Deutschmann Automation

Cam Controls | Fieldbus Gateways | Industrial Ethernet Products

User manual
Universal Fieldbus-Gateway
UNIGATE®

CANopen® (Master) - ProfibusDP (Slave)

Article-no.: V2856E
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Disclaimer of liability

We have checked the contents of the document for conformity with the hardware and software described. Nevertheless, we are unable to preclude the possibility of deviations so that we are unable to assume warranty for full compliance. The information given in the publication is, however, reviewed regularly. Necessary amendments are incorporated in the following editions. We would be pleased to receive any improvement proposals which you may have.

Art.-No.: V2856E

1 Information on CE marking of the module

1.1 EU Directive EMC

The following applies to the module described in this User Manual:

Products which bear the CE mark comply with the requirements of EU Directive „Electromagnetic Compatibility“ and the harmonised European Standards (EN) listed therein.
The EU Declarations of Conformity are available at the following location for perusal by the responsible authorities in accordance with the EU Directive, Article 10:

Deutschmann Automation GmbH & Co. KG, Carl-Zeiss-Str. 8, 65520 Bad Camberg, Germany

1.2 Scope of application

The modules are designed for use in the industrial sector and comply with the following requirements.

Scope of application	Requirement applicable to	
	Emitted interference	Interference immunity
Industry	EN 55011 Kl. A	EN 61000-6-2

Note installation guidelines

The module complies with the requirements if you

1. comply with the installation guidelines described in the User Manual when installing and operating the module.
2. also follow the rules below on installation of the equipment and on working on switch cabinets.

1.3 Installation of the unit

Modules must be installed in electrical equipment rooms/areas or in enclosed housings (e.g. switch boxes made of metal or plastic). Moreover, you must earth the unit and the switch box (metal box) or at least the DIN-rail (plastic box) onto which the module has been snapped.

1.4 Working on switch cabinets

In order to protect the modules against static electrical discharge, the personnel must discharge themselves electrostatically before opening switch cabinets or switch boxes.

2 Information for the machine manufacturer

2.1 Introduction

The UNIGATE module does not constitute a machine as defined by the EU "Machinery“ Directive. Consequently, the module does not have a Declaration of Conformity in relation to the EU Machinery Directive .

2.2 EU Machinery Directive

The EU Machinery Directive stipulates the requirements applicable to a machine. The term "machine" is taken to mean a totality of connected parts or fixtures (see also EN 292-1, Paragraph 3.1)
The module is a part of the electrical equipment of the machine and must thus be included by the machine manufacturer in the Declaration of Conformity process.

3 Introduction

The UNIGATE CANopen®-ProfibusDP module serves as a coupling between a CANopen® bus system and ProfibusDP to EN 50 170. In this application, it functions as a gateway and on the ProfibusDP-side it operates as slave and on the CANopen®-side it operates as master

Through a mapping that can be configured, the user is in the position to prescribe how CANopen® data are to be imaged in the Profibus and also the other way round.

The module essentially consists of the following hardware components:

- Electrically isolated interface to the ProfibusDP and to CANopen®
- Profibus ASIC
- CAN-Controller SJA 1000
- Microprocessor 89C51RD2
- RAM and EPROM
- Serial port (RS232) for a configuration via PC

4 Mode of operation of the system

4.1 General explanation

Communication can be split into seven layers, Layer 1 to Layer 7, in accordance with the ISO/OSI Model.
The DEUTSCHMANN AUTOMATION gateways convert Layers 1 and 2 of the corresponding bus systems. Layers 3 to 6 are blank, and Layer 7 is converted in accordance with the configured mapping.

The Gateway can be configured through the software WINGATE® that is also supplied.
This Gateway module from the UNIGATE range of Deutschmann Automation allows a coupling between **ProfibusDP** and **CANopen®**.
Here the Gateway on the CANopen® side acts as a standard-compliant master and on the ProfibusDP side as a standard-compliant slave so that the problems that appear again and again (to couple the CANopen® Slave participant to a Siemens PLC with ProfibusDP) are solved.

Like all UNIGATE modules this gateway is also developed for the practical industrial use. It has 9 LEDs available that allow the user an easy diagnosis.
Like the complete UNIGATE family, the gateway can be configured via the WINDOWS software "WINGATE®" that is available free of charge. For a further description see chapter 4.3.

4.2 Interfaces

The gateway has a standard-compliant CANopen® interface and a Profibus-interface available as well as an RS232 interface, where a PC can be connected for configuration.

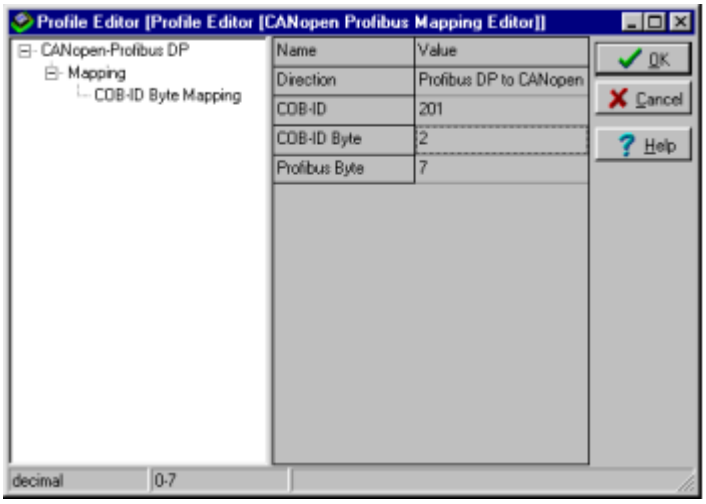
4.3 Data exchange

The data exchange between the Profibus and the CANopen® will be fixed with the Mapping which is configured via "WINGATE®".

Mapping means the illustration of data of one fieldbus to any other fieldbus. As data all data can be used which are made available from the corresponding busses.
The Mapping works in both directions from the Master to the Slave as well as reverse.
Example:
That way it can be defined that the 2nd byte of the COB-ID201 (CANopen®-participant) is transfered into the Profibus data as 7th byte.
At present 512 mappings are possible. However, the Profibus makes only a maximum of 244 bytes In and 244 bytes Out possible. All 488 bytes can be mapped via COB-IDs. The data are transfered as PDOs only. From Gateway software-revision 2.2 on SDO accesses are also supported (see chapter 4.3.7)

4.3.1 Configuration of the mapping

In order to create or work on such a mapping, please connect the UNIGATE with the PC via the RS23-interface and there start the software "WINGATE®".
After the start of the software an upload from the connected device will be carried out automatically. The corresponding matching parameters to this device are displayed. Please look for the entry "Profile" in the table and click doubled onto the value "map ...". After a short period a dialogue is displayed. With it, it is possible to process all map entries (similar to the following picture):



Now the Mappings can be changed, deleted or new ones can be added. Afterwards you only have to download the data to the Gateway (menu file\download) and UNIGATE works with the new configuration.

It is allowed to map the same byte of a PDO several times to different positions in the Profibus.
However, a maximum of 8 mappings per PDO may be entered!

At the mapping from Profibus to CANopen® several mappings can be configured for each Profibus-byte. There the total number of these multiple mappings must not exceed 127.

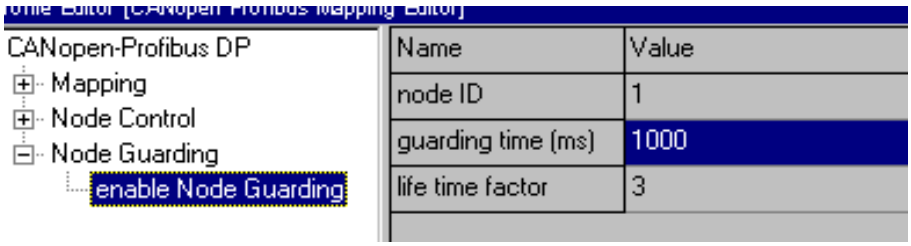
If possible for the PDO-mappings only COB-IDs from the range 181H..580H should be used (see DS301-specification for CANopen®). Otherwise it might result in crossovers with COB-IDs that CANopen® uses for other tasks (SDO-messages, emergency-messages and so on).

