Deutschmann Automation

Cam Controls | Fieldbus Gateways | Industrial Ethernet Products

Instruction manual
Universal Fieldbus-Gateway
UNIGATE®

UNIGATE SC232/485 - Fast Ethernet
UNIGATE SC232/422 - Fast Ethernet

V3299E

Deutschmann Automation GmbH & Co. KG Carl-Zeiss-Str. 8 D-65520 Bad Camberg
Tel:+49-(0)6434-9433-0 Hotline: +49-(0)6434-9433-33 Fax: +49-(0)6434-9433-40
Internet: http://www.deutschmann.de

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.: V3299E

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 harmonized 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-Straße 8, D-65520 Bad Camberg, Germany

1.2 Scope of application

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

1.3 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.

1.4 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 top-hat rail (plastic box) onto which the module has been snapped.

1.5 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 Fast Ethernet 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 89/392/EEC

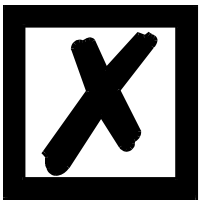
The EU Machinery Directive stipulates the requirements applicable to a machine. The term "machine" is taken to mean a totality of connected parts or fixtures (see also EN 292-1, Paragraph 3.1)
The module is a part of the electrical equipment of the machine and must thus be included by the machine manufacturer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

3 Introduction

The UNIGATE SC232/485-Fast Ethernet module serves to adapt a serial port to an Ethernet with TCP/IP-protocol. In this application it functions as a gateway. It can be operated at any processing system with TCP/IP-protocol and UDP-protocol.

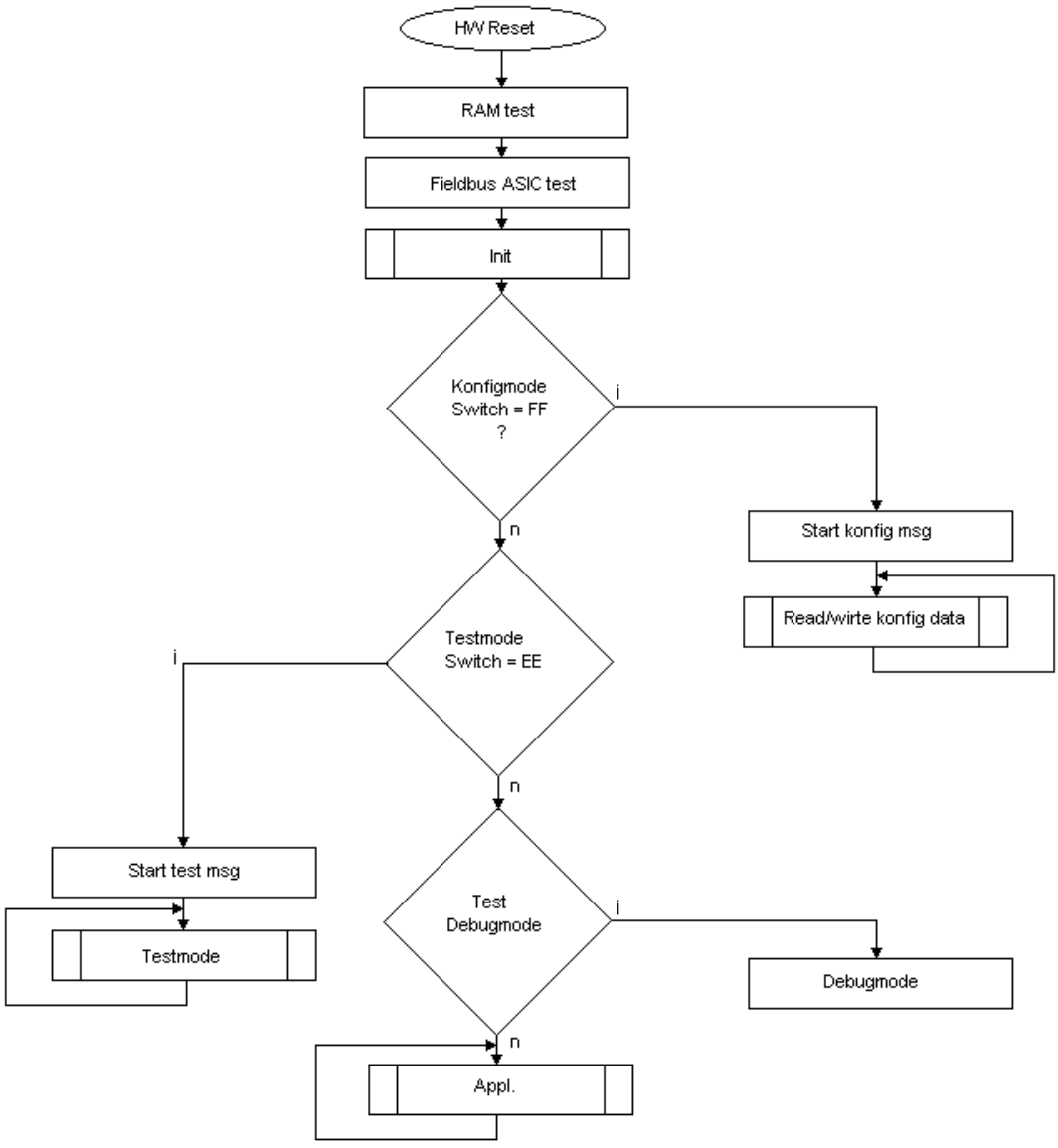
The module SC essentially consists of the following hardware components:

- Electrically isolated 10/100 BaseT interface to the Ethernet
- Ethernet controller W3100A and REALTEK RTL8201L
- Microprocessor 80 C 32
- RAM, EPROM and EEROM
- Optionally electrically isolated
- Serial port (RS232, RS485 and RS422) to the device connected externally



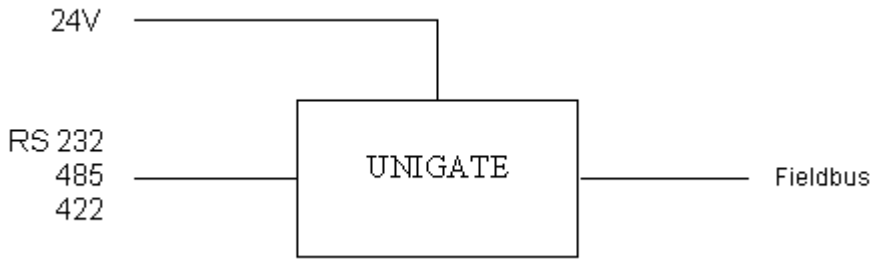
Please note:
This instruction manual is valid for UNIGATE SC (gateway capable for scripts).
The information given in this instruction manual is about the UNIGATE SC-Fast Ethernet, unless differences are explicitly pointed out.

