from the hardware catalogue of the hardware configuration to the bus string in the configuration window.



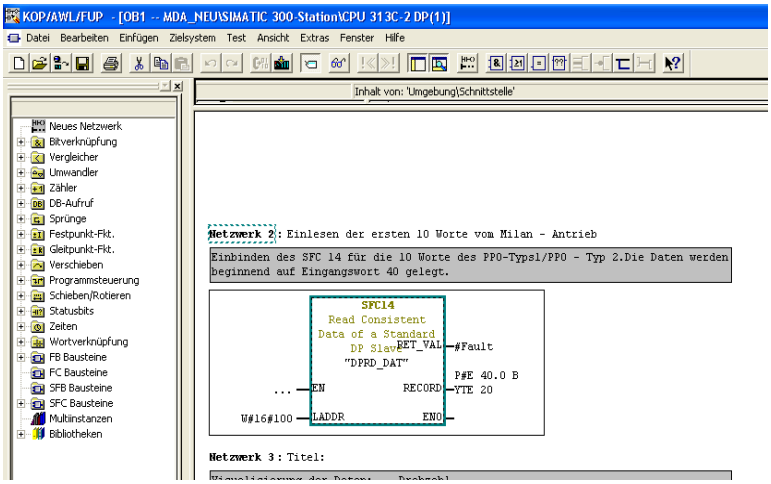
A general window opens where you have to set the bus address. Then select the PPO types and drag them into the I/O fields of the actuator.
To set the bus address, use the "Fieldbus" window in the MDAwin operating software.

3.7 Integrating SFC14 and SFC 15

Use PPO type 1 or PPO type 1/PPO type 2 to change the parameters. Since more than 4 bytes are exchanged, depending on the PLC used, the system component SFC14 has to be integrated in OB1. Only the type range S7-400 is able to directly and consistently receive larger data stacks via Profibus and does not require using these functional blocks.
Functional blocks SFC 14 and 15 are system functional blocks of Siemens Step7 generation. Functional blocks can directly be established in the Step7 manager block directory. For further description of input and output assignment of functional blocks, refer to Step7 help.

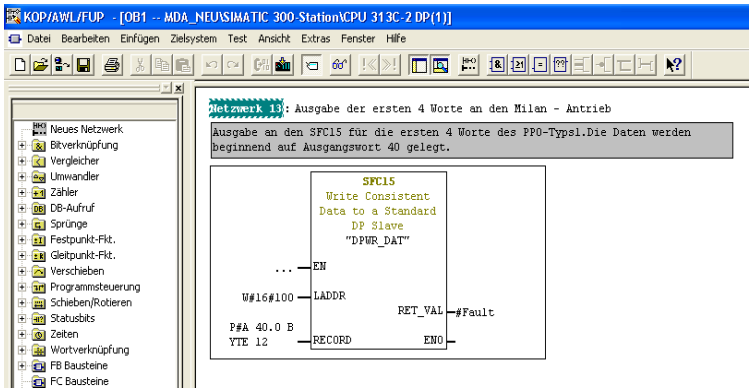
This system component reads consistent data from the drive. In the following PPO type 1/PPO type 2 is used (i.e. write 6 words and read 10 words).

LADDR: W#16#100	100hex = 256dez	I/O address range
RECORD: P#40.0 Byte 20		Pointer to data range where data are to be recorded



SFC 15 writes consistent data to the drive. In the following, PPO type 1/PPO type 2 is used (i.e. write 6 words and read 10 words).

LADDR: W#16#100	100hex = 256dez	I/O address range
RECORD: P#40.0 Byte 20		pointer to data range where data are to be recorded



3.8 Functional blocks

Functional blocks are available for the bus communication of the MDA with a Siemens S7. When using these blocks, the bus communication does not have to be programmed as the functional blocks may be integrated in existing applications.
The "S7 functional blocks for Profibus DP" manual contains the description of the individual functional blocks.

4 Parameters

4.1 List of the parameter numbers

PNU	Subindex	Description
1 99	17	Driving data records 1 to 99
100 897		Not used
898 899	17	Driving data records Run Inching 1 Inching 2
900 999		Reserved for Profidrive
1000		Not used
1001	16	System parameters
1002	20	Actual values
1003	27	Drive data
1004 1005		Not used
1006	20	Reference operation
1007	9	Bus interface
1008	8	Control loop
1009	16	Fault register
1010	16	Warning register
1011	17	Status hardware
1012		Customer designation
1013 1020		Not used
1021	4	Technological function: Flying referencing
1022		Technological function: Electric shaft
1023		Technological function: Override
1024 1100		Not used
1101- 1104	5	Digital inputs 1 to 4
1105 1140		Not used
1141 1144	6	Digital outputs 1 to 4
1145 1180		Not used
1181	9	Analogue input
1182 1184		Not used
1185 1190		Not used
1191	11	Analogue output (not implemented)
1192 1200		Not used
1201 1204	9	Speed position controller, controller record 1to 4
1205 1210		Not used
1211	9	Current operational data
1212 1220		Not used
1221 1300		Not used
1301 1400		Soft PLC parameter (not implemented)
1401 1500	8	Event buffer (only readable with MDAwin)

4.2 PROFIDRIVE profile parameter numbers

The parameter numbers 900 to 999 are defined or reserved for PROFIDRIVE according to the profile. The following table includes an overview of the parameter numbers defined in the PROFIDRIVE PROFIBUS profile which are used in the MDA interface.

PNU	AK	Designation	Data type
927	1,2	Parameter change rights (PKW)	Unsigned16 (11 bit = max. of 2048 PNUs)
947	1	Fault number	
971	2	Save parameter to non-volatile memory	

4.2.1 PNU 927, Parameter change rights (PKW)

With this value the parameter change rights for the PROFIBUS interface can be requested or transferred. An error may occur if the MDAwin operating software has the parameter change rights; i.e. the "Online Level 1" operation mode has been selected or another master has already requested the parameter change rights.

The change rights can be requested or transferred by sending a telegram:

PWE	Designation
0	PROFIBUS interface does not have the parameter change rights
1	PROFIBUS interface has the parameter change rights

A value higher than 1 will be considered as a fault.

By reading the PNU, it can be checked which interface does have the change rights actually:

PWE	Designation
0	MDA has the parameter change rights
1	RS232 has the parameter change rights (MDAwin)
2	PROFIBUS interface has the parameter change rights
3	CANopen interface has the parameter change rights

4.2.2 PNU 947, Fault number

If the bit 3 (fault) is set in the status word, the fault number can be queried in this parameter. The parameter is a Read-only parameter.