4.3.2 Node guarding

If a CANopen® slave controlled by node guarding, it cyclically receives the node guard request to answer the inquiry through the CANopen® master. The slave for his part answers this node guarding inquiry with the corresponding answer. That way, both master and slave can control themselves mutually.
If the slave receives no node guard inquiry it assumes that the bus connection is broken or the master went down.

Settings

As presetting it applies tfor all slaves that no node guarding is carried out. Shall that node guarding be activated for a slave, an entry "enable node guarding" has to be added to the current WINGATE configuration. The parameters "node ID", "guarding time" and "life time factor" are to be determined in every entry.

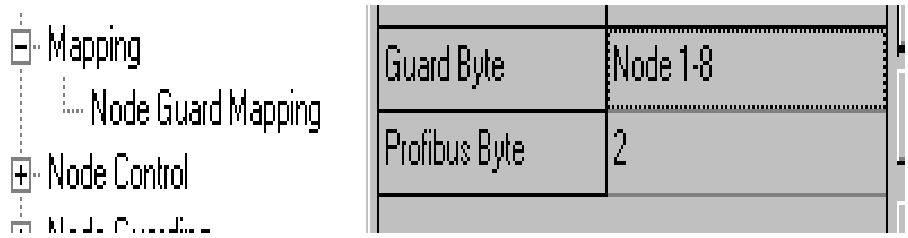


Settings to node guarding

The parameter node ID indicates the ID of the CANopen® node on which the control is supposed to happen. With the guarding time the interval in which the the master calls on the slave to send its guarding answer is to be indicated in milliseconds.
The life time factor states how often the answer of the slave may be missing before the master assumes a failure of the slave.
These settings are available from Gateway software-revision 1.1 on.

4.3.3 Displaying the node guarding states

The node guard mapping is used to represent the node guard states of the single slaves to the Profibus. Always 8 slaves are represented in one byte; so exactly one bit of information is reserved for one. This information can be shown in any desired spot in the Profibus data of the Gateway. So they are shown in the input area of the Profibus master for this Gateway.



Display of the node guarding information

Arrangement of the bits for the nodes 1- 8:

Node 1-8

Byte MSB (bit 7)	...	LSB (bit 0)
SlavenNode ID 8	...	Slave node ID 1

If no node guard is activated for a slave, the slave went down or still no node guarding information was exchanged, the corresponding bit for this slave is 0. The bit is 1, if node guarding was activated for this slave and the slave answered in the corresponding time period to the node guarding inquiries.

Example: For node 1 and 2 node guarding is activated. Slave 1 doesn not answer to the node guarding and slave ID 2 works regularly. A mapping of information is entered into the Profibus in the 2nd byte.

Profibus data of the Gateway:

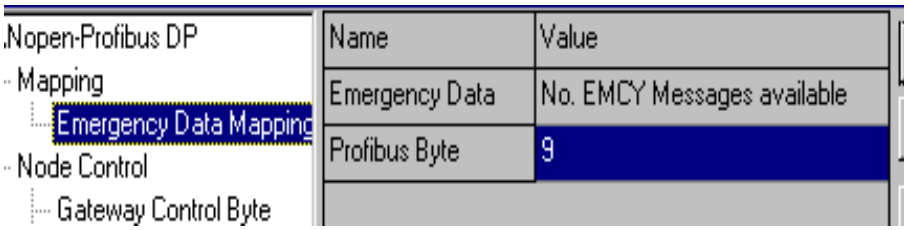
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4
xx	xx	0x40	xx	xx

These settings are available from Gateway software-revision 1.1 on.

4.3.4 Emergency Messages

The gateway can received up to 10 Emergency messages of all those slaves, for which node guarding was activated and writes them into a queue. Simultaneously an internal counter is raised which contains the number of received EMCY messages. The data of the current messagesas well as the number of the received EMCY messages and the node ID of the sender of the message can be shown in the Profibus output data of the gateway. With the control byte the next message can be recalled. If the data of the EMCY message is shown in the bus data, the new data in the Profibus is already visible with the toggle of the data

.

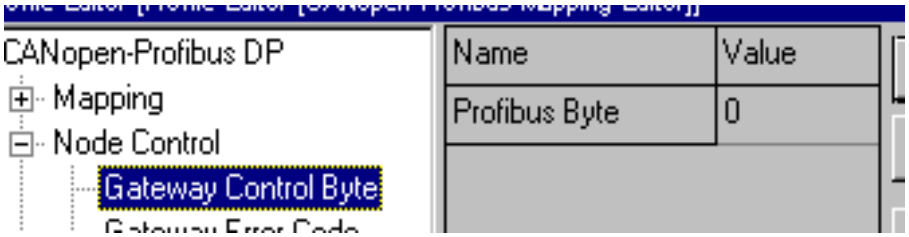


Setting of the emergency messages

These settings are available from Gateway software-revision 1.1 on.

4.3.5 Gateway control byte

Some characteristics of the Gateway can be controlled by Profibus data. For this the information of the Profibus has to be transmitted to the gateway, that means that the information has to be in the input area of the gateway. Only if this information is shown from the Profibus in the Gateway, the data can be analysed by the Gateway.



Setting of the Gateway control byte

Gateway control byte							
Bit 7 EMCY toggle bit	Bit 6 set OP toggle bit	Bit 5 Request to response	res.	res.	res.	res.	res.

4.3.5.1 Bit 7 (MSB): EMCY toggle bit

With this bit the next relevant EMCY message can be transfered to the curretn data buffer, no matter whether the data is shown in the Profibus or not. The counter is lowered by 1, provided that it does not equal 0.

4.3.5.2 Bit 6: set operational toggle bit

If this bit is changed the Gateway sends the message 'set operational' to the slaves. This feature is to be used if some slaves are slower than the master, and are only then ready when the master already sent this message.

This setting is available from Gateway software-revision 1.1 on.

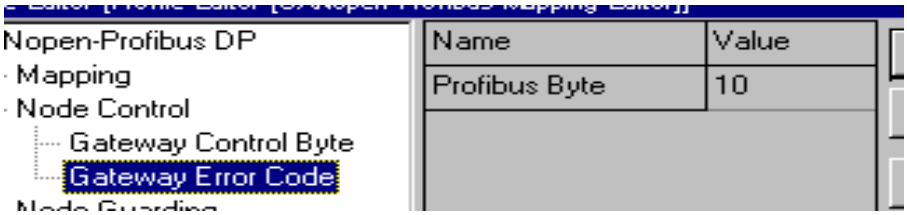
4.3.5.3 Bit 5: RTR - Request to response

With this bit (transition from 0 -> 1) RTR-telegrams can be sent to any PDO mapped as Rx. This RTR results in the fact that the addressed PDOs are sent and with it they are updated in the Gateway.
If the RTR-function is used, at least 1 Rx-PDO has to be mapped. Furthermore the amount of mapped Rx-PDOs must not exceed 50, since otherwise it will result in an overrun.

This setting is available from Gateway software-revision 2.3 on.

4.3.6 Gateway error byte

The Gateway's current error state itselfcan be shown in the Profibus as well as the other values of the node guarding or the slave data.



Setting of the error byte

This setting is available from Gateway software-revision 1.1 on.