3.1 UNIGATE SC-Fast Ethernet software flow chart



3.2 UNIGATE application diagram

The following graph shows a typical connection scheme.



4 RS-interface

4.1 RS-interface at the UNIGATE SC-Fast Ethernet

On principle the hardware cannot be distinguished from the standard gateway. In addition to the regular hardware, a special hardware version is available, which however, is only required for the generation of a script. Due to technical reasons this advanced hardware is not available for all buses; a development can be made on another than the target hardware though.
Compared to the standard gateway, this development gateway is equipped with an extra-interface RS232, which however, is only available to the outside at the version with 9-pole D-SUB. This debug-interface itself is always operated with 9600 baud, no parity, 8 data bits and 1 stop bit. Apart from that there are no further differences, neither in the software nor in the hardware.

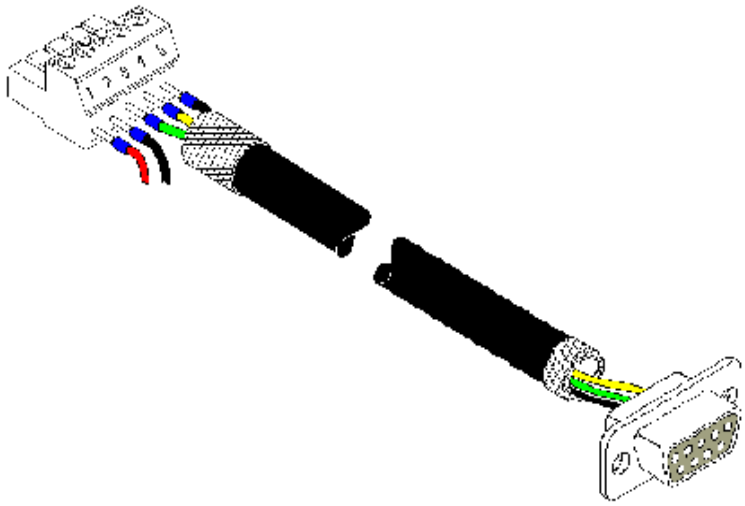
5 Operation modes of the gateway

5.1 Configuration mode (config mode)

The configuration mode serves to configure the gateway. Adjustments at the gateway's configuration are only possible in this mode. The gateway will be starting in this mode in case both switches S4 as well as S5 are set on position "F" when switching on the gateway and also RS232 is to be selected as interface. Right after switching on the gateway in the configuration mode it will be sending its starting message, that looks analog with the following message:
"RS-FE-SC P(232/485) V1.52[28] (c)dA Switch=0xFF Script(8k)="Leer" Author="Deutschmann Automation GmbH" Version="1.0" Date=21.08.2001 SN=47110001 IP=0.0.0.0".
In the configuration mode the gateway always operates with the settings 9600 Bauds, no Parity, 8 Databits and 1 Stopbit, the RS-State LED will always be flashing red, the "Error No/Select ID" LEDs are of no account for the user. All software revisions contain the configuration mode.

Connection cable from the gateway to the PC

The cable is supposed to look as follows



Connection table 5pin screw-plug connector - PC

Screw-plug-connector	Name	D-SUB plug-connector	Name
Pin 3	Rx	Pin 3	Tx
Pin 4	Tx	Pin 2	Rx
Pin 5	GND	Pin 5	GND

5.2 Test mode

Setting of the test mode

The test mode is set by bringing the switches S4 and S5 in position "E". Beyond it the interface switch has to be set on "232". All other switches will not be taken into consideration for the setting of the test mode. Now the gateway has to be restarted with these settings (by a short disconnection from the power supply).
The test mode is contained from software revision V3.0 on. The test mode may be helpful to integrate the gateway in the relevant environment, for instance to "see" permanent changing data of the fieldbus in the SPS or also in order to test the parameters of the RS-interface.

Mode of operation of the test mode

After the restart in the test mode the gateway will be sending the values 0-15 in hexadecimal representation ("0".."F") in ASCII-coding with the current settings for the Baud rate, Parity, Start-, Data-, and Stopbits on the serial side every second. Simultaneously the same values are issued binary on the fieldbus-interface provided that this is possible on the fieldbus at the moment (In case the fieldbus has a data width of more than 1 byte, all characters of the fieldbus will be set to the current test character).

In this mode the State-LED on the RS-side will be flashing red, the "Error No/Select ID" LEDs will be displaying the value in a binary way, that is issued that moment. Additionally each character that is received at one of the interfaces will also be output at the same interface as a local echo. On the fielbus-side only the first byte will be used for the local echo, that means on receiving as well as on transmitting only the first byte of the bus data is looked at, the other bus data do not change compared to the last data.

5.3 Data exchange mode

The gateway has to be in the data exchange mode, so that a data exchange between the RS-side of the gateway and the fieldbus is possible. As long as the gateway is not in the configuration mode or the test mode, the data exchange mode is active. In the data exchange mode the gateway will carry out the Script.

6 Mode of operation of the system

6.1 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 customized bus system (RS485 / RS232) to the corresponding fieldbus system. Layers 3 and 4 are covered by the UDP/IP-protocol, TCP/IP-protocol, Layer 5 and 6 are blank, and Layer 7 is forwarded transparently on the standard gateways. However, customized adaptations are also possible here (e. g. adaptations to existing profiles of the fieldbus systems).