This PNU offers an overview over selected faults. If the fault number 12 is indicated, a detailed fault signal within the manufacturer-specific PNU 1009 “Fault register".

PWE	Designation
0	Without fault
1	DC-link circuit below 180V
2	DC-link circuit above 400V
3	Motor temperature above 140°C
4	Electronics temperature above 78°C
5	Brake supply voltage not in range from 20V to 28V
6	Quick stop
7	Fault occurred during reference operation
8	Motor current switched off
9	Fault in driving data record
10	Fault in the system parameters
11	Drive blocked
12	Collective fault, for details refer to the fault register PNU 1009

4.2.3 PNU 971, Save parameter to non-volatile memory

Use this function to store all parameter settings in the non-volatile EEPROM memory. The PWE parameter value must take the value 1 during transmission.

The values changed via PROFIBUS are discarded when switching off the MDA or in case of a power failure since they are only stored in the RAM. If the changed parameters are to be retained even after the MDA has been switched off, use this PNU to save the values before switching off the mains voltage.

From a physical point of view, EEPROM memories possess a lower number of maximum possible write cycles than RAM memories. Therefore, parameter changes should only be stored into the EEPROM if this data is to be maintained even after switching off the MDA.

Consequently, it is recommended to only save data after successful parameterization or prior to disconnecting the voltage.

4.3 Device-specific parameter numbers

In the following, the individual device-specific PNUs are listed in detail. In the access column, the abbreviations RO for read only and RW for read/write are used.
In the AK column, the task ID required to assign a task is indicated. The ID is required to read or describe the respective subindex. For more detailed information refer to section "3.4.6 PKW processing".

4.3.1 PNU 1 to 99 driving data records, PNU 898 and 899 push-to-run driving data records

Use PNU 1 to 99 to program the driving data records in the same way as via the "DDR editor" window in the MDAwin operating software. For information on the individual parameters, please refer to the "DDR editor window" section in the "User Manual RS232 Firmware".
PNUs 898 and 899 (push-to-run driving data records 101 and 102) enable changing the parameters for push-to-run operation and are described in detail in the "Manual operation window" section in the "User Manual RS232 Firmware".

Sub-index	AK	Parameter	List	Min	Max	Default	Unit	Access
1	6,7	Controller type	0=None 1=Torque 2=Output speed 3=Absolute position 4=Relative position 5=Modulo position 6=Contouring error			0		RW
2	6,7	Feature	Bit00=Synchronisation Bit01=Nominal value externally allowed Bit02=Stop with position dwell time Bit03=Stop with brake Bit04=Intermediate stop without current Bit05=with speed limitation Bit06-07=Reserved			0 0 0 0 0 0 0		RW
3	6,8	Nominal value		-2^{31}	$+2^{31}-1$	0	type dep.	RW
4	6,8	Target time		0	$+2^{32}$	0	ms	RW
5	6,7	Torque		0	10000	500	mNm	RW
6		Reserved						
7	6,7	Maximum speed		0	8000	4000	rpm	RW
8	6,7	Nominal output speed for position control		0	8000	3000	rpm	RW
9	6,7	Acceleration value		100	65535	1000	rpm/s	RW
10	6,7	Deceleration value		100	65535	1000	rpm/s	RW
11	6,8	Holding time (ms)		0	1000000	0	ms	RW
12	6,7	Acceleration ramp	0=Linear 1=Sinesquare	0	1	0		RW
13	6,7	Deceleration ramp	0=Linear 1=Sinesquare	0	1	0		RW
14	6,7	Driving data record linking	0=None 1=Overhung 2=Maintain position 3=Brake 4=Without power	0	99	0		RW
15	6,7	Next DDR		0	99	0		RW
16	6,7	Control parameter record		1	4	1		RW
17	6,7	Program identification		0	99	0		RW

4.3.2 PNU 1001 System parameters

For a detailed parameter description refer to the "System window" section in the "RS232 Firmware" user manual.

Sub-index	AK	Parameters	List	Min	Max	Default	Access
1	6,7	System type	0=Linear 1=Round shaft/modulo			0	RW
2	6,7	Display unit Time	0=Second 1=Minute			0	RW
3	6,7	Display unit Position	0=Turn 1=Degree 2=Minute 3=Second 4=Increments 5=m 6=dm 7=cm 8=mm 9=µm			4	RW
4	6,7	Display unit Temperature	0=°Celsius 1=Fahrenheit			0	RW
5	6,7	Conversion Motor unit	0=Motor turn 1=Gear rotation 2=Increments			0	RW
6	6,7	Conversion System unit	0=Turn 1=m 2=dm 3=cm 4=mm 5=µm 6=Degree 7=Minute 8=Second			0	RW
7	6,7	Conversion Motor value		1	65000	1	RW
8	6,7	Conversion System value		1	65000	1	RW
9	6,7	Inversion of direction system	0=No 1=Yes			0	RW
10	6,7	Inversion of direction gear	0=No 1=Yes			0	RW
11	6,7	Gear factor input		1	1000	1	RW
12	6,7	Gear factor output		1	1000	1	RW
13		Reserved				0	
14	6,7	Software limit switch	0=Not activated 1=Activated			0	RW
15	6,8	Software limit switch negative		-2^{31}	$+2^{31}-1$	0	RW
16	6,8	Software limit switch positive		-2^{31}	$+2^{31}-1$	0	RW

4.3.3 PNU 1002 Actual values

For a detailed parameter description refer to the "Actual values window" and "Drive information window" sections in the "RS232 Firmware" user manual.
These parameters are described by the system and may not be changed by the user. The user has read access only.