4.3.7 SDO Obj Mapping

Available from Gateway software-revision 2.2 on!

SDO-transfer through a "window" in the PB. Here the following fixed data record structure is used in the PB, that is mapped to the PB-data from the PB-index on. With it a difference is made between:

PB-Idx (In) = Data from the PB-Master (PLC) to UNIGATE
PB-Idx (Out) = Data to the PB-Master (PLC) from UNIGATE

The user has to see to it that enough space is reserved for the longest data record in the PB-data.
The SDO-transfer is always initiated by the PB-Master and it is completed when Request-no. in the PB-output-data is identical to the Response-no. in the PB-input-data.

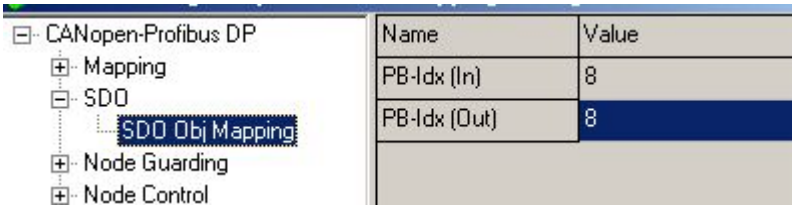
Data record structure (PB-input = data from the PB-Master):

```
    0     1       2         3          4            5            6          7..n
+-----------+-------+---------+------------+------------+----------+------------+
| Obj-Index | Index | Command | Request-no | Node-no    | Data-Len | Data ...   |
+-----------+-------+---------+------------+------------+----------+------------+
                        |
                        +- 1 = Read, 2 = Write, Other value = Not supported
```

Data record structure (PB-output = data to the PB-Master):

```
    0     1       2         3          4            5             6          7..n
+-----------+-------+--------+------------+-----------+----------+-----------+
| Obj-Index | Index | Status | Response-no| Node-no   | Data-Len | Data ...  |
+-----------+-------+--------+------------+-----------+----------+-----------+
                          |
                           +- 0 = Ok, 1 = Busy, Other values = Error
```

Example:



In this example the PB-Idx (In) and PB-Idx (Out) equal 8
Please note:
The counting starts at index "0" = 1. byte, i. e. in our example the value "8" corresponds to the 9. byte!

We want to query the manufacturer hardware version (object - index 1009h) from a connected CANopen® Slave. The CANopen® Slave has the Node ID = 5.

The Data-Len Request's size has to be selected as large as the receive data length that is maimally to be expected! Otherwise data that exceeds the set length is cut off.
If the size Data-Len Request is the same or larger than the receive data length, then the actual data length comes back as Data-Len Response.

Data from the PB-Master (PLC) Data to the PB-Master (PLC)

Request

PB-Idx (In)	Data (Hex)	Description
0	...	1. byte
1	...	2. byte
2	...	3. byte
3	...	4. byte
4	...	5. byte
5	...	6. byte
6	...	7. byte
7	...	8. byte
8	10	Obj-Index
9	09	Obj-Index
10	00	Sub-Index
11	01	Command (1 = read)
12	01	Auftrag-Nr (1. Auftrag)
13	05	Knoten-Nr (Node-ID = 5)
14	02	Data Len (data length = 2)
15	...	Data...
16	...	17. byte

Response

PB-Idx (In)	Data (Hex)	Desription
0	...	1. byte
1	...	2. byte
2	...	3. byte
3	...	4. byte
4	...	5. byte
5	...	6. byte
6	...	7. byte
7	...	8. byte
8	10	Obj-Index
9	09	Obj-Index
10	00	Sub-Index
11	00	Status (0 = ok)
12	01	Auftrag-Nr (1. Auftrag)
13	05	Knoten-Nr (Node-ID = 5)
14	02	Data Len (data length = 2)
15	47	Data... (47h = hardw.vers. „G“)
16	...	17. byte

4.3.8 Triggerbyte

With WINGATE® the first Profibus-byte can be configured as Triggerbyte.
In this case an evaluation of the Profibus data only occurs, if the first byte changes.

The other way round the Gateway counts up the first byte of the Profibus data to the Profibus-Master by one, if the follwing data have changed.

4.3.9 Slave mode

The Slave mode can be activated through WINGATE®. In case the Slave mode is enabled, then only the starting sequence of the master function is not transferred. It is not a CANopen® Slave conforming to the standards and an EDS file is not supplied.

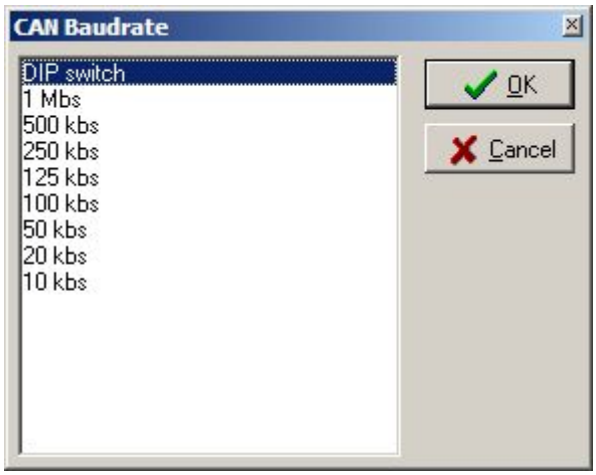
Parameter	Value
Software Revision	V 1.4
Device type	CANopen-Profibus DP
Profile	**map ...**
Profibus DP Triggerbyte	**On Change**
Slave Mode	**enabled**

4.3.10 CAN Baud rate

Available from the Gateway software revision 2.6 and WINGATE Built 376 on!
The CAN baud rate can be set via WINGATE.

Parameter	Value
Software Revision	**V 2.6**
Device type	**CANopen-Profibus DP**
Profile	**map ...**
Profibus DP Triggerbyte	**On Trigger**
Slave Mode	**enabled**
CAN Baudrate	**DIP switch**

The default-setting “DIP switch“ results in the baud rate being taken over by the DIP-switch as usual (1 MBaud, 500 kBd, 250 kBd oder 125 kBd).
In case a baud rate is configured via WINGATE, then the value of the DIP-switch will be oberwritten and a baud rate according to the below picture is set.



It is therefore possible to set further baud rates other than the 4 mentioned above.

4.4 Starting phase

During the starting phase the UNIGATE sends the NMT-command "BusStart" every 2 seconds, that means all connected CANopen®-Slaves are set into the condition "Operational". As soon as the Gateway has received the first PDO, that is available in the Mapping, this starting phase is left, which means that the NMT-command is not sent any more. There is no such thing as a Timeout here since the CANopen®-Slaves do not have to react to this NMT-command. In case a CANopen®-Slave is later connected in the net, it will consequently not receive this NMT-command any more. However, it can be re-activated any time through the PB-command-byte (bit 6) in order to put later CANopen®-Slaves into the condition "Operational".