The gateway can be configured through the software WINGATE® that is also supplied (see also chapter 8.2).

6.2 Interfaces

The gateway features the RS232 and RS485 interfaces. Switchover is performed by means of a slide switch accessible for the customer. The Ethernet gateway thus allows access to all devices connected to the RS485 bus via one single Internet address resp. access to the device connected to the RS232 interface.

6.3 Data exchange

The Ethernet-Client processor sends the output data to the gateway. The data received from the master is transferred in the gateway to the external device in accordance with the selected protocol. The external device responds in accordance with the protocol conventions.
The data received from the external device is sent by the gateway to the responsible client processor via the TCP/IP-protocol or the UDP/IP-protocol.

6.4 Possible data lengths

The table below shows the maximum transferable data:

Input data	max. 1000 bytes	Variable: maximum value in this case
Output data	max. 1000 bytes	Variable: maximum value in this case

6.5 Run-up phase

In the run-up phase the master establishes a TCP/IP-connection to the gateway. Data exchange with the external device does not occur until after the run-up phase has been completed with no errors.

7 Generating a script - only for UNIGATE SC-Fast Ethernet

7.1 What is a script?

A script is a sequence of commands, that are executed in that exact order. Because of the fact that also mechanisms are given that control the program flow in the script it is also possible to assemble more complex processes from these simple commands.

The script is memory-oriented. It means that all variables always refer to one memory area. While developing a script you do not have to take care of the memory management though. The Protocol Developer takes on this responsibility for you.

7.2 Memory efficiency of the programs

A script command can carry out e. g. a complex checksum like a CRC-16 calculation via data. For the coding of this command only 9 byte are required as memory space (for the command itself). This is only possible when these complex commands are contained in a library.
A further advantage of this library is, that the underlying functions have been in practical use for a couple of years and therefore can be described as 'void of errors'. As these commands are also present in the native code for the controller, at this point also the runtime performance of the script is favorable.

7.3 What can you do with a script device?

Our script devices are in the position to process a lot of commands. In this case a command is always a small firmly outlined task. All commands can be put into classes or groups. A group of commands deals with the communication in general. This group's commands enable the gateway to send and receive data on the serial side as well as on the bus-side.

7.4 Independence of buses

Basically the scripts do not depend on the bus, they are supposed to operate on. It means that a script which was developed on a Profibus gateway can also be operated on an Interbus without changes, since the functioning of these buses is very similar. In order to also process this script on an Ethernet gateway, perhaps further adjustments have to be made in the script, so that the script can be executed reasonably.
There are no fixed rules how which scripts have to operate properly. When writing a script you should take into account on which target hardware the script is to be executed, so the necessary settings for the respective buses can be made.

The Ethernet gateway has 4 communication channels.

For the channels the following adjustments in the script in each case have to be made:

* The port numbers (Destination-Port and Source-Port)
* At client operation TCP or at UDP the destination-IP-address
* The mode or the protocol of the channel:
  0 = TCP-server,
  1 = TCP-client,
  2 = UDP,
  3 = Channel not used (closed)

WIthout these settings a connection to the gateway cannot be set up via the Ethernet. Only ICMP-data traffic (PING) is possible.

7.5 Further settings at the UNIGATE SC-Fast Ethernet

Most devices require no further adjustments, except for those made in the script itself. However, there are also exceptions to it. These settings are made by means of the software WINGATE. If you know our UNIGATE-series, you are already familiar with the proceeding with it. An example is the adjustment of the IP-address and the net-mask of an Ethernet-gateway. These values have to be known as fixed values and are not available for the runtime. Another reason for the configuration of the values in WINGATE is the following: After an update of the script these values remain untouched, i. e. the settings that were made once are still available after a change of the script.
Only this way it is also possible that the same script operates on different Ethernet-gateways, that feature different IP-addresses.

7.6 The use of the Protocol Developer

The Protocol Developer is a tool for an easy generation of a script for our script gateways. Its operation is exactly aimed at this use. After starting the program the script that was loaded the last time is loaded again, provided that it is not the first start.
Typical for Windows script commands can be added by means of the mouse or the keyboard. As far as defined and required for the corresponding command, the dialog to the corresponding command is displayed, and after entering the values the right text is automatically added to the script. The insertion of new commands by the Protocol Developer is carried out in a way that existing commands will not be overwritten. Generally a new command is inserted in front of the one where the cursor is positioned. Of course the commands can also be written by means of the keyboard or already written commands can also be modified.

7.7 Accuracies of the baud rates at UNIGATE SC

The baud rate of the serial interface is derived from the processor's crystal frequency.
Meanwhile all Script-gateways, except for the MPI-Gateways (20 MHz), are working with a crystal frequency of 40 MHz.
You can enter any desired integer baud rate into the script. After that the firmware adjusts the baud rate, that can be derived the most precisely from the crystal frequency.
The baud rate the gateway is actually working with (BaudIst) can be determined as follows:

BaudIst = (F32 / K)
F32 = Crystal frequency [Hz] / 32
K = Round (F32 / BaudSoll);
Round () is a commercial roundoff

Example:
The actual baud rate is to be calculated, when 9600 baud are pre-set, where the gateway is operated with 40 MHz:

F32 = 40000000 / 32 = 1250000
K = Round(1250000 / 9600) = Round(130.208) = 130
BaudIst = 1250000 / 130 = 9615.38

I. e.: The baud rate actually adjusted by the gateway is 9615.38 baud

The resulting error in per cent can be calculated as follows:

Error[%] = (abs(BaudIst - BaudSoll) / BaudSoll) * 100

In our example the following error results:

Error = (abs(9615.38 - 9600) / 9600) * 100 = 0.16%

In practise errors below 2% can be tolerated!