Sub-index	AK	Parameters	Min	Max	Unit	Access
1	6	Torque/Force	-10000	10000	mNm	RO
2	6	Output speed/Speed	-8000	8000	rpm	RO
3	6	Position	-2^{31}	$+2^{31}-1$	Inc.	RO
4	6	Error	0	65k	Inc.	RO
5	6	DC-link circuit			*10 V	RO
6	6	24 VDC internal			*10 V	RO
7	6	24 VDC external			*10 V	RO
8	6	Brake voltage			*10 V	RO
9	6	Temperature electronics			*10 °C	RO
10	6	Temperature motor			*10 °C	RO
11	6	Temperature motor controls			*10 °C	RO
12	6	Temperature ballast			*10 °C	RO
13	6	Active DDR	0	99		RO
14	6	Info status 1				RO
15	6	Info collective faults				RO
16	6	Info collective warnings				RO
17	6	Info status 2				RO
18	6	Info drive				RO
19		Reserved				
20		Reserved				

4.3.3.1 Subindex 14 Info status 1

Bit	Decimal	Description
0	1	Collective warning
1	2	Collective fault
2	4	DDR active
3	8	Setpoint (type of setpoint depends on the driving data record type)
4	16	Reference operation active
5	32	Fieldbus active
6	64	Control error
7	128	Intermediate stop during driving data record processing
8	256	Single step mode active
9	512	Single step pause active
10	1024	Reference set
11 - 15	> 2048	reserved

4.3.3.2 Subindex 15 Info collective faults

Bit	Decimal	Comment
0	1	Collective fault Voltage monitoring Uzk < 180V
1	2	Collective fault Temperature monitoring Uzk > 400V
2	4	Collective fault Motor monitoring
3	8	Collective fault LocalCAN monitoring
4	16	Collective fault Fieldbus monitoring
5	32	Collective fault Driving data record processing
6	64	Collective fault Parameters
7	128	Collective fault Logic hardware
8 - 15	> 256	reserved

4.3.3.3 Subindex 16 Info collective warnings

Bit	Decimal	Designation
0	1	Collective warning Voltage monitoring
1	2	Collective warning Temperature monitoring
2	4	Collective warning Motor monitoring
3	8	Collective warning LocalCAN monitoring
4	16	Collective warning Fieldbus monitoring
5	32	Collective warning Driving data record processing
6	64	Collective warning Parameters
7	128	Collective warning Logic hardware
8 – 15	> 256	reserved

4.3.3.4 Subindex 17 Info status 2

Bit	Decimal	Description
0	1	Stop command is present
1	2	Stop command Rf0 is present
2	4	Quickstop command is present
3	8	Indication of the synchronisation status for Technological function Electric shaft
4 - 15	> 16	reserved

4.3.3.5 Subindex 18 Info drive

Bit	Decimal	Description
0	1	limit switch plus
1	2	limit switch minus
2	4	Drive without power
3	8	Drive at standstill
4	16	Brake active
5	32	Fan active
6 - 15	> 64	reserved

4.3.4 PNU 1003 Drive data

For a detailed parameter description refer to the "Hardware window" section in the "RS232 Firmware" user manual.

The functions quick stop ramp and quick stop value are available from firmware version APP 02.01 and operating software MDAwin 02.01 and higher.

NOTE

Modifications of the motor data, the motor offset and the UZK correction factor may cause major faults or even a complete failure of the drive.

→ The values may only be changed by the service department of GFC AntriebsSysteme.

Sub-index	AK	Parameters	List	Min	Max	Default	Unit	Access
1	6	Motor type	0=Not defined 1=MES35 2=MES63 3=MES56			0		RO
2	6	Motor pole pairs	0=Not defined 3-6	0	6	0		RO
3	6	Feedback source	0=Resolver 1=Hyperface			0		RO
4	6	Brake	0=Not available 1=available			0		RO
5		Fan	0=Not available 1=continuous 2=temperature-controlled			0		RW
6		Reserved						
7	6	Current factor		1000	10000	1750		RO
8	6,7	Max. torque positive		0	10000	4000	mNm	RW
9	6,7	Max. torque negative		0	10000	4000	mNm	RW
10	6,7	Max. speed positive		0	8000	4000	rpm	RW
11	6,7	Max. speed negative		0	8000	4000	rpm	RW
12	6,7	Speed limit		0	10000	6000	rpm	RW
13	6	Resolver offset		-1	4095	-1	Inc.	RO
14	6	Align Current		0	65535	1000	mNm	RO
15	6	Align Period		0	65535	1000	ms	RO
16	6	Position ind. impulses		1	65535	4096		RO
17	6,7	Position holding time		0	65535	0	ms	RW
18	6	Brake apply time		0	5000	40	ms	RO
19	6	Brake release time		0	5000	40	ms	RO
20	6	UZK correction factor		0	1000	90		RO
21	6,7	Ballast monitoring	0=User defined 1=None 2=internal 3=100W external 4=200W external 5=400W external			2		RW
22	6	Ballast time constant		0	65535	250		RO
23	6	Ballast fault		0	65535	700		RO
24	6	Max. motor torque		0	10000	4000	mNm	RO
25	6	Max. motor speed		0	8000	4000	rpm	RO
26	6,7	Quick stop ramp	0=Linear 1=Sinesquare	0	1	0		RW
27	6,7	Quick stop value		100	65535	65535	rpm/s	RW

4.3.5 PNU 1006 Reference operation

For a detailed parameter description refer to the "Reference operation window" section in the "RS232 Firmware" user manual.

The functions Timeout and Next DDR with DDR no. are available from firmware version APP 02.01 and operating software version MDAwin 02.01 and higher.

Sub-index	AK	Parameters	List	Min	Max	Default	Unit	Access
1	6,7	Type	0=None 1=Marker 2=Flank 3=Limit switch positive 4=Limit switch negative 5=Block positive 6=Block negative			0		RW
2	6,7	Start	0=Power up 1=First start 2=Manual 3=Input			0		RW
3	6,7	Behaviour after reference	0=No operation 1=Approach limit switch positive 2=Approach limit switch negative 3=Approach position 4=Next DDR			0		RW
4	6,7	Reference traverse	0=positive 1=negative			0		RW
5	6,7	Absolute resolver position		-1	4095	-1		RW
6	6,7	Output speed/ speed		-8000	8000	100	rpm	RW
7	6,7	Torque/ Force		0	10000	500	mNm	RW
8	6,8	Reference offset		-2^{31}	$+2^{31}-1$	0	Incr	RW
9	6,8	Position after ref operation		-2^{31}	$+2^{31}-1$	0	Incr	RW
10	6,8	Manual reference position		-2^{31}	$+2^{31}-1$	0	Incr	RW
11	6,7	Acceleration		100	65535	1000	rpm/s	RW
12	6,7	Deceleration		100	65535	1000	rpm/s	RW
13	6,7	Acceleration ramp	0=Linear 1=Sinesquare			0		RW
14	6,7	Deceleration ramp	0=Linear 1=Sinesquare			0		RW
15	6,7	Brake	0=No 1=Yes			0		RW
16		Reserved						
17	6,7	Time-out value		0	65535	0	s	RW
18	6,7	DDR no.		0	99	0		RW
19		Reserved						
20		Reserved						

4.3.6 PNU 1007 Bus interface

For a detailed description of the parameters refer to the "MDAwin operating software" section in this manual and to the "Fieldbus window" section in the "RS232 Firmware" user manual.