4.5 Data cycle time

Cycle times of data through the Gateway:
Among other things the actual cycle time of data from CANopen® to Profibus or the other way round depends on the following parameters:

- Amount of Mappings
- Length of the configured Profibus data
- Amount of COB-IDs used at the Mappings
- Amount of changed Profibus data between two transmissions
- Amount of mapped bytes in a COB-ID
- Baud rate in the Profibus or CAN

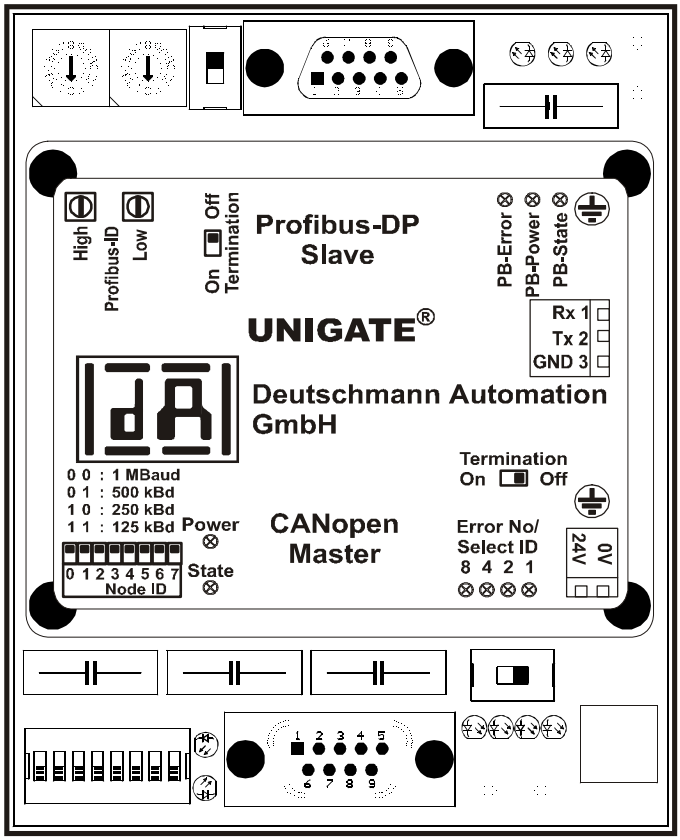
On account of the large amount of parameters and their interdependence a formula for the calculation of the cycle time cannot be stated. From practical measurements cycle times of 100µs up to 100ms were observed, whereas the maximum Profibus-configuration time of 244 byte I/O and 488 mappings was measured.
In practice, on "regular" conditions,a cycle time of of some milliseconds is to be expected. In order to optimize the cycle time, the following guidelines should be kept:

- Amount of Mappings as small as possible
- Length of the Profibus-configuratio as short as possible
- Use of all 8 bytes in the COB-IDs if possible => Use of the least possible amount of COB-IDs

5 Hardware ports, switches and LEDs

5.1 Drawing of the unit

5.1.1 UNIGATE CANopen® - ProfibusDP



5.2 Configuration

5.2.1 Profibus

- Configuration data: In accordance with GSD file (DAGW2862.gsd)
- Diagnostic data: Max. 8 bytes (see Chapter Error handling)
- Baud rate: Automatic detection up to 12 MBaud
- Sync: Supported
- Freeze: Supported
- Ident. No.: 0x2862

5.2.2 CANopen®

- Baud rate: In accordance with DIP-Switch

5.2.3 RS232

- Start bit: 1
- Data bits: 8
- Stop bit: 1
- Parity: None
- Baud rate: 9600 Baud

5.3 Connectors

5.3.1 Connector to the power supply

The connection cable to the power supply must be plugged in at the connector accessible on the underside of the device.

Pin assignment (2-pin screw-type/plug connector)

Pin No.	Name	Function
1	24 V / DC	24 V supply voltage
2	0 V / DC	0 V supply voltage

5.3.2 ProfibusDP connector

The connector (labelled: ProfibusDP) for connection to Profibus is located on the upper side of the device.

Pin assignment (9-pin D-SUB socket)

Pin No.	Name	Function
1		
2		
3	B	Non-inverting input/output signal from Profibus
4		
5	M5	DGND – data reference potential
6	P5	5 V supply voltage
7		
8	A	Inverting input/output signal from Profibus
9		

5.3.3 CANopen® connector

The connector (labelled: CANopen®) for connection to CANopen® is located on the underside of the device.
Pin assignment (9-pin D-SUB plug)

Pin No.	Name	Function
1		
2	CAN-L	Dominant low
3	CAN-GND	CAN Ground
4		
5		
6		
7	CAN-H	Dominant high
8		
9		

5.3.4 RS232 (configuration interface)

The right side of the device has to be opened in order to use the serial interface for the configuration, since the plug is located under the board.
For this please remove the three star-grip-screws and take off the green lid. Now the socket is accessible. Now you can directly connect a PC to the device by means of the software WINGATE. No switches have to be shifted to get into a specific configuration mode.

Pin assignment (3-pin screw-type/plug connector)

Pin Nr.	Name	Funktion
1	Rx232	Receive signal
2	Tx232	Transmit signal
3	GND	Ground

5.3.5 Power supply

The device must be powered with 10.8-30 VDC via the separate 2-pin screw-/plug-connector. Please note that the devices of the series UNIGATE can not be operated with AC voltage.

5.3.6 Shield terminal lead

The shield signal for the electronic circuitry is connected to the DIN-rail via the connector provided (from hardware revision C on the shield connection with the DIN-rail is directly made through the left side piece of the device). The shield signal for the CANopen® cable and the Profibus cable shield is not electrically connected to the shield signal of the electronic circuitry for reasons relating to interference immunity.

5.4 LEDs

The gateway features 9 LEDs with the following significance

LED Profibus Error	red	Profibus error
LED Profibus Power	green	Profibus supply voltage
LED Profibus State	red/green	Interface status ProfibusDP
LED CANopen® Power	green	Supply voltage CANopen®
LED CANopen® State	red/green	Interface status CANopen®
LED Error No / Select ID	yellow	Binary display of the connection/error number

In the configuration mode these displays are not valid and only meant for internal use.

5.4.1 LED “Profibus Error“

This LED is activated directly by the Profibus ASIC and signals that the Profibus is not in “DATA EXCHANGE” status.

5.4.2 LED “Profibus Power“

This LED is connected directly to the electrically isolated supply voltage of the Profibus end.

5.4.3 LED “Profibus State“

Lights green	Profibus in Data Exchange status
Blinks green	Gateway waiting for Profibus configuration data
Blinks green/red	Gateway waiting for Profibus parameter data
Lights red	General Profibus error

5.4.4 LED “CANopen® Power“

This LED is connected directly to the electrically isolated supply voltage of the CANopen®-end.

5.4.5 LED “CANopen® State“

Lights green	Data exchange active via CANopen®
Flashes green	CANopen® ok but did not receive any CAN-data yet
Lights red	General gateway error (see LEDs Error No.)
Flashes red/green	UNIGATE is in the configuration mode

5.4.6 LEDs “Error No. / Select ID“

If these 4 LEDs flash and LED “State“ simultaneously lights red, the error number is displayed in binary notation (conversion table, see Annex) in accordance with the table in Chapter "Error handling". Otherwise, the number of the sent CAN-records is indicated with the LEDs 1 + 2, and with the LEDs 3 + 4 the number of received CAN-records is indicated, also in binary notation.

5.5 Switches

The gateway features 5 switches with the following functions:

Rotary coding switch, Profibus High	ProfibusDP ID (High Byte)
Rotary coding switch, Profibus Low	ProfibusDP ID (Low Byte)
Slide switch “Termination“	Switchable ProfibusDP terminating resistor
DIP switch CANopen®	Node-ID and baud rate
Slide switch “Termination“	Switchable CANopen® terminating resistor

5.5.1 Rotary coding switch (Profibus ID)

These two switches are used to set the Profibus ID (00..7D) of the gateway in hexadecimal notation. A conversion table from decimal to hexadecimal can be found in the Annex. This value is read in only once when the gateway in activated and cannot be changed via the Profibus.

5.5.2 Slide switch Termination Profibus

If the gateway is operated as the first or last physical device in the ProfibusDP, there must be a bus termination at this gateway. In order to do this, either a bus terminating resistor must be activated in the connector or the resistor (220 Ω) integrated in the gateway must be activated. In order to do this, slide the slide switch to position ON. In all other cases, the slide switch must remain in position OFF. Please refer to the general Profibus literature for further information on the subject of bus termination.