In the following please find a listing of baud rates at a 40 MHz-crystal frequency with the corresponding errors:

4800 baud:	0.16%
9600 baud:	0.16%
19200 baud:	0.16%
38400 baud:	1.35%
57600 baud:	1.35%
62500 baud:	0%
115200 baud:	1.35%
312500 baud:	0%
625000 baud:	0%

7.8 Script processing times

The Script is translated by the Protocol Developer and the consequently generated code is loaded into the Gateway. Now the processor in the Gateway interprets this code. In this case, there are commands that can be processed very fast (e. g. "Set Parameter"). There are also commands, however, that take longer (e. g. copying 1000 bytes). Consequently, for one thing the processing time differs due to the kind of Sript command. But the processing time of the Script commands is considerably more determined by the processor time that is available for this process. Since the processor has to carry out several tasks simultaneously (multitasking system) only a part of the processor's capacity is available for the Script processing. The following tasks - in the order of priority - are executed on the processor:

- Sending and receiving data at the Debug-interface (provided that the Protocol Developer has been started on the PC)
- Sending and receiving data at the RS-interface
- Sending and receiving data at the Fieldbus-interface
- Tasks controlled via internal clock (1 ms) (e. g. flashing of an LED)
- Processing of the Script

From experience approximately 0.5 ms can be calculated for each Script line. This value confirmed itself again and again in many projects as a standard value. He is always quite right if the processor has enough time available for the Script processing.
By means of the tasks mentioned above, the following recommendation can be formulated in order to receive a rather fast Script processing:

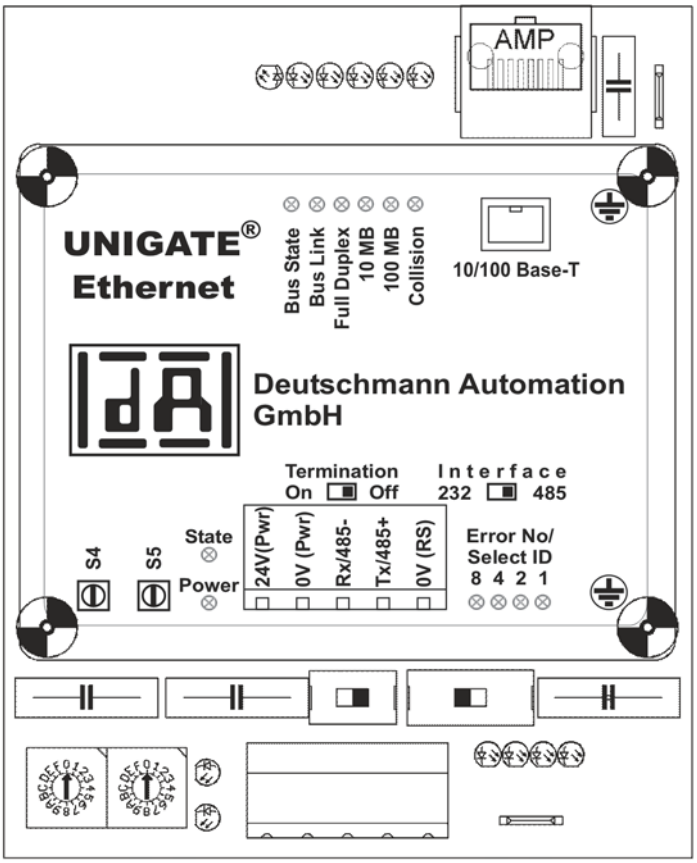
- Deactivate the Debug-interface (it is the normal case in the serial use)
- Keep the data length at the RS-interface as small as possible. The baud rate is not the problem here, but the amount of characters which are transfered per second.
- Do not unnecessarily extend the data length at the Fieldbus side. Especially at acyclical bus data, if possible do only send them when changes were made. The data length at buses that are configured to a fixed length (e. g. Profibus) should not be longer than absolutely necessary.

If the processing time should be too large in spite of these measures, there is the possibility to generate a customized Script command, that executes several tasks in one Script command. Please contact our support department for this purpose.

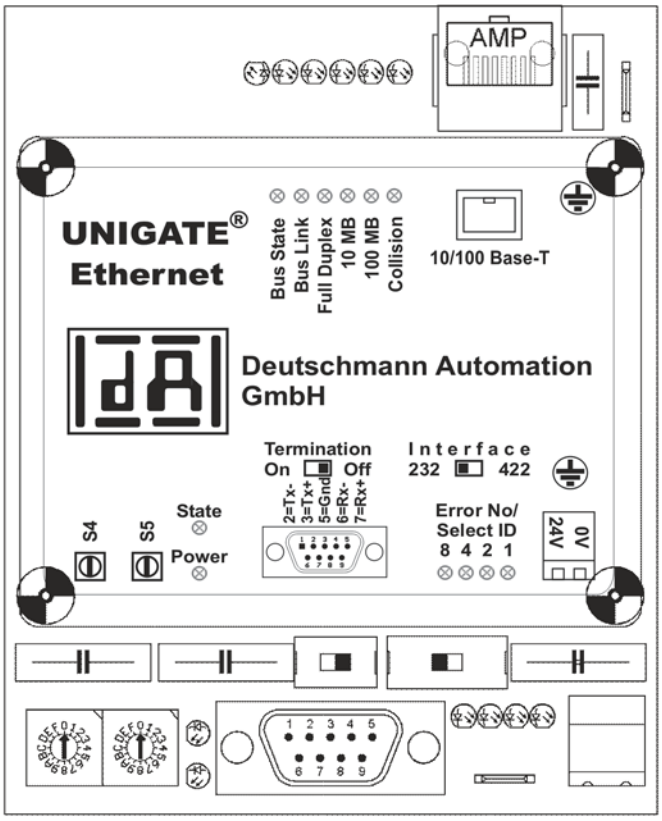
8 Hardware ports, switches and LEDs

8.1 Drawing of the unit

8.1.1 Model UNIGATE SC232/485-Fast Ethernet



8.1.2 Model UNIGATE SC232/422-Fast Ethernet



8.2 Configuration of the UNIGATE SC-Fast Ethernet

The gateway is delivered by the manufacturer without script
The configuration of the gateway can be changed by the customer. That is what the software WINGATE® that comes along with the gateway is meant for.
For the configuration the gateway has to be brought to the configuration mode. For that reason the switches S4 and S5 have to be set to the position "F" each and the interface-switch has to be set to "232". Consequently a connection to the PC has to be established and the gateway has to be started once more. The program WINGATE® automatically selects the interface parameters correctly. For the operation of WINGATE® please take a look at the WINGATE® Online help.