Sub-index	AK	Parameters	List	Min	Max	Default	Access
1	6	Type	0=None 1=PROFIBUS 2=CANopen 3=DeviceNet			0	RO
2	6,7	Bus termination	0=No 1=Yes			0	
3	6,7	Slave address		0	255	2	RW
4		Baud rate				0	
5		Operation mode				0	
6	6,7	Diagnosis	0=Off 1=On			0	
7	6,7	Disable fieldbus access	0=No 1=Yes			0	
8	6,7	Rights	0=Read only 1=Change DDR 2=Only service and bus cannot be changed 3=Everything can be changed			0	
9		Reserved					

4.3.7 PNU 1008 Control loop

For a detailed parameter description refer to the "Control loop window" section in the "RS232 Firmware" user manual.
These parameters are adapted to the mounted motor in the factory and may not be changed by the user. The user has read access only.

NOTE

Modifications of the control loop parameters may cause major faults or even a complete failure of the drive.

→ The values may only be changed by the service department of GFC AntriebsSysteme.

Sub-index	AK	Parameters	Min	Max	Default	Unit	Access
1	6	Field-P amplification (KP)	1	65535	5000	1000th	RO
2	6	Field-P scaling	-1000	1000	1		RO
3	6	Field-I reset time (TN) (µs)	0	65535	5000	10ys	RO
4	6	Field-I scaling	-1000	1000	1		RO
5	6	Torque-P amplification (KP)	1	65535	5000	1000th	RO
6	6	Torque-P scaling	-1000	1000	1		RO
7	6	Torque-I reset time (TN) (µs)	0	65535	5000	10ys	RO
8	6	Torque-I scaling	-1000	1000	1		RO

4.3.8 PNU 1009 Fault register

For a detailed parameter description refer to the "Drive fault window" section in the "RS232 Firmware" user manual.
Subindices 9 to 16 are currently not assigned. The meanings of the numbers in each subindex are explained in the following tables. The fault numbers are set by the system and will be cancelled after acknowledgement. The user has read access only.

Subindex	AK	Parameters	Access
1	6	Faults Voltage	RO
2	6	Faults Temperature	RO
3	6	Faults Motor	RO
4	6	Faults LocalCAN	RO
5	6	Faults Fieldbus	RO
6	6	Faults Driving data record	RO
7	6	Faults Parameters	RO
8	6	Faults Logic hardware	RO
9 – 16		Fault registers 09 to 16	

4.3.8.1 Subindex 1 Individual fault register 1 (voltages)

Bit	Decimal	Description
0	1	Voltage monitoring DC-circuit link UZK < 180V
1	2	Voltage monitoring DC-circuit link UZK < 400V
2	4	Voltage monitoring Brake
3 - 15	> 8	reserved

4.3.8.2 Subindex 2 Individual fault register 2 (temperatures)

Bit	Decimal	Description
0	1	Temperature monitoring Motor
1	2	Temperature monitoring Electronics
2	4	Temperature monitoring Power electronics
3	8	Temperature monitoring Ballast resistor
4 - 15	> 16	reserved

4.3.8.3 Subindex 3 Individual fault register 3 (motor)

Bit	Decimal	Description
0	1	Resolver signal
1	2	Resolver index
2	4	Encoder signal
3	8	Encoder index
4	16	Loss of Spi synchronisation
5	32	reserved
6	64	reserved
7	128	reserved
8	256	reserved
9	512	Fault Motor controls
10	1024	Motor blocked (during resolver adjustment)
11	2048	Number of pole pairs incorrect
12	4096	Motor incorrectly connected
13	8192	Output speed fault
14	16284	Hardware fault
15	32768	Firmware fault

4.3.8.4 Subindex 4 Individual fault register 4 (LocalCAN)

Bit	Decimal	Description
0	1	Connection CAN XC-DSP
1	2	Connection CAN XC-I/OBox
2 – 15	> 4	reserved

4.3.8.5 Subindex 5 Individual fault register 5 (fieldbus)

Bit	Decimal	Description
0	1	Connection monitoring bus
1	2	Fault in the slave drive (for Technological function Electric shaft)
2 - 15	> 4	reserved

4.3.8.6 Subindex 6 Individual fault register 6 (driving data manager)

Bit	Decimal	Description
0	1	Reference operation fault
1	2	Process driving data record
2	4	Quickstop is performed
3	8	Drive blocked during driving data record
4	16	Switch-on limit active
5	32	Drive does not stop after stop command
6	64	Positioning commands without set reference
7	128	Analogue value outside the valid range
8	256	Range overflow of absolute encoder (APP 02.00 and MDAwin 02.00)
9 – 15	> 512	reserved

4.3.8.7 Subindex 7 Individual fault register 7 (parameters)

Bit	Decimal	Description
0	1	Fault Motor parameters
1	2	Fault System parameters
2 – 15	> 4	reserved

4.3.8.8 Subindex 8 Individual fault register 8 (logic hardware)

Bit	Decimal	Description
0	1	Fault in the EEPROM
1	2	Fault in the Flash-CRC
2	4	Fault during system start
3 – 15	> 8	reserved

4.3.9 PNU 1010 Warning register

For a detailed parameter description refer to the “Drive warning window” section in the “RS232 Firmware” user manual.
Subindices 9 to 16 are currently not assigned. The meanings of the number in each subindex are explained in the following tables.

Subindex	AK	Parameters	Access
1	6	Warnings Voltage	RO
2	6	Warnings Temperature	RO
3	6	Warnings Motor	RO
4	6	Warnings LocalCAN	RO
5	6	Warnings Fieldbus	RO
6	6	Warnings Driving data manager	RO
7	6	Warnings Parameters	RO
8	6	Warnings Logic hardware	RO
9 – 16		Warning registers 09 to 16	

4.3.9.1 Subindex 1 Individual warning register 1 (voltages)

Bit	Decimal	Description
0	1	Voltage monitoring DC-circuit link UZK
1	2	Voltage monitoring Brake
2 – 15	> 4	reserved

4.3.9.2 Subindex 2 Individual warning register 2 (temperatures)

Bit	Decimal	Description
0	1	Temperature monitoring Motor
1	2	Temperature monitoring Electronics
2	4	Temperature monitoring Power electronics
3	8	Temperature monitoring Ballast resistor
4 – 15	> 16	reserved

4.3.9.3 Subindex 3 Individual warning register 3 (motor)

Bit	Decimal	Description
0 – 15	> 1	reserved

4.3.9.4 Subindex 4 Individual warning register 4 (LocalCAN)

Bit	Decimal	Description
0	1	Connection CAN XC-DSP
1	2	Connection CAN XC-I/OBox
2 – 15	> 4	reserved

4.3.9.5 Subindex 5 Individual warning register 5 (fieldbus)

Bit	Decimal	Description
0	1	Connection monitoring via bus
1 – 15	> 2	reserved

4.3.9.6 Subindex 6 Individual warning register 6 (driving data manager)

The warning „limit switch reached“ is available from firmware version APP 02.01 and operating software version MDAwin 02.01 and higher.