5.5.3 Dip-switch

This switch is used to set the Node-ID and the baud rate of the CAN-bus.
With the bits 2 to 7 the Node-ID is set, with the bits 0 and 1 the baud rate is set.
Setting the baud rate:

Bit 0	Bit 1	Baud rate
0	0	1 MB
0	1	500 kBaud
1	0	250 kBaud
1	1	125 kBaud

5.5.4 Slide switch (CANopen® Termination)

If the gateway is operated as the first or last physical device in the CANopen® bus, there must be a bus termination at this gateway. In order to do this, either a bus terminating resistor in the connector or the resistor (120 Ω) integrated in the gateway must be activated. In order to do this, slide the slide switch to position ON. In all other cases, the slide switch must remain in position OFF. Please refer to the general CANopen® literature for further information on the subject of bus terminations.

6 Error handling

If the gateway detects an error, the error is signalled by the “State“ LED lighting red and, simultaneously, the error number being indicated by means of LEDs “Error No.“ as shown in the table below. In addition, this error number is transferred as an external diagnostic byte via the Profibus to the Master. A distinction can be made between two error categories:
Serious errors (1-5): In this case, the gateway must be switched off and switched back on again. If the error occurs again, the gateway must be exchanged and returned for repair.
Warnings (6-15): These warnings are displayed for one minute simply for information purposes and are then automatically reset. If such warnings occur frequently, please inform the after-sales service.

In the configuration mode these displays are not valid and only meant for internal use.

LED8	LED4	LED2	LED1	Error no. resp. ID	Error description
0	0	0	0	0	Reserved
0	0	0	1	1	Reserved
0	0	1	0	2	EEROM error
0	0	1	1	3	RAM error or ASIC error
0	1	0	0	4	Error at Reset CAN-Bus
0	1	0	1	5	Error at "Set Operational" CAN-Bus
0	1	1	0	6	Reserved
0	1	1	1	7	Error at generating PDO
1	0	0	0	8	Error at generating SDO
1	0	0	1	9	Buffer overflow or Timeout at RS232
1	0	1	0	10	Error at "Add-Node"
1	0	1	1	11	Incorrect CANopen® handle (e. g. more than 8 mappings / PDO)
1	1	0	0	12	Profibus configuration error
1	1	0	1	13	General CAN-driver error (e. g. no bus connected or wrong wiring)
1	1	1	0	14	Error at access SDO
1	1	1	1	15	Internal error

Table 1: Error handling

7 Installation guidelines

7.1 Installation of the module

The module of size (90 x 127 x 55 mm W x H x D) has been developed for switch cabinet use (IP 20) and can thus be mounted only on a standard mounting channel (deep DIN-rail to EN 50022).

7.1.1 Mounting

- Engage the module from the top in the DIN-rail and swivel it down so that the module engages in position.
- Other modules may be rowed up to the left and right of the module.
- There must be at least 5 cm clearance for heat dissipation above and below the module.
- The standard mounting channel must be connected to the equipotential bonding strip of the switch cabinet. The connection wire must feature a cross-section of at least 10 mm².
- An earthing terminal must be positioned next to the module so as to allow the shield connection on the device to be implemented as short as possible with a flexible wire (1.5 mm²).
  From hardware-revision C on the shield-connection is carried out with the DIN-rail through the integrated earthing connection in the left side piece of the device.

7.1.2 Removal

- First disconnect the power supply and signal lines.
- Then push the module up and swivel it out of the DIN-rail.

Vertical installation
The standard mounting channel may also be mounted vertically so that the module is mounted turned through 90°.

7.2 Wiring

7.2.1 Connection systems

The following connection systems must resp. may be used when wiring the module:
- Standard screw-type/plug connection (power supply)
- Push-lock terminals (connection terminals for earthing, not applivable from hardware-rev. C on)
- 9-pin SUB-D plug connectors (ProfibusDP and CANopen® connection)

a) In the case of standard screw-type terminals, one lead can be clamped per connection point. It is best to then use a screwdriver with a blade width of 3.5 mm to firmly tighten the screw.

Permitted cross-sections of the line:
- Flexible line with wire-end ferrule: 1 x 0.25 ... 1.5 mm²
- Solid conductor: 1 x 0.25 ... 1.5 mm²
- Tightening torque: 0.5 ... 0.8 Nm

b) The plug-in connection terminal strip is a combination of standard screw-type terminal and plug connector. The plug connection section is coded and can thus not be plugged on the wrong way round.

c) The 9-pin SUB-D plug connectors are secured with two screws with "4-40-UNC" thread. It is best to use a screwdriver with a blade width of 3.5 mm to screw the screw tight.
Tightening torque: 0.2... 0.4 Nm

7.2.2 ProfibusDP and CANopen® communication interfaces

7.2.2.1 Bus line with copper cable

This interfaces are located on the module in the form of two 9-pin SUB-D plugs (1 x socket, 1 x pin) on the front side of the housing.

- Plug the Profibus connector onto the SUB-D socket labelled "ProfibusDP" and the CANopen® connector onto the SUB-D plug (pin) labelled "CANopen®".
- Firmly screw the securing screws of the plug connector tight using a screwdriver.
- If the module is located at the start or end of the CANopen® line or of the Profibus line, you must connect the bus terminating resistor of the corresponding bus integrated in the gateway. In order to do this, slide the slide switch to the position labelled ...on...
- If the module is not located at the start or at the end, you must set the slide switch to position "off".

7.2.2.2 Power supply

The device must be powered with 10.8...30 V DC.

- Connect the supply voltage to the 2-pin plug-in screw terminal in accordance with the labelling on the front panel of the device.

7.2.2.3 Shield connection

The shield of the CANopen® cable and the Profibus cable is connected to the equipotential bonding system via an RC snubber circuit. This means that there are two electrically isolated shields in the device. This guarantees higher interference immunity of the module since the "cable shield current" which may be up to a few Amperes owing to potential differences between two bus users is not discharged via the device.

If the device is subject to high mechanical or chemical stress, it is advisable to use a tin-plated DIN-rail in order to ensure greater contact stability of the shield connection!

7.2.2.4 Equipotential bonding connection

- Fit an earthing terminal to the DIN-rail directly next to the module. The earthing terminal automatically establishes an electrical connection to the DIN-rail.
  Connect the shield connection terminal to the earthing terminal using a flexible wire with a diameter of 1.5 mm² which should be as short as possible.
  From hardware-revision C on the shield-connection is carried out with the DIN-rail through the integrated earthing connection in the left side piece of the device.
- Connect the DIN-rail to the equipotential bonding rail with as low an impedance as possible. Use a flexible earthing wire with a cross-section of at least 10 mm² for this.

7.2.3 Line routing, shield and measures to combat interference voltage

This Chapter deals with line routing in the case of bus, signal and power supply lines, with the aim of ensuring an EMC-compliant design of your system.

7.2.4 General information on line routing

- Inside and outside of cabinets

In order to achieve EMC-compliant routing of the lines, it is advisable to split the lines into the following line groups and to lay these groups separately.

⇒ Group A: • shielded bus and data lines (e.g. for ProfibusDP, CANopen®, RS232C and printers etc.)
• shielded analogue lines
• unshielded lines for DC voltages ≥ 60 V
• unshielded lines for AC voltage ≥ 25 V
• coaxial lines for monitors
⇒ Group B: • unshielded lines for DC voltages ≥ 60 V and ≥ 400 V
• unshielded lines for AC voltage ≥ 24 V and ≥ 400 V
⇒ Group C: • unshielded lines for DC voltages > 400 V

The table below allows you to read off the conditions for laying the line groups on the basis of the combination of the individual groups.