8.2.1 Ethernet

- Protocol (UDP/IP or TCP/IP), up to 4 connections at the same time
- Baud rate: 10 MBaud / 100 MBaud autodetect
- IP-address (gateway)
- Ethernet (MAC-address)
- IP-destination host

The WINGATE® software can be used to change this configuration.

8.3 Connectors

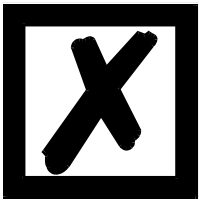
8.3.1 Connector to the external device (RS-interface)

The connection cable to the external device must be plugged in at the connector accessible on the underside of the device.
Pin assignment (5-pin screw-type plug connector; not available for RS422)

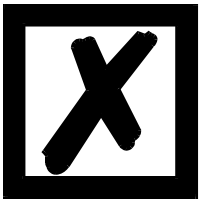
Pin No.	Name	Function
1	10.8..30 V/DC power supply	Power supply
2	0 V power supply	Power supply
3	RX / RS485- (RS485 B)	Receive signal
4	TX / RS485+ (RS485 A)	Transmit signal
5	GND	Reference for PIN 3 + 4

Pin assignment (9-pin D-SUB, plug)
(Standard for the RS232/422-model, optional for the RS232/485-model)

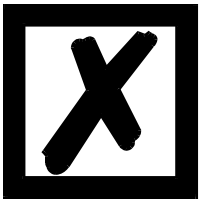
Pin No.	Name	Function
1	Shield	
2	Rx	Receive signal
	RS485-	Transmit-receive signal
	RS422- (Tx)	Transmit signal
3	Tx	Transmit signal
	RS485+	Transmit-receive signal
	RS422+ (Tx)	Receive signal
4		
5	GND	Ground connection, reference for PIN 2+3+6+7
6	RS422- (Rx)	Receive signal
7	RS422+ (Rx)	Receive signal
8		
9		



Attention:
The assignment of the 9-pin D-SUB plug may differ from the above pin assignment and also a customized configuration is possible.



Attention:
In case the RS-interface is <u>NOT</u> potentially divided, "GND" and "supply 0V" are connected internally.



Attention:
In case RS422 is selected, then the termination switch has to be set to ON, in order to avoid communication errors!

Pin assignment (2-pin screw-type/plug connector; only in conjunction with 9-pin D-SUB.)

Pin No.	Name	Function
1	10.8..30 V / DC	10.8..30 V supply voltage
2	0 V / DC	0 V supply voltage

8.3.2 Ethernet 10/100BASE-T-connection RJ45-plug connector

The connector (labelled: 10/100 Base-T) for connection to the Ethernet is located on the upper side of the device.

Pin No.	Name	Function
1	TX +	Transmission line +
2	TX -	Transmission line +
3	RX +	Receiving line +
4		Not connected
5		Not connected
6	RX -	Receiving line -
7		Not connected
8		Not connected

8.3.3 Power supply

The device must be powered with 10.8-30 V. On the version with 5-pin screw-type/plug connector, the power supply is routed via this connector; on the version with 9-pin D-SUB connector, the power supply is routed via the separate 2-pin screw-type/plug connector.

8.3.4 Shield terminal lead

The shield signal for the electronic circuitry is connected to the top-hat rail via the connector provided. The shield signal for the Ethernet connection is not electrically connected to the shield signal of the electronic circuitry for reasons relating to interference immunity.

8.4 LEDs

The gateway UNIGATE SC has 12 LEDs available with the following significance:

LED Bus State	red/green	Network status
LED Full Duplex	yellow	Duplex transmission
LED Bus Link	green	Ethernet linkpulses found
LED 10 MB	green	Network data communication
LED 100 MB	green	Network data communication
LED Collision	red	Occurrence of collision
LED Power	green	Supply voltage RS485/RS232
LED State	red/green	User-defined / general gateway error
LED Error No / Select ID	yellow	User-defined / general gateway error

8.4.1 LED “Bus State“

Lights green	TCP/IP-connection established and active
Flashes green	Gateway waiting for connection set-up
Flashes green/red	Gateway waiting for Ethernet initialization
Lights red	General network error

8.4.2 LED "Bus Link"

This LED is directly selected by the Ethernet controller ASIC and signals the presence of the gateway in a net that is able to work. (Link pulses are received.)

8.4.3 LED "Full Duplex"

This LED flashes when the data transmission is full duplex.

8.4.4 LED "10 MB"

This LED displays, that the data communication occurs on the Ethernet LAN with 10 Mbit.

8.4.5 LED "100 MB"

This LED displays, that the data communication occurs on the Ethernet LAN with 100 Mbit.

8.4.6 LED "Collision"

This LED indicates a collision of data in the Ethernet.

8.4.7 LED “Power“

This LED is connected directly to the (optionally also electrically isolated) supply voltage of the RS485/RS232 end.

8.4.8 LED “State“

Lights green	Controllable via Script
Flashes green	Controllable via Script
Flashes green/red	Controllable via Script
Lights red	General gateway error (see LED’s Error No.), controllable via Script
Flashes red	UNIGATE is in the configuration / test mode, controllable via Script

8.4.9 LEDs “Error No. / Select ID“ at UNIGATE SC-Fast Ethernet

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 address with which communication is currently running via the RS485 interface is displayed, also in binary notation.