Bit	Decimal	Description
0	1	Contouring error available
1	2	Global speed limit reached
2	4	Global torque limit reached
3	8	Switch-on limit active
4	16	Range overflow of absolute encoder (APP 02.00 and MDAwin 02.00)
5	32	Limit switch (positive or negative) reached (APP 02.01 and MDAwin 02.01)
6 – 15	> 64	reserved

4.3.9.7 Subindex 7 Individual warning register 7 (parameters)

Bit	Decimal	Description
0	1	Warning Motor parameters
1	2	Warning System parameters
2 – 15	> 4	reserved

4.3.9.8 Subindex 8 Individual warning register 8 (logic hardware)

Bit	Decimal	Description
0 – 15	> 1	reserved

4.3.10 PNU 1011 Hardware status

For a detailed parameter description refer to the "name plate window", “I/O drive window” and the “drive info drive” section in the "RS232 Firmware" user manual.

Sub-index	AK	Parameters	List	Min	Max	Default	Access
1	6	Logic variant					RO
2	6	Bus module variant	0=No module available 1=Profibus 2=CANopen				RO
3	6	I/O interface variant	0=No module available 1=Type1				RO
4	6	Number of digital inputs on interface		0	4	4	RO
5	6	Number of digital outputs on interface		0	4	4	RO
6	6	Number of analogue inputs on interface		0	2	1	RO
7	6	Number of analogue outputs on interface		0	2	0	RO
8	6	Status digital inputs					RO
9	6	Status digital outputs					RO
10	6	Status analogue input 1		-2^{31}	$+2^{31}-1$	0	RO
11 - 17		Reserved					

4.3.10.1 Subindex 8 Status digital inputs

Bit	Decimal	Description
0	1	Digital input 1 set
1	2	Digital input 2 set
2	4	Digital input 3 set
3	8	Digital input 4 set
4 - 15	> 16	reserved

4.3.10.2 Subindex 9 Status digital outputs

Bit	Decimal	Description
0	1	Digital output 1 set
1	2	Digital output 2 set
2	4	Digital output 3 set
3	8	Digital output 4 set
4 - 15	> 16	reserved

4.3.11 PNU 1012 Customer designation

PNU 1012 enables writing and reading of customer designation 1 from the name plate. To be able to use this PNU, the customer designation may only consist of 11 digits; the first digit is either a positive or negative algebraic sign, the remaining 9 digits may only take the values 0 to 9. Other combinations or letters in this field may cause faults during writing or reading. Task ID 6 is used to read the field, task ID 8 to write the field.
For a description of the customer designation 1 field, refer to the "Name plate window" section in the "RS232 firmware" user manual.

4.3.12 PNU 1101 to 1104 digital inputs 1 to 4

For a detailed parameter description refer to the "I/O drive window" section in the "RS232 Firmware" user manual.

The functions limit switch positive / negative with warning are available from firmware version APP 02.01 and operating software version MDAwin 02.01 and higher.

Subindex	AK	Parameters	List	Min	Max	Default	Access
1	6,7	Module address	0=Not assigned 1=Interface 2=Reserved			0	RO
2	6,7	Input number		0	255	0	RO
3	6,7	Feature	Bit00=Active High/Low Bit01=In combination with DDR Bit02-07=Reserved			1	RW
4	6,7	DDR no.	DDR no.	0	99	0	RW
5	6,7	Function	0=None 1=Synchronisation 2=GOTO DDR(x) 3=Intermediate stop 4=Single step mode 5=Reference 6=Reference start 7=Start / stop 8=limit switch negative 9=limit switch positive 10=controller enable RF0 11=Quick stop 12=Power amplifier off 13=Start 14=Stop 15=Teach in 16=Ack fault 17=set reference manually 18=limit switch negative with warning 19=limit switch positive with warning	0	19	0	RW

4.3.13 PNU 1141 to 1144 digital outputs 1 to 4

For a detailed parameter description refer to the "I/O drive window" section in the "RS232 Firmware" user manual.

Subindex	AK	Parameters	List	Min	Max	Default	Access
1		Module address	0 = Not assigned 1 = Interface 2 = Reserve			0	RO
2		Output number		0	255	0	RO
3		Feature	Bit00=Active High/Low Bit01=In combination with DDR Bit02-07=Reserved			1	RW
5		DDR no.	DDR no.	0	99	0	RW
6		Function	0=None 1=collective warning 2=collective fault 3=DDR active 4=Setpoint reached 5=reference operation 6=fieldbus active 7=control error 8=intermediate stop 9=single step mode 10=single step pause 11=reference set 12=limit switch positive 13=limit switch negative 14=drive without power 15=drive at standstill 16=Ack Quick stop 17=Ack Stop 18=Ack RFO stop 19=PB-I/O extension	0	646	0	RW

4.3.14 PNU 1181 Analogue input

For a detailed parameter description refer to the "I/O drive window" section in the "RS232 Firmware" user manual.

The functions filter adjustment and dead zone value are available from firmware version APP 02.01 and operating software version MDAwin 02.01 and higher.

Sub-index	AK	Parameters	List	Min	Max	Default	Access
1	6,7	Module address	0=Not assigned 1=Interface 2=Reserved			0	RO
2	6,7	Input number		0	255	0	RO
3	6,7	Feature	Bit00=Inverse signal Bit01=Fault hardware range yes/no Bit02-D07=Reserved				RW
4	6,7	Function	0=None 1=Output speed setpoint 2=Torque setpoint 3=Speed limit 4=Torque limit			0	RW
5	6,7	Function value min.		-32k	+32k	0	RW
6	6,7	Function value max.		-32k	+32k	0	RW
7	6,7	Interface value min.		-32k	+32k	0	RW
8	5,7	Interface value max.		-32k	+32k	0	RW
9	6,7	Input type	0=No 1= –10 ... +10V 2=Reserved			0	RW
10	6,7	Filter adjustment		0	65535	1988	RW
11	6,7	Dead zone value		0	65535	5	RW

4.3.15 PNU 1201 to 1204 Speed position controller, controller records 1 to 4

For a detailed parameter description refer to the "Speed position controller window" section in the "RS232 Firmware" user manual.