	Group A	**Group B**	**Group C**
Group A	1	2	3
Group B	2	1	3
Group C	3	3	1

Table 2: Line laying instructions as a function of the combination of line groups

1) Lines may be laid in common bunches or cable ducts.
2) Lines must be laid in separate bunches or cable ducts (without minimum clearance).
3) Lines must be laid in separate bunches or cable ducts inside cabinets but on separate cable racks with at least 10 cm clearance outside of cabinets but inside buildings.

7.2.4.1 Shielding of lines

Shielding is intended to weaken (attenuate) magnetic, electrical or electromagnetic interference fields.
Interference currents on cable shields are discharged to earth via the shielding bus which is connected conductively to the chassis or housing. A low-impedance connection to the PE wire is particularly important in order to prevent these interference currents themselves becoming an interference source.
Wherever possible, use only lines with braided shield. The coverage density of the shield should exceed 80%. Avoid lines with foil shield since the foil can be damaged very easily as the result of tensile and compressive stress on attachment. The consequence is a reduction in the shielding effect.
In general, you should always connect the shields of cables at both ends. The only way of achieving good interference suppression in the higher frequency band is by connecting the shields at both ends.
The shield may also be connected at one end only in exceptional cases. However, this then achieves only an attenuation of the lower frequencies. Connecting the shield at one end may be more favourable if

- it is not possible to lay an equipotential bonding line
- analogue signals (a few mV resp. mA) are to be transmitted
- foil shields (static shields) are used.

In the case of data lines for serial couplings, always use metallic or metallised plugs and connectors. Attach the shield of the data line to the plug or connector housing.

If there are potential differences between the earthing points, a compensating current may flow via the shield connected at both ends. In this case, you should lay an additional equipotential bonding line.

Please note the following points when shielding:

- Use metal cable clips to secure the shield braiding. The clips must surround the shield over a large area and must have good contact.
- Downstream of the entry point of the line into the cabinet, connect the shield to a shielding bus. Continue the shield as far as the module, but do not connect it again at this point!

- Downstream of the entry point into the switch cabinet, the CANopen® cable shield and the ProfibusDP cable shield must be connected to the equipotential bonding strip.

Shielded data lines and unshielded power supply lines (< 60 V DC) are routed to and connected to the module. All cable shields must be earthed at both ends in order for the module to comply with all required EMC limits.

8 Representation of the data in ProfibusDP

Any standard-compliant ProfibusDP Master can exchange data with the gateway. It is also possible to use very "simple" Master connections owing to the data structure.

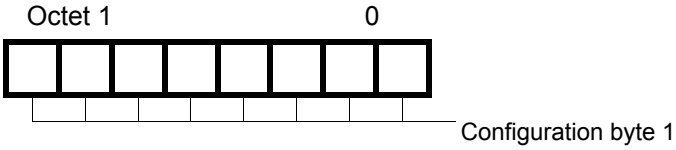
8.1 Configuration telegram

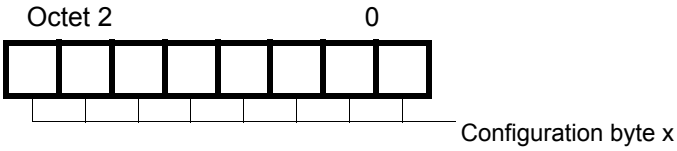
After programming, the Master must send a configuration telegram to the corresponding Slave. The configuration telegram provides the Slave with information on the length of the input/output data. If the user has set the 'Length byte' flag, this means the maximum data lengths. Otherwise, it means the actual lengths.

The user normally also configures the configuration telegram in the project planning tool where he may also, if necessary, enter the address range in which the useful data is stored.

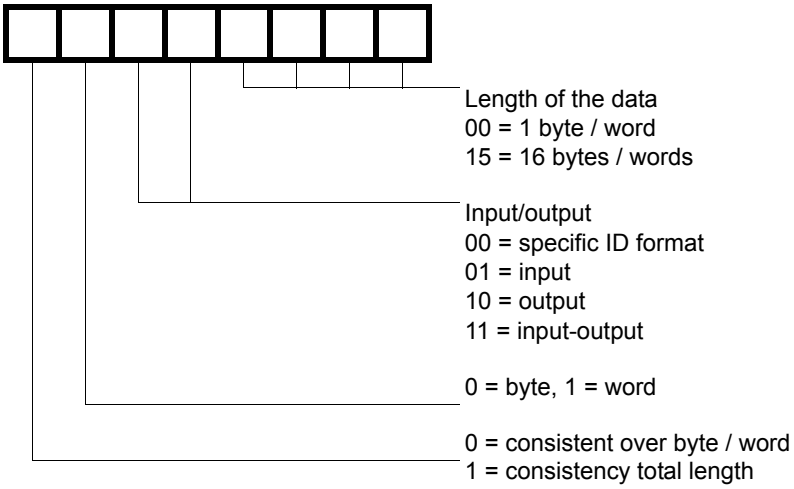
You can write up to 16 bytes or words in one octet of the DataUnit (DU). Inputs and outputs having the same format can be combined in one octet. Otherwise, you must use as many octets as the number of different bytes/words you wish to use and which cannot be combined in one octet.
If the module detects, during the check, that the maximum permitted input/output data lengths have been exceeded, it signals incorrect configuration to the Master during a subsequent diagnostic scan. It is then not ready for useful data communication.

8.2 Configuration telegram





Structure of an octet in the configuration telegram:

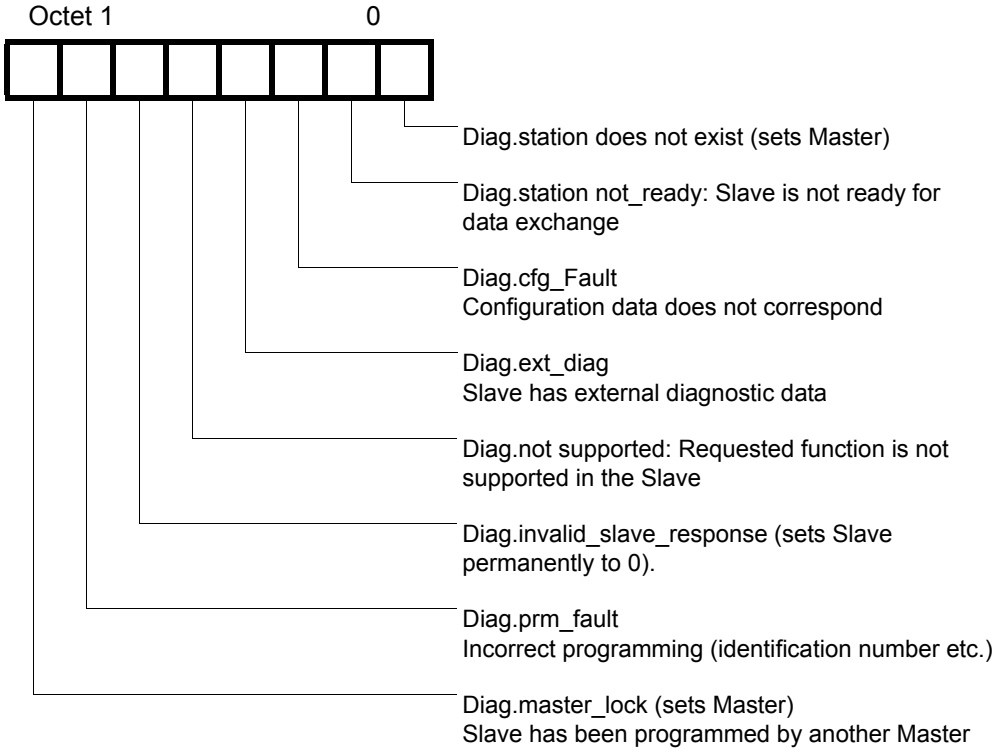


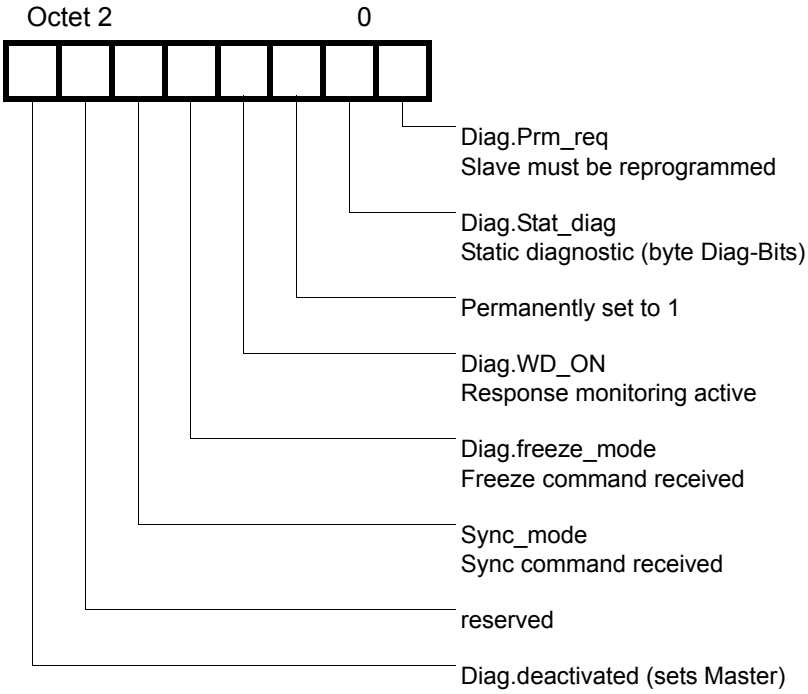
8.3 Diagnosis

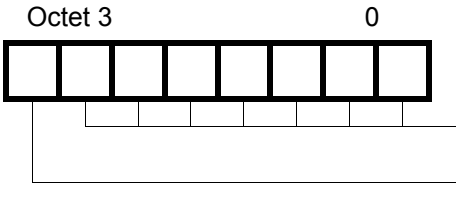
Diagnostic data is high-priority data. The gateway runs an external diagnostic if it detects an internal error.

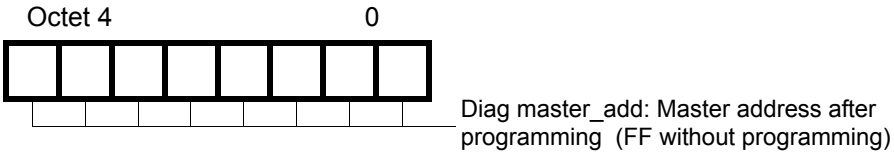
Representation of the information in the external diagnostic byte:

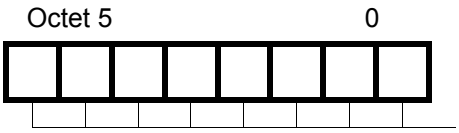
The diagnostic information of a DP Slave consists of standard diagnostic information items (6 bytes) and a user-specific diagnostic information item. (Error number)
Telegram for diagnostic request:

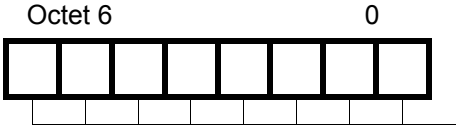


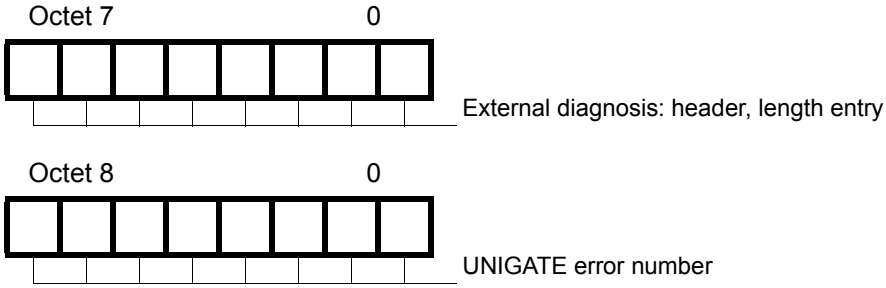

Octet 2
0
Diag.Prm_req
Slave must be reprogrammed
Diag.Stat_diag
Static diagnostic (byte Diag-Bits)
Permanently set to 1
Diag.WD_ON
Response monitoring active
Diag.freeze_mode
Freeze command received
Sync_mode
Sync command received
reserved
Diag.deactivated (sets Master)


Octet 3
0
reserved
Diag.ext_overflow


Octet 4
0
Diag master_add: Master address after
programming (FF without programming)


Octet 5
0
Ident. number high byte


Octet 6
0
Ident. number low byte



8.4 Data exchange

After the Master, in the diagnostic, detects that the Slave is ready for data exchange, it sends data exchange telegrams. Either the Master stores the data in the input/output direction in the address area specified during project planning or the control program must fetch or retrieve the data using specific function blocks.

9 Technical data

9.1 Device data

The technical data of the module is given in the table below.

No.	Parameter	Data	Explanations
1	Location	Switch cabinet	DIN-rail mounting
2	Enclosure	IP24 / IP67	Protection against foreign bodies and water to IEC 529 (DIN 40050)
3	Cooling	Convection	No additional cooling required
4	Service life	10 years	
5	Housing size	90 mm x 127 mm x 55 mm	W x H x D
6	Installation position	Any	
7	Weight	0.3 kg	
8	Operating temperature	0ºC... +45ºC (w/o forced convection) 0ºC... +65ºC (with forced convection)	
9	Storage/transport temperature	-40ºC ... +70ºC	
10	Atmospheric pressure during operation during transport	 795 hPa ... 1080 hPa 660 hPa ... 1080 hPa	
11	Installation altitude	2000 m 4000 m	Unrestricted Restricted - Ambient temperature ≤ 40 ºC
12	Relative humidity	Max. 80 %	No condensation, no corrosive atmosphere
13	Particles / dirt	Sand and dust may not penetrate the device	
14	External power supply	10.8...30 V DC	Standard power supply unit to DIN 19240
15	Current consumption at 24 V DC	Typ. 120 mA max 150 mA	At 10.8V. typ. 350 mA
16	Power supply at the Profibus interface	5 V DC / max. 50 mA	(max. 50 mA at < 30 ºC ambient temperature)
17	Reverse voltage protection	Yes	But does not function!
18	Short-circuit protection	Yes	
19	Overload protection	Poly-switch	Thermal fuse
20	Undervoltage detection (USP)	≤ 9 V DC	
21	Emergency power supply	≥ 5 ms	Device fully operable
22	Insulation voltage	500 V DC	IEC 1131-2

Table 2: Technical data of the module

The table below lists all tests, standards and regulations on the basis of which the module has been tested.

No.	Parameter	Data	Explanations
1	Vibration test	5 Hz ≤ f ≤ 26 Hz, amplitude = 0.75 mm 26 Hz ≤ f ≤ 500 Hz, acceleration = 20 m/s^2 → Frequency sweep : 1 octave/min. → 10 frequency sweeps each in x, y, z	(IEC 68-2-6Fc sinusoidal)
2	Shock test	Shock waveform = semi-sinusoidal Acceleration = 15g (150 m/s^2) Shock duration = 11 ms → 3 shocks in +/- direction in x, y, z	(IEC 68-2-27-Ea)
3	ESD	8 kV discharge in air 4 kV contact discharge	EN 50082-2
4	Electromagnetic fields	10 V/m	EN 50082-2
5	BURST	2 kV / 5 kHz supply voltage 1 kV / 5 kHz data lines	EN 50082-2
6	Emitted interference	Limit value class A	EN 55011
7	Approvals	CE mark Profibus certification	→ Certificate of Conformity → PROFIBUS User Organisation

Table 3: Tests, standards and regulations

9.1.1 Interface data

The table below lists the technical data of the interfaces and ports on the device. The data has been taken from the corresponding Standards.