8.5 Switches

The gateway features 4 switches with the following functions:

Rotary coding switch S4	RS485 ID (High Byte)
Rotary coding switch S5	RS485 ID (Low Byte)
Slide switch “Interface“	Selector switch for RS485 or RS232 interface
Slide switch “Termination“	Switchable RS485 terminating resistor

8.5.1 Rotary coding switches S4 + S5 (RS485 ID)

These two switches are used to set the RS485 ID of the gateway in hexadecimal notation provided an ID is required for the bus. Please refer to the Annex for a conversion table from decimal to hexadecimal. This value is read in only once when the gateway is activated.

8.5.2 Slide switch (RS485/RS232 interface)

This slide switch is used to select whether an RS485 interface or an RS232 interface is connected at the connector to the external device.

8.5.3 Slide switch (RS485/RS422 termination)

If the gateway is operated as the first or last physical device in the RS485 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 (150 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 RS485 literature for further information on the subject of bus terminations.

If the integrated resistor is used, please allow for the fact that this also activates a pull-down resistor (390 Ω) to ground and a pull-up resistor (390 Ω) to VCC.

At the RS422-interface the transmission line is terminated. The receive line is always firmly terminated.

9 Error handling at UNIGATE SC-Fast Ethernet

LED8	LED4	LED2	LED1	Error no. resp. ID	Error description
0	0	0	0	0	Reserved
0	0	0	1	1	Hardware fault
0	0	1	0	2	EEROM error
0	0	1	1	3	Internal memory error
0	1	0	0	4	Fieldbus hardware fault or wrong fieldbus ID
0	1	0	1	5	Script error
0	1	1	0	6	Reserved
0	1	1	1	7	RS-transmit buffer overflow
1	0	0	0	8	RS-receive buffer overflow
1	0	0	1	9	RS-time out
1	0	1	0	10	General fieldbus error
1	0	1	1	11	Parity- or frame check-error
1	1	0	0	12	Reserved
1	1	0	1	13	Reserved
1	1	1	0	14	Fieldbus buffer overflow
1	1	1	1	15	Reserved

10 Installation guidelines

10.1 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 top-hat rail to EN 50022).

10.1.1 Mounting

- Engage the module from the top in the top-hat 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).

10.1.2 Removal

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

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

10.2 Wiring

10.2.1 Connection systems

The following connection systems must resp. may be used when wiring the module:
- Standard screw-type/plug connection (power supply + RS)
- Push-lock terminals (connection terminals for earthing)
- 8-pin RJ45-plug connection (Ethernet 10/100 BaseT-connection)
- 9-pin SUB-D-plug connection (RS232-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

10.2.2 Ethernet communication interface

10.2.2.1 Bus line with copper cable

This interface is located on the module in the form of a 8-pin RJ45 socket on the front side of the housing.

- Plug the 10/100 BaseT-connector onto the RJ45 socket labelled "10/100 BaseT" until it snaps in.

- Please note that the length of the line to the adjacent Ethernet participants does not fall below 0.6 m.

10.2.2.2 Power supply

The device must be powered with 10,8...30 V DC.
Please note that the devices of the series UNIGATE can not be operated with AC voltage.

- Connect the supply voltage to the 5-pin or optional 2-pin plug-in screw terminal in accordance with the labelling on the front panel of the device.

10.2.2.3 Shield connection

The module features two contact points for equipotential bonding and the shield of the RS end. The shield connection on the Ethernet-side 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 top-hat rail in order to ensure greater contact stability of the shield connection!

10.2.2.4 Equipotential bonding connection

- Fit an earthing terminal to the top-hat rail directly next to the module. The earthing terminal automatically establishes an electrical connection to the top-hat 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.

- Connect the top-hat 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.

10.2.3 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.

10.2.4 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 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 : 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 .

10.2.4.1 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 favorable 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 metallized plugs and connectors. Attach the shield of the data line to the plug or connector housing. Do not connect the shield to PIN 1 of the multipole connector!

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!

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.

- You must earth the shielded RS232C connection cable via the shield terminal on the module using a flexible wire with a cross-section of at least 1.5 mm² which is as short as possible.

- You must also earth the other end of the cable shield of the RS232C connection cable. (see also chapter 10.2.2.3)

11 Representation of the data in Ethernet-TCP/IP

Each Ethernet-Client processor with TCP/IP network-protocol in a 10/100 Mbaud Ethernet can exchange data with the gateway.

11.1 Network-addresses, network-connections

After switching on, the gateway is waiting for data communication with a network-participant. In this case the gateway is always prepared to react to ICMP messages (e. g. **PING** Request and Reply). The functions of the ARP-protocol are also available.

11.2 TCP-connection setup

In the characteristic application in the TCP/IP-protocol, after switching on, the gateway is in the state "Passive Open" under an IP-address and port number that was determined in the configuration. A Client processor is in the position to open a TCP/IP connection with the gateway under the port determined in the configuration. After a successful connecting, data can be exchanged.

11.3 Data exchange

At the protocol TCP/IP, a full duplex data connection is available after establishing a connection between the gateway and the attached Ethernet-Client. The data stream is protected by the TCPI/IP-protocol in both directions.
When operating with UDP/IP-protocol, no connection is established before data is transferred. In this case the application is responsible for the control of the data flow as well as for the backup of the data.

11.3.1 TCP or UDP?

TCP is a connection-oriented protocol: Here a fixed logical connection between Client and Server exists in the course of the data communication. TCP features all mechanisms, that are required, in order to open a connection and to guarantee a flawless data transfer across the network and then again close the connection. For that reason the protocol software creates and administers own buffers for each connection. In case a lot of UNIGATE-servers are to be addressed from one processor at the same time, storage limits in the processor might result in an extreme case.

In contrast to TCP, UDP does not have mechanisms available to repeat data packets or to check them on their completeness. The data communication with UDP is to be recommended if a parent protocol guarantees a flawless transmission between the terminal device at the UNIGATE-server and the application on the TCP/IP-station anyhow.