Sub-index	AK	Parameter	Min	Max	Default	Unit	Access
1	6,7	Output speed P-amplification (KP)	1	65535	5800	1000th	RW
2	6	Output speed P-scaling	-1000	1000	1		RO
3	6,7	Output speed I reset time (TN) (µs)	0	65535	131	10ys	RW
4	6	Output speed I-scaling	-1000	1000	1		RO
5	6,7	Position P-amplification (KP)	1	65535	6500	1000th	RW
6	6,7	Pilot control	0	65535	1000		RW
7	6,7	Positioning window	0	30000	10		RW
8	6,7	Contouring error window	0	30000	1000		RW
9	6	Driving data record end window	0	30000	5		RO

4.3.16 PNU 1211 Operational data

For a detailed parameter description refer to the "Operational data window" section in the "RS232 Firmware" user manual.

Sub-index	AK	Parameters	Unit	Access
1	6	Operation time	Sec	RO
2	6	Motor running time	Sec	RO
3	6	Fault Temp.Elect.		RO
4	6	Fault Temp.Motor		RO
5	6	Fault Temp.PE		RO
6	6	Fault DC-link circuit		RO
7	6	Fault Fieldbus		RO
8	6	Fault Excess current		RO
9	6	Number of restarts		RO

4.3.17 PNU 1401 to 1500 Event buffer

Depending on the version, this function is available for firmware version APP 02.00 and operating software version MDAwin 02.00 and higher. Die eingetragenen Ereignisse können über das Fenster Ereignisspeicher im Bedienprogramm MDAwin ausgelesen werden.

At the moment, the event buffer cannot be read via the Profibus interface of the MDA.

The parameters are described in detail in the “Event buffer window” of the “RS232 Firmware” user manual.
Prior to being able to read the event buffer, the PNU 1501 sub-index 1 has to be read once. Due to this reading process, an image of the event buffer is created which will not be influenced by new events while reading the individual entries.

Subindex	AK	Parameters	List	Min	Max	Default	Access
1		Event class (Type)	0 No entry 1 Fault 2 Warnings 3 Info 4 Write parameters 5 Command 6 System message	0	6	0	RO
2		Event number (Message)	event class-dependent	0	64k	0	RO
3		Event parameter (Value)		0		0	RO
4		Date, year		00	99	0	RO
5		Date, month		01	12	0	RO
6		Date, day		01	31	0	RO
7		Time, hour		00	23	0	RO
8		Time, minute		00	59	0	RO

4.4 Technological functions

The parameter numbers for the technological functions of the MDA are listed below. Depending on the version of the drive, these functions are available.

4.4.1 PNU 1021 Technological function: Flying referencing

Depending on the version, this function is available for firmware version APP 02.00 and operating software version MDAwin 02.00 and higher.

Subindex	AK	Parameters	List	Min	Max	Default	Access
1	6	Alternation ID	0=blocked 1=enabled	0	1	0	RO
2	6,7	Reference type					RW
3	6,8	active position					RW
4	6,8	nominal position					RW

4.4.2 PNU 1022 Technological function: Electric shaft

Depending on the version, this function is available for firmware version APP 02.00 and operating software version MDAwin 02.00 and higher.

Subindex	AK	Parameters	List	Min	Max	Default	Access
1	6	Alternation ID	0=blocked 1=enabled	0	1	0	RO
2	6	Operation mode					
3	6	Gear factor input					
4	6	Gear factor output					
5	6	CAN-ID Master					
6	6	CAN-ID Slave					
7	6	Sync mode					
8	6	Timeout					
9	6	Behaviour on error					

4.4.3 PNU 1023 Override

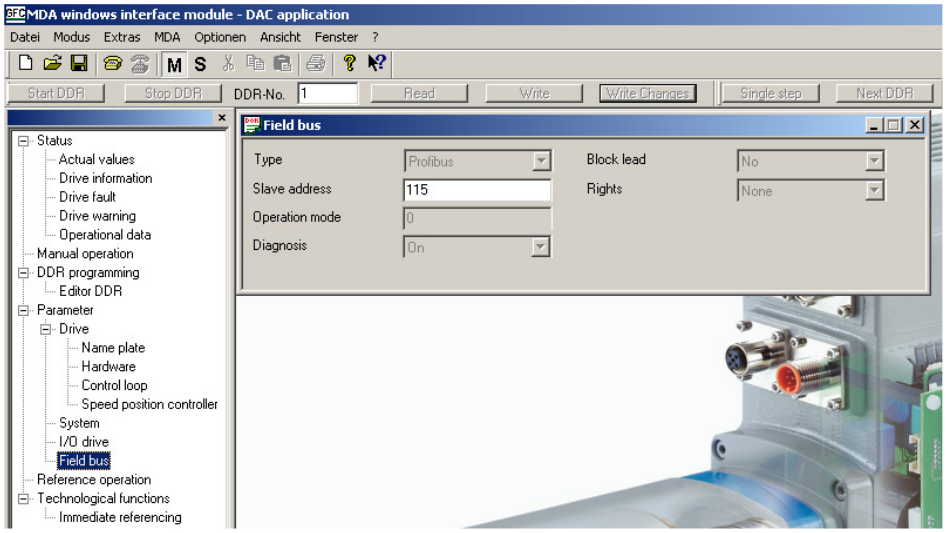
Depending on the version, this function is available for firmware version APP 02.00 and operating software version MDAwin 02.00 and higher. For a detailed description of this function refer to the “Override” section in this manual.
The subindex 1 is not used.

Subindex	AK	Parameter	Liste	Min	Max	Default	Zugriff
1		reserved					
2	6,7	Function	0=Aus 1=speed 2=time and speed			0	RW
3	6,7	value		0	255	100	RW

5 MDAwin operating software

For a detailed description of the MDAwin operating software refer to the "MDAwin operating software" section in the "RS232 Firmware" user manual.

5.1 Settings in the Fieldbus window



Type The bus module included within the drive is automatically detected and viewed, if there is a connection to the drive available (online).

Slave address The address of the slave (0...127) is entered in this field. An address may be assigned only once within a segment.
The address 125 is preset on delivery.

Operation mode This function is not yet available via PROFIBUS. Use bit 12 of the control word to change the operation mode via the PROFIBUS interface of the MDA. For more detailed information refer to section 3, "PROFIBUS DP" of the present manual.