No.	Interface designation Physical interface	ProfibusDP RS485	RS232-C RS232-C	CANopen® RS485
1	Standard	EIA Standard	DIN 66020	CiA® DS 102
2	Transmission mode	Symmetrical asynchronous serial half-duplex → Difference signal	Asymmetrical asynchronous serial full duplex → Level	Symmetrical asynchronous serial half-duplex → Difference signal
3	Transmission method	Master / Slave	Master / Slave	Master / Slave
4	Number of users : - Transmitters - Receivers	32 32	1 1	32 32
5	Cable length: - Maximum - Baud rate-dependent	1200 m 93.75 kBd → 1200 m 187.5 kBd → 1000 m 500 kBd → 400 m 1.5 MBd → 200 m >1.5 MBd → 100 m	15 m No	1300 m 50 kBd → 1300 m 100 kBd → 640 m 200 kBd → 310 m 500 kBd → 112 m 1 MBd → 40 m
6	Bus topology	Line	Point-to-point	Line
7	Data rate: - Maximum - Standard values	12 Mbit/s 9.6 kBit/s 19.2 kBit/s 93.75 kBit/s 187.5 kBit/s 500 kBit/s 1.5 Mbit/s 3 MBit/s 6 MBit/s 12 Mbit/s	38.4 kBit/s 2.4 k/B 4.8 k/B 9.6 kBit/s 19.2 kBit/s 38.4 kBit/s	1Mbit/s 125 kB 250 kB 500 kB 1MB
8	Transmitter: - Load - Maximum voltage - Signal, unloaded - Signal, loaded	54 Ω - 7 V ... 12 V ± 5 V ± 1.5 V	3 ... 7 kΩ ± 25 V ± 15 V ± 5 V	54 Ω - 7 V ... 12 V ± 5 V ± 1.5 V
9	Receiver: - Input resistance - Max. input signal - Sensitivity	12 Ω - 7 V ... 12 V ± 0.2 V	3 ... 7 Ω ± 15 V ± 3 V	12 Ω - 7 V ... 12 V ± 0.2 V
10	Transmit range (SPACE): - Voltage level - Logic level	- 0.2 ... + 0.2 V 0	+ 3 ... + 15 V 0	- 0.5 ... + 0.05 V 0
11	Transmit pause (MARK): - Voltage level - Logic level	+ 1.5 ... +5 V 1	- 3 ... –15 V 1	+ 1.5 ... +3 V 1

Table 4: Technical data of the interfaces and ports on the module

10 Commissioning guide

10.1 Note

Only trained personnel following the safety regulations may commission the UNIGATE.

10.2 Components

You will require the following components to commission the UNIGATE:
- UNIGATE
- Connector for CANopen® connection to the gateway
- Connector for Profibus connection to the gateway
- Profibus cable (this cable is generally already installed on site!)
- 24 V DC power supply (DIN 19240)
- GSD file and User Manual (to be ordered separately or from the Internet at http:// www.deutschmann.de).

10.3 Installation

The UNIGATE module features enclosure IP 20 and is thus suitable for switch cabinet use. The device is designed for snapping onto a 35 mm DIN-rail.

10.4 Commissioning

It is essential that you perform the following steps during commissioning in order to ensure that the module operates correctly:

10.5 Setting the Profibus address

Set the Profibus address at the fieldbus end of the module on the two rotary switches designated "Profibus-ID".

Attention:

The Profibus address set must correspond to the planned address under COM Profibus !

It is read in only on power-up of the gateway!

10.6 Profibus connection

Connect the device to the Profibus at the interface labelled "ProfibusDP".

10.7 Setting the CANopen® address and Baud rate

Set the CANopen® address and the Baud rate at the fieldbus end of the module on the DIP-switch.

Attention:

The CANopen® address set must correspond to the planned address!
All users in the CANopen® have to use the same Baud rate!
These values are read in only on power-up of the gateway!

10.8 CANopen® connection

Connect the device to the CANopen® at the interface labelled "CANopen®".

10.9 Connecting the supply voltage

Please connect 10.8...30 DC voltage to the terminals provided for this.

10.10 Shield connection

Connect the PE wire at the terminal provided for this (not applicable from hardware-rev. C on). Earth the DIN-rail onto which the module has been snapped.

10.11 Project planning

Use any project planning tool for project planning.
If the required GSD file was not supplied with your project planning tool, please copy this file from the enclosed diskette or download this file from the Internet (www.deutschmann.de).

10.12 Literature

We recommend that you read book "Schnelleinstieg in ProfibusDP", author M.Popp, to help you quickly get to grips with the subject of the ProfibusDP and the mode of operation of the available ASICs. The book can be ordered from the PROFIBUS User Organisation, Order No. 4.071.

Address:
PROFIBUS Nutzerorganisation e.V.
Haid-und-Neu-Str. 7
D-76131 Karlsruhe
Germany
Tel:+49-(0)721 9658 590

11 Servicing

Should questions which are not covered in this Manual crop up, please contact us directly.

Please note down the following information before calling:

- Device designation
- Serial number (S/N)
- Article number
- Error number and error description

You can reach us during hotline hours which are as follows

Monday to Thursday from 8 am to midday and from 1 pm to 4 pm, Friday from 8 am to midday.

Deutschmann Automation GmbH
Carl-Zeiss-Straße 8
D-65520 Bad-Camberg
Germany
Tel.: +49 6434 9433-0
Fax: +49 6434 9433-44
Hotline: +49 6434 9433-33
E-mail: service@deutschmann.de

11.1 Returning a device

If you return a device, we require as comprehensive a fault/error description as possible. We require the following information in particular:

- What error number was displayed?
- What is the supply voltage (±0.5 V) with gateway connected?
- What were you last doing or what last happened on the device (programming, error on power-up, ...)?

The more precise information a fault/error description you provide, the more exactly we will be able to pinpoint the possible causes.

11.2 Downloading PC software and GSD files etc.

You can download the current version of WINGATE® and the current GSD-file (DAGW2862.gsd) free of charge from our homepage at

http://www.deutschmann.de

12 Annex

12.1 Hexadecimal table

Hex	Decimal	Binary
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
A	10	1010
B	11	1011
C	12	1100
D	13	1101
E	14	1110
F	15	1111

13 EG Certificate of Conformance

EG Certificate of conformance as defined by the EG-EMV-Guideline (92/31/EWG)

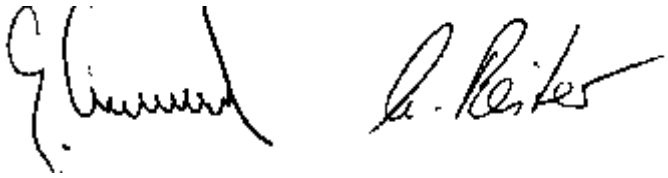
This is to declare that we,

company Deutschmann Automation GmbH
Max-Planck-Straße 21
D-65520 Bad Camberg

developed, produced and offered the below mentioned product for sale in correspondence with the above mentioned EG-guideline.

Product:	Gateway
Type designation:	**UNIGATE® CANopen® (Master) - ProfibusDP (Slave)**
Applied standards:	EN 50082-2 EN 550011

Bad Camberg



Gunther Lawaczeck Michael M. Reiter