11.4 Data exchange mode

The gateway has to be in the data exchange mode, so that a data exchange between the RS-side of the gateway and the fieldbus is possible. As long as the gateway is not in the configuration mode or the test mode, the data exchange mode is active. In the data exchange mode the gateway will carry out the set protocol with those parameters preset through WINGATE.

11.4.1 Direct data exchange

In the Ethernet the data from the RS-interface are represented unchanged via a TCP/IP connection.

11.4.2 MODBUS-TCP

The Modbus protocol is already available as script for the serial interface for all script gateways.

Now this additional function can be adjusted at the Fast Ethernet gateway so that the Modbus data can be made available as TCP-Modbus data packet on the Ethernet side.
(MODBUS-TCP).
For this purpose the channel that is used for this feature has to be set up as MODBUS-TCP channel in the script.
For this function a running Modbus-Script is required.

11.4.3 E-mail

On occurrence of particular events it is possible to send an e-mail to certain subscribers of a mailserver. (The event is to be queried from the script.) In the data that are received by the serial interface or that are to be output at the serial interface certain characters or character strings can be analyzed. On appearance of a particular sequence an e-mail that was prepared before and that was written in the script can be sent to one or several subscribers. For this purpose the e-mail is sent to a webserver.
This e-mail function is called up from the script.

11.4.4 Server

11.4.4.1 Webserver

Websites can be called up through a communication channel that has been set up as webserver channel via a script. Here the internal data system is used. Several websites can be placed or rather websites, image files and Java-applets can be called up. This way it is also possible to represent the dynamically changing data of an application, that is connected to the serial interface (shift register). Apart from that it is possible to remote-control an application with control elements on the website or to transmit data to this application.

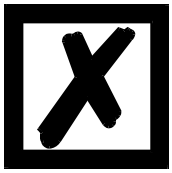
Dynamic data on a website without Java-applet: not specified yet.
Taking over CGI-script-commands from a website: not specified yet.
(String could be sent to the active communication channel.)
The webserver is set up once by initializing the channel in the script.
Additionally the existence of data files, which can be called up as website, in the data system has to be guaranteed.
The webserver is running irrespective of the script.

11.4.4.2 FTP-server

For this function of the FTP-server 2 of the 4 available communication channels have to be set up. One of the channels is in charge of the control, the other channel is responsible for the data transmission. Once that the set up of the channels has been carried out initially in the script, it is possible on the Ethernet side to store files in the internal file system, to load files, to delete files etc...with a FTP-client-program.

Available functions:

PUT	=	Create and write file
GET	=	Read file
DIR	=	Read directory
DEL	=	Delete file
DEL *.*	=	Deleting all files and initializing (mapping) the file system.



Warning:
The script- and conig-file will be deleted also.

Subdirectories are not intended. For that reason you cannot switch to subdirectories and subdirectories cannot be created. For the FTP-server the two channels have to be set up initially in the script.
The FTP-server is running irrespective of the script.

11.4.4.3 File system

A file system is available. The gateway is equipped with an additional memory module that can store data of the file system permanently. It is possible to store up to 128 files in the file system. The file names may exist of up to 24 characters. At present the maximum memory capacity is 256KByte. Components for an expansion to up to 2MByte will be available soon.

12 Technical data

12.1 Device data

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

No.	Parameter	Data	Explanations
1	Location	Switch cabinet	Top-hat rail mounting
2	Enclosure	IP24 / IP67	Protection against foreign bodies and water to IEC 529 (DIN 40050)
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	0 ºC ... +45 ºC (without mandatory convection) 0 ºC ... +65 ºC (with mandatory convection)	
9	Storage/transport temperature	- 10 ºC ... + 70 ºC	
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	Reverse voltage protection	Yes	But does not function!
17	Short-circuit protection	Yes	
18	Overload protection	Poly-switch	Thermal fuse
19	Undervoltage detection (USP)	≤ 9 V DC	
20	Emergency power supply	≥ 5 ms	Device fully operable
21	Insulation voltage	500 V DC	IEC 1131-2

Table: 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	

Table: Tests, standards and regulations

12.1.1 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	Ethernet 10 BaseT Ethernet 10/100 BaseT	RS232-C RS232-C	RS485/RS422 RS485/RS422
1	Standard		DIN 66020	EIA Standard
2	Transmission mode	Symmetrical asynchronous serial half-duplex → Difference signal	Asymmetrical asynchronous serial full duplex → Level	Symmetrical asynchronous serial half-duplex full duplex at RS422 → Difference signal
3	Transmission method	Multimaster CSMA/CD	Master / slave	Master / slave
4	Number of users : - Transmitters - Receivers	512 512	1 1	32 32
5	Cable length: - Maximum	100 m	15 m no	1200 m <93.75 kBd→1200 m 312, kBd→500 m 625 kBd→250 m
6	Bus topology	Star	Point-to-point	Line
7	Data rate: - standard	10 Mbit/s 100 Mbit/s	120 kBit/s 2.4 k/B 4.8 k/B 9.6 kBit/s 19.2 kBit/s 38.4 kBit/s	625 kBaud 2.4 kBit/s 4.8 kBit/s 9.6 kBit/s 19.2 kBit/s 57.6 kB 312.5 kB 625 kB
8	Transmitter: - Load - Maximum voltage - Signal, unloaded - Signal, loaded	100 Ω	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	100 Ω	3 ... 7 Ω ± 15 V ± 3 V	12 Ω - 7 V ... 12 V ± 0.2 V
10	Transmit range (SPACE): - Voltage level - Logic level		 + 3 ... + 15 V 0	 - 0.2 ... + 0.2 V 0
11	Transmit pause (MARK): - Voltage level - Logic level		 - 3 ... –15 V 1	 + 1.5 ... +5 V 1