Diagnosis This function is available for firmware version APP 02.00 and operating software version MDAwin 02.00 and higher. The diagnosis function via PROFIBUS can be switched off. When switching off, no telegrams will be sent to the master when a fault occurs at the MDA. Thus, no fieldbus fault is displayed at the superordinate controls if an MDA internal fault occurs. The internal fault detection at the MDA can only be realised via the status word.

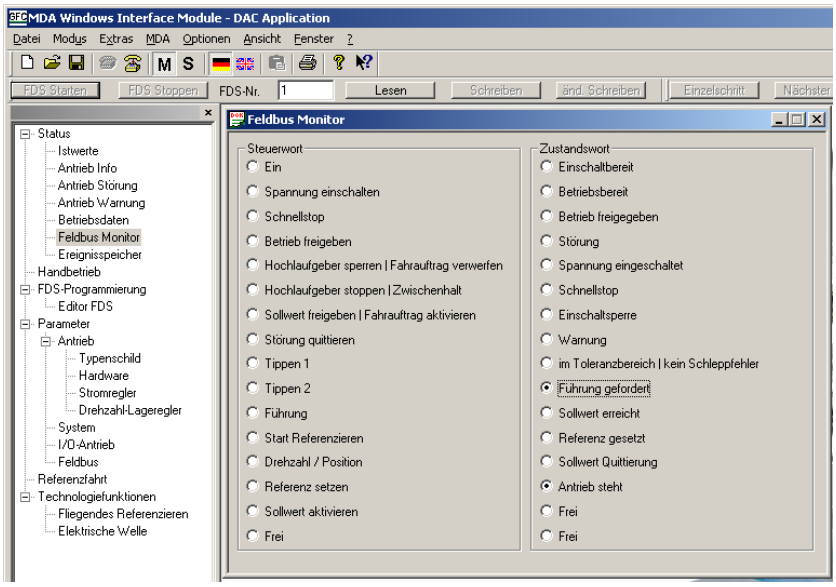
Disable fieldbus Access This function has not yet been implemented.

Rights The PROFIBUS interface of the MDA is definitely set to access level 4 Planner (refer to online level 4 for MDAwin).

The MDA automatically detects the baud rate; therefore the baud rate setting is only required for superordinate controls – the bus master. During bus initialisation phase the MDA adapts to the master baud rate.

5.2 Fieldbus monitoring window

This function is available from firmware version APP 02.04 and operating software version MDAwin 02.04 and higher.



This window displays the control and state word of a drive equipped with fieldbus interface. For this, there must be an active connection to the drive. The update is carried out at the same frequency as the update of other displays, like speed or position. No indication can be made on transient procedures via the fieldbus monitor. This window is used to commission a drive with fieldbus interface.

6 Electrical connection

DANGER

Lethal voltages at the control and power connections even if the drive is at a standstill.

Electric shock risk

→ Disconnect all wires of the connected control and power cables – also those which are not required – at the respective terminals in the control cabinet and protect them against direct contact.

→ It is not permitted by any means to just cut the connecting cables at the unassembled end.

6.1.1 Plug wiring

For a detailed plug wiring description refer to the "Electrical connection" section in the "RS232 Firmware" user manual.

6.1.2 Cable sets

For a detailed parameter description refer to the "Electrical connection" section in the "RS232 Firmware" user manual.

7 Examples

7.1.1 Example finite state machine for position control

		Description	Status
Master	**Slave**		
0x0000		Start-up	
	0x2200	Drive at standstill, control requested	Not ready for switch-on
0x0406		Provide control, ON 2 and ON 3 [a)]	
	0x2231		Ready for switch-on
0x0407		Switch-on ON 1	
	0x2233		Ready for operation
0x043F		Enable operation	
	0x2237		Operation enabled
0x0C0F		Start reference operation	
	0x2237	Reference operation started	Operation enabled
	0x2A37	Reference operation performed	Operation enabled
0x043F		End of reference operation, bit 4 and 5 ON [b)]	
	0x2A37		Operation enabled
0x047F		Start drive task	
	0x3A37	Drive at standstill, drive task accepted	
	0x1A37	Drive is running, drive task accepted	
	0x1E37	Drive is running, drive task accepted, setpoint reached	
	0x3E37	Drive is at standstill, drive task accepted, setpoint reached	Operation enabled
0x043F		Start drive task	
	0x2E37	Drive at standstill, drive task accepted	
	0x0A37	Drive is running, drive task accepted	
	0x0E37	Drive is running, drive task accepted, setpoint reached	
	0x2E37	Drive is at standstill, drive task accepted, setpoint reached	Operation enabled
0x047F		Start drive task	
	0x3E37	Drive at standstill, drive task accepted	
	0x1A37	Drive is running, drive task accepted	
0x047B			
	0x1857	OFF 3 results in Quickstop	Switch-on inhibit
	0x385F	Drive is at standstill, Quickstop results in fault	Fault
0x04FB			
	0x3857	Acknowledge fault	Switch-on inhibit
1.		1st option [c)]	
0x04FA		OFF 1	
	0x2200	Drive at standstill, control requested	Not ready for switch-on
0x0000		OFF 1 requires a reset of all bits	
	0x2200		Not ready for switch-on
	...	From the start	
2.		2nd option	
0x0000		Deactivate control, same result as OFF 1	
	0x2200	Drive at standstill, control requested	Not ready for switch-on
	...	From the start	

Comments on the table above

a) "Provide control" is evaluated first; then "ON 2" and "ON 3" can be processed. This is how the telegram has to be implemented in accordance with PROFIDRIVE V2.0.

b) Bit 4 and 5 are required for operation. However, they do not influence the finite state machine. For this reason, they can also be changed immediately.

Since Firmware APP 02.01 bits 4 and 5 are necessary for executing the reference operation.

c) PROFIDRIVE V2.0 does not provide any information regarding the effect of deactivating the control. Since active deactivation is equal to a 0x0000 telegram which is also generated when interrupting the PROFIBUS, the drive is stopped with OFF 1. This corresponds to the Fail Safe mode and was approved by the notified body for PROFIBUS.

7.1.2 Example finite state machine for speed control

		Description	Status
Master	**Slave**		
0x0000		Start-up	
	0x2200	Drive at standstill, control requested	Not ready for switch-on
0x0406		Provide control, ON 2 and ON 3 [a)]	
	0x2231		Ready for switch-on
0x0407		Switch-on ON 1	
	0x2233		Ready for operation
0x1407		Speed mode	
	0x2233		
0x140F		Operation enabled [b)]	
	0x2237	[d)]	Operation enabled
0x143F		Bit 4 and 5 ON	
	0x2237		Operation enabled
0x147F		Start drive task [e)]	
	0x2237	Drive at standstill, drive task accepted	
	0x0237	Drive is running, drive task accepted	
	0x0E37	Drive is running, drive task accepted, f or n reached	
	0x0237	Drive is running, drive task accepted	
	0x2237	Drive at standstill, drive task accepted	
0x143F		Level bit 6 is zero again because of new flank	
0x147F		Start drive task [e)]	
	0x2237	Drive at standstill, drive task accepted	
	0x0237	Drive is running, drive task accepted	
	0x0E37	Drive is running, drive task accepted, f or n reached	
0x143F		Stop drive task	
	0x0237	Drive is running, drive task accepted	
	0x2237	Drive at standstill, drive task accepted	
0x147F		Start drive task [e)]	
	0x2237	Drive at standstill, drive task accepted	
	0x0237	Drive is running, drive task accepted	
0x147D			
	0x2067	OFF 2 results in tapering off	Switch-on inhibit
1.		1st option [c)]	
0x147C		OFF 1	
	0x2200	Drive at standstill, control requested	Not ready for switch-on
0x0000		OFF 1 requires a reset of all bits	
	0x2200		Not ready for switch-on
	...	From the start	
2.		2nd option	
0x0000		Deactivate control, same result as OFF 1	
	0x2200	Drive at standstill, control requested	Not ready for switch-on
	...	From the start	

Comments on the table above

a) Provide control is evaluated first; then "ON 2" and "ON 3" can be processed. This is how the telegram has to be implemented in accordance with PROFIDRIVE V2.0.

b) Bit 4 and 5 are required for operation. However, they do not influence the finite state machine. For this reason, they can also be changed immediately. For reasons of clarity, they will be changed from the next telegram.

c) PROFIDRIVE V2.0 does not provide any information regarding the effect of deactivating the control. Since active deactivation is equal to a 0x0000 telegram which is also generated when interrupting the PROFIBUS, the drive is stopped with OFF 1. This corresponds to the Fail Safe mode and was approved by the notified body for PROFIBUS.

d) The value 0x2A37 may also be displayed here if either the reference operation has been performed with regards to the position or if the entries "None" or "Powerup" are already available in the programming tool for "Reference operation".

7.2 Example: Parameter transmission

Master	Slave	Description
239F 0000 0000 0001		Request parameter change rights [a]
	139F 0000 0000 0001	Positive telegram confirmation
7382 0100 0000 0002		Set controller type output speed in the manual operation1 DDR [b]
	4382 0100 0000 0002	Positive telegram confirmation

Comments on the table above

a) First of all, parameter change rights are requested by sending the value 0x01 to the PNU 927 (0x39F). The order recognition for the respective telegram is combined with the PNU.

b) As an example, type of controller (sub-index 1) within the manual operation driving data record 1 (PNU 898, 0x382) is set to speed (value 0x02).

8 Literature

8.1 Milan user manuals

1. Short instructions
   Order no.: Y004.135

2. User manual RS232 Firmware
   Order no.: Y003.804

3. Dimension sheet
   Order no.: Y003.805
   (2D and 3D-CAD data of the MDA for common CAD systems can be ordered from GFC AntriebsSysteme)

4. Technical data
   Order no.: Y003.806

5. Interface description PROFIBUS DP
   Order no.: Y004.011

6. Interface description CANopen
   Order no.: Y004.013

7. Functional block description S7 functional blocks for Profibus DP
   Order no.: Y004.012

8. Functional block description PLC function blocks for CANopen
   Order no.: Y004.014

9. Operation instructions Operation box PV 1608
   Order no.: Y004.010

8.2 Further literature

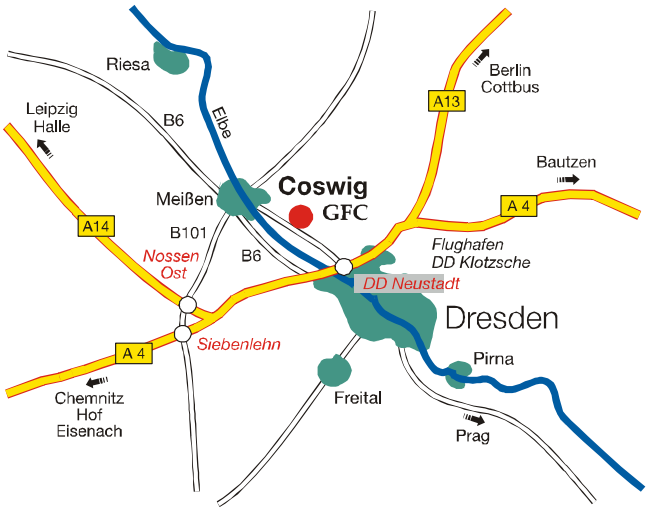
1. As an introduction to Profibus DP:
   Manfred Popp: PPROFIBUS DP, Grundlagen, Tipps und Tricks für Anwender.
   Hühtig Verlag, ISBN 3-7785-2676-6

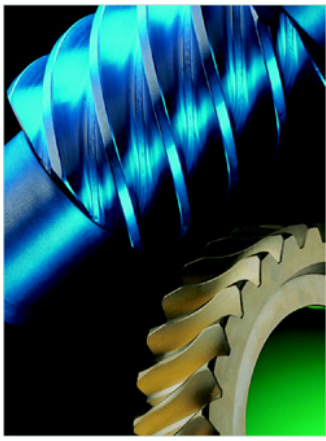
2. Guidelines for the electrician:
   Installation guide Profibus DP/FMS, order no. 2.112
   Available from:
   PROFIBUS Nutzerorganisation Haid-und-Neu-Str. 7
   D – 76131 Karlsruhe
   Tel +49-721/ 9658590
   Fax +49-721/ 9658589
   http:/ www.profibus.com

3. Profibus profile:
   Profile for Profidrive variable speed drives,
   Version 2, order no. 071
   Available from: PROFIBUS Nutzerorganisation Haid-und-Neu-Str. 7
   D – 76131 Karlsruhe
   Tel +49-721/ 9658590
   Fax +49-721/ 9658589
   http:/ www.profibus.com

4. Profibus guideline:
   Connection technology for Profibus, order no. 2.142
   Available from: PROFIBUS Nutzerorganisation Haid-und-Neu-Str. 7
   D – 76131 Karlsruhe
   Tel +49-721/ 9658590
   Fax +49-721/ 9658589
   http:/ www.profibus.com

5. Profibus-DP/ DPV1
   Hühtig Verlag, ISBN 3-7785-2676-6





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