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

13 Commissioning guide

13.1 Note

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

13.2 Components

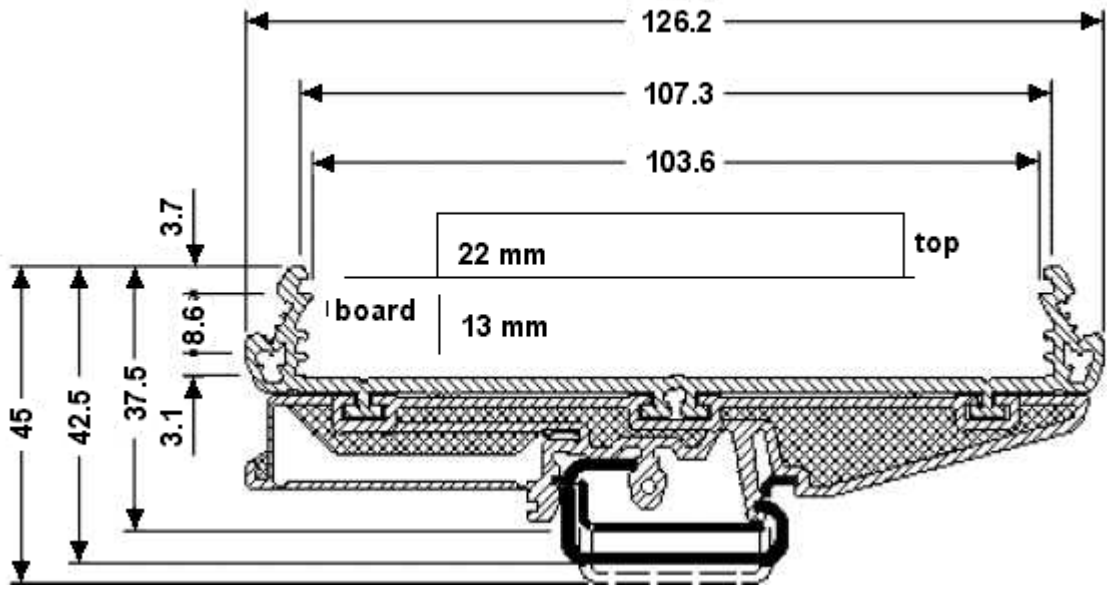
You will require the following components to commission the UNIGATE:

- UNIGATE
- Connection cable from gateway to the process
- Connector for the Ethernet connection to the gateway
- Ethernet cable (this cable is generally available on site!)
- 10.8..30 V DC power supply (DIN 19240)
- Enclosed CD containing instruction manual

13.3 Installation

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

13.4 Dimensional drawing DIN-rail mounting



13.5 Commissioning

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

13.6 Ethernet connection

Connect the device to the Ethernet network at the interface labelled "10/100 BaseT".

13.7 Connection of the process device

Please also read the user manual provided for the process device when commissioning the process device.

13.8 Connecting the supply voltage

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

13.9 Shield connection

Connect the PE wire at the terminal provided for this. Earth the top-hat rail onto which the module has been snapped.

13.10 Project planning

With the socket-API (e. g. Winsock under Windows or Berkley sockets under UNIX) it is possible to realize various application cases within your software. The API provides the complete functionality for the data transport across the network.
Deutschmann Automation GmbH & Co. KG offers a demonstration program for the PC for a simple demonstration of data communication (starterkit software). Please copy this program from the enclosed diskette or download this file from the Internet (www.deutschmann.de).

13.11 Literature

We recommend that you read book "Ethernet-TCP/IP für die Industrieautomation", author Frank J. Furrer, to help you quickly get to grips with the subject of the Ethernet-TCP/IP and the mode of operation of the Ethernet networks. The book is available in bookstores (ISBN 3-9520919-0-1).

14 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 & Co. KG
Carl-Zeiss-Straße 8
D-65520 Bad Camberg
Germany

Central office and sales department	+49-(0)6434-9433-0
Technical hotline	+49-(0)6434-9433-33
Fax sales department	+49-(0)6434-9433-40
Fax technical hotline	+49-(0)6434-9433-44
E-mail technical hotline	hotline@deutschmann.de

14.1 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.

14.2 Downloading PC software and GSD files etc.

You can download the current version of WINGATE® free of charge from our Internet server.

http://www.deutschmann.de

15 Annex

15.1 Explanations of the abbreviations

General

CL	=	Product group CL (Compact Line)
CX	=	Product group CX
GT	=	Galvanic separation RS-side
GY	=	Housing color gray
RS	=	Product group RS
SC	=	Product group SC (Script)
232/485	=	Interface RS232 and RS485 switchable
232/422	=	Interface RS232 and RS422 switchable
DB	=	Additional RS232 DEBUG-interface
D9	=	Connection of the RS through 9-pin D-SUB instead of 5-pin screw-plug connector
PL	=	Board only without DIN-rail module and without housing cover
PD	=	Board only without DIN-rail module and with housing cover
AG	=	Gateway installed in a die-cast aluminum housing
EG	=	Gateway installed in a stainless steel housing
IC	=	Product group IC (IC-design DIL32)
16	=	Script memory expanded to 16KB
5V	=	Operating voltage 5V
3,.3V	=	Operating voltage 3.3V

Fieldbus

ASI	=	AS-Interface (AS-i)
CO	=	CANopen
C4	=	CANopen V4
C4X	=	CANopen V4-version X (see comparison table UNIGATE® IC for the respective product)
DN	=	DeviceNet
EC	=	EtherCAT
EI	=	Ethernet/IP
FE	=	Ethernet 10/100 MBit
FEX	=	Ethernet 10/100 MBit-version X (see comparison table UNIGATE® IC for the respective product)
IB	=	Interbus
IBL	=	Interbus
LN62	=	LONWorks62
LN512	=	LONWorks512
MPI	=	Siemens MPI®
PL	=	Powerlink
PN	=	Profinet-IO
PBDP	=	ProfibusDP
PBDPL	=	ProfibusDP-version L (see comparison table UNIGATE® IC for the respective product)
PBDPX	=	ProfibusDP-version X (see comparison table UNIGATE® IC for the respective product)
PBDPV0	=	ProfibusDPV0
PBDPV1	=	ProfibusDPV1
RS	=	Serial RS232/485/422

15.2 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